**PROJECT ARCHITECT NOTE: AMEND, SPECIFY OR SELECT BOLDED ITEMS THIS SECTION**

# PART 1 - GENERAL

* 1. **SUMMARY**
		1. Provisions of Division 01 apply to this section
		2. Section Includes:
			1. Hot Water Heating Boilers.
			2. Low-Pressure Steam Boilers.
			3. Packaged Heaters, Gas-Fired.
			4. HVAC Equipment with Gas-Fired Heaters.
			5. Natural Gas Fuel System Piping and Accessories.
		3. Related Sections:
	2. Section 09 90 00: Paints and Coatings.
	3. Section 23 05 13: Basic HVAC Materials and Methods.
	4. Section 23 07 00: HVAC Insulation.
	5. Section 23 20 13: Above Ground HVAC Piping.
	6. Section 23 20 16: Underground HVAC Piping.
	7. Section 22 10 00: Plumbing.
	8. Section 23 25 00: HVAC Water Treatment.
	9. Section 23 80 00: Heating, Ventilation and Air Conditioning Equipment.
	10. Section 23 09 23: Environmental Controls Energy Management Systems.

# QUALITY ASSURANCE

* + 1. Standards and Codes: Comply with applicable codes, specifications and standards having jurisdiction including but not limited to: ASME, AGA, ANSI, ASTM, UL, NEC, UMC, NFPA 8501, and SCAQMD.
		2. Qualifications of Manufacturers and Installers: Comply with provisions in Section 15010: Basic Mechanical Requirements.

# SUBMITTALS

* + 1. Comply with provisions of Division 01 and Section 15010: Basic Mechanical Requirements.
		2. Manufacturer's Data:
			1. Complete materials list of items proposed to be furnished and installed under this section. Materials lists, which do not require performance data, shall include manufacturer's name, type, and model number for indicated installation.
			2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements. Literature shall include descriptions of equipment, types, models and sizes proposed, capacity tables or curves marked to indicate performance characteristics, electrical requirements, options selected, space requirements (including allowances for servicing if indicated) and other data necessary to ensure compliance with requirements of this Specification and performances indicated on Drawings.
			3. Certification by manufacturer and SCAQMD that the boilers or water heater are in compliance with the ultra low nox and CO emission standard of SCAQMD.
			4. Source test report as required by SCAQMD.
			5. Permits as required by SCAQMD.
		3. Shop Drawings indicating methods of installation of equipment and materials, and details of supporting structures for items indicated. Items to be submitted shall include but not be limited to the following:
			1. Layout Drawings of Equipment: Include plans, elevations and sections, of proposed equipment drawn to scale, to establish which equipment shall fit in allotted spaces with clearance for installation and maintenance. Indicate proposed details for attachment, anchoring to, and hanging from structural framing of building. Indicate vibration isolation units, foundations, supports, and openings for passage of pipes and ducts.
			2. Electrical interlock or control diagrams for electrically controlled components furnishing more than one automatic or manual control devices, which are not indicated on Drawings.
		4. Manufacturer's Recommended Installation Procedures: Manufacturer's recommended installation procedures, when reviewed by the Architect shall become basis for inspecting actual installation procedures provided.

# PRODUCT HANDLING

* + 1. Protection, Replacements, Delivery and Storage: Comply with provisions stated under Section 15010: Basic Mechanical Requirements.

# COORDINATION

* + 1. Coordinate related and adjacent activities in accordance with provisions of Section 01100: Coordination.

# PART 2 - PRODUCTS

* 1. **HEATING EQUIPMENT AND MATERIALS**
		1. Provide heating equipment and materials as indicated on Drawings and specified herein. Sizes, capacities, and operating conditions shall be as indicated on equipment schedules.

**PROJECT ARCHITECT NOTE: EDIT THE FOLLOWING BY DELETING BOILER TYPES THAT ARE NOT USED.**

**HOWEVER, DO NOT CHANGE THE BOILER DESIGNATIONS (B-1 etc) BUT LABEL THEM**

**"Not In Contract “ INSTEAD OF DELETING.**

# B-1: BOILER, STEAM, CAST IRON, GAS-FIRED, ULTRA LOW NOX TYPE, POWER BURNER, UNDER 2000 MBH.

* + 1. General: UL listed or AGA approved, low-pressure steam, gas-fired, cast iron sectional, jacketed, insulated, and constructed in accordance with requirements of Section IV of ASME Boiler and Pressure Vessel Code and so labeled. Boiler shall be furnished with forced draft burner, ultra low nox type, automatic combustion and safety controls, accessories, and trim: Weil McLain, Peerless, H.B. Smith, or equal.
			1. Design, construction, testing and installation shall be in accordance with CCR Title 8, Boiler and Fired Pressure Vessel Safety Orders, UL 795, ASME CSD-1, ANSI Z 21.13, and SCAQMD Rule 1146.2 and Rule 1121.
			2. Each boiler section shall be hydrostatically pressure tested before shipment in accordance with Section IV of ASME Code.
			3. Boiler shall be completely assembled at the Project site in accordance with manufacturer's installation instructions.
			4. Boiler shall be suitable for a steam system and be stamped for a maximum working pressure of 15 psig.
			5. Boiler shall be thoroughly cleaned in accordance with manufacturer's instructions prior to being placed into service.
			6. Cover boiler with a minimum of 2 inches insulation with factory applied 20 gage steel jacket. Minimum jacket heat loss shall not exceed ASHRAE 90 standards.
			7. Factory paint exposed surfaces of boiler, steel jacket and supporting structure with heavy-capacity, rust-inhibitive and heat- resistant industrial paint.
			8. Steam outlets shall be sized so steam velocity does not exceed 40 feet in accordance with second at maximum rated capacity and zero psig.
			9. Inlet piping shall be furnished with a capped tee at final turn into boiler to serve as a clean out. Clean-out openings shall be extended outside jacket and capped. Boiler shall include inspection and clean-out tappings at side, at bottom and top, in front and back sections, as well as intermediate sections.
			10. Pilot lines, gas valves, relays and wiring shall be located outside boiler jacket.
			11. Each boiler section shall be evenly spaced with spacing pads and sealed with heavy insulating rope for complete retention of products of combustion.
			12. A clean-out plate shall be provided on front of boiler for inspection.
			13. Boiler shall be provided with flame observation ports in front and back sections.
			14. Boiler shall be provided with adjustable damper to pressurize boiler and securely locked in position after desired combustion and pressure readings are obtained.
			15. Boiler sections shall be full wet back design.
		2. Accessories and Trim: Provide accessories specified or required for satisfactory and safe operation of unit. Trim shall be ASME-approved for working pressure of boiler.
			1. Safety Relief Valves:

RV-3: ASME-approved type furnished in quantity and size to provide ample relieving capacity in accordance with ASME Boiler Code. ASME stamped and certified with manual lifting device to permit testing.

* + - 1. Blowdown Valves:

BBV-1: Blow-off type or globe type with plug-type disc and seat suitable for blow-off service.

BBV-2: Manufactured by Milwaukee Valve, Apollo, or equal.

* + - 1. Pressure Gauges:

PG-1: As required by ASME Boiler Code. Gauge shall indicate pressure near outlet. Install on front of boiler for easy reading.

* + - 1. Gauge Glass:

LLG-1: Provide with 3 try cocks and blow-down valve piped to floor drains.

* + - 1. Burners:

PB-1: Burner shall be ultra low nox type, capable of generating NOX emissions in accordance with requirements of SCAQMD Rule 1146.2, power fired packaged type completely assembled and wired at factory, to operate with natural gas.

# B-2: BOILER, STEAM, CAST IRON, GAS-FIRED, POWER BURNER, 2000 MBH AND OVER

* + 1. General: UL listed or AGA approved, low-pressure steam, gas-fired, cast iron sectional, jacketed, insulated, and constructed in accordance with requirements of Section IV of ASME Boiler and Pressure Vessel Code and so labeled. Boiler shall be furnished with power fired burner, automatic combustion and safety controls, accessories, and trim: Weil McLain No. 88, No. 94 Peerless Series, or H.B. Smith.
			1. Design, construction, testing and installation shall be in accordance with CCR Title 8, Boiler and Fired Pressure Vessel Safety Orders, UL 795, ASME CSD-1, ANSI Z 21.13, and SCAQMD Rule 219, Rule 1146.1 and current BACT-LAER.
			2. Each boiler section shall be hydrostatically pressure tested before shipment in accordance with Section IV of ASME code.
			3. Boiler shall be completely assembled at the Project site in accordance with manufacturer's installation instructions.
			4. Boiler shall be suitable for a steam system and be stamped for a maximum working pressure of 15 psig.
			5. Boiler shall be thoroughly cleaned in accordance with manufacturer's instructions prior to being placed into service.
			6. Cover boiler with a minimum of 2 inches insulation with factory applied 20 gage steel jacket. Minimum jacket heat loss shall not exceed ASHRAE 90 standards.
			7. Factory paint exposed surfaces of boiler, steel jacket and supporting structure with heavy-capacity, rust-inhibitive and heat- resistant industrial paint.
			8. Steam outlets shall be sized so steam velocity does not exceed 40 feet in accordance with second at maximum rated capacity and zero psig.
			9. Inlet piping shall be furnished with a capped tee at final turn into boiler to serve as a clean out. Clean-out openings shall be extended outside jacket and capped. Boiler shall include inspection and clean-out tappings at side, at bottom and top, in front and back sections, as well as intermediate sections.
			10. Pilot lines, gas valves, relays and wiring shall be located outside boiler jacket.
			11. Each boiler section shall be evenly spaced with spacing pads and sealed with heavy insulating rope for complete retention of products of combustion.
			12. A clean-out plate shall be provided on front of boiler for inspection.
			13. Boiler shall be provided with flame observation ports in front and back sections.
			14. Boiler shall be provided with adjustable damper to pressurize boiler and securely locked in position after desired combustion and pressure readings are obtained.
			15. Boiler sections shall be full wet base design.
		2. Accessories and Trim: Provide accessories specified or required for satisfactory and safe operation of unit. Trim shall be ASME approved for working pressure of boiler.
			1. Safety Relief Valves:

SRV-3: ASME approved type furnished in quantity and size to provide ample relieving capacity in accordance with ASME Boiler Code. ASME stamped and certified with manual lifting device to permit testing.

* + - 1. Blowdown Valves:

BBV-1: Blow-off type or globe type with plug type disc and seat suitable for blow-off service.

BBV-2: Manufactured by Milwaukee Valve, Apollo, or equal.

* + - 1. Pressure Gauges:
			2. Gauge Glass:

PG-1: As required by ASME Boiler Code. Gauges shall indicate pressure near outlet. Install on front of boiler for easy reading.

LLG-1: Provide with 3 try cocks and blow- down valve piped to floor drains.

* + - 1. Burners:

PB-1: Burner shall be power fired, packaged type, completely assembled and wired at factory, to operate with natural gas.

# B-3: BOILER, HOT WATER, WATER TUBE, GAS-FIRED, ULTRA LOW NOX TYPE, POWER BURNER, UNDER 2,000 MBH

* + 1. General: UL listed or AGA approved, hot water, water tube, steel tube jacketed, insulated, and constructed in accordance with requirements of Section IV of ASME Boiler and Pressure Vessel Code and so labeled, and shall be National Board registered. Boiler shall be furnished with power fired burner, ultra low nox type, automatic combustion and safety controls, control panel, accessories and trim: Ajax, Rite, Parker, Bryan, or Patterson Kelly.
			1. Design, construction, testing and installation shall be in accordance with CCR Title 8, Boiler and Fired Pressure Vessel Safety Orders, UL 795, ASME CSD-1, ANSI Z 21.13 and SCAQMD Rule 1121 and Rule 1146.2.
			2. Boiler straight tubes shall be 2 inches outside diameter, 13 gage minimum wall steel tubes to specification SA178A, bent tubes shall be 1-5/16 inches outside diameter to specification SA53.
			3. Straight tubes shall be rolled and flared into tube sheet and inclined for internal circulation.
			4. Head plates shall be removable without disturbing piping for ease in inspecting and cleaning tube bundle.
			5. Sheet metal surfaces shall be galvanized steel. Exterior surfaces shall be primed with zinc chromate and painted with 2 coats of baked enamel finish or with galvanized finish.
			6. Pilot lines, gas valves, relays and wiring shall be located outside boiler jacket.
			7. Boiler shall be furnished with a barometric damper (BD-1) with thermo-electric switch as required by UL, and provide variable air openings and adjusted by counterweights to maintain proper draft condition under varying rates of fire and stack draft conditions.
		2. Accessories and Trim: Provide accessories specified or required for satisfactory and safe operation of unit. Trim shall be ASME approved for working pressure of boiler.
			1. Safety Relief Valves:

SRV-3: ASME approved type furnished in quantity and size to provide ample relieving capacity in accordance with ASME Boiler Code, ASME stamped and certified with manual lifting device to permit testing.

* + - 1. Combination Pressure/Temperature Gauges:

PG-2: As required by ASME Boiler Code. Gauges shall indicate pressure-temperature near outlet. Install on front of boiler for easy reading.

* + - 1. Burners:

PB-1: Burners shall be ultra low nox type capable of generating NOX emission in accordance with requirements of SCAQMD Rule 1146.2, power burner, packaged type, completely assembled and wired at factory to operate with natural gas.

# B-4: BOILER, HOT WATER, WATER TUBE, GAS-FIRED, FORCED DRAFT, 2,000 MBH AND OVER

* + 1. General: UL listed or AGA approved, hot water, water tube, steel tube jacketed, insulated, and constructed in accordance with requirements of Section IV of ASME Boiler and Pressure Vessel Code and so labeled, and shall be National Board registered.
		2. Boiler shall be furnished with forced draft burner, automatic combustion and safety controls, control panel, accessories and trim: Patterson Kelly, Ajax, Rite, Parker, or Bryan.
			1. Design, construction, testing and installation shall be in accordance with CCR Title 8, Boiler and Fired Pressure Vessel Safety Orders, UL 795, ASME CSD-1, ANSI Z 21.13 and SCAQMD Rule 219, Rule 1146.1 and BACT-LAER.
			2. Boiler straight tubes shall be 2 inches outside diameter, 13 gage minimum wall steel tubes to specification SA178A, bent tubes shall be 1-5/16 inches outside diameter to specification SA53.
			3. Straight tubes shall be rolled and flared into tube sheet and inclined for internal circulation.
			4. Head plates shall be removable without disturbing piping for ease in inspecting and cleaning tube bundle.
			5. Sheet metal surfaces shall be galvanized steel. Exterior surfaces shall be primed with zinc chromate and painted with 2 coats of baked enamel finish or with galvanized finish.
			6. Pilot lines, gas valves, relays and wiring shall be located outside boiler jacket.
			7. Boiler shall be furnished with a barometric damper (BD-1) with thermo-electric switch as required by UL, and provide variable air openings and adjusted by counterweights to maintain proper draft condition under varying rates of fire and stack draft conditions.
		3. Accessories and Trim: Provide accessories specified or required for satisfactory and safe operation of unit. Trim shall be ASME approved for working pressure of boiler.
			1. Safety Relief Valves:

SRV-3: ASME approved type furnished in quantity and size to provide ample relieving capacity in accordance with ASME Boiler Code, ASME stamped and certified with manual lifting device to permit testing.

* + - 1. Combination Pressure/Temperature Gauges:

PG-2: As required by ASME Boiler Code. Gauge shall indicate pressure/temperature near outlet. Install on front of boiler for easy reading.

* + - 1. Burners:

PB-1: Burners shall be forced-draft packaged type, completely assembled and wired at factory to operate with natural gas.

# AUTOMATIC BOILER CONTROLS

* + 1. Boiler controls shall provide operations listed herein and as indicated on applicable standard boiler control wiring diagrams. Controls shall be set and adjusted by factory authorized personnel only.
			1. System shall be started by a manual bypass timer, which shall energize control panel. On a steam boiler system shall be switched from night to day operation.
			2. On a steam boiler, a thermostat in outside air shall switch system to night mode whenever outside air temperature is above set point and back to day mode when temperature is below set point.
			3. On a hot water boiler, a thermostat in outside air shall prevent boiler from being energized whenever outside air temperature is above set point.
			4. On a steam boiler, provide 24 hour day-night operation. Each boiler shall operate from pressure switch for day operation and from night set back aquastat for night operation. System shall be furnished with a day-night switch for each boiler. System shall be electrically interlocked to vacuum pump switch and float switch on vacuum pump for vacuum switch day operation and float switch night operation.
			5. Flame safeguard control for power burner shall be of non- recycling automatic electronic combustion programming type providing pre-ventilation cycle with full protection against flame failure during both ignition and normal burner operating periods. Manual starting required after shutdown on safety. Burner and blower controls interlocked to prevent burner operation without proven draft. Control shall contain interlock circuit for connection to valve seal over-travel switch on main flame valve; FLS-3.
			6. Boilers with power burners shall be modulation operation with low fire start.
			7. Operating Fuel Shut-Off Valve: FGV-1, 2, 3 or 4 as applicable.
			8. Safety Fuel Shut-Off Valve: FGV-6.
			9. Firing rate valve shall regulate fuel input in response to load demand; FGV-5.
			10. On steam boilers, pump and low water control, with automatic reset, shall start boiler feed pumps and close main burner fuel valves, before water in boiler reaches lowest operating level; LWC-1.
			11. Low water control with manual reset shall close safety shut- off valves when water in boiler reaches lowest permissive level; LWC-2.
			12. On hot water boilers, low water control with automatic reset shall close safety shut-off valves when water reaches lowest operating level; LWC-3.
			13. On steam boilers, pressure operating control shall be pressure-stat with adjustable set point and adjustable differential wired into boiler control circuit to maintain steam pressure at set point; OPC-1.
			14. On steam boilers, high limit control shall shut off fuel to burner when pressure reaches predetermined level not to exceed 15 psig; HPC-1.
			15. On hot water boilers, temperature-operating control shall be aquastat with adjustable set point and adjustable differential wired into boiler control circuit to maintain water temperature at set point; OTC-1.
			16. On hot water boilers, high limit control shall shut off fuel to burner when temperature reaches predetermined level not to exceed 250 degrees F.; HLC-2.
			17. Gas pressure supervision shall be provided by pressure switches interlocked to accomplish a non-recycling safety shut-down in event of either high or low gas pressure; GPS-1.
		2. Pilot Gas Train: A separate gas cock, gas pressure regulator, and pilot safety shut-off gas valve shall be provided for ignition gas supply.
		3. Gas Valve Train: In addition to operating and safety controls such as automatic fuel valve, automatic gas safety shut-off valves and gas pressure switches, furnish the following:
			1. 1/4 inch pressure tapping with 1/4 inch pipe plug upstream and downstream of each valve and regulator in gas train.
			2. Manually operated AGA approved plug cock or ball valve upstream of all valves.
			3. Main gas pressure regulator with vent to outside atmosphere, in accordance with codes.
			4. Manually operated AGA approved plug cock or ball valve shall be located downstream of both safety shut-off gas valves to permit leakage testing of valves.
		4. Master Sequence Programmer: On 2 or more boilers, a master sequence programmer shall be provided for fully automatic operation of boilers through selectable sequence programming so that required number of boilers are operating at any time to meet demand. Programmer shall be furnished with a bellows for steam applications or temperature sensor for hot water applications, operating plate, boiler sequencing switches, operating relays, lead boiler selector switch, hands-off auto selector switch, indicating lights, steam pressure gauge, wiring and a numbered terminal strip.
			1. In steam applications programmer shall include a sample line from steam header to programmer enclosure and shall be furnished with shut-off valve, unions, and blow-down valve.
			2. Operation of programmer shall start lead boiler on low fire. After lead boiler is modulated to high fire programmer starts first lag boiler. As demand continues, programmer starts second lag boiler. As load decreases burners shall modulate from high fire to low fire in reverse order and shut off as their respective firing rates approach minimum.
			3. Programmer shall be Heattimer, Honeywell W7100J, or equal, for hot water boilers.
		5. Boiler Control Panel: Panel shall be a NEMA I type and be furnished with programmer controller, 24 hour operation day-night system for steam boilers and be furnished with wiring, switches, transformer, relays, indicating lights, a numbered terminal strip, and short circuit protection for circuits, and motors.
			1. Hot water and steam boilers over 400 MBH shall have a control panel. On systems with 2 or more boilers, provide a separate master control panel for sequence programmer.
			2. Panel shall contain one amber light to indicate panel power on, yellow light for call for heat, amber light for pilot proven, green light for fuel valve open, red lights for low water, high pressure (steam), high temperature (hot water), ignition failure, main flame failure and high-low gas pressure, white for day run and blue for night run.
			3. Provide panel power on-off switch, a safety interlock which turns power off to cabinet when cabinet door is opened, reset buttons operable through cover of cabinet, time switch, boiler run/reset switch, and a boiler control start switch. Indicating lights to be one inch faceted 120 volt type. Switches and lights shall be installed on front of panel and wired to numbered terminal strips. Wiring shall be marked with wire markers. Door shall be furnished with flush type lock, spring latching.
			4. Cabinets, control devices, and wiring shall conform to NEC and Electrical Safety Orders of CEC, Title 8, Industrial Relations. Panel shall be listed under UL 508 standard for Industrial and Flame Control Panels. Electrical circuit for boiler controls shall not exceed 120 volts and shall be 2 wire with one conductor grounded with controls in ungrounded conductor. Power wiring and control wiring including required transformers shall be pre-wired at factory. Components shall be UL approved or component recognized. Control panel assemblies shall bear a UL label.
			5. Switches and indicator lights on face of panel to be identified with permanently engraved nameplates as noted on Drawings. Identify controls and wiring within panel.
			6. Drawings identified with Project name shall be provided with boiler control panels. One copy shall be provided in laminated form.
			7. Control panels shall be by Burner or Boiler Manufacturers, Controlco Systems, Klockner-Moeller, Controltech, or Calhoun and Poxon.
		6. Upon completion of boiler installation, furnish services of factory-trained representative of manufacturer to provide a 4 hour demonstration to Owner personnel operation of boiler controls, accessories and trim, adjustment of burners for proper input and maximum efficiency throughout range of firing rates, and provide boiler full-capacity rating.
			1. Before starting boiler for tests, provide visual inspection of complete installation, to ascertain that no damage has occurred to parts of boiler and controls during shipment and installation. Replace damaged parts before proceeding with tests.
			2. Provide a flue gas analysis with a carbon monoxide content of 0 percent and a minimum carbon dioxide content of 10 percent with boiler operating at practical firing rates of burner and with flue gas temperatures not exceeding 500 degrees F. For boilers 75 MBH and larger, record NOX content in PPM, corrected to 3 percent oxygen.
			3. Furnish and install equipment necessary for test and provide sufficient number of operators to conduct test. Provide a complete record of test data with copy for the PI witnessing test. Set exact date and hour for starting test so the PI can witness test.
			4. Record main gas supply pressure at inlet of gas line control assembly, gas manifold pressure, control settings and chimney draft- inches water column.

# PACKAGED HEATERS, ROOF MOUNTED

* + 1. Packaged, roof-mounted, heating and make-up air unit types, sizes, and capacities shall be as indicated on Drawings. Units shall be designed for 80 percent thermal efficiency with gravity-vented gas furnaces, arranged for roof mounting on a field-assembled curb, slab, post and rail equipment platform. Units are to be arranged for field duct connection with horizontal supply connection, at bottom of downturn discharge plenum, horizontal inlet connection or at bottom of unit.
		2. Units shall be furnished with a centrifugal blower, an open drip-proof blower motor, and an adjustable belt drive, factory installed. Furnish required controls, dampers, and inlets to provide an air control cycle as indicated on Drawings. Unit cabinet shall be fully insulated.
		3. Units shall be furnished for natural gas, supply voltage, 24 volt control transformer, gravity vent cap, motor contactor, motor starter, intermittent spark pilot, intermittent spark pilot with timed lockout and a gas control system. Include terminal block wiring.
		4. Gas furnace shall be furnished with a heat exchanger of aluminized 409, 321 stainless steel, die-formed burners of aluminized 409 stainless steel, and an aluminized 409 stainless steel drip pan.
		5. Accessories: Provide convenience outlets, firestats, freezestats, filter racks with one inch disposable type filters, summer/winter controls, remote deluxe console with required lights and switches, outside air rain hoods and evaporative coolers.
		6. Duct furnace incorporated into packaged heating and make-up air units shall be AGA design-certified and bear AGA label.
		7. Manufacturer: Reznor, Sterling, or Modine.

# WALL HEATERS

* + 1. WH-1: Heater shall be gas-fired, wall furnace type, vented, counter-flow, with fan, AGA approved and labeled, and meeting requirements of San Bernardino County Heating Code for surface installation. Unit shall be Williams Furnace Co. model FA Forsaire, or equal, and be furnished with header plate for locating and supporting type B or BW vent pipe, draft diverter, baked enameled cold rolled steel casing complete with supply and return air grilles, heat exchanger, clam shell type, ceramic coated inside and out, with joints electrically welded, cast iron burner, direct drive blower with a 2-speed motor, and pilot burner, 100 percent shut-off safety controls, automatic gas valve, transformer, limit switch, operating switch, wall thermostat, and time switch, manufacturer shall guarantee heat exchanger for 10 years.
		2. WH-2: Same as WH-1, except with direct vent and sealed combustion chamber and furnished with exterior vent air intake and flue discharge terminal cap and guard. Unit shall be Williams Furnace Co. model DVF Forsaire, or equal.
		3. WH-3: Heater shall be gas-fired, wall furnace, direct vent, sealed combustion chamber, gravity type, AGA approved and labeled, and meeting requirements of the San Bernardino County Heating Code for surface installation. Unit shall be Williams Furnace Co. model DV-5 Debonair, or equal, and be furnished with baked enameled cold-rolled steel casing complete with supply and return air grilles, sealed combustion chamber with clam shell type heat exchanger, ceramic coated inside and out, with joints electrically welded, and cast iron burner, exterior vent air intake and flue discharge terminal cap and guard, 100 percent shut-off safety controls, automatic gas valve, wall thermostat and time switch, manufacturer shall guarantee heat exchanger for 10 years.
		4. WH-4: Heater shall be gas-fired wall furnace, vented, gravity type, AGA approved and labeled, and meeting requirements of San Bernardino County Heating Code for surface installation. Unit shall be Williams Furnace Co. model GV-5 Monterey, or equal, and be furnished with header plate for locating and supporting type B or BW vent pipe, draft diverter, baked enameled cold rolled steel casing complete with supply and return air grilles, heat exchanger, clam shell type, ceramic coated inside and out, with joints electrically welded, and cast iron burner, 100 percent shut-off safety controls, automatic gas valve, wall thermostat, and time switch; manufacturer shall guarantee heat exchanger for 10 years.

# ELECTRIC HEATER

* + 1. EH-1: Heater shall be high intensity radiant heat type and be furnished with tubular quartz lamp corrosion resistant enclosure support bracket, input regulator, and time switch. Unit shall be UL listed and labeled for either 120 or 240 volts. Unit shall be Apextro Infratube, Chromalox, or Electromode.

# UNIT HEATER

* + 1. UH-1: Heater shall be gas-fired, suspended type, vented with fan, AGA approved and labeled. Unit shall be furnished with vent connection and built-in draft diverter, horizontal and vertical discharge air louvers, aluminized steel heat exchanger, aluminized steel burner with stainless steel ribbon, totally enclosed direct drive fan motor with fan guard, 100 percent shut-off safety controls, fan and limit switch, transformer, automatic gas valve and pressure regulator, wall thermostat, time switch, operating switch and manual summer/winter switch, and hanger terminals. Unit shall be Reznor Series XL, Modine, or Janitrol.

# HVAC EQUIPMENT

* + 1. Materials and Installation: Refer to Section 15700: Heating, Ventilation and Air Conditioning Equipment.

# PIPING, FITTINGS, AND VALVES

* + 1. Materials and Installation: Refer to Section 15050: Basic Mechanical Materials and Methods.

# GAS FUEL BURNING EQUIPMENT ACCESSORIES

* + 1. Refer to Table 1 at the end of this section.
		2. Power Burner:

PB-1: Burner shall be furnished with a complete factory packaged and tested ultra low nox combustion system which shall reduce NOX emissions to less than 30 PPM and comply with SCAQMD Rule 219 Rule 1146.1, Rule 1146.2 and Rule 1121. NOX reductions shall be achieved by use of both flue gas re-circulation and secondary gas combustion. Flue gas damper shall be directly linked to burner modulation motor in order to maintain appropriate flow of re-circulated flue gas. Secondary gas combustion shall be provided by a secondary, gas combustion proportioning control valve. Basic control of secondary combustion shall be obtained from burner mounted main gas butterfly valve. Burner shall incorporate a characterized cam fuel metering system, which shall provide adjustable, accurate, repeatability of fuel/air ration throughout firing range. Flue gas re-circulation blower shall be supplied with fan proving air switch, separate motor starter, and time-delay module which shall activate operation of flue gas re- circulation fan 5 seconds after main fuel valves are energized. Burner shall be Power Flame NOVA, Gordon-Piatt, or Webster with internal gas recirculation.

* + 1. Flame Safeguard Controls:
			1. Atmospheric Burner, Single Pilot, 400 MBH and Under:

FLS-1: Furnished for single pilots to prevent fuel to burner in event of pilot ignition or main flame failure during operation for atmospheric burners with on-off fire. Unit shall be solid state type with minimum purge of 15 seconds, trial for ignition of 15 seconds and pilot shall be furnished with intermittent operation for atmospheric burners with on-off fire. Control shall be manual reset type on main flame failure by opening and closing a manual switch. Units shall be Honeywell S8610H, or equal. This system, together with Honeywell combination regulator, pilot valve and main valve VR8304 and Honeywell Q345 ignition pilot, shall not require a boiler control panel.

* + - 1. Atmospheric Burner, Single Pilot, 401-1,999 MBH:

FLS-2: Furnished for single pilots to prevent flow of fuel to burner in event of pilot ignition or main flame failure during operation for atmospheric burners with high-low fire. Control shall be a microprocessor based burner management system with 5 status LED's and may be used with a plug-in message center accessory, to display in English, burner and circuit status as well as self-diagnostics, and cause of last 6 lockouts. This display may be accessed at any time control is powered. Programming sequence shall be non-recycling upon flame failure and require a manual reset to restart burner. Pilot trial for ignition shall be 10 seconds maximum. A proof of valve closure circuit shall be provided. Flame failure response time shall be 4 seconds maximum. Pilot shall be intermittent type. Control shall be capable of communicating with energy management systems with Microsoft Windows through a communication interface and be UL approved. Control shall be Honeywell model RM7895, or equal.

* + - 1. Mechanical Draft Burner:

FLS-3: Furnished with FR-1 to prevent flow of fuel to burner in event of pilot ignition main flame failure during operation of power burners with modulated fire. Control shall be a microprocessor system with 5 status LED's and a message center to display in English. Burner and circuit status as well as self-diagnostics, and cause of last 6 lockouts. This display may be accessed at any time control is powered. Programming sequence shall be non- recycling upon flame and combustion air failure and require manual reset to restart burner. Control shall provide a proven open damper purge and a proven low fire start. A proof of fuel valve closure circuit shall be provided. Pilot and main flame trial for ignition shall be limited to 10 seconds maximum. Flame failure response time shall be 4 seconds. Proven purge period shall be 30 seconds minimum, post purge period shall be 15 seconds minimum. Pilot shall be interrupted type. Control shall be capable of communicating with energy management systems with Microsoft Windows through a communication interface and be UL approved. Control shall be Honeywell model RM7800L, or equal.

* + 1. Flame Detectors and Rods:
			1. Flame Detectors:

FR-1: Furnished for detecting ultra- violet radiation of gas flames where refractory becomes extremely hot. Wired to FLS to provide complete shut-off and alarm actuation in case of flame failure or malfunction of any component and following flame failure. Fireye, Honeywell C7027A, or equal.

* + - 1. Flame Rod:

FR-2: Furnished for flame safeguard control to detect minimum safe pilot and main flame. Wired to FLS to provide complete shut down in case of flame failure, Honeywell Q179A, or equal. On boilers with runner pilots ignitor and flame rod are to be separate units or comply with installation requirements.

FR-3: Low voltage intermittent pilot assembly furnished for FLS-1, Honeywell Q 345, or equal.

* + 1. Boiler Pilot Assembly:

BTPA-1: Gas pilot assembly with ignition electrode and flame rod, AGA listed, Honeywell Q179A, or equal.

* + 1. Gas Pressure Switch:

GPS-1: UL listed pressure switch with manual reset to shut off fuel to burner when gas pressure reaches a predetermined minimum or maximum limit, Honeywell C6097, or equal.

* + 1. Operating Pressure Controller:

OPC-1: To regulate flow of fuel to burner to maintain predetermined operating steam pressure not to exceed 15 psig.

U.L. listed pressure controller, **(typical to OPC -2 and –3.)** Range 0-15 psig with adjustable differential, Honeywell P7810A, or equal. Provide single pole double throw switch, one normally open, one normally closed, on main steam headers for 2 or more boilers in lead lag control; Honeywell P7810A, or equal.

OPC-2: To provide direct control of modulating gas valves to maintain predetermined operating steam pressure not to exceed 15 psig with on-off switch feature combination; Pressure- troll Controller, Honeywell P7810B, or equal.

OPC-3: To provide a minimum pressure of 15 psig in hot water heating systems. When system is energized, contact shall close and energize a water make up pump. Range 5-50 psig with adjustable differential; Honeywell L404A, P7810A, or equal.

* + 1. Operating Temperature Controller:

OTC-1: To regulate flow of fuel to boiler, to provide predetermined temperature level, copper liquid filled bulb. Temperature range 100 degrees to 240 degrees F. with adjustable differential, UL listed totally enclosed snap-acting switch, **(typical to OTC -2 and –3,)** Honeywell L4006A, L4008A, L6006C, L6006A,

L4031, or equal. L6006C shall be single pole, double throw, one normally open, one normally closed, on main hot water header for lead lag control for 2 or more boilers.

OTC-2: Night set back controller to regulate flow of fuel to steam boilers, to maintain flow of fuel to steam boilers, to maintain 190 degrees F. Temperature range 100 degrees to 240 degrees F. with adjustable differential; U.L. listed totally enclosed snap-acting switch, **(typical to OTC -2 and –3).** Honeywell L6006A, L4006A, L4008A, L6006C, or equal.

OTC-3: To provide direct control of modulating gas valves to maintain predetermined temperature level, with on-off end switch, proportional temperature controller, UL listed totally enclosed snap-acting switch, **(typical to OTC -2 and –3).** Honeywell T991A, or equal.

* + 1. High Limit Controls:

HPC-1:UL listed pressure controller type, 2-15 psig range, single pole, double throw with manual reset to shut off boiler when pressure rises above setting. Honeywell P7810D, or equal.

HTC-1: High temperature controller to shut off burners when temperature reaches a predetermined maximum, not to exceed 250 degrees F. with manual reset, single pole, single throw UL listed totally enclosed snap-acting switch. Honeywell L4006E, L4008E, L4031, or equal.

* + 1. Low Water Cut-Off and Pump Control:

LWC-1: Starts feed pump and opens boiler feed valve at lower water level and shuts off burner if water drops to lowest operating level. Float actuated electrical snap switches, maximum working pressure 150 psig; switches sealed from float chamber; packless construction with full size drain valve. Chamber body of ductile iron, copper float and brass bellows. UL listed for boiler service. McDonnell Miller No. 150S, or equal.

LWC-2: UL listed electric probe type to shut off burner when water drops to unsafe level and requires manual resetting, Warrick series 26M, or equal. Unit shall be furnished with solid state relay, 3-second time delay power outage feature, series 3E electrode holder, series 3R stainless steel, type 316 electrode, and series 3C electrode fitting.

LWC-3: On steam systems it opens auxiliary water makeup valves on drop of water level below LWC-1 setting. On hot water systems it shuts off burner if water drops to lowest operating level. Float actuated electrical switches; switches sealed from float chamber; packless construction with full size drain bellows. UL listed for boiler service. McDonnell Miller No. 63, or equal. Provide McDonnell Miller test and check valves on hot water boilers.

* + 1. Outside Air Lockout Thermostat:

OSA-1: UL listed thermostat with remote bulb to switch system to night mode whenever outside air temperature is above the set point, Honeywell T675A, or equal, complete with 0 degrees to 100 degrees F. range, 5 feet capillary tube length with adjustable differential of 3 degrees to 10 degrees F. Bulb in OSA shielded from direct sunlight.

* + 1. Flow Switches:

FS-1: Flow switches to be installed in hot water heating piping so that boiler shall not operate if there is no flow in pipe. Flow switches to be McDonnell Miller FS4-3, or equal. Provide necessary tee or fitting in existing piping.

* + 1. Modulating Motors:

MOD-1: Modulating reversing proportional motors to drive burner firing rate valves or dampers with 15 seconds operating time and one-cam adjusted micro switch auxiliary, Honeywell M9484, or equal.

* + 1. Barometric Damper:

BD-1: Barometric damper for draft control, UL listed, installed in accordance with manufacturer's instructions and adjusted based on instrument reading to maintain draft recommended by boiler manufacturer for installation, Field M + MG2 double acting type, or equal.

* + 1. Pilot Solenoid Valves:

PSV-1: Pilot solenoid valves to be General Controls K- 3A **(1/2 inch and larger),** S-311 **(3/8 inch and smaller**), Honeywell V4046, or equal. Each ignition pilot to be equipped with solenoid valve as required by UL 795.

* + 1. Valves, Fuel Gas Control:

FGV-1:Valve, Gas, Automatic, Diaphragm, On-Off: UL listed and AGA certified; NEMA 1 enclosure; sized for boiler input rating, dual valve diaphragm type; 24V; normally closed; for natural gas; complete with pressure regulator; intermittent pilot. Honeywell VR8304, or equal.

FGV-2:Valve, Gas, Automatic Motorized, On-off: UL listed, and AGA certified; NEMA 1 enclosure; sized for boiler input rating, 120V, electro-hydraulic-spring return; normally closed; for natural gas; on-off control; maximum of 15 psi close off pressure; maximum of 13 second opening and maximum of one second closing time. General Controls AH2/V710, Honeywell V5055A/V4055A, V5097A/V4055A, or equal.

FGV-3:Valve, Gas, Automatic, Motorized, Off-Low-High: UL listed and AGA certified; NEMA 1 enclosure; sized for boiler input rating; 120V; electro-hydraulic-spring return; normally closed; for natural gas; off-low-high control; maximum of 15 psi close off pressure; minimum of 26 second opening and maximum of one second closing time. General Controls AH4/V710, Honeywell V5055B /V4062A, V5097B /V4062A, or equal.

FGV-4:Valve, Gas, Automatic, Motorized, On-Off, Proof of Closure: UL listed and AGA certified; NEMA 1 enclosure; sized for boiler input rating; 120 V; electro-hydraulic-spring return; normally closed; for natural gas, on-off control; maximum of 15 psi close off pressure; maximum of 13 second opening and maximum of one second closing time; complete with valve seal over travel interlock switch. General Controls AH2/V710, Honeywell V5055C/V4055D, V5097C/V4055D, or equal.

FGV-5:Valve, Gas, Firing Rate: Sized for boiler input rating; for natural gas; modulating control; butterfly type; proportions gas in proper ratio to combustion air; open or closed by an actuator as combustion control programs burner firing rate to meet boiler load; Honeywell V51E with an M9484 modulating motor, Maxon CV valve, or equal.

FGV-6:Valve, Gas, Electrical For Pilot Line: Gas valve for installation in pilot line to supply ribbon pilot of fuel type boilers, for use with natural gas. Maximum operating gas pressure 1-1/2 psig, with capacities based on one inch pressure drop through valve. Provide with 40 volt-amperes transformer. Body, aluminum; soft seat; packless type, normally closed. Closes on circuit failure sizes 3/8 inch through 1-1/2 inches, for 24V/60 cycle operation. General Controls K-3A, Honeywell V8295, or equal. **(For FLS-1)**

FGV-6A: Same as FGV-6 except for 120V/60 cycle operation. **(For FLS-2 and FLS-3.)**

* + 1. Valves, Fuel Gas Stop:

FGV-7:Valves or Cocks, Gas **(2 Inches and Smaller):** Bronze or brass with lever handle and travel stop. Rated for 125 psig **(steam**) working pressure, screwed.

Walworth Crane American

FGV-8:Same as FGV-7, but with square head or flat head without travel stop.

FGV-9:Valves or Cocks, Gas **(2 Inches and Smaller**): Full area cocks, bronze plug and washer, and iron body rated for 125 psig **(steam)** working pressure, black, with travel stop. Square head operator and screwed ends.

Crane Jenkins American

FGV-10: Valves, Gas **(2-1/2 Inches and Larger):** Semi-steel body rated for a minimum of 125 psig **(steam)** working pressure, lubricated iron plug with operating wrench, screwed.

Walworth Homestead American

FGV-11: Valve, Gas **(2-1/2 Inches and Larger**): Same as FGV-7, except flanged ends with cast iron flanges, American Standard, Class 125 **(B16.1).**

* + 1. Valves, Boiler Blow-Off:

BBV-1: Boiler Blow-Off **(Drain):** Drain valves furnished with boilers shall be removed and replaced with following:

2 Inches and Smaller:

|  |  |  |
| --- | --- | --- |
| Walworth | Nordstrom | Wheatley |
| 1796 | 142 | 303 |
| 2-1/2 Inches and Larger: |
| Homestead | Walworth | American |
| 24212 | 1797 F | M-4000 |
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| **PART 3 - EXECUTION** |  |  |  |
| **3.01 INSTALLATION CODES** |  |  |  |

A. Installation of boilers and appliances in this section shall conform with applicable requirements of current issue of National Fire Codes, NEC, ANSI, NFPA 70, UMC, ASME Boiler Code CDS-1, UL 795 and ANSI S 21.13.

#  INSTALLATION

* + 1. Boilers, heating furnaces, and similar equipment shall be installed on level non-combustible surfaces.
		2. Clearance:
			1. Outdoor boiler design, certified by AGA for outdoor installation, shall not be installed inside any roofed structure or below eaves, roof overhangs, near windows, or near conditioning blowers or intake ducts. Minimum space requirements and clearances from adjoining structure shall conform to manufacturer's recommendations.
			2. Indoor boiler design-certified by AGA for indoor installation shall not be installed without appropriate draft hood. Vent cap shall be installed on top of chimney to avoid downdrafts. Minimum space allowances and clearances shall be as recommended by manufacturer.
		3. Combustion Air: Fuel-burning boilers and equipment shall be provided with sufficient supply air for proper fuel combustion. Conform to UMC requirements.
		4. Venting:
			1. Fuel-burning boilers and equipment shall be vented to atmosphere to conform to UMC requirements.
			2. Gas vents and chimneys shall be installed in accordance with the terms of their listing, the manufacturer’s instruction and applicable code requirements.

#  PIPE INSTALLATION

* + 1. Refer to the applicable provisions of Section 15050: Basic Mechanical Materials and Methods, Section 15400: Plumbing, and Section 15180: Heating and Air Conditioning Piping Systems.
		2. In addition, conform to following requirements:
			1. Before installation, thoroughly clean inside of pipes, fittings, and valves of dirt, scale, sand and foreign materials.
			2. Provide offsets, changes in direction, branch connections and changes in size with fittings, bushings are not permitted.
			3. Provide connections to equipment so that weight of pipes does not rest on equipment. Provide floor stands or hangers to carry piping weight. Provide final connections to equipment so that equipment may be removed without disturbing piping.
			4. Welded pipe branches and changes in direction shall be installed with welding fittings except that reducing branches may be furnished with welding bosses. Fishmouth pipe branches may be furnished instead of welding bosses, when branch is at least 2 pipe sizes smaller than main. When branch is less than 2 pipe sizes smaller than main, furnish Weld-O-Lets. When main is less than 4 inches, furnish welding T's. Reduction in main run of piping shall be provided with eccentric reducers.
			5. Furnish threaded joint for pipe up to 2-1/2 inches and welded joints for pipes 3 inches and larger.
			6. Piping shall be gas and watertight.

# NATURAL GAS FUEL SYSTEMS

* + 1. Install gas fuel systems as indicated on Drawings and as specified herein. Comply with applicable requirements of National Fire Codes and Uniform Mechanical Code.

# GAS APPLIANCES GENERAL REQUIREMENTS

* + 1. Gas-fired equipment requiring a draft diverter shall be furnished with an AGA approved built-in draft diverter or an AGA approved diverter in vent pipe immediately above, and same size as, vent discharge of equipment.
		2. Provide gas burning heating equipment or appliances with flue **(or vent).** Furnish UL type B gas vent pipe and fittings, double walled metallic type with air space between walls, non-ferrous inter-flue, and non-ferrous or galvanized steel outer casing. Terminate each flue with weather cap of same material.
			1. Install and support flues so that their weight cannot be transmitted to equipment or appliance. Support at each joint. Furnish joints tight with suitable lock or manufacturer's sealing cement. Maintain clearance to combustible materials with spacers and collars.
			2. Terminate each flue above roof with outlet opening not less than 12 inches from any portion of building, nor less than 4 feet from any portion of building or structure which extends at an angle of more than 45 degrees upward from horizontal. Terminate not less than 4 feet from, or one foot above any door, windows, or air intake.
		3. Gas-fired appliances shall be furnished with a gas shut-off on main burner and on pilot line in addition to service stop at point where gas line connects to unit. Flexible connectors permitted under San Bernardino County Heating Code shall not be installed in or through walls, partitions or structural members.
		4. Unless otherwise specified, gas appliances and control equipment on gas- fired appliances shall be AGA approved for service in which it is installed.

# PROTECTION

* + 1. Protect the Work of this section until Substantial Completion.

# CLEANUP

* + 1. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

TABLE 1

CONTROLS AND LIMIT DEVICES FOR BOILERS

BOILER TYPE ATMOSPHERIC

FORCED DRAFT

INPUT RANGE (MBH) 0 to 400 401 to 1,999

NUMBER OF PILOTS 1 1 1

CONTROL MODE On High Modulation

 Off Low

TYPE OF FLAME FLS-1 FLS-2 FLS-3

SAFE GUARD

TYPE OF PYLOT IM IM IR

(IM - Intermittent, FR-3 FR-2 FR-1 IR - Interrupted)

SAFETY CONTROL TIMING MAXIMUM TIME (Secs.)

PILOT TRIAL 15 10 10

MAIN FLAME TRIAL NA NA 10

FLAME FAILURE PRESSURE 4 4 4

PREVENTILATION PERIOD 0 30 30

GAS PRESSURE SWITCH

HIGH NA GPS-1 GPS-1

LOW NA GPS-1 GPS-1 HOT WATER TEMPERATURE

OPER. OTC-1 OTC-1 OTC-1 & 3

LIMIT HTC-1 HTC-1 HTC-1 STEAM PRESSURE CONTROL

OPER. OPC-1 OPC-1 OPC-1

LIMIT HPC-1 HPC-1 HPC-1 WATER LEVEL CONTROL

OPER. LWC-1 LWC-1 LWC-1

LIMIT LWC-2 LWC-2 LWC-2

SAFETY GAS VALVE CONTROL

SAFETY FGV-1 FGV-3 FGV-2

SAFETY Dual FGV-4 FGV-4

 Valve

FIRING RATE FGV-5

SURPV. AIR FLOW NA NA Required PROVEN LOW FIRE START NA NA Required

PROOF OF VALVE CLOSURE Required Required

VALVE SEAL OVER TRAVEL Required Required

# END OF SECTION