

Model ICB 100-800 HP

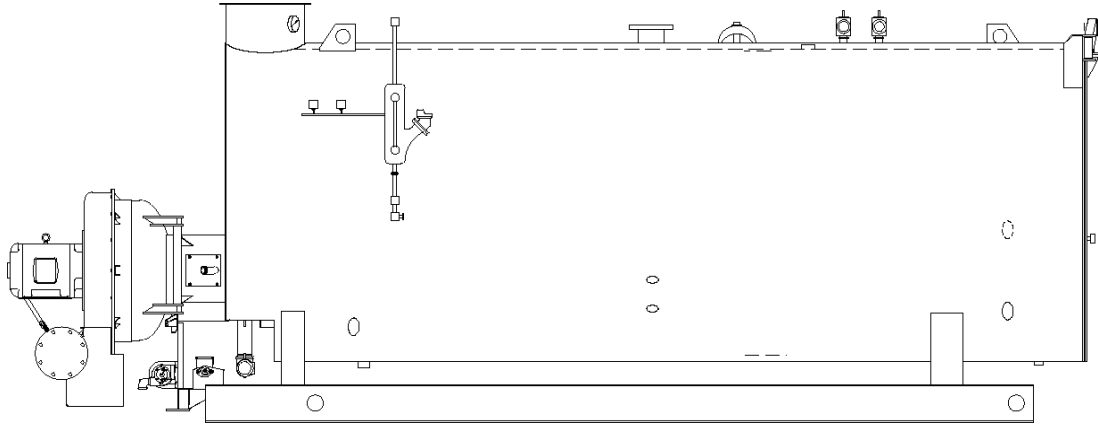


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FEATURES AND BENEFITS

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
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- 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 |
| 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 | 6123 | 8165 | 10206 | 12247 | 14288 | 16329 | 20412 | 24494 | 28576 | 32659 |
| Gas (Therm/hr.) | 40.8 | 51.0 | 61.2 | 81.6 | 102.1 | 122.5 | 142.9 | 163.3 | 204.1 | 244.9 | 285.8 | 326.6 |
| POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ) | | | | | | | | | | | | |
| Blower Motor hp | 3 | 5 | 7-1/2 | 7-1/2 | 7-1/2 | 15 | 20 | 25 | 30 | 40 | 60 | 75 |
| 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 |
| BOILER DATA | | | | | | | | | | | | |
| 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 |
| 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 | 37.4 | 44.8 | 59.8 | 74.7 | 89.7 | 104.6 | 119.6 | 149.4 | 179.3 | 209.2 | 239.1 |
| Gas CFH (1000 Btu) | 4184 | 5230 | 6277 | 8369 | 10461 | 12553 | 14645 | 16738 | 20922 | 25106 | 29291 | 33475 |
| Gas (Therm/hr.) | 41.8 | 52.3 | 62.8 | 83.7 | 104.6 | 125.5 | 146.5 | 167.4 | 209.2 | 251.1 | 292.9 | 334.8 |
| POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ) | | | | | | | | | | | | |
| 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 |
| BOILER DATA | | | | | | | | | | | | |
| 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 |
| RATINGS — SEA LEVEL TO 700 FT. | | | | | | | | | | | | |
| 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 | 6123 | 8165 | 10206 | 12247 | 14288 | 16329 | 20412 | 24494 | 28576 | 32659 |
| Gas (Therm/hr.) | 40.8 | 51.0 | 61.2 | 81.6 | 102.1 | 122.5 | 142.9 | 163.3 | 204.1 | 244.9 | 285.8 | 326.6 |
| POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ) | | | | | | | | | | | | |
| Blower Motor hp | 3 | 5 | 7-1/2 | 7-1/2 | 7-1/2 | 15 | 20 | 25 | 30 | 40 | 60 | 75 |
| 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 |
| BOILER DATA | | | | | | | | | | | | |
| 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 |
| RATINGS — SEA LEVEL TO 700 FT. | | | | | | | | | | | | |
| 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 | 37.4 | 44.8 | 59.8 | 74.7 | 89.7 | 104.6 | 119.6 | 149.4 | 179.3 | 209.2 | 239.1 |
| Gas CFH (1000 Btu) | 4184 | 5230 | 6277 | 8369 | 10461 | 12553 | 14645 | 16738 | 20922 | 25106 | 29291 | 33475 |
| Gas (Therm/hr.) | 41.8 | 52.3 | 62.8 | 83.7 | 104.6 | 125.5 | 146.5 | 167.4 | 209.2 | 251.1 | 292.9 | 334.8 |
| POWER REQUIREMENTS — SEA LEVEL TO 700 FT. (60 HZ) | | | | | | | | | | | | |
| 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 |
| BOILER DATA | | | | | | | | | | | | |
| 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 OF) | 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 | 6123 | 8165 | 10206 | 12247 | 14288 | 16329 | 20412 | 24494 | 28576 | 32659 |
| Gas (Therm/hr) | 40.8 | 51.0 | 61.2 | 81.6 | 102.1 | 122.5 | 142.9 | 163.3 | 204.1 | 244.9 | 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 | 75 | 75 |
| 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 |

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 A4-6. 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 OF) | 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 | 37.4 | 44.8 | 59.8 | 74.7 | 89.7 | 104.6 | 119.6 | 149.4 | 179.3 | 209.2 | 239.1 |
| Gas CFH (1000 Btu) | 4184 | 5230 | 6277 | 8369 | 10461 | 12553 | 14645 | 16738 | 20922 | 25106 | 29291 | 33475 |
| Gas (Therm/hr) | 41.8 | 52.3 | 62.8 | 83.7 | 104.6 | 125.5 | 146.5 | 167.4 | 209.2 | 251.1 | 292.9 | 334.8 |
| 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 | 75 |
| 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 |

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 A4-7. 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 |
| RATINGS - SEA LEVEL TO 700 FT. | | | | | | | | | | | | |
| 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 | 6123 | 8165 | 10206 | 12247 | 14288 | 16329 | 20412 | 24494 | 28576 | 32659 |
| Gas (Therm/hr) | 40.8 | 51.0 | 61.2 | 81.6 | 102.1 | 122.5 | 142.9 | 163.3 | 204.1 | 244.9 | 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 | 75 | 75 |
| 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 |

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

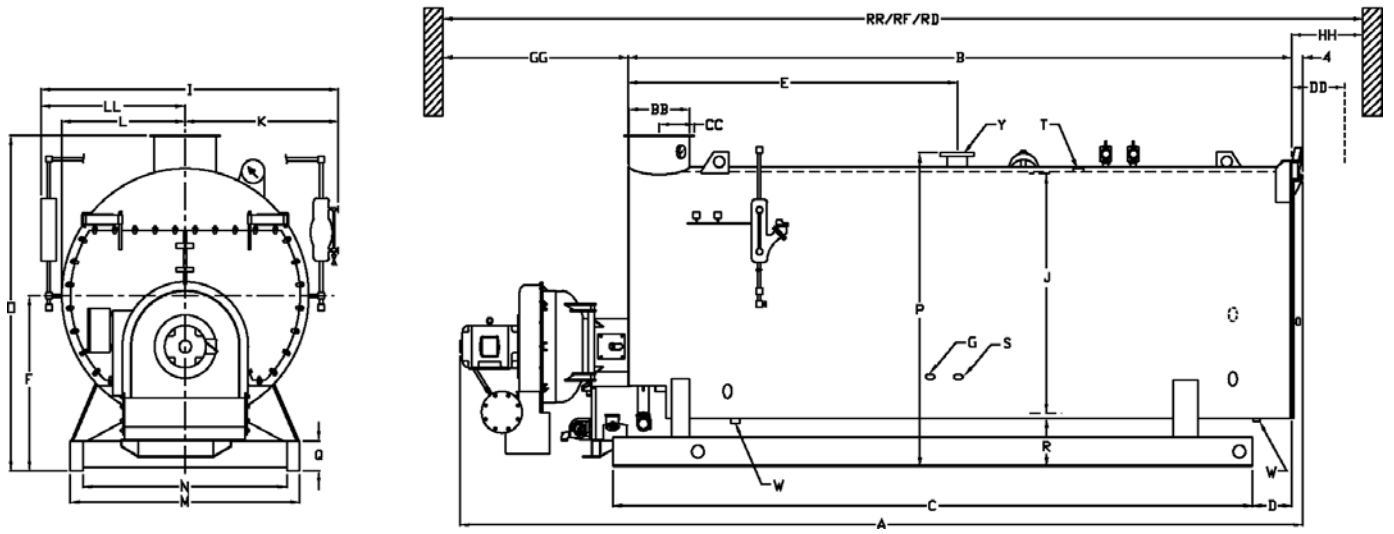
Table A4-8. Model ICB-LE Hot Water Ratings, 3 Pass

| 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 |
| RATINGS - SEA LEVEL TO 700 FT. | | | | | | | | | | | | |
| 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 | 37.4 | 44.8 | 59.8 | 74.7 | 89.7 | 104.6 | 119.6 | 149.4 | 179.3 | 209.2 | 239.1 |
| Gas CFH (1000 Btu) | 4184 | 5230 | 6277 | 8369 | 10461 | 12553 | 14645 | 16738 | 20922 | 25106 | 29291 | 33475 |
| Gas (Therm/hr) | 41.8 | 52.3 | 62.8 | 83.7 | 104.6 | 125.5 | 146.5 | 167.4 | 209.2 | 251.1 | 292.9 | 334.8 |
| 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 | 75 |
| 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 |

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

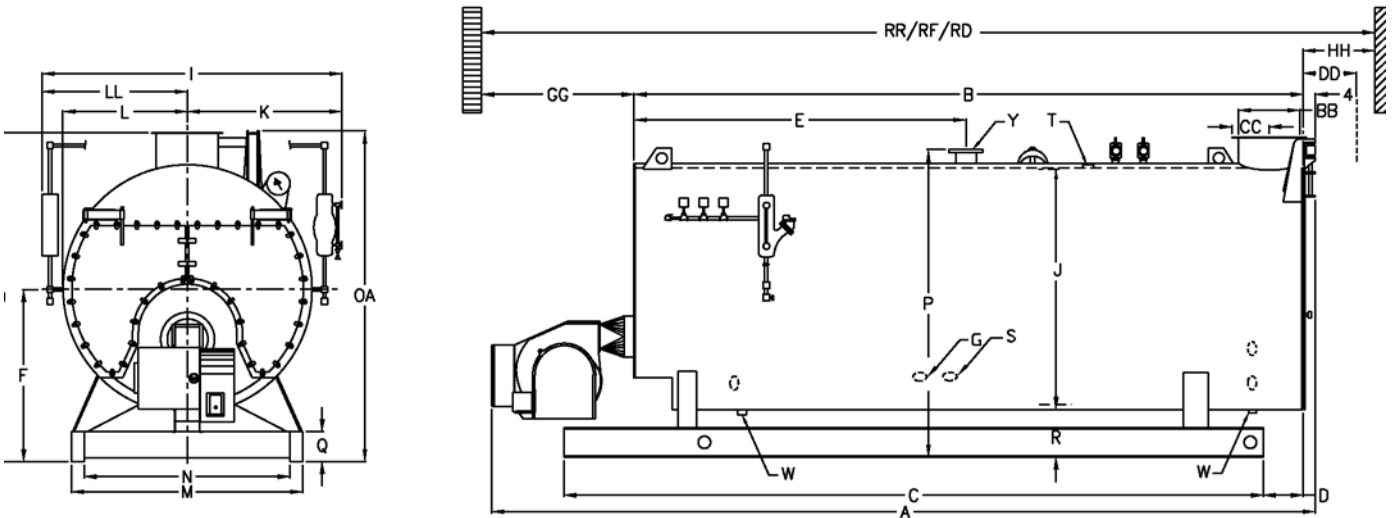


Figure A4-1. Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional)

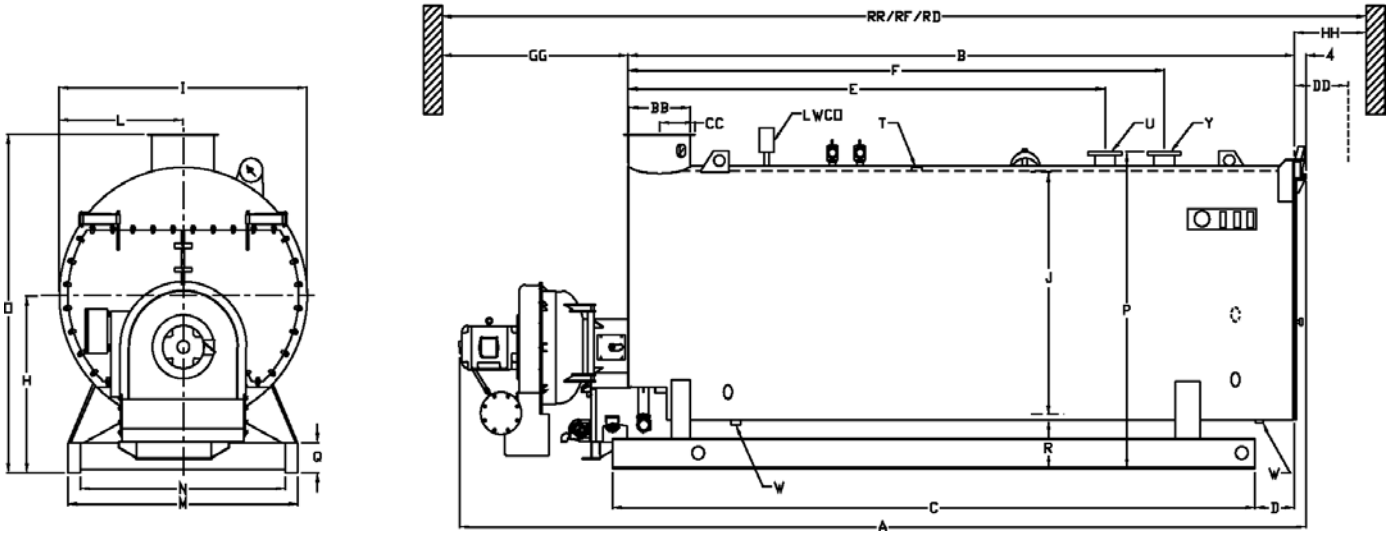
Table A4-9. Model ICB Steam Boiler Dimensions, 4-Pass and 3-Pass

| BOILER H.P. | DIM | 100 | 125 | 150 | 200 | 250 | 300 | 350 | 400 | 500 | 600 | 700 | 800 |
|--|-----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| LENGTHS | | | | | | | | | | | | | |
| 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" |
| WIDTHS | | | | | | | | | | | | | |
| 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" |
| HEIGHTS | | | | | | | | | | | | | |
| 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" |
| CONNECTIONS | | | | | | | | | | | | | |
| 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" |
| MINIMUM CLEARANCES | | | | | | | | | | | | | |
| 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" |
| MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM: | | | | | | | | | | | | | |
| 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" |
| WEIGHTS | | | | | | | | | | | | | |
| 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

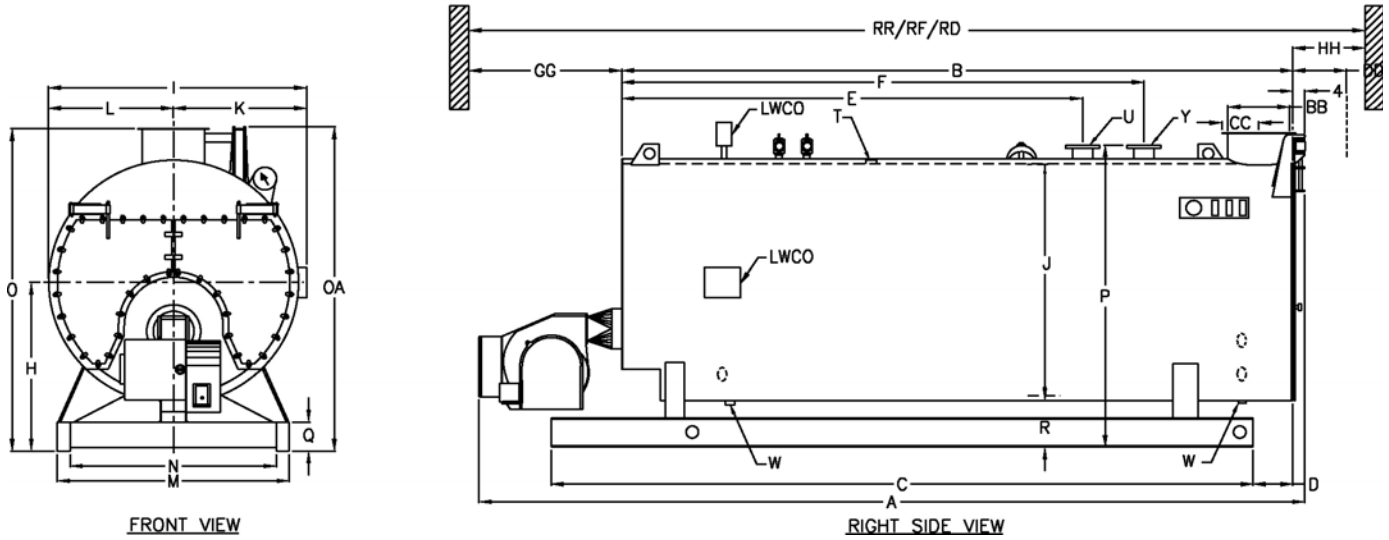


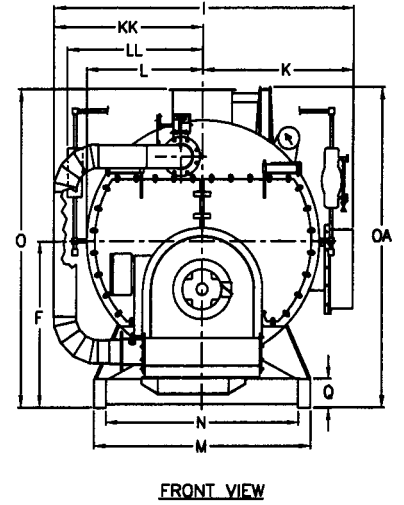
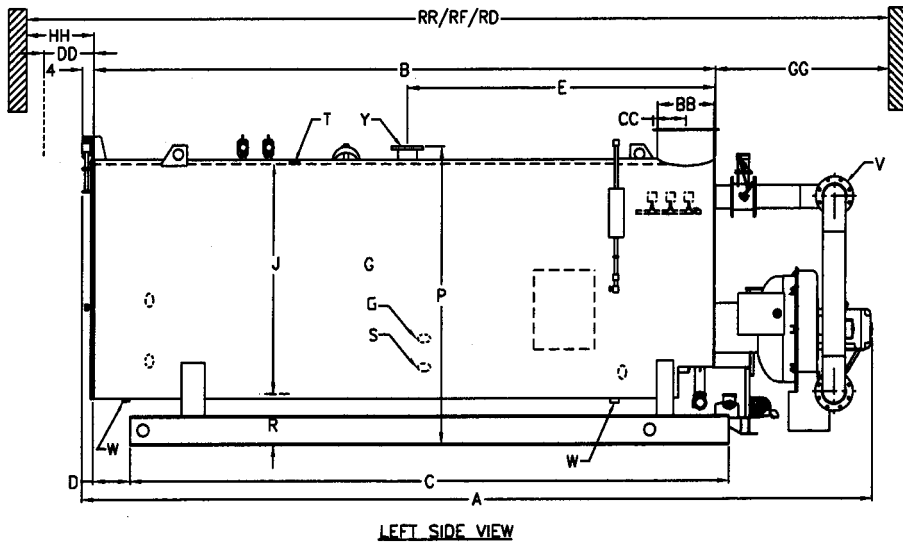
Figure A4-2. Model ICB Hot Water Boiler Dimensions, 4-Pass and 3-Pass (Optional)

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 |
|--|-----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| LENGTHS | | | | | | | | | | | | | |
| 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" |
| WIDTHS | | | | | | | | | | | | | |
| 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" |
| HEIGHTS | | | | | | | | | | | | | |
| 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" |
| CONNECTIONS | | | | | | | | | | | | | |
| 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" |
| MINIMUM CLEARANCES | | | | | | | | | | | | | |
| 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" |
| MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM: | | | | | | | | | | | | | |
| 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" |
| WEIGHTS | | | | | | | | | | | | | |
| 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

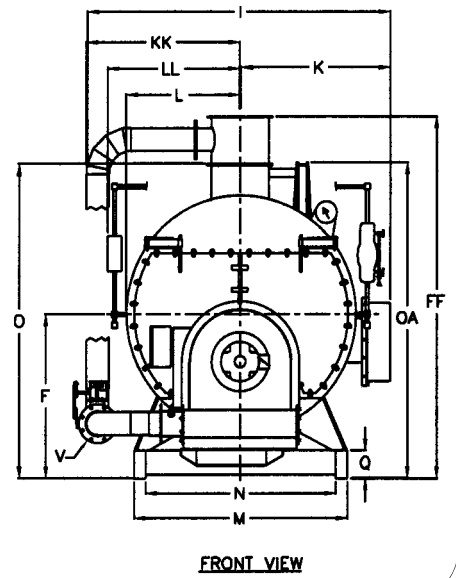
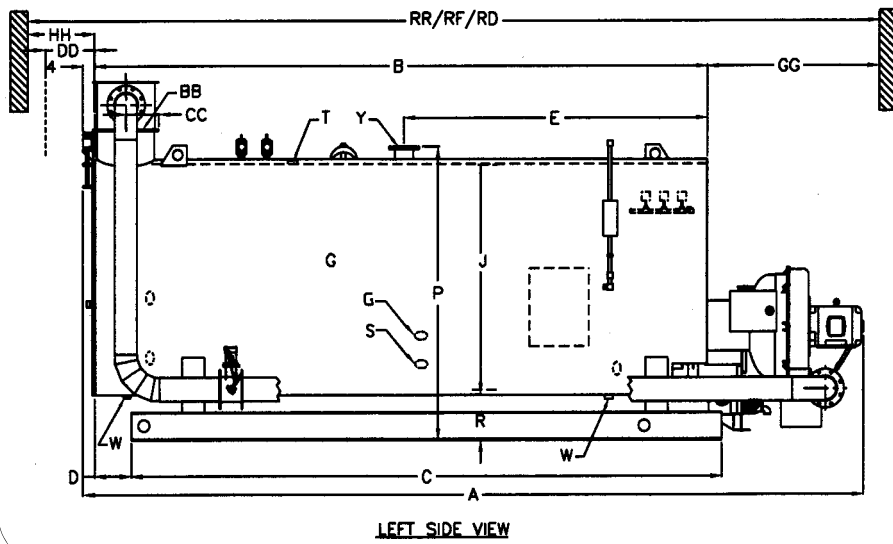


Figure A4-3. Model ICB-LE Steam Boiler Dimensions, 4-Pass and 3-Pass (Optional)

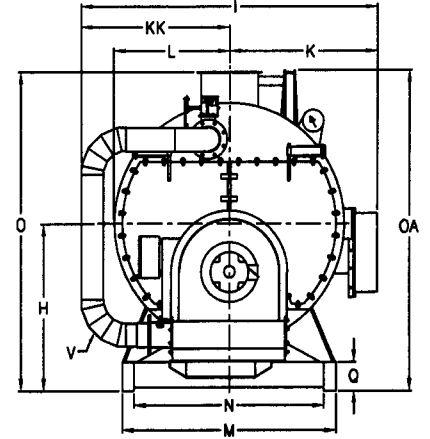
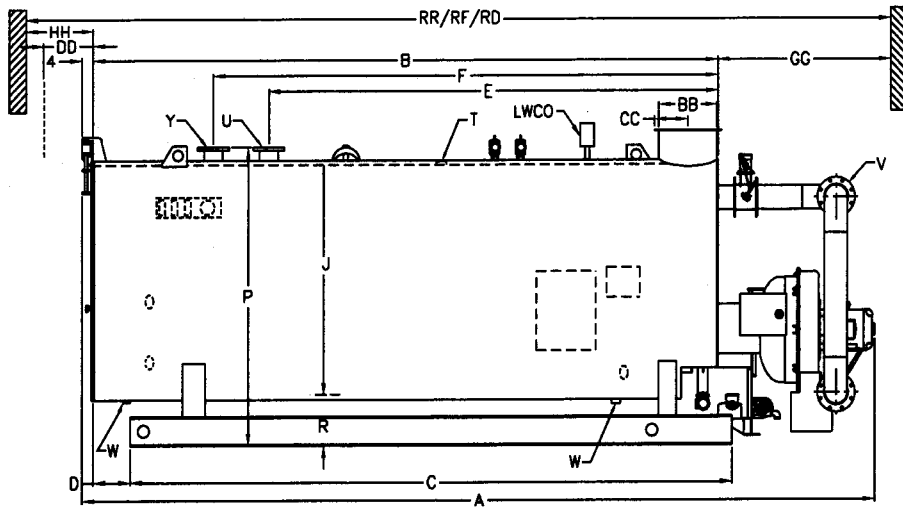
Table A4-11. Model ICB-LE Steam Boiler Dimensions, 4-Pass and 3-Pass

| BOILER H.P. | DIM | 100 | 125 | 150 | 200 | 250 | 300 | 350 | 400 | 500 | 600 | 700 | 800 |
|--|-----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| LENGTHS | | | | | | | | | | | | | |
| 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" |
| WIDTHS | | | | | | | | | | | | | |
| 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" |
| HEIGHTS | | | | | | | | | | | | | |
| 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" |
| CONNECTIONS | | | | | | | | | | | | | |
| 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" |
| MINIMUM CLEARANCES | | | | | | | | | | | | | |
| 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" |
| MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM: | | | | | | | | | | | | | |
| 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" |
| WEIGHTS | | | | | | | | | | | | | |
| 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 |

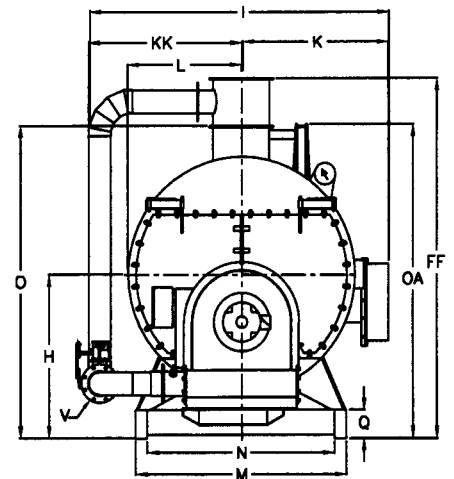
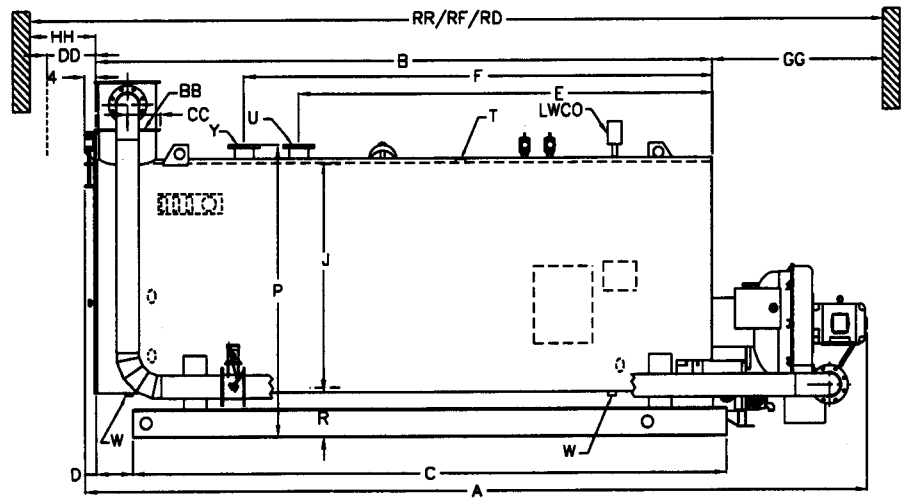
NOTE: Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for actual option requirements.



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 |
|--|-----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| LENGTHS | | | | | | | | | | | | | |
| 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" |
| WIDTHS | | | | | | | | | | | | | |
| 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" |
| HEIGHTS | | | | | | | | | | | | | |
| 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" |
| CONNECTIONS | | | | | | | | | | | | | |
| 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" |
| MINIMUM CLEARANCES | | | | | | | | | | | | | |
| 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" |
| MINIMUM BOILER ROOM LENGTH ALLOWING FOR DOOR SWING AND TUBE REMOVAL FROM: | | | | | | | | | | | | | |
| 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" |
| WEIGHTS | | | | | | | | | | | | | |
| 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 |

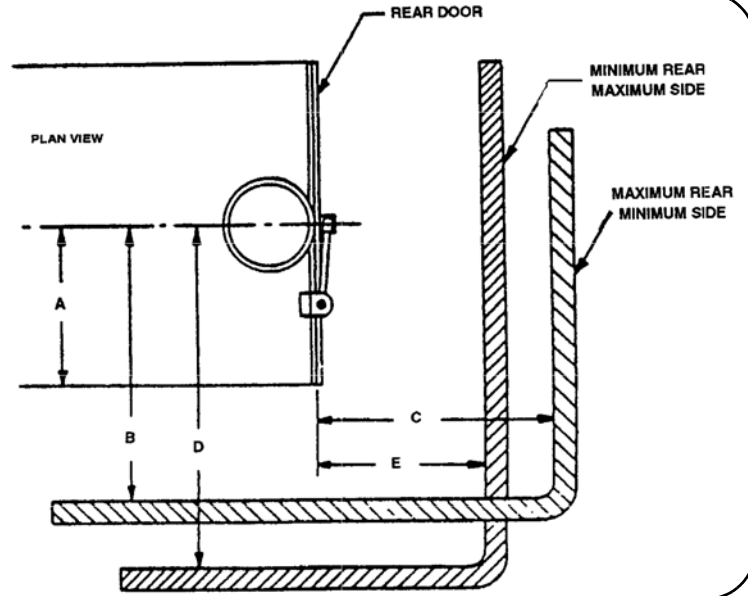
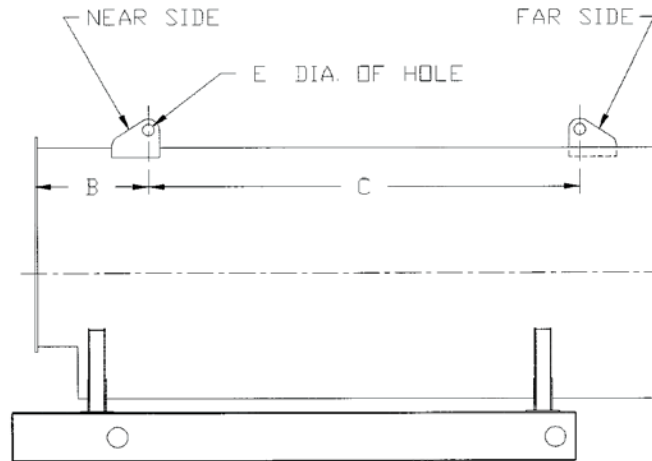
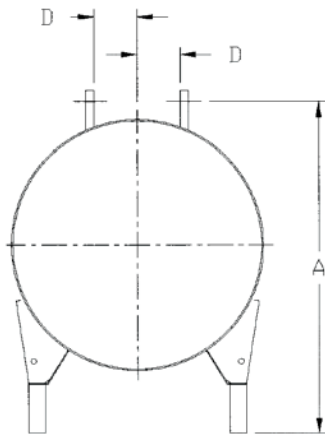


Figure A4-5. Space Required to Open Rear Head on Model ICB Boilers



| 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

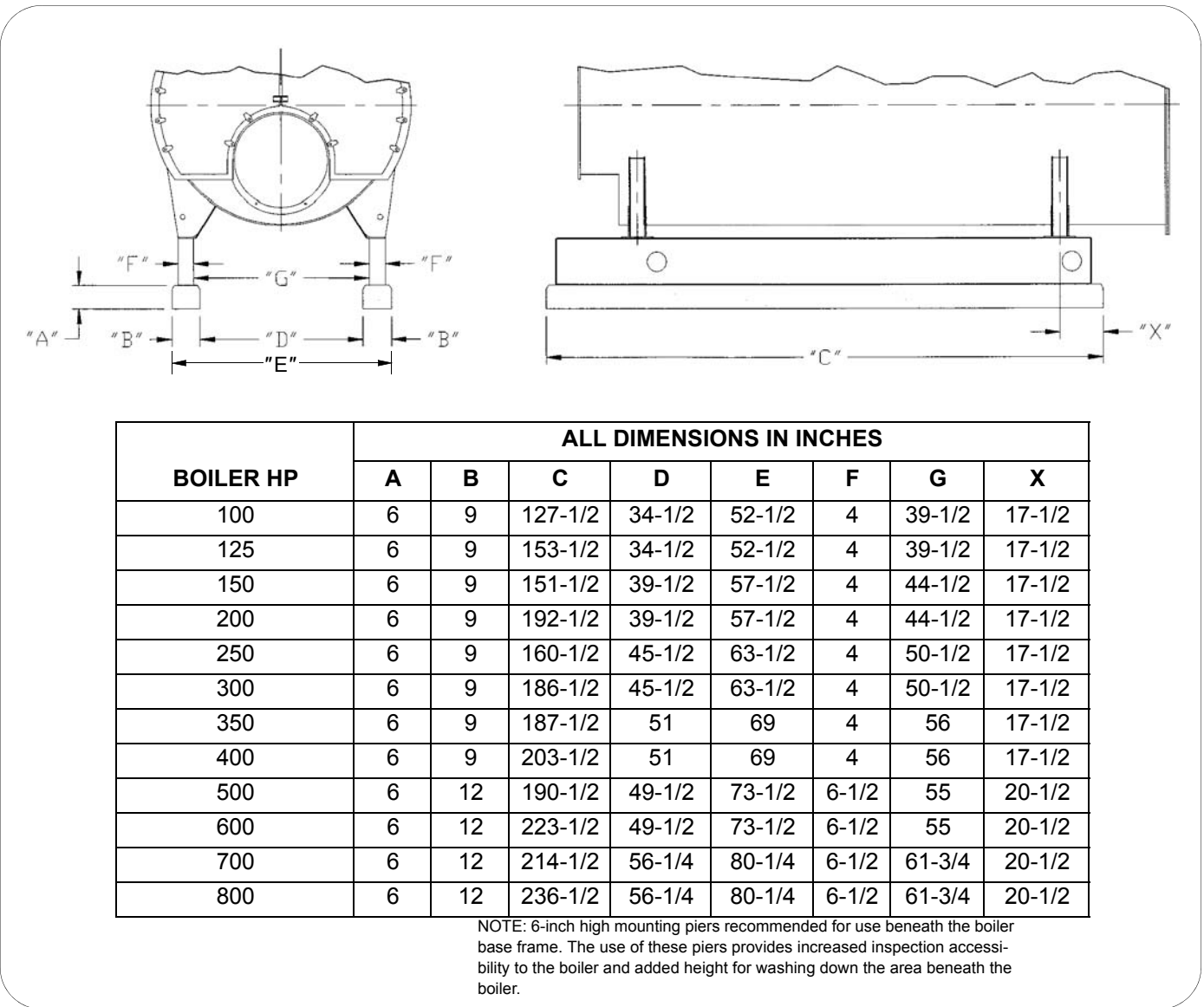


Figure A4-7. Model ICB Boiler Mounting Piers

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.



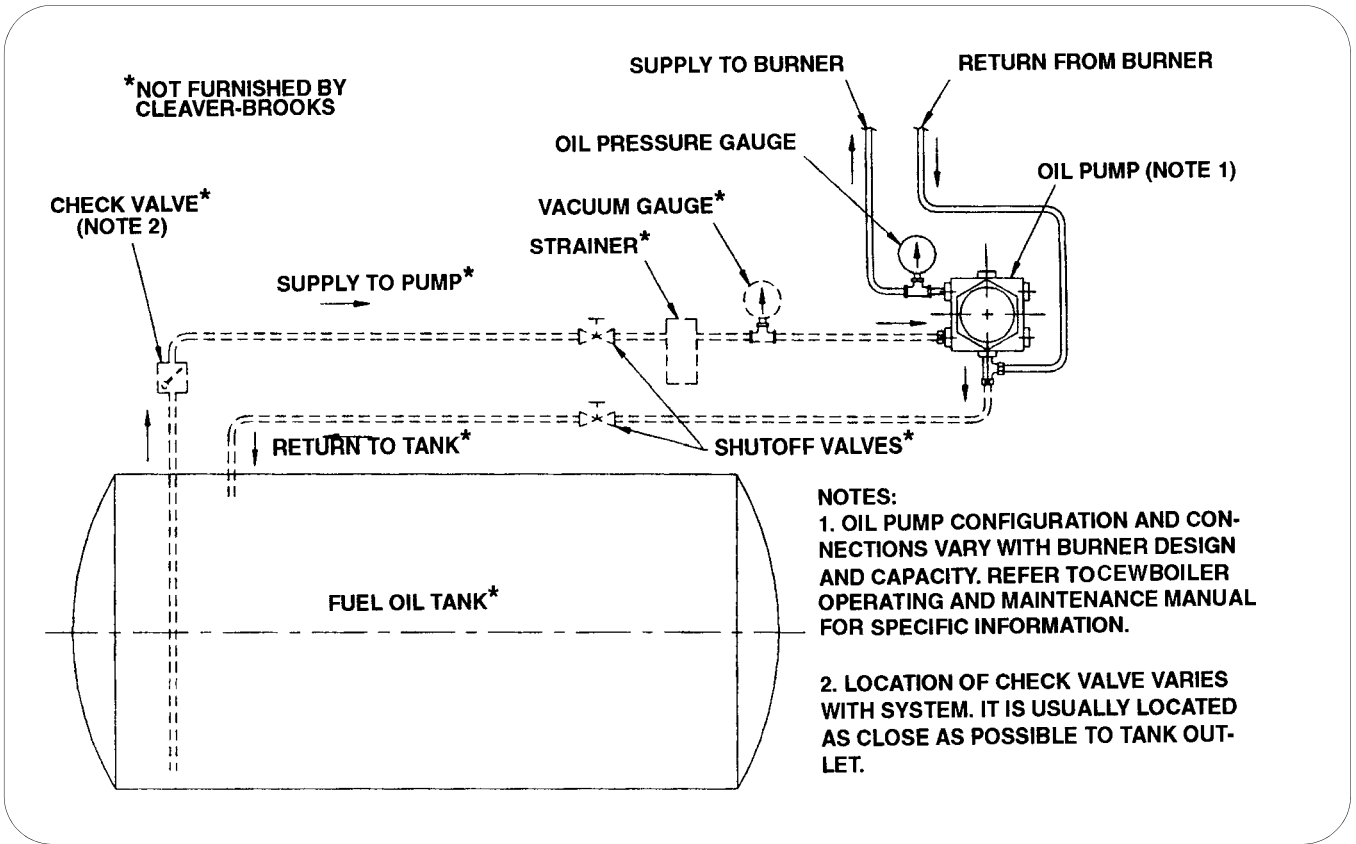
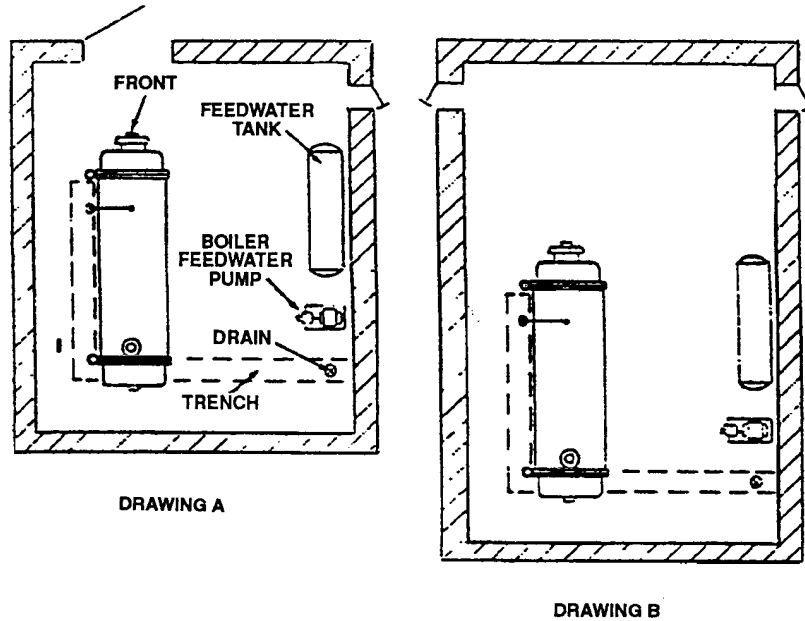


Figure A4-8. Typical Fuel Oil Supply Arrangement



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.

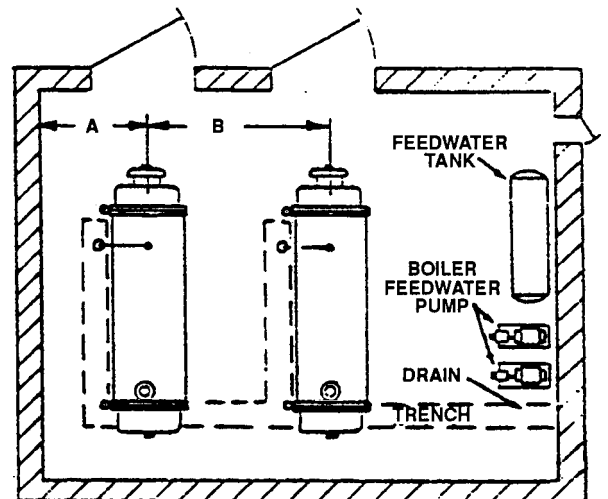


Figure A4-10. Boiler Room Width (Typical Layout) — Model ICB