





## Suggested Specifications Keystone KS 399/500

### General Requirements

1. Contractor shall supply and install Qty.: \_\_\_\_\_ Triangle Tube Model No. KS \_\_\_\_\_ gas fired condensing modulating boiler(s).
2. The boiler shall be a Triangle Tube Keystone Model KS \_\_\_\_\_, rated at the input and output shown on the schedule. The boiler shall modulate 20- 100% of full fire. The unit(s) shall be design-certified to comply with the current edition of the Harmonized ANSI Z21.13 / CSA 4.9 Standard for Gas- Fired Low Pressure Steam and Hot Water Boilers. The unit(s) shall be designed and constructed in accordance with the ASME Boiler & Pressure Vessel Code, Section IV requirements for 160 psi (1103 kPa) maximum working pressure, and shall bear the ASME "H" Stamp and be listed by the National Board. The unit(s) shall be constructed to comply with the efficiency requirements of the latest edition of ASHRAE Standard 90.1. The boiler shall be equipped with an ASME certified pressure relief valve set at 75 psi (517 kPa). Optional pressure relief valves with settings of 30 psi (207 kPa), 50psi (345 kPa), 60 psi (413 kPa), 125 psi (861 kPa) or 150 psi (1034 kPa) may be used.
3. The boiler shall be listed with AHRI (Air Conditioning, Heating and Refrigeration Institute). The boiler shall have a minimum thermal efficiency of 94%, and a minimum combustion efficiency of 95%.
4. The water tube heat exchanger shall be 316 stainless steel, rated for 160 psi (1103 kPa) working pressure. The heat exchanger shall be a low water volume design, welded construction, with no gaskets, o-rings or bolts in the header. Heat exchanger shall be accessible for visual inspection and cleaning of all internal surfaces. The boiler shall be fully condensing design with built-in condensate drain and trap. The heat exchanger shall have a limited ten-year warranty.
5. Each boiler shall be fully test fired, (with water, gas, and venting connected), and all safety components tested, at the factory.
6. The boiler shall be suitable for sealed combustion operation, and removal of jacket panels shall not affect the combustion seal. The boiler jacket shall be a unitized shell finished with acrylic thermo-set paint baked at not less than 325°F (163°C). The frame shall be constructed of galvanized steel for strength and protection. Chamber shall include a sight glass for viewing flame. Boiler shall be certified for zero clearance to combustible surfaces.
7. All water, gas, vent and air connections shall be on the top of the boiler, and the top jacket panels shall be split, such that they are removable without disconnecting the water, gas, vent or air connections.
8. Boiler shall operate on 4-13" w.c. supply gas pressure, and shall need no component changes to operate at high altitude, up to 10,000 feet.
9. The boiler shall use a premix burner with a stainless steel woven metal fiber wrap, and a negative pressure gas valve to burn cleanly, with NOx emissions not exceeding 10 ppm. The boiler shall meet the emissions requirements of SCAQMD 2012.
10. The boiler shall be designed for vertical or horizontal Category IV venting, up to 100 equivalent feet with 4" PVC, CPVC or stainless steel vent material. Air may be taken from the room, or ducted directly to the boiler, using up to 100 equivalent feet of 4" ABS, PVC, CPVC or galvanized pipe. The boiler shall be shipped with PVC sidewall vent and air terminals, for use with horizontal systems. The first section of CPVC vent pipe shall be shipped with each boiler.

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11. Unit shall be 120VAC, single phase, less than 6 Amps for connection to a 15A breaker. The control circuit shall be 24VAC.
  12. The boiler control shall be an integrated electronic PID temperature and ignition control with LCD and touchpad and shall control the boiler operation and firing rate. The boiler display shall be visible without the removal of any jacket panels or control panels.
  13. The control shall have the ability to control the boiler pump, system pump and indirect domestic water pump, each with delay features. The control shall be able to cascade and lead-lag with other Keystone controllers, without additional system controllers.
  14. The control shall have the ability to integrate indirect domestic water heating with the boiler system. The control shall have domestic hot water priority, and shall have the ability to recognize a domestic water sensor or closure from tank stat on the same terminals. The boiler shall be shipped with the domestic water heater sensor, as standard equipment.
  15. The control shall have built-in outdoor reset feature with customizable reset curves, based on the outdoor temperature and desired system water temperature. The boiler shall be shipped with the outdoor reset sensor, as standard equipment.
  16. The control shall have the ability to accept a 4-20 mA or 0-10 VDC (with supplemental kit) input connection from an external control or building automation system, to modulate the flame. The control shall have dry alarm contacts for ignition failure announcement.
  17. The control shall monitor flue gas temperature and shall stop boiler operation if flue temperature is excessive.
  18. The control shall easily allow the user to force the boiler into minimum or maximum firing rate, for boiler setup and diagnostic purposes. Control shall have 3 menu structures for user mode, setup mode and diagnostic mode.
  19. Allowable control adjustments shall include: boiler temperature setpoint; domestic water temperature setpoint; °F or °C display; outdoor reset selection; low boiler setpoint temperature (for outdoor reset operation); boiler temperature at high outdoor temperature (for outdoor reset operation); boiler setpoint at low outdoor temperature (for outdoor reset operation); warm weather shutdown; automatic remote signal selection; anti-short-cycle feature enable/disable.
  20. In addition to the adjustable parameters, the control shall display the boiler's inlet water temperature, boiler temperature rise (delta-T), stack temperature, outdoor air temperature, rate indication in %, boiler high limit setpoint, flame sense signal, control alerts and control lockouts.
  21. Control diagnostics shall include, at a minimum, the following: ignition failure, grounded flame rod, safety chain interrupt, boiler high limit exceeded, sensor errors (open or shorted), and fan speed proving rate failure.
- Standard features shall include:**
- High heat exchanger condensing efficiency
  - Modulation down to 20% of full fire (5:1 turn-down)
  - Sealed combustion chamber
  - Pre-mix stainless steel burner
  - Low NOx system exceeds the most stringent regulations for air quality – 10 ppm NOx.
  - Horizontal or vertical direct vent
  - Horizontal vent and air terminals
  - Vent and air pipe lengths of up to 100 equivalent feet (each)
  - Built-in condensate trap
  - Vent temperature cutoff feature
  - Indirect water heater priority (sensor included)
  - 160 psi (1102 kPa) maximum working pressure
  - Stainless steel heat exchanger with welded construction
  - ASME "H" stamp
  - 75 psi (517 kPa) ASME rated pressure relief valve
  - Water flow switch
  - Temperature & pressure gauge
  - Drain valve
  - Water flow switch



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- Multiple pump control for boiler pump, system pump and indirect domestic water pump, each with delay
- Electronic PID modulating control
- Direct spark ignition
- Large user-interface and display
- Alarm output
- Accepts external (4-20 mA or 0-10 V) modulation control
- Outdoor air temperature sensor
- On/off service switch
- Manual reset high limit
- Burner site glass
- Zero clearance to combustible surfaces
- 10 year limited warranty on heat exchanger

### Model Schedule

Model	Maximum Input MBH [kW]	Maximum Output MBH [kW]
KS 399	399 [116.9]	382 [112.0]
KS 500	500 [146.5]	475 [138.4]

