Operating and Servicing Manual for MARK V POOL HEATER

TYPE DM

TELEDYNE LAARS
❑ 6000 Condor Drive, Moorpark, CA 93021 • (805) 529-2000 FAX (805) 529-5934
❑ 480 S. Service Road West, Oakville, Ontario, Canada L6K 2H4 • (905) 844-8233 FAX (905) 844-2635
❑ 20 Industrial Way, Rochester, NH 03867 • (603) 335-6300 FAX (603) 335-3355

Litho in U.S.A. © Teledyne Laars 9510

CONTENTS

LIST OF ILLUSTRATIONS

1/1. INTRODUCTION

This instruction manual supplies installation, operation and maintenance information for the Teledyne Laars Mark V Swimming Pool Heater. A check-out procedure is included in Section 4 for quickly isolating troubles should they occur.

It is strongly recommended that the installation procedure in Section 2 be reviewed before a heater is installed. Experience has shown that most service calls are brought about by improper installation, rather than faulty operation of heater. Before installing check local and state codes.

1/2. DESCRIPTION

The Mark V is a compact, high performance swimming pool heater. The water velocity is carefully balanced in the heat exchanger to prevent both scale formation internally and generation of corrosive condensate externally. As equipped, the unit is suitable only for the heating of swimming pools and should not be used under any circumstances as a heating boiler or as a general service water heater nor for heating of salt water pools. Consult factory for the proper Teledyne Laars products applicable to these functions.

Type DM swimming pool heaters are manufactured under the requirements of the American National Standards Institute Z 21.56 Gas Fired Swimming Pool Heaters.

1/3. WARRANTY

The Mark V is sold with a limited warranty. Details of the warranty are specified on the written warranty furnished with the heater. See written warranty furnished with heater for the length of the warranty period of various heater parts.

Warranty claims must be made to an authorized Laars representative or to the factory. Claims must include serial and model number, installation date and name of installer. Shipping costs are not included in warranty coverage.

1/4. HEATER CAPACITY

Before installing the heater, see Sizing Chart (Fig. 1) to make sure the heater to be installed has sufficient capacity for the pool size and expected use. Use the Intermittent Heating Selection Table for maximum operating economy, and particularly if fast pool heating is desired (24 to 48 hours). Use the Temperature Maintenance Selection Table if minimum pool heating is desired or if a longer heating period is acceptable.

CAUTION:

For your safety do not store or use gasoline or other flammable liquids or vapors in the vicinity of this or any other appliance.

SIZING CHART

Below are sizing tables for both types of heater usage—*temperature maintenance* and *intermittent heating*. To use either table, first determine the temperature *rise* that will be required (that is, the difference between the desired pool temperature and the average air temperature during the coldest month you intend to use your pool. Next, calculate the square footage of your pool (length times width). The sizing tables list the maximum square footage recommended for each heater model to accomplish a given temperature rise.

Temperature Maintenance Selection Table

TEMP. RISE	MODEL NUMBER 125	175	250	325	400
	Max. Square Footage of Pool				
15°	620	855	1239	1580	1920
20°	456	642	912	1210	1435
25°	368	515	737	995	1151
30°	308	430	616	794	955
35°	263	367	526	683	826

Use this table if you wish to keep your pool heated continuously during the swiming season. Table is based on 3½ mph average wind and average pool depth of 5.5 feet.

Intermittent Heating Selection Table (Oversize Heaters)

TEMP. RISE	MODEL NUMBER 125	175	250	325	400
	Max. Square Footage of Pool				
15°	345	476	690	880	1070
20°	255	358	510	675	800
25°	205	287	410	555	642
30°	172	240	343	443	533
35°	147	205	293	380	460

Use this table if you wish to raise your pool temperature by a given amount within 24 to 48 hours. Table is based on 3½ mph average wind and average pool depth of 5.5 feet.

FIG. 1

Section 2
Installation Instructions

2/1. GENERAL

To validate the factory warranty, the Mark V must be installed, adjusted and operated in accordance with instructions and diagrams contained in this section. This heater is designed *only* for use with potable water such as is furnished by municipal water distribution systems. The heater is *not* warranted for use with mineral water, sea water, salt water, or any other non-potable waters.* Compliance with all local building and safety codes is necessary when installing a gas appliance.

* Salt-water models available.

2/2. LOCATION

Make sure heater is level.

In lieu of the foregoing the DM Series may be installed as permitted by ANSI Z223.1-1974, Section 1.4.7, Paragraph 1.4.7.3 and the Code for Installation of Heat Producing Appliances (1967), Section 2, Paragraph 2.2.e which states:

"Residential type boilers may be mounted on floors other than as specified in Section 2.2.a, provided the appliance is such that flame or hot gases do not come in contact with its base, and further provided the floor under the appliance is protected with hollow masonry not less than 4 inches thick covered with sheet metal of not less than 24 gauge. Such masonry shall be laid with ends unsealed and joints matched in such a way as to provide a free circulation of air from side to side through the masonry."

This installation is depicted in Figure below.

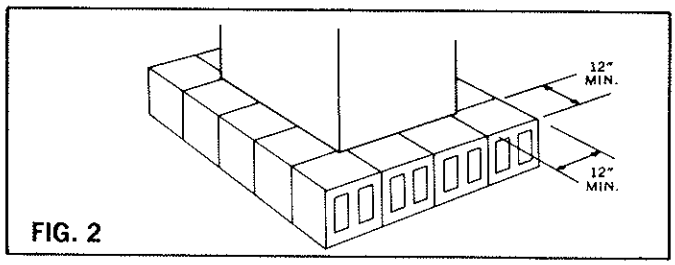


FIG. 2

2/3. ASSEMBLY

This Swimming Pool Heater is shipped in two or three pieces and is assembled either at pool-side or at the warehouse for delivery to job site. Available in two configurations, one for outdoor installation and one for indoor installation.

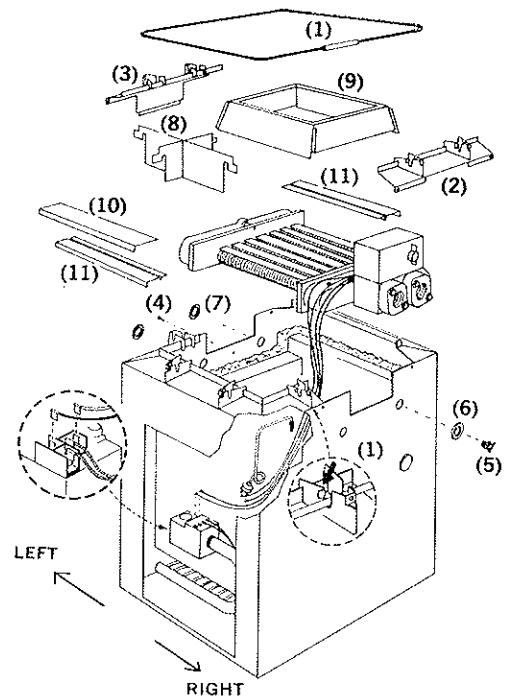
Reversible Heat Exchanger

The Mark V can be installed with the water connections at either end. The pool heating assembly is shipped with the water connections on the *right* side of the heater. Left side water connections can often simplify installation and improve access for heater service and maintenance. The change from *right* to *left* is easily made either at the warehouse or at poolside before installing the selected top assembly.

Follow these step-by-step instructions and the drawing at right.

1. Bend the retaining tabs and lift out wire guard. (1)
2. Remove screws and lift out gap spacers. (2 & 3)
3. Remove and discard shipping screw located between drain and plug on side of heater opposite water connections. (4)
4. Remove drain valve (large hex.) located under water connections. (5)
5. Remove all grommets (2 each side). (6 & 7)
6. In order, lift out the wind deflector (8), the lower flue collector (9), front insulation cover (10), and the front and rear insulation block covers. (11)
7. Disconnect black wire and white wire from gas valve. Pull wires through and coil them on top of heat exchanger.
8. Disconnect pressure switch tube at the header and the location clip in the door opening. Place pressure switch and tubing on top of heat exchanger.
9. Lift out heat exchanger, turn and replace with water connections on left side of heater.
10. Reconnect tubing to header, straightening the tubing as required to bring pressure switch to the top left of the door opening.
11. Reroute black and white wires on left side of heater, fasten securely clear of the heat exchanger. Reconnect wires to gas valve.
12. In order, replace front and rear insulation block covers (11), front insulation cover (10), lower flue collector (9), and wind deflector. (8)
13. Replace gap spacers* (2 & 3). Tighten screws securely.
14. Replace grommets* (6 & 7).
15. Reinstall drain plug* (large hex.) (5).
16. Reinstall wire guard (1), bend retaining tabs to original position.
17. Complete the heater assembly by attaching the selected top assembly and install the heater according to the instructions which follow.

*Note: These items must be replaced *opposite* their original positions (they are relative to the heat exchanger).



LOW PROFILE—OUTDOOR

The Pool Heater comes in two packages:

A. Pool Heating Assembly
B. Grate Top Assembly

NOTE: Model 125 heater for outdoor installation is furnished only as a stacktop with vent cap/stack. Follow instructions under STACKTOP-INDOOR and install vent cap/stack in same manner as Draft Hood, Fig. 5.

(1) Place Grate Top Assembly on the Heater Assembly so that the flue collector seats on the collector base. See Figure 3. The flue collector is designed to seat loosely, allowing

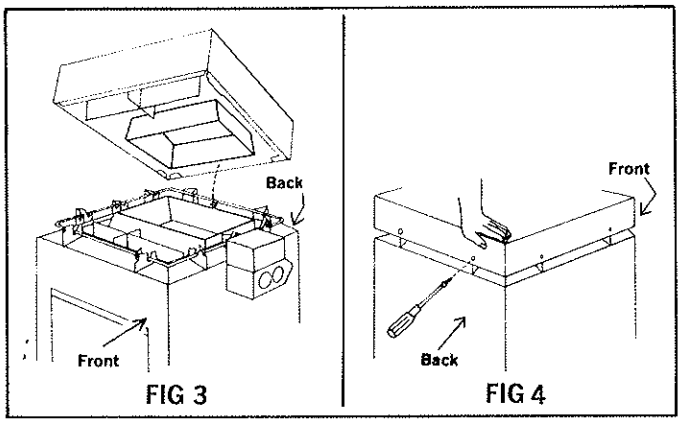


FIG 3 FIG 4

movement for alignment of the screw holes. * *
(2) Align the two screw holes on the back side of the heater, insert two self-threading screws (furnished) and *tighten part way only*. See Figure 4.
(3) Align the two screw holes on the front and insert screws part way only. Repeat procedure on the two sides. If remaining holes cannot be aligned, back off on the previously set screws slightly to permit additional movement of the top assembly.
(4) After all eight screws have been set, tighten all screws evenly and firmly.

STACKTOP—INDOOR

The Pool Heater comes in three packages:
A. Pool Heating Assembly
B. Stacktop Assembly
C. Draft Hood for indoor installation

(1) Place Stacktop Assembly on the Heater Assembly so that the flue collector seats on the collector base. See Figure. 3. The flue collector is designed to seat loosely, allowing movement for alignment of the screw holes. * *
(2) Align the two screw holes on the back side of the heater, insert two self-threading screws (furnished) and *tighten part way only*. See Figure 4.
(3) Align the two screw holes on the front and insert screws part way only. Repeat procedure on the two sides. If remaining holes cannot be aligned, back off on the previously set screws slightly to permit additional movement of the top assembly.
(4) After all eight screws have been set, tighten all screws evenly and firmly.
(5) Install the factory supplied Draft Hood (see rating plate for proper part number). Attach with screws and clips supplied, as shown in Fig. 5. See VENTING.

* * *Do not remove the flue collector from the grate top or stack top assemblies under any circumstances. Removal of the flue collector voids the warranty and the AGA certification.*

Draft Hood for indoor installation
(Extend vent pipe thru Roof using Roof Jack and terminating with an approved vent cap).
When used outdoors vent cap is recommended

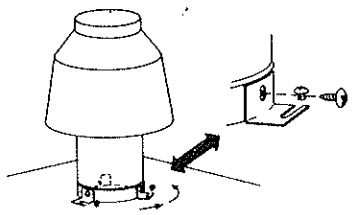


FIG 5

The Draft Hood must be connected to a vent of same size, terminating above the roof. The vent should have an approved cap installed which permits a full equivalent opening for flue products.

2/4. INDOOR INSTALLATION

Mark V stacktop models may be installed within a shelter or building, provided that the factory-furnished Draft Hood is installed without modification.

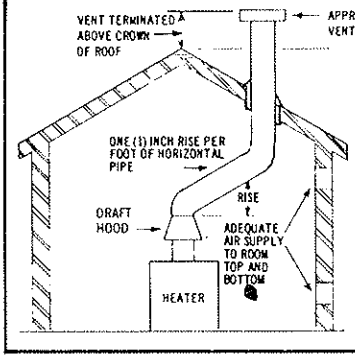


FIG. 5A

NOTE:
1. Draft Hood must sit directly on top of the heater as shown and must not be altered in any manner.
2. An Underwriters Laboratory approved vent cap is **required** to eliminate down draft and allow your heater to function properly.
3. Use approved roof fitting.

Air Supply

If heater is installed in a room enclosure, provide an uninterruptible air opening into the room of the size shown below. Locate one of the openings at ceiling and one at floor level.

Model	Net Free Opening Area	
	At Ceiling	At Floor
125/175	½ sq. ft. (72 sq. in.)	½ sq. ft. (72 sq. in.)
250	¾ sq. ft. (108 sq. in.)	¾ sq. ft. (108 sq. in.)
325	¾ sq. ft. (108 sq. in.)	¾ sq. ft. (108 sq. in.)
400	1 sq. ft. (144 sq. in.)	1 sq. ft. (144 sq. in.)

2/5. CLEARANCES FOR INDOOR INSTALLATION

The following minimum clearances must be provided from combustible materials:

Water Connection side and Access Door side – 18″
Remaining two sides – 6″

2/6. OUTDOOR INSTALLATION

The Mark V Low Profile models may be installed in the open or in an unroofed enclosure, such as a walled or fenced area. Minimum clearance from combustible fences and shrubbery of 6 inches is required for fire protection. See Fig. 5B.

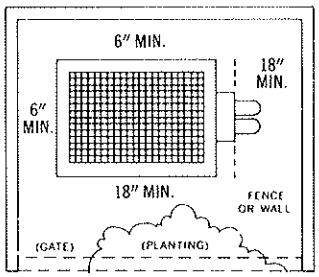


FIG. 5B

Note: When locating the low-profile heater, consider the seasonal or prevailing winds. High winds can roll over or deflect off adjacent buildings or walls and create a draft reversal, causing a flame roll-out which might damage controls. Normally, locating the heater **3 feet or more** from such walls will remedy the situation. If downdraft conditions are severe, convert heater to Stack-Top with Vent Cap/Stack.

The Stacktop Mark V, when equipped with the factory supplied Vent Cap/Stack, may also be installed outdoors.
Do not place any heater under any kind of roof or overhang that is less than 3 feet above the top of the Grate Top or Vent Cap/Stack (Fig. 5C). When installing the heater

under a roof or overhang, at least two sides of the structure must be completely open to outside air from floor to roof. *Never install the heater under any kind of roof or overhang which communicates in any way (doors, windows, louvers, grills, etc.) with an inhabited area of a building, even though such communication might be through another structure such as a garage or utility room.* (Fig. 5D). Do not install heater under an eave where roof drainage falls directly on the heater.

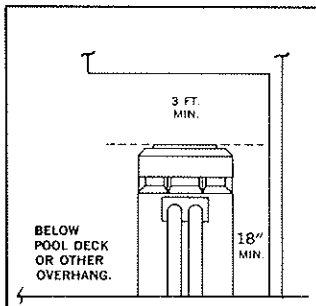


FIG. 5C

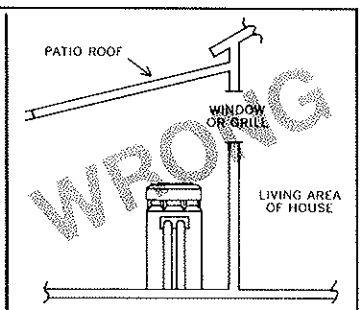


FIG. 5D

2/7. ELECTRIC WIRING – WARNING

Do not connect heater to any source of electricity.

The Teledyne Laars Mark V has a built-in Thermoelectric Generator. This provides a completely self-contained electrical system, and no external connections are required. Any attempt to make external electrical connections will damage the heater.

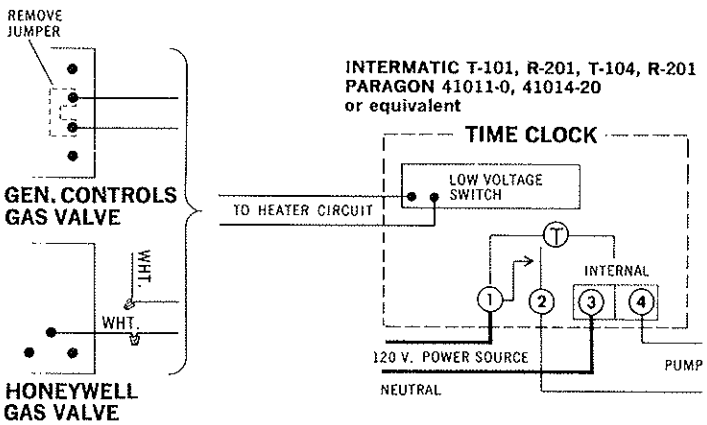
AUXILIARY TIME CLOCK WIRING INSTRUCTIONS

If a time clock is used to control filter pump operation it should have a separate low voltage switch to turn off heater *before* turning off pump. If the low voltage switch timing is adjustable, set switch to shut off heater approximately 15 minutes ahead of filter pump. This allows the residual heat to be absorbed into the pool water and prevents excessive heat build-up in the heat exchanger.

Mark V pool heaters use either General Controls or Honeywell gas valves. Follow the appropriate instructions below to interlock a timeclock auxiliary switch into the control wiring of the heater.

General Controls Valve:

1. Remove jumper lug from the terminals of the gas valve. (see illustration)
2. Connect the field-installed switch across the terminals from which the jumper was removed. Be sure the wires from the generator and wire harness are connected exactly as they originally were. Tighten screws securely.



Honeywell Valve:

1. Remove factory-provided wire nut on white wire from terminal block on the gas valve.
2. Connect the field installed switch across these ends using wire nuts.

Be sure that the run of wire between heater and switching device is fairly short or the resistance of the wire will reduce available millivoltage to a critical level for operating the gas valve. Also, the contact points of the switching device must be silver or some other low resistance alloy.

2/8. GAS SUPPLY AND PIPING

Heaters are normally fitted for operation at altitudes below 3000 feet. Heaters fitted for higher altitudes are marked with a sticker or tag on manifold. CHECK NAME PLATE FOR CORRECT GAS. Provide gas pipe size as follows:

Distance from meter	Heater Model			
	125/175	250	325	400
0-100′	1″	1¼″	1¼″	1¼″
100-300′	1¼″	1¼″	1½″	1½″

For Propane Gas use one size smaller.

The above are Teledyne Laars recommended pipe sizes. Check local code requirements for compliance.

Provide mainline gas pressure as follows: (Measured in "inches of water" column)

Natural Gas:	Maximum 7″	Minimum 5″
Propane Gas:	Maximum 11″	Minimum 11″

Setting of Pressure Regulator on Natural Gas heaters is pre-set at the factory and normally does not need adjustment.

For correct procedure for gas pressure measurement, see Fig. 13.

If mainline gas pressure is inadequate, check for too small a pipe size between meter and heater, or for gas meter with limited capacity.

Do not pressure test gas piping with heater connected or serious damage to the gas controls will result.

2/9. AUTOMATIC CHLORINATORS

A concentration of chlorine in the heater can be very destructive. The following rules about the installation and operation of such devices must be followed:

1. The chlorinator should be installed so it introduces the gas or solution downstream from the heater, and if possible, at a lower position than heater outlet fitting.
2. The chlorinator should be wired so it cannot operate unless the filter pump is running. If chlorinator has an independent clock control be sure the filter and chlorinator clock are synchronized and chlorinator operates only within the filter cycle time period.
3. The chlorinator should be provided with an anti-syphoning device so that when piping drains after the pump shuts off chlorine will not syphon into the heater.
4. When the operation of a chlorinator is such that it must be installed in the pump suction, or some other place where the chlorine solution flows through the heater, corrosion of the heater can occur. Excessive concentrations of chlorine caused by improper adjustment or failure of the chlorination equipment, or any other reasons for a corrosive concentration which result in heater damage is not covered by heater warranty.

2/10. WATER PIPING

1. The piping diagrams shown in Figure 6 cover nearly all situations and various types of filters. Select the one which best fits your installation.

2. You will notice that all diagrams show the installation of a *manual* by-pass valve between the heater inlet and outlet. This valve is *only* to be installed if the system filter-flow rate exceeds 100 gallons per minute. The manual by-pass is *not necessary* when the water system flow rate is less than 100 gallons per minute, because under these conditions an *automatic* by-pass valve built into the heater maintains proper flow through the heater.

3. When pipe, fittings, grids or any other element of the filter system are made of plastic materials, they may be damaged by the momentary "back syphoning" of hot water from the heater when the pump stops running. To prevent such a backflow, install a check valve and "heat sink" pipe in the piping between the filter and the heater, as shown in Figure 7.

NOTE: If galvanized piping is used, all joints between copper and galvanized piping must be made with dielectric insulated fittings. When plastic pipe (PVC, etc.) is used, be sure that joints are not made directly to the heater headers, see Fig. 7.

The Universal Flange Coupling furnished with the heater accepts threaded 1½" iron pipe, unthreaded 1¼" iron pipe and 1½" copper pipe without adapter. See Figure 8.

4. Anti-syphon protection is built into the heater. No separate Hartford loop is required.

5. No water flow adjustments are necessary unless external by-pass valve is required.

6. Do not install any valve or other variable restriction in the return piping between heater outlet and pool.

7. If normal filtration rate exceeds 100 gpm:

a. Provide manual by-pass valve shown in drawings (Figs. 6A, B, C, D.)

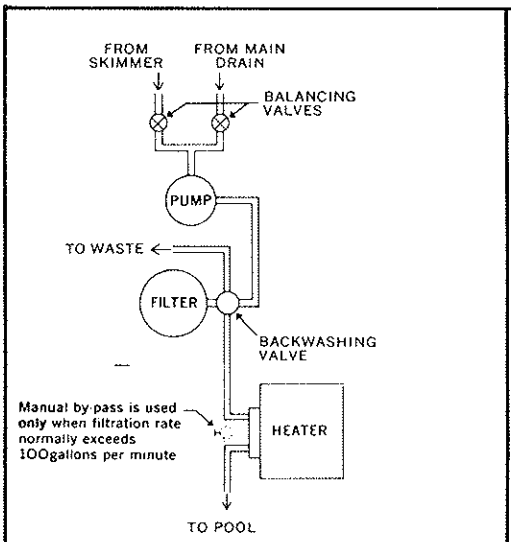
b. Install thermometer in threaded drain provision to the right of header casting. See Figure 9.

c. Set by-pass as follows:

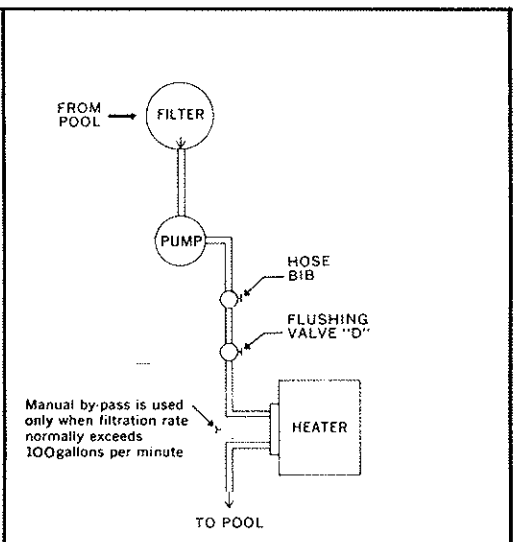
(1) Clean filter.
(2) Close by-pass valve.
(3) Close heater main gas valve.
(4) Start filter pump.
(5) After 3 minutes note and record thermometer reading (this is pool temperature).
(6) Open heater main gas valve and start heater.

SUGGESTED PIPING ARRANGEMENT FOR VARIOUS TYPES OF FILTERS:

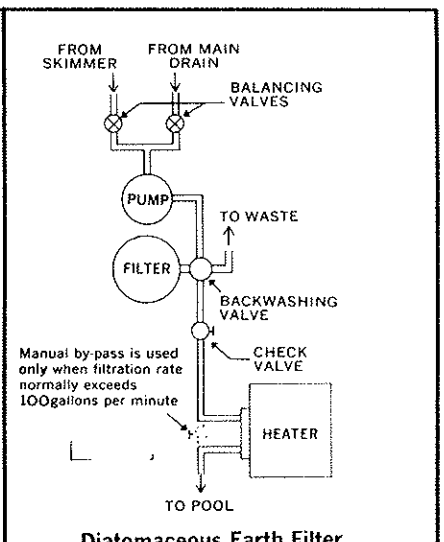
Check local plumbing and boiler codes for special requirements



Pressure Sand Filter
FIG. 6A



Skim Filter
FIG. 6B



Diatomaceous Earth Filter or Spin Filter
FIG. 6C

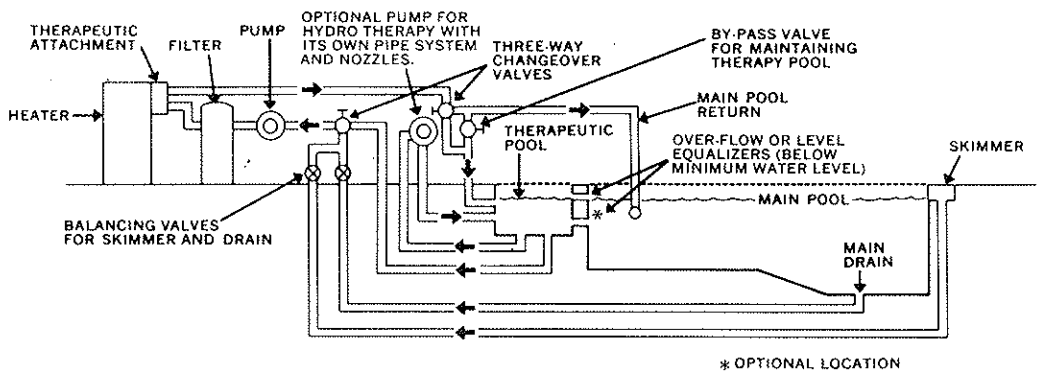


FIG. 6D PIPING DIAGRAM FOR SPA POOLS

(7) Gradually open manual by-pass valve until thermometer reads the temperature differential shown in the table below. The valve must be as near closed as possible and still maintain this temperature rise.

The chart also lists the minimum flow rates for filter systems used with the heater.

MODEL	ABOVE POOL TEMP. TEMP. DIFF. MIN.	ABOVE POOL TEMP. TEMP. DIFF. MAX.	Minimum filter system flow in GPM
125	22	26	14
175	22	26	15
250	24	28	20
325	24	28	26
400	24	28	26

(8) Be sure thermometer reading remains constant for at least 3 minutes.

(9) Remove handle from by-pass valve, since this is now a permanent adjustment to your system.

The automatic by-pass valve in the heater will take over and will maintain proper flow through the heater at all times.

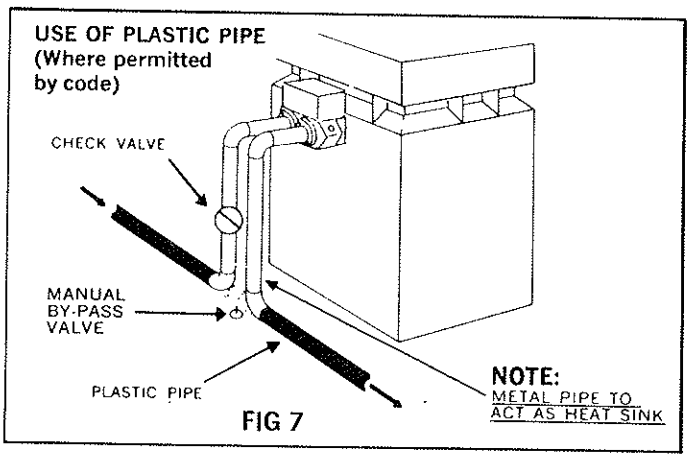


FIG 7

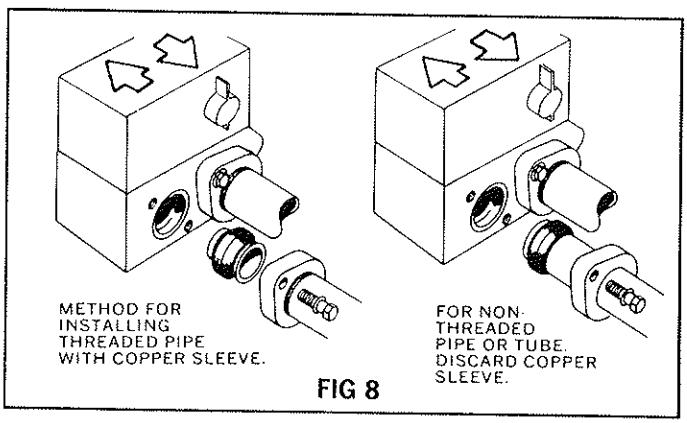


FIG 8

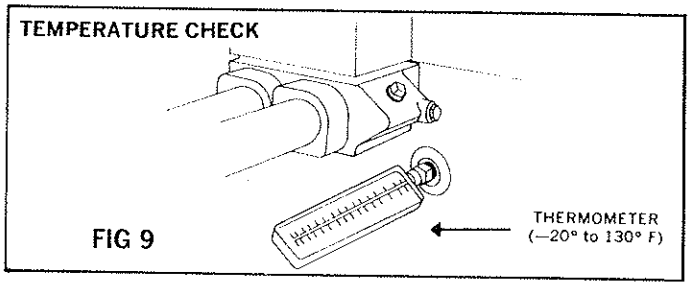
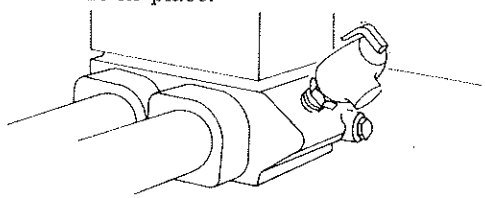


FIG 9

2/11. PRESSURE RELIEF VALVE

A pressure relief valve is not furnished with Type DM heaters. Check local building and plumbing codes to determine whether a pressure relief valve is required. A 75 PSI rated relief valve is recommended for protection of components of the filtering system if there is a water shut-off valve installed between the heater and the pool. If a pressure relief valve is *not* used, the standard ¾" brass pipe plug should be left in place.



2/12. SPECIAL ADJUSTMENT OF PRESSURE FLOW SWITCH

The pressure flow switch has been pre-set at the factory for normal pool installations. *Do not tamper* with this switch, unless one of the following conditions prevail:

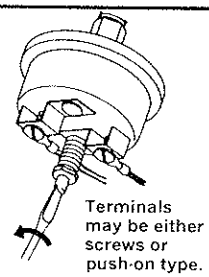
1. The heater is installed 3 feet or more *below* the surface of the pool, or
2. Any part of the filter system piping is 3 feet or more *above* the top of the heater jacket.

In such case, follow the detailed instructions for adjusting the switch contained in Fig. 10.

On some installations the piping from the heater to the pool is short, therefore the back pressure is too low to activate the pressure switch. On this type of installation, install a directional fitting where return piping enters the pool. The back pressure will be increased and the heater will operate properly.

Note: If heater is installed more than *15 feet below* the pool surface, or more than *6 feet* above the pool surface, the adjustment shown in Fig. 10 should not be used. Consult factory.

POOL FILTER MUST BE CLEAN BEFORE ADJUSTMENTS ARE MADE.



1. Turn operating gas valve to OFF.
2. Set pool thermostat to SWIM.
3. Clean filter thoroughly.
4. Start filter system.
5. Turn operating gas valve to ON. Heater should come on.
6. Turn pressure switch adjustment screw counter-clockwise very slowly until the heater goes OFF.
7. Turn pressure adjustment screw clockwise ¼ turn. Heater should come back ON.
8. **CAUTION:** Check pressure switch adjustment by turning filter pump OFF. Heater should shut off immediately. If it does not shut off, start filter pump immediately and repeat steps 6 and 7, then recheck.
9. Set pool thermostat to desired temperature.
10. When pressure switch is properly set, the heater should come ON about 10 seconds after filter pump is started, and should shut OFF immediately after pump shuts OFF.

FIG 10

3/1. LIGHTING AND ADJUSTING PILOT

1. Follow instruction on the name and rating plate. For safety always shut off the Operating Gas Valve and wait 5 minutes before lighting pilot.

2. Use Visoflame pilot lighter as instructed on the plate in the control compartment.

WARNING

When lighting or re-lighting the pilot, always turn the thermostat to its lowest position and turn the Operating Gas Valve to OFF. WAIT FIVE MINUTES.

It is always a safe practice to keep the head and face well away from the lower firebox opening when lighting the pilot should there be accumulated gas in the firebox, a reduced pilot flame or a pilot burner that is out of position.

The Visoflame lighter tube permits ignition of the pilot at arms length without bringing the head or face near the firebox opening or the burner tray. To check for pilot ignition, depress gas valve knob (on General Controls valve) or Visoflame button (on Honeywell valve) — and flame will return to the lighter tube and be visible if pilot is lit. When pilot is lighted, turn the Operating Gas Valve to ON, replace the door and *then* turn the thermostat to operating position. This procedure will protect the person lighting the heater from any rollout or flashout when main gas burners ignite.

3/2. START-UP PROCEDURE

In a new pool, it is strongly recommended that the filter be operated with the heater off long enough to completely clean and clear the pool water and filter system. This action will remove construction residue and dirt from the water, and at the same time rapidly fill the filter with sediment. The resulting pressure variations in the system would cause the heater to cycle on and off severely. While this cycling would not damage the heater in any way, it is inefficient and uneconomical since little effective water heating would result. To start heater:

1. Start filter motor.
2. Make sure pilot is lighted properly.
3. Turn operating gas valve to "ON".
4. If heater is equipped with ON/OFF toggle switch, be sure switch is on.
5. Set pool thermostat to SWIM setting. Heater should come on. Until the pool reaches approximately 70 degrees there will be a considerable amount of condensate dripping from the heat exchanger into the firebox. This will stop after pool reaches temperature.
6. Caution! Keep all objects off the vent screen. Blocking air flow will damage heater and invalidate warranty.

IMPORTANT

Special safety controls on the Mark V heater prevent heater from coming on unless the filter system is operating. When raising the temperature of a cold pool, remove all time clock stops so the filter system and heater can operate continuously until pool temperature reaches the selected temperature set on the thermostat. When the selected temperature is reached the heater will automatically shut off and the filter system will continue to operate.

Replace time clock stops to provide for a single filter cycle each 24 hours according to the recommendations of the filter manufacturer.

This time cycle may not be long enough to keep the pool water at the desired swimming temperature. Adjust "ON" time until heater shuts off on its own controls before the time clock shuts down the filter system.

3/3. INLET-OUTLET TEMPERATURES

Do not be concerned about the fact that the outlet piping, carrying the heated water to the pool, does not feel hot. The outlet pipe on the Mark V carries a large volume of pool water, which has by-passed the heater, mixed with a relatively small volume of heated water; thus the temperature difference between inlet and outlet pipes is so small that it would be difficult to sense by touching them.

3/4. TEMPERATURE CONTROLS

The Mark V thermostat control is factory-set to cover a range from approximately 70° at the lowest setting to 110° at the highest setting in increments of 5° as indicated by the nine marks on the face of the dial. (See Fig. 11.) Use a pool thermometer to determine the best swimming temperature for you and mark the pointer position of the thermostat dial face for reference.

This pool heater is equipped with an ON/OFF switch on the side of the Thermostat control box. This switch is intended to permit shutting off the heater without requiring access to the Main Gas Valve, but should be used with discretion. See paragraph 3/5 "Spring and Fall Operation."

IMPORTANT

The Mark V thermostat cannot be calibrated in the field. If control is faulty, replace according to instructions in 4/8. Heater can be completely shut down *only* by turning Main Gas Valve to OFF. Do not use the thermostat control for this purpose. If heater has ON/OFF switch, turning switch to OFF will shut heater off except for pilot light.

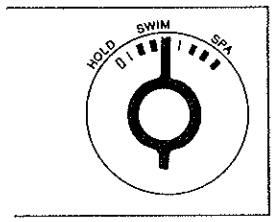


FIG 11

3/5. SPRING AND FALL OPERATION

During periods when pool is used intermittently, do not turn the heater "OFF". Best results will be obtained by turning the thermostat down to "HOLD". This will prevent the pool and surrounding ground from becoming "chilled," and also permit the pool to be raised to swimming temperature in a shorter time. If heater will not be used for a period of time, turn gas valve to OFF position or use ON/OFF toggle switch if heater is so equipped.

CAUTION: In areas where freezing weather occurs *drain heater before first frost. Shut off all gas valves.* Drain the heater by opening the drain cocks, one on the right side and one on the left side. (See fig.12).

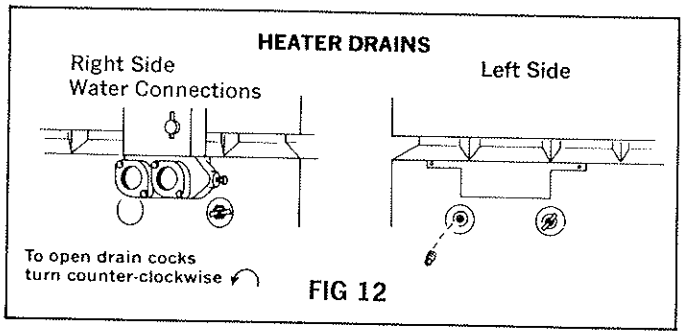


FIG 12

As a precautionary measure it is recommended that the drain plug on the left side be removed as well. Leave all drain cocks open and drain plug out until ready to use heater again. *Heater must be level to permit adequate draining.*

When compressed air is used to blow out lines it is still necessary to follow the above procedure. Be sure drains are left open after draining.

If your area has only the occasional short cold snap, the stagnant water in the heat exchanger can still freeze anytime the filter pump shuts down. To protect the heater during such periods, keep the pool temperature at 70°F. or warmer and *run the filter pump continuously.* Remove all time clock stops during the danger period. Should you not wish to maintain pool temperature, shut down and drain your filter system and the pool heater as described above.

The Mark V pool heater is not designed for use as a heating boiler and it will not function properly when so used. Consult factory for proper models for this application.

The Mark V is not designed for continuous use as an "anti-freezing" device for pools. Operating the heater for long periods at or near freezing temperature of the pool water will seriously damage the heater and may create a dangerous condition by fouling the external heat exchanger passages, which results in incomplete combustion of the fuel.

3/6. POOL WATER CHEMISTRY

The mineral content of your pool water increases every day. This is due to the natural evaporation which removes only distilled water and leaves the minerals behind. Also the regular addition of algaecidal and sanitizing chemicals adds greatly to the mineral content of the pool. If the concentration of minerals in the pool is permitted to become too high, the minerals will precipitate out of the water and deposit on the walls of the pool, in the filter and in the tubes of the heater.

For this reason it is very advantageous to drain the pool regularly (at least every two years). This precautionary measure will save you from expensive repairs to your pool finish, filter system and heater.

Another important safety precaution — always keep the pH of your pool water between 7.3 and 7.7. This will add years to the life of your pool finish, filter system and heater.

Algaecidal and sanitizing chemicals are either alkaline or acid. Sodium and calcium hypochlorites are alkaline. Chlorine gas and practically all other dry chlorine pool products are acid. Whichever type of chlorine is used, it is extremely important that pH be checked frequently and adjusted as indicated and that pool water be changed when dissolved solids become excessive. It is generally recommended by pool sanitation chemical suppliers that total alkalinity of pool water be kept in the 60 to 80 ppm range when sodium or calcium hypochlorites are used and the 80 to 100 ppm range when other dry (acid) chlorine products or chlorine gas are used.

3/7. THERAPEUTIC POOLS

Therapeutic pools or "spa" pools are usually piped and controlled so that very warm or hot water, often with air injection, is forced at high velocity into a confined area of a swimming pool or into a small separate pool. Both the energy of the water and the heat furnish certain hydrotherapeutic benefits.

These pools are excellent for body-conditioning and for arthritic and rheumatic problems, but persons using a therapeutic pool at such high temperatures should do so only under competent medical advice. Small children, debilitated persons, and others in poor health should *not* use highly heated pools. It is also good practice for persons using high temperature pools to be attended by another person out of the pool.

For control of a separate therapeutic pool in conjunction with a main pool Teledyne Laars manufactures a special Spa-Temp Control, which can be added to any Mark IV heater. This attachment allows heating each of the pools separately to the desired temperature without affecting the other temperature setting. For instructions on the installation and use of this control, see Document 4013.

3/8. PERIODIC INSPECTION

The Mark V has been designed and constructed for a long perfomance life when installed and operated properly under normal conditions. A yearly inspection, as outlined below, is strongly recommended as a means of keeping your Mark V operating efficiently throughout the year.

1. *Inspect the internal wet surfaces of the heater exchanger annually,* and remove any accumulation of scale in the tubes. The Mark V is designed for scale-free operation in most areas of the country, but extremely high mineral content in the water in some locales makes totally scale-free operation impossible. Instructions for this inspection are given in paragraph 4/11.

2. The external condition of the tubes can be inspected for soot accumulation by placing a mirror between and under the burners when the heater is firing. If soot has accumulated it must be removed and the bad combustion causing it corrected. If there are any questions contact the factory for instructions.

3. *Inspect the gas and electric millivolt controls annually* to ensure safe and dependable operation.

Specifically, these include:

a. High Temperature Limit Switch. See Par. 4/9

b. Water Pressure Switch. See Par. 4/7

c. Automatic Gas Valve. See Fig. 16.

Moisture and dust can infiltrate these controls after many years, and can eventually cause deterioration. A regular inspection schedule with repair or replacement as needed will keep your Mark V performing properly.

Keep this manual for reference by you or your service technician when inspecting or servicing the heater.

4/1. GENERAL PRECAUTIONS

This section contains instructions for making tests and repairs to the Mark V. Step by step procedures are included for trouble shooting the electrical millivolt-control system, and it is strongly advised that these and other procedures be reviewed before undertaking actual repair.

Remember that most complaints about the heater are not related to the heater at all, but to other things that affect its operation. Most often these are things like improper heater installation, inoperative pump, clogged filters and strainers, closed valves in the circulating system, inadequate gas supply, improperly adjusted time clocks. A quick-reference Trouble Shooting Chart is included at the back of this manual. See Fig. 31.

4/2. REGULATED GAS PRESSURE

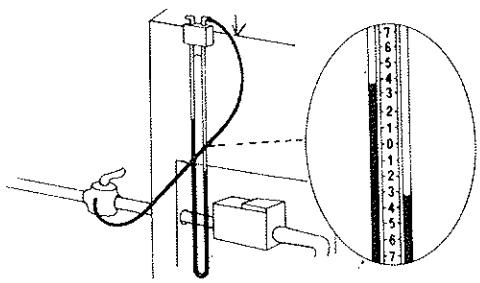
It is desirable to check the main line gas pressure and the regulated gas pressure in the heater manifold to make sure both are adequate to operate the heater. (See paragraph 2/8).A slack-tube manometer is a convenient way to check this, and a kit is available from factory. Instructions for operating the manometer are included with the test kit, but the proper connection is shown in Figure 13.

4/3. ELECTRICAL TROUBLE SHOOTING

The Mark V pool heater may have either a General Controls gas valve or a Honeywell gas valve. The electrical troubleshooting procedures in the following pages are illustrated with the General Controls valve. The procedure is the same with the Honeywell valve if it is understood that the two center terminals in the General Controls valve (with Jumper) are replaced by a single terminal on the Honeywell valve. See Fig. 17A, Page 14 for wiring hookup on each valve.

TESTING MAIN LINE GAS PRESSURE

1. Attach slack tube manometer to heater jacket.
2. Open both valves on manometer.
3. Shut off gas to heater by using shut-off cock **ahead** of heater controls.
4. Remove ⅛" NPT test plug in upstream shut-off valve as illustrated.
5. Screw in ⅛" NPT fitting from manometer kit. Attach manometer hose to fitting and to one of the manometer valves.
6. Open all gas valves, light pilot and bring on main gas burners.
7. Mainline gas pressure will register on manometer. With burners on it should read between 5" and 8" WCP for Nat. Gas and between 11" and 13" WCP for Propane gas.



TESTING MANIFOLD REGULATED GAS PRESSURE

1. Attach slack tube manameter to heater jacket.
2. Open both valves on manometer.
3. Shut off manual main gas valve.
4. Remove ⅛" NPT Plug on valve outlet face marked "press-tap" and screw in ⅛" fitting from manometer kit. Connect manometer hose to fitting and to one of the manometer valves.
5. Wait 5 minutes. Relight pilot as instructed on rating plate and bring on main burners.
6. Manometer should register 4" WCP for Nat. gas and 11" WCP for Propane gas.
7. On Natural Gas models remove regulator cap screw on top of valve marked "Reg. Adj.". Turn screw adjustment clockwise to increase or counterclockwise to decrease gas pressure to 4" WCP.
8. On Propane Gas models there is no regulator adjustment. Consult the supplier for adjustment of tank regulator to 11" WCP.

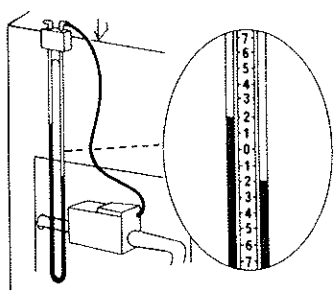


FIG 13

ELECTRICAL SYSTEM TROUBLE SHOOTING SEQUENCE
Heater Does Not Come On.
If Heater Will Not Shut Off See Step 4.

Step 1.

Experience shows that most complaints about properly installed heaters not coming on have nothing to do with the heater itself. Usually something has happened to reduce water flow through the heater. The protective switches in the heater then operate to protect it.

Any of the following could keep the heater OFF. Check them first.

1. Be sure heater is properly installed. See Section 2.
2. Be sure filter is clean. Build-up of residue on the filter can lower the pressure through the heater and shut it off.
3. Make sure pump is not airlocked, clogged or inoperative.
4. Check main drain and skimmer valves to be sure they are open.
5. Be sure thermostat control is set to SWIM or higher. Move the control knob back and forth 6 or 7 times to free the contacts. Often this is all that is required to fix or clean thermostat contacts. Be sure that the toggle switch is in the ON position.

If Heater Still Does Not Operate, Remove Control Compartment Door And —

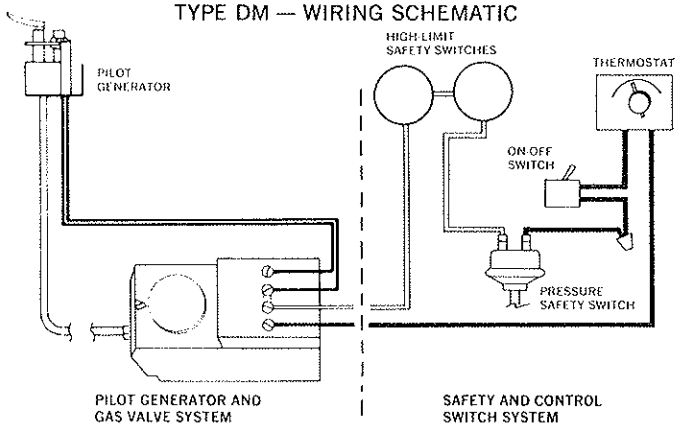
6. Make sure pilot is ON and adjusted properly. See Para. 3/2.
7. Make sure gas valve is ON and gas pressure is available.
8. Make a careful visual inspection of all electrical connections and wiring. Finding a loose connection or a charred wire can save a lot of time.

If the pump and filter system is properly circulating water and all the above items have been checked, the trouble is in the heater control systems. Go to Step 2.

NOTE: Keep the filter system running. The check-out procedures in Steps 1, 2, and 3 depend on the heater coming on to tell you when the trouble has been located.

CAUTION: If filter is off, DO NOT let burners come on for more than five seconds during service procedure. Shut off operating gas valve until you know what the trouble is.

TYPE DM — WIRING SCHEMATIC



Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 17A, page 14.

FIG 14

Step 2.

This step will isolate the trouble area:
The protective controls or thermostat,
or
The gas valve, pilot generator or grounded wire harness.

Place jumper or any short circuit as shown below.
If heater comes on with jumper in place and shuts off when it is removed, the trouble is in the protective controls or thermostat. Go to Step 3.

If the heater does not come on, the trouble is either a grounded wire harness, the gas valve or the pilot generator.

To test for grounded wire harness, disconnect harness wires and replace jumper. If heater comes on, harness is grounded. Inspect for pinched or pierced insulation, a terminal touching a metal ground, loose strands of wire grounded, broken or burned wires, etc.

If heater does not come on, the trouble is in the pilot generator or gas valve.

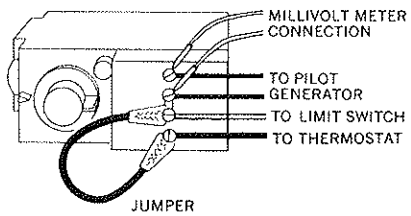
To test pilot generator:
With jumper in place, connect leads from millivolt meter to gas valve as shown below. Reverse leads if needle deflects in opposite direction.

If meter reads more than 200 millivolts and the gas valve doesn't open, the gas valve is defective and should be replaced.

If meter reads less than 200 millivolts, disconnect pilot generator leads from valve and connect them directly to the millivolt meter. If meter does not read over 600 millivolts, the pilot generator is out of position at the pilot burner (reposition and retest), or the pilot generator is weak and should be replaced. See paragraph 4/4. The generator must be properly enveloped in the pilot flame to generate its full potential.

If heater still does not come on after replacement of pilot generator cartridge, the problem is in the gas valve. Replace valve. See paragraph 4/6.

WARNING: Never leave a jumper on a heater control to keep the heater operating. The jumper is only a trouble shooting device, not a cure.



Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 17A, page 14.

FIG 15

Step 3.

If the heater comes on when the jumper is installed as in Fig. 15 and shuts off when the jumper is removed, the problem is in one or more of the protective switches or their wiring.*

In this step, jumpers will be used to remove each of the protective switches from the circuit, one at a time, to determine which one is keeping the heater off.

** Check for terminals loose on wire end, loose terminal screws, cut or broken wires.*

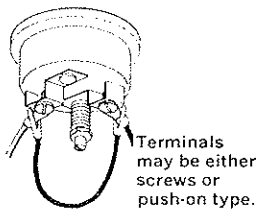
IMPORTANT: If water flow through the heater is stopped after the heater has been on for more than three (3) minutes, the residual heat in the firebox will heat the standing water in the tubes and travel to the pool thermostat and the high-limit switches. This may prevent the heater from coming ON for several minutes after starting water flow through the heater. Cool the heater by turning the Operating Gas Valve to OFF and let the pool water circulate through the heater for ten (10) minutes before proceeding with these tests.

NOTE: Keep filter pump running and turn the gas valve ON so that heater will come on when the troublesome switch is jumpered.

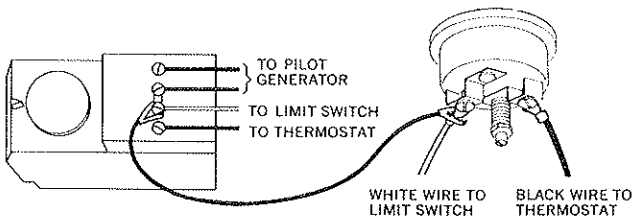
Remove control compartment door. Rotate thermostat shaft clockwise to the stop.

To find out which switch is keeping the heater off, add jumpers one at a time.

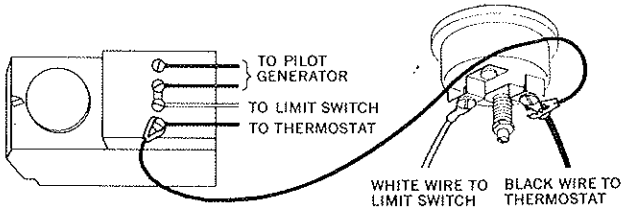
1. First put a jumper wire here. If heater comes on, the Pressure Switch is keeping the heater off. See paragraph 4/7.



2. Connect jumper to the **white** wire terminal on pressure switch and the **white** wire of wiring harness that is connected to gas valve terminal block. If the heater comes on the High Limit Switches are keeping heater off. See Para. 4/9.

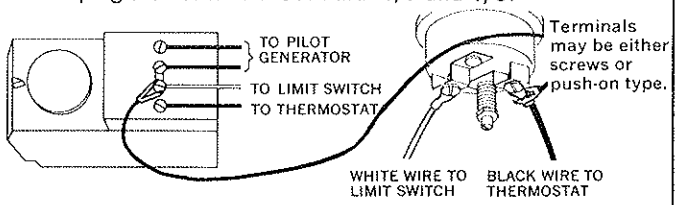


3. Connect jumper to the **black** wire terminal on pressure switch and the **black** wire of wiring harness that is connected to gas valve terminal block. If the heater comes on the thermostat is keeping the heater off. See Para 4/8.

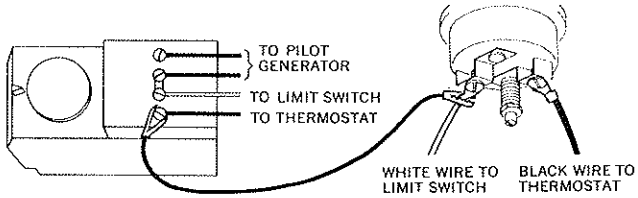


Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 17A, page 14.

4. Connect jumper to the **black** wire terminal on pressure switch and **white** wire on gas valve terminal block. If heater comes on **both** the pressure switch and the high limit switch are keeping the heater off. See Para. 4/7 and 4/9.



5. Connect jumper to the **white** wire terminal on pressure switch and the **black** wire on gas valve terminal block. If heater comes on **both** the pressure switch and the thermostat are keeping the heater off. See Para. 4/7 and 4/8.



Testing for Voltage Loss in Safety Circuit

This test determines whether or not there is excessive voltage drop (resistance) in any contact or control.

High resistance in the safety circuit can cause intermittent operation and is a warning of future problems. This test must be done with filter pump and burners ON.

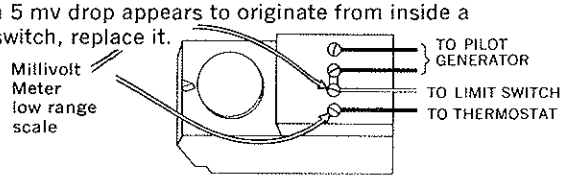
6. Attach the millivolt meter as shown below. Using the low range scale on the millivolt meter, the reading should be 20 mv or less. This is the total voltage drop through the safety controls and wire harness.

7. If the voltage drop is over 20 mv locate source of voltage drop by jumpering out the pressure switch, thermostat, and the high limits in turn, using the millivolt meter to jumper the controls instead of a jumper wire. See 1 thru 5. When all the voltage drops obtained in this manner are added up, the total should be the same as the mv reading obtained in 6.

8. If there is more than 10 mv drop across the **pressure switch,** make sure the 2 screw terminals are tight. If this doesn't eliminate the voltage drop, remove the adjustment screw (with spring) and rub the tip of the screw on a paper towel to remove any contamination. Replace screw and tighten until the heater comes on. Then turn the screw back and forth ½ turn about a dozen times to make sure the contacts are clean. Readjust the pressure switch by the procedure in Figure 10.

9. If there is more than a 10 mv drop in the **thermostat,** check and clean the spade terminals and retighten the terminal screws on the thermostat. If this does not eliminate the high voltage drop, replace the thermostat.

10. If there is more than a 10 mv drop in the **high limit switches** check each switch independently as shown in Fig. 23. Make sure the quick connect terminals are attached tightly to the wire and the limit switch. If more than a 5 mv drop appears to originate from inside a limit switch, replace it.



Measuring total voltage drop of safety circuit

Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 17A, page 14.

FIG 16

ELECTRICAL TROUBLE SHOOTING SEQUENCE

Heater stays on — The controls will not shut it off . . .

Step 4.

This step will determine whether the controls or the gas valve is keeping the heater on. Keep filter pump running while conducting these tests.

First, disconnect one of the lead wires to the pressure switch, as shown. **If heater goes off,** turn off filter and reconnect pressure switch. If heater comes on the problem is in the switch assembly, causing delayed on-off action. Check as follows:

1. *Switch may be out of adjustment.* See Para. 2/12 for proper adjustment procedure.

2. *Syphon loop may be clogged.* Disassemble switch assembly and blow out until clear. See Para. 4/7.

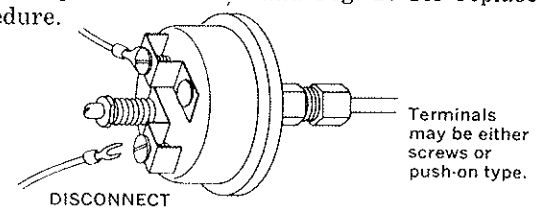
3. *Pressure switch may be defective.* See Para. 4/7. for testing and replacement procedure.

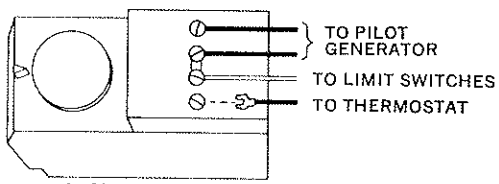
If heater still stays on with the pressure switch disconnected, (See illustration below) wiring may be at fault.

4. *Shorts in wire insulation.* Make visual inspection. Jiggle wires to detect loose connection. Disconnect one of the lead wires of the wire harness at the gas valve. If heater goes off, wiring is at fault. Repair or replace Wire Harness.

If heater still stays on with wiring disconnected at gas valve, (See illustration below) the gas valve is at fault.

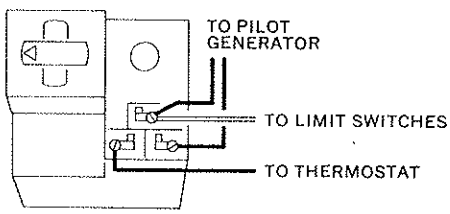
5. *Debris may have collected under gas valve seat.* Replace gas valve. *Disassembly of valve will invalidate manufacturer's warranty.* See Para. 4/6 and Fig. 20 for replacement procedure.





GENERAL CONTROLS GAS VALVE

FIG 17



HONEYWELL GAS VALVE

Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve.

FIG 17A

4/4. PILOT GENERATOR REPLACEMENT

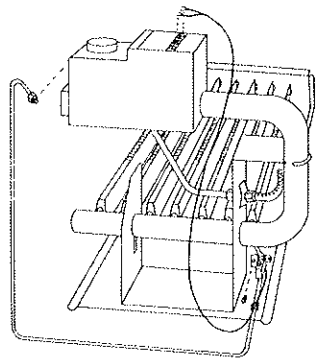
The procedure for testing the pilot generator is found in Figure 15. To remove the pilot and generator assembly, follow the steps in Fig. 18

PILOT GENERATOR UNIT REPLACEMENT

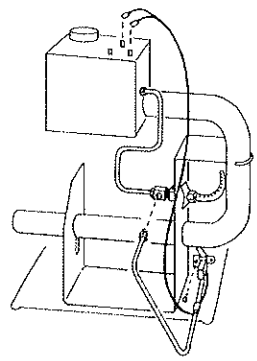
1. Disconnect pilot generator wires from gas valve and remove retainer bands.
2. Grasp shielded wire at base of pilot generator and pull down while deflecting spring clip.
3. To replace reverse procedure.

PILOT BURNER ASSEMBLY REPLACEMENT

1. Disconnect pilot generator wires from gas valve.
2. Disconnect pilot gas tube at pilot burner.
3. Disconnect pilot burner from its bracket by removing screw into pilot bracket.
4. Also, pilot burner attached to main burner can be removed by following procedure in Par. 4/10.



GENERAL CONTROLS GAS VALVE



HONEYWELL GAS VALVE

FIG 18

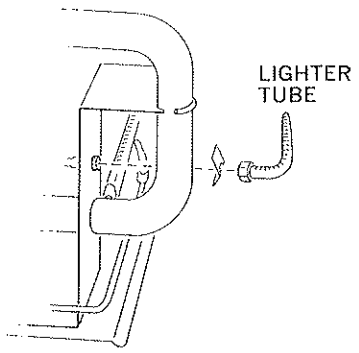
4/5. VISOFLAME PILOT LIGHTER

Visoflame pilot lighting is used to facilitate the lighting of the pilot and to make it easy to determine if the pilot is burning properly.

General Controls gas valve: With gas valve knob set on pilot position, pressing down on the knob sends gas through the lighter tube, escaping through the perforations for sure easy lighting of the pilot flame.

Honeywell gas valve: With gas valve knob set on pilot position, press red Visoflame button next to perforated lighter tube.

To check for a lighted pilot, press gas valve knob down (General Controls valve) or press Visoflame button (Honeywell valve) and flame will return along the perforations and be readily detectable, indicating the pilot is burning.



VISOFLAME REMOVAL

1. Remove compression cap and cleat which holds perforated tube.
2. Pull assembly from heater.
3. Reverse procedure to replace.

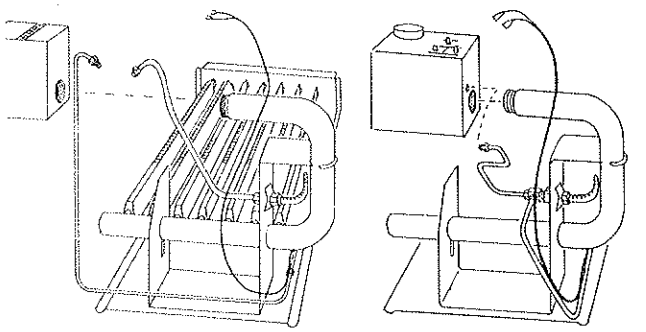
NOTE: It is important that perforated tube be adjusted so that torch flame from end properly lights pilot burner. Secure in proper position by tightening the tube retaining nut.

FIG 19

4/6. GAS VALVE REPLACEMENT

WARNING: Never attempt to repair the gas valve. When defective operation has been determined, replace it. Attempts to repair it can void the warranty and possibly lead to dangerous results.

Procedure for testing the operating gas valve is found in paragraph 4/3, Step 2. To remove and replace gas valve, follow steps in Fig. 20.



GENERAL CONTROLS GAS VALVE HONEYWELL GAS VALVE

REMOVING GAS VALVE

1. Turn off main line gas cock.
2. Disconnect main gas line.
3. Disconnect pilot tubing and all wiring from gas valve.
4. Detach burner shelf ass'y. and control ass'y. from heater jacket and bottom pan and slide out.
5. Unscrew gas valve from manifold pipe.
6. Replace and reassemble.

FIG 20

4/7. TESTING PRESSURE SWITCH

1. Turn thermostat to maximum warm position.

2. With filter pump running, if connecting a jumper across the pressure switch (Fig. 16) brings the heater on, the contact points in the switch are open. This does not mean the switch is defective – check switch operation as follows:

Back wash filter before attempting to calibrate pressure switch. Verify correct flow by inserting hand in front of pool return line closest to equipment. If filter is clean you should feel a fast water flow on palm of hand.

Remove jumper (General Controls valve) or disconnect white wire (Honeywell), and connect millivolt meter to pilot generator terminals at the gas valve. See Figs. 21 and 17A.

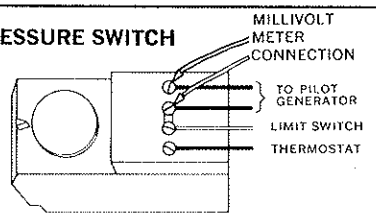
Start and stop the filter pump. The meter should register 200 millivolts or more when the pump and heater come on under normal conditions and should jump cleanly to 500 millivolts or more when the pump is shut off.

If the millivolt meter needle does not register, rises or falls slowly or hesitates going up or down, a defective pressure switch or clogged connector tube should be suspected.

a. To clean connector tube, remove tube from heater and switch
b. Blow out until clear
c. Fill switch and tubing with heavy non-detergent oil, SAE 40 preferred, using a pump-type oil can. The connector must be completely filled with oil.
d. Reinstall connector tube to heater and pressure switch. Tube must be *air tight.*
e. Reconnect wire terminals, start filter pump and retest pressure switch.

If cleaning pressure switch tube does not correct the erratic millivolt meter readings, replace the switch.

TESTING PRESSURE SWITCH



Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 17A, page 14.

REMOVAL AND REPLACEMENT OF PRESSURE SWITCH

1. Disconnect wires from pressure switch.
2. Disconnect pressure switch from pigtail tube fitting.
3. Reverse procedure to replace, being sure pigtail and switch are filled with oil.

REMOVE AND REPLACEMENT OF CONNECTOR TUBE

1. Remove top assembly.
2. Remove gap spacer.
3. Remove copper tubing from header and remove switch from tubing.
4. Reverse procedure to replace, being sure pigtail and switch are filled with oil.

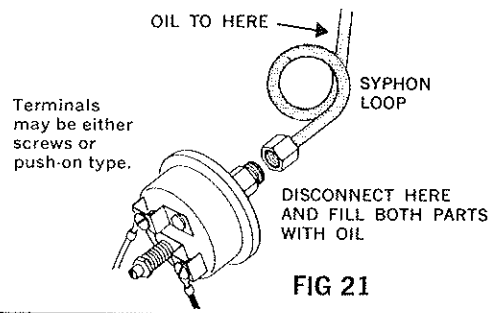


FIG 21

4/8. TESTING THERMOSTAT

The thermostat dial does not have temperature markings other than the nine reference marks which cover an approximate range from 70°F. to 110°F. Use an accurate pool thermometer to determine the dial setting which gives you the most comfortable swimming temperature and mark the dial for future reference.

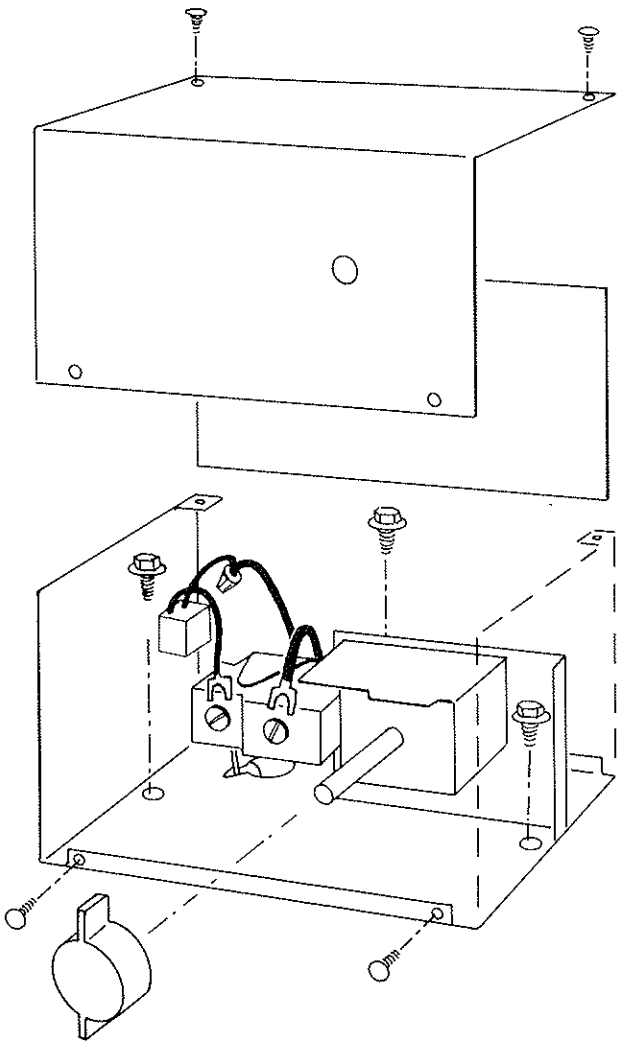
The Mark V thermostat can not be calibrated in the field, and if found to be defective, must be replaced or returned to the factory for checking and recalibration.

The condition of the thermostat can be checked with a millivolt meter.

Make sure pump is on and has been circulating water through the heater for at least fifteen (15) minutes.

Rotate thermostat knob *counter-clockwise* to the stop to shut heater OFF. Connect millivolt meter to pilot generator terminals on the Operating Gas Valve. Meter should read between 500-750 millivolts.

Rotate knob *clock-wise* slowly, while watching the millivolt meter, until the ON position is reached. This will be indicated by the millivolt needle moving to between 200-250 millivolts. The millivolt meter should move cleanly without hesitation. Now turn the thermostat knob slowly *counter-clockwise* until millivolt meter needle moves back without hesitation to between 500-750 millivolts. The thermostat knob should not have to be rotated more than one dial mark to obtain this. If knob has to be moved more than two marks, or the millivolt meter needle hesitates on the way up or down, the thermostat should be replaced. See Fig. 22 .



REMOVAL AND REPLACEMENT OF THERMOSTAT

1. Loosen set screw and remove knob.
2. Remove two screws at front and two screws at top of the thermostat housing. Remove front/top cover plate and lift out rear plate.
3. Disconnect the two black wires at the thermostat terminal block.
4. With nut driver, remove three screws holding base plate to header.
5. Lift base plate and thermostat away from header to clear bulb and provide access to two screws holding thermostat to its mounting plate. (High limit switch can remain with base plate).
6. Remove two screws holding thermostat to mounting plate and carefully remove thermostat, capillary tube and bulb.
   Reverse procedure to replace.

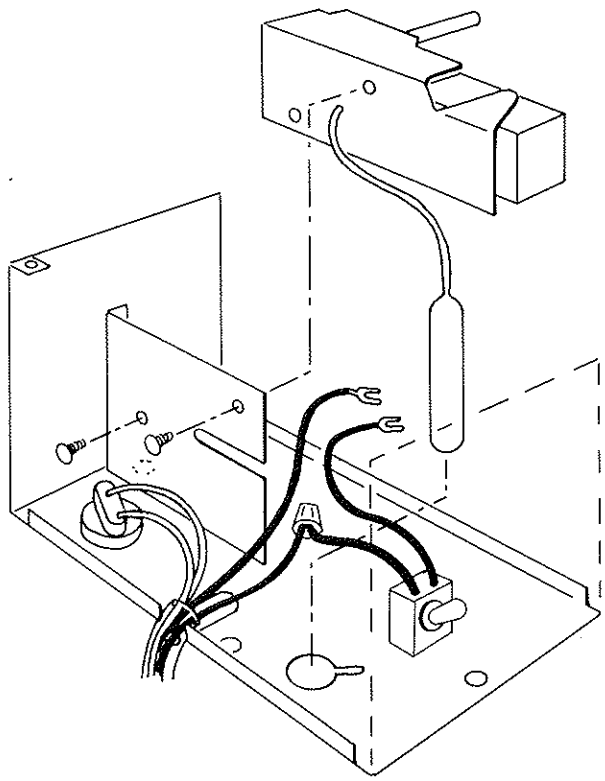


FIG 22

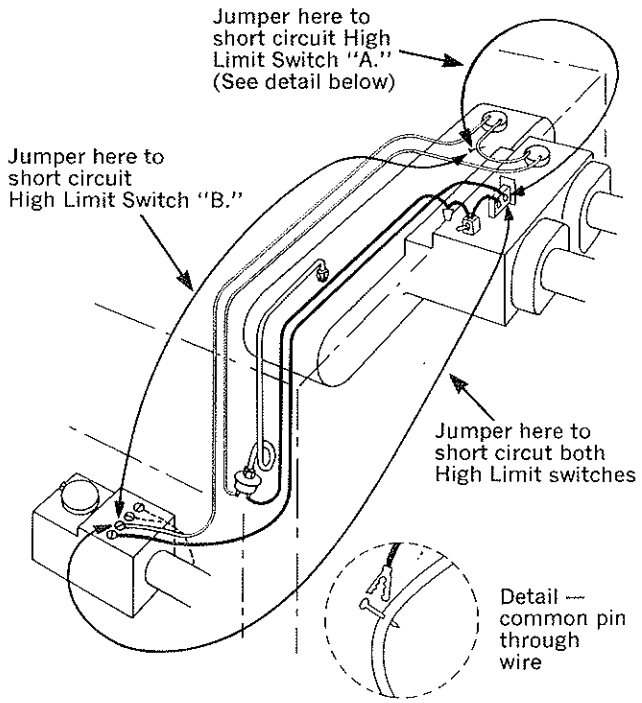
4/9. HIGH LIMIT SWITCHES.

NOTE: The high limit safety switches are pre-set at the factory and no field adjustment should be attempted. Before replacing either of the high limit switches make sure they are not holding the heater off because of overheating in the heater tubes due to other causes. The limit switches may be performing their proper function. Follow steps in Fig. 23 .

TESTING AND REPLACEMENT OF HIGH LIMIT SWITCHES

1. Install thermometer.
2. Install a jumper between the white wire terminals of the pressure switch and the gas valve to eliminate both switches from the circuit.
3. Let heater run 5-10 minutes, temperature should be approximately 30° higher than the pool water temperature. If this temperature is excessive, check the Automatic Flow Control Valve (paragraph 4/13). If temperature is normal:
   a) Jumper each high limit switch in turn to determine which one is holding the heater off.
   b) Replace defective switch.

NOTE: The high limit switches can be jumpered individually without removing them from the header. Simply push a common pin through the white wire between the two high limits, one of which is in the control box, the other installed within the jacket. Use exposed part of the pin as a jumper terminal. Attach other end of jumper to the white wire terminal at the pressure switch to short circuit the switch in the control box; attach to the white wire terminal at the gas valve to short circuit the switch hidden under the heater jacket.



Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 17A, page 14.

FIG 23

4/10. REMOVAL OF THE GAS BURNERS

REPLACEMENT OF GAS BURNERS

1. Turn off main line gas cock.
2. Turn off gas valve.
3. Grasp burner firmly and push away from manifold. (A screw driver can be used to pry the burner retainer clip free of the orifice groove.) Push burner inward until clear of orifice. Now drop burner down and slide from heater.
4. To replace, insert burner into rear rail slot, line up with proper orifice and snap into position.

NOTE: To remove burner with pilot attached:

1. Turn off gas.
2. Loosen compression nut on pilot burner.
3. Detach pilot burner from bracket on main burner by removing screw into pilot bracket.
4. Swing pilot burner upward and out of the way of bracket on burner.
5. Grasp main burner firmly, push toward fire-box until clear of orifice, drop down and remove.

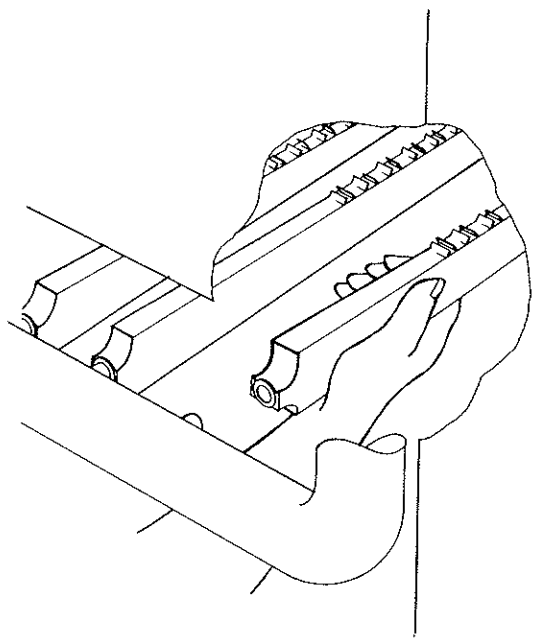


FIG 24

4/11. PERIODIC INSPECTION OF HEAT EXCHANGER

Scale accumulation can be detected by a quick periodic inspection of heat exchanger tubes and should be made from time to time on the tube having the highest temperature. This tube is also the last pass through the heat exchanger. It is easily viewed by removing the drain valve and bushing shown in Figure 25. The complete heat exchanger inspection is accomplished by removing it from the heater as shown in Figure 26.

The tubes should be inspected after 60 days of operation, and then again after 120 days of operation. From the appearance of the tubes, it will then be possible to set up a regular inspection schedule.

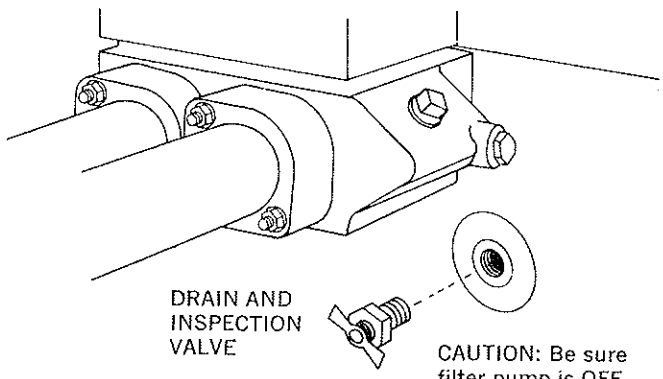
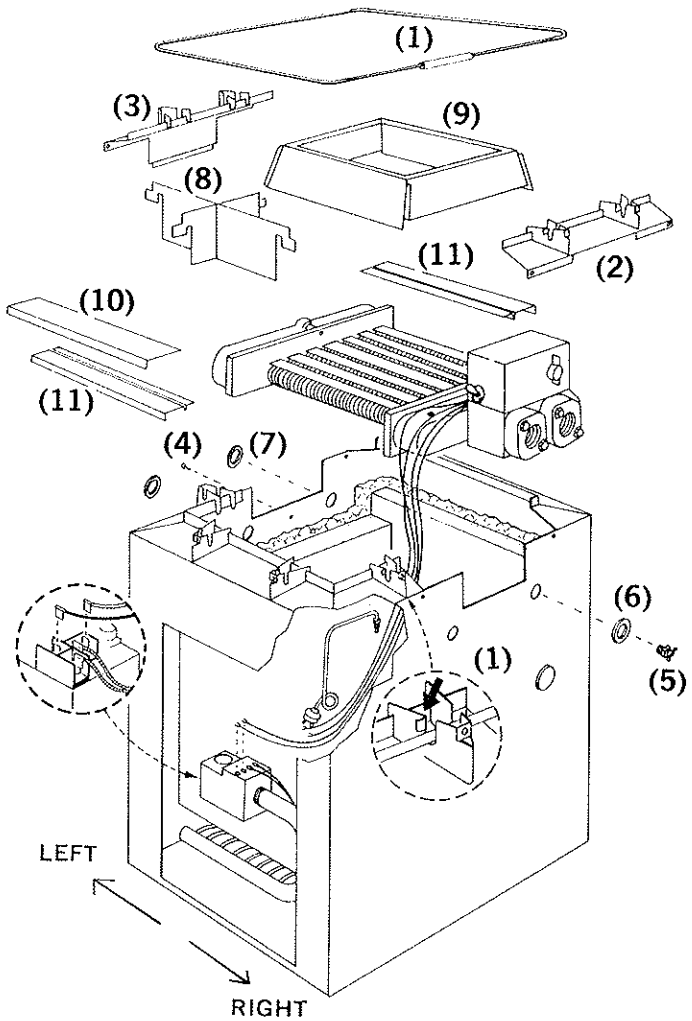


FIG 25

REMOVAL OF HEAT EXCHANGER

1. Remove top assembly by unscrewing from vent blades.
2. Bend the retaining tabs and lift out wire guard. (1)
3. Remove screws and lift out gap spacers. (2 & 3)
4. Remove and discard shipping screw located between drain and plug on side of heater opposite water connections. (4)
5. Remove drain valve (large hex.) located under water connections. (5)
6. Remove all grommets (2 each side). (6 & 7)
7. In order, lift out the wind deflector (8), the lower flue collector (9), front insulation cover (10), and the front and rear insulation block covers. (11)
8. Disconnect syphon loop fitting at heat exchanger.
9. Disconnect black and white wires from gas valve and pressure switch. Pull wires through and coil them on top of heat exchanger.
10. Disconnect water piping and lift out heat exchanger.

IMPORTANT — While heat exchanger is removed from the heater inspect the firewall refractory insulation blocks . . . check for wear, cracks, and breakage. Replace where necessary.



Terminals may be either screws or push-on type.

FIG 26

4/12. TESTING AND CLEANING THE HEAT EXCHANGER

Caution: Black carbon soot on a dirty heat exchanger can, under certain conditions, be ignited by a random spark or open flame. To prevent this unlikely occurrence, dampen the soot deposits with a wet brush or fine water spray before servicing or cleaning the heat exchanger.

1. Any accumulation of soot or corrosion products on the outside of the tubes can be readily removed with a wire brush with the Tube Heat Baffles removed. If heat exchanger has been removed from heater, a high velocity water force may be used. **Never use compressed air.** *Do not use water with heat exchanger in place* as it will damage firebox and insulation.

2. There are two (2) ways to clean the inside of the tubes:
   Acid Cleaning:
   After removing the water header castings, bolts, gaskets, and Tube Heat Baffles, the exchanger can be immersed in a properly inhibited muriatic acid solution (3 part water to 1 part acid solution). The inhibited muriatic acid solution, however, will remove some copper, but at a slow rate. When tubes are clean, flush the assembly with soda-ash solution. Dry and paint steel plates with a good quality rust inhibiting paint.

   Reaming:
   The tubes may be reamed out as shown in Fig. 27 For easy reaming, dry the heat exchanger first. Also, withdraw the reamer frequently to remove lime powder and prevent the drill bit from binding in the tube.

NOTE: Use *only* the correct size carbide tipped reamers which are available from the factory.

3. Install new gaskets. DO NOT use the old gaskets.

4. Tighten bolts progressively, starting with two center bolts, keeping header straight on the tube plate. Maximum torque is 20 foot pounds. DO NOT over-tighten.

5. Pressure test heat exchanger for leaks with city water pressure before re-installing. See Figure 27.

6. When re-installing the heat exchanger, carefully hold refractory insulation blocks apart and lower the heat exchanger into place. Be sure that the sheet metal covers which protect the insulation blocks and tee-baffles are carefully replaced.

7. If a header bolt is stripped it may be driven out of header plate and replaced. Order Teledyne Laars Part No. F-283.

CLEANING AND TESTING OF HEAT EXCHANGER

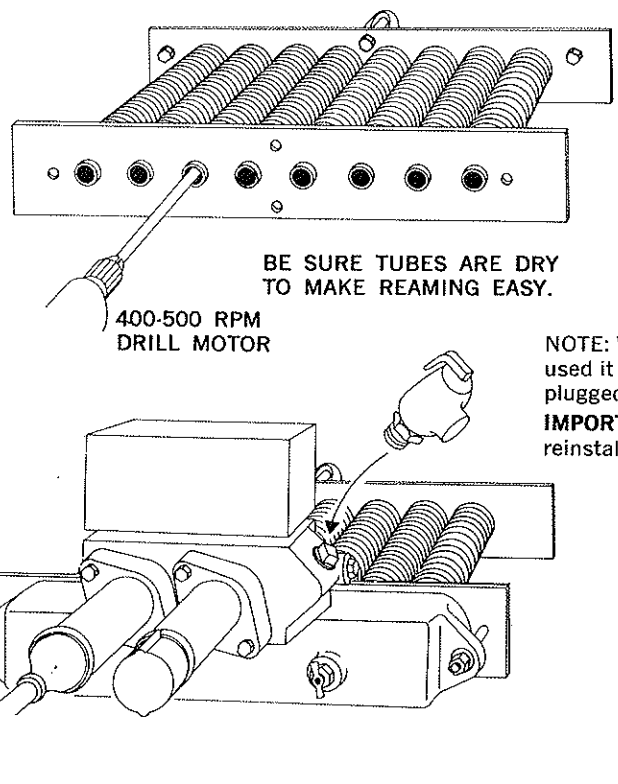


FIG 27

4/13. AUTOMATIC FLOW CONTROL VALVE

The automatic flow control valve maintains the correct flow of water through the heater over widely varying conditions of filter flow.

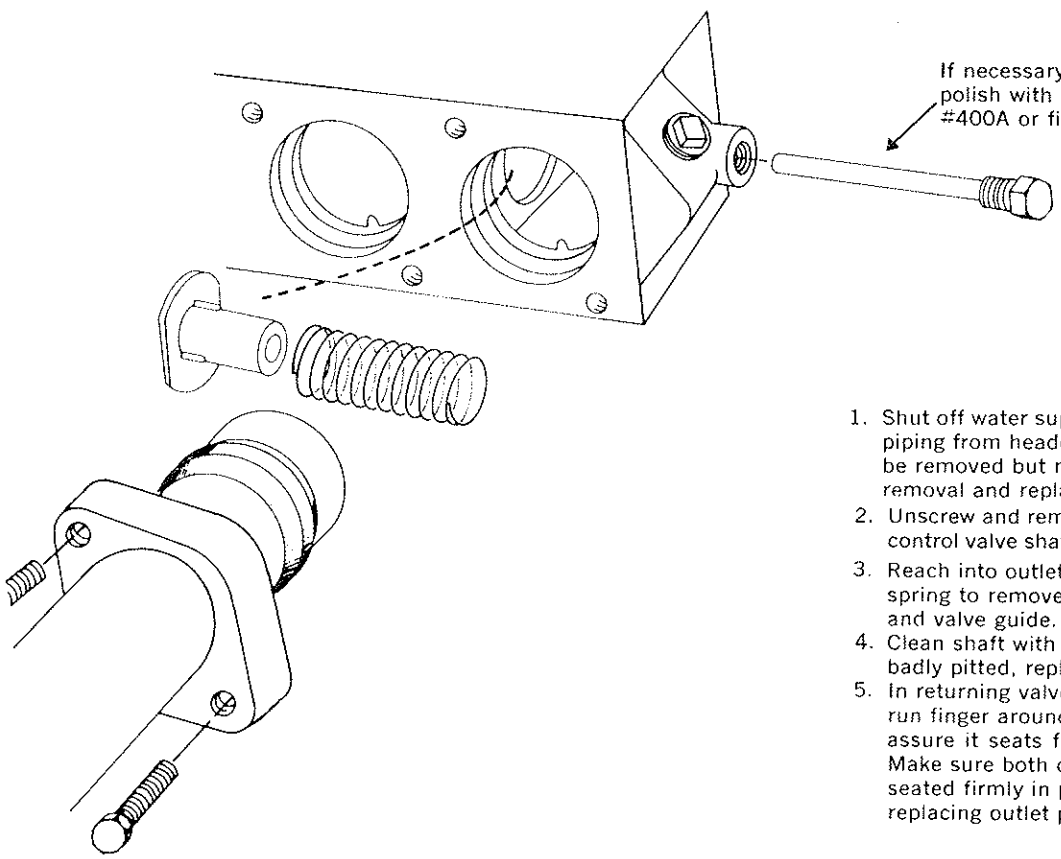
It is an extremely simple device, having only one moving part, and it ordinarily requires no service. The parts are made of Lexan® and stainless steel and will resist normal pool water for many years. Extremely high acid or chlorine concentration may, however, damage valve parts. Extreme hard water may leave deposits on valve parts which may make the valve sluggish or inoperative. Such a condition might overheat the water in the heater, but not heat enough water to raise the pool temperature as desired. If heater tube water is overheated because of a sticky valve, the high-limit switch will open to cycle the heater. If the automatic flow valve *stays* closed, too much water flows through the heater causing condensation on tubes. Either situation can result in inadequate heating.

The function of the automatic flow control valve may be tested by removing the drain valve and bushing below the water connection casting and inserting a thermometer (see Fig. 9).

When the pool filter is delivering normal flow to the heater, the thermometer should read approximately 30°F ABOVE pool temperature.

To determine if valve is stuck in open position, shut off filter and unscrew pipe plug (or pressure relief valve if used). Make visual inspection of disc. If not properly seated in flush position, disassemble the valve and overhaul. Figure 28 shows the procedure for removal and cleaning of the valve. If parts are pitted due to corrosion by excessive acid or chlorine in the pool water, they should be replaced. A parts list is shown on page 23.

DISASSEMBLY PROCEDURE AND LIGHT OVERHAUL — AUTOMATIC FLOW CONTROL VALVE.

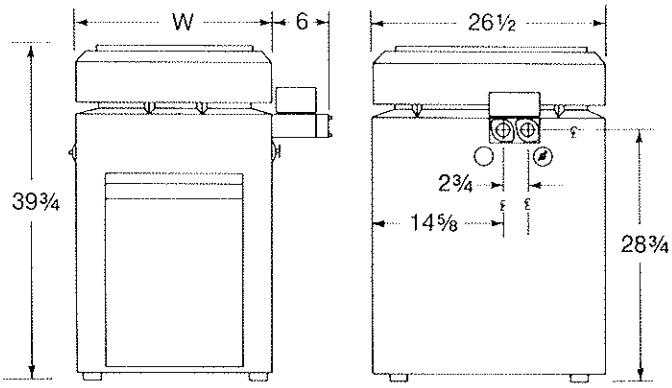


1. Shut off water supply and remove outlet piping from header (inlet pipe need not be removed but may be to facilitate removal and replacement of spring).
2. Unscrew and remove automatic flow control valve shaft.
3. Reach into outlet opening and depress spring to remove spring, valve disc, and valve guide.
4. Clean shaft with crocus cloth or, if badly pitted, replace with new parts.
5. In returning valve assembly to header, run finger around edge of disc face to assure it seats flush in the valve. Make sure both disc and spring are seated firmly in position before replacing outlet pipe.

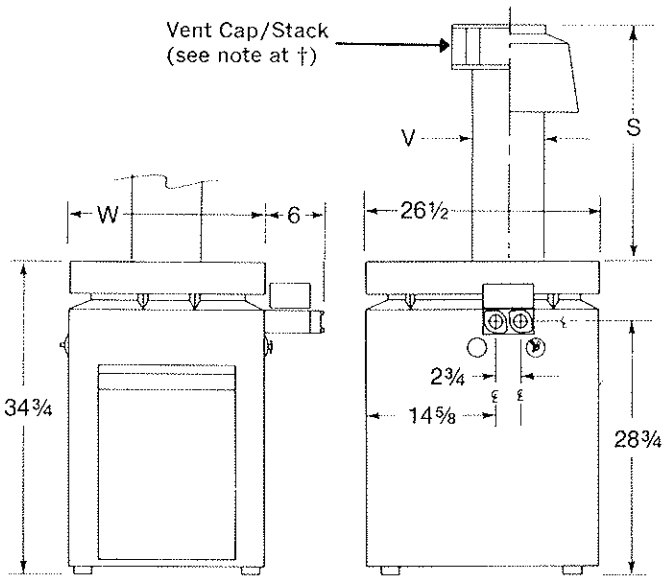
FIG 28

CAPACITIES AND DIMENSIONS

LOW PROFILE POOL HEATER



STACKTOP POOL HEATER



Model No.	Vent (V)	Width (W)	Stack(S) Indoor	Stack(S) Outdoor	BTU/HR. Input [3]	BTU/HR. Output [5] Outdoor	BTU/HR. Output [5] Indoor	Shipping Weight [6]
125*	5	15	20½	17⅜	125,000	87,500	87,500	200
175	6	18	20¾	—	175,000	122,500	122,500	217
250	7	22½	28½	—	250,000	175,000	175,000	250
325	8	26¾	29½	—	325,000	227,500	227,500	277
400	9	31¾	30¾	—	400,000	280,000	280,000	308

*This size not available in Low Profile model.

†Vent Cap/Stack is not supplied by Teledyne Laars except with Model 125.

1. The Type DM is design-certified by A.G.A. as a swimming pool heater for both natural gas and propane gas.
2. The Mark V is constructed for 125 psi. working pressure.
3. Derate BTU input and output 4% for every 1000 ft. installation altitude is above sea level. No derating necessary up to 3000 ft. elevation.
4. The Mark V is design-certified by A.G.A. and C.G.A. for indoor or outdoor installation. The Stacktop models may be installed indoors with a draft hood or outdoors with a vent cap/stack. The Low Profile models may only be installed outdoors.
5. For propane gas reduce input and output approximately five percent.
6. Shipping weight of Stacktop models includes Draft Hood.
7. A Universal Flange Coupling accepts threaded 1½" iron pipe, unthreaded 1¼" iron pipe and 1½" copper pipe without adapter.

FIG 29

EXPLODED DWG. OF MARK V COMPONENTS — TYPE DM

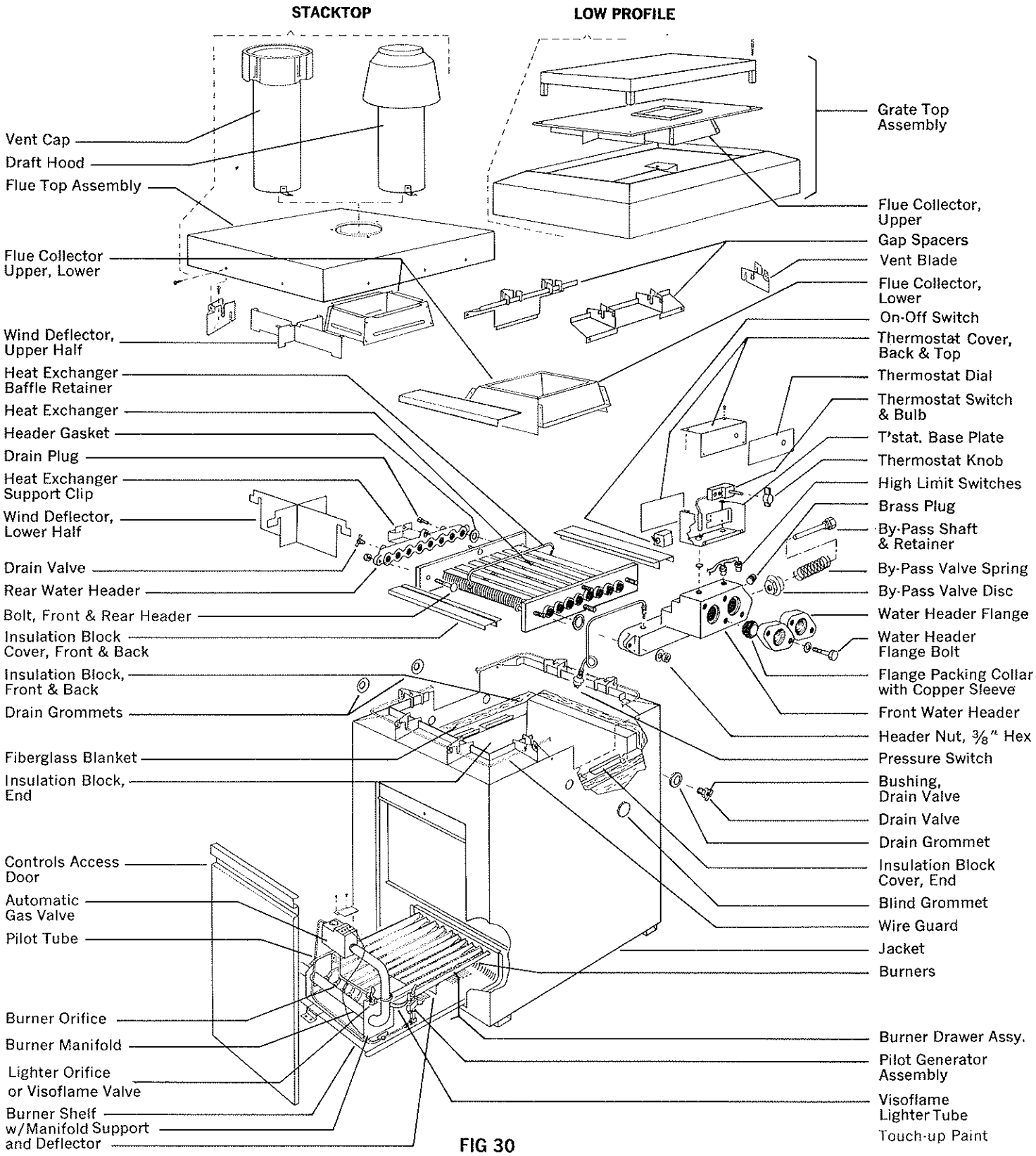


FIG 30

PARTS LIST FOR MARK V POOLHEATERS — Type DM

DESCRIPTION	FOR MODEL SIZES	PART NUMBER
PILOT GAS SYSTEM		
Pilot Assembly, G/C, Nat.	All	R-568
Pilot Assembly, G/C, LPG	All	R-569
Pilot Generator Cartridge, G/C	All	W-125
Lighter Tube Orifice, Nat.	All	W-188
Lighter Tube Orifice, LPG	All	W-189
Visoflame Lighter Tube	All	W-162
Visoflame Valve w/orifice, Nat. (HW only)	All	W-163
Visoflame Valve w/orifice, LP (HW only)	All	W-163
Visoflame Tee Assembly (HW only)	All	W-164
MAIN GAS SYSTEM		
Gas Valve, G/C B69RGJ77 — ½ x ¾ — Nat.	125 & 175	V-454
Gas Valve, G/C B69RG76 — ¾ x ¾ — Nat.	250, 325, 400	V-455
Gas Valve, G/C B69RG75 — ½ x ¾ — 100% Shut-off — Nat.	125 & 175	V-456
Gas Valve, G/C B69RG74 — ¾ x ¾ — 100% Shut-off — Nat.	250, 325, 400	V-457
Gas Valve, G/C B69AG73 — ½ x ¾ — Propane	125 thru 400	V-458
Gas Valve, HWVS820H1018 — ½ x ¾ — 100% Shut-off — Nat.	125 & 175	V-491
Gas Valve, HWVS820H1000 — ¾ x ¾ — 100% Shut-off — Nat.	250, 325, 400	V-492
Gas Valve, HWVS880H1023 — ½ x ¾ — Nat.	125 & 175	V-489
Gas Valve, HWVS880H1015 — ¾ x ¾ — Nat.	240, 325, 400	V-490
Gas Valve, HWVS820B1037 — ½ x ¾ — Propane	125 thru 400	V-493
Gas Orifice, Nat. (See Note 1)	All	L-322
Gas Orifice, LPG (See Note 1)	All	L-329
Burner, Main, w/Pilot Bracket	All	L-334
Burner, Main	All	L-055
ELECTRICAL SYSTEM		
Thermostat Dial	All	U-484
High Limit Switch, set at 140° (Thermostat Box)	All	E-722
High Limit Switch, set at 150° (Under Jacket)	All	E-639
Thermostat, Laars, 70-105°	All	E-741
Cover, Thermostat	All	3725-00
Wire Harness (See Note 3)	All	E-745
Knob, Pointer Black	All	E-711
Pressure Switch, Laars, set at 2 PSI	All	R-132
Pressure Switch, Laars, (special application) set at 1 PSI	All	R-113
High Limit Switch Retainer	All	S-990
"O" Ring	All	E-363
Thermostat Retainer (Base Plate)	All	S-989
On-Off Switch		E-770

VENT SYSTEM

	MODEL SIZE				
	125	175	250	325	400
DM — LOW PROFILE — OUTDOOR					
Vent Terminal, Grate Type	N.A.	D110	D111	D112	D113
DM — STACKTOP — OUTDOOR					
Flue Top Assembly	D114	D115	D116	D117	D118
Vent Cap (Nat. Gas & Propane)	D015	See Note 2			
DM — STACKTOP — INDOOR					
Flue Top Assembly	D114	D115	D116	D117	D118
Draft Hood	D025	D026	D027	D032	D033

DESCRIPTION	FOR MODEL SIZES	PART NUMBER
WATER SYSTEM		
Pressure Relief Valve, ¾ NPT, 75 PSI*	All	A-633
Front Header	All	S-985
Rear Header	All	S-052
Header Gasket	All	S-152
Packing Collar for Flange	All	S-531
Flange	All	S-533
Flange Bolts	All	F-089
Copper Sleeve for Flange	All	S-280
Clip for Tube Baffles	All	S-572
Grommet for Drain Plug	All	S-988
Drain Cock, Rear Header (See Fig. 12)	All	P-587
Drain Plug, Rear Header (See Fig. 12)	All	P-268
Drain Cock, Front Header (See Fig. 12)	All	P-587
Bushing For P-587	All	P-185
Brass Pipe Plug ¾", Front Header	All	P-270
By-Pass Shaft & Retainer	All	S-609
By-Pass Valve Spring, White	125	S-614
Restrictor	125	S-003
By-Pass Valve Spring, Red	175	S-613
By-Pass Valve Spring, Blue	250	S-612
By-Pass Valve Spring, Brass	325	S-611
By-Pass Valve Spring Black	400	S-610
By-Pass Valve Rod Retainer	All	S-087
By-Pass Valve Disc	All	S-580
Bolt, for Front and Rear Headers, 2¾"	All	F-283
Washer, for Header	All	F-111
Nut, for Header	All	F-031
Heat Exchanger Assembly	125	3082-01
Heat Exchanger Assembly	175	3082-02
Heat Exchanger Assembly	250	3082-03
Heat Exchanger Assembly	325	3082-04
Heat Exchanger Assembly	400	3082-05
FIREBOX COMPONENTS		
Insulation, Fibreglass Blanket for Sides	All	T-020
Insulation Block, End, 16½ x 18⅜	All	T-034
Insulation Block 9½ x 21	125	T-039
Insulation Block, 12¼ x 21	175	T-035
Insulation Block, 16¾ x 21	250	T-036
Insulation Block, 21 x 21	325	T-037
Insulation Block, 26 x 21	400	T-038
JACKET COMPONENTS		
Jacket, Door, w/Latch	State Model	
Jacket, Assembly (less Top Assembly)	State Model	
Jacket, Gap Spacer	State Model	
Heat Exchanger Support Clip	State Model	
Heat Exchanger Tee-Baffle	State Model	
Flue Collector, Upper Half	State Model	
Flue Collector, Lower Half	State Model	
Clip, Draft Hood	State Model	
Touch-up Paint Can	All	X-060

*See Par. 2/11 regarding use of pressure relief valve.

NOTES:

1. For altitudes higher than 2000 feet above sea level consult factory for orifice size.
2. Purchase locally. Must be U.L. approved.
3. Heaters with Serial No. A 7508988 and below use E-745 Wire Harness. Heaters with Serial No. A 7508989 and above use E-752 Wire Harness.

TROUBLE SHOOTING CHART

Use this chart for quick reference to maintenance and service procedures.

HEATER WILL NOT COME ON

See Figs. 14, 15, & 16.

HEATER WILL NOT SHUT OFF – See Fig. 17.

What to look for	Why did this happen	What to do
1. Pressure switch is clogged.		1. See Par. 4/7.
2. Short in wire harness.		2. Check wiring (see Fig. 17).
3. Defective gas valve.	Possible debris in gas line.	3. Replace gas valve. See Par. 4/6.

SOOT HAS FORMED IN THE COMBUSTION CHAMBER AND FLAMES ARE COMING OUT OF THE SIDES OF THE HEATER

What to Look For	Why did this happen	What to do
1. Too much water flowing through heater.	Water flow valve out of adjustment causing heat exchanger fins to plug.	1. Clean heat exchanger. See Par 4/12. Adjust water flow. See Par. 4/13
2. Lack of adequate air supply.		2. Provide adeq air supply to heater. See Par. 2/4.
3. Improper venting.		3. Provide proper venting of heater. See Par. 2/4.
4. Burner air inlet throat.	Possible restriction by small animal, lint or dirt.	4. Clean burners.
5. Gas burning at orifice (flashback).	Improper gas supply.	5. Check name plate for correct gas. See Par. 2/8.
6. Time Clock out of adjustment.	If the clock prevents heater from bringing cold pool temp. up in one continuous operation, condensate damage may result	6. Adjust time clock properly. See Par. 3/2. Clean heat exchanger. See Par. 4/12.
7. Collapsed firebox.		7. Replace firebox. See Fig. 26 for access procedure.
8. Gas regulator out of adjustment.	Pressure too high.	8. See Fig. 13 for testing procedure.
9. Automatic flow control valve may be stuck shut	Mineral deposits on valve parts. Corrosion of valve parts.	9. Check for excessive hardness, acidity or chlorine Par. 3/6. Clean heat exchanger. See Par. 4/12. Repair valve. See Par. 4/13.

HEATER WILL NOT BRING POOL UP TO DESIRED TEMPERATURE

What to Look For	Why did this happen	What to do
1. Filter not operating long enough to permit heater to heat pool.	Time clock incorrectly set.	1. Re-set time clock See Par. 3/2.
2. Filter clogging up rapidly, thus reducing flow and pressure and shutting off heater.	Filter is not being cleaned often enough	2. Clean filter more frequently.
3. Thermostat out of adjustment or defective.	Damage in handling. Out of calibration.	3. Test thermostat – replace if needed. See Par. 4/8.
4. Pressure switch inoperative.		4. Test Pressure Switch. Replace if necessary. See Par. 4/7
5. Gas line too small.		5. Check gas pipe size chart. See Par. 2/8.
6. Heater too small.		6. Check pool sizing chart. Install larger heater if nec. See Fig. 1.

SCALE HAS FORMED IN ONE OR MORE TUBES IN THE HEATER

What to Look For	Why did this happen	What to do
1. Unnecessary manual by-pass valve installed.		1. Close by-pass valve and remove handle. See Par. 2/10.
2. Manual by-pass valve out of adjustment.		2. Adjust by-pass valve properly. See Par. 2/10.
3. Excessive hardness in pool water. Total alkalinity of pool water should be kept in the 80 to 100 ppm range.	Water supply is hard, pH is too high. Calcium hypochlorite is being used for chlorination. Concentration of scale forming minerals in pool due to evaporation.	3. Empty pool and refill. If supply water causes rapid scale deposit, consult a local water treatment company. Inspect and clean boiler tubes regularly.
4. Heater improperly installed.		4. See Sec. 2.
5. Automatic flow control valve may be stuck open.	Mineral deposits on valve parts. Corrosion of valve parts.	5. Check water for excessive hardness, acidity or chlorine. Also check if chlorine is being fed through heater. Repair valve See Par. 2/9, 4/13.
6. Heater staying "on" when filter flow diminishes as a result of debris.	Defective pressure switch or high limit switch.	6. Replace pressure switch or high limit switch. See Par. 4/7. and 4/9.
7. Chlorinator is connected upstream of heater.		7. Install Chlorinator downstream of heater. See Par. 2/9.

FIG 31