

The following Addendum forms part of the Contract Documents for Project R.076516.013. The following changes, additions or deletions shall be made to the following documents as indicated and all other Contract Documents shall remain the same.

This Addendum Number 02 contains 6 written pages, and 46 pages of attachments as follows:

LEED Scorecard attachment to Section 01 35 21 – LEED Requirements, 1 page

Section 23 73 11 Air Handling Units – Packaged, 12 pages

Section 25 30 02 EMCS Field Control Devices, 18 pages

Drawing M3.03 – Fire Protection Schematic

Drawing M5.01 – Mechanical Schedules

Drawing E4.05 – Communication Pathway and Access Point Plan – Ground Floor

Drawing E4.06 – Communication Pathway and Access Point Plan – Second Floor

Sketch ADD-2-MSK-01

Sketch ADD-02-ESK-01

Sketch ADD-02-ESK-02

Sketch ADD-02-ESK-03

Sketch ADD-02-ESK-04

Sketch ADD-02-ESK-05

Sketch ADD-02-ESK-06

Sketch ADD-02-ESK-07

Sketch ADD-02-ESK-08

Sketch ADD-02-ESK-09

Sketch ADD-02-ESK-10

1 ARCHITECTURAL

1.1 SPECIFICATIONS

.1 SECTION 01 35 21 – LEED REQUIREMENTS

- .1** End of Section; add LEED Scorecard attachment, titled 441 University Ave; LEED Canada NC 2009, attached to and forming part of this Addendum.

2 MECHANICAL

2.1 SPECIFICATIONS

.1 SECTION 23 81 40 - AIR AND WATER SOURCE UNITARY HEAT PUMP

- .1** Item 2.4.1.9; revise to read as follows;
 - .9** The outdoor unit shall be capable of operating in heating mode down to -20°C ambient temperatures or cooling mode down to -40°C ambient temperatures.

- .2 Section 23 73 11 Air Handling Units – Packaged
 - .1 Replace forms part of this Addendum.
- .3 Section 25 30 01 EMCS Building Controllers
 - .1 Item 2.7.5.1; revise to read as follows:
 - .1 MCU I/O points as required.
 - .2 Item 2.9.4.5; revise to read as follows:
 - .5 Sequence of operation as indicated on the drawings.
- .4 Section 25 30 02 EMCS Field Control Devices
 - .1 Replace forms part of this Addendum.

2.2 DRAWINGS:

- .1 DRAWING M3.03 - FIRE PROTECTION SCHEMATIC
 - .1 Replace forms part of this Addendum, incorporating the following changes:
 - .1 Added flow switch for roof vestibule sprinkler connection from Zone 4 on second floor.
- .2 DRAWING M3.04 - MECHANICAL CONTROL SCHEMATICS
 - .1 Detail #3; revise detail as shown in sketch ADD-2-MSK-0, attached to and forming part of this Addendum.
- .3 DRAWING M5.01 - MECHANICAL SCHEDULES
 - .1 Replace forms part of this Addendum, incorporating the following changes:
 - .1 Added note to dedicated outdoor air system schedule.
 - .2 Added note # 4 to air source heat pumps schedule.
 - .3 Added note to boiler schedule.
 - .4 Updated plumbing fixture schedule.

3 ELECTRICAL

3.1 SPECIFICATIONS

- .1 Not Used

3.2 DRAWINGS

- .1 DRAWING E0.01 – ELECTRICAL LEGEND AND DRAWING LIST
 - .1 Revise as shown in Sketch ADD-02-ESK-01; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 Symbols for poke through and floor monuments, located in meeting rooms, have been revised.

- .2 New symbols have been added for poke through/floor monuments with A/V capacity.
- .2 DRAWING E1.01- ELECTRICAL SITE PLAN
 - .1 Revise as shown in Sketch ADD-02-ESK-02; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 Added key Note SP.5.
- .3 DRAWING E4.01 - POWER AND COMMUNICATION PLAN - BASEMENT
 - .1 Revise as shown in Sketch ADD-02-ESK-03; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 Supply and install four (4) new twist lock receptacles for data racks. New twist lock outlets to be installed above the racks and below the cable tray to the rear of the rack. Ensure that the electrical wiring and outlets do not interface with the installation of the cable system.
- .4 DRAWING E4.02 - POWER AND COMMUNICATION PLAN - GROUND FLOOR
 - .1 Revise as shown in Sketch ADD-02-ESK-04; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 Supply and install 19mm plywood on all perimeter walls of New Electrical Room 113A.
 - .2 Replace 4-Gang recessed concrete floor boxes in meeting rooms 126 and 118 with a recessed poke through with a 6-Gang recessed floor boxes with AV capacity.
 - .3 Key note 20 has been revised. This note is applicable to all trench works in meeting room 121.
- .5 DRAWING E4.03 - POWER AND COMMUNICATION PLAN - SECOND FLOOR
 - .1 Revise as shown in Sketch ADD-02-ESK-05; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 Supply and install 19mm plywood on all perimeter walls of New Electrical Room 205.
 - .2 New service/grounding conduits for new second floor tenant's (tenant 230) added to the drawing.
 - .2 Revise as shown in Sketch ADD-02-ESK-06; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 Replace 6" recessed poke throughs in meeting rooms 220, 207 and 209 (applicable to two (2)) with an 8" recessed poke through with AV capacity. Key notes have been revised accordingly.
- .6 DRAWING E4.04 - COMMUNICATION PATHWAY AND ACCESS POINT PLAN - BASEMENT
 - .1 Revise as shown in Sketch ADD-02-ESK-07; attached to and forming part of this Addendum, incorporating the following changes:

- .1 Demark Room 004A layout has been revised.
 - .2 General Note 1; revise to read as follow:
 - .3 Electrical contractor is responsible to provide pre-engineered sleeves for all slab and wall penetrations required to complete ELEC/COMM scope of work. Include x-ray for floor slab penetrations in this scope. All sleeves to be installed may not be shown on drawings. Contractor to review on site for exact quantities and locations of new penetrations in slabs and walls which require sleeves.
- .7 DRAWING E4.05 COMMUNICATION PATHWAY AND ACCESS POINT PLAN - GROUND FLOOR and
DRAWING E4.06 COMMUNICATION PATHWAY AND ACCESS POINT PLAN - SECOND FLOOR
- .1 Replace forms part of this Addendum, incorporating the following changes:
 - .1 Main Equipment Room (102A) and communication rooms layout has been revised.
 - .2 All consolidation points have been deleted from both floors. Electrical contractor to homerun the communication conduits the closest cable tray. Refer to detail 2-E6.09.
 - .3 Rout new conduits for back bone cabling to TC Room 161 directly from Main Equipment Room (102A).
 - .4 Key notes have been revised.
 - .5 In-field cable tray size has been revised to 300mm (12" Wide) x 100mm (4" Deep); key note PW.33 to read as follow:
 - .6 Supply and install new 300mmw x 100mmd in-field basket type cable tray. New cable tray to be grounded.
 - .7 Added new General Note 2.
 - .8 All consolidation points have been deleted. Electrical contractor to homerun the communication conduits the closest cable tray. Refer to detail 2-E6.09.
- .8 DRAWING E5.02 - LOW VOLTAGE - GROUND FLOOR
- .1 Revise location of Sound Masking control panel, associated conduits, accessories, and wiring from COMM 129 to Electrical room 113A.
 - .2 Revise location of rack for CCTV MVR, switch, associated conduits, accessories, and wiring from COMM 129 to IT Storage Room 114.
 - .3 Revise location of Main Security System Panel from east wall of COMM 129 to the south wall of COMM 129.
 - .4 Add Note to COMM 129 as follows:

“STACK CONTROL PANELS ABOVE EACH OTHER.
COORDINATE CONTROL PANELS IN ROOM TO MAINTAIN
ACCESS TO RACKS. DO NOT LOCATE CONTROL PANELS IN
FRONT OR REAR OF RACKS.”

- .9 DRAWING E5.03 - LOW VOLTAGE - SECOND FLOOR
 - .1 Revise location of Sound Masking Control Panel, associated conduits, accessories, and wiring to Electrical room 205 instead of COMM 223.
 - .2 Revise location of Door Control Panel from the east wall of COMM 223 to the south wall of COMM 223.
 - .3 Add Note to COMM 223 as follows:

“STACK CONTROL PANELS ABOVE EACH OTHER.
COORDINATE CONTROL PANELS IN ROOM TO MAINTAIN
ACCESS TO RACKS. DO NOT LOCATE CONTROL PANELS IN
FRONT OR REAR OF RACKS.”
- .10 DRAWING E6.04 - ELECTRICAL SCHEDULES
 - .1 Description for fixture type “F”; revise to read as follows:

“2'X4' LED WRAPAROUND. DIE FORMED COLD ROLLED STEEL
HOUSING. STEEL END PLATES WITH LIGHT-SEAL
EMBOSSMENT. BAKED WHITE ENAMEL FINISH. TO BE
COMPLETED WITH MOUNTING KIT”
- .11 DRAWING E6.08 - ELECTRICAL RISER DIAGRAM
 - .1 Revise as shown in Sketch ADD-02-ESK-08; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 Revise grounding detail
 - .2 Provide dedicated 2” (50mm) conduit for grounding conductor between base building electrical room and new second floor tenant's (Tenant 230) service location.
 - .3 Revise communication riser diagram
- .12 DRAWING E6.09 - ELECTRICAL DETAILS
 - .1 Revise as shown in Sketch ADD-02-ESK-09; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 New detail 1-E6.09 for typical floor boxes/ poke-throughs located in the meeting rooms.
 - .2 Revise detail 2-E6.09
 - .3 Electrical contractor to homerun the communication conduits the closest cable tray.
- .13 DRAWING E6.10 - ELECTRICAL RISER DIAGRAM
 - .1 Revise as shown in Sketch ADD-02-ESK-10; attached to and forming part of this Addendum, incorporating the following changes:
 - .1 New riser diagram for CCTV & security system for Tenant 230. All cameras added as part of Addendum #1 will belong to Tenant 230.

- .2 Provide empty conduit system for the security system to second floor tenant. New 4"x4" pull box to be located on the secure side of the ceiling outside the tenant space (3' short of the demising wall) at the 2nd floor.
- .3 Security detail notes for CRA CCTV Riser & Details have been revised.

END OF ADDENDUM 02

LEED Canada NC 2009		61	15	34	0	TARGETED CERTIFICATION:		Gold	
Sustainable Sites		17	1	8	0			Responsibility	
Construction Activity Pollution Prevention		PREREQUISITE				SSp1	Civil Engineer		
Site Selection	1	1				SSc1	Architect		
Development Density & Community Connectivity	5	3		2		SSc2	Architect		
Brownfield Redevelopment	1			1		SSc3	Architect		
Alternative Transportation: Public Transportation Access	6	6				SSc4.1	Architect		
Alternative Transportation: Bicycle Storage & Changing Rooms	1	1				SSc4.2	Architect		
Alternative Transportation: Low-Emitting and Fuel-Efficient Vehicles	3	3				SSc4.3	Architect		
Alternative Transportation: Parking Capacity	2	2				SSc4.4	Architect		
Site Development: Protect and Restore Habitat	1			1		SSc5.1	Landscape Architect		
Site Development: Maximize Open Space	1			1		SSc5.2	Landscape Architect		
Stormwater Design: Quantity Control	1			1		SSc6.1	Civil Engineer		
Stormwater Design: Quality Control	1			1		SSc6.2	Civil Engineer		
Heat Island Effect: Non-Roof	1			1		SSc7.1	Architect		
Heat Island Effect: Roof	1	1				SSc7.2	Architect		
Light Pollution Reduction	1		1			SSc8	Electrical Engineer		
Water Efficiency		2	0	8	0			Responsibility	
Water Use Reduction - 20%		PREREQUISITE				WEp1	Mechanical Engineer		
Water Efficient Landscaping	4			4		WEc1	Landscape Architect		
Innovative Wastewater Technologies	2			2		WEc2	Mechanical Engineer		
Water Use Reduction - 30, 35 or 40%	4	2		2		WEc3	Mechanical Engineer		
Energy & Atmosphere		21	8	6	0			Responsibility	
Fundamental Commissioning of Building Energy Systems		PREREQUISITE				EAp1	Commissioning Agent		
Minimum Energy Performance						EAp2	Energy Modeler		
Fundamental Refrigerant Management						EAp3	Mechanical Engineer		
Optimize Energy Performance	19	11	4	4		EAc1	Energy Modeler		
On-Site Renewable Energy	7	7				EAc2	Energy Modeler		
Enhanced Commissioning	2			2		EAc3	Commissioning Agent		
Enhanced Refrigerant Management	2		2			EAc4	Mechanical Engineer		
Measurement & Verification	3	3				EAc5	M&V Consultant		
Green Power	2		2			EAc6	Client/Owner		
Materials & Resources		5	2	7	0			Responsibility	
Storage & Collection of Recyclables		PREREQUISITE				MRp1	Architect		
Building Reuse: Maintain Existing Walls, Floors, and Roof	3	2		1		MRc1.1	Architect		
Building Reuse: Maintain Interior Non-Structural Elements	1			1		MRc1.2	Architect		
Construction Waste Management	2	2				MRc2	Contractor		
Materials Reuse	2			2		MRc3	Architect		
Recycled Content	2		1	1		MRc4	Contractor		
Regional Materials	2		1	1		MRc5	Contractor		
Rapidly Renewable Materials	1			1		MRc6	Architect		
Certified Wood	1	1				MRc7	Architect		
Indoor Environmental Quality		10	1	4	0			Responsibility	
Minimum Indoor Air Quality (IAQ) Performance		PREREQUISITE				EQp1	Mechanical Engineer		
Environmental Tobacco Smoke (ETS) Control						EQp2	Architect		
Outdoor Air Delivery Monitoring	1	1				EQc1	Mechanical Engineer		
Increased Ventilation	1			1		EQc2	Mechanical Engineer		
Construction IAQ Management Plan: During Construction	1	1				EQc3.1	Contractor		
Construction IAQ Management Plan: Before Occupancy	1	1				EQc3.2	Contractor		
Low-Emitting Materials: Adhesives and Sealants	1	1				EQc4.1	Architect		
Low-Emitting Materials: Paints and Coatings	1	1				EQc4.2	Architect		
Low-Emitting Materials: Flooring Systems	1	1				EQc4.3	Architect		
Low-Emitting Materials: Composite Wood and Agrifibre Products	1	1				EQc4.4	Architect		
Indoor Chemical & Pollutant Source Control	1			1		EQc5	Architect		
Controllability of Systems: Lighting	1	1				EQc6.1	Electrical Eng. / Interiors		
Controllability of Systems: Thermal Comfort	1			1		EQc6.2	Mechanical Engineer		
Thermal Comfort: Design	1	1				EQc7.1	Mechanical Engineer		
Thermal Comfort: Verification	1	1				EQc7.2	Mechanical Engineer		
Daylight and Views: Daylight	1			1		EQc8.1	Architect		
Daylight and Views: Views	1		1			EQc8.2	Architect		
Innovation In Design		3	3	0	0			Responsibility	
Innovation in Design: Low Mercury Lamps	1	1				IDc1.1	Client/Owner		
Innovation in Design: Low Emitting Furniture	1	1				IDc1.2	Client/Owner		
Innovation in Design: TBD	1		1			IDc1.3	Client/Owner		
Innovation in Design: TBD	1		1			IDc1.4	Client/Owner		
Innovation in Design: TBD	1		1			IDc1.5	Client/Owner		
LEED® Accredited Professional	1	1				IDc2	LEED Consultant		
Regional Priority		3	0	1	0			Responsibility	
Durable Building	1			1		RPc1	Building Scientist		
Regional Priority: SSc2 - Development Density and Community Connectivity	1	1				RPc2.1	LEED Consultant		
Regional Priority: SSc7.2 - Heat Island Effect, Roof	1	1				RPc2.2	LEED Consultant		
Regional Priority: EAc1 - Optimize Energy Performance >40%	1	1				RPc2.3	LEED Consultant		

TARGETED TOTAL	61	15	34	0	61 / 110			
----------------	----	----	----	---	----------	--	--	--

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 90.1-2010, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 ANSI/ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .2 American National Standards Institute (ANSI)
 - .1 ANSI/AMCA 210-07, Laboratory Methods of Testing Fans for Aerodynamic Performance Ratings.
 - .2 ANSI/AHRI 1060-2011, Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .4 Underwriter's Laboratories (UL)
 - .1 UL 1995 – 2011, Heating and Cooling Equipment
- .5 National Fire Protection Agency (NFPA)
 - .1 NFPA 90A -2012, Installation of Air Conditioning and Ventilating Systems
- .6 Master Painters Institute (MPI)
 - .1 MPI-INT 5.3-2007, Galvanized Metal.

1.2 RELATED SECTIONS

- .1 Section 23 05 53.01 – Mechanical Identification
- .2 Section 23 84 13 – Humidifiers
- .3 Section 25 90 01 – Site Requirements, Applications and Systems Sequences of Operation

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation, filters, adhesives, and paints, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate following:

- .1 Unit performance. Indicate all parameters as indicated in mechanical schedules.
- .2 Component arrangement
- .3 Fan construction, motor, operating point on performance curve
- .4 Enthalpy wheel performance at summer and winter operating conditions
- .5 Air handling unit cabinet and door construction, dimensions and weights. Include all necessary service clearances
- .6 Supply Air, Return Air, Exhaust Air, and Outdoor Air connection Points
- .7 Filters
- .8 Dampers
- .9 Preheat Coil, DX expansion coil, and drain pan construction
- .10 Water source heat pump performance and construction
- .11 Factory mounted controls
- .12 Work to be provided by others

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.
- .2 Include following:
 - .1 Approved equipment shop drawings
 - .2 Recommended service and preventative maintenance information
 - .3 Commissioning and testing reports

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00.
- .2 Provide one spare set of filters.
- .3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00.
 - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .3 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.
-

1.7 SUBMITTALS

- .1 Provide required information in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Submit shop drawing that include the following minimum information. Shop drawings submitted without this information will be automatically rejected:
 - .1 Construction details: Submit unit construction drawings for the following components:
 - .1 Side panels, including connection details.
 - .2 Top panel, including connection details.
 - .3 Floor, including connection details.
 - .4 Doors, hinges, latch, viewing port.
 - .5 Fan, motor and drive, mounting and isolation.
 - .6 Coil section.
 - .7 Pipe and conduit penetration through casing or floor.
 - .8 Drain pan.
 - .9 Damper, linkage and drive construction and mounting.
 - .2 Materials of Construction: Indicate material and gauge of all construction components.
 - .3 Mass Distribution Drawings: Show point loads, and recommended method of unit installation.
 - .4 Fan Performance Data: Submit fan performance curves as well as performance tables.
 - .5 Air Blenders: Make, model, selection criteria and pressure drop curves.
 - .6 Coils: Selection criteria indicating air side and fluid side capacities, in and out conditions, velocities, pressure drops and fouling factors. Submit a drawing showing headers, circuiting, arrangement, connection sizes, and materials of construction.
 - .7 Air Filters: Media, efficiency rating, velocity, pressure drop charts and capacities. Indicate mounting method and arrangement.
 - .8 Vibration Isolator Shop Drawings.
 - .9 Humidifier shop drawings and capacities.
 - .10 Table indicating pressure drops through all components of the unit.
 - .11 Damper Shop Drawings.
 - .12 Detailed composite wiring diagrams showing factory installed wiring, including wiring of the control components.
 - .13 Sound Levels: Submit sound power levels generated by the air handling unit at the inlet and outlet of the unit and outside the fan section. List for individual octave bands in dB referenced to A rating.

Part 2 PRODUCTS

2.1 GENERAL

- .1 A packaged energy recovery ventilator capable of transferring sensible and latent energy with supplementary heating and cooling. Energy recovery shall be through an energy recovery wheel installed within the unit. System to include:
 - .1 Enthalpy Wheel and wheel drive system
 - .2 Ventilation air fan
 - .3 Exhaust air fan
 - .4 Heating, Cooling, and Preheat coils
 - .5 Dampers
 - .6 Temperature Sensors and Controls.
 - .7 Water source heat pumps
 - .8 Filters
- .2 All components to be factory assembled and run tested.
- .3 Unit shall be constructed in accordance with UL 1995, ASHRAE 90.1, and NFPA 90A. Unit shall be listed for use within Canada. Airflow data shall comply with ANSI/AMCA 210.
- .4 Unit nameplate shall be as indicated in Section 23 05 53.01.

2.2 CASINGS

- .1 Heavy gauge galvanized steel panels with galvanized steel frame reinforced and braced for rigidity.
 - .1 Paint cabinet with baked on enamel paint
- .2 Removable panels shall be provided to access all internal components for necessary maintenance.
- .3 Unit frame to include 150mm base rails. Unit shall have provisions for rigging and lifting integrated into the base rails of the unit.
- .4 Cabinet shall be insulated throughout with a minimum of 25mm insulation. Provide galvanized steel liner.

2.3 DRAIN PANS

- .1 Construction: stainless steel. Rounded corners.
- .2 Drain connection: in bottom at low point.
- .3 Installation: slope without sag minimum 1% to ensure no standing water at any time or at any point.

2.4 FANS

- .1 Fans to be selected to operate on a stable, efficient part of the fan curve when delivering air quantities scheduled against static of the system.

- .2 Fan blades shall be statically and dynamically balanced and tested prior to shipment. Fan discharges and intakes to be as indicated on mechanical drawings.
- .3 Supply and exhaust fans to be forward-curved, DWDI. Fan shaft to be solid steel, turned, ground, polished, and finished off with a corrosion resistant coating. Fan wheels shall be keyed to the shaft and have pillow block bearings.
- .4 Fan drives shall be designed for a 1.3 service factor. Fan shall be equipped with an adjustable motor sheave. Drives are to be factory mounted with final alignment and belt adjustment completed before unit startup.
- .5 Maximum sound power levels, as indicated.
- .6 Mount fans on open spring vibration isolation mounts.

2.5 MOTORS

- .1 Motors shall be designed for severe duty in accordance with IEEE 841 standards and shall meet NEMA MG1 Part 31. Motors shall be operable at 600 Volts, 60 Hz, 3-phase.
- .2 Motor enclosure shall be totally enclosed fan cooled and rated to IP55. A non metallic cooling fan shall be provided. Frame, end bells and fan cowl shall be manufactured of heavy duty cast iron. The end plates shall be sealed to the frame joints. Enclosure shall be epoxy coated and rated for ASTM B117-90 96 hour salt spray test.
- .3 Motor windings shall have class F insulation with class B temperature rise ratings. Windings shall be 200C inverter spike resistant wire. Motor windings shall withstand 2000V transients. Motor service factor shall be 1.15 on sine wave power and 1.0 on VFD power.
- .4 Bearings shall be regreasable without disassembly and provide for the elimination of purged grease. Bearing life shall be a minimum of L10 at 50000 hours. Bearing seals shall be Inpro or equivalent.
- .5 Motors shall be balanced to less than 0.08 inches per second (filter out) and the vibration test data shall be shipped with the motor.
- .6 Nameplates shall be stainless steel and contain both NEMA data and bearing data.
- .7 Motors used with variable frequency drives shall be provided with a brush system to electrically ground the shaft and discharge any induced voltage on the motor shaft, with a direct path to ground.
- .8 Motor shall be provided with a 3 year warranty.

2.6 ENTHALPY WHEEL

- .1 Enthalpy recovery performance for the wheel shall be certified by AHRI to AHRI Standard 1060. Wheels tested in independent labs and rated in accordance to AHRI Standard 1060 without AHRI certification are not acceptable
 - .2 Enthalpy wheel shall conform to the requirements of NFPA-90A.
 - .3 Enthalpy wheel cassette shall be complete with face seal and perimeter seal to minimize exhaust air transfer ratio when tested in accordance with AHRI Standard 1060. Exhaust air transfer ratio values must be certified to AHRI.
-

- .4 Enthalpy wheel shall be self cleaned by two counter flow airstreams and come equipped in slide out cassette for easy removal for maintenance.
- .5 Enthalpy wheel shall have permanently sealed ball bearings with 200,00 hour L-10 life.

2.7 DAMPERS

- .1 Unit shall include an outside air motorized damper and exhaust air motorized damper.
- .2 Dampers shall be insulated with a leakage not to exceed 25.3 l/s/m² at 250 Pa. Dampers shall be provided with extruded EPDM gasketing on the leading edges of the damper blades.
- .3 Dampers shall be parallel blade, normally closed.

2.8 FILTER BOX

- .1 Provide blank-off plates and gaskets to prevent air bypass where required.
- .2 Filters:
 - .1 Minimum Efficiency Reporting Value (MERV) value 8 filtration media to ASHRAE 52.2 to be used on:
 - .1 Supply pre-filter.
 - .2 Minimum Efficiency Reporting Value (MERV) value 13 filtration media to ASHRAE 52.2 to be used on:
 - .1 Supply final filter.
 - .3 Immediately prior to occupancy, replace filtration media with new filtration media.

2.9 COILS

- .1 Heating and Cooling Coil
 - .1 Units shall be equipped with an integrated Water Source Heat Pump section which shall be suitable for cooling tower/boiler loop applications.
 - .2 To be UL and CSA approved.
 - .3 Evaporator coil shall include cooling and heating stages in quantities sufficient to meet the scheduled cooling and heating capacities.
 - .4 Reversible refrigerant circuits shall include externally equalized thermostatic expansion valve and reversing valve.
 - .5 Condenser shall be coaxial tube-in-tube with copper inner tubes and steel outer tubes or brazed steel plates. Condenser shall be selected with 2.7°C sub-cooling and have maximum working pressures of 2760 kPa on the water side and 4550 kPa on the refrigerant side.
 - .6 Water connections to be NPT type and mounted external to the unit.
 - .7 Refrigeration system shall incorporate a single variable speed compressor.
 - .8 Unit to be charged with R410a refrigerant, factory run and leak tested with all necessary controls for operation.
 - .9 Unit shall include refrigerant high and low pressure gauge connections.
 - .10 Unit shall include refrigerant suction and discharge valves.

- .2 Preheat Coil:
 - .1 Casings: 1.5mm thick galvanized sheet steel.
 - .1 Supports of galvanized steel channel.
 - .2 Blank-off plates. Insulated sandwich construction.
 - .2 Coil: cleanable fins.
 - .1 Tubes: copper.
 - .2 Fins: aluminum.
 - .3 Headers: cast brass.
 - .4 Pressure tests: 1.7 MPa.
- .3 Ratings: ARI certified.

2.10 CONTROLS

- .1 A recessed integral electrical control compartment shall be furnished on the side of the unit. All components shall be factory-mounted and wired to a labeled terminal strip. All components and wiring shall be identified using printed self-adhesive labels, consistent with the numbering used in the wiring diagrams.
- .2 Unit shall be equipped with preheat frost prevention to prevent frost from forming on the enthalpy wheel and allow for continuous ventilation. Unit shall come equipped with sensing and control devices for modulating control of preheat coil.
 - .1 Control valve provided by Controls Contractor.
- .3 Unit shall come equipped with a factory-installed, programmed and run tested DDC Controls Package which shall include a stand-alone microprocessor-based DDC controller and necessary sensors and interfaces to provide control of post-conditioning and pre-conditioned functions and unit operation.
- .4 An intelligent programmable interface device with remote temperature sensor shall be included for communication, display, setpoint control and to allow for servicing. Interface device to be unit mounted. Remote temperature sensor to be installed in S/A discharge duct downstream of unit by Division 25.
- .5 The DDC controller shall be native BACnet for communication with BAS. Interoperability shall be tested and approved by the BACnet Testing Laboratory. Minimum points to be provided for communication with BAS are as follows:
 - .1 Outside air temperature
 - .2 Supply air temperature
 - .3 Return air temperature
 - .4 Exhaust air temperature
 - .5 Outside air humidity
 - .6 Return air humidity
 - .7 Supply blower operation
 - .8 Cooling setpoint
 - .9 Cooling temperature band
 - .10 Heating setpoint
 - .11 Heating temperature band

- .12 Damper positions
- .6 Safety controls for heat pump refrigeration circuit shall be auto reset on the low pressure side and manually reset on the high pressure side.
- .7 Provide unit with low leaving water temperature (freeze stat) safety switch.
- .8 Provide device and contacts to provide a 24 VAC signal when filters require replacing.
- .9 Unit shall come equipped with a wheel rotation sensor. A 24 VAC signal shall be provided if the enthalpy wheel fails.
- .10 Provide unit with a factory installed thermostat to control free cooling.
- .11 Include provision to wire a field supplied motorized on/off 2-way water shut-off valve. Valve shall be interlocked with unit to turn off water flow when the unit compressor is off.
- .12 All unit safety controls shall be factory mounted and wired, requiring only field installation of remote sensing devices.
- .13 Interlock exhaust air and outside air damper position with fan operation. A signal shall be sent if the dampers fail.
- .14 Provide all controls points as depicted on drawing M3.04 Detail 1.
- .15 Refer to drawing M3.04 Detail 1. for Sequences of Operation.

2.11 HUMIDIFIERS

- .1 In accordance with Section 23 84 13.
- .2 Air handling unit manufacturer shall mount steam grid provided by humidifier manufacturer. Balance of steam humidifier components shall be mounted in the field by the contractor. Provide minimum absorption distance downstream of humidifier as scheduled.
- .3 Steam supply and drain connections shall be on the same side of the AHU with both pipe connections extended 6" beyond the casing exterior wall at the factory.

2.12 AIRFLOW MEASURING PROBES

- .1 Provide on each fan, air flow measuring probes.
- .2 Each airflow probe shall contain multiple, averaged velocity pressure taps located symmetrically around the throat of the fan inlet and a single static pressure tap located on the fan housing. The entire airflow monitoring probe must be located outside the inlet throat as to not obstruct airflow.
- .3 The probes shall be capable of producing steady, non-pulsating signal of the velocity pressure, independent of the upstream static pressure without adversely affecting the performance of the fan. The sensing probes shall be accurate $\pm 3\%$ of actual fan airflow.

2.13 AIRFLOW DISPLAY

- 1.1.1 Provide on indicated fans a method of displaying digitally, in real time, the fans current air flow.
- 1.1.2 The display shall be capable of showing the airflow of four (4) independent fans simultaneously.

- 1.1.3 For interaction with a controller, the display shall output one (1) 0-10VDC signal for each fan being monitored.
- 1.1.4 The output signal shall be accurate to $\pm 0.5\%$ of Natural Span, including non-linearity, hysteresis and non-repeatability.
- 1.1.5 The display must be water tight allowing for use in outdoor locations. If the display is not water tight it shall be enclosed in a weatherproof housing.

1.2 DRAINS

- 1.2.1 Provide 1 1/4" capped floor drain connections on the side of the unit for complete drainability of the base pan for the following sections:
 - 1.2.1.1 Fresh Air Plenums
 - 1.2.1.2 Humidifier Sections
 - 1.2.1.3 Service Corridors
 - 1.2.1.4 Fan Sections
 - 1.2.1.5 Sections upstream and downstream of coils
 - 1.2.1.6 All sections if unit has washdown liner

1.3 LIGHTS

- 1.3.1 Marine lights with protective cast metal cage and glass globes complete with duplex receptacles shall be installed on the wall across from the access doors. One (1) switch with an indicator light shall be installed on the exterior of the unit. Factory wire from switch to all lights in EMT conduit with liquid tight connections. At all split sections, provide a one foot long piece of flexible conduit, with the extra wire spooled, for reconnection on site by the installing contractor. Electrical power shall be 120V/1/60.

1.4 FILTER GAUGES

- 1.4.1 Provide Dwyer 2000 magnehelic gauges.
 - 1.4.2 Magnehelic gauges shall be accurate to $\pm 2\%$ of full range.
 - 1.4.3 Provide sensing probes and shut off valves for each gauge.
 - 1.4.4 Provide one gauge flush mounted into the casing for each filter bank.
-

2.14 TEST PORTS

- .1 Provide 1” diameter test ports for unit air stream testing in each plenum section between each component within the AHU. Test ports shall have a tube that extends between the inside and outside of the unit and a screwed cap on the exterior to allow access. The test ports shall have been flanged on the exterior to allow air seal and shall be flanged on the interior to cover the penetration of the casing.

2.15 ELECTRICAL

- .1 Factory wire and test all air handling units. Have units approved by CSA or ETLc.
- .2 Supply one @ 600V/60 Hz/3 Ph power connection for motors and other large electrical devices and one @ 120 V/208V/60 Hz/1 Ph power connection for lights, controls, heaters, etc.
- .3 Provide a separate 120 V/ 1 phase feed for a 20 amp convenience outlet.
- .4 Provide necessary circuit breakers and/or fuses for each type of electric device.
- .5 A bonding wire shall be provided between the motor loads and the electrical panel. Use of the air handling unit casing for a bond will not be accepted.
- .6 Label and number code all wiring and electrical devices in accordance with the unit electrical diagram. Mount the devices in a control panel inside the unit’s service enclosure or on the outside. Ensure the control panel meets the CSA or Canadian Electrical Code (CEC) standard for the specific installation.
- .7 Provide a system of motor control including all necessary terminal blocks, motor contactors, motor overload protection, grounding lugs, auxiliary contactors and terminals for the connection of external control devices or relays. Individually fuse all fan and branch circuits.
- .8 Wire from the motors to the motor control in accordance with the local electrical code and contained by EMT conduit with liquid tight connections. Seal the casing penetrations in a manner that eliminates air leaks. At all split sections, provide a 1 foot long piece of flexible conduit, with the extra wire spooled, for reconnection on site by the installing contractor.
- .9 External disconnects shall be provided in a NEMA 4 enclosure for superior water protection. Disconnects must be interlocked with the electrical panels for added personnel safety.

2.16 FIELD ASSEMBLED AIR-HANDLING UNIT

- .1 The air-handling unit shall be field assembled on site by the contractor. All parts shall be pre-formed by the manufacturer and partially assembled where access is possible. The parts shall be labeled according to an assembly drawing. All assembly material required such as insulation, sealants, fasteners and hardware shall be supplied by the manufacturer as part of the kit.
- .2 Where access permits, sections of the exterior casing shall be pre-assembled in the factory. Otherwise, casing panels shall be shipped individually.
- .3 The unit base shall be made in factory-assembled sections with joining flanges for field assembly. The base sections shall be pre-painted and pre-insulated in the factory.

- .4 The doors and frames shall be pre-assembled (complete with windows where specified).
- .5 Where access permits, the coil and filter racks shall be pre-assembled and pre-painted in the factory.
- .6 The fan shall be assembled in the factory complete with motor, protective screening, belt guards and isolation base. The fan and guarding shall be pre-painted in the factory. The fan assembly shall undergo a test run in the factory. Where access permits, the fan assembly shall be shipped in one piece. If access does not permit shipping in one piece, the fan shall be disassembled and shipped in pieces.
- .7 The manufacturer shall supply a representative to supervise the assembly of the air-handling unit on the job-site.
- .8 The coils shall be installed on site by the contractor.
- .9 The air-handling unit shall be finish-painted on site by the contractor.
- .10 The electrical panels shall be pre-assembled and pre-tested in the factory. The manufacturer shall provide all necessary conduits and fittings to extend the motor wiring to the electrical panel.
- .11 The air-handling unit manufacturer shall provide marine light fixtures, duplex receptacles, the light switch and the necessary conduit and fittings for field installation of the fixtures.
- .12 All factory and field wiring and assembly shall be done in accordance with the C.E.C.
- .13 The contractor shall be responsible for obtaining electrical approval of the final assembly.

2.17 FINISH

- .1 Unit shall be finished painted with two components, etch bond primer and finish painted with alkyd enamel, color as selected by Owner. All uncoated steel shall be painted with grey enamel. All metal surfaces shall be prepainted with vinyl wash primer to ensure paint bonds to metal. Outdoor unit shall be finish coated with polyurethane paint. Paint for outdoor units shall be tested to ATSM B117 for 5000hr salt spray endurance.

2.18 AIR LEAKAGE TESTING

- .1 Unit manufacturer shall factory pressure test each air handling unit to ensure the leakage rate of the casing does not exceed 0.5% of the unit airflow at 1.5% of the rated static pressure for 4" thick casing units (1.0% of the unit air flow at 1.5 times the rated static pressure for 2" thick casing units).
- .2 Test shall be conducted in accordance with SMACNA duct construction manual. A calibrated orifice shall be used to measure leakage airflow.
- .3 The consultant shall witness the pressure test on the first two units. Provide for all transportation for the consultant and owner to the factory.

2.19 SOUND TESTING

- .1 Air handling unit sound power levels are not to exceed the levels shown on the equipment schedule.

- 1.4.5 Furnish sound power levels at supply connection, return connection, outside air opening relief air openings and casing radiation for each air handling unit. Test data shall show sound power levels re 10-12 watts for each of the nine octave band center frequencies.
- 1.4.6 The air handling unit manufacturer shall be responsible for providing an independent agency to factory test units. The consultant shall witness the sound test on the units. Provide for all transportation for the consultant and owner to the factory.

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

- .1 Provide appropriate protection apparatus.
- .2 Install units in accordance with manufacturer's instructions and as indicated.
- .3 Ensure adequate clearance for servicing and maintenance.
- .4 Ducts to be connected to unit inlet and outlet collars with flexible duct collars to Section 23 33 00

3.3 FANS

- .1 Install fan sheaves required for final air balance.

3.4 DRIP PANS

- .1 Install deep seal P-traps on drip lines.
 - .1 Depth of water seal to be 1.5 times static pressure at this point.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 Related Sections:
 - .1 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.
 - .2 Section 25 05 01 - EMCS: General Requirements.
 - .3 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.
 - .4 Section 25 05 54 - EMCS: Identification.
 - .5 Section 26 05 00 - Common Work Results - Electrical.
 - .6 Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI).
 - .1 ANSI C12.7-2014, Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13-2016, Standard Requirements for Instrument Transformers.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B148-2014, Standard Specification for Aluminum-Bronze Sand Castings.
- .3 National Electrical Manufacturer's Association (NEMA).
 - .1 NEMA 250-2014, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .4 Air Movement and Control Association, Inc. (AMCA).
 - .1 AMCA Standard 500-D-2012, Laboratory Method of Testing Dampers For Rating.
- .5 Canadian Standards Association (CSA International).
 - .1 CAN/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.

1.4 SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02.
- .2 Pre-Installation Tests.
 - .1 Submit samples at random from equipment shipped, as requested by Departmental Representative, 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.

1.5 EXISTING CONDITIONS

- .1 Cutting and Patching: in accordance with Section 01 73 00 supplemented as specified herein.
- .2 Repair surfaces damaged during execution of Work.
- .3 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

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, vibration-proof assembly.
- .3 Operating conditions: 0 - 32°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.
- .8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.
- .9 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01.

2.2 CONTROL PANELS

- .1 Provide control panel of unitized cabinet type construction. Mount relays, switches and controllers with control point adjustment in cabinet and pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
 - .2 Fabricate panels from 3 mm rolled sheet metal sheet with baked enamel finish, flush fitting, gasketed doors hung on piano type hinges and three point latches and locking handles. CSA approved for line voltage applications.
 - .3 Mount panels on vibration free walls or free standing angle iron supports. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.
 - .4 Provide pans and rails for mounting terminal blocks, relays, wiring and other necessary devices.
-

- .5 Provide an individual switch for disconnection and a fuse for isolation of all panel mounted instruments requiring a 120 volt supply.
- .6 Make all wiring connections in the shop from the equipment mounted on the panel to numbered terminal blocks conveniently located in the panel, including the power supply for all instruments.
- .7 Identify all wiring by means of stamped markings on heat shrinkable tubing. Install all wiring neatly and laced or bunched into cable form using plastic wire clips, where practical, contained in plastic wiring channels with covers. Maximum 25 conductors to each wire bundle.
- .8 Provide terminal blocks, tabular clamp, 300 V, complete with track. Each terminal shall be clearly indelibly marked with the wire number connection to it. Each field connecting conductor shall be served by one terminal. Provide 20% spare unit terminals, with a minimum of two spare terminals. Provide all necessary terminal block accessories such as manufacturer jumpers and marking tape.
- .9 Install "Hand-Off-Auto" selector switches such that safety controls and electrical over current protection are not overridden when selector switch is in the "Hand" position. "Hand-Off-Auto" selector switches shall be provided for all ventilation fans and sump pumps.
- .10 Control Power for control panel shall be 120 Volts A.C. from panel circuits provided by Division 16.
- .11 Install bonding conductor between main control and auxiliary panels complete with grounding lugs, in addition to CSA grounding requirements.

2.3 WIRE

- .1 Control wiring for digital functions shall be 1 mm minimum with 300 Volt insulation.
- .2 Control wiring for analog functions shall be 1 mm minimum with 300 Volts insulation, twisted and shielded, 2 or 3 wire to match analog function hardware.
- .3 Sensor wiring shall be 1 mm minimum twisted and shielded, 2 or 3 wire to match analog function hardware or 1.3 mm as required by code.
- .4 Transformer current wiring shall be 1.3 mm minimum.

2.4 CONDUITS AND CABLES

- .1 Install wiring in conduit or trays. Conform to Division 26 requirements for conduit and trays specifications.
 - .2 Seal conduit where such conduit leaves heated areas and enters unheated area.
 - .3 In the field panel, run low level signal lines in separate conduit from high level signal and power transmission lines.
 - .4 Identify each cable and wire at every termination point.
 - .5 Provide instrumentation complete with standard electrical conduit box for termination unless otherwise noted.
 - .6 Where applicable, mount field interface equipment (i.e. relays, transducers, etc.) in local device cabinets adjacent to field interface panels.
-

- .7 Separate conduits shall be provided for pneumatic tubing and electrical wiring runs.
- .8 Color code all conductors and conduits by permanently applied color bands. Color code shall follow base building schedule.

2.5 TEMPERATURE SENSORS AND THERMOSTATS

- .1 General: To be resistance or thermocouple type to following requirements:
 - .1 Thermocouples: limit to temperature range of 200 degrees C and over.
 - .2 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm °C.
 - .3 Sensing element: hermetically sealed.
 - .4 Stem and tip construction: copper or type 304 stainless steel.
 - .5 Time constant response: less than 3 seconds to temperature change of 10°C.
 - .6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length to be half of pipe diameter.
 - .7 Temperature sensors provided in inmate accessible areas to be provided with protective wire guard cover.
- .2 Room temperature sensors and display wall modules.
 - .1 Temperature sensing and wall module.
 - .1 Jack connection for plugging in laptop personal computer for access to field adjustments of damper ranges, user adjustable set-point range, unoccupied set-points, as well as PI tuning variables.
 - .2 Integral thermistor sensing element 10,000 ohm at 24 degrees.
 - .3 Accuracy 0.2°C over range of 0 to 70°C.
 - .4 Stability 0.02°C drift per year.
 - .5 Separate mounting base for ease of installation.
 - .2 Room temperature sensors.
 - .1 Wall mounting, in slotted type covers having brushed aluminum finish.
 - .2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2°C.
 - .3 Sensor shall be complete with override button and +/-1°C temperature adjustment for private office areas.
 - .3 VRF equipment thermostats
 - .1 Wall mounted thermostats for controlling VRF indoor units to be provided by VRF equipment manufacturer and installed by Division 25.
- .3 Duct temperature sensors:
 - .1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length as required to measure temperature from centre of duct.

- .2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 600 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance.
- .4 Outdoor air temperature sensors:
 - .1 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in NEMA 4 enclosure.
- .5 Remote Bulb Thermostat:
 - .1 Line Voltage remote bulb type thermostat with:
 - .1 30A rating at 120V
 - .2 Copper capillary tube, length to suit site installation.
 - .3 Cast weather tight box.

2.6 CARBON DIOXIDE SENSOR

- .1 Requirements:
 - .1 Used for CO2 based ventilation control.
 - .2 Non-Dispersion-Infrared (NDIR) technology used to measure carbon dioxide gas.
 - .3 Device provides voltage or current output based on CO2 levels.
 - .4 Automatic Background Calibration (ABC) algorithm based on long-term evaluation reduces required typical zero-drift check maintenance
 - .5 Power supply: 24 V DC into load of 575 ohms.

2.7 TEMPERATURE TRANSMITTERS

- .1 Requirements:
 - .1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.
 - .2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01°C per volt change.
 - .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
 - .4 Input and output short circuit and open circuit protection.
 - .5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.
 - .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.
 - .7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
 - .8 Integral zero and span adjustments.
 - .9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50°C.
 - .10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.
 - .11 Transmitter ranges: select narrowest range to suit application from following:
 - .1 Minus 50 degrees C to plus 50°C, plus or minus 0.5°C.

- .2 0 to 100°C, plus or minus 0.5°C.
- .3 0 to 50°C, plus or minus 0.25°C.
- .4 0 to 25°C, plus or minus 0.1°C.
- .5 10 to 35°C, plus or minus 0.25 °C.

2.8 HUMIDITY SENSORS

- .1 Duct Requirements:
 - .1 Range: 5 - 90% RH minimum.
 - .2 Operating temperature range: 0 - 60 degrees C.
 - .3 Absolute accuracy:
 - .1 Duct sensors: plus or minus 3%.
 - .4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.
 - .5 Maximum sensor non-linearity: plus or minus 2% RH with defined curves.
 - .6 Duct mounted sensors: locate so that sensing element is in air flow in duct, 3m downstream of steam dispersion device.
- .2 Outdoor Humidity Requirements:
 - .1 Range: 0 - 100% RH minimum.
 - .2 Operating temperature range: -40°C.
 - .3 Absolute accuracy: plus or minus 2%.
 - .4 Temperature coefficient: plus or minus 0.03%RH/ degrees C over 0 to 50 degrees C.
 - .5 Must be unaffected by condensation or 100% saturation.
 - .6 No routine maintenance or calibration is required.

2.9 HUMIDITY TRANSMITTERS

- .1 Requirements:
 - .1 Input signal: from RH sensor.
 - .2 Output signal: 4 - 20 mA onto 500 ohm maximum load.
 - .3 Input and output short circuit and open circuit protection.
 - .4 Output variations: not to exceed 0.2% of full scale output for supply voltage variations of plus or minus 10%.
 - .5 Output linearity error: plus or minus 1.0% maximum of full scale output.
 - .6 Integral zero and span adjustment.
 - .7 Temperature effect: plus or minus 1.0% full scale/ 6 months.
 - .8 Long term output drift: not to exceed 0.25% of full scale output/ 6 months.

2.10 PRESSURE TRANSDUCERS

- .1 Requirements:
 - .1 Combined sensor and transmitter measuring pressure.

- .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
- .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.
- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.
- .5 Temperature effects: not to exceed plus or minus 1.5% full scale/ 50°C.
- .6 Over-pressure input protection to at least twice rated input pressure.
- .7 Output short circuit and open circuit protection.
- .8 Accuracy: plus or minus 1% of Full Scale.

2.11 DIFFERENTIAL PRESSURE TRANSMITTERS

- .1 Requirements:
 - .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
 - .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
 - .3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.
 - .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.
 - .5 Integral zero and span adjustment.
 - .6 Temperature effects: not to exceed plus or minus 1.5% full scale/50°C.
 - .7 Over-pressure input protection to at least twice rated input pressure.
 - .8 Output short circuit and open circuit protection.
 - .9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.12 STATIC PRESSURE SENSORS

- .1 Requirements:
 - .1 Multipoint element with self-averaging manifold.
 - .1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).
 - .2 Accuracy: plus or minus 1% of actual duct static pressure.

2.13 STATIC PRESSURE TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
 - .2 Calibrated span: not to exceed 150% of duct static pressure at maximum flow.
 - .3 Accuracy: 0.4% of span.
 - .4 Repeatability: within 0.5% of output.
 - .5 Linearity: within 1.5% of span.
 - .6 Deadband or hysteresis: 0.1% of span.

- .7 External exposed zero and span adjustment.
- .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

2.14 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

- .1 Requirements:
 - .1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.
 - .2 Adjustable setpoint and differential.
 - .3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.
 - .4 Switch assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.
 - .5 Accuracy: within 2% repetitive switching.
 - .6 Provide switches with isolation valve and snubber, where code allows, between sensor and pressure source.
 - .7 Switches on high temperature hot water service: provide pigtail syphon.

2.15 TEMPERATURE SWITCHES

- .1 Requirements:
 - .1 Operate automatically. Reset automatically, except as follows:
 - .1 Low temperature detection: manual reset.
 - .2 Adjustable setpoint and differential.
 - .3 Accuracy: plus or minus 1 degrees C.
 - .4 Snap action rating: 120V, 15 amps as required. Switch to be DPST for hardwire and EMCS connections.
 - .5 Type as follows:
 - .1 Duct, general purpose: insertion length = 460 mm.
 - .2 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.
 - .3 Low temperature detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 30 mm length.
 - .4 Strap-on: with helical screw stainless steel clamp.

2.16 SUMP LEVEL SWITCHES

- .1 Requirements:
 - .1 Liquid level activated switch sealed in waterproof and shockproof enclosure.
 - .2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.
 - .3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

2.17 AIR PRESSURE GAUGES

- .1 Diameter: 38 mm minimum.
- .2 Range: zero to two times operating pressure of measured pressure media or nearest standard range.

2.18 ELECTROMECHANICAL RELAYS

- .1 Requirements:
 - .1 Double voltage, DPDT, plug-in type with termination base.
 - .2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
 - .3 Contacts: rated at 5 amps at 120V AC.
 - .4 Relay to have visual status indication

2.19 SOLID STATE RELAYS

- .1 General:
 - .1 Relays to be socket or rail mounted.
 - .2 Relays to have LED Indicator.
 - .3 Input and output Barrier Strips to accept 14 to 28 AWG wire.
 - .4 Operating temperature range to be -20°C to 70°C.
 - .5 Relays to be CSA Certified.
 - .6 Input/output Isolation Voltage to be 4000 VAC at 25°C for 1 second maximum duration.
 - .7 Operational frequency range, 45 to 65 HZ.
- .2 Input:
 - .1 Control voltage, 3 to 32 VDC.
 - .2 Drop out voltage, 1.2 VDC.
 - .3 Maximum input current to match AO (Analog Output) board.
- .3 Output.
 - .1 AC or DC Output Model to suit application.

2.20 CURRENT TRANSDUCERS

- .1 Requirements:
 - .1 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:
 - .1 4-20 mA DC.
 - .2 0-1 volt DC.
 - .3 0-10 volts DC.
 - .4 0-20 volts DC.
 - .2 Frequency insensitive from 10 - 80 hz.
 - .3 Accuracy to 0.5% full scale.
 - .4 Zero and span adjustments. Field adjustable range to suit motor applications.

- .5 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

2.21 CURRENT SENSING RELAYS

- .1 Requirements:
 - .1 Suitable to detect belt loss or motor failure.
 - .2 Trip point adjustment, output status LED.
 - .3 Split core for easy mounting.
 - .4 Induced sensor power.
 - .5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.
 - .6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.
 - .7 Adjustable latch level.

2.22 CONTROL DAMPERS

- .1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 1219 mm high. Three or more sections to be operated by jack shafts.
- .2 Materials:
 - .1 Frame: 2.03 mm minimum thickness extruded aluminum. For outdoor air and exhaust air applications, frames to be insulated.
 - .2 Blades: extruded aluminum. For outdoor air/exhaust air applications, blades to be internally insulated.
 - .3 Bearings: maintenance free, synthetic type of material.
 - .4 Linkage and shafts: aluminum, zinc and nickel plated steel.
 - .5 Seals: synthetic type, mechanically locked into blade edges.
 - .1 Frame seals: synthetic type, mechanically locked into frame sides.
- .3 Performance: minimum damper leakage meet or exceed AMCA Standard 500-D ratings.
 - .1 Size/Capacity: refer to damper schedule
 - .2 25 L/s/m² maximum allowable leakage against 1000 Pa static pressure for outdoor air and exhaust air applications.
 - .3 Temperature range: minus 30°C to plus 40°C.
- .4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.
- .5 Jack shafts:
 - .1 25 mm diameter solid shaft, constructed of corrosion resistant metal complete with required number of pillow block bearings to support jack shaft and operate dampers throughout their range.
 - .2 Include corrosion resistant connecting hardware to accommodate connection to damper actuating device.
 - .3 Install using manufacturers installation guidelines.
 - .4 Use same manufacturer as damper sections.

2.23 ELECTRONIC CONTROL DAMPER ACTUATORS

- .1 Requirements:
 - .1 Direct mount proportional type as indicated.
 - .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
 - .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
 - .4 Power requirements: 5 VA maximum at 24 V AC.
 - .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
 - .6 For VAV box applications floating control type actuators may be used.
 - .7 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.24 CONTROL VALVES

- .1 Body: globe style.
 - .1 Flow characteristic to suit coil application.
 - .2 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.
 - .3 Normally open
 - .4 Two port, as indicated.
 - .5 Leakage rate ANSI class IV, 0.01% of full open valve capacity.
 - .6 Packing easily replaceable.
 - .7 Stem, stainless steel.
 - .8 Plug and seat, stainless steel, brass
 - .9 Disc, replaceable, material to suit application.
 - .10 NPS 2 and under:
 - .1 Screwed National Pipe Thread (NPT) tapered female connections.
 - .2 Valves to ANSI Class 250, valves to bear ANSI mark.
 - .3 Rangeability 50:1 minimum.
 - .11 NPS 2½ and larger:
 - .1 Flanged connections.
 - .2 Valves to ANSI Class 150, valves to bear ANSI mark.
 - .3 Rangeability 100:1 minimum.
- .2 Butterfly Valves NPS 2 and larger:
 - .1 Body: ANSI Class 150 cast iron installed in locations as indicated.
 - .2 End connections to suit flanges that are ANSI Class 150.
 - .3 Extended stem neck to provide adequate clearance for flanges and insulation.
 - .4 Pressure limit: bubble tight sealing to 170 kilopascals.
 - .5 Disc/vane: 316 stainless steel.
 - .6 Seat: PTFE (polytetrafluoroethylene)
 - .7 Stem: 316 stainless steel.

- .8 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.
- .9 Flow characteristic linear.
- .10 Maximum flow requirement as indicated on control valve schedule.
- .11 Maximum pressure drop as indicated on control valve schedule: pressure drop not to exceed one half of inlet pressure.
- .12 Normally open, as indicated.
- .13 Valves are to be provided complete with mounting plate for installation of actuators.

2.25 ELECTRONIC / ELECTRIC VALVE ACTUATORS

- .1 Requirements:
 - .1 Construction: steel, cast iron, aluminum.
 - .2 Control signal: 0-10V DC or 4-20 mA DC.
 - .3 Positioning time: to suit application. 90 sec maximum.
 - .4 Fail to normal position as indicated.
 - .5 Scale or dial indication of actual control valve position.
 - .6 Size actuator to meet requirements and performance of control valve specifications.
 - .7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.
 - .8 Minimum shut-off pressure: refer to control valve schedule.

2.26 PANELS

- .1 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 Departmental Representative without adding additional cabinets.
- .3 Panels to be lockable with same key.

2.27 WIRING

- .1 In accordance with Section 26 27 26.
- .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: #18AWG.
 - .2 Analog input and output: shielded #18 minimum solid copper.

2.28 FREEZESTATS

- .1 Freeze protection is a dedicated equipment protection system. Software alarms on temperature and rate of rise/fall of temperature shall be used for alarming purposes through the EMRS.

- .2 Minimum 6.1 m (20 feet) vapour tension element, which shall serpentine on the inlet face on all coils. Provide additional sensors, wired in series, to provide 3.25 m per sq.m. (One linear foot per square foot) of coil surface area.
- .3 Provide freeze stat for each 3.25m² (60 ft²) of duct area where necessary, wired in series with safety circuit.
- .4 Hardwire interlock device to shut down fans and position mixing dampers to the full recirculation position, as applicable. Refer to drawing sequences of operation.
- .5 Provide device hardwire interlocked such that AHU fan will shut down when HOA switch is in Hand or Auto position.
- .6 Set-point shall be adjustable in the range of, at minimum, 0 °C. to 7 °C. (32 °F. to 45 °F.). Provide a scale with temperature setting clearly displayed.
- .7 SPDT switch contacts. Switch contacts shall be rated for duty.
- .8 Provide suitable supports.
- .9 Provide complete with auxiliary contacts for monitoring by the BAS.
- .10 Must be mounted horizontally across the coil using capillary clips
- .11 Where capillary enters through fan cabinet to have protective sleeve around capillary

2.29 LATCHING TYPE CONTROL RELAYS

- .1 Pickup rating, time and hold rating as required for individual applications.
- .2 Rated for a minimum of ten (10) million mechanical operations and a minimum of 500,000 electrical operations.
- .3 Provide complete isolation between the control circuit and the BAS digital output.
- .4 Located in the BLSC, ASC, UC or other local enclosures.
- .5 Malfunction of a BAS component shall cause the controlled output to fail to the positions identified in the failure procedure.
- .6 10 amp contact rating.
- .7 Pin type terminals complete with mounting bases.

2.30 MOMENTARY TYPE CONTROL RELAYS

- .1 Coil ratings of 120 VAC, 50 mA or 10-30 VAC/VDC, 40 mA as suitable for the application.
- .2 Provide complete isolation between the control circuit and the BAS digital output.
- .3 Located in the BLSC, ASC, UC or other local enclosures.
- .4 10 amp contact rating.
- .5 LED status indication.

2.31 CURRENT SENSING RELAY – ELECTRIC MOTOR STATUS MONITORING SERVICE

- .1 Rated for the applicable load.
- .2 SPDT Status Indication relay contacts. Status indication relay shall have an accessible trip adjustment over its complete operating range. Provide LED indication of relay status.
- .3 Long term drift shall not exceed 2.5% of full range per 6 months.
- .4 Current transformer and relay shall have over current and over voltage protection.
- .5 Transformer and relay may be combined into a single unit or can be separate units.
- .6 Transformer core shall be sized for the application.
- .7 Accuracy- $\pm 2\%$ of reading from 10% to 100% of full scale range, $\pm 2\%$ full scale from 0 to 10% of full scale range.
- .8 Temperature range of -15 °C. to 60 °C. (5 °F. to 140 °F.).
- .9 Must be split core complete with LED indication and have a zero and span adjustments.
- .10 Relay portion shall not be installed in within the MCC tubs. Relay portion shall be installed in local field panel enclosure, in the BLSC, ASC, UC enclosure, or in the wiring channel between MCC tubs. Provide device securely mounted with screw type wire terminations.
- .11 Device shall be mounted for easy access.

2.32

WATER DIFFERENTIAL PRESSURE SENSOR

- .1 Cast aluminum NEMA 1 enclosure.
 - .2 Complete with transducer with output of 4-20 mA proportional to the pressure sensed.
 - .3 Over pressure protection of five times the rated input.
 - .4 Easily accessible, integral non-interacting zero and span adjustment.
 - .5 Operating range to suit application.
 - .6 Accuracy of $\pm 2\%$ of full scale reading.
 - .7 Valve tappings shall be installed by the Mechanical subcontractor.
 - .8 Furnish the valves to the mechanical subcontractor. Provide differential pressure transducer installation complete with a 3-valve manifold mounted within a suitable enclosure. Installation shall allow the transducer to be isolated for service.
 - .9 Basis of design, Setra or Greystone
-

2.33 TERMINAL BOX DAMPER OPERATORS

- .1 Terminal unit damper operators and controller shall be provided and installed by the controls trade, coordinate quantity and size with Mechanical Contractor.
- .2 Provide low voltage transformers as required.

2.34 CARBON MONOXIDE (CO) MONITORING SYSTEM

- .1 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - .1 Honeywell/Vulcain 301C and E3Point controllers.
- .2 Provide a package gas detection system serving the following areas:
 - .1 ARB Apparatus Bay
 - .2 Reporting station Vehicle Bay
- .3 System shall meet the following requirements:
 - .1 Sensor will be powered by a central control panels power output rated at 17-27 Vac or by an external power supply rated at 17-27 Vac or 24-38 Vdc. Fully addressable gas sensor must be capable of communicating digitally with Building automation system through BACnet MS/TP. Gas sensors must be installed in a true daisy chain with an end of the line resistor on the last sensor. Capable of remote sensing, at distances of up to 300 feet, the gas monitor will incorporate either an electrochemical cell (for toxic gas monitoring) a catalytic combustion cell (for explosive gas monitoring) or a diffusion fuel cell (for oxygen sensing). Unit sensing cell must compensate for variations in relative humidity and temperature to maintain high levels of accuracy.
 - .2 When placed into a network configuration the sensor will be capable of two alarm levels. For local activate of fans or louvers or communication with the ECMS a DPDT relay (rated at no less than DPDT 1/8 HP, 5A, 2A, 24 Vdc or 240 Vac) will be activated at programmable set points.
 - .3 A ten step LED display will provide reading of concentration of gas. Normal operation will be indicated by a green LED; fault operation will be indicted by a yellow LED. Sensor must be capable of sounding an audible alarm (rated at n less than 65Db at a distance of 3 feet), which will be activated at fully programmable levels.
 - .4 Sensor will be capable of operating within relative humidity ranges of 5-90% and temperature ranges of 32oF to 100 oF (0 oC to 40 oC). Sensor must also have optional capacity of operating within a -40 oF to 140 oF* (-40 oC to 50 oC) temperature range.
 - .5 System shall be interlocked with exhaust fans serving the above noted areas.
 - .6 Energy management system shall monitor all alarms and fan operation of the gas detection system.
 - .7 Sensors and controllers mounted within the garage area are to be protected from water spray with splash guards.
 - .8 Unit will be manufactured to UL 1244 label and CSA 22.2.
 - .9 Controllers to be powered by an integral UPS to prevent nuisance alarms from power failures or surges.

- .10 Sensor alarm levels to activate and unit to be installed to the following parameters:

TOXIC GASES	FIRST ALARM SETPOINT (TLV-TWA)	SECOND ALARM SETPOINT (TLV-STEL)	SENSOR LOCATION	RADIUS OF COVERAGE
Carbon Monoxide (CO)	25 ppm	100 ppm	3-5 ft. above the floor	50 feet
Diesel (NO ₂)	1 ppm	3 ppm	Provide sensors at 3-5ft above the floor and at 1ft below the ceiling.	50 feet

- .4 Provide security guard cover for all sensors/transmitters.
- .5 Sensor wiring shall be 18 AWG minimum
- .1 Tie-in output from each CO sensor-transmitter to the building automation system as a separate analog-in (AI).

2.35 GAS CHECK METER

- .1 Meter to be pulse type, complete with temperature correction. Complete with connection to BAS for metering of consumption.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.
- .4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
- .5 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00. Maintain fire rating integrity.
- .6 Electrical:
- .1 Complete installation in accordance with Section 26 05 00.
- .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

- .3 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .4 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.
- .5 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.
- .7 Mechanical: supply and install in accordance with Section 23 05 05.
 - .1 Pipe Taps.
 - .2 Wells and Control Valves.
 - .3 Air flow stations, dampers, and other devices.
- .8 VAV Terminal Units: supply, install and adjust as required.
 - .1 Air probe, actuator and associated VAV controls.
 - .2 Tubing from air probe to DP sensor as well as installation and adjustment of air flow sensors and actuators.
 - .3 Co-ordinate air flow adjustments with balancing trade.

3.2 TEMPERATURE AND HUMIDITY SENSORS

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.
- .3 Outdoor installation:
 - .1 Protect from solar radiation and wind effects by non-corroding shields.
 - .2 Install in NEMA 4 enclosures.
- .4 Duct installations:
 - .1 Do not mount in dead air space.
 - .2 Locate within sensor vibration and velocity limits.
 - .3 Securely mount extended surface sensor used to sense average temperature.
 - .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
 - .5 Support sensor element separately from coils, filter racks.
- .5 Averaging duct type temperature sensors.

- .1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
- .2 Wire multiple sensors in series for low temperature protection applications.
- .3 Wire multiple sensors separately for temperature measurement.
- .4 Use software averaging algorithm to derive overall average for control purposes.
- .6 Thermowells: install for piping installations.
 - .1 Locate well in elbow where pipe diameter is less than well insertion length.
 - .2 Thermowell to restrict flow by less than 30%.
 - .3 Use thermal conducting paste inside wells.

3.3 PANELS

- .1 Arrange for conduit and tubing entry from top, 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 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

- .1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.
- .2 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.5 I/P TRANSDUCERS

- .1 Install air pressure gauge on outlet.

3.6 AIR PRESSURE GAUGES

- .1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.
- .2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

3.7 IDENTIFICATION

- .1 Identify field devices in accordance with Section 25 05 54.

3.8 AIR FLOW MEASURING STATIONS

- .1 Protect air flow measuring assembly until cleaning of ducts is completed.

3.9 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11.

END OF SECTION



Do not scale drawings.
Verify all dimensions and conditions on site and
immediately notify the engineer of all discrepancies.

project title titre du projet	
----------------------------------	--

FIRE PROTECTION SCHEMATIC

designed by
conc par

approved by
approuvé par

tender soumission	M.B.	project manager administrateur de projets
----------------------	------	---

project date date du projet	2017-02-24
--------------------------------	------------

project no. no. du projet	R.076516.013
------------------------------	---------------------

drawing no.
dessine no. **M3.03**

DEDICATED OUTDOOR AIR SYSTEM SCHEDULE																					
TAG	SUPPLY FAN			RETURN FAN			GLYCOL HEATING COIL					DX COOLING						FILTERS		NOTES	
	AIR FLOW	E.S.P.	MOTOR POWER	AIR FLOW	E.S.P.	MOTOR POWER	EWLT/WT	FLOW RATE	E.A.T. DB	L.A.T. DB	E.A.T.	WB	L.A.T.	WB	TOTAL CAPACITY	SENSIBLE CAPACITY	REFRIGERANT TYPE	EFFICIENCY	EER		I.E.E.R.
DOAS-1	4247.5 L/s	1.22 kPa	22 kW	4247.5 L/s	1.49 kPa	11 kW	71.1°C / 60°C	5.5 L/s	-23 °C	23 °C	25 °C	19 °C	12 °C	12 °C	111 kW	66 kW	R410A	10.8	14.1	50mm MERV 8 350mm MERV 14	

DEDICATED OUTDOOR AIR SYSTEM SCHEDULE - CONTINUED																					
TAG	HEAT RECOVERY															WEIGHT	ELECTRICAL			NOTES	
	WINTER						SUMMER						V	Ø	Hz						
	OUTDOOR AIR		EXHAUST AIR		TEMPERED AIR		OUTDOOR AIR		EXHAUST AIR		TEMPERED AIR										
E.A.T. DB	E.A.T. WB	AIR FLOW	L.A.T. DB	L.A.T. WB	AIR FLOW	L.A.T. DB	L.A.T. WB	E.A.T. DB	E.A.T. WB	AIR FLOW	L.A.T. DB	L.A.T. WB	AIR FLOW	L.A.T. DB	L.A.T. WB						
DOAS-1	23 °C	24 °C	4444.0 L/s	22 °C	13 °C	4247.5 L/s	14 °C	8 °C	32 °C	24 °C	4444.0 L/s	24 °C	17 °C	4247.5 L/s	25 °C	19 °C	6207.8 kg	575	3	60	
NOTE: 1. DOAS UNIT SHALL BE SHIPPED IN MODULES AND BUILT UP ON SITE.																					

SPLIT SYSTEM SCHEDULE									
TAG	TOTAL COOLING CAPACITY (kW)			ELECTRICAL DATA			CONDENSING UNIT		
	VOLTAGE	PHASE	HERTZ	M.O.P.	M.C.A.				
AC-1	3.52	208 V	1	60 Hz	15.0 A	1.5 A	CU-5		
AC-2	3.52	208 V	1	60 Hz	15.0 A	1.5 A	CU-5		
AC-3	3.52	208 V	1	60 Hz	15.0 A	1.5 A	CU-5		
AC-4	3.52	208 V	1	60 Hz	15.0 A	1.5 A	CU-5		
AC-5	3.52	208 V	1	60 Hz	15.0 A	1.5 A	CU-5		
AC-6	3.52	208 V	1	60 Hz	15.0 A	1.5 A	CU-5		
AC-7	3.52	208 V	1	60 Hz	15.0 A	1.5 A	CU-5		

EVAPORATOR SCHEDULE									
TAG	TOTAL COOLING CAPACITY (kW)			ELECTRICAL DATA			CONDENSING UNIT		
	VOLTAGE	PHASE	HERTZ	M.O.P.	M.C.A.				
EV-1	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-2	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-3	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-1		
EV-4	7.03	7.91 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-1		
EV-5	7.03	7.91 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-1		
EV-6	7.03	7.91 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-1		
EV-7	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-1		
EV-8	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-1		
EV-9	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-1		
EV-10	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-1		
EV-11	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-2		
EV-12	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-2		
EV-13	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-14	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-15	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-16	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-17	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-18	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-19	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-20	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-1		
EV-21	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-1		
EV-22	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-1		
EV-23	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-1		
EV-24	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-1		
EV-25	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-2		
EV-26	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-2		
EV-27	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-2		
EV-28	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-2		
EV-29	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-2		
EV-30	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-3		
EV-31	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-3		
EV-32	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-3		
EV-33	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-3		
EV-34	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-3		
EV-35	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-3		
EV-36	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-3		
EV-37	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-3		
EV-38	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-4		
EV-39	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-40	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-41	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-42	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-4		
EV-43	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-44	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-45	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-4		
EV-46	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-4		
EV-47	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-3		
EV-48	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-3		
EV-49	10.55	11.72 kW	208 V	1	60 Hz	15.0 A 3.5 A	CU-4		
EV-50	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-3		
EV-51	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-4		
EV-52	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-53	7.03	7.91 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-4		
EV-54	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-55	7.03	7.91 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-4		
EV-56	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-57	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-58	8.79	9.96 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-3		
EV-59	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-60	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-4		
EV-61	5.28	5.86 kW	208 V	1	60 Hz	15.0 A 1.6 A	CU-4		
EV-62	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-1		
EV-63	7.03	7.91 kW	208 V	1	60 Hz	15.0 A 2.7 A	CU-2		
EV-64	3.52	3.96 kW	208 V	1	60 Hz	15.0 A 1.2 A	CU-1		

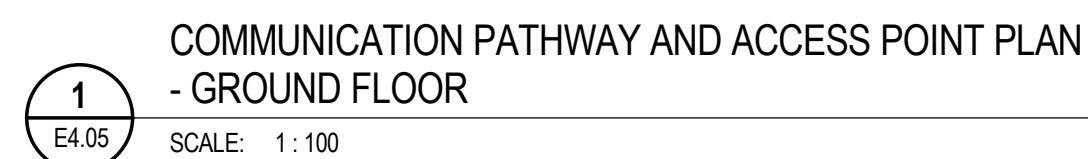
- NOTE:
1. EACH EVAPORATOR UNIT SHOULD HAVE THEIR OWN THERMOSTAT
2. PRIMARY HEATING AIR SOURCE HEAT PUMP TO BE INTEGRATED TO SECONDARY HEATING (RADIANT PANELS)
3. PROVIDE CENTRAL CONTROLLER BACNET INTEGRATION OR VRF SYSTEM
4. THERMOSTAT TO BE LOCABLE FOR LIMITED OVERDRIVE FUNCTION AND ±1°C TEMPERATURE ADJUSTMENT

PLUMBING FIXTURE SCHEDULE		
TAG	FIXTURE	DESCRIPTION/FORM
FD-1	FLOOR DRAIN	FINISHED AREA FLOOR DRAIN, EPOXY COATED CAST IRON BODY, ANCHOR FLANGE AND CLAMPING COLLAR TO SUIT THE FLOOR CONSTRUCTION WITH PRIMARY AND SECONDARY WEEPHOLES, ADJUSTABLE ROUND NICKEL BRONZE STRAINER, NO HUB OUTLET, VANILLA, PROOF, SCREWS, SUPPDER DRAIN ANGLE GRATE, ALL DUCO COATED CAST IRON BODY, FLASHING CLAMP TO SUIT THE FLOOR CONSTRUCTION, 45 DEGREE OUTLET COW BACKWATER VALVE
FD-2	PIT DRAIN	FLOOR DRAIN - EPOXY COATED, CAST IRON BODY, 5" (127 MM) DIAMETER NICKEL BRONZE, ADJUSTABLE ROUND STRAINER, 4" (102 MM) CAST IRON FUNNEL, TOP PRIMER CONNECTION WITH FLANG, ANCHOR FLANGE AND WEEPHOLES, NO HUB OUTLET
FD-3	FUNNEL FLOOR DRAIN	PRECAST TERRAZZO FLOOR MOUNTED FOUP SINK, 914mm x 610mm x 350mm, 150mm FRONT DROP, MARBLE CHIPS CAST IN PORTLAND CEMENT GROUTED AND SEALED, CAST INTEGRAL, ONE PRICE SS CAP ON FRONT DROP, INTEGRAL CAST BRASS DRAIN, SS STRAINER, 70mm OUTLET, SS BACK GRASH PANELS ON WALL, WALL SIZES, COW WALL MOUNTED FAUCET, SOLID CAST BRASS BODY, LEAD-FREE, 200mm CENTRES, 1/4 TURN CERAMIC DISC CARTRIDGES, CAST METAL, ELVER HANDLES, HOSE END VACUUM BREAKER, INTEGRAL STOPS, 70mm HOSE WITH HANGER
J5-1	JANITOR SINK	COUNTER MOUNTED ABOVE COUNTER, RECTANGULAR DESIGN, SEALED OVERFLOW, CENTRE HOLE ONLY, 560mm x 470mm x 105, COW COW HARD WIRED C.P. 100mm C.P. SOLID CAST BRASS BODY WITH INTEGRAL PROXIMITY SENSOR, WITH HAND RESISTANT 1/2 LPM FLOW SPRAY OUTLET, CONTROL MODULE, SOLIDINO, STRAINER, TEMPERED WATER SUPPLIES BY THERMOSTATIC MIXING VALVE WITH BACK CHECKS AND STOPS HOUSED IN 350mm SQ. RECESSED METAL BOX WITH 350mm SQ. V.P. & S.F. FACE, LOCATED IN WALL UNDER BASIN, FLEXIBLE CONDUIT FROM CONTROL MODULE TO FAUCET AND SINK AND PROVIDED, POWER REQUIREMENT 15 VA
L-2	WALL MOUNT	VITREOUS CHINA WALL HUNG BASIN CANCASA B601-04 COMPLANT, SEALED OVERFLOW 100mm CENTRES, 80mm x 50mm x 180mm DEEP, COW SEM PREESTAL, P-TRAP COVER, EXTENDED CONCEALED ARM BASIN CARRIER, INTEGRAL BACKSPASH, SEF DRAINING DECK AREA, COW HARD WIRED C.P. 100mm C.P. SOLID CAST BRASS BODY WITH INTEGRAL PROXIMITY SENSOR, WITH HAND RESISTANT 1/2 LPM FLOW SPRAY OUTLET, CONTROL MODULE, SOLIDINO, STRAINER, TEMPERED WATER SUPPLIED BY THERMOSTATIC MIXING VALVE WITH BACK CHECKS AND STOPS HOUSED IN 350mm SQ. RECESSED METAL BOX WITH 350mm SQ. V.P. & S.F. FACE, LOCATED IN WALL UNDER BASIN, FLEXIBLE CONDUIT FROM CONTROL MODULE TO FAUCET AND SINK AND PROVIDED, POWER REQUIREMENT 15 VA
NFHB	NON-FREEZE HOSE BIBB	EXTERIOR HOSE BIBB, CONCEALED NON-FREEZE WALL HYDRANT, NICKEL BRONZE BOX AND DOOR, CHROME PLATED HYDRANT FACE, INTEGRAL VACUUM BREAKER, 20mm HOSE CONNECTION, ALL BRONZE HUB, SEAT CASING AND INTERNAL WORKING PARTS
SH-1	SHOWER VALVE AND HAND SHOWER/HAND	LUMP RECEIVED, EXTENSION, UNLOCKED CLAMP, PRECAST TERRAZZO SHOWER RECEPTOR, 613mm x 1000mm, MARBLE CHIPS CAST IN PORTLAND CEMENT, GROUTED AND SEALED, THRESHOLD ON ONE SIDE, INTEGRAL, CAST BRASS DRAIN WITH SS STRAINER, COW HAND SHOWER SYSTEM WITH LEVEL HANDLES, PRESSURE BALANCING MIXING VALVE WITH ADJUSTABLE STOP SCREWS TO LIMIT HANDLE TURN, HAND SHOWER WITH 150mm FLEXIBLE METAL HOSE, IN-LINE VACUUM BREAKER, ADJUSTABLE CRADLE OR HAND SHOWER TO BE MOUNTED TO VERTICAL MOUNTING BAR, COW 6.7 LPM FLOW RESTRICTOR PLATE
SK-1	COUNTER MOUNTED COUNTERTOP MOUNT SINK	SS COUNTER MOUNT SINK, 1 HOLE LOCATED CENTRE BACK, 200mm CENTRES, 567mm x 520mm x 200mm DEEP, BACK LEDGE, SATIN FINISH, SELF DRAINING, 180MM COW STRAINERS, 30mm TAILPICE, SMOOTH DRAINAGE AND MOUNTING KIT, COW DECK MOUNTED FAUCET, SOLID CAST BRASS BODY, LEAD-FREE, 1/4 TURN CERAMIC DISC VALVE CARTRIDGES, 30MM GOOSENECK SPOUT, 6.3 LPM VANILLA, RESISTANT LAMINAR FLOW OUTLET, METAL WRESTLEABLE LEVER HANDLES, CAST BRASS P-TRAP, CLEANOUT, CHROME PLATED FLEXIBLE SUPPLY PIPES WITH SCREWDRIVER STOP, REDUCERS, DISCUTCHION
U-1	WALL HUNG URINAL	VITREOUS CHINA BARRIER-FREE URINAL, WALL HUNG FOR FLUSH VALVE, WASH OUT, FLUSH ACTION 0.5 LIFT TO 3.8 LIFT, EXTENDED SIDES FOR PRIVACY, INTEGRAL FLUSH SPRINGER, 10mm TOP SPUD, WALL HANGERS, OPEN TRAP, COW REMOVABLE STAINLESS STEEL STRAINER, NO TOUCH FLUSH VALVE UNIT, HIGH EFFICIENCY 0.4 LPT FACTORY SET FLOW, QUET ACTION, PERMEX DIAPHRAGM TYPE, WITH DUAL FILTERED BY PASS INFRARED PROXIMITY SENSOR, SOLIDINO FLUSH CONTROL, CIRCUITRY, IN-L & S, WALL ACCESS CLEANOUT, 800 MAP, 4.2 LPT
WC-1	FLOOR MOUNTED TOILET	VITREOUS CHINA FLOOR MOUNTED TOILET, WHITE, ELONGATED BOWL, HIGH EFFICIENCY, FULL GLAZED SANIM INTERNAL TRAPWAY, TOP SPUD, COW HEAVY DRAIN, OPEN FRONT SEAT, 150mm FRONT SEAT, COW COVER, EXPOSED, ELECTRONIC FLUSH VALVE COW MANUAL, OVERDRIVE, HARD WIRED CONNECTION, REDUCED FLOW 4.2 LPT, PROVIDE BOLTS, FLOOR FLANGE, BOLT CAPS, PERFORMANCE RATING: 800 MAP @ 4.2 LPT
WC-2	FLOOR MOUNTED BARRIER FREE TOILET	VITREOUS CHINA FLOOR MOUNTED TOILET, WHITE, CANCASA B601-04 COMPLANT, ELONGATED BOWL, HIGH EFFICIENCY, FULLY GLAZED SANIM INTERNAL TRAPWAY, TOP SPUD, COW HEAVY DUTY OPEN FRONT SEAT COW COVER, EXPOSED, ELECTRONIC FLUSH VALVE COW MANUAL, OVERDRIVE, HARD WIRED CONNECTION, REDUCED FLOW 4.2 LPT, PROVIDE BOLTS, FLOOR FLANGE, BOLT CAPS, MOUNT ELECTRONIC SENSOR ABOVE SEAT COVER WHEN FULLY OPEN, PERFORMANCE RATING: 800 MAP @ 4.2 LPT

VIBRATION ISOLATION SCHEDULE						
EQUIPMENT TYPE	LOCATION	BASE TYPE	ISOLATOR TYPE	MINIMUM DEFLECTION (mm)	NOTES	
AIR HANDLING UNIT	FAN ROOM		NSN / EP3	8.9		
AIR TERMINAL UNITS	VARIOUS		NH / H1	8.9		
BASEMOUNTED FAN	SOUTH SIDE WALL		FS / H2	5.8		
VERTICAL IN-LINE PUMPS	MECHANICAL ROOM		NSN / EP3	3.81		1

NOTE:
1. PROVIDE SH OR FS ISOLATORS ON ADJACENT PIPING/DUCTWORK
ISOLATOR TYPE:
NSN / EP3 - NEPRENE / STEEL / NEOPRENE PAD
NH / H1 - ELASTOMERIC HANGER
FS / H2 - OPEN SPRING FLOOR MOUNT

ELECTRIC DOMESTIC WATER HEATER SCHEDULE						
TAG	HEATING ELEMENT	STORAGE (L)	RECOVERY (H)	ELECTRICAL	VOLT	NOTES
HWT-1	SINGLE ELEMENT	43	53	3kW	240 V	
HWT-2	SINGLE ELEMENT	65	53	3kW	240 V	
HWT-3	SINGLE ELEMENT	43	53	3kW	240 V	
HWT-4	SINGLE ELEMENT	43	53	3kW	240 V	
HWT-5	SINGLE ELEMENT	43	53	3kW	240 V	
HWT-6	SINGLE ELEMENT	108	53	3kW	240 V	
HWT-7	SINGLE ELEMENT	43	53	3kW	240 V	
HWT-8	SINGLE ELEMENT	43	53	3kW	240 V	
HWT-9	SINGLE ELEMENT	65	53	3kW	240 V	
HWT-10	SINGLE ELEMENT	65	53	3kW	240 V	
HWT-11	SINGLE ELEMENT	43	53	3kW	240 V	



1. ACCESS POINT LOCATIONS AND ASSOCIATED DATA DROPS ARE FOR REFERENCE ONLY. FINAL LOCATION AND QUANTITIES MAY VARY ON SITE. EACH DATA DROP FOR ACCESS POINT MUST BE COMPLETE WITH BOTH THE CONDUIT AND THE ACCESSIBLE FINAL PLACEMENT ON SITE AS DIRECTED BY OTHER TEAM.
2. ELECTRICAL CONTRACTOR IS RESPONSIBLE TO PROVIDE PRE-ENGINEERED SLEEVES FOR ALL SLAB AND WALL PENETRATIONS REQUIRED TO COMPLETE ELEC/COMM SCOPE OF WORK. INCLUDE X-RAY FOR FLOOR SLAB PENETRATIONS IN THIS SCOPE. ALL SLEEVES TO BE INSTALLED MAY NOT BE SHOWN ON DRAWINGS. CONTRACTOR TO REVIEW ON SITE FOR EXACT QUANTITIES AND LOCATIONS OF NEW PENETRATIONS IN SLABS AND WALLS WHICH REQUIRE SLEEVES.

[illegible]

3	ADDENDUM 02	2017-04-05
2	ADDENDUM 01	2017-03-24
1	ISSUE FOR BID	2017-02-24
rev.	description	date

Do not scale drawings.
Verify all dimensions and conditions on site and
immediately notify the engineer of all discrepancies.

DIALOG®

project title	
titre du projet	

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON.

drawing title
titre du dessin

COMMUNICATION PATHWAY AND ACCESS POINT PLAN - GROUND FLOOR

drawn by
dessine par **D.D.**

designed by
conc par

approved by
approuvé par

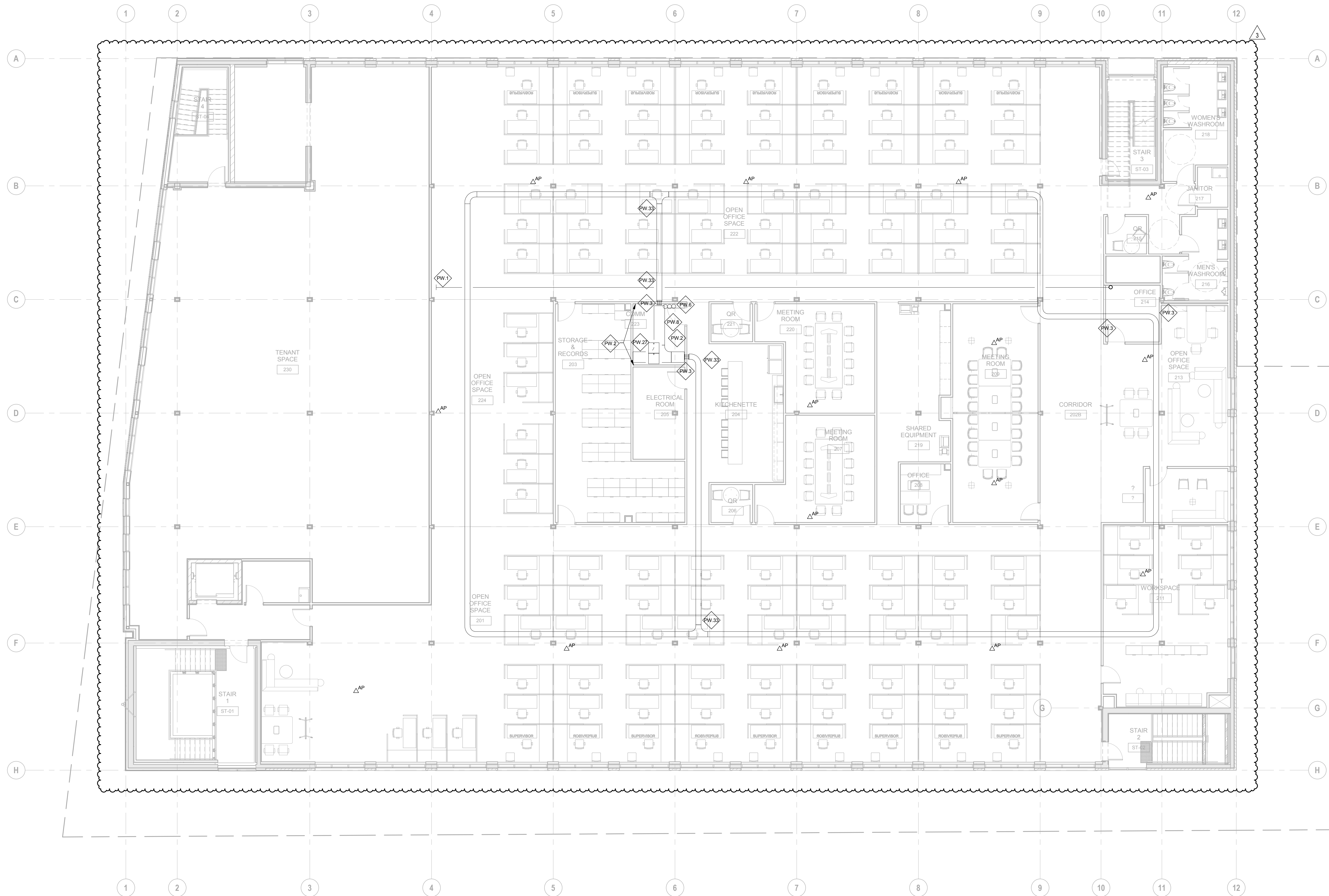
bid soumission	M.B.	project manager administrateur de projets
-------------------	------	---

project date	
date du projet	2017-02-24

project no. no. du projet	R.076516.013
------------------------------	---------------------

drawing no.
dessine no. **E4.05**

scale(s)



COMMUNICATION PATHWAY AND ACCESS POINT PLAN
- SECOND FLOOR
SCALE: 1:100

GENERAL NOTES:

1. ACCESS POINT LOCATIONS AND ASSOCIATED DATA DROPS ARE FOR REFERENCE ONLY. FINAL LOCATION AND QUANTITIES MAY VARY ON SITE. EACH DATA DROP FOR ACCESS POINT MUST BE COMPLETE WITH 6m OF SPAN COB CABLE TO ENABLE FINAL PLACEMENT ON SITE AS ENGINEERED SLEEVES FOR ALL SLAB AND WALL PENETRATIONS REQUIRED TO COMPLETE ELEC COMM SCOPE OF WORK. INCLUDE X-RAY FOR FLOOR SLAB PENETRATIONS IN THIS SCOPE. ALL SLEEVES TO BE INSTALLED MAY NOT BE SHOWN ON DRAWINGS. CONTRACTOR TO REVIEW ON SITE FOR EXACT QUANTITIES AND LOCATIONS OF NEW PENETRATIONS IN SLABS AND WALLS WHICH REQUIRE SLEEVES.
2. ELECTRICAL CONTRACTOR IS RESPONSIBLE TO PROVIDE PRE-ENGINEERED SLEEVES FOR ALL SLAB AND WALL PENETRATIONS REQUIRED TO COMPLETE ELEC COMM SCOPE OF WORK. INCLUDE X-RAY FOR FLOOR SLAB PENETRATIONS IN THIS SCOPE. ALL SLEEVES TO BE INSTALLED MAY NOT BE SHOWN ON DRAWINGS. CONTRACTOR TO REVIEW ON SITE FOR EXACT QUANTITIES AND LOCATIONS OF NEW PENETRATIONS IN SLABS AND WALLS WHICH REQUIRE SLEEVES.

KEY NOTES

- PW.1 SUPPLY AND INSTALL FOUR 2 X 53mm CONDUITS TO BASEMENT DEMARK POINT FOR THE FUTURE TENANT. TERMINATE CONDUITS ADJACENT TO THE DEMARKING WALL. CONDUITS TO BE EXTENDED LATER BY TENANT.
- PW.2 PROVIDE 19mm (3/4") PLYWOOD BACKBOARD, INSTALLED IN ELECTRICAL COMMUNICATIONS AND DATA ROOMS, AND DEMARK ROOMS RECEIVING WIRING AND EQUIPMENT. FINISHED WITH INTUMESCENT COATING. PAINT FINISH TO MEET THE INTENT OF FIRE RATED PANEL REQUIREMENTS LISTED IN CSR 1302 AND AMBIFLEX 800 S REQUIREMENTS. CONSTRUCT PLYWOOD BACKBOARDS FROM MINIMUM 1220 MM X 2440 MM BOARDS ON ALL WALLS OVER 300 MM IN LENGTH. MOUNTED 150 MM FROM FINISHED FLOOR.
- PW.3 SUPPLY AND INSTALL 4 X 100mm (4") PRE-ENGINEERED SLEEVES THROUGH WALL INTO CEILING SPACE. SLEEVES GROUNDED TO TRAY. LOW MOUNTING KIT AND WATERFALL TO CABLE TRAY IF OVER 305mm (12") ABOVE.
- PW.6 SUPPLY AND INSTALL 1 X 50mm (2") RISER SLEEVES THROUGH COMM 128 INTO CEILING SPACE OF COMM 223 PERFORM CUTTING AND CORING WORK AND BACKBOARDING AND BACKBOARDING WITH SPECIFIED BACKBOARD.
- PW.8 SUPPLY AND INSTALL NEW 600mmW x 100mmH IN-ROOM BASKET TYPE CABLE TRAY. NEW CABLE TRAY TO BE GROUNDED TO TBR TELECOM GROUNDING BUSBAR.
- PW.27 NEW DATA RACK/CABINETS SHALL BE SUPPLIED AND INSTALLED BY TENANT.
- PW.33 SUPPLY AND INSTALL NEW 305mmW x 100mmH IN-FIELD BASKET TYPE CABLE TRAY. NEW CABLE TRAY TO BE GROUNDED.

3	ADDENDUM 02	2017-04-05
2	ADDENDUM 01	2017-03-24
1	ISSUE FOR BID	2017-02-24
rev.	description	date

Do not scale drawings.
Verify all dimensions and conditions on site and
immediately notify the engineer of all discrepancies.

DIALOG

project title
titre du projet

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON.

drawing title
titre du dessin
**COMMUNICATION PATHWAY
AND ACCESS POINT PLAN -
SECOND FLOOR**

drawn by
dessiné par D.D.

designed by
conçu par M.A.

approved by
approuvé par N.A.

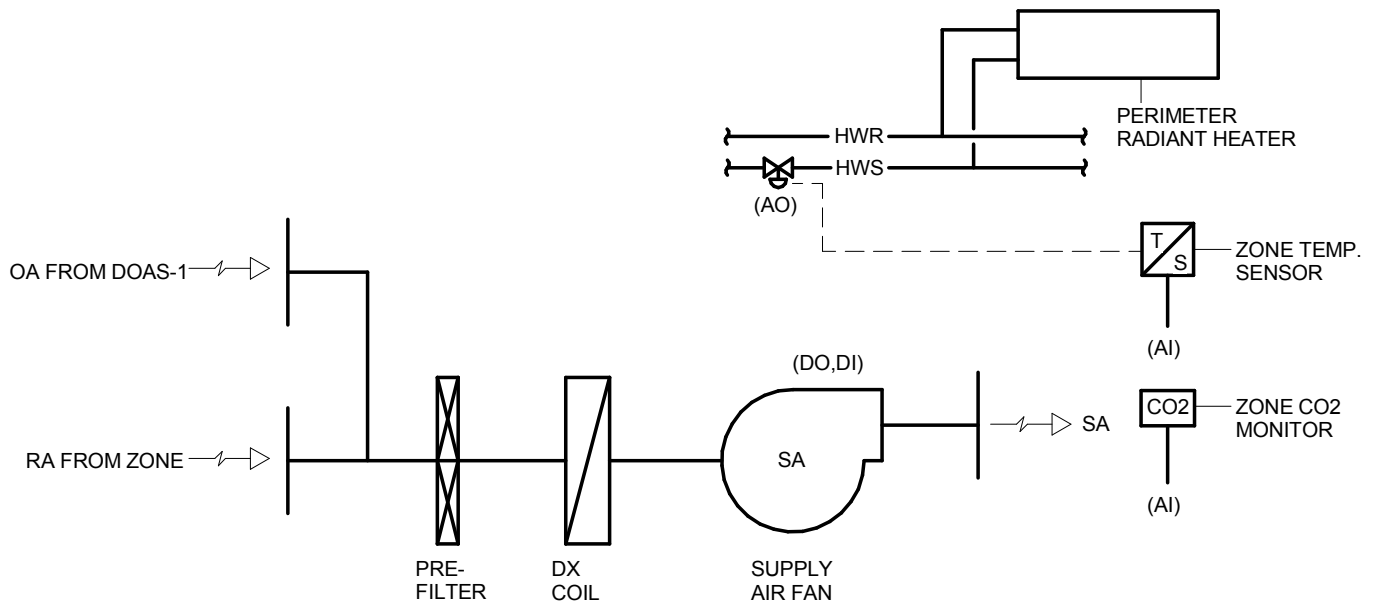
bid
soumission M.B.

project manager
administrateur de projets

project date
date du projet 2017-02-24

project no.
no. du projet R.076516.013

drawing no.
dessiné no. E4.06



SEQUENCE OF OPERATION:

1. SYSTEM SHALL BE ENABLED AND CONTROLLED BY THE BAS BASED ON ZONE OCCUPANCY AS FOLLOWS.
2. UPON CONFIRMATION OF OCCUPANCY BY ZONE OCCUPANCY SENSOR, THE ASSOCIATED ZONE FAN COIL UNIT AND PERIMETER RADIANT HEATING DEVICE SHALL ENTER 'OCCUPIED MODE'.
3. UPON CONFIRMATION OF NO OCCUPANCY BY ZONE OCCUPANCY SENSOR, THE ASSOCIATED ZONE FAN COIL UNIT AND PERIMETER RADIANT HEATING DEVICE SHALL ENTER 'UNOCCUPIED MODE' AFTER A TIME DELAY OF 15 MIN. (ADJUSTABLE)

OCCUPIED MODE:

1. FAN COIL UNIT SUPPLY AIR FAN SHALL BE ENABLED AND OPERATE CONTINUOUSLY.
2. ON A CALL FOR COOLING, FAN COIL SHALL MODULATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE SETPOINT OF 23°C (ADJUSTABLE). PERIMETER RADIATOR VALVE SHALL BE FULLY CLOSED DURING COOLING OPERATION.
3. FIRST STAGE OF HEATING WILL BE THE FAN COIL UNIT, IF SPACE TEMPERATURE IS NOT MET ON A CALL FOR HEATING, PERIMETER RADIATOR CONTROL VALVE SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE SETPOINT OF 22°C (ADJUSTABLE).

UNOCCUPIED MODE:

1. FAN COIL UNIT SUPPLY AIR FAN SHALL BE DISABLED.
2. ON A CALL FOR COOLING, FAN COIL UNIT SHALL MODULATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE SETPOINT OF 26°C (ADJUSTABLE). PERIMETER RADIATOR VALVE SHALL BE FULLY CLOSED DURING COOLING OPERATION.
3. FIRST STAGE OF HEATING WILL BE THE FAN COIL UNIT, IF SPACE TEMPERATURE IS NOT MET ON A CALL FOR HEATING, PERIMETER RADIATOR CONTROL VALVE SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE SETPOINT OF 20°C (ADJUSTABLE).

NOTES:

1. ZONE CARBON DIOXIDE MONITOR SHALL REPORT CO2 CONCENTRATION TO THE BAS.
2. REFER TO PLANS FOR QUANTITY AND LOCATION OF FAN COIL UNITS, ZONE TEMPERATURE SENSORS AND CO2 MONITORS REQUIRED.

1

TYPICAL FAN COIL UNIT AND PERIMETER RADIANT HEATER CONTROL SCHEMATIC

ADD-2-MSK-01

SCALE: N.T.S.

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

M3.04 - MECHANICAL CONTROL SCHEMATICS

DESIGNED BY: R.D.

DRAWN BY: Z.H.

APPROVED BY: Approver

TENDER:

M.B.

PLOT SCALE: N.T.S.

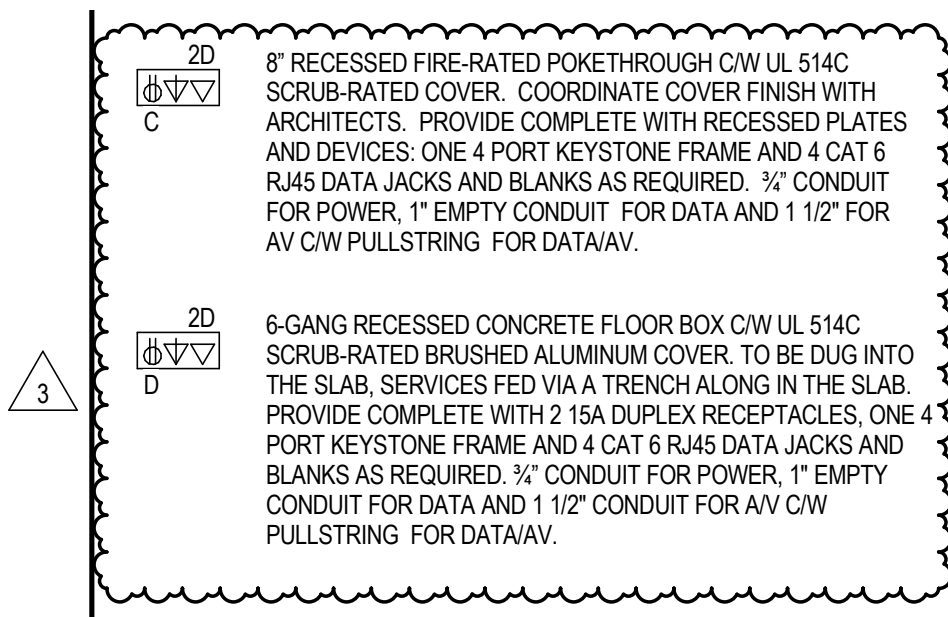
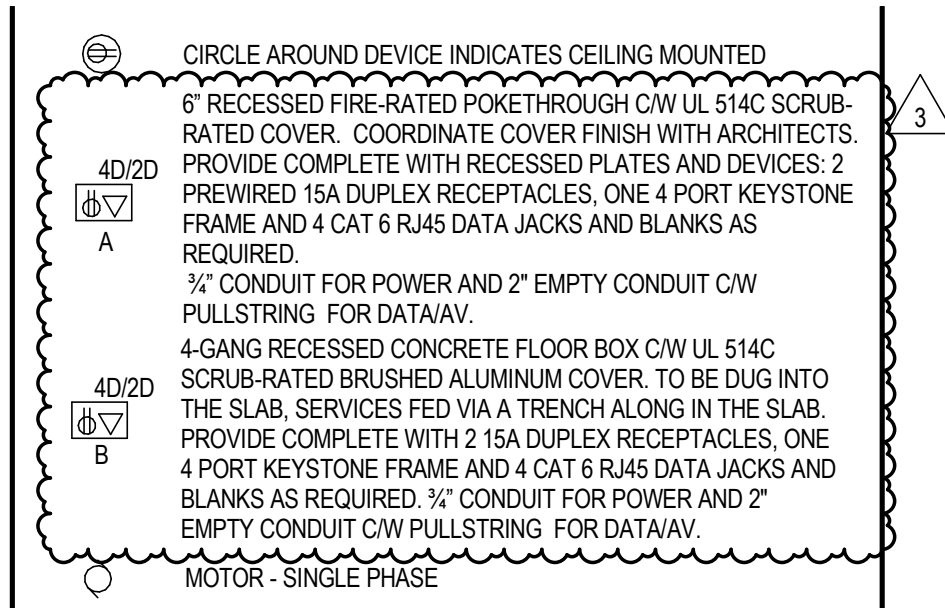
DRAWING NO: ADD-2-MSK-01

PROJECT NO: R.076516.013

PROJECT DATE: FEBRUARY 24, 2017

DATE PLOTTED:

CAD FILE: -



3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

ELECTRICAL LEGEND

DESIGNED BY: MA

DRAWN BY: DD

APPROVED BY: NA

TENDER:

M.B.

PLOT SCALE: NTS

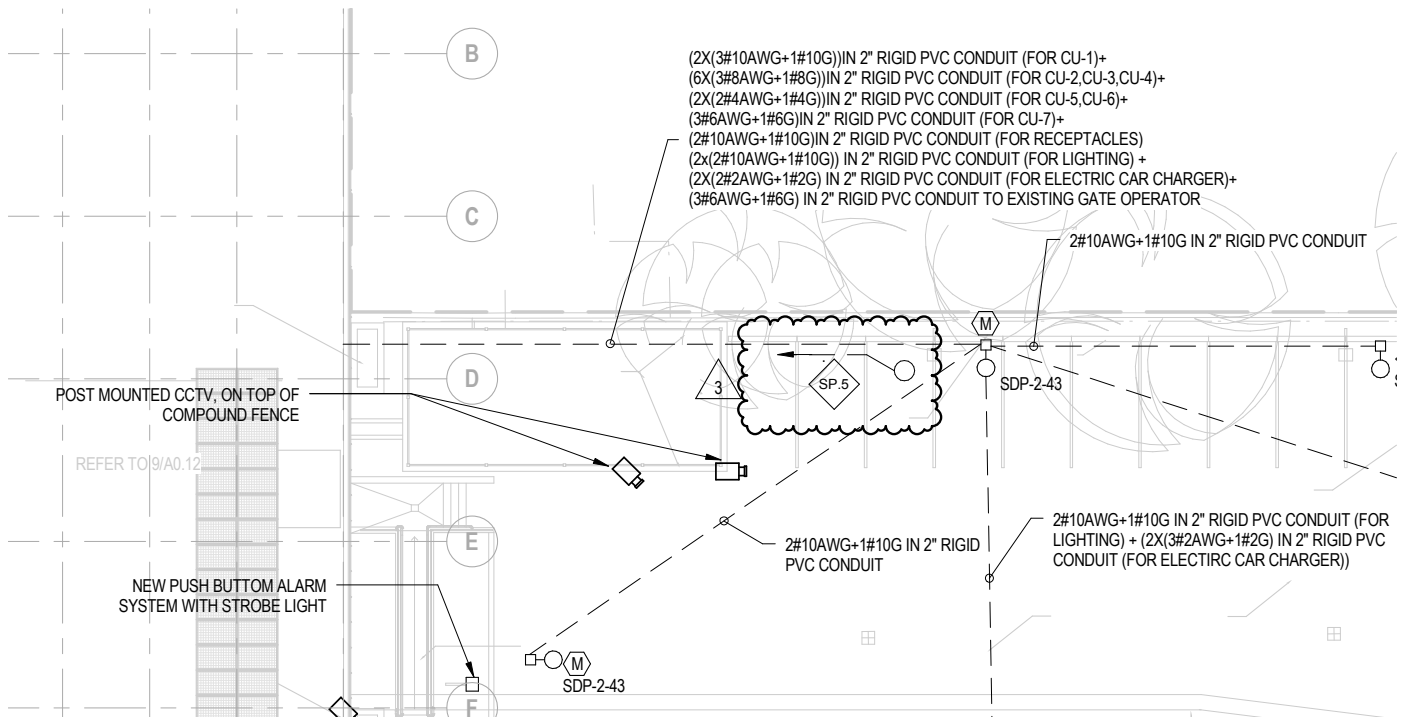
DRAWING NO: ESK-01

PROJECT NO: R.076516.013

PROJECT DATE: JUNE 07, 2016

DATE PLOTTED: 2017-04-05

CAD FILE: -



KEY NOTES

SP.1	REMOVE EXISTING LIGHTING FIXTURES AND SALVAGE FOR REUSE. REINSTALL SALVAGED FIXTURES AT 3500mm A.F.F. (AT GROUND FLOOR CEILING LEVEL). FEED FIXTURES FROM NEW CONDUIT AND WIRINGS LOCATED INSIDE CEILING SPACE OF GROUND FLOOR.
SP.2	REMOVE EXISTING LIGHTING FIXTURES AND SALVAGE FOR REUSE. AFTER RECLADDING IS COMPLETE, REINSTALL EXISTING SALVAGED LIGHT FIXTURES REUSE EXISTING CIRCUIT AND CONDUITS ETC. ENSURE PROPER OPENNING AFTER INSTALLATION IS COMPLETED.
SP.3	PROVIDE OUTDOOR DUAL AC LEVEL 2 ELECTRIC VEHICLE CHARGER. REFER TO DETAIL E6.09-7 FOR INSTALLATION.
SP.4	DEMOLISH EXISTING WIRINGS TO THE EXISTING GATE. SUPPLY AND INSTALL NEW WIRINGS AND CONDUIT TO THE GATE. VERIFY POWER REQUIREMENTS ON SITE. WIRING SIZE IS FOR PRICING PURPOSES ONLY.
SP.5	SUPPLY AND INSTALL 2 X 2" EMPTY CONDUIT TO NEW SECOND FLOOR TENANT'S (TENANT 230) SERVICE LOCATION. TERMINATE OUTSIDE THE TENANT SPACE WHERE THE CONDUIT FOR ELECTRICAL SERVICE WILL BE CONNECTED.

3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

ELECTRICAL SITE PLAN

DESIGNED BY: MA

DRAWN BY: DD

APPROVED BY: NA

TENDER:

M.B.

PLOT SCALE: NTS

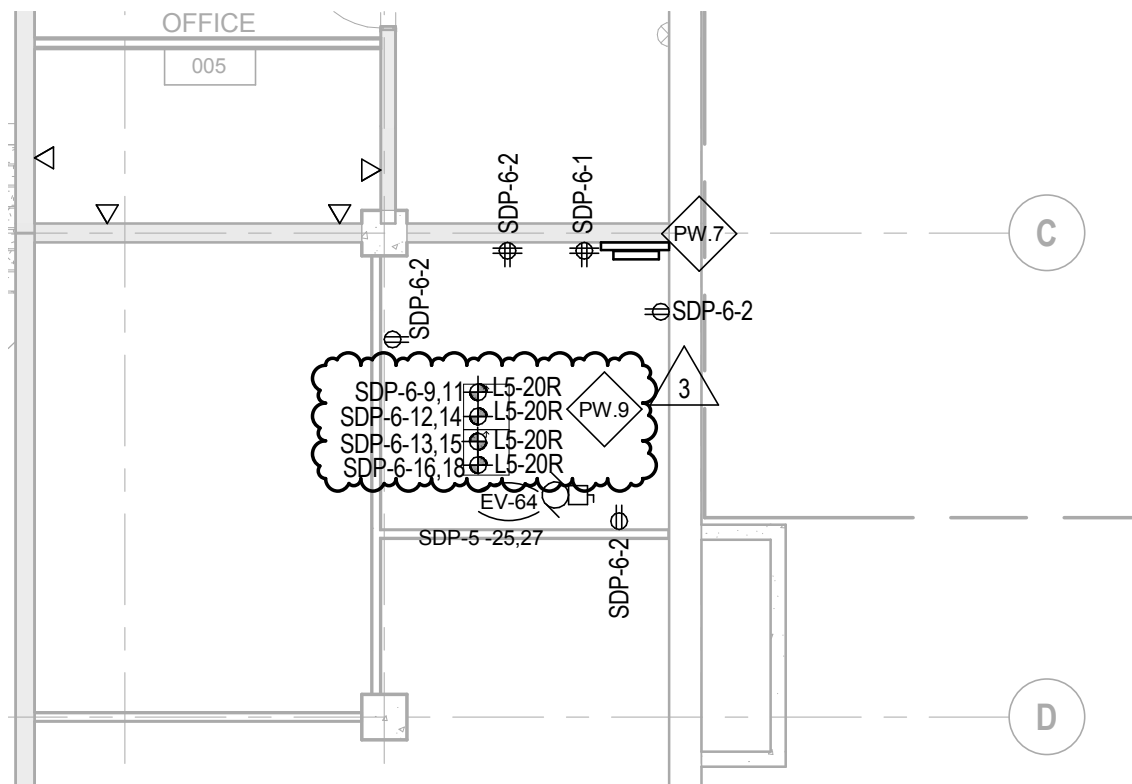
DRAWING NO: ESK-02

PROJECT NO: R.076516.013

PROJECT DATE: JUNE 07, 2016

DATE PLOTTED: 2017-04-05

CAD FILE: -



KEY NOTES

PW.3	SUPPLY AND INSTALL 4 X 103mm (4") PRE-ENGINEERED SLEEVES THROUGH WALL INTO CEILING SPACE. SLEEVES GROUNDED TO TRAY, C/W MOUNTING KIT AND WATERFALL TO CABLE TRAY IF OVER 305mm (12") ABOVE.
PW.7	SUPPLY AND INSTALL TELECOM GROUNDING BUSBAR ON A PLYWOOD BACKBOARD.
PW.9	NEW TWIST LOCK OUTLETS TO BE INSTALLED ABOVE THE RACKS AND BELOW THE CABLE TRAY TO THE REAR OF THE RACK. ENSURE THAT THE ELECTRICAL WIRING AND OUTLETS DO NOT INTERFERE WITH THE INSTALLATION OF THE CABLE SYSTEM.
PW.11	SUPPLY AND INSTALL THREE (3) MULTICIRCUIT METERS AND EIGHTEEN (18) DIGITAL METERS. REFER TO SINGLE LINE DIAGRAM (DRAWINGS E6.02) AND DIGITAL METERS SCHEDULE (DRAWING E6.09).
PW.12	SUPPLY AND INSTALL THREE (3) DIGITAL METERS FOR PANEL "SDP-3" AND "SDP-5". REFER TO SINGLE LINE DIAGRAM (DRAWINGS E6.02) AND DIGITAL METERS SCHEDULE (DRAWING E6.09).
PW.15	NEW ELECTRICAL EQUIPMENT FOR PV SYSTEM TO BE INSTALLED IN ELECTERICAL ROOM 009.

3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

**POWER AND COMMUNICATION PLAN -
BASEMENT**

DESIGNED BY: MA

DRAWN BY: DD

APPROVED BY: NA

TENDER:

M.B.

PLOT SCALE: NTS

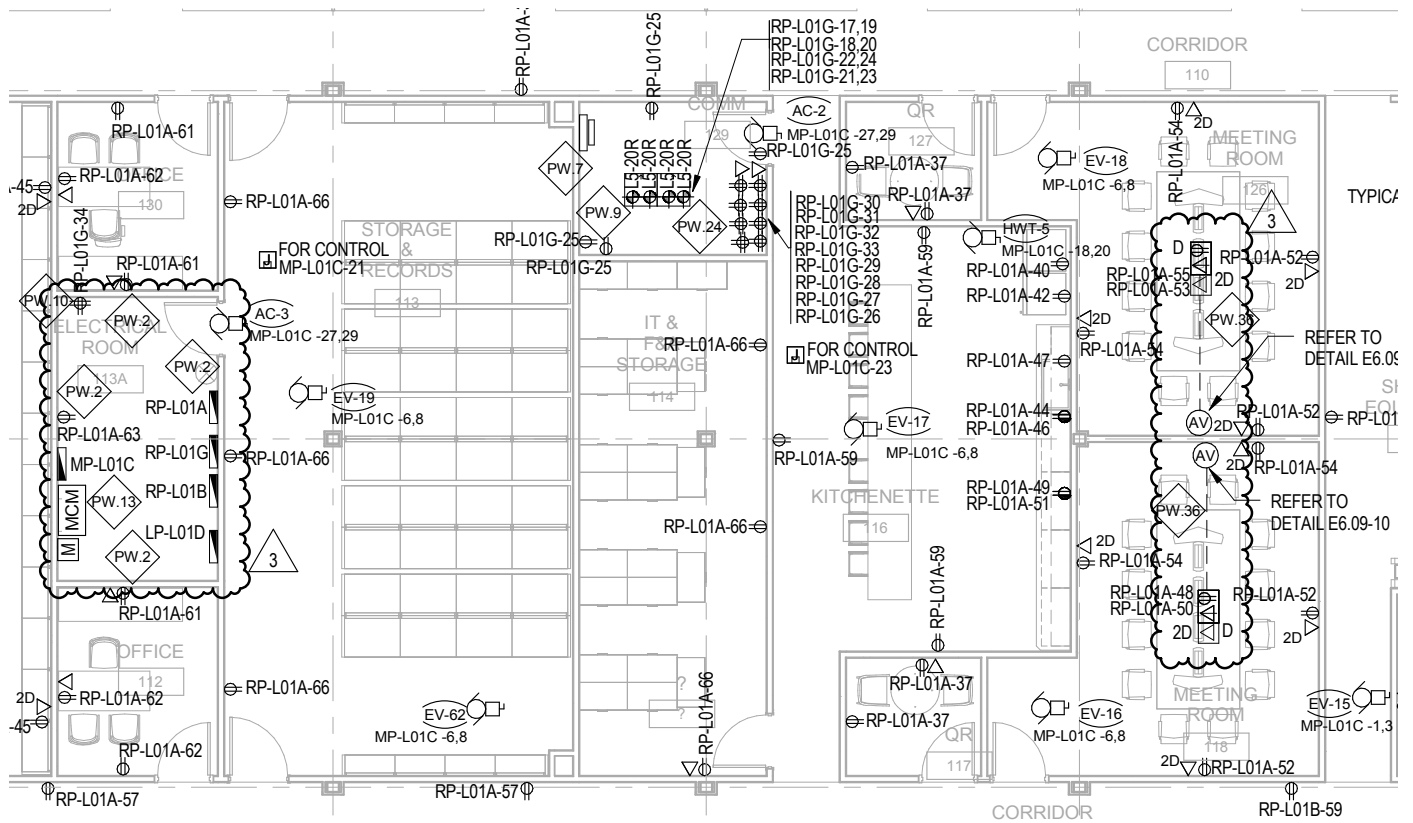
DRAWING NO: ESK-03

PROJECT NO: R.076516.013

PROJECT DATE: JUNE 07, 2016

DATE PLOTTED: 2017-04-05

CAD FILE: -



PW.18	SUPPLY AND INSTALL 2-GANG WALL MOUNTED BOX FOR SOUND SYSTEM CABLES.
PW.19	SUPPLY AND INSTALL SEPARATED SOLIDLY GROUNDED EQUIPMENT GROUNDING CONDUCTOR TERMINATING IN THE ELEVATOR MACHINE SPACE.
PW.20	CUT THE FLOOR SLAB, RUN 3/4" CONDUIT FOR POWER, 2" CONDUIT FOR DATA INSIDE THE FLOOR AND COVER THE GROOVE WITH CONCRETE AFTER COMPLETION. CONTRACTOR TO SCAN THE FLOOR PRIOR STARTING THE WORK.
PW.24	PROVIDE A DEDICATED DATA DROP FOR THE ACCESS CONTROL. THE INTRUSION SYSTEM WILL REQUIRE A DSL ANALOG TELEPHONE LINE IF VOIP IS NOT USED.
PW.25	PROVIDE SERVICE, FOR THE TENANT SPACE, 3' SHORT OF THE DEMISING WALL AND TERMINATE ON THE UNSECURED SIDE OF THE CEILING C/W 100' SPARE CABLES FOR EACH PHASE AND NEUTRAL. TENANT TO EXTEND ELECTRICAL SERVICE FROM THIS LOCATION TO THEIR ELECTRICAL ROOM USING DIELECTRIC FITTINGS. REFER TO SINGLE LINE DIAGRAM FOR MORE DETAILS.
PW.36	CUT THE FLOOR SLAB, RUN 3/4" CONDUIT FOR POWER, 1" CONDUIT FOR DATA AND 1 1/2" CONDUIT FOR AV INSIDE THE FLOOR AND COVER THE GROOVE WITH CONCRETE AFTER COMPLETION. CONTRACTOR TO SCAN THE FLOOR PRIOR STARTING THE WORK.

3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

**POWER AND COMMUNICATION PLAN -
GROUND FLOOR**

DESIGNED BY: MA

DRAWN BY: DD

APPROVED BY: NA

TENDER:

M.B.

PLOT SCALE: NTS

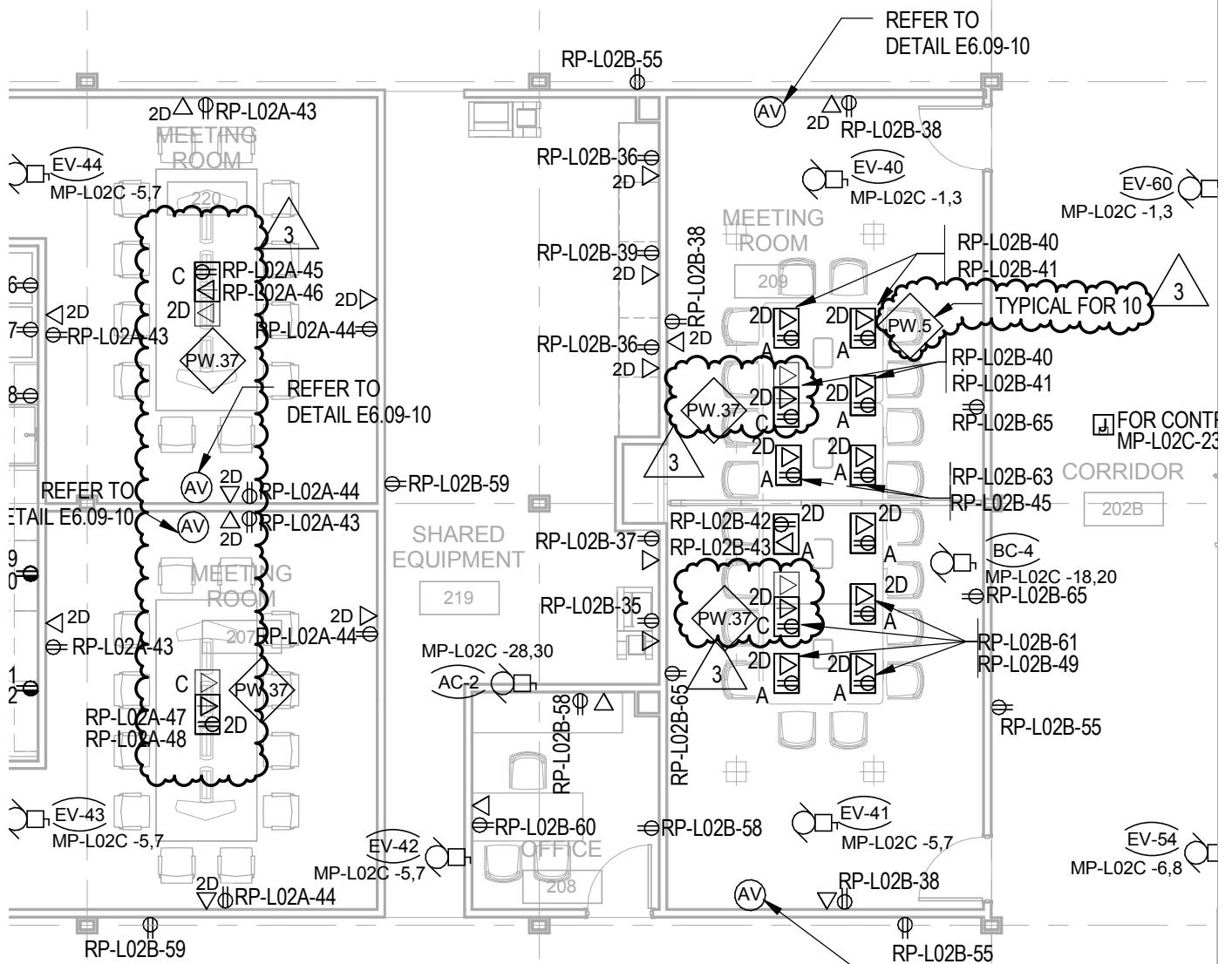
DRAWING NO: ESK-04

PROJECT NO: R.076516.013

PROJECT DATE: JUNE 07, 2016

DATE PLOTTED: 2017-04-05

CAD FILE: -



3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

**POWER AND COMMUNICATION PLAN -
SECOND FLOOR**

DESIGNED BY: MA

DRAWN BY: DD

APPROVED BY: NA

TENDER:

M.

PLOT SCALE: NTS

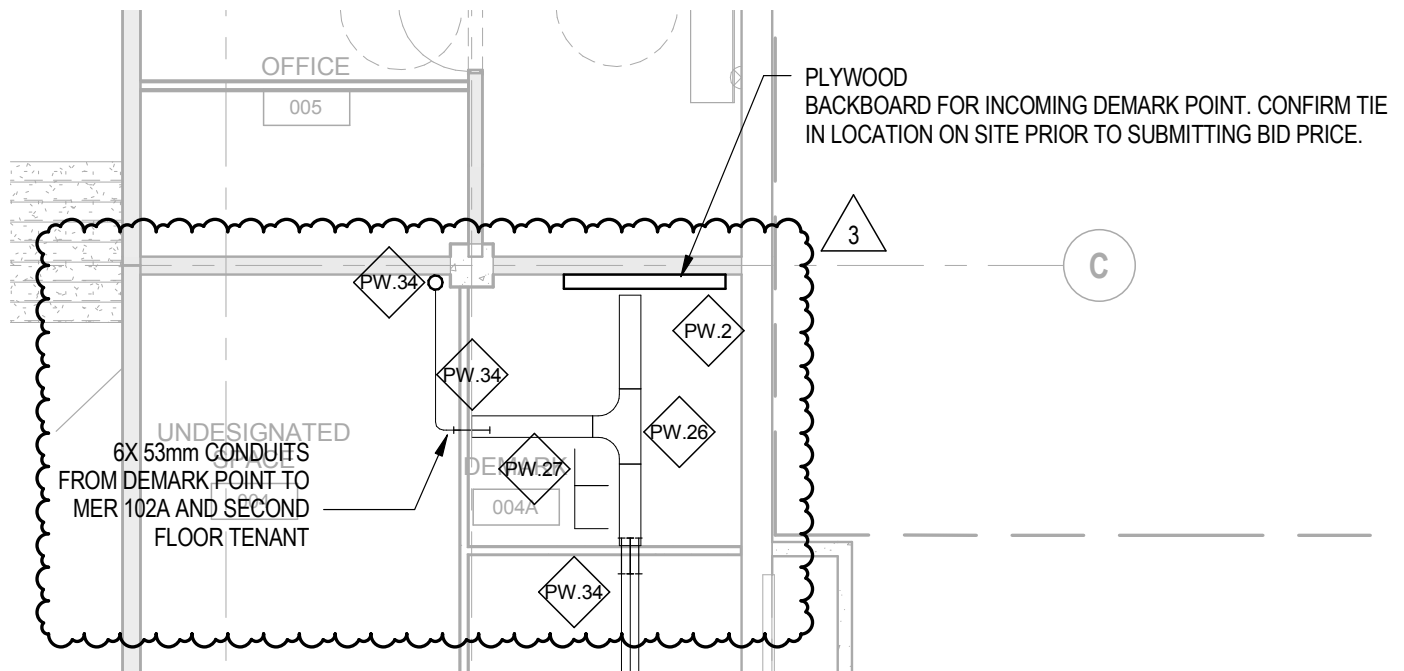
DRAWING NO: ESK-06

PROJECT NO: R.076516.013

PROJECT DATE: JUNE 07, 2016

DATE PLOTTED: 2017-04-05

CAD FILE: -



GENERAL NOTES:

1. ELECTRICAL CONTRACTOR IS RESPONSIBLE TO PROVIDE PRE-ENGINEERED SLEEVES FOR ALL SLAB AND WALL PENETRATIONS REQUIRED TO COMPLETE ELEC/COMM SCOPE OF WORK. INCLUDE X-RAY FOR FLOOR SLAB PENETRATIONS IN THIS SCOPE. ALL SLEEVES TO BE INSTALLED MAY NOT BE SHOWN ON DRAWINGS. CONTRACTOR TO REVIEW ON SITE FOR EXACT QUANTITIES AND LOCATIONS OF NEW PENETRATIONS IN SLABS AND WALLS WHICH REQUIRE SLEEVES.

3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

**COMMUNICATION PATHWAY AND ACCESS
POINT PLAN - BASEMENT**

DESIGNED BY: MA

DRAWN BY: DD

APPROVED BY: NA

TENDER:

M.

PLOT SCALE: NTS

DRAWING NO: ESK-07

PROJECT NO: R.076516.013

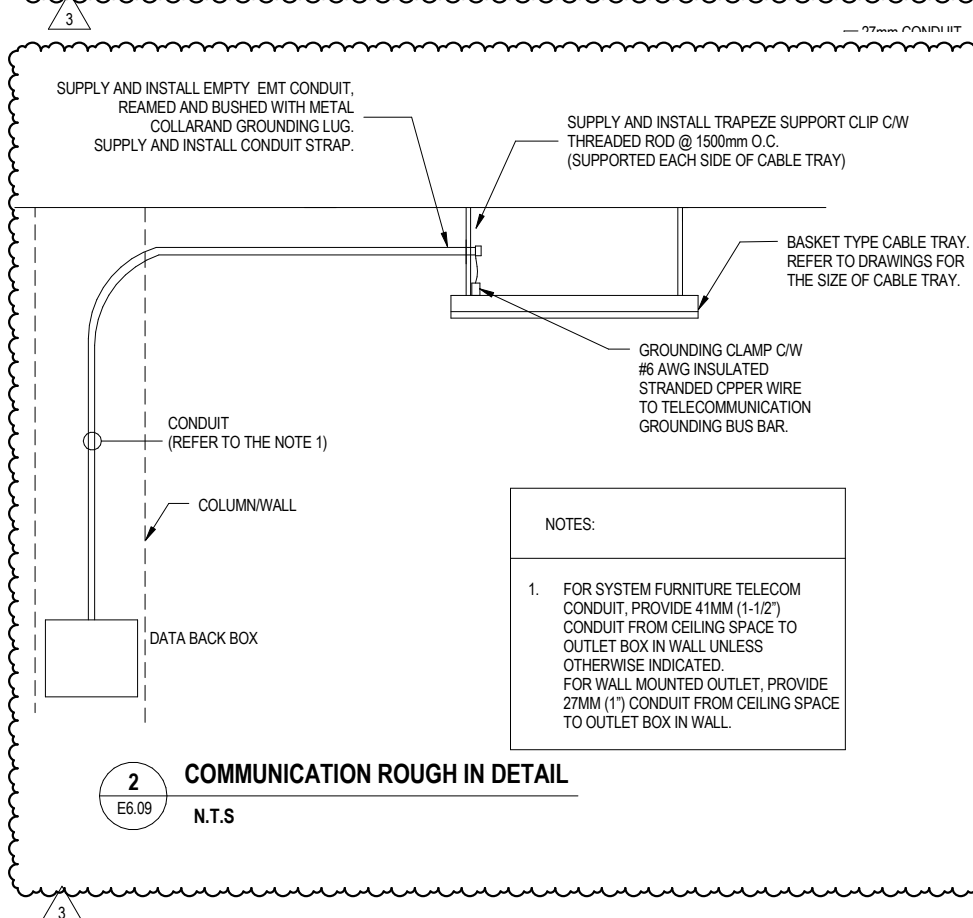
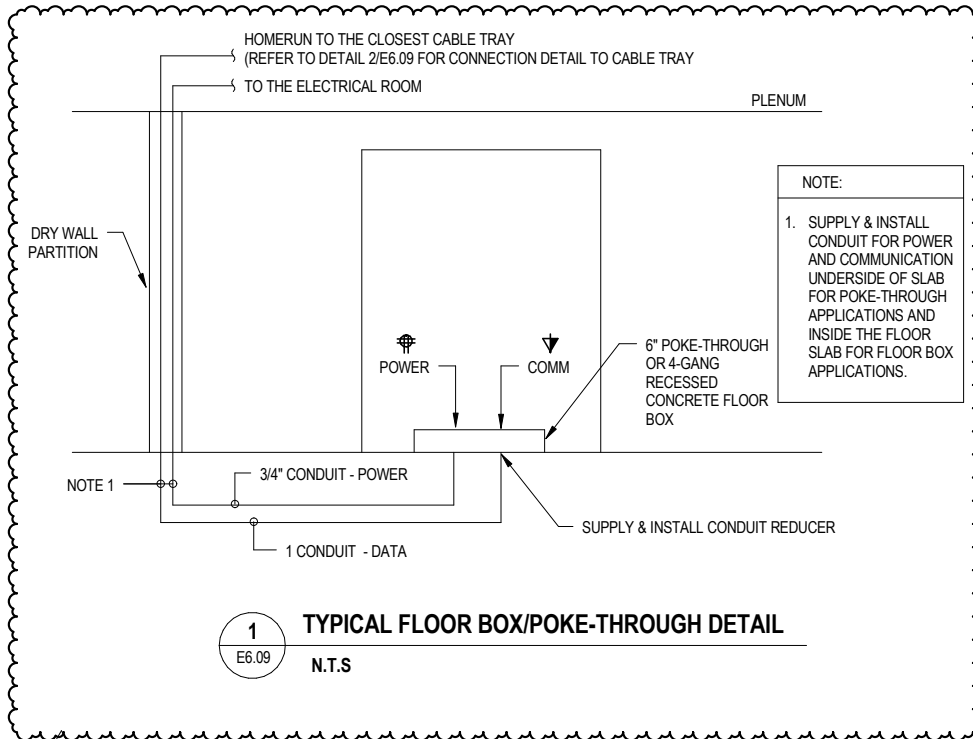
PROJECT DATE: JUNE 07, 2016

DATE PLOTTED: 2017-04-05

CAD FILE: -



3	ADDENDUM 02	2017-04-05		
REV	DESCRIPTION	DATE		
PROJECT TITLE: 441 UNIVERSITY RECAPITALIZATION 441 UNIVERSITY AVENUE WINDSOR, ON		DRAWING TITLE: GROUNDING DETAIL AND COMMUNICATION RISER DIAGRAM	DRAWING NO: ESK-08	
			PROJECT NO: R.076516.013	
		DESIGNED BY: MA	TENDER: M.	PROJECT DATE: JUNE 07, 2016
		DRAWN BY: DD		DATE PLOTTED: 2017-04-05
		APPROVED BY: NA	PLOT SCALE: NTS	CAD FILE: -



3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:

441 UNIVERSITY RECAPITALIZATION

441 UNIVERSITY AVENUE
WINDSOR, ON

DRAWING TITLE:

ELECTRICAL DETAILS

DESIGNED BY: MA

DRAWN BY: DD

APPROVED BY: NA

TENDER:

M.

PLOT SCALE: NTS

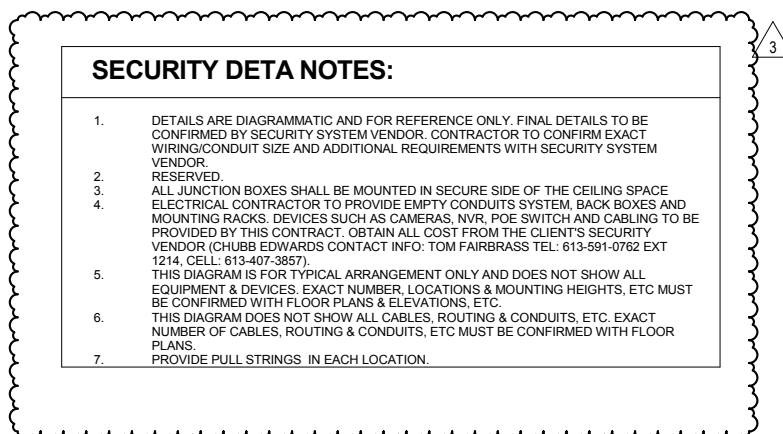
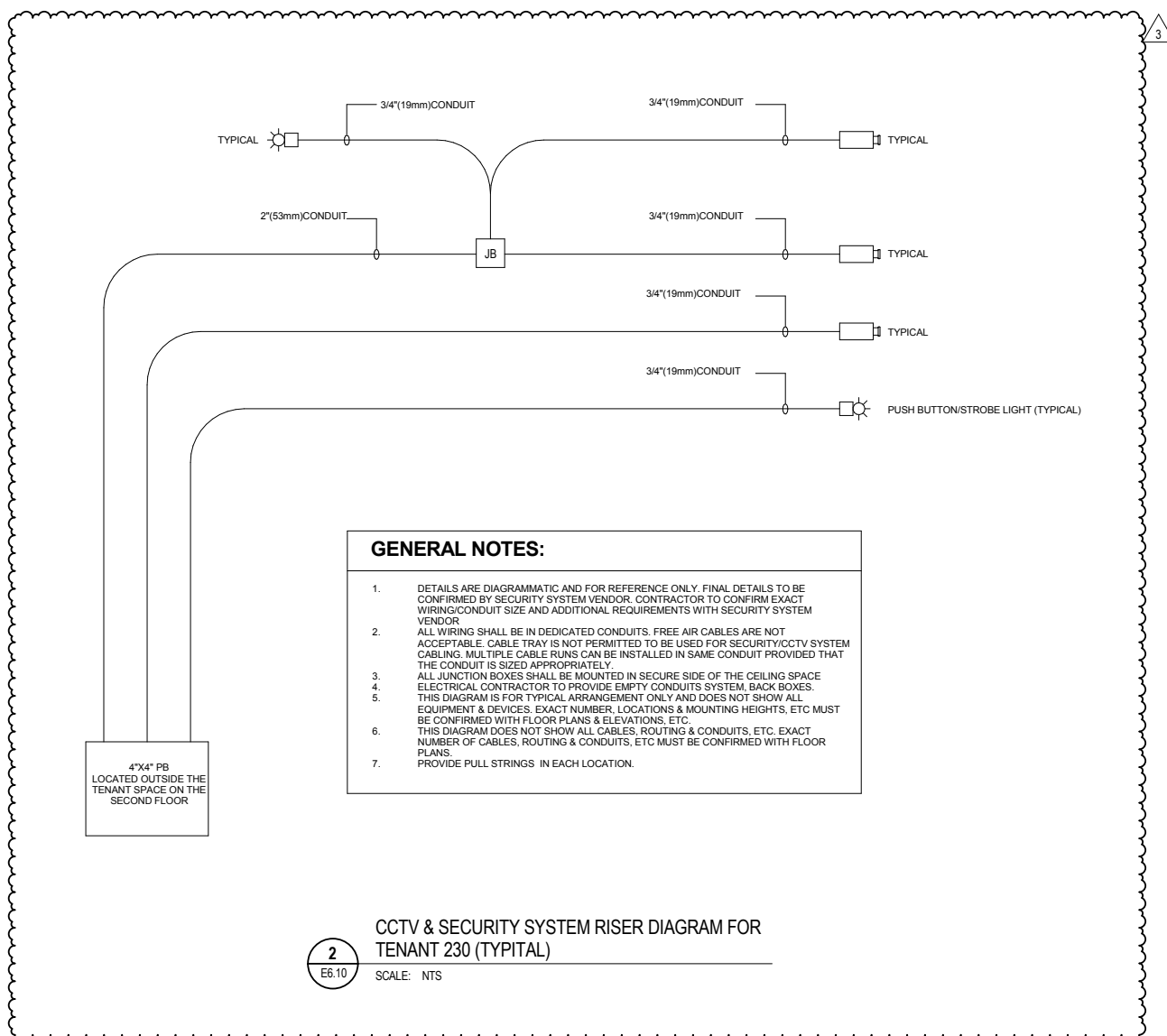
DRAWING NO: ESK-09

PROJECT NO: R.076516.013

PROJECT DATE: JUNE 07, 2016

DATE PLOTTED: 2017-04-05

CAD FILE: -



3	ADDENDUM 02	2017-04-05
REV	DESCRIPTION	DATE

PROJECT TITLE:	DRAWING TITLE:		DRAWING NO:	ESK-10
441 UNIVERSITY RECAPITALIZATION 441 UNIVERSITY AVENUE WINDSOR, ON	ELECTRICAL RISER DIAGRAM		PROJECT NO:	R.076516.013
	DESIGNED BY: MA	TENDER: M.	PROJECT DATE:	JUNE 07, 2016
	DRAWN BY: DD		DATE PLOTTED:	2017-04-05
	APPROVED BY: NA	PLOT SCALE: NTS	CAD FILE:	-