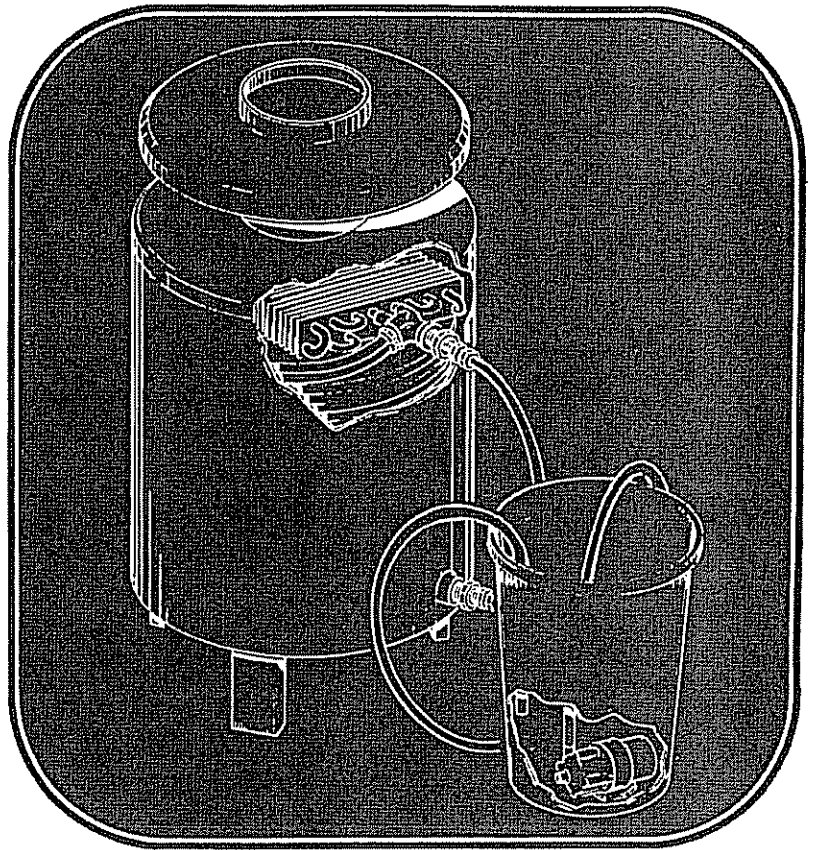


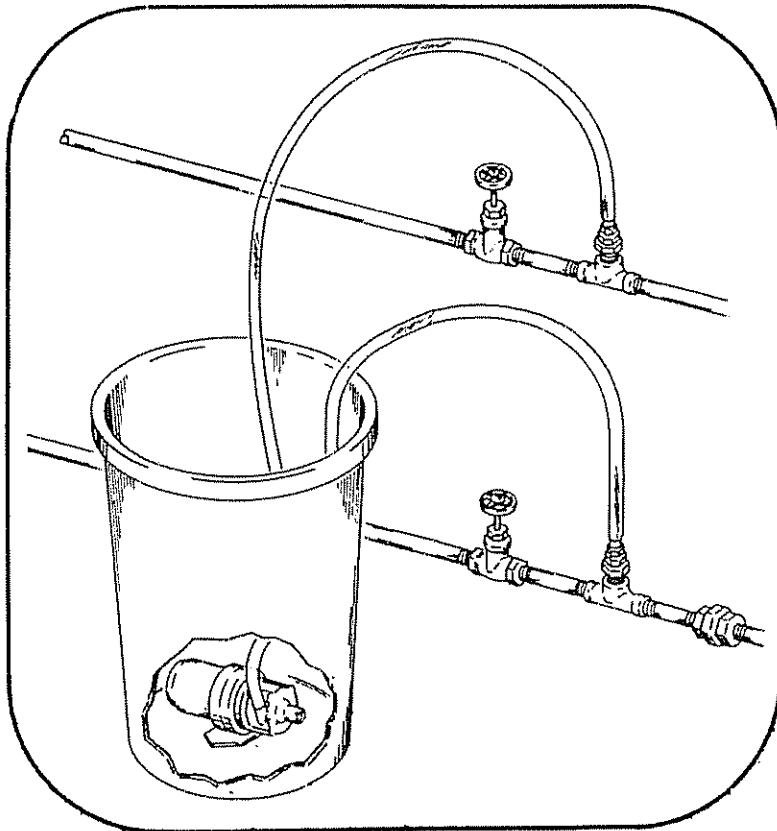
ALL ABOUT DELIMING COIL TYPE* WATER HEATERS



This manual has been prepared especially for the maintenance of A. O. Smith copper water heaters and boilers.

The information can be adapted to deliming other types of water using equipment such as heat exchangers and condensers.

* Deliming tank type water heaters: Request Form 4800 "Why? When & How to Remove Water Scale" from your distributor.



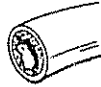
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WHY DELIME?

The reasons for recommending the removal of lime scale from copper coil water heaters and other types of heat exchangers are essentially the same regardless of application or type of heat energy used. Harmful water scale deposits result in:

1. NOT ENOUGH HOT WATER.

Lime scale forms an insulating crust on the heat transfer surfaces which restricts water flow.



2. EXTENDED HEATING CYCLE.

Because the heat transfer surfaces are coated, recovery time is extended causing longer operational periods.



3. HIGHER UTILITY BILLS.

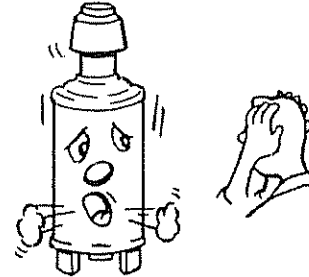
Extended burner operation pushes up the bills but not the benefits.



4. NOISY OPERATION.

Water scale deposits cause noisy operation because the accumulation traps or prevents the

rapid release of hot water from the source of heat. The trapped water is heated above its boiling point causing audible and sometimes alarming sounds.



5. SHORTENED UNIT LIFE.

Heating surfaces lose direct contact with the water as scale builds up. Higher operating temperatures reduce unit life, increase repair bills and makes replacement time come sooner.

6. USER DISSATISFACTION.

The water heater user soon becomes dissatisfied with less hot water, slower recovery and higher operating costs. If the maintenance problem is unrecognized or ignored the heat transfer surfaces could burn out.

Most water heater guarantees state that failure must be due to defective material or workmanship and not the result of water scale deposits.

WHEN TO DELIME

For the purpose of this publication, water hardness and treatment are defined in Table 1.

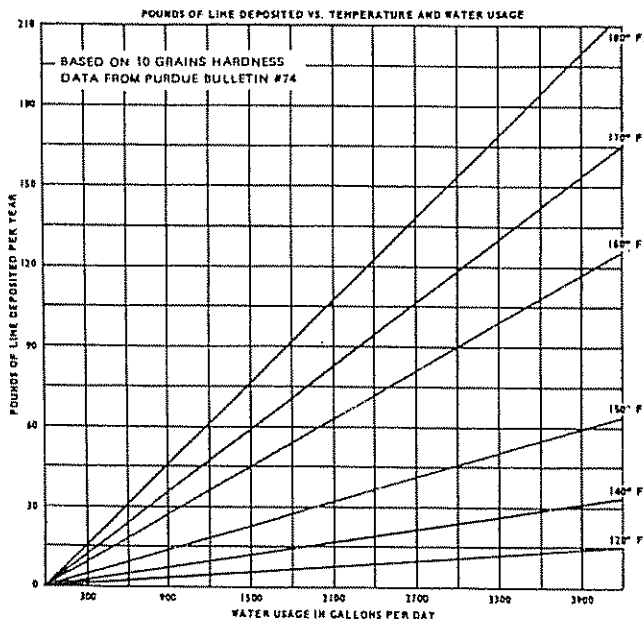
TABLE 1

Term	Description	Removed By	Problem Can Be Reduced Or Eliminated By
• Lime or Hard Water.	Calcium and Magnesium Carbonate.	Deliming with UN•LIME. Professional Delimer. See page 3.	•• Water Softening or Feeding Glassy Phosphates.
Silica Bearing Water.	Collodial Silica or Siliceous Material.	Silicate Remover. See page 3.	

• ABOUT 85% OF THIS COUNTRY'S AREA IS SERVED WITH WATER CONTAINING CONCENTRATIONS OF DISSOLVED MINERALS SUFFICIENT TO FORM LIME SCALE.

•• LIMING CAN ALSO BE REDUCED BY ADJUSTING THE TEMPERATURE CONTROL TO THE LOWEST SETTING WHICH WILL PROVIDE ADEQUATE HOT WATER SERVICE. THE RATE OF LIME SCALE FORMATION AT 180°F WATER TEMPERATURE IS SEVEN TIMES GREATER THAN AT 140°F.

The amount of calcium carbonate (lime) released from water is in direct proportion to water temperature and usage, see chart. 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.

It is good practice to record the normal temperature rise through a copper coil water heater at the time of installation or immediately after deliming. In this way the normal temperature rise can be established and used as a guide for future deliming. Generally, the interval will be from two to six months unless the temperature rise increases 5°F over normal or rumbling and pounding occurs in the heater. Then the time to delime is at hand.

DELIMER

UN•LIME

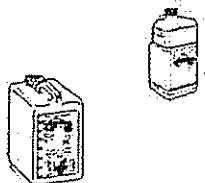
A. O. Smith recommends the use of UN•LIME for deliming. UN•LIME is a patented food grade acid which is easy to handle and does not create the harmful fumes which are associated with other products, thus a well ventilated area is not required.

Read the instructions on the label for additional information.

UN•LIME may be obtained from your dealer, distributor or A. O. Smith Product Service Division.

1 gal. plastic jug, part no. 4763, packed four per case.

5 gal. plastic Flo-Jug part no. 4813.



QUANTITY

Table 2 shows the amount of delimer needed to delime A. O. Smith copper water heaters and boilers.

TABLE 2 - DELIMER QUANTITIES

Heater Input, Btuh	Delimer Required, Gallons
Up to 225,000	3
300,000	4
399,000 and 420,000	5
670,000	7
1,340,000	15

NOTE: REFER TO NOTE ON PAGE 4 FOR UNITS WITH 1,000,000 BTUH INPUT RATING.

SILICATE REMOVER

Silicate remover - ammonium bifluoride flakes can be used in conjunction with UN•LIME delimer and pump type deliming kit, Part No. 4930, to delime and remove siliceous materials from copper coil water heaters. Siliceous material is a residue of silica bearing water and is deposited inside coils and heat exchangers.

- The Part No. 4920 pump, contained in the kit, is equipped with a titanium shaft. As this shaft will not withstand the silicate remover solution, it must be replaced with a stainless steel shaft (A. O. Smith Part No. 4926).

Because silica bearing water is found in limited, undefined areas of the country, the additive is used on an "as needed" basis. The guideline to follow is - where UN•LIME alone does not remove all of the water deposits, add silica remover.

Used in combination with UN•LIME delimer, you now have the ability to remove silicates in addition to calcium and magnesium carbonates from the waterways. Field test indicate this combination will prove effective in most troublesome water areas.

Silicate remover is not for use in glass-lined water heaters.

You may purchase silicate remover locally or from Sargent Welsh Scientific Co., 7300 Linder Ave., Skokie, Illinois 69976, their Part No. SC10575, packed in one pound containers.

For each gallon of UN•LIME in circulation, we recommend 3 1/3 oz. of additive.

TESTING DELIMER

Delimer is easily tested for strength by placing some lime scale or white chalk into a glass with a small amount of the delimer. If the material is vigorously dissolved by the solution, the delimer can be reused.

DELIMING TANK TYPE HEATERS

Request Form No. 4800 "WHY? WHEN & HOW to Remove Water Scale from Tank Type Water Heaters" from your dealer, distributor or the A. O. Smith Product Service Division.

PUMP DELIMING KIT

A. O. Smith Part No. 4930 motorized delimiting pump kit, fig. 1, complete with pump, hoses, fittings, container and instructions, is available from your dealer, distributor or the A. O. Smith Product Service Division.

NOTE: To delime units with 1,000,000 Btu/h input rating, obtain A. O. Smith delimiting kit, Part No. 4915-1 and UN•LIME delimer (7 gallons required).

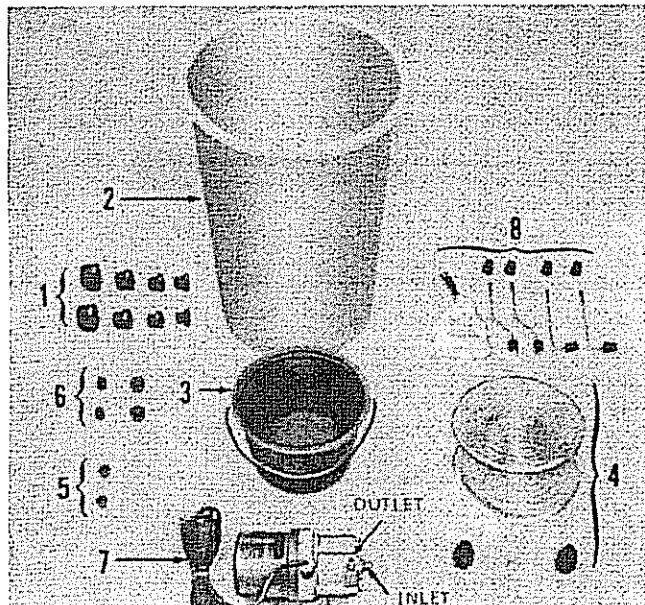


FIGURE 1. PUMP DELIMITING KIT

Item		Qty.	Part No.	
1	Bushing, Plastic:			
	3/4" X 1/2"	2	4944	
	1" X 1/2"	2	4745	
	1 1/4" X 1/2"	2	4746	
	1 1/2" X 1/2"	2	4747	
2	Large Container	1	4752-1	
3	Small Container	1	4752-2	
4	Hose Kit-With Fittings	1	4750	
5	Plug, Plastic Cap 3/4" O.D. Tube	2	4754	
6	Plug, Plastic Pipe:	1/2"	2	4761
		3/4"	2	4762
7	Pump, 120V Submersible	1	4920 -2	
8	Stopper Kit *	2	6002	

* A screwdriver, straight pliers or offset pliers may be used to help wedge the stoppers in place to prevent seepage.

HOW TO DELIME

LIGHT LIME DEPOSIT REMOVAL

Where a regular preventive maintenance plan is in effect for light lime deposits, either the gravity circulation (standpipe) or forced circulation (Pump Delimiting Kit) delimiting method can be applied through the delimiting fittings shown in fig. 2. If the heater is heavily limed or its condition unknown, it is best to observe the instructions on the following pages for heavy lime deposit removal. Thereafter, with proper maintenance, the heater can be delimed by following the procedure for light lime deposits.

A. O. Smith installation instruction manuals show the location of delimiting fittings and thermometers in copper water heating systems.

Figure 2 shows a typical piping arrangement, with service tees, that permits gravity or forced circulating delimiting of light lime deposits. Copper or brass valves, pipe and fittings are recommended between the gate valves and the heater. The installation of delimiting fittings must comply with local codes.

HEAVY LIME DEPOSIT REMOVAL

When a deliming plan is not followed it is possible to build up heavy lime deposits.

Heavy lime deposits are evidenced by a rumbling or pounding noise. Should this occur, the water circuits must be delimed individually. A periodic check of the heat exchanger tube containing the high limit control will give visual evidence of lime.

Should the delimer pump be unable to maintain a flow of delimer during deliming, the cause could be a blocked circuit. Contact your dealer, distributor or the A. O. Smith Product Service Division for repair and deliming of components that are completely restricted with lime scale. Blocked combustion coils cannot be salvaged in most cases.

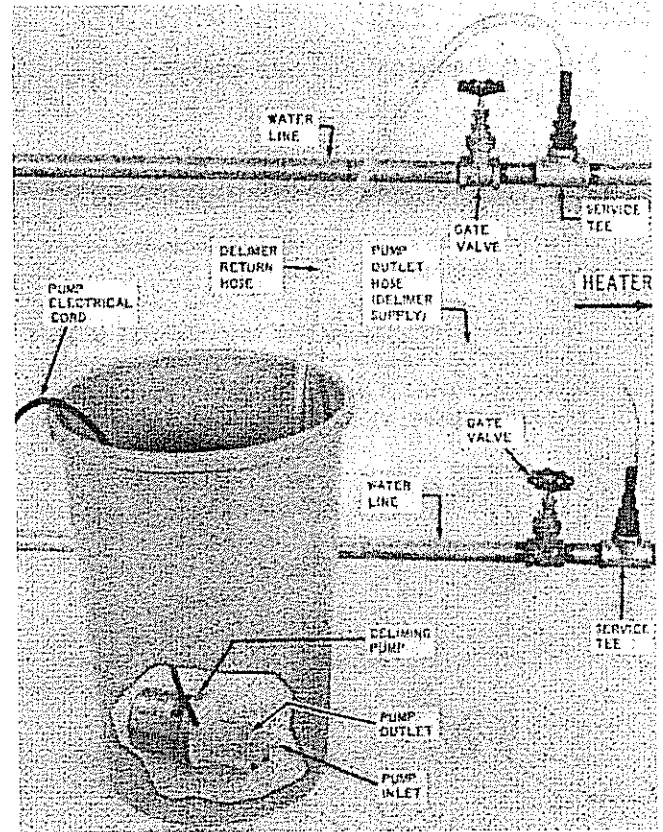


FIGURE 2. DELIMER PUMP HOOKUP

DELIMING PROCEDURE

UNITS WITH 160,000 THRU 670,000 BTU INPUT

NOTE: A screwdriver, straight pliers or offset pliers may be used to help wedge the stoppers in place to prevent seepage.

The water flow through these heaters is divided into two or four circuits, fig. 3. To effectively clean each water circuit, delimer must be directed through each passage individually.

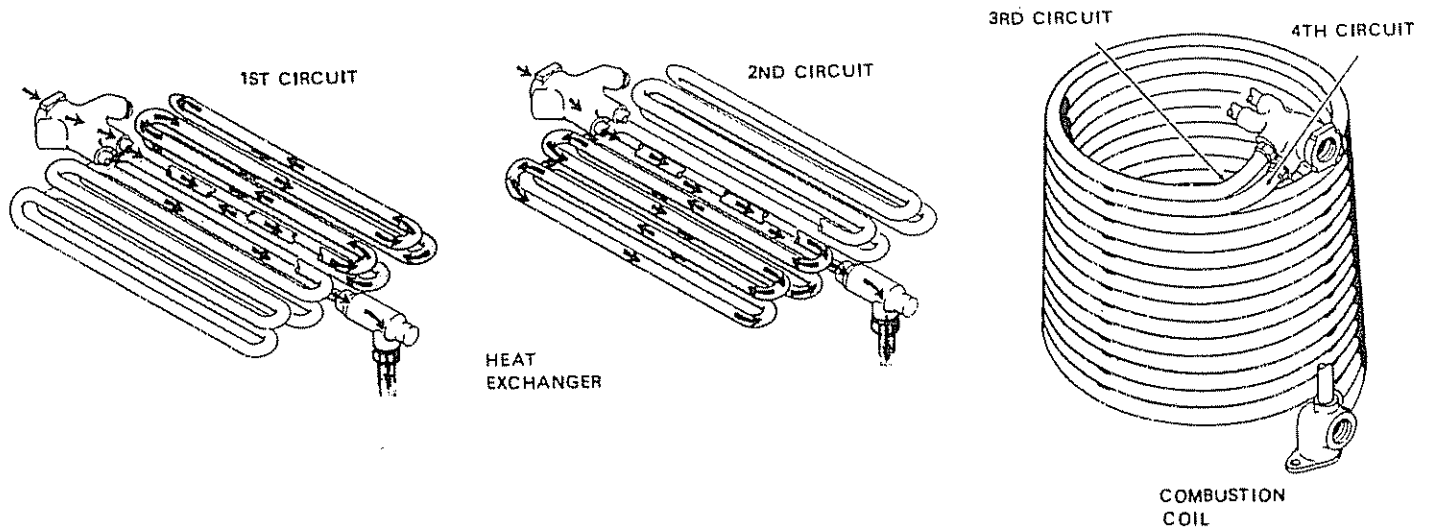


FIGURE 3. FOUR CIRCUIT WATER FLOW

Deliming First Circuit:

1. Shut off electrical and gas supply to the heater.
2. Close gate valves on heater water circulating lines and drain heater.
3. Disconnect the inlet and outlet water lines from the heater.
4. Insert the stoppers firmly into all but one of the water passages of the heat exchanger manifold, fig's. 4 and 5. (See stopper instruction sheet, A. O. Smith Part No. 6002-1).

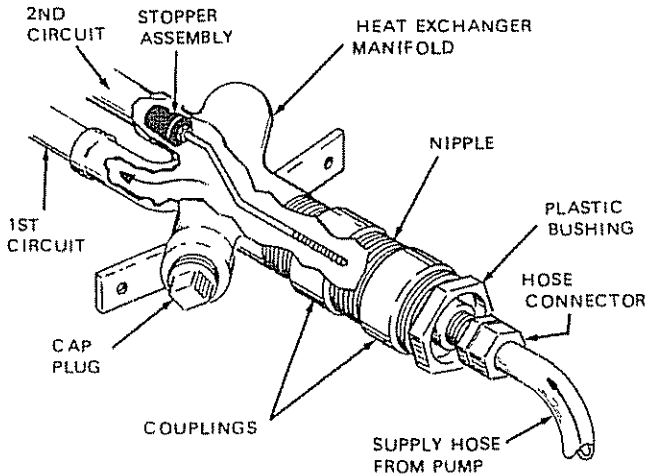


FIGURE 4. UNITS WITH 160,000 THRU 225,000 BTUH INPUT

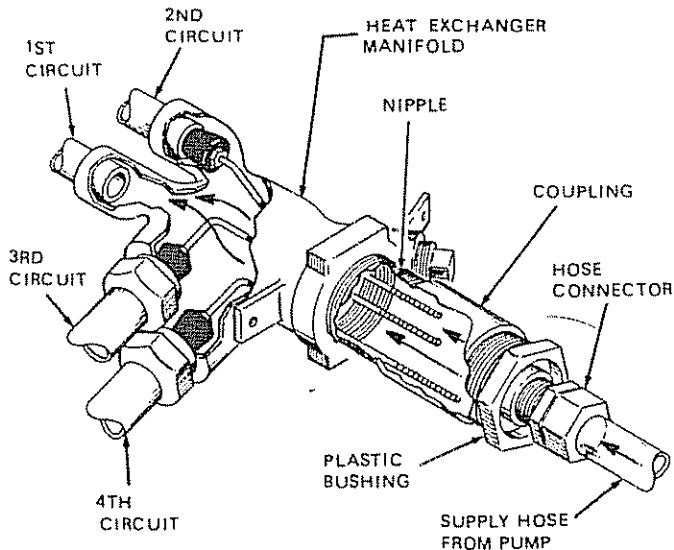


FIGURE 5. UNITS WITH 300,000 THRU 670,000 BTUH INPUT

6. Attach a plastic hose to the manifold at the base of the heater. Use plastic bushings if necessary.
7. Place pump and return hose into the plastic container and add the amount of delimer indicated in Table 2, page 3. Secure the end of the return hose so it will not flip out of container.
8. Start pump by connecting into a grounded 120 volt electrical outlet.
9. Observe delimer action in return hose. When foaming or bubbling action has stopped, test delimer (see page 4). If delimer is still active, allow the pump to run for an additional 10 to 15 minutes to dissolve any remaining scale in unit.
10. Drain delimer from circuit. Use the pail to transfer delimer to the container
11. Delimer can be reused until weakened. See page 4 for testing delimer.

Deliming Remaining Circuits:

1. Transfer stopper, opening second circuit and closing first circuit in manifold, fig's. 6 and 7.
2. Delime second circuit as previously outlined for first circuit.
3. Drain delimer and test for possible reuse. See page 4.
4. Delime third and fourth circuits, positioning stoppers as shown in fig's. 8 and 9. Only units of 300,000 Btuh input or higher will have four circuits as shown in fig. 3.
5. Drain delimer after each circuit is delimed and test for possible reuse.
6. Disconnect the deliming equipment and reconnect all lines.
 - Water lines must be flushed out before reconnecting the unit. This is to remove any scale which may have been dislodged from the piping during disconnection.

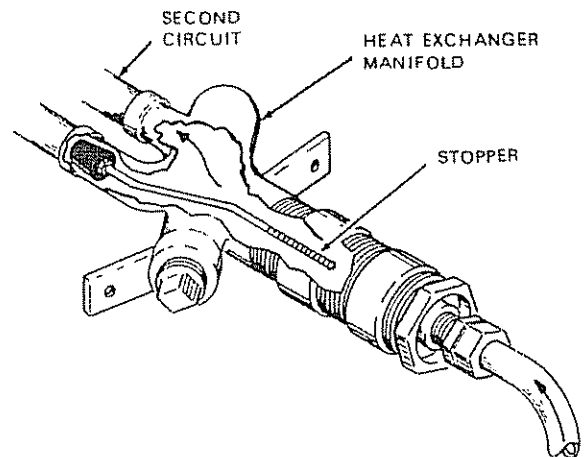


FIGURE 6. UNITS WITH 160,000 THRU 225,000 BTUH INPUT

7. Attach a plastic hose to the discharge side of the delimer pump. Attach the other end of the hose to the heat exchanger manifold. Use plastic bushings and fittings if necessary, fig's. 4 and 5. Obtain nipples and couplings locally.

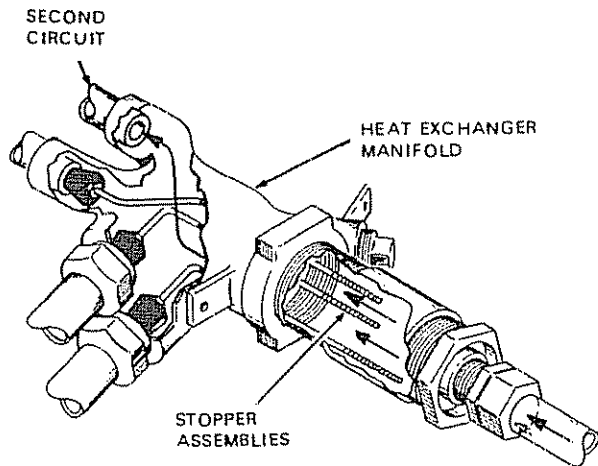


FIGURE 7. UNITS WITH 300,000 THRU 670,000 BTUH INPUT

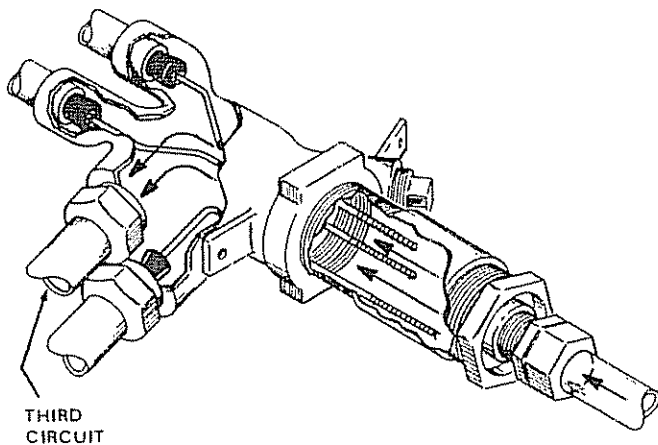


FIGURE 8

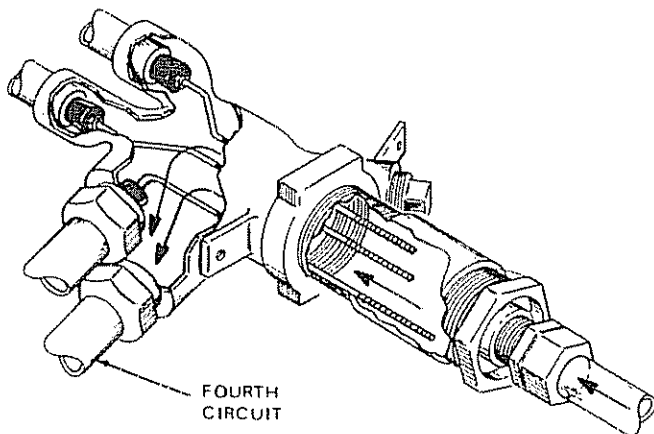


FIGURE 9

Returning Unit to Operation:

1. Open the water inlet gate valve and the heater drain valve and flush the heater with fresh flowing water for about 5 minutes.
2. Close the heater drain valve.

3. Open outlet gate valve in heater circulating line. Be sure heater is completely filled with water before restoring gas and electric power.
4. Test for leaks.
5. Light unit according to instruction on Lighting and Operating Plate attached to the unit.
6. Check system for proper operation.
7. Flush all deliming kit parts with water before storing.

UNITS WITH 1,340,000 BTUH INPUT

The water flow through this unit is divided into eight circuits, four circuits in each coil and heat exchanger assembly. To effectively clean each water circuit, delimer must be directed through each passage individually.

Disconnecting the unit from the inlet and outlet water lines is not required to delime the coil and heat exchanger assemblies.

This unit will require removal of the back panel for deliming.

Preparing Unit For Deliming:

1. Shut off electrical and gas supply to the unit and remove back panel.
2. Close gate valves on inlet and outlet water lines and drain unit. Both drain valves must be opened to properly drain all water from unit.
 - Be sure gate valves do not leak as this will dilute delimer. If valves leak, remove heater from water lines.
3. Remove the plug from the deliming tee on the water inlet line.
4. Bush down opening in deliming tee to 1/2" and install street ell, fig. 10.
5. Attach plastic return hose to street ell, fig. 10.
6. Attach open end of supply hose to the discharge port of the deliming pump.
7. Close drain valves.



FIGURE 10

Deliming Circuits of #2 Coil and Heat Exchanger Assembly:

1. Remove plug from #1 coil and heat exchanger assembly manifold, fig. 11 and insert stoppers into the four heat exchanger water passages, fig. 12.
 - Figure 11 shows unit with delimiting kit already attached to heat exchanger manifolds.



FIGURE 11

2. Install a nipple and coupling at the manifold to allow for the length of the stopper rods, fig. 12.
3. Install plug.

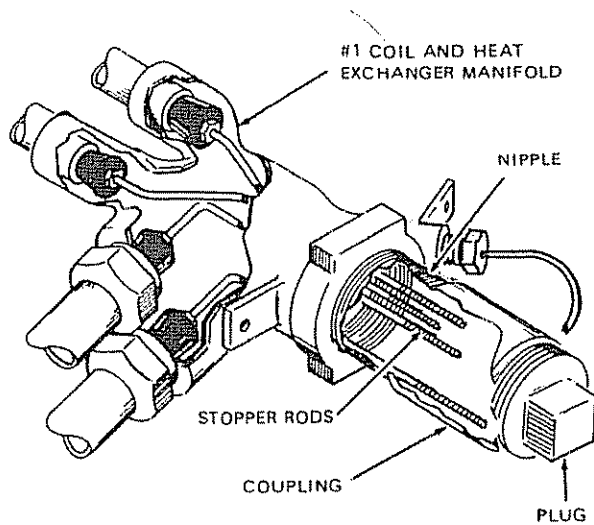


FIGURE 12

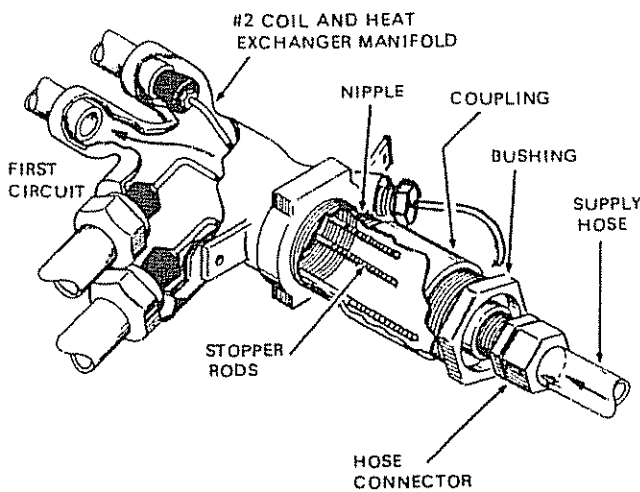


FIGURE 13

4. Remove plug from #2 coil and heat exchanger manifold and insert stoppers into three of the heat exchanger water passages, fig. 13.
5. Install a nipple, coupling, bushing and supply hose assembly to manifold, fig. 13.
6. Attach open end of supply hose to the discharge port of the delimiting pump.
7. Place pump and return hose into plastic container, fig. 14, and add 7 gallons of delimer. Secure end of return hose so it will not flip out of the container.

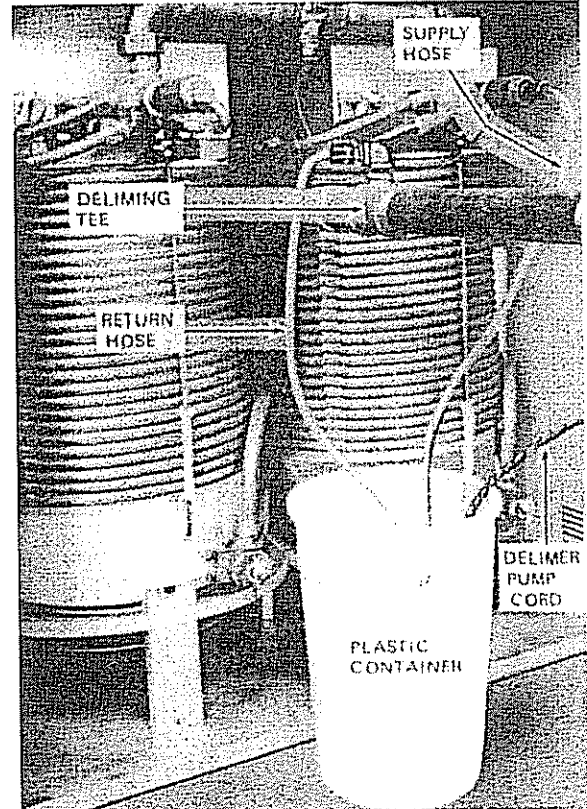


FIGURE 14

8. Start pump by connecting into a grounded 120 volt electrical outlet.
9. Observe delimer action in return hose. When foaming or bubbling action has stopped, test delimer. See page 4. If delimer is still active, allow the pump to run for an additional 10 to 15 minutes to dissolve any remaining scale in unit.
10. Drain delimer after each circuit is delimed and test for possible reuse. See page 4.
11. Transfer stopper, opening second circuit in manifold, fig. 15.
12. Delime second circuit as previously outlined for first circuit.

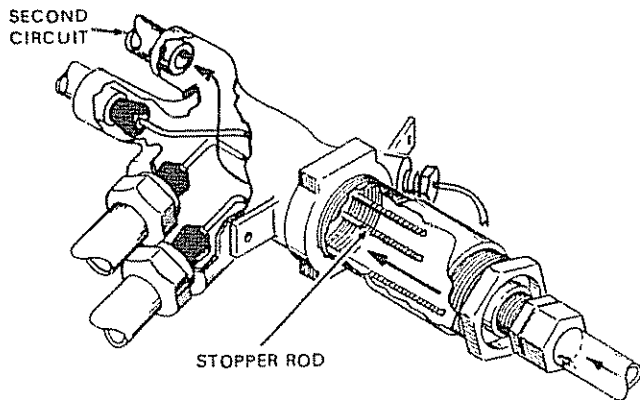


FIGURE 15

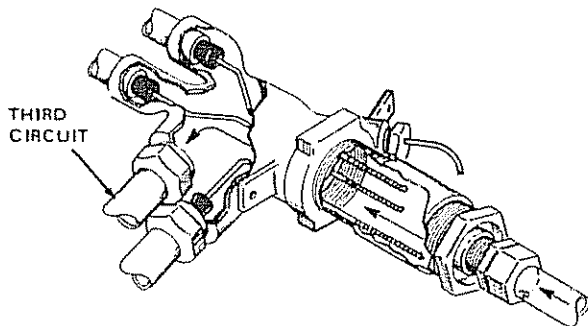


FIGURE 16

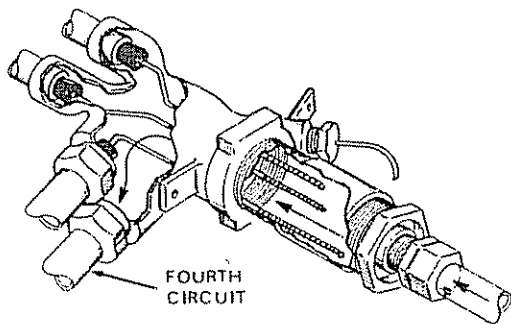


FIGURE 17

13. Delimit third and fourth circuits, positioning stoppers as shown in fig's. 16 and 17.

Delimiting Circuits of #1 Coil and Heat Exchanger Assembly:

1. Remove nipple, coupling and hose assembly.
2. Install fourth stopper into open circuit of #2 coil and heat exchanger manifold.
3. Move to #1 coil and heat exchanger assembly and remove nipple, coupling and plug assembly. Install this assembly into #2 coil and heat exchanger manifold.
4. Remove one of the stoppers from the heat exchanger manifold in #1 coil and heat exchanger.
5. Install nipple, coupling and hose assembly into #2 coil and heat exchanger manifold.
6. Perform remaining delimiting procedure as outlined for #2 coil and heat exchanger assembly.

Returning Unit to Operation:

1. Remove all stoppers and fittings from both #1 and #2 coil and heat exchanger assemblies.
2. Disconnect delimiting equipment and reinstall plugs.
 - If water lines were disconnected, the lines must be flushed out before reconnecting the unit. This is to remove any scale which may have been dislodged from the piping during disconnection.
3. Check all plugs and fittings for tightness.
4. Open both drain valves at rear of unit.
5. Open water inlet gate valve and flush unit with fresh flowing water for about 5 minutes.
6. Close drain valves and open water outlet gate valve. Check for leaks.
7. Restore gas and electrical power.
8. Light burners as outlined on the Lighting and Operating Plate attached to the floor of the unit.
 - Be sure heater is completely filled with water before lighting the unit.
9. Check system for proper operation.
10. Flush all delimiting kit parts with water before storing.

UNITS WITH 110,000 AND 120,000 BTU INPUT

1. Shut off electric and gas supply to the heater.
2. Close gate valves on heater water circulating line and drain heater. Close drain valve after heater is drained.
3. Disconnect the inlet and outlet water lines from the heater.
4. Insert one stopper firmly into one of the water passages of the heat exchanger manifold, fig. 18.

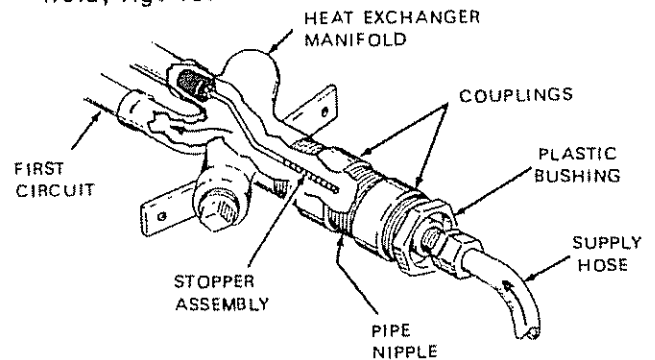


FIGURE 18

5. Install proper bushing from kit. It may be necessary to install a nipple and couplings to allow for clearance of the stopper rod, fig. 18.
6. Attach a plastic hose to the discharge side of the pump. Attach the other end of the hose to the bushing in the heat exchanger manifold, fig. 18.
7. Insert one stopper firmly into the lower coil tubing outlet in manifold, fig. 19.

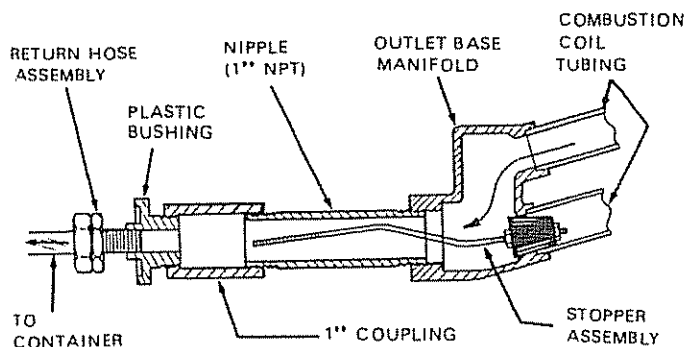


FIGURE 19

8. Install nipple, coupling, plastic bushing and return hose assembly as shown in fig. 19.
9. Place pump and return hose into the plastic container and pour 3 gallons of delimer into the container. Secure the end of the return hose so it will not flip out of container.
10. Start pump by connecting to a grounded 120 volt electric outlet.
11. Observe delimer action in return hose. When foaming or bubbling action has ended, allow the pump to run for an additional 10 to 15 minutes to dissolve any remaining scale.
12. Drain delimer from heater. Use the pail to transfer the delimer to the container. Close drain valve.
13. Test delimer, see page 4.
14. Transfer the stopper in the heat exchanger manifold passage, fig. 20, and reinstall pump supply hose assembly.

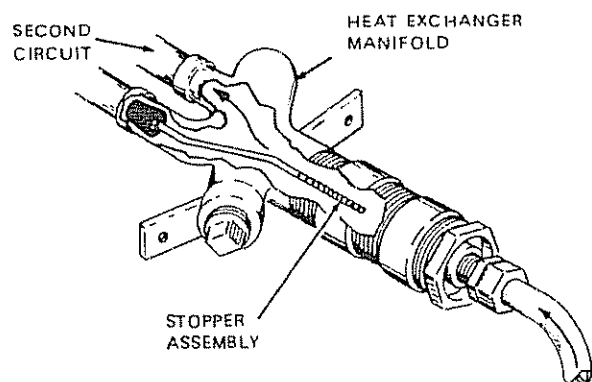


FIGURE 20

15. Transfer stopper assembly in outlet base manifold to upper coil tubing outlet.
 - To insert stopper into upper outlet of manifold, it will be necessary to maneuver the stopper assembly into position, fig's. 21 and 22.
 - It may be necessary to bend stopper rod to allow installation of nipple, fig. 22.
16. Reinstall return hose assembly and delime a previously outlined.

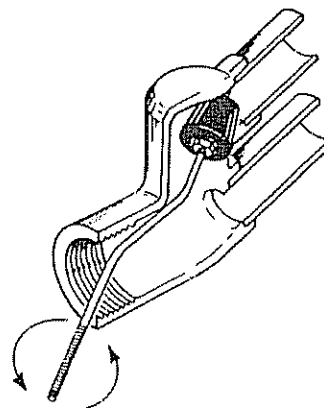


FIGURE 21

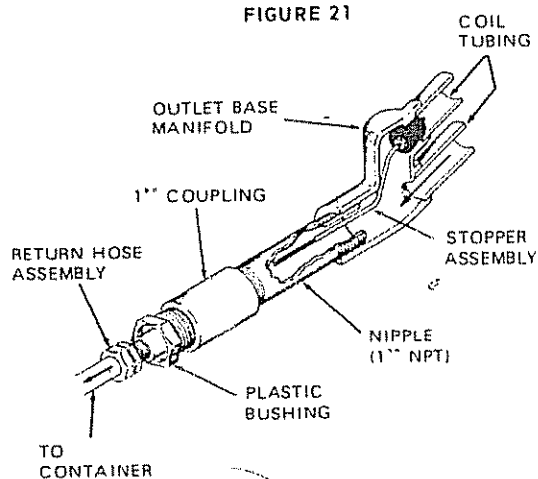


FIGURE 22

Returning Unit To Operation:

1. Remove stoppers and deliming kit from heater. Reconnect all lines.
 - Water lines must be flushed out before reconnecting the unit. This is to remove any scale which may have been dislodged from the piping during disconnection.
2. Open the water inlet gate valve and the drain valve and flush the heater with fresh flowing water for about 5 minutes.
3. Close drain valve and open water outlet gate valve. Check for leaks.
4. Restore gas and electrical power.
5. Light unit according to instructions on Lighting and Operating Plate attached to unit.
6. Check system for proper operation.
7. Flush all deliming kit parts with water before storing.

REPLACEMENT PARTS CATALOGS

These catalogs illustrate a full line of Master-Fit parts, relief valves, delimiting products and service aids for all makes of gas and electric water heaters.

Form no. 23745 for Residential and Light Commercial parts catalog

Form no. 6244 for Commercial parts catalog.

Form no. 3305 for A. O. Smith and B & G motors catalog.



GAS AND ELECTRIC WATER HEATER CHECKLISTS

For water heater service call takers and servicemen

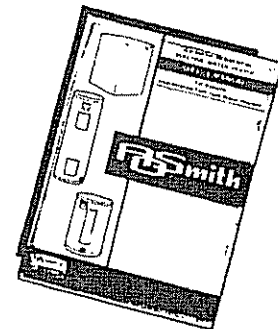
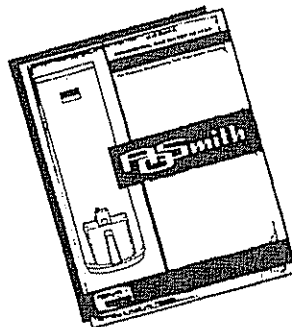
Helps save the user and the dealer needless service trips and expense. Speeds on-the-job service.

Simplifies the job of water heater service through novel complaint-action approach.

- Free! Gas Water Heater Checklist; 12 pages, 11 complaint-remedy charts. Request Form No. 4159G.
- Free! Electric Water Heater Checklist; 6 pages, 6 complaint-remedy charts. Request Form No. 4159E.



RESIDENTIAL WATER HEATER SERVICE MANUALS



Gas water heater service manual has glossary, recovery and orifice tables, gas and combustion information, control servicing plus complaint remedy charts.

Electric water heater service manual has complaint-remedy charts and describes techniques to make service easier. Includes glossary and electrical theory sections.

A. O. SMITH PART NO.	DESCRIPTION
22727	40 pages, 60 illustrations, 10 tables, 8 1/2" X 11"

A. O. SMITH PART NO.	DESCRIPTION
22728	72 pages, 100 illustrations, 15 tables, 8 1/2" X 11"

All publications listed above may be ordered from your distributor or from the A. O. Smith Product Service Division whose address is listed at the right.

A.O. SMITH WATER PRODUCTS CO., INC.
5621 W. 115TH STREET
ALSIP, ILLINOIS 60803