Instruction Manual

COMMERCIAL ELECTRIC WATER HEATERS

MODELS DVE-150 THRU DVE-10000
DHE-200 THRU DHE 10000

INSTALLATION - OPERATION - SERVICE - MAINTENANCE - LIMITED WARRANTY

A.O. Smith

A DIVISION OF A.O. SMITH CORPORATION
RENTON, WASHINGTON

ASME

L H W

Thank you for buying this energy efficient water heater from A.O. Smith Water Products Company. We appreciate your confidence in our products.

⚠ WARNING

Read and understand this instruction manual and the safety messages herein before installing, operating, or servicing this water heater.

Failure to follow these instructions and safety messages could result in death or serious injury.

This manual must remain with the water heater.

⚠ WARNING

If the heater becomes immersed in water up to or above the level of the bottom of the element doors, the heater should be examined by a qualified service agency before it is placed in operation, see Page 2.

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

PRINTED IN THE U.S.A 1207

09063340-000

SAFE INSTALLATION, USE, AND SERVICE

The proper installation, use and servicing of this water heater is extremely important to your safety and the safety of others.

Many safety-related messages and instructions have been provided in this manual and on your own water heater to warn you and others of a potential injury hazard. Read and obey all safety messages and instructions throughout this manual. It is very important that the meaning of each safety message is understood by you and others who install, use, or service this water heater.

	**This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.**

DANGER	**DANGER indicates an imminently hazardous situation which, if not avoided, could result in death or injury.**
WARNING	**WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.**
CAUTION	**CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**
CAUTION	**CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, could result in property damage.**

All safety messages will generally tell you about the type of hazard, what can happen if you do not follow the safety message, and how to avoid the risk of injury.

IMPORTANT DEFINITIONS

- **Qualified Installer or Service Agency:**

  Installation and service of this water heater requires ability equivalent to that of a Qualified Agency (as defined by ANSI below) in the field involved. Installation skills such as plumbing, air supply, venting, gas supply, electrical supply are required in addition to electrical testing skills when performing service.

- **ANSI Z223.1 2006 Sec. 3.3.83:**

  “Qualified Agency” - “Any individual, firm, corporation or company that either in person or through a representative is engaged in and is responsible for (a) the installation, testing or replacement of gas piping or (b) the connection, installation, testing, repair or servicing of appliances and equipment; that is experienced in such work; that is familiar with all precautions required; and that has complied with all the requirements of the authority having jurisdiction.”

GENERAL SAFETY

When servicing this unit, verify the power to the unit is turned off prior to opening the control cabinet door.

⚠ WARNING

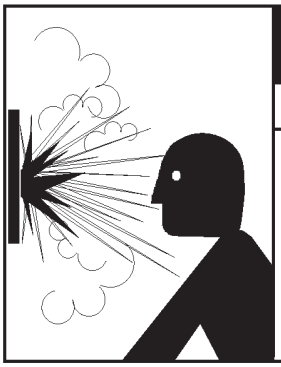
Read and understand this instruction manual and the safety messages herein before installing, operating, or servicing this water heater.

Failure to follow these instructions and safety messages could result in death or serious injury.

This manual must remain with the water heater.

⚠ WARNING

- **Before removing any access panels or servicing the water heater, make sure the electrical supply to the water heater is turned "OFF."**
- **Failure to do this could result in death, serious bodily injury, or property damage.**

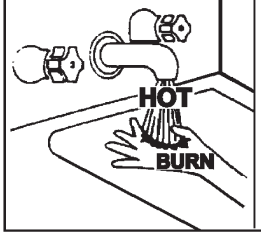


⚠ WARNING

Explosion Hazard

- Overheated water can cause water tank explosion.
- Properly sized temperature and pressure relief valve must be installed in opening provided.

⚠ DANGER



Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.

Children, the elderly, and the physically or mentally disabled are at highest risk for scald injury.

Feel water before bathing or showering.

Temperature limiting valves are available.

Read instruction manual for safe temperature setting.

CAUTION

Improper Installation, use and service may result in property damage.

- Do not operate water heater if flood damaged.
- Inspect anode rods regularly, replace when significantly depleted.
- Install in location with drainage.
- Fill tank with water before operation.
- Properly sized thermal expansion tanks are required on all closed water systems.

Refer to this manual for installation and service.

Complies with ASHRAE 90.1b-1992.

A.O. SMITH WATER PRODUCTS CO.
P.O. BOX 58549, RENTON, WASH 98058-1549

AUTOMATIC ELECTRIC WATER HEATERS

CAT. NO.	ASME NO.	PH.	HZ.	AMP.	VOLTS

NO. ELEMENTS	WATTS EA.	TOTAL WATTS

E67917 LISTED WORKING PRESSURE _____ TEST PRESSURE _____

UL 709T

77105-300

USE ON A.C. CURRENT ONLY
FOR SUPPLY CONNECTIONS, USE WIRE SUITABLE FOR AT LEAST 75° C.

09066105

09876798
model #: 18 DIGIT MODEL NO.
item id: XXXXXXXXXX
serial #: K07R000489
lot: 3 gas type: 0

TABLE OF CONTENTS

INTRODUCTION

Thank You for purchasing this water heater. Properly installed and maintained, it should give you years of trouble free service.

Abbreviations Found In This Instruction Manual:

- ANSI - American National Standards Institute
- ASME - American Society of Mechanical Engineers
- GAMA - Gas Appliance Manufacturer's Association
- NEC - National Electrical Code
- NFPA - National Fire Protection Association
- UL - Underwriters Laboratory

PREPARING FOR THE INSTALLATION

1. Read the "General Safety" section of this manual first and then the entire manual carefully. If you don't follow the safety rules, the water heater may not operate safely. It could cause DEATH, SERIOUS BODILY INJURY AND/OR PROPERTY DAMAGE.

   This manual contains instructions for the installation, operation, and maintenance of the electric water heater. It also contains warnings throughout the manual that you must read and be aware of. All warnings and all instructions are essential to the proper operation of the water heater and your safety. **READ THE ENTIRE MANUAL BEFORE ATTEMPTING TO INSTALL OR OPERATE THE WATER HEATER.**

2. The installation must conform with these instructions and the local code authority having jurisdiction and the requirements of the power company. In the absence of code requirements, follow NFPA-70 (current edition). The National Electrical Code may be ordered from: National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

3. If after reading this manual you have any questions or do not understand any portion of the instructions, contact A.O. Smith Water Products Customer Care Center at 1-800-527-1953.

   A sample rating plate and barcode tag are shown on page 3 of this manual. In order to expedite your request, please have the serial number and item ID from the barcode tag available for the technician.

4. Carefully plan your intended placement of the water heater. Examine the location to ensure the water heater complies with the "Locating the New Water Heater" section in this manual.

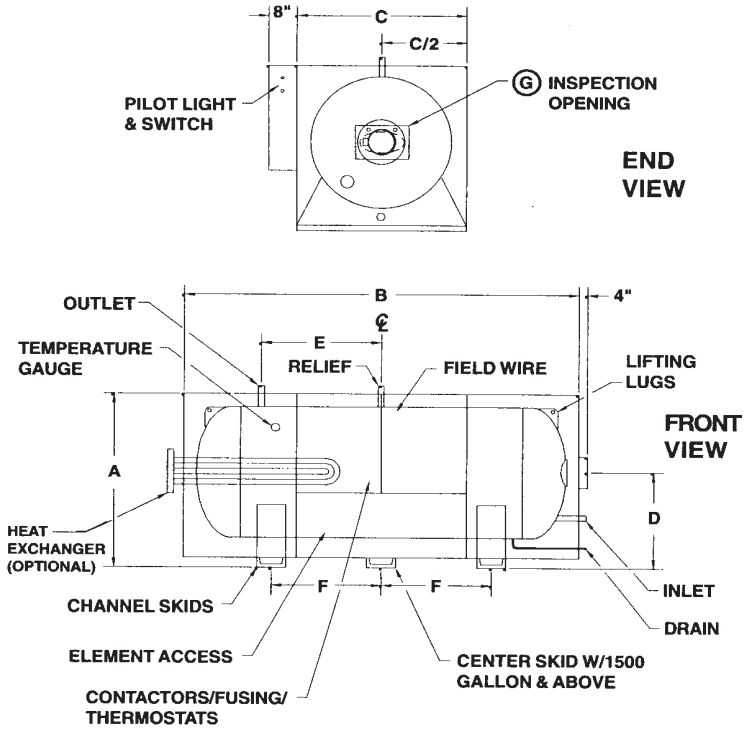
   INSTALLATION AND SERVICE OF THIS WATER HEATER REQUIRES ABILITY EQUIVALENT TO THAT OF A LICENSED TRADESMAN OR QUALIFIED AGENCY (Page 2) IN THE FIELD INVOLVED. PLUMBING AND ELECTRICAL WORK ARE REQUIRED.

5. For installation in California this water heater must be braced or anchored to avoid falling or moving during an earthquake. See instructions for correct installation procedures. Instructions may be obtained from California Office of the State Architect, 1102 Q Street, Suite 5100, Sacramento, CA 95811.

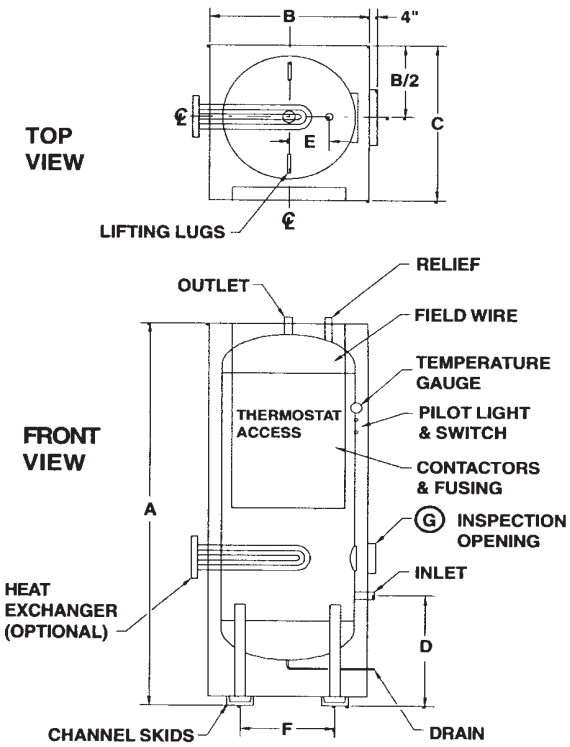
6. Massachusetts Code requires this water heater to be installed in accordance with Massachusetts 248-CMR 2.00: State Plumbing Code and 248-CMR 5.00.

DIMENSIONS AND CAPACITIES DATA

HORIZONTAL MODELS



VERTICAL MODELS



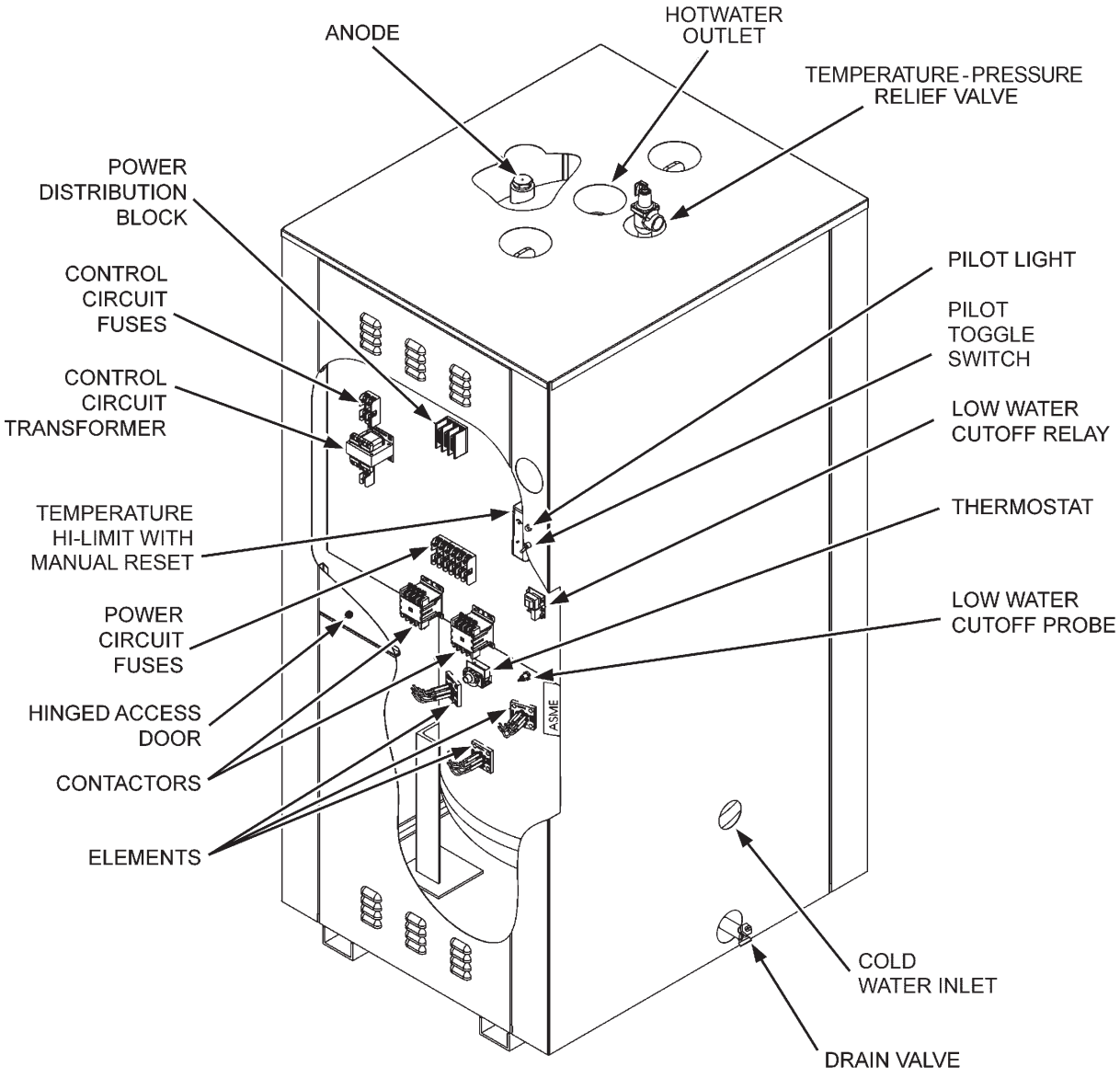
ALL DIMENSIONS IN INCHES

A. O. Smith Model*	Nominal Gallon Capacity	Maximum KW Input	Height A	Width (Length) B	Depth C	D	E	Skid Spacing F	Inspection Opening G	Inlet Outlet Opening	Drain Opening	Relief Valve Opening**
HORIZONTAL ELECTRIC STORAGE HEATER												
DHE-200	200	180	38-1/2	77	36	10-1/2	17-1/2	18		1-1/2	3/4	3/4
DHE-250	250	240	38-1/2	91	36	10-1/2	24	24		1-1/2	3/4	1
DHE-300	300	300	44-1/2	81	42	8-1/4	17	18	Optional	2	3/4	1
DHE-350	350	330	44-1/2	93	42	8-1/4	23	24		2	3/4	1
DHE-400	400	390	44-1/2	100	42	8-1/4	26-1/2	27-1/2		2	3/4	1
DHE-500	500	480	51	94	48	14	24	24	4" X 6"	2	1-1/4	1
DHE-600	600	600	51	109	48	14	32	32		2	1-1/4	1
DHE-700	700	690	51	121	48	14	38	38	Handhole	2	1-1/4	1
DHE-800	800	780	57	111	54	16-1/2	32	32		2	1-1/2	1
DHE-1000	1000	990	61	111	60	16-1/2	29-1/2	29-1/2		3	1-1/2	1
DHE-1250	1250	1200	61	138	60	16-1/2	43	43		3	1-1/2	1
DHE-1500	1500	1500	61	150	60	16-1/2	50	49	11" x 15"	3	1-1/2	1
DHE-2000	2000	1980	70	177	66	20	60	60	Manhole	3	2	1-1/4
DHE-3000	3000	3000	76	211	72	20	72-1/2	74		3	2	1-1/2
DHE-5000	5000	3000	82	296	78	20-1/2	113-1/2	115		3	2	1-1/2
DHE-7500	7500	3000	94	317	90	21-1/2	121	119		4	2	1-1/2
DHE-10,000	10,000	3000	106	345	102	22	132	130		4	2	1-1/2
VERTICAL ELECTRIC STORAGE HEATER												
DVE-150	150	150	83-1/2	30	37	16	6	17		1-1/4	3/4	3/4
DVE-150L	150	150	59-1/2	36	43	17-1/2	6	21		1-1/4	3/4	3/4
DVE-200	200	180	79-1/2	36	43	17-1/2	6	21		1-1/2	3/4	3/4
DVE-250	250	240	93	36	43	17-1/2	6	21	Optional	1-1/2	3/4	1
DVE-300	300	300	83-1/2	42	49	19	6	25-1/2		2	3/4	1
DVE-350	350	330	95-1/2	42	49	19	6	25-1/2		2	3/4	1
DVE-400	400	390	102-1/2	42	49	19	6	25-1/2		2	3/4	1
DVE-500	500	480	97	48	55	21	6	30	4" X 6"	2	1-1/4	1
DVE-600	600	600	112	48	55	21	6	30		2	1-1/4	1
DVE-700	700	690	124	48	55	21	6	30	Handhole	2	1-1/4	1
DVE-800	800	780	116	54	61	23	8	34		2	1-1/2	1
DVE-1000	1000	990	116	60	67	24-1/2	10	38		3	1-1/2	1
DVE-1250	1250	1200	143	60	67	24-1/2	10	38	11" x 15"	3	1-1/2	1
DVE-1500	1500	1500	155	60	67	24-1/2	10	38		3	1-1/2	1
DVE-2000	2000	1980	183	66	73	25	12	42-1/2	Manhole	3	2	1
DVE-3000	3000	3000	217	72	79	27-1/2	14	47		3	2	1-1/2
DVE-5000	5000	3000	309	78	85	30	14	51		3	2	1-1/2
DVE-7500	7500	3000	330	90	97	30	14	59-1/2		4	2	1-1/2
DVE-10,000	10,000	3000	358	102	109	30	14	68		4	2	1-1/2

*Complete Model Number includes the desired KW at end, e.g.: DVE-500-120 when KW = 120.
**Size may vary according to KW input.
Minimum installation clearances required: 30" from front, 12" from top, and 24" from right side.

FEATURES AND COMPONENTS

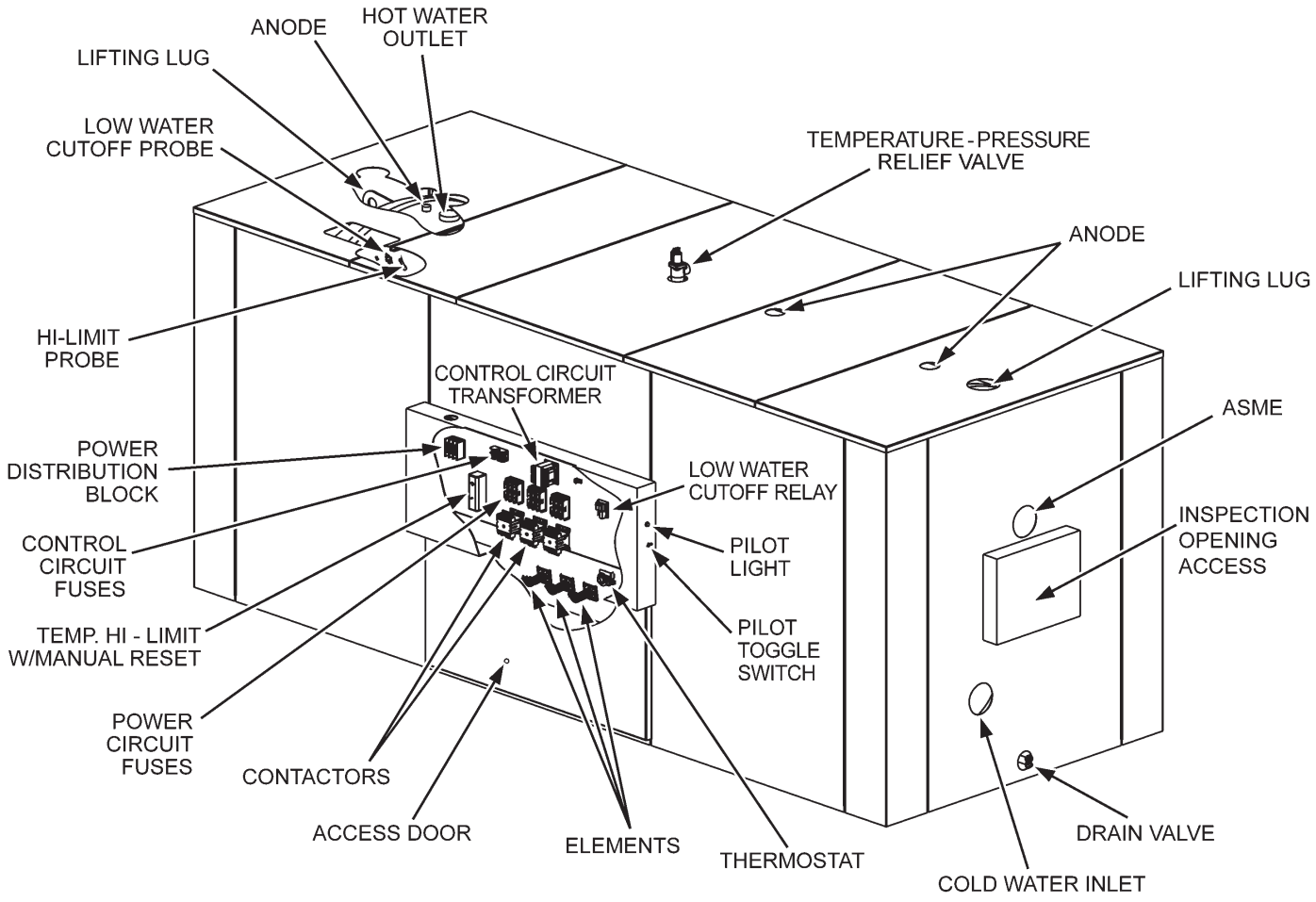
NOTE: Your actual configuration may vary.



DVE
Vertical Water Heater (typical).

FEATURES AND COMPONENTS

NOTE: Your actual configuration may vary.



DHE

Horizontal Water Heater (typical).

LOCATING THE NEW WATER HEATER

FACTS TO CONSIDER ABOUT THE LOCATION

CAUTION

Property Damage Hazard

- All water heaters eventually leak
- Do not install without adequate drainage.

Carefully choose a location for the new water heater. The placement is a very important consideration for the safety of the occupants in the building and for the most economical use of the appliance.

Whether replacing an old water heater or putting the water heater in a new location, the following critical points must be observed. The water heater must be located:

1. On a level surface. Shim the channel type skid base as necessary if levelling is required.

2. Near a floor drain. The heater should be located in an area where leakage of the tank or connections will not result in damage to the area adjacent to the heater or to lower floors of the structure.

   When such locations cannot be avoided, a suitable drain pan should be installed under the heater.

   The pan should be at least 2 inches deep, have a minimum length and width of at least 2 inches greater than the dimensions of the water heater and should be piped to an adequate drain.

   The discharge opening of the relief valve should always be piped to an open drain.

3. Close to the point of major hot water usage and the power supply.

Hot water piping and branch circuit wiring should be as short as possible.

Insulate hot and cold water piping where heat loss and condensation may be a problem.

Heater construction permits installation, maintenance, and service work to be performed through the front and right side openings.

Suggested clearances from adjacent surfaces are 12 inches on top, 30 inches in front and 24 inches on right side for access to the unit.

The heater may be installed on or against combustible surfaces. The left side and back may be placed flush against adjacent surfaces. Be sure to place the cover plates over the rear crating couplings before locating vertical model heaters. The heater may be installed in a confined space if adequate ventilation is provided.

The temperature of the space in which the water heater is installed must not go below 32°F or above 122°F.

INSTALLATION

REQUIRED ABILITY

INSTALLATION AND SERVICE OF THIS WATER HEATER REQUIRES ABILITY EQUIVALENT TO THAT OF A QUALIFIED AGENCY (PAGE 2) IN THE FIELD INVOLVED. PLUMBING AND ELECTRICAL WORK IS REQUIRED.

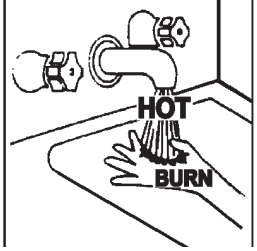
GENERAL

The installation must conform to these instructions and the local code authority having jurisdiction. Grounding and electrical wiring connected to the water heater must also conform to the National Electrical Code, NFPA 70. This publication is available from The National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

Do **NOT** test electrical system before heater is filled with water, follow the START UP procedure in the OPERATION section of this manual.

The principal components of the heater are identified in the Features and Components illustrations on pages 6 and 7.

⚠DANGER



Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.

Children, the elderly, and the physically or mentally disabled are at highest risk for scald injury.

Feel water before bathing or showering.

Temperature limiting valves are available.

Read instruction manual for safe temperature setting.

MIXING VALVE USAGE:
Water heaters are intended to produce hot water. Water heated to a temperature which will satisfy space heating, clothes washing, dish washing, cleaning and other sanitizing needs can scald and permanently injure you upon contact. Some people are more likely to be permanently injured by hot water than others. These include the elderly, children, the infirm, or physically/developmentally disabled. If anyone using hot water in your home fits into one of these groups or if there is a local code or state law requiring a maximum water temperature at the hot water tap, then you must take special precautions. In addition to using the lowest possible temperature setting that satisfies your hot water needs, a means such as a **MIXING VALVE**, should be used at the hot water taps used by these people or at the water heater.

MIXING VALVES for reducing point of use temperature are available. Consult a qualified installer or service agency. Follow all manufacturer's Instructions for installation of these valves. Before changing the factory setting on the thermostat, read the "Temperature Regulation" section in this manual, see Page 14.

⚠ WARNING

Toxic Chemical Hazard

- Do not connect to non-potable water system.

CHEMICAL VAPOR CORROSION

This water heater shall not be connected to any heating system(s) or component(s) used with a non-potable water heating appliance.

Toxic chemicals, such as those used for boiler treatment shall not be introduced into this system.

Water heater corrosion and component failure can be caused by the heating and breakdown of air borne chemical vapors. Spray can propellants, cleaning solvents, refrigerator and air conditioning

refrigerants, swimming pool chemicals, water softener chemicals, calcium and sodium chloride, waxes, and process chemicals are typical compounds which are potentially corrosive. These materials are corrosive at very low concentration levels with little or no odor to reveal their presence.

Products of this sort should not be stored near the heater. Also, air which is brought in contact with the water heater should not contain any of these chemicals. If necessary, uncontaminated air should be obtained from remote or outside sources.

CIRCULATING PUMP

Field installed circulating pumps should be of all bronze constructions.

To optimize the total storage capacity of a horizontal vessel, particularly under low draw conditions, it is recommended to utilize a pump and recirculation line sized to turn the entire storage capacity of the tank once each hour (i.e., a 600 gallon tank would require a 10 gpm pump).

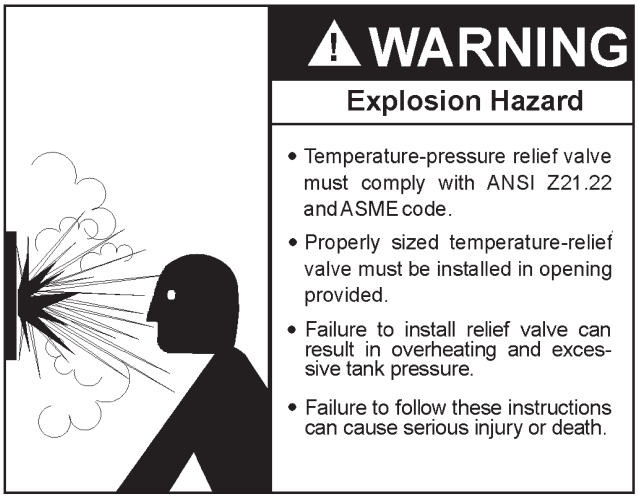
INSULATION BLANKETS

Insulation blankets are available to the general public for external use on electric water heaters but are not necessary with this product. The purpose of an insulation blanket is to reduce the standby heat loss encountered with storage tank heaters. Your water heater meets or exceeds the EPACT and ASHRAE/IES 90.1 standards with respect to insulation and standby loss requirements, making an insulation blanket unnecessary.

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

- Do not cover the temperature and pressure relief (T & P) valve with an insulation blanket.
- Do not cover the instruction manual. Keep it on the side of the water heater or nearby for future reference.
- Do obtain new warning and instruction labels for placement on the blanket directly over the existing labels.

TEMPERATURE-PRESSURE RELIEF VALVE



A.O. Smith Water Products Company has provided this water heater with a properly certified temperature & pressure relief valve.

The valve is certified by a nationally recognized testing laboratory that maintains periodic inspection of production of Listed equipment of materials as meeting the requirements for Relief Valves for Hot Water Supply Systems, ANSI Z21.22 and the ASME code.

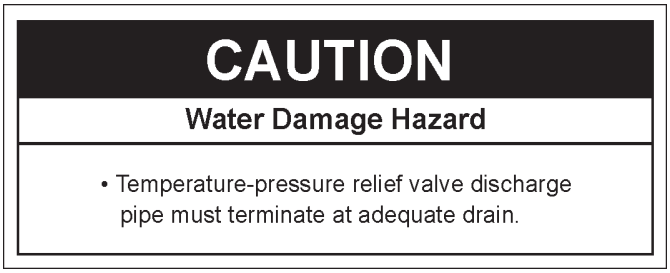
If replaced, the valve must meet the requirements of local codes, but not less than a combination temperature and pressure relief valve certified as indicated in the above paragraph. Contact the A.O. Smith Customer Care Center for replacement temperature & pressure relief valves 800-527-1953.

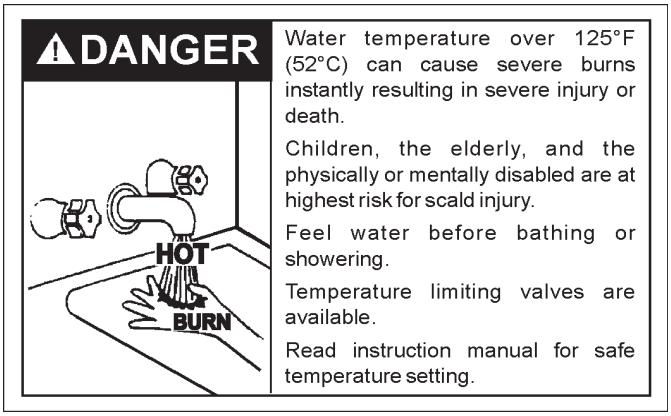
The valve must be marked with a maximum set pressure not to exceed the marked hydrostatic working pressure of the water heater (150 psi = 1,035 kPa) and a discharge capacity not less than the water heater input rate as shown on the model rating plate. The temperature setting of the relief valve should not exceed 210°F.

For safe operation of the water heater, the relief valve must **NOT** be removed from its designated opening nor plugged.

The temperature-pressure relief valve must be installed directly into the fitting of the water heater designed for the relief valve. Provide tubing so that any discharge will exit only within 6 inches (153 mm) above an adequate drain or external to the building or structure. Be certain that no contact is made with any live electrical part. The discharge opening must **NOT** be blocked or reduced in size under any circumstances. Excessive length, over 30 feet (9.14 m), or use of more than four elbows can cause restriction and reduce the discharge capacity of the valve.

Do **NOT** place shut-off valve or other obstruction between the temperature-pressure relief valve and the tank. Relief valve discharge piping must be provided by the installer. The discharge tube must be threaded directly into the relief valve opening and routed to the nearest drain. There cannot be any valves or obstructions in the discharge piping and excessive lengths should be avoided. Improper installation of the relief valve discharge tubing can result in system failure, property damage, injury, or death.





Once the water heater is installed and filled with water, check the operation of the temperature-pressure relieve valve. Follow the instructions in the Maintenance section of this manual, see Page 15.

If after manually operating the valve it fails to completely reset and continues to release water, immediately close the cold water inlet to the water heater, follow the “Draining” instructions and replace the temperature-pressure relief valve with a properly rated/sized new one.

ELECTRICAL

GENERAL

Check the water heater model and rating plate information against the characteristics of the branch circuit electrical supply. Do not connect the heater to an improper source of electricity.

Voltage applied to the heater should not vary more than +5% to -10% of the model and rating plate marking for satisfactory operation.

Do **NOT** energize the branch circuit for any reason before the water heater tank is filled with water. Doing so may cause the heating elements to fail.

The factory wiring is attached to a terminal block on the unit. The branch circuit is connected to the block through an opening provided on the heater. Factory terminal block has 500 MCM maximum copper wire size capacity in each opening. If apparent field wire size is over 500 MCM multiple terminal blocks will be furnished. If other opening sizes are desired they should be specified when unit is ordered.

The installation must conform to these instructions and the local code authority having jurisdiction. Grounding and electrical wiring connected to the water heater must also conform to the National Electrical Code, NFPA 70. This publication is available from The National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

BRANCH CIRCUIT

The branch circuit wire size should be established through reference to the **NEC (National Electrical Code)** or other locally approved sources in conjunction with the water heater amperage rating.. Wire rated at 75°C should be used. For convenience, portions of the wire size tables from the Code are reproduced in Table 1. It is suggested the electrician size the branch circuit at 125 percent of the heater rating and further increase wire size as necessary to compensate for voltage drop in long runs. Voltage drop should not exceed 3% at the water heater.

HEATER CIRCUITS

The water heater's electrical components are pictured and identified by the Features and Components illustrations on pages 6 and 7. The model and rating plate illustration identifies the heater electrical characteristics. The heater has two electrical circuits:

Control Circuit: 120V circuit containing all safety and control devices. The control circuit operates the contactors in the power circuit.

Power Circuit: High voltage, single or three phase circuit that carries the heating element load.

The following section and pages describe the water heater circuits and includes wiring diagrams.

Portion of Table 310-16		Portion of Table 310-16	
Allowable Ampacities of Insulated Copper Conductors		Allowable Ampacities of Insulated Aluminum and Copper-Clad Aluminum Conductors	
Not More than Three Conductors in Raceway or Cable or Direct Burial (Based on Ambient Temperature of 86°F (30°C).		Not More than Three Conductors in Raceway or Cable or Direct Burial (Based on Ambient Temperature of 86°F (30°C).	
Size	Temperature Rating of the Conductor, see Table 310-13 in the NEC.	Size	Temperature Rating of the Conductor, see Table 310-13 in the NEC.
AWG MCM	167°F (75°C)	AWG MCM	167°F (75°C)
	TYPES RH, RHW, RUH (14-2), THW, THWN, XHHW, USE		TYPES RH, RHW, RUH (12-2), THW, THWN, XHHW, USE
18	-----	12	15
16	-----	10	25
14	15	8	40
12	20	6	50
10	30	4	65
8	45	3	75
6	65	2	90
4	85	1	100
3	100	1/0	120
2	115	2/0	135
1	130	3/0	155
1/0	150	4/0	180
2/0	175	250	205
3/0	200	300	230
4/0	230	350	250
250	255	400	270
300	285	500	310
350	310	600	340
400	335	700	375
500	380	750	385
600	420	800	395
700	460	900	425
750	475	1000	445
800	490	1250	485
900	520	1500	520
1000	545	1750	545
1250	590	2000	560
1500	625		
1750	650		
2000	665		

These ampacities relate only to conductors described in Table 310-13 of the NEC. For ambient temperatures over 30°C, see Correction Factors, Note 13 in the NEC.

TABLE 1. BRANCH CIRCUIT WIRE SIZE.

CONTROL CIRCUITS

The heater is equipped with one of the following control circuits, resulting in:

A. Thermostats (mechanical)... where all of the heating elements are switched on/off by one or more thermostats. Heaters with thermostat control are adjusted as described in TEMPERATURE REGULATION section of this manual, see Page 14.

B. Step controlled element operation...where elements are staged on/off individually or in groups rotationally by the controller. An optional feature is modulation which operates in conjunction with the staged on/off element operation.

C. Sequencer... operates in conjunction with a thermostat (mechanical). The sequence is activated by a thermostat then the sequence switches on the heater elements in 3 sequences (multiple elements and contactors are required).

Additional instructional literature is provided with heaters equipped with modulating solid state step control or a sequencer.

All control circuits are operated on single-phase 120 volt current.

Control circuit wiring is 14 Awg, AWM (Appliance Wiring Material) type, rated 600 volts, 105°C.

Standard equipment includes control circuit fusing.

POWER CIRCUIT

Power circuit wiring is type THHN (or equivalent) rated 600 volts, 105°C, sized as necessary.

The following wiring diagrams are included in this manual to show typical arrangements of electrical components in the control and power circuits by voltage and phase characteristics. They are to be used as a reference by the installer or servicer in performing their work. An actual diagram of the water heater wiring is furnished with the heater.

ELECTRICAL AND RECOVERIES DATA

STANDARD KW INPUTS

Standard KW Ratings	Number of Immersion Heaters	BTU Input	GPH Recovery 100°F Rise	Number of 50A Contactors Three-Phase 208V, 240V	Number of 50A Contactors Three-Phase 480V, 600V	Amperage Draw Three-Phase 208V	Amperage Draw Three-Phase 240V	Amperage Draw Three-Phase 480V	Amperage Draw Three-Phase 600V
15	1-15KW	51,195	61	1	1	42	37	19	15
24	2-12KW	81,912	98	2	1	67	58	27	23
30	2-15KW	102,390	123	2	1	83	72	36	29
36	3-12KW	122,868	147	3	1	100	87	43	35
45	3-15KW	153,585	184	3	2	126	109	54	44
60	4-15KW	204,720	246	4	2	167	145	72	58
75	5-15KW	255,975	307	5	3	208	181	90	72
90	6-15KW	307,170	369	6	3	250	217	109	87
105	7-15KW	358,365	430	7	4	292	253	127	101
120	8-15KW	409,560	492	8	4	333	289	145	115
150	10-15KW	511,950	615	10	5	416	361	180	144
180	12-15KW	614,340	738	12	6	499	433	217	173
210	14-15KW	716,730	861	14	7	583	505	253	202
240	16-15KW	819,120	984	16	8	666	577	289	231
270	18-15KW	921,510	1,107	18	9	750	650	325	260
300	20-15KW	1,023,900	1,230	20	10	832	722	361	289
330	22-15KW	1,126,290	1,353	22	11	916	794	397	318
360	24-15KW	1,228,680	1,476	24	12	999	866	433	346
390	26-15KW	1,331,070	1,599	26	13	1,083	938	469	375
420	28-15KW	1,433,460	1,722	28	14	1,166	1,010	505	404
450	30-15KW	1,535,850	1,845	30	15	1,249	1,083	542	433
480	32-15KW	1,638,240	1,968	32	16	1,332	1,155	578	462
510	34-15KW	1,740,630	2,091	34	17	1,416	1,227	613	491
540	36-15KW	1,843,020	2,214	36	18	1,499	1,299	650	520
570	38-15KW	1,945,410	2,337	38	19	1,582	1,371	686	548
600	40-15KW	2,047,800	2,460	40	20	1,664	1,443	722	577
630	42-15KW	2,150,190	2,583		21			758	606
660	44-15KW	2,252,580	2,706		22			794	635
690	46-15KW	2,345,970	2,829		23			830	664
720	48-15KW	2,457,360	2,952		24			866	693
810	54-15KW	2,764,530	3,321		27			974	779
900	60-15KW	3,071,700	3,690		30			1,083	866
990	66-15KW	3,378,870	4,059		33			1,191	953
1080	72-15KW	3,686,040	4,428		36			1,299	1,039
1170	78-15KW	3,993,210	4,797		39			1,408	1,126
1260	84-15KW	4,300,380	5,166		42			1,516	1,213
1350	90-15KW	4,607,550	5,535		45			1,624	1,300
1440	96-15KW	4,914,720	5,904		48			1,732	1,386
1530	102-15KW	5,221,890	6,273		51			1,841	1,473
1620	108-15KW	5,529,060	6,642		54			1,949	1,559
1800	120-15KW	6,141,600	7,380		60			2,170	1,732
1980	132-15KW	6,757,740	8,118		66			2,382	1,905
2040	136-15KW	6,962,520	8,364		68			2,454	1,963
2220	148-15KW	7,576,860	9,102		74			2,670	2,136
2250	150-15KW	7,679,250	9,225		75			2,707	2,165
2400	160-15KW	8,188,800	9,840		80			2,887	2,310
2640	176-15KW	9,010,320	10,824		88			3,175	2,540
2820	188-15KW	9,624,660	11,562		94			3,392	2,714
3000	200-15KW	10,236,000	12,300		100			3,608	2,887

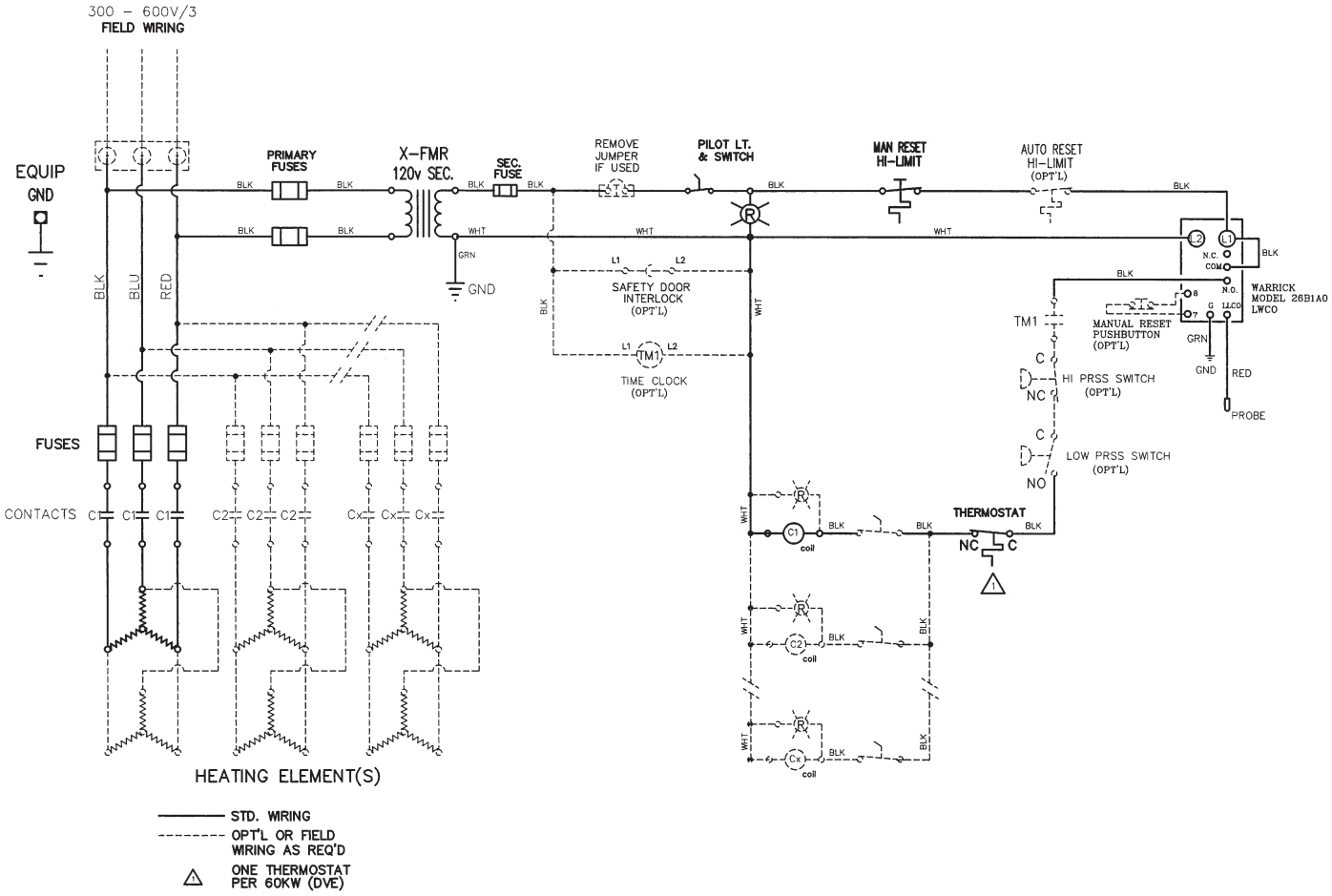
Not Recommended

Not Recommended

TABLE 2.

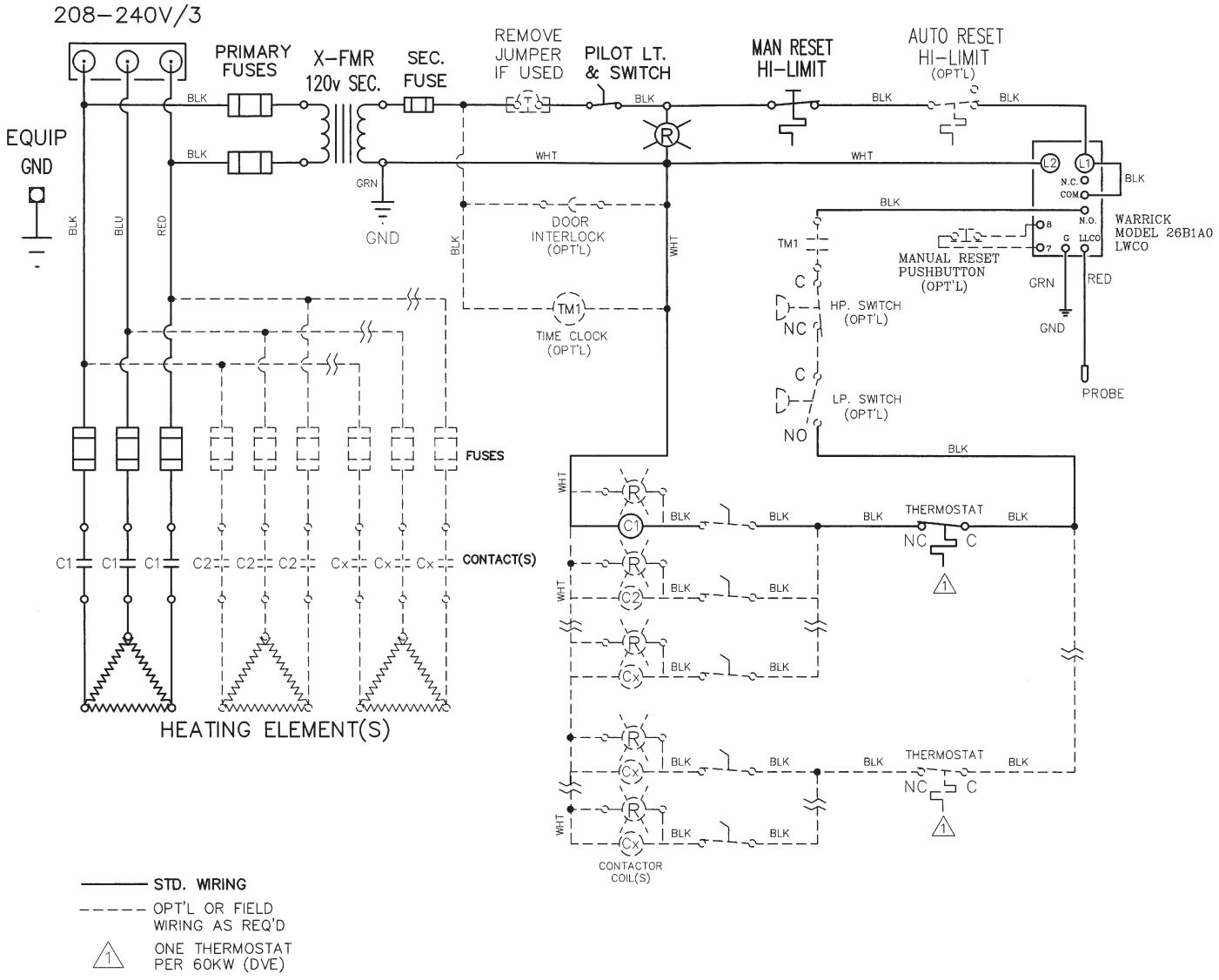
WIRING DIAGRAMS

TURN OFF THE HEATER ELECTRICAL SUPPLY BEFORE SERVICING ANY ELECTRICAL COMPONENTS.
300-600 VOLTS STANDARD THERMOSTAT CONTROL WIRING (WYE).



WIRING DIAGRAMS

TURN OFF THE HEATER ELECTRICAL SUPPLY BEFORE SERVICING ANY ELECTRICAL COMPONENTS.
208-240 VOLTS, STANDARD THERMOSTAT CONTROL WIRING (DELTA)



OPERATION

GENERAL

Refer to the Features and Components section of this manual (pages 6 & 7) for the location of components mentioned in the instructions that follow.

NEVER operate the heating elements without being certain the water heater is filled with water, and a temperature and pressure relief valve is installed in the relief valve opening on top of the heater.

An electric type low water cutoff is provided on all heaters as standard equipment. The water probe is installed near the top of the tank to monitor the presence of water. The control circuit is opened if the water level is below this point.

The pilot switch (power on/off toggle switch) on the cabinet front permits the heater to be turned on and off without having to operate the electrical disconnect switch.

⚠DANGER

Full power is present whenever the cabinet door is opened even with the pilot switch turned off.

Optional manual override switches on the cabinet front allow elements to be manually de-energized if full capacity is not needed.

FILLING THE WATER HEATER

CAUTION

Property Damage Hazard

In order to avoid water heater damage, fill tank with water before operating.

To fill the water heater with water:

1. Turn off the electrical disconnect switch.
2. Turn off pilot toggle switch.
3. Close the heater drain valve.
4. Open a nearby hot water faucet to allow the air in the system to escape.
5. Fully open the cold water inlet valve, filling the heater and piping.
6. Close the hot water faucet when water starts to flow from the faucet. Leave the cold water inlet valve fully open. The heater is now ready for start up and temperature regulation.
7. Close the cabinet door and perform start up checks listed below before turning on the electricity.

START UP

The following checks should be made by the installer when the water heater is placed into operation for the first time:

1. Check all factory and field made water and electrical connections for tightness. Also check connections on top of the heater. Repair water leaks and tighten electrical connections as necessary.
2. Turn on the electrical disconnect switch and pilot toggle switch. The pilot toggle switch is located on cabinet.
3. Observe the operation of the electrical components during the first heating cycle. **USE CARE AS THE ELECTRICAL CIRCUITS ARE ENERGIZED.**

Temperature control and contactor operation should be checked by allowing heater to come up to temperature and shut off automatically. **USE CARE AS THE ELECTRICAL CIRCUITS ARE ENERGIZED.**

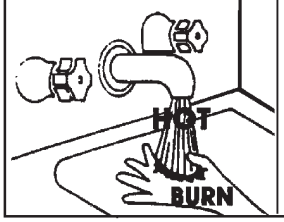
DRAINING THE WATER HEATER

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

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

Follow FILLING instructions when restoring hot water service, see the list above.

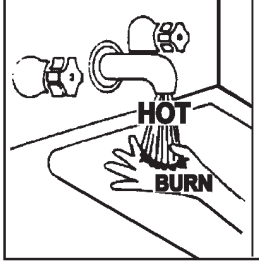
⚠DANGER



- Burn hazard
- Hot water discharge.
- Keep clear of relief valve discharge outlet.

TEMPERATURE REGULATION

⚠DANGER



Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.

Children, the elderly, and the physically or mentally disabled are at highest risk for scald injury.

Feel water before bathing or showering.

Temperature limiting valves are available.

Read instruction manual for safe temperature setting.

HOTTER WATER CAN SCALD: Water heaters are intended to produce hot water. Water heated to a temperature which will satisfy space heating, clothes washing, dish washing, and other sanitizing needs can instantly scald and permanently injure you upon contact. Some people are more likely to be permanently injured by hot water than others. These include the elderly, children, the infirm, or physically/developmentally disabled. If anyone using hot water in your home fits into one of these groups or if there is a local code or state law requiring a certain temperature water at the hot water tap, then you must take special precautions. In addition to using the lowest possible temperature setting that satisfies your hot water needs, a means such as a mixing valve, should be used at the hot water taps used by these people or at the water heater. Mixing valves are available from your local plumbing contractor. Follow manufacturer's

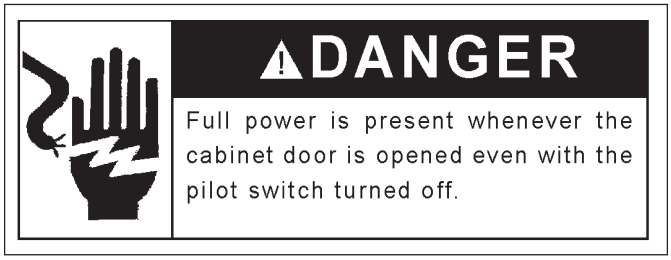
instructions for installation of the valves. Before changing the factory setting on the thermostat, read the entire "Temperature Regulation" section in this manual.

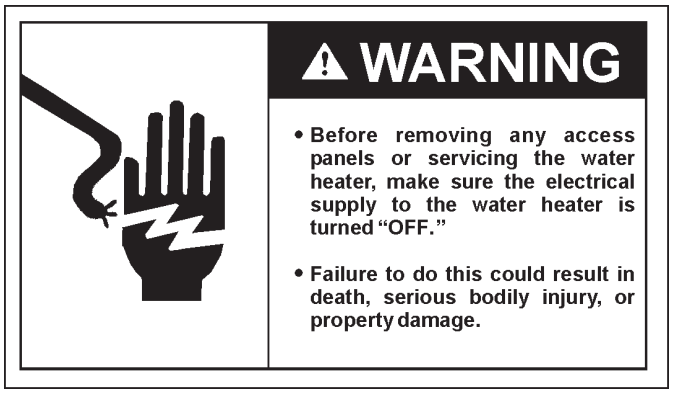
It is recommended that lower water temperatures be used to avoid the risk of scalding. It is further recommended, in all cases, that the water temperature thermostat be set for the lowest temperature which satisfies your hot water needs. This will also minimize water scale formations on the heating elements and provide the most energy efficient operation of the water heater. Thermostat(s) are factory set at 120°F (49°C) unless specified differently by state requirements.

KEEPING THE THERMOSTAT SETTING AT 120°F WILL REDUCE THE RISK OF SCALDS.

Figure 1 shows the approximate time-to-burn relationship for normal adult skin.

TEMPERATURE ADJUSTMENT





Always close and lock the cabinet door after making a temperature adjustment. Turn on electricity.

THERMOSTAT TEMPERATURE CONTROL

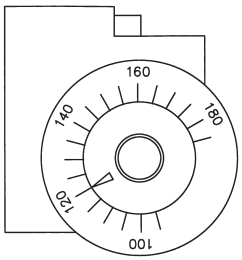
When the water heater **CIRCULATING PUMP** (optional) is provided, horizontal and vertical model heater thermostats may be set to 185°F if dishwasher rinse water is supplied by the heater.

WITHOUT the circulating pump, horizontal model heaters should be set not higher than 165°F. Vertical models may be set as desired, not to exceed 185°F.

Where **MULTIPLE THERMOSTATS** are used on a vertical model heater, they may all be set at the same temperature or 2° to 4°F apart to achieve "step control". The bottom thermostat is set the hottest and the top thermostat the coolest.

Temperature Settings	Time to Produce 2nd & 3rd Degree Burns on Adult Skin
180°F (82°C)	Nearly Instantaneous
160°F (71°C)	About 1/2 second
150°F (66°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
80°F (27°C)	- - - - - - - - - - - - - - -

FIGURE 1.



TEMPERATURE CONTROL (MECHANICAL THERMOSTAT)
FIGURE 2A.

SOLID STATE STEP CONTROL (WITH OR WITHOUT MODULATION)

Additional instructional literature is provided with the heater sequencer control.

HIGH TEMPERATURE DEVICES

A manual reset temperature high limit is in the control circuit in addition to the automatic device previously described. The contacts open at 210°F and must be manually reset after the temperature hi-limit switch has been activated and the water temperature is below 210°F.

The reset button is located on the temperature hi-limit in the control cabinet of the heater. Disconnect the power before opening the door to push the reset button.

MAINTENANCE

GENERAL

Water heater maintenance includes inspection and testing of the Temperature Pressure Relief Valve, periodic tank flushing and cleaning, and removal of lime scale from the heating elements. Where used, water heating system circulating pumps should be oiled.

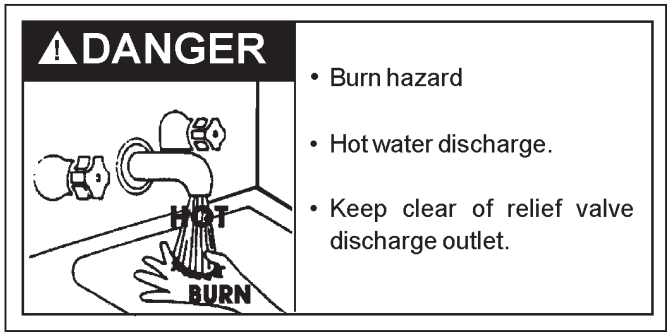
Tank flushing and circulating pump lubrication should be performed in accordance with the maintenance schedule, see Table 6 on page 16. Tank sediment removal and element lime scale removal must be performed when needed as determined by periodic inspections.

ANODE INSPECTION AND REPLACEMENT

This water heater is equipped with a sacrificial anode. Anodes protect the glass-lined tank from corrosion by sacrificing themselves through electrolysis. When the anode material is consumed, there is no more protection and corrosion of the tank accelerates.

Inspection of the anode every 6 to 12 months allows you to identify a spent anode and replace it. Replace the anode when its diameter is 3/8" (1 cm) of an inch, or annually which ever is first. Aggressive, very hot and softened water causes rapid consumption of the anode requiring frequent inspections. Anodes are available from your distributor or A.O. Smith.

TEMPERATURE-PRESSURE RELIEF VALVE OPERATION



The **TEMPERATURE-PRESSURE RELIEF VALVE** must be manually operated at least once a month. Lift the lever at the top of valve several times until the valve seats properly and operates freely, see Figure 2B.

When checking the temperature-pressure relief valve operation, make sure that (1) no one is in front of or around the outlet of the temperature-pressure relief valve discharge line, and (2) that the water discharge will not cause any property damage, as the water may be extremely hot. Use care when operating valve as the valve may be hot.

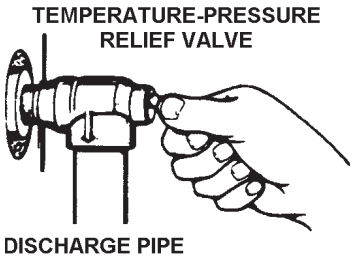


FIGURE 2B.

If after manually operating the valve, it fails to completely reset and continues to release water, immediately close the cold water inlet to the water heater, follow the draining instructions in the Operation section of this manual, and replace the temperature-pressure relief valve with a properly rated/sized new one, see Page 9.

If the temperature-pressure relief valve on the appliance weeps or discharges periodically, this may be due to thermal expansion. Consult your local water supplier or a Qualified Service Agency for further information. **DO NOT PLUG THE TEMPERATURE-PRESSURE RELIEF VALVE**.

Component	Operation	Interval	Required
Tank	Flushing	Monthly	
	Sediment Removal	As Needed	
Elements	Lime Scale Removal	As Needed	UN-LIME delimer and element gaskets

TABLE 6. MAINTENANCE SCHEDULE.

FLUSHING

1. Turn off the electrical disconnect switch.
2. Open the drain valve. Allow water to flow until it runs clean.
3. Close the drain valve when finished flushing.
4. Turn on the electrical disconnect switch.

SEDIMENT REMOVAL

Water borne impurities consist of fine particles of soil and sand which settle out and form a layer of sediment on the bottom of the tank. In time, if not removed, the level of sediment might reach the heating elements causing premature heating element failure.

For convenience, sediment removal and element lime scale removal should be performed at the same time as follows:

WATER AND LIME SCALE REMOVAL

Water and lime scale accumulations on the heating elements is a normal condition, common to all immersion type elements. Factors which affect the amount of this formation are:

1. Amount of hot water used. As the volume of water heated increases, more scale results.
2. Water temperature. As the temperature of the water is increased, more scale is deposited on the elements.
3. Mineral level characteristics of the water supply. Regardless of water treatment, the elements should be examined regularly.

STRANGE SOUNDS

Water scale accumulations may cause noises to occur during operation.
It is recommended that a lower heating element be removed periodically for examination. If it is scaled, all of the elements should be removed and cleaned. If the tank bottom has an accumulation of sediment, it should be cleaned.

Lime scale should be removed by dissolving the accumulation in UN-LINE delimer. UN-LIME is a non-muriatic delimer, available through water heater distributors. Do not use muriatic or hydrochloric acid base deliming solutions to remove lime scale from the elements.

ALL MODELS: DO NOT POUR DELIMER INTO TANK.

1. **Turn off electrical disconnect switch.**
2. Drain heater following DRAINING instructions, see Page 14.
3. Disconnect the wires attached to the elements terminals. Try not to disturb the wiring unnecessarily and reconnection will be easier.
4. Remove the bolts from each element and remove the elements from the openings.

   Use a twisting, pulling action to remove elements scaled beyond the size of the tank openings.

   Brush loose scale from elements.

   Silicates, sulfates and aluminates must be removed by scraping or other mechanical means. Lime scale dissolvents will not remove these types of scale which are occasionally encountered.
5. Lime scale removal:

   Place limed ends of heating elements into UN-LIME delimer and allow scale to dissolve. Do not permit delimer or water to contact heating element electrical terminals.
6. Flush cleaned ends of elements with water when deliming or cleaning is completed.
7. Remove sediment and scale from the tank bottom through the access provided by the element opening or tank cleanout, if furnished.

   The cold water inlet valve and drain valve may be opened to air the cleanout process.
8. Clean remaining gasket material from tank and element flanges. Do not reuse original element gasket.
9. Replace elements as follows:

   Put a new gasket on each element.

   Install into tank opening from which element was removed.

   Uniformly tighten element bolts. Torque to approximately 32 ft/lbs.
10. Attach wires to element terminals from which they were removed.
11. Follow FILLING instructions in the Operation section of this manual to restore hot water service, see Page 14.

    Check for water leaks around elements and proper operation when heater is filled and during operation.

TROUBLESHOOTING CHECKLIST

Before calling for service, check the following points to see if the cause of trouble can be identified and corrected. Reviewing this checklist may eliminate the need of a service call and quickly restore hot water service.

The illustration in the Features and Components section of this manual identifies the location of most of the heater components, see Pages 6 and 7.

⚠ WARNING

- **Before removing any access panels or servicing the water heater, make sure the electrical supply to the water heater is turned "OFF."**
- **Failure to do this could result in death, serious bodily injury, or property damage.**

BE SURE TO TURN OFF THE ELECTRICITY (ELECTRICAL DISCONNECT SWITCH) WHEN CHECKING EQUIPMENT.

NOT ENOUGH OR NO HOT WATER

1. Be certain the electrical disconnect switch serving the water heater is in the ON position. The pilot toggle switch on the cabinet should be ON.

In some areas water heater electrical service may be limited by the power company. If the heater operates on a controlled circuit, heater recovery may be affected.

The optional manual override switches on the cabinet front may be turned off, de-energizing the elements.

2. Check the fuses.

The electrical disconnect switch usually contains fuses.

The water heater has fuses located behind the cabinet front door, see the Features and Components section of this manual on pages 6 and 7.

3. If the water was excessively hot, and is now cold, the temperature hi-limit cutoff may have tripped open.

To reset, turn off the electricity, open the control cabinet door, and push the reset button.

Repeated operation of the temperature hi-limit cutoff should be investigated by a qualified installer or service agency.

4. The storage capacity and/or recovery rate of the water heater may have been exceeded by a large demand for hot water. See pages 5 and 11.

Large demands require a recovery period to restore water temperature.

5. Cold 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.

7. Sediment or lime scale may be affecting water heater operation. Refer to the MAINTENANCE section of this manual for details.

WATER IS TOO HOT

Refer to the TEMPERATURE REGULATION section of this manual.

WATER HEATER MAKES STRANGE SOUNDS

1. Sediment or lime scale accumulations on the elements causes sizzling and hissing noises when the heater is operating.

The sounds are normal, however, the tank bottom and elements should be cleaned. Refer to MAINTENANCE section of this manual for details.

2. Some of the electrical components of the water heater make sounds which are normal ie. contactors will "Click" or snap as the heater starts and stops.

LEAKAGE CHECKPOINTS

1. Check to see if the drain valve is tightly closed.

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. Water supply systems may, because of code requirements or such conditions as high line pressure, among others, have installed devices such as pressure reducing valves, check valves, and back flow preventers. Devices such as these cause the water system to be a closed system.

As water is heated, it expands (thermal expansion). In a closed system the volume of water will grow when it is heated. As the volume of water grows there will be a corresponding increase in water pressure due to thermal expansion. Thermal expansion can cause intermittent temperature-pressure relief valve operation: water discharged from the valve due to excessive pressure build up. This condition is not covered under the limited warranty. The temperature-pressure relief valve is not intended for the constant relief of thermal expansion.

A properly sized thermal expansion tank should be installed on all closed systems to control the harmful effects of thermal expansion. Contact a local qualified service agency to have a thermal expansion tank installed.

4. Examine the flange area of the elements for gasket leakage.

Tighten the bolts or, if necessary, follow the WATER AND LIME SCALE REMOVAL procedure in the MAINTENANCE section of this manual to replace the gaskets.

IF YOU CANNOT IDENTIFY OR CORRECT THE SOURCE OF MALFUNCTION:

1. Place the water heater electrical disconnect switch in the OFF position.
2. Close the cold water inlet valve to the heater.
3. Contact the A.O. Smith Water Products Company Customer Care Center at 800-527-1953.

WARRANTY

A. O. Smith Corporation, the warrantor, extends the following LIMITED WARRANTY to the owner of this water heater:

1. THE TANK
   If the glass-lined tank in this water heater shall prove upon examination by the warrantor to have leaked due to natural corrosion from potable water therein, during the first THREE years after initial installation, the warrantor will supply a complete new A. O. Smith water heater of equivalent size and current model. Some government agencies are requiring energy efficient standards for water heaters. In the event regulations prohibit sale of a model of equivalent size and construction, A. O. Smith will provide a model which complies with the regulations of your area, in which case the consumer will be charged the difference in price between the like replacement and the energy efficient model required. The warranty on the replacement water heater will be limited to the unexpired term of the original warranty.

2. ALL OTHER PARTS
   If within ONE year after initial installation of this water heater, any part or portion shall prove upon examination by the warrantor to be defective in material or workmanship, the warrantor will repair or replace such part or portion at its option.

3. CONDITIONS and EXCEPTIONS
   This warranty shall apply only when the water heater is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and good industry practices. In addition, a temperature and pressure relief valve, certified by A.G.A.and approved by the American Society of Mechanical Engineers, must have been installed.
   a. This warranty shall apply only when the heater is used:
      (1) at temperatures not exceeding the maximum setting of its thermostat;
      (2) at water pressure not exceeding the working pressure shown on the water heater;
      (3) when filled with potable water, free to circulate at all times;
      (4) in a noncorrosive and non-contaminated atmosphere;
      (5) in the United States, its territories or possessions, and Canada.
      (6) used with factory approved anode(s) installed;
      (7) in its original installation location;
      (8) sized in accordance with proper sizing techniques for commercial water heaters;
      (9) bearing a rating plate which has not been altered, defaced or removed except as required by the warrantor;
      (10) not used in a closed system without a properly sized and installed thermal expansion tank;
      (11) fired at the proper voltage and wattage;
      (12) maintained in accordance with the instructions printed in the manual included with the heater.
   b. Any accident to the water heater, any misuse, abuse (including freezing) or alteration of it, any operation of it in a modified form, or any attempt to repair tank leaks will void this warranty.

4. SERVICE and REPAIR EXPENSE
   Under this limited warranty the warrantor will provide only a replacement water heater or part thereof. The owner is responsible for all other costs. Such costs may include but are not limited to:
   a. Labor charges for service, removal, repair, or reinstallation of the water heater or any component part;
   b. Shipping, delivery, handling, and administrative charges for forwarding the new heater or replacement part from the nearest distributor and returning the claimed defective heater or part to such distributor;
   c. All cost necessary or incidental for any materials and/or permits required for installation of the replacement heater or part.

5. LIMITATIONS ON IMPLIED WARRANTIES
   Implied warranties, including any warranty of merchantability imposed on the sale of this heater under state law are limited to one (1) year duration for the heater or any of its parts. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

6. CLAIM PROCEDURE
   Any claim under this warranty should be initiated with the dealer who sold the heater, or with any other dealer handling the warrantor's products. If this is not practicable, the owner should contact:

U.S. Customers	Canadian Customers
A. O. Smith Water Products Company	A. O. Smith Enterprises, Ltd.
500 Tennessee Waltz Parkway	P. O. Box 310 - 768 Erie Street
Ashland City, TN 37015	Stratford, Ontario N5A 6T3
Telephone: 1-800-323-2636	Telephone: 1-800-265-8520

   a. The warrantor will only honor replacement with identical or similar water heater or parts thereof which are manufactured or distributed by the warrantor.
   b. Dealer replacements are made subject to in-warranty validation by warrantor.

7. DISCLAIMERS
   NO OTHER EXPRESS WARRANTY HAS BEEN OR WILL BE MADE IN BEHALF OF THE WARRANTOR WITH RESPECT TO THE MERCHANTABILITY OF THE HEATER OR THE INSTALLATION, OPERATION, REPAIR, OR REPLACEMENT OF THE HEATER. THE WARRANTOR SHALL NOT BE RESPONSIBLE FOR WATER DAMAGE, LOSS OF USE OF THE UNIT, INCONVENIENCE, LOSS OR DAMAGE TO PERSONAL PROPERTY, OR OTHER CONSEQUENTIAL DAMAGE. THE WARRANTOR SHALL NOT BE LIABLE BY VIRTUE OF THIS WARRANTY OR OTHERWISE FOR DAMAGE TO ANY PERSONS OR PROPERTY, WHETHER DIRECT OR INDIRECT, AND WHETHER ARISING IN CONTRACT OR IN TORT.
   a. Some states do not allow the exclusion or limitation of the incidental or consequential damage, so the above limitation or exclusion may not apply to you.
   b. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Fill in the following for your own reference. Keep it. Registration is not a condition of warranty. The model and serial number are found on the heater's rating plate.

Model No._____ Serial No._____ Date Installed _____

Dealer's Name_____

Dealer's Address _____Phone No. _____

City and State _____Zip _____

NOTES

www.aosmithwaterheaters.com