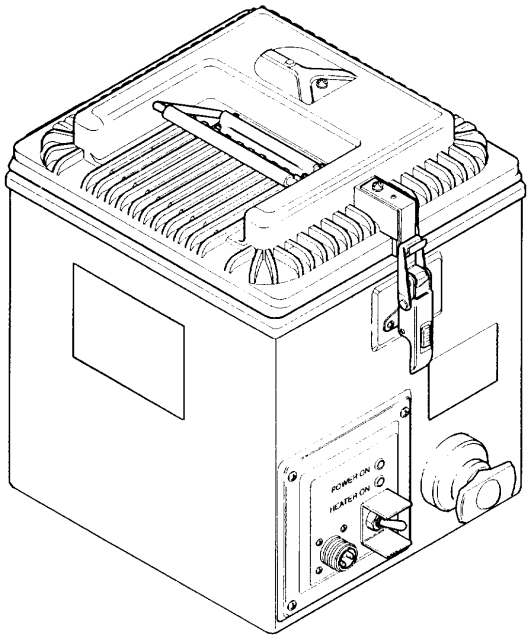
TECHNICAL MANUAL

OPERATOR'S AND UNIT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR HEATER, WATER AND RATION (HWR)

NSN 7310-01-387-1305



Model RAK-15

Model 471012

HEADQUARTERS, DEPARTMENT OF THE ARMY
22 JANUARY 1996

CHANGE NO. 1

HEADQUARTERS, DEPARTMENT OF THE ARMY
WASHINGTON, DC, 30 APRIL 2003

TECHNICAL MANUAL

OPERATOR'S, AND UNIT MAINTENANCE MANUAL, INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR HEATER, WATER AND RATION (HWR)

NSN: 7310-01-387-1305
MODEL RAK-15 AND 471012

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TM 10-7310-241-12&P, dated 22 JANUARY 1996, is updated as follows:

1. File this sheet in front of the manual for reference.

2. This change is a result of corrected or added National Stock Numbers (NSN)s and/or CAGEC codes and part numbers as well as an additional model number.

3. A vertical bar in the outer margin of the page indicates a new or updated change.

4. Remove old pages and insert new pages as indicated below:

Remove Pages	**Insert Pages**	**Remove Pages**	**Insert Pages**
Cover	Cover	4-9 to 4-12	4-9 to 4-12
a/(b blank)	a to b	----------	4-12.1 to 4-12.4
----------	A/(B blank)	4-13 to 4-14	4-13 to 4-14
i-iv	i-iv	----------	4-14.1 to 4-14.2
1-1 to 1-10	1-1 to 1-10	4-15 to 4-18	4-15 to 4-18
----------	1-11 to 1-13/(14blank)	----------	4-18.1 to 4-18.3/(4 blank)
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----------	2-2.1 to 2-2.2	----------	4-22.1 to 4-22.23/(24 blank)
2-3 to 2-8	2-3 to 2-8	Appendix B-1 to B-4	Appendix B-1 to B-4
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2-9 to 2-18	2-9 to 2-18	Appendix C-7 to C-18	Appendix C-7 to C-18
----------	2-18.1 to 2-18.3/(blank)	----------	Appendix C-18.1 to C-18.2
2-19 to 2-20	2-19 to 2-20	Appendix C-19 to C-20	Appendix C-19 to C-20
3-1 to 3-6	3-1 to 3-6	----------	Appendix C-20.1 to C-20.3/(4 blank)
----------	3-6.1/(2 blank)	Appendix D-1 to D-2	Appendix D-1 to D-2
3-7 to 3-10	3-7 to 3-10	Appendix E-1 to E-2	Appendix E-1 to E-2
----------	3-10.1 to 3-10.2	Glossary-1 to Glossary-2	Glossary-1 to Glossary-2
3-11 to 3-12	3-11 to 3-12	Index-1/(Index-2 blank)	Index-1/(Index-2 blank)
4-1 to 4-8	4-1 to 4-8	----------	Electronic 2028 Instructions/(Blank)
----------	4-8.1 to 4-8.2	Sample DA Form 2028	Sample DA Form 2028
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WARNING

- FIRST AID. Never work on the HWR unless there is another person present who is competent in administering first aid. The absence of first aid can result in serious personal injury or even death. Refer to FM 21-11 (First Aid for Soldiers) for appropriate first aid instructions.
- ELECTRIC SHOCK. Do not be misled by the term "low-voltage". Whenever possible turn off and disconnect the HWR power supply before performing any work. Potentials as low as 30 V dc can cause severe electric shock or death under adverse conditions.
- HEALTH HAZARD (1). Use the HWR to HEAT water only or to HEAT unopened prepackaged food and water. Using the HWR to prepare, boil, fry or cook food can be a hazard to health.
- HEALTH HAZARD (2). Prior to starting the vehicle, ensure the lid is closed and the latches are clamped down. Also, ensure the HWR is securely attached to its mounting bracket. Failure to comply can result in serious burn injuries.
- HIGH TEMPERATURES (1). Be aware that normal operating temperatures within the HWR are up to 190 ^{o}F (88 ^{o}C) and can reach higher temperatures under abnormal conditions. Always use gloves or other hand protection as necessary. Unprotected exposure to high temperatures can cause serious burn injuries.
- HIGH TEMPERATURES (2). The removable container and its handle may be HOT. Use gloves or other hand protection, or remove the lid and use the latch retaining lip on the front of the lid to remove the container.
- HIGH TEMPERATURES (3). If the HWR has been operating, internal components (e.g., heating element) may still be hot for up to 30 minutes after power is switched off or disconnected.
- OVERPRESSURE. Do not open the cover if the pressure relief valve is making a "hissing" noise or venting steam. Set the LO/OFF/HI switch to OFF, wait until the noise or steam has stopped then open the cover with extreme care using gloves or other hand protection as necessary. Failure to comply can result in serious burn injuries.
- HYGIENE WATER. Always cool heated water by adding sufficient cold potable water before using for hygiene purposes. Heated water can cause serious burn injuries.
- HEATED WATER. When dispensing heated water, always use a suitable vessel and avoid contact with the tap spigot, which will be extremely hot. Failure to comply can result in serious burn injuries.
- WATER SPILLAGE. Always ensure that the cover is properly closed and latched before operating the HWR or at any time that the host vehicle is mobile. Failure to secure the cover can result in the accidental spillage of water.
- OVERFILLING (1). When heating water only, do not fill the outer container above the one-gallon level. Overfilling can result in the accidental spillage of heated water.
- OVERFILLING (2). When heating water and unopened rations, do not fill the outer container above the 40 fluid ounce level. Overfilling can result in the accidental spillage of heated water.
- WATER/FOOD CONTAMINATION (1). Only use the inner container for carrying, holding and heating clean potable water or heating unopened rations. Using the inner container for any other purpose (e.g., personal hygiene) can result in contamination of water or food.

WARNING

- WATER/FOOD CONTAMINATION (2). Always ensure that the inner container and cover are clean before fitting them to the HWR. Dirt or other debris will result in the contamination of water or food.

- NON-POTABLE/DIRTY WATER (1). Only use clean, potable water as defined in FM 10-52 (Water Supply in Theaters of Operations) when filling the outer container. Non-potable or dirty water can cause contamination of water or food.

- NON-POTABLE/DIRTY WATER (2). Only use clean, potable water as defined in FM 10-52 (Water Supply in Theaters of Operation) when cleaning the HWR. Non-potable or dirty water can cause contamination of water or food.

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LIST OF EFFECTIVE PAGES

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Change .. 1 .. 30 April 2003

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Page / WP No.	Change No.	Page / WP No.	Change No.
Front Cover	1	4-13 to 4-14	1
a/b	1	4-14.1 to 4-14.2	1
A/(B blank)	1	4-15 to 4-18	1
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2-1 to 2-2	1	Appendix A-1/(A-2 blank)	0
2-2.1 to 2-2.2	1	Appendix B-1 to B-4	1
2-3 to 2-8	1	Appendix B-4 to B-4.1/(2 blank)	1
2-8.1 to 2-8.2	1	Appendix C-1 to C-6	0
2-9 to 2-18	1	Appendix C-7 to C-18	1
2-18.1 to 2-18.3/(blank)	1	Appendix C-18.1 to C-18.2	1
2-19 to 2-20	1	Appendix C-19	1
3-1 to 3-6	1	Appendix C-20 to C-20.3/(4 blank)	1
3-6.1/(2 blank)	1	Appendix D-1 to D-2	1
3-7 to 3-10	1	Appendix E-1 to E-2	1
3-10.1 to 3-10.2	1	Appendix F	0
3-11 to 3-12	1	Glossary-1 to Glossary-2	1
4-1 to 4-8	1	Index-1/(Index-2 blank)	1
4-8.1 to 4-8.2	1	Sample DA Form 2028	1
4-9 to 4-12	1	DA Form 2028	1
4-12.1 to 4-12.4	1		

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TECHNICAL MANUAL
No. TM 10-7310-241-12&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 22 JANUARY 1996

OPERATOR'S AND UNIT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR HEATER, WATER AND RATION (HWR)

NSN 7310-01-387-1305
For
Models RAK-15 and 471012

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Soldier and Biological Command, ATTN: ASSB-RIM-L(N), Kansas Street Natick, Ma. 01760-5052.

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TABLE OF CONTENTS

		Page
CHAPTER 1	**INTRODUCTION**	1-1
Section I	General Information	1-3
Section II	Equipment Description and Data	1-10
Section III	Principles of Operation	1-11
CHAPTER 2	**OPERATING INSTRUCTIONS**	2-1
Section I	Description and Use of Operator's Controls and Indicators	2-2
Section II	Preventive Maintenance Checks and Services (PMCS)	2-3
Section III	Operation Under Usual Conditions	2-8
Section IV	Operation Under Unusual Conditions	2-20
CHAPTER 3	**OPERATOR MAINTENANCE INSTRUCTIONS**	3-1
Section I	Operator's Lubrication Instructions	3-1
Section II	Operator's Troubleshooting Procedures	3-2
Section III	Operator's Maintenance Procedures	3-6
CHAPTER 4	**UNIT MAINTENANCE INSTRUCTIONS**	4-1
Section I	Repair Parts, Tools, Special Tools, Test, Measurement and Diagnostic Equipment (TMDE); Support Equipment	4-1
Section II	Service Upon Receipt	4-2
Section III	Preventive Maintenance Checks and Services (PMCS)	4-2
Section IV	Unit Troubleshooting Procedures	4-4
Section V	Unit Maintenance Procedures	4-9
Section VI	Preparation for Storage or Shipment	4-22

TABLE OF CONTENTS (Continued)

Page

APPENDIX A REFERENCES A-1

APPENDIX B MAINTENANCE ALLOCATION CHART (MAC) B-1

Section I Introduction B-1
Section II Maintenance Allocation Chart Model RAK-15 ..... B-4
Section II.1 Maintenance Allocation Chart Model 471012 ..... B-4.1
Section III Tools and Test Equipment B-4
Section IV Remarks B-4

APPENDIX C REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL) C-1

Section I Introduction C-1
Section II Repair Parts List C-7
Section III Special Tools List C-18
Section IV Cross-reference Indexes C-18

APPENDIX D COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS

Section I Introduction D-1
Section II Components of End Item List D-2
Section III Basic Issue Items List D-2

APPENDIX E EXPENDABLE AND DURABLE ITEMS LIST E-1

Section I Introduction E-1
Section II Expendable and Durable Items List E-2

APPENDIX F OPERATOR'S LUBRICATION INSTRUCTIONS F-1

GLOSSARY Glossary-1

Section I Abbreviations Glossary-1
Section II Definition of Unusual Terms Glossary-2

INDEX Index-1

HOW TO USE THIS MANUAL

Depending upon the particular requirement, the information contained in this manual can be accessed by using any one of the following three methods:

a. Front Cover Index. Use the front cover index and corresponding page locator "bleeds" to access the required chapter or appendix. The first page of each chapter contains an index, which provides a listing of the chapter contents. The first section or paragraph in each appendix provides a description of the purpose and contents of the appendix.

b. List of Contents. Use the Table of Contents to obtain the page number associated with the required chapter, section or appendix.

c. Index. Use the Index to obtain the alphabetical location of the subject matter of interest.

The following brief descriptions of the major divisions of the manual are provided as a general guide to where information can be found:

Chapter 1 - Introduction.

This chapter provides general information and gives a brief description of the Heater, Water and Ration (HWR) and its purpose.

Chapter 2 - Operating Instructions.

This chapter describes the operator's controls and indicators, operator's PMCS and operation of the HWR under usual/unusual conditions.

Chapter 3 - Operator Maintenance Instructions.

This chapter contains the lubrication instructions, troubleshooting procedures and maintenance procedures, which can be performed by operating personnel.

Chapter 4 - Unit Maintenance Instructions.

This chapter contains the repair, service upon receipt, check procedures, unit PMCS, troubleshooting procedures, maintenance procedures and preparation for storage or shipment, performed by unit maintenance personnel.

Appendix A - References.

This appendix lists the Forms, Field Manuals, Technical Manuals, Army Regulations, Department of the Army Pamphlets and Miscellaneous Publications referenced in this manual.

Appendix B - Maintenance Allocation Chart (MAC).

This appendix includes the Maintenance Allocation Chart, which designates the overall authority and responsibility for the performance of maintenance functions on end items or components.

Appendix C - Repair Parts and Special Tools List (RPSTL).

HOW TO USE THIS MANUAL (Continued)

This appendix illustrates and lists the authorized replacement parts for the HWR.

Appendix D - Components of End Items (COEI) and Basic Issue Items (BII) Lists.

This appendix illustrates and lists the COEI and BII for the HWR.

Appendix E - Expendable and Durable Items List.

This appendix lists items that are used to operate and maintain the HWR.

Appendix F - Operators Lubrication Instructions.

This appendix contains the statement "Lubrication Not Required".

Glossary - Defines abbreviations and unusual terms found in this manual and not listed in AR 310-25 (Dictionary of United States Army Terms)

Index - Alphabetically lists the names and paragraph numbers of subjects found in this manual.

Metric Conversion Chart - Printed on the inside of the rear cover. All measurements in this manual are given in U.S. standard units with the equivalent metric units in parentheses.

CHAPTER 1

INTRODUCTION

Page

Section I	GENERAL INFORMATION	1-3
1-1	Scope	1-3
1-2	Maintenance Forms and Procedures	1-3
1-3	Safety, Care and Handling	1-3
1-4	Corrosion Prevention and Control (CPC)	1-4
1-5	Destruction of Army Materiel to Prevent Enemy Use	1-4
1-6	Preparation for Storage or Shipment	1-4
1-7	Reporting Equipment Improvement Recommendations (EIR)	1-4
1-8	Warranty Information	1-4
1-9	Common Name/Official Nomenclature Cross-reference List	1-5
1-10	List of Abbreviations	1-5
Section II	EQUIPMENT DESCRIPTION AND DATA	1-5
1-11	Equipment Characteristics, Capabilities and Features	1-6
1-12	Location and Description of Major Components for Model RAK-15	1-7
1-12.1	Location and Description of Major Components for Model 471012	1-8
1-13	Equipment Data	1-10
Section III	PRINCIPLES OF OPERATION	1-11
1-14	HWR Functional Description	1-11

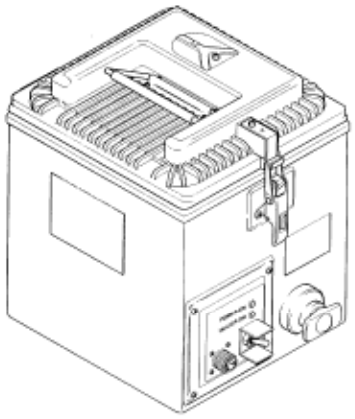


**Figure 1-0. Heater, Water and Ration (HWR)
(Model RAK-15)**

**Figure 1-0.1 Heater, Water and Ration (HWR)
(Model 471012)**

Section I. GENERAL INFORMATION

1-1. SCOPE

a. Type of Manual. Operator's and Unit Maintenance Manual including Repair Parts and Special Tools List.

b. Model Number and Equipment Name. Heater, Water and Ration (HWR): 7310-01-387-1305 for Models RAK-15 and 471012.

NOTE

This technical manual, TM 10-7310-241-12&P, contains two distinctly different models of the HWR each with their own separate model numbers. Please be aware that when performing maintenance procedures or ordering replacement parts you will need to find the corresponding information for either Model RAK-15 or Model 471012. The current NSN for both models is 7310-01-387-1305.

c. Purpose of Equipment.

(1) The HWR provides a mounted potable water and prepackaged rations heating facility for the crew of any military vehicle, which has a 22 - 28 V dc (24 V dc nominal) electrical system. Operation is possible at any time (including full battle conditions) in any climate while stationary or mobile.

(2) When used for water only, the HWR heats approximately one gallon of potable water for beverages, hygiene or medical Purposes.

(3) When used for rations the HWR heat up to five unopened MRE entrees together with 40 fluid ounces of potable water.

(4) With the cover closed and locked the HWR can keep the contents hot for as long as operationally required.

1-2. MAINTENANCE FORMS AND PROCEDURES

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750 (The Army Maintenance Management System (TAMMS)) as contained in the Maintenance Management Update.

1-3. SAFETY, CARE AND HANDLING

a. For artificial respiration procedures, refer to FM 21 -11 (First Aid for Soldiers).

b. The HWR uses a power supply of 22 - 28 V dc (24 V dc nominal). Ensure that the power supply is turned off whenever the HWR is not being operated. Use extreme care if performing troubleshooting or maintenance procedures with the power supply connected.

c. The maximum temperature in the HWR is 160 ^{O}F (71 ^{O}C) or 190 ^{O}F (88 ^{O}C) during normal operation and can reach 205 ^{O}F (96 ^{O}C) (Model RAK-15), or 239 ^{O}F (Model 471012) during overheat conditions before automatic shutdown occurs. Take care to avoid burns if the cover is opened immediately after the HWR has been in operation and be aware that internal heat is retained for long periods when the cover is kept closed.

1-3. SAFETY, CARE AND HANDLING (Continued)

d. Use standard hand tools when tightening bolts, nuts and screws and only tighten with sufficient torque to ensure that the associated part is held firmly in position.

e. Ensure the latch hook is properly engaged with the flat center part of the fold-down wire handle before using the cover to remove the inner container and its contents from the HWR.

f. To avoid accidental damage or contamination, ensure the cover and inner container are placed in a safe, clean location when removed from the HWR.

1-4. CORROSION PREVENTION AND CONTROL (CPC)

a. Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is therefore important that any corrosion problem with this equipment is reported so that it can be corrected and improvements made to prevent the problem on future equipments.

b. While corrosion is typically associated with the rusting of metals it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling or breaking of these materials may be caused by a corrosion problem.

c. If a corrosion problem is identified it can be reported using SF 368 (Product Quality Deficiency Report). The use of keywords such as "corrosion", "rust", "deterioration" or "cracking" will ensure that the information is identified as a CPC problem.

d. The completed form should be submitted to the address specified in DA PAM 738-750 (The Army Maintenance Management System (TAMMS)).

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For appropriate instructions, refer to TM 750-244-3 (Procedure for Destruction of Equipment to Prevent Enemy Use).

1-6. PREPARATION FOR STORAGE OR SHIPMENT

Preparation of the HWR for storage or shipment is covered in Chapter 4, Section VI of this manual.

1-7. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your HWR needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on a SF 368 (Product Quality Deficiency Report). Mail it to us at Commander, U.S. Army Soldier and Biological Command, ATTN: ASSB-RIM-L(N), Kansas Street Natick, Ma. 01760-5052. We will send you a reply.

1-8. WARRANTY INFORMATION

The HWR is warranted for 12 months. The warranty starts on the date entered in Block 23, DA Form 2408-9 in the logbook. Report all defects in material and workmanship to your supervisor who will take the appropriate action.

1-9. COMMON NAME/OFFICIAL NOMENCLATURE CROSS-REFERENCE LIST

A cross-reference between the common names used throughout this manual and the official nomenclature is provided in the following listing:

COMMON NAME	OFFICIAL NOMENCLATURE
Bucket (Model 471012)	Container Assembly
Connector Plug	Connector, Plug, Electrical
Connector Receptacle	Connector, Receptacle, Electrical
Control Panel	Control Panel Assembly
Cover	Cover Assembly
Heater	Heater Assembly
HEATER ON lamp	LED, Yellow
Heating Element	Element, Electrical
HWR	Heater, Water and Ration (HWR)
Inner Container	Container Assembly, Inner
Latch	Catch, Clamping
LO/OFF/HI Switch	Toggle Switch Assembly
Main Case	Main Case Assembly
Outer Container	Container Assembly, Outer
Overheat Sensor	Thermistor Assembly
PCB	PCB Assembly
Power Cable	Cable Assembly, Power, Electrical
POWER ON Lamp	LED, Green
Tap	Tap Assembly
Thermal Protector (Model 471012)	Switch, Thermal
Spigot (Model 471012)	Faucet, Single

1-10. LIST OF ABBREVIATIONS

Refer to Section I of the Glossary for an alphabetical list of the abbreviations used in this manual and their exact meaning.

Section II. EQUIPMENT DESCRIPTION AND DATA

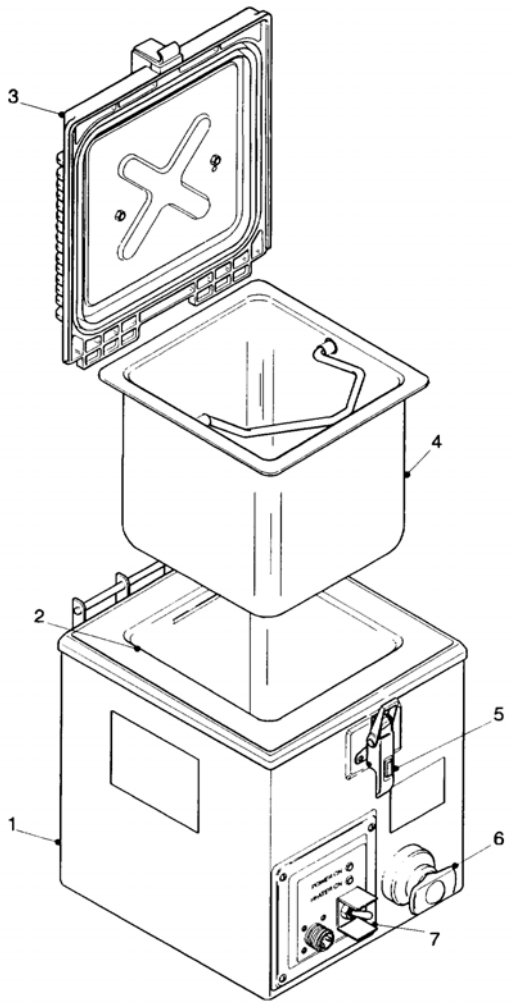
1-11. EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES

a. Characteristics.	Model RAK-15	Model 471012
	Operates in any military vehicle with a 22 - 28 V dc (24 V dc nominal) power supply.	Operates in any military vehicle with 24 V dc power supply.
	Switch-selected low (LO) heating range of 150 -160 ^{O}F (66 - 71 ^{O}C).	Switch position I heating range of 150 -160 ^{O}F (66 - 71 ^{O}C).
	Switch-selected high (HI) heating range of 180 -190 ^{O}F (82 - 88 ^{O}C).	Switch position II has a heating range of 180 -190 ^{O}F (82 - 88 ^{O}C).
	Switch-selected OFF setting.	Switch-selected OFF setting.
	Automatic protection against power supply reverse polarity connection, undervoltage conditions, and overvoltage surges.	Automatic protection against power supply overvoltage surges, and overheat conditions. There is no automatic protection for reverse polarity connection.
	Automatic shutdown protection against overheat and "boil-dry" conditions.	Automatic shutdown protection against overheat conditions.
	Non-spill operation under all conditions of service.	Non-spill operation, except through the pressure relief valve if tipped.

b. Capabilities.	Model RAK-15	Model 471012
	Heats up to one gallon of potable water.	Heats up to 1.05 gallons of potable water.
	Heats up to five MRE entrees, or equivalent unopened prepackaged food, and 40 fluid ounces of potable water.	Heats up to five MRE entrees, or equivalent unopened prepackaged food, and 40 fluid ounces of potable water.
	Keeps contents hot for extended periods of time when the cover is closed and latched.	Keeps contents hot for extended periods of time when the cover is closed and latched.

c. Features.	Model RAK-15	Model 471012
	Visual indication of power and heating status.	Visual indication of power and heating status.
	Dual-action pressure/vacuum relief facility for safe operation.	Relief valve only provides pressure relief. Vacuum relief is achieved by momentarily opening the spigot.
	Insulated for reduced heat loss and the safety of personnel.	Insulated for reduced heat loss and the safety of personnel.

1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS FOR MODEL RAK-15



1 MAIN CASE. This is a stainless steel open-box structure, which acts as the outermost housing insulated by preformed fiber blocks. Three stainless steel 5/16 inch fixing studs enable secure installation in the host vehicle. The top edge is fitted with a preformed flexible rubber seal that engages with a matching seal on the cover to form a steam/watertight joint when the latter is closed and latched. The bottom of the case is closed by a welded base plate that has four preformed "feet" for mounting.

2 OUTER CONTAINER. This is a food-quality seamless stainless steel vessel, which is capable of holding up to one gallon of potable water (inner container removed) or 40 fluid ounces of potable water (inner container in place). An integral heater is externally attached to the bottom surface and water can drain-off by means of a dispensing outlet that operates in conjunction with the tap.

3 COVER. This is a molded plastic cookware structure with internal air cavities acting as heat barriers and fitted with a removable pressure/vacuum relief valve. The rear edge connects with a hinge pivot bar on the main case and the front edge carries a metal hook that engages with the latch. The bottom edge is fitted with a preformed flexible rubber seal, which engages, with a matching seal on the main case to form a steam/watertight joint when closed and latched. When removed the cover allows user access to the inner and outer containers and also acts as a suitable lifting device for the inner container.

1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS FOR MODEL RAK-15 (Continued)

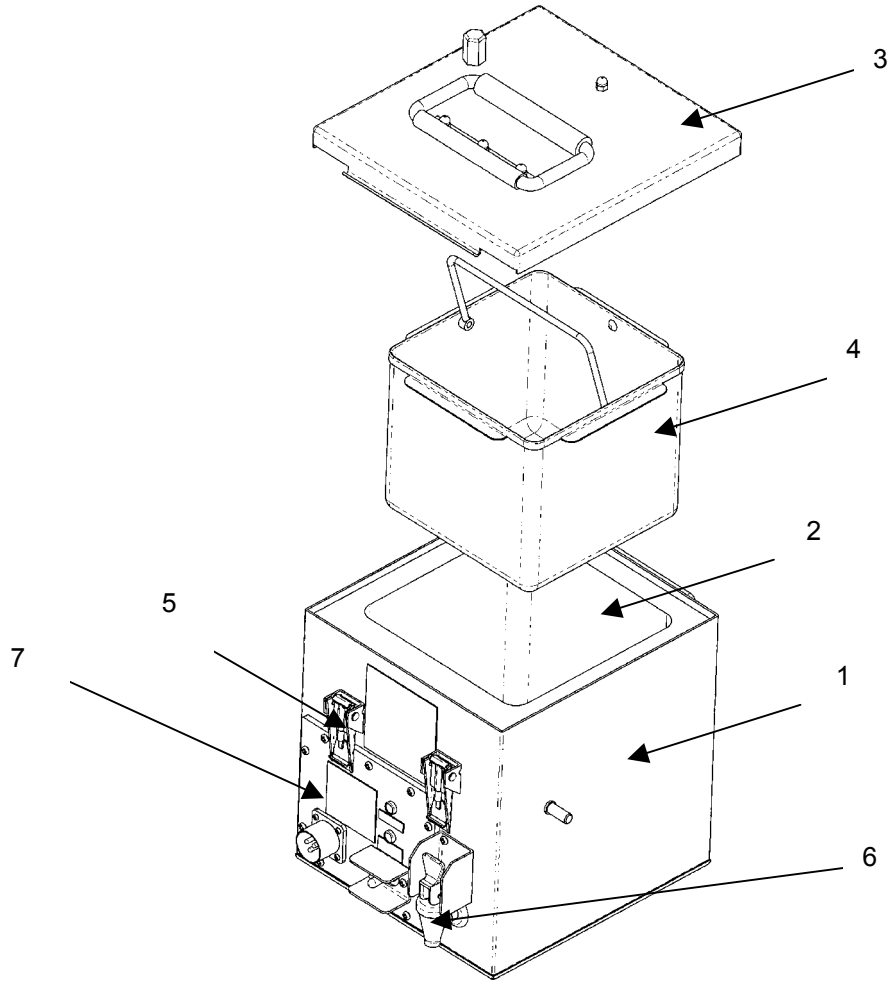
4 INNER CONTAINER. This is a food-quality seamless stainless steel vessel, which is capable of holding up to five unopened MRE entrees or equivalent unopened prepackaged food. The container is placed within the outer container and has a fold-down wire handle to facilitate lifting either by hand or by means of the metal hook on the cover. The handle is easily removed for cleaning or sanitizing purposes.

5 LATCH. This is a quick-release toggle clip, which in conjunction with the hook on the cover, holds the cover securely in position under all conditions. The latch mechanism self-locks in the "fully-down" position and will release only after upward pressure is applied to a slide-action unlocking button.

6 TAP. This is a spring-loaded, pull-to-operate valve, which allows water to drain from the outer container and dispensed via a spigot. Protection of the operator against accidental burning is provided by a heatproof plastic shroud.

7 CONTROL PANEL. This provides for the connection of the power supply and carries the operator electrical controls and indicators. The panel is sealed to the main case by a flat silicone rubber gasket and is easily removable for repair at Unit level.

1-12.1 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS FOR MODEL 471012



1-12.1 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS FOR MODEL 471012 (Continued)

1 MAIN CASE. This is a stainless steel open-box structure, which acts as the outermost housing for the HWR. The bottom of the case has a base plate, which contains three pre-formed feet for mounting. The user is able to secure the main case to their vehicle for safe usage.

2 OUTER CONTAINER. This is a stainless steel vessel capable of holding up to 1.05 gallons of potable water (inner container removed) or 40 fluid ounces of potable water (inner container in place). A heater is attached to the bottom surface. The water drains by means of a dispensing outlet at the bottom corner of the main container by using the spring-loaded spigot lever.

3 COVER. The cover contains a pressure relief valve on the top surface. The rear edge of the cover connects to the main case and the front edge of the cover contains a bar that will hook and secure the two latches. The cover has a spring-activated handle for easy lifting. When removed the cover allows user access to the inner and outer containers.

4 INNER CONTAINER. This is stainless steel vessel capable of holding up to five unopened MRE entrees, or equivalent unopened prepackaged food. The inner container fits inside the outer container and has a fold-down handle to facilitate lifting.

5 LATCHES. There are two self-locking quick-release latches on the main case, which hook on the cover to hold the cover securely in position.

6 SPIGOT. The lever on top of the spigot is spring-loaded. The lever can rotate 180 degrees and be locked in the open position.

7 CONTROL PANEL. The panel provides the connection for the supply of power and contains the operator electrical controls and indicators. The panel is easily removable for repair at the unit level.

1-13. EQUIPMENT DATA

a. Physical Data.

	Model RAK-15	Model 471012
Height (closed, handle up)	12.5 in. (318 mm)	11.92 in.
Height (closed, handle down)	10.5 in. (267 mm)	9.92 in. (252 mm)
Height (cover fully open)	19.0 in. (483 mm)	20 in.
Width	8.5 in. (216 mm)	8.95 in. (227 mm)
Depth	11.5 in. (292 mm)	12 in. (310 mm)
Weight	17 lbs (7.7 kg)	18 lbs

b. Fixtures/Fittings.

	Model RAK-15	Model 471012
Power connector	3-pin shrouded plug.	3-pin shrouded plug.
Power Switch	LO/OFF/HI 3-position DPDT toggle switch with center-off position.	I/O/II 3-position toggle switch with center-off position.
POWER ON lamp	Green LED.	Green LED.
HEATER ON lamp	Yellow LED.	White LED.
Latch (main case + cover)	Self-locking quick-release toggle clip + hook.	Two self-locking quick-release latches.
Lifting handle (cover)	Fold-down heatproof grip.	Spring-loaded fold-down lifting handle with heatproof grip.
Tap / Spigot	Spring-loaded pull-to-operate water valve.	Spring-loaded lever action.
Pressure/vacuum relief	Dual-action air valve preset at 0.3 psi (20.7 mb).	Relief valve only provides pressure relief. Vacuum relief is achieved by momentarily opening the spigot.

c. Electrical Data.

	Model RAK-15	Model 471012
Supply voltage	22 - 28 V dc (24 V dc nominal).	22 - 28 V dc (24 V dc nominal).
Supply current	15 A (maximum).	15 A (maximum), (14 A nominal).
Power consumption	300 W (nominal).	400 W (nominal).
Heater type	Resistive element affixed to the underside of the outer container.	Resistive element affixed to the underside of the outer container.
Heater resistance	1.6 ohm (nominal at ambient temperature with power off).	2.0 ohms (nominal at ambient temperature with power off).
Heater control	On/off switching determined by LO and HI temperature sensors using thermal feedback.	Power switching determined by setting I (low) and II (high) temperature sensors.
Heater safety cut-out	“Boil-dry" temperature sensor operating at 490 ^{O}F (255 ^{o}C). Non-repairable thermal fuse operating at 374 ^{O}F (190 ^{o}C).	Internal temperature greater than 239 ^{o}F.

1-13. EQUIPMENT DATA (Continued)

d. Performance Data.	Model RAK-15	Model 471012
Heating (water only)	Temperature of one gallon of water will be raised by 100 °F (56 °C) in one hour (max) at an ambient temperature of 70 °F (21 °C) using HI switch setting.	Temperature of one gallon of water will be raised by 100 °F (56 °C) in one hour (max) at an ambient temperature of 70 °F (21 °C) using the II switch setting.
Heating (rations + water)	Temperature of up to five MRE entrees and 40 fluid ounces of water will be raised to between 150 °F (66 °C) and 160 °F (71 °C) at an ambient temperature of 70 °F (21 °C) using HI switch setting.	Temperature of up to five MRE entrees and 40 ounces of water will be raised to 185°F ± 5°F (85°C ± 2.8°C) at an ambient temperature of 70°F (21°C) using the III switch setting.
Heat retention	Better than 45% of the selected heating range at 3 hours after HWR is turned off with the cover closed and latched.	More than 45% of the selected heating range at 3 hours after HWR is turned off with the cover closed and latched.
Heating range (low)	150 - 160 °F (66-71 °C)	150 - 160 °F (66-71 °C)
Heating range (high)	180 - 190 °F (82-88 °C)	180 - 190 °F (82-88 °C)
Automatic Shutdown	Power supply voltage less than 22 V dc. Internal temperature greater than 205 °F (96 °C). "Boil-dry" condition detected.	Power supply voltage less than 20 V dc. Internal temperature greater than 239 °F.
Overvoltage Protection	Voltage greater than 39 V dc.	Voltage greater than 30 V dc.

e. Environmental Data.	Model RAK-15	Model 471012
Temperature (operating)	Between -25 and 140 °F (-32 and 60 °C).	Complies with MIL-PRF-44466A.
Temperature (storage)	Between -60 and 160 °F (-51 and 71 °C).	Complies with MIL-PRF-44466A.
Humidity (storage)	Between 10 and 90%.	Between 10 and 90%. It also operates after a 4-hour soak at a temperature of 140°F and 94% ± 4% humidity.

Section III. PRINCIPLES OF OPERATION

1-14. HWR FUNCTIONAL DESCRIPTION

a. PL1. Electrical connector, which accepts the 22 - 28 V dc, power supply via a suitable power cable (not part of the HWR) from the host vehicle electrical system.

b. Input Circuit. Electronic network that protects against reverse polarity connection of the power supply and overvoltage surges in excess 39 V dc (Model RAK-15 only). For Model 471012, if it does not receive the correct polarity, it will malfunction in a hazardous manner even with the switch in the OFF (0) position.

c. 16 V Power Supply. Provides a stabilized supply of +16 V dc to power the electronic circuits for Model RAK-15.

d. Low Voltage Detector. Electronic circuit that monitors the power supply and activates the heater off latch if the voltage level falls below 22 V dc for Model RAK-15. The undervoltage protection feature for Model 471012 shuts off power to the unit when supply voltage drops below 20 V dc.

1-14. HWR FUNCTIONAL DESCRIPTION (Continued)

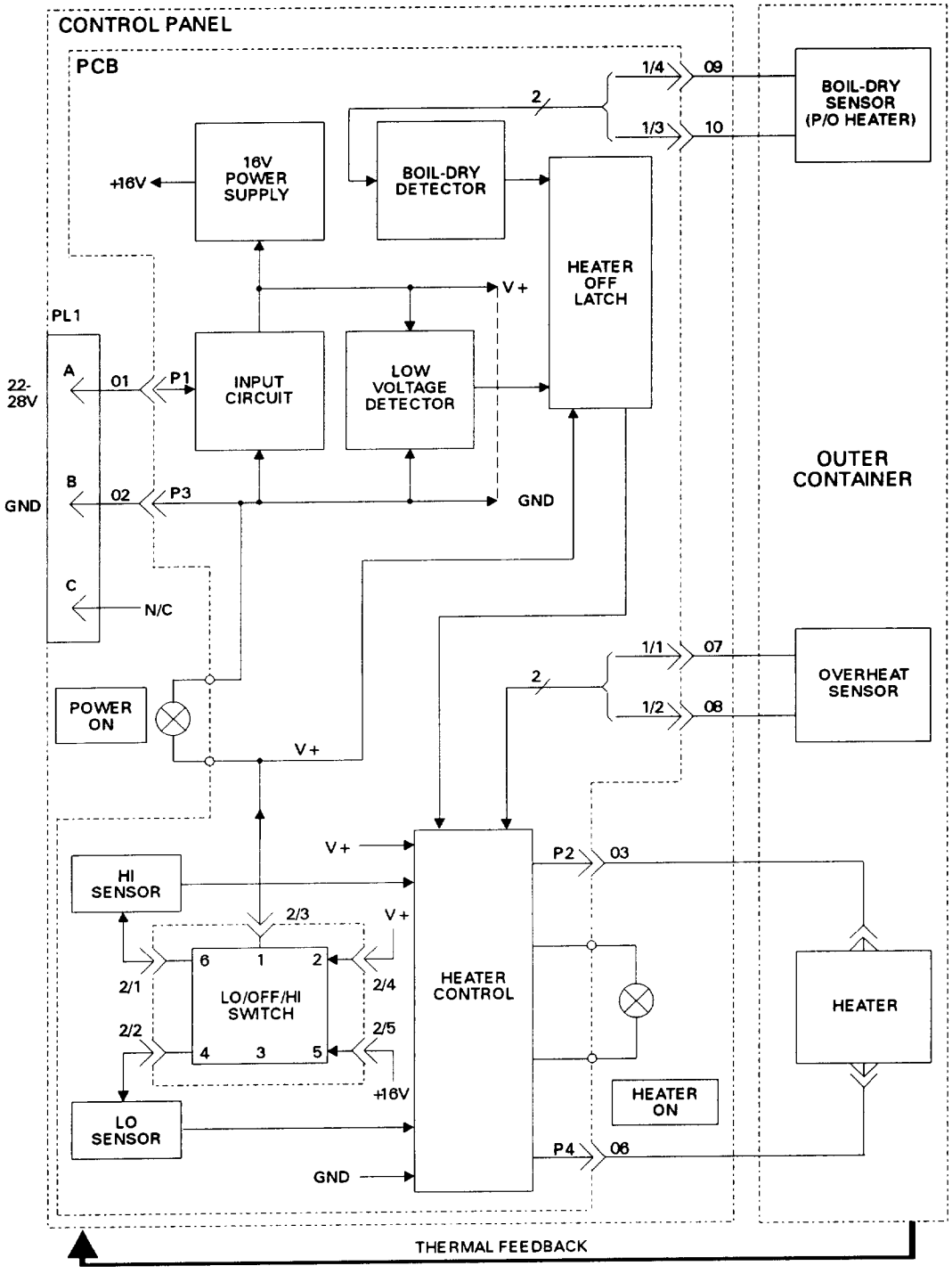


Figure 1-1. HWR Block Schematic Diagram (Model RAK-15)

1-14. HWR FUNCTIONAL DESCRIPTION (Continued)

e. Boil-dry Sensor. Temperature-dependent network that directly monitors the heater temperature and outputs a corresponding signal to the boil-dry detector. The sensor is mechanically a part of the heater for Model RAK-15.

f. Boil-dry Detector. Monitors the output from the boil-dry sensor and activates the heater off latch when the signal represents a heater temperature of 490 °F (255 °C) for Model RAK-15.

g. Heater Off Latch. Electronic circuit that is enabled by the V+ supply when the LO/OFF/HI switch is set to LO or HI. In operation the circuit is latched "off" to disable the heater control circuit and thereby prevent heating operation if the power supply is less than 22 V dc or if the internal temperature is greater than 205 °F (96 °C) for Model RAK-15, or 20 V dc, or if the internal temperature is greater than 239 °F for Model 471012.

NOTE

If the circuit has been latched in the "off" condition it will need to be "unlatched" by first setting the LO/OFF/HI switch to OFF (to remove the V+ supply) then reselecting the LO or HI heating range as required.

h. POWER ON Lamp. Green LED that lights to provide visual indication the power supply is turned on when the LO/OFF/HI switch is set to the LO or HI position (Model RAK-15) or setting I (low) or II (high) for (Model 471012).

i. LO Sensor. Temperature-dependent network which provides a control input to the heater control circuit when selected via the LO position of the LO/OFF/HI switch (Model RAK-15) or the I/0/II switch for (Model 471012). The sensor measures thermal feedback from the outer container and thereby maintains the internal temperature within the LO heating range.

j. HI Sensor. Temperature-dependent network which provides a control input to the heater control circuit when selected via the HI position of the LO/OFF/HI switch (Model RAK-15) or the I/0/II switch for (Model 471012). The sensor measures thermal feedback from the outer container and thereby maintains the internal temperature within the HI heating range.

k. Power Switch. Operator-controlled 3-position toggle switch with a center OFF position. Selects a heating range of 150 -160 °F (66 - 71 °C) when the setting is LO or I or a heating range of 180 -190 °F (82 - 88 °C) when the setting is HI or II. If the power supply is turned on, the switch also lights the POWER ON lamp and enables the heater off latch when set to the LO or HI (I or II) position.

l. Heater Control. Electronic circuit that normally provides on/off relay switching of the heater in response to the control input received from the LO or HI sensor via the power switch (i.e., acts as a thermal servo). The circuit can also be disabled by the heater off latch or the overheat sensor in order to prevent heating operation under abnormal conditions (Model RAK-15).

m. HEATER ON Lamp. Yellow LED (Model RAK-15) or white LED (Model 471012) that lights to provide visual indication that power is being applied to the heater.

n. Heater. Comprises a 28 V, 15 A heating element, which supplies conductive heat to the outer container when power is applied from the heater control circuit. The heater is protected by a non-repairable thermal fuse that operates at a temperature of 374 °F (190 °C) (Model RAK-15).

o. Overheat Sensor. The temperature-dependent network that monitors conductive heat from the outer container and disables the heater control circuit. If the temperature rises above a level of 205 °F (Model RAK-15) or 239 °F (Model 471012). The action is delayed for a short period of time (approximately 20 seconds) in order to prevent spurious operation.

CHAPTER 2

OPERATING INSTRUCTIONS

		Page
Section I	DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS	2-2
2-1	General	2-2
2-2	Operator's Controls and Indicators for Model RAK-15	2-2
2-2.1	Operator's Controls and Indicators for Model 471012	2-2.1
Section II	PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)	2-3
2-3	General	2-3
2-4	PMCS Procedures	2-3
2-5	Cleaning Agents	2-4
Section III	OPERATION UNDER USUAL CONDITIONS	2-8
2-6	General	2-8
2-7	Assembly and Preparation for Use for Model RAK-15	2-8
2-7.1	Assembly and Preparation for Use for Model 471012	2-8.1
2-8	Initial Checks	2-9
2-9	Operating Procedures for Model RAK-15	2-9
2-9.1	Operating Procedures for Model 471012	2-18.1
2-10	Decals and Instruction Plates for Model RAK-15	2-19
2-10.1	Decals and Instruction Plates for Model 471012	2-19
Section IV	OPERATION UNDER UNUSUAL CONDITIONS	2-20
2-11	General	2-20
2-12	Unusual Environment/Weather	2-20
2-13	Emergency Procedures	2-20
2-14	Nuclear, Biological and Chemical (NBC) Decontamination Procedures	2-20

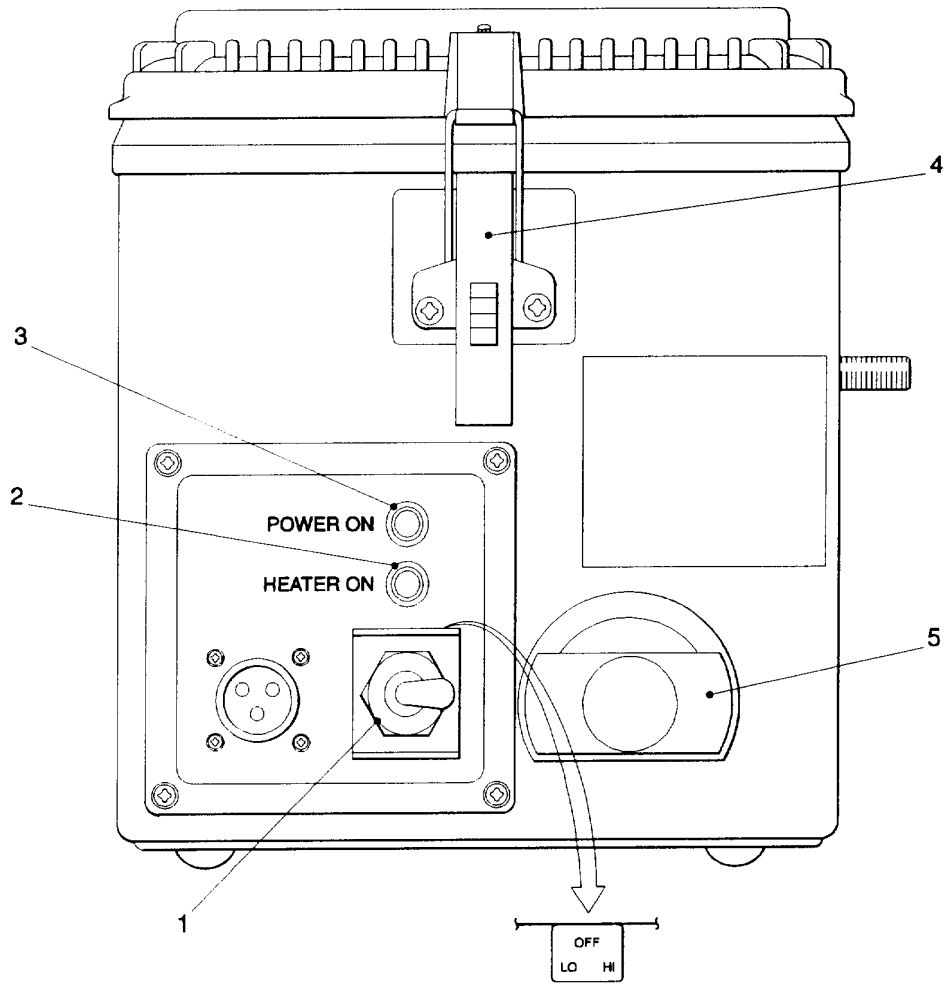
Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2-1. GENERAL

The HWR was designed for installation in a variety of military vehicles and for operation under a wide range of conditions. Operating personnel should be aware of any peculiarities or operational limitations that are applicable to their particular installation.

2-2. OPERATOR'S CONTROLS AND INDICATORS FOR MODEL RAK-15

The operator's controls and indicators are all located on the front of the HWR.



1 LO/OFF/HI switch (3-position)
Selects heating range of 150 -160 ^{O}F (66 - 71 ^{O}C) when set to the LO position.
Deselects heating when set to the center OFF position.
Selects heating range of 180 -190 ^{O}F (82 - 88 '^{O}C) when set to the HI position.

2-2. OPERATOR'S CONTROLS AND INDICATORS FOR MODEL RAK-15 (Continued)

2 HEATER ON lamp
Indicates heating cycle status.
Lights when power is being applied to the heater.
Goes off when the selected temperature is reached.

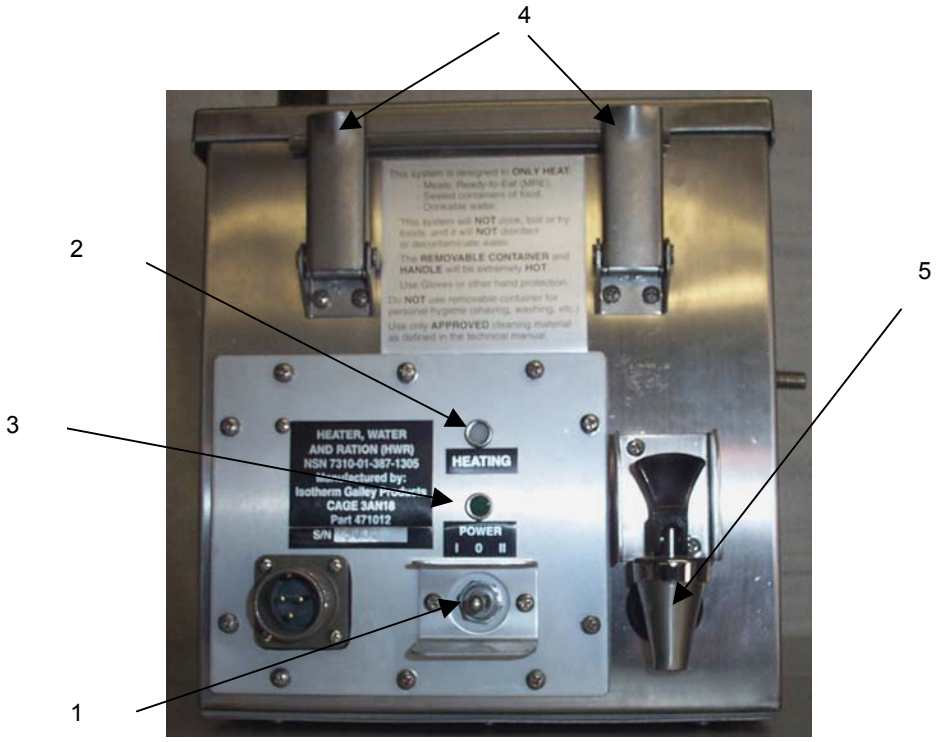
3 POWER ON lamp
Indicates power supply status and setting.
Lights when power supply is present and the switch is set to either LO or HI position.
Goes off when power supply is not present or switch is set to the OFF position.

4 LATCH
Quick-release toggle clip with self-lock closing and manual unlocking action.
Secures cover in place to maintain steam/watertight seal with the main case.
Latch bridle engages with the latch hook on the front edge of the cover.

5 TAP
Spring-loaded pull-to-operate action.
Protective shroud prevents accidental hand contact with steam or heated water.
Allows water to be drained-off from the outer container.

2-2.1 OPERATOR'S CONTROLS AND INDICATORS FOR MODEL 471012

The operator's controls and indicators are all located on the front of the HWR.



1 I/O/II switch (3-position)
Selects heating range of 150 -160 °F (66 - 71 °C) when set to the LO position.
Deselects heating when set to the center OFF position.
Selects heating range of 180 -190 °F (82 – 88 °C) when set to the HI position.

2-2.1 OPERATOR'S CONTROLS AND INDICATORS FOR MODEL 471012 (Continued)

2 HEATER ON light
Indicates heating cycle status.
Lights when power is applied to the heater.
Goes off when the selected temperature is reached.

3 POWER ON light
Indicates power supply and setting.
Lights when power supply is present and the switch is set to either setting I or II.
Goes off when power supply is not present or switch is set to the O (OFF) position.

4 LATCH
Two-quick-release toggle clips with self-lock closing and manual unlocking action.
Secures the cover in place.
Latch bridle engages with the latch hook on the front edge of the cover.

5 SPIGOT
Spring-loaded lever action. The lever rotates 180 degrees, and locks in the “open” position.
Allows water to drain-off from the outer container.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-3. GENERAL

Preventive Maintenance Checks and Services (PMCS) provide systematic care, inspection and servicing of the HWR to keep it in good condition and helps to prevent malfunctions.

The responsibilities associated with operation of the HWR are as described in the following subparagraphs:

a. Perform the PMCS procedures each time that the HWR is operated. Always perform the procedures in the same order so that a routine is established which allows any malfunction(s) to be quickly identified.

b. Perform the BEFORE (B) PMCS immediately prior to operating the HWR. Comply with all applicable WARNINGS, CAUTIONS and NOTES.

c. Perform the DURING (D) PMCS by monitoring the operation of the HWR. Comply with all applicable WARNINGS, CAUTIONS and NOTES.

d. Perform AFTER (A) PMCS immediately after operating the HWR. Comply with all applicable WARNINGS, CAUTIONS and NOTES.

e. Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) to record any malfunction(s) which are identified before, during, or after operation and cannot be corrected. DO NOT record any malfunction(s) that have already been identified and corrected.

f. Be prepared to assist with higher-level maintenance tasks when requested.

2-4. PMCS PROCEDURES

The Preventive Maintenance Checks and Services given in Table 2-1 list the inspections and care required to keep the HWR in good operating condition.

2-4. PMCS PROCEDURES (Continued)

The following subparagraphs describe the column entries in Table 2-1 on page 2-5:

a. The "ITEM No." column indicates the consecutive numerical order assigned to the procedures. The item numbers are also used when recording the results of PMCS on DA Form 2404 (Equipment Inspection and Maintenance Worksheet).

b. The "INTERVAL" column indicates when a check or service is performed.

c. The "LOCATION, ITEM TO CHECK/SERVICE" column identifies the part that is checked or serviced.

d. The "PROCEDURE" column contains appropriate instructions for the performance of each check or service.

e. The "NOT FULLY MISSION CAPABLE IF" column describes the conditions under which the HWR is not mission capable and why it cannot be used.

f. Refer to Chapter 3, Section II, Operator's Troubleshooting Procedures if the HWR does not perform as stated.

g. If a fault is identified and cannot be corrected, write out a DA Form 2404 IMMEDIATELY and report it to Unit level maintenance.

h. The following general checks should be performed as necessary:

(1) **Sanitizing.** When the HWR is stored for long periods, the HWR should be cleaned and sanitized before use. Refer to Chapter 3, Section III for cleaning and sanitizing procedures.

(2) **Cleanliness.** Remove any accumulated dirt, grease, oil or debris on external surfaces. Refer to Chapter 3, Section III for cleaning and sanitizing procedures.

(3) **Corrosion.** Report corrosion problems in accordance with the instructions given in Chapter 1, Section I, Paragraph

(4) **Screws and Nuts.** Check for looseness, missing, bent or broken screws and nuts. Report any defects to Unit level maintenance.

(5) **Power Cable Connector Plug.** Check for proper fit of the connector plug and for signs of physical damage to the connector plug or power cable. Tighten connector plug to hand tightness if it is loose. Report any damage to Unit level maintenance.

2-5. CLEANING AGENTS

a. Cleaning Internal Metal Parts. Use hand dishwashing compound or food service disinfectant as authorized by Appendix E, Section II, Item 3.

b. Cleaning External Metal Parts. Use hand dishwashing compound as authorized by Appendix E, Section II, Item 3.

c. Cleaning Rubber and Soft Plastic Parts. Use hand dishwashing compound as authorized by Appendix E, Section II, Item 3.

2-4 PMCS PROCEDURES (Continued)

TABLE 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) FOR MODELS RAK-15 AND 471012

Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Mission Capable if:
1	Before	Cover	a. Inspect for loose/missing parts and physical damage.	If parts such as screws are loose/missing or damaged it will prevent safe usage.
			b. Check cover seal is properly fitted and not distorted (open cover, Paragraph 2-9).	Cover seal is badly fitted or loose and leakage of steam or water is possible.
			c. Inspect for dirt, grease, oil or food debris.	
			d. Inspect for signs of corrosion (Paragraph 1-4).	
2	Before	Inner Container	a. Check inner container is present and can be easily lifted out of the outer container.	Container is missing. Fold-down wire lifting handle is missing or broken.
			b. Inspect for physical damage such as holes or large dents.	Container has damage preventing safe usage.
			c. Inspect for dirt, grease, oil or food debris.	
			d. Inspect for signs of corrosion (Paragraph 1-4).	
3	Before	Outer Container	a. Inspect for physical damage such as holes or large dents.	Container has damage preventing safe usage.
			b. Inspect for dirt, grease, oil or food debris.	
			c. Inspect for signs of corrosion (Paragraph 1-4).	
4	Before	Main Case	a. Inspect for loose/missing parts and physical damage.	If parts such as screws are loose/missing or damaged it will prevent safe usage.
			b. Check case seal is properly fitted and not distorted.	Case seal is badly fitted or loose and leakage of steam or water is possible.

TABLE 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) FOR MODELS RAK-15 AND 471012 (Continued)

Item No.	Interval	Location: Item to Check/ Service	Procedure	Not Fully Mission Capable if:
			c. Inspect for dirt, grease, oil or food debris. d. Inspect for signs of corrosion (Paragraph 1-4).	
5	Before	Latch	a. Check latch is secured to the main case and has no missing or broken parts. b. Check lock and unlock operation is correct.	Latch has loose or missing screws. Any part is broken, loose or missing. Latch will not lock and/or unlock.
6	Before	Tap/Spigot	a. Ensure it is secured to the main case and has no missing or broken parts. b. Verify that it can be easily operated over its full range with no binding.	Tap/Spigot has loose or missing screws. Any part is broken, loose or missing. Tap/Spigot does not move freely or is jammed in one position.
7	Before	Control Panel	a. Check control panel is secured to the main case and has no missing or broken parts. b. Check power cable connector plug is properly connected to the connector receptacle. c. Check power switch is securely held in position and operates with a firm, positive action.	Control panel has loose or missing screws. Any part is loose or missing. Power cable connecting plug cannot be connected or connection is unsafe. Power switch is loose or its operation is not satisfactory.
8	During	Main Case	Check for leakage of water indicated by damp or discoloured patches on the case seal.	Leakage of water is observed.
9	During	Tap/Spigot	Check for leakage of water after each operation.	Leakage of water is observed.
10	After	Cover	Inspect for dirt, grease, oil, or food debris.	

2-4 PMCS PROCEDURES (Continued)

TABLE 2-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) FOR MODELS RAK-15 AND 471012 (Continued)

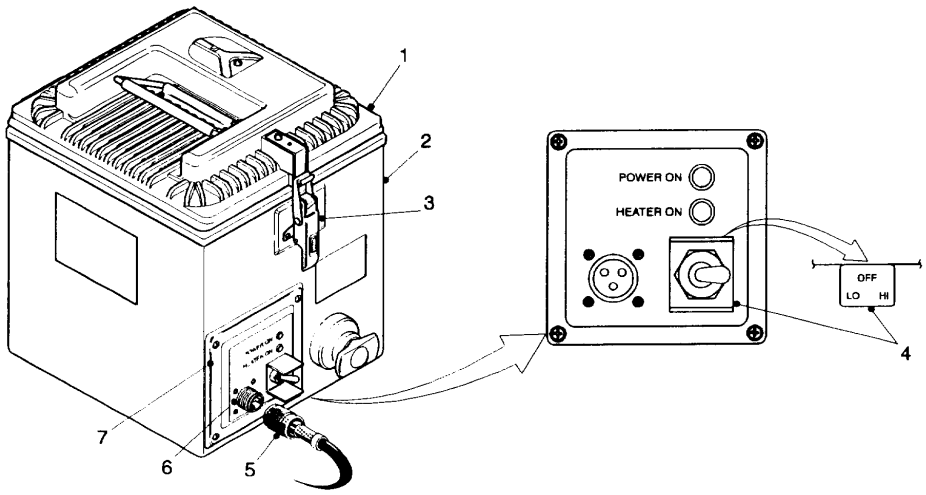
Item No.	Interval	Location: Item to Check/ Service	Procedure	Not Fully Mission Capable if:
11	After	Inner Container	a. Check food has been removed.	
			b. Inspect for dirt, grease, oil, or food.	
12	After	Outer Container	a. Check water has been removed.	
			b. Inspect for dirt, grease, oil or food.	
13	After	Main Case	a. Inspect for dirt, grease, oil, or food.	
			b. Check inner container is present.	Inner container is missing.
			c. Check cover is installed and the latch is closed and locked.	Cover will not fit or latch will not close and lock.

Section III. OPERATION UNDER USUAL CONDITIONS

2-6. GENERAL

The instructions in this section are for personnel who operate the HWR. Refer to the appropriate technical manual(s) for information relating to the power supply arrangements for the HWR in particular types of host vehicle.

2-7. ASSEMBLY AND PREPARATION FOR USE FOR MODEL RAK-15



a. Assembly.

(1) Verify that the HWR is securely fitted.

(2) Verify that the cover (1) is correctly positioned on top of the main case (2).

(3) Verify that the latch (3) is closed and locked in position.

b. Preparation for Use.

NOTE

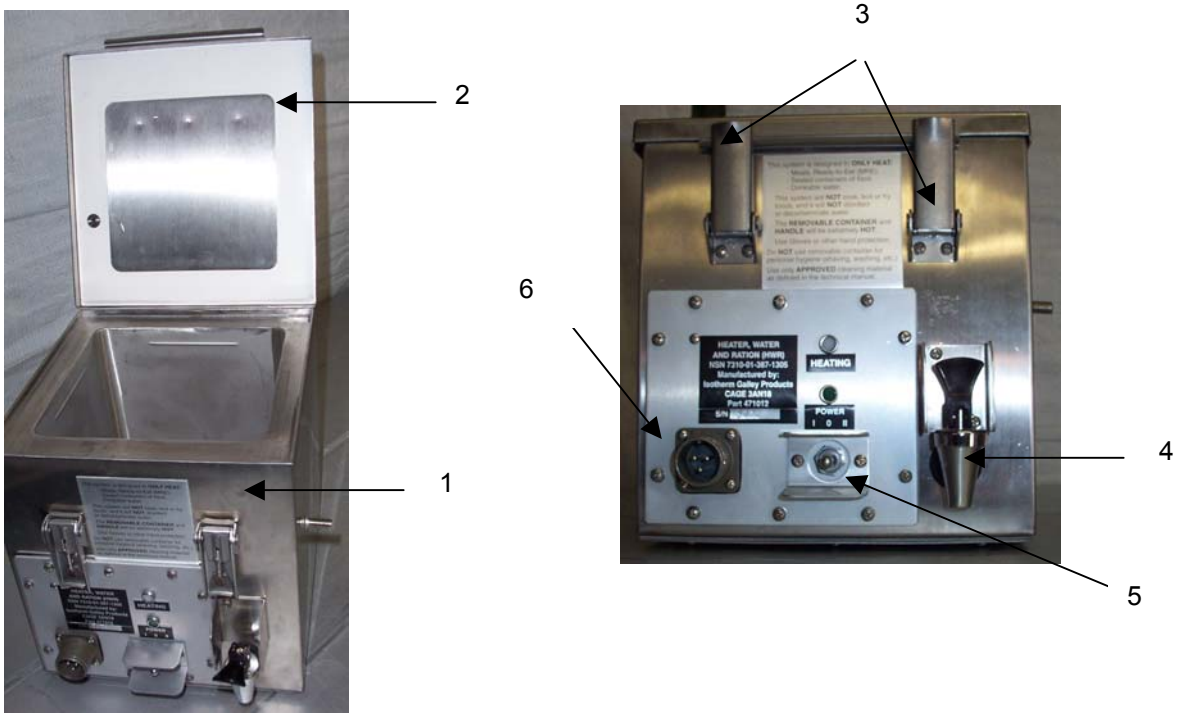
The HWR requires a power supply of 22 - 28 V dc (24 V dc nominal) capable of providing a maximum load current of 15 A.

(1) Connect power cable connector plug (5) to connector receptacle (6) on the control panel (7).

(2) Set power switch (4) on the control panel (7) to OFF.

(3) Turn on the vehicle power supply.

2-7.1 ASSEMBLY AND PREPARATION FOR USE FOR MODEL 471012



a. Assembly.

(1) Install the HWR (1) where sufficient room exists to open and remove the lid (2), and to extract the inner container.

(2) Position the HWR (1) so that it is nominally level, faces the user, and provides easy access to the power cable connection, lid latches (3), spigot (4) and operating controls (5).

(3) Position the HWR (1) so that the outlet of the spigot (4) is free of obstructions, and permits water to be drawn off into a cup or canteen.

b. Preparation for Use.

NOTE

The HWR draws a maximum current of 15 amps at a nominal vehicle charging voltage of 28 V DC. Dedicate a 20 A circuit to the HWR. The wires used for the power cable should be 14 gauge or larger.

(1) Position the HWR (1) so the length of the power cable will reach the HWR from the designated circuit access point in the vehicle's electrical system.

2-7.1 ASSEMBLY AND PREPARATION FOR USE FOR MODEL 471012 (Continued)

CAUTION

If the HWR does not receive power of the correct polarity, it will malfunction in a hazardous manner, with power being supplied to the heating element even with the switch in the OFF (0) position.

(2) Ensure that the power cable connector mates correctly with the HWR receptacle (6), and that the following polarity is observed:

Pin A: Positive (+)	(Violet wire)
Pin B: Negative (-)	(Orange wire)
Pin C: No Connection	(Yellow wire)

2-8. INITIAL CHECKS

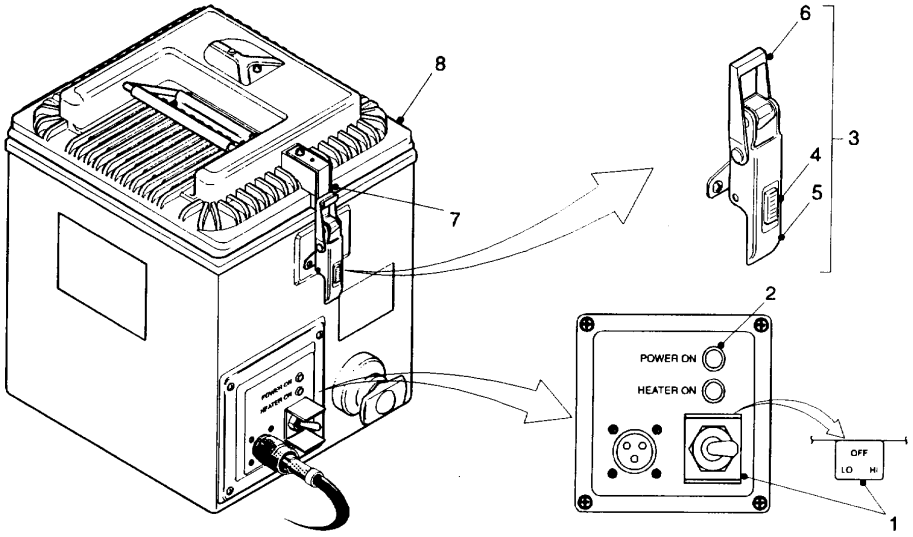
Before operating the HWR, perform the BEFORE (B) Preventive Maintenance Checks and Services (PMCS) given in Table 2-1. Comply with all applicable WARNINGS, CAUTIONS and NOTES.

2-9. OPERATING PROCEDURES FOR MODEL RAK-15

WARNING

- HEALTH HAZARD (1). Use the HWR to HEAT water only or to HEAT unopened pre-packaged food and water. Using the HWR to prepare, boil, fry or cook food can result in a hazard to health.
- WATER/FOOD CONTAMINATION (1). Only use the inner container for carrying/holding clean potable water or heating rations. Using the inner container for any other purpose (e.g., personal hygiene) can result in the contamination of water or food.

a. Heating Water. To heat water, perform the following steps in the order given.

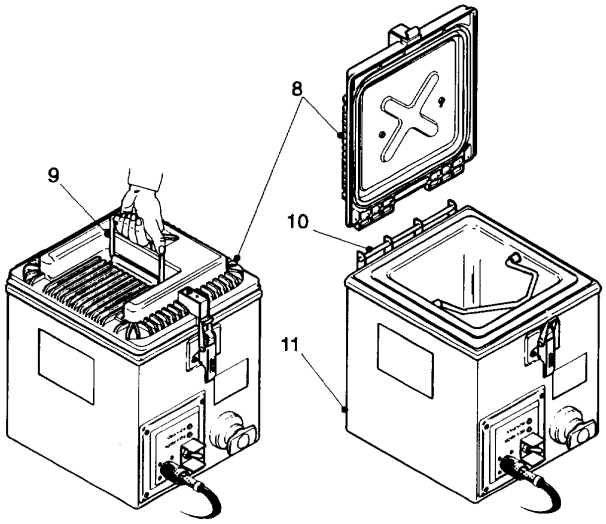


(1) Ensure that the LO/OFF/HI switch (1) is set to OFF and verify that the POWER ON lamp (2) is off.

(2) Unfasten the latch (3) by first pushing the spring-loaded unlocking catch (4) upwards with the thumb then pulling the operating lever (5) outwards while holding the unlocking catch in the "fully-up" position.

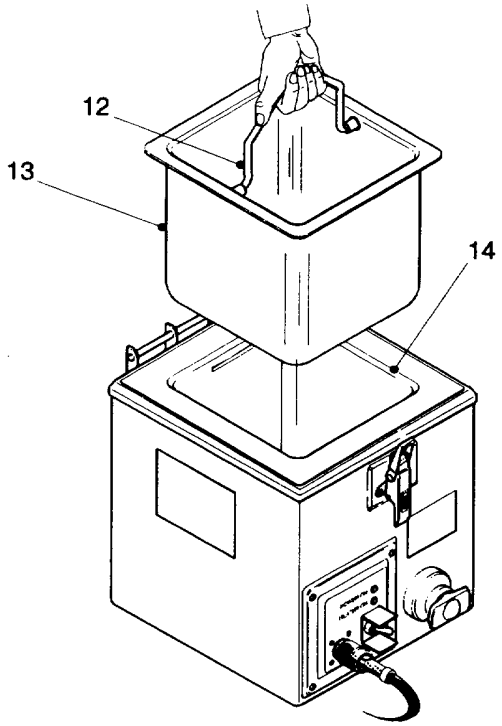
(3) Disengage the latch bridle (6) from the latch hook (7) located on the front edge of the cover (8).

2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)



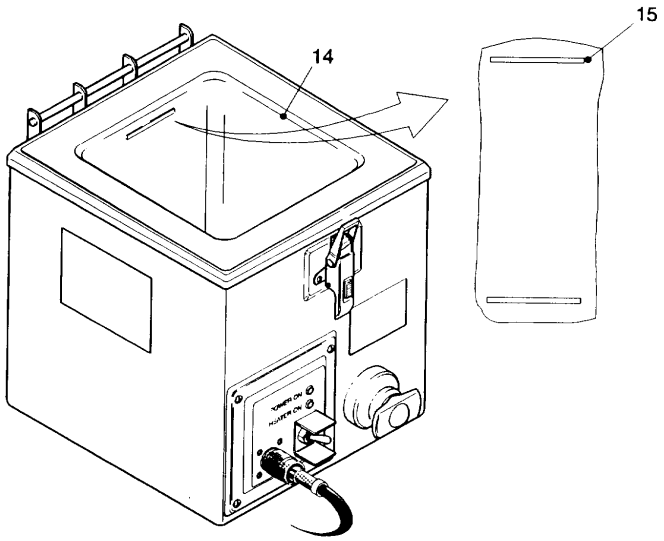
(4) Using the fold-down heatproof handle (9), carefully open the cover (8) and disengage it from the hinge pivot bar (10) located along the top rear edge of the main case (11).

(5) Place the cover (8) on a clean, unobstructed surface so that it is laying flat in a safe position.



2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

(6) Using the fold-down wire handle (12), lift the inner container (13) out of the outer container (14) and place on a clean, unobstructed surface so that it is standing upright in a safe position.



WARNING

- NON-POTABLE/DIRTY WATER (1). Only use clean, potable water as defined in FM 10-52 (Water Supply in Theatres of Operations) when filling the outer container. Non-potable or dirty water can cause contamination of water or food.

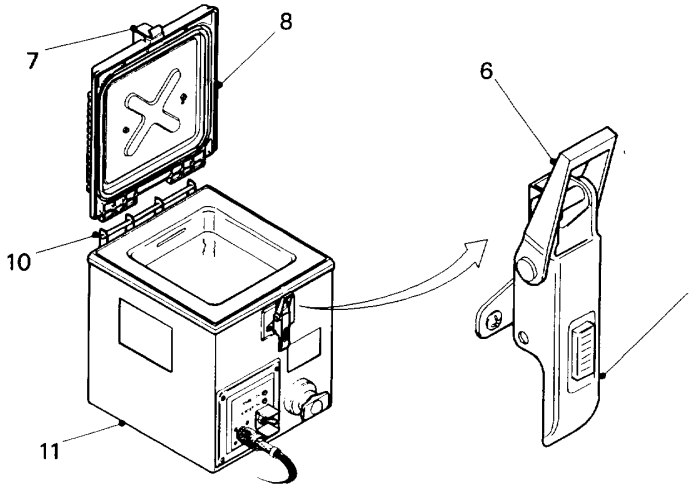
- OVERFILLING (1). When heating water only, do not fill the outer container above the one-gallon level. Overfilling can result in the accidental spillage of heated water.

CAUTION

BLOCKAGE OF TAP. Only use the outer container for heating water. Preparing beverages or soups in the outer container can result in the tap becoming blocked with solid residue.

(7) Fill the outer container (14) with clean, potable water up to the one-gallon level line (15), which is the upper embossed mark on the rear wall.

2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

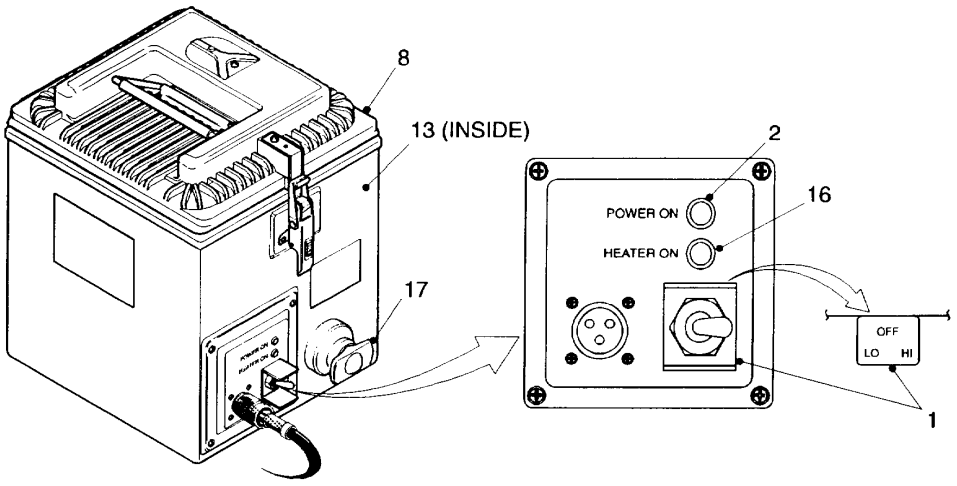


(8) Position the cover (8) on the hinge pivot bar (10) then carefully lower into position making sure that it is properly aligned with the top of the main case (11).

(9) With the cover (8) in place, engage the latch bridle (6) with the latch hook (7) then push the operating lever (5) to the "fully-down" position and verify that it is locked by attempting to pull it outwards.

NOTE

The latch self-locking mechanism engages automatically with an audible "click" when the operating lever is in the "fully-down" position.



2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

WARNING

WATER SPILLAGE. Always ensure that the cover is properly closed and latched before operating the HWR or at any time that the host vehicle is mobile. Failure to secure the cover can result in the accidental spillage of heated water.

CAUTION

OVERHEATING. To avoid overheating, do not operate without water in the outer container. Overheating can result in the HWR becoming non-operational.

(10) Set the LO/OFF/HI switch (1) to HI and verify that the POWER ON lamp (2) and HEATER ON lamp (16) are both on.

(11) Water has been heated to the selected temperature when the HEATER ON lamp (16) goes off again.

WARNING

- HEATED WATER. When dispensing heated water, always use a suitable vessel and avoid contact with the tap spigot, which will be extremely hot. Failure to comply can result in serious burn injuries.

- HYGIENE WATER. Always cool heated water by adding sufficient cold potable water before using for hygiene purposes. Heated water can cause serious burn injuries.

(12) Set the LO/OFF/HI switch (1) to OFF and dispense heated water as required by operating the pull-action tap (17).

NOTE

If a continuous supply of heated water is needed, leave the LO/OFF/HI switch set to LO or HI. The water will then be thermostatically maintained at the selected temperature for as long as required.

(13) If further heating of water is not required, set the LO/OFF/HI switch (1) to OFF and verify that the POWER ON lamp (2) is off.

(14) Using the tap (17), drain-off any remaining water and dispose of in accordance with applicable instructions.

WARNING

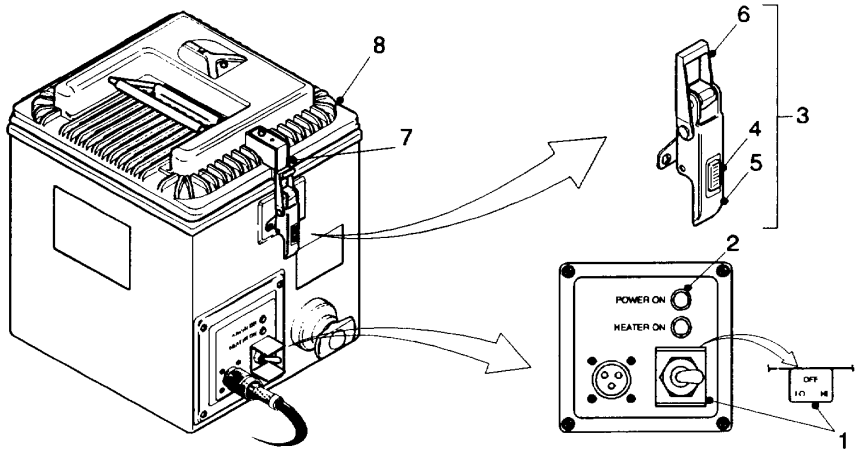
WATER/FOOD CONTAMINATION (2). Always ensure that the inner container and cover are clean before fitting them to the HWR. Dirt or other debris will result in the contamination of water or food.

(15) Install the inner container (13).

(16) Install the cover (8) as described in steps (8) and (9).

2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

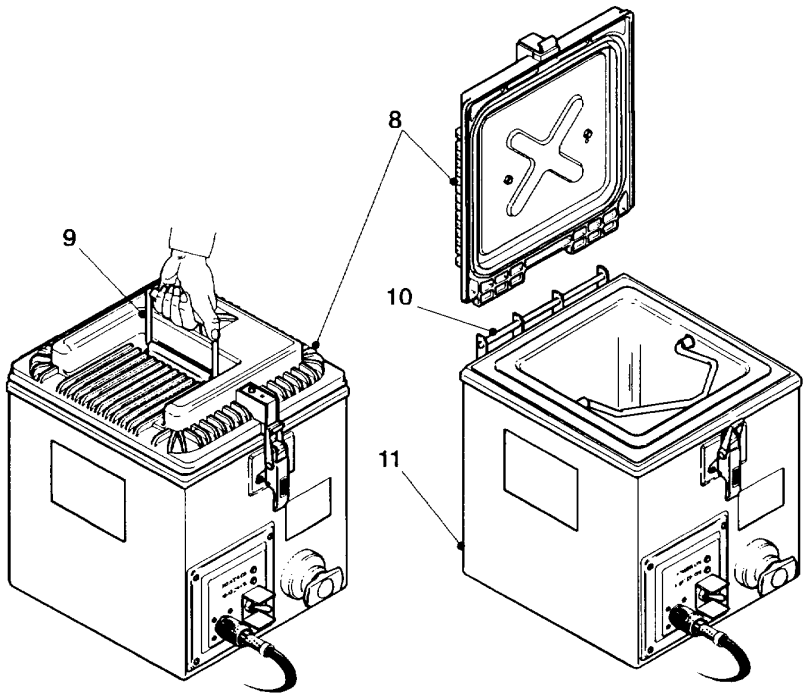
b. Heating Rations.



(1) Ensure that the LO/OFF/HI switch (1) is set to OFF and verify that the POWER ON lamp (2) is off.

(2) Unfasten the latch (3) by first pushing the spring-loaded unlocking catch (4) upwards with the thumb then pulling the operating lever (5) outwards while holding the unlocking catch (4) in the "fully-up" position.

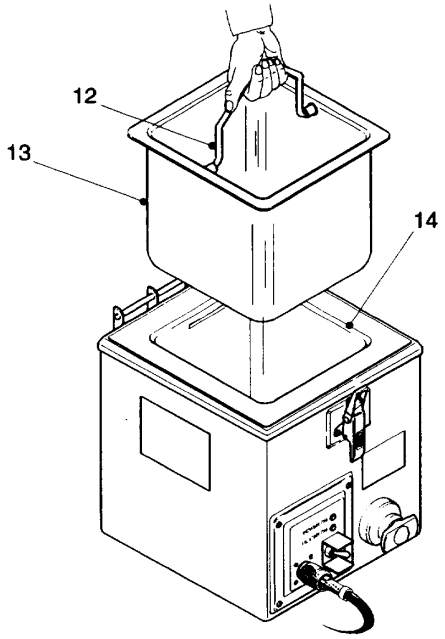
(3) Disengage the latch bridle (6) from the latch hook (7) located on the front edge of the cover (8).



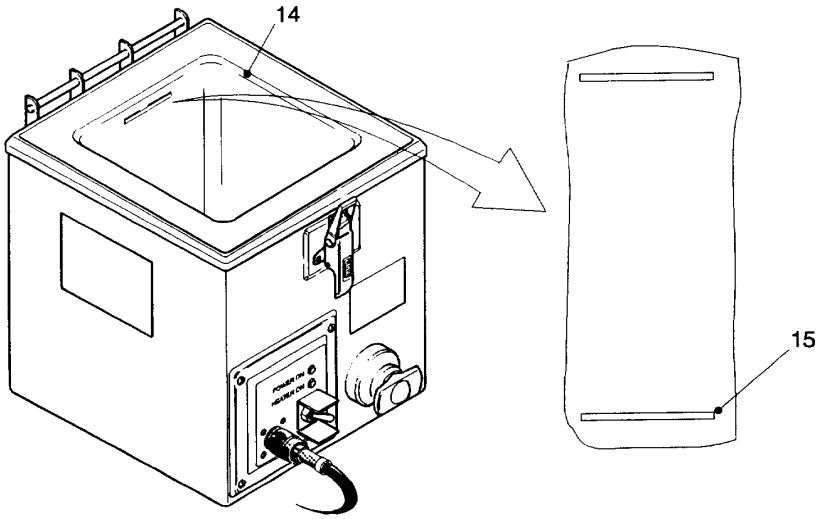
2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

(4) Using the fold-down heatproof handle (9), carefully open the cover (8) and disengage it from the hinge pivot bar (10) located along the top rear edge of the main case (11).

(5) Place the cover (8) on a clean, unobstructed surface so that it is laying flat in a safe position.



(6) Using the fold-down wire handle (12), lift the inner container (13) out of the outer container (14) and place on a clean, unobstructed surface so that it is standing upright in a safe position.



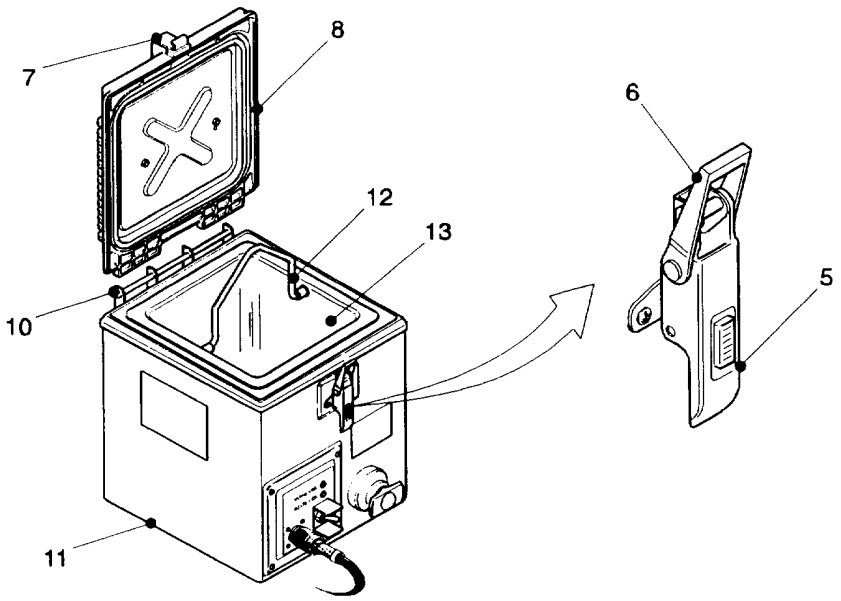
2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

WARNING

- NON-POTABLE/DIRTY WATER (1). Only use clean, potable water as defined in FM 10-52 (Water Supply in Theatres of Operations) when filling the outer container. Non-potable or dirty water can cause contamination of water or food.

- OVERFILLING (2). When heating water and rations, do not fill the outer container above the 40 fluid ounce level. Overfilling can result in the accidental spillage of heated water.

(7) Fill the outer container (14) with clean, potable water up to the 40 fluid ounce level line (15), which is the lower embossed mark on the rear wall.



(8) Place up to five unopened MRE entrees or other unopened pre-packaged food in the inner container (13) and add sufficient clean, potable water to just cover the rations.

WARNING

WATER/FOOD CONTAMINATION (2). Ensure that the inner container and cover are clean before fitting them to the HWR. Dirt or debris will result in contamination of water or food.

(9) Using the folding wire handle (12), install the inner container (13) into the main case (11) and ensure that it is properly positioned.

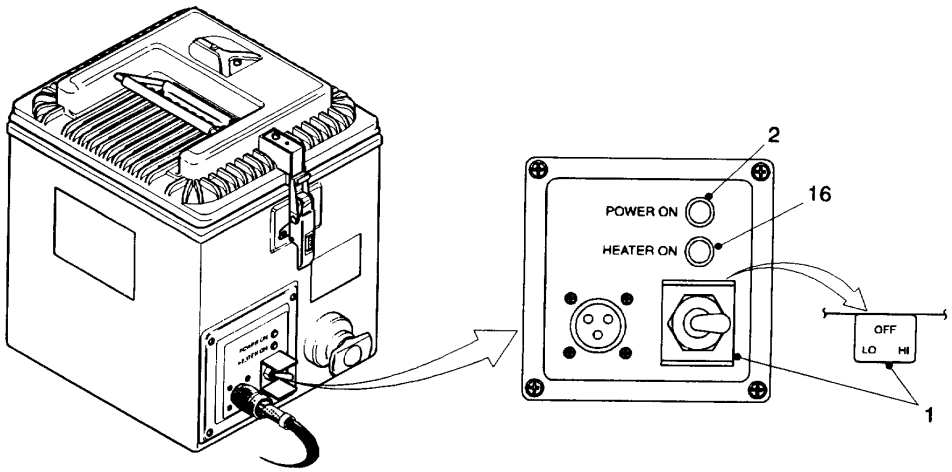
(10) Position the cover (8) on the hinge pivot bar (10) then carefully lower into position making sure that it is properly aligned with the top of the main case (11).

(11) With the cover (8) in place, re-engage the latch bridle (6) with the latch hook (7) then push the operating lever (5) to the "fully-down" position and verify that it is locked by attempting to pull it outwards.

2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

NOTE

The latch self-locking mechanism engages automatically with an audible "click" when the operating lever is in the "fully-down" position.



WARNING

WATER SPILLAGE. Always ensure that the cover is properly closed and latched before operating the HWR or at any time that the host vehicle is mobile. Failure to secure the cover can result in the accidental spillage of water.

CAUTION

OVERHEATING. To avoid overheating, do not operate the HWR without water in the outer container. Overheating can result in the HWR becoming non-operational.

(12) Set the LO/OFF/HI switch (1) to HI and verify that the POWER ON lamp (2) and HEATER ON lamp (16) are both on.

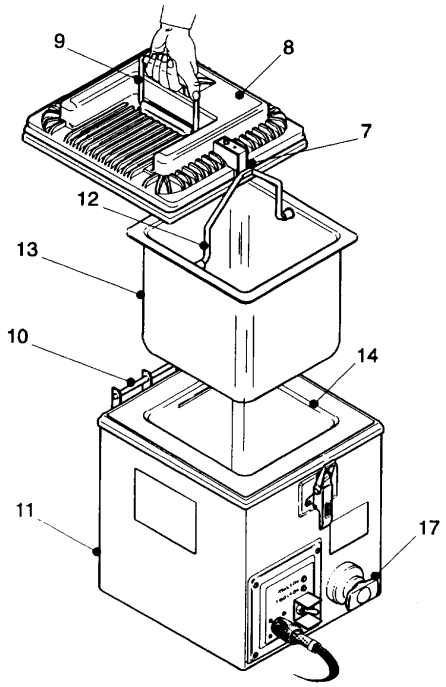
(13) Water (and rations) have been heated to the selected temperature when the HEATER ON lamp (16) goes off again.

NOTE

When the water has heated, the rations may still require heating and a longer warm-up time should therefore be allowed. Leave the LO/OFF/HI switch set to LO or HI for as long as is needed, the water will be thermostatically maintained at the selected temperature and the rations will continue to be heated.

(14) If further heating of rations is not required, set the LO/OFF/HI switch (1) to OFF and verify that the POWER ON lamp (2) is off.

2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)



WARNING

- OVERPRESSURE. Do not open the cover if the pressure relief valve is making a "hissing" noise or venting steam. Set the LO/OFF/H1 switch to OFF, wait until the noise or steam has stopped then open the cover with extreme care using gloves or other hand protection as necessary. Failure to comply can result in serious burn injuries.

- HIGH TEMPERATURES (1). Be aware that normal operating temperatures within the HWR are up to 190 °F (88 °C) and can reach higher temperatures under abnormal conditions. Always use gloves or other hand protection as necessary. Unprotected exposure to high temperatures can cause serious burn injuries.

(15) Using the fold-down heatproof handle (9), carefully open the cover (8) and disengage it from the hinge pivot bar (10) located along the top rear edge of the main case (11).

(16) Holding the cover (8) by means of the fold-down heatproof handle (9), engage the latch hook (7) with the flat center part of the folding wire handle (12) on the inner container (13).

(17) Carefully lift out the inner container (13) together with its contents and place on a clean, unobstructed surface so that it is standing upright in a safe position.

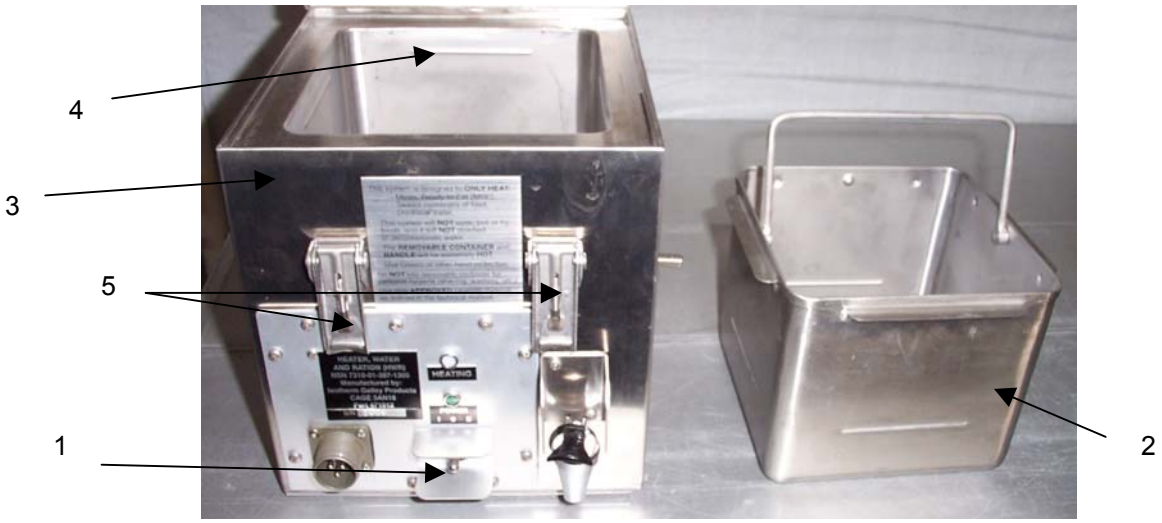
(18) Any heated water remaining in the outer container (14) can be dispensed by operating the pull-action tap (17).

2-9. OPERATING PROCEDURES FOR MODEL RAK-15 (Continued)

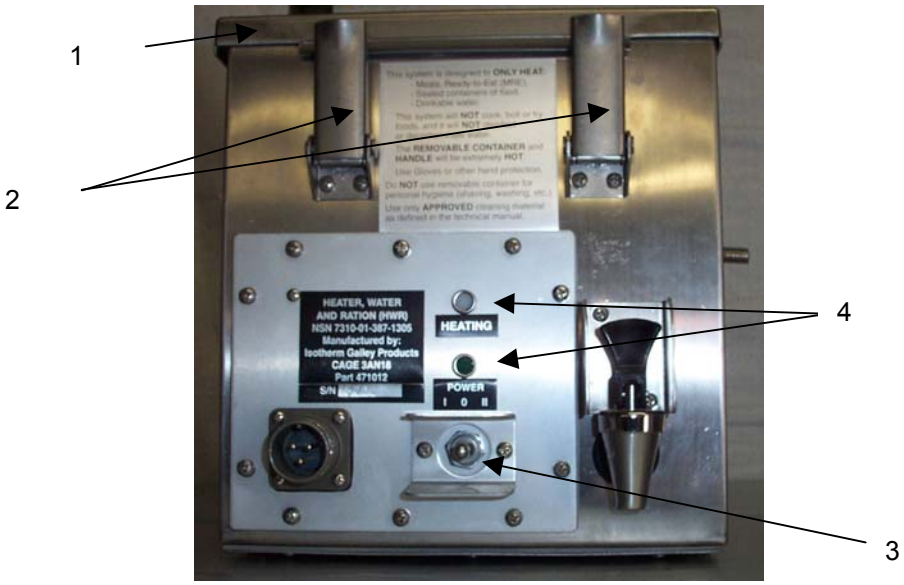
(19) If further operation is not required, perform step (1) and then steps (9) thru (11).

2-9.1 OPERATING PROCEDURES FOR MODEL 471012

a. Heating Water.



(1) With switch at "0" (1), remove inner container (2) and fill main container (3) with potable water, to the upper fill line (4).



(2) Close the lid (1) and use the latches (2) to secure the HWR. Move the switch (3) to position "II". Both the indicator lights (4) will illuminate.

2-9.1 OPERATING PROCEDURES FOR MODEL 471012 (Continued)

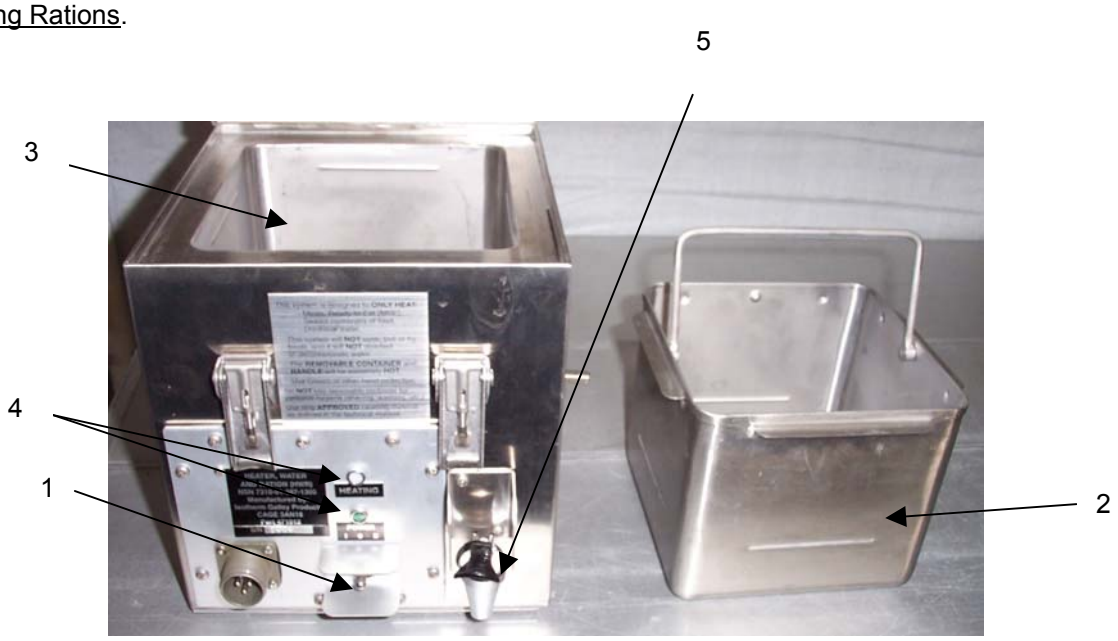
WARNING

HIGH TEMPERATURES (1). Be aware that normal operating temperatures within the HWR are up to 190 °F (88 °C) and can reach higher temperatures under abnormal conditions. Always use gloves or other hand protection as necessary. Unprotected exposure to high temperatures can cause serious burn injuries.

(3) When white lamp begins to cycle on and off, water temperature will be maintained between 180 °F and 190 °F. Hot water can be dispensed through the spigot for beverages or for hygienic needs.

(4) When main container is empty, or when need for hot water has been fulfilled, move the switch to "0".

b. Heating Rations.



(1) With the switch (1) in position 0 (OFF), remove inner container (2) and add potable water to the main container (3), up to the lower fill line.

NOTE

To heat MRE entrees in the shortest possible time, but with minimum water available for beverages, add potable water to the main container to approximately ½ " (13 mm) below the lower fill line. A little water added to the inner container will also aid heat convection, resulting in faster, more uniform heating.

(2) Place MRE entrees in the inner container (2), and place it in the HWR.

(3) Close the lid and latch securely. Place the switch (1) in Position II. Both lights (4) will illuminate.

(4) When white indicator light begins to cycle on and off, water is approaching desired temperature. MRE entrees will require additional time to heat up, depending on amount present and the nature of their contents.

2-9.1 OPERATING PROCEDURES FOR MODEL 471012 (Continued)

WARNING

HIGH TEMPERATURES (1). Be aware that normal operating temperatures within the HWR are up to 190 °F (88 °C) and can reach higher temperatures under abnormal conditions. Always use gloves or other hand protection as necessary. Unprotected exposure to high temperatures can cause serious burn injuries.

(5) After MRE entrees are warm, move switch to "0" (OFF). Water may be drawn from spigot (5), for making beverages or for hygienic use.

CAUTION

Always use caution when opening the lid.

(6) Carefully unlatch and open lid.

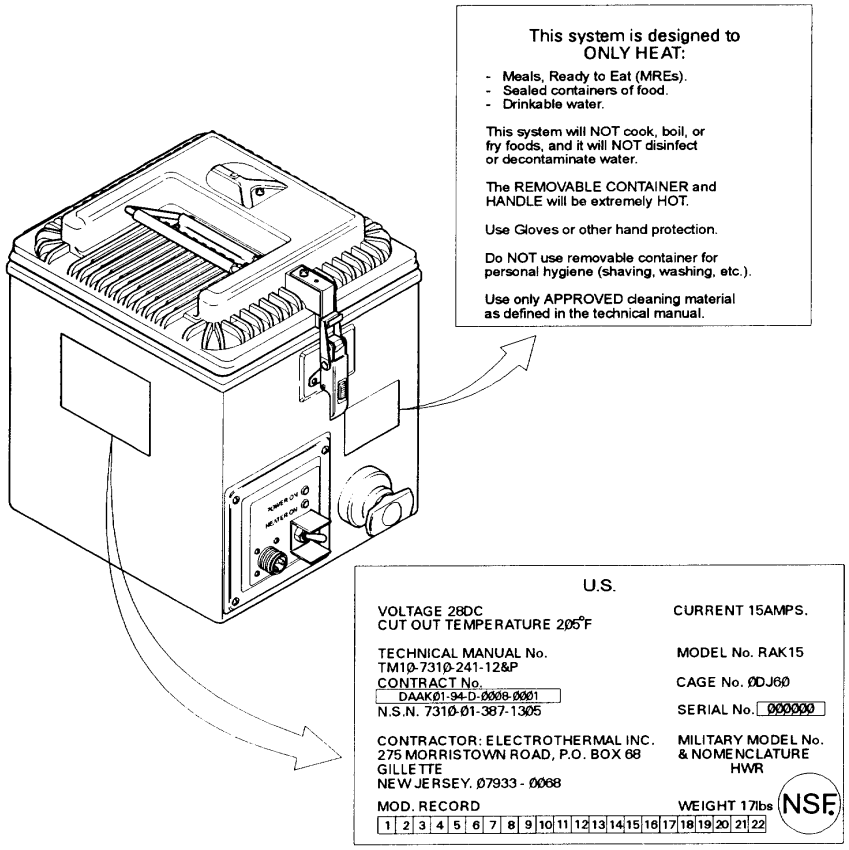
WARNIN G

HIGH TEMPERATURES (2). The removable container and its handle may be HOT. Use gloves or other hand protection, or remove the lid and use the latch retaining lip on the front of the lid to remove the container.

(7) Using gloves or other form of protection, remove inner container (2) and remove MRE entrees from the container. Do not drink any water that was added to inner container (2) to aid convection, the packaging MRE materials may be contaminated.

2-10. DECALS AND INSTRUCTION PLATES FOR MODEL RAK-15

The HWR carries a Data Name Plate and an Instruction Plate, which are illustrated below.



2-10.1 DECALS AND INSTRUCTION PLATES FOR MODEL 471012

This system is designed to
ONLY HEAT:

– Meals, Ready-to-Eat (MRE),
– Sealed containers of food,
– Drinkable water.

This system will **NOT** cook boil or fry foods, and it will **NOT** disinfect or decontaminate water.

The **REMOVABLE CONTAINER** and **HANDLE** will be extremely **HOT**.

Use Gloves or other hand protection.

Do **NOT** use removable container for personal hygiene (shaving, washing, etc.)

Use only **APPROVED** cleaning material as defined in the technical manual.

Instruction Plate

Name Plate

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-11. GENERAL

This section contains special instructions/precautions for operating the HWR under unusual environment/weather conditions and procedures for operating the HWR under emergency conditions.

2-12. UNUSUAL ENVIRONMENT/WEATHER

The HWR is designed to operate over a wide range of operational and climatic conditions within the protection of a vehicle. However, the following extreme conditions may require procedures which ensure that safe and efficient operation of the HWR can be maintained.

a. Operation in Extreme Cold. There are no special instructions/precautions for operating the HWR in temperatures as low as -40 ^{O}F (40 ^{O}C).

b. Operation in Extreme Heat. There are no special instructions/precautions for operating the HWR in temperatures as high 140 ^{O}F (60 ^{O}C).

c. Operation in High Humidity. There are no special instructions/precautions for operating the HWR in humidity greater than 94 ± 4% at a temperature of 140 ^{O}F (60 ^{O}C).

2-13. EMERGENCY PROCEDURES

The HWR should not be operated when either, or both, of the following conditions are present:

a. The load current (up to 15 A) will degrade the host vehicle electrical system.

b. Power usage is restricted for operational reasons.

2-14. NUCLEAR, BIOLOGICAL AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES

Refer to the appropriate host vehicle manual(s) for the NBC decontamination instructions (if any) which are applicable to the HWR.

CHAPTER 3

OPERATOR MAINTENANCE INSTRUCTIONS

Page

Section I OPERATOR'S LUBRICATION INSTRUCTIONS 3-1
3-1 Lubrication Instructions 3-1

Section II OPERATOR'S TROUBLESHOOTING PROCEDURES 3-2
3-2 General 3-2
3-3 Troubleshooting Instructions for Model RAK-15 3-2
3-3.1 Troubleshooting Instructions for Model 471012 3-5

Section III OPERATOR'S MAINTENANCE PROCEDURES
3-4 General 3-6
3-5 Inspection 3-6
3-6 Cleaning for Model RAK-15 3-6
3-6.1 Cleaning for Model 471012 3-10
3-7 Sanitizing 3-10.2

Section I. OPERATOR'S LUBRICATION INSTRUCTIONS

3-1. LUBRICATION INSTRUCTIONS

Lubrication Not Required.

Section II. OPERATOR'S TROUBLESHOOTING PROCEDURES

3-2. GENERAL

Operator troubleshooting is based on malfunctions or failures observed during operator PMCS or operational use of the HWR.

3-3. TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15

WARNING

- ELECTRIC SHOCK. Do not be misled by the term "low voltage". Whenever possible turn off and disconnect the HWR power supply before performing any work. Potentials as low as 30 V dc can cause severe electric shock or death under adverse conditions.
- HIGH TEMPERATURES (1). Be aware that normal operating temperatures within the HWR are up to 190 'F (88 *C) and can reach higher temperatures under abnormal conditions. Always use gloves or other hand protection as necessary. Unprotected exposure to high temperatures can cause serious bum injuries.
- FIRST AID. Never work on the HWR unless there is another person present who is competent in administering first aid. The absence of first aid ran result in serious personal injury or even death. Refer to FM 21 -11 (First Aid for Soldiers) for appropriate first aid instructions.

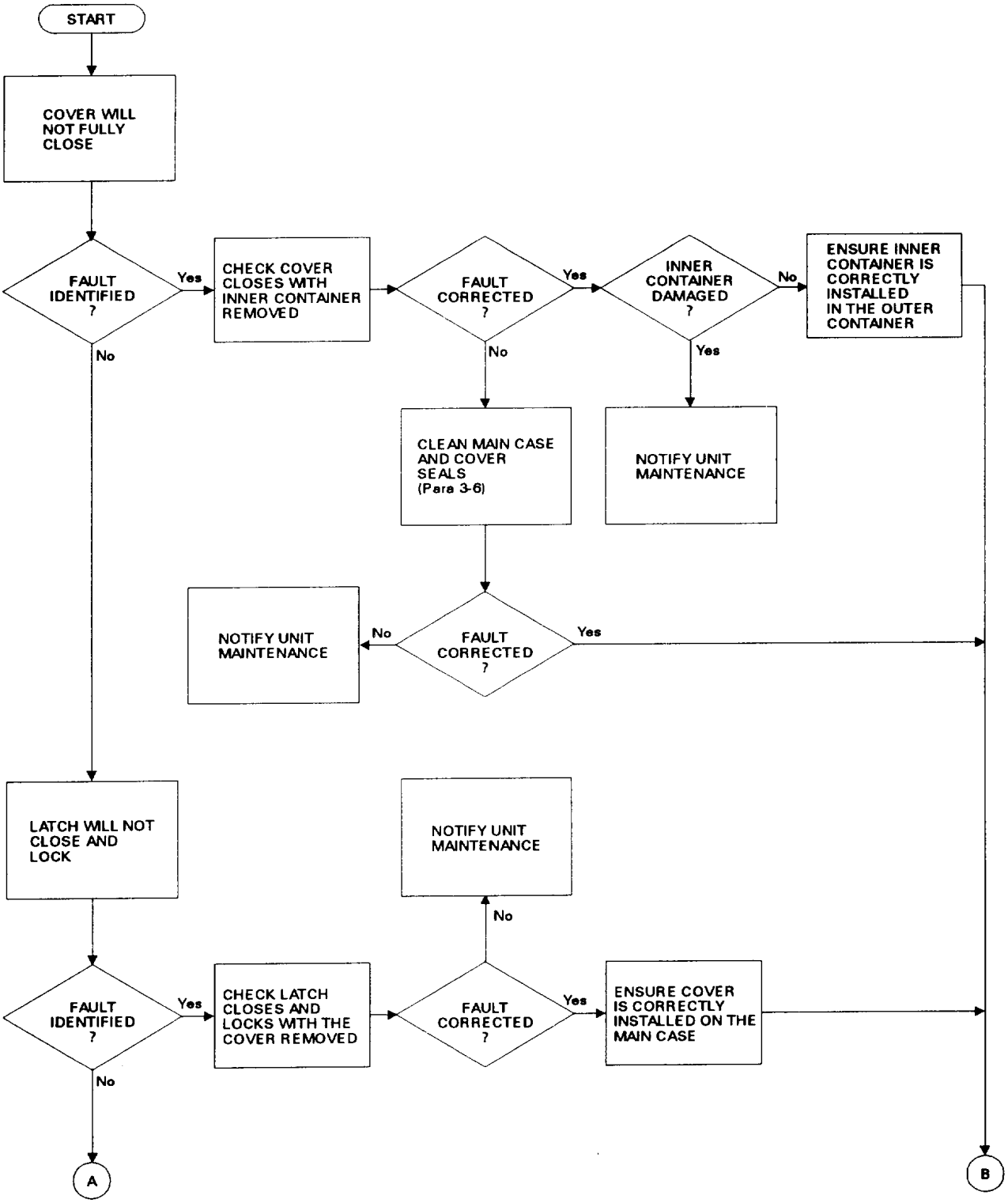
CAUTION

DISASSEMBLY. Do not attempt disassembly beyond that which is necessary for operator troubleshooting and maintenance. Unauthorized disassembly can result in the HWR becoming non-operational.

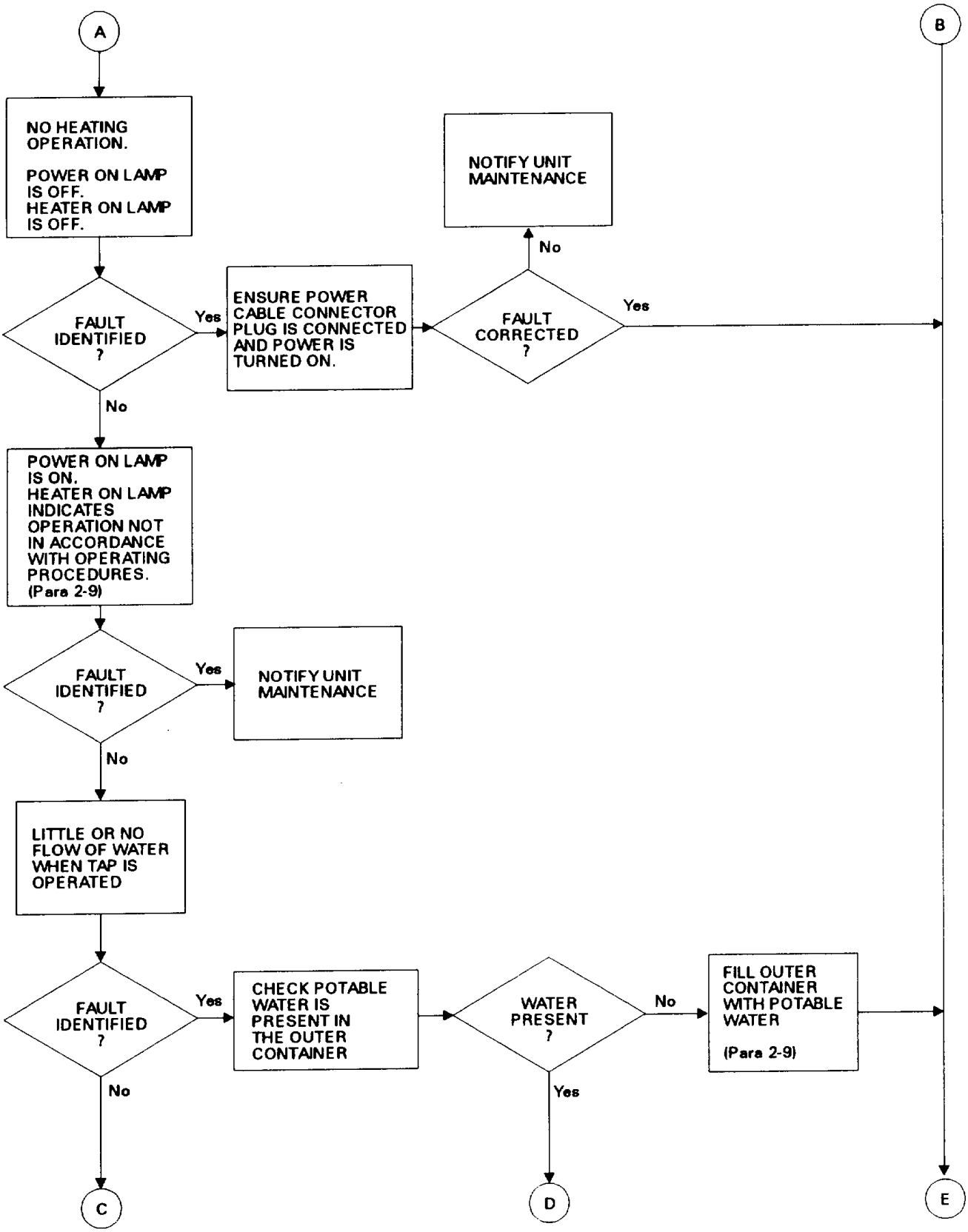
This troubleshooting flowchart describes typical malfunctions, which are most likely to occur when operating the HWR. To use the flowchart, commence at the START function and check each set of fault conditions against the observed malfunction. When the matching fault conditions are identified, rectify the malfunction by following the corrective action instructions in the order in which they appear.

The flowchart cannot contain all the malfunctions that may occur or all the corrective actions needed to rectify a particular malfunction. If a particular malfunction cannot be identified, or is not cleared by the corrective actions, notify unit maintenance.

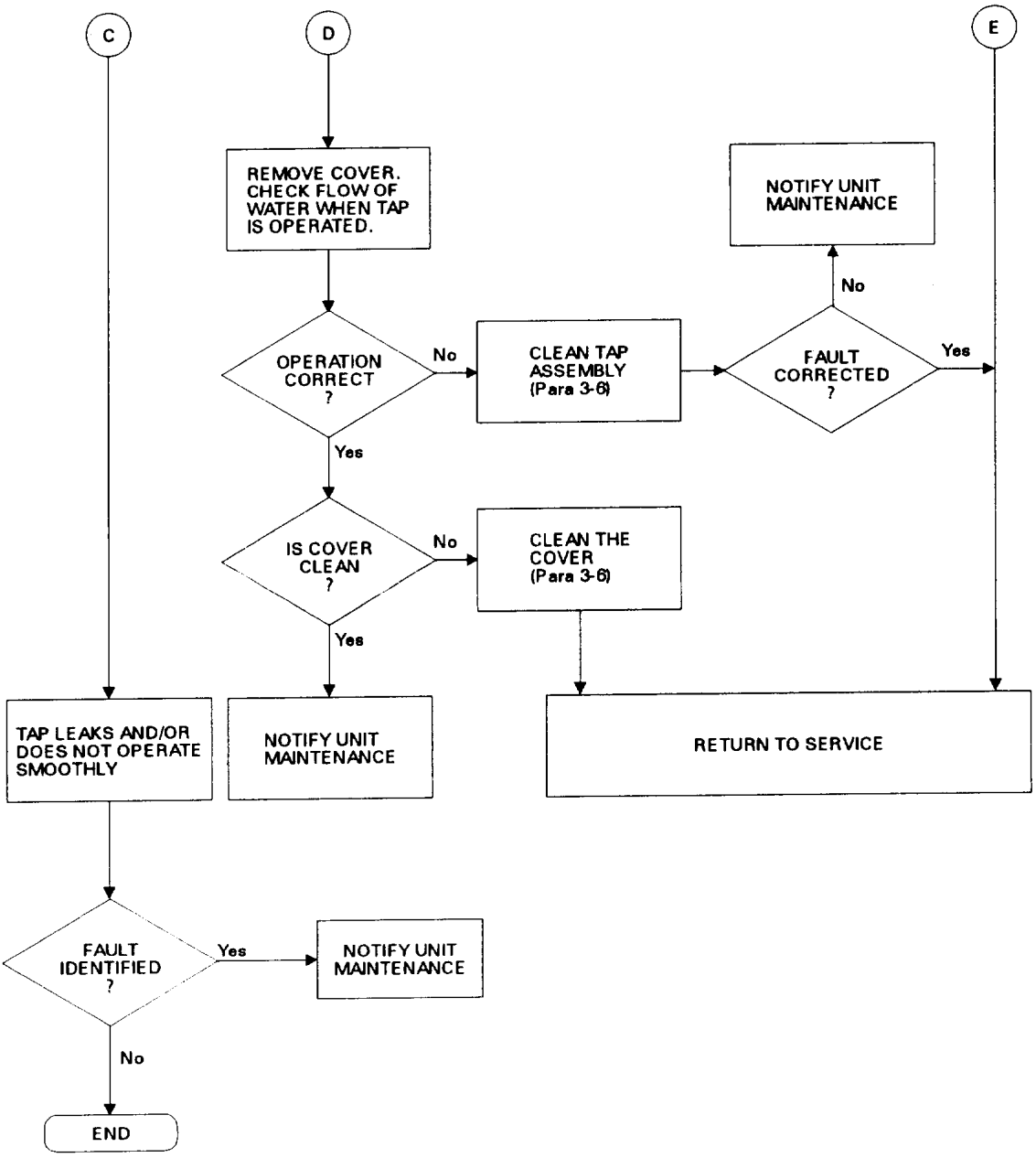
3-3. TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15 (Continued)



3-3. TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15 (Continued)



3-3. TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15 (Continued)



3-3.1. TROUBLESHOOTING INSTRUCTIONS FOR MODEL 471012

Problem	Probable Cause	Recommended Solution
No power	Vehicle's electrical system is Disconnected. Power shut off to HWR circuit	Connect electrical system. Turn power on to HWR circuit.
HWR circuit breaker trips	Circuit is 15 amps or less. Other equipment is installed in the same circuit.	Install HWR in a dedicated 20 A circuit. Ensure that the other equipment is operating correctly, and that the total current draw does not exceed circuit capacity.

3-3.1 TROUBLESHOOTING INSTRUCTIONS FOR MODEL 471012 (Continued)

Problem	Probable Cause	Recommended Solution
HWR heats in switch setting 0 (OFF) when connected, but green light stays on.	The positive and negative wires of the power cable are connected incorrectly.	Connect Pin A to +24 V dc and connect Pin B to Ground. Pin C should have no connection.
Excessive time is required to heat water.	Lid open. Latches not clamped down. Lid not sealing properly.	Close lid. Clamp down latches. Adjust latches so lid seals tightly.
Excessive time is required to warm MRE entrees.	Lid open. Latches not clamped down. Lid not sealing properly. Switch is on Setting I Main container was filled with water above lower indicator line.	Close lid. Clamp down latches. Adjust latches so lid seals tightly. Position switch to Setting II Reduce water level in main container to lower indicator line.

Section III. OPERATOR'S MAINTENANCE PROCEDURES

3-4. GENERAL

Corrective maintenance by the operator is limited to the following procedures as authorized by the "Inspect" and "Service" functions of the MAC in Appendix B:

a. Inspection. Visual checks for correct installation, physical damage, and loose or missing parts.

b. Cleaning. Cleaning of internal and external parts using hand dishwashing compound.

c. Sanitizing. Sanitizing of internal parts using food service disinfectant.

3-5. INSPECTION

Perform inspection of the HWR as described in Chapter 2, Section II, Preventive Maintenance Checks and Services (PMCS). Report defects on DA Form 2404 (Equipment Inspection and Maintenance Worksheet).

3-6. CLEANING FOR MODEL RAK-15

Cleaning of the HWR should be performed when required by the procedures described in Chapter 2, Section II, Preventive Maintenance Checks and Services (PMCS). Wipe the HWR cover, inner/outer containers and main case with a dry cleaning cloth (Appendix E, Section II, Item 2) after every use.

The HWR should be cleaned and sanitized weekly or more frequently if food stains appear.

3-6. CLEANING FOR MODEL RAK-15 (Continued)

WARNING

NON-POTABLE/DIRTY WATER (2). Only use clean, potable water as defined in FM 10-52 (Water Supply in Theaters of Operations) when cleaning the HWR. Non-potable or dirty water can cause contamination of water or food.

CAUTION

- IMMERSION IN WATER. Do not immerse the HWR in water. The seeping of water to the control panel can result in the HWR becoming non-operational.

- CLEANING MATERIALS. Only use the authorized cleaning materials listed in Section II of Appendix E. Materials such as metal scouring pads can cause damage to the surface finish.

- DISHWASHING COMPOUND. Discard heated hand dishwashing compound solution in accordance with the disposal instructions in FM 21-10 (Field Hygiene and Sanitation).

NOTE

When the HWR is mounted in the host vehicle it is not necessary to disconnect the power supply when performing the cleaning procedures.

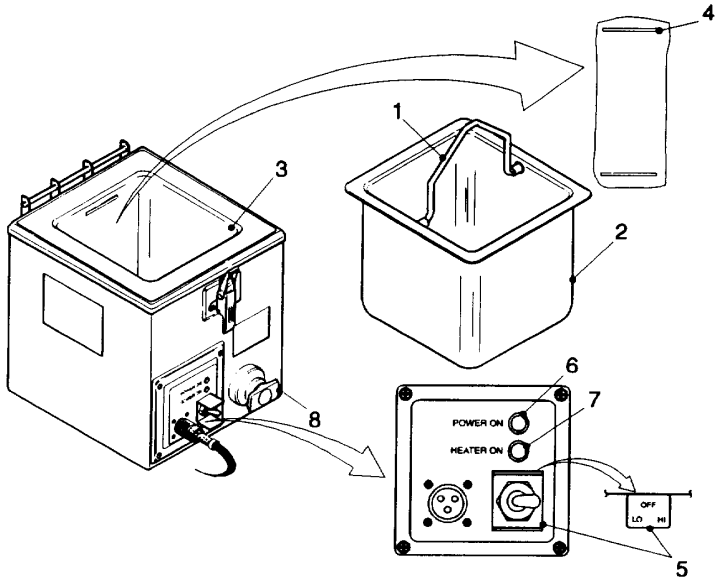
3-6. CLEANING FOR MODEL RAK-15 (Continued)

a. Preliminary/Final Procedures.

(1) To prepare the HWR for cleaning, perform steps (1) thru (6) of Subparagraph 2-9a.

(2) To return the HWR to normal service, perform steps (9) thru (11) of Subparagraph 2-9b.

b. Cleaning the Inner/Outer Containers and Tap. Perform the following procedural steps in the given order:



(1) Prepare the HWR for cleaning in accordance with step (1) of Subparagraph 3-6a.

NOTE

If required, the fold-down wire handle (1) can be removed from the inner container (2) by squeezing the vertical arms towards the center until both ends are clear of the bearing sockets.

(2) Remove any loose food from the inner container (2) and outer container (3) by pre-scraping.

(3) Fill the outer container (3) with clean, potable water up to the one-gallon level line (4) embossed on the rear wall.

(4) Set the LO/OFF/HI switch (5) to LO and verify that the POWER ON lamp (6) and HEATER ON lamp are both on.

(5) When the HEATER ON lamp (7) goes off again (i.e., water is at selected temperature), set the LO/OFF/HI switch (5) to OFF and verify that the POWER ON lamp (6) is off.

(6) Using the pull-action tap (8), half-fill the inner container (2) with heated water from the outer container (3).

3-6. CLEANING FOR MODEL RAK-15 (Continued)

(7) Using a field mess spoon (Appendix E, Section II, Item 6), add one ounce (i.e., two spoonfuls) of hand dishwashing compound (Appendix E, Section II, Item 3) to both containers and stir vigorously to produce suds.

NOTE

In step (8), retain the wash water if the cover (Subparagraph 3-6c) and/or the main case (Subparagraph 3-6d) are to be cleaned.

(8) Clean the pull-action tap (8) by draining-off one canteen cupful of the outer container (3) wash water and discard if not required.

(9) Using a scrub brush (Appendix E, Section II, Item 1) or a scouring pad (Appendix E, Section II, Item, (5), scrub both containers until they are free of any persistent food residue and/or discoloration.

(10) Discard the contents of both containers.

(11) Half-fill the outer container (3) with clean, potable water and rinse off all traces of hand dishwashing compound.

(12) Flush the pull-action tap (8) by draining-off the outer container (3) rinse water into a receptacle of suitable capacity and discard.

(13) Rinse the inner container (2) with clean, potable water to remove all traces of hand dishwashing compound.

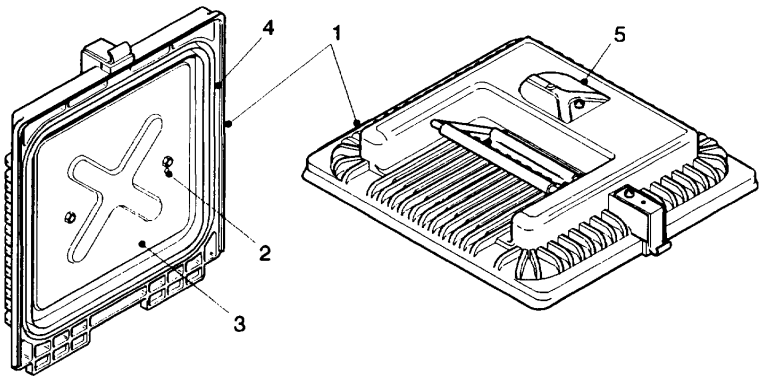
(14) Allow both containers to air dry.

NOTE

To clean the cover, perform the procedure in Subparagraph 3-6c or to clean the main case perform the procedure in Subparagraph 3-6d. Otherwise, proceed to step (15).

(15) Return the HWR to normal service in accordance with step (2) of Subparagraph 3-6a.

c. Cleaning the Cover. Perform the following procedural steps in the given order:



3-6. CLEANING FOR MODEL RAK-15 (Continued)

(1) To prevent the seeping of liquid into the interior of the cover (1), block-off the small steam hole (2) in the seal retaining plate (3) using an easily removable means (e.g., tapered wooden peg of suitable size).

(2) Remove any loose food from the seal retaining plate (3) and cover seal (4) by pre-scraping.

(3) Using a scrub brush (Appendix E, Section II, Item 1) or a scouring pad (Appendix E, Section II, Item 5), scrub the seal retaining plate (3) until it is free of any persistent food residue and/or discoloration.

(4) Wash the cover (1) with the heated hand dishwashing compound solution retained in step (8) of Subparagraph 3-6b taking care to avoid splashing or immersing the pressure relief valve (5).

(5) Rinse the cover (1) with clean, potable water to remove all traces of hand dishwashing compound taking care to avoid splashing or immersing the pressure relief valve (5).

(6) Allow cover (1) to air dry.

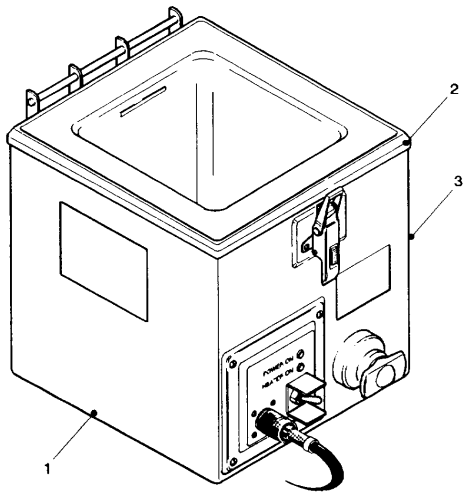
(7) On the cover (1), unblock the small steam hole (2) in the seal retaining plate (3).

NOTE

To clean the main case, perform the procedure in Subparagraph 3-6d. Otherwise proceed to step (8).

(8) Return the HWR to normal service in accordance with step (2) of Subparagraph 3-6a.

d. Cleaning the Main Case. Perform the following procedural steps in the given order:



3-6. CLEANING FOR MODEL RAK-15 (Continued)

(1) Remove any loose food from the main case (1) and case seal (2) by pre-scraping.

(2) Wipe the case seal (2) with a cleaning cloth (Appendix E, Section II, Item 2), which has been soaked in the heated hand dishwashing compound solution retained in step (8) of Subparagraph 3-6b.

(3) Wipe the case seal (2) with a damp cleaning cloth (Appendix E, Section II, Item 2) to remove all traces of hand dishwashing compound.

(4) Clean the main case (1) using a cleaning cloth (Appendix E, Section II, Item 2) and the heated hand dishwashing compound solution retained in step (8) of Subparagraph 3-6b taking care to avoid splashing the control panel (3).

(5) Rinse the main case (1) with clean, potable water to remove all traces of hand dishwashing compound taking care to avoid splashing the control panel (3).

(6) Allow the main case (1) to air dry.

(7) Return the HWR to normal service in accordance with step (2) of Subparagraph 3-6a.

3-6.1 CLEANING FOR MODEL 471012

a. Preliminary/Final Procedures.

(1) Ensure the power switch is in the OFF position and the heater is completely cooled.

(2) Remove the cover (Subparagraph 4-12.1a).

b. Cleaning the Inner Container and Spigot..

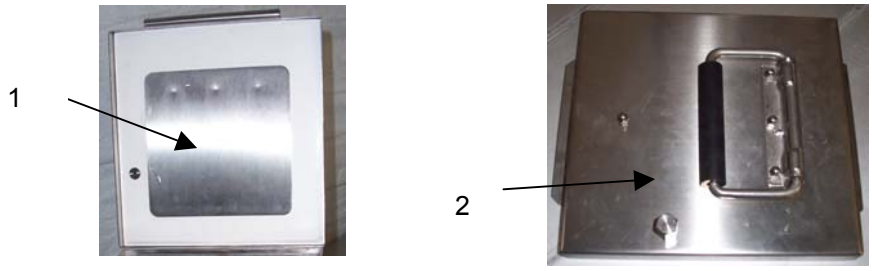
(1) Clean the inside and outside of the inner container (1) with a solution of dishwashing detergent and warm water. For tougher stains, a mild scouring pad can be used.

3-6.1 CLEANING FOR MODEL 471012 (Continued)

(2) Clean the interior of the spigot (2) by drawing off a solution of dishwashing detergent and hot water, or descaling agent through the spigot and then flushing thoroughly with warm water.

(3) If a more thorough cleaning is required, following the instructions to remove the spigot (Subparagraph 4-15.1). Then, clean the spigot body with a pipe cleaner and a small brush. Clean the valve seal with a small brush.

c. Cleaning the Cover and Relief Valve.

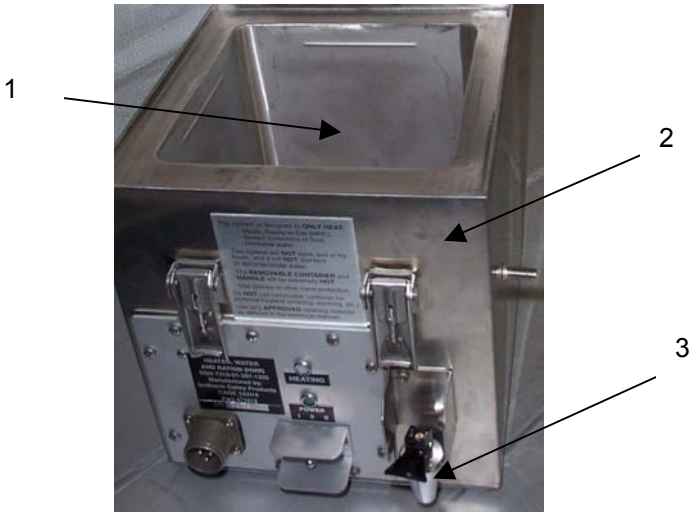


(1) Clean the inside (1) and outside (2) of the lid with a solution of dishwashing detergent and warm water. Use a soft cloth to avoid damage to the lid seal.

(2) Ensure that the entrance and exit ports of the relief valve are not blocked. The entrance port of the relief valve can be accessed through the hole in the lid seal. The exit ports of the relief valve are located on the side of the valve body.

(3) Clean the port areas with a pipe cleaner and/or a small brush. Blow any loose material away. If a more thorough cleaning is required, follow the instructions to replace the valve (Subparagraph 4-12.1e).

d. Cleaning the Main Case.



3-6.1 CLEANING FOR MODEL 471012 (Continued)

(1) Clean the inside (1) and outside (2) of the main container with a solution of dishwashing detergent and warm water. For tougher stains, use a mild scouring pad on the inside surface only of the main container.

(2) Thoroughly flush the container and spigot (3) with water after cleaning.

3-7. SANITIZING

Sanitizing of the HWR should be performed when required by the procedures described in Chapter 2, Section II, Preventive Maintenance Checks and Services (PMCS). The HWR should be cleaned and sanitized weekly or more frequently if food stains appear.

WARNING

NON-POTABLE/DIRTY WATER (2). Only use clean, potable water as defined in FM 10-52 (Water Supply in Theaters of Operations) when cleaning the HWR. Non-potable or dirty water can cause contamination of water or food.

CAUTION

- IMMERSION IN WATER. Do not immerse the HWR in water. The seeping of water to the control panel can result in the HWR becoming non-operational.
- CLEANING MATERIALS. Only use the authorized cleaning materials listed in Section II of Appendix E. Materials such as metal scouring pads can cause damage to the surface finish.
- FOOD SERVICE DISINFECTANT. Discard heated food service disinfectant solution in accordance with the disposal instructions in FM 21-10 (Field Hygiene and Sanitation).

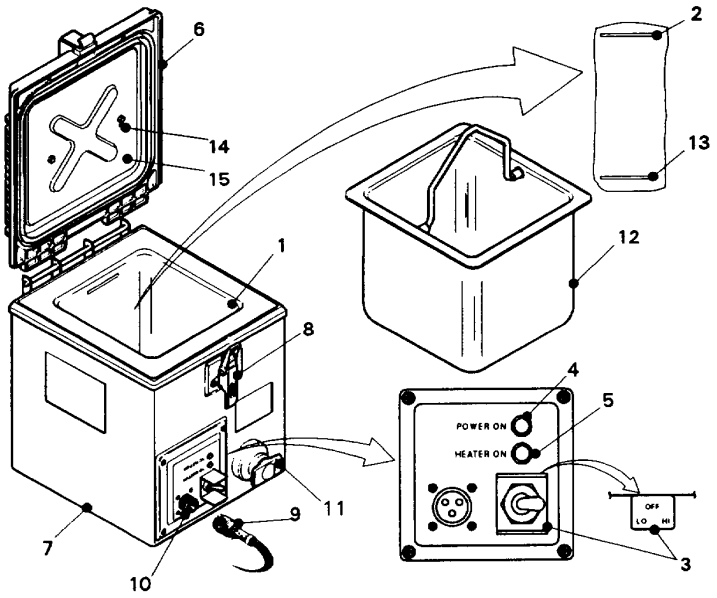
3-7. SANITIZING (Continued)

a. Preliminary/Final Procedures.

(1) To prepare the HWR for sanitizing, perform steps (1) thru (6) of Subparagraph 2-9a.

(2) To return the HWR to normal service, perform steps (9) thru (11) of Subparagraph 2-9b.

b. Sanitizing Procedure. Perform the following procedural steps in the given order:



(1) Prepare the HWR for sanitizing in accordance with step (1) of Subparagraph 3-7a.

(2) Fill the outer container (1) with clean, potable water up to the one-gallon level line (2) embossed on the rear wall.

(3) Set the LO/OFF/HI switch (3) to LO and verify that the POWER ON lamp (4) and HEATER ON (5) are both on.

(4) When the HEATER ON lamp (5) goes off again (i.e., water is at selected temperature), set the LO/OFF/HI switch (3) to OFF and verify that the POWER ON lamp (4) is off.

(5) Fit the cover (6) onto the main case (7) ensuring that it is properly closed and secured by the latch (8).

(6) Turn off the power supply then disconnect the power cable connector plug (9) from the connector receptacle (10).

(7) Remove the HWR from the host vehicle, place upright in a suitable work location then unlatch and remove the cover (6).

3-7. SANITIZING (Continued)

(8) Using a field mess spoon (Appendix E, Section II, Item 6), and add one spoonful of food service disinfectant (Appendix E, Section II, Item 4) to the heated water in the outer container (1) and stir thoroughly until fully dissolved.

(9) Wait five minutes then drain-of one canteen cupful of the food service disinfectant/heated water solution through the pull-action tap (11) and discard.

(10) Using the pull-action tap (11), drain-off the heated food service disinfectant solution into the inner container (12) until the level in the outer container (1) falls to the 40 fluid ounce level line (13).

(11) Install the inner container (112) into the main case (7) taking care to not spill the heated food service disinfectant solution.

(12) To prevent the seeping of liquid into the interior of the cover (6), block-off the small steam hole (14) in the seal retaining plate (15) using an easily removable means (e.g., tapered wooden peg of suitable size).

(13) Install the cover (6) onto the main case (7) ensuring that it is properly closed and secured by the latch (8).

(14) Temporarily invert the HWR to allow the heated food service disinfectant solution to reach all internal surfaces then return it to the upright position.

NOTE

Allow the HWR to stand upright for a minimum period of twenty minutes before proceeding to step (15).

(15) Unlatch and remove the cover (6) then remove the inner container (12) the heated food service disinfectant solution.

(16) Using the pull-action tap (11), drain-off the heated food service disinfectant solution from the outer container (1).

(17) Half-fill the outer container (1) with clean, potable water to remove all traces of food service disinfectant..

(18) Flush the pull-action tap (11) by draining-off the outer container (1) rinse water into a receptacle of suitable capacity and discard.

(19) Rinse the inner container (12) with clean, potable water to remove all traces of food service disinfectant.

(20) Allow the cover (6) and both containers to air dry.

(21) On the cover (6), unblock the small steam hole (14) in the seal retaining plate (15).

(22) Install the HWR in the host vehicle, connect the power cable connecting the plug (9) to the connector receptacle (10) then turn on the power supply.

(23) Return the HWR to normal service in accordance with step (2) of Subparagraph 3-7a.

CHAPTER 4

UNIT MAINTENANCE INSTRUCTIONS

Page

Section I REPAIR PARTS, TOOLS, SPECIAL TOOLS, TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE), SUPPORT EQUIPMENT 4-1
4-1 Common Tools and Equipment 4-1
4-2 Special Tools, TMDE and Support Equipment 4-2
4-3 Repair Parts 4-2

Section II SERVICE UPON RECEIPT 4-2
4-4 Unpacking 4-2
4-5 Checking Unpacked Equipment 4-2
4-6 Installation Instructions 4-2

Section III PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) 4-2
4-7 General 4-2
4-8 PMCS Procedures 4-3

Section IV UNIT TROUBLESHOOTING PROCEDURES 4-4
4-9 General 4-4
4-10 Troubleshooting Instructions for Model RAK-15 4-4
4-10.1 Troubleshooting Instructions for Model 471012 ..... 4-8.1

Section V UNIT MAINTENANCE PROCEDURES 4-9
4-11 General 4-9
4-12 Repair of Cover Assembly for Model RAK-15 4-10
4-12.1 Replacement of the Cover Assembly for Model RAK-15 ..... 4-12.1
4-13 Replacement of Inner Container Assembly for Model RAK-15 4-13
4-14 Replacement of Latch Assembly for Model RAK-15 4-14
4-14.1 Replacement of the Latch for Model 471012 ..... 4-14.1
4-15 Repair of Tap Assembly for Model RAK-15 4-15
4-15.1 Replacement of the Tap Assembly for Model 471012 ..... 4-18.1
4-16 Repair of Control Panel Assembly for Model RAK-15 4-19
4-16.1 Replacement of the Control Panel Assembly for Model 471012 4-21

Section VI PREPARATION FOR STORAGE OR SHIPMENT 4-22.23
4-17 Special Instructions for Administrative Storage 4-22.23
4-18 Preparation for Storage 4-22.23
4-19 Preparation for Shipment 4-22.23

Section I. REPAIR PARTS, TOOLS, SPECIAL TOOLS, TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE), SUPPORT EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) as applicable for your unit.

The following tool kits are required for maintenance of the HWR at Unit level:

a. Tool Kit, General Mechanics: Automotive.

b. Shop Equipment, Common, No 1.

4-2. SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

a. List of Special Tools. No special tools are required.

b. List of Test, Measurement and Diagnostic Equipment.

Multimeter, Digital (Component of Shop Equipment, Common, No 1). (Appendix B, Section III, Item 2).

c. List of Support Equipment. No support equipment is required.

4-3. REPAIR PARTS

Repair parts are listed and illustrated in Appendix C of this manual.

Section II. SERVICE UPON RECEIPT

4-4. UNPACKING

The HWR is packaged in a cardboard container designed for shipment and handling. No unusual unpacking procedures are required, but exercise care when removing the HWR from the container to prevent accidental damage. Keep the container (plus packing material) for future use.

4-5. CHECKING UNPACKED EQUIPMENT

After unpacking, check the HWR for damage, completeness and modifications as follows:

a. Inspect for damage incurred during shipment. If the HWR has been damaged, report the damage on SF 364 (Report of Discrepancy).

b. Check against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions in DA Pam 738-750.

c. Check the modification status. If the HWR has been modified the Modification Work Order (MWO) number will appear near the nomenclature plate. Check to see if the MWO number (if any) and appropriate notations concerning the MWO have been entered in this manual. Current MWO's are listed in DA Pam 750-10.

4-6. INSTALLATION INSTRUCTIONS

Refer to the appropriate technical manual(s) for information on the installation kit, which covers all the location, mounting and electrical connection requirements for the HWR in the host vehicle.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-7. GENERAL

Preventive Maintenance Checks and Services (PMCS) provide systematic care, inspection and servicing of the HWR to keep it in good condition and help to prevent malfunctions.

The responsibilities associated with PMCS of the HWR at Unit level are as described in the following subparagraphs:

a. Always perform the PMCS procedures in the same order so that a routine is established which allows any malfunction(s) to be quickly identified.

4-7. GENERAL (Continued)

b. Perform the PMCS procedures at a regular time within the stated periods.

c. Comply with all applicable WARNINGS, CAUTIONS and NOTES.

d. Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) to record any malfunction(s), which are identified during PMCS and cannot be corrected. DO NOT record any malfunction(s), which have been identified and corrected.

e. Be prepared to assist with higher-level maintenance tasks when requested.

4-8. PMCS PROCEDURES

The Preventive Maintenance Checks and Services given in Table 4-1 list the inspections and care required to keep the HWR in good operating condition.

The following subparagraphs describe the column entries in Table 4-1:

a. The "ITEM No." column indicates the consecutive numerical order assigned to the procedures. The item numbers are also used when recording the results of PMCS on DA Form 2404, Equipment Inspection and Maintenance Worksheet.

b. The "INTERVAL" column indicates when a check or service should be performed.

c. The "LOCATION, ITEM TO CHECK/SERVICE" column identifies the part that is checked or serviced.

d. The "PROCEDURE" column contains appropriate instructions for the performance of each check or service.

e. The "NOT FULLY MISSION CAPABLE IF" column describes the conditions under which the HWR is not mission capable and why it cannot be used.

f. Refer to Chapter 4, Section IV, Unit Troubleshooting Procedures if the HWR does not perform as stated.

g. If a malfunction is identified and cannot be corrected, write out a DA Form 2404 IMMEDIATELY and report it to the supervisor.

h. The following general checks should be performed as necessary:

(1) **Corrosion.** Report corrosion problems in accordance with the instructions given in Chapter 1, Section I, Paragraph 1-4.

(2) **Screws and Nuts.** Check for looseness, missing, bent or broken condition. Tighten or replace as required.

(3) **Power Cable Connector Plug.** Check for proper fit of the connector plug and for signs of physical damage to the connector plug or power cable. Tighten connector plug to hand tightness if loose.

4-8. PMCS PROCEDURES (Continued)

TABLE 4-1. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Item No.	Interval	Location: Item to Check/ Service	Procedure	Not Fully Mission Capable if.
1	Monthly	Pressure Relief Valve	a. Test operation of pressure relief valve (Paragraph 4-12).	Pressure relief valve does not seat correctly.

Section IV. UNIT TROUBLESHOOTING PROCEDURES

4-9. GENERAL

Unit troubleshooting is based on malfunctions or failures observed during operator PMCS (Chapter 2, Table 2-1), Unit PMCS (Table 4-1) or operational use of the HWR.

4-10 TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15

WARNING

- ELECTRIC SHOCK. Do not be misled by the term "low-voltage". Whenever possible turn off and disconnect the HWR power supply before performing any work. Potentials as low as 30 V dc can cause severe electric shock or death under adverse conditions.
- HIGH TEMPERATURES (1). Be aware that normal operating temperatures within the HWR are up to 190 *F (88 'C) and can reach higher temperatures under abnormal conditions. Use gloves or other hand protection as necessary. Unprotected exposure to high temperatures can cause serious burn injuries.
- FIRST AID. Never work on the HWR unless there is another person present who is competent in administering first aid. The absence of first aid can result in serious personal injury or even death. Refer to FM 21 -11 (First Aid for Soldiers) for appropriate first aid instructions.

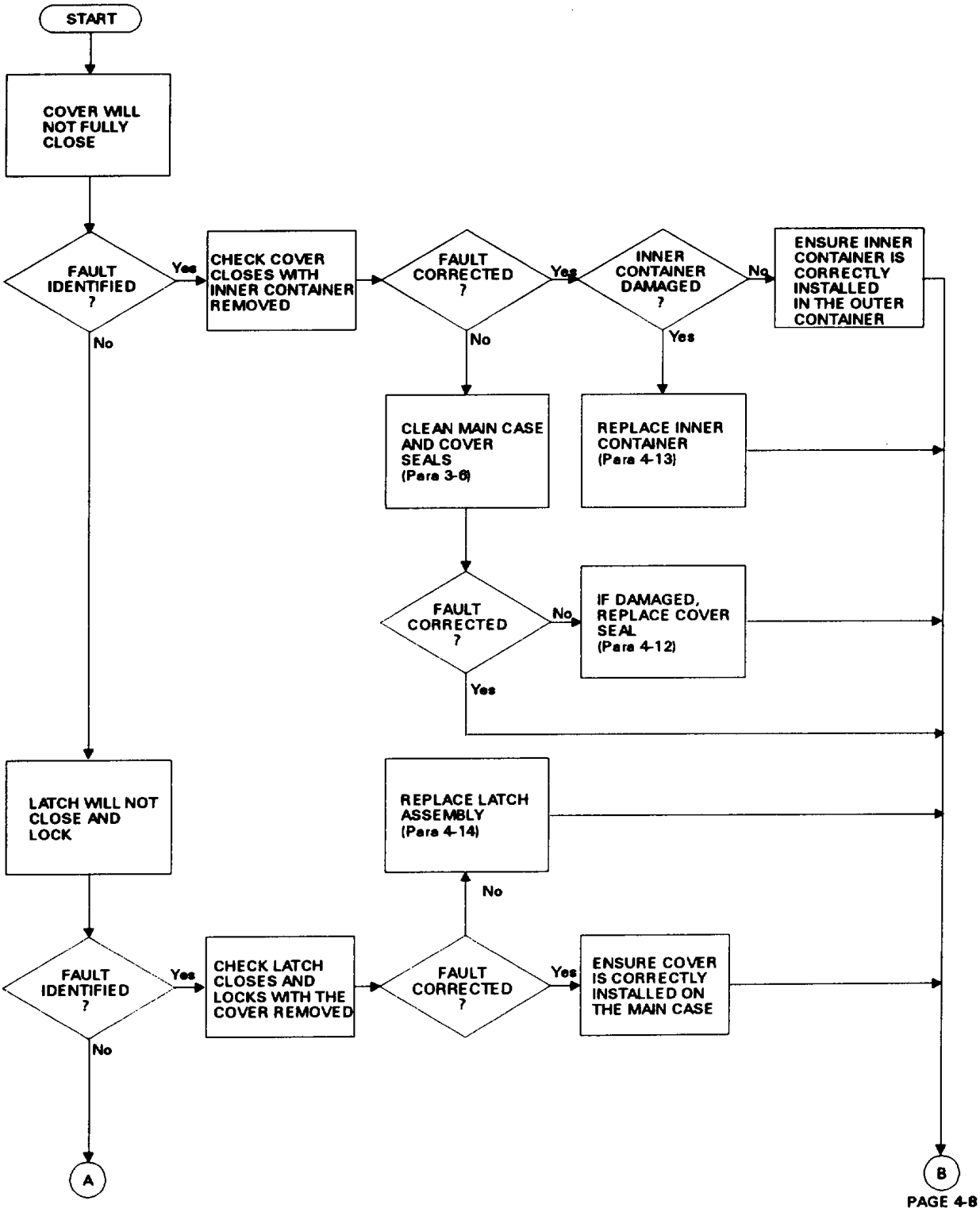
CAUTION

DISASSEMBLY. Do not attempt disassembly beyond that which is necessary for unit troubleshooting and maintenance. Unauthorized disassembly can result in the HWR becoming non-operational.

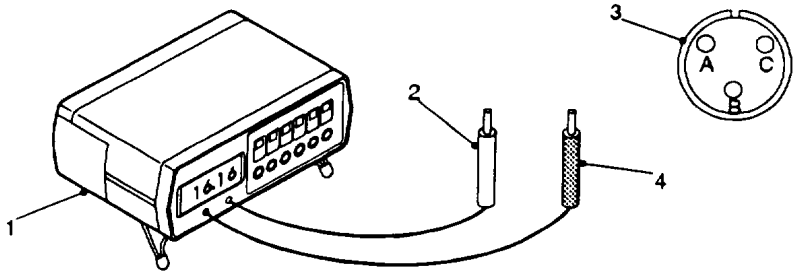
This troubleshooting flowchart describes typical malfunctions, which are most likely to occur when operating the HWR. To use the flowchart, commence at the START function and check each set of fault conditions against the observed malfunction. When matching fault conditions are identified, rectify the malfunction by following the corrective action instructions in the order in which they appear.

The flowchart cannot contain all the malfunctions that may occur or all the corrective actions needed to rectify a particular malfunction. If a particular malfunction cannot be identified, or is not cleared by the corrective actions, notify your supervisor.

4-10 TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15 (Continued)



4-10. TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15 (Continued)



A

NO HEATING OPERATION.

POWER ON LAMP IS OFF.
HEATER ON LAMP IS OFF.

FAULT IDENTIFIED ?

Yes

ENSURE POWER CABLE CONNECTOR PLUG IS CONNECTED AND POWER IS TURNED ON.

FAULT CORRECTED ?

Yes

No

No

CHECK POWER SUPPLY POLARITY:

* DISCONNECT POWER CABLE CONNECTOR PLUG (3) FROM HWR CONNECTOR RECEPTACLE.
* SET MULTIMETER (1) TO READ DC VOLTS.
* CONNECT RED (+) TEST PROBE (2) TO A ON POWER CABLE CONNECTOR PLUG (3).
* CONNECT BLACK (-) TEST PROBE (4) TO B ON POWER CABLE CONNECTOR PLUG (3).
* VERIFY MULTIMETER READING IS A POSITIVE (+) VOLTAGE.

POLARITY CORRECT ?

Yes

CONNECT POWER CABLE CONNECTOR PLUG (3) TO HWR CONNECTOR RECEPTACLE

No

REFER TO HOST VEHICLE TECHNICAL MANUAL(S)

TEST OPERATION OF TOGGLE SWITCH (Para 4-16)

OPERATION CORRECT ?

No

RELACE TOGGLE SWITCH (Para 4-16)

Yes

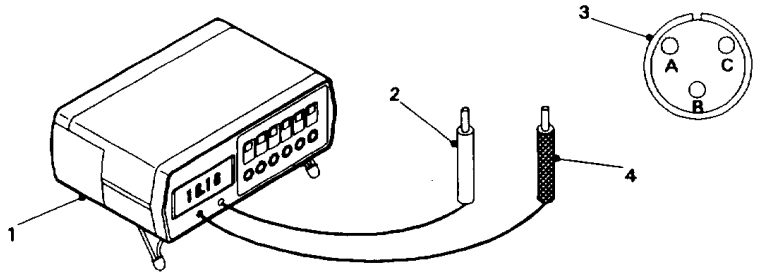
REPLACE HWR

C

D

PAGE 4-8

4-10. TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15 (Continued)



C

NO HEATING OPERATION. POWER ON LAMP IS OFF. HEATER ON LAMP IS ON BRIEFLY THEN OFF.

FAULT IDENTIFIED ? — Yes

CHECK POWER SUPPLY VOLTAGE:

* DISCONNECT POWER CABLE CONNECTOR PLUG (3) FROM HWR CONNECTOR RECEPTACLE.
* SET MULTIMETER (1) TO READ DC VOLTS.

  CONNECT RED (+) TEST PROBE (2) TO A ON POWER CABLE CONNECTOR (3).
* CONNECT BLACK (-) TEST PROBE (4) TO B ON POWER CABLE CONNECTOR PLUG (3).
* OBSERVE MULTIMETER READING.

LESS THAN +22Vdc ? — Yes — REFER TO HOST VEHICLE TECHNICAL MANUAL(S)

No — REPLACE HWR

No

POWER ON LAMP IS ON. HEATER ON LAMP INDICATES OPERATION NOT IN ACCORDANCE WITH OPERATING PROCEDURES. (Para 2-9)

FAULT IDENTIFIED ? — Yes — REPLACE HWR

No

LITTLE OR NO FLOW OF WATER WHEN TAP IS OPERATED

FAULT IDENTIFIED ? — Yes — REMOVE COVER. CHECK FLOW OF WATER WHEN TAP IS OPERATED

OPERATION CORRECT ? — No — CLEAN TAP ASSEMBLY (Para 3-6)

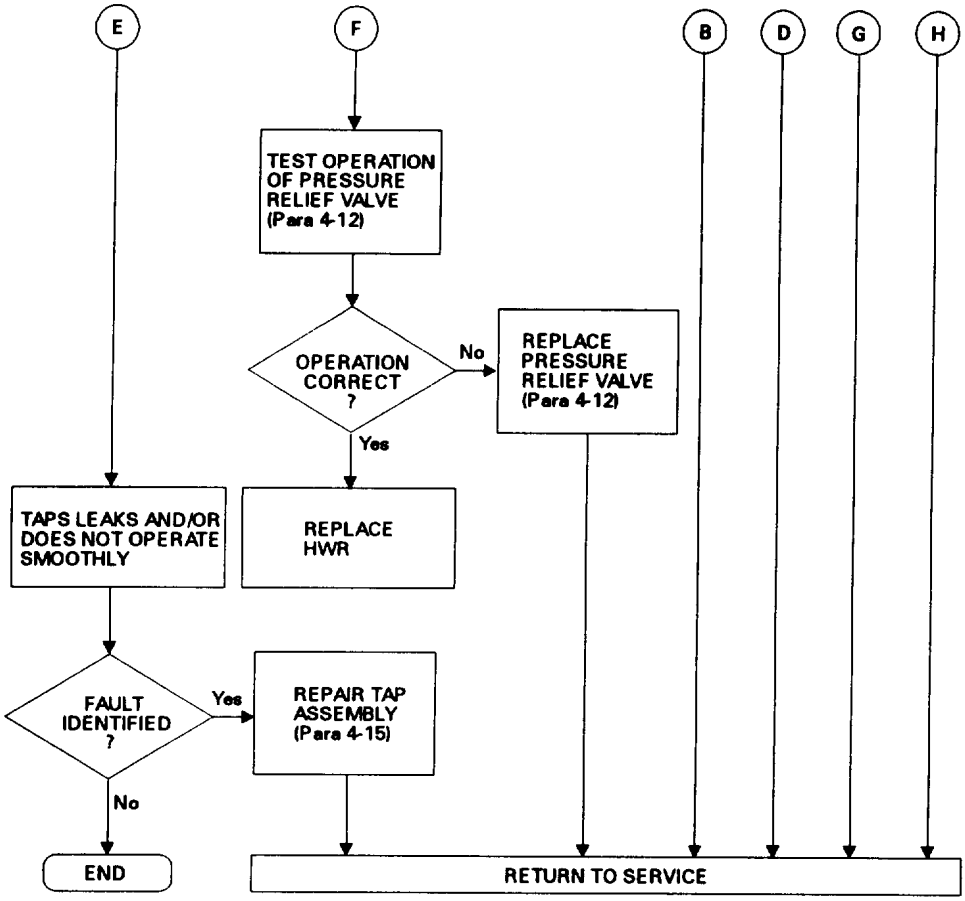
Yes — F

FAULT CORRECTED ? — Yes — H

No — REPAIR TAP ASSEMBLY (Para 4-15) — G

No — E

4-10. TROUBLESHOOTING INSTRUCTIONS FOR MODEL RAK-15 (Continued)



4-10.1 TROUBLESHOOTING INSTRUCTIONS FOR MODEL 471012

Problem	Probable cause	Solution
Inner container sticks in the main Container.	Inner container's sides are bowed out.	Carefully tap sides of the inner container with a rubber mallet, to remove bowing.
Tap has low flow rate.	Lid is closed and latched, preventing air from entering. Tap or tap shank is clogged.	Open lid. Inspect tap and shank. Clean tap and/or shank if required.
Tap leaks: - at outlet. - at shank.	Tap valve seal is leaking. Shank is loose at tap.	Inspect tap valve seal. Replace if required. Tighten tap on shank. Re align tap vertically by loosening the jam nut then re-tightening.

4-10.1 TROUBLESHOOTING INSTRUCTIONS FOR MODEL 471012 (Continued)

Problem	Probable cause	Solution
Tap leaks: -at main container outlet.	Shank jam nut is loose.	Tighten jam nut.
	Shank O-ring is leaking.	Replace O-ring.
HWR vents at lid gasket.	Lid gasket is leaking.	Tighten or replace lid gasket.
Pressure relief valve. - leaks between lid and manifold.	Valve inlet port is loose. O-ring is leaking.	Re-tighten inlet port on underside of lid. Replace O-ring.
- always vents	Valve is stuck open.	Replace valve.
- allows excessive pressure build-up	Inlet port is blocked, or valve is dirty.	Clean as required.
	Relief valves are defective.	Replace relief valve.
HWR circuit breaker trips.	Heating element is shorting.	Replace heating element.
	Insulation is wet.	Repair leak. Replace insulation.
	Thermal switch or thermal switch wiring is shorting.	Repair wiring or replace thermal switch
	Circuit board is defective	Replace circuit board
HWR heats in OFF (0) position. White light illuminates; green does not.	HWR power cable is incorrectly wired (wrong polarity).	Check cable wiring for correct polarity. Pin A is positive and pin B is negative.(Refer to vehicle manual) Rewire as required.
HWR heats in OFF (0) position. White light illuminates; green does not. (Continued)	Power transistor isolator is shorting.	Replace isolator.
	Heating element is shorting.	Replace heating element.
	Insulation is wet.	Repair leak. Replace insulation.
	Circuit board is defective	Replace circuit board
HWR heats in OFF (0) position. Both lights illuminate.	Switch is defective.	Replace switch.
	Circuit board is defective.	Replace circuit board.
HWR does not heat in either setting. Neither light illuminates.	Vehicle circuit breaker has tripped.	Reset breaker. If problem persists, check for shorting.
	Switch or switch wiring is defective.	Rewire or replace switch.
	Thermal switch or thermal switch wiring is defective.	Rewire or replace thermal switch.

4-10.1 TROUBLESHOOTING INSTRUCTIONS FOR MODEL 471012 (Continued)

Problem	Probable cause	Solution
	Circuit board is defective.	Replace circuit board.
HWR does not heat in either setting. Green light illuminates, white does not.	Voltage at HWR is low. Thermistor wire is broken. Circuit board is defective.	Start engine of vehicle. If necessary, check vehicle charging system. Rewire or replace thermistor Replace circuit board.
HWR does not heat in either setting. Both lights illuminate.	Heating element is burned out.	Replace heating element.
HWR functions correctly in one setting but not in the other.	Switch or switch wiring is defective. Circuit board is defective.	Rewire or replace switch. Replace circuit board.
HWR heats in settings I and II. Green light illuminates; white does not.	White light is burned out.	Replace white indicator light.
HWR heats in settings I and II White light illuminates, green does not.	Green light is burned out. Circuit board is defective.	Replace green indicator light. Replace circuit board.
HWR only heats water lukewarm.	Thermistor wire is broken.	Rewire or replace thermistor.
White light does not cycle on and off when desired temperature is reached; water temperature is excessive in setting I or Setting II.	Thermistor not firmly secured to wall of container. Circuit board is defective.	Re-mount thermistor firmly to wall. Replace circuit board.
HWR takes excessive time to heat in settings I and II. Both lights illuminate.	Heating element defective. Thermistor wire broken. Circuit board is defective.	Replace heating element. Rewire or replace thermistor. Replace circuit board.

Section V. UNIT MAINTENANCE PROCEDURES

4-11. GENERAL

This section contains unit maintenance procedures as authorized by the Maintenance Allocation Chart (MAC) provided in Appendix B. The maintenance procedures consist of step-by-step instructions and will be performed by one person unless otherwise indicated in the initial setup.

Read all WARNINGS, CAUTIONS, NOTES and instructions carefully before working on the HWR. Read and understand all the WARNINGS listed in the front of this manual.

WARNING

- ELECTRIC SHOCK. Do not be misled by the term "low-voltage". Whenever possible turn off and disconnect the HWR power supply before performing any work. Potentials as low as 30 V dc can cause severe electric shock or death under adverse conditions.

- HIGH TEMPERATURES (1). Be aware that normal operating temperatures within the HWR are up to 190 ^{O}F (88 ^{O}C) and can reach higher temperatures under abnormal conditions. Use gloves or other hand protection as necessary. Unprotected exposure to high temperatures can cause serious burn injuries.

- FIRST AID. Never work on the HWR unless there is another person present who is competent in administering first aid. The absence of first aid can result in serious personal injury or even death. Refer to FM 21-11 (First Aid for Soldiers) for appropriate first aid instructions.

CAUTION

- DISASSEMBLY. Do not attempt disassembly beyond that which is necessary for each maintenance task. Unauthorized disassembly can result in the HWR becoming non-operational.

- WORK SURFACE. Always ensure that the work surface is clean and not obstructed. A dirty or unsafe surface can cause damage to the HWR.

4-12. REPAIR OF COVER ASSEMBLY FOR MODEL RAK-15

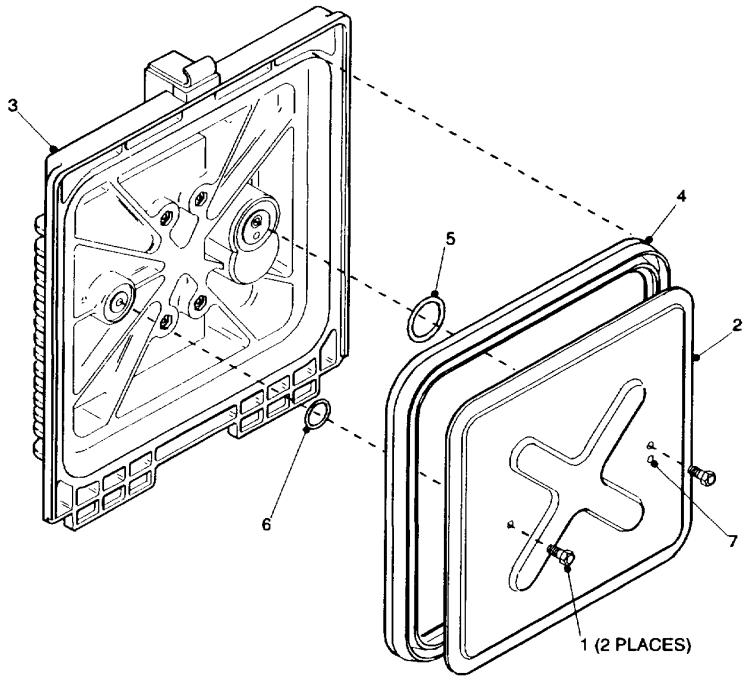
This task covers: a. Removal of Cover Seal and Preformed Packing.
b. Installation of Cover Seal and Preformed Packing.
c. Removal of Pressure Relief Valve.
d. Test of Pressure Relief Valve.
e. Installation of Pressure Relief Valve.

INITIAL SETUP

Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section III, Item 1).

Parts/materials: Kit, Cover Seal, and Kit, Pressure Relief Valve.

HWR Condition: Cover removed (Subparagraph 2-9a, steps (1) thru (5)).



a. Removal of Cover Seal and Preformed Packing.

(1) Remove and retain two screws (1) securing the seal retaining plate (2) to the underside of the cover (3).

(2) Carefully lift the seal retaining plate (2) from its seating in the cover seal (4).

(3) Remove and retain the seal retaining plate (2).

(4) Remove and discard the cover seal (4).

(5) Remove and discard the large preformed packing (5).

(6) Remove and discard the small preformed packing (6).

4-12. REPAIR OF COVER ASSEMBLY FOR MODEL RAK-15 (Continued)

b. Installation of Cover Seal and Preformed Packing.

(1) Install cover seal (4) by aligning it with the cover (3) and pressing firmly into position.

(2) Install large preformed packing (5) in the cover (3) and ensure that it is correctly positioned.

(3) Install small preformed packing (6) in the cover (3) and ensure that it is correctly positioned.

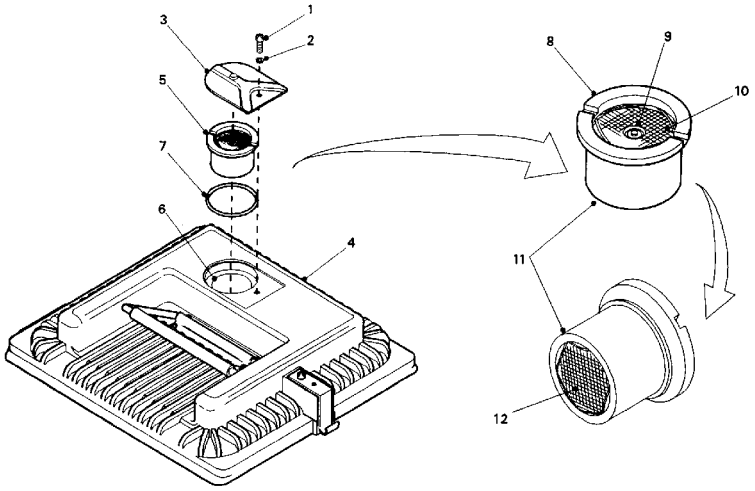
(4) Install seal retaining plate (2) to the cover seal (4) with the small steam hole (7) located as shown.

CAUTION

DAMAGE TO SCREWS. In step (5), use standard hand tools to install the screws (1) and only tighten with sufficient torque to ensure that the seal retaining plate (2) is held firmly in position. The application of excessive torque can result in damage to the screws (1).

(5) Ensure that both screw holes are correctly aligned then install and tighten the two screws (1).

(6) Install the cover (Subparagraph 2-9a, steps (8) and (9)).



c. Removal of Pressure Relief Valve.

(1) Remove and retain screw (1) and lock washer (2) securing the valve retaining plate (3) to the cover (4).

(2) Lift up valve retaining plate (3) from the cover (4) to gain access to the pressure relief valve (5).

(3) Carefully lift out pressure relief valve (5) from the valve recess (6).

(4) Remove and discard preformed packing (7) from the valve recess (6).

4-12. REPAIR OF COVER ASSEMBLY FOR MODEL RAK-15 (Continued)

d. Testing of Pressure Relief Valve.

(1) Place the pressure relief valve (5) on a clean, flat surface with the flange (8) uppermost and verify that the valve stem (9) is level with the inward gauze filter (10).

(2) Using a suitable tool (e.g., ballpoint pen top), carefully depress the valve stem (9) to its full extent and verify that it moves freely with no binding of the internal spring.

(3) Release the valve stem (9) and verify that it returns to a position level with the inward gauze filter (10).

(4) Hand-hold the pressure relief valve (5) and place the base (11) firmly against the mouth.

(5) Blow sharply through the outward gauze filter (12) and verify that the valve operates with a clearly audible sound.

(6) Verify that the valve stem (9) has returned to a position level with the inward gauze filter (10).

e. Installation of Pressure Relief Valve.

(1) Check valve recess (6) is clean and the small steam hole at the bottom is not blocked.

(2) Install preformed packing (7) in the valve recess (6) and ensure that it is correctly positioned.

(3) Install pressure relief valve (5) in the valve recess (6) and rotate with downwards pressure to ensure that it is correctly positioned.

(4) Install the valve retaining plate (3) in the cover (4) and ensure that it is correctly positioned.

CAUTION

DAMAGE TO SCREW. In step (5), use standard hand tools to install the screw (1) and only tighten with sufficient torque to ensure that the valve retaining plate (3) is held firmly in position. The application of excessive torque can result in damage to the screw (1).

(5) Ensure that the screw hole is correctly aligned then install lock washers (2) and install and tighten screws (1).

(6) Install the cover (Subparagraph 2-9a, steps (8) and (9)).

4-12.1 REPLACEMENT OF THE COVER ASSEMBLY FOR MODEL 471012

This task covers:

a. Removing the Lid.
b. Installing the Lid.
c. Testing the Pressure Relief Valve.
d. Serving the Pressure Relief Valve.
e. Replacing the Pressure Relief Valve.
f. Installing the Pressure Relief Valve.
g. Removing the Lid Gasket.
h. Installing the Lid Gasket.
i. Servicing the Lid.

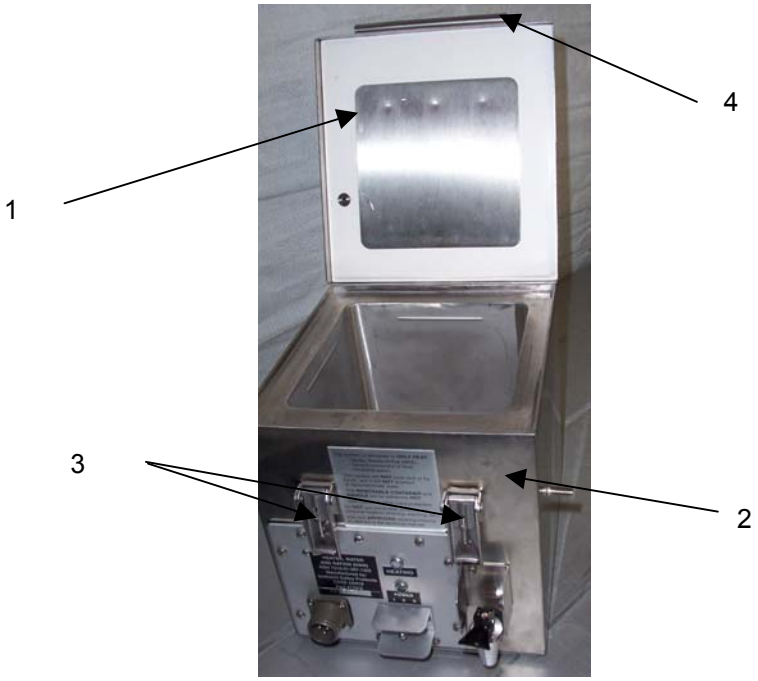
4-12.1 REPLACING THE COVER ASSEMBLY FOR MODEL 471012 (Continued)

INITIAL SETUP

Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section III, Item 1).

Parts/materials: Pressure Relief Valve, Dishwashing detergent, Small brush, Water, and Loctite 242.

HWR Condition: Power cable disconnected and power switch turned off.



CAUTION

To avoid possible damage to the lid hinge mechanism, do not attempt to force the lid backwards from its normal open rest position, which is just past the vertical. Ensure that the lid seals tightly against the HWR body by adjusting the lid securing latches. Do not over tighten the latches.

a. Removing the Lid. To remove the lid (cover) (1), rotate it upwards to its normal open rest position (just past the vertical) and lift it from the HWR body (2).

b. Installing the Lid.

NOTE

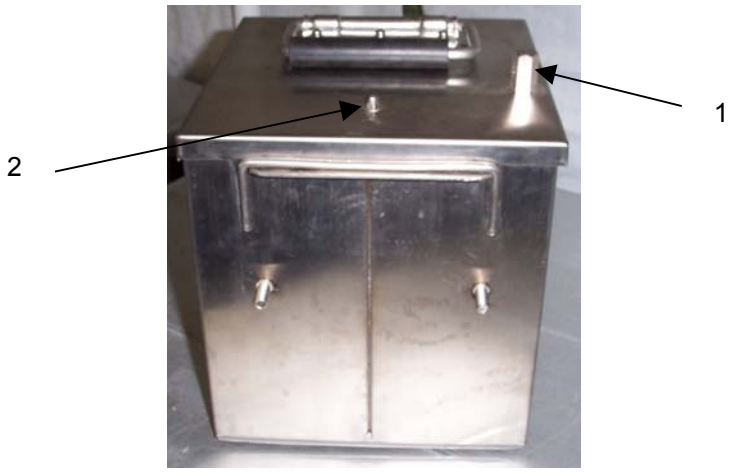
When closing the lid, ensure that it is centrally located over the main container.

(1) To install the lid (1) reverse the rotation of the lid and place it on the HWR body (2).

(2) The lid (1) is secured in the closed position using the two adjustable latches (3), which clamp onto the curved front lip (4) of the lid.

4-12.1 REPLACING THE COVER ASSEMBLY FOR MODEL 471012 (Continued)

c. Testing the Pressure Relief Valve.

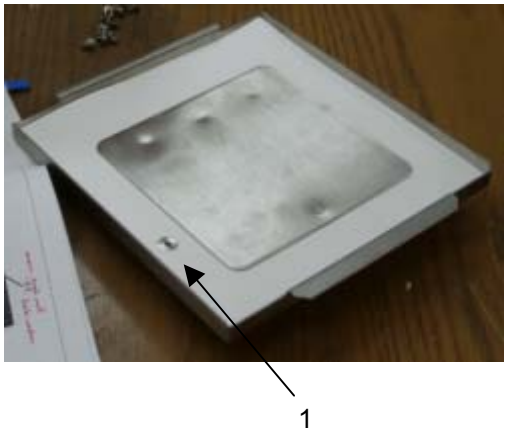


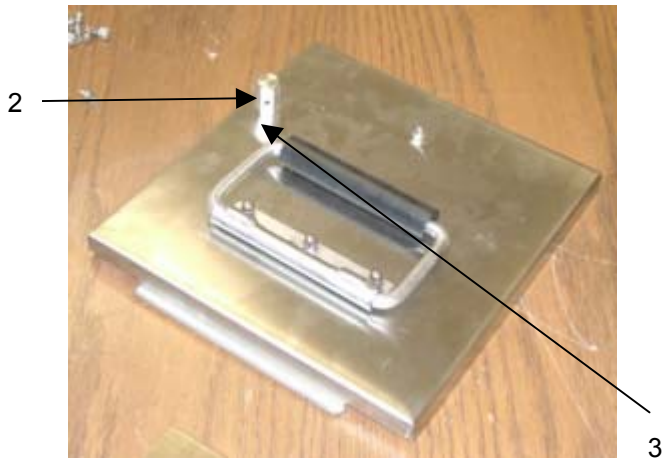
(1) Place your mouth over one of the 1/8" diameter outlets of the pressure relief valve (1), while holding your finger over the other outlet (2).

(2) Suck on the valve outlet and you should feel (and hear) the valve mechanism opening; then blow into the valve outlet and you should feel the outlet pressurize, as the valve mechanism closes.

(3) If the valve does not appear to be operating correctly, replace the valve (Subparagraph 4-12.1e, step (1)).

d. Servicing the Pressure Relief Valve.





(1) Ensure that the entrance or inlet (1) and exit ports (2) of the relief valve (3) are not blocked. The entrance port (1) of the relief valve (3) is accessed through the hole in the lid seal.

(2) The exit ports of the relief valve are located on the side of the valve body. Clean the port areas with a small brush. Blow away any loose material.

4-12.1 REPLACING THE COVER ASSEMBLY FOR MODEL 471012 (Continued)

e. Replacing the Pressure Relief Valve.

NOTE

The pressure relief valve consists of a valve body, an inlet port, a valve spring and ball (the latter two items located inside the valve body), and an "0" ring installed between the valve body and the top surface of the lid.

(1) While securing the inlet port (1) with a screwdriver, unscrew the valve body (3), taking care to set aside the "0" ring (not visible, goes between the valve body and the lid), ball, and spring.

NOTE

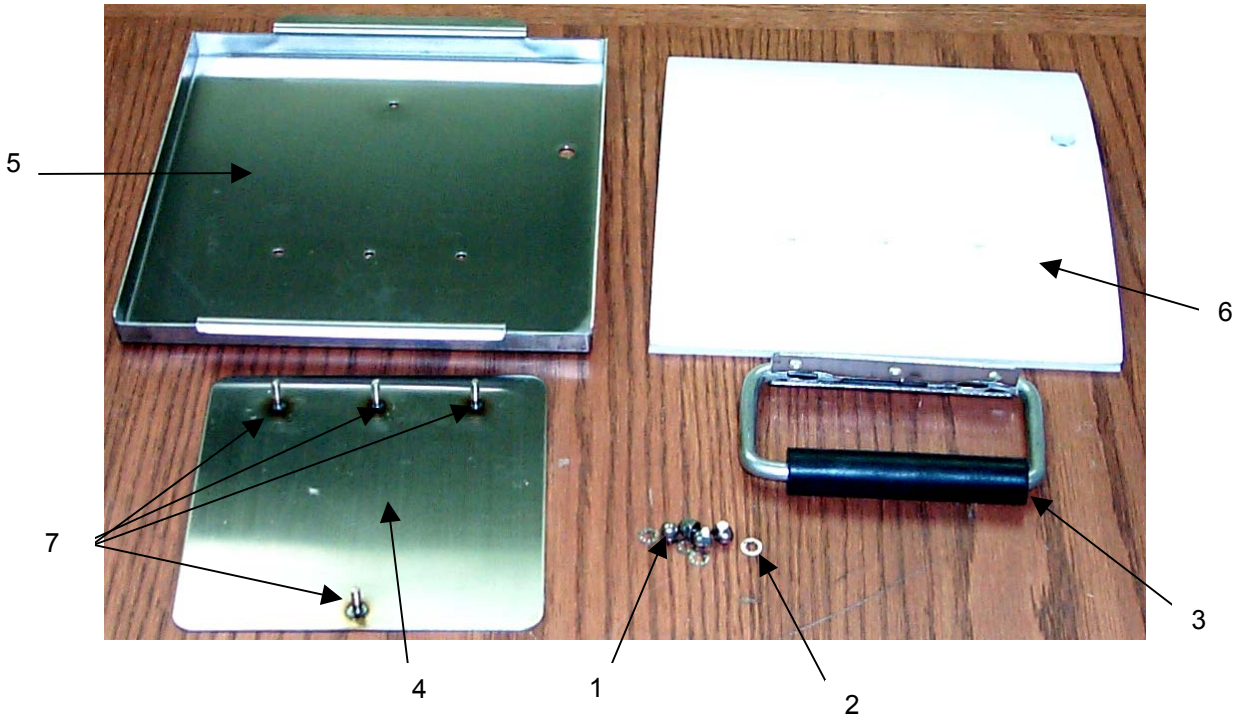
If the "0" ring has been damaged or shows signs of wear, replace it with a new one.

f. Installing the Pressure Relief Valve.

(1) Install the spring and ball (1) inside the valve body (2).

(2) Install the “O” ring between the valve body (2) and the top surface of the lid.

g. Removing the Lid Gasket.



4-10.1 REPLACING THE COVER ASSEMBLY FOR MODEL 471012 (Continued)

(1) Remove the four acorn nuts (1) and the four tooth washers (2) that secure the handle (3) and the gasket retaining plate (4) to the lid (5).

(2) Remove the handle (3) and the gasket retaining plate (4) from the lid (5).

(3) Remove the lid gasket (6) from the lid (5).

h. Installing the Lid Gasket.

(1) Apply Loctite 242 or equivalent to the threads of the four gasket retaining plate studs (7), prior to installing and tightening the four acorn nuts (1).

NOTE

When installing the lid gasket, ensure that the gasket fits tightly over the manifold retainers, where they project from the interior surface of the lid.

(2) Install the lid gasket (6) to the lid (5).

(3) Install the gasket retaining plate (4) and the handle (3) to the lid (5).

(4) Install the four tooth washers (2) and four acorn nuts (1) to secure the handle (3), and the gasket retaining plate (4) to the lid (5).

i. Servicing the Lid. Clean the inside and outside of the lid with a solution of dishwashing detergent and warm water. Use a soft cloth to avoid damage to the lid seal.

4-13. REPLACEMENT OF INNER CONTAINER ASSEMBLY

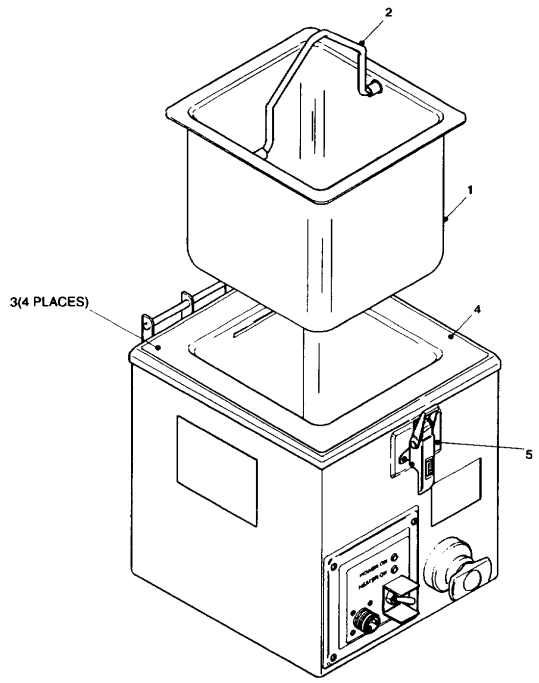
This task covers: a. Removal of inner container assembly.
b. Installation of inner container assembly.

INITIAL SETUP

Tools: None.

Parts/materials: None.

HWR Condition: Cover removed (Subparagraph 2-9a, steps (1) thru (5)).



a. Removal of inner container assembly. Remove inner container (1) using fold-down wire handle (2).

b. Installation of inner container assembly.

(1) Install inner container (1) using fold-down wire handle (2) and check that it seats evenly on the four "pips" (3) embossed on the top flange of the outer container (4).

(2) Install the cover (Subparagraph 2-9a, steps (8) and (9)) and check that the latch (5) will close and lock.

4-14. REPLACEMENT OF LATCH ASSEMBLY FOR MODEL RAK-15

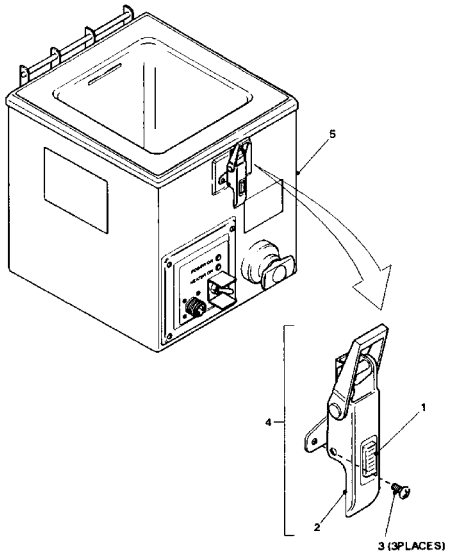
This task covers: a. Removal of Latch Assembly.
b. Installation of Latch Assembly.

INITIAL SETUP

Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section II, Item 1).

Parts/materials: None.

HWR Condition: Cover removed (Subparagraph 2-9a, steps (1) thru (5)).
Inner Container removed (Subparagraph 4-13a).



a. Removal of latch assembly.

(1) Operate unlocking catch (1) upwards to release the operating lever (2).

(2) Rotate operating lever (2) upwards to its full extent and hold in position.

(3) Remove and retain three mounting screws (3) securing latch assembly (4) to the main case (5).

(4) Remove latch assembly (4).

b. Installation of Latch Assembly.

(1) Rotate operating lever (2) upwards to its full extent and hold in position.

(2) Locate latch assembly (4) on the main case (5) and position it such that the three mounting holes are correctly aligned.

4-14. REPLACEMENT OF LATCH ASSEMBLY FOR MODEL RAK-15 (Continued)

CAUTION

DAMAGE TO SCREWS. In step (3), use standard hand tools to install the mounting screws (3) and only tighten with sufficient torque to ensure that the latch assembly (4) is held firmly in position. The application of excessive torque can result in damage to the mounting screws (3).

(3) Install and tighten three mounting screws (3).

(4) Install the inner container (Subparagraph 4-13b, step (1)).

(5) Install the cover (Subparagraph 2-9a, steps (8) and (9)).

4-14.1. REPLACEMENT OF THE LATCH FOR MODEL 471012

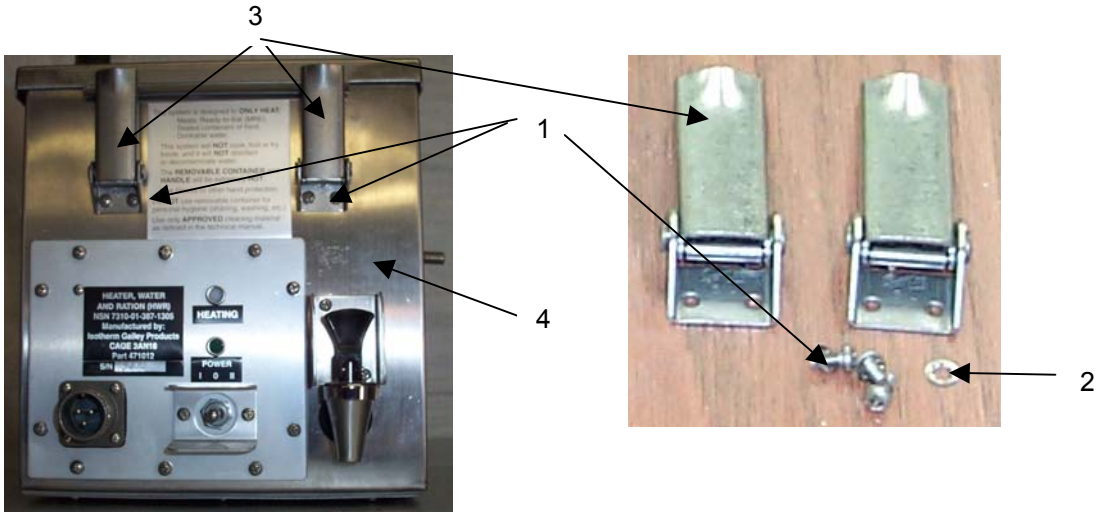
This task covers:
a. Replacing the Latch.
b. Installing the Latch.
c. Adjusting the Latch.

INITIAL SETUP

Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section III, Item 1).

Parts/materials: Latch (fastener).

HWR Condition: Power off, cable disconnected, and cover removed (Subparagraph 4-12.1a. steps (1) and (2)).



4-14.1. REPLACEMENT OF THE LATCH FOR MODEL 471012 (Continued)

a. Replacing the Latch.

(1) Remove the two screws (1), and lock washers (2) that secure each latch (3) to the main container (4).

(2) Remove the latch (3).

b. Installing the Latch.

(1) Install the latch (3).

(2) Install the two lock washers (2), and the two screws (1) to secure the latch (3) to the main container (4).

c. Adjusting the Latch.

CAUTION

Do not over tighten the latches - the lid seal or latch retaining lip can be damaged. Do not adjust the latches so tightly that the latch retaining lip on the lid is deformed.

(1) Adjust the length of each latch by turning the threaded clasp arm in the latch body.

(2) Adjust the latches so that the lid seals tightly against the HWR body, and so that each latch requires the same effort to close.

4-15. REPAIR OF TAP ASSEMBLY FOR MODEL RAK-15

This task covers: a. Removal of valve preformed packing, valve spring, body gasket and body preformed packing.
b. Installation of valve preformed packing, valve spring, body gasket, and body preformed packing.

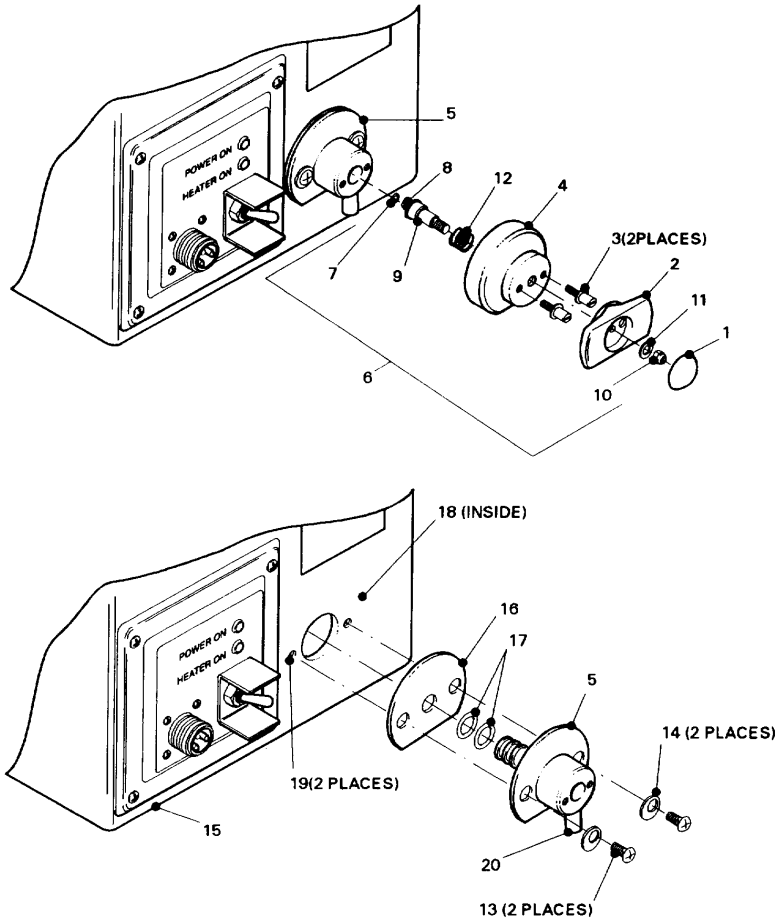
INITIAL SETUP

Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section III, Item 1).

Parts/materials: Kit, Tap Assembly.

HWR Condition: Cover removed (Subparagraph 2-9a, steps (1) thru (5)).
Inner Container removed (Subparagraph 4-13a).

4-15. REPAIR OF TAP ASSEMBLY FOR MODEL RAK-15 (Continued)



a. Removal of valve preformed packing, valve spring. body gasket and body preformed packing.

(1) Using a flat tip screwdriver, remove the press-fit plastic cap (1) from center of the handle (2).

(2) Loosen two captive screws (3) securing the shroud (4) to the tap body (5).

(3) Withdraw the complete tap valve assembly (6) from the tap body (5).

(4) Remove and discard the valve preformed packing (7).

4-15. REPAIR OF TAP ASSEMBLY FOR MODEL RAK-15 (Continued)

CAUTION

VALVE PARTS. Care should be taken when performing step (5) as the valve parts will be loose when the valve nut (10) is released from the threaded portion of the valve stem (9).

(5) Perform the following:

Insert a flat tip screwdriver into slot (8) to prevent the valve stem (9) from rotating.

Remove and retain valve nut (10) and washer (11).

Withdraw handle (2), shroud (4) and valve spring (12) from the valve stem (9).

Discard the valve spring (12).

(6) Remove and retain two screws (13) and special washers (14) securing the tap body (5) to the main case (15).

(7) Carefully withdraw tap body (5) and gasket (16) until free of the main case (15).

(8) Remove and discard the preformed packing (17).

(9) Remove and discard the gasket (16).

b. Installation of valve preformed packing, valve spring, body gasket, and body preformed packing.

(1) Install gasket (16) and preformed packing (17) on the valve body (5).

(2) Install tap body (5) and gasket (16) by carefully pushing into the water outlet on the outer container (18) until even contact is made with the main case (15).

(3) Rotate tap body (5) and gasket (16) to the left or right as necessary to align with the two mounting holes (19) while ensuring that the spigot (20) is orientated as shown.

CAUTION

DAMAGE TO SCREWS. In step (4), use standard hand tools to install the screws (13) and only tighten with sufficient torque to ensure that the tap body (5) is held firmly in position. The application of excessive torque can result in damage to the screws (13).

(4) Install and tighten two screws (13) and special washers (14). Orient washers (14) to cover holes on tap body (5).

4-15. REPAIR OF TAP ASSEMBLY FOR MODEL RAK-15 (Continued)

CAUTION

VALVE PARTS. Care should be taken when performing step (5) as the valve parts will be loose until the valve nut (10) is started on the threaded portion of the valve stem (9).

(5) Perform the following:

a. Install valve spring (12) and shroud (4) on the valve stem (9).

b. Install two mounting screws (3) and handle (2) on the shroud (4).

c. Install washer (11) and valve nut (10) on the valve stem (9).

d. Insert a flat tip screwdriver into slot (8) to prevent valve stem (9) from rotating.

e. Tighten valve nut (10).

(6) Check that the valve stem (9) can move freely over its full range with no binding of the valve spring (12).

(7) Install preformed packing (7) on the valve stem (9).

(8) Install the tap valve by carefully pushing it fully home into the tap body (5).

(9) Rotate the tap valve to the left or right as necessary to achieve correct positioning of the two mounting screws (3) with the tap body (5).

CAUTION

DAMAGE TO SCREWS. In step (10), use standard hand tools to install the screws (3) and only tighten with sufficient torque to ensure that the tap valve is held firmly in position. The application of excessive torque can result in damage to the screws (3).

(10) Tighten two mounting screws (3) securing shroud (4) to the tap body (5).

(11) Install press-fit plastic cap (1) in the center of the handle (2).

(12) Install the inner container (Subparagraph 4-13b, step (1)).

(13) Install the cover (Subparagraph 2-9a, steps (8) and (9)).

4-15.1. REPLACEMENT OF THE TAP ASSEMBLY FOR MODEL 471012

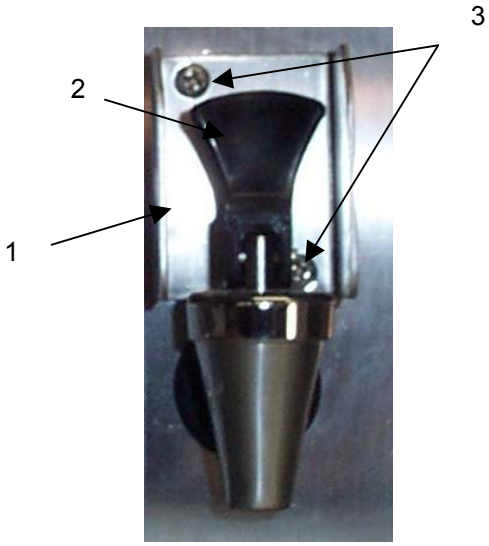
This task covers:
a. Removing the Spigot.
b. Installing the Spigot.
c. Servicing the Spigot.

INITIAL SETUP

Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section III, Item 1).

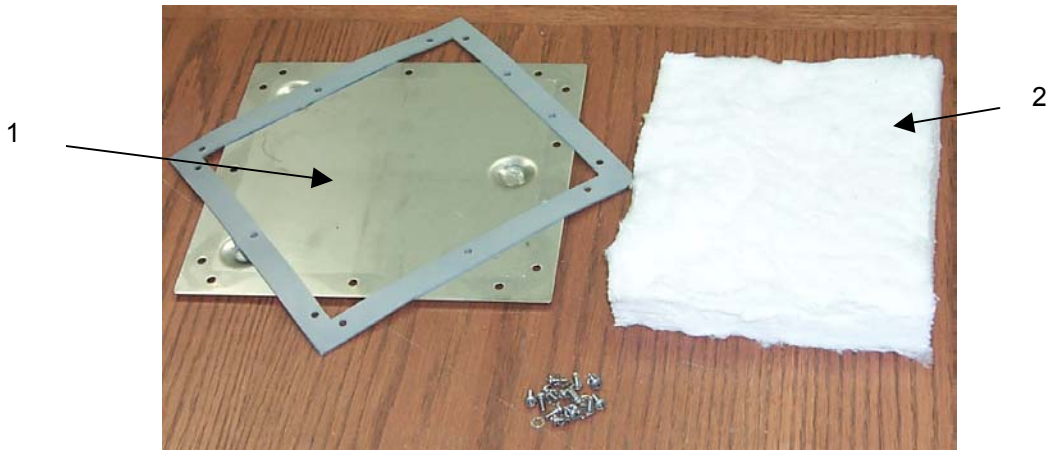
Parts/materials: Faucet, single, Loctite 242, Dishwashing detergent, small brush, and Water.

HWR Condition: Power supply turned off.
Power cable disconnected.



a. Removing the Spigot.

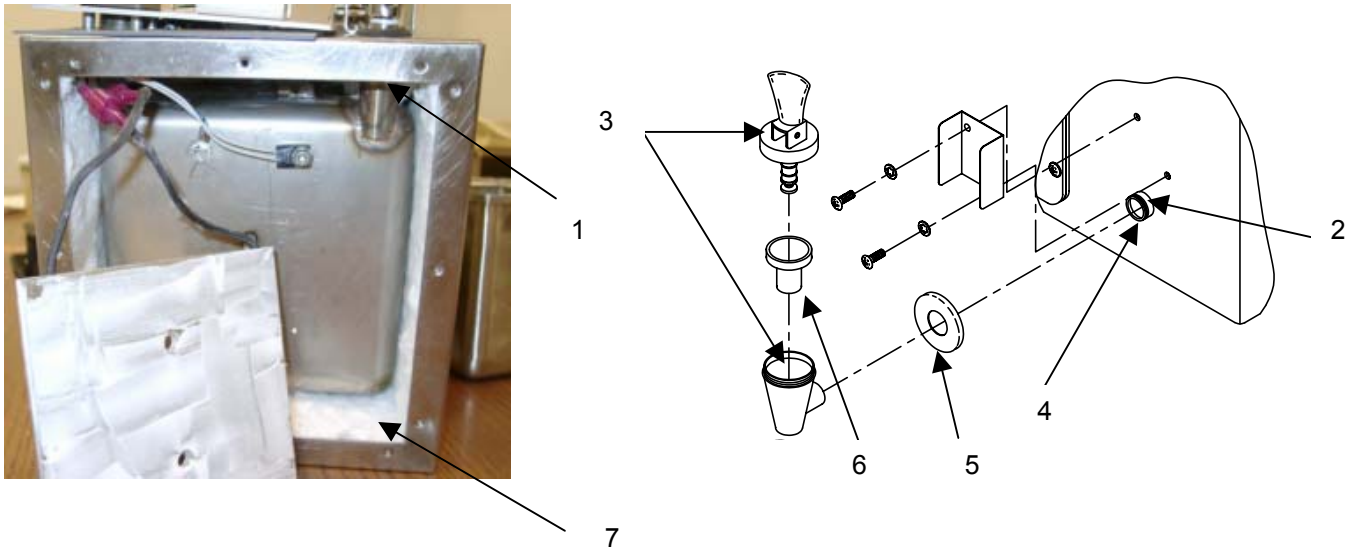
(1) Remove the guard (1) around the tap(spigot) (2) by removing the two screws (3).



(2) Remove the base plate (1) (Subparagraph 4-16.1q steps (1) thru (2)).

(3) Remove the bottom piece of insulation (2) and the piece of insulation located around the main container outlet.

4-15.1. REPLACEMENT OF THE TAP ASSEMBLY FOR MODEL 471012 (Continued)



(4) Loosen the jam nut (1) from the shank (2).

(5) Turn the tap assembly (3) in a counterclockwise direction, while holding the jam nut (1) stationary, until it comes off the shank (4).

(6) Remove the tap assembly (3) by pulling it through the grommet (5).

CAUTION

Be careful not to damage the tap body or the tap handle when removing the tap shank.

(7) Remove the tap shank (6) from the tap.

CAUTION

It is recommended that the shank "0" ring be left in position, unless it is suspected of leaking and must be removed for inspection. If it is leaking, remove and discard the shank "0" ring (not visible goes between spigot shank and the body) by prying it out of the main container outlet.

b. Installing the Spigot.

CAUTION

Do not apply Loctite to the threads on the other end of the shank.

(1) Apply Loctite 242 (or equivalent) to the threads on the spigot end of the shank, prior to installing and tightening the tap shank (6) into the tap.

4-15.1. REPLACEMENT OF THE TAP ASSEMBLY FOR MODEL 471012 (Continued)

NOTE

When installing the tap assembly, turn the assembly to the last possible vertical position, prior to tightening the shank jam nut.

NOTE

If the shank "0" ring (not visible, but goes between spigot shank and the body) was removed, install the “O” ring by inserting it in the main container outlet.

(2) Install the tap shank (6) to the tap.

(3) Install the tap assembly (3) by pushing it through the grommet (5).

(4) While holding the jam nut stationary, turn the tap assembly (3) clockwise until the jam nut (1) secures to the tap shank (6).

(5) Tighten the jam nut (1) to the shank (2).

(6) Install the bottom piece of insulation and the piece of insulation (7) located around the main container outlet.

(7) Install the base plate (1) (Subparagraph 4-16.1q, steps (1) thru (2)).

(8) Install the guard (1) around the tap (2) by securing the two screws (3).

c. Servicing the Spigot.

NOTE

Ensure that the valve seal is properly seated in the spigot bonnet before reassembly.

(1) Clean the interior of the spigot by drawing off a solution of dishwashing detergent and hot water, or descaling agent through the spigot and then flushing thoroughly with warm water.

(2) If a more thorough cleaning is required, remove the spigot (Subparagraph 4-15.1a, steps (1) thru (8)).

(3) Clean the spigot body with a pipe cleaner or small brush.

(4) Clean the valve seal with a small brush.

4-16. REPAIR OF CONTROL PANEL ASSEMBLY FOR MODEL RAK-15

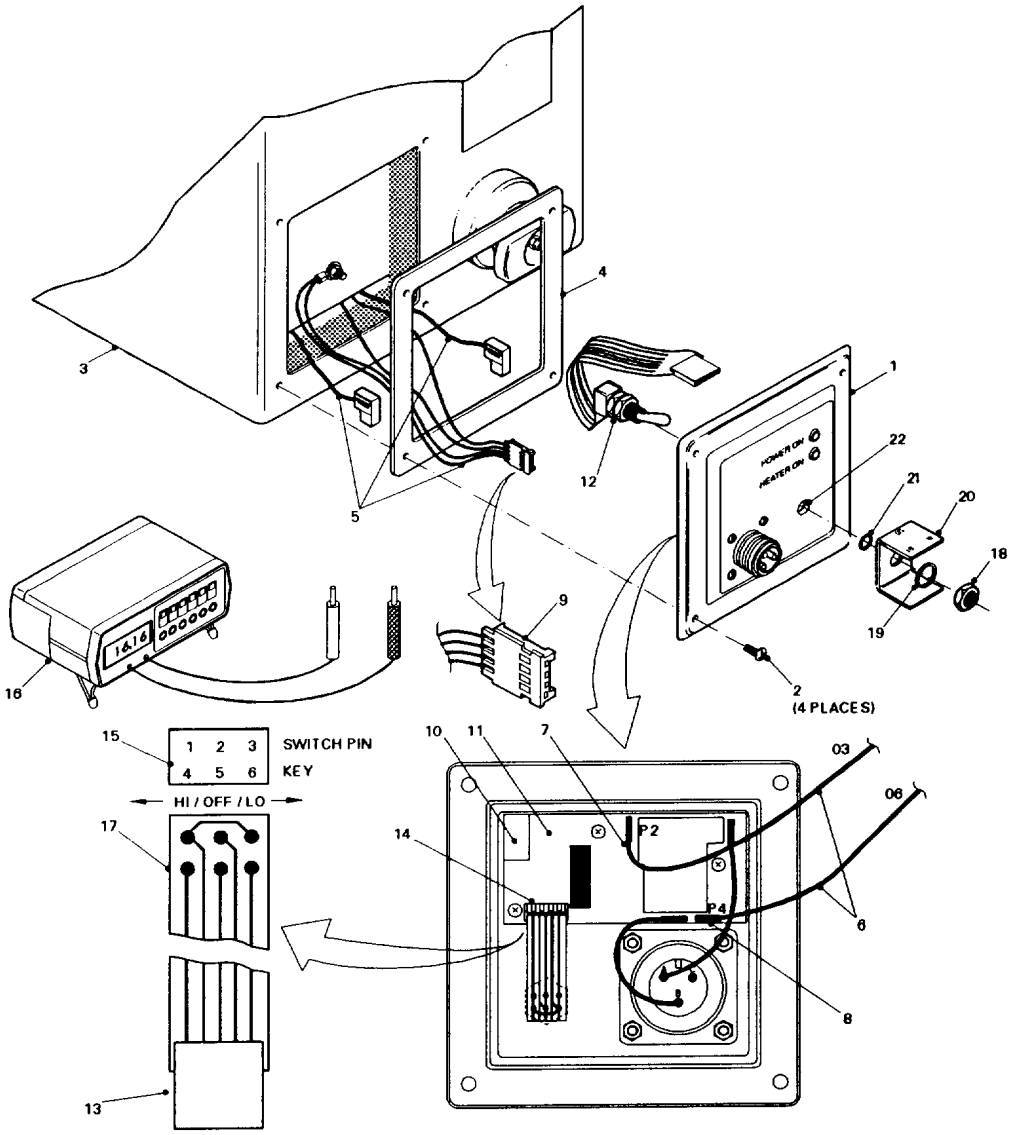
This task covers: a. Removal of control panel.
b. Test of toggle switch.
c. Removal of toggle switch.
d. Installation of toggle switch.
e. Installation of control panel.

INITIAL SETUP

Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section III, Item 1).
Shop Equipment, Common, No 1 (Appendix B, Section III, Item 2).

Parts/materials: None.

HWR Condition: Vehicle power supply turned off.
Power cable connector plug disconnected.



4-16. REPAIR OF CONTROL PANEL ASSEMBLY FOR MODEL RAK-15 (Continued)

a. Removal of Control Panel.

(1) Support the control panel (1) by hand and remove four mounting screws (2) until it is detached from the main case (3).
The gasket (4) usually remains on the case.

(2) Withdraw control panel (1) to the full extent of the interconnect wiring (5).

(3) Disconnect 03 and 06 heater power supply wires (6) from connectors P2 (7) and P4 (8) on the PCB (11).

(4) Disconnect overheat sensor/boil-dry sensor connector (9) from connector CONN 1 (10) on the PCB (11).

(5) Remove and retain the control panel (1) complete with gasket (4) and mounting screws (2).

b. Test of Toggle Switch.

(1) Operate switch (12) between the LO, OFF and HI positions and verify that the action is firm with a positive stop in each position.

(2) Disconnect switch connector (13) from connector CONN 2 (14) on the PCB (11).

NOTE

In steps (3) and (4) "open-circuit" is taken to be a reading greater than 50 ohms and "continuity" is taken to be a reading less than 0.5 ohms. A key (15) is provided for pin identification.

(3) Using the digital multimeter (16) set to read resistance, perform the following:

a. Set switch (12) to the OFF (center) position and check that an open-circuit reading is obtained between pins 1 & 2 (15), pins 2 & 3 (15), pins 4 & 5 (15) and pins 5 & 6 (15).

b. Set switch (12) to the LO (left) position and check that a continuity reading is obtained between pins 1 & 2 (15) and pins 4 & 5 (15). Check also that an open-circuit reading is obtained between pins 5 & 6 (15).

c. Set switch (12) to the HI (right) position and check that a continuity reading is obtained between pins2 &3 (15) and pins5&6 (15). Check also that an open-circuit reading is obtained between pins 4 & 5 (15).

(4) Using the digital multimeter (16) set to read resistance, check that a continuity reading is obtained for each track of the ribbon-cable (17) between the switch (12) to the control panel (1).

c. Removal of Toggle Switch.

(1) Verify that switch connector (13) is disconnected from connector CONN 2 (14) on the PCB (11).

(2) Loosen lock nut (18) securing the switch (12) to the control panel (1).

(3) Remove and retain the lock nut (18), washer (19), switch guard (20) and switch gasket (21).

(4) Withdraw the toggle switch (12) from the rear of the control panel (1).

4-16. REPAIR OF CONTROL PANEL ASSEMBLY FOR MODEL RAK-15 (Continued)

d. Installation of Toggle Switch.

(1) Using the keyway (22) to ensure correct positioning, insert toggle switch (12) into the control panel (1) then install switch gasket (21), switch guard (20) and washer (19) in that order.

CAUTION

DAMAGE TO LOCK NUT. In step (2), use standard hand tools to install the lock nut (18) and only tighten with sufficient torque to ensure that the switch (12) is held firmly in position. The application of excessive torque can result in damage to the threads on the switch (12) and/or the lock nut (18).

(2) Install and tighten the lock nut (18).

(3) Reconnect switch connector (13) to connector CONN 2 (14) on the PCB (11).

e. Installation of Control Panel.

NOTE

Ensure that the control panel (1) is complete with gasket (4), and mounting screws (2) before installing.

(1) Reconnect the overheat sensor/boil-dry sensor connector (9) to connector CONN 1 (10) on the PCB (11).

(2) Reconnect 03 and 06 heater power supply wires (6) to connectors P2 (7) and P4 (8) respectively on the PCB (11).

(3) Locate control panel (1) on the main case (3) and position such that it is orientated as illustrated with the four mounting holes correctly aligned.

CAUTION

DAMAGE TO SCREWS. In step (4), use standard hand tools to install the screws (2) and only tighten with sufficient torque to ensure that the control panel (1) is held firmly in position. The application of excessive torque can result in damage to the screws (2).

(4) Install and tighten four mounting screws (2).

4-16.1 REPLACMENT OF THE CONTROL PANEL ASSEMBLY FOR MODEL 471012

This task covers:
a. Removing the Control Panel.
b. Inspecting the Switch.
c. Testing the Switch.
d. Repairing the Switch.
e. Replacing the Switch.
f. Installing the Switch.

4-16.1. REPLACMENT OF THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

This task covers: (Continued)

g. Inspecting the Circuit Board.
h. Replacing the Circuit Board.
i. Installing the Circuit Board.
j. Repairing the Circuit Board.
k. Inspecting the Indicator lights.
l. Replacing the Indicator Lights.
m. Installing the Indicator Lights.
n. Inspecting the Receptacle.
o. Replacing the Receptacle.
p. Installing the Receptacle.
q. Removing the Base Plate.
r. Installing the Base Plate.
s. Inspecting the Thermistors.
t. Testing the Thermistors.
u. Replacing the Thermistors.
v. Installing the Thermistors.
w. Repairing the Thermistors.
x. Inspecting the Thermal Switch.
y. Replacing the Thermal Switch.
z. Installing the Thermal Switch.
aa. Inspecting the Isolator.
bb. Inspecting the Heating Element.
cc. Testing the Heating Element.
dd. Replacing the Heating Element.
ee. Installing the Heating Element.
ff. Installing the Control Panel.

INITIAL SETUP

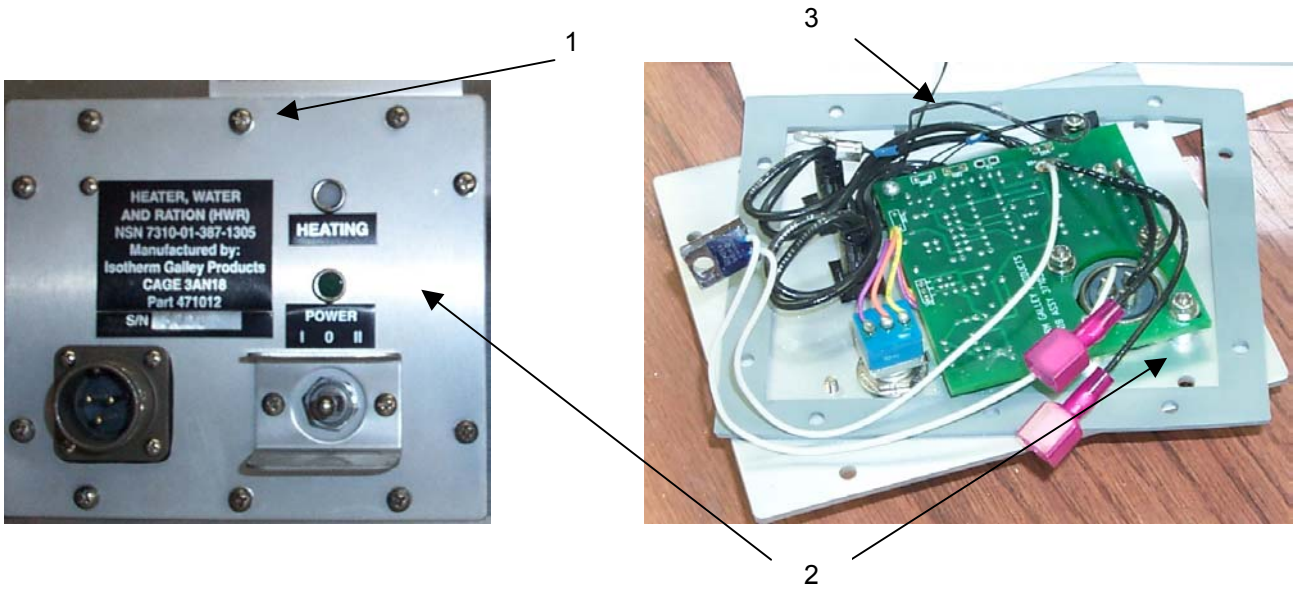
Tools: Tool Kit, General Mechanics: Automotive (Appendix B, Section III, Item 1).
Shop Equipment, Common, No 1 (Appendix B, Section III, Item 2).

Parts/materials: Gasket, Receptacle, Thermistors, Thermal Switch, Circuit Board, Cleaning Cloth, Conformal Coating, Heat Shrinking Tubing, Heating Element, Indicator Lights, and Toggle Switch

HWR Condition: Cover removed.

4-16.1. REPLACMENT OF THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

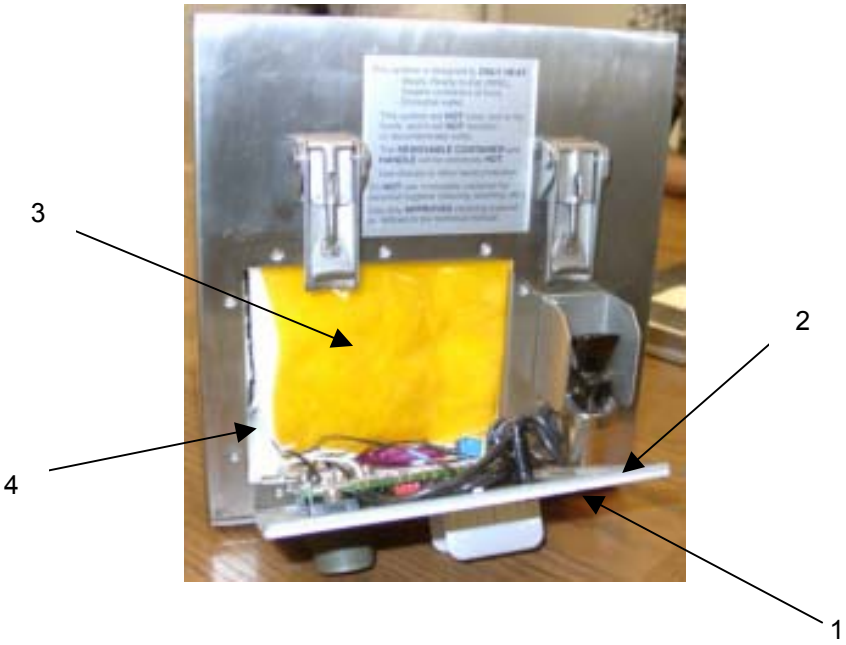
a. Removing the Control Panel.



CAUTION

Do not remove the smaller screw used to secure the power transistor of the circuit board to the control plate

(1) Remove the 10 screws and lock washers (1) that secure the control panel (2) and gasket (3) to the main container.



4-16.1 REPLACMENT OF THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

NOTE

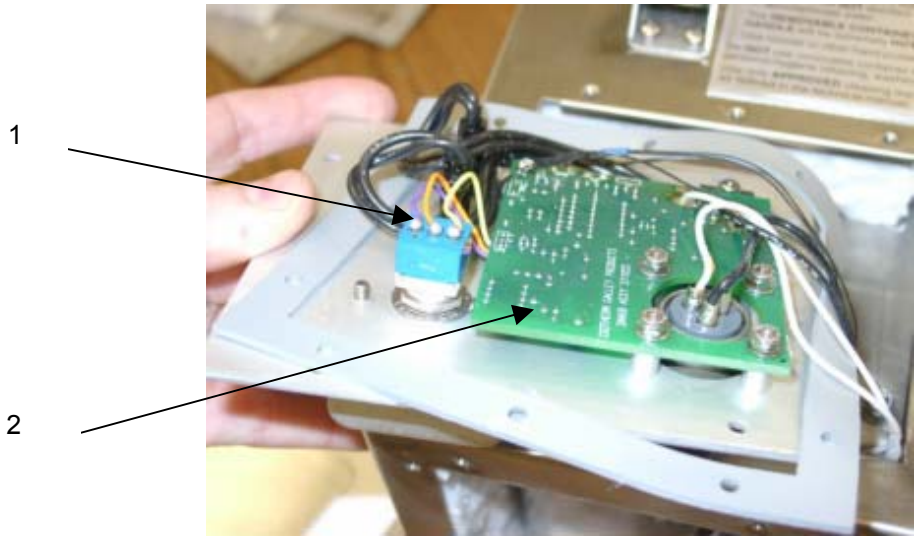
Some of the wires are fragile.

(2) Carefully pull the control panel (1) and gasket (2) away from the main container noting the location of the wires and the protective sheet (3).

(3) Remove the protective sheet (3) located between the control panel (1) and the front piece of insulation (4).

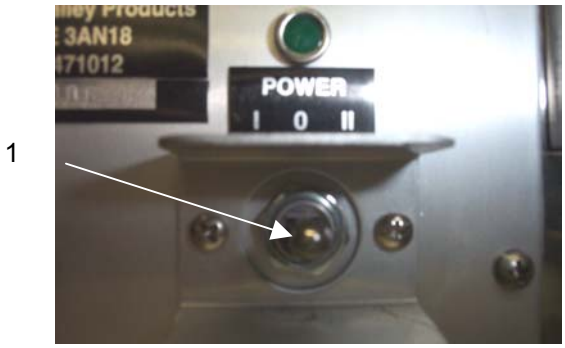
(4) If access is required to the thermistors, the heating element or the thermal switch, remove the front piece of insulation (3). It may also be necessary to remove the base plate (Subparagraph 4-16.1q steps (1) thru (3)).

b. Inspecting the switch.



Check the three wires (1) between the switch and the circuit board (2) to determine if the wires are correctly connected and securely attached.

c. Testing the switch.



4-16.1. REPLACMENT OF THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

(1) Place the switch (1) in position 0 and measure the resistance between pins 1 and 2, between pins 1 and 3 and between pins 2 and 3. In every case, an open circuit should exist between the pins.

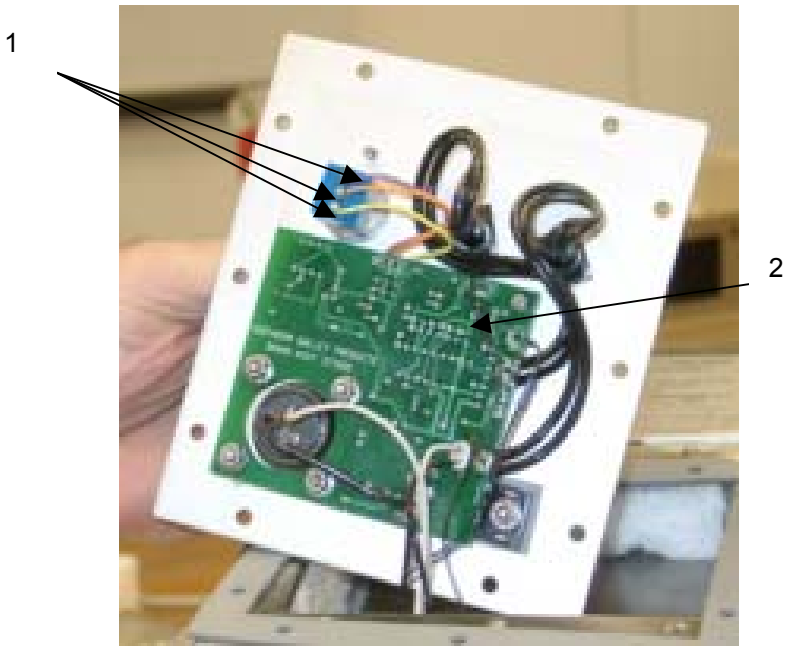
(2) Place the switch (1) in position I and measure the resistance between each set of pins. In this case, a short circuit should exist between pins 1 and 2. An open circuit should exist between pins 1 and 3 and between pins 2 and 3.

(3) Place the switch (1) in position II and measure the resistance between each set of pins. In this case, a short circuit should exist between pins 2 and 3. An open circuit should exist between pins 1 and 3 and between pins 1 and 2.

(4) If the switch (1) passes all of the above tests, it is operating correctly. Resolder the three wires to the switch, as discussed in Repairing the Switch (Subparagraph 4-16.1d, steps (1) thru (3)).

(5) If the switch fails any of the above tests, replace the switch (Subparagraph 4-16.1e, steps (1) thru (6)).

d. Repairing the Switch.



NOTE

The wiring connections should be pin 1 violet, pin 2 orange, pin 3 yellow.

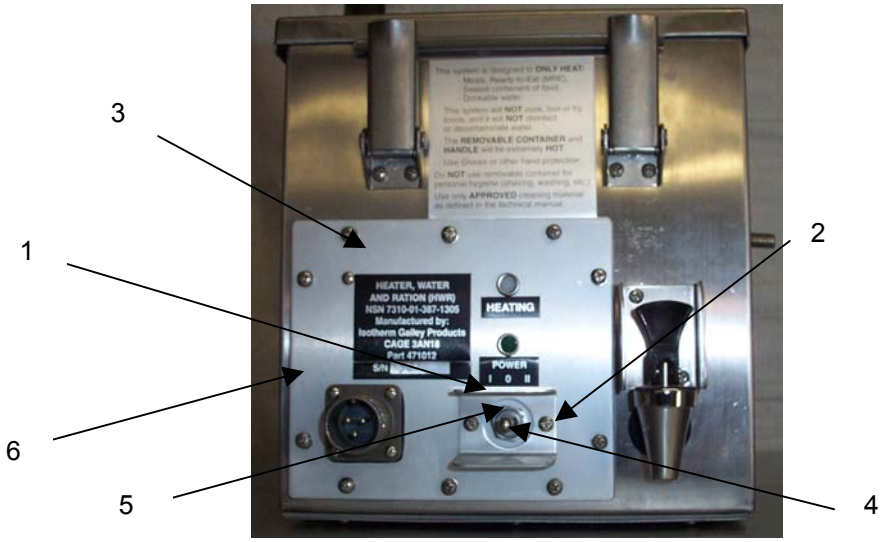
(1) If the three wires (1) between the switch and the circuit board (2) are not correctly connected or securely attached, then solder the wires securely to their correct locations, and touch up soldered connections, on both sides of the circuit board, with conformal coating.

(2) Verify that the HWR is now operating correctly.

(3) If not, unsolder the wires connected to pins 1, 2 and 3 of the switch, noting the color coding of wires.

4-16.1. REPLACMENT OF THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

e. Replacing the Switch.



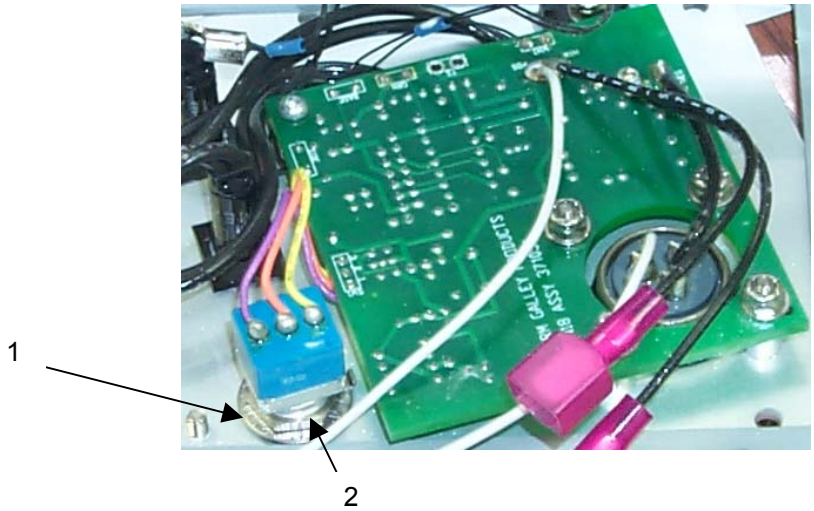
(1) Remove the switch guard (1) by removing two screws (2).

(2) Remove the control panel (3) (Subparagraph 4-16.1a, steps (1) thru (4)).

(3) Unsolder the wires connected to pins 1, 2 and 3 of the switch (4) (reference Subparagraph 4-16.1d, steps (1) thru (3)).

(4) Loosen the securing nut located on the switch threads, and unscrew and remove the panel dress nut (5).

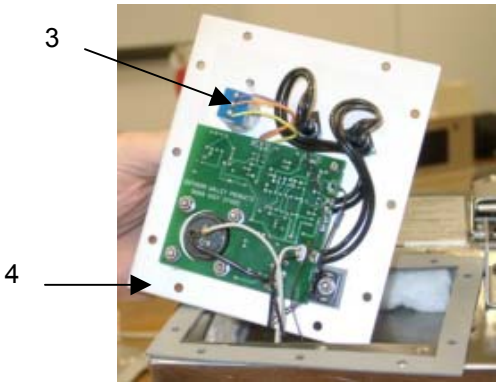
(5) Remove the switch (4) from the control plate (6).

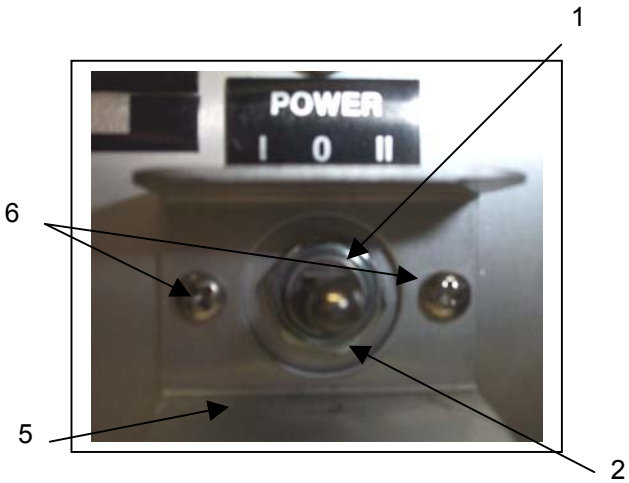


(6) Remove the switch seal (1) and securing nut (2) from the switch threads.

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

f. Installing the Switch.





NOTE

When installing the switch, ensure that the decorative nut is threaded onto the switch so that the outer face of the nut is flush with the threaded body of the switch, and the flats on the decorative nut are at the top and bottom positions. The securing nut is then tightened to secure the switch to the control plate.

(1) Install the switch seal (1) and the securing nut (2) to the switch threads.

(2) Install the switch (3) to the control plate (4).

(3) Tighten the securing nut (1) of the switch threads, and install the panel dress nut (2).

(4) Solder the three wires (3) connected to pins 1, 2, 3 of the switch.

(5) Install the control panel (4) (Subparagraph 4-16.1ff, steps (1) thru (5)).

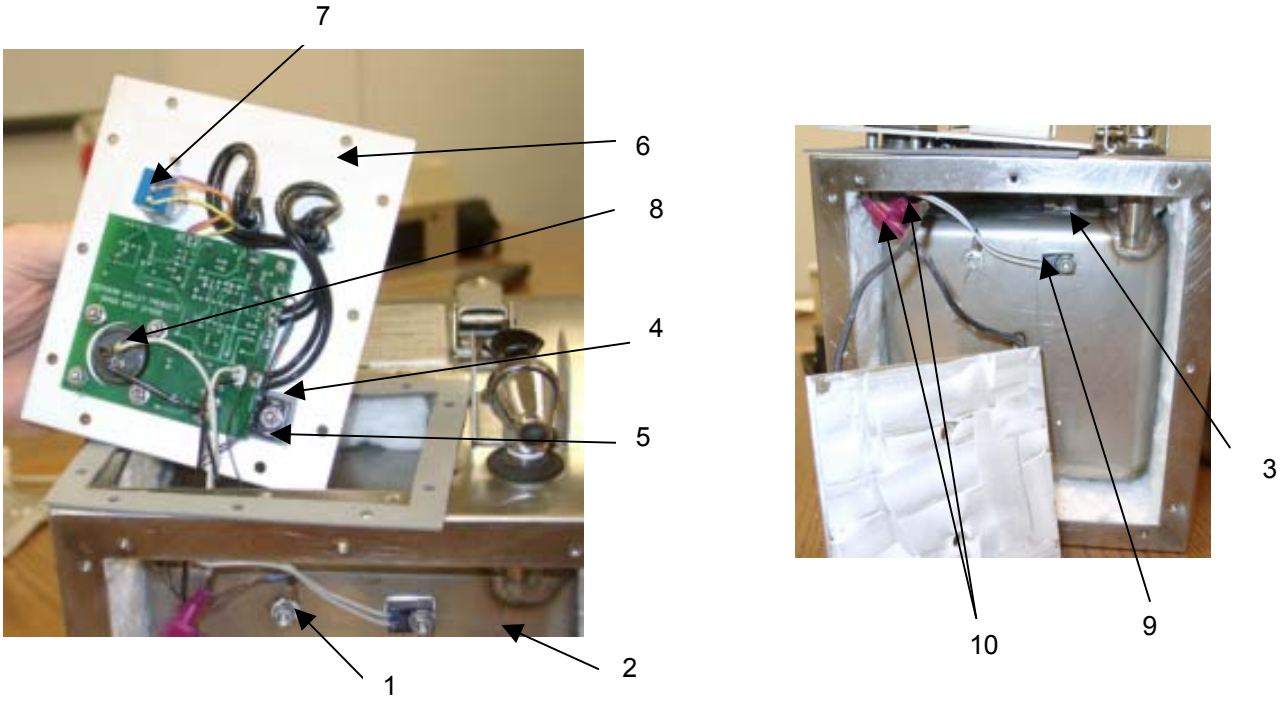
(6) Install the switch guard (5) using the two screws (6).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

g. Inspecting the Circuit Board.

(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Check the circuit board wiring diagram to determine if all the wires are correctly connected and securely attached.



(3) Ensure that the thermistor mounted to the base (1) of the main container (2) is connected to the circuit board location marked "BASE", and the thermistor mounted to the side (3) of the main container (2) is wired to the circuit board location marked "SIDE".

(4) Ensure the gray thin isolator (4) is sandwiched between the black power transistor (5) and the control plate (6) and that it is centered. Ensure the power transistor (5) mounting screw is tight.

(5) If not, conduct a continuity check on the wires that connect the switch (7) and the receptacle (8) to the circuit board. Also, ensure there is continuity between the locations on the circuit board where the thermal switch (9) wires are attached.

h. Replacing the Circuit Board.

NOTE

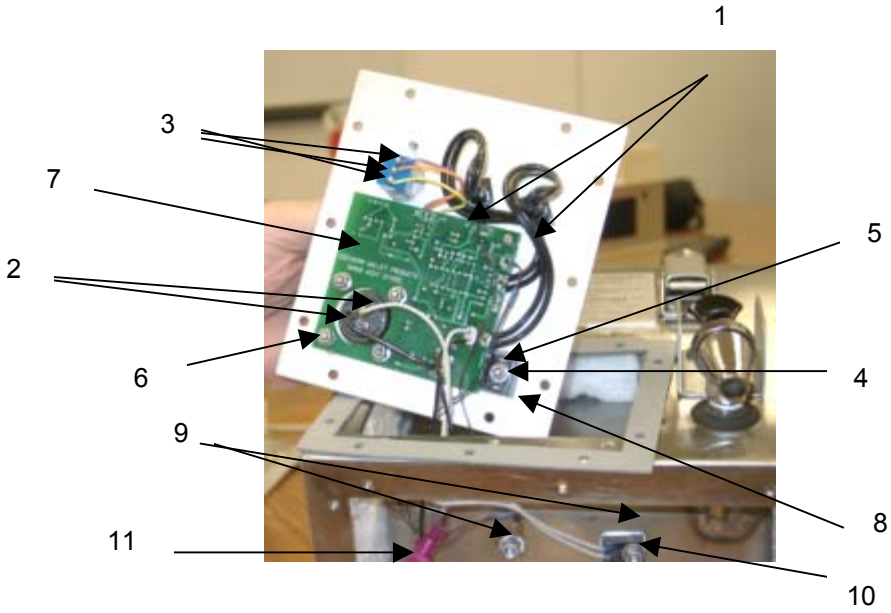
The circuit board is supplied with the thermistors and thermal switch installed. It also includes installed wire lengths for connecting the circuit board to the receptacle, the switch and the heating element. The power transistor is an integral part of the circuit board.

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)), and the base plate (Subparagraph 4-16.1q, steps (1) thru (3)).

(2) Unscrew the thermistors (1) and (3) and the thermal switch (9).

(3) Disconnect the heating element (electrical element) leads (10) from the heating element wires attached to the circuit board.



(4) Unsolder the leads (1) from the indicator lights .

(5) Unsolder the wires connected to the receptacle (2) and the switch (3).

(6) Remove the screw, washer, and lock nut (4) that secure the power transistor (5) to the control panel.

(7) Remove the four lock nuts and four washers (6) that secure the circuit board (7) to the control panel.

(8) Remove the circuit board (7) and the thin gray isolator (8).

CAUTION

Ensure the thermistor attached to location "SIDE" on the Circuit board is screwed to the side of the container. Ensure the thermistor attached to location "BASE" on the Circuit board is screwed to the base of the container, next to the heater. This base thermistor should have blue heat shrink tubing on the wires for identification purposes.

i. Installing the Circuit Board.

(1) Apply some insulating compound to both of the thermistors (9) and the thermal switch (10).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

NOTE

When installing the circuit board, ensure that the isolator is installed between the power transistor and the control panel. Touch up all soldered connections, on both sides of the circuit board with conformal coating.

(2) Install the isolator (8) and the circuit board (7).

(3) Install the four washers and lock nuts (6) to secure the circuit board (7) to the control panel.

(4) Install the washer, screw, and the lock nut (4) to secure the power transistor (5) to the control panel.

(5) Solder the wires connected to the receptacle (2) and the switch (3).

(6) Solder the leads to the indicator lights (1).

(7) Connect the heater element leads (11) to the heater element wires that are attached to the circuit board (7).

(8) Screw on the thermistors (9) and the thermal switch (10).

(9) Install the base plate (Subparagraph 4-16.1r steps (1) thru (3)), and the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

j. Repairing the Circuit Board.

NOTE

If a wire has to be spliced together, solder and cover the splice with heat shrinking tubing or equivalent.

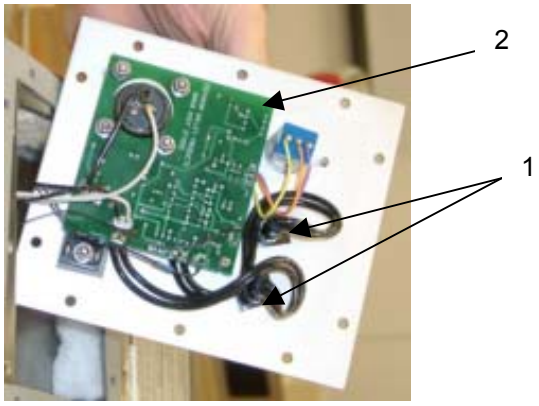
(1) If necessary, re-solder the wires securely to their correct locations and touch up soldered connections, on both sides of the circuit board, with conformal coating.

(2) Verify that the HWR is operating correctly.

(3) If not, replace the circuit board, as described in (Subparagraph 4-16.1h, steps (1) thru (8)).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

k. Inspecting the Indicator Lights.

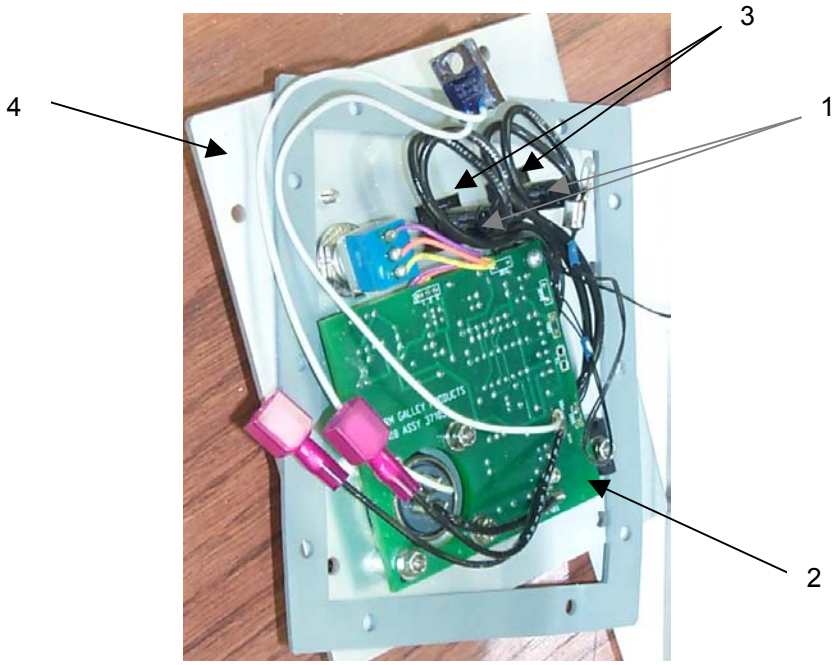


(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Check the two leads (1) to determine if they are correctly connected to the circuit board (2) and securely attached. The leads must be connected to the location marked "GRN" (green indicator light) or ”WHT” (white indicator light) on the circuit board.

(3) The bulb is not replaceable. If necessary, replace the entire light assembly (Subparagraph 4-16.1l, steps (1) thru (4)).

l. Replacing the Indicator Lights.



4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

NOTE

The following procedure applies to either the green indicator light or the white indicator light.

(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Unsolder the two indicator light leads (1) from the circuit board (2).

(3) Remove the spring plate (3) that secures the indicator light in place.

(4) Remove the indicator light (1) from the control plate (4).

m. Installing the Indicator Lights.

NOTE

When installing the indicator light, ensure that the leads are correctly attached to the circuit board. Touch up the soldered connections, on both sides of the circuit board with conformal coating.

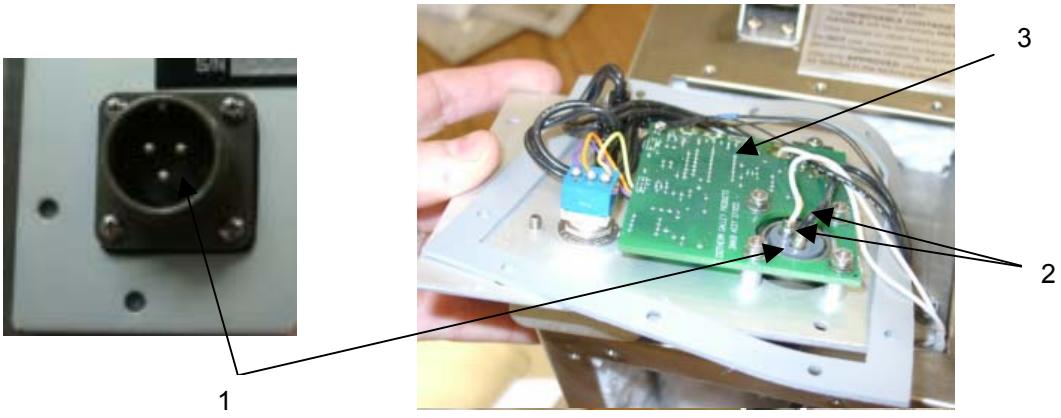
(1) Install the indicator light (1) on the control plate (4).

(2) Install the spring plate (3) to secure the indicator light in place.

(3) Solder the two indicator light leads (1) to the circuit board (2).

(4) Install the control panel (Subparagraph 4-16.1ff, steps (1) thru (5)).

n. Inspecting the Receptacle.



(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Check the front and back of the receptacle (1) to determine if any of the pins are bent, broken or shorted together.

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

(3) If any of the pins are bent, broken or shorted, replace the receptacle (1), as described (Subparagraph 4-16.1o, steps (1) thru (7)).

(4) If not, check the two wires (2) between pins A and B of the receptacle (1) and the circuit board (3) to determine if the wires are correctly connected and securely attached. Perform a continuity check on these two wires. Pin C should have no connection.

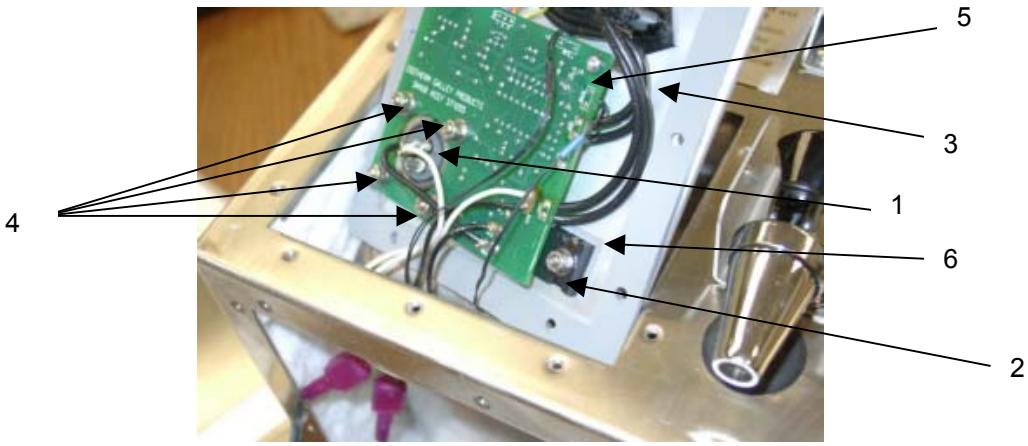
NOTE

If a wire has to be spliced together, the splice must be soldered and covered with heat shrink tubing or equivalent.

(4) If the wires are loose, solder the wires securely to their correct locations and touch up soldered connections, on both sides of the circuit board (3), with conformal coating.

(6) If a repair was made, verify that the HWR is now operating correctly.

o. Replacing the Receptacle.



(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Unsolder the wires connected to pins A and B of the receptacle (1). Pin C has no wire connection.

(3) Remove the screw, washer, and lock nut that secure the power transistor (2) to the control plate (3).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

(4) Remove the four screws, washers, and lock nuts (4) that secure the circuit board (5) and receptacle (1) to the control plate (3).

(5) Carefully lift the circuit board (5) and the isolator (6) away from the control plate (3).

(6) Remove the receptacle (1) and receptacle gasket (7) from the control plate (3).

(7) Remove the receptacle gasket (7) from the receptacle (1).

p. Installing the Receptacle.

NOTE

When installing the receptacle, ensure that the receptacle is correctly positioned with respect to the control panel (key will be at top of connector). Observe the proper polarity; the red wire goes to pin A and the black wire goes to pin B. In some units one of the leads of the thermal switch is connected to pin A instead of the red wire.

NOTE

Ensure that the isolator is installed between the power transistor and the control panel.

(1) Install the receptacle gasket (7) to the receptacle (1).

(2) Install the receptacle gasket (7) and receptacle (1) to the control plate (3).

(3) Carefully, place the isolator (6) and circuit board (5) on the control plate (3).

(4) Install the fours washers, screws, and lock nuts (4) to secure the receptacle (1) and circuit board (5) to the control plate (3).

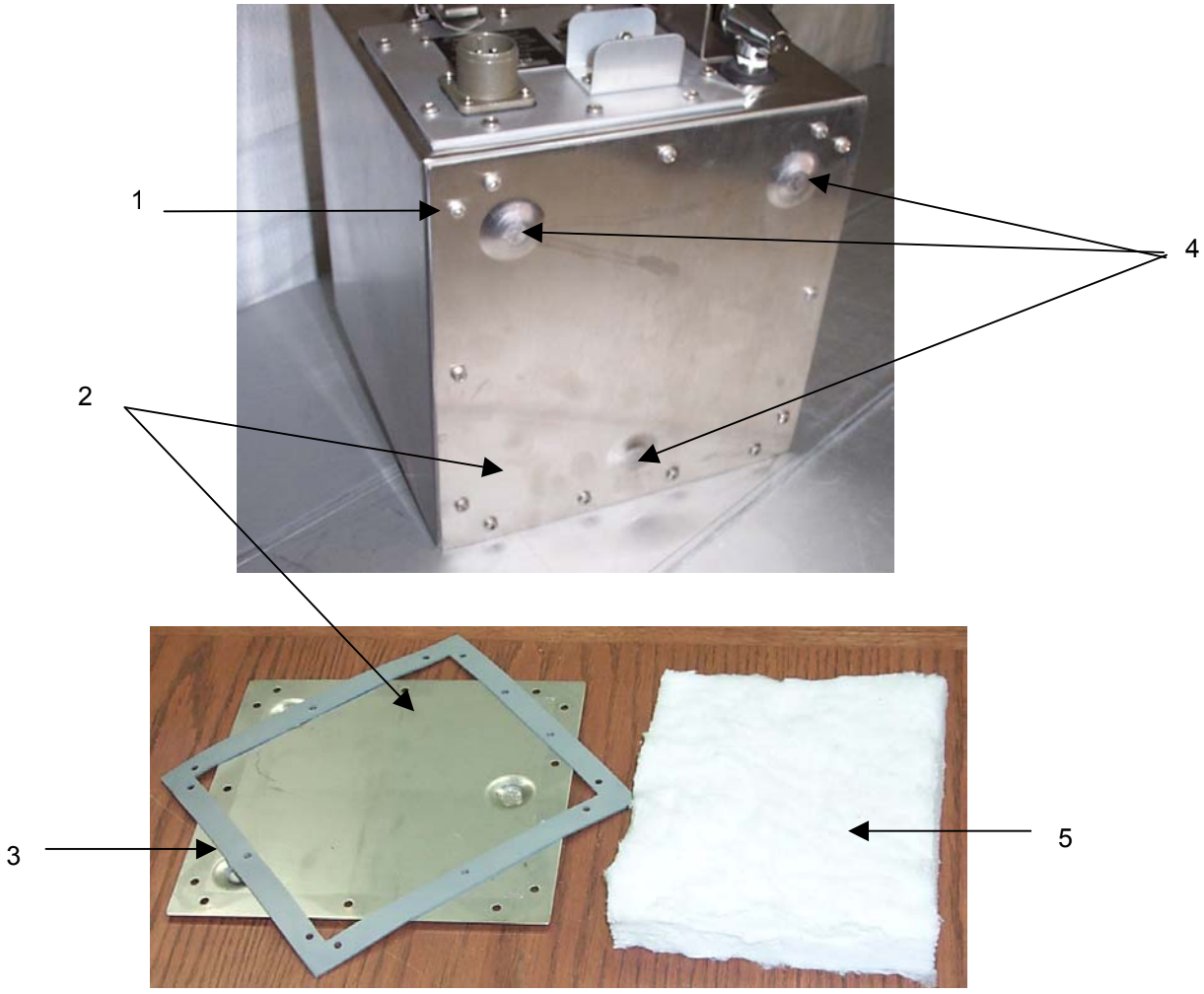
(5) Install the washer, screw, and lock nut to secure the power transistor (2) of the circuit board (5) to the control plate (3).

(6) Solder the wires to pins A and B of the receptacle (1). Pin C should not be connected.

(7) Install the control panel (Subparagraph 4-16.1ff, steps (1) thru (5)).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

q. Removing the Base Plate.



(1) Remove the 13 screws (1) and lock washers that secure the base plate (2) and gasket (3) to the main container.

(2) Remove the base plate (2) and gasket (3), noting that the three feet (4) are on the exterior of the base plate (2).

(3) If access is required to the heating element, thermal switch, or the tap shank jam nut, or you are removing the spigot, then remove the piece of insulation (5) located between the base plate (2) and the heating element retaining plate.

r. Installing the Base Plate.

NOTE

When installing the base plate, ensure that the base plate gasket is correctly aligned and that all mating surfaces are clean.

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

(1) If access is required to the heating element, thermal switch, or the tap shank jam nut, install the piece of insulation (5) between the base plate (2) and the heating element retaining plate.

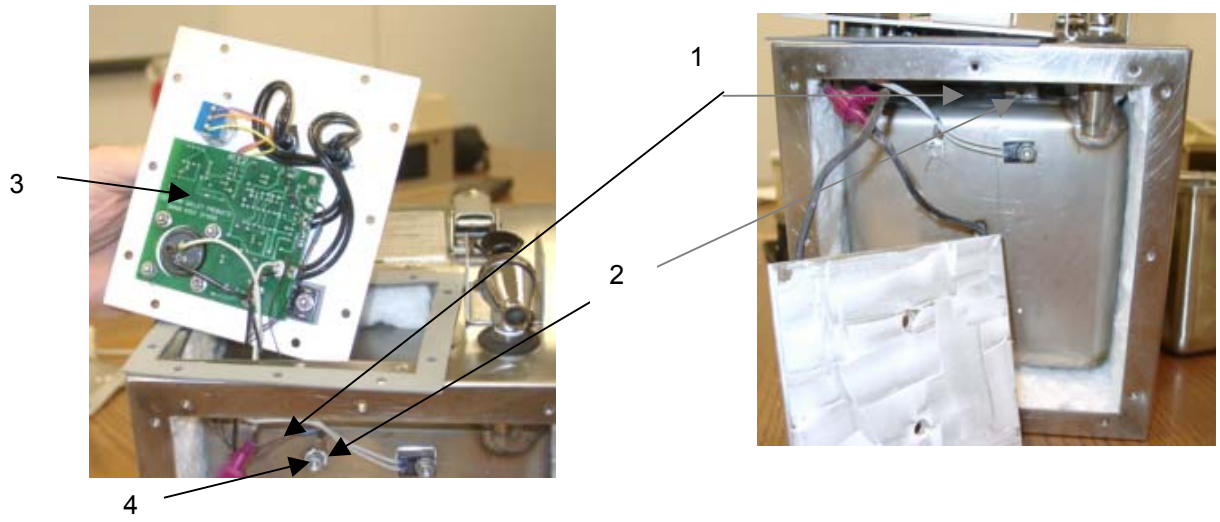
(2) Install the gasket (3) and base plate (2).

(3) Install the 13 screws and lock washers (1) to secure the gasket (3) and base plate (2) to the main container.

s. Inspecting the Thermistors.

NOTE

The following procedure applies to either thermistor.



(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Check the wires (1) between the thermistors (2) and the circuit board (3) to ensure the wires are not broken, and are correctly connected and securely attached. Polarity is not important.

(3) Ensure the thermistors (2) are firmly attached to the HWR.

(4) Ensure that the thermistor mounted to the base of the main container (near the heater) is connected to the circuit board location marked "BASE", and the thermistor mounted to the side of the main container is wired to the circuit board location marked "SIDE". The "BASE" thermistor should have blue heat shrink tubing around the wires to help identification. Unscrew and swap the thermistors if required.

t. Testing the Thermistors.

(1) With the thermistor (2) between 68 F and 77 F, measure the resistance between the two wires. The resistance should be between 10,000 and 12,500 ohms. When the thermistor (2) is warmer, the resistance is less and vice versa.

(2) If the thermistor resistance is out of tolerance, replace the thermistor as described in the next paragraph.

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

u. Replacing the Thermistors.

NOTE

The following procedures apply to both of the two thermistors.

(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)). If the thermistor next to the heating element needs replacing, remove the base plate (Subparagraph 4.16.1q, steps (1) thru (3)).

(2) Remove the lock nut (4) that secures the thermistor (2).

(3) Unsolder the thermistor wires (1) from the circuit board (3).

(4) Remove the thermistor (2) from the mounting stud.

(5) If the thermistor being replaced is mounted next to the heater on the base of the container, place some blue heat shrink tubing or equivalent on the wires of the new thermistor to assist identification.

v. Installing the Thermistors.

(1) Apply a thin layer of insulating compound or equivalent to the bottom surface of the thermistor (2), prior to installing.

CAUTION

Ensure the thermistor attached to location "SIDE" on the circuit board is screwed to the side of the container. Ensure the thermistor attached to location "BASE" on the circuit board is screwed to the base of the container, next to the heater. The base thermistor should have blue heat shrink tubing on the wires for identification purposes.

NOTE

When installing the thermistor, ensure that the thermistor is tight against the container after the lock nut is tightened. It may be necessary to install a washer between the nut and the thermistor.

(2) Install the thermistor (2) to the mounting stud.

(3) Solder the thermistor wires (1) to the circuit board (3).

(4) Install the lock nut (4) to secure the thermistor (2).

(5) If the thermistor was replaced, install the base plate (Subparagraph 4-16.1r steps (1) thru (3)).

(6) Install the control panel (Subparagraph 4-16.1ff, steps (1) thru (5)).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

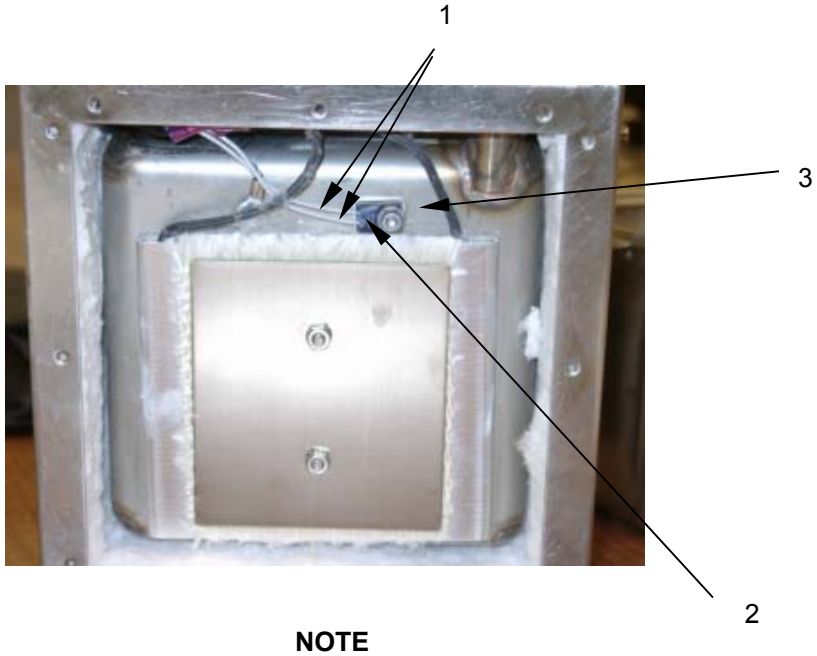
w. Repairing the Thermistors.

(1) If necessary, re-solder the wires (1) securely to their correct locations and touch up connections, on both sides of the circuit board with conformal coating.

(2) If a repair was made, verify that the HWR is now operating correctly.

(3) If a defective thermistor (2) is still suspected, unsolder (and disconnect) the thermistor wires (1) from the circuit board (3).

x. Inspecting the Thermal Switch.



NOTE

Perform the test at room temperature only.

NOTE

The thermal switch is a temperature-activated switch that breaks contact (opens) when the temperature of the wall it is attached to exceeds 239 ^{O}F and makes contact (closes) when the temperature of that wall drops below 230 ^{O}F.

(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Verify that the two thermal switch leads (1) are correctly connected to the circuit board and securely attached. In some units the thermal switch may be connected directly between Pin A of the receptacle and the POS terminal on the circuit board. In this latter case, a jumper will be installed between the two terminals marked TS.

(3) Remove the base plate (Subparagraph 4-16.1q steps (1) thru (3)). Ensure the thermal switch (2) is securely mounted to the base of the main container (3) adjacent to the heater.

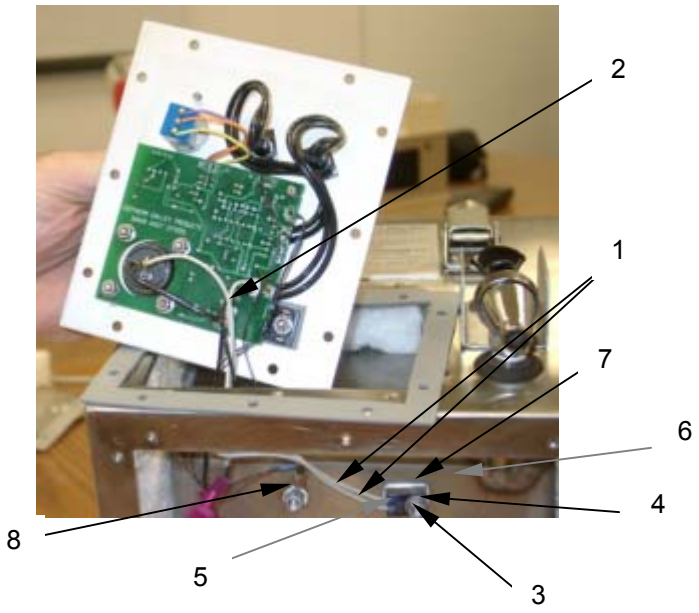
4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

(4) Ensure there is continuity between the locations on the circuit board where the thermal switch leads (1) are attached. It may be necessary to remove the conformal coating at the circuit board connection with a solvent such as acetone or lacquer thinner to ensure good contact with the test probes.

(5) If there is no continuity, replace the thermal switch (2) as described in the next paragraph.

(6) If necessary, re-solder the thermal switch leads (1) to their correct locations and touch up the soldered connections, on both sides of the circuit board, with conformal coating.

y. Replacing the Thermal Switch.



(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Remove the base plate (Subparagraph 4-16.1q steps (1) thru (3)).

(3) Unsolder the two thermal switch leads (1) from the circuit board (2).

NOTE

In some units the defective thermal switch may be connected to the terminals marked "TS" on the circuit board.

(4) Remove the lock nut (3) and washer (4) that secure the thermal switch (5) to the main container (6).

(5) Remove the thermal switch (5) from the mounting stud (7).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

z. Installing the thermal switch.

NOTE

When installing the thermal switch, ensure that it is aligned parallel to the front edge of the heating element. Touch up the soldered connections, on both sides of the circuit board, with conformal coating.

(1) Apply a thin layer of insulating compound to the bottom surface of the thermistor (8), prior to installing it.

NOTE

The new thermal switch should be connected between Pin A of the receptacle and the POS terminal on the circuit board, replacing the red wire, which should be discarded. A jumper wire (22 ga) must then be installed between the two terminals marked "TS."

(2) Install the thermal switch (5) to the mounting stud (7).

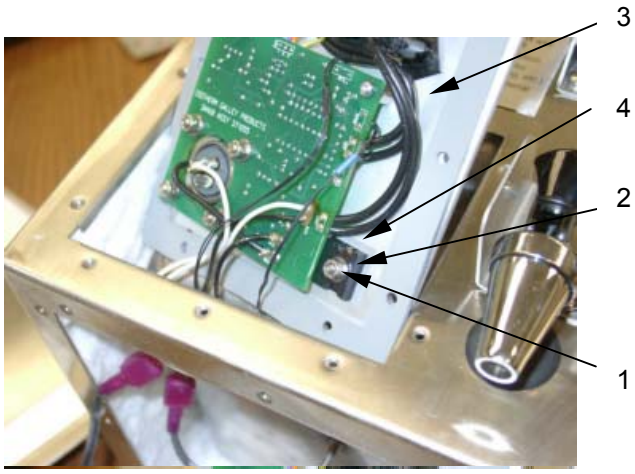
(3) Install the washer (4) and lock nut (3) to secure the thermal switch (5) to the main container (6).

(4) Solder the two thermal switch leads (1) to the circuit board (2).

(5) Install the base plate (Subparagraph 4-16.1r, steps (1) thru (3)).

(6) Install the control panel (Subparagraph 4-16.1ff, steps (1) thru (5)).

aa. Inspecting the Isolator.



(1) Remove the control panel (Subparagraph 4-16.1a, steps (1) thru (4)).

(2) Remove the screw, washer, and lock nut (1) that secure the power transistor (2) of the circuit board to the control panel (3).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

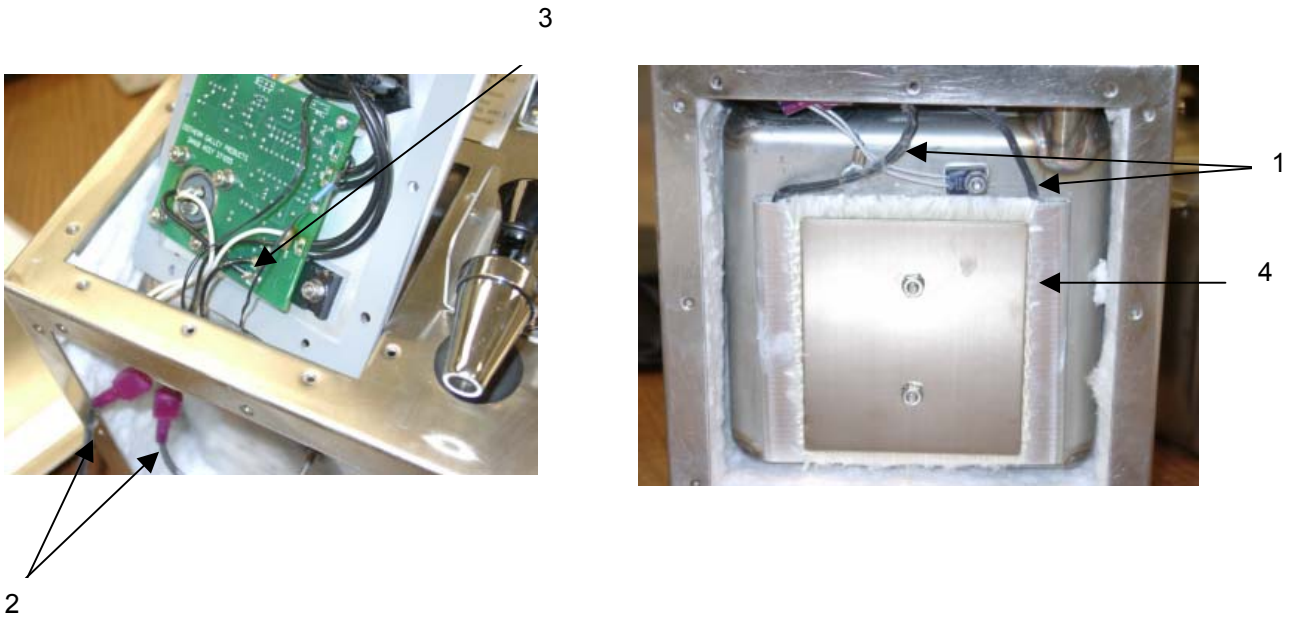
CAUTION

Do not bend the legs on the transistor, when removing the isolator.

(3) Remove the isolator (4) from underneath the power transistor (2).

(4) Inspect the isolator (4) to determine if it has any holes (other than the mounting hole), rips or tears. If the isolator (4) is damaged, replace the isolator with a serviceable item from stock.

bb. Inspecting the Heating Element.



CAUTION

Do not supply power to a disassembled HWR, as described below, if there is any danger of wires or components shorting.

NOTE

In many of the procedures, a check is first made to determine if the component is wired correctly and, if a repair is made, the user is instructed to "check the HWR to determine if it is operating correctly." If the repair was the obvious cause of the problem, then the HWR is reassembled and checked. However, if the repair may not clearly solve the problem, then the repair is tested by carefully supplying power for several seconds to the HWR and observing if the component operates correctly.

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

NOTE

The white light is wired directly in parallel with the heating element, therefore, power is applied to the heater whenever the white light is on.

(1) Check the two heating element leads (1) to verify that the electrical connections (2) (located in the mid-point of each lead) are securely attached.

(2) If they are not, re-attach them. If either connection (2) is loose or defective, replace it.

(3) Check the two heater element leads (1) to determine if they are correctly connected to the circuit board (3) and securely attached.

(4) If not, solder them securely to their correct locations, marked "HTR" on the circuit board (3). Touch up the soldered connections, on both sides of the circuit board, with conformal coating.

(5) If a repair was made, verify that the HWR is now operating correctly.

(6) If it is not, unsolder the two heating element leads (1) from the circuit board (3).

cc. Testing the Heating Element.

NOTE

When measuring the resistance, ensure that the resistance of the ohmmeter leads is not included in the measured value. Ensure the ohmmeter used is calibrated and zeroed.

(1) Measure the resistance between the two heating element leads (1). The measured value should be in the range of 1.86 to 2.06 ohms.

(2) Ensure there is no continuity between the leads (1) and the metal case of the heating element (4).

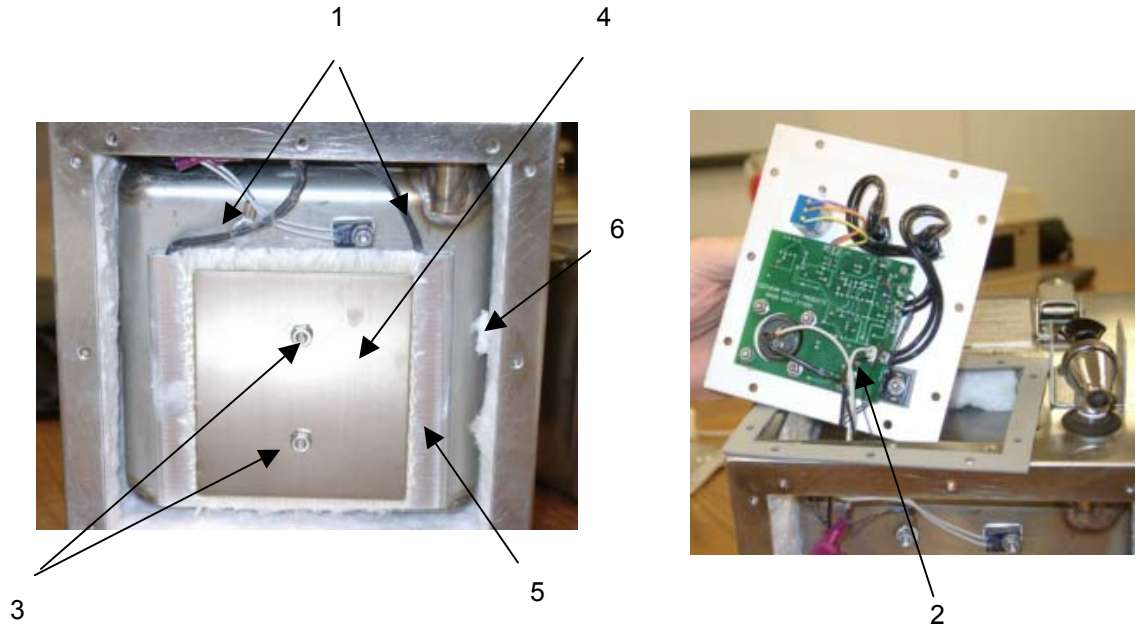
(3) If the heating element resistance is within the specified range, it is operating correctly. Resolder the two heating element leads (1) to the circuit board (3) and touch up the soldered connections, on both sides of the circuit board (3), with conformal coating.

(4) If the heating element resistance is outside the specified range, replace the heating element as described in the next paragraph.

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

dd. Replacing the Heating Element.

(1) Remove the base plate (Subparagraph 4-16.1q, steps (1) thru (3)).



(2) Disconnect the two heating element leads (1) from the leads attached to the circuit board (2).

(3) Remove the two locknuts (3) that secure the heating element retaining plate (4).

(4) Remove the retaining plate (4), fiberglass cloth, and the heating element (5) from the mounting studs.

ee. Installing the Heating Element.

NOTE

When installing the heating element, ensure that the bottom surface of the main container and the top surface of the heating element are free from grit or particles of insulation.

(1) Apply insulating compound to the non-seam side of the heating element. Ensure that the heating element surface, with the seam, faces towards the base plate away from the container.

(2) Install the heating element (5), fiberglass cloth, and the retaining plate (4) to the mounting studs.

(3) Install the two lock nuts (3) to secure the heating element retaining plate (4).

(4) Connect the two heating element leads (1) from the leads attached to the circuit board (2).

(5) Install the piece of insulation (6) covering the heater, and the base plate (1) (Subparagraph 4-16.1r, steps (1) thru (3)).

4-16.1 REPLACING THE CONTROL PANEL ASSEMBLY FOR MODEL 471012 (Continued)

ff. Installing the Control Panel.

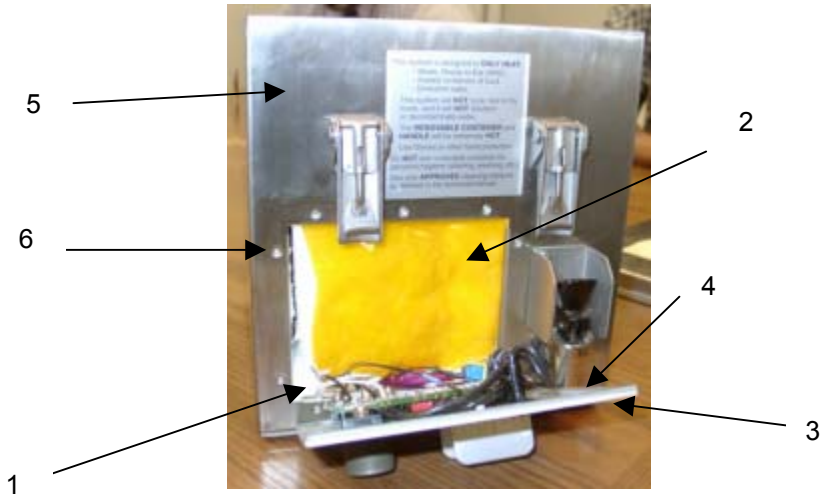
NOTE

When installing the control panel, ensure that the control panel gasket is correctly aligned and that all mating surfaces are clean.

NOTE

If a new control plate is installed, remove the circuit board, the isolator, the receptacle, the indicator lights and the switch from the old control plate and install these components on the new control plate, using the procedures contained in this section.

(1) Install the base plate (Subparagraph 4-16.1r steps, (1) thru (3)), if necessary.



(2) Install the front piece of insulation (1).

(3) Place the protective sheet (2) between the control panel (3) and the front piece of insulation (1).

CAUTION

When installing the control panel be cautious some of the wires are fragile.

(4) Carefully, install the gasket (4) and control panel (3) to the main container (5) remembering the location of the protective sheet (2) and wires.

(5) Install the 10 screws and lock washers (6) to secure the gasket (4) and control panel to the main container (5).

Section VI. PREPARATION FOR STORAGE OR SHIPMENT

4-17. SPECIAL INSTRUCTIONS FOR ADMINISTRATIVE STORAGE

a. Administrative Storage. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be mission ready within 24 hours or within the time frame as determined by the directing authority. During the storage period, appropriate maintenance checks and services should be completed, shortcomings and deficiencies should be corrected and all Modification Work Orders (MWOs) should be applied.

b. Storage Site Selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers, or other containers may be used.

4-17. PREPARATION FOR USE

To prepare the HWR for storage, perform the inspection, cleaning, and sanitizing procedures described in Chapter 3, Section III, Subparagraph 3-5, 3-6, and 3-7.

4-18. PREPARATION FOR SHIPMENT

Prepare the HWR for shipment by packing it into the original, or similar, packaging and container in which it was received.

APPENDIX A

REFERENCES

A-1. SCOPE

This appendix lists the Forms, Field Manuals, Technical Manuals, Army Regulations, Department of the Army Pamphlets and Miscellaneous publications referenced in this manual.

A-2. FORMS

Recommended Changes to Publications ..... DA Form 2028
Equipment Inspection and Maintenance Worksheet ..... DA Form 2404
Equipment Control Record ..... DA Form 2408-9
Report of Discrepancy ..... SF 364
Product Quality Deficiency Report ..... SF 368

A-3. FIELD MANUALS

Water Supply in Theaters of Operations ..... FM 10-52
Field Hygiene and Sanitation ..... FM 21-10
First Aid for Soldiers ..... FM 21-11

A-4. TECHNICAL MANUALS

Procedure for Destruction of Equipment to Prevent Enemy Use ..... TM 750-244-3

A-5. ARMY REGULATIONS

Dictionary of United States Army Terms ..... AR 310-25

A-6. DEPARTMENT OF THE ARMY PAMPHLETS

Consolidated Index of Army Publications and Blank Forms ..... DA Pam 25-30
US Army Equipment Index of MWOs ..... DA Pam 750-10
The Army Maintenance Management System (TAMMS) ..... DA Pam 738-750

A-7. MISCELLANEOUS PUBLICATIONS

Expendable and Durable Items ..... CTA 50-970

APPENDIX B

MAINTENANCE ALLOCATION CHART

SECTION I. INTRODUCTION

B-1. SCOPE

This appendix is divided into four sections as follows:

a. Section I. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

b. Section II. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section III. This section lists the tools (common and special) and test equipment required for each maintenance function as referenced from Section II.

d. Section IV. This section contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS

Maintenance functions are limited to and defined as the following:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through visual examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operation condition, to clean, preserve, drain, paint or to replenish fuel/lubricants/hydraulic fluids or compressed air supplies.

d. Adjust. To maintain within prescribed limits by bringing into proper or exact position or by setting operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring or diagnostic equipment used in precision measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacement, sealing or fixing into position a spare, repair part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and the assigned maintenance level is shown in the 3rd position of the SMR code.

B-2. MAINTENANCE FUNCTIONS (Continued)

i. Repair. The application of maintenance services including fault location troubleshooting, removal/installation, disassembly/assembly procedures and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction or failure in a part, subassembly, module (component or assembly), end item or system.

j. Overhaul. The maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical manuals (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

B-3. MAINTENANCE ALLOCATION CHART

An explanation of the column entries is as follows:

a. GROUP NUMBER. This column lists group numbers (or functional group codes) the purpose of which is to identify components, assemblies, subassemblies and modules within the next higher assembly.

b. COMPONENT/ASSEMBLY. This column contains the name or nomenclature of components, assemblies, subassemblies and modules for which maintenance is authorized. Throwaway items such as lamps, tubes, resistors, modules, cards and like items are not considered repairable and therefore are not listed. However, a listing of such items in the Repair Parts and Special Tools Lists (RPST) in Appendix C gives automatic authorization to replace such items at the lowest level of maintenance.

c. MAINTENANCE FUNCTION. This column lists the maintenance functions to be performed on the items listed in Column 2. When items are listed without maintenance functions it is solely for the purpose of having the group numbers in the MAC and RPSTL coincide.

d. MAINTENANCE LEVEL. This column specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate "worktime" figures will be shown for each level. The number of task-hours specified by the "worktime" figures will be shown for each level. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in Column 3. The subcolumns of Column 4 are as follows:

UNIT	DIRECT SUPPORT	GENERALSUPPORT	DEPOT
C = Operator/Crew	F = Direct Support	H = General Support	D = Depot
O = Organizational			

B-3. MAINTENANCE ALLOCATION CHART (Continued)

e. TOOLS AND TEST EQUIPMENT CODE. This column specifies (by a reference code number) the common tool sets, individual tools, special tools and the test and support equipment required to perform the designated maintenance function listed in Column 3. These reference code numbers are listed in Section III.

f. REMARKS CODE. This column contains an alphabetic code, which identifies the remarks listed in Section IV. These remarks pertain to the item immediately adjacent to the particular code.

B-4. TOOLS AND TEST EQUIPMENT

The list of tools and test equipment for HWR is a supplement to the Maintenance Allocation Chart. All the common tools and special tools are listed as well as the test and support equipment required by the indicated maintenance level to perform its authorized maintenance functions.

An explanation of the column entries is as follows:

a. TOOL OR TEST EQUIPMENT CODE. This column contains numbers, which coincide with the numbers used in Column 5 in the MAC. The numbers indicate the applicable tools and test equipment required for performing the designated maintenance functions.

b. MAINTENANCE LEVEL. This column contains the letter codes which indicate the maintenance category allocated to the specific tool or test equipment.

c. NOMENCLATURE. This column lists the name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. NATIONAL STOCK NUMBER. This column lists the National stock number of the specific tool or test equipment.

e. TOOL OR TEST EQUIPMENT NUMBER. This column lists the manufacturer's part number of the specified tool or test equipment.

B-5. REMARKS

An explanation of the column entries is as follows:

a. REMARKS CODE. This code refers to the appropriate item in the MAC.

b. REMARKS. This column provides the required explanatory information necessary to clarify items appearing in the MAC.

Section II. MAINTENANCE ALLOCATION CHART FOR MODEL RAK-15

GROUP No.	COMPONENT/ ASSEMBLY	MAINT FUNCTION	MAINTENANCE LEVEL					TOOLS & TEST EQUIP CODE	REMARKS CODE
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
			C	0	F	H	D		
00	HEATER, WATER AND RATION (HWR)								
01	COVER ASSEMBLY	INSPECT	0.1						A
		SERVICE	1.0						E
		REPAIR		0.3				1	B
0101	PRESSURE RELIEF VALVE	TEST		0.1					D
		REPLACE		0.2				1	
02	INNER CONTAJNER ASSEMBLY	INSPECT	0.1						A
		SERVICE	1.0						E
		REPLACE		0.1					
03	MAIN CASE ASSEMBLY	INSPECT	0.1						A
		SERVICE	1.0						E
0301	LATCH ASSEMBLY	INSPECT	0.1						A
		REPLACE		0.2				1	
0302	TAP ASSEMBLY	INSPECT	0.1						A
		SERVICE	1.0						E
		REPAIR		0.3				1	B
0303	CONTROL PANEL ASSEMBLY	REPAIR		0.3				1	B
030301	TOGGLE SWITCH ASSEMBLY	TEST		0.3				2	C
		REPLACE		0.3				1	

SECTION II.1 MAINTENANCE ALLOCATION CHART FOR MODEL 471012

GROUP No.	COMPONENT/ ASSEMBLY	MAINT FUNCTION	MAINTENANCE LEVEL					TOOLS & TEST EQUIP CODE	REMARKS CODE
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
			C	0	F	H	D		
00	HEATER, WATER AND RATION (HWR)								
01	COVER ASSEMBLY	INSPECT	0.1						A
		SERVICE	1.0						E
		REPAIR		0.3				1	B
0101	PRESSURE RELIEF VALVE	TEST		0.1					D
		SERVICE	0.1						
		REPLACE		0.2				1	
02	INNER CONTAINER ASSEMBLY	INSPECT	0.1						A
		SERVICE	1.0						E
03	MAIN CONTAINER ASSEMBLY	INSPECT	0.1						
		SERVICE	1.0						E
0301	FASTENER, PAWL	INSPECT		0.1					A
		REPLACE		0.2				1	
0302	TAP ASSEMBLY (Faucet, Single)	INSPECT		0.1					A
		SERVICE	0.1						E
		REPLACE		0.3				1	B

SECTION II.1 MAINTENANCE ALLOCATION CHART FOR MODEL 471012 (Continued)

GROUP No.	COMPONENT/ ASSEMBLY	MAINT FUNCTION	MAINTENANCE LEVEL					TOOLS & TEST EQUIP CODE	REMARKS CODE
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
			C	0	F	H	D		
0303	CONTROL PANEL ASSEMBLY	INSPECT		0.1					
		REPAIR		0.3				1	B
030301	SWITCH, TOGGLE	INSPECT		0.2					
		TEST		0.2				2	C
		REPAIR		0.2				2	
		REPLACE		0.3				1	
0304	CIRCUIT BOARD ASSEMBLY	INSPECT		0.2				1	
		REPAIR		0.3				2	
		REPLACE		0.3				2	
030401	LIGHT, INDICATOR	INSPECT		0.2				1	
		REPLACE		0.3				2	B
030402	THERMAL SWITCH	INSPECT		0.2				1	
		REPLACE		0.3				1	B
030403	THERMISTER	INSPECT		0.2				1	
		TEST		0.3				2	
		REPLACE		0.3				1	B
030404	ISOLATOR	INSPECT		0.2				1	
030405	CONNECTOR, RECEPTACLE, ELECTRICAL	INSPECT		0.2				1	
		REPLACE		0.3				1	B
04	ELEMENT, ELECTRICAL (other parts)	INSPECT		0.2				1	
		TEST		0.3				2	
		REPLACE		0.4				1	B

SECTION III. TOOLS AND TEST EQUIPMENT

TOOL OR TEST EQUIP CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL OR TEST EQUIP NUMBER
1	0	TOOL KIT, GENERAL MECHANICS: AUTOMOTIVE	5180-00-177-7033	
2	0	SHOP EQUIPMENT, COMMON, No 1	4910-00-754-0654	

SECTION IV. REMARKS

REMARKS CODE	REMARKS
A	VISUAL INSPECTION.
B	REPAIR BY REPLACEMENT OF PARTS.
C	ELECTRICAL TEST.
D	MECHANICAL TEST.
E	CLEAN AND SANITIZE. (Note, service time includes heating of water in HWR.)

APPENDIX C

REPAIR PARTS AND SPECIAL TOOLS LIST

SECTION I. INTRODUCTION

C-1. SCOPE

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement and diagnostic equipment (TMDE) and other special support equipment required for the performance of operator/unit maintenance of the HWR. It authorizes the requisitioning, issue and disposition of spares, repair parts and special tools as indicated by the Source, Maintenance and Recoverability (SMR) codes.

C-2. GENERAL

In addition to Section I this Repair Parts and Special Tools List is divided into the following sections:

a. Section II. Repair Parts List. A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence with the parts in each group listed in ascending figure and item number sequence.

b. Section III. Special Tools List. A list of special tools, special TMDE and other special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in Column 5) for the performance of maintenance.

c. Section IV. Cross-Reference Indexes. A list, in National Item Identification Number (NIIN) sequence, of all National stock numbered items appearing in the listings followed by a list of alphanumeric sequence of all part numbers appearing in the listing. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance. The figure and item number index lists figure and item number in alphanumeric sequence and cross-references the NSN, CAGEC and part number.

C-3. EXPLANATION OF COLUMNS (Sections II and III)

a. ITEM No (Column 1). Indicates the number used to identify items called out in the illustration.

b. SMR Code (Column 2). The Source, Maintenance and Recoverability (SMR) code is a 5-digit code containing supply/requisitioning information, maintenance category authorization criteria and disposition instructions as shown in the following breakdown:

Source Code		Maintenance Code	Recoverability Code
XX	X	X	X
1st and 2nd positions	3rd position	4th position	5th position
How to get an item.	Who can install, replace or use the item.	Who can do complete repair* on the item.	Who determined disposition action on an unserviceable item.

*Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

C-3. EXPLANATION OF COLUMNS (Sections II and III) (Continued)

(1) Source Code. The source code describes how to get an item needed for maintenance, repair or overhaul of an end item/equipment. Explanations of the source codes are as follows:

Code		Explanation
PA PB PC** PD PE PF PG		Stocked items. Use the applicable NSN to request/requisition items with these source codes. They are authorized to the category indicated by the code entered in the 3rd position of the SMR code. ****NOTE**: Items coded PC are subject to deterioration.
KD KF KB		Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3rd position of the SMR code. The complete kit must be requisitioned and applied.
MO	(Made at org/AVUM Level)	Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by the part number in the DESCRIPTION AND USABLE CODE (UOC) column and listed in the Bulk Material group of the repair parts list in the RPSTL. If the item is authorized to you by the code entered in the 3rd position of the SMR code, but the source code indicates that it is made at a higher level, order the item from the higher level of maintenance.
MF	(Made at DS/AVUM Level)	
MH	(Made at GS Level)	
ML	(Made at Specialized Repair Activity (SRA))	
MD	(Made at Depot)	
AO	(Assembled by org/AVUM Level)	Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the code entered in the 3rd position of the SMR code authorizes you to replace the item but the source code indicates that the item is assembled at a higher level, order the item from the higher level of maintenance
AF	(Assembled by DS/AVIM Level)	
AH	(Assembled by GS Category)	
AL	(Assembled by SRA)	
AD	(Assembled by Depot)	
XA	Do not requisition an "XA"-coded item. Order its next higher assembly. (See NOTE).	
XB	If an "XB"-coded item is not available from salvage, order it using the CAGEC and part number given.	
XC	Installation drawing, diagram, instruction sheet or field service drawing that is identified by manufacturer's part number.	
XD	Item is not stocked. Order an "XD"-coded item through normal supply channels using the CAGEC and part number given if no NSN is available.	

NOTE

Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes except for those source coded "XA" or those aircraft support items restricted by the requirements of AR 700-42.

C-3. EXPLANATION OF COLUMNS (Sections II and III) (Continued)

(2) Maintenance Code. The maintenance code describes the level(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the 3rd and 4th positions of the SMR Code as follows:

(a) The maintenance code entered in the 3rd position describes the lowest maintenance level authorized to remove, replace and use an item. The maintenance code entered in the 3rd position will indicate authorization to one of the following levels of maintenance:

Code	Application/Explanation
C	Crew or operator maintenance done within organizational or aviation unit maintenance.
O	Organizational or aviation unit category can remove, replace and use the item.
F	Direct support or aviation intermediate level can remove, replace and use the item.
H	General support level can remove, replace and use the item.
L	Specialized repair activity can remove, replace and use the item.
D	Depot level can remove, replace and use the item.

(b) The maintenance code entered in the 4th position indicates whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (ie. perform all authorized repair functions). Some limited repair may be done on the item at a lower level of maintenance if authorized by the Maintenance Allocation Chart (MAC) and SMR codes. The 4th position will contain one of the following maintenance codes:

Code	Application/Explanation
O	Organizational or aviation unit is the lowest level that can do complete repair of the item.
F	Direct support or aviation intermediate is the lowest level that can do complete repair of the item.
H	General support is the lowest level that can do complete repair of the item.
L	Specialized repair activity is the lowest level that can do complete repair of the item.
D	Depot is the lowest level that can do complete repair of the item.
Z	Non-repairable. No repair is authorized.
B	No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B"-coded item). However, the item may be reconditioned by adjusting, lubricating, etc at the user level.

C-3. EXPLANATION OF COLUMNS (Sections II and III) (Continued)

(3) Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the 5th position of the SMR code as follows:

Code	Application Explanation
Z	Non-repairable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in the 3rd position of the SMR code.
O	Repairable item. When not economically repairable, condemn and dispose of the item at organizational or aviation unit level.
F	Repairable item. When not economically repairable, condemn and dispose of the item at direct support or aviation intermediate level.
H	Repairable item. When not economically repairable, condemn and dispose of the item at general support level.
D	Repairable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item not authorized below depot level.
L	Repairable item. Condemnation and disposal not authorized below specified repair activity.
A	Item requires special handling or condemnation procedures because of specific reasons (eg, precious metal content, high dollar value, critical material or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. CAGEC (Column 3). The Contractor and Government Entity Code (CAGEC) is a 5-digit numeric code which is used to identify the manufacturer, distributor or Government agency etc, that supplies the item.

d. PART NUMBER (Column 4). Indicates the primary number used by the manufacturer (individual, company, firm, corporation or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards and inspection requirements to identify an item or range of items.

NOTE

When an NSN is used to requisition an item, the item received may have a different part number from the part ordered.

e. DESCRIPTION AND USABLE ON CODE (UOC) (Column 5). This column includes the following information:

(1) The Federal item name and, when required, a minimum description to identify the item.

(2) The physical security classification of the item is indicated by the parenthetical entry, eg, Phy Sec C1 (C)-Confidential, Phy Sec C1 (S)-Secret, Phy Sec C1 (T)-Top Secret.

(3) Items that are included in kits and sets are listed below the name of the kit or set.

(4) Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry.

C-3. EXPLANATION OF COLUMNS (Sections II and III) (Continued)

(5) Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured/fabricated.

(6) When the item is not used with all serial numbers of the same model, the effective serial numbers are shown on the last line(s) of the description (before UOC).

(7) The usable on code, when applicable (Paragraph 5, Special Information).

(8) In the Special Tools List section, the basis of issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE and other special support equipment. When density of equipments supported exceeds density spread indicated in the basis of issue, the total authorization is increased proportionately.

f. QTY (Column 6). The QTY (quantity per figure) indicates the quantity of the item used in the breakdown shown on the illustration figure which is prepared for a functional group, subfunctional group or an assembly. A "V' appearing in this column in lieu of a quantity indicates that the quantity is variable and the quantity may vary from application to application.

C-4. EXPLANATION OF COLUMNS (Section IV)

a. NATIONAL STOCK NUMBER (NSN) INDEX.

(1) STOCK NUMBER. This column lists the NSN by National item identification number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN. When using this column to locate an item, ignore the first 4 digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

(2) FIG. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in Section II and Section III.

(3) ITEM. The item number identifies the item associated with the figure listed in the adjacent FIG column. This item is also identified by the NSN listed on the same line.

b. PART NUMBER INDEX. Part numbers in this index are listed by part number in ascending alphanumeric sequence (ie., vertical arrangement of letter and number combination which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

(1) CAGEC. The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code used to identify the manufacturer, distributor or Government agency etc, that supplies the item.

(2) PART NUMBER. Indicates the primary number used by the manufacturer (individual, firm, corporation or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards and inspection requirements to identify an item or range of items.

(3) STOCK NUMBER. This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and CAGEC columns to the left.

(4) FIG. This column lists the number of the figure where the item is identified/located in Sections II and III.

(5) ITEM. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

C4. EXPLANATION OF COLUMNS (Section IV) (Continued)

c. FIGURE AND ITEM NUMBER INDEX.

(1) FIG. This column lists the number of the figure where the item is located and identified in Sections II and III.

(2) ITEM. This column lists the number assigned to the item as it appears in the figure referenced in Column 1.

(3) STOCK NUMBER. This column lists the NSN for the item.

(4) CAGEC. The Commercial and Government Entity Code (CAGEC) is a 5-digit alphanumeric code used to identify the manufacturer, distributor or Government agency etc, that supplies the item.

(5) PART NUMBER. This column indicates the primary number used by the manufacturer (individual, firm, corporation or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards and inspection requirements to identify an item or range of items.

C-5. SPECIAL INFORMATION

Not applicable to the HWR.

C-6. HOW TO LOCATE REPAIR PARTS

a. When National Stock Number or Part Number is Not Known.

(1) First. Using the table of contents, determine the assembly group or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups and the listings are divided into the same groups.

(2) Second. Find the figure covering the assembly group or subassembly group to which the item belongs.

(3) Third. Identify the item on the figure and use the Figure and Item Number Index to find the NSN.

b. When National Stock Number or Part Number is Known.

(1) First. Using the National Stock Number or the Part Number Index, find the pertinent National Stock Number or Part Number. The NSN index is in National Item Identification Number (NIIN) sequence and the part numbers in the Part Number Index are listed in ascending alphanumeric sequence. Both indexes cross reference you to the illustration/figure and item number of the item.

(2) Second. Turn to the figure and item number, verify that the item is the one required then locate the item number in the repair parts list for the figure.

C-7. ABBREVIATIONS

Refer to Section I of the Glossary for an alphabetical list of the abbreviations used in this manual and their exact meaning.

SECTION II. REPAIR PARTS LIST

This section illustrates and lists the spares and repair parts authorized for the performance of maintenance.

The parts are contained in functional groups in ascending numerical order with the parts in each group listed in figure item number sequence.

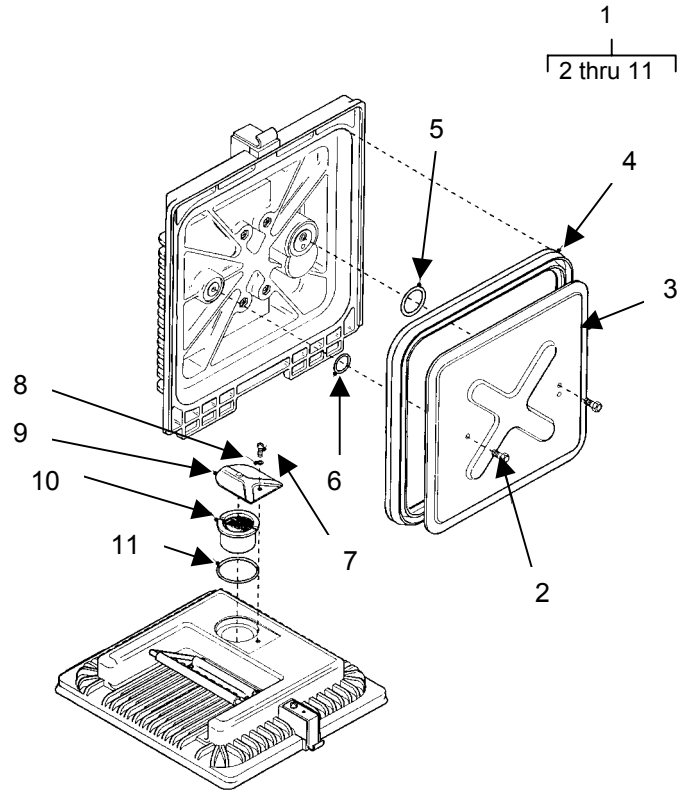


Figure C-1. Cover Access Model RAK-15

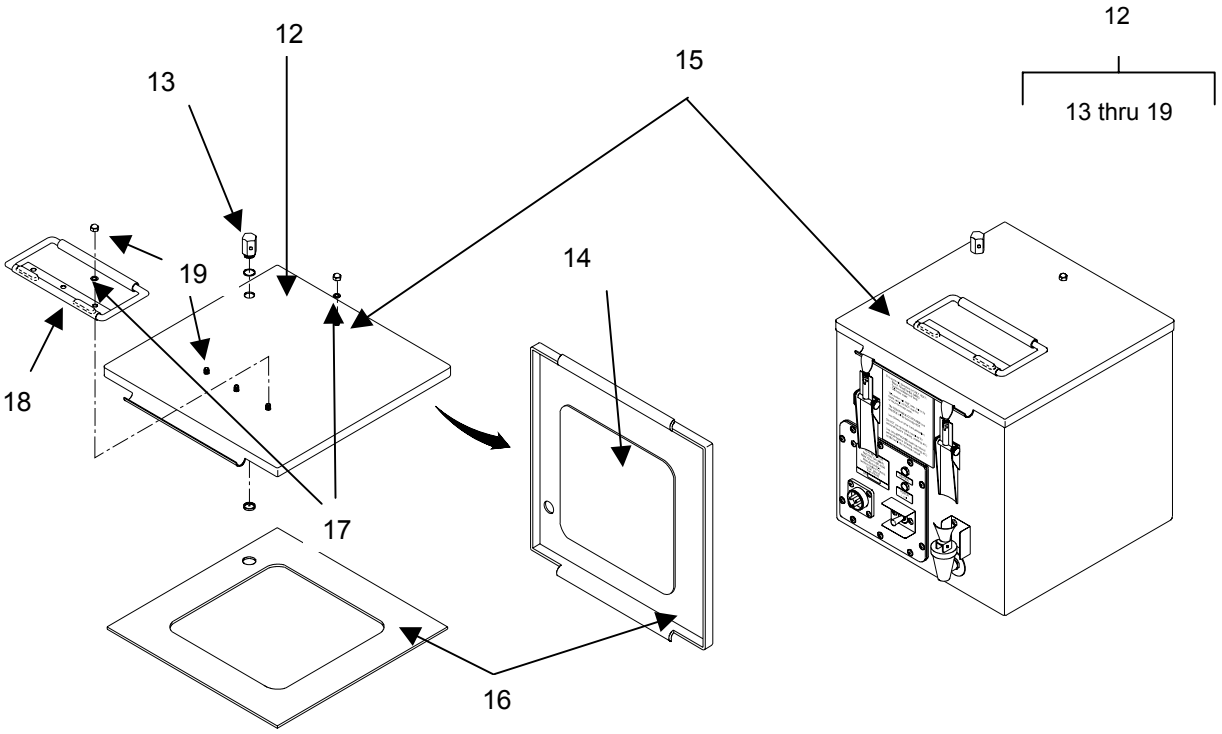


Figure C-1.1. Cover Access Model 471012

(1) ITEM No.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 01: Cover Assembly FIG. C-1 Cover, Assembly (Model RAK-15) and FIG. C-1.1 Cover, Assembly (Model 471012)	
1	PAOOO	5340-01-498-1122	05852	AZ137603	Cover Access Model RAK-15	1
2	XDOZZ		ODJ60	SM0440807	Screw, Seal Retaining Plate M4 x 8mm lg Hex Hd St/Stl	2
3	XDOZZ		ODJ60	AZ137628	Plate, Seal Retaining	1
4	KFOZZ		ODJ60	AZ137625	Seal, Cover (Part of Kit, P/N AZ1376128)	1
5	KFOZZ		ODJ60	M6833	Packing, Preformed, Large (Part of Kit, P/N AZ1376128)	1
6	KFOZZ		ODJ60	M6832	Packing, Preformed, Small (Part of Kit, P/N AZ1376128)	I
7	XDOZZ		ODJ60	SM1140807	Screw, Plate, Valve Retaining M4 x 8mm lg Pan Hd Cross Tip St/Stl	1
8	XDOZZ		ODJ60	WM804	Washer, Special M4 Spring St/Stl	1
9	XDOZZ		ODJ60	AZ1 376127	Plate, Valve Retaining	1
10	KFOZZ		ODJ60	AZI 376120	Valve, Pressure Relief (Part of Kit, P/N AZ1376141)	1
11	KFOZZ		ODJ60	M6836	Packing, Preformed (Part of Kit, P/N AZ1376141)	1
	PAOOZ	5330-01-498-2147	05852	AZ1376128	Parts Kit, Seal Seal (1) C-1-4 Packing, Large (1) C-1-5 Packing, Small (1) C-1-6	1
	PAOOZ	4820-01-498-8789	05852	AZ1376141	Parts, Kit, Valve Valve (1) C-1-10 Packing (1) C-1-11	1
12	PAOOO	5340-21-921-8004	3AN18	271038	Cover Access Model 471012	1
13	PAOZZ	4820-21-921-8012	3AN18	271070	Valve,Relief	1
14	XAOZZ		3AN18	271027	Plate, Retaining	1
15	XAOZZ		3AN18	271013	Lid	1
16	XAOZZ		3AN18	271010	Gasket, Bottom	1
17	XAOZZ		70318	#8 Stainless	Lockwasher, Stainless	4
18	XAOZZ		98003	500-56-M21-SP	Handle	1
19	XAOZZ		70318	8-32 Stainless	Nut, Acorn Head	4

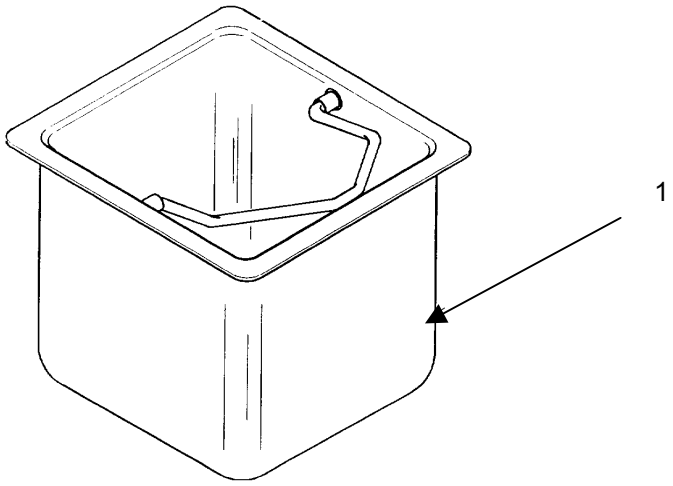


Figure C-2. Inner Container Assembly Model RAK-15

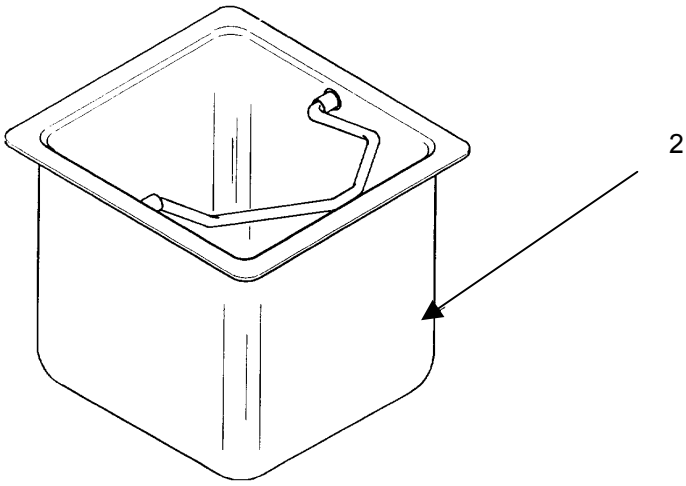


Figure C-2.1 Container Model 471012

(1) ITEM No.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 02: Inner Container Assembly FIG. C-2: Inner Container Assembly (Model RAK-15) and FIG. C-2.1: Container (Model 471012)	
1	PAOOZ	7310-01-497-3045	05852	AZ137605	Container Assembly, Inner Model RAK-15	1
2	PAOOZ	7310-21-914-8871	3AN18	470024	Container Model 471012	1

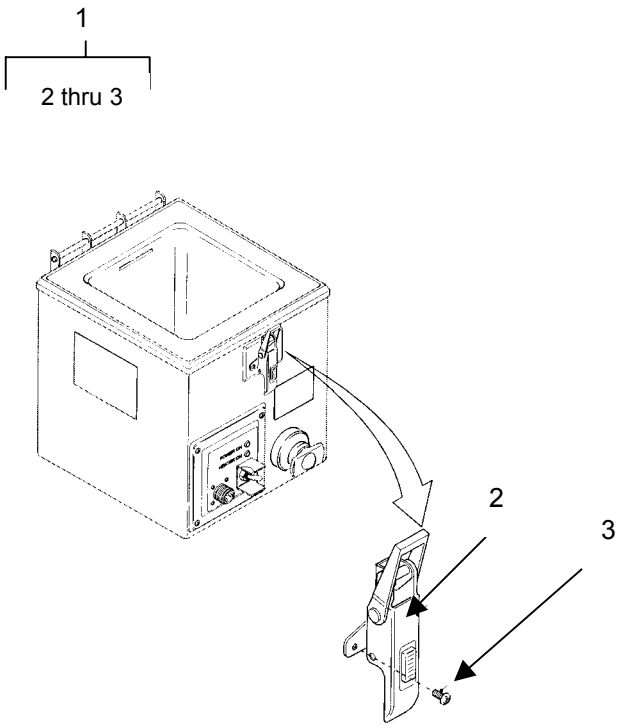


Figure C-3. Catch, Clamping Model RAK-15

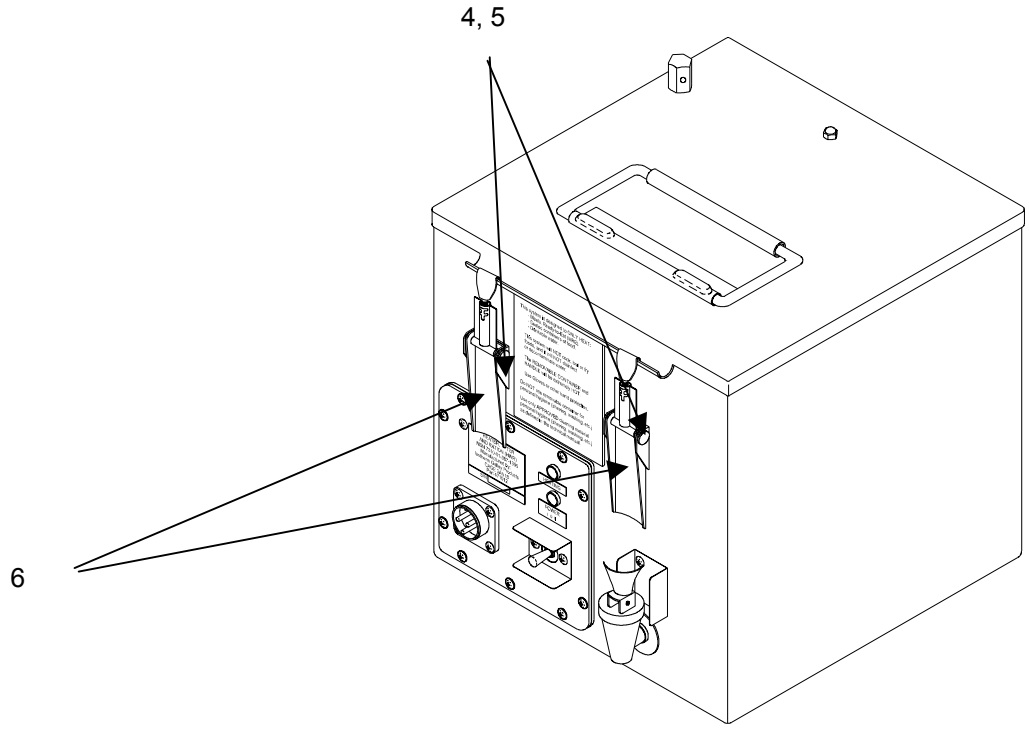


Figure C-3.1 Catch, Clamping Model 471012

(1) ITEM No.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 03: Main Case Assembly FIG. C-3 Latch Assembly (Model RAK-15) and FIG. C-3.1 Latch (Model 471012)	
1	PAOZZ	5340-01-497-5169	05852	AZM6633	Catch, Clamping Model RAK-15	
2	XAOZZ		ODJ60	M6633	Latch	
3	XAOZZ		ODJ60	SM1141007	Screw, Machine M4 x 10 lg Pan Hd Cross Tip st/Stl	1
4	XDOZZ		70318	#6 Stainless	Lockwasher, stainless	4
5	PAOZZ	5340-00-676-7966	71286	5IL-1-1BF	Catch, Clamping Model 471012	2
6	XDOZZ		70318	6-32 x 5/16 LG	Screw, Stainless	4

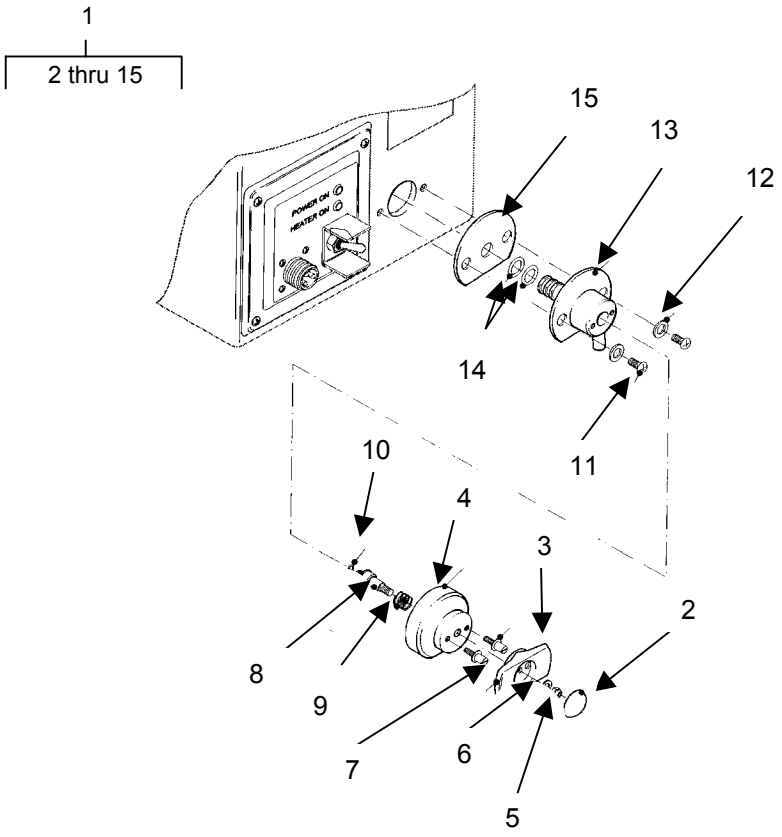


Figure C-4. Faucet, Single Model RAK-15

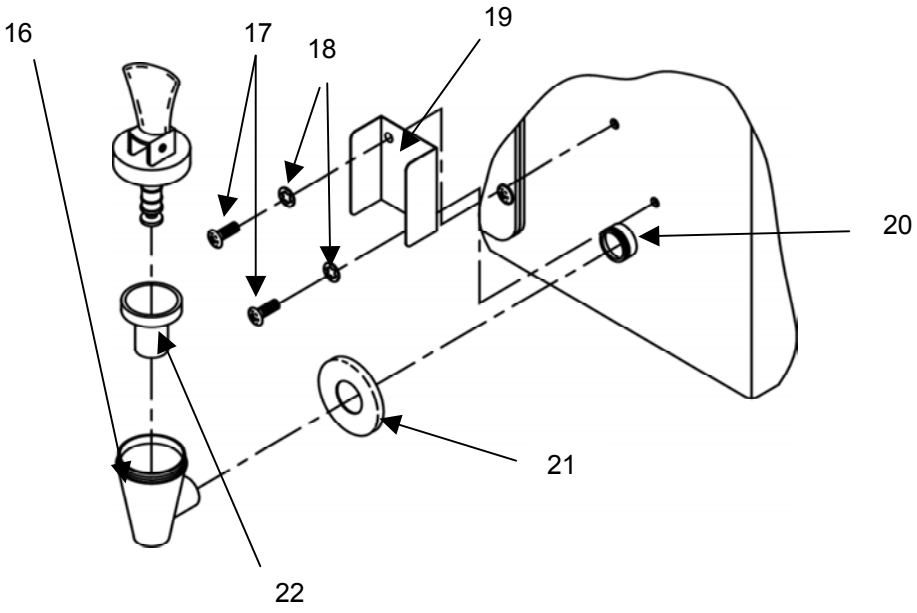


Figure C-4.1 Faucet, Single Model 471012

(1) ITEM No.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 03: Main Case Assembly FIG. C-4 Faucet, Single (Model RAK-15) and FIG. C-4.1 Faucet, Single (Model 471012)	
I	PAOOO	4510-01-497-5221	05852	AZ1376137	Faucet, Single Model RAK-15	1
2	XAOZZ		ODJ60	AZ1376136	Latch	1
3	XAOZZ		ODJ60	AZ1376109	Screw Captive	2
4	XAOZZ		ODJ60	AZ137696	Shroud	1
5	XAOZZ		ODJ60	M5270	Nut M5 Aerotight st/Stl	1
6	XAOZZ		ODJ60	WM705	Washer ms Plain St/Stl	1
7	XAOZZ		ODJ60	AZ137694	Handle	1
8	XAOZZ		ODJ60	AZ137650	Valve Stem	1
9	KFOZZ		ODJ60	M6644	Spring, Valve (Part of Kit, P/N AZ1376129)	1
10	KFOZZ		ODJ60	M6661	Packing, Preformed (Part of Kit, P/N AZ1376129)	1
11	XAOZZ		ODJ60	SM1141207	Screw, Tap Body M4 x 12 lg Pan Hd Cross Tip St/Stl	2
12	XAOZZ		ODJ60	AZ1376116	Washer, Special	2
13	XAOZZ		ODJ60	AZ137692	Tap Body	1
14	KFOZZ		ODJ60	M6664	Packing, Preformed (Part of Kit, P/N AZ1376129)	2
15	KFOZZ		ODJ60	AZ1 376121	Gasket (Part of Kit, P/N AZ1376129)	1
	PAOZZ	4820-01-498-8793	05852	AZ1376129	Parts Kit, Valve Spring (1) C-4-9 Packing (1) C-4-10 Packing (2) C-4-14 Gasket (1) C-4-15	1
16	PAOOZ	4510-21-914-2033	3AN18	170033	Faucet, Single Model 471012	1
17	XDOZZ		70318	6-32 x 5/16 LG	Screw, Stainless	2
18	XDOZZ		70318	#6 Stainless	Lockwasher, stainless	2
19	XDOZZ		3AN18	270003	Guard, Spigot	1
20	XDOZZ		3AN18	270058	Shank, Spigot	1
21	XDOZZ		94223	RB235	Grommet	1
22	PAOZZ	5330-01-429-2851	87924	3PS-18	Gasket	1

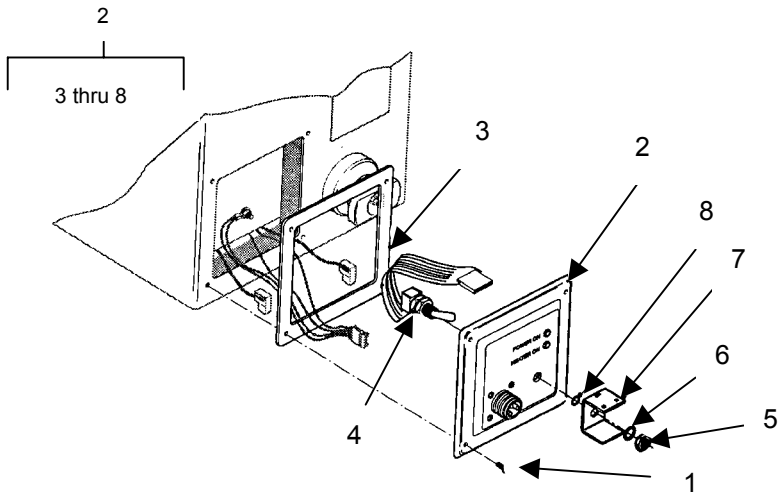


Figure C-5. Control Panel Assembly Model RAK-15

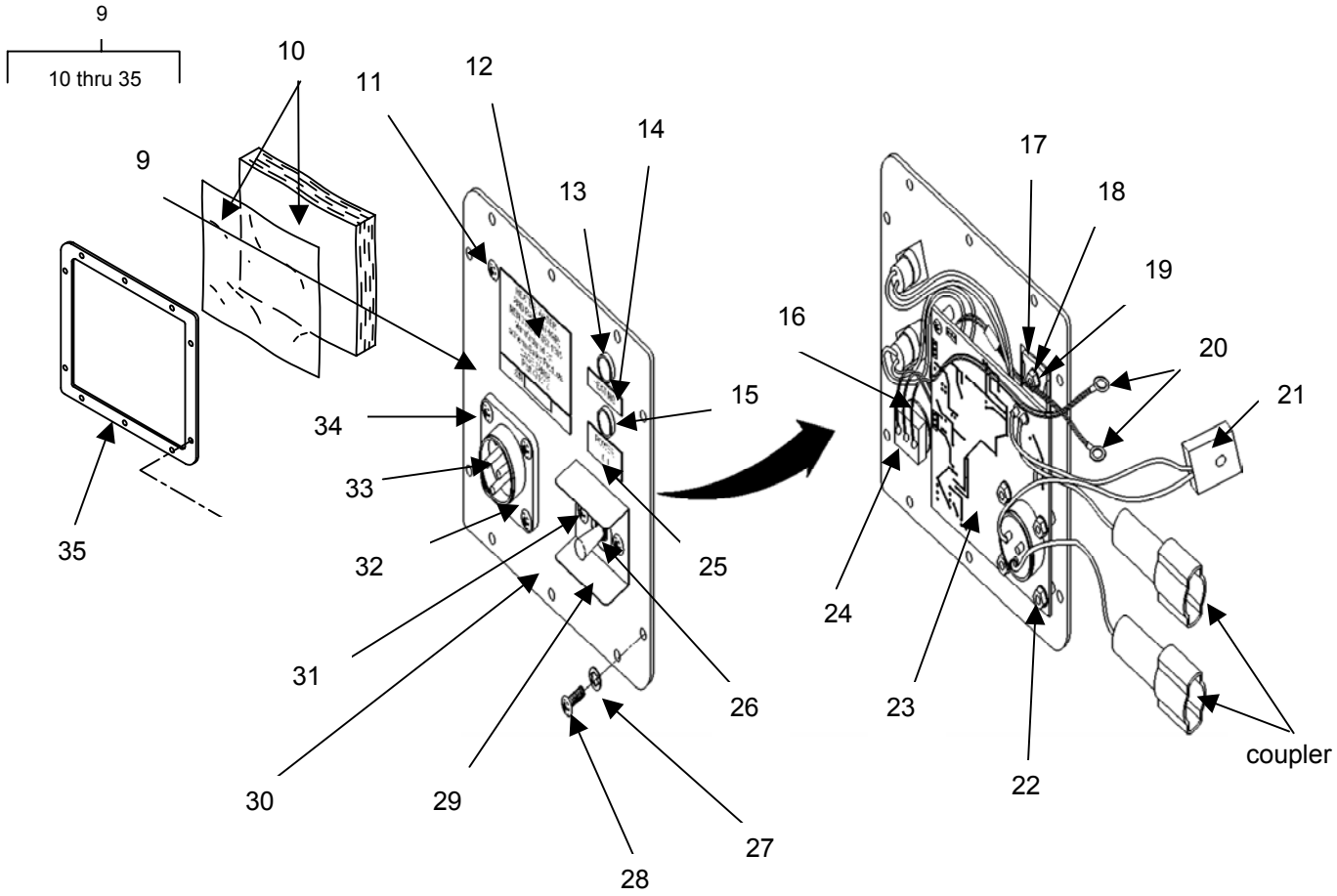


Figure C-5.1. Control Panel Assembly Model 471012

(1) ITEM No.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 03: Main Case Assembly FIG. C-5 Control Panel Assembly (Model RAK-15) and FIG. C-5.1 Control Assess (Model 471012)	
1	XDOZZ		ODJ60	SM1141007	Screw, Machine M4x 101g Pan Hd Cross Tip St/Stl	4
2	PAOOO	5998-01-498-9582	05852	AZ137608	Control Assembly Model RAK-15	1
3	XDOZZ		ODJ60	AZ137643	Gasket	1
4	PAOZZ		ODJ60	AZ1376130	Toggle Switch Assembly	1
5	XAOZZ		ODJ60	M7010	Nut, Switch Guard	2
6	XAOZZ		ODJ60	M7011	Washer, Switch Guard	1
7	KFOZZ		ODJ60	AZ137632	Switch Guard (Part of Kit, P/N AZ1376111)	1
8	KFOZZ		ODJ60	M6792	Packing, Preformed (Part of Kit, P/N AZ1376111)	1
	XDOZZ		ODJ60	AZ1376111	Kit, Switch Guard Guard (1) C-5-7 Packing (1) C-5-8	1
9	PAOOO	7310-20-000-0566	3AN18	471011	Control Panel Assembly Model 471012	1
10	XDOZZ		3AN18	270056	Insulation Set	1
11	XDOZZ		70318	4-40 X1/2 LG	Screw, Stainless	1
12	XDOZZ		3AN18	271067	Plate, Instruction	1
13	XDOZZ		51054	2139-1-22-20160	Light, Indicator, White	1
14	XDOZZ		3AN18	171048/2	Nameplate, Heating	1
15	XDOZZ		51054	2139-1-22-20140	Light, Indicator, Green	1
16	XDOZZ		1PZR2	U60	Seal, Switch	1
17	PAOOZ		55285	K4-104	Isolator, Plate	1
18	XDOOZ		70318	4-40 Stainless	Locknut, With Plastic Insert	5
19	XDOOZ		70318	#8 Stainless	Washer, Flat	5
20	XADOO		56866	QTRL1Z-103G-8	Thermistor	2
21	XAOOO		C2367	H06-130-05-0191	Switch, Thermal	1
22	XDOOZ		94223	608-034	Spacer	4
23	XAOOO		3AN18	371055	Circuit Board	1
24	PAOOZ	5930-01-122-0458	96906	MS27718-21-1	Switch, Toggle	1
25	XDOZZ		3AN18	1710048/1	Nameplate, Power	1
26	XDOZZ		1PZR2	A540	Nut, Panel	1
27	XDOZZ		70318	#6 Stainless	Lockwasher, stainless	16
28	XDOZZ		70318	6-32 X 3/8 LG	Screw, Stainless	10
29	XDOZZ		3AN18	270041	Guard, Switch	1
30	XAOOZ		3AN18	270040	Plate, Control	1
31	XDOOZ		70318	6-32 X 1/4 LG	Screw, Stainless	2
32	PAOOZ	5330-00-946-8344	77820	10-40450-16	Gasket	1
33	PAOOZ	5935-01-191-4015	96906	MS3102R16-10P	Connector, Receptacle, Electrical	1
34	XDOZZ		70318	4-40 X 7/8 LG	Screw, Stainless	4
35	XDOZZ		3AN18	270052	Gasket, Front	1

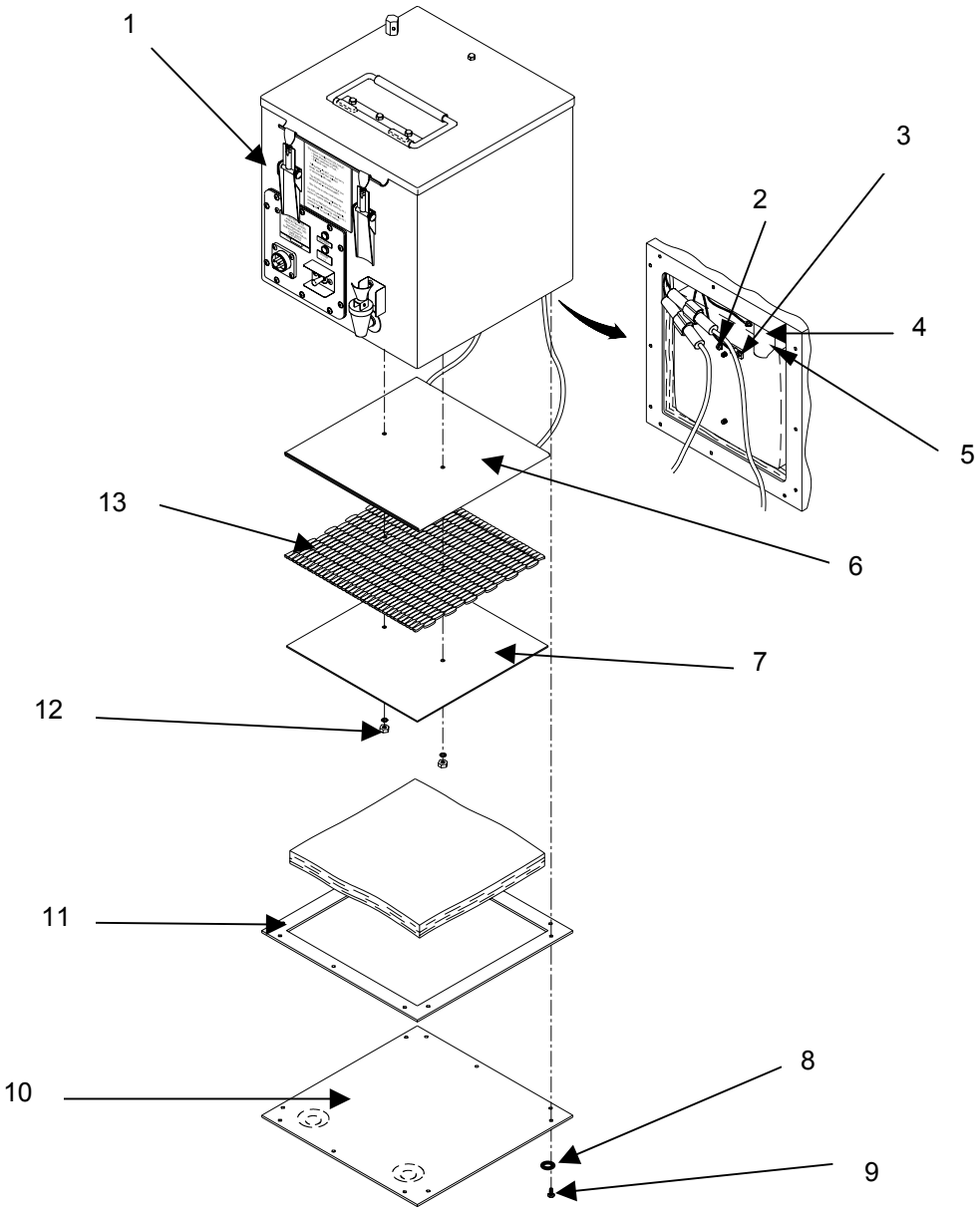


Figure C-6. Other Parts for Model 471012

(1) ITEM No.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 04: Other Parts for FIG. C-6 (Model 471012)	
1	XAOOO		3AN18	470020	Body Model 471012	1
2	XDOZZ		70318	6-32 Stainless	Locknut (secures thermistors and thermal switch)	3
3	XDOZZ		70318	#6 Stainless	Washer (secures thermistors and thermal switch)	3
4	XDOZZ		94223	1590012	Nut, Jam	1
5	XDOZZ		02697	E0540 2-013	Packing Preformed	1
6	PAOOO	4520-20-000-0574	3AN18	271004	Element, Electrical	1
7	XDOZZ		3AN18	270022	Plate, Retaining	1
8	XDOZZ		70318	#6 Stainless	Lockwasher, stainless	10
9	XDOZZ		70318	6-32 x 5/16 LG	Screw, Stainless	13
10	XDOZZ		3AN18	270021	Plate, Base	1
11	XDOZZ		3AN18	270053	Gasket Base	1
12	XDOZZ		94223	8-32 Stainless	Locknut	2
13	XDOZZ		35427	ENVT400x062	Cloth, Fiberglass	1

SECTION III. SPECIAL TOOLS LIST

(Not Applicable)

SECTION IV. CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5340-01-498-1122	C-1	1		C-4.1	18
	C-1	2		C-4.1	19
	C-1	3		C-4.1	20
	C-1	4		C-4.1	21
	C-1	5	5330-01-429-2851	C-4.1	22
	C-1	6			
	C-1	7		C-5	1
	C-1	8	5998-01-498-9582	C-5	2
	C-1	9		C-5	3
	C-1	10		C-5	4
	C-1	11		C-5	5
5330-01-498-2147	C-1			C-5	6
4820-01-498-8789	C-1				
				C-5	7
5340-21-921-8004	C-1.1	12		C-5	8
4820-21-921-8012	C-1.1	13			
	C-1.1	14		C-5.1	9
	C-1.1	15		C-5.1	10
	C-1.1	16		C-5.1	11
	C-1.1	17		C-5.1	12
	C-1.1	18		C-5.1	13
	C-1.1	19		C-5.1	14
				C-5.1	15
7310-01-497-3045	C-2	2		C-5.1	16
				C-5.1	17
7310-21-914-8871	C-2.1	1		C-5.1	18
				C-5.1	19
5340-01-497-5169	C-3	1-3		C-5.1	20
	C-3			C-5.1	21
	C-3			C-5.1	22
				C-5.1	23
	C-3.1	4	5930-01-122-0458	C-5.1	24
5340-00-676-7966	C-3.1	5		C-5.1	25
	C-3.1	6		C-5.1	26
				C-5.1	27
4510-01-497-5221	C-4	1		C-5.1	28
	C-4	2		C-5.1	29
	C-4	3		C-5.1	30
	C-4	4		C-5.1	31
	C-4	5	5330-00-946-8344	C-5.1	32
	C-4	6	5935-01-191-4015	C-5.1	33
	C-4	7			
	C-4	8	4520-20-000-0574	C-6	6
	C-4	9			
	C-4	10			
	C-4	11			
	C-4	12			
	C-4	13			
	C-4	14			
	C-4	15			
4820-01-498-8793	C-4				
4510-21-914-2033	C-4.1	16			
	C-4.1	17			

PART NUMBER INDEX (Continued)

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
05852	AZ137603	5340-01-498-1122	C-1	1
05852	AZ137605	7310-01-497-3045	C-2	2
05852	AZ137608	5998-01-498-9582	C-5	2
ODJ60	AZ137625		C-1	4
ODJ60	AZ137628		C-1	3
ODJ60	AZ137632		C-5	7
ODJ60	AZ137643		C-5	3
ODJ60	AZ137650		C-4	8
ODJ60	AZ137692		C-4	13
ODJ60	AZ137694		C-4	7
ODJ60	AZ137696		C-4	4
ODJ60	AZ1376109		C-4	3
ODJ60	AZ1376116		C-4	12
ODJ60	AZ1376120		C-1	10
ODJ60	AZ1376121		C-4	15
ODJ60	AZ1376127		C-1	9
05852	AZ1376128	5330-01-498-2147	C-1	
05852	AZ1376129	4820-01-498-8793	C-4	1
ODJ60	AZ1376130		C-5	4
ODJ60	AZ1376136		C-4	2
ODJ60	AZ1376137		C-4	1
05852	AZ1376141	4820-01-498-8789		
05852	AZM6633		C-3	1
1PZR2	A540		C-5.1	26
02697	E0540 2-013		C-6	5
35427	ENVT400x062		C-6	13
C2367	H06-130-05-0191		C-5.1	21
55285	K4-104		C-5.1	17
96906	MS3102R16-10P	5935-01-191-4015	C-5.1	33
96906	MS27718-21-1	5930-01-122-0458	C-5.1	24
ODJ60	M5270		C-4	5
ODJ60	M6644		C-4	9
ODJ60	M6661		C-4	10
ODJ60	M6663		C-3	2
ODJ60	M6664		C-4	14
ODJ60	M6792		C-5	8
ODJ60	M6832		C-1	6
ODJ60	M6833		C-1	5
ODJ60	M6836		C-1	11
ODJ60	M7010		C-5	5
ODJ60	M7011		C-5	6
3AN18	170033	4510-21-914-2033	C-4.1	16
56866	QTRL1Z-103G-8		C-5.1	20
94223	RB235		C-4.1	2
ODJ60	SM0440807		C-1	2

PART NUMBER INDEX (Continued)

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
ODJ60	SM1 140807		C-1	7
ODJ60	SM1141007		C-3	3
ODJ60	SM1141007		C-5	1
ODJ60	SM1141207		C-4	11
1PZR2	U60		C-5.1	16
ODJ60	WM705		C-4	6
ODJ60	WM804		C-1	8
94223	1590012		C-6	4
3AN18	171048/2		C-5.1	14
3AN18	1710048/1		C-5.1	25
3AN18	270003		C-4.1	19
3AN18	270021		C-6	10
3AN18	270022		C-6	7
3AN18	270040		C-5.1	4
3AN18	270041		C-5.1	29
3AN18	270052		C-5.1	35
3AN18	270053		C-6	11
3AN18	270056		C-5.1	10
3AN18	270058		C-4.1	20
3AN18	271004	4520-20-000-0574	C-6	6
3AN18	271010		C-1.1	16
3AN18	271013		C-1.1	15
3AN18	271027		C-1.1	14
3AN18	271038	5340-21-921-8004	C-1.1	12
3AN18	271067		C-5.1	12
3AN18	271070	4820-21-921-8012	C-1.1	13
51054	2139-1-22-20140		C-5.1	15
51054	2139-1-22-20160		C-5.1	13
81337	471012	7310-01-387-1305		
70318	4-40 STAINLESS		C-5.1	18
70318	4-40 X 7/8 LG		C-5.1	34
70318	4-40 X1/2 LG		C-5.1	11
87924	3PS-18	5330-01-429-2851	C-4.1	22
3AN18	371055		C-5.1	23
3AN18	470020		C-6	1
3AN18	470024	7310-21-914-8871	C-2.1	1
3AN18	471011	7310-20-000-0566	C-5.1	9
71286	5IL-1-1BF	5340-00-676-7966	C-3.1	5

PART NUMBER INDEX (Continued)

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
70318	6-32 X 1/4 LG		C-5.1	31
98003	500-56-M21-SP		C-1.1	18
94223	608-034		C-5.1	22
70318	#6 STAINLESS		C-6	3
70318	6-32 STAINLESS		C-6	2
70318	6-32 X 3/8 LG		C-5.1	1
70318	6-32 X 5/16 LG		C-5.1	28
70318	8 STAINLESS		C-5.1	17
94223	8-32 STAINLESS		C-6	12
70318	8-32 STAINLESS		C-1.1	19
77820	10-40450-15	5330-00-946-8344	C-5.1	32

FIGURE AND ITEM NUMBER INDEX

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
C-1	1	5340-01-498-1122	ODJ60	AZ137603
C-1	2		ODJ60	SM0440807
C-1	3		ODJ60	AZ137628
C-1	4		ODJ60	AZ137625
C-1	5		ODJ60	M6833
C-1	6		ODJ60	M6832
C-1	7		ODJ60	SM1140807
C-1	8		ODJ60	WM804
C-1	9		ODJ60	AZ1376127
C-1	10		ODJ60	AZ1376120
C-1	11		ODJ60	M6836
C-1		4820-01-498-8798		
C-1		7310-01-497-3045		
C-1.1	12	5340-21-921-8004	3AN18	271038
C-1.1	13	4820-21-921-8012	3AN18	271070
C-1.1	14		3AN18	271027
C-1.1	15		3AN18	271013
C-1.1	16		3AN18	271010
C-1.1	17		70318	#8 Stainless
C-1.1	18		98003	500-56-M21-SP
C-1.1	19		70318	8-32 Stainless
C-2	1		ODJ60	AZ137605
C-2.1	2	7310-21-914-8871	3AN18	470024
C-3	I	5310-01-497-5169	ODJ60	AZM6633
C-3	2		ODJ60	M6663
C-3	3		ODJ60	SM1141007
C-3.1	4		70318	#6 Stainless
C-3.1	5	5340-00-676-7966	71286	5IL-1-1BF
C-3.1	6		70318	6-32 x 5/16 LG

FIGURE AND ITEM NUMBER INDEX (Continued)

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
C-4	1	4510-01-497-5221	ODJ60	AZ1376137
C-4	2		ODJ60	AZ1376136
C-4	3		ODJ60	AZ1376109
C-4	4		ODJ60	AZ137696
C-4	5		ODJ60	M5270
C-4	6		ODJ60	WM705
C-4	7		ODJ60	AZ137694
C-4	8		ODJ60	AZ137650
C-4	9		ODJ60	M6644
C-4	10		ODJ60	M6661
C-4	11		ODJ60	SM1141207
C-4	12		ODJ60	AZ1376116
C-4	13		ODJ60	AZ137692
C-4	14		ODJ60	M6664
C-4	15		ODJ60	AZ1376121
C-4		4820-01-498-8793		
C-4.1	16	4510-21-914-2033	3AN18	170033
C-4.1	17		70318	6-32 x 5/16 LG
C-4.1	18		70318	#6 Stainless
C-4.1	19		3AN18	270003
C-4.1	20		3AN18	270058
C-4.1	21		94223	RB235
C-4.1	22	5330-01-429-2851	87924	3PS-18
C-5	1		ODJ60	SM1141007
C-5	2	5998-01-498-9582	ODJ60	AZ137608
C-5	3		ODJ60	AZ137643
C-5	4		ODJ60	AZ1376130
C-5	5		ODJ60	M7010
C-5	6		ODJ60	M7011
C-5	7		ODJ60	AZ137632
C-5	8		ODJ60	M6792
C-5.1	9	7310-20-000-0566	3AN18	471011
C-5.1	10		3AN18	270056
C-5.1	11		70318	4-40 X1/2 LG
C-5.1	12		3AN18	271067
C-5.1	13		51054	2139-1-22-20160
C-5.1	14		3AN18	171048/2
C-5.1	15		51054	2139-1-22-20140
C-5.1	16		1PZR2	U60
C-5.1	17		55285	K4-104
C-5.1	18		70318	4-40 Stainless
C-5.1	19		70318	#8 Stainless
C-5.1	20		56866	QTRL1Z-103G-8
C-5.1	21		C2367	H06-130-05-0191
C-5.1	22		94223	608-034
C-5.1	23		3AN18	371055
C-5.1	24	5930-01-122-0458	96906	MS27718-21-1
C-5.1	25		3AN18	1710048/1
C-5.1	26		1PZR2	A540
C-5.1	27		70318	#6 Stainless
C-5.1	28		70318	6-32 X 3/8 LG
C-5.1	29		3AN18	270041
C-5.1	30		3AN18	270040
C-5.1	31		70318	6-32 X 1/4 LG
C-5.1	32	5330-00-946-8344	77820	10-40450-15
C-5.1	33	5935-01-191-4015	96906	MS3102R16-10P
C-5.1	34		70318	4-40 X 7/8 LG
C-5.1	35		3AN18	270052

FIGURE AND ITEM NUMBER INDEX (Continued)

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
C-6	1		3AN18	470020
C-6	2		70318	6-32 Stainless
C-6	3		70318	#6 Stainless
C-6	4		94223	1590012
C-6	5		02697	E0540 2-013
C-6	6	4520-20-000-0574	3AN18	271004
C-6	7		3AN18	270022
C-6	8		70318	#6 Stainless
C-6	9		70318	6-32 x 5/16 LG
C-6	10		3AN18	270021
C-6	11		3AN18	270053
C-6	12		94223	8-32 Stainless
C-6	13		35427	ENVT400x062

APPENDIX D
COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS
SECTION I. INTRODUCTION

D-1. SCOPE

This appendix lists components of the end item and basic issue items for the HWR to help you inventory the items for safe and efficient operation of the equipment.

D-2. GENERAL

The Components of End Item (COEI) and Basic Issue Items (BII) lists are divided into the following sections:

a. Section II, Components of End Item. This listing is for information purposes only and is not authority to requisition replacements. These items are part of the HWR. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Items of COEI are removed and separately packaged for transportation or shipment only when necessary. Illustrations are furnished to help you find and identify the items.

b. Section III, Basic Issue Items. These essential items are required to place the HWR in operation, to operate it and to perform emergency repairs. Although shipped separately packaged, the BII must be with the HWR during operation and whenever it is transferred between property accounts. This list is your authority to request/requisition them for replacement based on authorization of the item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

D-3. EXPLANATION OF COLUMNS (Sections II and III)

An explanation of the column entries in Sections II and III is as follows:

a. ILLUSTRATION NUMBER ILLUST No.). This column indicates the number of the illustration in which the item is shown.

b. NATIONAL STOCK NUMBER. This column indicates the National Stock Number (NSN) assigned to the item and used to request or requisition the item.

c. DESCRIPTION, CAGEC AND PART NUMBER. This column contains the Federal item name and, if required, a description to identify and locate the item. The last line for each item indicates the Commercial and Government Entity Code (CAGEC) in parenthesis followed by the part number.

d. USABLE ON CODE (UOC). This column contains a 3-digit code, which identifies the different model types on which the item is used. Uncoded items are applicable to all models.

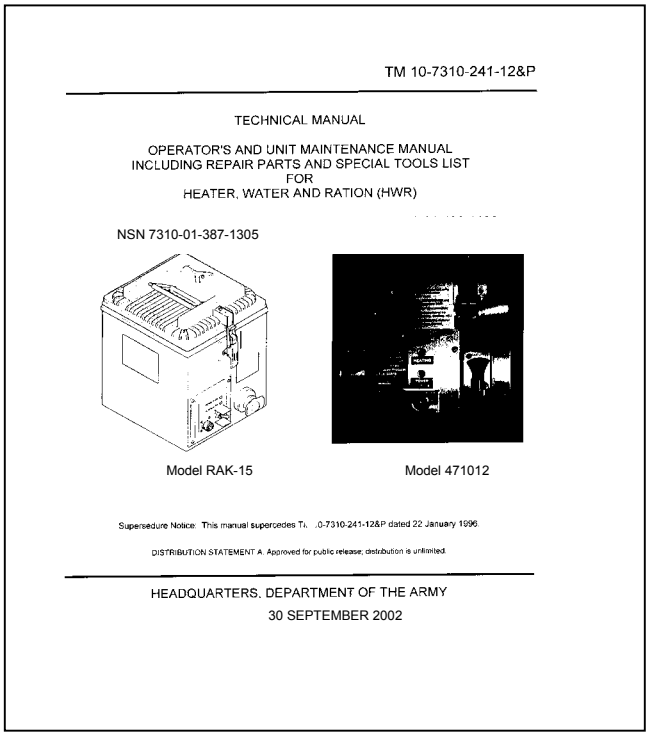
e. UNIT OF MEASURE (U/M). This column indicates the measure used in performing the operation/maintenance function and is expressed by a 2-character alphabetical abbreviation (e.g., EA, IN, PR).

f. QUANTITY (CITY). This column indicates the quantity of the item authorized to be used with/on the HWR.

SECTION II. COMPONENTS OF END ITEM LIST

ILLUST No	NATIONAL STOCK NUMBER	DESCRIPTION, CAGEC AND PART NUMBER	U/M	QTY

SECTION III. BASIC ISSUE ITEMS


TM 10-7310-241-12&P

TECHNICAL MANUAL

OPERATOR'S AND UNIT MAINTENANCE MANUAL
INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST
FOR
HEATER, WATER AND RATION (HWR)

NSN 7310-01-387-1305

Model RAK-15 Model 471012

Supersedure Notice: This manual supercedes TM 10-7310-241-12&P dated 22 January 1996.

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY
30 SEPTEMBER 2002

ILLUST No	NATIONAL STOCK NUMBER	DESCRIPTION, CAGEC AND PART NUMBER	U/M	QTY
	NSN 7310-01-387-1305	Operator's and Unit Maintenance Manual including Repair Parts and Special Tools List TM 10-7310-241-12&P		1

APPENDIX E

EXPENDABLE AND DURABLE ITEMS LIST

SECTION I. INTRODUCTION

E-1. SCOPE

This appendix contains the Expendable and Durable Items List (EDIL) which identifies the requirements for maintaining the HWR. This listing is for information purposes only and is not authority to requisition the listed items. These items are authorized by CTA 50-970 (Expendable and Durable Items) except for Medical, Class V, Repair Parts and Heraldic.

E-2. EXPLANATION OF COLUMNS (Section II)

An explanation of the column entries in Section II is as follows:

a. ITEM NUMBER. This column indicates the number assigned to the entry in the listing for referencing when required.

b. LEVEL. This column indicates the lowest level of maintenance that requires the listed item.

C - Operator/Crew Maintenance

O - Organizational Maintenance

F - Direct Support Maintenance

H - General Support Maintenance

c. NATIONAL STOCK NUMBER. This column indicates the National Stock Number (NSN) assigned to the item and used to request or requisition the item.

d. ITEM NAME, DESCRIPTION, CAGEC, PART NUMBER. This column contains the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity Code (CAGEC) in parenthesis followed by the part number.

e. UNIT OF MEASURE (U/M). This column indicates the measure used in performing the operation/ maintenance function and is expressed by a 2-character alphabetical abbreviation (e.g., EA, IN, PR). If the Unit of Measure (U/M) differs from the Unit of Issue (U/I) as shown in the Army Master Data File (AMDF) then the lowest Unit of Issue (U/1) that will satisfy the requirements should be requisitioned.

SECTION II. EXPENDABLE AND DURABLE ITEMS LIST

ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	ITEM NAME, DESCRIPTION, CAGEC, PART NUMBER	U/M
1	C	7920-00-324-2746	Brush, Scrub (80244) H-B-00555 CL2	EA
2	C	7920-00-401-8034	Cloth, Cleaning (80244) A-A-162 TY1CL1	EA
3	C	5970-01-093-7139	Conformal Coating Mil-I-46058 Type SR	EA
4	C	7930-00-281-4731	Dishwashing Compound, Hand (58536) A-A-5	OZ
5	C	6840-00-810-6396	Disinfectant, Food Service (81349) MIL-D-11309	OZ
6	C	5970-00-241-5406	Insulating Compound 120-8	EA
7	C		Loctite 242	EA
8	C	7920-00-753-5242	Pad, Scouring (83421) 7920-00-753-5242	EA
9	C	7340-00-243-5390	Spoon, Field Mess (81349) MIL-F-284	EA

APPENDIX F

OPERATOR'S LUBRICATION INSTRUCTIONS

(Lubrication Not Required)

GLOSSARY

Section I. ABBREVIATIONS

Following is an alphabetical listing of the abbreviations used in this manual. The exact word or phrase is identified for each abbreviation.

A	Ampere
AMDF	Army Master Data File
BOI	Basis of Issue
C	Celsius (degree)
CAGEC	Contractor and Government Entity Code
cm	Centimeter
COEI	Component of End Item
dc	Direct Current
DPDT	Double Pole Double Throw
EDIL	Expendable and Durable Items List
EIC	End Item Code
EIR	Equipment Improvement Recommendations
F	Fahrenheit (degree)
GND	Ground
HWR	Heater, Water and Ration
kg	Kilogram
LED	Light Emanating Diode
MAC	Maintenance Allocation Chart
mb	Millibar
mm	Millimeter
MTOE	Modified Table of Organization and Equipment
MWO	Modification Work Order
NIIN	National Item Identification Number (last 9 digits of the NSN)
NSN	National Stock Number
Ohm	Ohmmeter
PMCS	Preventive Maintenance Checks and Services
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauged
RPSTL	Repair Parts and Special Tools List
SCD	Source Control Drawing
SMR	Source, Maintenance, and Recoverability
SRA	Specialized Repair Activity
TMDE	Test, Measurement and Diagnostic Equipment
TOE	Table of Organization and Equipment
U/I	Unit of Issue
U/M	Unit of Measure
UOC	Usable on Code
V	Voltage
w	Watt

Section II. DEFINITION OF UNUSUAL TERMS

(Not Applicable)

INDEX

Page

Abbreviations Glossary-1
Appendix A – References A-1
Appendix B - Maintenance Allocation Chart (MAC) B-1
Appendix C - Repair Parts and Special Tools List (RPSTL) C-1
Appendix D - Components of End Item (COEI) and Basic Issue Items (BII) Lists D-1
Appendix E - Expendable and Durable Items List (EDIL) E-1
Appendix F – Operator's Lubrication Instructions F-1
Basic Issue Items List D-2
Chapter 1 – Introduction 1-1
Chapter 2 - Operating Instructions 2-1
Chapter 3 - Operator Maintenance Instructions 3-1
Chapter 4 - Unit Maintenance Instructions 4-1
Components of End Item List D-2
Cross-reference Indexes C-18
Definition of Unusual Terms Glossary-2
Description and Use of Operators Controls and Indicators 2-2
Equipment Description and Data 1-5
Expendable and Durable Items List E-2
General Information 1-3
Glossary Glossary-1
Introduction (Appendix B) B-1
Introduction (Appendix C) C-1
Introduction (Appendix D) D-1
Introduction (Appendix E) E-1
Maintenance Allocation Chart B-4
Operation Under Usual Conditions 2-8
Operation Under Unusual Conditions 2-20
Operator's Lubrication Instructions 3-1
Operator's Maintenance Procedures 3-6
Operator's Troubleshooting Procedures 3-2
Preparation for Storage or Shipment 4-22
Preventive Maintenance Checks and Services (Operator) 2-3
Preventive Maintenance Checks and Services (Unit) 4-2
Principles of Operation 1-8
Remarks B-4.1
Repair Parts List C-7
Repair Parts, Special Tools, Test, Measurement and Diagnostic Equipment (TMDE), Support Equipment C-1
Service Upon Receipt 4-2
Special Tools List C-18.2
Tools and Test Equipment B-4.1
Unit Maintenance Procedures 4-9
Unit Troubleshooting Procedures 4-4

By Order of the Secretary of the Army

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

Administrative Assistant to the
Secretary of the Army
01219

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These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@avma27.army.mil>
To: amssbriml@natick.army.mil

Subject: DA Form 2028

1. From: Joe Smith
2. Unit: home
3. Address: 4300 Park
4. City: Hometown
5. St: MO
6. Zip: 77777
7. Date Sent: 19-OCT-93
8. Pub no: 55-2840-229-23
9. Pub Title: TM
10. Publication Date: 04-JUL-85
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12. Submitter Rank: MSG
13. Submitter FName: Joe
14. Submitter MName: T
15. Submitter LName: Smith
16. Submitter Phone: 123-123-1234
17. Problem: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. Text:

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE *21 October 2003*

TO: *(Forward to proponent of publication or form) (Include ZIP Code)* COMMANDER U.S. ARMY SOLDIER AND BIOLOGICAL CHEMICAL COMMAND ATTN: AMSSB-RIM-L KANSAS STREET NATICK, MA 01760-5052	FROM: *(Activity and location) (Include ZIP Code)* *PFC Jane Doe* *CO A 3rd Engineer BR* *Ft. Leonardwood, MO 63108*

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 10-1670-296-23&P	30 October 2002	Unit Manual for Ancillary Equipment for Low Velocity Air Drop Systems

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON ***(Provide exact wording of recommended changes, if possible).***
	0036 00-2				*1*	*In table 1, Sewing Machine Code Symbols, the second sewing machine code symbol should be MD ZZ not MD 22.* *Change the manual to show Sewing Machine, Industrial: Zig-Zag; 308 stitch; medium-duty; NSN 3530-01-181-1421 as a MD ZZ code symbol.*

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Jane Doe, PFC	508-233-4141	Jane Doe *Jane Doe*

DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPPC V3.00

TO: (*Forward direct to addressee listed in publication)*	FROM: (*Activity and location) (Include ZIP Code)*	DATE
COMMANDER U.S. ARMY SOLDIER AND BIOLOGICAL CHEMICAL COMMAND ATTN: AMSSB-RIM-L KANSAS STREET NATICK, MA 01760-5052	*PFC Jane Doe* *CO A 3rd Engineer BR* *Ft. Leonardwood, MO 63108*	*21 October 2003*

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 10-1670-296-23&P	30 October 2002	Unit Manual for Ancillary Equipment for Low Velocity Air Drop Systems

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
0066 00-1					*4*			*Callout 16 in figure 4 is pointed to a D-Ring. In the Repair Parts List key for figure 4, item 16 is called a Snap Hook. Please correct one or the other.*

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)* COMMANDER U.S. ARMY SOLDIER AND BIOLOGICAL CHEMICAL COMMAND ATTN: AMSSB-RIM-L KANSAS STREET NATICK, MA 01760-5052	FROM: *(Activity and location) (Include ZIP Code)*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER TM 10-7310-241-12&P	DATE	TITLE Operator's and Unit Maintenance Manual Including Repair Parts and Special Tools List for Heater, Water and Ration (HWR)

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward direct to addressee listed in publication)*	FROM: (*Activity and location) (Include ZIP Code)*	DATE

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 074437-000