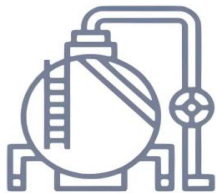


Model CB 15-100 HP

SAMPLE SPECIFICATIONS - HOT WATER

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MODEL CB HOT WATER BOILER (15-100 HP, 30 PSIG, 125 PSIG)

1.01 Boiler Characteristics (Hot Water)

- A. The Hot Water Boiler shall be Cleaver-Brooks Model CB, Fuel Series _____ (100, 200, 400, 600, 700), _____ hp designed for _____ psig (30, 125, or other psig hot water). The maximum water temperature will be _____ degree F, and the maximum system temperature drop will be _____ degree F.
- B. The boiler shall have a maximum output of _____ Btu/hr, or _____ horsepower when fired with CS 12-48 _____ oil and/or natural gas, _____ Btu/cu-ft. Electrical power available will be _____ Volt _____ Phase _____ Cycle.

1.02 General Boiler Design

- A. The boiler shall be a four pass horizontal firetube updraft boiler with five (5) square feet of heating surface per rated boiler horsepower. It shall be mounted on a heavy steel frame with integral forced draft burner and burner controls. The complete package boiler shall be approved as a unit by Underwriters Laboratories and shall bear the UL/ULC label.
 1. The boiler shall be completely preassembled and fire tested at the factory.

The unit shall be ready for immediate mounting on floor or simple foundation and ready for attachment of water, steam, fuel, electrical, vent and blowdown connections.
 2. The boiler shall be built to comply with the following insurance and codes _____ (Factory Mutual, ASME CSD-1).
- B. Boiler Shell (Hot Water)
 1. The boiler shell must be constructed in accordance with ASME Boiler Code and must receive authorized boiler inspection prior to shipment. A copy of the inspection report shall be furnished to the purchaser.
 2. The hot water return and outlet connections shall be located on the top center line of the boiler. The boiler shall be designated to rapidly mix the return water with the boiler water. Forced internal circulation shall be used.
 3. A dip tube shall be included as an integral part of the water outlet.
 4. Two lifting eyes shall be located on top of the boiler.
 5. Front and rear doors on the boiler shall be hinged or davited. Doors are to be sealed with fiberglass tadpole gaskets and fastened tightly using heavy capscrews that thread into replaceable brass nuts.
 6. Rear refractory and insulation shall be contained in the formed door, which must swing open for inspection of brick work.
 7. The boiler tubes shall not include turbulators, swirlers or other add-on appurtenances.
 8. Front and rear tube sheets and all flues must be fully accessible for inspection and cleaning when the doors are swung open. The shell must be furnished with adequate handholes to facilitate boiler inspection and cleaning.

9. The exhaust gas vent shall be located near the front of the boiler on the top center line and shall be capable of supporting 1000 lbs and shall contain a stack thermometer
- C. Observation ports for the inspection of flame conditions shall be provided at each end of the boiler.
- D. The boiler insulation shall consist of a 2 inch blanket under a sectional preformed sheet metal lagging. This insulation must be readily removable and capable of being reinstalled, if required.
- E. The entire boiler based frame and other components shall be factory painted before shipment using a hard finish enamel coating.

1.03 Hot Water Boiler Trim

- A. Low Water Cutoff
A low water cutoff control (manual reset) shall be mounted on the top centerline of the boiler wired into the burner control circuit to prevent burner operation if boiler water falls below a safe level.
- B. Pressure and Temperature Gauges
Pressure and temperature gauges shall be mounted on the boiler with temperature sensing element located adjacent to the hot water outlet.
- C. Relief Valves
Water relief valves of a type and size to comply with ASME Code requirements shall be shipped loose.
- D. Temperature Controls
Temperature controls to regulate burner operation shall be mounted on the unit with temperature sensing elements located adjacent to the hot water outlet. Controls shall be high limit (manual reset), operating limit (auto reset), and firing rate control (30-100 hp).

1.04 Burner and Controls

- A. Mode of Operation
Select one of the following:
 - 15 and 20 hp. Burner operation shall be on-off principle.
 - 30 and 40 hp. Burner operation shall be high-low-off principle. The burner shall always return to low fire position for ignition.
 - 50 - 100 hp. Burner operation shall be full modulation principle. The burner shall always return to low fire position for ignition.

1.05 Blower

- A. Air for combustion shall be supplied by a forced draft blower mounted in the front boiler door, above the burner, to eliminate vibration and reduce noise level.
- B. Maximum sound level of the boiler/burner package shall not exceed _____ dbA (when measured in accordance with ABMA Sound Test Standards).
- C. The impeller shall be cast aluminum, radial blade, carefully balanced, and directly connected to the blower motor shaft.

1.06 Combustion Air Control

Select one of the following:

- 15 and 20 hp. Combustion air damper shall be manually set for proper air-fuel ratios.
- 30 and 40 hp. Combustion air damper shall be linked to damper motor. Auxiliary switch on the damper motor shall control high or low firing rate.
- 50 - 100 hp. Combustion air damper and cam operated fuel metering valves shall be operated by a single damper control motor that regulates the fire according to load demand. Potentiometer type position controls shall be provided to regulate operation of the damper control motor (remove this sentence when a CB-HAWK Flame Safeguard is used).

1.07 Fuel Specification and Piping

Select one of the following fuel types:

- Fuel series 700 - Gas fired (4.4.1).
- Fuel series 100 - Light oil (No. 2) fired (4.4.2).
- Fuel series 200 - Light oil or gas fired (4.4.3).
- Fuel series 600 - No. 6 oil fired (4.4.4).
- Fuel series 400 - No. oil or gas fired (4.4.5).

A. Fuel Series 700 - Gas Fired

1. Burner Type - The burner shall be integral with the front head of the boiler and of high radiant multi-port type for gas. The burner shall be approved for operation on natural gas fuel.
2. Gas Pilot - The gas pilot shall be a premix type with automatic electric ignition. An electronic detector shall monitor the pilot so that the primary gas valve cannot open until pilot flame has been established. The pilot train shall include two manual shut-off valves, solenoid valve, pressure regulator and pressure gauge.
3. Gas Burner Piping - Gas burner piping on all units shall include pressure regulator, primary gas shutoff valve, motor operated with proof of closure switch and plugged leakage test connection. The main gas valve(s) shall be wired to close automatically in the event of power failure, flame failure, low water or any safety shutdown condition. A lubricating plug cock or butterfly shutoff valve shall be provided as a means for a tightness check of the primary shut off valve. An additional plug cock on butterfly valve shall be furnished at entrance to gas train. Select one of the following:
 - a. 15-50 hp. Burners equipped as shown above.
 - b. 60-100 hp. High and low gas pressure switches shall be provided.
4. Burner Turndown - Select one of the following:
 - a. 15 and 20 hp. Burner shall operate on the on/off principle.
 - b. 30 and 40 hp. Burner shall operate on the high-low-off principle with a turndown of 3:1 when firing natural gas.
 - c. 50-100 hp. Turndown range of burner shall be 4:1 when firing natural gas.

B. Fuel Series 100 - Light Oil Fired

1. Burner Type - The burner shall be integral with the front head of the boiler, and shall be a low pressure air atomizing type approved for operation with CS12-48, Commercial No. 2 oil.
 2. Oil Pilot - The oil pilot shall be air atomizing type with automatic electric ignition and include oil solenoid valve. An electronic detector shall monitor the pilot so that the primary oil valve cannot open until flame has been established.
 3. Oil Pump - An oil pump with a capacity of approximately twice the maximum burning rate shall be included. Select one of the following:
 - a. 15 hp through 40 hp. The oil pump shall be integral with the burner and belt driven from the blower motor.
 - b. 50 hp through 100 hp. Separate motor driven pump set, shipped loose to be installed in a location favorable to the oil storage tank, shall be provided.
 4. Oil Burner Piping - Fuel oil piping on the unit shall include oil pressure regulating devices, oil metering controls, solenoid shutoff valves, pressure gauges and fuel strainer, all integrally mounted on the unit. Select one of the following:
 - a. 50 hp through 100 hp. A fuel oil controller shall be provided to combine all of the fuel oil controls into a single casting which is mounted on the front door of the unit. A single tip retractable nozzle shall be used for the low pressure air atomizing burner.
 - b. 70 hp through 100 hp. A low oil pressure switch shall be included in the oil piping.
 5. Low Pressure Air Atomizing - Select one of the following:
 - 15 hp through 40 hp. Belt driven air compressor, lubricating oil tank, oil level indicator, inlet air filter, air pressure gauge, and low atomizing air pressure switch.
 - 50 hp through 100 hp. Separate air compressor module mounted on boiler base rail with low atomizing air pressure switch.
 6. Burner Turndown - Turndown range of the burner shall be 4:1 when firing No. 2 oil. Select one of the following:
 - 15 and 20 hp. Burner shall operate on the on/off principle.
 - 30 and 40 hp. Burner shall operate on the high-low-off principle with a turndown of 3:1 when firing No. 2 oil.
 - 50 hp through 100 hp. Turndown range shall be 4:1 when firing No. 2 oil.
- C. Fuel Series 200 - Light Oil or Gas Fired
1. Burner Type - The burner, integral with the front head of the boiler, shall be a combination of the low pressure air atomizing type for oil and high radiant multi-port type for gas. The burner shall be approved for operation with either CS12-48 Commercial No. 2 Oil or natural gas.
 2. Gas Pilot - The gas pilot shall be premix type with automatic electric ignition. An electronic detector shall monitor the pilot so that the primary fuel valve cannot open until flame has been established. The pilot train shall include two manual shut-off valves, solenoid valve, pressure regulator and pressure gauge.
 3. Oil Burner
 - a. Oil Pump - An oil pump with a capacity of approximately twice the maximum burning rate shall be included. Select one of the following:

- 1) 15 hp through 40 hp. The oil pump shall be integral with the burner and belt driven from the blower motor.
 - 2) 50 hp through 100 hp. Separate motor driven pump set, shipped loose, to be installed in a location favorable to the oil storage tank, shall be provided.
- b. Oil Burner Piping - Fuel oil piping on the unit shall include oil pressure regulating devices, oil metering controls, solenoid shutoff valves, pressure gauges and fuel strainer, all integrally mounted on the unit. Select one of the following:
- 1) 50 hp through 100 hp. A fuel oil controller shall be provided to combine all of the fuel oil controls into a single casting which is mounted on the front door of the unit. A single tip retractable nozzle shall be used for the low pressure air atomizing burner.
 - 2) 70 hp through 100 hp. A low oil pressure switch shall be included in the oil piping.
 - 3) Low pressure air atomizing - Select one of the following:
 - 15 hp through 40 hp. Belt driven air compressor, lubricating oil tank, oil level indicator, inlet air filter, air pressure gauge and low atomizing air pressure switch.
 - 50 hp through 100 hp. Separate air compressor module mounted on boiler base rail with low atomizing air pressure switch.
4. Gas Burner
- a. Gas Burner Piping - gas burner piping on all units shall include pressure regulator, primary gas shutoff valve, motor operated with proof of closure switch and plugged leakage test connection. The main gas valve(s) shall be wired to close automatically in the event of power failure, flame failure, low water or any safety shutdown condition. A lubricating plug cock or butterfly shutoff valve shall be provided as a means for a tightness check of the primary shut off valve. An additional plug cock or butterfly valve shall be furnished at entrance to gas train.
- Select one of the following:
- 15-50 hp. Burners equipped as shown above.
 - 60-100 hp. High and low gas pressure switches shall be provided.
5. Burner Turndown - Select one of the following:
- 15 and 20 hp. Burner shall operate on the on/off principle.
 - 30 and 40 hp. Burner shall operate on the high-low-off principle with a turndown of 3:1
 - 50-100 hp. Turndown range of the burner shall be 4:1.
6. Fuel Series 600 - No. 6 Oil Fired
- a. Burner Type - The burner shall be integral with the front head of the boiler and low pressure air atomizing type approved for operation with CS12-48, Commercial No. 6 Oil.
- b. Gas Pilot - The gas pilot shall be a premix type with automatic electric ignition. An electronic detector shall monitor the pilot so that the primary oil valve cannot open until pilot flame has been established. The pilot train shall

include two manual shut-off valves, solenoid valve, pressure regulator and pressure gauge.

- c. Oil Pump - An oil pump set with a capacity of approximately twice the maximum burning rate shall be included.

A separate motor driven pump set shall be included shipped loose for location favorable to the oil storage tank.

- d. Oil Burner Piping - A fuel oil controller combining all of the fuel oil controls into a single casing shall be provided. Oil pressure regulating devices, oil metering controls, solenoid shutoff valves, high and low oil temperature switches and necessary pressure and temperature gauges shall be included in this packaged assembly mounted on the front door of the boiler. A fuel strainer shall also be provided, mounted to the boiler. A single tip retractable nozzle shall be used for the low pressure air atomizing burner. Flexible hoses shall be provided to allow easy removal of the nozzle for inspection when it is placed in the vice jaws located on the front door of the boiler.

The metering valve shall permit circulation of hot oil to the burner at all times. The burner drawer oil piping and nozzle shall be purged of oil on each shutdown.

For 70 through 100 hp, a low oil pressure switch shall be included in the oil piping.

- e. Low Pressure Air Atomizing

- 1) 50 through 100 hp. Separate air compressor module mounted on boiler base rail with low atomizing air pressure switch.

- f. Oil Preheat

The oil shall be preheated by a safety type water-to-water-to-oil preheating system in conjunction with an electric preheater, each with thermostatic control. Both heaters shall be mounted, piped, and wired on the boiler.

- 1) 50 through 100 hp. Electric preheater size shall be 5 kW.

7. Fuel Series 400 - No. 6 Oil or Gas Fired

- a. Burner Type - The burner shall be integral with the front head of the boiler and shall be a combination of the low pressure atomizing type for oil and high radiant multi-port type for gas. The burner shall be approved for operation with either CS12-48 Commercial No. 6 oil or natural gas.
- b. Gas Pilot - The gas pilot shall be a premix type with automatic electric ignition. An electronic detector shall monitor the pilot so that the primary oil valve cannot open until pilot flame has been established. The pilot train shall include two manual shut-off valves, solenoid valve, pressure regulator and pressure gauge.

8. Oil Burner

- a. Oil Pump - An oil pump set with a capacity of approximately twice the maximum burning rate shall be included.
- b. Oil Burner Piping - A fuel oil controller combining all of the fuel oil controls into a single casing shall be provided. Oil pressure regulating devices, oil metering controls, solenoid shutoff valves, high and low oil temperature switches, and the necessary pressure and temperature gauges shall be included in this packaged assembly mounted on the front door of the boiler. A fuel strainer shall also be provided, mounted to the boiler. A single tip retractable nozzle shall be used for the low pressure air atomizing burner.

Flexible hoses shall be provided to allow easy removal of the nozzle for inspection when it is placed in the vice jaws located on the front door of the boiler. The metering valve shall permit circulation of hot oil to the burner at all times. The burner drawer oil piping and nozzle shall be purged of oil at each shutdown.

For 70 through 100 hp, a low oil pressure switch shall be included in the oil piping.

9. Low Pressure Air Atomizing

- a. 50 through 100 hp. Separate air compressor module mounted on boiler base rail with low atomizing air pressure switch.

10. Oil Preheat

The oil shall be preheated by a safety type water-to-water-to-oil preheating system in conjunction with an electric preheater, each with thermostatic control. Both heaters shall be mounted, piped, and wired on the boiler. Select one of the following:

- a. 50 through 100 hp. Electric preheater size shall be 5 kW.

11. Gas Burner

- a. Gas Burner Piping - Gas burner piping on all units shall include pressure regulator, primary gas shutoff valve, motor operated with proof of closure switch and plugged leakage test connection. The main gas valve(s) shall be wired to close automatically in the event of power failure, flame failure, low water or any safety shutdown condition. A lubricating plug cock or butterfly shutoff valve shall be provided as means for a tightness check of the primary shutoff valve. An additional plug cock or butterfly valve shall be furnished at entrance to gas train. Select one of the following:

- 1) 50 hp. Burner equipped as shown above.
- 2) 60 through 100 hp. High and low gas pressure switches shall be provided.
- 3) Burner Turndown - Turndown shall be 4:1.

D. Boiler Flame Safeguard Controller and Control Panel

1. CB780E Flame Safeguard

2. 4.5.1.1 Boilers with CB780E Control - Each boiler shall be factory equipped with flame safeguard controller providing technology and functions equal to the Cleaver-Brooks Model CB780E.

Controller shall be computerized solid state having sequence and flame-on lights and digital "first out" fault code indications of flame safeguard trip functions. It shall include dynamic self-check logic. The controller shall have a fixed operating sequence incapable of being manually altered. The sequence shall include start, pre-purge, pilot and main fuel ignition run and post-purge cycles.

Controller shall be the non-recycle type for maximum safety that shall shutdown the burner and indicate as a minimum the following trip functions: pilot and main flame failure, high and low fire proving switch faults, running interlocks open, false flame signal and fuel valve open (when proof of closure switch is furnished).

The controller shall have a run/test switch. It shall allow interruptions to sequence just after pre-purge, during pilot ignition trial and run cycles for adjustments to firing rate motor, damper linkages and pilot flame for minimum turndown tests.

3. Control Panel: The control panel shall be mounted on the front door of the boiler in a location convenient to the operator. The hinged metal cabinet will have NEMA 1A rating that includes a neoprene dust seal and a Yale cabinet key type lock.

The panel shall contain the boiler flame safeguard controller, blower motor starter, indicating lights and selector switches.

The panel shall have a removable sub-base for mounting the flame safeguard controller, blower motor starter, and terminal blocks. For combination gas-oil and heavy oil fired boilers the panel will contain the fuel selector and/or oil heater selector switch.

The panel shall contain the following lights and switches:

- a. Lights
 - White - load demanded.
 - White - fuel valve open.
 - Red - low water.
 - Red - flame failure.
- b. Control Switches
 - Burner On-Off.
 - Manual-Automatic.
 - Manual Firing Rate Control.
4. Oil, heat and moisture resistant wire shall be used and identified with circuit numbers corresponding to the electrical wiring diagram.
5. All electrical equipment and wiring shall be in conformance with Underwriters Laboratories requirements.
6. Boiler to be supplied with a control circuit transformer and fuse protection for the control circuit.
7. Control Panel: The control panel shall be mounted on the front door of the boiler in a location convenient to the operator. The hinged metal cabinet will have NEMA 1A rating that includes a neoprene dust seal and a Yale cabinet key type lock.

The panel shall contain the boiler flame safeguard controller, indicating lights and selector switches.

Panel shall have a removable sub-base for mounting the flame safeguard controller, and terminal blocks. For combination gas-oil and heavy oil fired boilers the panel will contain the fuel selector and/or oil heater selector switch.
8. Oil, heat, and moisture resistant wire shall be used and identified with circuit numbers corresponding to the electrical wiring diagram.
9. All electrical equipment and wiring shall be in conformance with Underwriters Laboratories requirements.
10. Boiler to be supplied with a control circuit transformer and fuse protection for the control circuit.

1.08 Efficiency Guarantee

The boiler manufacturer shall guarantee that, at the time of startup, the boiler will achieve _____ fuel-to-steam efficiency at 100% firing rate when burning natural gas and _____ fuel-to-steam efficiency at 100% firing rate when burning oil (add efficiency guarantees at 25%,

50%, and 75% of rating, if required). If the boiler(s) fail to achieve the corresponding guaranteed efficiency as published, the boiler manufacturer will rebate, to the ultimate boiler owner, five thousand dollars (\$5,000) for every full efficiency point (1.0%) that the actual efficiency is below the guaranteed level.

The specified boiler efficiency is based on the following conditions.

A. Fuel specification used to determine boiler efficiency:

1. Natural Gas

Carbon, % (wt) = 69.98

Hydrogen, % (wt) = 22.31

Sulfur, % (wt) = 0.0

Heating value, Btu/lb = 21,830

2. No. 2 Oil

Carbon, % (wt) = 85.8

Hydrogen, % (wt) = 12.7

Sulfur, % (wt) = 0.2

Heating value, Btu/lb = 19,420

3. No. 6 Oil

Carbon, % (wt) = 86.6

Hydrogen, % (wt) = 10.9

Sulfur, % (wt) = 2.09

Heating value, Btu/lb = 18,830

B. Efficiencies are based on ambient air temperature of 80 °F, relative humidity of 30%, and 15% excess air in the exhaust flue gas.

C. Efficiencies are based on manufacturer's published radiation and convection losses. (For Cleaver-Brooks radiation and convection losses, see Boiler Efficiency Facts Guide, publication number CB-7767).

D. Any efficiency verification testing will be based on the stack loss method.

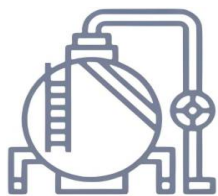
1.09 Warranty

A. All equipment is to be guaranteed against defects in materials and/or workmanship for a period of 12 months from date of start-up or 18 months from date of shipment, whichever comes first.

EXECUTION

2.01 Shop Tests

- A. The packaged boiler must receive factory tests to check the construction, controls, and operation of the unit. All tests may be witnessed by the purchaser, if desired.
- B. Start-up Service
 1. After boiler installation is completed, the manufacturer shall provide the services of a field representative for starting the unit and training the operator at no additional costs.
 - a. A factory approved and authorized start-up report shall be submitted to the customer/user at the time of start-up.



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Notes