

# COMMERCIAL GAS

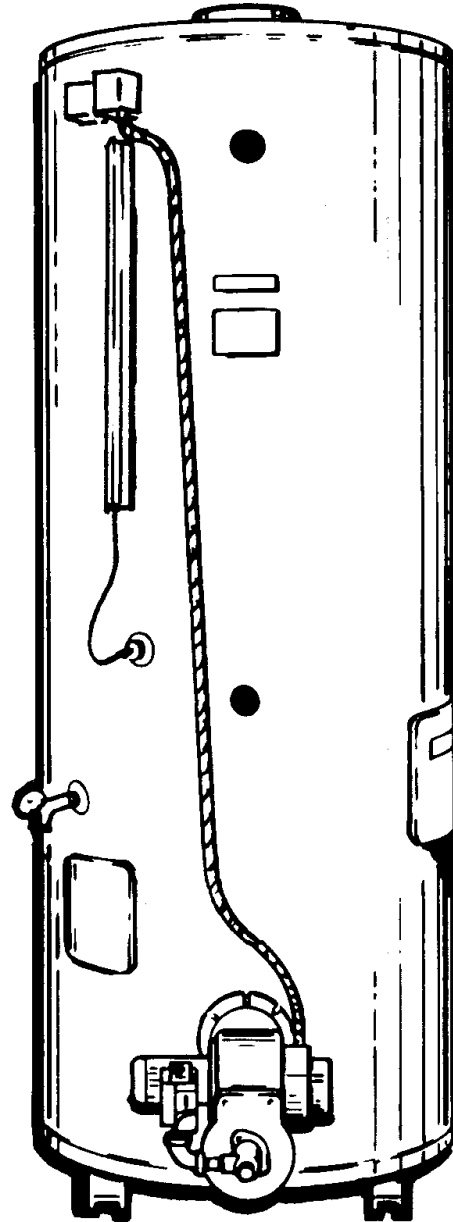
## Lined Tank Type Water Heater

• Installation • Service • Maintenance



**WARNING:** If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

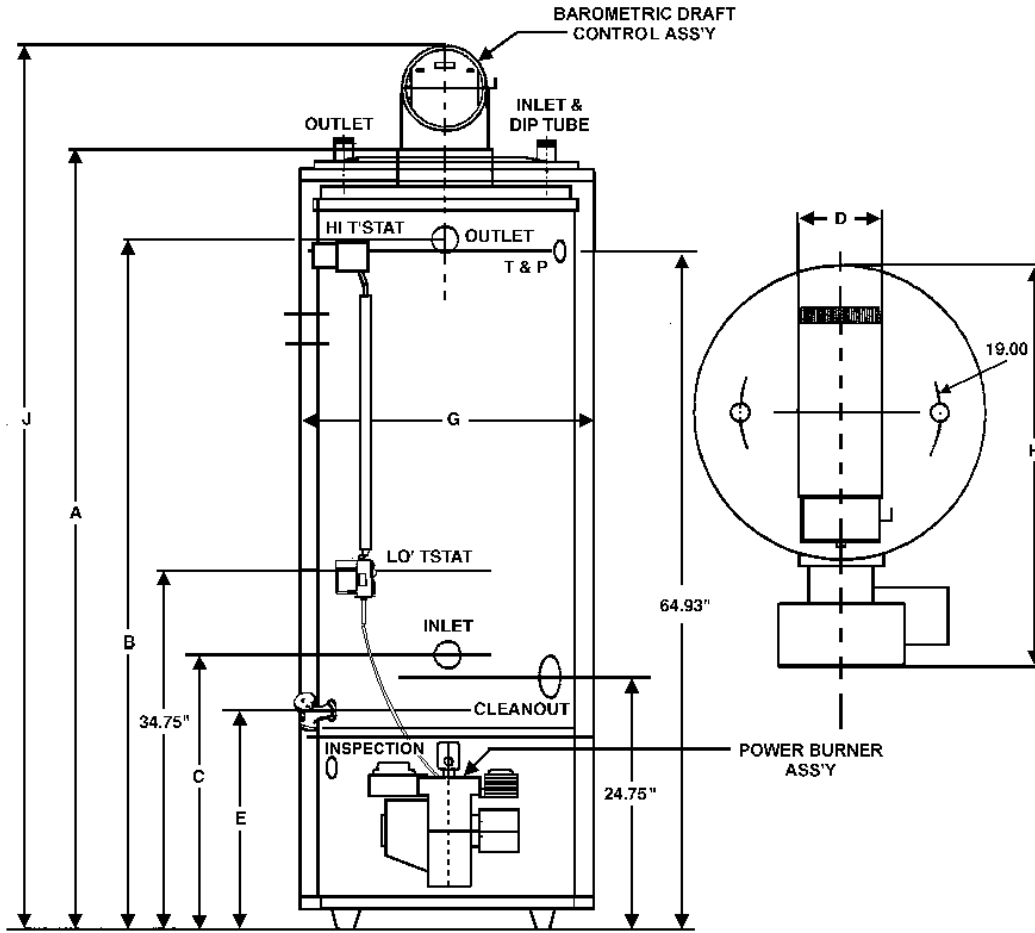


TEXT PRINTED OR OUTLINED IN RED CONTAINS INFORMATION RELATIVE TO YOUR SAFETY. PLEASE READ THOROUGHLY BEFORE INSTALLING AND USING THIS APPLIANCE.

PLACE THESE INSTRUCTIONS ADJACENT TO HEATER AND NOTIFY OWNER TO KEEP FOR FUTURE REFERENCE.

# FEATURES AND SPECIFICATIONS

The illustration shows a typical gas-fired commercial gas power burner, tank-type water heater. The principal components of the heater are shown and identified here. By referring to the plate on the heater jacket the unit may be identified in the specifications presented in Table 1 and 2.



**TABLE 1 - NOMINAL MODEL DIMENSIONS AND WEIGHTS**

MODELS	A	B	C	D	E	G	H	J	GAS	APPROX. SHIP. WT. (LBS.)		IN	OUT
										ASME	STD.		
***81-140	74 3/4	65	26 3/4	6	21 3/8	27 3/4	38	85 1/4	1/2	658	556	1 1/2	1 1/2
***81-199	74 3/4	65	26 3/4	6	21 3/8	27 3/4	38	85 1/4	1/2	635	545	1 1/2	1 1/2
***81-270	74 3/4	65	26 3/4	8	21 3/8	27 3/4	38	85 1/4	3/4	632	547	1 1/2	1 1/2
***81-370	74 3/4	65	26 3/4	8	21 3/8	27 3/4	38	85 1/4	3/4	731	634	1 1/2	1 1/2

**TABLE 2 - MODEL ENERGY CONSUMPTION AND PERFORMANCE DATA**

MODELS	STORAGE CAPACITY U.S. GALLONS	INPUT RATING BTU/HR.	RECOVERY RATE GPH@100°F RISE	RECOVERY RATE GPH@140°F RISE	MAXIMUM AMPERES 120V, 60Hz, 1Ø
***81-140	81	140,000	136	97	5
***81-199	81	199,000	193	138	5
***81-270	81	270,000	262	187	5
***81-370	81	370,000	359	256	5

Model Designator: Sample \*\*\*81-140NEA  
 \*\*\* = Letter designator  
 81 = Gallon Capacity  
 140 = 140,000 BTU/HR input

N = Natural Gas  
 E = 3 Year Warranty  
 A = ASME Construction

# FOREWORD

These designs comply with the latest version of the American National Standard for Gas Water Heaters, Volume III, ANSI Z21.10.3 - CSA 4.3.

Detailed installation diagrams are found in this manual. These diagrams will serve to provide the installer with a reference for the materials and methods of piping necessary. It is highly essential that all water, gas piping and wiring be installed as shown on the diagrams.

Particular attention should be given to the installation of thermometers at the locations indicated on the diagrams as these are necessary for checking the proper functioning of the heater.

The \*\*\*81-140 through \*\*\*81-370 models are designed to operate on either natural or propane gases. **HOWEVER, MAKE SURE** the gas on which the heater will operate is the same as that specified on the heater model and rating plate.

**THESE HEATERS MUST NOT BE INSTALLED DIRECTLY ON COMBUSTIBLE FLOORS.**

In addition to these instructions, the equipment shall be installed in accordance with those installation regulations in force in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

The installation must conform to these instructions and the local code authority having jurisdiction. In the absence of local codes the installation must comply with the latest editions of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and the National Electric Code, NFPA 70. The former is available from the Canadian Standards Association, 8501 Pleasant Valley Road, Cleveland, OH 44131 and both documents are available from the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

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# GENERAL SAFETY INFORMATION

## PRECAUTIONS

DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDERWATER. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

IF THE UNIT IS EXPOSED TO THE FOLLOWING, DO NOT OPERATE HEATER UNTIL ALL CORRECTIVE STEPS HAVE BEEN MADE BY A QUALIFIED SERVICEMAN.

1. EXTERNAL FIRE.
2. DAMAGE.

3. FIRING WITHOUT WATER.
4. SOOTING.

Heater must be protected from freezing downdrafts during shutdown periods.

## CHEMICAL VAPOR CORROSION



**CORROSION OF THE FLUEWAYS AND VENT SYSTEM MAY OCCUR IF AIR FOR COMBUSTION CONTAINS CERTAIN CHEMICAL VAPORS WHICH BREAK DOWN INTO ACIDS AT HIGH TEMPERATURE. SUCH CORROSION MAY RESULT IN FAILURE AND RISK OF ASPHYXIATION.**

Spray can propellants, cleaning solvents, refrigerator and air conditioning refrigerants, swimming pool chemicals, calcium and sodium chloride (water softener salt), waxes, and process chemicals contain typical compounds which are potentially corrosive. Do not store products of this sort near the heater. Also, air which is brought in contact with the heater should not contain any of these chemicals. If necessary, uncontaminated air should be obtained from remote or outside sources. The limited warranty is voided when failure of water heater is due to a corrosive atmosphere. (Refer to the limited warranty for complete terms and conditions).

## IMPROPER COMBUSTION



### WARNING

ATTIC AND/OR EXHAUST FANS OPERATING ON THE PREMISES WITH A WATER HEATER CAN RESULT IN CARBON MONOXIDE POISONING AND DEATH.

OPERATING THESE FANS CAN PRODUCE A NEGATIVE DRAFT IN THE AREA OF THE WATER HEATER PREVENTING THE PRODUCTS OF COMBUSTION FROM EXHAUSTING THROUGH THE CHIMNEY OR VENT PIPE.

The venting of the water heater should be inspected by a qualified service technician at the time of installation and periodically thereafter to ensure a down-draft condition does not exist.

DO NOT OBSTRUCT THE FLOW OF COMBUSTION AND VENTILATING AIR. ADEQUATE AIR FOR COMBUSTION AND VENTILATION MUST BE PROVIDED FOR SAFE OPERATION.

## LIQUID PETROLEUM MODELS

Water heaters for propane or liquefied petroleum gas (LPG) are different from natural gas models. A natural gas heater will not function safely on LP gas and no attempt should be made to convert a heater from natural gas to LP gas.

LP gas must be used with great caution. It is highly explosive and heavier than air. It collects first in the low areas making its odor difficult to detect at nose level. If LP gas is present or even suspected, do not attempt to find the cause yourself. Go to a neighbor's house, leaving your doors open to ventilate the house, then call your gas supplier or service agent. Keep area clear until a service call has been made.

At times you may not be able to smell an LP gas leak. One cause is odor fade, which is a loss of the chemical odorant that gives LP gas its distinctive smell. Another cause can be your physical condition, such as having a cold or diminishing sense of smell with age. For these reasons, the use of a propane gas detector is recommended.

Only trained LP professionals should conduct the required safety checks in accordance with industry standards.

## EXTENDED NON-USE PERIODS



### WARNING

HYDROGEN GAS CAN BE PRODUCED IN A HOT WATER SYSTEM SERVED BY THIS HEATER THAT HAS NOT BEEN USED FOR A LONG PERIOD OF TIME (GENERALLY TWO WEEKS OR MORE). HYDROGEN GAS IS EXTREMELY FLAMMABLE. To reduce the risk of injury under these conditions, it is

recommended that the hot water faucet be opened for several minutes at the kitchen sink before using any electrical appliance connected to the hot water system. If hydrogen is present, there will probably be an unusual sound such as air escaping through the pipe as the water begins to flow. **THERE SHOULD BE NO SMOKING OR OPEN FLAME NEAR THE FAUCET AT THE TIME IT IS OPEN.**

## INSULATION BLANKETS

Insulation blankets available to the general public for external use on gas water heaters are not approved for use on your water heater. The purpose of an insulation blanket is to reduce the standby heat loss encountered with storage tank water heaters. Your water heater meets or exceeds the ASHRAE/IES 90.1b-1992 standards with respect to insulation and standby loss requirements making an insulation blanket unnecessary.



### WARNING

Should you choose to apply an insulation blanket to this heater, you should follow these instructions. Failure to follow these instructions can result in fire, asphyxiation, serious personal injury or death.

- **Do not** apply insulation to the top of the water heater, as this will interfere with safe operation of drafthood.
- **Do not** cover the temperature & pressure relief valve.
- **Do not** cover the instruction manual. Keep it on the side of the water heater or nearby for future reference.
- **Do** obtain new labels from manufacturer for placement on the blanket directly over the existing labels.

## HIGH ALTITUDE INSTALLATIONS



### WARNING

INSTALLATIONS ABOVE 2000 FEET REQUIRE REPLACEMENT OF THE BURNER ORIFICE IN ACCORDANCE WITH SECTION 8.1.2 OF THE NATIONAL FUEL GAS CODE (ANSI Z223.1). FAILURE TO REPLACE THE ORIFICE WILL RESULT IN IMPROPER AND INEFFICIENT OPERATION OF THE APPLIANCE RESULTING IN THE PRODUCTION OF INCREASED LEVELS OF CARBON MONOXIDE GAS IN EXCESS OF SAFE LIMITS WHICH COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

As elevation above sea level is increased, there is less oxygen per cubic foot of air. Therefore, the heater input rate should be reduced at high altitudes for satisfactory operation with the reduced oxygen supply. Failure to make this reduction would result in an overfiring of the heater, causing sooting, poor combustion and/or unsatisfactory heater performance.

Ratings specified by manufacturers for most appliances apply for elevations up to 2000 feet. For elevations above 2000 feet, ratings must be reduced at the rate of 4% for each 1000 feet above sea level. For example, if a heater is rated at 120,000 Btu/hr. at sea level, to rate the heater at 4000 feet, you subtract 4 (once for each thousand feet) x .04 (4% input reduction) x 120,000 (the original rating) from the original rating. Therefore, to calculate the input rating at 4000 feet:  $4 \times .04 \times 120,000 = 19,200$  btu/hr.,  $120,000 - 19,200 = 100,800$  btu/hr. At 6000 feet elevation, the heater rating would be 91,200 btu/hr.

The input reduction is primarily achieved by reducing the size of the main burner orifices. To do this, the main burner orifices require replacement with orifices sized for the particular installation elevation. Correct orifice sizing and parts may be obtained from the manufacturer. See the REPLACEMENT PARTS section of this manual. When ordering, be sure to state the model number and the altitude of the location where the heater is being installed.

Upon completion of derating of the heater, adjustment to the gas pressure regulator may be required. See ADJUSTMENT PROCEDURE in this manual for inlet and manifold pressure requirements.

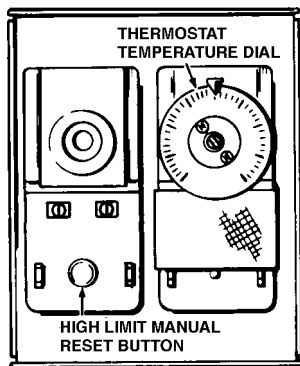
Also, due to the input rating reduction required at high altitudes, the output rating of the appliance is also reduced and should be compensated for in the sizing of the equipment for applications.

## FEATURES

### HIGH LIMIT SWITCH (E.C.O.)

The dual bulb controller ((fig. 1) contains the high limit (energy cutoff) sensor. The high limit switch interrupts main burner gas flow should the water temperature reach 205°F (96°C).

In the event of high limit switch operation, the appliance cannot be restarted unless the water temperature is reduced by at least 20°F (11°C) and the high limit reset button on front of limit control (fig.1) is depressed.



DUAL-BULB THERMOSTAT (COVER REMOVED)

FIGURE 1

Continued manual resetting of high limit control, preceded by higher than usual water temperature is evidence of high limit switch operation. The following is a possible reason for high limit switch operation.

- A malfunction in the thermostatic controls would allow the gas valve to remain open causing water temperature to exceed the thermostat setting. The water temperature would continue to rise until high limit switch operation.

Contact your dealer or servicer if continued high limit switch operation occurs, to determine the reason for operation.

### CIRCULATING PUMP

A circulating pump is used when a system requires a circulating loop or there is a storage tank used in conjunction with the heater.

Refer to the piping diagrams at rear of manual for electrical hookup information and install in accordance with the latest version of the National Electric Code ANSI/NFPA No. 70.

Only all bronze circulators are used with commercial water heaters. Although circulators are oiled and operated by the manufacturer some circulators must be oiled again before operating. Please refer to manufacturer's instructions.

### DISHWASHING MACHINE REQUIREMENT

All dishwashing machines meeting the National Sanitation Foundation requirements are designed to operate with water flow pressures between 15 and 25 pounds per square inch. Flow pressures above 25 pounds per square inch, or below 15 pounds per square inch, will result in improperly sanitized dishes. Where pressures are high, a water pressure reducing or flow regulating control valve should be used in 180° line to the dishwashing machine, and should be adjusted to deliver water between these limits.

The National Sanitation Foundation also recommends circulation of 180°F water. Where this is done, the circulation should be very gentle so that it does not cause any unnecessary turbulence inside the water heater. The circulation should be just enough to provide 180°F water at the point of take-off to the dishwashing machine. Adjust flow by means of the plug cock in the circulating line.

## INSTALLATION INSTRUCTIONS

### REQUIRED ABILITY

INSTALLATION OR SERVICE OF THIS WATER HEATER REQUIRES ABILITY EQUIVALENT TO THAT OF A LICENSED TRADESMAN IN THE FIELD INVOLVED. PLUMBING, AIR SUPPLY, VENTING, GAS SUPPLY AND ELECTRICAL WORK ARE REQUIRED.

### UNCRATING

Uncrate the heater by removing the outside mat and top locator. The shipping pallet must be removed from the unit. It may be possible to simply unbolt the base from the pallet and, with the help of 2 or more persons, work the unit off the pallet. Some units will be too heavy and will require the use of jacks or lifting equipment to safely remove the pallet and move the unit into position. Be careful when moving this heater. It will tip over easily.

The heater is shipped with a burner and draft control. The burner and draft control are shipped in separate cartons. They should be installed as received without any alterations.

Discard the shipping crate and packaging cartons in an appropriate manner.

### LOCATING THE HEATER



**THERE IS A RISK IN USING FUEL BURNING APPLIANCES SUCH AS GAS WATER HEATERS IN ROOMS, GARAGES OR OTHER AREAS WHERE GASOLINE, OTHER FLAMMABLE LIQUIDS OR ENGINE DRIVEN EQUIPMENT OR VEHICLES ARE STORED, OPERATED OR REPAIRED. FLAMMABLE VAPORS**

ARE HEAVY AND TRAVEL ALONG THE FLOOR AND MAY BE IGNITED BY THE HEATER'S IGNITION SYSTEM OR MAIN BURNER FLAMES CAUSING FIRE OR EXPLOSION. SOME LOCAL CODES PERMIT OPERATION OF GAS APPLIANCES IN SUCH AREAS IF THEY ARE INSTALLED 18 INCHES OR MORE ABOVE THE FLOOR. THIS MAY REDUCE THE RISK IF LOCATION IN SUCH AN AREA CANNOT BE AVOIDED.

**⚠ WARNING**

**FLAMMABLE ITEMS, PRESSURIZED CONTAINERS OR ANY OTHER POTENTIAL FIRE HAZARDOUS ARTICLES MUST NEVER BE PLACED ON OR ADJACENT TO THE HEATER. OPEN CONTAINERS OF FLAMMABLE MATERIAL SHOULD NOT BE STORED OR USED IN THE SAME ROOM WITH THE HEATER.**

THE HEATER SHALL BE LOCATED OR PROTECTED SO IT IS NOT SUBJECT TO PHYSICAL DAMAGE BY A MOVING VEHICLE.

**THE HEATER MUST NOT BE LOCATED IN AN AREA WHERE IT WILL BE SUBJECT TO FREEZING.**

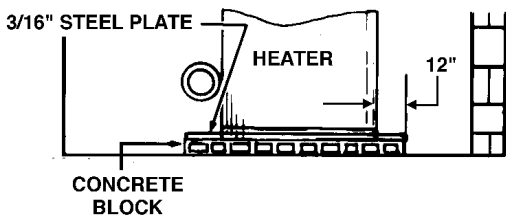
When installing the heater, consideration must be given to proper location. Location selected should be as close to a gas vent or chimney as practicable, with adequate air supply and as centralized with the piping system as possible.

LOCATE HEATER NEAR A FLOOR DRAIN. THE HEATER SHOULD BE LOCATED IN AN AREA WHERE LEAKAGE FROM THE TANK OR CONNECTIONS WILL NOT RESULT IN DAMAGE TO THE ADJACENT AREA OR TO LOWER FLOORS OF THE STRUCTURE.

WHEN SUCH LOCATIONS CANNOT BE AVOIDED, A SUITABLE METAL DRAIN PAN, ADEQUATELY DRAINED, SHOULD BE INSTALLED UNDER THE HEATER. Such pans should be fabricated with sides at least 2" deep, with length and width at least 2" greater than the diameter of the heater and must be piped to an adequate drain. THE PAN MUST NOT RESTRICT COMBUSTION AIR FLOW.

Units which are to be installed on combustible flooring must be supported by a full layer of hollow concrete blocks, from 8" to 12" thick and extending 12" (minimum) beyond the heater in all directions. The concrete blocks must provide an unbroken concrete surface under the heater with the hollows running continuously and horizontally. A 3/16 inch steel plate must cover the concrete blocks, see fig. 2.

NOTE: If electrical conduits run under the floor of the proposed heater location, insulate the floor as recommended above.



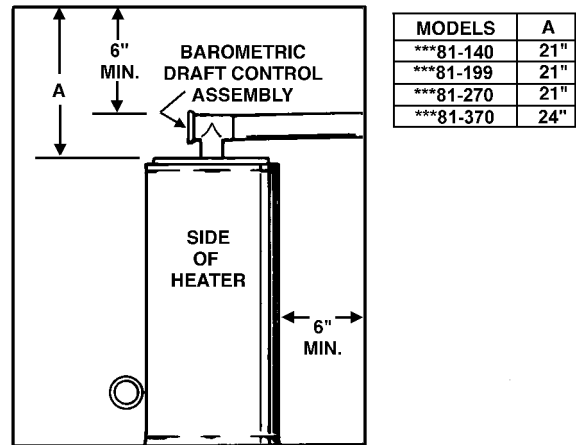
**PROPER INSTALLATION ON COMBUSTIBLE FLOORING  
FIGURE 2**

For appliance installation locations with elevations above 2000 feet, refer to HIGH ALTITUDE INSTALLATIONS section of this manual for input reduction procedure.

**CLEARANCES**

These heaters are design certified by the Underwriter's Laboratories for installation on non-combustible flooring in an alcove with clearances to combustible construction of 6" from the sides and rear, and 6" minimum between vent pipe and ceiling. Minimum clearance from barometric draft control to combustible material is 6". A minimum of 21" from top of heater to the ceiling is required, except for the \*\*\*81-370 which requires a minimum of 24".

A clearance of 24" shall be maintained from serviceable parts, such as the relief valve, power burner, thermostat and drain valve.



**PROPER INSTALLATION CLEARANCES  
FIGURE 3**

**LEVELLING**

The heater shall be installed plumb to the ground. If it is necessary to adjust the heater, use metal shims under the channel type skid base.

**HARD WATER**

Where hard water conditions exist, water softening or the threshold type of water treatment is recommended. This will protect the dishwashers, coffee urns, water heaters, water piping and other equipment.

See MAINTENANCE section for details of tank cleanout procedures.

**AIR REQUIREMENTS**

KEEP APPLIANCE AREA FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS.

DO NOT OBSTRUCT THE FLOW OF COMBUSTION OR VENTILATING AIR.

**⚠ WARNING**

**FOR SAFE OPERATION PROVIDE ADEQUATE AIR FOR COMBUSTION AND VENTILATION. AN INSUFFICIENT SUPPLY OF AIR WILL CAUSE RECIRCULATION OF COMBUSTION PRODUCTS RESULTING IN AIR CONTAMINATION THAT MAY BE HAZARDOUS TO LIFE. SUCH A CONDITION OFTEN WILL RESULT IN A YELLOW, LUMINOUS BURNER FLAME, CAUSING**

**CARBONING OR SOOTING OF THE COMBUSTION CHAMBER, BURNERS AND FLUE TUBES AND CREATES A RISK OF ASPHYXIATION.**

**MECHANICAL EXHAUSTING OF ROOM AIR**

Where an exhaust fan is installed in the same room with a heater, sufficient openings for air must be provided in the walls. **UNDERSIZED OPENINGS WILL CAUSE AIR TO BE DRAWN INTO THE ROOM THROUGH THE CHIMNEY, CAUSING POOR COMBUSTION. SOOTING MAY RESULT IN SERIOUS DAMAGE TO THE HEATER AND RISK OF FIRE OR EXPLOSION.**

**UNCONFINED SPACE**

In buildings of conventional frame, brick or stone construction, unconfined spaces may provide adequate air for combustion, ventilation, and draft hood dilution.

If the unconfined space is within a building of tight construction (buildings using the following construction: weather stripping, heavy insulation, caulking, vapor barrier, etc.), air for combustion, ventilation and draft hood dilution must be obtained from outdoors. The installation instructions for confined spaces in tightly constructed buildings must be followed to ensure adequate air supply.

**CONFINED SPACE**

When drawing combustion and dilution air from inside a conventionally constructed building to a confined space, such a space shall be provided with two permanent openings, ONE IN OR WITHIN 12 INCHES OF THE ENCLOSURE TOP AND ONE IN OR WITHIN 12 INCHES OF THE ENCLOSURE BOTTOM. Each opening shall have a free area of at least one square inch per 1000 Btuh of the total input of all appliances in the enclosure, but not less than 100 square inches.

If the confined space is within a building of tight construction, air for combustion, ventilation and draft hood dilution must be obtained from outdoors. When directly communicating with the outdoors through vertical ducts, two permanent openings, located in the above manner, shall be provided. Each opening shall have a free area of not less than one square inch per 4000 Btuh of the total input of all appliances in the enclosure. If horizontal ducts are used, each opening shall have a free area of not less than one square inch per 2000 Btuh of the total input of all appliances in the enclosure.

**VENTING**



**WARNING**

**THE INSTRUCTIONS IN THIS SECTION ON VENTING MUST BE FOLLOWED TO AVOID CHOKED COMBUSTION OR RECIRCULATION OF FLUE GASES. SUCH CONDITIONS CAUSE SOOTING OR RISKS OF FIRE AND ASPHYXIATION.**

Type B venting may be used with these heaters. All local and utility regulations on venting should be followed.

**BAROMETRIC DRAFT CONTROL ASSEMBLY**

A double-acting barometric draft control assembly is provided with each unit. The draft control assembly must be installed without alteration. This assembly is factory adjusted for horizontal application only and must be attached to the heater as shown in

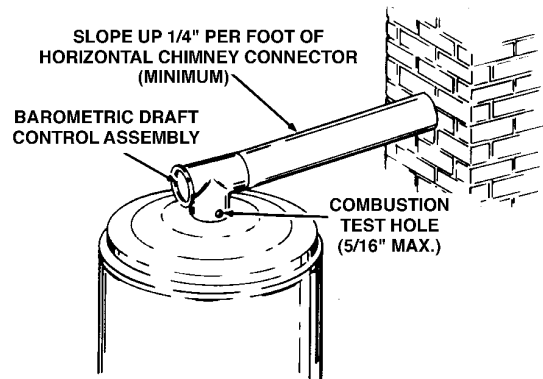
figure 4. The outlet of the draft control assembly may be rotated to face in direction needed. The assembly must be fitted to the jacket cover such that it is plumb and level to the ground. Fasten the draft control assembly to the top cover using sheet metal screws at three locations, or more, as required.

Dampers or other obstructions must not be installed between the heater and the barometric draft control assembly.

Do not adjust settings on gate. Counterweight washers are factory adjusted and should result in breeching pressure measurements at the combustion test hole (fig. 4) within the range shown in table 6.

**NOTE:** A negative draft must be maintained in the vent piping.

When installed, the damper gate must pivot freely in the ring guides. This gate will automatically adjust to regulate the chimney draft imposed on the heater.



**PROPER DRAFT CONTROLLER AND VENT PIPE INSTALLATION  
FIGURE 4**

**VENT CONNECTION**

Vent connections must be made to an adequate stack or chimney. Refer to the National Fuel Gas Code (latest version) or to the vent pipe manufacturer's gas vent and chimney sizing table to properly design and size the venting system. Refer to Table 3 for the vent pipe size required for installation to the barometric draft control assembly outlet.

**TABLE 3 - BAROMETRIC DRAFT CONTROL ASSEMBLY OUTLET SIZE**

MODEL	DRAFT CONTROL OUTLET DIAMETER
***81-140	6"
***81-199	6"
***81-270	8"
***81-370	8"

Where an existing chimney or vent is to be used, be sure that the chimney or vent has adequate capacity for the number and sizes of gas appliances being vented through it. Inspect the chimney or vent and remove all soot or other obstructions which will retard free draft.

Vent connectors making horizontal runs must have a minimum upward slope toward the chimney or vent of 1/4 inch per foot. Vent connector length should be kept as short as possible. Be sure that the vent pipe does not extend beyond the inside wall of a chimney.

In venting systems where a continuous or intermittent back (positive) draft is found to exist, the cause must be determined and corrected. In some cases, a special vent cap may be required.

Do not install this unit on the positive draft side of a venting system being served by a power exhauster.

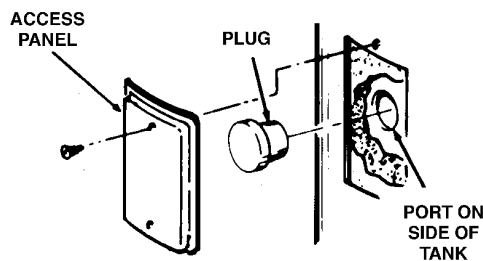
## DRAIN VALVE AND ACCESS PANELS

The heaters are equipped with a 3/4" drain valve mounted above and to the left of the burner. See page 2.

The combustion chamber observation access panel is located above and to the left of the burner. A plug located under the panel, see fig. 5, is inserted into the combustion chamber wall. This plug should not be removed except, in rare cases, when the combustion chamber requires cleaning or replacement.

### **! WARNING**

**DO NOT REMOVE THIS PLUG WHILE THE HEATER IS IN OPERATION. THE COMBUSTION CHAMBER IS UNDER PRESSURE AND MAIN BURNER FLAMES WILL ESCAPE THROUGH THE OPENING. THIS IS AN EXTREMELY HAZARDOUS CONDITION WHICH MAY RESULT IN SERIOUS INJURY.**

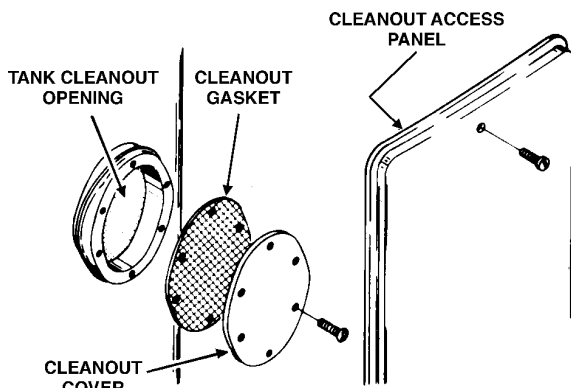


COMBUSTION CHAMBER ACCESS PORT  
FIGURE 5

### IMPORTANT

Before removing the access panel and observation plug, **BE SURE THAT THE ELECTRICAL POWER TO THE HEATER IS "OFF"**. This will prevent the heater from operating while servicing the unit. Remember to install the plug and access cover **BEFORE** restoring electrical power to the heater.

Another access panel is located above and to the right of the burner, fig. 6. This panel covers the cleanout opening in the tank which is sealed by a gasket and cover.



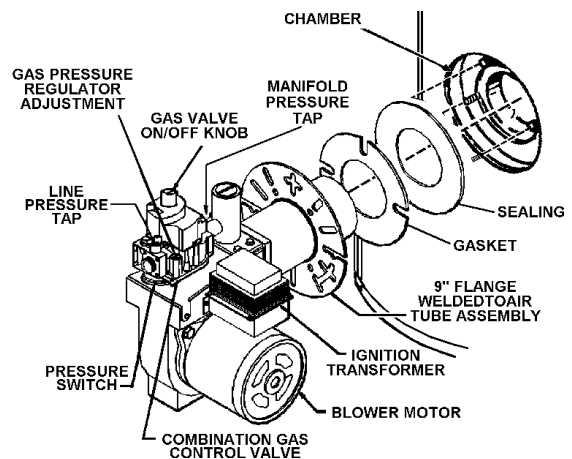
TANK CLEANOUT PORT  
FIGURE 6

Occasionally, some water seepage will occur at a cleanout port. To correct this situation, slightly tighten the cleanout cover bolts until the seepage is eliminated. Do not overly tighten the bolts or the cleanout gasket will be damaged. Tighten each bolt gradually and alternate between opposed bolts on the cleanout cover.

## BURNER INSTALLATION

Remove the factory-installed insulation covering the combustion chamber opening. (A utility knife is useful for cutting out the insulation). Cut the insulation back even with the jacket opening. Install the flange gasket (which is usually taped to the heater jacket) over the three bolts protruding from the tank at the combustion chamber opening.

Remove the hardware (3 hex nuts, 3 flat washers, and 3 lock washers) from the shipping bag attached to the heater's electrical conduit.



POWER BURNER INSTALLATION  
FIGURE 7

Begin assembling the power burner to the tank by placing the power burner nozzle in the combustion chamber opening. Slide the nozzle into the tank and rotate the mounting flange to engage the mounting bolts, refer to Figure 7. Then, place the flat washers followed by the lock washers, and finally the hex nuts on the mounting bolts. Hand tighten the nuts. Then gradually tighten each nut alternating between the 3 mounting bolts. Do not over tighten as damage to the flange gasket or to the tank may result. Refer to figure 7.

### GAS METER SIZE — CITY GASES ONLY

Be sure that the gas meter has sufficient capacity to supply the full-rated gas input of the water heater as well as the requirements of all other gas fired equipment supplied by the meter. If gas meter is too small, request the gas company to install a larger meter having adequate capacity.

### GAS PRESSURE REGULATION

Main manual pressure to the water heater should be between 4.5" minimum and 10.5" maximum w.c. for natural gas and 11.0" minimum and 13.0" maximum w.c. for propane gas. The inlet gas pressure must not exceed the maximum value. A service regulator is necessary if higher gas pressures are encountered. See Table 6.



**⚠ WARNING**

THE HEATER IS NOT INTENDED FOR OPERATION AT HIGHER THAN 10.5" W.C. - NATURAL GAS, 13.0" W.C. - PROPANE GAS (1/2 POUND PER SQUARE INCH GAUGE) SUPPLY GAS PRESSURE. HIGHER GAS PRESSURES REQUIRE SUPPLEMENTAL REDUCING SERVICE REGULATION. EXPOSURE TO HIGHER GAS SUPPLY PRESSURE MAY CAUSE DAMAGE TO THE GAS CONTROLS WHICH COULD RESULT IN FIRE OR EXPLOSION. IF OVERPRESSURE HAS OCCURRED, SUCH AS THROUGH IMPROPER TESTING OF GAS LINES OR EMERGENCY MALFUNCTION OF THE SUPPLY SYSTEM, THE GAS VALVE MUST BE CHECKED FOR SAFE OPERATION. MAKE SURE THAT THE OUTSIDE VENTS ON THE SUPPLY REGULATORS AND THE SAFETY VENT VALVES ARE PROTECTED AGAINST BLOCKAGE. THESE ARE PARTS OF THE GAS SUPPLY SYSTEM, NOT THE HEATER. VENT BLOCKAGE MAY OCCUR DURING ICE STORMS.

DISCONNECT THE APPLIANCE AND ITS MAIN MANUAL GAS SHUTOFF VALVE FROM THE GAS SUPPLY PIPING SYSTEM DURING ANY SUPPLY PRESSURE TESTING EXCEEDING 1/2 PSIG. GAS SUPPLY LINE MUST BE CAPPED WHEN DISCONNECTED FROM THE HEATER. FOR TEST PRESSURES OF 1/2 PSIG OR LESS, THE APPLIANCE NEED NOT BE DISCONNECTED, BUT MUST BE ISOLATED FROM THE SUPPLY PRESSURE TESTING BY CLOSING THE MAIN MANUAL GAS SHUT OFF VALVE.

**GAS PIPING**

Contact your local gas service company to ensure that adequate gas service is available and to review applicable installation codes for your area.

Size the main gas line in accordance with Table 4. The figures shown are for iron pipe or equivalent at 0.5 in. w.c. pressure drop, which is considered normal for low pressure systems. Note that an excess number of fittings such as elbows and tees will add to the pipe pressure drop. No additional allowance is necessary for an ordinary number of fittings.

IF COPPER SUPPLY LINES ARE USED THEY MUST BE INTERNALLY TINNED AND CERTIFIED FOR GAS SERVICE.

IT IS IMPORTANT TO GUARD AGAINST GAS VALVE FOULING FROM CONTAMINANTS IN THE GAS WAYS. SUCH FOULING MAY CAUSE IMPROPER OPERATION, FIRE OR EXPLOSION.

BEFORE ATTACHING THE GAS LINE, BE SURE THAT ALL GAS PIPE IS CLEAN ON THE INSIDE.

TO TRAP ANY DIRT OR FOREIGN MATERIAL IN THE GAS SUPPLY LINE, A DRIP LEG (SOMETIMES CALLED DIRT LEG) MUST BE INCORPORATED IN THE PIPING. SEE FIG. 8. THE DRIP LEG MUST BE READILY ACCESSIBLE, REFER TO FIG. 8, AND NOT SUBJECT TO FREEZING CONDITIONS. INSTALL IN ACCORDANCE WITH RECOMMENDATIONS OF SERVICING GAS SUPPLIERS. REFER TO THE NATIONAL FUEL GAS CODE (LATEST VERSION).

To prevent damage, care must be taken not to apply too much torque when attaching gas supply pipe to gas valve inlet.

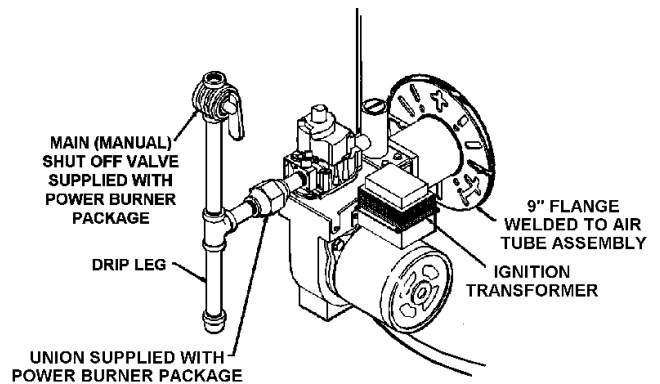
**TABLE 4  
MAXIMUM CAPACITY OF PIPE IN CUBIC FEET  
OF GAS PER HOUR**

(Based upon a Pressure Drop of 0.5 inch Water Column and 0.6 Specific Gravity Gas and max. gas pressure of .5 psig)

LENGTH IN FEET	NOMINAL IRON PIPE SIZE (INCHES)								
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
10	175	360	680	1,400	2,100	3,950	6,300	11,000	23,000
20	120	250	465	950	1,460	2,750	4,350	7,700	15,800
30	97	200	375	770	1,180	2,200	3,520	6,250	12,800
40	82	170	320	660	990	1,900	3,000	5,300	10,900
50	73	151	285	580	900	1,680	2,650	4,750	9,700
60	66	138	260	530	810	1,520	2,400	4,300	8,800
70	61	125	240	490	750	1,400	2,250	3,900	8,100
80	57	118	220	460	690	1,300	2,050	3,700	7,500
90	53	110	205	430	650	1,220	1,950	3,450	7,200
100	50	103	195	400	620	1,150	1,850	3,250	6,700
125	44	93	175	360	550	1,020	1,650	2,950	6,000
150	40	84	160	325	500	950	1,500	2,650	5,500
175	37	77	145	300	460	850	1,370	2,450	5,000
200	35	72	135	280	430	800	1,280	2,280	4,600

Apply joint compounds (pipe dope) sparingly and only to the male threads of pipe joints. Do not apply compound to the first two threads. Use joint compounds resistant to the action of liquefied petroleum gases.

BEFORE PLACING THE HEATER IN OPERATION, CHECK FOR GAS LEAKAGE. USE SOAP AND WATER SOLUTION, OR OTHER MATERIAL ACCEPTABLE FOR THE PURPOSE IN LOCATING GAS LEAKS. DO NOT USE MATCHES, CANDLES, FLAME OR OTHER SOURCES OF IGNITION FOR THIS PURPOSE.



**POWER BURNER ASSEMBLY, GAS MANIFOLD AND SUGGESTED INLET PIPING - FIGURE 8**

**HEATER WIRING INSTRUCTIONS**

The power burner should be wired to the heater as shown in Figure 9. The model's rating plate (or see Table 2) provides the electrical information needed to size the complete heater branch supply circuit.

All electrical work must be installed in accordance with the latest version of the National Electrical Code and local requirements. When installed, the appliance must be electrically grounded in accordance with local codes or, in the absence of local codes, with the latest version of the National Electrical Code, ANSI/NFPA 70.

With the power burner installed in the heater, the electrical wiring can be completed. On \*\*\*81-140 and \*\*\*81-199 models, remove the power burner backplate and fasten the conduit assembly to the power burner assembly. Next, connect the black wire to the terminal marked "1" and the white wire to the terminal marked "2".

On \*\*\*81-270 and \*\*\*81-370 models, remove the two screws above and below the control board on the junction box cover of the power burner. Swing the junction box cover open and fasten the conduit assembly in one of the knock-out holes in the side of the junction box. Connect the black wire to the terminal marked "1" and the white wire to the terminal marked "2".

Finally, bring electrical power to the junction box mounted on the heater jacket. Fasten conduit to any convenient knock-out hole in the junction box. Use the two wire nuts from the shipping bag to connect the hot and neutral conductors to the black and white wires, respectively. Connect the ground conductor to the ground screw in the back of the junction box.

Check all electrical connections to be sure that they are proper and secure.

**DO NOT ENERGIZE THE BRANCH CIRCUIT BEFORE THE HEATER TANK IS FILLED WITH WATER.**

## WATER LINE CONNECTION

This manual provides detailed installation diagrams (see pages 12-16) of this manual for typical methods of application for the water heaters.

The water heater may be installed itself, or with a separate storage tank, on both single and two-temperature systems. When used with a separate storage tank, the circulation may be either by gravity or by means of a circulating pump. When a circulating pump is used it is important to note that the flow rate should be slow so that there will be a minimum of turbulence inside the heater.

If a water heater is installed in a closed water system, contact the water supplier or local plumbing inspector on how to control this situation.

## WATER (POTABLE) HEATING AND SPACE HEATING (See pages 12-16)

1. All piping components connected to this unit for space heating applications shall be suitable for use with potable water.
2. Toxic chemicals, such as those used for boiler treatment, shall NEVER be introduced into this system.
3. This unit may NEVER be connected to any existing heating system or component(s) previously used with a non-potable water heating appliance.
4. When the system requires water for space heating at temperatures higher than required for domestic water purposes, a tempering valve must be installed. Please refer

to installation diagrams on pages 12-16 of this manual for suggested piping arrangements.



**CAUTION**  
A closed system will exist if a check valve (without bypass), pressure reducing valve (without bypass), or a water meter (without bypass) is installed in the cold water line between the water heater and street main (well).

Excessive pressure may develop in such closed systems, causing premature tank failure or intermittent relief valve operation. This is not a warranty failure. An expansion tank or similar device may be required in the inlet supply line between the appliance and the meter or valve to compensate for the thermal expansion of the water.

## SYSTEM CONNECTIONS

The system installation must conform to these instructions and to the local code authority having jurisdiction. Good practice requires that all heavy piping be supported.

## RELIEF VALVE

This heater is equipped with an approved temperature and pressure relief valve. ASME ratings cover pressure relief. A.G.A. ratings cover release rate with temperature actuation.

Your local code authority may have other specific relief valve requirements.



**WARNING**  
THE PURPOSE OF RELIEF VALVE IS TO AVOID EXCESSIVE PRESSURE OF TEMPERATURE INTO THE STEAM RANGE, WHICH MAY CAUSE SCALDING AT FIXTURES, TANK EXPLOSION, SYSTEM OR HEATER DAMAGE. NO VALVE IS TO BE PLACED BETWEEN THE RELIEF VALVE AND THE TANK.

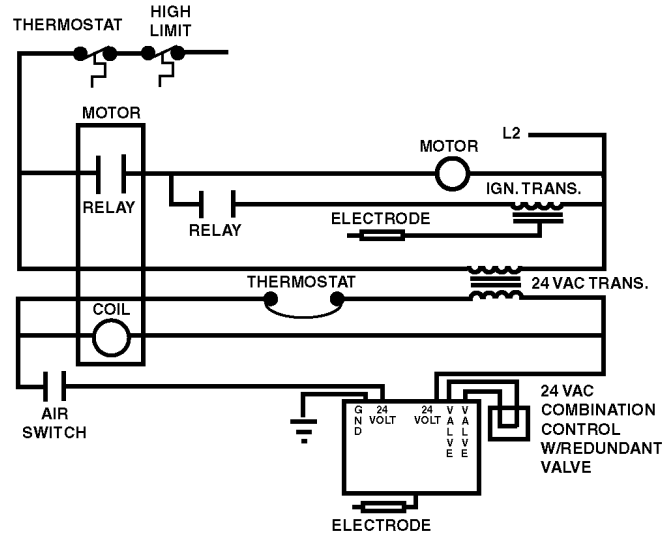
A DRAIN LINE MUST BE CONNECTED TO THE RELIEF VALVE TO DIRECT DISCHARGE TO A SAFE LOCATION TO AVOID SCALDING OR WATER DAMAGE. THIS LINE MUST NOT BE REDUCED FROM THE SIZE OF THE VALVE OUTLET AND MUST NOT CONTAIN VALVES, RESTRICTIONS NOR SHOULD IT BE LOCATED IN FREEZING AREAS. DO NOT THREAD OR CAP THE END OF THIS LINE. RESTRICTED OR BLOCKED DISCHARGE WILL DEFEAT THE PURPOSE OF THE VALVE AND IS UNSAFE. INSTALL DISCHARGE LINE TO ALLOW COMPLETE DRAINAGE OF BOTH THE VALVE AND LINE.

## THERMOMETERS (Not Supplied)

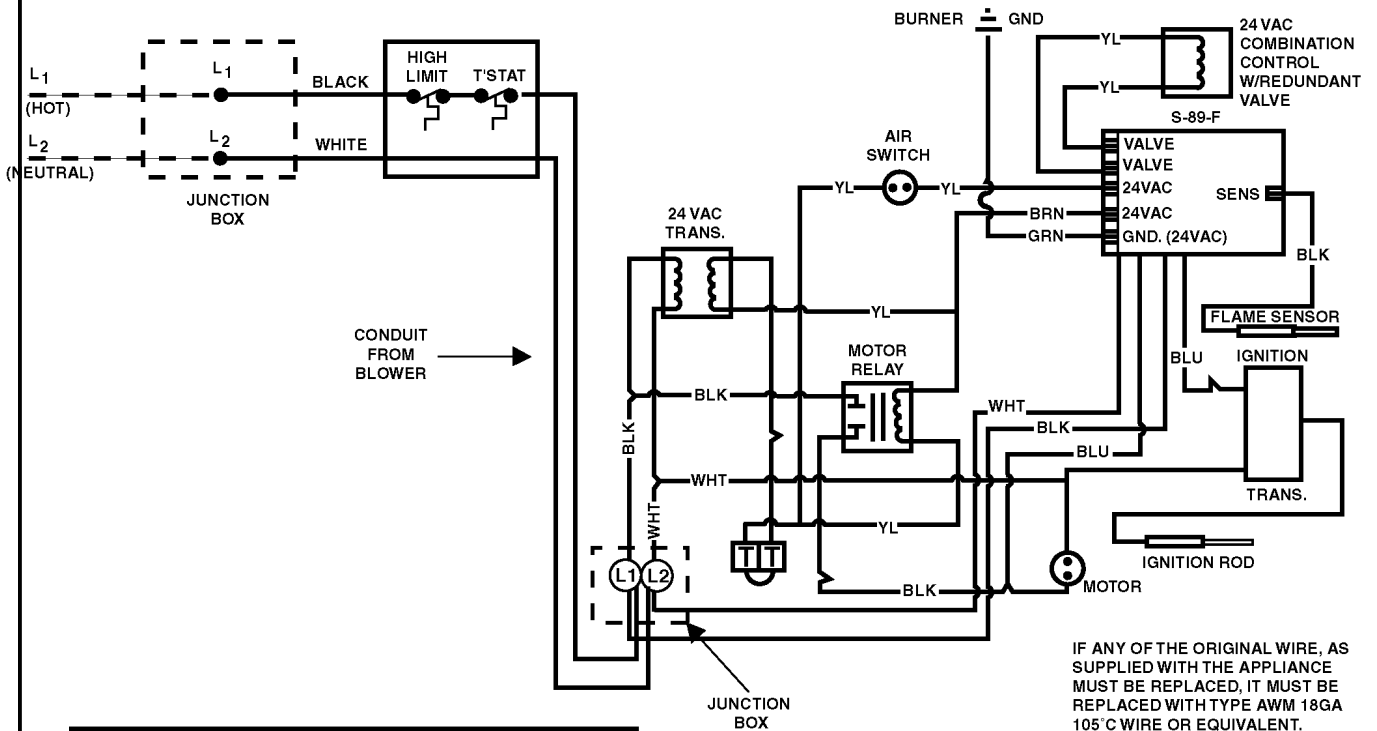
Thermometers should be obtained and field installed as shown in the installation diagrams.

Thermometers are installed in the system as a means of detecting the temperature of the outlet water supply.

### SCHEMATIC DIAGRAM



### WIRING DIAGRAM



**ELECTRICAL WIRING REPLACEMENT**

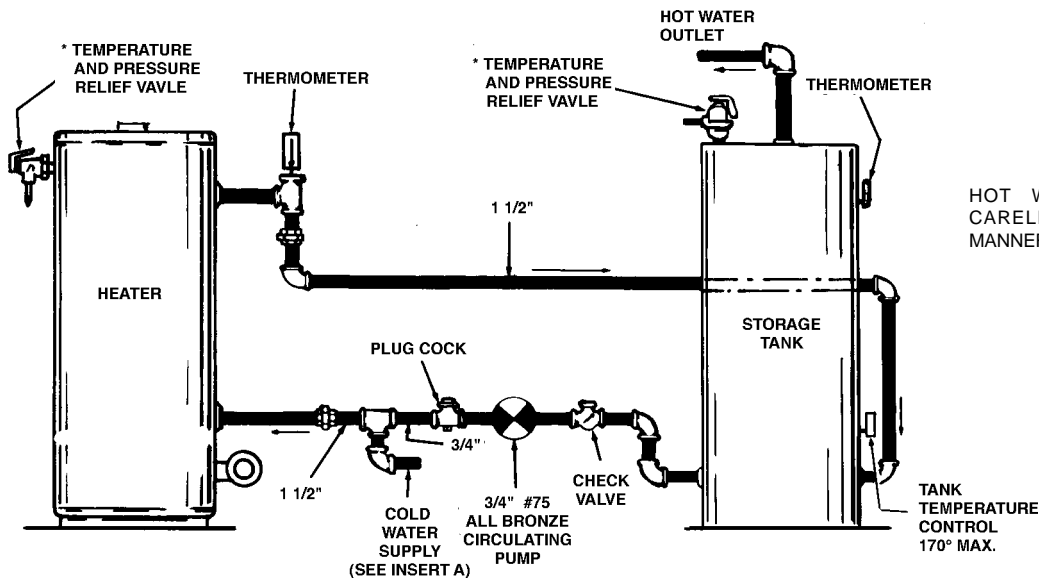
If any of the original wiring, as supplied with the appliance, must be replaced. It must be replaced with 16 AWG, or greater, copper conductor with 600V, 105°C rated, thermoplastic insulation.

IF ANY OF THE ORIGINAL WIRE, AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE AWM 18GA 105°C WIRE OR EQUIVALENT.

WIRING FOR \*\*\*81-140 THRU \*\*\*81-370  
FIGURE 9

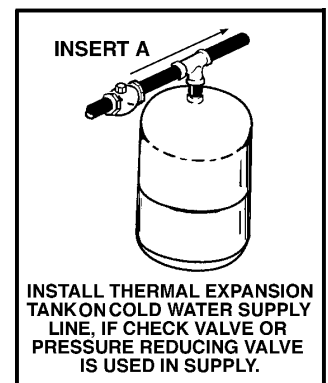
# INSTALLATION DIAGRAMS

## ONE TEMPERATURE - ONE HEATER VERTICAL STORAGE TANK FORCED CIRCULATION WITH OR WITHOUT BUILDING RECIRCULATION



### SCALD PREVENTION

HOT WATER CAN SCALD IF USED CARELESSLY OR IN UNANTICIPATED MANNER.



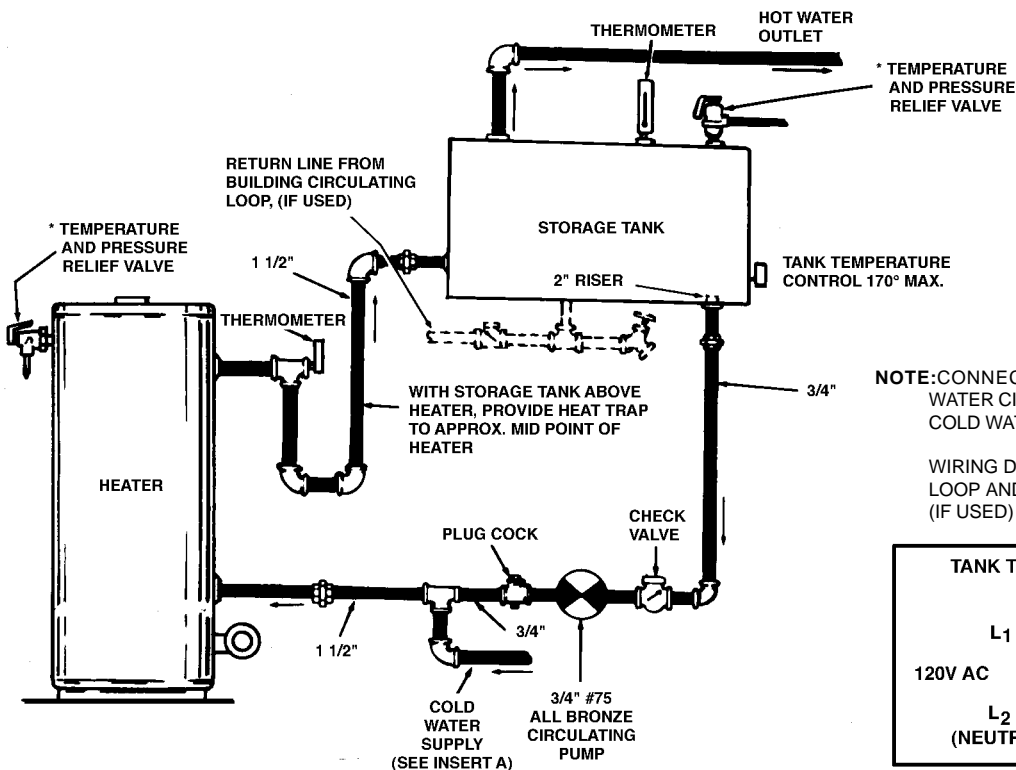
**NOTE:**CONNECT RETURN LINE FROM HOT WATER CIRCULATING LOOP (IF USED) TO COLD WATER INLET LINE.



**TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL SECTION ON PAGE 17 & 19. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.**

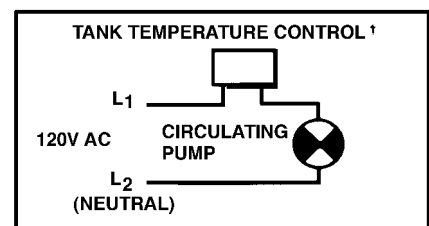
**CAUTION:** IF BUILDING COLD WATER SUPPLY HAS A BACK-FLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE, PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.

## ONE TEMPERATURE - ONE HEATER HORIZONTAL STORAGE TANK FORCED CIRCULATION WITH OR WITHOUT BUILDING RECIRCULATION



**NOTE:**CONNECT RETURN LINE FROM HOT WATER CIRCULATING LOOP (IF USED) TO COLD WATER INLET LINE.

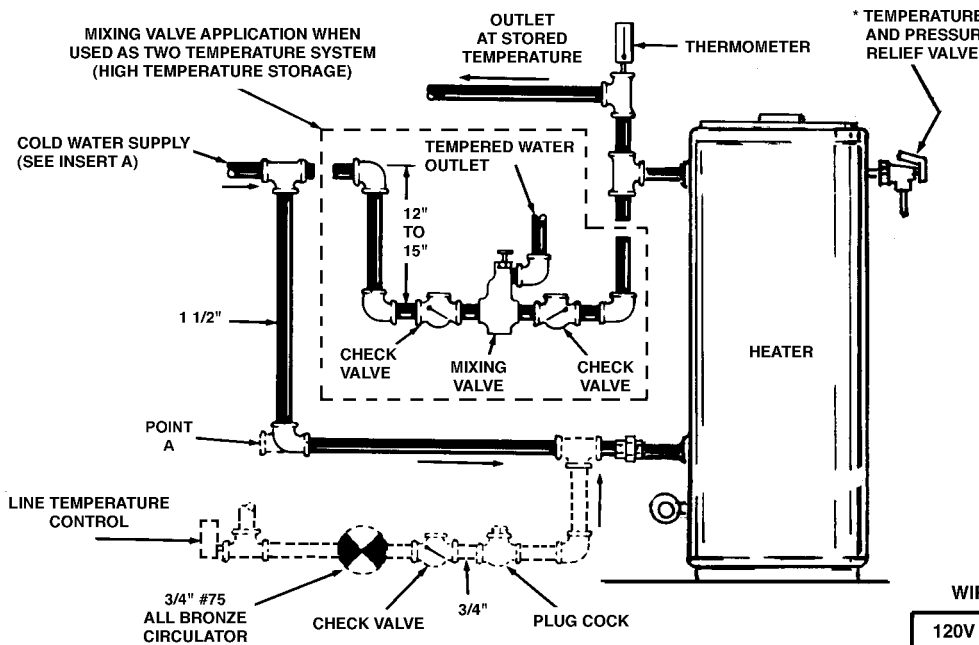
WIRING DIAGRAM FOR HEATER TO TANK LOOP AND/OR HOT WATER LOOP (IF USED)



\*PIPE TO OPEN DRAIN

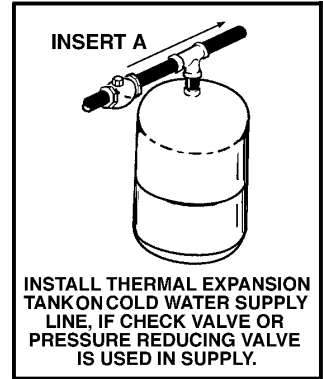
INSTALL IN ACCORDANCE WITH LOCAL CODES

## ONE OR TWO TEMPERATURE - ONE HEATER MEDIUM TEMPERATURE STORAGE WITH OR WITHOUT RECIRCULATION (FOR STORAGE OR INSTANTANEOUS HEATERS ONLY)

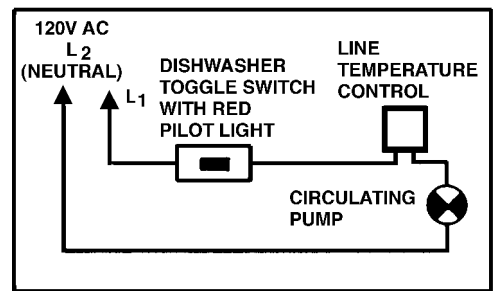


\*TEMPERATURE AND PRESSURE RELIEF VALVE  
 \*PIPE RELIEF VALVE TO OPEN DRAIN  
 NOTE: IF TEMPERED WATER IS RECIRCULATED, RETURN LINE SHOULD BE CONNECTED AT POINT "A".

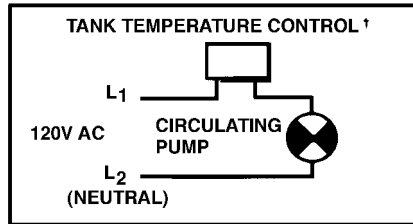
INSTALL IN ACCORDANCE WITH LOCAL CODES.



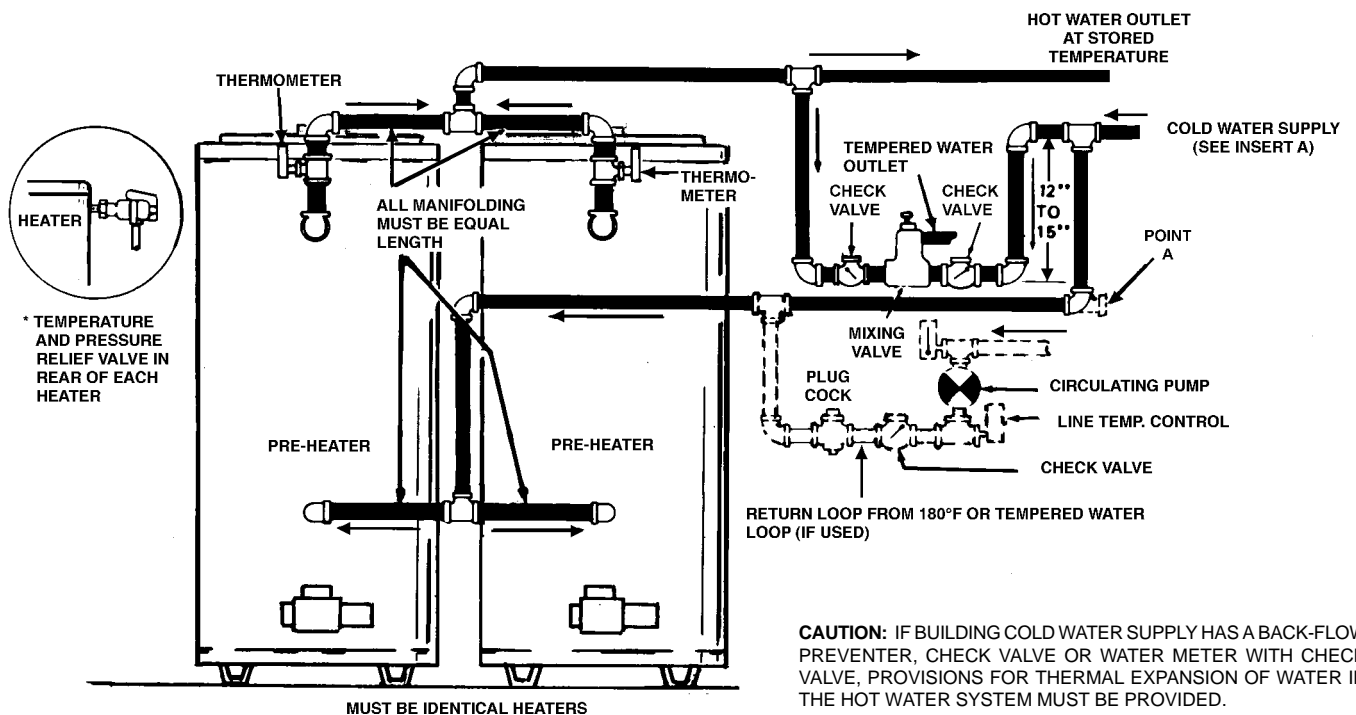
WIRING DIAGRAM FOR 180°F LOOP (IF USED)



**⚠ DANGER**  
 TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL SECTION ON PAGE 17 & 19. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTISCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

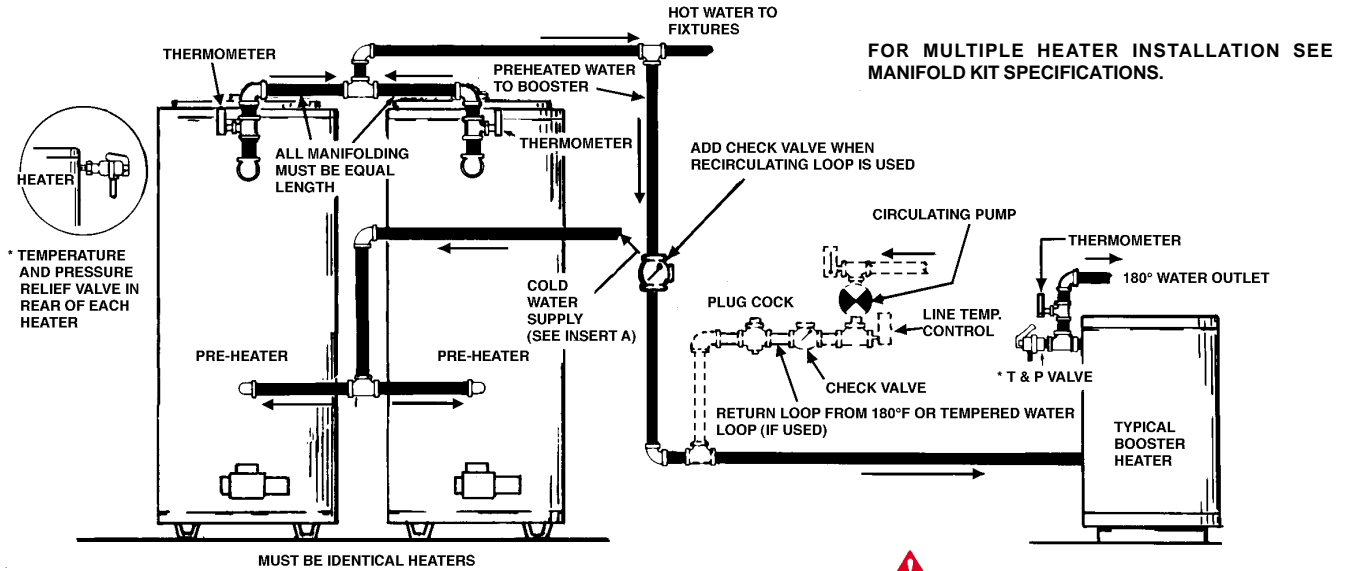


## TWO TEMPERATURE - TWO PRE-HEATERS HIGH TEMPERATURE STORAGE WITH OR WITHOUT RECIRCULATION (FOR STORAGE OR INSTANTANEOUS HEATERS ONLY)



**CAUTION:** IF BUILDING COLD WATER SUPPLY HAS A BACK-FLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE, PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.

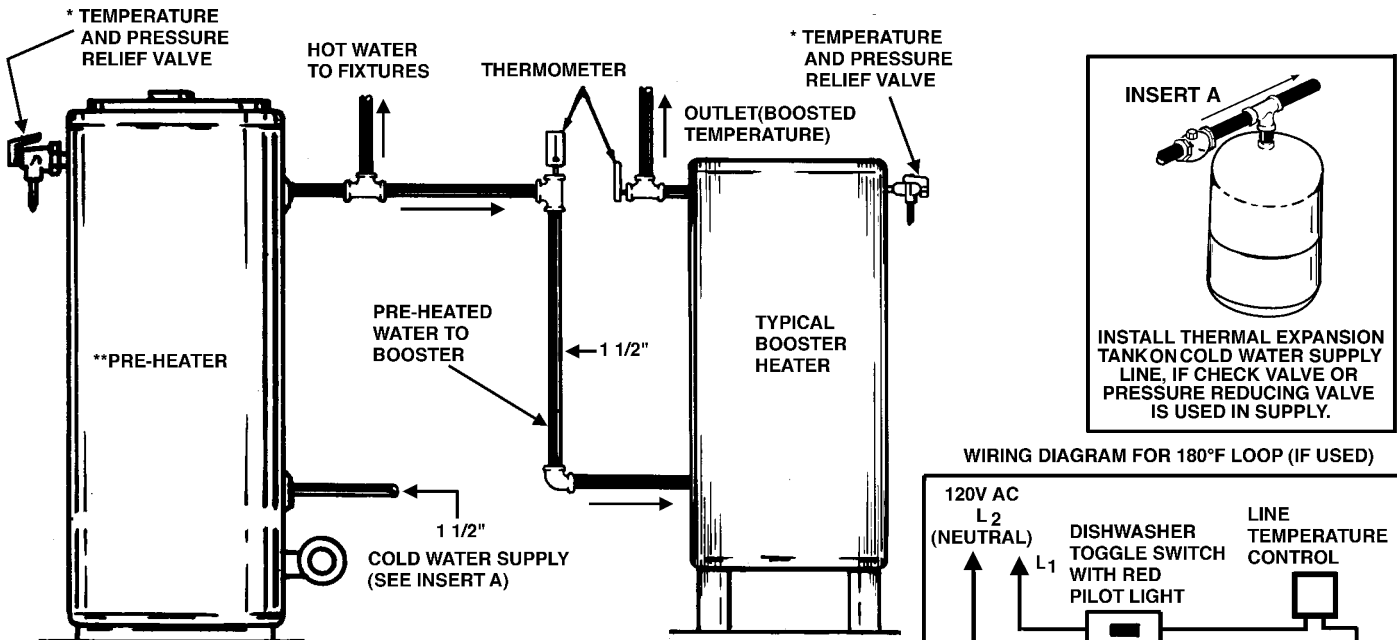
## TWO TEMPERATURE - THREE HEATERS (TWO PRE-HEATERS/ONE BOOSTER) WITH OR WITHOUT CIRCULATION (FOR STORAGE OR INSTANTANEOUS HEATERS ONLY)



**CAUTION:** IF BUILDING COLD WATER SUPPLY HAS A BACK-FLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE, PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.

**⚠ DANGER**  
TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL SECTION ON PAGE 17 & 19. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

## TWO TEMPERATURE - TWO HEATERS (ONE PRE-HEATER/ONE BOOSTER HEATER) WITH OR WITHOUT RECIRCULATION (FOR STORAGE OR INSTANTANEOUS HEATERS ONLY)

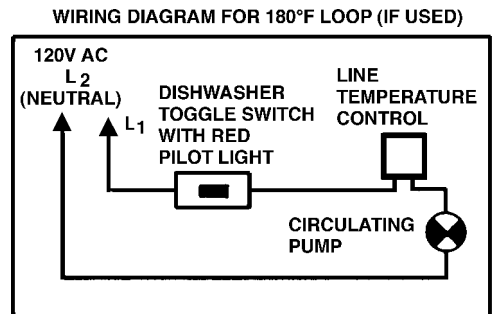
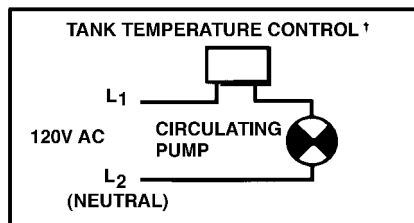


\* PIPE RELIEF VALVE TO OPEN DRAIN.  
\*\* TEMPERATURE SETTING OF PRE-HEATER SHOULD BE 120°F MIN. OR 150°F MAX.

CONNECT CIRCULATING LINE FROM FIXTURES, IF USED, TO COLD WATER SUPPLY LINE OF PRE-HEATER.

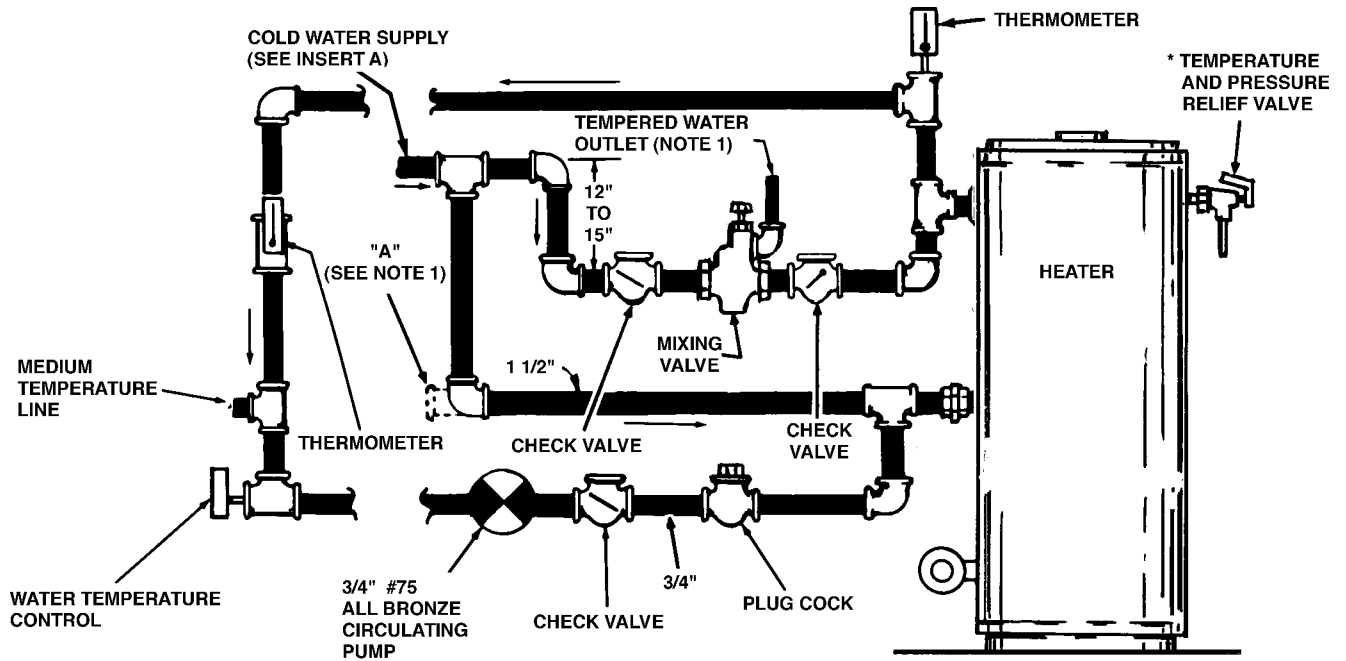
CONNECT CIRCULATING LINE OF 180°F OR BOOSTED WATER, IF USED, TO INLET WATER LINE TO BOOSTER.

INSTALL IN ACCORDANCE WITH LOCAL CODES.



WIRING DIAGRAM FOR FIXTURE OR BOOSTER LOOP (IF USED) - OTHER THAN DISHWASHER

**ONE OR TWO TEMPERATURE - ONE HEATER MEDIUM TEMPERATURE STORAGE  
WITH RECIRCULATED LOOP  
(FOR STORAGE OR INSTANTANEOUS HEATERS ONLY)**



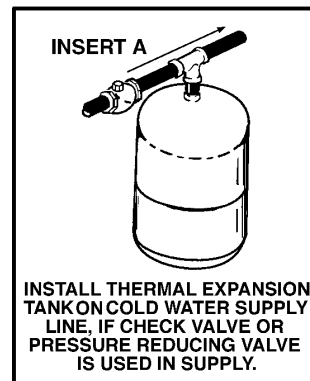
**NOTE:**IF TEMPERED WATER IS RECIRCULATED, RETURN LINE SHOULD BE CONNECTED AT POINT "A".

**NOTE:**STORED TEMPERATURE WATER LOOP, IF USED, CONNECT TO COLD WATER INLET.

**⚠ DANGER**

TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE CONTROL SECTION ON PAGE 17 & 19. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

**CAUTION:** IF BUILDING COLD WATER SUPPLY HAS A BACK-FLOW PREVENTER, CHECK VALVE OR WATER METER WITH CHECK VALVE, PROVISIONS FOR THERMAL EXPANSION OF WATER IN THE HOT WATER SYSTEM MUST BE PROVIDED.



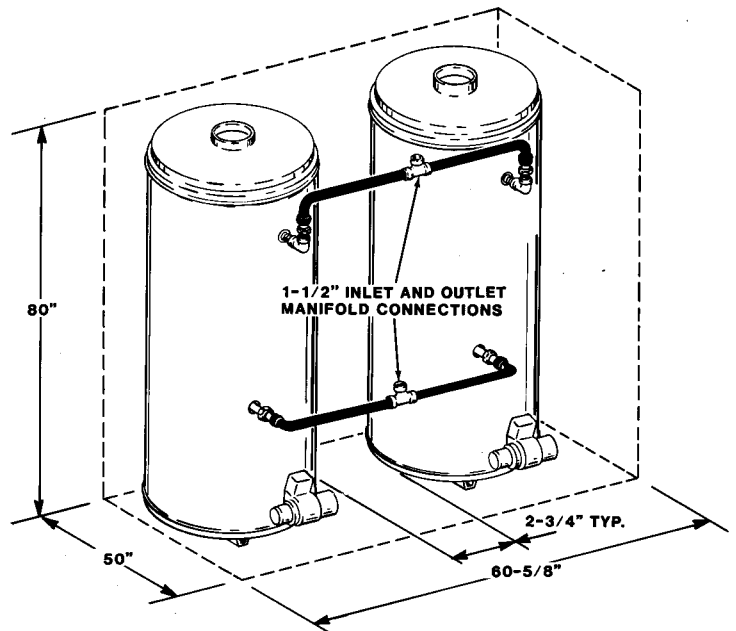
**NOTES**

## MANIFOLD KITS

Precision cut type "L" all copper manifold kits from your manufacturer assure water flow balance of all units. Without this balance, the full water heating and storage potential of the system cannot be achieved. Plus, the units with the higher water flow may have a shortened life. Unions shown in piping diagrams are not included in the manifold kits.

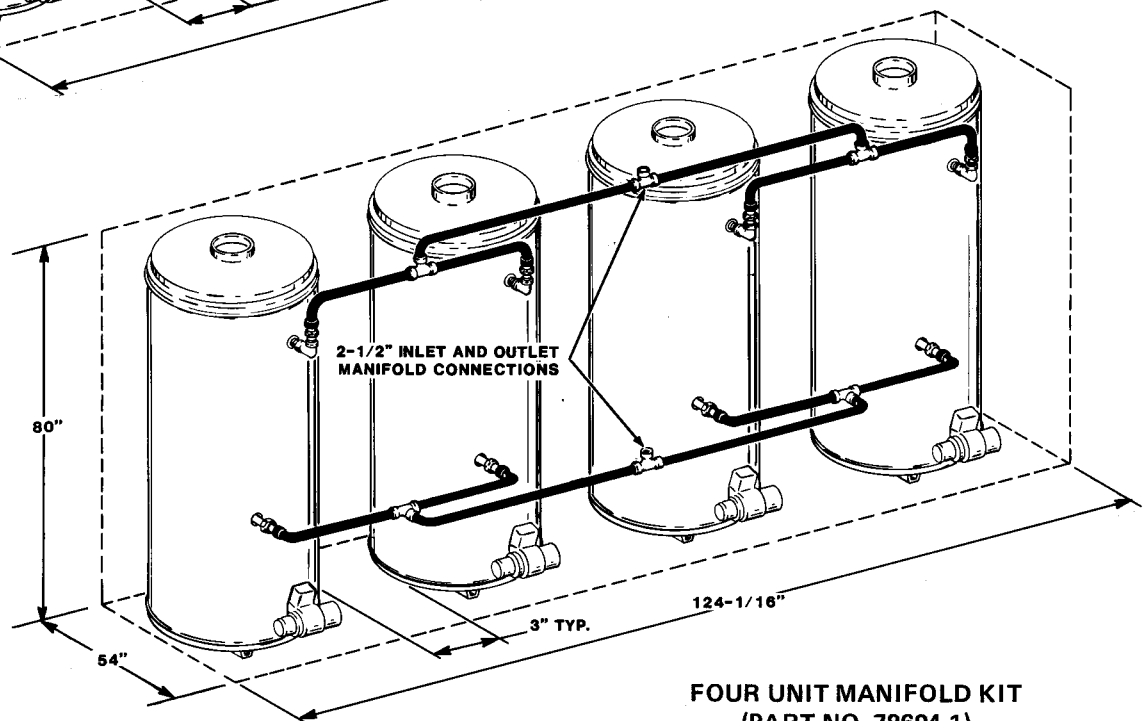
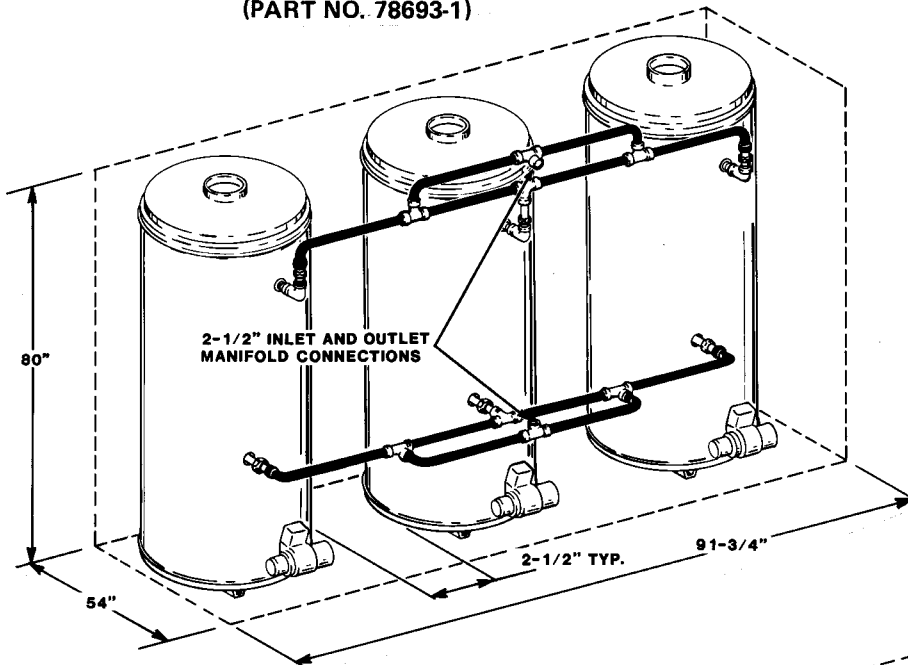
Dimensions shown are for minimum space occupied by the water heaters assemblies.

Space for the barometric draft control assemblies, combustion clearances and servicing must be added.



**TWO UNIT MANIFOLD KIT  
(PART NO. 78692-1)**

**THREE UNIT MANIFOLD KIT  
(PART NO. 78693-1)**



**FOUR UNIT MANIFOLD KIT  
(PART NO. 78694-1)**



# PRIOR TO START UP

## IMPORTANT

IT IS REQUIRED THAT A QUALIFIED PERSON PERFORM THE INITIAL FIRING OF THE HEATER. AT THIS TIME THE USER SHOULD NOT HESITATE TO ASK THE INDIVIDUAL ANY QUESTIONS WHICH HE MAY HAVE IN REGARD TO THE OPERATION AND MAINTENANCE OF THE UNIT.

A CHECKLIST AND SERVICE INFORMATION section is included at the rear of this manual. By using this checklist the user may be able to make minor operational adjustments and save himself unnecessary service calls. However, the user should not attempt repairs which are not listed in this section.

## REQUIRED EQUIPMENT AND ABILITY

INSTALLATION OR SERVICE OF THIS WATER HEATER REQUIRES ABILITY EQUIVALENT TO THAT OF A LICENSED TRADESMAN IN THE FIELD INVOLVED. PLUMBING, AIR SUPPLY, VENTING, GAS SUPPLY AND ELECTRICAL WORK ARE REQUIRED.

Before attempting start-up, thoroughly study and familiarize yourself with the exact sequence of operation and all other details on the specific heater being used.

The power burner is equipped with a direct spark ignition system and automatically sequences prepurge and ignition, senses and ignites main burner flame and sequences burner operation. Heater is equipped with an ignition module which locks out after an unsuccessful ignition attempt. Turn off electric power for ten seconds before restarting.

Be certain that water heater is full of water, that air is purged from all lines, no leaks (gas and water) and all inlet water lines are open.

The following test equipment should be on hand: (all test equipment must be acclimated to ambient temperature before calibration and use.)

- CO<sub>2</sub> indicator (Fyrite or similar) or O<sub>2</sub> analyzer
- CO indicator (Monoxor or similar)
- Stack thermometer
- Draft Gauge or inclined manometer
- Two U-tube manometers or calibrated 0-10" and 0-35" w.c. pressure gauges.
- Combination volt/ammeter.
- Attach a gas pressure gauge or manometer to upstream side of main gas cock and a gas pressure gauge or manometer to the manifold pressure tapping.
- Check voltage at disconnect switch to make certain that it matches that shown on the burner label.
- Apply a few drops of No. 20 SAE non-detergent oil to motor bearings.

- Drill max. 5/16" hole in breeching as close as possible to flue connection on heater to install stack thermometer and combustion analyzing equipment. (See fig. 4).
- You are now ready to begin the burner start up procedure.

Follow the OPERATIONAL PROCEDURE in the OPERATIONAL AND ADJUSTMENT PROCEDURE section of this manual.

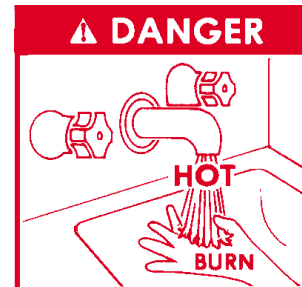
## PURGING

Gas line purging is required with new piping or systems in which air has entered.



**PURGING SHOULD BE PERFORMED BY PERSONS EXPERIENCED IN THIS TYPE GAS SERVICE. TO AVOID RISK OF FIRE OR EXPLOSION, PURGE DISCHARGE MUST NOT ENTER CONFINED AREAS OR SPACES WHERE IGNITION CAN OCCUR. THE AREA MUST BE WELL VENTILATED AND ALL SOURCES OF IGNITION MUST BE INACTIVATED OR REMOVED.**

## WATER TEMPERATURE CONTROL



**THIS WATER HEATER IS EQUIPPED WITH AN ADJUSTABLE THERMOSTAT TO CONTROL WATER TEMPERATURE. HOT WATER TEMPERATURES REQUIRED FOR AUTOMATIC DISHWASHER AND LAUNDRY USE CAN CAUSE SCALD BURNS RESULTING IN SERIOUS PERSONAL INJURY AND/OR DEATH. THE TEMPERATURE AT WHICH INJURY OCCURS VARIES WITH THE PERSON'S AGE AND TIME OF EXPOSURE. THE SLOWER RESPONSE TIME OF CHILDREN, AGED OR DISABLED PERSONS INCREASES THE HAZARDS TO THEM. NEVER ALLOW SMALL CHILDREN TO USE A HOT WATER TAP, OR TO DRAW THEIR OWN BATH WATER. NEVER LEAVE A CHILD OR DISABLED PERSON UNATTENDED IN A BATHTUB OR SHOWER.**

THE WATER HEATER SHOULD BE LOCATED IN AN AREA WHERE THE GENERAL PUBLIC DOES NOT HAVE ACCESS TO SET TEMPERATURES.

**SETTING THE WATER HEATER TEMPERATURE AT 120°F WILL REDUCE THE RISK OF SCALDS.** Some states or provinces require settings at specific lower temperatures.

Below you will find listed Table 5 the approximate time-to-burn relationship for normal adult skin. Short repeated heating cycles caused by small hot water uses can cause temperatures at the point of use to exceed the thermostat setting by up to 20°F (11°C). If you experience this type of use, you should consider using lower temperature settings to reduce scald hazards.

## OPERATIONAL AND ADJUSTMENT PROCEDURE (INITIAL START UP)

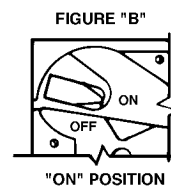
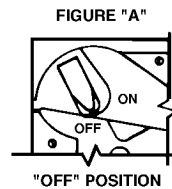
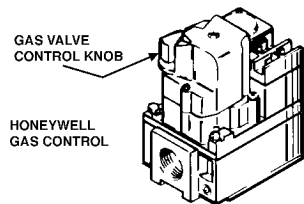
### FOR YOUR SAFETY READ BEFORE LIGHTING



**WARNING: IF YOU DO NOT FOLLOW THESE INSTRUCTIONS EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.**



- A. THIS APPLIANCE DOES NOT HAVE A PILOT. IT IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE BURNER. DO NOT TRY TO LIGHT BURNER BY HAND.
- B. BEFORE OPERATING SMELL ALL AROUND THE APPLIANCE AREA FOR GAS. BE SURE TO SMELL NEXT TO THE FLOOR BECAUSE SOME GAS IS HEAVIER THAN AIR AND WILL SETTLE ON THE FLOOR.
- WHAT TO DO IF YOU SMELL GAS:
- DO NOT TRY TO LIGHT ANY APPLIANCE.
  - DO NOT TOUCH ANY ELECTRIC SWITCH; DO NOT USE ANY PHONE IN YOUR BUILDING.
  - IMMEDIATELY CALL YOUR GAS SUPPLIER FROM A NEIGHBOR'S PHONE. FOLLOW THE GAS SUPPLIER'S INSTRUCTIONS.
  - IF YOU CANNOT REACH YOUR GAS SUPPLIER, CALL THE FIRE DEPARTMENT.
- C. USE ONLY YOUR HAND TO PUSH IN OR TURN THE GAS CONTROL KNOB. NEVER USE TOOLS. IF THE KNOB WILL NOT PUSH IN OR TURN BY HAND, DON'T TRY TO REPAIR IT. CALL A QUALIFIED SERVICE TECHNICIAN. FORCE OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.
- D. DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. IMMEDIATELY CALL A QUALIFIED SERVICE TECHNICIAN TO INSPECT THE APPLIANCE AND TO REPLACE ANY PART OF THE CONTROL SYSTEM AND ANY GAS CONTROL WHICH HAS BEEN UNDER WATER.
- E. DO NOT OPERATE APPLIANCE UNLESS UNIT IS FILLED WITH WATER AND INLET LINES ARE FULLY OPEN.



### OPERATING INSTRUCTIONS

1. STOP! READ THE SAFETY INFORMATION ABOVE ON THIS LABEL.
2. REMOVE APPLIANCE THERMOSTAT COVER. ROTATE THE THERMOSTAT DIAL COUNTERCLOCKWISE TO LOWEST SETTING.
3. TURN OFF ALL ELECTRIC POWER TO THE APPLIANCE.
4. THIS APPLIANCE IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE BURNER. DO NOT TRY TO LIGHT THE BURNER BY HAND.
5. TURN GAS VALVE CONTROL KNOB CLOCKWISE TO "OFF" (FIG. A). NOTE: HALFWAY THRU THE TURN, THE KNOB WILL POP UP. CONTINUE TO TURN UNTIL KNOB LOCKS INTO THE "OFF" POSITION.
6. WAIT FIVE (5) MINUTES TO CLEAR OUT ANY GAS. IF YOU THEN SMELL GAS:  
 STOP! FOLLOW "B" IN THE SAFETY INFORMATION ABOVE IN THIS LABEL. IF YOU DON'T SMELL GAS, GO TO NEXT STEP.
7. TURN GAS VALVE CONTROL KNOB COUNTERCLOCK WISE TO "ON" (FIG. B). NOTE HALFWAY THRU THE TURN DEPRESS THE KNOB AND CONTINUE TURNING UNTIL IT LOCKS INTO THE "ON" POSITION.
8. TURN ON ALL ELECTRIC POWER TO THE APPLIANCE.
9. SET THERMOSTAT TO DESIRED SETTING. HEATER WILL AUTOMATICALLY BEGIN OPERATION. MOTOR WILL RUN APPROXIMATELY 45 SECONDS (PREPURGE), THEN MAIN BURNER IGNITION WILL OCCUR.
10. REPLACE THERMOSTAT CONTROL COVER.
11. HEATER IS EQUIPPED WITH AN IGNITION MODULE WHICH LOCKS OUT AFTER AN UNSUCCESSFUL IGNITION ATTEMPT. IF MAIN BURNER DOES NOT LIGHT DURING THIS PERIOD, REPEAT STEPS 2 THRU 9. IF THE APPLIANCE WILL NOT OPERATE, FOLLOW THE INSTRUCTIONS, "TO TURN OFF GAS TO APPLIANCE", AND CALL YOUR SERVICE TECHNICIAN OR GAS SUPPLIER.

### TO TURN OFF GAS TO APPLIANCE

1. REMOVE THERMOSTAT CONTROL COVER.
2. SET THE THERMOSTAT TO LOWEST SETTING.
3. TURN OFF ALL ELECTRIC POWER TO THE APPLIANCE IF SERVICE IS TO BE PERFORMED.
4. TURN GAS VALVE CONTROL KNOB CLOCKWISE TO "OFF". REFER TO STEP 5 OF "OPERATING INSTRUCTIONS" ABOVE.
5. REPLACE THERMOSTAT CONTROL COVER.

**TABLE 5**

Temperature Setting	Time to Produce 2nd & 3rd Degree Burns on Adult Skin
180°F (82°C)	Nearly instantaneous
170°F (77°C)	Nearly instantaneous
160°F (71°C)	About 1/2 second
150°F (65°C)	About 1-1/2 seconds
140°F (60°C)	Less than 5 seconds
130°F (54°C)	About 30 seconds
120°F (49°C)	More than 5 minutes

Valves for reducing point-of-use temperature by mixing cold and hot water are available. Also available are inexpensive devices that attach to faucets to limit hot water temperatures. Contact a licensed plumber or the local plumbing authority.

The water temperature is controlled by a thermostat, fig. 1, which has two sensing elements. One sensor is located near the top of the tank and the other is near the center. The thermostat is set in the lowest position before the heater leaves the factory.

The thermostat temperature dial, fig. 1, is accessible by removing the control cover. The dial is adjustable and may be set for 120° (49°C) to 180°F (82°C) water temperature, but 120°F (49°C) is the recommended starting point. It is suggested the dial be placed on the lowest setting which produces an acceptable hot water supply. This will always give the most energy efficient operation. The temperature control has a 4°F fixed differential.

**ADJUSTMENT PROCEDURE**

1. Check gas line pressure and manifold pressure (table 6) and adjust as required.
2. Check barometric damper for proper operation. Parts must move freely.
3. Allow the unit to operate for 15 minutes. Draw hot water from the heater or storage tank to continue main burner operation.
4. Determine heat input rate:
  - The input rate for natural gas models can be estimated by timing the meter, if no other appliances are operating.

\*With a stopwatch, or a wristwatch, which can display the time in seconds, read the gas meter and measure the amount of time required for the heater to consume 5 cubic feet of gas. The actual rate may then be estimated by using the formula below:

Input Rate (Btuh) =

$\frac{\text{Actual Heating Value of Gas (Btu/ft}^3) \times 18000}{\text{number of seconds to use 5 ft}^3 \text{ of gas}}$

The approximate heating value of natural gas is 1050 Btu/ft<sup>3</sup>. Obtain the actual heating value of the gas at the site from the gas utility. Propane (L.P.) gas has an approximate heating value of 2500 Btu/ft<sup>3</sup>.

For example: Assume a \*\*\*81-270, firing on natural gas, consumes 5 ft<sup>3</sup> of gas in 71.0 seconds.

The estimated input rate is:

$$\frac{(1050) \times (18000)}{71.0} = 266000 \text{ Btuh}$$

This is an acceptable input rate for a \*\*\*81-270, installed at an altitude up to 2000 feet, as it is within 2% of the rated input. For installations at higher altitudes, the input will be less for the reasons explained in the FOREWORD.

- The input may be adjusted by adjusting the pressure regulator. Remove the top cap to expose the adjustment screw. Turning the screw in increases the gas pressure and backing the screw out decreases the pressure. Do not turn the adjusting screw in past the point where no further increase in pressure is noted.

The manifold pressure is measured at the manifold pressure tap, see Figure 7, and should be used as a reference point for making pressure regulator adjustments. Table 6 gives the design manifold pressures for each model. Increase or reduce the pressure as required to obtain the rated input.

If an acceptable rate cannot be achieved by adjusting the pressure regulator (manifold pressure), first check to be certain that the gas supply pressure to the unit is adequate. If the supply pressure is inadequate, a different burner orifice may be required. Obtain from the utility the heating value and specific gravity of the gas at the site. Provide this information and the altitude of the site to the manufacturer to obtain a larger orifice size.



**WARNING**  
**UNDER NO CIRCUMSTANCES SHOULD THE INPUT RATE EXCEED THE INPUT RATE SHOWN IN THE HEATER RATING PLATE. OVERFIRING COULD RESULT IN DAMAGE OR SOOTING OF THE HEATER.**

5. Make combustion measurements and corresponding air shutter adjustments per table 6. Combustion results from table 6 are for natural gas models.
  - Proceed with CO<sub>2</sub> test of the flue gases with an Orsat or other similar combustion test equipment. If the CO<sub>2</sub> content is within range (see table 6) no adjustment of the air shutter is required. Flue gas temperature and CO<sub>2</sub> measurements should be repeated 3 times to ensure accurate readings.
  - Check the flue gas temperature ahead of the barometric damper. See table 6 (net temp. = gross temp. = ambient temp.)
  - Check breeching pressure and the barometric damper control to make sure it operates freely and there is no discharge of flue products into the room. See "Venting" section.

**TABLE 6**  
**NOMINAL START-UP SPECIFICATIONS**

MODEL	***	***	***	***
	81-140	81-199	81-270	81-370
Max. Gas Line Press.(W.C.)	Nat. Gas - 10.5"W.C./Prop. Gas - 13.0"			
Manifold Press. (W.C.)				
Natural Gas	3.5	3.5	3.5	3.5
Propane Gas	3.5	3.5	3.5	3.5
Orifice				
Natural Gas	0.24	0.308	0.386	0.532
Propane Gas	0.209	0.257	0.302	0.368
Air Shutter Setting No.				
Natural Gas	2.5	5.75	4	6.5
Propane Gas	4.5	10	4	8.5
CO <sub>2</sub> %	9.2%	9.8%	7.5%	8.0%
CO Parts Per Million	<200	<200	<200	<200
Gross Stack Temp. (°F)	305	338	468	540
Breeching Press.(inches W.C.)	Ranges from - 0.30 to - 0.05 Inches Water Column			

6. Check main burner operation by cycling on and off the thermostat dial several times. Wait 1 minute between cycles for regulators and sequencing to reset.

7. When all adjustments are satisfactory:

- Fill in part no. 170037 "Start-up" form.
- Adjust thermostat temperature dial to deliver desired water temperature at point of use.
- For subsequent normal starting and shutoff procedure, see OPERATIONAL PROCEDURE.

# MAINTENANCE

## MAINTENANCE SCHEDULE

Water heater maintenance includes periodic tank flushing and cleaning, and removal of lime scale. The power burner should be inspected and adjusted to maintain proper combustion. Refer to table 7. A periodic inspection of the venting system and barometric damper should be made. Where used, the water heating system circulating pump should be oiled.

Following are the instructions for performing some of the recommended maintenance. Power burner inspection and adjustment should be performed by a competent technician.

**TABLE 7  
RECOMMENDED MAINTENANCE SCHEDULE  
FOR THE \*\*\*81-140 THRU \*\*\*81-370 HEATER**

COMPONENTS	OPERATION	INTERNAL	REQUIRED
Tank	Flushing	Monthly	
	Sediments Removal	Semi-Annually	
	Lime Scale Removal	As Required	UN•Lime Delimer
Relief Valve	Inspect	Semi-Annually	
Circulating Pump and Power Burner Motor(1)	Oiling	Quarterly	SAE No. 20 Non-Detergent Motor Oil
Power Burner and Ignition Device (2)	Inspection and Adjustment	Semi-Annually	Combustion Test Kit and Test Specifications
Main Burner Vent System and Barometric Damper	Inspect	Semi-Annually	
Barometric Damper	Inspect	Semi-Annually	Draft Gauge
Anode(s)	Inspect	Annually	

## FLUSHING

1. Turn off the heater electrical disconnect switch.
  - For convenience, the switch on the outside of the control compartment can be used.
2. Open the drain valve and allow water to flow until it runs clean.
3. Close the drain valve when finished flushing.
4. Turn on the heater electrical disconnect switch.

## DRAINING

The heater must be drained if it is to be shut down and exposed to freezing temperatures. Maintenance and service procedures may also require draining the heater.

1. Turn off the heater electrical disconnect switch.
2. Close the cold water inlet valve to heater.
3. Open a nearby hot water faucet to vent the system.
4. Open the heater drain valve.
5. If the heater is being drained for an extended shutdown, it is suggested the drain valve be left open during this period.

Reverse these instructions when restoring hot water service.

## SEDIMENT REMOVAL

Waterborne impurities consist of fine particles of soil and sand which settle out and form a layer of sediment on the bottom of the tank.

For convenience, sediment removal and lime scale removal should be performed at the same time.

## LIME SCALE REMOVAL

The amount of calcium carbonate (lime) released from water is in direct proportion to water temperature and usage. The higher the water temperature or water usage, the more lime deposits are dropped out of the water. This is the lime scale which forms in pipes, heaters and on cooking utensils.

Lime accumulation not only reduces the life of the equipment but also reduces efficiency of the heater and increases fuel consumption.

The usage of water softening equipment greatly reduces the hardness of the water. However, this equipment does not always remove all of the hardness (lime). For this reason it is recommended that a regular schedule for deliming be maintained.

The depth of lime build-up should be measured periodically. Heaters will have about 3" of lime build-up when the level of lime has reached the bottom of the cleanout opening or about 1" of lime build-up if it has reached the drain valve opening. A schedule for deliming should be set up, based on the amount of time it would take for a 1" build-up of lime.

Example 1: Initial inspection, six months after installation, shows 1/2" of lime accumulation. Therefore, the heater can be delimed once a year.

Example 2: Initial inspection, six months after installation, shows 2" of lime accumulation. Therefore, the heater should be delimed every 3 months.

Sediment and lime scale removal may be accomplished through the cleanout opening furnished on the heater, see DRAIN VALVE AND ACCESS PANELS. The heater must be drained, see DRAINING, before removing cleanout cover on tank.

To dissolve and remove the more stubborn mineral deposits, UN•LIME® Professional Delimer should be used.

UN•LIME Delimer is an easy-to-handle patented food grade acid formulated specifically for lime scale removal from all types of water using equipment. Available in 1 gallon (part no. 4763) and 5 gallon (part no. 4813) sizes. Hydrochloric base acids are not recommended for use on glass-lined tanks.

Form No. 4800, entitled "Why, When and How", describes tank cleaning methods and materials. UN•LIME and the booklet may be obtained through your dealer or distributor.

To clean heater through cleanout opening, proceed as follows:

1. Turn off water inlet valve, the heater electrical disconnect switch and open drain valve.
2. Remove outer cover plate from lower side of heater jacket.
3. Remove cover from cleanout opening.
4. Remove lime, scale or sediment using care not to damage the glass-lining.
5. Inspect cleanout plate gasket: If new gasket is required, replace with part no. 99038.
6. Install cleanout plate. Be sure to draw plate up tight by tightening screws securely.
7. Close drain valve, open water inlet line and turn on the power burner electrical disconnect switch.
8. Check for water leakage.
9. Replace outer jacket cover plate.

## RELIEF VALVE

At least twice a year, the temperature and pressure relief valve should be checked to ensure that it is in operating condition. To check the relief valve, lift the lever at the end of the valve several times. The valve should seat properly and operate freely.

### CAUTION

**BEFORE MANUALLY OPERATING THE VALVE, MAKE SURE THAT A DRAIN LINE HAS BEEN ATTACHED TO THE VALVE TO DIRECT THE DISCHARGE TO AN OPEN DRAIN. FAILURE TO TAKE THIS PRECAUTION COULD MEAN CONTACT WITH EXTREMELY HOT WATER PASSING OUT OF THE VALVE DURING THIS CHECKING OPERATION.**

If the temperature and pressure relief valve on the heater discharges periodically or continuously, it may be due to thermal expansion of water in a closed water supply system, or, it may be due to a faulty relief valve.

Thermal expansion is the normal response of water when it is heated. In a closed system, thermal expansion will cause the system pressure to build until the relief valve actuation pressure is equaled. Then, the relief valve will open, allowing some water to escape, slightly lowering the pressure.

Contact your water supplier or local plumbing inspector on how to control this situation.

Two common corrections are listed in the Checklist and Service Information which appears later in this manual.

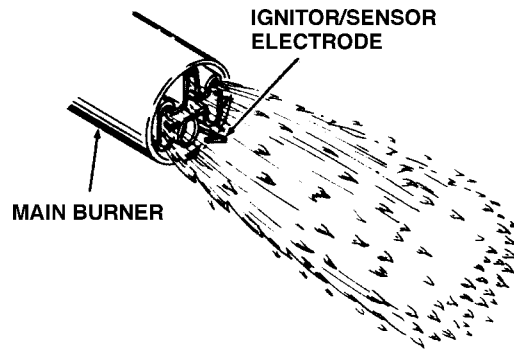
**ABOVE ALL, DO NOT PLUG THE TEMPERATURE AND PRESSURE RELIEF VALVE. THIS IS NOT A SOLUTION AND CAN CREATE A HAZARDOUS SITUATION.**

## CIRCULATING PUMP

The water heating system may include a circulating pump. Where used, it should be lubricated as directed by the circulator manufacturer.

## POWER BURNER

Keep the area around the burner clear and free of combustible materials, gasoline or other flammable liquids or vapors. Do not obstruct burner air openings or ventilation grilles for combustion air.



**TYPICAL MAIN BURNER FLAME  
FIGURE 10**

The main burner flames (fig. 10) should be visually checked once a year for proper operation. This can be observed through the "peep sight" port on the burner housing. Burner flame should be blue. DO NOT use the observation port on the side of the tank to inspect the burner flame.

1. Add a few drops of no. 20 non-detergent oil (\*\*81-140 thru \*\*81-370) into the oil tubes once every three months.
2. At least annually, contact a qualified service agency for a burner readjustment, cleaning and other than routine maintenance.

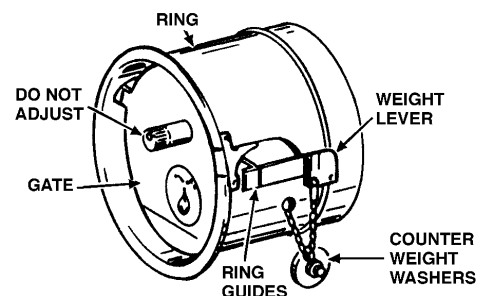
Should the main burner or burner air openings require cleaning, remove the burner and clean with a soft brush. Clean main burner orifice with a suitable soft material.

## VENT SYSTEM

Examine the vent system every six months for obstructions and/or deterioration of vent piping. Remove any soot or obstructions and replace damaged vent piping.

## BAROMETRIC DRAFT CONTROL

The heater is equipped with a double acting barometric draft control. This control assembly is factory adjusted to automatically regulate the chimney draft imposed on the unit. The damper gate must pivot freely in the ring guides, see figure 11.



**BAROMETRIC DRAFT CONTROL  
FIGURE 11**

To test gate for operation gently tap gate and observe. DO NOT ATTEMPT TO ADJUST THIS CONTROL. DO NOT OIL.

## ANODE ROD INSPECTION

The heater tank is equipped with anode rods to provide corrosion control. At least once a year the anode rods should be checked to determine if replacement is necessary. Initially the anode rods are approximately 7/8" (22mm) in diameter with a 1/8" (3mm) diameter steel core wire running down the center of the anode material. THE ANODES SHOULD BE REPLACED when the 1/8" (3mm) diameter core wire is visible as this means that the anode material has been expended in the control of corrosion.

For models with top inlet and outlet, it is recommended that, before removing the inner cover for cleaning, inspection or removal of inner parts, you obtain two new nipple collars, part no. 74060. The nipple collars on the heater will usually be damaged when removed. New pipe collars will insure that the seal is such as to prevent leakage of flue products when properly installed.

NOTE: Anode rod inspection may need to be made more frequently in areas subject to acid rain that obtains their water supply from surface water as the low pH will accelerate anode activity.

CAUTION: Close cold water inlet valve serving heater and open nearby hot water faucet to relieve the pressure in the heater before attempting to remove anode(s) for inspection.

## ELECTRICAL SERVICING



**LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION.**

VERIFY PROPER OPERATION AFTER SERVICING.

# CHECKLIST AND SERVICE INFORMATION

### IMPORTANT

The installer may be able to observe and correct certain problems which might arise when the unit is put into operation or when it is refired after a prolonged shutdown. HOWEVER, it is recommended that only qualified servicemen, using appropriate test equipment, be allowed to service the heater.

BE SURE TO TURN OFF THE ELECTRICITY WHENEVER POSSIBLE OR APPROPRIATE WHILE CHECKING EQUIPMENT.

### BURNER OPERATIONAL PROBLEMS.

1. Refer to TROUBLESHOOTING.

### NOT ENOUGH OR NO HOT WATER

1. Be certain the electrical disconnect switch serving the water heater is in the ON position.
2. Check the fuses.
  - The electrical disconnect switch usually contains fuses.
3. The capacity of the heater may have been exceeded by a large demand for hot water.
  - Large demands require a recovery period to restore water temperature.

4. Colder incoming water temperature will lengthen the time required to heat water to the desired temperature.
  - If the heater was installed when incoming water temperature was warm, colder water creates the effect of less hot water.
5. Look for hot water wastage and leaking or open hot water faucets.
6. Sediment or lime scale may be affecting water heater operation. Refer to MAINTENANCE for details.
7. The heater's temperature high limit sensor has activated. Press the reset button on the thermostat.
8. Burner may not be firing at proper rate.
  - Check gas pressure. Adjust to obtain required manifold pressure.
  - If rate adjustment is made, readjust burner air shutter.
9. Burner fan wheel may be dirty.
  - Clean fan wheel with a stiff brush.
  - Readjust burner air shutter. Refer to the ADJUSTMENT PROCEDURE section of this manual.
10. Flue baffles may have deteriorated excessively.
  - Remove jacket top and replace flue baffles. New flue baffles may be ordered from the manufacturer, see enclosed parts list for model application information.
  - If the jacket cover is removed for inspection, service or baffle replacement, the sealer tape must be replaced. Inner cover sealer tape, part number 6158 is available from your distributor or the manufacturer.

### WATER IS TOO HOT

1. Refer to WATER TEMPERATURE CONTROL.

### WATER HEATER MAKES SOUNDS

1. Sediment or lime scale accumulations cause rumbling and pounding noises when the heater is operating.
  - The sounds are normal, however, the tank bottom should be cleaned. Refer to MAINTENANCE for details.
2. Some of the electrical components of the water heater make sounds which are normal.
  - Contacts click or snap as the heater starts and stops.
  - Transformers often hum.

### WATER LEAKAGE IS SUSPECTED

1. Check to see if the water heater drain valve is tightly closed. Also check the cleanout opening for leakage.
2. The apparent leakage may be condensation which forms on cool surfaces of the heater and piping.
3. If the outlet of the relief valve is leaking it may represent:
  - Excessive water pressure.
  - Excessive water temperature.
  - Faulty relief valve.

Excessive water pressure is the most common cause of relief valve leakage. It is often caused by a "closed system". If a check valve is in the inlet system it will not permit the expanded hot water volume to equalize pressure with the main. The relief valve must release this water or the water heater or plumbing system will be damaged. Refer to MAINTENANCE – RELIEF VALVE.

When such a condition is encountered, local codes or inspection agency should be consulted to determine which system is acceptable in your area. These may consist of:

- Installation of a second relief valve with lower setting than the primary relief valve.
- An expansion tank of suitable size and pressure rating and provision to avoid water logging.

## HOT WATER ODOR

On occasion, hot water may develop a strong odor. If this occurs, drain the heater completely, flush thoroughly, and refill. If the problem persists, chlorination of the heater and replacement of the factory installed aluminum anodes with magnesium anodes may correct the condition.

Occasionally water softener companies recommend removal of heater anodes for odor reasons.



### CAUTION

Unauthorized removal of the anode(s) will void the warranty. For further information contact your dealer.

## ANODE ROD MAINTENANCE

The anode rod is used to protect the tank from corrosion. Most hot water tanks are equipped with an anode rod. The submerged rod sacrifices itself to protect the tank. Instead of corroding the tank, water ions attack and eat away the anode rod. This does not effect the water's taste or color. The rod must be maintained to keep the tank in operating condition.

Anode deterioration depends on water conductivity, not necessarily water condition. A corroded or pitted anode rod indicates high water conductivity and should be checked and/or replaced more often than an anode rod that appears to be intact. Replacement of a depleted anode rod can extend the life of your water heater. Inspection should be conducted by a qualified technician, and at a minimum should be checked annually after the warranty period.

## TROUBLESHOOTING

Make sure thermostat and operation controls are calling for heat. Defective wiring or loose connections can simulate the component defects outlined below. Check associated wiring before replacing component.

Keep the gas valve control knob in the "OFF" position unless a run on gas is intended.

Checks must be made in the order outlined below.

### MOTOR WILL NOT RUN

Confirm 120V between strip terminals 1 and 2, and 1 and GND.

Check 24V\* operating control circuit.

1. Between left terminal T and GND.
  - If no voltage, transformer is defective.
  - If very low voltage,\* circuit is overloaded or transformer is defective.
2. Between right terminal T and GND.
  - If no voltage, circuit between T and T is open.

Check for 120V between motor relay terminal 4 and strip terminal 2.

- If no voltage, motor relay is defective.
- If voltage present, motor is defective.

### MOTOR RUNS IN REPEATED CYCLES – NO FLAME PRESENT

1. Motor relay drops out due to low voltage.
  - Check valve circuit for ground or overload.

### MOTOR RUNS CONTINUOUSLY, PREPURGE TIME ELAPSES, BUT NO FLAME PRESENT

Electric check only (no trial for flame).

Gas valve control knob "OFF".

1. Check for 24V between strip terminal 3 and GND (Models \*\*\*81-140 and \*\*\*81-199) or between interlock switch terminal NC, and GRD, on models \*\*\*81-270, \*\*\*81-370.

Momentarily turn burner switch off to reset control board for each of the following steps. Tests are valid only during the 5 second trial for ignition following prepurge as indicated by the neon bulb located on the control board next to the high voltage coil. To observe bulb, remove board and cover by removing the Hi Voltage stud terminal, and remount board.

1. Observe neon bulb during trial for ignition.
  - If no glow, control board is defective.
2. Check for 24 V between valve terminals.
  - If no voltage, board is defective.
  - If no voltage present, valve may be defective.
3. Check for spark at Hi Voltage stud terminal.
  - If no spark, board is defective.
4. Check for spark at electrode.
  - If no spark, electrode or cable is defective.

Trial for flame. Gas valve control knob "ON". Reset after each trial.

1. Check that normal gas pressure is available ahead of automatic gas valve and that gas valve control knob is "ON".
2. During trial for ignition, confirm 24V at valve and check manifold pressure.
  - If no pressure, defective valve confirmed.
  - If manifold pressure present, spark electrodes are defective or misadjusted.

3. Gross air misadjustment. See table 6.

Flame on 5 seconds only.

1. Recheck polarity of 120V supply and that system is grounded (120V between terminal 1 and GND).
2. Recheck sensor wire and flame electrode.
3. Gross air misadjustment. See table 6.
4. If 1, 2, and 3 OK, board is defective.

\*Normal low voltage: Burner in standby - 24V min. Burner running (gas valve energized) - 21V min.

## REPLACEMENT PARTS

Replacement parts may be ordered. Refer to the Yellow Pages for where to call or contact the contractor or dealer. If for any reason the installer or dealer fails to provide satisfactory service you should write the company. When ordering parts be sure to state the quantity, part number and description of the items including the complete model and serial number as it appears on the product. Refer to the parts list for more information.

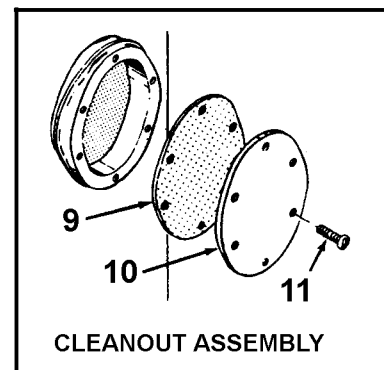
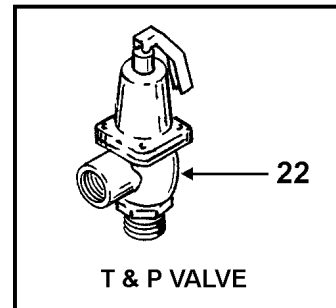
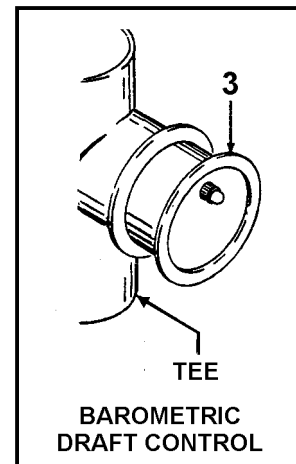
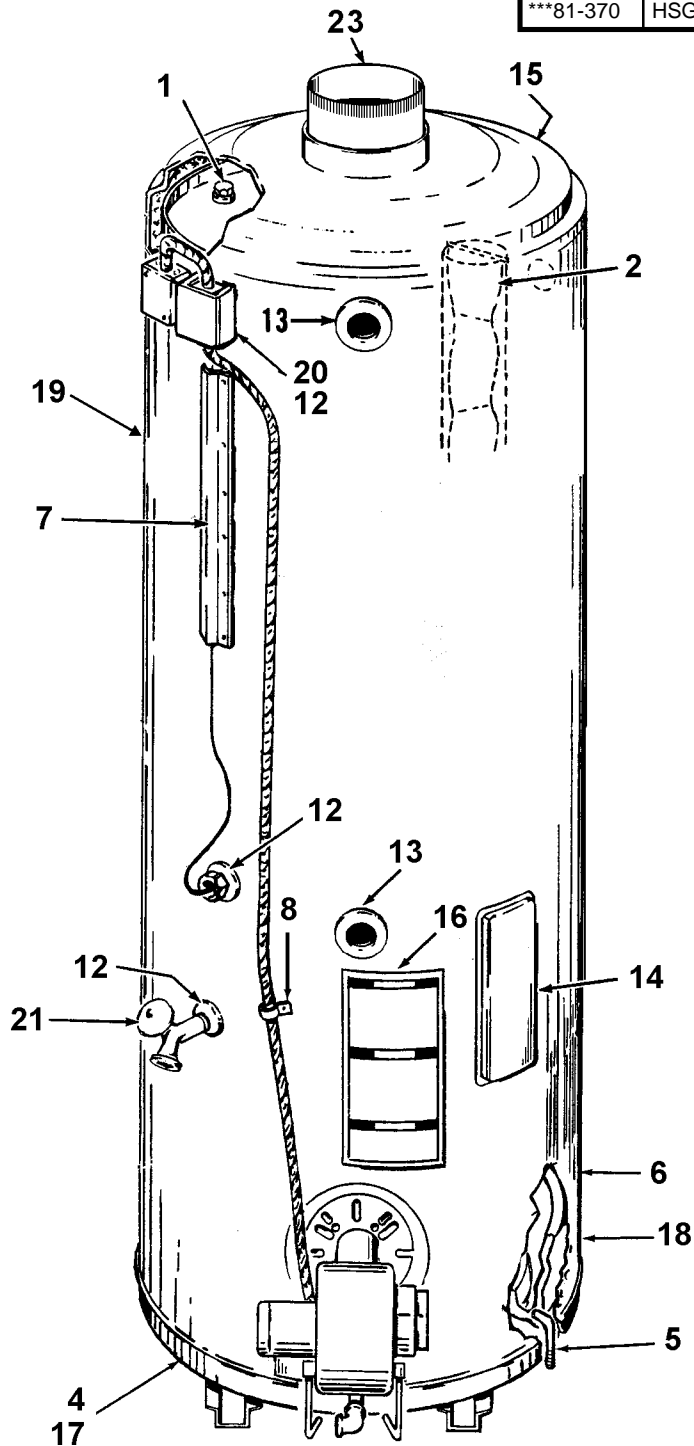
# COMMERCIAL GAS

## Lined Tank Type Water Heater

### REPLACEMENT PARTS LIST

#### MAIN BURNER ORIFICE CHART

Models	Burner Number	Natural Gas		Propane Gas	
		Wayne C.S. Part No.	(Decimal)	Wayne C.S. Part No.	(Decimal)
***81-140	HSG-200	62459-001	0.24	62459-001	0.209
***81-199	HSG-200	62459-001	0.38	62459-001	0.257
***81-270	HSG-400	62459-002	0.368	62459-002	0.302
***81-370	HSG-400	62459-002	0.532	62459-002	0.386





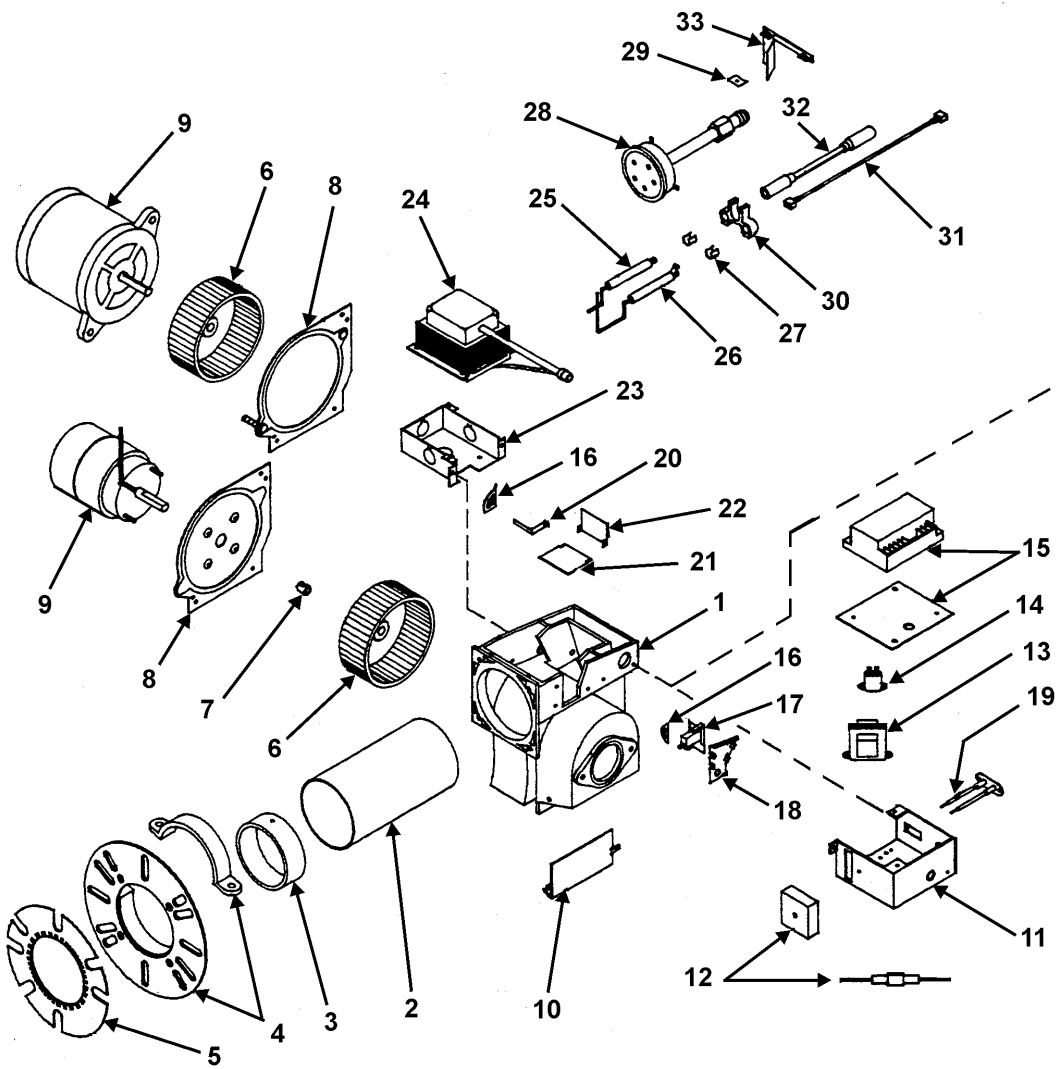
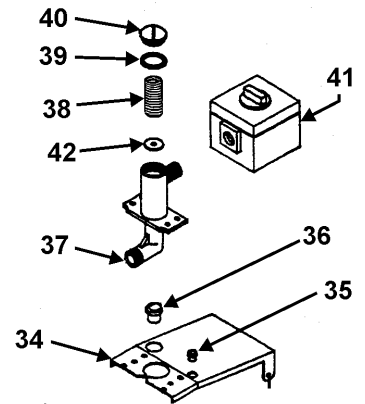
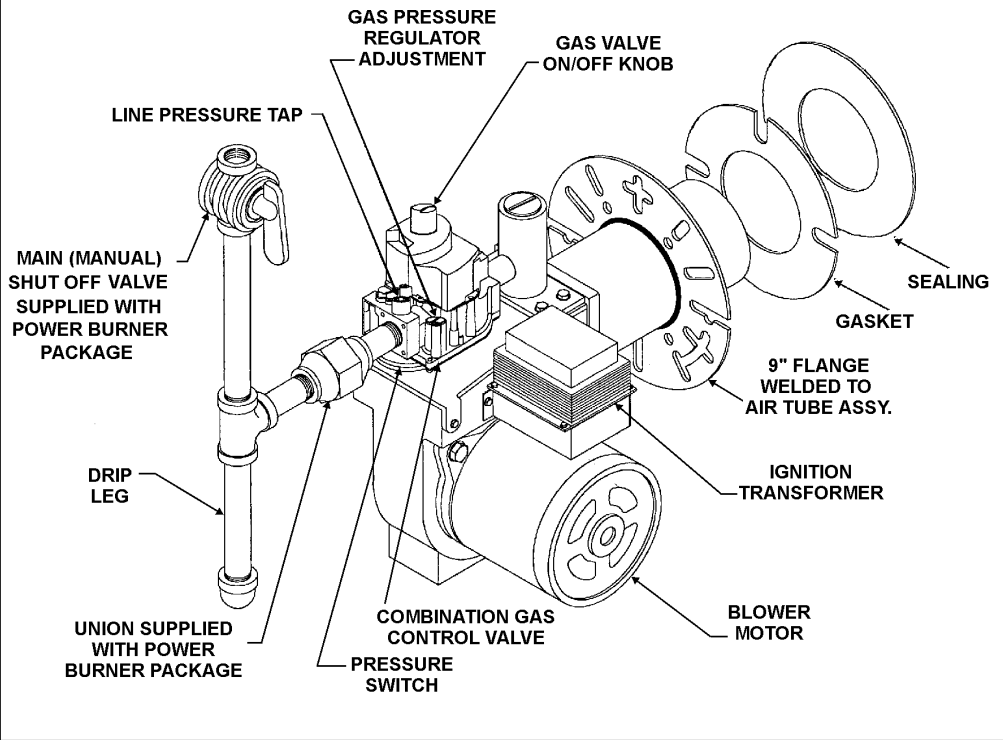
Item	Description	***81-140	***81-199	***81-270	***81-370
1	Anode	183523-42(2)	183523-42(2)	183523-42(2)	183523-42(2)
2	Baffle, Flue	193888(7)	193888(7)	193888(7)	193888(7)
3	Barometric Draft Control w Tee Assy.	170777	170777	170777-1	170777-1
4	Jacket Base with Skids	76242	76242	76242	76242
5	Bolt, Base	41431(4)	41431(4)	41431(4)	41431(4)
6	Chamber, Combustion	76508-1	76508-1	76508-1	76508-1
7	Channel, Wire	95312-3	95312-3	95312-3	95312-3
8	Clamp	94694	94694	94694	94694
<b>Cleanout Assembly:</b>					
9	Gasket	<u>99038</u>	<u>99038</u>	<u>99038</u>	<u>99038</u>
10	Pressure Plate	<u>99037</u>	<u>99037</u>	<u>99037</u>	<u>99037</u>
11	Screw, Self Tapping (Req'd)	<u>69852-1</u>	<u>69852-1</u>	<u>69852-1</u>	<u>69852-1</u>
12	Collar, Pipe	20172-21(2)	20172-21(2)	20172-21(2)	20172-21(2)
13	Collar, Pipe	95030-3(2)	95030-3(2)	95030-3(2)	95030-3(2)
14	Cover, Cleanout Opening	181260	181260	181260	181260
15	Jacket, Top	97062-6	97062-6	97062-6	97062-6
16	*Decals:				
	ASHRAE	160659	160659	160659	160659
	ASME	68065	68065	68065	68065
	California	42985	42985	42985	42985
	Caution (Electric)	98299	98299	98299	98299
	Cleanout	97444	97444	97444	97444
	Clearance	190105	190105	190105	190105
	Gas Pressure:				
	Natural	190005	190005	190005	190005
	Propane	190005-1	190005-1	190005-1	190005-1
	Hot	41355	41355	41355	41355
	Installer	170013	170013	170013	170013
	Instruction	78662	78662	78662	78662
	Lighting and Operation Label	190191	190191	190191	190191
	Lime Tamer	78640	78640	78640	78640
	N. Carolina	43117	43117	43117	43117
	Plate-Press, Data	77995	77995	77995	77995
	Relief Valve	191068	191068	191068	191068
	Warning	41142	41142	41142	41142
	Water Inlet	94518	94518	94518	94518
	Water Outlet	94519	94519	94519	94519
	Wiring	194129	194129	194129	194129
	800-HELP Line	190600	190600	190600	190600
17	Gasket, Skirt Ring	76443	76443	76443	76443
18	Jacket	193440	193440	193440	193440
19	Jacket, ASME	193440	193440	193440	193440
20	Thermostat with ECO	<u>192828</u>	<u>192828</u>	<u>192828</u>	<u>192828</u>
21	Valve, Drain	26273-4	26273-4	26273-4	26273-4
22	Valve, T & P	192467	192467	192467	192467
23	Reducer, Flue	76707-0	76707-0	76707-4	76707-4
24	*Wire:				
	AWG Stranded, 105°C, AWM & TEW				
	Black	86578	86578	86578	86578
	Red	86579	86579	86579	86579
	White	86580	86580	86580	86580
	Yellow	98199	98199	98199	98199
	18 AWG Stranded, 105°C, AWM & TEW				
	Red	41976	41976	41976	41976

\*Items not illustrated. ( ) Reflects quantities.

Part numbers underlined are recommended stock items for emergency replacement. (Consider gas used in your area only).

All information such as model and series number, type of gas and specifications must be supplied to State Water Heaters.

# MODEL HSG 200/400 GAS BURNER



Item	Description	Part Number
1	Burner Housing	6206
2	Air Tube-HSG200 6"	6206-1
	Air Tube-HSG400 6 1/4"	6206-2
	Air Tube-HSG200/400 9"	6206-3
	Air Tube-HSG200/400 12"	6206-4
3	Air Cone-(HSG200 only)	6206-5
4	Adjustable Flange Assembly	6206-6
5	Flange Gasket	6206-7
6	Blower Wheel HSG200 5 1/4"OD	6206-8
	Blower Wheel HSG400 5 1/2" OD	6206-9
7	Blower Wheel Bushing (Used with 62355-001 Motor Oil)	6206-10
8	Side Plate (Used with 62355-001 Motor Oil)	6206-11
	Side Plate (Used with 20627 Motor Oil)	6206-12
9	Motor Shaded Pole 1/12 HP 3200 RPM 115V60	6206-13
	Motor Split Phase 1/7 or 1/8 HP 3450 RPM 115V60	6206-14
10	Combustion Air Inlet Damper	6206-15
11	Control Box	6206-16
12	30 Sec. Prepurge Timer: Used with Primary Safety Control P/N's 6206-22 & 6206-21 (Special Limit Applications Only)	6206-17
13	24 Volt Transformer	6206-18
14	Motor Relay	6206-19
15	Primary Safety Control H'Well S89-F1007 w/30 Sec Prepurge	6206-20
	Primary Safety Control Fenwall 05-319000-251 w/30 Sec Prepurge	6206-21
	NOTE: Not to be used with Honeywell VR845M-5006 gas valve.	
	Primary Safety Control H'Well S89E-1033 w/o 30 Sec. Purge (Special Limit Applications Only)	6206-22
	Primary Safety Control Fenwall 05-319-000-051 w/o 30 Sec Purge (Special Limit Applications Only)	6206-23
	NOTE: Not to be used with Honeywell VR845M-5006 gas valve.	
	Primary Safety Control Mounting Plate Fenwall Primary Only	6206-24
16	Damper Indicator Pointer	6206-25
17	Air Proving Switch, Only	6206-26
18	Air Proving Switch/Mounting Plate Slot Cover Assembly	6206-27
19	Thermostat Terminal Strip	6206-28
20	Adjustment Arm Off-Cycle Damper	6206-29
21	Off-Cycle Damper Plate	6206-30
22	Mounting Bracket Off-Cycle Damper	6206-31
23	Junction Box	6206-32
24	Ignition Transformer 7500V	6206-33
25	Electrode Assembly	6165
26	Sensor Probe Assembly	6166
27	Insulator Bushing	6206-34
28	Chamber/Manifold-HSG200 6"	6206-35
	Chamber/Manifold-HSG400 6 1/4"	6206-36
	Chamber/Manifold-HSG200 9"	6206-37
	Chamber/Manifold-HSG400 9"	6206-38
	Chamber/Manifold-HSG200 12"	6206-39
	Chamber/Manifold-HSG400 12"	6206-40
29	Clip, Electrode Bracket	6206-41
30	Electrode Bracket Support (Includes Items 27, 29 and Set Screws)	6206-42
31	11" Sensor Wire-6", 6 1/4" Burner	6206-43
	14" Sensor Wire-9" Burner	6206-44
	17" Sensor Wire-12" Burner	6206-45
32	8" Ignition Wire-6", 6 1/4" Burner	6206-46
	11" Ignition Wire-9" Burner	6206-47
	14" Ignition Wire-12" Burner	6206-48
33	Baffle Plate (Not used on HSG 6" and 6 1/4")	6206-49
34	Top Plate/Housing Cover	6206-50
35	Strain Relief Bushing/Sensor Wire	6206-51
36	Strain Relief Bushing/Sensor Wire	6206-52
37	Orifice Housing	6206-53
38	Orifice Spring	6206-54
39	Orifice Gasket	6206-55
40	Orifice Cap	6206-56
41	Gas Valve Honeywell VR8450M-HSG200	6206-58
	Gas Valve Honeywell VR845M-5006, HSG400	6356
	NOTE: Not to be used with Fernwall primary safety controls 05319000-051 & 05-319000-251	
42	Orifice Package-HSG200	6206-60
	Orifice Package-HSG400	6206-61
43	Optional Pedestal Mounting (Not shown)	6206-62

