

TECHNICAL MANUAL

**OPERATOR'S, UNIT AND
DIRECT SUPPORT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)
FOR**

JELRUS BURN-OUT FURNACE

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and the content requirements normally associated with Army technical manuals. This technical manual does, however, contain all essential information required to operate and maintain the equipment

Approved for public release; distribution is unlimited.

**HEADQUARTERS, DEPARTMENT OF THE ARMY
28 SEPTEMBER 1990**

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SUPPLEMENTARY INTRODUCTORY MATERIAL

1-1. Maintenance Forms and Records.

Department of the Army forms and procedures used for equipment maintenance will be those described by DA Pam 738-750, The Army Maintenance Management System.

1-2. 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 the procedures, please let us know. Mail your letters, 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 Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Blvd, St. Louis, MO 63120-1798. A reply will be furnished to you.

1-3. Destruction of Army Material to Prevent Enemy Use.

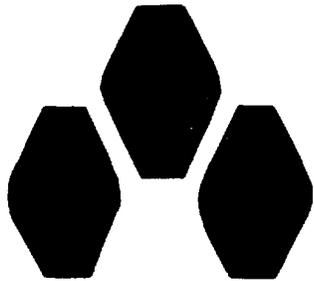
Refer to TM 750-244-3 for instructions covering the destruction of Army Material to prevent enemy use.

1-4. Administrative Storage of Equipment.

a. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period appropriate maintenance records will be kept.

b. Before placing equipment in administrative storage, current preventive maintenance checks and services should be completed. Shortcomings and deficiencies should be corrected, and all modification work orders (MWO's) should be applied.

c. Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, Conex containers and other containers may be used.



JELRUS

TEMP-MASTER™

Burn-Out Furnaces
Operating and
Maintenance Instructions



SPECIFICATIONS

	M Series	L Series
Maximum Temperature	2000°F (1093°C)	2000°F (1093°C)
Electrical	100V, 50/60HZ, 800 watts 115V, 50/60HZ, 1150 watts 230V, 50/60HZ, 1150 watts	100V, 50/60HZ, 1100 watts 115V, 50/60HZ, 1600 watts 230V, 50/60HZ, 1600 watts
Capacity	16 inlay rings, 4 medium or 1 large flask.	28 inlay rings, 6 medium or 3 large flasks.
Heat Rates	8 settings vary power to heating plates to accommodate any workload.	8 settings vary power to heating plates to accommodate any workload.
Automatic Soak Timer	0 - 4 hours	0 - 4 hours
Dimensions (Overall)	10-3/4" W x 13-7/8" D x 18-3/4" H (27.3 cm x 35.2 cm x 47.6 cm)	14-1/2" W x 14-3/8" D x 18-3/4" H (36.8 cm x 36.5 cm x 47.6 cm)
Dimensions: (Heating Chamber)	5-1/2" W x 5-1/4" D x 5-1/8" H (14.0 cm x 13.3 cm x 13.0 cm)	9-1/8" W x 5-1/4" D x 5-1/8" H (23.2 cm x 13.3 cm x 13.0 cm)

INSTALLATION INSTRUCTIONS

1. Remove all packing material from the furnace and furnace chamber.
2. Place the furnace in position allowing a minimum of two inches of air space on all sides.
3. Open the furnace door by grasping the handle and pulling forward.
4. Install the ceramic tray or trays into furnace chamber. The tray serves to collect wax residue and foreign material, and prevents them from soaking into the floor of the furnace.
5. Close the furnace door.
6. Plug the power cord into a wall receptacle. A separate circuit is recommended. The voltage rating of your furnace is shown on the serial number plate.
7. The furnace is now ready for operation.

PLEASE OBSERVE THE FOLLOWING IMPORTANT CAUTIONS:

- DO NOT INSTALL CLOSER THAN 2 INCHES FROM ANY COMBUSTIBLE MATERIAL
- HOT GASES ARE VENTED THROUGH VENT HOLE ON TOP OF FURNACE. DO NOT BLOCK

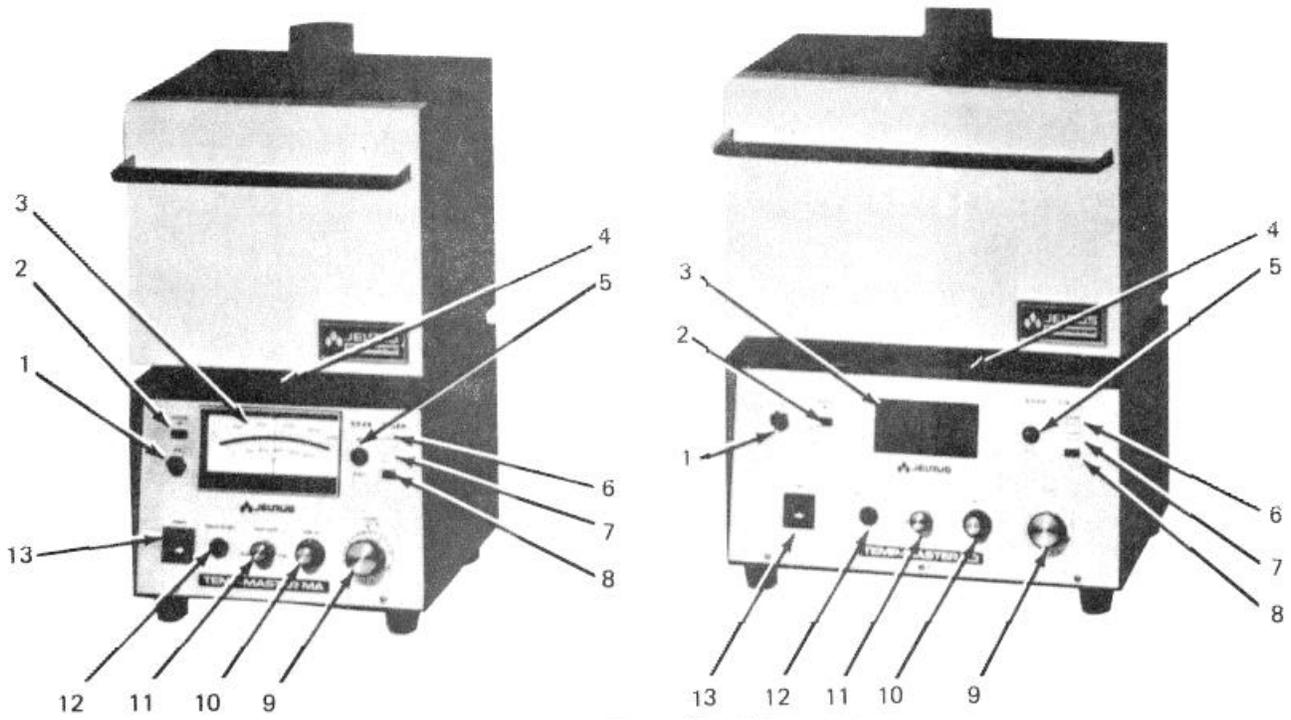


Figure 1. Front Panel Controls

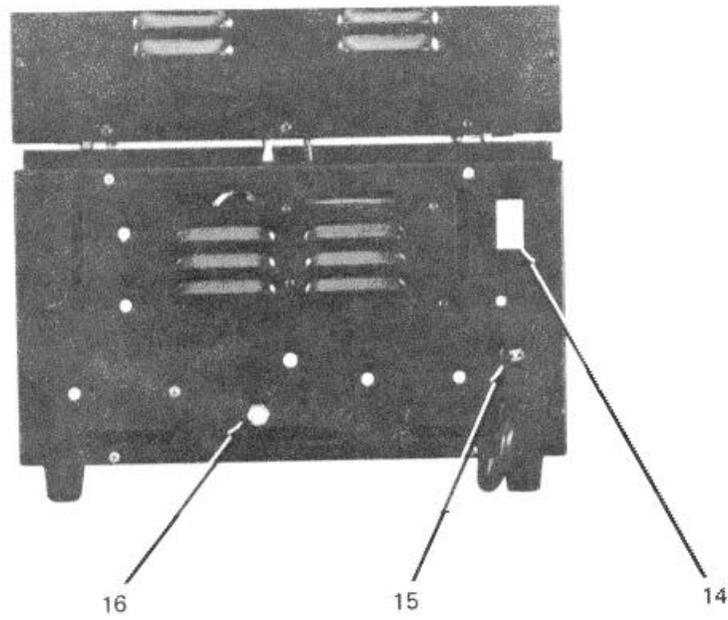


Figure 2. Lower Rear of Furnace

FRONT PANEL CONTROLS (See Figure 1)

1. **CAL. adjust control** Used during calibration procedure to accurately set pyrometer. (Protected by dust cap.)
2. **HEATER ON light** Lights when power is applied to the heating elements in the furnace.
3. **Pyrometer** Normally displays furnace temperature. When **PRESS TO SET** button is pressed, displays set temperature.
4. **Door interlock switch** Removes electrical power from heating elements when the furnace door is opened
5. **SET/RESET switch** Controls the operation of the timer. In **RESET** position, desired heat soak time is selected on **SOAK TIMER HOURS** control. In **SET** position, timer runs when furnace reaches set temperature. Placing switch in **RESET** position when soak time is complete will silence the buzzer.
6. **SET light** Lights when the Timer has been set to the desired heat soak time and the **SET/RESET** switch has been placed in the **SET** position.
7. **RUN light** Lights when the furnace has reached the set temperature.
8. **READY light** Lights when the furnace has maintained the set temperature for the selected time.
9. **SOAK TIMER HOURS control** Used to select the desired heat soak time, up to four hours. Starts to run when furnace reaches the set temperature.
10. **TEMP SET control** Used to select the desired furnace temperature. Control has an outer locking ring.
11. **HEAT RATE control** Used to select the desired rate of temperature rise.
12. **PRESS TO SET button** Press to display desired furnace temperature on the pyrometer.
13. **POWER switch** Main **ON/OFF** switch. Lights when **ON**.

REAR PANEL CONTROLS (See Figure 2)

14. **BUZZER switch** In **ON** position, buzzer will sound when **READY** light lights. In **OFF** position, buzzer will not sound.
15. **FUSE** Main electrical protection Proper replacement value is shown on the back panel.
16. **ALIGN control** Determines how closely the actual furnace soak temperature coincides with the set temperature. (Protected by dust cap.) This control is factory set and normally does not require adjustment.

OPERATION

Timed Soak Time

1. Press POWER switch ON. The light in the POWER switch will light. The pyrometer will indicate the actual furnace temperature.
2. Press the PRESS TO SET button. The pyrometer will now indicate the set temperature.
3. To change the set temperature:
 - a) Press and hold in the PRESS TO SET button.
 - b) Turn the outer locking ring on the TEMP SET control counterclockwise to the UNLOCK position.
 - c) Adjust the TEMP SET control until the desired set temperature is displayed on the pyrometer. Always allow a few seconds for the pyrometer readout to stabilize.
 - d) Turn the outer locking ring on the TEMP SET control clockwise to the LOCK position. Be careful not to change the setting when turning the locking ring.
 - e) Release the PRESS TO SET button.

If the furnace temperature is lower than the set temperature, the HEATER ON light will light.

4. Set the HEAT RATE control to the desired rate of temperature rise, typically the fifth mark above the SLOW position.
5. Set the timer system as follows.
 - a) Place the SET/RESET switch in the RESET position.
 - b) Turn the SOAK TIMER HOURS control clockwise, to the desired soak time at the set temperature.
 - c) Place the SET/RESET switch in the SET position. The SET light will light.

When the furnace temperature reaches the set temperature the timer will start to run, the RUN light will light and the HEATER ON light will turn off. The heater and HEATER ON light will cycle on and off to maintain the furnace set temperature.

When the SOAK TIMER HOURS control has run down to 0 hours the RUN light will turn off, the READY light will light and the buzzer will sound.

6. To silence the buzzer, place the SET/RESET switch in the RESET position. The furnace will continue to maintain the set temperature.

NOTE: If a buzzer signal is not desired, place the BUZZER switch on the rear panel in the OFF position. All lights and the timer will continue to function normally.

Other Modes of Operation

1. To maintain the set temperature for long periods of time without a time signal or buzzer, perform steps 1 through 4 as above. Then place the SET/RESET switch in the RESET position. The furnace will stay at the set temperature but the SET, RUN and READY lights and the buzzer will not function.
2. If a buzzer signal is desired when the furnace reaches the set temperature perform steps 1 through 5 as above. In step 5b set the SOAK TIMER HOURS control 0.

CAUTION!

When loading casting rings, position them so that they do not touch the exposed heating plate wires.

CALIBRATION PROCEDURE

This furnace is equipped with a thermocouple which projects into the furnace chamber. Thermo-couple characteristics change with time, and calibration should be spot-checked about once a month.

A Tempil Pellet that will fuse and begin to flow at 1300° F (704°C) is packed with the furnace and should be used for calibration. For accurate results, the following procedure is recommended:

1. Place the pellet on a small thin metal or ceramic tray in approximately the center of the furnace about 1 " above the floor of the furnace.
2. Close the door of the furnace and press the POWER switch ON.
3. Press the PRESS TO SET button.
4. Adjust the TEMP SET control to 1000°F (538°C).
5. Release the PRESS TO SET button.
6. Set the HEAT RATE control to an approximate midrange setting (4th or 5th mark above the SLOW position).
7. Soak at 1000°F (538°C) for at least three minutes.
8. Press the PRESS TO SET button.
9. Adjust the TEMP SET control to 1500°F (816°C).
10. Release the PRESS TO SET button.
11. Unscrew the black dust cap over the CAL. adjust control.
12. When the furnace temperature indicated on the pyrometer is 1200°F (649°C), begin to check for melting every 25°F. When checking, open the furnace door just enough to determine by a quick glance if the Tempil Pellet has begun to liquefy around the edges. Keep the furnace door closed as much as possible during this observation period to prevent heat loss.
13. When the 1300° F (704°C) Tempil Pellet BEGINS to melt or liquefy around the edges, immediately turn the slotted CAL. adjust control until the pyrometer indicates 1300° F (704°C).
14. Replace black dust cap over the CAL. adjust control.

ALIGNMENT

The ALIGN control allows the user to adjust the coincidence between the control point (when the furnace turns off) and the preselected set temperature. For best results it should be adjusted so that the HEATER ON light turns off when the actual furnace temperature as registered on the pyrometer is a few degrees below the desired set temperature.

This control is factory preset and should rarely require adjustment unless the furnace is serviced. Remove the black dust cap if adjustments are required.

SERVICE INFORMATION

All service on this furnace should only be performed by qualified service technicians.

BE SURE TO UNPLUG THE POWER CORD AND WAIT FOR THE FURNACE TO COOL BEFORE PERFORMING ANY SERVICE OPERATION

If you need help with operating or servicing your Jelrus equipment, please call Jelrus anytime between 9:00 am and 5:00 p.m. Eastern time.

516 - 775-1645

212 - 347-7100

800 - 221-6721

DOOR INTERLOCK SWITCH

Your furnace is equipped with a door interlock switch which removes electrical power from the heating elements when the furnace door is opened. This feature is built into the furnace to ensure the safety of the operator.

The operation of this switch may be checked by opening the furnace door, and observing the HEATER ON light turning off. Should opening the furnace door not turn the HEATER ON light off, the door interlock switch should be readjusted or replaced. Failure to do so will result in the heating plates being energized while the door is open, which represents a potential shock hazard. As part of your normal maintenance this switch (P/N 33945) should be replaced once every 5 years.

TROUBLESHOOTING CHART

PROBLEM	PROBABLE CAUSE
Furnace does not heat, POWER switch <u>ON</u> ; POWER switch light not lit.	No power at wall outlet Defective fuse Defective POWER switch
Furnace does not heat; POWER switch light lit, HEATER ON light not lit; pyrometer temperature below set temperature.	Door not completely closed or defective door interlock switch Defective solid-state relay Defective control circuit board
Furnace does not heat, POWER switch ON, POWER switch light lit, HEATER ON light lit.	Defective heating plates
Turning TEMP SET control does not advance pyrometer reading, POWER switch ON, PRESS TO SET button pressed.	Loose connections at pyrometer Defective control circuit board Defective PRESS TO SET button or temperature set potentiometer Defective power supply board
Furnace does not shut off at set temperature (exceeds set temperature by more than 200°F).	Defective solid-state relay Defective control circuit board
Average furnace temperature does not coincide with set temperature.	Adjust ALIGN control at rear of furnace Defective control circuit board
Pyrometer deflects to full scale (2000°F) (digital models only display first digit).	Defective thermocouple Defective control circuit board Defective power supply board
Timer does not function correctly, furnace at set temperature, RUN light lit.	Defective timer Defective control circuit board
Buzzer does not sound, SOAK TIMER HOURS control at 0 hours; READY light lit.	BUZZER switch on rear panel in <u>OFF</u> position or defective Defective buzzer Defective timer

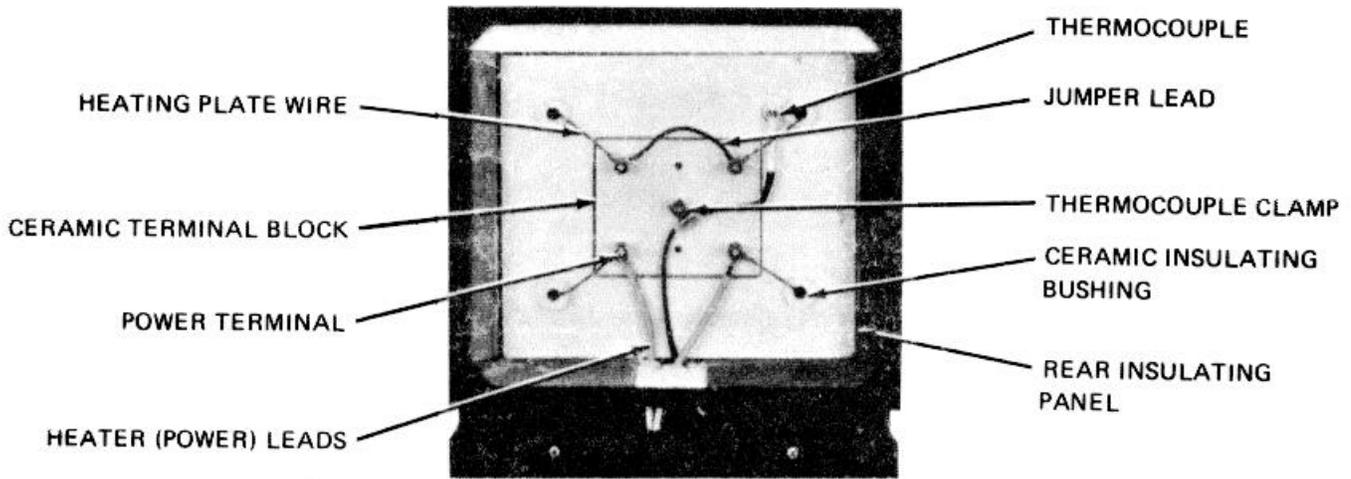


Figure 3. Temp-Master MA And MD (115V And 230V) With Upper Rear Panel Removed

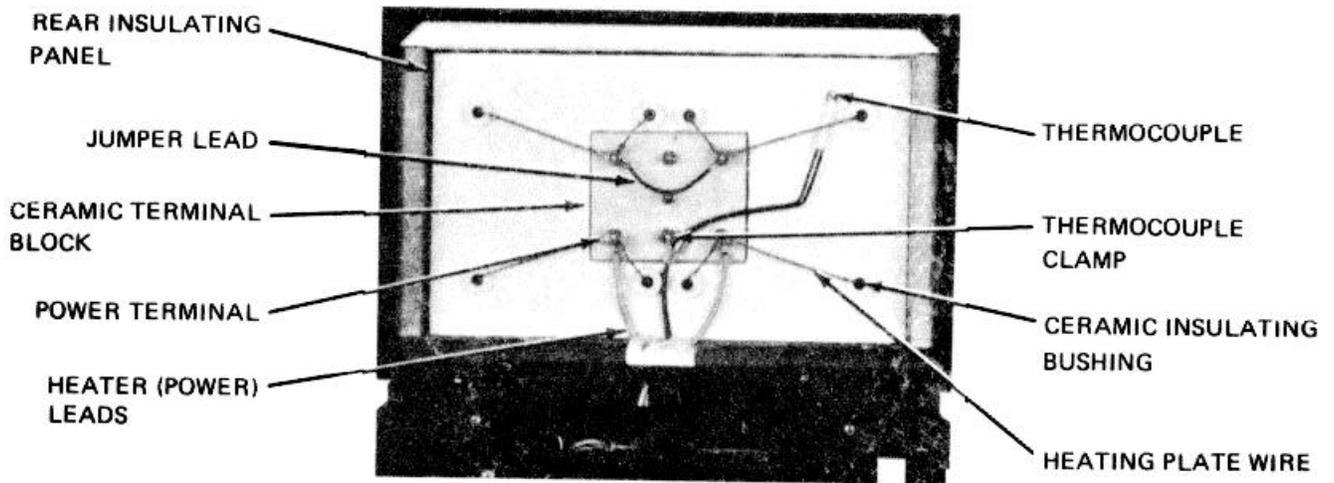


Figure 4. Temp-Master LA And LD (115V) With Upper Rear Panel Removed

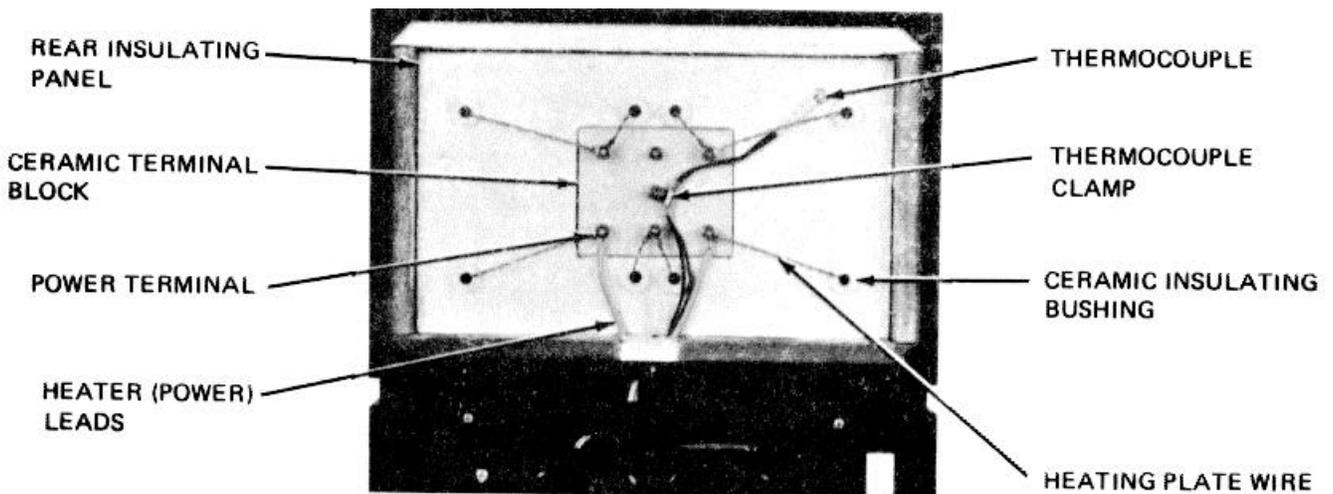


Figure 5. Temp-Master LA And LD (230V) With Upper Rear Panel Removed

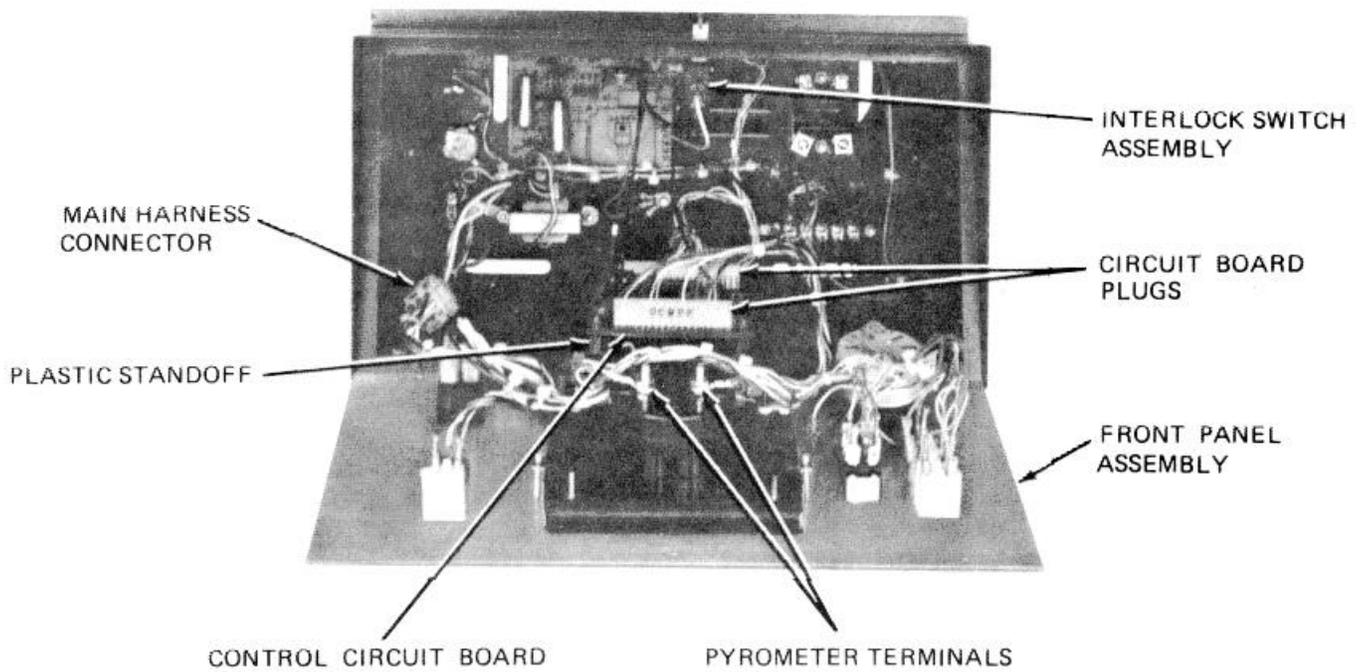


Figure 6. Temp-Master LA With Front Panel Removed (Temp-Master MA is similar)

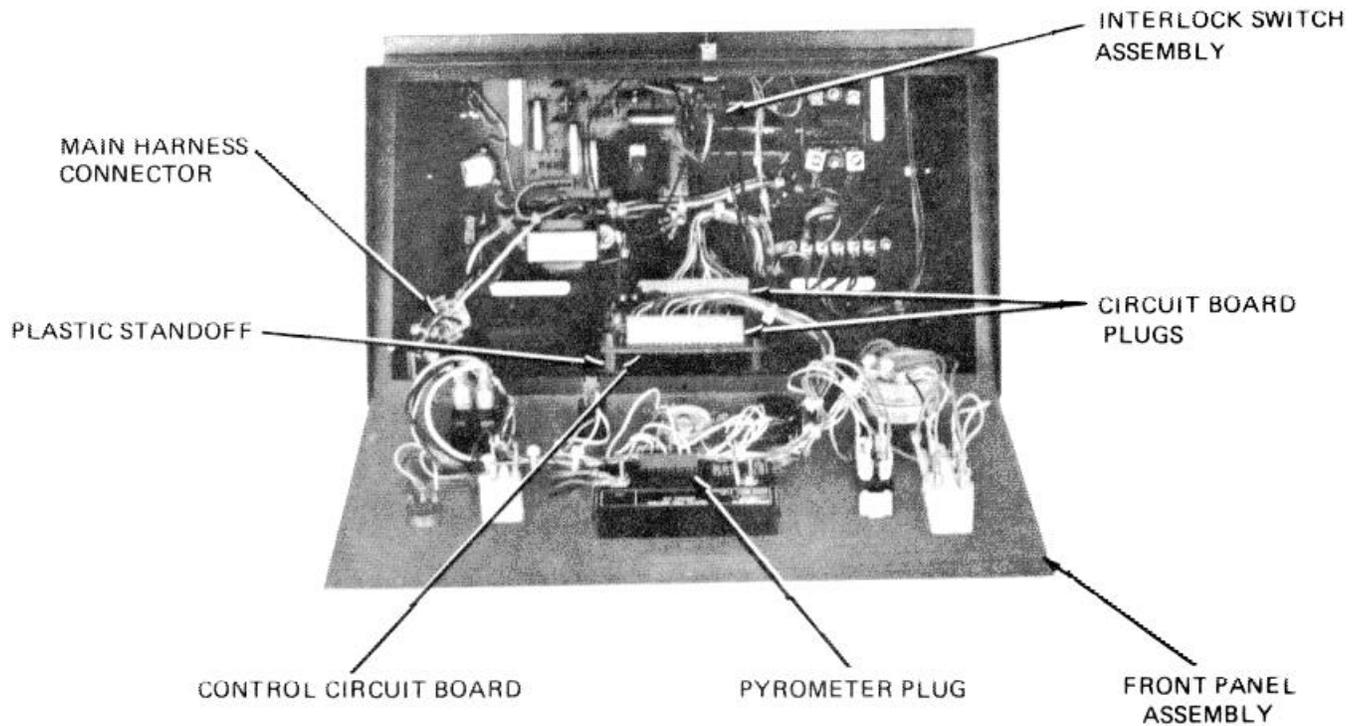


Figure 7. Temp-Master LD With Front Panel Removed (Temp-Master MD is similar)

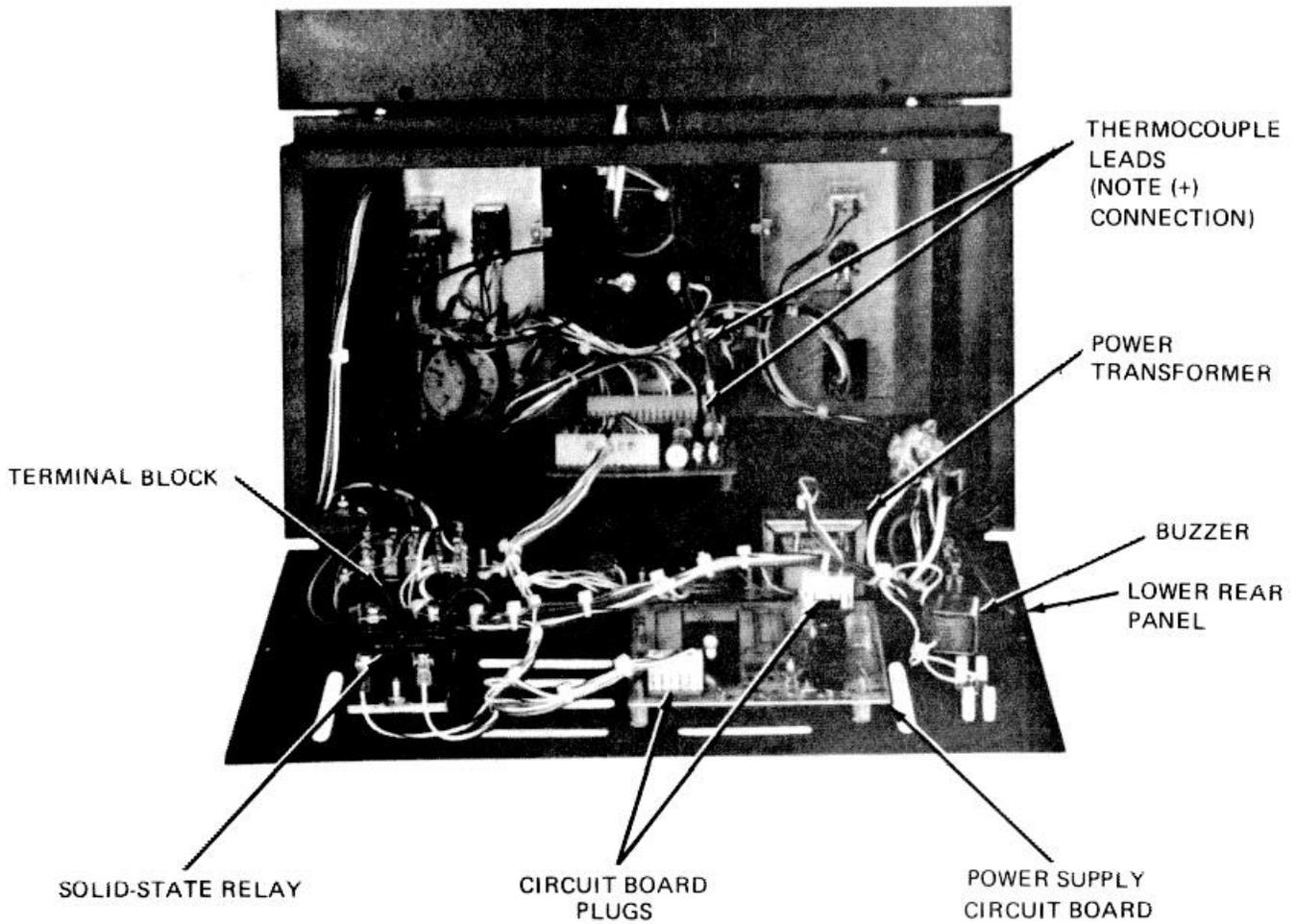


Figure 8. Temp-Master With Lower Rear Panel Removed

REPLACEMENT OF HEATING PLATES

M Series - 1 15V, P.N. 33915 (Set of 2)
M Series - 230V, P.N. 33916 (Set of 2)

L Series - (1 15/230V) P.N. 33918 (Set of 2 Side Plates)
L Series - (11 5/230V) P.N. 33917 (Set of 2 Rear Plates)

1. Remove the upper rear panel. Refer to Figures 3, 4 and 5 on Page 7 for the location of the heater connections and arrangement of hardware.
2. Remove the nuts which hold the heating plate wires to the power terminals and straighten the heating plate wires.
3. Open the furnace door and locate the two ceramic sections at the front of the furnace chamber. Remove the right-hand ceramic section by lifting it upward until the bottom of the section clears the sheet metal housing. Pull the bottom of the ceramic section out toward you so that it is in front of the sheet metal, and then pull it down so the upper half clears the sheet metal housing. The furnace door should be held partially open while removing the ceramic sections, because they are not readily removed when the door is fully open. Remove the left-hand ceramic plate after completing removal of the right-hand as previously described.
4. Remove the floor plate, then carefully slide the two side heating plates out the front of the furnace. The two rear heating plates on the LA and LD Models may now be removed.
5. Check condition of the filler strip insulation located in the space to the left and right of the ceramic front sections. Replace if required.
6. Check the condition of the floor plate which provides insulation and serves as a spacer between the bottom ends of the heating plates. Replace if required.
7. To install the new heating plates reverse the above procedure. Push the ceramic insulating bushings back into place on the rear insulating panel. When reconnecting the heating plate wires at the rear of the furnace, be sure to replace all hardware in its original position and make all connections tight.

REPLACEMENT OF THE THERMOCOUPLE

1. Remove the upper and lower rear panel.
2. Remove the thermocouple leads from the black connector block on the printed circuit board.
3. Remove the clamp which secures the thermocouple to the ceramic terminal block located in the upper half of the furnace. Remove the heating plate wire which crosses over the thermocouple and bend it out of the way to permit sliding the thermocouple out of the rear of the furnace. Remove the two loose thermocouple wires from the base of the unit.
4. Bend the new thermocouple wires at a 90° angle, approximately 3-3/8" from the exposed tip of the thermocouple. Be certain that there is a ceramic insulating bead covering the thermocouple wires where they cross the heating plate wire.
5. Feed the two thermocouple wires from the upper housing into the lower housing. Insert the new thermocouple into the hole at the rear of the heating chamber.
6. Reverse Step 3.
7. Connect the thermocouple wires to the control circuit board terminals. Observe the correct polarity. The replacement thermocouple is supplied with the positive wire tagged "(+)", and the insulation on the wires is color coded red for positive and black for negative. If the (+) marker is lost or missing from the thermocouple wire, the polarity of the thermocouple may be determined by color or by holding a magnet to each of the wires. The wire which is attracted to the magnet is negative.
8. Reconnect the heating plate wire which was removed in Step 3.

REPLACEMENT OF THE ANALOG PYROMETER

1. Remove the lower front panel
2. Remove the two nuts which secure the wire harness to the pyrometer, and lift the two plastic wire clamps away from the back of the pyrometer.
3. Remove the nuts on the pyrometer terminals at the back of the pyrometer and remove the wires which are attached to these terminals.
4. Loosen the screws on the pyrometer "T" brackets located on either side of the pyrometer, and remove the two "T" brackets. Remove the pyrometer.
5. To install the pyrometer, reverse the above procedure. When reinstalling the pyrometer "T" brackets, install them so that the screws are at a slight angle from the vertical position. Tighten the bracket screws ONLY MODERATELY, alternating from one side to the other until secure. Also, be certain that the green wire is connected to the positive terminal of the pyrometer (marked +)

REPLACEMENT OF THE DIGITAL PYROMETER

1. Remove the lower front panel.
2. Unplug the plug on the rear of the digital pyrometer by pulling the plug straight out.
3. Loosen and remove the two nuts on the rear of the digital pyrometer. Remove the two lugs and the terminal strip attached to each of the two mounting studs and finally remove the mounting bar which holds the digital pyrometer in place. The digital pyrometer may now be removed from the front of the furnace.
4. To reinstall, reverse the above procedure. Be sure that the two lugs removed in Step 3 are reconnected and that the mounting nuts are NOT overtightened.

REPLACEMENT OF DOOR INSULATION AND SPRINGS

1. Open the door and locate and remove the two screws on the door closest to the door hinges which hold the retainer strip in place. Remove this retainer strip.
2. The one piece door insulation may now be removed by slightly lifting and sliding toward the rear of the furnace.
3. If springs are to be replaced, remove each spring from the hook which holds it in place and remove both the hook and spring.
4. To reinstall the new door insulation or springs and hooks reverse the above procedure.

REPLACEMENT OF CONTROL AND POWER SUPPLY PRINTED CIRCUIT BOARDS

1. Remove the lower rear panel.
2. Remove the connectors from the defective board. (If it is the control board, also remove the thermocouple leads.) The control board is on the bottom of the furnace; the power supply board is on the rear panel.
3. To remove either board, depress each plastic tab and gently pull the board straight up. The board must be released from each standoff, one at a time, until all four are disengaged.
4. To reinstall, reverse the above procedures, noting that the new board "snaps" into place.

NOTE: When ordering either circuit board, be sure to include Model, serial number and, if digital pyrometer, whether reading is ° F or °C.

Jelrus Burn-Out Furnace

Door Interlock Switch Replacement Instructions

1. Make sure furnace is unplugged.
2. Remove lower front panel retaining screws and remove front panel.
3. Tag and disconnect wires from door interlock switch.
4. Remove door interlock switch mounting screws and nuts.
5. Position replacement door interlock switch and install mounting screws and nuts.
6. Install wiring as tagged.
7. Adjust door interlock switch stop to activate switch when door is opened.
8. Position lower front panel and install mounting screws and nuts.

PARTS COMMON TO MODELS MA, MD, LA & LD

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
28277	Dust Cap for Align and Calibrate Controls	33943	Ready Light Assembly
33128	Soak Timer Hours Knob-60 Hz	33945	Door Interlock Switch Assembly
33129	Soak Timer Hours Knob-50 Hz	33957	Vent Hole Ring and Ceramic Vent Tube
33130	Jumper Lead	33958	Ceramic Insulating Bushings (Pkg. of 4)
33140	Thermocouple	33960	Solid-State Relay
33256	Tray for Heating Chamber	33965	Buzzer and Mounting Hardware
33263	Power Switch-1 15V	33967	Mounting Feet (Set of 4)
33264	Power Switch-230V	3397,0	Align Potentiometer
33266	Knob for Temp Set Control	33972	Timer Assembly
33267	Locking Ring for Temp Set Control	33985	Support Kit - Power Supply Circuit Board
33279	Knob for Heat Rate Control	33986	Support Kit - Control Circuit Board
33280	Timer Set/Reset Switch	33993	Control Circuit Board-0C Only
33285	Heat Rate Control Assembly	33997	Door Spring and Hook Assembly Kit
33295	Press To Set Button Assembly	33998	Door Hinges (Set of 2)
33358	Buzzer Switch and Mounting Hardware	33964	15A Ceramic Fuses (Pkg. of 5)
33364	Terminal Block (Rear Panel)	90219	Fuseholder
33395	Power Transformer-230V	110062	Temperature Set Potentiometer
33417	Control Circuit Board-°F Only	110063	Calibrate Potentiometer
33940	Heater On Light Assembly	33902	Tempil Pellet Kit (1300-F) (Pkg. of 5)
33941	Set Light Assembly		
33942	Run Light Assembly		

**PARTS USED ONLY ON
MODELS MA & LA**

**PARTS USED ONLY ON
MODELS MD & LD**

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
33393	Power Transformer 110V/115V	33394	Power Transformer 100V/115V
33440	Power Supply Circuit Board	33441	Power Supply Circuit Board
33920	Pyrometer (Analog)	33925	Pyrometer (Digital/°F)

**PARTS USED ONLY ON
MODELS MA & MD**

**PARTS USED ONLY ON
MODELS LA & LD**

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
33208	Ceramic Front Section (Set of 2)	33708	Ceramic Front Section (Set of 2)
33210	Rear Insulating Panel w/Block	33710	Rear Insulating Panel w/Block
33230	Door Assembly	33730	Door Assembly
33272	Door Insulation	33733	Door Insulation
33375	Line Cord 11 5V	33875	Line Cord 11 5V
33915	Heating Plates Assembly (Set of 2)	33917	Heating Plate Assembly, Rear (Set of 2)
33935	Ceramic Terminal Block w/Terminals	33918	Heating Plate Assembly, Side (Set of 2)
33955	Upper Rear Panel Kit	33936	Ceramic Terminal Block w/Terminals
33975	Heater (Power) Leads (Set of 2)	33956	Upper Rear Panel Kit
33980	Floor Plate & Back Plate with Filler Strip Insulation Kit	33976	Heater (Power) Leads (Set of 2)
33996	Door Handle Kit	33981	Floor Plate with Filler Strip Insulation Kit
33982	Heating Chamber Insulation Kit	33995	Door Handle Kit
		33983	Heating Chamber Insulation Kit



Jelrus Dental Products Corporation
2020 Jericho Turnpike, New Hyde Park, NY 11040
Call TOLL-FREE 800-221-6721 (except in New York,
call 516-775-1645 or 212-347-7100)

582 1K 27905

APPENDIX A

REFERENCES

A-1. **Scope.** This appendix contains all forms, pamphlets and technical manuals referenced in both the Air mobile and Semitrailer mounted Laboratories.

A-2. **Forms.**

Recommended Changes to Publications	DA Form 2028
	DA Form 2028-2
Quality Deficiency Report.....	SF 368
Equipment Inspection and Maintenance Work Sheet.....	DA Form 2404
Hand Receipts.....	DA Form 2062

A-3. **Field Manuals.**

Petroleum Testing Facilities:	
Laboratories and Kits	FM 10-72
Inspecting and Testing Petroleum Products.....	FM 10-70
ASTM Test Method Supplement to.....	FM 10-92C1/C2

A-4. **Technical Manuals.**

Atlas-Copco Compressor.....	TM 10-4310-392-13&P
Alcor Jet Fuel Thermal Oxidation Tester Operating and Maintenance Manual	TM 10-6635-210-13&P
Bacharach Gas Alarm and Calibration Data	TM 10-6665-297-13&P
Brother Portable Typewriter.....	TM 10-7430-218-13&P
Chemtrix Field Ph Meter	TM 10-6630-237-13&P
Elkay Manufacturing 30 GPH Cooler	TM 10-4130-240-13&P
Emcee Micro-Separometer	TM 10-6640-222-13&P
Foxboro Pressure Recording Gauge	TM 10-6685-365-13&P
Gammon Aqua Gio Water Detector.....	TM 10-6640-221-13&P
Gammon Mini Monitor Fuel Sampling Kit.....	TM 10-6630-230-13&P
Jelrus Burn-Out Furnace	TM 10-6640-231-13&P
Koehler Cleveland Open Tester	TM 10-6630-236-13&P
Koehler Cloud and Pour Point Chamber.....	TM 10-6630-238-13&P
Koehler Copper Strip Corrosion Bomb Bath	TM 10-6640-220-13&P
Koehler Distillation Apparatus	TM 10-6630-233-13&P
Koehler Dropping Point Apparatus	TM 10-6635-211-13&P
Koehler Electric Pensky-Martins Tester	TM 10-6630-231-13&P
Koehler Foaming Characteristics Determination Apparatus	TM 10-6640-228-13&P
Koehler Kinematic Viscosity Bath	TM 10-6630-239-13&P
Koehler Tag Closed Cup Flash Tester.....	TM 10-6630-235-13&P
Lab-Line Explosion Proof Refrigerator.....	TM 10-6640-219-13&P
Lily Freezer	TM 10-6640-234-13&P
Millipore OM 39 Filter Holder	TM 10-6640-225-13&P
Millipore Vacuum Pump	TM 10-6640-217-13&P
Ohaus Harvard Trip Balance	TM 10-6670-278-13&P
Precision Gas-Oil Distillation Test Equipment	TM 10-6630-219-13&P
Precision General Purpose Water Bath.....	TM 10-6640-229-13&P

Precision High Temperature Bronze Block Gum Bath	TM 10-6630-234-13&P
Precision General Purpose Ovens.....	TM 10-6640-218-13&P
Precision Heater Instruction Manual and Parts List.....	TM 10-8640-223-13&P
Precision Oxidation Stability Bath	TM 10-6640-232-13&P
Precision Pensky-Martens Flash Testers.....	TM 10-6630-231-13&P
Precision Reid Vapor Pressure Bath.....	TM 10-6640-226-13&P
Precision Slo-Speed Stirrer	TM 10-6640-224-13&P
Precision Universal Centrifuge	TM 10-6640-230-13&P
Precision Universal Penetrometer	TM 10-6640-228-13&P
Sargent-Welch Vacuum Pump.....	TM 10-4310-391-13&P
Sartorius Analytical Balance.....	TM 10-6670-277-13&P
Scotsman Cuber	TM 10-6640-227-13&P
Soltec VOM-Multimeter.....	TM 10-6625-3127-13&P
Teel Self-Priming Centrifugal Pump.....	TM 10-6640-217-13&P
Teel Submersible Pump	TM 10-4320-320-13&P
Texas Instrument TI-503011 Calculator.....	TM 10-7420-210-13&P

A-5. **Pamphlets.**

The Army Maintenance Management System (TAMMS)	DA Pam 738-750
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A-6. **Miscellaneous Publications.**

The Army Integrated Publishing and Printing Program	AR 25-30
Laboratory, Airmobile, Aviation Fuel	MIL-L-52733A(ME)
Apparatus, Instruments, Chemicals, Furniture, and Supplies for Industrial, Clinical, College and Government Laboratories	Fisher Scientific Laboratories Catalog
Petroleum-Petrochemical Testing Equipment	Precision Scientific Catalog

APPENDIX B

MAINTENANCE ALLOCATION CHART

SECTION I. INTRODUCTION

B-1. **General**

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the 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 lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. **Maintenance Functions.** Maintenance functions will be limited to and defined as follows:

a Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards

c Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to 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, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of knob 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 emplacing, seating, 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 is shown as the third position code of the SMR code.

i. Repair. The application of maintenance services, including fault location/troubleshooting,² removal/installation, and disassembly/assembly procedures³, 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. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (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 a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

B-3. Explanation Of Columns In The MAC, Section II.

a. Column 1. Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group number shall be "00 "

b. Column 2. Component/ Assembly Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3. Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2. (For a detailed explanation of these functions, see paragraph B-2.)

d. Column 4. Maintenance Category Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category 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 category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate work time figures will be shown for each category. The work time 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 (including any necessary disassembly/ assembly time), troubleshooting/fault location 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 the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

1 *Services - inspect, test, service, adjust, align, calibrate, and/or replace*

2 *Fault locate/troubleshoot - the process of investigating and detecting the cause of equipment malfunctioning, the act of isolating a fault within a system or unit under test (UUT)*

3 *Disassemble/assemble - encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i a., assigned an SMR code) for the category of maintenance under consideration*

4 *Actions - welding, grinding, riveting, straightening, facing, remachining, and/or resurfacing*

- C.....Operator/Crew
- O.....Unit Maintenance
- F.....Direct Support Maintenance
- H.....General Support Maintenance
- D.....Depot Maintenance

e. Column 5. Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6. Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in section IV

B-4. Explanation Of Columns In Tool And Test Equipment Requirements, Section III.

a. Column 1. Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, section II, column 5

b. Column 2. Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3. Nomenclature. Name or identification of the tool or test equipment

d. Column 4. National Stock Number. The National stock number of the tool or test equipment

e. Column 5. Tool Number. The manufacturer's part number

B-5. Explanation Of Columns In Remarks, Section IV.

a. Column 1. Reference Code. The code recorded in Column 6, Section II

b. Column 2. Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, section II

SECTION II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
			C	O	F	H	D		
01	BURN-OUTFURNACE	INSPECT CALIBRATE REPLACE REPAIR	0	2				1 1,2,3	A

**SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
MAINTENANCE ALLOCATION CHART**

(1) TOOL/TEST EQUIP REF CODE	(2) MAINTENANCE CATEGORY	(3) NOMENCLATURE	(4) NSN	(5) TOOL NUMBER
1	O, F	TOOL KIT, GENERAL AUTOMOTIVE	5180-00177-7033	(50980) SC 5180-90- CL-N26
2	O,F	KIT, SOLDERING GUN, 115V, 60 CYCLE,COMPLETE WITH SOLDER AND CAE	343999-618-6623	
3	O,F	MULTIMETER, 0-500V	6625-00-691-2453	

SECTION IV. REMARKS

REFERENCE CODE	REMANRKS
A	Repair at organization is limited to replacement of parts such as knobs, handles, power cord, door interlock switch, thermocouple, pyrometer and door assemblies.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

NOT APPLICABLE

C-1/(C-2 Blank)

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

NOT APPLICABLE

D-1/(D-2 Blank)

APPENDIX E

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

NOT APPLICABLE

E-1/(E-2 Blank)

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

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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 decigrams = .035 ounce
 1 dekagram = 10 grams = .35 ounce
 1 hectogram = 10 dekagrams = 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 milliliters = .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
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