

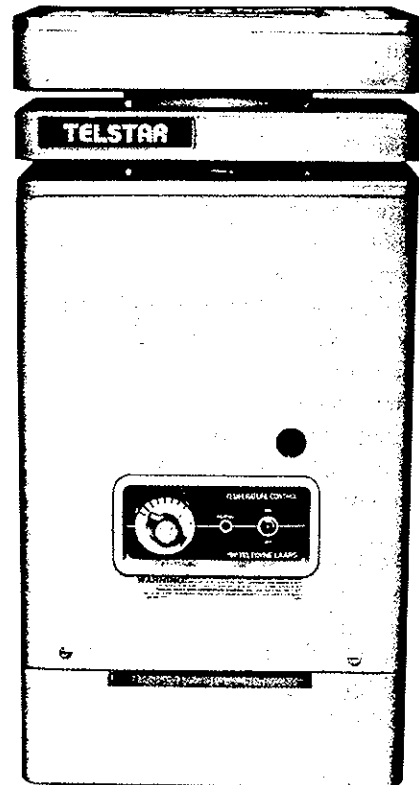
FOR YOUR SAFETY - This product must be installed and serviced by a professional service technician, qualified in pool heater installation. Improper installation and/or operation could create carbon monoxide gas and flue gases which could cause serious injury or death. Improper installation and/or operation will void the warranty.

Installation, Operation and Service Manual

TELSTAR® Spa & Hot Tub Heater

Models TGT-50
& TGS-50

parts4heating
800-536-1582 Fax: 866-448-9304
info@parts4heating.com



WARNING: If these instructions are not followed exactly, a fire or explosion may result, causing property damage, personal injury or death.

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

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier

 **TELEDYNE LAARS**

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SECTION 1. General Information

1A. Introduction

This manual contains necessary information for the assembly, installation, operation and service of the Telstar spa and hot tub heater. Review this manual completely before proceeding with the installation.

Installation and use of the heater must conform to local codes, or in their absence, with the latest National Fuel Gas code, ANSI Z223.1 and the latest National Electric Code, ANSI/NFPA 70. In Canada, it must conform to CAN/CGA 1-B149.1 or .2 and the Canadian Electric code, C22.1 Part 1.

Keep this document for future reference.

1B. Description

The Telstar spa and hot tub heater is a compact, high-performance, energy-efficient gas-fired heater. It has been engineered to control the water velocity through the heat exchanger to prevent both scale formation inside and surface condensate. The Telstar heater is shipped from the factory for outdoor installation, but is easy to convert for indoor use. Standing pilot models are available in natural and LP gas models. The spark ignition model is for use with natural gas only.

The Telstar heater is for heating spas and hot tubs and should not be used under any circumstances as a heating boiler, a general service heater, or for salt water applications. Consult the factory for applicable products.

The Telstar models TGT-50 and TGS-50 are design-certified by the American and Canadian Gas Associations laboratories as complying with Standard ANSI Z21.56 and CAN 1-4.7 for gas-fired pool heaters. For U.S. applications requiring listing or recognition by Underwriters laboratories, Teledyne Laars can provide models TGT-55 and TGS-55. Special features of these heaters are covered by an addendum to this document.

1C. Warranty

The Telstar heater is sold with a limited warranty. Details of the warranty, including length of the warranty of the various heater parts, are specified on the back cover of this manual and on the warranty card furnished with the heater. The warranty does not apply to heaters improperly installed or operated. Any modifications of the heater, gas controls, gas orifices, wiring or vent terminations will void the warranty.

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

SECTION 2. Installation

⚠ WARNING

Improper installation or maintenance can cause nausea or asphyxiation from carbon monoxide and flue gases which could result in severe injury or death.

⚠ WARNING

Special Precautions for LP Gas Heaters:

Because LP gas is heavier than air, do not install a heater using LP gas in a pit or other location, including indoors, where gas fumes might collect. Locate the heater a safe distance from LP gas storage and filling equipment. Consult local codes and fire protection authorities about specific installation restrictions.

2A. General (United States) **(See page 2 for Canada)**

All gas-fired heaters require correct installation to assure safe operation. The requirements for spa and hot tub heaters include the following:

1. Appropriate site location (clearances).
2. Sufficient combustion air and ventilation air.
3. Adequate venting (products of combustion).
4. Properly sized gas pipe.
5. Adequate water flow.

The Fuel Gas Code offers general guidelines for combustion air, ventilation air, and venting. Follow these guidelines to make sure the installation is safe and efficient.

Pick a heater location that will supply enough air for proper venting, and allow space for maintenance access. Recommended clearances are specified in Section 2B and 2C.

Locate the heater in an area where condensate leakage of the heater or connections will not damage the area around the appliance or the structure. If such a location cannot be avoided, install a suitable drain pan under the heater. This pan must not restrict air flow.

The Telstar is design-certified for installation on a combustible floor.

Safe operation at the proper gas manifold pressure requires correct sizing of supply gas pipe. The National Fuel Gas Code also offers general criteria for gas piping (see Section 2D).

If the above installation requirements are not followed, the fuel used in these appliances could produce and expose

you to substances that are known to cause cancer or reproductive harm.

Install the heater in accordance with all local codes and ordinances and the most recent edition of the National Fuel Gas Code, ANSI Z223.1.

The National Fuel Gas Code is available from:

International Approval Services (formerly the American Gas Association)

Administrative
1515 Wilson Blvd.
Arlington, VA 22209

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

2A. General (Canada Only)

All gas-fired heaters require correct installation to assure safe operation. The requirements for spa and hot tub heaters include the following:

1. Appropriate site location (clearances).
2. Sufficient combustion air and ventilation air.
3. Adequate venting (products of combustion).
4. Properly sized gas pipe.
5. Adequate water flow.

Pick a heater location that will supply enough air for proper venting, and allow space for maintenance access. Recommended clearances are specified in Section 2B and 2C.

Locate the heater in an area where condensate leakage of the heater or connections will not damage the area around the appliance or the structure. If such a location cannot be avoided, install a suitable drain pan under the heater. This pan must not restrict air flow.

The Telstar is design-certified for installation on a combustible floor.

Do not operate this heater outdoors at temperatures below -7°C (20°F).

Safe operation at the proper manifold pressure requires correct sizing of gas supply pipe. The gas installation code offers general criteria for gas piping (see Section 2D).

If the above installation requirements are not followed, the fuel used in these appliances could produce and expose you to substances that are known to cause cancer or reproductive harm.

Install the heater in accordance with all local codes and ordinances and the most recent edition of the CGA standards, CAN/CGA-B149.1 or .2 installation codes for Gas Burning Appliances.

The Canadian Gas Codes are available from:

Canadian Gas Association
55 Scarsdale Road
Don Mills, Ontario
M3B 2R3

2A-1 Location/Mounting

If you need to securely mount the heater, use the four

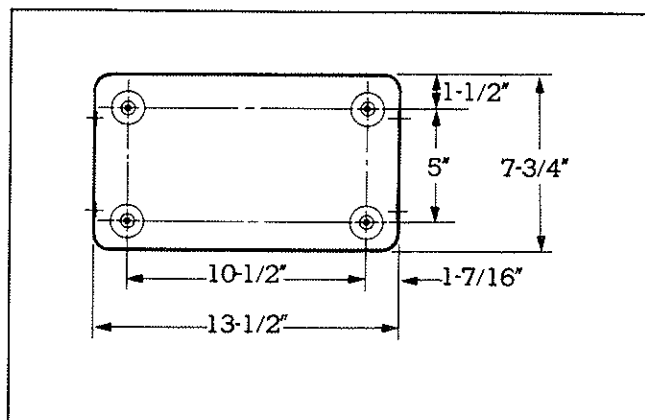


Figure 1. Mounting Hole Dimensions

mounting holes located in the base of the heater to secure it in place with 1/4" bolts (see Fig. 1). Remove the lower wrap for access to the mounting holes. Install mounting bolts before connecting the gas line.

2B. Outdoor Installation

2B-1 Heater Clearances

Locate the heater in an open, unroofed area, and maintain the following clearances:

Top of heater	36" to eaves
Blank side and rear	6" minimum clearance
Piping side	18" minimum clearance
Front of heater	18" minimum

Do not install the heater in a location where leaves or other combustible materials can gather around the base or on the top.

Do not locate the heater close to sprinklers; the water could damage the controls and the electronics.

If you are installing the heater under an overhang, there must be a minimum clearance of 3 feet above the top of the heater. The area under the overhang must be open on three sides. Protect the heater from direct water drainage.

⚠ WARNING

In United States

Do not install the heater with the top of the vent assembly within 4 feet of any opening into a building

In Canada

Do not install the heater with the top of the vent assembly within 10 feet of any opening into a building.

IMPORTANT: High winds can roll over fences and deflect off buildings, creating a draft reversal in the heater, possibly damaging the controls. If such conditions prevail, place the heater at least three feet from any wall or fence.

2C. Indoor Installation

Only the natural gas model of the Telstar is certified for indoor installation. The Telstar as shipped is ready for outdoor installation. As such, it must be converted to indoor installation with the Teledyne Laars indoor draft hood kit, part number D6800. Install the draft hood without modification.

Once installed, the draft hood must connect to a vent pipe that extends at least two feet above the highest point of the roof or other object that is within ten feet of the vent. Install a listed cap that allows a full equivalent opening for flue products.

2C-1. Heater Clearance

Top of Heater	36" minimum clearance
Blank side and rear	6" minimum clearance
Piping side	18" minimum clearance
Front of heater	18" minimum clearance

2C-2. Combustion and Ventilation Air Supply

All indoor installations must have openings to outside air for combustion and ventilation. Fig. 2 shows the general configuration acceptable. Teledyne Laars does not recommend indoor installations that do not provide combustion air from outside the building. When the heater is installed in a room or enclosed area, provide two unobstructed openings, one 12" below the ceiling and one 12" above the floor. If the heater is installed in a residential garage, the burners must be 18" above the garage floor. Install all venting to the heater in accordance with the the National Fuel Gas Code; in Canada, the Gas Installation Code CAN/CGA B149.1 or 2.

Table I. Required Net Free Combustion Air Opening for Each of Two Openings for Indoor Installation

Combustion Air Source	Directly from Outside	From Another Room
Net free	15 sq. in.	100 sq. in.

2D. Gas Supply and Piping

Check heater rating plate to make sure that the fuel requirement (natural or LP gas) is the same as that available at the site. Provide gas pipe size as shown in Table II. These are Teledyne Laars recommended pipe sizes.

Table II: Gas Pipe Sizing

Distance from Meter	Required Pipe Size (Nat. Gas)
0-100'	1/2"
101-200'	3/4"*

* For LP gas, pipe may be one size smaller.

Check local codes for compliance. Do not use a restrictive gas cock. Provide a union and a manual gas valve in the gas line outside the heater jacket.

Before operating the heater, test all gas connections for leaks with a soap solution. Do not use an open flame. Disconnect the heater and its individual shut-off valve from the gas supply piping during any pressure testing if test pressure is in excess of 1/2 psig (3.7 kPa). If test pressure is equal to or less than 1/2 psig (3.7 kPa), close the manual shut-off valve on the heater during the piping pressure test.

Check the heater and its gas connection for gas leaks before placing it in operation.

Supply gas pressure must be as shown in Table III.

Table III: Supply Gas Pressure

	Minimum	Maximum
Natural Gas	5" W.C.	10" W.C.
LP Gas	10" W.C.	14" W.C.

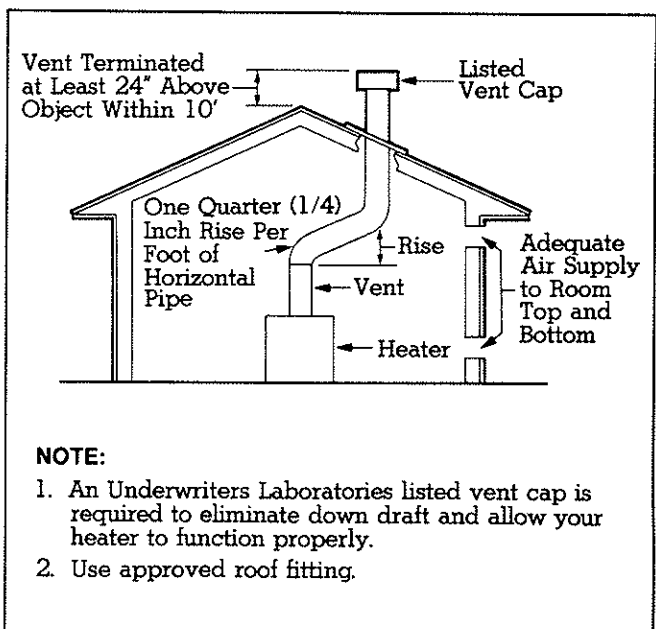


Figure 2. Venting

If supply gas pressure is inadequate after testing, see Figs 18 and 19, check for undersized pipe between meter and heater, a restrictive fitting, or an undersized gas meter. The heater pressure regulator is pre-set at the factory and normally does not need adjustment.

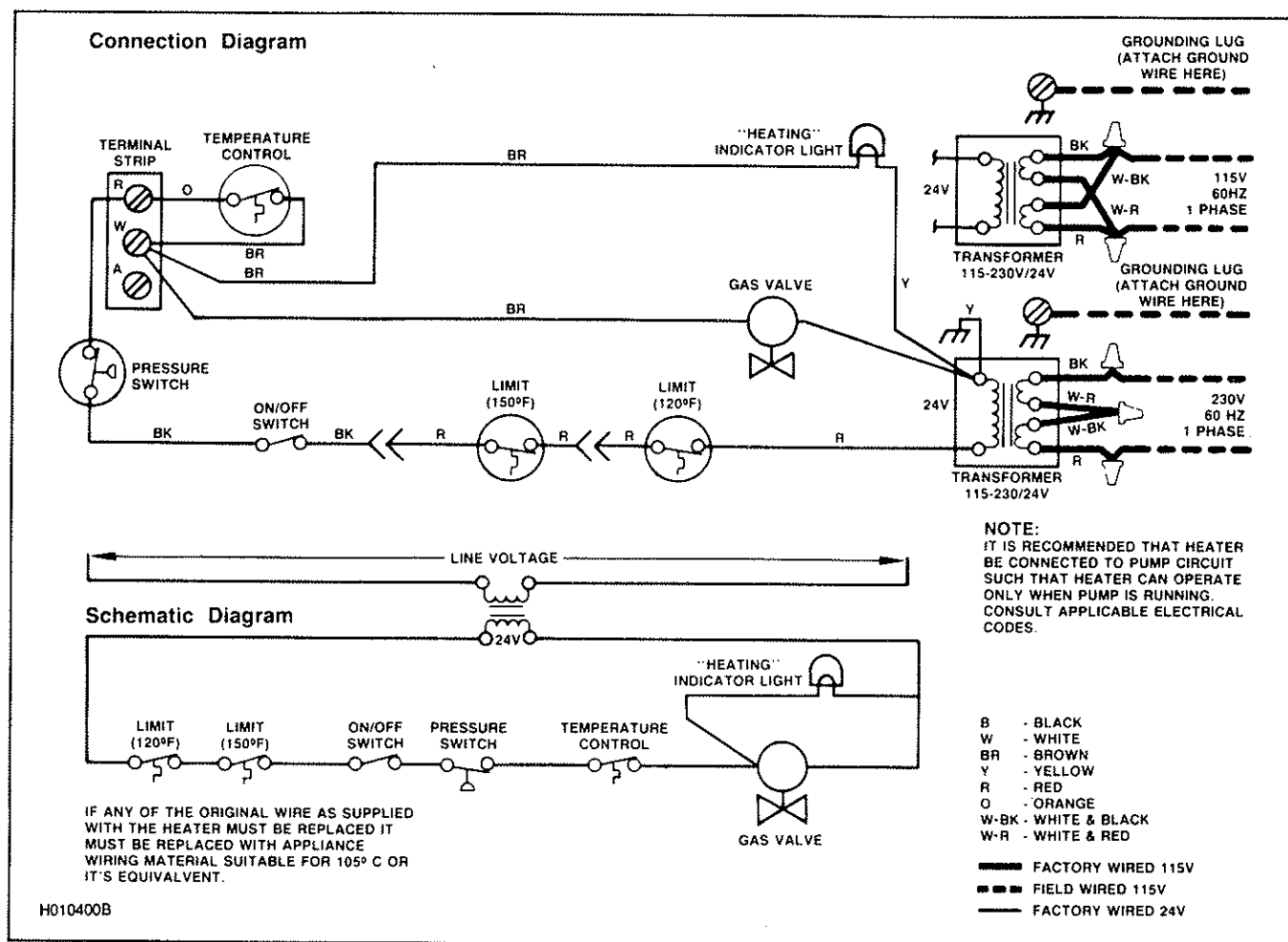


Figure 3. Wiring Diagram, Model TGT Heater

2E. Electrical Wiring

The Telstar heater has a 24V control system which gets power from a 120-240V/24V transformer inside the heater. This transformer is factory wired for 240V installations. For 120V installations, connect the transformer leads as shown in the wiring diagrams, Figs. 3 and 4 (also provided on the inside of the heater housing). Connect field wires to the pigtail leads in the junction box located behind the gas valve (see Fig. 5).

No external junction box is required. Make connections exactly as shown and there must be a definite grounding means. Electrical wiring, including grounding and bonding means, must be in accordance with local codes, or in their absence, the latest National Electrical code ANSI/NFPA 70, or in Canada, the Canadian Electric code, C221. For 240V installations, service voltage must be between 207V and 253V. For 120V installations, service voltage must be between 103V and 127V.

The Telstar heater has a terminal strip for easy remote control wiring. For operation from a remote temperature control, move the orange wire from the pressure switch from the rear of the "R" terminal of the strip to the bottom "A" terminal. Connect the remote temperature control between

the "R" and "A" terminals, as illustrated in Fig. 6. Teledyne Laars recommends that the factory supplied temperature control remain in series with the remote temperature control in the control circuit as an added safety control, as shown in the wiring diagram. This will ensure safe operation of the heater if the remote temperature control fails. **NOTE:** Turn the factory supplied temperature control to the full "MAX" (clockwise) position on the dial. Apply the "Heater Externally Controlled" label, supplied with the heater, to the temperature control bezel below the temperature control knob.

2F. Water Piping

The Telstar heater is virtually free of residual heat effects, so PVC Schedule 40 plastic piping can be connected directly to the heater if it is acceptable to the authorities having jurisdiction.

Fig. 7 illustrates typical piping for a system. The Telstar heater has a built-in bypass control which maintains proper heat exchanger water flow in spite of input flow variations. However, water flow must be at least 10 GPM under worse case conditions (dirty filters, restricted eyeball fittings, etc.) or the heater will not operate properly. An external bypass valve is necessary if the system flow rate exceeds 80 GPM.

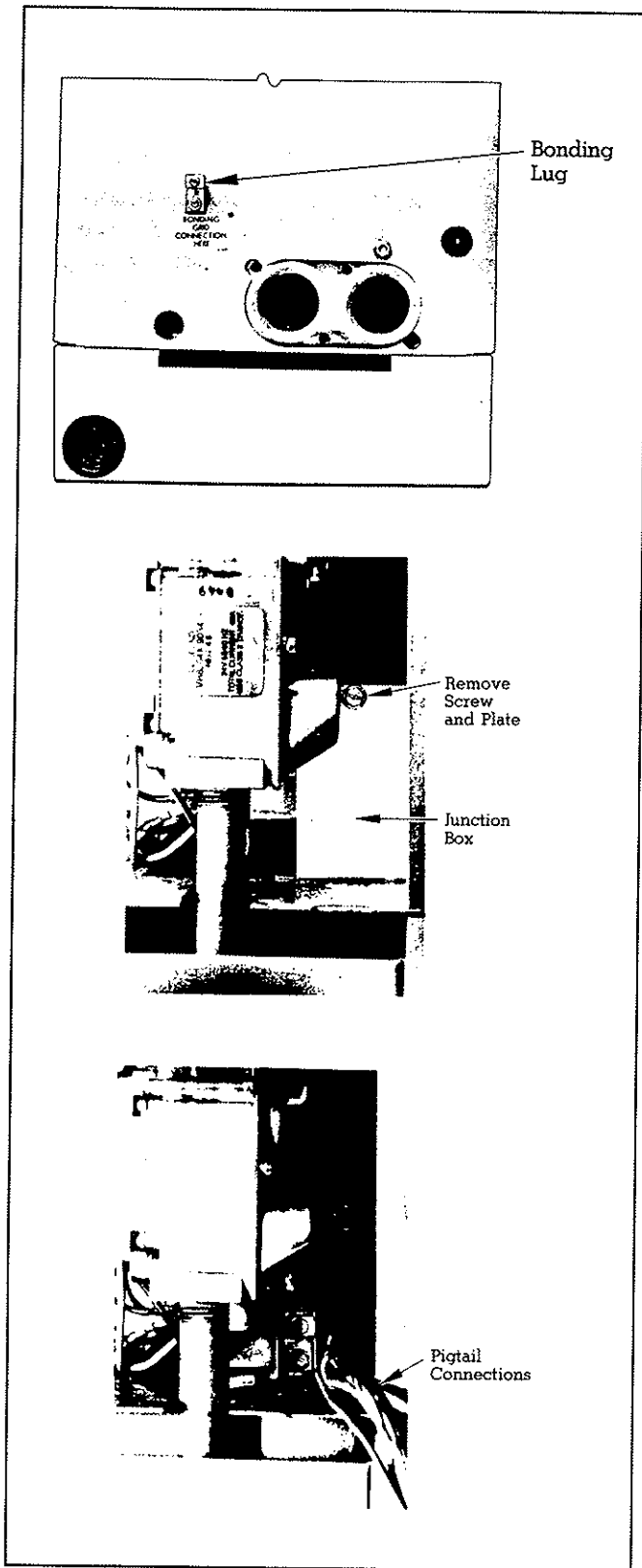


Figure 5. Line Voltage Connection

3. After 3 minutes, note the 'cold' temperature reading.
4. Turn the heater on and note the 'hot' temperature reading after it becomes steady (after about 30 seconds).

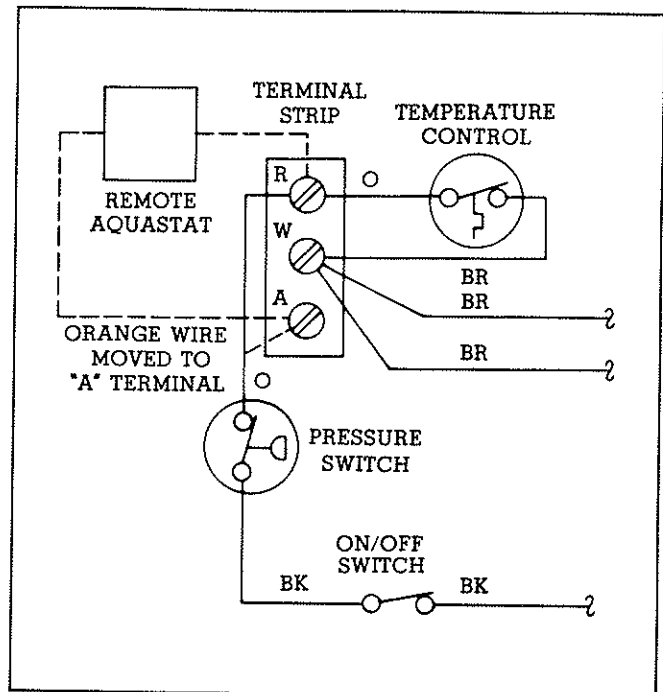


Figure 6. Remote Control Wiring, Model TGT

5. Slowly open the bypass valve until the temperature rise (the difference between the 'hot' and 'cold' readings) is between 14 and 20°F (7.8 and 11.1°C). When the temperature stays in this range, remove the handle from the bypass valve. The heater's internal bypass control will automatically offset changes in flow.

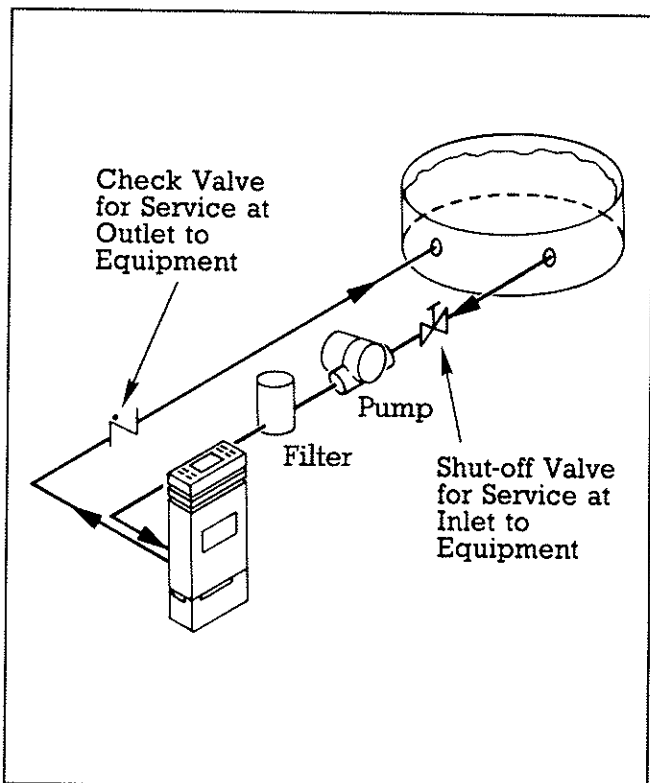


Figure 7. Typical Installation

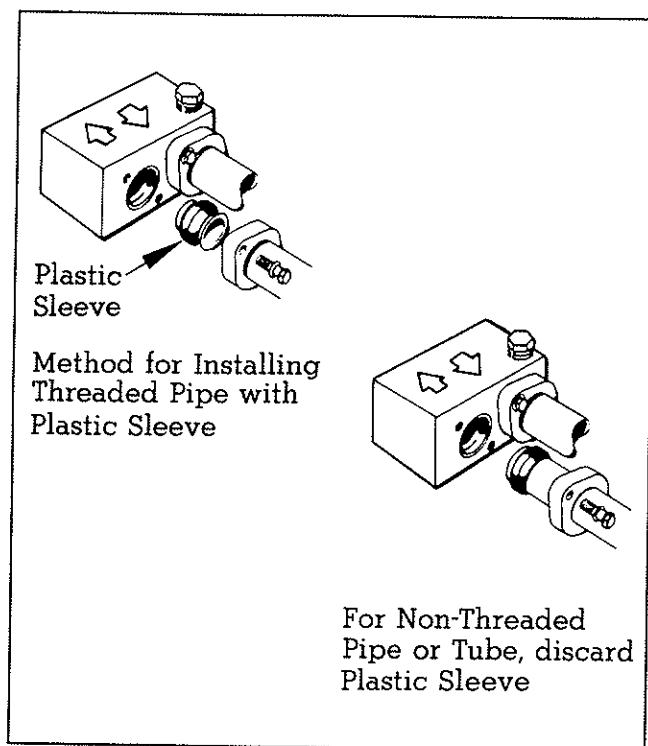


Figure 8. Piping Connections

2F-1. Pressure Relief Valve

A pressure relief valve is not supplied with the Telstar heater except in Canada. Check local codes or with the authority having jurisdiction to determine if one is required for your installation. If the water piping permits the heater to be isolated, or if local codes require a pressure relief valve, install it at the outlet of the heater.

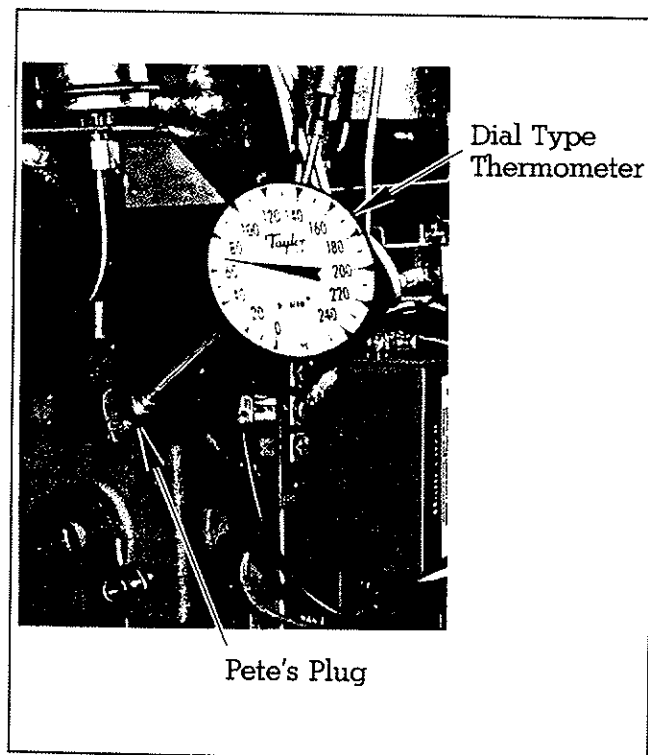


Figure 9. Thermometer Location

2F-2. Automatic Chemical Dispensers

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

When an automatic dispenser is used, install it downstream of the heater, in the spa/hot tub inlet line, and at a lower elevation than the heater outlet connection.

IMPORTANT

1. Install an anti-siphoning device on the dispenser so that if the piping drains after the pump shuts off, the sanitizing chemical will not siphon into the heater.
2. Wire an electric dispenser so it cannot operate unless the filter pump is running. If the dispenser has an independent clock control, synchronize the filter and dispenser clock so the dispenser operates only when the filter pump is running.
3. If the dispenser is equipped with its own pump, install it so it introduces the gas or solution downstream from the heater and if possible, at a position lower than the heater outlet fitting.

2F-3. Pressure Switch

Telstar heaters have adjustable pressure switches factory set at 3 psig, with a sealed minimum pressure adjustment stop at 3 psig. The adjustable pressure switch makes it possible to increase the setting when necessary to offset hydrostatic pressure effects caused by the heater being more than a few feet below spa level.

Spa/hot tub and piping locations are different, and in some cases, it will be necessary to adjust the pressure switch in the field. Use the following procedure to adjust it. Be sure the filter is clean before the adjustment. A dirty filter could cause an incorrect setting.

IMPORTANT: Only adjust the pressure switch to turn the heater OFF.

- a. Begin with heater power off and the pressure switch set to its minimum. Turn the thumbwheel to move it against the stop.
- b. Turn on the pump, and confirm by means of an audible click or with an ohmmeter, that the pressure switch closes (if it fails to close, a switch with a lower minimum setting is required).
- c. Turn the thumbwheel in the direction of higher pressure setting until the contacts open.
- d. With the pump still running, reduce the pressure setting one or two psig or more to re-close the contacts, allowing for reduced pressure availability when the filter becomes dirty.
- e. Turn off the pump and make sure the pressure switch contacts open. The contacts must open when the pump is off.

It may be necessary to repeat these steps to get a satisfactory setting. The final setting must guarantee that the heater will not operate when the pump is off, yet permit heater operation when the pump is on and the filter is reasonably clean. If satisfactory operation cannot be achieved, contact the Teledyne Laars factory.

Elevated spas are a special problem when the water surface is more than eight feet above the heater because the pressure switch cannot be adjusted higher than 4 or 5 psig. A special pressure switch, Part No. R0015500, is available from the factory for such installations. This switch is adjustable to 9 or 10 psig and can be used in installations in which the spa is as much as 20 feet above the heater.

When the water surface is more than a few feet below the heater, a switch with 1 psig setting can be used. This switch, Part No. R0011300, is also available from the factory.

Spas more than 20 feet above or five feet below the heater cannot generally be handled with a pressure switch. In such cases, an external flow switch must be used, connected as shown in Fig. 10.

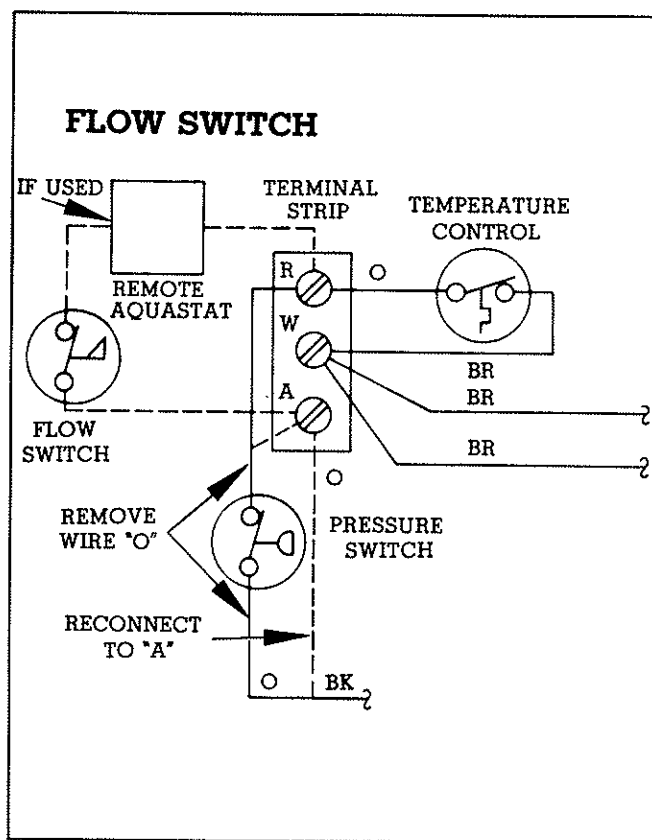


Figure 10. External Flow Switch Connection

1. Disconnect the black wire from the toggle switch to the pressure switch and connect it to "A".
2. Remove the orange wire from the pressure switch to "R" and discard it.
3. Connect the flow switch between "A" and "R".

4. If used, connect the remote thermostat in series with the flow switch.

Use wire with insulation of 105°C temperature rating (or better). Route the wire through the plastic bushing at the rear of the heater.

SECTION 3.

Operation

3A. Operating Instructions

IMPORTANT: Do not operate the heater unless the spa/hot tub is properly filled with water. Refer to spa/hot tub manufacturer or installer for correct water level.

CAUTION

When lighting pilot or working with other components in the vicinity of the pilot and main burner, keep the head and body away from the heater. There may be some gas which could be a burn hazard.

OVERHEATING: Should overheating happen, or the gas supply fail to shut off, turn off external manual gas control.

3A-1. Removal & Replacement of Heater Housing

a. Removal

1. Remove the two screws located on the bottom of the heater housing (see Fig. 11).
2. Grasp the heater housing near the bottom and angle it outward, thus "hinging" along the top front edge of the housing.
3. Pull downwards, releasing the top of the heater housing from between the support clips in the top assembly.

b. Replacement

1. Grasp the heater housing near the top by the left and right sides, and place the top front edge of the housing between the support clips and the top assembly.
2. "Hinge" the cover into position making sure the left and right edges insert under the back panel edge. Also, the bottom edge of the housing should insert under the base of the rear panel.
3. Replace the screws on the left and right sides of the housing. NOTE: The engagement holes are located slightly higher than the holes in the housing in order to "lift" the housing into place.

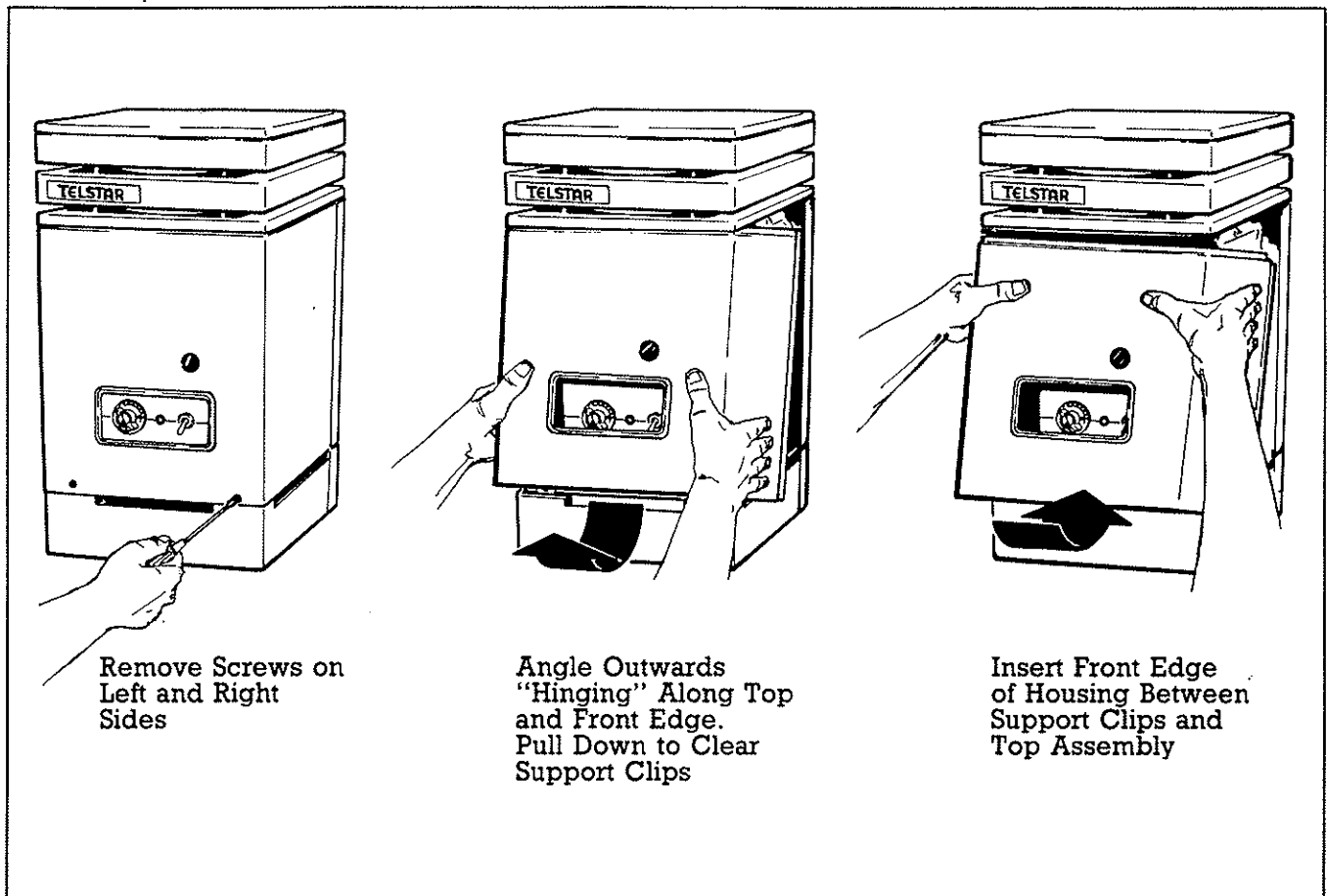


Figure 11. Housing Removal and Replacement

3A-2. Standing Pilot Models (TGT)

a. Start-up

1. Remove the heater housing.
2. Turn the toggle switch to OFF (see Fig. 12).
3. Turn the gas valve knob to the OFF position; wait five minutes to let the natural air flow clear the accumulation of any unburned gases from the heater which could flashback if ignited (see Fig. 13).

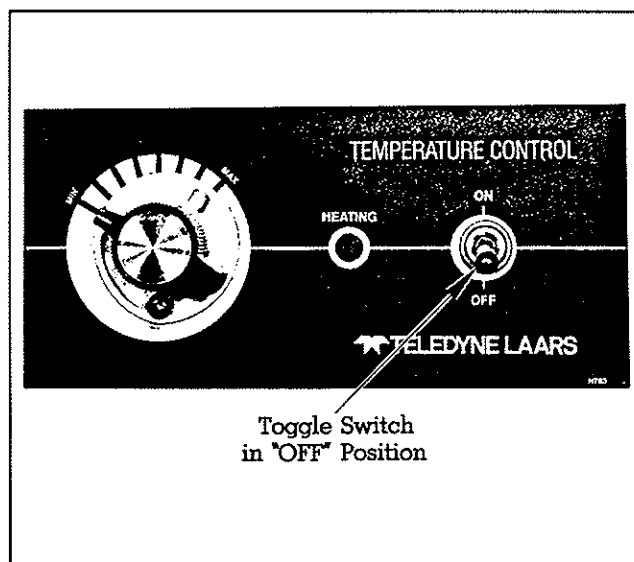


Figure 12. Temperature Control

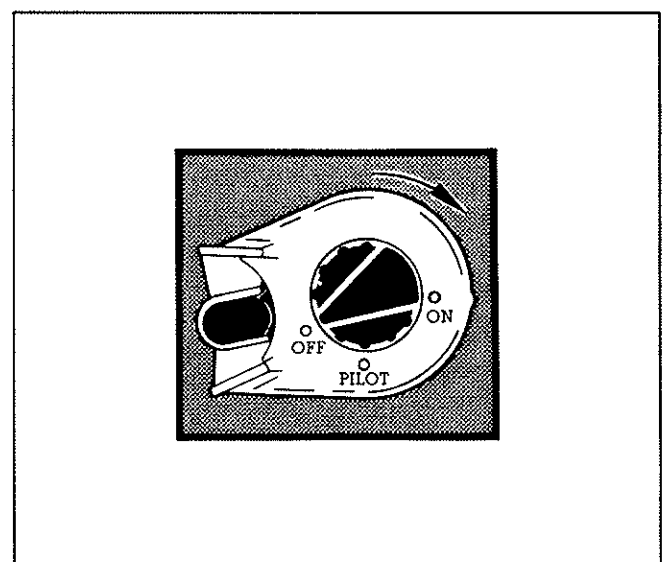


Figure 13. Gas Valve

4. Turn the gas valve knob to pilot position, depress and light pilot with match. Hold knob down for one minute.
5. Turn gas valve knob to ON position and replace heater housing.
6. Turn temperature control to desired temperature.

7. Turn toggle switch ON and the "HEATING" light will come on.

b. Shutdown

1. Turn toggle switch to OFF position.
2. For complete shutdown, remove heater housing, turn gas valve knob to OFF position and replace heater housing.

c. Normal Operating Sequence

When the pump is running, the Telstar heater will turn itself ON and OFF in response to changes in the water temperature. When the temperature control calls for heat, the red "HEATING" light will go on and the main burners will light. The heater will operate until the temperature control senses that the desired water temperature has been reached and will shut down the main burners.

3A-3. Spark Ignition Models (TGS)

a. Start-up

1. Remove the heater housing.
2. Position the toggle switch to OFF.
3. Turn the gas valve knob OFF position; wait five minutes to allow the natural air flow to clear the accumulation of any unburned gases from the heater which could flash-back if ignited.
4. Turn gas valve knob to ON position and replace heater housing.
5. Turn temperature control to desired setting.
6. Turn toggle switch to ON position; the "HEATING" light will come on. The pilot will light followed by the main burners.

When these steps are accomplished, the pilot will light automatically and the heater will operate whenever the temperature control calls for heat.

b. Shut-down

1. Turn toggle switch to OFF.
2. For complete shutdown, remove heater housing, turn gas valve knob to OFF position and replace heater housing.

c. Normal Operating Sequence

When the pump is running, the Telstar heater will turn itself ON and OFF in response to changes in the water

temperature. When the temperature control calls for heat, the red "HEATING" light will go on and the main burners will fire. The main burners are lit by an electronic ignition control utilizing a spark-lit pilot. The heater will operate until the temperature control senses that the desired water temperature has been reached and will shut down both pilot and main gas flow.

3B. Temperature Control

The Telstar temperature control covers a range from approximately 70°F to 104°F (21°C to 40°C) in increments of 5°F as indicated by the marks on the face of the dial. Use a pool thermometer to determine the best temperature for you and position the TEMP-LOK at that setting. See Section 3E for important Consumer Product Safety Commission guidelines for spa water temperature.

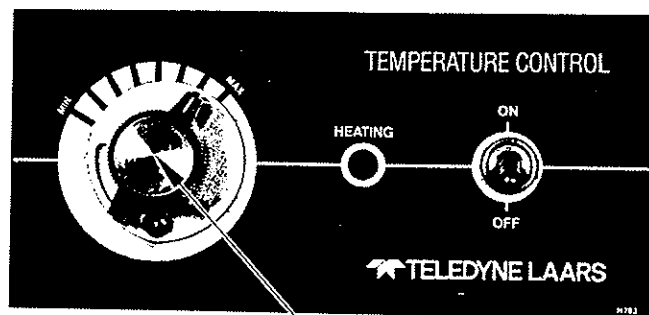
The ON/OFF switch permits turning the heater off without changing the temperature setting or requiring access to the main gas valve. The ON/OFF switch will turn the heater off except for the pilot light on standing pilot models. The pilot light can be shut off only by turning the main gas valve to OFF.

IMPORTANT: The Telstar temperature control cannot be calibrated in the field. If the control is defective, replace it. Do not use the temperature control to turn off the heater.

3C. The TEMP-LOK

The Telstar spa/hot tub heater uses the Teledyne Laars TEMP-LOK feature (see Fig. 14) for the convenience and safety of the spa user. It is a disk located below the temperature control knobs which includes a stop to limit the maximum temperature setting. It can be adjusted as necessary to provide a safe, satisfactory spa water temperature.

When adjusting the TEMP-LOK, first set the knob to the desired temperature. Then loosen the screw to allow the TEMP-LOK disk to be rotated counter-clockwise against the knob. Tighten screw with TEMP-LOK disk in this position. The TEMP-LOK will then "remember" that setting - a convenient way to be sure the spa is always at the temperature you want for comfort and safety.



Temperature Control

Figure 14. TEMP-LOK

3D. Inlet/Outlet Temperatures

Do not worry that the outlet piping does not feel hot. When installed in a full flow system, the outlet pipe of the Telstar carries a large volume of spa water. Most of this water has by-passed the heat exchanger and is mixed with a relatively small volume of heated water. So the temperature difference between inlet and outlet pipes is so small it would be difficult to sense by touch.

3E. Safety Rules for Spa/Hot Tubs

The following safety rules, recommended by the U.S. Consumer Product Safety Commission, should be observed when using the spa:

1. Spa or hot tub water temperature should never exceed 104°F (40°C). 100°F (38°C) is considered safe for a healthy adult. Special caution is recommended for young children.
2. The drinking of alcoholic beverages before or during spa or hot tub use can cause drowsiness which could lead to unconsciousness and subsequently result in drowning.
3. **Pregnant women beware!** Soaking in water above 102°F (39°C) can cause fetal damage during the first three months of pregnancy (which could result in the birth of a brain-damaged or deformed child). If pregnant women are going to use a spa or hot tub, they should make sure the water temperature is below 100°F (38°C).
4. The water temperature should always be checked with an accurate thermometer before entering a spa or hot tub. Thermostats may vary by as much as 4°F (3.3°C).
5. Persons with a medical history of heart disease, circulatory problems, diabetes, or blood pressure problems should consult their physician before using a hot tub or spa.
6. Persons taking any medication which induces drowsiness, such as tranquilizers, antihistamines, or anticoagulants should not use spas or hot tubs.
7. Prolonged immersion in hot water can induce hyperthermia.

Hyperthermia occurs when the internal body temperature reaches a level several degrees above the normal body temperature of 98.6°F (36.6°C). Symptoms include dizziness, fainting, drowsiness, lethargy, and an increase in the internal body temperature.

The effects of hyperthermia include:

1. Unawareness of impending hazard
2. Failure to perceive heat
3. Failure to recognize need to leave spa
4. Physical inability to leave spa
5. Fetal damage in pregnant women
6. Unconsciousness resulting in a danger of drowning

3F. Spa Water Chemistry

The control of proper chemical balance in spa water is more critical than in a swimming pool for satisfactory heater operation. Usage density in a spa is many times greater than a swimming pool. The spa size, the higher water temperature, and the heavy usage, mean chemical values in a spa can differ greatly. The lack of the right chemical content can result in unsanitary water conditions, and affect the life of the heater.

Maintaining sanitary water conditions in a spa can only be done by regular water changes and the proper addition of sanitizing chemicals.

3F-1. Corrosion

The corrosive action of spa water is increased by the following:

- a. Low pH - acidity
- b. Low Total Alkalinity - bicarbonates
- c. Low Calcium hardness - soft water

NOTE: Teledyne Laars does not warrant heat exchangers damaged by corrosive water.

pH. The pH measurement is the most important test to maintain correct water balance in pool or spa water. Low values are acidic.

Commonly used solid sanitizers, such as "tri-chlor" or bromine compounds are acidic, and prolonged use of these products without water changes or the use of compounds to raise the pH will result in corrosive water. Frequent pH testing is necessary to protect your heater and other equipment. "Di-chlor" sanitizer is neutral.

Total Alkalinity. Water with low total alkalinity is corrosive even if the pH is correct. At normal pH levels, total alkalinity is a measure of bicarbonates in the water. Low bicarbonate levels will permit the pH to vary widely when other chemicals are added, and conversely, correct levels will stabilize the pH.

Calcium Hardness. Hard water can cause scale formation and reduce heater efficiency. Soft water is very corrosive and in areas where the water is known to be soft this must be checked and adjusted to a correct value each time the spa water is changed.

3F-2. Testing

Teledyne Laars recommends that owners purchase a test kit and use it regularly. A minimum kit will measure chlorine, alkalinity and the pH level.

The pool/spa owner should have a professional service technician perform more extensive chemical testing and water changing.

TEST	RECOMMENDED LEVEL
Free Chlorine or	1.0 - 3.0 ppm
Bromine	2.0 - 4.0 ppm
pH	7.2 to 7.6
Total Alkalinity (T.A.)	100 to 150 ppm
Calcium Hardness (CH)	200 to 400 ppm
Langelier Saturation Index (SI)	-0.5 to +0.5
Cyanuric Acid	30 to 150 ppm
Total Dissolved Solids (TDS)	2000 ppm
Copper	0 ppm

Water Changing

Teledyne Laars recommends regular draining of the water every 60 days during light use and every 30 days during heavy use. The cost of water to fill a spa is low, equal to the cost of water used by an average family for 3 to 4 days.

When in doubt, change the water!

3G. Winter Freeze

During periods when the spa is used intermittently, do not turn the heater OFF, just turn the thermostat to MIN. This will prevent the water and surrounding ground from becoming chilled, and also permit the water to be raised to desired temperature in a shorter time. If heater will not be used for a longer period of time, turn external gas valve to OFF position, or if not provided, remove heater housing and turn off gas valve knob. Toggle switch may be turned to OFF position.

The Telstar heater is not designed for continuous use as an anti-freezing device. Operating the heater for long periods when the water temperature is less than 70°F (21°C) will seriously damage the heater, and may cause a dangerous condition by fouling the heat exchanger passages, which could result 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 spa temperature, shut down and drain your filter system and the spa heater as described above.

CAUTION

In areas where freezing weather occurs, drain the heater before the first frost. Turn off all gas valves. Drain the heater by using the drain valve located inside the heater on the left side of the casting (see Fig. 15). Leave the drain valve open until ready to use the heater again.

Do not use the heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and replace any part of the control system and any gas control which has been under water.

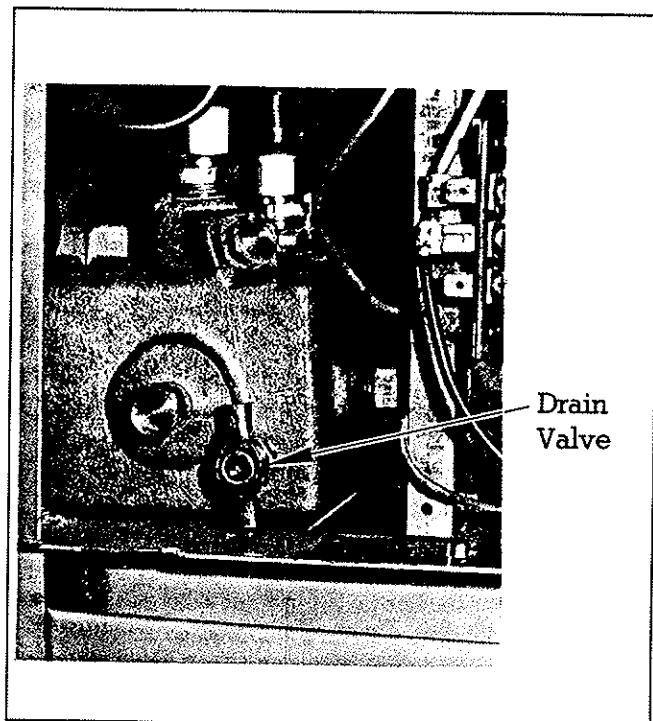


Figure 15. Drain Valve and Plug Locations

SECTION 4. Maintenance

4A. Periodic Inspection and Maintenance

The Telstar has been designed and constructed for a long performance life when installed and operated properly under normal conditions. Regular annual inspections, as outlined below, are strongly recommended as a means of keeping your heater operating efficiently.

1. Keep leaves and debris off the top of the heater. Check for and clear any accumulation of flammable debris, leaves, paper, etc. from beneath the heater or nearby. Be sure that gasoline or other flammable liquids or vapors are not stored near the heater.

2. Check venting of indoor heaters for looseness and leaks. Make sure that all openings for combustion and ventilation air are clear.
3. Inspect the surface condition of the heat exchanger for soot accumulation by placing a mirror under the burner when the heater is firing. If soot has accumulated, remove it and correct the cause.
4. Check for spider webs in pilot and burner orifices, especially at spring start-up.

4A-1. Annual Inspection by Pool Service Technician

Have a competent service agency inspect the gas and electric controls annually to insure safe and dependable operation. Specifically, these include:

1. High Temperature Limit Switches.
2. Water Pressure Switch.
3. Automatic Gas Valve.
4. Ignitor Sensor and High Tension Lead (electric ignition models).
5. Gas Pressure
6. Temperature Rise
7. Pilot and Burner Flame (See Fig 16).

An abnormal flame appearance or a yellowish flame may indicate that the burners require cleaning. The burner/gas valve assembly can be easily removed:

- a. Turn off gas supply.
- b. Remove lower wrap.
- c. Disconnect gas supply piping.
- d. Disconnect wires on the gas valve.
- e. Remove the burner support screw located on the left side, near the bottom of the combustion chamber. Remove burner/gas valve assembly from the right side, off the support flange (see Fig. 17).

Closely inspect and clean the burner ports using a fine wire brush. Reinstall the assembly carefully and connect wires as shown on the wiring diagram (wiring diagram is attached to inside of heater housing).

Moisture and dust can infiltrate these controls after many years, and can eventually cause deterioration. An annual inspection schedule and repair or replacement as needed will keep your heater performing properly.

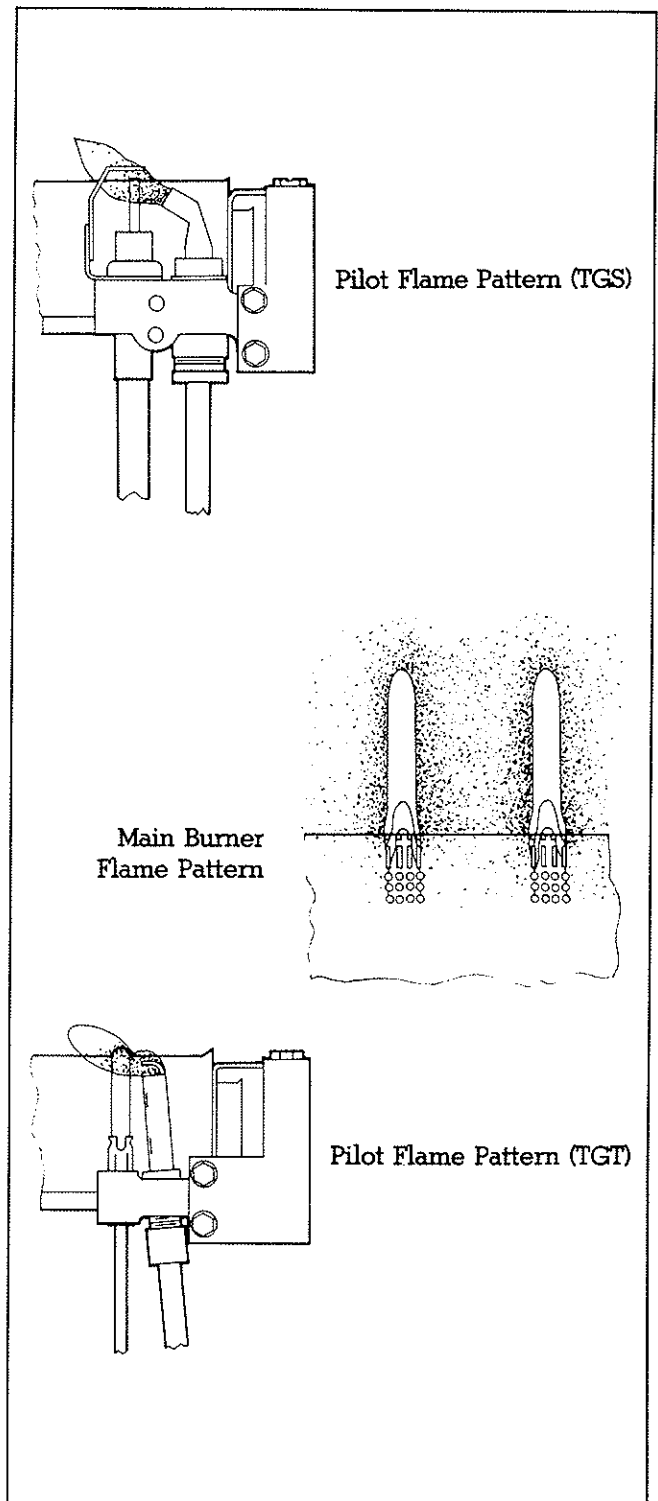
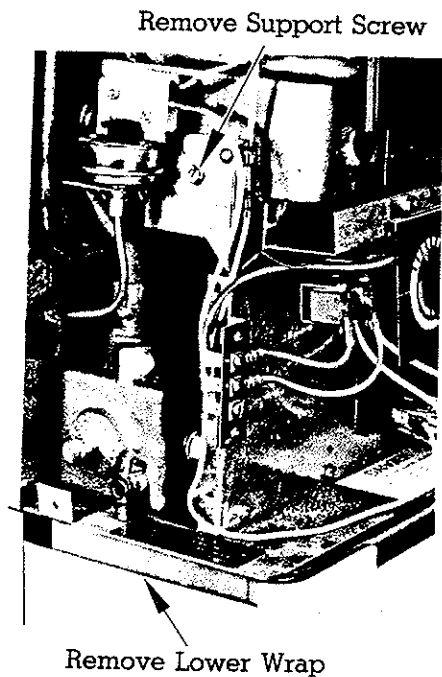


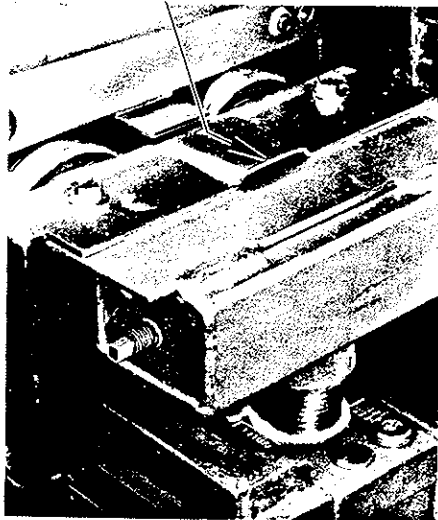
Figure 16. Pilot Flame Pattern

4B. Troubleshooting Preliminary Checks

Experience shows that most complaints about heaters not firing 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.



Remove Burner Assembly
to the Right *



* Lower Wrap Must Be Removed
before Removing Burner Assembly

Figure 17. Burner Removal

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

1. Be sure the heater is properly installed.
2. Be sure filter is clean. Build-up of residue on the filter can lower the pressure at the heater and shut it off.
3. Make sure pump is not airlocked, clogged or inoperative.
4. Make sure main drain and skimmer valves are open.
5. Make sure gas valve is on and correct pressure available.
6. Make a careful inspection of all electrical connections and wiring. Finding a loose connection or a damaged wire can save a lot of time.
7. Verify that the electrical circuit serving the heater is on.
8. Verify that the temperature control knob is set high enough to call for heat and that the toggle switch is turned on.

If the pump and filter system is properly circulating water and all of the above items have been checked, the trouble is in the heater control system.

NOTE: Keep the filter system running.

4C. Sequence of Operation

1. Standing Pilot Models

- a. Pilot is lit with a match following the lighting instructions.
- b. Toggle switch is turned ON.
- c. Upon operation of the pump, the pressure switch contacts close.
- d. If the water temperature is below the desired set temperature, the temperature control contacts close, calling for heat. The HEATING light comes on, the 24-volt gas valve is energized and the main burners light.
- e. When the water temperature reaches the desired set point, the temperature control contacts open and the red HEATING light goes off.

2. Spark Ignition Models

- a. Toggle switch is turned ON.
- b. Upon operation of the pump, the pressure switch contacts close.
- c. If the water temperature is below the desired set temperature, the temperature control contacts close, calling for heat. The HEATING light comes on, and the

ignition control is energized. An electric spark ignites the pilot. When the pilot flame is proven, the spark stops and the gas valve opens and the main burners light.

- d. When the water temperature reaches the desired set point, the temperature control contacts open and the red HEATING light goes off.

4D. Gas Pressure

Use a slack-tube manometer to check main line gas pressure. A manometer kit is available from the factory and includes operating instructions. Proper connections are shown in Figs. 18 & 19.

4E. Electrical Troubleshooting Instruments Required

Volt-Ohmmeter

D.C. Microammeter

Millivoltmeter

For models TGT (Standing Pilot) see Figs. 21 and 22.

For models TGS (Spark Ignition) see Figs. 24 and 25.

1. Model TGT (Standing Pilot models)

a. Pilot will not stay lit.

Check the thermocouple using a millivoltmeter; readings should be as follows:

1. Open circuit should be at least 20 millivolts (see Fig. 20).
2. Closed circuit should be at least 10 millivolts. If the minimum readings are low, it could indicate a dirty or clogged pilot. Clean pilot and re-check millivolts before replacing the thermocouple.

b. Pilot is lit; main burners do not light.

1. High and low voltage step-by-step check-out

- a. Set volt-ohmmeter on appropriate scale and check for 120/240 volts to transformer. If meter does not register 120/240 volts, check disconnect switch, circuit breaker, or fuses.
- b. If there is 115/230 volts, set volt-ohmmeter on appropriate range for 24-volt reading.
- c. Connect one lead from meter to the yellow wire side of the transformer (Point 1 on Fig. 22 and 25). This lead will stay connected until electrical tests are completed (Low voltage readings should be in the range of 20 to 28 vac).
- d. Move the other meter lead from point to point as follows:

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 side of gas valve illustrated; if no plug is provided in gas valve, pressure is taken in manual (external) shut-off valve.
 5. Screw in $\frac{1}{8}$ " NPT fitting from manometer kit. Attach manometer hose to fitting and to one of the manometer valves as shown.
 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 10" | 11" to 14" |
| WC— | WC— |
| | LP Gas |

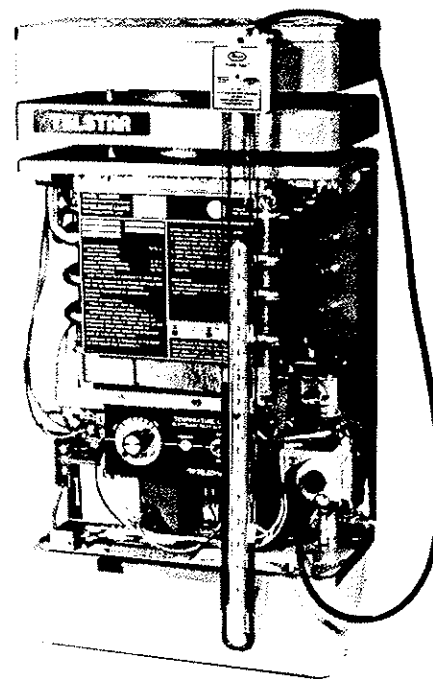


Figure 18. Main Line Gas Pressure Test

Point 2. If the meter shows 24 volts, transformer is good. If no voltage, replace transformer.

Point 3. Disconnect wires and check male connection for 24 volts. If there is no voltage reading, replace the 120°F high limit. Reconnect wires.

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 manifold as shown. 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
9" WC—LP Gas
7. To adjust gas pressure, remove regulator cap screw on top of valve marked "Reg. Adj." Turn screw adjustment clockwise to increase or counter-clockwise to decrease gas pressure.

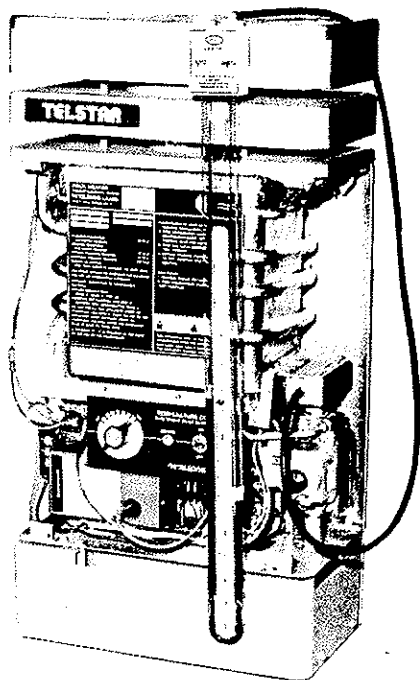


Figure 19. Manifold Gas Pressure Test

Point 4. Disconnect wires and check male connection for 24 volts. If there is no voltage reading, replace the 150°F high limit and check for cause.

Point 5. With toggle switch in "ON" position, check for 24 volts. If there is no reading, replace the ON/OFF switch.

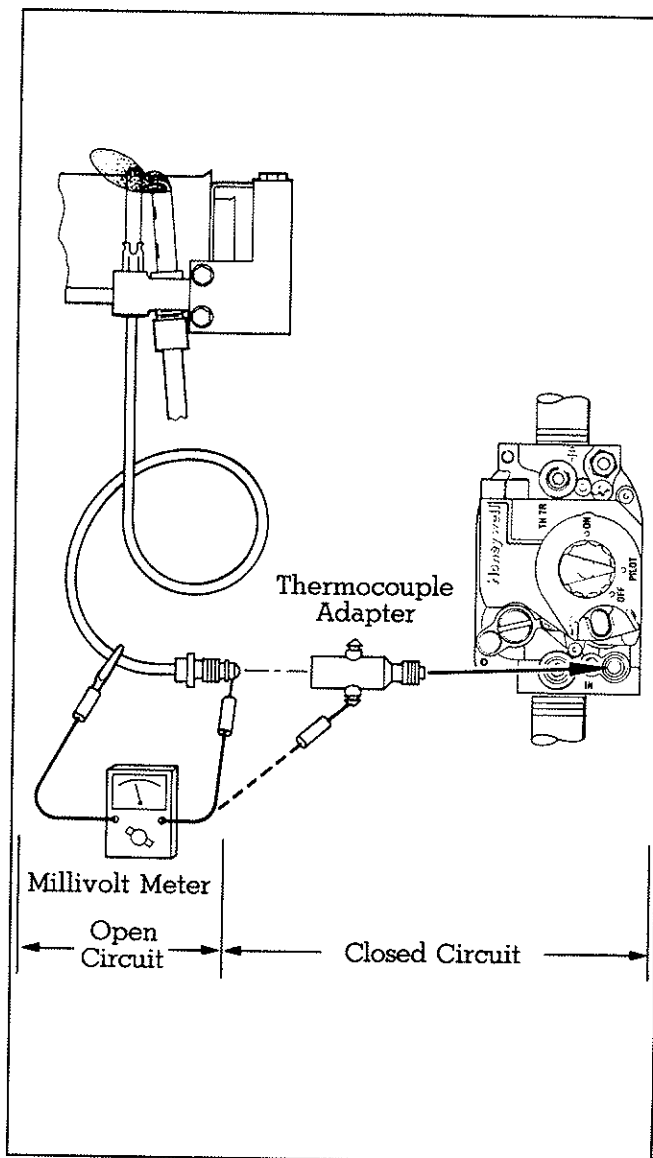


Figure 20. Thermocouple Checkout

Point 6. With pump running, check for 24 volts. If there is no reading, check for a dirty filter or blockage between the pump and the heater. If system is clear, replace the pressure switch.

Point 7. With temperature control set to call for heat, check for 24 volts. If there is no voltage reading, replace the temperature control.

Point 8. With the gas valve turned on, check for 24 volts at the brown wire. If the heater won't fire, replace the gas valve. If the heater fires but the front panel indicator light does not come on, replace the light.

2. Model TGS (Spark Ignition)

a. Ignition Control Electrical Check-out

Before beginning the electrical diagnosis, make a visual check of the ignition control components.

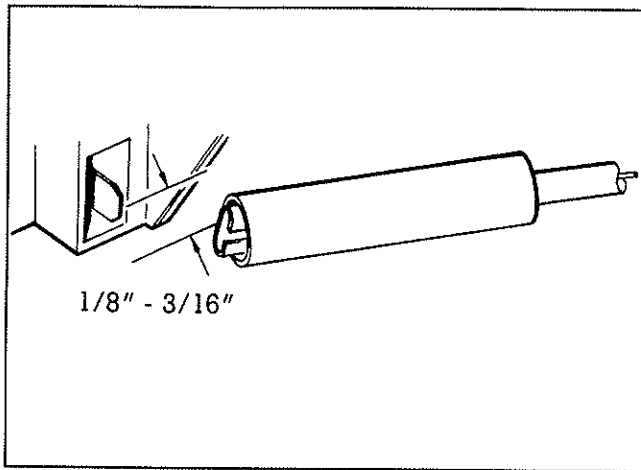


Figure 23. Pulling Ignition Wire from Ignition Control to look for Spark

1. **Pilot Burner.** Make sure it is properly positioned next to main burner as shown and free of soot and dirt (see Fig. 24).
2. **Igniter-Sensor Electrode.** Check for proper spark gap. Electrode must be clean, and the terminal connection tight.
3. **High Voltage Ignition Lead.** Connections must be tight and silicone rubber boots in place. Bare metal parts at the base of the manifold bracket must be at least 3/8" from other metal objects.
4. **Electrical Connections.** Be sure that all wire connections at the ignition control and the gas valve are tight.

b. Pilot Burner Will Not Light

1. With toggle switch at ON position, and the thermostat set high enough to call for heat, a spark should immediately appear at the pilot burner electrode.
2. If there is no spark, pull the ignition wire from the ignition control and hold the bare terminal 1/8" to 3/16" from the ignition stud with a pair of insulated pliers. (See Fig. 23). If no spark jumps this gap, check for 24 volts between the yellow and brown wires on the left side of the ignition control. If no voltage is read, refer to "High and Low Voltage step-by-step Checkout."
3. If sparking occurs at the pilot burner, but there is no pilot ignition after two or three minutes, check for voltage between the yellow wire terminal on the transformer and the pilot gas valve terminal (orange wire) on the gas valve.
4. If no voltage is shown, the ignition control may be defective and require replacement. Check connections.

NOTE: Do not repair the ignition control in the field. If it does not operate properly, replace it.

5. If voltage is between 20 and 28 volts, but there is no pilot gas flow, check for cause. The gas supply may be turned off, or the gas valve may be defective.

c. Pilot and Main Burners Do Not Light

1. High and Low Voltage step-by-step Checkout.

- a. Set volt-ohmmeter on appropriate scale and check for 115/230 volts to transformer. If 115/230 volts is not present, check disconnect switch, circuit breaker, or fuses.
- b. If 115/230 volts is present, set volt-ohmmeter on appropriate range for 24-volt reading.

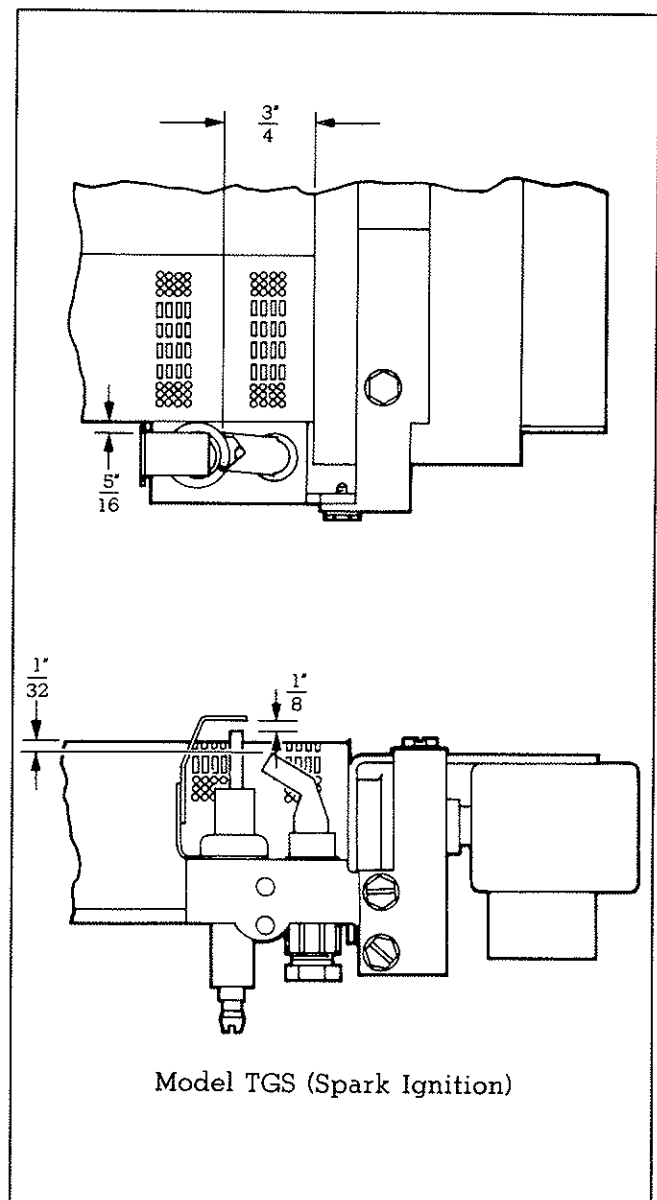


Figure 24. Pilot Burner Location - Model TGS

WIRING DIAGRAM - MODEL TGS 50 HEATER

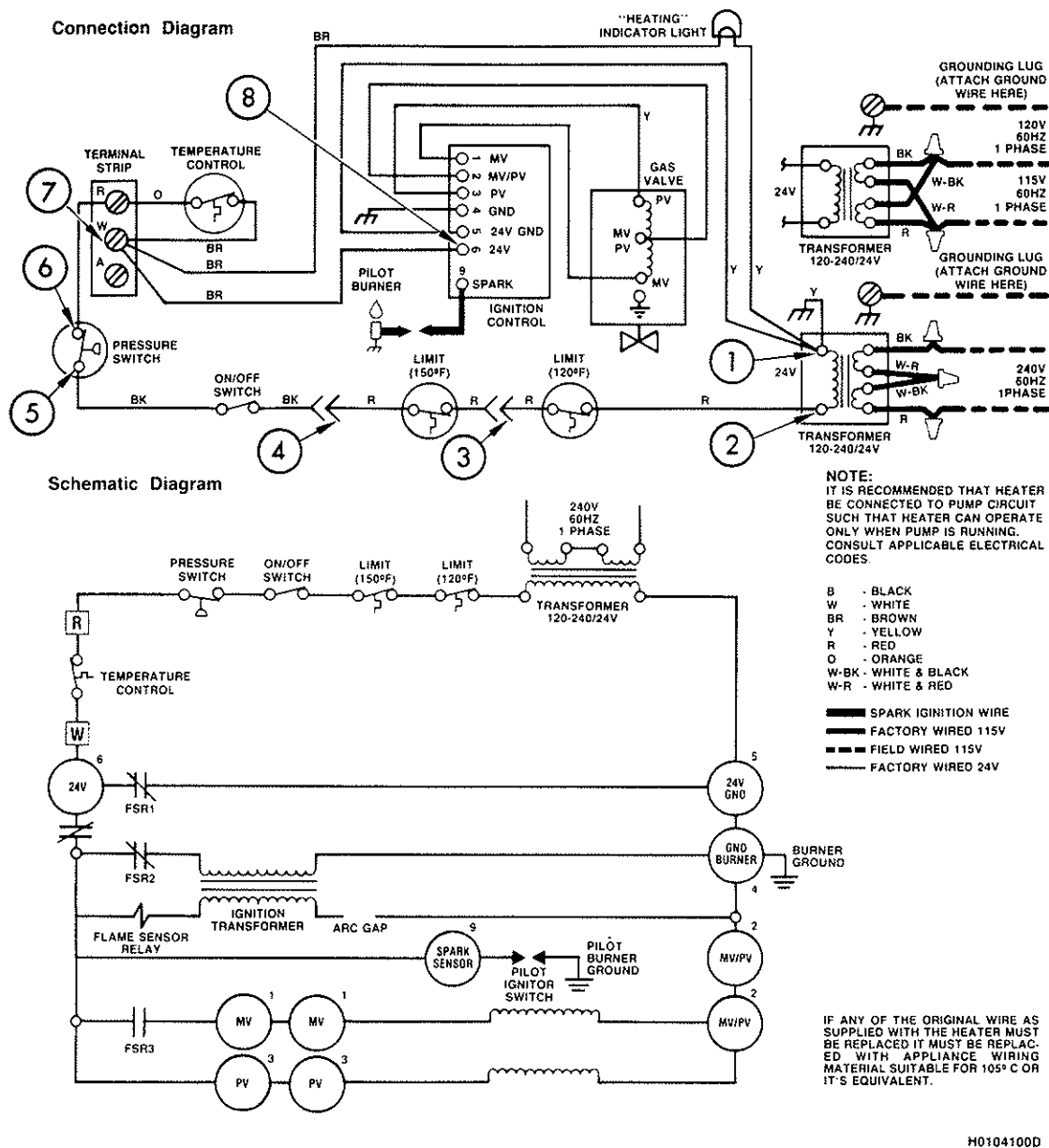


Figure 25. Troubleshooting Wiring Diagram - Model TGS Heater

- c. Connect one lead from meter to the yellow wire side of the transformer (Point 1 on Fig. 22 and 24). This lead will stay connected until electrical tests are completed (Low voltage readings should be in the range of 20 to 28 volts).
- d. Move the other meter lead from point to point as follows:

Point 2. If 24 volts appears on the meter, transformer is good. If no voltage, replace the transformer.

Point 3. Disconnect wires and check male connection for 24 volts. If there is no voltage reading, replace the 120°F high limit. Reconnect wires.

Point 4. Disconnect wires and check male connection for 24 volts. If there is no voltage reading, replace the 150°F high limit. Reconnect wires.

Point 5. With toggle switch in ON position, check for 24 volts. If there is no reading, replace the ON/OFF switch.

Point 6. With pump running, check for 24 volts. If there is no reading, check for dirty filter or blockage between the pump and the heater. If system is clear, adjust or replace the pressure switch.

Point 7. With temperature control set to call for heat, check for 24 volts. If there is no reading, replace the temperature control.

Point 8. Check for 24 volts between terminals 5 and 6 (tran. yellow and 24 VAC) on ignition module. If there is no reading check back through previous steps.

Point 9. On the the ignition module, check for 24 volts between terminals 2 and 3 (tran. yellow and PV). If voltage is present and the pilot burner does not light, see Section 4E.

Point 10. On the ignition module, check for 24 volts between terminals 1 and 2 (MV and tran. yellow). If voltage is present and main burners do not light, go to Section 4E.

d. Pilot Burner Lit - No Main Burner Ignition

1. When pilot burner is lit, the sparking should stop and the main burners should light.
2. If sparking continues and the main burners do not fire, the ignition cable or connections may be bad, wet or the pilot flame is unsatisfactory.
3. If wires and connections appear okay, measure the flame sensing current by connecting a DC microammeter as shown in Fig. 26.

NOTE: Separate meter leads from each other and keep them clear of the heater chassis for most of their length.

4. With pilot burner lit, the meter should indicate a flame sensing current of one microampere or more with or without the main burners operating. The ignition control will not permit main burner operation if flame sensing current is below 0.6 microamperes. Inadequate flame current is caused by unsatisfactory pilot flame, electrode configuration or poor cable and connections.
5. If pilot flame and sensing components are okay, the main burners should come on shortly after pilot ignition. If there is no main burner ignition, check for voltage between the yellow wire terminal on the transformer and

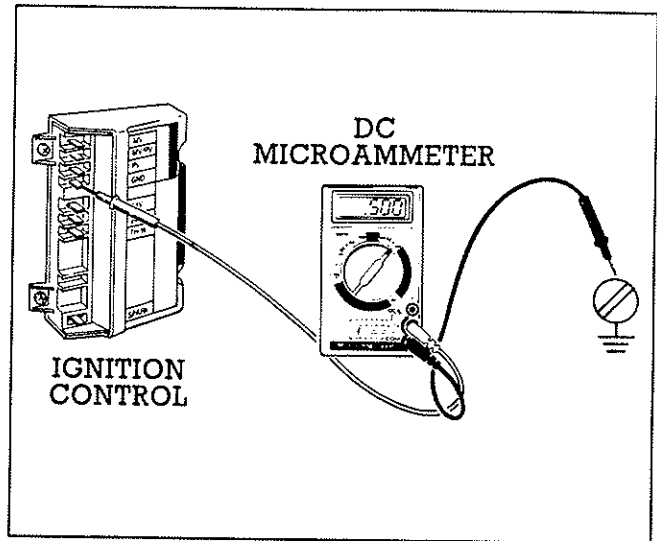


Figure 26. Pilot Burner Test

the brown wire terminal on the gas valve.

6. If voltage is between 20 and 28 volts, but there is no main burner gas flow, replace the gas valve.

e. ON/OFF Main Burner Cycling

If a safety control or the temperature controller is not causing the problem, cycling is generally due to erratic pilot burner flame. Downdraft conditions, pilot or chassis components out of position or low gas pressure can be the cause.

When gas lines are undersized, the pilot flame will appear to be satisfactory before the main burners come on, but shrink when the main burners fire.

4F. Heater Dimensions

Fig. 27 shows the heater's dimensions and general configuration.

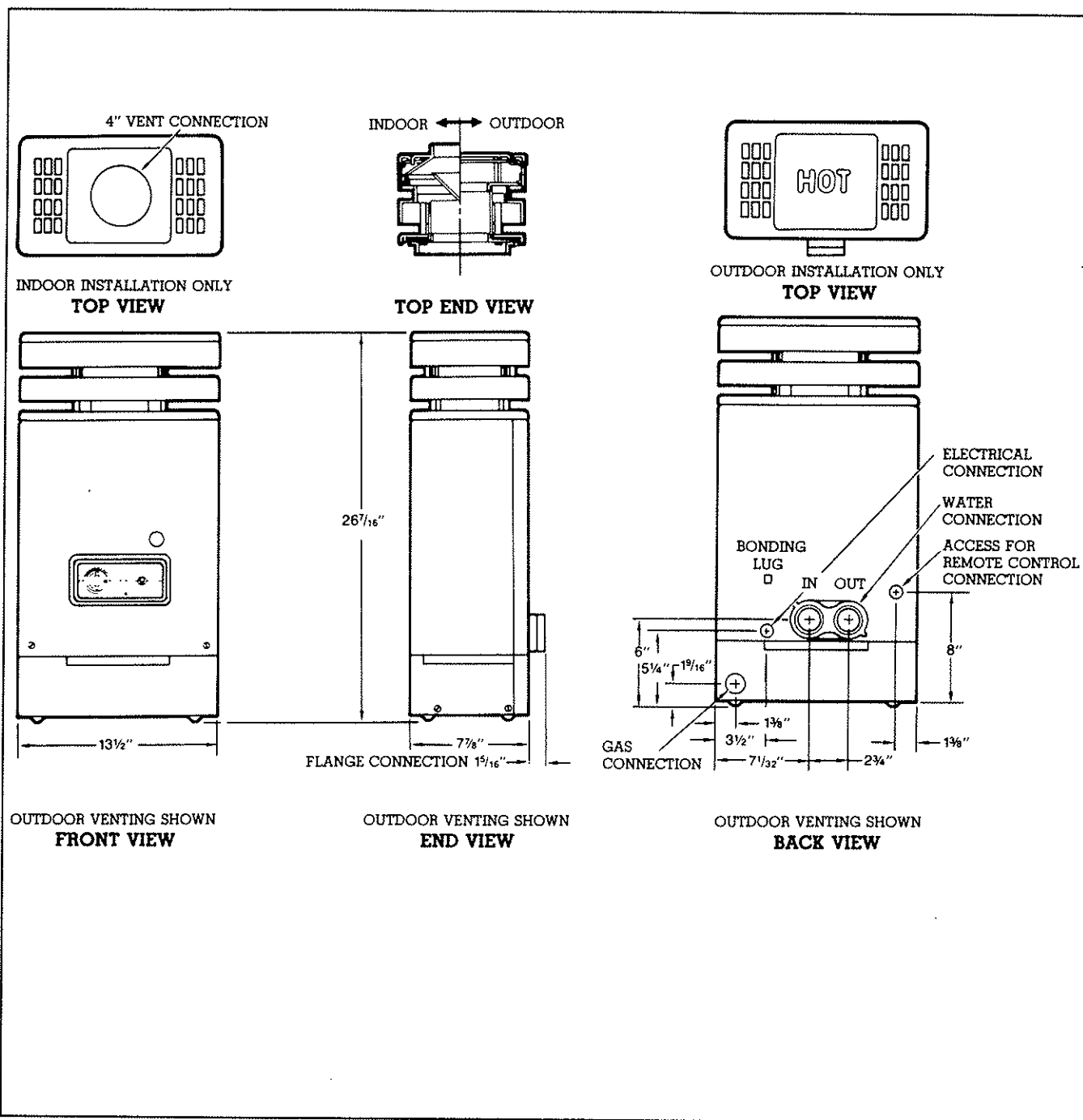


Figure 27. Dimensions

TELSTAR (Spark Ignition) Spa Heaters—TGS-50
TELSTAR (Standing Pilot) Spa Heaters—TGT-50

V. Component Parts Identification

Refer to Parts List for Key Numbers and corresponding Teledyne Laars Parts Numbers.

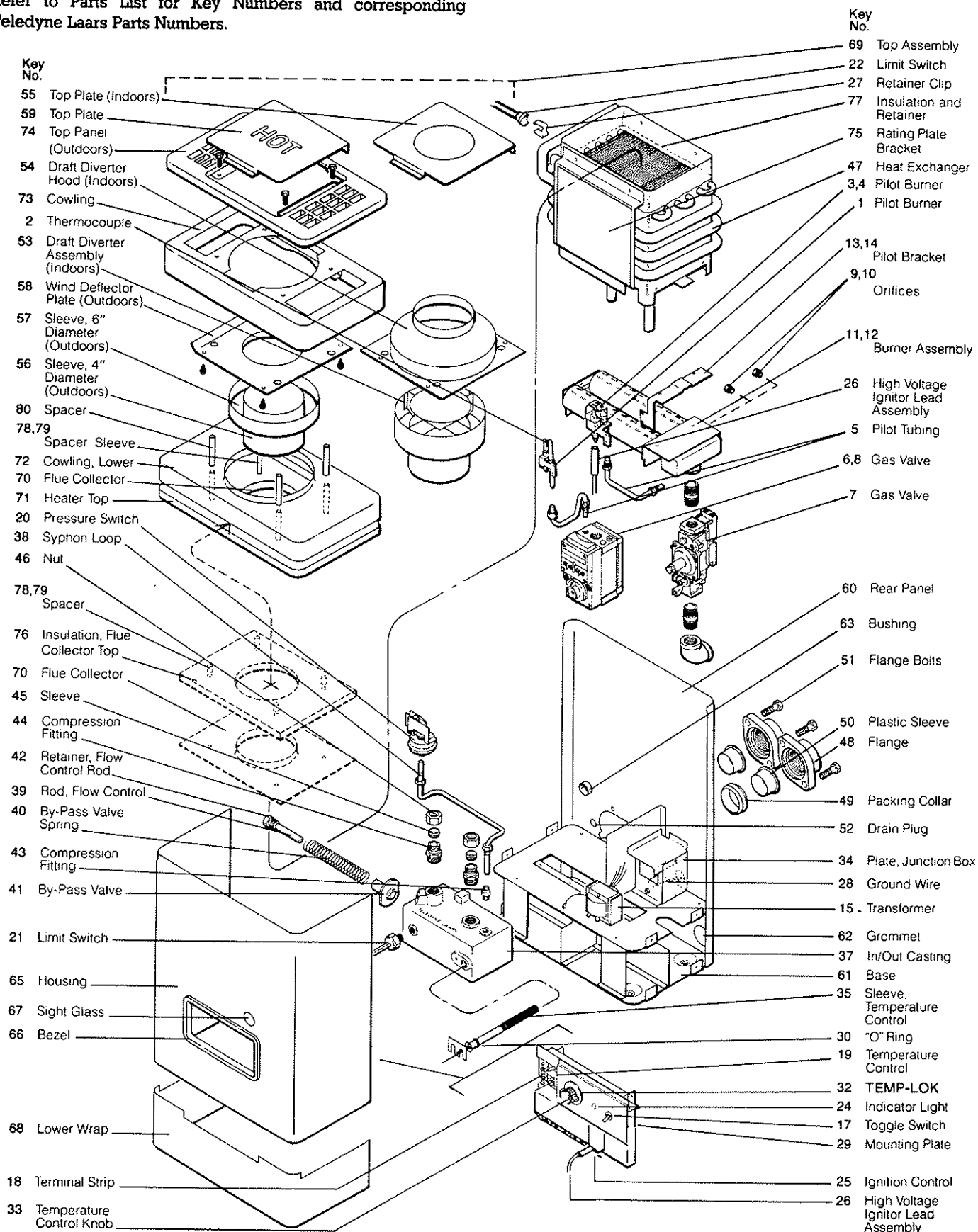


Fig. 28. Exploded View of Telstar Components.

TELSTAR (Spark Ignition) Spa Heaters—TGS-50
TELSTAR (Standing Pilot) Spa Heaters—TGT-50
W. Parts List

Key No.	Description	TGT-50	TGS-50	Key No.	Description	TGT-50	TGS-50
Pilot Gas System				Water System			
1	Pilot Burner, RS 2BLC Natural Gas	W-00330	-----	37	Casting, In/Out Bronze Header	104892	104892
2	Thermocouple, RS 2C 12"	W-00332	-----	38	Syphon Loop 3/16"	104923	104923
3	Pilot Burner, HW Q362A Natural Gas	-----	W-00333	39	Rod, Flow Control (See Note 4)	S-00743	S-00743
4	Pilot Burner, RS 2BLC LPG	W-00331	-----	40	Bypass Valve, Spring	S-00612	S-00612
5	Tube, Pilot Gas, Formed	105287	104905	41	Bypass Valve (See Note 4)	S-00742	S-00742
Main Gas System				42	Retainer Flow Control Rod (See Note 4)	S-00087	S-00087
6	Gas Valve, HW VR8200 Natural Gas, 1/2"	V-00589	-----	43	Compression Fitting, 3/16" Tube x 1/8" NPT	P-00197-01	P-00197-01
7	Gas Valve, HW VR8204 Natural Gas, 1/2"	-----	V-00591	44	Compression Fitting, 5/8" Tube x 1/2" NPT	P-00700	P-00700
8	Gas Valve, HW VR8200 LPG, 1/2"	V-00590	-----	45	Sleeve, Compression Fitting, 5/8" Tube	P-00701	P-00701
9	Main Burner Orifices, Two #43, Natural Gas (Note 2)	L-00531	L-00531	46	Nut, Compression Fitting, 5/8" Tube	P-00702	P-00702
10	Main Burner Orifices, Two #53, LPG (Note 2)	L000541	-----	47	Heat Exchanger Assembly	S-00724	S-00724
11	Burner Assembly, Natural Gas (Note 1)	L-00544	L-00544	48	Flange, 1-1/2" Bronze	104894	104894
12	Burner Assembly, LPG (Note 1)	L-00544	-----	49	Packing Collar for Flange	S-00531	S-00531
13	Pilot/Hx Bracket, Natural Gas	104895-01	104895-02	50	Plastic Sleeve for Flange	S-00280	S-00280
14	Pilot/Hx Bracket, LPG	104895-01	-----	51	Flange Bolts, 3/8"-16 x 1-1/2"	F-00167	F-00167
Electrical System				52	Drain Plug, 1/4" NPT Brass	P-00268	P-00268
15	Transformer, 115-230/24V (30VA)	E-00974	E-00974	Vent System			
16	Fusible Link	E-00994	E-00994	53	Draft Diverter Assembly (Indoors)	104982	104982
17	Toggle Switch On-Off Assembly	104988	104988	54	Draft Diverter Hood/Wind Deflector Plate Assembly (Indoors)	104995	104995
18	Terminal Strip	E-00985	E-00985	55	Top Plate (Indoors)	104889	104889
19	Temperature Control, Laars, 70°-107°	E-00971	E-00971	56	Sleeve, 4" Diameter (Outdoors)	104969	104969
20	Pressure Switch, 2 PSI	R-00145	R-00145	57	Sleeve, 6" Diameter (Outdoors)	104970	104970
20	Pressure Switch, 1 PSI (See Note 3)	R-00113	R-00113	58	Wind Deflector Plate (Outdoors)	104971	104971
20	Pressure Switch, 3 PSI (See Note 3)	R-00130	R-00130	59	Top Plate (Outdoors)	104888	104888
20A	Pressure Switch, (See Note 5)	R-00155	R-00155	Jacket Components			
21	Limit Switch, Lower, 135° F	104912	104912	60	Rear Panel	104883	104883
22	Limit Switch, Upper, 150° F	104911	104911	61	Base	104932	104932
23	Time Delay Relay	E-00816	E-00816	62	Grommet, Slitted, 1-1/2"	F-00388	F-00388
24	Heating Indicator Light, Red	E-00817	E-00817	63	Bushing, Nylon	S-00649	S-00649
25	Ignition Control, HW S86F	-----	E-00940	64	Control Panel, Weldment	104942	104942
26	High Voltage Ignitor Lead Assembly	-----	104495-01	65	Housing, Weldment	104959	104959
27	Retainer Clip, Upper, 150° F Limit	F-00377	F-00377	66	Bezel	S-00721	S-00721
28	Ground Wire Assembly	104975	104975	67	Sight Glass	F-00387	F-00387
29	Temperature Control Mounting Plate Assembly	104910	104910	68	Lower Wrap	104962	104962
30	"O" Ring	E-00363	E-00363	69	Top Assembly	104877	104877
31	Temperature Control Logo	H-00783	H-00783	70	Flue Collector	104873	104873
32	TEMP-LOK	104567	104567	71	Heater Top	104890	104890
33	Knob	E-00945	E-00945	72	Cowling, Lower	104886	104886
34	Plate, Junction Box	104963	104963	73	Cowling, Weldment	104960	104960
35	Sleeve, Temperature Control Bulb	104449	104449	74	Top Panel	104875	104875
36	Wire Harness (Not Shown)	R-00111	R-00112	75	Rating Plate Bracket	104896	104896
				76	Insulation, Flue Collector Top	T-00221	T-00221
				77	Insulation, Heat Exchanger (Not Shown)	T-00225	T-00225
				78	Spacer Sleeve, 5/16" O.D. x 5/32" (4 Required)	F-00373-01	F-00373-01
				79	Spacer Sleeve, 5/16" O.D. x 2-7/32" (4 Required)	F-00373-02	F-00373-02
				80	Spacer, Threaded, 5/16" Hex x 2-21/32" (4 Required)	F-00378	F-00378

Notes:

1. Main Burner Orifices not included.
2. For altitudes higher than 2000 ft. above sea level, consult factory for orifice size.

3. Special application, consult factory.
4. Key Nos. 39, 41 and 42 available in assembly R-00206.
5. Service part pressure switch adjustable from 1/2 PSI to 10 PSI.

Teledyne Laars TELSTAR Limited Warranty

Your Teledyne Laars TELSTAR spa heater is backed by this double Warranty to assure your complete satisfaction:

1. Controls, copper heat exchanger tubes and firebox panels are warranted against defects in materials and workmanship for two (2) years from date of purchase.
2. All other parts are warranted against defects in materials and workmanship for five (5) years from date of purchase.

The above warranty applies only if the installation and operating instructions applicable to the model purchased are expressly and completely followed. These instructions are furnished with the unit and also are available by writing the Teledyne Laars factory. The liability of Teledyne Laars shall not exceed the repair or replacement of defective parts and shall not include transportation to or from factory, field labor, and consequential or incidental

damages. Ship inoperative parts or complete heater, together with Serial Number and purchase date, transportation prepaid, directly to address below. Attention: Service Manager. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.



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