



OPERATOR'S MANUAL

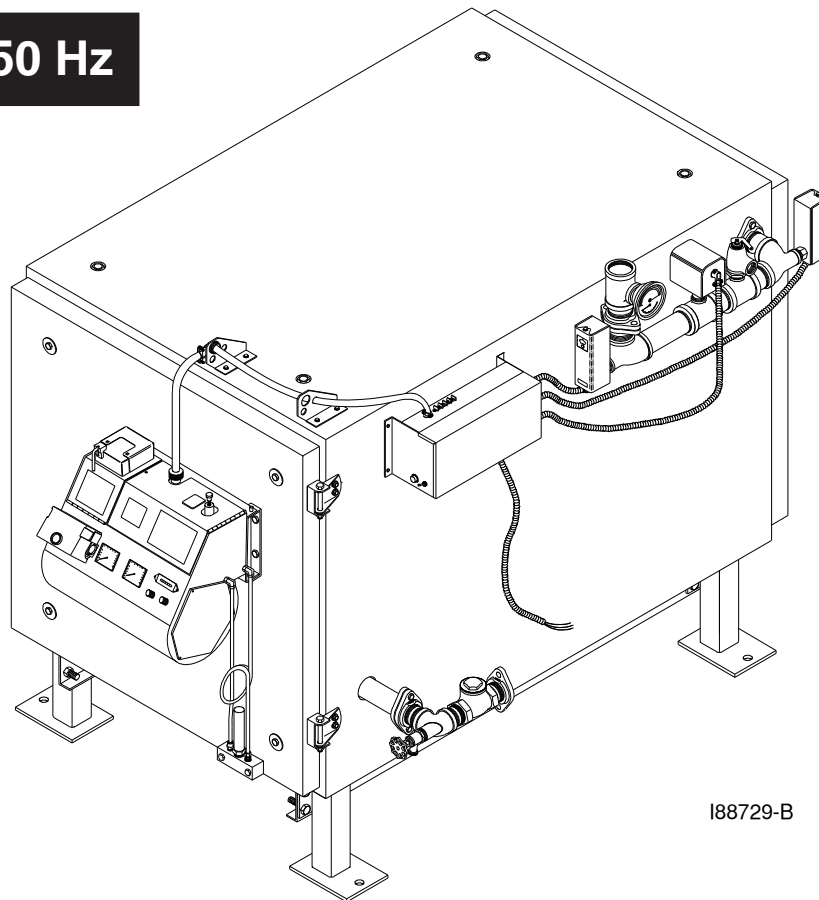
CLEAN BURN COIL TUBE BOILER MODELS:

CB-200-CTB COIL TUBE BOILER *with CB-500-5W Burner & Metering Pump*

CB-350-CTB COIL TUBE BOILER *with CB-551-5W Burner & Metering Pump*

CB-500-CTB COIL TUBE BOILER *with CB-551-H5-5W Burner & Metering Pump*

230 V / 50 Hz



188729-B

PUBLICATION DATE: 5/3/10, Rev. 7

CLEAN BURN PART #43186



WARNING: DO NOT assemble, install, operate, or maintain this equipment without first reading and understanding the information provided in this manual. Installation and service must be accomplished by qualified personnel. Failure to follow all safety precautions and procedures as stated in this manual may result in property damage, serious personal injury or death.

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DECLARATION OF CONFORMITY

Manufacturer: Clean Burn Inc.
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Leola, PA
USA

European Representative: TÜV Rheinland North America
12 Commerce Rd.
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USA

Equipment: CTB-350 #90192
CTB-200 #90201
CTB-500 #90227

EMC Competent Body: TÜV Rheinland Product Safety GmbH
Am Grauenstein
D-51105 Köln

I hereby declare that the above named machinery complies with Essential Health and Safety Requirements of the Industrial Machinery Directive (IMD - 98/37/EEC) as amended, with the Low Voltage Directive (LVD – 73/23/EEC) as amended, and with the Electromagnetic Compatibility Directive (EMC – 89/336/EEC) as amended.

Safety Standard:

EN 230: 1990 Monobloc Oil Burners – Safety, Control, and Regulation Devices and Safety Times.
EN 292-1:1991 Safety of machinery - Basic concepts, general principles for design - Part 1 : Basic terminology, methodology.
EN 292-2:1991+A1 Safety of machinery - Basic concepts, general principles for design - Part 2 : Technical principles and specifications
EN 60204-1:2000 Safety of machinery. Electrical equipment of machines. General requirements.

EMC Standards:

EN 55014-1: 2000 Electromagnetic Compatibility – Requirements for Household Appliances, Electric Tools, and Similar Apparatus. Part 1: Emission.
EN 55014-2: 2000 Electromagnetic Compatibility – Requirements for Household Appliances, Electric Tools, and Similar Apparatus. Part 2: Immunity.
EN 50165: 1997 Electrical Equipment of Non-Electric Appliances for Household and Similar Purposes. Safety Requirements.

Note: Above equipment is subject to an EMC Technical Construction File and Competent Body Certificate Number AV 72032554 0001.



3 May, 2010

Ryan D. Gamber
Engineering Manager

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SECTION 1: INTRODUCTION

Guide to this Manual

This manual contains all the information necessary to safely install and operate the Clean Burn Coil Tube Boilers (CTB), Models CB-200-CTB, CB-350-CTB, and CB-500-CTB. Consult the Table of Contents for a detailed list of topics covered. You'll find this manual's step-by-step procedures easy to follow and understand. Should questions arise, please contact your Clean Burn dealer before starting any of the procedures in this manual.

As you follow the directions in this manual, you'll discover that assembling and operating the Clean Burn CTB involves six basic activities as outlined here:

- **UNPACKING & PRE-INSTALLATION CONSIDERATIONS** (Section 2)
- **ASSEMBLY** (Section 3)
- **INSTALLATION** (Section 4)
- **OPERATION**
 - **Oil Pump Priming** (Section 5)
 - **Starting and Adjusting the Burner** (Section 6)
 - **Resetting the Oil Primary Control** (Section 7)
 - **Adjusting the Draft** (Section 8)
- **MAINTENANCE** (Section 9)
- **THE CTB HYDRONICS SYSTEM** (Section 10)

The manual also contains important and detailed technical reference materials which are located at the back of the manual in the Appendixes.

Please read all sections carefully--including the following safety information--before beginning any installation/operation procedures; doing so ensures your safety and the optimal performance of your Clean Burn Coil Tube Boiler.

WARNING!



STOP

**YOUR SAFETY IS AT STAKE!
DO NOT INSTALL, OPERATE OR
MAINTAIN THIS EQUIPMENT
WITHOUT FIRST READING
AND UNDERSTANDING THE
OPERATOR'S MANUAL!**

For Your Safety...

For your safety, Clean Burn documentation contains the following types of safety statements (listed here in order of increasing intensity):

- **NOTE:** A clarification of previous information or additional pertinent information.
- **ATTENTION:** A safety statement indicating that potential equipment damage may occur if instructions are not followed.



CAUTION: A safety statement that reminds of safety practices or directs attention to unsafe practices which could result in personal injury if proper precautions are not taken.



WARNING: A *strong* safety statement indicating that a hazard exists which can result in injury or death if proper precautions are not taken.



DANGER! *The utmost levels of safety must be observed;* an extreme hazard exists which would result in high probability of death or irreparable serious personal injury if proper precautions are not taken.

In addition to observing the specific precautions listed throughout the manual, **the following general precautions apply and *must be heeded to ensure proper, safe boiler operation.***



DANGER! DO NOT create a fire or explosion hazard by storing or using gasoline or other flammable or explosive liquids or vapors near your boiler.



DANGER! DO NOT operate your CTB if excess oil, oil vapor or fumes have accumulated in or near your boiler. As with any oil burning appliance, improper installation, operation or maintenance may result in a fire or explosion hazard.



WARNING: DO NOT add inappropriate or hazardous materials to your used oil, such as:

- Anti-freeze
- Carburetor cleaner
- Paint thinner
- Parts washer solvents
- Gasoline
- Oil additives
- Any other inappropriate/hazardous material



WARNING: Burning chlorinated materials (chlorinated solvents and oils) is *illegal*, will *severely damage* your heat exchanger, immediately *void* your warranty, and adversely affect the proper, safe operation of your CTB. Instruct your personnel to *never* add hazardous materials to your used oil.

For Your Safety... (continued)



WARNING: Never alter or modify your CTB without prior written consent of Clean Burn, Inc. Unauthorized modifications or alteration can adversely affect the proper, safe operation of your boiler.



WARNING: The burner which is shipped with your Clean Burn CTB is to be used *only* with your boiler according to the instructions provided in this manual. **DO NOT** use the burner for any other purpose!



WARNING: For the safe installation and operation of the CTB, the boiler cannot be raised above the floor level, suspended from the ceiling, installed on a raised platform, or placed over top of any equipment, office space, parts room, etc. or installed in any other manner than directly on a concrete floor.



WARNING: Electrical installation of the boiler is to be performed only by qualified personnel (i.e. licensed electrician/engineer). Improper electrical installation can adversely affect the proper, safe operation of the boiler and may cause serious personal injury/death.



WARNING: Install the boiler in an area away from the main shop traffic. ***It is essential for personal safety that only manufacturer-trained, qualified personnel have access to operate and maintain the boiler.***



WARNING: **DO NOT** operate your boiler when the ambient temperature is above 35° C (95° F).



WARNING: ***The Best Operator is a Careful Operator!*** By using common sense, observing general safety rules, and adhering to the precautions specific to the equipment, you, the operator, can promote safe equipment operation. ***Failure to use common sense, observe general safety rules, and adhere to the precautions specific to the equipment may result in equipment damage, fire, explosion, personal injury and/or death.***



WARNING: The installation, operation, and maintenance of this equipment must be accomplished by qualified personnel and in compliance with the specifications in the Clean Burn Operator's Manual and with all national, state, and local codes or authorities having jurisdiction over environmental control, building inspection and fuel, fire and electrical safety.

Failure to comply with these standards and requirements may result in equipment damage, fire, explosion, personal injury and/or death.

For Your Safety... (continued)

Guidelines for Coil Tube Boiler Usage

- This boiler is listed for commercial and/or industrial use only; it is *not* listed for residential use.
- This boiler is designed to burn the following fuels:
 - Used crankcase oil up to 50 SAE
 - Used transmission fluid
 - Used hydraulic oils
 - #2, #4, and #5 fuel oils

NOTE: Used oils may contain other substances, including gasoline, that may hinder performance.

- Make sure you comply with all environmental regulations concerning the use of your boiler. These regulations require that:
 - Your used oil is generated on-site. You may also accept used oil from "do-it-yourself" oil changers.
 - Hazardous wastes, such as chlorinated solvents, are NOT to be mixed with your used oil.
 - The flue gases are vented to the outdoors with an appropriate stack.
 - Your used oil is recycled as fuel for "heat recovery". DO NOT operate your boiler in warm weather just to burn oil.

Contact your Clean Burn dealer for current environmental regulations.


- If your CTB ever requires service, call your Clean Burn dealer. DO NOT allow untrained, unauthorized personnel to service your CTB. Make sure that your boiler receives annual preventative maintenance to ensure optimal performance.



For Your Safety... (continued)

Guidelines for Used Oil Tanks

For the safe storage of used oil and the safety of persons in the vicinity of the used oil supply tank, ensure that your tank installation adheres to the following safety guidelines:

- **The tank installation must meet all national and local codes.** Consult your local municipal authorities for more information as necessary.
- **Review and adhere to the safety guidelines for used oil supply tanks as stated in the WARNING shown.**
- Ensure that the tank for your boiler installation complies with all code and safety requirements as stated here. If the tank does not comply, **DO NOT** use it.
- If you do not have a copy of the tank safety label pictured at right, please contact your Clean Burn dealer for the label, which is to be affixed directly on your used oil supply tank.


WARNING

Fire and explosion hazards.
 To prevent serious injury or death:

ONLY place these listed substances in this used-oil supply tank:


- Used crankcase oil
- Used automatic transmission fluid
- Used hydraulic oil
- #2 fuel oil

Do **NOT** place flammable or corrosive substances such as gasoline, chlorinated oils, solvents, paint thinners, or any other unsafe substances in this used-oil supply tank.

Do NOT weld or allow open flame within 35 feet of this used-oil supply tank.

Tank installation **MUST** comply with NFPA 30 and 31 Fire Codes, including the following requirements:

- Tank must be listed to UL 80 or UL 142.
- Tank must be vented to outside.
- Emergency vent or explosion relief must be installed on tank.
- Inside fill allowed only with funnel including 1/4 turn-to-close ball valve, which must be closed after filling.
- All other openings must be plugged.
- All oil lines must be constructed of copper, steel, or brass components. Do **NOT** use rubber or plastic tubing or piping, or any other inappropriate material.



Follow all instructions for tank installation in Operator's Manual.

42366

For Your Safety... (continued)

Safety Labels

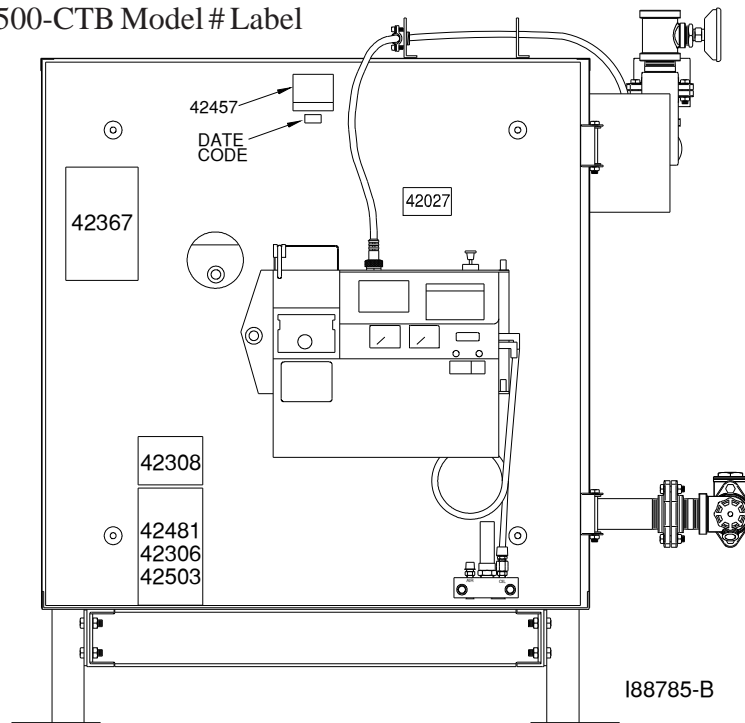
Following are the locations and descriptions of all labels on your CTB. The following illustrations show the location of ALL labels on your boiler. Please note that some labels denote model number, model description, etc. while others contain important safety messages.

Each **Safety Label** contains an important safety message starting with a key word as discussed earlier in this section (e.g. ATTENTION, CAUTION, WARNING, DANGER). For your safety and the safe operation of your CTB, review all labels and heed all safety messages as printed on the labels.

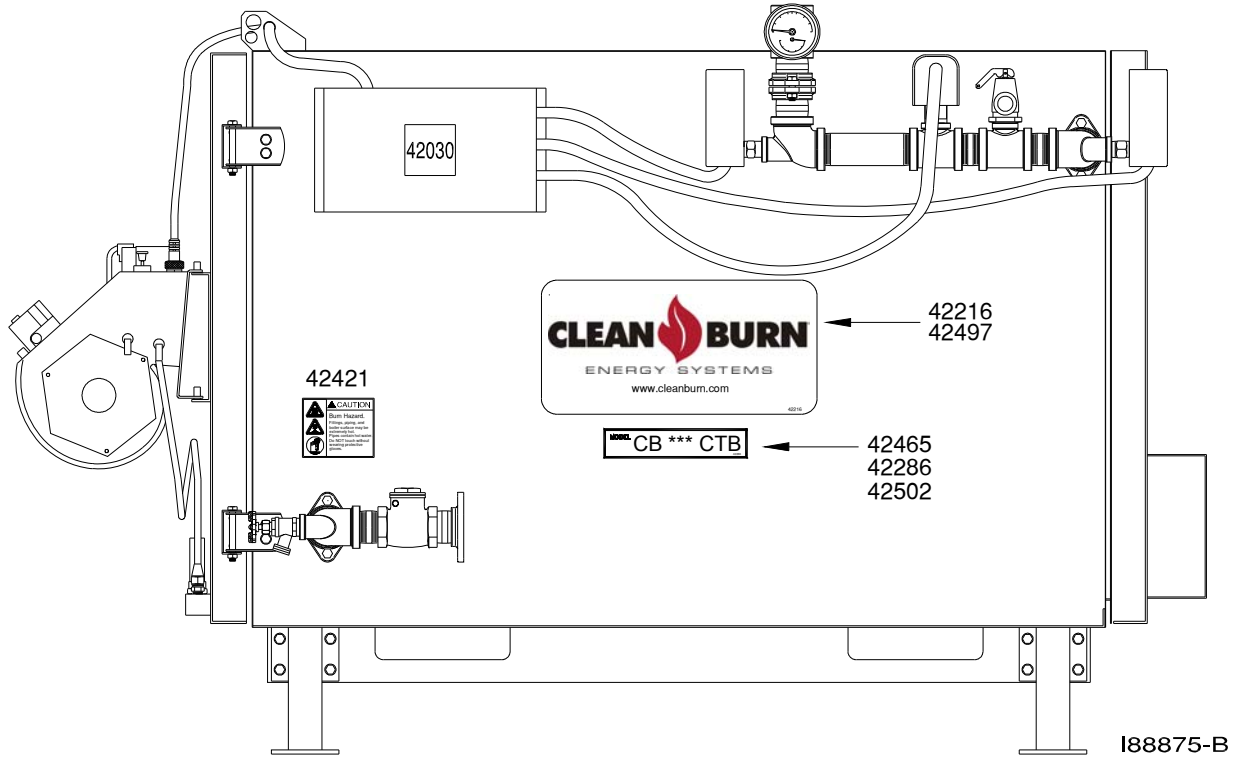
If any labels on your Clean Burn CTB ever become worn, lost or painted over, please call your Clean Burn dealer for free replacements.

CTB Cabinet Labels

<u>Label Part #</u>	<u>Description</u>
42367	C.B. Safety Warning Label (multiple messages - fire/shock/burn hazards)
42457	Made in USA/Patent Pending Label
42027	Burn Hazard/Hazardous Voltage Warning Label
42308	Header Label
42481	CB-200-CTB CE Data Label
42306	CB-350-CTB CE Data Label
42503	CB-500-CTB CE Data Label
42030	Electrical Shock Hazard Warning Label
42421	CTB Hot Water Caution Label
42216	C.B. Logo Label - 22 cm x 11 cm (8.75" x 4.25")
42297	C.B. Logo Label - 51 cm x 20 cm (20" x 8")
42465	CB-200-CTB Model # Label
42286	CB-350-CTB Model # Label
42502	CB-500-CTB Model # Label



CTB Cabinet Labels (continued)



CTB Cabinet Safety Labels

⚠ WARNING

Hazardous voltage.

To prevent serious injury, shut OFF main power to unit before removing cover.

Line voltage is present on most subbase terminals when power is ON. If the furnace is not wired correctly, fire, shock or damage could result.

- ONLY a qualified electrician should wire this furnace.
- ONLY use copper conductors.

42030

⚠ WARNING

Burn Hazard. Hazardous Voltage.

Burner may fire at any time. Disconnect burner power cord before swinging open burner or clean-out door.

42027

⚠ WARNING

Fire, explosion and burn hazards:

Maintain clearances from combustibles as listed on unit. ONLY burn used crankcase oil, automatic transmission fluid, hydraulic oil, or #2 fuel oil. NEVER burn any other substances in this unit.

Hot gases and ash may be released when inspection port is opened.

- Wear safety goggles and hand protection when opening inspection port.
- Keep face away and open port slowly.

To avoid possible injury, death, or equipment damage, read and understand operator's manuals and all safety precautions before installing, operating, or servicing this equipment.

42367

For Your Safety... (continued)

CTB Cabinet Safety Labels (continued)



CAUTION

Burn Hazard.

Fittings, piping, and boiler surface may be extremely hot.


Pipes contain hot water.

Do NOT touch without wearing protective gloves.

42421

CLEAN BURN, INC.
LEOLA, PA

USED-OIL BURNING APPLIANCE

NO.


MULTI-OIL HEATING SYSTEM

INSTALL AND USE ONLY IN ACCORDANCE WITH THE MFR'S INSTALLATION AND OPERATING INSTRUCTIONS. FOR COMMERCIAL OR INDUSTRIAL USE ONLY.

AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED PRIOR TO INSTALLATION.

42308

MODEL NO.	<input type="text" value="CTB-200-CE"/>				
INPUT RATING W/NO 2 FUEL OIL (KW/HR)	<input type="text" value="58.6"/>				
LISTED FUELS	INPUT	ATOM AIR PRESS		OIL PRESS	
	<u>-LPH-</u>	<u>-PSIG-</u>	<u>-BAR-</u>	<u>-PSIG-</u>	<u>-BAR-</u>
NO 2 OIL	<input type="text" value="3.8"/>	<input type="text" value="14"/>	<input type="text" value=".96"/>	<input type="text" value="2.5"/>	<input type="text" value=".17"/>
USED					
CRANKCASE OIL	<input type="text" value="3.8"/>	<input type="text" value="14"/>	<input type="text" value=".96"/>	<input type="text" value="2.7"/>	<input type="text" value=".19"/>
HYDRAULIC OIL	<input type="text" value="3.8"/>	<input type="text" value="14"/>	<input type="text" value=".96"/>	<input type="text" value="2.5"/>	<input type="text" value=".17"/>
ATF	<input type="text" value="3.8"/>	<input type="text" value="18"/>	<input type="text" value="1.24"/>	<input type="text" value="3.4"/>	<input type="text" value=".23"/>
NO 4 OIL	<input type="text" value="3.8"/>	<input type="text" value="18"/>	<input type="text" value="1.24"/>	<input type="text" value="4.0"/>	<input type="text" value=".28"/>
NO 5 OIL	<input type="text" value="3.8"/>	<input type="text" value="18"/>	<input type="text" value="1.24"/>	<input type="text" value="4.0"/>	<input type="text" value=".28"/>

MODEL NO.	<input type="text" value="CB 350-I CTB"/>		BTU/HR	KW	
INPUT RATING W/NO 2 FUEL OIL			<input type="text" value="350,000"/>	<input type="text" value="103"/>	
LISTED FUELS	INPUT	AIR PRESS		OIL PRESS	
	<u>-LPH-</u>	<u>-PSIG-</u>	<u>-BAR-</u>	<u>-PSIG-</u>	<u>-BAR-</u>
NO 2 OIL	<input type="text" value="9.5"/>	<input type="text" value="16.0"/>	<input type="text" value="1.1"/>	<input type="text" value="6.0"/>	<input type="text" value="41"/>
USED					
CRANKCASE OIL	<input type="text" value="9.5"/>	<input type="text" value="16"/>	<input type="text" value="1.1"/>	<input type="text" value="7"/>	<input type="text" value="4.8"/>
HYDRAULIC OIL	<input type="text" value="9.5"/>	<input type="text" value="16"/>	<input type="text" value="1.1"/>	<input type="text" value="7"/>	<input type="text" value="4.8"/>
ATF	<input type="text" value="9.5"/>	<input type="text" value="18"/>	<input type="text" value="1.2"/>	<input type="text" value="9.5"/>	<input type="text" value="6.5"/>
NO 4 OIL	<input type="text" value="9.5"/>	<input type="text" value="20"/>	<input type="text" value="1.4"/>	<input type="text" value="9.5"/>	<input type="text" value="6.5"/>
NO 5 OIL	<input type="text" value="9.5"/>	<input type="text" value="20"/>	<input type="text" value="1.4"/>	<input type="text" value="9.5"/>	<input type="text" value="6.5"/>

MAX. FLUE DRAFT IN W.C.

INSTALL ON NONCOMBUSTIBLE FLOOR
MINIMUM CLEARANCE TO COMBUSTIBLE SURFACES (CM.)
CLEARANCES MAY BE INCREASED FOR SERVICE

TOP	<input type="text" value="46"/>	CHIMNEY	<input type="text" value="46"/>	SIDE	<input type="text" value="16"/>
FRONT	<input type="text" value="122"/>	REAR	<input type="text" value="16"/>	SERVICE SIDE	<input type="text" value="76"/>

FLUE DRAFT IN W.C.

INSTALL ON NONCOMBUSTIBLE FLOOR
MINIMUM CLEARANCE TO COMBUSTIBLE SURFACES (IN./CM)
CLEARANCES MAY BE INCREASED FOR SERVICE

TOP	<input type="text" value="18/46"/>	CHIMNEY	<input type="text" value="18/46"/>	SIDE	<input type="text" value="6/16"/>
FRONT	<input type="text" value="48/122"/>	REAR	<input type="text" value="6/16"/>	SERVICE SIDE	<input type="text" value="30/76"/>

	POWER	VOLTS	AMPS	HZ
OIL PUMP MOTOR HP.	<input type="text" value="1/20"/>	<input type="text" value="230"/>	<input type="text" value=".40"/>	<input type="text" value="50"/>
BURNER MOTOR HP.	<input type="text" value="1/10"/>	<input type="text" value="230"/>	<input type="text" value=".56"/>	<input type="text" value="50"/>
BURNER HEATER WATTS	<input type="text" value="400"/>	<input type="text" value="230"/>	<input type="text" value="1.65"/>	<input type="text" value="50"/>
CIRCULATOR BOILER (OPT) HP	<input type="text" value="1/6"/>	<input type="text" value="230"/>	<input type="text" value="1.10"/>	<input type="text" value="50"/>
CIRCULATOR LOAD (OPT) MAX.	<input type="text" value=""/>	<input type="text" value="220"/>	<input type="text" value="1.5"/>	<input type="text" value="50"/>
DRAFT IND. (OPT) HP	<input type="text" value="1/10"/>	<input type="text" value="230"/>	<input type="text" value=".56"/>	<input type="text" value="50"/>
AIR COMPRESS. (OPT) HP.	<input type="text" value="1/3"/>	<input type="text" value="230"/>	<input type="text" value="1.8"/>	<input type="text" value="50"/>
TOTAL CIRCUIT AMPACITY				<input type="text" value="6"/>
MAXIMUM FUSE SIZE / WITH OPTIONS				<input type="text" value="15/20"/>

	POWER	VOLTS	AMPS	HZ
OIL PUMP MOTOR HP.	<input type="text" value="1/6"/>	<input type="text" value="230"/>	<input type="text" value="1.3"/>	<input type="text" value="50"/>
BURNER MOTOR HP.	<input type="text" value="1/10"/>	<input type="text" value="230"/>	<input type="text" value=".56"/>	<input type="text" value="50"/>
BURNER HEATER WATTS	<input type="text" value="450"/>	<input type="text" value="230"/>	<input type="text" value="1.7"/>	<input type="text" value="50"/>
CIRCULATOR BOILER (OPT) HP.	<input type="text" value="1/6"/>	<input type="text" value="230"/>	<input type="text" value="1.1"/>	<input type="text" value="50"/>
DRAFT IND. (OPT) HP	<input type="text" value="1/4"/>	<input type="text" value="230"/>	<input type="text" value="1.3"/>	<input type="text" value="50"/>
AIR COMPRESS. (OPT) HP.	<input type="text" value="1/3"/>	<input type="text" value="230"/>	<input type="text" value="1.8"/>	<input type="text" value="50"/>
TOTAL CIRCUIT AMPACITY				<input type="text" value="8"/>
MAXIMUM FUSE SIZE / WITH OPTIONS				<input type="text" value="15/20"/>

BURNER REQUIRES A MINIMUM AIR SOURCE OF 2.0 S.C.F.M. (57 L/MIN) AT 25 P.S.I (1.72 bar). INSTALL AND USE ONLY IN ACCORDANCE WITH THE MFR'S INSTALLATION AND OPERATING INSTRUCTIONS. FOR COMMERCIAL OR INDUSTRIAL USE ONLY.

AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED PRIOR TO INSTALLATION.

42481

BURNER REQUIRES A MINIMUM AIR SOURCE OF 2.0 S.C.F.M. (57 L/MIN) AT 25 P.S.I (175 KPA). INSTALL AND USE ONLY IN ACCORDANCE WITH THE MFR'S INSTALLATION AND OPERATING INSTRUCTIONS. FOR COMMERCIAL OR INDUSTRIAL USE ONLY.

AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED PRIOR TO INSTALLATION.

42306

CTB Cabinet Safety Labels (continued)

MODEL NO.	CTB-500-CE				
INPUT RATING W/NO 2 FUEL OIL (KW/HR)	147.0				
<u>LISTED FUELS</u>	INPUT	ATOM AIR PRESS		OIL PRESS	
	<u>-LPH-</u>	<u>-PSIG-</u>	<u>-BAR-</u>	<u>-PSIG-</u>	<u>-BAR-</u>
NO 2 OIL	13.5	16	1.1	2.5	0.17
USED					
CRANKCASE OIL	13.5	16	1.1	2.5	0.17
HYDRAULIC OIL	13.5	22	1.5	2.1	0.15
ATF	13.5	20	1.4	2.3	0.16
NO 4 OIL	13.5	16	1.1	2.5	0.17
NO 5 OIL	13.5	16	1.1	2.5	0.17

MAX. FLUE DRAFT IN W.C.					-.06 (1.5mm)
INSTALL ON NONCOMBUSTIBLE FLOOR					
MINIMUM CLEARANCE TO COMBUSTIBLE SURFACES (CM.)					
CLEARANCES MAY BE INCREASED FOR SERVICE					
TOP	46	CHIMNEY	46	SIDE	16
FRONT	122	REAR	16	SERVICE SIDE	76

	POWER	VOLTS	AMPS	HZ
OIL PUMP MOTOR HP.	1/20	230	0.40	50
BURNER MOTOR HP.	1/10	230	0.70	50
BURNER HEATER WATTS	500	230	1.9	50
CIRCULATOR BOILER (OPT)	1/2	230	2.7	50
CIRCULATOR LOAD (OPT) MAX.				
DRAFT INDUCER HP	1/4	230	1.3	50
AIR COMPRESS. (OPT) HP.	1/2	230	3.0	50
TOTAL CIRCUIT AMPACITY			10.0	
MAXIMUM FUSE SIZE / WITH OPTIONS			20.0	

BURNER REQUIRES A MINIMUM AIR SOURCE OF 2.0 S.C.F.M. (57 L/MIN) AT 25 P.S.I (1.72 bar). INSTALL AND USE ONLY IN ACCORDANCE WITH THE MFR'S INSTALLATION AND OPERATING INSTRUCTIONS. FOR COMMERCIAL OR INDUSTRIAL USE ONLY.

AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED PRIOR TO INSTALLATION.

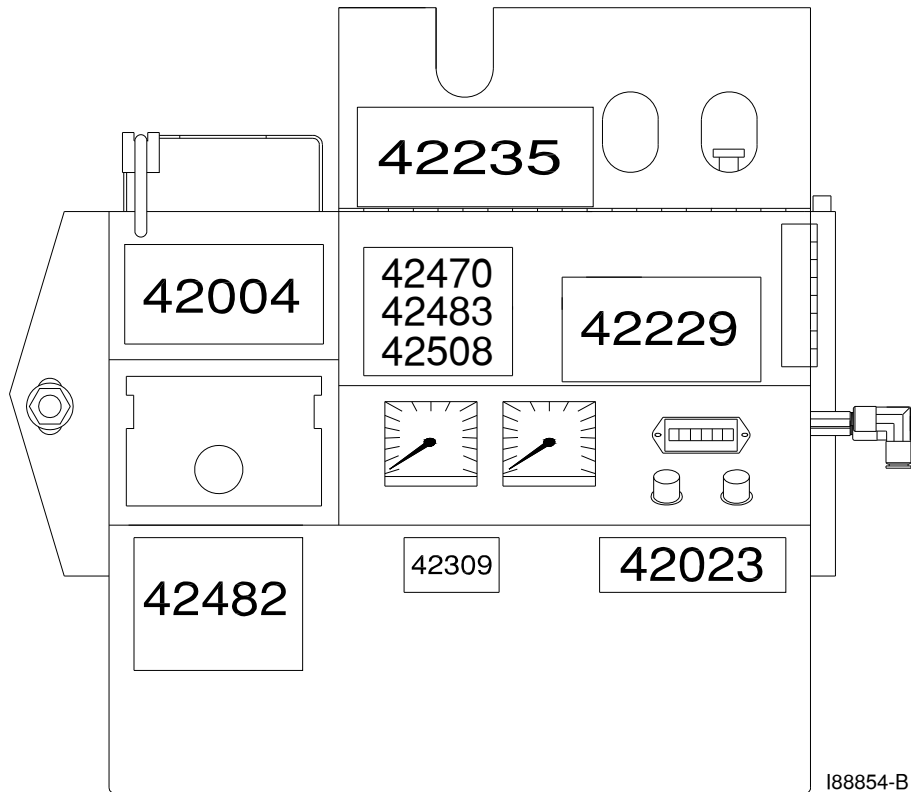
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For Your Safety... (continued)

CTB Burner Labels

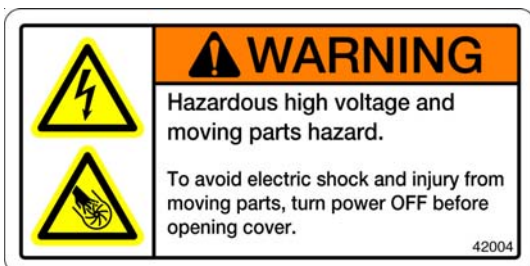
Label

Part #	Description
42004	Burner Safety Warning Label (High Voltage/Moving Parts Hazard)
42235	Burner Safety Warning Label (Fire/Explosion Hazard - Burner Installation and Service)
42470	CB-500-CE-5W Burner Model/Serial Number
42483	CB-551-CE Burner Model/Serial Number
42508	CB-551-H5-CE Burner Model/Serial Number
42229	C.B. Logo/Burner Description Label
42482	Burner Safety Warning Label (Fire/Explosion Hazard - Reset Button)
42309	CE Mark Label
42023	Burner Power Label



188854-B

CTB Burner Safety Labels



SECTION 2: UNPACKING & PRE-INSTALLATION CONSIDERATIONS

Before assembling your coil tube boiler (CTB) , you must accomplish the following activities described in this section:

- Removing the Shipping Crate
 - Unpacking and Inspecting All Components
 - Warranty Registration
 - Review the Pre-Installation Considerations
-

Removing the Shipping Crate

1. Carefully remove the top boards of the shipping crate. Then remove the front, back, and side panels.
2. Remove the bolts holding the boiler on the shipping pallet.
3. Carefully lift the CTB off the shipping pallet with a fork lift.

ATTENTION: DO NOT attempt to slide the CTB out of the shipping crate--you may damage the cabinet.

Unpacking and Inspection

Following is an itemized list of all components you should have received in your Clean Burn Coil Tube Boiler shipment. Open all shipping containers and inspect all components according to the list. Immediately notify the freight company and your Clean Burn dealer in case of shipping damage or shortage(s). Keep all components together so you will have them as needed for CTB assembly and installation.

Model CB-200-CTB, CB-350-CTB and CB-500-CTB Component List

- Coil Tube Boiler with factory-installed controls
(including operating aquastat, high temperature cut-off, flow switch, relief valve, and check valve)
 - Components packed inside boiler:
 - Ceramic combustion chamber sleeve
 - Combustion chamber sleeve mounting stand
 - Ceramic target (pre-mounted)
 - Canister filter
 - Vacuum gauge
 - Check valve with screen (for tank)
 - Boiler gauge
 - Tube sealant
 - Burner hook-up kit
 - Barometric damper
 - Burner
 - Oil pump (metering pump)
 - CTB base stand with hardware
 - Draft Inducer
-

Pre-Installation Considerations

The following information is critical to the proper installation of your Clean Burn Coil Tube Boiler system; read this section carefully before starting any other procedures.

Determining the CTB System Setup

Before installing the CTB, you must determine the following which relate to your installation:

- (1) The **type of oil storage tank** you will be using (related information in Section 4)**
- (2) The **positioning of your oil pump** (related information in Section 4)
- (3) The **appropriate size for your oil lines** (related information in Section 4)
- (4) The **electrical requirements** for your CTB installation (related information in Section 4)
- (5) The type of **hydronic installation** you will be using (related information in Section 10)

****IMPORTANT NOTE:** If you are installing an inside oil tank in the same room as the boiler, you must allow a 1.5 m (5 ft) minimum clearance between the tank and the boiler. *The oil tank should be set and installed in position BEFORE the boiler is installed.*

Selecting a Location

The location you select for your CTB must allow the following:

- Installation in a dedicated boiler/mechanical room with a minimum fire rating of two (2) hours.
- Installation on a substantial, level, non-combustible concrete floor (minimum 10 cm / 4" thick).
- Proper clearances from combustibles. *Verify according to your local safety codes.*
- Safe, easy access for servicing.
- Adequate combustion air per national and local codes.
- Proper stack installation and materials.



WARNING: For the safe installation and operation of the CTB, the boiler cannot be raised above the floor level, suspended from the ceiling, installed on a raised platform, or placed over top of any equipment, office space, parts room, etc. or installed in any other manner than directly on a concrete floor.

Selecting a Location (continued)

Adhere to the following *minimum* clearances from combustibles. Specifications are also provided for servicing clearance. **Be sure to check local codes which may differ from these specifications.** Refer to Figure 2A for a single CTB and Figure 2B for dual-stacked CTB boilers.

Fig. 2A and 2B Description		Clearance from Combustibles	Clearance for Service
A	Above	46 cm (18")	46 cm (18")
B	Front	61 cm (24")	122 cm (48")
C	Stack	46 cm (18")	46 cm (18")
D	Rear	15 cm (6")	102 cm (40")
E	L.H. Side	15 cm (6") *	15 cm (6") *
F	R.H. Side	76 cm (30")	76 cm (30")
G	Bottom	15 cm (6")	15 cm (6")

* 91 cm (36") may be required

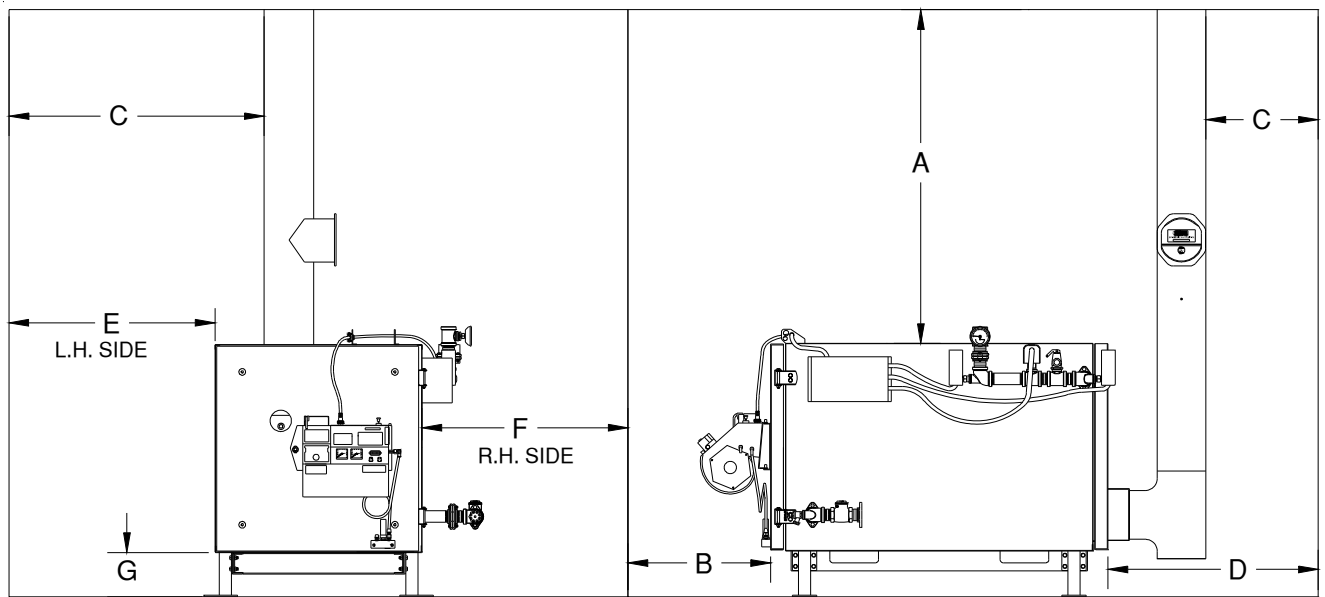


Figure 2A - Single Boiler Minimum Installation Clearances

188734-B

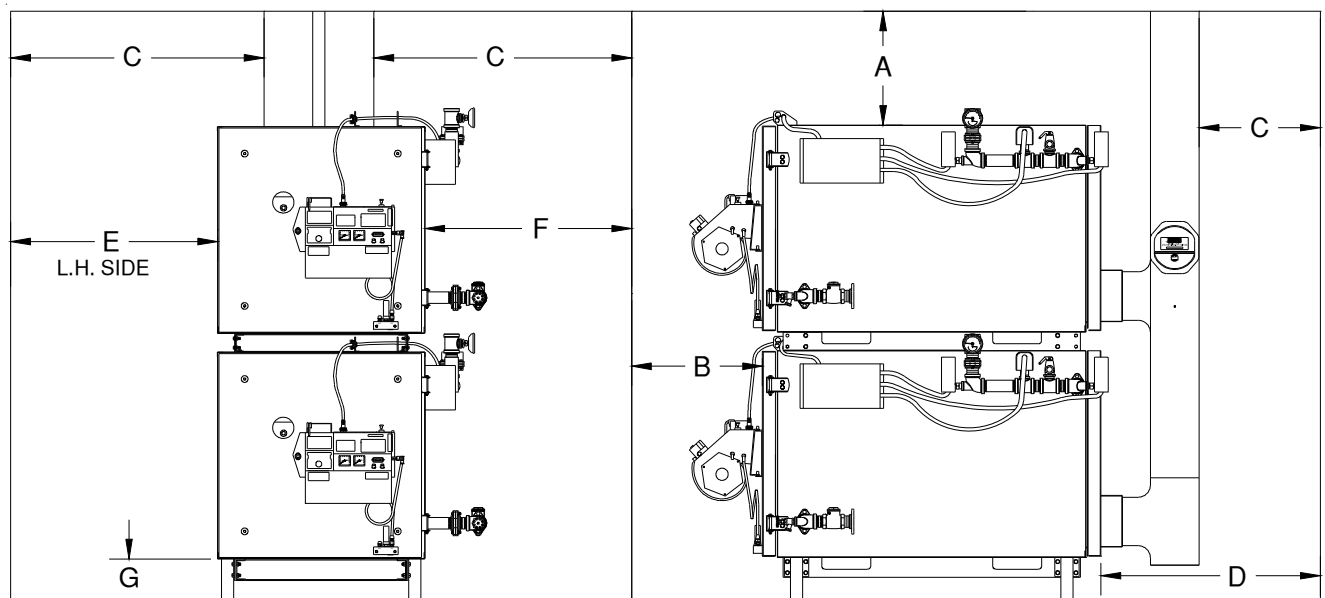


Figure 2B - Dual-Stacked Boilers Minimum Installation Clearances

188733-C

SECTION 3: COIL TUBE BOILER ASSEMBLY

Understanding Assembly

Assembling your Clean Burn Coil Tube Boiler (CTB) is a multi-step process. Note that some assembly procedures apply only to certain CTB installations or configurations (i.e. single model or dual-stacked boilers); the assembly procedures are outlined below as they appear in this section.

Be sure to refer to the appropriate instructions for your CTB configuration.

Single Boiler Assembly Only

- Installing the CTB on the Support Stand

Dual-Stacked Boiler Assembly Only

- Assembling the Dual-Stacked Boiler

Assembly For All Boilers

- Connecting the CTB
- Installing the Ceramic Sleeve
- Checking the Burner Nozzle and Electrodes
- Installing the Connector Block on the CTB Door
- Installing the Oil Line Tubing
- Installing the Air Line Tubing
- Locking the Burner into Firing Position

Single Boiler Assembly

DETAIL OF ITEM 21

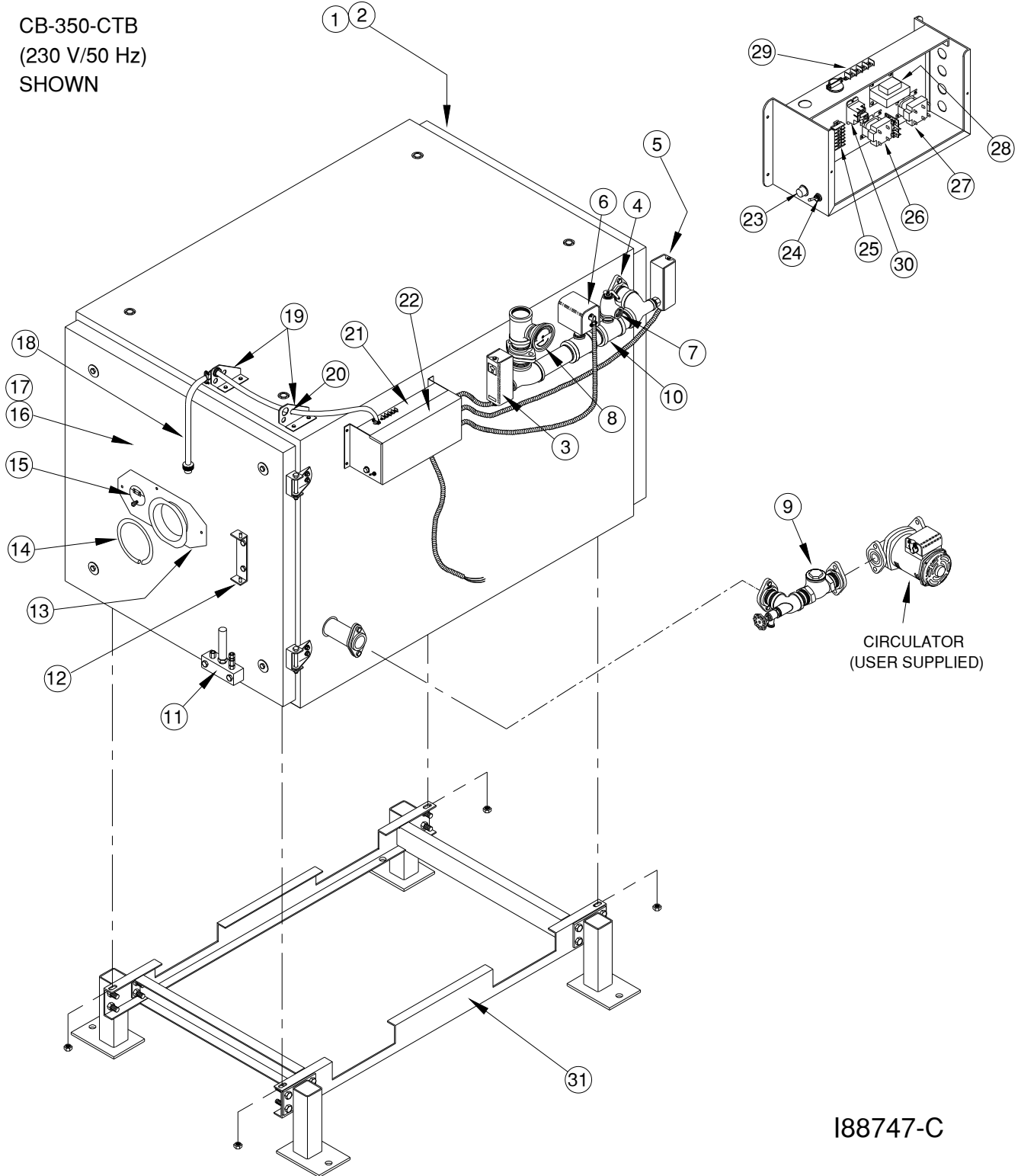


Figure 3A - Single Boiler Assembly Component Detail

CB-350-CTB CE PARTS LIST

NUMBER	QTY	PART #	DESCRIPTION
31	1	90188	BASE
30	1	33529	COIL RELAY 240 VAC 30 A
29	1	33331	TERMINAL BLOCK
28	1	33340	TRANSFORMER 230V-24V
27	1	33328	RELAY DPDT
26	1	33352	RELAY DELAY
25	1	33486	TERMINAL BLOCK ASSEMBLY
24	1	33286	SWITCH DPDT
23	1	33338	AMBER LIGHT
22	1	27058	CONTROL BOX LID
21	1	12240	CONTROL BOX
20	1	33105	SNAP IN BUSHING
19	2	27158	L-BRACKET
18	1	33534	CONNECTOR CORD
17	1	31176	INSULATION – DOOR
16	1	11405	DOOR W.A.
15	1	21077	PORT LID
14	1	14084	ROPE GASKET
13	1	11583	BURNER MOUNT W.A.
12	1	11582	HINGE BRACKET W.A.
11	1	13141	ACCUMULATOR BLOCK ASSEMBLY
10	1	14272	UPPER PIPE ASSEMBLY
9	1	14293	CHECK VALVE AND PIPE ASSEMBLY
8	1	33330	GUAGE BOILER TEMP/PRESS
7	1	35048	RELIEF VALVE 3/4" MALE
6	1	35123	FLOW SWITCH TACO
5	1	28149	HIGH TEMP CUT-OFF
4	1	35079	COIL FLANGE 1-1/4"
3	1	28150	AQUASTAT
2	1	31166	INSULATION PANEL
1	1	11380	PANEL 350 REAR W.A.

PARTS THAT DIFFER ON THE CB-200-CTB CE

NO	QTY	PART #	DESCRIPTION
31	1	90200	BASE
17	1	31216	INSULATION 200 DOOR
16	1	11540	DOOR W.A.
10	1	14307	UPPER PIPE ASSEMBLY
9	1	14298	CHECK VALVE AND PIPE ASSY
4	1	35116	COIL FLANGE 1" NPT
2	1	31215	INSULATION PANEL
1	1	11539	PANEL 200 REAR W.A.

PARTS THAT DIFFER ON THE CB-500-CTB CE

NO	QTY	PART #	DESCRIPTION
31	1	90206	BASE
17	1	31240	INSULATION 500 DOOR
16	1	11564	DOOR W.A.
10	1	14315	UPPER PIPE ASSEMBLY
9	1	14314	CHECK VALVE AND PIPE ASSY
4	1	35121	COIL FLANGE 1 1/2" NPT
2	1	31239	INSULATION PANEL
1	1	11563	PANEL 500 REAR W.A.

	200-CTB	350-CTB	500-CTB
Refractory Cylinder	21120	21140	21174
Refractory Cylinder Stand	27155	27190	27200

Single Boiler Assembly

Installing the CTB on the Support Stand



WARNING: Use extreme caution when moving and lifting the CTB (with a forklift) into place on the support stand. One CTB can weigh up to 907 kg (2000 pounds). Clean Burn recommends placing safety blocking underneath the unit until it is properly installed and secured on the support stand. *Failure to follow these basic safety guidelines may result in serious personal injury and/or damage to the unit.*

1. Refer to Figure 3A to become familiar with the components required for CTB assembly.
2. Assemble the CTB support stand as shown in Figure 3B, using the hardware provided.
3. Move the support stand into the approximate position where the CTB is to be installed, and place blocks (approximately 25 cm / 10 inches high) inside the stand to provide safety support for the boiler.
4. Use a forklift to carefully lift the CTB into position over top of the support stand.



- WARNING:** Secure the boiler to the forklift prior to lifting to prevent possible equipment damage or personal injury.
5. Lower the boiler down onto the safety blocks positioned inside the support stand.
 6. Insert bolts (provided) into the keyhole slots in the boiler, and then lift the stand in position against the bottom of the boiler.
 7. Tighten the bolts to firmly attach the stand to the bottom of the boiler.
 8. Carefully lift the assembled boiler (with stand) off the safety blocks and move the unit into place.
 9. Proceed with the remainder of boiler assembly procedures marked for **ALL CTB Models**.

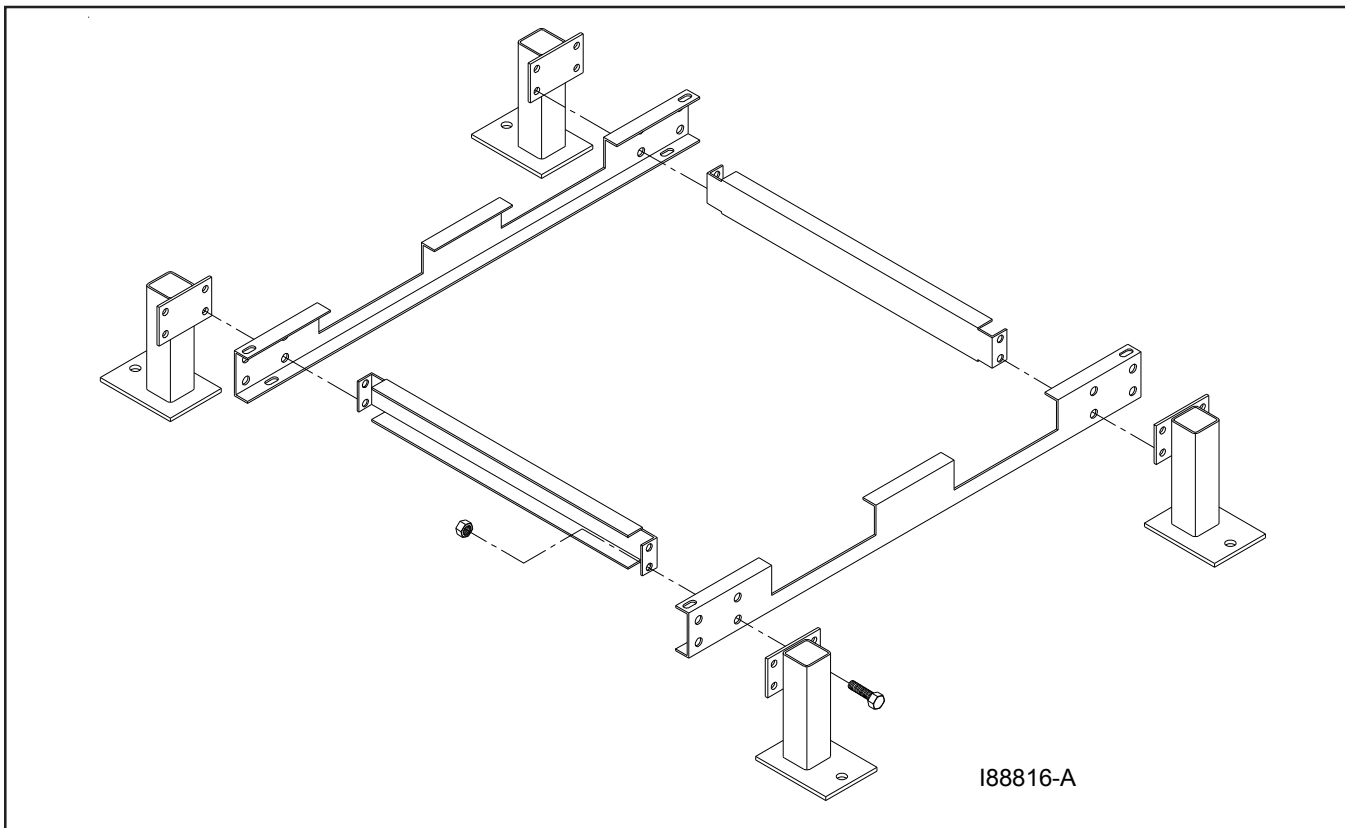


Figure 3B - Assembling the Support Stand

Dual-Stacked Boiler Assembly

Assembling the Dual-Stacked Boiler



WARNING: Use extreme caution when moving and lifting one of the CTB's (with a forklift) into place on the support stand. One CTB can weigh up to 907 Kg (Weight of CB-500 with water). Clean Burn recommends placing safety blocking underneath the unit until it is properly installed and secured on the support stand. *Failure to follow these basic safety guidelines may result in serious personal injury and/or damage to the unit.*

1. Refer to Figures 3C and 3D. Move the support stand into the approximate position where the dual-stacked boiler is to be installed, and place blocks (approximately 10 inches high) inside the stand to provide safety support for the boiler.

NOTE: If the support stand has not been assembled, refer to Figure 3B.

NOTE: Only use 19 cm (7 1/2") legs when stacking the boilers. Taller legs may be unstable.

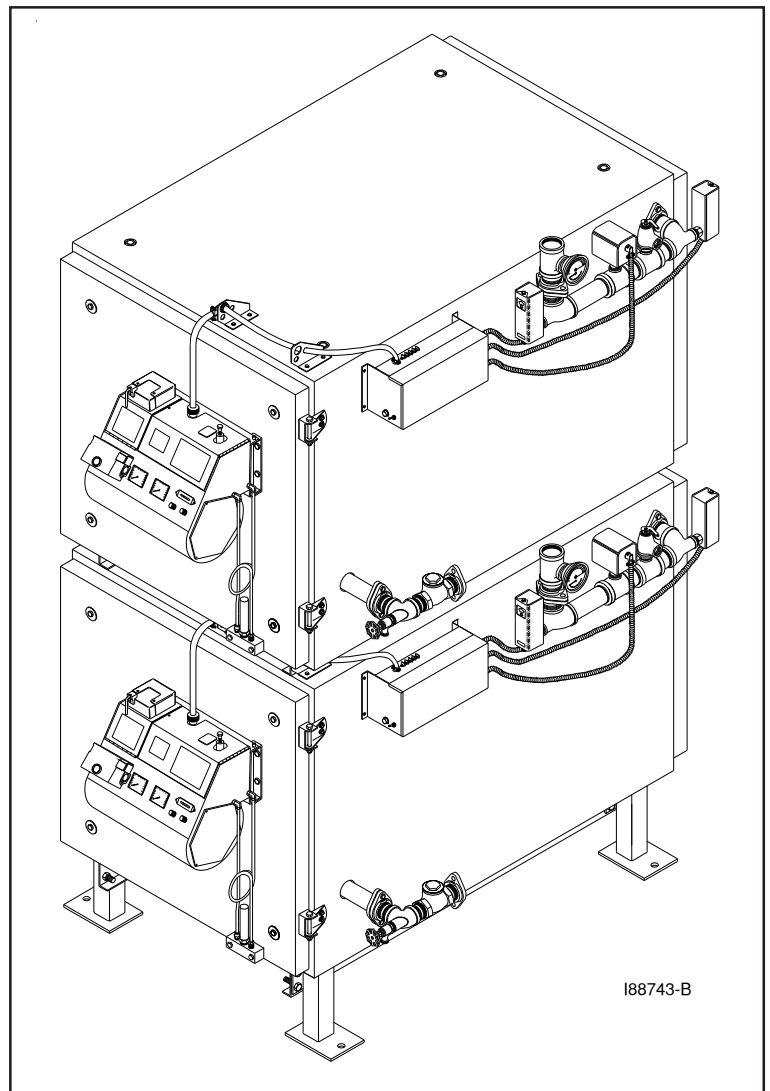
2. Use a forklift to carefully lift one CTB into position over top of the support stand.



WARNING: Secure the boiler to the forklift prior to lifting to prevent possible equipment damage or personal injury.

3. Lower the boiler down onto the safety blocks positioned inside the support stand.
4. Insert bolts (provided) into the keyhole slots in the boiler, and then lift the stand in position against the bottom of the boiler.
5. Tighten the bolts to firmly attach the stand to the bottom of the boiler.
6. Carefully lift the assembled boiler (with stand) off the safety blocks and move the unit into place for the rest of assembly.

NOTE: This boiler will be referred to as the "bottom" boiler for the remainder of this procedure.



**Figure 3C - Dual-Stacked Boilers
(Completely Assembled)**

(Procedure continued on page 3-6)

Dual-Stacked Boiler Assembly

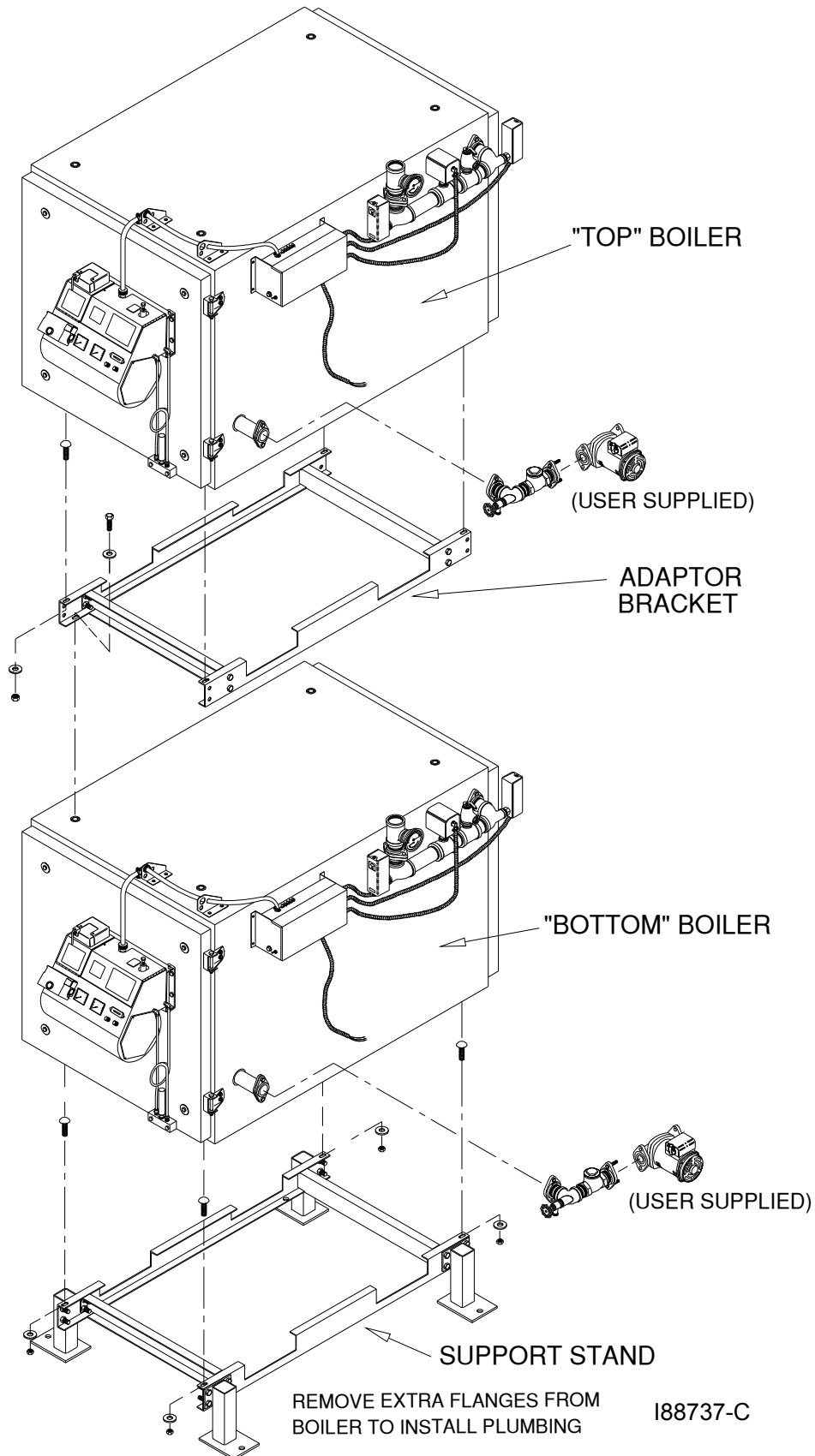


Figure 3D - Dual-Stacked Boiler Assembly Detail

Dual-Stacked Boiler Assembly

Assembling the Dual-Stacked Boiler (continued)

7. Refer to Figures 3D and 3E. Assemble the adaptor bracket using the 1" x 3/8" bolts provided.
NOTE: The adaptor bracket is installed between the two boilers; it is fastened to the underside of the "top" boiler unit.
8. If you have not already done so, remove the pre-assembled hardware from the top of the "bottom" boiler. You will use this hardware to fasten the adaptor bracket.
9. Use a forklift to carefully lift the "top" boiler unit from underneath (*see safety warning at the beginning of this procedure*).
10. Attach the adaptor bracket to the bottom of the boiler using the 1" x 3/8" carriage bolts provided. **DONOT** completely tighten the bolts until the two units are assembled together.
NOTE: The notches on the adaptor bracket are designed to fit around standard forklift forks.
11. After the bracket has been attached to the underside of the "top" boiler unit, move the "top" unit into position over the "bottom" unit.
12. Carefully lower the "top" boiler down onto the "bottom" boiler, watching for alignment of the bracket holes and the holes in the top of the boiler below.
13. Install the hardware through the lower set of holes in the adaptor bracket into the top of the "bottom" boiler while checking for proper alignment of the two units. Ensure that ALL hardware is securely tightened.

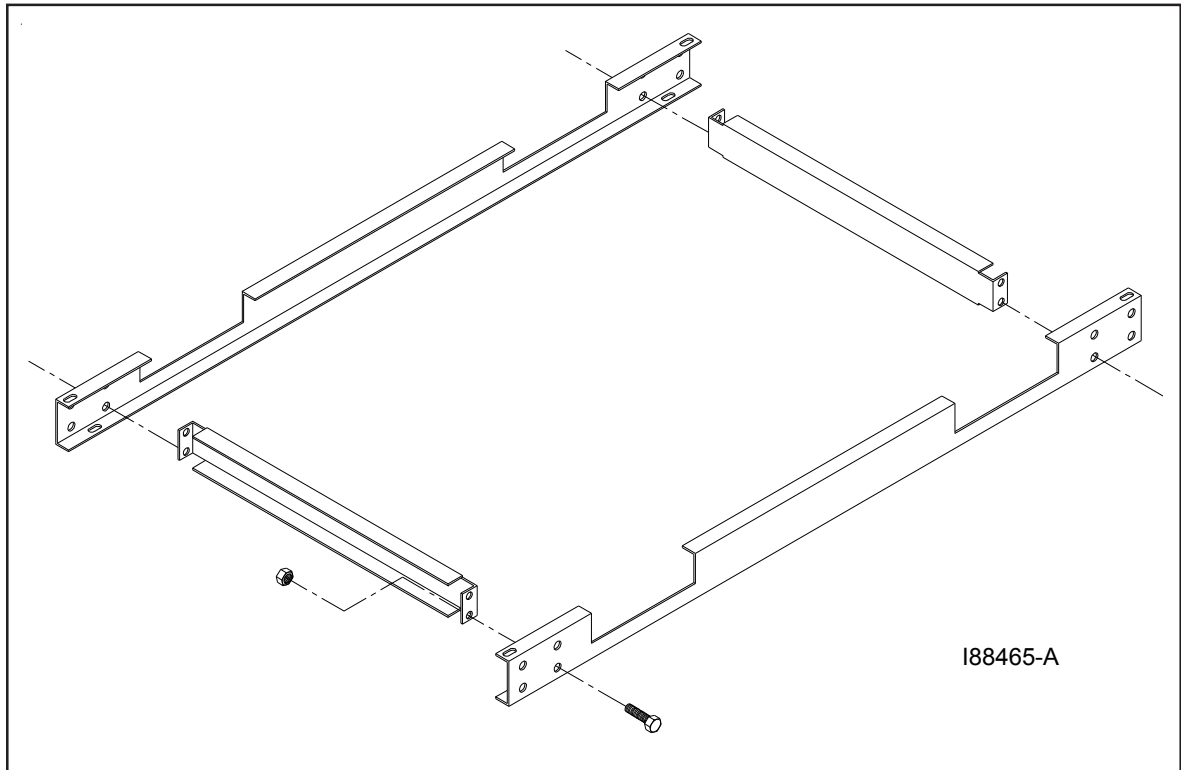


Figure 3E - Dual-Stacked Boiler Adaptor Bracket

Assembly for ALL Boilers

Connecting the CTB

Refer to Figures 3A, 3C, and 3D. Connecting the boiler involves three activities:

- Supply Side Connections
- Return Side Connections
- Wiring

NOTE: If you are installing dual-stacked boilers, each boiler must be installed in the same manner according to the following guidelines for connections/wiring.

Supply Side Connections

- Install the temperature/pressure gauge into the first tee (the 1/2" tapping). Be sure to use pipe dope on the threads of the gauge. Tighten the gauge into the tee.
- All other components on the supply side are factory installed and pre-wired for operation.

Return Side Connections

Boiler circulator - (*user-supplied*)

NOTE: Installation instructions are provided for both required and optional components.

- Mount the boiler circulator (*user supplied*) onto the flanged check valve assembly mounted on the boiler. Place a gasket between the two flanges and tighten.
- Install the return piping assembly onto the other side of the circulator flange. Place a gasket between the two flanges and tighten.

Wiring

- For *each* boiler, connect the wire from the CTB control box to the circulator. Refer to the CTB wiring diagram in Appendix B as needed. If necessary, excess length may be trimmed from the circulator wires.

Assembly for ALL Boilers

Installing the Ceramic Sleeve in the Boiler

NOTE: The ceramic target is factory-installed.

1. Refer to Figures 3F and 3G.
2. Swing open the clean-out door on the CTB front to gain access to the combustion chamber.
3. Install the stand for the ceramic sleeve as detailed in Figure 3F. Position the stand on the coils approximately 3" in from the door opening.
4. After the ceramic sleeve has been installed and positioned properly, close the clean-out door.
5. Tighten the four (4) nuts and washers in a criss-cross pattern until all are snug.

NOTE: The ceramic sleeve needs to seat firmly against the door insulation for proper combustion. Carefully position the ceramic sleeve on the stand so that it extends out slightly beyond the door opening, so that the door will push the ceramic sleeve in place as it is closed.

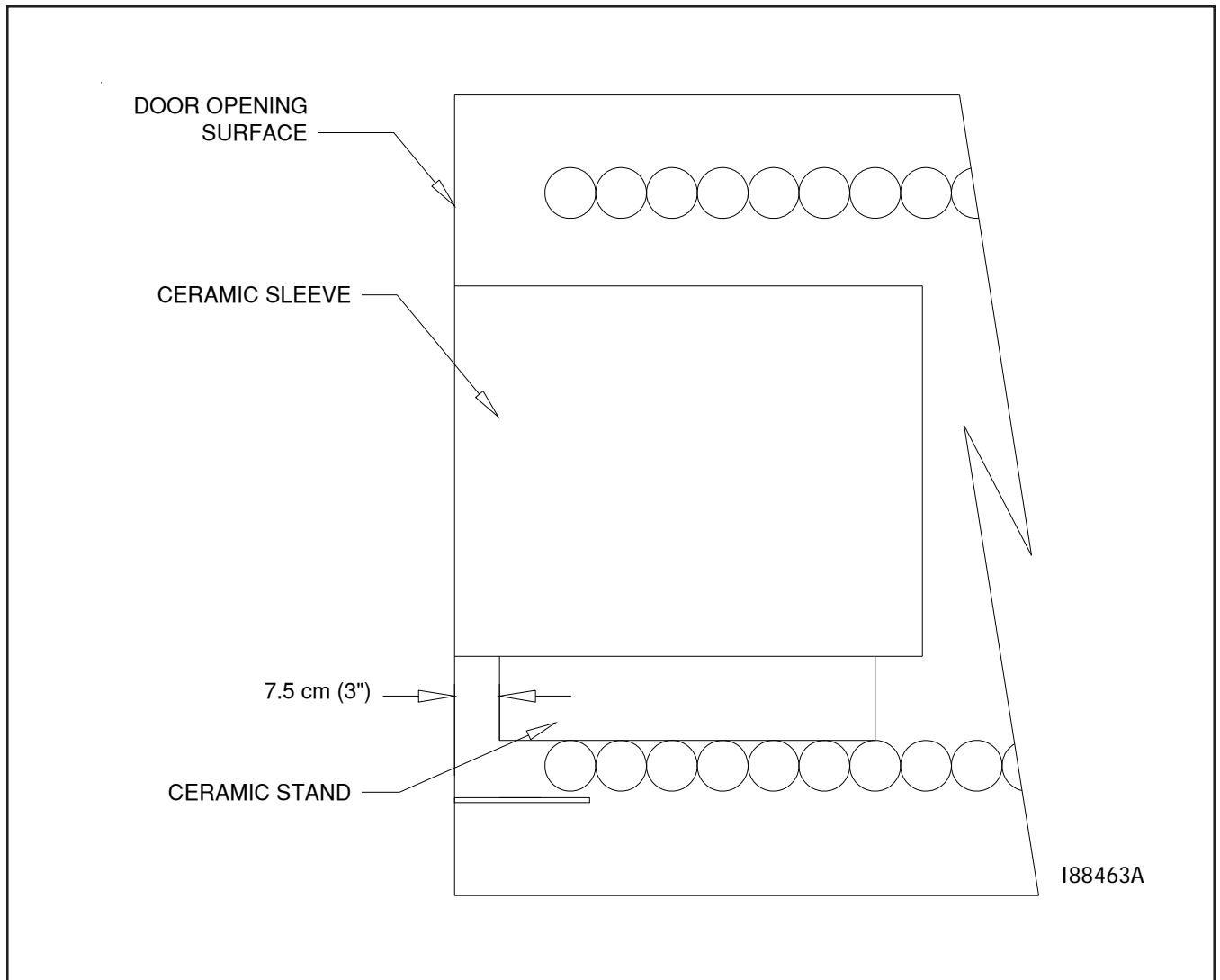


Figure 3F -Positioning of the Ceramic Stand and Ceramic Sleeve

Assembly for ALL Boilers

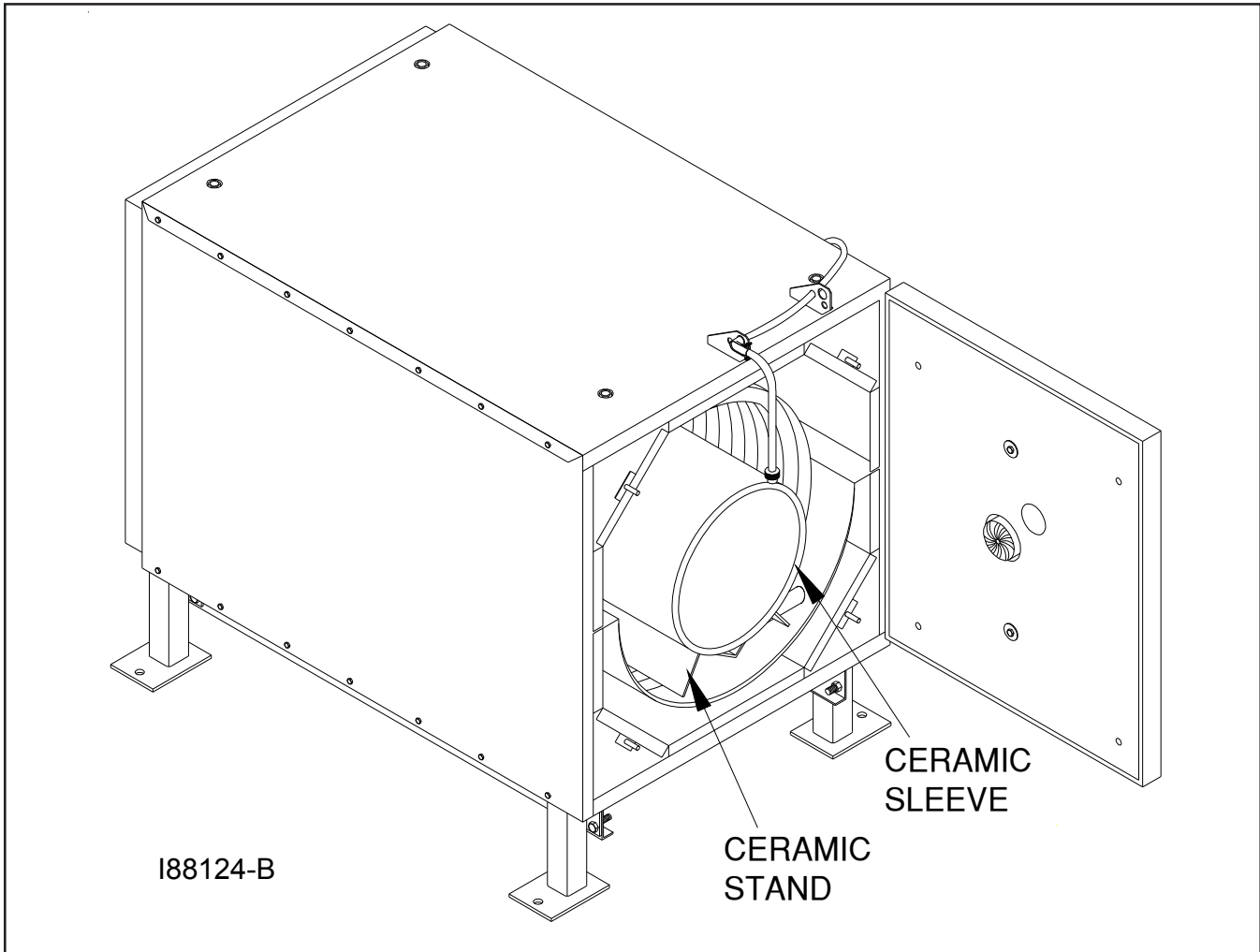


Figure 3G - Ceramic Stand and Sleeve Installed in the Combustion Chamber

Assembly for ALL Boilers

Checking the Burner Nozzle and Electrodes

NOTE: The burner nozzle is factory installed. Models CB-200-CTB and CB-350-CTB use a Delavan 9-5 nozzle. Model CB-500-CTB uses a 9-28 Delavan nozzle. The nozzle size is indicated on the nozzles as shown in Figure 3H. Refer also to **Appendix A** at the back of the manual for additional specifications on the burner nozzle.

ATTENTION: Check the electrode settings as specified in Figure 3H. The electrode settings must be correct for your burner to operate properly.

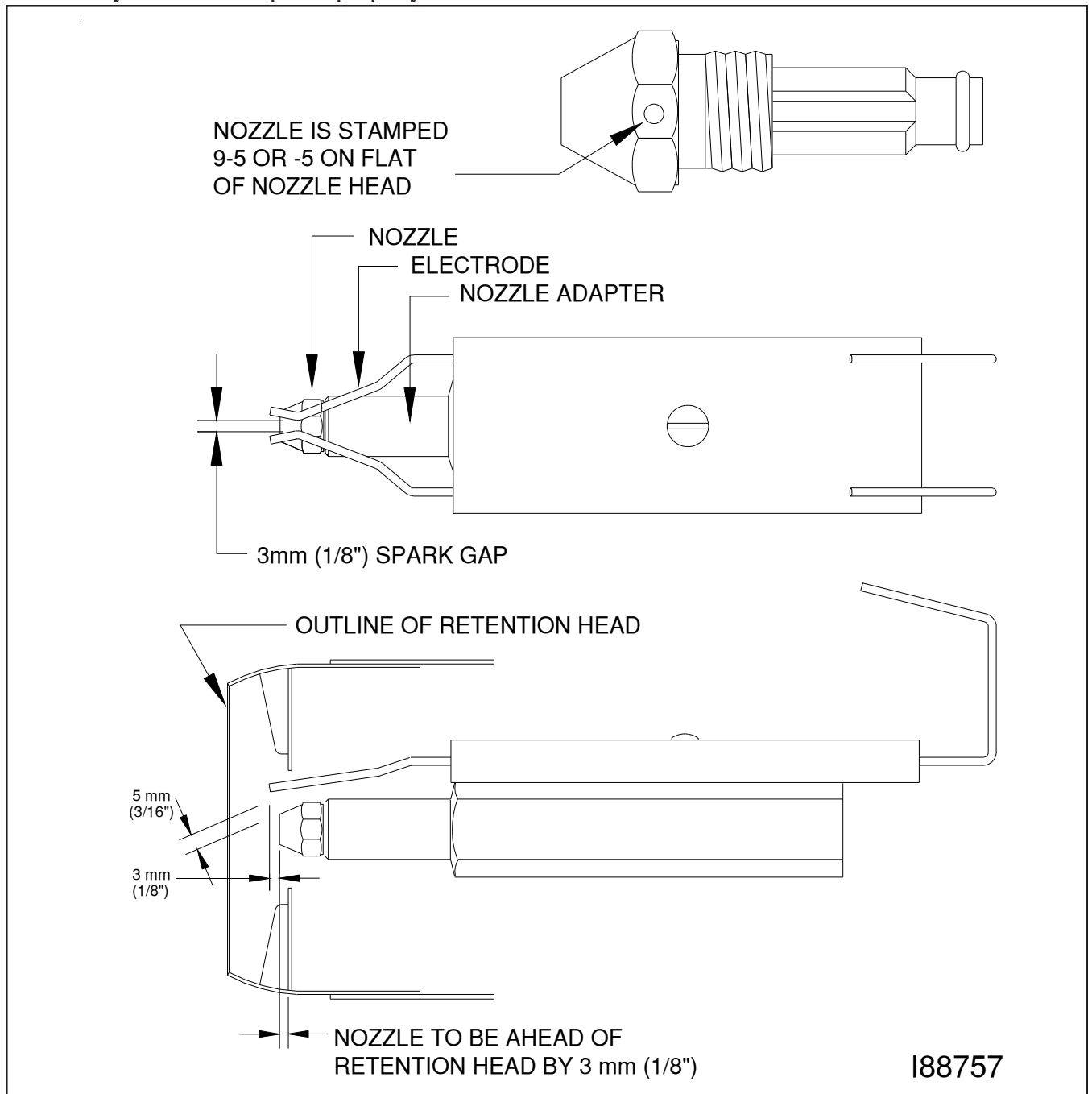


Figure 3H - Burner Nozzle and Electrode Specifications

Assembly for ALL Boilers

Mounting the Burner on the Hinge Bracket

NOTE: The burner may have been mounted on the CTB at the factory. If this is the case, simply check the clearance between the retention head and the boiler to make sure the burner swings freely into firing position. If adjustments are necessary, follow the procedure below to adjust the hinge bracket bolts.

1. Remove the nut from the burner mounting flange on the boiler cabinet, and set it aside for later use.
2. Lift the burner into position and mount it on the hinge bracket of the boiler cabinet.
3. Carefully swing the burner and check the clearance between the retention head and the boiler throat. There must be at least 3 mm (1/8") clearance, so the retention head is not "bumped" as you swing the burner into firing position.

If the retention head "bumps" the boiler throat, adjust the hinge bracket bolts as follows:

- While supporting the burner, slightly loosen the two (2) hinge bracket bolts.
- Carefully re-position the burner so it swings freely into its firing position.
- With the burner in its firing position, re-tighten the hinge bracket bolts.

Installing the Connector Block on the CTB Door

1. Refer to Figure 3I on the next page.
2. Use the two (2) bolts to install the aluminum connector block onto the CTB cabinet.
3. Remove and discard the red caps and plugs from the fittings and ports on the connector block. DO NOT allow any dirt/debris to enter these components during CTB assembly.

ATTENTION: The connector block includes an accumulator. The accumulator functions like a shock absorber on the oil line to prevent pressure buildup and protect vital burner components. It is important that the connector block is installed as shown so that the accumulator is in a vertical position to prevent sediment from settling in the accumulator. *Never operate your CTB without the connector block and accumulator properly installed on the boiler, or damage may occur to vital burner components.*

ATTENTION: DO NOT use teflon tape or teflon pipe dope products on any fittings; teflon residue will plug vital burner components. Non-hardening pipe dope compounds are recommended.

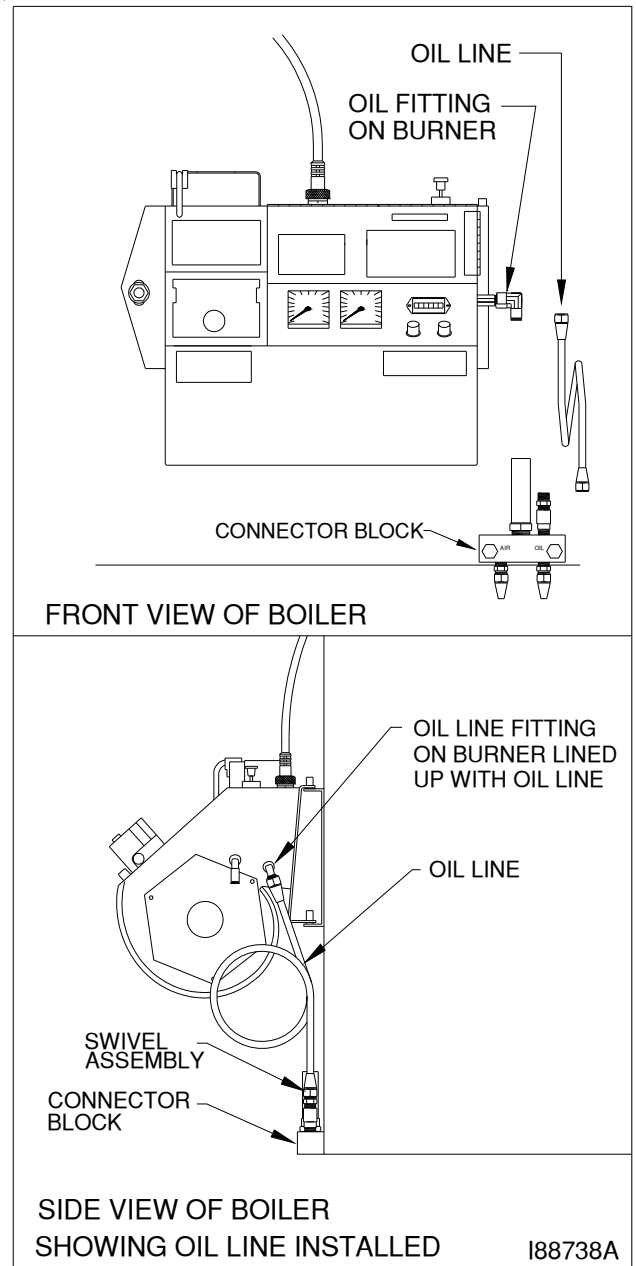
Assembly for ALL Boilers

Installing the Oil Line Tubing

NOTE: DO NOT disassemble the compression fitting from the swivel fitting. To prevent leaks, the NPT threads of the compression fitting have been sealed with hydraulic sealant during assembly of the fittings at the factory.

1. Remove and discard the outer red protective caps from the oil line tubing.
2. Loosely install the oil line tubing into the oil line fitting on the burner.
3. Use a wrench to slightly rotate the oil line fitting on the burner counterclockwise so the tubing lines up with the swivel assembly. Slightly bend the tubing as shown in Figure 3I, if required, to "line up" the oil line.
4. Make sure that the curl in the oil line is positioned as shown in Figure 3I so that the burner can swing open correctly.
5. Install the oil line tubing and tighten the nuts on the compression fittings. **DO NOT** overtighten these fittings to avoid damaging the ferrules.

NOTE: You may also check the positioning of the oil line according to Figure 3J on the next page which provides a larger front view of the connector block assembly.



**Figure 3I - Installation of
Connector Block and Oil Line**

Assembly for ALL Boilers

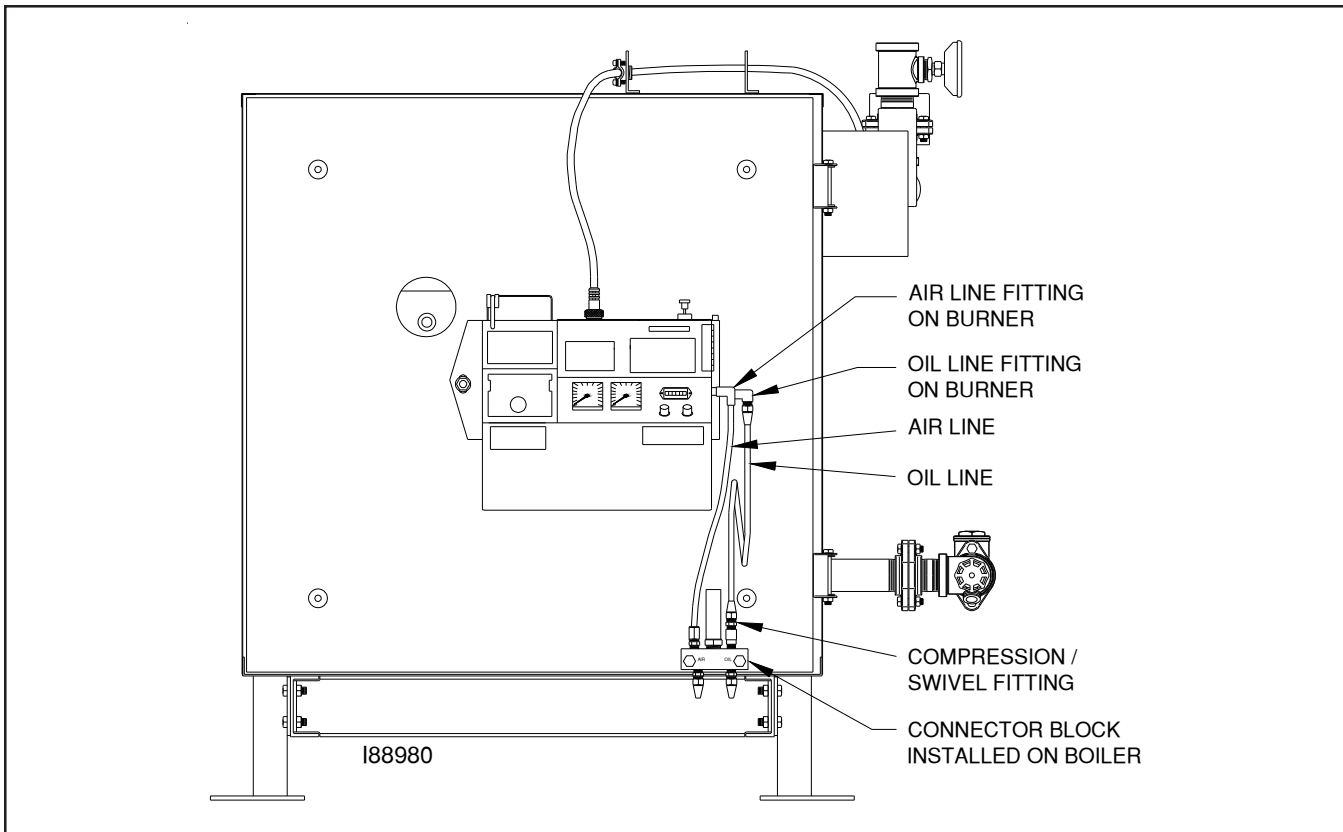


Figure 3J - Installation of Connector Block, Oil Line and Air Line (Front View)

Installing the Air Line Tubing

1. Remove and discard the outer red protective caps from the air line tubing.
2. Refer to Figure 3J. Push the air line tubing into the fitting on the connector block until the tubing bottoms out in the fitting.
3. Repeat this procedure to connect the air line tubing to the air line fitting on the side of the burner.

Locking the Burner into Firing Position

1. Swing the burner into firing position.
2. Install and tighten the lock nut on the mounting plate bolt to secure the burner in its firing position.
3. Plug the burner electrical cable into the receptacle on the top of the burner housing.
4. Tighten the locking ring to secure the electrical cable.

NOTE: Be sure to properly align the plug when plugging it into the receptacle. See Fig 3K.

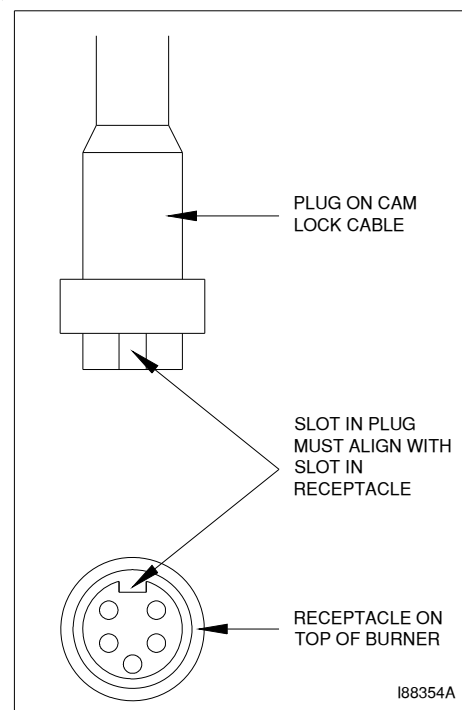


Figure 3K - Detail of Burner Electric Receptacle

SECTION 4: COIL TUBE BOILER INSTALLATION

Understanding Installation

Installing your Clean Burn Coil Tube Boiler (CTB) is a multi-step process which includes:

- (1) Oil Tank Installation Specifications
- (2) Installing the Metering Pump*
- (3) Connecting Water to the CTB
- (4) Installing the Oil Lines
- (5) Installing the Compressed Air Line
- (6) Wiring the CTB and Pump
- (7) Installing the Stack
- (8) Inspecting the Installation

***NOTE:** This manual provides information for the installation of a metering pump with the CTB. If you ordered a J-pump, please also refer to the separate *J-Pump Installation Manual* included with your shipment.

Clean Burn recommends that you review all procedures before beginning installation, paying careful attention to safety information statements. **Figures 4A / 4B provide a general overview of a typical coil tube boiler installation and should be reviewed closely before proceeding.**



WARNING: Improper installation can adversely affect the proper, safe operation of your CTB. It is critical that your boiler installer reads and follows the instructions provided in this manual. Access to the boiler must be restricted; only trained, qualified personnel should be permitted to perform installation and operation procedures.

Important Safety Guidelines for Safe Installation

General installation of the appliance shall be in accordance with the manufacturer's literature, in addition to complying with the following:

BS5410 Code of Practice for Oil Firing

1997: Installation up to 45 KW output capacity for space heating and hot water supply purposes.

1998: Installation of 44 KW and above capacity for space heating, hot water and steam supply purposes.

1978: Installation for furnaces, kilns, ovens and other industrial purposes.

The Building Regulations:

England and Wales: Approved Document J: Heat Producing Appliances (1991).

Scotland: Technical standards for compliance with the Building Standard (Scotland) Regulations 1990, Part F: Heat Producing Installations and Storage of Liquid and Gaseous Fuels.

Northern Ireland: The Building Regulations (Northern Ireland) 1990. Technical Booklet L - Heat Producing Appliances, July 1991.

Republic of Ireland: The Building Regulations of Ireland 1997, Part J: Heat Producing Appliances.

Isle of Man, Jersey and Guernsey: The Building Bylaws - BS 7671: 1992 IEE Wiring Regulations 16th Edition.


Important Safety Guidelines for Safe Installation (continued)


The Environmental Protection Act 1990, Part 1: Processes prescribed for air pollution control by local enforcing authorities PG1/1 (95).


Secretary of State's Guidance: Waste Oil Burners, less than 0.4 MW net rated thermal input. November 1995 (Appendix A of OFTEC OFSA 103).

OFTEC Guidelines: Document OFG100 for externally serviced oil fired appliances.


Important Notes to the Electrician


 **WARNING:** Electrical installation of the boiler is to be performed only by qualified personnel (i.e. licensed electrician/engineer). Improper electrical installation can adversely affect the proper, safe operation of the boiler and may cause serious personal injury/death.

 **WARNING:** Before completing any boiler wiring, refer to the wiring diagrams in Appendix B at the back of the manual. Carefully review the wiring assignments and colors, noting that the Clean Burn wire colors may not be "standard" or familiar.

 **WARNING:** High earth leakage current / earth connection is essential and must be established before connecting the main power supply.

 **WARNING:** Low voltage terminals are only protected by basic insulation--caution is required.

 **CAUTION:** Use only approved wire conduit and connectors when wiring the Clean Burn boiler. An emergency stop device (i.e. "panic button") must be installed at ground level in the mains cable to the boiler to ensure the safety of boiler operators and service personnel. The external disconnect device must employ a contact separation of 3mm in all poles; the external breaker must be an approved type.

 **CAUTION:** The mains cable must be introduced into the control box using conduit connectors which provide adequate strain relief. The mains cable installation must be accomplished using suitably rated and approved wiring (BASEC or HAR) or appropriate current-carrying capacity. The wires should have a minimum rating of 90 °C (194 °F).

NOTE: According to Clause 4A of 61000-3-11 (International Electrical Standard), the user must determine, in consultation with the supply authority, that the boiler is connected only to a supply with an impedance of $3.773 \times 10^{-3} + 2.358 \times 10^{-3}$ or less.

Typical Installation Diagrams

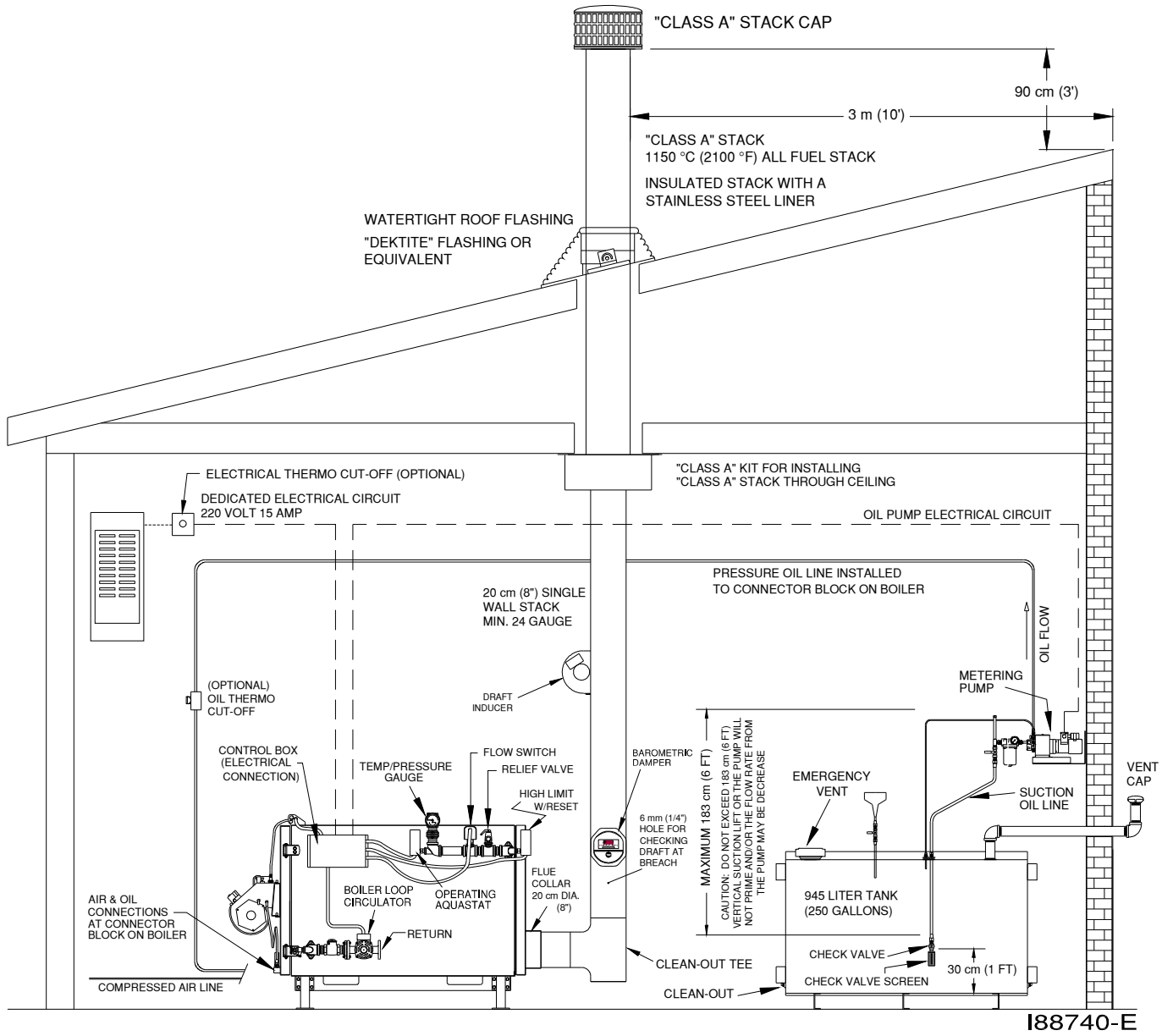
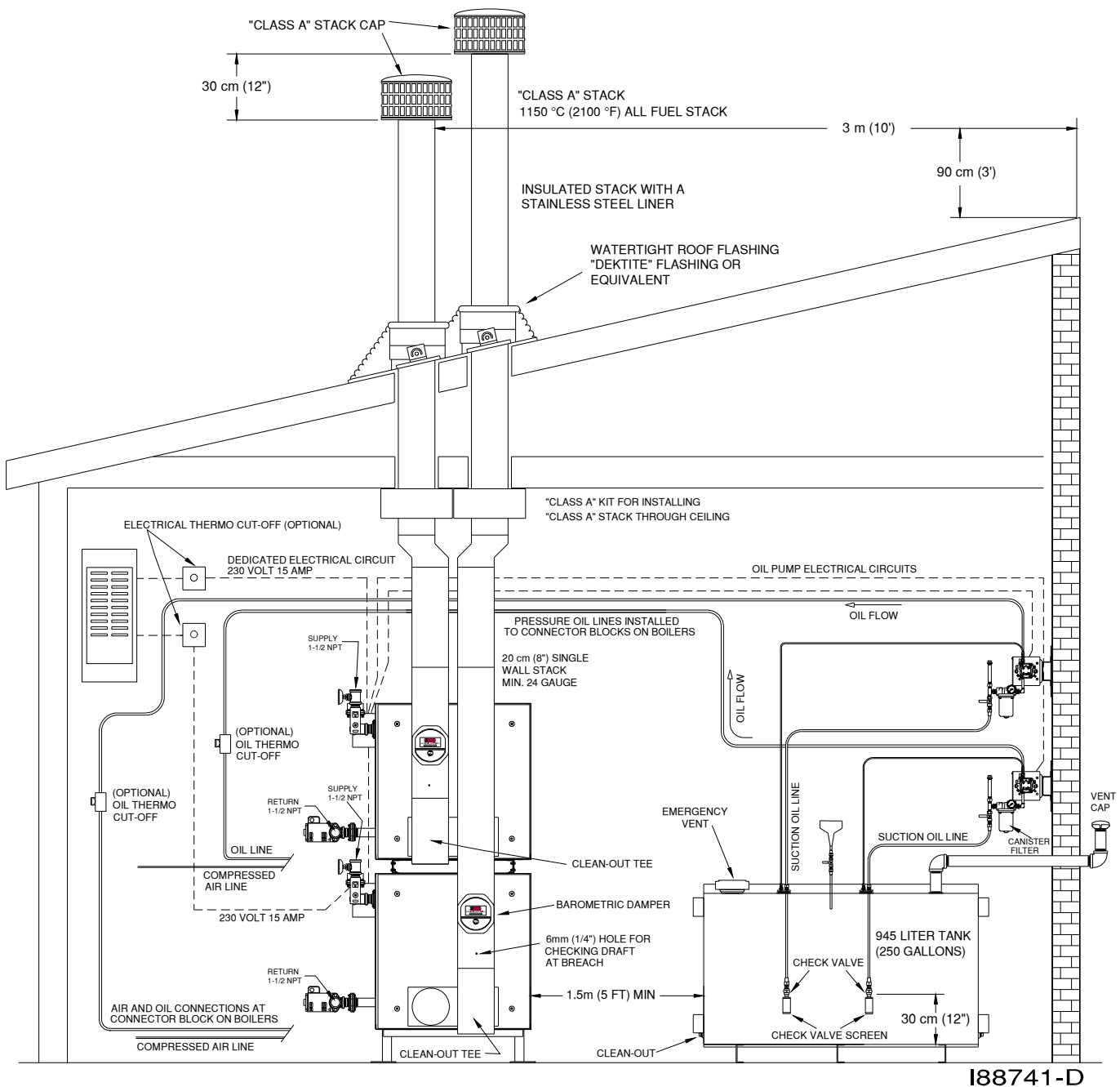


Figure 4A - Typical Single Boiler Installation Diagram

Typical Installation Diagrams (continued)



**Figure 4B - Typical Dual-Stacked Boiler Installation Diagram
(Two CB-350-CTB Boilers Shown)**

Combustion Air Requirements

The CTB system designer/installer must ensure that there is the proper amount of combustion air in the boiler/mechanical room.

Refer to Figure 4C.

Combustion Air is the required amount of air that the equipment needs to permit the satisfactory combustion of oil, the proper venting of combustion gases, and to maintain a safe ambient temperature within the space at safe limits under normal conditions of use.

The following requirements should be followed for proper supply of combustion air:

Units located in confined spaces (units in a boiler room/mechanical room) must have two (2) permanent openings, one near the top of the enclosure and one near the bottom of the enclosure as follows:

1. If all of the air is taken directly from the outside of the building by use of vertical ducts - each of the two openings must have a total free area of not less than 6.5 cm^2 (1 in^2) per 4,000 BTU/hr's, or 225 cm^2 (35 in^2) per gallon of oil, of the total appliance(s) input rating.
2. If all of the air is taken directly from the outside of the building by use of horizontal ducts - each of the two openings must have a total free area of not less than 6.5 cm^2 (1 in^2) per 2,000 BTU/hr's, or 450 cm^2 (70 in^2) per gallon of oil, of the total appliance(s) input rating.
3. If all of the air is taken directly from inside of the building - each of the two openings must have a total free area of not less than 6.5 cm^2 (1 in^2) per 1,000 BTU/hr's, or 900 cm^2 (140 in^2) per gallon of oil, of the total appliances(s) input rating.

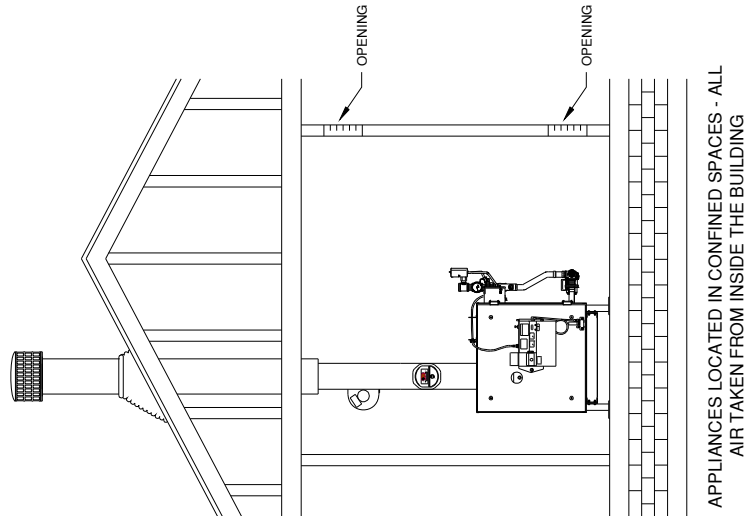
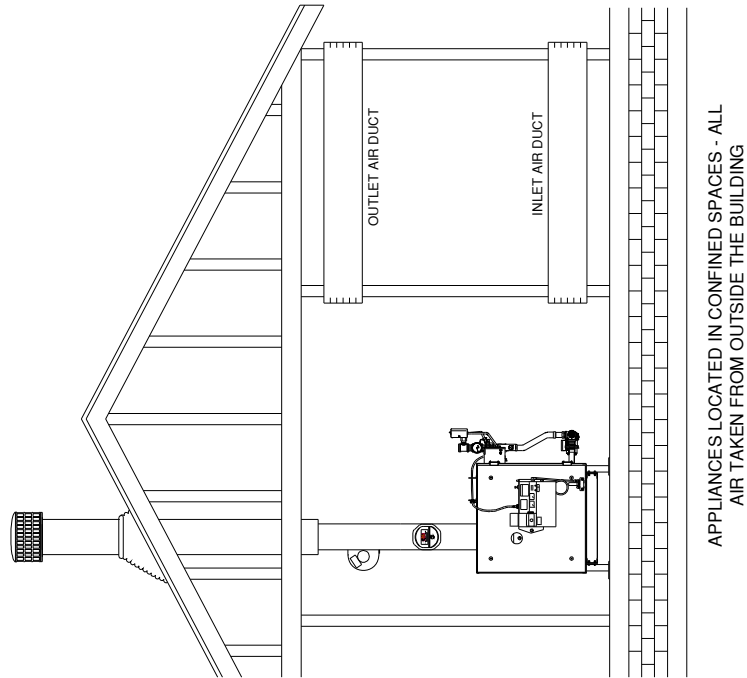
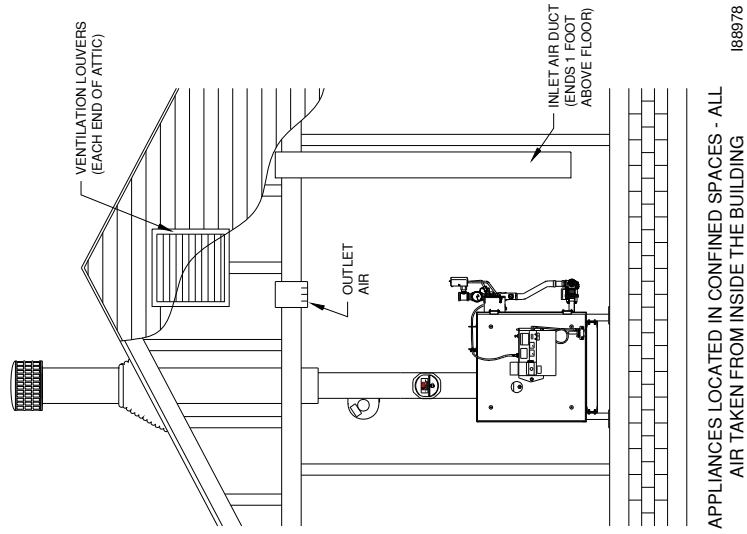


Figure 4C - Air for combustion and ventilation


Oil Tank Installation Specifications



Ensure that your tank installation adheres to the following safety guidelines as stated here and in **Section 1** of this manual.

The tank safety label (shown at right) also summarizes these important specifications for tank installation and usage. If you do not have a copy of this label, please contact your Clean Burn dealer for a copy, which is to be affixed directly to your used oil supply tank.

- **The tank installation must meet all national and local codes.** Consult your local municipal authorities for more information as necessary.
- Use a minimum **945 liter (250 gallon) tank**. DO NOT use a drum as a substitute for an appropriate tank. The tank must be large enough to allow water, sludge, etc. to settle out of the used oil.
- The tank must have a **manual shut-off type valve** on the side of the tank to allow the water, sludge, etc. to be drained from the bottom of the tank.
- **All unused openings in the tank must be plugged** or capped off.
- For optimal system functioning, Clean Burn recommends inside tank installations as shown in Figures 4A and 4B.
- The tank must be **vented to the outside** of the building using iron or steel pipe and fittings with an approved vent cap.
- Carefully review the oil tank and pump installation details as shown in Figures 4A, 4B, and 4C, including the metering pump installation and specifications for the oil line installation. (Procedures for installing these components can be found in the following pages.)

IMPORTANT NOTE: If you are installing an inside oil tank in the same room as the boiler, you must allow a 1.5 m (5 foot) minimum clearance between the tank and the boiler. The oil tank should be set and installed in position **BEFORE** the boiler is installed.


WARNING

Fire and explosion hazards.
 To prevent serious injury or death:

ONLY place these listed substances in this used-oil supply tank:


- Used crankcase oil
- Used automatic transmission fluid
- Used hydraulic oil
- #2 fuel oil

Do NOT place flammable or corrosive substances such as gasoline, chlorinated oils, solvents, paint thinners, or any other unsafe substances in this used-oil supply tank.

Do NOT weld or allow open flame within 35 feet of this used-oil supply tank.

Tank installation MUST comply with NFPA 30 and 31 Fire Codes, including the following requirements:

- Tank must be listed to UL 80 or UL 142.
- Tank must be vented to outside.
- Emergency vent or explosion relief must be installed on tank.
- Inside fill allowed only with funnel including 1/4 turn-to-close ball valve, which must be closed after filling.
- All other openings must be plugged.
- All oil lines must be constructed of copper, steel, or brass components. Do NOT use rubber or plastic tubing or piping, or any other inappropriate material.



Follow all instructions for tank installation in Operator's Manual.

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Oil Tank Installation Specifications (continued)

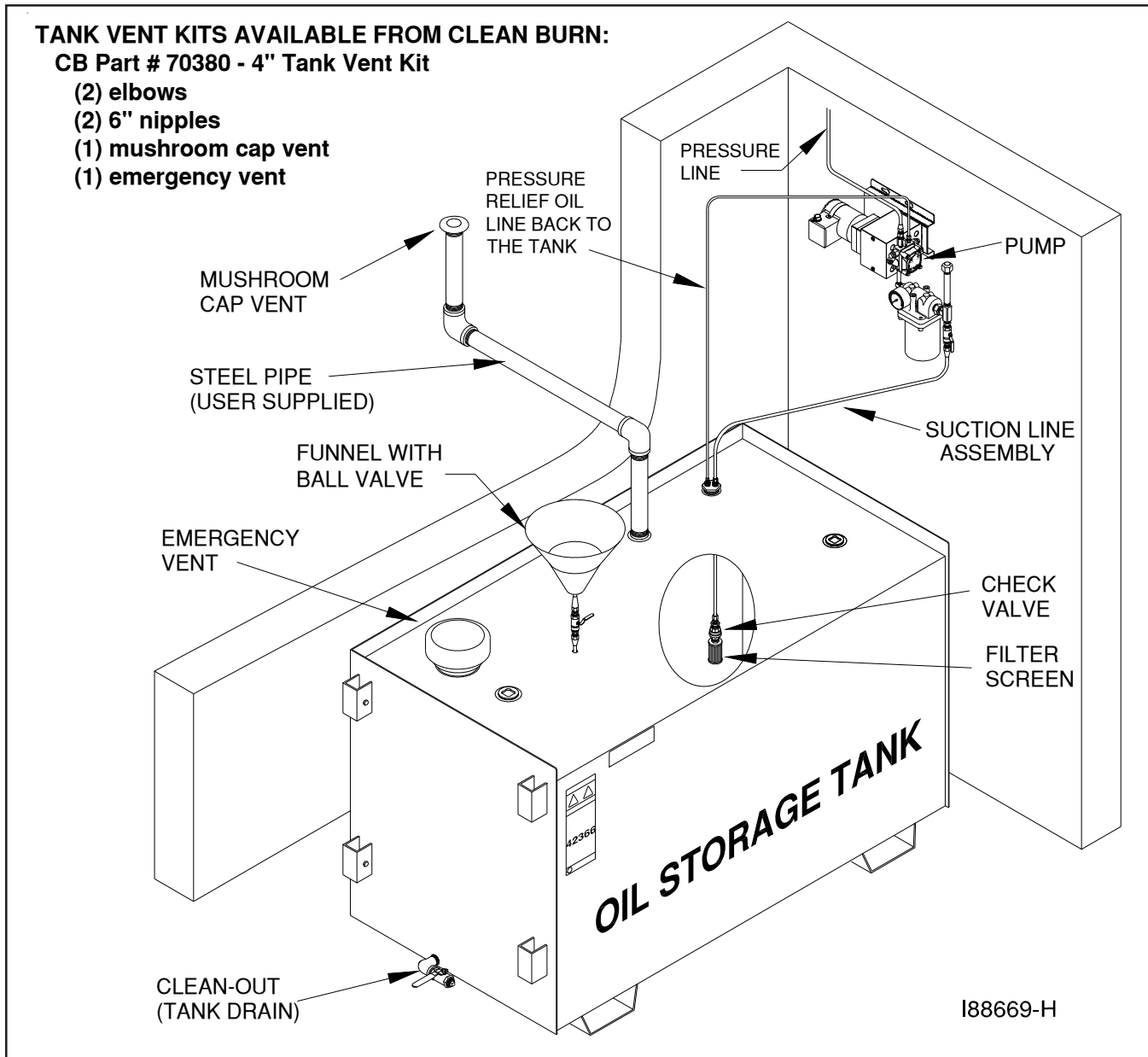


Figure 4D - Typical Metering Pump Installation with Inside Tank

Installing the Tank Vent and Emergency Vent

Some codes require that you install a tank vent (to the outside) and an emergency vent for your tank as shown in Figure 4D. **Tank Vent Kits** are available from Clean Burn; contact your local Clean Burn dealer to order. Be sure to check your local codes for any additional tank installation requirements, and adhere to the following installation guidelines:

- Install a length of minimum 50 mm (2") steel pipe (user-supplied) terminating outside with a proper vent cap as shown in Figure 4D. Consult local codes for information and requirements concerning the proper venting of oil storage tanks.
- Install an emergency vent as shown in Figure 4D. Contact your tank manufacturer for information concerning the proper emergency vent for your tank.

Installing the Metering Pump

Preparing for Installation

Before starting installation of the metering pump, review Figures 4E, 4F, and 4G to become familiar with the metering pump components. You will also need to accomplish the following activities:

- Verify that you have the proper metering pump for your boiler (note the specific gear motor part numbers shown in Figure 4F).
- Gather all required tools and materials as needed for installation; as indicated in the following procedures, some materials (e.g. fittings, tubing) are to be user-supplied.
- *Standard mounting* is vertical mounting on a wall; **this pump installation is recommended.** *Alternate mounting* is horizontal mounting on a bracket. Be sure to carefully follow the appropriate procedures/diagrams for pump mounting.
- For optimal metering pump functioning, mount the pump at a distance from the oil tank that will comply with the following requirements:
 - The suction oil line may NOT exceed **183 cm (6') TOTAL vertical lift AND 122 cm (4') TOTAL horizontal lift.**

Standard Mounting: Vertical Positioning

1. Refer to Figures 4E, 4F, and 4G. Note that the metering pump is shipped with the pump head already positioned for the standard vertical wall mounting.
2. Use the appropriate type of bolts and washers (user-supplied) to securely mount the metering pump to the appropriate wall in your building at a distance from the tank that complies with the suction oil line requirements.

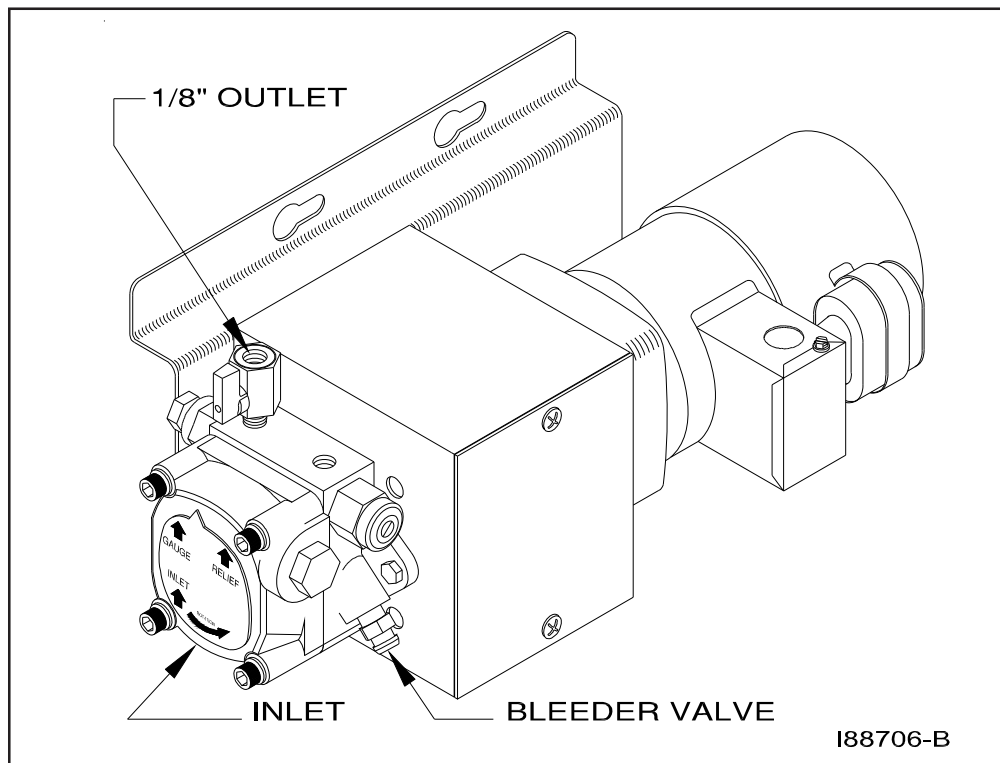
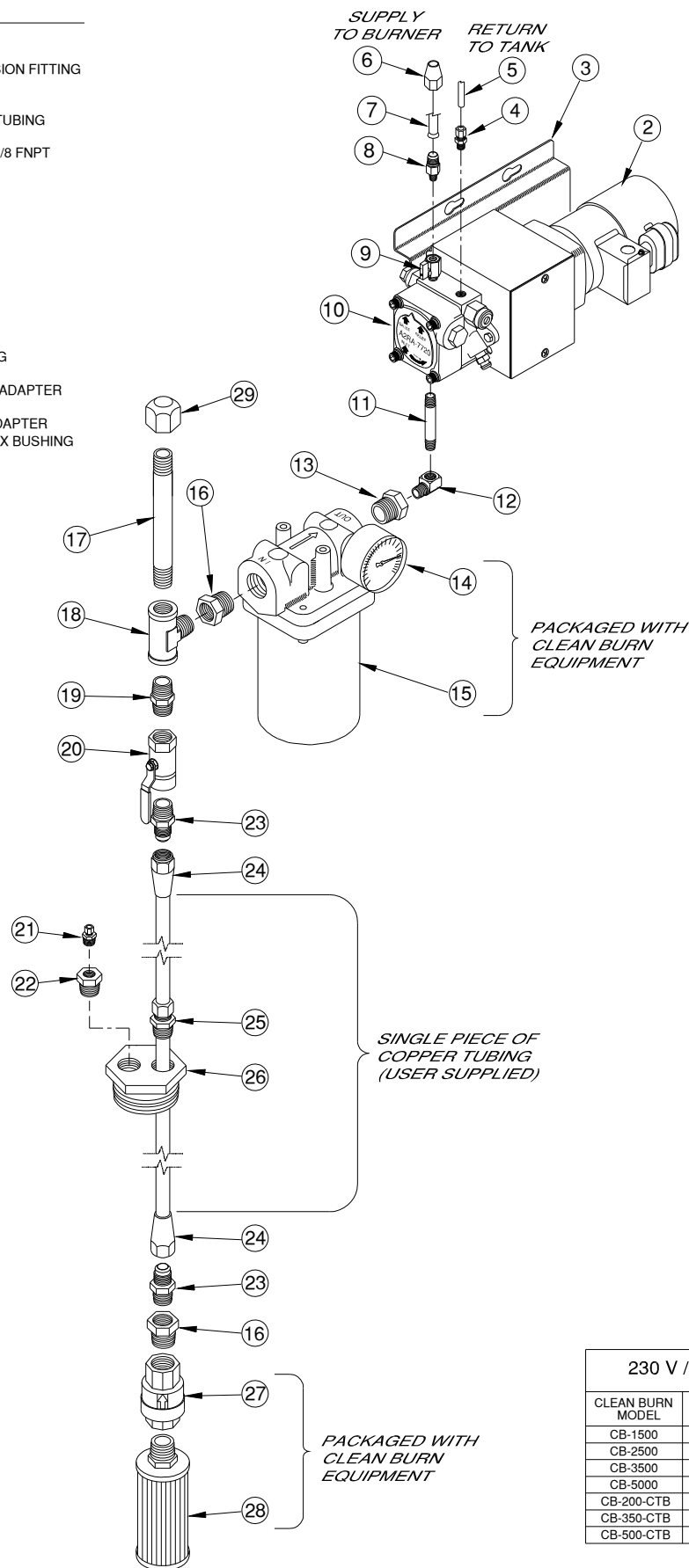


Figure 4E - Standard (Recommended) Vertical Mounting of the Metering Pump

#	PART #	DESCRIPTION
2	see chart	GEARMOTOR
3	11322	MOUNT - METER PUMP
4	32037	1/8 NPT X 1/4 TUBE COMPRESSION FITTING
5	N/A	1/4 COPPER OR ALUM. TUBING
6	N/A	3/8 OR 1/2 TUBE FLARE NUT
7	N/A	3/8 OR 1/2 COPPER OR ALUM. TUBING
8	N/A	1/8 M NPT X 3/8 OR 1/2 FLARE
9	32526	MINI BALL VALVE 1/8 MNPT X 1/8 FNPT
10	32475	METER PUMP
11	32467	1/4" X 3" NIPPLE
12	32210	1/4" STREET ELBOW
13	32336	1/4" X 3/4" BRASS BUSHING
14	32123	VACUUM GAUGE
15	32127	CANISTER FILTER- LENZ
16	32430	1/2" x 3/4" BUSHING, BRASS
17	32446	1/2" X 5" NIPPLE
18	32429	1/2" STREET TEE, BRASS
19	32137	1/2" HEX NIPPLE
20	32142	1/2" BALL VALVE
21	32062	1/4" NPT x 1/4" TUBING FITTING
22	32443	1/4" x 1/2" BUSHING
23	32141	1/2" NPT x 1/2" TUBING FLARE ADAPTER
24	32140	1/2" LONG NUT
25	32139	1/2" NPT x 1/2" TUBING SLIP ADAPTER
26	32442	2" x 1/2" x 1/2" NPT DUPLEX HEX BUSHING
27	32021	3/4" CHECK VALVE
28	32061	3/4" CHECK VALVE SCREEN
29	32445	1/2" PIPE CAP



230 V / 50 Hz	
CLEAN BURN MODEL	GEARMOTOR PART #
CB-1500	33425
CB-2500	33426
CB-3500	33427
CB-5000	33428
CB-200-CTB	33530
CB-350-CTB	33436
CB-500-CTB	33571

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Figure 4F - Metering Pump Component Detail

Alternate Mounting: Horizontal Positioning

ATTENTION: If the metering pump is to be mounted horizontally or on a bracket as shown in Figure 4G, the pump head must be rotated counterclockwise so that it is aligned in a horizontal position. *The gauge arrow on the pump head must point up, or the pump will not prime.*

1. Refer to Figures 4F and 4G.
2. Remove the two pump mounting bolts. The coupling is keyed and does not have set screws.
3. Rotate the pump head 180 degrees to the horizontal position as shown in Figure 4G.
4. Re-install and tighten the two pump mounting bolts.
5. Use the appropriate type of bolts and washers (user-supplied) to securely mount the metering pump to the mounting bracket, which is to be installed on the appropriate wall in your building at a distance from the tank that complies with the suction oil line requirements.

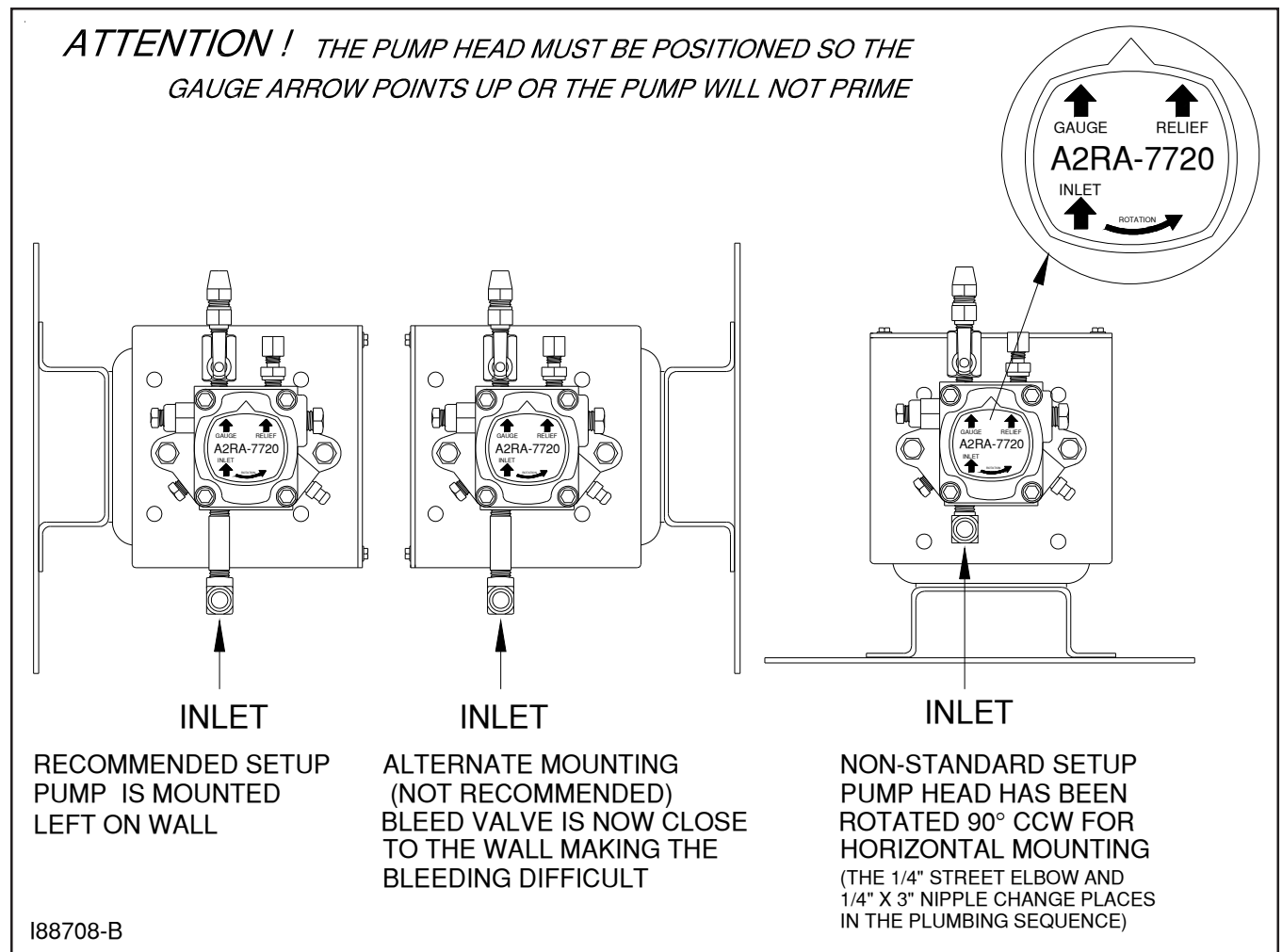


Figure 4G - Proper Positioning of Metering Pump Head

Connecting Water to the Coil Tube Boiler

IMPORTANT NOTE! Detailed information on the installation and operation of the hydronics system is provided in Section 10 of this manual. The instructions provided here are abbreviated and serve only to indicate *when* these procedures should be performed; consult Section 10 for the detailed version.

1. Connect the desired header supply and return lines to the CTB.
2. Have the water trim installed by a certified hydronics technician. Heat exchangers must be used for domestic water heater installations.
3. For air separation and elimination, Clean Burn recommends the Enhanced Spiral-Type Air Separator which can be supplied by your local Clean Burn dealer. Installing an air separator helps ensure that air is purged from the boiler, which is necessary for optimal startup and operation of the burner.
4. The relief valve discharge must be piped to within four inches of the floor or to a floor drain. Be sure to allow for clearance to remove the back panel for servicing.

Filling the Coil Tube Boiler with Water

ATTENTION: *It is necessary to fill the CTB with water prior to wiring and turning the CTB ON.* The boiler circulator bearings are water lubricated and should not be allowed to operate dry. Filling the CTB with water provides immediate lubrication of the bearings. Purging air from the water is also critical; doing so enables proper startup of the burner.

1. Fill the CTB with clean tap water.
ATTENTION: To prevent damage to the CTB, DO NOT fill the boiler with water when the boiler is hot.
2. The pressure gauge should read 0.8 bar (12 psig). If a different operating pressure is needed, contact the Clean Burn Service Department for additional instructions.)
3. **Refer to Section 10, The CTB Hydronic System, for additional information.**

Installing the Suction Oil Line Components

ATTENTION: It is critical that you adhere to the following specifications for suction oil line installation (oil line from the tank to the pump). If these specifications are not met, the metering pump will not function correctly and the burner will shut down on reset. The majority of service problems with the metering pump are caused by leaks at fittings in the suction oil line; these problems are eliminated by ensuring a 100% airtight suction oil line which slants up to the pump.

- All suction oil line components must be installed as shown in Figures 4A, 4B, and 4F. **Suction line size is 1/2" (12.7 mm) diameter.** Proper installation allows the suction oil line to be filled with used oil during initial priming.
- The suction oil line may NOT exceed **183 cm (6') TOTAL vertical lift AND 122 cm (4') TOTAL horizontal lift** (which equals 6.0" hg maximum operating vacuum). To determine if your suction oil line will meet this specification for maximum operating vacuum, base the calculation for your installation on the following equivalents:

30 cm (1') vertical = 0.75" hg (vacuum)

122 cm (4') horizontal = 0.75" hg (vacuum)

NOTE: ALSO ADD 0.75" hg to the final sum to account for every oil filter, shut-off valve, and check valve on the suction side of the pump assembly.

Sample calculation: 183 cm / 30 vertical cm feet x 0.75" = 4.50" hg AND

122 horizontal cm = 0.75" hg

4.50" hg + 0.75" hg + 0.75" hg = 6.00" hg vacuum

- The metering pump must be installed with a **3/4" check valve and screen** at the end of the suction oil line, or the pump will not maintain its prime.
 - Use **Permatex #2 non-hardening gasket sealer** on every threaded fitting. DO NOT use teflon tape or teflon pipe dope compounds; the teflon can flake off and cause damage to the pump head.
 - **The suction oil line must be 100% airtight for proper system functioning.** Use only high-quality flare fittings for the copper tubing. DO NOT use compression fittings. DO NOT use any steel pipe unions. DO NOT use sweat copper pipe. These types of fittings cause air leaks in the suction oil line and will require re-installation.
 - **The suction oil line must slant up to the pump;** any high spots will trap air and will not allow the pump to prime.
1. **Assemble the suction oil line fittings (from the metering pump to the canister filter):**
 - a. Refer to Figure 4F for a detailed look at the metering pump components and fittings.
 - b. Remove the plug from the 1/4" inlet port of the pump.
 - c. Install the 1/4" x 3" brass nipple into the 1/4" inlet port on the pump.
 - d. Install the 1/4" brass street elbow onto the 3" brass nipple; turn the fitting onto the nipple until it is tight and faces away from the pump mounting plate.
 - e. Prepare the canister filter for installation:
 - Install the 3/4" x 1/4" brass hex bushing into the outlet port of the canister filter. *Check the direction of the arrow for the proper flow.*
 - Install the 3/4" x 1/2" brass bushing into the inlet port of the canister filter.

Installing the Suction Oil Line Components (continued)

(e.) Prepare the canister filter for installation (*continued*):

- Remove the plug from one of the 1/8" gauge ports in the canister filter and install the vacuum gauge. Seal the threads of the gauge with Permatex #2 non-hardening gasket sealer.
- Install the 1/2" threaded pipe adapter into one side of the 1/2" ball valve.
- Install the 1/2" MPT x 1/2" flare adapter into the other side of the ball valve.
- Install this assembly into one side of the 1/2" brass tee.
- Install the assembled 1/2" tee into the 3/4" x 1/2" brass bushing, which is installed in the inlet port of the canister filter. Make sure that the 1/2" flare adapter is pointing down.
- Install the canister filter assembly onto the 1/4" brass street elbow as shown in Figure 4E. The canister filter must be installed with the arrow pointing towards the pump (direction of oil flow).
- Install the 1/2" x 5" brass nipple into the top side of the 1/2" brass tee assembly.
- Loosely install the 1/2" brass cap onto this nipple. DO NOT tighten the cap at this time.

2. **Install the suction oil line (from the the tank to the canister filter):**

- a. Refer to Figures 4A, 4B, and/or 4F.
- b. Prepare a piece of 1/2" O.D. copper tubing (user-supplied) which will function as the pick-up line from the tank to the canister filter. This copper tubing must have the following specifications:
 - The tube must be one continuous piece of 1/2" O.D. copper tubing with no kinks or fittings.
 - The tube is to slant up from the tank to the pump with no loops or high points to trap air.
- c. Locate the 2" MPT x 1/2" FPT x 1/2" FPT duplex, slip-thru hex bushing (which will eventually be installed into one of the 2" openings on the tank). *Note that the fitting is marked "S" for suction and "R" for return.*
- d. Install the 1/2" MPT x 1/2" slip fitting into the "S" side of the 2" duplex slip-thru hex bushing.
- e. Install the 1/4" MPT x 1/4" compression fitting into the 1/2" x 1/4" brass bushing.
- f. Install the 1/2" x 1/4" brass bushing into the "R" side of the 2" duplex slip-thru hex bushing.
- g. Measure the height of the oil tank (from the bottom of the tank, NOT the floor) to the 2" opening that you are going to use for the supply oil line. Deduct 30 cm (12") from this measurement and transfer this new measurement onto the 1/2" O.D. copper tubing.
- h. Remove the locking nut and ferrel sleeve connector from the 1/2" slip fitting, and slide them over the copper tubing.
- i. Slide the 1/2" O.D. copper tubing through the 1/2" slip fitting, which is installed in the "S" side of the 2" hex bushing.
- j. Install the screen into one side of the 3/4" check valve (making sure the arrow is pointing away from the screen assembly).
- k. Install the 3/4" x 1/2" brass bushing into the 3/4" check valve.
- l. Install the 1/2" MPT x 1/2" flare adapter into the 3/4" x 1/2" brass bushing.

Installing the Suction Oil Line Components (continued)

- (2.) **Install the suction oil line (*continued*):**
- m. Slide the 1/2" flare nut over the end of the 1/2" copper tubing, and flare the end of the tubing.
NOTE: Use a high-quality flaring tool (such as a Ridgid Flaring Tool) to ensure that all flares are made properly (i.e. so they will be 100% airtight).
 - n. Install the flared oil line and nut onto the assembled check valve/screen and tighten.
 - o. Pick up the assembled oil line, and carefully guide the end of the tubing with the check valve through the 2" tank opening.
 - p. Apply Permatex #2 non-hardening gasket sealer (or equivalent) to the threads of the 2" duplex slip-thru tank bushing, and tighten this fitting into the tank.
 - q. Pull the 1/2" copper tubing back up through the slip fitting until you see the mark that you put on the tubing earlier. Holding the tubing with one hand, push the ferrel sleeve connector and locking nut down the tubing, then tighten onto the 1/2" slip fitting. The oil line is now installed in the correct position off of the bottom of the tank.
 - r. Carefully bend the oil line up to the canister filter; use a spring bender over the oil line while bending the tubing to prevent kinks in the oil line. Allowing for the flare nut, cut off the excess tubing.
 - s. Install the 1/2" flare nut onto the tubing, and flare the end of the tubing.
 - t. Install the end of the tubing with the flare nut onto the 1/2" flare adapter (on the ball valve assembly at the canister filter).
 - u. Install a vent from the tank to the outside of the building according to code. The tank must be properly vented to allow air to enter the tank as oil is pumped out and to safely vent fumes to the outside. See Figures 4A/4B.
 - v. Install plugs in all other tank openings as required by code.
 - w. Inspect the installation. For proper suction oil line operation, make sure all components are installed and positioned as specified in this manual.

Installing the Pressure Relief Oil Line Back to the Tank

ATTENTION: It is critical that you adhere to the following specifications for plumbing the pressure relief back to the tank.

The metering pump requires the installation of a pressure relief oil line back to the tank that you are pulling oil from as shown in Figures 4A, 4B, and 4D.

- The **pressure relief** will open and relieve pressure if there is a restriction in the pressure oil line, clogged nozzle, etc.

Be sure to use Permatex #2 non-hardening gasket sealer to seal every threaded fitting. **DO NOT** use teflon tape or teflon pipe dope compounds.

1. Refer to Figure 4H.
2. Remove the plug from the relief port on top of the metering pump head.
3. Install the 1/8 NPT x 1/4 tube compression fitting in the relief port on top of the metering pump head.
4. Install 1/4" O.D. copper tubing (user-supplied) from the pressure relief port back to the oil tank. Refer to Figure 4D as needed.

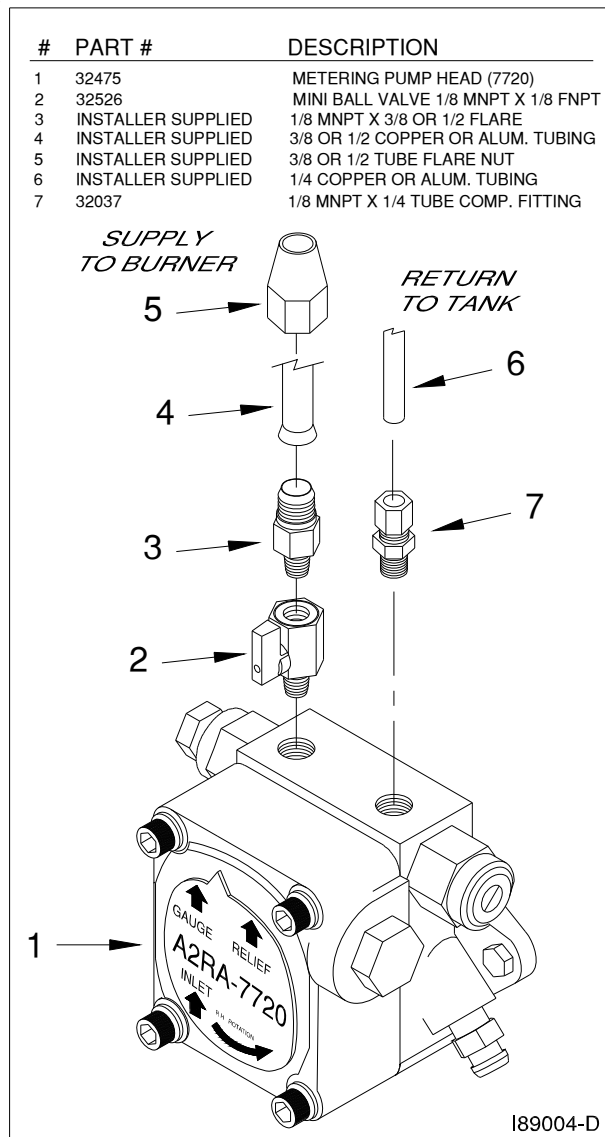


Figure 4H - Pressure Relief Oil Line Back to the Tank

Installing the Pressure Oil Line Components

ATTENTION: It is critical that you adhere to the following specifications for pressure oil line installation (oil line from the pump to the boiler); if these specifications are not met, the metering pump will not function correctly and the burner will shut down on reset.

- The parameters for pressure oil line installation are:

Length of Pressure Line

Up to 30 meters (100')

(Please note that some installations will allow for a greater pressure line length.

Contact your Authorized Clean Burn Distributor for more information.)

Line Size

9.5 mm (3/8") O.D. copper tubing

- **If possible, the pressure oil line should slant up to the burner** with no loops or high points to trap air.
 - Local codes may require the installation of an in-line "**Fire-O-Matic**" safety valve. Be sure to check all appropriate codes to ensure compliance.
1. Refer to Figures 4A/4B, and 4H.
 2. Make sure you have purchased all the necessary fittings to complete the installation correctly.
 3. Install the fittings and components as shown in the related illustrations. Be sure to use Permatex #2 non-hardening gasket sealer to seal every threaded fitting. **DO NOT** use teflon tape or teflon pipe dope compounds.

Installing the Compressed Air Line

NOTE: Your air compressor system must supply air pressure to the boiler with the following requirements: **3.5 bar (50 psi)** and **water trap or dryer**. If you do not have shop air, an optional air compressor is available. Contact your local Clean Burn dealer for more information.


1. Run a compressed air line from your shop air to the connector block on the boiler. Use minimum 1/4" O.D. copper tubing or equivalent for the compressed air line.
2. Install an easily accessible shut-off valve in the air line so the burner can be serviced without shutting off the shop air in your service area.
3. If necessary, install a pressure regulator (additional to the burner air regulator) in the air line, and set it at 3.5 bar (50 psi.)

ATTENTION: DO NOT feed full shop air pressure to the burner or damage to burner components may occur.

4. Install a water trap or extractor/dryer in the air line with an automatic drain so compressed air (rather than water) is supplied to the burner.

ATTENTION: Water must not be fed to the burner, or the flame will be extinguished and the burner will shut down. Be sure to drain water from your compressor tank on a regular basis to keep water out of the air line.

Wiring the Coil Tube Boiler


 **WARNING:** To avoid electrical shock, make sure that power to the CTB is turned OFF before connecting any wires. A licensed electrician should install all wiring to your furnace. All wiring must be in accordance with national and local codes. Properly size all wires and use electrical conduit for all electrical lines. Specific wiring schematics are provided in **Appendix B** at the back of this manual. **For safe and proper operation of the boiler, DO NOT alter factory installed wiring.**

Wiring your boiler requires the installation of the following lines/circuits:


- (1) A dedicated electrical line to the CTB (see IMPORTANT NOTE below)
- (2) A pump electrical circuit from the CTB to the oil pump (see IMPORTANT NOTE below)
- (3) A separate circuit for the load loop circulator

IMPORTANT NOTE: Separate, dedicated lines/circuits must be wired *for each boiler* in the dual-stacked unit.

Wiring to the Coil Tube Boiler

 **WARNING:** A fuse-protected disconnect must be mounted in a readily accessible location for the installation of the unit. This device can also be used for a disconnect in case of an emergency.

1. Install a *dedicated electrical circuit* to the electrical junction box on the CTB. Note that a dual-stacked boiler will require two circuits.

-  **CAUTION:** DO NOT tie into an *existing* circuit, or electrical overload may occur.
2. Wire the CTB according to the Wiring Schematic in Appendix B. **Ensure that the ground wire is attached to the GREEN ground screw on the boiler junction box.**
 3. Check for correct voltage at the CTB and refer to the following chart.
ATTENTION: Incorrect voltage may damage the CTB components.

Total Amp Draw Per Burner & Circulator: 9.4 amps				
Load Circulator Ampacity: 2.5 amps (when wired through the CTB control box)				
Model	Voltage	Breaker Qty. & Size*	Phase	Hertz
CB-200-CTB (single)	230	(1) @ 20 amps	Single	50
CB-200-CTB (Dual-Stacked)	230	(2) @ 20 amps	Single	50
CB-350-CTB (single)	230	(1) @ 20 amps	Single	50
CB-350-CTB (Dual-Stacked)	230	(2) @ 20 amps	Single	50
CB-500-CTB (single)	230	(1) @ 20 amps	Single	50

***NOTE:** Breaker size with optional equipment is 30 amps. When installing any optional equipment (e.g. air compressor), you must use a 30 amp breaker. Make sure a qualified electrician properly sizes and installs this electrical circuit. Note that minimum wire size with a 30 amp breaker is 10-gauge copper wire.

 **CAUTION:** DO NOT turn on main power until instructed to do so.

Wiring to the Metering Pump



WARNING: DO NOT wire the oil pump directly into your building's electrical system. The oil pump must be activated (receive power from) the burner via the pump electrical circuit. DO NOT wire the pump directly to a wall outlet so that it runs continuously; this will seriously damage your metering pump and/or boiler and may result in a fire or explosion hazard.

1. Install the oil pump electrical circuit from the CTB to the oil pump location using approved electrical conduit (refer to Figures 4A/4B).
2. Wire the oil pump circuit according to the wiring schematic provided (Appendix B).

Wiring the Load Loop Circulator

NOTE: To reduce the amount of cold water returned to the boiler (and to protect the boiler from thermal shock), an optional circulator aquastat can be supplied by your Clean Burn Dealer.

1. Refer to the related information and illustrations in Section 10 and the CTB Wiring Diagram in Appendix B to locate and understand the wiring for the load loop circulator.
2. The cold water return in your CTB system installation should not be below 60°C (140°F).

NOTE: For installations where cold water return is a risk, Clean Burn recommends installation of a blending loop. If a blending loop is installed in your CTB system, the load loop circulator should be wired separately from the CTB control box. Refer to Section 10 for additional information.

Installing the Stack



WARNING: Inappropriate stack materials or improper stack design/installation can adversely affect the proper, safe operation of your coil tube boiler.

Stack designs are generally classified as follows:

- (1) "Class A" stack through the ceiling of the building
- (2) "Class A" stack through the sidewall and up the side of the building

Stack Design and Specifications

ATTENTION: *The stack design must be single and dedicated for each unit (boiler) according to the following specifications.* Failure to adhere to this rule may result in less than optimal system performance.

Figure 4H illustrates the through-the-ceiling stack design for a single boiler; this stack design is preferable and is more commonly used. Refer to Figure 4I for the dual-stacked boiler stack design. When designing your stack, adhere to the following specifications:

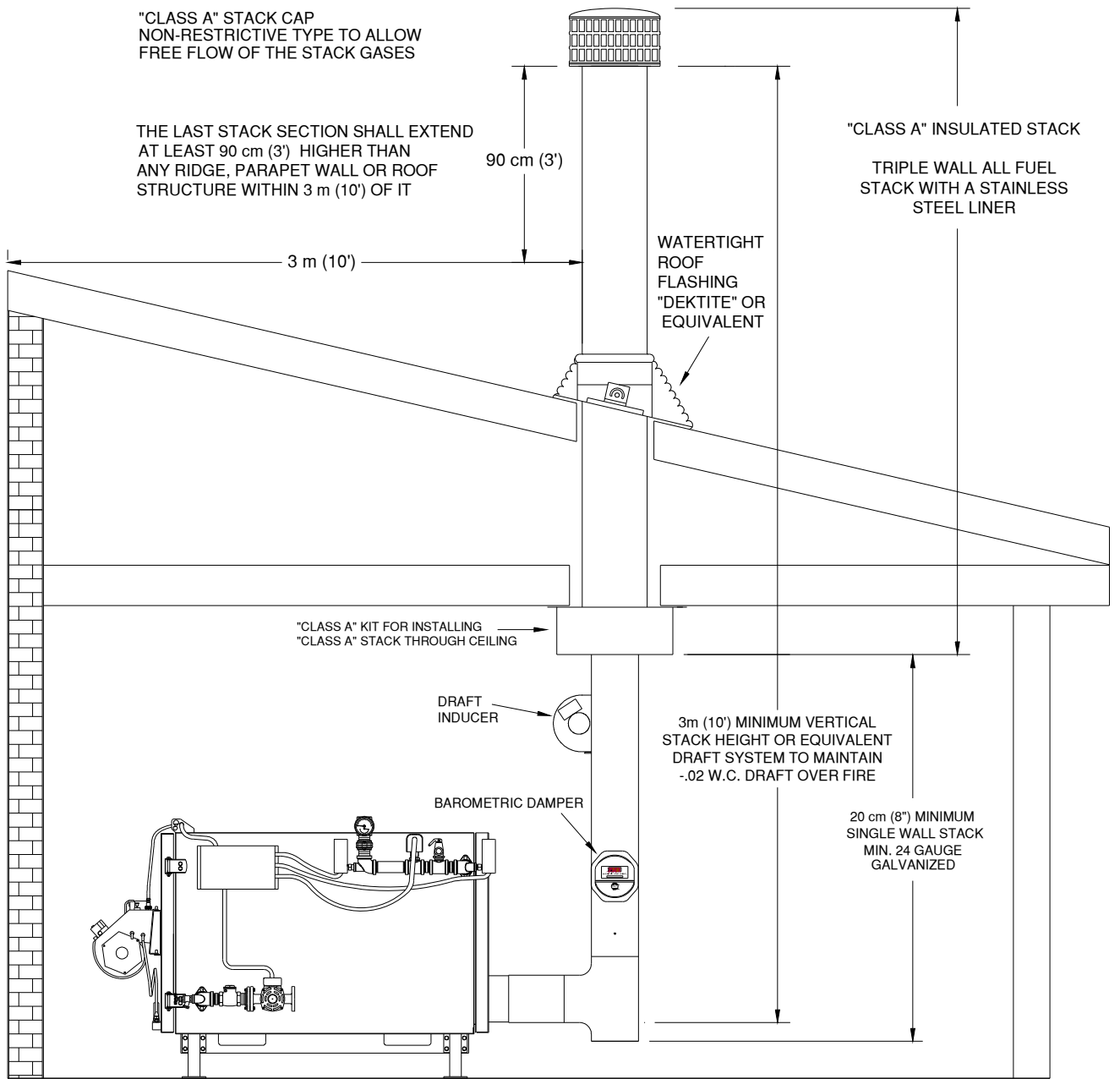
- Models CB-200-CTB and CB-350-CTB require **20 cm (8" I.D.) stack components.**
- Model CB-500-CTB requires **25 cm (10" I.D.) stack components.**
- Dual-stacked units require two (2) stack runs as single stacks.
- **Ensure that the vertical stack height is at least 3m (10') PLUS 45 cm (1.5') for every fitting.** (e.g. 45 degree, 90 degree, or T) in the stack run. If needed, increase the vertical length of the stack or install a draft inducer to obtain -.02" W.C. draft over fire. (Section 8 contains details on adjusting the draft.)
- **Keep the horizontal stack run as short as possible;** slant it upward at a minimum of 6 mm (1/4") per 30 cm (12") of run.
- **Keep the stack design simple.** Complicated stacks (with long runs and many turns) reduce draft and result in poor burner performance. **Your stack may include only one 90 degree turn.** All other stack turns must be at 45 degrees or less to ensure optimal draft and burner performance.

NOTE: If you plan to use an existing masonry chimney, the chimney must be lined and be located inside the building. Exterior masonry chimneys chill the stack gases and result in poor draft and poor burner performance.

ATTENTION: **If you have an exhaust fan(s) in your shop, it is critical that you have adequate make up air (source of fresh air to replace the stale air exhausted by the fan).** When an exhaust fan is run without adequate make up air, the resulting vacuum in the building will draw combustion products back into the burner. This back draft causes poor burner performance and may damage vital burner components. Refer to Section 8 in this manual for additional information concerning exhaust fans and proper make up air.

Stack components should be installed in the following order:

- (1) Inside stack (the stack components from the coil tube boiler breach to within 457 mm / 18" of the ceiling, roof, or sidewall of your building)
- (2) Barometric damper(s)
- (3) "Class A" stack penetration through the ceiling, roof, or sidewall
- (4) "Class A" stack on the exterior of the building
- (5) "Class A" stack cap



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Figure 4H - Installation of "Class A" Stack Through Roof/Ceiling (Single Boiler)

Installing the Stack (continued)

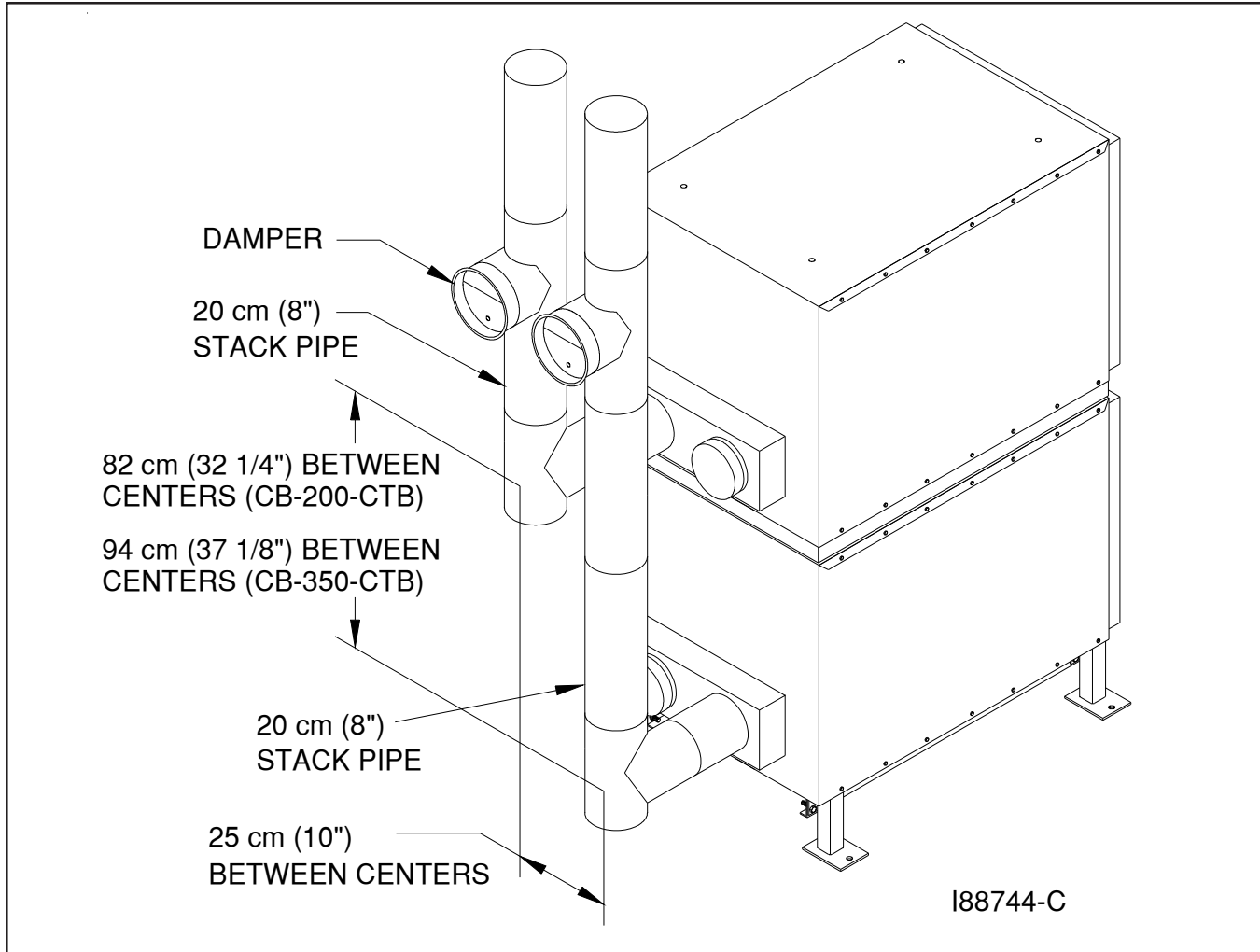


Figure 4I - Detail of Dual-Stacked Boiler Stack Installation

Installing the Interior Stack



CAUTION: Single wall stack components may be used *only* for those portions of the stack which are located inside your building and away from any fire/burn hazards.

1. The stack can be installed from either side of the smoke hood breach. Install the 20 cm (8") smoke cap onto the unused smoke hood breach ring assembly.
2. Install a piece of the single-wall 24-gauge galvanized stack (minimum 45 cm (18") in length) onto the smoke hood breach.
3. Install an elbow or clean-out tee (with a smoke cap installed in the bottom) onto the extension piece from the boiler smoke hood breach.
4. Install a smoke pipe tee onto this elbow or clean-out tee (for the installation of the barometric damper).

ATTENTION: Avoid additional 90-degree turns in the stack. Each additional 90-degree turn slows down stack gases, creates back-pressure, and results in repeated burner shutdown and unnecessary service calls. All other turns in the stack should be at a 45-degree (or smaller) angle.

Installing the Barometric Damper(s)

1. Refer to Figure 4J. Install a single wall tee (min. 24 gauge) on the first straight vertical or horizontal stack section within 1 meter (40 inches) of the CTB breach.
NOTE: This tee is required to support the barometric damper. You must purchase this tee when you purchase your stack materials (8" single wall tee - CB#70174).
ATTENTION: For Dual-Stacked CTB Units Only - You are required by code to install two dampers (provided) - one for each boiler. DO NOT attempt to substitute other types of dampers--they will not allow the unit to function properly and may void your warranty.
2. Install the barometric damper in the opening of the tee. Use a small spirit level to make sure that it is properly level.
3. Install two self-tapping screws as shown in Figure 4J (i.e. one on each side of the barometric damper) to hold the damper in place. DO NOT install a screw at the bottom of the barometric damper, or the flapper of the damper will not operate correctly.

NOTE: Specifications for adjusting the barometric damper for proper draft overfire are provided in **Section 8** of this manual.

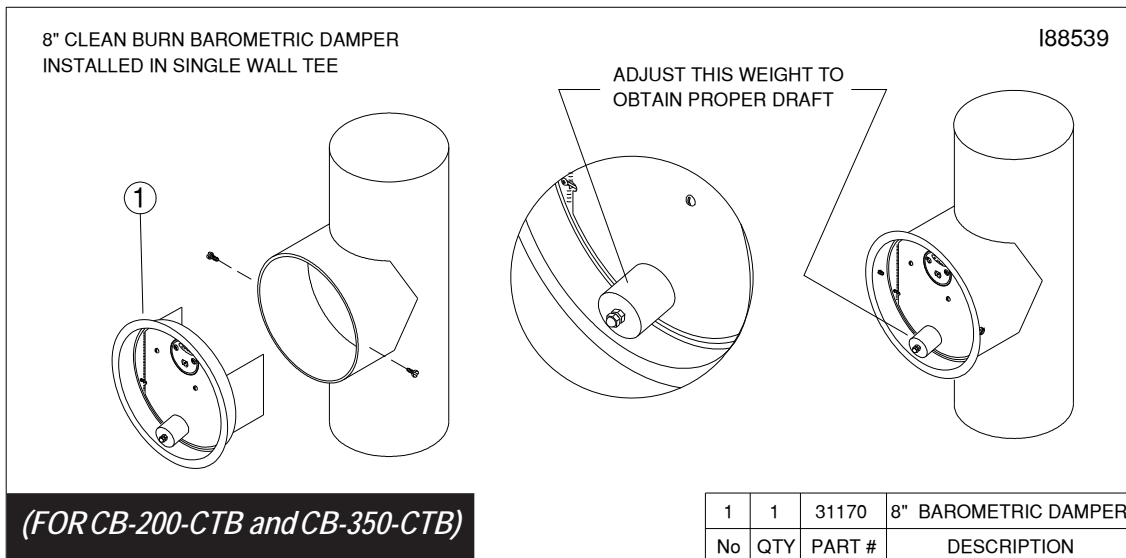
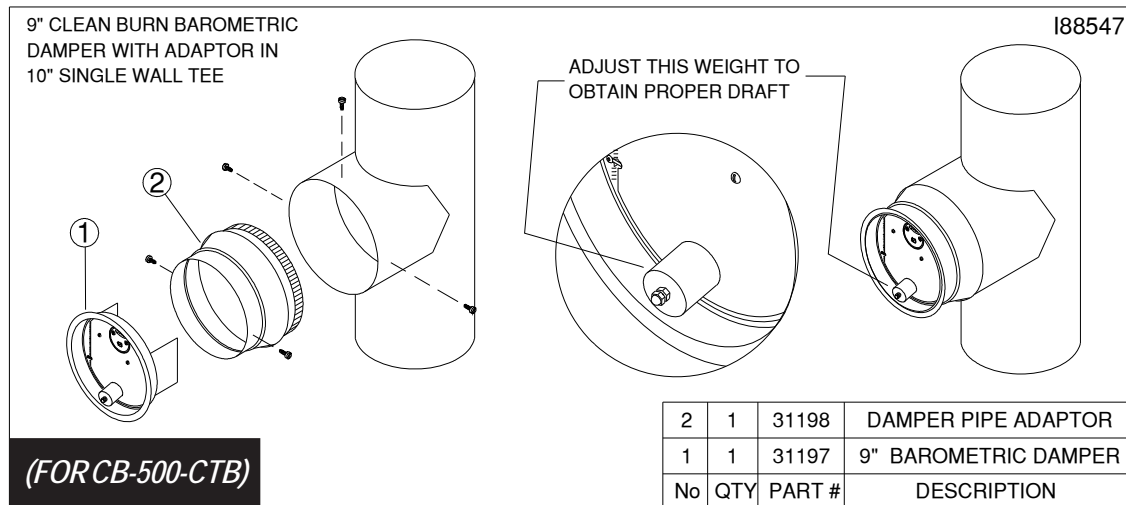


Figure 4J - Installation of Barometric Damper

Installing the Optional Stack Safety Switch



CAUTION: For your safety and the safe operation of your heating equipment, the stack switch must be installed by a qualified installer in accordance with the installation instructions provided here. Wiring must be accomplished in accordance with all applicable codes. Failure to adhere to these safety recommendations may result in serious personal injury and/or equipment damage.

1. Follow the instructions in the *Operator's Manual, Section 4* to install a proper stack, including the barometric damper which must be installed within 1 meter (40 inches) of the breach.

NOTE: The barometric damper must be installed so that it is level and the flapper moves freely.

2. Ensure that main power to the heating equipment is turned OFF.
3. Position the stack safety switch over the lip of the barometric damper as shown in Figure 4K.
4. Drill a pilot hole for the mounting screw, and mount the stack safety switch using the mounting screw supplied with the switch.

NOTE: The mounting screw must not interfere with the free movement of the flapper on the barometric damper.

5. Install the wall thermostat according to the instructions provided in the *Operator's Manual, Section 4*. Wire the wall thermostat and stack safety switch in series as shown in Figure 4L. Install the wire so that it is secured away from any hot surfaces.

NOTE: If a 24V thermostat is not used to activate the boiler, the stack safety switch is connected directly to the landings on top of the control box. Refer to Appendix B for the control box wiring diagram.

6. When the heating equipment installation is completed, follow the instructions in the *Operator's Manual, Sections 5 and 6* to prime the pump and start/adjust the burner.
7. Follow instructions in the *Operator's Manual, Section 8* to check the draft; this is crucial for the proper, safe operation of the heating equipment.

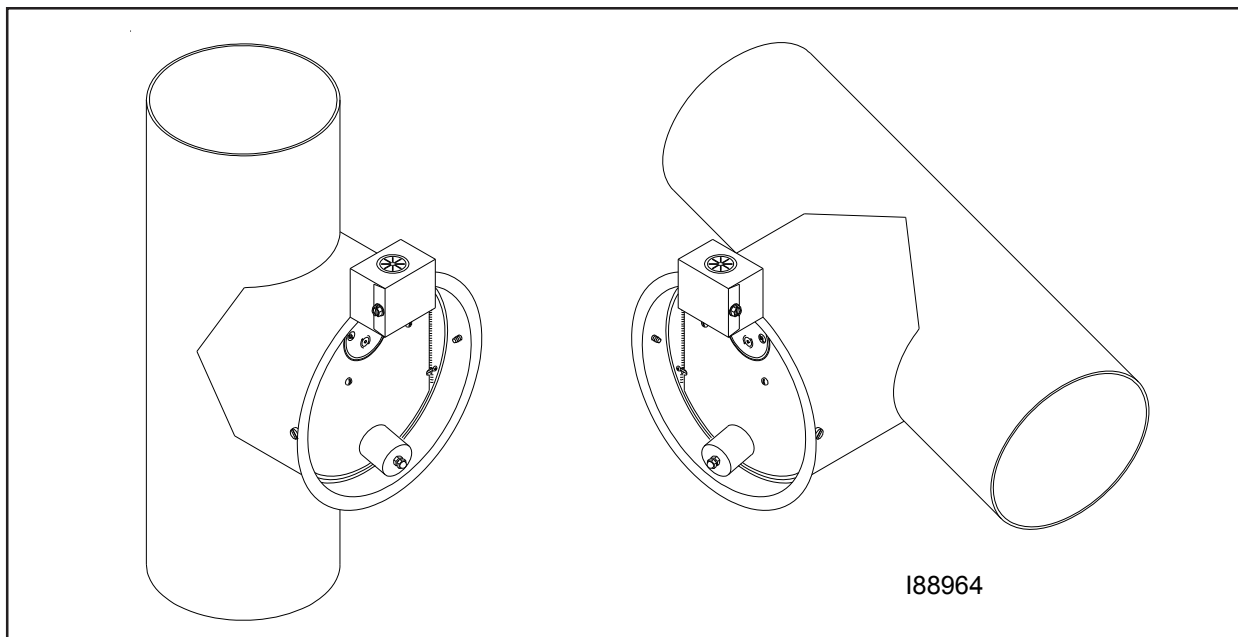


Figure 4K - Stack Safety Switch Installed on the Barometric Damper

Resetting the Stack Safety Switch



WARNING: BURN HAZARD! To prevent serious personal injury, be sure to allow ample time, at least 30 minutes, for the stack, barometric damper, and switch to cool down before attempting to access and service these components. It is crucial to identify the cause of the stack obstruction (e.g. heavy snowfall) and correct it *before* resetting the stack safety switch and re-starting the burner. **DO NOT operate the heating equipment with an obstructed stack;** failure to correct an obstructed stack may result in fire, explosion, and/or burn hazards causing serious personal injury or death.

NOTE: In locations where heavy snowfall occurs, it is critical that the stack remain unobstructed by snow. For safe heating equipment operation, be sure to keep the area surrounding the stack clear of snow.

1. Before resetting the stack safety switch, check the stack to make sure it is clear of any obstructions.
2. Remove the cover from the stack safety switch, and push the small button in the middle of the switch.
3. Pushing the stack safety switch reset button will re-establish the thermostat circuit, and the burner will start (assuming the wall thermostat is calling for heat).

Understanding the Function of the Stack Safety Switch

The **Stack Safety Switch** monitors the temperature at the barometric damper on the stack and is designed to detect the obstruction of the free flow of stack gases from the heating equipment and shut down the burner. Obstruction of the stack results in the “spillage” of stack gases from the barometric damper, which heats up the switch. The switch then opens, disconnecting the thermostat circuit to the burner, and the burner shuts off.

Stack Safety Switch Specifications

Switching Voltage	24 volts
Switch OPEN Temperature	180 °F
Switch Type	L180, normally closed, manual reset

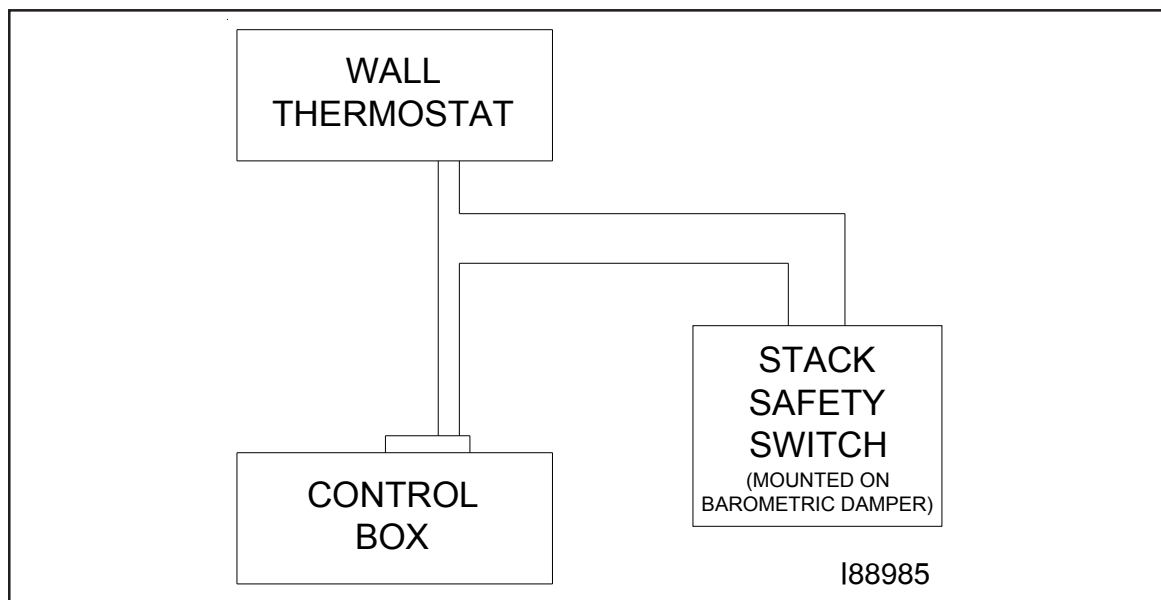


Figure 4L - Stack Safety Switch Wiring Diagram

Installing the Stack Penetration



WARNING: When running the stack through your ceiling, roof, or sidewall, you must use **"Class A" double-wall insulated all-fuel stack components** with a stainless steel liner. **DO NOT** run single-wall stack through your ceiling, roof or sidewall. **NEVER** locate a stack joint inside walls or in a joist spacer. Ensure proper clearances from combustibles per all applicable codes.

1. Refer to Figure 4H as needed.
2. Follow the installation instructions provided by the stack manufacturer.

Installing the Exterior Stack

ATTENTION: All exterior stack pieces must be **"Class A" double-wall insulated all-fuel stack components** with a stainless steel liner.

- **DO NOT** use Class B Vent/double-wall stack components (i.e. for gas fired appliances only).
- **DO NOT** use Type L Vent/double-wall stack components (for approved fuel oil appliances only).
- **DO NOT** use single-wall stack for your exterior stack. Single-wall exterior stack chills the stack gases and results in poor draft and poor burner performance.

1. Refer to Figure 4H as needed.
2. Follow the installation instructions provided by the stack manufacturer.
3. Install water-tight roof flashing around the penetration of the exterior stack.

NOTE: Clean Burn recommends the use of "Dektite" roof flashing (or equivalent) which ensures a water-tight seal when installed properly. Contact your local Clean Burn dealer for details.

Installing the Stack Cap

NOTE: Proper installation of a "Class A" stack cap ensures the free flow of stack gases which is essential for optimal burner performance.

1. Refer to Figure 4H as needed. Your stack cap should be classified as: "Class A" non-restrictive, all-fuel type.
2. Install the stack cap according to the manufacturer's instructions.

Installing the Draft Inducer

ATTENTION: The Field brand draft inducers have been tested for use on Clean Burn Equipment. **DO NOT** use other models or brands of draft inducers.

Understanding the Importance of the Draft Inducer

The draft inducer is designed to aid in the removal of the natural draft created by the appliance to vent the combustion gases to the outside of the building. As the paddle wheel turns, a negative pressure is maintained within the stack so that the combustion gases can leave the boiler and travel out of the stack. (See Figure 4M.) *Proper sizing, installation, and adjustment of the draft inducer are critical for optimal draft inducer operation.*

Installing the Draft Inducer (continued)

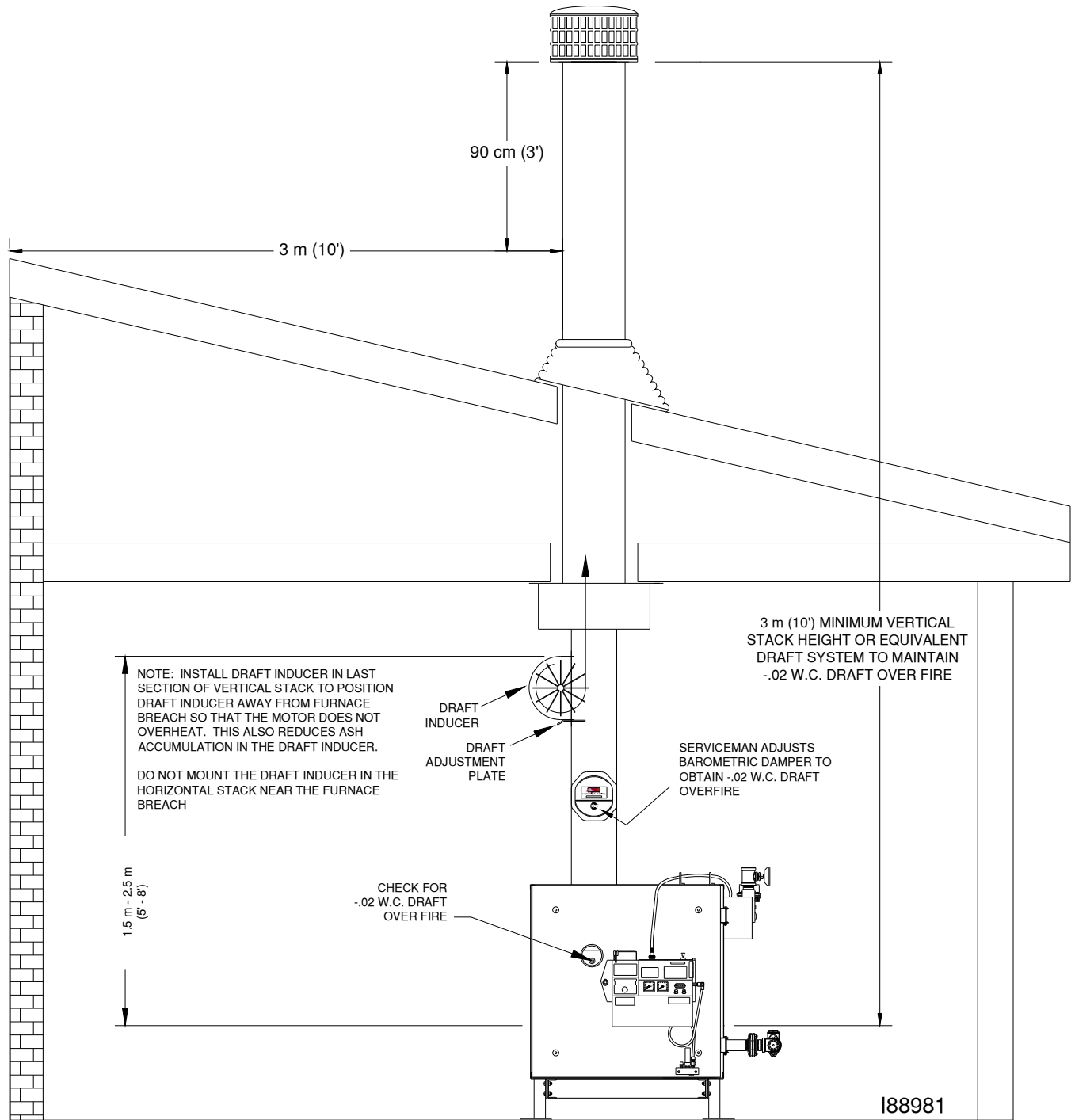


Figure 4M - Installation of the Draft Inducer



WARNING: Turn OFF the main power to the boiler before proceeding with the installation of the draft inducer.

ATTENTION: It is very important to install the draft inducer on a vertical section of stack to isolate the inducer from excessive heat and ash buildup. Never install the draft inducer on a horizontal section of stack close to the breach where heat and ash will damage the inducer motor.

Installing the Draft Inducer (continued)

1. Refer to Figure 4M. Follow the instructions included with the draft inducer to mount the draft inducer on the section of single-wall vertical stack.
2. Position the draft plate all the way out so that it does not reduce the draft produced by the draft inducer. You will adjust the draft plate later as part of **Adjusting the Draft Overfire (Section 8)**.

Wiring the Draft Inducer for Normal Operation*

*(No exhaust fans in the building)

1. Wire the draft inducer according to the **Wiring Diagram** in the **Burner Control Box** and also provided in **Appendix B** at the back of this manual.

Installing the Wall Thermostat or Aquastat

IMPORTANT NOTE: A 24V wall thermostat is available separately from Clean Burn (i.e. it is not included with the CTB). If a 24V thermostat is used to activate the boiler, a qualified technician would need to remove the jumper from the external four landings on top of the black control box on the side of the boiler and use it to connect landings 5 and L1 on the internal terminal block. The 24V thermostat is then connected into the optional stack safety switch landing. Refer to Appendix B for the control box wiring diagram.

Refer to Appendix A in this manual for additional information on remote temperature sensing controls available from Clean Burn for your CTB system installation.

1. Select a location for the thermostat on an interior wall away from any hot or cold drafts.
2. Remove the top cover from the thermostat by pushing gently on the latch at the top center of the body. (*Hold the thermostat base in one hand, and grasp the body with the other hand; push in on the latch with your thumb, and pull the cover away from the base.*)
ATTENTION: DO NOT use a screwdriver to pry the cover off the base, or damage may occur.
3. Remove the green paper insert and the black plastic battery isolator from the battery section of the thermostat.
4. Refer to the **Burner Wiring Diagram** in **Appendix B** at the back of this manual. Run two wire, 18-gauge (minimum) thermostat cable from the terminals on the back of the thermostat base to the T/T terminals of the control box on the side of the boiler. **DO NOT** run the wiring to the primary control!
5. Mount the thermostat base 1.5 meters (60" to 66") from the floor using the hardware provided.
6. Reassemble the thermostat body onto the base. (*Align the hinges at the bottom of the cover with the slots at the bottom of the base, and swing the cover up into place.*)

Replacing the Wall Thermostat Batteries

1. Proper battery level is indicated by the room temperature being displayed on the LCD screen.
2. When the battery level becomes low, a battery icon along with the word "REPLACE" will be displayed in the lower left corner of the LCD screen. Replace the batteries to ensure proper operation, following the previous instructions on the thermostat disassembly procedure.
3. If the batteries are not replaced, the display will slowly become dim and not display any information. The thermostat will eventually not function. If this happens, replace the batteries immediately.

Inspecting the Coil Tube Boiler Installation

Following the completion of all installation activities described in this chapter, the CTB should be inspected by qualified personnel before firing. This ensures that your installation meets all applicable national and local codes and allows for any deficiencies in the installation to be corrected before CTB startup. *Improper installation will void your warranty.*

NOTE: Important! During the inspection, be sure to **check the aquastat settings**. Initial settings are listed here:

- Operating Aquastat 82 °C (180 °F) minimum
- Hi-limit Aquastat (with manual reset) 115 °C (240 °F)

Refer to Section 6 for burner startup and final adjustments of the aquastat.

Any changes to these settings should be made only by a qualified hydronics technician. See Section 10, The CTB Hydronics System, for more information.

SECTION 5: METERING PUMP PRIMING

Understanding Metering Pump Priming

Preparing your Clean Burn boiler for operation begins with priming the metering pump. The procedures in this section must be performed in sequence *without interruption* to properly prime the pump.

IMPORTANT NOTE FOR DUAL-STACKED UNITS: The priming procedures will have to be performed for one burner, and then repeated for the other burner (i.e. get one burner running first before attempting priming of the other burner.)

Required Tools and Materials

The following tools and materials are required for oil pump priming and should be gathered before starting any procedures:

- 3/8" open-end wrench
- 5/8" open-end wrench
- Rags
- Two containers (minimum 4 liters / one-gallon each)
- Permatex #2 non-hardening gasket sealer
- Adjustable Wrench
- Pipe Wrench

Priming the Metering Pump

ATTENTION: *The priming process must be done precisely as described in this procedure to ensure that all air is thoroughly bled from the system.* Failure to bleed all air from the system will result in repeated burner shutdowns on reset.

1. Refer to Figure 5A.
2. Remove the 1/4" NPT plug from the side of the pump head, and set it aside.
3. Remove the 1/2" brass cap from the 1/2" brass nipple. Place a funnel in the opening. Slowly pour used oil into the funnel ***until oil comes out of the side of the pump head***; this will fill the oil line, canister filter, and pump head with oil.
ATTENTION: NEVER run the pump head dry (i.e. without oil in the pump head). Doing so will severely damage the pump.
4. Apply Permatex #2 non-hardening gasket sealer to the threads of the plug (removed from the pump head). Re-install the plug and tighten.
5. Apply Permatex #2 non-hardening gasket sealer to the threads of the 1/2" brass nipple. Re-install the 1/2" brass cap on the brass nipple and tighten.
6. Open the bleeder on the pump two to three (2-3) full turns, and position a container to catch oil which will flow from the bleeder during pump priming.
7. Close the mini ball valve at the outlet port of the pump head.
ATTENTION: Verify that the relief oil line is installed back to the tank before closing the mini ball valve. Closing the mini ball valve will cause the internal pump relief valve to open.

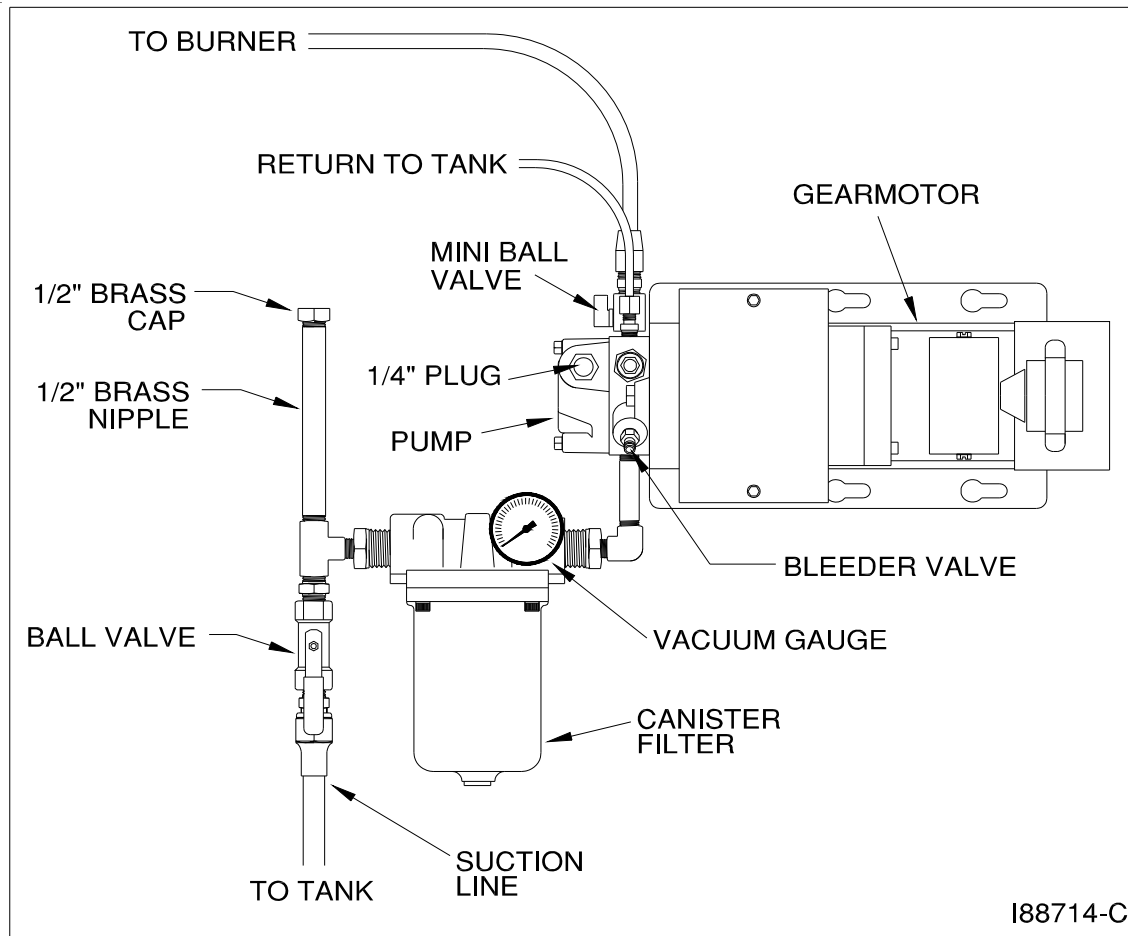


Figure 5A - Priming the Metering Pump

Priming the Metering Pump (continued)

8. Activating the Pump

NOTE: The coil tube boiler features a priming switch which is mounted on the left-hand side of the electrical junction box on the front of the boiler cabinet. The priming switch has two positions:

- **PRIME (switch is in the UP position / orange indicator light is ON):** this is used only for pump priming. When the switch is in the UP position, the pump circuit is activated for priming. The pump will continue to run as long as the switch is in this position. The oil primary control circuit is de-activated so the burner cannot run while the switch is in the UP position.
 - **BURNER (switch is in the DOWN position):** this is used for normal burner operation. When the switch is in the DOWN position, the burner controls the operation of the pump. The pump will only run while the burner is running.
- a. Refer to Figure 5B to locate the priming switch.
 - b. Turn the priming switch to the UP position. The pump should immediately start running.

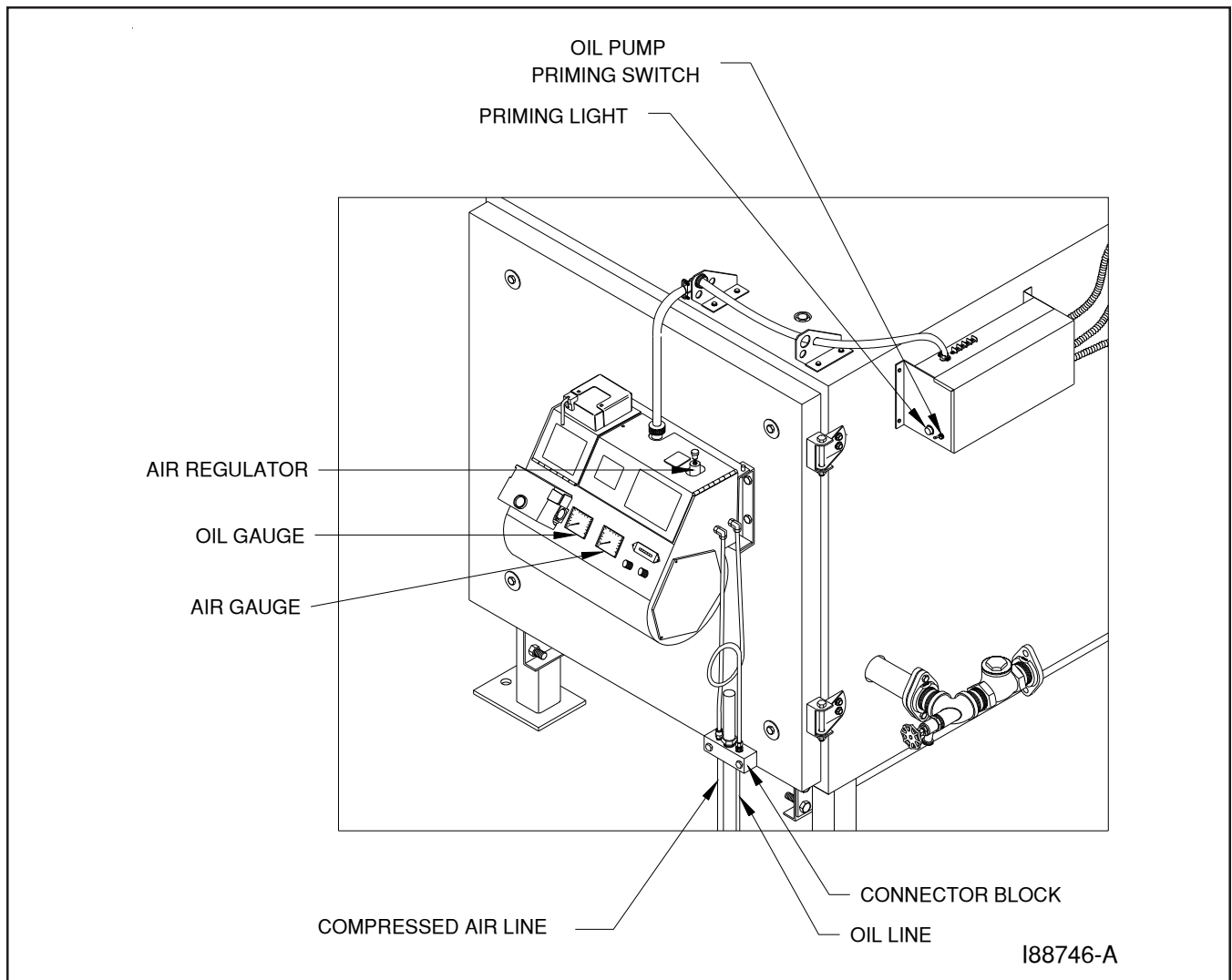


Figure 5B - Detail of Burner Connections/Components

Priming the Metering Pump (continued)

9. Run the pump until a solid stream of oil flows from the pump bleeder. This will bleed all air out of the suction line, oil filter and pump head.
ATTENTION: For the metering pump to operate correctly, it is very important that the system is entirely full of oil and all air is bled out. The burner will shut down if there is any air in the system.
 10. Open the mini ball valve at the outlet port of the pump head to allow the pressure oil line to be filled.
 11. Close and tighten the bleeder on the pump.
 12. Turn the priming switch to the DOWN position so that the pump stops running.
 13. Disconnect the pressure oil line from the burner and position a container to catch oil which will flow from the pressure oil line during pump priming.
 14. Turn the priming switch to the UP position. The pump should start running immediately.
 15. Run the oil pump until the proper flow of oil has been established, and the oil line has been completely flushed out.
 16. Turn the priming switch to the DOWN position so that the pump stops running.
 17. Re-connect the oil line to the connector block.
-

Vacuum Testing the Oil Pump

Vacuum testing the oil pump is a very accurate way to determine the following:

- The condition of the pump -- the ability of the pump to pull a vacuum and suck oil from the tank.
- The condition of the fittings, gaskets and seals from the ball valve to the pump -- these components must all be airtight to avoid suction leaks.

The following procedure provides instructions for vacuum testing the pump and canister filter on systems equipped with a ball valve.

ATTENTION: For the pump to pull and hold vacuum, it is critical that all fittings are airtight. If any of these fittings are loose, the pump may not pull a vacuum or may lose the vacuum rapidly. It is also critical that all fittings in the suction line, including fittings on the canister filter, are 100% airtight.

1. Follow the instructions to prime the pump (previous procedure).
NOTE: The pump will not pull a vacuum if the pump is dry. There must be oil in the gears of the pump before the pump can pull a vacuum.
2. With the pump running, open the bleeder two to three full turns, and make sure that oil is flowing from the bleeder. DO NOT close the bleeder yet.
3. Refer to Figure 5A. Close the ball valve at the inlet to the canister filter. Observe the vacuum gauge.
NOTE: The ball valve must have a stainless steel ball and should be pressure tested by the manufacturer to ensure that it does not leak. If the ball valve leaks, the vacuum test will not be accurate.
4. The vacuum should increase within 30 seconds to 15 inches of vacuum. When the vacuum gauge reads 15 inches of vacuum, first close and tighten the bleeder, then turn the pump off, and close the mini ball valve at the outlet port of the pump. Observe the vacuum gauge.
NOTE: If the pump will not pull at least 15 inches of vacuum, there is a very serious suction leak, or the pump is damaged.

Vacuum Testing the Oil Pump (continued)

5. If there are no suction leaks, the system will hold vacuum.

NOTE: It is acceptable for the vacuum to drop one to five inches within one minute as the seal in the pump seats. The vacuum should then hold steady for 15 minutes.

ATTENTION: If the vacuum drops *more than one to five inches within the first minute*, there is one or more leaks somewhere between the pump and the ball valve. Do the following:

- Wipe your finger along the cylinder at the shaft of the pump. If there is oil here, the pump seal is damaged. Replace the pump.
 - Disassemble and clean all the fittings from the pump to the ball valve. Properly seal all fittings with Permatex #2 non-hardening gasket sealer or equivalent. Check the condition of the o-ring on the canister filter and tighten the four canister filter bolts in a crisscross pattern.
 - Repeat the procedure to vacuum test the system to ensure that the system is air tight.
6. Follow the instructions to prime the metering pump after a vacuum test has been performed.

SECTION 6: STARTING AND ADJUSTING THE BURNER

Understanding Burner Startup and Adjustment

ATTENTION: Before starting the burner, you must fill the coil tube boiler with water. Refer to Section 10 in this manual for more information on the hydronics system. *DO NOT bypass the CTB controls to operate the burner!*

FORDUAL-STACKED UNITS ONLY: Clean Burn recommends that you complete burner startup and adjustment for one burner before starting the second burner.

Starting and adjusting the burner involves a series of separate procedures which must be accomplished in sequence without interruption. Review all the procedures before attempting burner startup and adjustment, paying careful attention to safety information statements.

Preparing the Hydronics System for Burner Startup

The following procedure should be performed prior to burner startup to ensure that all key components of the hydronics system are functioning properly. Ensure that air is purged from the system. If the CTB circulator becomes air-bound, it will not produce sufficient flow to activate the flow switch, and the burner will not start properly.

1. Turn the load temperature controller (i.e. thermostat or aquastat) OFF.
2. Set the operating aquastat (on the CTB) at 82 °C (180 °F).

Preparing the Burner for Startup

1. If you have not already done so, disconnect one side of the jumper wire from the terminal block on top of the control box on the side of the boiler (this prevents the burner from running.) A wiring diagram is provided in Appendix B.
2. Turn the main power to the CTB ON (the green power light on the burner should be ON).
3. Wait at least 15 minutes until the preheater block is thoroughly warmed up. Feel the back of the burner box to make sure the preheater is sufficiently warm. The proving switch on the preheater block will not allow the burner to start until the block is at least 48 °C (120 °F).

NOTE: The preheater block will remain warm as long as power is supplied to the burner. If the main power supply is ever turned OFF, you must wait at least 15 minutes until the preheater block is thoroughly warm before starting the burner.

(Continued)

Preparing the Burner for Startup (continued)

4. Refer to Figure 6A. Loosen the locking nut on the air regulator.
5. Turn the adjustment knob on the air regulator counterclockwise until 13 mm (1/2") of the threads on the knob are exposed. **DO NOT** back the knob all the way out.
NOTE: The air gauge will not show any pressure until the burner starts. Before starting the burner for the first time, it is very important to turn the air regulator completely OFF as described.
6. **Initial Adjustment of the Combustion Air Band**
Rotate the combustion air band to adjust it to the appropriate slot opening as listed in the following **Initial Adjustment Charts**. Use a ruler to accurately set the slot opening at the widest section of the slot.

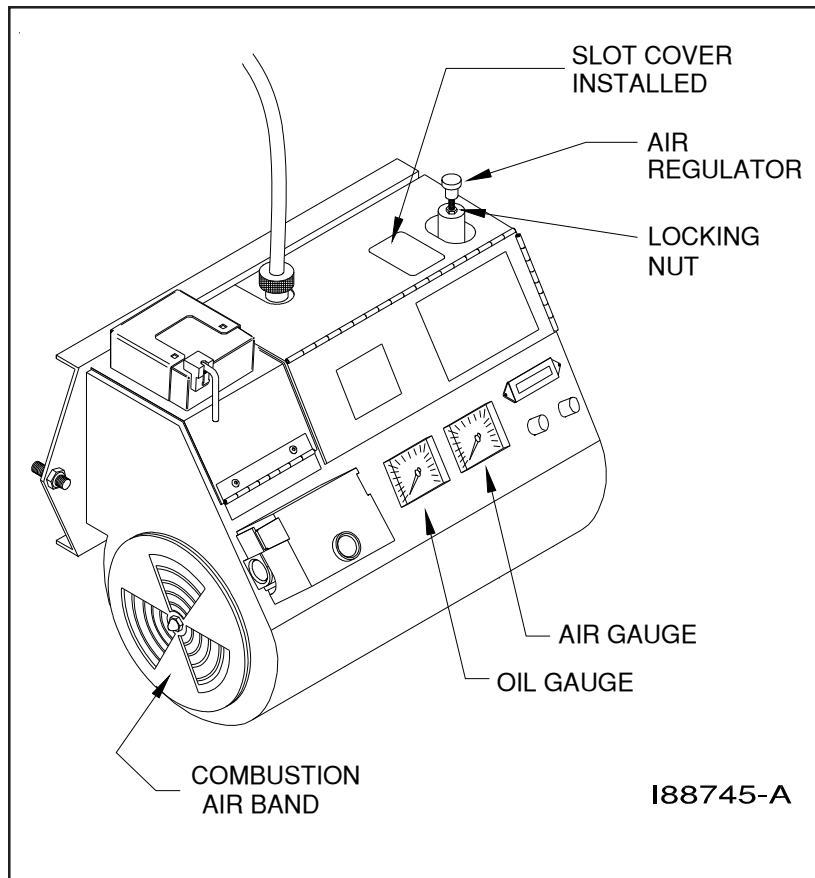


Figure 6A - Component Detail of the CB-500 Series Burner



WARNING: The combustion air band must be properly adjusted to ensure that the burner ignites and burns correctly. **DO NOT** attempt to start the burner with the combustion air band wide open or completely closed. The burner may not ignite correctly. Failure to heed this warning may result in a fire or explosion hazard.

IMPORTANT NOTE: This initial setting of the combustion air band will allow you to start the burner. You will fine tune the combustion air band further as described later in these instructions.

ATTENTION: The settings shown in the charts below are only *initial* adjustments. ***Final adjustments must be done by inspecting the flame length according to the illustrations provided on the following page.***

NOTE: *The oil pressure is automatically adjusted by the metering pump.*

Initial Adjustments for CB-200-CTB

NOTE: Only Gearmotor part #33530 may be used with the CB-200-CTB.

Maximum Input = 59 KW (200,000 BTUH) @ 5.3 LPH (1.4 GPH) per CB-500-CE 5W Burner

Oil Type	Oil Pressure/Flame Length	Air Bar (PSI)	Air Band	Nozzle
#2 Fuel Oil*	<i>check flame length</i>	0.8-1.1 (12-16)	10 mm (3/8")	9-5
Used Crankcase Oil	<i>check flame length</i>	0.8-1.1 (12-16)	10 mm (3/8")	9-5
Used ATF	<i>check flame length</i>	0.8-1.1 (12-16)	10 mm (3/8")	9-5
Used Hydraulic Oil	<i>check flame length</i>	0.8-1.1 (12-16)	10 mm (3/8")	9-5
#4 and #5 Fuel Oils	<i>check flame length</i>	0.8-1.1 (12-16)	10 mm (3/8")	9-5

Preparing the Burner for Startup (continued)

Initial Adjustments for CB-350-CTB

NOTE: Only Gearmotor part # 33436 may be used with the CB-350-CTB.

Maximum Input = 103 KW (350,000 BTUH) @ 9.5 LPH (2.5 GPH) per CB-551-CE 5W Burner

Oil Type	Oil Pressure/Flame Length	Air Bar (PSI)	Air Band	Nozzle
#2 Fuel Oil*	<i>check flame length</i>	0.8-1.1 (12-16)	12 mm (1/2")	9-5
Used Crankcase Oil	<i>check flame length</i>	0.8-1.1 (12-16)	12 mm (1/2")	9-5
Used ATF	<i>check flame length</i>	0.8-1.1 (12-16)	12 mm (1/2")	9-5
Used Hydraulic Oil	<i>check flame length</i>	0.8-1.1 (12-16)	12 mm (1/2")	9-5
#4 and #5 Fuel Oils	<i>check flame length</i>	0.8-1.1 (12-16)	12 mm (1/2")	9-5

Initial Adjustments for CB-500-CTB

NOTE: Only Gearmotor part # 33571 may be used with the CB-500-CTB.

Maximum Input = 146 KW (500,000 BTUH) @ 13 LPH (3.4 GPH) per CB-551-H5-CE 5W Burner

Oil Type	Oil Pressure/Flame Length	Air Bar (PSI)	Air Band	Nozzle
#2 Fuel Oil*	<i>check flame length</i>	1 - 1.2 (14-18)	16 mm (5/8")	9-28
Used Crankcase Oil	<i>check flame length</i>	1 - 1.2 (14-18)	16 mm (5/8")	9-28
Used ATF	<i>check flame length</i>	1 - 1.2 (14-18)	16 mm (5/8")	9-28
Used Hydraulic Oil	<i>check flame length</i>	1 - 1.2 (14-18)	16 mm (5/8")	9-28
#4 and #5 Fuel Oils	<i>check flame length</i>	1 - 1.2 (14-18)	16 mm (5/8")	9-28

* If you are burning light viscosity oils such as #2 fuel oil, it may be necessary to install a smaller nozzle. Call your Clean Burn dealer for more information.

Starting the Burner

- Re-connect the control wire. Turn the aquastat to call for heat (to start the burner).
If the burner refuses to start, review the *Preparing the Burner for Startup* procedure. If, after repeating this procedure, the burner still refuses to start, check the following system components for proper functioning:
 - Verify that the red wire (per the burner wiring diagram) is energized to 230VAC.
 - Reset the hi-limit switch.
 - If the flow switch is not closing, the circulator is air-locked. Air must be purged from the system.
 - Verify that the prime switch (on the control box) is set to RUN (DOWN position).
- Adjusting the Air Regulator:**
 As soon as the burner starts running, turn the knob on the air regulator clockwise to achieve proper operating air pressure. Refer to the **Initial Adjustment Charts**.
NOTE: If the safety reset on the primary control is activated and the burner stops running, see Section 7 for further instructions on restarting you burner.
- Observing the Flame Length:**
 Visually inspect the flame length through the observation port. Refer to Figure 6B for an illustration of the desired flame length. The flame should extend no more than one-half of the way down the combustion chamber.



WARNING: The observation port gets hot as the burner fires. To avoid personal injury, always wear heavy work gloves and safety glasses when opening the port and viewing the flame.

CAUTION

WHEN OPENING INSPECTION PORT

PORT MAY BE HOT

PROTECT HANDS

WEAR SAFETY GOGGLES

KEEP FACE AWAY

OPEN PORT SLOWLY

Starting the Burner (continued)

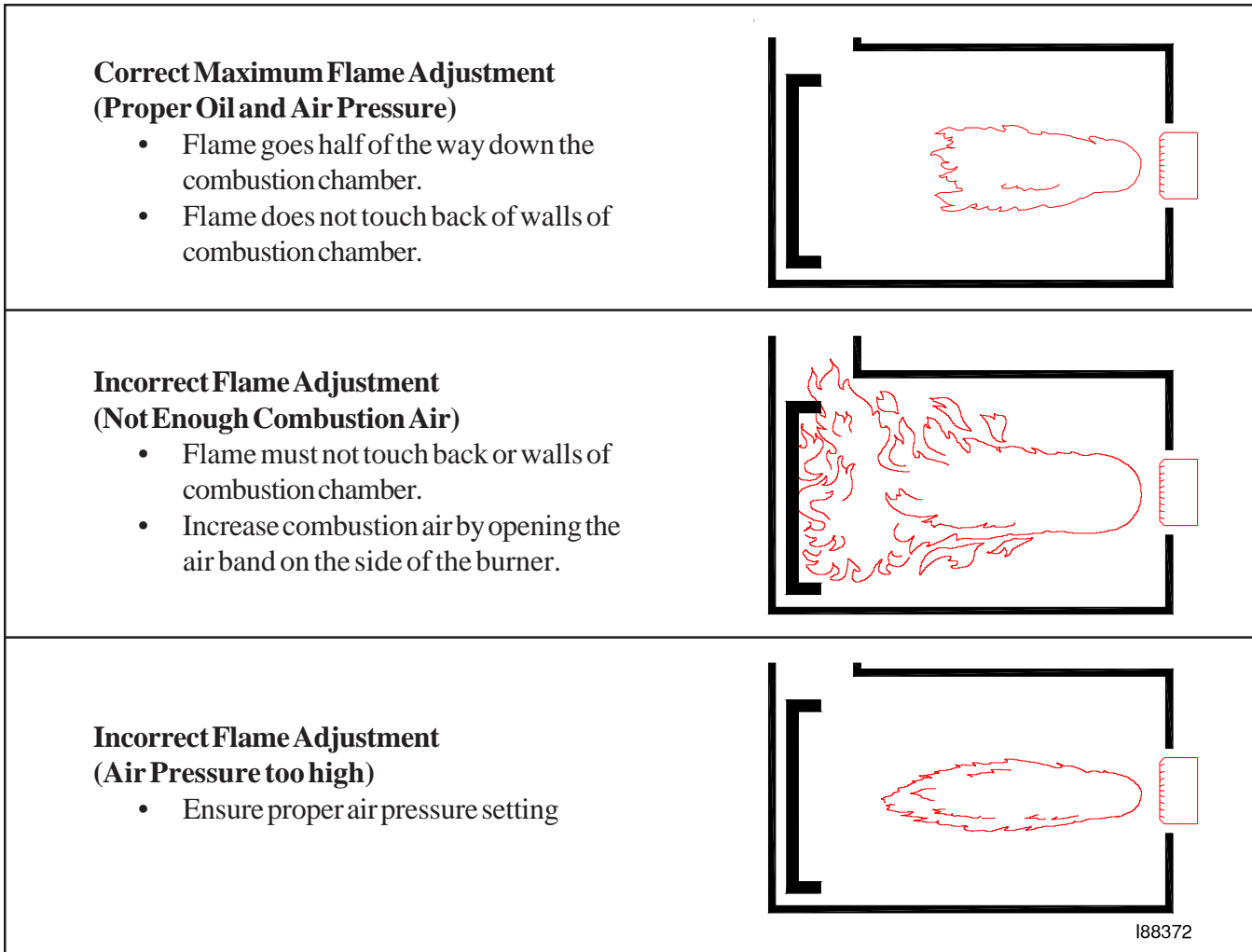


Figure 6B - Flame Length Adjustment

4. Check the flame length after the burner has fired for 15 minutes.
5. Tighten the locking nuts on the air regulator.

Starting the Burner (continued)

6. **Checking for Proper CTB System Operation:**

Observe the boiler temperature and water pressure.

7. After the burner stops running when the operating aquastat set temperature is reached, check the following:
- air has been purged from water lines
 - water pressure is satisfactory (i.e. not greater than 1.5 bar (22 psi); normal pressure is 0.8 bar (12 psi)
 - all system controls functioning properly
8. Reset the operating aquastat to the normal operating range; 82 - 93 °C (180 - 200 °F) and repeat steps 6 and 7, observing the CTB operation.
9. Reset the load temperature controller (i.e. thermostat or aquastat) to the normal operating temperature.
10. As the CTB temperature drops, the burner will start running. Continue observing the CTB operation through several burner ON/OFF cycles to ensure proper system performance.

11. **Fine Tuning the Combustion Air Band:**

NOTE: The initial setting of the combustion air band may require additional adjustment.

- Refer to Figure 6A to identify the combustion air band location on the burner.
- Observe the flame. The flame should be yellow-white with sharp tips and no "sparkles."
- If the flame is orange in color or the flame length is too long, the oil you are burning requires MORE combustion air. OPEN the air band 3 mm (1/8") to 6 mm (1/4"), and re-check the flame for the proper characteristics.
- Re-check the flame after five minutes. You should see a yellow-white flame with sharp tips and no "sparkles", and the flame should extend half of the way down the combustion chamber.

12. **Checking for a Smokeless Burn:**

Check for a smokeless burn by observing the stack while the burner is running. If you see any smoke, repeat the previous steps for setting the combustion air band and adjusting the air regulator. After adjusting the combustion air band, re-check the flame length.

NOTE: Check for a smokeless burn periodically (as you do the flame length). Immediately readjust the burner if you ever see smoke coming from the stack. Smoke indicates improper air/fuel adjustment.

NOTE: When using instruments to adjust the burner for a smokeless burn, the following readings should be achieved:

- Draft over fire should be -0.02 to -0.04 inch w.c.
- Adjust for a smoke spot of a trace to 2
- For the CB-500-CTB adjust for a CO₂ reading of 12.5 to 14% or an O₂ reading of 2 to 4%
- For the CB-350-CTB adjust for a CO₂ reading of 12 to 13.5% or an O₂ reading of 4 to 7%
- For the CB-200-CTB adjust for a CO₂ reading of 10.5 to 12.5% or an O₂ reading of 3 to 5%
- Cad cell reading of 200 to 500 ohms

NOTE: On the CB-200-CTB the flame can not be observed through the inspection door. The CB-200-CTB must be adjusted with instruments for proper combustion. Obtain the above settings by adjusting the air band 10 mm (3/8") to 13 mm (1/2"). The metering pump will deliver a constant oil flow and set the flame length.

SECTION 7: RESETTING THE OIL PRIMARY CONTROL

Understanding the Danfoss Oil Primary Control

The oil primary control will shut the oil pump and oil solenoid off when it detects flame-out during burner operation. The oil primary control will then wait approximately 15 seconds (while the burner motor, air solenoid, and transformer are energized) and attempt to re-ignite the burner (recycle mode). If the burner does not re-ignite, the control will shut the burner off on safety lock-out. The following procedure explains what should be done when this occurs. *It is very important that you follow these instructions precisely when resetting the safety on the primary control and restarting the burner.*

Resetting the Danfoss Oil Primary Control



DANGER! DO NOT reset the oil primary control if oil mist is present in the combustion chamber or when the combustion chamber is hot! DO NOT operate your CTB if excess oil, oil vapor or fumes have accumulated in or near your boiler. As with any oil burning appliance, improper operation may result in a fire or explosion hazard.

1. Refer to Figure 7A.
2. Allow 5 to 10 minutes for all fuel mist to exhaust from the combustion chamber.
3. If the combustion chamber is hot, allow the boiler to cool for at least 30 minutes. DO NOT push the reset button.
4. When you are sure that all fuel mist has cleared and the boiler has cooled, push in and hold the reset button for three seconds, then release. This will reset the control at any time during its operation.
5. If the burner will not restart, call your Clean Burn dealer immediately.

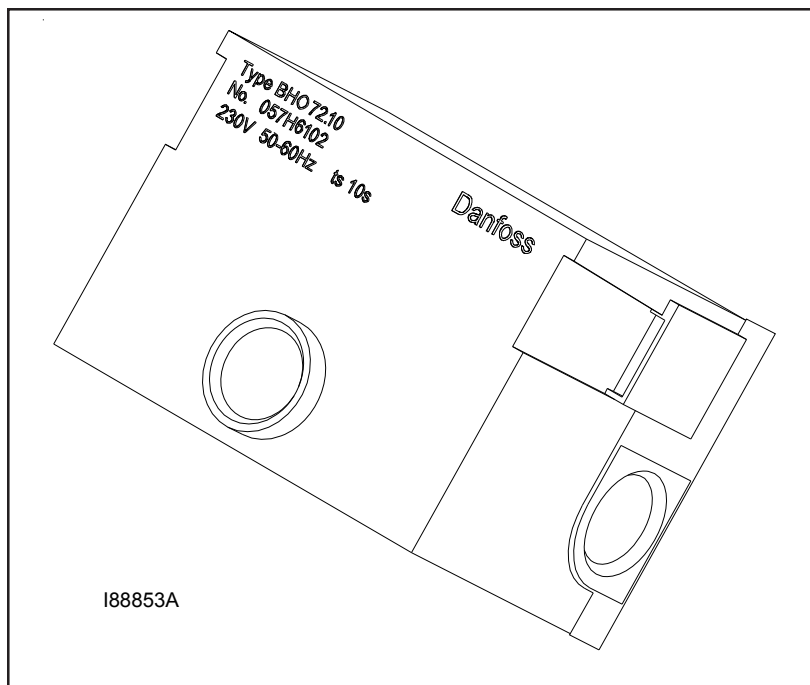


Figure 7A - Danfoss Oil Primary Control

SECTION 8: ADJUSTING THE DRAFT OVER FIRE

Understanding the Importance of Draft

Draft in the Coil Tube Boiler is created as the hot combustion gases rise up the stack, creating a negative pressure inside the stack and the boiler. This negative pressure is measured as inches of water column (W.C.) of draft. A proper draft overfire of -0.02 w.c. is essential so that all combustion products travel away from the burner, down the combustion chamber, through the boiler flues and up the stack.

Checking for Correct Draft Over Fire

NOTE: The CTB is equipped with an observation/draft reading port to check draft over fire. *A qualified serviceman with proper equipment must adjust your CTB for proper draft. Contact your Clean Burn dealer for this service.*

1. Insert the probe of the draft gauge instrument into the draft reading port in the observation port as shown in Figure 8A.
2. Adjust the barometric damper to achieve the *required draft over fire of -0.02 w.c.* (water column).
3. Record the reading in the Maintenance Record located in the Appendixes.
4. If correct draft over fire cannot be achieved, contact your Clean Burn dealer immediately.

ATTENTION: Only operate your CTB with a draft over fire of -0.02 w.c. Poor draft results in back pressure and poor burner performance. **DO NOT** operate your CTB with a draft over fire greater than -0.04 w.c.; an abnormally high stack temperature may result from a draft over fire that is too high.

ATTENTION: Backdraft must be resolved or your boiler will not operate correctly!

Under backdraft conditions, draft overfire readings will show positive pressure in the combustion chamber. Backdraft means that oil spray, combustion products, and heat are blown back against the burner. Backdraft results in oil-fouled retention heads and electrodes. Severe backdraft will force heat back against the burner and result in heat damage to the cad cell and transformer.

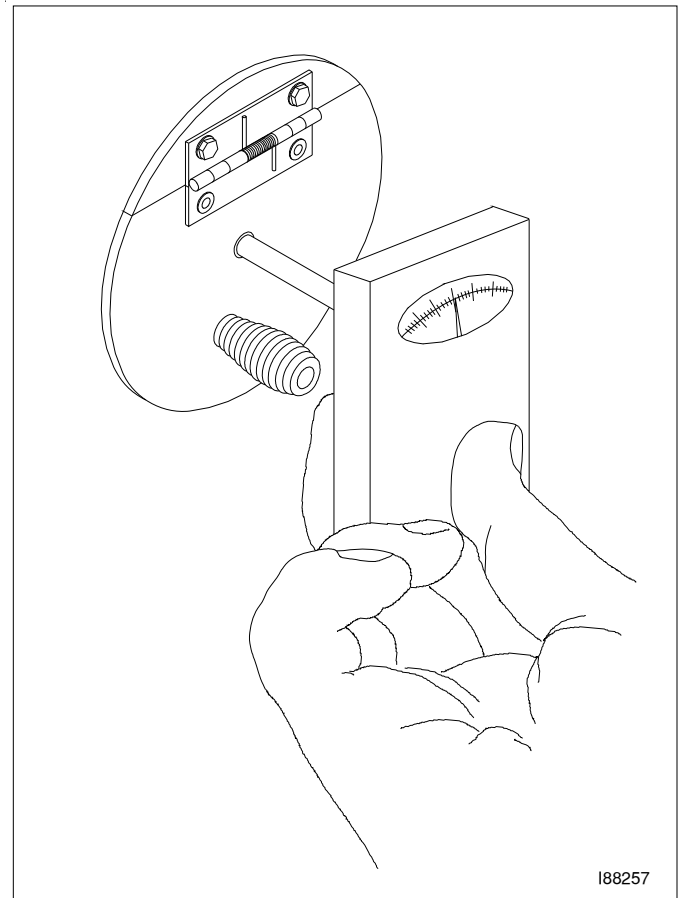


Figure 8A - Checking for Proper Draft Over Fire

Checking for Correct Draft Over Fire (continued)

Backdraft is caused by the following conditions:

- Poor draft caused by improper stack design. (See Section 4.)
- Poor draft caused by improper adjustment of the barometric damper.
- Incorrect combustion air band setting on the burner. (See Section 6.)
- Boiler flues are plugged with ash. (See Section 9.)
- Improper seal on clean-out door on back panel. (See Section 9.)
- Exhaust fans in your building are sucking gases down the stack.

Understanding the Effect of Exhaust Fans on Draft

Any type of exhaust fan, paint booth, or exhaust system in a building will create negative pressure in the building unless there is a source of make-up air (i.e. fresh air which enters the building and replaces the air removed by the exhaust fans.)

If there is insufficient make-up air, the exhaust fan will suck air and combustion gases down the coil tube boiler stack and create backdraft in the boiler. After the burner is shut down, the backdraft may suck the residual heat out of the combustion chamber and into the burner causing damage to the burner. Even if the exhaust fan is on another level of the building or in another room away from the boiler, the exhaust fan will still create backdraft at the boiler.

Checking Draft Overfire to Determine Severity of Backdraft

The following procedure is an accurate method of determining how much backdraft is created by the exhaust fans. Once this is determined, you can select the correct method for resolving the backdraft.

1. Turn off ALL exhaust fans and close ALL doors and windows in the building (any open door or window will allow make-up air to enter the building and will negate the test).
2. Start the coil tube boiler and adjust the barometric damper so that the draft overfire is $-.02$ w.c.
3. Check the draft overfire again. Now have someone start the exhaust fans.
4. Note how much the draft overfire has changed.

ATTENTION: If the draft overfire changed towards positive, it is mandatory that make-up air is provided to the building or severe damage to the boiler and burner will occur. If the draft overfire remained constant at $-.02$ w.c., there is sufficient make-up air entering the building, and the exhaust fan is not adversely affecting the draft.



CAUTION: Under no circumstances should the equipment room ever be under a negative pressure. Look for exhaust fans, compressors, air handling units, or anything else that may take air away from the boiler. Also look for chemical fumes, solvents, refrigerants, etc. that may be in use around the boiler and cause damage to it.

Adjusting Draft Over Fire with A Draft Inducer Installed

NOTE: The draft inducer is purposely sized to create a generous draft. When adjusting the barometric damper, you will find that the flapper is open most of the time. This allows the draft inducer to suck cool air through the damper to protect the inducer motor from heat damage.

1. Use a draft gauge to check draft over fire.
2. Adjust the barometric damper to obtain -0.02 w.c. draft over fire. If you still have too much draft, adjust the draft plate on the draft inducer. Move the plate in 1/4" to reduce the draft. Recheck the draft reading.

SECTION 9: MAINTENANCE

Understanding Maintenance

Maintaining your Clean Burn CTB is an important activity which includes several periodic maintenance activities and an annual burner tune-up...all are necessary to keep your boiler running in peak condition.



WARNING: Failure to maintain and/or improper servicing by unqualified personnel may adversely affect the proper, safe operation of your coil tube boiler, may reduce the service life of your boiler, and may void your warranty.

The following chart summarizes all the maintenance activities which should be performed on the CTB at the intervals indicated. Instructions/procedures for these activities are included in this chapter.

Maintenance Activity	Interval
Cleaning the canister filter	Before vacuum gauge reads 10" HG of vacuum
Servicing the metering pump	At least once a year
Cleaning the check valve/screen	At least once a year
Cleaning water/sludge out of oil tank	At least once a year
Cleaning out ash (CB-200-CTB)*	Approx. every 750 hrs. per burner hour meter
Cleaning out ash (CB-350-CTB)*	Approx. every 1000 hrs. per burner hour meter
Cleaning out ash (CB-500-CTB)*	Approx. every 1000 hrs. per burner hour meter
Checking boiler water condition	Periodically by qualified water treatment company
Annual burner tune-up	At least once a year

*It is very important to clean the ash from the CTB on schedule. Normal use of the boiler requires clean-out at least twice during the heating season. Heavy, around-the-clock usage requires more frequent clean-out (e.g. one month of continual running of the boiler is 720 hours).

NOTE: IMPORTANT! Record all maintenance activities in the Maintenance Record provided in the Appendixes.

Annual Preventative Maintenance and Burner Tune-up

The Clean Burn CTB requires annual preventative maintenance. The burner also requires an annual tune-up to keep it running in peak condition. The burner tune-up should be performed by a qualified Clean Burn service technician who has the necessary parts and expertise.

Contact your local Clean Burn dealer to schedule the annual maintenance for your boiler. Various levels of service are provided to fit your particular need. This work is usually performed during the warm-weather months to prepare the boiler for the next heating season.

Cleaning the Canister Filter

ATTENTION: Never operate the oil pump with more than 10" HG of vacuum on the vacuum gauge. High vacuum on the suction side of the pump separates air from the oil (cavitation) and will cause the burner to shut down.

The following protective gear should be worn when cleaning the filter:

- Rubber gloves
- Safety goggles

1. Close the ball valve adjacent to the filter.
2. Position a container under the filter.
3. Unscrew the four bolts, remove the canister bowl, and filter element. Now pour the oil into the container.
4. Clean the filter element and the bowl in a parts washer.
5. Referring to Figure 9A, check the condition of the O-rings. Replace any that are cracked or worn.
6. Ensure that the canister filter is 100% airtight by firmly tightening the four bolts.
7. Open the ball valve. Refer to Sections 5 and 6 for instructions on priming the pump and starting the burner.

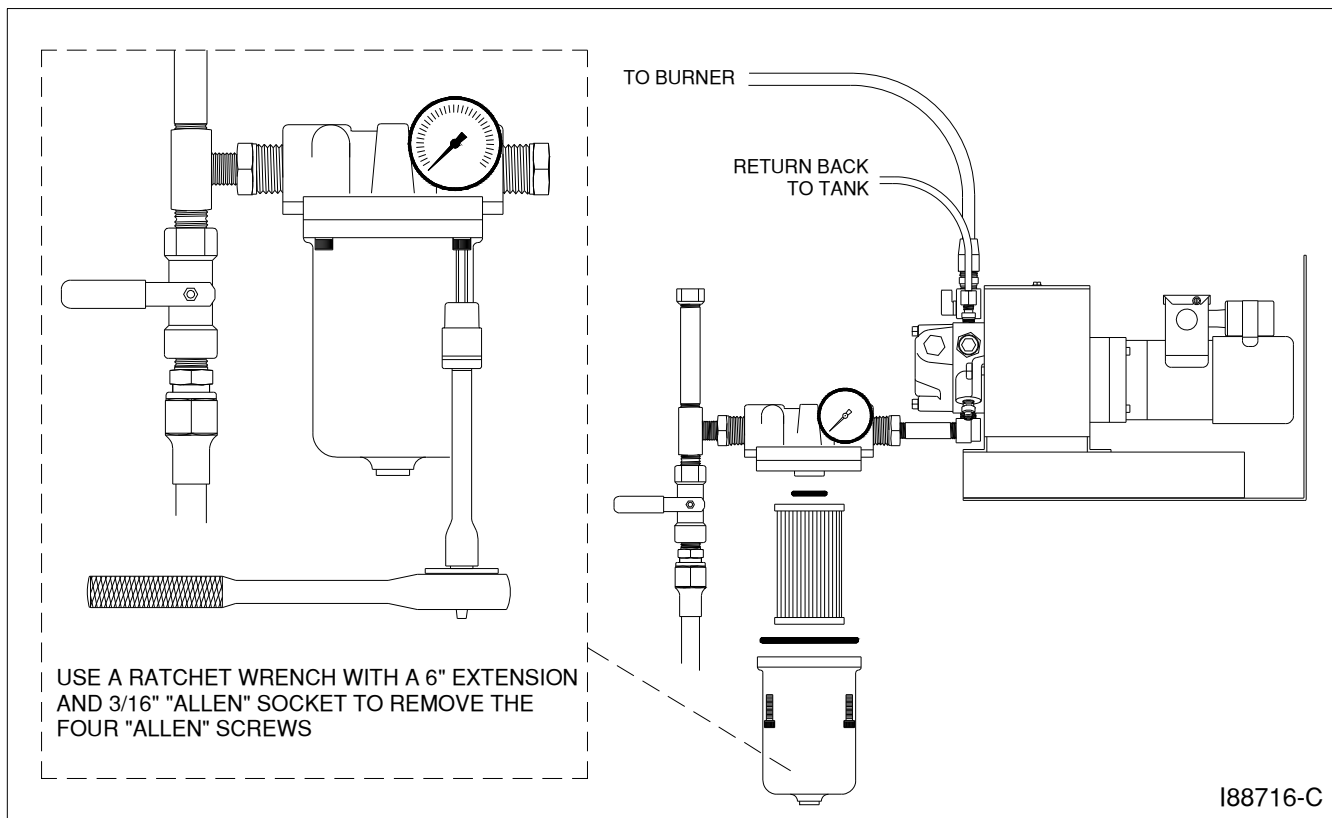


Figure 9A - Canister Filter Component Detail

Servicing the Metering Pump

1. Refer to Figure 9B.
2. Remove the pump head cover (part 1).
3. Remove the screen (part 2) and wash it.
4. Remove and discard the used gasket (part 3).
5. Install a new gasket (Clean Burn Part #32422).
6. Replace the screen and pump head cover.

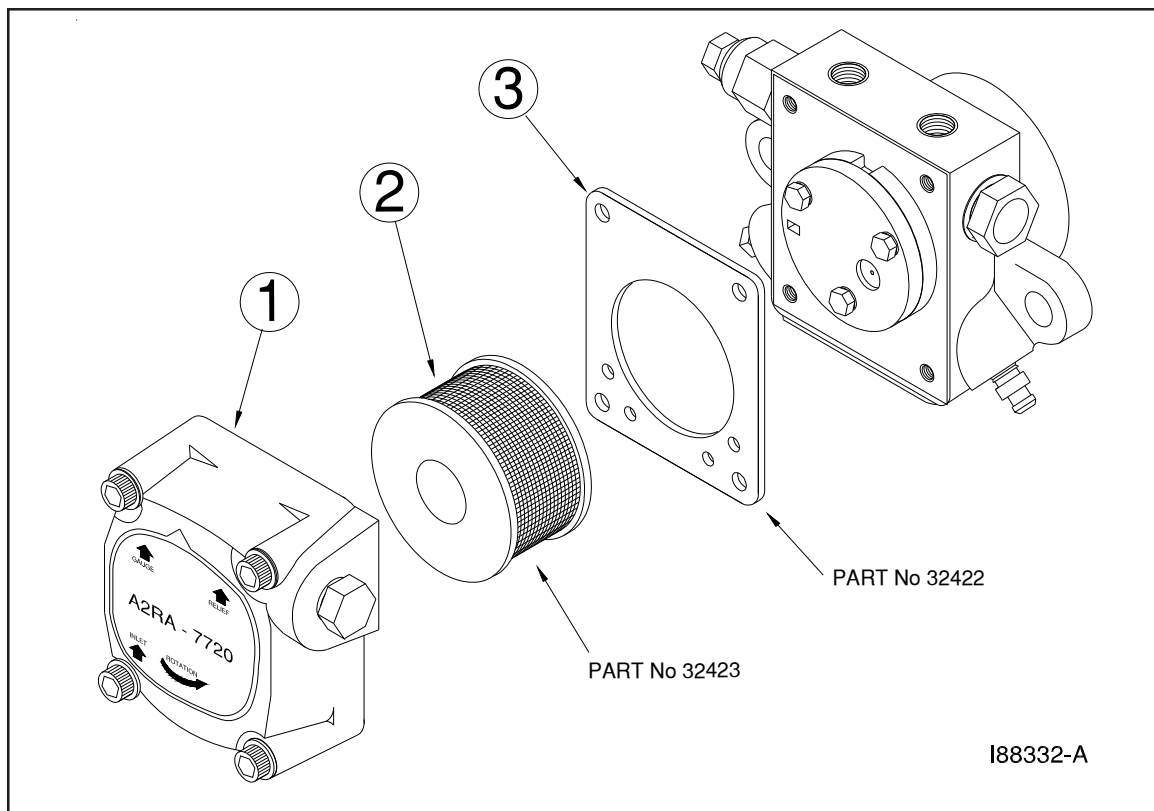


Figure 9B - Servicing the Metering Pump

Cleaning the Check Valve / Screen

This procedure applies to coil tube boiler installations with inside and outside tanks. The following protective gear should be worn when cleaning the check valve/screen:

- Rubber gloves
- Safety goggles

1. Refer to Figure 9C. Remove the one-piece suction oil line from the tank.
2. Remove the check valve and screen. Clean these components in a parts washer.
3. Check the operation of the check valve. The valve must seat so it is airtight to hold pump prime.
4. Re-assemble and re-install the components. Apply Permatex #2 non-hardening gasket sealer or equivalent to the threaded fittings. Firmly tighten all connections so the suction line is 100% airtight.
5. Follow pump priming instructions in Section 5 to re-establish prime.

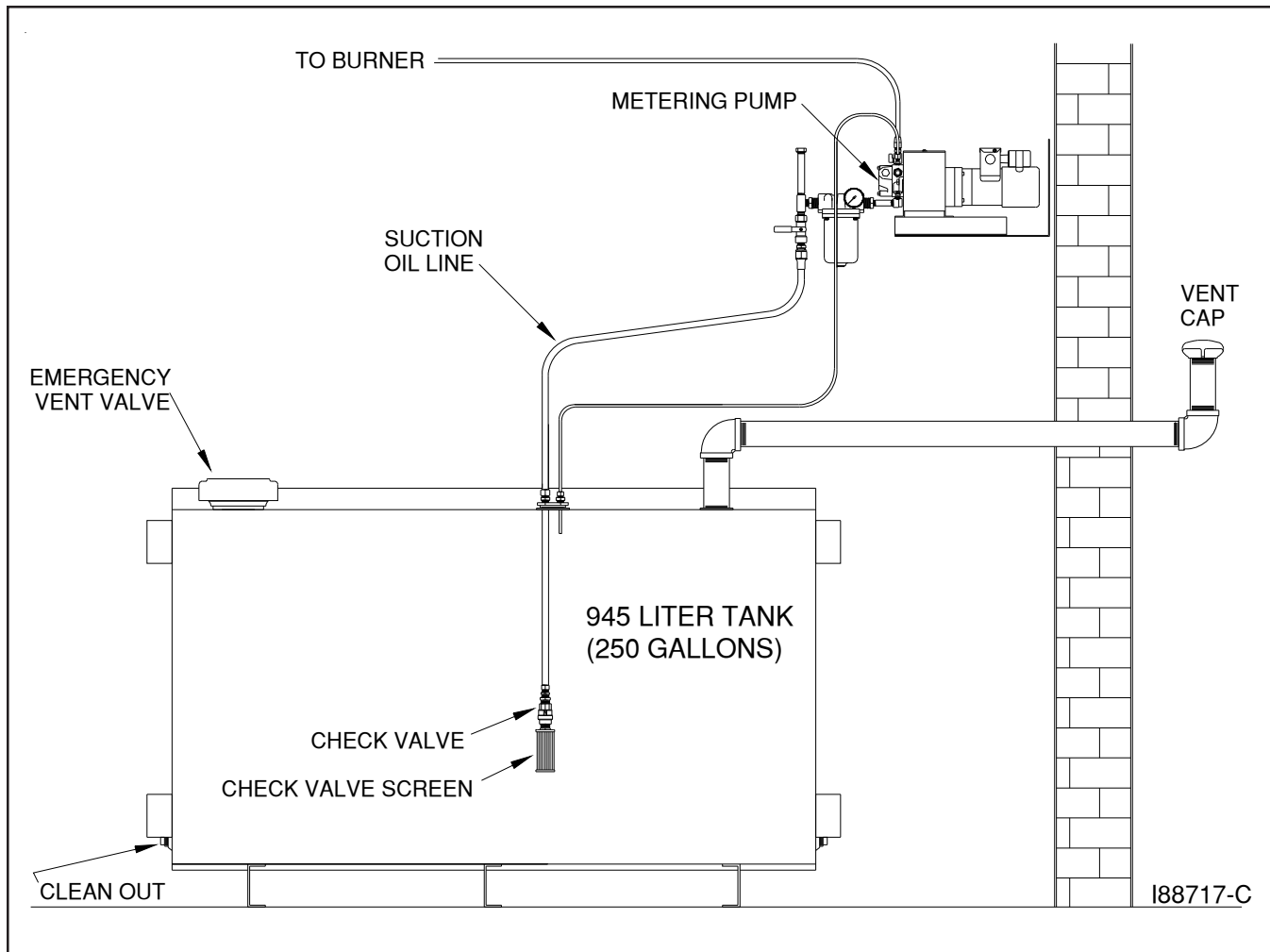


Figure 9C - Check Valve Detail

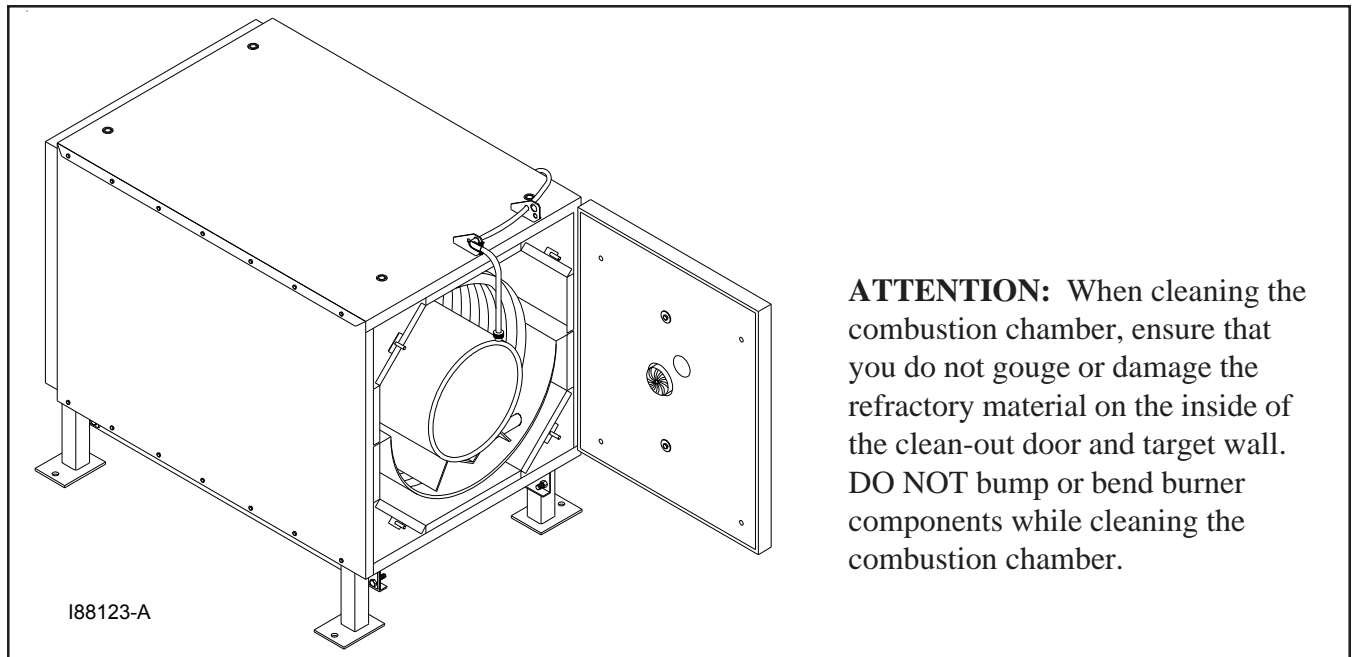
Cleaning the Ash from the Coil Tube Boiler

ATTENTION: Your CTB may require frequent clean out of the ash due to contaminants in the oil or heavy use. As ash accumulates, CTB heat output declines, and the stack temperature rises. 3 mm (1/8") of ash has the insulating capacity of 2.5 cm (1") of fiberglass insulation and reduces heat transfer significantly. Never allow more than 6 mm (1/4") of ash to accumulate in the combustion chamber heat exchanger flues or stack.

The following protective gear should be worn when cleaning the ash:

- Respirator for fine particles
 - Safety goggles
 - Rubber gloves
 - Protective clothing
1. Ensure that power has been turned OFF, and all "hot" components have been allowed to cool sufficiently. Shop air should be turned OFF and disconnected. Allow at least one hour for the ceramics to cool.
 2. Clean the ash from the combustion chamber (see Figure 9D):
 - a. If the air and oil lines must be disconnected to open the clean out door:
 1. Bleed-down pressure on the air and oil lines by slightly loosening the fittings at the bottom of the connector block.
 2. With air and oil pressure completely bled off, disconnect the air and oil pressure lines from the bottom of the connector block.

NOTE: Cover these lines to keep dirt from entering the air/oil supply.
 - b. Remove the lock nuts on the clean-out door.
 - c. Carefully swing open the clean-out door to expose the coiled heat exchanger, flue passages, and the combustion chamber.
 - d. Remove the two ceramic sleeve half-pieces from the combustion chamber, and remove the supporting ceramic stand pieces.
 - e. Use a wire or bristle brush to thoroughly clean out the ash from the combustion chamber and flue passages.
 - f. While cleaning out the combustion chamber, also check the burner retention head and throat. Carefully clean these elements.



ATTENTION: When cleaning the combustion chamber, ensure that you do not gouge or damage the refractory material on the inside of the clean-out door and target wall. DO NOT bump or bend burner components while cleaning the combustion chamber.

Figure 9D - Accessing the Combustion Chamber for Cleaning

Cleaning the Ash (continued)

- (2.)
 - h. Thoroughly vacuum any remaining ash residue from the flue passages. A long wand on the hose of your shop vac is helpful in reaching all the way back.
 - i. Inspect the combustion chamber and its components to ensure that it is in good condition. Inspect the inside of the clean-out door and target wall. Make sure the refractory material on the inside of the door is in good condition, and the door seals tightly when closed. If the door does not seal tightly, replace any damaged components.
3. Clean the ash from the stack components:
 - a. Brush accumulated ash from the stack cap.
 - b. Lightly tap the stack components to loosen the ash.
 - c. Allow ash and dust to settle in the clean-out tee or elbow, then vacuum out.
 - d. Disconnect the stack from the CTB breach.
 - e. Thoroughly vacuum out the back of the boiler, including the boiler breach (through the breach). If desired, the back panel can be removed for cleaning.

ATTENTION: When handling the front door and rear panel, be careful that you do not damage the insulation seal surfaces. Two technicians may be required to remove and install the rear panel safely. The panel weighs approximately 39 Kg (85 lbs).
4. Reassemble the boiler components (ceramic stand, ceramic sleeve, back panel, etc.) If necessary, refer to Section 3 for additional Assembly information.
5. Close the clean-out door, install and tighten the washer and nuts. Make sure that the clean-out door and rear panel close and seal properly. Reconnect all disconnected lines (oil and air) on the bottom of the connector block.

NOTE: You may need to bleed air from the oil line before starting the burner. See Section 5 for pertinent instructions.

Cleaning the Oil Tank

DO NOT allow water, sludge, or other debris to accumulate in your oil supply tank to the point that non-combustible or harmful materials are drawn into the pump or burner.

Drain water and sludge from the bottom of your tank at least once a year, and more frequently with water accumulation.

End of Season Maintenance

Turn main power to your coil tube boiler OFF at the end of the heating season. Environmental regulations allow your used oil to be burned only for "heat recovery." DO NOT operate your boiler during warm weather just to burn oil. *Contact your local Clean Burn dealer to schedule your annual burner tune-up. Allow only trained, authorized service personnel to service your burner.*

In the "off" season after the boiler has been cleaned, spray the combustion chamber with a light coat of oil to reduce corrosion caused by moisture in the air.

NOTE: If the CTB is not used during the cold-weather months, it must be protected to prevent damage from freezing temperatures.

SECTION 10: THE CTB HYDRONIC SYSTEM

Understanding the CTB Hydronic System

The Clean Burn Coil Tube Boiler (CTB) is designed to function as a low-mass boiler (i.e. it will not maintain boiler water temperature when there is no call for heat). *Low-mass boilers require that a sufficient, constant flow of water be maintained through the coil* in order to: (a) remove the heat from the boiler when the burner is firing AND (b) prevent the flow switch from shutting off the burner.

IMPORTANT NOTE: When designing the system layout and application for your CTB, keep in mind that it is NOT suitable for open systems. The Clean Burn CTB has been designed to operate as a closed loop boiler system. Potable water heating (i.e. for domestic or washing purposes) can be accomplished by incorporating a heat exchanger into the system.

Special Safety Guidelines for the Design and Installation of Hydronic Systems

Adhere to the following *Safety Guidelines* when designing and setting up the CTB hydronics system:

- The CTB must be installed on non-combustible flooring.
- The CTB must be installed in accordance with national, state, and local plumbing, heating, and electrical codes and the regulations of the serving utilities which may differ from this manual. Authorities having jurisdiction should be consulted before installations are made. In all cases, reference should be made to all applicable standards.
- The heating system must be designed by a competent hydronics contractor, and only persons knowledgeable in the layout and installation of hydronic heating systems should install this boiler.
- The boiler must be connected to an approved chimney in good condition. Serious property damage could result if the boiler is connected to a dirty or inadequate chimney. The interior of the chimney flue must be inspected periodically through the heating season for any obstructions. A clean and unobstructed chimney flue is necessary to allow noxious fumes that could cause serious injury to vent safely and will contribute toward maintaining the boiler's efficiency.
- It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is completed.
- To ensure optimum performance, qualified personnel must perform proper and timely maintenance on the CTB according to the procedures provided in Section 9 of this manual.

CTB System Function and Configuration

Water Flow and Temperature

The Clean Burn Coil Tube Boiler design requires continuous water flow through the boiler heat exchanger to ensure proper system operation. The boiler circulator must be capable of developing sufficient (head) pressure to overcome the resistance of the boiler plus the circulating system at the required flow rate. If the water flow through the boiler is too low, the flow switch will not allow the burner to operate. (Refer to Appendix A, as needed, for CTB system specifications.)

Heating systems using zone valves, zone pumps, or three-way valves may experience reduced water flow through the boiler. This condition can cause excessive water temperature rise and unstable boiler operation. The normal temperature rise across the boiler is 11 °C (20 °F). **Minimum operating temperature for the CTB is 71 °C (160 °F).** To avoid condensation, the return water temperature should not fall below 60 °C (140 °F).

System Pressure

The Clean Burn CTB is designed to operate in closed, pressurized hydronic systems. Certain levels of pressure are required for proper system operation--**a minimum of 0.8 bar (12 PSI) should be maintained on the system where the boiler supply water temperature is 93 °C (200 °F) or less.** If a higher working pressure is required, contact the Clean Burn Service Department for proper pressure requirements.

Sample System Configuration: Primary/Secondary Pumping System

A sample hydronic system setup using Clean Burn Coil Tube Boilers is shown in Figure 10A. This system, a *Primary/Secondary Pumping System*, allows for many special hydronic requirements (e.g. water return temperatures below the normal 60 °C (140 °F), variable flow zones, multiple zones, multi-temperature systems, and/or multiple boilers) and provides maximum flexibility while maintaining optimal system functioning. **A critical advantage of this type of system is that it dramatically reduces the danger of thermal shock to the boiler.**

In a Primary/Secondary Pumping System (as shown in Figure 10A), the primary loop circulator runs when any of the zones call for heat. In some system setups, the circulator may run continuously during the heating season. The circulator pushes hot water past the zone tees; any of the secondary zone pumps can draw hot water out of the first tee (as though the tee were a boiler). Each zone then returns cooler water through the second tee where it mixes with the hot water being pushed through by the primary loop circulator. **The close positioning of the two zone tees is crucial to the operation of the system; the tees must be at least 15 cm (6") but not more than 31 cm (12") apart.** This allows for circulators of different flow rates to be used in the same system while maintaining proper flow and functioning.

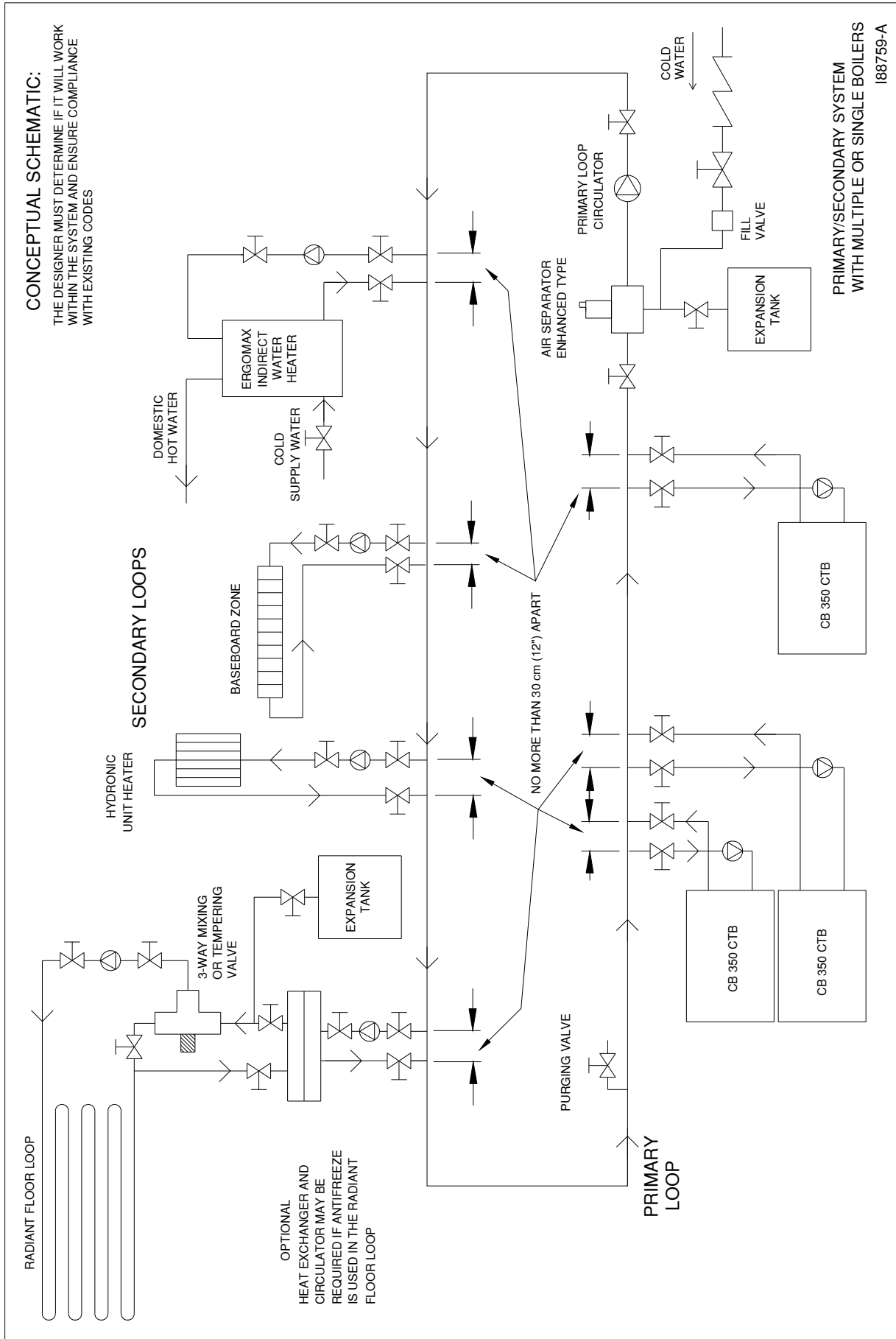


Figure 10A - Sample Primary/Secondary Hydronic System Diagram

CTB Setup Options

When designing and setting up the CTB Hydronic System, please be aware of the following options and special setup requirements:

(1) *The boiler circulator (which you may have ordered from Clean Burn for your CTB system) is sized to ensure a flow of water through the coil tube ONLY; it is NOT sized to be used as a system circulator. An additional circulator must be installed to flow water through the system and to the boiler.*

(2) *In low load conditions, Clean Burn recommends the installation of a larger storage tank next to the CTB to extend the run time and to reduce the occurrence of short cycling. Position the tank close to the boiler to reduce the required connective piping as shown in sample configuration, Figure 10B.*

(3) *If hot water is required in the system installation for washing or other related activities, Clean Burn offers Ergomax Heat Exchangers/Storage Tanks in 182, 273, and 450 liter sizes (48, 72, and 119 gallon sizes). Contact your local Clean Burn representative for additional details on these CTB system components. Refer to Figure 10C for a sample system configuration using an Ergomax Heat Exchanger. This configuration is ideal for installations requiring pressure washing, car/truck washing, etc. The Ergomax unit works well with a CTB because it stores boiler water in the tank and acts as a buffer (tempering) tank while enabling reduction of short cycling.*

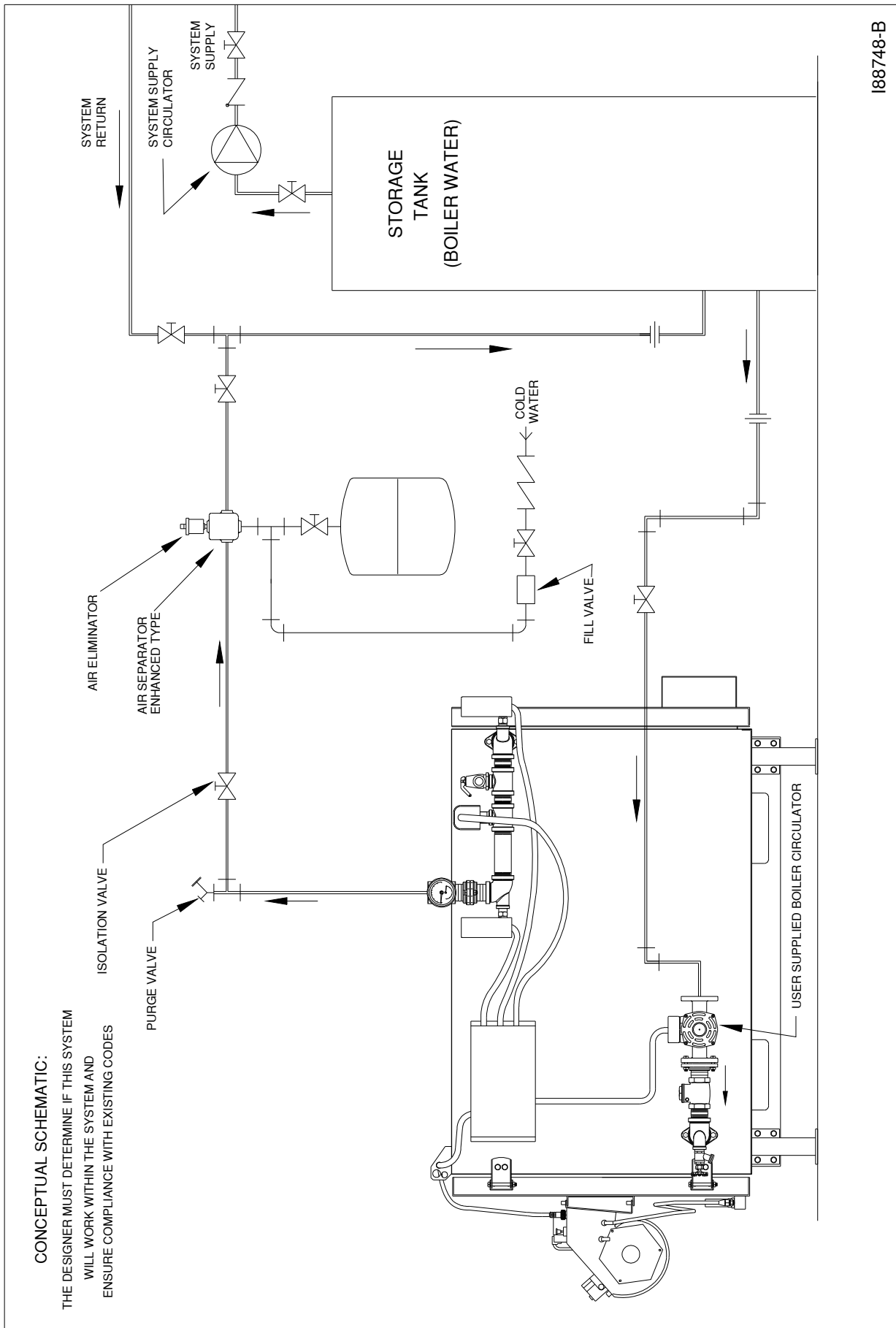


Figure 10B - Model CB-350-CTB with Additional Larger Storage Tank

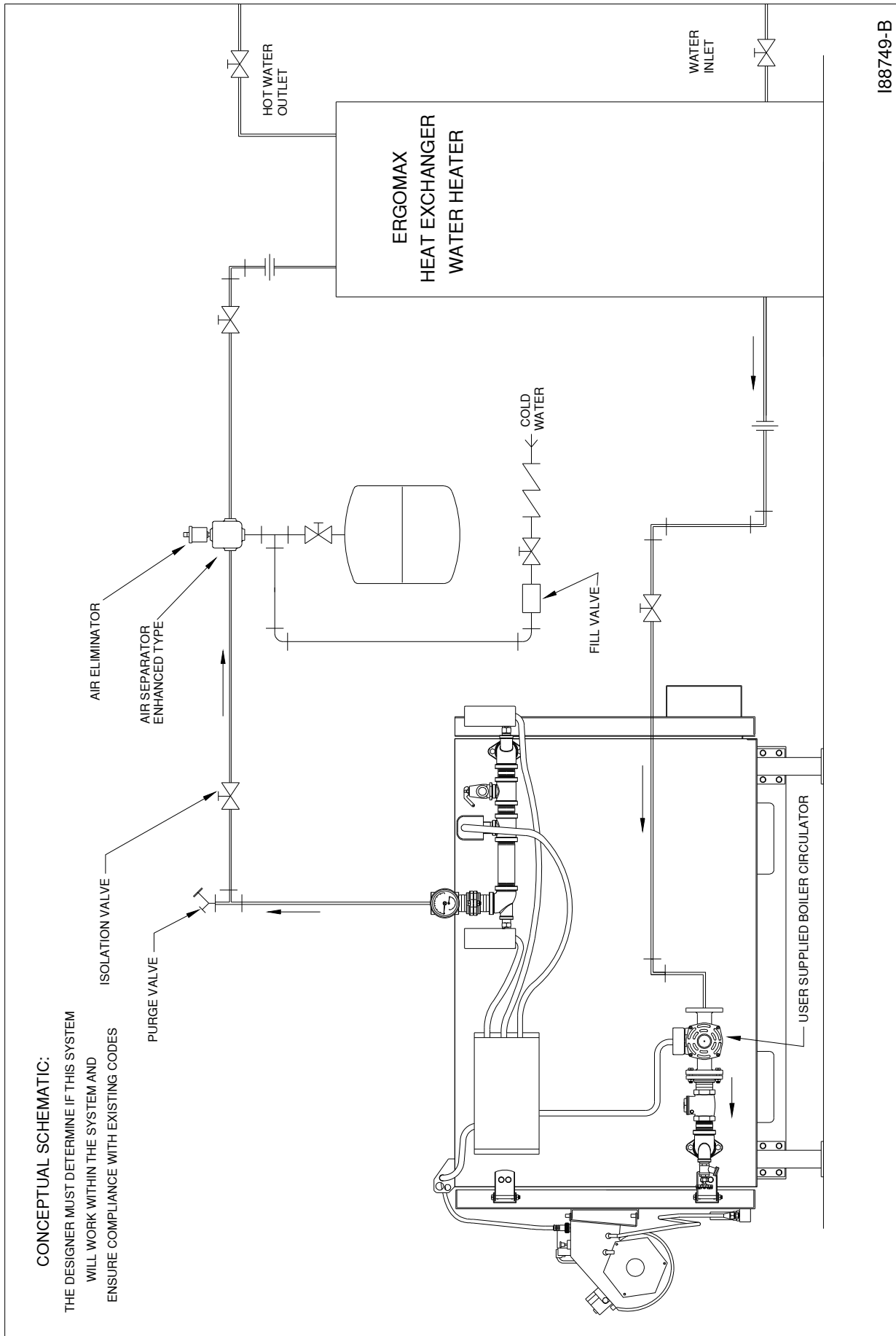


Figure 10C - CB-350-CTB with Ergomax Indirect Water Heater

Guidelines for CTB Setup and Operation

1. Refer to the appropriate illustration in this section for your CTB system configuration, as well as Figures 4A/4B in the Installation chapter.
2. Connect the supply and return piping to the heating system. (Additional information in Section 4).



CAUTION: Hot water pipes shall have clearances of at least 13 mm (1/2") from all combustible surfaces. For additional technical reference material, see I=B=R Installation and Piping Guide No. 200.

3. The relief valve must be installed with the spindle in the vertical position. The relief valve discharge pipe must be extended to within four inches of the floor or to a drain.
4. To reduce the amount of cold water returned to the boiler (and to protect the boiler from thermal shock), a return blend loop should be utilized.
5. Fill the entire heating system with water and vent air from the system according to the following instructions:
 - (a) Close the isolation valve in the boiler supply piping.
 - (b) Isolate all circuits by closing the zone valves or balancing valves.
 - (c) Attach a hose to the purge valve located just below the isolation valve in the boiler supply piping.

NOTE: Ensure that the end of the hose drains into a bucket located in a drain area or outside.
 - (d) Starting with one circuit, open the first zone valve ONLY.
 - (e) Open the purge valve.
 - (f) Open the fill valve (the make-up water line should be located on the system side of the isolation valve in the boiler supply piping.)
 - (g) Allow water to overflow from the bucket until discharge from the hose is bubble-free.

ATTENTION: Air in the hose may cause the hose to "jump" and water to spray out; ensure that the area (and equipment nearby) is protected from any possible water damage.
 - (h) Open the zone valve to the second zone to be purged, then close the first. Repeat this step until all zones have been purged, but always have one zone open. At completion, open all zone valves.
 - (i) Close the purge valve, continue filling the system until the pressure gauge reads 0.8 bar (12 psi). Close the fill valve.

NOTE: If the make-up water line is equipped with a pressure reducing valve, the system will automatically fill to 0.8 bar (12 psi).
 - (j) Open the isolation valve in the boiler supply piping.
 - (k) Remove the hose from the purge valve.
 - (l) As soon as the boiler is filled, heat the water in the boiler to 82 °C (180 °F) to de-aerate the water.

Guidelines for Preventing Oxygen Contamination

ATTENTION: Oxygen contamination of boiler water will cause corrosion of iron and steel boiler components, and can lead to boiler failure (and void warranty). Causes of oxygen contamination include:

- Addition of excessive make-up water as a result of system leaks
- Absorption through open tanks and fittings
- Oxygen permeable material in the distribution system

To ensure optimal CTB maintenance and operation, follow these recommendations to eliminate damaging oxygen contamination:

- Repair system leaks to eliminate the need for the addition of make-up water
- Eliminate open tanks from the system
- Eliminate and/or repair leaky fittings
- Use non-permeable materials in the distribution system
- Isolate the boiler from the water heater system (i.e. wash and potable waters) by installing a heat exchanger.

Guidelines for Initial Cleaning of the Hydronics System and Maintaining Water Quality

- Clean the boiler with an alkaline cleaner (e.g. soda ash or detergent) as recommended by a qualified water treatment company.
NOTE: This is necessary to remove oil or other coatings from the tube surfaces. These protective coatings are commonly applied to new tubes to prevent rusting during storage/transit and will cause corrosion if left on the tubes during operation of the boiler.
- After cleaning the boiler, drain the system in a manner and to a location that hot water can be discharged safely.
- Remove plugs from all available locations, and wash the water side of the boiler as thoroughly as possible using a high-pressure water stream.
- Refill the system with fresh water.
- Test the pH of the water in the system. The pH should be higher than 8.5 but lower than 9.5. Add appropriate boiler water treatment compounds as recommended by your qualified water treatment company (if necessary) to bring the pH within the specified range.
- Heat the water in the boiler to 82 °C (180 °F) to de-aerate the water.

Guidelines for CTB Operation

After proper and safe CTB boiler setup and installation has been accomplished, CTB operation proceeds as follows:

- (a) Refer to Section 6 for instructions on starting the CTB.
- (b) Following burner startup, set the operating control dial at 82 - 93 °C (180 - 200 °F).

ATTENTION: If, during normal operation, it is necessary to add water to your system more than once a year, consult a qualified service technician to check your system for leaks. A leaky system will increase the volume of make-up water supplied to the boiler which can significantly shorten the life of the boiler and cause damage to the boiler.

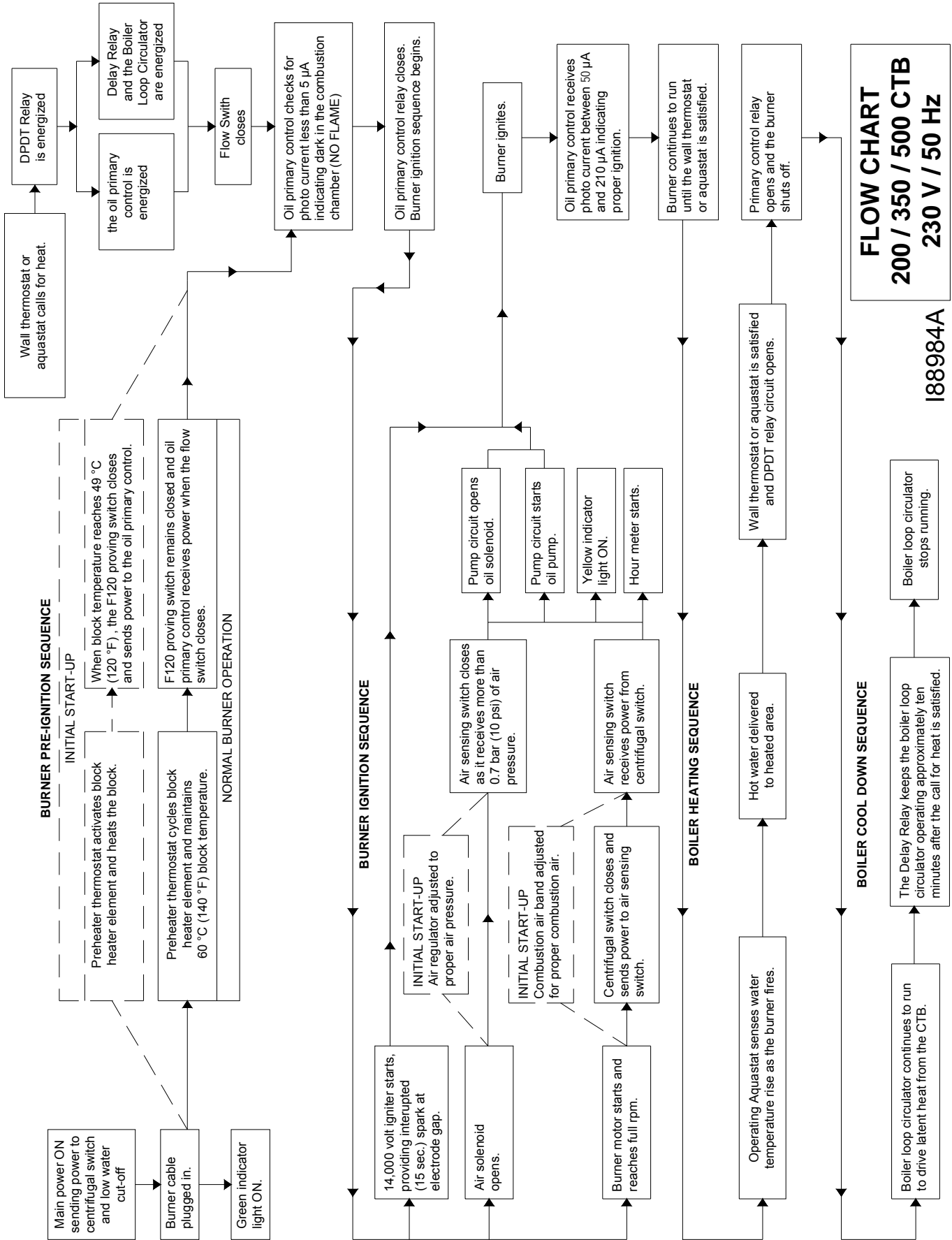
SECTION 11: TROUBLESHOOTING

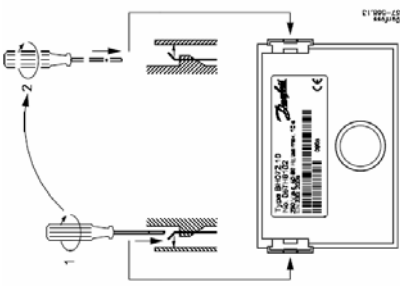
The following charts and tables are provided for reference in troubleshooting any difficulties encountered in boiler operation and adjustment.

- The **Flow Chart** outlines the proper sequence of events in boiler operation -- use this chart to help diagnose where a problem may be occurring.
- More specific troubleshooting information is provided in the **Troubleshooting Tables** following the flow chart. Each table lists a **Problem**, **Possible Cause**, and **Possible Action(s)** to fix the problem.

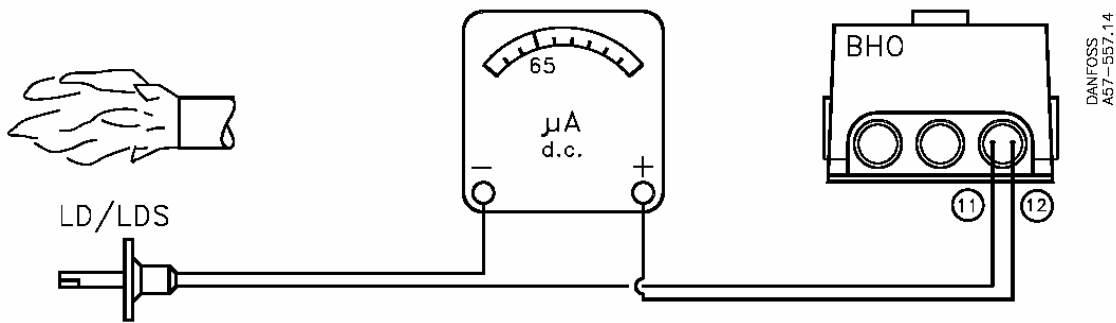
The CTB sequence of operation is summarized as follows:

- (1) A call for heat by the thermostat energizes the DPDT relay which in turn energizes the circulator delay relay and the boiler loop circulator to establish a flow of water through the coil.
- (2) The flow switch closes. The power then continues from the flow switch through the high limit aquastat, through the operating aquastat, and then to the burner.
- (3) If the burner ignites within approximately 15 seconds and the photo unit sees a flame, the burner will continue to operate until the call for heat is satisfied or the setting of the operating aquastat is reached.
- (4) If the thermostat is not satisfied, but the temperature setting of the operating aquastat is reached, the burner will stop until the return water drops the water temperature in the boiler (re-closing the operating aquastat and turning the burner back on).
- (5) The boiler loop circulator will operate as long as the thermostat is calling for heat.
- (6) The boiler loop circulator circuit includes a delay relay that keeps the circulator operating approximately ten minutes after the call for heat is satisfied.



PROBLEM	POSSIBLE CAUSE	POSSIBLE ACTION(S)
<p>Burner won't run at all <i>and</i> Green power light is NOT ON.</p>	<ol style="list-style-type: none"> 1. Circuit breaker/main switch open. 2. Fuse/breaker blown. 3. Burner cable is damaged or not plugged in properly. 	<ol style="list-style-type: none"> 1. Close circuit breaker/switch. 2. Electrician should check out electrical system. 3. Check burner cable.
<p>Burner won't run at all <i>and</i> Green power light is ON.</p> 	<ol style="list-style-type: none"> 1. Oil primary control has shut down on safety reset. 2. Wall thermostat is not operating. 3. Heater block is not heating up. 4. F-120 proving switch has not closed. 5. Check the condition of the Oil primary control. 6. Oil primary control is damaged. 	<ol style="list-style-type: none"> 1. Follow the directions in Section 7 to reset the oil primary control. 2. Check the wall thermostat and thermostat cable. 3. Feel the back of the burner; it should be 60 °C (140 °F). If the heater block is NOT HOT: (a) Wait 15 minutes for the heater block to heat up and re-check the back of the burner, and (b) Check the block heater thermostat and block heater element. Refer to the wiring diagram and ladder schematic in Appendix B. 4. If the block is HOT: (a) Check the red wire at the F-120 proving switch for power. If there is NO power at the red wire, refer to the wiring diagram and ladder schematic in Appendix B to troubleshoot the circuit that provides power to the proving switch. (b) If there is power at the red wire at the proving switch, check for power at the black wire. If there is NO power at the black wire, replace the F-120 proving switch. 5. (a) Check the physical condition of the top primary control cover and the lower base to make sure there was no heat damage. (b) Disconnect the top cover of the primary control and check the base wiring. Follow the burner wiring label. 6. Replace oil primary control: (a) Check voltage – it must be 230 volts.

PROBLEM	POSSIBLE CAUSE	POSSIBLE ACTION(S)
<p>Burner ignites, but will not stay running <i>and</i> Burner shuts off on reset within 15 seconds.</p>	<ol style="list-style-type: none"> 1. There is a fuel delivery problem. 2. The cad cell is dirty. 3. Cad cell wires are loose. 4. Cad cell / cad cell wires are damaged. 5. The primary control is not receiving the proper μA signal from the cad cell. 	<ol style="list-style-type: none"> 1. Follow the procedures listed in the next problem. 2. Clean and check the condition of the cad cell and cad cell wires. 3. Check that the blue and black wires are connected properly into the primary base (terminals 11 and 12) 4. Replace the cad cell and cad cell wires. If the cad cell is heat damaged: (a) Clean your furnace, including the combustion chamber, flues and stack. Refer to instructions in Section 9. (b) Check for backdraft caused by exhaust fans in your building. Follow instructions in Section 8. 5. The photo current is measured with a direct current ammeter in series with the photo unit (+ pole on terminal 12). With a flame, cad cell current must be between $50\ \mu\text{A}$ and $210\ \mu\text{A}$ at 240V. With no flame, the measured photo current must be maximum $5\ \mu\text{A}$ at 230V.



<p>Burner ignites and runs properly, but the burner shuts off on reset periodically (e.g. the burner goes off on reset during the night and requires resetting in the morning).</p>	<ol style="list-style-type: none"> 1. There is air in the suction oil line due to leaks at the fittings 2. There is air trapped in a high point in the pressure oil line. 	<ol style="list-style-type: none"> 1. Follow the procedures in Section 5 to vacuum test the pump. Re-install and properly seal the suction line fittings to eliminate air leaks. 2. Follow instructions in Section 4 to bleed the air out of the pressure oil line.
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PROBLEM	POSSIBLE CAUSE	POSSIBLE ACTION(S)
<p>Burner ignites <i>and</i> Burner shuts off on reset sometime later during the day or night.</p>	<ol style="list-style-type: none"> 1. There is air in the fuel supply. 2. The primary control is not receiving the proper μA signal from the cad cell. 3. There is insufficient air pressure. 4. The heater block is cold. 5. The electrodes are fouled. 	<ol style="list-style-type: none"> 1. Prime the pump. If the pump will not prime or there is air in the oil stream from the pump bleeder, follow the steps in the next problem ("Pump will not prime.") 2. Check for proper μA signal. Follow the procedures in the previous problem (top, page 10-4) 3. Follow the instructions in Section 5 to adjust the air regulator for proper air pressure. DO NOT turn the air compressor off while the furnace is operating. If you turn the air compressor off at night, turn the wall thermostat to OFF so the burner will not run. 4. DO NOT shut off power to the furnace overnight, or the heater block will cool down, and the burner will not re-start the next morning. To turn the furnace "off" overnight, turn the wall thermostat to OFF. The heater block will stay hot. 5. If oil residues have built up on the electrodes and retention head, follow the instructions in Section 8 to check for proper draft overfire. Clean the electrodes and retention head.

PROBLEM	POSSIBLE CAUSE	POSSIBLE ACTION(S)
<p>Pump will not prime <i>and</i> Pump motor is running.</p>	<ol style="list-style-type: none"> 1. There is a leak(s) in the suction line. 2. The pump is not installed so it will fill with oil during the priming process. 3. The pump gears are dry. 4. The pump seal is damaged. 5. The ball valve is closed. 6. The canister filter is dirty. 7. The check valve is dirty. 8. The pump is damaged or worn out. 	<ol style="list-style-type: none"> 1. Follow the specifications in Section 4 to make sure the suction line is installed properly and that all fittings are 100% airtight. 2. Make sure the pump head is filled with oil prior to starting the pump. See Section 5. 3. Follow the procedure in Section 5 to fill the oil line and prime the pump. 4. With the pump not running, wipe your finger along the bottom of the cylinder at the pump shaft. If there is oil at the pump shaft, the seal is damaged. Replace the pump, or replace the seal. NOTE: Some oils will expand as they warm up. Because there is a check valve in the suction line, the expanding oil may build up pressure and damage the oil seal. Install a mini-accumulator in the 1/8" port of the canister filter to prevent the pressure build-up. 5. Open the ball valve on the suction line. 6. Refer to Section 9 to clean the canister filter. 7. Refer to Section 9 to clean the check valve. 8. Replace the pump.

PROBLEM	POSSIBLE CAUSE	POSSIBLE ACTION(S)
<p>Pump will not prime <i>and</i> Pump motor is NOT running.</p>	<ol style="list-style-type: none"> 1. There is NO power on the pump circuit from the burner. 2. The pump motor has shut off on thermal overload. 	<ol style="list-style-type: none"> 1. Start the burner and adjust the air pressure regulator to 15 PSI. (a) If the amber "pump" light on the burner comes ON, the pump circuit on the burner has activated properly. Refer to the wiring diagram and ladder schematic in Appendix B to troubleshoot the pump circuit from the burner to the pump. (b) If the amber "pump" light on the burner does NOT come ON, there is a problem with pump circuit in the burner. With the burner running, check for power at the brown wire on the air pressure switch. If there is NO power at the brown wire, replace the burner motor. If there is power at the brown wire, replace the air sensing switch. 2. (a) The pump motor is too hot—the internal thermal protection switch shut the motor off. Wait for the motor to cool down; the thermal switch will automatically reset. Check voltage and amperage draw of the pump motor. Call your dealer if the problem persists. (b) The coupling is not adjusted properly, keeping the shafts of the motor and pump from turning freely. Re-position the coupling so that both shafts turn freely. (c) The shaft on the motor or oil pump will not turn freely. If you can't turn the shafts, replace the faulty part(s).
<p>Blower motor runs all the time.</p>	<ol style="list-style-type: none"> 1. Blower motor circuit is wired incorrectly. 	<ol style="list-style-type: none"> 1. Refer to wiring diagram and ladder schematic in Appendix B to troubleshoot the blower motor circuit.
<p>Blower motor will not run.</p>	<ol style="list-style-type: none"> 1. The blower motor is not wired correctly. 2. The Blower / Fan switch is defective. 3. The blower motor has overheated and shut down on thermal reset. 	<ol style="list-style-type: none"> 1. Check the blower motor wiring. Refer to the wiring diagram and ladder schematic in Appendix B. Follow the directions in Section 6 to test for proper fan operation. If the fan does not operate, shut OFF power to the furnace and call your Clean Burn dealer for service. 2. Replace the Blower / Fan switch. 3. Reset the red button on the motor thermal reset. Check voltage and amperage draw of the blower motor. Call your dealer if the problem persists.

APPENDIX A

Detailed Coil Tube Boiler Specifications

CTB Technical Specifications

Model	CB-200-CTB	CB-350-CTB	CB-500-CTB
Maximum Input	59 KW (200,000 BTUH)*	103 KW (350,000 BTUH)*	146 KW (500,000 BTUH)*
Listed Fuels	#2, #4, #5 fuel oils Used crankcase oil Used ATF Used hydraulic oil	#2, #4, #5 fuel oils Used crankcase oil Used ATF Used hydraulic oil	#2, #4, #5 fuel oils Used crankcase oil Used ATF Used hydraulic oil
Water Volume	19 Liters (5 Gallons)	45 Liters (12 Gallons)	78 Liters (20.6 Gallons)
Cabinet Dimensions	L X W X H 102cm X 74cm X 75cm (40" X 29" X 29 ½")	L X W X H 142cm X 86cm X 88cm (56" X 34" X 34.5")	L X W X H 168cm X 102cm X 107cm (66" X 40" X 42")
Overall Length (With Bumer / Breach)	150 cm (59")	188 cm (74")	218 cm (86")
Approximate Weight	307 Kg (677 lbs) – dry	562 Kg (1240 lbs) - dry	725 Kg (1600 lbs) - dry
Mounting	non-combustible floor	non-combustible floor	non-combustible floor
Electrical Requirements	230 Volts / 50 Hz	230 Volts / 50 Hz	230 Volts / 50 Hz
Maximum Fuse Size	20 Amps**	20 Amps**	20 Amps**
Approximate Amp Draw	9 Amps	10 Amps	12 Amps
Maximum Oil Consumption	5.3 LPH (1.4 GPH)	9.5 LPH (2.5 GPH)	12.9 LPH (3.4 GPH)
Oil Pump	Suntec A2RA-7710	Suntec A2RA-7710	Suntec A2RA-7710
Oil Pump Motor	Bison Gear Motor 1/20 HP	Bison Gear Motor 1/20 HP	Bison Gear Motor 1/20 HP
Pump Motor Rotation	CCW shaft end	CCW shaft end	CCW shaft end
Canister Filter	Lenz DH-750-100	Lenz DH-750-100	Lenz DH-750-100
Stack Size	20 cm (8")	20 cm (8")	25 cm (10")
Approximate Air Compressor Requirements	0.06 CMM @ 1.7 bar 2.0 CFM @ 25 PSI	0.07 CMM @ 1.7 bar 2.5 CFM @ 25 PSI	0.07 CMM @ 1.7 bar 2.5 CFM @ 25 PSI

*Nominal values; actual values will vary depending on installation.

** With optional accessories, 30 amps may be required.

Burner Technical Specifications

Model	CB-200-CTB	CB-350-CTB	CB-500-CTB
Burner	CB-500-CE 5W	CB-551-CE 5W	CB-551-H5-CE 5W
Ignition Transformer	Danfoss 14,000 Volts	Danfoss 14,000 Volts	Danfoss 14,000 Volts
Nozzle	Delavan 9-5	Delavan 9-5	Delavan 9-28
Burner Motor	1/10 HP 2800 RPM With Centrifugal Switch	1/10 HP 2800 RPM With Centrifugal Switch	1/10 HP 2800 RPM With Centrifugal Switch
Burner Motor Rotation	CCW Shaft End	CCW Shaft End	CCW Shaft End
Compressed Air Requirements	0.06 CMM @ 1.7 bar 2.0 CFM @ 25 PSI	0.07 CMM @ 1.7 bar 2.5 CFM at 25 PSI	0.07 CMM @ 1.7 bar 2.5 CFM at 25 PSI
Oil Primary Control	Danfoss	Danfoss	Danfoss
Heater Element in Preheater Block	450 Watts	450 Watts	500 Watts
Air Pressure Switch	MPL 808	MPL 808	MPL 808
Heater Thermostat	60 °C (140 °F)	60 °C (140 °F)	71 °C (160 °F)

NOTE: These specifications apply for each CTB unit or coil.

CB-200-CTB Hydronic Specifications

- Water flow through the boiler: 57 LPM (15 GPM) at 6.0-6.7 m (20-22 ft.) of head (pressure)
- 11 °C (20 °F) temperature rise (ΔT)
- Coil length: 34 m (112 ft) long, 2.5 cm (1") dia. steel tubing made to Sch. 40 piping specs
- Coil Volume: 19 Liters (5 Gallons)
- Coil Dry Weight: 86 Kg (189 lbs.)
- System operating pressure: 0.8 to 1.5 bar (12 to 22 psi)
- Standard relief valve setting: 2 bar (30 psi)
- Relief valve capacity: 550 MBH
- Heating surface: 3.6 m² (38.7 ft²)

CB-350-CTB Hydronic Specifications

- Water flow through the boiler: 95 LPM (25 GPM) at 5.5 m (18 ft.) of head (pressure)
- 11 °C (20 °F) temperature rise (ΔT)
- Coil length: 48 m (158 ft.) long, 3 cm (1-1/4") dia. steel tubing made to Sch. 40 piping specs
- Coil Volume: 47 Liters (12.3 Gallons)
- Coil Dry Weight: 163 Kg (359 lbs.)
- System operating pressure: 0.8 to 1.5 bar (12 to 22 psi)
- Standard relief valve setting: 2 bar (30 psi)
- Relief valve capacity: 710 MBH
- Heating surface: 6.3 m² (68 ft²)

CB-500-CTB Hydronic Specifications

- Water flow through the boiler: 132 LPM (35 GPM) at 6.7 m (22 ft.) of head (pressure)
- 11 °C (20 °F) temperature rise (ΔT)
- Coil length: 59 m (195 ft.) long, 3.8 cm (1-1/2") dia. steel tubing made to Sch. 40 piping specs
- Coil Volume: 78 Liters (20.6 Gallons)
- Coil Dry Weight: 240 Kg (530 lbs.)
- System operating pressure: 0.8 to 1.5 bar (12 to 22 psi)
- Standard relief valve setting: 2 bar (30 psi)
- Relief valve capacity: 970 MBH
- Heating surface: 9 m² (97 ft²)

CTB Accessories and Parts Reference

C.B. Part #

<u>500-CTB</u>	<u>350-CTB</u>	<u>200-CTB</u>	<u>Description</u>
11578	90187	90199	Boiler Stacking Adapter Kit (optional)
90206	90188	90200	Boiler Stand (optional)
		35116	Flange, 1" NPT (set)
	35061		Flange, 1-1/2 NPT (set)
	35079	35079	Flange, 1-1/4 NPT (set)
	35053	35053	Flange Gasket, 3-hole
35125			500 Flange Gasket, 3-hole
28150	28150	28150	Operating Aquastat, L4006A
28149	28149	28149	High Temperature Cut-off, L4006H
35123	35123	35123	Flow Switch (without paddle)
35124	35124	35124	Stainless Steel Paddle for Taco Flow Switch (sized to fit)
	35117		Stainless Steel Paddle for M&M Flow Switch (sized to fit)
33330	33330	33330	Temp-Pressure Boiler Gauge
35136	35135	35048	Relief Valve, 2 bar (30 psi)
35049	35049	35049	Well Immersion, 3/4" NPT

Ergomax Indirect Water Heater (Heat Exchangers)*

* *Contact the CB Parts/Service Department for help in specifying the appropriate model*

35096	E24, 98 liters (26 gallons)	
35097	E44, 182 liters (48 gallons)	
35098	E45, 182 liters (48 gallons)	
35099	E65, 273 liters (72 gallons)	
35100	E109, 450 liters (119 gallons)	
35107	Air Separator, EAS - 1-1/2	(1-1/2" piping with air vent)
35108	Air Separator, EAS -2	(2" piping with air vent)

Remote Temperature Controls

33557	Wall Thermostat
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CTB Dimensions

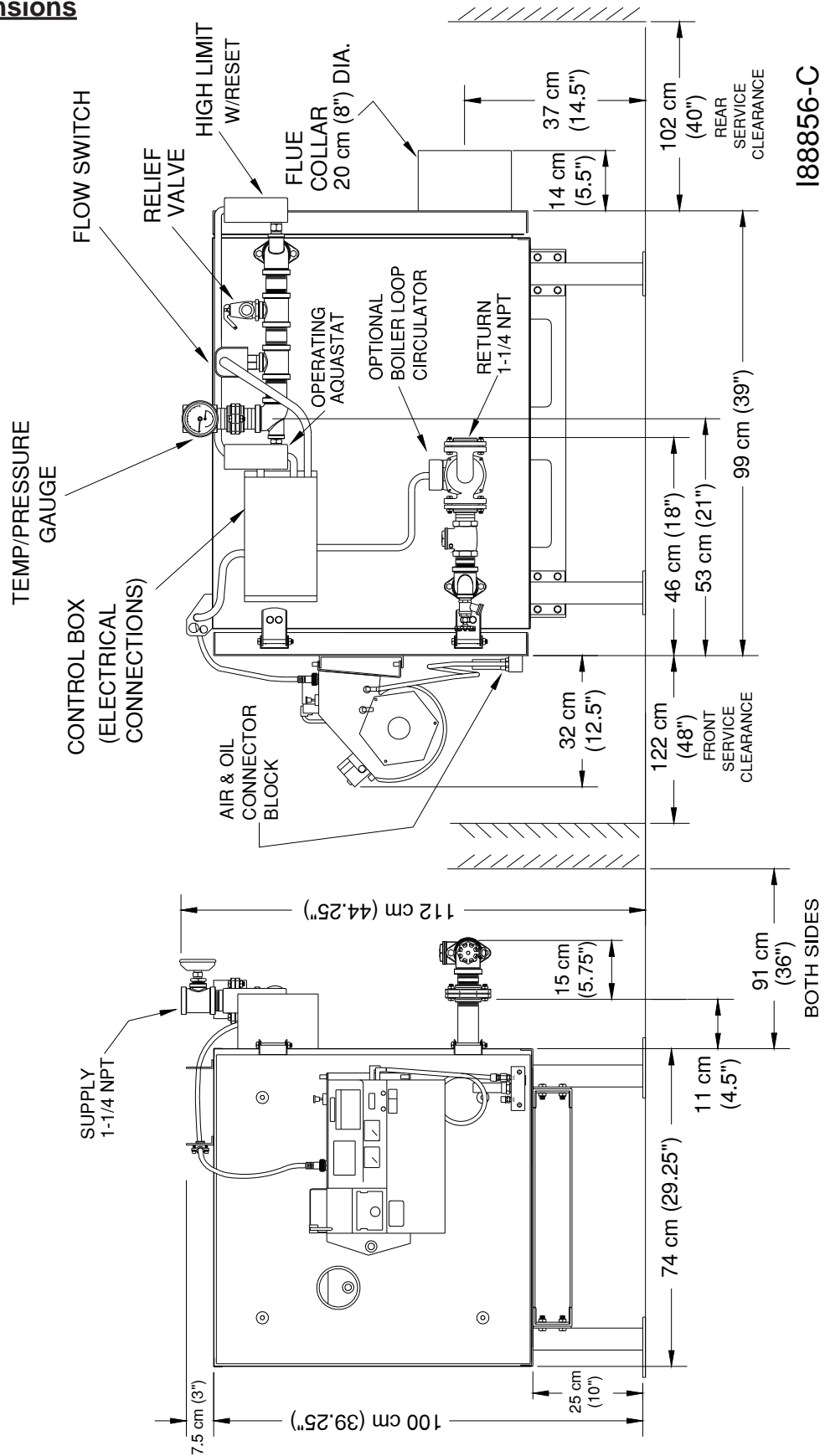


Figure A1 - Model CB-200-CTB Dimensions (Single Boiler)

CTB Dimensior

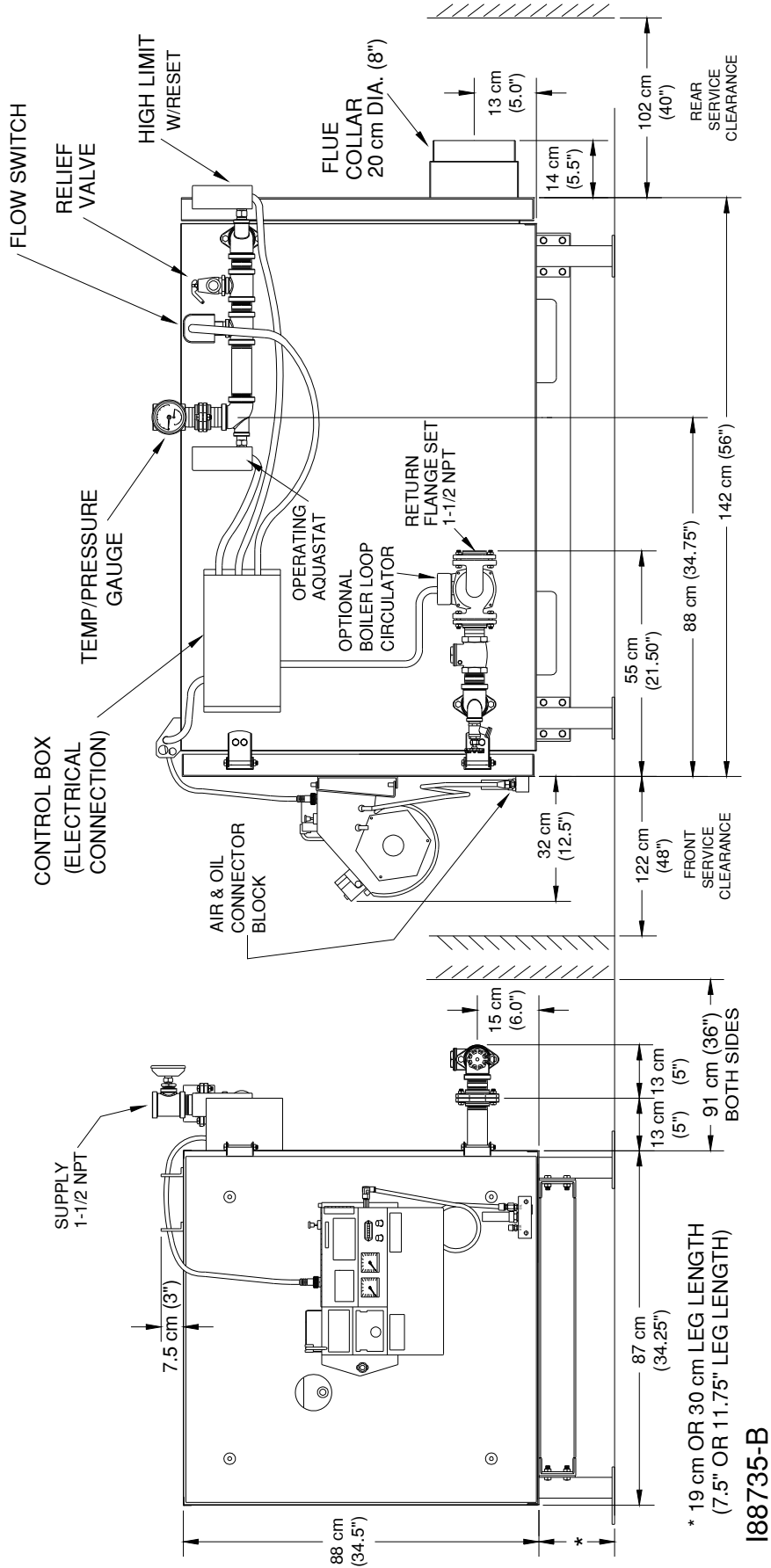
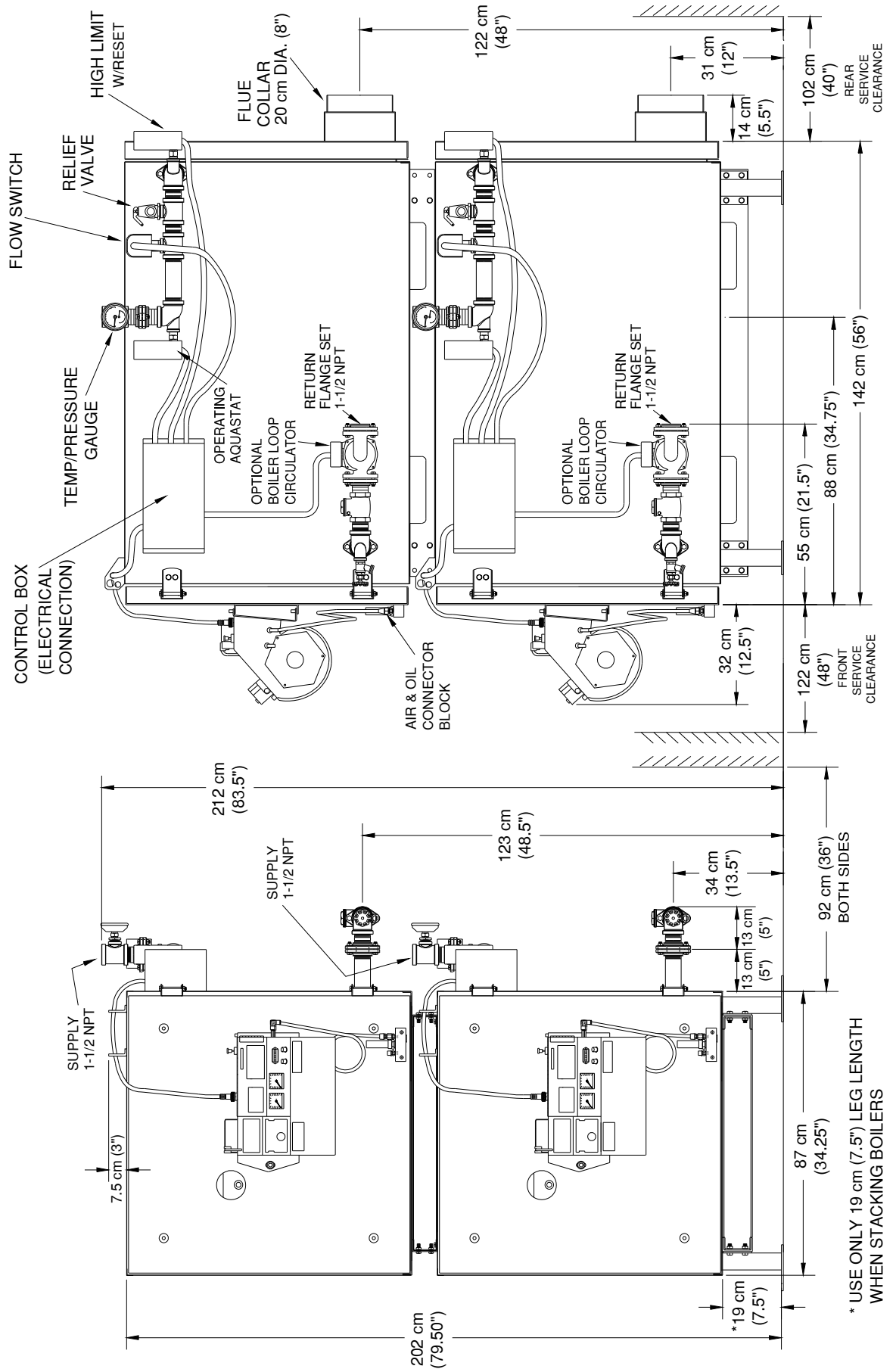


Figure A2 - Model CB-350-CTB Dimensions (Single Boiler)



* USE ONLY 19 cm (7.5") LEG LENGTH WHEN STACKING BOILERS

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Figure A3 - Dual-Stacked Boiler Dimensions (Two CB-350-CTB Boilers)

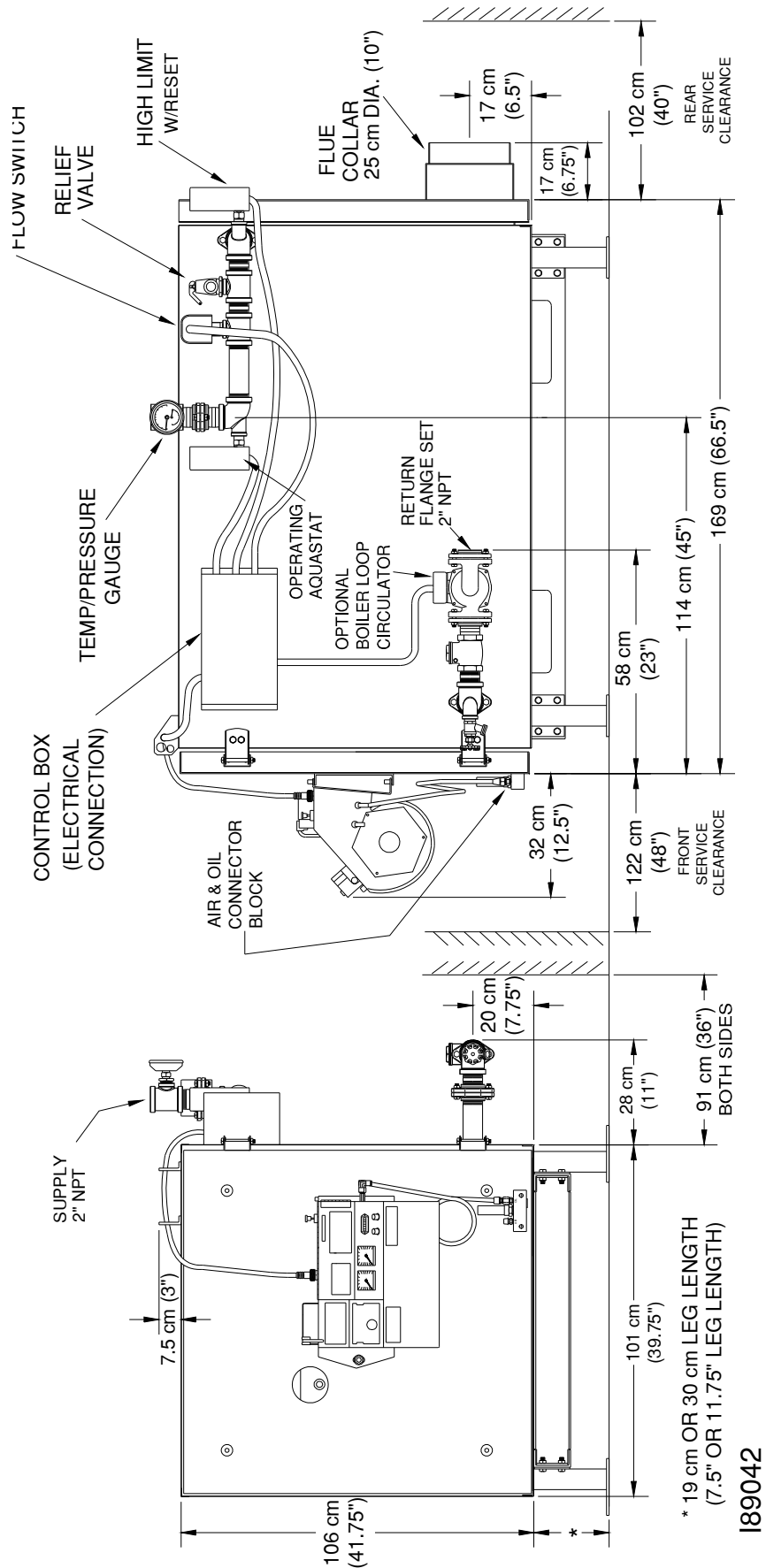
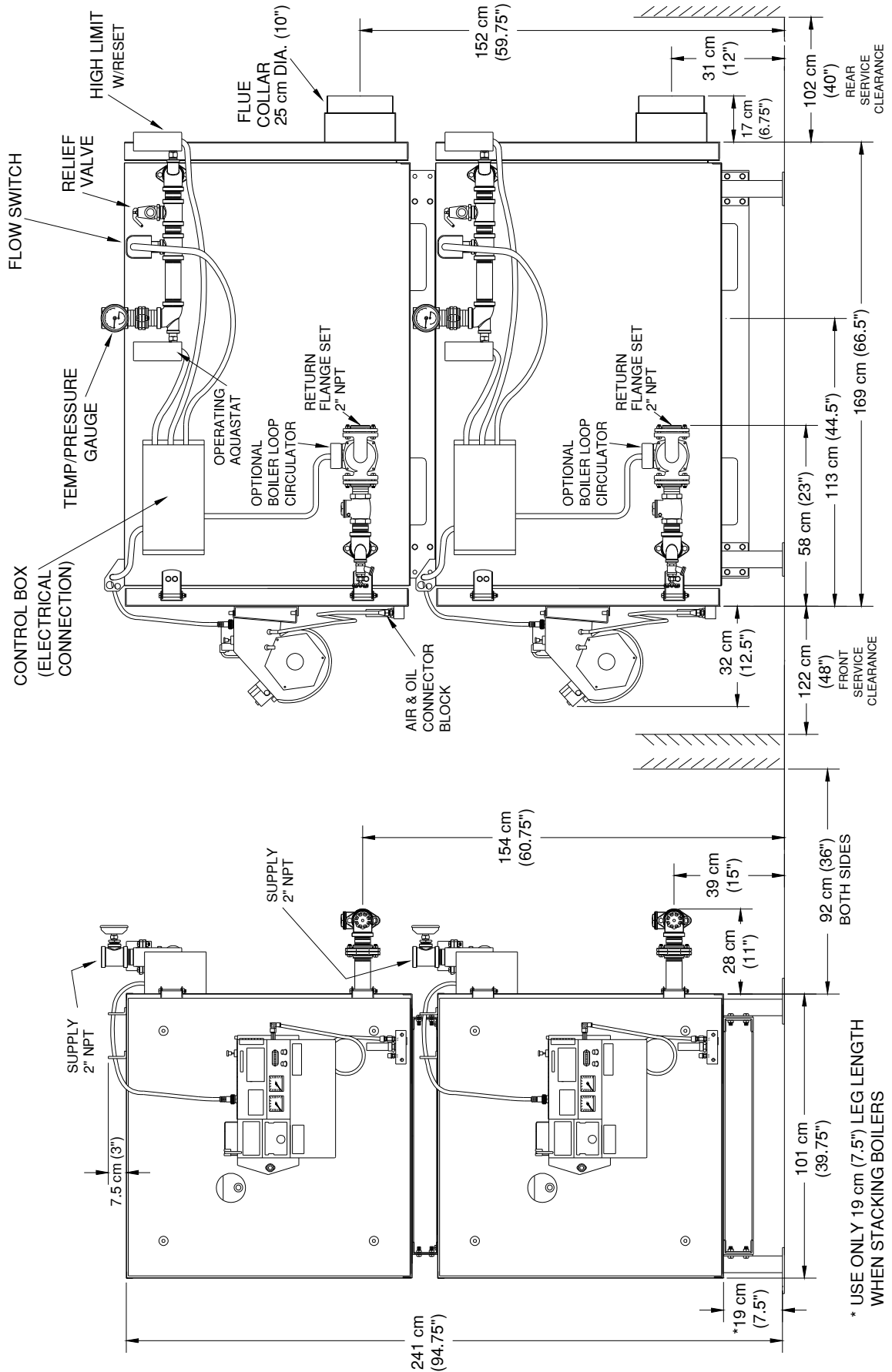


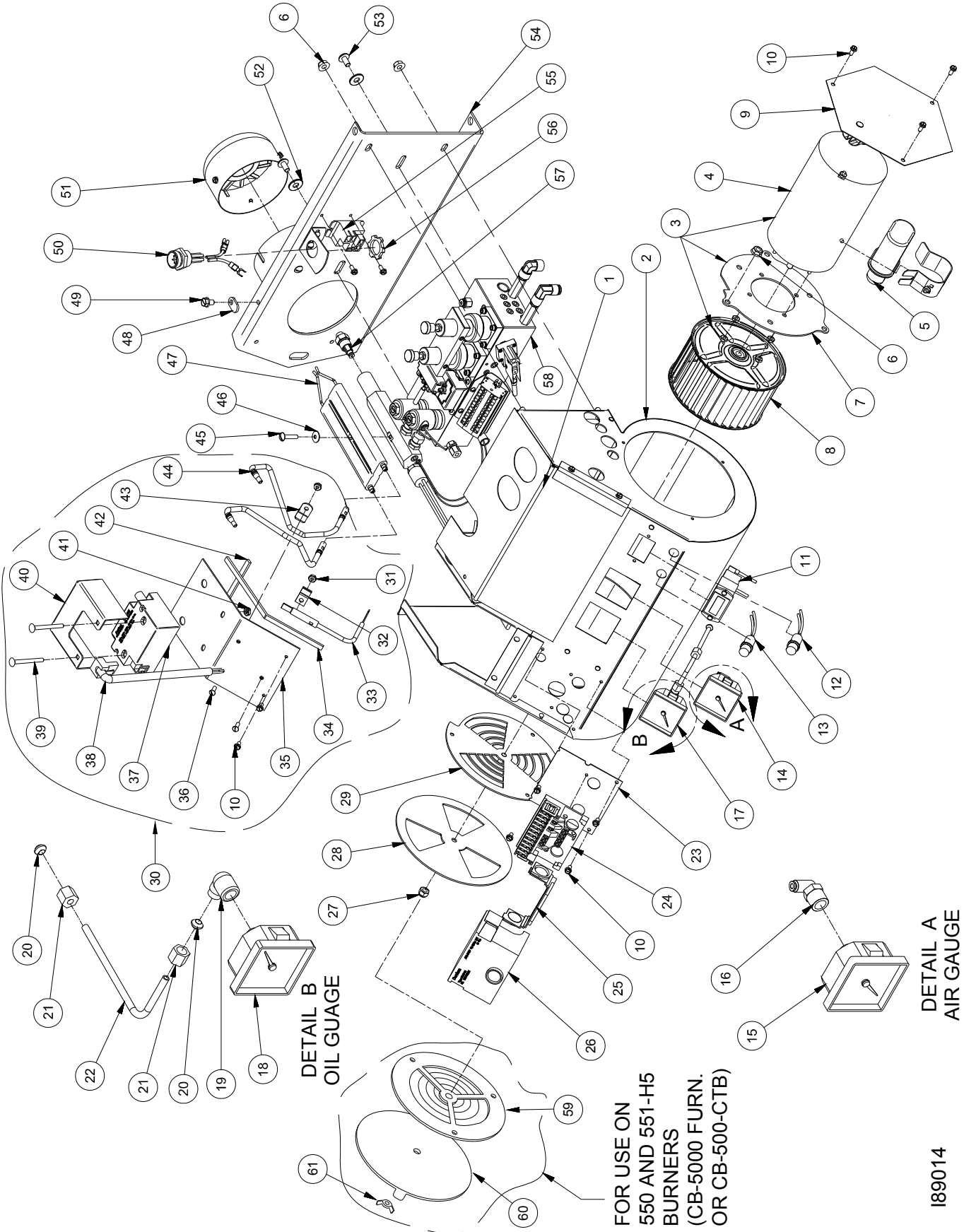
Figure A4 - Model CB-500-CTB Dimensions (Single Boiler)



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Figure A5 - Dual-Stacked Boiler Dimensions (Two CB-500-CTB Boilers)

Burner Components

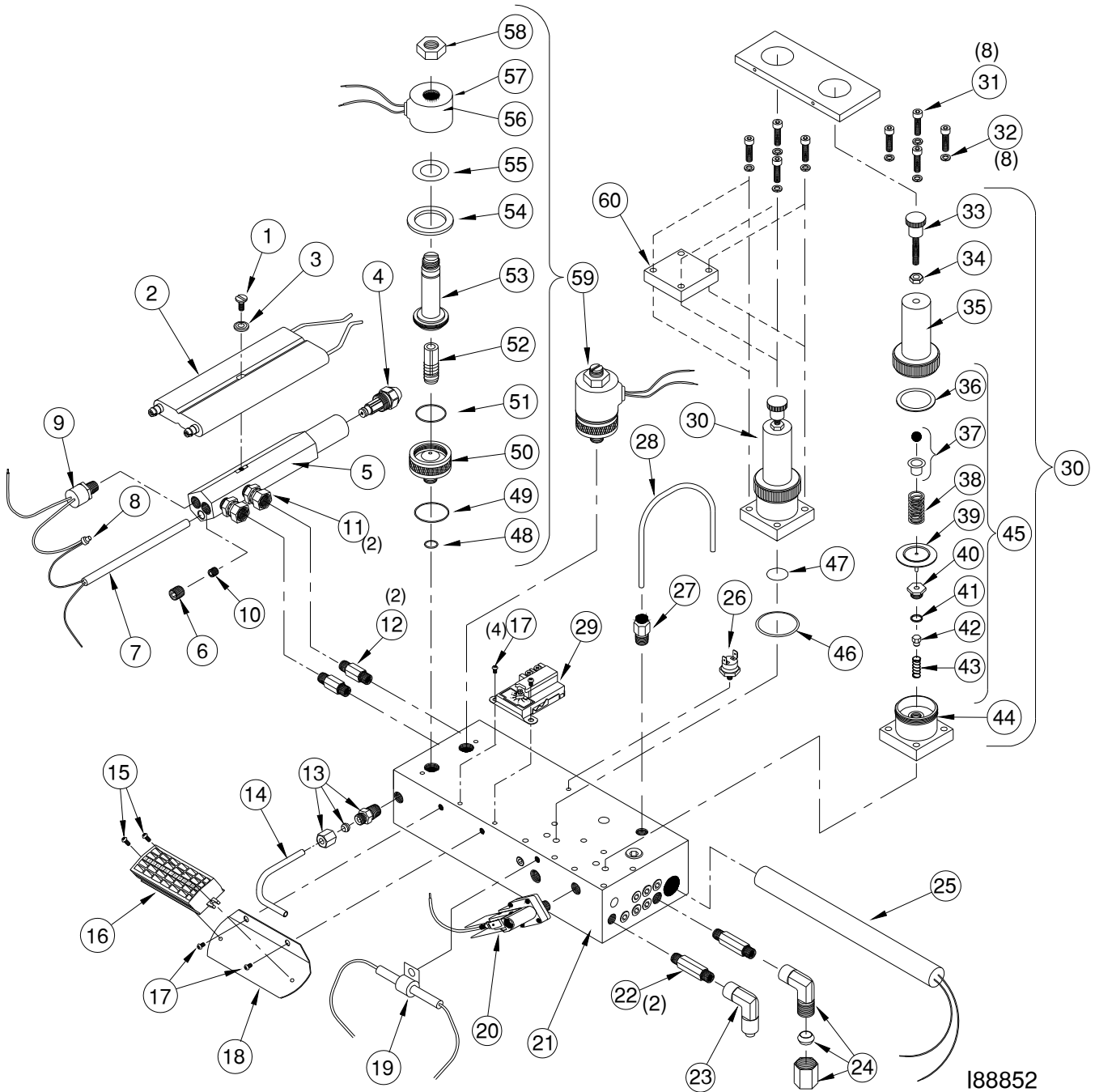


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Burner Components (continued)

<u>Item #</u>	<u>Part #</u>	<u>Description</u>	<u>Item #</u>	<u>Part #</u>	<u>Description</u>
1	11265	COVER - HINGED W A	42	31158	GASKET-SHORT.125"x.25"x3.8125"
2	11335	HOUSING A	43	33142	CLAMP 3/8 FLEX CONDUIT or 1/4
3	12230	BLOWER MOTOR A INT'L	44	33528	SPARK PLUG CABLE
4	33337	MOTOR CB 500-I BURNER	45	34326	10-32 X 7/8 SLOTD PAN HD SCREW
5	70439	CAPACITOR 1 MFD - 660v 50/60Hz	46	34165	#12 X 9/16 BONDED NEOPRENE
6	34092	1/4-20 HEX SERRATED FLANGE NUT	47	33527	ELECTRODES, PLUG-IN
7	26044	MOTOR MOUNT PLATE	48	26078	TRANSFORMER LID TAB
8	31113	FAN SQUIRREL CAGE	49	34155	1/4-20 X 1/2 SLOTTED HEX WASHR
9	14085	RIGHT SIDE COVER A	50	12285	CONNECTOR RECEPTICAL ASSY
10	34178	8-32 X 3/8 SLOTTED HEX W/F	51	11308	RETENTION HEAD A. S-40
11	33161	HOURMETER (50 HZ)		11376	RETENTION HEAD A. (350/500 CTB)
12	33338	AMBER LIGHT (230 V INT'L)		11427	RETENTION HEAD A. (CB-5000)
13	33166	GREEN LIGHT (230 V INT'L)	52	34052	1/4 USS FLAT WASHER ZINC
14	14087	GAUGE 0-60 A	53	34000	1/4-20 X 1/2 SLOT TRUSS M/S Z
15	32179	SQUARE GAUGE 0-60	54	11334	HINGE MOUNT PLATE WA
16	32253	FEM EL 1/8TPX1/8NPT	55	33529	COIL RELAY 240V AC 30A
17	14086	GAUGE 0-15 A	56	33250	LOCKNUT-CONDUIT 1/2
18	32178	SQUARE GAUGE 0-15	57	32000	NOZZLE 9-5 (30609-5 BULK)
19	32473	CONNECTOR FEMALE ELL BODY ONLY		32002	NOZZLE 9-11 (CB-5000)
20	32198	SLEEVE 3/16 OD TUBE		32006	NOZZLE 9-28 (CB-500-CTB)
21	32197	NUT 3/16 OD TUBE	58	13156	HEATER BLOCK A CB 500 I
22	54020	TUBING COPPER 3/16		13182	HEATER BLOCK A CB-551-H5 INT'L
23	26122	PLATE PRIMARY	59	11584	AIR INTAKE INNER PLATE
24	33522	BASE FOR BHO 64 PRIMARY	60	11585	AIR INTAKE OUTER PLATE
25	33523	FRONT PLATE	61	34417	WING NUT 5/16
26	33521	PRIMARY BURNER CONTROL BHO 64			
27	34124	1/4-20 ESNA NUT NE ZINC			
28	26103	PLATE - AIR FLOW OUTER			
29	11359	INNER DRAFT PLATE A			
30	11551	IGNITER PLATE ASSY			
	11605	IGNITER PLATE ASSY - 551-H5 BURNER			
31	34172	LOCK NUT (KEPS) 8-32 Z			
32	33208	WIRE CLAMP			
33	33525	PHOTO UNIT LD			
34	31159	GASKET 1/8" THICK			
35	26120	IGNITER PLATE			
36	34061	8-32 X 1/2 SLOTTED ROUND M/S Z			
37	33524	IGNITER, DANFOSS			
	33570	IGNITER, DANFOSS TYPE HPM			
38	33526	PRIMARY CABLE w/ PLUG			
39	34403	CARRIGE BOLT 10/24 x 2			
40	26121	IGNITER COVER			

Burner Components (continued)



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Figure A7 - CB-500-CE 5W and CB-551-CE 5W Preheater Block and Electrode Assemble Component Detail

Burner Components (continued)

<u>Item#</u>	<u>C.B. Part#</u>	<u>Qty.</u>	<u>Component Description</u>
1	34169	1	ELECTRODE SCREW - 10-32 x 3/4
2	33527	1	PLUG IN ELECTRODE
3	34165	1	WASHER
4	32000	1	9 - 5 NOZZLE
5	13150	1	NOZZLE ADAPTOR
6	32007	1	PLUG - 1/8 NPT
7	33375	1	140 WATTS HEATER
8	33381	1	INSULATED CAP CRIMP CONNECTOR
9	33418	1	THERMOSTAT L-130
10	32199	1	PLUG - 1/16 NPT
11	32050	2	SWIVEL FITTING
12	32189	2	HEX NIPPLE - 1/8 NPT x 1-1/2
13	32043	1	MALE CONNECTOR - 3/16T x 1/8 NPT
14	54020	1	3/16 COPPER TUBING(OIL GAUGE LINE)
15	32201	2	MACH. SCREW PHILLIPS HD. 6-32 x 3/8 Z
16	33247	1	TERMINAL BLOCK
17	34036	4	MACH. SCREW PHILLIPS HD. 6-32 x 1/4 Z
18	26059	1	TERMINAL BLOCK BRACKET
19	33278	1	THERMAL CUT-OFF
20	33057	1	AIR PRESSURE SWITCH
21	26090	1	HEATER BLOCK
22	32190	2	HEX NIPPLE - 1/8 NPT x 2
23	32202	1	FEMALE ELBOW (FOR 1/4" AIR LINE)
24	32201	1	FEMALE ELBOW (FOR 3/8" OIL LINE)
25	33289	1	PRE-HEATER ELEMENT (450 WATTS)
26	33378	1	PROVING SWITCH (NORMALLY OPEN)
27	32325	1	MALE ELBOW 1/8 x 1/8 NPT (FOR AIR GAUGE LINE)
28	54020	1	3/16 COPPER TUBING(OIL GAUGE LINE)
29	33011	1	HEATER BLOCK THERMOSTAT(NORMALLY CLOSED)
30	32359	2	REGULATOR SURFACE MOUNT
31	34148	8	REGULATOR MOUNTING SCREW
32	34114	8	LOCK WASHER #8 Z
33	34147	2	REGULATOR THREADED STEM
34	34022	2	HEX NUT - 10-32 Z
35	32306	2	BONNET
36	32226	2	DIAPHRAM RING
37	32364	2	CAP AND BALL ASSEMBLY
38	32227	2	COMPRESSION SPRING
39	32360	2	DIAPHRAM
40	32361	2	BRASS POPPET SEAT
41	32223	2	POPPET 'O' RING
42	32222	2	POPPET VALVE
43	32221	2	POPPET SPRING
44	32362	2	BASE
45	13142	2	REGULATOR KIT COMPONENTS
46	32308	2	REGULATOR OUTER "O" RING
47	32309	2	REGULATOR INNER "O" RING
48	33311	2	SOLENOID INNER "O" RING
49	33312	2	SOLENOID OUTER "O" RING
50	33313	2	MANIFOLD MOUNT SOLENOID BODY
51	33314	2	BODY "O" RING
52	33315	2	PLUNGER ASSEMBLY
53	33316	2	PLUNGER GUIDE ASSEMBLY
54	33317	2	FLUX PLATE
55	33318	2	WASHER SEAL
56	33384	2	COIL (230 V)
57	33320	2	COIL HOUSING
58	33321	2	NUT
59	33371	2	AIR/OIL SOLENOID ASSEMBLY (230 V)
60	26107	1	REG. SQUARE CAP

Burner Components (continued)

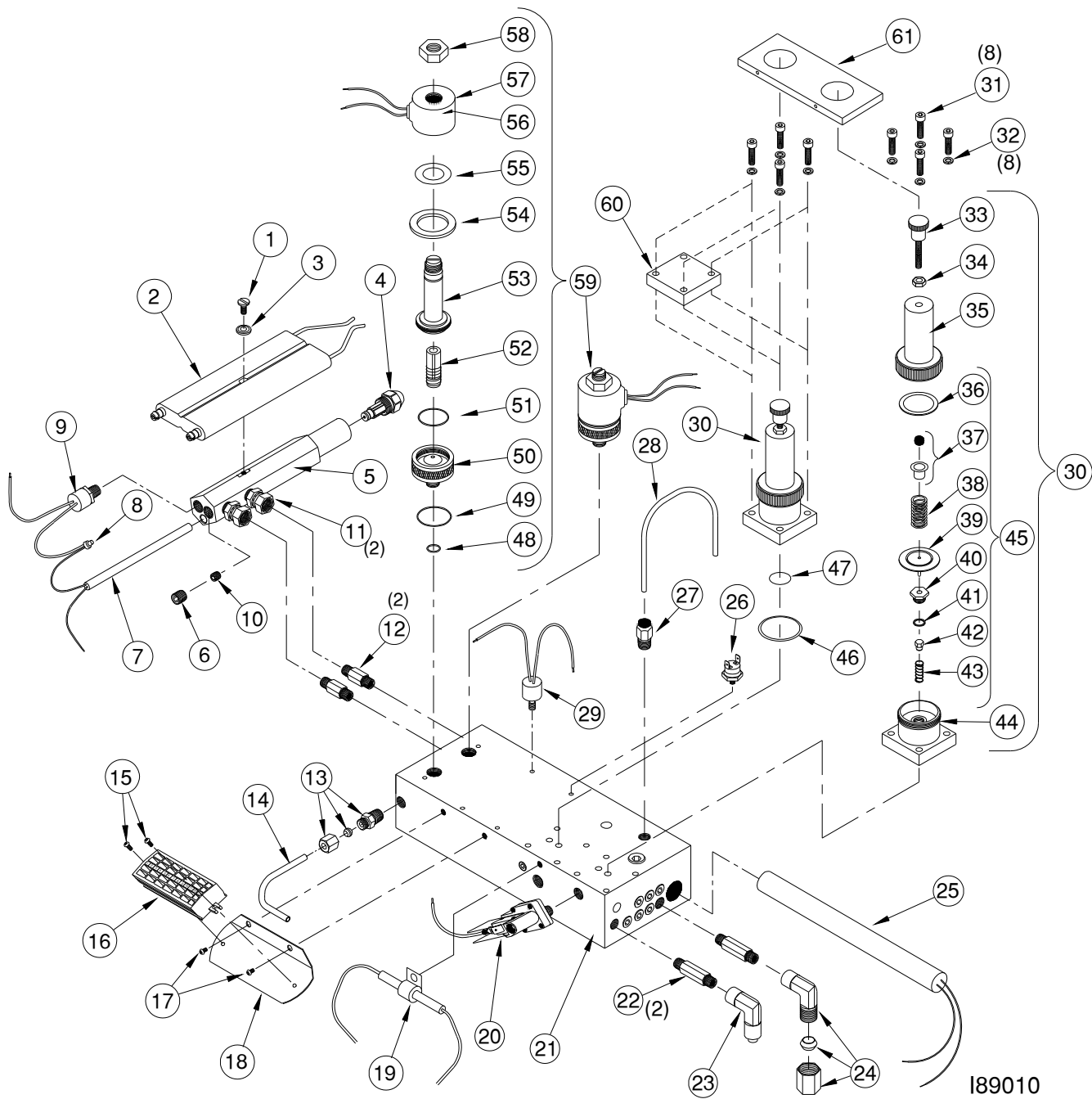


Figure A8 - CB-551-H5 CE 5W Preheater Block and Electrode Assemble Component Detail

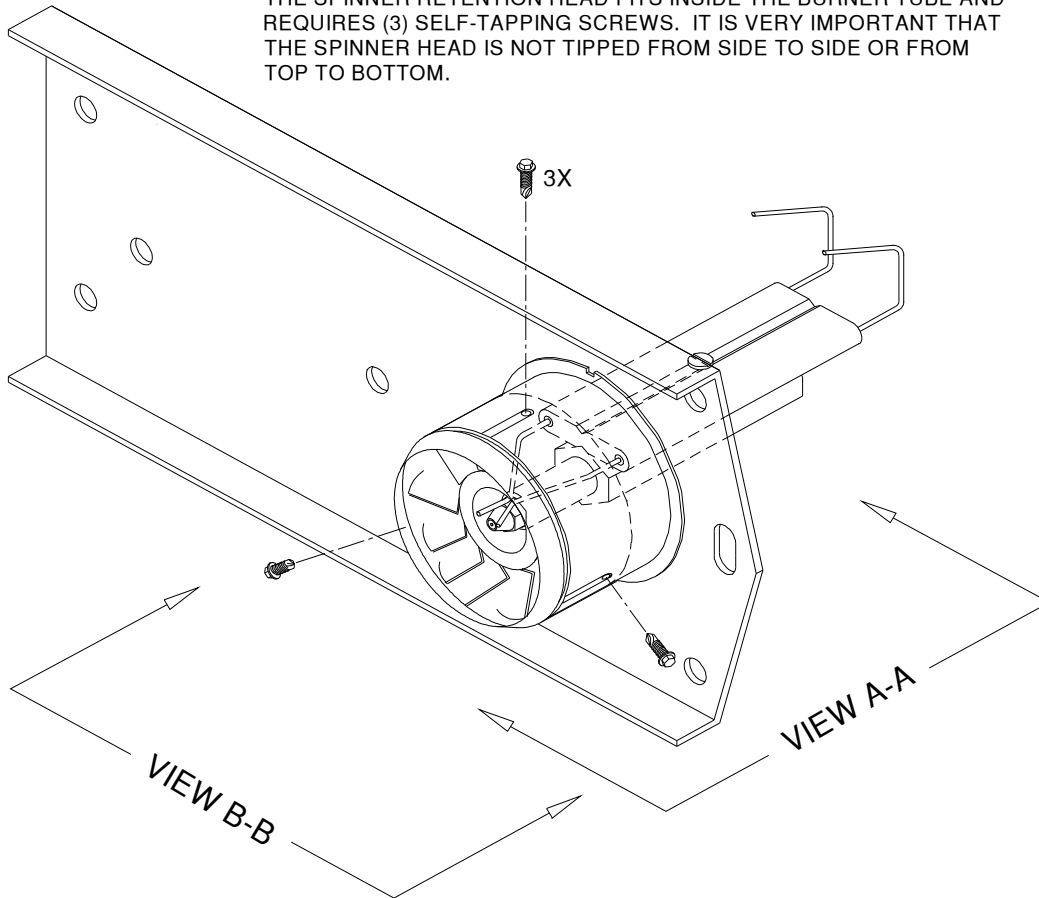
Burner Components (continued)

<u>Item #</u>	<u>Part #</u>	<u>Description</u>	<u>Item #</u>	<u>Part #</u>	<u>Description</u>
1	34326	10-32 X7/8 SLOTD PAN HD SCREW	41	32223	POPPET O-RING (VITON)
2	33527	ELECTRODES, PLUG-IN CB-500-5W	42	32222	POPPET VALVE
3	34165	#12 X9/16 BONDED NEOPRENE	43	32221	POPPET SPRING
4	32006	NOZZLE 9-28 (CB-551-H5)	44	32362	BASE REGULATOR MONNIER
5	26089	NOZZLE ADAPTER	45	13142	REGULATOR KIT
6	32007	PLUG HEX SOC 1/8 NPT	46	32308	O-RING LARGE (Surf Mnt Regltr)
7	33375	HEATER NOZZLE 140 WATT (230 V)	47	32309	O-RING
8	33381	CONNECTOR CRIMPED	48	33311	O RING INNER
9	33418	THERMOSTAT L130	49	33312	O RING OUTER
10	32199	PLUG HEX SOC 1/16 NPT	50	33313	BODY MANFOLD MOUNT
11	32050	SWIVEL ADAPTER 1/8X1/8	51	33314	O RING BODY
12	32189	NIPPLE 1/8 NPT X 1 1/2	52	33315	NUCLEUS (PLUNGER ASSEMBLY)
13	32043	MALE 3/16T X1/8NPT Connector	53	33316	PLUNGER GUIDE A
14	54020	TUBING COPPER 3/16	54	33317	PLATE FLUX
15	34137	6-32 X 3/8 PAN PHILTYPE-F	55	33318	WASHER SEAL
16	33247	TERMINAL BLOCK	56	33384	COIL - 230V/50Hz
17	34036	6-32 X 1/4 PHILPAN HEAD	57	33320	HOUSING
18	26059	TERMINAL BLOCK BRKT	58	33321	NUT
19	33278	THERMAL CUT-OFF 199	59	33371	SOLENOID 230V 50 HZ KIP
20	33057	AIR PRESSURE SWITCH	60	26107	CAP REGULATOR REPLACEMENT
21	26126	HEATER BLOCK H5	61	26055	LOCK PLATE
22	32190	NIPPLE 1/8 NPT X 2			
23	32202	FEM EL 1/4T PUSH X 1/8NPT			
24	32201	FEM EL 3/8T COMP X 1/8NPT			
25	33569	HEATER 500 W (230V 50HZ INT'L)			
26	33378	PROVING SW. 120V/230V			
27	32325	FITTING STRAIGHT MALE			
28	32485	TUBING NYLON AIR 1/8" x 13"			
29	33561	HEATER BLOCK THERMOSTAT - L160			
30	32359	REGULATOR			
31	34148	8-32 X 5/8 SOCKT HEAD CAP SCRW			
32	34114	#8 MEDIUM L/W ZINC			
33	34147	THD KNOB 10-32 X 1.5			
34	34022	HEX N 10-32 Z			
35	32306	BONNET			
36	32226	DIAPHRAGM RING			
37	32364	WASHER (CAP/BALL ASSEMBLY)			
38	32227	COMPRESSION SPRING			
39	32360	DIAPHRAGM - SOLID STEM			
40	32361	OBSOLETE - SEAT - USE 32305			

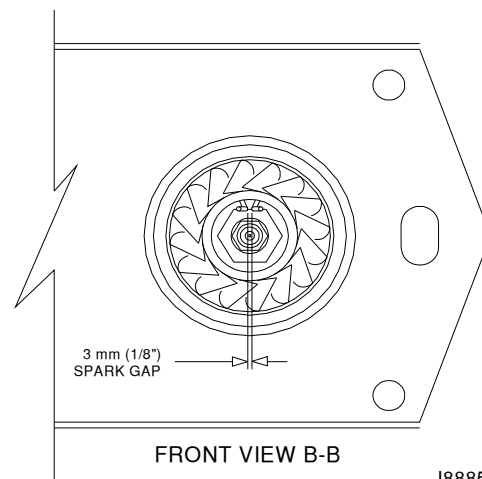
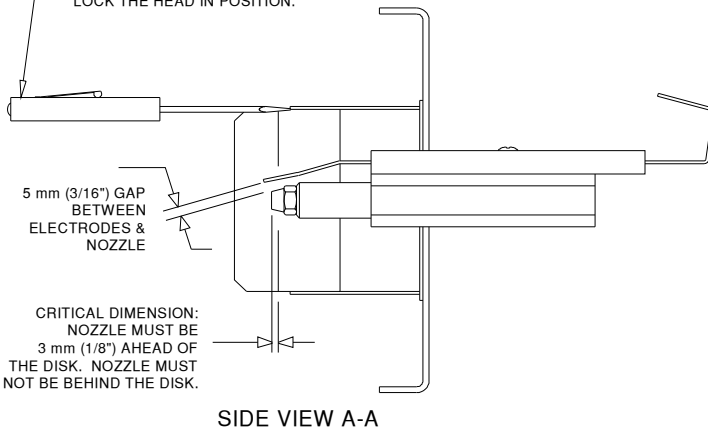
Burner Components (continued)

INSTALLATION OF THE SPINNER RETENTION HEAD

THE SPINNER RETENTION HEAD FITS INSIDE THE BURNER TUBE AND REQUIRES (3) SELF-TAPPING SCREWS. IT IS VERY IMPORTANT THAT THE SPINNER HEAD IS NOT TIPPED FROM SIDE TO SIDE OR FROM TOP TO BOTTOM.



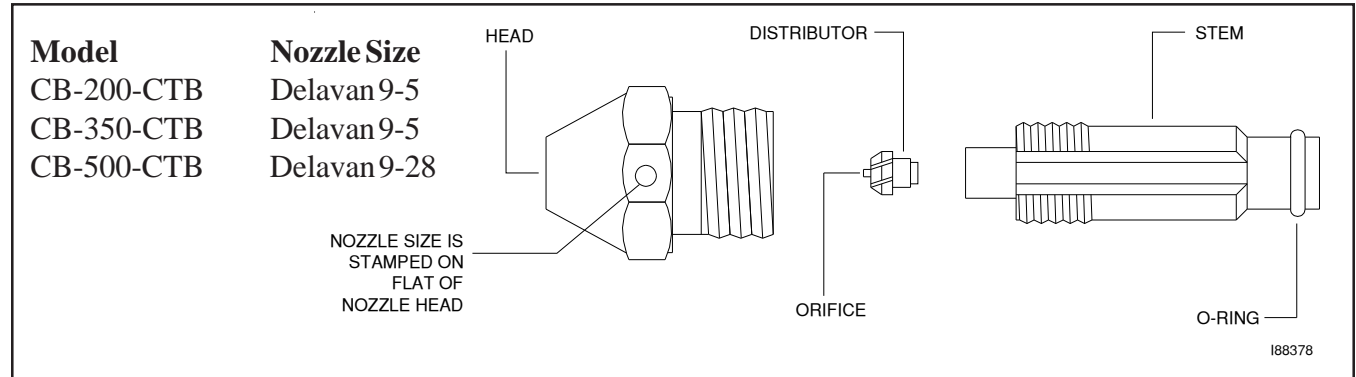
USE PROVIDED SCREWDRIVER AS WEDGE TO HOLD THE SPINNER RETENTION HEAD IN POSITION. THEN TIGHTEN THE THREE SCREWS TO LOCK THE HEAD IN POSITION.



188850

NOTE: Clean Burn recommends the use of a special tool (CB Part# 70306) to set the retention head.

Figure A9 - Burner Electrode Specifications

Burner Components (continued)**Removing the Nozzle for Cleaning:**

NOTE: Due to swivel fittings on the air and oil lines, it is not necessary to disconnect these lines when swinging the burner open.

1. Remove the lock-down nut on the mounting flange bolt.
2. Disconnect the burner power cable.
3. Carefully swing the burner open to its maintenance position.
4. Remove the nozzle from the nozzle adapter with a 5/8" socket.

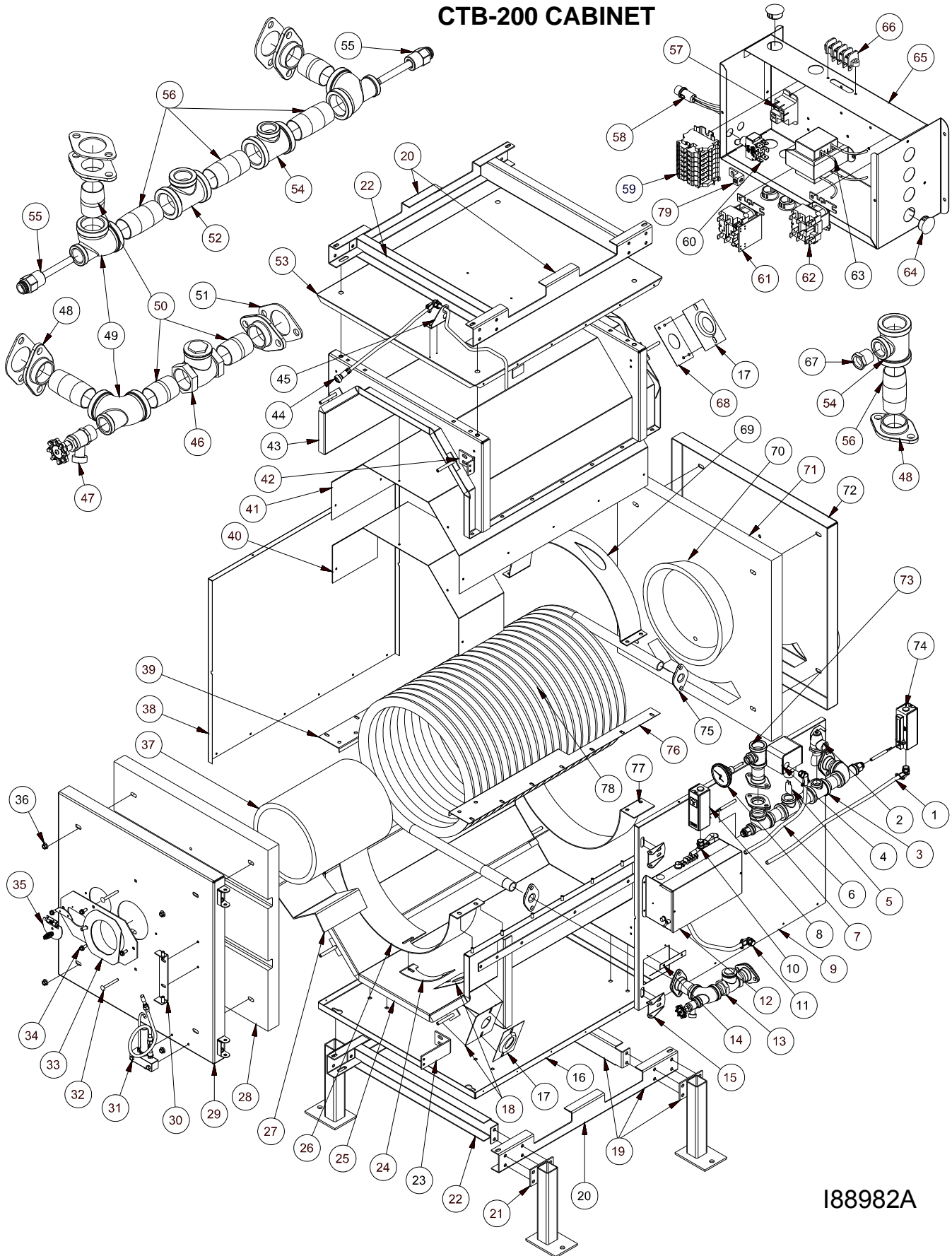
Cleaning the Nozzle:

1. Unscrew the stem from the nozzle head.
2. Spray WD-40 or equivalent through the orifice to thoroughly remove any blockage.
CAUTION: DO NOT damage or deform the nozzle orifice; DO NOT use a torch tip cleaner or other inappropriate device to clean the orifice. If the blockage is a "tarry" material or a hard, black material, call your Clean Burn dealer for service.
3. Flush all components with WD-40 to remove oil residues.
4. Reassemble the nozzle components. When tightening the stem, just barely "snug" it down. DO NOT overtighten.
5. Check the O-ring on the nozzle stem. Replace the O-ring if it is in the least bit cut or deformed.
6. Lubricate the O-ring on the nozzle stem with a couple of drops of new motor oil, then re-install the nozzle.
7. Check the electrodes for proper gap and clearances.
8. Re-install the burner and adjust for optimal performance as necessary.

NOTE: If the nozzle plugs within a few days after cleaning, call your Clean Burn Dealer for service.

Figure A10 - Cleaning the Nozzle

CTB-200 CABINET

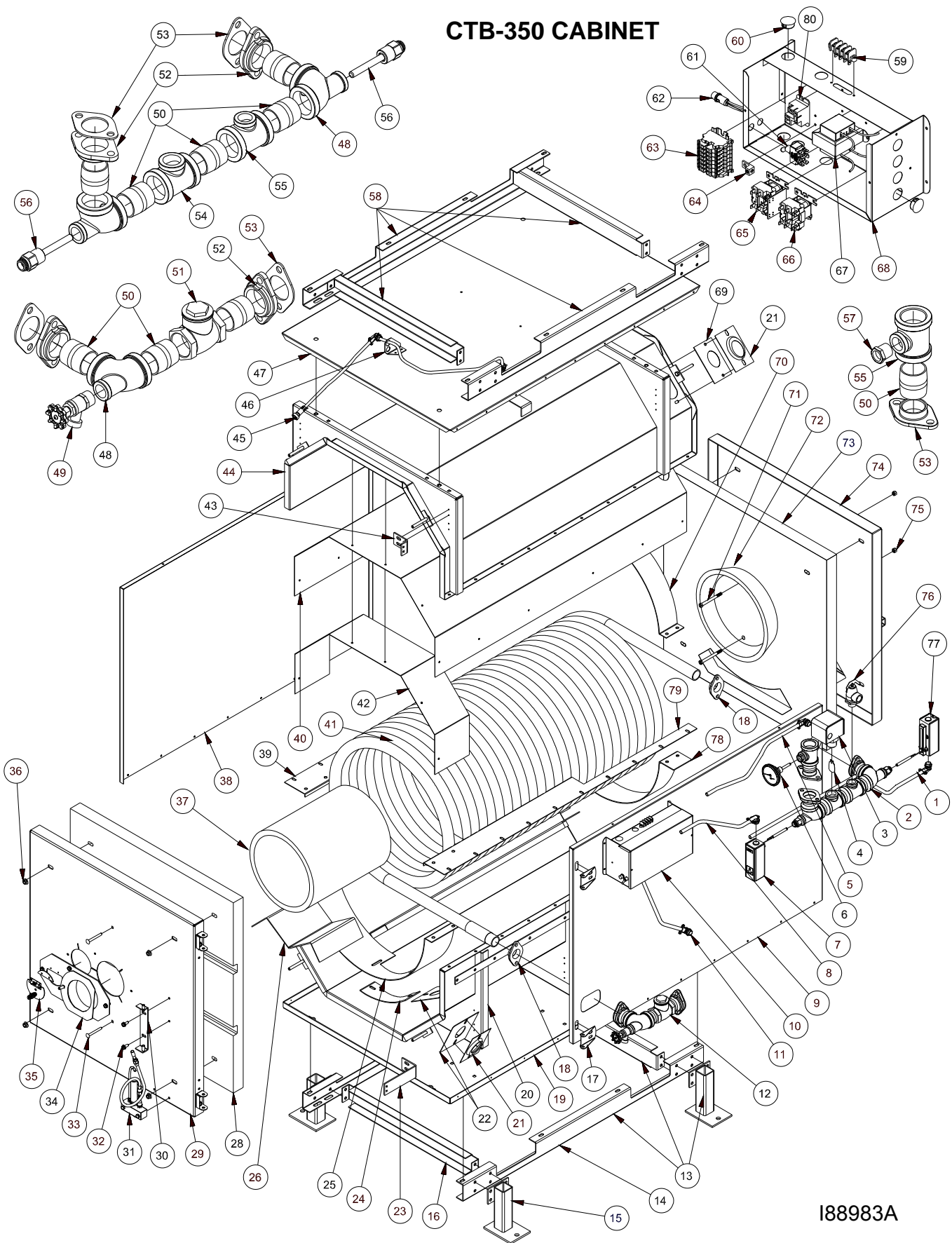


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CB-200-CTB Components

Item #	Part #	Description	Item #	Part #	Description
1	12282	WIRE HARNESS HI LIMIT A	50	35052	NIPPLE 1 1/4 X 2 BLK
2	35048	RELIEF VALVE 3/4 M	51	35053	GASKET FLANGE
3	14300	PIPE MANIFOLD 1 1/4 A	52	35119	1 1/4 X 1 1/4 X 1 TEE BLK
4	35123	FLOW SWITCH TACO	53	27140	JACKET TOP 200
5	35124	PADDLE FLOW SW 200CTB TACO	54	35066	TEE 1 1/4 X 1 1/4 X 3/4 BLK
6	12289	WIRE HARNESS FLOW SW 200 CE A	55	35049	WELL 3/4 NPT X 1 1/2 EXT (INS)
7	33330	GAUGE BOILER, TEMP-PRESSURE	56	35118	NIPPLE 1 1/4 X 3 BLK
8	28150	AQUASTAT 100-200F OPERATING	57	33529	COIL RELAY 240V AC 30A
9	27139	JACKET RH SIDE 200	58	33338	AMBER LIGHT (230 V INT'L)
10	12279	WIRE HARNESS OPER 200 A	59	33486	TERMINAL BLOCK (2 CIRCUIT)
11	12283	WIRE HARNESS CIR 200 A	60	33286	SWITCH DPDT ON-ON
12	12290	CONTROL BOX 230V CTB A	61	33352	RELAY DELAY
13	14298	PIPE & CHECK VALVE 1 1/4 A	62	33328	RELAY DPDT
14	27148	SHIELD RET TUBE	63	33340	TRANSFORMER 24-240V
15	21057	HINGE BRACKET	64	33131	KNOCK-OUT SEAL/PLUG
16	27136	BASE 200 CTB	65	27109	BOX JUNCTION A
17	27189	SEAL PLATE STAMPED 200	66	33331	TERMINAL BLOCK (4 POST) CTB
18	27144	SEAL PLATE FRONT OUTER	67	35057	BUSHING 3/4 X 1/2 BLK
19	11541	STAND 200 CTB A	68	27143	SEAL PLATE REAR OUTER
20	27151	CHANNEL ADPTER FRAME 200 CTB	69	27134	RING TOP STACK END
21	11542	LEG 200 CTB 11.4" WA	70	31264	EERGEY RETENTION DISC
22	27122	CHANNEL F/R 200/350 ADAPTOR	71	31215	INSULATION 200 REAR PANEL
23	27147	BRACKET HINGE 200 CTB	72	11539	PANEL REAR 200 CTB WA
24	27146	FILLER FRONT TUBE	73	14307	PIPE SUPPLY 1 1/4 CE A
25	11537	BASE 200 CTB WA	74	28149	AQUASTAT 100-240F HIGH LIMIT
26	27133	RING BURNER END	75	35116	FLANGE B&G 1 NPT
27	27155	STAND REFACY CYL 200 CTB	76	27132	BAFFLE RH 200
28	31216	INSULATION 200 FRONT DOOR	77	27129	RING BOTTOM STACK END
29	11540	DOOR 200 CTB WA	78	27803	COIL 1" TUBE 22.5 T 200CTB
30	11033	HINGE BRACKET W A	79	33145	SCREW LUG
31	14061	HOOK-UP KIT - 200,350,2800	80	33331	TERMINAL BLOCK (4 POST) CTB
32	34120	5/16-18 X 2 3/4 CARR BOLT S.S.			
33	11407	BURNER MOUNT CTB WA			
34	34158	1/4-20 FIN HEX NUT BRASS			
35	11325	INSPECTION DOOR A			
36	34009	3/8-16 HEX SERR FLANGE NUT PLT			
37	21120	REFRACTORY CYL 10 X 14			
38	27138	JACKET LH SIDE 200			
39	27131	BAFFLE LH 200			
40	27150	LINER PROTECTOR			
41	27149	LINER TOP CRADLE			
42	27123	BRACKET 350 HINGE			
43	11538	CRADLE TOP WA			
44	33534	CONN CORD 5-WIRE 51"			
45	27158	BRACKET BURNER CORD			
46	35115	SWING CHECK VALVE 1 1/4 NPT			
47	35065	BOILER DRAIN 3/4 NPT			
48	35079	FLANGE STAMPED (B&G) 1 1/4			
49	35051	TEE 1 1/4 X 3/4 X 1 1/4 BLK			

CTB-350 CABINET

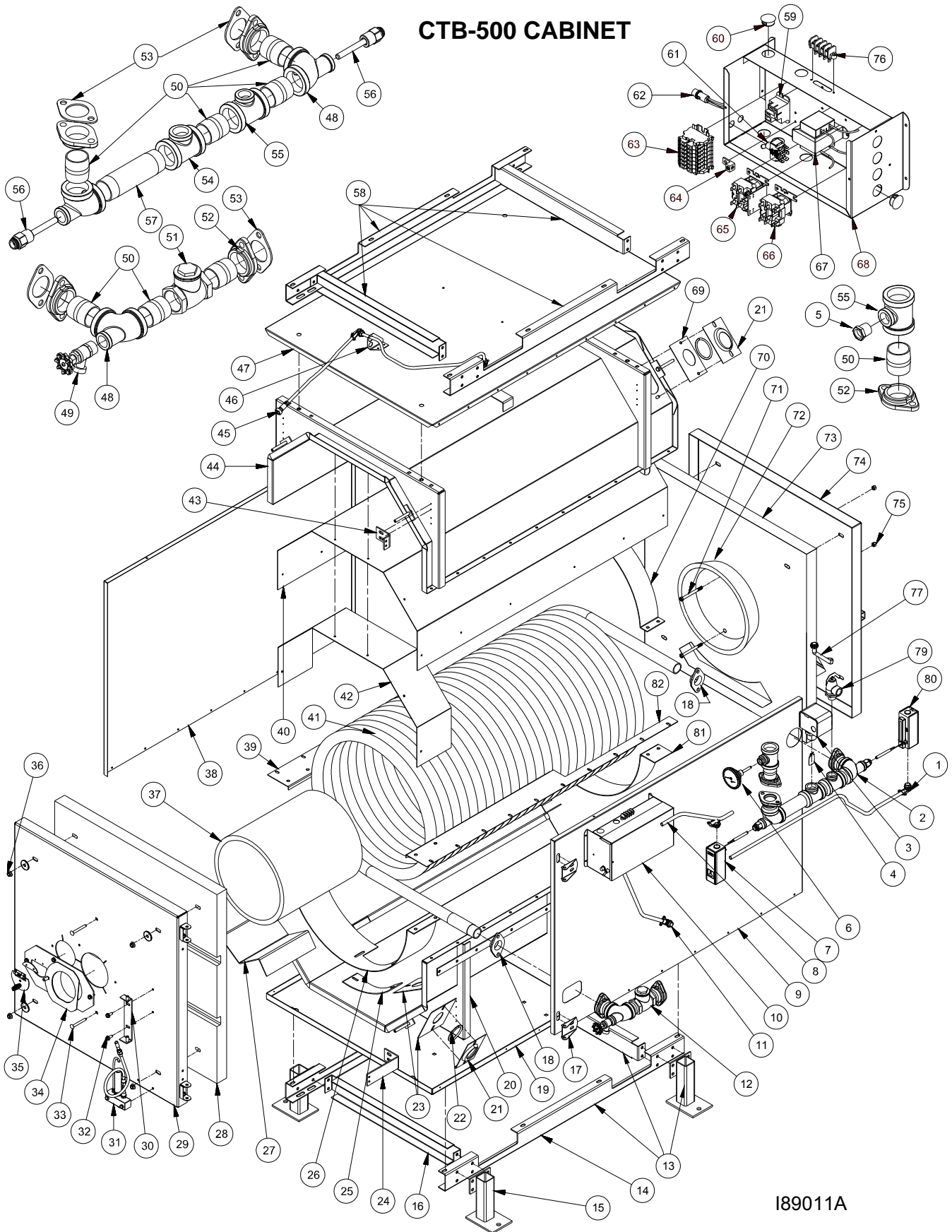


I88983A

CB-350-CTB Components

Item #	Part #	Description	Item #	Part #	Description
1	12246	WIRE HARNESS HI L A	50	35069	NIPPLE 1 1/2 X 2 BLK
2	14292	CTB UPPER PIPE ASSEMBLY - INTL	51	35081	SWING CHECK 1 1/2
3	35123	FLOW SWITCH TACO	52	35061	FLANGE SET 1 1/2 NPT
4	35124	PADDLE FLOW SW 200CTB TACO	53	35053	GASKET FLANGE
5	12276	WIRE HARNESS FLOW SWITCH -INTL	54	35084	TEE 1 1/2 X 1 1/2 X 1 BLK
6	33330	GAUGE BOILER, TEMP-PRESSURE	55	35083	TEE 1 1/2 X 1 1/2 X 3/4 BLACK
7	28150	AQUASTAT 100-200F OPERATING	56	35049	WELL 3/4 NPT X 1 1/2 EXT (INS)
8	12275	WIRE HARNESS OPER A - INTL	57	35057	BUSHING 3/4 X 1/2 BLK
9	27093	JACKET R.H. SIDE	58	90187	CTB 350 BOILER STACKING KIT
10	12250	CONTROL BOX 230 V A	59	33529	COIL RELAY 240 VAC 30A
11	12248	WIRE HARNESS CIR A	60	33131	KNOCK-OUT SEAL/PLUG
12	14293	CTB DRAIN PIPE ASSEMBLY - INTL	61	33286	SWITCH DPDT ON-ON
13	90188	STAND FOR 350 CTB BOLTED A	62	33338	AMBER LIGHT (230 V INT'L)
14	27121	CHANNEL SIDE 350 ADAPTOR	63	33486	TERMINAL BLOCK A (SCREW)
15	11557	LEG KIT 7" A	64	33145	SCREW LUG
16	27122	CHANNEL F/R 200/350 ADAPTOR	65	33352	RELAY DELAY
17	21057	HINGE BRACKET	66	33328	RELAY DPDT
18	35079	FLANGE STAMPED (B&G) 1 1/4	67	33340	TRANSFORMER 24-240V
19	27084	BASE CTB	68	27109	BOX JUNCTION A
20	11373	BASE CTB WA	69	27187	SEAL PLATE BACK OUTSIDE
21	27186	SEAL PLATE STAMPED 350	70	27089	RING TOP STACK END
22	27188	SEAL PLATE FRONT OUTSIDE	71	34150	3/8- 16 X 4 HEX HEAD BOLT
23	27193	DOOR MOUNTING BRACKET	72	31264	ENERGY RETENTION DISC
24	27191	FILLER FRONT TUBE 350 CTB	73	31166	INSULATION PANEL
25	27086	RING BURNER END	74	11380	PANEL REAR 350 WA
26	27053	STAND REFRACTORY BACK	75	34067	3/8-16 FIN HEX NUT 18-8 S.S.
27	27052	STAND REFRACTORY FRNT	76	35048	RELIEF VALVE 3/4 M
28	31176	INSULATION 350 DOOR	77	28149	AQUASTAT 100-240F HIGH LIMIT
29	11405	DOOR WA	78	27037	RING STACK END
30	11033	HINGE BRACKET W A	79	27088	BAFFLE LH
31	14061	HOOK-UP KIT - 200,350,2800	80	33331	TERMINAL BLOCK (4 POST) CTB
32	34158	1/4-20 FIN HEX NUT BRASS			
33	34120	5/16-18 X 2 3/4 CARR BOLT S.S.			
34	11407	BURNER MOUNT CTB WA			
35	11325	INSPECTION DOOR A			
36	34009	3/8-16 HEX SERR FLANGE NUT PLT			
37	21029	CYLINDRICAL REFRACTORY			
38	27050	JACKET L.H. SIDE			
39	27087	BAFFLE RH			
40	27090	LINER COMBUSTION CHAMBER			
41	27802	COIL 1 1/4 PIPE 26.5T			
42	27115	LINER PROTECTOR			
43	27123	BRACKET 350 HINGE			
44	11374	COVER TOP WA			
45	33534	CONN CORD 5-WIRE 51"			
46	27158	BRACKET BURNER CORD			
47	27095	JACKET TOP CTB			
48	35082	TEE 1 1/2 X 3/4 X 1 1/2 BLK			
49	35065	BOILER DRAIN 3/4 NPT			

CTB-500 CABINET



I89011A

CB-500-CTB Components

Item #	Part #	Description	Item #	Part #	Description
1	12296	WIRE HARNESS HI L A	42	27180	LINER PROTECTOR
2	14315	CTB 500 UPPER PIPE ASSY.	43	27193	BRACKET 500 HINGE
3	35123	FLOW SWITCH TACO	44	11562	COVER TOP WA
4	35124	PADDLE FLOW SWITCH TACO	45	33534	CONN CORD 5-WIRE 51"
5	35057	BUSHING 3/4 X 1/2 BLK	46	27158	BRACKET BURNER CORD
6	33330	GAUGE BOILER, TEMP-PRESSURE	47	27173	JACKET TOP CTB
7	28150	AQUASTAT 100-200F OPERATING	48	35133	TEE 2 X 3/4 X 2 BLK
8	12299	WIRE HARNESS OPERATING AQUASTAT	49	35065	BOILER DRAIN 3/4 NPT
9	27172	JACKET R.H. SIDE	50	35128	NIPPLE 2 X 2 1/2 BLK
10	12290	CONTROL BOX 230V ASSY.	51	35126	SWING CHECK 2"
11	12248	WIRE HARNESS CIR A	52	35120	FLANGE 500 2" NPT
12	14314	CHECK / DRAIN PIPE ASSEMBLY	53	35125	GASKET FLANGE 2"
13	90206	STAND FOR 500 CTB BOLTED A	54	35132	TEE 2 X 2 X 1 BLK
14	27195	CHANNEL SIDE 500 ADAPTOR	55	35131	TEE 2 X 2 X 3/4 BLACK
15	11552	LEG KIT 11 3/4" A	56	35049	WELL 3/4 NPT X 1 1/2 EXT (INS)
16	27122	CHANNEL F/R 200/350/500 ADAPTOR	57	35127	NIPPLE 2 X 6 BLK
17	21057	HINGE BRACKET	58	11578	CTB 500 BOILER STACKING KIT
18	35121	FLANGE 500 1 1/2 NPT	59	33529	COIL RELAY 240V AC 30A
19	27170	BASE CTB	60	33131	KNOCK-OUT SEAL/PLUG
20	11572	BASE CTB WA	61	33286	SWITCH DPDT ON-ON
21	27178	SEAL PLATE STAMPED 500	62	33338	AMBER LIGHT 240V
22	54013	ROPE-FIBERGLASS 44in	63	33486	TERMINAL BLOCK A (SCREW)
23	27177	SEAL PLATE FRONT OUTSIDE	64	33145	SCREW LUG
24	11581	DOOR MOUNTING BRACKET	65	33352	RELAY DELAY
25	27179	FILLER FRONT TUBE 500 CTB	66	33328	RELAY DPDT
26	27166	RING BURNER END	67	33340	TRANSFORMER 24-240V
27	27200	STAND REFRACTORY 1 Pc 500	68	27109	BOX JUNCTION A
28	31240	INSULATION 500 DOOR FRONT	69	27176	SEAL PLATE FLAT REAT
29	11564	DOOR WA FRONT	70	27167	RING TOP STACK END
30	11582	HINGE BRACKET 3 DEG. W. A	71	34150	3/8 - 16 X 4 HEX HEAD BOLT
31	14103	HOOK-UP KIT - 5000	72	31264	ENERGY RETENTION DISC
32	34158	1/4-20 FIN HEX NUT BRASS	73	31239	INSULATION REAR DOOR 500
33	34120	5/16-18 X 2 3/4 CARR BOLT S.S.	74	11563	REAR 500 WA DOOR / BREACH
34	11407	BURNER MOUNT 3 DEG. CTB W.A.	75	34067	3/8-16 FIN HEX NUT 18-8 S.S.
35	11325	INSPECTION DOOR A	76	33331	TERMINAL BLOCK (4 POST) CTB
36	34009	3/8-16 HEX SERR FLANGE NUT PLT	77	12298	WIRE HARNESS FLOW SWITCH
37	21174	CYLINDRICAL REFRACTORY	79	35136	RELIEF VALVE 3/4 FM
38	27171	JACKET L.H. SIDE	80	28149	AQUASTAT 100-240F HIGH LIMIT
39	27163	BAFFLE L.H.	81	27165	RING STACK END
40	27181	LINER COMBUSTION CHAMBER TOP	82	27164	BAFFLE RH
41	27804	COIL 1 1/2 PIPE 28.5T 500CTB			

APPENDIX B

Wiring Diagrams

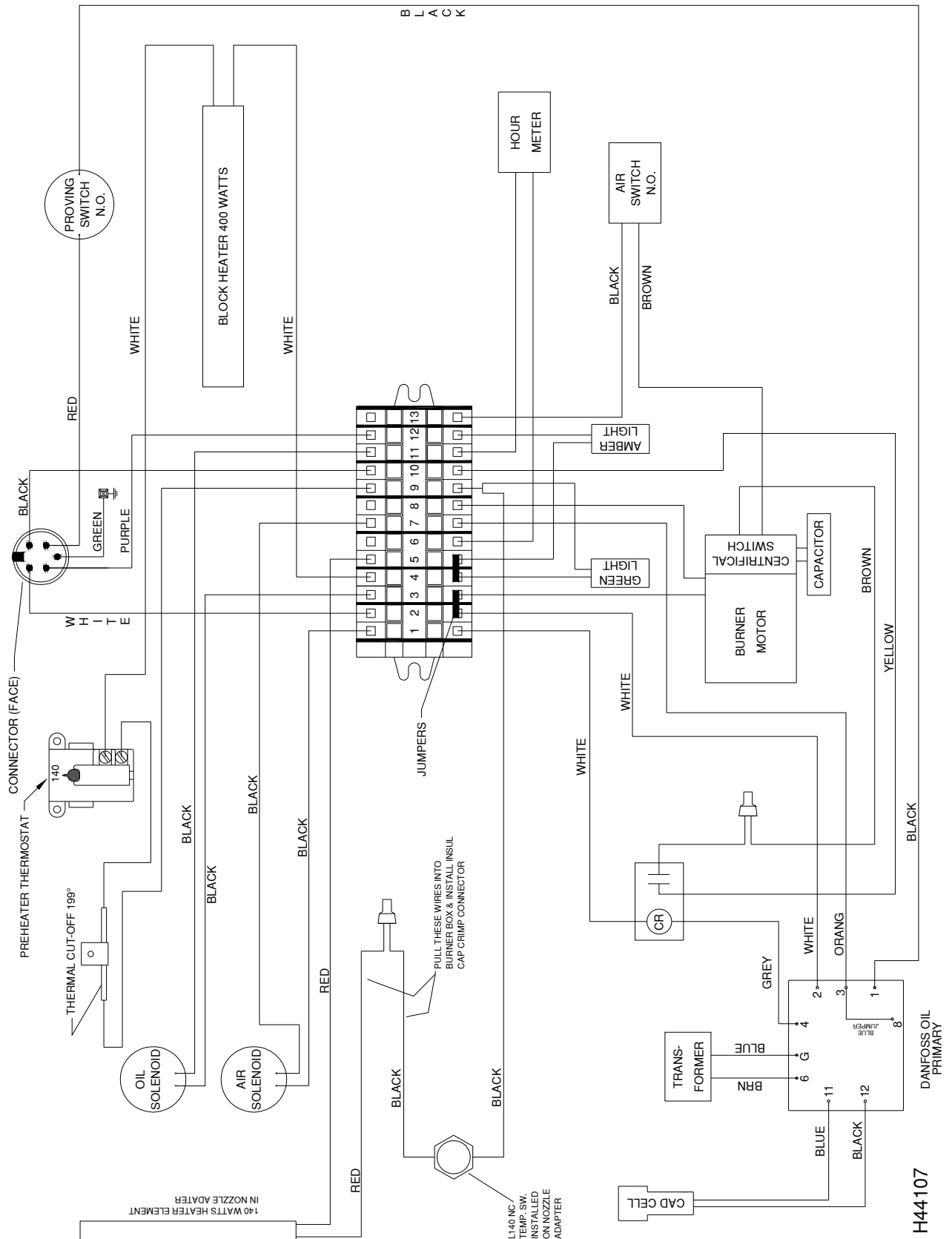


Figure B1 - CB-500-CE 5W and CB-551-CE 5W Burner Wiring Diagram

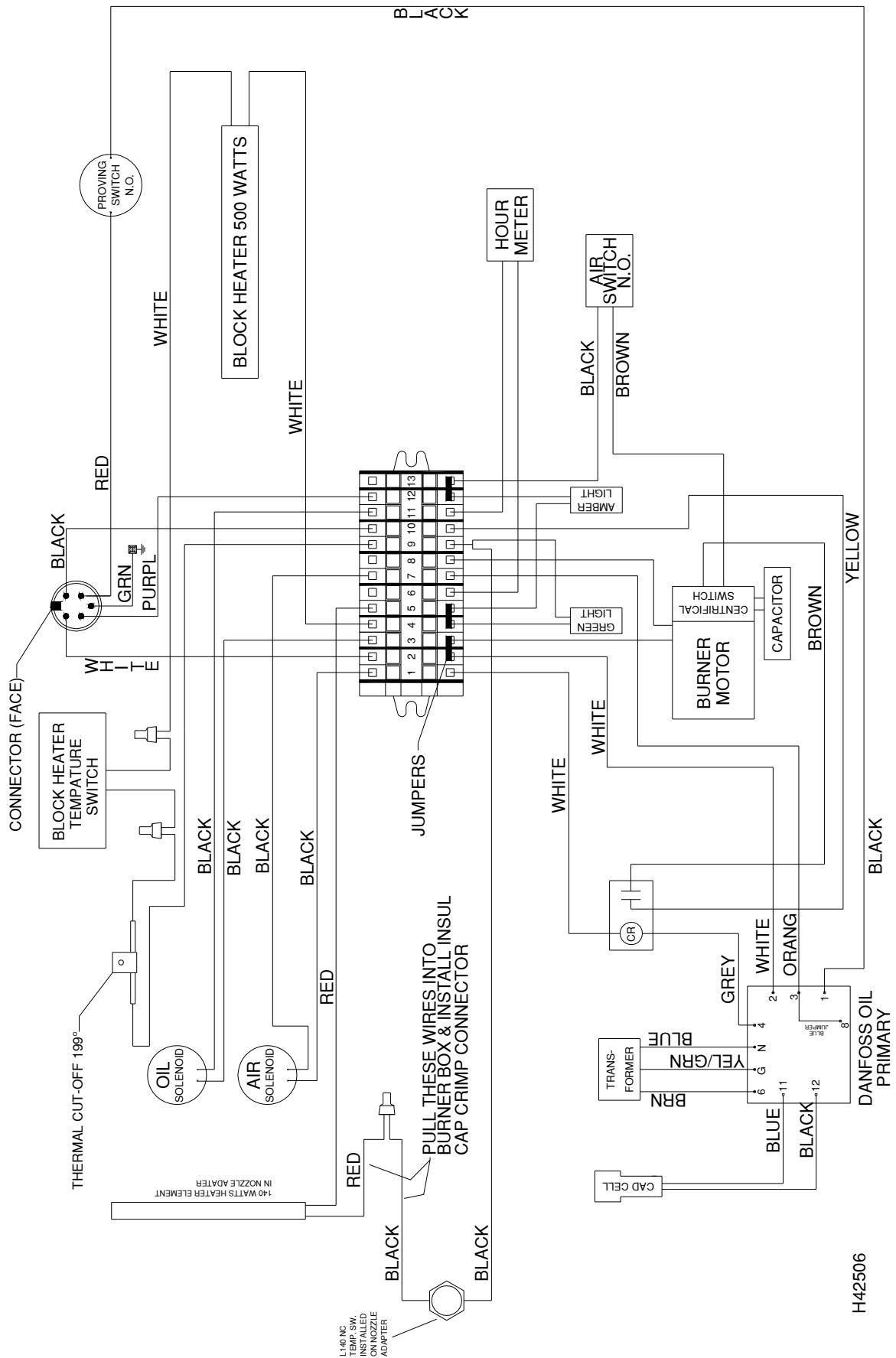


Figure B2 - CB-551-H5 CE 5W Burner Wiring Diagram

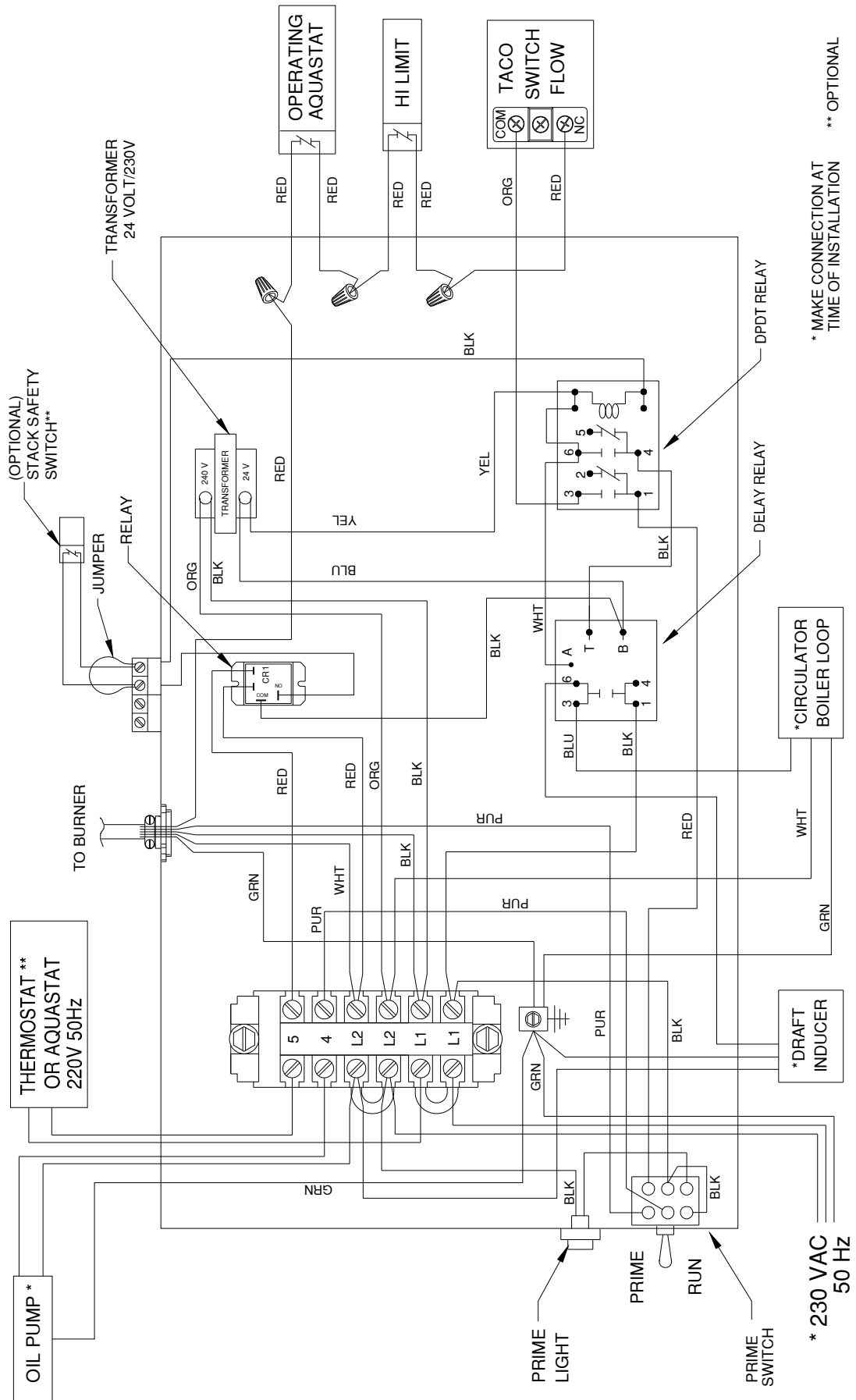


Figure B3 - Control Box Wiring Diagram

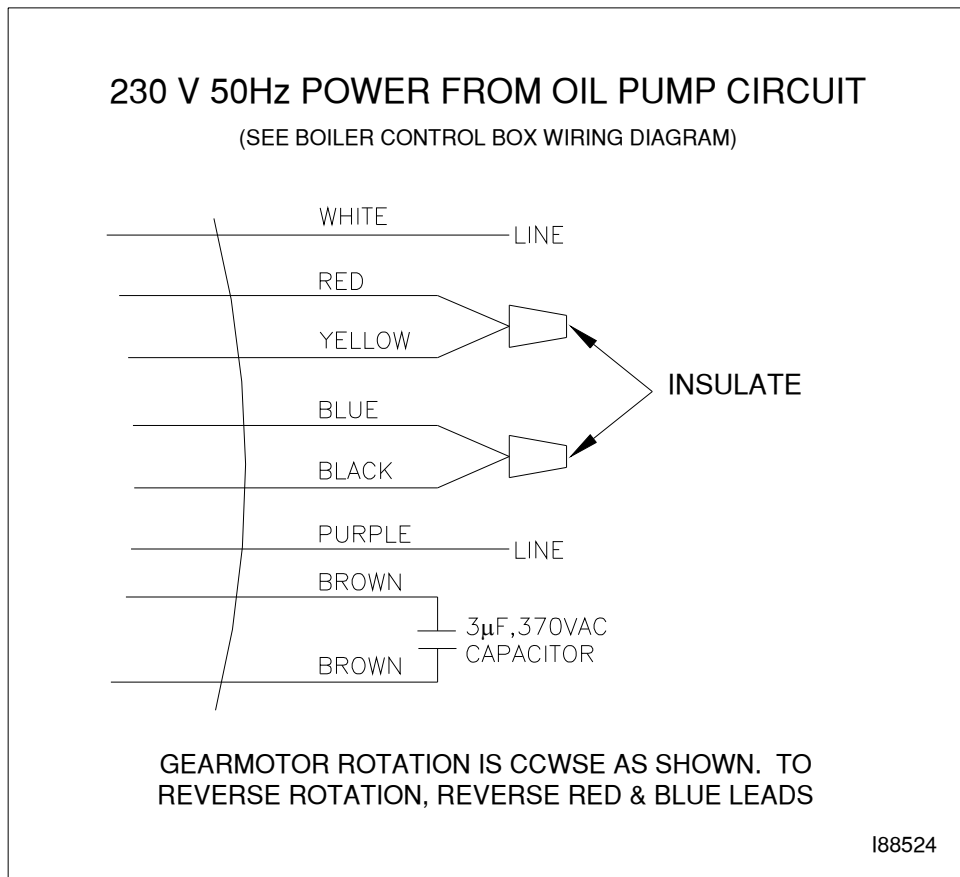


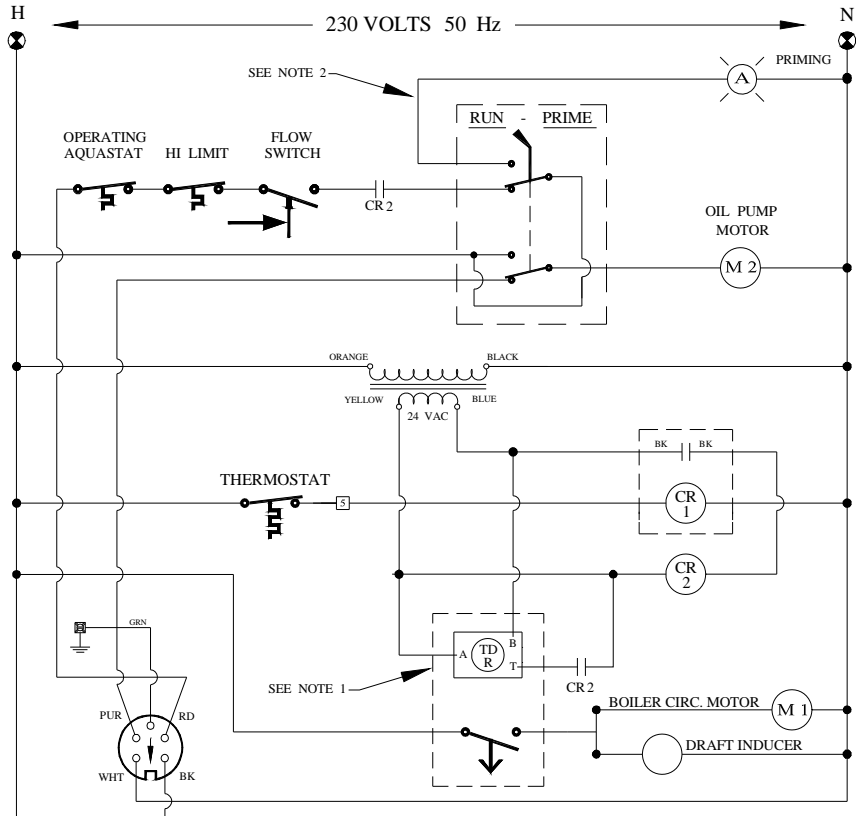
Figure B4 - Metering Pump Wiring Diagram

NOTE 1:

TDR TIMER CONTACT CLOSSES INSTANTANEOUSLY WHEN RELAY IS ENERGIZED (TRIGGERED BY CR2) AND OPENS 10 MINUTES AFTER CR2 IS DE-ENERGIZED

NOTE 2:

D P D T TOGGLE SWITCH ON FURNACE CABINET TOGGLE DOWN: BURNER TOGGLE UP: PRIME



⊗ - CONNECTION TO CUSTOMER POWER

□ - CONNECTION AT TERMINAL BLOCK INSIDE BOILER CONTROL BOX

DWG. No. 44111		
DRAWN BY: RM		
DATE: 9/28/05		
REVISION		
No.	DATE	BY

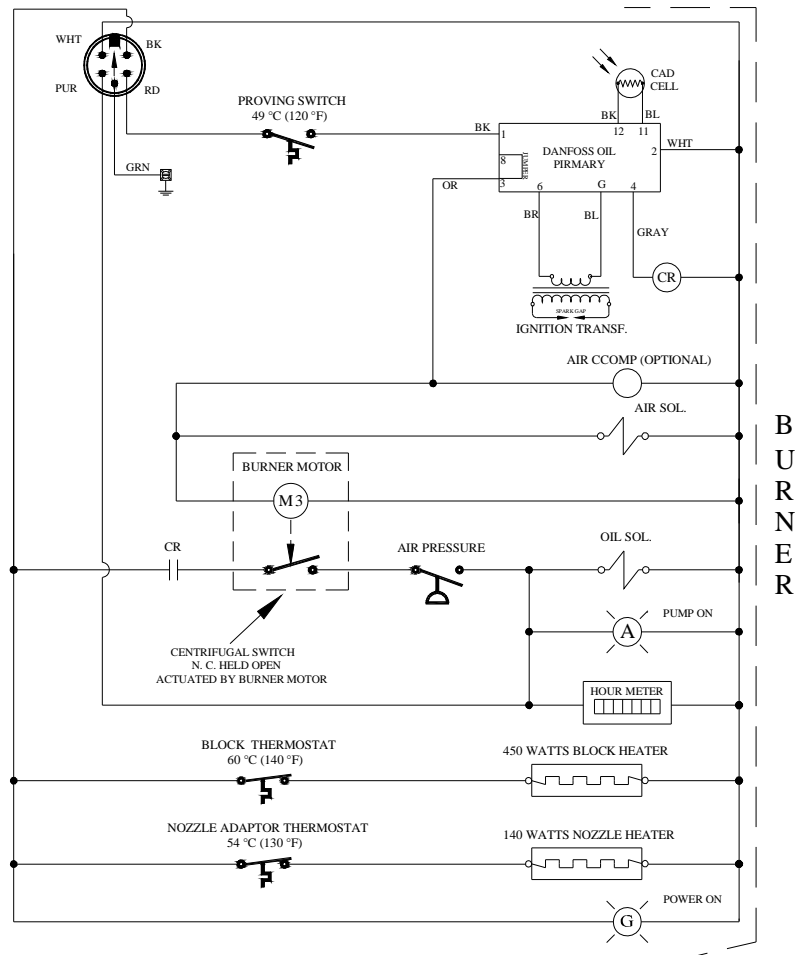


Figure B5 - Coil Tube Boiler Ladder Schematic

APPENDIX C

Additional Installation and Maintenance Requirements

The following activities must also be accomplished for boiler installations in the United Kingdom:

- Installing a cover over the air regulator on the burner
- Installing a fire valve above the burner

Instructions and/or drawings for these activities are provided in this Appendix.

Installing a Cover over the Air Regulator

BURNER INSTALLATION:

A cover (C.B. #31185) must be placed over the air regulator to prevent unauthorized adjustment after the equipment has been commissioned by a qualified person (Figure 1).

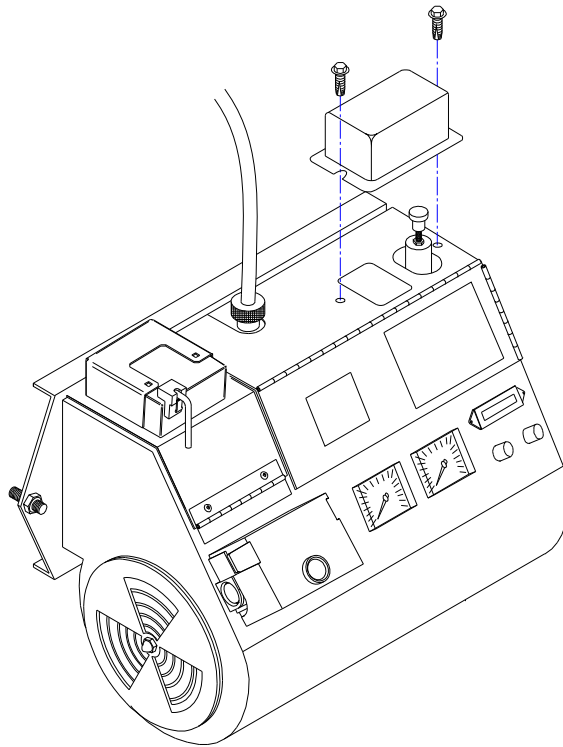


FIGURE 1 - Air Regulator Cover Installation

188330-A

Figure C1 - Installing a Cover over the Air Regulator on the Burner

Installing a Fire Valve

Install a fire valve element in a position above the burner as shown in Figure C2 to provide adequate protection in accordance with BS 5410 Parts 1 and 2.

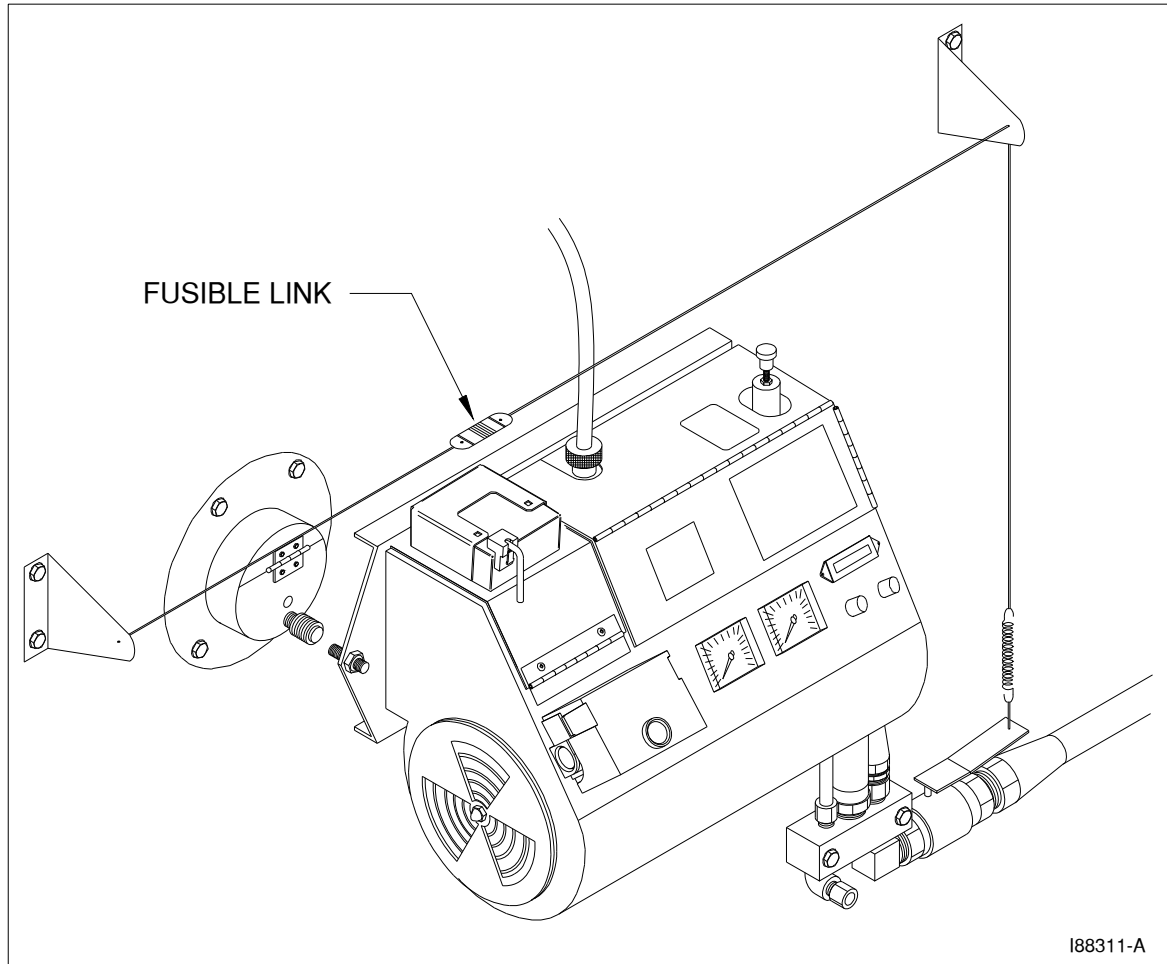


Figure C2 - Installation of a Fire Valve

APPENDIX D

Boiler Service Record

Boiler Purchased: Date _____ From (name/phone) _____

Boiler Installed: Date _____ By (name/phone) _____

Boiler Inspected: Date _____ By (name/phone) _____

Note: Refer to Section 9 for Maintenance Instructions

<u>Draft Readings</u> (Date / Draft)		<u>Service Record</u> (Date / Initials of Technician)						
Burner	Stack	Canister Filter	Metering Pump	Check Valve and Screen	Chamber	Stack	Oil Tank	A.P.M.*

*A.P.M. is Annual Preventative Maintenance on the Burner (Burner Tune-up)

