

**Typical Specification for Lochinvar<sup>®</sup> KNIGHT™ Fire Tube Boiler**  
*Models 55,000 – 399,000 Btu/Hr*

The **BOILER** shall be a **LOCHINVAR KNIGHT** Model **KHB**\_\_\_\_\_ or **WHB**\_\_\_\_\_ having a modulating input rating of \_\_\_\_\_ Btu/Hr, an output of \_\_\_\_\_ Btu/Hr and shall be operated on (Natural Gas) (L.P. Gas). The **BOILER** shall be capable of following performance:

Model	Turndown	Minimum Input	Maximum Input
KHB055 / WHB055	6.7:1	8,300	55,000
KHB085 / WHB085	10:1	8,500	85,000
KHB110 / WHB110	10:1	11,000	110,000
KHB155 / WHB155	10:1	15,500	155,000
KHB199 / WHB199	10:1	19,900	199,000
KHB285 / WHB285	10:1	28,500	285,000
WHB399	10:1	39,900	399,000

The **BOILER** shall bear the ASME "H" stamp for 80 psi working pressure and shall be National Board listed. The **BOILER** shall have a fully welded, stainless steel, fire tube heat exchanger. There shall be no banding material, bolts, gaskets or "O" rings in the pressure vessel construction. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. The condensate collection basin shall be constructed of welded stainless steel. The complete heat exchanger assembly shall carry a fifteen (15) year limited warranty.

The heat exchanger shall have a volume of water no less than:

Model	Water Content
KHB055 / WHB055	2.3 gallons
KHB085 / WHB085	2.2 gallons
KHB110 / WHB110	3.2 gallons
KHB155 / WHB155	3.2 gallons
KHB199 / WHB199	5.2 gallons
KHB285 / WHB285	4.9 gallons
WHB399N	6.5 gallons

The **BOILER** shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard. The **BOILER** shall operate at a minimum of 95% AFUE Efficiency (KHB/WHB055-285) and 94.4% THERMAL Efficiency (WHB399) as registered with AHRI. The **BOILER** shall be certified for indoor installation.

The **BOILER** shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided for observing the burner flame and combustion chamber. The burner shall be a premix design constructed of high temperature stainless steel with a woven FeCrAlloy outer covering to provide smooth operation at all modulating firing rates. The **BOILER** shall be supplied with a negative pressure regulation gas valve and be equipped with a pulse width modulation blower system to precisely control the fuel/air mixture to the burner. The **BOILER** shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.

The **BOILER** shall utilize a 24 VAC control circuit and components. The control system shall have a factory installed display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The **BOILER** shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 30 psi (standard); outlet water temperature sensor with a dual thermistor to verify accuracy; system supply water temperature sensor; outdoor air sensor, flue temperature sensor with dual thermistor to verify accuracy; low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.

The **BOILER** shall feature the “SMART SYSTEM™” control which is standard and factory installed with 128 x 128 resolution display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities, USB drive for simple uploading of parameters and a PC port connection for connection to a local computer for programming and trending. A secondary operating control that is field mounted outside or inside the appliance is not acceptable. The **BOILER** shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The **BOILER** shall have a built-in “Cascade” with leader redundancy to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal “Cascade” function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The **BOILER** shall be capable of remote communication via optional CON-X-US™ Remote Connectivity with the capability of historical trending and sending text message or email alerts to notify the caretaker of a boiler alarm and remote programming of onboard boiler control. The control must have optional capability to communicate via Modbus protocol with a minimum of 46 readable points. The **BOILER** shall have an optional gateway device which will allow integration with LON or BacNet protocols.

The “SMART SYSTEM™” control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0-10 VDC output signal shall control a variable speed boiler pump (pump shall be supplied by manufacturer) to keep a fixed Delta T across the boiler regardless of the modulation rate. The **BOILER** shall have the capability to receive a 0-10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues such as erratic temperature cycling.

The **BOILER** shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 46 connection points for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Low Water Cut Off, Louver Proving Switch, Tank Thermostat, Domestic Hot Water Building Recirculation Pump Contacts, Domestic Hot Water Building Recirculation Temperature Sensor Contacts, Remote Enable/Disable, System Supply Temperature Sensor, Outdoor Temperature Sensor, Tank Temperature Sensor, Modbus Building Management System Signal and Cascade Control Circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 120 volt / 60 hertz / single phase on all models. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.

The **BOILER** shall be installed and vented with a (select one):

**(a) Direct Vent system with horizontal sidewall termination** of both the exhaust vent and combustion air. The flue shall be Category IV approved material constructed of PVC, CPVC, Polypropylene or Stainless Steel. A separate pipe shall supply combustion air directly to the boiler from the outside. The boiler’s total combined air intake length shall not exceed 100 equivalent feet. The boiler’s total combined exhaust venting length shall not exceed 100 equivalent feet.

**(b) Direct Vent system with vertical roof top termination** of both the exhaust vent and combustion air. The flue shall be Category IV approved material constructed of PVC, CPVC, Polypropylene or Stainless Steel. A separate pipe shall supply combustion air directly to the boiler from the outside. The boiler’s total combined air intake length shall not exceed 100 equivalent feet. The boiler’s total combined exhaust venting length shall not exceed 100 equivalent feet. The air inlet must terminate on the rooftop with the exhaust.

**(c) Vent system with Vertical rooftop Exhaust and Horizontal sidewall Air Intake** with the combustion air intake in a different pressure zone. The flue shall be Category IV approved material constructed of PVC, CPVC, Polypropylene or Stainless Steel. A separate pipe shall supply combustion air directly to the boiler from the outside in a different pressure zone from that of the exhaust vent. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet.

**(d) Vertical rooftop or Horizontal sidewall exhaust** with the combustion air drawn from the equipment room. The flue shall be Category IV approved material constructed of PVC, CPVC, Polypropylene or Stainless Steel. The boiler's total exhaust venting length shall not exceed 100 equivalent feet. Combustion air drawn from the equipment room shall be supplied with properly sized combustion and ventilation air openings based on NFPA requirements.

The **BOILER** shall have an independent laboratory rating for Oxides of Nitrogen (NO<sub>x</sub>) to meet the requirements of South Coast Air Quality Management District in Southern California and the requirements of Texas Commission on Environmental Quality. The manufacturer shall verify proper operation of the burner, all controls and the integrity of the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

The **BOILER** shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. The **BOILER** shall be certified for operation at elevations of 4,500 feet, and above, by a 3<sup>rd</sup> party organization.

The **BOILER** shall be suitable for use with polypropylene glycol up to a 50% concentration. The de-rate associated with the glycol will vary per glycol manufacturer.

#### **STANDARD CONSTRUCTION**

The **BOILER** shall be constructed in accordance with the following code requirements as standard equipment. Manufacturing of special models to meet the below code requirements is not acceptable.

**California Code** (Except 285-399)

**Massachusetts Code**

**Kentucky Code**

**CRN Approval in Canada**

**Note: Due to the large disparity in CSD-1 interpretation from state to state, please confirm to the factory all controls required in your jurisdiction.**