

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Thermostats.

**1.2                RELATED SECTIONS**

- .1        Section 23 33 00 - Duct Work Accessories: Installation of automatic dampers.
- .2        Section 25 90 00 - Sequence Of Operation.
- .3        Section 26 27 26 - Wiring Devices: Elevation of exposed components.
- .4        Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3                REFERENCES**

- .1        AMCA 500 - Test Methods for Louvres, Dampers and Shutters.
- .2        ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .3        ASTM B32 - Solder Metal.
- .4        ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .5        ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.
- .6        NEMA DC 3 - Residential Controls - Electric Wall-Mounted Room Thermostats.
- .7        NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

**1.4                SUBMITTALS FOR REVIEW**

- .1        Section 21 05 00: Procedures for submittals.
- .2        Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- .3        Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

**1.5                SUBMITTALS FOR INFORMATION**

- .1        Section 21 05 00: Submittals for information.
- .2        Manufacturer's Instructions: Provide for all manufactured components.

## **1.6 SUBMITTALS AT PROJECT CLOSEOUT**

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
- .3 Revise shop drawings to reflect actual installation and operating sequences.
- .4 Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- .5 Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owners name and registered with manufacturer.

## **1.7 QUALITY ASSURANCE**

- .1 The Installer shall have an established working relationship with the Control System Manufacturer, and be the authorized representative of the Manufacturer at bid time.
- .2 The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
- .3 All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off-the-shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Engineer in writing. Spare parts shall be available for at least 5 years after completion of this contract.

## **1.8 REGULATORY REQUIREMENTS**

- .1 All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, provincial, and national authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
  - .1 Canadian Electric Code (CEC)
  - .2 National Building Code (NBC)
  - .3 ASHRAE 135
  - .4 Underwriters Laboratories UL916

## **1.9 WARRANTY**

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.

- .3 All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period
- .4 At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Engineer, the Engineer shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.
- .5 Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labour and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Consultant review.

**1.10 MAINTENANCE SERVICE**

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide service and maintenance of control system from Date of Substantial Completion.
- .3 Provide complete service of controls systems, including call backs. Make minimum of two complete normal inspections of approximately four (4) hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

**1.11 SYSTEM AND COMPONENT PERFORMANCE**

- .1 Existing system is Delta Controls. New control components to integrate with existing building automation system.

**Table 1  
 Reporting Accuracy**

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (±1°F)
Outside Air	±1.0°C (±2°F)
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Carbon Dioxide (CO <sub>2</sub> )	±30 ppm

**Table 2  
 Control Stability and Accuracy**

Controlled Variable	Control Accuracy	Range of Medium
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.5°C (±3°F)	

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**Part 2            Products**

**2.1                CONTROL PANELS**

- .1        Utilize existing control panels. Expand system with new panels or controller modules where available capacity is required.

**2.2                INPUT/OUTPUT SENSORS**

- .1        Temperature:
  - .1        Resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 21 degrees C (70 degrees F), interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
  - .2        Measuring current maximum 5 mA with maximum self-heat of 0.017 degrees C/mW(0.031 degrees F/mW) in fluids and 0.008 degrees C/mW(0.014 degrees F/mW) in air.
  - .3        Provide 3 lead wires and shield for input bridge circuit.
  - .4        Use insertion elements in ducts not affected by temperature stratification or smaller than one square metre. Use averaging elements where larger or prone to stratification sensor length 2.5 m(8 feet) or 5 m(16 feet) as required.
  - .5        Insertion elements for liquids: with brass socket, minimum insertion length of 60 mm(2-1/2 inches).
  - .6        Room sensors: Locking cover.
  - .7        Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.
  - .8        Room security sensors: Stainless steel cover plate with insulated back and security screws.
- .1        Digital to Pneumatic Transducers:
  - .1        Convert continuous proportional current or voltage to 0 to 138 kPa (0 to 20 psi).

**2.3                THERMOSTATS (DDC)**

- .1        Digital Room Thermostats (Commercial):
  - .1        Digital display
  - .2        CO2 Sensing

**2.4                RELAYS.**

- .1        Control Relays. Control relays shall be plug-in type, ULC/CSA listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
- .2        Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable  $\pm 100\%$  from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

**2.5 CURRENT TRANSFORMERS.**

- .1 AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
- .2 Transformers shall be available in various current ratios and shall be selected for  $\pm 1\%$  accuracy at 5 A full-scale output.
- .3 Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

**2.6 VOLTAGE TRANSFORMERS.**

- .1 AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
- .2 Transformers shall be suitable for ambient temperatures of  $4^{\circ}\text{C}$ - $55^{\circ}\text{C}$  ( $40^{\circ}\text{F}$ - $130^{\circ}\text{F}$ ) and shall provide  $\pm 0.5\%$  accuracy at 24 Vac and 5 VA load.
- .3 Windings (except for terminals) shall be completely enclosed with metal or plastic.

**2.7 CURRENT SWITCHES.**

- .1 Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Section 21 05 00: Verification of existing conditions before starting work.
- .2 Verify that systems are ready to receive work.
- .3 Beginning of installation means installer accepts existing conditions.
- .4 Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- .5 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- .6 Ensure installation components are complementary to installation of similar components.
- .7 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- .8 The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Consultant and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any

changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

### **3.2 INSTALLATION**

- .1 Install to manufacturers written instructions.
- .2 Check and verify location of thermostats, CO2 Detectors and other exposed control sensors with plans and room details before installation. Locate 1 200 mm (47 inches) above floor. Align with lighting switches.
- .3 Provide security protection on thermostats to match existing conditions.

### **3.3 MANUFACTURER'S FIELD SERVICES**

- .1 Section 21 05 00: Prepare and start systems.
- .2 Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

### **3.4 DEMONSTRATION AND INSTRUCTIONS**

- .1 Section 21 05 00: Demonstrating installed work.
- .2 Demonstrate complete and operating system to Owner.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Sequence of operation:
  - .1    Fan coil units.
  - .2    Terminal air units.

**1.2            RELATED SECTIONS**

- .1    Section 25 30 00 - Instruments And Control Elements.
- .2    Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3            SYSTEM DESCRIPTION**

- .1    This section defines the manner and method by which controls function.
- .2    Requirements for each type of control system operation are specified.
- .3    Equipment, devices, and system components required for control systems are specified in other Sections.

**1.4            SUBMITTALS FOR REVIEW**

- .1    Section 21 05 00: Procedures for submittals.
- .2    Shop Drawings: Indicate mechanical system controlled and control system components.
  - .1    Label with settings, adjustable range of control and limits. Include written description of control sequence.
  - .2    Include flow diagrams for each control system, graphically depicting control logic.
  - .3    Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

**1.5            SUBMITTALS AT PROJECT CLOSEOUT**

- .1    Section 21 05 00: Submittals for project closeout.
- .2    Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

**1.6            QUALITY ASSURANCE**

- .1    Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the Province of Manitoba.

**Part 2            Products**

**2.1                Not Used**

.1                Not Used

**Part 3            Execution**

**3.1                COPIER EXHAUSTERS**

.1                On/off switch located in ceiling space near fan. Switch set to on position.

**3.2                TERMINAL AIR UNITS**

.1                Single temperature thermostat set at 24°C (75°F) maintains constant space temperature by modulating variable volume damper operator.

.2                Where CO2 sensor exists, when CO2 sensor indicates high level of local CO2 levels, increase supply air to the space proportional to the CO2 level. Reset VAV to temperature based control when CO2 levels reach normal conditions.

**END OF SECTION**