

**DIRECT SPARK IGNITION — DIRECT VENT
GAS WATER HEATER
FOR INSTALLATION IN RECREATIONAL
VEHICLES AND MOBILE HOUSING**

FOR YOUR SAFETY IF YOU SMELL GAS.

1. OPEN WINDOWS.
2. DON'T TOUCH ELECTRICAL SWITCHES.
3. EXTINGUISH ANY OPEN FLAMES.
4. IMMEDIATELY SHUT OFF GAS SUPPLY TO HEATER.

WARNING

DRAIN HEATER IF SUBJECT TO FREEZING TEMPERATURE. DO NOT STORE OR USE GASOLINE, OR OTHER COMBUSTIBLE MATERIALS OR LIQUIDS NEAR OR ADJACENT TO THIS HEATER OR ANY OTHER APPLIANCE. THIS APPLIANCE SHALL NOT BE INSTALLED IN ANY LOCATION WHERE FLAMMABLE LIQUIDS OR VAPORS ARE LIKELY TO BE PRESENT.

INSTALLER: AFFIX THESE INSTRUCTIONS TO
OR ADJACENT TO WATER HEATER.

OWNER: RETAIN THESE INSTRUCTIONS AND
WARRANTY FOR FUTURE REFERENCE.



MOR-FLO[®] 18460 SOUTH MILES ROAD
INDUSTRIES, INC. CLEVELAND, OHIO 44128
12161 683-7300 • TELEX: 985-486

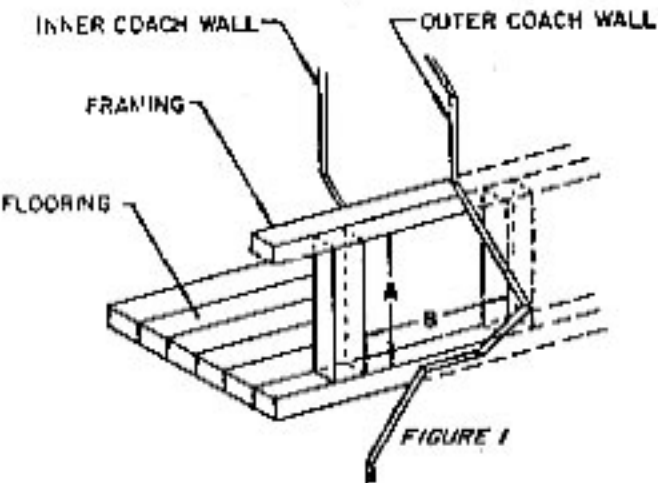
AMERICAN 2341 MICHIGAN AVENUE
APPLIANCE MFG. CORP. SANTA MONICA, CA. 90404
12131 829-1755 • TELEX: 852-422

INSTALLATION REQUIREMENTS

This installation must conform with the requirements of the authority having jurisdiction or in the absence of such requirements with the national gas code, ANSI Z223.1-1974; and American National Standard For Recreational Vehicles — 501C-1977, in Canada C.S.A. Z240.4.

- (1) The appliance shall be disconnected from the gas supply piping system during any pressure testing of the system.
- (2) The appliance and its gas connection shall be leak tested before placing the appliance in operation.

Minimum clearance from combustible materials on sides, top, floor, and rear = 0 inches. Provide room for access to rear of heater for servicing.



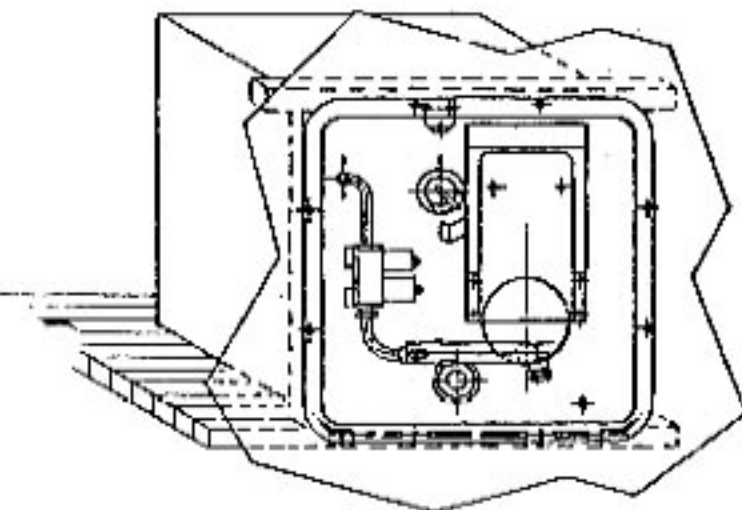
Provide an opening flush with floor in outer wall of coach as shown.

Wall of coach should contain framing as shown in figure-1. Maintain inside dimensions listed below.

	A	B
6 Gal. Models	12 $\frac{3}{4}$	12 $\frac{3}{4}$
10 Gal. Models	16 $\frac{1}{4}$	16 $\frac{1}{4}$

FDSI MODELS

(separate door frames)

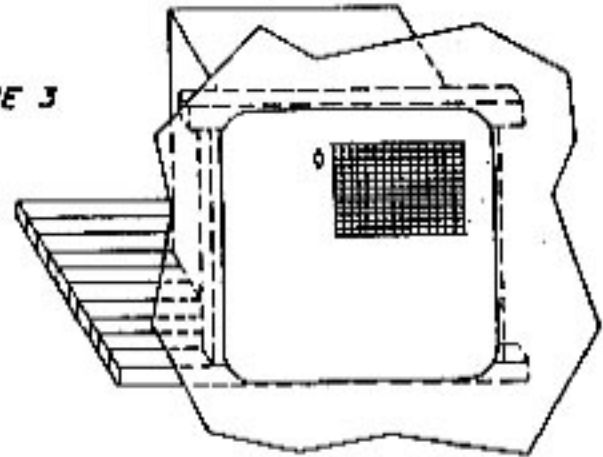


- A. Insert heater into the framed opening. Front of housing should be flush with outside wall. Secure to coach with nails at bottom and sides of control housing compartment. Place caulking to inside of housing frame. Insert frame into housing compartment and secure with three #10-24 x 3 $\frac{1}{2}$ " screws.
- B. To install door, locate holes in bottom of door over pins on the lower control housing frame. Close door so that the latch protrudes through the slot in the door. Turn latch 90 degrees to fasten door.

DSI MODELS

Hinged Door

FIGURE 3



- A. Insert heater into framed opening. Place caulking sealant between heater flange and outer wall of the coach to insure a water-tight bond. Secure heater to wall using (12) No. 8 x $\frac{1}{4}$ " wood screws, screwed through holes in front mounting panel of heater.
- B. To install door, slip one hinge pin into slot on each side of door, then insert other end of hinge pins behind spring brackets on heater frame, close door so that latch protrudes through slot in door. Turn latch 90 degrees to fasten the door.

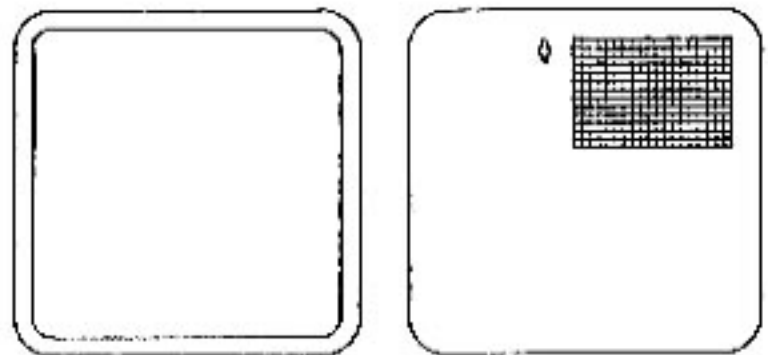


FIGURE 2

REAR CONNECTIONS

- Connect water lines to fitting provided, 1/2" female pipe threads.
- Connect 3/8" gas supply piping to gas connection supplied with heater. Turn on gas and check leaks, using a soap and water solution. **Be sure there are no leaks in gas system.**

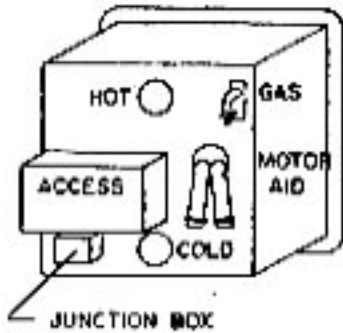


FIGURE 4

INSTALLATION OF MOTOR AID EXCHANGER

- Place copper "Y" in heater lines as shown in sketch.
- Secure hoses to "Y" with hose clamps.
- Attach hose from motor-aid heat exchanger to "Y"s.
- Secure hoses to motor-aid and "Y"s with clamps.
- Check all connections for water leaks and proper water circulation through motor-aid heat exchanger, with engine running.

The motor-aid heat exchanger is designed to operate safely and efficiently for an indefinite period of time and should require no maintenance. Be sure to check your heater hoses for cracks after the first year of operation, since a cracked or broken hose could cause a great inconvenience on an outing.

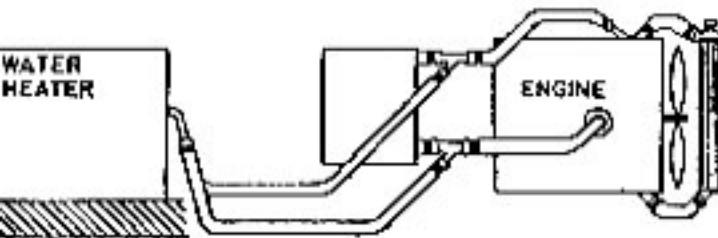


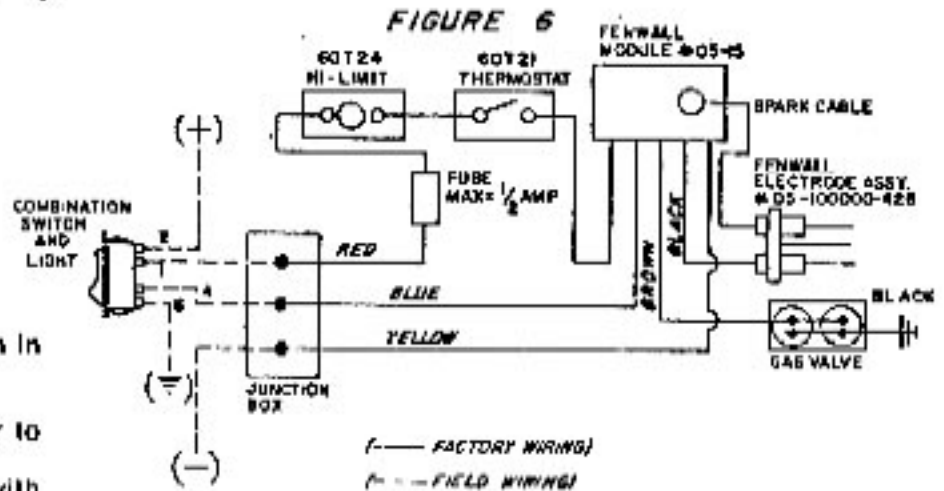
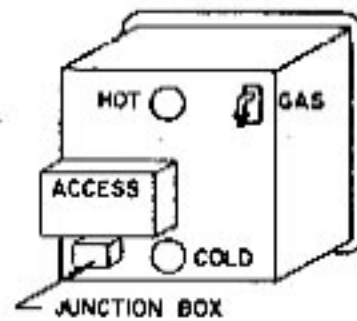
FIGURE 5

ELECTRICAL CONNECTIONS

Make sure water heater is filled with water before making electrical connections.

Make electrical connections as shown on this wiring diagram.

System must be fused with a 500 milliamp fuse. Do not use fuse of larger current rating.



DISCONNECT POWER SUPPLY BEFORE SERVICING THERMOSTAT AND HI-LIMIT UNDER ACCESS COVER WIRING DIAGRAM 12V DC 1 AMP

WIRING DIAGRAM

LIGHTING INSTRUCTION

Figure (7) - Purge air by loosening manifold nut at gas valve. When air is purged, tighten nut and check for leaks using a soapy solution. Figure (7A) - Air cannot be purged by above process. Lighting instructions must be repeated until air is purged. Turn gas supply "on". Turn switch to "on" position, spark should begin and main burner should lite. If spark stops before main burner lites, turn switch to off, wait 5 seconds and turn switch to "on" position. This will re-start the ignition cycle. The first start-up of the heater may require several ignition cycles before all air is purged from the gas lines.

If the burner will not come on, the following items should be checked before calling a service man.

- Switch turned off.
- Gas supply to heater empty or turned off.
- Reset button on ECO tripped.
- Fuse blown.

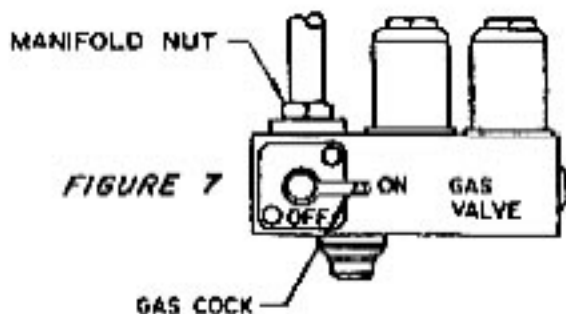


FIGURE 7

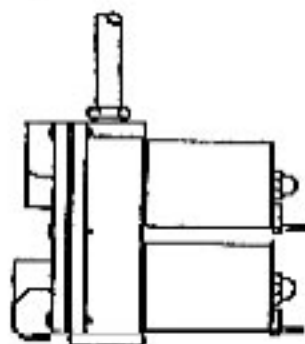


FIGURE 7a

BURNER

All air shutters are pre-set at the factory to obtain a blue or orange-blue flame. If it is necessary to adjust the air shutter, be sure to maintain the blue or orange-blue flame color. Do not allow the burner flame to burn with a yellow flame, because sooting will occur.

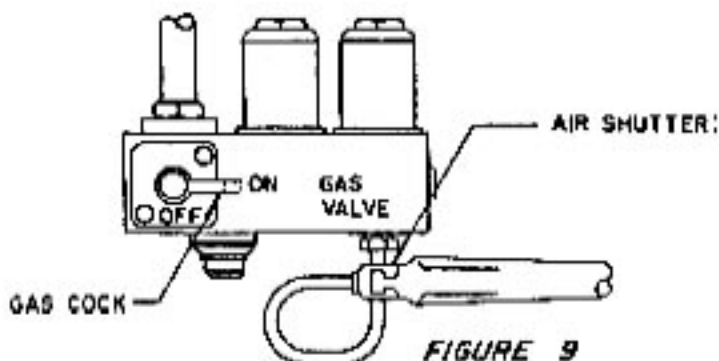


FIGURE 9

THERMOSTAT AND MANUAL TEST

This water heater is provided with a high temperature cut-off device in the event of thermostat failure. Temperature above 190°F will cause manual reset button to trip shutting down main burner.

To activate burner, the water temperature must be below 100°F, push reset button to re-activate burner.

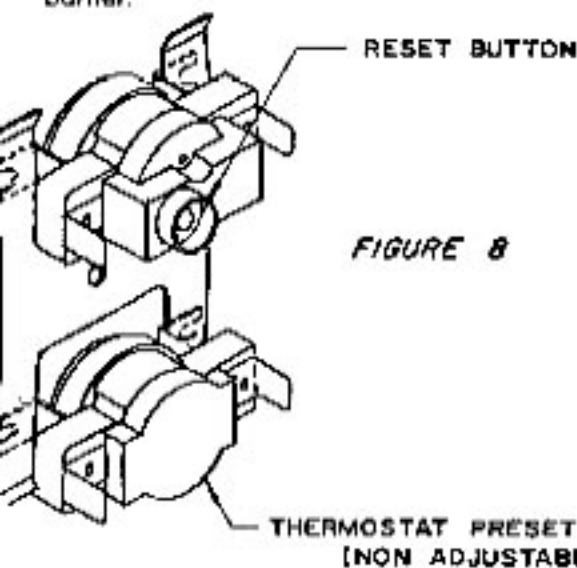


FIGURE 8

LOCATED UNDER ACCESS COVER, ON REAR OF WATER HEATER.

TURN AIR SHUTTER TO OBTAIN PROPER BLUE FLAME.

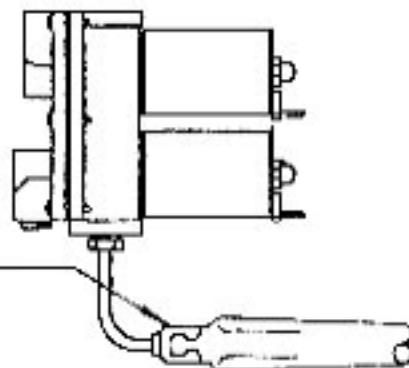
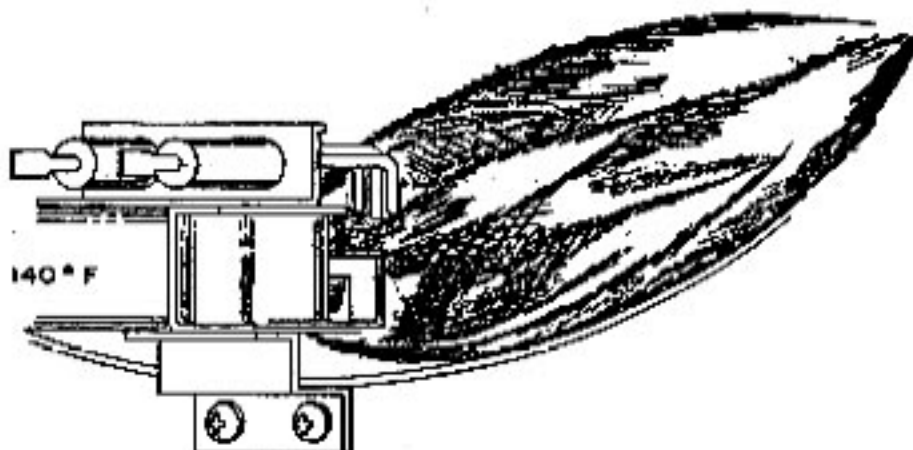


FIGURE 9a



BURNER FLAME

In cases where sooting has occurred, there is a possibility that this condition may be corrected by making the correct air shutter adjustment. If the burner flame continues to burn yellow after adjusting the air shutter, check for an obstruction in the burner or the flue box. A stiff brush is recommended for the removal of soot deposits. If there is soot in the burner, check to make sure the gas valve is shutting off clean. This can be checked by turning the off-on switch to the off position. There should be no flame at the burner orifice or at the burner.

DRAINING AND STORAGE INSTRUCTION

If RV is to be stored during winter months, the water heater must be drained to prevent damage from freezing.

1. Turn off power & gas.
2. Turn off pressure pump on water system.
3. Open both hot & cold water faucets.
4. Open drain on water heater.
5. Follow RV manufacture instructions for draining entire water system.

NOTE: Be certain to refill water heater with water before re-lighting.

SERVICE HINTS, DIAGNOSIS AND CORRECTIVE MEASURES

The only tools required to service the 05-15 and 16 are a phillips head screwdriver and a 20,000 OHMS/volt multi-tester (Radio Shack 28-4013, Allied WV-518A, triplitt model 310-C or equivalent)

WHAT'S WRONG	WHY	WHAT TO DO
1. Lockout Occurs 3-10 Seconds After Ignition	<ol style="list-style-type: none"> 1. Reverse Polarity 2. System Improperly Grounded 3. Gas Pressure Too High, Causing Flame To Lift Off Burner. 4. Sensor Probe Incorrectly Positioned In Flame Pattern 	Paragraph 1 Paragraph 2 Check To Insure Input Pressure As Specified On Manufacturer's Data Plate. Paragraph 6
2. Flame Not Established	Spark Gap Too Small	Paragraph 3A
Arcing To Ground	Spark Gap Too Large	Paragraph 3A
3. No Spark	Corroded Connector	Paragraph 3B
4. Arcing Other Than Across Gap	<ol style="list-style-type: none"> 1. Cracked or Dirty Insulator 2. Broken High Voltage Lead 	Paragraph 3C
Weak Spark	High Voltage Lead Too Close To Metal Surface	Paragraph 3E
No Flame	Valve Malfunction	Paragraph 4
Low Flame Current	Electrode Improperly Placed	Paragraph 5
and/or Nuisance Lockouts	<ol style="list-style-type: none"> 1. Flame Current Falls Below 2.5UA 2. Low Gas Pressure 	Paragraph 6 Check To Ensure That Manifold Pressure Meets Manufacturer's Specifications.

TEMPERATURE AND PRESSURE RELIEF VALVE

The temperature and pressure relief valve is designed to open if the temperature of the water within the heater reaches 210°F, or if the water pressure in the heater reaches 150 pounds. Recreational vehicle water systems are closed systems and during the water heating cycle, the pressure build-up in the water system will reach 150 pounds. When this pressure is reached, the pressure relief valve will open and water will drip from the valve. This dripping will continue until the pressure is reduced to below 150 pounds, and the valve closes. This condition is normal and does not indicate a defective relief valve.

BURNER COMPARTMENT MAINTENANCE

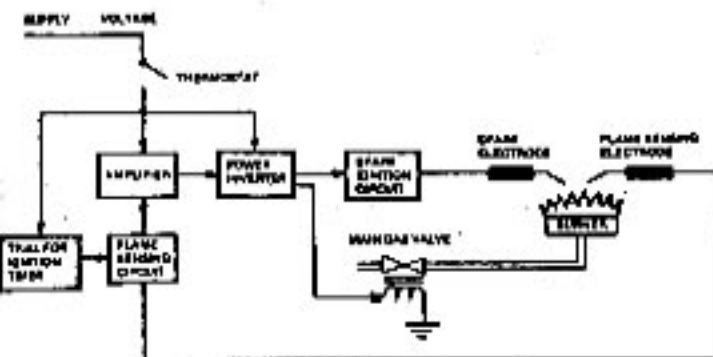
Periodically check control compartment and screen in door to see that no foreign material has accumulated to prevent flow of combustion and ventilating air. Periodically check burner flame visually, and compare with sketch under the burner adjustment section.

WARNING:

Do not store or use combustible materials or liquids near or adjacent to this heater. The appliance shall not be installed in any location where flammable liquids or vapors are likely to be present.

DESCRIPTION

The Fenwal series 05-15 (12VDC) and 05-16 (24VAC) direct spark ignition systems operate through a thermostat to provide a means of ignition for the burner on gas-fired equipment. This is accomplished by generating a spark between high voltage electrode and ground. Once the flame is established, a flame rod monitors the main burner flame (see figure #1). Refer to bulletins No. 5-15A and 5-16A for installation instructions.



Block Diagram

SEQUENCE OF OPERATION

On a call for heat, voltage is applied to the ignitor across terminals 1 (power) and 6 (ground) of the input connector. A high voltage spark is then generated from the spark electrode to ground. Simultaneously, the gas valve is energized.

At the start of each heat cycle, there is a "trial for ignition period" of three to ten seconds duration depending upon the model ignitor used. Normally, main burner flame will be established before the end of this period. Once the flame is established, sparking will cease and the "flame rod" will provide flame monitoring for the remainder of the heat cycle. If the flame is extinguished during this cycle, the ignitor will start sparking automatically in an attempt to re-establish the flame. If this does not occur within the "trial for ignition period", the system will go into lockout closing the gas valve.

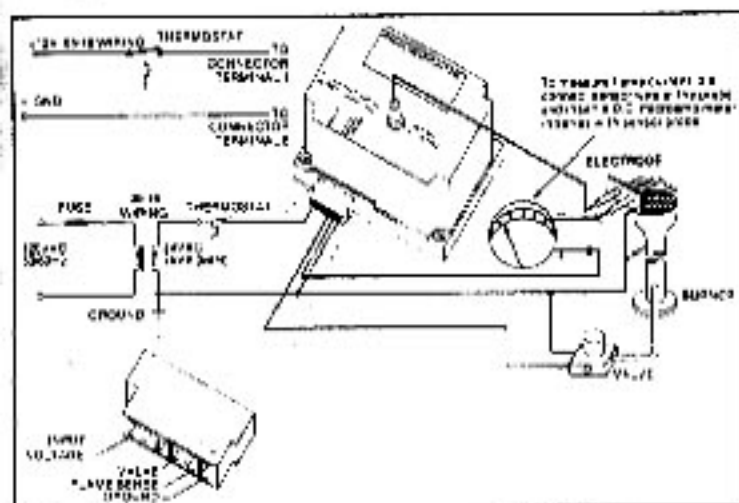


FIGURE 10

TROUBLESHOOTING

Although the following tests can be made using a standard volt meter, it is quicker and more convenient to use a fenwal model 05-125539-001 test adaptor (see figure #3).

PRELIMINARY CHECKS

1. Input polarity —
If a spark is present and the gas valve opens for the flame establishing period but then locks out at the end of three to ten seconds, check the input voltage at terminal 1 and 6 for the proper polarity. Terminal 1 should be "hot"; (12-VDC (05-15) or 24VAC (05-16)) with respect to ground. Terminal 6 is neutral, or zero voltage, with respect to ground (see figure #1).
2. Improper grounding —
If a flame is present during the trial for ignition period but the system shuts down, insure that the burner is properly grounded. If the burner is not grounded, the flame monitoring signal will not function and the system will go into lockout. Check for loose or corroded terminals and replace if necessary. Ensure good electrical connection by scraping paint or any other foreign matter off the area where ground connection is made.

It is equally important to be certain that the electrode bracket assembly is properly grounded. The bracket should be common with the ground lead on the input connector (ground terminal 6). If the bracket is not properly grounded, damage to the ignitor can result.

3. Inoperative high voltage —
If there is no spark or sparking is intermittent, check the following, after disconnecting voltage to the system.
 - A. Check spark gap. Gap should be $1/8"$ + $1/32"$ from H.V. to ground. **CAUTION: never replace the component board without first checking to insure that the electrode has the proper gap. If the gap is too wide, damage to the ignitor can result.**
 - B. Check electrode leads and determine there is no corrosion at the terminals. If there is corrosion, clean it off.
 - C. Check ceramic insulators for cracks, foreign matter, and carbon. If there are cracks, replace electrodes. If there is carbon or foreign matter, clean it off.
 - D. Check high voltage lead wire for cracks or breaks. If there are cracks, breaks, or chafing, replace high voltage wire.

- E. Check that the high voltage leak wire is not too close to a metal surface to insure that arcing will not occur at any point other than across the H. V. electrode. Also insure that the high voltage lead wire is not taped or connected to a metal frame along its length, sharp metal edges, or crossing. Do not bundle with other wires. Always leave one inch spacing between the high voltage lead wire and any other metal or wires.
- F. For best operation, the high voltage wire should be as short as possible and should not exceed 24 inches in length.
- G. Check to ensure that the high voltage terminal is clear of dust, moisture or any foreign matter that could create high voltage leakage to ground.

4. Valve malfunction —

With power applied to the ignitor, sparking should occur and the solenoid valve should open simultaneously. If sparking occurs, but the valve does not open, place a volt meter between terminal 4 on the input connector and ground (or across valve). Recycle the ignitor by turning the thermostat down for five seconds minimum and then back up and determine if voltage is present at the valve. (terminals 4 (valve) and 6 (ground) in figure 10.) If voltage is present, and the valve does not open, remove wires from the valve terminals and retest the valve on a known voltage source. If valve does not function still, it should be replaced. If the voltage is not present at terminals 4 & 6, the ignitor should be replaced. Check P. C. connector area. (clean with soft rubber eraser only.) Also, check the terminals in the plastic connector for good contact.

The valve relay is rated for 12VDC on the 05-15 and 24 VAC on the 05-16, both at .5 amps. If a valve is used with a higher current rating than that specified, damage can result to the relay contacts.

5. Electrode placement —

- A. Electrode should be placed so optimum flame current is achieved for proper application.
- B. Flame should not impinge on any portion of ceramic insulator.

6. Flame current —

The flame detector circuit uses the ionized gas flame to conduct the flame signal. This signal is a small DC current which can be measured directly with a 0 to 50 microamp meter.

Although the minimum flame current necessary to keep the 05-15 and 05-16 ignitor from going into lockout is 2.5 microamps, the lowest recommended is 5.0 microamps. These ignitors can stand flame currents as high as 30 to 40 microamps.

To measure flame current, first shut off the power to the system and then remove the flame sensing lead wire from the electrode terminal and insert a 0-50 DC microamp meter in series with the sensor electrode and the sensor lead wire. "Plus" terminal of meter to component board and "negative" terminal to sense electrode. Energize the ignitor. If the meter reads below zero, shut the system off and reverse meter leads.

Once the flame is established, assure that the flame current is above the minimum specified. If not, assure that the system has the proper input voltage, and then relocate the sensor electrode in the flame pattern until flame current is increased.

Once the flame has been established and the system is in its heat cycle, occasional sparking may occur. This is common in some installations and is not significant. Sparking will not damage the ignitor.

7. Ambient temperatures —

The 05-15 and 05-16 are designed to operate over the temperature range of -40 to 150 degrees F. Care should be taken to insure that it operates within range.

8. Relative humidity —

The 05-15 and 05-16 are coated for moisture resistance to 90 percent relative humidity. Caution should be taken to protect the component board against direct exposure to water.

NOTE: This test adaptor is available from Fenwal Inc., Ashland, Mass.

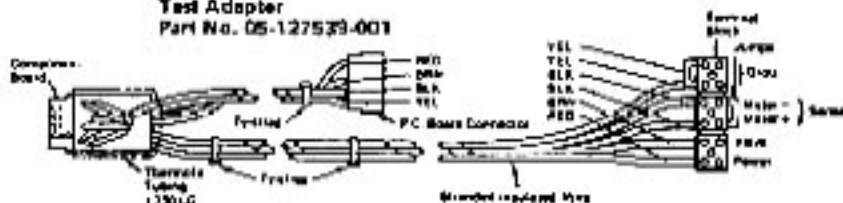
WARRANTIES

If the ignitor is damaged due to mishandling, or is not applied or installed properly, warranties will be voided. The 05-15 and 05-16 ignitors are not field repairable. All ignitors that fail to function properly should be returned to the attention of customer service.

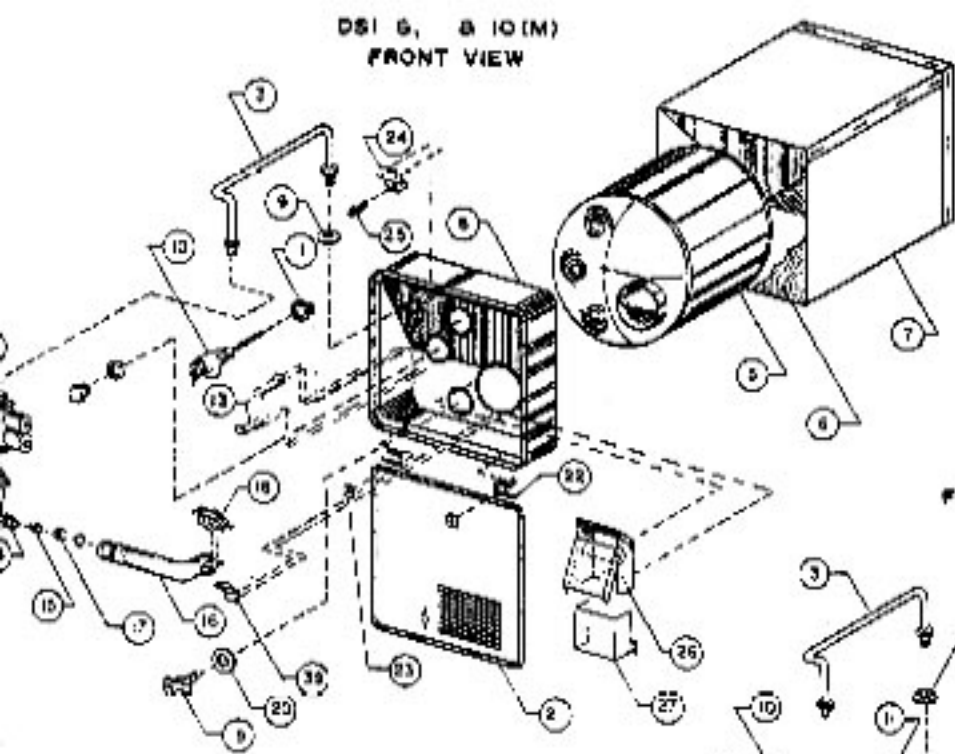
CAUTION

The Fenwal series 05-15 (12 VDC) and 05-16 (24 VAC) direct spark ignition systems are designed for use on new gas fired equipment or as replacements for an existing Fenwal spark ignitor. Any substitution or other application must be expressly approved in writing by the manufacturer of the equipment. Improper substitution or application may result in a malfunction of equipment, and the creation of an explosive atmosphere.

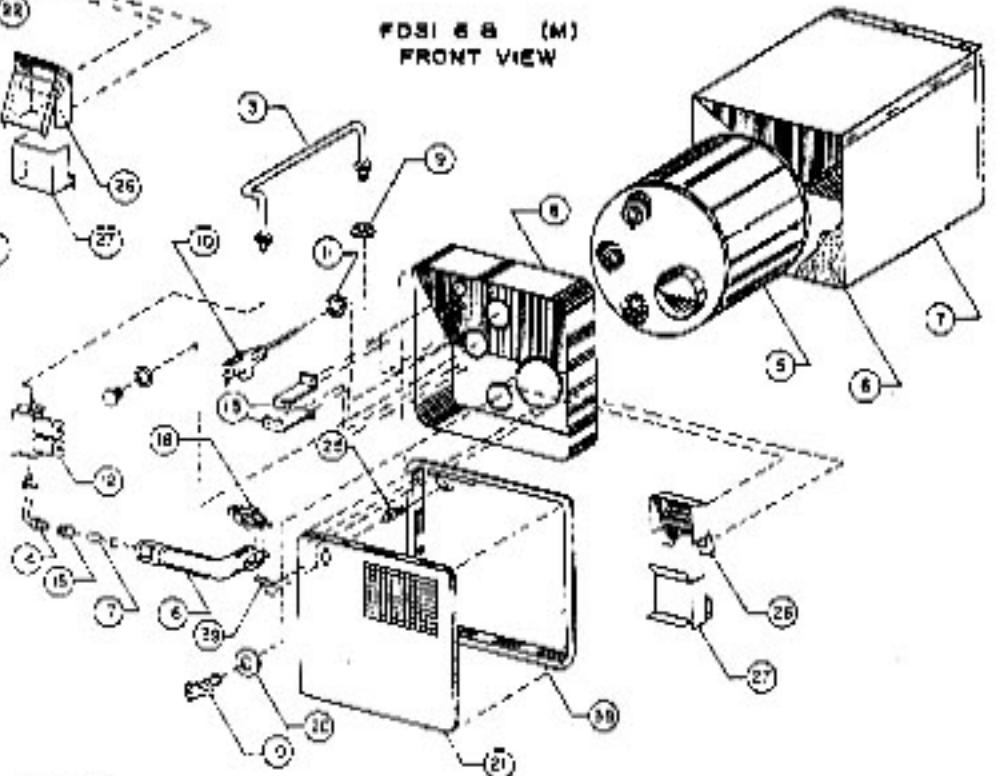
Figure 3.
05-15 & 16
Test Adapter
Part No. 05-127539-001



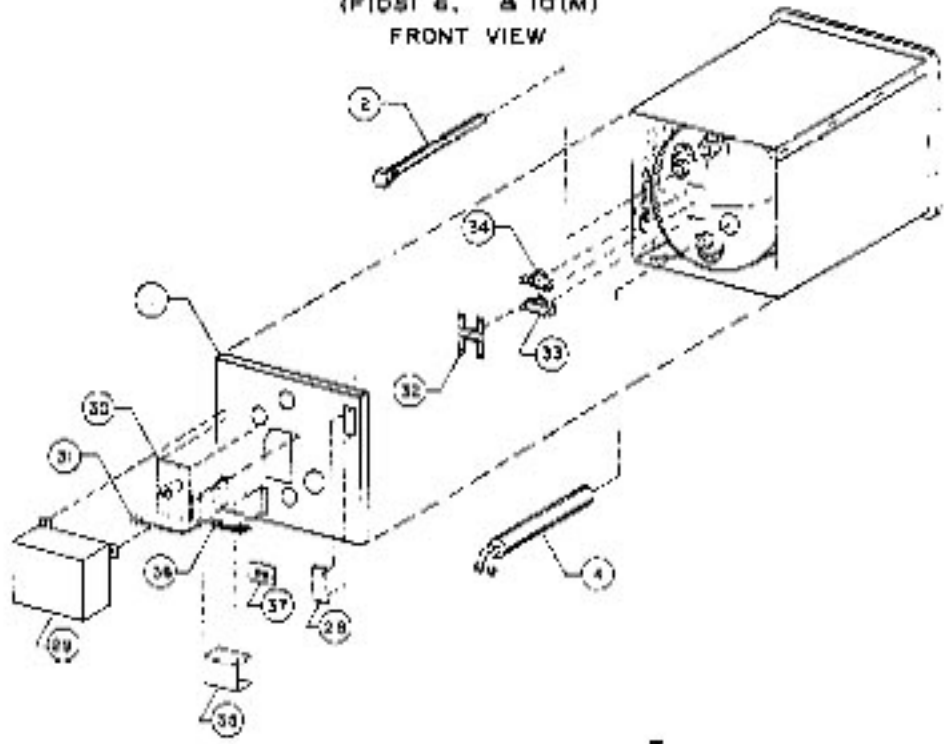
DSI 6, 8 & 10(M)
FRONT VIEW



FDSI 6 & 8 (M)
FRONT VIEW



(FDSI 6, 8 & 10(M)
FRONT VIEW



Part Number	Reference Number	Part	Model
2000509	1	Rear Cover Assy	FDSI 6 & DSI 6
2000511			FDSI 6M & DSI 6M
2000510			DSI 10
2000512			DSI 10M
4700242	2	Anode Rod	6 & 10
3700085	3	Gas Supply Inlet-Manifold	6 Gallon
3700086			10 Gallon
3000041	4	Motor-Aid Heat-Exchanger	(All Models)
Not Replaceable	5	Tank	
Not Replaceable	6	Fiberglass Insulation-Blanket	
Not Replaceable	7	Jacket	
Not Replaceable	8	Control Housing	
4400031	9	Front Gas Supply-Manifold	
		Grommet	
4300024	10	PTR Valve	
4400013	11	PTR Valve Spud Flange	
		Gas Valve	
3200510	12	Gas Valve	
2800055	13	Gas Valve Mounting-Bracket	
3700084	14	Burner Manifold	6 & 10
3600039	15	Burner Orifice	FDSI 6
			DSI 6 & 10
			(All Models)
3000003	16	Burner Assembly	
3100039	17	Burner Air Shutter	
3200198	18	Electrode Assembly	
4300034	19	Drain Valve	
4400019	20	Drain Valve Spud Flange	
2000151	21	Door, Screen Included	FDSI 6
2000458			DSI 6
2000153			DSI 10
2600107	22	Door Hinge Pin	DSI 6 & 10
2600030	23	Door Hinge Pin Fastener	DSI 6 & 10
2600033	24	Door Latch Bracket	DSI 6 & 10
2600031	25	Door Latch Assembly	(All Models)
2000084	26	Flue Collector	6 Model
2000093		Back Assembly	10
2700074	27	Flue Collector Front	6 Model
2700112			10
4400015	28	Rear Inlet Gas Supply	
		Manifold Grommet	
4800016	29	Control Cover	
3200241	30	Ignition Control Module	
3200269	31	Spark Cable	
2800032	32	Thermostat & ECO Bracket	
3200244	33	Thermostat	
3200245	34	ECO	
2600005	35	Junction Box Cover	
3200194	36	Wiring Harness	
4200059	37	Switch & Plate	
2000150	38	Door Housing Frame Assembly	FDSI 6
3100040	39	Burner Support Bracket	

NOTE: All screws in assembly are standard hardware items.

When ordering parts, be certain to specify the exact model number of your heater complete serial number, part number, and the name of the part from this list. All parts not covered by the warranty will be shipped C.O.D. (NOTE: Warranty covers mechanical parts for a period of one year only.)



TM

MOR-FLO/AMERICAN
Water Heaters