

**FOR YOUR SAFETY** — An odorant is added to the gas used by this appliance.  
If you smell gas:

1. **Open windows**
2. **Don't touch electrical switches**
3. **Extinguish any open flame**
4. **Immediately call your gas supplier**

Do not store or use gasoline or other flammable liquids or vapors in the vicinity of this or any other appliance.

# Installation, Operating and Servicing Manual

parts**4**heating  
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for

## MARK V POOL HEATER

TYPE DR

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 **TELEDYNE LAARS**

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## 1/1. INTRODUCTION

This instruction manual supplies assembly, installation, operation and maintenance information for the Teledyne Laars Mark V Swimming Pool Heater. A check-out procedure is included in Section 5 for quickly isolating troubles should they occur.

It is strongly recommended that the installation procedure in Section 3 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 or for heating of salt water pools. Consult factory for the proper Teledyne Laars products applicable to these functions.

Mark V swimming pool heaters are design certified by the American Gas Association as complying with the American National Standards Institute Standard 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.

*For spa and hot tub heater sizing see Document 3038.*

## 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.<br>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 swimming season. Table is based on 3½ mph average wind and average pool depth of 5.5 feet.

**Intermittent Heating Selection Table (Thrift Heating)**

| TEMP.<br>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 / Assembly Instructions

## 2/1. GENERAL

There are two types of Mark V pool heaters — the Low Profile and the Stacktop. The heaters are shipped in either two or three packages for assembly at poolside, or at the warehouse before delivery to the job site. The Mark V **Low Profile Heater** (Outdoor Only) comes in two packages:

1. Pool Heater Assembly
2. Grate Top Assembly

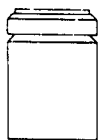
The Mark V **Stacktop Heater** (Indoor or Outdoor) requires three packages:

1. Pool Heater Assembly
2. Stacktop Assembly
3. Draft Hood for *indoor* installation OR Vent Cap/ Stack for *outdoor* installation.

See tables below for proper part numbers.

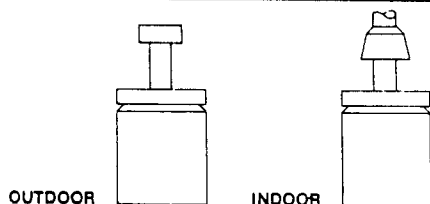
Low Profile Models — *Outdoor Only*.

| Model | Top Assembly |
|-------|--------------|
| 125   | D153         |
| 175   | D110         |
| 250   | D111         |
| 325   | D112         |
| 400   | D113         |



Stack Top Models — *Indoor/Outdoor*.

| Model | Top Assembly | Draft Hood | Vent Cap/ Stack |
|-------|--------------|------------|-----------------|
| 125   | D114         | D025       | D005            |
| 175   | D115         | D026       | D006            |
| 250   | D116         | D027       | D007            |
| 325   | D117         | D032       | D008            |
| 400   | D118         | D033       | D009            |



## 2/2. REVERSIBLE HEAT EXCHANGER

Before assembling the Pool Heater and the selected Top Assembly, note that the Mark V heater can be installed with the water connections at either end.

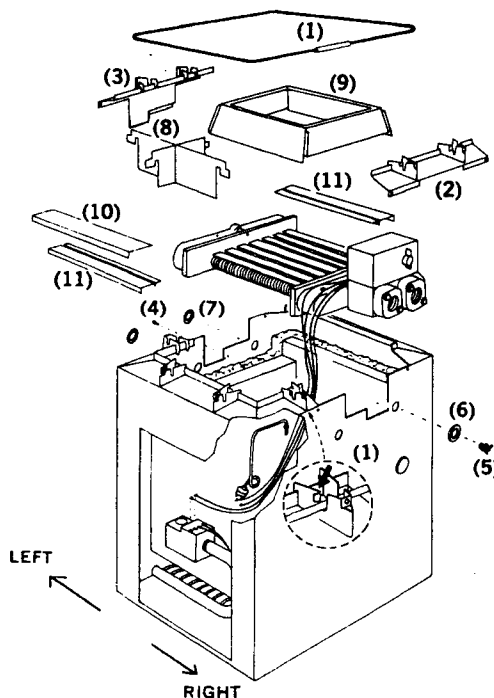
The pool heating assembly is shipped with the water connections on the *right* side of the heater. Left side water connections can often simplify installation and improve access for heater service and maintenance. The change from *right* to *left* is easily made either at the warehouse or at poolside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

Follow these step-by-step instructions and the accompanying drawing:

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).



## 2/3. ASSEMBLING THE MARK V POOL HEATER

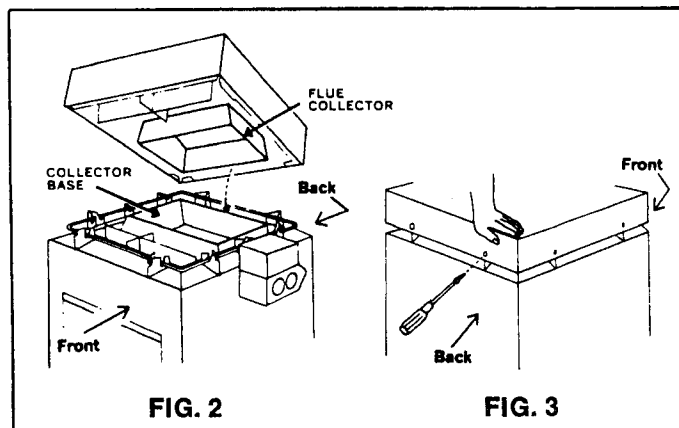
(1) Place Top Assembly (Grate Top or Stack Top) on the Heater Assembly so that the flue collector (attached to the Top Assembly) seats on the lower flue collector (on the heater assembly). See Fig. 2. The flue collector is designed to seat loosely, allowing movement for alignment of the screw holes.\*

(2) Align the two screw holes on the back side of the boiler, insert two self-threading screws (furnished) and tighten *part way only*. See Figure 3.

(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.

*\*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.*



See Fig. 7 for proper installation of Draft Hood or Vent Cap/stack on Stacktop models.

## Section 3 / Installation Instructions

### 3/1. GENERAL

This pool heater must be installed in accordance with all local codes and ordinances and the National Fuel Gas Code, ANSI Z 223.1 — 1974.

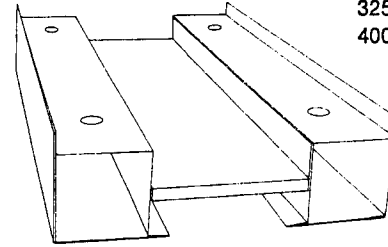
The Mark V pool heater is design certified for use only on a noncombustible surface. However, the heater may be placed on other than noncombustible floors *if* heater is installed on a *special base assembly* available from Teledyne Laars. See Fig. 4 for part number of base assembly for each heater size.

Under the National Fuel Gas Code it is also permissible to place the heater on other than noncombustible floors when the installation complies with the requirements of the American Insurance Association. These requirements specify that the floor under the heater be protected with hollow masonry not less than 4" thick, covered with sheet metal of not less than 24Ga. Such masonry must 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. See Fig. 5.

*Heater must be level.*

### NON-COMBUSTIBLE BASE

| HEATER MODEL | SPECIAL BASE NUMBER |
|--------------|---------------------|
| 125          | 4022-01             |
| 175          | 4022-02             |
| 250          | 4022-03             |
| 325          | 4022-04             |
| 400          | 4022-05             |



NOTE:  
ADDS 4" TO OVERALL  
HEIGHT OF HEATER

FIG. 4

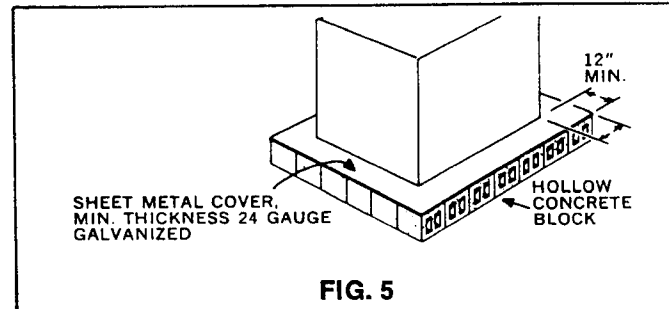


FIG. 5

### 3/2. OUTDOOR INSTALLATION OF LOW-PROFILE AND STACK-TOP MODELS

Heater must be located in an open, unroofed area. Minimum clearances from combustible construction for service access must be maintained as follows:

Blank side and rear of heater.  
Front of heater and piping side.

6" Minimum clearance to combustible construction.  
18" Minimum clearance for service access.

Never install the heater under any kind of roof overhang. Do not locate heater below or adjacent any doors, windows, louvers, grills, etc. which communicate in any way with an inhabited area of building, even though such communication might be through another structure such as a garage or a utility room. (Fig. 6).

Do not install heater under an eave where roof drainage falls directly on the heater.

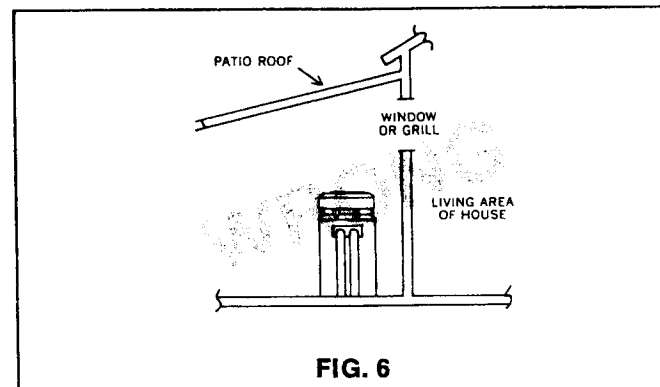


FIG. 6

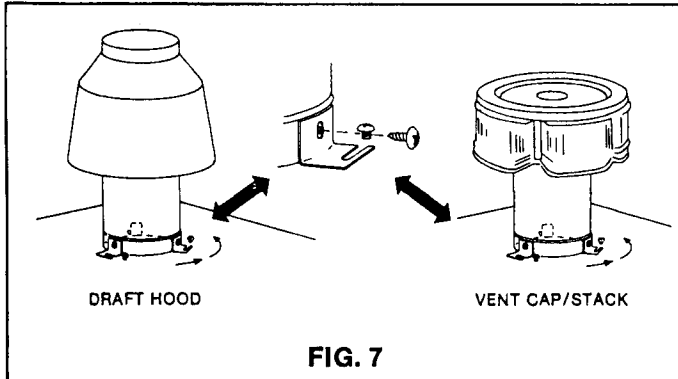
### Low Profile (Grate Top) Models

**IMPORTANT:** When locating a low profile heater, consider that high winds can roll over or deflect off adjacent buildings and walls and create a draft reversal causing flame rollout which might damage the controls. Normally, placing the heater at *least three feet* from any wall will prevent this condition. (If conditions are severe, a heater with Stacktop and Vent Cap/Stack should be selected).

### Stack Top Models

Mark V Stacktop heaters can be installed outdoors if equipped with the factory-supplied Vent Cap/Stack. Refer to Section 2/1 for the correct part number or check rating plate on the heater.

See Fig. 7 for proper installation of Vent Cap/Stack.

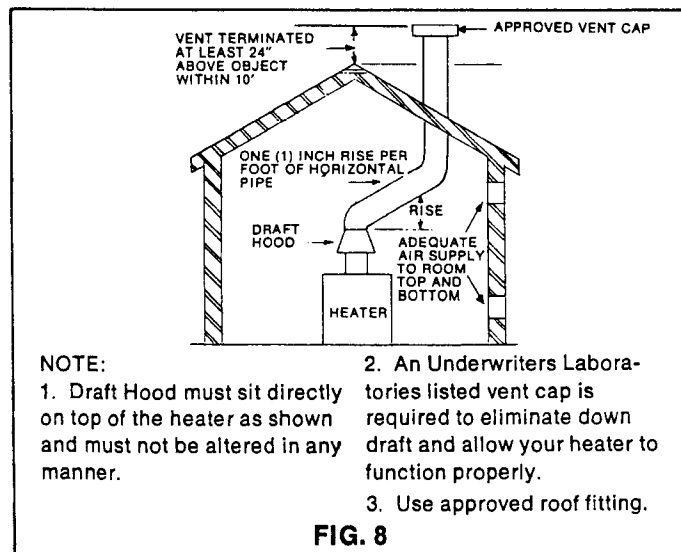


### 3/3. INDOOR INSTALLATION OF STACKTOP MODELS

Mark V pool heaters, when equipped with the Stacktop assembly and the proper draft hood are design-certified for indoor installation. The draft hood must be the one furnished by the factory and must be installed without modification. See Section 2/1 for correct draft hood part number or check rating plate on heater.

Install Draft Hood directly on top of heater. See Fig. 7 for proper installation of Draft Hood.

The Draft Hood must be connected to a vent of the same or larger size, terminating at least two feet (2') above any portion of the roof or other object which is within 10' of the stack. The vent should have an approved cap installed which permits a full equivalent opening for flue products. See Fig. 8.



### Heater clearances

Minimum clearances from combustible construction and for service access must be observed as follows:

|                                  |   |
|----------------------------------|---|
| Blank side and rear of heater.   | 6" Minimum clearance to combustible construction. |
| Front of heater and piping side. | 18" Minimum clearance for service access.         |

### Combustion and Ventilation Air Supply

When the heater is installed in a room or enclosure, there must be uninterrupted openings to *outside air* for combustion and ventilation. The table below shows the net free opening areas required at *both ceiling and floor* for each heater model. Teledyne Laars does not recommend installations which depend on infiltration for combustion.

| Model   | Net Free Opening Area     |                           |
|---------|---------------------------|---------------------------|
|         | At Ceiling                | At Floor                  |
| 125/175 | 1/2 sq. ft. (72 sq. in.)  | 1/2 sq. ft. (72 sq. in.)  |
| 250     | 3/4 sq. ft. (108 sq. in.) | 3/4 sq. ft. (108 sq. in.) |
| 325     | 3/4 sq. ft. (108 sq. in.) | 3/4 sq. ft. (108 sq. in.) |
| 400     | 1 sq. ft. (144 sq. in.)   | 1 sq. ft. (144 sq. in.)   |

### Special ventilation for propane-fired pool heaters

All liquified petroleum gases are heavier than air, hence structures above ground for housing pool heater, regulators, meters etc., must have open vents near the floor level. Such equipment must not be installed in pits or underground vaults unless suitable provisions for forced ventilation are made.

### 3/4. ELECTRIC WIRING — WARNING

*Do not connect heater to any source of electricity.*

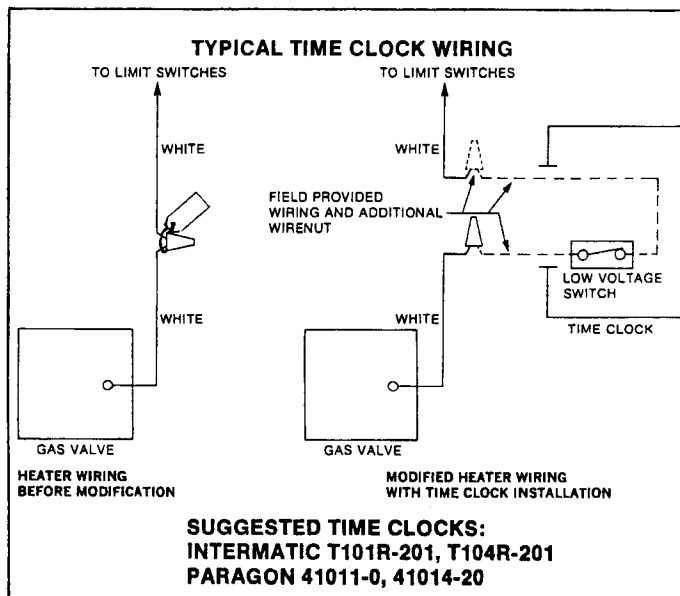
The Teledyne Laars Mark V has a built-in Thermo-electric Generator. This provides a completely self-contained electrical system, and no external connections are required. Any attempt to make external electrical connections will damage the heater.

### 3/5. 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 (fireman switch) timing is adjustable, set switch to shut off heater approximately 15 minutes ahead of filter pump. This allows the residual heat to be carried into the pool water and prevents excessive heat build-up in the heat exchanger.

To incorporate a timeclock auxiliary switch into the control wiring of the heater, do the following:

1. Remove door to gas valve compartment.
2. Remove factory-provided wire nut from white wire tagged "fireman switch", and separate the ends.
3. Connect the field installed wires from the timeclock auxiliary switch to these ends with wire nuts. Field provided wire should have at least 3/64" thick insulation and a temperature rating of 105°C. or greater.



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.

### 3/6. WATER PIPING

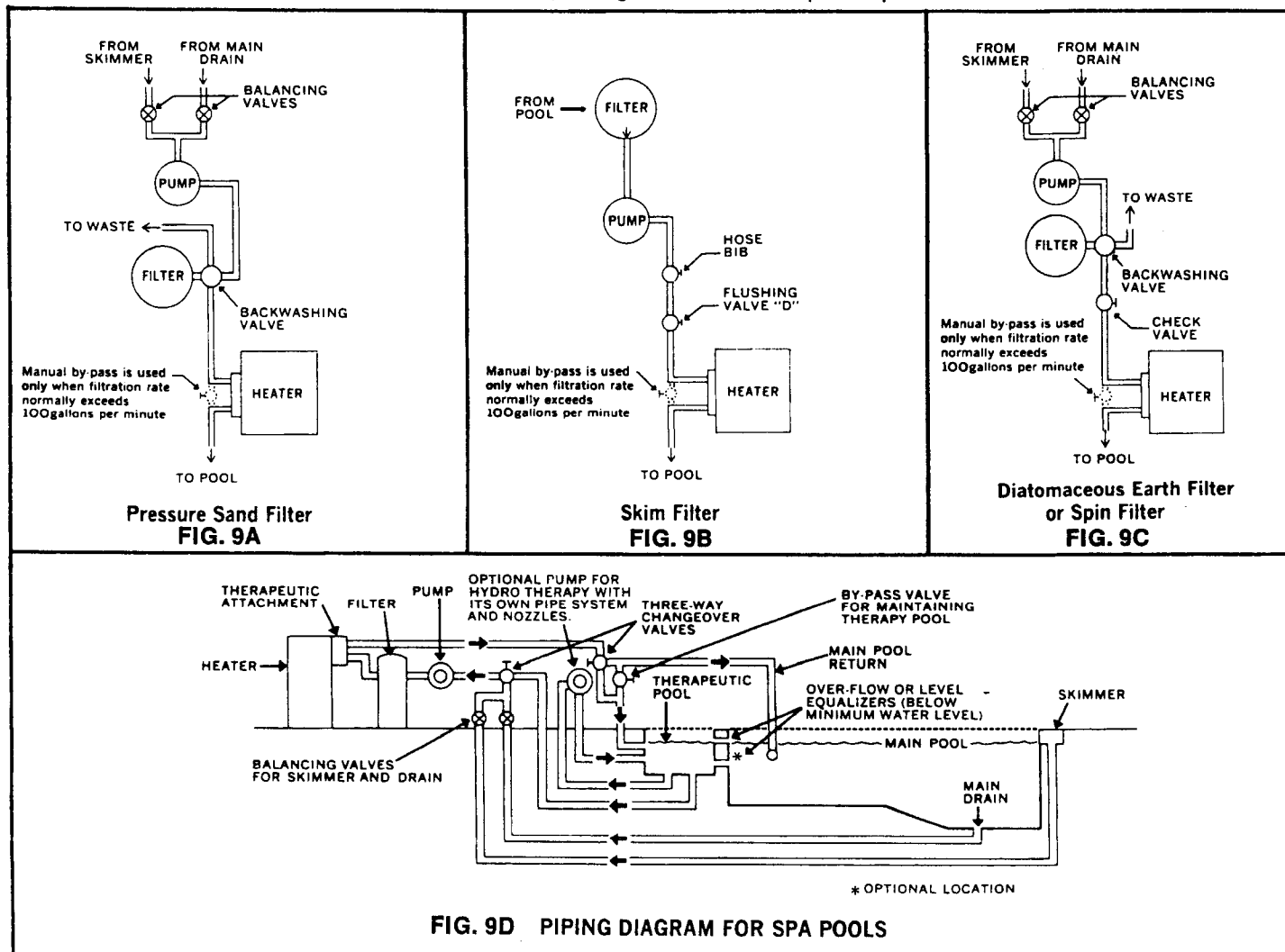
1. The piping diagrams shown in Figure 9 cover nearly all situations and various types of filters. Select the one which best fits your installation.

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 10.

### SUGGESTED PIPING ARRANGEMENT FOR VARIOUS TYPES OF FILTERS:

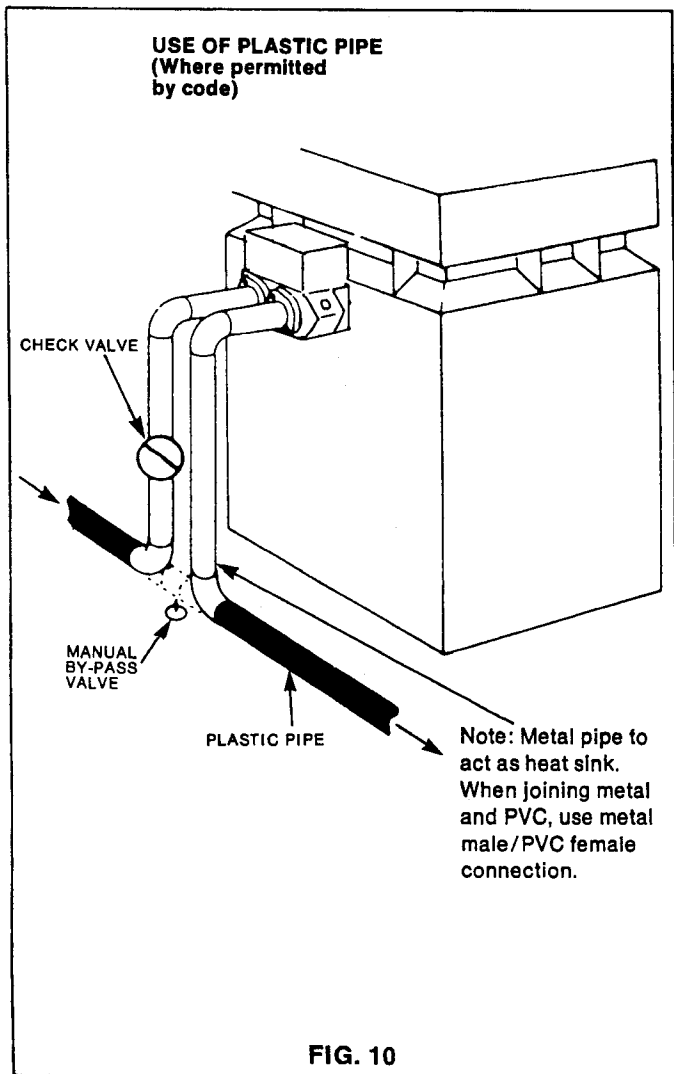
Check local plumbing and boiler codes for special requirements



**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. 10.

The Universal Flange Coupling furnished with the heater accepts threaded  $1\frac{1}{2}$ " iron pipe, unthreaded  $1\frac{1}{4}$ " iron pipe and  $1\frac{1}{2}$ " copper pipe without adapter. See Figure 11.

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 90 gpm:
  - a. Provide manual by-pass valve shown in drawings. (Figs. 9A, B, C, D.)
  - b. Install thermometer in threaded drain provision to the right of header casting. See Figure 12.
  - c. Set by-pass as follows:
    - (1) Clean filter.
    - (2) Close by-pass valve.
    - (3) Close heater main gas valve.
    - (4) Start filter pump.

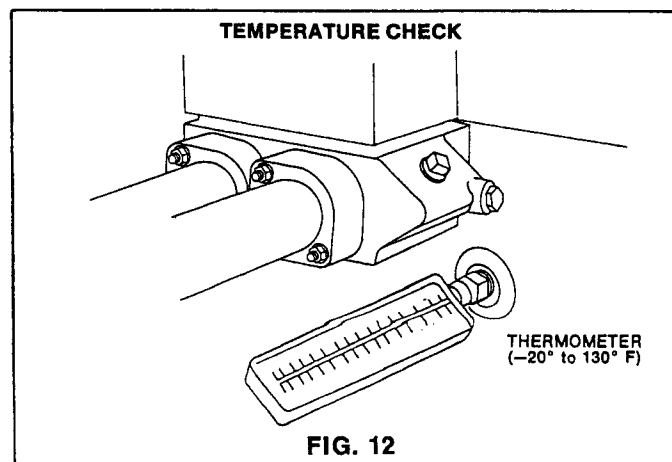
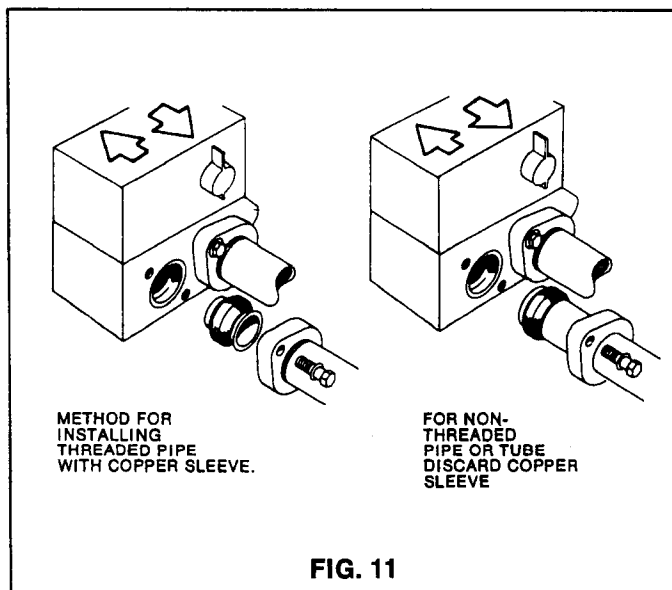


- (5) After 3 minutes note and record thermometer reading (this is pool temperature).
- (6) Open heater main gas valve and start heater.
- (7) Gradually open manual by-pass valve until thermometer reads the temperature differential shown in the table below. The valve must be as near closed as possible 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.<br>TEMP. DIFF. |      | Minimum<br>filter system<br>flow in GPM |
|-------|---------------------------------|------|---|
|       | MIN.                            | MAX. |   |
| 125   | 22                              | 32   | 15                                      |
| 175   | 22                              | 28   | 15                                      |
| 250   | 22                              | 28   | 20                                      |
| 325   | 24                              | 32   | 25                                      |
| 400   | 24                              | 34   | 35                                      |

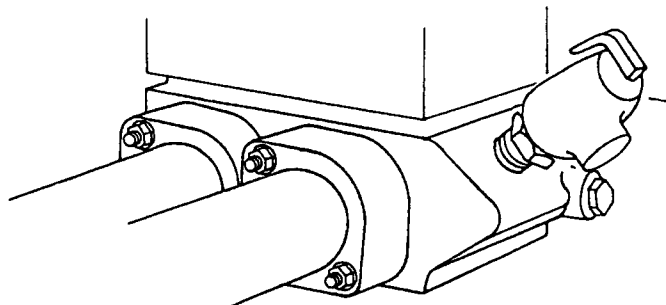
- (8) Be sure thermometer reading remains constant for at least 3 minutes.
  - (9) Remove handle from by-pass valve, since this is now a permanent adjustment to your system.
- The automatic by-pass valve in the heater will take over and will maintain proper flow through the heater at all times.





### 3/7. PRESSURE RELIEF VALVE

A pressure relief valve is not furnished with Mark V 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  $\frac{3}{4}$ " brass pipe plug should be left in place.



### 3/8. 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 cases, follow the detailed instructions for adjusting the switch contained in Fig. 13.

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. 13 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  $\frac{1}{4}$  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.

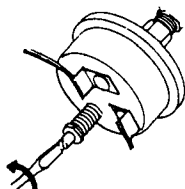


FIG. 13

### 3/9. AUTOMATIC CHLORINATORS

A concentration of chlorine in the heater can be very destructive. Heater damage caused by excessive concentrations of chlorine, for any reason, is not covered by the heater warranty.

#### IMPORTANT:

1. The chlorinator should be provided with an anti-syphoning device so that if the piping drains after the pump shuts off, chlorine will not syphon into the heater.
2. An electric 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. If the chlorinator is equipped with its own pump, it should be installed so it introduces the gas or solution downstream from the heater, and if possible, at a position lower than the heater outlet fitting.

### 3/10. GAS SUPPLY AND PIPING

Heaters are normally fitted for operation at altitudes below 2,000 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               |
| 0-50'               | $\frac{3}{4}$ "   | 1"                | 1"                | 1 $\frac{1}{4}$ " | 1 $\frac{1}{4}$ " |
| 50-100'             | 1"                | 1"                | 1 $\frac{1}{4}$ " | 1 $\frac{1}{4}$ " | 1 $\frac{1}{4}$ " |
| 100-300'            | 1 $\frac{1}{4}$ " | 1 $\frac{1}{4}$ " | 1 $\frac{1}{4}$ " | 1 $\frac{1}{2}$ " | 1 $\frac{1}{2}$ " |

For Propane Gas use size smaller except 125 size which requires  $\frac{3}{4}$ " from 0'-50'.

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:                                    |             |             |
| Without pressure regulation (B69AG92 Gas Valve) | Maximum 12" | Minimum 11" |
| With pressure regulation (B69R9G98 Gas Valve)   | Maximum 14" | Minimum 11" |

\*5.5" minimum for Model DR-400.

The Pressure Regulator is pre-set at the factory and normally does not need adjustment.

For correct procedure for gas pressure measurement see Fig. 16.

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.

Before operating the pool heater, test all gas connections for leaks.

## Section 4 / Operating Instructions

### 4/1. LIGHTING AND SHUTDOWN

Full lighting and shutdown instructions are included on the rating plate attached to the heater inside the controls compartment.

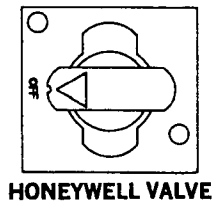
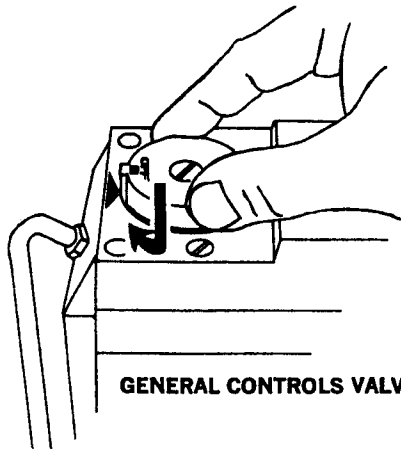
When lighting or relighting the pilot always turn the temperature control to its *lowest setting* and turn the gas valve and toggle switch to OFF. WAIT FIVE MINUTES.

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.

#### ● Lighting

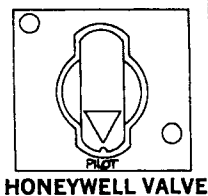
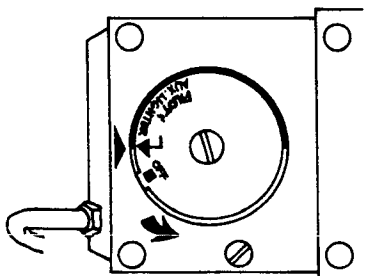
### Step 1.

Press Gas Valve Knob and turn clockwise to OFF. WAIT FIVE MINUTES.



### Step 2.

Turn Gas Valve Knob counter-clockwise to PILOT position.

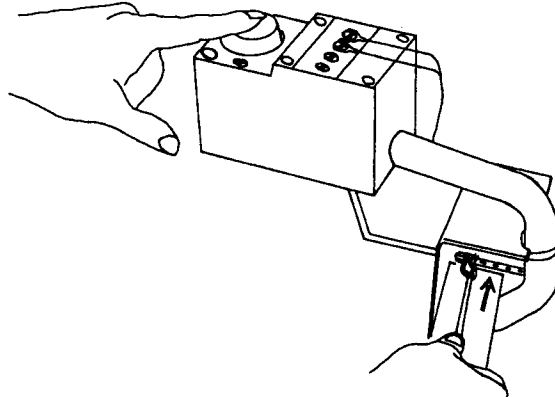


### Step 3.

Light Pilot using VISOFLEAME Lighter Tube.

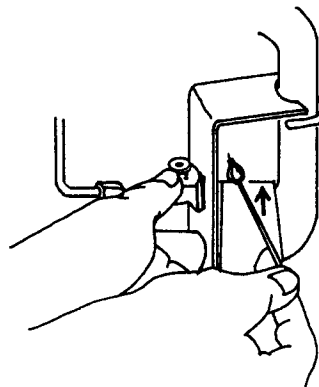
General Controls valve:

Press valve knob down and light gas at VISOFLEAME tube. Hold valve knob down for 30 seconds, then release.



Honeywell valve:

Press VISOFLEAME button down and light gas at VISOFLEAME tube. Hold button down for 30 seconds, then release.



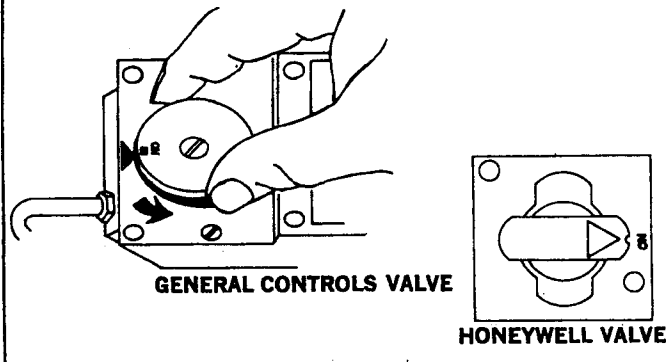
The VISOFLEAME lighter tube permits ignition of the pilot at arms length without bringing the head or face near the firebox opening or the burner tray. The VISOFLEAME tube is also used to prove pilot ignition — depress gas valve knob (on General Controls valve) or VISOFLEAME button (on Honeywell valve) and flame will return to the lighter tube and be visible if pilot is lit.

**NOTE:** Heaters having 100% gas shut-off controls and Honeywell gas valve require that both the VISOFLEAME button and the gas valve knob be depressed simultaneously for 30 seconds.

A notch is provided in the VISOFLEAME instruction plate to hold a lighted match while these buttons are held down.

## Step 4.

Turn on main burners by turning knob counter-clockwise to ON position.



5. Replace door.
6. Position toggle switch to ON.
7. Turn the Temperature Control to higher setting to bring on the main burners.

**NOTE:** The on/off toggle must be ON for heater to operate.

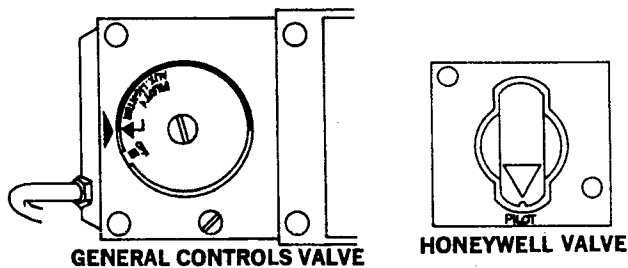
### ● Relighting

If pilot goes out, repeat steps 1 through 4.

### ● Shutdown

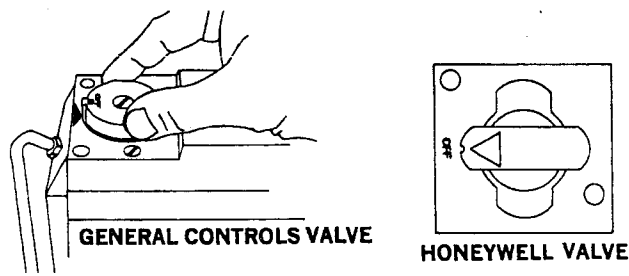
## Step 1.

To shut off main burners, turn knob to pilot position. Or move toggle switch to OFF.



## Step 2.

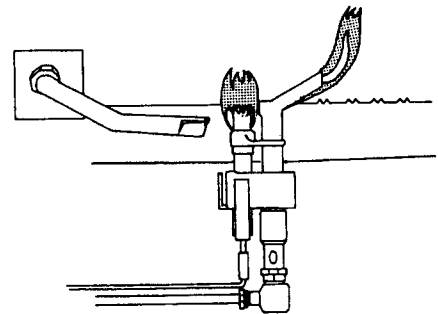
For complete shut off, press knob and turn to OFF position.



## 4/2. 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 pump.
2. Make sure pilot has stable flame.



3. Position toggle switch to ON.
4. Turn gas valve knob to 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.

**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.

## 4/3. 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.

## 4/4. TEMPERATURE CONTROLS

The Mark V temperature 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 indi-

cated by the nine marks on the face of the dial. (See Fig. 14). Use a pool thermometer to determine the best swimming temperature for you and mark the pointer position of the thermostat dial face for reference.

The pool heater is equipped with an ON/OFF switch on the side of the temperature 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 4/5 "Spring and Fall Operation."

**IMPORTANT:** The Mark V Temperature Control cannot be calibrated in the field. If control is faulty, replace according to instruction in 5/8. Do not use the temperature control to shut off the heater. The ON/OFF switch will shut the heater off except for the pilot light. The heater can be completely shut off only by turning the main gas valve to OFF.

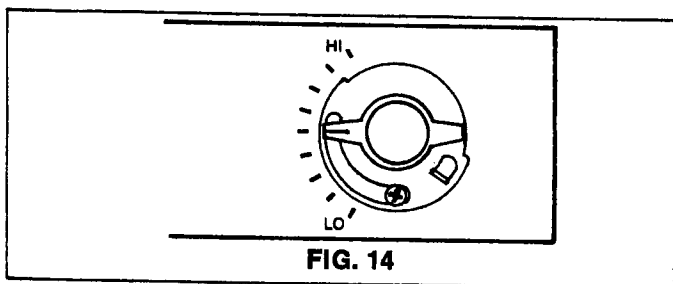


FIG. 14

#### 4/5. 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 "LO." 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.

**CAUTION:** In areas where freezing weather occurs drain heater before first frost. Shut off all gas valves. Drain the heater by opening the drain cock(s), and removing all drain plugs. (See Fig. 15).

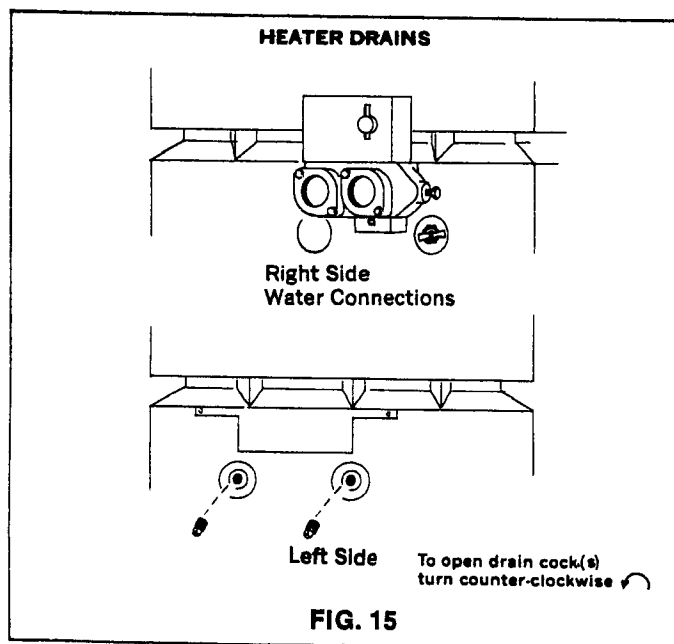


FIG. 15

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.

*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 pool water temperatures less than 70°F. 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.*

If your area has only the occasional short cold snap, the stagnant water in the heat exchanger can still freeze any time the filter pump shuts down. To protect the heater during such periods, 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.

#### 4/6. 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.

#### 4/7. 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 hydro-therapeutic 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 V 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.

#### 4/8. POOL ENERGY SAVING TIPS

The following recommendations are offered to assist in conserving fuel use, and in minimizing the cost of operating your pool heater without sacrificing pool comfort unduly.

- (1) Reduce the heater thermostat setting to maintain a 78 degree or lower temperature. The National Swimming Pool Institute and the American Red Cross hold that the most healthful swimming temperature is 78 degrees. Be certain that you are using an accurate pool thermometer. A variance of four degrees — from 78 degrees to 82 degrees — will use as much as 40% more gas.
- (2) Heat pools only during the three month summer swimming season. Heating a pool for three rather than five months will reduce gas consumption by an additional 33%.
- (3) Mark the proper setting on your pool heater thermostat control and discourage further adjustment.
- (4) Set your filter time clock to start the pump no earlier than 6 a.m. during the pool heating season. This is the time when nightly heat loss stabilizes.
- (5) For pools which have only weekend use, heater thermostat setting should be reduced by eight or 10 degrees during the week. Thermostat should be reset to the 78 degree level before use.
- (6) During the winter and when on vacation for more than one week, turn off the pool heater, including the pilot light.
- (7) Shelter the pool where possible from prevailing winds by using well trimmed hedges or other landscaping, cabanas or fencing as windbreaks.
- (8) Use a pool cover where practical. This will reduce heat loss due to evaporation, conserve chemicals and reduce dirt load on filtering systems.
- (9) Before relighting the pilot light and the heater at the beginning of each swimming season have a competent swimming pool heater technician inspect it and make any needed adjustments. Follow a regular program of preventive maintenance. An annual inspection and de-liming of the heat exchanger when necessary will maintain heating efficiency.

#### 4/9. PERIODIC INSPECTION

The Mark V has been designed and constructed for a long performance 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.

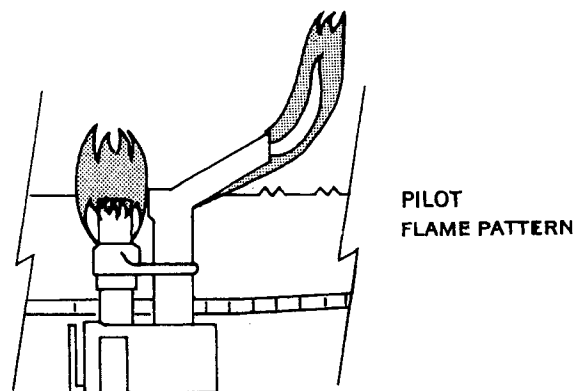
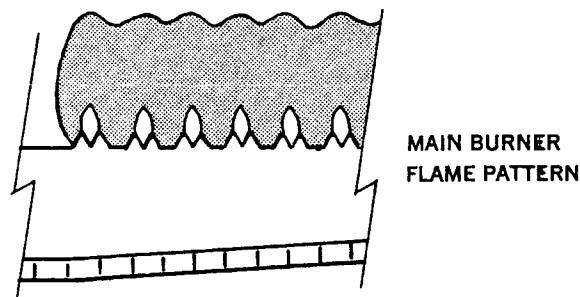
1. Keep leaves and debris off of grate top on low-profile heaters. On outdoor stack-top models, check that vent cap/stack is fastened securely and is clear of debris.
2. Check venting of indoor stack-top heaters for looseness and leaks. Make certain that all openings to outside air are unobstructed.

3. *Inspect the internal wet surfaces of the heat 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 5/11.

4. 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.

5. Check for spider webs in pilot and burner orifices especially at spring start-up.

6. Make a visual check of the burner and pilot flame. Flame pattern should be as shown.



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

Specifically, these include:

- a. High Temperature Limit Switch. See Par. 5/9.
- b. Water Pressure Switch. See Par. 5/7.
- c. Automatic Gas Valve. See Fig. 18.

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.

## Section 5 / Maintenance

### 5/1. GENERAL PRECAUTIONS

This section contains instructions for use by a qualified serviceman in 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. 32.

### 5/2. REGULATED GAS PRESSURE

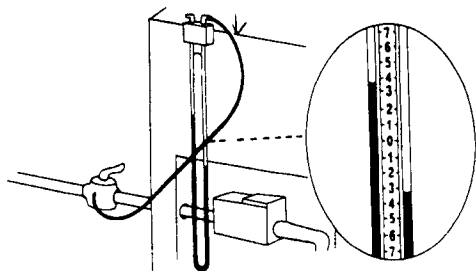
It is desirable to check the main line gas pressure and the regulated gas pressure in the heater manifold to make sure both are adequate to operate the heater. (See paragraph 3/10). A slack-tube manometer is a convenient way to check this, and a kit is available from factory. Instructions for operating the manometer are included with the test kit, but the proper connection is shown in Figure 16.

### 5/3. 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. 20 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  $\frac{1}{8}$ " NPT test plug in upstream shut-off valve as illustrated.
5. Screw in  $\frac{1}{8}$ " 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 the manometer. With burners on, readings should be as follows:
  - 5" to 7" WC — Natural Gas
  - 11" to 12" WC — Propane without pressure regulation (B69AG92 Gas Valve)
  - 11" to 14" WC — Propane with pressure regulation (B69R9G98 Gas Valve)



#### TESTING MANIFOLD REGULATED GAS PRESSURE

1. Attach slack tube manometer to heater jacket.
2. Open both valves on manometer.
3. Shut off manual main gas valve.
4. Remove  $\frac{1}{8}$ " NPT Plug on valve outlet face and screw in  $\frac{1}{8}$ " fitting from manometer kit. Connect manometer hose to fitting and to one of the manometer valves.
5. Wait five minutes. Relight pilot as instructed on rating plate and bring on main burners.
6. Manometer should register as follows:
  - 4" WC — Natural gas
  - 11" WC — Propane without pressure regulation (B69AG92 Gas Valve)
  - 9" WC — Propane with pressure regulation (B69R9G98 Gas Valve)
7. To adjust regulated gas pressure:
  - Natural gas — 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" WC.
  - Propane gas, with pressure regulation — same as on natural gas, but adjust to 9" WC.
  - Propane gas, without pressure regulation — consult gas supplier for tank regulator adjustment to provide 11" WC.

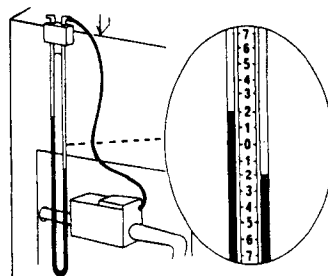


FIG. 16

## 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 3.
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 at mid-range 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.

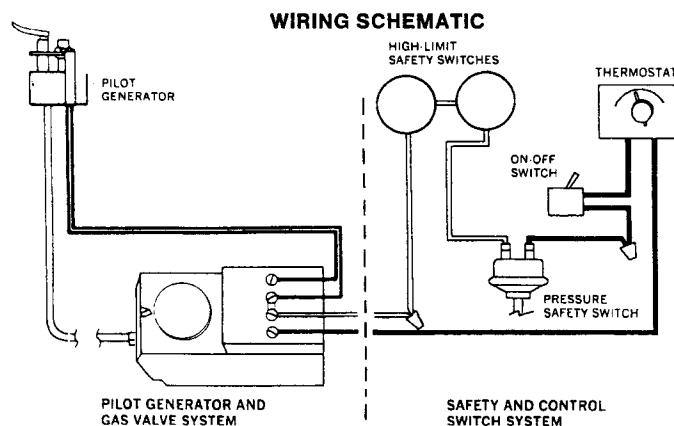
**If Heater Still Does Not Operate, Remove Control Compartment Door And —**

6. Make sure pilot is ON and adjusted properly. See Para. 4/2.
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.



**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. 20A.

**FIG. 17**

### 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:

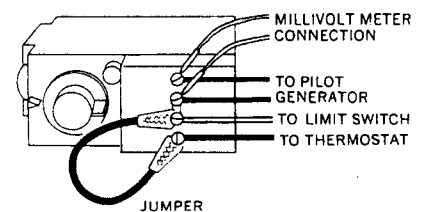
With jumper in place, connect leads from millivolt meter to gas valve as shown below. Reverse leads if needle deflects in opposite direction.

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 500 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 5/4. The generator must be properly enveloped in the pilot flame to generate its full potential. Note: In order to conduct this test on heater with 100% shut-off control, the gas control knob must be held down to prevent the pilot from going out.

If heater still does not come on after replacement of pilot generator cartridge, the problem is in the gas valve. Replace valve. See paragraph 5/6.

**WARNING:** Never leave a jumper on a heater control to keep the heater operating.



**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. 20A.

**FIG. 18**

## Step 3.

If the heater comes on when the jumper is installed as in Fig. 18 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.

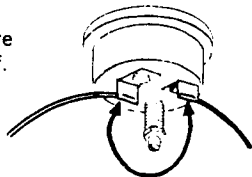
**IMPORTANT:** If water flow through the heater is stopped after the heater has been on for more than three (3) minutes, the residual heat in the firebox will heat the standing water in the tubes and travel to the pool thermostat and the high-limit switches. This may prevent the heater from coming ON 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.

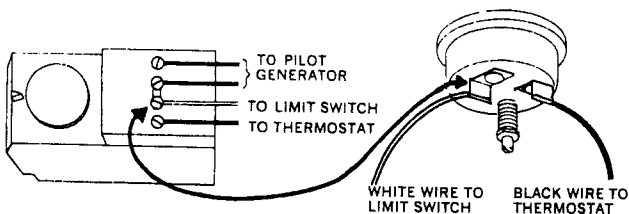
Remove control compartment door. Rotate thermostat shaft clockwise to the stop.

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

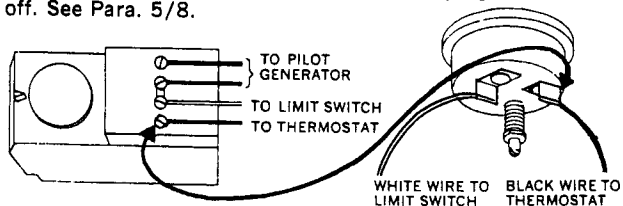
1. First put a jumper wire here.  
If heater comes on, the Pressure Switch is keeping the heater off.  
See paragraph 5/7.



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. 5/9.

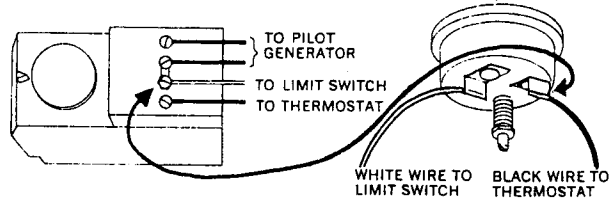


3. Connect jumper to the black wire terminal on pressure switch and the black wire of wiring harness that is connected to gas valve terminal block. If the heater comes on, the temperature control or toggle switch is keeping the heater off. See Para. 5/8.

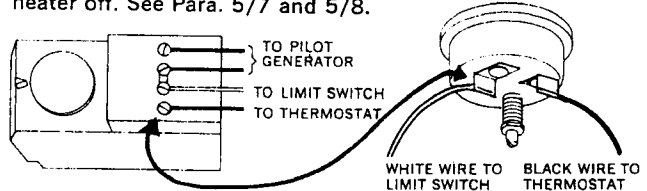


**Note:** The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 20A.

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. 5/7 and 5/9.



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 temperature control (or toggle switch) are keeping the heater off. See Para. 5/7 and 5/8.



### 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 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 1/2 turn about a dozen times to make sure the contacts are clean. Readjust the pressure switch by the procedure in Figure 13.

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 10 mv drop across the toggle switch, flip toggle several times. If this does not eliminate the excessive drop, replace the switch.

11. If there is more than a 10 mv drop in the high limit switches check each switch independently as shown in Fig. 26. 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.

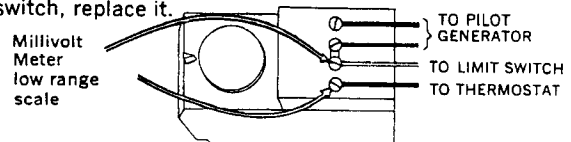


FIG. 19



## 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:

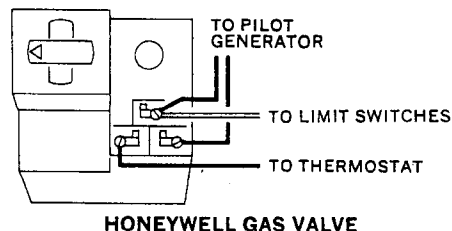
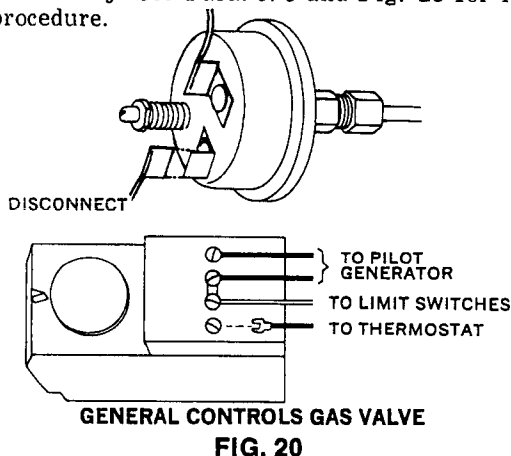
1. *Switch may be out of adjustment.* See Para. 3/8 for proper adjustment procedure.
2. *Syphon loop may be clogged.* Disassemble switch assembly and blow out until clear. See Para. 5/7.
3. *Pressure switch may be defective.* See Para. 5/7. for testing and replacement procedure.

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. 5/6 and Fig. 23 for replacement procedure.



**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. 20A

## 5/4. PILOT GENERATOR REPLACEMENT

The procedure for testing the pilot generator is found in Figure 18. To remove the pilot and generator assembly follow the steps in Fig. 21.

### 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. 5/10.

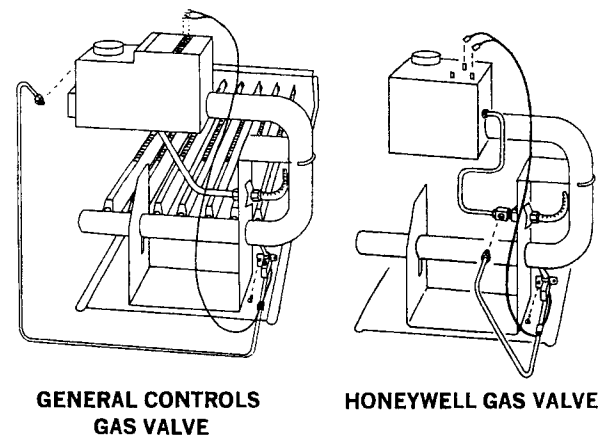


FIG. 21

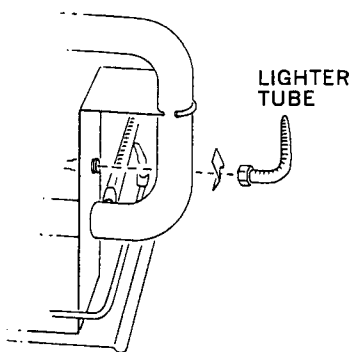
## 5/5. VISOFAME PILOT LIGHTER

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. 22

### 5/6. 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 5/3, Step 2. To remove and replace gas valve, follow steps in Fig. 23.

#### 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.

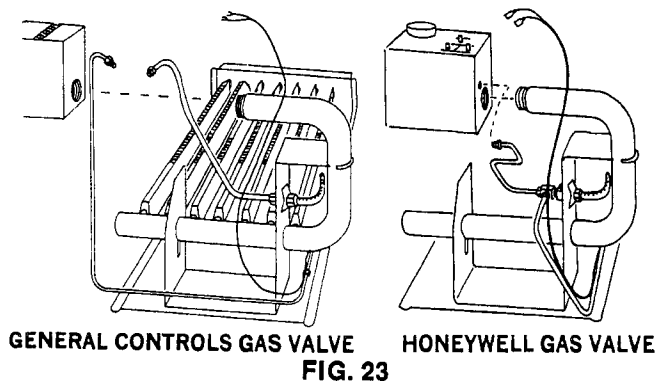


FIG. 23

### 5/7. TESTING PRESSURE SWITCH

1. Turn thermostat to maximum warm position.

2. With filter pump running, if connecting a jumper across the pressure switch (Fig. 19) 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. 24 and 20A.

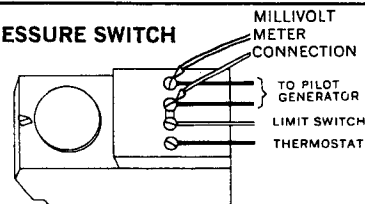
Start and stop the filter pump. The meter should register 200 millivolts or more when the pump and heater come on under normal conditions and should jump cleanly to 500 millivolts or more when the pump is shut off.

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. 20A.

#### 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.

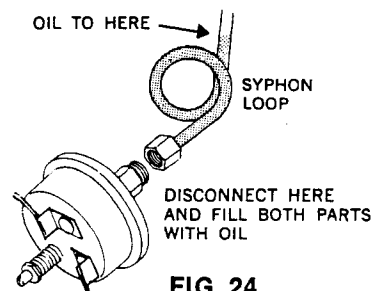


FIG. 24

### 5/8. TESTING TEMPERATURE CONTROL

The control 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 control 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.

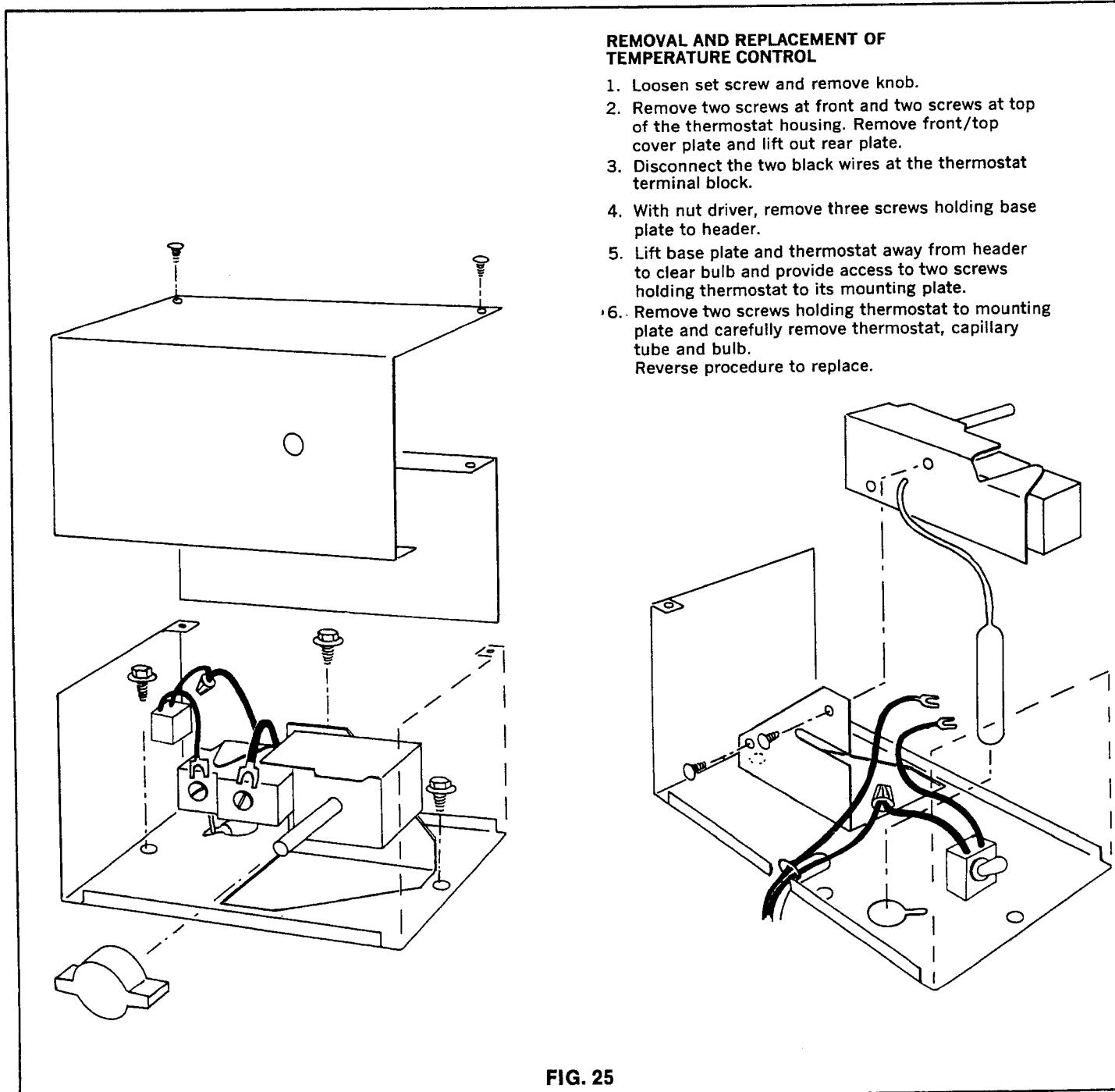
The condition of the control can be checked with a millivolt meter.

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

Rotate 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. 25.

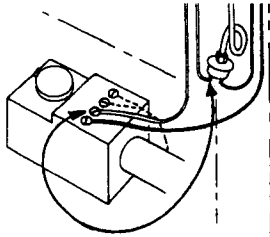


## 5/9. HIGH LIMIT SWITCHES.

**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. 26.

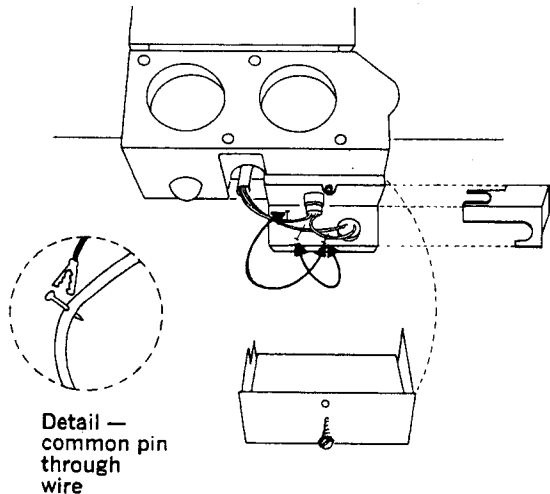
### TESTING AND REPLACEMENT OF HIGH LIMIT SWITCHES

1. Install thermometer as shown in Fig. 12.
2. Install a jumper between the white wire terminal 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 5/13). 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.

**REMOVE ALL JUMPERS WHEN TESTING IS COMPLETE.**

**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. 20A.

**FIG. 26**

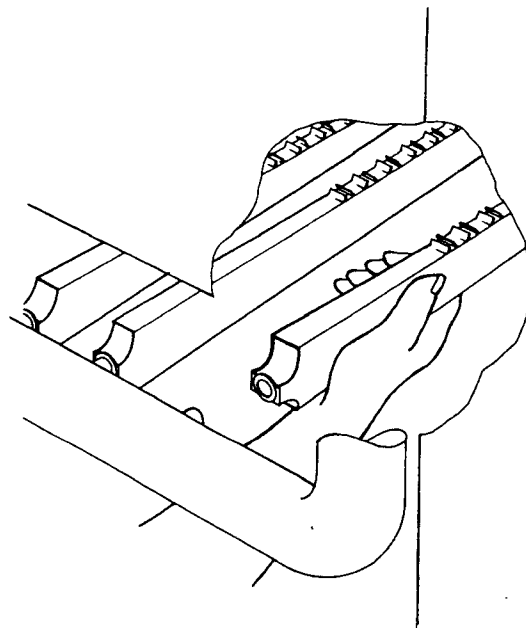
## 5/10. REMOVAL OF THE GAS BURNERS.

### 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.

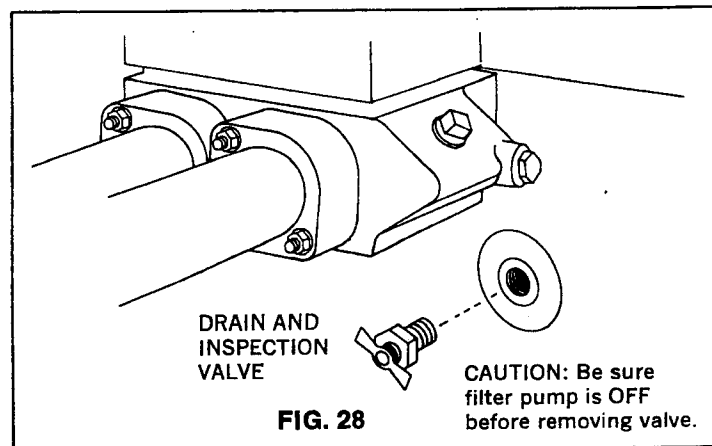


**FIG. 27**

## 5/11. PERIODIC INSPECTION OF HEAT EXCHANGER WATER PASSAGES

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 28. The complete heat exchanger inspection is accomplished by removing it from the heater as shown in Figure 29.

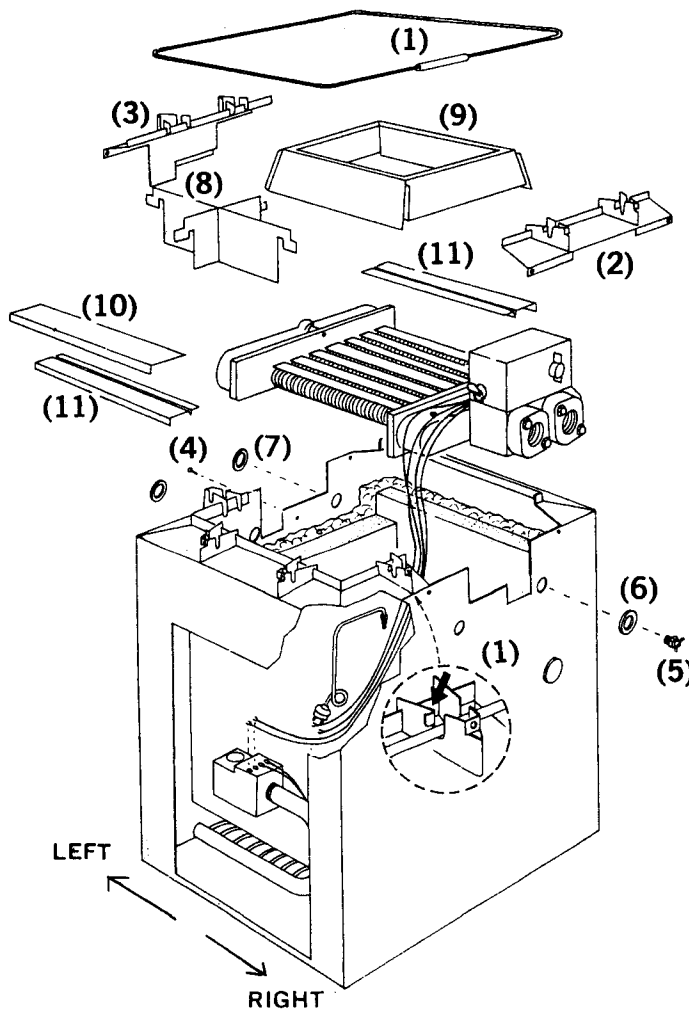
The tubes should be inspected after 60 days of operation, and then again after 120 days of operation. From the appearance of the tubes, it will then be possible to set up a regular inspection schedule.



## 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.



## 5/12. 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. Light accumulation of soot or corrosion on the outside of the tubes can be readily removed with a wire brush if the tube heat baffles are removed. If soot or corrosion is heavy, remove the heat exchanger to allow thorough cleaning and to prevent any removed material from falling into the burners or blocking the burner ports.

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. 30. 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 30.

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-296 (round head) or F-318 (flat head).

### CLEANING AND TESTING OF HEAT EXCHANGER

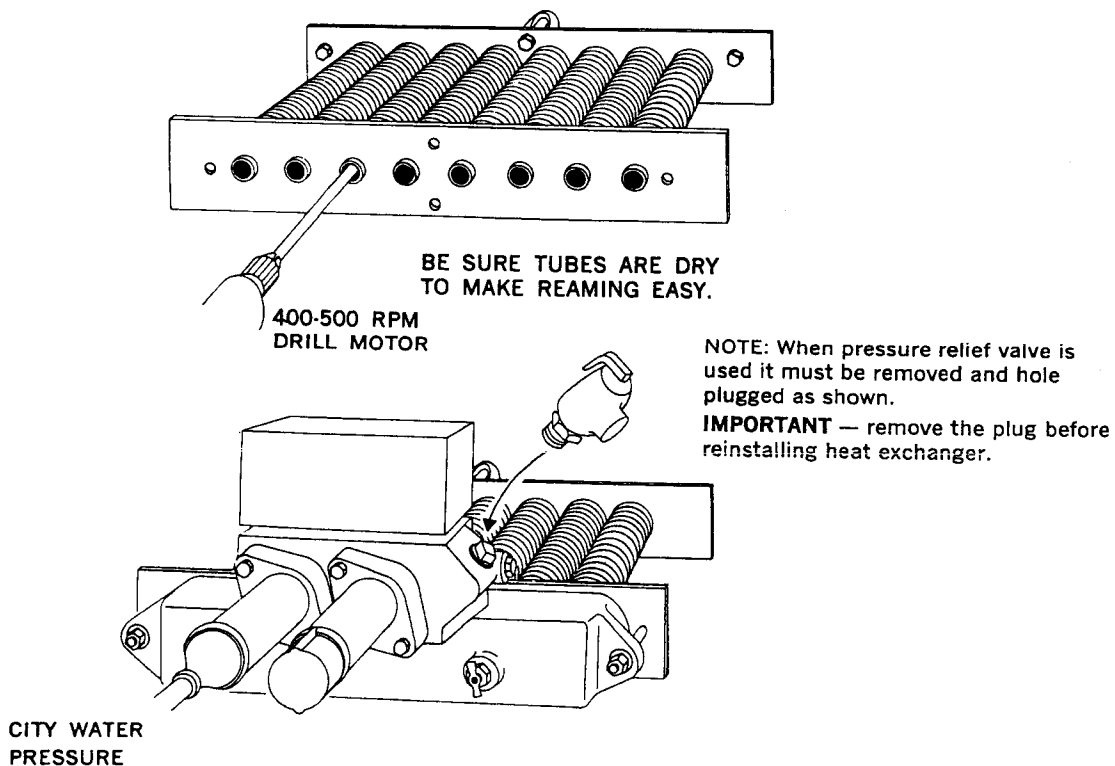


FIG. 30

### 5/13. 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, caus-

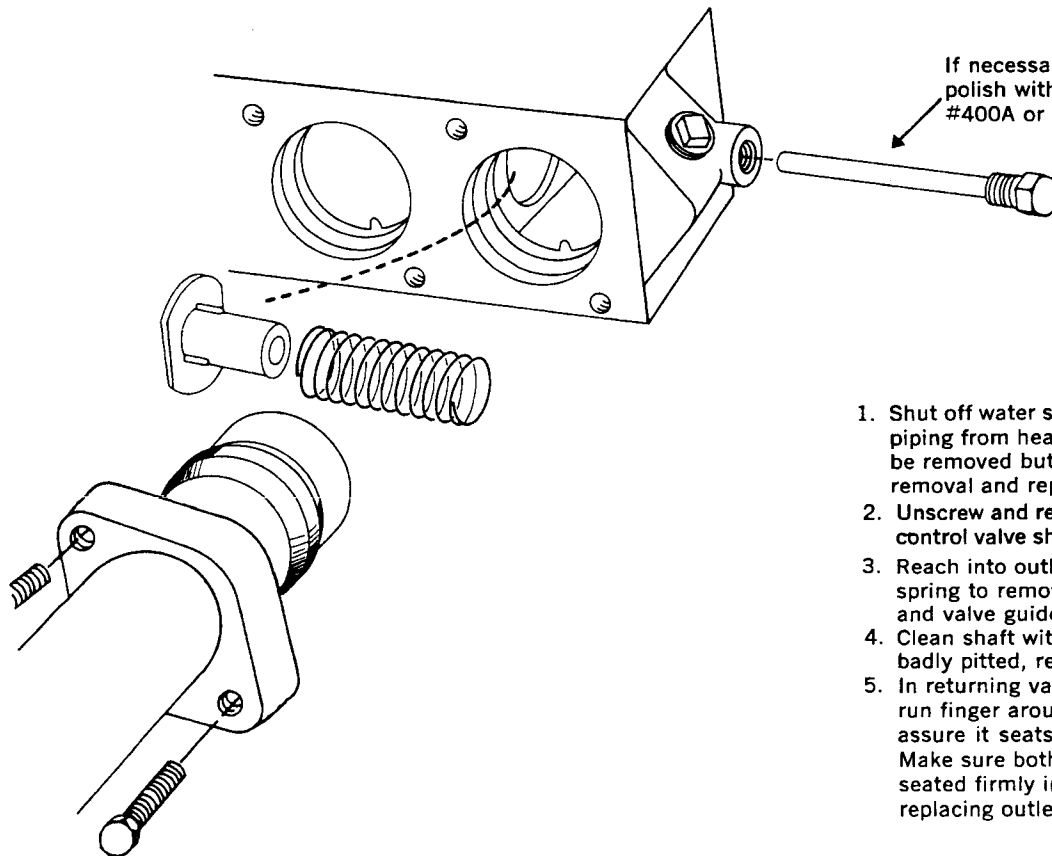
ing condensation on tubes. Either situation can result in inadequate heating.

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 thermometer (see Fig. 15.)

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 31 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, the parts should be replaced. A parts list is shown on page 20.

#### 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. 31

# Section 6/Appendix

## TROUBLE SHOOTING CHART

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

### HEATER WILL NOT COME ON

See Figs. 17, 18, & 19.

### HEATER WILL NOT SHUT OFF — See Fig. 20.

| What to look for               | Why did this happen          | What to do                          |
|--------------------------------|------------------------------|-------------------------------------|
| 1. Pressure switch is clogged. | Possible debris in gas line. | 1. See Par. 5/7.                    |
| 2. Short in wire harness.      |                              | 2. Check wiring (see Fig. 20).      |
| 3. Defective gas valve.        |                              | 3. Replace gas valve. See Par. 5/6. |

### SOOT HAS FORMED IN THE COMBUSTION CHAMBER AND/OR 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. 5/12. Adjust water flow. See Par. 5/13.   |
| 2. Lack of adequate air supply.                    |  | 2. Provide adeq. air supply to heater. See Par. 3/3.  |
| 3. Improper venting.                               |  | 3. Provide proper venting of heater. See Par. 3/3.  |
| 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. 3/10.   |
| 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. 4/2. Clean heat exchanger. See Par. 5/12.   |
| 7. Collapsed firebox.                              |  | 7. Replace firebox. See Fig. 29 for access procedure.   |
| 8. Gas regulator out of adjustment.                | Pressure too high.   | 8. See Fig. 16 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. 4/6. Clean heat exchanger. See Par. 5/12. Repair valve. See Par. 5/13. |

### 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. 4/2.                                   |
| 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. 5/8.                 |
| 4. Pressure switch inoperative.   |   | 4. Test Pressure Switch. Replace if necessary. See Par. 5/7.          |
| 5. Gas line too small.  |   | 5. Check gas pipe size chart. See Par. 3/10.                          |
| 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

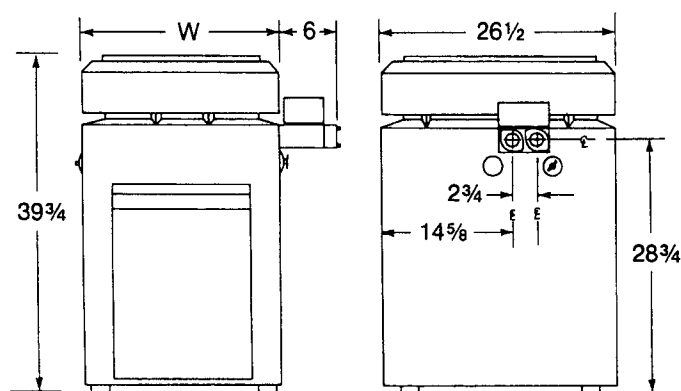
| What to look for   | Why did this happen  | What to do   |
|--|--|--|
| 1. Unnecessary manual by-pass valve installed.   | Water supply is hard. pH is too high. Calcium-hypochlorite is being used for chlorination. Concentration of scale forming minerals in pool due to evaporation. | 1. Close by-pass valve and remove handle. See Par. 3/6.  |
| 2. Manual by-pass valve out of adjustment.   |  | 2. Adjust by-pass valve properly. See Par. 3/6.  |
| 3. Excessive hardness in pool water. Total alkalinity of pool water should be kept in the 80 to 100 ppm range. |  | 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.  | Mineral deposits on valve parts. Corrosion of valve parts.   | 4. See Sec. 3.   |
| 5. Automatic flow control valve may be stuck open.   |  | 5. Check water for excessive hardness, acidity or chlorine. Also check if chlorine is being fed through heater. Repair valve. See Par. 3/9, 5/13.        |
| 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. 5/7. and 5/9.  |
| 7. Chlorinator is connected upstream of heater.  |  | 7. Install Chlorinator downstream of heater. See Par. 3/9.   |

FIG. 32

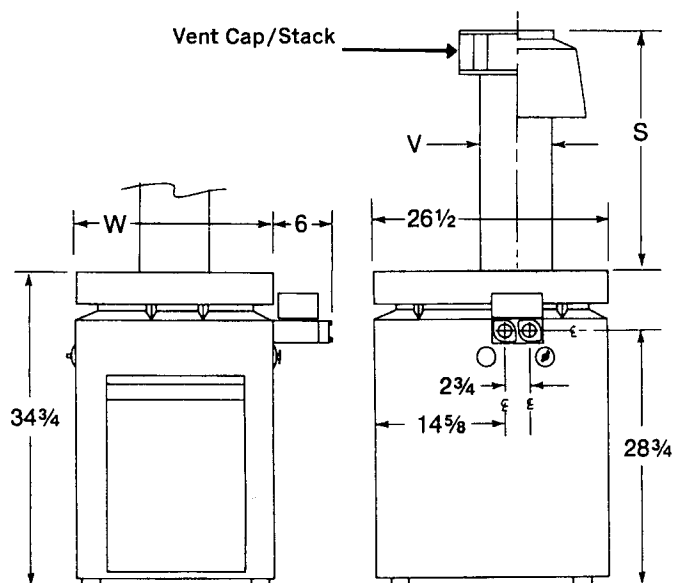


## CAPACITIES AND DIMENSIONS

### LOW PROFILE POOL HEATER



### STACKTOP POOL HEATER

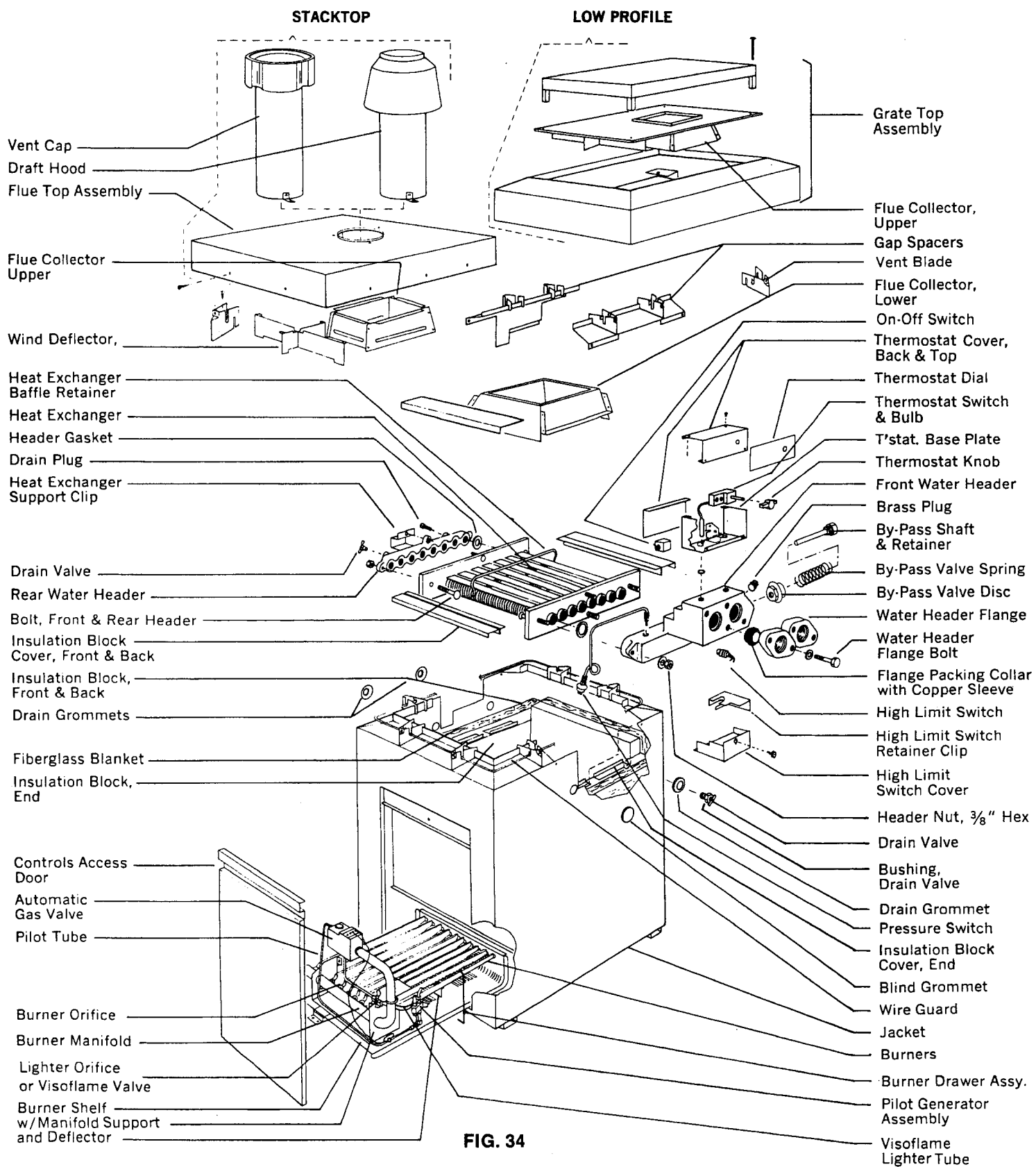


| Model No. | Vent (V) | Width (W)       | Stack(S)        |                 | BTU/HR. Input <sup>3.5</sup> | BTU/HR. Output <sup>3.5</sup> | Shipping Weight <sup>6</sup> |
|-----------|----------|-----------------|-----------------|-----------------|------------------------------|-------------------------------|------------------------------|
|           |          |                 | Indoor          | Outdoor         |                              |                               |                              |
| 125       | 5        | 15              | 20              | $17\frac{3}{8}$ | 125,000                      | 87,500                        | 200                          |
| 175       | 6        | 18              | $20\frac{3}{4}$ | 18              | 175,000                      | 122,500                       | 217                          |
| 250       | 7        | $22\frac{1}{2}$ | $28\frac{1}{2}$ | 23              | 250,000                      | 175,000                       | 250                          |
| 325       | 8        | $26\frac{3}{4}$ | $29\frac{1}{2}$ | $23\frac{1}{2}$ | 325,000                      | 227,500                       | 277                          |
| 400       | 9        | $31\frac{3}{4}$ | $30\frac{3}{4}$ | $26\frac{3}{4}$ | 400,000                      | 280,000                       | 308                          |

1. The Mark V 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  $1\frac{1}{2}$ " iron pipe, unthreaded  $1\frac{1}{4}$ " iron pipe and  $1\frac{1}{2}$ " copper pipe without adapter.

**FIG. 33**

**EXPLODED DWG. OF MARK V COMPONENTS — Type DR**



**FIG. 34**

## Parts list for Mark V pool heaters, Type DR

TO OBTAIN OR ORDER PARTS FOR THE MARK V POOL HEATER

Check with your nearest Teledyne Laars dealer or distributor. They have many of the commonly needed parts in stock. If your dealer cannot supply you, contact Service Manager, Teledyne Laars, P.O. Box 3911, North Hollywood, Ca. 91605, Telephone: 213/875-0201

| 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 B69RGJ95 — 1/2 x 3/4 — Nat.                  | 125 & 175     | V-454 |
| Gas Valve, G/C B69RGJ97 — 3/4 x 3/4 — Nat.                  | 250, 325, 400 | V-455 |
| Gas Valve, G/C B69RG93 — 1/2 x 3/4 — 100% Shut-off— Nat.    | 125 & 175     | V-456 |
| Gas Valve, G/C B69RG96 — 3/4 x 3/4 — 100% Shut-off— Nat.    | 250, 325, 400 | V-457 |
| Gas Valve, G/C B69RG98 — 1/2 x 3/4 — 100% Shut-off— Propane | 125 thru 400  | V-532 |
| Gas Valve, HW VS880H1023 — 1/2 x 3/4 — Nat.                 | 125, 175      | V-489 |
| Gas Valve, HW VS880H1015 — 3/4 x 3/4 — Nat.                 | 250, 325, 400 | V-490 |
| Gas Orifice, Nat. (See Note 1)                              |               | L-322 |
| Gas Orifice, Propane (See Note 1)                           |               | L-329 |
| Burner, Main, w/Pilot Bracket                               | All           | L-334 |
| Burner, Main  | All           | L-055 |

### ELECTRICAL SYSTEM

|                                   |                                  |       |
|-----------------------------------|----------------------------------|-------|
| Thermostat Dial                   | All                              | H-619 |
| High Limit Switch, set at 140°    | All                              | E-722 |
| High Limit Switch, set at 150°    | All                              | E-639 |
| Temp. Control, Laars, 70°-110°    | All                              | E-741 |
| Protector Sleeve, Bulb            | All                              | 4449  |
| Cover, Temp. Control*             | All                              | 4331  |
| Base, Temp. Control*              | All                              | 4330  |
| Base, Temp. Control*              | All                              | 4332  |
| Wire Harness                      | All                              | R-294 |
| Knob, Pointer, Black              | All                              | E-945 |
| Stop Plate, "Safe-T-Lok"          | All                              | 4361  |
| Screw, Stop Plate                 | All                              | F-333 |
| Pressure Switch, 2 PSI (Standard) | All                              | R-132 |
| Pressure Switch, 1 PSI            | Consult Factory<br>Ref. Par. 3/8 | R-113 |
| Pressure Switch, 3 PSI            |                                  | R-130 |
| High Limit Switch Retainer clip   | All                              | 4184  |
| High Limit Switch Retainer        | All                              | S-989 |
| Cover, High Limit Switches        | All                              | 4183  |
| "O" Ring                          | All                              | E-363 |
| On-Off Switch                     |                                  | E-770 |

\*Mark V heaters manufactured prior to June 1978 had different temperature control box (2" taller). Complete replacement is required.

### VENT SYSTEM

|                              | MODEL SIZE |      |      |      |      |
|------------------------------|------------|------|------|------|------|
|                              | 125        | 175  | 250  | 325  | 400  |
| <b>LOW PROFILE — OUTDOOR</b> |            |      |      |      |      |
| Vent Terminal, Grate Type    | D153       | D110 | D111 | D112 | D113 |
| <b>STACKTOP — OUTDOOR</b>    |            |      |      |      |      |
| Flue Top Assembly            | D114       | D115 | D116 | D117 | D118 |
| Vent Cap                     | D005       | D006 | D007 | D008 | D009 |
| (Nat. Gas & Propane)         |            |      |      |      |      |
| <b>STACKTOP — INDOOR</b>     |            |      |      |      |      |
| 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, 3/4 NPT, 75 PSI*     | All | A-633   |
| Front Header (Casting S-673)                | All | R-572   |
| Rear Header (Casting S-052)                 | All | R-567   |
| Header Gasket                               | All | S-152   |
| Packing Collar for Flange                   | All | S-531   |
| Flange                                      | All | S-533   |
| Flange Bolts, 2" Long                       | All | F-317   |
| 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. 15)       | All | P-587   |
| Drain Plug, Rear Header (See Fig. 15)       | All | P-268   |
| Drain Cock, Front Header (See Fig. 15)      | All | P-587   |
| Bushing For P-587                           | All | P-185   |
| Brass Pipe Plug 3/4", 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, Carriage, 2 3/4" For Headers          | All | F-296   |
| Bolt, Carriage, 2 1/2", Front Header, Lower | All | F-283   |
| Bolt, Csk, Sq. Neck, 2 3/4" For Headers     | All | F-318   |
| Washer, for Header                          | All | F-111   |
| Nut, for Header                             | All | F-031   |
| Heat Exchanger Tube Assembly                | 125 | 3082-01 |
| Heat Exchanger Tube Assembly                | 175 | 3082-02 |
| Heat Exchanger Tube Assembly                | 250 | 3082-03 |
| Heat Exchanger Tube Assembly                | 325 | 3082-04 |
| Heat Exchanger Tube Assembly                | 400 | 3082-05 |

### FIREBOX COMPONENTS

|  |     |       |
|--|-----|-------|
| Insulation, Fibreglass Blanket for Sides | All | T-020 |
| Insulation Block, End, 16 1/2 x 18 13/16 | All | T-034 |
| Insulation Block 9 1/2 x 21              | 125 | T-039 |
| Insulation Block, 12 1/4 x 21            | 175 | T-035 |
| Insulation Block, 16 3/4 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) |             |       |
| Jacket, Gap Spacer                   |             |       |
| Heat Exchanger Support Clip          |             |       |
| Heat Exchanger Tee-Baffle            |             |       |
| Flue Collector, Upper Half           |             |       |
| Flue Collector, Lower Half           |             |       |
| Clip, Draft Hood                     |             |       |
| Touch-up Paint Can                   | All         | X-060 |

\*See Par. 3/7 regarding use of pressure relief valve.

### NOTES:

1. For altitudes higher than 2000 feet above sea level, consult factory for orifice size.

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info@parts4heating.com

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