PART 1 - GENERAL

1.1 APPLICABLE REQUIREMENTS

A. All work to be furnished and installed under this section shall comply with all the requirements of General Conditions, Supplemental Conditions, Division 01 - General Requirements, and Section 220500 - Basic Plumbing Materials and Methods, and other Sections in Division 22 specified herein.

1.2 SCOPE

A. All work to be furnished and installed under this section shall include but not necessarily be limited to the following:
   1. Water heaters
      a. Natural Gas Condensing Tank Type
   2. Storage Tank
   3. Expansion Tank
   4. Condensate Neutralizer

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 220500: Basic Plumbing Materials and Methods

B. Section 224000: Plumbing Fixtures

C. Section 235100: Breechings, Chimneys and Stacks

1.4 QUALITY ASSURANCE – WATER HEATERS

A. Manufacturers and Representatives Qualifications. Firms regularly engaged in manufacture of water heating equipment, systems and service shall have been active in the field and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Minimum Efficiency: Minimum efficiencies shall meet or exceed the values required by the local energy code. Water heater shall include automatic temperature control for maintaining leaving water temperature setpoint.

C. ASME Compliance: Condensing water heaters must be constructed in accordance with ASME Water heater and Pressure Vessel Code, Section IV (HLW) Potable Water Heaters.

D. ANSI Compliance: Condensing water heaters must be tested for compliance with ANSI Z21.10.3 (2011) / CSA 4.3 Gas Water Heater. For use as a potable water heater, "American National Standard / CSA Standard for Gas Water Heaters." Condensing water heaters shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.5 SUBMITTALS

A. Prior to construction submit for approval all materials and equipment in accordance with Division 01. Submit manufacturer's data, colors, installation instructions, and maintenance and operating instructions for all components of this section including, but not limited to, the following:
   1. Water heaters
   2. Storage Tank
   3. Expansion Tank
   4. Recirculating Pump
   5. Thermostatic Mixing Valve

B. HVAC Work: Coordinate with Division 23, Section 235100 for flue and vent requirements.

C. Electrical Work: Refer to Division 22, Section 220500 for requirements and coordinate with Division 26.

D. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.

E. Water Heater Pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 gpm to maximum value of water heater.

F. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, elevations, sections, and methods of assembly of components and anchorages.

G. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between portions of wiring that are factory installed and portions that are to be field installed.

H. Operation and Maintenance Data: Submit maintenance data and parts lists for each type and size of water heater, control, and accessory, including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual, in accordance with requirements of Division 01. Submit operational manuals.

I. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

J. Start-up: Provide written report on start-up in accordance with Section 220500.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver units to the site in containers with manufacturer's stamp or label affixed.

B. Store and protect products against dirt, water, chemical, and mechanical damage. Do not install damaged products - remove from project site.

1.7 COORDINATION

A. Coordinate size and location of concrete bases and attachments with structural design. Coordinate with Divisions 03 for specification of concrete, reinforcement and formwork requirements.

1.8 WARRANTY

A. Provide one year (12 months) warranty from date of Certificate of Occupancy. The warranty shall include repair or replacements of components that fail in materials or workmanship within the warranty period and shall include parts, labor, travel costs, and living expenses to repair or replace products or systems.

B. Tanks shall have a three-year (36 months) warranty against leaks. The warranty shall include replacement parts, labor, travel costs, and living expenses to repair or replace products or systems.

C. Condensing Water Heaters: The heat exchanger shall carry a minimum five years from shipment, non-prorated, limited warranty against any failure due to waterside corrosion, condensate corrosion, thermal stress, mechanical defects, or workmanship.

PART 2 - PRODUCTS

2.1 NATURAL GAS, HIGH EFFICIENCY CONDENSING, TANK TYPE WATER HEATER

A. Water heater shall be fully condensing, minimum 95% thermal efficiency, with closed combustion venting. Refer to schedule on drawings for sizing, capacities, recovery rate, power requirements and models.

B. Water heater shall be of a seamless glass lined steel tank construction with sacrificial magnesium anode rods and include a powered natural gas burner with electronic flame safeguard, intermittent ignition, automatic gas valve, and gas pressure regulator. Maximum supply gas pressure to heater 14" W.C. Maximum operating pressure of 150 psig. Bolted hand hole cleanout.

C. Water heater shall be suitable for sealed combustion direct venting using a CPVC air intake pipe and CPVC exhaust pipe for a total distance of 50 equivalent feet of vent (minimum) and 50 equivalent feet of intake (minimum). Termination may utilize a single opening manufactured concentric vent assembly. The heater shall be approved for 2”, or less, clearances to combustibles.

D. Water heater controls shall include integrated solid state temperature and direct spark ignition control device with integral diagnostics, LED fault display capability and a digital display of temperature settings.

E. Tank shall be foam insulated and equipped with an ASME rated temperature and pressure relief valve. The water heater shall be UL listed and exceed the minimum efficiency requirements of ASHRAE/IESNA 90.1.

F. Set initial water heater temperature to 140°F (minimum).

G. Manufacturer: A.O.Smith Cyclone BT Series, Bock OT Series, Bradford White EF Series or equal.

2.2 DOMESTIC HOT WATER STORAGE TANK

A. Factory jacketed and insulated domestic hot water storage tank designed for storing potable water and connected hot water sources such as instantaneous water heaters, heat pump water heaters, and solar thermal heat sources. Refer to drawings for locations, sizes, capacities, connections and model numbers.

B. Features:
1. Storage section shall be constructed and stamped for 150 psi working pressure under Section VIII of the ASME Code. Heavy gauge steel with powder coat paint.
2. Tank shall be insulated and jacketed. Insulation shall be minimum R-12.5 to meet requirements of U.S. Department of Energy and ASHRAE/IESNA 90.1.
3. Tank liner shall be glass coated or ceramic porcelain to provide corrosion resistance.
4. Cathodic protection with magnesium anodes.
5. Hand hole cleanout for maintenance removal of accumulated lime and sediment.
6. Temperature and pressure relief valve opening on top of tank.
7. Temperature sensor wells located in the upper and lower portions of the tank to accommodate field supplied 1/4” round temperature sensors.
8. Hot water and cold water connections shall be minimum 2” NPT.
9. Bottom drain outlets shall be minimum 1” NPT with brass drain valve.
10. Sensor wells shall be in the top..

C. Manufacturers: A.O.Smith E-Tech #EJV Series, Niles Steel Tank JS Series, RECO, Adamson or equal.

2.3 TEMPERATURE AND PRESSURE RELIEF VALVES

A. Temperature and Pressure Relief Valve: Lead free bronze body construction, thermostat and test lever, temperature relief set at 210ºF, and pressure relief set at 125 psi. Certified to meet ASME low pressure heating boiler code and ANSI Z21.22.

B. Manufacturers: Watts #LF Series (100XL, 40, 140, N240, 340), Cash Acme #FVX Series or equal.

2.4 VACUUM RELIEF VALVES

A. Vacuum Relief Valve: Provide on incoming cold water service where hot-water storage tank or indirect water heater is located at an elevation above the plumbing fixture outlets. Lead free brass body construction, protective cap, 1/2” male NPT, maximum operating temperature 250°F. Tested and rated to ANSI Z21.22.

B. Manufacturers: Watts #LFN36 Series, Cash Acme #VR-801, or equal.

2.5 THERMAL EXPANSION TANK

A. Furnish and install one thermal expansion tank in each closed domestic hot water piping system as shown on drawings. Size tank per hot water piping system volume and operating conditions. Minimum three (3) gallon acceptance volume.

B. Construction:
1. Designed and constructed vessel per ASME Code Section VIII, Division 1.
2. Tanks rated for maximum 150 psig working pressure.
3. Steel tank with stainless steel connection and painted.
4. Butyl diaphragm bonded to polypropylene liner. Pre-charged air chamber to 55 psig with Schrader air valve.
5. Tank saddle support for wall or upper attachment support or ring base for floor attachment.

C. Manufacturer: Amtrol Therm-X-Trol, Watts PLT, Adamson, RECO or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orient so controls and devices needing service and maintenance have adequate access.

D. Connect water piping to units with shutoff valves and unions as required for maintenance and system isolation.

E. Connect all drain outlets and route to approved termination locations as shown and as required by code.

F. Start-Up: Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls. Start-up to be by authorized manufacturer's representative or agent.

3.2 WATER HEATER EXAMINATION

A. Before water heater installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations. Examine piping and electrical connections to verify actual locations, sizes and other conditions affecting water heater performance, maintenance and operations.
1. Final water heater locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where water heaters will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 WATER HEATER INSTALLATION

A. Install water heaters level on concrete bases or walls. Coordinate with Division 03 for concrete materials and installation requirements.

B. Provide seismic anchorage attachments on vertical tanks heaters with support points at upper 1/3 and lower 1/3.

C. Install gas-fired water heaters in accordance with:
1. Local, state, provincial, and national codes, laws, regulations, and ordinances.
2. National Fuel Gas Code, ANSI Z223.1/NFPA 54 – 2012 edition.
3. California Electrical Code, CEC - 2013 edition.
4. Manufacturer's installation instructions, including required service clearances and venting guidelines.

D. Assemble and install water heater ASME Pressure/Temperature Relief Valve as required by local and State Code

E. Install electrical devices furnished with water heater but not specified to be factory mounted.

F. Install control wiring to field-mounted electrical devices.

3.4 WATER HEATER CONNECTIONS

A. Piping installation requirements are specified in other Division 23 sections. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to water heater to permit service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection and pitched for gravity flow. Provide condensate neutralizer for condensing water heaters.

D. Connect gas piping to water heater gas valve with unions. Piping shall be at least full size of gas train connection. Provide a reducer if required at final connection.

E. Connect hot-water piping to supply and return water heater tappings with shutoff valve and union or flange at each connection.

F. Multiple heaters shall be piped such that all cold water entering the system will go through the heat exchanger first. Each water heater shall have individual isolation valves for servicing and a hot water hose connection for start-up and field testing.

G. Install piping from safety pressure and temperature relief valves to nearest floor sink or to the exterior of the building.

H. Install vacuum relief valve in incoming cold water pipe to water heaters where water heaters are located at an elevation above the fixture outlets in the hot water system.

I. Install flue venting and combustion air intake ducting.

J. Connect venting full size to water heater connections.

K. Ground equipment according to Division 26 Section - Grounding and Bonding for Electrical Systems.

L. Connect wiring according to Division 26 Section - Low-Voltage Electrical Power Conductors and Cables.

3.5 CONDENSATE NEUTRALIZER

A. Route condensate from condensing style water heaters to floor sink through a manufactured condensate neutralizer.

B. Manufacturer: JJM Boiler Works, Axiom Industries or equal.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections
   1. Installation and Startup Test: Perform installation and startup checks according to manufacturer's written instructions.
   2. Leak Test: Repair leaks and retest until no leaks exist.
   3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion, if necessary.
   4. Controls and Safeties: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
      b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.7 OPERATION MANUALS, START-UP SERVICE, WARRANTIES, ACCEPTANCE AND GUARANTEES

A. General: Refer to Section 220500 for requirements.

END OF SECTION