
# *Model FLX*

## Installation Instructions

FLEXIBLE WATERTUBE
BOILER

HOT WATER
and STEAM

1,500,000 to 12,000,000 BTU/hr
Gas or Oil fired

750-154
08/06

# CLEAVER-BROOKS
# MODEL FLX
# FLEXIBLE WATERTUBE BOILER
# HOT WATER AND STEAM

1,500,000 Btu/Hour to 12,000,000 Btu/Hour

INSTALLATION INSTRUCTIONS

CleaverBrooks®

Please direct purchase orders for replacement manuals to your local Cleaver-Brooks authorized representative

Manual Part No. 750-154
8/06

Printed in U.S.A.

# *WARNING*

**DO NOT OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS YOU FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL.**

**DO NOT ALLOW OTHERS TO OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS THEY FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL.**

**FAILURE TO FOLLOW ALL APPLICABLE WARNINGS AND INSTRUCTIONS MAY RESULT IN SEVERE PERONAL INJURY OR DEATH.**

TO: **Owners, Operators and/or Maintenance Personnel**

This operating manual presents information that will help to properly operate and care for the equipment. Study its contents carefully. The unit will provide good service and continued operation if proper operating and maintenance instructions are followed. No attempt should be made to operate the unit until the principles of operation and all of the components are thoroughly understood. Failure to follow all applicable instructions and warnings may result in severe personal injury or death.

It is the responsibility of the owner to train and advise not only his or her personnel, but the contractors' personnel who are servicing, repairing or operating the equipment, in all safety aspects.

Cleaver-Brooks equipment is designed and engineered to give long life and excellent service on the job. The electrical and mechanical devices supplied as part of the unit were chosen because of their known ability to perform; however, proper operating techniques and maintenance procedures must be followed at all times. Although these components afford a high degree of protection and safety, operation of equipment is not to be considered free from all dangers and hazards inherent in handling and firing of fuel.

Any "automatic" features included in the design do not relieve the attendant of any responsibility. Such features merely free him of certain repetitive chores and give him more time to devote to the proper upkeep of equipment.

It is solely the operator’s responsibility to properly operate and maintain the equipment. No amount of written instructions can replace intelligent thinking and reasoning and this manual is not intended to relieve the operating personnel of the responsibility for proper operation. On the other hand, a thorough understanding of this manual is required before attempting to operate, maintain, service, or repair this equipment.

Because of state, local, or other applicable codes, there are a variety of electric controls and safety devices which vary considerably from one boiler to another. This manual contains information designed to show how a basic boiler operates.

Operating controls will normally function for long periods of time and we have found that some operators become lax in their daily or monthly testing, assuming that normal operation will continue indefinitely. Malfunctions of controls lead to uneconomical operation and damage and, in most cases, these conditions can be traced directly to carelessness and deficiencies in testing and maintenance.

It is recommended that a boiler room log or record be maintained. Recording of daily, weekly, monthly and yearly maintenance activities and recording of any unusual operation will serve as a valuable guide to any necessary investigation.

Most instances of major boiler damage are the result of operation with low water. We cannot emphasize too strongly the need for the operator to periodically check his low water controls and to follow good maintenance and testing practices. Cross-connecting piping to low water devices must be internally inspected periodically to guard against any stoppages which could obstruct the free flow of water to the low water devices. Float bowls of these controls must be inspected frequently to check for the presence of foreign substances that would impede float ball movement.

The waterside condition of the pressure vessel is of extreme importance. Waterside surfaces should be inspected frequently to check for the presence of any mud, sludge, scale or corrosion.

The services of a qualified water treating company or a water consultant to recommend the proper boiler water treating practices are essential.

The operation of this equipment by the owner and his operating personnel must comply with all requirements or regulations of his insurance company and/or other authority having jurisdiction. In the event of any conflict or inconsistency between such requirements and the warnings or instructions contained herein, please contact Cleaver-Brooks before proceeding

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### To the installer of this Cleaver-Brooks FLX Flexible Watertube Boiler:

This manual presents information to assist in the installation of Cleaver-Brooks Model FLX Flexible Watertube Boilers. Items covered include lifting and moving the boiler, placement of the boiler, boiler room requirements, connections to the boiler, system operating requirements, and water treatment. The information is presented to enable the installer to quickly install the unit with the least risk of damage to the equipment as possible.

Recommendations given in this manual are minimum requirements pertaining to the Cleaver-Brooks FLX series boiler. Insurance and local or state regulatory codes may contain additional or more stringent requirements than those noted in this manual. Installation must conform to the requirements of the owner's insurance carrier, state and local codes governing such equipment, and/or any other authority having jurisdiction. Prior to installation, the proper authorities having jurisdiction are to be consulted, permits obtained, etc.

Section 5 in this manual contains a checklist to verify installation. Complete the checklist prior to start up of the boiler.

If you are not certain about what procedures should be performed for installation and under start-up, refer to the guidelines on the following page.

Further information about the Cleaver-Brooks FLX model boilers may be obtained from your local Cleaver-Brooks authorized Representative. For further information regarding operation of this boiler, refer to the FLX Steam and Hot Water Boiler Operating and Maintenance Manual (750-177).

# INSTALLATION AND STARTUP GUIDELINES

| | |
|---|---|
| • Installation should include: | • Start-up should include: |
| • Proper setting of the boiler | • Complete inspection of the boiler |
| • Hot water and/or steam piping and code compliance | • Complete inspection of accessories |
| • Blowoff piping and code compliance | • Firing the unit |
| • Water connections | • Boiling out the unit |
| • Relief valves, piping, and drains | • Conducting normal safety checks |
| • Stack connection | • Providing operating instructions |
| • Electrical system code compliance | • Providing maintenance training |
| • Fuel supply system lines | • Reviewing maintenance and parts program |
| | * Not provided by Cleaver-Brooks |

# SAFETY PRECAUTIONS

Throughout this manual, procedures or operations that require special attention will be emphasized with a cautionary note. These notes will be identified by the symbols **!WARNING, CAUTION!** or **NOTE:** The significance of the symbols is as follows:

**!WARNING Indicates a potentially hazardous situation which, if not avoided, could result in serious personal injury or death.**

**CAUTION!** Indicates a potentially hazardous situation which, if not avoided, could result in damage to the equipment.

**NOTE:** Indicates information that is vital to the operation or maintenance of the equipment.

# 1 LIFTING AND MOVING THE BOILER

Cleaver-Brooks Model FLX boilers are equipped with two lifting lugs located on the boiler's upper drum. The front lifting lug protrudes through the roof panel and the rear lifting lug is located in the stack area. These lugs should be used to lift the boiler. The boiler should not be lifted by the base, or moved by pushing, prying or pulling on the boiler casing or the burner.

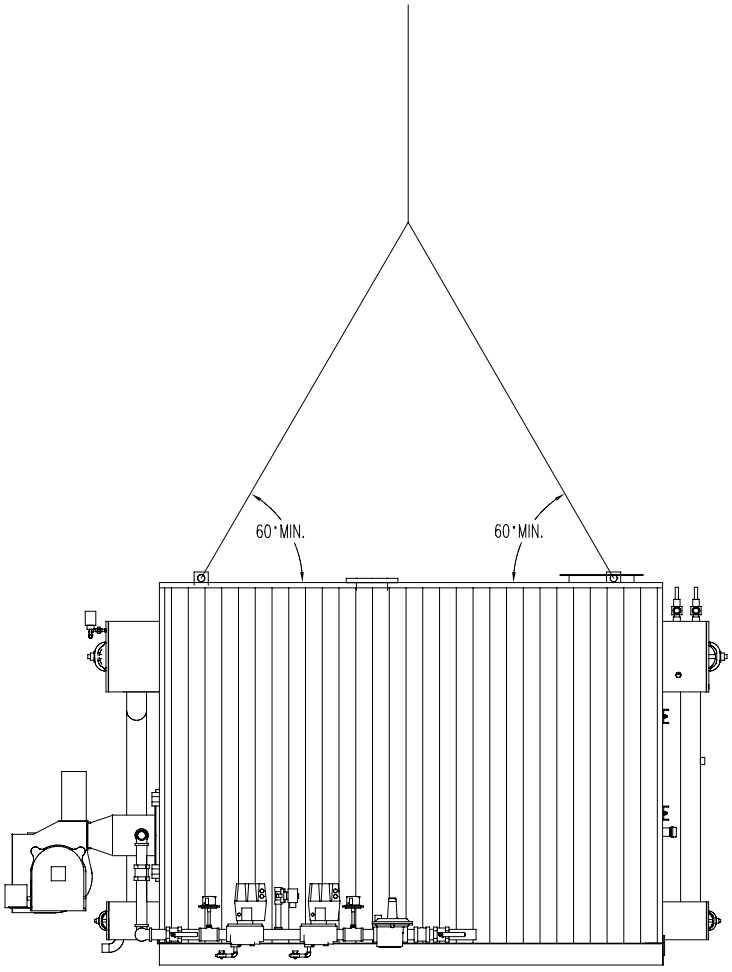


**Fig. 1-1 Lifting the Boiler**

Suitable equipment adequate to safely lift and support the weight of the boiler within the restrictions of the chain angles should be on hand when the boiler arrives at the site. Approximate shipping weights for Cleaver-Brooks FLX boilers are listed in the Appendix, Table 1.

If roller dollies are used to transport the boiler, they should be positioned under the base rails at the lifting lugs. If pipes or other rollers are used to move the boiler, the boiler must be supported by at least three evenly spaced rollers at all times.

**CAUTION!** In order to avoid damage to the unit, lifting or moving the boiler should only be done by experienced personnel with suitable equipment for moving heavy industrial equipment.

# 2 THE BOILER ROOM

## Placement of the Boiler

The boiler must be installed on a noncombustible floor. If the floor is not level, piers or a raised pad slightly larger in length and width than the boiler base dimensions will make boiler installation and leveling easier. Installation on a raised pad or piers will make boiler drain connections more accessible. The floor, pad, or piers must be of sufficient load bearing strength to safely support the operating weight of the boiler and any additional equipment installed with it. Approximate operating weights for FLX series boilers are listed in the Appendix, Table 2.

After the boiler is in place, it must be leveled. Both side-to-side and front-to-back level can be verified by using the vertical connection between the upper and lower drums at the back of the boiler as a reference. If shims are required to level the boiler, the weight of the boiler must be evenly distributed at all points of support.

## Clearances

The boiler must be installed so that all components remain accessible for inspection, cleaning, or maintenance. Field-installed piping and electrical connections to the burner or boiler must be arranged so as to avoid interfering with removal of the inner and outer casing panels or with the burner and burner door as they are moved.

Adequate clearance to walls or other obstructions is required for casing removal and upper pass cleaning or tube replacement. In addition to maintaining clearances to walls or obstructions for inspection or maintenance purposes, boiler surfaces that become heated during operation require at least the minimum clearances to combustible materials shown in the Appendix, Table 3. The shaded sections in Fig. 2-1 show areas that must be kept clear of field installed connections to the boiler for access or maintenance purposes. Minimum clearances to walls or other obstructions and combustible construction are shown in the Appendix, Table 3 and in Fig. 2-2.

## Combustion Air Supply

A positive means of supplying a volume of outside air adequate for complete fuel combustion in the boiler and proper ventilation of the boiler room must be provided.

The amount of air required, and the duct and air supply opening areas, are determined by maximum fuel input rating of the burner and the altitude of the installation. Air inlets must be sized in accordance with applicable engineering guidelines and regulatory code.

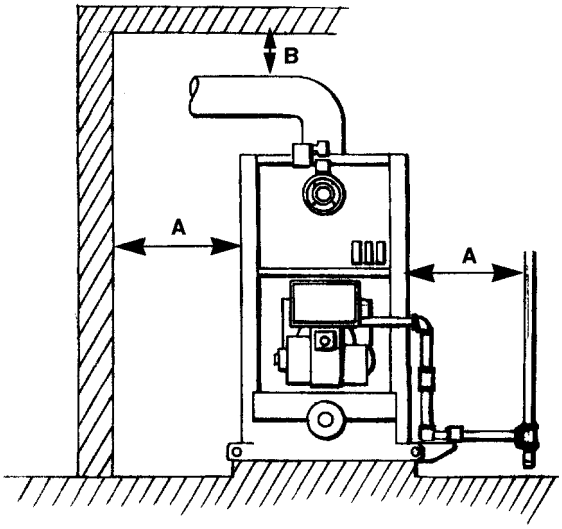


**Fig. 2-1 Clearance to Walls, Obstructions, or Combustible Construction (See also Appendix, Table 3)**

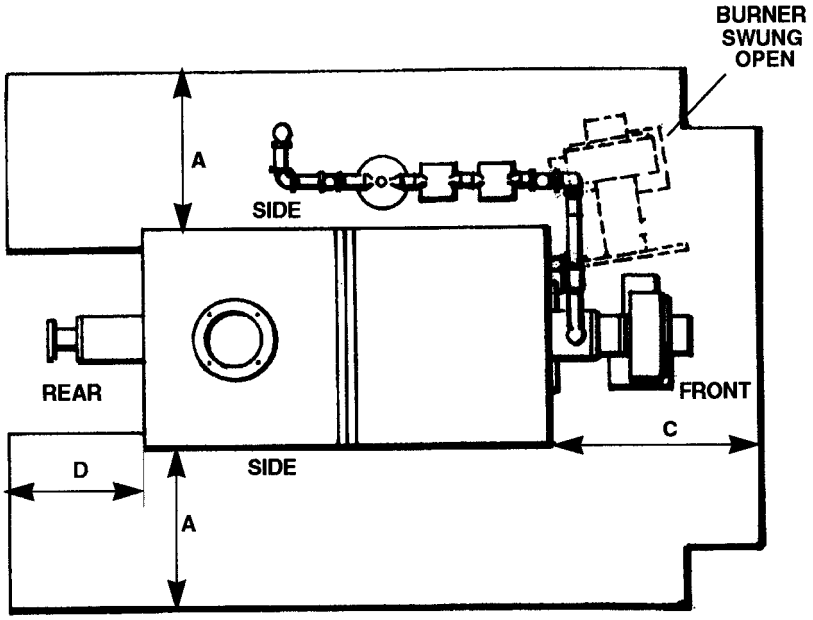


**Fig. 2-2 Clear Areas Required For Access And Maintenance**

# 3 CONNECTIONS AND SYSTEM REQUIREMENTS

Drain connections are provided at the front and/or rear of the bottom drum. A drain valve and piping, piped to a safe point of discharge must be installed. A gate or ball valve meeting the minimum service requirements for the installation is suitable for this application. In no case, however, should the drain or blowoff valve have a pressure rating less than 30 psi, and a temperature rating less than 250 °F.

**NOTE:** All connections made to the boiler must be arranged so that all components remain accessible for inspection, cleaning, or repairs.

The relief valve is a very important safety device and deserves attention accordingly. The purpose of the valve(s) is to relieve pressure buildup over the design pressure of the vessel. The size, rating, and number of valves on a boiler are determined in accordance with the ASME and other codes. The proper installation of a valve is of primary importance to its service life.

**!WARNING Incorrect or improper installation of the relief valve may affect valve operation. Only certified personnel such as the relief valve manufacturer's representative should adjust or repair the boiler relief valves. Failure to heed this warning could result in serious personal injury or death.**

**CAUTION!** Care must be exercised in the installation of a relief valve to ensure that the valve functions as designed. Apply only a moderate amount of pipe compound to male threads. Avoid over-tightening, as this may distort valve seating surfaces. Use only flatted wrenches on the flats of the valve.

Do not paint, oil, or otherwise cover any interior or working parts of the relief valve. A relief valve does not require any lubrication or protective coating to work properly.

A relief valve must be mounted in a vertical position. Discharge piping must be properly piped to drains to prevent buildup of back pressure and accumulation of foreign material around the valve seat area.

The discharge piping must be properly arranged and supported so that its weight does not bear upon the valve. The discharge piping from the relief valve(s) should be as short and direct as possible and must be routed to a point of safe discharge.

Discharge piping from relief valves, blowdown valves, and other drains must be arranged so that all components remain accessible for inspections, cleaning, or maintenance. Relief valves and their discharge piping are to be installed to conform to ASME code requirements.

**!WARNING Discharge piping from relief valves, blowdown valves, and other drains must be routed to a safe point of discharge, so that discharge of hot water or steam cannot cause serious personal injury or death or damage to property.**

### System Connections (Hot Water Boiler)

Connection to the system header or supply line is made at the flanged fitting at the upper drum front. The system connection for return flow to the boiler is located at the back of the bottom drum.

Stop valves should be installed between each boiler and the system and return lines. The stop valves should be located as close to the boiler as possible to provide for draining or pressure testing the boiler without draining the system. Lug-style butterfly valves meeting the service requirements of the system are suitable for this location.

**CAUTION!** Make certain that supply and return stop valves are fixed in the open position at all times when the burner is firing, in order to avoid damage to the equipment.

### System Connection (Steam Boiler)

Connection to the main steam header is made at the flanged nozzle projecting upward from the top drum. A suitable stop valve is required, by ASME Code, to be installed between the boiler and main steam header if multiple boilers are tied to the header. This valve should be located as close as possible to the boiler to facilitate venting and pressure testing. A suitably rated gate valve is recommended for this purpose. Local codes frequently address this area, care should be taken to ensure compliance.

Feedwater is introduced at the designated connection at the rear of the boiler. The feedwater supply should provide sufficient pressure to meet the minimum flow requirements shown in the Appendix, Table 5. The feedwater piping should also include suitably rated stop and check valves.

### Circulation (Hot Water Boiler)

Boilers, as an integral part of hot water systems, require proper circulation of water within certain limits of temperature, flow, and pressure in order to attain maximum efficiency, economy, and length of service. All valves, piping, pumps, and receivers should be installed in accordance with prevailing codes and practices and the manufacturer's recommendations. For further information on circulation, refer to the FLX Hot Water Boiler Operating and Maintenance Manual (750-177).

### Air Removal (Hot Water Boiler)

Any dissolved gases that may be released in the boiler will collect at the top of the drum, where they will escape through the air vent tapping. This tapping, on the top center line of the upper drum, should be connected to the expansion or compression tank. Fig. 3-1 shows a typical hot water system installation.

**NOTE**: Reverse or balanced returns are shown and are recommended since they help equalize the paths of water flow and simplify the balancing of the circuits.

**A. Individual Zone Circuits**: Many systems employ a main circulating pump (located in the boiler room) for each zone. Pump size and capacity can vary from zone to zone depending on the zone location, total heat load, number of branches, head, and type and quantity of heat users or radiation equipment in the zone. Each one can be operated independently of the others. Each zone pump takes suction from a common supply header and the zone returns empty into a common return header. There may or may not be smaller, secondary pumps out in the zone itself.

**B. Primary Loop Circuit**: A common system employs one main or primary supply header and one common return header, usually connected by means of a radiation device in a remote hallway or other non-critical area. Individual zone take-offs from the common supply header feed the various zones. Individual zone returns empty into the common return header such that all of the zones are in parallel with respect to the

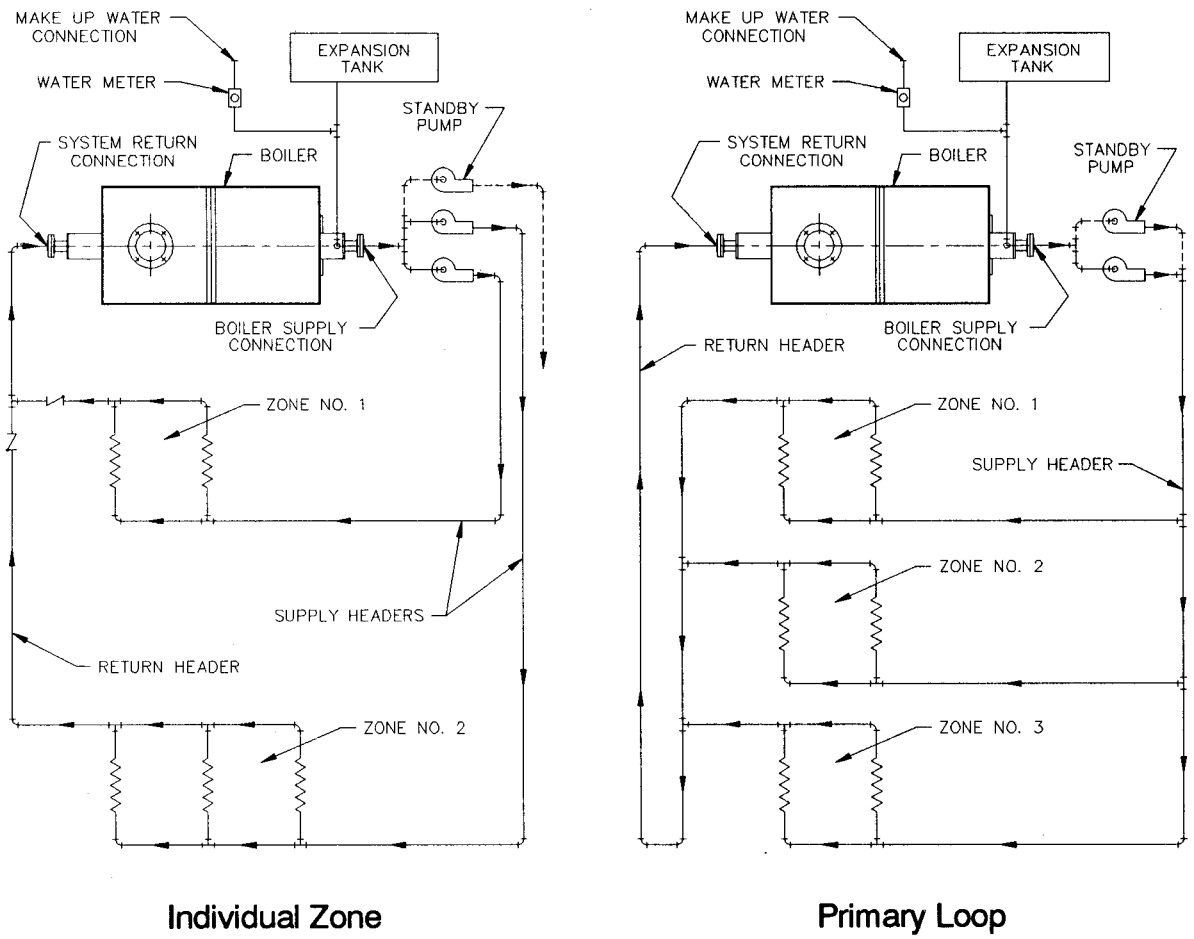


**Fig. 3-1 Typical Circuit or System Schematic**

two headers. The supply header usually decreases in size as it passes the zone take-offs, and the return header increases in size as it picks up the zone returns. There may or may not be smaller, secondary pumps out in the zone itself.

## Fuel Connections—Gas Fuel

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 done in accordance with all applicable engineering guidelines and regulatory codes. All connections made to the boiler must 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 regulator (supplied by Cleaver-Brooks). 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 Dimension Diagram (DD) furnished by Cleaver-Brooks for this 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 Fuel

An oil-fired burner is equipped with an oil pump, which draws fuel from a storage tank and supplies pressurized oil to the nozzle(s). The burner supply 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. Oil lines must be sized for the burner and burner supply pump capacities.

The burner supply pump suction should not exceed 10" Mercury. 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.

**CAUTION!** Non-hardening oil pipe dope is recommended for use on the threads of all fittings in the oil supply system. The use of Teflon tapes or paste is not recommended. Careless application of these materials may allow them to be introduced into and damage critical internal areas of the burner pump.

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 and burner supply pump capacities. A strainer mesh of 150 microns (.005") is recommended.

A check valve usually is installed in the line in order 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. Fig 3-2 Shows a typical oil fuel supply arrangement.

## Electrical Connections

Electrical supply to the boiler must be of proper voltage and phase, as inscribed on the burner or electrical panel nameplate. All connections made to the boiler must comply with code requirements and must be arranged so that all components remain accessible for inspection, cleaning, or maintenance. When wiring this boiler, refer to the wiring diagram (WD) prepared by Cleaver-Brooks for this particular installation.

## Flue Vent Connections

The flue connection (breeching) between the boiler and the chimney must be no smaller in diameter than the flue vent opening provided on the boiler. The proper sizing of stacks and breeching is required in order to maintain the proper flue gas velocity with a static draft condition (0" Water Column) at the boiler flue vent.

There should be no long horizontal runs in the flue pipe, and all horizontal pipes should be pitched away from the boiler at least 1/4" per foot. A drain connection should be provided at all low spots, as shown in Fig. 3-3. Round breeching or stacks generally are more efficient than square or rectangular shapes and should be used when possible.

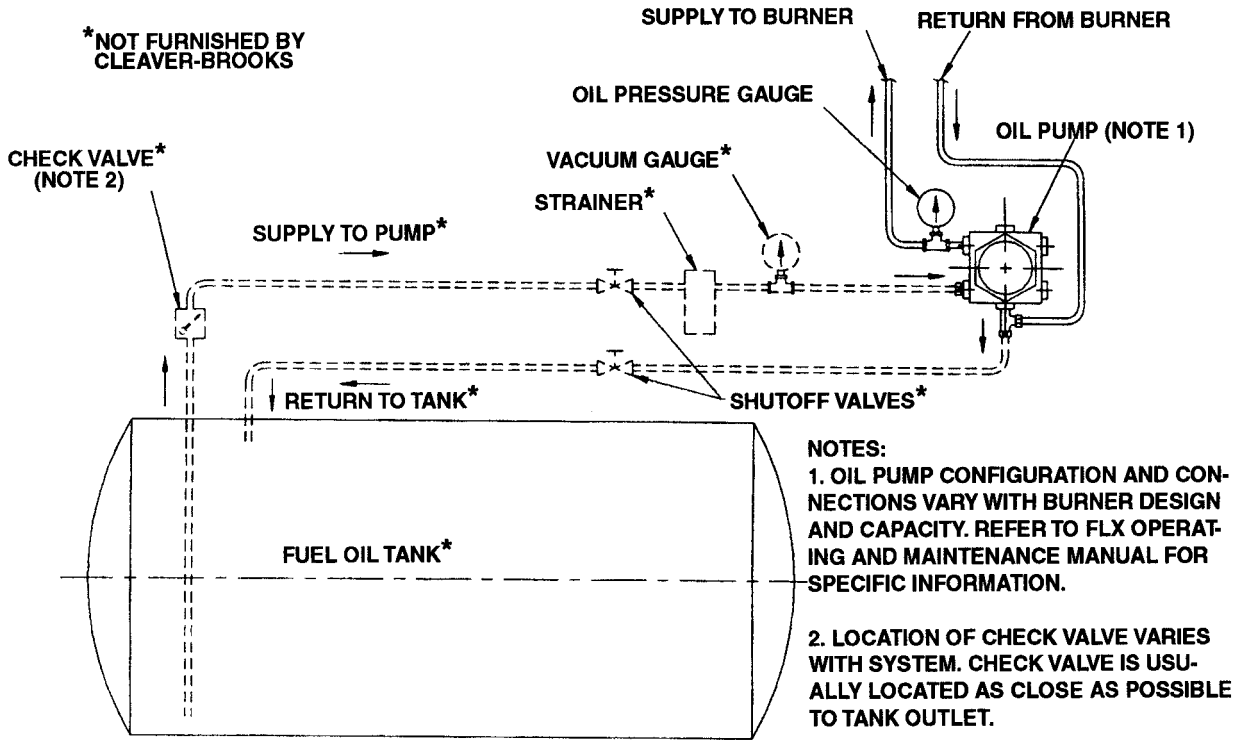


**Fig. 3-2 Burner Oil Supply Pump Installation**

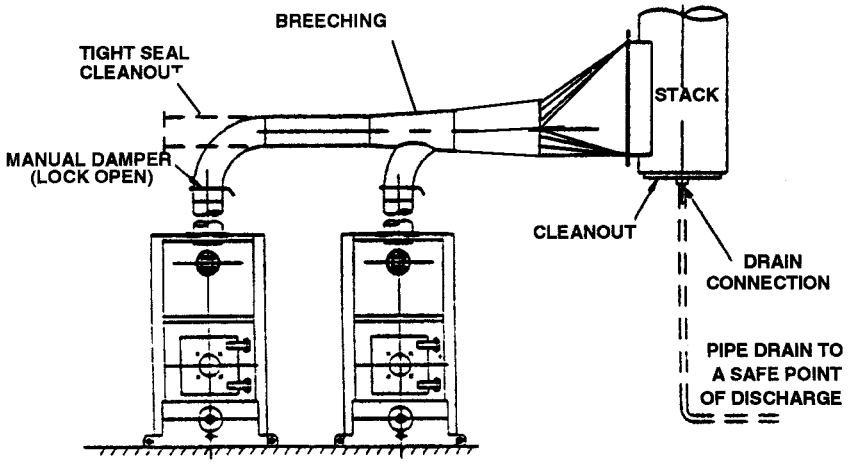


**Fig. 3-3 Breeching Arrangement, Single or Multiple Boiler Installation**

The maximum load on the flue vent connection and the top casing of the FLX boiler must be limited to 200 pounds of vertical load, with no side load.

> **CAUTION!** The top casing of a FLX series boiler should not be used as a work platform. Imposing vertical loads on the top casing in excess of 200 pounds may result in structural damage to the boiler casing and possible leakage of products of combustion to surrounding spaces.

### Multiple Boiler Connections

When multiple boilers are to be connected to a common breeching, the breeching must be designed and constructed so as to maintain required flue gas velocity and draft conditions. Fig. 3-3 and Table 4 in the Appendix show breeching sizes and installation details for multiple boiler connections. Horizontal breeching, such as shown in Fig. 3-3, is recommended in order to prevent condensation that may form in the breeching from returning to the boiler.

# 4 WATER REQUIREMENTS

## Water Quality

Good water quality in the boiler is essential. Close attention to water quality will pay dividends in the form of proper operation, longer life, less downtime, and prevention of costly repairs. The water used to fill the boiler or to make up for system losses should be free of dissolved oxygen or corrosive gases, sediments or other contaminants and should be at a minimum temperature of 70 degrees Fahrenheit. The exclusive use of clean, properly treated make-up water in the boiler will yield maximum efficiency and the longest possible trouble-free life from the pressure vessel.

**CAUTION!** If the boiler is to be used for temporary heat, as for example in new construction, properly treated water still must be used. Failure to do so can cause damage to the boiler.

## Water Treatment

Maintaining boiler water quality generally requires proper feedwater treatment before and after introduction of water into the boiler. The selection of pretreatment processes depends upon the water source, its chemical characteristics, the amount of makeup water needed, system operation practices, and so on. Treating methods include filtering, softening, demineralizing, deaerating, and preheating. After treatment involves chemical treatment of the boiler water.

Steam boilers have critical water quality limits, which must be observed in order to ensure optimum steam purity and boiler life expectancy. The limits are shown in the Appendix, Table 6.

A properly sized water meter should be installed in a raw water makeup line in order to accurately determine the amount of water admitted to the boiler.

## Pressure Test of Boiler and System Piping

All new boilers and systems must be checked for leaks. Fill the boiler and system with clean water. Pressure should be increased to a point just below the relief valve setting or as required. Check for leaks in the system and boiler fittings, including the internal tube-to-drum connections, at this elevated pressure. Minor leaks at tube-to-drum connections may develop from movement incurred in shipping or in handling during installation. If such leaks occur, it will be necessary to reseat tube fittings. Minor tube ferrule leaks may be stopped by tightening the ferrule retainer nut. If a ferrule leak persists, the ferrule will need to be driven further into the drum socket, using an installation tool designed for this purpose, which is available from your local Cleaver-Brooks authorized Representative.

## Boilout of a New Boiler

An internal cleaning procedure (boilout) is vital to the efficiency and proper operation of the boiler and the system and is required before the unit is put into service. The internal surfaces of the newly installed boilers may contain oil, grease, or other contaminants which, if not removed, can adversely affect system performance. In extreme instances, contamination could cause localized reduction of heat transfer and result in overheating of pressure vessel surfaces.

For further information on boilout of a new boiler, refer to the Cleaver-Brooks FLX Hot Water Boiler Operation and Maintenance Manual (750-145) or consult your local Cleaver-Brooks Authorized Parts and Service Representative.

### System Cleaning

Certain extraneous materials do find their way into the system during construction. The most common materials are: Pipe dope, thread cutting oils, soldering flux, rust preventatives or slushing compounds, core sand, welding slag, and sand or clays from the job site. To obtain optimum performance, the system should be cleaned and flushed. Cleaning a hot water system is accomplished in much the same manner as cleaning the boiler and may be done at the same time.

For more information on system cleaning, consult a qualified professional.

# 5 INSTALLATION CHECKLIST

This installation checklist should be used as an aid to ensure that the boiler is ready for start-up. The list includes those items that have been found to cause delays in start-up. Attention to these items will assist in bringing the equipment on line without needless delay or additional service charges. Installation must be completed before start-up can be scheduled. With all aspects of the boiler installation addressed and complete, your local Cleaver-Brooks Service Representative should be contacted for start-up. Mark the appropriate space for each item on the checklist. The installation should not be considered complete until all boxes have been checked yes or no.

## GENERAL

| Yes | No | |
|---|---|---|
| ___ | ___ | 1. Are all Cleaver-Brooks supplied items in good, operating shape? If not, note here. |
| ___ | ___ | 2. Is the burner fuel and pilot supply piping properly installed? |
| ___ | ___ | 3. If dual-fuel is specified, are both fuels available for start-up? |
| ___ | ___ | 4. Where required, will qualified operators for the boiler or burnerbe present for start-up? |
| ___ | ___ | 5. Will operating personnel be available for training during start-up? |
| ___ | ___ | 6. Will a person be available at all times to assist the service technician with miscellaneous tasks in the boiler room? |
| ___ | ___ | 7. A full capacity load (sufficient for high fire fuel/air ratio adjustment) will be required for complete burner adjustment. Can this load be absorbed by the system, and have provisions been made to put a full load on the boiler during start-up? |

## BOILER

| Yes | No | |
|---|---|---|
| ___ | ___ | 8. Is the boiler and/or auxiliary equipment installed in accordance with manufacturer's and insurer's requirements and applicable insurance and regulatory codes? |
| ___ | ___ | 9. Has all system piping to and from the boiler been completed? |

___ ___ 10. Is the relief valve(s) properly installed?

___ ___ 11. Is the relief valve discharge piping properly installed with no weight or strain on the valve(s)?

___ ___ 12. Is the boiler drain valve(s) installed properly?

___ ___ 13. Are boiler drain and relief valves piped to a place of safe discharge, and are the drain lines installed in accordance with all applicable regulatory codes?

___ ___ 14. Is the return water temperature thermometer installed in the system return fitting?

## ELECTRICAL

Yes No

___ ___ 15. Is the available power supply (voltage and phase) correct (per the burner data plate information?

___ ___ 16. Have all electrical connections been made for boiler and all auxiliary equipment?

___ ___ 17. Have emergency and safety devices been installed in accordance with regulatory codes?

___ ___ 18. Have all boiler field-wired connections been made according to the wiring diagram supplied by Cleaver-Brooks for this particular installation?

## WATER

Yes No

___ ___ 19. Has the makeup water system and pressure regulating valve been connected and are they operable?

___ ___ 20. Have the boiler and system been pressure tested to check for leaks?

___ ___ 21. Has the boiler and system been filled with properly treated water at a minimum temperature of 70 degrees Fahrenheit? This must be done prior lo start-up.

## GAS FUEL

Yes No

___ ___ 22. Have all gas lines been pressure tested according to local codes, then purged of air?

___ ___ 23. Is gas pressure and volume sufficient for the boiler(s) at maximum demand firing rate, as stated on the burner nameplate?

___ ___ 24. Are gas pressure gauges installed and are they indicating proper gas pressure upstream of the regulator?

___ ___ 25. Are gas vents including vent valves, properly piped to a point of safe discharge? Has insurance inspection, if required, been completed?

## OIL FUEL

Yes No

___ ___ 26. Has the fuel oil installation been done in accordance with all applicable local, state, and insurer requirements.

___ ___ 27. Has the burner oil supply pump been properly located and installed so as not to exceed the head limitations of pump location or suction limitations of the pump?

___ ___ 28. Has a vacuum gauge been installed between the oil pump and the suction shutoff valve?

___ ___ 29. Are strainers installed so as to prevent entry of foreign materials into fuel control valves?

___ ___ 30. Have oil lines been checked for leaks?

# APPENDIX

**Table 1: Cleaver-Brooks Model FLX Shipping Weights**

| BOILER MODEL | 200-250 | 300-350 | 400-600 | 700-900 | 1000-1200 |
|---|---|---|---|---|---|
| Hot Water - Shipping Weight (lbs) | 3900 | 5000 | 6100 | 8500 | 10,000 |
| Steam - Shipping Weight (lbs) | 5700 | 6200 | 7900 | 10,200 | 11,700 |

Note: Dry weights are for factory assembled boilers with burner attached

**Table 2: Cleaver-Brooks Model FLX Operating Weights**

| BOILER MODEL | 200-250 | 300-350 | 400-600 | 700-900 | 1000-1200 |
|---|---|---|---|---|---|
| Hot Water - Operating Weight (lbs) | 4700 | 5900 | 7600 | 10,500 | 12,300 |
| Steam - Operating Weight (lbs) | 6600 | 7200 | 9200 | 12,500 | 14,100 |

**Table 3: Minimum clearances to obstructions and combustible construction**

| BOILER MODEL | 200-250 | 300-350 | 400-600 | 700-900 | 1000-1200 |
|---|---|---|---|---|---|
| Sides (Inches) | 28 | 32 | 34 | 40 | 40 |
| Top (Inches) | 18 | 18 | 18 | 18 | 18 |
| Front (Inches) | 48 | 48 | 48 | 48 | 48 |
| Back (Inches) | 24 | 24 | 24 | 24 | 24 |
| Flue (Inches) | 18 | 18 | 18 | 18 | 18 |

**Table 4: Minimum boiler feed rates (steam boilers)**

| BOILER MODEL | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. Feed Rate (gpm) | 6.6 | 8.2 | 9.9 | 11.6 | 13.2 | 14.9 | 16.5 | 18.2 | 19.8 | 23.1 | 26.4 | 29.7 | 33.0 | 36.4 | 39.6 |

Note: Feedwater to the boiler must be at least 60 deg F for minimum performance. 212 deg F is preferred.

**Table 5: Boiler water quality limits (steam boilers)**

| | |
|---|---|
| Silica | 150 ppm |
| Specific Conductance | 3500 $\mu$mho/cm |
| Total Alkalinity | 300 ppm as $CaCO_3$ |
| Total Hardness | 0 ppm as $CaCO_3$ |
| Oxygen ($O_2$) | 7 ppb |
| pH | 7 - 10 |
| Total Iron | 0.05 ppm |
| Oily Matter | 1 ppm |

## *NOTES*

## *NOTES*

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