

OWNER'S MANUAL

SMALL UNIT SHOWER

NSN. 4510-01-409-0139
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Operators / Maintenance Manual No. 271032UST, Rev. 1, December 21, 1996 for use with Shower Unit, Small, Model No. MFX 2710 Manufactured, Tested and Sold by U.S. Thermal, Inc.

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Inventory Checklist

Heater MFX 2705

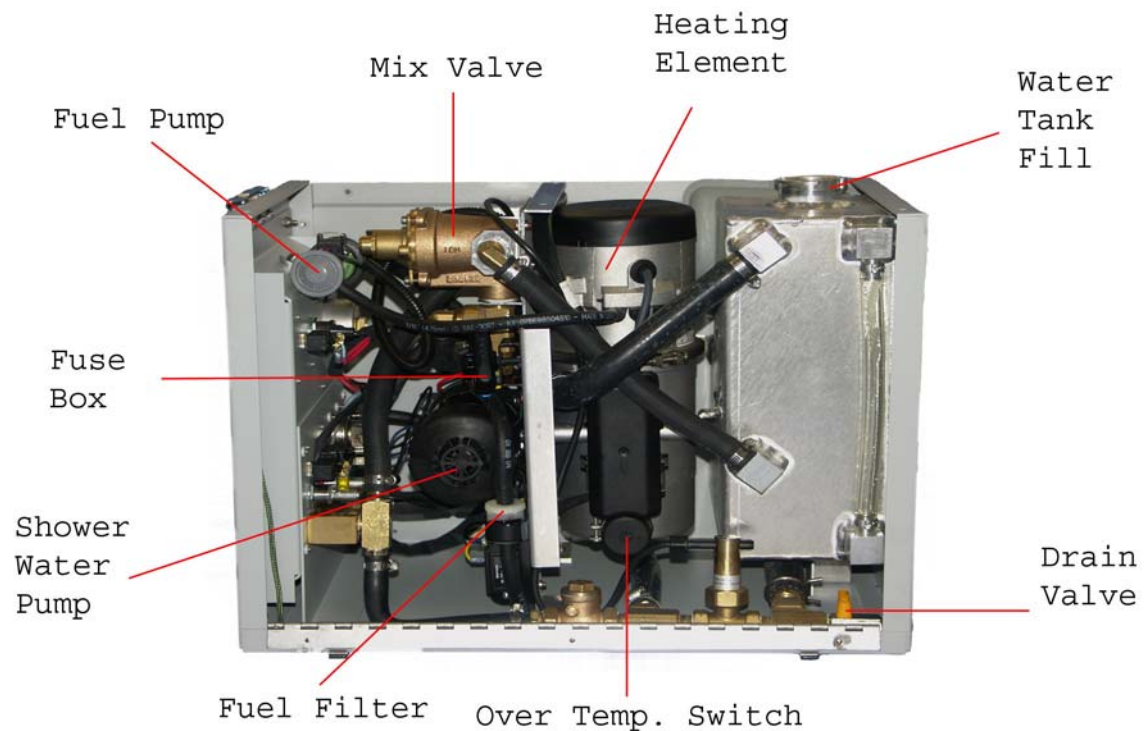
- _____ Accessory Tray (1)
- _____ Inlet water hose with strainer and 20# pressure reducer (1)
- _____ Outlet water hose (1)
- _____ Fuel cap adapter (1)
- _____ 2" Cam loc x 3/4 MGH adapter (1)
- _____ Power cable (1)
- _____ Short handle scrub brush (1)
- _____ Drain hose "Y" adapter (1)
- _____ Spray gun (1)
- _____ Owner's manual (1)

_____ Spare Parts Container

- _____ Fuel connection O-rings (2)
- _____ Fuel filter (1)
- _____ Fuses (2-20 amp, 1-5 amp)
- _____ Rubber seat and washer for shower head (1 ea.)
- _____ 24V Bulb (1)

Tent MFX 2735

- _____ Tent bag (1)
- _____ Shower cover (1)
- _____ Airframe (1)
- _____ Shower tubing with 4 shower heads (1)
- _____ Floor (1)
- _____ Shower pan bag
- _____ Shower stall pans (4)
- _____ Matting 2ftx2ft sections (7)
- _____ Drain hose assembly (2)
- _____ Air pump with inflation hose (1)
- _____ Tent stake pouch (1)
- _____ 9" Aluminum stakes (16)
- _____ Patch kit pouch (1)
- _____ 3oz container of adhesive (1)
- _____ Roller (1)
- _____ Laminated instruction card (1)
- _____ Patching material



SMALL UNIT SHOWER BY U.S. THERMAL, INC

1. GENERAL DESCRIPTION OF THE SHOWER SYSTEM FOLLOWS

U.S. Thermal's Portable Water Heating System delivers endless hot water for field showers, equipment cleaning, deicing, as well as hazardous material decontamination. This compact and portable system was designed to produce pressurized hot water from any source – a 5-gallon can, a stream, and a tank, ect. U. S. Thermal's Portable Water Heating System consists of a Model 2705 Water Heater with accessory tray, Model 2735 Shower Shelter, spray wand, 15 amp slave cable, fuel can adapter and a 2" female cam lock x ¾" male garden hose adapter for connection to a 160 gallon pillow tank.

A. MODEL 2705 WATER HEATER

1. The dimensions of the heater are 13" wide, 20" high and 21" long.
2. The empty weight of the heater unit is 65 pounds.
3. The heater is multi-fuel powered which means it can burn fuels including diesel, fuel oil, kerosene, jet fuel, and others.
4. The maximum heating capacity of the heater is 31,000 BTU with a maximum fuel consumption of one quart per hr.
5. Included with the heater is an accessory tray for storage of all hoses, connectors, and other accessories.

B. MODEL 2735 SHOWER SHELTER

1. The shower shelter has floor dimensions of 8 ft 4in. x 13 ft 2 in. and folds into 2 bags weighing 75 lbs. each.
2. The shower shelter comes with four shower stalls, which are removable for cleaning or reconfiguring the shelter as a small command post. The shelter cover is also removable for cleaning.
3. Water conserving shower heads are provided and the stalls are pre-plumbed for incoming water and shower drains.
4. Zippers are located on all sides for extra ventilation and ease of access.
5. Skylights and screened vents are also included.
6. Hanging storage bags are located behind each stall. Mesh toilet article bags are also provided inside each stall.
7. A manual air pump, tent stakes and patch kit are also provided.

C. SPRAY WAND

1. The spray wand weighs 2 pounds and is equipped with a squeeze on/off pistol grip trigger.
2. The output of the spray wand is 1.5 gallons per minute at 30 psi.
3. The spray wand uses the same inlet and outlet hoses as the shower shelter and stores in the accessory tray.
4. Multiple uses include cleaning the shower shelter, equipment cleaning, deicing and hazardous material decon, etc.

2. PRECAUTIONS!!! IMPORTANT!!! READ BEFORE ATTEMPTING TO OPERATE THE UNIT

- ***WARNING***USE ONLY ARMY MEDICAL DEPARTMENT (AMEDD) APPROVED POTABLE WATER**
- ***WARNING***ONLY OPERATE UNIT IN WELL VENTILATED OUTDOOR AREAS. NEVER OPERATE UNIT IN EXPLOSIVE ATMOSPHERES**
- ***WARNING***DO NOT OPERATE IN ENCLOSED AREAS. DIRECT EXHAUST AWAY FROM SHELTER. KEEP FUEL CAN AND ANY FLAMMABLE MATERIALS AWAY FROM EXHAUST.**
- ***WARNING***PART OF THE HEATER MAY BECOME HOT DURING OPERATION. USE CAUTION WHEN HANDLING.**
- ***WARNING***USE DIESEL OR JP-8 FUELS ONLY.**
- ***WARNING***USE 24 VOLT POWER SUPPLY ONLY.**
- ***WARNING***ALWAYS REMOVE THE FUEL CONNECTION AND POWER CORD WHEN UNIT IS NOT IN USE.**
- ***WARNING***WHEN THE WATER TANK IS HOT, PRESSURE CAN BE CREATED INSIDE THE TANK. USE CAUTION WHEN REMOVING THE FILL CAP.**
- ***WARNING***ALWAYS FLUSH, DRAIN, AND CLEAN HEATER AND HOSES COMPLETELY FOLLOWING USE.**
- ***WARNING***DURING COLD WEATHER, IF WATER IS LEFT TO FREEZE INSIDE THE HEATER MAJOR DAMAGE CAN OCCUR!!! WATER STANDING IN THE HEATER CAN PROMOTE SCALE BUILD UP. DRAIN WATER FROM THE UNIT WHEN NOT IN USE!!!**
- ***WARNING***EVACUATE AND LOWER SHELTER IF WIND CONDITIONS EXCEED 30 MPH.**

3. HEATER PRINCIPLES OF OPERATIONS

The MFX Model 2705 water heater actually contains 4 separate subsystems which work together to provide warm water for showering, equipment cleaning, deicing, and hazardous material decontamination, etc. The four subsystems are: Fuel system, combustion air system, hot water tank system, and water mixing system.

- A. **FUEL SYSTEM**: The fuel system draws fuel from the fuel can, via the fuel cap adapter, through a fuel filter and into the fuel pump. From there it is pumped into the heater combustion chamber where it is combined with air and ignited to produce heat. The combustion chamber is surrounded by water cavity where heat is absorbed by the water.
- B. **COMBUSTION AIR SYSTEM**: The combustion air system draws air into the heater via a combustion fan which pulls air in through an air inlet located inside the case. Once inside the combustion chamber the air combines with fuel and is ignited. The products of combustion exit the combustion chamber via an exhaust tube, which leads to the muffler. From the muffler the exhaust is released to the atmosphere.
- C. **HOT WATER TANK SYSTEM**: The hot water tank system consists of three components, circulating pump, water tank, and heat exchanger. When the heater is operating, the circulating pump continuously draws water from the tank (which holds about 2 gallons) and pushes it through the heat exchanger and back into the water tank. The heater unit tries to maintain a constant tank temperature of 194F. Once the tank temp. reaches 176F, the unit automatically reduces heat output to ¼ maximum. If the water temp. continues to increase (because of lack of demand for the heat) and reaches 194F the heater will automatically shut down the flame and the heater goes into standby status. In standby status, the circulating pump continues to run. When the temp. falls below 167F the flame automatically re-ignites to raise the temperature. A flow

switch has been installed in the water system to make sure that there is water flowing through the heat exchanger any time the fuel pump is operating. If water stops flowing, the heater will automatically shut down.

- D. WATER MIXING SYSTEM: The water mixing system consists of two components, a water mixing valve and a pump. The pump pulls both cold water from the water inlet and hot water from the hot water tank through the mixing valve and pushes it out to the showerheads. As hot water is drawn from the tank, the tank is automatically refilled with cold water, which is continuously heated. The water-mixing valve is designed to monitor the outgoing water temp. and adjust the amounts of hot and cold water added to the mixture to produce outgoing water at a constant preset temperature.

NOTE! FOR BEST PERFORMANCE IT'S RECOMMENDED THAT THE WATER SUPPLY BE AT THE ELEVATION OF THE HEATER OR ABOVE.

4. REQUIREMENTS FOR OPERATION

The three requirements that must be met before the unit can be operated are fuel, electrical power, and water.

A. FUEL

The heater can burn both diesel and JP-8 fuels. A Fuel cap adapter is supplied with the system for use with the new plastic 5-gallon fuel can per MIL-C-53109. For use simply place fuel line in fuel can and screw on adapter cap loosely. Next insert quick connect fitting into the coupler on the face of the unit marked "Fuel". For venting, the fuel cap adapter should not be screwed tightly during operation. A five-gallon fuel can holds enough fuel for approximately 20 hours of continuous operation in high mode. It is not necessary to drain the fuel cap adapter between uses. Draining the fuel cap adapter will create an air bubble in the fuel system and the heater will shut down until the fuel pump re-primed the fuel system.

NOTE! To prevent fuel from overheating, keep the fuel can in a shaded area whenever possible.

B. ELECTRIC POWER

The Model 2710 operates on a 24 volt DC electrical system. A specially designed lightweight (15 AMP) power cable is provided to draw power from any NATO standard slave cable receptacle. **DO NOT USE CABLE FOR ANY OTHER PURPOSE OTHER THAN FOR THIS UNIT!!!** (Such as jump-starting other vehicles).

C. WATER SUPPLY

Although the heater was designed to use water from any source, a tank, a stream, or pressurized water source up to 60 psi etc., use only army medical department (AMEDD) approved potable water.

5. HEATER OPERATING INSTRUCTIONS

1. Close heater drain valve.
2. Remove tank cap by pushing down on cap while twisting.
3. Completely fill tank with water.
4. Replace cap on tank.
5. Connect inlet water supply to heater. It is best to have the supply tank at or above the level of the heater.
6. Connect water outlet from heater to shower shelter.
7. Connect electrical supply (24V) and fuel supply to heater. Be sure fuel tank is vented.
8. Turn pump switch to "ON".
9. Push button on each showerhead to let water flow. Hold button until only water is flowing. -No air.
10. Turn pump "OFF"
11. Remove tank cap and refill water level to top again. Replace cap.
12. Turn heater switch to "START" position hold for five seconds and switch to "RUN" position. **DO NOT** leave switch in "START" position for more than 30 seconds!!
13. Allow water in tank to heat until the heater cycles down to a lower output. This will be evident by a change in sound.
14. Turn shower pump switch "ON". Shower is ready for use.

15. Under certain operation conditions it is possible for the heater tank to empty for a few seconds, which will interrupt water flow to the showerhead. This is normal and the tank will automatically refill and resume service.
16. After use, turn pump switch and heater switch to the "OFF" position. The heater blower will continue to run for 90 seconds. DO NOT turn the main power (emergency use only) off, as this will abort the cooling cycle.
17. Drain the tank by opening the drain valve and then the tank cap. Make sure the rubber seal on the bottom of the tank cap stays in place on its retaining barb.
18. Disconnect hose from water supply. Leave hoses connected to the face of the heater.
19. Turn the pump switch on.
20. Reach into each shower stall and push the showerhead button until all water has drained and only air comes from the head.
21. Turn pump "OFF" and disconnect power cable from the heater and power source and store in the accessory tray.
22. Disconnect water hoses, drain and store in accessory tray.
23. Disconnect fuel line from heater. Remove cap from fuel can. Wipe fuel off hose and store in accessory tray.
24. ALWAYS DRAIN THE WATER HEATER WHEN NOT IN USE!!!

6. HEATER STORAGE INSTRUCTIONS

1. After use, the heater must be drained (see instructions above). Also make sure before storing the heater that the pump has been run with hoses connected to the heater such that the pump has pumped all water from it and has pumped air only for at least 10 seconds. This assures that the pump head contains no water. It is a good idea to rotate the unit at various angles with the drain valve open to assure that all water has been drained. Do not allow water to freeze inside the unit or major damage will occur!!!
2. Wipe down heater and accessories with damp cloth and store accessories in tray. Attach tray to unit using the four clips attached.
3. Replace all dust caps and plugs on the face of the heater and if possible store in a dry place.

*****IN ORDER TO PREVENT SCALE BUILD UP INSIDE THE HEATER, ALWAYS DRAIN THE HEATER COMPLETELY WHEN NOT IN USE!!!**

7. ERECTING THE SHOWER SHELTER

1. Choose an area that is at least 15'x10' which is clear of all sharp objects and has a slight slope for drainage of the shower pans. An 8' clearance height is required. The 15' dimension should be across (perpendicular to) the slope.
2. The shower shelter is packed in 2 bags. One contains the tent, support structure, and floor. The other contains the shower pans, floor mats; drain hoses, stakes, patch kit and air pump. Locate bag containing the rolled up tent and remove tent from the bag.
3. Unfold the tent and position it in the chosen area making sure that the arrows on the edge of the floor point downhill for shower drainage.
4. Make sure door zippers are at least partially open.
5. Locate the zippered slot at the corner marked "INFLATE". Open the zipper to reveal the air inflation/deflation valve on the dark gray tube.
6. Remove the dust cover from the valve and turn the stem in the center of the valve counter clockwise until tight. Go to the opposite leg (diagonally) and repeat step 6.
7. Secure the air pump and air fill hose located in the shower pan bag.
8. Make sure that the air fill hose is connected to the discharge port (top port on the handle) on the air pump, and insert the hose end into the inflation/deflation valve, and rotate a quarter turn clockwise to lock in place.
9. Using the manual air pump, inflate the tent. This should take from 6 to 8 minutes. (Note: Once the tubes are firm lift up on the center of the structure and assist it upright into place.) The shelter is equipped with a pressure relief valve. This small valve is located directly above the air inflation/deflation valve. If the air is escaping from this relief valve discontinue inflating, the tubes are full.
10. Remove the air pump from the valve and replace the dust cover. Go inside the tent and store pump on the inflation/deflation leg using the straps provided.
11. Adjust cover and tube feet as needed to position the structure in full upright position.

12. Open the shower pan bag and remove: 7 sections of matting, 4 shower pans, 1 shower curtain and drain hoses.
13. Install the shower curtain and 4 shower pans inside tent. Make sure to follow corresponding color codes on quick connect buckles. White buckles snap to white buckles and black buckles to black buckles. Shower stalls on one side have 2 white buckles and shower stalls on the other side have 4 white buckles.
14. Install black drain hose into black drainage tubes protruding from the rear of shower stall pans.
15. Locate two flaps (one on each side of the door) along the downhill edge of shelter where cover meets the floor. Fold down flap and run drainage hoses through flap making sure the drain tubes protruding from underneath the cover are not kinked or obstructed in any way and are pointing down hill.
16. Connect both drain hoses to the short Y-adapter piece if a single drainage line is desired.
17. Place one 2'x2' square of matting in each shower stall. Place the remaining three pieces down the center aisle of the tent where needed.
18. Locate the tent stakes stored in the shower pan bag. Install in position to anchor the four tie down ropes located at the corners of the shelter cover. Install remaining stakes in the grommet loops located along the base of the shelter.
19. Open the skylights and vents as needed.
20. For ventilation, the zippered door openings on all sides can be folded inward and held by Velcro fasteners.
21. For night uses, each shower stall has an elastic band sewn inside the shower approximately 65" off the floor for hanging a flashlight or a chemical light stick.
22. For storage, the accessory tray and one bag can be put in the other bag and stored behind the shower stalls.

8. STRIKING AND STORAGE OF THE SHOWER SHELTER

- A. The shower shelter internal water supply hoses must be drained before storage of the shelter. If the internal supply hoses have not been drained, follow steps 16 thru 23 in section 5 above.
- B. Clean and dry the tent.
- C. Remove drain hoses, matting, 4 shower pans and one shower curtain and pack neatly inside a storage bag.
 - **NOTE: In order to keep both bags under the 75lb. Weight limit, make sure to remove ONE shower curtain, which weighs 3 lbs. and pack in the bag with the shower pans.
- D. Remove air pump and air hose from storage straps and store in the shower pan bag.
- E. Remove all tent stakes, clean and store in the tent stake bag located in the shower pan bag.
- F. Open both deflation valves by removing dust cap and pushing in on the stem in the center of the valve while turning clockwise until valve locks in the open position.
- G. Unzip shelter doors to allow any air remaining inside the tent to escape. *Note: Avoid walking on the tent.
- H. Fold cover toward the center of the tent so Velcro strips located where the tent cover attaches to the floor can be seen all the way around.
- I. Begin folding the tent from the arrow end (8' wide). Start with a 2' wide fold and continue folding until you reach the opposite side of floor. After each fold press as much air from tent as possible. An eight-foot section of tent approx. 36" wide should remain. Fold this section into thirds.

9. OPERATING THE SPARY WAND

- A. Make sure pump switch is in the "OFF" position.
- B. Attach spray wand to the quick connect fitting on the end of the water discharge hose.
- C. Turn pump switch to the "ON" position.
- D. Squeeze trigger handle until all air is discharged from water lines. Release to stop water flow.
- E. Before disconnecting spray wand, make sure pump switch is in "OFF" position and the squeeze handle to release pressure in the line.

10. CLEANING PROCEDURES

A. Shower Shelter

1. Cover: The cover can be cleaned with mild soap and water combination. Brush large clumps of dirt from cover while dry. Completely wet the area to be cleaned, then using a SOFT brush or rag, brush on soap and water solution and rinse with fresh water. Allow to air dry before storage.
2. Airframe: The airframe can also be cleaned with soap and water. See above procedure. It may be easier to clean the airframe with the shelter cover removed.
****NOTE: Do NOT use soap to clean areas to be patched. This area should be cleaned with rubbing alcohol or mild solvent.
3. Floor: To clean the floor, first remove the shelter cover and airframe if desired. Sweep any large clumps of dirt from the floor. Spray or mop with mild soap and water solution with commercial disinfectant cleanser such as Lysol or Dow bathroom disinfectant. Rinse with fresh water and allow to air dry.
4. Shower Pans and Matting: The shower pans and matting can be cleaned using the same procedure as the floor. Matting may require using the brush and spray gun provided and a more concentrated cleaner/disinfectant.
****NOTE: Before using ANY cleaner always test a small area of all three fabrics, and check for adverse reactions before use!!!

B. Heater

1. Heater and Accessories: The heater and all accessories can be cleaned with a soap and water solution or mild detergent. Using a soft rag, wipe off all exterior surfaces of the heater and accessories. Rinse with fresh water and wipe dry.
2. De-Scaling the Heater: The internal heater and tank should be de-scaled at least once a year or more often under heavy usage or poor water quality. The worst condition for scale buildup inside the heater occurs when water is left to stand inside the heater. Always drain the heater when not in use. Instructions for de-scaling the heater follow.
 - a. Set up the heater as detailed previously in the owner's manual. Make sure to use fresh water to fill the heater tank.
 - b. In a bucket, thoroughly mix two gallons cold water and 4lbs. de-liming solution.
 - c. Place the inlet and outlet hoses in the bucket.
 - d. Switch the pump to the "ON" position. Switch the heater switch to the "START" position. DO NOT switch the heater to "RUN". The water should remain cold. Do not heat.
 - e. While occasionally stirring, allow the de-liming solution to circulate for one hour.
 - f. Drain the heater and flush THOROUGHLY with fresh water.
 - g. Drain the heater and clean the inlet strainer before use or storage.

The recommended de-scaling material is "Koil Kleen" available in 8lb jars from U.S. Thermal (513-777-7763)

Koil Kleen can be extremely irritating to the eyes upon direct contact. Skin contact may cause burns. It is harmful if swallowed. In case of eye contact, flush with water for 15 minutes. If swallowed, drink 2 large glasses of water and consult a physician. Refer to material safety data sheet for disposal and other information.

11. PREVENTIVE MAINTENANCE

- A. Heater: The internal heater needs to be disassembled and cleaned once a year under normal operation. To do this (refer to diagrams on pg 21 and 24)
 1. Remove the top and rear case panels and hot water tank.
 2. Remove black plastic protective cap from heater body and unplug heater-wiring harness.
 3. Remove hose between heater circulating pump and brass assembly at the brass assembly.
 4. Using an Allen wrench remove one bolt on circulating pump. Next rotate pump forward for access to the mounting bolts.

5. Remove heater mounting bolts and remove heater from case.
 6. Using a large Phillips screwdriver remove clamp around center of the heater body.
 7. Pull heater apart to expose the burner element and combustion chamber. Using a soft bristle brush remove any carbon from the burner and heat exchanger. Visually inspect both the heater and burner element for damage.
 8. Re-assemble the heater by performing steps 8 thru 1 in reverse order.
- B. Strainers: Three different strainers need to be checked and cleaned periodically.
1. An inline strainer is located in the inlet water line. Unscrew the end and remove the plastic strainer insert. Flush screen and replace. Use caution when reinstalling the insert. If installed in the wrong direction, the strainer will not reassemble properly and water flow may be disrupted.
 2. The tank fill strainer located in the tank fill neck should be cleaned and free of all foreign material.
 3. The showerhead strainers are located in the fittings at the end of the black showerhead hoses. Remove the strainers clean and replace. This item need only be performed if the strainer becomes clogged.
- C. Fuel Filter: The fuel filter should be replaced at each yearly inspection or as needed. The fuel filter is located in a clip inside the case door and is readily accessible.
- D. Temperature Control Valve: The temperature control valve should be disassembled and cleaned at each yearly inspection. Since foreign particles will affect the operation of this valve, it is important that both incoming water strainers are kept in place and in good condition.
- E. Dust Plugs: Always keep dust plugs and caps on the quick connect fittings and electric receptacles whenever hoses and power cord are not in use.
- F. Lubrication: The O-rings on the quick connect fittings should be routinely lubricated with Vaseline or vegetable oil to maintain proper operation. In addition, the brass pressure reducer located at the end of the inlet hose should also be routinely lubricated with a few drops of vegetable oil.
- G. General Inspection: A general inspection should be given to hoses, fittings, and cable before each day's operation. Also, open the door and inspect the interior of the unit for any leaks or other problems.

12. TROUBLE SHOOTING

- A. A fuse has blown.
1. Look inside heater unit for shorts or frayed wires.
 2. Replace blown fuses with properly rated fuses.
- B. The red fault indicator light begins flashing. – The fault indicator light on the face of the heater indicates the kind of fault by means of a Blinking Code during the purge cycle of the heater. After the short rapid blinks the long slow blinks are counted. Make sure to count the first long blink immediately after the short rapid blinks!

LIGHT BLINKING CODES FOR MALFUNCTIONS

Failure Symptom	Probable Cause	Check and Correct
No Function	Electrical Wiring, Fuses	Fuses Battery Connection Positive on A5, Negative on A3, Positive Signal on A1 Replace Control Unit
2X No Start and no combustion after start and repeat start	Fuel System	Fuel Level Type of Fuel Fuel Filter Fuel Can, not vented Fuel Line Connections (Air bubble in fuel line) Air intake or exhaust restricted or plugged Clean starting air hole in burner
3X Flame Out During Operation	Fuel Supply	Restriction in fuel system Fuel Filter Fuel Can, not vented Fuel Line Connections (Air bubble in fuel line) Type of Fuel Clean or replace Burner
4X Low Voltage for more than 30 Sec	Burner Electrical System	Load Test Batteries Corrosion Loose Connections
5X Flame Sensor Permanently Hot	Defective Flame Sensor	Replace flame sensor
6X Flame Sensor	Wiring	Damaged wiring, Open or short circuit
7X Temperature Sensor	Defective Flame Sensor	Replace flame sensor
8X Over Heat Situation or No Flow	Defective temp. Sensor	Replace temp. sensor
	No Flow	Water level or flow restricted Air trapped in water circuit Reset Temp. limiter (push on round rubber boot) Damaged or corroded wiring, open or short circuit
Fuel Metering Pump		Replace fuel pump
9X Combustion Air Fan	Wiring	Damaged wiring, Open or short circuit
	Defective combust. air fan	Replace combustion air fan
10X Ceramic Igniter	Wiring	Damaged wiring, Open or short circuit
	Defective ceramic igniter	Replace ceramic igniter

- C. There is low water flow. (Note that the showerheads are water conserving with a flow rate of ½ gallons per minute at 30 lbs. of pressure)
1. Check for air leaks in the incoming water hose and connections.
 2. Check for fouled inlet strainer and clean if necessary.
 3. Make sure that the tank cap is sealed properly.
 4. The pump is defective.
- D. The shower water temperature will not control to desired temperature.
1. The water temperature is too cold.
 - a. The water-mixing valve is not set properly. Using a pair of pliers, turn the mixing knob on the valve counterclockwise to raise the temperature.
 - b. The tank water is not up to temperature. Allow the heater to catch up. Use less volume of water.
 - c. The incoming water is extremely cold. This means that more heat is required to bring the water up to the desired temperature. Reduce the volume of water being used so the heater can keep up.
 - d. The water mixing-valve is fouled by foreign particles, which prevent the valve from working. The water mixing-valve must be disassembled and cleaned. If the valve still doesn't work properly the valve motor must be replaced.
 2. The water temperature is too hot.
 - a. The water-mixing valve is not set properly. Using a pair of pliers, turn the mixing knob on the valve clockwise to lower the temperature
 - b. The water mixing-valve is fouled by foreign particles, which prevent the valve from working. The water mixing-valve must be disassembled and cleaned. If the valve still doesn't work properly the valve motor must be replaced.
- E. The unit will not attempt to start.
1. Check that the main power switch is in the "ON" position.
 2. Check electrical connections at the heater and power source.
 3. A fuse is blown in the heater fuse box. Replace fuse and retry.
 4. Main power switch or heater power switch is defective.
 5. The heater control unit is defective.
- F. The heater attempts to start but does not fire off.
1. The fuel line and fuel filter are not primed with fuel. Attempt a restart. Depending on the distance to the fuel source, it may take several start attempts to prime the empty fuel line. Visually watch for fuel in the fuel filter.
 2. The fuel can is not vented; therefore the fuel pump cannot draw fuel from the can. Vent the fuel can by loosening the fuel cap adapter.
 3. The fuel line is leaking air. Stop the air leak. Check clamps and O-rings on quick connect fittings.
 4. The fuel filter is clogged. Replace.
- G. The shower pump keeps running even through the showerhead buttons are not depressed.
1. Air is in the shower lines. Push the showerhead buttons until all air is purged from the lines.
 2. A showerhead is leaking. Pop off showerhead button with a flat tip screwdriver and remove valve with an 11/16th sock. Replace rubber washer and seat. Reassemble.
 3. Defective pressure-switch on the pump. Replace pump.
- H. A particular showerhead does not have as much flow as the others.
1. The strainer at the brass connection of the showerhead hose to the shower tubing is fouled. Remove strainer and flush with fresh water. Replace.
- I. The following explains visual inspection for assessment of the burner condition. The burner and evaporator have specific features indicating their need for replacement or their serviceable condition. The following describes the criteria for a correct inspection. See section 14 for assembly procedures.

Burner Housing – The starting air bore (Fig. 506) must not be clogged, otherwise there will be no start. To correct this clogged condition; first remove the glow plug. Then, carefully remove any contamination (e.g. with a wire of 1.5mm diameter).

Rear Wall with Metal Evaporator – The pilot flame exit bore (Fig. 503) must not be clogged or there will be no start. The repair is to replace the burner. If the evaporator is missing in the

vicinity of the pilot flame exit bore (Fig. 504) in one or several of the locations shown, there will be no start. The repair is to replace the burner. Cracks, delaminations, as well as black or other discolorations of the evaporator do not cause a burner failure and are meaningless. A lack of evaporator in the area shown (Fig. 503) does not cause a burner failure. This area burns off approx. 300 to 400 operating hours. If only half of the evaporator is left (Fig. 505), the replacement of the burner is recommended but is not compulsory. Coke deposits on the evaporator surface (except for the pilot flame exit bore) are normal and must not be removed (e.g. by scraping). When the load changes from full to part load and vice versa the burner normally is self-cleaning.

Combustion Chamber – The combustion chamber (Fig. 506) should not be damaged (e.g. dented). A combustion chamber with dents may cause insufficient combustion or coking of the heater. To repair, replace the burner. The air bores (Fig. 506) in the combustion chamber must not be coked. Coked air bores may cause a no-start or insufficient combustion. To repair remove coke deposits by careful scraping.

Burner Assembly – The cables of the glow plug and flame sensor must be routed as shown in Fig. 502. The threaded connection of the housing and combustion chamber must be secure (Fig. 506). The housing and combustion chamber (Fig. 506) must be connected securely without any play (check by slight movement of the fuel pipe.). The O-ring must have a tight fit around the fuel chamber upper edge (Fig. 506) and must seal completely. The gap between the housing edge and combustion chamber upper edge (Fig. 506) is not required to be equal around the entire circumference. The insulation (Fig. 502) must be in place.

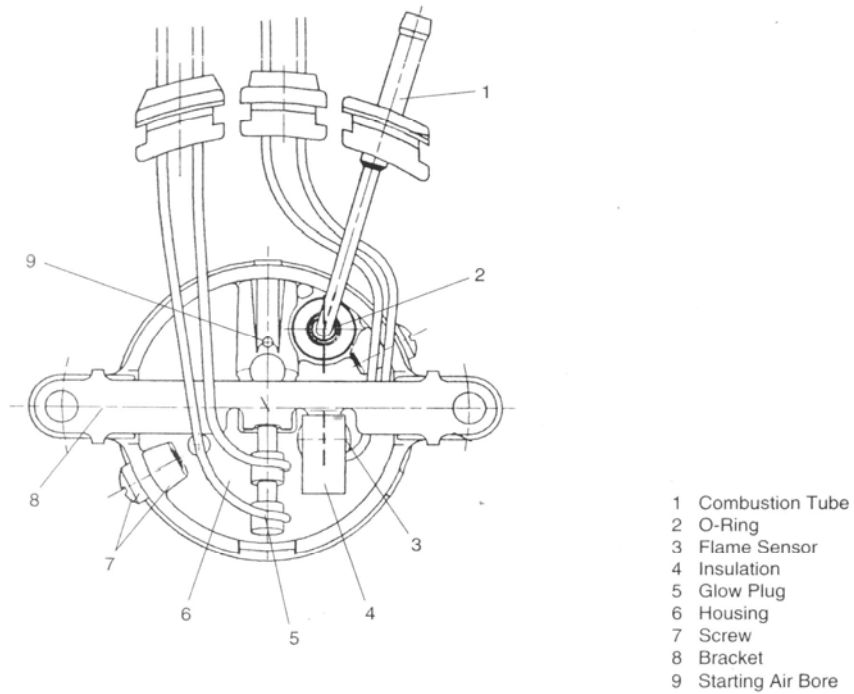


Fig. 502

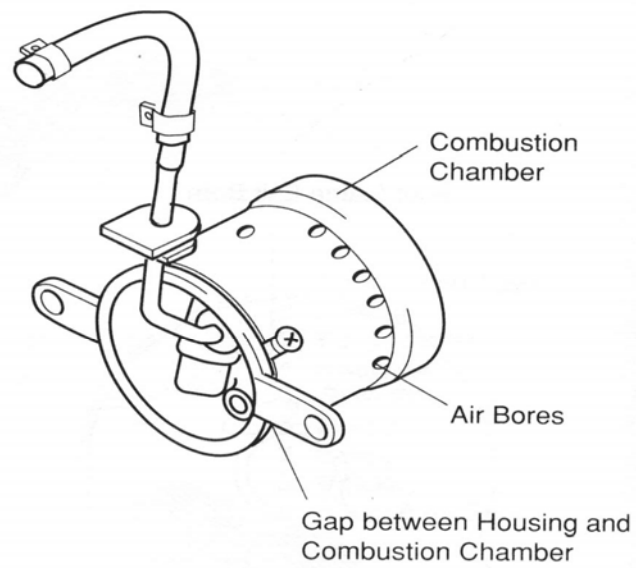


Fig. 506 Visual Inspection, Burner Assembly

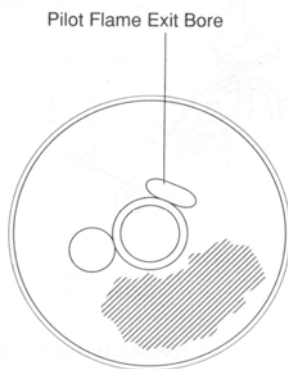


Fig. 503 Visual Inspection, Pilot Flame Exit Bore

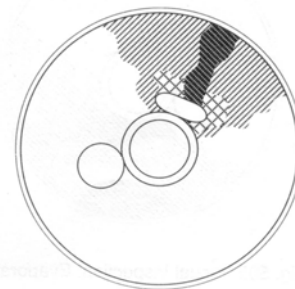


Fig. 504 Visual Inspection, Evaporator

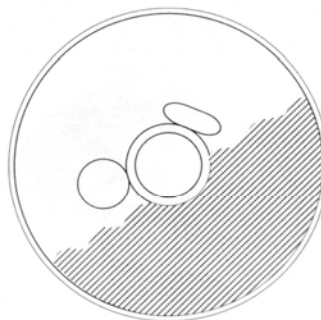


Fig. 505 Visual Inspection, Evaporator

- J: The following are component tests, which can be preformed. During electrical testing of the temperature sensor using a digital multimeter the following readings should be obtained:
- 1.1 Temperature Sensor Resistance Check – Resistance at 77F – 990 to 1010 ohms. Test current less than 1 ma.
 - 1.2 Glow Plug resistance test – Resistance at 77 F – 1.3 to 1.44 ohms. Test current less than 5 ma.
 - 1.3 Flame sensor resistance test – Cold test: resistance at 77 F – 2.6 to 3.4 ohms, tests current less than 5 ma.

13. Repair – Shower Shelter

A. Shower Shelter:

1. Air Frame:

- a. If an air leak is discovered and the shelter is needed, a temporary repair can usually be accomplished with the use of duct tape. Where possible, wrap the tape completely around the tube while it is inflated. There is less than 2 pounds per square inch pressure in the tubes when inflated.
- b. When time allows, a permanent repair can be made by deflating the airframe and following the instructions below.

2. Shelter Cover:

- a. When patching the shelter cover always cover from the inside of the shelter. Make sure to apply glue to rubber-coated side of cover and patch. Adhesive will not adhere to fabric side of the material or the patch.

3. Floor: Use the patch kit instructions on page 17 to make repairs on the floor.