



SERVICE MANUAL FOR POWER VENTED WATER HEATERS

TTW1 MODEL SERIES: MITW40L, MITW50L

**TTW2 MODEL SERIES: MIITW50T, MIITW75T, M2CTW50T, M2CTW75T,
TW-50S65, TW-75S75**

TTW1 MODEL SERIES STARTS ON PAGE 2

TTW2 MODEL SERIES STARTS ON PAGE 16

CAUTION!

INFORMATION PROVIDED IN THIS MANUAL IS INTENDED TO ASSIST QUALIFIED SERVICE PERSONNEL. SERVICING OF THE UNIT MAY REQUIRE KNOWLEDGE OF ELECTRICAL TESTING EQUIPMENT. IF YOU ARE UNFAMILIAR, OR UNSURE OF THE TESTING EQUIPMENT, CONSULT A QUALIFIED ELECTRICIAN.

NOTICE:

THIS MANUAL DOES NOT REPLACE THE INSTALLATION AND OPERATING INSTRUCTION MANUAL WHICH ACCOMPANIED THE WATER HEATER. IF YOU ARE MISSING THE MAIN MANUAL, CONTACT THE MANUFACTURER LISTED ON THE RATING PLATE FOR REPLACEMENT INFORMATION.

TTW1 SERVICE MANUAL

The TTW1 is a power vented water heater that is equipped with safety controls and an electronic ignition system. In order for the water heater to perform satisfactorily, it must be installed with the appropriate fuel type, supply pressure, voltage, branch circuit wiring, circuit breaker, venting and plumbing connections by a qualified professional.

IMPORTANT

The TTW1 is equipped with a power supply cord that has a three pronged plug. This plug must be plugged into a properly grounded receptacle. If local codes require the water heater to be hard wired with conduit, the water heater must be wired by a qualified professional.

BASIC OPERATION OF THE WATER HEATER

The water heater is equipped with a surface mounted thermostat that senses the tank's temperature. When the water temperature inside the tank drops below the setting of the thermostat, the switch inside of the thermostat closes sending a 110/120 volt power supply to the blower and the primary side of the transformer. With 110/120 volts supplied from the thermostat, the blower begins to operate and closes the pressure switch if venting conditions are normal. The secondary (24 volt) side of the transformer is connected to the ignition module through the pressure switch, temperature switch, and gas valve ON/OFF switch (SCP gas valves only). With the pressure switch closed, the ignition module initiates an ignition sequence by sending a high voltage spark to the electrode in the pilot assembly and sending 24 volts to the pilot gas valve. After the spark ignites the pilot gas, the ignition module will sense the pilot flame and turn off the spark and the module will allow 24 volts to energize the main gas valve. Gas will flow to the main burner and will be lit by the pilot. The main burner will heat the tank of water until the thermostat is satisfied. When the thermostat is satisfied, the burners and blower will stop operating. In event the tank water becomes excessively hot, a built in manual reset high limit will open preventing operation of the water heater. If this occurs see page 5 for instructions regarding the resetting of the high limit.

IMPORTANT REMINDERS FOR INITIAL START UP OF THE WATER HEATER

The timing of the ignition sequence will vary depending upon the model of the ignition module supplied with your water heater. Refer to the model number of the ignition module inside the control box.

Robertshaw SP745 Ignition Module: (Supplied on TTW1 models manufactured before 7/1/95).

The ignition module will lock out if a pilot flame is not established within 60 seconds of the initial ignition attempt. When the module locks out, the power supply to the water heater needs to be interrupted before another ignition attempt can be made. During initial start up, the module may lock out if air in the gas line prevents the pilot from igniting. In some installations, it may be necessary to repeat several ignition attempts upon initial start up of the unit. This can be accomplished by interrupting the power supply to the water heater. Follow the lighting instructions provided on the water heater.

Robertshaw SP845 Ignition Module: (Supplied on TTW1 models manufactured after 3/30/95).

This ignition module may have a 15 second delay or prepurge timing (indicated by letter "P" following "845" in the model number) before the ignition sequence will begin. The green LED indicator light on the module indicates the module has 24 volts and is activated. After the 15 second prepurge period, the pilot valve will open and the pilot electrode will start sparking (non-prepurgue modules will begin sparking immediately after being powered). If the pilot does not light within 90 seconds, the pilot valve will close and the pilot electrode will stop sparking. The induced draft blower will continue to run. After

a 6 minute delay period (to allow gas to vent from the combustion chamber), another attempt will be made to ignite the pilot. If the pilot still fails to light, a third and final attempt will be made after the 6 minute interpurge period. If the pilot fails to light on the third attempt, the control "locks out" and no additional ignition attempts will be made until the ignition module is reset by interrupting the power supply. If the module is "locked out" the induced draft blower continues to operate and the green light on the module will blink.

Proper Setting of the Thermostat.

The thermostat is preset from the factory at a setting approximating 120°F. An individual installation may require different water temperatures than the factory setting. If the water is too cold or hot, see the installation instructions for thermostat adjustment.

REMEMBER: HOTTER WATER INCREASES THE RISK OF SCALD INJURY.

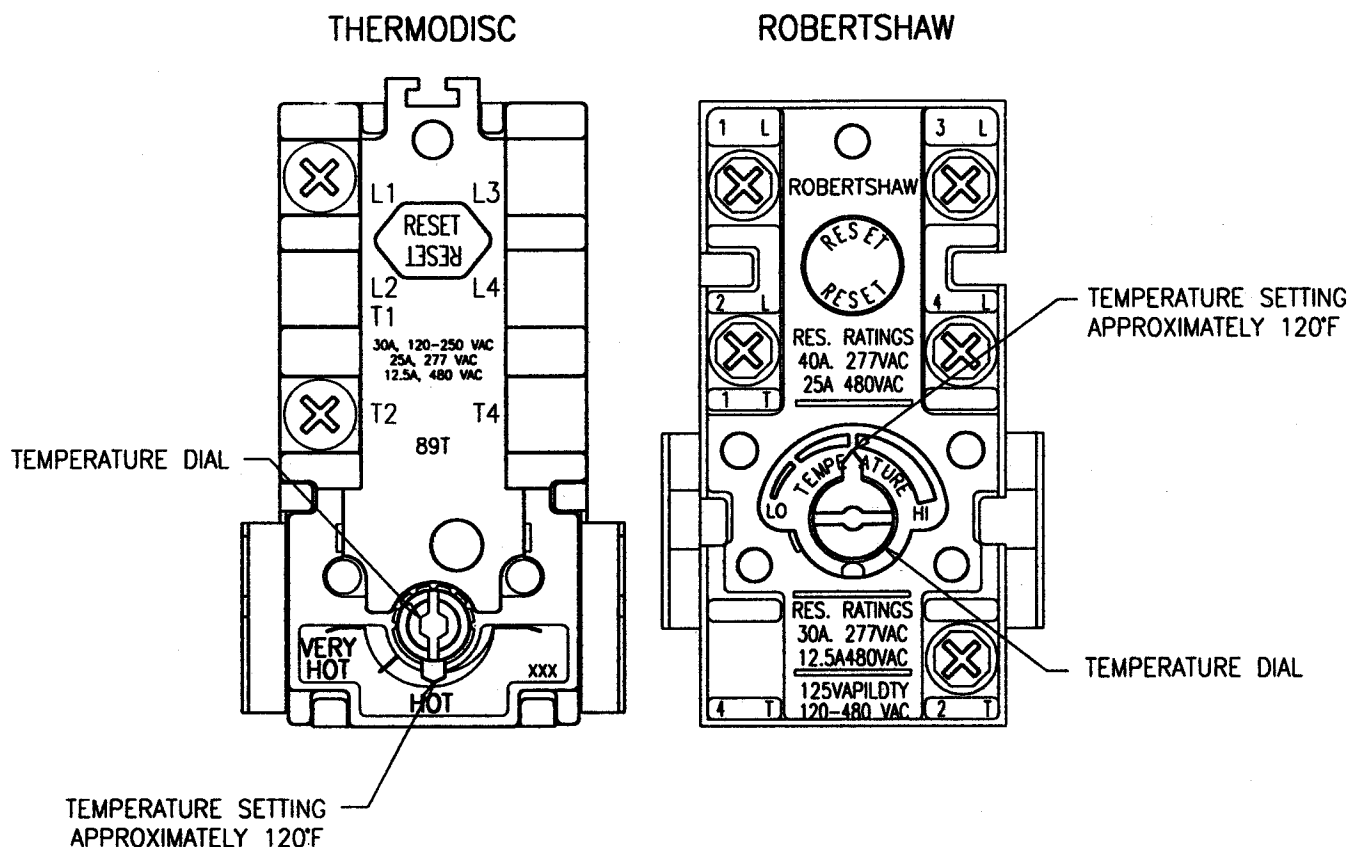


Figure 1
TYPICAL WATER HEATER INSTALLATION FOR TTW1

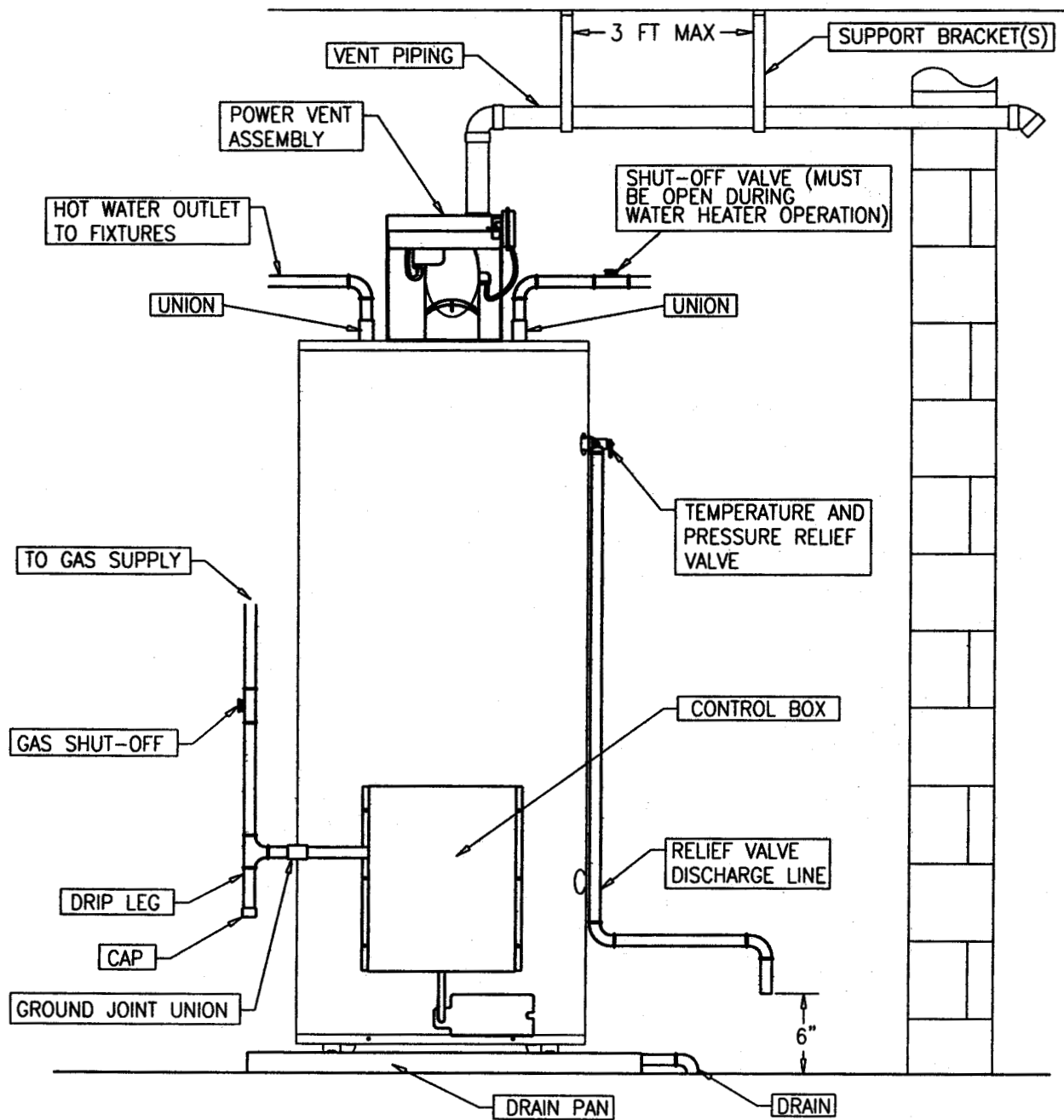


Figure 2
TTW1 POWER VENT ASSEMBLY (AMETEK BLOWER)

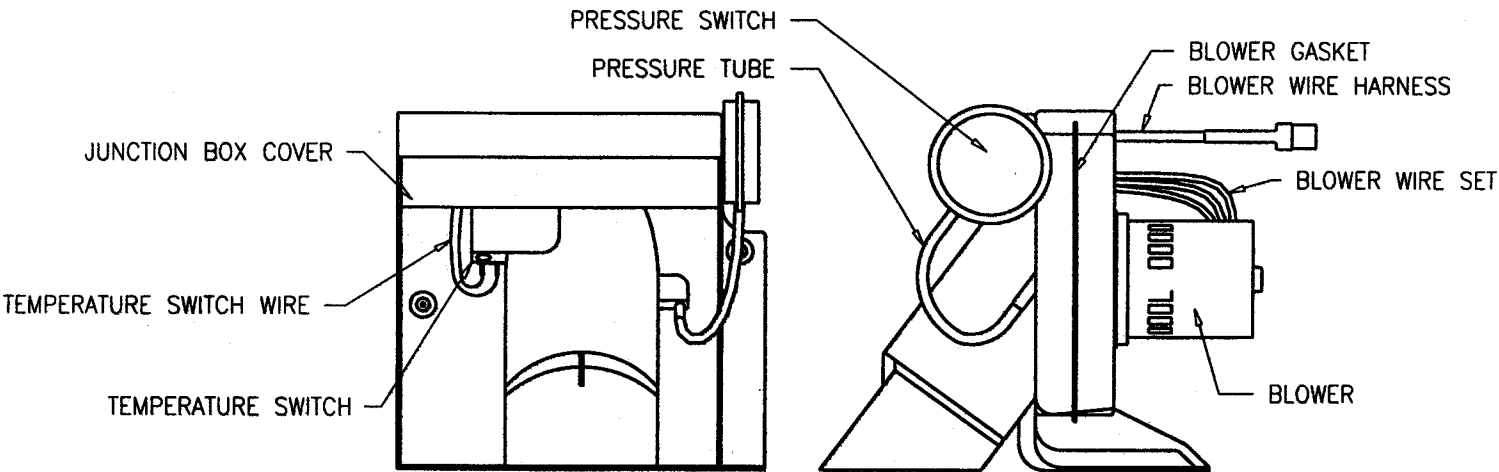
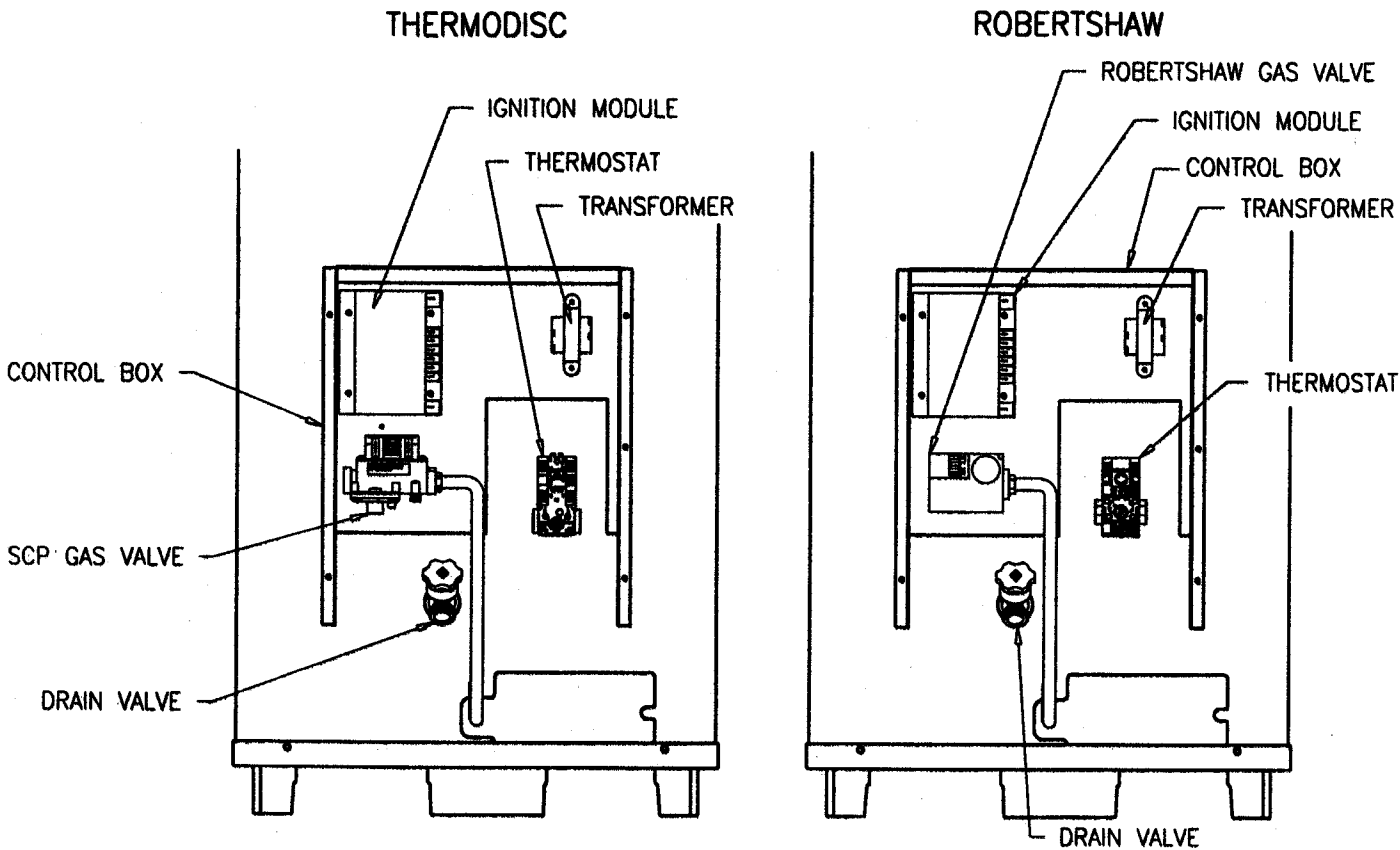


Figure 3
TTW1 CONTROL BOX



TTW1 TROUBLE SHOOTING TABLES

These tables are intended for a qualified service technician who has the proper equipment.

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water - Water heater does not come on (blower does not come on)	Water heater not properly connected to a 110/120 VAC source. Green Light status on SP845 ignition module: OFF	Check to see that water heater is properly connected to a 110/120 volt source. Use a Voltmeter and measure voltage between the bottom terminal of the thermostat (black wire of line cord) and the white wire terminal from the line cord on the transformer.	If no voltage is present at the thermostat and transformer terminals, check the plug connection. Check voltage at the receptacle. Check circuit breaker or fuses. If water heater is properly connected to a 110/120 volt source, check next possible cause.
	Power vent assembly wire harness is not plugged in. Green Light status on SP845 ignition module: OFF	Make certain that power vent assembly wire harness (see Figure 2) is plugged into the power vent receptacle in the jacket top. Check plug connector and make sure pins are not bent and make full contact.	Plug in cord. Straighten bent terminal pins or replace harness if connector is defective.
	Thermostat is set at a lower temperature than the temperature of the water in the tank. Green Light status on SP845 ignition module: OFF	Disconnect power supply & check thermostat setting (see figure 3).	If necessary, refer to installation instructions & adjust thermostat, reconnect power supply.
	Resettable HIGH LIMIT. on thermostat has been tripped Green Light status on SP845 ignition module: OFF	Disconnect power supply & push red reset button on thermostat. (see figure 3) If the thermostat clicks then the HIGH LIMIT has been reset.	If the HIGH LIMIT. has been tripped, observe water heater operation to determine cause of tripped HIGH LIMIT. Check hot water temperature at a nearby faucet with the thermostat set @ HOT or center detent position. Temperature should be approximately 120°F when the burner shuts off.
	Improper wiring or loose wire Module Light Status: May be either ON or OFF. If light is OFF, check wires before module, if ON check wires to gas valve.	Disconnect power supply. Check for loose wires & check wiring per wire diagram. (see figure 3&4) A volt-ohmmeter may be used to isolate defective wire connections.	Correct wiring problem. Check for loose terminal connections. Reconnect power supply to the water heater.

TTW1 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water - Water heater does not come on (blower does not come on)	Blower is malfunctioning Module Light Status: OFF	Unplug blower from power vent receptacle. Check for voltage between two outside terminals in receptacle on top of the water heater. If voltage between the two terminals is 110/120 volts, blower assembly is defective.(see figure 5)	Disconnect power supply. Open junction box of blower assembly & check wiring. If wiring is correct, replace blower assembly
Insufficient Hot Water. Water heater lights correctly but only operates for a few minutes (shuts down before thermostat is satisfied)	Excessive vent length or partially blocked vent Module Light Status: ON for a short time, then OFF.	Check vent for blockage and agreement with installation instructions	Correct venting
	High vent temperature Module Light Status: ON for a short time, then OFF	Disconnect power supply. Remove wires from the temperature switch. (see fig 2) Check for continuity across the temperature switch.	If switch is open, contact technical service about potential causes for high vent temperatures.
	Blower assembly is not performing at full capacity. (Pressure switch not closing due to insufficient blower capacity). Module Light Status: OFF or ON for a short time.	Examine the blower assembly for any abnormalities such as a misaligned or damaged gasket or any apparent physical damage. If nothing can be detected by a visual examination, then perform the following pressure check on the blower assembly. Turn off the power supply to the water heater, remove the vent from the blower assembly and disconnect the pressure tube from the blower assembly pressure tap. (Use the pressure tap on the flue collector housing connected to the pressure switch with plastic tubing). Attach a slope manometer or a standard manometer to the pressure tap. Turn on the power to the blower assembly. With the blower running and the vent removed the pressure should be -1.3" w.c. to -1.4" w.c. at normal altitude (0-3,000 ft.).	If an abnormality is found or the pressure test failed, replace the blower assembly. If the problem is a misaligned or damaged gasket, contact your supplier for a replacement gasket.

TTW1 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. No ignition; <i>blower comes on, ignitor does not spark</i>	Improper wiring, loose, or broken wire. Pilot electrode may be corroded. Spark may be grounding through wire or insulator. Module Light Status: May be OFF or ON	Disconnect power supply. Check for loose or damaged wires & check wiring per wire diagram. (see figure 3&4) Check pilot electrode and insulator.	Correct wiring problem. Clean electrode, if necessary. Replace pilot if defective. Reconnect power supply to the water heater.
	Vent blockage or excessive vent length is preventing pressure switch from closing Module Light: OFF or brief ON period.	Examine vent for blockage & compare vent installation to instructions	Remove blockage and/or correct vent installation
	Loose or damaged pressure switch hose Module Light: OFF	Examine hose to make sure that it is secured to the pressure switch & blower assembly pressure tap. Examine hose for any holes or leaks.(see fig 2)	Secure hose if loose, or replace hose if damaged.
	Damaged ignitor-Pilot Assembly Module Light: ON	Disconnect the power supply. Use a flashlight to examine the electrode-pilot assembly. There should be a 1/8 inch gap between the spark electrode and the pilot hood. Look for flaws in high voltage lead wire.	Replace ignitor-pilot assembly if damaged
	Faulty Transformer Module Light: OFF	Disconnect the power supply. Remove the orange wire & white wire from the 24 volt side of the transformer. (Take care to prevent these wires from touching). Re-connect power supply. Use a voltmeter to check the voltage across the two ex-posed leads on the transformer. If the voltage is between 22 & 27 volts the transformer is acceptable.	Replace transformer if test voltage is not within the range specified. Disconnect the power supply before replacing the transformer or wires. Reconnect the power supply after replacement is complete.

TTW1 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. No ignition; <i>blower comes on, ignitor does not spark</i>	Gas valve switch (SCP gas valve) may be in off position, switch may be defective, terminals may be loose. Module Light: OFF	Make sure switch is in ON position. Make sure terminals to switch are secure. Switch may be verified with a voltmeter. There should be 24 volts between TH on ignition module and ground.	Push switch to ON position, repair terminal connections.
	Open Pressure Switch or Vent Temperature Limit Switch, Defective wire or terminal, defective transformer. SP845 Module: Green indicator light on module does not light. (Green light should be lit if there is power to the module).	Disconnect power supply. Disconnect both the red wire to the "TH" terminal on the module and the white wire to the "TR" terminal. Reconnect power supply. Connect voltmeter to these wire terminals. Is there 22-27 volts? If so, proceed to the next step to troubleshoot the module. If no voltage, check for voltage at the transformer and proceed to the pressure switch and vent safety switch. Verify an open safety control by checking continuity. Wiring and terminals can also be checked using continuity.	If pressure switch is open, check for proper vent lengths and or blockage at the vent terminal. Also make sure the pressure hose has a tight connection and does not leak. Test for blower capacity (see next page) before replacing pressure switch. If temperature switch is open, check for possible causes of overheating such as improper vent sizing, wrong burner orifice or manifold pressure, incorrect flue baffle.

TTW1 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. No ignition; <i>blower comes on, ignitor does not spark</i>	Faulty ignition module (refer to figure 4) (24 volts is available at the module) No spark to pilot and pilot valve remains closed (no pilot gas flow). Module Light: ON	Disconnect power supply. Remove red wire from the TH terminal on module. Pull the white wire partially off the terminal on the 24 volt side of the transformer. Reconnect power supply. Use a voltmeter to measure the voltage between the red wire and the partially removed white transformer terminal wire with the power turned on to the unit. Make sure the gas valve switch (SCP valve) is in the "ON" position.	If the voltage between the red wire & the transformer is between 22 & 27 volts, the ignition module needs to be replaced. Disconnect the power supply before replacing the ignition module or wires. Reconnect the power supply after replacement is completed.
	Blower assembly is not performing at full capacity. (Pressure switch not closing due to insufficient blower capacity). Module Light: OFF	Examine the blower assembly for any abnormalities such as a misaligned or damaged gasket or any apparent physical damage. If nothing can be detected by a visual examination, then perform the following pressure check on the blower assembly. Turn off the power supply to the water heater, remove the vent from the blower assembly and disconnect the pressure tube from the blower assembly pressure tap. (Use the pressure tap on the flue collector housing connected to the pressure switch with plastic tubing). Attach a slope manometer or a standard manometer to the pressure tap. Turn on the power to the blower assembly. With the blower running and the vent removed the pressure should be -1.3" w.c. to -1.4" w.c. at normal altitude (0-3,000 ft.).	If an abnormality is found or the pressure test failed, replace the blower assembly. If the problem is a misaligned or damaged gasket, contact your supplier for a replacement gasket

TTW1 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. Blower comes on, ignitor does spark but pilot does not ignite	Manual lever on gas valve is turned off (Robertshaw gas valve only).	Check to see if lever is in the on position. (figure 3)	Turn lever to on position
	Sparking is occurring at the wrong location	Check to see if spark is between ignitor and pilot hood.	Refer to Damaged Ignitor-Pilot Assembly Section.
	Loose wires	Disconnect power supply. Check for loose wires.	Reconnect loose wire. Reconnect power supply to the water heater.
	Crushed or plugged pilot gas supply line. Plugged pilot orifice.	Examine pilot gas supply line for kinks or blockage. Examine pilot orifice by holding up to light and looking through hole (should see light through orifice hole if not plugged).	Replace pilot assembly if necessary.
	Insufficient gas supply pressure to water heater.	Turn off manual gas valve on gas supply line to water heater. Install 1/8" gas barb fitting on the gas supply line as close as practical to the water heater (some shutoff valves have plugs or a reducer can be installed at the drip leg) and connect to manometer. Turn on gas supply and measure both with the water heater off and turned on. Inlet gas pressure with the main burner operating should be in the range specified on the rating plate. Recheck supply pressure with other gas appliances in operation.	Adjust gas supply regulator to provide proper pressure. Make sure the gas line is adequately sized for the water heater and all other appliances. Refer to the latest edition of the National Fuel Gas Code, ANSI Z223.1
	Gas Valve	Disconnect power supply. Remove the wires marked PV and PV/MV from the ignition module. Connect one lead of the voltmeter to ground. Connect the other lead to PV . Reconnect the power supply to the water heater and check voltage. between the two terminals on the module after the pilot starts sparking. Repeat voltage check at MV terminal on the module.	If the voltage at the PV and PV/MV terminals on the ignition module is between 22 and 27 volts, replace the gas valve. If the voltage is not between 22 and 27 volts, replace the module. Disconnect the power supply before replacing the gas valve or wires. Reconnect the power supply after replacement is completed. Note: On Robertshaw gas valves, probe the end of the wires to P and C on the gas valve before replacing the valve to make sure the wire leads are not defective.

TTW1 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. Blower comes on, ignitor sparks, pilot lights, ignitor continues to spark and main burner does not ignite	Poor pilot flame	Look to see if pilot flame is surrounding the ignitor and touching the pilot burner hood. Pilot flame must not be lifting or blowing off the hood or electrode.	Adjust pilot adjustment on the gas valve (see figure 3) (Robertshaw gas valve only - no adjustment on SCP valve). If pilot flame does not envelope the electrode with the pilot adjustment full open (screw backed out on Robertshaw valve), check for partially plugged pilot orifice.
	Loose wires	Disconnect the power supply. Check for loose or damaged electrode wire.	Properly secure any loose wires and reconnect power supply. Replace pilot if electrode wire is damaged.
	Ignition module	Check for voltage at the main valve terminal on the ignition module.	Replace module if no voltage at MV terminal and module is powered (green light on or 24 volts between TR and TH)
Blower comes on, ignitor sparks, pilot ignites and sparking stops but the main burner does not come on.	Loose or defective main gas valve wire. (MV)	Disconnect the power supply. Check for loose wire terminals or defects in the wires or terminals.	Properly secure any loose wires and reconnect power supply. Replace wires if terminals are loose or broken or wires defective. (SCP valve has wires soldered to valve coil and cannot be replaced.)
	Gas valve or Ignition module	Disconnect power supply. Remove the wire from the MV terminal on the ignition module. Connect one lead of the voltmeter to the ground screw and the other lead to the MV terminal on the ignition module. Reconnect the power supply to the water heater and check the voltage between the MV terminal on the ignition module and ground.	If voltage is between 22 and 27 volts replace the gas valve. If voltage is less than 22 volts replace the module. Disconnect the power supply before replacing the gas valve, ignition module or wires. Reconnect the power supply after replacement is completed. Note: On Robertshaw gas valves, probe the end of the wire to M on the gas valve before replacing the valve to make sure the wire lead is not defective.

Figure 4A
TTW1 WIRING DIAGRAM (SCP GAS VALVE)

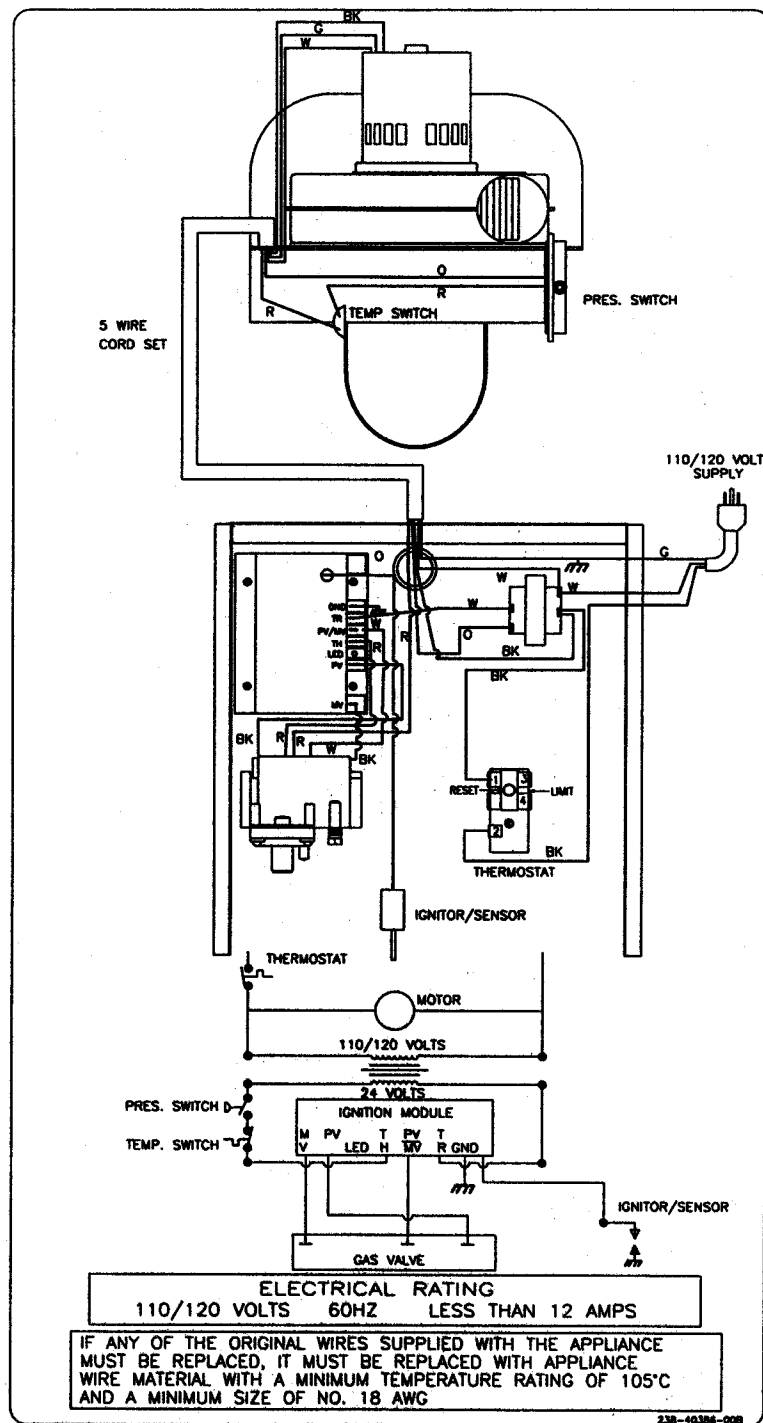


Figure 4B
TTW1 WIRING DIAGRAM (ROBERTSHAW GAS VALVE)

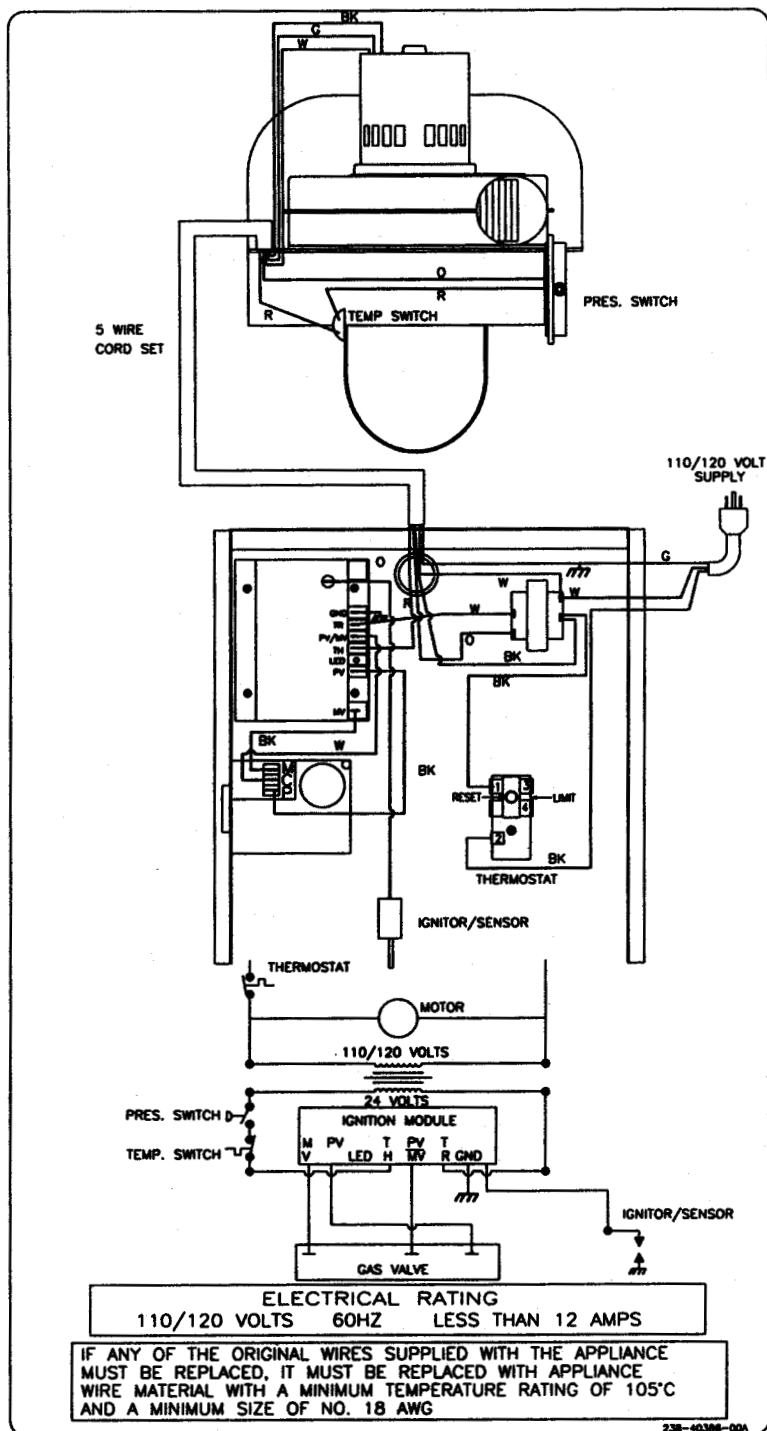
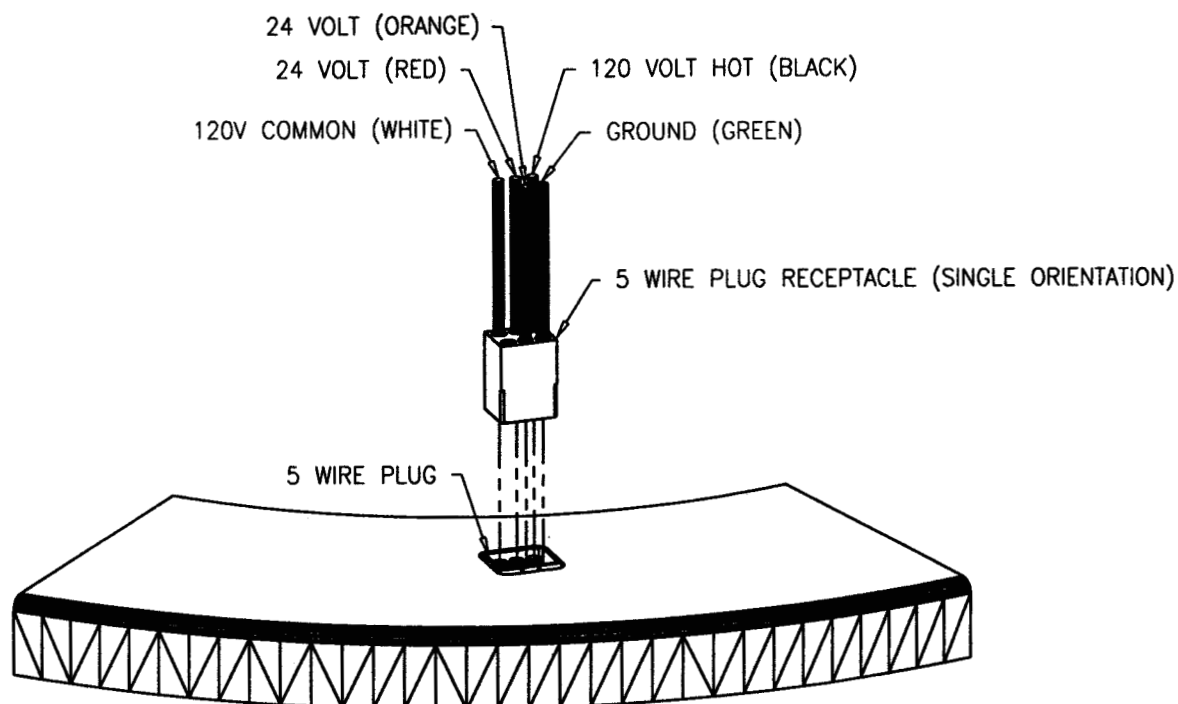


Figure 5
TTW1 BLOWER HARNESS CONNECTION TO JACKET HEAD PLUG



TTW1 HIGH ALTITUDE INSTALLATIONS FOR ELEVATIONS OVER 3,000 FEET ABOVE SEA LEVEL

The capacity of the induced draft blower decreases with increasing altitude due to a reduction in the air density. In order to assure safe and reliable performance of the water heater, the following guidelines must be followed. Refer to the venting tables below for maximum distances for the altitudes in your location.

HIGH ALTITUDE VENTING LENGTHS - TTW1			
Altitude above sea level	Maximum venting length reduction - Horizontal venting	Maximum venting length reduction - Vertical venting	Pressure Switch Setting
0-3,000 Ft	No reduction in vent length required	No reduction in vent length required	No change
over 3,000-5,000 Ft	Use only 3" PVC. No reduction in vent lengths from tables in instruction manual.	Use only 3" PVC. No reduction in vent lengths from tables in instruction manual.	No change
over 5,000 Ft - 7,000 Ft.	Use only 3" PVC Reduce maximum vent lengths by 30 ft.	Use only 3" PVC. No reduction in vent lengths for vertical (through the roof) venting tables.	No change
Over 7,000 Ft.	Use only 3" PVC Reduce maximum vent lengths by 45 ft.	Use only 3" PVC. No reduction in vent lengths for vertical (through the roof) venting tables.	No change

TTW2 SERVICE MANUAL

The TTW2 model series power vented water heaters are equipped with vent safety controls and use the Honeywell Smartvalve electronic ignition system. In order for the water heater to perform satisfactorily, it must be installed with the correct type gas, supply pressure, voltage, branch circuit wiring, circuit breaker, venting and plumbing connections by a qualified professional.

IMPORTANT

The TTW2 is equipped with a power supply cord that has a three pronged plug. This plug must be plugged into a properly grounded receptacle. If local codes require the water heater to be hard wired with conduit, the water heater must be wired by a qualified professional.

BASIC OPERATION OF THE WATER HEATER WITH THE HONEYWELL SMARTVALVE CONTROL PACKAGE

The water heater is equipped with a surface mounted thermostat located to the right of the gas control that senses the tank's temperature. When the water temperature inside the tank drops below the setting of the thermostat, the switch inside the thermostat closes sending a 110/120 volt power supply to the blower and the primary side of the transformer (located inside the blower control box). With 110/120 volts supplied from the thermostat, the blower begins to operate and closes the pressure switch under normal venting conditions. The secondary (24 volt) side of the transformer is connected to the Honeywell Smartvalve control through the pressure switch and vent temperature switch. When the pressure switch closes, the ignition sequence is initiated by the Honeywell Smartvalve. Low voltage power (24 volts) is sent to the hot surface pilot igniter and the pilot valve allowing pilot gas to flow to the pilot. After 3-4 seconds, the igniter glows red and the pilot gas ignites. The pilot flame sensor rod detects the presence of the pilot, turning off the igniter and opening the main gas valve. The pilot flame ignites the main burner. The main burner will heat the tank of water until the thermostat is satisfied. When the thermostat is satisfied, the burners and blower will stop operating. In the event the tank water becomes excessively hot, a built in manual reset high limit will open preventing operation of the water heater. If this occurs, see the instructions in this manual regarding resetting of the high limit.

FEATURES OF THE HONEYWELL SMARTVALVE GAS CONTROL AND INITIAL START-UP OF THE WATER HEATER

The Honeywell Smartvalve gas control incorporates the ignition control inside the gas valve plastic cover. The control module cannot be separated from the gas valve. A dedicated Honeywell pilot incorporating a miniature 24 volt hot surface element is used to ignite the pilot gas. The gas control monitors the presence of the pilot flame during the water heating cycle. If for any reason the pilot flame is extinguished during operation, both the pilot and main gas valves close and the ignition sequence is repeated. The control will not "lock out" if the gas supply runs out or is shut off, but will attempt to light the pilot for a 90 second period with a 5 minute retry delay. If the pilot igniter is broken, the pilot wires shorted or disconnected, then the pilot valve will not open.

A switch on the left side of the gas valve acts as an emergency gas shutoff and will not allow gas to flow to either the pilot or main burners if the switch is in the OFF position. Make sure this switch is in the ON position before attempting to start the water heater.

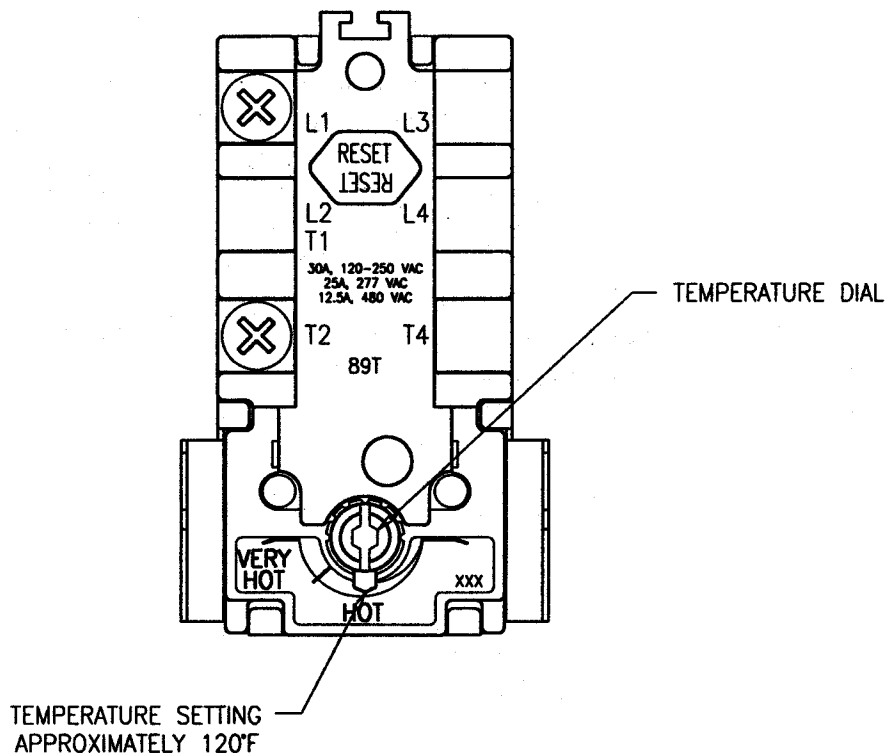
On initial start-up, a couple of attempts may be required to get the pilot and main burners to light due to air in the piping, gas valve and pilot tube. If the pilot does not light within 90 seconds, the control will make another

attempt after a 5 minute delay period. Another ignition attempt can be initiated without the waiting period by interrupting the power supply for 5 seconds. Follow the lighting instructions provided on the water heater.

Proper Setting of the Thermostat.

An individual installation may require different water temperatures than the factory setting. If the water is too cold or hot, see the installation instructions for thermostat adjustment.

REMEMBER: HOTTER WATER INCREASES THE RISK OF SCALD INJURY.



SEQUENCE OF OPERATION FOR HONEYWELL SV9501M "SMARTVALVE" HOT SURFACE PILOT IGNITION SYSTEM

Mode of Operation	Normal Sequence of Events	Abnormal Modes	System Response
Call for Heat	Thermostat contacts close on temperature drop completing 120 volt circuit to transformer and induced draft blower. 24 volt circuit completed to "Smartvalve" after pressure switch closes.	Pressure switch remains open.	Ignition sequence does not begin until pressure switch closes.
Safe Start Check	Pilot flame sensor checks to make sure flame is not present. Igniter circuit checked to make sure igniter is not broken or wires shorted.	Flame present in combustion chamber or igniter broken. Internal self check abnormal.	Valves and igniter remain off. If flame signal is detected, wait for signal to disappear. If internal self check is abnormal, system waits 5 minutes before retry.
Trial for Ignition	-SV9501M Powers Igniter Circuit and pilot valve opens. -Igniter heats up and glows red. -Pilot gas flows. See note	Igniter Broken or Missing	No system response. No gas flow.
Ignition	Pilot lights. Flame rod senses flame.	No flame.	-Igniter stays on. Pilot valve remains open for up to 90 seconds. Ignition sequence will retry after 5 minutes. If pilot eventually lights (gas pressure interruption), normal operation resumes.
Main Burner Operation.	-Igniter off. -Main valve opens. -Main burner lights.	-Flame outage occurs during run cycle.	-Main valves and pilot valves close. Self check circuit. -SV9501M powers igniter circuit and pilot valve opens. Attempts to relight pilot. If successful, normal operation resumes. If pilot flame is lost more than 5 times in heating cycle, then there will be a 5 minute delay before ignition retry.
		-Igniter opens (Breaks or shorts out).	-Pilot and main valves close; System shuts down.
		Pressure switch opens due to vent blockage or incorrect installation.	-Pilot and main valves close, gas control deactivated until pressure switch closes. Induced draft blower continues to run as long as thermostat calls for heat.

SEQUENCE OF OPERATION FOR HONEYWELL SV9501M "SMARTVALVE" - CONTINUED

Mode of Operation	Normal Sequence of Events	Abnormal Modes	System Response
Main Burner Operation (Continued)		-Vent high limit control opens.	-Gas valves close, igniter off. Induced draft blower continues to run. High limit will reset when the vent temperatures are reduced and normal operation will resume.
		Electrical power interruption.	-Gas valves close. Ignition sequence resumes when power is restored.
Thermostat setting satisfied - system shuts down (standby mode).	Thermostat contacts open on rise in temperature. Induced draft blower stops and transformer is denergized, interrupting 24 volt circuit to Smartvalve.		- Main and pilot valves close. Blower stops.

Note: During the trial for ignition period, the pilot igniter will turn off about 30 seconds into the trial for ignition if the pilot flame has not lit. It will turn back on for the final 30 seconds of the 90 second trial for ignition. The pilot valve will be energized during the entire trial for ignition. This is normal operation for this gas ignition system.

HONEYWELL "SMARTVALVE" SV9501M TROUBLESHOOTING SEQUENCE.

Note: Before troubleshooting, familiarize yourself with the startup and sequence of operation. This flow chart is intended to summarize the detailed procedures of the TTW2 troubleshooting charts on the following pages and provide a quick reference for a logical procedure for diagnosing a service problem. Refer to the troubleshooting tables for more detail on testing for a particular problem.

PROCEDURE:	CHECK:	CORRECTIVE ACTION:
- Turn gas supply off. Disconnect power to the water heater for 15 seconds, then turn back on. - Set thermostat to call for heat. Power venter should be operating. - Test to determine if SV9501M is powered (24 volts nominal): Disconnect control wiring connector to valve and measure voltage between pins to blue and yellow wires. Should measure around 24 volts ($\pm 10\%$). Should also measure 24 volts between pins to red and yellow wires. Is voltage to control within specs? YES↓ NO→	- Line voltage power (115 volts nominal). - Low voltage transformer output (24 volts nominal) - Thermostat and high limit control. - Blower pressure switch and vent high limit switch. Switches are closed during normal operation. - Blower. - Venting system obstructions.	- Check fuse, breakers, and line cord. Reset breakers or replace fuses. - Reset high limit, if tripped. Check thermostat setting and operation if high limit trips. - Clear obstruction in venting system or correct installation (see manual for maximum lengths and elbows). - Replace defective components.
Reconnect control wire to Smartvalve. Interrupt power to the water heater for 15 seconds, then restart. Does igniter warm up and glow red? YES↓ NO→	- Unplug pilot burner wire harness from valve. Measure voltage at SV9501M on two inside terminal pins. Should measure 24 volts.	- Replace SV9501M gas valve if igniter terminals do not have 24 volts ($\pm 10\%$). - If igniter terminals on valve produces 24 volts and igniter does not glow red, replace igniter or pilot assembly.
Turn gas on. Does pilot burner light? YES↓ NO→	Measure voltage to SV9501M. Voltage must be at least 22 volts.	- Check transformer output. - Check line voltage supply.
	Check for plugged pilot orifice, pilot adjustment (turn screw counterclockwise to open), low inlet gas pressure or manual supply valve shut off.	- Correct low gas supply pressure. - If pilot orifice and pilot adjustment checks have been O.K., replace igniter/flame rod assembly.
	- Make all above checks. Igniter glows red. Determine if gas is flowing to the pilot.	- Replace SV9501M gas valve if there is no gas flow to the pilot.
Does main valve open (Main burner ignition)? YES↓ NO→	Replace igniter/flame rod assembly (or entire pilot assembly), but retain old one. Restart troubleshooting sequence. Does main valve open? YES↓ NO→	Replace SV9501M valve. Save old pilot or igniter assembly for future service.
System O.K.	Discard old igniter or pilot assembly.	

TTW2 TROUBLESHOOTING TABLES

Note: Before troubleshooting, familiarize yourself with the startup and sequence of operation. These tables are intended for a qualified service technician who has the proper equipment.

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water - Water heater does not come on (blower does not come on)	Water heater not properly connected to a 110/120 VAC source.	Check to see that water heater is properly connected to a 110/120 volt source. Use a Voltmeter and measure voltage between the bottom terminals of the thermostat (black wires of wire harness) and a suitable metal ground such as the thermostat bracket.	If no voltage is present at one of the thermostat terminals, check the plug connection. Check voltage at the receptacle. Check circuit breaker or fuses. If water heater is properly connected to a 110/120 volt source, check next possible cause.
	Power vent assembly wire harness is not plugged in.	Make certain that power vent assembly wire harness (see Figure 2) is plugged into the power vent receptacle in the jacket top. Check plug connector and make sure pins are not bent and make full contact.	Plug in cord. Straighten bent terminal pins or replace harness if connector is defective.
	Thermostat is set at a lower temperature than the temperature of the water in the tank.	Disconnect power supply & check thermostat setting (see figure 3).	If necessary, refer to installation instructions & adjust thermostat, reconnect power supply.
	Resettable HIGH LIMIT. on thermostat has been tripped	Disconnect power supply & push red reset button on thermostat. (see figure 3) If the thermostat clicks then the HIGH LIMIT has been reset.	If the HIGH LIMIT. has been tripped, observe water heater operation to determine cause of tripped HIGH LIMIT. Check hot water temperature at a nearby faucet with the thermostat set @ HOT or center detent position. Temperature should be approximately 120°F when the burner shuts off.
	Improper wiring or loose wire	Disconnect power supply. Check for loose wires or defective terminals on thermostat and crimp connectors from power cord inside blower junction box & check wiring per wire diagram. (see figure 3&4) A volt-ohmmeter may be used to isolate defective wire connections.	Correct wiring problem. Check for loose terminal connections. Reconnect power supply to the water heater.

TTW2 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water - Water heater does not come on (blower does not come on)	Blower is malfunctioning	Disconnect power supply and open blower junction box cover. Pull black wire terminal partly off transformer and probe this terminal with voltmeter and connect the other probe to the ground screw. Reconnect power supply and measure voltage. Should measure 110-120 volts.	Disconnect power supply. Open junction box of blower assembly & check wiring. If wiring is correct, replace blower assembly
Insufficient Hot Water. Water heater lights correctly but only operates for a few minutes (shuts down before thermostat is satisfied)	Excessive vent length or partially blocked vent	Check vent for blockage and agreement with installation instructions	Correct venting
	High vent temperature	Disconnect power supply. Remove wires from the temperature switch. (see fig 2) Check for continuity across the temperature switch.	If switch is open, contact technical service about potential causes for high vent temperatures.
	Blower assembly is not performing at full capacity. (Pressure switch not closing due to insufficient blower capacity).	Examine the blower assembly for any abnormalities such as loose blower mounting bolts, a damaged gasket, bent blower wheel, or any apparent physical damage. Make sure the blower vent hood is making a good seal with the gasket around the flue tube. If nothing can be detected by a visual examination, then perform the following pressure check on the blower assembly. Turn off the power supply to the water heater, remove the vent from the blower assembly and disconnect the pressure tube from the blower assembly pressure tap. (Use the pressure tap on the flue collector housing connected to the pressure switch with plastic tubing). Attach a slope manometer or a standard manometer to the pressure tap. Turn on the power to the blower assembly. With the blower running and the vent removed the pressure should be -1.55" w.c. to -1.65" w.c. at normal altitude (0-3,000 ft.).	If an abnormality is found or the pressure test failed, replace the blower assembly. Make sure blower mounting nuts are snug on the bracket plate so that the blower seals tightly to the gasket. Replace gasket around flue tube if worn or defective.

TTW2 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. No ignition; <i>blower comes on, pilot ignitor does not glow</i>	Vent blockage or excessive vent length is preventing pressure switch from closing	Examine vent for blockage & compare vent installation to instructions. (Also see open pressure switch).	Remove blockage and/or correct vent installation
	Faulty Transformer	Disconnect the power supply. Remove the yellow & blue wire from the 24 volt side of the transformer. (Take care to prevent these wires from touching). Re-connect power supply. Use a voltmeter to check the voltage across the two ex-posed leads on the transformer. If the voltage is between 22 & 27 volts the transformer is acceptable.	Replace transformer if test voltage is not within the range specified. Disconnect the power supply before replacing the transformer or wires. Reconnect the power supply after replacement is complete.
	Loose, or broken wire, poor crimp connection on wire terminal.	Disconnect power supply. Check for loose or damaged wires & check wiring per wire diagram. (see figure 6,8&10) Check pilot wiring, wire connection to gas control, wires to thermostat. Disconnect the control wire plug connector to the gas control and probe the pins connected to the blue and yellow wires. Voltage should measure between 22 and 27 volts.	Correct wiring problem. Replace pilot if wires or terminals are defective. Reconnect power supply to the water heater.
	Loose or damaged pressure switch hose	Examine hose to make sure that it is secured to the pressure switch & blower assembly pressure tap. Examine hose for any holes or leaks.(see fig. 8)	Secure hose if loose, or replace hose if damaged.
	Damaged ignitor-Pilot Assembly	Disconnect the power supply. Unplug the wire connector from the pilot to the gas control. Reconnect power and probe the two inside pins with a voltmeter. Voltage output to the igniter should be 22 to 27 volts.	If voltage output is within specs, replace pilot assembly. If no voltage output, proceed with checking the controls below.

TTW2 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. No ignition; <i>blower comes on, pilot ignitor does not glow</i>	Open Pressure Switch or Vent Temperature Limit Switch.	Disconnect power supply. After determining the igniter output terminals did not produce sufficient voltage (previous test), proceed with checking the voltage from the 3 wire plug to the gas control. Disconnect the wire connector from the control, turn on the power supply and probe with a voltmeter the pins from the blue and yellow wires. Voltage should be 22-27 volts. Then probe between the yellow and red pins. The red wire completes the circuit through the pressure switch and vent limit switch. There should be 22-27 volts from this circuit. If no voltage is present between red and yellow, remove the blower control box cover and partially remove the red wire from the pressure switch and probe between this switch terminal and the terminal on the transformer to the yellow wire. If voltage is 22-27 volts, probe between the vent limit switch terminals and the yellow wire terminal on the transformer. Limit switch is open if 22-27 volts is not present on both terminals.	If pressure switch is open, (no voltage output at red wire terminal of pressure switch) check for proper vent lengths and or blockage at the vent terminal. Also make sure the pressure hose has a tight connection and does not leak. Test for blower capacity (see next page) before replacing pressure switch. If temperature switch is open, check for possible causes of overheating such as improper vent sizing. Call Tech Service for more information. If both switches are closed, but voltage is below specs between the yellow and red pins on the wire connector to the Smartvalve control, check for defects in the wires and wire terminals and verify voltage output from the transformer (previous test).

TTW2 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. No ignition; <i>blower comes on, pilot ignitor does not glow.</i>	Smartvalve control may be defective.	Disconnect power, remove three wire connector to gas control. Reconnect power and measure voltage between yellow and blue wire connector pins and yellow and red wire pins as in previous test procedures. Voltage should be 22 to 27 volts in both cases. Disconnect pilot wire connector from control and measure voltage between two inside pins as described under damaged pilot-igniter assembly.	If voltage to the gas control (yellow to blue and yellow to red) is within specs, but there is insufficient voltage output to the igniter, replace the gas control. After disconnecting gas supply pipe and pilot and manifold tubes, control may be removed from bracket by removing top and bottom screws.
	Blower assembly is not performing at full capacity. (Pressure switch not closing due to insufficient blower capacity).	Examine the blower assembly for any abnormalities such as loose blower mounting bolts, a damaged gasket, bent blower wheel, or any apparent physical damage. Make sure the blower vent hood is making a good seal with the gasket around the flue tube. If nothing can be detected by a visual examination, then perform the following pressure check on the blower assembly. Turn off the power supply to the water heater, remove the vent from the blower assembly and disconnect the pressure tube from the blower assembly pressure tap. (Use the pressure tap on the flue collector housing connected to the pressure switch with plastic tubing). Attach a slope manometer or a standard manometer to the pressure tap. Turn on the power to the blower assembly. With the blower running and the vent removed the pressure should be -1.55" w.c. to -1.65" w.c. at normal altitude (0-3,000 ft.).	If an abnormality is found or the pressure test failed, replace the blower assembly. Make sure blower mounting nuts are snug on the bracket plate so that the blower seals tightly to the gasket. Replace gasket around flue tube if worn or defective.

TTW2 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
No Hot Water. Blower comes on, ignitor does glow red but pilot does not ignite	Gas valve switch may be in the OFF position.	Check to make sure switch on left side of gas control is in ON position.	Push switch to ON position.
	Insufficient gas supply pressure to water heater.	Remove metal cover over control. Turn off manual gas valve on gas supply line to water heater. Remove 1/8" gas plug on gas control inlet flange and screw in barb fitting and connect to manometer. Turn on gas supply and measure both with the water heater off and turned on. Inlet gas pressure with the main burner operating should be in the range specified on the rating plate. Recheck supply pressure with other gas appliances in operation.	Adjust gas supply regulator to provide proper pressure. Make sure the gas line is adequately sized for the water heater and all other appliances. Refer to the latest edition of the National Fuel Gas Code, ANSI Z223.1
	Insufficient voltage to water heater, gas control or pilot igniter.	Measure voltage to the water heater (115 to 120 volts). Measure voltage to the gas control (yellow and blue and yellow and red pins, 24 volts nominal). Measure output to the pilot igniter wires (see previous tests). Should measure 24 volts nominal.	If voltage to water heater is low (below 110 volts), have electrician investigate cause. If low voltage to control is below specs, check transformer output or wiring. If voltage to control is sufficient, but output to igniter is inadequate, replace gas control.
	Crushed or plugged pilot gas supply line. Plugged pilot orifice.	Examine pilot gas supply line for kinks or blockage. Examine pilot orifice by holding up to light and looking through hole (should see light through orifice hole if not plugged).	Replace pilot assembly if necessary.
No Hot Water. Blower comes on, ignitor glows, pilot lights, and main burner does not operate.	Poor pilot flame	Look to see if pilot flame is surrounding the flame sensor and touching the pilot burner hood. Pilot flame must not be lifting or blowing off the hood or flame sensor.	Adjust pilot screw adjustment on the gas valve by removing the large hex head plug screw behind the pilot fitting and turning screw in to decrease pilot flame, out to increase. If pilot flame does not envelope the electrode with the pilot adjustment full open (screw backed out on Robertshaw valve), check for partially plugged pilot orifice or low gas supply pressure (previous test).

TTW2 TROUBLE SHOOTING TABLES - CONTINUED

PROBLEM	POSSIBLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
<i>No Hot Water. Blower comes on, ignitor glows, pilot lights, and main burner does not operate.</i>	Loose flame sensor wire or defective pilot.	Disconnect the power supply. Check for loose or damaged flame sensor wire (Connected to flame rod on pilot). Check to see if flame sensor rod is loose or touching top ground strap.	Replace pilot if flame sensor wire or terminal connection is damaged. Replace pilot if flame sensor is loose or bent out of place.
	Drafts causing pilot to flutter or blow off.	Make sure a fan or dehumidifier is not near the water heater and aimed to force a draft at the burner access panel.	Correct draft condition and recheck operation.
	Gas Control	Make previously described tests for voltage at the gas valve and inlet gas pressure.	Replace gas control after making all previous checks and replacing pilot first. Recheck for proper operation after replacing gas control.

TTW2 HIGH ALTITUDE INSTALLATIONS FOR ELEVATIONS OVER 3,000 FEET ABOVE SEA LEVEL

HIGH ALTITUDE MODIFICATIONS FOR TTW2 MODELS		
Altitude above sea level	Maximum venting length reduction	Pressure switch setting
0-3,000 Ft	No reduction in vent length required	No change
over 3,000-5,000 Ft.	Maximum vent length for 3" PVC is 15 ft. with 3 elbows. For longer vent lengths use 4" diameter PVC.	No change
over 5,000-10,000 Ft.	Use only 4" PVC. Reduce maximum vent lengths shown on venting label for 4" PVC by 20 Ft.	Use high altitude pressure switch. Contact Technical Service.

Figure 6
TTW2 WIRING DIAGRAM

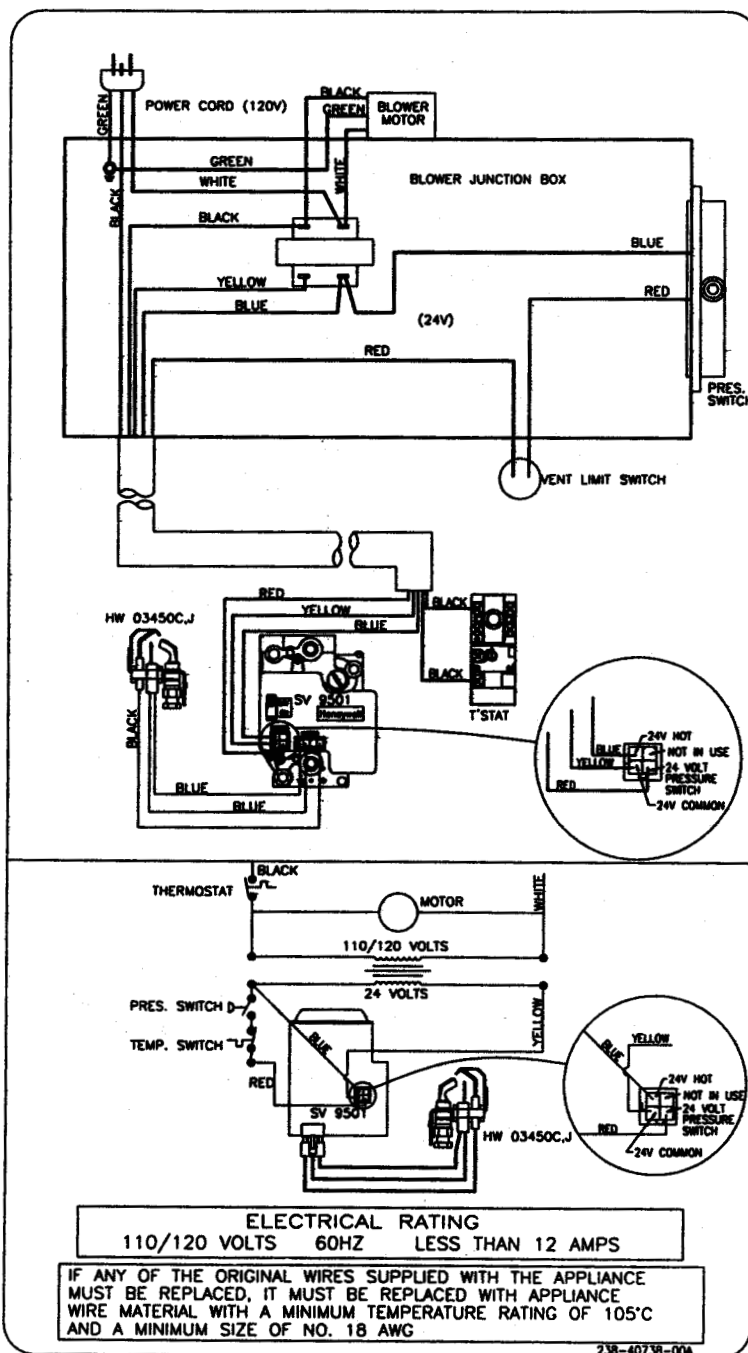


Figure 7
TYPICAL WATER HEATER INSTALLATION FOR TTW2

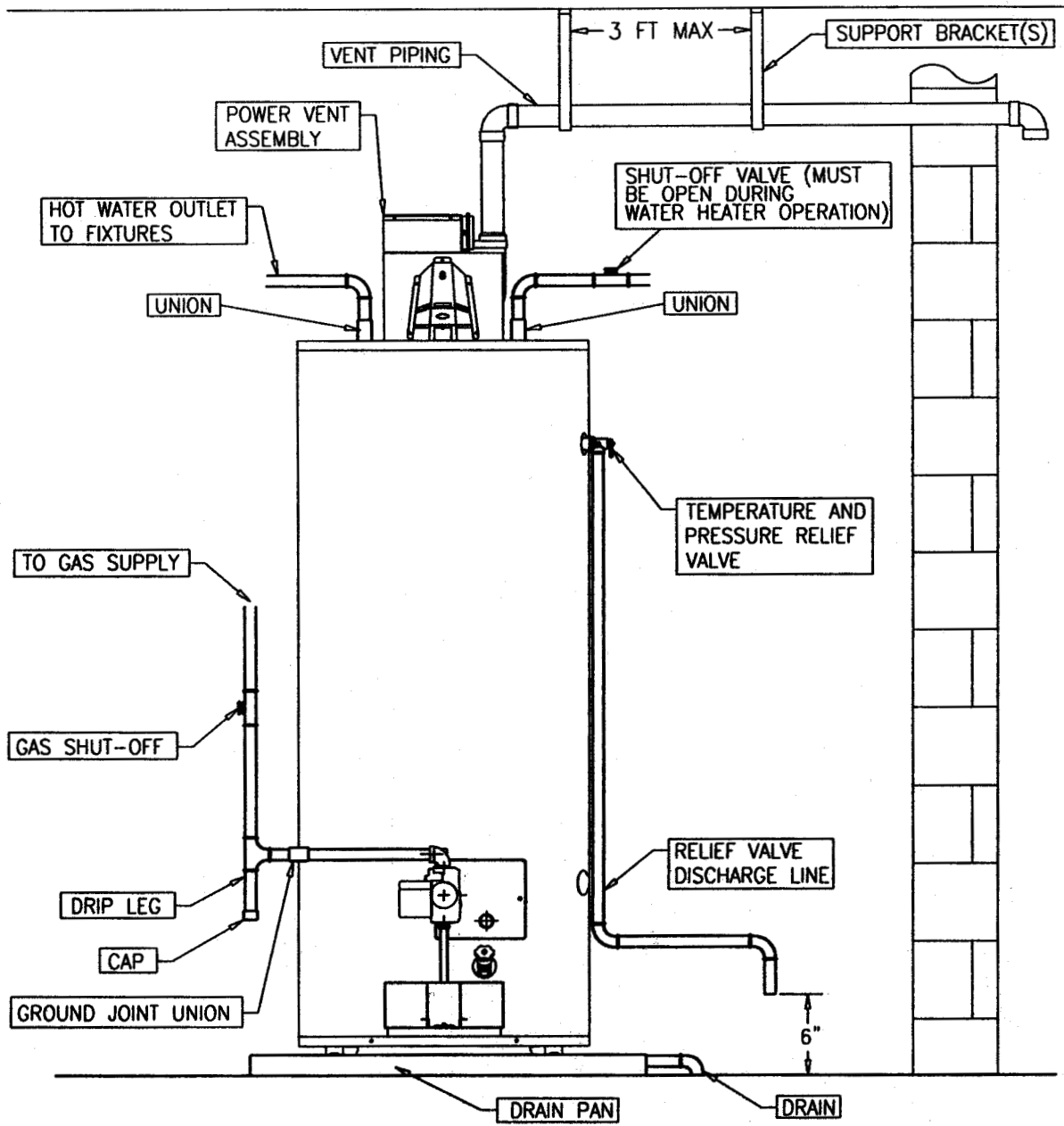


Figure 8
TTW2 BLOWER ASSEMBLY WITH CONTROL BOX

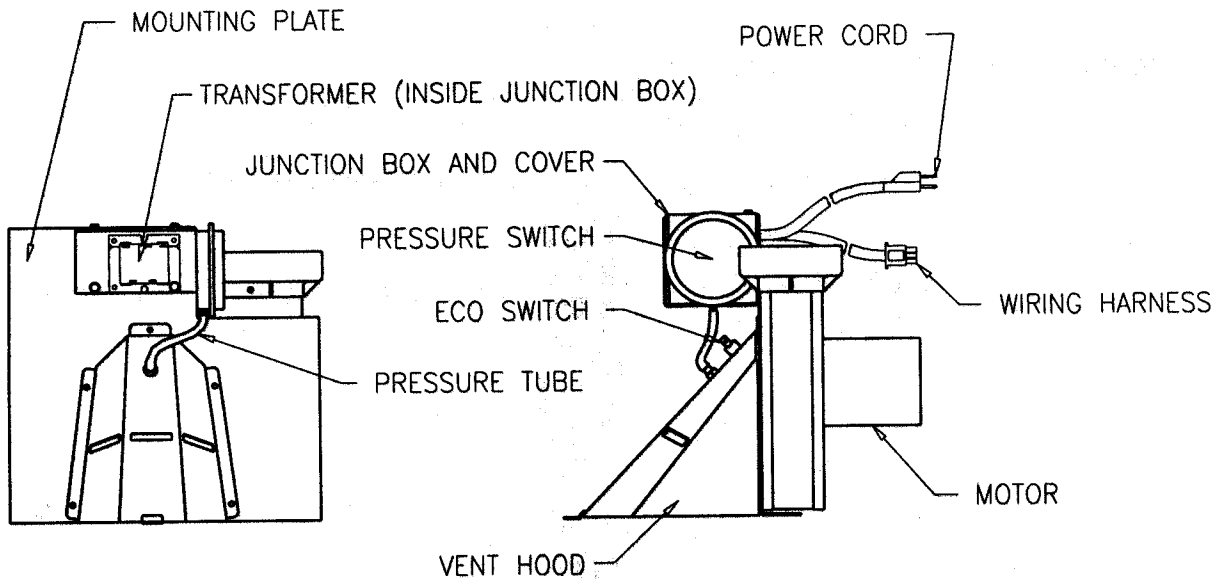
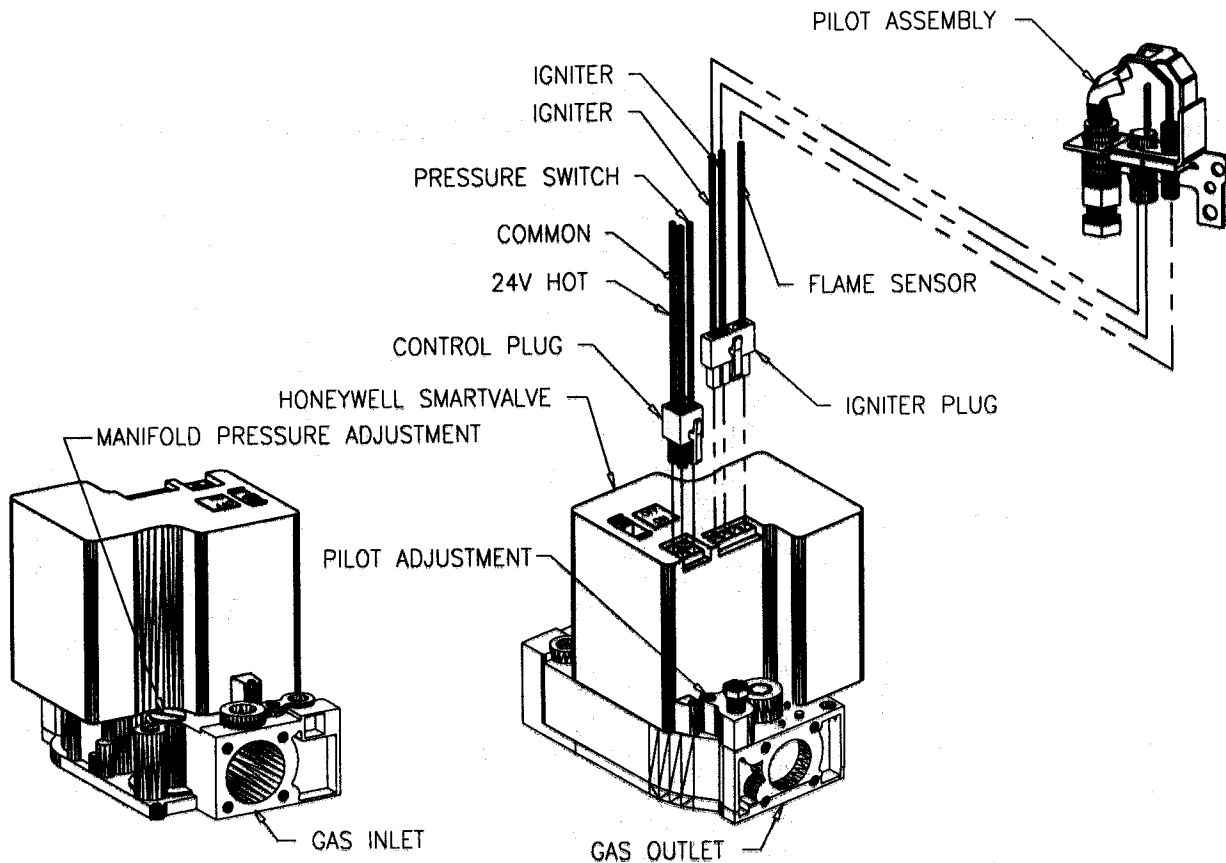


Figure 9
TTW2 HONEYWELL SMARTVALVE GAS CONTROL WITH PILOT



NOTE: PLUGS ARE SINGLE ORIENTATION ONLY.

Figure 10
TTW2 WIRE HARNESS TO JACKET HEAD CONNECTION

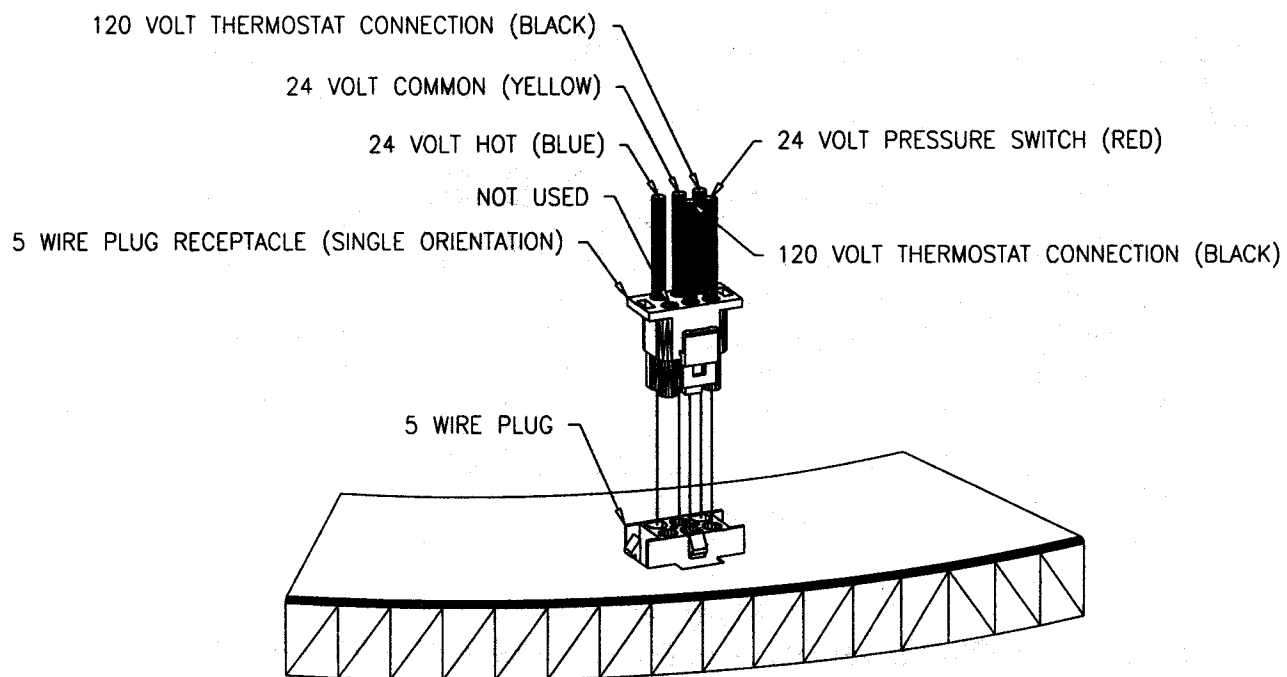


Figure 11
USING VOLTMETER TO CHECK IGNITER VOLTAGE OUTPUT FROM SMARTVALVE

