

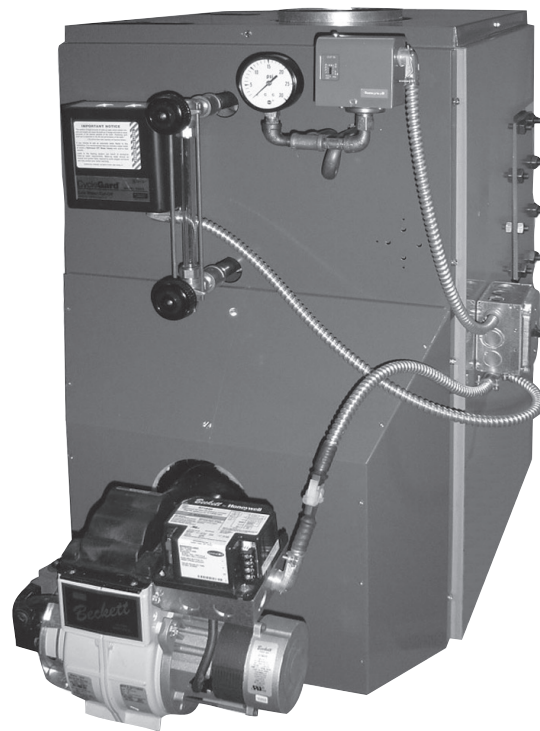


## ESC V STEAM SERIES 5 OIL-FIRED CAST IRON BOILER

### INSTALLATION, OPERATION & MAINTENANCE MANUAL

#### Models

ESC-3090S  
ESC-3090ST  
ESC-4125S  
ESC-4125ST  
ESC-5185S  
ESC-5185ST  
ESC-6210S  
ESC-6210ST



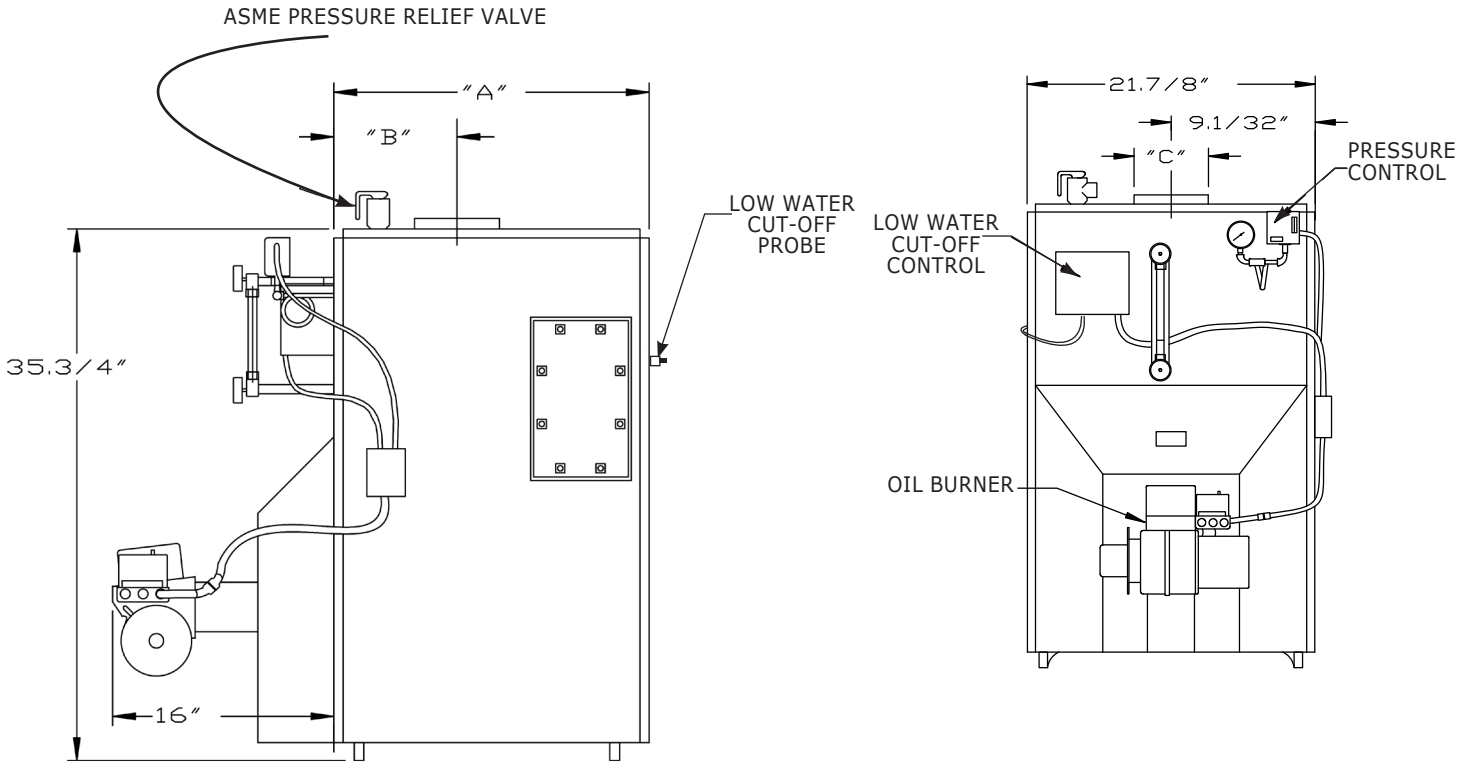
**PATENT 7,823,544**



Manufactured by:  
ECR International Inc.  
2201 Dwyer Avenue, Utica, NY 13501  
Tel. 800 253 7900  
[www.ecrinternational.com](http://www.ecrinternational.com)  
PN 240012151 REV. D [04/30/2019]

## DIMENSIONS

**Figure #1**



<b>DIMENSIONS</b>			
Boiler No.	Length of Flush Jacket	Front of Jacket to Center Line of Flue Outlet	Flue Outlet Diameter
	-A-	-B-	-C-
ESC-3090	$16 \frac{3}{8}''$	$6 \frac{1}{2}''$	6"
ESC-4125	$20 \frac{1}{4}''$	$8 \frac{1}{2}''$	6"
ESC-5185	$23 \frac{5}{8}''$	$10 \frac{1}{4}''$	7"
ESC-6210	$27 \frac{1}{2}''$	$8 \frac{5}{16}''$	8"

**STANDARD EQUIPMENT:** Crated boiler, flush jacket, oil burner, target wall/liner, safety valve, steam water level gauge, steam pressure gauge, steam pressure control, low water cut-off, drain valve, wiring harness, burner electric disconnect, 2" supply tapplings, 1½" return tapping, skim port, and primary control.

**(NOTE:** For tankless heater units, add tankless hot water coil, and low limit control.)

## RATINGS, DATA



### RATINGS

Boiler Model Number		Oil Burner Input <sup>(1)</sup>		Heating Capacity MBH <sup>(4)</sup>	Net AHRI Ratings <sup>(3)</sup>		Min. Natural Draft Chimney Size		A.F.U.E. Rating <sup>(4)</sup>
WITHOUT TANKLESS	WITH TANKLESS	G.P.H.	MBH <sup>(2)</sup>		Steam MBH	Sq. Ft. Steam	Round	Square	
ESC-3090S	ESC-3090ST	0.90	126	106	80	333	6	8"x8"x15'	82.0
ESC-4125S	ESC-4125ST	1.25	175	147	110	458	6	8"x8"x15'	82.0
ESC-5185S	ESC-5185ST	1.85	259	216	162	675	8	8"x8"x15'	82.0
ESC-6210S	ESC-6210ST	2.10	294	247	185	771	8	8"x8"x15'	82.0

**NOTES:**

<sup>(1)</sup> Burner input is based on an oil heating value of 140,000 Btu/gal.

<sup>(2)</sup> MBH = 1000 Btu per hour [Btu = British Thermal Unit].

<sup>(3)</sup> Net AHRI Steam Ratings based on piping and pick-up allowance of 1.333. Consult manufacturer before selecting boiler for installations having unusual piping and pick-up requirements, such as intermittent system operation, extensive piping, etc.

<sup>(4)</sup> Heating Capacity and AFUE based on 13.0% CO<sub>2</sub> with -0.02" W.C. draft over fire and #1 smoke or less. Tested in accordance with U.S. Department of Energy test procedures.

#### TANKLESS WATER HEATER CAPACITIES

Boiler Model Number	Input Rate G.P.H.	Tankless Heater Number	Tankless Heater Capacity Intermittent Draw G.P.M.	Boiler Water Content (Gallons)	
				To Water Line	To LWCO Line
ESC-3090ST	0.90	L-24	2	11	8
ESC-4125ST	1.25	L-24	4½	13	9
ESC-5185ST	1.85	L-24	4½	15	10
ESC-6210ST	2.10	L-24	4½	17	11

## TABLE OF CONTENTS

Dimensions.....	2
Ratings, Data.....	3
Safety Symbols.....	4
Locating The Boiler.....	5
Ventilation And Combustion Air.....	6
Supply And Return Piping.....	8
Venting System Inspection & Installation.....	12
Oil Tank And Piping.....	13
Electrical Wiring.....	14
Operating Instructions.....	16
Start-Up Cleaning.....	19
Maintenance Procedures.....	20
Service Checklist.....	23

**KEEP THIS MANUAL NEAR BOILER  
RETAIN FOR FUTURE REFERENCE**

### SAFETY SYMBOLS

The following defined symbols are used throughout this manual to notify reader of potential hazards of varying risk levels.

#### **DANGER**

Indicates a hazardous situation which, if not avoided, WILL result in death or serious injury.

#### **WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

#### **NOTICE**

Indicates information which should be followed to ensure proper installation and operation.

**IMPORTANT: Read and understand the following instructions COMPLETELY before installing.**

#### **DANGER**

Burn, scald Hazard. Water temperatures exceeding 125°F will cause severe burns instantly or death by scalding. Failure to follow the instructions in this manual could result in death or serious injury.

#### **WARNING**

Installations of boilers and venting shall be done by qualified expert and in accordance with this manual. Installing or venting a boiler or any other gas appliance with improper methods or materials could result in serious injury or death due to fire or to asphyxiation from poisonous gases such as carbon monoxide which is odorless and invisible.

#### **WARNING**

Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids.

Do not obstruct air openings to boiler room.

Modification, substitution or elimination of factory equipped, supplied or specified components could result in personal injury or the loss of life.

**Owner** - Installation and service of this boiler must be performed by a qualified installer.

**Installer** - Leave all instructions with the boiler for future reference.

When this product is installed in the Commonwealth of Massachusetts the installation must be performed by a Licensed Plumber or Licensed Gas Fitter.

**PATENT 7,823,544**

## LOCATING THE BOILER

Installations shall conform to the requirements of the authority having jurisdiction. Such applicable requirements take precedence over the general instructions of this manual. In the absence of such requirements, the installation shall conform to NFPA-31 Standard for the Installation of Oil-Burning Equipment, latest edition.

Where required by the authority having jurisdiction, the installation must conform to the American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME No. CSD-1.

### Locating the boiler:

- Locate boiler in front of final position before removing crate.
- Provide level solid base as near chimney as possible and centrally located with respect to heat distribution system as practical.
- Allow 24 inches in front, top and right hand side for servicing and cleaning, or removing tankless water heating coil.
- Recommend 24 inches be allowed in back of boiler for convenience when skimming hole is used.
- When installed in a utility room, the door should be wide enough to allow largest boiler part to enter, or to permit replacement of another appliance such as water heater.
- Install boiler such that oil ignition system components are protected from water (dripping, spraying, rain etc.) during appliance operation and service.

### ⚠ WARNING

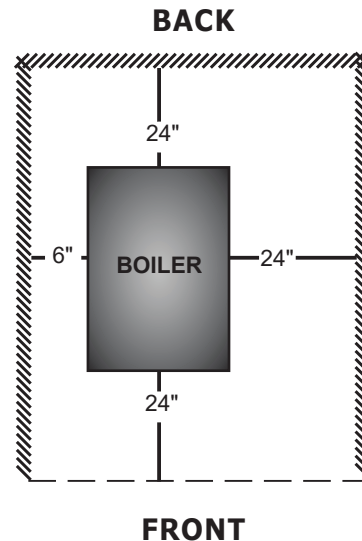
Fire hazard. Do not install boiler on combustible flooring or carpeting. Failure to follow these instructions could result in death or serious injury.

FOR INSTALLATION ON NON-COMBUSTIBLE FLOORS ONLY  
Boiler must not be installed on carpeting or vinyl flooring.  
Minimum clearances to combustible construction are:

TOP	24 IN.
FRONT	24 IN.
FLUE CONNECTOR	9 IN.
REAR	24 IN.
LEFT SIDE	6 IN.
RIGHT SIDE	24IN.

**NOTE:** Clearance for access should exceed fire protection clearance.

**Figure #2 - Minimum Clearances To Combustible Construction (as seen from above)**



**⚠ WARNING**

Asphyxiation, fire hazard. Do not obstruct air openings to combustion area. Follow instructions below, to maintain adequate combustion air.

Provide combustion air and ventilation air in accordance with Chapter 5, Air for Combustion and Ventilation, of NFPA 31, Standard for the Installation of Oil-Burning Equipment, applicable provisions of local building codes, or the following recommendations.

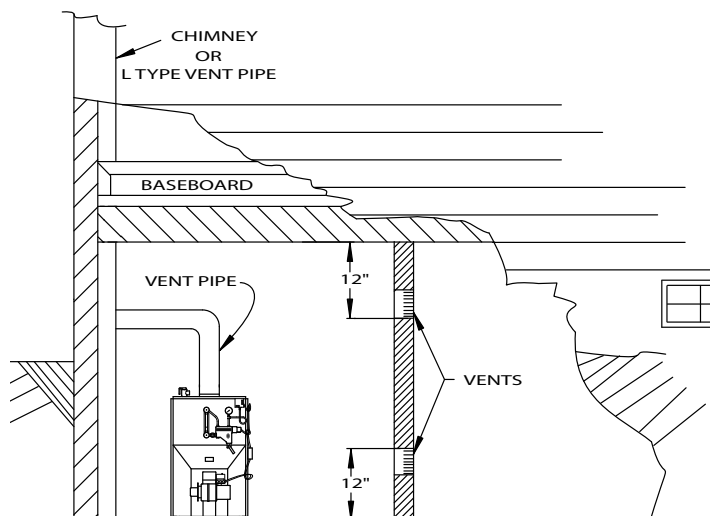
<b>COMBUSTION AIR REQUIREMENTS</b>				
<b>(Minimum Opening Requirement)</b>				
<b>Input (Mbh)</b>	<b>Unconfined Area*</b>		<b>Confined Area**</b>	
	<b>Outside</b>	<b>Inside</b>	<b>Outside Combustion Air</b>	
	<b>Combustion Air 1 Sq.In./5000 BTU/Hr (Step 4)</b>	<b>Combustion Air 1 Sq. In./1000 BTU/ Hr (Min. 100 Sq. In.) (Figure #1)</b>	<b>Vertical Ducts 1 Sq. In./4000 BTU/Hr (Figures # 2 &amp; #3)</b>	<b>Horizontal Ducts 1 Sq. In./2000 BTU/Hr (Figure # 4)</b>
126	26	126	32	63
175	35	175	44	88
259	52	259	65	130
294	59	294	74	147

\* A space whose volume is not less than 50 cubic feet per 1000 BTU/Hour of all appliances installed in that space (cubic feet of space = height x width x length)

\*\* A space whose volume is less than 50 cubic feet per 1000 BTU/Hour of all appliances installed in that space (cubic feet of space = height x width x length)

- Ventilation of boiler room must be adequate enough to provide sufficient air to properly support combustion, venting and maintain safe ambient temperatures under normal operating conditions.
- When the boiler is located in an unconfined space in a building of conventional construction frame, masonry or metal, infiltration normally is adequate to provide air for combustion and ventilation. However, in any building which has been altered to conserve energy or to minimize infiltration, the boiler area should be considered as a confined space.
- When the boiler is installed in an unconfined space, in a building of unusually tight construction, air for combustion and room ventilation must be obtained from outdoors or from spaces freely communicating with the outdoors. A permanent opening or openings having a total free area of not less than 1 square inch per 5,000 BTU per hour of total input rating of all appliances shall be provided. Ducts may be used to convey make-up air from the outdoors and shall have the same cross-sectional area of the openings to which they are connected.
- When air for combustion and room ventilation is from inside buildings, the confined space shall be provided with two permanent openings, one starting 12 inches from the top and one 12 inches from the bottom of the enclosed space. Each opening shall have a minimum free area of 1 square inch per 1,000 BTU per hour of the total input rating of all appliances in the enclosed space, but must not be less than 100 square inches. These openings must freely communicate with the interior areas having adequate infiltration from the outside. See **Figure #3**.

**Figure #3**



5. When the boiler is installed in a confined space and all air is provided from the outdoors, the confined space shall be provided with two permanent openings, one commencing within 12 inches from the top and one commencing 12 inches from the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors. One of the following methods must be used to provide adequate air for ventilation and combustion.

- A. When directly communicating with the outdoors, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure. **(Figure #4)**
  - B. When communicating with the outdoors by means of vertical ducts, each opening shall have a minimum free area 1 square inch per 4,000 BTU per hour of total input rating of all appliances in the enclosed space. **(Figure #5)**
  - C. If horizontal ducts are used, each opening shall have a minimum free area 1 square inch per 2,000 BTU per hour total input rating of all appliances in the enclosed space. **(Figure #6)**
  - D. When ducts are used, they shall be of the same cross sectional area as the free area of the area of the openings to which they connect. The minimum dimension of rectangular air ducts shall not be less than 3 inches.
6. In calculating free area using louvers, grills or screens for the above, consideration shall be given to their blocking effect. Screens used shall not be smaller than 1/4 inch mesh. If the free area through a design of louver or grill is known, it should be used in calculating the size opening required to provide the free area specified. If the design and free area is not known, it may be assumed that wood louvers will have 20-25% free area and metal louvers and grills will have 60-75% free area. Louvers and grills shall be fixed in the open position or interlocked with the boiler so that they are opened automatically during boiler operation.

Figure #4

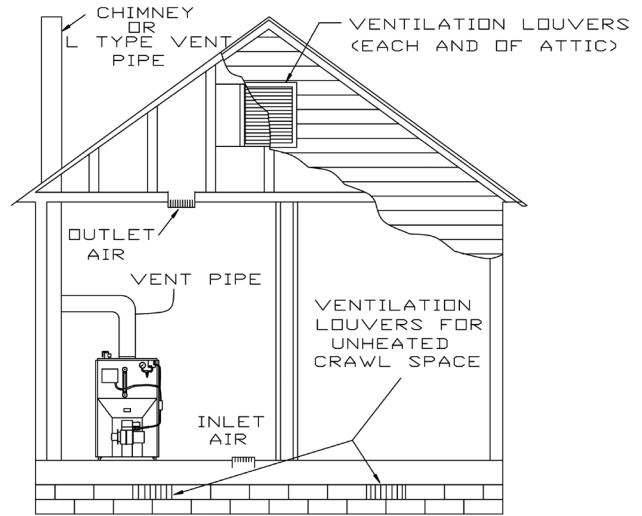


Figure #5

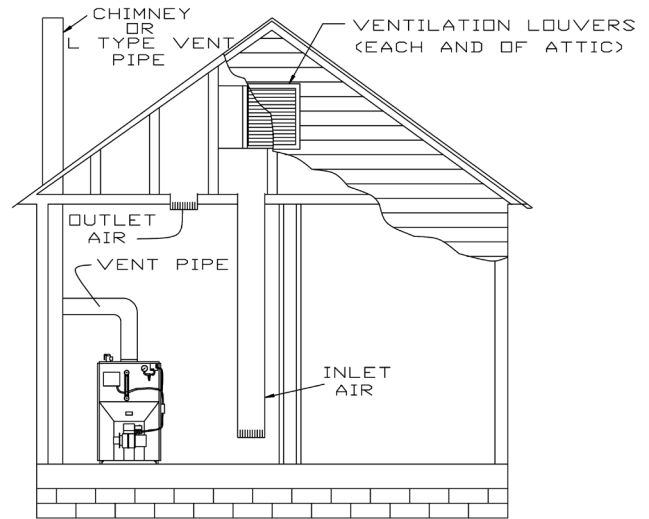
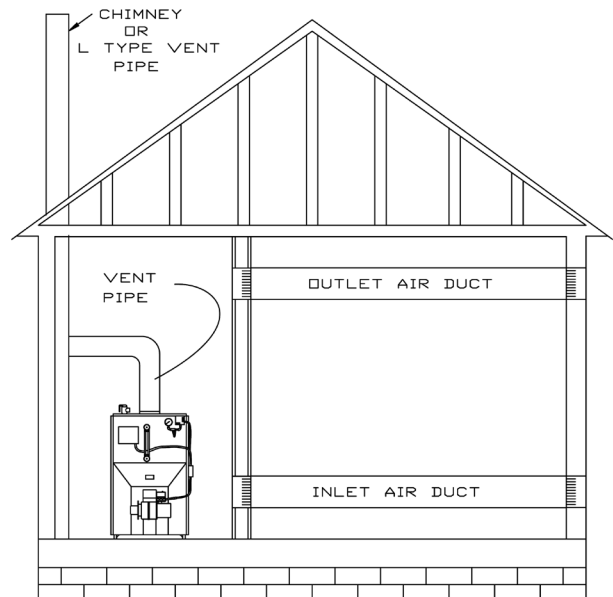


Figure #6



### ⚠️ WARNING

Burn, Scald Hazard! Discharge line shall be installed to safety valve outlet connection to avoid burns, scalding due to discharge of steam and/or hot water during operation. Failure to follow these instructions could result in death or serious injury.

#### Discharge line shall:

- Connect to safety valve outlet. Piped down to safe point of disposal. Check local codes for maximum distance from floor or allowable safe point of discharge.
- Do not use plastic pipe. Use materials suitable for exposure to temperatures of 375° F (191°C); or greater.
- Pipe size be of equal to or greater than of safety valve outlet over entire length of discharge line.
- Have no intervening shutoff valve between safety valve and discharge to atmosphere. Do not plug or place any obstruction in discharge line.
- Terminate freely to atmosphere where any discharge will be clearly visible and at no risk of freezing.
- Allow complete drainage of valve and discharge line.
- Install safety valve with spindle in vertical position.
- Do not install shutoff valve between boiler and safety valve.
- Support safety valve discharge piping.
- Be short and straight as possible.
- Terminate with plain end, not threaded.

Refer to local codes and appropriate ASME Boiler and Pressure Vessel Code for additional installation requirements.

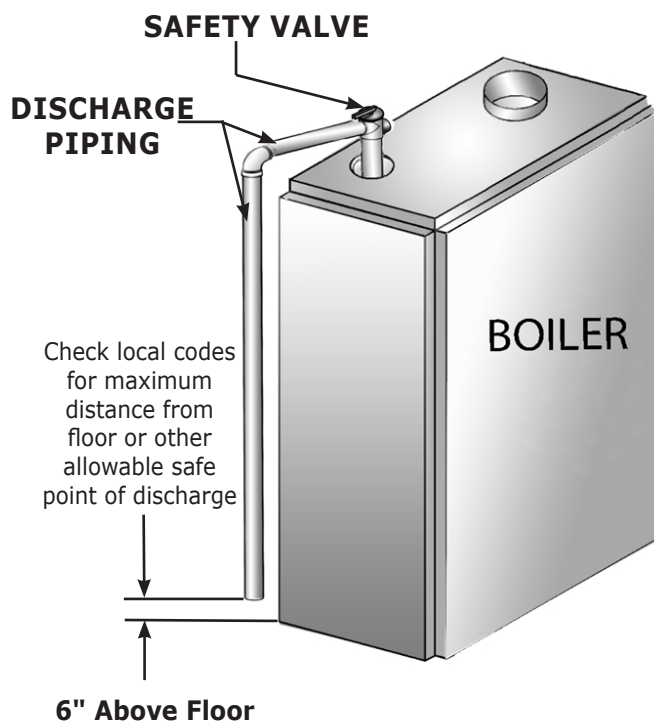
#### Excessive Make-Up Water

A leaky system will increase the volume of make-up water supplied to the boiler, which can significantly shorten the life of the boiler.

Make-up water contains dissolved minerals, salts, and oxygen. When fresh, cool make-up water is heated in the boiler, minerals fall out as sediment. The salts coat the inside of the boiler, and oxygen escapes as a gas. Accumulation of sediment eventually isolates the water from contacting the cast iron. When this happens the cast iron in that area gets extremely hot and eventually cracks.

The presence of free oxygen or chloride salts in the boiler corrodes the cast iron from the inside. More make-up water and higher concentrations of contaminants damage the boiler sooner.

#### Safety Valve Piping



### NOTICE

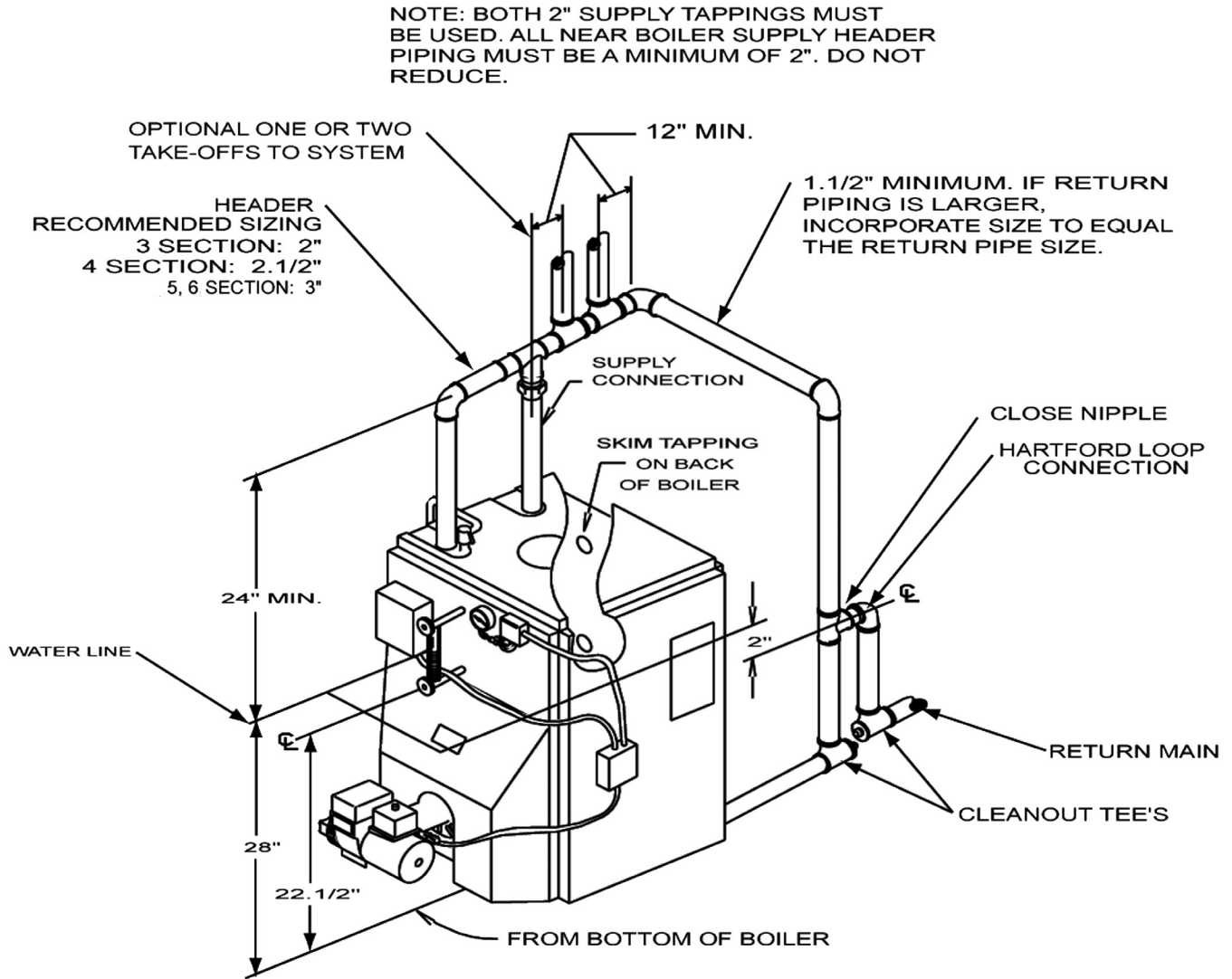
- Do not use softened water in steam boilers, accelerated boiler corrosion will result.
- Consult local water treatment companies for unusually hard water area (above 7 grains hardness) or low pH water conditions. Boiler water pH of 7 to 8.5 is manufacturer recommended.



## SUPPLY AND RETURN PIPING

1. Suggested piping for steam heating system can be seen in **Figure #7**. Actual piping may vary based on system design and local conditions.

**Figure #7**



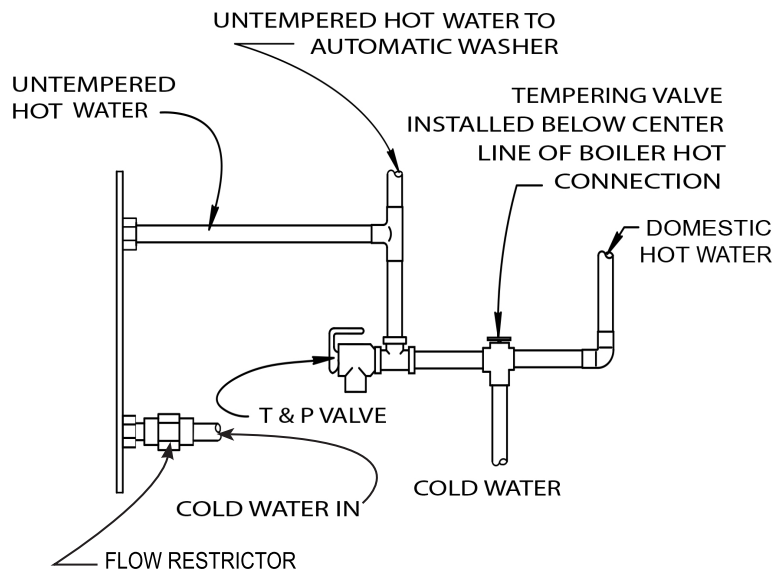
**⚠ DANGER**

Burn, scald Hazard. Water temperatures exceeding 125°F will cause severe burns or death by scalding. Failure to follow these instructions will result in death or serious injury.

2. See **Figure #8** for typical piping for domestic hot water heater.
  - Automatic mixing valve or tempering valve must be installed on tankless heater outlet. Install per valve manufacturer's instructions.
  - Installing a flow restrictor in the cold water inlet may be desirable to prevent excessive flow which reduces water heating capacity
3. See **Figures #9** and **#10** for the suggested piping for a modular steam boiler.

Figure #8

**PIPING FOR BUILT-IN  
DOMESTIC HOT WATER HEATER**



# SUPPLY AND RETURN PIPING

Figure #9 SUGGESTED PIPING FOR MODULAR STEAM BOILERS - PUMPED RETURN

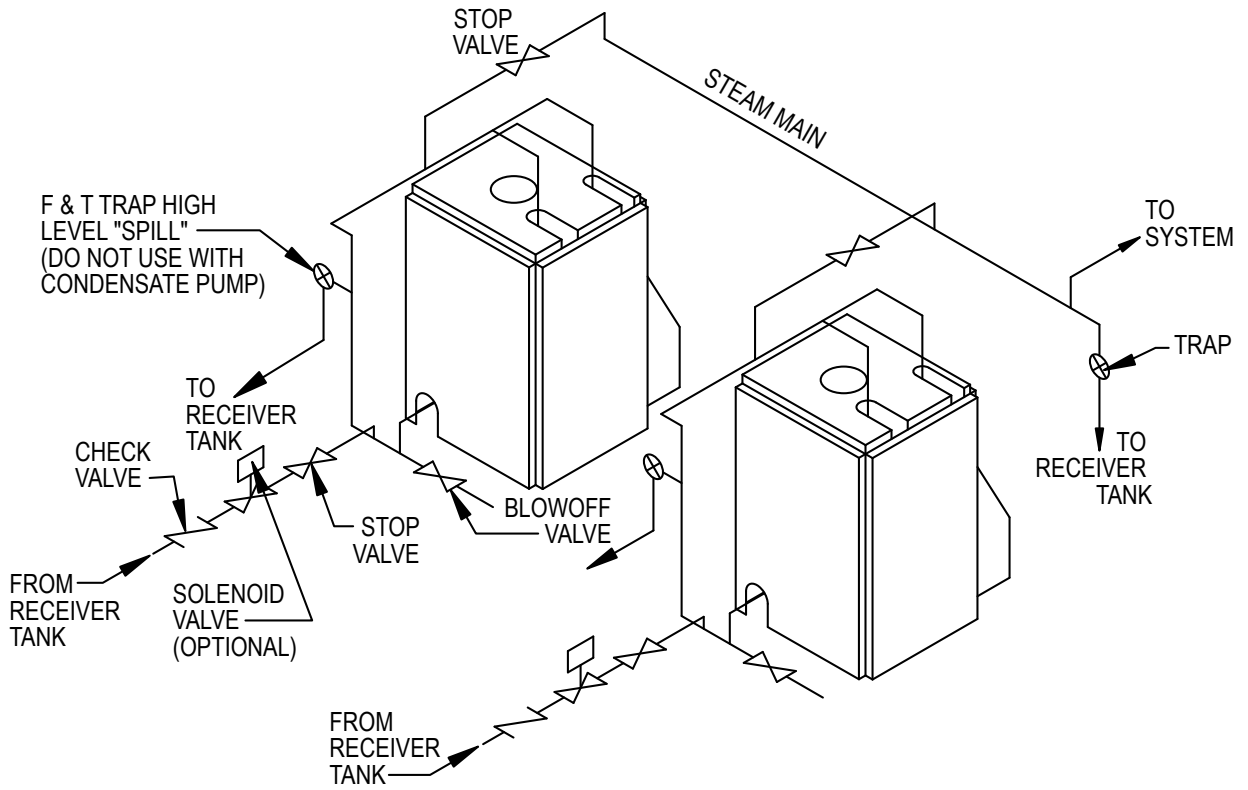
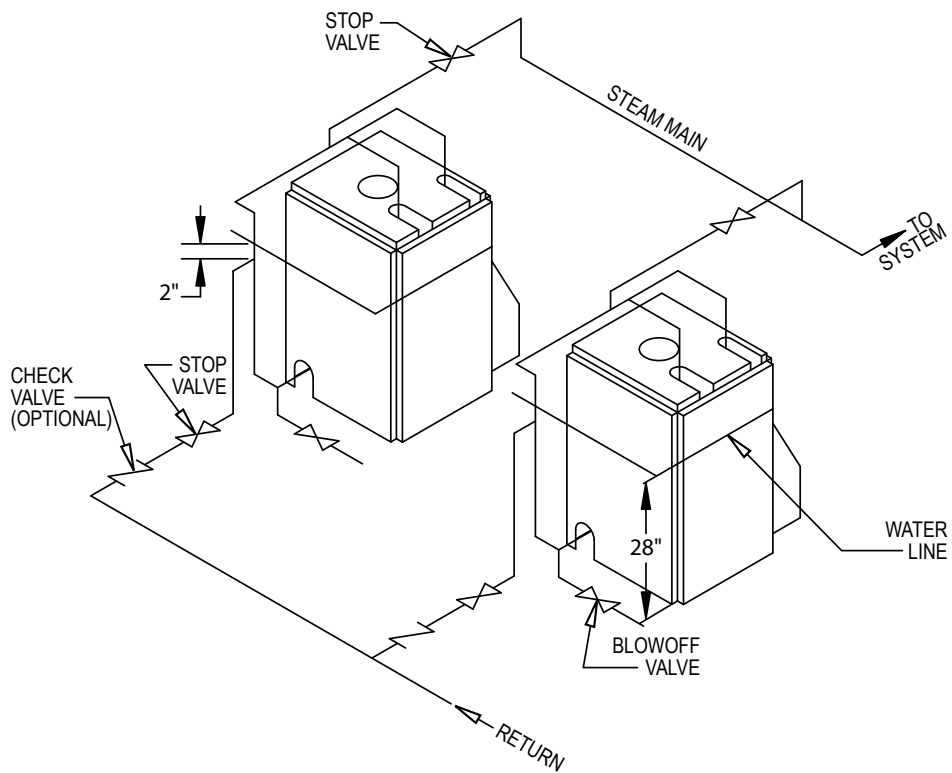


Figure #10 SUGGESTED PIPING FOR MODULAR STEAM BOILERS - GRAVITY RETURN



### Venting System Inspection and Installation:

- Provide venting system in accordance with Chapter 6, Venting of Combustion (Flue) Gases, of NFPA 31, Standard for the Installation of Oil-Burning Equipment, and applicable provisions of local building codes.
- Boiler is to be vented by natural draft and shall not be connected into any portion of mechanical draft system operating under positive pressure.
- Inspect chimney to verify it is constructed according to the latest revision of the NFPA 211. Local regulations may differ from this code and should be checked. Where there is a conflict, the local code will prevail.
- Install boiler into chimney having a masonry or metallic chimney liner.
- Unlined chimney will have leaks that will cause poor chimney performance (no draft), and could result in positive pressure in the combustion chamber.
- Horizontal portions of venting system should not exceed 10 feet in length. Horizontal lengths over 10 ft. will have a negative effect on chimney performance.
- Chimney shall extend at least 3 feet above the highest point where it passes through the roof.
- Type L venting systems shall extend at least 2 feet above the highest point where it passes through the roof.
- Extend chimney or type L venting system at least 2 ft. above any portion of building within 10 ft. See **Figure #11**.
- See Ratings Table page 3 for recommended minimum chimney or vent sizes.
- Inadequate draft causes improper combustion, resulting in dirty flue ways and high fuel bills.
- Connect flue pipe same size as boiler outlet to chimney, sloping upward continuously toward the chimney approximately 1/4" per foot. Bolt or screw joints together to avoid sag.
- Install listed draft regulator (barometric draft control) in the chimney connector as close as practical to the boiler, per instructions provided with the control.
- Recommended overfire draft is -0.02" W.C.

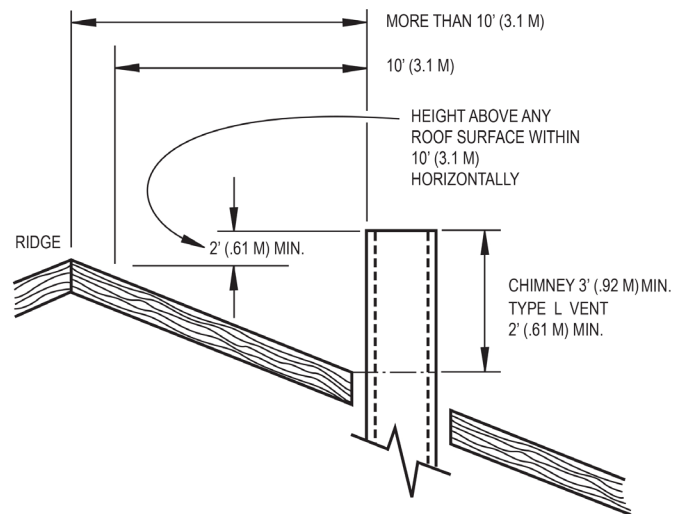
If oil fired water heater is vented into same flue as boiler, provide separate hole into chimney whenever possible.

When this isn't possible, use "Y" connection in flue pipe, using separate draft regulator for each unit.

When chimney does not provide adequate draft to handle input from water heater and boiler simultaneously, wire units so only one will operate at a time, favoring water heater.

Adequate draft is defined as -0.02" W.C. draft over fire.

**Figure #11**



## Oil Tank and Piping

Provide oil tank and piping in accordance with Chapter 7, Fuel Oil Tanks, of NPFA 31, Standard for the Installation of Oil-Burning Equipment, and applicable provisions of local building codes.

### Tank Installation

- Install oil tank and piping in accordance with National Board of Fire Underwriters and local regulations.
- Oil storage tank, vent, fill pipe and caps should be as prescribed by local codes.
- In no case should vent pipe be smaller than 1¼" I.P.S. Fill pipe should not be less than 2" I.P.S.

### Suction Line Installation

- Suction line from tank to burner should be one continuous piece of tubing to prevent air entering line.
- Suction line, must be ¾" O.D. copper tubing for runs of 50 feet or less, and ½" O.D. for longer runs.

## Oil Line Installation

- Oil return line, same size as suction line, must be used on any installation where bottom of tank is below fuel unit of burner.
- Bury oil lines or protect from mechanical injury.
- Flare fittings on all oil lines are recommended. Compression fittings on suction line often allow air to be drawn into fuel pump, making it difficult to maintain oil pressure at nozzle.
- Do not run overhead fuel lines from tank to oil burner.

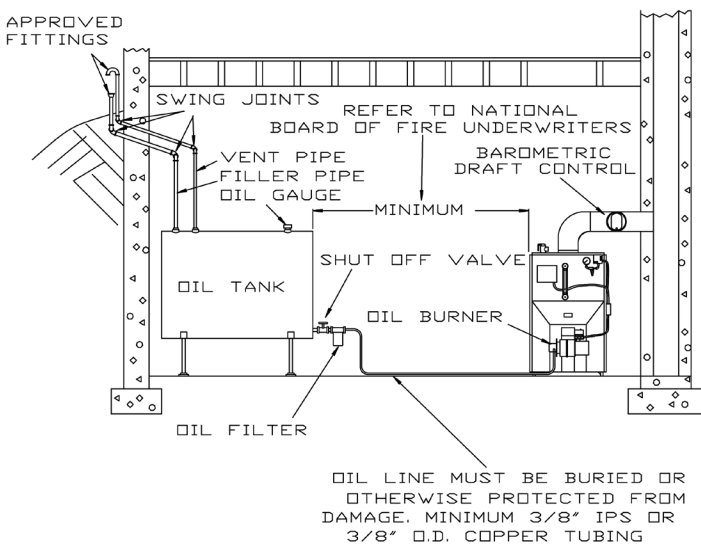
### Fuel Pump Connections

- Fuel pump connections and by-pass should be made according to instructions attached to fuel pump.
- If tank is more than 20' from boiler, install two stage fuel unit in place of single stage pump supplied as standard equipment with burner.
- Verify rotation and speed are the same and pump is suitable for burner horsepower rating.

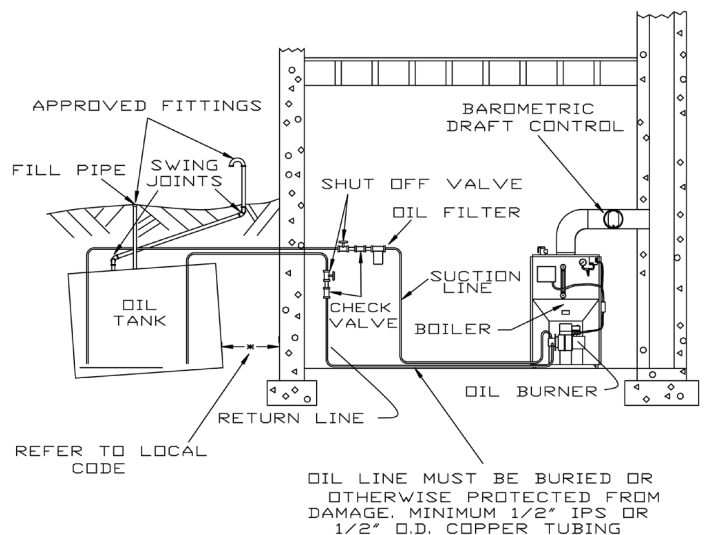
Install oil line filter and shut-off valve in the suction line. Install shut-off valves in both suction and return lines at the burner for convenience in servicing burner.

Allow extra tubing at burner so burner may be removed from boiler for cleaning without disconnecting tubing. An optional flexible oil line is available. See **Figures #12 - #13**.

**Figure #12 Typical Installation Single Pipe Oil System**



**Figure #13 Typical Installation Two Pipe Oil System**



### **WARNING**

Electrical shock hazard. Turn OFF electrical power supply at service panel before making electrical connections. Failure to do so could result in death or serious injury.

Electrical wiring shall conform with the latest revisions of the National Electrical Code, ANSI/NFPA No. 70, and/or local authority having jurisdiction.

The boiler, when installed, shall be electrically grounded in accordance with these requirements.

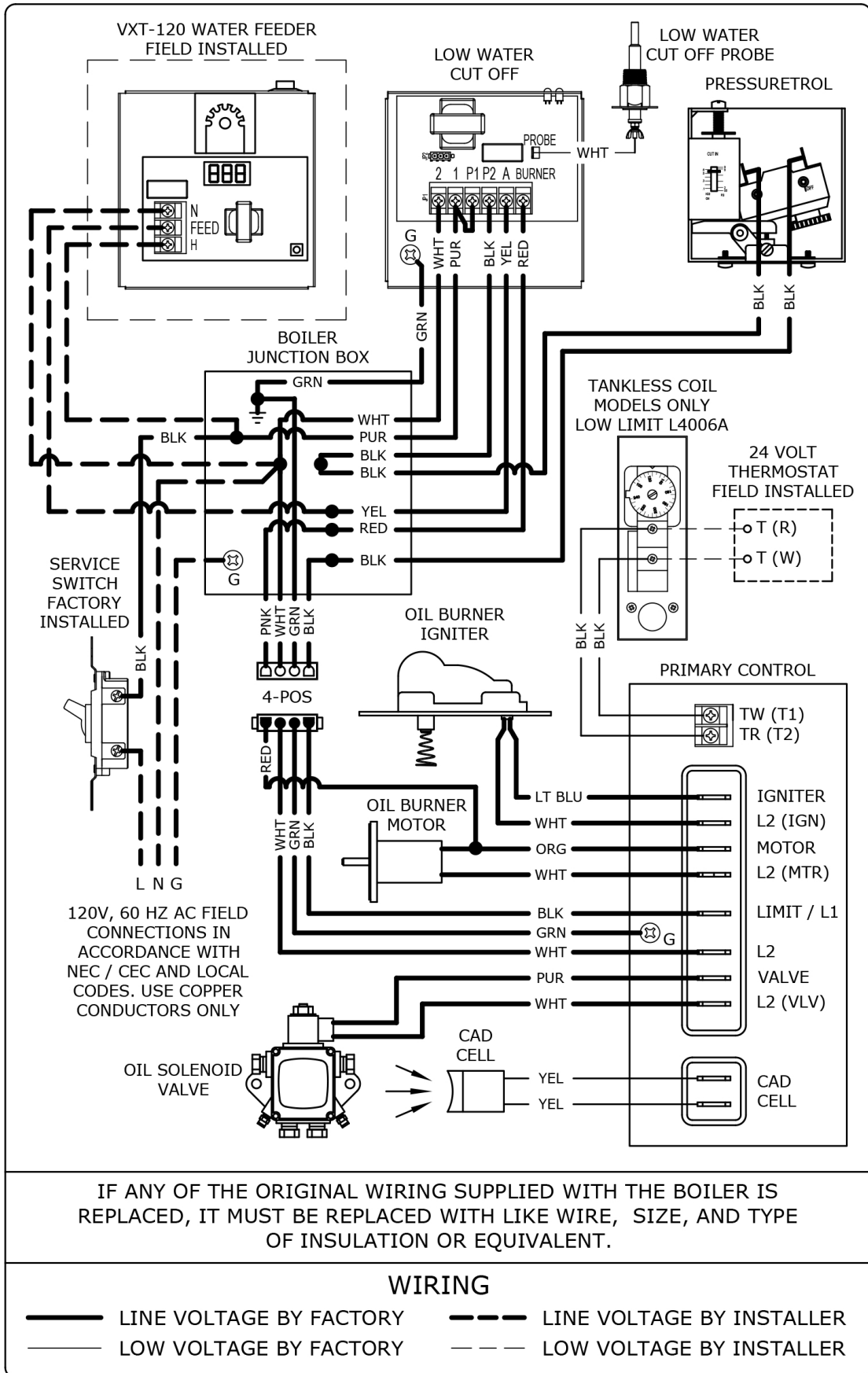
Install fused disconnect switch between boiler and meter at a convenient location.

### **Thermostat Installation**

1. Install thermostat on inside wall about four feet above floor.
2. **NEVER** install thermostat on outside wall.
3. Do not install thermostat where it will be affected by drafts, hot or cold pipes, sunlight, lighting fixtures, television, fireplaces, or chimneys.
4. Check thermostat operation by raising and lowering thermostat as required to start and stop burner.
5. Instructions for final adjustment of thermostat are packaged with thermostat (adjusting heating anticipator, calibration, etc.).

# ELECTRICAL WIRING

## CONTROL WIRING FOR OIL FIRED STEAM BOILER



## OPERATING INSTRUCTIONS

### Filling System with Water

Steam boilers are partially filled with water. Fill boiler to normal water line for proper system operation. Normal water line is 28" from the bottom of the boiler as shown on the label on front of boiler and **Figure #14**.

1. Close boiler drain valve.
2. Open valves at top and bottom of glass water level gauge. Close petcock on bottom of lower gauge glass fitting.
3. Open fill valve and allow water to run into boiler.
4. Continue to fill boiler until water reaches indicated water line.

### Normal Water Line

- Normal water line is 28" from bottom of the boiler and shown on label on the front of the boiler.
- Normal water line is determined with the boiler off and cold, when all water in the system is inside the boiler and return piping below the water line and everything above the water line is air, no steam.
- When boiler is making steam, actual water level drops below the normal water line.

### Sequence of Operation

On a call for heat, thermostat contacts close, energizing the burner. Ignition system is activated and ignition will begin.

In event of a low water condition, the automatic low water cut off will interrupt power to the burner. The burner will remain off until the low water condition is corrected, either by manually filling the boiler or by utilizing a water feeder device which automatically fills the boiler.

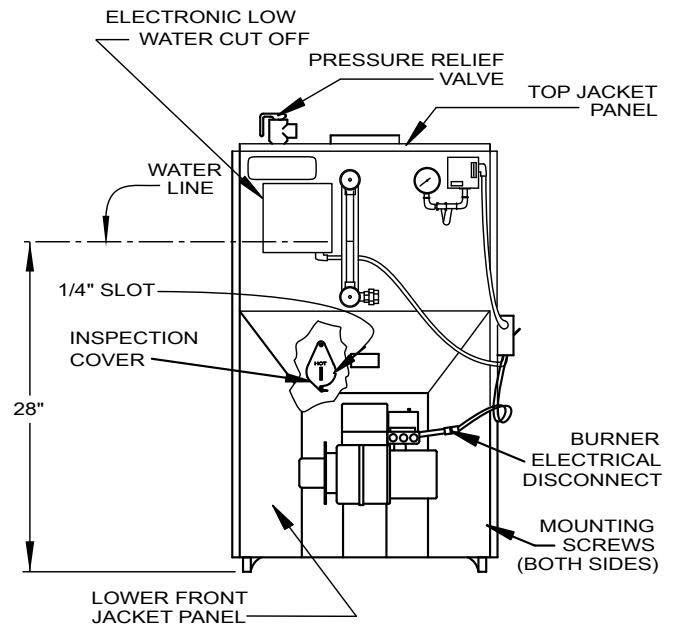
### Low Water Cut Off Test

- Before putting boiler in service, test the low water cut off device for proper operation.
- With boiler water level at normal water line, set thermostat to call for heat. The amber LED lamp on the low water cut off control should be off and boiler should fire.
- Slowly lower the water level to a point below low water cut off probe. The amber LED lamp on the control will light. The lamp may flicker first with a bouncing water level. Stop draining the boiler when the light glows steadily. **NOTE:** The water level should not be lowered beyond a visible point in the gauge glass.
- Burner should shut down within 15 seconds.
- Refill boiler to normal water level.
- Refer to Hydrolevel control instructions provided with boiler for additional details and troubleshooting info.

## WARNING

Burn, scald Hazard. Water temperatures exceeding 125°F will cause severe burns or death by scalding. Failure to follow these instructions could result in death or serious injury.

Figure #14





### Adjust Steam Pressure Control

- Steam pressure limit control (pressuretrol) shuts off gas to main burners when steam pressure in boiler reaches cut-off setpoint (i.e. sum of cut-in and differential setpoints).
- Burner refires when steam pressure drops to cut-in setpoint.
- System pressure requirements are based on size and condition of pipes, and load.
- Cut-in setting of pressuretrol should never be less than twice the system pressure drop for good system operation.
  - A. In typical single family residence with clean one-pipe heating system and cast iron radiation, cut-in is usually set at minimum setting, i.e. 1/2 psi.
- Steam radiation is sized based on square feet of equivalent direct radiation (EDR). This is based on steam pressure in the radiator of just less than 2 psi.
- Set differential adjustment at 1 psi, i.e. steam pressure required in radiators. Results in cut-off setpoint of 1½ psi.
- Larger systems or other types of systems such as two pipe systems, or systems with convectors or fan coil units, pressuretrol settings need to be determined on system-by-system basis.
- Cut-in setpoint is determined by system pressure drop to furthest radiator or terminal unit. Double system pressure drop as safety factor, resulting in the rule cut-in setting should never be less than twice system pressure drop.
- Differential setpoint is steam pressure required at terminal heating units.

Boiler will now operate in correct pressure range. It maintains enough steam pressure to send steam out to furthest radiator, and not go over optimum steam pressure required at the radiators.

## OPERATING INSTRUCTIONS

### Start-Up And Adjustment Of Oil Burner

(See oil burner instructions for nozzle and electrode setting)

#### Do not set fire visually.

Instruments are only reliable method to determine proper air adjustments.

Improperly adjusted burner causes soot and high fuel bills because of incomplete combustion of the fuel oil. This may require excessive boiler maintenance, service costs, and in some instances, house cleaning or redecorating.

Consult a qualified service mechanic to make proper adjustments with smoke tester, CO2 indicator, and draft gauge.

1. Check oil burner nozzle to verify it is tight in adapter. Burner mounting bolts should be tight.
2. Check electrode setting, they may have been jarred out of position during transportation.
3. Set burner air band and air shutter per Preliminary Settings chart below.
4. Set room thermostat to call for heat, or jump thermostat contacts on boiler control.
5. Open all oil line valves.
6. Turn service switch on. Burner should start.
7. On one pipe fuel systems only, bleed pump as soon as burner starts. Allow oil to run until all traces of air in suction line disappear.
8. Turn "OFF" burner and install pressure gauge on pump.
9. Start burner again and check oil pressure for proper setting per chart below. Adjust if necessary.
10. Use draft gauge to adjust draft regulator to obtain -0.02" W C. draft overfire.
11. After operating 10 minutes to warm up boiler, take smoke reading in the flue pipe between boiler and draft regulator. Smoke should be zero.

12. A new boiler may require more than 10 minutes to burn clean due to oil film on new heat exchanger.
13. Gradually close burner's air adjustment to obtain smoke reading showing trace of smoke. Once smoke reading is trace, measure CO2. To provide a safety factor, increase air to reduce CO2 reading by 1/2% to 1%.

#### Safe Start Check

1. Place jumper across cad cell terminals.
2. Set thermostat to call for heat.
3. Burner must not start. Verify control remains in standby mode.
4. End the call for heat and remove cad cell jumper.

#### Simulate Flame Failure and Ignition Failure

1. Set thermostat to call for heat.
2. After flame is established and burner igniter turns off, close the hand valve in oil supply line.
3. At flame loss, primary control will enter Recycle mode. Control will remain in Recycle mode for 60 seconds.
4. After 60 second Recycle period, control will try to restart the system.
5. After 15 second trial for ignition, primary control will lock out the burner. Verify burner motor and igniter are off and burner oil solenoid valve is not energized.
6. Open hand valve in the oil line.
7. Click the reset button on primary control and verify burner lights.
8. End the call for heat.

#### BECKETT AFG PRELIMINARY SETTINGS

BOILER NO.	HEAD TYPE	HEAD SETTING	STATIC PLATE	NOZZLE	PUMP PRESSURE [PSI]	AIR BAND	AIR SHUTTER
3090	L1	--	3 <sup>3</sup> / <sub>8</sub>	0.75-60°B	150	1	3
4125	V1	0	2 <sup>3</sup> / <sub>4</sub>	1.10-60°B	140	1	8
5185	F12	--	2 <sup>3</sup> / <sub>4</sub>	1.50-70°B	150	2	10
6210	F16	--	--	1.75-70°B	145	2	10

#### CARLIN EZ PRELIMINARY SETTINGS

BOILER NO.	BURNER MODEL	NOZZLE	PUMP PRESSURE [PSI]	HEAD SETTING	AIR SHUTTER	AIR SETTING
3090	EZ-1HP	0.75-70°B	145	0.75	BLANK	45%
4125	EZ-1HP	1.00-70°B	155	0.85/1.00	BLANK	70%
5185	EZ-2HP	1.50-70°B	155	1.50	3 SLOT	40%
6210	EZ-2HP	1.65-60°B	165	2.00	OPEN	30%

**IMPORTANT:** Check safety control circuit after burner adjustments have been made for satisfactory performance.

### **WARNING**

Following service procedures must be performed by qualified service agent. Boiler owner shall not attempt these steps. Failure to do so could result in death or serious injury.

It is very important to clean a new steam boiler after it has been installed and put into continuous operation.

This must be done to remove any accumulation of oil, grease, sludge, etc., that may be present in system. These substances may cause boiler water to foam and surge, producing an unsteady water line, throwing water into steam header, and possibly preventing steam generation.

### **Skimming and Blow-down**

### **WARNING**

Burn Scald Hazard. Water temperatures in excess of 125°F. Failure to follow these instructions could result in death or serious injury.

New boilers must be skimmed at time of installation to remove threading oil and other impurities that float on surface of the water.

1. Remove cap from skimmer nipple on back of boiler, and pipe to floor drain or bucket. Extend skimmer piping as necessary to avoid interfering with or damaging the low water cut off probe. Raise water level to skimmer tapping.
2. Fire burner to maintain water temperature of 180-200°F.
3. Feed water to boiler to maintain water level. Adjust water feed rate to maintain continuous flow of 1 gallon per minute. Do not allow boiler to steam.
4. Continue skimming until water runs clear. This may take several hours.
5. Drain boiler completely to remove any foreign material.
6. Fill boiler to water line.
  - Fire burners, allow normal steam pressure to build up.
  - Run connection from boiler drain valve to safe discharge point outside.
  - Shut off burner, open drain valve, allow all of water in boiler to drain out.
  - Close drain valve.
  - Allow boiler to cool, slowly refill boiler to water line.
  - Repeat this step as many times as necessary until blow-down water is clear.
7. Following final blow-down, allow boiler to cool.
  - Add fresh water slowly up to normal water line.
  - Start burner.
  - Maintain at least 180°F for 15 minutes to remove dissolved gasses from fresh water.
  - Shut off burner.

8. Allow system to operate for one week to give majority of system dirt a chance to work its way back to boiler.
  - Check water in gauge glass. Gauge glass should be dry above water line.
  - Water line should not bounce more than one inch when boiler is steaming.
  - If you see water droplets carrying over from top of gauge glass, or excessive bouncing of water line, boiler needs further cleaning.
  - Take water sample and boil it on stove to see if it foams. If it does, this indicates boiler needs to be cleaned.

### **NOTICE**

Clean water with no additives is essential to proper operation of your boiler and heating system. Boiler cleaners and chemical cleaning, if used and not rinsed properly, may be harmful to the system.

If further cleaning is necessary, repeat skimming and blow-down procedure above. A long skim should be all you need to clean the boiler.

In more troublesome cases it may be desirable to flush the system while, in very extreme cases, it may be necessary to chemically clean and flush heating system.

Check water level frequently. Be sure top and bottom valves on gauge glass are always open so actual water level is shown at all times.

### **WARNING**

Burn and scald hazard. Verify Boiler is off and cooled before performing maintenance. Have a qualified service agent perform maintenance. Failure to follow these instructions could result in death or serious injury.

Manufacturer suggests a qualified service agency be employed to make an annual inspection of the boiler and heating system.

Before seasonal start up have a qualified service agency check boiler for soot and scale in flues, change oil filter and nozzle, clean burner and re-adjust burner input rate to maintain proper operation and high operating efficiency.

On steam boilers verify boiler is filled to water line as indicated in **Figure #14**. Gauge valves should be normally open. To remove dirt from gauge glass petcock may be opened to flush out the glass.

Radiator valves on one-pipe steam system must be either wide open or tightly shut. Do not attempt to regulate room temperature by partially closing the radiator valve.

Air vents on steam radiators and the supply main release air from the system. If radiators do not heat satisfactorily, make sure the air vents are clean and operational.

The area around the boiler must be kept clear and free of combustible materials, gasoline and other flammable vapors and liquids.

Free flow of combustion and ventilation air to the boiler and boiler room must not be restricted or blocked.

Periodic inspection and tightening of the tankless heater/cover plate bolts will reduce the risk of leaks.

### **Boiler Flue Passages**

Inspect Boiler and vent pipe for accumulation of soot or scale deposits periodically, at least once every year before start of heating season. When soot is present on section walls and flueways, improper combustion will result, causing additional sooting and scaling until flueways are completely closed. To remove soot and scale from flueways, remove top jacket panel, top clean out plate, and open burner swing door.

### **Opening Burner Swing Door (See Figure #14)**

1. Turn off boiler and allow boiler to cool down.
2. Disconnect burner wiring harness at factory supplied burner electrical disconnect.
3. Loosen screws on sides of lower front jacket panel. Pull bottom part of lower front jacket panel forward and lift lower front panel up and off boiler.

4. Close oil valve and disconnect oil line from burner.  
**IMPORTANT: Do not open swing door with oil line attached.**
5. Remove nut from swing door stud on right hand side of door
6. Swing open burner door to left.
7. Remove blanket insulation on bottom of boiler to prevent damage.
8. Using flue brush, brush soot and scale into bottom of boiler where it can be removed through swing door opening.

### **NOTICE**

Use caution when vacuuming in chamber area to avoid damaging target wall.

9. Replace blanket insulation on bottom of boiler.

### **Closing Burner Swing Door**

1. Swing burner door to right until swing door insulation is slightly compressed and stud is exposed.
2. Attach nut to stud and tighten until built-in stop contacts mounting door.
3. Reconnect oil line to burner.
4. Replace lower front jacket panel and tighten screws.
5. Reconnect burner wiring harness.
6. Turn on power to boiler and bleed oil line.

### **Oil Burner**

- Manufacturer recommends replacing nozzle at start of each heating season.
- Lubricate oil burner motor – if required – with few drops of electric motor oil. Do not over oil.
- Check electrodes for carbon or cracks in insulators.
- Check burner controls.
- Burner should be setup per “Startup and Adjustment of Oil Burner”.

### **Vent Pipe and Chimney**

Check vent piping at least once a season. Verify vent pipe connections to chimney are secure. Verify there are no obstructions in vent pipe or chimney. If vent pipe or chimney show signs of leaking or deterioration, or vent pipe is sagging, repair or replace immediately as necessary.

### Safety Valve

Refer to safety valve manufacturer's instructions provided with safety valve.

### Low Water Cut Off

Check low water cut off monthly per "*Low Water Cut Off Test*" to verify it is providing proper protection.

Remove low water cut off probe at the beginning of each heating season for inspection and cleaning. Clean any sediment or scale with scouring pad or steel wool. More frequent cleaning may be required on boilers requiring frequent additions of make-up water.

### Boiler Water Treatment Other Than Cleaners

In steam systems where the system is tight, free from leaks, and all steam is returned to the boiler as condensate, the amount of make-up water is small. Water treatment is generally not required.

In steam systems with less than 90% of steam being returned as condensate, or with very hard or corrosive make-up water, treatment may be desirable. Follow recommendations of your local boiler water treatment specialist.

### Foaming, Priming or Surging

These terms describe a fluctuating water line, causing water to leave the boiler with steam. It is caused by any combination of the following:

1. Threading oil and/or organic matter in boiler water.  
Follow instructions under section: **START-UP CLEANING.**
2. Faulty quick vents that do not release air until sizeable pressure is built up. If old style – replace. If dirty – clean until you can easily blow through valve.
3. Adjustment of steam pressure control to wide differential increases difficulty if quick vents are old style, slow releasing type, or dirty. Always set steam pressure control differential as low as possible.
4. Soap and chemicals in boiler water cause extreme surging. Boiler cleaners and chemical cleaning additives are not recommended. If used and not rinsed properly, may be harmful to the system.



## SERVICE CHECKLIST

Inspect Chimney and Flue Pipe	[ X ]	Controls and Safety Devices	[ X ]
Inspect and Clean Appliance	[ X ]	Nozzle-Size, Angle, Type	[ * ]
Inspect Oil Line - Size/Leaks	[ X ]	Pump Pressure/Vacuum	[ * ]
Inspect Electrical Connections	[ X ]	Line Voltage/Motor Amps	[ * ]
Install New Filter	[ X ]	Smoke Test	[ * ]
Room Make-up Air	[ X ]	Draft-Overfire/In Flue	[ * ]
Electrode Setting	[ X ]	CO <sub>2</sub> or O <sub>2</sub>	[ * ]
Proper Light-Off (Hot & Cold)	[ X ]	Flue Gas Temperature	[ * ]

\* Measure with instruments and record results below.

SERVICE RECORD											
Date	Nozzle			Pump Pressure PSI	Line Voltage	Motor Amps	Smoke#	Draft		CO <sub>2</sub> or O <sub>2</sub>	Flue Temp °F
	Size	Angle	Type					O.F.	INF		



2201 Dwyer Avenue, Utica, NY 13501

Tel. 800 253 7900

[www.ecrinternational.com](http://www.ecrinternational.com)

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