Part 1 GENERAL

1.1 REFERENCES

.1 CSA International

.1 CAN/CSA-A82-06, Fired Masonry Brick Made From Clay or Shale.

.2 CAN/CSA-A165 SERIES-04(R2009), CSA Standards on Concrete Masonry Units. Covers: A165.1, A165.2, A165.3.

.3 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.

.4 CAN/CSA-A370-04(R2009), Connectors for Masonry.

.5 CAN/CSA A371-04(R2009), Masonry Construction for Buildings.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Samples:

.1 Submit duplicate full size samples of masonry units.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect masonry products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 MASONRY UNITS

.1 Modular concrete brick: to CAN/CSA-A165.2.

.1 Type: modular concrete brick.

.2 Grade: standard grade.

.3 Size: to match existing.

.4 Texture: to match existing.

2.2 REINFORCEMENT AND CONNECTORS

.1 Wire reinforcement: to CAN/CSA-A371.

.2 Connectors shall be corrosion resistant: to CAN/CSA-A370.

2.3 MORTAR AND GROUT

.1 Mortar: to CAN/CSA-A179.

.1 Colour: ground coloured natural aggregates or metallic oxide pigments.

.2 Mortar Type: S.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.

.1 Bond: to match existing.

.2 Coursing height: to match existing.

.3 Jointing: tool to match existing where exposed or where paint or other finish coating is specified to provide smooth, compressed, concave surface.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.3 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.

.2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

.2 Building-in:

.1 Install masonry connectors and reinforcement.

.2 Install loose steel lintels over openings where indicated.

.3 Provision for movement:

.1 Leave 3 mm space below shelf angles.

.4 Interface with other work:

.1 Cut openings in existing work as indicated.

.2 Make good existing work. Use materials to match existing.

.5 Build in flashings in masonry in accordance with CAN/CSA-A371.

.1 Install flashings under steel angles over openings.

.2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:

.1 For masonry backing embed flashing 25 mm in joint.

.2 For wood frame backing, staple flashing to walls behind sheathing paper.

.3 Lap joints 150 mm and seal with adhesive.

.6 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

3.4 REINFORCING AND CONNECTING

.1 Install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371 and CSA S304.1 unless indicated otherwise.

.2 Prior to placing mortar and grout, obtain Contract Administrator's approval of placement of reinforcement and connectors.

3.5 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CAN/CSA-A371, CSA S304.1 and as indicated.

.2 Tie masonry veneer to backing in accordance with NBC, CAN/CSA-A371, CSA S304.1 and as indicated.

3.6 GROUTING

.1 Grout masonry in accordance with CAN/CSA-A179, CAN/CSA-A371 and CSA S304.1 and as indicated.

3.7 ANCHORS

.1 Supply and install metal anchors.

3.8 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA S304.1.

3.9 SITE TOLERANCES

.1 Tolerances of CAN/CSA-A371 apply.

3.10 FIELD QUALITY CONTROL

.1 Inspection will be carried out by Contract Administrator.

3.11 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

3.12 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

.2 Repair damage to adjacent materials caused by masonry products installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA A371-04, Masonry Construction for Buildings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.

1.3 FIELD MEASUREMENTS

.1 Make field measurements necessary to ensure proper fit of members.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle masonry accessories in accordance with manufacturer’s recommendations and as follows:

.1 Keep fillers and adhesives dry, protected against dampness, and freezing.

.2 Store packaged materials off ground and in accordance with manufacturer's written instructions.

Part 2 Products

2.1 MATERIALS

.1 Mechanical fasteners: recommended by flashing manufacturer to suit project requirements.

2.2 FLASHINGS

.1 Sheet metal: galvanized steel.

.1 Thickness: 0.6 mm.

.2 Finish: prefinished finish colour to match existing.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION: MATERIALS

.1 Install continuous movement joint fillers in movement joints at locations indicated on drawings.

.2 Lap adhesive: apply adhesive to flashing lap joints.

.3 Mechanical fasteners: install fasteners to suit application and in accordance with manufacturer's written installation instructions.

3.3 INSTALLATION: MOISTURE CONTROL

.1 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

3.4 INSTALLATION: FLASHINGS

.1 Build in flashings in masonry in accordance with CAN/CSA A371.

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings, and at base of cavity wall and where cavity is interrupted by horizontal members or supports and as shown on drawings. Install flashings under weep hole courses and as indicated.

.2 In cavity walls and veneered walls, carry flashings from front edge of exterior masonry, under outer wythe, then up backing not less than 150 mm, and as follows:

.1 For masonry backing embed or bond flashing 25 mm in joint.

.2 For concrete backing, insert or bond flashing into reglets.

.3 For wood frame backing, staple flashing to walls behind water resistive paper, and lap joints.

.4 For gypsum board and glass fibre faced sheathing backing, bond to wall using manufacturer's recommended adhesive.

.3 Lap joints 150 mm and seal with adhesive.

.2 Form flashing (end dams) at lintels, sills and wall ends to prevent water from travelling horizontally past flashing ends.

.3 Install vertical flashing where outer veneer returns at window or door jambs, to prevent contact of veneer with inner wall.

3.5 CLEANING

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 – GENERAL

1.1 References

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-11.3, Hardboard.
.2 Canadian Standards Association (CSA)
  .1 CSA B111 - Wire Nails, Spikes and Staples.
  .2 CSA O80 - Wood Preservation.
  .3 CAN/CSA O141 - Softwood Lumber.
  .4 CSA O151 - Canadian Softwood Plywood.
.3 National Lumber Grades Authority (NLGA)
  .1 Standard Grading Rules for Canadian Lumber.

1.2 Quality Assurance

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

PART 2 - PRODUCTS

2.1 Materials

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with CAN/CSA-O141, Spruce, Pine or Fir NLGA No. 2 or better grade. Glued end-jointed (finger-jointed) lumber is not acceptable
.2 Canadian softwood plywood (CSP): to CSA 0151, standard construction, square edge. Exterior sheathing grade.
.3 Hardboard paneling: to CAN/CGSB-11.3, smooth, tempered, 1219 x 2438 x 3 mm thick panels.
.4 Nails, spikes and staples: to CSA B111 and NBC requirements. Galvanized.
.5 Bolts: steel, of sizes required, complete with nuts and washers. Galvanized.
.6 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead plugs, recommended for purpose by manufacturer.
.7 Surface-applied wood preservative: copper napthenate or pentachlorophenol base water repellent preservative. Use clear for materials exposed in final assembly, coloured elsewhere.

2.2 Pressure Preservative Treated Wood

.1 Provide lumber materials pressure preservative treated for:
  .1 Rough bucks at openings.
  .2 Wood strapping.
  .3 Lumber used on exterior of building, above or below grade.
.2 Treat material to CAN/CSA-O80 using Type-C (copper chromate arsenate) preservative to obtain a minimum net retention level of 6.4 kg/m3) of wood.
.3 Materials shall be dried after treatment to a moisture content of 19% or less.
.4 Each piece of treated material shall be identified with a tag or ink mark bearing the Canadian Wood Preservers' Bureau quality mark.
.5 Apply surface applied wood preservative to heartwood exposed from ripping, end cutting or boring.

PART 3 - EXECUTION

3.1 Installation

.1 Comply with requirements of NBC, Part 9 supplemented by following paragraphs.
.2 Install members true to line, levels and elevations. Space uniformly.
.3 Construct continuous members from pieces of longest practical length.
.4 Install spanning members with "crown-edge" up.
.5 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
.6 Countersink bolts where necessary to provide clearance for other Work.
.7 Use fastenings of following types, except where specific type is indicated or specified:
  .1 To hollow masonry, plaster and panel surfaces use toggle bolt.
  .2 To solid masonry and concrete use expansion shield with lag screw, lead plug with wood screw.
  .3 To structural steel use bolts through drilled hole, or welded stud-bolts or power driven self-drilling screws, or welded stud-bolts or explosive actuated stud-bolts.
.8 Install furring and blocking as required to space-out and support surface wall and ceiling finishes, facings, fascia, soffit, siding and other Work as indicated. Align and plumb faces of furring and blocking to tolerance of 1:600.
.9 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other Work. Except where indicated otherwise, use material at least 38 mm thick.
.10 Install fascia backing, nailers and other wood supports as required and secure using galvanized fasteners.

~End~

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit one copy of manufacturer's printed product literature, specifications and data sheet.

Part 2 Products

2.1 INSULATION

.1 Batt and blanket mineral fibre: to CAN/ULC S702.

.1 Type: 1.

.2 Thickness: as indicated on drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Do not enclose insulation until it has been inspected and approved by Contract Administrator.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include:

.1 Product characteristics.

.2 Performance criteria.

.3 Limitations.

.2 Quality assurance submittals:

.1 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

2.2 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.3 ACCESSORIES

.1 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

.2 Staples: minimum 6 mm leg.

.3 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall assemblies prior to installation of plywood to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 Quality Assurance

.1 Coordinate installation of air barrier materials with work of other trades to minimize exposure of membrane to elements or damage, and to

.2 Overlap and seal air barrier with air and vapour barrier membranes installed by other trades to ensure continuity of building air/vapour barrier system over entire building.

1.2 Environmental Conditions

.1 Apply primers and membranes in dry weather and only when air and surface temperature are within manufacturer's recommended limits.

.2 For applications below recommended temperature consult manufacturer and do not proceed until approved by manufacturer or his representative.

PART 2 - PRODUCTS

2.1 Materials

.1 Self-adhesive air barrier membrane: modified bitumen on high-density polyethylene film, with silicone release paper on adhesive side, minimum 1.0 mm thick.

.1 Acceptable material – exterior walls: Soprema Sopraseal Stick 1100, Bakor Blueskin SA, WR Grace Perm-A-Barrier, IKO Aquabarrier AVB.

.2 Primers: as recommended by manufacturer and suitable for substrate.

.3 Mastics and sealants: as recommended by manufacturer, suitable for substrate.

.4 Flashing and stripping membranes: as recommended by air barrier membrane manufacturer.

PART 3 - EXECUTION

3.1 Examination

.1 Verify that surfaces and conditions are cured, dry and acceptable for installation of air barrier membranes.

.2 Notify Contract Administrator in writing of unsuitable surfaces or working conditions and await remedial measures. Commencement of work shall imply acceptance of surfaces and working conditions.

3.2 Preparation

.1 Clean substrates of all snow, ice, loose particles, oil, grease, dirt, curing compounds, or other foreign matter detrimental to installation and bonding of air barrier membrane.

.2 Repair defects in concrete and masonry surfaces such as mortar droppings spalled or poorly consolidated areas, honeycombing. Patch rough areas with a well-adhered parge coat to provide smooth surface. Allow to fully cure and dry.

.3 Remove sharp protrusions, form lines and rough edges.

3.3 Priming

.1 Prime all surfaces and substrates to receive self-adhesive air barrier membranes.

.2 Apply primers in accordance with manufacturer's instructions, at recommended rate of application.

.3 Do not apply to frozen or damp surfaces. Apply in dry weather when air and surface temperatures are within manufacturer's recommended limits.

.4 Avoid pooling of primer and allow to cure until tack-free.

.5 Prime only an area that can be covered in a working day. Re-prime areas which over dry or become soiled or dusty.

3.4 Workmanship

.1 Install materials in accordance with manufacturer's instructions using only materials approved for use with their products.

.2 Apply with good construction practice to maintain continuity of air barrier membrane over building elements.

.3 Do not commence work until all other work penetrating substrates has been completed, and reviewed by Contract Administrator.

.4 Use largest lengths possible to minimize joints. Overlap side and end laps minimum 50 mm. Stagger end laps minimum 300 mm in adjacent rows.

.5 Locate end joints minimum 300 mm from internal and external corners.

.6 Masonry cavity walls:

.1 Install sheets horizontally between masonry ties penetrating membrane.

.2 Overlap horizontal joints minimum 50 mm. Slit membrane at each tie and seal making air tight.

3.5 Installation Self-Adhesive Air Barrier

.1 Apply membrane in accordance with manufacturer's instructions.

.2 Roll out sheets and press firmly to substrate. As installation progresses roll with hand roller to ensure positive bond.

.3 At all internal corners, both vertical and horizontal, provide a fillet strip formed of liquid mastic. Do not use fibre or wood cants.

.4 Flash and seal around all penetrations and protrusions such as pipes, conduits, steel angle supports, masonry ties and anchors. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal around all protrusions with mastic sealant. Make airtight.

3.6 Patching and Repairing

.1 Inspect membrane for defects and poor workmanship before covering and make corrections immediately.

.2 Ensure full contact and bond to substrates. Patch and repair loose or poorly bonded areas.

.3 Patch and repair misaligned or inadequately lapped seams, tears, punctures or fishmouths to the satisfaction of the Contract Administrator.

.4 Patch cuts, tears, and punctures by bonding an additional layer of air barrier membrane over damaged area. Patch shall extend minimum 150 mm in all directions from fault. Seal and make airtight.

~End~

Part 1 General

1.1 REFERENCES

.1 ASTM International Inc.

.1 ASTM D41-05, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

.2 ASTM D312-00(2006), Standard Specification for Asphalt Used in Roofing.

.3 ASTM D6162-00a, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.

.4 ASTM D6163-00e1, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.

.5 ASTM D6164-05, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.2 CGSB 37-GP-56M-80b(A1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

.3 CAN/CGSB-51.33-[M89], Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

.3 Canadian Roofing Contractors Association (CRCA)

.1 CRCA Roofing Specifications Manual-1997.

.4 Canadian Standards Association (CSA International)

.1 CSA A123.21-04, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems

.2 CSA-A123.4-04, Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.

.3 CSA O121-08, Douglas Fir Plywood.

.4 CSA O151-04, Canadian Softwood Plywood.

.5 Factory Mutual (FM Global)

.1 FM Approvals - Roofing Products.

.6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.7 Underwriters Laboratories' of Canada (ULC)

.1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S704-[03], Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting one week prior to beginning waterproofing Work, with roofing contractor's representative to:

- .1 Verify project requirements.
- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

- .1 Provide one copy of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide one copy of WHMIS MSDS, and indicate VOC content for:
  - .1 Primers.
  - .2 Asphalt.
  - .3 Sealers.
  - .4 Filter fabric.

.2 Provide shop drawings:

- .1 Indicate flashing, and tapered insulation details.
- .2 Provide layout for tapered insulation.

.3 Test and Evaluation Reports: submit laboratory test reports certifying compliance of membrane with specification requirements.

.4 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

1.4 QUALITY ASSURANCE

.1 Installer qualifications: company specializing in application of modified bituminous roofing systems approved by manufacturer, during the bidding period as well as during installation.

1.5 FIRE PROTECTION

.1 Fire Extinguishers:

- .1 Maintain one cartridge operated type or stored pressure rechargeable type with shut-off nozzle,
- .2 ULC labelled for A, B and C class protection.
- .3 Size as indicated on roof per torch applicator, within 6 m of torch applicator.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.

.4 Remove only in quantities required for same day use.

.5 Place plywood runways over completed Work to enable movement of material and other traffic.

.6 Store sealants at +5 degrees C minimum.

.7 Store insulation protected from weather and deleterious materials.

1.7 SITE CONDITIONS

.1 Ambient Conditions

.1 Do not install roofing when temperature remains below -18 degrees C for torch application or to manufacturers' recommendations.

.2 Minimum temperature for solvent-based adhesive is -5 degrees C.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.8 WARRANTY

.1 The membrane manufacturer must supply a written and signed document issued in the name of the owner, certifying the product's performance for a ten (10) year period starting from the date of acceptance of the work and once all material had been installed in accordance with the manufacturer's requirements.

.2 The roofing contractor will supply a written and signed document issued in the name of the owner certifying that the work completed to remain as installed, free from any application defect, for a period of two (2) years from the date of acceptance.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to the Contract Administrator stating that materials and components, as assembled in system, meet this requirement.

.2 Roofing System: to CSA A123.21 for wind uplift resistance.

2.2 DECK PRIMER

.1 Asphalt primer: to CGSB 37.5-M89.

.1 Elastocol Stick by Soprema or approved equal in accordance with B7.

2.3 VAPOUR RETARDER

.1 Self adhesive air/vapour barrier modified bitumen membrane]

.1 Sopravap'r by Soprema or approved equal in accordance with B7.

2.4 MEMBRANE

.1 Base sheet: to CGSB 37-GP-56M.

.1 Colvent 810, or approved equal in accordance with B7, adhered directly to insulation.

.2 ULC certification: Class A.

.2 Cap sheet membrane: to CGSB 37-GP-56M.

.1 Colvent Traffic Cap 860 GR, or approved equal in accordance with B7, heat welded to base sheet.

.2 ULC certification: Class A.

.3 Parapet base sheet:

.1 Sopralene Flam Stick. Prime substrate with Elastiocol Stick.

.4 Parapet cap sheet:

.1 Colvent Traffic Cap 860 GR, or approved equal in accordance with B7, heat welded to base sheet

2.5 POLYISOCYANURATE INSULATION

.1 To CAN/ULC-S704, Type 2, Class 2.

.1 Sopra-Iso Insulation by Soprema or approved equal in accordance with B7.

.2 Sopra-Iso Plus Insulation by Soprema or approved equal in accordance with B7.

2.6 TAPERED INSULATION

.1 To CAN/CGSB 51.20M, Type 4.

.1 Posi-Slope extruded polystyrene insulation or approved equal in accordance with B7.

Part 3 Execution

3.1 QUALITY OF WORK

.1 Do examination, preparation and roofing Work in accordance with CRCA Roofing Specification Manual.

.2 Do priming in accordance with manufacturers written recommendations.

.3 The interface of the walls and roof assemblies will be fitted with durable rigid material plywood providing connection point for continuity of air barrier.

3.2 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions:

.1 Inspect deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.

.2 Evaluation and Assessment:

.1 Prior to beginning of work ensure:

.1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.

.2 Curbs have been built.

.3 Roof drains have been installed at proper elevations relative to finished roof surface.

.4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing materials during rain or snowfall.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, walks and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Contract Administrator .

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.4 PRIMING DECK

.1 Apply deck primer to wood roofing substrate at the rate recommended by manufacturer.

3.5 VAPOUR RETARDER (WOOD DECK)

.1 Adhere one-ply vapour barrier membrane to manufacturer’s recommendations.

.2 Modified bituminous vapour retarder sheet. Unroll and let relax prior to installation.

3.6 CONVENTIONAL MEMBRANE ROOFING APPLICATION

.1 Tapered insulation application:

.1 Adhere insulation to vapour retarder as per manufacturer’s recommendations.

.2 Install tapered insulation as first insulation layer. Stagger joints between layers 150 mm minimum.

.2 Insulation: fully adhered, adhesive application:

.1 Adhere insulation to tapered insulation using two-part urethane adhesive.

.2 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.3 Cut end pieces to suit.

.4 Apply adhesive in continuous ribbons at 300 mm on centre.

.3 Base sheet application:

.1 Apply in strict accordance with manufacturer’s recommendations.

.2 Adhere to support by peeling off release protection film.

.3 Apply pressure over entire surface using a membrane roller.

.4 Application to be free of blisters, wrinkles and fishmouths.

.4 Cap sheet application:

.1 Apply in strict accordance with manufacturer's recommendations.

.2 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.

.3 Unroll and heat weld cap sheet onto base sheet taking care not to burn membrane or its reinforcement.

.4 Application to be free of blisters, fishmouths and wrinkles.

.5 Flashings:

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.

.2 Adhere base sheet onto substrate.

.3 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.

.4 Provide 75 mm minimum side lap and seal.

.5 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.

.6 Do work in accordance with manufacturer's recommendations

.6 Roof penetrations:

.1 Install roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

3.7 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspection of roofing application will be carried out by Contract Administrator.

3.8 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Furnish and install where indicated on plans metal roof hatch Type D. The roof hatch shall be double leaf. The roof hatch shall be pre-assembled from the manufacturer.

1.2 Shop Drawings

.1 Product Data: Submit manufacturer's product data.

.2 Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

.3 Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 Delivery, Storage and Handling

.1 Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

PART 2 - PRODUCTS

2.1 Manufacturer

.1 Basis-of-Design Manufacturer: Type D Roof Hatch by The Bilco Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-933-8478, Web: www.bilco.com.

2.2 Roof Hatch

.1 Furnish and install where indicated on plans metal roof hatch Type D, size 2235 x 2235. Length denotes hinge side. The roof hatch shall be double leaf. The roof hatch shall be pre-assembled from the manufacturer.

.2 Performance characteristics:

.1 Covers shall be reinforced to support a minimum live load of 40 psf (195kg/m^2) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m^2) wind uplift.
.2 Operation of the covers shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
.3 Operation of the covers shall not be affected by temperature.
.4 Entire hatch shall be weather tight with fully welded corner joints on covers and curb

.3 Covers: Shall be 2.3mm aluminum with a 76mm beaded flange with formed reinforcing members. Covers shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

.4 Cover insulation: Shall be fiberglass of 25mm thickness, fully covered and protected by a metal liner 18 gauge (1mm) aluminum.

.5 Curb: Shall be 305mm in height and of 11 gauge (2.3mm) aluminum. The curb shall be formed with a 89mm flange with 11mm holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material

as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 153mm on center, to be bent inward to hold single ply roofing membrane securely in place.

.6 Curb insulation: Shall be rigid, high-density fiberboard of 1" (25mm) thickness on outside of curb.

.7 Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.

2.3 Hardware

.1 Heavy pintle hinges shall be provided
.2 Covers shall be equipped with an enclosed two point spring latch with interior and exterior turn handles
.3 Roof hatch shall be equipped with interior and exterior padlock hasps.
.4 The latch strike shall be a stamped component bolted to the curb assembly.
.5 Covers shall automatically lock in the open position with a rigid hold open arm equipped with a 25mm diameter red vinyl grip handle to permit easy release for closing.
.6 Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
.7 Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

2.4 Finishes

.1 Factory finish shall be mill finish aluminum.

PART 3 – EXECUTION

3.1 Examination

.1 Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

.2 Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

.1 Test units for proper function and adjust until proper operation is achieved.
.2 Repair finishes damaged during installation.
.3 Restore finishes so no evidence remains of corrective work.

3.3 Adjusting and Cleaning

.1 Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

~End~

PART 1 - GENERAL

1.1 References

.1 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-19.13, Sealing Compound, One-component, Elastomeric, Chemical Curing.

1.2 Environmental and Safety Requirements

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to Labour Canada.
.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 Sealant Materials

.1 Urethanes, One Part, Self-Leveling.
.1 To CAN/CGSB-19.13, Type 1.
.2 Acceptable material: Sikaflex 1cSL, Bostik Chem-Calk 950.
.2 Urethanes, One Part, Non-Sag.
.1 To CAN/CGSB-19.13, Type 2.
.2 Acceptable products: Sikaflex 1a, Tremco DyMonic, Bostik Chem-Calk 900.
.3 Sealant colours: selected by Contact Administrator from manufacturer’s standard colour selection.
.4 Foam backer rods: extruded polyethylene foam, compressible, oversized 30 to 50%.
.1 Acceptable material: Tremco Tundra Foam.
.5 Bond breaker tape: polyethylene bond breaker tape that will not bond to sealants.
.6 Expanding foam sealant: high-density open cell polyurethane foam, pre-compressed, impregnated with water-based, stabilized acrylic, self-adhesive. Secondary seal requiring primary seal of wet sealant.
.1 Acceptable material: Emseal Greyflex.
.7 Adhesives: type recommended by expanding foam sealant manufacturer.
.8 Primers: type recommended by sealant manufacturer, for appropriate sealant and corresponding substrate.
.9 Joint cleaner: non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

2.2 Sealant Selection

.1 Perimeters of exterior openings where frames meet exterior facade of building: Urethanes One Part, Non-Sag.
.2 Expansion and control joints in exterior surfaces of precast, architectural wall panels: Urethanes One Part, Non-Sag.
.3 Expansion and control joints in exterior surfaces of unit masonry walls: Urethanes One Part, Non-Sag.
.4 Coping joints and coping-to-facade joints: Sealant type: Urethanes One Part, Non-Sag.
.5 Cornice and wash (or horizontal surface joints): Sealant type: Urethanes One Part, Selfleveling.
.6 Exterior joints in horizontal wearing surfaces (as itemized): Sealant type: Urethanes One Part, Self-leveling.
.7 Perimeters of interior frames where frames meet interior finishes: Urethanes One Part, Non-Sag.

.8 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant type: Urethanes One Part, Non-Sag.
.9 Under thresholds at exterior doors. Sealant type: Urethanes, One Part, Non-Sag.
.10 As itemized in other sections.

PART 3 - EXECUTION

3.1 Protection

.1 Protect installed Work of other trades from staining or contamination.

3.2 Preparation of Joint Surfaces

.1 Before commencing application of sealants test materials for indications of staining or poor adhesion.
.2 Ascertain that sealers and coatings applied to sealant substrates are compatible with sealant used and that full bond between the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and bond, if necessary.
.3 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
.4 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair Work.
.5 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
.6 Ensure joint surfaces are dry and frost free.
.7 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 Backup Material

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install foam backer rod to achieve correct joint depth and shape, with approximately 30% compression.

3.5 Expanding Foam Sealants

.1 Install expanding foam sealants in accordance with manufacturer’s instructions.
.2 Coordinate installation with Work of other trades to ensure foam sealants are installed before building joints are covered.
.3 For expansion and control joints above grade in exterior walls install as secondary seal with wet caulking as primary seal.
.4 Where used as a secondary seal together with field applied wet caulking provide bond breaker tape or backer rod between foam sealant and caulking.
.5 Size preformed foam sealant to suit joint depth and width allowing for proper compression of the material.
.6 Use adhesives recommended by manufacturer, suitable for substrate and application.
.7 Install in longest possible lengths. Keep number of joints to a minimum. Join individual strips by means of scarf joint, cut at approximately 30°.

3.6 Application

.1 Sealant:
- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as Work progresses and upon completion.

.2 Curing:
- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup:
- .1 Clean adjacent surfaces immediately and leave Work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as Work progresses.
- .3 Remove masking tape after initial set of sealant.

~End~

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-[06a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

.1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-0, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide shop drawings to Contract Administrator. Indicate each type of door and frame, materials, core thickness mortises, reinforcements, arrangement of hardware, location and methods of anchors, exposed fastenings and reinforcing and finishes. Indicate detail of jamb and head, frame types.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store in a dry location, above ground to prevent corrosion. Protect by suitable means until installed. Brace and stack to prevent wracking, bending, twisting or other damage.

Replace or make good materials that become damaged or defective as directed by Contract Administrator.

Part 2 Products

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts, except:

.1 Doors: 1.2mm (18 gauge).

.2 Frames: 1.6mm (16 gauge).

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.

.2 Stiffened: face sheets insulated core.

.1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m³.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

.1 Maximum VOC limit 50 g/L to GC-03.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 99 – Painting for Minor Works. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior top caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Metallic paste filler: to manufacturer's standard.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.2 mm (18 gauge) thermally broken type construction.

.4 Interior frames: 1.2 mm (18 gauge).

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare frame for door silencers, 3 for single door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, steel stiffened, insulated core construction.

.2 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.3 Blank, reinforce, drill doors and tap for mortised, templated hardware.

.4 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.5 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.6 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.7 Manufacturer's nameplates on doors are not permitted.

2.11 HOLLOW STEEL CONSTRUCTION

.1 Form face sheets for exterior doors from 1.2 mm (18 gauge) sheet steel.

.2 Form face sheets for interior doors from 1.2 mm (18 gauge) sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.

.4 Fill voids between stiffeners of exterior doors with polyurethane core.

.5 Fill voids between stiffeners of interior doors with honeycomb core.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.

.2 Provide even margins between doors and jambs and doors and finished floor as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor: 13 mm.

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

PART 1 - GENERAL

1.1 Related Work

.1 Metal doors and frames: Section 081100.

1.2 References

.1 Canadian Steel Door and Frame Manufactures' Association (CSDFMA)

.1 Canadian Manufacturing Specification for Steel Doors and Frames.

1.3 Requirements of Industry

.1 Hardware for doors in fire separations and exit doors shall be certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Use UL or ULC approved and labeled hardware for exit doors and doors in fire separations.

1.4 Hardware List

.1 Submit vertical form hardware schedule. Indicate hardware proposed including make, model, material, function, finish and other pertinent information.

1.5 Shop Drawings

.1 Submit shop drawings at time of submittal of hardware list.

.2 Submit shop drawings for electric and electronic door hardware. List each item separately. Indicate schematic wiring diagrams, electrical service requirements, interconnection diagrams, parts lists and part numbers for each item.

1.6 Maintenance Materials

.1 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

1.7 Delivery, Storage and Handling

.1 Store finishing hardware in locked, clean, and dry area.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware. Label each package as to item. Maintain inventory list with hardware schedule.

PART 2 - PRODUCTS

2.1 Hardware Items

.1 Use one manufacturer's products only for all similar items.

2.2 Template and Reinforcing Units

.2 Supply all necessary templates, blueprints and reinforcing units to Subcontractors requiring such items for completion of their portion of the Work.

2.3 Locksets

.1 Bring in locksets from factory properly itemized as to keying and location.

.2 All locks to have 5" backset unless design of door makes this impossible. In that case, backset shall be 2-3/4" or as specified in the Hardware Schedule.

2.4 Butts

.1 Provide doors up to and including 7'-0" in height and 3'-0" in width with 1.5 pair butts. Provide doors over these sizes with two pair butts, or as specified in the Hardware Schedule.

2.5 Fastening

.1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.2 Use fasteners supplied by manufacturers with each specific hardware item only. No substitutions will be permitted.

.3 Exposed fastening devices to match material and finish of hardware.

.4 Where pull is required on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plates to cover fasteners.

.5 Include provisions for drilling push/pull plates to accept lock cylinder where both items occur on the same door.

.6 Use fasteners compatible with material through which they pass.

2.6 Keying

.1 Key all door locks under existing master key system as directed.

.2 Submit keying schedule for approval.

.3 Stamp keying code numbers cylinders.

PART 3 - INSTALLATION

3.1 Installation Instructions

.1 Furnish door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.2 Furnish manufacturers' instructions for proper installation of each hardware component.

.3 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Manufacturing Specification for Steel Doors and Frames.

3.2 Mounting Heights

.1 The following dimensions are only to be used as a general guide in the placement of hardware. Where special items are concerned, or uncertainty exists, check with the Contract Administrator before fitting.

.2 Dimensions indicated are from finish floor to centre line of item, except as noted
- .1 Knob Locksets:..... 40-5/16"
- .2 Push/Pull Plates:..... 42"

.3 Guard Bars:..... 43"
.4 Exit Device (to cross bar):..... 40-5/16"

.3 Push and pull plates: install 5" from edge of door to centre of plate, unless indicated otherwise. Where pulls are mounted back to back use #5 mounting.

3.3 Final Inspection and Certification

.4 The hardware supplier shall, upon completion of the Work, visit the job Site, check the installation of all hardware, and certify in writing to the Contract Administrator that the hardware, as specified, has been correctly installed and is in proper working order.

~End~

Part 1 GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [current edition].

.2 Maintenance Repainting Manual - [current edition].

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copy of WHMIS MSDS for products used.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store painting materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.

.4 Fire Safety Requirements:

.1 Supply 1, 9 kg, Type ABC, dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.4 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.

.2 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

.3 Additional application requirements:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Supply paint materials for paint systems from single manufacturer.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

.3 Materials in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual "Approved Product" listing.

.4 Colours:

.1 Interior existing concrete – Light Grey.

.2 Interior new plywood – Light Grey.

.3 Interior new unexposed misc. steel – Red Primer.

.4 Interior new steel doors – Dark Grey (to match existing).

.5 Exterior new steel door – Dark Grey (to match stripe on building).

.6 Submit proposed Colour Schedule to Contract Administrator for review.

.5 Mixing and tinting:

.1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations.

.2 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.6 Gloss/sheen ratings:

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish	Max. 5	Max. 10
Gloss Level 2 - Velvet	Max.10	10 to 35
Gloss Level 3 - Eggshell	10 to 25	10 to 35
Gloss Level 4 - Satin	20 to 35	min. 35
Gloss Level 5 - Semi-Gloss	35 to 70	
Gloss Level 6 - Gloss	70 to 85	
Gloss Level 7 - High Gloss	More than 85	

.2 Gloss level ratings of painted surfaces as indicated.

.7 Painting Systems:

.1 Concrete Masonry Units:

.1 EXT 4.2A – Latex, finish to match existing premium grade.

.2 Galvanized Metal:

.1 EXT 5.3B - Alkyd G5 semi-gloss finish premium grade.

.3 Shop Primed Steel:

.1 EXT 5.1D – Alkyd G5 semi-gloss finish premium grade.

.4 Plywood Paneling

.1 EXT 6.4B – Alkyd G5 semi-gloss finish premium grade.

Part 3 EXECUTION

3.1 GENERAL

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual.

3.2 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Contract Administrator damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PREPARATION

.1 Protection of in-place conditions:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Contract Administrator.

.2 Protect factory finished products and equipment.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Contract Administrator.

.3 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.

.7 Touch up of shop primers with primer as specified.

.8 Clean and roughen existing interior concrete walls using abrasive blasting (sandblasting or light brush shotblast). Sweep and pressure wash surface after blasting to remove dust and debris. Patch holes and cracks with filler. Surface should be free from moisture before application of paint.

3.4 APPLICATION

.1 Paint only after prepared surfaces have been accepted by Contract Administrator.

.2 Apply paint by brush, roller, airless sprayer. Conform to manufacturer's application recommendations.

.3 Apply coats of paint in continuous film of uniform thickness.

.1 Repaint thin spots or bare areas before next coat of paint is applied. Provide additional coats at no additional cost to the Contract.

.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.5 Sand and dust between coats to remove visible defects.

.6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.7 Mechanical/Electrical Equipment:

.1 Do not paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, unless indicated.

.2 Do not paint over nameplates.

.3 Paint both sides and edges of backboards for telephone and electrical equipment before installation.

.1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.5 CLEANING

.1 Leave Work area clean at end of each day.

.2 Place paint and primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 American National Standards Institute (ANSI)

.1 ANSI/NFPA 10-2010, Portable Fire Extinguishers.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S508-[M90(R1995)], Rating and Fire Testing of Fire Extinguishers and Class "D" Extinguishing Media.

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual.

1.5 Waste Management and Disposal

.1 Separate and recycle waste materials.

PART 2 PRODUCTS

1.1 Multi-Purpose Dry Chemical Extinguishers

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection, USCG approved with proper bracket, red powder paint finish, nameplates, rechargeable, pressure gauge, c/w wall mounting bracket.

.2 Size 4.5 kg.

.3 Acceptable product: Pyro-chem or approved equal in accordance with B7.

1.2 Extinguisher Brackets

.1 Type recommended by extinguisher manufacturer.

1.3 Identification

.1 Identify extinguishers in accordance with recommendations of NFPA 10.

.2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

PART 3 EXECUTION

1.4 Installation

.1 Install extinguishers in complete accordance with NFPA 10.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 Submittals

.1 Submittals: in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions. Identify section and paragraph number.
- .5 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual.
  - .2 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator before final inspection.
  - .3 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Colour coding chart.
  - .4 Maintenance data to include:
    - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
    - .2 Data to include schedules of tasks, frequency, tools required and task time.
  - .5 Performance data to include:
    - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
    - .2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 230593 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 1 copy of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.

.2 Make changes as required and re-submit as directed by Contract Administrator.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Keep one (1) complete set of white prints at the site during work marking changes as work progresses and as changes occur, including all addenda, change orders, site instructions, clarifications and revisions for the purpose of As-Built Drawings.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Contract Administrator for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB (Testing, Adjusting & Balancing) report.

1.3 Maintenance

.1 Furnish spare as follows:

.2 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

PART 2 PRODUCTS

2.1 Materials

.1 Not Applicable.

PART 3 EXECUTION

3.1 Painting Repairs And Restoration

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.2 Cleaning

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 Field Quality Control

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

.1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual and as-built drawings as part of instruction materials.

.1 Instruction duration time requirements as specified in appropriate sections.

.4 The City may record these demonstrations on video tape for future reference.

3.5 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.3 Electrical Equipment Manufacturers' Association Council (EEMAC)

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 Submittals

.1 Submittals: in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.3 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual.

1.3 Quality Assurance

.1 Regulatory Requirements: work to be performed in compliance with applicable Provincial regulations.

1.4 Delivery, Storage, And Handling

.1 Packing, shipping, handling and unloading:

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 GENERAL

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 Motors

.1 Provide motors for mechanical equipment as specified.

.2 Motors 373 W and under: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors over 373 W: speed as indicated, continuous duty, built-in overload protection, resilient mount, three phase, 575 V, unless otherwise specified or indicated.

2.3 Temporary Motors

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Contract Administrator for temporary use. Work will only be accepted when specified motor is installed.

2.4 Drive Guards

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm dia holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.-

.5 Guard for flexible coupling:

- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Installation

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 Field Quality Control

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 Cleaning

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

1.2 Submittals

.1 Product Data:

.2 Submittals: in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:

.1 Submit samples in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.3 Quality Assurance

.1 Quality assurance submittals: submit following in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.4 Delivery, Storage, And Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 Manufacturer's Equipment Nameplates

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 Identification Ductwork Systems

.1 50 mm high directional arrows 150 mm long x 50 mm high.

.2 Colours: black, or coordinated with base colour to ensure strong contrast.

2.3 Controls Components Identification

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Nameplates

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.3 Location Of Identification On Ductwork Systems

.1 On long straight runs in open areas:
at not more than 4 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 At least once in each small room through which ductwork passes.

.3 On both sides of visual obstruction or where run is difficult to follow.

.4 On both sides of separations such as walls, floors.

.5 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible.

.6 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.4 Cleaning

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Definitions

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 Qualifications Of Tab Personnel

.1 Submit names of personnel to perform TAB to Contract Administrator within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 Purpose Of Tab

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 Exceptions

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 Co-ordination

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

1.6 Pre-Tab Review

.1 Review contract documents before project construction is started and confirm in writing to Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contract Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 Start-Up

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 Operation Of Systems During Tab

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.9 Start Of Tab

.1 Notify Contract Administrator 3 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Application of weatherstripping, sealing, and caulking.

.2 Provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts and air shafts are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

1.10 Application Tolerances

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 5%, minus 5%.

1.11 Accuracy Tolerances

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 Instruments

.1 Prior to TAB, submit to Contract Administrator list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Contract Administrator.

1.13 Submittals

.1 Submit, prior to commencement of TAB proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 Preliminary Tab Report

.1 Submit for checking and approval of Contract Administrator, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 Tab Report

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 1 copy of TAB Report to Contract Administrator for verification and approval, in D-ring binders, complete with index tabs.

1.16 Verification

.1 Reported results subject to verification by Contract Administrator.

1.17 Settings

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time.

1.18 Completion Of Tab

.1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.19 Air Systems

.1 Standard: TAB to most stringent of TAB standards of AABC and SMACNA.

.2 Do TAB of following systems, equipment, components, controls:

.1 Supply fans with and without filters in place with adjustment using specified speed controller, if applicable.

.2 Grilles.

.3 Dampers.

.4 Louvers.

.3 Qualifications: personnel performing TAB current member in good standing of AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, louver or diffuser).

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Definitions:

.1 For purposes of this section:

.1 "EXPOSED" - means "not concealed" as previously defined.

.2 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

.3 Reference Standards:

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-07, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM C518-10, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.2 ASTM C209-10, Standard Test Methods for Cellulosic Fiber Insulating Board.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 Action And Informational Submittals

.1 Provide submittals in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.3 Quality Assurance

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.4 Delivery, Storage And Handling

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

PART 2 PRODUCTS

2.1 Fire And Smoke Rating

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 Insulation

.1 Elastomeric Nitrile-rubber foam insulation that is closed cell, flexible, and has a built-in vapour barrier with silver finish (as scheduled in PART 3 of this Section).

.2 Insulation must have a thermal conductivity of ≤ 0.034 W/(m.K) at 0°C and ≤0.036 W/(m.K) at 24°C when measured according to ASTM C177, ASTM C518 or EN ISO 8497. Insulation must have water vapour permeability of 0.13 µgm/(N.h) when measured to BS4370-2:1993.

.3 Acceptable Product: Armacell Armaflex Duct

2.3 Accessories

.1 As necessary per manufacturer’s recommendations and printed instructions.

PART 3 EXECUTION

3.1 Application

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 Pre-Installation Requirements

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, free from foreign material.

3.3 Installation

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Hangers and supports in accordance with Section 233114 - Metal Ducts - Low Pressure to 500 Pa.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

3.4 Ductwork Insulation Schedule

.1 Insulation types and thicknesses: conform to following table:

Location	Insulation	Vapour Retarder	Thickness (mm)
All ducting on main floor	Armaflex	Built-in	25

3.5 Cleaning

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM A480/A480M-10, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-09, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-09, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition 2005.

1.2 Submittals

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 PRODUCTS

2.1 Seal Classification

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C

.2 Seal classification:

.1 Class C: transverse joints and connections made air tight with tape. Longitudinal seams unsealed.

2.2 Sealant

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of -30°C to +93°C.

2.3 Tape

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 Fittings

.1 Fabrication of all fittings, elbows, branches, transitions, etc.: to SMACNA.

2.5 Duct Construction

.1 All new ducting to be aluminum, painted to match existing.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.6 Hangers and Supports

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to SMACNA.

.3 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

PART 3 EXECUTION

3.1 General

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.2 Hangers

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA

3.3 Sealing and Taping

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2006.

1.2 Submittals

.1 Submittals in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.3 Instructions: submit manufacturer's installation instructions.

.4 Closeout submittals: submit maintenance and engineering data for incorporation into manual.

PART 2 PRODUCTS

2.1 General

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 Flexible Connections

.1 Frame: galvanized sheet metal frame 75 mm thick with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at -40°C to +90°C, density of 1.3 kg/m^2.

2.3 Access Doors in Ducts

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks.

2.4 Turning Vanes

.1 Factory or shop fabricated single thickness, to recommendations of SMACNA and as indicated.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 Installation

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlet and outlet to supply air fans.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 150 x 150 mm for viewing.

.2 Locations:

.1 Control dampers.

.2 Devices requiring maintenance.

.3 Required by code.

.4 Heating coils.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locations:

.1 For traverse readings:

.1 Inlets and outlets of fan systems.

.2 Main and sub-main ducts.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 Cleaning

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

.1 Balancing dampers for mechanical forced air ventilation systems.

1.2 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Division 01 shall apply to all work in Division 23.

.3 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

.1 Performance data.

.2 Quality assurance submittals: submit following in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Contract Administrator will make available 1 copy of systems supplier's installation instructions.

.3 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.4 Delivery, Storage, and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 General

.1 Manufacture to SMACNA standards.

2.2 Manual Blast Gate (Slide) Balancing Dampers

.1 Size and configuration to recommendations of SMACNA.

.2 Locking screw for full volume control.

.3 Fabricated of same material as adjacent duct, complete with appropriate ends for round or rectangular ducting.

.4 Acceptable Product: Sheet Metal Connectors, Unitex, KB Duct or acceptable equal in accordance with B7.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Installation

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Runouts to supply grilles: install balancing damper located as close as possible to main ducts.

.4 Dampers: vibration free.

.5 Ensure damper operators are observable and accessible.

.6 Mark balanced position on blast gate damper blade with permanent marker.

3.3 Cleaning

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

.1 Performance data.

.2 Quality assurance submittals: submit following in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Contract Administrator will make available 1 copy of systems supplier's installation instructions.

.3 Closeout Submittals

.1 Provide maintenance data for incorporation into manual.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 Multi-Leaf Dampers

.1 Opposed blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded thermally broken aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Electric operator:

.1 Provide electrical actuator with spring return for "fail-safe" in normally closed position.

.2 Size operators to control dampers against maximum pressure or dynamic closing pressure, whichever is greater.

.3 Provide operators with adjustable spring and stroke. Provide adjustable external stops to limit stroke in either direction.

.6 Performance:

.1 Leakage: in closed position less than 15.2 l/s/m² of rated air flow at 250 Pa differential across damper.

.2 Pressure drop: at full open position less than 7 Pa differential across damper at 5.08 m/s.

.7 Refer schedule on drawings for size and actuator details.

.8 Acceptable materials: Tamco 9000BF or equal in accordance with B7.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Installation

.1 Install as shown on drawings.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

3.3 Cleaning

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99-2003, Standards Handbook.

.2 AMCA 300-2008, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301-2006, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.3 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210-2007, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 System Description

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, total static pressure, kW, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal.

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.3 Provide :

.1 Fan performance curves showing point of operation, kW and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.5 Quality assurance submittals: submit following in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual.

1.4 Maintenance

.1 Extra Materials:

.1 Furnish list of recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.5 Delivery, Storage, and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 Fans General

.1 Motors:

.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 For use with variable speed controllers.

.3 Sizes as indicated.

.2 Factory primed before assembly in colour standard to manufacturer.

.3 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

2.2 Centrifugal Roof Supply Fan (SF-F63)

.1 Roof mounted, filtered, belt-driven, double-width/double-inlet, forward curved, centrifugal blower type supply fan.

.2 Heavy-duty galvanized steel construction c/w permanent washable filters, filter rack,

roof curb and curb seal, duct adapter, and gravity backdraft damper.

.3 Provide industrial-grade Honeywell wall-mount cooling thermostat.

.4 Acceptable Product: Refer to HVAC Schedule on drawings.

2.3 Inline Centrifugal Supply Fan (SF-F64)

.1 Duct mounted supply fan shall be of the centrifugal, direct-driven, inline type. The fan housing shall be of a square design constructed of aluminum and shall include mounting collars with inlet and discharge arrangement and orientation suitable for the intended location as shown on the drawings.

.2 The fan wheel shall be centrifugal, backward-inclined, constructed of aluminum, and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

.3 Provide Brushless DC motor w/remote dial, hangers, and vibration isolators.

.4 Acceptable Product: Refer to HVAC Schedule on drawings.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Fan Installation

.1 Install fans as indicated, complete with vibration isolation, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Bearings and extension tubes to be easily accessible.

3.3 Cleaning

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 System Description

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.2 Quality assurance submittals: submit following in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.4 Delivery, Storage, and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.5 Maintenance

.1 Extra Materials:

.1 Provide maintenance materials.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

PART 2 PRODUCTS

2.1 General

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.3 Concealed manual volume control damper operators.

.4 Finish and colour: as directed by Contract Administrator.

2.2 Manufactured Units

.1 Grilles, louvers, and diffusers of same generic type, products of one manufacturer.

2.3 Supply Grilles

.1 Acceptable materials: As shown on drawings, or equal in accordance with B7.

2.4 Fixed Louvers - Aluminum

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: Drainable blades, 35° angle

.4 Frame, head, sill and jamb: 152 mm deep one piece extruded aluminum, minimum 2 mm thick.

.5 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, SS washer and aluminum body.

.6 Screen: 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvers in formed U-frame.

.7 Finish and Colour: Specified by Contract Administrator.

.8 Acceptable materials: E.H. Price DE635 or equal in accordance with B7.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Installation

.1 Install in accordance with manufacturer’s instructions.

.2 Install with oval head cadmium plated screws in countersunk holes where fastenings are visible.

3.3 Cleaning

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.18- M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.

.3 Underwriters' Laboratories of Canada

.1 ULC -S111- 07, "Fire Tests for Air Filter Units".

.4 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 Shop Drawings and Product Data

.1 Submit shop drawing and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 Closeout Submittals

.1 Provide maintenance data for incorporation into manual.

1.4 Maintenance Materials

.1 Provide maintenance materials.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

1.5 Extra Materials

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Contract Administrator, supply 1 complete set of filters for each filter unit or filter bank.

PART 2 PRODUCTS

2.1 General

.1 Media: suitable for air at 100% RH and air temperatures between -40 and +50°C.

2.2 Accessories

.1 Holding frames: permanent channel section construction of extruded aluminum, 1.6 mm thick, except where specified otherwise.

.2 Seals: to ensure leakproof operation.

2.3 Cotton Panel Filters

.1 Disposable pleated reinforced cotton dry media.

.2 Holding frame: galvanized steel, or slide-in channel for side or bottom access.

.3 Performance: MERV 8 to ASHRAE 52.2

.4 Nominal thickness:

.1 Size to ensure airflows shown on drawing can be maintained up to end of filter lifespan

.5 UL -900 listed.

.6 Acceptable product: Dafco Aerostar or equal in accordance with B7.

.7 Refer to drawings and schedule for specific individual filter requirements.

PART 3 EXECUTION

3.1 Installation General

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

3.2 Replacement Media

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.46, Electric Air-Heaters.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 Shop Drawings and Product Data

.1 Submit shop drawing and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit product data and include:
.1 Element support details.
.2 Heater: total kW rating, voltage, phase.
.3 Number of stages.
.4 Rating of stage: rating, voltage, phase.
.5 Heater element watt/density and maximum sheath temperature.
.6 Maximum discharge temperature.
.7 Physical size.
.8 Unit support.
.9 Clearance from combustible materials.
.10 Internal components wiring diagrams.
.11 Minimum operating airflow.
.12 Pressure drop at operating airflow.

PART 2 PRODUCTS

2.1 Electric Duct Heaters

.1 Flanged type, CSA certified according to CSA standard C22.2 No. 155 and UL 1996. Electric heaters shall be manufactured and approved for zero clearance for all combustible materials.

.2 Heater frames shall be made of galvanized steel, assembled with rivets – no welding allowed. The control panel shall have pre-punched flanges for easy field installation and rounded corners therefore preventing sharp edges.

.3 Heating elements shall be open coil, grade C nickel chrome alloy supported by ceramic bushings in an enclosed frame design.

.4 Electric heaters shall be provided with a SCR modulating heating output controller. The controller shall stop the electric heater when there is no airflow.

.5 Furnish duct heaters with magnetic contactors, automatic and manual thermal cutouts, airflow switch, transformer with secondary fuse, internal wiring and disconnects, duct thermostat, and round collar adapter for direct mounting to round ducting.

.6 All the controls shall be integrated and pre-wired within a NEMA-1 control panel which

will include a removable, hinged door to provide easy access.

.7 Acceptable product and performance: Refer to schedule on mechanical drawings or approved equal in accordance with B7.

PART 3 EXECUTION

3.1 Installation General

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

.2 Make power and control connections to CSA C22.2 No.46.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests in presence of Authority having Jurisdiction.

.1 Provide test report and include copy with Operations and Maintenance Manuals.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.46-M1988, Electric Air-Heaters.

1.3 PRODUCT DATA

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit product data sheets for unit heaters. Include:

.1 Product characteristics.

.2 Performance criteria.

.3 Mounting methods.

.4 Physical size.

.5 kW rating, voltage, phase.

.6 Cabinet material thicknesses.

.7 Limitations.

.8 Colour and finish.

.3 Submit product data sheets for unit and baseboard heaters.

.1 Include product characteristics, performance criteria, physical size, limitations and finish.

.4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

Part 2 Products

2.1 UNIT HEATERS

.1 Unit heater: CSA listed washdown unit heater, corrosion resistant.

.2 Fan type unit heaters with built-in high-heat limit protection, fan-delay switches.

.3 Fan motor: totally enclosed][permanently lubricated ball bearing type with resilient mount.

.1 Built-in fan motor thermal overload protection.

.4 Hangers: as required.

.5 Controls enclosed in a NEMA 4X enclosure

.6 Elements: tubular stainless steel with aluminum fins.

.7 Cabinet: stainless steel.

2.2 UNIT HEATER CONTROLS

.1 Wall mounted thermostats: type: low voltage.

Part 3 Execution

3.1 INSTALLATION

.1 Suspend unit heaters from ceiling or mount on wall as indicated.

.2 Install thermostats in locations as indicated in mechanical drawings.

.3 Make power and control connections.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Section Includes:

.1 General requirements for Control Systems that are common to NMS Control Sections.

.2 Related Sections:

.1 Section 25 05 54 - Controls: Identification.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.4 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

1.3 System Description

.1 The controls shall include but not be limited to:

.1 All Variable Frequence Drives
.2 All Reduced Voltage Starters
.3 Any electrical monitoring devices or protective relays (ex: Phase Voltage Monitor)
.4 Any PLC or SCADA hardware

1.4 Scope of Control Work

.1 The Contractor shall engage a factory trained representative to supervise the installation, setup, calibrate and operationally verify and commission the following:

.1 All Variable Frequence Drives
.2 All Reduced Voltage Starters
.3 Any SCADA RTU systems

.2 The Contactor shall provide a certified instrument technician in order to operate all field devices that are wired to the SCADA in order for City of Winnipeg staff to verify loop is correctly wired to the SCADA.

.3 The Contractor shall submit written reports identifying the commissioning work, together with any parameter settings and final adjustments.

.4 The Contractor is only responsible for termination to the terminals within the SCADA cabinet and internal wiring.

1.5 Submittals

.1 Make submittals in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit for review:

.1 Equipment list and systems manufacturers 10 days after award of contract.

PART 2 - PRODUCTS

.1 Not Used

PART 3 - EXECUTION

3.1 Manufacturer's Recommendations

.1 Installation: to manufacturer's recommendations.

3.2 Painting

.1 Painting: as follows:

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.

.3 Clean and prime exposed hangers, racks, fastenings, and other support components.

.4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

~End~

PART 1 - GENERAL

1.1 Summary

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, the Control System Work and nameplates materials, colours and lettering sizes.

.2 Related Sections.

.1 Section 25 05 01 - Controls: General Requirements.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1-06, The Canadian Electrical Code, Part I (20th Edition), Safety Standard for Electrical Installations.

1.3 Definitions

.1 For acronyms and definitions refer to Section 25 05 01 - Controls: General Requirements.

1.4 System Description

.1 Language Operating Requirements: provide identification for control items in English.

1.5 Submittals

.1 Submittals in accordance with The General Conditions for Construction (Revision 2006 12 15) supplemented and modified by requirements of this Section.

.2 Submit to Contract Administrator for approval samples of nameplates, identification tags and list of proposed wording.

PART 2 - PRODUCTS

2.1 Nameplates for Panels

.1 Provide panel identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for each panel size 4 engraved as indicated.

.3 Nameplate for each panel mounted device size 2 engraved as indicated.

2.2 Nameplates for Field Devices

.1 Provide field device identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for field device size 7 engraved as indicated.

.3 Nameplate shall be attached by chain.

2.3 Wiring

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each control panel.

PART 3 - EXECUTION

3.1 Nameplates and Labels

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 Existing Panels

.1 Correct existing nameplates and legends to reflect changes made during Work.

~End~

PART 1 - GENERAL

1.1 Summary

.1 Section Includes:

.1 Control processors integral to the Control System: SCADA system, displays, HMI interface.

.2 Related Sections:

.1 Section 25 05 01 - Controls: General Requirements.

.2 Section 25 05 54 - Controls: Identification.

.3 Section 26 05 01 - Common Work Results - Electrical.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.5 Section 26 27 26 - Wiring Devices.

.6 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7-1993 (R1999), Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Canadian Standards Association (CSA International).

.1 CSA-C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

1.3 Definitions

.1 Acronyms and Definitions: refer to Section 25 05 01 - Controls: General Requirements.

1.4 Submittals

.1 Submit shop drawings and manufacturer's installation instructions in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Pre-Installation Tests.

.1 Test all I/O points, components and wiring within the RTU control panel prior to shipment from control panel manufacturer. Replace devices not meeting specified performance.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

PART 2 - PRODUCTS

2.1 General

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: 0 - 32 degrees C with 10 - 90 % RH (non-condensing) unless otherwise specified. Provide control panel environmental controls as required.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Control panel equipment to be unaffected by external transmitters including walkie talkies.

.6 Control Panel to be constructed in a CSA approved shop.

2.2 Process Controller

.1 Process Controller Requirements:

- .1 32 bit controller
- .2 32 MHz clock & integrated watchdog timer
- .3 16MB flash ROM, 4MB CMOS RAM, 4kB EEPROM
- .4 Analog inputs - five (5) selectable as 0-10VDC or 0-20mA with removable terminal blocks
- .5 Analog output – none
- .6 Discrete inputs/outputs – 8 user selectable as dry contact inputs or open drain outputs, with removable terminal blocks
- .7 Communication ports:
  - .1 Three (3) RS-232/485 serial ports,
  - .2 One (1) RJ-45 10/100Base-T Ethernet port
  - .3 Two (2) USB 2.0 compliant ports
- .8 Power supply – 11 – 30 VDC, 12W at 24VDC maximum
- .9 Three (3) year warranty

.2 Additional I/O Board:

- .1 Analog inputs - eight (8) selectable as 0-10VDC or 0-20mA with removable terminal blocks
- .2 Analog output – two (2) at 0-20mA with removable terminal blocks
- .3 Discrete inputs – 32 at 12/24VDC, with removable terminal blocks
- .4 Discrete outputs – 16 dry contact relay outputs, with removable terminal blocks
- .5 Additional I/O board as required

Approved Manufacture; Schneider Electric model TBUP357-1-A-2-0-A-B-1-0. No alternates will be accepted.

.3 Programming to be provided by the City. Contractor to coordinate all SCADA communication I/O points with City of Winnipeg.

2.3 Level Display

.1 Level display to act as backup to the process controller and provide pump control based on water level.

.2 Requirements:

.1 Dual line 6 digit programmable display and function keys
.2 Front display and keypad to be rated NEMA 4X, IP65
.3 One (1) 4-20mA input
.4 Four (4) relay outputs
.5 12/24VDC input power
.6 Alarm status indicators

Approved Manufacturer; Precision Digital model PD6000-7R4

2.4 HMI Display

.1 Display to provide operator interface to view status and alarms of lift station.

.2 Requirements:

.1 Backlit colour LCD touchscreen panel
.2 Display size 12.1 inch
.3 Analogue touchscreen panel with 65536 colour and 800 x 600 pixels SVGA
.4 Processor frequency 266MHz
.5 Built-in real time clock
.6 Application memory flash EPROM 32 MB
.7 Data backup SRAM 512kB with lithium battery
.8 Communication ports:
.1 Two (2) USB type A ports
.2 One (1) RS-232/422/485 through SUB-D 9 port
.3 One (1) RS-485 through RJ45 port
.4 One (1) Ethernet TCP/IP through RJ45 port
.9 30W, 24VDC power supply
.10 Flush mounting rated NEMA 12

Approved Manufacturer; Schneider Electric model Magelis Advanced Panel XBTGT6330.

2.5 Ultrasonic Transducer Remote controller:

.1 Remote controller for ultrasonic level transducer should be capable of:

.1 Single or dual point level monitoring,
.2 Auto false echo suppression for fixed obstruction avoidance,
.3 Panel mount,
.4 Differential amplifier transceiver for common mode noise reduction and improve signal to noise ratio,
.5 Power supply: AC (100 to 230V AC, 60Hz),
.6 Outputs: 4-20 mA,
.7 Safety Approvals: FM/CSA Class 1 Div. 2,

.8 Display Option: Local Operator Interface (LOI)

.9 Approved product; Siemens Milltronic MultiRanger 100/200.

2.6 Surge Protection Device

.2 Maximum rated surge current – 20kA per phase

.3 Rated applications – ANSI-IEEE C62.41 Location C, B & A

.4 Fail safe design with dual component-level fusing

.5 ET recognized component under UL 1449 3rd Edition as a type 4 SPD

.6 Input frequency - 47 to 64 Hz

.7 Maximum continuous operating current – 15 amps

.8 Modes of protection – L-N, L-G, N-G

.9 Status indicating light

.10 Short circuit rating – 100kAIC short circuit current rating with a 15 amp Class T fuse

.11 Din-Rail mounted or screw down

.12 Acceptable material – Total Protection Solutions model LoadTrack LT-15A

2.7 UPS and Power Supply

.1 Combined power supply unit with UPS power backup

.2 120VAC input

.3 24VDC output, capable of delivering 2 amps for a duration of one hour with utility power failure

.4 Din-Rail mounted

.5 Acceptable material – Phoenix Contact model TRIO-PS/1AC/24DC/5

2.8 Loop Isolators and Splitters

.1 2 Channel Loop Isolator

.1 2 x 4-20 mA input channels

.2 2 x 4-20 mA output channels

.3 Operating power drawn from the loop on the output side (loop powered).

.4 Acceptable material – Moore Industries MiniMoore MIX/2XPRG/2x4-20MA/12-42DC DIN

.2 4 Channel Loop Isolator

.1 4 x 4-20 mA input channels

.2 4 x 4-20 mA output channels

.3 Operating power drawn from the loop on the output side (loop powered).

.4 Acceptable material – Moore Industries MiniMoore MIX/4x4-20MA/4x4-20MA/12-42DC DIN

.3 Loop Splitter

.1 2 x 4-20 mA input channels

.2 4 x 4-20 mA output channels

.3 Power: 24 VDC

.4 Acceptable material – Moore Industries MiniMoore MIT/2XPRG/2x4-20mA/U DIN

2.9 Panels

.1 Free-standing or wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Contract Administrator without adding additional cabinets.

.3 Panels to be lockable with same key.

PART 3 - EXECUTION

3.1 Installation

.1 Control panel to be manufactured within a CSA approved facility.

.2 Provide terminal blocks and wireways within control panel as required.

.3 Install panel in location as indicated on drawings.

.4 Connect all field wiring to control panel and terminate.

.5 Power to be applied to control panel after installation of panel is complete and all field wiring has been terminated and verified.

.6 Provide all configuration for all components as required. Any and all custom objects or applications that have been used in the development of the programs for all devices shall have full source code turned over to the City. There shall be no custom objects that are locked preventing the City from modifying the object and/or application. No intellectual property rights on the programs, objects or applications are permitted. City to have full access to all aspects of programs, objects and applications. Provide a hard copy of all files to be included within the O&M manuals.

3.2 Testing and Commissioning

.1 Calibrate and test control panel devices for accuracy and performance.

.2 Verify control system operates as specified in control narrative.

.3 Contractor shall arrange factory acceptance testing for control panels at panel shop. Contract Administrator will co-ordinate with the City for representatives to be present.

~End~

PART 1 - GENERAL

1.1 Summary

.1 Scope

.1 ADS Flowshark Pulse modules shall be supplied by the City of Winnipeg and installed by the Contractor.

.2 Section Includes:

.1 Instrumentation devices integral to the Control System: transmitters, sensors, controls, meters, switches, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

.2 Related Sections:

.1 Section 25 05 01 - Controls: General Requirements.

.2 Section 25 05 54 - Controls: Identification.

.3 Section 26 05 01 - Common Work Results - Electrical.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.5 Section 26 27 26 - Wiring Devices.

.6 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 American National Standards Institute (ANSI).

.1 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Canadian Standards Association (CSA International).

.1 CSA-C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.3 Definitions

.1 Acronyms and Definitions: refer to Section 25 05 01 - Controls: General Requirements.

1.4 Submittals

.1 Submit shop drawings and manufacturer's installation instructions in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Pre-Installation Tests.

.1 Submit samples at random from equipment shipped, as requested by Contract Administrator, for testing before installation. Replace devices not meeting specified performance and accuracy.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

PART 2 - PRODUCTS

2.1 General

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.

.3 Operating conditions: 0 - 32 degrees C with 10 - 90 % RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

2.2 Ultrasonic transducer

1. Contractor to supply and install the Ultrasonic transducer as indicated in the drawing.

2.3 Current Transformers

.1 Requirements:

.1 Current transformer ratio should be as indicated on the drawing.

.2 Current transformers should be in accordance to ANSI/ IEEE C57.13.

2.4 Panels

.1 Free-standing or wall mounted enamelled steel cabinets with hinged and key-locked front door as indicated on drawings.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Contract Administrator without adding additional cabinets.

.3 Panels to be lockable with same key.

2.5 Wiring

.1 Should be in accordance with Section 26 27 26 - Wiring Devices.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:

.1 Field wiring to digital device: #14 AWG TECK 90 Cu or RW90 Cu in conduit in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Analog input and output: shielded #18 minimum stranded twisted pair ACIC Cu.

2.6 Flow Monitors

.1 ADS FlowShark Pulse modules to be connected to existing flow meters. Modules shall be mounted, calibrated, wired to RTU and commissioned by SFE Global. Contact information is:

Nick Schellenberg

Telephone: 204-654-2713

E-mail: Nick.Schellenberg@sfeglobal.com

PART 3 - EXECUTION

3.1 Installation

.1 Instrument components are not specifically located on drawings, but located on drawings in the general vicinity. The instrument components shall be field located as defined by mechanical piping and in accordance with the following:

.1 Instrument components shall not be attached to vibrating equipment, but shall be remotely mounted to a solid structure or on approved instrument mounting stands.

.2 Location of instruments, when shown on the drawings, is only approximate. The Contractor is responsible for actual location of field devices and must avoid interferences between conduit, pipes, equipment and instruments while providing maximum accessibility.

.3 Locate instruments components at eye level and in an easily accessible location.

.4 Instrument components that must be removed for servicing shall be installed with re-usable connectors, unions and flexible conduit.

.5 Electrical connections and terminations for field instruments and other field devices shall be in strict compliance with the manufacturer’s instructions and loop drawings. This will include wire, wire termination, labelling, rigid and flexible conduit, fittings, and seals where required.

.2 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.3 Support field-mounted panels, transmitters and sensors on wall or pipe stands with approved mounting brackets or stands at a nominal height of 1.4 meters off the floor.

.4 For instruments with pre-terminated cable lengths provide a junction box as close as practical to connect with armoured cable or cable in conduit.

.5 Allow for a variation of 3 meters from locations of devices as shown on drawings without extra cost provided pertinent information is provided prior to installation. Exact location will be determined by the installation of piping and mechanical equipment.

.6 Threaded fastenings for mounting instrument components shall have either lock nuts or double nuts.

.7 Cover locally mounted instrument components, after installation, with plastic bags to protect them from dust, dirt, paint spray, insulation materials, etc. Protect from mechanical damage.

.8 Field instruments located outdoors shall be winterized to prevent process or measurement fluids from freezing.

.9 All instrument signal wiring and 120 Vac wiring shall be run by the Contractor from the field instrument to the field device as shown on the loop drawings. This includes wiring, rigid and flexible conduit, fittings and seals where shown. Conduit penetrations are not permitted into the top of any field junction box.

.10 Electrical:

.1 Provide and route all instruments, power and control signal cabling.

.2 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Refer to electrical control schematics included as part of control design schematics on drawings. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Contract Administrator before beginning Work.

.4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.5 Install communication wiring in conduit.

.1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.6 Install conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 Instrument Supports

.1 Clean and paint fabricated galvanized carbon steel mounting stands and brackets.

.2 Before a mounting stand is attached to a concrete floor the surface of the concrete to be in contact with grout shall be roughed and cleaned of all dirt, oil, grease and loose material.

3.3 Panels

.1 Arrange for conduit and tubing entry from bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 Calibration Tagging

.1 When satisfactorily inspected and calibrated, the item shall have a tag affixed to it in an immediately visible location, which shall indicate that the device has been calibrated, by whom and the date of the calibration. Calibration procedures and records shall be available to the Contract Administrator throughout the course of the project and shall be delivered to the Contract Administrator upon the completion of work.

3.5 Identification

.1 All field-mounted instrument items shall have an approved identification tag permanently attached by the Contractor upon completion of the initial inspection and calibration. This tag shall reflect the device's identification as shown on the appropriate drawing.

.2 The tag will be permanently attached to the instrument with screws, rivets, or stainless steel or Monel wire, as appropriate. If an instrument is inside a protective enclosure or mounted behind a panel, instrument identity tags shall be mounted twice, once on the instrument and again on the enclosure. All instruments mounted on a control panel shall have an identity tag mounted on the instrument body and again on the face of the panel below the instrument face.

.3 Identify field devices in accordance with Section 25 05 54 - Controls: Identification.

3.6 Testing and Commissioning

.1 Calibrate and test field devices for accuracy and performance.

~End~

PART 1 - GENERAL

1.1 Related Sections

.1 This section covers items common to sections of Division 26.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83 (R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.2 EEMAC Y1-1-1955, Equipment Green Colour for Outdoor Electrical Equipment.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 Definitions

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 Design Requirements

.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.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.5 Submittals

.1 Submittals: in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit for review single line electrical diagrams and locate under plexiglass as indicated.

.1 Electrical distribution system in electrical room.

.3 Shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Provinces of Manitoba, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.

.6 If changes are required, notify Contract Administrator of these changes before they are made.

.4 Quality Control in accordance The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

.5 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

.6 Commissioning Plan: Submit to Contract administrator, the proposed plan for testing all new devices and I/O over a period of one complete week with the Contract Administrator and the City. Plan shall include required pre-commissioning tests and forms for verification of products on site.

.7 Protective device and cable length information for Arc-Flash Hazard Analysis. The Contractor shall supply all required details for the lengths of cables and detailed operational information about protective devices for the Contract Administrator to aquire an Arc-Flash Hazard Analysis. This information must be submitted to the Contract Administrator within three weeks of award of contract.

1.6 Quality Assurance

.1 Quality Assurance in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.7 Delivery, Storage and Handling

.1 Material Delivery Schedule: provide Contract Administrator with schedule within 2 weeks after award of Contract.

1.8 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Contract Administrator.

.4 Fold up metal banding, flatten and place in designated area for recycling.

.5 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.6 Place materials defined as hazardous or toxic waste in designated containers.

.7 Ensure emptied containers are sealed and stored safely for disposal away from children.

.8 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Do not dispose of preservative treated wood through incineration.

.10 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.11 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Contract Administrator.

1.9 Care, Operation and Start-up

.1 Instruct Contract Administrator in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.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 aspects of its care and operation.

1.10 Operating and Maintenance Manuals

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Service instructions: Including a list of spare parts and replacement parts and the names and addresses of all suppliers.

.3 Maintenance instructions: Including start up, proper adjustment, lubrication and shutdown procedures.

.4 Installation instructions.

.5 Operating instructions.

.6 Safety precautions.

.7 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

PART 2- PRODUCTS

2.1 Materials And Equipment

.1 Provide material and equipment.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from Electrical Inspections Department before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.2 Electric Motors, Equipment And Controls

.1 Provide all power and control wiring and connections including mechanical control wiring as specified on mechanical and electrical drawings.

.2 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.3 Control wiring and conduit: in accordance with Section 250501 - Controls: General Requirements except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

.4 Supply and install all unit heaters in accordance with specification 238240 Unit Heaters - Electric

2.3 Warning Signs

.1 Warning Signs: in accordance with requirements of Electrical Inspection Department and Contract Administrator.

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

2.4 Wiring Terminations

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 Equipment Identification

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

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

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

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

.6 Identify equipment with Size 3 labels engraved with equipment tag.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.6 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, using Electrovert Type Z cable markers (or equal in accordance with B7), on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 Use number coded wires in control cables, matched throughout system. Identify conductors with permanent indelible identifying markings, numbered on both ends.

.6 Use number coded pairs in instrument cables, matched throughout system. Pairs shall also be colour coded black and white for polarity indication. Identify conductor pairs with permanent identifying markings at both ends.

2.7 Cable Identification

.1 Identifiable with permanent indelible identifying markings, using Brady PermaSleeves Cable Markers (or equal in accordance with B7).

.2 Cable Tags shall have letter sizes of 4mm or greater and shall be impressed within the cable.

.3 Tags shall be permanently mounted to all cables entering or leaving and enclosure.

.4 Cable tags shall be reviewed with the Contract Administrator prior to purchase and attachment.

2.8 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 outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.

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

2.9 Electrical Single Line Diagrams

.1 Provide electrical single line diagrams under Plexiglas as follows:

.1 Electrical distribution system: locate in main electrical room

.2 Drawings: 280 x 432 mm minimum size.

PART 3- EXECUTION

3.1 Installation

.1 Do complete installation in accordance with the current edition of the Canadian Electrical Code, CSA C22.1, except where specified otherwise.

.2 Do overhead and underground systems in accordance with the current edition of CSA C22.3 No.1 except where specified otherwise.

.3 Perform all work in accordance with local codes and bylaws.

3.2 Nameplates and Labels

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 Conduit and Cable Installation

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: PVC, sized for free passage of conduit, and protruding 50 mm.

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

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

3.4 Location of Outlets

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings, and as shown on the drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 Mounting Heights

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: 1500 mm.

.6 Fire alarm stations: 1500 mm.

.7 Fire alarm bells: 2100 mm.

.8 Wall mounted speakers: 2100 mm.

3.6 Co-ordination of Protective Devices

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 Field Quality Control

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct and pay for the following tests in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Point to point wire continuity test for all conductors.

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

.3 Circuits originating from branch distribution panels.

.4 Lighting and its control.

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

.6 Systems: fire alarm system and communications.

.7 Test resistance to ground of the completed grounding electrode.

.8 Insulation resistance testing:

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

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

.3 Check resistance to ground before energizing.

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

.4 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.5 Submit test results for Contract Administrator’s review.

3.8 Cleaning

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

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

3.9 As-Built Drawings

.1 The Contractor shall maintain As-Built Drawings on site at all times, As-Built Drawings shall be always kept up to date.

.2 The Contractor shall turn over AutoCAD based As-Built Drawings at the end of the project for the Contract Administrator to review in accordance with the City requirements.

3.10 Commissioning

.1 The Contractor shall provide a commissioning plan and assistance during the week of commissioning the plant. Final commissioning will be coordinated with the Contract Administrator.

.2 A factory representative shall be provided for commissioning all reduced voltage starters.

3.11 Training

.1 The Contractor shall provide two one day sessions for each site for orientation and training of City staff members to the new facilities.

~End~

PART 1– GENERAL

1.1 Section Includes

.1 Materials and installation for wire and box connectors.

1.2 References

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No.65-93 (R1999), Wire Connectors.

PART 2- PRODUCTS

2.1 Materials

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable and flexible conduit as required to: CAN/CSA-C22.2 No.18.

PART 3- EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

~End~

PART 1 - GENERAL

1.1 Related Sections

.1 Section 26 05 20 – Wire and Box Connectors 0 - 1000 V.

.2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.3 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89 (R1994), Type TECK 90 Cable.

1.3 Product Data

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.3 Contractor should verify that the voltage drop is in accordance to the latest CEC 8-102.

2.2 1 kV TECK90 Power Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (#12 AWG minimum where not indicated)

.3 Contractor should verify that the voltage drop form the branch circuit to the field instrument is in accordance to the latest CEC 8-102 (voltage drop should be less than 3 %).

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

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

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.3 600 V TECK90 Control Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (#14 AWG minimum where not indicated)

.3 Contractor should verify that the voltage drop form the branch circuit to the field instrument is in accordance to the latest CEC 8-102 (voltage drop should be less than 3 %).

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

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

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.4 300 V Instrument Cable – Armoured

.1 Conductors: #16 AWG, 7 strands concentric lay, Class B tinned copper, twisted pairs/triads.

.2 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.3 Twisted pairs/triads cabled with staggered lays.

.4 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.7 Fastenings:

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

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.5 Type RW90 Conductor

.1 In accordance with CSA C22.2 No.38

.2 Circuit conductors shall be concentric stranded soft copper, size as indicated (#12 AWG minimum where not indicated).

.3 Insulation to be chemically cross-lined thermosetting polyethylene rated type RW90 XLP, 600V

.4 Suitable for installation in temperatures down to minus 40 °C.

.5 90 °C conductor operating temperature.

2.6 Type TEW Conductor

.1 Circuit conductors shall be stranded soft copper, as per ASTM B-3 and B-8.

.2 Insulation to be thermoplastic compound meeting the requirements of Canadian Standards Association Type TEW, per CSA 22.2 Part 1, No.127.

.3 Insulation rated to 600 Volts.

.4 Suitable for installation in temperatures down to minus 40 °C

.5 105 °C conductor operating temperature.

.6 Use #16 AWG for PLC cabinet internal wiring.

2.7 Wiring Identification

.1 Provide wiring identification in accordance with Section 26 05 01 – Common Work Results – Electrical.

2.8 Cable Identification

.1 Provide wiring identification in accordance with Section 26 05 01 – Common Work Results – Electrical.

.2 Provide cable tags for each of the cables listed in the cable schedules in Part 4. For each cable, use the cable tag text provided in the cable schedules.

PART 3– EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 Installation of TECK Cable 0 - 1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Where multiple cables are installed in parallel, install cable tray for support.

.3 Provide a cable tray for transfer of cables from the electrical room to the main area of the plant.

.4 Provide a resealable fire separation, Roxtec or equivalent in accordance with B7, for cable penetrations through wall.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors 0 - 1000 V.

3.3 Installation of Armoured Cables

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors 0 - 1000 V.

3.4 Installation of Control Cables

.1 Install control cables in conduit.

.2 Ground control cable shield.

PART 4– CABLE SCHEDULES

4.1 General

.1 The cable schedules given herein list all major cable runs and are not an exhaustive list of all required cables. The contractor is responsible for supplying and installing all cables required to complete a fully functional electrical system.

4.2 Cable Schedules

DUMOULIN FLOOD PUMPING STATION (0139F) - CABLE SCHEDULE							
CABLE TAG	**CABLE TYPE**	**FROM**	**TO**	**LENGTH (m)**	**ROUTING**	**NOTES**	**REV.**
C-F72-A	2-3C, 250 kcmil, TECK90, 1000V	DP-F70	MCC-F72	TBD			0
C-F72-B	2-3C, 250 kcmil, TECK90, 1000V	GENERATOR HOOK-UP JUNCTION BOX JB-F71	MCC-F72	TBD			0
C-F01-1	1-3C, 500 kcmil, TECK90, 1000V	STARTER MS-F01 IN MCC-F72	PUMP DISCONNECT SWITCH DS-F01	TBD			0
C-F02-1	1-3C, 2/0 AWG, TECK90, 1000V	STARTER MS-F02 IN MCC-F72	PUMP DISCONNECT SWITCH DS-F02	TBD			0
C-F01-2	1-3C, 500 kcmil, TECK90, 1000V	PUMP DISCONNECT SWITCH DS-F01	FLOOD PUMP P-F01	TBD			0
C-F02-2	1-3C, 2/0 AWG, TECK90, 1000V	PUMP DISCONNECT SWITCH DS-F02	FLOOD PUMP P-F02	TBD			0
C-F73-1	1-2C, 6 AWG, TECK90, 1000V	MCC-F72	TRANSFORMER XFMR F73	TBD			0
C-F73-2	1-3C, 3 AWG, TECK90, 600V	TRANSFORMER XFMR F73	PANEL PNL-F73	TBD			0
C-F74	1-3C, 6 AWG, TECK90, 1000V	MCC-F72	60A WELDING RECEPTACLE RCPT-F74	TBD			0
C-F60-1	1-3C, 12 AWG, TECK90, 1000V	MCC-F72	DISCONNECT SWITCH DS-F60	TBD			0
C-F61-1	1-3C, 12 AWG, TECK90, 1000V	MCC-F72	DISCONNECT SWITCH DS-F61	TBD			0
C-F62-1	1-3C, 12 AWG, TECK90, 1000V	MCC-F72	DISCONNECT SWITCH DS-F62	TBD			0
C-F63-1	1-3C, 12 AWG, TECK90, 1000V	VFD-F63 IN MCC-F72	DISCONNECT SWITCH DS-F63	TBD			0
C-F64-1	1-3C, 8 AWG, TECK90, 1000V	MCC-F72	DISCONNECT SWITCH DS-F64	TBD			0
C-F65-1	1-3C, 12 AWG, TECK90, 1000V	MCC-F72	DISCONNECT SWITCH DS-F65	TBD			0
C-F66-1	1-3C, 12 AWG, TECK90, 1000V	MCC-F72	DISCONNECT SWITCH DS-F66	TBD			0
C-F60-2	1-3C, 12 AWG, TECK90, 1000V	DISCONNECT SWITCH DS-F60	UNIT HEATER UH-F60	TBD			0
C-F61-2	1-3C, 12 AWG, TECK90, 1000V	DISCONNECT SWITCH DS-F61	UNIT HEATER UH-F61	TBD			0
C-F62-2	1-3C, 12 AWG, TECK90, 1000V	DISCONNECT SWITCH DS-F62	UNIT HEATER UH-F62	TBD			0
C-F63-2	1-3C, 12 AWG, TECK90, 1000V	DISCONNECT SWITCH DS-F63	SUPPLY FAN SF-F63	TBD			0
C-F64-2	1-3C, 8 AWG, TECK90, 1000V	DISCONNECT SWITCH DS-F64	DUCT HEATER HCE-F64	TBD			0
C-F65-2	1-3C, 12 AWG, TECK90, 1000V	DISCONNECT SWITCH DS-F65	UNIT HEATER UH-F65	TBD			0
C-F66-2	1-3C, 12 AWG, TECK90, 1000V	DISCONNECT SWITCH DS-F66	UNIT HEATER UH-F66	TBD			0
C-L01-1	1-3C, 8 AWG, TECK90, 1000V	PUMP P-L01 STARTER IN MCC-F72	PUMP DISCONNECT SWITCH DS-L01	TBD			0
C-L02-1	1-3C, 8 AWG, TECK90, 1000V	PUMP P-L02 STARTER IN MCC-F72	PUMP DISCONNECT SWITCH DS-L02	TBD			0
C-L01-2	1-3C, 8 AWG, TECK90, 1000V	PUMP DISCONNECT SWITCH DS-L01	SEWAGE LIFT PUMP P-L01	TBD			0
C-L02-2	1-3C, 8 AWG, TECK90, 1000V	PUMP DISCONNECT SWITCH DS-L02	SEWAGE LIFT PUMP P-L02	TBD			0
C-F73-1	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	LIGHTS	TBD			0
C-F73-2	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	LIGHTS	TBD			0
C-F73-3	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	LIGHTS	TBD			0
C-F73-4	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	LIGTHS	TBD			0
C-F73-5	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	SUMP (FLOOD) RECEPTACLE	TBD			0
C-F73-6	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	INTERCOM PLUG	TBD			0
C-F73-7, 9	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	20 AMP RECEPTACLE	TBD			0
C-F73-8	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	PLUG (SUMP/FLOOD)	TBD			0
C-F73-10	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	OUTSIDE RECEPTACLE	TBD			0
C-F73-11	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	SF-F64	TBD			0
C-F73-12	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	SUMP PUMP RECEPTACLE	TBD			0
C-F73-13	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	RTU PANEL	TBD			0
C-F73-14	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	RECEPTACLE (COMM. CHAMBER ACCESS)	TBD			0

C-F73-15	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	CSO TERMINATION PANEL	TBD			0
C-F73-16	1-2C, 12 AWG, TECK90, 600V	PANEL PNL-F73	MOTORIZED DAMPER RELAY MD-F63.EC	TBD			0
CA-F72	1-2C, 14 AWG, TECK90, 600V	VOLTAGE MONITOR EAF-F72 IN MCC-F72	RTU PANEL RTU-F80	TBD			0
CA-F80-1	1-2C, 14 AWG, TECK90, 600V	RTU PANEL RTU-F80	STARTER MS-F01 IN MCC-F72	TBD			0
CA-F80-2	1-2C, 14 AWG, TECK90, 600V	RTU PANEL RTU-F80	STARTER MS-F02 IN MCC-F72	TBD			0
CA-F01-1	1-26C, 14 AWG, TECK90, 600V	STARTER MS-F01 IN MCC-F72	RTU PANEL RTU-F80	TBD			0
CA-F01-2	1-1PR, 18 AWG, ACIC, 600V	STARTER MS-F01 IN MCC-F72	RTU PANEL RTU-F80	TBD			0
CA-F01-3	1-2C, 14 AWG, TECK90, 600V	PUMP DISCONNECT SWITCH DS-F01	RTU PANEL RTU-F80	TBD			0
CA-F01-4	1-2C, 14 AWG, TECK90, 600V	STARTER MS-F01 IN MCC-F72	PUMP DISCONNECT SWITCH DS-F01	TBD			0
CA-F01-5	1-2C, 14 AWG, TECK90, 600V	STARTER MS-F01 IN MCC-F72	EMERGENCY STOP HSS-F010-2	TBD			0
CA-F01-6	1-2C, 14 AWG, TECK90, 600V	RTU PANEL RTU-F80	P-F01 SEAL WATER SOLENOID VALVE	TBD			0
CA-F02-1	1-26C, 14 AWG, TECK90, 600V	STARTER MS-F02 IN MCC-F72	RTU PANEL RTU-F80	TBD			0
CA-F02-2	1-1PR, 18 AWG, ACIC, 600V	STARTER MS-F02 IN MCC-F72	RTU PANEL RTU-F80	TBD			0
CA-F02-3	1-2C, 14 AWG, TECK90, 600V	PUMP DISCONNECT SWITCH DS-F02	RTU PANEL RTU-F80	TBD			0
CA-F02-4	1-2C, 14 AWG, TECK90, 600V	STARTER MS-F02 IN MCC-F72	PUMP DISCONNECT SWITCH DS-F02	TBD			0
CA-F02-5	1-2C, 14 AWG, TECK90, 600V	STARTER MS-F02 IN MCC-F72	EMERGENCY STOP HSS-F020-2	TBD			0
CA-F02-6	1-2C, 14 AWG, TECK90, 600V	RTU PANEL RTU-F80	P-F02 SEAL WATER SOLENOID VALVE	TBD			0
CA-F64	1-2C, 14 AWG, TECK90, 600V	DRYWELL SUPPLY FAN SF-F64	RTU PANEL RTU-F80	TBD			0
CA-F821	1-2C, 14 AWG, TECK90, 600V	PUMP LEVEL FLOOD	RTU PANEL RTU-F80	TBD			0
CA-L01-1	1-12C, 14 AWG, TECK90, 600V	PUMP P-L01 STARTER IN MCC-F72	RTU PANEL RTU-F80	TBD			0
CA-L01-2	1-2C, 14 AWG, TECK90, 600V	PUMP P-L01 STARTER IN MCC-F72	P-L01 DISCONNECT SWITCH DS-L01	TBD			0
CA-L01-3	1-2C, 14 AWG, TECK90, 600V	PUMP P-L01 STARTER IN MCC-F72	EMERGENCY STOP HSS-L010-2	TBD			0
CA-L01-4	1-2C, 14 AWG, TECK90, 600V	RTU PANEL RTU-F80	P-L01 SEAL WATER SOLENOID VALVE	TBD			0
CA-L02-1	1-12C, 14 AWG, TECK90, 600V	PUMP P-L02 STARTER IN MCC-F72	RTU PANEL RTU-F80	TBD			0
CA-L02-2	1-2C, 14 AWG, TECK90, 600V	PUMP P-L02 STARTER IN MCC-F72	P-L02 DISCONNECT SWITCH DS-L02	TBD			0
CA-L02-3	1-2C, 14 AWG, TECK90, 600V	PUMP P-L02 STARTER IN MCC-F72	EMERGENCY STOP HSS-L020-2	TBD			0
CA-L02-4	1-2C, 14 AWG, TECK90, 600V	RTU PANEL RTU-F80	P-L02 SEAL WATER SOLENOID VALVE	TBD			0
CA-L831	1-4C, 14 AWG, TECK90, 600V	COMMUNITOR CHAMBER FLOOD	RTU PANEL RTU-F80	TBD			0

~End~

PART 1 - GENERAL

1.1 Related Sections

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 References

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 Description

.1 Supply and install a complete grounding system. Securely and adequately ground all components of the electrical system in accordance with the requirements of all related sections in the current edition of the Canadian Electrical Code, CSA C22.1, as adopted by the Province of Manitoba.

.2 The system to consist of cables, ground rods, supports, and all necessary materials and inter-connections to provide a complete system. Measured resistance to ground of the network shall not exceed 5 ohms.

PART 2 - PRODUCTS

2.1 Equipment

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.

.3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.5 Insulated grounding conductors: stranded copper type RW90 complete with a green jacket.

.6 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 Installation General

.1 Connect grounds to existing building grounding system.

.2 Install complete, permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Include a separate green ground wire in all power conduits including branch circuit wiring sized to Table 16 of the current edition of the Canadian Electrical Code.

.9 Expansion joints and telescoping sections of raceways shall be bonded using jumper cables as per the current edition of the Canadian Electrical Code.

.10 Use Burndy compression connectors or approved equal in accordance with B7 for all grounding splices and terminations unless otherwise shown on the Drawings. For bolted ground connections use Burndy Engineering Company's "Durium" hardware or approved equal in accordance with B7.

.11 Connect all transformer neutrals to the main building ground wire, using compression terminations.

.12 Install rigid conduit sleeves c/w bushings where ground wires pass through concrete slab.

.13 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.14 Install separate ground conductor to outdoor lighting standards.

.15 Connect building structural steel and metal siding to ground by welding copper to steel.

.16 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.17 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

.18 Ground secondary service pedestals.

3.2 System and Circuit Grounding

.1 Install system and circuit grounding connections to neutral of secondary 120 V system.

3.3 Equipment Grounding

.1 Install grounding connections to typical equipment included in, but not necessarily limited to the following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

.2 All frames and metallic enclosures of all electrical equipment and electrically operated equipment shall be grounded through the conduit system and/or via a ground wire.

.3 All transformers, switchgear, motor control centres, panelboards and splitters fed from the main distribution center shall be grounded by grounding conductors sized in accordance with the current edition of the Canadian Electrical Code. The ground wire shall be terminated at each end with an appropriate grounding lug which shall be connected to the equipment ground bus.

.4 All sub panels such as lighting panels, local distribution panels, etc., shall be grounded with a green ground wire run back to the panel from which it is fed. The ground conductor shall be sized according to the current edition of the Canadian Electrical Code.

.5 All main distribution centres, switchgear, motor control centres, and all panels requiring equipment grounds shall contain a ground bus of adequate size, and tapped for lugs for the ground wire required.

.6 All motors shall be grounded by means of an adequately sized ground wire contained within the feeder conduit.

3.4 Communication Systems

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

3.5 Field Quality Control

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

~End~

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

PART 2 - PRODUCTS

2.1 Support Channels

.1 U shape, size 41 x 41 mm, 2.5 mm thick, solid configuration surface mounted or suspended.

PART 3 - EXECUTION

3.1 Installation

.1 Secure equipment to solid concrete or steel structures.

.2 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors and to toggle bolts.

.3 Secure equipment to poured concrete with expandable inserts.

.4 Secure equipment to wood trusses with ¼" lag screws.

.5 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.6 Support equipment, conduit or armoured cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.7 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel 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.

.8 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.

.9 For surface mounting of two or more conduits use channels at spacing as per Rule 12-1010(1) of the current edition of the Canadian Electrical Code.

.10 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.11 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.12 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.13 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.

.14 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

~End~

PART 1 - GENERAL

1.1 Related Sections

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 Shop Drawings And Product Data

.1 Submit shop drawings and product data for cabinets in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Splitters

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 Junction And Pull Boxes

.1 PVC 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 Junction boxes to be used for electrical connection of a generator shall have multiple lug sizes to allow for several generator feed sizes to be used. Provide secondary compartment to allow for close up of the enclosure with external cables attached.

2.3 Cabinets

.1 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface mounting.

PART 3 - EXECUTION

3.1 Splitter Installation

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 Junction, Pull Boxes and Cabinets Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

~End~

PART 1 - GENERAL

1.1 References

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

PART 2 - PRODUCTS

2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Conduit Boxes

.1 Cast FS or FD copper free aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle for rigid conduit or TECK Cable.

.2 PVC boxes for PVC conduit.

.3 Conduit boxes must be rated for the environment they are located in.

2.3 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.

~End~

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.3 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.

.4 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.

1.2 Preferences

.1 In general power and control wiring shall be by TECK or armoured cable. Where suitable, PVC conduit may be used in wet areas and RGS may be used in dry areas.

PART 2 - PRODUCTS

2.1 Conduits

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Rigid pvc conduit: to CSA C22.2 No. 211.2.

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 Channel type supports for two or more conduits at spacing as per Rule 12-1010 of the current edition of the Canadian Electrical Code for rigid metal conduit.

.4 Channel type supports for two or more conduits at spacing as per Rule 12-1114 of the current edition of the Canadian Electrical Code for pvc conduit.

.5 Threaded rods, 6 mm dia., to support suspended channels.

2.3 Conduit Fittings

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

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

2.4 Expansion Fittings for Rigid Conduit

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

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

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

2.5 Fish Cord

.1 Polypropylene.

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 Surface mount conduits.

.3 Install conduit sealing fittings in hazardous areas. Fill with compound.

.4 Minimum conduit size for lighting and power circuits: 19 mm.

.5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.6 Mechanically bend steel conduit over 19 mm dia.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Install fish cord in empty conduits.

.9 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.10 Dry conduits out before installing wire.

.11 Connect conduit to equipment securely to maintain continuity for the purpose of bonding to ground.

.12 Provide for expansion and contraction of the conduit system.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended or surface channels.

.4 Do not pass conduits through structural members except as indicated.

3.3 Concealed Conduits

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 Conduits In Cast-In-Place Concrete

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 Conduits Underground

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

~End~

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No.126.1-02, Metal Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1-2002, Metal Cable Tray Systems.

.2 NEMA VE 2-2001, Cable Tray Installation Guidelines.

1.2 SUBMITTALS

.1 Provide submittals in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.4 Identify types of cabletroughs used.

.5 Show actual cabletrough installation details and suspension system.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

Part 2 Products

2.1 CABLETROUGH

.1 Cabletroughs and fittings: to NEMA VE 1 and CAN/CSA C22.1 No. 126.1.

.2 Ladder type, Class D1 to CAN/CSA C22.2 No. 126.1.

.3 Trays: extruded aluminum, minimum 300 mm wide with minimum depth of 75 mm.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.

.1 Radii on fittings: 300 mm minimum.

.5 Solid covers for complete cabletrough system including fittings.

.6 Barriers where different voltage systems are in same cabletrough.

.7 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.

.8 Provide fire stop material at firewall penetrations.

2.2 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cabletrough system in accordance with NEMA VE 2.

.2 Support cabletrough on both sides.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Lay cables into cabletrough. Use rollers when necessary to pull cables.

.3 Secure cables in cabletrough at 6 m centres, with nylon ties.

.4 Identify cables every 30 m with size 2 nameplates in accordance with Section 26 05 01 – Common Work Results – For Electrical.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Transformer shall be supplied by the City of Winnipeg and installed by the Contractor.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 01 - Common Work Results for Electrical.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No.47-M90(R2007), Air-Cooled Transformers (Dry Type).

.2 CSA C9-02(R2007), Dry-Type Transformers.

.3 CAN/CSA-C802.2-06, Minimum Efficiency Values for Dry Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 DESIGN DESCRIPTION

.1 Design 1.

.1 Type: ANN.

.2 Single phase, 25 kVA, 600V input, 120/240 V output, 60 Hz.

.3 Voltage taps: standard.

.4 Insulation: Class 220, 150 degrees C temperature rise.

.5 Basic Impulse Level (BIL): standard.

.6 Hipot: standard.

.7 Average sound level: standard

.8 Impedance at 17 degrees C: standard

.9 Enclosure: NEMA, removable metal front panel.

.10 Mounting: floor.

.11 Finish: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.12 Copper windings.

.13 Winding configuration to be as noted on drawings.

.14 Harmonic Mitigating Phase Shifting transformers as indicated on drawings.

.15 KL-Rated Transformers as indicated on drawings.

.16 Voltage Regulation to be 4% or better.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results for Electrical.

.2 Label size: 7.

.3 Nameplate wording: XFMR-F73.

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on floor.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

.9 Make conduit entry into bottom 1/3 of transformer enclosure.

3.2 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by dry type transformers installation.

END OF SECTION

PART 1 - GENERAL

1.1 Scope

.1 The Panelboard shall be supplied by the City of Winnipeg and installed by the Contractor.

1.2 Section Includes

.1 Materials and installation for standard and custom breaker type panelboards.

1.3 Related Sections

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 Section 26 28 21 - Moulded Case Circuit Breakers.

.3 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.4 References

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.5 Shop Drawings

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 - PRODUCTS

2.1 Panelboards

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 600 V panelboards: Bus and breakers rated as indicated on drawings. 22 kA (symmetrical) interrupting capacity minimum.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: tin plated copper mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Tin plated copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

2.2 Breakers

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to City of Winnipeg.

.5 Interrupting capacity of each breaker must be in accordance to the panelboard interrupting capacity.

2.3 120 V Surge Suppressor

.1 Able to withstand a maximum surge current of 40 kA.

.2 DIN rail mount,

.3 Rated as type II TVSS,

.4 3 step visual indication,

.5 Integrated terminal disconnect to avoid fire risk,

.6 Acceptable Product: ABB OVR40150SP or EATON SPD50600Y1A

2.4 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 - EXECUTION

3.1 Installation

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

~End~

Part 1 General

1.1 SCOPE

.1 The MCC shall be supplied by the City of Winnipeg and installed by the Contractor.

1.2 RELATED SECTIONS

.1 Section 26 29 10 – Motor Starters to 600 V

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 SUBMITTALS

.1 Provide submittals in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence and cleaning procedures.

.4 Submit shop drawings and indicate:

- .1 Outline dimensions.
- .2 Configuration of identified compartments.
- .3 Floor anchoring method and dimensioned foundation template.
- .4 Cable entry and exit locations.
- .5 Dimensioned position and size of busbars and details of provision for future extension.
- .6 Schematic and wiring diagrams.

.5 Closeout Submittals: provide operation and maintenance data for motor control centre for incorporation into manual.

- .1 Include data for each type and style of starter.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Collect, package and store existing busbars, wireways, sills, copper ground straps and other associated components for recycling and reuse.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials.

Part 2 Products

2.1 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor CSA 12 gasketted enclosure.

.4 Class II, Type B.

2.2 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, minimum 305 mm high, as indicated.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Cables to enter at top and/or bottom as required.

.8 Removable lifting means.

.9 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.10 Divide assembly for shipment to site, complete with hardware and instructions for re-assembly.

2.3 SILLS

.1 Continuous channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.4 BUSBARS

.1 Main horizontal and branch vertical, three phase and neutral high conductivity tin plated copper busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: 600 A as indicated.

.2 Branch vertical busbars: 600 A as indicated.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current minimum of 22 kA rms symmetrical.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.5 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

.2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

2.6 MOTOR STARTERS AND DEVICES

.1 As per Section 26 29 10 – Motor Starters to 600 V.

.2 Quantity and ratings as per single line drawings.

2.7 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front.

.7 Devices and components by one manufacturer to facilitate maintenance.

.8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

2.8 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 01 - Common Work Results - For Electrical.

2.9 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - For Electrical.

.1 Motor control centre main nameplate: size No. 7, engraved “NON ESSENTIAL MCC”.

.2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.10 FINISHES

.1 Apply finishes in accordance with Section 26 05 01 - Common Work Results - For Electrical.

.2 Paint motor control centre exterior light gray and interiors white.

2.11 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

Part 3 Execution

3.1 INSTALLATION

.1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.2 Make field power and control connections as indicated.

.3 Ensure correct overload heater elements are installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - For Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hour period.

~End~

Part 1 General

1.1 RELATED SECTIONS

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

Part 2 Products

2.1 MATERIALS

.1 NEMA 4 rated enclosure for all locations except within electrical rooms and control rooms.

.2 NEMA 12 rated enclosures for devices within electrical rooms or control rooms.

.3 Door: minimum 1 m wide, hinged, minimum 3 point latching, with padlocking means.

.4 Door interlocks

Part 3 Execution

3.1 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and mount on concrete pad.

.2 Mount equipment in enclosure.

~End~

PART 1 - GENERAL

1.1 Section Includes

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 Related Sections

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 References

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 Shop Drawings And Product Data

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Switches

.1 15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111 as required.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver cadmium oxide contacts.

.3 Fully enclosed with urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 1200 Series or equivalent in accordance with B7.

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Brown urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Brown urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 5252 or approved equal in accordance with B7.

2.3 Cover Plates

.1 Stainless steel or PVC cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Weatherproof double lift spring-loaded stainless steel or PVC cover plates, complete with gaskets for duplex receptacles as indicated on the drawings.

.6 Weatherproof spring-loaded stainless steel or PVC cover plates complete with gaskets for single receptacles or switches as indicated on the drawings.

2.4 Welding Receptacles

.1 Provide a 600V, 60A, 3 phase welding receptacle with integral disconnect switch.

PART 3 - EXECUTION

3.1 Installation

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount lighting fixture receptacles local to fixtures.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Welding Receptacles:

.1 Mount welding receptacles at 1.2 m.

~End~

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2No.248.12-94, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit fuse performance data characteristics for each fuse type and size. Performance data to include: average melting time-current characteristics.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.1 Place materials defined as hazardous or toxic waste in designated containers.

.2 Ensure emptied containers are sealed and stored safely for disposal away from children.

.3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

1.5 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in moisture free location.

1.6 MAINTENANCE MATERIALS

.1 Provide maintenance materials.

.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.

Part 2 Products

2.1 FUSES GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer for entire project.

2.2 FUSE TYPES

.1 Class L fuses (formerly HRC-L).

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses (formerly HRCI-J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R-R fuses (formerly HRCI-R). For UL Class RK1 fuses, peak let-through current and its peak let-through values not to exceed limits of UL 198E-1982, table 10.2.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.4 Class C fuses (formerly HRCII-C).

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 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

~End~

PART 1 - GENERAL

1.1 Scope

.1 Circuit breakers shall be supplied by the City of Winnipeg and installed by the contractor.

1.2 Section Includes

.1 Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters, fused circuit breakers, and accessory high-fault protectors.

1.3 Related Sections

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.4 References

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.5 Submittals

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 - PRODUCTS

2.1 Breakers General

.1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, Fused circuit breakers, and Accessory high-fault protectors: to CSA C22.2 No. 5

.2 Bolt-on and Plug-in moulded case circuit breaker: quick-make, quick-break over center switching mechanism that is mechanically trip-free, for manual and automatic operation with temperature compensation for 40 degrees C ambient. Automatic tripping of the breaker shall be clearly indicated by the handler position. Contacts shall be non-welding silver alloy, and arc extinguishing shall be accomplished by means of DE-ION arc chutes.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as indicated on the drawings.

.7 Circuit breakers identified as MCP will operate on the magnetic principle with a current sensing element in each pole.

.8 Circuit breakers 600 A through 2500 A frame shall be Cutler-Hammer type Westinghouse Series C with microprocessor-based RMS sensing trip units or approved equal in accordance with B7.

.1 Each moulded case circuit breaker microprocessor-based tripping system shall consist of three current transformers, and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analysing the secondary current signals received from the circuit breaker current transformers and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.

.2 Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed. Rating plugs shall be interlocked such that a breaker cannot be closed and latched with the rating plug removed.

.3 The microprocessor-based trip unit shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.

.4 When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override. Internal ground fault protection adjustable pick-up ratings shall not exceed 1200 amperes.

.5 Breakers shall have built-in test points for testing the long time delay, instantaneous, and ground fault functions of the breaker by means of a 120 Volt operated test set. Provide one test set capable of testing all breakers 600 ampere frame and above.

.6 System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

.1 Adjustable long time pick-up and delay.

.2 Adjustable short time pick-up and delay.

.3 Adjustable instantaneous pick-up.

.4 Adjustable ground pick up.

.7 Circuit Breakers shall be Cutler-Hammer type Westinghouse Series C circuit breakers, microprocessor-based RMS sensing trip units type Digitrip RMS 310 LSI or LSIG trip units or approved equal in accordance with B7.

.8 Accessories:

.1 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

.9 Enclosure:

.1 All enclosed circuit breakers shall have EEMAC 1 general purpose enclosures.

.2 All enclosed circuit breakers shall have metal nameplates, front cover mounted, that contain a permanent record of catalog number and maximum rating. Provide handle mechanisms that are padlockable in the “OFF” position.

2.2 Thermal Magnetic Breakers

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 Acceptable Product: Cutler-Hammer type Westinghouse Series C or approved equal in accordance with B7

.

2.3 Magnetic Breakers

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

PART 3 - EXECUTION

3.1 Factory Testing

.1 Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of CSA standard.

3.2 Installation

.1 Install circuit breakers as indicated on drawings per the manufacturer's recommendations.

3.3 Field Settings

.1 The contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operating condition. The settings shall be in accordance with the drawings.

~End~

PART 1 - GENERAL

1.1 Scope

.1 Disconnect switches for pumps P-F01 and P-F02 shall be supplied by the City of Winnipeg and installed by the contractor. All other disconnect switches shall be supplied by the contractor.

1.2 Section Includes

.1 Materials and installation for fused and non-fused disconnect switches.

1.3 Related Sections

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.4 References

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.5 Submittals

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Disconnect Switches

.1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 - EXECUTION

3.1 Installation

.1 Install disconnect switches.

~End~

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14-95(R2001), Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2001, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

.1 Submit to Contract Administrator one copy of test results.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Contract Administrator.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.

.2 Convertible contact type: contacts field convertible from NO to NC, electrically held, with poles to suit. Coil rating: 120 VAC. Contact rating: 120 VAC, 2 A minimum or 24 VDC, 2 A minimum as required.

.3 Fixed contact plug-in type: general purpose with poles to suit. Coil rating: 120 V. Contact rating: 120 VAC, 2 A minimum or 24 VDC, 2 A minimum as required.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 SOLID STATE TIMING RELAYS

.1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.

.2 Operation: programmable On-Delay. Time range must be adjustable from 0.05 seconds to 300 hours.

.3 Supply voltage: 120 VAC, 60 Hz.

.4 Temperature range: minus 20 degrees C to 60 degrees C.

.5 Output contact rating: maximum voltage 300 V AC or DC. Current: NEMA ICS 1.

2.4 OPERATOR CONTROL STATIONS

.1 Enclosure:

.1 In general CSA Type 4X, surface mounting.

.2 In clarifier electrical room with positive pressure CSA Type 1, surface mounting.

2.5 PUSHBUTTONS

.1 Heavy duty Oil tight. Operator extend type. Black, with 1-NO and 1-NC contacts rated at 2 A minimum, AC, labels as indicated. Stop pushbuttons coloured red, labelled as indicated. Push-pull emergency stop pushbuttons to be Allen Bradley 800H-FPX6D4 or approved equal in accordance with B7.

2.6 SELECTOR SWITCHES

.1 Maintained, 2 or 3 position as required labelled as indicated heavy duty oil tight, operators standard, contact arrangement as indicated, rated 120 VAC, 2 A minimum or 24 VDC, 2 A minimum as required.

2.7 INDICATING LIGHTS

.1 Heavy duty Oil tight, full voltage, LED type, lens colour: as indicated, supply voltage: 120 VAC, lamp voltage: 120 VAC, labels as indicated.

2.8 CONTROL AND RELAY PANELS

.1 CSA Type 1 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.9 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 600 V, 60 Hz ac.

.3 Secondary: 120 V, AC.

.4 VA Rating: as required by loads plus 20%.

.5 Secondary fuse rating: as required by loads

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.10 SMART RTU

.1 32-bit ARM7 controller CPU, 32 MHz clock with integrated watchdog timer.

.2 Memory: 16 MB FlashROM, 4 MB CMOS RAM, 4 kB EEPROM.

.3 Event logging capacity 2000 events.

.4 5 selectable analog inputs.

.5 8 selectable digital I/O.

.6 Input power: 24 VDC.

.7 Ethernet port: RJ45, 10/100 BaseT.

.8 Suitable for Class 1 Div. 2 environment.

.9 Operation range: -40C to 70C.

.10 3 serial ports.

.11 DIN rail mounted.

.12 Acceptable product: Schneider SCADAPack 357E with 5606 I/O expansion module.

2.11 MODEM

.1 2 modems should be provided:

.1 Wireless modem with external antenna (acceptable product: sixnet BT-6801 HSPA), SIM card and MTS account.

.2 Landline modem (acceptable product: part # 2708203 by Pheonix Contact).

2.12 ETHERNET SWITCH

.1 A DIN rail mounted 8 port Ethernet switch should be provided in the RTU panel.

.2 Acceptable product: N-Tron 708TX.

Part 3 Execution

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

~End~

Part 1 General

1.1 SCOPE

.1 Motor starters shall be supplied by the City of Winnipeg and install by the Contractor.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

.1 National Electrical Manufacturer's Association (NEMA)

.1 NEMA Standards Publication ICS 2-2000: Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual.

.2 Include operation and maintenance data for each type and style of starter.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials.

.2 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformer.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 MATERIALS

.1 Starters: to NEMA ICS 2-2000

.2 Tin plated copper buswork. Aluminium buswork is not acceptable.

2.2 FULL VOLTAGE MANUAL MOTOR STARTERS

.1 NEMA rated magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Solid state motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control motor circuit interrupter, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Pushbuttons and selector switches: heavy duty oil tight labelled as indicated.

.2 Indicating lights: LED full voltage, heavy duty oil tight type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.3 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with 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 26 05 01 - Common Work Results - Electrical.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Reduced Voltage Starter designation label, white plate, black letters, size 4 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control in MCC as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical 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.

~End~

PART 1 - GENERAL

1.1 Scope

.1 This specification shall apply to the materials, design, fabrication, inspection, and testing of 600 V Reduced Voltage Starters (RVS).

.2 RVS shall be supplied by the City of Winnipeg and installed by the Contractor.

.3 Detailed specifications on the RVS shall be indicated in this specification, drawings and attachments. In case of a conflict between the various specifications, the vendor shall contact the Purchaser for clarification. The RVS shall be manufactured by Benshaw.

.4 Ensure starter can handle the motor loads of the existing pumps.

1.2 Related Sections

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 References

.1 The RVS shall be designed, manufactured and tested in accordance with the latest applicable standards of CSA, NEMA, ANSI and UL, including but not limited to:

.1 CSA C22.2 No. 14-M91—Industrial Control Equipment

.2 NEMA ICS7—Industrial Control and Systems Adjustable Frequency Drives

.3 NEMA MG1—Motors and Generators

.4 NEMA ICS 7.1—Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Frequency Drives

.2 In all cases where more than one regulation, code, standard or specification applies to the same conditions, the most stringent one shall apply. Conflicts among any of the provisions of these listed codes, standards or specifications shall be referred to the Purchaser for resolution.

1.4 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Drawings shall be in SI units. If imperial units are used as well, they shall be shown in parenthesis after the SI units. In case of conflict between the two, SI units shall be considered to be correct.

.3 Equipment tag number, purchase order number and project name shall be shown on all Supplier supplied drawings. Data shall be located close to the title block.

.4 All drawings and data shall be submitted in a form that is easily reproduced. All data and drawings shall be submitted in both paper and electronic form. Final drawings are all required to be as-built.

.5 Review or approval of Supplier's drawings, design calculations and other documentation does not relieve Supplier of any responsibility for correctness of such drawings, calculations or other documentation.

.6 The following information shall be submitted to the Contract Administrator for approval:

.1 Master drawing index
.2 Dimensioned front view elevation
.3 Dimensioned floor plan
.4 Dimensioned top view
.5 Unit control schematics and wiring diagrams
.6 Nameplate schedule
.7 Cable entry/exit locations
.8 Assembly ratings, including short circuit, voltage, and continuous current ratings
.9 Major component ratings
.10 Minimum clearances to other equipment.
.11 Frequency spectrum for harmonic currents at line side of filter (where provided) at 50% and 100% of rated load.
.12 Manufacturers technical data sheets

1.5 Closeout Submittals

.1 Operation and maintenance manuals shall include as a minimum for each type and style of starter: Instruction books and/or leaflets, recommended renewal parts list and a complete set of as-built drawings.

.2 The following information shall be submitted to Contract Administrator for record purposes:

.1 Final as-built drawings and information
.2 Certified production test reports
.3 Installation information
.4 Seismic certification and equipment anchorage details (where applicable)

PART 2 - PRODUCTS

2.1 General

.1 All RVS will be fed from a MCC provided by others and protected by breakers. Vendor shall indicate recommended breaker size.

.2 The RVS shall consist of a disconnect, logic board, keypad, SCRs, and bypass contactors for up to speed paralleling and across the line starting.

.3 The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs, and SCR gate firing output circuits. The logic board shall be identical for all ampere ratings and voltage classes specified.

2.2 Enclosure

.1 The RVS shall be suitable for mounting inside a MCC. The MCC must have tin plated copper buswork. Aluminium buswork is not acceptable.

.2 A panel mounted non-resetable elapsed-time meter to measure operating hours with a minimum 6 digits display.

.3 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical. Nameplates shall be permanently attached with screws.

.4 The enclosure shall have appropriate warning labels.

2.3 Ratings

.1 The RVS shall be designed for heavy-duty applications and in accordance with applicable datasheets.

.2 The RVS shall operate normally with incoming voltage and frequency of 600 V 60 Hz ± 10 % and have an overload capability of 125 % continuous and 500% for 30 seconds.

.3 The RVS shall consist of six SCR rated for a minimum of 1600 V peak inverse voltage and sized to withstand starting circuits of 500% for 30 seconds.

.4 Operating Conditions: Suitable for 0 °C to 40 °C and 5 % to 95 % relative humidity.

.5 The RVS shall be capable of starting when fed from temporary diesel generator (nominal size of 500 kVA).

.6 Drive rated for a minimum fault current of 22 kA Sym. I.C.

2.4 Protection

.1 Overvoltage, undervoltage and phase loss protection should be provided with the RVS.

.2 Motor overload protection shall be two staged based upon an inverse time algorithm, one overload protection characteristic for starting and another for running. The overload characteristics shall be selectable by programming between Classes 5, 10, 20 and 30.

.3 Motor protection in the by-pass mode shall be provided by bimetallic overloads.

.4 Overload resets shall be mechanical pushbuttons from outside the enclosure and be capable of being electrically or automatically reset upon a fault condition.

.5 The SCR shall be complete with snubber networks to prevent false firing due to dV/dT effects.

.6 Over-temperature protection shall be provided on the heat sink and the control board.

.7 Phase Current Imbalance Protection: Trip level: 5 % to 30 % of motor FLA between any two phases and 1 to 20 second delay.

.8 Overcurrent Protection: Trip level: 50 % to 300 % of motor FLA and 1 to 20 second delay.

.9 Load Loss Trip Protection: Under current trip level: 10-90% of motor FLA and 1 to 60 second delay.

.10 Coast down Lockout Timer: 1 to 60 minutes.

.11 Starts-Per-Hour Lockout Timer: Range: 1 to 10 successful starts per hour. Time between starts: 1 to 60 minutes between start attempts.

.12 The RVS shall be capable of being setup and tested without a motor connected.

2.5 Adjustments and Configurations

.1 Acceleration adjustments shall be programmable and shall be capable of dual ramp settings with the following ranges:

.1 Programmable Ramp Types: Voltage Ramp (VR) or Current Ramp (CR).

.2 Starting Torque: 0 % to 100% of line voltage (VR) or 0 % to 600 % of motor FLA (CR).

.3 Ramp Time: 1 to 120 seconds.

.4 Current Limit: 200 % to 600 % (VR or CR).

.2 Deceleration adjustments shall be programmable with the following ranges:

.1 Begin Deceleration Level: 0 % to 100% of line voltage.

.2 Stop Deceleration Level: 0 % to 100 % less than Begin Deceleration Level

.3 Deceleration Time: 1 to 60 seconds

.3 The RVS shall be capable of being programmed that in the event of a fault, the motor either coasts to stop or decelerates according to the deceleration adjustment levels.

.4 Built In Self Test (BIST).

2.6 Interface

.1 Should be supplied with remote mount LCD display. This display should be mounted on the panel door.

.2 The operator interface terminal shall have an alphanumeric, high resolution, high brightness LCD display, door mounted and complete with the following status indicators:

.1 Control “Power On”

.2 Full voltage “At Speed”

.3 Shorted SCR

.4 Phase loss

.5 Shunt trip

.6 Overload

.7 Over temperature

.8 Overcurrent

.3 The operator interface terminal shall allow complete control of the RVS and modification of adjustments and configuration parameters. All electrical values, parameters, application and activity function access, faults and local control shall be in plain English.

.4 The following monitoring values shall be available when in the operating mode:

.1 Phase currents

.2 Power factor

.3 Torque

.4 Remaining thermal capacity

.5 Elapse time

.6 Run cycle counter

.7 Lockout time values

.8 Fault codes

.9 Fault history complete with time and date stamps for the last three faults

.5 A reset key will allow a parameter to return the existing value if adjustment is not required and the value is displayed.

.6 The RVS shall have the following door mounted pilot light indicators (LED or neon type, colour as indicated), selector switches and push buttons:

.1 Running – Bypass Contactor Indicating Light (Green)

.2 Overload – Bypass Contactor Indicating Light (Yellow)

.3 Bypass Contactor – Overload Reset Pushbutton

.4 Soft Starter / Off / Bypass Contactor Selector Switch

.5 Off / Hand / Auto Selector Switch

.7 The RVS shall have Modbus RTU (2 wire, RS485, multidrop) interface for remote interrogation by a DCS or PLC controller. Vendor shall indicate all drive parameters that are accessible from this interface.

2.7 Control Systems – Analog and Discrete I/O

.1 RVS shall have a minimum of 3 programmable inputs used for the following control:

.1 2 wire start/stop control (Discrete Input)

.2 RVS shall have a minimum of 3 programmable dry relay outputs (form C) used to indicate:

.1 Fault Status (Discrete Output)

.2 Run Status (Discrete Output)

.3 Ready Status (Discrete Output)

.3 The contact rating for the 3 programmable dry relay outputs shall be a minimum of 2 A resistive at 120 Vac and 2 A resistive at 24 Vdc.

.4 User configurable analog I/O (4 – 20 mA).

2.8 Factory Testing

.1 The manufacturer's standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA and NEMA standards. Results from the test shall be provided with closeout submittals.

2.9 Acceptable Product

.1 Benshaw BIPC-300055-01-XX MX^2 controller.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with Manufacturer's installation instructions and recommendations.

.2 Hire factory trained representative for setup and commissioning of RVS. Provide written report to Contract Administrator.

.3 Hire factory trained representative to provide one day of training for City of Winnipeg personnel.

.4 Confirm power lugs and RVS can accommodate the pump motor cables leads.

.5 Setup RVS so that pump ramps up to speed over 30 seconds and ramps down to 50 % voltage over 15 seconds at which point it stops the equipment.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Reduced Voltage Starter (Solid-State)

.1 Reduced Voltage Starter (Solid State) shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

Part 1 General

1.1 SCOPE

.1 Variable Frequency Drives (VFD) shall be supplied by the City of Winnipeg and installed by the Contractor.

.2 This specification shall apply to the materials, design, fabrication, inspection, and testing of 600 V AND 240 V VFDs used to control the speed and torque of NEMA design B induction motors.

.3 Detailed specifications on the VFD shall be indicated in this specification, drawings and attachments. In case of a conflict between the various specifications, the vendor shall contact the Contract Administrator for clarification. The VFD shall be manufactured by ABB.

.4 Ensure VFD can handle the motor loads of the equipment actually purchased by the Contractor.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 REFERENCES

.1 The VFD shall be designed, manufactured and tested in accordance with the latest applicable standards of CSA, NEMA, ANSI and UL, including but not limited to:

.1 CSA C22.2 No. 14-M91—Industrial Control Equipment
.2 IEEE 519-1992 – Guide for Harmonic Content and Control
.3 NEMA ICS7—Industrial Control and Systems Adjustable Frequency Drives
.4 NEMA MG1—Motors and Generators
.5 NEMA ICS 7.1—Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Frequency Drives

.2 In all cases where more than one regulation, code, standard or specification applies to the same conditions, the most stringent one shall apply. Conflicts among any of the provisions of these listed codes, standards or specifications shall be referred to the Contract Administrator for resolution.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Drawings shall be in SI units. If imperial units are used as well, they shall be shown in parenthesis after the SI units. In case of conflict between the two, SI units shall be considered to be correct.

.3 Equipment tag number, purchase order number and project name shall be shown on all Supplier supplied drawings. Data shall be located close to the title block.

.4 All drawings and data shall be submitted in a form that is easily reproduced. All data and drawings shall be submitted in both paper and electronic form. Final drawings are all required to be as-built.

.5 Review or approval of Supplier's drawings, design calculations and other documentation does not relieve Supplier of any responsibility for correctness of such drawings, calculations or other documentation.

.6 The following information shall be submitted to the Contract Administrator for approval:

.1 Master drawing index
.2 Dimensioned front view elevation
.3 Dimensioned floor plan
.4 Dimensioned top view
.5 Unit control schematics and wiring diagrams
.6 Nameplate schedule
.7 Cable entry/exit locations
.8 Assembly ratings, including short circuit, voltage, and continuous current ratings
.9 Major component ratings
.10 Minimum clearances to other equipment.
.11 Frequency spectrum for harmonic currents at line side of filter (where provided) at 50% and 100% of rated load.
.12 Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and toral harmonic current distortion (TDD). The VFD manufacturere shall provide calculations specific to the installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE electrical system standard 519. All VFDs shall include a minimum of 3% equivalent impedance reactors. VFDs shall include some form of active mitigation.
.13 Manufacturers technical data sheets

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual.

.2 Operation and maintenance manuals shall include as a minimum for each type and style of starter: Instruction books and/or leaflets, recommended renewal parts list and a complete set of as-built drawings.

.3 The following information shall be submitted to Contract Administrator for record purposes:

.1 Final as-built drawings and information
.2 Certified production test reports
.3 Installation information
.4 Seismic certification and equipment anchorage details (where applicable)

Part 2 Products

2.1 GENERAL

.1 All VFDs shall be a solid state AC to AC inverter controlled device utilizing the latest isolated gate bipolar transistor (IGBT) technology. The VFD shall utilize Direct Torque Control (DTC) as the primary motor control, employing an inner loop torque control strategy that mathematically determines the optimal motor torque and flux every 25

microseconds. The VFD must also provide an optional motor control operational mode for scalar of V/Hz operation.

.2 The VFDs will be fed from a MCC or distribution panel and be protected by breakers. Vendor shall indicate recommended breaker size.

.3 The benefits that the motor control DTC shall make available for the operation of a NEMA design B induction motor shall be:

.1 Steady state speed accuracy within 1/10th the slip without an encoder, for process repeatability.

.2 100% motor torque from zero speed available for acceleration with the VFD continuous current rating equal to or greater then the motor full load amp rating.

.3 At and below 90% speed, 100% torque is achievable even with 10% low line voltage.

.4 Ability to limit torque to protect the mechanical system with a common single torque setting above and below field weakening.

.5 Ability to provide torque in % of motor shaft torque (with in +/- 4% linearity) on the VFD control panel, analog output or via field bus of actual.

.6 Quiet motor operation for audibly friendly working environment in comparison to other low voltage PWM solutions utilizing a carrier frequency.

.7 Have available the ability to operate in open loop torque control, with an ability to switch between speed and torque control on the fly with the change of state to a digital input.

.8 Have an ability to share load or speed between two or more induction AC motors connected to the same system, when those motors are controlled by separate VFDs.

2.2 RATINGS

.1 The VFD shall be designed for heavy-duty applications and in accordance with applicable datasheets.

.2 The VFD shall be rated to operate from 3-phase power at 525 to 690 VAC (600 Vac, UL and CSA) +10/-10% and 208 to 240 VAC. The overvoltage trip level shall be a minimum of 30% over nominal, and the undervoltage trip level shall be a minimum 35% under the nominal voltage.

.3 The VFD shall be rated to operate at the following environmental operating conditions: ambient temperature 0 to 40°C continuous. VFDs that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level without derating, less than 95% humidity, non-condensing.

.4 The VFD shall be rated to operate from input power from 48Hz to 63Hz.

.5 Output voltage and current ratings shall match the adjustable frequency operating requirements of standard NEMA design A or NEMA design B motors.

.6 The Heavy Duty overload current capacity shall be 150% of rated current for one (1) minute out of five (5) minutes.

.7 The VFD efficiency shall be 98% or better of the full rated capability of the VFD at full speed and load.

.8 The VFD shall be capable of starting when fed from temporary diesel generator (nominal size of 500 kVA).

.9 Drive rated for a minimum fault current of 65 kA Sym. I.C.

2.3 CONSTRUCTION

.1 All models shall provide a complete, ready-to-install solution.

.2 The latest, most efficient IGBT power technology shall be used. This technology shall be used for all power and voltage ranges offered by the manufacturer.

.3 The VFD shall offer microprocessor based control logic that is isolated from power circuitry.

.4 The VFD shall use the same main control board for all ratings.

.5 Control connections shall remain consistent for all power ratings.

.6 Wall mountable VFDs shall be available from 1 to 2 HP and have the following features;

.1 Wall mounted NEMA Type 12 enclosures

.2 Include a control panel mounted on the front of the VFD

.3 Include coated circuit boards as standard

.4 Include integrated internal AC line reactor or DC choke

.5 Offer option internally mounted braking chopper for use in dynamic braking with 100% continuous duty operation.

.7 Desired optional features shall be furnished and mounted by the VFD manufacturer and shall also be available as field installable kits as an alternative. All optional features shall carry all of the necessary certifications as described above. Field installed kits shall not affect the VFD's certification.

.8 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical. Nameplates shall be permanently attached with screws.

.9 The enclosure shall have appropriate warning labels indicating "CAUTION MULTIPLE CONTROL POWER SOURCES"

.10 A panel mounted non-resetable elapsed-time meter to measure operating hours with a minimum 6 digits display.

2.4 OPERATOR INTERFACE

.1 The VFD shall be equipped with a front mounted operator control panel consisting of a four- (4) line by 20-character back-lit alphanumeric LCD display and a keypad with keys for Run/Stop, Local/Remote, Increase/Decrease, Reset, Menu navigation and Parameter select/edit.

.2 The control panel shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.

.3 The display of the control panel shall have the following features:

.1 The LCD display shall have contrast adjustment provisions to optimize viewing at angle.

.2 All parameter names, fault messages, warnings and other information shall be displayed in complete English words or standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or cross-reference table.

.3 During normal operation, one (1) line of the control panel shall display the speed reference, and run/stop forward/reverse and local/remote status. The remaining three (3) lines of the display shall be programmable to display the values of any

three (3) operating parameters. The selection shall include at least the following values:

.1 Speed/torque in percent (%), RPM or user-scaled units

.2 Output frequency, voltage, current and torque

.3 Power and kilowatt hours

.4 Heatsink temperature and DC bus voltage

.5 Status of discrete inputs and outputs

.6 Values of analog input and output signals

.7 Values of PID controller reference, feedback and error signals

.4 The control panel shall be used for local control, for setting all parameters, and for stepping through the displays and menus.

.5 A copy function to upload and store parameter settings from a VFD and download stored parameter settings to the same VFD or to another VFD shall exist.

.6 An intelligent start-up assistant shall be provided as standard. The Start-up routine will guide the user through all necessary adjustments to optimize operation.

.1 The Start-Up routine shall include “plug and produce” operation, which automatically recognizes the addition of options and fieldbus adapters and provides the necessary adjustment assistance.

.2 The Start-Up routine shall prompt the user for Motor Nameplate Data including power, speed, voltage, frequency and current.

.3 An auto-tune function shall identify the optimal motor tuning parameters for typical applications.

.4 An auto-tune function shall also be available to tune the PID speed regulator loop. Manual adjustments shall also be allowed.

.5 A selection of at least six (6) pre-programmed application macro parameter sets shall be provided to minimize the number of parameter adjustments required during start-up. Macros offered shall include Factory Default, Hand/Auto, PID Control, and Torque Control. A selection of two (2) user defined macros shall are also be available.

.6 Selection shall be offered for both 2-wire and 3-wire Start/Stop control.

2.5 PROTECTIVE FEATURES

.1 For each programmed warning and fault protection function, the VFD shall display a message in complete English words or Standard English abbreviations. The five (5) most recent fault messages and times shall be stored in the VFD’s fault history.

.2 The VFD shall include internal MOV’s for phase to phase and phase to ground line voltage transient protection.

.3 Output short circuit and ground fault protection rated for 100,000 amps without relying on line fuses shall be provided per UL508C.

.4 Motor phase loss protection shall be provided.

.5 The VFD shall provide electronic motor overload protection qualified per UL508C.

.6 Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated voltage or undervoltage at 65% of min. rated voltage.

.7 The VFD shall protect itself against input phase loss.

.8 A power loss ride through feature shall allow the VFD to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

.9 Stall protection shall be programmable to provide a warning or stop the VFD after the motor has operated above a programmed torque level for a programmed time limit.

.10 Underload protection shall be programmable to provide a warning or stop the VFD after the motor has operated below a selected underload curve for a programmed time limit.

.11 Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.

.12 Input terminals shall be provided for connecting a motor thermistor (PTC type) to the VFD's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact.

2.6 CONTROL INPUTS AND OUTPUTS

.1 Discrete Inputs

.1 Minimum of six (6) discrete inputs shall be provided.

.2 A minimum of six (6) of the inputs shall be independently programmable with function selections (run/stop using 2 wire or 3 wire control, hand-off-auto, etc.).

.3 Inputs shall be designed for use with either the VFD's internal 24 VDC supply or a customer supplied external 24 VDC supply.

.4 VFD shall operate at two (2) different speeds controlled by two (2) external switches.

.2 Discrete outputs

.1 Minimum of three (3) form C relay contact outputs shall be provided

.2 All outputs shall be independently programmable to activate with at least 30 function selections including;

.1 Operating conditions such as drive ready, drive running, reversed and at set speed

.2 General warning and fault conditions

.3 Adjustable supervision limit indications based on programmed values of operating speed, speed reference, current, torque and PID feedback.

.4 Relay contacts shall be rated to switch 2 Amps at 24 VDC or 115/230 VAC.

.3 Analog Inputs

.1 Minimum of two (2) analog inputs shall be provided:

.1 At least one (1) must support bi-polar voltage input

.2 Resolution of analog inputs must be at least 11bit total resolution

.2 Inputs shall be independently programmable to provide signals including speed / frequency reference, torque reference or set point, PID set point and PID feedback / actual.

.3 A differential input isolation amplifier shall be provided for each input.

.4 Analog input signal processing functions shall include scaling adjustments, adjustable filtering and signal inversion.

.5 If the input reference is lost, the VFD shall give the user the option of the following. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus.

.1 Stopping and displaying a fault

.2 Running at a programmable preset speed

.3 Hold the VFD speed based on the last good reference received

.4 Cause a warning to be issued, as selected by the user.

.6 When inputs are used as speed references, reference signal processing shall include increase/decrease floating point control and control of speed and direction using a “joystick” reference signal. Two (2) analog inputs shall be programmable to form a reference by addition, subtraction, multiplication, minimum selection or maximum selection.

.4 Analog Outputs

.1 Minimum of two (2) 0 / 4-20 mA analog outputs shall be provided.

.2 Outputs shall be independently programmable to provide signals proportional to output function selections including output speed, frequency, voltage, current and power.

2.7 CONTROL FUNCTIONS AND ADJUSTMENTS

.1 Output frequency shall be adjustable between 0Hz and 300Hz. Operation above motor nameplate shall require programming changes to prevent inadvertent high-speed operation.

.2 Stop mode selections shall include coast to stop and ramp to stop.

.3 The VFD shall be capable of controlling deceleration of a load without generating an overvoltage fault caused by excessive regenerated energy. Overvoltage control on deceleration shall extend the ramp time beyond the programmed value to keep the amount of regenerated energy below the point that causes overvoltage trip.

.4 The VFD shall be capable of starting into a rotating motor with or without existing magnetic flux on the motor regardless of the motor direction. From the time the start signal is given to the VFD to the time the VFD has control of the motor shall not exceed two (2) seconds. Once the VFD has control of the motor it will than accelerate or decelerate the motor to the active reference speed without tripping or faulting or causing component damage to the VFD. The VFD shall also be capable of flux braking at start to stop a reverse spinning motor prior to ramp.

.5 The VFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.

.6 Control functions shall include two (2) sets of acceleration and deceleration ramp time adjustments with linear and an s-curve ramp time selection.

.7 Speed control functions shall include:

.1 Adjustable min/max speed limits.

.2 Selection of up to 15 preset speed settings for external speed control.

.3 Three sets of critical speed lockout adjustments.

.4 A built-in PID controller to control a process variable such as pressure, flow or fluid level.

.8 Functions shall include flux optimization for optimizing energy efficiency and limit the audible noise produced by the motor by providing the optimum magnetic flux for any given speed / load operating point.

.9 The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay

output shall include programmable time delays that will allow for VFD acceleration from zero speed without signaling a false underload condition.

.10 Three (3) programmable critical frequency lockout ranges shall be provided to prevent the VFD from operating the load continuously at an unstable speed.

.11 The VFD shall offer software to select the VFDs action in the event of a loss of the primary speed reference.

.12 The VFD shall have fifteen (15) internal adaptive programming blocks capable of twenty (20) different functions. These blocks shall be connectable to VFD's actual signals and functions allowing the user to tailor the VFD to the specific application requirements without additional hardware. These blocks shall be programmable through the standard operator panel and through the use of programming software.

2.8 COMMUNICATIONS

.1 The VFD shall be capable of communicating with other VFDs or controllers via a serial communications link. A variety of communications interface modules for the typical overriding control systems shall be available.

.2 The VFD shall have a Modbus/TCP interface module for remote interrogation by a DCS or PLC controller. Vendor shall indicate all drive parameters that are accessible from this interface.

.3 Interface modules shall mount directly to the VFD control board or be connected via fiber optic cables to minimize interference and provide maximum throughput.

.4 I/O shall be accessible through the serial communications adapter. Serial communication capabilities shall include, but not be limited to:

.1 Run-Stop control
.2 Hand-Off-Auto Control
.3 Speed Adjustment
.4 PID (proportional/integral/derivative) control adjustments
.5 Current Limit
.6 Accel/Decel time adjustments

.5 The VFD shall have the capability of allowing the overriding controller to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information.

.6 A connection shall also be provided for personal computer interface. Software shall be available for VFD setup, diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of VFD performance.

2.9 FACTORY TESTING

.1 The manufacturer's standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA and NEMA standards. Results from the test shall be provided with closeout submittals.

2.10 ACCEPTABLE PRODUCT

.1 ABB ACS550-U1-02A7-6 VFD for 1 HP Drives

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Manufacturer's installation instructions and recommendations.

.2 Hire factory trained representative for setup and commissioning of VFD. Provide written report to Contract Administrator.

.3 Hire factory trained representative to provide one day of training for City of Winnipeg personnel.

.4 Confirm power lugs and VFD can accommodate the pump motor cables leads.

.5 Setup VFD so that equipment is controlled as per controls narrative.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Flourescent Lamp Ballast.

.2 ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

1.2 Related Sections

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 Shop Drawings And Product Data

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Contract Administrator.

.3 Photometric data to include: VCP Table and spacing criterion.

PART 2 - PRODUCTS

2.1 Lamps

.1 Lamps as per luminarie schedule on electrical drawings.

2.2 Luminaires

.1 Luminaries as per luminaire schedule on electrical drawings.

2.3 Emergency Lighting

.1 Battery packs shall be 12V-72W complete with 2 MR16 LED, 12V-5W lamps in a NEMA 4X enclosure designed for wet locations. Lumacell RG-NX Series or approved equal in accordance with B7.

.2 Remote lamps shall have 2 MR16 LED, 12V-5W lamps in a NEMA 4X enclosure designed for wet locations. Lumacell MQMP-NX Series or approved equal in accordance with B7.

PART 3 - EXECUTION

3.1 Installation

.1 Locate and install luminaires as indicated.

3.2 Luminaire Supports

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.3 Luminaire Alignment

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Lighting

.1 Lighting shall be considered incidental to the Contract Lump Sum Price for "Electrical".

~End~