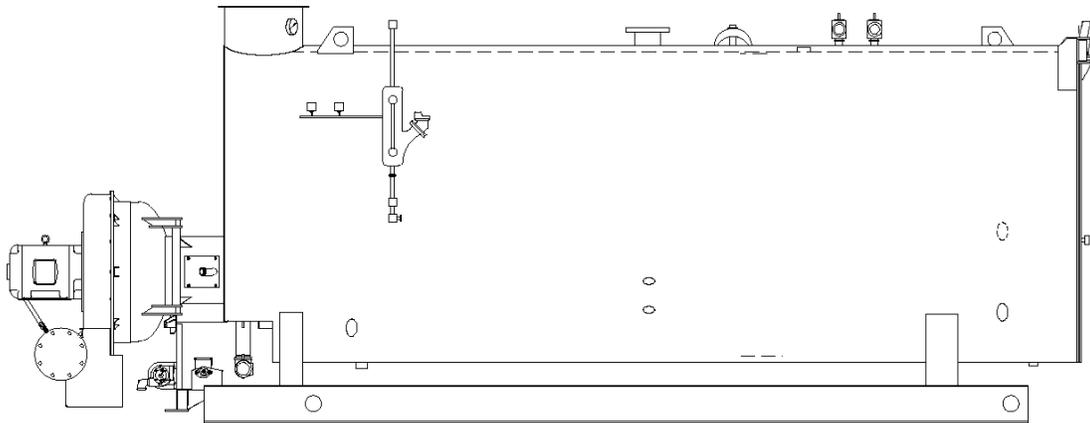


# Model ICB 100-800 HP



## Table of Contents

FEATURES AND BENEFITS	A4-3
Four-Pass Intercooled Design	A4-3
Three-Pass Intercooled Design	A4-3
Intercooled Rear Turnaround	A4-3
Front and Rear Doors:	A4-3
Natural Gas, No. 2 Oil, or Combination Burners	A4-3
PRODUCT OFFERING	A4-3
DIMENSIONS AND RATINGS	A4-5
PERFORMANCE DATA	A4-18
ENGINEERING DATA	A4-18
Blowdown Water Requirements	A4-19
Burner/Control Information	A4-19
Fuel Connections — Gas	A4-19
Fuel Connections — Oil	A4-19
Boiler Room Information	A4-20
Stack Support Capabilities	A4-20
Boiler Room Combustion Air	A4-20
Stack/Breeching Size Criteria	A4-21
SAMPLE SPECIFICATIONS	A4-29

ILLUSTRATIONS

Figure A4-1. Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional) . . . . . A4-9  
 Figure A4-2. Model ICB Hot Water Boiler Dimensions, 4-Pass and 3-Pass (Optional) . . . . . A4-11  
 Figure A4-3. Model ICB-LE Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional) . . . . . A4-13  
 Figure A4-4. Model ICB-LE Hot Water Boiler Dimensions, 4-Pass and 3-Pass (Optional) . . . . . A4-15  
 Figure A4-5. Space Required to Open Rear Head on Model ICB Boilers . . . . . A4-17  
 Figure A4-6. Model ICB Boilers Lifting Lug Location . . . . . A4-17  
 Figure A4-7. Model ICB Boiler Mounting Piers . . . . . A4-18  
 Figure A4-8. Typical Fuel Oil Supply Arrangement . . . . . A4-27  
 Figure A4-9. Boiler Room Length (Typical Layouts) — Model ICB . . . . . A4-28  
 Figure A4-10. Boiler Room Width (Typical Layout) — Model ICB . . . . . A4-28

TABLES

Table A4-1. Model ICB Steam Boiler Ratings, 4-Pass . . . . . A4-5  
 Table A4-2. Model ICB Steam Boiler Ratings, 3-Pass . . . . . A4-5  
 Table A4-3. Model ICB Hot Water Boiler Ratings, 4-Pass . . . . . A4-6  
 Table A4-4. Model ICB Hot Water Boiler Ratings, 3-Pass . . . . . A4-6  
 Table A4-5. Model ICB-LE Steam Boiler Ratings, 4 Pass . . . . . A4-7  
 Table A4-6. Model ICB-LE Steam Boiler Ratings, 3 Pass . . . . . A4-7  
 Table A4-7. Model ICB-LE Hot Water Ratings, 4 Pass . . . . . A4-8  
 Table A4-8. Model ICB-LE Hot Water Ratings, 3 Pass . . . . . A4-8  
 Table A4-9. Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass . . . . . A4-10  
 Table A4-10. Model ICB Hot Water Boiler Dimensions, 4-Pass and 3-Pass . . . . . A4-12  
 Table A4-11. Model ICB-LE Steam Boiler Dimensions, 4-Pass and 3-Pass . . . . . A4-14  
 Table A4-12. Model ICB-LE Hot Water Boiler Dimensions, 4-Pass and 3-Pass . . . . . A4-16  
 Table A4-13. Model ICB Steam Volume and Disengaging Areas . . . . . A4-21  
 Table A4-14. Model ICB Steam Boiler Safety Valve Outlet Size . . . . . A4-22  
 Table A4-15. Model ICB Hot Water Boiler Relief Valve Outlet Size . . . . . A4-22  
 Table A4-16. Model ICB Recommended Steam Nozzle Size . . . . . A4-23  
 Table A4-17. Model ICB Recommended Non-Return Valve Size . . . . . A4-23  
 Table A4-18. Model ICB Blowdown Tank Sizing Information . . . . . A4-24  
 Table A4-19. Altitude Correction for Gas . . . . . A4-24  
 Table A4-20. Sound Levels in dBA for 4-Pass ICB Boilers at High Fire . . . . . A4-24  
 Table A4-21. Model ICB, Standard, Min. Req. Gas Pressure Standard, FM & IRI Gas Trains . . . . . A4-25  
 Table A4-22. Model ICB, Low NOx, Min. Req. Gas Pressure Standard, FM & IRI Gas Trains . . . . . A4-26

## FEATURES AND BENEFITS

The Cleaver-Brooks Model ICB Boiler line provides a quality product utilizing a baseline boiler/burner design. Additionally, the boiler/burner package is UL compliant. The following features apply:

### Four-Pass Intercooled Design:

- Four-pass design provides high flue gas velocities and low stack temperatures to maximize efficiency.

### Three-Pass Intercooled Design (optional):

- Versatile design offered with choice of three or four-pass construction to meet application needs.

### Intercooled Rear Turnaround:

- Rear furnace turnaround area is fluid cooled and has a davited access opening for full accessibility to 2nd pass tubes and furnace. It eliminates confined space issues and provides for ease of maintenance. All tubes can be removed from either the front or rear of the boiler.

### Front and Rear Doors:

- Davit, front and rear doors, all sizes.
- Provides access to front and rear tube sheet.
- Rear door completely covers and insulates rear tube sheet.

### Natural Gas, No. 2 Oil, or Combination Burners Available:

- Combination gas/oil burners provide quick fuel changeover without burner adjustment.
- Ultra low NOx emissions (<9ppm), consult factory.

## PRODUCT OFFERING

Cleaver-Brooks Model ICB Boilers are available in low pressure steam, high pressure steam, and hot water designs. Burners are available to fire natural gas, No. 2 oil, or a combination of oil and gas. Standard product offering is:

- 100 – 800 hp.
- 30 and 125 psig hot water.
- 15 – 300 psig steam.
- Full modulation, all sizes.

Available options include the following (contact your local Cleaver-Brooks Authorized Representative for option details).

- Boiler Options:
  - Three-pass design.
  - Drain valves.
  - Additional screwed or flanged tappings.
  - Blowdown valves.
  - Non-return valves.
  - Feedwater valves and regulators.
  - Surface blowdown systems.
  - Blend pump.
  - Surge load baffles.
  - Seismic design.

- Burner/Control Options:
  - Flame safeguard controllers.
  - Lead/lag system.
  - High altitude design.
  - Special insurance and code requirements (e.g., IRI, FM, CSD-1).
  - Alarm bell/silence switch.
  - Special motor requirements (TEFC, high efficiency).
  - Special indicating lights.
  - Elapsed time meter.
  - Voltmeter/micro-ammeter.
  - NEMA enclosures.
  - Low-fire hold control.
  - Remote emergency shut-off (115V).
  - Circuit breakers.
  - Day/night controls.
  - Special power requirements.
  - Stack thermometer.
- Fuel Options
  - Air atomizing oil burner, 200 – 800 hp.
  - Pressure atomizing oil burner, 100 – 150 hp.
  - Gas strainer.
  - Gas pressure gauge.
  - Future gas conversion.
  - Oversized/undersized gas trains.

## ***DIMENSIONS AND RATINGS***

Dimensions and ratings for the Model ICB Boilers are shown in the following tables and illustrations. The information is subject to change without notice.

- Table A4-1 Model ICB Steam Boiler Ratings, 4-Pass
- Table A4-2 Model ICB Steam Boiler Ratings, 3-Pass (Optional)
- Table A4-3 Model ICB Hot Water Boiler Ratings, 4-Pass
- Table A4-4 Model ICB Hot Water Boiler Ratings, 3-Pass (Optional)
- Figure A4-1 Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional)
- Table A4-9 Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional)
- Figure A4-6 Model ICB Hot Water Boiler Dimensions, 4-Pass and 3-Pass (Optional)
- Table A4-10 Model ICB Hot Water Boiler Dimensions, 4-Pass and 3-Pass (Optional)
- Figure A4-5 Space Required to Open Rear Head on Model ICB Boilers
- Figure A4-6 Model ICB Boilers Lifting Lug Location
- Figure A4-7 Model ICB Boiler Mounting Piers

**Table A4-1. Model ICB Steam Boiler Ratings, 4-Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL Model ICB	FP-3	FP-3	FP-3	FP-4	FP-4	D145P	D175P	D210P	D252P	D300P	D336P	D378P
<b>RATINGS — SEA LEVEL TO 700 FT.</b>												
Rated Capacity (lbs-steam/hr. from and at 212°F)	3450	4313	5175	6900	8625	10350	12075	13800	17250	20700	24150	27600
Btu Output (1000 Btu/hr.)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
<b>APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 82% EFFICIENCY</b>												
Light Oil gph (140,000 Btu/gal)	29.2	36.4	43.7	58.3	72.9	87.5	102.1	116.6	145.8	175.0	204.1	233.3
Gas CFH (1000 Btu)	4082	5103	6124	8165	10206	12247	14280	16329	20415	24494	28576	32659
Gas (Therm/hr.)	40.8	51.0	61.2	81.7	102.1	122.5	142.8	163.3	204.2	245.0	285.8	326.6
<b>POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ)</b>												
Blower Motor hp	3	5	7-1/2	7-1/2	7-1/2	15	20	25	30	40	60	60
Separate Compressor Motor hp (Oil only)	**	**	**	3	3	—	7-1/2	7-1/2	7-1/2	7-1/2	7-1/2	15
Integral Oil/Air Motor hp (Oil only)	—	—	—	—	—	2	—	—	—	—	—	—
Oil Metering Pump Motor hp (Oil only)	—	—	—	—	—	—	1/2	3/4	3/4	3/4	3/4	1
Circulating Oil Pump Motor hp (Oil only)	1/3*	3/4*	3/4*	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
<b>BOILER DATA</b>												
Heating Surface sq.-ft. (Fireside)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

\* = Base rail mounted oil pump will be 3-phase voltage

\*\* = No air compressor required (pressure atomized system)

NOTE: All fractional hp motors will be single phase voltage except oil metering pump motor (3-phase); integral motors will be 3-phase voltage.

**Table A4-2. Model ICB Steam Boiler Ratings, 3-Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL Model ICB	FP-3	FP-3	FP-3	FP-4	FP-4	FP-4	FP-4	D175P	D210P	D252P	D300P	D336P
<b>RATINGS — SEA LEVEL TO 700 FT.</b>												
Rated Capacity (lbs-steam/hr. from and at 212°F)	3450	4313	5175	6900	8625	10350	12075	13800	17250	20700	24150	27600
Btu Output (1000 Btu/hr.)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
<b>APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 80% EFFICIENCY</b>												
Light Oil gph (140,000 Btu/gal)	29.9	37.5	45.0	60.0	74.5	89.5	104.5	119.5	149.5	179.5	209	239
Gas CFH (1000 Btu)	4184	5230	6280	8370	10460	12555	14650	16750	20925	25100	29300	33500
Gas (Therm/hr.)	41.8	52.3	62.8	83.7	104.6	125.5	146.5	167.5	209.3	251.0	293.0	335.0
<b>POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ)</b>												
Blower Motor hp	2	3	5	7-1/2	7-1/2	10	10	20	25	30	40	60
Separate Compressor Motor hp (Oil only)	**	**	**	3	3	3	3	5	5	7-1/2	7-1/2	7-1/2
Integral Oil/Air Motor hp (Oil only)	—	—	—	—	—	—	—	—	—	—	—	—
Oil Metering Pump Motor hp (Oil only)	—	—	—	—	—	—	—	1/2	3/4	3/4	3/4	3/4
Circulating Oil Pump Motor hp (Oil only)	1/3*	3/4*	3/4*	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
<b>BOILER DATA</b>												
Heating Surface sq.-ft. (Fireside)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

\* = Base rail mounted oil pump will be 3-phase voltage

\*\* = No air compressor required (pressure atomized system)

NOTE: All fractional hp motors will be single phase voltage except oil metering pump motor (3-phase); integral motors will be 3-phase voltage.



**Table A4-3. Model ICB Hot Water Boiler Ratings, 4-Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL Model ICB	FP-3	FP-3	FP-3	FP-4	FP-4	D145P	D175P	D210P	D252P	D300P	D336P	D378P
<b>RATINGS — SEA LEVEL TO 700 FT.</b>												
Btu Output (1000 Btu/hr.)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
<b>APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 82% EFFICIENCY</b>												
Light Oil gph (140,000 Btu/gal)	29.2	36.4	43.7	58.3	72.9	87.5	102.1	116.6	145.8	175.0	204.1	233.3
Gas CFH (1000 Btu)	4082	5103	6124	8165	10206	12247	14280	16329	20415	24494	28576	32659
Gas (Therm/hr.)	40.8	51.0	61.2	81.7	102.1	122.5	142.8	163.3	204.2	245.0	285.8	326.6
<b>POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ)</b>												
Blower Motor hp	3	5	7-1/2	7-1/2	7-1/2	15	20	25	30	40	60	60
Separate Compressor Motor hp (Oil only)	**	**	**	3	3	—	7-1/2	7-1/2	7-1/2	7-1/2	7-1/2	15
Integral Oil/Air Motor hp (Oil only)	—	—	—	—	—	2	—	—	—	—	—	—
Oil Metering Pump Motor hp (Oil only)	—	—	—	—	—	—	1/2	3/4	3/4	3/4	3/4	1
Circulating Oil Pump Motor hp (Oil only)	1/3*	3/4*	3/4*	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
<b>BOILER DATA</b>												
Heating Surface sq.-ft. (Fireside)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

\* = Base rail mounted oil pump will be 3-phase voltage

\*\* = No air compressor required (pressure atomized system)

NOTE: All fractional hp motors will be single phase voltage except oil metering pump motor (3-phase); integral motors will be 3-phase voltage.

**Table A4-4. Model ICB Hot Water Boiler Ratings, 3-Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL Model ICB	FP-3	FP-3	FP-3	FP-4	FP-4	FP-4	FP-4	D175P	D210P	D252P	D300P	D336P
<b>RATINGS — SEA LEVEL TO 700 FT.</b>												
Btu Output (1000 Btu/hr.)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
<b>APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 80% EFFICIENCY</b>												
Light Oil gph (140,000 Btu/gal)	29.9	37.5	45.0	60.0	74.5	89.5	104.5	119.5	149.5	179.5	209	239
Gas CFH (1000 Btu)	4184	5230	6280	8370	10460	12555	14650	16750	20925	25100	29300	33500
Gas (Therm/hr.)	41.8	52.3	62.8	83.7	104.6	125.5	146.5	167.5	209.3	251.0	293.0	335.0
<b>POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ)</b>												
Blower Motor hp	2	3	5	7-1/2	7-1/2	10	10	20	25	30	40	60
Separate Compressor Motor hp (Oil only)	**	**	**	3	3	3	3	5	5	7-1/2	7-1/2	7-1/2
Integral Oil/Air Motor hp (Oil only)	—	—	—	—	—	—	—	—	—	—	—	—
Oil Metering Pump Motor hp (Oil only)	—	—	—	—	—	—	—	1/2	3/4	3/4	3/4	3/4
Circulating Oil Pump Motor hp (Oil only)	1/3*	3/4*	3/4*	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
<b>BOILER DATA</b>												
Heating Surface sq.-ft. (Fireside)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

\* = Base rail mounted oil pump will be 3-phase voltage

\*\* = No air compressor required (pressure atomized system)

NOTE: All fractional hp motors will be single phase voltage except oil metering pump motor (3-phase); integral motors will be 3-phase voltage.

**Table A4-5. Model ICB-LE Steam Boiler Ratings, 4 Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL	LND54P	LND84P	LND105P	LND125P	LND145P	LND175P	LND210P	LND252P	LND300P	LND315P	LND378P	LND420P
RATINGS - SEA LEVEL TO 700 FT.												
Rated Capacity (lbs-steam/hr from and at 212 °F)	3450	4313	5175	6900	8625	10350	12075	13800	17250	20700	24150	27600
Btu Output (1000 Btu/hr)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 82% EFFICIENCY												
Light Oil gph (140,000 Btu/gal)	29.2	36.4	43.7	58.3	72.9	87.5	102.1	116.6	145.8	175.0	204.1	233.3
Gas CFH (1000 Btu)	4082	5103	6124	8165	10206	12247	14280	16329	20415	24494	28576	32659
Gas (Therm/hr)	40.8	51.0	61.2	81.7	102.1	122.5	142.8	163.3	204.2	245.0	285.8	326.6
POWER REQUIREMENTS - SEA LEVEL TO 700 FT. (60 HZ)												
Blower Motor hp	5	7 1/2	10	15	15	20	25	30	40	60	60	60
Separate Compressor Motor hp (Oil only)	-	-	-	-	-	5	5	7 1/2	7 1/2	7 1/2	15	15
Integral Oil/Air Motor hp (Oil only)	1	1	1	1	2	-	-	-	-	-	-	-
Oil Metering Pump Motor hp (Oil only)	-	-	-	-	-	1/2	3/4	3/4	3/4	3/4	1	1
Circulating Oil Pump Motor hp (Oil only)	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
BOILER DATA												
Heating Surface sq-ft. (Fireside)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

**Table A4-6. Model ICB-LE Steam Boiler Ratings, 3 Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL	LND54P	LND63P	LND84P	LND105P	LND145S	LND145P	LND175P	LND210P	LND252P	LND300P	LND315P	LND378P
RATINGS - SEA LEVEL TO 700 FT.												
Rated Capacity (lbs-steam/hr from and at 212 °F)	3450	4313	5175	6900	8625	10350	12075	13800	17250	20700	24150	27600
Btu Output (1000 Btu/hr)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 80% EFFICIENCY												
Light Oil gph (140,000 Btu/gal)	29.9	37.5	45.0	60.0	74.5	89.5	104.5	119.5	149.5	179.5	209	239
Gas CFH (1000 Btu)	4184	5230	6280	8370	10460	12555	14650	16750	20925	25100	29300	33500
Gas (Therm/hr)	41.8	52.3	62.8	83.7	104.6	125.5	146.5	167.5	209.3	251.0	293.0	335.0
POWER REQUIREMENTS - SEA LEVEL TO 700 FT. (60 HZ)												
Blower Motor hp	5	5	7 1/2	10	15	15	20	25	30	40	60	60
Separate Compressor Motor hp (Oil only)	-	-	-	-	-	-	5	5	7 1/2	7 1/2	7 1/2	15
Integral Oil/Air Motor hp (Oil only)	1	1	1	1	2	2	-	-	-	-	-	-
Oil Metering Pump Motor hp (Oil only)	-	-	-	-	-	-	1/2	3/4	3/4	3/4	3/4	1
Circulating Oil Pump Motor hp (Oil only)	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
BOILER DATA												
Heating Surface sq-ft. (Fireside)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

**Table A4-7. Model ICB-LE Hot Water Ratings, 4 Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL	LND54P	LND84P	LND105P	LND125P	LND145P	LND175P	LND210P	LND252P	LND300P	LND315P	LND378P	LND420P
<b>RATINGS - SEA LEVEL TO 700 FT.</b>												
Btu Output (1000 Btu/hr)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
<b>APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 82% EFFICIENCY</b>												
Light Oil gph (140,000 Btu/hr)	29.2	36.4	43.7	58.3	72.9	87.5	102.1	116.6	145.8	175.0	204.1	233.3
Gas CFH (1000 Btu)	4082	5103	6124	8165	10206	12247	14280	16329	20415	24494	28576	32659
Gas (Therm/hr)	40.8	51.0	61.2	81.7	102.1	122.5	142.8	163.3	204.2	245.0	285.8	326.6
<b>POWER REQUIREMENTS - SEA LEVEL TO 700 FT. (60 HZ)</b>												
Blower Motor hp	5	7 1/2	10	15	15	20	25	30	40	60	60	60
Separate Compressor Motor hp (Oil only)	-	-	-	-	-	5	5	7 1/2	7 1/2	7 1/2	15	15
Integral Oil/Air Motor hp (Oil only)	1	1	1	1	2	-	-	-	-	-	-	-
Oil Metering Pump Motor hp (Oil only)	-	-	-	-	-	1/2	3/4	3/4	3/4	3/4	1	1
Circulating Oil Pump Motor hp (Oil only)	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
<b>BOILER DATA</b>												
Heating Surface sq-ft. (Fire)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

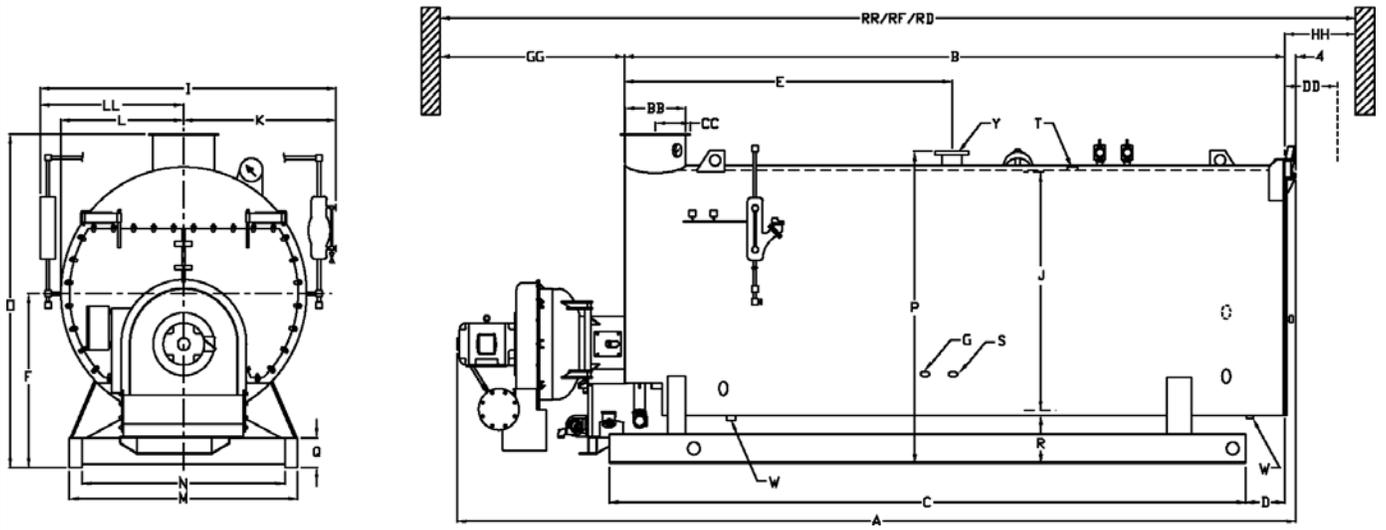
NOTE: All fractional hp motors will be single phase voltage except oil metering pump motor (3-phase); integral motors will be 3-phase voltage.

**Table A4-8. Model ICB-LE Hot Water Ratings, 3 Pass**

BOILER H.P.	100	125	150	200	250	300	350	400	500	600	700	800
BURNER MODEL	LND54P	LND63P	LND84P	LND105P	LND145S	LND145P	LND175P	LND210P	LND252P	LND300P	LND315P	LND378P
<b>RATINGS - SEA LEVEL TO 700 FT.</b>												
Btu Output (1000 Btu/hr)	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23433	26780
<b>APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY BASED ON NOMINAL 80% EFFICIENCY</b>												
Light Oil gph (140,000 Btu/hr)	29.9	37.5	45.0	60.0	74.5	89.5	104.5	119.5	149.5	179.5	209	239
Gas CFH (1000 Btu)	4184	5230	6280	8370	10460	12555	14650	16750	20925	25100	29300	33500
Gas (Therm/hr)	41.8	52.3	62.8	83.7	104.6	125.5	146.5	167.5	209.3	251.0	293.0	335.0
<b>POWER REQUIREMENTS - SEA LEVEL TO 700 FT. (60 HZ)</b>												
Blower Motor hp	5	5	7 1/2	10	15	15	20	25	30	40	60	60
Separate Compressor Motor hp (Oil only)	-	-	-	-	-	-	5	5	7 1/2	7 1/2	7 1/2	15
Integral Oil/Air Motor hp (Oil only)	1	1	1	1	2	2	-	-	-	-	-	-
Oil Metering Pump Motor hp (Oil only)	-	-	-	-	-	-	1/2	3/4	3/4	3/4	3/4	1
Circulating Oil Pump Motor hp (Oil only)	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	1	1
<b>BOILER DATA</b>												
Heating Surface sq-ft. (Fire)	353	438	555	729	885	1055	1384	1522	1734	2094	3244	3641

NOTE: All fractional hp motors will be single phase voltage except oil metering pump motor (3-phase); integral motors will be 3-phase voltage.

4-PASS "ICB" STANDARD STEAM BOILERS



3-PASS "ICB" STANDARD STEAM BOILERS

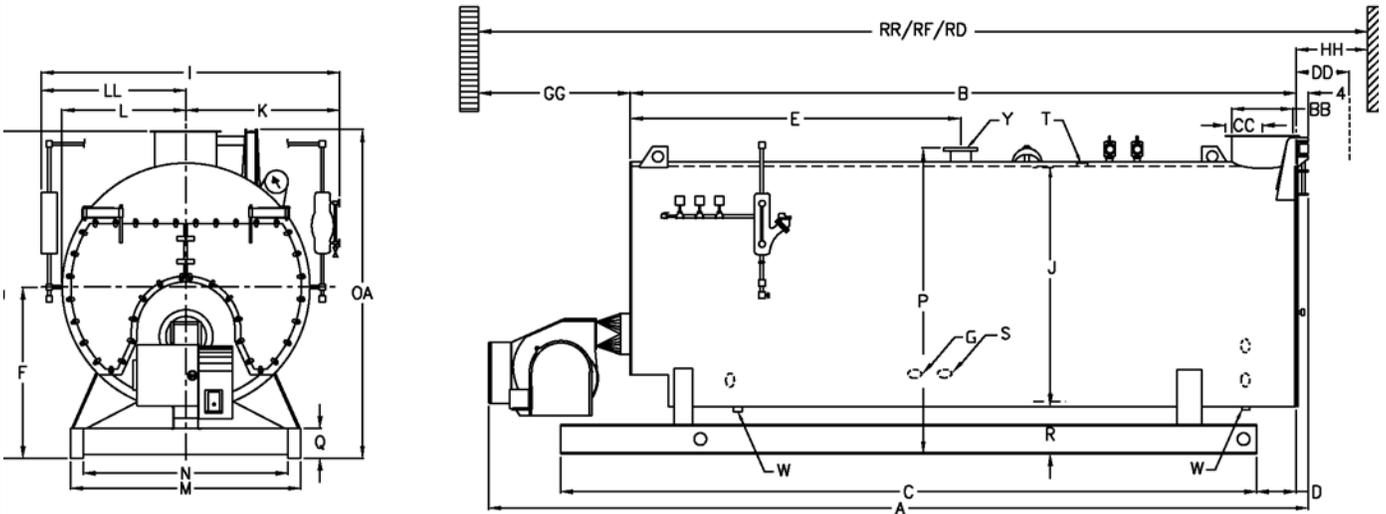


Figure A4-1. Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional)

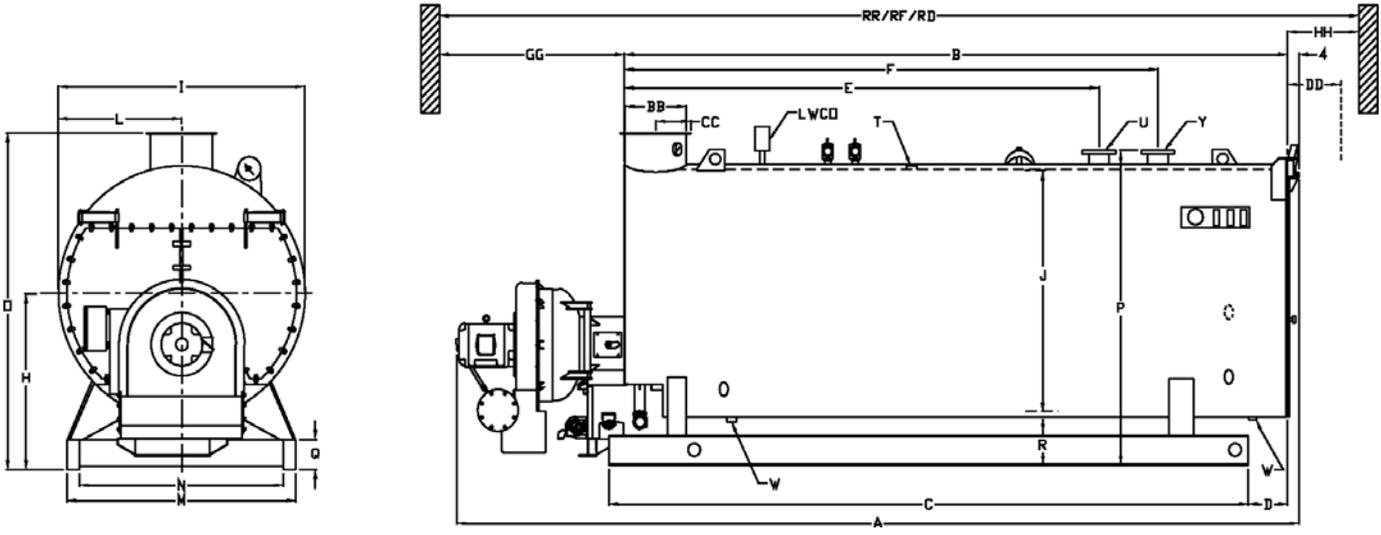
**Table A4-9. Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass**

BOILER H.P.	DIM	100	125	150	200	250	300	350	400	500	600	700	800
<b>LENGTHS</b>													
Overall (3-Pass)	A	171"	197"	195"	243-1/2"	208-1/2"	234-1/2"	237-1/2"	263"	255"	290-1/2"	281-1/2"	306-1/2"
Overall (4-Pass)	A	171"	197"	195"	243-1/2"	208-1/2"	241"	247"	268"	257-1/2"	290-1/2"	284-1/2"	312"
Shell	B	127-7/8"	153-7/8"	151-7/8"	192-7/8"	160-7/8"	186-7/8"	189-7/8"	205-7/8"	195-3/4"	228-3/4"	219-7/8"	241-7/8"
Base Frame	C	124-3/8"	150-3/8"	148-3/8"	189-3/8"	157-3/8"	183-3/8"	184-3/8"	200-3/8"	187-1/4"	220-1/4"	211-3/8"	233-3/8"
Base Frame to Rear Flange	D	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	14-1/2"	14-1/2"	14-1/2"	14-1/2"
Flange to Steam Nozzle	E	55-7/8"	61-7/8"	65-7/8"	77-7/8"	68-7/8"	80-7/8"	78-7/8"	94-7/8"	82-3/4"	106-3/4"	98-7/8"	111-7/8"
<b>WIDTHS</b>													
Overall	I	80"	80"	85"	85"	97"	97"	103"	103"	117"	117"	131"	131"
I.D. Boiler	J	55"	55"	60"	60"	72"	72"	78"	78"	92"	92"	106"	106"
Center to Water Column	K	42-1/2"	42-1/2"	45"	45"	51"	51"	54"	54"	61"	61"	68"	68"
Center to Lagging	L	30-1/2"	30-1/2"	33"	33"	39"	39"	42"	42"	49"	49"	56"	56"
Center to Auxiliary LWCO	LL	37-1/2"	37-1/2"	40"	40"	46"	46"	49"	49"	56"	56"	63"	63"
Base Outside	M	47-1/2"	47-1/2"	52-1/2"	52-1/2"	58-1/2"	58-1/2"	64"	64"	68"	68"	74-3/4"	74-3/4"
Base Inside	N	39-1/2"	39-1/2"	44-1/2"	44-1/2"	50-1/2"	50-1/2"	56"	56"	55"	55"	61-3/4"	61-3/4"
<b>HEIGHTS</b>													
Base to Boiler Centerline	F	44-1/2"	44-1/2"	46"	46"	54"	54"	56"	56"	65-1/2"	65-1/2"	71"	71"
Base to Vent Outlet	O	80-3/4"	80-3/4"	85"	85"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to Rear Door Davit	OA	82-1/4"	82-1/4"	86-1/2"	86-1/2"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to Steam Outlet	P	78-3/8"	78-3/8"	82-3/8"	82-3/8"	96-1/4"	96-1/4"	101-1/2"	101-1/2"	118"	118"	130-5/8"	130-5/8"
Base Frame	Q	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"
Base to Bottom Boiler	R	16"	16"	16"	16"	17"	17"	17"	17"	19"	19"	17-1/2"	17-1/2"
<b>CONNECTIONS</b>													
Chemical Feed	G	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
Feedwater Inlet (Both Sides)	S	1-1/4"	1-1/2"	1-1/2"	2"	2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"
Steam Nozzle (15 psig) 150 LB. FLG.	Y	8"	8"	8"	10"	12"	12"	12"	12"	12"	12"	12"	12"
Steam Nozzle (150 psig) 300 LB. FLG.	Y	4"	4"	4"	4"	6"	6"	6"	6"	8"	8"	8"	8"
Drain — Front & Rear (15 psig)	W	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
Blowdown-Front & Rear(150 psig)	W	1-1/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"
Surface Blowoff (150 psig only)	T	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
Vent Stack Diameter (Flanged)	BB	16"	16"	16"	16"	20"	20"	20"	20"	24"	24"	24"	24"
Flange to Center Vent	CC	9-1/8"	9-1/8"	9-1/8"	9-1/8"	10-5/8"	10-5/8"	10-5/8"	10-5/8"	12-5/8"	12-5/8"	12-5/8"	12-5/8"
<b>MINIMUM CLEARANCES</b>													
Rear Door Swing	DD	34"	34"	36"	36"	43"	43"	46"	46"	53"	53"	60"	60"
Tube Removal — Front	GG	95"	121"	119"	160"	122"	148"	149"	165"	146"	179"	170"	192"
Tube Removal — Rear	HH	96-1/2"	122-1/2"	120-1/2"	161-1/2"	126-1/2"	152-1/2"	150-1/2"	166-1/2"	148-1/2"	181-1/2"	172-1/2"	194-1/2"
<b>MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM:</b>													
Front of Boiler	RF	257"	309"	307"	389"	326"	378"	385"	417"	395"	461"	450"	494"
Rear of Boiler (3-Pass)	RR	303-1/2"	355-1/2"	351-1/2"	441"	371"	423"	427"	468-1/2"	441-1/2"	510"	492"	539"
Rear of Boiler (4-Pass)	RR	303-1/2"	355-1/2"	351-1/2"	441"	371"	429-1/2"	436-1/2"	473-1/2"	444"	510"	495"	544-1/2"
Thru Window or Door (3-Pass)	RD	237"	263"	263"	311-1/2"	283-1/2"	309-1/2"	315-1/2"	341"	340"	375-1/2"	373-1/2"	398-1/2"
Thru Window or Door (4-Pass)	RD	237"	263"	263"	311-1/2"	283-1/2"	316"	325"	346"	342-1/2"	375-1/2"	376-1/2"	404"
<b>WEIGHTS</b>													
Normal Water Weight (lbs)	—	5,140	6,515	7,184	9,612	10,175	12,278	13,192	14,593	17,870	21,780	26,638	30,026
Shipping Weight — (15 psig) (lbs)	—	10,123	11,303	11,931	14,106	16,958	19,051	22,344	23,918	28,934	33,189	41,179	45,226
Shipping Weight — (150 psig) (lbs)	—	10,877	12,220	13,112	15,637	17,613	20,404	25,344	27,175	31,990	36,780	45,724	50,244
Shipping Weight — (200 psig) (lbs)	—	11,420	12,850	14,000	16,575	19,400	22,400	25,810	25,740	33,710	39,100	50,025	55,000

NOTE: Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for actual option requirements.



4-PASS "ICB" STANDARD HOT WATER BOILERS



3-PASS "ICB" STANDARD HOT WATER BOILERS

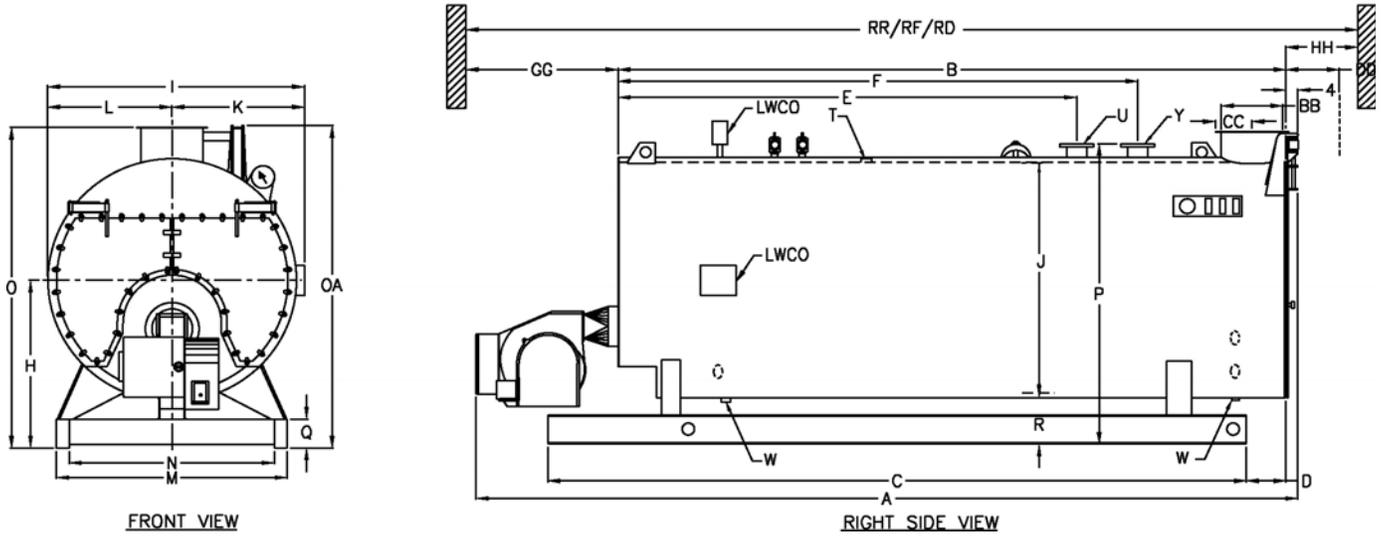


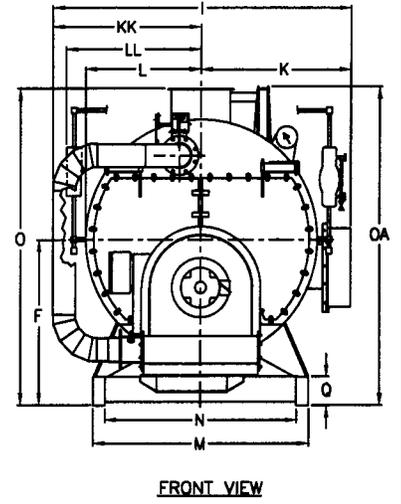
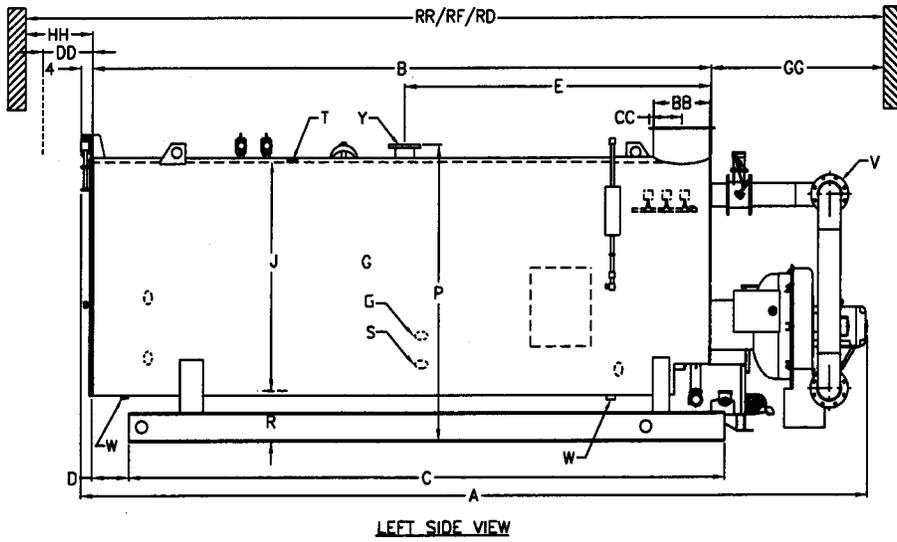
Figure A4-2. Model ICB Hot Water Boiler Dimensions, 4-Pass and 3-Pass (Optional)

**Table A4-10. Model ICB Hot Water Boiler Dimensions, 4-Pass and 3-Pass**

BOILER H.P.	DIM	100	125	150	200	250	300	350	400	500	600	700	800
<b>LENGTHS</b>													
Overall (3-Pass)	A	171"	197"	195"	243-1/2"	208-1/2"	234-1/2"	237-1/2"	263"	255"	290-1/2"	281-1/2"	306-1/2"
Overall (4-Pass)	A	171"	197"	195"	243-1/2"	208-1/2"	241"	247"	268"	257-1/2"	290-1/2"	284-1/2"	312"
Shell	B	127-7/8"	153-7/8"	151-7/8"	192-7/8"	160-7/8"	186-7/8"	189-7/8"	205-7/8"	195-3/4"	228-3/4"	219-7/8"	241-7/8"
Base Frame	C	124-3/8"	150-3/8"	148-3/8"	189-3/8"	157-3/8"	183-3/8"	184-3/8"	200-3/8"	187-1/4"	220-1/4"	211-3/8"	233-3/8"
Base Frame to Rear Flange	D	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	14-1/2"	14-1/2"	14-1/2"	14-1/2"
Flange to Return	E	82"	98"	95-5/8"	136-5/8"	101-5/8"	115-5/8"	117-5/8"	132-5/8"	125-1/2"	143-1/2"	139-1/2"	161-1/2"
Flange to Outlet	F	97-1/2"	123"	120-5/8"	161-5/8"	127-5/8"	141-5/8"	143-5/8"	158-5/8"	152-1/2"	175"	171"	193"
<b>WIDTHS</b>													
Overall	I	65"	65"	70"	70"	82"	82"	88"	88"	102"	102"	116"	116"
I.D. Boiler	J	55"	55"	60"	60"	72"	72"	78"	78"	92"	92"	106"	106"
Center to LWCO Controller	K	34-1/2"	34-1/2"	37"	37"	43"	43"	46"	46"	53"	53"	60"	60"
Base Outside	M	47-1/2"	47-1/2"	52-1/2"	52-1/2"	58-1/2"	58-1/2"	64"	64"	68"	68"	74-3/4"	74-3/4"
Base Inside	N	39-1/2"	39-1/2"	44-1/2"	44-1/2"	50-1/2"	50-1/2"	56"	56"	55"	55"	61-3/4"	61-3/4"
<b>HEIGHTS</b>													
Base to Boiler Centerline	H	44-1/2"	44-1/2"	46"	46"	54"	54"	56"	56"	65-1/2"	65-1/2"	71"	71"
Base to Vent Outlet	O	80-3/4"	80-3/4"	85"	85"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to Rear Door Davit	OA	82-1/4"	82-1/4"	86-1/2"	86-1/2"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to Return/Outlet	P	78-3/8"	78-3/8"	82-3/8"	82-3/8"	96-1/4"	96-1/4"	101-1/2"	101-1/2"	118"	118"	130-5/8"	130-5/8"
Base Frame	Q	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"
Base to Bottom Boiler	R	16"	16"	16"	16"	17"	17"	17"	17"	19"	19"	17-1/2"	17-1/2"
<b>CONNECTIONS</b>													
Water Return (150 lb Flange)	U	4"	6"	6"	6"	8"	8"	8"	10"	10"	12"	12"	12"
Water Outlet (150 lb Flange)	Y	4"	6"	6"	6"	8"	8"	8"	10"	10"	12"	12"	12"
Drain — Front & Rear	W	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
Air Vent	T	1-1/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"
Vent Stack Diameter (Flanged)	BB	16"	16"	16"	16"	20"	20"	20"	20"	24"	24"	24"	24"
Flange to Center Vent	CC	9-1/8"	9-1/8"	9-1/8"	9-1/8"	10-5/8"	10-5/8"	10-5/8"	10-5/8"	12-5/8"	12-5/8"	12-5/8"	12-5/8"
<b>MINIMUM CLEARANCES</b>													
Rear Door Swing	DD	34"	34"	36"	36"	43"	43"	46"	46"	53"	53"	60"	60"
Tube Removal — Front	GG	95"	121"	119"	160"	122"	148"	149"	165"	146"	179"	170"	192"
Tube Removal — Rear	HH	96-1/2"	122-1/2"	120-1/2"	161-1/2"	126-1/2"	152-1/2"	150-1/2"	166-1/2"	148-1/2"	181-1/2"	172-1/2"	194-1/2"
<b>MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM:</b>													
Front of Boiler	RF	257"	309"	307"	389"	326"	378"	385"	417"	395"	461"	450"	494"
Rear of Boiler (3-Pass)	RR	303-1/2"	355-1/2"	351-1/2"	441"	371"	423"	427"	468-1/2"	441-1/2"	510"	492"	539"
Rear of Boiler (4-Pass)	RR	303-1/2"	355-1/2"	351-1/2"	441"	371"	429-1/2"	436-1/2"	473-1/2"	444"	510"	495"	544-1/2"
Thru Window or Door (3-Pass)	RD	237"	263"	263"	311-1/2"	283-1/2"	309-1/2"	315-1/2"	341"	340"	375-1/2"	373-1/2"	398-1/2"
Thru Window or Door (4-Pass)	RD	237"	263"	263"	311-1/2"	283-1/2"	316"	325"	346"	342-1/2"	375-1/2"	376-1/2"	404"
<b>WEIGHTS</b>													
Normal Water Weight (lbs)	—	5,848	7,397	8,378	11,180	11,940	14,380	16,190	17,884	22,572	27,431	32,991	37,120
Shipping Weight — (30psig) (lbs)	—	10,123	11,303	11,931	14,106	16,958	19,051	22,344	23,918	28,934	33,189	41,179	45,226
Shipping Weight — (125psig) (lbs)	—	10,238	11,418	13,153	15,679	18,609	21,270	24,522	26,631	32,175	36,972	47,122	51,782

NOTE: Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for actual option requirements.

4-PASS "ICB" LOW NOx STEAM BOILERS



3-PASS "ICB" LOW NOx STEAM BOILERS

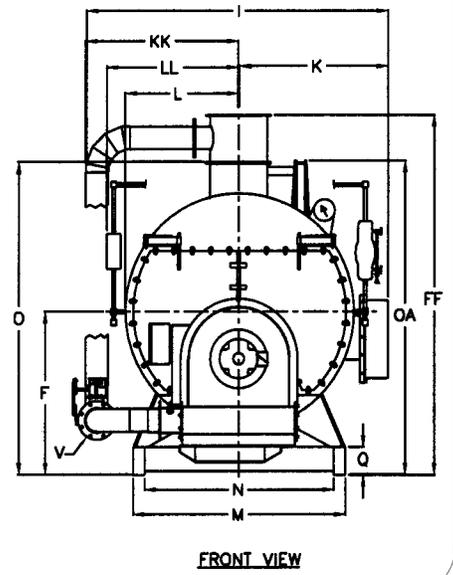
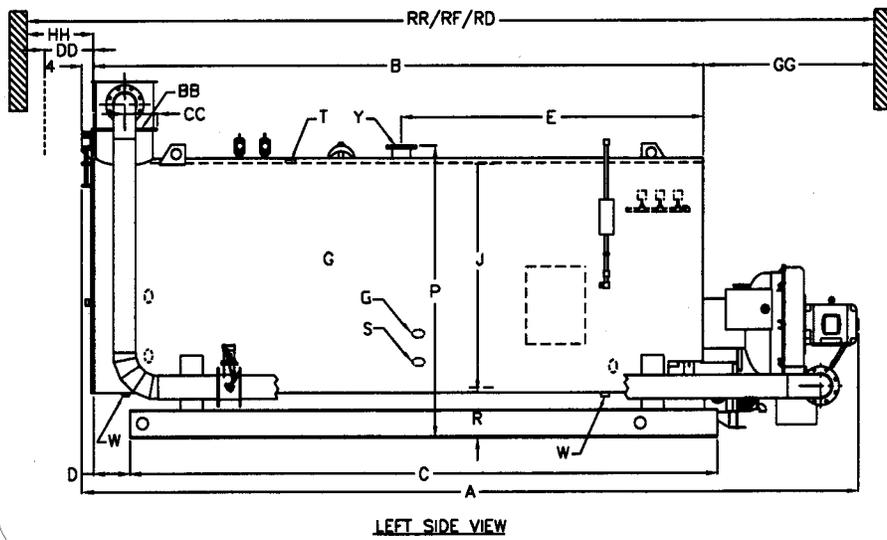


Figure A4-3. Model ICB-LE Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional)

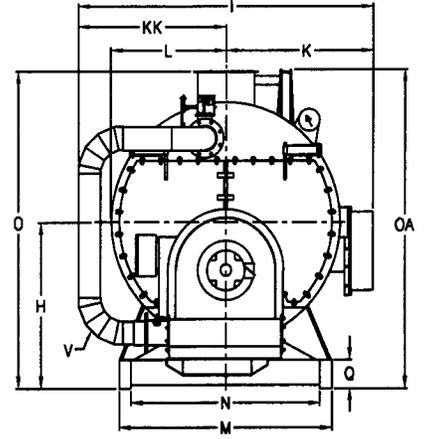
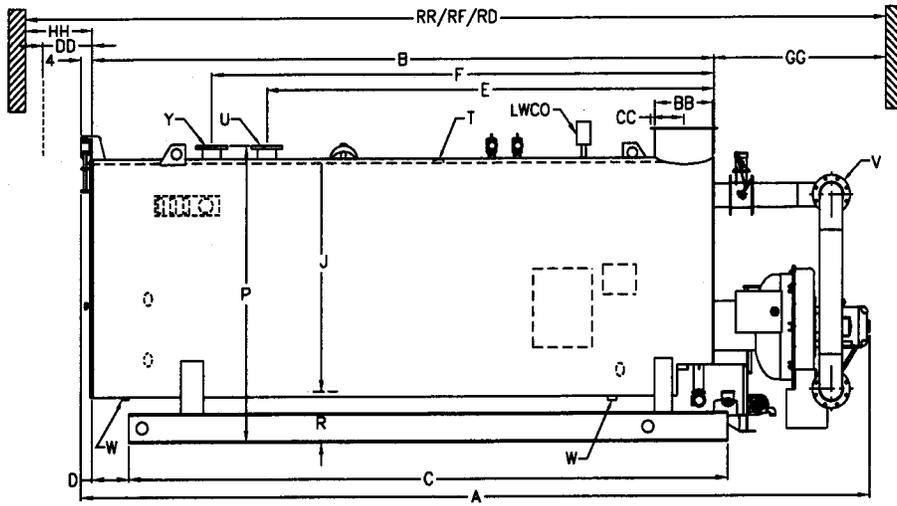
Table A4-11. Model ICB-LE Steam Boiler Dimensions, 4-Pass and 3-Pass

BOILER H.P.	DIM	100	125	150	200	250	300	350	400	500	600	700	800
<b>LENGTHS</b>													
Overall (3-Pass)	A	173"	199"	199"	240"	215"	241"	247"	268"	257-1/2"	290-1/2"	285-1/2"	312"
Overall (4-Pass)	A	173"	201"	199"	240"	215"	244"	252"	270-1/2"	257-1/2"	293-1/2"	290"	312"
Shell	B	127-7/8"	153-7/8"	151-7/8"	192-7/8"	160-7/8"	186-7/8"	189-7/8"	205-7/8"	195-3/4"	228-3/4"	219-7/8"	241-7/8"
Base Frame	C	124-3/8"	150-3/8"	148-3/8"	189-3/8"	157-3/8"	183-3/8"	184-3/8"	200-3/8"	187-1/4"	220-1/4"	211-3/8"	233-3/8"
Base Frame to Rear Flange	D	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	14-1/2"	14-1/2"	14-1/2"	14-1/2"
Flange to Steam Nozzle	E	55-7/8"	61-7/8"	65-7/8"	77-7/8"	68-7/8"	80-7/8"	78-7/8"	94-7/8"	82-3/4"	106-3/4"	98-7/8"	111-7/8"
<b>WIDTHS</b>													
Overall (3-Pass)	I	87"	87"	92"	92"	104"	106"	112"	112"	126"	128"	142"	142"
Overall (4-Pass)	I	82"	82"	87"	87"	100"	100"	109"	109"	122"	122"	133"	133"
I.D. Boiler	J	55"	55"	60"	60"	72"	72"	78"	78"	92"	92"	106"	106"
Center to Water Column	K	44-1/2"	44-1/2"	47"	47"	53"	53"	56"	56"	63"	63"	70"	70"
Center to Outside FGR Pipe (3-Pass)	KK	42-1/2"	42-1/2"	45"	45"	51"	53"	56"	56"	63"	65"	72"	72"
Center to Outside FGR Pipe (4-Pass)	KK	37"	37"	37"	37"	47"	47"	53"	53"	59"	59"	59"	59"
FGR Duct Size (3-Pass)	V	6"	6"	6"	6"	6"	8"	8"	8"	8"	10"	10"	10"
FGR Duct Size (4-Pass)	V	6"	6"	6"	6"	8"	8"	8"	8"	10"	10"	10"	10"
Center to Lagging	L	30-1/2"	30-1/2"	33"	33"	39"	39"	42"	42"	49"	49"	56"	56"
Center to Auxiliary LWCO	LL	37-1/2"	37-1/2"	40"	40"	46"	46"	49"	49"	56"	56"	63"	63"
Base Outside	M	47-1/2"	47-1/2"	52-1/2"	52-1/2"	58-1/2"	58-1/2"	64"	64"	68"	68"	74-3/4"	74-3/4"
Base Inside	N	39-1/2"	39-1/2"	44-1/2"	44-1/2"	50-1/2"	50-1/2"	56"	56"	55"	55"	61-3/4"	61-3/4"
<b>HEIGHTS</b>													
Base to Boiler Centerline	F	44-1/2"	44-1/2"	46"	46"	54"	54"	56"	56"	65-1/2"	65-1/2"	71"	71"
Base to Vent Outlet	O	80-3/4"	80-3/4"	85"	85"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to Rear Door Davit	OA	82-1/4"	82-1/4"	86-1/2"	86-1/2"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to FGR Stack Extension (3-Pass Only)	FF	94-3/4"	94-3/4"	99"	99"	118"	118"	123"	123"	142-1/2"	142-1/2"	155-5/8"	155-5/8"
Base to Steam Outlet	P	78-3/8"	78-3/8"	82-3/8"	82-3/8"	96-1/4"	96-1/4"	101-1/2"	101-1/2"	118"	118"	130-5/8"	130-5/8"
Base Frame	Q	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"
Base to Bottom Boiler	R	16"	16"	16"	16"	17"	17"	17"	17"	19"	19"	17-1/2"	17-1/2"
<b>CONNECTIONS</b>													
Chemical Feed	G	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
Feedwater Inlet (Both Sides)	S	1-1/4"	1-1/2"	1-1/2"	2"	2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"
Steam Nozzle (15 psig) 150 LB. FLG.	Y	8"	8"	8"	10"	10"	12"	12"	12"	12"	12"	12"	12"
Steam Nozzle (150 psig) 300 LB. FLG.	Y	4"	4"	4"	4"	6"	6"	6"	6"	8"	8"	8"	8"
Drain — Front & Rear (15 psig)	W	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
Blowdown-Front & Rear(150 psig)	W	1-1/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"
Surface Blowoff (150 psig only)	T	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
Vent Stack Diameter (Flanged)	BB	16"	16"	16"	16"	20"	20"	20"	20"	24"	24"	24"	24"
Flange to Center Vent	CC	9-1/8"	9-1/8"	9-1/8"	9-1/8"	10-5/8"	10-5/8"	10-5/8"	10-5/8"	12-5/8"	12-5/8"	12-5/8"	12-5/8"
<b>MINIMUM CLEARANCES</b>													
Rear Door Swing	DD	34"	34"	36"	36"	43"	43"	46"	46"	53"	53"	60"	60"
Tube Removal — Front	GG	95"	121"	119"	160"	122"	148"	149"	165"	146"	179"	170"	192"
Tube Removal — Rear	HH	96-1/2"	122-1/2"	120-1/2"	161-1/2"	126-1/2"	152-1/2"	150-1/2"	166-1/2"	148-1/2"	181-1/2"	172-1/2"	194-1/2"
<b>MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM:</b>													
Front of Boiler	RF	257"	309"	307"	389"	326"	378"	385"	417"	395"	461"	450"	494"
Rear of Boiler (3-Pass)	RR	305-1/2"	357-1/2"	355-1/2"	437-1/2"	377-1/2"	429-1/2"	436-1/2"	473-1/2"	444"	510"	496"	544-1/2"
Rear of Boiler (4-Pass)	RR	305-1/2"	359-1/2"	355-1/2"	437-1/2"	377-1/2"	432-1/2"	441-1/2"	476"	444"	513"	500-1/2"	544-1/2"
Thru Window or Door (3-Pass)	RD	239"	265"	267"	308"	290"	316"	325"	346"	342-1/2"	375-1/2"	376-1/2"	404"
Thru Window or Door (4-Pass)	RD	239"	267"	267"	308"	290"	319"	330"	348-1/2"	342-1/2"	378-1/2"	382"	404"
<b>WEIGHTS</b>													
Normal Water Weight	—	5,140	6,515	7,184	9,612	10,175	12,278	13,192	14,593	17,870	21,780	26,638	30,026
Shipping Weight — (15psig)	—	10,123	11,303	11,931	14,106	16,958	19,051	22,344	23,918	28,934	33,189	41,179	45,226
Shipping Weight — (150psig)	—	10,877	12,220	13,112	15,637	17,613	20,404	25,344	27,175	31,990	36,780	45,724	50,244

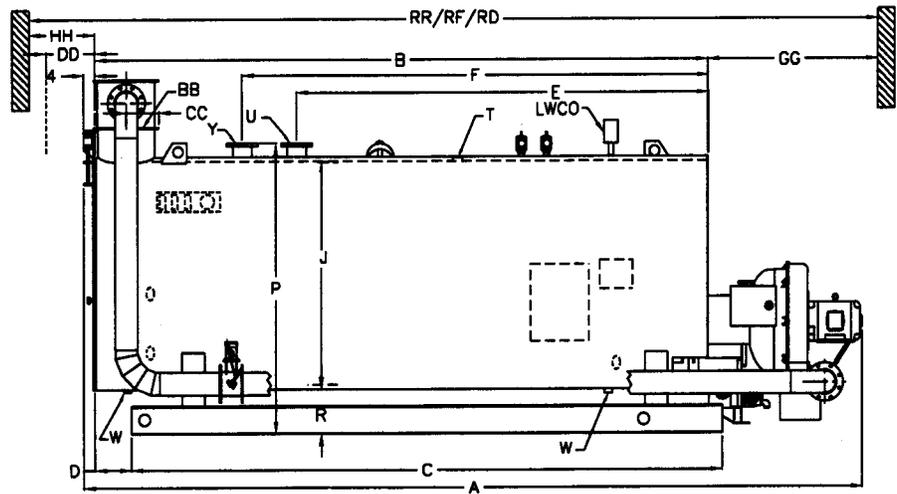
NOTE: Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for actual option requirements.



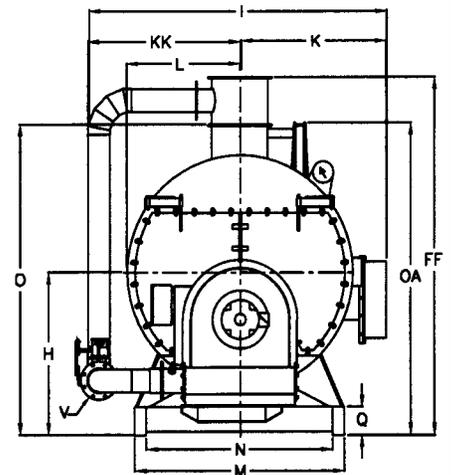
4-PASS "ICB" LOW NOx HOT WATER BOILERS



3-PASS "ICB" LOW NOx HOT WATER BOILERS



LEFT SIDE VIEW



FRONT VIEW

Figure A4-4. Model ICB-LE Hot Water Boiler Dimensions, 4-Pass and 3-Pass (Optional)

Table A4-12. Model ICB-LE Hot Water Boiler Dimensions, 4-Pass and 3-Pass

BOILER H.P.	DIM	100	125	150	200	250	300	350	400	500	600	700	800
<b>LENGTHS</b>													
Overall (3-Pass)	A	173"	199"	199"	240"	215"	241"	247"	268"	257-1/2"	290-1/2"	285-1/2"	312"
Overall (4-Pass)	A	173"	201"	199"	240"	215"	244"	252"	270-1/2"	257-1/2"	293-1/2"	290"	312"
Shell	B	127-7/8"	153-7/8"	151-7/8"	192-7/8"	160-7/8"	186-7/8"	189-7/8"	205-7/8"	195-3/4"	228-3/4"	219-7/8"	241-7/8"
Base Frame	C	124-3/8"	150-3/8"	148-3/8"	189-3/8"	157-3/8"	183-3/8"	184-3/8"	200-3/8"	187-1/4"	220-1/4"	211-3/8"	233-3/8"
Base Frame to Rear Flange	D	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	9-1/2"	14-1/2"	14-1/2"	14-1/2"	14-1/2"
Flange to Return	E	82"	98"	95-5/8"	136-5/8"	101-5/8"	115-5/8"	117-5/8"	132-5/8"	125-1/2"	143-1/2"	139-1/2"	161-1/2"
Flange to Outlet	F	97-1/2"	123"	120-5/8"	161-5/8"	127-5/8"	141-5/8"	143-5/8"	158-5/8"	152-1/2"	175"	171"	193"
<b>WIDTHS</b>													
Overall (3-Pass)	I	87"	87"	92"	92"	104"	106"	112"	112"	126"	128"	142"	142"
Overall (4-Pass)	I	81-1/2"	81-1/2"	84"	84"	100"	100"	109"	109"	122"	122"	129"	129"
I.D. Boiler	J	55"	55"	60"	60"	72"	72"	78"	78"	92"	92"	106"	106"
Center to Control Panel	K	44-1/2"	44-1/2"	47"	47"	53"	53"	56"	56"	63"	63"	70"	70"
Center to Outside FGR Pipe (3-Pass)	KK	42-1/2"	42-1/2"	45"	45"	51"	53"	56"	56"	63"	65"	72"	72"
Center to Outside FGR Pipe (4-Pass)	KK	37"	37"	37"	37"	47"	47"	53"	53"	59"	59"	59"	59"
FGR Duct Size (3-Pass)	V	6"	6"	6"	6"	6"	8"	8"	8"	8"	10"	10"	10"
FGR Duct Size (4-Pass)	V	6"	6"	6"	6"	8"	8"	8"	8"	10"	10"	10"	10"
Center to Lagging	L	30-1/2"	30-1/2"	33"	33"	39"	39"	42"	42"	49"	49"	56"	56"
Base Outside	M	47-1/2"	47-1/2"	52-1/2"	52-1/2"	58-1/2"	58-1/2"	64"	64"	68"	68"	74-3/4"	74-3/4"
Base Inside	N	39-1/2"	39-1/2"	44-1/2"	44-1/2"	50-1/2"	50-1/2"	56"	56"	55"	55"	61-3/4"	61-3/4"
<b>HEIGHTS</b>													
Base to Boiler Centerline	H	44-1/2"	44-1/2"	46"	46"	54"	54"	56"	56"	65-1/2"	65-1/2"	71"	71"
Base to Vent Outlet	O	80-3/4"	80-3/4"	85"	85"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to Rear Door Davit	OA	82-1/4"	82-1/4"	86-1/2"	86-1/2"	101"	101"	106"	106"	122-1/2"	122-1/2"	135-5/8"	135-5/8"
Base to FGR Stack Extension (3-Pass Only)	FF	94-3/4"	94-3/4"	99"	99"	118"	118"	123"	123"	142-1/2"	142-1/2"	155-5/8"	155-5/8"
Base to Return/Outlet	P	78-3/8"	78-3/8"	82-3/8"	82-3/8"	96-1/4"	96-1/4"	101-1/2"	101-1/2"	118"	118"	130-5/8"	130-5/8"
Base Frame	Q	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"	12"
Base to Bottom Boiler	R	16"	16"	16"	16"	17"	17"	17"	17"	19"	19"	17-1/2"	17-1/2"
<b>CONNECTIONS</b>													
Water Return (150 lb Flange)	U	4"	6"	6"	6"	8"	8"	8"	10"	10"	12"	12"	12"
Water Outlet (150 lb Flange)	Y	4"	6"	6"	6"	8"	8"	8"	10"	10"	12"	12"	12"
Drain — Front & Rear	W	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
Air Vent	T	1-1/4"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	2"	2"	2"	2"
Vent Stack Diameter (Flanged)	BB	16"	16"	16"	16"	20"	20"	20"	20"	24"	24"	24"	24"
Flange to Center Vent	CC	9-1/8"	9-1/8"	9-1/8"	9-1/8"	10-5/8"	10-5/8"	10-5/8"	10-5/8"	12-5/8"	12-5/8"	12-5/8"	12-5/8"
<b>MINIMUM CLEARANCES</b>													
Rear Door Swing	DD	34"	34"	36"	36"	43"	43"	46"	46"	53"	53"	60"	60"
Tube Removal — Front	GG	95"	121"	119"	160"	122"	148"	149"	165"	146"	179"	170"	192"
Tube Removal — Rear	HH	96-1/2"	122-1/2"	120-1/2"	161-1/2"	126-1/2"	152-1/2"	150-1/2"	166-1/2"	148-1/2"	181-1/2"	172-1/2"	194-1/2"
<b>MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM:</b>													
Front of Boiler	RF	257"	309"	307"	389"	326"	378"	385"	417"	395"	461"	450"	494"
Rear of Boiler (3-Pass)	RR	305-1/2"	357-1/2"	355-1/2"	437-1/2"	377-1/2"	429-1/2"	436-1/2"	473-1/2"	444"	510"	496"	544-1/2"
Rear of Boiler (4-Pass)	RR	305-1/2"	359-1/2"	355-1/2"	437-1/2"	377-1/2"	432-1/2"	441-1/2"	476"	444"	513"	500-1/2"	544-1/2"
Thru Window or Door (3-Pass)	RD	239"	265"	267"	308"	290"	316"	325"	346"	342-1/2"	375-1/2"	376-1/2"	404"
Thru Window or Door (4-Pass)	RD	239"	267"	267"	308"	290"	319"	330"	348-1/2"	342-1/2"	378-1/2"	382"	404"
<b>WEIGHTS</b>													
Normal Water Weight (lbs)	—	5,848	7,397	8,378	11,180	11,940	14,380	16,190	17,884	22,572	27,431	32,991	37,120
Shipping Weight — (30psig) (lbs)	—	10,123	11,303	11,931	14,106	16,958	19,051	22,344	23,918	28,934	33,189	41,179	45,226
Shipping Weight — (125psig) (lbs)	—	10,238	11,418	13,153	15,679	18,609	21,270	24,522	26,631	32,175	36,972	47,122	51,782

NOTE: Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for actual option requirements.



BOILER HP	ALL DIMENSIONS IN INCHES				
	A	B	C	D	E
100 - 125	31	45	47	70	34
150 - 200	33	47	52	80	36
250 - 300	39	53	58	86	43
350 - 400	42	56	61	92	46
500 - 600	49	65	69	106	53
700 - 800	56	74	80	121	60

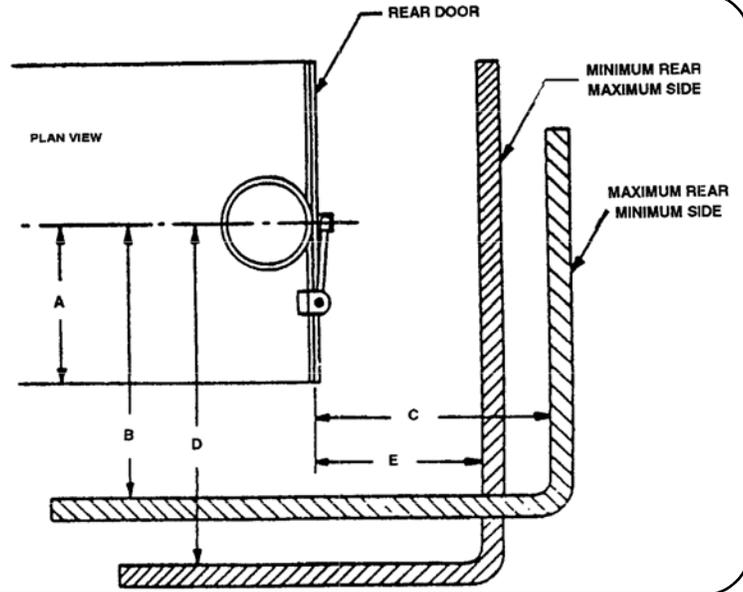
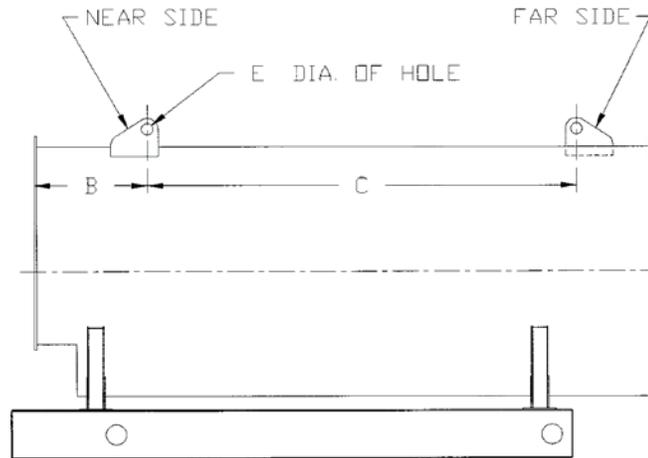
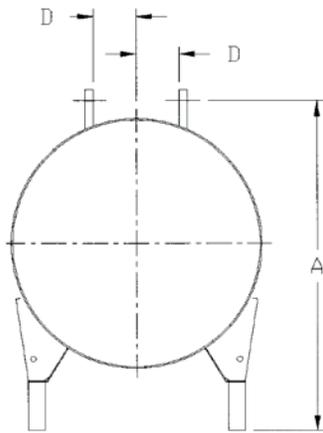


Figure A4-5. Space Required to Open Rear Head on Model ICB Boilers



BOILER HP	ALL DIMENSIONS IN INCHES				
	A	B	C	D	E
100	75-1/4	21-3/8	81-1/4	10	3
125	75-1/4	21-3/8	107-1/4	10	3
150	79-1/2	25-3/8	96-1/2	10	3
200	79-1/2	25-3/8	137-1/2	10	3
250	94	32	96-1/4	10	3
300	94	32	122-1/4	10	3
350	99	32	123-1/4	10	3
400	99	32	139-1/4	10	3
500	115-1/2	34	125-3/4	11	3
600	115-1/2	34	158-3/4	11	3
700	128-1/4	34	151	11	3
800	128-1/4	34	173	11	3

NOTE: A, B, and C dimensions may vary by 1 inch.

Figure A4-6. Model ICB Boilers Lifting Lug Location

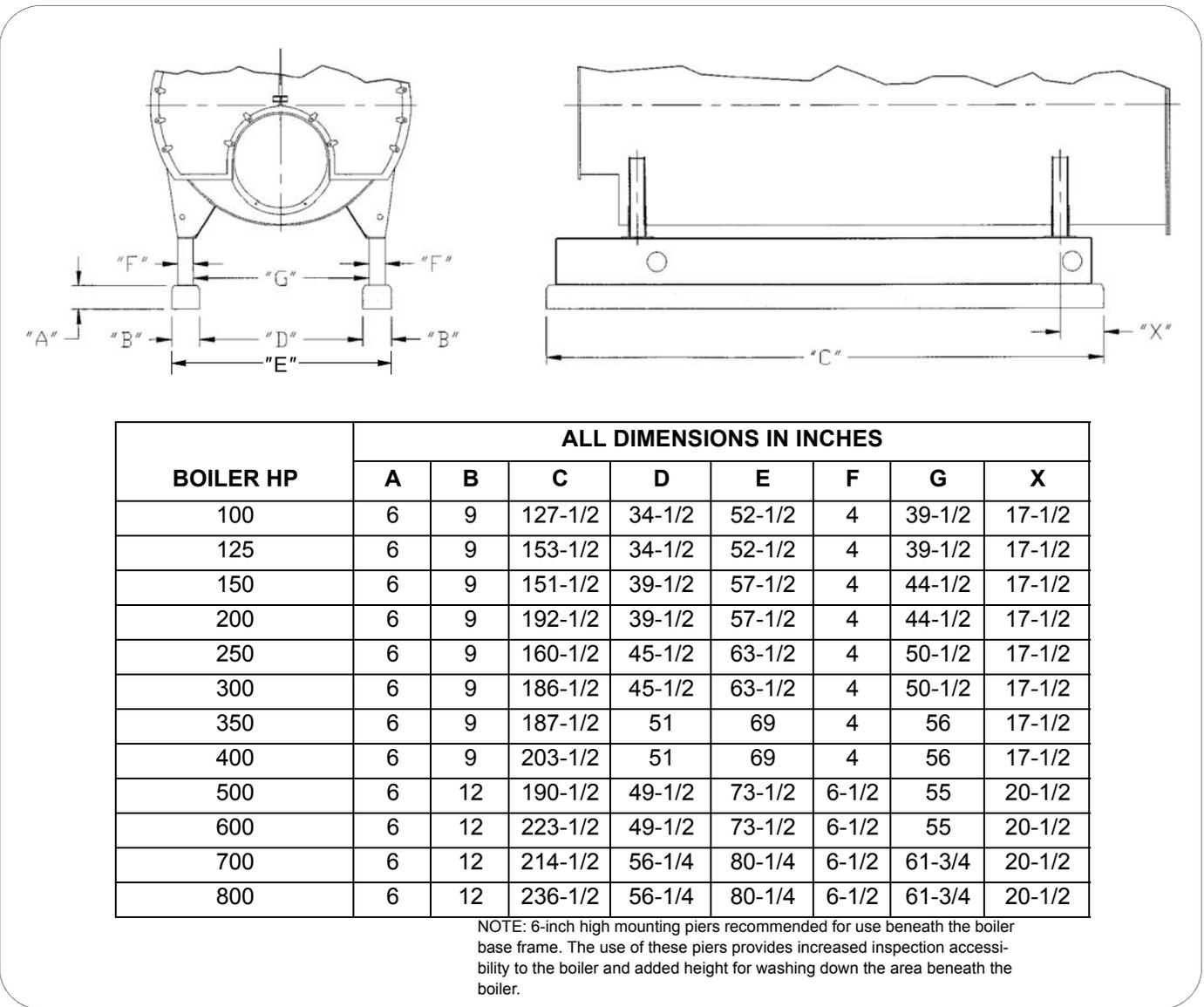


Figure A4-7. Model ICB Boiler Mounting Piers

**PERFORMANCE DATA**

Contact your local Cleaver-Brooks Authorized Representative for efficiencies or additional information.

Cleaver-Brooks ICB boilers are available with the standard burner package, or optional induced flue gas recirculation, refer to the Model ICB-LE for low NOx information.

**ENGINEERING DATA**

The following engineering information is provided for Model ICB Boilers. Additional detail is available from your local Cleaver-Brooks Authorized Representative.

Boiler Information

Table A4-13 shows steam volume and disengaging area for Model ICB Boilers.

Table A4-14 lists quantity and outlet size for safety valves supplied on Model ICB Steam Boilers.

Table A4-15 lists quantity and outlet size for relief valves supplied on Model ICB Hot Water Boilers.

Table A4-16 gives recommended steam nozzle sizes on Model ICB Boilers.

Table A4-17 shows recommended non-return valve sizes for Model ICB Boilers.

### Blowdown Water Requirements

Some local codes require blowdown tanks to be constructed in accordance with recommendations of the National Board of Boiler and Pressure Vessel Inspectors.

The National Board's recommendations base the size of the blowdown tank on the removal of at least 4 inches of water from the boiler.

Table A4-18 lists the approximate quantity of water represented by 4 inches of water at normal operating level for Cleaver-Brooks Model ICB Boilers.

### Burner/Control Information

#### ***Burner Characteristics***

Maximum altitude for standard burners is 700 feet. Contact your local Cleaver-Brooks Authorized Representative for higher altitude availability. Note that altitude correction and burner changes are required for higher altitudes which may alter dimensions, motor hp and gas pressures.

#### ***Gas-Fired Burners***

Table A4-19 lists minimum required gas pressure for altitude correction.

Table A4-21 shows minimum and maximum gas pressure requirements for Standard, FM and IRI ICB Boiler gas trains upstream of the gas pressure regulator.

For oversized or undersized gas trains or altitude above 700 feet, contact your local Cleaver-Brooks Authorized Representative.

### Fuel Connections — Gas

The local gas company should be consulted for requirements and authorization for installation and inspection of gas supply piping. Installation of gas supply piping and venting must be in accordance with all applicable engineering guidelines and regulatory codes. All connections made to the boiler should be arranged so that all components remain accessible for inspection, cleaning and maintenance.

A drip leg should be installed in the supply piping before the connection to the gas pressure regulator. The drip leg should be at least as large as the inlet fitting supplied with the boiler. Consideration must be given to both volume and pressure requirements when choosing gas supply piping size. Refer to the boiler dimension diagram provided by Cleaver-Brooks for the particular installation. Connections to the burner gas train should be made with a union, so that gas train components or the burner may be easily disconnected for inspection or service. Upon completion of the gas piping installation, the system should be checked for gas leakage and tight shutoff of all valves.

### Fuel Connections — Oil

Oil-fired burners are equipped with an oil pump, which draws fuel from a storage tank and supplies pressurized oil to the burner nozzle(s). The burner supply oil pump has a greater capacity than the burner requires for the maximum firing rate. Fuel not delivered to the nozzle is returned to the storage tank. A two-pipe (supply and return) oil system is recommended for all installations. Figure A4-8 shows a typical fuel oil supply arrangement. Oil lines must be sized for the burner and burner supply oil pump capacities.

The burner supply oil pump suction should not exceed 10" Hg. If a transfer pump is

used, it must have a pumping capacity at least equal to that of the burner pump(s). Supply pressure to the burner pump should not exceed 3 psig.

A strainer must be installed in the supply piping upstream of the burner supply pump in order to prevent entry of foreign material into the pump, fuel control valves, or burner nozzle(s). The strainer must be sized for the burner supply pump capacity. A strainer mesh of 150 microns (0.005") is recommended.

Install a check valve in the line to prevent draining of the oil suction line when the burner is not in operation. Location of the check valve varies with the system, but usually it is located as close as possible to the storage tank.

Installation of a vacuum gauge in the burner supply line between the burner oil pump and the strainer is recommended. Regular observation and recording of the gauge indication will assist in determining when the strainer needs servicing.

Upon completion of the oil piping installation, the system should be checked for oil or air leakage and tight shutoff of all valves.

### Boiler Room Information

Figure A4-9 shows typical boiler room length requirements.

Figure A4-10 shows typical boiler room width requirements.

### Stack Support Capabilities

100 – 800 hp Model ICB Boilers can support up to 2000 lbs without additional support.

100 – 800 hp Model ICB Boilers can be reinforced to support up to 3000 lbs.

### Boiler Room Combustion Air

When determining boiler room air requirements, the size of the room, air flow, and velocity of air must be reviewed as follows:

1. Size (area) and location of air supply openings in boiler room.
  - A. Two (2) permanent air supply openings in the outer walls of the boiler room are recommended. Locate one (1) at each end of the boiler room, preferably below a height of 7 feet. This allows air to sweep the length of the boiler.
  - B. Air supply openings can be louvered for weather protection, but they should not be covered with fine mesh wire, as this type of covering has poor air flow qualities and is subject to clogging by dust or dirt.
  - C. A vent fan in the boiler room is not recommended, as it could create a slight vacuum under certain conditions and cause variations in the quantity of combustion air. This can result in unsatisfactory burner performance. Under no condition should the total area of the air supply openings be less than one (1) square foot.
  - D. Size the openings by using the formula:

$$\text{Area (sq.-ft.)} = \text{CFM/FPM}$$

2. Amount of air required (cfm).
  - A. Combustion Air = Rated bhp x 8 cfm/bhp.
  - B. Ventilation Air = Maximum bhp x 2 cfm/bhp or a total of 10 cfm/bhp – up to 1000 feet elevation. Add 3 percent more per 1000 feet of added elevation.
3. Acceptable air velocity in Boiler Room (fpm).
  - A. From floor to (7) foot height – 250 fpm.

B. Above (7) foot height – 500 fpm.

Example: Determine the area of the boiler room air supply openings for (1) 300 hp boiler at 800 feet altitude. The air openings are to be 5 feet above floor level.

- Air required:  $300 \times 10 = 3000$  cfm (from 2B above).
- Air velocity: Up to 7 feet = 250 fpm (from 3 above).
- Area Required:  $\text{Area} = \text{cfm}/\text{fpm} = 3000/250 = 12$  sq.-ft. total.
- Area/Opening:  $12/2 = 6$  sq.-ft./opening (2 required).

**Notice**

**Consult local codes, which may supersede these requirements.**

**Stack/Breeching Size Criteria**

The design of the stack and breeching must provide the required draft at each boiler flue gas outlet. Proper draft is critical to burner performance.

Although constant pressure at the flue gas outlet of the Model ICB is not required, it is necessary to size the stack/breeching to limit flue gas pressure variation. The allowable pressure range is  $-0.25''$  W.C. to  $+0.25''$  W.C.

For additional information, please review Section I4, General Engineering Data (Stacks) and Section F, Stacks. Stack and breeching sizes should always be provided by a reputable stack supplier who will design the stack and breeching system based on the above criteria. Your local Cleaver-Brooks Authorized Representative is capable of assisting in your evaluation of the stack/breeching design.

**Table A4-13. Model ICB Steam Volume and Disengaging Areas**

BOILER HP	STEAM VOLUME CU-FT.		STEAM RELIEVING AREA SQ.-IN	
	HIGH PRESSURE (A)	LOW PRESSURE (B)	HIGH PRESSURE (A)	LOW PRESSURE (B)
100	11.2	16.5	3917	4363
125	14	20.5	4882	5443
150	19	26.3	5472	5990
200	25	34.6	7200	7891
250	27.8	41.4	6811	7618
300	33.2	49.4	8122	9072
350	47.9	66.3	9374	10238
400	52.6	72.9	10296	11246
500	74.5	94.9	11405	12168
600	89.6	114.2	13723	14630
700	100.8	127	14602	15538
800	112.7	142	16315	17381

NOTE:  
 1. Based on normal water level.  
 A. Based on 150 psig design pressure.  
 B. Based on 15 psig design pressure.

**Table A4-14. Model ICB Steam Boiler Safety Valve Outlet Size**

VALVE SETTING		15 PSIG STEAM		150 PSIG STEAM		200 PSIG STEAM		250 PSIG STEAM	
BOILER HP	NO. OF VALVES REQ'D	OUTLET SIZE (IN.)	NO. OF VALVES REQ'D	OUTLET SIZE (IN.)	NO. OF VALVES REQ'D	OUTLET SIZE (IN.)	NO. OF VALVES REQ'D	OUTLET SIZE (IN.)	
100	1	2-1/2	1	1-1/2	1	1-1/2	1	1-1/4	
125	1	2-1/2	1	2	1	(1) 1-1/2	1	1 1/2	
150	1	3	2	(1) 1-1/2 (1) 1-1/4	2	1-1/4 (1) 1	2	1	
200	2	(1) 2-1/2 (1) 2	2	1-1/2	2	(1) 1-1/2 (1) 1-1/4	2	1-1/4	
250	2	(2) 2-1/2	2	(1) 2 (1) 1-1/2	2	1-1/2 (1) 1-1/4	2	(1) 1-1/2 (1) 1-1/4	
300	2	3 (1) 2-1/2	2	(1) 2 (1) 1-1/2	2	(2) 1-1/2	2	(1) 1-1/2 (1) 1-1/4	
350	2	(2) 3	2	2	2	2 (1) 1-1/2	2	1-1/2	
400	2	(2) 3	2	(1) 2-1/2 (1) 2	2	2 (1) 1-1/2	2	(1) 2 (1) 1-1/2	
500	3	(2)3 (1) 2-1/2	2	(1) 2-1/2 (1) 2	2	(1) 2-1/2 (1) 2	2	(1) 2 (1) 1-1/2	
600	3	(3) 3	2	(2) 2-1/2	2	(1) 2-1/2 (1) 2	2	2	
700	4	(4) 3	3	(2) 2-1/2 (1) 2	2	2-1/2	2	(1) 2-1/2 (1) 2	
800	5	(3) 3 (2) 2-1/2	3	(2) 2-1/2 (1) 2	2	2-1/2	2	2-1/2	

NOTE: Valve manufacturers are Kunkle, Consolidated or Conbraco, depending on availability. This table revised 04/2012.

**Table A4-15. Model ICB Hot Water Boiler Relief Valve Outlet Size**

VALVE SETTING		30 PSIG HW		125 PSIG HW		150 PSIG HW	
BOILER HP	NO. OF VALVES REQ'D	OUTLET SIZE (IN.)	NO. OF VALVES REQ'D	OUTLET SIZE (IN.)	NO. OF VALVES REQ'D	OUTLET SIZE (IN.)	
100	1	2	1	1	1	2	
125	1	2-1/2	1	1-1/4	2	(1) 1-1/2 (1) 2	
150	1	2-1/2	1	1-1/4	2	(1) 1-1/2 (1) 2	
200	2	(1) 2-1/2 (1) 1	2	1	2	2	
250	2	(1) 1-1/4 (1) 2-1/2	1	2	2	(1) 2 (1) 2-1/2	
300	2	(1) 2-1/2 (1) 2	1	2	2	(1) 1-1/2 (1) 2	
350	2	2-1/2	1	2-1/2	2	(2) 2-1/2	
400	3	(1) 1 (2) 2-1/2	1	2-1/2	2	(1) 2-1/2 (1) 3	
500	4	(1) 2 (2) 2-1/2	1	2-1/2	2	(1) 3 (1) 2-1/2	
600	3	2-1/2	2	(1) 1 (1) 2-1/2	2	3	
700	4	(4) 2-1/2	2	(1) 2-1/2 (1) 1-1/4	3	(2) 3 (1) 2-1/2	
800	5	(1) 1 (4)2-1/2	2	(1) 2-1/2 (1) 2	3	3	

NOTE: Relief valve is Kunkle #537 for 30# & 125#(Section IV) boiler and is Kunkle #927 for 150# HTHW (Section I) boiler.



**Table A4-16. Model ICB Recommended Steam Nozzle Size**

OPERATING PRESSURE	BOILER HP												
	PSIG	100	125	150	200	250	300	350	400	500	600	700	800
15	8	8	8	10	10	12	12	12	12	12	12	12	12
30	6	6	6	8	8	8	10	10	10	12	12	12	12
40	6	6	6	6	8	8	8	10	10	10	12	12	12
50	4	6	6	6	6	8	8	8	10	10	10	12	12
75	4	4	4	6	6	6	8	8	8	8	10	10	10
100	4	4	4	6	6	6	6	6	8	8	8	10	10
125	4	4	4	4	6	6	6	6	8	8	8	8	8
150	2.5	3	3	4	4	6	6	6	6	6	8	8	8
200	2.5	2.5	3	4	4	4	4	6	6	6	6	6	6
250	2	2.5	3	3	4	4	4	4	6	6	6	6	6

NOTES:

1. Steam nozzle sizes given in inches.
2. Recommended steam nozzle sizes based on 4000 to 5000 fpm steam velocity.
3. All standard steam nozzle sizes for 150 psig design pressure or greater are the same as 125 psig operating pressure on the above table. To increase or decrease the standard size, request the change with your local Cleaver-Brooks authorized representative.
4. Shaded area denotes special surge load baffles must be installed to avoid possible water carryover.
5. For incremental operating pressure, see Table I3-1 Steam System Fundamentals.

**Table A4-17. Model ICB Recommended Non-Return Valve Size**

BOILER HP	BOILER CAPACITY (LBS/HR)	OPERATING PRESSURE (PSIG)							
		50	75	100	125	150	175	200	250
100	3450	2-1/2	2-1/2	NA	NA	NA	NA	NA	NA
125	4313	3	2-1/2	2-1/2	2-1/2	NA	NA	NA	NA
150	5175	3	3	2-1/2	2-1/2	2-1/2	2-1/2	NA	NA
200	6900	3*	3	3	3	3	2-1/2	2-1/2	2-1/2
250	8625	4	3*	3	3	3	3	3	3
300	10350	4	4	4	3*	3	3	3	3
350	12025	4	4	4	4	4	3*	3	3
400	13800	5	4	4	4	4	4	4	3*
500	17210	6	5	5	4	4	4	4	4
600	20700	6	6	5	5	5	4	4	4
700	24150	6	6	6	5	5	5	5	4
800	27600	6	6	6	6	6	5	5	5

NOTE:

Valve sizes (300# flanges) given in inches).

Standard non-return valve selections limited to a maximum 2 to 1 turndown (50% of full boiler output); selection based on typical valve sizing recommendations. For final valve selection contact your authorized C-B representative. For high turndown applications see Boiler Book Section I3, Table I3-3.

\*Indicates pressure drop of less than 7.5 psig. All other selections are less than 6 psig pressure drop.



**Table A4-18. Model ICB Blowdown Tank Sizing Information**

BOILER HP	WATER (GAL)
100	75
125	94
150	102
200	135
250	125
300	150
350	174
400	191
500	206
600	248
700	266
800	297

NOTE: Quantity of water removed from boiler by lowering normal water line 4"

**Table A4-19. Altitude Correction for Gas**

ALTITUDE (FT.)	CORRECTION FACTOR	ALTITUDE (FT.)	CORRECTION FACTOR
1000	1.04	6000	1.25
2000	1.07	7000	1.3
3000	1.11	8000	1.35
4000	1.16	9000	1.4
5000	1.21	—	—

NOTE: To obtain minimum required gas pressure at altitudes above 700 feet, multiply the pressure by the listed factors:  
 Inches WC x 0.577 = oz/sq.-in.  
 oz/sq.-in x 1.732 = Inches WC.  
 Inches WC x 0.0361 = psig.  
 oz/sq.-in x 0.0625 = psig.  
 psig x 27.71 = Inches WC.  
 psig x 16.0 = oz/sq.-in.

**Table A4-20. Sound Levels in dBA for 4-Pass ICB Boilers at High Fire**

BHP	Sound Level — dBA
	ICB
100	80.0
125	84.5
150	84.5
200	84.5
250	84.5
300	91.0
350	94.0
400	91.5
500	93.5
600	93.5
700	93.7
800	93.7

**Table A4-21. Model ICB, Standard Emissions, Minimum Required Gas Pressure at Entrance to Standard, FM & IRI Gas Trains (Upstream of Gas Pressure Regulator)**

BOILER HP	STD PIPE SIZE (Inches)	PRESSURE REQUIRED, 3-PASS ("WC)			PRESSURE REQUIRED, 4-PASS ("WC)		
		GPR*	Minimum	Maximum	GPR*	Minimum	Maximum
100	2	RV91	8.5	27.7	RV91	10.5	27.7
125	2	RV91	13.5	27.7	RV91	16	27.7
150	2	RV91	17	27.7	RV91	21	27.7
200	2-1/2	RV111	20	27.7	210G	26	277
250	2-1/2	210G	32.5	277	210G	33	277
300	2-1/2	210G	45	277	210G	45.5	277
350	3	210G	46	277	210G	46.5	277
400	1.5-2	S	133	208	S	133	208
	2-2.5	S	91	133	S	94	133
	2.5	S	64	91	S	66	94
	3	S	39	64	S	42	66
500	1.5-2.5	S	191	277	S	183	277
	2-2.5	S	139	191	S	133	183
	2.5	S	94	139	S	89	133
	3	S	55	94	S	53	89
600	2-1.5-2.5	S	249	277	S	244	277
	2-2.5	S	191	249	S	188	244
	2.5	S	130	191	S	133	188
	2.5-3	S	108	130	S	111	133
	3	S	66	108	S	72	111
700	2-3	S	233	277	S	230	277
	2.5-3	S	141	233	S	141	230
	3	S	91	141	S	91	141
	4	S	58	91	S	64	91
800	2.5-3	S	177	277	S	175	277
	3	S	114	177	S	114	175
	4	S	72	114	S	72	114

NOTE: Where multiple gas train sizes are shown, the shaded row indicates standard size. For altitudes above 700 feet, contact your local Cleaver-Brooks authorized representative.

\* GPR Gas Pressure Regulator

S-Siemens regulating actuator.



**Table A4-22. Model ICB, Low NOx, Minimum Required Gas Pressure at Entrance to Standard, FM & IRI Gas Trains (Upstream of Gas Pressure Regulator)**

BOILER HP	STD PIPE SIZE (Inches)	PRESSURE REQUIRED, 3-PASS ("WC)			PRESSURE REQUIRED, 4-PASS ("WC)		
		GPR*	Minimum	Maximum	GPR*	Minimum	Maximum
100	2	RV91	13	27.7	RV91	15	27.7
125	2	RV91	19.5	27.7	RV91	17.5	27.7
150	2	RV91	20	27.7	RV91	21.5	27.7
200	2-1/2	210G	27	277	210G	32.5	277
250	2-1/2	210G	30	277	210G	35.5	277
300	2-1/2	210G	43	277	210G	47.5	277
350	3	210G	45	277	210G	49.5	277
400	1.5-2	S	133	208	S	133	208
	2	S	91	133	S	91	133
	2.5	S	66	91	S	66	91
	3	S	39	66	S	42	66
500	1.5-2.5	S	188	277	S	186	277
	2-2.5	S	136	188	S	136	186
	2.5	S	91	136	S	94	136
	3	S	53	91	S	55	94
600	2-1.5-2.5	S	252	277	S	247	277
	2-2.5	S	194	252	S	191	247
	2.5	S	130	194	S	133	191
	2.5-3	S	108	130	S	111	133
	3	S	69	108	S	75	111
700	2-3	S	235	277	S	230	277
	2.5-3	S	144	235	S	141	230
	3	S	91	144	S	91	141
	4	S	61	91	S	61	91
800	2.5-3	S	175	277	S	175	277
	3	S	111	175	S	114	175
	4	S	69	111	S	3	114

NOTE: Where multiple gas train sizes are shown, the shaded row indicates standard size. For altitudes above 700 feet, contact your local Cleaver-Brooks authorized representative.

\* GPR Gas Pressure Regulator

S-Siemens regulating actuator.

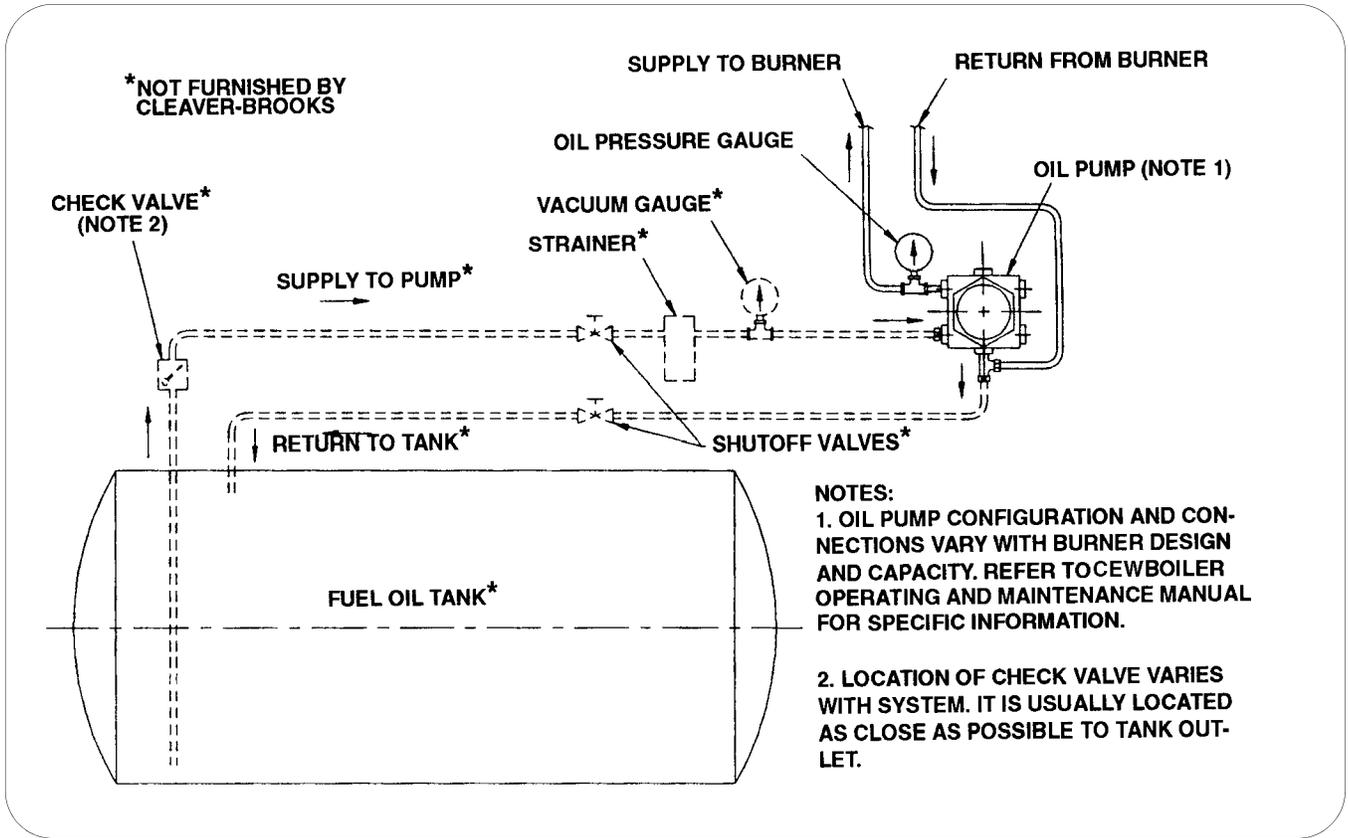
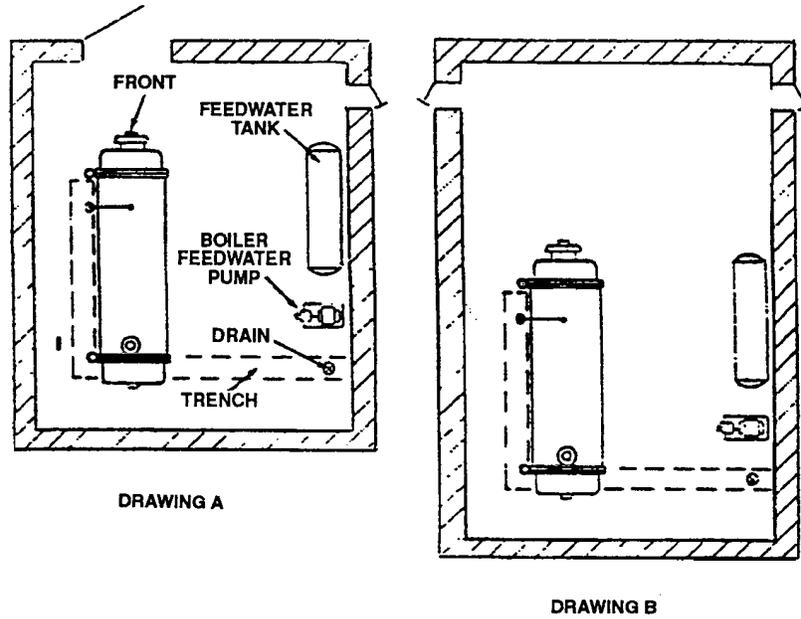


Figure A4-8. Typical Fuel Oil Supply Arrangement



DRAWING A

DRAWING B

1. Shortest boiler room length (Dwg A) is obtained by allowing for possible future tube replacement (from front or rear of boiler) through a window or doorway. Allowance is only made for minimum door swing at each end of the boiler. This arrangement provides sufficient aisle space at the front of the boiler but a "tight" space condition at the rear.  
If space permits, approximately 1.5 additional feet should be allowed at the rear for additional aisle and working space.
2. Next shortest boiler room length (Dwg B) is obtained by allowing for possible future tube replacement from the front of the boiler. Allowance is only made for minimum door swing at the rear.  
If space permits, approximately 1.5 additional feet should be allowed at the rear for additional aisle and working space.

Figure A4-9. Boiler Room Length (Typical Layouts) — Model ICB

BOILER HP	100 – 125	150 – 200	250 – 300	350 – 400	500 – 600	700 – 800
DIM. "A"	84-1/2	87	93	96	103	110
DIM. "B"	115-1/2	120	138	144	170	184

NOTES:

1. Recommended Minimum Distance Between Boiler and Wall.  
Dimension "A" allows for a clear 42" aisle between the water column on the boiler and the wall. If space permits, this aisle should be widened.
2. Recommended Minimum Distance Between Boilers.  
Dimension "B" between boilers allows for a clear aisle of:  
42" – 100-200 hp  
48" – 250-400 hp  
60" – 500-800 hp  
If space permits, this aisle should be widened.

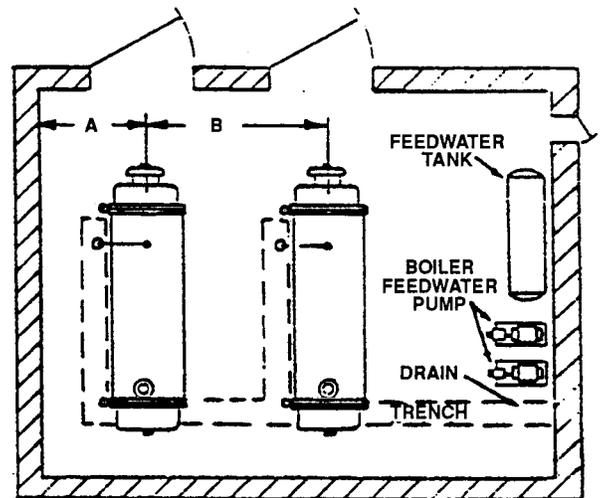


Figure A4-10. Boiler Room Width (Typical Layout) — Model ICB

# MODEL ICB

## SAMPLE SPECIFICATIONS

PART 1	GENERAL.....	A4-30
1.1	Boiler Characteristics (Steam).....	A4-30
PART 2	PRODUCTS.....	A4-30
2.1	General Boiler Design.....	A4-30
2.2	Steam Boiler Trim.....	A4-31
2.3	Burner and Controls.....	A4-32
2.4	Efficiency Guarantee .....	A4-36
2.5	Warranty .....	A4-36
PART 3	EXECUTION.....	A4-36
3.1	Shop Tests.....	A4-36
PART 1	GENERAL.....	A4-37
1.1	Boiler Characteristics (Hot Water) .....	A4-37
PART 2	PRODUCTS.....	A4-37
2.1	General Boiler Design.....	A4-37
2.2	Hot Water Boiler Trim .....	A4-38
2.3	Burner and Controls.....	A4-38
2.4	Efficiency Guarantee .....	A4-43
PART 3	EXECUTION.....	A4-43
3.1	Warranty .....	A4-43
3.2	Shop Tests.....	A4-43
3.3	Start-Up Service .....	A4-43

The following sample specification is provided by Cleaver-Brooks to assist you in meeting your customer's specific needs and application.

The Sample Specifications are typically utilized as the base template for the complete boiler specification. Contact your local Cleaver-Brooks Authorized Representative for information on special insurance requirements, special code requirements, optional equipment, or general assistance in completing the specification.

## *PART 1 GENERAL*

### **Model ICB Steam Boiler (100 – 800 hp, 15 – 300 psig)**

#### **1.1 Boiler Characteristics (Steam)**

- A. The Steam Boiler shall be Cleaver-Brooks Model ICB, Fuel Series \_\_\_\_\_ (100, 200, 700), \_\_\_\_\_ hp designed for \_\_\_\_\_ psig (15, 150, 200, 250, 300 psig steam). The maximum operating pressure shall be \_\_\_\_\_ psig.
- B. The boiler shall have a maximum output of \_\_\_\_\_ Btu/hr, or \_\_\_\_\_ horsepower when fired with CS 12-48 No. 2 oil and/or natural gas, \_\_\_\_\_ Btu/cu-ft. Electrical power available will be \_\_\_\_\_ Volt \_\_\_\_\_ Phase \_\_\_\_\_ Cycle and 115/1/60 for the control circuit.

## *PART 2 PRODUCTS*

#### **2.1 General Boiler Design**

- A. Number of Passes — Select one of the following:
  - (Four-Pass) The boiler shall be a four-pass intercooled horizontal firetube updraft boiler. It shall be mounted on a heavy steel frame with forced draft burner and burner controls.
  - (Three-Pass) The boiler shall be a three-pass intercooled horizontal firetube updraft boiler. It shall be mounted on a heavy steel frame with forced draft burner and burner controls.
1. Approvals: The complete burner/boiler package shall be approved as a unit by Underwriters Laboratories Inc. and bear the UL/cUL label.
2. 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.
- B. Boiler Shell (Steam)
  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. Two lifting eyes shall be located on top of the boiler.
  3. Front and rear doors on the boiler shall be davited.

4. The rear door shall be insulated with a blanket material and a steel covering to give the surface a hard durable finish.
5. The boiler tubes shall not include turbulators, swirlers or other add-on appurtenances.
6. The boiler shall be furnished with a manhole and handholes to facilitate boiler inspection and cleaning.
7. Exhaust Vent — Select one of the following:
  - (Four-Pass) The exhaust gas vent shall be located near the front of the boiler on the top center line and shall be capable of supporting 2000 lbs.
  - (Three-Pass) The exhaust gas vent shall be located at the rear of the boiler on the top center line and shall be capable of supporting 2000 lbs.
8. Observation ports for the inspection of flame conditions shall be provided at each end of the boiler.
9. 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.
10. The entire boiler based frame and other components shall be factory painted before shipment using a hard finish enamel coating.
11. An inner rear turnaround access opening shall swing on a davit, to allow full accessibility to the 2nd pass tubes and furnace.
12. Tubes shall be removable from either the front or rear of the boiler.

## 2.2 Steam Boiler Trim

- A. 3.1 Water Column

A water column shall be located on the right hand side of the boiler complete with gauge glass set and water column blowdown valves.

  1. Feedwater Pump Control

The boiler feedwater pump control shall be included as an integral part of the water column to automatically actuate a motor driven feedwater pump maintaining the boiler water level within normal limits.
  2. Low Water Cutoff

The low water cutoff shall be included as an integral part of the boiler feedwater control wired into the burner control circuit to prevent burner operation if the boiler water level falls below a safe level.
- B. Auxiliary Low Water Cutoff

The auxiliary low water cutoff shall be included, piped to the vessel, and wired to the burner control circuit. A manual reset device shall be used for this control.
- C. Steam Pressure Gauge

The steam pressure gauge shall be located at the front of the boiler and include cock and test connection.
- D. Safety Relief Valves

Safety valves of a type and size to comply with ASME Code requirements shall be shipped loose.
- E. Steam Pressure Controls

The steam pressure controls to regulate burner operation shall be mounted near the water column.

## 2.3 Burner and Controls

- A. Mode of Operation  
Burner operation shall be the full modulation principle. The burner shall always return to low fire position for ignition.
- B. Blower
1. All air for combustion shall be supplied by a forced draft blower mounted on the burner, to eliminate vibration and reduce noise level.
  2. Maximum sound level of the boiler/burner package shall not exceed \_\_\_\_\_ dBA (when measured in accordance with ABMA Sound Test Standards).
  3. The impeller shall be fabricated aluminum with radial blade, carefully balanced, and directly connected to the blower motor shaft.
- C. Combustion Air Control — Select one of the following:
- (Four-Pass) Combustion air damper and fuel control valve (100 – 250 hp) or cam operated fuel metering valve (300 – 800 hp) shall be operated by a single damper control motor that regulates the flame according to load demand. Potentiometer type position controls shall be provided to regulate operation of the damper control motor.
  - (Three-Pass) Combustion air damper and fuel control valve (100 – 350 hp) or cam operated fuel metering valve (400 – 800 hp) shall be operated by a single damper control motor that regulates the flame according to load demand. Potentiometer type position controls shall be provided to regulate operation of the damper control motor.
- D. Fuel Specification and Piping  
Select one of the following fuel types:
- Fuel series 700 — Gas fired (para 4.4.1).
  - Fuel series 100 — Light oil (No. 2) fired (para 4.4.2).
  - Fuel series 200 — Light oil or gas fired (para 4.4.3).
1. FUEL SERIES 700 — GAS FIRED
- a. Burner Type — The burner shall be mounted at the front of the boiler and be of high radiant multi-port type for gas. The burner shall be approved for operation on natural gas fuel.
  - 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 gas valve cannot open until pilot flame has been established. The pilot train shall include one (1) shut-off valve, solenoid valve, pressure regulator, and one (1) plugged leakage test connection (Canada only).
  - c. Gas Burner Piping — Select one of the following:
    - 1) 100 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) motorized gas valve with proof of closure switch, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
    - 2) 125 – 250 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, two (2) motorized gas valves, one (1) valve with proof of closure switch, two (2) plugged leakage test

connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.

- 3) 300 – 350 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, two (2) motorized gas valves, one (1) valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
- 4) 400 – 800 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, two (2) motorized gas valves, one (1) valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.

## 2. FUEL SERIES 100 — LIGHT OIL FIRED

- a. Burner Type — The burner shall be mounted at the front of the boiler, and shall be approved for operation with CS12-48, Commercial No. 2 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 gas valve cannot open until pilot flame has been established. The pilot train shall include one (1) shut-off valve, solenoid valve, pressure regulator, and one (1) plugged leakage test connection (Canada only).
- c. Oil Pump — An oil pump with a capacity of approximately twice the maximum burning rate shall be included. Pump shall be motor driven and shipped loose to be field installed near the oil storage tank. Oil pump motor starter shall also be provided.
- d. Oil Burner Piping
  - 1) Four-Pass — Select one of the following:
    - 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
    - 200 – 250 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, atomizing air proving switch, low oil pressure switch, and pressure gauge all integrally mounted on the unit.
    - 300 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut-off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.
  - 2) Three-Pass — Select one of the following:
    - 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
    - 200 – 350 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off

- valves, atomizing air proving switch, low oil pressure switch, and pressure gauge all integrally mounted on the unit.
- 400 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut-off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.
- e. Oil Atomization Type — Select one of the following:
- 1) 100 – 150 hp. Burner shall include a complete mechanical oil atomizing system and be of the pressure atomizing type.
  - 2) 200 – 800 hp. Burner shall be a low pressure air atomizing type, including a “shipped loose” air compressor assembly.
3. FUEL SERIES 200 — LIGHT OIL OR GAS FIRED
- a. Burner Type — Select one of the following:
- 1) 100 – 150 hp. The burner, mounted at the front of the boiler, shall be a combination 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. 2 oil or natural gas.
  - 2) 200 – 800 hp. The burner, mounted at the front of the boiler, shall be a combination of 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.
- b. 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 one (1) manual shut-off valve, solenoid valve, pressure regulator, and one (1) plugged leakage test connection (Canada only).
- c. Oil Burner
- 1) Oil Pump — An oil pump with a capacity of approximately twice the maximum burning rate shall be included. Pump shall be motor driven and shipped loose to be field installed near the oil storage tank. Oil pump motor starter shall also be provided.
  - 2) Oil Burner Piping
    - Four-Pass — Select one of the following:
      - a. 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
      - b. 200 – 250 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, atomizing air proving switch, low oil pressure switch and pressure gauge all integrally mounted on the unit.
      - c. 300 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut-off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.
    - Three-Pass — Select one of the following:

- a. 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
  - b. 200 – 350 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, atomizing air proving switch, low oil pressure switch and pressure gauge all integrally mounted on the unit.
  - c. 400 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut- off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.
- 3) Oil Atomization Type — Select one of the following:
- 100 – 150 hp. Burner shall include a complete mechanical oil atomizing system and be of the pressure atomizing type.
  - 200 – 800 hp. Burner shall be a low pressure air atomizing type, including a “shipped loose” air compressor assembly.
- d. Gas Burner Piping — Select one of the following:
- 1) 100 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) motorized gas valve with proof of closure switch, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
  - 2) 125 – 150 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) solenoid and one (1) motorized gas valve with proof of closure switch, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
  - 3) 300 – 350 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) solenoid and one (1) motorized gas valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
  - 4) 400 – 800 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, two (2) motorized gas valves and one (1) valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water or any abnormal shutdown condition.
- E. Control Panel and Flame Safeguard Controller
1. Control Panel  
A factory prewired control panel shall be supplied with the boiler/burner package. Panel may be mounted on the burner or boiler.

2. The panel will have a NEMA 1A rating and contain the flame safeguard controller, burner motor starter, air compressor motor starter, oil metering pump motor starter, control circuit transformer and fuses, selector switches, indicating lights and terminal strips. Lights shall indicate load demand, flame failure, low water, and fuel valve open.
3. The panel shall contain fuse protection for the burner motor, air compressor motor, and oil metering pump.
4. The flame safeguard controller shall be a CB110 flame monitor with EPD170 program module. Flame detector shall be ultra-violet type.

#### 2.4 Efficiency Guarantee

- A. The boiler must be guaranteed to operate at a minimum fuel-to-steam efficiency of \_\_\_\_\_ percent at 100 percent of rating when burning natural gas and \_\_\_\_\_ fuel-to-steam efficiency at 100% firing rate when burning oil (Contact your local Cleaver-Brooks Authorized Representative for efficiency details).

#### 2.5 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.

### *PART 3 EXECUTION*

#### 3.1 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.

## PART 1 GENERAL

### Model ICB Hot Water Boiler (100 – 800 hp, 30 psig, 125 psig)

#### 1.1 Boiler Characteristics (Hot Water)

- A. The Hot Water Boiler shall be Cleaver-Brooks Model ICB, Fuel Series \_\_\_\_\_ (100, 200, 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 No. 2 oil and/or natural gas, \_\_\_\_\_ Btu/cu-ft. Electrical power available will be \_\_\_\_\_ Volt \_\_\_\_\_ Phase \_\_\_\_\_ Cycle and 115/1/60 for the control circuit.

## PART 2 PRODUCTS

#### 2.1 General Boiler Design

- A. Number of Passes — Select one of the following:
  - (Four-Pass) The boiler shall be a four-pass intercooled horizontal firetube updraft boiler. It shall be mounted on a heavy steel frame with forced draft burner and burner controls.
  - (Three-Pass) The boiler shall be a three-pass intercooled horizontal firetube updraft boiler. It shall be mounted on a heavy steel frame with forced draft burner and burner controls.
1. Approvals: The complete burner/boiler package shall be approved as a unit by Underwriters Laboratories Inc. and bear the UL/cUL label.
2. 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.
- 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 designed 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 davited.
  6. The rear door shall be insulated with a blanket material and a steel covering to give the surface a hard durable finish.
  7. The boiler tubes shall not include turbulators, swirlers or other add-on appurtenances.

8. The boiler shall be furnished with a manhole and handholes to facilitate boiler inspection and cleaning.
9. Exhaust Vent — Select one of the following:
  - (Four-Pass) The exhaust gas vent shall be located near the front of the boiler on the top center line and shall be capable of supporting 2000 lbs.
  - (Three-Pass) The exhaust gas vent shall be located at the rear of the boiler on the top center line and shall be capable of supporting 2000 lbs.
10. Observation ports for the inspection of flame conditions shall be provided at each end of the boiler.
11. 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.
12. The entire boiler based frame and other components shall be factory painted before shipment using a hard finish enamel coating.
13. An inner rear turnaround access opening shall swing on a davit, to allow full accessibility to the 2nd pass tubes and furnace.
14. Tubes shall be removable from either the front or rear of the boiler.

## 2.2 Hot Water Boiler Trim

- A. Hot Water Connections  
The hot water outlet and return connections shall be located on the top center line of the boiler. The internal design of these connections shall provide forced internal circulation, mixing return water with the hot water within the boiler.
- B. Dip Tube  
The dip tube, an integral part of the hot water outlet, and an air vent tapping in the boiler shell must be provided for removal of air.
- C. Low Water Cutoff  
A low water cutoff control 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. A manual reset device shall be used on this control.
- D. 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.
- E. Relief Valves  
Water relief valves of a type and size to comply with ASME Code requirements shall be shipped loose.
- F. Temperature Controls  
The temperature controls to regulate burner operation shall be mounted on the unit with temperature sensing elements located adjacent to the hot water outlet.

## 2.3 Burner and Controls

- A. Mode of Operation  
Burner operation shall be the full modulation principle. The burner shall always return to low fire position for ignition.
- B. Blower
  1. All air for combustion shall be supplied by a forced draft blower mounted on the burner, to eliminate vibration and reduce noise level.

2. Maximum sound level of the boiler/burner package shall not exceed \_\_\_\_\_ dBA (when measured in accordance with ABMA Sound Test Standards).
  3. The impeller shall be fabricated aluminum with radial blade, carefully balanced, and directly connected to the blower motor shaft.
- C. Combustion Air Control — Select one of the following:
- (Four-Pass) Combustion air damper and fuel control valve (100 – 250 hp) or cam operated fuel metering valve (300 – 800 hp) shall be operated by a single damper control motor that regulates the flame according to load demand. Potentiometer type position controls shall be provided to regulate operation of the damper control motor.
  - (Three-Pass) Combustion air damper and fuel control valve (100 – 350 hp) or cam operated fuel metering valve (400 – 800 hp) shall be operated by a single damper control motor that regulates the flame according to load demand. Potentiometer type position controls shall be provided to regulate operation of the damper control motor.
- D. Fuel Specification and Piping  
Select one of the following fuel types:
- Fuel series 700 — Gas fired (para 4.4.1).
  - Fuel series 100 — Light oil (No. 2) fired (para 4.4.2).
  - Fuel series 200 — Light oil or gas fired (para 4.4.3).
1. FUEL SERIES 700 — GAS FIRED
- a. Burner Type — The burner shall be mounted at the front of the boiler and of high radiant multi-port type for gas. The burner shall be approved for operation on natural gas fuel.
  - 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 gas valve cannot open until pilot flame has been established. The pilot train shall include one (1) shut-off valve, solenoid valve, pressure regulator, and one (1) plugged leakage test connection (Canada only).
  - c. Gas Burner Piping — Select one of the following:
    - 1) 100 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) motorized gas valve with proof of closure switch, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
    - 2) 125 – 250 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) solenoid and one (1) motorized gas valve with proof of closure switch, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
    - 3) 300 – 350 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) solenoid and one (1) motorized gas valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the

event of power failure, flame failure, low water, or any abnormal shutdown condition.

- 4) 400 – 800 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, two (2) motorized gas valves and one (1) valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.

## 2. FUEL SERIES 100 — LIGHT OIL FIRED

- a. Burner Type – The burner shall be mounted at the front of the boiler, and shall be approved for operation with CS12-48, Commercial No. 2 oil.
- b. 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 one (1) manual shut-off valve, solenoid valve, pressure regulator, and one (1) plugged leakage test connection (Canada only).
- c. Oil Pump – An oil pump with a capacity of approximately twice the maximum burning rate shall be included. Pump shall be motor driven and shipped loose to be field installed near the oil storage tank. Oil pump motor starter shall also be provided.
- d. Oil Burner Piping
  - 1) Four-Pass — Select one of the following:
    - 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
    - 200 – 250 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, atomizing air proving switch, low oil pressure switch, and pressure gauge all integrally mounted on the unit.
    - 300 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut-off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.
  - 2) Three-Pass — Select one of the following:
    - 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
    - 200 – 350 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, atomizing air proving switch, low oil pressure switch, and pressure gauge all integrally mounted on the unit.
    - 400 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut-off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.

- e. Oil Atomization Type — Select one of the following:
  - 1) 100 – 150 hp. Burner shall include a complete mechanical oil atomizing system and be of the pressure atomizing type.
  - 2) 200 – 800 hp. Burner shall be a low pressure air atomizing type, including a “shipped loose” air compressor assembly.
- 3. FUEL SERIES 200 — LIGHT OIL OR GAS FIRED
  - a. Burner Type — Select one of the following:
    - 1) 100 – 150 hp. The burner, mounted at the front of the boiler, shall be a combination 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. 2 oil or natural gas.
    - 2) 200 – 800 hp. The burner, mounted at the front of the boiler, shall be a combination of 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.
  - b. 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 one (1) manual shut-off valve, solenoid valve, pressure regulator, and one (1) plugged leakage test connection (Canada only).
  - c. Oil Burner
    - 1) Oil Pump – An oil pump with a capacity of approximately twice the maximum burning rate shall be included. Pump shall be motor driven and shipped loose to be field installed near the oil storage tank. Oil pump motor starter shall also be provided.
    - 2) Oil Burner Piping
      - Four-Pass — Select one of the following:
        - a. 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
        - b. 200 – 250 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, atomizing air proving switch, low oil pressure switch and pressure gauge all integrally mounted on the unit.
        - c. 300 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut- off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.
      - Three-Pass — Select one of the following:
        - a. 100 – 150 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, and pressure gauge all integrally mounted on the unit.
        - b. 200 – 350 hp. Fuel oil piping on the unit shall include oil pressure regulating device, oil metering controls, two (2) solenoid oil shut-off valves, atomizing air proving switch, low oil pressure switch and pressure gauge all integrally mounted on the unit.

- c. 400 – 800 hp. Fuel oil piping on the unit shall include oil metering system, one (1) solenoid oil shut- off valve, one (1) motorized oil valve with proof of closure switch, pressure relief valve, atomizing air proving switch, and low oil pressure switch all integrally mounted on the unit.
  - 3) Oil Atomization Type — Select one of the following:
    - 100 – 150 hp. Burner shall include a complete mechanical oil atomizing system and be of the pressure atomizing type.
    - 200 – 800 hp. Burner shall be a low pressure air atomizing type, including a “shipped loose” air compressor assembly.
  - d. Gas Burner Piping — Select one of the following:
    - 1) 100 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) motorized gas valve with proof of closure switch, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
    - 2) 25 – 250 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) solenoid and one (1) motorized gas valve with proof of closure switch, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
    - 3) 300 – 350 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, one (1) solenoid and one (1) motorized gas valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water, or any abnormal shutdown condition.
    - 4) 400 – 800 hp. Gas burner piping on all units shall include two (2) manual shut-off valves, gas pressure regulator, two (2) motorized gas valves and one (1) valve with proof of closure switch, main gas vent valve, two (2) plugged leakage test connections, and high and low gas pressure switches. The gas valves shall be wired to close automatically in the event of power failure, flame failure, low water or any abnormal shutdown condition.
- E. Control Panel and Flame Safeguard Controller
1. Control Panel

A factory prewired control panel shall be supplied with the boiler/burner package. Panel may be mounted on the burner or boiler.
  2. The panel will have a NEMA 1A rating and contain the flame safeguard controller, burner motor starter, air compressor starter, oil metering pump motor starter, control circuit transformer and fuses, selector switches, indicating lights and terminal strips. Lights shall indicate load demand, flame failure, low water, and fuel valve open.
  3. The panel shall contain fuse protection for the burner motor, air compressor motor, and the oil metering pump.

4. The flame safeguard controller shall be a CB110 flame monitor with EPD170 program module. Flame detector shall be ultra-violet type.

#### 2.4 Efficiency Guarantee

- A. The boiler must be guaranteed to operate at a minimum fuel-to-water efficiency of \_\_\_\_\_ percent at 100 percent of rating when burning natural gas and \_\_\_\_\_ fuel-to-steam efficiency at 100% firing rate when burning oil (Contact your local Cleaver-Brooks Authorized Representative for efficiency details).

### *PART 3 EXECUTION*

#### 3.1 Warranty

- A. All equipment is to be guaranteed against defects in materials and/or workmanship for a period of 12 months from date of

#### 3.2 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.

#### 3.3 Start-Up Service

- A. 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.
  1. A factory approved and authorized start-up report shall be submitted to the customer/user at the time of start-up.

# Notes