



OIL BURNER
INSTALLATION INSTRUCTIONS
AND
BURNER SPECIFICATIONS
FOR
PFA-3
BOILERS



PLUMBING & HEATING
P.O. BOX 2003
NEW BRUNSWICK, N.J. 08903

**PLAINTIFF'S
EXHIBIT**

ASI-537

PART NO. 30740 (11/72)

07814

GENERAL INFORMATION

This manual is to be used in conjunction with the appropriate PFA-3 boiler manual. The boiler should be assembled, tested, and the boiler controls installed before the burner is unpacked and serviced for installation. All electrical and oil lines should be run adjacent to the boiler-burner installation. It is important that the serviceman and installer have the following instruments available for proper testing, adjustments, and servicing the burner:

- CO₂ Test Instrument
- Smoke Tester
- Draft Gauge (Inclined tube .0 to 1.0 inch)
- Oil Pressure Gauge
- Oil Vacuum Gauge
- Multi-Meter
- Flame Mirror

The burners covered by this book have been specifically designed and tested for the boiler-burner units involved. At the rear of this manual are specific charts showing "Air Handling Data", "Burner Data", and various parts data. For proper burner operation the dimensions shown should be strictly adhered to.

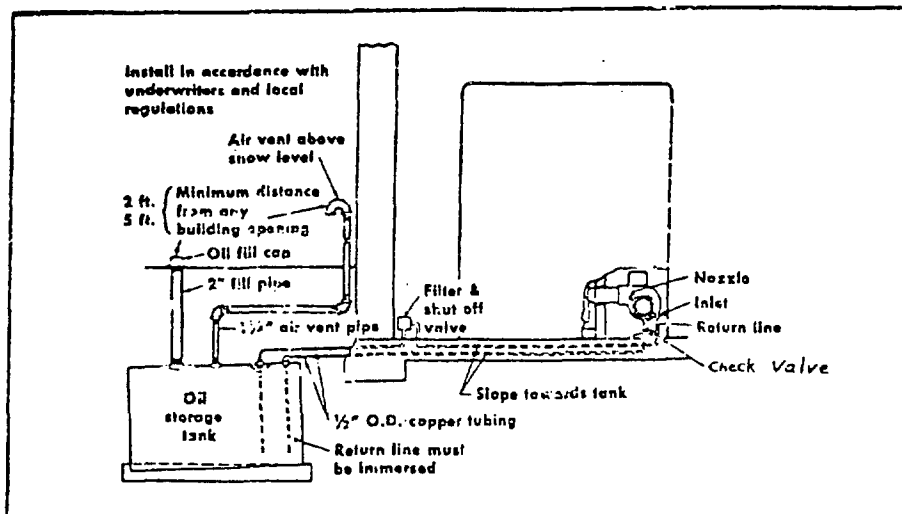
AIR FOR COMBUSTION

It is necessary to have sufficient outside air for combustion to be supplied at all times to the Boiler Room. A permanent opening or duct should be provided such that the boiler input will not exceed 5000 Btu/h/square inch of free area. The air inlet opening should be located at a point where it cannot be covered with snow or where it cannot be obstructed by any other means. Movable louvers should not be used. Never depend on an open door that can be closed for the air inlet, or rely on cracks under doors or around loose windows.

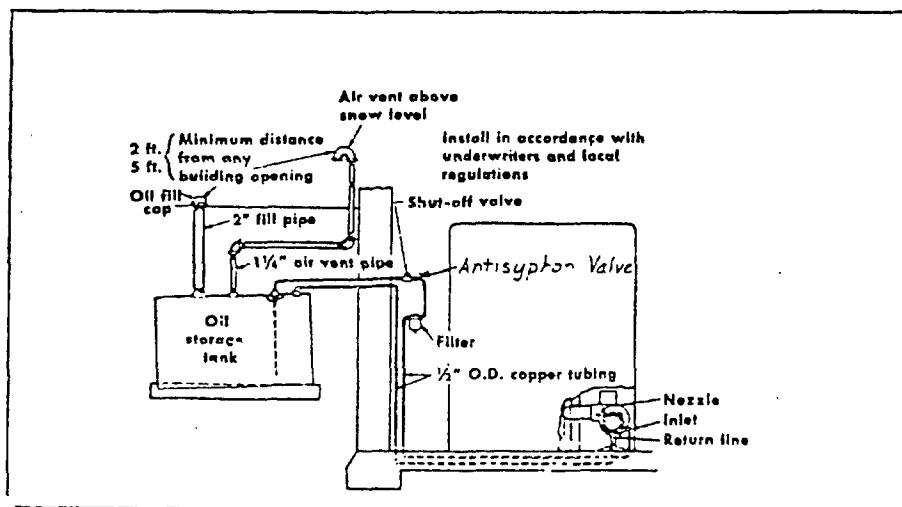
FUEL SYSTEM

All Burners are furnished with two-stage fuel units. Two-pipe systems are recommended. Refer to Fuel Unit Literature for proper vacuum, pipe sizes, etc. Suggested piping is illustrated below.

FUEL-UNIT ABOVE TANK, TWO-PIPE SYSTEM



FUEL-UNIT BELOW TANK, TWO-PIPE SYSTEM



PREPARATION OF BURNER FOR INSTALLATION ON BOILER

1. Insert proper nozzle. (See "Nozzle Data" in charts of this manual.)
2. Check nozzle settings as shown in this manual.
3. Check electrode settings as shown in this manual.
4. Be sure all parts and settings agree with those shown in this manual.
5. Set drawer assembly to middle position on side of housing.
6. Burner is now ready for installation on boiler mounting plate.

ELECTRICAL POWER CONNECTION

Check burner, this manual, and wiring diagrams for the proper power supply to be connected to burner and controls. Note that all burners are factory wired, eliminating field wiring as much as possible.

START -UP AND FINAL ADJUSTMENTS

1. Make sure that flue damper in PFA-3 boiler is in full open position.
(To be adjusted later if required.)
2. CAUTION Make sure there is water in the boiler and that there is oil in the oil line to prevent burn-out of Fuel Unit.
3. Connect oil lines to burner.
4. Connect electrical power wiring to burner and boiler controls.
5. Set air adjustments on burner to half open position. (These adjustments are temporary and will probably have to be changed to achieve proper smoke and CO₂ readings.)
6. Turn on power to burner.
7. Set limit and operating controls to desired settings. Burner should start.
8. Check smoke characteristics immediately. Adjust air to get No. 2 smoke or less.
9. Check oil pressure. Should be 100 P.S.I.

10. Check CO₂ reading (should be 12% $\pm$ 1%)

11. Check Out Operation of:

Limit Control
Operating Control
Low Water Cut-Off

Ignition Characteristics
Burner Safety Circuit
Re-check CO₂ and Smoke Readings

SERVICE TIPS

The following information has been compiled to assist the installer and serviceman in locating and correcting service problems with our "LC" series burners. These burners are equipped with 3450 r.p.m. motors and pumps, one-stage firing, and with flame reversion.

All of the models can be fired with draft or with pressure in the firebox. (See boiler installation manual for maximum allowable pressure in the firebox.)

A forced draft burner supplies all the air for combustion and can be fired in a boiler with natural draft, induced draft or with no draft.

Pressure firing is a term used when there is pressure in the firebox during the burner operation. The pressure is produced by the resistance through the boiler or furnace and the combustion air supplied by the burner.

AIR FOR COMBUSTION

If lack of combustion air is suspected, close the door to the boiler or furnace room and operate the burner for at least 30 minutes. If the flame appears to become gassy and tends to snuff out, insufficient combustion air is the cause and corrective measures must be taken to provide the proper amount of air.

BLOWER WHEELS (FANS) - VIBRATION

If undue vibration is detected in the burner, it could be caused by the blower wheel being out of balance. Check to determine if any foreign matter has been drawn into the burner and lodged in the blower wheel. If not, replace the blower wheel. Remove the motor from the burner and run it without the blower wheel to determine if there is any undue vibration. Replace the motor if the operation is not smooth. When installing a new blower wheel in the burner, it is very important that it be secured tightly to the motor shaft.

The replacement blower wheel must be located on the motor shaft so that the set screws bear on the center of the flat on the 1/4 H. P. motors. Make sure that the set screws on blower wheels are securely tightened. There should be adequate clearance on both sides of the blower wheel in the housing.

The blower wheels used in the burners are dynamically balanced for operation at 3450 r.p.m. and any replacement should be an exact duplicate of the original.

DRAFT

The burners are designed for firing against pressure in the firebox, but operate just as satisfactorily in a natural draft installation.

It is important that the vent or chimney be located so as to be free of downdrafts. Forced draft burners can operate with back pressure in the boiler and flue pipe, but strong surges of down draft can cause the fire to become smoky and erratic. After a shut-down the heat in the combustion area could damage the burner if it is forced back through the burner by down-drafts. It may be necessary to increase the height of the vent or chimney above the building and in some instances install a dutch cap or similar appliance to prevent downdrafts.

FUEL SYSTEM

The burners can be installed with a single line if no lift from the oil tank is involved. If a long single line is used, it should be large enough in diameter so that the vacuum reading on the fuel unit is no more than 10 inches. If the oil tank is below the level of the burner, use a two-line system.

If two or more burners are piped to a common suction line, each burner must have its own check valve.

If the pressure gauge on the fuel unit shows the 100 p.s.i. cannot be obtained, the fuel unit should be replaced. The quick cut-off pumps used should never be adjusted above 100 p.s.i.

A pressure gauge and a vacuum gauge should be used if a fuel unit problem is suspected. If the pressure is excessive, such as 125# to 150#, check the flame base at the flame retention cup. Excessive pressure may cause the flame to lift away from the spinner. The pressure should be maintained at 100#.

Refer to the fuel unit manufacturers data for the proper vacuum for the installation. If the vacuum reads higher than the calculated vacuum (see manufacturers instructions) check for restrictions in the oil line. Excessively long lines, closed tank valve, kinked copper tubing, plugged check valve, or an oil filter. Undersized oil line, excessive oil lift or a restricting check valve. If the vacuum reads low, look for air leaks in the suction line, valve fittings or fuel unit. On a gravity flow installation, no vacuum will be shown on the gauge except where there are restrictions caused by a closed valve, plugged oil filter, kinked, undersized, or excessively long suction line.

All restrictions must be eliminated and undersized or excessively long lines replaced with lines of a greater diameter so that the vacuum reading will be no more than 10 inches.

A singing sound in the fuel unit may indicate air in the suction line. Excessively high vacuum can also cause noise in the fuel unit. Air in the suction line can cause delayed lighting. This condition will in time coat the photocell with carbon and safety shut-downs may result.

If it is suspected that the oil is returning to the tank after shut-down, inspect for leaks in the suction line and check valve. If the check valve is not seating properly and there is a slight air leak in the suction line, the oil will flow back to the oil tank. On the next start up of the burner, there will be a delay in the oil delivery while the pump is lifting the oil from the tank. Repair any air leaks and replace the check valve if necessary.

IGNITION PROBLEMS

Hard (rough) lighting can be caused by ignition problems. Check the transformer for adequate spark. Check for a spark by momentarily short circuiting the transformer across the terminals by use of a screwdriver with an insulated handle. A 3/4" long spark should be obtained. If there is no spark or if the spark was weak (less than 1/2 inch), replace the transformer. Check the spark gap with the dimensions in the installation manual.

With standard control systems the spark should appear immediately when the burner starts. If a delay is detected, check the power supply to the burner. When a condition of this type is suspected, the best check is to have a voltage recorder connected to the burner for a period of 48 hours. This will indicate any voltage drop during that period. Voltage drops are usually caused by undersized wiring or a long run from the burner to the source of power. If delayed ignition is not corrected, it could cause an explosion.

Check the drawer assembly for possible high voltage leaks in the insulators. If in doubt, change the electrode assemblies. Check the electrode springs and points for adequate clearance to the ground. Check for carbon on the electrode points. Check all dimensions on the drawer assembly according to the dimensions shown in the manual and reset if necessary.

If the cup is not correctly positioned in relation to the end cone hard lighting could occur. This is usually caused when the cup is positioned too far back inside the end cone. To correct this condition, loosen the screw that locks the drawer assembly in place and move the assembly forward in steps of 1/16 of an inch until the lighting is smooth.

Be sure to tighten the set screw after making this adjustment and check the electrode springs from the electrodes to the transformer, making sure there is adequate clearance to a ground and there is no possibility of a short circuit.

If the fire is clean with no smoke while in operation, but the heating unit continues to become coated with soot, check for short cycles on the burner. Short cycling will eventually cause hard lighting due to carbon on the spinner and nozzles. Under these conditions the limit control on the heating unit should be set with a greater differential.

INSTRUMENTS

In most forced draft units it is impossible to view the flame satisfactorily so instruments must be used to properly adjust the flame.

Do not attempt to obtain a higher percentage of CO₂ than a clean fire will give. Keeping the heating surface of the unit clean is more important than securing a higher percentage of CO₂. Set the flame at no more than #2 on the Bacharach scale.

NOZZLES

Use only the nozzles recommended for they are of the proper type, capacity and spray angle, and these nozzles should give the best performance in each burner and unit combination under normal conditions.

However, because of the great variation in fuel oils in different localities, normal conditions do not always apply. Nozzles will not always deliver the gallons per hour or the spray angle with which they are marked, and in some instances nozzles other than those furnished as original equipment could give better performance.

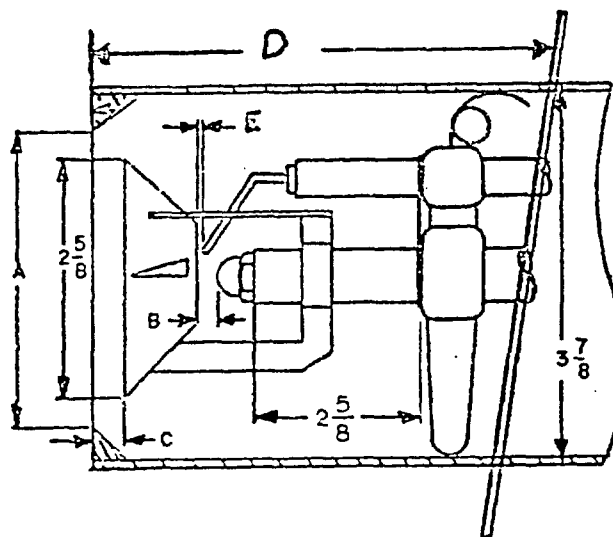
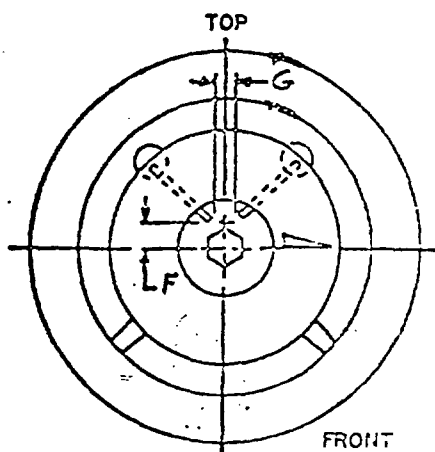
The nozzles used should give smooth lighting and be able to produce a CO₂ reading of 10.5 to 12.5 percent with no more than a #2 smoke.

Do not attempt to install the nozzle through the end cone. It is impossible to get a tight joint between the nozzle and the adapter unless two wrenches are used. Remove the drawer assembly from the burner and then remove the cup before installing the nozzle.

Boiler Number	Burner Model No. & Spec. No.	"A"	"B"	"C"
		I. D. Of End Cone	Nozzle To Back of Cup	From Face of Cup To End Cone
PFA-34	LC334-A3/1171	3"	1/4"	3/16" to 1/4" *
PFA-35	LC334-A/1172	3-1/4"	1/4"	1/16" to 1/4"
PFA-36	LC534-A/1173	3-3/16"	1/4"	1/16" to 1/4"
PFA-37	LC534-A/1173	3-9/16"	1/4"	1/16" to 1/4"

* CUP EXTENDS IN FRONT OF END CONE ON PFA-34 BOILERS

Boiler Number	Burner Model No. & Spec. No.	"D"	Electrode Settings		
		Burner Flange To End of Air Tube	"E" Back of Cup To Electrode Points	"F" Centerline Nozzle up To Electrodes	"G" Spark Gap
PFA-34	LC334-A3/1171	2"	1/32"	1/4"	1/8"
PFA-35	LC334-A/1172	2"	1/32"	1/4"	1/8"
PFA-36	LC534-A/1173	2"	1/32"	1/4"	1/8"
PFA-37	LC534-A/1173	2"	1/32"	1/4"	1/8"



IR HAND NO DATA

<u>Boiler</u> <u>No.</u>	<u>Burner No.</u> <u>& Spec. No.</u>	<u>LLR</u> <u>Boiler</u> <u>Rating</u> <u>GPH</u>	<u>End Cone Data</u>		<u>Cap Data</u>	
			<u>I. D.</u>	<u>Part No.</u>	<u>O. D.</u>	<u>Part No.</u>
PFA-34	LC334-A3/1171	2.05	3"	C51671	2-5/8"	A40752
PFA-35	LC334-A/1172	3.30	3-1/4"	C61681	2-5/8"	A40752
PFA-36	LC534-A/1173	3.95	3-9/16"	C51691	2-5/8"	A40752
PFA-37	LC534-A/1173	4.30	3-9/16"	C51691	2-5/8"	A40752

<u>Boiler</u> <u>No.</u>	<u>Burner No.</u> <u>& Spec. No.</u>	<u>Stabilizer</u> <u>Ring Part No.</u>	<u>Disc Data</u>		<u>Qty.</u> <u>Used</u>	<u>Nozzle Data</u>		
			<u>O. D.</u>	<u>Part No.</u>		<u>Size</u> <u>G. P. H.</u>	<u>Spray</u> <u>Angle</u>	<u>Typ</u>
PFA-34	LC334-A3/1171	A41181	2-1/4"	S40904-3	1	2.50	70	B
PFA-35	LC334-A/1172	A41181	2-1/4"	S40904-3	1	3.25	45	F
PFA-36	LC534-A/1173	A41181	2-1/4"	S40904-3	1	4.00	45	P
PFA-37	LC534-A/1173	A41181	2-1/4"	S40904-3	1	4.50	45	P

BURNER RATING CAPACITY CHART

<u>Boiler Number</u>	<u>Burner No.</u> <u>& Spec. No.</u>	<u>Gallons Per Hour</u>	
		<u>Min.</u>	<u>Max.</u>
PFA-34	LC334-A3	2.00	4.00
PFA-35	LC334-A	2.00	3.00
PFA-36	LC534-A	3.00	6.00
PFA-37	LC534-A	3.00	6.00

TRANSFORMER

Allanson Mfg. Corp. - Niagara Falls, New York

<u>Burner Model</u>	<u>Surray Part No.</u>	<u>Manufacturer</u>		<u>Type</u>	<u>Burner</u>
		<u>Name</u>	<u>Part No.</u>		
LC334-A3					
LC334-A					
LC534-A	MS1072	Allanson	452		

TWO-STAGE FUEL UNITS FOR OIL BURNERS

Sundstran Hydraulics - Rockford, Illinois

<u>Burner Model</u>	<u>Sunray Part No.</u>	<u>Manufacturer</u>		<u>Shaft</u>	
		<u>Name</u>	<u>Part No.</u>	<u>DIA.</u>	<u>FLAT</u>
LC334-A3					
LC334-A					
LC534-A	P40072	Sundstrand	H3BA200	7/16"	1-3/16"

MOTORS FOR OIL BURNERS

Marathon Electric Mfg. Corp, Wausau, Wisconsin

<u>Burner Model</u>	<u>Sunray Part No.</u>	<u>MFRS. Part No.</u>	<u>H. P.</u>	<u>Frame</u>	<u>Voltage and Cycles</u>	<u>Type</u>	<u>Shaft</u>	
							<u>DIA.</u>	<u>FLAT</u>
LC334-A3								
LC334-A						split		
LC534-A	M40061	48S34S3B	1/4	48-6	115-60	phase	1/2"	1-3/8"

BURNER MOUNTINGS

PARTS INFORMATION

<u>American-Standard Boiler No.</u>	<u>Burner Model No. And Spec. No.</u>	<u>Air Tube Part No.</u>	<u>Welded Flange & Air Tube Assembly Part No.</u>
PFA-34	LC334-A3/1171	---	A51232-7-3
PFA-35	LC334-A/1172	---	A51242-7-3-1/4
PFA-36	LC534-A/1173	---	A51262-7-3-9/16
PFA-37	LC534-A/1173	---	A51262-7-3-9/16

CAUTION TO INSTALLERS AND OWNERS

The heat transfer surface of this boiler has been carefully designed to give optimum performance and reliability. However, the presence of contaminants such as scale or lime, sediment and boiler sealing compounds in the section waterways may cause premature failure of the sections.

If leaks occur in the system and are undetected or neglected, fresh water replaces the water lost through the leaks. Nearly all water contains dissolved minerals ("lime"). As water is heated in the boiler, the minerals are deposited, mostly at the bottom of the sections directly above the fire. No appreciable amount of lime is deposited in a system with no leaks; but when water is hard and makeup water must be added frequently and in large amounts, boiler waterways may be coated with a thick layer of lime within days or a few weeks of operation. Lime is an insulator, which causes overheating of boiler metal: if deposition of lime is not halted, the boiler will fail. To stop lime deposition, stop system leaks.

Leaks may occur occasionally in any system. These leaks are usually of such a nature that they can be prevented or corrected by good workmanship. Every effort should be made to correct them without the use of boiler sealing compounds. If compounds are used, they should be used as sparingly as possible, and never in excess of manufacturers recommendations. Following use, the boiler must be flushed out thoroughly, or serious damage is likely to result.

Sediment which may accumulate in the boiler should be flushed out in accordance with recommended maintenance practices. Excessive use of water should be avoided because of the danger of lime and corrosion buildup.

Glycol anti-freeze is sometimes added to system water to protect against freezeup. Although American Standard can not recommend this practice, we realize that glycol anti-freeze will occasionally be used. Heat transfer through glycol is poorer than through water: use no more than 50 percent glycol in the system. With any proportion of glycol, radiator output will be lower than with pure water at the same temperature.

It is always better, when possible, to drain the system rather than add anti-freeze; neither the heating system nor plumbing system water will freeze so long as the heating system continues to operate; and the plumbing system is not protected against freezeup when the heating system is off, whether or not the heating system contains anti-freeze.

Cast iron is highly resistant to corrosion. However, some propellants used in aerosol cans break down into poison gas and corrosive gas, at high temperatures. If aerosol mixtures are used near boilers, the aerosol will enter the boiler flame and will be heated. Continued use of aerosol cans near heating system boilers can result in severe boiler heating surface corrosion and possible danger to health.

The installer of this boiler is responsible for showing to the owner operator the location of all emergency shutoff devices, and instructing him in the use of each.

CONSUMER PROTECTION - WARRANTY

American-Standard products normally reach owners or consumer-users through an industry channel of distributors and plumbing and heating contractors. Experience has shown that claims of defects in our products generally relate to abuse or to other damage which occur after our sale and are not our responsibility. Since determining proper responsibility requires local inspection, our warranty (set forth below) extends only to our direct buyers; distributors are best equipped to obtain the facts underlying claims, to place responsibility where it belongs and to recommend/handle repair or replacement.

American-Standard warrants only to its distributors and other direct Buyers that it will furnish by freight a replacement for, or at its option repair, any product of its manufacture or part or portion thereof, proved to its satisfaction to be defective in material or workmanship under normal use and service within one year after installation.

THERE IS NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING NO IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY FOR FITNESS FOR A PARTICULAR PURPOSE AND AMERICAN-STANDARD WILL NOT BE RESPONSIBLE FOR ANY DAMAGES WHATSOEVER, NOR FOR LABOR OR TRANSPORTATION EXPENSES RELATING TO SUCH REPLACEMENT OR SUCH REPAIR, NOR WILL IT BE HELD RESPONSIBLE FOR WARRANTY ADJUSTMENTS COSTING MORE THAN THE PRICE OF THE PRODUCT TO ITS DISTRIBUTORS AND OTHER DIRECT BUYERS.

Goods of other manufacturers sold by American-Standard are not warranted unless accompanied by an express written warranty, but the Seller will endeavor to secure for its direct Buyers the benefits of warranties extended by such other manufacturers for such goods.

American-Standard is proud of its record for product quality and for fairness in handling warranty matters; and, if an ultimate user of our products should feel our warranty system described above does not work fairly in his case, he should write the Office of the President, Director of Consumer Affairs, U. S. Plumbing/Heating, American-Standard, 40 West 40th Street, New York, N. Y. 10018.

DEALER'S NAME: _____

ADDRESS: _____

TELEPHONE NO.: _____

DATE OF INSTALLATION: _____



PLUMBING & HEATING DIVISION

NEW BRUNSWICK, NEW JERSEY 08903