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# CSI SPECIFICATION: *MPCQ Platinum*

# SECTION: 230913 Instrumentation and Control devices for HVAC

## PART 1 GENERAL

### 1.1 Summary

**A. Section Includes:**

1. Multi-stage steam boiler cycling and set point sequencing control.

**B. Related Sections:**

1. Conforms to applicable building code requirements of all authorities having jurisdiction.

### 1.2 References

**A. International Organization for Standardization (ISO)**

1. Manufacturer shall be ISO 9001:2008 Quality Management Systems Certified.

**B. Underwriters Laboratories, Inc. (UL):**

1. The control shall be tested per standard 916 “Energy Management Equipment”.

**C. The City of New York, Department of Environmental Protection (DEP).**

1. The control shall be approved for installation in New York City by DEP.

### 1.3 Quality Assurance

**A. Manufacturer’s Quality System:**

1. Registered to ISO 9001:2008 Quality Standard, including in-house engineering for product design activities.
2. The control must be UL tested and certified per standard 916 “Energy Management Equipment”.

### 1.4 Control Operation

**A. Description:** The control shall operate on 120 VAC, with a maximum power of 30 VA. The control shall be pre-engineered and programmed exclusively for the cycling, sequencing, and lead rotation of multiple steam boilers based on a PID logic. It shall incorporate the following integrated functions: Steam Outdoor Reset, Steam Set Point, Outdoor temperature cutoff(s), day/night heat level programming, and Boost (optimum start/stop).

**B. Stages:** The control shall have eight normally open relay contacts that can be used to start and stop each stage. The control shall have the capability to operate multiple single-stage, two-stage, three-stage, or four-stage steam boilers. It shall be capable of controlling a total of eight stages without the use of additional control extensions. It shall be capable of controlling up to 24 total stages using a maximum of two external compatible extension controls.

**C. Sequence of Operation:**

1. **Cycle Operating Concept:** By monitoring the outside temperature, the control shall be able to anticipate the heating needs of the building. Each Cycle period (usually 60 minutes long but adjustable between 10 minutes and 240 minutes, depending on the building response) is divided into a Cycle-ON segment and a Cycle-OFF segment. The length of the Cycle-ON segment will vary with the outdoor temperature and the Heat Adjustment selection. The colder it is outside, the longer the ON part of the cycle shall be, and the shorter the OFF part of the cycle shall be. The Heat Adjustment selection provides multiple ratios of Cycle-ON to Cycle-OFF that varies based on the building heat dissipation rate.
2. **Adding and Subtracting Stages:** After the purge elapses and during the establishing heat and Cycle-On periods, the control shall use a number of adjustable settings to customize the sequencing to the specific application and equipment being controlled. These settings shall include reaction time, minimum runtime, last stage hold, and standby delay. If additional output is required, the control shall wait a full reaction time before energizing any additional stages. If the control PID requires output reduction, the control shall turn-off a stage after making sure that the stage has run for a full minimum runtime before de-energizing it.

**D. Space Average Feedback Operation:** Is used to prevent space over heating and minimizes fuel consumption. If the control is equipped with Internet communication, the control shall have the option of accepting values from up to 128 space sensors. The sensors shall be of the wired or wireless type. For each space sensor configured, the control shall provide the option of including it in or excluding it from the space average calculation. ***The control shall not start a heating cycle if the space average is at or greater than the space average target setting.*** The control shall have a day space average target setting and a night space average target setting. Each shall take effect during its scheduled time.

1. **Smart Space Average:** The control shall incorporate a statistical logic to exclude sensors from the space average based on how far off their current values are from the total average based on an adjustable differential. The control shall average the temperature of all the space sensors that are selected to be part of the space average. Then it shall scan through them and exclude all the sensors that have a reading greater than the sum of space average and the differential. In addition, it shall exclude all the sensors that have a reading that is less than the space average minus the differential. Then, the control shall recalculate the space average using only the included sensors (all excluded sensors values shall be logged but not included in the space average). This new calculation shall be the smart space average that shall be used by the control logic to manage the space heat.
2. **Day and Night Space Average Target:** The control shall have two independent space average target settings: a day setting and a night setting. The day space average setting shall take effect when the control is operating in the day schedule while the night space average setting shall take effect when the control is operating in the night schedule. Both settings are adjustable.
3. **Space Lockout:** Prior to the control starting the heat establish and cycle mode, the control shall check that the smart space average is less than the day space average target or night space average target depending on the time of day and the current schedule. ***If the space average calculation was at or greater than the space average target, the control shall start the space lockout feature where no heat output shall be active.*** This heat off period shall remain until the space average temperature drops below the space average target. In this case, the control shall evaluate its parameters for starting a new heating cycle (outdoor temperature, return line temperature, etc.).

**E. Features:**

1. **Heat Adjustment:** The control shall provide two (2) independent heat adjustments, one for Normal (Day) mode and one for Save (Night) mode. The heat adjustment shall allow for the selection of various “cycling” curves that regulate the heating system in accordance with the outside temperature.

2. **Schedules:** A digital, 7 day electronic time clock shall be incorporated to switch between the Normal (Day) and Save (Night) modes of operation. The clock shall be capable of 4 separate Normal (Day) / Save (Night) schedules per day and each day can be programmed independently. The normal/save schedule shall be stored in E-Prom indefinitely. Copy and erase functions shall be provided to facilitate programming.
3. **Manual Shift:** A menu selection option shall be provided to immediately switch from the Normal (Day) to Save (Night), Save to Normal mode, or Save to Extended Day with an adjustable delay. If a shift to Save (Night) or to Normal (Day) is selected the control shall remain as such until the next setting on the schedule. In Extended Day mode, a shift to Normal (Day) the control shall automatically revert back to the Save (Night) mode after an adjustable time delay that ranges from 60 to 240 minutes.
4. **Boost (Optimum Start/Stop):** The control shall incorporate 3 separate field selectable "boost" functions. During the "boost" period the steam source will not be cycled. The digital display will indicate a boost is occurring and the type of boost. The choices shall be:
    a. **Manual boost** shall offer a fixed warm-up period of 0-120 minutes.
    b. **Vari-Boost** shall offer an automatic variable warm-up period that varies in length based on the outside temperature.
    **c. Vari-Boost with Early Shutdown** shall provide an automatically variable warm-up with an automatically variable early switch to the Setback Save mode based on the outside temperature.
5. **Season:** A summer/winter menu selection shall be provided for summer shutdown. In the summer mode the control panel will not activate the steam source.
6. **Set Point**: The control shall provide an integral sensor set point adjustment for steam heating or process applications.
7. **Reaction Time and Minimum Runtime:** The control shall have the capability of adjusting the rate at which stages are added or subtracted using the Reaction Time and Minimum Runtime settings.
8. **Last Stage Hold:** The control shall have a last stage hold feature that shall keep the last boiler's lowest stage on for an additional, field adjustable, PSI above the set point before de-energizing it to reduce short cycling of the lead boiler.
9. **Purge Time:** The control shall have an adjustable purge delay. This setting shall determine the delay time required for a boiler to start to produce output
10. **Rotation:** The control shall be capable of rotating the boilers either based on an adjustable time period (between 1 hour and 999 hours), First-On/First-Off, or manually.
11. **Parallel or Normal Sequencing:** The control shall have an option for parallel sequencing where the control shall start the lower firing stages on all boilers before energizing the higher firing stages. Also, it shall have a normal sequencing mode where it shall bring on the lowest stage of a unit followed by the next higher stage on the same unit. Then when all stages on that unit are energized, it shall do the same to the next unit inline.
12. **Memory:** The control shall store all configuration and settings on EE-Prom. In case of power failure the control should be able to retrieve all of its latest settings.
13. **Display:** The control shall have a four line by twenty-character alphanumeric display capable of displaying both numbers and characters. The display shall be visible with no ambient light. All control operation information shall be available for display. During times of inactivity, or 5 minutes after the last user entry, the display shall enter default mode. In this mode the control shall display the outdoor temperature, system pressure, and each stage status.
14. **Setback Schedule or Remote Setback:** The control shall have a setback setting were it will reduce the pressure of the system either based on the programmed schedule or using an external setback signal.

**F. Inputs:**

1. **Outdoor Temperature:** This shall be the value read from the outdoor sensor placed on the north side of the building at least 10 Ft. above the ground.
2. **System Pressure:** This shall be the value read from the system pressure transducer placed on the main header to measure the steam pressure.
3. **External Shutdown:** The control shall be capable of accepting a dry-contact shutdown input. This shall prevent any stage from being activated when the contact is closed.
4. **Prove Input:** The control shall be capable of accepting a dry-contact system prove input to check on system components before energizing any boiler stage. This shall prevent any stage from being activated until the contact is closed.
5. **Optional Sensor Inputs:** The control circuitry shall be capable of accepting one standard and up to three optional (sensor) inputs. These sensor inputs shall be of the thermistor type or switch type. Operating temperature range shall be -30°F to 250°F. Optional (sensor) inputs shall include multiple thermistor type sensors or dry-contacts.
6. **Optional Wireless Sensor Input:** The control shall be capable of accepting wireless sensor and transceiver devices through a RS485 connection. Wireless sensors shall be of the space temperature sensor, outdoor temperature sensor, water temperature sensor, and switch sensor types.
7. **Optional Network Sensor Inputs:** The control shall be capable of communicating to up to 128 additional sensors through these inputs.

**G. Outputs:**

1. Eight Stage relay outputs
2. System relay output

**H. Data Points:**

1. **Day-Heat Adjustment/Night-Heat Adjustment:** The control shall have two individually changeable heat-adjustments, one for the day and the second for the night. The heat-adjustment setting shall change the ratio of the Cycle-ON to Cycle-OFF at any given outdoor temperature.
2. **Day Outdoor Cutoff/Night Outdoor Cutoff:** The control shall provide two (2) integral outdoor sensor set points, one for Normal (Day) operation and one for Save (Night) operation. They shall be independently adjustable, in 1° increments. Their settings shall be digitally displayed. The range of settings is 20° to 100°. The settings shall be stored in E-Prom for an indefinite time period.
3. **Heating Cycle Length:** The cycle length shall be adjustable between 10 to 240 minutes. The control shall digitally display the elapsed time of the cycle as well as the current segment of the current cycle.
4. **System Set Point:** The control shall provide an adjustable system pressure set point. The sensor's set point and current pressure shall be digitally displayed.

## 1.5 Communication Options (Select one)

**A. Internet Communication:** The control shall be capable of communicating to the Internet using a high-speed Internet connection to communicate to the manufacturer or manufacturer representative web servers to send or receive its information.

1. **Remote users** of the control shall have the capability of changing control parameters remotely using a web browser when provided with security log in information to the manufacturer's web site. In case of Internet communication malfunction, the control shall be capable of operating independently.

2. **Security:** The control shall offer two levels of security, a web security and a control security. The web security shall have a minimum of two levels, a READ ONLY user and a FULL RIGHTS user. Multiple users shall be capable of accessing the control through the web system at the same time. During that access period, only a single user shall be capable of changing the control settings. The control security shall have a password security that allows only authorized users to make control changes.
3. **Control and Sensor Data Logging/History:** The control shall be capable of sending all of its data as well its sensor data to a remote server for storage. The data shall be accessible through the Internet using a web browser.
4. **Alarms:** The control shall have alarm setting and delivery capabilities. The control and Internet system shall be capable of sending multiple alarm deliveries for each occurrence to cell phones as a text message or to multiple email addresses.

**B. BACnet IP Communication:** The control shall be BACnet IP capable. It shall provide the user with BACnet IP communication Interface to an Energy Management System (EMS) or Building Management System (BMS) on the same BACnet network. The control shall be designed to be BACnet Application Specific Controller (B-ASC). The control shall manage the boilers through direct wiring to the equipment and not through the BACnet network.

**C. BACnet MSTP Communication:** The control shall be BACnet IP capable. However, will communicate to the BACnet network through a BACnet IP to BACnet MSTP router that is supplied by the control manufacturer at additional cost. It shall provide the user with BACnet MSTP communication Interface to an Energy Management System (EMS) or Building Management System (BMS) on the same BACnet network. The control shall be designed to be BACnet Application Specific Controller (B-ASC). The control shall manage the boilers through direct wiring to the equipment and not through the BACnet network.

**D. MODBUS (RTU):** The control shall be MODBUS RTU capable. It shall provide the user with RS485 communication Interface to an Energy Management System (EMS) or Building Management System (BMS) on the same BACnet network. The control shall manage the valve and/or boiler through direct wiring to the equipment and not through the MODBUS network.

**E. LonWorks, Johnson Metasys, Johnson N2, Honeywell, Tridium, and other protocol communications:** The control shall be BACnet IP capable. However, will communicate to the other proprietary protocols through a BACnet IP to the specified proprietary protocol through a gateway that is supplied by the control manufacturer at additional cost. It shall provide the user with proprietary protocol communication Interface to an Energy Management System (EMS) or Building Management System (BMS). The control shall be designed to be BACnet Application Specific Controller (B-ASC). The control shall manage the boilers through direct wiring to the equipment and not through the BACnet network.

**F. Optional Add-Ons:** Internet capable controls shall be capable of connecting to and alarming on different adjustable settings and delays for the following sensors.

1. **Wireless Space, Temperature, and Switch Sensors:** The control shall be capable of communicating to wireless space temperature, wireless outdoor temperature, and wireless temperature/ switch sensors.
2. **Stack Network Temperature Sensor**
3. **Oil Tank Level**
4. **Domestic Hot Water and other Temperature Sensors**
5. **Flame Failure and other Switch Sensor**
6. **Pressure Network Sensor**
7. **Water Counter/Pulse Network Sensor**
8. **Smoke Alarm Sensor**
9. **Sump Pump Float Sensor**

## 1.6 Regulatory Approvals

**A. Underwriters Laboratories, Inc. (UL):**
The control shall be tested per standard 916 "Energy Management Equipment".

**B. The City of New York, Department of Environmental Protection (DEP).**

The control shall be approved for installation in New York City by DEP under "Engineering Criteria for Fuel Oil Burning Equipment".

## 1.7 Included Items

**A. Outdoor Temperature Sensor** shall be of the Thermistor type capable of measuring between –30°F to 250°F. It shall have a weather shield.

**B. System Pressure Sensor** shall be a pressure transducer to measure the pressure of the steam system at the main header. It shall be rated for 0-30PSI.

## 1.8 Security

**A. Control Local Security:**

1. The control shall have a secure password to deter unauthorized users. The password shall be optionally activated.
2. The control shall have a key locked enclosure.

**B. Control Remote Security:**

1. To access the control remotely, the control, web server, or proprietary software shall deter unauthorized users by requiring a secure password for logging to the control interface.