SECTION 23 09 33 SAMPLE SPECIFICATION FOR BOILER CONTROLLER CONVERSION KIT

HARSCO INDUSTRIAL, PATTERSON-KELLEY **NURO**® CONTROL CONVERSION KIT

Part 1 - GENERAL

1.01 RELATED DOCUMENTS

A. ANSI Z21.13 / CSA 4.9 (Gas Fired Low Pressure Steam and Hot Water Boilers)

B. ASME Section IV (“H” Stamp Heating Boilers)

C. ASME CSD-1 (Controls and Safety Devices)

D. NBIC - Part 1 (Installation)

E. NFPA 54/ANSI Z221.3 (National Fuel Gas Code)

F. NFPA 70 (National Electric Code)

1.02 SUMMARY

A. This section includes controls for gas-fired condensing and non-condensing appliances.

B. Related Sections include, but are not limited to, the following:

1. Section 23 05 19 “Meters and Gages for HVAC Piping”
2. Section 23 05 48 “Vibration and Seismic Controls for HVAC Piping…”
3. Section 23 05 53 “Identification for HVAC Piping and Equipment”
4. Section 23 09 13 “Instrumentation and Control Devices for HVAC”
5. Section 23 11 23 “Facility Natural-Gas Piping”
6. Section 23 11 26 “Facility Liquefied-Petroleum Gas Piping”
7. Section 23 37 00 “Air Outlets and Inlets”

1.03 SUBMITTALS

A. The contractor shall submit, in a timely manner, all submittals for approval to the engineer. Under no circumstances shall the contractor install any materials until the engineer has made final approval on the submittals.

B. Product data and/or drawings shall be submitted to the engineer for approval and shall consist of:

    1. General assembly drawing of the boiler or hot water heater including product description, model number, dimensions, clearances, weights, service sizes, etc.
    2. Schematic flow diagram of the appliance gas valve train(s).
    3. Schematic wiring diagram of the appliance control system that shows all components, interlocks, etc. and shall clearly identify factory wiring and field wiring.

C. Full Function Factory Fire Test must be performed and documented on the appliance fire test label. A Factory Authorized Start-up must be completed prior to final acceptance by the engineer.

D. Operation and Maintenance Manuals shall be submitted prior to final acceptance by the engineer and shall contain shop drawings, product data, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data, etc.

1.04 QUALITY ASSURANCE

A. The equipment shall, at a minimum, be in strict compliance with the requirements of this specification, shall perform as specified and shall be the manufacturer's standard commercial product unless specified otherwise.

B. Electrically operated components specified are to be “Listed” and/or “Labeled” as defined by NFPA 70, Article 100.

C. Each appliance shall bear an ASME “H” stamp in accordance with ASME Section IV.

D. Each appliance shall be CSA certified to the ANSI Z21.13 / CSA 4.9 standard for Gas Fired Low Pressure Steam and Hot Water Boilers and shall bear an authorized CSA rating label.

E. Each appliance shall be AHRI listed and certified in accordance with the Commercial Boiler program and the BTS-2000 testing standard.

F. Each appliance shall be SCAQMD certified *(relevant jurisdictions).*

G. Each appliance shall undergo a Full Function Factory Fire Test and bear a fire test label.

H. Each appliance shall be registered through the National Board from the factory.

I. The manufacturer shall make available, upon request, all quality assurance documentation and results of Full Function Factory Fire Test based on the appliance serial number.

1.05 COORDINATION

A. Equipment shall be handled, stored and installed in accordance with the manufacturer's instructions.

B. Factory Authorized Start-up must be completed after all appliance electrical connections are verified.

Part 2 – Product

2.01 MANUFACTURERS

A. Furnish and install factory "packaged" control devices as manufactured by Harsco Industrial, Patterson-Kelley or as approved and accepted control replacements by the Engineer as defined for appliances in the table below:

Model Number	Fuel Type	Vent Category	Max Input High Fire (BTU/Hr)	Min Input Low Fire (BTU/Hr)	Turndown Ratio	Max Output (BTU/Hr)	AHRI Efficiency
C750	NG or LP	II or IV	750,000	150,000	5:1	712,500	95%
C900	NG or LP	II or IV	900,000	180,000	5:1	846,000	94%
C1050	NG or LP	II or IV	1,050,000	210,000	5:1	987,000	94%
C1500H	NG or LP	II or IV	1,500,000	300,000	5:1	1,440,000	96%
C2000H	NG or LP	II or IV	2,000,000	400,000	5:1	1,920,000	96%
C2500	NG or LP	II or IV	2,500,000	500,000	5:1	2,375,000	95%
C3000	NG or LP	II or IV	3,000,000	600,000	5:1	2,850,000	95%
C4000	NG or LP	II or IV	4,000,000	800,000	5:1	3,800,000	95%
SC-3000	NG or LP	II or IV	3,000,000	600,000	5:1	2,907,000	96.90%
SC-4000	NG or LP	II or IV	4,000,000	800,000	5:1	3,840,000	96%

B. Each factory “packaged” kit shall be shipped complete with all components and accessories necessary for a complete and operable appliance as hereinafter specified. Each kit shall be furnished factory assembled with the required wiring for installation. Each kit shall be readily transported and ready for installation.

C. All “Approved Equal” or “Approved Alternate” conversion kits must demonstrate compliance with the requirements of this specification.

2.02 COMPONENTS

A. BOILER CONTROL SYSTEM

1. Each appliance shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.
2. Each appliance shall be provided with a “Full Modulating” firing control system whereby the firing rate is infinitely proportional at any firing rate between low fire and high fire as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.
3. The appliance control system shall provide the minimum capabilities:
    a. 7” color touchscreen display with one or more USB ports.
    b. Standard on-board Ethernet port for wired internet connectivity and embedded wireless driver for optional wireless internet connectivity to remote monitoring and software update services.
    c. Parameter uploads and downloads via external USB flash drive.
    d. Software updates via external USB flash drive.
    e. Capture screen shots from the control’s display by saving digital image files to external USB flash drive.
    f. Local Representative Screen can be programmed to provide contact information for the local boiler manufacturer’s representative.
    g. Programmable Relay Outputs for direct control of pumps, control valves, dampers and other auxiliary devices.
    h. Multiple boiler “cascade” network up to 24 boilers without any external control panel. The installation of external sequencing control panels is not acceptable.
    i. Automatic hybrid system control for multiple boiler “cascade” systems with both condensing and non-condensing boilers. This control logic prioritizes condensing boilers at low water temperatures and prioritizes non-condensing boilers at high water temperatures.
    j. Auxiliary Boiler Relay for multiple boiler “cascade” systems which can be used to enable a 3rd party boiler platform in the event the “cascade” system is unable to satisfy the heating load.
    k. Programmable Boiler and System pump control for multiple boiler “cascade” systems installed in a Primary-Secondary piping arrangement.

l. Programmable Control Valve logic for multiple boiler “cascade” systems installed in a Primary-Only piping arrangement.

m. Integration with external Building Management Systems (BMS) via MODBUS® RTU protocol. **NOTE:** Optional Protocol Converter for communication via LONWORKS® and BACnet® must be available for purchase from the boiler manufacturer.

n. Hardwire integration with Building Management Systems (BMS) via 4-20mA analog control signal for temperature or firing rate control.

o. Intuitive “Setup Wizards” ask the user a series of questions and allow for step-by-step configuration of the boiler control.

p. On-Screen error notifications with a comprehensive description of all alarm conditions and several troubleshooting steps.

q. Automatic flue gas temperature and outlet (supply) temperature compensation to prevent over-firing of the boiler equipment.

r. Automatic differential temperature compensation to prevent over-firing of the boiler equipment in a low flow condition.

s. Automatically adjust the temperature set point and shutdown the boiler based on the outdoor air temperature conditions.

t. Night Setback functionality via external point of closure (or BMS integration) for unique “Occupied” and “Unoccupied” temperature setpoint values.

u. Maintain single temperature set point with a minimum outlet (supply) water temperature of 42°F up to a maximum outlet (supply) water temperature of 194°F.

v. On-Board DHW Priority capable of seamless transition between Comfort Heat (CH) and Domestic Hot Water (DHW) operation.

w. On-Board CH&DHW operation for simultaneous Comfort Heat (CH) and Domestic Hot Water (DHW) operation.

x. Alarm Relay Output to announce alarm conditions which require manual reset.

y. Programmable Low Fire Delay to prevent excessive short-cycling of the boiler equipment.

z. Local Manual Operation.

2. The appliance control system shall be capable of interfacing with the following external control devices:

   a. Building Management System (MODBUS®). **NOTE:** Optional Protocol Converter for communication via LONWORKS® and BACnet® must be available for purchase from the boiler manufacturer.

   b. Domestic Hot Water Break-on-Rise Aquastat (Normally Closed).

c. Domestic Hot Water Tank Temperature Sensor (12kΩ).
d. External Header Temperature Sensor (12kΩ).
e. Outdoor Air Temperature Sensor (12kΩ).

B. BOILER SAFETY and TRIM DEVICES

1. The appliance manufacturer shall furnish and test the following safety and trim devices with each boiler:
   a. Safety relief valve shall be provided in compliance with the ASME code. Contractor is required to pipe the relief valve discharge piping to an acceptable drain.
   b. Water pressure/temperature gauge.
   c. Low Water / Flow cutoff switch.
   d. Manual reset high limit water temperature controller.
   e. Operating temperature control to control the sequential operation of the burner.
   f. High and Low Gas Pressure switches.
   g. Flame rod / ionization probe flame detection.
2. The appliance manufacturer shall provide a CSD-1 form identifying each safety and trim device.
3. The appliance shall be capable of interfacing with the following external safety devices:
   a. Auxiliary Low Water Cutoff device.
   b. Combustion Air Damper End Limit Switch.
   c. Emergency Stop (E-Stop) switch.
   d. External Safety Device w/ contact closure.

C. MAIN GAS TRAIN

1. Appliances configured for single fuel operation shall be equipped with an integral main gas valve train capable of burning either Natural Gas or Propane Gas.
2. Each fuel gas valve train shall include at least the following:
   a. One (1) upstream manual shutoff valve for field-connection.
   b. One (1) combination Air-Gas ratio control and safety shutoff valve with dual solenoids (in-series) that can be independently energized for leak testing and integrated into a single body design. The combination gas valve shall operate as a “Zero Governor” and control to a neutral gas pressure inside the gas valve.
   c. One (1) low gas pressure switch (manual reset).

d. One (1) high gas pressure switch (manual reset).
e. Two (2) gas pressure test ports.
f. One (1) downstream manual shutoff valve.

3. The main gas valve train shall be piped, and wired per the instructions set by the factory and allow for operation at full rated boiler capacity from 3.5" W.C. up to the maximum inlet gas pressure of 14.0" W.C.
4. If the supplied gas pressure exceeds 14" W.C., the contractor shall supply a suitable intermediate gas pressure regulator of the lock-up type to reduce the gas pressure to acceptable levels.

Part 3 - Execution

3.01 INSTALLATION

A. Installation shall be performed by the contractor in accordance with the requirements of the applicable codes. Contractor shall review the boiler and installation for compliance with requirements and/or issues that may affect appliance performance. Installation should not proceed until unsatisfactory conditions have been corrected.

B. The contractor shall mount the equipment as described below:

1. Install appliance on cast-in-place concrete equipment base in compliance with the requirements for equipment bases and foundation specified in Section 03 30 00 "Cast-in-Place Concrete."
2. If required by the local code, install vibration isolation devices in compliance with Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. The contractor shall install gas-fired appliance in accordance with NFPA 54/ANSI Z223.1 (United States), or CAN/CSA B/149.1 (Canada).

D. The contractor shall install gas-fired appliance in accordance with NBIC – Part 1 (Installation), or another installation code having local jurisdiction.

E. The contractor shall assemble and install any external safety/trim devices.

F. The contractor shall install any electrical devices furnished with the appliance, but not specified to be factory-mounted.

G. The contractor shall install control wiring to field mounted electrical devices in accordance with the requirements of NFPA 70.

H. The contractor shall install electrical (power) wiring to the appliance in accordance with the requirements of NFPA 70.

3.02 CONNECTIONS

A. GAS PIPING

1. Each appliance shall be provided with all necessary gas connections. Refer to the appliance specification sheet or manual for connection sizes.
2. Install gas piping in accordance with NFPA 54/ANSI Z223.1 (United States), or CAN/CSA B/149.1 (Canada).
3. For appliances configured for Natural Gas, refer to the requirements of Section 23 11 23 “Facility Natural-Gas Piping”.
4. For appliances configured for Propane Gas, refer to the requirements of Section 23 11 26 “Facility Liquefied-Petroleum Gas Piping”.

B. ELECTRICAL

1. Install an external disconnect and overload protection for each boiler in accordance with the requirements of NFPA 70.
2. The voltage requirements for the boilers shall be 110-120VAC, Single Phase, 60Hz.
3. The amperage requirements for each boiler is described in the table below:

	Internal Overload Protection	Recommended Circuit Capacity
C750	6 Amps	10 Amps
C900	6 Amps	10 Amps
C1050	6 Amps	10 Amps
C1500H	15 Amps	20 Amps
C2000H	15 Amps	20 Amps
C2500	15 Amps	20 Amps
C3000	20 Amp	20 Amps
C4000	20 Amps	20 Amps
SC-3000	20 Amps	20 Amps
SC-4000	20 Amps	20 Amps