

CEW OHIO SPECIAL

100-225 HP Wetback



Boiler Book
03/2018



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FEATURES AND BENEFITS

The Model CEW Ohio Special Firetube boiler is designed, manufactured, and packaged by Cleaver-Brooks specifically for operation in the state of Ohio, under the rules and regulations for unattended units. The unique design of the Ohio Special Boiler serves your steam needs and reduces unnecessary labor costs. All units are factory fire tested and shipped as a package, ready for quick connection to utilities. In addition to the features provided on all Cleaver-Brooks Firetube boilers, the following features apply to the Model CEW Ohio Specials.

Less than 360 Square Feet of Heating Surface:

The greatest amount offered in any packaged boiler for unattended steam boiler operation in Ohio - means long life and years of service at the high efficiencies.

Front and Rear Doors:

- Davited, front and rear doors, all sizes.
- Provides access to front and rear tube sheet.
- Large rear access plug for turnaround and furnace access.
- 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.

PRODUCT OFFERING

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

- 100 - 225 hp.
- Three pass wetback design.
- 15 - 250 psig steam.
- Full modulation, all sizes.

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

Boiler Options:

- Drain valves.
- Additional screwed or flanged tappings.
- Blowdown valves.
- Non-return valves.
- Feedwater valves and regulators.
- Surface blowdown systems.
- Surge load baffles.
- Seismic design.

Burner/Control Options:

- Flame safeguard controllers.
- Lead/lag system.
- Special insurance and code requirements (e.g., IRI, FM, CSD-1).

BOILER BOOK CEW OHIO SPECIAL

- Alarm bell/silence switch.
- Special motor requirements (TEFC, high efficiency).
- Special indicating lights.
- Main disconnect.
- Elapsed time meter.
- NEMA enclosures.
- Low-fire hold control.
- Remote emergency shut-off (115V).
- Circuit breakers.
- Day/night controls.
- Special power requirements.
- Stack thermometer.

Fuel Options:

- Gas strainer.
- Gas pressure gauge.
- Future gas conversion.
- Oversized/undersized gas trains.

DIMENSIONS AND RATINGS

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

- Table 1. Model CEW Ohio Special Steam Boiler Ratings
- Table 2. Model CEW Ohio Special Steam Boiler Dimensions
- Figure 1. Model CEW Ohio Special Boiler Space Requirements to Open Rear Door
- Figure 2. Lifting Lug Location, Model CEW Ohio Special Boilers
- Figure 3. Model CEW Ohio Special Boiler Mounting Piers

Table 1: Model CEW Ohio Special Steam Boiler Ratings

BOILER HP	100S	125S	150S	175S	200S	225S
RATINGS - SEA LEVEL TO 1000 FT						
Rated Capacity (lbs-steam/hr from and at 212 °F)	3450	4313	5175	6038	6900	7763
Btu Output (1000 Btu/hr)	3348	4184	5021	5858	6695	7532
APPROXIMATE FUEL CONSUMPTION AT RATED CAPACITY						
Light Oil gph (140,000 Btu/gal)	29.9	37.4	44.8	52.3	59.8	67.2
Gas CFH (1000 Btu/ft ³)	4184	5230	6277	7323	8369	9415
Gas (Therm/hr)	41.8	52.3	62.8	73.2	83.7	94.1
POWER REQUIREMENTS — SEA LEVEL TO 1000 FT (60 HZ)						
Oil Pump Motor hp (oil firing only)	1/2	1/2	1/2	1/2	1/2	1/2
Blower Motor, hp (NO. 2 oil& combination)	2	3	5	5	7.5	10
Blower Motor, hp	1-1/2	3	5	5	7-1/2	10
Air Comp. Motor, hp	2	2	2	3	3	3
WEIGHTS IN POUNDS						
Normal Water Capacity	7430	7430	7430	8293	8293	8293
Approx. Wt. -15 psig	10311	10311	10311	11150	11150	11150
Approx. Wt. -150 psig	12558	12558	12558	13515	13515	13515
Approx. Wt. -200 psig	13632	13632	13632	14465	14465	14465
Approx. Wt. -250 psig	15079	15079	15079	16029	16029	N/A
BOILER DATA						
Heating Surface sq-ft (fireside)	354	354	354	358	358	358

NOTE: All fractional hp motors will be single phase voltage, integral hp motors will be 3-phase voltage.

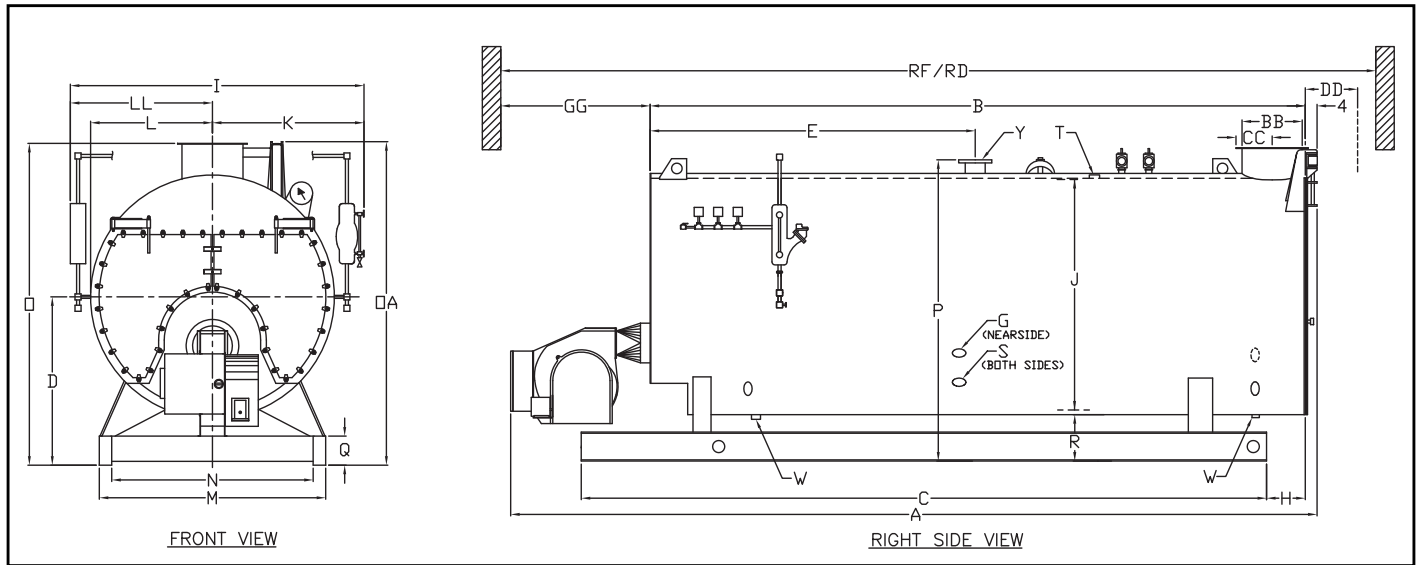


Table 2: Model CEW Ohio Special Steam Boiler Dimensions

Description	DIM	100S-150S	175S-225S
	(inches)		
LENGTHS			
Overall	A	207-1/2	228-1/2
Shell	B	157-3/8	170-3/8
Base Frame	C	174-7/8	196-1/2
Base Frame to Rear Flange	H	13-1/2	13-1/2
Flange to Steam Nozzle	E	63-7/8	56-1/4
WIDTHS			
Overall ^C	I	85	85
I. D. Boiler	J	60	60
Center to Water Column	K	45	45
Center to Lagging	L	33	33
Center to Auxiliary LWCO	LL	40	40
Base Outside	M	52-1/2	52-1/2
Base Inside	N	44-1/2	44-1/2
HEIGHTS			
Base to Boiler Centerline	D	46	46
Base to Vent Outlet	O	85	85
Base to rear Door Davit	OA	86-1/2	86-1/2
Base to Steam Outlet	P	82-3/8	82-3/8
Base Frame	Q	12	12
Base to Bottom Boiler	R	16	16
CONNECTIONS			
Chemical Feed	G	1	1
Feedwater Inlet (Both Sides)	S	1-1/2	1-1/2
Steam Nozzle (15 psig) ^A	Y	8	10
Steam Nozzle (150 psig) ^B	Y	4	4

Table 2: Model CEW Ohio Special Steam Boiler Dimensions (Continued)

Description	DIM	100S-150S	175S-225S
		(inches)	
Drain - Front & Rear (15 psig)	W	1-1/2	2
Blowdown - Front & Rear (150 psig)	W	1-1/2	1-1/2
Surface Blowoff (150 psig)	T	1	1
Surface Blowoff (15 psig)	T	1-1/2	1-1/2
Vent Stack Diameter (Flanged)	BB	16	16
Flange to Center Vent	CC	10-1/8	10-1/8
MISCELLANEOUS			
Rear Door Swing	DD	36	36
Tube Removal - Front Only	GG	124	137
Min. Boiler Room Length For Tube Removal Front	RF	318	344
Min. Boiler Room Length For Tube Removal Thru Door	RD	276	297

NOTES:

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

A. 150 psig Flange.

B. 300 psig Flange.

C. Overall width may increase with the addition of electrical options due to control panel mounting.

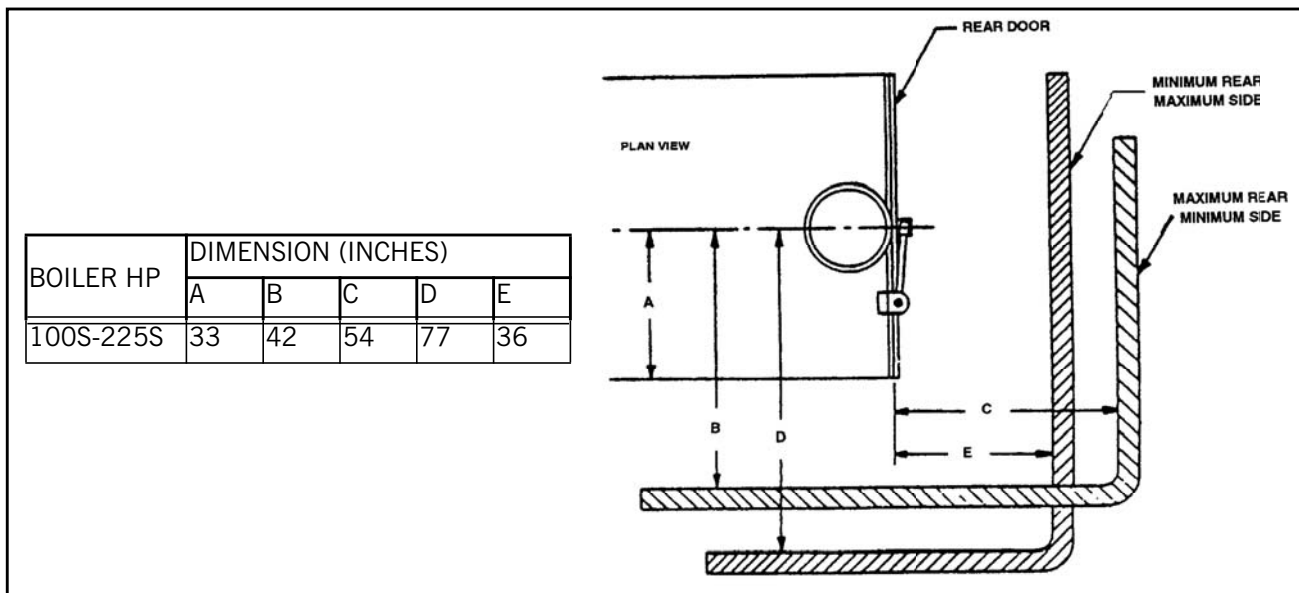


Figure 1. Space Required to Open Rear Head

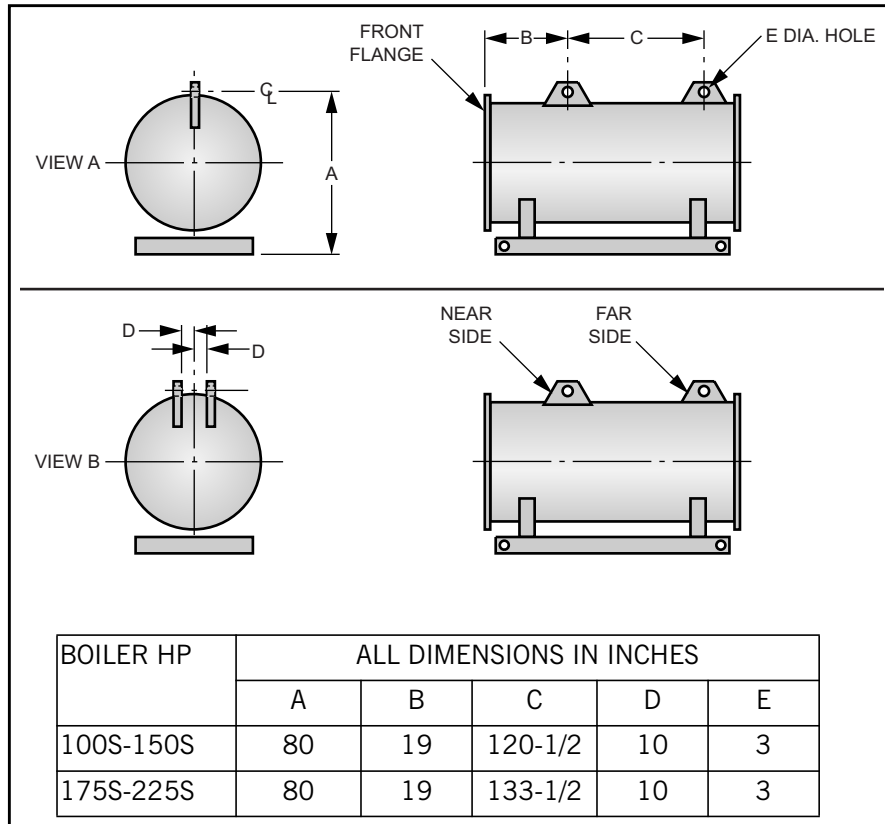


Figure 2. Model CEW Ohio Special Boilers Lifting Lug Location

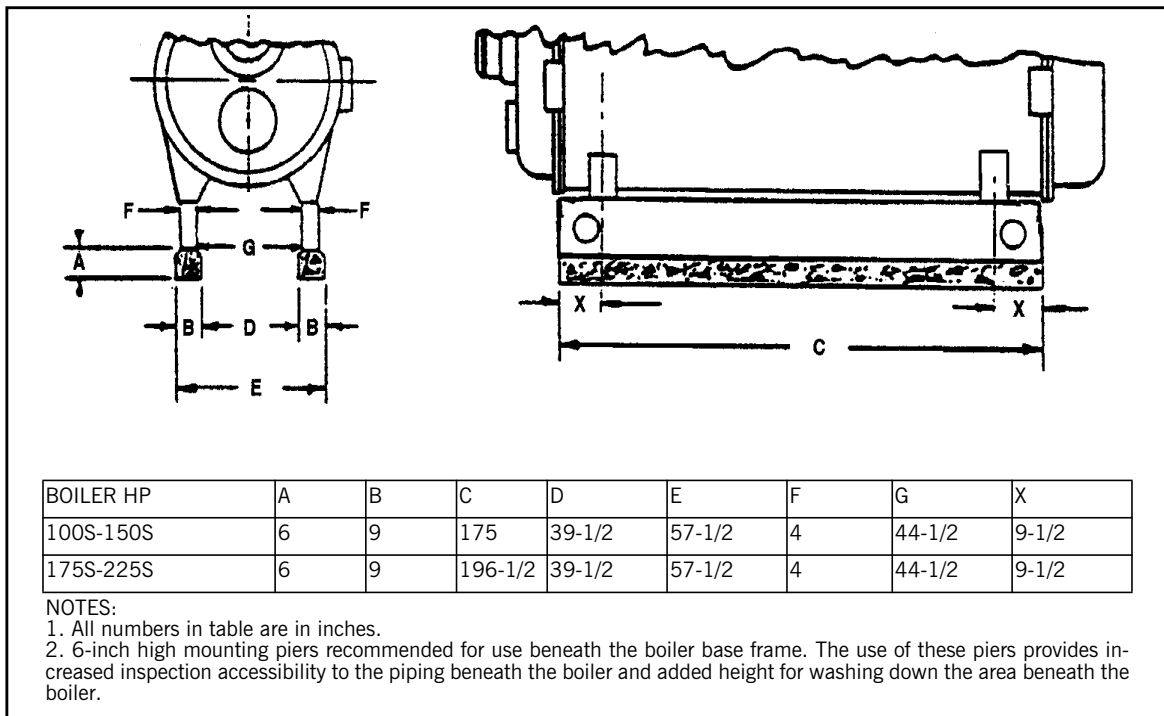


Figure 3. Model CEW Ohio Special Boiler Mounting Piers

PERFORMANCE DATA

Contact your local Cleaver-Brooks authorized representative for efficiencies or additional information.

ENGINEERING DATA

The following engineering information is provided for Model CEW Ohio Special Boilers. Model CEW Ohio Special Boilers are designated by an "S" following the horsepower number. Additional detail is available from your local Cleaver-Brooks authorized representative.

Boiler Information

Table 3 lists quantity and outlet size for safety valves supplied on Model CEW Ohio Special boilers.

Table 4 shows steam volume and disengaging area for Model CEW Ohio Special boilers.

Table 5 gives recommended steam nozzle sizes on Model CEW Ohio Special Boilers.

Table 6 shows recommended non-return valve sizes for Model CEW Ohio Special 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 7 lists the approximate quantity of water represented by 4 inches of water at normal operating level for Cleaver-Brooks Model CEW Ohio Special Boilers.

Burner/Control Information

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 8 shows correction factors for gas pressure at elevations over 700 ft above sea level.

Table 9 shows minimum and maximum gas pressure requirements for Standard, FM and IRI CEW Ohio Special Boiler gas trains upstream of the gas pressure regulator.

For oversized or undersized gas trains or altitude above 1,000 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 4 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 A9-6 shows typical boiler room length requirements.

Figure A9-7 shows typical boiler room width requirements.

Stack Support Capabilities

100 - 225 hp Model CEW Ohio Special Boilers can support up to 2000 lbs without additional support.

100 - 225 hp Model CEW Ohio Special 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.
 - D. Under no condition should the total area of the air supply openings be less than one (1) square foot.
 - E. 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).

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 CEW Ohio Special 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. and up to $+0.5''$ at high fire, when an economizer is used.

The maximum pressure variation at any firing rate for the boiler is $0.25''$ W.C.

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 3: Safety Valve Outlet Size

VALVE SETTING	15 PSIG STEAM		150 PSIG STEAM		200 PSIG STEAM		250 PSIG STEAM	
	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.)
100S	1	2-1/2	1	1-1/2	1	1-1/2	1	1-1/4
125S	1	2-1/2	1	2	1	1-1/2	1	1-1/2
150S	1	3	1	2	1	1-1/2	1	1-1/2
175S	1	3	1	2	1	2	1	1-1/2
200S	1	3	1	2-1/2	1	2	1	2
225S	2	2-1/2	1	2-1/2	1	2	1	2

NOTE:

Valve manufacturers are Kunkle, Consolidated or Conbraco, depending on availability. Valve requirements can vary with special pressure settings.

Table 4: 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
100S-150S	23.5	27.1	5990	6221
175S-225S	25.8	29.7	6566	6826

NOTE:

Based on normal water level.

Values are based on standard controls. Optional controls may result in different values.

A. Based on 150 psig design pressure.

B. Based on 15 psig design pressure.

Table 5: Model CEW Ohio Special Recommended Steam Nozzle Size

OPERATING PRESSURE PSIG	BOILER HP					
	100S	125S	150S	175S	200S	225S
15	8	8	8	8	10	10
30	6	6	6	6	8	8
40	6	6	6	6	6	8
50	4	6	6	6	6	6
75	4	4	4	6	6	6
100	4	4	4	4	6	6
125	4	4	4	4	4	4
150	2.5	3	3	4	4	4
200	2.5	2.5	3	3	4	4

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 the 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.

Table 6: Recommended Non-Return Valve Size

BOILER HP	BOILER CAPACITY (LB/HR)	OPERATING PRESSURES (PSIG)						
		50	75	100	125	150	175	200
100S	3450	2-1/2	2-1/2	NA	NA	NA	NA	NA
125S	4313	3	2-1/2	2-1/2	2-1/2	NA	NA	NA
150S	5175	3	3	2-1/2	2-1/2	2-1/2	2-1/2	NA
175S	6037	3	3	2-1/2	2-1/2	2-1/2	2-1/2	NA
200S	6900	3*	3	3	3	3	2-1/2	2-1/2
225S	7762	3	3	3	3	3	2-1/2	2-1/2

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.

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

Table 7: Blowdown Tank Sizing Information

BOILER HP	WATER (GAL)
100S-150S	110
175S-225S	120

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

Optional level controls can alter water quantities.

Table 8: Altitude Correction for Gas

ALTITUDE (FT)	CORRECTION FACTOR	ALTITUDE (FT)	CORRECTION FACTOR
1000	1.04	6000	1.25
2000	1.07	7000	1.30
3000	1.11	8000	1.35
4000	1.16	9000	1.40
5000	1.21	-	-

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.

i 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 9: Minimum and Maximum Gas Pressure at Entrance to Standard, FM and IRI Gas Trains (Upstream of Gas Pressure Regulator)

BOILER HP	PIPE SIZE (Inches)	PRESSURE REQUIRED ("WC)					
		MAX 1 PSIG INLET, MIN SUPPLY PRESSURE ("WC)			MAX 10 PSIG INLET, MIN SUPPLY PRESSURE ("WC)		
		UL	FM	IRI	UL	FM	IRI
100S	2	14	14	15.5	19.5	19.5	21
125S	2	23.5	23.5	23.5	32.5	32.5	32.5
150S	2	22	22	22	27	27	27
175S	2-1/2	20.5	20.5	20.5	22.5	22.5	22.5
200S	2-1/2	25.5	25.5	25.5	28.5	28.5	28.5
225S	2-1/2	N/A	N/A	N/A	36	36	36

Note: For undersized or oversized gas trains or altitudes above 1,000 feet, contact your local Cleaver-Brooks representative.

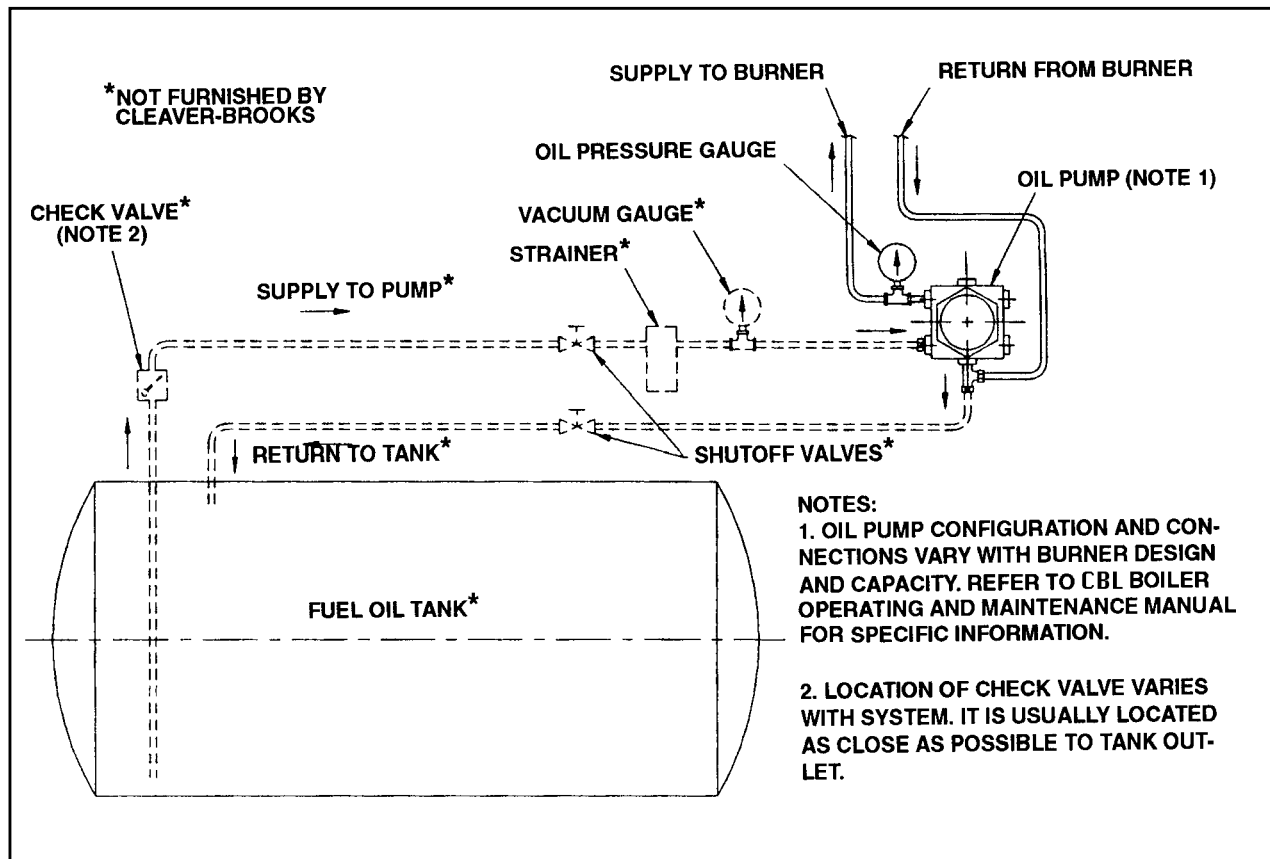


Figure 4. Typical Fuel Oil Supply Arrangement

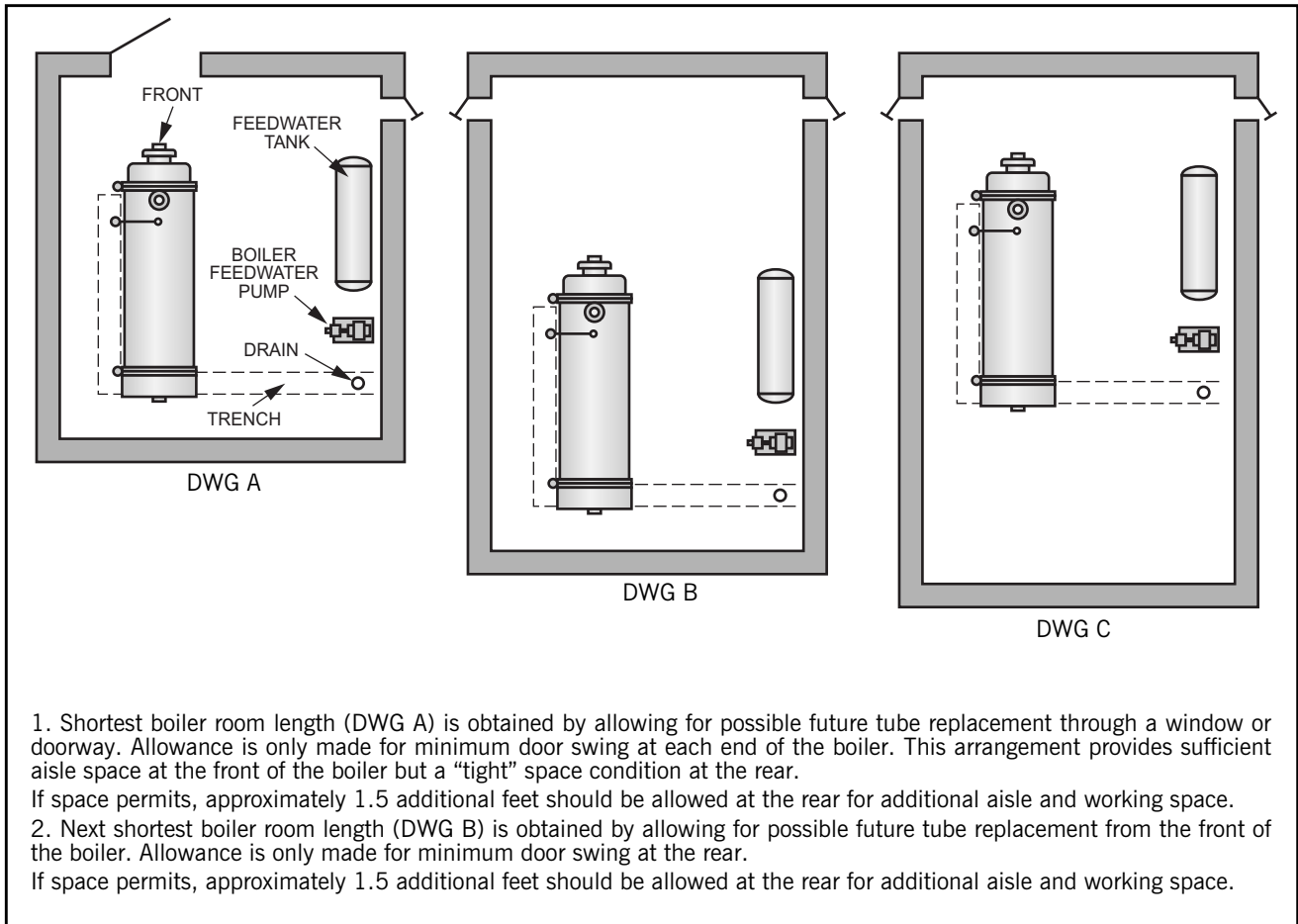


Figure 5. Boiler Room Length (Typical Layouts)

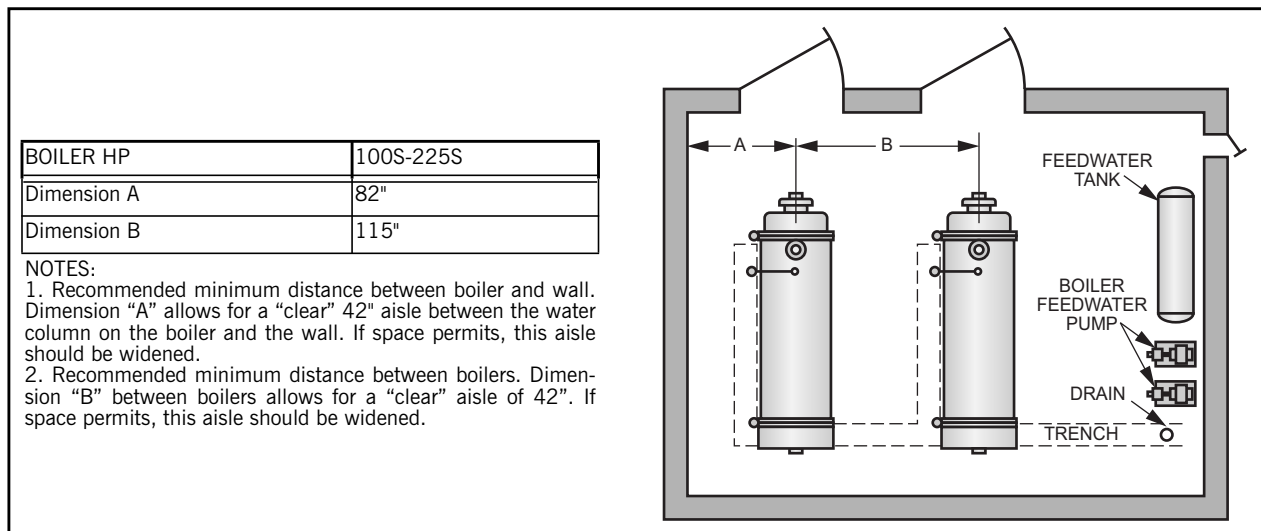


Figure 6. Boiler Room Width (Typical Layout)



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