TM 09211A-14&P/1

U.S. MARINE CORPS TECHNICAL MANUAL

OPERATION AND MAINTENANCE MANUAL FOR THE TRAY RATION HEATING SYSTEM

NSN 7310-01-295-7479

Contractor: Babington Enterprises
Contract No: M67854-95-C-2139

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OCTOBER 1996
PCN 18409211000

Department Of The Navy
Headquarters, U.S. Marine Corps
Washington, DC 20380-0001

31 October 1996

1. This manual, authenticated for the Marine Corps use and effective upon receipt and describes operation, maintenance, equipment and employment in the United States Marine Corps.
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REPORTING OF ERRORS

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How to Use This Manual

This manual contains the following:

1. Information for safe and efficient operation of your equipment. These instructions provide you with a general knowledge of the equipment, its characteristics, usual and unusual operation procedures, and maintenance procedures.
2. Trouble shooting procedures so that you can keep your equipment operating properly
3. The best possible operating instructions under most circumstances. Emergencies, adverse weather, terraine, and the like may require modification of these procedures.
4. Uses a "positive" approach to emphasize what you can do. Unusual operations or configurations are prohibited unless specifically included. Do not attempt any questionable operation that is not specifically permitted in this manual.
5. Befor operating any part of the Tray Ration Heating System, do the following:
    a. Read and follow all WARNINGS and CAUTIONS.
    b. Read the General Information, Installation, and Operating Instructions located in chapters 1 through 3.

WARRANTY INFORMATION

Limited twelve 12 month warranty

Babington Enterprises, Inc. makes the following limited warranties on the DUI-24/300Q Inverter provided with the Tray Ration Heating System. Babington Enterprises warrants this product against defects in materials and workmanship for a period of twelve (12) months from the date of Government acceptance. During this period, Babington Enterprises will repair a defective inverter assembly without charge to the Government. You must deliver the entire product to:

Babington Enterprises
1113 Ingleside Avenue
McLean, Virginia 22101

All transportation changes to the manufacturer will be borne by the Government.

Your Responsibility

1. You must notify Babington Enterprises within thirty (30) days after you discover the defect.
2. Warranties extend only to defect in materials or workmanship as limited above and do not extend to any product or parts which have ben lost or discarded by you or damage to products or parts caused by misuse, accident, improper installation, improper maintenance, or use in violation of instructions provided in this manual; or to units that have been altered or modified without authorization of Babington Enterprises or to damage to products or parts thereof which have had the serial number removed, altered, defaced, or rendered illegible.
3. The inverter assembly is not field reparable. No attempt should be made to repair or otherwise modify the assembly.

Warnings point out dangerous steps in the procedures in this manual. Your safety depends on following the instructions in all WARNINGS. Several general WARNINGS are included below:

WARNING

NEVER USE GASOLINE IN THE TRAY RATION HEATER. GASOLINE IS VOLITILE AND MAY EXPLODE, CAUSING DEATH, SERIOUS INJURY, AND/OR SIGIFIGANT DAMAGE TO EQUIPMENT. USE ONLY DOESEL, DF-1, DF-2, DFA, KEROSENE, OR JP-8.

WARNING

Drain all water from TRH tank before lifting the TRH into a HMMWV or removing it from the vehicle. Attempting to lift a TRH containing water can result in injuries from lifting strain or equipment drop. Four persons are required to properly lift a drained TRH.

WARNING

The tray rack and heated tray packs are hot. Remove tray packs with the tray pack-handling tool and remove #10 cans with the #10 can handling tool. Exercise care when opening the lid of the TRH. Exercising care when opening heated cans as they become pressurized. Wear protective gloves when handling hot tray packs and #10 cans. Placing hands into water even if "protected" by a glove could result in a serious injury.

WARNING

Dowfrost® is toxic in strong concentrations. Use only as directed. Do not ingest Dowfrost®

FIRST AID

For First Aid refer to FM 21-11

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LIST OF EFFECTIVE PAGES

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Original…….31 October 1996

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A	0		
B blank	0		
Record of changes (back blank)	0		
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SAFETY SUMMARY

The following *WARNINGS* and *CAUTIONS* appear on the page referenced and are listed here for emphasis.

WARNING

NEVER USE GASOLINE IN THE TRAY RATION HEATER. GASOLINE IS VOLITILE AND MAY EXPLODE, CAUSING DEATH, SERIOUS INJURY, AND/OR SIGIFIGANT DAMAGE TO EQUIPMENT. USE ONLY DOESEL, DF-1, DF-2, DFA, KEROSENE, OR JP-8. (Page 1—1, 1-9, 2-3, 2-6, 3-6)

WARNING

Drain all water from TRH tank before lifting the TRH into a HMMWV or removing it from the vehicle. Attempting to lift a TRH containing water can result in injuries from lifting strain or equipment drop. Four personnel are required to properly lift a drained TRH. (Page 2-1, 2-10)

WARNING

Do NOT turn power on until procedure to fill heater tank with water is complete. (Page 2-5)

WARNING

TRH exhaust pipe may be hot. DO NOT touch. DO NOT place objects in front of the exhaust. (Page 2-9)

WARNING

TRH tank water may be scalding and could cause serious injury. Remain clear while tank is draining. (Page 2-9)

WARNING

DO NOT expose the Airtronic Burner, TRH electrical control box, or inverter to rain or water to avoid electrical shock. Unplug inverter and TRH electrical control box prior to servicing or replacing system components. (Page 2-11)

WARNING

Before resetting the inverter circuit breaker, make sure the TRH red, pull-on/push-off switch is in the OFF position. This will prevent inadvertent turn-on of the Airtronic Burner. The inverter circuit breaker is located below the receptacle box on the inverter. When the inverter is on and functioning properly, a green LED indicator illuminates to indicate DC power is flowing to the inverter. The inverter on-off switch enables the flow of 120 VAC 60 Hz power from the inverter to the TRH electrical control box. The switch should be turned OFF to prevent unnecessary discharge of the HMMWV battery when the TRH is not in use. (Page 3-1)

WARNING

The tray rack and heated tray packs are hot. Remove tray packs with the tray pack handling tool and remove #10 cans with the #10 can handling tool. Exercise care when opening heated cans as they become pressurized. Wear protective gloves when handling hot tray packs and #10 cans. Placing hands into water, even if "protected" by a glove, could result in serious injury.(Page 3-4)

WARNING

Dowfrost® is toxic in strong concentrations. Use only as directed. Do not ingest Dowfrost®. (Page 3-6)

WARNING

Use the boil mode only for short periods of time. Extended use of the boil mode produces excessive steam through the pressure relief hole in the back of the lid and causes excessive pressure to accumulate in the canned food. Personnel can be burned by vented steam or pressurized, scalding can contents. (Page 5-5)

WARNING

Before removing Airtronic Burner from the TRH, make sure the TRH red, pull-on/push-off switch is in the OFF position and the TRH electrical control box is unplugged from a power source to prevent electrical shock and inadvertent Airtronic Burner ignition. (Page 5-10)

Keep face and hands away from flame tube when using test box to avoid accidental burning. (Page 5-13)

CAUTION

NEVER PLUG AN ADDITIONAL APPLIANCE INTO THE INVERTER RECEPTICLE THAT USES MORE THAN 150 WATTS OF POWER. (Page 1-11)

CAUTION

Do not use the lid handle as a lifting device for the TRH as it will result in equipment damage. (Page 2-1)

CAUTION

The Tray Ration Heater exhaust pipe may be hot. Do not touch. Do not palce objects in front of the exhaust. When the canvas cover is used in the HMMVW, slide the 90° exhaust elbow over the exhaust pipe to angle hot exhaust away from the canvas cover and prevent damage to canvas or HMMVW. (Page 2-1)

CAUTION

Make sure all switches are in the off position.

CAUTION

Omission of any procedure in the deinstallation, packing, storage, or transportation process could adversely affect system safety and/or operational effectiveness.

CAUTION

Lift the TRH with a forklift only if the TRH is on a pallet. Puncture of the TRH wall with a forklift tine can damage the TRH beyond repair.

CAUTION

To maintain water temperature, and reduce the chance of water contamination and accidental burning, keep the tank top closed except when loading and unloading tray packs.

CAUTION

Lid locking levers are adjustable. Excessive force is not required to close the lid. Equipment damage can result if locking levers are out of adjustment. The lid should be just tight enough to prevent water leakage around the lid gasket.

CAUTION

When operating the TRH in cold weather, keep the lid closed and latched except when loading and unloading the heater tank with tray

CHAPTER 1

GENERAL INFORMATION

Section I. INTRODUCTION

This manual prescribes operation and maintenance procedures for the Tray Ration Heating System (TRHS). The TRHS is comprised of a Tray Ration Heater (TRH) and associated collateral and support equipment that form a component of the Marine Corps Combat Field Feeding System. When installed on an M998 High-Mobility Multipurpose Wheeled Vehicle (HMMWV) the TRHS is a fully-mobile system with heat-on-the-move capability to feed 250 hot tray ration meals to personnel in remote areas. The system also supports non-mobile-feeding requirements.

The TRH consists of a stainless steel hot-water tank and a multi-fuel, Airtronic Burner that operates from its own fuel source (5-gallon can). A thermodisc maintains water temperature between 180°F to 200°F (180°F ±5°F is required for heating tray packs). The TRH will heat 18 tray packs to serving temperature in about 40 minutes. When installed on the HMMWV, the TRH uses vehicular electrical power. If the TRH is not HMMWV-mounted, it can be plugged into any 120 VAC, 60 Hz source.

WARNING

NEVER USE GASOLINE IN THE TRAY RATION HEATER. GASOLINE IS VOLITILE AND MAY EXPLODE, CAUSING DEATH, SERIOUS INJURY, AND/OR SIGIFIGANT DAMAGE TO EQUIPMENT. USE ONLY DOESEL, DF-1, DF-2, DFA, KEROSENE, OR JP-8.

The TRHS can be fully installed on a HMMWV without material handling equipment. Easily installed, ratchet-operated tiedown straps secure the TRH as well as beverage containers and side-loading pan carriers for transportation within the HMMWV. After filling the TRH with potable water, and connecting the fuel and electrical power, the TRH is ready for operation. Every TRHS is equipped with support items, including serving tables, serving utensils, insulated beverage containers, side-loading pan carriers, can opener, and rain cover kit.

When the HMMWV arrives at the feeding location, serving tables and equipment are deployed and a serving line is established. Hot tray packs are taken from the heater or side-loading pan carriers, opened, and served. As hot tray packs are taken from the heater, they are replaced with cold ones, which will then be ready to serve at the next feeding site. Disposable plates and utensils, packaged in the unitized tray ration box, are used to feed cafeteria-style meals. When serving is completed, tables and equipment are put back on the HMMWV and secured for travel.

The following paragraphs describe the equipment included in the TRHS. Table 1-1 lists all equipment provided with the TRHS. Figures 1-1 and 1-2 illustrate key components of the TRHS as installed in a HMMWV.

Table 1-1. TRHS Equipment

ITEM	Qty
Quadruple Container (Quadcon)[1]	1
Tray Ration Heating System	
Heater Tank with Airtronic Burner	1
Can, Fuel, Five-Gallon	1
Holder, Fuel Can, Bracket Assembly	1
Fuel Line with Quick Disconnect (12½-ft)	1
Fuel Can Adapter Kit	1
Collateral Equipment	
Padlock (for Quadcon)	2
Tables, Folding, Stainless	3
Bracket, Table, Rear	1
Bracket, Table, Forward	1
Clamp, Table	1
Tiedown Straps, TRH	2
Rain Cover Kit	
Storage Bag	1
Canvas, Foul Weather	1
Poles, 8-ft Extendible	5
Stays, Tent	4
Pegs, Tent	4
Fire Extinguisher, 5-lb	1
Bracket, Fire Extinguisher	1
Tool Box, Portable	1
Screwdriver, Cross Tip (¼-in)	1
Screwdriver, Flat Tip (¼-in)	1
Key Set, Hexagonal (2 to 5 mm)	1
Pliers, Slip Joint, 8-in	1
Wrench, Adjustable	1
Hammer, Blacksmith's, 3-lb	1
Pan Carriers, Side-Loading	3
Beverage Dispenser, 5-gallon	6
Tiedown Straps, Pan Carriers and Beverage Dispensers	2
Gloves, Thermal (pr)	2
Technical Manual	1
Utensil Box, Portable	1
Can Opener, Stainless Steel, Edlund #1, w/Knife	1
Table Adapter, Can Opener	2
Tin Snips	1
Thermometers, Pocket	2
Spoodle, 8-oz	2
Spoon, Perforated, 11-in	4
Spoodle, 4-oz	2
Spoon, Serving, 11-in	6
Spatula	2
Tongs, 9-in	2
Knife, Cooks	1
Wire Whip, French, 12-in	1
Insulated Tray Pack Holders w/ Lids	24
High Temperature Drain Hose, 4-ft	1
Tray Pack Handling Tool	1
#10 Can Handling Tool	1
Exhaust Elbow	1
Strap Adapter	1

[1] Government furnished equipment (Marine Corps end items only).

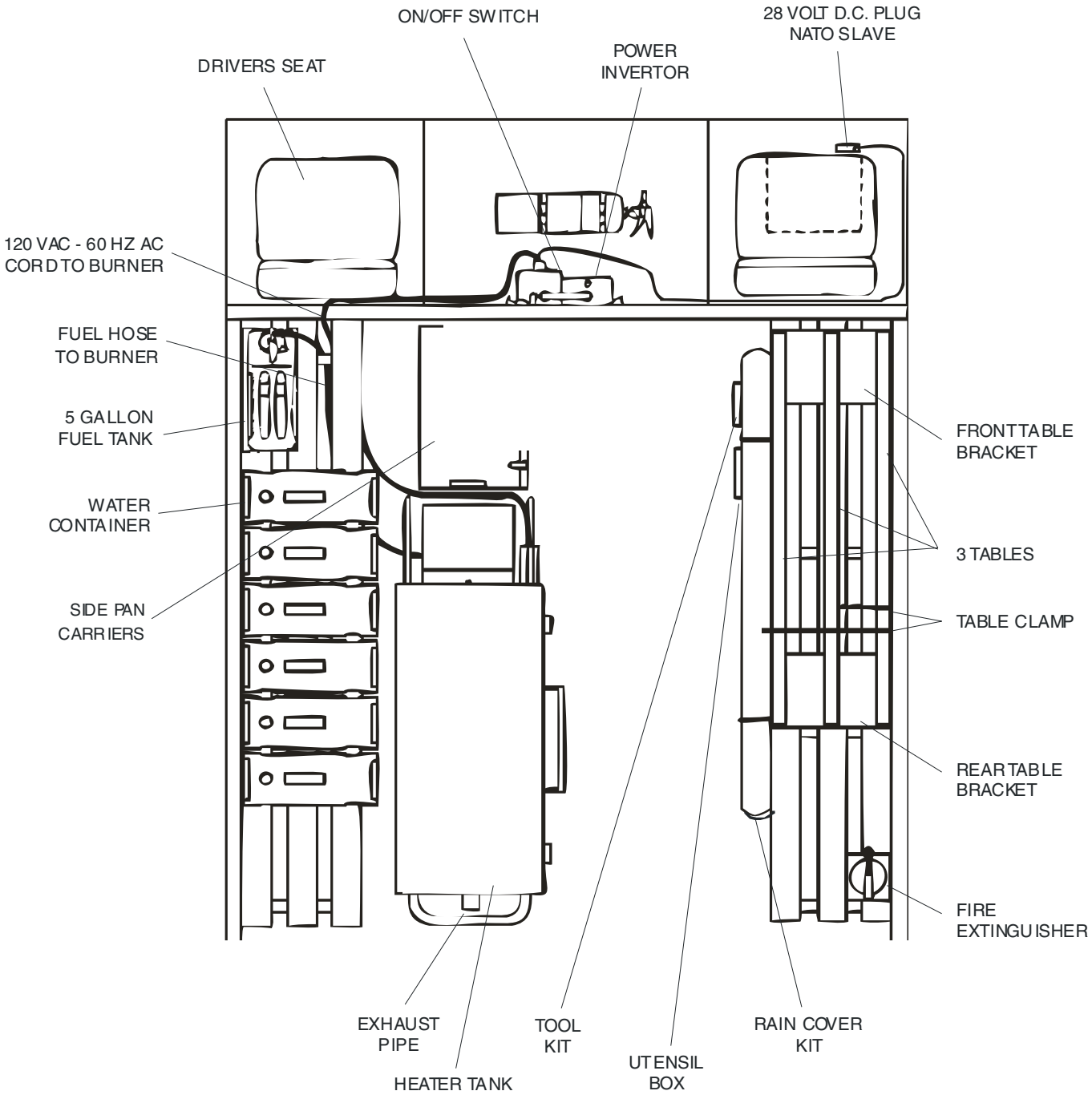


Figure 1-1. Installed TRHS, Top View

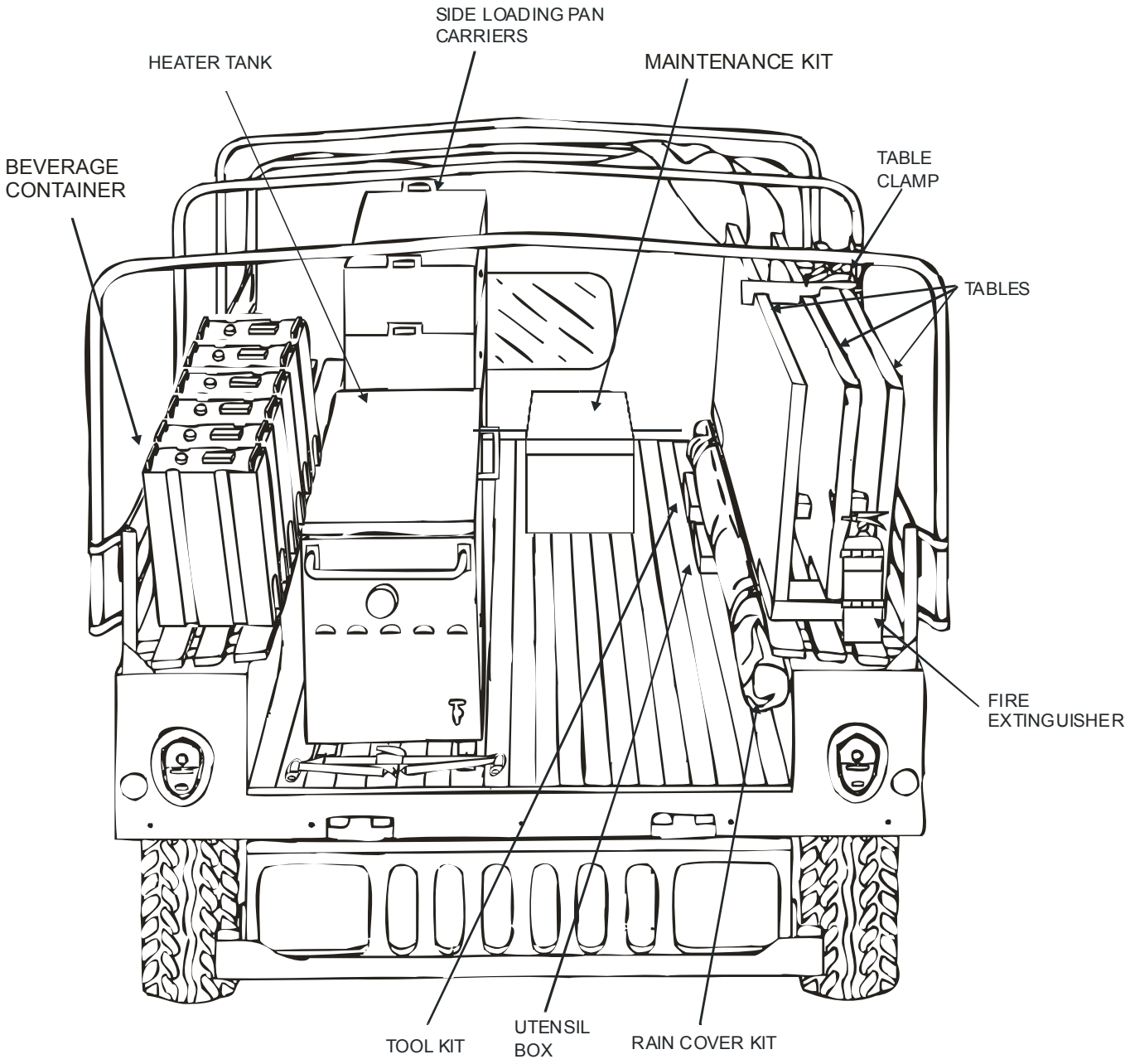


Figure 1-2. Installed TRHS, Tailgate View

Section II. EQUIPMENT DESCRIPTION

1-1. TRAY RATION HEATER. **The TRH is comprised of an Airtronic Burner, heater tank with removable tray-pack rack, and stabilizing devices (ratchet-operated straps). The TRH electrical control box (with red, pull-on/push-off switch), includes such safety features as a circuit breaker, low-water sensor, thermodisc, and mercury tilt switch (turns the Airtronic Burner off in the event of an excessive angle of operation). Each component of the TRH is illustrated in the following paragraphs. Functional component descriptions are provided as required.**

a. <u>TRH Tank</u>. Figures 1-3, 1-4, 1-5, and table 1-2, contain identification of TRH parts and other TRH components.

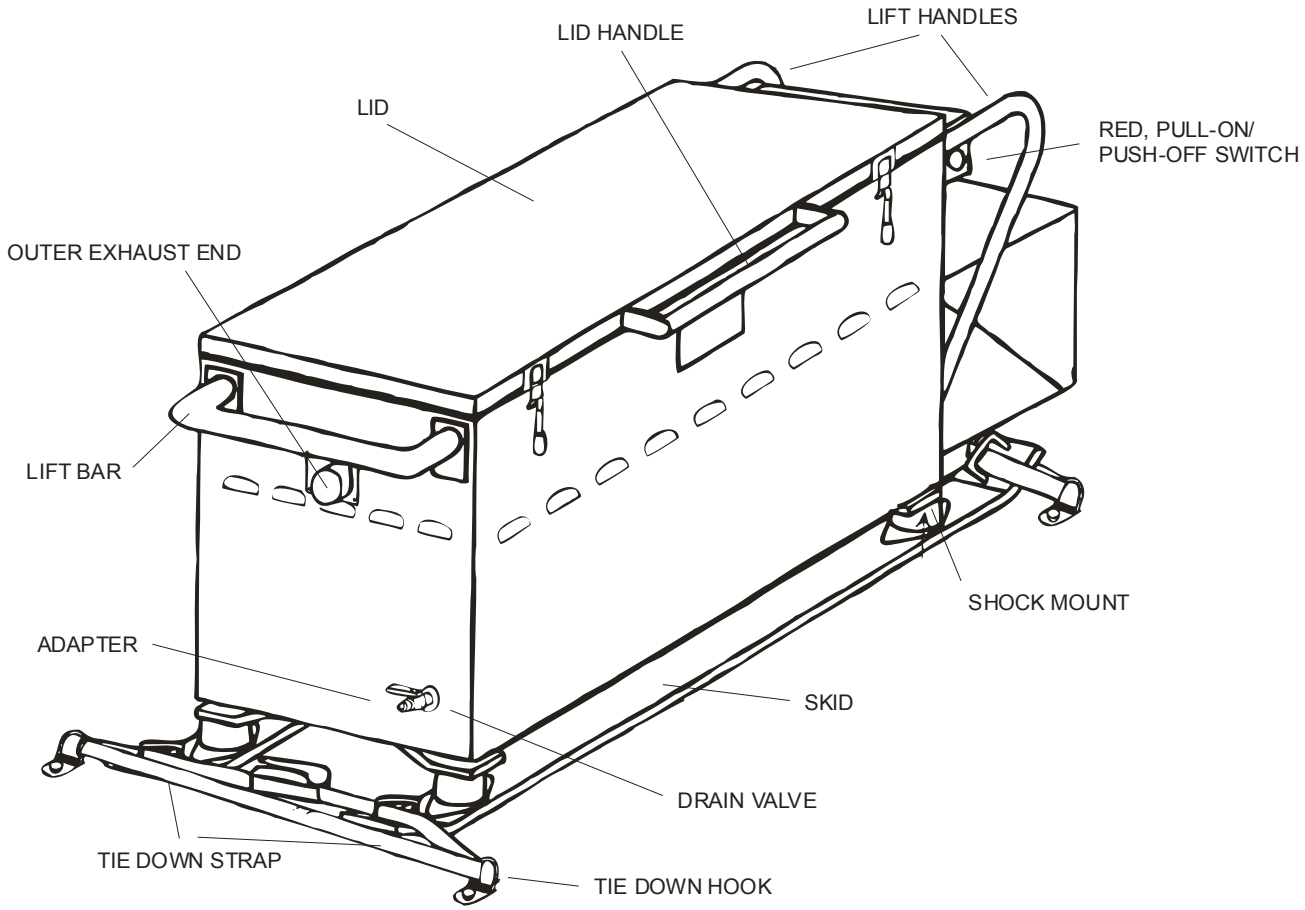


Figure 1-3. Tray Ration Heater

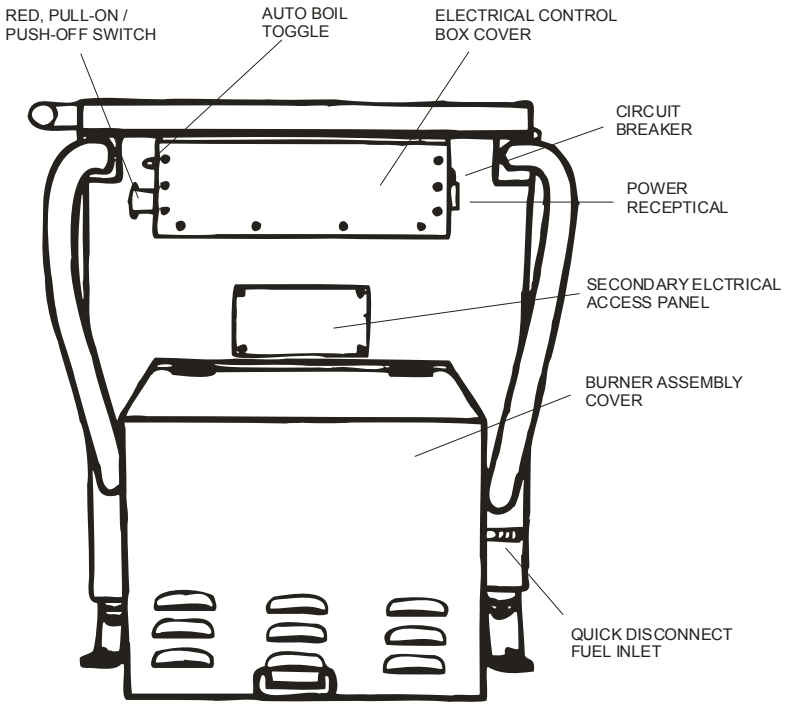


Figure 1-4. TRH—End View of Tank with Airtronic Burner Cover

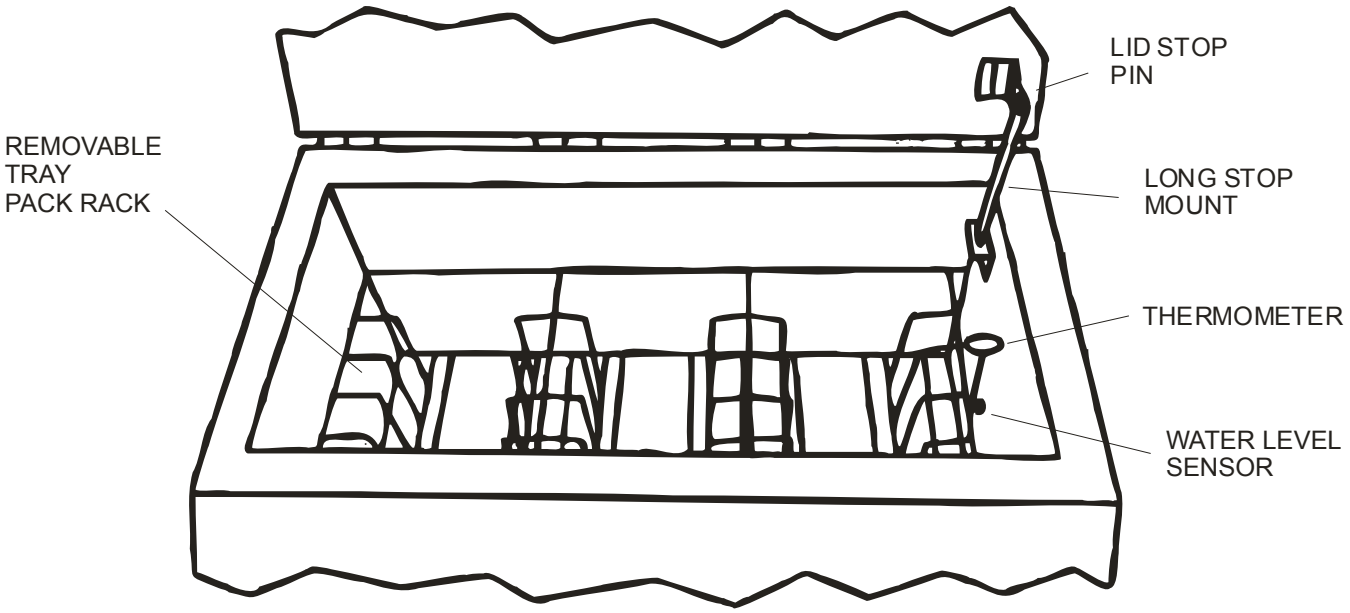


Figure 1-5. Open TRH Tank with Removable Tray Pack Rack

Table 1-2. TRH Tank

Dimensions (Approximate)

Height	25.5 inches
Length	53.0 inches
Width	23.0 inches

Weights (Approximate)

Empty	285 pounds
With Tray Rations and Water	400 pounds

Capacity ..... 30 gallons

Construction Supported Stainless Steel. 2" insulation layer between interior and exterior walls. Top connected by hinges and held open by a lockable hinge arm. Top closed and fastened with two pullover latches.

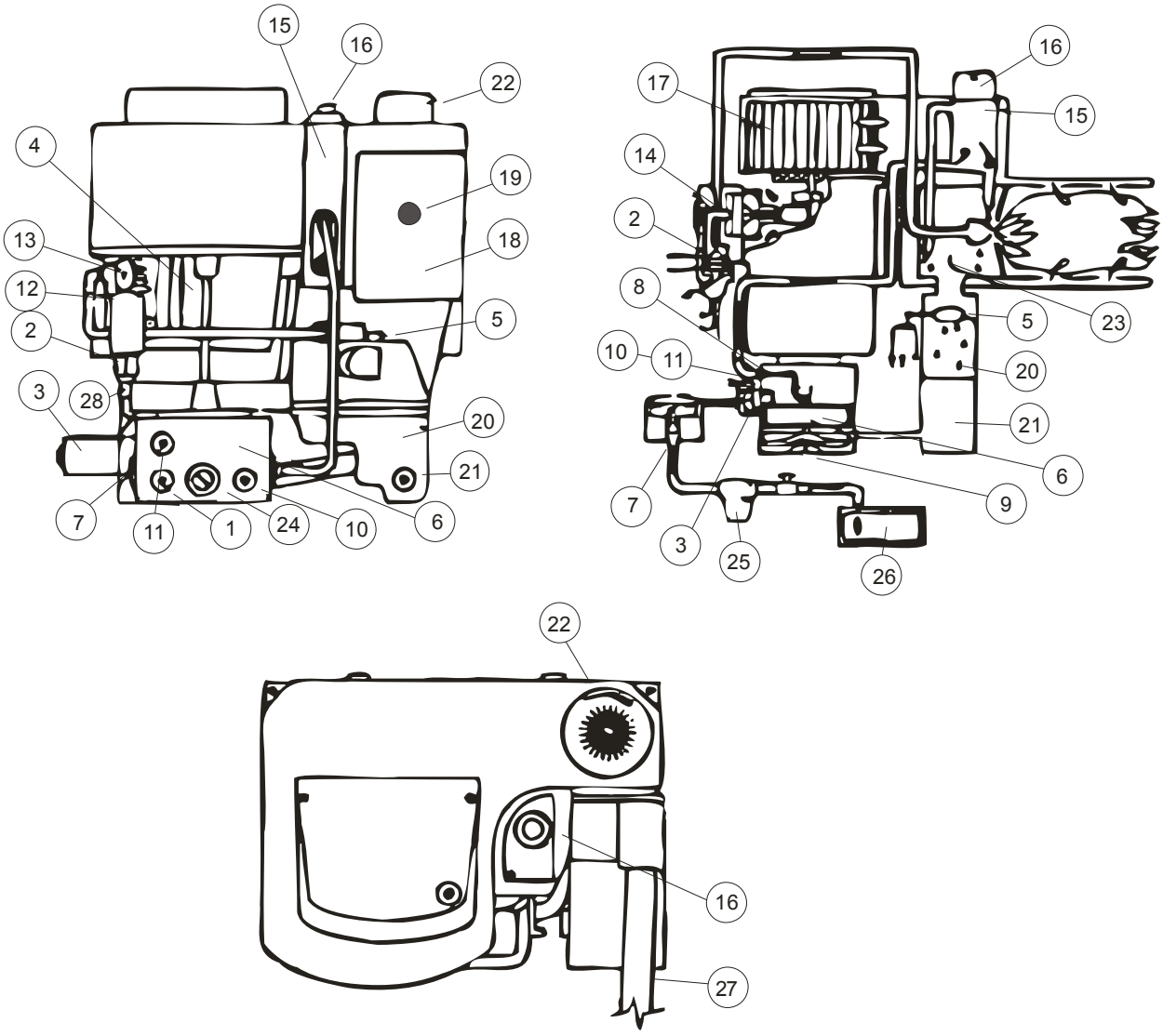
Drain Drain valve (¾-inch) at the bottom right corner, opposite the Airtronic Burner end of water tank.

Tray Pack Capacity 18/25 (with/without rack)

The TRH tank can withstand cross-country transportation while loaded with 18 tray packs, securely held in a welded wire rack, which is submerged in hot water. The tank is well insulated to reduce loss from heat generated by the Airtronic Burner, which is attached at one end.

b. Airtronic Burner. Table 1-3 contains Airtronic Burner data. Figure 1-6 contains front and top views of the Airtronic Burner as well as an internal side view.

The Airtronic Burner is a thermostatically controlled heat source for the TRH tank. It can heat the tank water to 212°F, if in the "boil" vice "auto" mode. The Airtronic Burner is attached to the tank by two mounting pins that support it above the HMMWV cargo bed. It uses fuel from a 5-gallon can mounted in the HMMWV. The Airtronic Burner can burn continuously for 10 hours on 5 gallons of fuel.



1. SUCTION INLET PORT	15. REGULATOR MODULE
2. SOLONOID VALVE (AIR)	16. FUEL FLOW CONTROL
3. SOLONOID VALVE (FUEL)	17. BLOWER WHEEL
4. ELECTRIC MOTOR	18. CONTROL BOX
5. OVERFLOW SAFTY FLOAT	19. RESET BUTTON
6. FUEL PUMP	20. FUEL SUMP
7. STARTING BUTTON, INLET VALVE	21. DRAINAGE PLUG
8. OUTLET NIPPLE	22. COMBUSTION AIR CONTROL
9. RETURN FUEL REGULATOR	23. ATOMIZING CHAMBER
10. FUEL PRESSURE GAUGE CONNECTION	24. PUMP PRESSURE ADJUSTMENT SCREW
11. FUEL VACUUM GAUGE CONNECTION	25. FUEL FILTER
12. COMPRESSOR	26. FUEL
13. COMPRESSOR PRESURE GAUGE CONNECTION	27. POWER CORD
14. FILTER	28. FINGER PRIMING PORT

Figure 1-6. Airtronic Burner, Multiple Views

Table 1-3 Airtronic Burner

Dimensions (Approximate)	
Height	**11.125 inches**
Width	**11.5 inches**
Depth	**12.25 inches**
Power Requirement	**120 VAC, 60 Hz**
Fuel System	
Fuel Requirements	**Diesel, DF-1, DF-2, DFA, JP-8, or Kerosine**
Fuel Pump	**Self Priming**

WARNING

NEVER USE GASOLINE IN THE TRAY RATION HEATER. GASOLINE IS VOLITILE AND MAY EXPLODE, CAUSING DEATH, SERIOUS INJURY, AND/OR SIGIFIGANT DAMAGE TO EQUIPMENT. USE ONLY DOESEL, DF-1, DF-2, DFA, KEROSENE, OR JP-8.

c. Airtronic Burner Fuel Supply System. Figure 1-7 portrays the fuel system; table 1-4 contains pertinent fuel system data. The 5-gallon fuel supply, independent of the vehicle supply, is easily installed/deinstalled for use inside the HMMWV or for use in static situations. A quick-disconnect Swagelok on the fuel line permits separation of the fuel source from the Airtronic Burner without spilling fuel line contents.

Table 1-4. Fuel Supply System

Tank	**Can, fuel, military, 5-gallon, plastic**
Bracket	**Stainless steel, with strap**
Fuel Line	**Hose, ¼-inch, fuel, 12½-foot total (12-foot section plus ½-foot section; one transparent, in-line fuel filter; four, ¼-inch hose clamps; and two, quick-disconnect fittings [Swagelok])**
Adapter Kit	**Fits fuel can for suction feed**

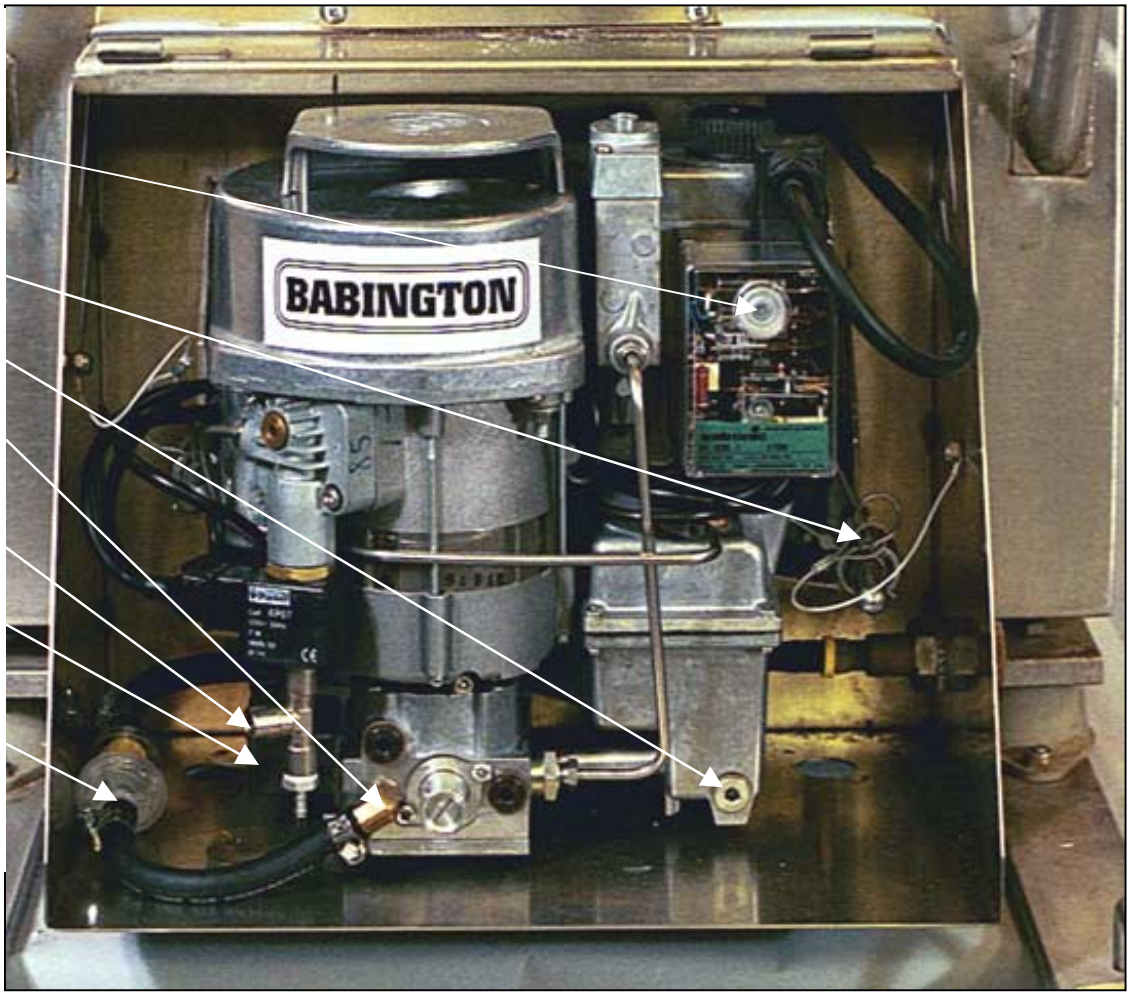


Figure 1-7. Airtronic Burner Fuel Supply System

d. <u>TRH Electrical Control Box</u>. Table 1-5 contains pertinent power data; figure 1-8 depicts the red pull-on/push-off switch and the auto/boil switch on the TRH electrical control box. The stainless steel, weatherproof, TRH electrical control box houses the external, red, pull-on/push-off switch, which is the primary operating control for the TRH. The TRH electrical control box also contains the auto/boil switch, Amphenol plug, circuit breaker, and internal safety controls (thermodisc, low water sensor, and mercury tilt switch).

Table 1-5. TRH Electrical Control Box

Power	**120 VAC, 60 Hz**
Box Type	**Stainless steel**
Primary Control	**Red, pull-on/push-off**

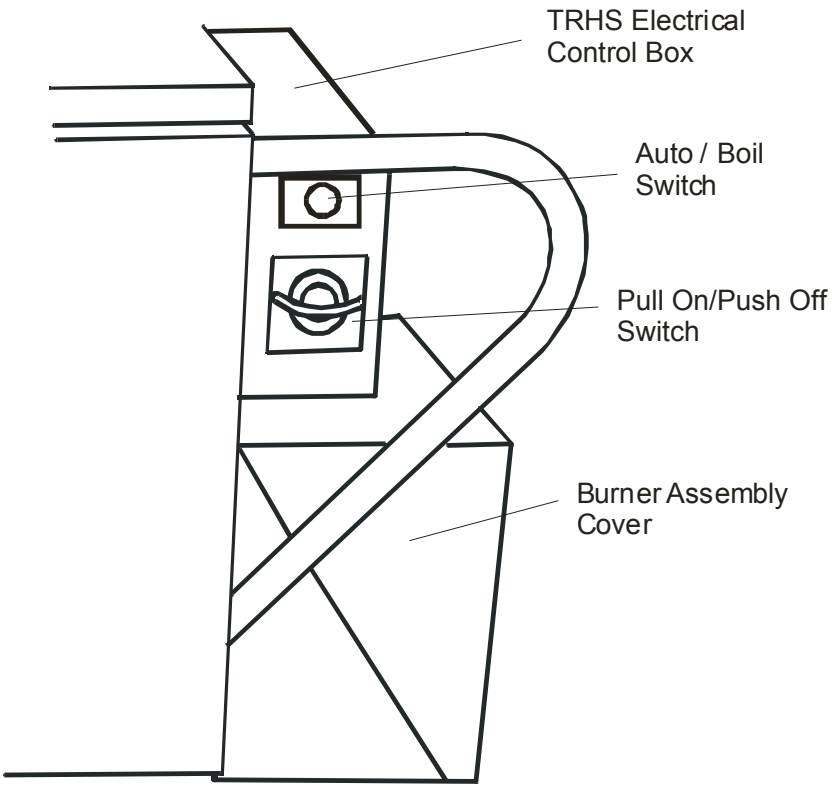


Figure 1-8. TRH Electrical Control Box

e. <u>TRH Stabilizing Devices</u>. Figure 2-1 illustrates TRH stabilization devices (tiedown straps).

1-2. INVERTER ASSEMBLY. **Table 1-6 contains relevant electrical data; figure 1-9 shows the inverter assembly.**

CAUTION

NEVER PLUG AN ADDITIONAL APPLIANCE INTO THE INVERTER RECEPTICLE THAT USES MORE THAN 150 WATTS OF POWER.

The inverter converts vehicular 24 VDC to 120 VAC, 60 Hz with quasi-sine wave. A NATO slave plug connects the inverter to the HMMWV 24 VDC receptacle, located under the passenger seat. The inverter contains an integral ground fault receptacle, from which a power cord to the control box energizes the system. A switch on the inverter allows current to flow from the HMMWV. A green LED "inverter" indicator illuminates when power from the HMMWV is flowing through the inverter. A red LED "low battery" warning indicator illuminates when the HMMWV battery power is low, at which time the engine should be started to recharge the batteries. The assembly is protected by a 5 amp circuit breaker.

Table 1-6. Inverter Assembly

Inverter	
Input	**24 VDC**
Output	**120 VAC, 60 Hz**
Dimensions	**7 x 7 x 14 inches**
Ground Fault Receptacle	
Output	**120 VAC, 60 Hz, 300 watts**
Cover	**Weatherproof**
Switch	**Toggle**
Circuit Breaker	**5 amp**

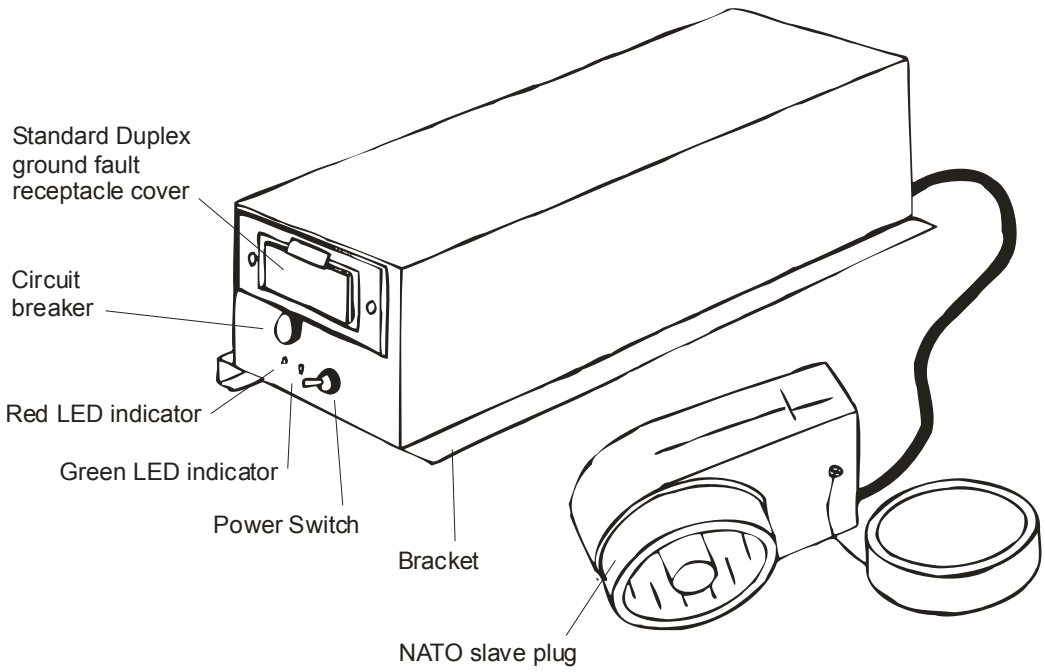


Figure 1-9. Inverter Assembly

1-3. SERVING TABLES, STOWING CLAMP, AND BRACKETS. **Three folding metal tables are stowed in the HMMWV as shown in figures 1-2 and 1-10. Two brackets, which fit on the right hand seat, secure the collapsed tables and prevent movement forward and back. A clamp, also installed on the right hand seat, and attached to the canvas support, secures and separates the tables.**

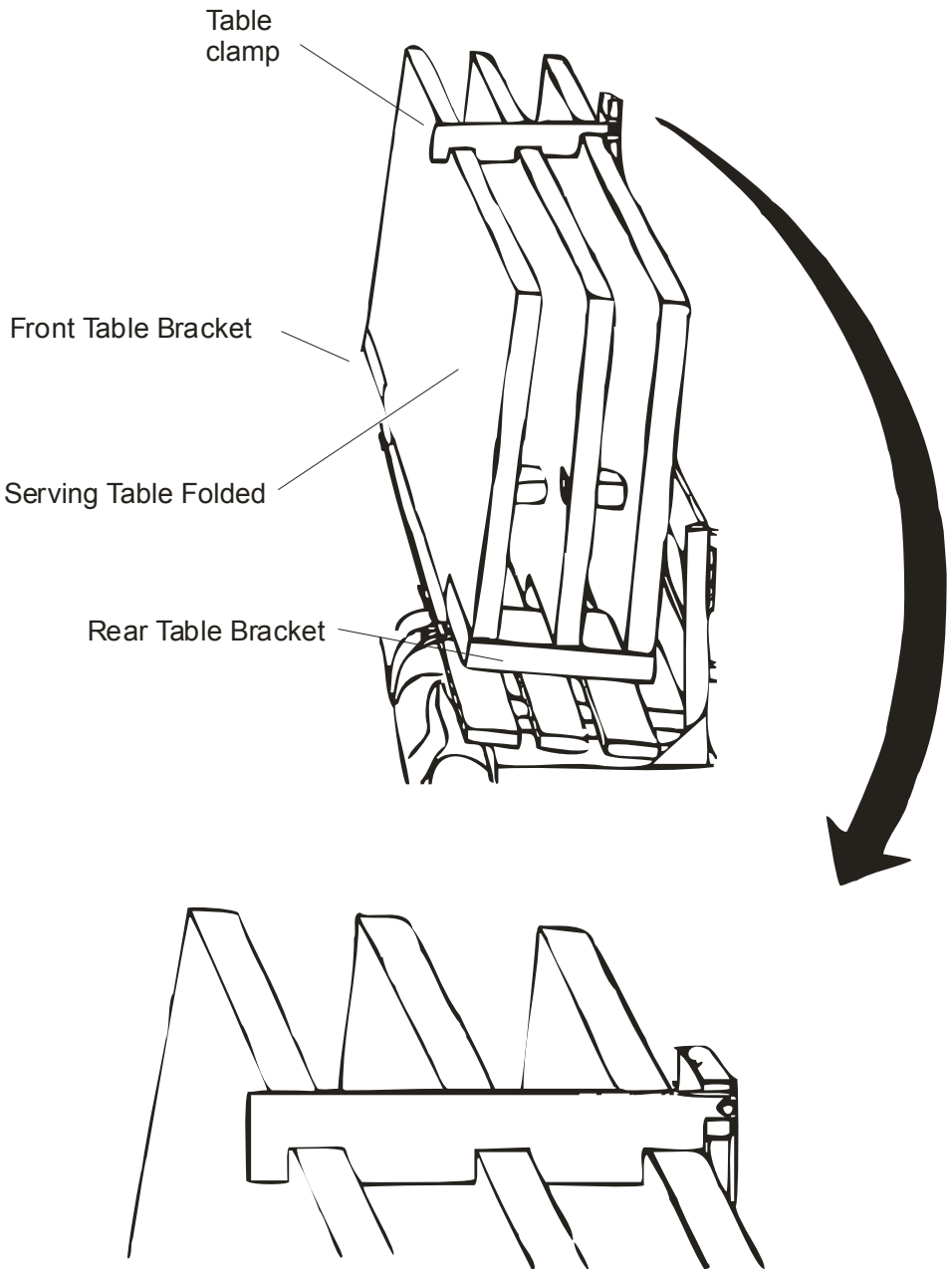


Figure 1-10. Serving Tables, Stowing Clamp, and Brackets

1-4. ADDITIONAL COLLATERAL EQUIPMENT. **The TRHS is equipped with additional collateral equipment as discussed below.**

a. <u>Rain Cover Kit</u>. This kit provides a cover for the serving table area in the event of inclement weather. The kit comes complete with canvas, extendible poles, metal pegs, and tent stays, as illustrated in figure 1-11. The 3-pound sledge is used only to drive the metal tent pegs into the ground.

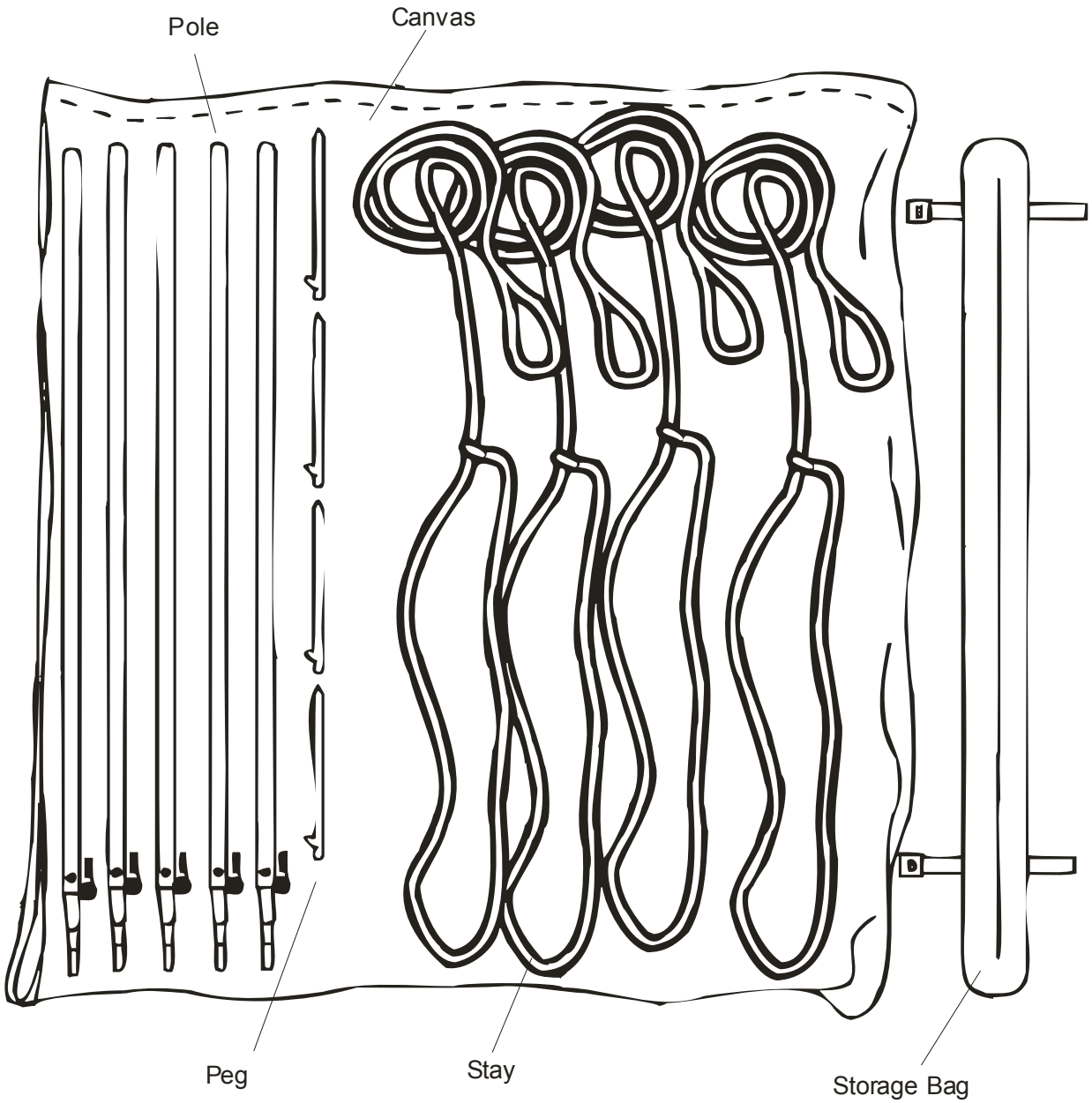


Figure 1-11. Rain Cover Kit

b. Side-Loading Pan Carriers. Three stackable, side-loading pan carriers are used to store 18 hot tray packs, which are heated prior to arrival at a feeding site. The heated tray packs are fitted into insulated tray pack holders, with lids, then placed into the side-loading pan carriers. Combined with 18 tray packs in the heater and those heated on site, a single HMMWV is capable of delivering at least 250 hot meals to the field at one site. Figure 1-12 illustrates the side-loading pan carriers.

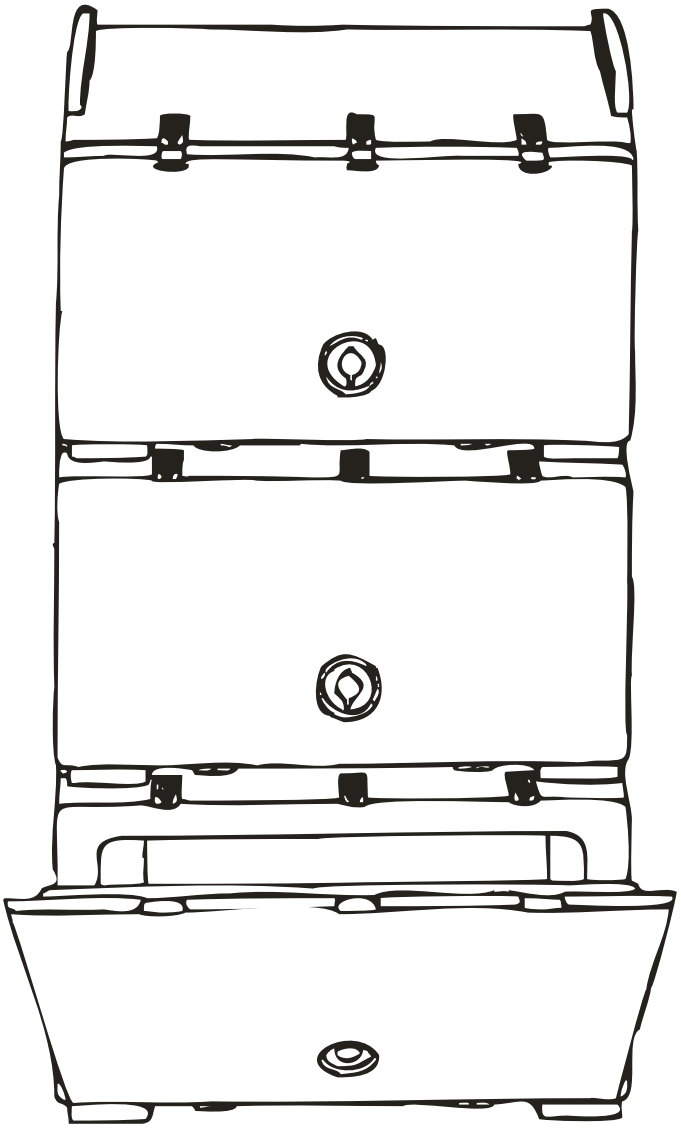


Figure 1-12. Side-Loading Pan Carriers

c. Other Equipment. Other essential TRHS collateral equipment includes: fire extinguisher, tool box, beverage dispensers, and serving utensils. Table 1-1 contains a complete listing of collateral equipment. Figure 1-2 shows collateral equipment stowed aboard the HMMWV. Figures A-1 and A-2 illustrate individual collateral equipment components.

CHAPTER 2

INSTALLATION

2-1. INSTALLATION OF THE TRHS IN THE HMMWV. **The TRHS can be easily and safely installed in a matter of minutes. All components can be installed without material handling equipment. The following paragraphs detail the installation of the TRH, the TRH fuel supply system, and the inverter. A table precedes each item and lists the equipment and manpower required to perform each component installation.**

a. Tray Ration Heater. Table 2-1 contains TRH data.

Table 2-1. TRH Installation Requirements

Manpower:	**4 Persons**
Equipment:	**Tiedown straps (2)**

WARNING

Drain all water from TRH tank before lifting the TRH into a HMMWV or removing it from the vehicle. Attempting to lift a TRH containing water can result in injuries from lifting strain or equipment drop. Four personnel are required to properly lift a drained TRH.

CAUTION

Do not use the lid handle as a lifting device for the TRH as it will result in equipment damage.

When the canvas cover is used in the HMMVW, slide the 90° exhaust elbow over the exhaust pipe to angle hot exhaust away from the canvas cover.

(1) Step 1. Assemble all equipment and personnel before commencing installation.

(2) Step 2. Place HMMWV tailgate in down position. Position TRH so that the Airtronic Burner end will enter the HMMWV first. Using four personnel, lift the heater by its side handles and move it into the HMMWV, taking care to keep the TRH relatively level so fuel will not run out of the Airtronic Burner. The skids on the bottom of the TRH will fit into the grooves on the cargo bed of the HMMWV. It may be necessary to move the TRH slightly from side to side so that it aligns with the cargo bed corrugated grooves.

Line up the TRH skid rings with the D-rings on the left side of the HMMWV cargo bed as illustrated in figure 2-1.

(3) Step 3. Install the two tiedown straps by looping them through the D-rings attached to the HMMWV cargo bed and the TRH skid rings. Snug the TRH to the bed of the HMMWV using the strap ratchet, but DO NOT overtighten. (Note: TRH may have to be lifted in order to install tiedown straps through D-rings.)

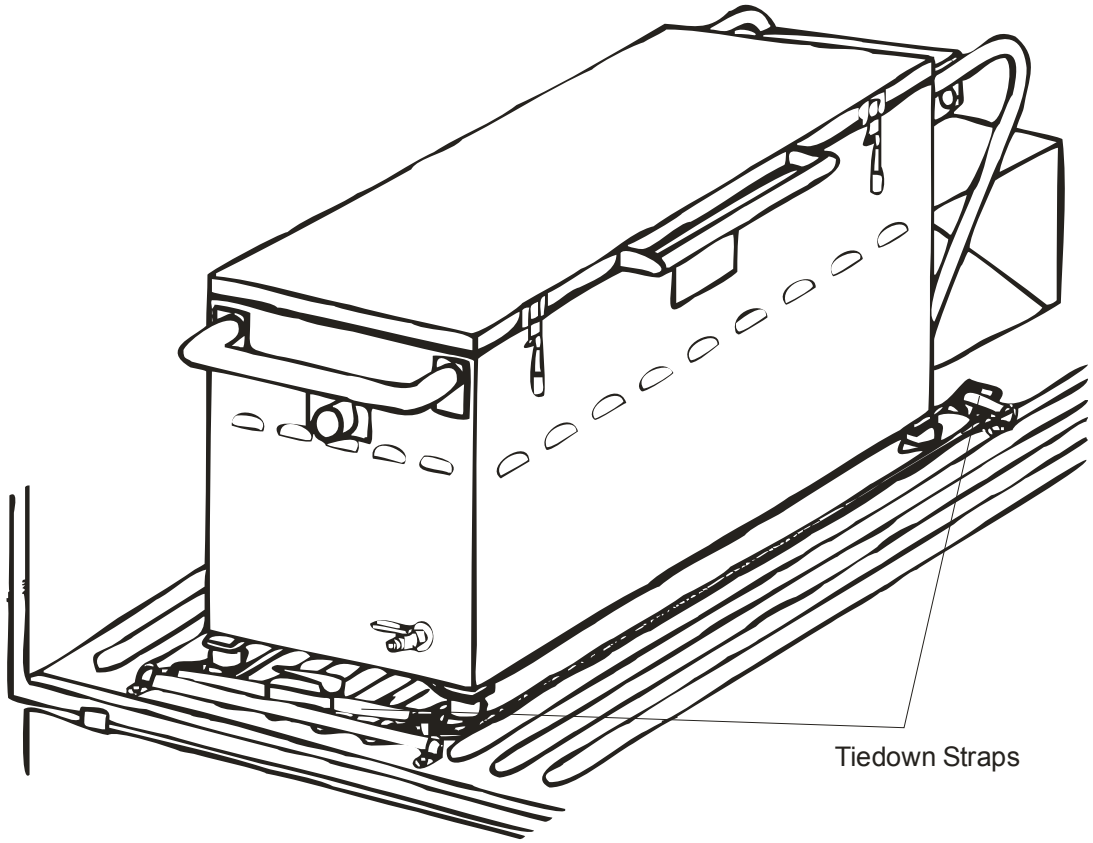


Figure 2-1. Cargo Bed Rings/Tiedown Strap Positioning

b. Fuel Can. Table 2-2 contains fuel can data.

Table 2-2. Fuel Can Installation

Manpower:	**1 Person**
Equipment:	**Five-gallon fuel can, fuel-can bracket, fuel-can adapter kit, and fuel line**

(1) Step 1. Install the fuel can bracket directly behind the driver's seat. The fuel can should be positioned in the HMMWV as shown in figure 1-1.

WARNING

Never use gasoline in the Tray Ration Heater. Gasoline is volatile and may explode, causing death, serious injury, and/or significant damage to equipment. Use only diesel, DF-1, DF-2, DFA, kerosine, or JP-8.

(2) Step 2. Place a fuel can, filled with appropriate fuel (table 1-3), (DO NOT fill can while in HMMWV) in the bracket and secure as shown in figure 2-2. Run the securing strap in back of the can and in back of the boards of the troop seat, go through fuel can handle. DO NOT run strap over the top of the can handles. Fasten the strap and tighten securely.

(3) Step 3. After the fuel can is in place and secure, connect the Airtronic Burner fuel line to the can using the adapter kit. The adapter kit (figure A-1), with flexible probe attached, screws onto the top of the fuel can. The male metal fitting on the fuel line snaps into the female fitting on the feed line of the fuel can adapter. The other end of the fuel line fits the Swagelok at the Airtronic Burner cover. The vent screw on top of the fuel can adapter must be opened slightly to vent the fuel can so that the fuel pump in the Airtronic Burner will draw fuel from the can properly. Ensure the fuel line connector "clicks" when attached to the Swagelok at the Airtronic Burner cover.

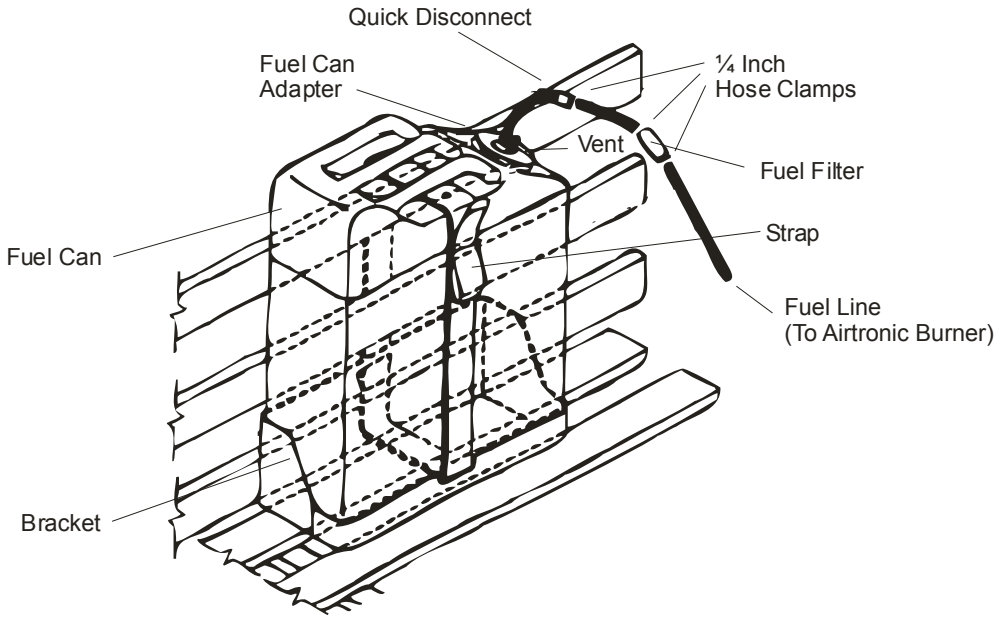


Figure 2-2. Fuel Can Installation

c. Rain Cover Kit. Sling the rain cover kit under the troop seat opposite the TRH using the storage bag straps (figure 1-2).

d. Table Brackets, Clamp, and Tables. Table 2-3 contains table bracket, clamps and table data.

Table 2-3. Table Bracket and Clamp Installation

Manpower:	**1 Person**
Equipment:	**Back bracket, front bracket, top clamp, and three tables**

(1) Step 1. Install front and rear table brackets on the right hand seat of the HMMWV as shown in figure 1-1. A square tubing guide on the bottom of each bracket fits between the wooden troop seat slats. The rear bracket (closest to the tailgate) is placed on the seat and moved back until it hits the seat frame. The front bracket is placed on the seat so that the tab on the side fits into the seat frame.

(2) Step 2. Install tables (figure 1-10).

(3) Step 3. Install the table clamp assembly in the location shown in figures 1-1 and 1-2. Fit the metal bracket end of the assembly around the top wooden back support of the seat. Place the upright part around the tubular support for the HMMWV canvas top. Insert the quick release pins behind the upright tubing to complete installation.

e. Inverter Assembly. Table 2-4 contains inverter assembly installation data.

Table 2-4. Inverter Assembly Installation

Manpower:	**1 Person**
Equipment:	**Inverter with receptacle and power cord**

WARNING

DO NOT turn power on until procedure to fill heater tank with water is complete.

CAUTION

Make sure all switches are in the off position.

(1) Step 1. Fit the metal bracket with attached inverter assembly over the middle of the panel that runs behind the driver and passenger seats.

(2) Step 2. Plug in the cable to HMMWV 24 VDC NATO receptacle under the front of the passenger seat.

(3) Step 3. Plug in the cord from the TRH electrical control box to the inverter receptacle outlet to send power to the TRH. Flip on the switch located on the top of the inverter to allow flow of 120 VAC 60 HZ to the outlet on the receptacle as shown in figure 1-9. The green LED indicator will illuminate if current is flowing through the inverter.

CAUTION

When the canvas cover is used in the HMMWV, the 90-degree exhaust elbow must be used to angle hot exhaust down and away from canvas cover.

f. Side-Loading Pan Carriers. Stack the three side-loading pan carriers behind the TRH (figure 1-1) and secure to HMMWV D-ring via ratchet-operated strap. It may be necessary to fasten the short strap adapter to a D-Ring and run the tiedown strap through the strap adapter as all HMMWVs are not configured the same.

g. Beverage Containers. Mount the six, 5-gallon beverage containers on the troop seat next to the TRH (figure 1-1) and secure to seat with a ratchet-operated strap slung over the containers and under the seat-support slats.

h. Fire Extinguisher. Mount the fire extinguisher/bracket (figure 1-1) to an upright troop-seat slat, behind the tables, by inserting the bracket quick-release pin behind the slat.

i. Tool Box, Utensil Box, and Maintenance Kit. Place these items on the deck of the HMMWV as shown in figure 1-2.

2-2. SERVICING NECESSARY FOR TRHS USE. **Service requirements prior to system operation are limited to filling the TRH fuel can with an approved fuel and filling the TRH with potable water. Cleaning procedures are discussed in chapter 4, Section III, and table 4-4.**

WARNING

Never use gasoline in the Tray Ration Heater. Gasoline is volatile and may explode, causing death, serious injury, and/or significant damage to equipment. Use only diesel, DF-1, DF-2, DFA, kerosine, or JP-8.

a. Fueling. Detach the fuel line from the fuel can via the quick disconnect. Unscrew the adapter kit from the fuel can. Unbuckle securing strap from fuel can and remove can from HMMWV before refilling to prevent any spillage inside the vehicle. After filling, secure cap, replace full fuel can in bracket, and secure with strap. Replace fuel cap with fuel adapter kit and reconnect the fuel line. Ensure fuel can is vented by loosening the vent screw on top of the adapter kit slightly.

b. Water Tank Servicing. For mobile operations, fill the TRH with potable water to the top of the tray pack rack only after it is installed in the HMMWV. Ensure that the drain valve (spigot) is closed before filling by pushing the drain valve handle until perpendicular to the spigot. The empty tray pack rack, however, should remain in the tank during filling. An empty tank will require approximately 10 gallons of potable water if 18 tray ration packs are to be placed in the tank. To cook fewer than 18 tray ration packs, add sufficient water so that only 1½ inches of the tray ration packs are exposed above the water line. If a water shortage is encountered, only enough water to cover the water-level sensor need be used. Additionally, if necessary to change water while the TRH is mounted in a HMMWV, a water hose may be connected to the drain hose and the tank backfilled after it is drained.

2-3. INITIAL CHECKOUT AND ADJUSTMENT OF THE TRHS. **The system checkouts and inspection procedures in table 2-5 and Airtronic Burner adjustment procedures in table 2-6 must be accomplished prior to operating the TRHS.**

Table 2-5. TRHS Initial Checkout Procedures

STEP	PROCEDURE
1	Visually inspect to ensure that required personnel, tools, parts, publications, accessories, and support equipment are on hand for mobile or non-mobile application of the TRHS, as required. Refer to table 1-1 for a complete listing of TRHS equipment.
2	Inventory equipment for missing items and visually inspect equipment for serviceability.
3	Install the TRHS in accordance with paragraph 2-1 of this manual.
4	Inspect all stabilizing devices (side braces, brackets, and tiedown straps) to ensure that TRHS is ready for travel.
5	Perform operational services outlined in paragraph 2-2 pertaining to fueling and filling of water tank.
6	Inspect fuel line for visible leakage at fuel can and Airtronic Burner attachment points, adapter kit, filter, and at the quick disconnect.
7	Keep inverter power switch in the OFF position to prevent battery discharge until TRH is ready for use.
8	Shut off TRH at the red, pull-on/push-off switch assembly by pushing the switch to the OFF position.
9	Ensure that inverter NATO slave plug is properly plugged into HMMWV 24 VDC outlet.
10	Ensure that Airtronic Burner power cord is properly inserted into the side of the TRH electrical control box via the push and twist Amphenol connection and the other end plugged into inverter outlet.
11	Inspect cable connection at the TRH electrical control box receptacle for tightness.
12	Adjust Airtronic Burner settings in accordance with table 2-6.
13	The TRH is ready for operational use.

Table 2-6. Airtronic Burner Checkout and Adjustment Procedures

STEP	PROCEDURE
1	Ensure that the TRHS has been properly installed and serviced for operation. Refer to table 2-5 and chapter 2.
2	Visually inspect for exterior damage to the Airtronic Burner (dents, loose or missing screws, and leaks.)
3	Inspect fuel line for secure connection to Airtronic Burner fuel pump at the suction inlet port. Refer to figures 1-6 and 1-7 for location.
4	Power the TRH using the switch on the inverter.
5	Start the Airtronic Burner by pulling the red, pull-on/push-off switch to the ON position. The Airtronic Burner should pre-purge for about 20 seconds, then ignite. After ignition, go to step 8. If the Airtronic Burner does not ignite, push red, pull-on/push-off to OFF and go to steps 6 and 7.
6	Locate the following adjustment mechanisms on the Airtronic Burner. Refer to figure 1-6: starting button inlet valve, finger priming port, solenoid valve (air), Airtronic Burner control box reset button, combustion air control knob, and fuel flow control knob. (Verify that the combustion air setting is at 9 and the fuel flow setting is between 1 and 1.5).
7	Locate and depress the reset button on the Airtronic Burner control box. Next, simultaneously cover the finger priming port and starting button inlet valve; pull the red, pull-on/push-off switch to the ON position. Upon ignition go to step 8. Repeat this fuel priming step once if the Airtronic Burner does not ignite. (Observe transparent fuel filter to check for fuel flow.) If the Airtronic Burner still fails to ignite refer to the troubleshooting guide in paragraph 5-5.
8	Allow the Airtronic Burner to run and observe exhaust gas. If exhaust gas is smoke free, go to step 9. If exhaust is smoking, refer to troubleshooting procedures in chapter 5.
9	Allow Airtronic Burner to operate for five minutes and observe overall functioning. If the Airtronic Burner shuts off automatically during the test period, refer to the troubleshooting guide in chapter 5.

2-4. RELOCATION OF THE TRHS. **The TRHS is designed for full operation during transport in a HMMWV. The system is rugged and fully capable of on-the-move operation over variable terrain. Although the system is rugged, care must be taken when deinstalling the system to safeguard personnel and the system itself. The following paragraphs outline deinstallation of the TRHS and give general guidelines for storage of the system.**

a. TRHS Deinstallation. Before deinstallation, review table 1-1 for familiarization with all system requirements.

WARNING

TRH exhaust pipe may be hot. DO NOT touch. DO NOT place objects in front of the exhaust.

CAUTION

Omission of any procedure in the deinstallation, packing, storage, or transportation process could adversely affect system safety and/or operational effectiveness.

(1) Step 1. Turn off TRH at the red, pull-on/push-off switch by pushing to off position (red light on switch should go out). Next, turn off power to the TRH at the inverter toggle switch (green indicator light on inverter should go out). Unplug power cable from the HMMWV 24 VDC NATO plug under the passenger seat. Next, unplug both ends of the power cable that leads from the TRH electrical control box to the inverter receptacle. Coil the cable store it in the plastic tool box. Lift and remove the inverter mounting bracket. Remove bracket and power cable from the HMMWV.

WARNING

TRH tank water may be scalding and could cause serious injury. Remain clear while tank is draining.

(2) Step 2. Park the HMMWV facing slightly uphill in an area where water drainage is permitted. Open tailgate. Attach the 4-foot drain hose to the drain valve. Open drain valve located at the rear of the water tank by pulling handle out completely until perpendicular to TRH tank and drain water from tank.

(3) Step 3. Disconnect fuel line from the Airtronic Burner by pulling on the diverging section of the female portion of the Swagelok fitting, which will cause the male end of the fitting to pop out (cover the male end of the Swagelok fitting with its protective cap and also insert the dirt protection plug into the

female portion of the Swagelok double shutoff fuel inlet system). Remove the fuel can from the HMMWV. Disconnect fuel line from fuel can by pulling the quick disconnect fitting between the adapter kit and the fuel line. Unscrew adapter kit from fuel can. Drain hose into fuel can (depress nipples on both end fittings simultaneously). Screw adapter kit back onto fuel can and close the vent screw on the adapter kit. Wipe fuel line clean and store in plastic tool box.

(4) Step 4. Close and latch the TRH lid. If necessary adjust lid latches by adjusting the position of the retaining nuts on the latch with an adjustable wrench. The lid need only be tight enough to prevent water leakage. Open ratchet to loosen and remove the tiedown straps. Release ratchet tension by pulling on the spring-tensioned slide bar on the under side of the ratchet handle in the direction of the arrow, then fully open the mechanism until the slide bar engages in the tab slots. The strap can now be unwound from the ratchet spindle. Roll the straps neatly and place them in the tool box for safe keeping.

WARNING

Drain all water from tank before removing TRH from vehicle or lifting TRH into vehicle. Attempting to lift a TRH containing water can result in injuries from lifting strain and/or equipment drop. Four personnel are required to properly lift a drained TRH.

(5) Step 5. Using the two built-in lift handles, and one lift bar, raise and slide the fully drained TRH out of the HMMWV. DO NOT use lid handle for this purpose. Refer to figure 1-3. Maintain the TRH relatively level when removing from the HMMWV to prevent fuel from running out of the Airtronic Burner into the fire box. Note: If fuel does enter the fire box, this does not create a safety hazard—the system will merely smoke when next started until the fuel burns out of the fire box.

(6) Step 6. Lift top clamp and remove tables from HMMWV. Detach fasteners from metal upright and remove top clamp. Remove table brackets from seat.

(7) Step 7. Check equipment list (table 1-1) and remove remaining components of the TRHS.

b. Packing and Storing the TRHS. Follow established procedures when packing the TRH and TRHS accessories for storage. The TRHS can operate in diverse environments. Accordingly, most enclosed storage facilities are adequate for storage of the system.

Initial checkout and adjustment procedures contained in paragraph 2-3 should be followed prior to placing the TRHS in service after any period of storage. When not in use, the TRHS should be stored in the Quadcon provided. The TRHS should never be left unprotected outdoors.

WARNING

DO NOT expose the Airtronic Burner, TRH electrical control box, or inverter to rain or water to avoid electrical shock. Unplug inverter and TRH electrical control box prior to servicing or replacing system components.

c. Transportation of the TRHS. The TRHS can be transported overland without restriction, provided it is properly secured in a HMMWV, or within a Quadcon.

CAUTION

Lift the TRH with a forklift only if the TRH is on a pallet. Puncture of the TRH wall with a forklift tine can damage the TRH beyond repair.

d. Reinstallation of the TRHS. Reinstallation of the TRHS should be accomplished in accordance with paragraph 2-1 of this manual.

CHAPTER 3

OPERATING INSTRUCTIONS

SECTION I. CONTROLS AND INDICATORS

This section provides operators and maintenance technicians with descriptions and illustrations of TRHS controls and indicators and discusses system operating procedures.

3-1. OPERATIONAL CONTROLS AND INDICATORS. **Operator controls and indicators are designed for ease of operation and monitoring.**

a. Inverter Circuit Breaker

WARNING

Before resetting the inverter circuit breaker, make sure the TRH red, pull-on/push-off switch is in the OFF position. This will prevent inadvertent turn-on of the Airtronic Burner. The inverter circuit breaker is located below the receptacle box on the inverter. When the inverter is on and functioning properly, a green LED indicator illuminates to indicate DC power is flowing to the inverter. The inverter on-off switch enables the flow of 120 VAC 60 Hz power from the inverter to the TRH electrical control box. The switch should be turned OFF to prevent unnecessary discharge of the HMMWV battery when the TRH is not in use.

b. Red, Pull-On/Push-Off Switch. This control is located on the TRH electrical control box as shown in figure 1-8. As the principal control on the TRHS, the pull on/push off style switch regulates the flow of electricity through a circuit breaker, to the TRH electrical control box, thermodisc, and automatic safety sensors located within the TRH electrical control box as seen in figure 5-4.

c. Reset Button. This control is located on the Airtronic Burner control box attached to the Airtronic Burner as shown in figure 1-6, Front View. In the event of automatic system shutdown because of improper flame or lack of fuel, this button must be reset before power can be restored to the Airtronic Burner following corrective action. If automatic shutdown occurs, wait 2 minutes before pressing the reset button. A waiting period is necessary to cool the bimetallic relay. Reset should restore power to the Airtronic Burner.

d. Combustion Air Control. This knob is located on the top right of the Airtronic Burner, just behind the Airtronic Burner control box as shown in figure 1-6, Top View. The knob has a center-positioned set screw, which, when tightened, prevents movement of the knob setting. The screw must be loosened before knob setting is changed. The combustion air setting should be at "9" for best results.

e. Fuel Flow Control. This screw adjustment is located on top of the Airtronic Burner, just to the left of the Airtronic Burner control box, as shown in figure 1-6, Top View. This screw regulates the flow of fuel to the combustion (atomization) chamber of the Airtronic Burner. By regulating the flow of fuel, this adjustment further controls heat output. The fuel flow setting should be set between "1" and "1.5" for best results.

Section II. OPERATING PROCEDURES

The TRHS is designed to operate within a wide range of climatic and physical conditions to meet the needs of personnel in the field. This section provides a step-by-step procedure for utilizing the TRHS after it is properly installed and serviced. System installation and checkouts should be accomplished in accordance with chapter 2. Rations and disposable mess gear loaded in the HMMWV with the TRHS are from unitized, tray-ration modules. Each module provides about 18 meals. The contents of 16 unpacked modules can be loaded in the HMMWV.

3-2. OPERATION UNDER NORMAL CONDITIONS. **Under normal conditions, no special servicing procedures or preventive maintenance activities need be accomplished. In general, this procedure would involve heating up to 18 tray packs of food in the TRH, setting up of a serving line, serving the food, and cleaning up and stowing equipment and food items. The following steps are a guide to using the TRHS.**

a. Step 1. Load TRH with tray packs and/or #10 cans (remove tray pack rack, if necessary) issued for feeding.

b. Step 2. To initiate operation, fill TRH with water such that 1½ inches of tray packs are exposed or water level is approximately 2 inches from the top.

c. Step 3. Close TRH lid and secure latches.

CAUTION

To maintain water temperature, and reduce the chance of water contamination and accidental burning, keep the tank top closed except when loading and unloading tray packs.

CAUTION

Lid locking levers are adjustable. Excessive force is not required to close the lid. Equipment damage can result if locking levers are out of adjustment. The lid should be just tight enough to prevent water leakage around the lid gasket.

d. Step 4. Ensure "auto/boil" switch on TRH electrical control box is in the "auto" position.

e. Step 5. Ensure inverter switch is turned ON.

f. Step 6. Check that the vent on the fuel can adapter is open.

g. Step 7. Pull the red, pull-on/push-off switch to the ON position.

h. Step 8. Observe TRH for 5 minutes to ensure Airtronic Burner is functioning properly.

i. Step 9. Allow tray packs to heat to 180°F for a minimum of 40 minutes before removing to serve or place into side-loading pan carriers.

j. Step 10. Set up serving line.

(1) During wet weather conditions, pitch the rain cover.

(2) Set up tables by lifting the table clamp, removing tables from the HMMWV, and assembling as shown in figure 3-1.

(3) Install the stainless steel Edlund can opener in a mounting bushing, which must be placed in the opening on a table end (the shank on the stainless Edlund is smaller than the shank on the regular Edlund, for which the hole in the table is sized). Place the following items on the tables: disposable mess gear, beverage containers, and supplements.

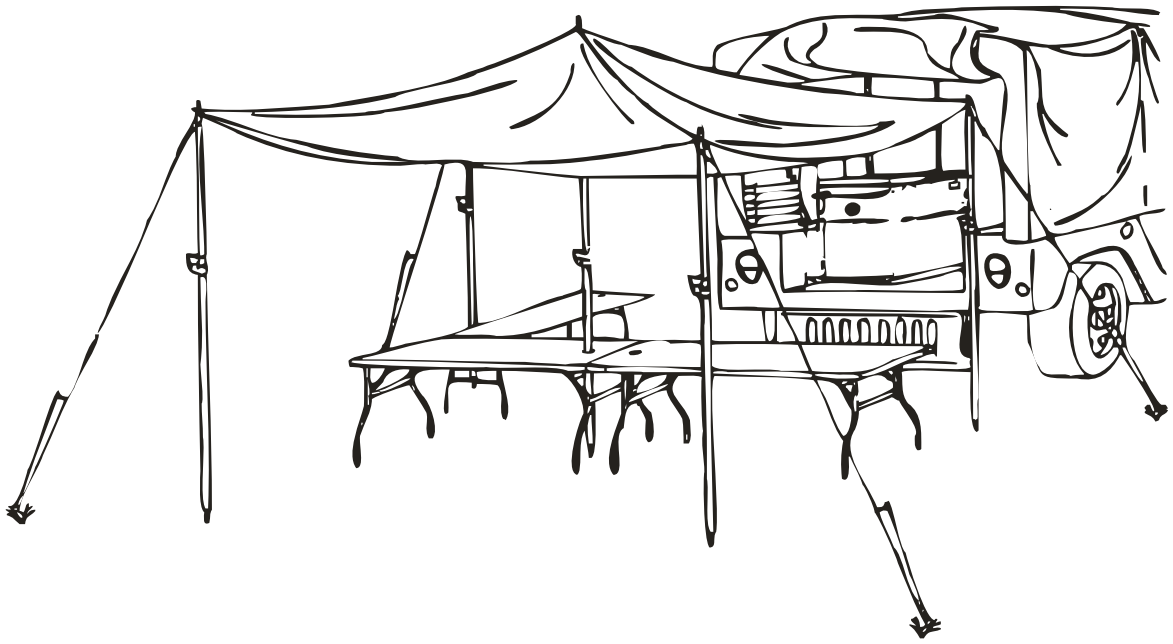


Figure 3-1. Serving Line Setup

k. Step 11. Remove tray packs from TRH tank first, then side-loading pan carriers. Replace with cold tray packs and close tank lid. Open tray packs and place on the serving line.

WARNING

The tray rack and heated tray packs are hot. Remove tray packs with the tray pack handling tool and remove #10 cans with the #10 can handling tool. Exercise care when opening heated cans as they become pressurized. Wear protective gloves when handling hot tray packs and #10 cans. Placing hands into water, even if "protected" by a glove, could result in serious injury.

l. Step 12. Clean tables and discard open tray packs and disposable mess gear. Repack can opener, beverage containers, cleaned serving utensils, and remaining food supplements in the HMMWV.

m. Step 13. Fold table legs and place tables in their brackets in HMMWV. Place tables in the brackets so folded legs of each table are facing each other as shown in figure 1-10. Lock tables in place using the table clamp.

3-3. TRHS MAXIMUM SINGLE SITE PROCEDURE. **The TRHS can be used to feed 250 hot meals at one site in 90 minutes. This time period is adequate to set-up, serve, and clean up. Approximately 42 tray packs (14 unitized, tray-ration modules) are required for 250 meals (meals may have 2, 3, or 4 tray packs/cans per unitized package). Table 3-1 provides a quick reference to assist TRHS operators when planning feeding activities.**

Table 3-1. Estimated Tray Pack Requirements

MARINES TO FEED	TRAY PACKS (3 PACKED)
18	3
36	6
54	9
72	12
90	15
108	18
126	21
144	24
162	27
180	30
198	33
216	36
234	39
252	42

a. Step 1. Heat 18 tray packs in preparation for the mission. Allow approximately 40 minutes for this activity. Place preheated 18 tray packs in the insulated, side-loading pan carriers as shown in figure 1-12.

b. Step 2. Place 18 cold tray packs in the TRH tank and proceed to the feeding site. Allow about 40 minutes for these tray packs to heat before serving.

c. Step 3. After arrival at the feeding site, set up the serving line. Comply with the following serving procedures:

(1) First, serve hot tray packs brought to the site in the TRH tank.

(2) Second, place remaining cold tray packs in the TRH tank and serve the 18 preheated tray packs in the side-loading pan carriers.

(3) Third, serve the remaining tray packs contained in the TRH tank. When these tray packs are heated, approximately 42 tray packs will have been cycled through the TRH tank to meet the requirement of 250 meals as follows:

18 Preheated Tray Packs
18 Tray Packs Heated During Travel
6 Tray Packs Placed in Tank at Site
42 Total Tray Packs

3-4. TRHS MAXIMUM MULTI-SITE CAPABILITY. **The TRHS is capable of providing 500 meals to three or more sites within a ration day. This requires approximately 28 unitized, tray-ration modules. The TRH fuel capacity is sufficient for at least 10 hours of continuous heater operation. The contents of 16 unitized tray ration modules can be loaded into the HMMWV at the beginning of the ration day, and will require subsequent replenishment.**

Operators must follow the pre-heating procedures listed in paragraph 3-3 so that hot meals are ready to serve at each site. At each site, operators must set up serving line, clean up tables and utensils, and stow TRHS equipment in the HMMWV for movement to a subsequent site.

3-5. TRHS OPERATION UNDER COLD/UNUSUAL CONDITIONS

CAUTION

When operating the TRH in cold weather, keep the lid closed and latched except when loading and unloading the heater tank with tray packs. Opening the TRH tank will result in heat loss.

a. General. The TRHS is designed to operate effectively in a cold weather down to -25°F. The following precautions must be followed during cold weather/unique conditions to prevent equipment damage and ensure overall system effectiveness.

b. TRH Use from 0°F to 32°F. If the TRHS is used once every 24 hours, no restrictions or special requirements apply when operating within this temperature range. The insulated tank and latched tank lid will maintain water temperature above 32°F.

Operators must ensure that the tank lid gasket is sealing properly and preventing unnecessary heat loss from the tank. Operators are also advised to monitor tank water temperature, using the tank-mounted pocket thermometer, during periods when the TRH is not in use.

If the TRH is used less than once every 24 hours, the tank should be drained after each use, and then refilled as required when operating between 0°F to 32°F.

WARNING

Never use gasoline in the Tray Ration Heater. Gasoline is volatile and may explode, causing death, serious injury, and/or significant damage to equipment. Use only diesel, DF-1, DF-2, DFA, kerosine, or JP-8.

Dowfrost® is toxic in strong concentrations. Use only as directed. Do not ingest Dowfrost®.

c. TRH Use from -25°F to 0°F. Special precautions must be taken when operating in this temperature range. "Dowfrost®" food grade propylene glycol antifreeze can be added to the water tank. Mix Dowfrost® and water as directed on the Dowfrost® container. This will prevent the TRH tank from freezing should the water not be heated for an extended period. Prior to operating the Airtronic Burner below 0°F, run the Airtronic Burner using DFA for five minutes to purge the fuel line and fuel sump of non-arctic fuel. No further adjustments are required. Burn kerosine or arctic diesel (DFA). Note: This must be accomplished prior to entering arctic conditions. Use the air-activated heaters in the maintenance kit to loosen solenoids and/or valves, if required.

d. High Altitude. No adjustment to the Airtronic Burner is required at high altitudes.

e. Inclement weather. When the canvas cover to the HMMVW is in use due to inclement weather, slide the 90° elbow (fig A-2) over the exhaust pipe to angle hot exhaust away from the canvas cover.

CHAPTER 4

SCHEDULED MAINTENANCE

Section I. INTRODUCTION

The purpose of this chapter is to prescribe the maintenance required for the TRHS. The general maintenance concept adopted for the TRHS combines all first and second-echelon organizational level maintenance. Operator maintenance will be done by Food Service Technicians (MOS 3381) of the using unit. Third and fourth-echelon maintenance (intermediate maintenance) will be performed by personnel in Maintenance Battalion, Force Service Support Group (FSSG). Troubleshooting and corrective maintenance presented later in this manual are based on manufacturer maintenance procedures.

This chapter illustrates the TRHS maintenance concept, operator responsibilities, and FSSG responsibilities. Illustrations in chapter 5 also support TRH Airtronic Burner maintenance and include exploded views of parts and components, and internal and external views of the Airtronic Burner to illustrate parts location and fuel/air flow.

Maintenance information is divided into two parts that correspond with organizational (first and second-echelon) and intermediate (third and fourth-echelon) maintenance. Fifth-echelon maintenance does not apply to the TRHS. Table 4-1 lists specific operator and maintenance technician responsibilities for replacement of TRHS components. Organizational level maintenance responsibilities include preventive maintenance checks and services and Airtronic Burner swap out and simple replacements. Intermediate maintenance responsibilities include troubleshooting and repair by piece-part replacement.

Table 4-1. System Maintenance Responsibilities

MAINTENANCE LEVEL	REPLACEMENT ASSEMBLY, COMPONENT, PART
ORGANIZATIONAL (1st/2nd Echelon)	**1. Replace in-line fuel filter** **2. Replace fuel hose/clamps** **3. Replace Airtronic Burner (swap-out)** **4. Replace TRH red pull-on/push-off switch peanut bulb** **5. Adjust TRH lid latches** **6. Replace TRH lid assembly** **7. Replace shock mount** **8. Replace lid gasket** **9. Replace Airtronic Burner control box** **10. Replace atomizing chamber** **11. Replace ignition chamber** **12. Replace photo cell/light socket**
INTERMEDIATE (3rd/4th Echelon)	**1. Replace TRH electrical control box components** **2. Replace water level sensor** **3. Replace thermodisc** **4. Replace Airtronic Burner components** **a. Electric motor and compressor** **b. Fuel pump and coupling** **c. Compressor head** **d. Piston ring and O-ring** **e. Compressor filter** **f. Solenoid air valve** **g. Solenoid fuel valve** **h. Overflow safety device** **6. Repair TRH Structural Components[2]** **a. Hinges** **b. Latches** **c. Handles** **d. Brackets** **e. Skids**

Section II. TOOLS AND EQUIPMENT

4-1. TRHS TOOL KIT. **A limited number of tools are issued with the TRHS tool kit to support maintenance activities in the field. Table 4-2 lists these tools.**

[2] **Structural repair via welding may be appropriate for incidental repair of these items. Reparability of stainless steel components is a matter of professional judgement of qualified maintenance technicians.**

Table 4-2. TRHS Tool Kit

ITEM	QUANTITY/UNIT OF ISSUE
Tool Box, Portable	**1 each**
Screwdriver, Cross Tip	**1 each**
Screwdriver, Flat Tip	**1 each**
Hex Wrench, Metric (2-5 mm)	**1 set**
Pliers, Slip Joint	**1 each**
Wrench, Adjustable	**1 each**

4-2. 3RD AND 4TH ECHELON TOOLS AND TEST EQUIPMENT. **A TRH maintenance kit (encased in a 14" cubic stainless steel box with assembly tray), with test equipment and spare parts, is issued with each TRHS, as shown in figure 4-1. Components of the maintenance kit are listed in table 4-3.**

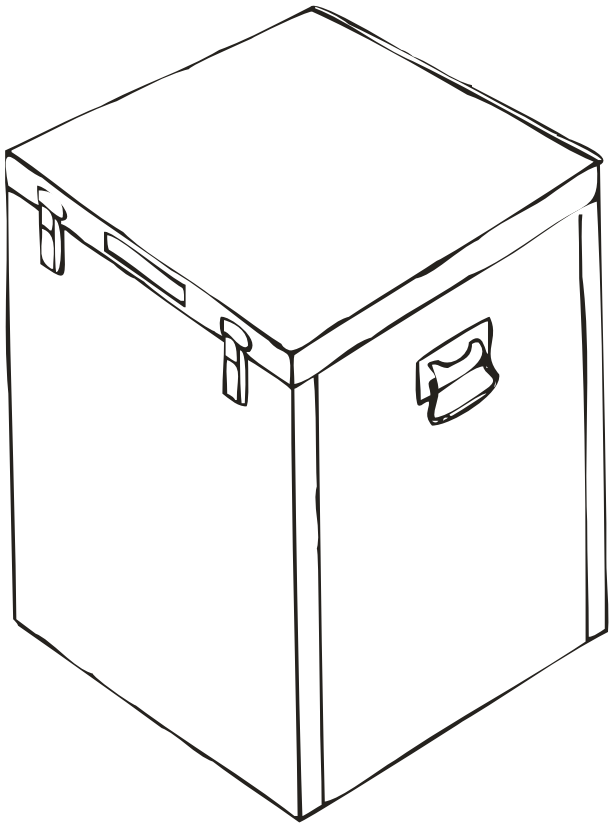


Figure 4-1. TRH Maintenance Box

Table 4-3. TRH Maintenance Box Components

ITEM	QUANTITY
Maintenance Kit Box & Assembly Tray	**1 each**
Technical Manual: TM 09211A-14&P/1	**1 each**
Airtronic Burner (spare)	**1 each**
Fuel Pump	**1 each**
Airtronic Burner Control Box	**1 each**
Electronic Troubleshooting Test Kit and Adapter	**1 each**
Fuel Solenoid Body and Coil	**1 each**
Air Compressor Solenoid Body and Coil	**1 each**
Compressor Cylinder Head	**1 each**
Compressor O-Ring and Piston-Ring Assembly	**1 each**
Burner Test Power Cord	**1 each**
Photo Cell	**1 each**
Photo Cell Light Socket	**1 each**
Spare Ignitor	**1 each**
TRH Lid Gasket, One Piece	**2 each**
Assorted Gaskets and O-Rings	**1 set**
Fuel Pump Pressure Gauge with Extension	**1 each**
Fuel Pump Vacuum Gauge with Extension	**1 each**
Compressor Pressure Gauge	**1 each**
Nylon Pump Coupling	**1 each**
Compressor Air Filter	**1 each**
Small Tool Kit	**1 set**
10 mm Wrench (Open/Box)	**1 set**
11 mm Wrench (Open/Box)	**1 each**
5/8-Inch Wrench (Open/Box)	**1 each**
1/8-Inch Flat-Tip Screwdriver	**1 each**
3/16-Inch Flat-Tip Screwdriver	**1 each**
Hose Clamps, Cotter Pins, and Clips	**1 each**
Air Activated MRE Heater[3]	**6 each**
Fuel Filter	**1 each**

Section III. SCHEDULED MAINTENANCE

4-3. OPERATOR PREVENTIVE MAINTENANCE (PM). **The TRHS requires minimal first and second-echelon preventive maintenance to remain operationally ready. Table 4-4 contains a preventive maintenance service chart, which lists task descriptions and a schedule for services. The schedule for services recommends four specific PM intervals. The specific intervals must be followed to maintain system readiness. The AN requirement means the task may be performed more frequently, if needed. For example, changing TRH tank water is scheduled for W, AN. This means the water must be changed weekly, but must be changed more frequently if food or other foreign matter have contaminated the tank.**

[3] **Maintenance kits with TRHS serial numbers 1-28 only. Maintenance kits delivered with subsequent serial numbers have a test box with integral adapter built in.**

Table 4-4. TRHS Operator Preventive Maintenance Schedule

STEP	MAINTENANCE TASK DESCRIPTION	SCHEDULE			
		MANDATORY INTERVALS			
		AU	D	W	AN
1	TRH Water Tank				
	a. Check water tank in TRH for leaks.		X		
	b. Check water level and fill.	X			
	c. Drain water from TRH, clean, and refill.	X			X
	d. Check straps and brackets for tightness.	X			
	e. Clean exterior of TRH.		X		X
	f. Inspect lid latches for serviceability.		X		
	g. Inspect lid gasket for serviceability.		X		
	h. Inspect tiedown straps for fraying/wear.	X	X		
	i. Inspect strap ratchets for serviceability.		X		
	j. Check tray pack rack for broken welds.		X		
2	TRH Fuel System				
	a. Check fuel level and fill.	X			X
	b. Inspect fuel line for leaks.		X		
	c. Check fuel can bracket/tiedown for tightness.		X		
	d. Inspect fuel filter for serviceability.	X			X
	e. Drain fuel hose.	X			
3	TRH Electrical System				
	a. Inspect inverter plugs/connections.		X		
	b. Inspect NATO slave plug connection.		X		
4	Airtronic Burner				
	a. Inspect Airtronic Burner for leaks.		X		
	b. Check screw on control box for tightness.		X		
	c. Observe Airtronic Burner exhaust for smoke and/or fuel mist.		X		
	d. Check air and fuel solenoid plugs for tightness.		X		
5	Table and Table Securing Devices				
	a. Clean table tops.	X			
	b. Lubricate table hinges.			X	
	c. Lubricate clamp hinges.			X	
	d. Adjust clamp hinges.				X
	e. Tighten nuts.			X	X
6	Serving Utensils, Nonexpendable				
	a. Inventory items.		X		
	b. Inspect and sanitize can opener.	X			X
	c. Reorder components as necessary.				X
	d. Inspect cleanliness of utensils.				X
7	Visual and Functional Checks:				
	a. Beverage containers.	X		X	
	b. Side-loading pan carriers.	X		X	
	c. Rain cover kit.	X		X	

LEGEND: AU=After Use; D=Daily; W=Weekly; AN=As Needed.

Note: Clean exterior of TRH tank with warm water. Clean interior of tank periodically with Scotch Brite™ to remove mineral deposits (rinse thoroughly). Lubricate table hinges and strap ratchets with WD-40®. DO NOT lubricate TRH lid hinges. Clean serving utensils, tray pack handling tool, #10 can handling tool, beverage containers, side-loading pan carriers, and insulated tray pack holders/lids with hot, soapy water and rinse thoroughly with clean, hot water. Keep tools dry and coat occasionally with a thin film of WD-40 to prevent rust. Clean dirt from rain cover kit storage bag and foul weather canvas with wet rag. Clean folding table tops with hot, soapy water, rinse with clean water, and dry. Wipe dirt from all brackets, clamps, and straps. The key to TRHS maintenance is the scrupulous performance of preventive maintenance checks and services.

CHAPTER 5

OPERATING PRINCIPLES, TROUBLESHOOTING, AND CORRECTIVE MAINTENANCE

Section I. OPERATING PRINCIPLES

This section contains a description and discussion of the mechanical and electrical operating principles of the TRH.

5-1. AIRTRONIC BURNER OPERATION. **The Airtronic Burner employs a unique fuel-atomization technique to achieve high-efficiency, reliable, smokeless operation. The atomization principle is shown in figure 5-1. Fuel is supplied to the exterior surface of a hollow convex atomizer that contains a small, laser-cut aperture. Fuel spreads out and covers the entire atomizing surface with a continuous, thin film, which flows over the exterior surface of the atomizer. As compressed air escapes through the small orifice, it ruptures the portion of the thin film that flows over the exterior surface of the atomizer. This creates a continual dispersion of liquid particles that are as much as 10 times smaller in diameter than those produced by a conventional, high-pressure nozzle. The portion of the liquid film not dispersed by the escaping air drains into a sump, where it is recirculated back to the fuel supply system by means of a simple pump. Fuel never passes through the orifice, just clean, filtered air. This makes the Airtronic Burner insensitive to contamination, even if the fuel contains water, dirt, or other particulate matter. In contrast, a conventional nozzle is subject to clogging because liquid fuel is forced internally through small openings.**

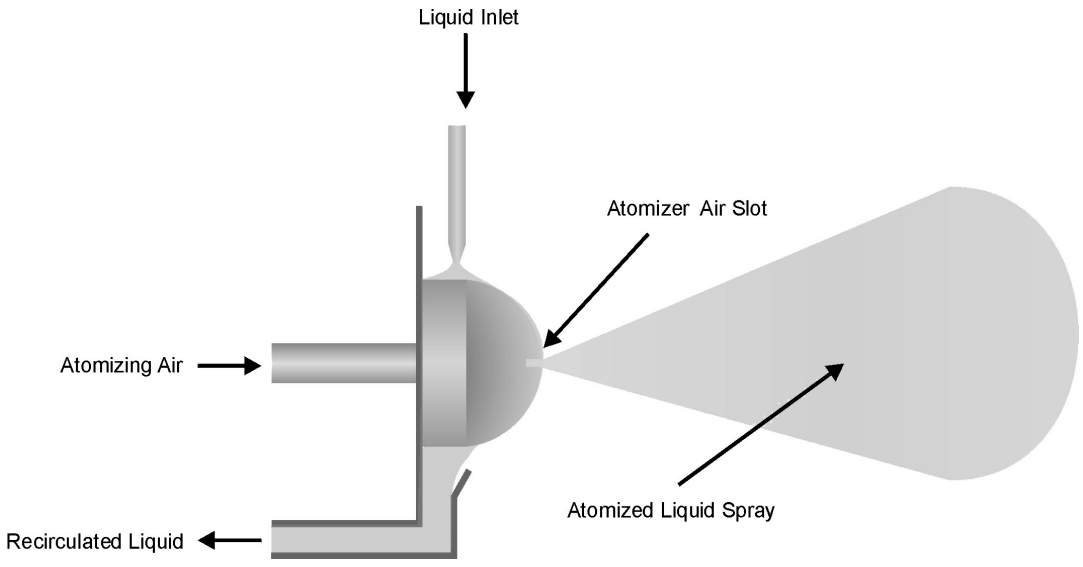


Figure 5-1. Babington Atomization Principle

The Airtronic Burner employs dual atomizers, as shown in figure 5-2. This is a unique innovation in small, oil burners. Two sprays converge in the flame tube to create an aerodynamic flame with excellent combustion stability. Combustion air is provided by a combustion air blower wheel. This air ventilates the atomizing chamber, where it co-mingles with the dual, mist-like fuel sprays leaving the atomizing tips. Additional air is passed through the center of the atomizing chamber where it intersects the spray from the dual atomizers.

Four louvers create a swirling combustion process within the flame tube where the dual sprays intersect. The swirling action is stopped by staged blasts of air, which causes the fire to fill the entire flame tube. This highly efficient fuel-air mixing process produces near perfect combustion, without smoke. Ignition is achieved with a compact, low-energy, solid-state ignition transformer, so small in size and weight that it can be located inside the Airtronic Burner housing.

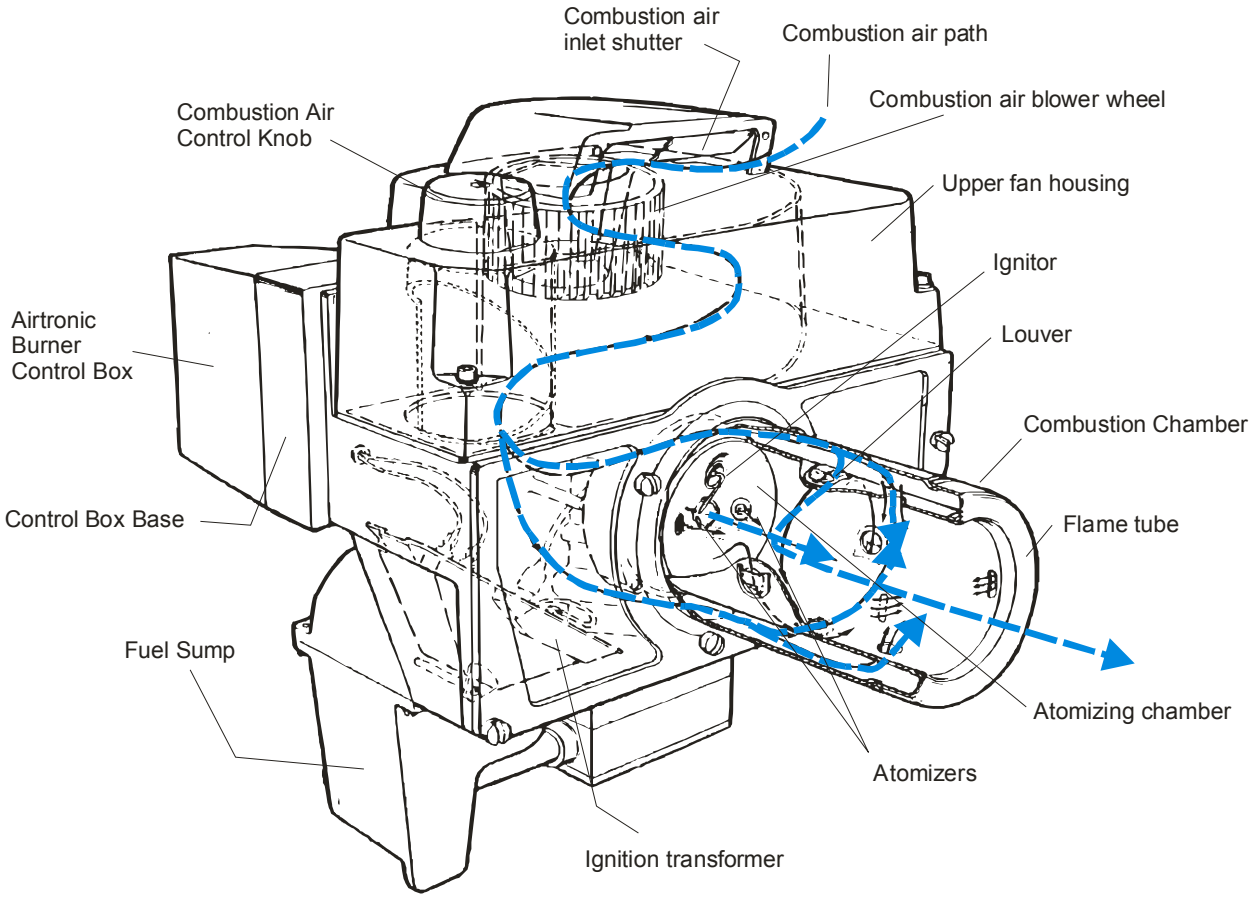


Figure 5-2. Airtronic Burner Fuel-Air Mixing Process

Airtronic Burner design is shown in figure 5-3. The Airtronic Burner is powered by a small, 75-watt motor. This double-shafted motor drives a blower wheel to provide combustion air; a simple compressor to supply atomizing air; and a self-priming fuel pump to deliver fuel to the atomizers.

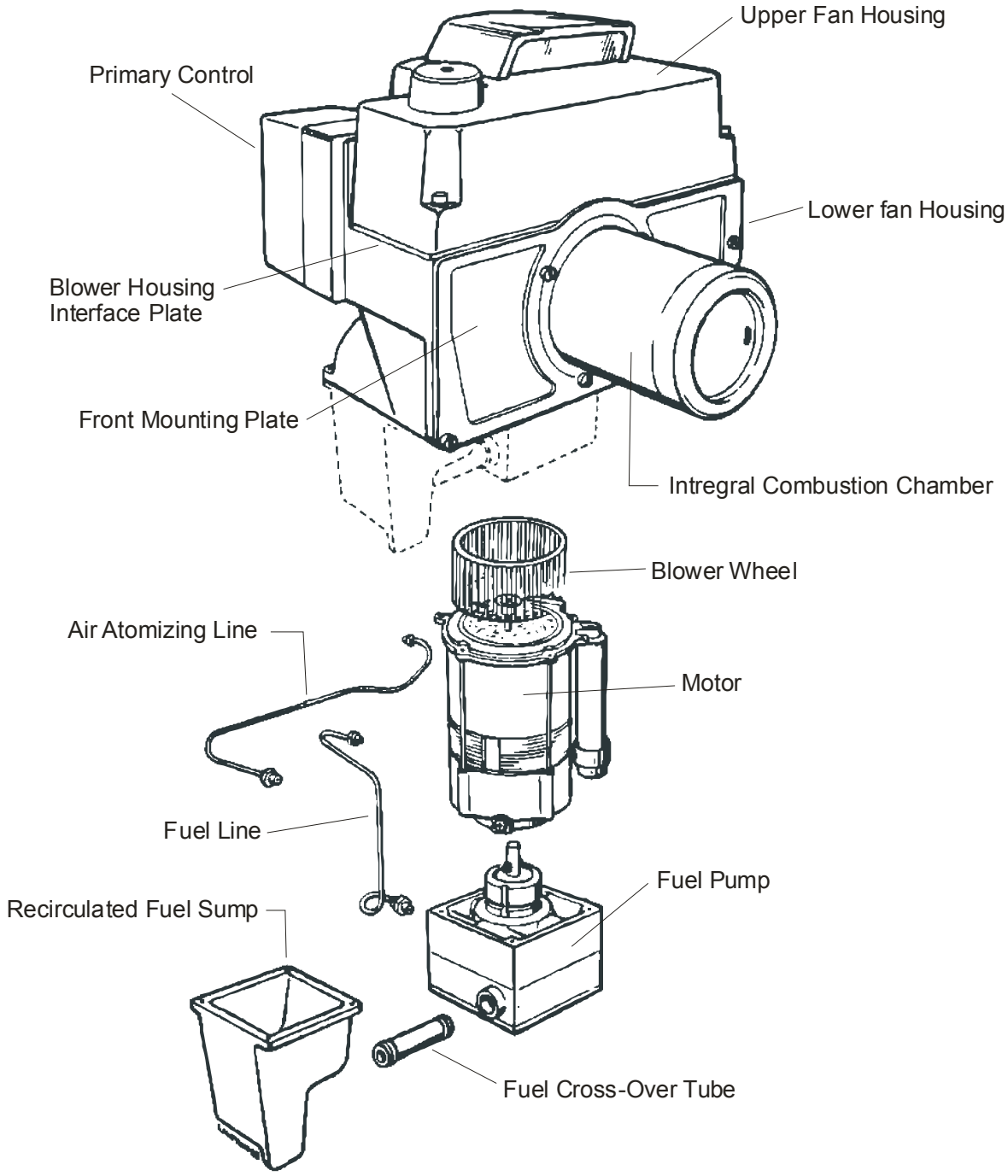


Figure 5-3. Airtronic Burner Design

5-2. ELECTRICAL CONTROL SYSTEM. **The TRH electrical system uses 120 VAC, 60 Hz, single-phase current, such as that provided by a standard U.S. electrical wall outlet. An inverter converts 24 VDC from the HMMWV NATO slave outlet to 120 VAC, 60 Hz. The Airtronic Burner maintains the TRH tank water temperature thermostatically within a 180°F to 200°F range. The electrical system automatically shuts off the Airtronic Burner at the TRH electrical control box in the event of: low water level, excessive light due to improper Airtronic Burner installation, tilt or accidental tipover, and loss of flame when the system is calling for heat. Figure 5-4 shows a schematic diagram of the TRH electrical control box circuitry. These built-in safety features are discussed in further in this chapter.**

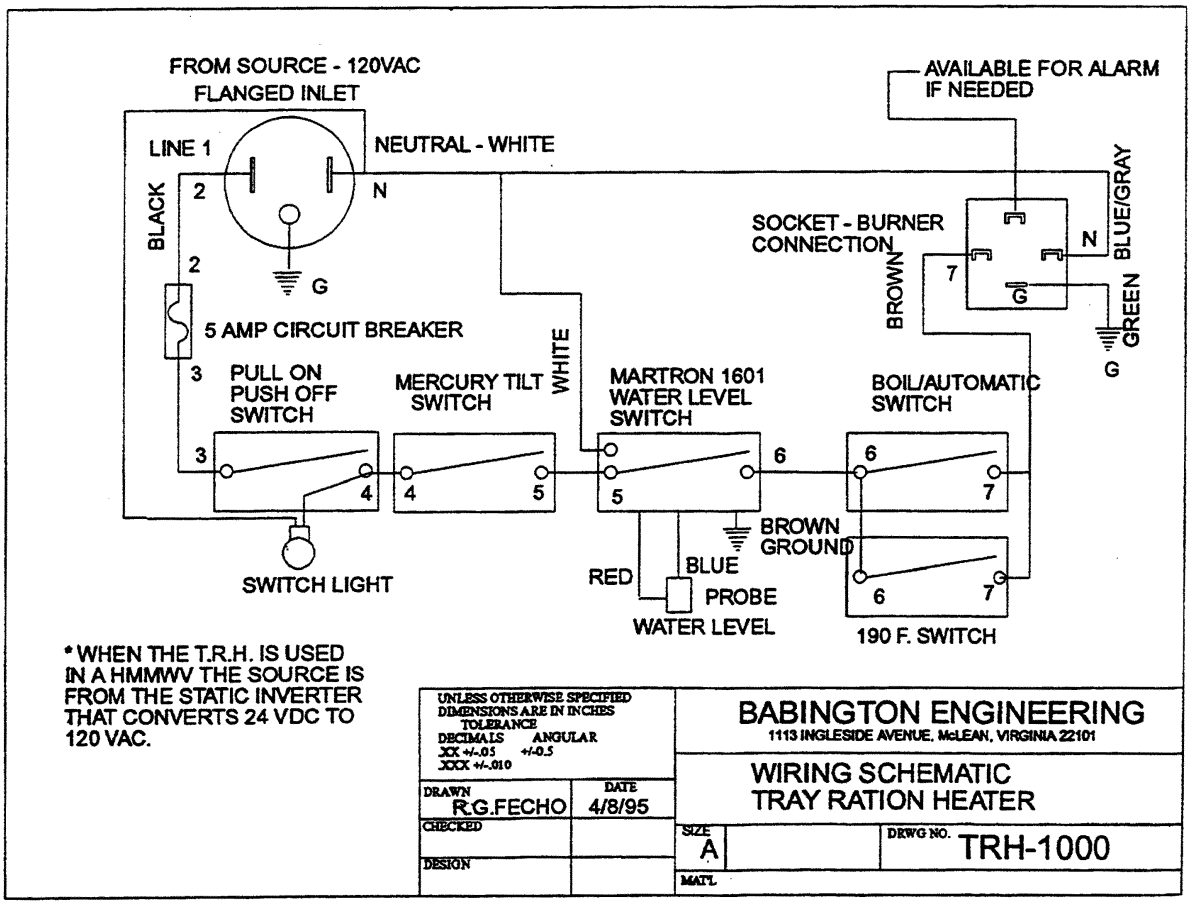


Figure 5-4. TRH Electrical Control Box Schematic

5-3. TRAY RATION HEATER SAFETY FEATURES. **The TRH has few controls and indicators. Built-in safeguards that automatically shut off the system establish the conditions for operator troubleshooting. Both the TRH and Airtronic Burner each have their own unique safety features and controls. The below listed components break the power supply to the Airtronic Burner as shown schematically in figure 5-5. Consequently, they must be functional before the Airtronic Burner will ignite.**

- **Circuit breaker on the TRH electrical control box (opposite the red, pull-on/push-off switch).**
- **Mercury tilt switch to shut down the Airtronic Burner in the case of accidental tipover or excessive tilt.**
- **Water-level sensor to ensure that the Airtronic Burner will not fire without sufficient water in the TRH tank.**
- **Thermodisc to regulate water temperature.**
- **Red, pull-on/push-off switch and auto/boil switch.**

WARNING

Use the boil mode only for short periods of time. Extended use of the boil mode produces excessive steam through the pressure relief hole in the back of the lid and causes excessive pressure to accumulate in the canned food. Personnel can be burned by vented steam or pressurized, scalding can contents.

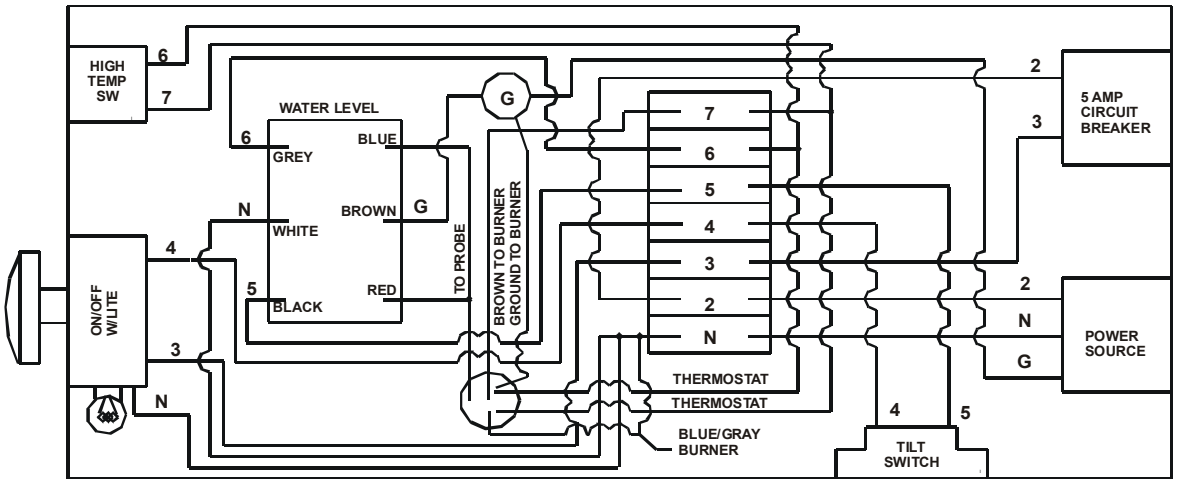


Figure 5-5. Wiring Diagram—TRH Electrical Control Box

5-4. AIRTRONIC BURNER SAFETY FEATURES. **When the TRH safety parameters listed in paragraph 5-3 are functional, the Airtronic Burner will operate under its own safety and control features, as listed below and shown schematically in figure 5-6.**

- **The Airtronic Burner photo cell must "see" dark prior to light-off. This ensures it is properly installed in the TRH, without "light leakage."**

- **During startup, the Airtronic Burner photo cell must "see" light to establish "proof-of-flame" within 10 seconds or the Airtronic Burner control box will go into "lockout."**

- **After "proof-of-flame" is established, the ignition spark will turn off. This increases ignitor and ignition transformer life.**

- **Airtronic Burner control constantly monitors flame to confirm "proof-of-flame."**

- **In the unlikely event the Airtronic Burner flames out for any reason, it will automatically relight within 10 seconds.**

- **If "proof-of-flame" is not re-established after 10 seconds during re-light trial, the Airtronic Burner control goes into "lockout."**

- **The fuel level in the Airtronic Burner sump is constantly monitored; if the level rises too high for any reason, the overflow safety float (figure 1-6) will shut off the inlet fuel solenoid until the fuel level recedes to proper operating level.**

Should the Airtronic Burner go into "lockout," it must be manually reset by pushing the button on the back of the Airtronic Burner control box. This button has a red light indicator for "lockout." After a two-minute wait, reset the Airtronic Burner control box by depressing the button and the red light will go out. This control box may also be removed and replaced with a test box. The operation of this test box is explained in the ensuing paragraph. It is an excellent diagnostic tool and the maintenance technician may use it to isolate virtually all but the simplest or obvious Airtronic Burner problems.

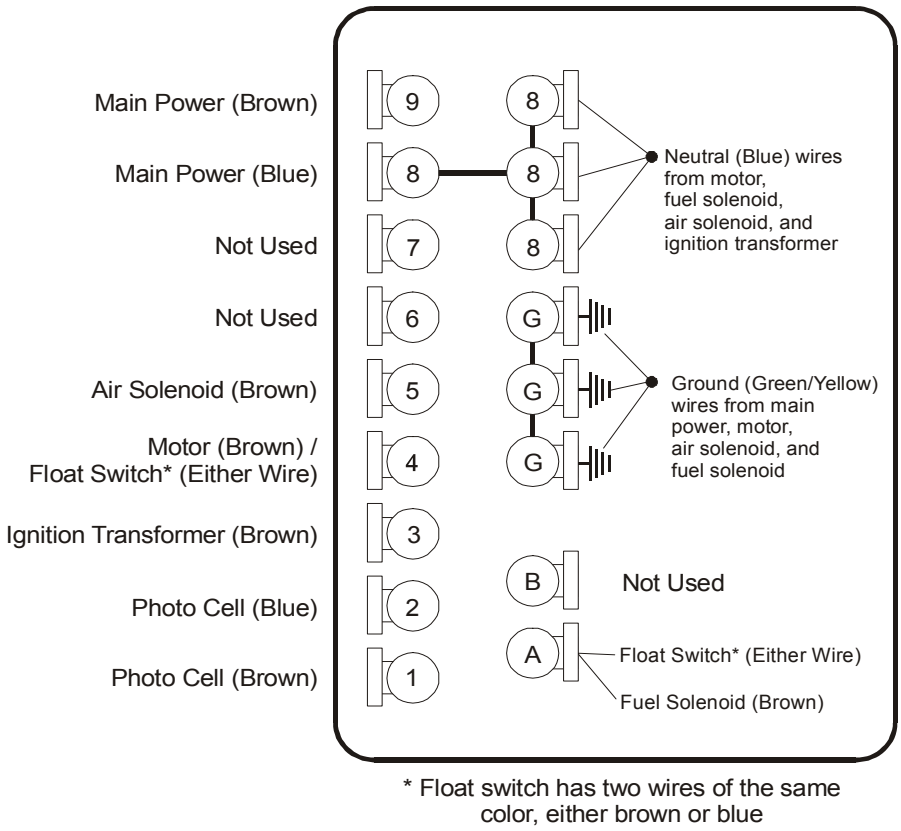


Figure 5-6. Wiring Diagram—Airtronic Burner Control Box Base

5-5. TEST BOX OPERATION. **The electronics within the Airtronic Burner control box provides the proper Airtronic Burner sequencing, which includes the safety features listed above. However, when diagnosing all but obvious Airtronic Burner problems, the Airtronic Burner control box should be replaced with the test box shown in figures 5-7 and 5-8. The test box is designed so that the main burner components (motor that drives fuel pump and combustion air blower wheel, spark, and atomizing air from compressor) can be operated independently. This box has five switches, only three of which are "live" and activate Airtronic Burner functions.**

The switch opposite the "blower" symbol energizes the motor, which drives the fuel pump, the combustion air blower, and the compressor. This switch also opens the inlet fuel solenoid to the Airtronic Burner. The practical effect of turning on this switch is to provide fuel to the atomizers and blower air through the air tube. The compressed air solenoid, which provides atomizing air, is not opened by this switch.

Energizing the switch opposite the "arc" symbol simply turns on the ignition spark. At this point, with two switches energized, two of the three combustion requirements are present (fuel over the atomizers and a spark to ignite the fuel spray when it occurs).

Energizing the switch opposite the "number one solenoid" symbol opens the compressor solenoid, which allows compressed air to enter the atomizers and exit the atomizing orifices. The instant this happens, a mist-like fuel spray is generated, followed by instantaneous ignition and combustion as the finely atomized dual sprays encounter the ignition spark.

The test box also contains two other switches, which should be ignored and left in the OFF position—they do not pertain to the TRH. The five green lights on the control box merely register the relative intensity of light that the photocell "sees." If the photocell "sees" light during prepurge, the Airtronic Burner will not ignite and the system will go to "lockout." In summary, the test box, coupled with the burner test power cord, allow the maintenance technician to independently operate or cycle individual components or operate the Airtronic Burner on a bench, without having to confront automatic sequencing and system safety features. As such, they are the most important diagnostic tools in the maintenance kit.

Figure 5-7. Test Box

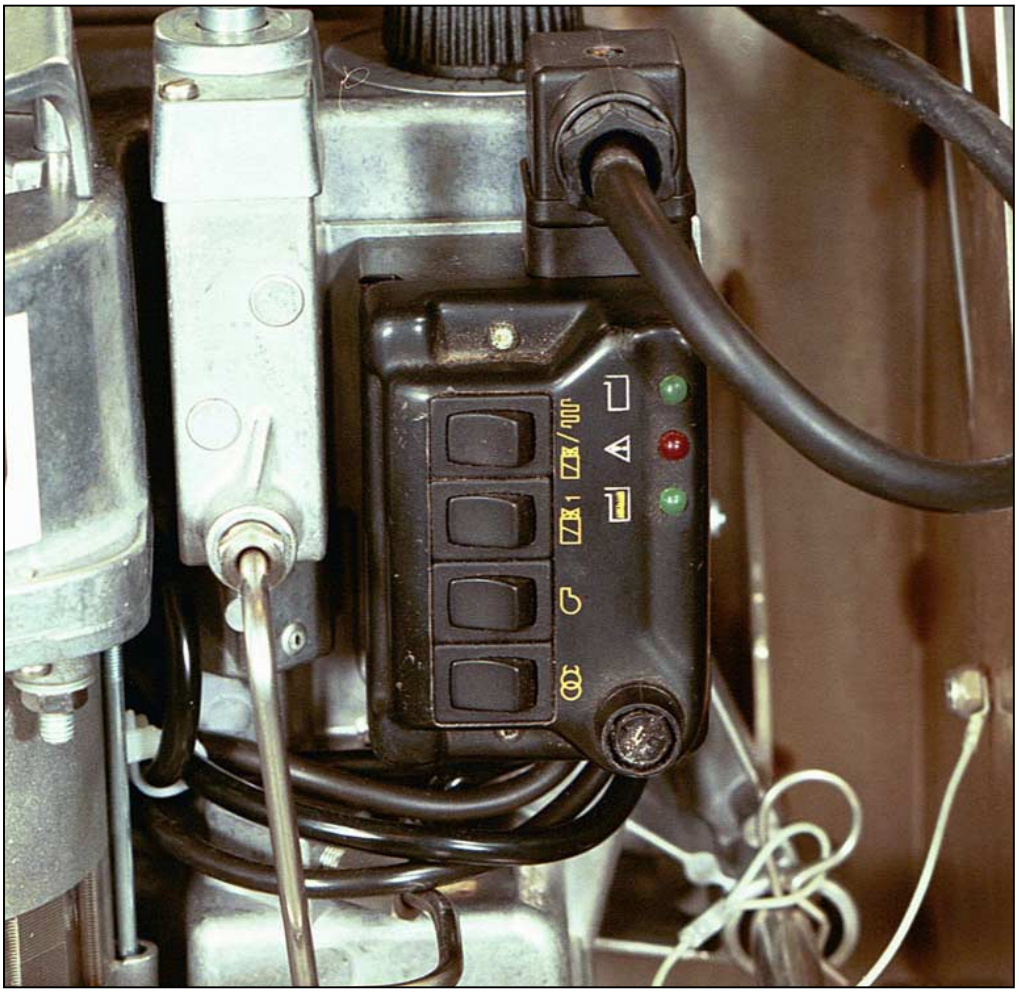


Figure 5-8. Test Box—Installed

Section II. TROUBLESHOOTING AND CORRECTIVE ACTION

5-6. TROUBLESHOOTING AND CORRECTIVE ACTION. **The following procedures should be followed by the operator or maintenance technician (as appropriate) in the event the TRH does not function properly.**

WARNING

Before removing Airtronic Burner from the TRH, make sure the TRH red, pull-on/push-off switch is in the OFF position and the TRH electrical control box is unplugged from a power source to prevent electrical shock and inadvertent Airtronic Burner ignition.

If necessary, the Airtronic Burner can be easily removed from the TRH by following the steps in table 5-1.

Table 5-1. Airtronic Burner Removal

STEP	PROCEDURE
1	Push the TRH red, pull-on/push-off switch to the OFF position and unplug the TRH electrical control box from the power source to prevent electrical shock and inadvertent Airtronic Burner ignition.
2	Lift the Airtronic Burner cover and tap to the right until it is off its hinges.
3	Unscrew the power cord and disconnect it from the top of the Airtronic Burner control box base.
4	Pull the retaining hairpins from the saddle pins on both sides of the Airtronic Burner and slide the Airtronic Burner off the saddle pins.
5	Extend the foot on the bottom of the fuel sump and set the Airtronic Burner down so that it does not tilt forward toward the flame tube.
6	Unscrew the fuel clamp on the suction inlet port and remove the fuel line.

Reverse the process to install the Airtronic Burner in the TRH. These sequences can be used as necessary to swap out an Airtronic Burner with one provided in the maintenance kit and either continue a mission and/or put the suspect Airtronic Burner on a bench for troubleshooting.

SYMPTOM 1 Pull red, pull-on/push-off switch to ON, but nothing happens; switch does not illuminate red.

PROBLEM **No electrical power to the TRH.**

ACTION

- **Ensure that 120 VAC power is supplied to TRH. If the inverter is the power source, ensure inverter circuit breaker is engaged and the green LED light is illuminated.**

- **Ensure circuit breaker on TRH electrical control box is engaged.**

- **Check power cord connections at TRH electrical control box and inverter ground fault receptacle.**

If all of these conditions are satisfied and still nothing happens when the "ON" switch is pulled, fill out an Equipment Repair Order (ERO) and request 3rd/4th echelon maintenance.

INTERMEDIATE MAINTENANCE ACTION

Isolate the faulty component by bypassing TRH electrical control box by connecting the burner power test cord to the top of the Airtronic Burner (unscrew and remove cable to electrical control box temporarily). If Airtronic Burner functions, replace red, pull-on/push-off switch in TRH electrical control box.

SYMPTOM 2 Pull red, pull-on/push-off switch to ON, but nothing happens; switch does illuminate red.

PROBLEM **Not enough water in the TRH, Airtronic Burner control box in "lockout," mineral buildup on water-level sensor, or a combination of the above.**

ACTION

- **Ensure that the water level in the TRH is above the water-level sensor.**
- **Push the round reset button on the Airtronic Burner control box.**
- **Clean the water-level sensor on the inside of the tank to remove mineral deposits.**

If all of these conditions are satisfied and still nothing happens when the "ON" switch is pulled, one of the above mentioned components has failed. Fill out an ERO and request 3rd/4th echelon maintenance.

INTERMEDIATE MAINTENANCE ACTION

Isolate the faulty component by systematically bypassing each component. Ensure that ample cold water is in the TRH to completely cover the water level sensor. First connect the burner power test cord to the top of the Airtronic Burner control box (unscrew and disconnect the internal cable from the Airtronic Burner to the TRH electrical control box temporarily). If the Airtronic Burner functions when the TRH electrical control box is bypassed by the burner power test cord, the malfunction is in the TRH electrical control box.

Remove the burner power test cord and reconnect the internal cable from the TRH electrical control box to the Airtronic Burner. Remove the TRH electrical control box cover. Pull the red, pull-on/push-off switch to ON. With a jumper wire and the aid of the schematic, jumper terminals 2 to 7 on the terminal block. If the Airtronic Burner runs, it confirms that the fault is in the TRH electrical control box. Jumper terminals 2 to 6 with the auto/boil switch on AUTO. If the Airtronic Burner runs, the thermodisc is functioning. Next, jumper terminals 2 to 5. If the Airtronic Burner runs, the water level switch is functioning. If the Airtronic Burner runs when terminals 2 to 4 are jumpered, the mercury tilt switch is functioning. Jumper terminals 2 to 3 and, if the Airtronic Burner continues to run, the red, pull-on/push-off switch is good. (If all the aforementioned components prove operative, either the circuit breaker is tripped or malfunctioning, or there is no electrical power to the TRH.)

SYMPTOM 3 Pull "ON" switch, motor runs but nothing else happens (no fuel spray from the exhaust pipe and the Airtronic Burner does not fire). Airtronic Burner then goes into "lockout."

PROBLEM **No fuel in the Airtronic Burner, or faulty compressor solenoid.**

ACTION

- **Ensure the fuel line to the Airtronic Burner is properly hooked up, with a serviceable fuel filter, there are no kinks in the fuel line, and the fuel can vent is open.**
- **Wait at least two minutes, push the reset button on the Airtronic Burner control box.**
- **Restart the Airtronic Burner while holding down the starting button inlet valve located on the side of the fuel pump (figure 1-6).**
- **To create even greater suction, also close off the brass finger priming port with a finger.**

If the Airtronic Burner does not light after this procedure, repeat procedure one more time to allow adequate time for complete fuel line charging and Airtronic Burner priming. This may be necessary, especially with a new Airtronic Burner, new fuel filter, or a relatively long fuel line.

If there is still no fire, remove and replace the Airtronic Burner in accordance with table 5-1. Fill out an ERO and request 3rd/4th echelon assistance for repair.

INTERMEDIATE MAINTENANCE ACTION

WARNING

Keep face and hands away from flame tube when using test box to avoid accidental burning.

Place Airtronic Burner on work bench and replace the control box with the test box. With the test box installed, turn on the switch to allow the motor and pump to run. Depress the starting button inlet valve and at the same time, cover the brass finger priming port with a finger. Maintain this dual priming condition for 40 seconds to 1 minute with only the one "blower" switch energized. Maintaining this condition for longer periods will not harm the equipment. Next, flip the "spark" switch and, looking down the burner tube, observe that the spark is blowing down in a spear-like shape. If the above priming exercise has been successful and no other problems exist, energize the third "number one solenoid" switch to allow atomizing air to exit the atomizers and create a spray, which should light instantaneously.

If this procedure does not create a spray, one of two conditions exists. Either there is still no fuel reaching the atomizers or there is no air reaching the atomizers.

To best determine which of these problems exist, remove the front flange assembly with air tube and flame tube to fully expose the atomizing chamber with its dual atomizers. This can easily be done by removing the three screws that hold the front flange assembly to the lower fan housing (figure 5-10). Now, turn on the "blower" switch while observing the surface of the atomizers. If a thin film of fuel can be seen passing over the atomizers, the problem is not with the fuel supply system. This observation should be made in a well lighted area and can best be seen immediately after the "blower" switch is energized. It may be difficult to detect the thin film of fuel passing over the atomizers, so it may be necessary to exercise the switch several times while observing the surface of the atomizers.

If fuel is reaching the atomizers, yet there is still no fuel spray when the "number one solenoid" switch is energized, the compressor solenoid is faulty. Replace the compressor solenoid. Note that these symptoms refer to no fuel spray, not poor fuel spray. If a poor spray is noted, refer to the next problem symptom and action.

SYMPTOM 4 Airtronic Burner goes through normal prepurge, fuel mist exits the exhaust pipe, followed by either no combustion or unstable combustion. If there is no combustion, the Airtronic Burner will go into "lockout."

PROBLEM **No ignition spark or improper ignition. The Airtronic Burner may also be running out of fuel or the atomizing chamber may have a clogged orifice.**

ACTION

Remove and replace the Airtronic Burner in accordance with table 5-1. Fill out an ERO and request 3rd/4th echelon assistance for repair/replacement.

INTERMEDIATE MAINTENANCE ACTION

- **Replace the Airtronic Burner control box with the test box.**
- **Energize the "blower" switch to create a fuel flow over the atomizers. When the "arc" switch is energized, a good spark should be visible blowing downward in a spear-like shape. If so, the problem is not with the ignition system.**
- **If the spark is arcing over to ground or it is not stable across the ignitor probes, readjust the ignitor gap. If there is no evidence of a spark or arcing anywhere, check the ignition connections and if there is still no spark, replace the triangular-shaped ignition transformer adjacent the atomizing chamber, inside the lower fan housing.**

If the fuel supply is adequate, after following the procedure outlined in the preceding problem discussion, but the fuel spray appears weak or contains big droplets, install the compressor pressure gauge (shortest of three gauges) in the head of the compressor (remove brass fitting from compressor cylinder with a 4mm Allen wrench and screw in compressor pressure gauge) (figure 1-6). The pressure gauge should read about 2 psi when the air solenoid is not energized. When the "number one solenoid" switch is energized to provide compressed air to the atomizers, the pressure should be between 20-32 psi (25-27 psi is optimum). A pressure reading above 32 psi indicates a partially clogged orifice. The greater the pressure, the more severely clogged the orifice. If the pressure reading is above 32 psi, replace the atomizing chamber (figure 5-7). A pressure reading below 20 psi indicates poor compressor performance. Service the compressor by replacing the piston ring and O-ring assembly. If compressor pressure remains too low, replace the compressor cylinder (figure B-1). The inner walls of a faulty compressor will show signs of uneven wear. If the above problem is solved when using the test box, but persists when the test box is replaced with the Airtronic Burner control box, the Airtronic Burner control box is defective and must be replaced.

SYMPTOM 5 Pull ON switch, Airtronic Burner goes through prepurge and lights, but shuts down after a few minutes.

PROBLEM **The Airtronic Burner is not being replenished with fuel from an external source.**

ACTION

- **Make sure an external fuel line is installed, the fuel can has an adequate supply of fuel, and the vent screw to the adapter kit is properly opened.**
- **Check that the adapter suction probe in the fuel can extends below the fuel level.**
- **Prime the Airtronic Burner during prepurge by depressing the starting button inlet valve as shown in figure 1-6, item #7.**
- **At the same time, close off the finger priming port with a finger to further enhance the priming process, as shown in figure 1-6, item #28.**
- **Make sure the fuel filter is not clogged and the fuel lines are connected properly and not kinked.**

If, after repeated priming as described, the Airtronic Burner keeps running for a few minutes and shuts off, this indicates that fuel pump suction is marginal. Remove and replace the Airtronic Burner in accordance with table 5-1. Fill out an ERO and request 3rd/4th echelon assistance for repair/replacement.

INTERMEDIATE MAINTENANCE ACTION

Verify fuel pump malfunction by connecting the fuel pump pressure gauge (positively graduated) and the fuel pump vacuum gauge (negatively graduated) (both found in the maintenance kit) to the ports identified in figure 5-9. Both of these gauges are mounted on 1½-inch coupling extensions. First remove the metal screws in the ports with a 5mm Allen wrench, then gently screw the gauges into the ports with an adjustable wrench. Fuel pump pressure should read between .48 and .65 bars and fuel pump vacuum should read between -.15 and -.35 bars. Fuel pump vacuum lower than -.36 bars may indicate a kinked fuel line, unvented fuel can, and/or clogged fuel filter. If these are not evident and fuel pump pressure is out of tolerance, replace the fuel pump. Removal of fuel sump will make fuel pump replacement easier. Drain the fuel sump first by opening the fuel sump drainage plug.

SYMPTOM 6 Any abnormal combustion problem such as smoke, rumbling, or combustion instability.

PROBLEM **Less than optimum Airtronic Burner performance.**

ACTION

- **Ensure that the fuel setting on the fuel flow control is between 1.0 and 1.5 kg/hr and the combustion air control is set at #9. In a static situation, the fuel setting need only be set at 1.0. In a fast-moving, off-road vehicle, a setting of 1.5 will provide superior combustion stability. A higher setting also simply heats the water faster.**

If this does not solve the problem, remove and replace the Airtronic Burner in accordance with table 5-1. Fill out an ERO and request 3rd/4th echelon assistance for repair/replacement.

INTERMEDIATE MAINTENANCE ACTION

- **Replace the Airtronic Burner control box with the test box.**

- **If the Airtronic Burner flame is not clean and uniform (absent "fire-flies," smoke, and odor) check for proper atomizing air pressures as previously discussed.**

- **If atomizing pressure is above the optimum range of 32 psi, replace the atomizing chamber.**

- **If the atomizing pressure is below 20 psi, replace the piston ring assembly and if below 16 psi, also replace the compressor cylinder. High compressor pressure indicates a clogged atomizing chamber that should be replaced.**

- **Low compressor pressure indicates poor compressor performance and the compressor O-ring and piston-ring assembly should be replaced. Also replace the compressor cylinder if a visual observation reveals surface wear along the cylinder wall.**

5-7. TROUBLESHOOTING SUMMARY. **When in doubt, always remove the Airtronic Burner and operate it with the test box. Set the Airtronic Burner on a bench and extend the support foot on the bottom of the burner so it will remain upright. Avoid tilting the Airtronic Burner downward toward the flame tube as this can cause fuel to run out of the sump. If the flame is clean and it turns on and off instantly without smoke as the "number one solenoid" switch is energized and de-energized, the Airtronic Burner is functioning properly. Maintenance of the Airtronic Burner is relatively simple given an understanding of how the Airtronic Burner works. Three conditions are required to make the Airtronic Burner work: a film of fuel over the outside of the atomizers and combustion air through the flame tube; a suitable spark to ignite the fuel spray; and a supply of compressed air to the atomizing orifices to create the mist-like fuel spray.**

Special care must be taken in removing and installing atomizing chambers to make sure dirt does not enter the fuel inlet tube at the back of the atomizer and the adjacent compressed air inlet tube. Connecting these two stainless steel tubes with a short piece of clean, flexible plastic tubing is an excellent way to keep these critical passageways clean. When atomizing chambers are not in use, they should be stored in a clean, protective box, such as that contained in the maintenance kit. If it is necessary to set an atomizing chamber down, always put the ignitor end facing down. Once an atomizing chamber is installed in the Airtronic Burner, it is well protected from dirt contamination because filtered fuel passes through the large fuel passages all the way to the atomizers. Moreover, nothing but clean filtered air passes through the atomizing orifices. Accordingly, dirt present in the atomizers is almost always introduced in the atomizing chamber prior to installation in the Airtronic Burner, most often because of careless handling or storage. It is imperative to keep this critical component clean. DO NOT clean an atomizing orifice by placing a shim in the orifice as this simply pushes the dirt back into the atomizer where it will eventually clog the orifice again. Replace the clogged atomizing chamber with a new one.

Table-2 summarizes optimum Airtronic Burner settings.

Table 5-2. Optimum Airtronic Burner Settings

Fuel Flow Control	**1.0 to 1.5**
Combustion air control	**9**
Compressor air pressure	**20 to 27 PSI**
Fuel pump pressure	**.48 to .65 bars (7.0-9.5 psi)**
Fuel pump vacuum	**-.15 to -.35 bars (4.5-10.0" HG)**

5-8. AIRTRONIC BURNER DISASSEMBLY. **The Airtronic Burner lends itself to easy disassembly and assembly as shown in figure 5-9. Should it be necessary to order a new Airtronic Burner, assembly instructions are contained in the shipping box.**

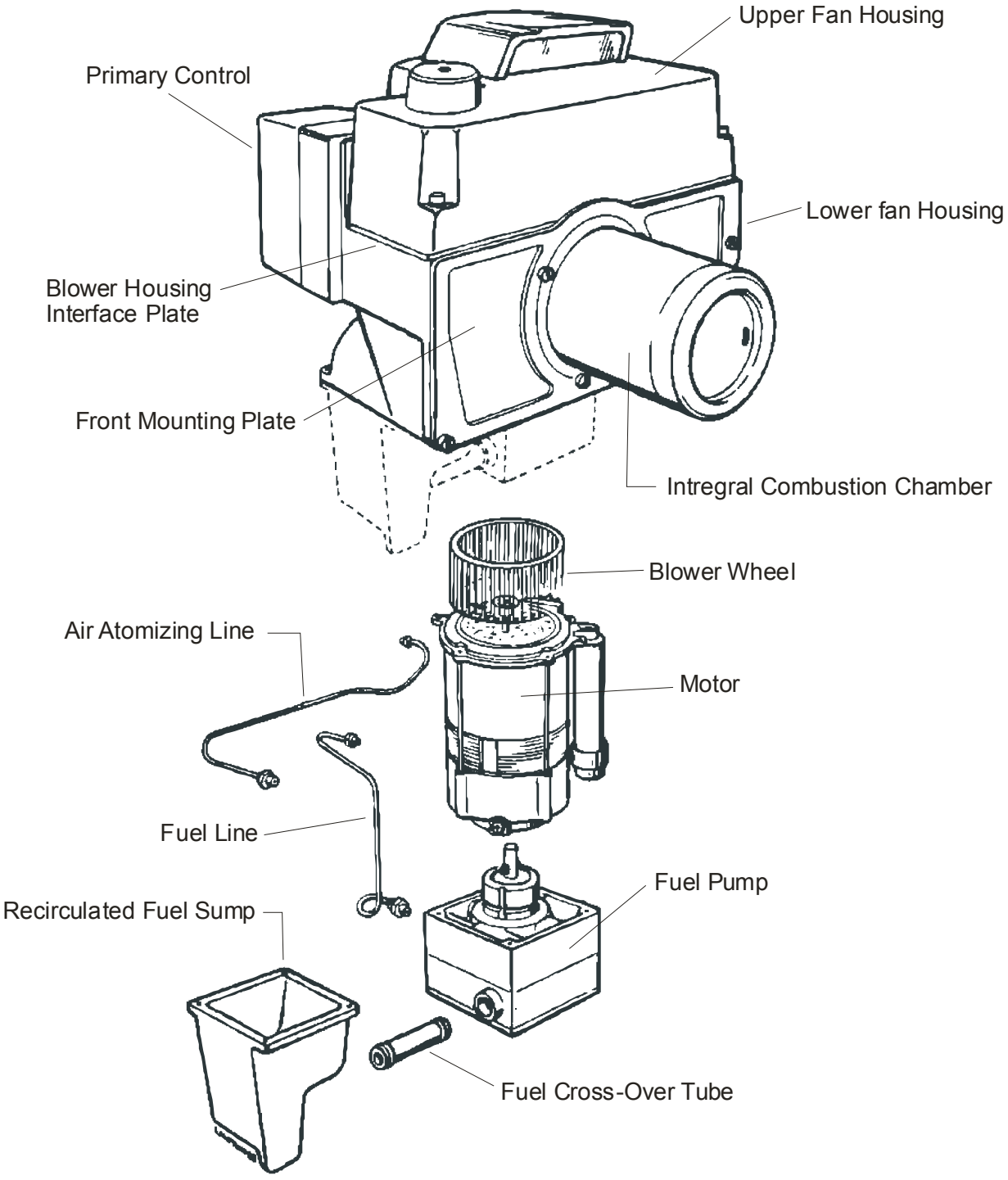


Figure 5-9. Airtronic Burner Design

To disassemble the major components of the Airtronic Burner:

a. Step 1. First remove the front flange of the lower fan housing by removing the three screws (figure 5-10) with a flat tip screwdriver to expose the atomizing chamber. It is not necessary to remove the air tube/flame tube assembly.

b. Step 2. Drain the fuel sump by unscrewing the fuel sump drainage plug with a 5mm Allen wrench and allowing the fuel to thoroughly drain into an appropriate container.

c. Step 3. Remove the atomizing chamber (figure 5-11) and store in a clean container with a plastic tube connecting the air and fuel connections at the back of the atomizing chamber. Removal and installation of the atomizing chamber does not require tools.

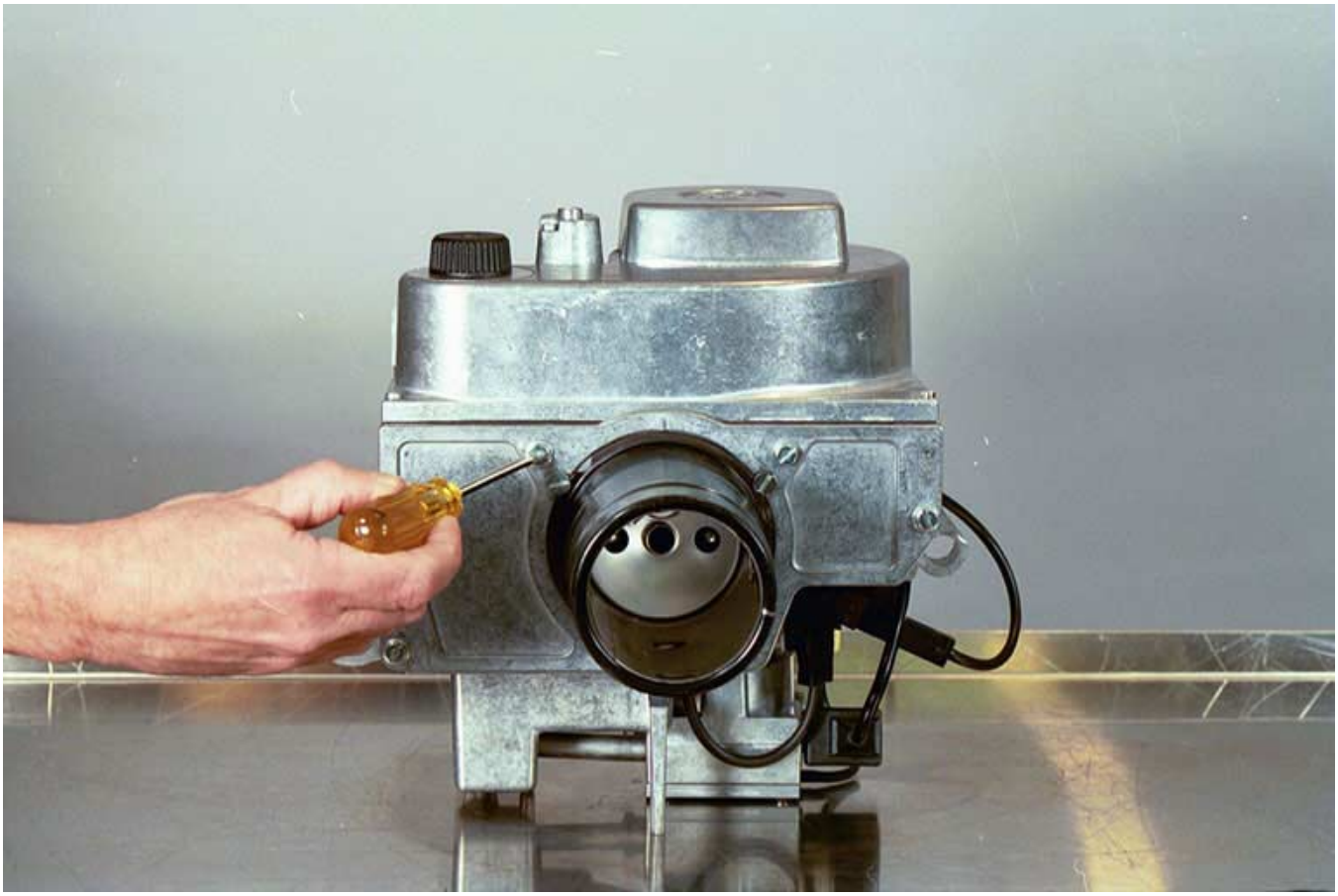


Figure 5-10. Front Flange Removal

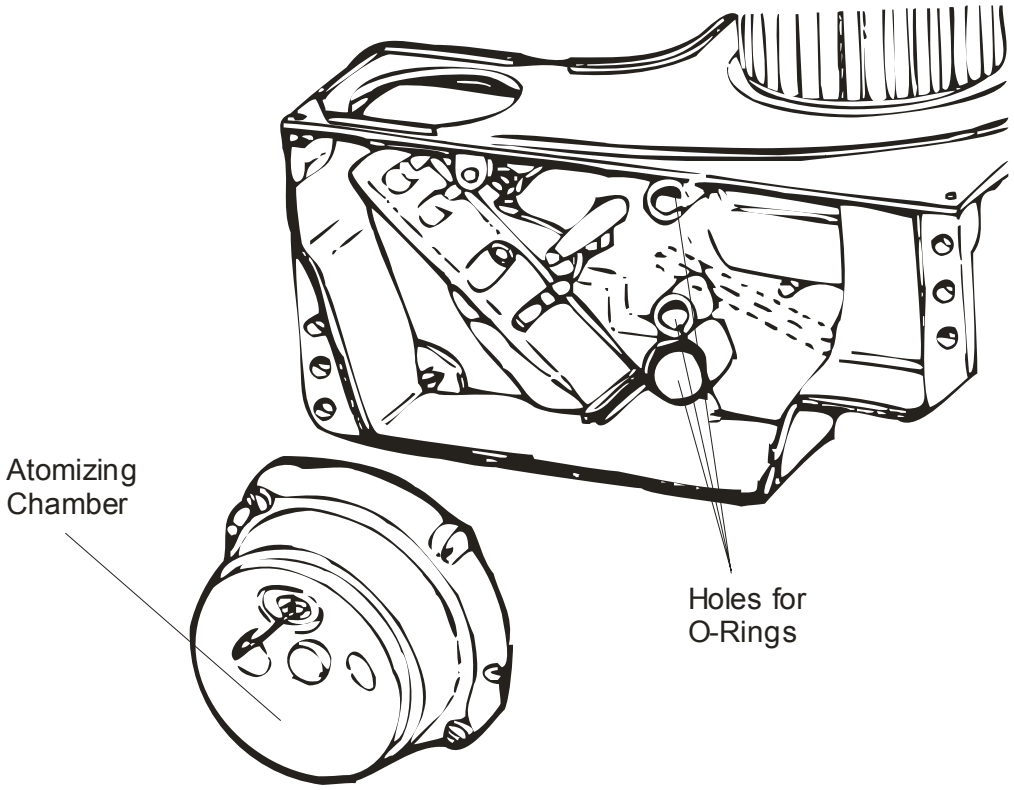


Figure 5-11. Atomizing Chamber Removal

As previously iterated, it is imperative that dirt does not contaminate the air passages of the atomizing chamber. When the atomizing chamber is removed, three machined holes in the lower fan housing (containing captured O-rings) will be exposed. These passageways, from top to bottom, deliver: fuel to the feed tubes within the atomizing chamber; compressed air to the bullet-shaped atomizers; and excess, unsprayed fuel back to the internal fuel sump for recirculation. To ensure that these passages remain clean, install the red plastic "O-ring" plug (figure 5-12) into the three holes. This plug will also allow servicing the Airtronic Burner upside down with minimum fuel leakage.

d. Step 4. Turn Airtronic Burner upside down and disconnect the air solenoid coil from the valve body to allow removal of the atomizing air line. Detach the 3-inch clear air line and unscrew the hex nut attached to the base of the brass finger priming port using a $^{5}/_{8}$-inch wrench. Set the air solenoid body in a clean place. Unscrew hex nuts on opposite ends of metal air line that leads from the air compressor using an 11mm wrench. Remove the metal air line and set in a clean place.

e. Step 5. Unscrew both metal fuel line hex-nut connections with 11mm wrench. Remove the metal fuel line and set in a clean place.

f. Step 6. Remove the four screws that hold the fuel sump to the lower fan housing using a flat tip screwdriver and slide the sump horizontally away from the pump to disengage the fuel cross-over tube from the sump pump (figure 5-13). Remove the sump.

g. Step 7. Disconnect the fuel solenoid coil from the solenoid body on the pump by sliding the retaining clip out with pliers.

h. Step 8. Disconnect the wires from the Airtronic Burner control box base.

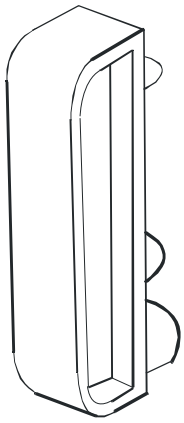


Figure 5-12. Atomizing Chamber O-Ring Plug

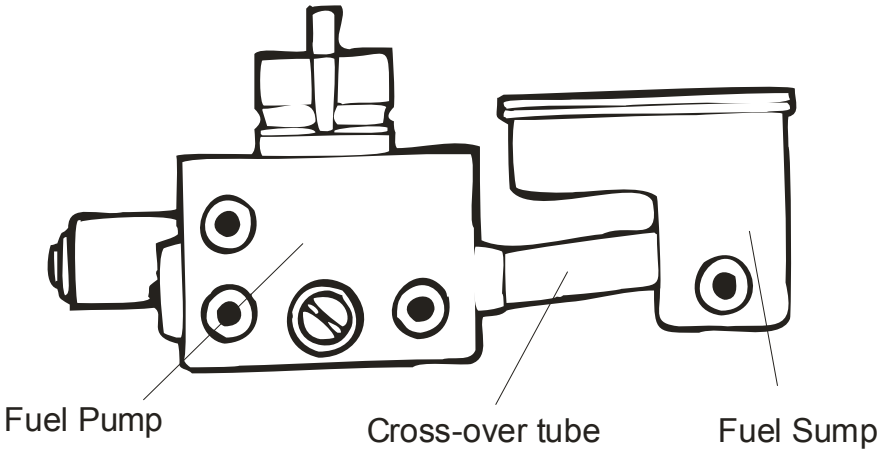


Figure 5-13 Fuel Pump/Fuel Sump Assembly

i. Step 9. Now remove the entire power pack, as shown in figure 5-14 (consisting of the motor, compressor, fuel pump, and blower wheel), by unscrewing the two 10mm hex nuts holding the motor mounts to the upper fan housing.

j. Step 10. Disassemble the fuel pump from the motor by loosening three screws on the base of the motor with a 4mm Allen wrench.

To reassemble the Airtronic Burner, follow the steps in reverse order. Note: The Airtronic Burner control box base schematic is contained in figure 5-6.

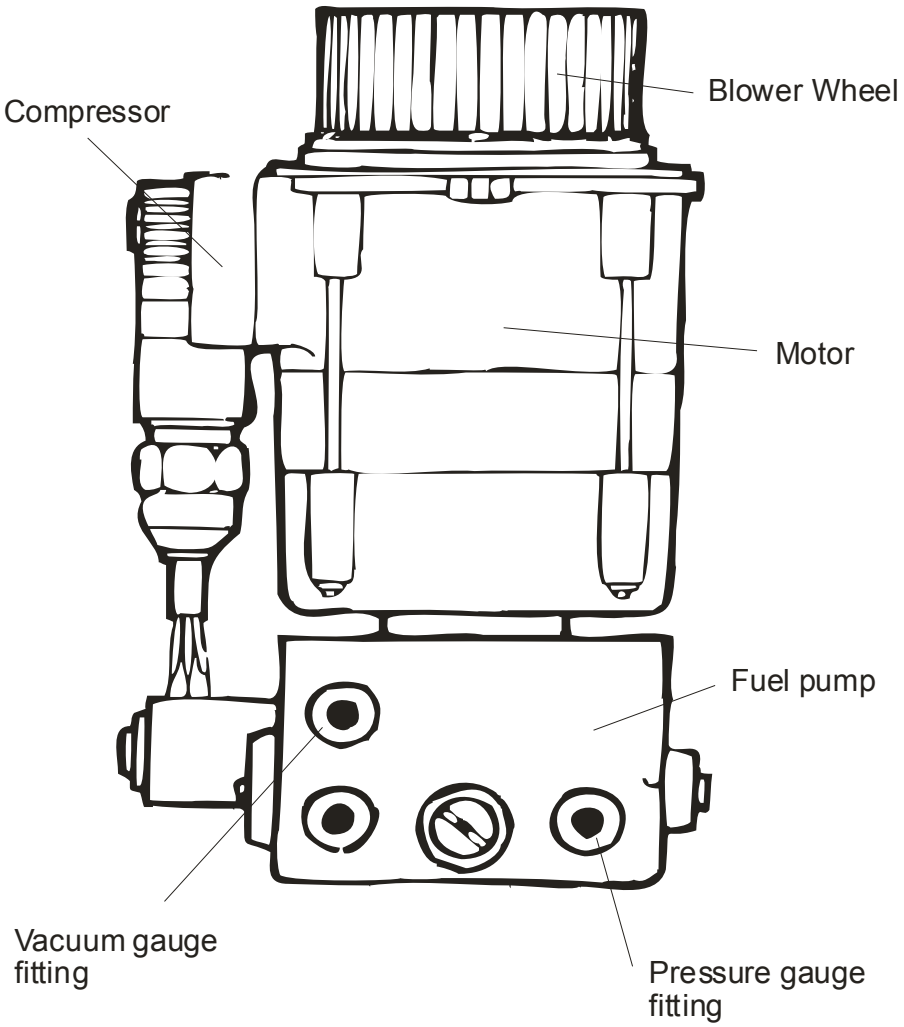


Figure 5-14. Airtronic Burner Power Pack Assembly

The overall design of the Airtronic Burner allows this simple disassembly procedure to be carried out quickly to separate all of the major components shown in figure 5-9. A complete breakdown of Airtronic Burner parts is contained in appendix B.

APPENDIX A

COMPONENTS OF END ITEM LIST

COMPONENT PARTS

Item	NSN/Stock No	Qty	Description
1	8115-01-354-0797	1	Container, Quadruple (Quadcon) [Weatherproof, flame retardant, dimensionally standard, reusable cargo container for transport and storage of organizational property and consumable supplies[4]] (figure A-1)
2	7310-01-295-7479	1	Tray Ration Heater [Heater tank, stainless steel, skid mounted, with aluminica-silica insulated fire box (perforated hastalloy top) and electrical control box] (figure 1-3)
3	B42000-95-0001	1	Airtronic Burner [(Includes primary control box) Babington Enterprises] (figure 3-2)
4	7240-01-337-5269	1	Can, Gasoline, 5-Gallon [Plastic, tan, with screw on, tethered cap] (figure 2-2)
5	2590-02-473-6331	1	Holder, Fuel Can, Bracket Assembly (figure 2-2)
6	TRH-FLA-001	1	Fuel Line with Quick Disconnect [12½' long overall, ¼" diameter; with in-line, transparent fuel filter; two female fittings for connection to fuel can adapter kit and Airtronic Burner Swagelok; and four ¼" hose clamps (Babington Enterprises)] (figure 2-2)
7	7240-21-911-8834	1	Fuel Can Adapter Kit (figure A-1)
8	DUI-24/300	1	Power Inverter, Ground Fault Interrupter, and NATO Slave Plug (2510-00-567-0128) [(Converts 24 VDC vehicular electrical power to 120 VAC, 60 Hz electrical power (Dimensions Unlimited, Inc)] (figure 1-9)

COLLATERAL EQUIPMENT

Item	NSN/Stock No	Qty	Description
9	60779	2	Padlock, Keyed [High security, precision 4-pin tumbler mechanism. Laminated steel case is rustproofed for extended wear. Two brass keys. Fits Quadcon. (Master Lock)] (figure A-1)
10	7105-01-250-0086	3	Tables, Stainless Steel [Folding legs; military green] (figure 1-2)
11	HMV105	1	Bracket, Table, Rear [Babington Enterprises] (figure 1-10)
12	HMV100	1	Bracket, Table, Forward [Babington Enterprises] (figure 1-10)
13	HMV110	1	Clamp, Table [Babington Enterprises] (figure

[4]Government furnished equipment (GFE).

			1-10)
14	CE-TD-001	2	Tiedown Straps, Tray Ration Heater [Comet Enterprises] (figure 1-3)
15	CE-SB-001	1	Storage Bag, Rain Cover Kit [Comet Enterprises] (figure 1-11)
16	CE-FW-001	1	Canvas, Foul Weather, Rain Cover Kit [Comet Enterprises] (figure 1-11)
17	HMV116	5	Poles, Tent, 8' Extendable, Military Green [Babington Enterprises] (figure 1-11)
18	CE-TS-001	4	Stays, Tent, Rain Cover Kit [Comet Enterprises] (figure 1-11)
19	CE-TP-001	4	Tent Pins, Rain Cover Kit [Comet Enterprises] (figure 1-11)
20	466288	1	Fire Extinguisher, with Mounting Bracket [Red, hand, 5 lb, dry chemical (Walter Kidde); 2-A, 10-B:C.] (figure A-1)
21	HMV117	1	Heavy duty steel strap bracket (Babington Enterprises)] (figure A-1)
22	7712	1	Tool Box, Portable [General-use tool box for carrying all hand tools (Rubbermaid)] (figure A-1)
23	5210-00-234-8913	1	Screwdriver, Cross Tip [Steel blade is securely attached in transparent plastic handle with comfortable grip. Phillips-type point. Heat treated blade with smooth, bright finish and corrosion-preventive coating. Has straight, round shank and a rounded handle end. Has a No. 2 point size tip, a ¼"-diameter, 4"-long exposed blade, and a _"-diameter handle. Size is approximately 7½" long overall.] (figure A-1)
24	5120-00-293-0314	1	Screwdriver, Flat Tip [Steel blade is securely attached in transparent plastic handle with comfortable grip. Heat treated with smooth, bright finish and corrosion-preventive coating. Has straight, round shank and a rounded handle end. Has a ¼"-wide tip, a 10"-long exposed blade, and a 1"-diameter handle. Size is approximately 13_" long overall.] (figure A-1)
25	D-1918	1	Key Set, Socket Head Screw [L-shaped wrenches for tightening and loosening hexagonal-socket screw products have two working ends and are made of tempered steel. Measures 2, 3, 4, and 5mm wide across flats (Esco 67-220, 67-230, 67-240, and 67-250).(Fab-X)] (figure A-1)
26	5120-00-278-0351	1	Pliers, Slip-Joint [Angled nose pliers are approximately 8" long and have multiple tongue-and-groove adjustments. With bolt and nut joint; does not have cutter. Straight jaws, grooved gripping surfaces. Made of strong, forged steel with chrome plating. Minimum work capacity is $1^{3}/_{16}$", jaw is _" long; has four adjustment positions.] (figure A-1)
27	5120-00-240-5328	1	Wrench, Adjustable [Heavy-duty, hardened steel with bright chrome or nickel-plated

			finish for tightening both square and hexagonal-head nuts and bolts. Has an open end rack and worm adjustment. Head is angled at 22½°. Consists of a frame (fixed jaw and handle) and a movable jaw and adjusting work. Jaw capacity is $^{15}/_{16}$". Size is 7½" to 8½" long.] (figure A-1)
28	5120-00-900-6103	1	Hammer (Peen), Blacksmith's/Engineer's, 3-Pound [Short-handled for driving tent pins. Handle length is approximately 16". Heavy-duty hammer has forged steel head with corrosion preventive coating. Has an octagonal face on one end of the head and a cross peen on the other end. End of peen is rounded and smooth. Cross peen is at a right angle to the handle axis.] (figure A-1)
29	200 MPC	3	Pan Carriers, Side-Loading [Cambro] (figure A-1)
30	7320-01-093-7371	6	Beverage Containers, 5-Gallon [Cambro] (figure A-1)
31	CE-TDB-001	2	Tiedown Straps, Beverage Containers/Pan Carriers [Comet Enterprises] (figure A-1)
32	2PX17	2	Gloves, Thermal, pr [Fire retardant, 17"-long oven mitts. Meet U.S. Government standards for heat and flame resistance. Water and stain repellent. Wipe clean. Wide palm.] (figure A-1)
33	PCN18409211000	1	Technical Manual (figure A-1)
34	7716	1	Utensil Box, Portable [General-use tool box for carrying all foodservice utensils, including can opener (Rubbermaid).] (figure A-1)
35	HMV300	1	Tray Pack Handling Tool [Babington Enterprises] (figure A-1)
36	S-11	1	Can Opener, Edlund #1, Stainless Steel [Manual can opener opens any size can, up to and including #10 round, 7" square, and 7" oblong. Easily cleaned and sanitized. Table-mounted, hand crank-operated opener. Furnished with three additional cutting wheels and feed wheels. Modified shaft, without table bracket (Edlund).] (figure A-1)
37	7330-01-234-2204	1	Can Opener, Knife [Edlund] (figure A-1)
38	5110-00-273-0128	1	Tin Snips [Aviation, $1^{3}/_{16}$" cutting length, approximately 10" long overall. Compound lever action for easy repetitive cutting. Blades are drop forged alloy steel and finely serrated to prevent slipping. Snips have cushion-grip handle and safety latch. Cutting capacity for cold rolled steel is 22 gauge.] (figure A-1)
39	10FT50R0/220	2	Thermometer, Pocket [0° to 220° F, accuracy ±2°. External recalibration adjustment. Hermetically sealed. 304 stainless steel construction with polycarbonate window. 5" stem length with high visibility dial layout. Protective polyethylene clip-sheath

			(Ashcroft).] (figure 1-5)
40	HMV303A	1	#10 Can Handling Tool [Babington Enterprises] (figure A-1)
41	61182	2	Spoodle, 8oz [$13^{5}/_{16}$" long (Vollrath).] (figure A-1)
42	7340-00-205-1421	4	Spoon, Perforated [Stainless steel, 11" long, has eyelet in handle for hanging. Bowl measures 3½" x 2½" x $^{9}/_{16}$". Slotted bowl has 6 to 10 slots and is ideal for mixing.] (figure A-1)
43	61172	2	Spoodle, 4oz [$12^{11}/_{16}$" long (Vollrath.] (figure A-1)
44	7340-00-240-7079	6	Spoon, Serving [Stainless steel, 11" long, has eyelet in handle for hanging. Bowl measures 3½" x 2½" x $^{9}/_{16}$".] (figure A-1)
45	7330-00-634-1995	2	Spatula [Has hole in handle for hanging. Conforms to NSF standards. Solid, flexible blade is straight offset and measures 7½" long and 3" wide. Comes with a plastic handle. Measures 14" long overall.] (figure A-1)
46	7330-00-616-0998	2	Tongs [Tweezer-style, 9"-long, one-piece tongs are made of seamless stainless steel. The tips are scooped and have sawtooth edges. Springs into open position when released. Conforms to NSF standards.] (figure A-1)
47	7340-00-488-7950	1	Knife, Cooks [Stamped, stainless steel blade measures 10" long. Has plastic or aluminum handle that is used best for cooking and general preparing of foods. Approximately 14½" long overall.] (figure A-1)
48	7330-00-205-3336	1	Wire Whip [Stainless steel, French-style whisk. Has seven to eight bow wires, firmly attached to the inside of the handle. Conforms to NSF standards. Made of .090 wire. Size 2½" diameter, 12" long.] (figure A-2)
49	K-RN1113	24	Insulated Tray Holder with Lid [Cambro] (figure A-2)
50	18014	1	Hose, Drain, High Temperature [Black, 4'long, ¾" diameter, female connectors (Melard).] (figure A-2)

51	**HMV400**	**2**	**Can Opener Adapter, Table Bushing [Adapts stainless Edlund can opener to stainless table (Babington Enterprises).] (figure A-2)**
52	**HMV500**	**1**	**Exhaust Elbow [Directs TRH exhaust downward in event HMMWV canvas cover is used in back of vehicle (Babington Enterprises).] (figure A-2)**
53	**HMV600**	**1**	**Strap Adapter [Adapts tiedown strap to HMMWV D-ring, if necessary (Comet Enterprises).] (figure A-2)**

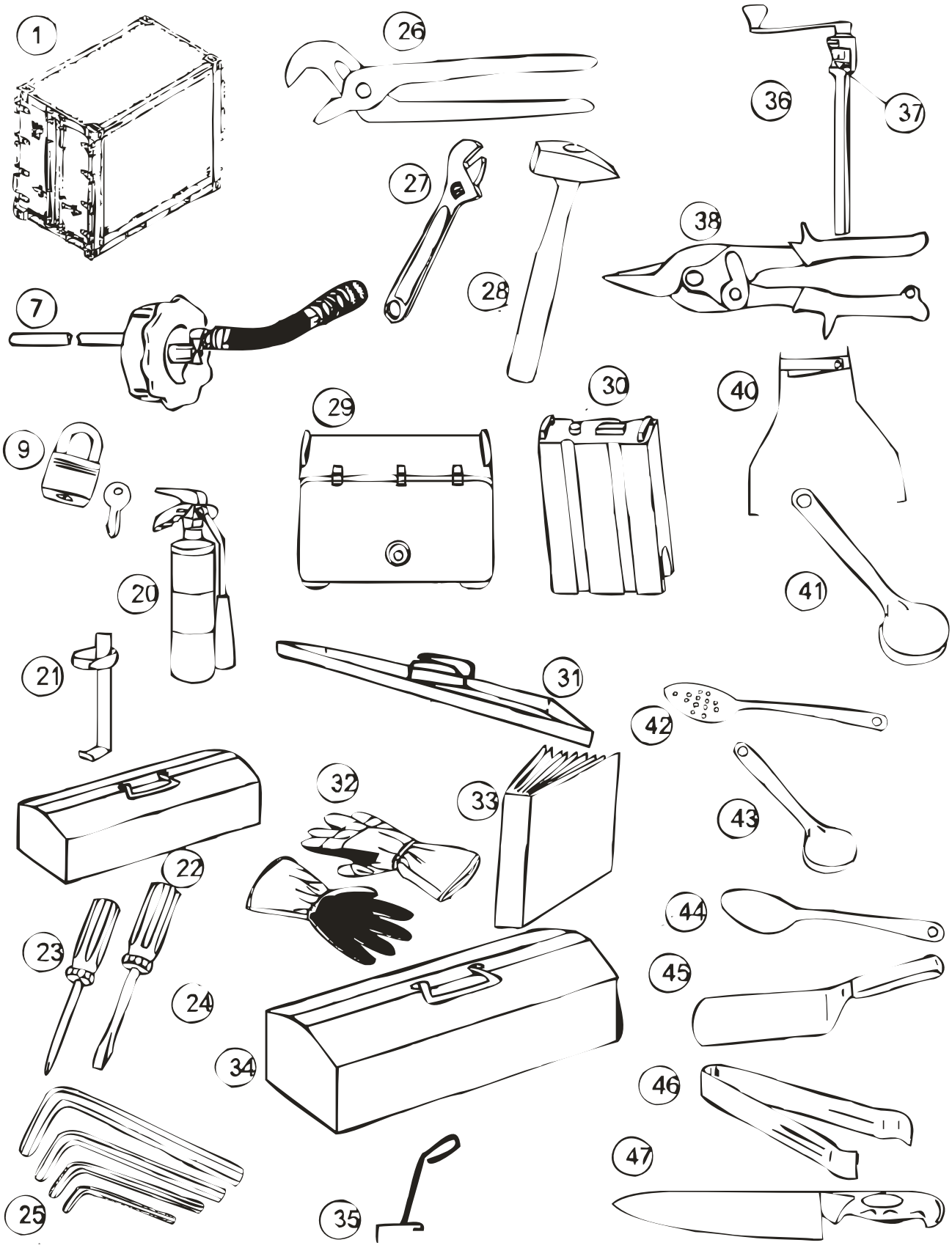


Figure A-1. Component Parts/Collateral Equipment

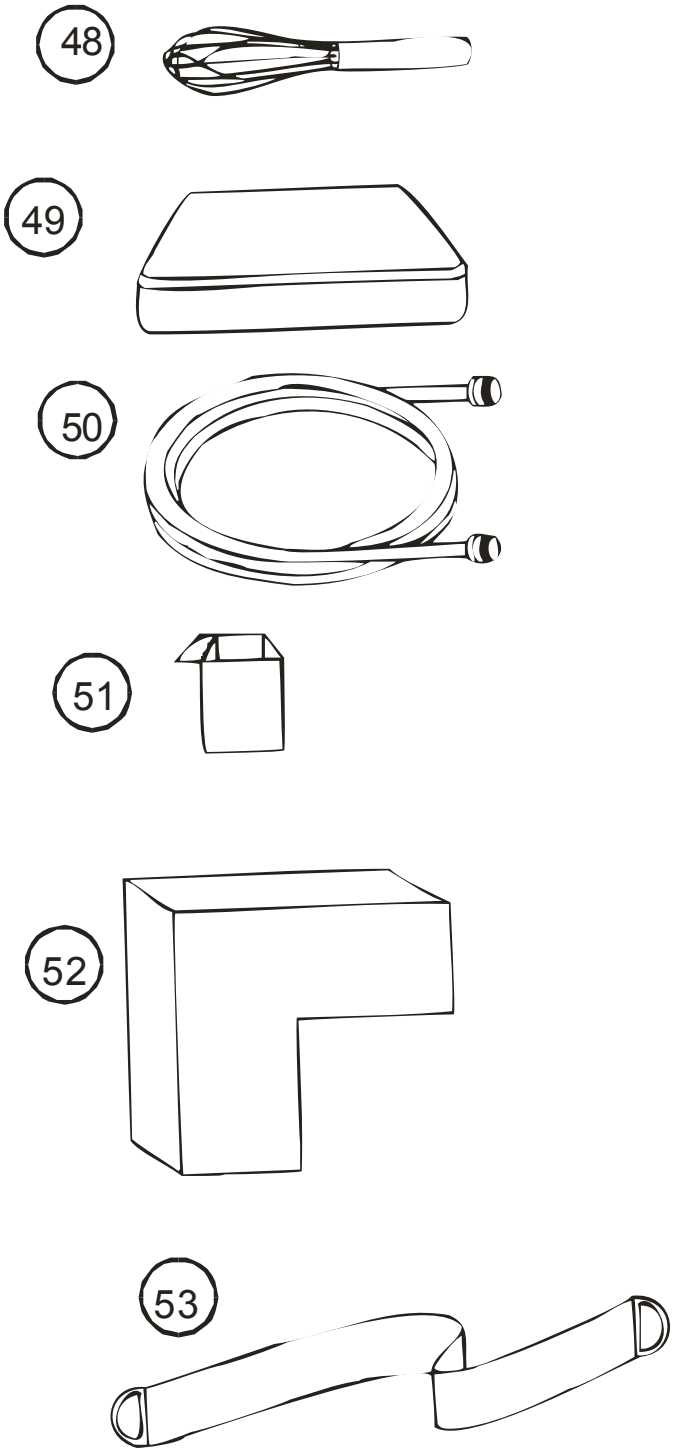


Figure A-2. Collateral Equipment

APPENDIX B

REPAIR PARTS LIST

AIRTRONIC BURNER

Item	Part No	Qty	Description
1-40	B42000-95-0001	1	Airtronic Burner, Complete [Babington Enterprises] (figure B-1)
1	B42000-95-0002	1	Double Shafted Motor and Compressor Assembly [Includes silencer assembly, piston/piston ring assembly, compressor head, check valve assembly, and filter; 75 watt, 120 VAC, 60 Hz, 3350 rpm (Babington Enterprises)] (figure B-1)
2	B42000-95-0003	1	Precision Bore Compressor Head, Check Valve Assembly, Filter, Retaining Plug, and Spacer [Babington Enterprises] (figure B-1)
3	B42000-95-0004	1	Compressor O-Ring and Piston Ring Assembly [Babington Enterprises] (figure B-1)
4	B42000-95-0005	1	Filter, Compressor [Babington Enterprises] (figure B-1)
5		1	Spacer (Not separately procurable)
6	B42000-95-0006	1	Compressor Solenoid Valve Body and Coil [Babington Enterprises] (figure B-1)
7	B42000-95-0010	1	Self-Priming/Recirculating Fuel Pump with Fluorsilicone Membrane [Babington Enterprises] (figure B-1)
8	B42000-95-0011	1	Shaft Coupling, Motor-Pump [Babington Enterprises] (figure B-1)
9	B42000-95-0013	1	Fuel Pump Solenoid Valve Body, Coil, and Cable [Babington Enterprises] (figure B-1)
10	B42000-95-0014	1	Fuel Pump Solenoid Cable [Babington Enterprises] (figure B-1)
11	B42000-95-0027	1	Atomizing Chamber Assembly (Includes backplate, air filter (2 pcs), backplate gasket, atomizer holder (2 pcs), atomizer (2 pcs), atomizer shields, feed tube (2 pcs), and atomizing chamber frontcup, ignition electrode, and gasket [Babington Enterprises]) (figure B-1)
12	B42000-95-0028	1	Ignition Electrode [Babington Enterprises] (figure B-1)
13	B42000-95-0023	1	Lower Fan Housing [Babington Enterprises] (figure B-1)
14	B42000-95-0039	2	Atomizing Chamber O-Ring [Babington Enterprises] (figure B-1)
15	B42000-95-0035	1	Burner Air Tube/Flame Tube Assembly [Babington Enterprises] (figure B-1)

16	B42000-95-0034	1	Flame Tube/Louver Assembly [Babington Enterprises] (figure B-1)
17	B42000-95-0034	1	Burner Air Tube [Babington Enterprises] (figure B-1)
18	B42000-95-0031	1	Front Mounting Plate and Gasket [Babington Enterprises] (figure B-1)
19	B42000-95-0038	1	Blower Wheel [Babington Enterprises] (figure B-1)
20	B42000-95-0029	1	Ignition Transformer and Retainer (115 V [Babington Enterprises]) (figure B-1)
21	B42000-95-0017	1	Primary Control Box (Satronic TF832.1, 110V, 50 Hz, 4A [Babington Enterprises] (figure B-1))
22	B42000-95-0018	1	Flame Sensing Photo Cell and Cable Holder Assembly [Babington Enterprises] (figure B-1))
23	B42000-95-0016	1	Base, Control Box (with quick connector male and quick connector female [Babington Enterprises]) (figure B-1))
24	B42000-95-0037	1	Overflow Safety Device [Babington Enterprises]) (figure B-1)
25	B42000-95-0042	1	Fuel Sump Gasket [Babington Enterprises]) (figure B-1)
26	B42000-95-0041	1	Gasket (Flow Control Module) [Babington Enterprises] (figure B-1)
27	B42000-95-0024	1	Fuel Flow Control Module (Includes firing rate control dial and O-ring [Babington Enterprises]) (figure B-1)
28	B42000-95-0042	2	O-Ring, Crossover Tube [Babington Enterprises] (figure B-1)
29	B42000-95-0036	1	Atomizing Chamber O-Ring Plug (For transport only [Babington Enterprises]) (figure B-1)
30	B42000-95-0025	1	Fuel Sump Assembly, Complete [Babington Enterprises] (figure B-1)
31	B42000-95-0040	3	Screw, Front Plate (MCS6X25 FZ, with 60 gr shore rubber bushing and 60 gr shore rubber washer [Babington Enterprises] (figure B-1))
32	B42000-95-0043	1	Compressor Air Filter Gasket [Babington Enterprises] (figure B-1)
33	B42000-95-0044	1	Compressor Air Filter Plug [Babington Enterprises] (figure B-1)
34	B42000-95-0026	1	Fuel Crossover Tube [Babington Enterprises] (figure B-1)
35	B42000-95-0020	1	Upper Fan Housing [Babington Enterprises] (figure B-1)
36	B42000-95-0045	2	Motor Mount Nut/Washer [Babington Enterprises] (figure B-1)

37	B42000-95-0022	1	Mounting Plate, Upper/Lower Housing [Babington Enterprises] (figure B-1)
38	B42000-95-0021	1	Blower Air Shutter [Babington Enterprises] (figure B-1)
39	B42000-95-0009	1	Compressor Air Line [Babington Enterprises] (figure B-1)
40	B42000-95-0019	1	Burner Power Cord (1.75m) [Babington Enterprises] (figure B-1)

TRAY RATION HEATER

Item	Part No	Qty	Description
41	TRH2020	1	Tray Ration Heater, Lid Assembly [Babington Enterprises] (figure B-2)
42	TRH1305	1	Gasket, Lid [Babington Enterprises] (figure B-2)
43	TRH1226	1	Retainer, Lid Gasket (4 pcs) [Babington Enterprises] (figure B-2)
44	TRH928A	1	Stop, Mount, Long [Babington Enterprises] (figure 1-5)
45	TRH928D	1	Pin, Lid Stop [Babington Enterprises] (figure 1-5)
46	TRH2050	1	Tray Ration Heater, Tank Assembly [Babington Enterprises] (figure 1-5)
47	TRH914	2	Skid [Babington Enterprises] (figure 1-3)
48	4C979-R2	4	Shock Mount [W.W. Grainger] (figure 1-3)
49	92210A83	8	5/16-18x1" Flat Head Socket Set Screw (Attaches shock mount base to skid; stainless steel [McMaster-Carr]) (figure B-3)
50	91893A030	8	5/16-18 Esna Lock Nut (Attaches shock mount base to skid; stainless steel [McMaster-Carr]) (figure B-3)
51	4P313	4	3/8-16x1" Hex Cap Screw (Attaches shock mount to TRH support; stainless steel [W.W. Grainger]) (figure B-3)
52	5X716	1	Drain Valve (Brass, 3/4" FNPT each end [W.W. Grainger]) (figure 1-3)
53	4X072	1	Adapter (Brass, 3/4" internal to 3/4" male hose thread; connects tank drain to drain valve [W.W. Grainger] (figure 1-3)
54	TRH1260	1	Cover, Airtronic Burner [Babington Enterprises] (figure 1-4)
55	92391A054	2	Quick Disconnect Clip with Lanyard (Retains Airtronic Burner on mounting saddle pins) [McMaster-Carr] (figure 1-7)
56	B-QC4-B1-400	1	Quick Disconnect Fuel Inlet [Washington Valve & Fitting] (figure 1-7)
57	B-QC4-D-4HC	1	Quick Disconnect Stem [Washington Valve] (figure 1-7)

58	TRH907	1	End, Outer Exhaust [Babington Enterprises] (figure 1-3)
59	TRH908A	1	Access Panel, Secondary, Electrical Control Box [Babington Enterprises] (figure 1-4)
60	TRH120B	1	Cover, Electrical Box [Babington Enterprises] (figure 1-4)
61	1492	1	Terminal Block (Style CA, 7 position [Allen-Bradley]) (figure B-4)
62	W58-XB1A4A-5	1	Circuit Breaker (5 Amp, 250 VAC max [Potter & Brumfield]) (figure B-4)
63	16-01	1	Liquid Level Switch (120 VAC, 60 cycle [Martron]) (figure B-4)
64	TRH1313	1	Insert, Martron Probe (Teflon [Babington Enterprises] (figure B-4)
65	TRH1314	1	Probe, Martron Sensor [Babington Enterprises] (figure B-4)
66	TOS-12C-L1	1	Mercury Tilt Switch [Mercury Displacement Ind.] (figure B-4)
67	60T21X-1236G	1	Thermodisc (L190-10F [Thermodisc]) (figure B-4)
68	800H-FRXTQ10RD4	1	Red, Pull-On/Push-Off Switch (Two position, illuminated, twist release, red cap, 120 VAC [Allen-Bradley]) (figure B-4)
69	2X464	1	Toggle Switch, Overtemperature (Two position, 10A-250 VAC [Grainger]) (figure B-4)
70	70205K41	1	Waterproof Toggle Boot [Grainger] (figure B-4)
71	PTO2E 12-3S	1	Quick Disconnect, Electrical, Bulkhead [Bendix] (figure B-4)
72	10-101960-123	1	Cap, Quick Disconnect, Electrical, Bulkhead (Waterproof [Bendix]) (figure B-4)
73	PTO6E 12-3P(SR)	1	Quick Disconnect, Electrical, Power Cord [Bendix] (figure B-3)
74	16/3SO/SOW	1	Power Cord (10' [Cut Cord]) (figure B-3)
75	H266HG	1	Power Inlet Plug, Power Cord (Hospital grade, 3 wire, 15A, 125V [Arrow-Hart]) (figure B-3)
76	S8-32F	32	Screw (#8-32, stainless steel, flat; for lid gasket retainer (22) and TRH electrical control box cover (10) [Babington Enterprises]) (figure B-3)
77	S10-32F	4	Screw (#10-32, stainless steel, round; for secondary electrical access panel [Babington Enterprises]) (figure B-3)
78	S10-32R	4	Screw (#10-32, stainless steel, round; for end, outer exhaust [Babington Enterprises]) (figure B-3)

79	TRH931	1	Removable Tray Pack Rack [Babington Enterprises] (figure 1-5)
80	TRH-FLT-001	1	Internal fuel line (c/o: female quick disconnect fuel inlet [parker P/N BH2-60Y-282]; 16" overall length of ¼" inside diameter fuel line hose, in 4" and 1' sections [McMaster-Carr P/N 54605K12];transperant fuel filter (Bosch P/N 54605K12); male nipple, ¼" hose to ¼" MNPT [McMaster-Carr P/N 5346K14]; coupling, ¼" internal hose to 1/8" MFNT to 1/8" MNPT [McMaster-Carr P/N 57085K41]; and four ¼" hose clamps [McMaster-Carr P/N 5321K14] (Babington Enterprises) (Figure 1-7)
81	L1	1	Vinle placard [15 ½" by 1 ¾", ½" red letters on yellow background: OPEN CAUTIOSLY-HOT WATER over DO NOT USE LID HANDLE FOR LIFTING, located on TRH tank underneath lid handle (Babington Enterprises)
82	L2	1	Aluminum Placard [8" by 1 ½", 6/8" black letters: HOT EXHAUST, located above TRH exhaust pipe (Babington Enterprises)
83	L3	1	Vinyl Placard (2 ¼" by 1", 3/16" blaock letters on white background: BOIL [7/16" space] AUTO. Located on TRH electrical control box over Boil/Auto switch (Babington Enterprises)
84	L4	1	Vinyl Plaard (2 ¼" by 1", 3/16" black letters on white background: PULL-ON over PUSH-OFF, located on TRH electrical control box under red, pull-on/push-off switch (Babington Enterprises)
85	L5	2	Vinyl Placard (9" by 2 ¼", 5/8" red letters on yellow background: DANGER! Over ½" letters: DO NOT USE GASOLINE, located on Airtronic Burner cover and below exhaust pipe (Babington Enterprises)

SELECTED MAINTEMAMNCE KIT COMPONENTS

ITEM	PART NO	QTY	DESRIPTION
86	mk-at	1	Small tool kit (10mm wrench (open/box); 11mm wrench (open/box); 5/8" wrench (open/box) 1/8" flat-tip screwdriver; and 3/16" flat tip screwdriver (Babington Enterprises)
87	SD-210	6	Air activated heater (Babington Enterprises)
88	B42000-95-0050	1	Airtronic troubleshooting test box (Babington Enterprises)

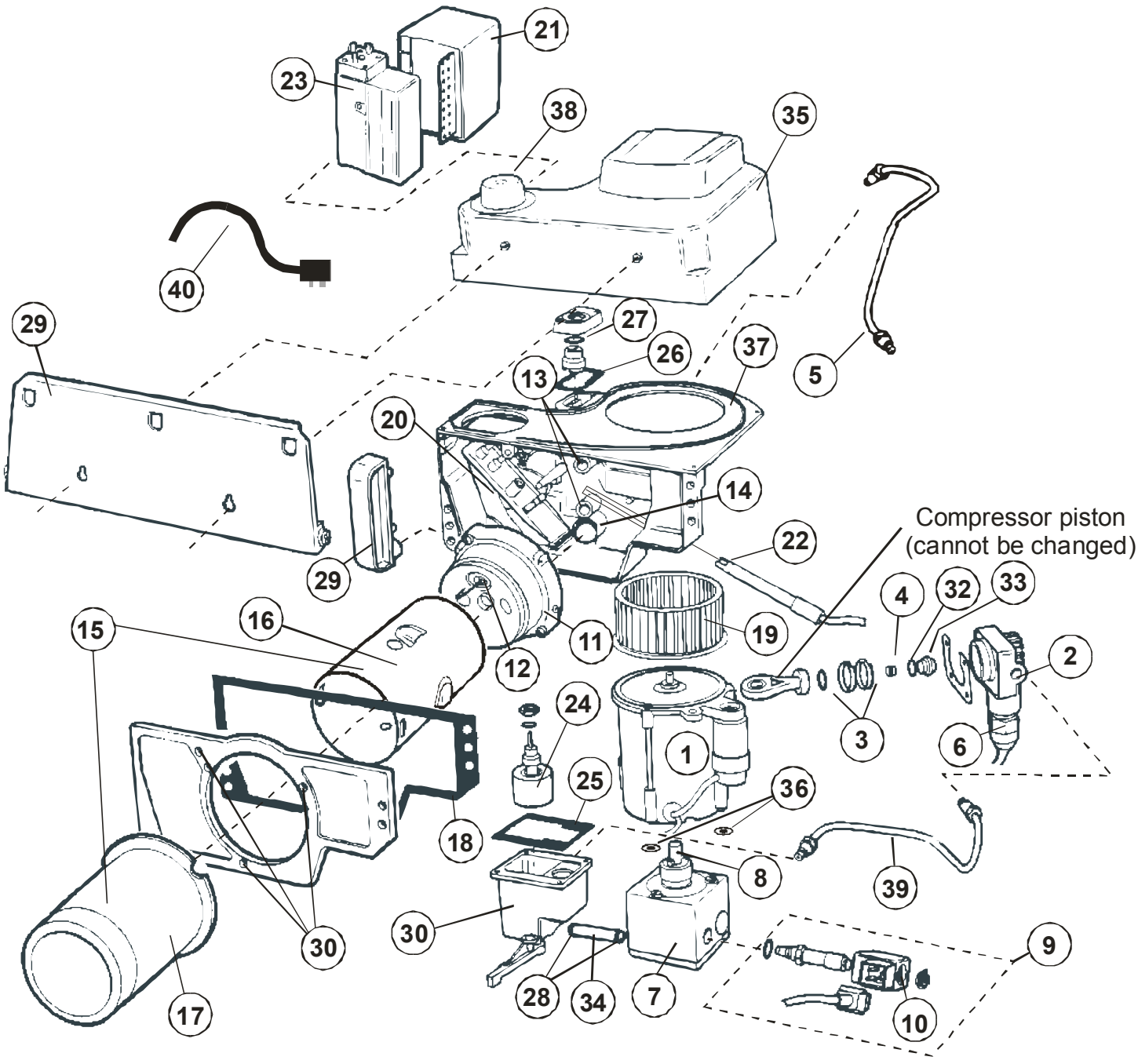


Figure B-1. Airtronic Burner

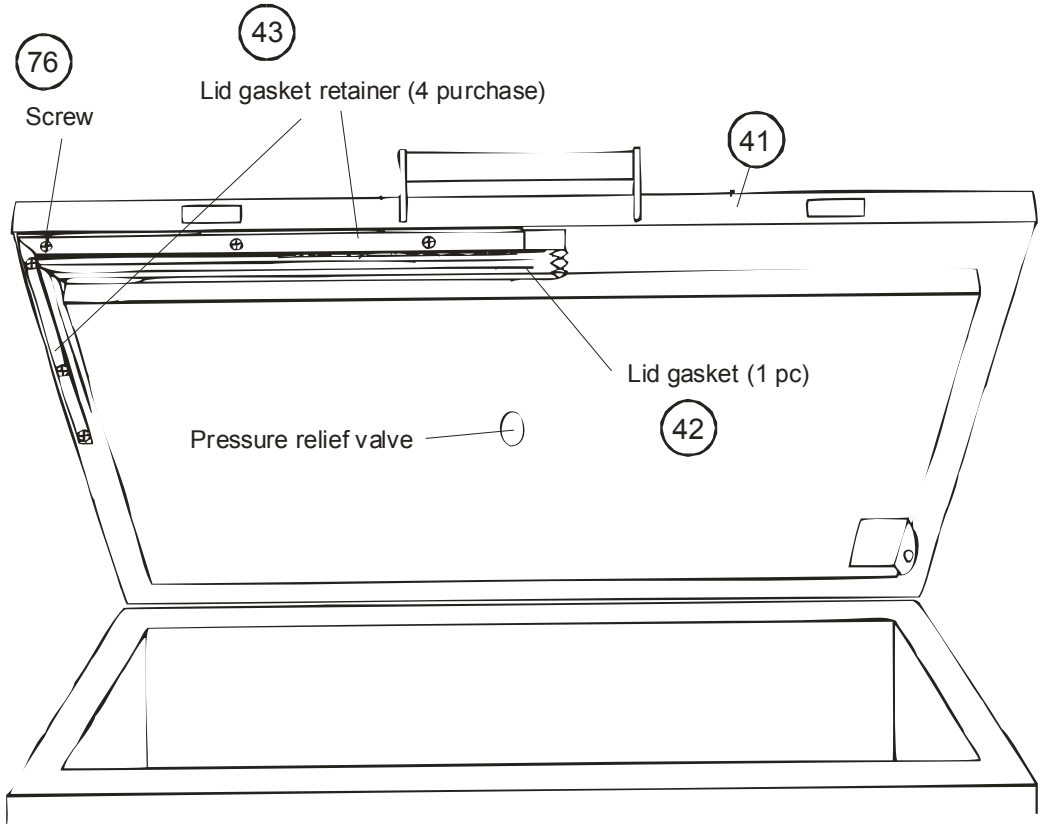


Figure B-2. Tray Ration Heater Lid Assembly

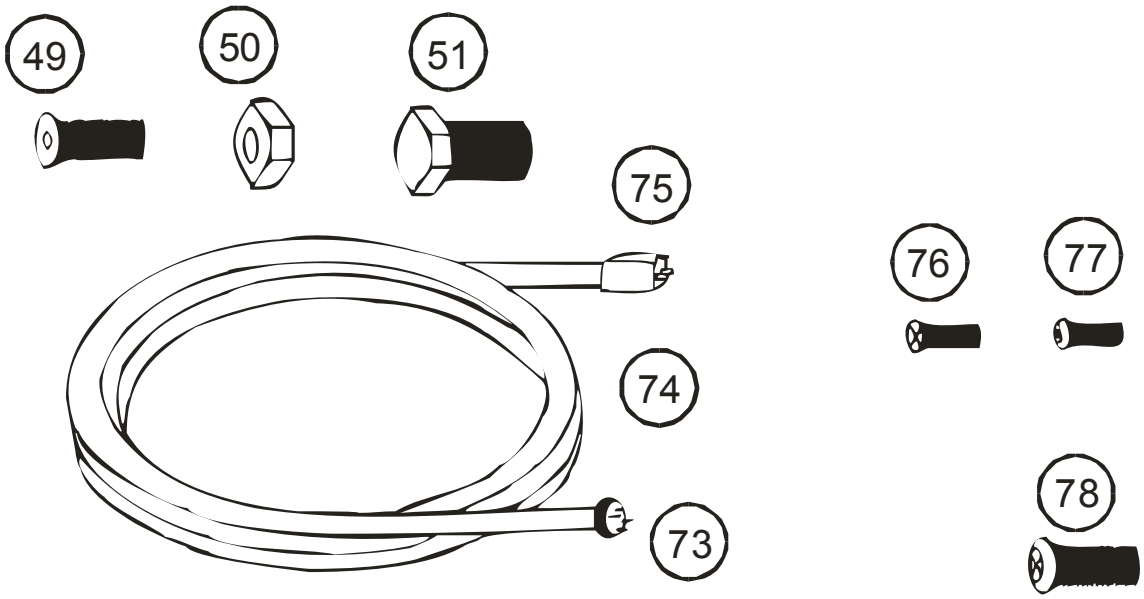


Figure B-3. TRH Screws, bolts/nuts, and power cord.

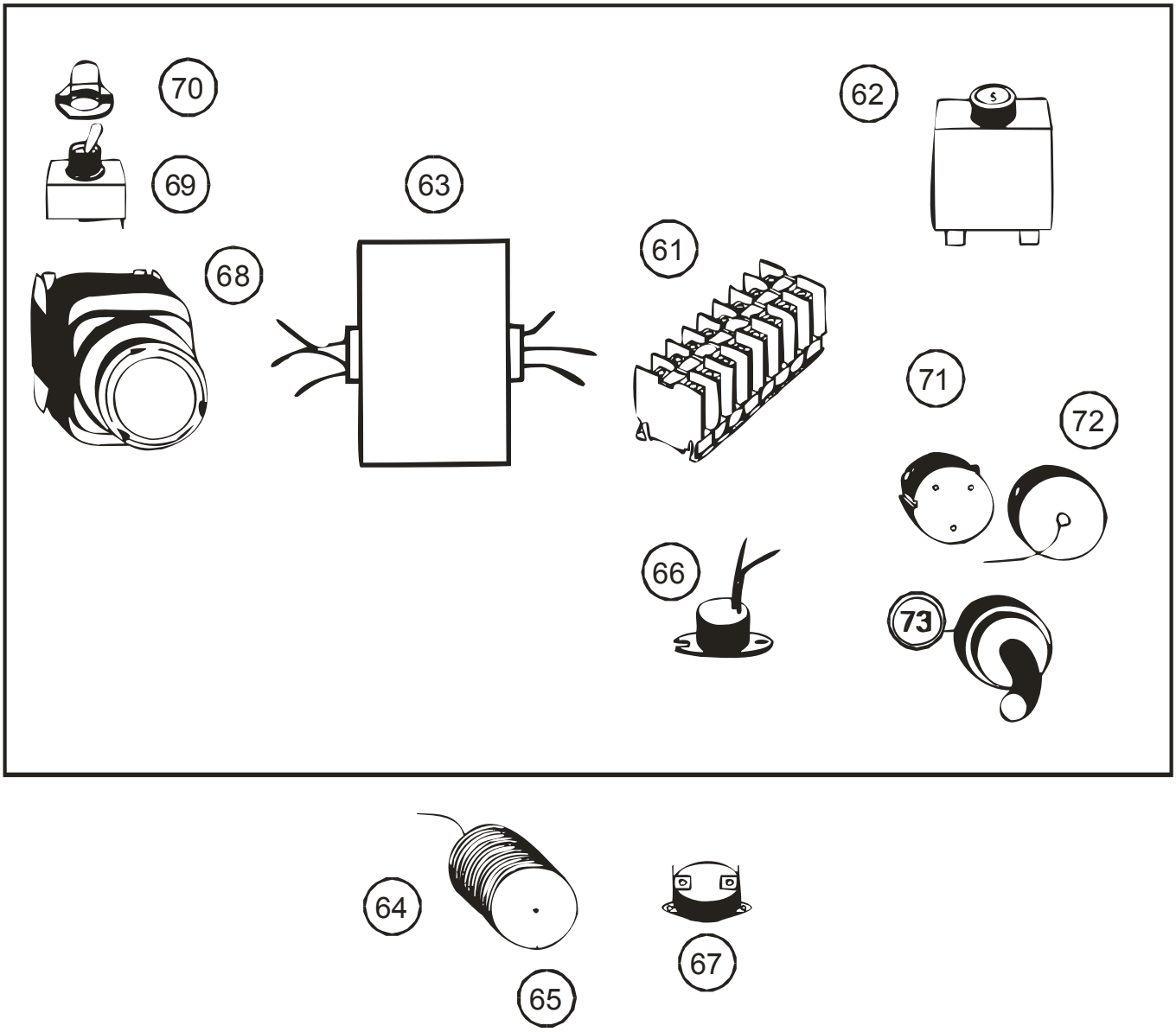


Figure B-4. TRH Electrical Control Box

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

Scotch Brite™	**14 pad box; rustproof steel wool with grease cutting detergents [3M Company]; use to clean foodservice utensils, exterior of Tray Ration Heater stainless steel surfaces, and remove mineral deposits from water level sensor probe on interior of Tray Ration Heater tank.**
WD-40®	**12 oz lubricant/penetrating oil; aerosol can [WD-40 Company]; use to lubricate and protect mounting bracket hinges and pins, table hinges, and tiedown strap ratchets.**
Dowfrost®	**Dowfrost® is a colorless, odorless liquid consisting of propylene glycol (95%), dipotassium phosphate (<5%), and deionized water (<5%). The boiling point is 370F. The flashpoint is 215F. It may be extinguished by water fog, alcohol foam, or dry chemical. It does not present a fire or explosive hazard. In the event of a spill, cover with absorbent material, soak up, and sweep into a bag. For disposal, incinerate or bury away from water supplies in accordance with local regulations. Dowfrost® may cause slight eye irritation, but is essentially nonirritating to the skin on prolonged contact. Single does oral toxicity is low. A single, prolonged inhalation is not likely to cause adverse effects. Repeated excessive ingestion may cause central nervous system effects. No carcinogenic effects have been observed in long-term animal studies. Birth defects are unlikely.**

First Aid:
Eyes: Irrigate immediately with water for 5 minutes.
Skin: Wash off with flowing water.
Inhalation: Remove to fresh air if effects occur. Consult medical attention.

Handling Precautions: No respiratory protection should be needed. No skin protection other than body covering should be needed. Use safety glasses. Exercise reasonable care and caution in storing and handling.

APPENDIX D

TRAY RATION PACKS AND MENUS

Purpose. The T Ration is designed to sustain groups of military personnel in highly mobile, field situations with good quality, nutritious, heat-and-serve meals. The T Ration is an integral part of the Marine Corps Field Feeding System.

Characteristics. Menu components are thermally processed, pre-prepared, shelf-stable foods. They are packaged in hermetically sealed, half-size, steam-table metal containers. The ration provides breakfast and lunch/dinner menus. The container serves as the package, heating pan, and serving tray. Each menu has been unitized. Instant beverages, nondairy creamers, hot sauce, and disposables (cups, 5-compartment trays, and utensils) are included in each module. A pallet load consists of 24 identical meal modules. The shelf life is a minimum of 3 years at 80°F. A unitized Cold Weather T Ration Supplement Module is available. The supplemental module contains Styrofoam clamshell trays and hot cups with lids, MRE pouch bread, candy, oatmeal cookie bars, soup, extra hot beverages, and non-dairy creamer.

	Average Net Weight/Module	Cube/Module
Breakfast	33 pounds	1.66 cubic feet
Dinner	45 pounds	1.66 cubic feet

Nutritional Data. Breakfast menus, including milk and bread supplements, provide an average of 1420 kilocalories (15% protein, 29% fat, and 56% carbohydrate) and the lunch/dinner menus, including milk and bread supplements, provide an average of 1420 kilocalories (17% protein, 30% fat, and 53% carbohydrate). The Cold Weather Supplement contains an additional 1020 kilocalories.

Requisition Information. Each individual tray pack item, meal module, and the cold weather supplement module have a National Stock Number. For situations that do not require unitized meals, individual cases of specific menu items (4 cans/case) can be ordered.

Preparation Requirements. Food personnel prepare the Tray Packs for serving. They should be heated, unopened, in the TRH for approximately 40 minutes at 180°F or opened and heated in an oven to an internal temperature of 165°F. Use the Edlund table-mounted opener to open the cans. Occasionally, tin snips prove useful in separating lid from can. Should the situation dictate, cans may be reheated once (then discarded). If a can has been heated, but not used, score the top with a diagonal line using a screwdriver. If a can is heated a second time, but again not used, score the top with another diagonal line (in the opposite direction). An "X" inscribed on the top of the can indicates the can must be destroyed and not served. Contact the Food Service Officer or Supply Officer for disposition instructions.

T Ration
Menu (FY95/96)

Day 1

Breakfast
8970-01-320-1849
Scrambled Eggs, Western Style
Potatoes w/Bacon Pieces
Peaches
Oatmeal, Instant, Assorted
Orange Juice, Instant

Lunch/Dinner
8970-01-320-4859
Chicken Breast w/Gravy
Glazed Sweet Potatoes
Corn
Yellow Cake w/Chocolate Crumb Topping
Lemon Beverage Powder

Day 2

Breakfast
8970-01-320-4850
Creamed Ground Beef
Potatoes w/Bacon Pieces
Oatmeal, Instant, Assorted
Coffee Cake w/Cinnamon Crumb Topping
Grape Juice, Instant

Lunch/Dinner
8970-01-320-4860
Lasagna
Green Beans
Chocolate Pudding
Grape Beverage Powder

Day 3

Breakfast
8970-01-320-4851
Scrambled Eggs, Plain
Ranchero Sauce
Ham Slices
Apple Dessert
Coffee Cake w/Cinnamon Crumb Topping
Orange Juice, Instant

Lunch/Dinner
8970-01-320-4861
Meatballs w/Gravy
White Rice
Mixed Vegetables
Chocolate Cake w/Vanilla Crumb Topping
Grape Beverage Powder

Day 4 **Breakfast**
8970-01-320-4852
Scrambled Eggs, Bacon, and Cheese
Pork Sausage Links
Pears
Spice Cake w/Vanilla Crumb Topping
Grape Juice, Instant

Lunch/Dinner
8970-01-320-4862
Boneless BBQ Pork Ribs
Hamburger Bun
Red Beans and Rice
Peas and Carrots
Yellow Cake w/Chocolate crumb Topping
Cherry Beverage Powder

Day 5 **Breakfast**
8970-01-320-4853
Corned Beef Hash
Coffee Cake w/Cinnamon Crumb Topping
Apple Dessert
Oatmeal, Instant, Assorted
Orange Juice, Instant

Lunch/Dinner
8970-01-320-4863
Beef Strips w/Peppers
Oriental Style Rice
Carrots, Sliced
Marble Cake w/Toffee Crumb Topping
Lemon/Lime beverage Powder

Day 6 **Breakfast**
8970-01-320-4854
Scrambled Eggs, Plain
Ranchero Sauce
Pork Sausage Links
Peaches
Spice Cake w/Vanilla Crumb Topping
Grape Juice, Instant

Lunch/Dinner
8970-01-320-4864
Chicken Chow Mein
Oriental Style Rice
Corn
Chocolate Cake w/Vanilla Crumb Topping
Lemon/Lime Beverage Powder

Day 7 **Breakfast**
8970-01-320-4855
Scrambled Eggs, Western Style
Ham Slices
Fruit Cocktail
Coffee Cake w/Cinnamon Crumb Topping
Oatmeal, Instant, Assorted
Orange Juice, Instant

Lunch/Dinner
8970-01-320-4865
Hamburger
Hamburger Bun
Pork and Beans
Peaches
Cheese Spread
Catsup/Relish/Mustard
Orange Beverage Powder

Day 8 **Breakfast**
8970-01-320-4856
Creamed Ground Beef
Potatoes w/Bacon Pieces
Spice Cake w/Vanilla Crumb Topping
Oatmeal, Instant, Assorted
Grape Juice, Instant

Lunch/Dinner
8970-01-320-6254
Spaghetti w/Meatballs
Green Beans
Marble Cake w/Toffee Crumb Topping
Cherry Beverage Powder

Day 9 **Breakfast**
8970-01-320-4857
Scrambled eggs, Bacon and Cheese
Ham Slices
Apple Dessert
Coffee Cake w/Cinnamon Crumb Topping
Orange Juice, Instant

Lunch/Dinner
8970-01-320-4866
Turkey Slices w/Gravy
Potatoes in Butter Sauce
Mixed Vegetables
Yellow Cake w/Chocolate Crumb Topping
Lemon/Lime Beverage Powder

Day 10 Breakfast
8970-01-320-4858
Corned Beef Hash
Pork Sausage Links
Oatmeal, Instant, Assorted
Coffee Cake w/Cinnamon Crumb Topping
Grape Juice, Instant

Lunch/Dinner
8970-01-320-4867
Beef Stew
White rice
Peas and Carrots
Marble Cake w/Toffee Crumb Topping
Grape Beverage Powder