

SECTION 23 09 00
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Related Documents: The general provisions of the Contract, including Bidding Requirements, General and Other Conditions, and Specific Requirements, apply to all work of this Section.
- B. Work Included in This Section:
 - 1. Electric/Electronic Automatic Control System.
- C. Related Work Specified in Other Sections:
 - 1. See other specification sections

1.02 QUALITY ASSURANCE

- A. Applicable Standards:
 - 1. Underwriters' Laboratories (UL).
 - 2. The New York Board of Standards and Appeals.
 - 3. National Fire Protection Association (NFPA).
 - 4. New York City State Building Code.
 - 5. National Electrical Code (NEC).
 - 6. ASHRAE Handbook of Fundamentals.
 - 7.

1.03 SUBMITTALS

- A. Submit the following in accordance with the requirements of the General Conditions.
- B. Catalog cuts.
- C. Operating and Maintenance Manual Instructions: Include the shop drawings in the Operating and Maintenance Instruction Manual. Include also supplementary instructions for maintenance and parts listed.
- D. Diagrams:
 - 1. Provide for approval, complete control system diagrams and data for all systems specified herein.
 - 2. Wiring diagram shall include all control equipment and systems.
 - 3. The control wiring shall include all mechanical equipment interlock wiring for the entire system.
 - 4. Index equipment data sheets and reference of operation to the wiring diagrams.
 - 5. Provide a sufficient number of copies for construction and coordination in addition to those required for approval.
 - 6. Shop drawings shall be required for but not limited to the following: Automatic control valves, dampers, damper actuator, flow switches, pressure switches, thermostats, controllers, sensing elements, control wiring, diagrams of operation, relays, switches, accessories.
- E. Schedule of damper sizes.
- F. Leakage and flow characteristic charts for dampers.
- G. Certification of control-instrument components.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide labor, materials, equipment and services required for a complete system of controls and shown or specified.

- B. The control system shall consist of necessary sensing elements, automatic valves, automatic dampers and actuators, controllers, thermostats, relays, manual switches, wiring, together with necessary accessories for the complete control of all equipment herein specified and described under Control Schemes. For all Mitsubishi units the unit manufacture shall provide the required Thermostats (Wall mounted programmable room sensors as specified on schedules), all controllers and all required sensors to have a complete functional and operating system.
- C. The control system shall be of the electric/electronic type, unless otherwise indicated. Control equipment shall be as manufactured by Mitsubishi, Johnson Service Company, Honeywell or Power. All controls shall be the product of one manufacturer.
- D. Control components shall be permanently identified by adhesive embossed plastic label corresponding to the numbers shown on the manufacturer's control diagrams submitted for approval.
- E. Damper valve and damper operators shall be fully proportioning, unless otherwise specified. Electric motors shall be oil immersed.

2.02 WIRING ELECTRIC COMPONENTS

- A. Electric wiring shall be run in rigid full weight galvanized conduit, and shall conform to requirements of the National Electric Code and to the requirements of the Electrical Contract. Electric components of the temperature control system shall have Underwriters' Laboratories approval.
- B. Contacts for thermostats controlling motors shall be normally open to "fail safe".

2.03 CONTROL VALVES

- A. General:
 - 1. Control valves for the radiators shall be Danfoss, thermostatic self-contained with sensor.
- B. Steam Control Valves:
 - 1. Steam pressure ahead of control valve inlets is 5 psig. Size all steam control valves for the difference of 5 psi for all steam coils. Steam control valves shall be linear in characteristic.
 - 2. Manufacturer:
 - a. Thomas S. Brown, Associates, Johnson Controls, Honeywell or approved equal.

2.04 DAMPERS

- A. Furnish and install automatic louver dampers at outside air intake louvers, at fan and where indicated on drawings.
- B. Two- position dampers shall be parallel-blade type.
- C. The temperature control manufacturer shall provide multiple blade dampers as indicated. Control dampers shall be the Johnson Service Company Proportion/Aire damper, or as approved. Dampers shall be as follows:
 - 1. Dampers shall be sized for the application by the control manufacturer using methods similar to control valve sizing.
 - 2. The Contractor shall submit a schedule of damper sizes to the Engineer within ten days after being awarded the Contract.
 - 3. Damper frames shall be constructed of 13 gauge galvanized sheet metal and shall have flanges for duct mounting.
 - 4. Damper blades shall not exceed six inches in width. Blades shall be of corrugated construction, fabricated from two sheets of No. 22 gauge galvanized sheet steel spot welded together. Blades shall be suitable for high velocity performance.
 - 5. Damper bearings shall be made of nylon. Bushings that turn in the bearings shall be of oil impregnated sintered metal. Replaceable butyl rubber seals shall be provided with each

- damper. Seals shall be installed along the top, bottom and sides of the frame and along each blade edge. Seals shall provide a tight closing low leakage damper.
6. Linkage shall provide a linear flow characteristic, shall be provided with each damper operator for all mixing damper applications.
 7. Leakage and flow characteristic charts shall be submitted to the Engineer prior to approval of dampers. Dampers located on building envelope shall have a maximum leakage rate of 4 cfm per square foot of face area at a 1 inch water gauge differential static pressure in accordance with New York City Energy Conservation Code.

2.05 THERMOSTATS

- A. Room Thermostats shall be as specified on drawings and shall be by Mitsubishi for the Mitsubishi units. All thermostats shall be temper proof.

2.06 PANELS

- A. Panels: Provide a steel panel for each control system. Panels shall be of unitized construction and securely mounted, where indicated on drawings or as directed by the Engineer. Panels shall be grouped in a location accessible to the Maintenance Foreman or Superintendent.
- B. Locate on Panel the Following Gauges:
 1. Outdoor air temperature.
 2. Supply air temperature for the ventilation system.
- C. Panels shall have dust proof enclosures and shall be supplied with identifying nameplates.

2.07 TIME CLOCK

- A. Furnish and install time clock as specified Time Switch of the 7 day type, powered by a self-starting synchronous motor, capable of being set for different ON-OFF times each day of the week, to an operating accuracy of plus or minus 15 minutes of the desired time.
- B. Time Switch contacts shall be capable of switching as required.
- C. Removable ON-OFF trippers shall make possible a minimum ON period of one hour and a minimum of 2 hours between one OFF operation and the next ON. Separate manual ON and OFF levers shall enable operation by hand without disturbing automatic settings.
- D. Enclosure shall be NEMA 1 surface (NEMA 1A flush) type. NEMA 1 enclosure shall be finished in baked beige epoxy enamel, with combination 1/2" - 3/4" knock-outs on bottom and both sides. Provision shall be made for positive padlocking and/or sealing.
- E. Terminal shall be capable of receiving # 8 AWG wire.
- F. Time Switch shall be TORK Model W series or equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Temperature control motors, controllers, relays and operating mechanisms shall be so located as to be readily accessible for maintenance.
- B. Post control diagrams and operating references in a frame with glass or clear plastic lens adjacent to the main control section panel or where directed by the Owner or Engineer.
- C. Include the services of a factory-trained Engineer to supervise and check out the automatic control systems, place system in operation, calibrate all sensors and controllers, make all corrections and adjustments as required to provide a complete and trouble free automatic control system. Instruct the Department personnel on details of the system operation, maintenance and service. Provide instruction, operation and service manuals.

- D. Duct mounted automatic control instruments shall be mounted on the exterior surface of the insulation, or suitable metal saddles.

3.02 GENERAL SAFETY CONTROL REQUIREMENTS

- A. Safety Controls Shall Conform to the Following:
 - 1. NFPA Bulletin 90A.
 - 2. New York City Code.
- B. Each installation shall be equipped with a manual emergency stop, located at a conveniently accessible point, for quick shutting down of all fans in case of fire.
- C. Under all schemes of control, starting the fan shall activate all automatic controls for any one system. When fan is not operating, respective outside air intake and exhaust dampers shall remain closed. However, heating coil control valves shall remain fail safe open at all times.
- D. Furnish and install low leakage automatic dampers by Honeywell, Imperial or Arrow Louver C., or approved equal where indicated on drawings.

3.03 SEQUENCE OF OPERATION

- A. Control Scheme B (Ventilation Supply Air System):
 - 1. Starting the supply fan manually or automatically shall, open the N.C. fixed outside air damper and place the system under automatic control and shall activate its automatic controls. Provide time delay switch.
 - 2. Supply fan shall be provided with a hand-off- automatic switch to permit independent operation. Provide pilot light for the fan in control panel. HOA and panel shall be located where indicated by owner.
- B. PACKAGE TYPE AIR HANDLING UNIT CONTROL SEQUENCES (DDC)
 - 1. Unit shall be started and stopped automatically from the DDC Scheduler. Provide a controller and sensor with setpoint adjustment for package type heat pump unit to integrate into the network. The discharge air sensor shall control the electronic control valves of the separate convector(s) and the dampers and modulating valves of the unit to maintain the discharge air temperature at temperature set point. (72°F winter occupied, 55°F winter unoccupied, 78°F summer occupied, and 85°F summer unoccupied). An electronic actuator damper shall close the outside air damper whenever the unit blowers are not operating and during the warm-up and pull-down cycle.
 - 2. Occupied Cycle: During the occupied period, the dampers shall open to provide a 65°F neutral discharge temperature. The minimum outside air indicated on the Drawings shall be introduced to meet room ventilation requirements.
 - 3. Cooling Mode - Occupied Cycle: The unit fan shall be on during the occupied cooling cycle. The central supply air fan shall be scheduled ON by the DDC Scheduler during the occupied cooling cycle.
 - a. The AC unit manufacturer recommended sequence to maintain the discharge air temperature at its setpoint..
 - 4. Unoccupied Cooling: The unit shall maintain discharge air temperature at its setpoint during the unoccupied time periods. The unoccupied setup temperature shall be 85°F. During the unoccupied cooling mode, the outside air intake damper shall be fully closed. The unit fan shall cycle on if cooling is required to maintain the discharge air temperature at its set point. The central supply air fan shall be scheduled off by the DDC Scheduler during the unoccupied cooling cycle.
 - 5. The Summer/Winter Change-Over: Summer/winter changeover shall be provided to automatically index unit controls to maintain occupied setting of 78°F during the cooling cycle and 72°F during the heating cycle. Change-over between heating and cooling shall be automatic and shall be controlled by a outside air temperature sensor or by a network variable command.

6. BMS I/O Points: Provide the BMS I/O points as specified.
7. For ceiling hung units, per NYC Mechanical Code MC 307.2.3, where the primary drain pan is not provided with auxiliary drain line or an auxiliary drain pan is not provided with an auxiliary drain line, a hard-wired water-level detection device located in the auxiliary pan shall shut off the equipment served prior to overflow of the auxiliary pan.

END OF SECTION 23 09 00 23 09 00