

SFM CONSTELLATION SERIES MODULAR OIL FIRED CAST IRON BOILERS



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An ISO 9001-2000 Certified Company



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SFM SERIES MODULAR OIL FIRED CAST IRON BOILERS

INSTALLATION MANUAL AND OPERATING INSTRUCTIONS

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

SAFETY SYMBOLS

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



DANGER

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



WARNING

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



CAUTION

Indicates a potential hazardous situation which, if not avoided, **MAY** result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT: Read the following instructions **COMPLETELY** before installing!



WARNING

1. Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids.
2. **DO NOT** obstruct air openings to the boiler room.
3. Modification, substitution or elimination of factory equipped, supplied or specified components may result in property damage, personal injury or the loss of life.
4. **TO THE OWNER:** Installation and service of this boiler must be performed by a qualified installer.
5. **TO THE INSTALLER:** Leave all instructions with the boiler for future reference.
6. When this product is installed in the Commonwealth of Massachusetts the installation must be performed by a Licensed Plumber or Licensed Gas Fitter.



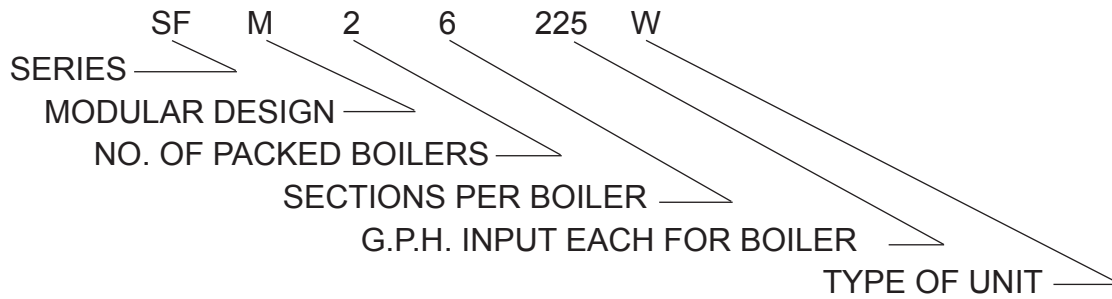
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US

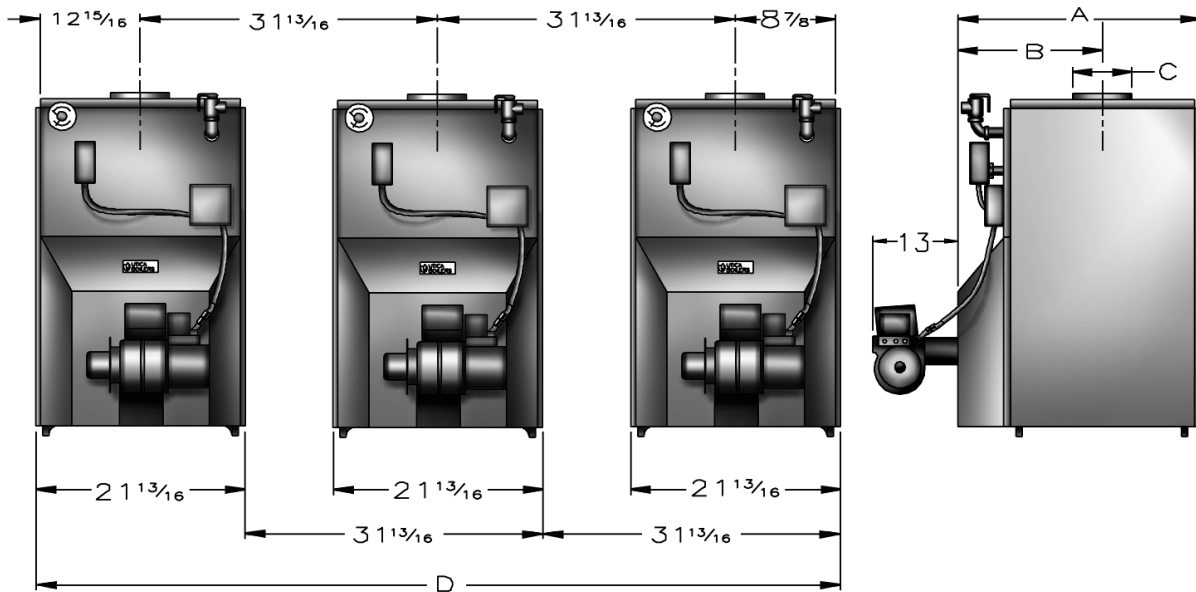
Tested for 75 PSI ASME
Working Pressure

DIMENSIONS

MODEL # CODE



MULTIPLE BOILER DIMENSIONAL DATA



MODEL NO.	A	B	C	D
SFM6225W *	29 $\frac{1}{4}$ "	13 $\frac{5}{8}$ "	8"	—
SFM7275W *	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	—
SFM24150W	21 $\frac{1}{2}$ "	12 $\frac{5}{8}$ "	6"	53 $\frac{13}{16}$ "
SFM25175W	25 $\frac{1}{8}$ "	14 $\frac{1}{4}$ "	7"	53 $\frac{13}{16}$ "
SFM25200W	25 $\frac{1}{4}$ "	14 $\frac{1}{4}$ "	7"	53 $\frac{13}{16}$ "
SFM26225W	29 $\frac{1}{4}$ "	13 $\frac{5}{8}$ "	8"	53 $\frac{13}{16}$ "
SFM27275W	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	53 $\frac{13}{16}$ "
SFM36225W	29 $\frac{1}{4}$ "	13 $\frac{5}{8}$ "	8"	85 $\frac{7}{16}$ "
SFM37275W	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	85 $\frac{7}{16}$ "
SFM47275W	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	87 $\frac{13}{16}$ "
SFM57275W	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	149 $\frac{1}{16}$ "
SFM67275W	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	181 $\frac{13}{16}$ "
SFM77275W	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	212 $\frac{11}{16}$ "
SFM87275W	32 $\frac{7}{8}$ "	13 $\frac{5}{8}$ "	8"	245 $\frac{5}{8}$ "

* SFM6225W & SFM7275W are Single Module Units

BOILER RATINGS, CAPACITIES & DIMENSIONS

NOTES:

1. Add suffix "T" to denote boiler with tankless heater.
2. I=B=R burner capacity is based on an oil heating value of 140,000 Btu/gal. and with 13% CO₂.
3. For equivalent square feet of radiation, divide I=B=R output by 150.
4. Net ratings based on 170 °F temperature in radiators and include 15% allowance for normal piping and pick-up load. Consult manufacturers for unusual piping and pick-up requirements.
5. Nozzle listed is for use with Beckett burner. When alternate burner is used, consult burner manufacturer's recommendations.
6. Electrical service to be 120 Volts, 15 Amps, 60 Hz. (Each Boiler).
7. The MEA number for the SFM series is 182-86E.
8. The MEA number for the AFG burner is 213-83-E.

STANDARD EQUIPMENT: Crated Boiler, Flush Jacket, Oil Burner, Target Wall/Liner, ASME Relief Valve, Thermitimeter Gauge, Drain Cock, Wiring Harness, Burner Electrical Disconnect, Plastic Cover, Supply Tapping - 2", Return Tapping - 1 ¼", High Limit and Circulator Control, Primary Control. For Tankless Heater Units-add Tankless Hot Water Coil.

MODEL NO.	FIRING RATE G.P.H.	INPUT M.B.H.	DOE OUTPUT M.B.H.	IBR OUTPUT M.B.H.	MODEL NO. OF MODULES	NO. OF MODULES	TOTAL BOILER WATER VOLUME GAL	BOILER WEIGHT LBS.	PUMP PRESSURE P.S.I	NOZZLE FURNISHED
SFH6225W	2.25	315	254	221	SFM6225W	1	19.5	915	140	2.00 45B
SFH7275W	2.75	385	307	267.1	SFM7275W	1	22.5	1058	140	2.25 45B
SFM24150W	3.00	420	350	304	SFM4150W	2	27.0	1251	140	1.25 80B
SFM25175W	3.50	490	412	358	SFM5175W	2	33.0	1546	140	1.50 80B
SFM25200W	4.00	560	462	402	SFM5200W	2	33.0	1546	140	1.75 80B
SFM26225W	4.50	630	508	442	SFM6225W	2	39.0	1831	140	2.00 45B
SFM27275W	5.50	770	614	534.2	SFM7275W	2	45.0	2116	140	2.25 45B
SFM36225W	6.75	945	762	663	SFM6225W	3	58.5	2745	140	2.25 45B
SFM37275W	8.25	1155	921	801.3	SFM7275W	3	67.5	3174	140	2.25 45B
SFM47275W	11.00	1540	1228	1068.4	SFM7275W	4	90.0	4232	140	2.25 45B
SFM57275W	13.75	1925	1535	1335.5	SFM7275W	5	112.5	5290	140	2.25 45B
SFM67275W	16.50	2310	1842	1602.6	SFM7275W	6	135.0	6347	140	2.25 45B
SFM77275W	19.25	2695	2149	1869.7	SFM7275W	7	157.5	7905	140	2.25 45B
SFM87275W	22.00	3080	2456	2136.8	SFM7275W	8	180.0	8464	140	2.25 45B

INTRODUCTION

All installations must conform to the requirements of the authority having jurisdiction. Such applicable requirements take precedence over the general instructions of this manual.

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

LOCATE BOILERS in front of final position before removing crate. Provide a level solid base as near the chimney as possible, and centrally located with respect to the heat distribution system as practical.



WARNING

BOILER MAY NOT BE INSTALLED ON COMBUSTIBLE FLOORING.

Allow 24 inches in the front and top for servicing and cleaning, or removing tankless water heating coil.

When installed in a utility room, the door should be wide enough to allow the largest boiler part to

enter, or to permit replacement of another appliance such as a water heater.

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

TOP	24 IN.
FRONT	24 IN.
FLUE CONNECTOR.....	9 IN.
REAR	6 IN.
SIDES	12 IN.

NOTE: Clearance for access should exceed fore protection clearance.

REMOVE CRATE and plastic protective wrapper and inspect for damage. All equipment is carefully manufactured, inspected and packaged by experienced workers. Our responsibility ceases upon delivery of the crated boiler to the carrier in good condition. Any claims for damage or shortage in shipment must be filed immediately against the carrier by the cosigner. Move boiler to permanent position by sliding or walking.

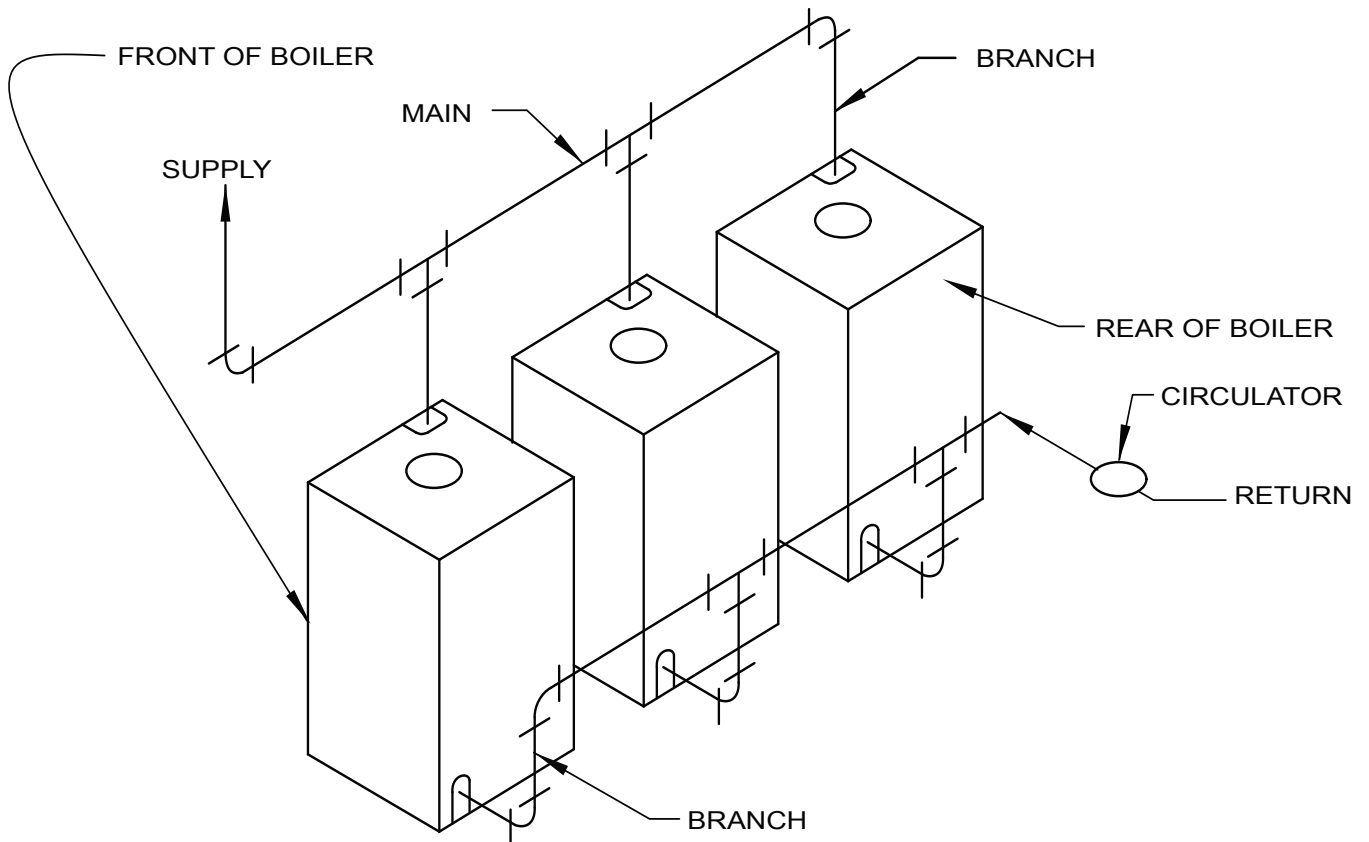
CONNECTING SUPPLY AND RETURN PIPING

The recommended method of connecting the supply and return piping can be seen in **Figure #1** below.

(For detailed piping recommendations refer to the engineering manual)

Figure #1

MODULAR BOILER HOOK-UP **RECOMMENDED PARALLEL PIPING**



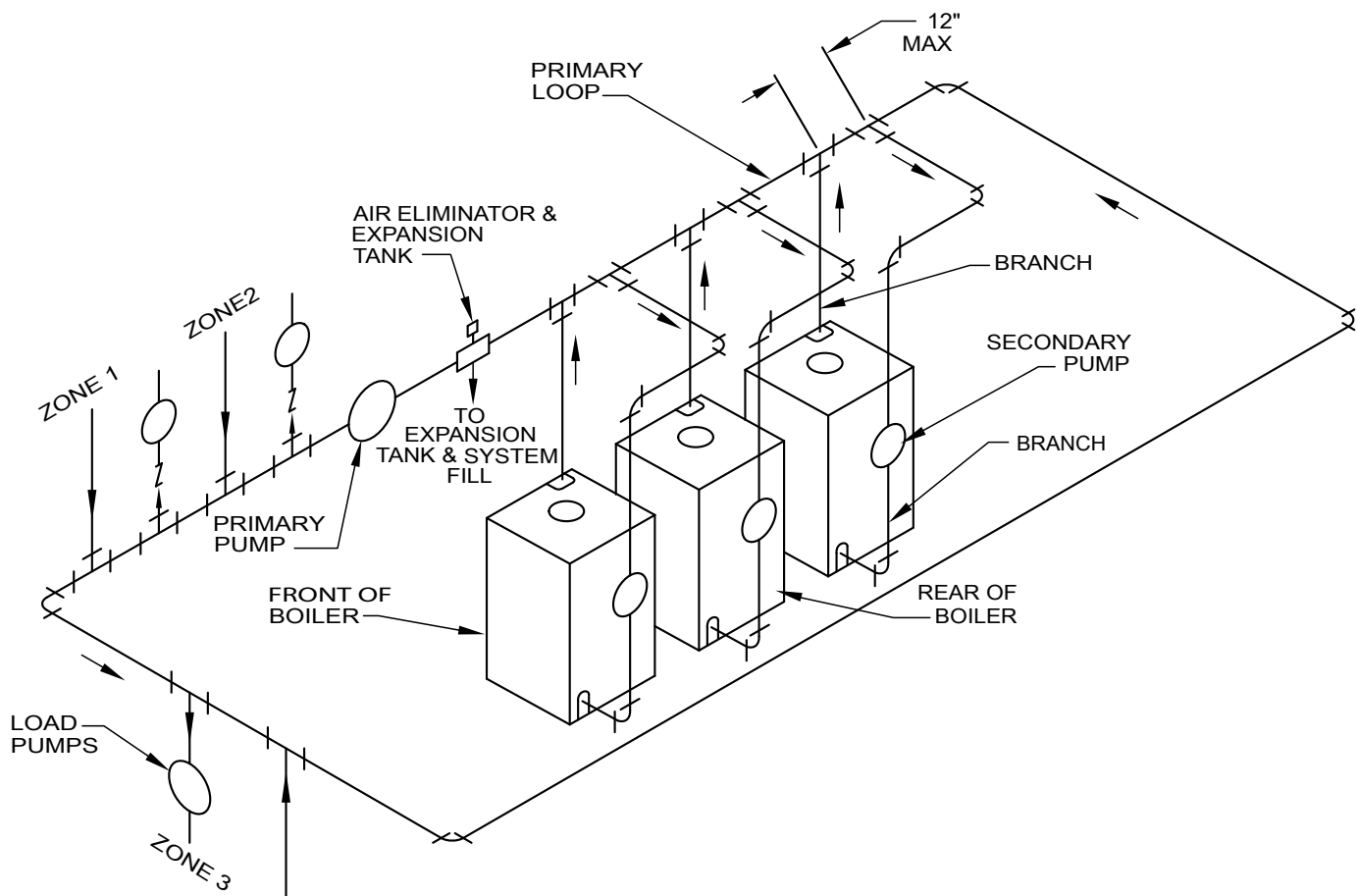
PRIMARY SECONDARY PIPING

An alternate method of connecting the supply and return piping can be seen in **Figure #2** below.

(Refer to the engineering manual for detailed piping recommendations.)

Figure #2

PRIMARY SECONDARY PIPING



Note: The tapping sizes for the supply and return piping are 2" and 1 ½" respectively. It is recommended that the main piping be 3" and the branches 1 ½".

VENTILATION & COMBUSTION AIR



WARNING

AIR OPENINGS TO COMBUSTION AREA MUST NOT BE OBSTRUCTED. FOLLOW THE CHART BELOW TO OBTAIN AND MAINTAIN ADEQUATE COMBUSTION AIR.

COMBUSTION AIR REQUIREMENTS (MINIMUM OPENING IN SQUARE INCHES)

*UNCONFINED AREA		**CONFINED AREA		
OUTSIDE COMBUSTION AIR		OUTSIDE COMBUSTION AIR		
1 IN ² /5000 BTU (PARAGRAPH 2)(SQ IN)		1 IN ² /1000 BTU (MIN 100IN ²) (FIG 4) (SQ IN)		
1 IN ² /4000 BTU (FIG 3)(SQ IN)		1 IN ² /2000 BTU (FIG 3)(SQ IN)		
BTU/HR INPUT				
315,000	63	315	78.75	158
385,000	77	385	96.25	193
420,000	84	420	105	210
490,000	98	490	123	245
560,000	112	560	140	280
630,000	126	630	158	315
770,000	154	770	193	385
945,000	189	945	237	473
1,155,000	231	1155	289	578
1,540,000	308	1540	385	770
1,925,000	385	1925	482	963
2,310,000	462	2310	578	1155
2,695,000	539	2695	675	1348
3,080,000	616	3080	770	1540

* Unconfined area: A space whose volume is not less than 50 cubic feet per 1000 BTU per hour of all appliances installed in that space (cubic feet of space = height x width x length).

** Confined area: A space whose volume is less than 50 cubic feet per 1000 BTU per hour of all appliances installed in that space (cubic feet of space = height x width x length).

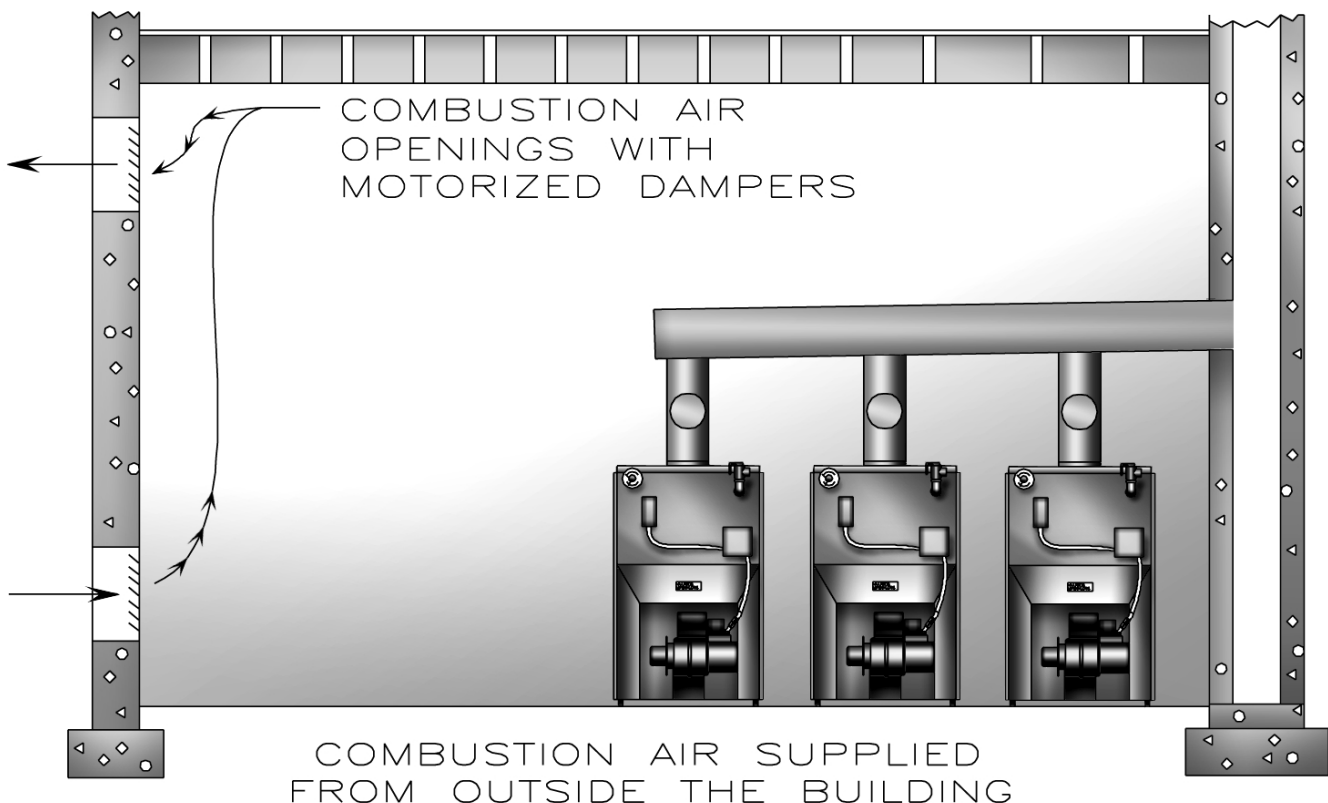
1. When a boiler is located in an unconfined space in a building of conventional construction frame, masonry or metal, infiltration normally is adequate to provide air for combustion and ventilation. **However, in any building which has been altered to conserve energy or to minimize infiltration, the boiler area should be considered as a CONFINED SPACE.** If there is any doubt, install air supply provisions for combustion and ventilation in accordance with section 5.3, Air for Combustion and Ventilation, of the latest revision of the NFPA 54 code, the recommendations that follow, or applicable provisions of the local building codes.
2. When a boiler is installed in an unconfined space, in a building of unusually tight construction, air for combustion and room ventilation must be obtained from outdoors or from spaces freely communicating with the outdoors. A permanent opening or openings having a total free area of not less than 1 square inch per 5,000 BTU per hour of total input rating of all appliances

VENTILATION & COMBUSTION AIR

- shall be provided. Ducts may be used to convey make-up air from the outdoors and shall have the same cross-sectional area of the openings to which they are connected.
3. When air for combustion and room ventilation is from inside buildings, the confined space shall be provided with two permanent openings, one starting 12 inches from the top and one 12 inches from the bottom of the enclosed space. Each opening shall have a minimum free area of 1 square inch per one thousand (1,000) BTU per hour of the total input rating of all appliances in the enclosed space, but must not be less than one hundred (100) square inches. These openings must freely communicate with the interior areas having adequate infiltration from the outside. See **Figure #4**.
 4. When the boiler is installed in a confined space and all air is provided from the outdoors, the confined space shall be provided with two permanent openings, one commencing within 12 inches from the top and one commencing 12 inches from the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors. One of the following methods must be used to provide adequate air for ventilation and combustion.
 - A. When directly communicating with the outdoors, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure. See **Figure #3**.

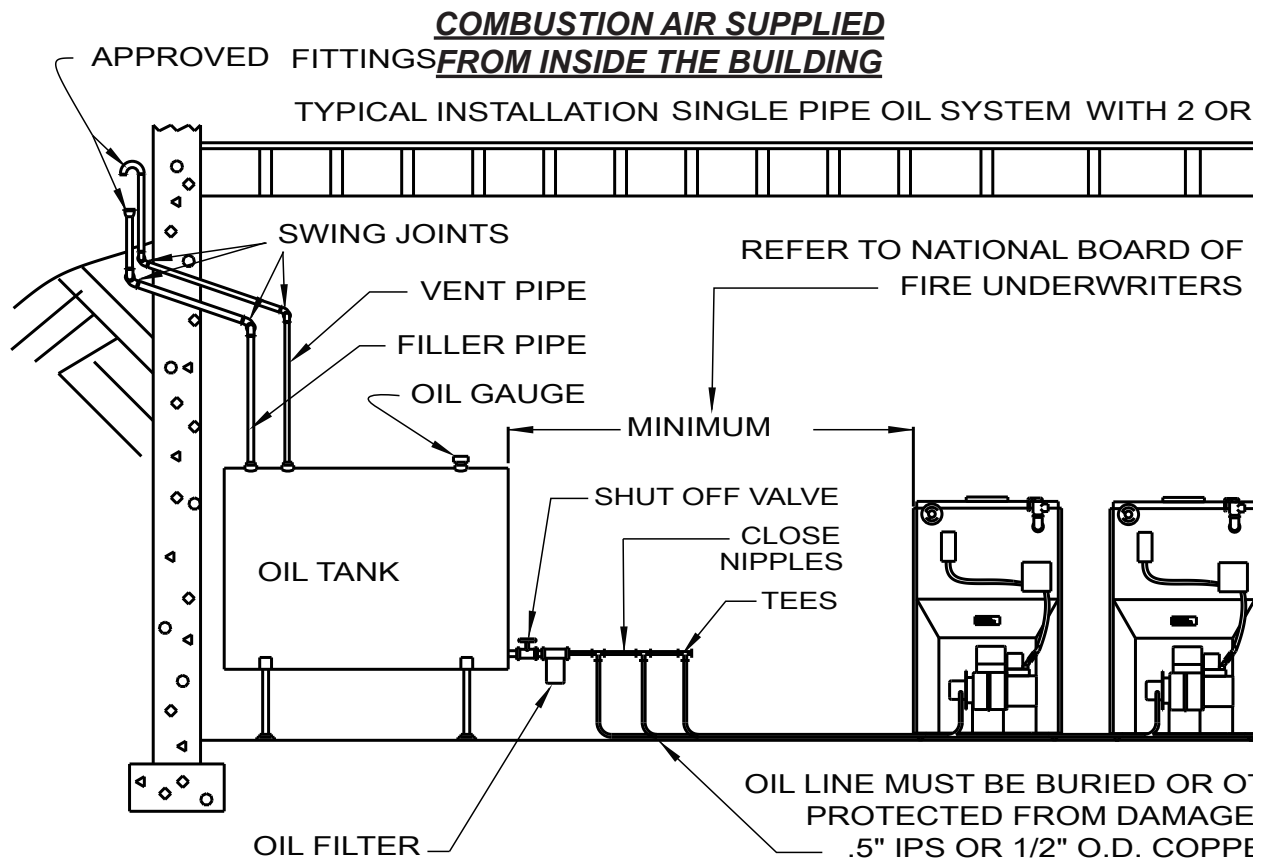
Figure #3

COMBUSTION AIR SUPPLIED FROM OUTSIDE THE BUILDING



VENTILATION & COMBUSTION AIR

Figure #4



VENTING SYSTEM INSPECTION & INSTALLATION

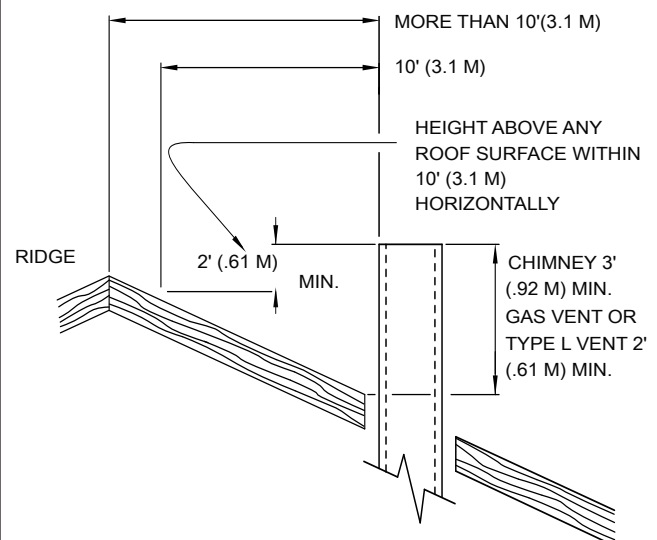
⚠ WARNING

BOILER IS TO BE VENTED BY NATURAL DRAFT AND SHALL NOT BE CONNECTED INTO ANY PORTION OF A MECHANICAL DRAFT SYSTEM OPERATING UNDER A POSITIVE PRESSURE.

INSPECT CHIMNEY to make certain it is constructed according to the latest revision of NFPA211. Local codes may differ from this code and should be checked. Where there is a conflict, the local code will prevail.

This boiler must be installed into a chimney which has a masonry or metallic chimney liner.

Figure #5



VENTING SYSTEM INSPECTION & INSTALLATION

An unlined chimney will have leaks that will cause poor chimney performance (NO DRAFT), and could result in poor positive pressure in the combustion chamber.

Horizontal portions of the venting system should not exceed 10 feet in length. Horizontal lengths over 10 feet will have a negative effect on the chimney performance.

The chimney should extend at least 2 feet above any portion of the building within 10 feet. See figure 5 at right. It should produce a negative draft of .06 to .08 inches of water column, (W.C.), as measured with a draft gauge between the boiler and barometric draft control while maintaining an .02 inch W.C. negative draft in the combustion chamber. See chart below for recommended chimney or vent sizes.

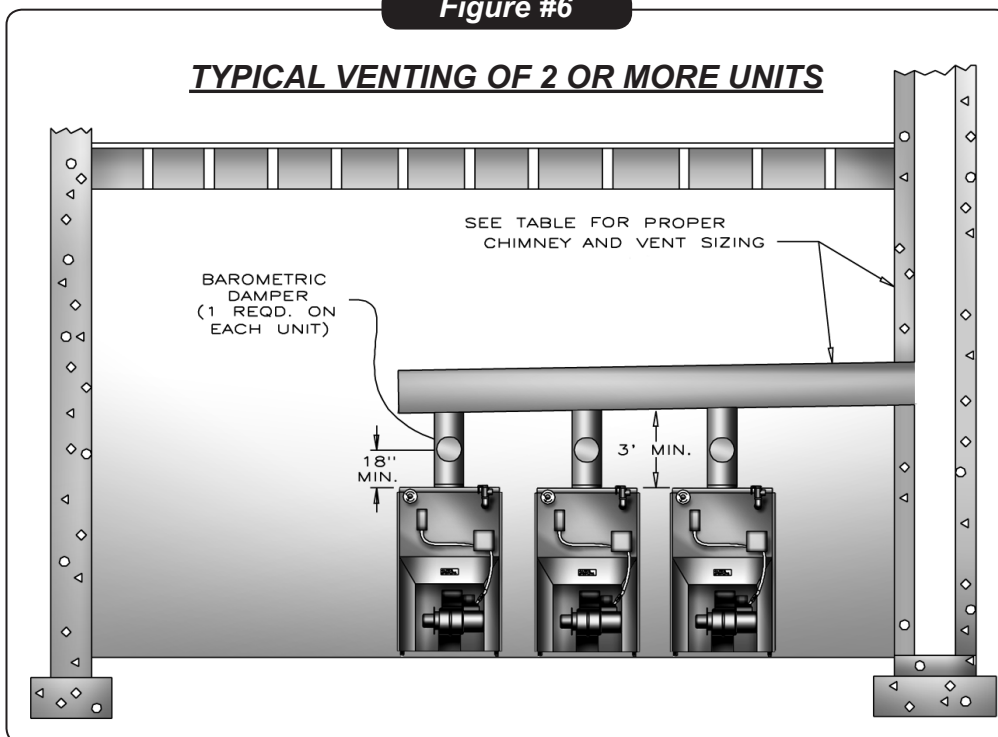
Inadequate draft will cause improper combustion, resulting in dirty flue ways and high fuel bills.

When installing a single boiler, connect the flue pipe with the same size as the boiler outlet to the chimney, sloping upward continuously toward the chimney approximately $\frac{1}{4}$ " per foot. Bolt or screw joints together to avoid sag.

If an oil fired water heater is vented into the same flue as the boiler, provide a separate hole into the chimney whenever possible. When this isn't possible, use a "Y" connection in the flue pipe, using a separate draft regulator for each unit. When a chimney will not provide adequate draft to handle the input from the water heater and boiler simultaneously, wire the units so that only one will operate at a time, favoring the water heater.

CHIMNEY OR VENT SIZES			
MODEL NO.	DIA. OF CHIMNEY OPENING (BREECHING)	CHIMNEY SIZE (IN. X IN. X FT.)	FLUE OUTLET SIZE
SFM6225W	8	8X8X15	8"
SFM7275W	9	8X12X15	8"
SFM24150W	9	8X12X15	6"
SFM25175W	9	8X12X20	7"
SFM25200W	9	8X12X20	7"
SFM26225W	9	8X12X20	8"
SFM27275W	10	12X16X15	8"
SFM36225W	12	12X16X15	8"
SFM37275W	14	12X16X20	8"
SFM47275W	14	12X16X15	8"
SFM57275W	18	16X20X20	8"
SFM67275W	18	20X20X15	8"
SFM77275W	22	20X24X15	8"
SFM87275W	22	20X24X20	8"

Figure #6



OIL TANK AND PIPING

Oil tank and piping should be installed in accordance with the National Board of Fire Underwriters and local regulations. Oil storage tank, vent, fill pipe and caps should be as prescribed by local codes. In no case should the vent pipe be smaller than 1 ¼" I.P.S. The fill pipe should not be less than 2" I.P.S.

The suction line from the tank to the burner should be one continuous piece of tubing to prevent air entering the line. The suction line, must be ⅜" O.D. copper tubing for runs of 50 feet or less, and ½" O.D. for longer runs. An oil return line, same size as the suction line, must be used on any installation where the bottom of the tank is below the fuel unit of the burner. Oil lines should be buried or otherwise protected from mechanical injury. Flare fittings on all oil lines are recommended. Compression fittings on the suction line often allow air to be drawn into the fuel pump, making it difficult to

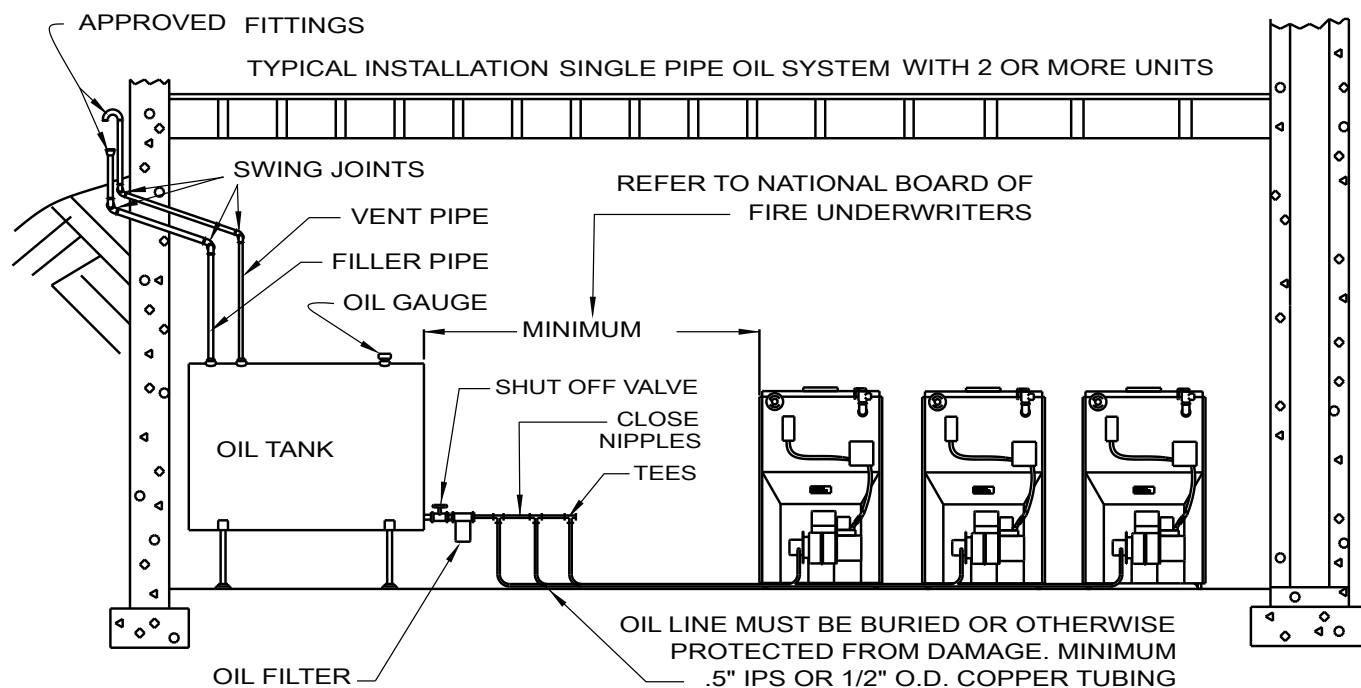
maintain oil pressure at the nozzle. Do not run overhead fuel lines from tank to oil burner.

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

An oil line filter and shut-off valve should be installed in the suction line. Shut-off valves should be installed in both the suction and return lines at the burner for convenience in servicing burner. Allow extra tubing at burner so burner may be removed from boiler for cleaning without disconnecting tubing. (See **Figures #7 & #8**). An optional flexible oil line is available.

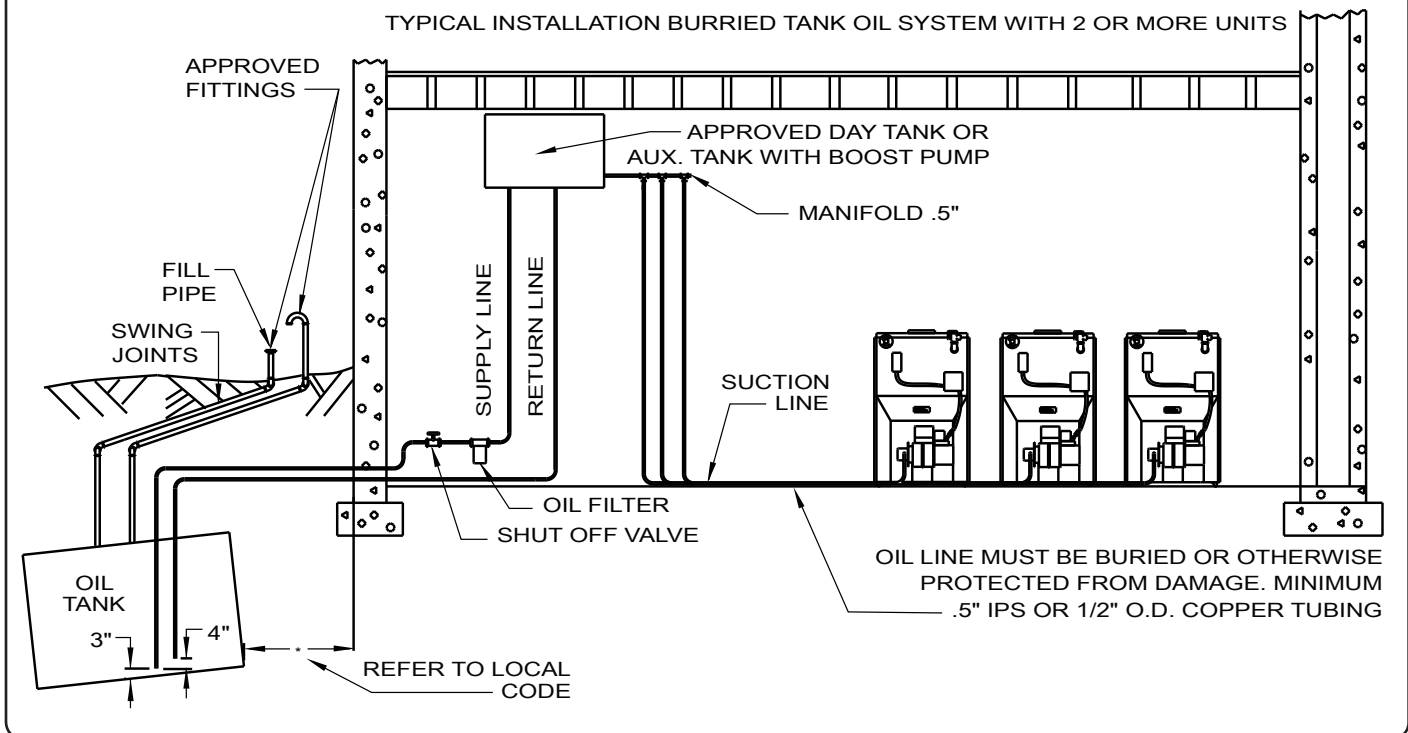
Figure #7

COMBUSTION AIR SUPPLIED FROM INSIDE THE BUILDING



OIL TANK AND PIPING

Figure #8



THERMOSTAT INSTALLATION

1. Thermostat should be installed on an inside wall about four feet above the floor.
2. **NEVER** install a thermostat on an outside wall.
3. Do not install a thermostat where it will be affected by:
 - A. Drafts
 - B. Hot or cold pipes
 - C. Sun light
 - D. Lighting fixtures
 - E. Television sets
 - F. A fireplace or chimney
4. Check thermostat operation by raising and lowering thermostat as required to start and stop the burner.
5. Instructions for the final adjustment of the thermostat are packaged with the thermostat (adjusting heating anticipator, calibration, ect.).

OPERATING INSTRUCTIONS

The venting system should be inspected at the start of each heating season. Check the vent pipe from the boiler to the chimney for signs of deterioration by rust or sagging joints. Repair if necessary.

Remove the vent pipe at the base of the chimney or flue and, using a mirror, check for obstruction.

The lever of the pressure relief valve, shown in **Figure #9**, on the boiler should be operated periodically to make sure that it is functioning properly. The pressure relief valve should open before the water pressure exceeds the 30 lb. reading on the gauge. If this pressure is exceeded and the pressure relief valve leaks water when the boiler is operating at normal pressures, it should be immediately replaced. Corrosion can build up rapidly at the valve seat and prevent its functioning as a safety device.



CAUTION

WATER WILL BE BOILING HOT.

START-UP AND ADJUSTMENT OF OIL BURNER

(See oil burner instructions for nozzle and electrode setting)

- A. Check oil burner nozzle to make certain it is tight in adapter. Burner mounting bolts should be tight.
- B. Check electrode setting, as they may have been jarred out of position during transportation.
- C. Lubricate burner motor and circulator motor if required. Some circulators are water lubricated and do not require oiling.
- D. Set room thermostat to call for heat, or jump thermostat contacts on the boiler control.
- E. Open all oil line valves.
- F. Turn service switch on. Burner should start.
- G. On one pipe fuel systems only, vent pump as soon as burner starts. Allow oil to run until all traces of air in the suction line disappear.
- H. Turn "OFF" burner and install pressure gauge port on pump.
- I. Start burner again and check oil pressure for 140 lbs. Adjust if necessary.



CAUTION

DO NOT SET FIRE VISUALLY.

Instruments are the only reliable method to determine proper air adjustments. An improperly adjusted burner causes soot and high fuel bills because of incomplete combustion of the fuel oil. This in turn may require excessive boiler maintenance, service costs, and in some instances, house cleaning or redecorating. A competent service mechanic should be consulted to make the proper adjustments with a smoke tester, CO₂ indicator and draft gauge. Bacharach or Dwyer test kits include these instruments.

INSTRUCTIONS FOR PROPER OPERATION OF THE BOILER-BURNER UNIT

A 1/4" diameter slot is provided in the inspection cover plate to take draft readings in the combustion chamber. See **Figure #9**. A 1/4" diameter hole will be required in the flue pipe between the boiler and barometric damper (if used) to take draft, CO₂, smoke and temperature readings. Adjust air shutter on oil burner to obtain a "trace" of smoke. Measure CO₂ at this point. Increase air adjustment to lower CO₂ approximately one (1) percent. Check to insure minimum negative .02 w.c., (water column), "overfire" draft and zero (0) smoke. If - .02 w.c. "overfire" draft can not be maintained, changes and/or modifications may be required in the venting or the chimney.

The following table (on next page) is provided as a guideline for initial start-up. Final adjustments **MUST** be made using combustion instruments as previously mentioned.

OPERATING INSTRUCTIONS

Model No.	End Cone	Static Disc	Air Band Setting	Air Shutter Setting	Head Setting	Low Firing Rate Baffle
SFM4150	F-6	2¾	2	6	—	0
SFM5175	F-12	3U	3	5	—	0
SFM5200	F-12	3U	5	5	—	0
SFM6225	—	L1	4	6	1	—
SFM7275	—	L1	4	6	2	—

Information in above table uses Beckett model AFG burner for model numbers SFM4150-5200 and Beckett model SMG for models 6225 and 7275.

CHECK SAFETY CONTROL CIRCUIT after burner adjustments have been made for satisfactory performance.

A. High limit control: remove cover and note temperature setting. See **Figure #13**. With the burner operating, decrease this setting to the minimum point. When boiler water temperature exceeds this set point, the high limit switch will open, shutting off the power to the oil burner. Return setting to desired high limit point. Burner should restart.

B. Primary control and flame sensor:

Check:

1. **Flame failure** - simulate by shutting off oil supply with hand valve while burner is on. Sixty seconds after flameout, the safety switch locks out, ignition stops, motor stops and oil valve - when used - closes. To restart, open oil supply valve and reset safety switch.
2. **Ignition failure** - with burner off, close oil supply valve and run through start-up procedure. The safety switch should lock out as in flame failure.
3. **Power failure** - Turn off main power supply switch while burner is operating. When burner stops, restore power and burner should start.

If operation is not as described as above, check **wiring and controls**.

PREVENTIVE MAINTENANCE of an oil fired boiler reduces operating costs. The boiler and vent pipe should be inspected for accumulation of soot or scale deposits periodically but at least once every year before the start of each heating season. When soot is present on the section walls and flueways, improper combustion will result, causing additional sooting and scaling until flueways are completely closed. To remove soot and scale from the flueways, remove top jacket panel, top clean-out plate, open burner swing door. (See **Figure #9** next page)

PERIODIC INSPECTION and tightening of the tankless heater/cover plate bolts will reduce the risk of leaks. See part number 6, in **Figure #14**, *Replacement Parts "Heat Exchanger"* section in the back of this manual.

INSTRUCTIONS FOR OPENING BURNER SWING DOOR

1. Turn off power to boiler.
2. Allow boiler to cool down.
3. Disconnect power cable at factory supplied burner electrical disconnect. See **Figure #9**
4. Loosen screws on the sides of the lower front jacket panel. See **Figure #9**.
5. Pull the bottom part of the lower front panel forward.
6. Lift the lower front panel up and off the boiler. See **Figure #9**.

OPERATING INSTRUCTIONS

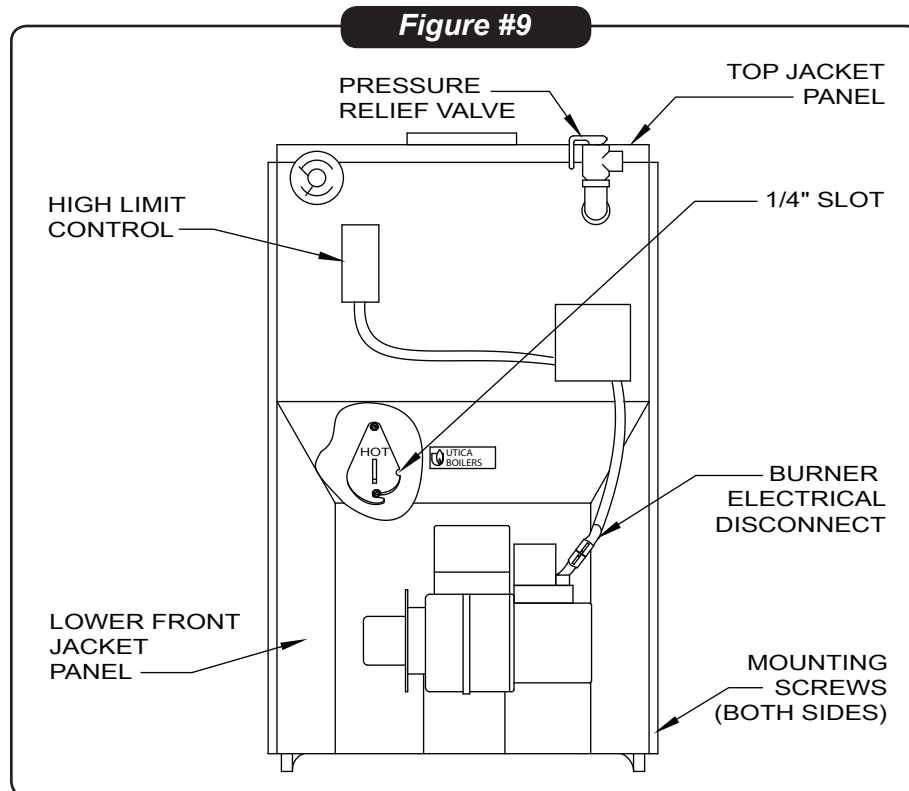
7. Close oil valve. See **Figures #3 & #4**.
8. Disconnect oil line from burner.
9. Do not try to swing door with oil line attached.
10. Remove nut from swing door stud on right hand side of door.
11. Swing open burner and door to the left.

Using a flue brush, brush the soot and scale into the combustion space where it can be removed through the swing door opening.

CAUTION

USE CAUTION WHEN VACUUMING IN THE CHAMBER AREA. DAMAGE TO CHAMBER COULD RESULT.

It is recommended to replace the nozzle at the start of each heating season. Lubricate the burner motor and circulator motor - if required - with a few drops of a good grade of light motor oil. Do not over oil. Have a competent service person service the burner and check the controls and check the electrodes for carbon or cracks in the insulators. Burners should be adjusted to produce the conditions shown in *Start-up and Adjustment of Oil Burner* procedure covered earlier in this section.



INSTRUCTIONS FOR CLOSING BURNER SWING DOOR

1. Swing burner and door to the right until insulation is slightly compressed and the stud is exposed.
2. Attach nut to the stud and tighten it until the built in stop contacts the mounting door.
3. Replace oil line to burner.
4. Replace lower jacket panel, and tighten the screws.
5. Connect the power cable at the factory supplied burner electrical disconnect.
6. Turn on power to boiler.
7. Bleed oil line.

CONTROL SYSTEMS

ELECTRICAL WIRING should conform with the latest edition of National Electrical Code ANSI/NFPA No. 70 and/or local authority having jurisdiction. A separate electrical circuit should be run

from the entry box with a fused disconnect switch in this circuit. Refer to component coding and wiring code for the following control systems and wiring diagrams.

COMPONENT CODING			
TH-1	Thermostat (millivolt)	1K2	Relay Contacts
TH-2	Thermostat (24 Volt)	LS	Limit Switch
TH-3	Thermostat (Line Voltage)	MS	Manual Switch
TR-1	Transformer (120V/24V 40VA)	CIR	Circulator
TR-2	Transformer (120V/24V 50VA)	ECO	Energy Cut-Off
LGV	24 Volt Gas Valve	PSC	Pilot Safety Coil
PS	Pressure Switch	—●—	Wire Connection
MR-PS	Manual Reset Pressure Sw.	LWCO	Low Water Cut Off
—○—	Control Terminal	EWf	Electric Water Feeder
1K	Relay Coil	PG	Power Generator
1K1	Relay Contacts		

SFM INDIVIDUAL MODULE WIRING:

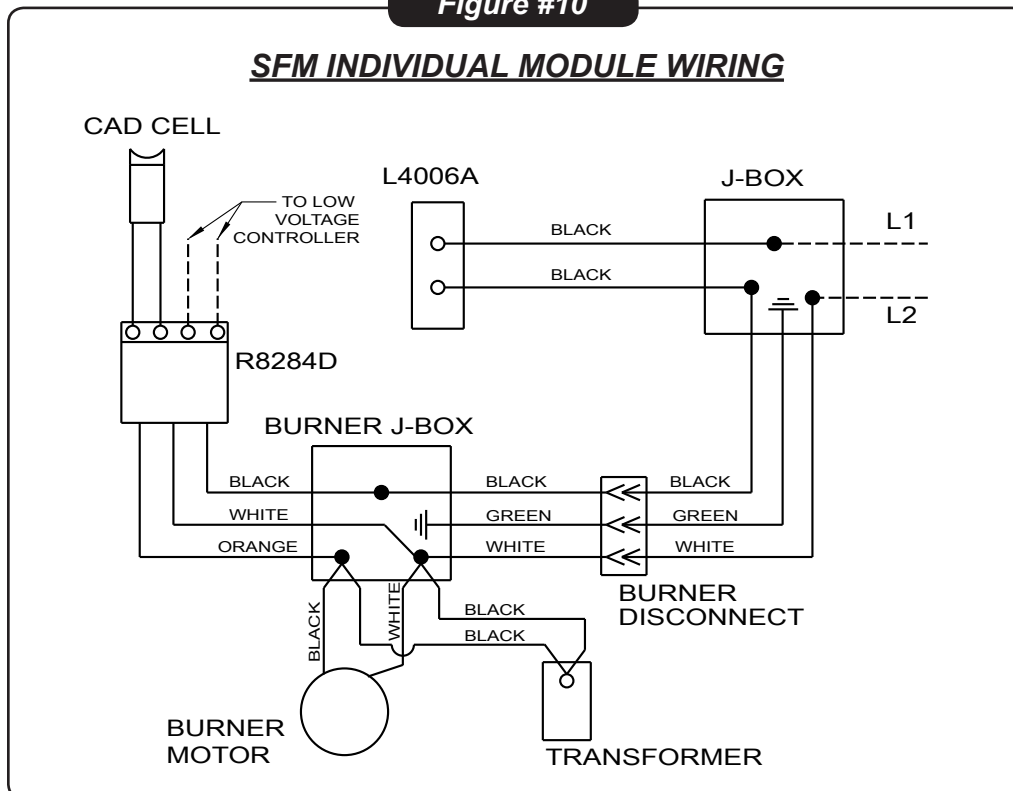
Refer to **Figure #10** below for factory module wiring.

WIRING CODE

—————	Line Voltage by Factory
—————	Low Voltage by Factory
- - - - -	Line Voltage by Installer
- - - - -	Low Voltage by Installer

** Not all components listed are used in all control systems.*

Figure #10



PHASE 2 CONTROLS:

This system consists of multiple outdoor thermostats with settings spaced at increments to actuate the number of modules necessary to match the heat load based on outdoor temperature. The heating modules are cycled as a group by an indoor-outdoor reset controller with temperature bulbs connected by capillary tubes. This system provides low cost control for small and medium heating systems of two to five modules where it is desired to control the supply water temperature in relation to outdoor temperature. Ratio and temperature range are adjustable. Control capillary tube length places some limitations on this system. Module location in relation to outside wall is important and should be checked before selecting this system. See **Figure #12**.

OPERATION:

When the outdoor temperature drops below set point of the main outdoor thermostat, the circulator is turned on. The indoor-outdoor control regulates the supply water temperature. Individual outdoor thermostats turn on more modules as the outdoor temperature falls below their set points.

PHASE 6 CONTROLS

Consist of a microprocessor control (W7100J) capable of sequentially step firing up to 6 heating modules necessary to match the heat load based on outdoor and/or indoor air temperature. The C7031G outdoor air sensor and C7170A discharge water temperature sensor work in unison to adjust the system water temperature corresponding to the heat load demand. This system utilizes lead lag operation to equalize the on time of each module. Separate control band, reset ratio, and setpoint control settings allows customizing of any modular heating system. See **Figure #13**.

OPERATION:

When the indoor air temperature drops below the thermostat setpoint, the system is energized. The first module will fire and the remaining ones will follow at one minute increments. Once the setpoint limits plus the control band setting is reached, the first module will cut out. If the system water temperature remains above the control band setting the remaining modules will begin to cut out. If the system water temperature drops below the lower control band setting, the next module in sequence will fire. This process of sequencing will continue until the heat load is satisfied.

Figure #12

PHASE 2 CONTROL WIRING FOR SPACE HEATING

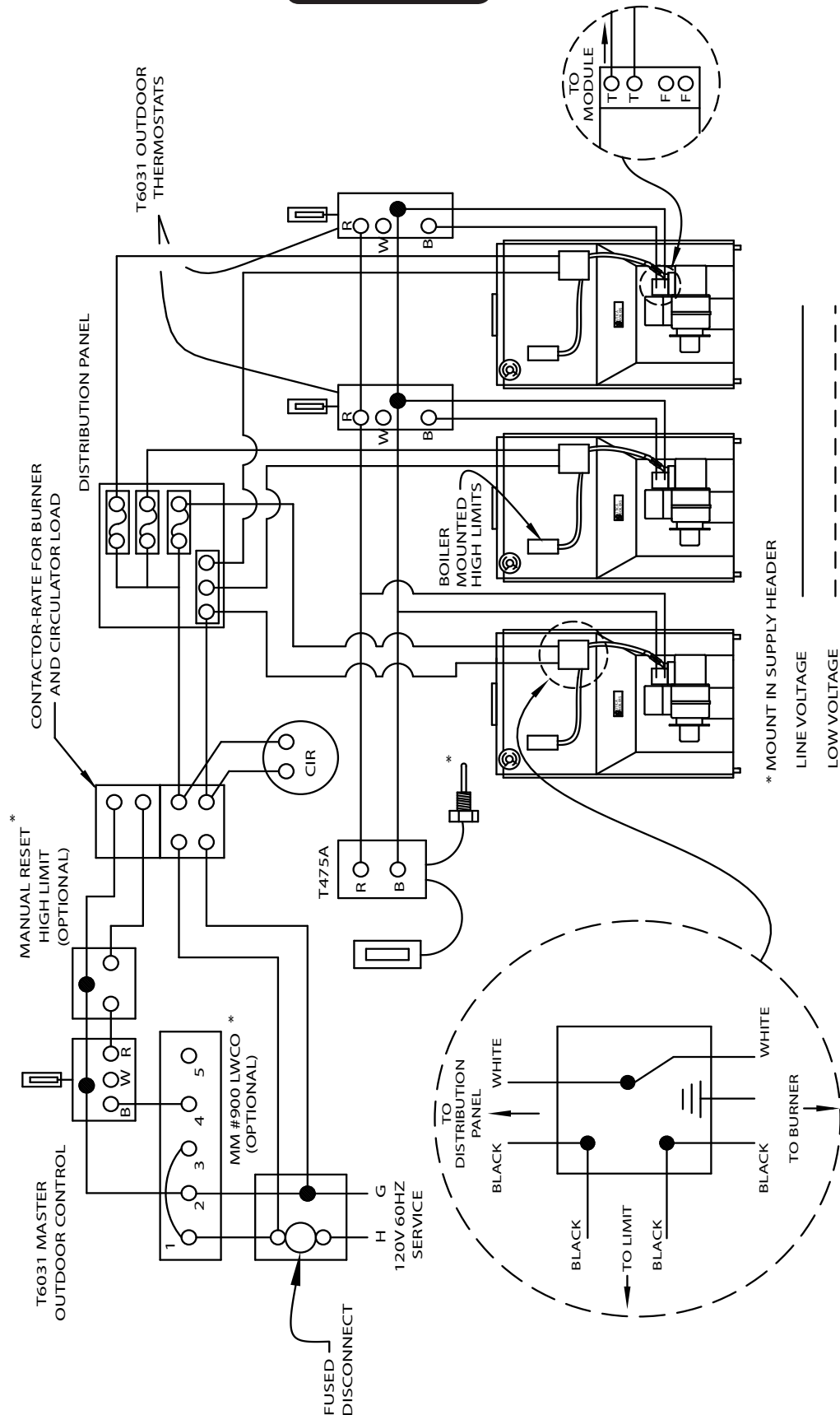
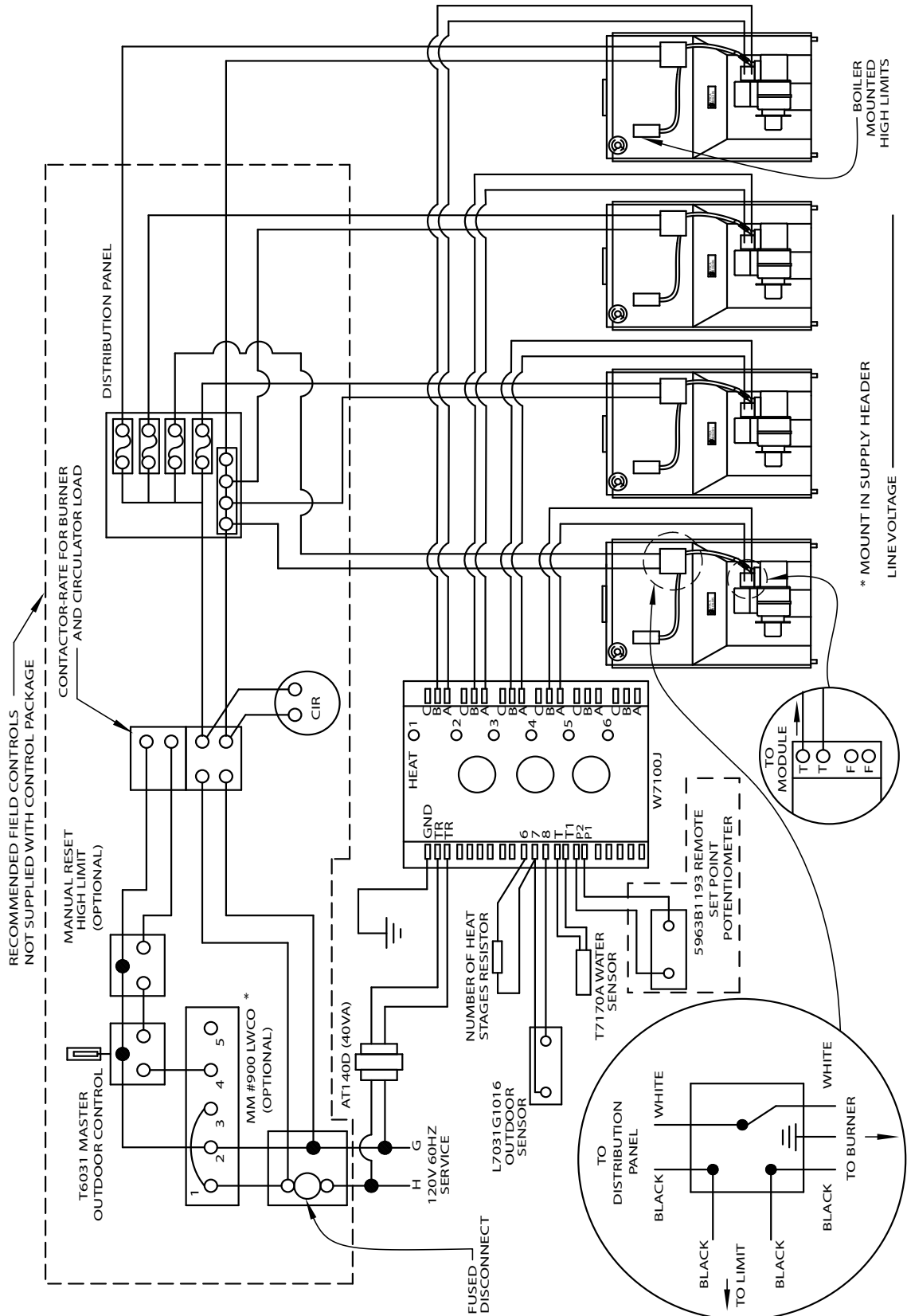


Figure #13

PHASE 6 CONTROL WIRING FOR SPACE HEATING



SERVICE CHECK LIST AND RECORD CHART

- | | |
|---|--|
| <div style="display: flex; flex-direction: column; gap: 10px;"> <div><input checked="" type="checkbox"/> Inspect Chimney and Flue pipe</div> <div><input checked="" type="checkbox"/> Inspect and Clean Appliance</div> <div><input checked="" type="checkbox"/> Inspect Oil Line - Size/Leaks</div> <div><input checked="" type="checkbox"/> Inspect Electrical Connections</div> <div><input checked="" type="checkbox"/> Install New Filter</div> <div><input checked="" type="checkbox"/> Room Make-up Air</div> <div><input checked="" type="checkbox"/> Electrode setting</div> <div><input type="checkbox"/> * Nozzle-Size, Angle, Type</div> </div> | <div style="display: flex; flex-direction: column; gap: 10px;"> <div><input type="checkbox"/> * Pump Pressure/Vacuum</div> <div><input type="checkbox"/> * Line Voltage/Motor Amps</div> <div><input type="checkbox"/> * Smoke Test</div> <div><input type="checkbox"/> * Draft-Overfire/In Flue</div> <div><input type="checkbox"/> * CO₂ or O₂</div> <div><input type="checkbox"/> * Flue Gas Temperature</div> <div><input checked="" type="checkbox"/> Proper Light-Off (Hot & Cold)</div> <div><input checked="" type="checkbox"/> Controls and Safety Devices</div> </div> |
|---|--|

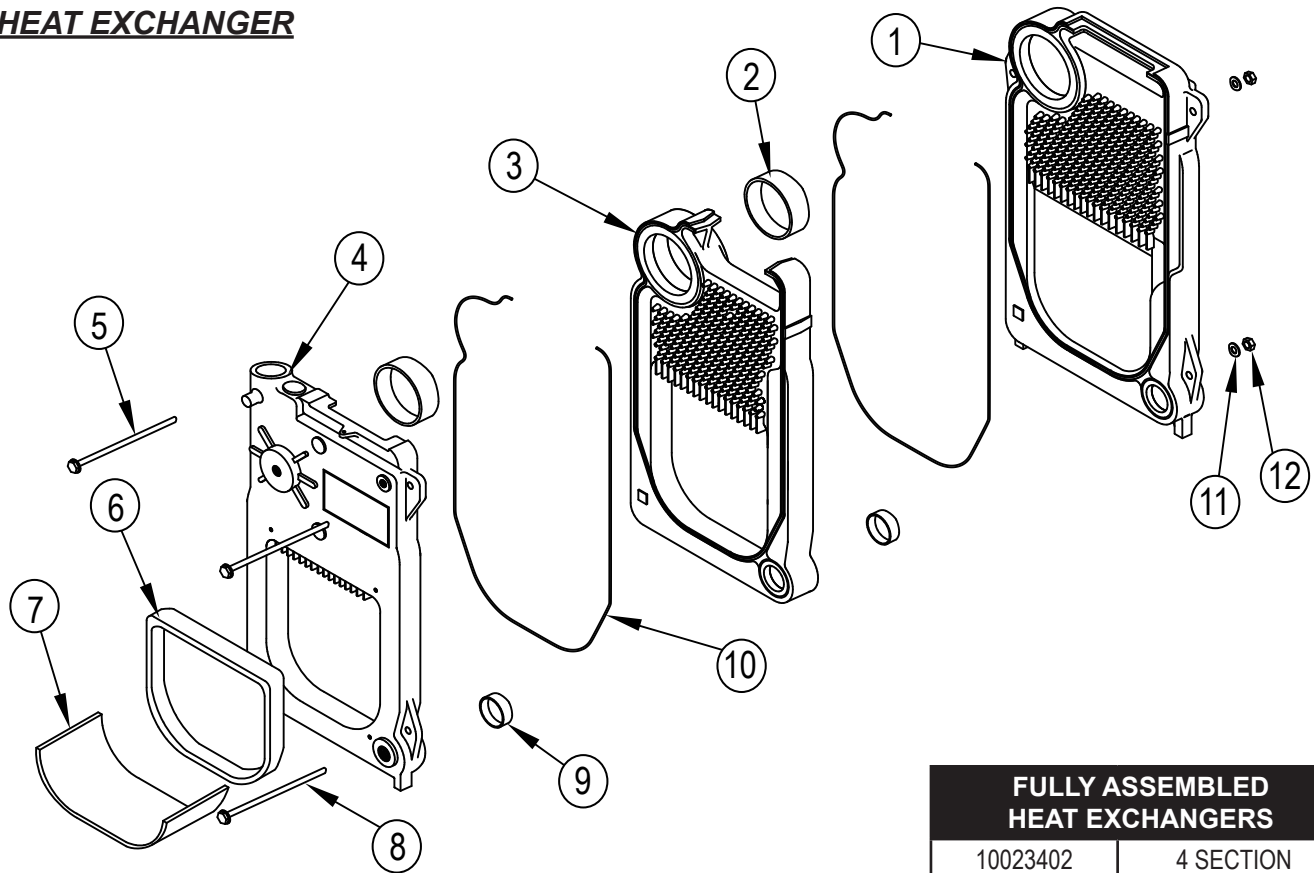
☐ * Measure with Instruments and Record results on chart provided below

SERVICE RECORD CHART									
Date	Nozzle			Pump Pressure PSI	Smoke #	Draft		CO ₂ or O ₂	Flue Temperature F°
	Size	Angle	Type			O.F.	NF		

SFM SERIES REPLACEMENT PARTS

Figure #14

HEAT EXCHANGER



FULLY ASSEMBLED HEAT EXCHANGERS

10023402	4 SECTION
10023403	5 SECTION
10023404	6 SECTION
10023405	7 SECTION

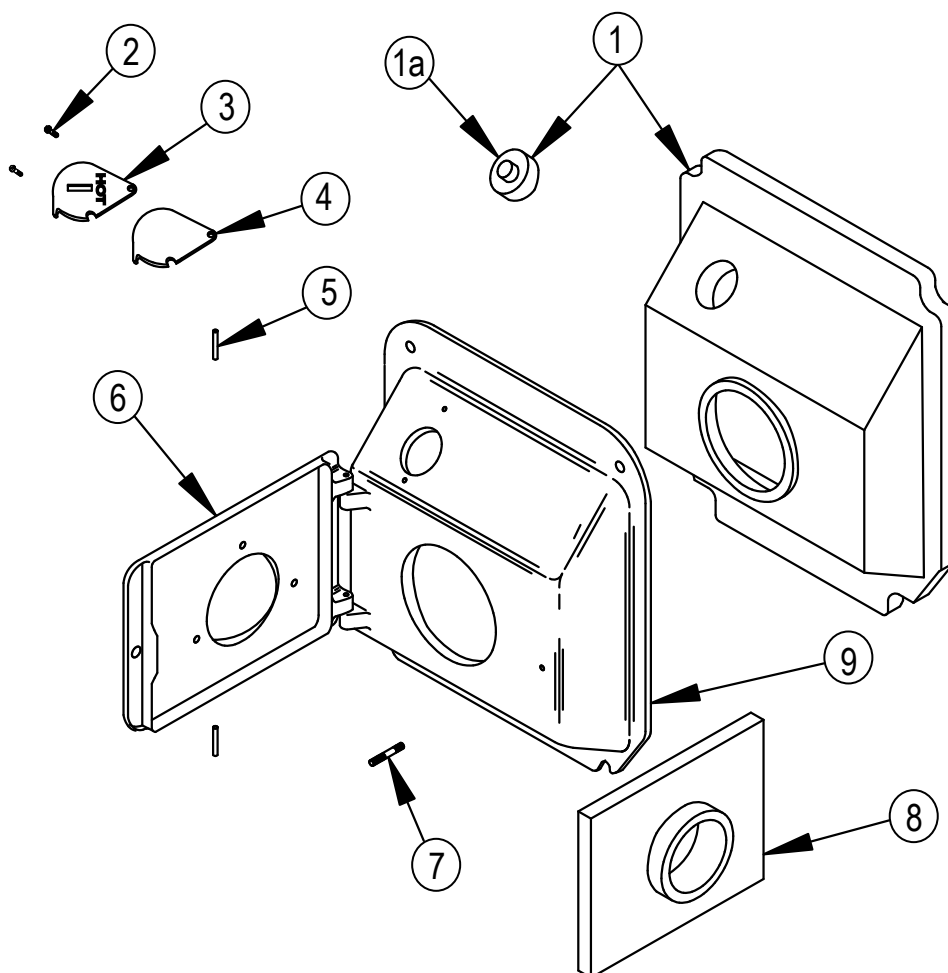
ITEM #	PART #	DESCRIPTION	QTY
1	10051702	REAR SECTION	1
2	100-1-8.01	#60 PUSH NIPPLE	
		4 SECTION	3
		5 SECTION	4
		6 SECTION	5
		7 SECTION	6
3	10051101	CENTER SECTION	
		4 SECTION	2
		5 SECTION	3
		6 SECTION	4
		7 SECTION	5
4	10051201	FRONT SECT. CASTOVER	1
5	HW02511	TIE ROD ½ X 14¼ (4 SEC)	2
	HW02512	TIE ROD ½ X 17⅞ (5 SEC)	
	HW02514	TIE ROD ½ X 21¾ (6 SEC)	
	HW02515	TIE ROD ½ X 25¼ (7 SEC)	
6	5611508	KIT - TARGET WALL & INSULATION BLANKET	1
7	25511005	INSUL BLANKET 16X24 (6 & 7 SECTION)	1

ITEM #	PART #	DESCRIPTION	QTY
8	HW-025.01	TIE ROD ½ X 12½ (4 SEC)	1
	HW-025.02	TIE ROD ½ X 16½ (5 SEC)	
	HW-025.03	TIE ROD ½ X 20½ (6 SEC)	
	HW-025.05	TIE ROD ½ X 9 (3 SEC)	
	HW-025.09	TIE ROD ½ X 23½ (7 SEC)	
9	100-1-5.01	#22 PUSH NIPPLE	
		4 SECTION	3
		5 SECTION	4
		6 SECTION	5
		7 SECTION	6
10	MS-006.00	ROPE MED DENSITY	
		4 SECTION (19.5')	1
		5 SECTION (26')	
		6 SECTION (32.5')	
		7 SECTION (39')	
11	HW-008.03	WASHER 1/2 ID FLAT	3
12	HW-003.05	NUT 1/2-13 HEX HEAD	3

SFM SERIES REPLACEMENT PARTS

Figure #15

SWING DOOR AND MOUNTING DOOR COMPONENTS

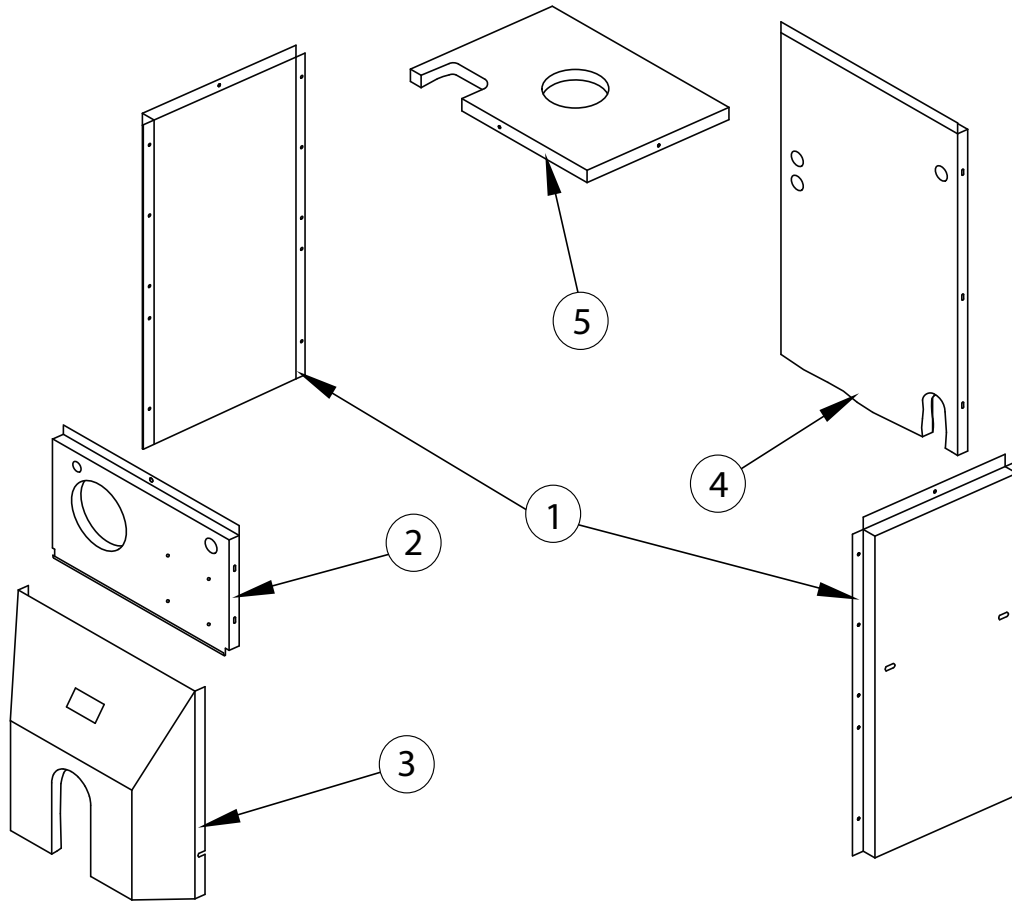


ITEM #	PART #	DESCRIPTION	QTY
1	2552901	MOUNTING DOOR INSULATION & PLUG	1
2	HW-005.01	SCREW ¼ -20 X ½ SELF TAPPING	2
3	10011701	OBSERVATION DOOR	1
4	25511101	OBS. DOOR GASKET	1
5	HW06801	¼ X 1¾ DRIVE LOCK PIN	2
6	10011501	SWING DOOR	1
7	HW06701	⅝ X 18 X 2 ⅝ STUD	1
8	2553303	INSULATION-SWING DOOR	1
9	10011301	MOUNTING DOOR	1

SFM SERIES REPLACEMENT PARTS

Figure #16

JACKET

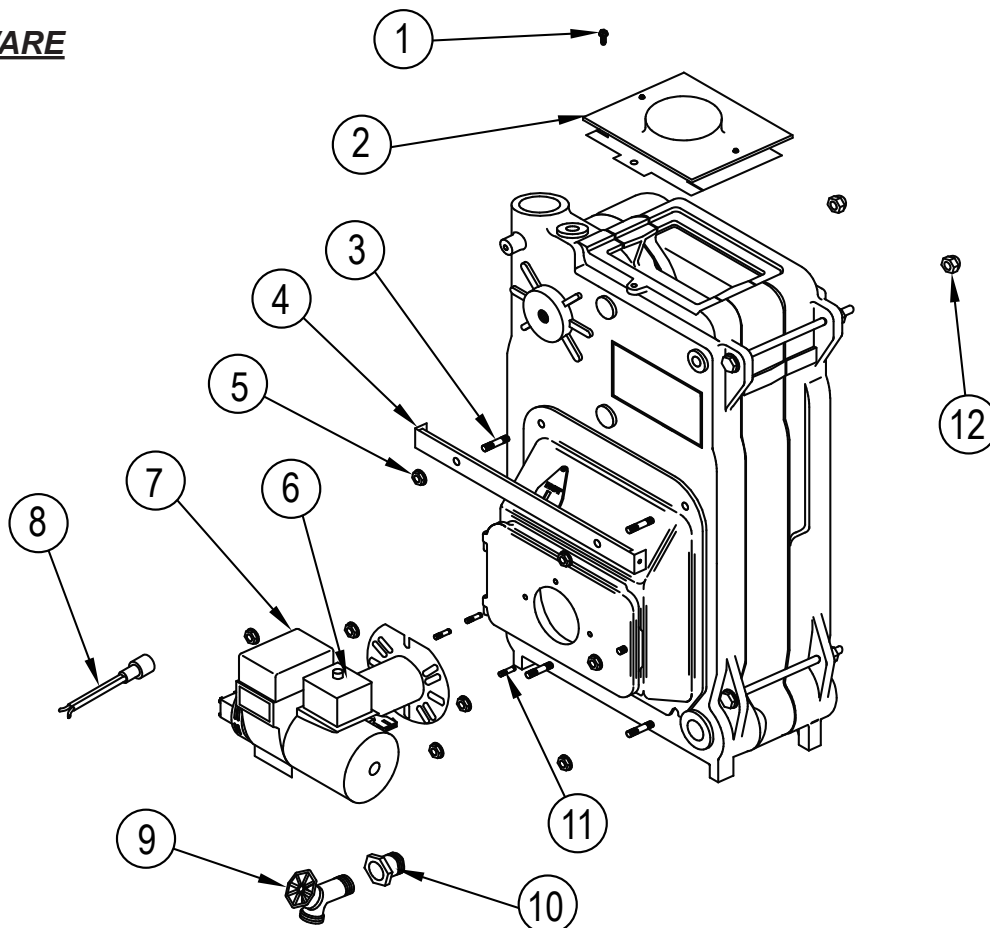


ITEM #	PART #	DESCRIPTION	QTY
1	21521803	SIDE PANEL 4 SECTION	2
	21521804	SIDE PANEL 5 SECTION	
	21521805	SIDE PANEL 6 SECTION	
	21521806	SIDE PANEL 7 SECTION	
2	21522401	TOP FRONT PANEL C/O	1
3	21521901	LOWER COWL	1
4	21521501	REAR PANEL	1
5	215-1-3.03	TOP PANEL 4 SECTION	1
	215-1-3.04	TOP PANEL 5 SECTION	
	2151307	TOP PANEL 6 SECTION	
	2151308	TOP PANEL 7 SECTION	

SFM SERIES REPLACEMENT PARTS

Figure #17

HARDWARE

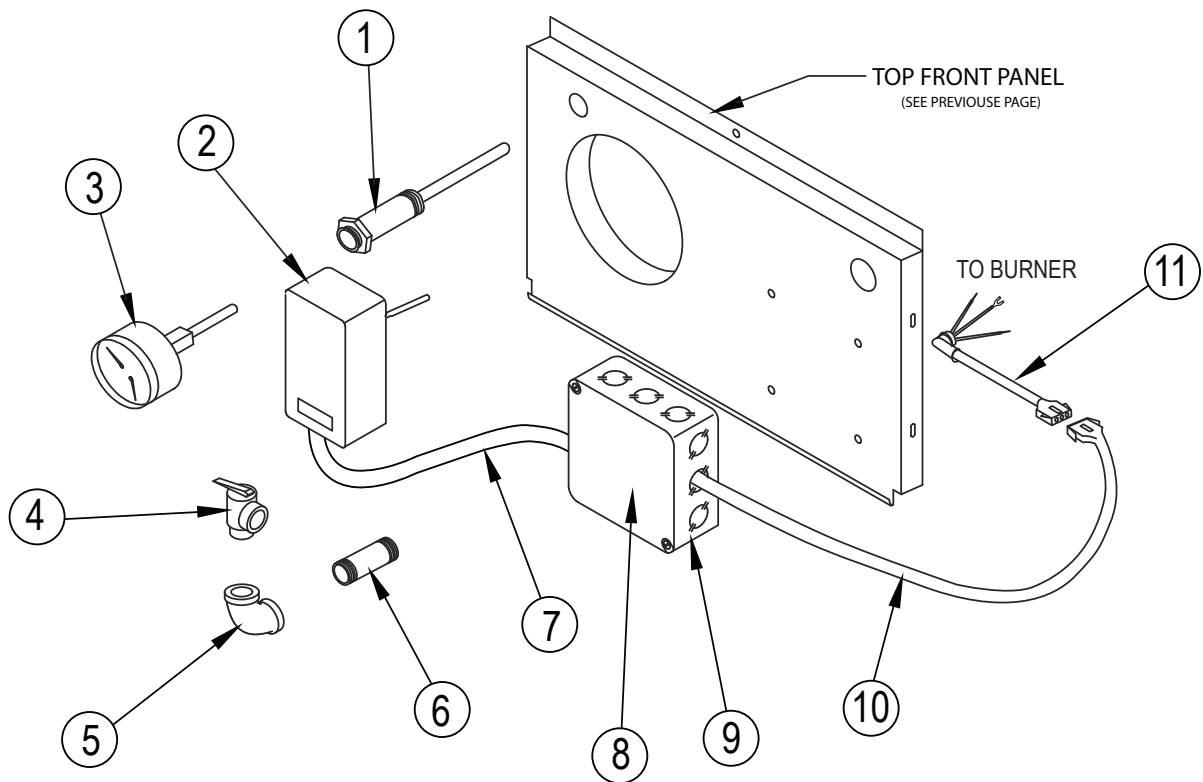


ITEM #	PART #	DESCRIPTION	QTY
1	HW-005.01	SCREW ¼ -20 X ½ SELF TAP	1
2	2452902	FLUE COLLECTOR ASSY (4 SECT)	1
	2452903	FLUE COLLECTOR ASSY (5 SECT)	
	2452907	FLUE COLLECTOR ASSY (6 SECT)	
	2452908	FLUE COLLECTOR ASSY (7 SECT)	
3	HW06701	STUD ⅝ - 18 X 2 ⅜	4
4	2252501	SUPPORT JACKET BRACKET	1
5	HW06901	NUT ⅝ -18 WISLOCK	8
6	RY-001.02	CONTROL R4184D	1
7	BN04004	BURNER OIL UT904C (4 SECTION)	1
	BN04006	BURNER OIL UT906C (5 SECTION)	
	BN08901	BURNER OIL UT1801 (6 & 7 SECTION)	
8	CD-001.01	CAD CELL C554A-1174	1
9	HW-016.02	DRAIN LONG (31-608-04)	1
10	PF-004.04	PIPE FITTING - BUSHING 1 ¼ X ¾	1
11	HW07001	STUD ⅝ -18 X 1 ⅜	3
12	HW06401	NUT - ACORN 1/2-13 UNC YELLOW	2

SFM SERIES REPLACEMENT PARTS

Figure #18

CONTROLS & HARDWARE



ITEM #	PART #	DESCRIPTION	QTY
1	AQ-020.01	WELL 3/4" X 3"	1
2	AQ-008.00	CONTROL L4006A-1827 HW LIMIT	1
3	GA-001.00	GAUGE - THERALTIMETER	1
4	VR-001.01	RELIEF VALVE - 30# 3/4"	1
5	PF-002.04	PIPE FITTING - 90° ELBOW	1
6	PF-005.11	PIPE FITTING - 3/4 " X 4" NIPPLE	1
7	28511601	HARNESS CONTROL BOX 21"	1
8	30A009701	4" J-BOX COVER	1
9	EF-013.01	JUNCTION BOX	1
10	1263012	HARNESS - BURNER 22"	1
11	1263013	HARNESS - BURNER 8"	1



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