

# TM 10-4520-265-14&P

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## TECHNICAL MANUAL

OPERATOR, FIELD, AND SUSTAINMENT  
MAINTENANCE MANUAL  
INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)  
FOR

LARGE CAPACITY FIELD HEATER,  
TYPE II, (LCFH TYPE II)  
350,000 BTU, INCLUDING DIESEL ENGINE

NSN: 4520-01-559-8737 (EIC: VYG)



**DISTRIBUTION STATEMENT A.** – Approved for public release; distribution is unlimited.

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HEADQUARTERS, DEPARTMENT OF THE ARMY

01 JUNE 2009



## WARNING SUMMARY

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and hazardous materials icons used within this technical manual.

### FIRST AID INFORMATION

For First Aid treatment, refer to FM 4-25.11.

#### EXPLANATION OF SAFETY WARNING ICONS



**CHEMICAL** - drops of liquid on hand shows that the material will cause burns or irritation to human skin or tissue.



**CRYOGENIC** - hand in block of ice shows that the material is extremely cold and can injure human skin or tissue.



**ELECTRICAL** - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.



**EXPLOSION** - rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition, or high pressure.



**EYE PROTECTION** - person with goggles shows that the material will injure the eyes.



**FIRE** - flame shows that a material may ignite and cause burns.



**HEAVY OBJECT** - human figure stooping over heavy object shows physical injury potential from improper lifting technique.



**HEAVY PARTS** - heavy object on human figure shows that heavy parts present a danger to life or limb.



**HOT AREA** - hand over object radiating heat shows that part is hot and can burn.



POISON - skull and crossbones shows that a material is poisonous or is a danger to life.



SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.



VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.



MOVING PARTS - hand with fingers caught between gears shows that the moving parts of the equipment present a danger to life or limb.



EAR PROTECTION - headphones over ears shows that noise level will harm ears.



ELECTRICAL - electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.

**GENERAL SAFETY WARNINGS DESCRIPTION**

**WARNING**



The LCFH Type II weighs approximately 625 pounds. Extreme care should be used at all times when moving it. Proper lifting equipment and observation of safety precautions is required to safely move the LCFH Type II. Under No Circumstances should anyone stand in the path of the LCFH Type II when it is being lifted or moved. Serious injury or death may result.

**WARNING**



Some items associated with or installed in the LCFH Type II require two to four people to lift/move. Use appropriate number of personnel when moving large, bulky, or heavy items. In order to avoid serious injury, never attempt to lift an item alone if it requires more than one person.

**WARNING**



The LCFH Type II exhaust stack surface reaches a temperature of 150° F (65.5° C). Do not touch or allow bare skin to come in contact with the exhaust stack unless the LCFH Type II has been shut down and cool. Coming in contact with hot surfaces may result in burns or other serious injury.

Do not allow bare skin to come in contact with the LCFH Type II air outlet duct during operation. The LCFH Type II air outlet duct reaches a temperature of 225°F (107°C) and may cause severe burns.

**WARNING**



Leather gloves and eye protection must be worn when performing maintenance. Failure to do so could result in serious injury to eyes or hands.

**WARNING**



Gloves, eye protection, and dust mask should be worn when handling chemicals such as cleaning solvents or other cleaning material. Failure to wear proper protection may result in skin irritation and/or eye injury.

**WARNING**



Hands and other body parts should be kept from the air inlet duct of the LCFH Type II. Moving parts inside the duct could cause severe injury or death.

The engine access panel on the side of the LCFH Type II should not be opened during operation. Moving parts inside the access door could cause serious injury or death.

**WARNING**



Do not touch cold metal parts with bare hands. Frostbite can cause permanent injury to personnel.

**WARNING**



Fuels and solvents are toxic, flammable, and explosive. Wear protective goggles and refuel only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and don't breathe vapors. Do not use near open flame or excessive heat. If you become dizzy, get fresh air immediately and get medical aid. If contact with eyes or skin is made, immediately flush with clean water and get medical aid for eyes immediately.

**WARNING**



Personnel should wear gloves when fueling the LCFH Type II or performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin under arctic conditions may cause frostbite or other serious injury.

**WARNING**



Do not wear any type of jewelry when working on the LCFH Type II. Jewelry can conduct electricity. Also, there are a number of moving parts that could catch jewelry and be a serious hazard. Failure to remove jewelry can cause injury or death.

**WARNING**



Hearing protection should be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.

**WARNING**



Disconnect the negative battery terminal on the battery closest to the engine bay access door before performing maintenance involving the batteries. Failure to do so may result in shock or other serious injury.

**WARNING**



Do not place the LCFH Type II over any fuel and/or electrical lines. Placing the heater over fuel and/or electrical lines may result in fire or explosion causing serious injury or death.

**WARNING**



The LCFH Type II should not be positioned any closer than 2 feet from an external bulk fuel supply. Placing the heater closer than 2 feet from a bulk fuel supply may result in fire or explosion causing serious injury or death.

**WARNING**



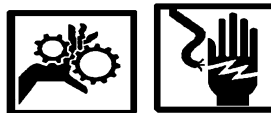
To prevent possible deadly carbon monoxide (CO) concentration, operate the LCFH Type II only in well-ventilated areas and place the unit as far away as possible from enclosure vent, door, and window openings. Failure to do so may result in serious injury or death.

**WARNING**



Do not operate radio equipment within 4 feet of the LCFH Type II, due to possible Electromagnetic Interference (EMI). If the heater interferes with other electronics equipment in its vicinity, move the equipment away from the heater until interference is no longer a problem. Failure to comply with this warning may result in equipment endangerment, radio interference, and/or severe injury to personnel.

**WARNING**



Jewelry can conduct electricity and become entangled in the LCFH Type II. Failure to remove jewelry can cause injury or death.





**LIST OF EFFECTIVE PAGES/WORK PACKAGES**

**NOTE:** Zero in the “Change No.” column indicates an original page or work package.

Date of issue for the original manual is:

Original 01 JUNE 2009

**TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 48 AND TOTAL NUMBER OF WORK PACKAGES IS 124, CONSISTING OF THE FOLLOWING:**

Page/WP No.	Change No.	Page/WP No.	Change No.
Front Cover	0	WP 0029 (2 pgs)	0
Blank	0	WP 0030 (2 pgs)	0
Warning Summary (6 pgs)	0	WP 0031 (6 pgs)	0
i-xxvi (26 pgs)	0	WP 0032 (2 pgs)	0
Chp 1 title page	0	WP 0033 (6 pgs)	0
Blank	0	WP 0034 (4 pgs)	0
WP 0001 (6 pgs)	0	WP 0035 (4 pgs)	0
WP 0002 (16 pgs)	0	WP 0036 (4 pgs)	0
WP 0003 (2 pgs)	0	WP 0037 (4 pgs)	0
Chp 2 title page	0	WP 0038 (2 pgs)	0
Blank	0	WP 0039 (14 pgs)	0
WP 0004 (6 pgs)	0	WP 0040 (8 pgs)	0
WP 0005 (34 pgs)	0	WP 0041 (10 pgs)	0
WP 0006 (6 pgs)	0	WP 0042 (10 pgs)	0
Chp 3 title page	0	WP 0043 (2 pgs)	0
Blank	0	WP 0044 (4 pgs)	0
WP 0007 (6 pgs)	0	WP 0045 (24 pgs)	0
Chp 4 title page	0	WP 0046 (4 pgs)	0
Blank	0	WP 0047 (2 pgs)	0
WP 0008 (2 pgs)	0	WP 0048 (2 pgs)	0
WP 0009 (4 pgs)	0	WP 0049 (8 pgs)	0
WP 0010 (4 pgs)	0	WP 0050 (4 pgs)	0
WP 0011 (2 pgs)	0	WP 0051 (4 pgs)	0
WP 0012 (14 pgs)	0	WP 0052 (8 pgs)	0
WP 0013 (2 pgs)	0	WP 0053 (4 pgs)	0
WP 0014 (2 pgs)	0	WP 0054 (4 pgs)	0
Chp 5 title page	0	WP 0055 (2 pgs)	0
Blank	0	WP 0056 (4 pgs)	0
WP 0015 (2 pgs)	0	WP 0057 (6 pgs)	0
WP 0016 (20 pgs)	0	WP 0058 (6 pgs)	0
Chp 6 title page	0	WP 0059 (2 pgs)	0
Blank	0	WP 0060 (4 pgs)	0
WP 0017 (2 pgs)	0	WP 0061 (16 pgs)	0
WP 0018 (2 pgs)	0	WP 0062 (4 pgs)	0
WP 0019 (2 pgs)	0	WP 0063 (12 pgs)	0
WP 0020 (2 pgs)	0	WP 0064 (8 pgs)	0
WP 0021 (2 pgs)	0	WP 0065 (10 pgs)	0
Chp 7 title page	0	WP 0066 (10 pgs)	0
Blank	0	WP 0067 (4 pgs)	0
WP 0022 (4 pgs)	0	WP 0068 (4 pgs)	0
WP 0023 (2 pgs)	0	WP 0069 (4 pgs)	0
WP 0024 (2 pgs)	0	WP 0070 (2 pgs)	0
WP 0025 (4 pgs)	0	WP 0071 (4 pgs)	0
WP 0026 (2 pgs)	0	WP 0072 (4 pgs)	0
WP 0027 (2 pgs)	0	WP 0073 (2 pgs)	0
WP 0028 (2 pgs)	0	WP 0074 (2 pgs)	0

Page/WP No.	Change No.	Page/WP No.	Change No.
WP 0075 (4 pgs)	0	WP 0123 (2 pgs)	0
WP 0076 (4 pgs)	0	WP 0124 (2 pgs)	0
WP 0077 (4 pgs)	0	Index-1 – Index-6	0
WP 0078 (2 pgs)	0	Foldouts	0
Chp 8 title page	0	Inside back cover	0
Blank	0	Back Cover	0
WP 0079 (4 pgs)	0		
WP 0080 (2 pgs)	0		
WP 0081 (42 pgs)	0		
WP 0082 (10 pgs)	0		
WP 0083 (8 pgs)	0		
WP 0084 (4 pgs)	0		
WP 0085 (8 pgs)	0		
WP 0086 (4 pgs)	0		
WP 0087 (30 pgs)	0		
Chp 9 title page	0		
Blank	0		
WP 0088 (2 pgs)	0		
WP 0089 (6 pgs)	0		
WP 0090 (6 pgs)	0		
WP 0091 (6 pgs)	0		
WP 0092 (4 pgs)	0		
WP 0093 (8 pgs)	0		
WP 0094 (2 pgs)	0		
WP 0095 (2 pgs)	0		
Chp 10 title page	0		
Blank	0		
WP 0096 (6 pgs)	0		
WP 0097 (10 pgs)	0		
WP 0098 (8 pgs)	0		
WP 0099 (6 pgs)	0		
WP 0100 (4 pgs)	0		
WP 0101 (6 pgs)	0		
WP 0102 (6 pgs)	0		
WP 0103 (4 pgs)	0		
WP 0104 (16 pgs)	0		
WP 0105 (4 pgs)	0		
WP 0106 (4 pgs)	0		
WP 0107 (4 pgs)	0		
WP 0108 (4 pgs)	0		
WP 0109 (4 pgs)	0		
WP 0110 (4 pgs)	0		
WP 0111 (4 pgs)	0		
WP 0112 (4 pgs)	0		
WP 0113 (4 pgs)	0		
WP 0114 (4 pgs)	0		
WP 0115 (2 pgs)	0		
WP 0116 (6 pgs)	0		
WP 0117 (6 pgs)	0		
Chp 11 title page	0		
Blank	0		
WP 0118 (2 pgs)	0		
WP 0119 (4 pgs)	0		
WP 0120 (8 pgs)	0		
WP 0121 (4 pgs)	0		
WP 0122 (2 pgs)	0		

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DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 01 JUNE 2009

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**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 letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), directly to: TACOM Life Cycle Management Command, ATTN: AMSTA-LCL-MPP/TECH PUBS, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. You may also send in your recommended changes via electronic mail or by fax. Our fax number is DSN 793-0726 and Commercial (309)782-0726. Our e-mail address is TACOMLCMC.DAForm2028@us.army.mil. A reply will be furnished to you.

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**TABLE OF CONTENTS**

Page No.  
WP Sequence No.

How To Use This Manual.....xxv

Chapter 1 – General Information, Equipment Description and Theory of Operation

    General Information..... WP 0001

        Table 1. Nomenclature Cross-Reference List .....0001-2

        Table 2. List of Acronyms and Abbreviations .....0001-3

    Equipment Description and Data ..... WP 0002

        Figure 1. Jack Assembly .....0002-2

        Figure 2. Non-Pneumatic Retractable Wheels .....0002-2

        Figure 3. Wheel Chocks .....0002-3

        Figure 4. Snow Skids.....0002-3

        Figure 5. Fork Lift Pockets.....0002-3

        Figure 6. Local Mobility Handles .....0002-4

        Figure 7. Lift/Tie Down Rings .....0002-4

        Figure 8. NATO Connector.....0002-4

        Figure 9. Duct Covers.....0002-5

        Figure 10. Air Inlet .....0002-5

        Figure 11. Heated Air Outlet.....0002-5

        Figure 12. Fresh Air Damper .....0002-6

        Figure 13. Inlet and Outlet Ducts.....0002-6

        Figure 14. Fuel Filler Port .....0002-6

        Figure 15. Fuel Gauge.....0002-7

        Figure 16. Fuel Tank .....0002-7

        Figure 17. External Fuel Connection.....0002-7

        Figure 18. Fuel Hose .....0002-8

        Figure 19. Exhaust Stack Stowage Area.....0002-8

        Figure 20. Exhaust Stack .....0002-8

        Figure 21. Engine Access Door.....0002-9

        Figure 22. Operator Control Panel Stowage Area.....0002-9

        Figure 23. Operator Control Panel .....0002-9

        Figure 24. Fuel System Access Door..... 0002-10

        Figure 25. Burner Door..... 0002-10

        Figure 26. Heat Exchanger Cover ..... 0002-10

        Figure 27. Engine Bay Cover ..... 0002-11

        Figure 28. Fan Cover..... 0002-11

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 29. Cabinet-Mounted Carbon Monoxide Detector .....	0002-11
Figure 30. Diesel Engine .....	0002-11
Figure 31. Alternator .....	0002-12
Figure 32. Burner Fuel Pump .....	0002-12
Figure 33. Batteries .....	0002-12
Figure 34. Flexible Shaft Coupling .....	0002-12
Figure 35. Air Inlet Fan .....	0002-13
Figure 36. Main Control Box Assembly .....	0002-13
Figure 37. Burner Assembly .....	0002-13
Figure 38. Heat Exchanger.....	0002-13
Figure 39. Main Power Shutdown Switch.....	0002-14
Table 1. LCFH Type II Equipment Data .....	0002-15
Theory of Operation .....	WP 0003
 Chapter 2 – Operator Procedures	
Description and Use of Operator Controls and Indicators .....	WP 0004
Figure 1. Operator Control Panel Controls and Indicators .....	0004-1
Table 1. Operator Control Panel Controls and Indicators .....	0004-1
Figure 2. Fuel Service Panel Controls and Indicators .....	0004-2
Table 2. Fuel Service Panel Controls and Indicators .....	0004-2
Figure 3. NATO Connector Controls and Indicators .....	0004-3
Table 3. NATO Connector Controls and Indicators.....	0004-3
Figure 4. Circuit Breakers (Main Control Box) Controls and Indicators .....	0004-3
Table 4. Circuit Breakers (Main Control Box) Controls and Indicators .....	0004-3
Figure 5. LCFH Type II Transport Controls and Indicators .....	0004-4
Table 5. LCFH Type II Transport Controls and Indicators .....	0004-4
Figure 6. Main Battery Shutdown Switch Controls and Indicators .....	0004-4
Table 6. Main Battery Shutdown Switch Controls and Indicators .....	0004-4
Figure 7. Burner Assembly Air Inlet Shutter Controls and Indicators .....	0004-5
Table 7. Burner Assembly Air Inlet Shutter Controls and Indicators .....	0004-5
Operation Under Usual Conditions .....	WP 0005
Figure 1. Lowering the Side Wheels .....	0005-3
Figure 2. Operating in a Wheels-Deployed Condition .....	0005-4
Figure 3. Deploy the Wheel Chocks .....	0005-5
Figure 4. Removing the Inlet and Outlet Duct Covers.....	0005-5

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 5. Remove the Inlet Duct Cover .....	0005-6
Figure 6. Install the Inlet or Outlet Duct.....	0005-7
Figure 7. Deploying the Exhaust Pipe .....	0005-7
Figure 8. Installing the Operator Control Box in the Shelter.....	0005-8
Figure 9. Deploying the Carbon Monoxide Detector .....	0005-9
Figure 10. Fueling the Internal Fuel Tank .....	0005-10
Figure 11. Operating from an External Fuel Supply .....	0005-12
Figure 12. Initial Operator Control Box Settings.....	0005-13
Figure 13. Starting the Heater .....	0005-14
Table 1. LCFH Type II Startup Time versus Outside Ambient Temperature .....	0005-15
Table 2. LCFH Type II Startup Codes .....	0005-15
Figure 14. Operating the Carbon Monoxide Detector .....	0005-16
Figure 15. Operating the Fresh Air Damper .....	0005-17
Figure 16. Shutting Down the LCFH Type II .....	0005-17
Figure 17. Stowing the External Fuel Supply .....	0005-18
Figure 18. Stowing the Operator Control Box .....	0005-19
Figure 19. Stowing the Flexible Inlet and Outlet Ducts .....	0005-20
Figure 20. Stowing Inlet and Outlet Duct Covers .....	0005-21
Figure 21. Stow the Inlet Duct Cover .....	0005-21
Figure 22. Stowing the Exhaust Pipe .....	0005-22
Figure 23. Stowing Wheel Chocks .....	0005-23
Figure 24. Lowering the Side Wheels .....	0005-24
Table 3. Decals and Instruction Plates.....	0005-25
Operation Under Unusual Conditions .....	WP 0006
Figure 1. Locate Engine Stop Lever .....	0006-4
Figure 2. Pull and Hold Engine Stop Lever Until Engine Stops .....	0006-5
 Chapter 3 – Troubleshooting Master Index	
Troubleshooting Index.....	WP 0007
Table 1. LCFH Type II Fault Code Series Key .....	0007-1
Table 2. Troubleshooting Index .....	0007-2
 Chapter 4 – Troubleshooting Procedures	
General LCFH Troubleshooting Procedures.....	WP 0008
Table 1. General LCFH Type II Troubleshooting Procedures.....	0008-2

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
LCFH Type II Fault Code Troubleshooting Procedures .....	WP 0009
Table 1. LCFH Type II Fault Code Troubleshooting Procedures .....	0009-1
Service Troubleshooting Procedures .....	WP 0010
Table 1. General LCFH Type II Troubleshooting Procedures .....	0010-1
Service Troubleshooting Procedures .....	WP 0011
Table 1. Diesel Engine Troubleshooting Procedures .....	0011-1
Service Troubleshooting Procedures .....	WP 0012
Table 1. LCFH Type II Fault Code Troubleshooting Procedures .....	0012-1
Field Troubleshooting Procedures .....	WP 0013
Table 1. Diesel Engine Troubleshooting Procedures .....	0013-1
Sustainment Troubleshooting Procedures .....	WP 0014
Table 1. Diesel Engine Troubleshooting Procedures .....	0014-1

**Chapter 5 – Operator PMCS Maintenance Instructions**

PMCS Introduction .....	WP 0015
Preventive Maintenance Checks and Services (PMCS) .....	WP 0016
Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II, (LCFH Type II) .....	0016-3
Figure 1. Before, During, and After Operation PMCS for Air Supply and Return Ducts PMCS .....	0016-4
Figure 2. Before, During, and After Operation PMCS for Operator Control Box and Operator Control Box Cable .....	0016-6
Figure 3. Before and After Operation PMCS for Batteries .....	0016-7
Figure 4. Before, During, and After Operation PMCS for Fuel Supply Service Panel, External Fuel Hose, Fuel Pump and Fuel Filter .....	0016-9
Figure 5. Before, During, and After Operation PMCS for Exhaust stack assembly and Inlet and outlet duct housings .....	0016-10
Figure 6. Before, During, and After Operation PMCS for Engine Oil Level, Engine Air Element, and Engine .....	0016-11
Figure 7. During Operation PMCS for Carbon Monoxide Detector on Operator Control Box and Fuel Gauge .....	0016-13
Figure 8. After Operation PMCS for Drive Shaft Coupling .....	0016-14
Figure 9. Monthly Operation PMCS for Jack Assembly .....	0016-15
Table 2. PMCS Mandatory Replacement Parts List .....	0016-17
Table 3. Lubricant Table for Large Capacity Field Heater, Type II, (LCFH Type II) .....	0016-19
Figure 10. Change Engine Oil .....	0016-20

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
<b>Chapter 6 – Operator Maintenance</b>	
Wheel Retraction Assembly, Replace.....	WP 0017
Figure 1. Replace Wheel Retraction Assembly.....	0017-2
Air Cleaner, Inspect, Service.....	WP 0018
Figure 1. Inspect and Replace Filter Element.....	0018-2
Carbon Monoxide Detector – Operator Control Box, Inspect, Test.....	WP 0019
Figure 1. Open and Inspect Operator Control Box.....	0019-1
Figure 2. Test the CO Detector.....	0019-2
Operator Control Box Assembly, Repair, Replace.....	WP 0020
Figure 1. Repair and Replace Operator Control Box.....	0020-1
Insulated Air Duct, 16 IN. X 15 FT., Inspect, Repair.....	WP 0021
Figure 1. Inspect and Repair Insulated Air Duct, 16 IN. X 15 FT.....	0021-2
<b>Chapter 7 – Service Maintenance</b>	
Service Upon Receipt.....	WP 0022
Service Maintenance, Introduction.....	WP 0023
Fuel Tank, Service.....	WP 0024
Figure 1. Service Fuel Tank.....	0024-2
Oil Pressure Switch, Inspect, Test, Replace.....	WP 0025
Figure 1. Oil Pressure Switch Inspection.....	0025-1
Figure 2. Replace Oil Pressure Switch.....	0025-3
Sheet Sound Installation, Inspect, Replace.....	WP 0026
Figure 1. Replace Foam Insulation.....	0026-2
Jack Assembly, Replace.....	WP 0027
Figure 1. Replace Jack Assembly.....	0027-2
Cabinet, Inspect, Service, Repair.....	WP 0028
Figure 1. Lubricate All Latches.....	0028-2
Door Latch, Service, Replace.....	WP 0029
Figure 1. Replace Door Latch.....	0029-2
Operator Box Mounting Bracket, Replace.....	WP 0030
Figure 1. Replace Operator Box Mounting Brackets.....	0030-2
Carbon Monoxide Detector – Cabinet, Inspect, Test, Replace.....	WP 0031
Figure 1. Open Fan Compartment Cover.....	0031-2
Figure 2. Inspect the Carbon Monoxide Detector.....	0031-3
Figure 3. Test the Carbon Monoxide Detector.....	0031-4
Figure 4. Replace the Carbon Monoxide Detector.....	0031-6



**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Exhaust Tube, Inspect, Repair.....	WP 0032
Figure 1. Inspect and Repair Heat Exchanger Exhaust Tube.....	0032-2
Mobility Handle, Replace.....	WP 0033
Figure 1. Removing the Carbon Monoxide Detector Cabinet Cover..	0033-1
Figure 2. Removing Bolts Along Edge of Heat Exchanger Cover.....	0033-2
Figure 3. Removing the Damaged Mobility Handle.....	0033-2
Figure 4. Installing the New Mobility Handle .....	0033-3
Figure 5. Reinstalling Bolts in Heat Exchanger Cover .....	0033-3
Figure 6. Installing the Covers on the Cabinet.....	0033-4
Figure 7. Removing the Damaged Rear Mobility Handle.....	0033-5
Figure 8. Installing New Rear Mobility Handle .....	0033-6
Figure 9. Closing Fuel System and Burner Access Doors .....	0033-6
10- Micron Fuel Filter, Service, Replace.....	WP 0034
Figure 1. Service and Replace Fuel Filter (Sheet 1 of 2).....	0034-3
Figure 1. Service and Replace Fuel Filter (Sheet 2 of 2).....	0034-4
Electrical Fuel Pump, Service, Replace .....	WP 0035
Figure 1. Service and Replace Electronic Fuel Pump (Sheet 1 of 2)..	0035-3
Figure 1. Service and Replace Electronic Fuel Pump (Sheet 2 of 2)..	0035-4
3-Way Fuel Solenoid Valve, Replace.....	WP 0036
Figure 1. Replace 3-Way Fuel Solenoid Valve (Sheet 1 of 2).....	0036-3
Figure 1. Replace 3-Way Fuel Solenoid Valve (Sheet 2 of 2).....	0036-4
Main Battery Shut-Off Switch, Test, Replace.....	WP 0037
Figure 1. Replace Main Battery Shut-Off Switch (Sheet 1 of 2).....	0037-3
Figure 1. Replace Main Battery Shut-Off Switch (Sheet 2 of 2).....	0037-4
Mechanical Hour Meter, Test, Replace.....	WP 0038
Figure 1. Test and Replace Mechanical Hour Meter.....	0038-2
2-Way Fuel Solenoid Valve, Replace.....	WP 0039
Figure 1. Removing Hardware Securing Retaining Plate.....	0039-1
Figure 2. Remove Fuel Filler Cap and Strainer.....	0039-2
Figure 3. Remove Retaining Plate .....	0039-2
Figure 4. Remove Hardware from Perimeter of End Panel.....	0039-3
Figure 5. Move End Panel from Heater to Gain Fuel Hose Access ...	0039-3
Figure 6. Remove External Fuel Hose from Fitting .....	0039-4
Figure 7. Set End Panel Aside .....	0039-5

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 8. Remove Burner Feed Line from Elbow Fitting .....	0039-5
Figure 9. Remove Burner Fuel Pump Fuel Hose to Elbow and Tee ..	0039-5
Figure 10. Disconnect Solenoid Wire Harness Connector .....	0039-6
Figure 11. Remove Screws at Base of 2-Way Solenoid Valve .....	0039-6
Figure 12. Remove Assembly and Place on Work Surface .....	0039-7
Figure 13. Remove Elbow Fitting from Side of Solenoid Valve.....	0039-7
Figure 14. Remove Defective Solenoid Valve and Clean Fittings.....	0039-8
Figure 15. Removing Hardware Securing Retaining Plate.....	0039-8
Figure 16. Apply Thread Sealant and Install Elbow Fitting .....	0039-9
Figure 17. Install Reassembled Assembly onto Burner Bracket.....	0039-9
Figure 18. Install Burner Fuel Pump Hose on Elbow and Tee .....	0039-10
Figure 19. Install Burner Feed Line on Elbow Fitting .....	0039-10
Figure 20. Connect Solenoid Wire Harness Connector .....	0039-11
Figure 21. Move End Panel into Position Near Fuel Tank End.....	0039-11
Figure 22. Install External Fuel Hose to Fitting .....	0039-12
Figure 23. Position Retaining Plate Over Fuel Tank Filler Neck .....	0039-12
Figure 24. Install Hardware Around Perimeter of End Panel .....	0039-13
Figure 25. Install Hardware to Secure Retaining Plate .....	0039-13
Pressure Gage, Replace .....	WP 0040
Figure 1. Removing Hardware Securing Retaining Plate.....	0040-1
Figure 2. Remove Fuel Filler Cap and Strainer.....	0040-2
Figure 3. Remove Retaining Plate .....	0040-2
Figure 4. Remove Hardware from Perimeter of End Panel.....	0040-3
Figure 5. Move End Panel from Heater to Gain Access .....	0040-3
Figure 6. Remove External Fuel Hose from Fitting .....	0040-4
Figure 7. Set End Panel Aside .....	0040-4
Figure 8. Install New Pressure Gage .....	0040-5
Figure 9. Move End Panel into Position Near Fuel Tank .....	0040-6
Figure 10. Install External Fuel Hose to Fitting .....	0040-6
Figure 11. Position Retaining Plate Over Fuel Tank Filler Neck .....	0040-7
Figure 12. Install Hardware Around Perimeter of End Panel .....	0040-7
Figure 13. Install Hardware to Secure Retaining Plate .....	0040-8

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Fuel Tank, Repair, Replace.....	WP 0041
Figure 1. Removing Hardware Securing Retaining Plate.....	0041-1
Figure 2. Remove Fuel Filler Cap and Strainer.....	0041-2
Figure 3. Remove Retaining Plate .....	0041-2
Figure 4. Remove Hardware from Perimeter of End Panel.....	0041-3
Figure 5. Move End Panel from Heater to Gain Access .....	0041-3
Figure 6. Remove External Fuel Hose from Fitting .....	0041-4
Figure 7. Set End Panel Aside .....	0041-4
Figure 8. Repairing the Fuel Tank.....	0041-5
Figure 9. Move End Panel into Position Near Fuel Tank End of Heater.....	0041-6
Figure 10. Install External Fuel Hose to Fitting .....	0041-6
Figure 11. Position Retaining Plate Over Fuel Tank Filler Neck .....	0041-7
Figure 12. Install Hardware Around Perimeter of End Panel .....	0041-7
Figure 13. Install Hardware to Secure Retaining Plate .....	0041-8
Figure 14. Replace Fuel Tank.....	0041-10
Fuel Tank Level Switch, Replace.....	WP 0042
Figure 1. Removing Hardware Securing Retaining Plate.....	0042-1
Figure 2. Remove Fuel Filler Cap and Strainer.....	0042-2
Figure 3. Remove Retaining Plate .....	0042-2
Figure 4. Remove Hardware from Perimeter of End Panel.....	0042-3
Figure 5. Move End Panel from Heater to Gain Access .....	0042-3
Figure 6. Remove External Fuel Hose from Fitting .....	0042-4
Figure 7. Set End Panel Aside .....	0042-4
Figure 8. Replace Fuel Tank Level Switch.....	0042-6
Figure 9. Move End Panel into Position Near Fuel Tank End of Heater.....	0042-8
Figure 10. Install External Fuel Hose to Fitting .....	0042-8
Figure 11. Position Retaining Plate Over Fuel Tank Filler Neck .....	0042-9
Figure 12. Install Hardware Around Perimeter of End Panel .....	0042-9
Figure 13. Install Hardware to Secure Retaining Plate .....	0042-10
External Fuel Supply Connector, Inspect, Replace .....	WP 0043
Figure 1. Inspect and Replace External Fuel Supply Connector .....	0043-2
External Fuel Hose Assembly, Inspect, Repair.....	WP 0044
Figure 1. Inspect and Repair External Fuel Hose Assembly.....	0044-2

**TABLE OF CONTENTS - Continued**

Page No.  
WP Sequence No.

Figure 2. Repairing the External Fuel Hose by Replacing Fittings....0044-3  
 Burner Fuel Pump Assembly, Inspect, Replace, Adjust ..... WP 0045  
 Figure 1. Inspect Burner Fuel Pump Assembly and Flexible Shaft....0045-2  
 Figure 2. Remove Negative Terminal of Battery Closest to  
     Engine Access Door.....0045-3  
 Figure 3. Remove Jumper Cable Between Batteries .....0045-4  
 Figure 4. Remove Hardware Securing Battery T-bar Closest to  
     Access Door .....0045-4  
 Figure 5. Remove Battery Hold-down Bracket.....0045-5  
 Figure 6. Remove Battery Closest to Engine Access Door.....0045-5  
 Figure 7. Remove Hardware Securing Battery T-bar Farthest  
     from Access Door.....0045-6  
 Figure 8. Remove Battery Hold-down Bracket of Battery Farthest  
     from Access Door.....0045-6  
 Figure 9. Remove Positive Battery Cable of Battery Farthest  
     from Access Door.....0045-7  
 Figure 10. Remove Battery Farthest from Access Door .....0045-7  
 Figure 11. Remove Wires Connected to Burner Fuel Pump.....0045-8  
 Figure 12. Tag and Mark All Fuel Hoses.....0045-8  
 Figure 13. Remove Fuel Hose at Back of Burner Fuel Pump .....0045-9  
 Figure 14. Remove Fuel Hose at Bottom of Burner Fuel Pump.....0045-9  
 Figure 15. Remove Fuel Hose at Top of Burner Fuel Pump..... 0045-10  
 Figure 16. Remove Hardware Securing Burner Fuel Pump to  
     Flywheel Cover ..... 0045-10  
 Figure 17. Remove Burner Fuel Pump from Flywheel Cover ..... 0045-11  
 Figure 18. Apply Grease to Burner Fuel Pump Shaft and  
     Drive Shaft Coupling..... 0045-11  
 Figure 19. Engage Burner Fuel Pump Shaft into Drive Shaft  
     Coupling..... 0045-12  
 Figure 20. Secure Burner Fuel Pump to Flywheel Cover..... 0045-12  
 Figure 21. Reinstall Fuel Hoses onto Burner Fuel Pump Fittings ... 0045-13  
 Figure 22. Reconnect Wires to Burner Fuel Pump..... 0045-14  
 Figure 23. Install Battery Farthest from Access Door ..... 0045-14  
 Figure 24. Install Positive Battery Terminal of Battery Farthest  
     from Access Door ..... 0045-15

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 25. Install Battery Hold-down Bracket and Secure with Hardware.....	0045-15
Figure 26. Install Battery Closest to Access Door.....	0045-16
Figure 27. Install Battery Hold-down Bracket on Battery Farthest from Access Door.....	0045-16
Figure 28. Secure Battery Hold-down Bracket with Hardware.....	0045-17
Figure 29. Install Jumper Cable Between Batteries.....	0045-17
Figure 30. Install Negative Terminal on Battery Closest to Access Door.....	0045-18
Figure 31. Adjust Burner Fuel Pump Assembly.....	0045-23
Inlet Fan Assembly, Replace.....	WP 0046
Figure 1. Replace Inlet Fan Assembly.....	0046-2
Safety Screen, Inspect, Replace.....	WP 0047
Figure 1. Inspect and Replace Safety Screens.....	0047-2
Engine System Assembly, Repair.....	WP 0048
Table 1. Replaceable Components Used To Repair Engine System Assembly.....	0048-1
24V Alternator Assembly with Pulley, Inspect, Test, Adjust, Replace.....	WP 0049
Figure 1. Inspect the Alternator Belt for Damage or Wear.....	0049-1
Figure 2. Test the Alternator.....	0049-2
Figure 3. Adjust and Replace 24V Alternator Assembly and Drive Belt.....	0049-5
Coupling Assembly, Replace.....	WP 0050
Figure 1. Replace Flexible Shaft Coupling.....	0050-3
Diesel Engine, Service, Repair.....	WP 0051
Figure 1. Check Oil.....	0051-2
Table 1. Replaceable Components Used to Repair Diesel Engine....	0051-3
Crankcase Cover, Replace.....	WP 0052
Figure 1. Remove Crankcase Cover.....	0052-2
Figure 2. Inspect and Install Crankcase Cover.....	0052-4
Figure 3. Remove Crankcase Cover.....	0052-6
Figure 4. Install Crankcase Cover.....	0052-8
Rocker Arm Assembly, Remove, Adjust, Install.....	WP 0053
Figure 1. Remove, Adjust, and Install Rocker Arm Assembly.....	0053-2

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Air Cleaner Assembly, Remove, Inspect, Install, Repair .....	WP 0054
Figure 1. Remove Diesel Engine Air Cleaner Components .....	0054-2
Figure 2. Inspect and Install Diesel Engine Air Cleaner Components .....	0054-4
Oil Strainer, Remove, Inspect, Install.....	WP 0055
Figure 1. Remove, Inspect, Install Oil Strainer.....	0055-2
Diesel Engine Fuel Injector, Remove, Inspect, Install, Repair.....	WP 0056
Figure 1. Remove, Inspect, and Install Diesel Engine Fuel Injector...	0056-2
Electric Starter Assembly, Remove, Service, Inspect, Install .....	WP 0057
Figure 1. Remove, Service, Inspect, and Install Diesel Engine Electric Starter.....	0057-3
Flywheel Assembly, Remove, Adjust, Inspect, Install, Repair .....	WP 0058
Figure 1. Remove, Service, Inspect, and Install Flywheel Housing and Cover.....	0058-3
Oil Fill Cap, Remove, Inspect, Install .....	WP 0059
Figure 1. Remove, Inspect, Install Oil Fill Cap .....	0059-2
Solenoid, Engine Shutdown Replace.....	WP 0060
Figure 1. Removing Solenoid Wire and Bolt Securing Solenoid Bracket .....	0060-1
Figure 2. Removing the Defective Engine Shutdown Solenoid from Fitting .....	0060-2
Figure 3. Installing a New Engine Shutdown Solenoid over Fitting....	0060-3
Figure 4. Installing Hex Head Screw on Engine Shutdown Solenoid .....	0060-3
Figure 5. Securing Engine Shutdown Solenoid to Mounting Bracket and Connecting Wire .....	0060-4
Burner Assembly, Service, Adjust, Repair .....	WP 0061
Figure 1. Disconnecting Electrical Connectors from Burner Assembly.....	0061-1
Figure 2. Removing the Ignition Assembly.....	0061-2
Figure 3. Removing Fuel Line and Spline Nut from Fuel Line Tube ..	0061-3
Figure 4. Removing Fuel Line Tube from Housing Assembly.....	0061-3
Figure 5. Removing Nozzle Assembly and Cleaning Swirlers .....	0061-4
Figure 6. Installing the Nozzle Assembly in Housing Assembly.....	0061-4
Figure 7. Installing the Fuel Tube.....	0061-4
Figure 8. Installing the Spline Nut .....	0061-5

**TABLE OF CONTENTS - Continued**

Page No.  
WP Sequence No.

Figure 9. Installing Fuel Line onto Fuel Line Tube .....	0061-5
Figure 10. Installing the Ignition Assembly on Burner Housing.....	0061-5
Figure 11. Reconnecting Electrical Connectors .....	0061-6
Figure 12. Disconnecting Electrical Connectors from Burner Assembly .....	0061-7
Figure 13. Removing the Ignition Assembly .....	0061-7
Figure 14. Removing Fuel Line and Spline Nut from Fuel Line Tube.....	0061-8
Figure 15. Removing Fuel Line Tube from Housing Assembly.....	0061-8
Figure 16. Removing Nozzle Assembly and Cleaning Swirlers .....	0061-9
Figure 17. Loosening Screw on Electrode Clamp .....	0061-9
Figure 18. Electrode and Nozzle Gap Adjustment Tool .....	0061-9
Figure 19. Adjusting Electrode Tip Distance from Nozzle Tip.....	0061-10
Figure 20. Adjusting the Electrode Tip Spacing .....	0061-10
Figure 21. Tightening Screw on Electrode Clamp.....	0061-11
Figure 22. Installing the Nozzle Assembly in Housing Assembly....	0061-11
Figure 23. Installing the Fuel Tube .....	0061-11
Figure 24. Installing the Spline Nut .....	0061-12
Figure 25. Installing Fuel Line onto Fuel Line Tube .....	0061-12
Figure 26. Installing the Ignition Assembly on Burner Housing.....	0061-12
Figure 27. Reconnecting Electrical Connectors .....	0061-13
Figure 28. Electrode and Nozzle Gap Adjustment Tool Template..	0061-15
Combustion Blower, Inspect, Test, Replace .....	WP 0062
Figure 1. Disconnect Combustion Blower Wiring Harness Connector .....	0062-2
Figure 2. Remove Combustion Blower from Burner Housing .....	0062-2
Figure 3. Remove, Clean, and Install Combustion Blower Wheel .....	0062-3
Figure 4. Install the Combustion Blower to Burner Housing .....	0062-3
Figure 5. Secure Combustion Blower to Burner Housing with Bolts..	0062-4
Figure 6. Connect Combustion Blower Wiring Harness Connector ...	0062-4
Flame Sensor, Inspect, Test, Replace .....	WP 0063
Figure 1. Inspect the Flame Sensor Wiring Harness and Connector .....	0063-1
Figure 2. Remove Hardware Securing Ignition Assembly.....	0063-2
Figure 3. Partially Remove Ignition Assembly to Expose Flame Sensor .....	0063-2

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 4. Inspect the Flame Sensor .....	0063-3
Figure 5. Position Ignition Assembly on Burner Housing and Secure with Hardware .....	0063-3
Figure 6. Remove Screws Securing Ignition Assembly .....	0063-4
Figure 7. Partially Remove Ignition Assembly to Expose Flame Sensor .....	0063-5
Figure 8. Disconnect Flame Sensor Connector .....	0063-5
Figure 9. Connect Multimeter Leads to Flame Sensor Connector .....	0063-6
Figure 10. Block Light from Flame Sensor .....	0063-6
Figure 11. Reconnect Flame Sensor Connector .....	0063-7
Figure 12. Position Ignition Assembly on Burner Housing and Secure with Screws .....	0063-7
Figure 13. Disconnect Flame Sensor Connector .....	0063-8
Figure 14. Remove Screws Securing Ignition Assembly .....	0063-9
Figure 15. Partially Remove Ignition Assembly to Expose Flame Sensor .....	0063-9
Figure 16. Unplug and Remove Defective Photocell from Flame Sensor .....	0063-10
Figure 17. Install New Flame Sensor Photocell .....	0063-10
Figure 18. Position Ignition Assembly on Burner Housing and Secure with Screws .....	0063-11
Figure 19. Reconnect Flame Sensor Connector .....	0063-11
Ignition Assembly, Replace .....	WP 0064
Figure 1. Remove Screws Securing Ignition Assembly .....	0064-2
Figure 2. Partially Remove Ignition Assembly to Expose Flame Sensor .....	0064-2
Figure 3. Remove Flame Sensor Bracket from Slot on Ignition Transformer .....	0064-3
Figure 4. Disconnect Ignition Transformer Connector and Cut Wires .....	0064-3
Figure 5. Remove Conduit Cover and Remove Defective Ignition Transformer .....	0064-4
Figure 6. Install New Ignition Transformer .....	0064-4
Figure 7. Install Wire Pins into Connector Body .....	0064-5
Figure 8. Reinstall Flame Sensor Assembly Bracket into Slot on Ignition Transformer .....	0064-5



**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 9. Position Ignition Transformer on Burner Housing and Secure with Screws.....	0064-6
Figure 10. Reinstall Conduit Cover .....	0064-6
Figure 11. Reconnect Ignition Transformer Connector .....	0064-7
Burner Nozzle and Electrode Assembly Repair, Replace.....	WP 0065
Figure 1. Disconnecting Electrical Connectors from Burner Assembly .....	0065-1
Figure 2. Removing the Ignition Assembly .....	0065-2
Figure 3. Removing Fuel Line and Spline Nut from Fuel Line Tube ..	0065-3
Figure 4. Removing Fuel Line Tube from Housing Assembly.....	0065-4
Figure 5. Removing Nozzle Assembly .....	0065-4
Figure 6. Replace Burner Nozzle and Electrode Assembly .....	0065-5
Figure 7. Cleaning Swirlers .....	0065-6
Figure 8. Loosening Screw on Electrode Clamp.....	0065-6
Figure 9. Electrode and Nozzle Gap Adjustment Tool .....	0065-6
Figure 10. Adjusting Electrode Tip Distance from Nozzle Tip.....	0065-7
Figure 11. Adjusting the Electrode Tip Spacing .....	0065-7
Figure 12. Tightening Screw on Electrode Clamp.....	0065-8
Figure 13. Install Burner Nozzle and Electrode Assembly .....	0065-9
Heat Exchanger, Inspect, Service, Replace.....	WP 0066
Figure 1. Inspect Heat Exchanger .....	0066-1
Figure 2. Heat Exchanger Inspection .....	0066-3
Figure 3. Drain Condensation from Heat Exchanger .....	0066-4
Figure 4. Clean Burner Tube Assembly .....	0066-5
Figure 5. Replace Heat Exchanger .....	0066-8
High Temperature Cutout Sensor, Test, Replace.....	WP 0067
Figure 1. Remove the Safety Screen .....	0067-1
Figure 2. Test and Replace High Temperature Cutout Sensor.....	0067-2
Figure 3. Install the Safety Screen .....	0067-3
Outlet Temperature Sensor, Test, Replace .....	WP 0068
Figure 1. Remove Heat Exchanger Panels .....	0068-1
Figure 2. Test for Continuity Across the Outlet Temperature Sensor Terminals .....	0068-2
Figure 3. Replace Outlet Temperature Sensor .....	0068-3

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Burner Relay, Replace .....	WP 0069
Figure 1. Remove Defective Burner Relay K2 .....	0069-1
Figure 2. Tag and Remove Wires from Burner Relay .....	0069-2
Figure 3. Connect Wires to New Burner Relay .....	0069-2
Figure 4. Install New Burner Relay on Bulkhead and Secure with Screw .....	0069-3
Wire Harness Assemblies, Inspect, Repair .....	WP 0070
Figure 1. Inspect and Repair Wire Harness Assemblies .....	0070-2
Battery Terminal Cable and Power Assemblies, Inspect, Service, Replace .....	WP 0071
Figure 1. Inspect, Service, Replace Battery Terminal Connector .....	0071-3
Battery, Inspect, Test, Replace .....	WP 0072
Figure 1. Inspect and Replace Battery .....	0072-3
Battery T-Bar and Hold Down Plate Assembly, Inspect, Replace .....	WP 0073
Figure 1. Inspect and Replace Battery T-Bar and Hold Down Plate Assembly .....	0073-2
Main Control Box Assembly, Replace .....	WP 0074
Figure 1. Replace Main Control Box Assembly .....	0074-2
NATO Connector, Remove, Inspect, Install .....	WP 0075
Figure 1. Remove, Inspect, and Install NATO Connector .....	0075-2
Operator Control Box Cable Assembly, Inspect, Test, Replace .....	WP 0076
Figure 1. Inspect Operator Control Box Cable Assembly .....	0076-1
Figure 2. Test Operator Control Box Cable Assembly .....	0076-2
Figure 3. Replace Operator Control Box Cable Assembly .....	0076-3
Carbon Monoxide Detector – Operator Control Box, Inspect, Test, Replace .....	WP 0077
Figure 1. Operator Control Box Mounted Carbon Monoxide Detector .....	0077-2
Preparation For Shipment and Storage .....	WP 0078
<b>Chapter 8 – Field Maintenance</b>	
Cabinet, Repair .....	WP 0079
Figure 1. Repair Top Panel Assembly .....	0079-2
Figure 2. Repair Rear Panel Assembly .....	0079-3
Figure 3. Repair Side and Front Door Assemblies .....	0079-4
Engine System Assembly, Replace .....	WP 0080
Diesel Engine, Repair, Replace .....	WP 0081
Table 1. Replaceable Components Used to Repair Diesel Engine ..	0081-1
Figure 1. Remove the Top Engine Compartment Cover .....	0081-2

**TABLE OF CONTENTS - Continued**

Page No.  
WP Sequence No.

Figure 2. Remove Negative Terminal of Battery Closest to Engine  
 Access Door .....0081-3

Figure 3. Remove Jumper Cable Between Batteries .....0081-4

Figure 4. Remove Hardware Securing Battery T-bar Closest to  
 Access Door .....0081-4

Figure 5. Remove Battery Hold-down Bracket.....0081-5

Figure 6. Remove Battery Closest to Engine Access Door.....0081-5

Figure 7. Remove Hardware Securing Battery T-bar Farthest from  
 Access Door .....0081-6

Figure 8. Remove Battery Hold-down Bracket of Battery Farthest  
 from Access Door .....0081-6

Figure 9. Remove Positive Battery Cable of Battery Farthest from  
 Access Door .....0081-7

Figure 10. Remove Battery Farthest from Access Door .....0081-7

Figure 11. Starter and Oil Pressure Switch Wires.....0081-8

Figure 12. Disconnect Flexible Exhaust Tube.....0081-8

Figure 13. Disconnect Wiring from Engine Shutdown Solenoid  
 and Burner Fuel Pump Solenoid .....0081-9

Figure 14. Remove Fuel Supply Hose From Tee and Clamp From  
 Flywheel Housing ..... 0081-10

Figure 15. Remove Dust Boot and Disconnect Wire from GP1 ..... 0081-11

Figure 16. Remove Harness from Burner Fuel Pump Housing..... 0081-11

Figure 17. Remove Cables and Grounding Strap from Base of  
 Engine..... 0081-12

Figure 18. Disconnect Remaining Two Fuel Lines from Burner  
 Pump ..... 0081-12

Figure 19. Remove Screws Securing Mounting Bracket to Engine  
 Vibration Mounts..... 0081-13

Figure 20. Remove Engine Head Cooling Air Inlet Hose ..... 0081-13

Figure 21. Remove Engine Oil Drain Hose from Spring Clamp ..... 0081-14

Figure 22. Attach Chain Lift to Engine Lifting Cable..... 0081-14

Figure 23. Remove Engine from Heater and Place on Rugged  
 Work Surface ..... 0081-15

Figure 24. Remove Engine Head Cooling Air Inlet Box ..... 0081-16

Figure 25. Remove Fuel Hose from Fuel Injector Pump..... 0081-16

Figure 26. Remove Hose from Engine Shutdown Solenoid Fitting.. 0081-17

Figure 27. Remove Fuel Hose from Fuel Injector Pump..... 0081-17

Figure 28. Remove Burner Pump Housing with Burner Fuel Pump  
 Attached..... 0081-17

**TABLE OF CONTENTS - Continued**

Page No.  
WP Sequence No.

Figure 29. Prevent the Flywheel from Turning ..... 0081-18

Figure 30. Remove Coupling from Engine Flywheel ..... 0081-18

Figure 31. Mark the Engine Shaft..... 0081-19

Figure 32. Loosen the Coupler Grip on Engine Shaft ..... 0081-19

Figure 33. Remove Hub and Rubber Coupling ..... 0081-20

Figure 34. Remove Engine Drain Hose and Drain Fitting ..... 0081-20

Figure 35. Remove Jumper from Rear of Air Preheater ..... 0081-21

Figure 36. Remove Ground Strap from Air Preheater..... 0081-21

Figure 37. Remove Lift Cable..... 0081-22

Figure 38. Install Drain Hose ..... 0081-22

Figure 39. Install Coupling Hub on Drive Shaft ..... 0081-23

Figure 40. Align Large Hole In Flywheel with Matching Hole in  
 Engine Block ..... 0081-23

Figure 41. Install Fuel Pump Coupling ..... 0081-24

Figure 42. Apply Grease to Burner Fuel Pump and Pump Drive  
 Coupling ..... 0081-24

Figure 43. Orient Engine Shaft and Burner Fuel Pump Shaft..... 0081-25

Figure 44. Install Burner Fuel Pump Housing ..... 0081-25

Figure 45. Install Engine Head Cooling Air Inlet Box ..... 0081-26

Figure 46. Install Engine Air Preheater Ground Strap..... 0081-27

Figure 47. Install Jumper on Engine Air Preheater ..... 0081-27

Figure 48. Install Fuel Hose onto Fuel Injector Pump ..... 0081-28

Figure 49. Install Hose onto Engine Shutdown Solenoid Fitting ..... 0081-28

Figure 50. Remove Fuel Hose from Fuel Injector Pump ..... 0081-29

Figure 51. Reinstalling the Engine into the Heater..... 0081-29

Figure 52. Reinstalling Engine Oil Pressure Wire ..... 0081-30

Figure 53. Securing Mounting Brackets to Vibration Mounts ..... 0081-31

Figure 54. Install Harness Over Burner Pump Housing ..... 0081-32

Figure 55. Install Engine Oil Hose in Spring Clamp ..... 0081-32

Figure 56. Install Engine Head Cooling Air Inlet Hose ..... 0081-33

Figure 57. Connect Two Fuel Hoses to Burner Fuel Pump ..... 0081-33

Figure 58. Install Wire to Threaded Stud Labeled GP1 ..... 0081-34

Figure 59. Install Battery Cables and Grounding Straps..... 0081-34

Figure 60. Install Fuel Line Clamp to Midpoint of Flywheel Housing 0081-35

Figure 61. Connect Fuel Supply Hose to Arm of Tee Connector..... 0081-35

Figure 62. Connect Wires to Engine Shutdown and Burner Fuel  
 Pump Solenoid ..... 0081-36

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 63. Connect Wires to Starter Solenoid.....	0081-36
Figure 64. Install New Flexible Exhaust Tube .....	0081-37
Figure 65. Install Battery Farthest from Access Door.....	0081-37
Figure 66. Install Positive Battery Terminal of Battery Farthest from Access Door .....	0081-38
Figure 67. Install Battery Hold-down Bracket and Secure with Hardware .....	0081-38
Figure 68. Install Battery Closest to Access Door .....	0081-39
Figure 69. Install Battery Hold-down Bracket on Battery Farthest from Access Door .....	0081-39
Figure 70. Secure Battery Hold-down Bracket with Hardware .....	0081-40
Figure 71. Install Jumper Cable Between Batteries .....	0081-40
Figure 72. Install Negative Terminal on Battery Closest to Access Door.....	0081-41
Figure 73. Install Top Engine Compartment Cover .....	0081-41
Figure 74. Install Top Engine Compartment Cover .....	0081-42
Cylinder Head, Remove, Inspect, Install, Repair .....	WP 0082
Figure 1. Remove Cylinder Head, O-Ring, Cylinder Head Gasket, Valve Cap, Cotter Assembly, Spring, Valve Stem Seal, and Air Intake Pipe Studs.....	0082-3
Figure 2. Service Cylinder Head Components .....	0082-4
Figure 3. Measure Stems, Valves, and Springs .....	0082-5
Figure 4. Inspect Stems, Valves, and Springs .....	0082-6
Figure 5. Install Air Intake Pipe Studs, Valves, Valve Stem Seal, Valve Spring, Cotter Assembly, and Cylinder Head .....	0082-8
Oil Pump, Remove, Inspect, Install, Repair .....	WP 0083
Figure 1. Remove Oil Pump .....	0083-2
Figure 2. Remove Oil Pump .....	0083-3
Figure 3. Inspect Oil Pump .....	0083-5
Figure 4. Install Oil Pump .....	0083-5
Rocker Arm Assembly, Remove, Inspect, Install, Repair .....	WP 0084
Figure 1. Remove, Inspect, and Install Rocker Arm Assembly .....	0084-2
Figure 2. Measure Rocker Arm Assembly.....	0084-3
Fuel Injection Pump Assembly, Remove, Inspect, Install, Adjust .....	WP 0085
Figure 1. Remove Fuel Injection Pump .....	0085-2
Figure 2. Inspect Fuel Injection Pump .....	0085-4
Figure 3. Install Fuel Injection Pump .....	0085-5
Figure 4. Fuel Injection Timing Adjustment .....	0085-7

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Governor Control, Remove, Inspect, Install .....	WP 0086
Figure 1. Remove Governor Control .....	0086-2
Figure 2. Install Governor Control .....	0086-4
Diesel Engine Vibration Mounts, Replace .....	WP 0087
Figure 1. Remove the Top Engine Compartment Cover .....	0087-2
Figure 2. Remove Negative Terminal of Battery Closest to Engine Access Door .....	0087-3
Figure 3. Remove Jumper Cable Between Batteries .....	0087-3
Figure 4. Remove Hardware Securing Battery T-bar Closest to Access Door .....	0087-4
Figure 5. Remove Battery Hold-down Bracket .....	0087-4
Figure 6. Remove Battery Closest to Engine Access Door .....	0087-5
Figure 7. Remove Hardware Securing Battery T-bar Farthest from Access Door .....	0087-5
Figure 8. Remove Battery Hold-down Bracket of Battery Farthest from Access Door .....	0087-6
Figure 9. Remove Positive Battery Cable of Battery Farthest from Access Door .....	0087-6
Figure 10. Remove Battery Farthest from Access Door .....	0087-7
Figure 11. Starter and Oil Pressure Switch Wires .....	0087-7
Figure 12. Disconnect Flexible Exhaust Tube .....	0087-8
Figure 13. Remove Wires from Engine Shutdown Solenoid and Burner Fuel Pump Solenoid .....	0087-8
Figure 14. Remove Fuel Supply Hose from Arm of Tee Connector .....	0087-9
Figure 15. Remove Clamp Securing Fuel Supply Hose to Engine Flywheel Housing .....	0087-9
Figure 16. Remove Wire Connected to Threaded Stud Labeled GP1 .....	0087-10
Figure 17. Remove Bolts Securing Clamps on Burner Pump Housing .....	0087-10
Figure 18. Remove Battery Cables and Grounding Strap .....	0087-11
Figure 19. Disconnect Two Remaining Fuel Lines from Burner Fuel Pump .....	0087-11
Figure 20. Remove Socket Cap Head Screws Securing Engine Mounting Bracket to Vibration Mounts .....	0087-12

**TABLE OF CONTENTS - Continued**

Page No.  
WP Sequence No.

Figure 21. Remove Engine Header Exhaust Hose ..... 0087-12

Figure 22. Remove Engine Oil Drain Hose from Spring Clamp ..... 0087-13

Figure 23. Attach Chain Lift to Engine Lifting Cable..... 0087-13

Figure 24. Remove Engine from Heater..... 0087-14

Figure 25. Marking Location of Vibration Mount..... 0087-14

Figure 26. Removing Defective Vibration Mount..... 0087-15

Figure 27. Cleaning the Area Below the Vibration Mount ..... 0087-15

Figure 28. Place New Vibration Mount in Position and Install Bolt . 0087-16

Figure 29. Installing Nut on Vibration Mount Bolt..... 0087-16

Figure 30. Installing the New Vibration Mount..... 0087-17

Figure 31. Reinstalling the Engine into the Heater..... 0087-18

Figure 32. Reinstalling Engine Oil Pressure Wire ..... 0087-18

Figure 33. Securing Mounting Brackets to Vibration Mounts ..... 0087-19

Figure 34. Install Harness Over Burner Pump Housing ..... 0087-20

Figure 35. Install Engine Oil Hose in Spring Clamp ..... 0087-20

Figure 36. Install Engine Head Cooling Hose ..... 0087-21

Figure 37. Connect Two Fuel Hoses to Burner Fuel Pump ..... 0087-21

Figure 38. Install Wire to Threaded Stud Labeled GP1 ..... 0087-22

Figure 39. Install Battery Cables and Grounding Straps..... 0087-22

Figure 40. Install Fuel Line Clamp to Midpoint of Flywheel  
Housing ..... 0087-23

Figure 41. Connect Fuel Supply Hose to Arm of Tee Connector.... 0087-23

Figure 42. Connect Wires to Engine Shutdown and Burner Fuel  
Pump Solenoid ..... 0087-24

Figure 43. Connect Wires to Starter Solenoid..... 0087-24

Figure 44. Connect Flexible Exhaust Tube to Engine Muffler..... 0087-25

Figure 45. Install Battery Farthest from Access Door ..... 0087-25

Figure 46. Install Positive Battery Terminal of Battery Farthest  
from Access Door..... 0087-26

Figure 47. Install Battery Hold-down Bracket and Secure with  
Hardware..... 0087-26

Figure 48. Install Battery Closest to Access Door ..... 0087-27

Figure 49. Install Battery Hold-down Bracket on Battery Farthest  
from Access Door..... 0087-27

Figure 50. Secure Battery Hold-down Bracket with Hardware..... 0087-28

**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 51. Install Jumper Cable Between Batteries .....	0087-28
Figure 52. Install Negative Terminal on Battery Closest to Access Door.....	0087-29
Figure 53. Install Top Engine Compartment Cover .....	0087-29
Figure 54. Checking for Movement of the Rubber Coupling After Installation.....	0087-30
 Chapter 9 – Sustainment Maintenance	
Diesel Engine, Repair.....	WP 0088
Crankshaft, Remove, Service, Inspect, Install .....	WP 0089
Figure 1. Remove Crankshaft Assembly.....	0089-2
Figure 2. Inspect and Install Crankshaft Assembly .....	0089-5
Balancer Shaft, Remove, Service, Inspect, Install, Repair .....	WP 0090
Figure 1. Inspect Balancer Shaft .....	0090-2
Figure 2. Install Balancer Shaft .....	0090-4
Camshaft Assembly, Remove, Inspect, Install, Repair .....	WP 0091
Figure 1. Remove Camshaft Assembly.....	0091-2
Figure 2. Inspect and Install Camshaft Assembly .....	0091-4
Fuel Injection Pump Assembly, Disassembly, Service, Inspect, Assembly, Repair .....	WP 0092
Figure 1. Disassembly, Service, Inspect, Assembly Fuel Injection Pump.....	0092-3
Piston And Connecting Rod, Remove, Service, Inspect, Install, Repair.....	WP 0093
Figure 1. Remove and Clean Piston and Connecting Rod .....	0093-3
Figure 2. Measure Piston .....	0093-4
Figure 3. Remove, Service, Inspect, and Install Governor.....	0093-6
Figure 4. Placement of Rings .....	0093-7
Governor Control, Remove, Service, Inspect, Install, Repair .....	WP 0094
Figure 1. Remove, Service, Inspect, and Install Governor.....	0094-2
Assembly, Main Wiring Harness, Replace .....	WP 0095
 Chapter 10 – Parts Information	
Repair Parts and Special Tools List (RPSTL) Introduction .....	WP 0096
Table 1. SMR Code .....	0096-1
Group 01 Assembly, Cabinet .....	WP 0097
Figure 1. Assembly, Cabinet .....	0097-1
Group 01 Insulation, Sheet Sound .....	WP 0098
Figure 2. Insulation, Sheet Sound .....	0098-2
Group 02 Fuel System Assembly.....	WP 0099



**TABLE OF CONTENTS - Continued**

	Page No. <u>WP Sequence No.</u>
Figure 3. Fuel System Assembly.....	0099-1
Group 02 Burner Fuel Valve Assembly.....	WP 0100
Figure 4. Burner Fuel Valve Assembly.....	0100-2
Group 02 Fuel Tank Assembly.....	WP 0101
Figure 5. Fuel Tank Assembly.....	0101-2
Group 03 Inlet Fan Assembly.....	WP 0102
Figure 6. Inlet Fan Assembly.....	0102-2
Group 03 Assembly, Engine System .....	WP 0103
Figure 7. Assembly, Engine System .....	0103-1
Group 03 Engine, Diesel .....	WP 0104
Figure 8. Engine, Diesel .....	0104-1
Group 04 Burner Assembly.....	WP 0105
Figure 9. Burner Assembly.....	0105-2
Group 04 Transformer, Ignition .....	WP 0106
Figure 10. Transformer, Ignition .....	0106-2
Group 04 Nozzle, Burner.....	WP 0107
Figure 11. Nozzle, Burner.....	0107-2
Group 04 Assembly, Heat Exchanger.....	WP 0108
Figure 12. Assembly, Heat Exchanger.....	0108-2
Group 04 Assembly, Transition Tube.....	WP 0109
Figure 13. Assembly, Transition Tube.....	0109-2
Group 05 Battery .....	WP 0110
Figure 14. Battery .....	0110-2
Group 06 Connector, NATO.....	WP 0111
Figure 15. Connector, NATO.....	0111-2
Group 07 Assembly, Main Control Box.....	WP 0112
Figure 16. Assembly, Operator Main Control Box.....	0112-2
Group 08 Assembly, Main Control Box.....	WP 0113
Figure 17. Assembly, Operator Control Box – Control Cable.....	0113-1
Group 09 Air Duct, Insulated, 16 IN. DIA X 15 FT. Long .....	WP 0114
Figure 18. Air Duct, Insulated, 16 IN. DIA X 15 FT. ....	0114-2
Group 99 Bulk Material.....	WP 0115
Figure 99. Bulk .....	0115-1
National Stock Number Index .....	WP 0116
Part Number Index .....	WP 0117

**TABLE OF CONTENTS - Continued**

Page No.  
WP Sequence No.

Chapter 11 – Supporting Information

References .....	WP 0118
Maintenance Allocation Chart (MAC) Introduction .....	WP 0119
Maintenance Allocation Chart (MAC).....	WP 0120
Table 1. Maintenance Allocation Chart for Large Capacity Field Heater, Type II, (LCFH Type II) .....	0120-1
Table 2. Tools and Test Equipment for Large Capacity Field Heater, Type II, (LCFH Type II) .....	0120-7
Table 3. Remarks for Large Capacity Field Heater, Type II, (LCFH Type II) .....	0120-7
Components of End Items (COEI) and Basic Issue Items (BII) Lists.....	WP 0121
Table 1. Components of End Items (COEI) List.....	0121-2
Table 2. Basic Issue Items (BII).....	0121-3
Additional Authorized List Items (AAL).....	WP 0122
Table 1. Additional Authorized List Items .....	0122-2
Expendable and Durable Items List .....	WP 0123
Table 1. Expendable and Durable Items List .....	0123-1
Tool Identification List.....	WP 0124
Table 1. Tool Identification List.....	0124-1
Alphabetical Index	
FO 1. LCFH Type II Wiring Diagram .....	FP-1
FO 2. LCFH Type II Wiring Schematic.....	FP-3
FO 3. LCFH Type II Fuel System Schematic Diagram .....	FP-5
FO 4. LCFH Type II Electrode Alignment Tool.....	FP-7

## HOW TO OBTAIN TECHNICAL MANUALS

When a new system is introduced to the Army inventory, it is the responsibility of the receiving units to notify and inform the Unit Publications Clerk that a Technical Manual is available for the new system. Throughout the life cycle of the new system, the Distribution Center DOL-W will also provide updates and change to the Technical Manual.

To receive new Technical Manuals or change packages to existing Technical Manuals (TM) for fielded equipment, provide the Unit Publications Clerk the full Technical Manual number, title, date of publication, and number of copies required. The Unit Publications Clerk will justify the request through the Unit Publications Officer. When the request is approved, the Unit Publications Clerk will use DA Form 12-R to order the series of Technical Manuals from the Army Publishing Directorate (APD).

### Instructions for Unit Publications Clerk

Obtain DA Form 12-R and request a publications account from the APD Website at <http://www.apd.army.mil>. Once on the Website, click on the "Orders/Subscriptions/Reports" tab. From the dropdown menu, select "Establish an Account", then select "Tutorial" and follow the instructions in the tutorial presentation.

Complete information for obtaining Army publications can be found in DA PAM 25-33.

## HOW TO USE THIS MANUAL

In this manual, primary chapters appear in upper case/capital letters; work packages are presented in numeric sequence, e.g., 0001, 0002; paragraphs within a work package are not numbered and are presented in a titled format. For a first level paragraph, titles are in all upper case/capital letters, e.g., FRONT MATTER. Subordinate paragraph titles will have the first letter of the first word of each principal word all upper case/capital letters, e.g., Manual Organization and Page Numbering System. The location of additional material that must be referenced is clearly marked. Illustrations supporting maintenance procedures/text are located underneath, or as close as possible to, their referenced paragraph.

**FRONT MATTER.** Front matter consists of front cover, warning summary, title block, table of contents, and how to use this manual page.

**CHAPTER 1 – GENERAL INFORMATION, EQUIPMENT DESCRIPTION, AND THEORY OF OPERATION.** Chapter 1 Contains introductory information on the Large Capacity Field Heater and its associated equipment as well as theory of operation.

**CHAPTER 2 – OPERATOR INSTRUCTIONS.** Chapter 2 contains operator procedures.

**CHAPTER 3 –TROUBLESHOOTING MASTER INDEX.** Chapter 3 provides a troubleshooting index listing all of the problems you are likely to encounter with the LCFH Type II as well as references to the individual troubleshooting procedure work packages.

**CHAPTER 4 –TROUBLESHOOTING PROCEDURES.** Chapter 4 provides troubleshooting procedures.

**CHAPTER 5 – PMCS MAINTENANCE INSTRUCTIONS.** Chapter 5 contains Preventive Maintenance Checks and Services (PMCS) procedures.

**CHAPTER 6 – OPERATOR MAINTENANCE INSTRUCTIONS.** Chapter 6 provides maintenance procedures authorized at the operator level that include service upon receipt, repair and replacement of key components, and preparation for storage and shipment.

**CHAPTER 7 – SERVICE MAINTENANCE INSTRUCTIONS.** Chapter 7 provides maintenance procedures authorized at the unit level that include repair and replacement of key components.

**CHAPTER 8 – FIELD MAINTENANCE INSTRUCTIONS.** Chapter 8 provides maintenance procedures authorized at the field level that include repair and replacement of key components.

**CHAPTER 9 – SUSTAINMENT MAINTENANCE INSTRUCTIONS.** Chapter 9 provides maintenance procedures authorized at the sustainment level that include repair and replacement of key components.

**CHAPTER 10 – PARTS INFORMATION.** Chapter 10 contains Repair Parts and Special Tools List (RPSTL), national stock number index, and part number index.

**CHAPTER 11 – SUPPORTING INFORMATION.** Chapter 11 contains references, maintenance allocation chart, and expendable and durable items list.

**REAR MATTER.** Rear matter consists of alphabetical index, DA Form 2028, authentication page, and back cover.

**Manual Organization and Page Numbering System.** The manual is divided into eleven major chapters that detail the topics mentioned above. Within each chapter are work packages covering a wide range of topics. Each work package is numbered sequentially starting at page 1. The work package has its own page numbering scheme and is independent of the page numbering used by other work packages. Each page of a work package has a page number of the form XXXX-YY where XXXX is the work package number (e.g. 0010 is work package 10) and YY represents the number of the page within that work package. A page number such as 0010-1/(2 Blank) means that page 1 contains information but page 2 of that work package has been intentionally left blank.

**Finding Information.** The table of contents permits the reader to find information in the manual quickly. The reader should start here first when looking for a specific topic. The table of contents lists the topics, figures and tables contained within each chapter, and the work package sequence number where it can be found.

Example: If the reader were looking for instructions on Operating Under Usual Conditions, the table of contents indicates that information on operation can be found in chapter 2. Scanning down the listings for Chapter 2, information on how to operate the LCFH Type II can be found in WP 0005, Operation Under Usual Condition (i.e. Work Package 5).

An Alphabetical Index can be found at the back of the manual; specific topics are listed with the corresponding work package number.

**END OF WORK PACKAGE**

**CHAPTER 1**

**GENERAL INFORMATION, EQUIPMENT DESCRIPTION,  
AND THEORY OF OPERATION  
FOR  
LARGE CAPACITY FIELD HEATER,  
TYPE II (LCFH TYPE II)**



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**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE****GENERAL INFORMATION**

---

**SCOPE****Type of Manual**

This manual contains an equipment description, operating instructions, and maintenance procedures for the Large Capacity Field Heater, Type II, ( LCFH Type II) NSN 4520-01-559-8737. This manual also provides a Repair Parts and Special Tools List (RPSTL), located in WP 0096 through WP0117. It also includes references to publications that contain information on separately documented components of the LCFH Type II.

**Part Number and Equipment Name**

Part Number 41000, Large Capacity Field Heater, Type II (LCFH Type II).

**Purpose of Equipment**

The LCFH Type II is a heating system that provides clean, heated ventilation air in a military environment and in worldwide temperature extremes. The LCFH Type II provides a minimum of 350,000 BTUH of heat and a minimum ventilation airflow rate of 2000 CFM.

**MAINTENANCE FORMS, RECORDS, AND REPORTS**

Department of the Army forms and procedures used for LCFH Type II maintenance shall be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS) Users Manual.

**REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)**

If your LCFH Type II 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.

If you have Internet access, the easiest and fastest way to report problems or suggestions is to go to <https://aeps.ria.army.mil/aepspublic.cfm> (scroll down and choose the "Submit Quality Deficiency Report" bar). The Internet form lets you choose to submit an Equipment Improvement Recommendation (EIR), a Product Quality Deficiency Report (PQDR) or a Warranty Claim Action (WCA).

You may also submit your information using an SF 368 (Product Quality Deficiency Report). You can send your SF 368 via e-mail, regular mail, or facsimile using the addresses/facsimile numbers specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual. We will send you a reply.

**CORROSION PREVENTION AND CONTROL (CPC)**

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

Corrosion specifically occurs with metals. It is an electrochemical process that causes the degradation of metals. It is commonly caused by exposure to moisture, acids, bases, or salts. An example is the rusting of iron. Corrosion damage in metals can be seen, depending on the metal, as tarnishing, pitting, fogging, surface residue, and/or cracking.

Plastics, composites, and rubbers can also degrade. Degradation is caused by thermal (heat), oxidation (oxygen), solvation (solvents), or photolytic (light, typically UV) processes. The most common exposures are excessive heat or light. Damage from these processes will appear as cracking, softening, swelling, and/or breaking.

SF Form 368, Product Quality Deficiency Report should be submitted to the address specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

**OZONE DEPLETING SUBSTANCES (ODS)**

There are no ozone depleting substances (ODS) used in the Large Capacity Field Heater, Type II.

**DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE**

Destruction of Army materiel to prevent enemy use shall be in accordance with TM 750-244-3.

**PREPARATION FOR STORAGE OR SHIPMENT**

Before placing the LCFH Type II in administrative storage or preparing the system for shipment, current maintenance services must be applied; defects and failures corrected; and Modification Work Orders (MWO's) applied. For storage and shipment, refer to WP 0078 of this manual.

**Placement of equipment in storage.** Equipment should be placed in storage for limited periods only, when a shortage of maintenance capability exists. Items should be mission ready within 24 hours or within time factors set by directing authority. During storage periods, maintenance records must be kept current.

**Battery storage instructions.** Batteries should be connected to a trickle charger at a minimum of every 6 months.

**Storage site selection.** Covered space is preferred. When sufficient covered space is not available, priority should be given to items that are most susceptible to deterioration from the elements. Open sites should be improved hardstand, if available. Unimproved sites should be firm, well-drained locations, free of excessive vegetation.

**WARRANTY INFORMATION**

The LCFH Type II components are warranted by the manufacturer for 5 years. The warranty starts on the date found in block 23, DA Form 2408-9, Equipment Control Record, in the log book. The warranty date is also displayed on the warranty information data plate mounted on the side of the heater. Report defects in material or workmanship to your supervisor, who will take appropriate action through your field maintenance shop.

**NOMENCLATURE CROSS-REFERENCE LIST**

**Table 1. Nomenclature Cross-Reference List.**

COMMON NAME	OFFICIAL NOMENCLATURE
Heater	Large Capacity Field Heater, Type II (LCFH Type II)
10-Micron Fuel Filter	Filter Element, Fluid
Electrical Fuel Pump	Pump, Fuel, Metering and Distributing
3-Way Fuel Solenoid Valve	Valve Assembly, Manifold
Main Battery Shut-Off Switch	Switch, Rotary
Mechanical Hour Meter	SHC Hour Meter
Safety Screen	Air Discharge Collar Assembly Air Inlet Collar Assembly
Woodruff Key	Machine Key



Table 1. Nomenclature Cross-Reference List. - Continued

COMMON NAME	OFFICIAL NOMENCLATURE
High Temperature Cutout Sensor	Thermostatic Switch
Flame Sensor	Cad Cell, Flame Sensor
Burner Relay (K2)	Relay, Electromagnetic, Burner (K2)
Gasket	Adhesive Backed Polyacrylic sponge
2-Way Fuel Solenoid Valve	Solenoid Valve

Table 2. List of Acronyms and Abbreviations

ACRONYM/ ABBREVIATION	MEANING
AAL	Additional Authorization List
A, Amp	Amperes
A/C	Air Conditioner
AMC	Army Materiel Command
AOAP	Army Oil Analysis Program
AR	Army Regulation
ASB	Army Science Board
AUTO	Automatic
BER	Beyond Economical Repair
B-HI	Burner High Fire
BII	Basic Issue Item
B-LO	Burner Low Fire
BOI	Basis of Issue
BTU	British Thermal Unit
BTUH	British Thermal Unit Hours
°C	Degrees Celsius
CAGEC	Commercial and Government Entity Code
CARC	Chemical Agent Resistant Coating
CB	Circuit Breaker
cc	Cubic centimeter
CFM	Cubic Feet per Minute
cm	Centimeter
CO	Carbon Monoxide
COEI	Component of End Item
COM	Common
COP	Computer Operating Properly
CPC	Corrosion Prevention Control
CTA	Common Table of Allowances
DA	Department of the Army
deg	Degree
DIA	Diameter
e.g.	For example
EIR	Equipment Improvement Recommendation
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
etc	Et cetera
°F	Degrees Fahrenheit
FGC	Functional Group Code
FIC/BTDC	Fast Idle Cam/Before Top Dead Center
Fig	Figure
ft	Foot
ft-lb	Foot/pound(s)
GP-1	Glow Plug
gph	Gallons per Hour
HCI	Hardness Critical Item
Hp	Horsepower
Hz	Hertz
IAW	In Accordance With

Table 2. List of Acronyms and Abbreviations. - Continued

ACRONYM/ ABBREVIATION	MEANING
ID	Inside Diameter
i.e.	That is
In	Inch(es)
JIC	Joint Industry Conference
JTA	Joint Table of Allowance
kg	Kilogram(s)
kg-cm	Kilogram-Centimeter
kPa	Kilopascal(s)
kW	Kilowatt
LCFH	Large Capacity Field Heater
l	Liter(s)
Lb	Pound(s)
lph	Liters per Hour
M	Meter(s)
max	maximum
mm	millimeter
MAN	Manual
MIL-STD	Military Standard
MOPP-IV	Mission Oriented Protective Posture - IV
MOS	Military Occupational Specialty
MPa	Mega Pascal
MTD	Modified Table of Distribution
MTOE	Modified Table of Organization and Equipment
MTTR	Mean Time to Repair
MWO	Modification Work Order
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological, and Chemical
NHA	Next Higher Assembly
NIIN	National Item Identification Number
NO	Normally Open
NSN	National Stock Number
OD	Outside Diameter
PAM	Pamphlet
PCB	Printed Circuit Board
PMCS	Preventive Maintenance Checks and Services
P/N	Part Number
POL	Petroleum, Oil, and Lubricant
ppm	Parts per million
PQDR	Product Quality Deficiency Report
Psi	Pounds per Square Inch
QD	Quick Disconnect
QDC	Quick Disconnect
qt	quart
QTY	Quantity
RPM	Revolutions per minute
RPSTL	Repair Parts and Special Tools List
SF	Standard Form
SIC	Standard Industry Classification
SMR	Source, Maintenance and Recoverability
SOP	Standard Operating Procedure
SRA	Special Repair Activity
TACH	Tachometer
TAMMS	The Army Maintenance Management System
TASMC	Theater Aviation Sustainment Maintenance Command

**Table 2. List of Acronyms and Abbreviations. - Continued**

ACRONYM/ ABBREVIATION	MEANING
TB	Technical Bulletin
TDA	Table(s) of Distribution and Allowance(s)
TDC	Top Dead Center
TM	Technical Manual
TMDE	Test, Measurement, and Diagnostic Equipment
TOE	Table of Organization and Equipment
U/I	Unit of Issue
UL	Underwriter's Laboratory
U/M	Unit of Measure
UOC	Usable On Code
UUT	Unit Under Test
V	Volts
VCO	Voltage Controlled Oscillator
VENT	Ventilation
VOM	Volt Ohm Meter
WCA	Warranty Claims Action
WP	Work Package
VDC	Volts Direct Current

**SAFETY, CARE, AND HANDLING**

**General Safety**

Be alert and note all **WARNINGS**, **CAUTIONS**, and **NOTES**. They appear before appropriate procedures. Be sure you read and understand each of the warnings, cautions, and notes. These provide for safe operation of the equipment, and protect you from injury or death and your equipment from damage.

**SUPPORTING INFORMATION FOR REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT**

Refer to the Maintenance Allocation Chart (MAC) in WP 0120 for a listing of maintenance items and tools or test equipment. Refer to the Repair Parts and Special Tools List (RPSTL) in WP 0096 through WP 0117 for details concerning repair parts.

**WARNINGS, CAUTIONS, AND NOTES**

Be alert and note **WARNINGS**, **CAUTIONS**, and **NOTES**. These provide for safe operation of the equipment and protect you and your equipment from injury and damage.

**END OF WORK PACKAGE**



---

**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**

---

**EQUIPMENT DESCRIPTION AND DATA**

---

**EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES****Characteristics**

The LCFH Type II aluminum housing and welded aluminum frame form a rugged, yet lightweight, structure suitable for military transport and airdrop.

The LCFH Type II has 16-inch inlet and outlet duct fittings.

The heater has an internal 35-gallon fuel tank adequate for 8 hours operation at maximum heat output, with an external fuel supply connection and fuel hose provided.

Runs on diesel or jet fuels, including JP-8, DF-A, DF-1, or DF-2. The heater size is 40 inches H x 44 inches W x 62 inches L and weighs 852 pounds in the fully fueled, ready-to-operate configuration.

Heater starts using its two internal storage batteries with ambient temperatures as low as -40°F. A NATO connector is provided to assist the heater in starting temperatures as low as -65°F.

Engine, burner components, and heat exchanger have been selected for low maintenance and long life, and the modular design provides short Mean Time To Repair (MTTR).

**Capabilities and Features**

- The LCFH Type II is self-powered by a 6.5 Hp militarized diesel engine.
- Engine noise control is accomplished with vibration isolation mounts, sound-deadening materials, and an oversized exhaust muffler system. A large, low rpm impeller wheel minimizes ventilation blower noise.
- The heater is controlled via an integral control panel connected to the heater with a 25-foot cable that is brought into the shelter during operation.
- Automatic safety controls give protection from over-temperature or flame-out faults.
- The controls can be operated when wearing arctic mittens or MOPP-IV gear and are shielded from the effects of Electromagnetic Interference (EMI) and are readily understandable.
- Both primary and backup carbon monoxide (CO) detectors in the ventilation air stream audibly announce high CO levels and are interlocked with the burner control logic.
- The heater has tie-down sling provisions and forklift guides enhancing its general transportability; handles and deployable wheels allow for local mobility.
- The LCFH Type II resists damage from rain, salt fog, fungus, and withstands a storage and transportation temperature range from -65°F to 160°F.
- Heater and all accessory items can be decontaminated after a chemical or biological attack.

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

The following are the major components of the Large Capacity Field Heater, Type II, (LCFH Type II). A brief description of the function of each component and its location is detailed below.

### Jack Assembly

Located on the front of the heater, the jack assembly (Figure 1, Item 1) permits the front wheel to be lowered in preparation for movement or raised in order for the heater to rest on the snow skids in preparation for use.

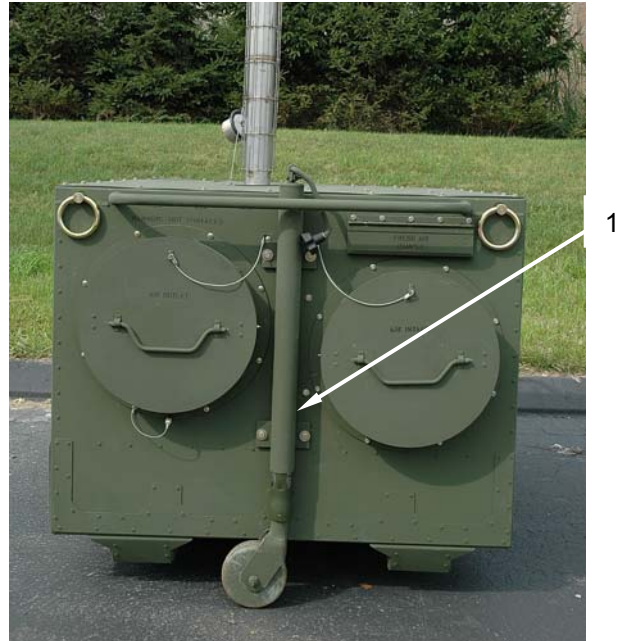


Figure 1. Jack Assembly.

### 10-inch Non-Pneumatic Retractable Wheels

The non-pneumatic wheels (Figure 2, Item 1) located on either side of the LCFH Type II, assist in the movement and placement of the heater.



Figure 2. Non-Pneumatic Retractable Wheels.

**Wheel Chocks**

Located in a stowage area just above the retractable wheels (Figure 3, Item 1), the wheel chocks prevent the heater from rolling when the wheels are in the down and deployed position.



Figure 3. Wheel Chocks.

**Snow Skids**

Located on the underside of the LCFH Type II, the snow skids (Figure 4, Item 1) provide a way for the LCFH Type II to be moved in snowy conditions and a support for the heater when the wheels are retracted.

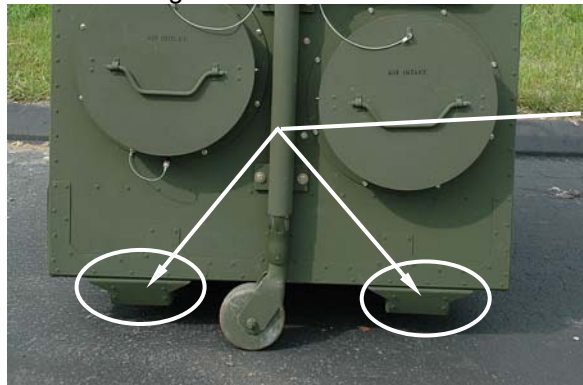


Figure 4. Snow Skids.

**Fork Lift Pockets**

Standard 10-inch by 3-inch forklift pockets (Figure 5, Item 1) are provided on either side of the heater to permit lifting the LCFH Type II from its transport and placing it into position outside the shelter.



Figure 5. Fork Lift Pockets.

**Local Mobility Handles**

**CAUTION**

Do not use local mobility handles for towing, lifting, etc.

Mobility handles (Figure 6, Item 1) are installed at either end of the heater to assist in fine positioning the LCFH Type II outside the shelter.



Figure 6. Local Mobility Handles.

**Lift/Tie-Down Rings**

**CAUTION**

Do not use local mobility handles for towing, lifting, etc.

Provided at the top four corners of the LCFH Type II to permit airlifting of the heater or to provide tie down points when the heater is transported (Figure 7, Item 1).



Figure 7. Lift/Tie-Down Rings.

**NATO Connector**

A NATO connector (Figure 8, Item 1) is mounted on the rear sidewall of the heater on the fresh air inlet side. The NATO connector is designed to be connected to a 24V source to provide an additional source of power in conditions of extreme cold.

The NATO connector is not to be used to provide power to other vehicles or equipment.

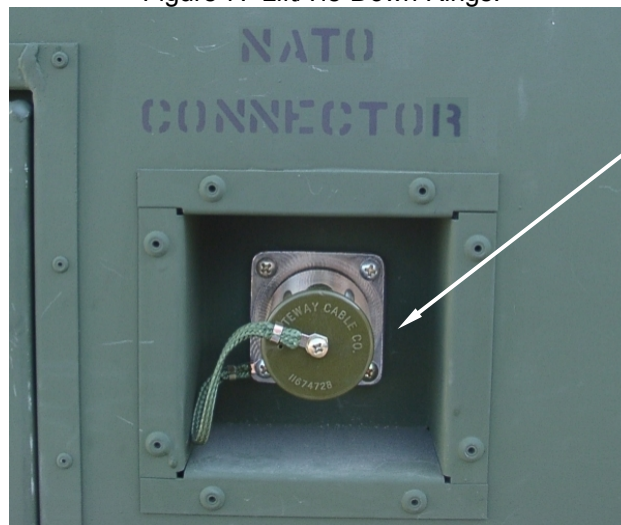


Figure 8. NATO Connector.



**Duct Covers**

Duct covers are provided to cover the inlet (Figure 9, Item 2) and outlet (Figure 9, Item 1) air ducts when the LCFH Type II is being moved or is in storage.

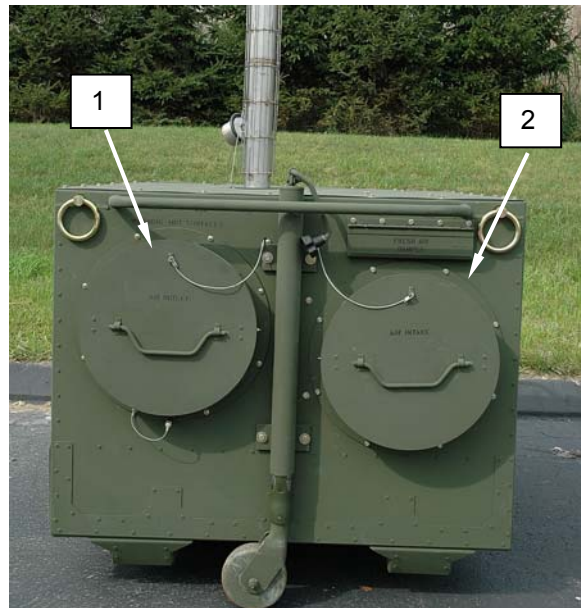


Figure 9. Duct Covers.

**Air Inlet**

Permits fresh air to enter (Figure 10, Item 1) the LCFH Type II for heating.



Figure 10. Air Inlet.

**Heated Air Outlet**

Conducts heated air (Figure 11, Item 1) from the LCFH Type II into the shelter.



Figure 11. Heated Air Outlet.

**Fresh Air Damper**

Located above the air inlet, the fresh air damper (Figure 12, Item 1) permits the operator to add fresh make-up air to the air that is recirculated throughout the shelter. A spring loaded prop is located under the fresh air damper to allow the operator to vary the size of the opening.



Figure 12. Fresh Air Damper.

**Inlet and Outlet Ducts**

The two flexible inlet and outlet ducts (Figure 13, Item 1) connect between the fresh air inlet and heated air outlet of the LCFH Type II and the shelter duct openings. Ducts are shown compressed in their stowed condition.



Figure 13. Inlet and Outlet Ducts.

**Fuel Filler Port**

The fuel filler port (Figure 14, Item 1) is located to the right of the fuel access door and permits fuel to be added to the internal fuel tank.

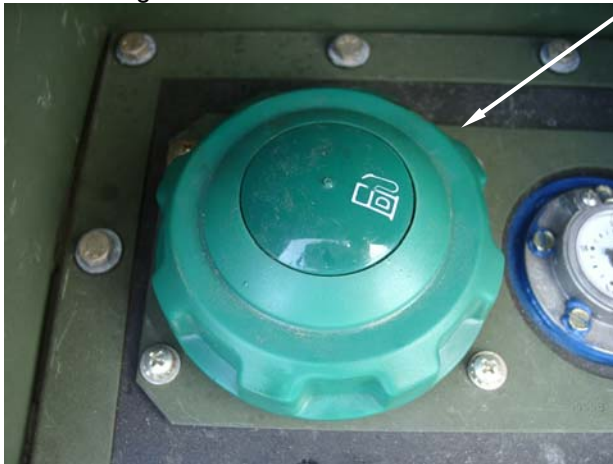


Figure 14. Fuel Filler Port.

**Fuel Gauge**

The fuel gauge (Figure 15, Item 1) is located next to the fuel filler port and provides an indication of the amount of fuel in the LCFH Type II internal tank.

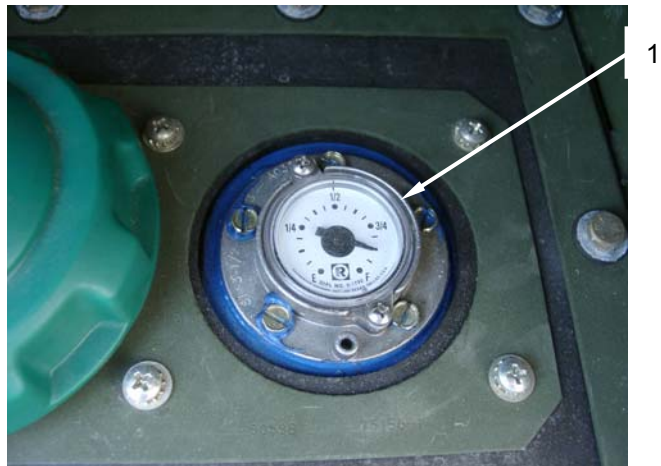


Figure 15. Fuel Gauge.

**Fuel Tank**

**NOTE**

The fuel tank is shown in Figure 16 with heater end panel removed for illustrative purposes.

The fuel tank (Figure 16, Item 1) occupies the bottom interior of the heater and is accessed through a quick disconnect fitting at the rear end panel. The fuel tank is constructed of a cross-linked polyethylene and has a capacity of 35 gallons.



Figure 16. Fuel Tank.

**External Fuel Connection**

**CAUTION**

The external fuel connection should not be used if the internal fuel tank is ruptured or otherwise leaking, as the fuel system utilizes a continuous fuel loop-back design.

The external fuel connection (Figure 17, Item 1) is located above the fuel filler port and fuel gauge and permits the LCFH Type II to be operated from an external bulk fuel supply, greatly extending its operating time.



Figure 17. External Fuel Connection.

**Fuel Hose**

This 25-foot flexible fuel hose (Figure 18, Item 1) is specially designed for the arctic environment and permits the LCFH Type II to be used with an external fuel supply. It also provides a means to refuel the internal tank. The fuel hose is stowed internally on the inside of the engine access door when not in use.



Figure 18. Fuel Hose.

**Exhaust Stack Stowage Area**

Allows the removable exhaust stack to be stowed prior to movement or storage (Figure 19, Item 1).



Figure 19. Exhaust Stack Stowage Area.

**Exhaust Stack**

A removable exhaust stack (Figure 20, Item 1) is located on the top of the LCFH Type II and conducts combustion gases from the diesel engine and the burner to the outside air. The stack is removed when the heater is transported and stowed in the exhaust stack stowage compartment located at the lower front portion of the heater.

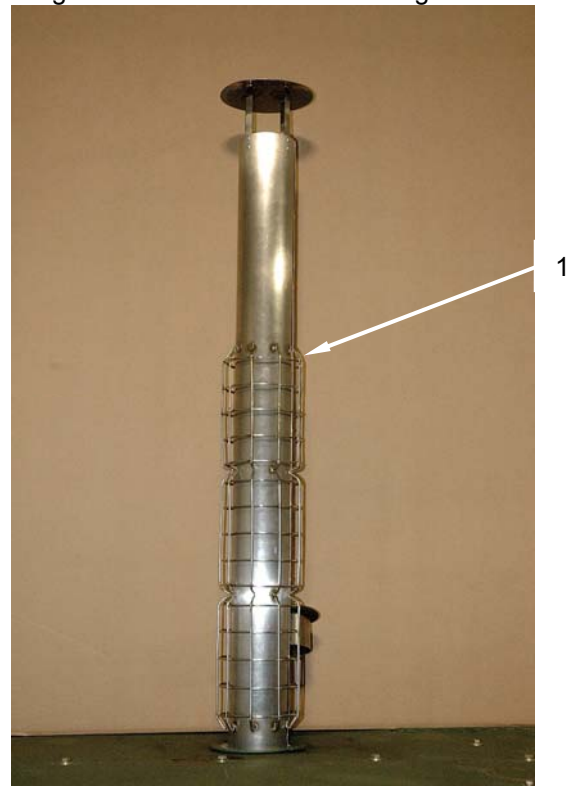


Figure 20. Exhaust Stack.

**Engine Access Door**

Located on the air inlet side of the heater, the engine access door (Figure 21, Item 1) permits entry to the side of the LCFH Type II for the maintenance of selected items, including the diesel engine, alternator, and batteries.



Figure 21. Engine Access Door.

**Operator Control Panel Stowage Area**

The control panel and attached 25-foot cable is stowed in this area (Figure 22, Item 1) when the heater is being moved or prepared for storage.



Figure 22. Operator Control Panel Stowage Area.

**Operator Control Panel**

Located in a compartment on the top surface of the LCFH Type II, the operator control panel (Figure 23, Item 1) is connected to the heater with a 25-foot cable. The control panel provides all control functions such as power ON/OFF, fuel internal/external selector, fault reset, vent manual/auto, temperature control, and temperature sensor. The control panel also features an LED display that provides status information to the operator, as well as fault information should a problem occur.



Figure 23. Operator Control Panel.

**Fuel System Access Door**

The fuel system access door (Figure 24, Item 1) permits access to the fuel filter and priming fuel pump. It also provides a stowage location for the technical manual and the electrode adjustment tool.



Figure 24. Fuel System Access Door.

**Burner Access Door**

The burner access door (Figure 25, Item 1) permits access to the burner area for maintenance.



Figure 25. Burner Access Door.

**Heat Exchanger Cover**

Removable top cover (Figure 26, Item 1) over the heat exchanger permits access to the assembly for maintenance or servicing.

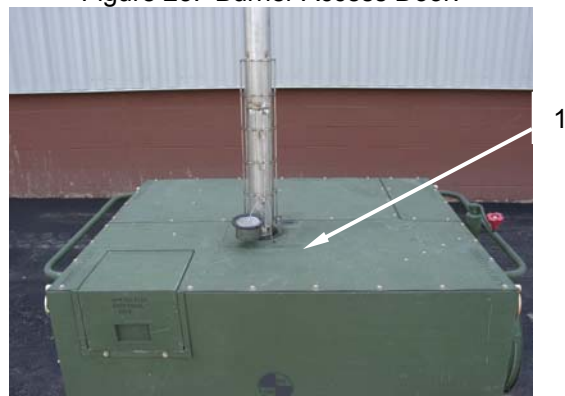


Figure 26. Heat Exchanger Cover.

**Engine Bay Cover**

Removable top cover (Figure 27, Item 1) over the engine bay that permits access to the engine for maintenance or servicing.

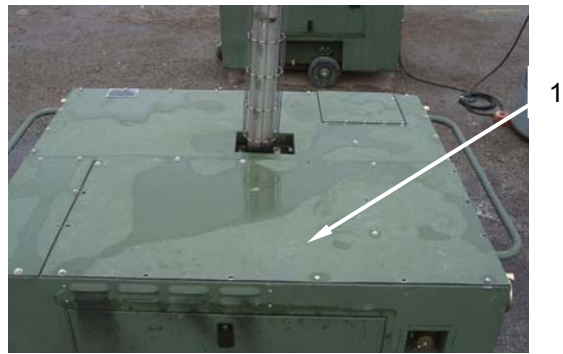


Figure 27. Engine Bay Cover.

**Fan Cover**

The fan cover (Figure 28, Item 1) is a removable top cover over the inlet fan assembly that permits access to the inlet fan and CO detector for maintenance or servicing.



Figure 28. Fan Cover.

**Cabinet-Mounted Carbon Monoxide Detector**

The cabinet-mounted carbon monoxide detector (Figure 29, Item 1) is located just under the fan cover and is designed to detect any carbon monoxide that could enter the inlet air stream. The carbon monoxide detector performs a self-test during each power up of the LCFH Type II and also features a “Push to Test” button.

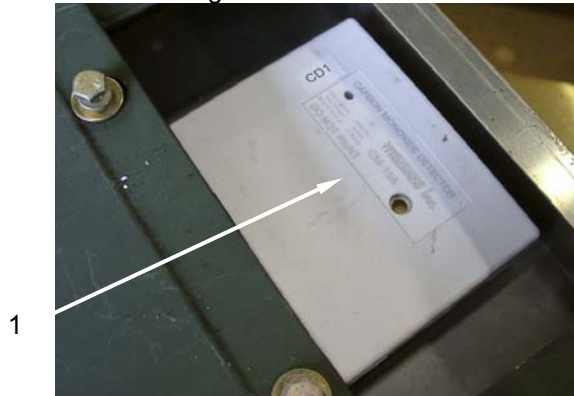


Figure 29. Cabinet-Mounted Carbon Monoxide Detector.

**Diesel Engine**

The diesel engine (Figure 30, Item 1) is located on the air inlet side of the heater and is the power plant for the LCFH Type II. The diesel engine drives the alternator, producing electricity for the heater control circuitry.

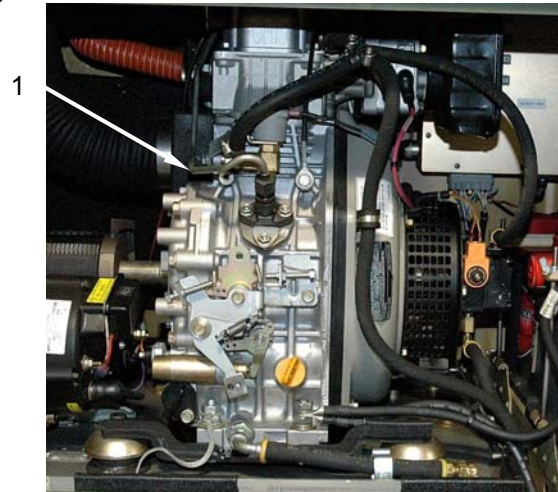


Figure 30. Diesel Engine.

**Alternator**

The alternator (Figure 31, Item 1) is located just behind the fresh air inlet and is driven by the diesel engine. The alternator is responsible for generating the power for the control circuitry in the LCFH Type II.



Figure 31. Alternator.

**Burner Fuel Pump**

Located on the diesel engine, the burner fuel pump (Figure 32, Item 1) provides a steady supply of fuel for all burner operations.

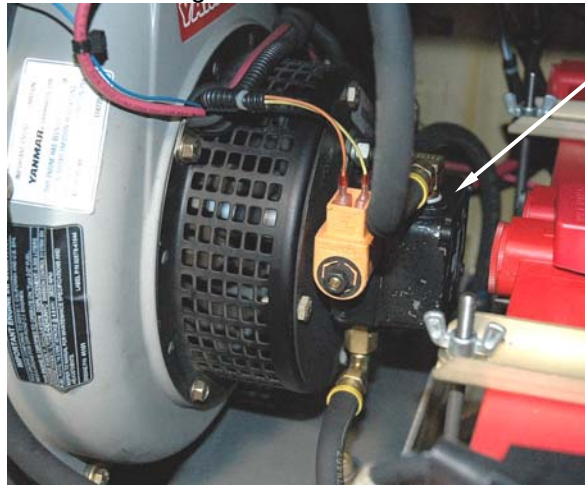


Figure 32. Burner Fuel Pump.

**Batteries**

Two 12VDC batteries (24 VDC total) (Figure 33, Item 1) are located behind the engine access door and provide starting energy for the diesel engine. The two batteries were specifically selected for their performance in extreme cold conditions.



Figure 33. Batteries.

**Flexible Shaft Coupling**

The flexible shaft coupling (Figure 34, Item 1) mechanically links and vibrationally isolates the inlet fan from the diesel engine.

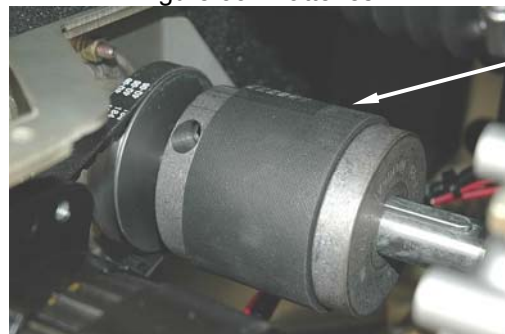


Figure 34. Flexible Shaft Coupling.



**Air Inlet Fan**

Located just behind the fresh air inlet air duct, the fresh air inlet fan (Figure 35, Item 1) draws air in from the outside and moves it through the LCFH Type II for heating.

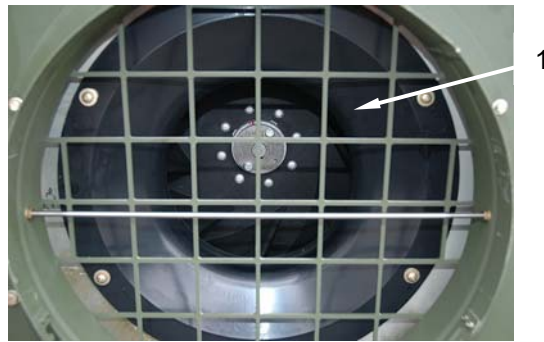


Figure 35. Air Inlet Fan.

**Main Control Box Assembly**

Located on the interior of the LCFH Type II near the diesel engine, the main control box (Figure 36, Item 1) contains the printed circuit board and other associated circuitry required to operate the heater.



Figure 36. Main Control Box Assembly.

**Burner Assembly**

The burner assembly (Figure 37, Item 1) is designed to be used with a variety of approved military fuels and is located behind the heat exchanger. The burner atomizes and burns the incoming fuel from the fuel pump.

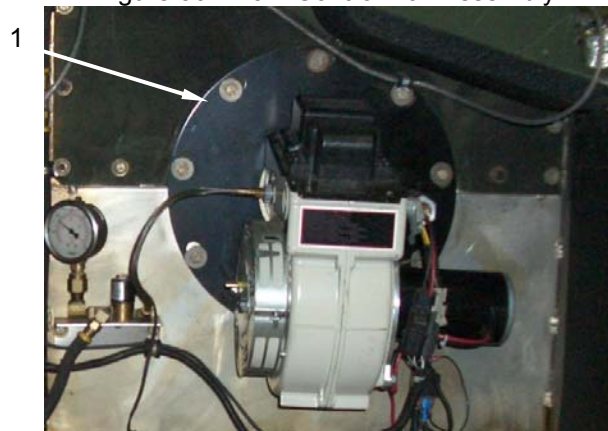


Figure 37. Burner Assembly.

**Heat Exchanger**

**NOTE**

Heat exchanger access cover removed in figure for illustrative clarity.

The heat exchanger (Figure 38, Item 1), positioned on the heated air outlet side of the heater, is designed to transfer the heat generated by the burner to the fresh air being drawn in by the fresh air inlet fan. This is done without mixing any of the combustion gases with the breathable air being made available to the shelter.

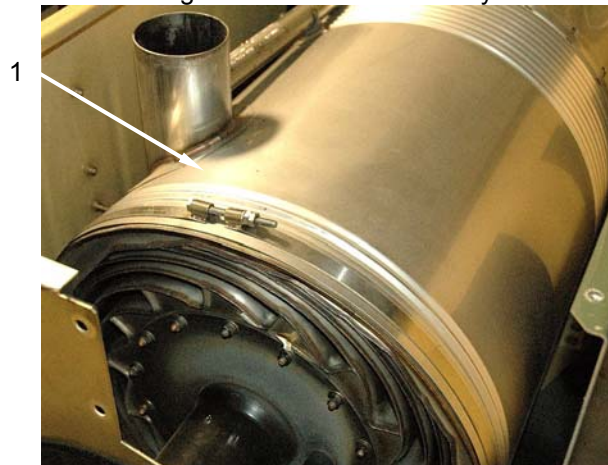


Figure 38. Heat Exchanger.

**Main Power Shutdown Switch**

Permits the operator or maintainer to disconnect the batteries from all internal LCFH Type II circuitry and prevents the heater from being accidentally started during maintenance or servicing (Figure 39, Item 1).

1

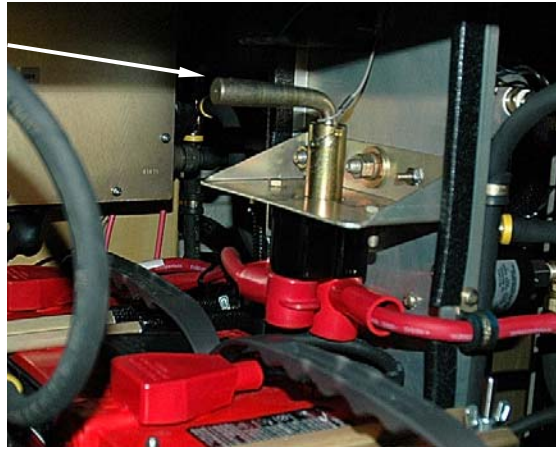


Figure 39. Main Power Shutdown Switch.

## EQUIPMENT DATA

Table 1. LCFH Type II Equipment Data.

Manufacturer	Hunter Manufacturing Company	
Part number	41000	
Operating temperature range	-65°F (-53.8 °C) to +65°F(+18.3°C)	
Unassisted Starting Temperature	-40°F (-40°C)	
Externally Assisted Starting Temperature	-65°F (-53.8°C)	
BTUH (maximum)	400,000	
Efficiency	82%	
Electrical system	24VDC	
Air flow		
Heated air (at 225°F [107°C])	2495 ft <sup>3</sup> /minute (70.6 m <sup>3</sup> /minute)	
Heater dimensions		
Length	62.0 in (157.5 cm)	
Width	44.5 in (113.0 cm)	
Height	40.0 in (101.6 cm)	
Heater volume	63.86 ft <sup>3</sup> (1.80 m <sup>3</sup> )	
Heater weight (without accessories or fuel)	607 lbs (275 kgs)	
Heater weight (without accessories but fully fueled)	852 lbs (386 kgs)	
Fuel requirements:		
Above +20°F (-6.7°C)	DF-2, DF-1, JP-8	
Above -25°F (-33.3°C)	DF-1, JP-8	
Above -60°F (-51°C)	JP-8	
Fuel tank capacity	35 gallons (132.5 liters)	
Fuel consumption	3.72 gph (14.1 lph) (at maximum heat output)	
	0.2 gph (0.75 lph) (in ventilation-air only mode)	
Number hours continuous operation (internal tank only)	8 hours (approx)	
Minimum safe distance to combustibles	2 ft (0.6 m)	
Batteries		
Quantity	2	
Type	Sulfuric Acid, H <sub>2</sub> SO <sub>4</sub>	
Rating	12VDC each	
Manufacturer	Optima	
NSN	6140-01-475-9361	
<b>Diesel Engine Data</b>		
	Unit	L70EE
Type	Single-cylinder, vertical-4cycle diesel	
Cooling system	—	Forced air cooling by flywheel fan
Combustion system	—	Direct injection system with compression ignition
Starting system	Starting motor	
Number of cylinder- Bore x Stroke	in (mm)	1 cylinder; 3.07 x 2.51 (78 x 64)
Displacement	qt (liter)	0.32 (0.306)

**Table 1. LCFH Type II Equipment Data - Continued**

Output	Continuous	kW(hp)	4.3(5.8)
	Maximum		4.8(6.4)
Operational engine speed		rpm	3000
Compression ratio		—	20.2
PTO shaft	PTO position		Crank shaft
	Direction of rotation		Counterclockwise viewed from PTO shaft
Fuel system	Fuel injection pump	—	Bosch type YANMAR PFE-M type
	Fuel injection timing (FIC:BTDC)	deg	15.0 ± 0.5
	Fuel injection nozzle	—	VCO nozzle Bosch made
	Fuel injection pressure	MPa (psi)	19.6 (2842.7)
	Fuel selection		DF-1, DF-2, and JP-8
Lubricating oil system	<b>CAUTION</b>		
	It is imperative that the lubricating oil used in the diesel engine adhere to the types and compression classifications shown below. Failure to do so may result in irreparable damage to the diesel engine and a voiding of the LCFH Type II warranty.		
	Type of lubrication	—	Forced lubrication via trochoid pump: splash lubrication for valve rocker arm chamber
	Lubricating oil filter	—	Resin, 60 mesh
	Lubricating oil selection	—	58°F to 32°F(-50°C to 0°C) MIL-L-46167 Arctic Engine Oil -22°F to 50°F(-30°C to 10°C) 5W30 A.P.I. Engine Service Classification CC, CD, or CF -4°F to 86°F(-20°C to 30°C) 10W30 A.P.I. Engine Service Classification CC, CD, or CF 14°F to 104°F(-10°C to 40°C) 20W40 A.P.I. Engine Service Classification CC, CD, or CF
Lubricating oil capacity full/effective	liter (quart)	1.1/0.4 (1.16/0.42)	
Air cleaner	—		Paper element filter
Exhaust silencer	—		Expansion silencer with cover
Governor	—		All speed type mechanical
Engine dimensions (Length x Width x Height)	in (mm)		14.1 x 16.6 x 17.7 (358 X 421 X 450)
Dry mass	lbs (kg)		73.8 (33.5)
Permissible angle of inclination	deg		20 (30:operating time 3 min. max.)
Balancer shaft	—		Single shaft

**COMMON TOOLS AND EQUIPMENT**

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

Repair parts are listed and illustrated in the repair parts and special tools list located in work packages 0096 through 0117.

**END OF WORK PACKAGE**

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**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**

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**THEORY OF OPERATION**

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**GENERAL**

The LCFH Type II is a heating system that provides clean, heated ventilation air in a military environment in worldwide temperature extremes. The LCFH Type II provides a minimum of 350,000 BTUH of heat and a minimum ventilation airflow rate of 2000 CFM.

**OPERATIONAL CONCEPT**

An operational cycle of the Large Capacity Field Heater begins by placing the power switch, located on the control panel, in the ON position. Once the power switch is engaged, 24VDC power is drawn from the two batteries located in the interior of the LCFH Type II and supplied to all heater subsystems.

The LCFH Type II can be operated from its internal fuel tank or from an external fuel source. The fuel source is selected via a two-position switch located on the operator control box. Fuel for both the diesel engine and the burner fuel pump is drawn through a 10-micron fuel filter which removes any impurities or sediment.

The LCFH Type II utilizes what is referred to as a continuous fuel-loop system. As fuel is drawn from the internal fuel tank and supplied to the burner and the engine, some of the unused fuel returns to the internal fuel tank.

When operating in external fuel mode, the LCFH Type II is connected to a bulk fuel supply by means of the external fuel hose. Fuel is drawn from the internal fuel tank until it reaches a low level as determined by the fuel level switch in the fuel tank. At this time fuel will start to be drawn directly from the external fuel source. As fuel from the continuous fuel loop returns fuel to the tank, the level inside the internal fuel tank rises, eventually reaching a point where the fuel level switch triggers a solenoid valve which once again begins drawing fuel from the internal fuel tank. This cycle of drawing fuel from the internal fuel tank and external fuel source continues throughout the operation of the LCFH Type II.

A self test is performed using built-in test logic designed into the control board. Once all heater subsystems are verified to be within nominal operating limits, the heater enters a startup sequence that varies with outside ambient temperature.

When the startup sequence is complete, fuel is pumped to the diesel engine by the priming fuel pump. Once fuel reaches the diesel engine, a START signal is sent from the control board. If the ambient temperature is  $-40^{\circ}$  F or above, the diesel engine will start unassisted using the two onboard batteries. If the ambient temperature is between  $-40^{\circ}$  F and  $-65^{\circ}$  F, the diesel engine requires additional power supplemented by an external 24VDC source connected to the NATO connector on the side of the heater.

Once the diesel engine starts, it drives a belt-driven alternator which takes over internal power generation and recharges the batteries for the next startup cycle.

The diesel engine crankshaft is directly coupled to the burner fuel pump which provides fuel to the burner nozzle. A combustion fan provides air to the burner assembly for combustion. Fuel is atomized by the burner nozzle and ignited by the two electrodes.

Heat generated by the burner assembly heats the interior of the heat exchanger which in turn heats fresh air which is drawn into the sealed, heated air compartment via a fresh air inlet fan which is connected to an isolated rubber coupling.

All combustion gases created by the diesel engine or the burner assembly are exhausted out through a stowable exhaust stack.

Heated air from the heat exchanger is then forced out the heated air outlet and into the outlet air duct. The outlet air duct delivers heated air from the LCFH Type II to the shelter.

The LCFH Type II can operate in three different modes: manual (MAN), ventilation air only (VENT), and automatic (AUTO). In Manual mode, the heater senses temperature via a sensor located at the heated air outlet and maintains a pre-determined set temperature (225 °F). The heater will then cycle on and off to maintain that temperature. In Ventilation Air Only mode, the diesel engine drives the air inlet fan and delivers unheated air to the shelter. In Automatic mode, the heater reacts to the temperature sensed by the thermistor at the operator control panel. The heater attempts to maintain a set temperature as selected by the operator, using the temperature control on the operator control panel.

During heater operation, the operator control panel is hung inside the shelter out of the direct path of the heated air outlet or the cold air from the shelter entrance. If the heater mode switch has been set to AUTO, the thermistor on the control panel monitors the temperature of the shelter interior and sends a signal to the heater that controls the firing of the burner assembly. The burner is then instructed to operate at full heat output, half heat output, or no heat output.

Fault detection circuitry designed into the heater constantly monitors heater status. If a problem should occur, the system will proceed to the shutdown mode and then into post-purge mode. A fault code will be displayed on the LED display of the operator control panel.

When the heater is to be shut down, the power switch is placed in the OFF position. The heater will then go through a shutdown sequence that includes a purge mode to ensure that all residual fumes have been removed from the heater, followed by engine shutdown.

**END OF WORK PACKAGE**

**CHAPTER 2**

**OPERATOR INSTRUCTIONS  
FOR  
LARGE CAPACITY FIELD HEATER,  
TYPE II (LCFH TYPE II)**





OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

INTRODUCTION

The following tables and illustrations provide the description and use of the controls and indicators pertaining to the LCFH Type II. Personnel operating and maintaining the LCFH Type II should know the location and proper use of every control and indicator. Use this work package to learn about each control and indicator and how it works.

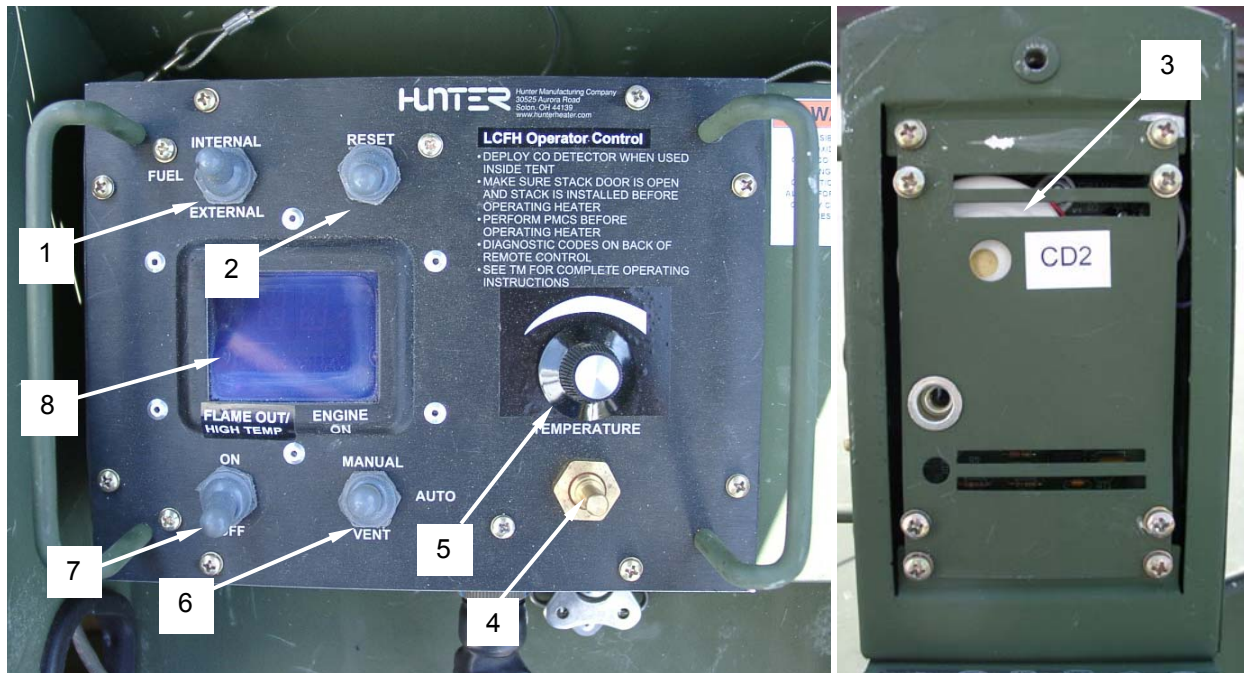


Figure 1. Operator Control Panel Controls and Indicators.

Table 1. Operator Control Panel Controls and Indicators.

Key	Control/Indicator	Function
1.	Fuel selector.	Permits selection between external and internal fuel sources.
2.	Fault reset.	Spring-loaded reset switch to permit heater to be reset after heater fault.
3.	Carbon monoxide detector.	Constantly monitors the air inside the shelter, detects any carbon monoxide that may be present and sounds an audible alarm.
4.	Thermistor.	Acts as a temperature sensor inside the shelter.
5.	Temperature.	Permits operator to select temperature of shelter.
6.	Heater mode.	Offers a choice of three modes of heater operation: MANUAL (provides as much heat as needed, no thermostat control), VENT (no heat, ventilation air only), and AUTO (heat output thermostatically controlled).
7.	Power.	Permits LCFH Type II to be turned on and off.
8.	LED display.	Displays system status as well as notice of any system fault codes that may occur.



Figure 2. Fuel System Controls and Indicators.

Table 2. Fuel System Controls and Indicators.

Key	Control/Indicator	Function
1.	Fuel filter.	Filters out any impurities that may be contained in fuel.
2.	Fuel tank filler cap.	Allows the internal fuel tank to be filled.
3.	External fuel connector.	Permits the connection of an external bulk fuel supply.
4.	Fuel gauge.	Provides operator with indication of fuel level of internal fuel tank.
5.	Fuel tank filler screen.	Filters fuel for any solid debris present in the supply.
6.	Fuel drain.	Permits the internal fuel tank to be drained.

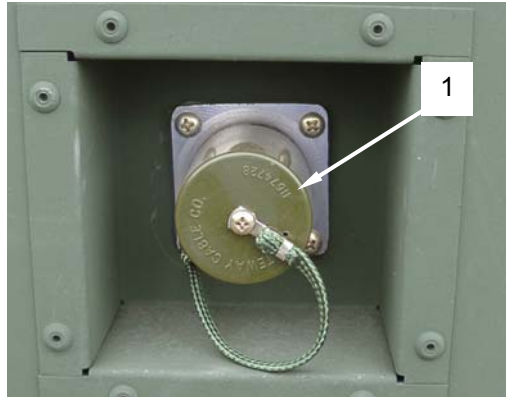


Figure 3. NATO Connector.

**Table 3. NATO Connector.**

Key	Control/Indicator	Function
1.	NATO Connector.	Allows connection of external 24VDC power to assist in starting between -40°F (-40°C) and -65°F (-53.8°C). Must not be used to power other vehicles or equipment.

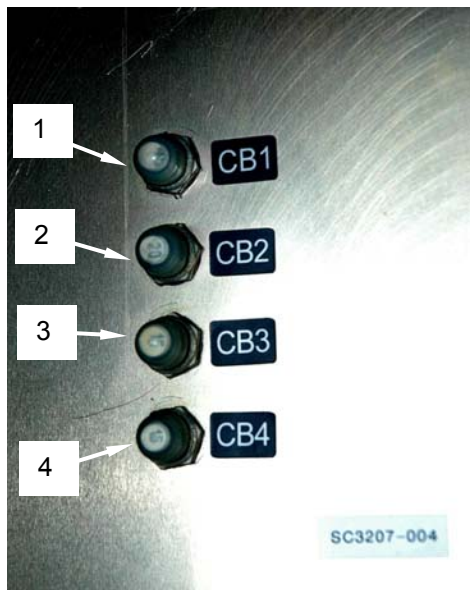


Figure 4. Main Control Box Circuit Breakers.

**Table 4. Main Control Box Circuit Breakers.**

Key	Control/Indicator	Function
1.	CB1.	45 Amp circuit breaker for Preheated.
2.	CB2.	25 Amp circuit breaker for Combustion Motor.
3.	CB3.	15 Amp circuit breaker to Power Circuit Board.
4.	CB4.	15 Amp circuit breaker to Power Circuit Board.

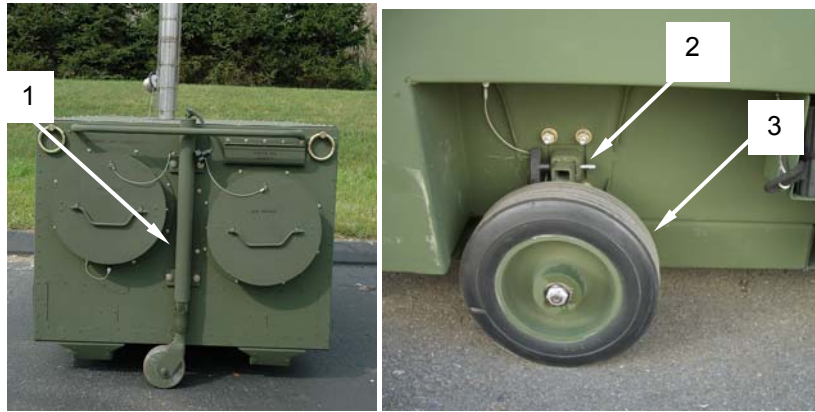


Figure 5. LCFH Type II Transport Controls.

Table 5. LCFH Type II Transport Controls.

Key	Control/Indicator	Function
1.	Jack Assembly.	Permits raising and lowering of front wheel.
2.	Retractable wheel quick release pin.	Allows the retractable wheel to be removed quickly to enable raising or lowering. Also permits quick replacement.
3.	Retractable side wheel.	Permits side wheels to be lowered for local mobility or retracted for skid use.

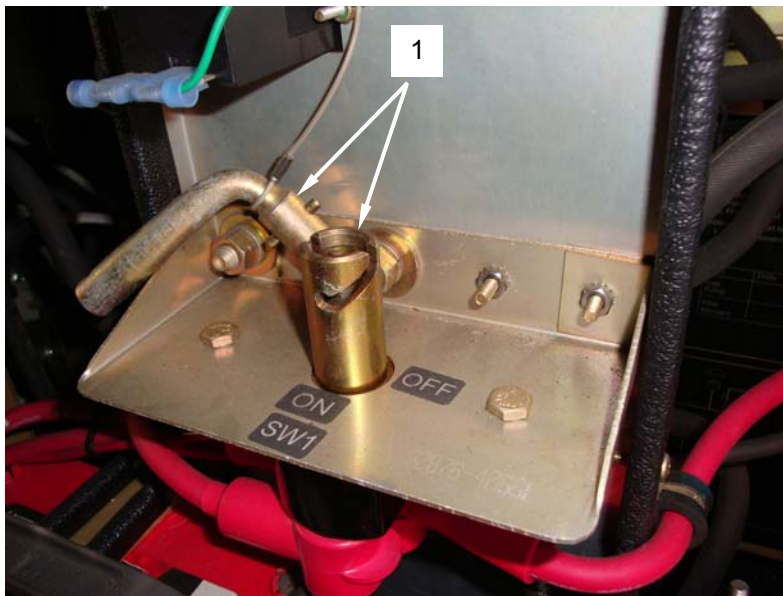


Figure 6. Main Battery Shutdown Switch.

Table 6. Main Battery Shutdown Switch.

Key	Control/Indicator	Function
1.	Main battery shutdown switch.	Permits operator or maintainer to disconnect batteries from all internal LCFH Type II circuitry and prevents heater from being accidentally started during maintenance or servicing. Once switch is in the OFF position, the handle can be removed to prevent accidental turn on.

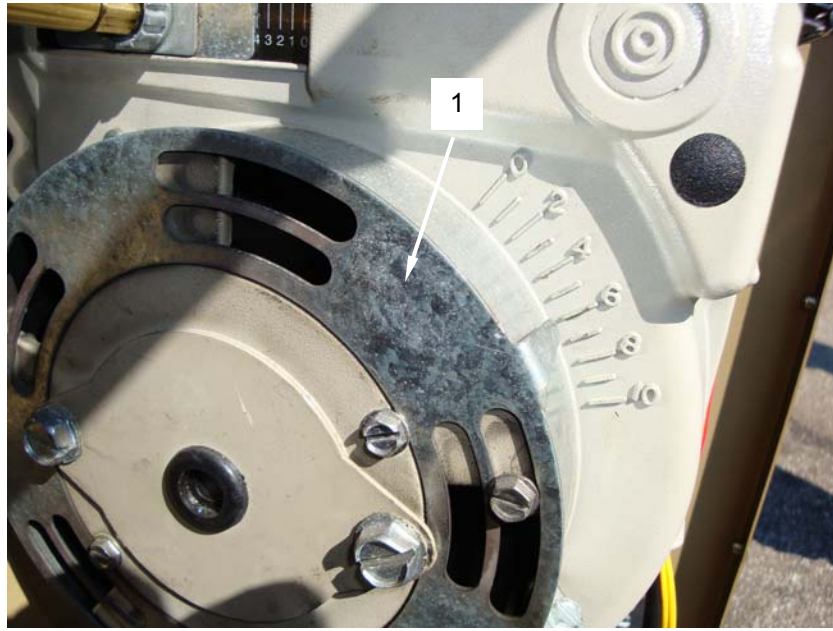


Figure 7. Burner Assembly Air Inlet Shutter.

**CAUTION**

The burner assembly air inlet shutter is factory set and must not be adjusted.

**Table 7. Burner Assembly Air Inlet Shutter.**

<b>Key</b>	<b>Control/Indicator</b>	<b>Function</b>
1.	Burner assembly air inlet shutter.	Controls the amount of air used by the burner assembly during combustion.



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**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE****OPERATION UNDER USUAL CONDITIONS**

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**INITIAL SETUP:**Not Applicable

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**SITING REQUIREMENTS****WARNING**

Do not place the LCFH Type II over any fuel and/or electrical lines. Placing the heater over fuel and/or electrical lines may result in electrical shock or fire, causing serious injury or death.

**WARNING**

The LCFH Type II should not be positioned any closer than 2 feet from an external bulk fuel supply. Placing the heater closer than 2 feet from a bulk fuel supply may result in fire or explosion, causing serious injury or death.

**WARNING**

Do not operate the LCFH Type II near other shelters or enclosures that may not be equipped with carbon monoxide detectors. Exhaust gases from the LCFH Type II may be pulled in by the fresh air intake of nearby shelters or enclosures causing a carbon monoxide hazard. Ensure that the LCFH Type II is placed as far away from other shelters/enclosures as possible. Failure to do so may result in severe injury or death to personnel.

When positioning the LCFH Type II in preparation for operation, a site should be selected that is:

- Within 12 feet of the duct tunnels installed on the side of the shelter.
- Within 25 feet of an external bulk fuel supply (if used).
- No closer than 2 feet from an external bulk fuel supply (if used).
- Preferably downgrade from the bulk fuel supply to encourage better fuel flow.
- Downwind from the shelter the heater is connected to as well as other surrounding shelters that may not have carbon monoxide detectors installed to prevent combustion gases from the exhaust stack from being blown back into the shelter(s).
- Hardstand or other improved areas; however, any area that is level and free of large holes, trees, debris, and properly drains, in the event of bad weather and is within the guidelines of the Unit Standard Operating Procedure (SOP), is acceptable.

## **SHELTER REQUIREMENTS**

The LCFH Type II is designed to be used with the Lightweight Maintenance Enclosure (LME) shelter which is equipped with duct tunnels that are 16 inches in diameter.

## **BEFORE OPERATION PMCS**

Perform the "Before Operation PMCS" on all LCFH Type II system components as outlined in WP 0016, prior to preparing the heater for use. All scheduled maintenance must be performed on the heater and its associated equipment prior to use.

## **POSITIONING THE HEATER OUTSIDE THE SHELTER**

To prepare the LCFH Type II for use, position the heater within 12 feet of the duct tunnels of the shelter, using a forklift rated to lift at least 607 pounds without fuel or 852 pounds if fully fueled.

In order to move the LCFH Type II into the proper position, the side wheels must be deployed and the front wheel lowered to permit local mobility.

## **NOTE**

The LCFH Type II may be safely operated in a wheels deployed (down) condition or with the LCFH Type II resting on its underside skids. The decision to operate with wheels deployed versus on skids is dictated by conditions in the field of deployment.

## **Lowering the Side Wheels**

Before the LCFH Type II can be rolled, or to permit local mobility, the side wheels must be lowered and locked into position.

1. Lower the front wheel (Figure 1, Item 5) by rotating the wheel jack handle (Figure 1, Item 1) clockwise until the front wheel (Figure 1, Item 5) contacts the ground and begins to tilt the heater back on its snow skids. Continue until the front wheel is completely lowered.
2. Remove the locking pin (Figure 1, Item 2) and remove wheel and axle assembly (Figure 1, Item 3).
3. Rotate the wheel and axle assembly (Figure 1, Item 3) 90 degrees.
4. Reinstall wheel and axle assembly (Figure 1, Item 3) and engage locking pin (Figure 1, Item 2).
5. Repeat for the opposite wheel.
6. Raise the front wheel (Figure 1, Item 5) by rotating the wheel jack handle (Figure 1, Item 1) counterclockwise until the top of the heater cabinet is parallel to the ground. Ensure that the front wheel is positioned to permit free movement of the caster (Figure 1, Item 4) or the front wheel will not swivel properly.



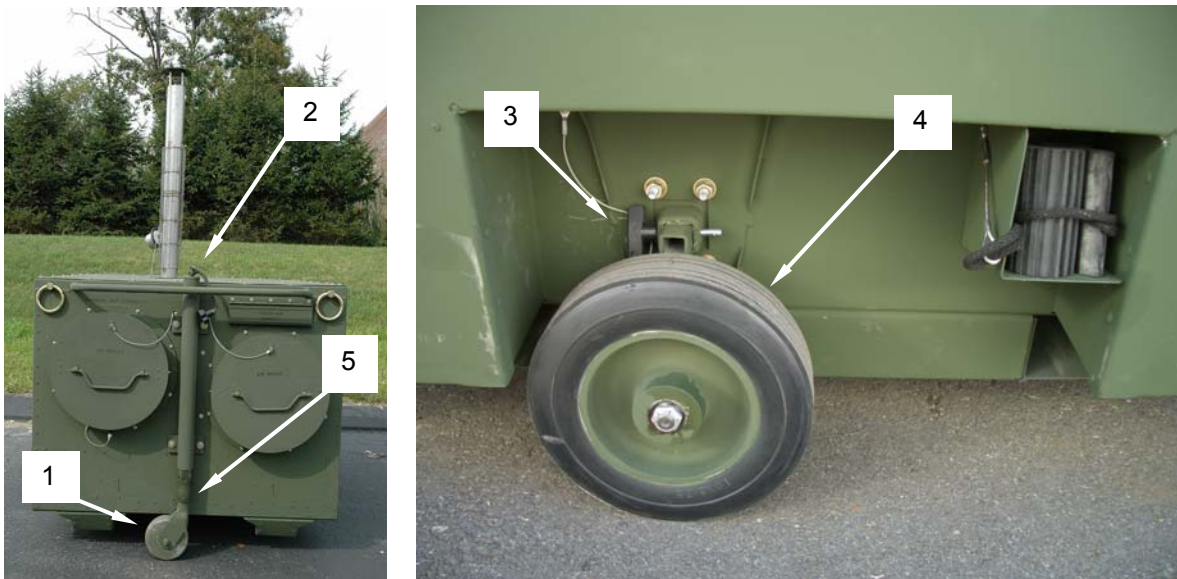


Figure 1. Lowering the Side Wheels.

#### END OF TASK

#### Checking the Battery Charge Status

Check the battery charge date indicated on the battery located inside the engine access door before putting the LCFH Type II into operation. Batteries should be connected to a trickle charger at a minimum of every 6 months.

#### END OF TASK

### Operating in a Wheels-Deployed Condition

Orient the heater so that the air inlet (Figure 2, Item 2) and heated air outlet (Figure 2, Item 1) end of the heater are directed toward the shelter duct tunnels. Position the heater so as to minimize bends in the ducts.

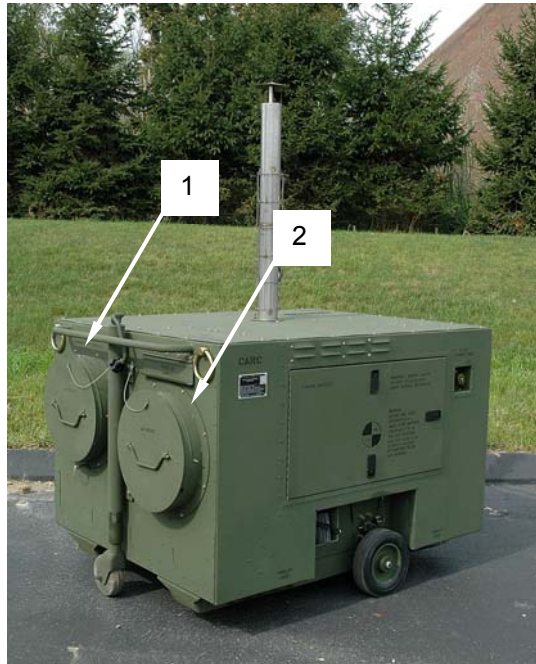


Figure 2. Operating in a Wheels-Deployed Condition.

**END OF TASK**

### Deploy the Wheel Chocks

1. Wheel chocks (Figure 3, Item 3) are provided to prevent the heater from moving once positioned. Remove the wheel chocks (Figure 3, Item 3) from their stowage location (Figure 3, Item 1) next to each wheel (Figure 3, Item 2).
2. Position a chock in front of and behind each wheel. Ensure that the wheel chocks are secure under the wheel so they will not move.

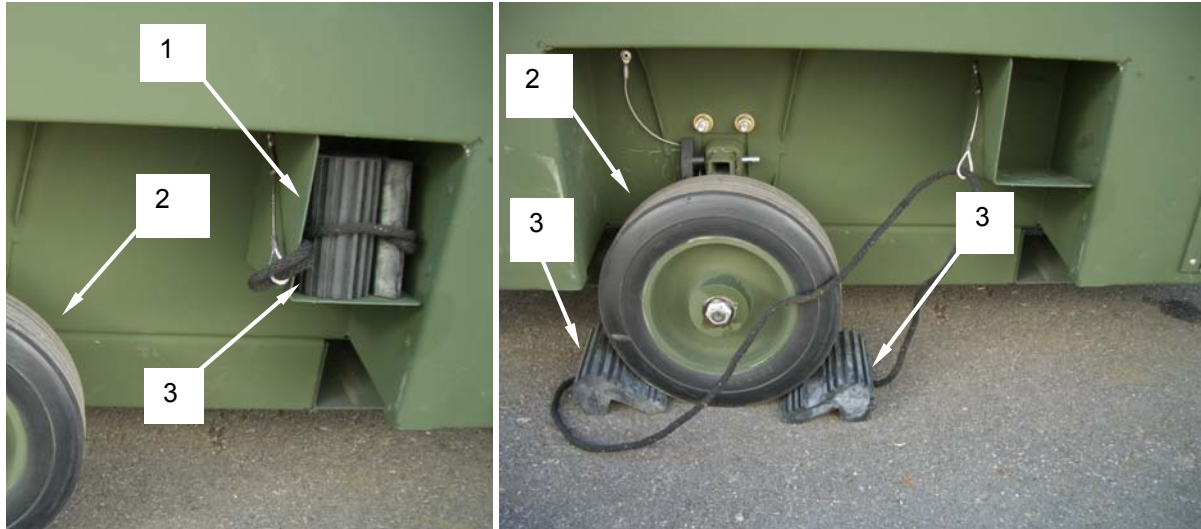


Figure 3. Deploy the Wheel Chocks.

### END OF TASK

### ASSEMBLY AND PREPARATION FOR USE

#### Removing the Inlet and Outlet Duct Covers

1. Remove the outlet duct cover (Figure 4, Item 2) protecting the heated air outlet (Figure 4, Item 1) by grasping the handle (Figure 4, Item 3) and pulling upward to disengage the locking clips (Figure 4, Item 4). Pull straight out from the heater.

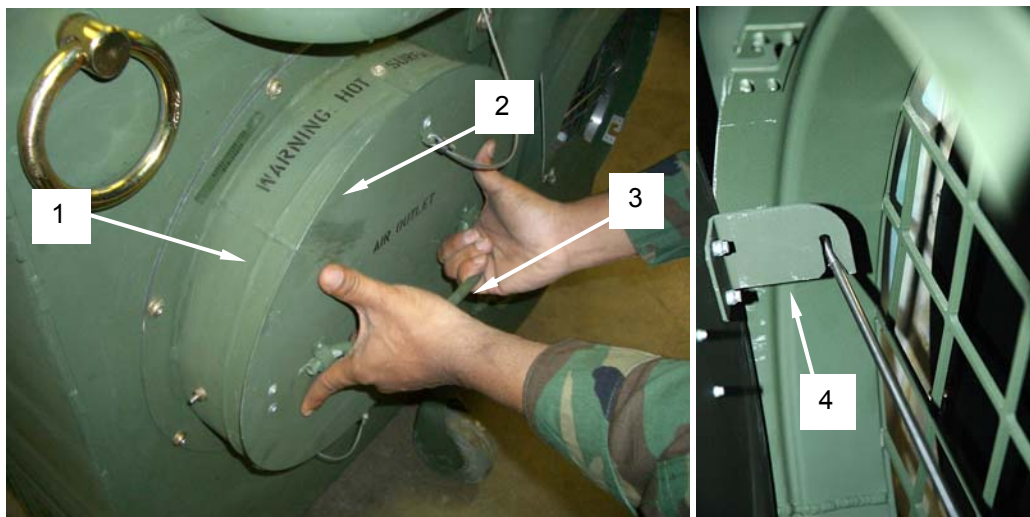


Figure 4. Removing the Inlet and Outlet Duct Covers.

**ASSEMBLY AND PREPARATION FOR USE - Continued**

2. Remove the inlet duct cover (Figure 5, Item 2) by grasping the handle (Figure 5, Item 6) and pulling straight up until the locking clips (Figure 5, Item 5) disengage from the rod (Figure 5, Item 4) that spans across the inlet duct opening (Figure 5, Item 3). Both duct covers are attached to the heater with wire lanyards (Figure 5, Item 1) to retain them to the heater when not in use.

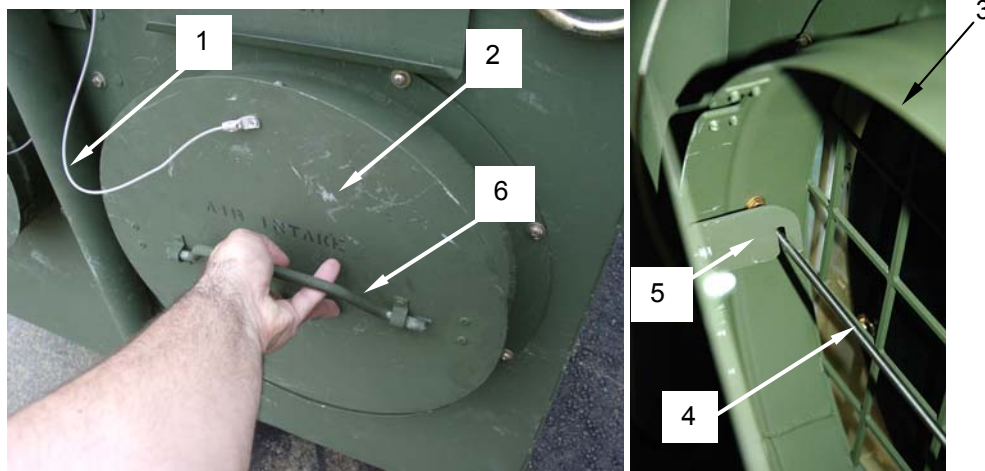


Figure 5. Remove the Inlet Duct Cover.

**END OF TASK****Installing the Flexible Ducts****WARNING**

Gloves should be worn to protect against cuts and/or pinched fingers. Failure to do so could result in injury to hands.

1. Disengage the internal stowage hook of both flexible ducts and expand the ducts to their full length. The ducts themselves are identical but can only be connected to the inlet and outlet ducts in one way. Air flow direction tags are mounted to each duct to indicate the direction of air flow. The inlet duct collar is outfitted with slots that accommodate pins on one duct. The outlet duct collar is outfitted with pins that protrude inward to accommodate slots on the opposite end of the second duct.
2. To install the inlet or outlet duct (Figure 6, Item 3) on the heater, push the duct end ring (Figure 6, Item 4) into the duct opening (Figure 6, Item 5) on the heater so that the slots (Figure 6, Item 2) on the end ring (Figure 6, Item 4) engage with the pins (Figure 6, Item 1) protruding from the inside of the duct opening (Figure 6, Item 5).
3. Rotate the end ring (Figure 6, Item 4) counterclockwise and pull until it locks in place. The air flow direction of the inlet and outlet ducts are tagged on the duct. They are oriented opposite to one another and can only be connected to the heater duct collars in one way.
4. Repeat for second duct.
5. Install the opposite ends of the ducts into the duct tunnels on the shelter.
6. Secure the tent duct tunnel ties to seal the ducts in the tent duct tunnels.

**ASSEMBLY AND PREPARATION FOR USE - Continued**



Figure 6. Install the Inlet or Outlet Duct.

**END OF TASK**

**Deploying the Exhaust Pipe**

1. To deploy the exhaust pipe (Figure 7, Item 7), open the exhaust pipe stowage door (Figure 7, Item 1) and remove the exhaust pipe (Figure 7, Item 7). Secure the stowage door (Figure 7, Item 1).
2. Remove the cap (Figure 7, Item 5) from the exhaust pipe port (Figure 7, Item 6) and set aside.
3. Align the cutout (Figure 7, Item 2) in the exhaust pipe with the pipe in the exhaust pipe port. Install the exhaust pipe (Figure 7, Item 7) into the exhaust pipe port (Figure 7, Item 6) until firmly seated.
4. Stow the cap (Figure 7, Item 5) on the exhaust pipe guard (Figure 7, Item 3) using the S-hook (Figure 7, Item 4) provided.

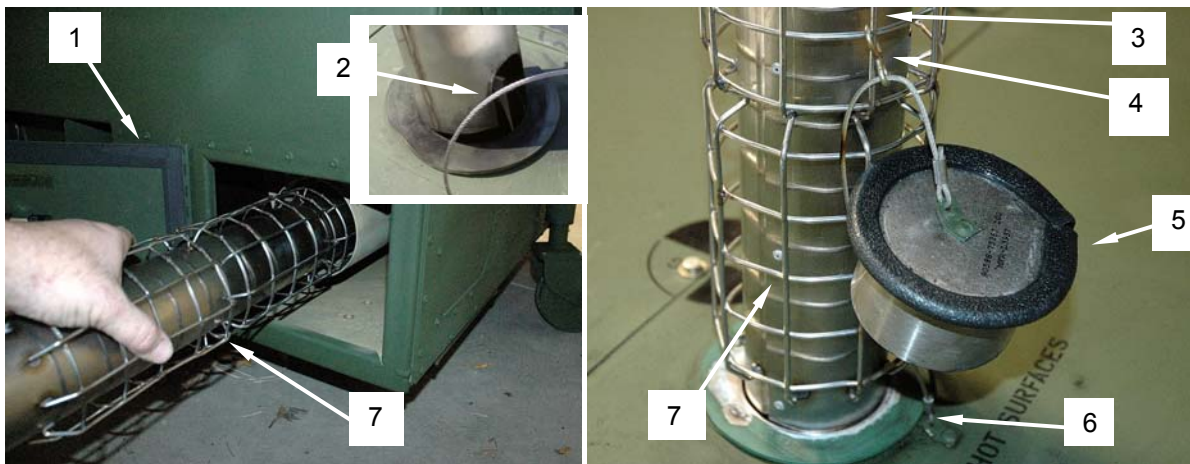


Figure 7. Deploying the Exhaust Pipe.

**END OF TASK**

### Installing the Operator Control Box in the Shelter

1. To install the operator control box in the shelter, open the operator control box cover (Figure 8, Item 1) on the top of the heater.
2. Unwind the 25-foot control cable (Figure 8, Item 4) to gain access to the operator control panel.
3. Remove the operator control box (Figure 8, Item 2) from its stowage location by releasing the single turn-key latch (Figure 8, Item 3) and lifting upward.
4. Slide the operator control box (Figure 8, Item 2) and attached cable (Figure 8, Item 4) under the side of the shelter in a convenient location that will not hinder entry or exit from the shelter or act as a trip hazard. Take care not to get any dirt or debris on the operator control box.
5. Hang the operator control box (Figure 8, Item 2) inside the shelter at a height of three to six feet using the attached cable (Figure 8, Item 5). Place the operator control box (Figure 8, Item 2) in a location that is not in the direct path of air coming from the heated air outlet duct or in the direct path of cold air entering from the shelter entry.

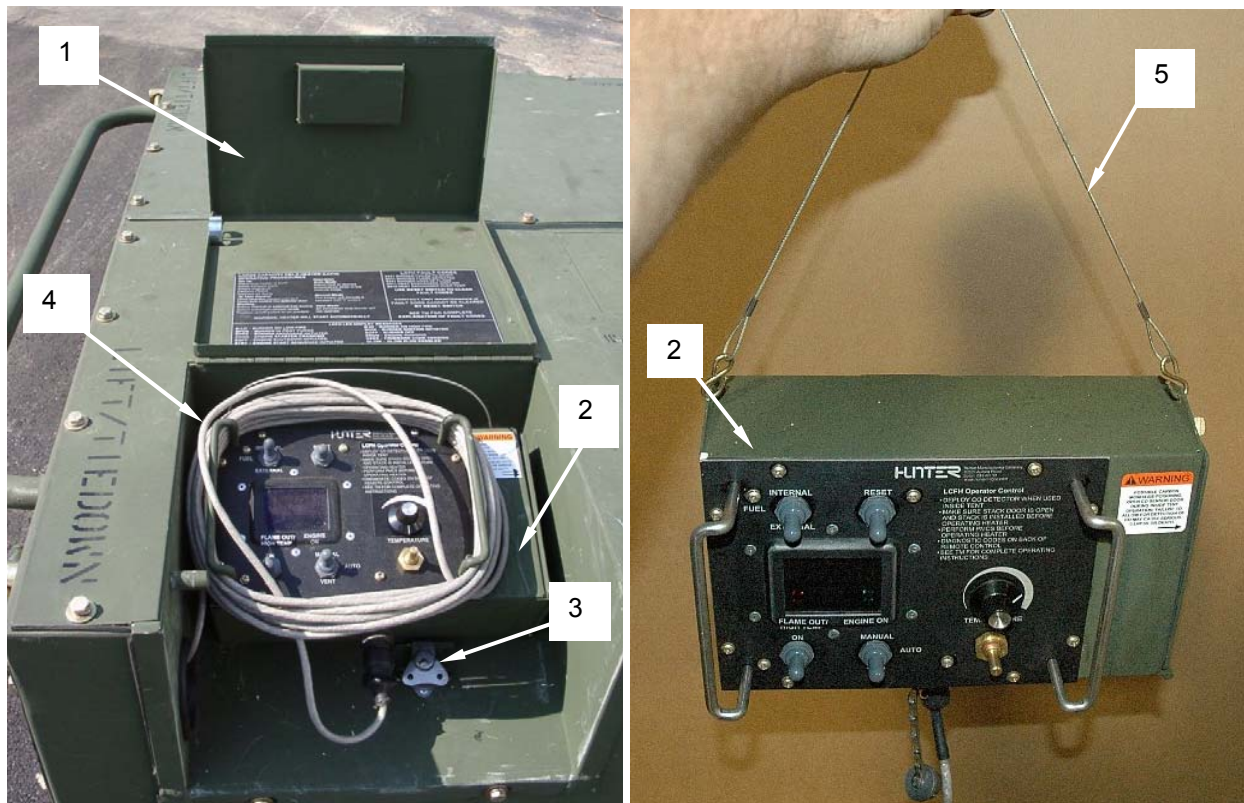


Figure 8. Installing the Operator Control Box in the Shelter.

**END OF TASK**

## Deploying the Carbon Monoxide Detector

### NOTE

The detector is only rated for operation above 32°F. The carbon monoxide detector will survive -65°F cold storage.

To deploy the carbon monoxide (CO) detector (Figure 9, Item 2) on the operator control box (Figure 9, Item 4), unscrew the small thumb screw (Figure 9, Item 1) on the cover (Figure 9, Item 3) protecting the CO detector (Figure 9, Item 2). Open the cover (Figure 9, Item 3) and allow it to hang below the CO detector.

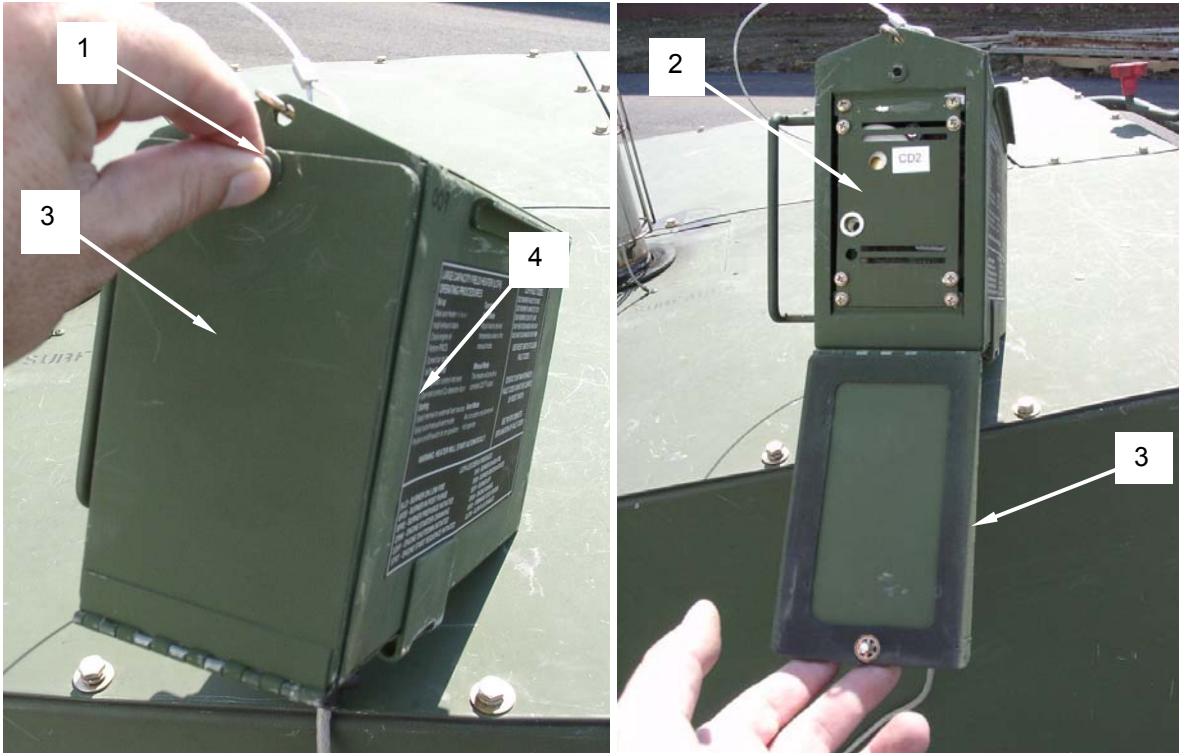


Figure 9. Deploying the Carbon Monoxide Detector.

END OF TASK

**FUELING THE LCFH TYPE II****WARNING**

Do not use unauthorized fuels. Use of unauthorized fuel may result in fire and/or explosion, causing severe injury or death.

**Fueling the Internal Fuel Tank****NOTE**

Be sure to place a petroleum absorbent material or mat under the fuel panel to catch any fuel that may spill or drip during the fueling operation. Be sure to dispose of the soiled material and/or mat in accordance with Unit SOP and local environmental regulations.

Be sure to rotate the fuel can so that the spout faces down when filling the LCFH Type II internal fuel tank to ensure that the fuel can is completely empty.

1. To fill the internal fuel tank (Figure 10, Item 3) with an approved fuel, as listed in WP 0002, remove the fuel filler cap (Figure 10, Item 1) on the rear of the heater.
2. Fill the fuel tank with approved fuel until the fuel can be seen just below the filler neck. The LCFH Type II fuel tank has a capacity of 35 gallons.
3. When the tank is full, replace the fuel filler cap (Figure 10, Item 1) and tighten securely. The fuel level in the tank is constantly displayed on the fuel gauge (Figure 10, Item 2).
4. Wipe up any spilled fuel with a wiping rag. Dispose of soiled rags and/or petroleum absorbent mat in accordance with unit SOP and local environmental regulations.

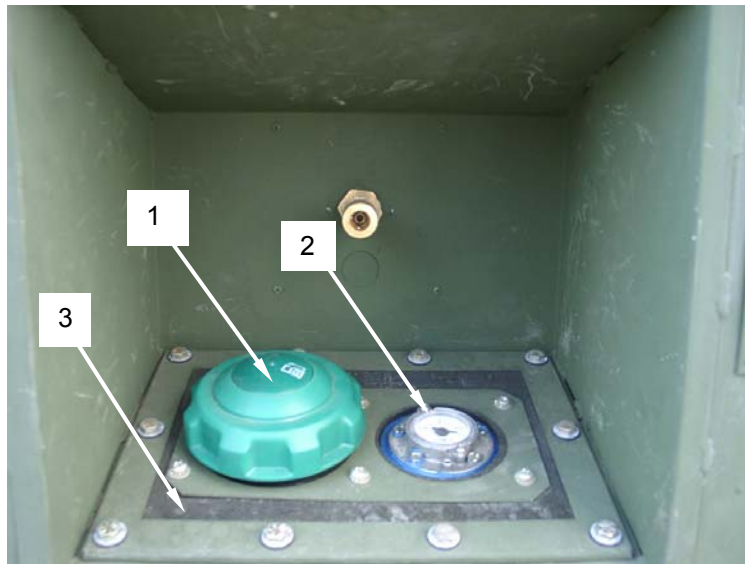


Figure 10. Fueling the Internal Fuel Tank.

**END OF TASK**



## Operating from an External Fuel Supply

### WARNING



The LCFH Type II should not be positioned any closer than 2 feet from an external bulk fuel supply. Placing the heater closer than 2 feet from a bulk fuel supply may result in fire or explosion causing serious injury or death.

### WARNING



The external fuel connection should not be used if the internal fuel tank is ruptured or otherwise leaking, as the fuel system utilizes a continuous fuel loop-back design. Using the external fuel connection, when there is a rupture or leak in the internal fuel tank, may result in fire or explosion causing severe injury or death.

### CAUTION

The external fuel supply should be located no more than 25 feet from the heater as the external fuel hose is 25 feet in length. The external fuel hose must not be lengthened by adding additional sections as this may place additional demands on the electrical fuel pump in the heater.

Fill the internal tank with a minimum of 8 gallons of fuel and prime engine IAW WP 0022. Failure to prime the diesel engine properly will result in starting difficulty and poor performance.

### NOTE

The external fuel supply should be placed slightly uphill from the LCFH Type II to aid in fuel flow.

The LCFH Type II can be switched from internal to external fuel mode (or vice versa) while the heater is operating. However, if the internal fuel tank is very low on fuel or empty, there may be a period of time when the heater sputters or runs erratically while air is purged from the external fuel hose. Allow the heater to run until all air is expelled and the heater resumes normal operation. A discussion on the operation of the fuel supply can be found in WP 0003, entitled Theory of Operation.

1. To operate the LCFH Type II from an external fuel source, retrieve the 25-foot external fuel hose (Figure 11, Item 1) from its storage location on the inside of the engine access panel (Figure 11, Item 6). Close engine access panel after the hose has been removed.
2. Remove the dust cap (Figure 11, Item 3) from the male quick disconnect end (Figure 11, Item 2) of the external fuel hose (Figure 11, Item 1).
3. Connect the male quick disconnect end (Figure 11, Item 2) of the 25-foot external fuel hose (Figure 11, Item 1) to the external fuel connector (Figure 11, Item 7) located at the rear of the heater.
4. Push back the outside collar of the external fuel connector, insert the male quick disconnect end and ensure that it is fully seated, and release the outside collar.
5. Pull on the external fuel hose to ensure a secure connection.

6. To connect the opposite end of the external fuel hose (Figure 11, Item 1) to a bulk fuel supply, first remove the dust plug (Figure 11, Item 4).
7. Connect the opposite end of the external fuel hose (Figure 11, Item 1) equipped with a 5/16 JIC female flare fitting (Figure 11, Item 5) to the bulk fuel supply. Be sure to place a petroleum absorbent mat or tray, containing petroleum absorbent material, under both connections.
8. Once the connection has been made between the LCFH Type II and the external fuel supply, place the FUEL selector switch in the EXTERNAL position as described in the section of this work package entitled "INITIAL OPERATOR CONTROL BOX SETTINGS."



Figure 11. Operating from an External Fuel Supply.

END OF TASK

**INITIAL OPERATOR CONTROL BOX SETTINGS**

1. Before powering up the LCFH Type II, the controls on the operator control box (Figure 12, Item 2) need to be set in the appropriate positions as follows.
2. If the heater is to be operated using the internal fuel tank only, place the fuel selector switch (Figure 12, Item 1) in the INTERNAL position. If the heater is to be operated using an external fuel supply, place the fuel selector switch in the EXTERNAL position.
3. Determine whether the heater will be operated in MANUAL, VENT, or AUTO mode. Place the operating mode switch (Figure 12, Item 5) in the desired position. In MANUAL mode, the heater will continue to generate heat continuously until shutdown. Heat output is not regulated by the thermistor (Figure 12, Item 4) in the operator control box. In VENT mode, the heater will not generate heat and will blow fresh, unheated air into the shelter. In AUTO mode, the heat output of the LCFH Type II is regulated by the temperature control (Figure 12, Item 3) on the operator control box and the installed thermistor (Figure 12, Item 4). When the temperature in the shelter reaches the temperature preset on the operator control box, the heater will either produce no heat, go into half heat output mode, or go into full heat output mode.
4. If the heater is to be operated in AUTO mode, set the temperature control (Figure 12, Item 3) on the operator control box to the desired position.
5. Once all controls on the operator control box are in the desired positions, the heater can now be powered up as detailed in the section to follow.

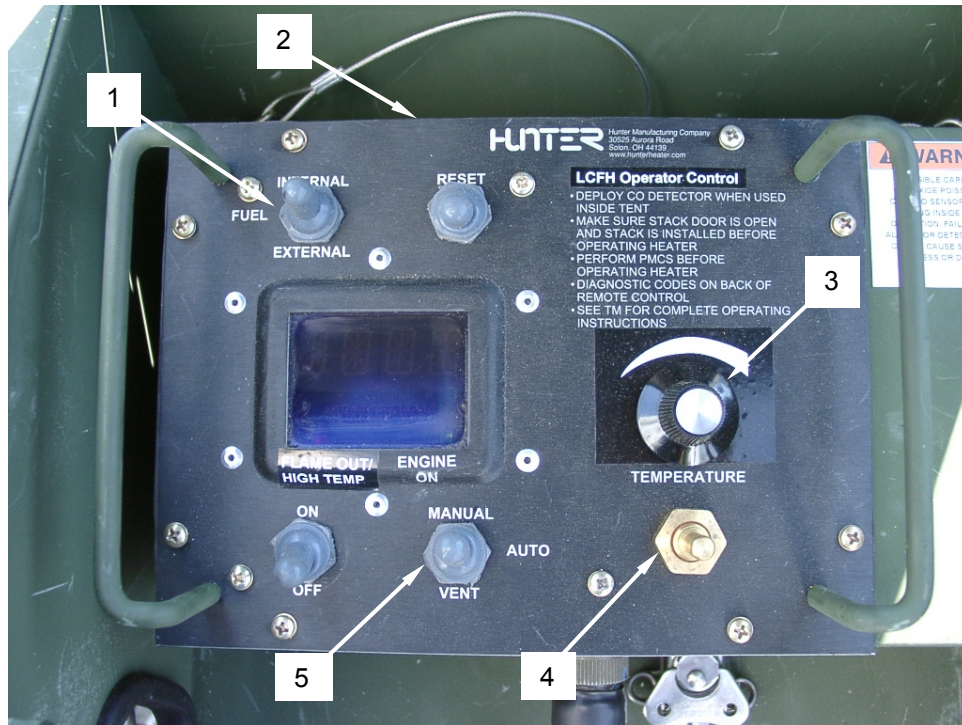


Figure 12. Initial Operator Control Box Settings.

**OPERATING PROCEDURES**

1. Ensure that all operator control box selector switches have been placed in the appropriate operational positions as described in the previous section entitled "Initial Operator Control Box Settings."

**CAUTION**

Once the power switch is placed in the ON position, be sure to wait the prescribed time as indicated in Table 1. Do not turn the power switch on and off until sufficient time has elapsed. Heat will not be supplied until after the initial startup time has passed and turning the power switch on and off will cause the LCFH Type II to cycle and restart the startup process.

**NOTE**

If the outside temperature is  $-40^{\circ}\text{F}$  or lower, connect the NATO connector on the side of the heater to a 24VDC power source such as from a humvee or cargo truck. At these temperatures, the internal batteries in the LCFH Type II may require supplemental power to permit heater startup. The NATO connector is not to be connected to other equipment.

When operating at a 10 degree or greater angle, the oil pressure fault code may come on if the system is starved for oil. Ensure that the heater is placed on ground that is approximately level for proper operation.

**NOTE**

Be sure to perform all Before Operation PMCS IAW WP 0015 before starting and using heater.

**NOTE**

Ensure that the power switch on control panel is in the OFF position. Open engine access door and ensure that the main battery shutdown switch (Figure 13, Item 1) is in the ON position before operating heater. Be sure to close the engine access panel before starting. Perform a walkaround of the heater before starting to ensure that the heater is completely ready for startup.

2. To start the heater, place the power switch (Figure 13, Item 2) on the operator control box in the ON position. The heater will perform a series of self tests that will be displayed on the LED display of the operator control box. If any faults are detected during the startup sequence, system startup will be aborted and the heater shut down. The fault code representing the cause of the problem will be shown on the operator control box display. If system startup is aborted and a fault code displayed, refer to WP 0007 for guidance on appropriate troubleshooting procedures.
3. Once the self test is complete, the heater will enter its startup procedure. The amount of time required for the startup sequence to complete is dependent on the outside ambient temperature. Table 1 provides an approximation of startup time versus outside temperature.

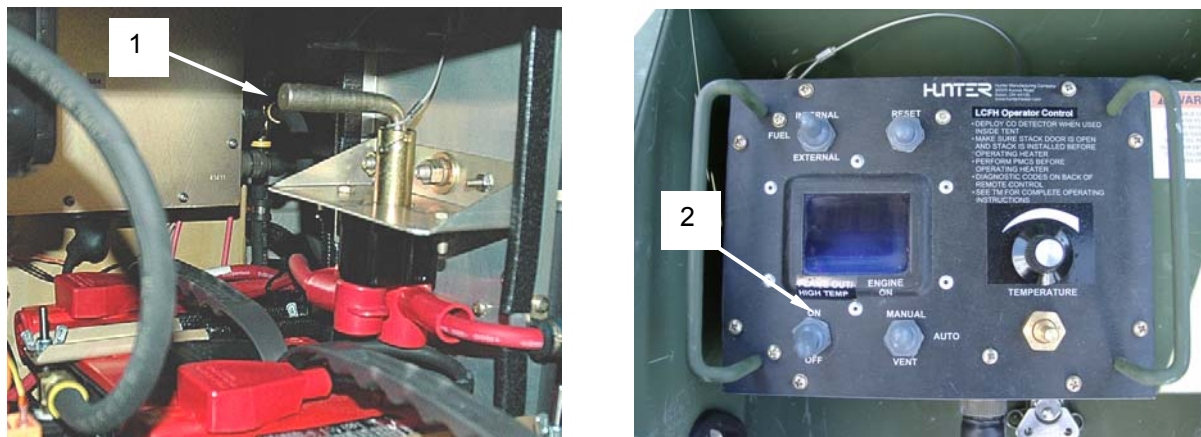


Figure 13. Starting the Heater.

**Table 1. LCFH Type II Startup Time Versus Outside Ambient Temperature.**

LCFH TYPE II STARTUP TIME	OUTSIDE TEMPERATURE
2 minutes	above 32°F (0°C)
3 minutes	32°F to 0°F (0°C to -17.8°C)
4 minutes	0°F to -30°F (-17.8°C to -34.4°C)
5 minutes	-30°F to -65°F (-34.4°C to -53.9°C)

During the startup sequence, a series of startup codes will be displayed on the operator control panel. Table 2 lists the codes and their meaning.

**Table 2. LCFH Type II Startup Codes.**

CODE	DESCRIPTION	CODE	DESCRIPTION
B-LO	Burner on low fire	B-HI	Burner on high fire
BPOS	Burner in post purge	BIGN	Burner ignition initiated
BPRE	Burner prepurge initiated	BOFF	Burner off
CRNK	Engine starter cranking	ERUN	Engine running
EOFF	Engine shutdown initiated	VXXX	Firmware code version (the XXX will be replaced with numbers representing the current firmware version)
STRT	Engine start sequence initiated	GLOW	Glow plug enabled

4. As the startup sequence progresses, the system will go through a fuel system purge sequence, and the glow plug on the diesel engine will be preheated.
5. The diesel engine start sequence will begin, which may involve multiple start attempts depending on the outside temperature.
6. Once the diesel engine has started and has stabilized, the burner fuel pre-purge sequence will begin.
7. When the burner pre-purge sequence is complete, the burner will start. The burner may require multiple start attempts depending on the outside temperature.
8. Once the burner has fired, the LED display on the operator control box will indicate either “B-LO” (burner in lo fire) or “B-HI” (burner in high fire), indicating that the system is running.
9. After a short time, the heater will begin sending heated air into the shelter.

**END OF TASK**

## Operating the Carbon Monoxide Detector

### WARNING



Actuation of the carbon monoxide detector indicates the presence of CO which can be FATAL. If the alarm sounds, perform the following steps immediately. Failure to do so may result in severe injury or death to personnel.

### NOTE

When the power switch on the operator control box is turned on, the status light (Figure 14, Item 3) on the front of the carbon monoxide detector (Figure 14, Item 1) will alternately switch between RED and GREEN, as the unit performs a two-and-a-half-minute warm-up and self-test procedure.

The audible tones on the detector will cycle twice, emitting two sets of four tones. At the end of this 2-1/2 minute cycle, the status light (Figure 14, Item 3) will turn GREEN to indicate normal operation and good, safe air. The alarm relay is energized during the 2-1/2 minute warm-up cycle.

The CO detector continuously monitors the air in the shelter. If the detector measures levels of CO greater than the danger level, the RED light will turn on, the Alarm Relay will switch to actuate the alarm circuits in the operator control box, the buzzer will sound, and the heater will shut down. The detector is programmed to alarm if the danger level of carbon monoxide is exceeded, which are time and concentration related. The alarm points are 70 ppm of carbon monoxide after 60 to 240 minutes, 150 ppm of CO after 10 to 50 minutes, and 400 ppm of CO after 4 to 15 minutes, per UL Standard 2034.

1. Immediately move to a location which has fresh air, outdoors, or by an open door/window.

### WARNING

Check that all persons are accounted for by doing a head count. Do not reenter premises until the medical personnel have arrived, the premises have been aired out, and the alarm remains in its normal condition.

2. Call for medical support personnel.
3. Press the reset button (Figure 14, Item 2). After following steps 1 and 2, if your alarm reactivates within a 24-hour period, repeat steps 1 and 2 and contact field maintenance to examine and/or replace the detector.

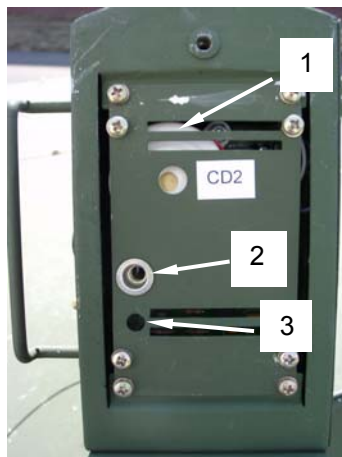


Figure 14. Operating the Carbon Monoxide Detector.

**END OF TASK**

## Operating the Fresh Air Damper

The fresh air damper (Figure 15, Item 1) permits outside air to be introduced into the inlet air stream of the LCFH Type II. This makeup air allows fresh air to mix with the air that is being circulated inside the shelter.

To deploy the fresh air damper, lift the damper door and engage the spring-loaded prop (Figure 15, Item 2) into one of the holes under the damper door.



Figure 15. Operating the Fresh Air Damper.

## END OF TASK

### Shutdown Procedure

1. To shutdown the LCFH Type II, place the power switch (Figure 16, Item 1) in the OFF position.
2. Once the heater has been instructed to shut down, the burner will be shut down followed by a burner post-purge and cool-down. This is in turn followed by a burner fan shut down and a shutdown of the diesel engine.
3. The entire shutdown process for the heater is estimated at three to five minutes but may vary depending on conditions.
4. Once heater is shutdown and cool, open the engine access panel and turn the main battery shutdown switch to the OFF position. Close the engine access door.
5. Once the heater has been successfully shut down, it should be maintained as outlined in WP 0015 and WP 0016 entitled "Preventive Maintenance Checks and Services."



Figure 16. Shutting Down the LCFH Type II.

## END OF TASK

## PREPARATION FOR MOVEMENT

### Stowing the External Fuel Supply

If operating from an external fuel supply, the external fuel hose (Figure 17, Item 2) must be stowed prior to movement.

1. Disengage the external fuel hose (Figure 17, Item 2) by pushing back the outside collar of the external fuel connector (Figure 17, Item 1), while pulling the external fuel hose.
2. Install the dust cap (Figure 17, Item 4) on the male quick disconnect end (Figure 17, Item 3) of the external fuel hose (Figure 17, Item 2).
3. Starting at the heater, begin coiling the external fuel hose while holding the hose at a higher level than the bulk fuel supply. This will force any fuel in the external fuel hose back into the bulk supply container.
4. Once at the bulk fuel container connector, remove the 5/16 JIC female flare fitting (Figure 17, Item 8) and install the dust plug (Figure 17, Item 7).
5. Return the coiled external fuel hose to its stowage location (Figure 17, Item 6) on the engine access door (Figure 17, Item 5).

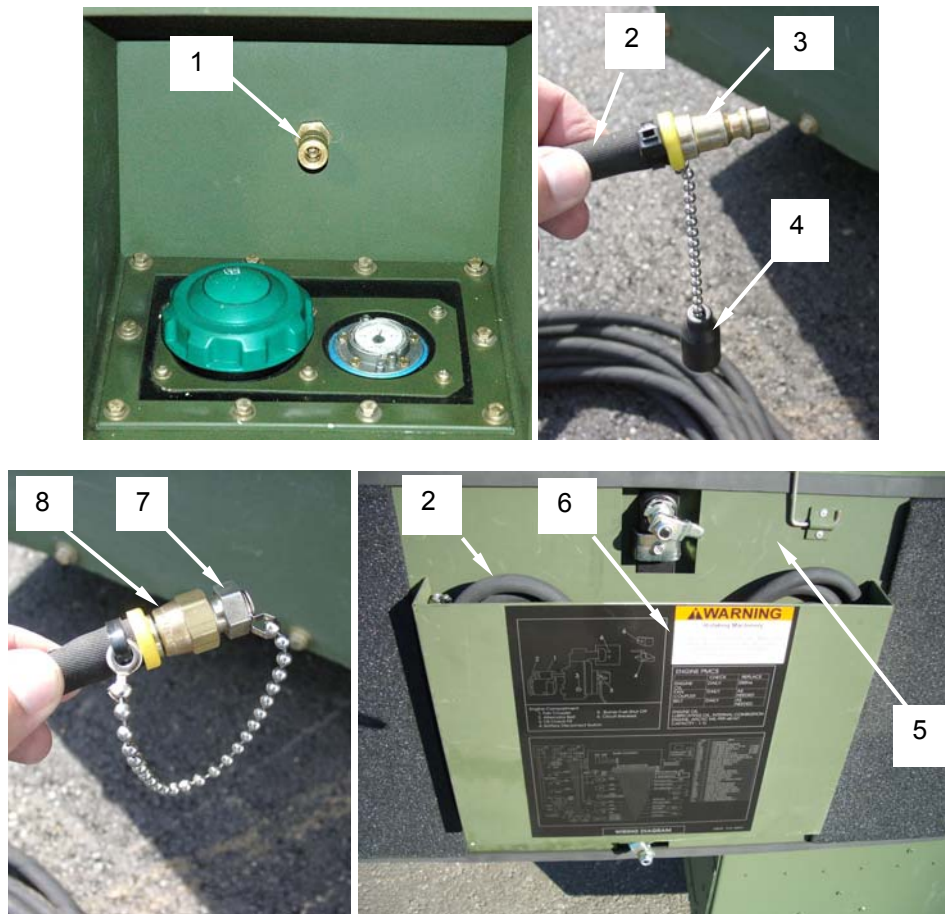


Figure 17. Stowing the External Fuel Supply.

**END OF TASK**



### Stowing the Operator Control Box

1. To prepare the LCFH Type II for movement, stow the operator control box (Figure 18, Item 8) by securing the CO detector. Close the cover (Figure 18, Item 9) on the side of the operator control box (Figure 18, Item 8) and secure by tightening the thumb screw (Figure 18, Item 1).
2. Remove the operator control box from its hanging location and pass the panel and its connecting cable under the wall of the shelter.
3. Stow the operator control box in its docking location by aligning the upper retaining rail (Figure 18, Item 2) on the panel with the mating rail on the cabinet. Secure the operator control box in place by engaging the turn-key latch (Figure 18, Item 3) on the tab (Figure 18, Item 4) at the lower right corner of the operator control box.
4. Wrap the operator control box cable (Figure 18, Item 6) neatly around the operator control box handles (Figure 18, Item 5).
5. Tuck the last portion of the cable, under the cable already secured, to prevent the cable from unwinding.
6. Close the outer operator control box cover (Figure 18, Item 7).

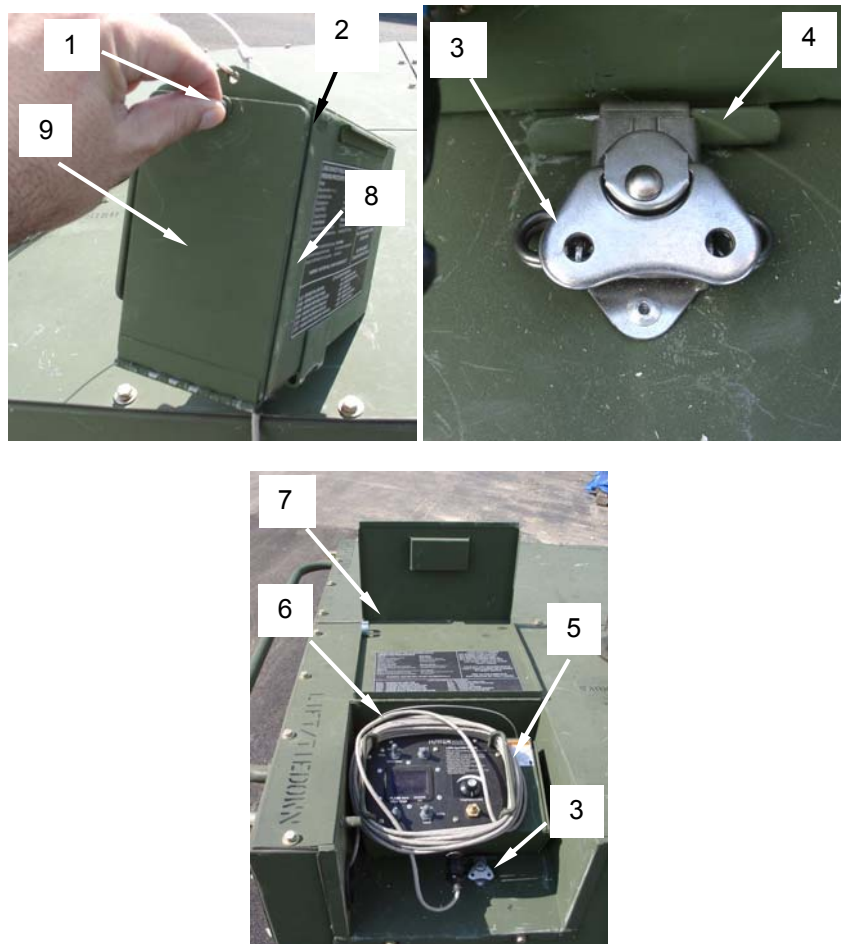


Figure 18. Stowing the Operator Control Box.

**END OF TASK**

## Stowing the Flexible Inlet and Outlet Ducts

### WARNING



Gloves should be worn to protect against cuts and/or pinched fingers. Failure to do so could result in injury to hands.

1. To prepare the ducts for movement, untie the tent duct tunnel ties and remove the ducts from the inlet and outlet tent duct tunnels.
2. At the heater duct opening (Figure 19, Item 1), push in and rotate the duct end ring (Figure 19, Item 7) counterclockwise to disengage the end ring (Figure 19, Item 7). Pull the duct (Figure 19, Item 6) straight out from the heater.
3. Repeat for second duct.
4. To stow the flexible duct, place the opening (Figure 19, Item 4) flat on the ground, and compress the remaining duct (Figure 19, Item 2) until the end is reached and the internal hook (Figure 19, Item 3) can be engaged on the large internal hoop (Figure 19, Item 5).
5. Repeat for second flexible duct.
6. Stow both flexible ducts in a location that prevents them from being damaged.



Figure 19. Stowing the Flexible Inlet and Outlet Ducts.

**END OF TASK**

**Stowing Inlet and Outlet Duct Covers**

1. Stow the outlet duct cover (Figure 20, Item 3) on the heated air outlet duct (Figure 20, Item 1) by grasping the handle (Figure 20, Item 2) and aligning the locking clips (Figure 20, Item 4) with the rod that extends across the duct collar.
2. Push down on the outlet duct cover (Figure 20, Item 3) to engage the locking clips (Figure 20, Item 4).

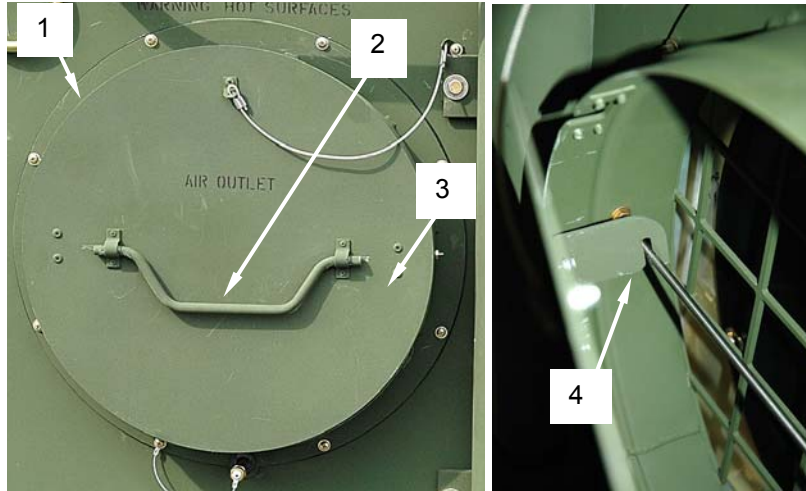


Figure 20. Stowing Inlet and Outlet Duct Covers.

3. Stow the inlet duct cover (Figure 21, Item 1) by grasping the handle (Figure 21, Item 5) and aligning the locking clips (Figure 21, Item 4) on the duct cover with the rod (Figure 21, Item 3) that spans across the inlet duct collar (Figure 21, Item 2).
4. Press down on the inlet duct cover (Figure 21, Item 1) to engage the locking clips (Figure 21, Item 4) on the rod (Figure 21, Item 3).

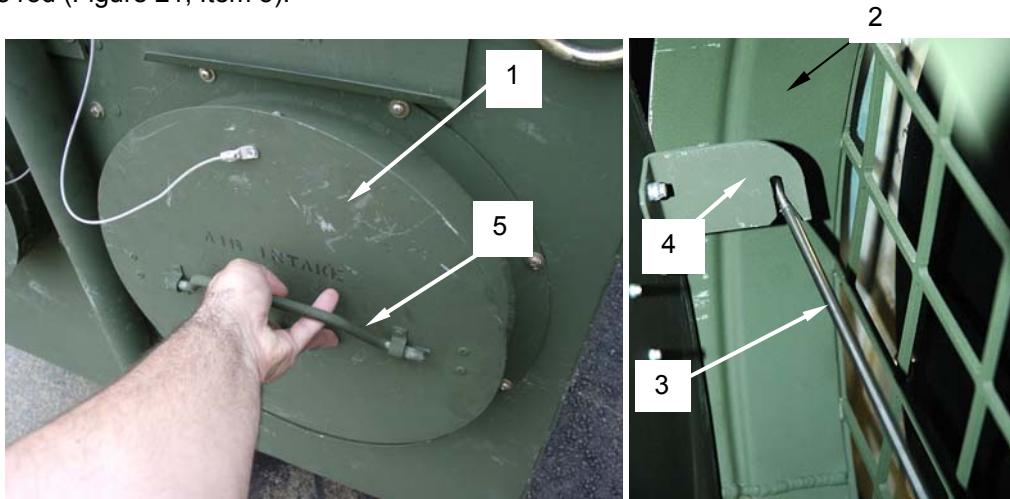


Figure 21. Stow the Inlet Duct Cover.

**END OF TASK**

## Stowing the Exhaust Pipe

### WARNING



The LCFH Type II exhaust stack surface reaches a temperature of 150° F (65.5° C). Do not touch or allow bare skin to come in contact with the exhaust stack unless the LCFH Type II has been shut down and cool. Coming in contact with hot surfaces may result in burns or other serious injury.

1. To stow the exhaust pipe (Figure 22, Item 1), remove from the exhaust pipe port (Figure 22, Item 5).
2. Open the exhaust pipe stowage door (Figure 22, Item 2) and insert the open end of the exhaust pipe (Figure 22, Item 1) first. Be sure that the exhaust pipe is inserted fully into the retaining tube (Figure 22, Item 3) inside the stowage area.
3. Secure the stowage door (Figure 22, Item 2).
4. Install the cap (Figure 22, Item 4) on the exhaust pipe port (Figure 22, Item 5).

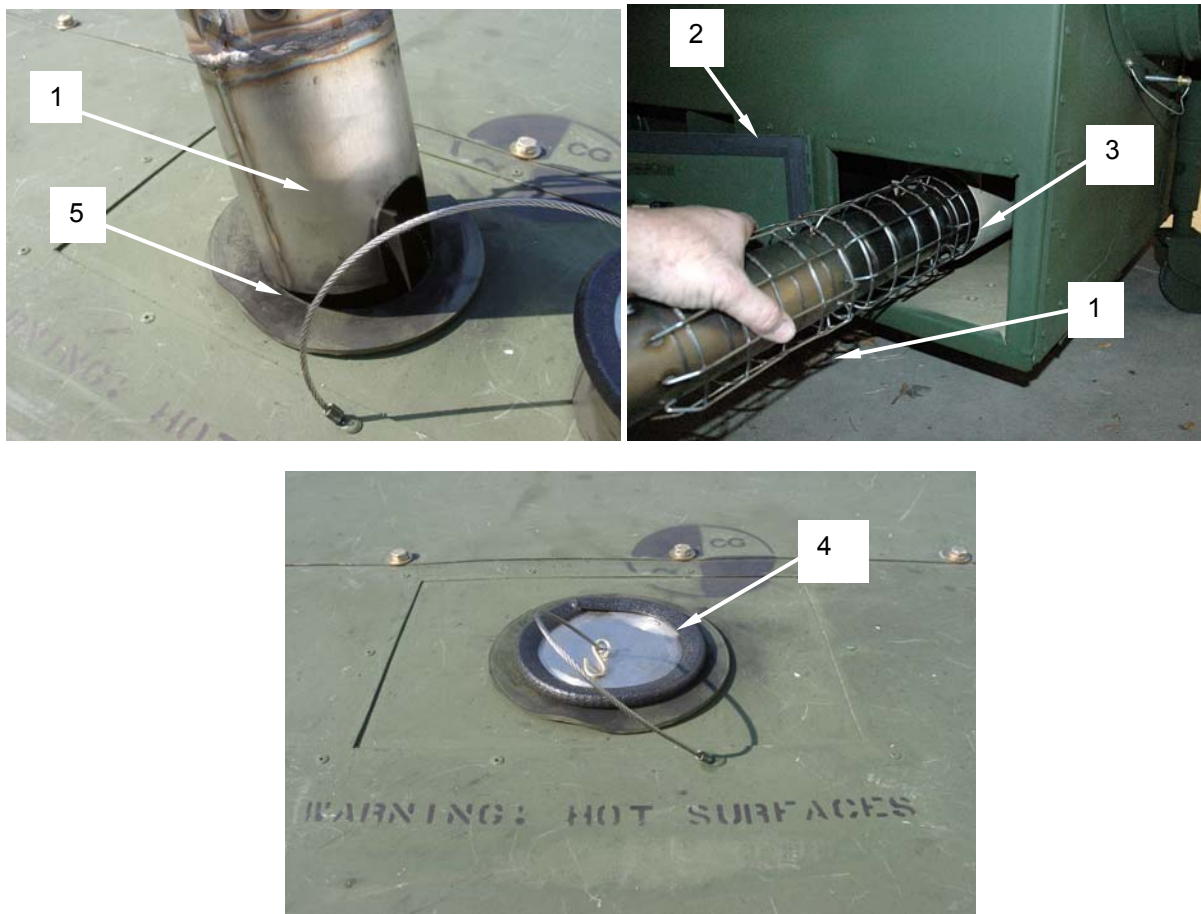


Figure 22. Stowing the Exhaust Pipe.

**END OF TASK**

### Stowing Wheel Chocks

1. If the heater is resting on its wheels and the wheel chocks are in place, they must be stowed prior to rolling the heater. Ensure that the heater will not move, and remove the wheel chocks one wheel at a time.
2. Stow the wheel chocks (Figure 23, Item 4) by placing them together so that their wider rear edges (Figure 23, Item 2) are opposite one another.
3. Wrap the tether (Figure 23, Item 1) around the chocks to hold them together.
4. Place the wheel chocks in their stowage area (Figure 23, Item 3) on either side of the heater cabinet.

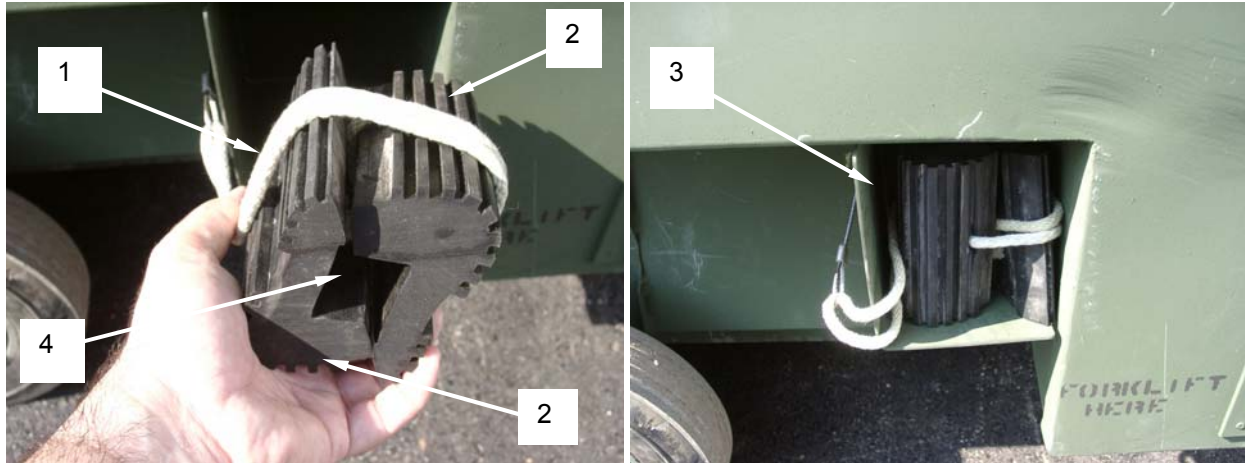


Figure 23. Stowing Wheel Chocks.

**END OF TASK**

### Lowering the Side Wheels

If the side wheels are in their raised position, they must be lowered and locked into position to permit local mobility.

1. Lower the front wheel (Figure 24, Item 2) by rotating the wheel jack handle (Figure 24, Item 1) clockwise until the front wheel (Figure 24, Item 2) contacts the ground and begins to tilt the heater back on its snow skids. Continue until the front wheel is completely lowered.
2. Remove the locking pin (Figure 24, Item 4) and remove wheel and axle assembly (Figure 24, Item 3).
3. Rotate the wheel and axle assembly (Figure 24, Item 3) 90 degrees.
4. Reinstall wheel and axle assembly (Figure 24, Item 3) and engage locking pin (Figure 24, Item 4).
5. Repeat for the opposite wheel.
6. Raise the front wheel (Figure 24, Item 2) by rotating the wheel jack handle (Figure 24, Item 1) counterclockwise until the top of the heater cabinet is parallel to the ground.

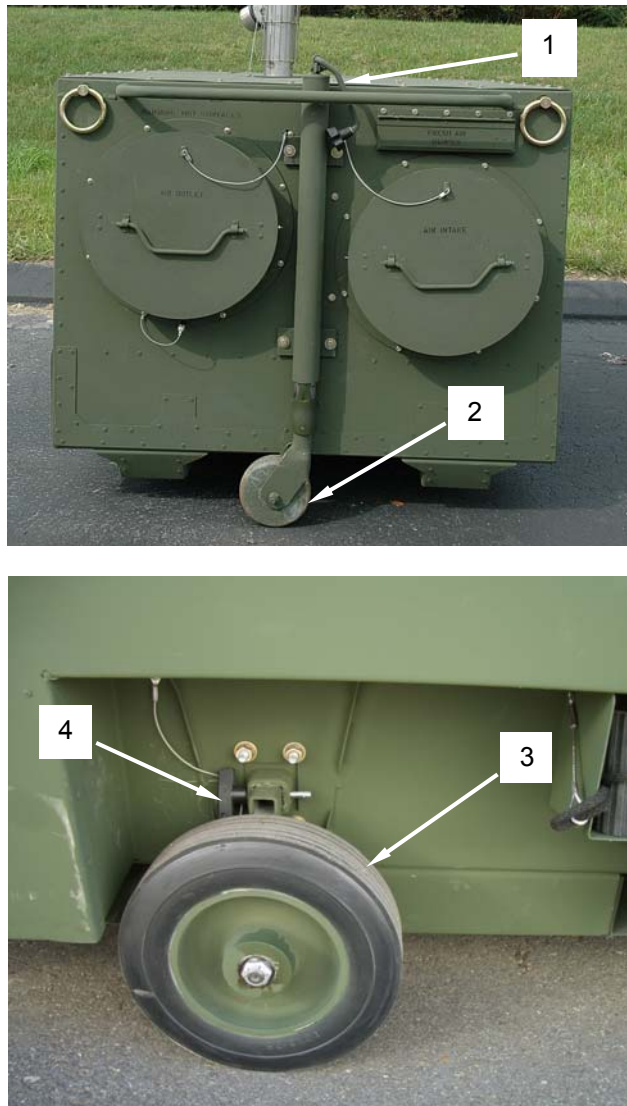


Figure 24. Lowering the Side Wheels.

**END OF TASK**

**DECALS AND INSTRUCTION PLATES**

The following instruction and/or warning plates can be found on the LCFH Type II:

**Table 3. Decals and Instruction Plates.**


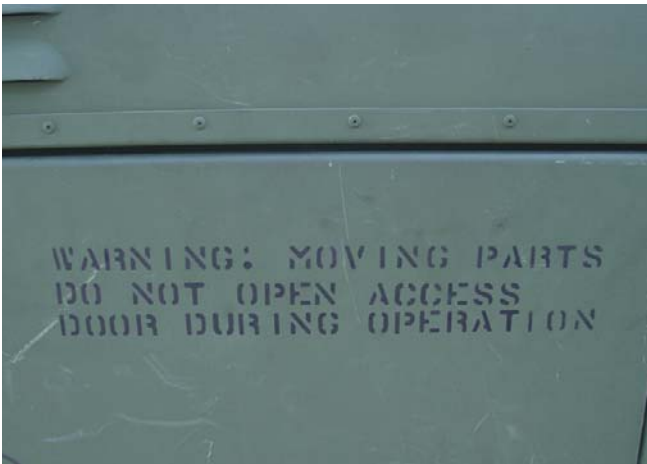
Decal	Description and Location
<div style="border: 1px solid black; padding: 5px;"> <p><b>LARGE CAPACITY FIELD HEATER(LCFH) OPERATING PROCEDURES</b></p> <p><b>Set up</b>                      Make sure heater is level                      Install exhaust stack                      Check engine oil                      Perform PMCS                      Connect air ducts</p> <p><b>In Tent Control</b>                      Feed operator control into tent                      Open tent control Co Detector door</p> <p><b>Starting</b>                      Select internal or external fuel source                      Select auto/manual/vent mode                      Position on/off switch to on position</p> <p><b>Operation</b>  <b>Auto Mode</b>                      Adjust heat to desired temperature when in the auto mode</p> <p><b>Manual Mode</b>                      The heater will provide a constant 225°F output</p> <p><b>Vent Mode</b>                      Air circulation only burner will not operate</p> <p><b>WARNING: HEATER WILL START AUTOMATICALLY</b></p> <hr/> <p><b>LCFH LED DISPLAY MESSAGES</b></p> <p>B-LO - BURNER ON LOW FIRE                      BPOS - BURNER IN POST PURGE                      BPRE - BURNER PREPURGE INITIATED                      CRNK - ENGINE STARTER CRANKING                      EOFP - ENGINE SHUTDOWN INITIATED                      STRT - ENGINE START SEQUENCE INITIATED</p> <p>B-HI - BURNER ON HIGH FIRE                      BIGN - BURNER IGNITION INITIATED                      BOFF - BURNER OFF                      ERUN - ENGINE RUNNING                      VXXX - FIRMWARE CODE VERSION                      GLOW - GLOW PLUG ENABLED</p> </div>	<p>Operating instructions for heater. Identical instruction plates located under operator control box cover on top of heater and on rear of operator control box.</p>
	<p>Warning label near exhaust stack port indicating that exhaust stack is a hot surface during operation. Located on top cover near exhaust stack access door.</p>
	<p>Warning label indicating that the engine access door is not to be opened during heater operation. Located on upper right corner of engine access door.</p>

Table 3. Decals and Instruction Plates. - Continued

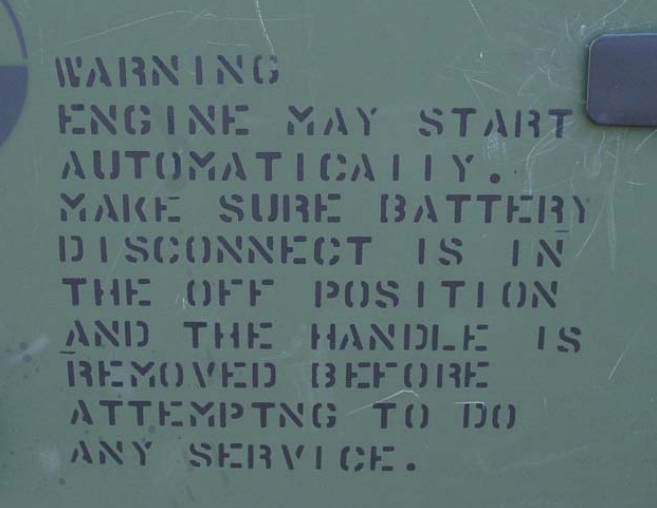


Decal	Description and Location
	<p>Warning label indicating that the engine may start automatically and that main battery switch must be set in the off position and removed prior to conducting any service inside the engine compartment. Located on engine access door.</p>
	<p>Warning labels located above heated air outlet alerting operator of hot air in excess of 225°F at heated air outlet when heater is in operation.</p>
	<p>Air Inlet label showing the location of air inlet duct connection. Located on surface of air inlet duct cover.</p>



Table 3. Decals and Instruction Plates. - Continued




Decal	Description and Location
	<p>Air Outlet label showing the location of air outlet duct connection. Located on surface of air outlet duct cover.</p>
	<p>Fresh Air Damper label located on the surface of the fresh air damper.</p>
	<p>LCFH Type II Data Plate located on the engine access door side of the heater at upper left corner of the heater containing information pertinent to the serial number, model number, NSN, etc.</p>

Table 3. Decals and Instruction Plates. - Continued


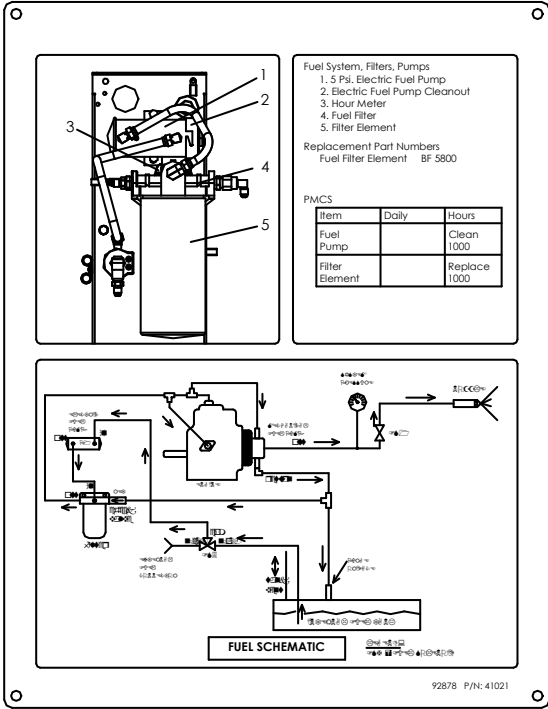
Decal	Description and Location
	<p>Carbon Monoxide Detector deployment warning label, located on lower right of operator control box, alerting operator to deploy the carbon monoxide detector on the operator control box before using the heater.</p>
	<p>Fuel system schematic. Located on inside of fuel access door.</p>

Table 3. Decals and Instruction Plates. - Continued

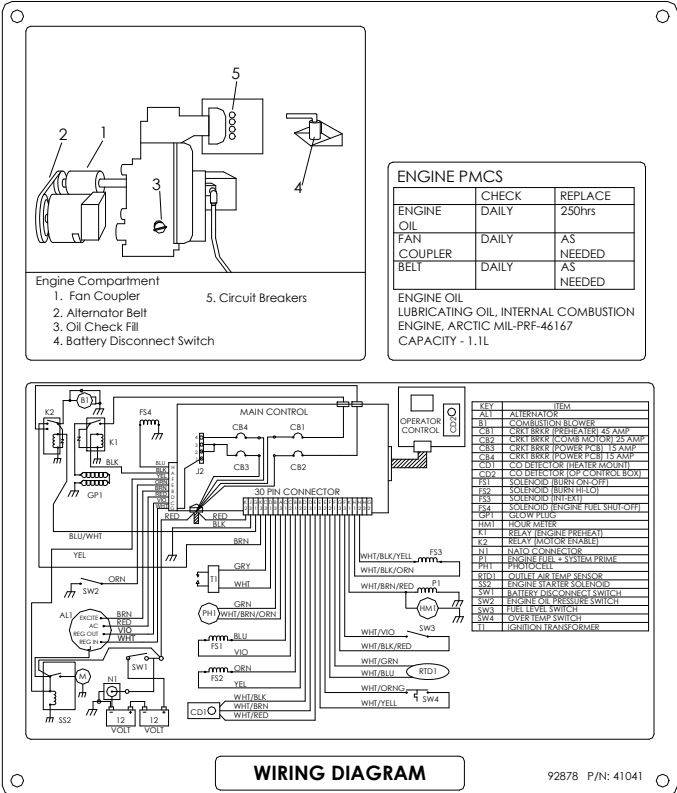

Decal	Description and Location															
 <p>Engine Compartment</p> <ol style="list-style-type: none"> <li>1. Fan Coupler</li> <li>2. Alternator Belt</li> <li>3. Oil Check Fill</li> <li>4. Battery Disconnect Switch</li> <li>5. Circuit Breakers</li> </ol> <table border="1"> <thead> <tr> <th colspan="3">ENGINE PMCS</th> </tr> <tr> <th></th> <th>CHECK</th> <th>REPLACE</th> </tr> </thead> <tbody> <tr> <td>ENGINE OIL</td> <td>DAILY</td> <td>250hrs</td> </tr> <tr> <td>FAN COUPLER</td> <td>DAILY</td> <td>AS NEEDED</td> </tr> <tr> <td>BELT</td> <td>DAILY</td> <td>AS NEEDED</td> </tr> </tbody> </table> <p>ENGINE OIL LUBRICATING OIL, INTERNAL COMBUSTION ENGINE, ARCTIC MIL-PRF-46167 CAPACITY - 1.1L</p> <p><b>WIRING DIAGRAM</b></p> <p>92878 P/N: 41041</p>	ENGINE PMCS				CHECK	REPLACE	ENGINE OIL	DAILY	250hrs	FAN COUPLER	DAILY	AS NEEDED	BELT	DAILY	AS NEEDED	<p>Electrical wiring diagram and schematic of main engine components. Also contains WARNING label for Rotating Machinery. Located on inside of engine access door.</p>
ENGINE PMCS																
	CHECK	REPLACE														
ENGINE OIL	DAILY	250hrs														
FAN COUPLER	DAILY	AS NEEDED														
BELT	DAILY	AS NEEDED														
 <p><b>USE FUEL AS SPECIFIED BELOW DO NOT USE GASOLINE</b></p> <table border="1"> <thead> <tr> <th>AMBIENT TEMPERATURE:</th> <th>TYPE:</th> </tr> </thead> <tbody> <tr> <td>ABOVE +20° F</td> <td>DF-2, DF-1, JP-8</td> </tr> <tr> <td>20° F TO -25° F</td> <td>DF1, JP-8</td> </tr> <tr> <td>-25° F TO -50° F</td> <td>JP-8</td> </tr> </tbody> </table> <p>92878 P/N: 40092</p> <p><b>WARNING USE AUTHORIZED FUELS ONLY</b></p>	AMBIENT TEMPERATURE:	TYPE:	ABOVE +20° F	DF-2, DF-1, JP-8	20° F TO -25° F	DF1, JP-8	-25° F TO -50° F	JP-8	<p>Placard above fuel access panel indicates authorized fuels and temperature ranges at which they should be used. Also, warning to use authorized fuels only.</p>							
AMBIENT TEMPERATURE:	TYPE:															
ABOVE +20° F	DF-2, DF-1, JP-8															
20° F TO -25° F	DF1, JP-8															
-25° F TO -50° F	JP-8															

Table 3. Decals and Instruction Plates. - Continued

Decal	Description and Location
	<p>Placard on exhaust stack storage door indicating proper stowage location.</p>
	<p>Label indicating location of NATO connector external 24VDC power point.</p>
	<p>Label above lift/tie-down ring (4 locations) indicating approved lift and tie down points.</p>

Table 3. Decals and Instruction Plates. - Continued

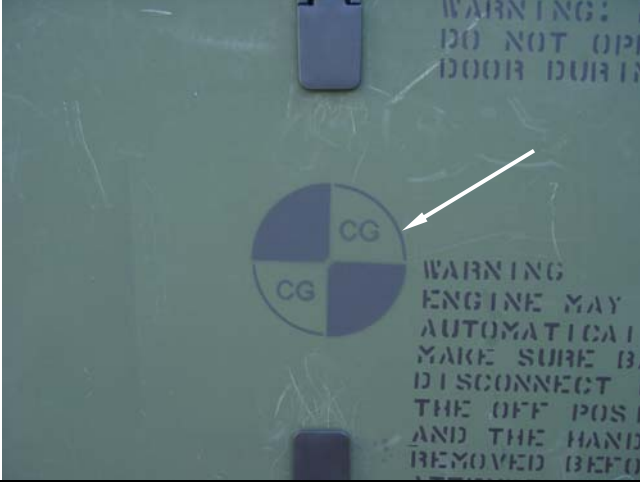
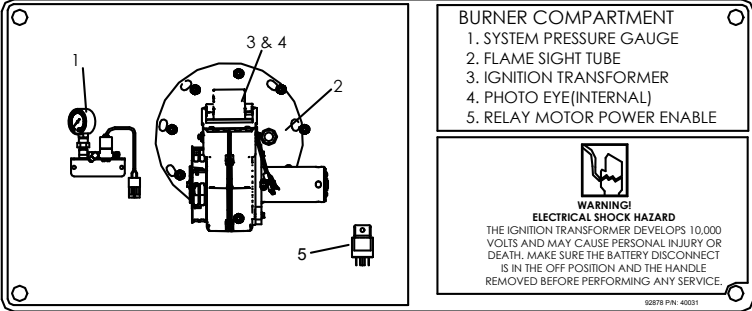
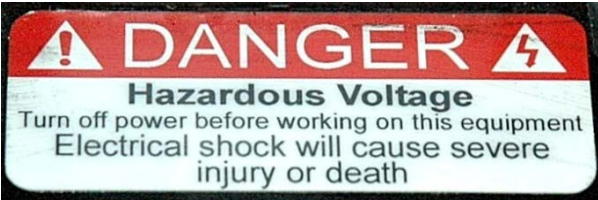

Decal	Description and Location
	<p>Center of gravity marking on heater sides and top (3 locations), indicating the location of the center of gravity of the heater for safe lifting and loading.</p>
 <p>BURNER COMPARTMENT</p> <ol style="list-style-type: none"> <li>1. SYSTEM PRESSURE GAUGE</li> <li>2. FLAME SIGHT TUBE</li> <li>3. IGNITION TRANSFORMER</li> <li>4. PHOTO EYE (INTERNAL)</li> <li>5. RELAY MOTOR POWER ENABLE</li> </ol> <p><b>WARNING!</b> ELECTRICAL SHOCK HAZARD THE IGNITION TRANSFORMER DEVELOPS 10,000 VOLTS AND MAY CAUSE PERSONAL INJURY OR DEATH. MAKE SURE THE BATTERY DISCONNECT IS IN THE OFF POSITION AND THE HANDLE REMOVED BEFORE PERFORMING ANY SERVICE.</p> <p><small>92878 P/N: 40031</small></p>	<p>Burner system schematic located on inside surface of burner access door.</p>
	<p>Warning label on burner system igniter pack alerting the operator to the existence of high voltage.</p>
	<p>Label on burner access door indicating function.</p>

Table 3. Decals and Instruction Plates. - Continued






Decal	Description and Location
	<p>Label on engine access door indicating function.</p>
	<p>Label located above forklift pockets (4 locations) indicating location.</p>
	<p>Label on fuel panel access door indicating location.</p>

Table 3. Decals and Instruction Plates. - Continued

Decal	Description and Location
	<p>Label on operator control box cover indicating location of operator control box.</p>
	<p>Chemical Agent Resistant Coating (CARC) label on upper left corner of the engine access panel side of heater.</p>

END OF TASK

END OF WORK PACKAGE





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**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE****OPERATION UNDER UNUSUAL CONDITIONS**

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**INITIAL SETUP:**

Not Applicable

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**UNUSUAL ENVIRONMENT/WEATHER****Operation in Extreme Sand, Dust, and/or High Winds****WARNING**

The heater has been designed to operate in dusty or sandy conditions. However, some forms of very fine dusts may be explosive (e.g., flour, chaff, coal, etc.). Before operation of the heater in dusty conditions, an attempt should be made to identify the dust type to ensure that it is not explosive in nature.

If possible, the heater should be positioned to minimize the amount of dust, sand, or any other material in the area that could be pulled into the heater by the fans.

When operating in conditions of extreme sand or dust, ensure that the air supply and return ducts are securely attached to the heater and the ducts are securely connected to the shelter.

If high winds are expected, the ducts may require additional anchor or tie downs to prevent high winds from shifting the equipment.

During refueling and at regular intervals between refueling, the heater and its ducts should be inspected for a buildup of dust or sand that would cover the heater or block the ducts or pipes.

During operation in extreme sand or dust, the fuel filter should be changed at twice the frequency noted in the Preventive Maintenance Checks and Services detailed in WP 0016.

Special care should be used during refueling to prevent sand or dust contamination of fuel, fuel supply, and fuel hoses.

**Operation in Extreme Rain or Humidity**

When operating in conditions of extreme rain or humidity, it is recommended that the heated air outlet duct and air supply inlet duct be secured to the heater and the ducts securely connected to the tent.

Under no circumstances should the heater be positioned in standing water. Heater site should be graded slightly, if necessary, to ensure that water runs away from heater and tent.

The inlet and outlet ducts and the heater itself might need to be raised higher off the ground to prevent water from entering the heater. The base contains three compartments in which the battery, combustion blower, and electronic controller are located. These compartments must not be submerged in standing water. If the heater is to be raised above ground level, make sure that water cannot run along ducts or along the operator control box cable and enter the tent.

If high winds accompany rain or humidity, additional anchors or tie downs may be required to prevent winds from shifting the equipment.

During refueling and at regular intervals between refueling, the heater and ducts and exhaust pipe should be inspected for a buildup of snow, dust, or sand that would cover the heater or block the ducts or pipes. Any buildup should be removed.

Special care should be used during refueling to prevent water, snow, sand, or dust contamination of fuel, fuel can, fuel hose, and fuel fittings.

### **Operation at High Altitude**

At altitudes above 6000 feet, adjustment to the burner fuel pump pressure may be necessary. Below 6000 feet elevation, the fuel pressure setting is 180 psi. At altitudes above 6000 feet, excessive smoke may be seen in the exhaust, and it may be necessary to reduce the fuel pressure to facilitate proper burner operation. Do not adjust the burner fuel pump pressure if excessive smoke is not being emitted in the exhaust.

Adjust burner fuel pump pressure for high altitude operation IAW WP 0045.

Be sure to reset the burner fuel pressure back to 180 psi when operating at altitudes below 6000 feet.

## **INTERIM NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) DECONTAMINATION PROCEDURES**

### **Operation in an NBC Environment**

#### **WARNING**

The heater is NOT DESIGNED TO BE OPERATED IN NBC ENVIRONMENTS.

Do not operate the LCFH Type II in NBC environments. If possible, cease operation of the LCFH Type II prior to an NBC event and do the following:

- Disconnect and store, under an impermeable cover, the flexible inlet/outlet ducts, and install the covers on the heater inlet/outlet duct openings.
- Remove and stow the exhaust stack and external fuel hose.
- Install the exhaust outlet cover and close and latch all access doors.

External surfaces of the heater are CARC painted and can be decontaminated; however, if possible, avoid contamination of the internal areas of the heater. If available, cover the heater with an impermeable plastic tarp.

### **END OF TASK**

**NBC Decontamination Procedures****WARNING**

For “immediate decontamination procedures,” use ONLY hot, soapy water for deconning HOT surfaces of the heater and stack. Shut down and cool the heater for any additional decontamination procedures.

DO NOT SPRAY DS2 OR ANY OTHER COMBUSTIBLE DECONTAMINATION SOLUTIONS OR COMPOUNDS ON AN OPERATING HEATER OR STACK. (NOTE: DS2 has a flashpoint of 160°F.)

Perform immediate, operational, or thorough decontamination procedures in accordance with FM 3-11.5 as the mission, resources, and tactical situation permit.

**END OF TASK****EMERGENCY SHUTDOWN PROCEDURES**

In the event the electronic shut-off solenoid malfunctions, the diesel engine may continue to run until it runs out of fuel. If this happens, the engine will have to be shut down manually using the following procedures.

**WARNING**

To avoid personal injury, remove all watches, rings, jewelry, and loose articles of clothing before performing any maintenance with the engine running and the engine bay access panel open. Hearing protection will be worn whenever the engine is running and the engine access panel is open.

1. Open the engine bay access panel.
2. Locate the engine stop lever (Figure 1, Item 1) which is located on the outboard side of the engine, just above the oil drain hose (Figure 1, Item 3) and to the left of the dipstick (Figure 1, Item 2).

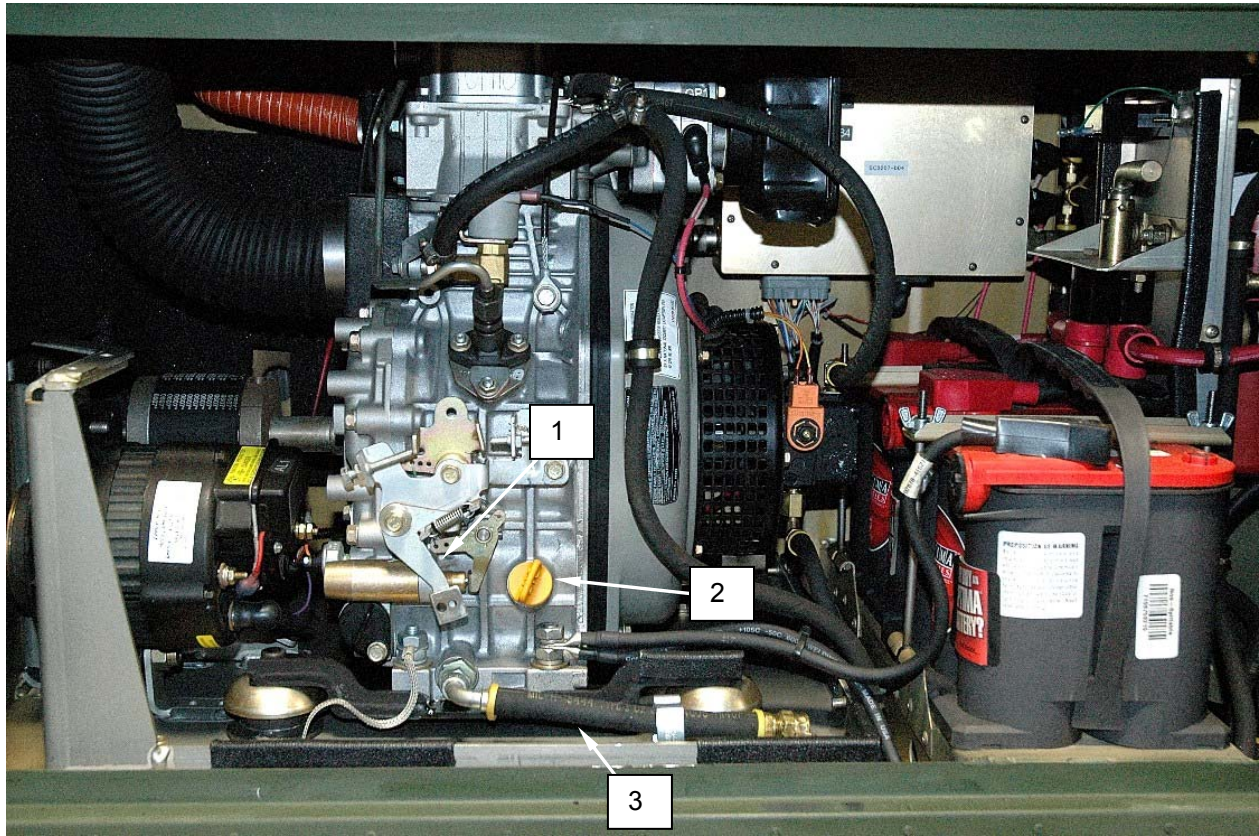


Figure 1. Locate Engine Stop Lever.

3. Pull the engine stop lever (Figure 2, Item 1) to the left, in the direction indicated by the arrow, and hold until the engine stops.



Figure 2. Pull and Hold Engine Stop Lever Until Engine Stops.

4. Upon shutdown, close all panels and notify local Service or Field maintenance of the malfunction.

**END OF TASK**

**END OF WORK PACKAGE**



**CHAPTER 3**

**TROUBLESHOOTING MASTER INDEX**  
**FOR**  
**LARGE CAPACITY FIELD HEATER,**  
**TYPE II (LCFH TYPE II)**





**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**

**TROUBLESHOOTING INDEX**

**GENERAL**

This chapter provides operator, service, field, and sustainment maintenance information and includes troubleshooting and general maintenance procedures. Troubleshooting instructions covered in this section are unique to the LCFH Type II.

**TROUBLESHOOTING INDEX**

The troubleshooting index lists common malfunctions that may occur during LCFH Type II inspection and operation. Find the malfunction to be eliminated and go to the indicated troubleshooting paragraph that follows. The index cannot list all malfunctions that may occur, all tests or inspections needed to find the fault, nor all actions required to correct the fault. If the existing malfunction is not listed, or cannot be corrected through this troubleshooting index, notify Service maintenance.

In Table 2 below, a soft fault is defined as one in which the engine continues to operate but the burner is fault locked out; however, the heater can be reset to attempt another burner run cycle. If the burner is running when a soft fault occurs, the heater will proceed to the post purge cycle followed by fault lock out.

If a hard fault occurs before the burner starts or after the burner has normally cycled off, (due to temperature regulation) then the heater will not proceed to post purge, and the engine will shut down.

The last ten fault codes that have been displayed on the operator control box can be displayed in reverse order by doing the following: Hold up the RESET switch while the units' power switch is initialized. The display will lock in a four (4) Dash mode, at which time the RESET may be released. Then the RESET switch can be toggled showing the last ten faults, starting with the most recent and working backwards. To exit this mode, simply turn the main power switch OFF; the unit will reset to a functional mode. This is useful in the case of a fault code being displayed too quickly to note or if maintenance wishes to view the last ten fault codes.

**Table 1. LCFH Type II Fault Code Series Key.**

<b>Series</b>	<b>System Affected</b>
100 series	Electrical
200 series	Burner
300 series	Carbon Monoxide (CO) sensor
400 series	Control panel
500 series	Engine
600 series	Solenoids
801	Software

Table 2. Troubleshooting Index.

Symptom	Maintenance Level/Work Package/Page No.			
	Operator	Service	Field	Sustainment
1. No power when power switch is turned on.	0008-2	0010-1	N/A	N/A
2. Heater will not start after 3 attempts.	0008-2	0010-2	N/A	N/A
3. Heater starts but sputters or runs erratically.	0008-2	0010-2	N/A	N/A
4. Heater runs then shuts down unexpectedly with no error code displayed on control panel.	0008-2	0010-3	N/A	N/A
5. A fuel leak is observed in the heater.	0008-2	0010-3	N/A	N/A
6. Engine will not crank.	*	0011-1	N/A	N/A
7. Engine will not start.	*	0011-1	N/A	N/A
8. Engine starts and stops.	*	N/A	0013-1	0014-1
9. Engine output drops.	*	0011-1	0013-1	0014-1
10. Engine runs rough.	*	0011-2	0013-1	0014-1
11. Engine emits white smoke.	*	0011-2	0013-1	0014-2
12. Engine emits black smoke.	*	0011-2	0013-1	0014-2
13. Engine speed fluctuates (races or uneven speed).	*	*	0013-1	N/A
<b>Soft Fault Codes</b> (Heater starts, continues to run, but displays one of the following fault codes):				
14. Fault code: <b>S221</b> Burner failed to start.	0009-1	0012-1	N/A	N/A
15. Fault code: <b>S231</b> flame detected in post-purge.	0009-1	0012-2	N/A	N/A
16. Fault code: <b>S241</b> Loss of flame detected during burner operation	0009-1	0012-2	N/A	N/A
17. Fault code: <b>S412</b> Heat exchanger over temperature.	0009-1	0012-3	N/A	N/A
<b>Hard Fault Codes</b> (Heater may or may not start, shuts down, and displays one of the following fault codes):				
18. Fault code: <b>H111</b> Open circuit on the alternator excitation line.	*	0012-2	N/A	N/A
19. Fault code: <b>H113</b> Open relay driver for alternator regulator.	*	0012-3	N/A	N/A
20. Fault code: <b>H114</b> Short circuit on alternator regulator enable relay circuit.	*	0012-3	N/A	N/A

Table 2. Troubleshooting Index. - Continued

Symptom	Maintenance Level/Work Package/Page No.			
	Operator	Service	Field	Sustainment
21. Fault code: <b>H112</b> Alternator excitation short circuit.	*	0012-4	N/A	N/A
22. Fault code: <b>H121</b> Alternator tachometer loss of signal during engine run.	0009-2	0012-4	N/A	N/A
23. Fault code: <b>H122</b> Alternator tachometer not detected during engine Crank.	0009-2	0012-4	N/A	N/A
24. Fault code: <b>H123</b> Alternator tachometer signal present after shutdown.	*	0012-5	N/A	N/A
25. Fault code: <b>H124</b> Alternator tachometer signal present before engine start.	*	0012-5	N/A	N/A
26. Fault code: <b>H130</b> Battery voltage low/high (checked during engine operation 19.5V to 32V).	0009-2	0012-6	N/A	N/A
27. Fault code: <b>H131</b> Battery low voltage (checked during engine start 15V minimum).	0009-3	0012-6	N/A	N/A
28. Fault code: <b>H211</b> Burner combustion fan low current (2.5 amps).	0009-3	0012-6	N/A	N/A
29. Fault code: <b>H251</b> Spark ignition transformer relay open circuit T1.	*	0012-7	N/A	N/A
30. Fault code: <b>H252</b> Spark ignition transformer relay short circuit T1.	*	0012-7	N/A	N/A
31. Fault code: <b>H311</b> Carbon monoxide detected at operator control panel.	0009-3	0012-7	N/A	N/A
32. Fault code: <b>H312</b> Carbon monoxide detected in inlet air.	0009-4	0012-7	N/A	N/A
33. Fault code: <b>H321</b> Carbon monoxide (CO) inlet air sensor open circuit (driver side).	*	0012-8	N/A	N/A
34. Fault code: <b>H322</b> Carbon monoxide (CO) inlet air sensor short circuit (driver side).	*	0012-8	N/A	N/A
35. Fault code: <b>H331</b> Carbon monoxide (CO) operator control panel (sensor open circuit driver side).	*	0012-8	N/A	N/A
36. Fault code: <b>H332</b> Carbon monoxide (CO) operator control panel (sensor short circuit driver side).	*	0012-8	N/A	N/A

Table 2. Troubleshooting Index. - Continued

Symptom	Maintenance Level/Work Package/Page No.			
	Operator	Service	Field	Sustainment
37. Fault code: <b>H421</b> operator control panel cable connection RS485 response timeout.	0009-4	0012-8	N/A	N/A
38. Fault code: <b>H431</b> Outlet temperature sensor (RTD1) open circuit.	*	0012-9	N/A	N/A
39. Fault code: <b>H432</b> Outlet temperature sensor (RTD1) short circuit.	*	0012-9	N/A	N/A
40. Fault code: <b>H511</b> Engine Fail to start after three tries.	0009-4	0012-9	N/A	N/A
41. Fault code: <b>H521</b> Engine fuel pump (P1) open circuit.	*	0012-9	N/A	N/A
42. Fault code: <b>H522</b> Engine fuel pump (P1) short circuit.	*	0012-9	N/A	N/A
43. Fault code: <b>H531</b> Engine oil pressure before engine start.	*	0012-10	N/A	N/A
44. Fault code: <b>H532</b> Engine oil pressure low during engine run.	0009-4	0012-11	N/A	N/A
45. Fault code: <b>H541</b> Engine pre-heat relay driver open circuit.	*	0012-10	N/A	N/A
46. Fault code: <b>H542</b> Engine pre-heat relay driver short circuit.	*	0012-10	N/A	N/A
47. Fault code: <b>H551</b> Engine starter relay driver open circuit.	*	0012-10	N/A	N/A
48. Fault code: <b>H552</b> Diesel engine starter relay short circuit.	*	0012-10	N/A	N/A
49. Fault code: <b>H561</b> Engine stop fuel solenoid relay driver open circuit.	0010-4	0012-11	N/A	N/A
50. Fault code: <b>H562</b> Engine stop fuel solenoid relay driver short circuit.	*	0012-11	N/A	N/A
51. Fault code: <b>H611</b> Fuel solenoid valve FS1 open circuit (burner on/off).	*	0012-11	N/A	N/A
52. Fault code: <b>H612</b> Fuel solenoid valve FS1 short circuit (burner on/off).	*	0012-11	N/A	N/A
53. Fault code: <b>H621</b> Fuel solenoid valve FS2 open circuit (burner high/low).	*	0012-12	N/A	N/A
54. Fault code: <b>H622</b> Fuel solenoid valve FS2 short circuit (burner high/low).	*	0012-12	N/A	N/A
55. Fault code: <b>H631</b> Fuel solenoid valve FS3 open circuit (internal/external fuel).	*	0012-12	N/A	N/A

**Table 2. Troubleshooting Index. - Continued**

Symptom	Maintenance Level/Work Package/Page No.			
	Operator	Service	Field	Sustainment
56. Fault code: <b>H632</b> Fuel solenoid valve FS3 short circuit (internal/external fuel).	*	0012-13	N/A	N/A
57. Fault code: <b>H801</b> Main control board detected loss of software control for greater than 1 second.	*	0012-13	N/A	N/A
* Cannot troubleshoot malfunction at this level. Refer the problem for resolution at the next higher maintenance level.				

**END OF WORK PACKAGE**



**CHAPTER 4**

**TROUBLESHOOTING PROCEDURES  
FOR  
LARGE CAPACITY FIELD HEATER,  
TYPE II (LCFH TYPE II)**





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**OPERATOR MAINTENANCE****GENERAL LCFH TYPE II TROUBLESHOOTING PROCEDURES**

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**INITIAL SETUP:****Personnel Required**

MOS non-specific

**Equipment Condition**

Place power switch to OFF position after fault code is displayed.  
Heater shut down and post-purge complete.  
Heater cool.

**References**

WP 0022  
WP 0049

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**TROUBLESHOOTING PROCEDURES**

The troubleshooting procedures contain tables listing the malfunctions, tests or inspections, and corrective action required to return the Large Capacity Field Heater, Type II, (LCFH Type II) to normal operation. Perform the steps in the order they appear in the tables.

**DO NOT START THE TASK UNTIL:**

- You understand the task.
- You understand what you are to do.
- You understand what is needed to do the work.
- You have the things you need.

**Table 1. General LCFH Type II Troubleshooting Procedures.**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
<p>No power when power switch is turned on.</p>	<p>Turn power switch OFF. Open side access door and verify that both batteries are installed and that the cables are attached securely.</p> <p>Turn power switch OFF. Verify that main battery switch is in the ON position.</p> <p>Verify that batteries are fully charged. If not, charge IAW WP 0022.</p>	<p>If batteries are not installed or appear to be damaged in any way or if the battery cables are not securely installed, notify Field Maintenance.</p> <p>Place battery switch in ON position.</p> <p>Attach NATO jumper cable, start heater, and recharge batteries until fully charged.</p> <p>If further corrective action is required, notify Service Maintenance.</p>
<p>Heater will not start after three attempts.</p>	<p>The heater will attempt to restart three times on its own. Determine if the heater has completed a restart cycle attempt.</p> <p>Check operator control for internal or external fuel source selection. Check and ensure proper fuel level in tank and or external fuel source.</p> <p>Check connection to external fuel source.</p> <p>Verify that batteries are fully charged. If not, charge IAW WP 0022.</p>	<p>Attempt up to three restart cycles in 60 minutes.</p> <p>Fill internal fuel tank or external fuel source with proper fuel as needed.</p> <p>If needed, repair or replace external fuel hose.</p> <p>If battery will not charge, check alternator voltage IAW WP 0049.</p> <p>If further corrective action is required, notify Service Maintenance.</p>
<p>Heater starts but sputters or runs erratically.</p>	<p>Check the fuel gauge and verify that there is sufficient fuel.</p> <p>Verify that the fuel being supplied is of an approved type and that it is clean and not contaminated.</p> <p>If heater has been switched from internal to external fuel mode, verify that heater has operated long enough to expel all air in the external fuel hose. This may only be a problem if fuel level in internal tank is very low when switched to external.</p>	<p>Turn power switch OFF. Fill the fuel tank with an approved fuel and/or replenish the external fuel supply with adequate supply of approved fuel. Attempt restart.</p> <p>Fill internal tank or bulk fuel supply with fuel is clean and not contaminated.</p> <p>Allow heater to operate long enough to expel all air that may be present in the external fuel hose.</p> <p>If problem persists, notify Service Maintenance.</p>
<p>Heater runs then shuts down unexpectedly with no fault code displayed on control panel.</p>	<p>Verify that there is sufficient fuel in the fuel tank or that the external fuel supply has sufficient fuel.</p>	<p>Turn power switch OFF. Fill the fuel tank with an approved fuel and/or replenish the external fuel supply with adequate supply of approved fuel. Attempt restart.</p> <p>If heater runs then shuts down unexpectedly again, notify Service Maintenance for further corrective action.</p>
<p>A fuel leak is observed in the heater.</p>	<p>Determine the area where the leak is originating.</p>	<p>Shut down heater. Inspect each area to determine the specific fitting or hose that is leaking. Take note of the fitting or hose that is leaking and notify Service Maintenance of the location determined.</p>

**END OF TASK**

**END OF WORK PACKAGE**

**OPERATOR MAINTENANCE**

**LCFH TYPE II FAULT CODE TROUBLESHOOTING PROCEDURES**

**INITIAL SETUP:**

**Personnel Required**

MOS non-specific

**Equipment Condition**

Place power switch to OFF position after fault code is displayed.  
 Heater shut down and post-purge complete.  
 Heater cool.

**References**

WP 0064 WP 0068  
 WP 0051

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures.**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Heater starts, displays fault code <b>S221</b> but burner fails to start.	<p>This fault code indicates that burner failed to start after 3 tries. The diesel engine and other systems may operate but the burner failed to start. Turn power switch OFF. Check to ensure that there is adequate fuel in the fuel tank or in the bulk fuel supply.</p> <p>Open the burner access door and ensure that the flame sensor wire harness connector is connected securely (see WP 0068 for location).</p>	<p>Fill heater with adequate fuel in the internal fuel tank or in the bulk fuel supply. Flip RESET switch, attempt restart.</p> <p>Connect flame sensor wire harness connector securely (see WP 0068 for location). Flip RESET switch, attempt restart.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>
Heater starts, runs properly but displays fault code <b>S231</b> when the system is in post-purge mode.	<p>This fault code indicates that there was a burner flame detected during burner post-purge. Turn power switch OFF. Check to see if this may be caused by excess fuel in the burner during system post-purge or by excess carbon in the burner.</p>	<p>View burner through sight glass and determine if flame is still present after burner is shutdown. If not, Flip RESET switch, attempt restart. If flame is visible, notify Service Maintenance.</p>
Heater starts, runs properly but displays fault code <b>S241</b> during burner operation.	<p>This fault code indicates that the burner had a loss of flame while running. Turn power switch OFF. Check to ensure that there is adequate fuel in the fuel tank or in the bulk fuel supply.</p> <p>Check to see if heater fuel mode switch is in external fuel mode when heater is operating from internal fuel supply.</p> <p>Open the burner access door and ensure that the ignition transformer, flame sensor, flame sensor and motor wire harness connectors are connected securely (see WP 0064 for location).</p>	<p>Fill heater with adequate fuel in the internal fuel tank or in the bulk fuel supply. Flip RESET switch, attempt restart.</p> <p>Place fuel mode switch in INTERNAL mode if operating from the internal fuel supply. Place in EXTERNAL mode if operating from external fuel supply.</p> <p>Connect flame sensor wire harness connector securely (see WP 0064 for location). Flip RESET switch, attempt restart.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
Heater starts, displays fault code <b>S412</b> but continues to run.	This fault code indicates that the heat exchanger over-temperature switch SW4 has been activated. Turn power switch OFF. Check and ensure that there is no blockage at air inlet or outlet duct.	Clear any blockage at air inlet or air outlet duct.  Flip RESET switch and attempt restart. If problem has not been corrected, notify Service Maintenance.
Heater starts, shuts down, and displays fault code <b>H121</b> .	<p>This fault code indicates a loss of signal from the alternator tachometer occurred during operation. Turn power switch OFF. Inspect engine bay, fuel access, and burner areas for any signs of fuel loss.</p> <p>Inspect wiring on alternator and ensure that all wires are secured and are undamaged.</p> <p>Inspect wiring on diesel engine fuel solenoid and ensure that wire is secure and is not broken or damaged.</p> <p>Ensure that the alternator belt is not broken or damaged.</p> <p>Ensure that flexible coupling is not broken or damaged.</p>	<p>Check to ensure that heater has adequate fuel. If any fuel loss is observed, notify Service Maintenance.</p> <p>Secure any loose connectors on alternator or diesel engine fuel solenoid.</p> <p>If any wires are cut or damaged, notify Service Maintenance.</p> <p>If alternator belt is loose or if broken, notify Service Maintenance.</p> <p>If flexible coupling assembly is loose or damaged, notify Service Maintenance.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>
Heater starts, shuts down, and displays fault code <b>H122</b> .	<p>This fault code indicates that the alternator tachometer was not detected during engine crank.</p> <p>During heater startup, determine if diesel engine starter is turning. If unsure, and problem persists, contact Service Maintenance.</p> <p>Turn power switch OFF. Inspect wiring on alternator and ensure that all wires are secured and are undamaged.</p> <p>Ensure that the alternator belt is not broken or damaged.</p> <p>Ensure that the flexible coupling is not broken or damaged.</p>	<p>If diesel engine starter is not turning during heater startup or if unsure and problem persists, contact Service Maintenance.</p> <p>Secure any loose wires on alternator. If wires are cut or damaged, notify Service Maintenance.</p> <p>If alternator belt is damaged or broken, notify Service Maintenance.</p> <p>If flexible coupling is broken or damaged, notify Service Maintenance.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>
Heater starts, shuts down, and displays fault code <b>H130</b> .	<p>This fault code indicates that the system is experiencing a battery low or high condition. Turn power switch OFF. Open engine access door and inspect the wires going to the alternator and ensure that they are all connected properly and that they are not cut or damaged in any way.</p> <p>Ensure that the alternator belt is not loose.</p> <p>Ensure that all of the battery cable connections are secure and that the cables are not damaged in any way.</p>	<p>Secure any loose or disconnected wires going to the alternator. Notify Service Maintenance if any wires are cut or damaged in any way.</p> <p>If alternator belt is loose, notify Service Maintenance.</p> <p>If any battery cable connections are loose or damaged, notify Service Maintenance.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, shuts down, and displays fault code <b>H131</b>.</p>	<p>This fault code indicates that the system is experiencing a battery low voltage condition (battery must have 15V minimum). Check outdoor temperature. If temperature is –40 degrees F or lower, use the NATO connector to provide supplemental source of 24VDC power to heater.</p> <p>Turn power switch OFF. Open engine access door and inspect the wires going to the alternator and ensure that they are all connected properly and that they are not cut or damaged in any way.</p> <p>Ensure that the alternator belt is not loose.</p> <p>Ensure that all of the battery cable connections are secure and that the cables are not damaged in any way.</p>	<p>Connect NATO connector to supplemental source of 24VDC power to heater.</p> <p>Secure any loose or disconnected alternator wires. If any alternator wires are cut or damaged, notify Service Maintenance.</p> <p>If alternator belt is loose, notify Service Maintenance.</p> <p>If battery connections are loose or damaged in any way, notify Service Maintenance.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>
<p>Heater starts, shuts down, and displays fault code <b>H211</b>.</p>	<p>This fault code indicates that there is a low current condition at the burner combustion fan. Turn power switch OFF. Open burner access door and check for broken combustion fan wiring harness or connector. Ensure that wire is not broken and that both halves of connector are securely mated.</p>	<p>Securely connect both halves of connector. If wiring or connector is damaged, notify Service Maintenance.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>
<p>Heater starts, shuts down, and displays fault code <b>H311</b>.</p>	<p>This fault code indicates that the LCFH Type II has detected carbon monoxide at the operator control panel.</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Evacuate any personnel that may be in the shelter and look for signs of carbon monoxide poisoning.</p> <p>Check the flexible air inlet duct, and ensure that it does not have any rips, tears, or other damage that would allow combustion exhaust to enter the inlet air flow.</p> <p>Check and ensure that the flexible inlet air duct is securely attached to the air inlet duct adapter on the LCFH Type II.</p> <p>Ensure that the shelter opening is not downwind of the LCFH Type II in such a way as to allow combustion exhaust to enter the shelter.</p> <p>Determine if there are any other sources of carbon monoxide (vehicles, generators, etc.) that may be running nearby. Determine if the combustion exhaust from those sources may be getting into the LCFH Type II airflow.</p>	<p>Repair any tears in the flexible air inlet duct with duct tape. Replace flexible air duct if damage cannot be completely repaired with duct tape.</p> <p>Attach flexible air inlet duct to air inlet duct adapter. Lock in place securely.</p> <p>Move LCFH Type II so that combustion exhaust does not enter shelter during LCFH Type II operation.</p> <p>Move sources of carbon monoxide a safe distance away from the shelter and the LCFH Type II.</p> <p>Restart LCFH Type II. If fault re-occurs, stop use of LCFH Type II and notify Service Maintenance.</p>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
<p>Heater starts, shuts down, and displays fault code <b>H312</b>.</p>	<p>This fault code indicates that the LCFH Type II has detected carbon monoxide at the cabinet mounted carbon monoxide detector.</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Evacuate any personnel that may be in the shelter and look for signs of carbon monoxide poisoning.</p> <p>Check the flexible air inlet duct and ensure that it does not have any rips, tears, or other damage that would allow combustion exhaust to enter the inlet air flow.</p> <p>Check and ensure that the flexible inlet air duct is securely attached to the air inlet duct adapter on the LCFH Type II.</p> <p>Ensure that the shelter opening is not downwind of the LCFH Type II in such a way as to allow combustion exhaust to enter the shelter.</p> <p>Determine if there are any other sources of carbon monoxide (vehicles, generators, etc.) that may be running nearby. Determine if the combustion exhaust from those sources may be getting into the LCFH Type II airflow.</p>	<p>Repair any tears in the flexible air inlet duct with duct tape. Replace flexible air duct if damage cannot be completely repaired with duct tape.</p> <p>Re-attach flexible air inlet duct to air inlet duct adapter. Lock in place securely.</p> <p>Move LCFH Type II so that combustion exhaust does not enter shelter during LCFH Type II operation.</p> <p>Restart LCFH Type II. If fault reoccurs, stop use of LCFH Type II and notify Service Maintenance.</p>
<p>Heater starts, shuts down, and displays fault code <b>H421</b>.</p>	<p>This fault code indicates that the system is not receiving a proper response from the operator control box. Turn power switch OFF. Ensure that the connection between the operator control box and the operator control box cable is secure. Ensure that the connector is not damaged in any way and that the cable is not cut or damaged.</p> <p>Turn power switch OFF. Ensure that the connection between the main control box and the operator control box cable is secure. Ensure that the connector is not damaged in any way and that the cable is not cut or damaged.</p>	<p>Secure connection between the operator control box and the operator control box cable. Notify Service Maintenance if connector is damaged in any way and/or the cable is cut or damaged.</p> <p>Secure the connection between the main control box and the operator control box cable. Notify Service Maintenance if connector is damaged in any way and/or the cable is cut or damaged.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>
<p>Heater starts, shuts down, and displays fault code <b>H511</b>.</p>	<p>This fault code indicates that the engine failed to start after three tries. Check to ensure that there is adequate clean fuel in the fuel tank or in the bulk fuel supply.</p>	<p>Fill internal fuel tank or ensure there is adequate fuel in the bulk fuel supply.</p> <p>If fuel is contaminated with dirt or water, notify Service Maintenance.</p>
<p>Heater starts, shuts down, and displays fault code <b>H532</b>.</p>	<p>This fault code indicates that the oil pressure of the diesel engine is low. Turn power switch OFF.</p> <p>Check oil level of diesel engine and ensure that level is adequate.</p>	<p>Fill diesel engine with oil to FULL level IAW WP 0051.</p> <p>If problem has not been corrected, notify Service Maintenance.</p>

**END OF TASK**

**END OF WORK PACKAGE**

**SERVICE MAINTENANCE**

**GENERAL LCFH TYPE II TROUBLESHOOTING PROCEDURES**

**INITIAL SETUP:**

**Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
 Wrench, Torque (WP 0124, Item 19)  
 Caliper, Digital Display (WP 0124, Item 2)

**Personnel Required**

Quartermaster and Chemical Equipment  
 Repairer 63J  
 Utilities Equipment Repairer 52C

**References**

WP 0074  
 WP 0023  
 WP 0034  
 WP 0081  
 WP 0047  
 WP 0037

**Equipment Condition**


Heater shut down and cool unless otherwise  
 indicated.  
 Main battery switch OFF and handle  
 Removed unless otherwise indicated.  
 Place power switch in OFF position before  
 attempting any corrective action.

**WARNING**



Hearing protection should be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.

**Table 1. General LCFH Type II Troubleshooting Procedures.**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>No power when power switch is turned on.</p>	<p style="text-align: center;"><b>WARNING</b></p>  <p>The equipment being tested or corrected operates at voltage and current that can cause serious injury or death.</p> <ol style="list-style-type: none"> <li>1. Open side access door and verify that both batteries are installed and that the cables are attached securely. Verify that batteries are fully charged.</li> <li>2. Check circuit breakers if needed.</li> <li>3. Ensure red power wire from batteries is properly terminated on the main electronics box.</li> <li>4. Make sure operator control box cable is properly connected at both ends.</li> <li>5. When this symptom cannot be resolved by taking previous steps, the problem lies with the main control box.</li> </ol>	<ol style="list-style-type: none"> <li>1. Install two batteries that are known to be in good condition and are approved for use with the LCFH Type II. Tighten all battery terminal connections. Repair any cables or terminal connectors that are damaged</li> <li>2. Reset breakers.</li> <li>3. Repair or replace as needed.</li> <li>4. Replace cable if needed.</li> <li>5. Replace Main Control Box Assembly IAW WP 0074.</li> </ol>

**Table 1. General LCFH Type II Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
Heater will not start after three attempts.	<ol style="list-style-type: none"> <li>1. The heater will attempt to restart three times on its own. Determine if the heater has completed a restart cycle attempt.</li> <li>2. Check operator control for internal or external fuel source selection, then check and ensure proper fuel level in tank and or external fuel source.</li> <li>3. Check connection to external fuel source.</li> <li>4. Re-set fault and attempt to restart unit. If unit is in ambient conditions less than 30° F the operator control should display "GLOW" prior to engine beginning to crank.               <ol style="list-style-type: none"> <li>a. Using a multimeter, check and ensure that the diesel engine air pre-heaters are powered with battery potential (approx 24VDC) when operator control displays "GLOW."</li> <li>b. If approximately 24VDC is present, make sure that pre-heaters are heating up by either measuring temperature or by measuring current (should be approximately 30 amps).</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Attempt up to three restart cycles in 60 minutes.</li> <li>2. Fill internal fuel tank or ensure external fuel source has adequate fuel.</li> <li>3. Repair or replace external fuel hose.</li> <li>4. If 24VDC is present when operator control displays "GLOW," make sure that pre-heaters are functioning. Use a multimeter and check to ensure that the diesel engine air pre-heaters are powered by approximately 24VDC when operator control displays "GLOW."               <ol style="list-style-type: none"> <li>a. Check wire connections to K1 and repair wiring or replace relay.</li> <li>b. Replace inlet air pre-heaters IAW WP 0081.</li> </ol> </li> </ol>
Heater starts but sputters or runs erratically.	<ol style="list-style-type: none"> <li>1. Check fuel source selection and check for contaminated fuel.</li> <li>2. Determine if fuel filter needs servicing.</li> <li>3. Make sure all flare fittings are tight and hoses are not cracked or split, allowing air into fuel system.</li> <li>4. Ensure that engine fuel solenoid is functioning properly. Should have battery potential (approximately 24VDC) during engine operation.</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain fuel tank and fill with approved fuel IAW 0023 that is known to be clean and free of contaminants.</li> <li>2. Service fuel filter IAW WP 0034 and attempt restart. If problem persists, change fuel filter IAW WP 0034. Attempt restart of heater.</li> <li>3. Tighten fittings or replace suspect hose.</li> <li>4. Repair wiring or replace engine fuel solenoid if needed.               <ol style="list-style-type: none"> <li>a. If no voltage at engine fuel solenoid, then check wiring and replace main control box assembly IAW WP 0074.</li> </ol> </li> </ol>



**Table 1. General LCFH Type II Troubleshooting Procedures. - Continued**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
<p>Heater runs then shuts down unexpectedly with no fault code displayed on control panel.</p>	<ol style="list-style-type: none"> <li>1. If operating the heater from a bulk fuel supply, determine if external fuel hose is kinked or damaged.</li> <li>2. Check for loose battery Connections.</li> <li>3. Check for loose connections on the main battery disconnect switch.</li> <li>4. Check main battery switch for proper operation.</li> </ol>	<ol style="list-style-type: none"> <li>1. Eliminate any kinks in the external fuel hose. Repair any damage to the fuel hose or the quick disconnect connectors IAW WP 0047.</li> <li>2. Re-tighten loose battery connections. Attempt restart.</li> <li>3. Re-tighten loose connections on battery disconnect switch. Attempt restart.</li> <li>4. Replace main battery switch IAW WP 0037.</li> </ol>
<p>Fuel leak is observed in the heater.</p>	<p>Determine the area where the leak is originating.</p>	<ol style="list-style-type: none"> <li>1. Shut down heater. If fuel leak has been detected in a flare fitting, re-tighten. If fitting continues to leak, inspect for dirt or debris on the flare "male" and "female" areas and clean if needed. If leak persists, replace both hose and component.</li> <li>2. For fuel leaks in hoses using barb fittings and screw hose clamps, ensure that the hose is fully inserted onto the hose barb and then re-tighten the clamp.</li> <li>3. If a leak is found anywhere along the length of the hose, replace entire hose.</li> </ol>

**END OF TASK**

**END OF WORK PACKAGE**



**SERVICE MAINTENANCE**

**DIESEL ENGINE TROUBLESHOOTING PROCEDURES**

**INITIAL SETUP:**

**Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
 Wrench, Torque (WP 0124, Item 19)  
 Caliper, Digital Display (WP 0124, Item 2)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**References**

WP 0074  
 WP 0053  
 WP 0057  
 WP 0056  
 WP 0018  
 WP 0051

**Equipment Condition**

Heater shut down and cool unless otherwise indicated.  
 Main battery switch OFF and handle removed unless specifically indicated.  
 Flip power switch to OFF position before attempting corrective action.

**WARNING**



Hearing protection should be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.

**Table 1. Diesel Engine Troubleshooting Procedures.**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Engine will not crank.	<ol style="list-style-type: none"> <li>1. During the time that the operator control displays "CRNK", measure voltage on yellow starter wire.</li> <li>2. If no voltage is present during the time the operator control displays "CRNK," check wiring for proper terminations and connections from starter to main control box.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove and replace starter motor IAW WP 0057.</li> <li>2. Repair connection or replace main control box assembly IAW WP 0074.</li> </ol>
Engine will not start.	<ol style="list-style-type: none"> <li>1. Check for improper valve / rocker arm clearance.</li> <li>2. Check for kinked, blocked, or clogged fuel line.</li> <li>3. Check for clogged, sticking, or worn fuel injector nozzle.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust valve clearance IAW WP 0053.</li> <li>2. Adjust fuel line and/or clear line of blockage.</li> <li>3. Remove and replace fuel injector IAW WP 0056.</li> </ol>
Engine output drops.	<ol style="list-style-type: none"> <li>1. Check for clogged or dirty air cleaner.</li> <li>2. Check for improper valve/rocker arm clearance.</li> <li>3. Check for clogged, sticking, or worn fuel injector nozzle.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove and replace air cleaner element IAW WP 0018.</li> <li>2. Adjust valve clearance IAW WP 0053.</li> <li>3. Remove and replace fuel injector IAW WP 0056.</li> </ol>

**Table 1. Diesel Engine Troubleshooting Procedures. - Continued**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Engine runs rough.	Check for clogged, sticking, or worn fuel injector nozzle.	<ol style="list-style-type: none"> <li>1. Remove and replace fuel injector IAW WP 0056.</li> <li>2. Refer problem to Field Maintenance level.</li> </ol>
Engine runs rough due to low compression pressure.	<ol style="list-style-type: none"> <li>1. Check for improper valve/rocker arm clearance.</li> <li>2. Check for leaks around fuel injector.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust valve clearance IAW WP 0053.</li> <li>2. Tighten fuel injector nuts to 7 to 9 ft-lbs. (100 to 120 kg-cm) IAW WP 0056.</li> <li>3. Refer problem to Field Maintenance level.</li> </ol>
Engine emits white smoke.	<ol style="list-style-type: none"> <li>1. Check to see if engine oil level is too high. Check for contaminants in the oil system.</li> <li>2. Check for improper valve/rocker arm clearance.</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain and service engine oil IAW WP 0051.</li> <li>2. Adjust valve clearance IAW WP 0053.</li> <li>3. Refer problem to Field Maintenance level.</li> </ol>
Engine emits black smoke.	<ol style="list-style-type: none"> <li>1. Check for clogged or dirty air filter.</li> <li>2. Check for clogged, sticking, or worn fuel injector nozzle.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove and replace air cleaner element IAW WP 0018.</li> <li>2. Remove and replace fuel injector IAW WP 0056.</li> <li>3. Refer problem to Field Maintenance level.</li> </ol>

**END OF TASK**

**END OF WORK PACKAGE**

**SERVICE MAINTENANCE**

**LCFH TYPE II FAULT CODE TROUBLESHOOTING PROCEDURES**

**INITIAL SETUP:**

**Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
 Wrench, Torque (WP 0124, Item 19)  
 Caliper, Digital Display (WP 0124, Item 2)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**References**

WP 0063, WP 0045, WP 0036, WP 0064,  
 WP 0061, WP 0065, WP 0037, WP 0067,  
 WP 0051, WP 0074, WP 0038, WP 0049,  
 WP 0057, WP 0053, WP 0031, WP 0077,  
 WP 0072, WP 0062, WP 0068, WP 0034,  
 WP 0035, WP 0005, WP 0025, WP 0095  
 WP 0071, WP 0076

**Equipment Condition**

Heater shut down and cool unless otherwise indicated.  
 Main battery switch OFF and handle removed unless specifically indicated.  
 Flip power switch to OFF position before attempting corrective action.

**WARNING**



Hearing protection must be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures.**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
Heater starts, displays error code <b>S221</b> but burner fails to start.	<p>This error code indicates that burner failed to start after three attempts. The diesel engine and other systems may operate, but the burner failed to start.</p> <ol style="list-style-type: none"> <li>1. Check to see if light from flame is visible in burner sight glass during trial for ignition sequence. If light is visible, then the problem is in photo eye or wiring to and from photo eye.</li> <li>2. If no light is visible in burner sight glass, check for proper burner pump fuel pressure (120 psi low fire, 180 psi high fire).</li> <li>3. If no light is visible and system fuel pressure is OK, check that burner nozzle pressure is present (pressure gauge is visible through fuel system access door) during trial for ignition sequence.</li> <li>4. If burner nozzle pressure is present on gauge, check ignition transformer.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn power switch to OFF. Check fuel level in tank and fill if needed.</li> <li>2. Repair flame sensor wiring or replace defective flame sensor IAW WP 0063.</li> <li>3. If pressure is low, adjust fuel pressure at on burner fuel pump mounted to diesel engine IAW WP 0045..</li> <li>4. If no pressure is visible on gauge, check burner fuel pump coupling IAW WP 0045.</li> <li>5. If pressure is not detectable on pressure gauge, check or replace FS1 fuel solenoid IAW WP 0036.</li> <li>6. Ensure all electrical connections to ignition transformer power input and replace if needed IAW WP 0064.</li> </ol>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
	<ol style="list-style-type: none"> <li>5. If ignition transformer is OK, check burner electrodes.</li> <li>6. If electrodes are clean and properly adjusted, check burner nozzle.</li> <li>7. Check for tripped circuit breakers on main control box.</li> <li>8. Make sure that burner air shutter and head position are correct. Refer to Figure 1, WP 0061.</li> </ol>	<ol style="list-style-type: none"> <li>7. Check electrodes. Clean, adjust and replace if necessary IAW WP 0065.</li> <li>8. Replace burner nozzle IAW WP 0065.</li> <li>9. Reset circuit breaker and attempt restart.</li> <li>10. Readjust burner head and air shutter position IAW WP 0061.</li> </ol>
<p>Heater starts, runs properly but displays error code <b>S231</b> when the system is in post-purge mode.</p>	<p>This error code indicates that there was a burner flame detected during burner post-purge.</p> <ol style="list-style-type: none"> <li>1. Determine if flame sensor is detecting light when it should not be.</li> <li>2. Air entrapped in the fuel lines can cause excessive fuel to be sprayed in the combustion chamber after burner is turned off. Check all fuel lines for tightness.</li> </ol>	<p>This problem may be caused by excess fuel in the burner during system post-purge or by excess carbon in the burner. Re-start heater and attempt to recreate problem. If problem doesn't reappear, it may be a one time occurrence.</p> <ol style="list-style-type: none"> <li>1. Ensure that flame sensor wire is not pinched and shorted.</li> <li>2. Clean burner of excess carbon IAW WP 0065.</li> </ol>
<p>Heater starts, runs for a time, and then displays error code <b>S241</b>.</p>	<p>This error code indicates that the burner had a loss of flame while running.</p> <ol style="list-style-type: none"> <li>1. Check for fuel contamination.</li> <li>2. Check for loose fuel line fittings.</li> <li>3. Remove fuel nozzle and ensure that it is not clogged, contaminated or damaged.</li> <li>4. Remove burner nozzle line assembly cone, and clean. Remove any excess carbon buildup and check electrode settings.</li> <li>5. Fuel filter may require replacement.</li> </ol>	<p>Turn power switch to OFF. Open the burner access door and ensure that the flame sensor wire harness connector is connected securely. Flip RESET and attempt restart. If securely connected and problem persists, replace flame sensor IAW WP 0067.</p> <ol style="list-style-type: none"> <li>1. Remove and clean fuel nozzle IAW WP 0065.</li> <li>2. Tighten all fuel fittings as required.</li> <li>3. Remove and clean burner IAW WP 0065.</li> <li>4. Replace fuel filter IAW WP 0034.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H111</b>.</p>	<p>This error code indicates that there is an open circuit on the alternator excitation line.</p> <ol style="list-style-type: none"> <li>1. Turn power switch to OFF. Check the alternator excitation wire (see WP 0049 for location) and ensure that it is connected securely and not broken or damaged in any way.</li> <li>2. Check alternator output and determine if alternator is operating correctly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Secure a loose alternator excitation wire.</li> <li>2. Repair a broken or damaged wire.</li> <li>3. Replace a defective alternator IAW WP 0049.</li> </ol>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**



SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, displays error code <b>S412</b> but unit continues to run.</p>	<p>This error code indicates that the heat exchanger over-temperature switch SW4 has been activated. Turn power switch to OFF.</p> <ol style="list-style-type: none"> <li>1. Check diesel engine RPM. Should be 3000 RPM.</li> <li>2. Check for duct restrictions at inlet or outlets.</li> <li>3. Check burner fuel pump pressure gauge during burner low fire and make sure gauge reads low fire pressure of 120 psi.</li> <li>4. Check burner fuel pump pressure gauge during high fire and make sure pressure is set for 180 psi.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust diesel engine throttle for 3000 RPM IAW WP 0051.</li> <li>2. Remove obstructions at inlet and/or outlet.</li> <li>3. If system fuel pressure during 90 second low fire operation is at high fire pressure of 180 psi, this would be cause of <b>S412</b> soft fault.</li> </ol> <p style="text-align: center;"><b>NOTE</b></p> <p>All troubleshooting for correct low fire pressure on burner fuel pump pressure gauge must be done within 90 seconds of startup as this ensures a low fire condition in the burner.</p> <p>Voltage at FS2 solenoid valve located on the pump should read zero during low fire operation and 24VDC during high fire operation.</p> <ol style="list-style-type: none"> <li>a. If system fuel gauge is at high fire pressure of 180 psi during low fire operation, shut down heater and check voltage at fuel valve solenoid FS2 located on burner fuel pump (WP 0045).</li> <li>b. If voltage at pump is 24 VDC during low fire operation, check wire harness for short, or replace main control box assembly IAW WP 0074.</li> </ol> <ol style="list-style-type: none"> <li>4. If burner fuel pump pressure is set above the set point of 180 psi, readjust burner fuel pump pressure at burner fuel pump IAW WP 0045.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H113</b>.</p>	<p>This error code indicates that there is an open relay driver for the alternator regulator enable circuit. Turn power switch to OFF.</p> <ol style="list-style-type: none"> <li>1. Check alternator regulator enable wires for damage. (see WP 0049 for location) and ensure that it is connected securely and not broken or damaged in any way.</li> <li>2. Check alternator output and determine if alternator is operating correctly. If alternator is operating properly, problem lies with the main control box assembly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Secure a loose alternator regulator wire. Repair a broken or damaged wire.</li> <li>2. Replace a defective alternator IAW WP 0049.</li> <li>3. Replace main control box assembly IAW WP 0074.</li> </ol>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, shuts down, and displays error code <b>H114</b>.</p>	<p>This error code indicates that there is an short circuit on the alternator regulator enable relay circuit. Turn power switch to OFF.</p> <ol style="list-style-type: none"> <li>1. Check the alternator regulator enable wire (see WP 0052 for location) and ensure that it is connected securely and not broken or damaged in any way.</li> <li>2. Check alternator output and determine if alternator is operating correctly. If alternator is operating properly, problem lies with the main control box assembly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Secure a loose alternator regulator wire. Repair a broken or damaged wire.</li> <li>2. Replace a defective alternator IAW WP 0049.</li> <li>3. Replace main control box assembly IAW WP 0074.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H112</b>.</p>	<p>This error code indicates that there is an short circuit on the alternator excitation line. Turn power switch to OFF.</p> <p>Check the alternator excitation wire (see WP 0052 for location) and ensure that the insulation has not been damaged and that the wire has not been shorted to ground.</p>	<ol style="list-style-type: none"> <li>1. Repair a broken or damaged alternator excitation wire. Ensure that it is not shorted to ground.</li> <li>2. Replace a defective alternator IAW WP 0049.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H121</b>.</p>	<p>This error code indicates that a loss of signal from the alternator tachometer occurred during operation. Turn power switch to OFF.</p> <ol style="list-style-type: none"> <li>1. Check fuel supply.</li> <li>2. Inspect engine bay, fuel access, and burner areas for any signs of fuel loss.</li> <li>3. Check for tripped circuit breakers on main control box assembly.</li> <li>4. Check alternator TACH wire and ensure that it is not disconnected, broken, or damaged in any way.</li> <li>5. Check fuel solenoid on diesel engine and ensure that it is not disconnected, broken or damaged in any way.</li> <li>6. Check and ensure that the alternator belt is not broken or damaged.</li> <li>7. Check and ensure that flexible coupling is not broken or damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that there is adequate fuel in the heater.</li> <li>2. Repair any damaged or defective fuel hoses or connections that are leaking fuel.</li> <li>3. Reset Circuit Breakers and attempt restart.</li> <li>4. Reconnect alternator TACH wire or diesel engine fuel solenoid wire if disconnected and tighten securely. Repair any broken or damaged alternator wires.</li> <li>5. Replace a broken or damaged alternator belt IAW WP 0049.</li> <li>6. Replace a damaged or broken flexible coupling IAW WP 0050.</li> </ol>



**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, shuts down, and displays error code <b>H122</b>.</p>	<p>This error code indicates that the alternator tachometer was not detected during engine crank.</p> <ol style="list-style-type: none"> <li>1. During heater startup, determine if diesel engine starter is turning.</li> <li>2. Measure voltage on the yellow wire connected to the starter solenoid.</li> <li>3. Turn power switch to OFF. Check and ensure that alternator TACH wire is connected properly and does not read open when checked with a multimeter.</li> <li>4. Check and ensure that the alternator belt is not broken or damaged.</li> <li>5. Check and ensure that flexible coupling is not broken or damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. If 24VDC voltage is present during engine cranking (CRNK displayed on the operator control box) then replace starter IAW WP 0057.</li> <li>2. If 24VDC is not present during engine cranking (CRNK displayed on the operator control box) then check wiring for bad connection, broken or damage wire and repair as necessary.</li> <li>3. Repair a damaged or defective alternator TACH wire.</li> <li>4. Replace a broken or damaged alternator belt IAW WP 0049.</li> <li>5. Replace a damaged or broken flexible coupling IAW WP 0050.</li> </ol>
<p>Heater starts, shuts down, displays error code <b>H123</b>, but engine continues to run.</p>	<p>This error code indicates that the alternator tachometer signal is present after shutdown. Turn power switch to OFF.</p> <p style="text-align: center;"><b>NOTE</b></p> <p>Sometimes the diesel engine will sputter during the fuel system shut down process and inadvertently display this fault code when no system defect is present.</p> <ol style="list-style-type: none"> <li>1. If engine is still running after shutdown process, then either of two problems exist:             <ol style="list-style-type: none"> <li>a. Diesel engine fuel solenoid has 24VDC on coil when it should be at zero potential.</li> <li>b. Diesel engine fuel solenoid is faulty and is stuck open.</li> </ol> </li> </ol>	<p style="text-align: center;"><b>WARNING</b></p> <div style="display: flex; justify-content: center; gap: 10px;">   </div> <p>Hearing protection should be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.</p> <p>Carefully place hand inside heater and touch engine stop lever only. Do not place hands or inside heater while heater is operating. Placing hands inside heater when it is operating may cause serious injury or death.</p> <p>Don hearing protection and open engine access door. Move bottom of engine stop lever to the left (see WP 0006 for location). Hold stop lever in this position until engine comes to a full stop.</p> <ol style="list-style-type: none"> <li>1. Check for shorted wire to 24VDC potential.</li> <li>2. Replace engine shutdown solenoid IAW WP 0060.</li> </ol>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater displays error code <b>H124</b>, but engine continues to run.</p> <p>Heater starts, shuts down, and displays error code <b>H130</b>.</p>	<p>This error code indicates that the alternator tachometer signal is present before engine start. This is most likely caused by the engine not shutting down properly during the previous operation or last shut down attempt. Refer to fault code H123 above for information.</p> <p>This error code indicates that the battery voltage is outside the operating range of a minimum 19.5VDC and a maximum of 32VDC.</p>	<p>Refer to fault code H123 above for information.</p> <ol style="list-style-type: none"> <li>1. Turn power switch to OFF.</li> <li>2. Open engine access door and inspect the wires going to the alternator. Ensure that the wires are all connected properly and that they are not cut or damaged in any way.</li> <li>3. Ensure the excitation wire (low) is connected properly and not damaged.</li> <li>4. Ensure that the alternator output wire (low) is not broken or damaged. Repair any broken or damaged wires.</li> <li>5. Ensure that the alternator belt is not loose. If loose, adjust the belt IAW WP 0049.</li> <li>6. Ensure that all of the battery cable connections are secure and that the cables are not damaged in any way. Replace any damaged cables IAW WP 0071.</li> <li>7. Test batteries IAW WP 0072. Replace one or more defective batteries.</li> <li>8. Test output of alternator. If no output voltage or low output voltage, replace alternator IAW WP 0049.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H131</b>.</p>	<p>This error code indicates that the system is experiencing a battery low voltage condition. The battery must have 15VDC minimum.</p> <ol style="list-style-type: none"> <li>1. Turn power switch to OFF. Measure battery voltage at NATO connector and ensure that it is between 15VDC and 24VDC.</li> <li>2. Check alternator belt and ensure that it is not damaged or loose.</li> <li>3. Check alternator output wire and ensure that it is not broken, damaged. Ensure that it is connected properly.</li> <li>4. Check that all battery connections are secure and undamaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check outdoor temperature. If temperature is -40 °F or lower, use the NATO connector to provide supplemental source of 24VDC power to heater. If batteries are still low or defective, replace batteries IAW WP 0072.</li> <li>2. Ensure that the alternator belt is not loose. If alternator belt is loose, adjust IAW WP 0049.</li> <li>3. Open engine access door and inspect the wires going to the alternator and ensure that they are all connected properly and that they are not cut or damaged in any way.</li> <li>4. Ensure that all of the battery cable connections are secure and that the cables are not damaged in any way.</li> </ol>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
Heater starts, shuts down, and displays error code <b>H211</b> .	<ol style="list-style-type: none"> <li>5. Check battery output voltage and ensure that it is between 15VDC and 24VDC.</li> <li>6. Check output of alternator during operation and ensure that voltage on the output wire is between 19.5VDC and 35VDC.</li> </ol> This error code indicates that there is a low current condition at the burner combustion fan. <ol style="list-style-type: none"> <li>1. Check combustion blower wiring harness and connector and ensure that wire is not broken or damaged. Ensure that both halves of connector are securely mated.</li> <li>2. Check combustion blower and ensure that it is functioning correctly.</li> <li>3. Check circuit breakers on main control box cover.</li> </ol>	<ol style="list-style-type: none"> <li>5. Replace battery if voltage is below 15VDC.</li> <li>6. Verify output of alternator. If no output voltage or low output voltage, replace alternator IAW WP 0049.</li> </ol> <ol style="list-style-type: none"> <li>1. Turn power switch to OFF. Securely mate both halves of the combustion blower wire harness connector. Repair or replace damaged combustion blower wiring harness.</li> <li>2. Replace a defective combustion blower IAW WP 0062.</li> <li>3. Reset if necessary.</li> </ol>
Heater starts, shuts down, and displays error code <b>H251</b> .	This error code indicates that an open circuit has been detected at spark ignition transformer relay T1. This is caused by a defective main control board.	Replace a defective main control box IAW WP 0074.
Heater starts, shuts down, and displays error code <b>H252</b> .	This error code indicates that a short circuit has been detected at spark ignition transformer relay T1. This is caused by a defective main control board.	Turn power switch to OFF. Replace a defective main control box IAW WP 0074.
Heater starts, shuts down, and displays fault code <b>H311</b> .	This fault code indicates that the LCFH Type II has detected carbon monoxide at the operator control panel. <p style="text-align: center;"><b>WARNING</b></p> Evacuate any personnel that may be in the shelter and look for signs of carbon monoxide poisoning. <ol style="list-style-type: none"> <li>1. Check the flexible air inlet duct and ensure that it does not have any rips, tears, or other damage that would allow combustion exhaust to enter the inlet air flow.</li> <li>2. Check and ensure that the flexible inlet air duct is securely attached to the air inlet duct adapter on the LCFH Type II.</li> <li>3. Ensure that the shelter opening is not downwind of the LCFH Type II in such a way as to allow combustion exhaust to enter the shelter.</li> <li>4. Check the exhaust stack and ensure that it is installed properly and does not have any damage that would allow combustion exhaust to enter the shelter.</li> <li>5. Determine if there are any other sources of carbon monoxide (e.g. vehicles, generators, etc.) that may</li> </ol>	<ol style="list-style-type: none"> <li>1. Repair any tears in the flexible air inlet duct with duct tape. Replace flexible air duct if damage cannot be completely repaired with duct tape.</li> <li>2. Attach flexible air inlet duct to air inlet duct adapter. Lock in place securely.</li> <li>3. Move LCFH Type II so that combustion exhaust does not enter shelter during LCFH Type II operation.</li> <li>4. Repair any damage to the exhaust stack with duct tape. Replace exhaust stack if damage cannot be completely repaired with duct tape.</li> <li>5. Move sources of carbon monoxide a safe distance away from the shelter and the LCFH Type II.</li> </ol>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, shuts down, and displays fault code <b>H312</b>.</p>	<p>be running nearby. Determine if the combustion exhaust from those sources may be getting into the LCFH Type II airflow.</p> <p>This fault code indicates that the LCFH Type II has detected carbon monoxide at the cabinet mounted carbon monoxide detector.</p> <p><b>WARNING</b> Evacuate any personnel that may be in the shelter and look for signs of carbon monoxide poisoning.</p> <ol style="list-style-type: none"> <li>1. Check the flexible air inlet duct and ensure that it does not have any rips, tears, or other damage that would allow combustion exhaust to enter the inlet air flow.</li> <li>2. Check and ensure that the flexible inlet air duct is securely attached to the air inlet duct adapter on the LCFH Type II.</li> <li>3. Ensure that the shelter opening is not downwind of the LCFH Type II in such a way as to allow combustion exhaust to enter the shelter.</li> <li>4. Check the exhaust stack and ensure that it is installed properly and does not have any damage that would allow combustion exhaust to enter the shelter.</li> <li>5. Determine if there are any other sources of carbon monoxide (e.g. vehicles, generators, etc.) that may be running nearby. Determine if the combustion exhaust from those sources may be getting into the LCFH Type II airflow.</li> </ol>	<ol style="list-style-type: none"> <li>6. If problem re-occurs and there is no evidence of high carbon monoxide levels, replace the operator control box carbon monoxide detector IAW WP 0077.</li> </ol> <ol style="list-style-type: none"> <li>1. Repair any tears in the flexible air inlet duct with duct tape. Replace flexible air duct if damage cannot be completely repaired with duct tape.</li> <li>2. Re-attach flexible air inlet duct to air inlet duct adapter. Lock in place securely.</li> <li>3. Move LCFH Type II so that combustion exhaust does not enter shelter during LCFH Type II operation.</li> <li>4. Repair any damage to the exhaust stack with duct tape. Replace exhaust stack if damage cannot be completely repaired with duct tape.</li> <li>5. Restart LCFH Type II. If fault reoccurs, stop use of LCFH Type II and notify Field Maintenance.</li> <li>6. If problem reoccurs and there is no evidence of high carbon monoxide levels, replace the cabinet mounted carbon monoxide detector IAW WP 0031.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H321</b>.</p>	<p>This error code indicates that an open circuit has been detected at the carbon monoxide inlet air sensor. Turn power switch to OFF. Check cabinet mounted carbon monoxide detector to determine if the wire harness is loose or disconnected.</p> <p>Test cabinet mounted carbon monoxide detector IAW WP 0031 to determine if it is operating correctly.</p>	<p>Secure a loose or disconnected wire harness connector on cabinet mounted carbon monoxide detector IAW WP 0031.</p> <p>Replace a defective cabinet mounted carbon monoxide detector IAW WP 0031.</p>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, shuts down, and displays error code <b>H322</b>.</p> <p>Heater starts, shuts down, and displays error code <b>H331</b>.</p>	<p>This error code indicates that a short circuit has been detected at the carbon monoxide inlet air sensor. Turn power switch to OFF. Check cabinet mounted carbon monoxide detector to determine if any of the wires are shorted to one another or to ground.</p> <p>Test cabinet mounted carbon monoxide detector to determine if it is operating correctly.</p> <p>This error code indicates that an open circuit has been detected at the carbon monoxide sensor located in the operator control box. Turn power switch to OFF. Check operator control box carbon monoxide detector to determine if any of the wires are loose or disconnected.</p> <p>Test operator control box carbon monoxide detector to determine if it is operating correctly.</p>	<p>Repair any shorted wires on carbon monoxide detector IAW WP 0031.</p> <p>Replace a defective cabinet mounted carbon monoxide detector IAW WP 0031.</p> <p>Secure any loose or disconnected wires on operator control box carbon monoxide detector IAW WP 0077.</p> <p>Replace a defective operator control box carbon monoxide detector IAW WP 0077.</p>
<p>Heater starts, shuts down, and displays error code <b>H332</b>.</p>	<p>This error code indicates that a short circuit has been detected at the carbon monoxide sensor on the operator control box. Turn power switch to OFF. Check operator control box carbon monoxide detector to determine if any of the wires are shorted to one another or to ground.</p> <p>Test operator control box carbon monoxide detector to determine if it is operating correctly.</p>	<p>Repair any shorted wires on operator control box carbon monoxide detector IAW WP 0077.</p> <p>Replace a defective operator control box carbon monoxide detector IAW WP 0077.</p>
<p>Heater starts, shuts down, and displays error code <b>H421</b>.</p>	<p>This error code indicates that the system is not receiving a response from the operator control box. Turn power switch to OFF. Ensure that the connection between the operator control box and the operator control box cable is secure. Ensure that the connector is not damaged in any way and that the cable is not cut or damaged.</p> <p>Ensure that the connection between the main control box and the operator control box cable is secure. Ensure that the connector is not damaged in any way and that the cable is not cut or damaged.</p>	<p>Tighten connection between operator box control cable and operator control box. Tighten connection between operator box control cable and main control box control box.</p> <p>Replace a damaged or defective operator control box control cable IAW WP 0076.</p>
<p>Heater starts, shuts down, and displays fault code <b>H431</b>.</p>	<p>This error code indicates that an open circuit or high resistance has been detected at the outlet temperature sensor RTD1.</p>	<p>Check and remove blockage at air inlet or air outlet, if detected.</p> <p>Repair the open wire to the outlet temperature sensor RTD1.</p> <p>Replace a defective RTD1 outlet temperature sensor IAW WP 0068.</p>
<p>Heater starts, shuts down, and displays fault code <b>H432</b>.</p>	<p>This error code indicates that a shorted circuit has been detected at the outlet temperature sensor RTD1.</p>	<p>Repair the shorted wire to the outlet temperature sensor RTD1.</p> <p>Replace a defective RTD1 outlet temperature sensor IAW WP 0068.</p>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, shuts down, and displays error code <b>H511</b>.</p>	<p>This error code indicates that the engine failed to start after three tries. Turn power switch to OFF.</p> <ol style="list-style-type: none"> <li>1. Check for proper fuel level in internal fuel tank or external fuel supply.</li> <li>2. Ensure fuel is not contaminated by dirt or water.</li> <li>3. Inspect the entire fuel system:                             <ol style="list-style-type: none"> <li>a. Check for loose fittings.</li> <li>b. Check fuel filter.</li> <li>c. Check fuel pump.</li> <li>d. Check burner fuel pump.</li> </ol> </li> <li>4. If unit is in extreme cold environment, check engine pre-heaters are functioning properly.</li> <li>5. Check engine fuel solenoid for proper operation. Solenoid will be powered by 24VDC when engine is supposed to be running.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fill internal fuel tank or ensure that there is adequate fuel in bulk fuel supply.</li> <li>2. Drain internal fuel tank or bulk fuel supply.</li> <li>3. Tighten loose fittings.</li> <li>4. Replace fuel filter IAW WP 0034.</li> <li>5. Replace electric fuel pump IAW WP 0035.</li> <li>6. Replace defective burner fuel pump coupling or burner fuel pump as necessary IAW WP 0035.</li> <li>7. If ambient is below 30 °F, "GLOW" will be displayed on operator control panel and engine pre-heaters will be powered with 24VDC potential.</li> <li>8. After ensuring all above items are correct, check engine fuel solenoid. Fuel solenoid needs to be powered by 24VDC during engine cranking.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H521</b>.</p>	<p>This error code indicates that an open circuit has been detected in the electric fuel pump circuit. Turn power switch to OFF. Check electric fuel pump wiring harness to determine if any of the wires are loose or disconnected.</p> <p>Determine if electric fuel pump is operating correctly.</p>	<p>Secure any loose or disconnected wires on electric fuel pump wiring harness IAW WP 0035.</p> <p>Replace a defective electric fuel pump IAW WP 0035.</p>
<p>Heater starts, shuts down, and displays error code <b>H522</b>.</p>	<p>This error code indicates that a short circuit has been detected in the electric fuel pump circuit. Turn power switch to OFF. Check electric fuel pump wiring harness to determine if any of the wires are shorted to ground or to one another.</p> <p>Determine if electric fuel pump is operating correctly.</p>	<p>Repair any shorted wires on electric fuel pump wiring harness IAW WP 0035.</p> <p>Replace a defective electric fuel pump IAW WP 0035.</p>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
Heater starts, shuts down, and displays error code <b>H531</b> .	This error code indicates that diesel oil pressure has been detected before engine start. <ol style="list-style-type: none"> <li>1. Check oil pressure switch, SW2, wiring harness and determine if any wires are loose or disconnected.</li> <li>2. Test oil pressure switch to determine if it is defective.</li> <li>3. Oil pressure switch is designed to be a closed switch (shorted to ground potential/chassis) when the engine is OFF.</li> <li>4. The switch will open (high resistance) when engine oil pressure is detected while running.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn power switch to OFF.</li> <li>2. Repair any loose or disconnected wires going to the oil pressure switch.</li> <li>3. Replace a defective engine oil pressure switch, SW2, in accordance with WP 0025.</li> </ol>
Heater starts, shuts down, and displays error code <b>H532</b> .	This error code indicates that the oil pressure of the diesel engine during operation is low. <ol style="list-style-type: none"> <li>1. Check oil level of diesel engine and ensure that level is adequate.</li> <li>2. Check diesel engine oil pressure switch wire and ensure that it is not shorted to ground/chassis.</li> <li>3. Check diesel engine oil pressure switch and ensure that it is working properly.</li> <li>4. Oil pressure switch is designed to be a closed switch (shorted to ground potential/chassis) when the engine is OFF.</li> <li>5. The oil pressure switch will open (high resistance) when engine oil pressure is detected while engine is running.</li> <li>6. If unit has in excess of 2000 hrs of operation, and this fault code is displayed during extreme cold environment, make sure that arctic oil is used for the appropriate temperature range IAW WP 0051, Table 1.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn power switch to OFF.</li> <li>2. Add engine oil to full mark IAW WP 0051. Refill fuel tank IAW WP 0005.</li> <li>3. Repair or replace a shorted diesel engine oil pressure switch wire.</li> <li>4. Replace a defective diesel engine oil pressure switch in accordance with WP 0025.</li> <li>5. Ensure proper arctic engine oil is being used IAW WP 0051.</li> <li>6. If fault condition is not remedied, replace oil pressure switch IAW WP 0025.</li> </ol>
Heater starts, shuts down, and displays error code <b>H541</b> .	This error code indicates that an open circuit has been detected at the diesel engine pre-heat relay driver on the main control box printed circuit board.	Replace main control box assembly IAW WP 0074.
Heater starts, shuts down, and displays error code <b>H542</b> .	This error code indicates that a short circuit has been detected at the diesel engine pre-heat relay driver on main control box printed circuit board.	Turn power switch to OFF. Replace main control box assembly IAW WP 0074.
Heater starts, shuts down, and displays error code <b>H551</b> .	This error code indicates that an open circuit has been detected at the diesel engine starter relay driver. This is caused by a defective main control board.	Turn power switch to OFF. Replace a main control box assembly IAW WP 0074.

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
Heater starts, shuts down, and displays error code <b>H552</b> .	This error code indicates that a short circuit has been detected at the diesel engine starter relay driver. This is caused by a defective main printed circuit board.	Turn power switch to OFF.  Replace main control box assembly IAW WP 0074.
Heater starts, shuts down, and displays error code <b>H561</b> .	This error code indicates that there is an open circuit detected at the engine fuel solenoid relay driver on the main control box printed circuit board.	Turn power switch to OFF.  Replace main control box assembly IAW WP 0074.
Heater starts, shuts down, and displays error code <b>H562</b> .	This error code indicates that a short circuit has been detected at the diesel engine fuel solenoid relay driver on main control box printed circuit board.	Turn power switch to OFF.  Replace main control box assembly IAW WP 0074.
Heater starts, shuts down, and displays error code <b>H611</b> .	This error code indicates that an open circuit has been detected at fuel solenoid valve FS1 (controls burner on/off).  1. Check wire on fuel solenoid valve FS1 and ensure that it is not loose or disconnected.  2. Check main wiring harness for broken wire or bad connection.  3. Check for an open (i.e. defective) coil on FS1 solenoid valve using a multimeter set to measure resistance. A good solenoid valve coil should measure approximately 65 to 70 Ohms.	1. Turn power switch to OFF.  2. Secure a loose or disconnected wire to the fuel solenoid valve, FS1.  3. Secure or repair loose or bad connection in main wire harness.  4. Replace a defective FS1 fuel solenoid valve IAW WP 0039.  5. If Items 1 through 3 are all tested and acceptable, replace main control box assembly IAW WP 0074.
Heater starts, shuts down, and displays error code <b>H612</b> .	This error code indicates that a short circuit has been detected at fuel solenoid valve FS1 which controls burner on/off.  1. Check wire on fuel solenoid valve FS1 and ensure that it is not shorted to ground.  2. Check wire on fuel solenoid valve FS1 and ensure that it is not shorted to chassis.  3. Check main wiring harness for shorted wire.  4. Check for an shorted (i.e. defective) coil on FS1 solenoid valve using a multimeter set to measure resistance. A good coil should measure approximately 65 to 70 Ohms.	1. Turn power switch to OFF.  2. Repair a shorted wire to the fuel solenoid valve, FS1.  3. Repair shorted wire in main wiring harness IAW 0095.  4. Replace a defective FS1 fuel solenoid valve IAW WP 0039.  5. If Items 1 through 3 are all tested and acceptable, replace main control box assembly IAW WP 0074.



**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

SYMPTOM	MALFUNCTION	CORRECTIVE ACTION
<p>Heater starts, shuts down, and displays error code <b>H621</b>.</p>	<p>This error code indicates that an open circuit has been detected at fuel solenoid valve FS2 which controls burner HI and LO fire. Solenoid is located on the burner fuel pump mounted to the diesel engine.</p> <ol style="list-style-type: none"> <li>1. Check wire on fuel solenoid valve FS2 and ensure that it is not loose or disconnected.</li> <li>2. Check main wire harness for broken wire or bad connection.</li> <li>3. Check for an open (i.e. defective) coil on FS2 solenoid valve using a multimeter set to measure resistance. A good coil should measure approximately 65 to 70 Ohms.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn power switch to OFF.</li> <li>2. Secure a loose or disconnected wire to the fuel solenoid valve, FS2.</li> <li>3. Secure or repair loose or bad connection in main wire harness IAW WP 0095.</li> <li>4. Replace a defective FS2 fuel solenoid valve IAW WP 0039.</li> <li>5. If Items 1 through 3 are all tested and acceptable, replace main control box assembly IAW WP 0074.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H622</b>.</p>	<p>This error code indicates that a short circuit has been detected at fuel solenoid valve FS2 which controls burner HI and LO fire. Solenoid FS2 is located on the burner fuel pump mounted to the diesel engine.</p> <ol style="list-style-type: none"> <li>1. Check wire on fuel solenoid valve FS2 and ensure that it is not shorted to chassis.</li> <li>2. Check main wiring harness for shorted wire.</li> <li>3. Check for an shorted (i.e. defective) coil on FS2 solenoid valve using a multimeter set to measure resistance. A good coil should measure approximately 65 to 70 Ohms.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn power switch to OFF.</li> <li>2. Repair a shorted wire to the fuel solenoid valve, FS2.</li> <li>3. Repair shorted wire in main wiring harness IAW WP 0095.</li> <li>4. Replace a defective FS2 fuel solenoid valve IAW WP 0039.</li> <li>5. If Items 1 through 3 are all tested and acceptable, replace main control box assembly IAW WP 0074.</li> </ol>
<p>Heater starts, shuts down, and displays error code <b>H631</b>.</p>	<p>This error code indicates that an open circuit has been detected at fuel solenoid valve FS3 which controls switching between internal and external fuel supply.</p> <ol style="list-style-type: none"> <li>1. Check wire on fuel solenoid valve FS3 near the electric fuel pump and ensure that it is not loose or disconnected.</li> <li>2. Check main wiring harness for broken wire or bad connection.</li> <li>3. Check for an open (i.e. defective) coil on FS3 solenoid valve using a multimeter set to measure resistance. A good coil should measure approximately 35 to 40 Ohms.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn power switch to OFF.</li> <li>2. Secure a loose or disconnected wire to the fuel solenoid valve, FS3.</li> <li>3. Secure or repair loose or bad connection in main wiring harness IAW WP 0095.</li> <li>4. Replace a defective FS3 fuel solenoid valve IAW WP 0036.</li> <li>5. If Items 1 through 3 are all tested and acceptable, replace main control box assembly IAW WP 0074.</li> </ol>

**Table 1. LCFH Type II Fault Code Troubleshooting Procedures. - Continued**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Heater starts, shuts down, and displays error code <b>H632</b> .	This error code indicates that a short circuit has been detected at fuel solenoid valve FS3 which controls switching between internal and external fuel supply. <ol style="list-style-type: none"> <li>1. Check wire on fuel solenoid valve FS3 and ensure that it is not shorted to chassis.</li> <li>2. Check main wiring harness for shorted wire.</li> <li>3. Check for a shorted (i.e. defective) coil on FS3 solenoid valve using a multimeter set to measure resistance. A good coil should measure approximately 35 to 40 Ohms.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn power switch to OFF.</li> <li>2. Repair a shorted wire to the fuel solenoid valve, FS3.</li> <li>3. Repair shorted wire in main wiring harness.</li> <li>4. Replace a defective FS3 fuel solenoid valve IAW WP 0036.</li> <li>5. If Items 1 through 3 are all tested and acceptable, replace main control Box assembly IAW WP 0074.</li> </ol>
Heater starts, shuts down, and displays error code <b>H801</b> .	This error code indicates that the main control box printed circuit board has detected a loss of software control for greater than one second.	Cycle the ON/OFF switch on the operator control panel to determine if problem has been resolved.  Turn power switch to OFF. Replace a defective main control box assembly IAW WP 0074.

**END OF TASK**

**END OF WORK PACKAGE**

**FIELD MAINTENANCE**

**DIESEL ENGINE TROUBLESHOOTING PROCEDURES**

**INITIAL SETUP:**

**Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**References**

WP 0085  
WP 0086

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool unless otherwise indicated.  
Main battery switch OFF and handle removed unless otherwise indicated.

**Table 1. Diesel Engine Troubleshooting Procedures.**

<b>SYMPTON</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Engine will not start.	Check for proper thickness of fuel injection pump shim IAW WP 0085.  Damaged or defective fuel injection pump.	Adjust shim thickness/injection timing IAW WP 0085.  Remove and replace fuel injection pump IAW WP 0085.  Refer problem to Sustainment Maintenance level.
Engine starts and stops.	Check for damaged governor control component IAW WP 0086.  Damaged or defective fuel injection pump.	Remove and replace damaged control component IAW WP 0086.  Remove and replace fuel injection pump IAW WP 0085.  Refer problem to Sustainment Maintenance level.
Engine output drops.	Damaged or defective fuel injection pump.	Remove and replace fuel injection pump IAW WP 0085.  Refer problem to Sustainment Maintenance level.
Engine runs rough.	Check governor control for proper position of regulator spring IAW WP 0086.  Check for proper thickness of fuel injection pump shim IAW WP 0085.  Damaged or defective fuel injection pump.	Adjust governor lever IAW WP 0086.  Adjust shim thickness/injection timing IAW WP 0085.  Remove and replace fuel injection pump IAW WP 0085.  Refer problem to Sustainment Maintenance level.
Engine emits white or black smoke.	Check injection timing (too slow) IAW WP 0085.	Adjust fuel injection pump timing by removing shims IAW WP 0085.  Refer problem to Sustainment Maintenance level.

**Table 1. Diesel Engine Troubleshooting Procedures. - Continued**

<b>SYMPTON</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Engine speed fluctuates (races or uneven speed).	<p>Check governor control for proper position of regulator spring IAW WP 0086.</p> <p>Damaged or defective governor control component IAW WP 0086.</p>	<p>Adjust governor lever IAW WP 0086.</p> <p>Remove and replace damaged control component IAW WP 0086.</p> <p>Refer problem to Sustainment Maintenance level.</p>

**END OF TASK**

**END OF WORK PACKAGE**

**SUSTAINMENT MAINTENANCE**

**DIESEL ENGINE TROUBLESHOOTING PROCEDURES**

**INITIAL SETUP:**

**Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 19)

**References**

WP 0092 WP 0089  
WP 0081 WP 0093  
WP 0091 WP 0082

**Personnel Required**

Quartermaster and Chemical Equipment  
Repairer 63J  
Utilities Equipment Repairer 52C

**Equipment Condition**

Heater shut down and cool unless otherwise  
indicated.  
Main battery switch OFF and handle removed.

**Table 1. Diesel Engine Troubleshooting Procedures.**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Engine will not start.	Check for defective injection pump delivery valve IAW WP 0092.	Remove and replace pump delivery valve IAW WP 0092.  If engine cannot be repaired, replace IAW WP 0081.
Engine starts and stops.	Check for defective injection pump delivery valve IAW WP 0092.  Possible crankshaft bearing seizure. Grasp flywheel, and attempt to manually rotate engine in clockwise direction to check for seizure.  Possible piston liner seizure. Grasp flywheel, and attempt to manually rotate engine in clockwise direction to check for seizure.	Remove and replace pump delivery valve IAW WP 0092.  Remove and replace crankshaft bearing IAW WP 0089.  Remove and replace piston components IAW WP 0093.  If engine cannot be repaired, replace IAW WP 0081.
Engine output drops.	Check for defective injection pump delivery valve IAW WP 0092.  Check for carbon deposits in the engine combustion chamber IAW WP 0091.  Possible piston seizure or wear. Inspect pistons IAW WP 0093.	Remove and replace pump delivery valve IAW WP 0092.  Clean carbon from engine combustion chamber IAW WP 0091.  Remove and replace damaged or worn piston components IAW WP 0093.  If engine cannot be repaired, replace IAW WP 0081.
Engine runs rough.	Check flywheel nut for proper tightness.	Tighten flywheel nut to 86 to 94 ft-lbs (1200 to 1300 kg-cm).  If engine cannot be repaired, replace IAW WP 0081.

**Table 1. Diesel Engine Troubleshooting Procedures. - Continued**

<b>SYMPTOM</b>	<b>MALFUNCTION</b>	<b>CORRECTIVE ACTION</b>
Low compression pressure.	<p>Check for leak at inlet and exhaust valves indicating worn valve seat or guide IAW WP 0092.</p> <p>Check for loose cylinder head nuts causing leak at cylinder head gasket.</p> <p>Check for broken or damaged cylinder head gasket IAW WP 0082.</p>	<p>Remove and replace inlet/exhaust valve components as required IAW WP 0092.</p> <p>Tighten cylinder head nuts in an even pattern to 30 to 33 ft-lbs (420 to 460 kg-cm).</p> <p>Remove and replace cylinder head gasket IAW WP 0082.</p> <p>If engine cannot be repaired, replace IAW WP 0081.</p>
Engine emits white smoke.	<p>Possible worn or broken piston ring or worn piston. Inspect piston assembly IAW WP 0093.</p> <p>Check for defective valve stem seal IAW WP 0093.</p>	<p>Remove and replace damaged piston assembly components IAW WP 0093.</p> <p>Remove and replace valve stem seal IAW WP 0082.</p> <p>If engine cannot be repaired, replace IAW WP 0081.</p>
Engine emits black smoke.	<p>Possible piston/cylinder liner seizure. Inspect for seized components IAW WP 0093.</p>	<p>Remove and replace damaged piston assembly components IAW WP 0093.</p> <p>If engine cannot be repaired, replace IAW WP 0081.</p>

**END OF TASK**

**END OF WORK PACKAGE**

**CHAPTER 5**

**PMCS MAINTENANCE INSTRUCTIONS**  
**FOR**  
**LARGE CAPACITY FIELD HEATER,**  
**TYPE II (LCFH TYPE II)**





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**OPERATOR AND FIELD MAINTENANCE****PMCS INTRODUCTION**

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**GENERAL**

The following information describes the PMCS procedures at the Operator and Field Maintenance level. The PMCS table has been provided to ensure the Large Capacity Field Heater, Type II, (LCFH Type II) is in proper operating condition and ready for its primary mission.

**Frequency of Performing PMCS**

PMCS will be performed before use of equipment, during modification and repair after use, or at any time deemed necessary by the maintenance officer.

**PMCS Columnar Entries Table 1**

Item Number. The item number column shall be used as a source of the item number required for the TM Number column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet), when recording the results of the PMCS.

Interval. This column identifies the required PMCS interval.

Item to be inspected. Contains the common name of the item to be inspected.

Procedures. Provides a brief description of the procedures by which the checks are to be performed.

**Recording Defects**

All defects discovered during the inspection will be recorded using the applicable specifics in DA PAM 750-8, DA PAM 738-751, and TB 43-0002-43.

**Over Age Items**

During any inspection, or at any time that an item is found to be over age (i.e., shelf/service life has expired as specified in TB 43-0002-43), the item will be removed from service, condemned, and tagged in accordance with DA PAM 738-751.

**Conservation of Resources**

To conserve time and labor, unit/detachment commanders may designate, in writing, personnel to accomplish classification inspection of over age equipment and the classification of Beyond Economical Repair (BER).

**Inspection Function Requirement**

Normally, equipment maintenance personnel at a packing or repair section activity will perform an inspection. The inspection of initial receipt items will be performed.

Should defect or damage be discovered at any point during the inspection, the inspection will be terminated, and the applicable item will be processed and forwarded to repair activity. The repair activity, in turn, will conduct an inspection.

## INTRODUCTION

Preventive Maintenance Checks and Services (PMCS) are performed to keep the Large Capacity Field Heater, Type II, (LCFH Type II) in good operating condition and ready for its primary mission. The checks are used to find, correct, and report problems. PMCS is performed every day the Large Capacity Field Heater, Type II, (LCFH Type II) is in operation and is done according to the PMCS table provided. Pay attention to **WARNING**, **CAUTION**, and **NOTE** statements. A **WARNING** indicates that someone could be hurt or killed. A **CAUTION** indicates that equipment could be damaged. A **NOTE** may make your maintenance or repair task easier.

Be sure to perform scheduled PMCS. Always perform PMCS in the same order so it becomes habit. With practice, you will quickly recognize problems with the equipment.

Use DA Form 2404, Equipment Inspection and Maintenance Worksheet, to record any discovered faults. Do not record faults that you fix.

## PMCS PROCEDURES

Table 1 lists inspections and care required to keep your equipment in good operating condition. It is arranged so that you can perform before operation checks as you walk around the equipment.

### Explanation of Table 1 columns

#### Item Number

Indicates the reference number. When completing DA Form 2404, Equipment Inspection and Maintenance Worksheet, include the item number for the item to check/service indicating a fault. Item numbers appear in the order you must perform the checks/services listed.

#### Interval

Indicates when you must perform the procedure in the procedure column.

- before** - perform before equipment operation
- during** - perform during equipment operation
- after** - perform after equipment has been operated
- weekly** - perform every week
- monthly** - perform each month
- hours** - perform at the noted hourly interval

#### Item to Check/Service

Indicates the item to be checked or serviced.

#### Procedure

Indicates the procedure you must perform on the item listed in Item to Check/Service column. You must perform the procedure at the time specified in the Interval column.

#### Not Fully Mission Capable If:

Indicates faults which will prevent your equipment from performing its primary mission. If you perform procedures listed in Procedure column which show faults listed in this column, do not operate the equipment. Follow standard procedures for maintaining the equipment or reporting equipment failure.

#### Other special entries

Observe all special information and notes that appear in Table 1.

When a check/service procedure is required for both weekly and before intervals, it is not necessary to perform the procedure twice if the equipment is operated during the weekly period.

## END OF WORK PACKAGE

**OPERATOR, SERVICE, AND FIELD MAINTENANCE**

**PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)  
INCLUDING LUBRICATION INSTRUCTIONS**

**INITIAL SETUP:**

**Tools and Special Tools**

None required.

**Personnel Required**

MOS non-specific

**Materials/Parts**

None required.

**Equipment Condition**

Heater shut down and cool unless otherwise indicated.  
All equipment shall be serviceable and ready for use.

**References**

DA PAM 750-8, DA PAM 738-751,  
TB 43-0002-43, DA Form 2404, WP 0021,  
WP 0059, WP 0055, WP 0081, WP 0053,  
WP 0054, WP 0024, WP 0017, WP 0052,  
WP 0028, WP 0065, WP 0066, WP 0050  
WP 0031, WP 0057, WP 0058, WP 0072

**GENERAL**

The following describe PMCS procedures at the service level. The PMCS table has been provided to ensure the Large Capacity Field Heater, Type II, (LCFH Type II) is in proper operating condition and ready for its primary mission.

**Frequency of Performing PMCS**

PMCS will be performed before use of equipment, during modification and repair after use, or at any time deemed necessary by the maintenance officer.

**PMCS Columnar Entries Table 2**

Item Number. The item number column shall be used as a source of the item number required for the TM Number column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet), when recording the results of the PMCS.

Interval. This column identifies the required PMCS interval.

Item to be inspected. Contains the common name of the item to be inspected.

Procedures. Provides a brief description of the procedures by which the checks are to be performed.

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**COMMON CHECKS AND CLEANING****Cleaning**

Always keep the equipment clean. Remove dirt, sand, and debris from all circuit breakers and hose connections.

**Bolts, Nuts, and Screws**

Check them for obvious looseness, missing, bent, or broken condition on equipment. If you find a bolt, nut, or screw you think is loose, tighten it or report it to your supervisor.

**Hoses**

Look for wear, damage, and leaks. Ensure clamps are tight. Wet spots show leaks, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or coupling, tighten it. If something is broken or worn out, report it to your supervisor.

**LEAKAGE DEFINITION FOR PERFORMING PMCS**

It is necessary for you to know how fluid leakage affects the status of the equipment. The following are the types/classes of leakage an operator needs to know to be able to determine the status of the water system. Learn these leakage definitions and remember: When in doubt, notify your supervisor.

**CAUTION**

Equipment operation is allowable with minor leakages (Class I or II). Of course, consideration must be given to fluid capacity in the system. When in doubt, notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks: Cease all operations, and report it immediately to your supervisor.

Class I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

Class II - Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.

Class III - Leakage of fluid great enough to form drops that fall from items being checked/inspected.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II).**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Before	Air Supply and Return Ducts	<ol style="list-style-type: none"> <li>1. Check the fresh air inlet (Figure 1, Item 2) and heated air outlet (Figure 1, Item 3) ducts for holes and tears in the fabric. Repair damaged ducts if possible. Replace duct if damage cannot be repaired.</li> <li>2. Check outside surface of duct for any dirt or debris. Clean dirt and debris from exterior of duct with a clean, dry rag.</li> <li>3. Check for and remove any obstructions inside of ducts.</li> <li>4. Inspect mounting rings (Figure 1, Item 1) on ends of ducts for any type of damage that would prevent the duct from being properly mounted to the heater inlet and outlet ducts.</li> </ol>	<p>There are holes, tears, or other damage that cannot be repaired and that would permit air to enter or escape through the side walls of the duct.</p> <p>Excessive dirt or debris is present on duct.</p> <p>Obstructions within the duct that cannot be cleared.</p> <p>Mounting rings damaged so as to prevent proper mounting to heater ducts.</p>
	During		Periodically check the fresh air inlet duct area (Figure 1, Item 2) and screen for dirt and debris. If excessive dirt or debris is evident, temporarily shut down the heater and clean/remove the dirt and debris.	Excessive dirt or debris is present in the return duct and inlet screen area that restricts airflow.
	After		After shutting down the heater, if excessive dirt or debris is evident on the fresh air inlet duct area (Figure 1, Item 2) and/or inlet screen, clean/remove the dirt and debris.	Excessive dirt or debris is present in the fresh air inlet duct area and/or inlet screen area that restricts airflow.



Figure 1. Before, During, and After Operation PMCS for Air Supply and Return Ducts PMCS.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
2	Before	Operator Control Box	<p style="text-align: center;"><b>CAUTION</b></p> <p>Be sure to perform ONLY a visual check of the POWER switch for damage. DO NOT flip the switch to the ON position.</p> <ol style="list-style-type: none"> <li>1. Perform a visual check of the operator control box (Figure 2, Item 3) and verify that the POWER switch (Figure 2, Item 8) and FUEL SELECTOR switch (Figure 2, Item 1), FAULT RESET switch (Figure 2, Item 2), VENT switch (Figure 2, Item 7), and TEMPERATURE control (Figure 2, Item 4) are undamaged.</li> <li>2. Check the LED display (Figure 2, Item 9), and ensure that it is not cracked or otherwise damaged.</li> <li>3. Check that the thermistor (Figure 2, Item 5) is not bent or otherwise damaged.</li> </ol>	<p>Operator control box is cracked, dented, or otherwise damaged as to prevent a weathertight seal or normal operation.</p> <p>POWER switch is damaged.</p> <p>FUEL SELECTOR switch is damaged.</p> <p>FAULT RESET switch is damaged.</p> <p>VENT switch is damaged.</p> <p>TEMPERATURE control is damaged.</p> <p>LED display is cracked or broken.</p> <p>Thermistor is bent or damaged.</p>
	During		Periodically monitor the operator control box (Figure 2, Item 3) during operation of the LCFH Type II. If fault code H561 or H562 appear while the LCFH Type II continues to run, contact Service Maintenance.	Fault codes appear during continuing operation of the LCFH Type II.
3	Before	Operator Control Box Cable	Check operator control box cable (Figure 2, Item 6) and verify that insulation and connectors are clean and undamaged.	<p>Operator control box cable insulation is cut or otherwise damaged exposing wires.</p> <p>Connectors are dented, bent, or otherwise damaged, preventing a secure connection to the operator control box or heater.</p>
	During		Periodically monitor the routing of the cable (Figure 2, Item 6) between heater and shelter to ensure that it is not pinched or damaged. Control any situations that would pinch, cut or damage the cable.	Damage to cable interferes with operation.
	After		Perform the BEFORE checks prior to storing the box and cable in the LCFH Type II operator control box compartment.	Damage to cable interferes with operation.

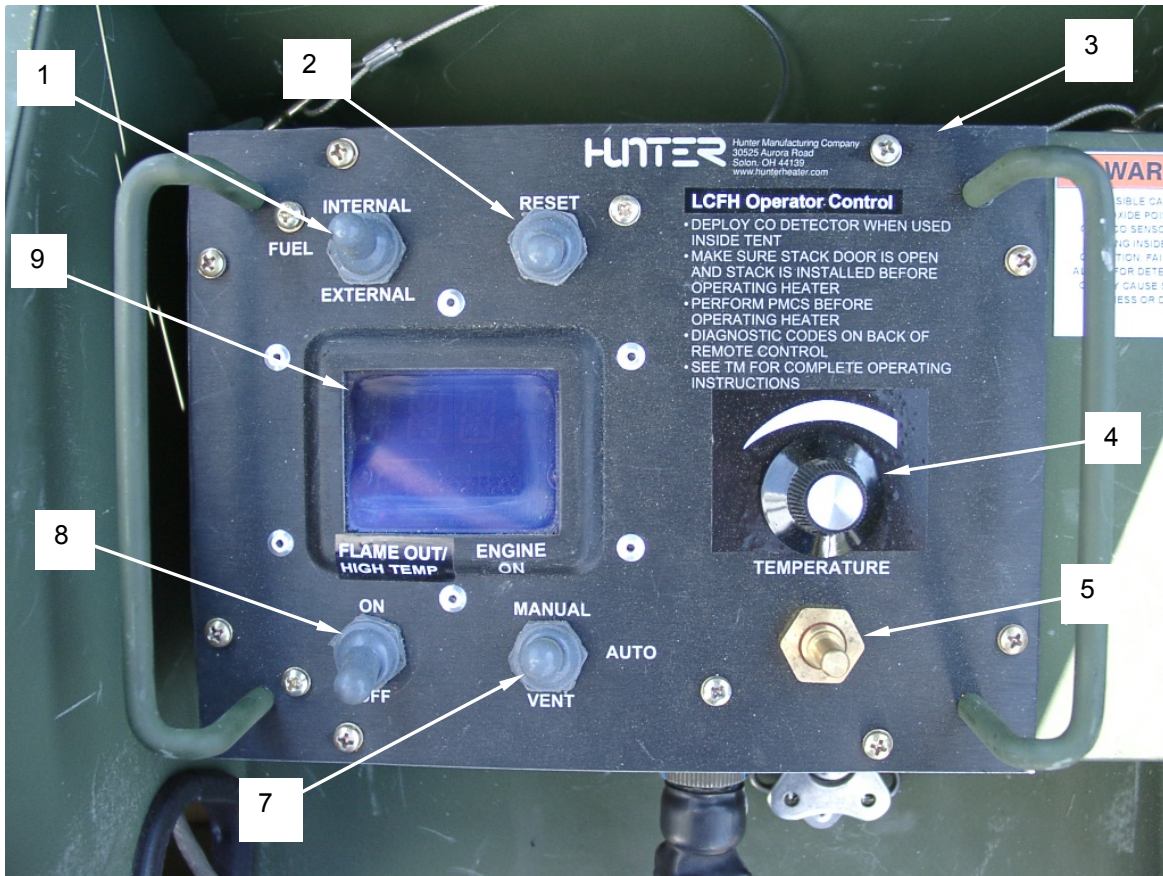


Figure 2. Before, During, and After Operation PMCS for Operator Control Box and Operator Control Box Cable.



**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
4	Before	Batteries	<ol style="list-style-type: none"> <li>1. Open engine bay access door and inspect the two batteries (Figure 3, Item 1 and 4) to ensure that there are no cracks, leaks, or other damage.</li> <li>2. Verify that the battery cables (Figure 3, Item 5) are securely mounted to the batteries.</li> <li>3. Verify that the battery cable insulation is not cut, cracked, or otherwise damaged so as to expose the wires.</li> <li>4. Ensure that the battery mounting brackets (Figure 3, Item 6) are secure and not bent, cracked or damaged.</li> <li>5. Ensure that the battery terminal protective covers (Figure 3, Item 3) are in place and undamaged.</li> </ol>	<p>Battery cracked or otherwise damaged.</p> <p>Battery leaking.</p> <p>Battery cable not securely installed.</p> <p>Battery cable insulation cut or cracked.</p> <p>Battery mounting bracket is loose or damaged.</p> <p>Battery terminal protective covers are missing or damaged.</p>
	After		Visually check for leaks or damage and notify Service Maintenance as required.	Damage that prevents safe use of the batteries.



Figure 3. Before and After Operation PMCS for Batteries.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
5	Before	Fuel Supply Service Panel and External Fuel Hose	<ol style="list-style-type: none"> <li>1. Inspect the fuel service panel area and ensure that the external fuel supply connector (Figure 4, Item 1) is clean and undamaged.</li> <li>2. Verify that the fuel filler cap (Figure 4, Item 7) is present, undamaged, and that the fuel filler cap gasket (Figure 4, Item 2) is in place.</li> <li>3. Remove the fuel filter screen (Figure 4, Item 3) and inspect to ensure that there is no sand or other debris. Clean as necessary with clean fuel or solvent. Replace screen (Figure 4, Item 3) and install fuel filler cap (Figure 4, Item 7).</li> <li>4. Check external fuel hose (Figure 4, Item 6) for cuts, cracks, dry rot or damaged end connectors. Replace if safe fuel transfer cannot be accomplished.</li> </ol>	<p>External fuel supply connector dirty, bent, or otherwise damaged.</p> <p>Fuel filler cap missing or damaged.</p> <p>Fuel filler cap gasket missing or damaged.</p> <p>Fuel filter screen is dirty and requires cleaning.</p>
	During		<ol style="list-style-type: none"> <li>1. If operating from internal fuel tank, periodically check fuel gauge and add fuel as required.</li> <li>2. If operating from external fuel source, periodically check the external fuel hose (Figure 4, Item 6) for cuts, leaks, or loose connections. If safe fuel transfer cannot be accomplished, remove and replace the hose.</li> </ol>	<p>Insufficient fuel in the tank to allow operation.</p> <p>Leaks or damage prevent safe transfer of fuel from the external source to the LCFH Type II.</p>
	After		<p>Prior to storage in the fuel compartment door pocket, drain excess fuel from the external fuel hose (Figure 4, Item 6) and check for cuts, cracks, dry rot or damaged end connectors. Replace if safe fuel transfer cannot be accomplished.</p>	<p>Damage would prevent safe transfer of fuel from the external source to the LCFH Type II.</p>
6	Before, During, and After	Fuel Pump and Fuel Filter	<ol style="list-style-type: none"> <li>1. Open the fuel filter access door and verify that the fuel filter (Figure 4, Item 5) is not cracked or otherwise damaged.</li> <li>2. Verify that there are no fuel leaks present around any of the fuel filter or fuel pump (Figure 4, Item 4) fittings.</li> </ol>	<p>Fuel filter cracked or damaged.</p> <p>Fuel leaks present around fuel filter and/or fuel pump.</p>

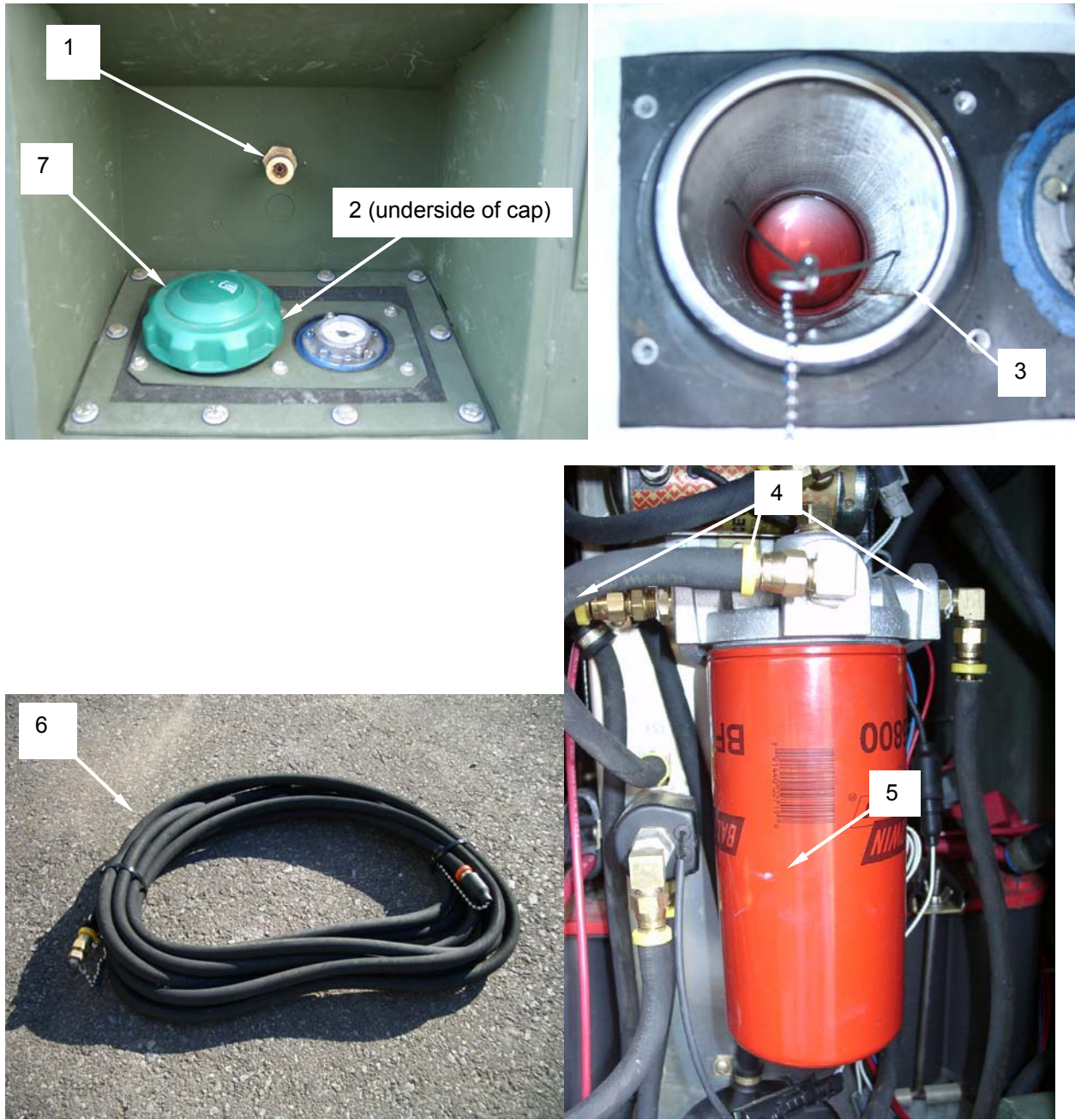


Figure 4. Fuel Filter Before, During, and After Operation PMCS for Fuel Supply Service Panel, External Fuel Hose, Fuel Pump.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
7	Before, During, and After	Exhaust Stack Assembly	1. Inspect the exhaust stack assembly (Figure 5, Item 6) and verify that the end (Figure 5, Item 3) that engages with the heater exhaust stack outlet (Figure 5, Item 4) is not bent, cracked, or damaged in any way, as to prevent the exhaust stack from fitting securely and completely into the exhaust stack outlet.  2. Verify that the downdraft cap (Figure 5, Item 1) on the top of the exhaust stack is present and is not damaged.  3. Verify that the heat shield (Figure 5, Item 5) on the exhaust stack is present and undamaged.	Exhaust stack or exhaust stack outlet is bent, cracked, or damaged.   Downdraft cap missing or inoperative.  Heat shield missing or damaged so as to allow operator to come in contact with hot stack.
8	Before, During, and After	Inlet and Outlet Duct Housings	Inspect the inlet and outlet duct housings and inlet screens (Figure 5, Item 2) to ensure that they are not bent or damaged, so as to prevent the flexible ducts from engaging completely.	Inlet and/or outlet duct damaged in such a way as to prevent a good seal between the flexible duct and the duct housing.

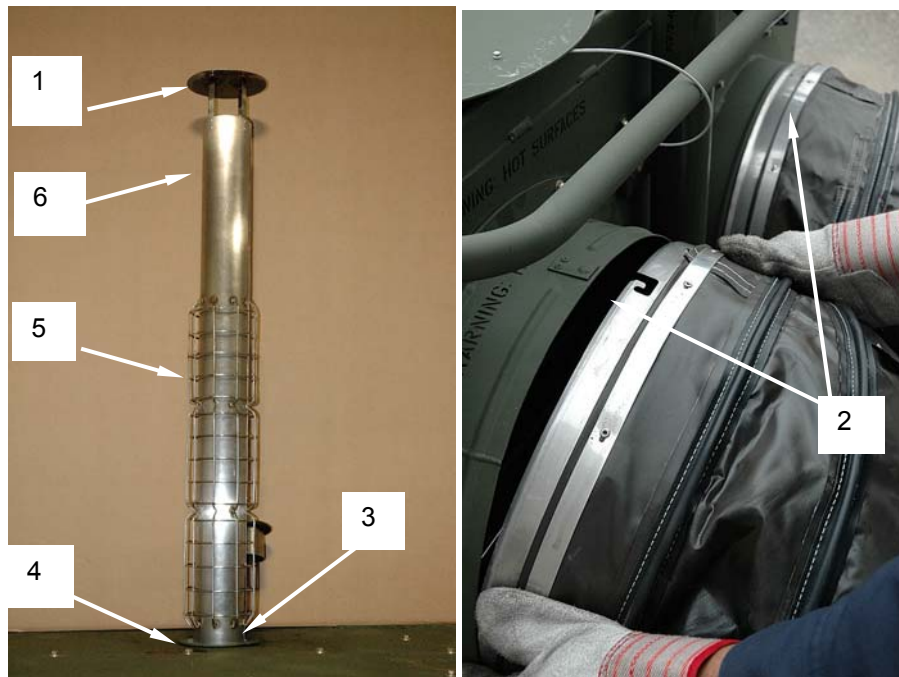


Figure 5. Before, During, and After Operation PMCS For Exhaust Stack Assembly And Inlet and Outlet Duct Housings.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
9	Before and During	Engine Oil Level	<p><b>CAUTION</b></p> <p>Ensure battery shutoff switch is in the OFF position before checking oil level.</p> <p>Open the engine bay access door and check the level of the diesel engine oil. To check the oil level, the engine must be standing level and be switched off.</p> <ol style="list-style-type: none"> <li>1. Remove any dirt from the oil dipstick area.</li> <li>2. Remove dipstick (Figure 6, Item 1) and clean.</li> <li>3. Insert dipstick in completely and then remove.</li> <li>4. Check dipstick oil level and, if necessary, add oil to the upper mark (Figure 6, Item 2).</li> </ol>	Engine oil is below MAX mark.
10	Before, During, and After	Engine	<p><b>WARNING</b></p> <p>Hearing protection should be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.</p> <p>Check for any oil or fuel leakage from engine.</p>	Class III oil or fuel leaks present. Refer to Service Maintenance.

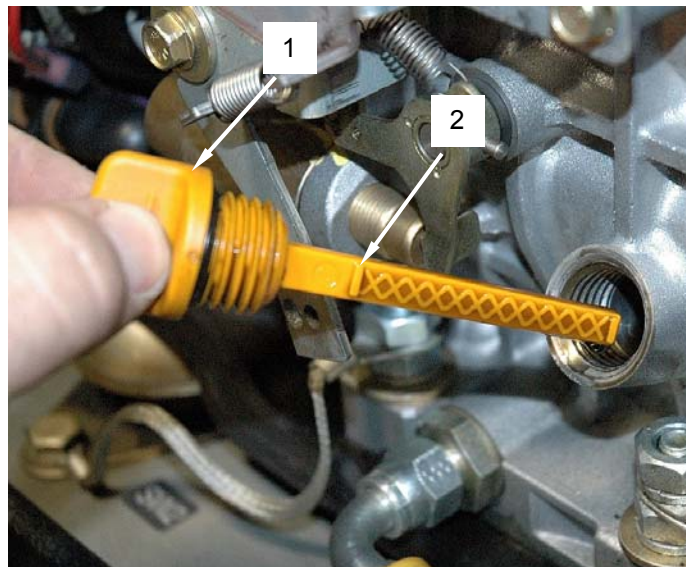


Figure 6. Before, During, and After Operation PMCS for Engine Oil Level, Engine Air Element, and Engine.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
11	During	Fuel Lines	<p><b>WARNING</b></p> <p>Hearing protection should be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.</p> <p>Do not place hands inside heater while heater is operating. Placing hands inside heater when it is operating may cause serious injury or death.</p> <p>Inspect all fuel lines in heater, and ensure that there are no leaks.</p>	<p>Any Class III leaks that are observed. Heater can be operated with Class I or Class II leaks; however, note all leaks and notify Service Maintenance.</p>
12	During	Oil Leaks	<p><b>WARNING</b></p> <p>Hearing protection should be worn when performing any troubleshooting or maintenance function requiring that the heater be operating with any of the access panels open. Failure to wear ear protection could result in hearing loss or damage.</p> <p>Do not place hands inside heater while heater is operating. Placing hands inside heater when it is operating may cause serious injury or death.</p> <p>Inspect interior of heater, and ensure that there are no oil leaks.</p>	<p>Any Class III leaks that are observed. Heater can be operated with Class I or Class II leaks; however, note all leaks and notify Service Maintenance.</p>

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
13	During	Carbon Monoxide Detector on Operator Control Box	Ensure that the hinged door (Figure 7, Item 3) on the operator control box carbon monoxide detector (Figure 7, Item 1) is in the down position and fully deployed.	Hinged door on carbon monoxide detector is in the closed position.
14	During	Fuel Gauge	Inspect fuel gauge (Figure 7, Item 2), and ensure that there is adequate fuel in the internal tank or in the external bulk fuel supply if applicable.	Low fuel level in internal tank or external fuel supply, if used.

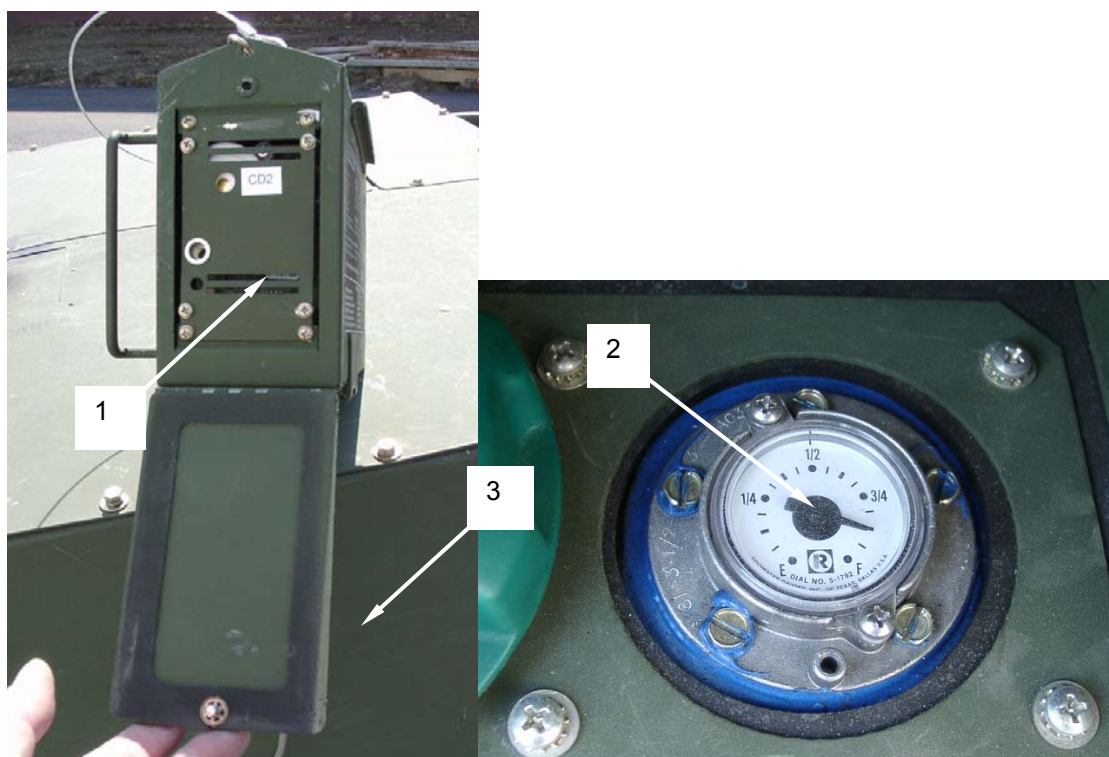


Figure 7. During Operation PMCS for Carbon Monoxide Detector on Operator Control Box and Fuel Gauge.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
15	After	Drive Shaft Coupling	Open the engine access door, and check the condition of the drive shaft coupling (Figure 8, Item 2). Coupling should be aligned properly within the drive sections (Figure 8, Item 1 and 3) and should not have excessive wear or appear damaged in any way.	Drive shaft coupling misaligned with drive sections.  Drive shaft coupling showing excessive wear or is damaged.

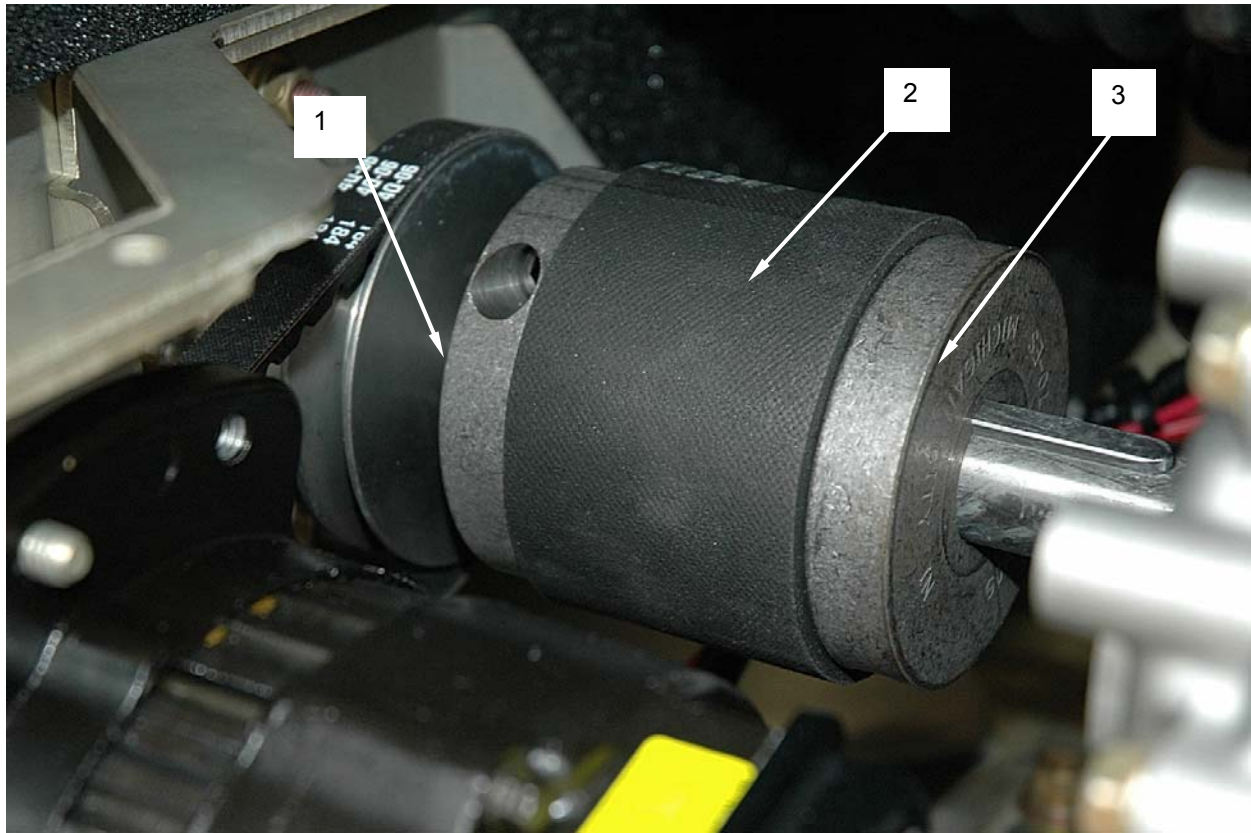


Figure 8. After Operation PMCS for Drive Shaft Coupling.



**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
16	Monthly	Jack Assembly	Fully extend and retract the jack assembly (Figure 9, Item 1) to maintain lubrication on the internal screw.	Jack assembly is damaged or does not extend and retract fully.

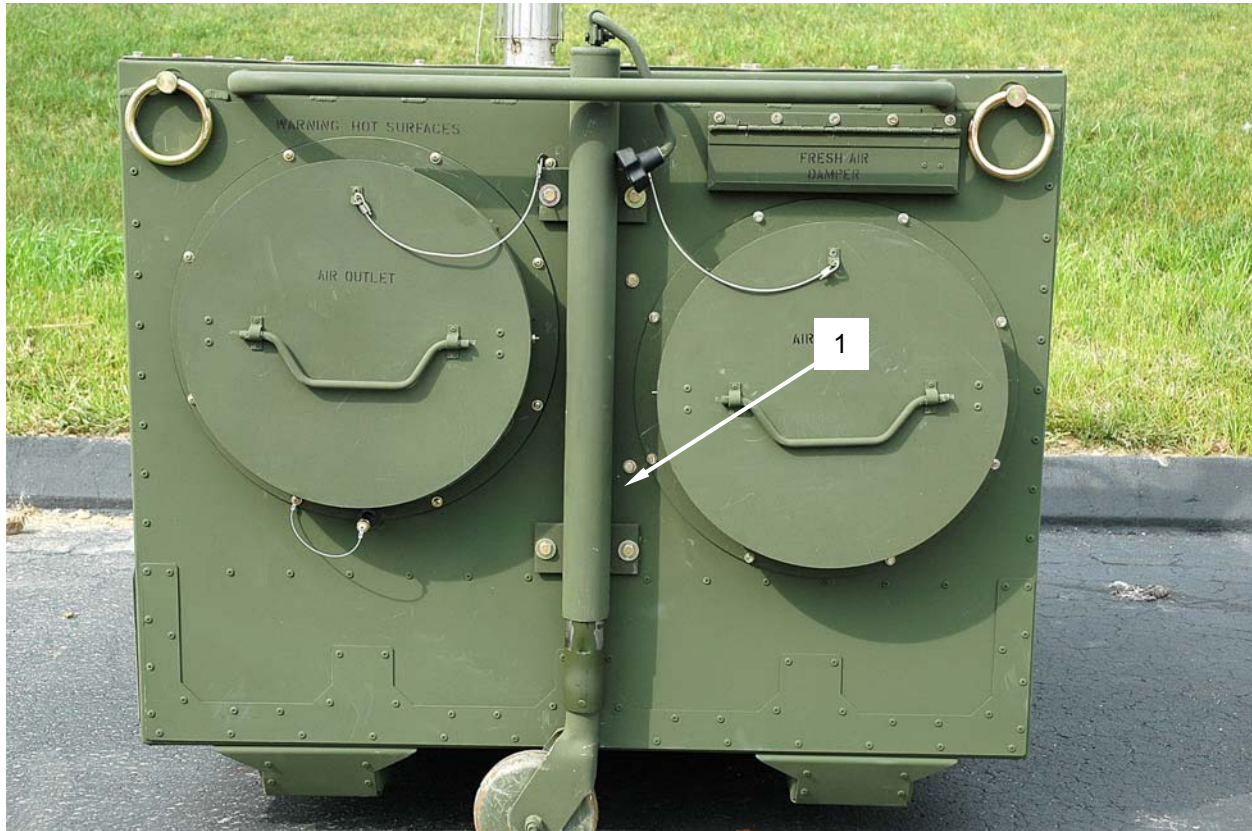


Figure 9. Monthly Operation PMCS for Jack Assembly.

**Table 1. Preventive Maintenance Checks and Services for Large Capacity Field Heater, Type II, (LCFH Type II). - Continued**

ITEM NO.	INTERVAL	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
17	250 hours	Heat Exchanger	Drain heat exchanger IAW WP 0066.	Heat exchanger retaining fluid.
18	500 hours	Diesel Engine Injection Pump	Inspect fuel injection pump for damage and evidence of leakage.  Check area around pump sealing gasket for leaks. Remove and replace gasket as required (refer to Field Maintenance).	Fuel leak of any kind is present.
19	500 hours	Engine Intake and Exhaust Valve Clearance	<b>NOTE</b>  First valve clearance check occurs between 20 and 50 hours of operation and at 500 hour intervals thereafter.  Adjust valve clearance of intake and exhaust valve seats (WP 0057).	Valves are not properly adjusted, causing improper engine operation.
20	500 hours	Diesel Engine Injection Nozzle	Inspect fuel injector nozzle. Replace as required (WP 0058).	Fuel injector nozzle clogged or otherwise not functional.
21	1000 hours	Engine Oil Strainer	Remove and clean engine oil strainer (WP 0055). Replace as required.	Oil strainer is clogged, dirty, or damaged.
22	1000 hours	Drive Shaft Coupling	Inspect drive shaft coupling IAW WP 0050.	Drive shaft coupling slipping causing system burner fuel pressure to fall below 200 psi.
23	Every 1250 hours	Burner Nozzle and Electrodes	Check burner nozzle and electrodes IAW WP 0065. Adjust if necessary.	Burner nozzle clogged or electrodes out of adjustment.
24	Once per year	Cabinet Mounted Carbon Monoxide Detector	Test carbon monoxide (CO) detector in heater cabinet. Replace if necessary (WP 0031).	CO detector does not operate.
25	Once per year	Heat Exchanger Outlet Temperature Sensor	Test heat exchanger outlet temperature sensor (WP 0072).	Sensor damaged or tests as open circuit when heater not operating.
26	Once per year	Tires	Inspect tires and replace wheel retraction assembly, if necessary (WP 0017).	Tires damaged.
27	Once per year	Fuel Tank	Drain accumulated water from fuel tank (WP 0024).	Water in fuel tank.

Table 2. PMCS Mandatory Replacement Parts List.

ITEM NO.	PART NUMBER (CAGEC)	NSN	NOMENCLATURE	QTY
<b>FIRST 20-50 HOURS</b>				
1			Diesel Engine Lubricating Oil	01
<b>EVERY 250 HOURS</b>				
2			Diesel Engine Lubricating Oil	01
<b>EVERY 500 HOURS</b>				
3	114250-12581(0AK42)	2940-01-310-4495	Engine Air Filter Element	01
<b>EVERY 1000 HOURS OR AS REQUIRED</b>				
4	BF-580 (12658)	2910-01-025-6853	Fuel Filter	01
<b>EVERY 1500 HOURS</b>				
5	40132(92878)	2910-01-539-7196	Alternator Drive Belt	01
6	40114(92878)	2835-01-540-2887	Flexible Engine Exhaust Tube	01
<b>EVERY 2500 HOURS</b>				
7	183250-39450 (0AK42)	5930-01-416-0372	Oil Pressure Switch	01
<b>EVERY 4000 HOURS</b>				
8	41072-SV (92878)	4530-01-568-5698	Burner Nozzle	01
<b>EVERY 5 YEARS</b>				
9	40480(92878)	6665-01-539-7171	Operator Control Box Carbon Monoxide Detector	01
10	40489(92878)	6665-01-539-8270	Cabinet Mounted Carbon Monoxide Detector	01

---

## Lubrication Service Intervals

### GENERAL

These lubrication instructions are for service level maintenance personnel. Lube intervals (on-condition or hard time) are based on normal operation. Lube more during constant use, and less during inactive periods. Use correct grade of lubricant for seasonal temperature expected IAW Table 3.

### CAUTION

Always wipe clean oil filler components before starting your lube service. Use correct type or grade of oil. Overfilling will cause spillage and harm engine components.

The engine oil filter shall be changed as applicable when:

- It is known to be contaminated or clogged.
- The prescribed hard time interval has arrived.

This heater is not enrolled in the Army Oil Analysis Program (AOAP). Hard time service intervals apply.

For equipment under manufacturer's warranty, hard time oil service intervals shall be followed. Intervals shall be shortened if lubricants are known to be contaminated or if operation is under adverse conditions (such as longer than usual operating hours, extended idling periods, or extreme dust).

**CAUTION**

It is imperative that the lubricating oil used in the diesel engine adhere to the types and compression classifications shown below. Failure to do so may result in irreparable damage to the diesel engine and a voiding of the LCFH Type II warranty.

**Table 3. Lubricant Table for Large Capacity Field Heater, Type II, (LCFH Type II).**

Lubricating Oil System	Type of lubrication	—	Forced lubrication via trochoid pump: splash lubrication for valve rocker arm chamber
	Lubricating oil filter	---	Resin, 60 mesh
	Lubricating oil selection	---	58°F to 32°F(-50°C to 0°C) MIL-L-46167 Arctic Engine Oil -22°F to 50°F(-30°C to 10°C) 5W30 A.P.I. Engine Service Classification CC, CD, or CF -4°F to 86°F(-20°C to 30°C) 10W30 A.P.I. Engine Service Classification CC, CD, or CF 14°F to 104°F(-10°C to 40°C) 20W40 A.P.I. Engine Service Classification CC, CD, or CF
	Lubricating oil capacity full/effective	liter (quart)	1.1/0.4 (1.16/0.42)

**WARNING**



Allow the engine to cool for approximately 30 minutes before changing oil. Engine oil is hot and presents a burn hazard. Coming in contact with hot engine oil may cause burns and severe injury.

**NOTE**

The engine must be standing level and be switched off. Be sure to change the oil when the engine is warm (not hot) so that the engine oil remains easy to drain. Be sure to collect the used oil and dispose of in accordance with Unit SOP and local regulations.

1. Remove oil drain hose (Figure 1, Item 1) from spring clamp (Figure 1, Item 2). Loosen and remove oil drain plug (Figure 1, Item 3) and allow the oil to drain out into an approved container.
2. Clean the oil drain plug (Figure 1, Item 2) and reinstall on oil drain hose (Figure 1, Item 1).
3. Return oil drain hose (Figure 1, Item 1) to spring clamp (Figure 1, Item 2).

**CAUTION**

Only MIL-L-46167 Arctic Engine Oil is approved for use with the LCFH Type II. Using an oil other than that approved may result in difficult starting and/or damage to the diesel engine.

4. Add 1.2 quarts (1.1 liters) of MIL-L-46167 Engine Oil, Arctic.

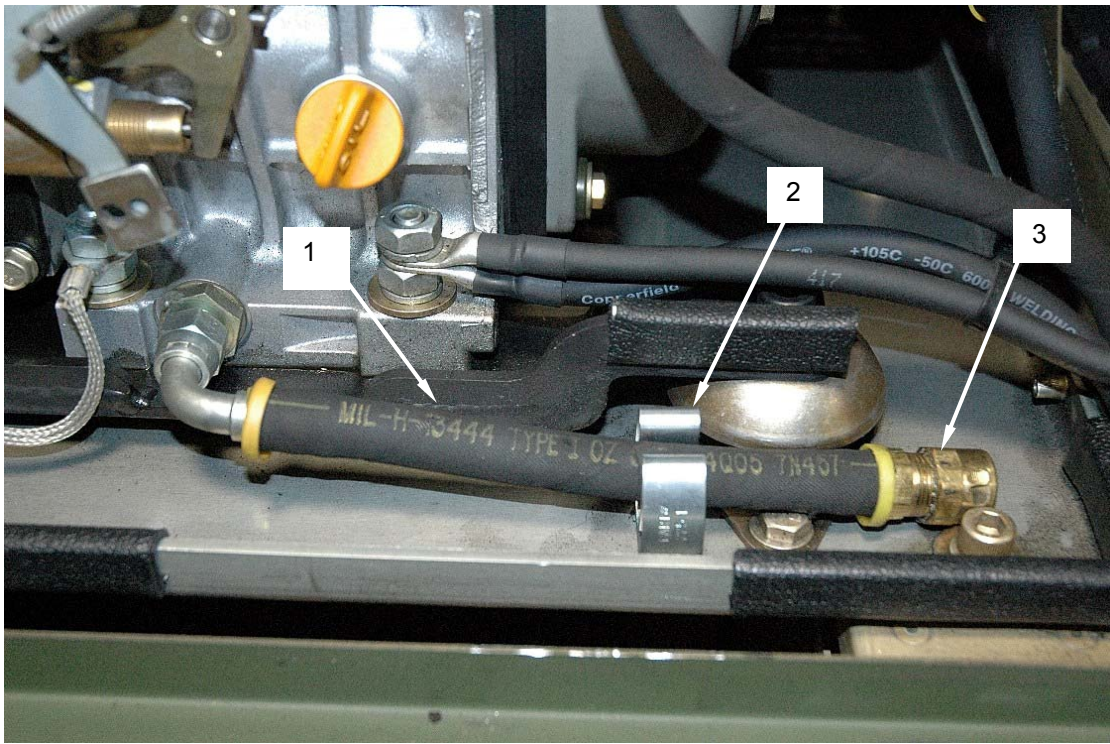


Figure 10. Change Engine Oil.

**END OF TASK**

**END OF WORK PACKAGE**

**CHAPTER 6**

**OPERATOR MAINTENANCE INSTRUCTIONS**  
**FOR**  
**LARGE CAPACITY FIELD HEATER,**  
**TYPE II (LCFH TYPE II)**





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**OPERATOR MAINTENANCE**  
**WHEEL RETRACTION ASSEMBLY**  
**REPLACE**

---

**INITIAL SETUP:****Equipment Condition****Personnel Required**

Heater shut down and cool (WP 0005).

MOS non-specific (1)

---

**REPLACE**

1. Extend jack assembly at front of heater until wheels clear ground and permit adequate access to remove wheel retraction assembly (Figure 1, Item 1).
2. Pull the locking pin (Figure 1, Item 4) that secures the wheel retraction assembly (Figure 1, Item 1) to the wheel retraction bracket (Figure 1, Item 2) on the cabinet (Figure 1, Item 3).
3. Take note of the position of the wheel retraction assembly (Figure 1, Item 1) so that the new assembly can be installed in the same orientation.
4. Pull the wheel retraction assembly (Figure 1, Item 1) from the wheel retraction bracket (Figure 1, Item 2).
5. Install a new wheel retraction assembly (Figure 1, Item 1) into the wheel retraction bracket (Figure 1, Item 2), taking care to orient the new assembly as noted earlier.
6. Install the locking pin (Figure 1, Item 4), securing the wheel retraction assembly in position.
7. Retract jack assembly until heater is returned to a level condition.

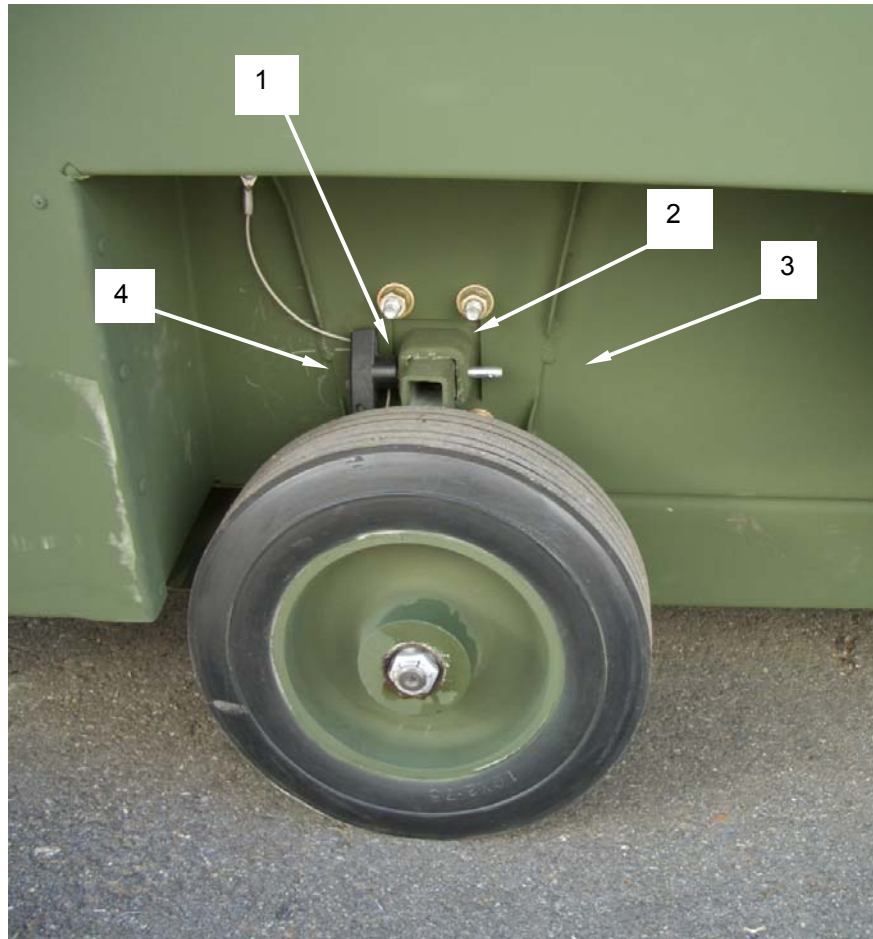
**REPLACE - Continued**

Figure 1. Replace Wheel Retraction Assembly.

**END OF TASK**

**END OF WORK PACKAGE**

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**OPERATOR MAINTENANCE****AIR CLEANER  
INSPECT, SERVICE**

---

**INITIAL SETUP:****Tools and Special Tools**

None required.

**Personnel Required**

MOS non-specific (1)

**Materials/Parts**

Rags, Wiping (WP 0123, Item 15)

**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

---

**WARNING**

Do not attempt to inspect, clean, or replace the air cleaner on a hot engine. Performing maintenance on a hot engine may result in burns and severe injury.

**INSPECT**

1. Remove the wingnut, (Figure 1, Item 3), seal washer (Figure 1, Item 2), and air cleaner cover (Figure 1, Item 1).
2. Pull out the filter element (Figure 1, Item 5).
3. Inspect the filter element for any accumulations of dust, dirt, or any other material that would restrict the flow of air to the engine. Replace the filter element as needed.

**SERVICE**

1. Remove the filter element (Figure 1, Item 5) as described in "INSPECT."
2. Install a new filter element (Figure 1, Item 5), ensuring that the new filter is seated securely on the filter element support (Figure 1, Item 4).
3. Install the air cleaner cover (Figure 1, Item 1).
4. Install the seal washer (Figure 1, Item 2) and wingnut (Figure 1, Item 3). Tighten securely.

SERVICE - Continued

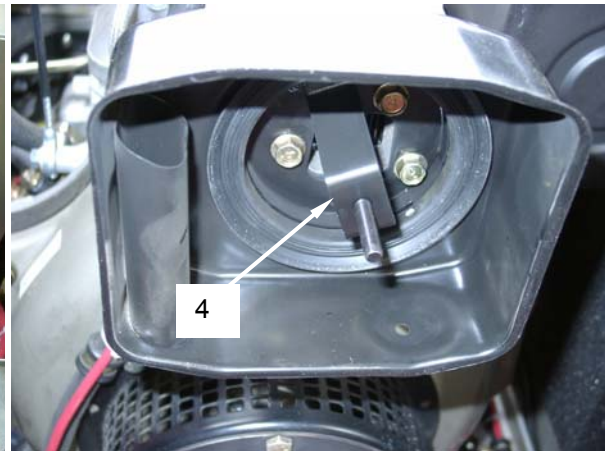
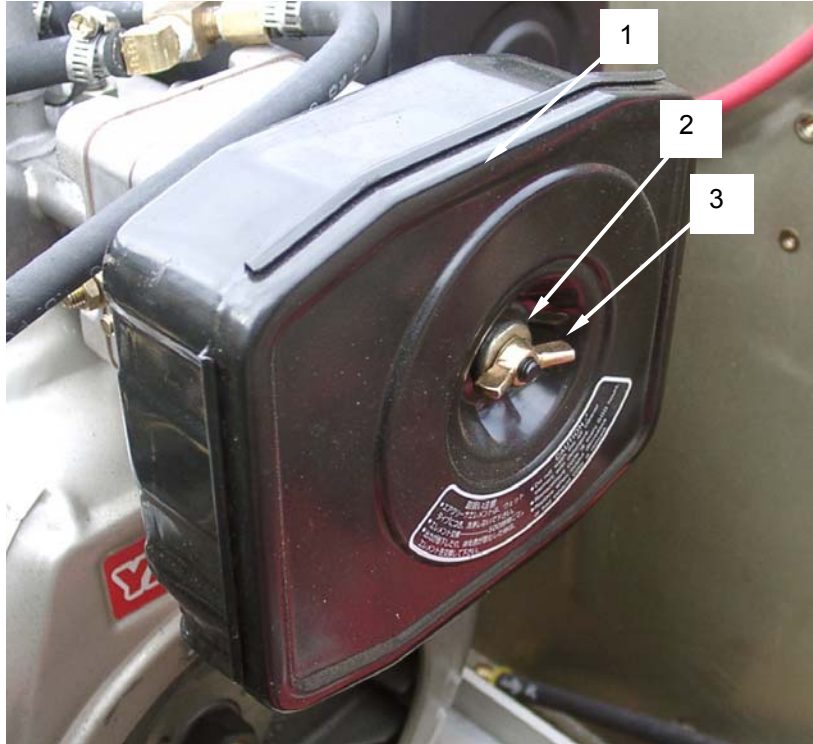


Figure 1. Inspect and Replace Filter Element.

END OF TASK

END OF WORK PACKAGE

## OPERATOR MAINTENANCE

CARBON MONOXIDE DETECTOR – OPERATOR CONTROL BOX  
INSPECT, TEST

## INITIAL SETUP:

## Personnel Required

MOS non-specific (1)

## References

WP 0077

## Equipment Condition

Heater shut down.

## NOTE

There are two carbon monoxide (CO) detectors used in the LCFH Type II. One is located in the operator control box while the second is located inside the LCFH Type II cabinet underneath the fan compartment cover. Only the detector in the operator control box can be inspected and tested at the operator level.

## INSPECT

1. Remove operator control box from heater.
2. Unscrew the small thumb screw (Figure 1, Item 1) on the cover (Figure 1, Item 3) protecting the CO detector (Figure 1, Item 2).
3. Open the cover (Figure 1, Item 3) and inspect the carbon monoxide detector (Figure 1, Item 2) for dents, punctures, or any other damage that would prevent the detector from operating properly. Ensure that the hinged outer cover (Figure 1, Item 3) operates properly. Ensure that the indicator lamp (Figure 1, Item 4) is not broken or missing. If damaged, refer the entire operator control box to Service Maintenance for carbon monoxide detector replacement IAW WP 0077.
4. Screw small thumb screw on the cover (Figure 1, Item 1).
5. Replace operator control box on heater.

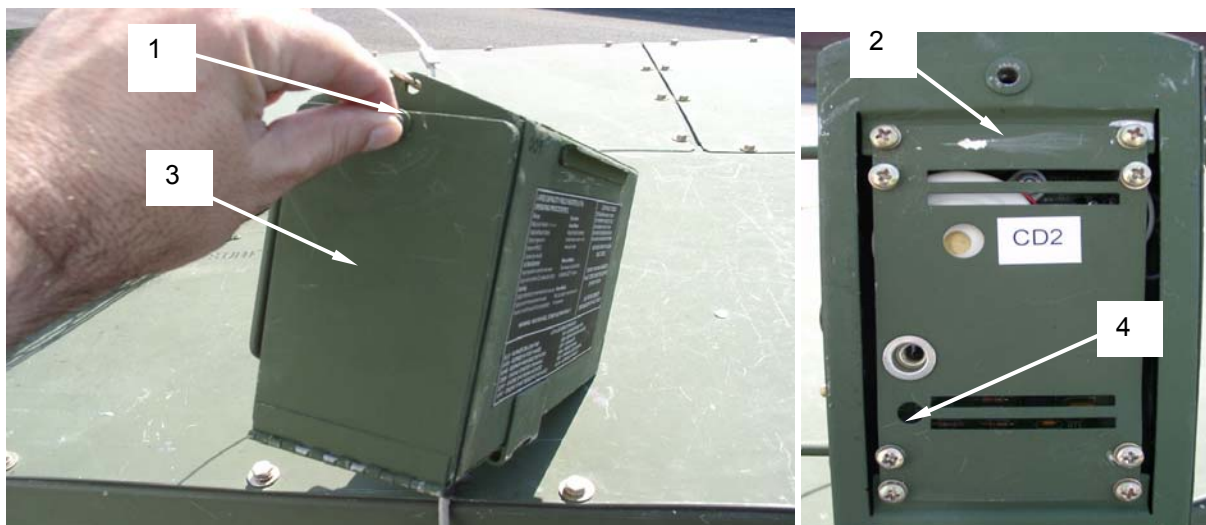


Figure 1. Open and Inspect Operator Control Box.

**TEST****NOTE**

To test the CO detector, ensure that the power switch in the operator control box is in the "ON" position and heater is in operational mode.

1. Remove operator control box from heater.
2. Unscrew the small thumb screw (Figure 2, Item 1) on the cover (Figure 2, Item 3) protecting the CO detector (Figure 2, Item 2).
3. The carbon monoxide detector (Figure 2, Item 2) performs a self test when power to the LCFH Type II is applied.
4. Within a few seconds, the carbon monoxide detector (Figure 2, Item 2) will produce a series of four chirps, followed by a delay of a few seconds, and then four more chirps. This indicates that the carbon monoxide detector is operating properly. If the detector does not chirp as described, notify Service Maintenance.
5. Screw the small thumb screw (Figure 2, Item 1) on the cover (Figure 2, Item 3).
6. Replace the operator control box on heater.

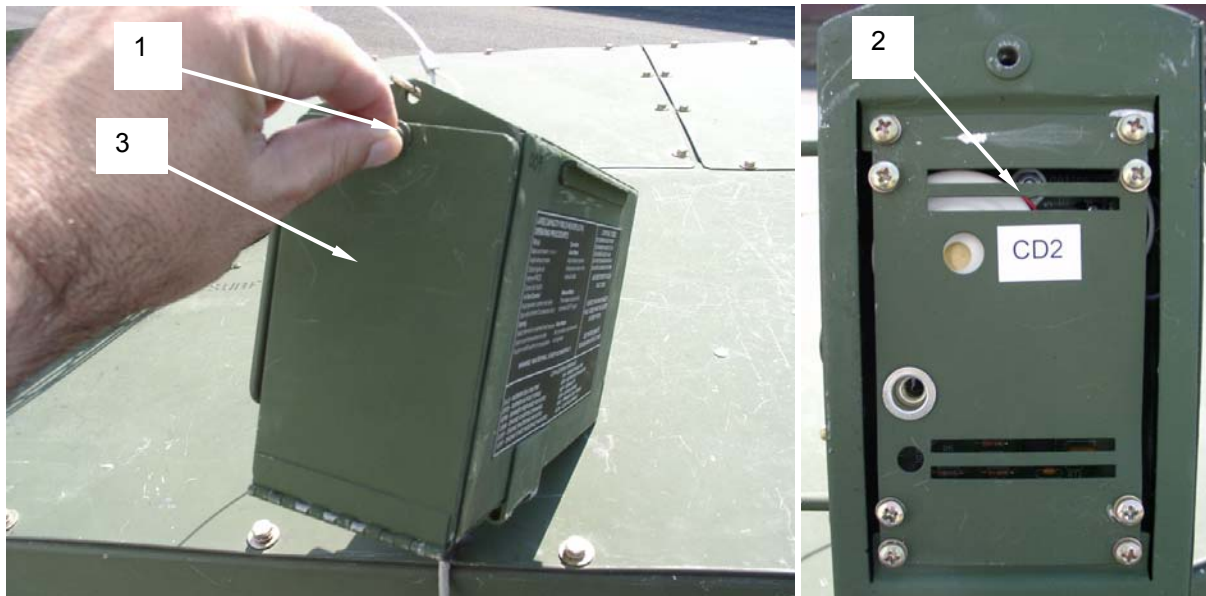


Figure 2. Test the CO Detector.

**END OF TASK**

**END OF WORK PACKAGE**

**OPERATOR MAINTENANCE**  
**OPERATOR CONTROL BOX ASSEMBLY**  
**REPAIR, REPLACE**

**INITIAL SETUP:**

**Equipment Condition**

**Personnel Required**

Heater shut down.

MOS non-specific (1)

**REPAIR**

1. Replace missing thumb screw (Figure 1, Item 1) as needed.
2. Replace missing chain-S hook (Figure 1, Item 2) as needed.
3. Replace missing lanyard (Figure 1, Item 3) as needed.

**END OF TASK**

**REPLACE**

Replace a defective operator control box (Figure 1, Item 4).

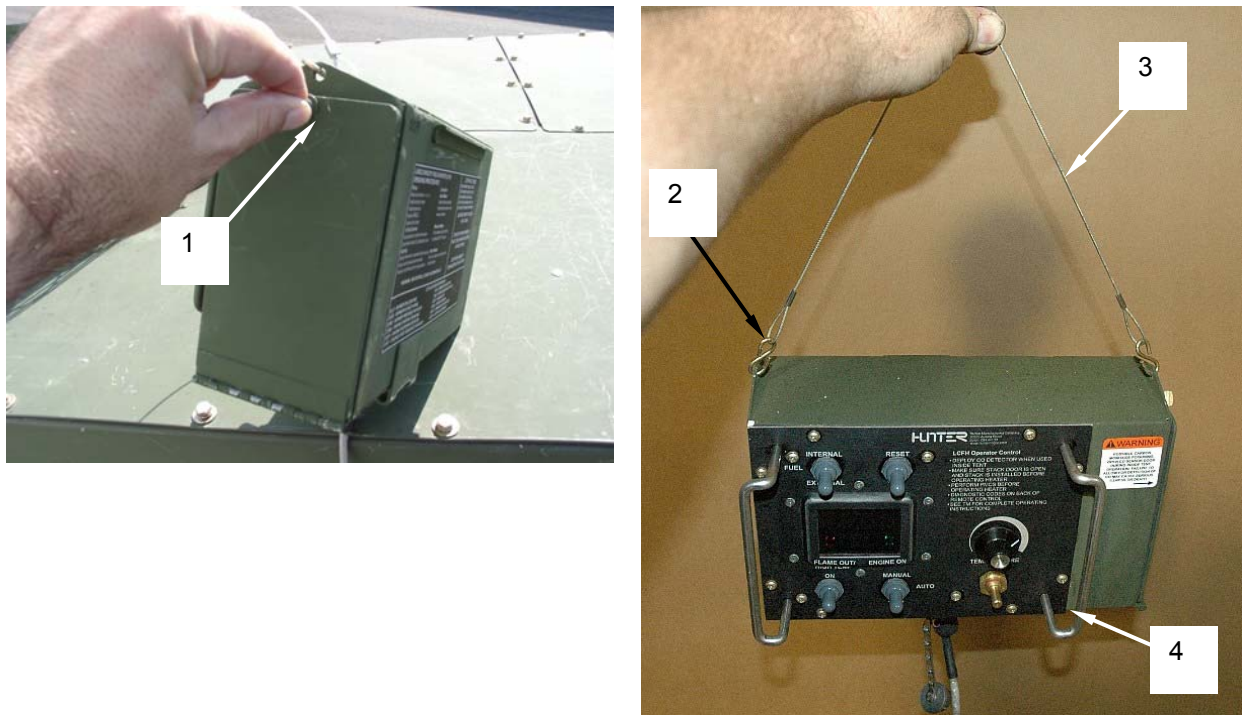


Figure 1. Repair and Replace Operator Control Box.

**END OF TASK**

**END OF WORK PACKAGE**





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**OPERATOR MAINTENANCE**  
**DUCT, AIR, INSULATED 16 IN.X 15 FT.**  
**INSPECT, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

None required.

**Personnel Required**

MOS non-specific (1)

**Materials/Parts**

Tape, Duct (WP 0123, Item 24)

**Equipment Condition**

Heater shut down and cool (WP 0005).

---

**NOTE**

The following procedures apply to both the inlet and outlet ducts.

Ducts should be removed from heater and shelter before performing "INSPECT."

**INSPECT**

1. Inspect the inlet and outlet ducts (Figure 1, Item 2) for cuts, abrasions, or other damage that would permit air to enter or exit the side walls of the ducts. Repair any rips or cuts in the duct before using.
2. Inspect the internal stow bar (Figure 1, Item 3) for dents or other damage that would prevent the duct from being stowed properly.

**END OF TASK****NOTE**

Ducts should be removed from heater and shelter before performing "INSPECT."

**REPAIR**

1. To repair rips, tears, or cuts in the fabric covering of the duct, cover with at least two layers of duct tape or similar tape, overlapping the edges of the cut or tear by at least two inches.
2. If damage to the duct is excessive and it is not practical to repair with tape, the duct should be replaced.

REPAIR - Continued

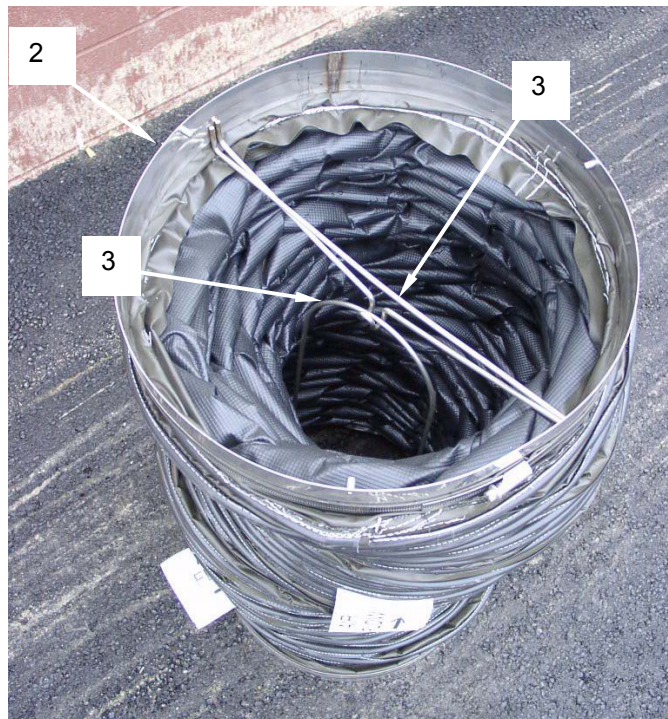
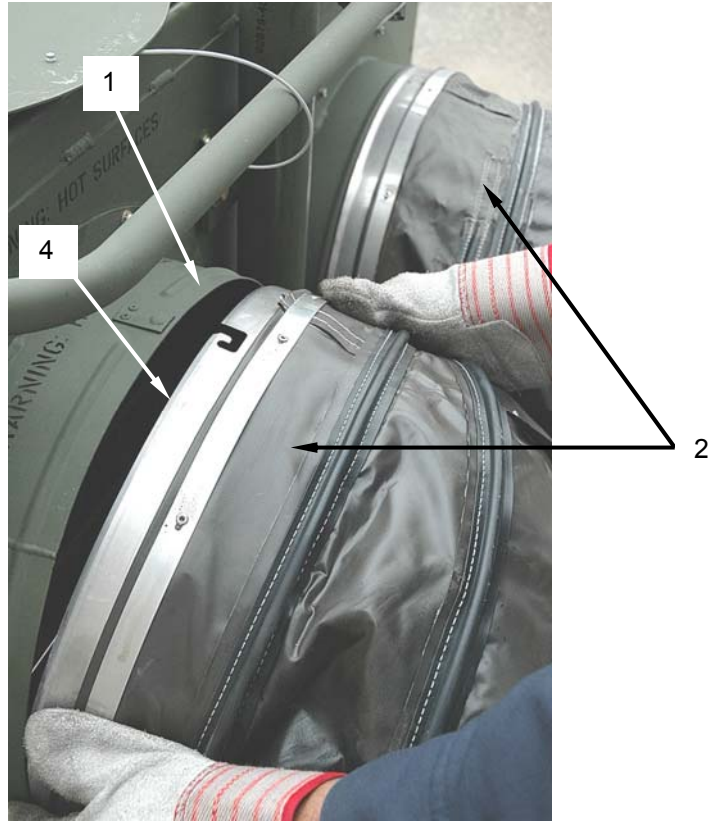


Figure 1. Inspect and Repair Insulated Air Duct, 16 IN. X 15 FT.

END OF TASK

END OF WORK PACKAGE

**CHAPTER 7**

**SERVICE MAINTENANCE  
FOR  
LARGE CAPACITY FIELD HEATER,  
TYPE II (LCFH TYPE II)**



**SERVICE MAINTENANCE****SERVICE UPON RECEIPT****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11,  
or 12) (Oil selection dependent on temperature,  
refer to WP 0002 for details)

**References**

WP 0002	WP 0015
WP 0005	WP 0016
DA PAM 750-8	SF 361

**SITING REQUIREMENTS**

Information about initial positioning of the LCFH Type II, as well as assembly and preparation for use of the LCFH Type II, are contained in WP 0005.

**CHECKING UNPACKED EQUIPMENT**

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 361, Transportation Discrepancy Report. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with applicable service instructions (e.g., for Army instructions, see DA PAM 750-8). Check to see whether the equipment has been modified.

**PRELIMINARY SERVICING OF EQUIPMENT**

Perform operator PMCS as described in WP 0015 and WP 0016.

**SERVICE UPON RECEIPT OF MATERIEL AND INSTALLATION INSTRUCTIONS****Preliminary Checks and Adjustments of Equipment**

LCFH Type II must be positioned as described in WP 0005.

**Unpacking the LCFH Type II**

Upon Receipt of a Crated Unit:

1. Remove crate top and discard.
2. Remove crate sides and discard.
3. If the crate contains the heater's ducts, remove ducts and set aside. There are two different crate configurations. The ducts are shipped separately if they are not present in the crate you are unpacking.
4. Continue with the next section entitled "Upon Receipt of a Skid-Shipped Unit," Step 3.

**SERVICE UPON RECEIPT OF MATERIEL AND INSTALLATION INSTRUCTIONS - Continued**

Upon Receipt of a Skid-Shipped Unit:

1. Remove the plastic wrap holding the ducts onto the LCFH Type II and remove the duct boxes from the top of the unit.
2. Inspect unit for any exterior damage.
3. Remove ducts from their boxes and inspect for damage.
4. Use a wrench or ratchet to remove the four lag-bolts holding the LCFH Type II to the skid and discard along with the 2 x 4's passing through the fork pockets.
5. Lift the LCFH Type II off the skid using a fork truck, or overhead lift and straps rated for 1,000 lbs utilizing the four lift rings. Discard skid.
6. Set the LCFH Type II on the ground and deploy the wheels if desired IAW WP 0005, Lowering the Side Wheels.
7. Open engine access door and remove dipstick from engine. Add oil IAW WP 0002, Table 1, Lubricating Oil System, Lubricating Oil Selection.
8. Remove "NO OIL" tag from the battery switch handle and insert handle into switch socket. Do not switch to ON at this time.
9. Check the unit's batteries with a Multimeter; set to read +24VDC. Charge batteries if necessary.
10. Fuel the unit with at least 1/4 tank of the approved fuel IAW WP 0002, Table 1, Fuel requirements.
11. Remove duct covers IAW WP 0005.
12. Install the exhaust pipe into the top of the unit IAW WP 0005.
13. Prime the Fuel System as follows:

**CAUTION**

The unit is shipped without fluids, and the fuel system must be primed and full before starting the unit. Failure to do so may damage the mechanical fuel pump located on the rear of the engine.

Only the lubricating oils specified in WP 0002, Table 1, Equipment Data, are approved for use with the LCFH Type II diesel engine. It is imperative that the lubricating oil used in the diesel engine adhere to the types and compression classifications shown for the temperature range of use. Failure to do so may result in irreparable damage to the diesel engine and a voiding of the LCFH Type II warranty.

- a. Switch the battery switch (SW1) to the ON position.
- b. Switch the power switch located on the operator control box to ON, until you hear a series of audible beeps, then switch OFF.

---

**SERVICE UPON RECEIPT OF MATERIEL AND INSTALLATION INSTRUCTIONS - Continued****CAUTION**

It is EXTREMELY important not to allow the burner fuel pump mounted to the diesel engine to run dry. Failure to repeat this procedure three times will cause catastrophic failure to the burner fuel pump mounted on diesel engine.

- c. Repeat above procedure three times. This will allow the large fuel filter to be filled with fuel and prime the remainder of the system.
14. Once the unit has been primed, switch the power switch to ON and allow the unit to crank and run in the VENT mode.
15. Run unit for a minimum of two minutes then shut down and check for leaks.
16. Switch Manual/Auto/Vent selector switch to "MANUAL." Restart and check burner operation.
17. Run unit for a minimum of two minutes then shut down and check for leaks.
18. Restart unit and run for at least 30 minutes in any mode and recheck for leaks before shutting the unit OFF.
19. Prepare unit for movement IAW WP 0005.

**END OF TASK****END OF WORK PACKAGE**





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**SERVICE MAINTENANCE**

---

**INTRODUCTION**

---

**SCOPE**

This chapter contains information necessary to maintain the Large Capacity Field Heater, Type II, (LCFH Type II), on the Service Maintenance level, in accordance with the Maintenance Allocation Chart (MAC) for the equipment.

**WIRING**

**General.** Preferred repair methods consist of replacing wires, terminals, connectors, etc. , rather than splicing wires, bending ends to form terminals, and other makeshift procedures, although the latter may be appropriate for emergency field repairs.

**Soldering Connections.** Wire connections must be made mechanically sound before they are soldered. Solder alone does not provide sufficient strength to prevent breakage. Joining surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should be rosin base flux and should be brushed onto the joint before soldering. If a flux-core solder is used, it should be a rosin core electrical solder. If uncored solder is used, it should be a lead-tin solder. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive build up of solder "gobs" on the joint should be avoided or removed.

**Insulating Joints.** The preferred method of insulating electrical joints is by the use of heat-shrink tubing. To apply, cut a piece of heat-shrink tubing of suitable diameter to a one-inch length for covering joints at terminals or connectors, or to a length about 1/2 inch (1.3 cm) longer than the joint to be insulated, and slide the tubing over the wire before making the joint. After the joint is made, slide the tubing so that it covers the joint, and shrink in place with moderate heat.

**Splicing Wires.** To repair broken or cut wires that are otherwise sound, the mating ends can be stripped and spliced. A commercial butt splice can be crimped onto the ends to join them, or a "Western Union" wire splice can be made. The latter is made by stripping 1/4-1/2 inch (6.5-12.7 mm) of insulation from the wire ends, holding the ends parallel, and facing in opposite directions, then twisting each end around the other wire at least three turns. Solder and apply insulation as described above.

**Crimping Terminals.** To install a terminal on the end of a wire, strip 1/4-1/2 inch (6.5 12.7 mm) of insulation from the end of the wire, apply a one-inch piece of heat-shrinking tubing (if the terminals are of the uninsulated type) and insert wire end into the shank of the terminal. Crimp the shank, and install heat shrink tubing, if necessary.

**CLEANING AND INSPECTION OF ANTIFRICTION BEARINGS**

Refer to TM 9-214, Inspection, Care, and Maintenance of Antifriction Bearings.

**CLEANING AND INSPECTION OF MECHANICAL PARTS****WARNING**

Drycleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

Compressed air used for cleaning purposes will not exceed 30 psi (kPa). Use only with effective personal protective equipment.

Clean metal parts in drycleaning solvent. Thoroughly dry the parts with compressed air, observing all safety precautions.

Fibrous or rubber parts can generally be cleaned with warm, soapy water and dried with compressed air.

Inspect metal parts for cracks, breaks, bends, worn edges, and rough bearing surfaces. Damage that alters the part or its function is cause for replacement of that part.

**GENERAL REPAIR**

Repair the unit to normal operating condition by replacing or repairing a defective component and/or by needed adjustments.

Cleaning and lubrication is sometimes all that is needed to return an item to operating condition.

Remove and replace only those items necessary to make repairs. After replacing the defective components, ensure that the unit operates correctly.

To paint metal, sand bare metal areas with sandpaper and refinish with primer and olive drab paint. Refer to TM 43-0139 for proper painting instructions. Allow paint to dry between coats.

**END OF WORK PACKAGE**

**SERVICE MAINTENANCE****FUEL TANK  
SERVICE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**Container, Fuel (Unit asset; Capacity 35 gallons or  
more)

Mat, Petroleum Absorbent (WP 0123, Item 14)

Gloves, Chemical And Oil Protective (WP 0123,  
Item 6)

Rags, Wiping, Clean (WP 0123, Item 15)

**Equipment Condition**

Heater shut down and cool (WP 0005).

**SERVICE****NOTE**

If the tank has a significant amount of fuel, it should be pumped or siphoned off through the fuel filler port into an approved container that is large enough to hold 35 gallons. Dispose of fuel according to unit SOP and local environmental regulations. Do not return fuel to the bulk fuel container.

1. To drain all accumulated water from fuel tank, ensure that the tank is down to approximately one or two gallons of fuel.
2. Ensure that LCFH Type II is positioned so that the fuel tank drain (Figure 1, Item 1), located on the underside of the heater just below the fuel filler port and fuel gauge area, is slightly downgrade to permit proper draining.
3. Place an approved, appropriated sized container under the fuel drain (Figure 1, Item 1).
4. Remove the drain plug (Figure 1, Item 2) from fuel tank and drain until empty.
5. When empty, install drain plug (Figure 1, Item 2) and tighten securely.

**SERVICE - Continued**



Figure 1. Service Fuel Tank.

**END OF TASK**

**END OF WORK PACKAGE**

**SERVICE MAINTENANCE****OIL PRESSURE SWITCH  
INSPECT, TEST, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 17) or,  
Tape, Antiseizing (WP 0123, Item 23)  
Gloves, Chemical And Oil Protective (WP 0123, Item 6)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

**References**

WP 0049

**INSPECT**

1. Inspect the oil pressure switch (Figure 1, Item 1) exterior to ensure there are no cracks or damage that may result in oil leakage.
2. Inspect the oil pressure signal wire and wire connection (Figure 1, Item 2) to the oil pressure switch for defects caused by excessive wear.

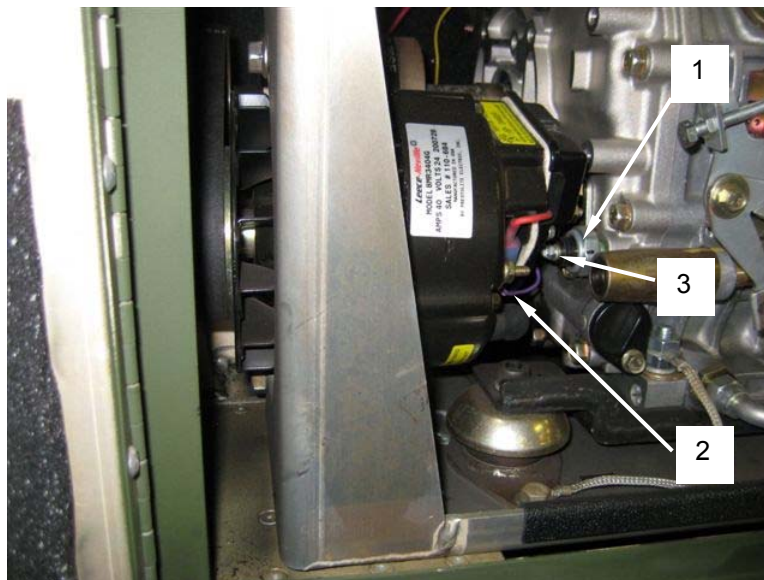


Figure 1. Oil Pressure Switch Inspection.

**END OF TASK**

**TEST****WARNING**

Do not wear any type of jewelry when working on the LCFH Type II. There are a number of moving parts that could catch jewelry and be a serious hazard.

**WARNING**

The heater engine must run briefly to perform the next task.

1. Using a multimeter, check resistance between oil pressure switch and engine ground (low resistance).
2. Set up heater for operation IAW WP 0005.
3. Start heater IAW WP 0005 while multimeter is between the oil pressure switch terminal (Figure 1, Item 3) and the engine ground.
4. While the engine is running, using the multimeter, determine if oil pressure switch opens (high resistance).
5. Shut heater down and cool.
6. Turn battery switch OFF.
7. If high resistance is not found, replace defective oil pressure switch.

**END OF TASK**

**REPLACE**

1. Loosen and remove upper alternator bolt (Figure 2, Item 1), loosen lower alternator nut and bolt, push alternator back towards engine coupling.
2. Remove oil pressure signal wire (Figure 2, Item 2) from oil pressure switch (Figure 2, Item 4).
3. Remove oil pressure switch (Figure 2, Item 4) from engine (Figure 2, Item 3) by loosening counter clockwise. Use rag to clean excess oil. Discard defective switch and rag properly.
4. Apply thread sealant (Figure 2, Item 5) to the threads on new oil pressure switch and install on engine (Figure 2, Item 3). Do not over tighten.
5. Install signal wire (Figure 2, Item 2) on oil pressure switch (Figure 2, Item 4).
6. Return alternator to proper position and reinstall upper bolt (Figure 2, Item 1). Adjust IAW WP 0049.

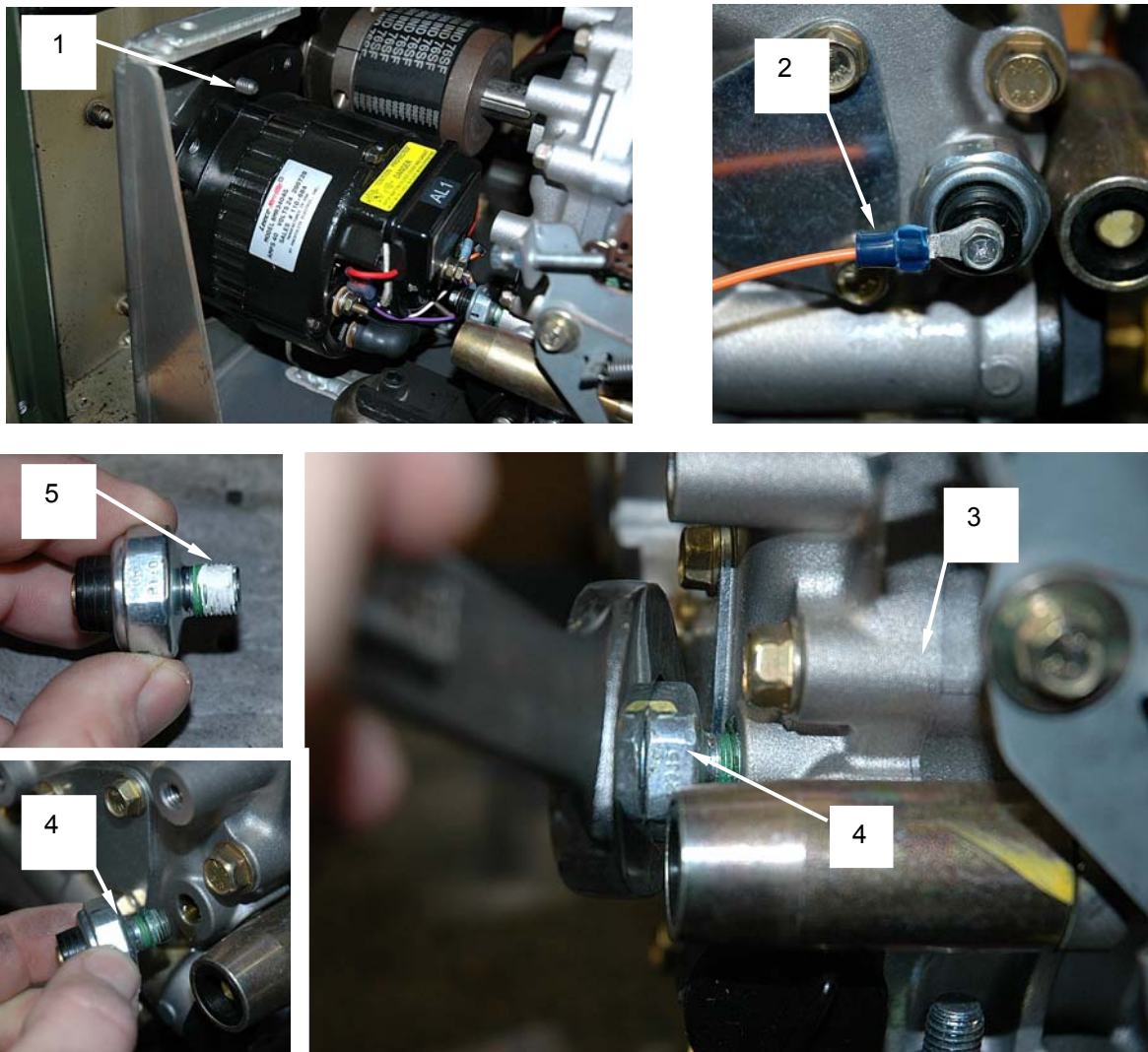


Figure 2. Replace Oil Pressure Switch.

**END OF TASK**

**END OF WORK PACKAGE**





**SERVICE MAINTENANCE****SHEET SOUND INSTALLATION  
INSPECT, REPAIR, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Heat Gun, Electric (WP 0124, Item 5)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Solvent, Degreasing (WP 0123, Item 20)  
Rags, Wiping, Clean (WP 0123, Item 15)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

**INSPECT****WARNING**

Cleaning solvents are flammable and toxic to the eyes, skin, and respiratory tract. Skin and eye protection are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated areas only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvents. Failure to observe this warning may result in injury or death to personnel.

**NOTE**

Sound insulation is installed on the divider bulkhead, fan bulkhead, engine bay door, engine access cover, and selected locations of the fuel/burner end wall. These locations have a combination of foam insulation bonded to a 1/8-inch sound dampening material. The fan housing, heat exchanger sidewalls, top cover, and operator control box tray have only the 1/8 inch dampening material applied.

Inspect all sound insulation for tears, cracks, delaminating, or other damage that would prevent the sound insulation from adequate restricting sound levels in the operating environment. Replace any damaged sound insulation.

**REPAIR**

Corners or other portions of sound insulation panels that no longer adhere to the cabinet panels may be repaired by cleaning the cabinet surface with solvent and applying some adhesive to the cabinet panel. Press the loose section of the sound insulation panel back into place.

**REPLACE****NOTE**

All sound insulation sections are pre-cut to size. Foam insulation is 1 or 2 inches thick depending on location.

1. To replace a section of damaged 1/8-inch sound dampening insulation (Figure 1, Item 3), pry the corner up using a putty knife or similar tool.
2. Set the heat gun to midrange and begin to heat the adhesive that bonds the insulation (Figure 1, Item 3) to the cabinet wall (Figure 1, Item 2), prying the insulation from the cabinet wall.
3. Continue until the damaged section of sound insulation is removed.
4. Clean the adhesive residue from the cabinet wall with a rag dampened with solvent.
5. If required for that section, install a new, pre-cut section of 1/8-inch sound dampening insulation by removing the paper backing, exposing the pressure sensitive adhesive backing.
6. Starting at one side, press the adhesive side of the 1/8-inch sound dampening insulation (Figure 1, Item 3) in place. Continue pressing the remainder of the insulation in place.
7. Install a new, pre-cut section of 1- or 2-inch foam sound insulation (Figure 1, Item 1) by removing the paper backing, exposing the pressure sensitive adhesive backing.
8. Starting at one side, press the adhesive side of the 1- or 2-inch sound insulation (Figure 1, Item 1) in place on top of the 1/8 inch sound dampening insulation (Figure 1, Item 3) already in place. Continue to press the remainder of the insulation (Figure 1, Item 1) in position.

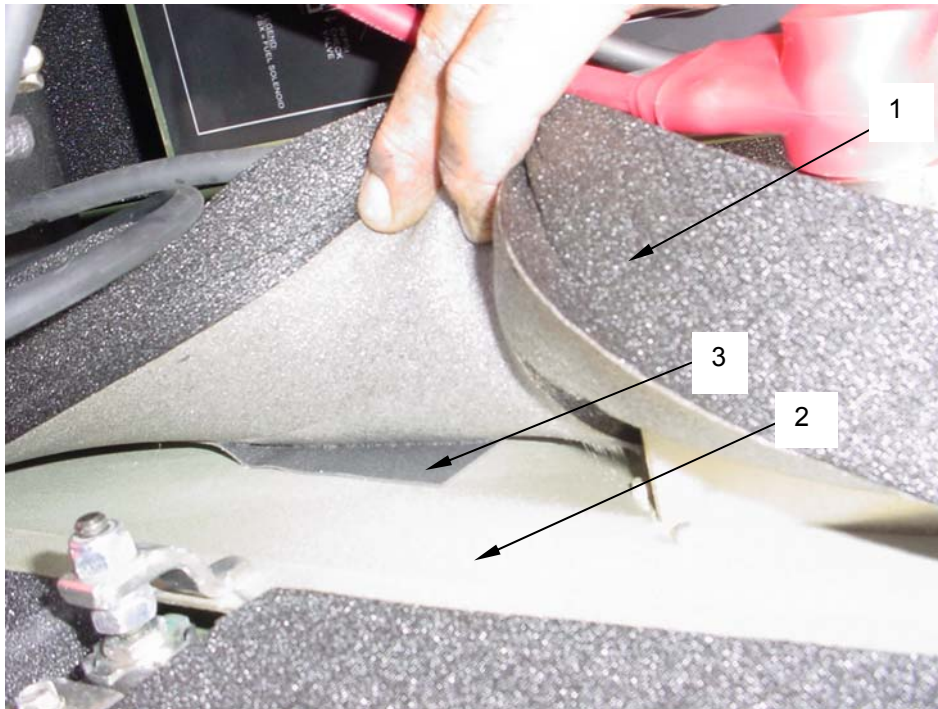


Figure 1. Replace Foam Insulation.

**END OF TASK**

**END OF WORK PACKAGE**

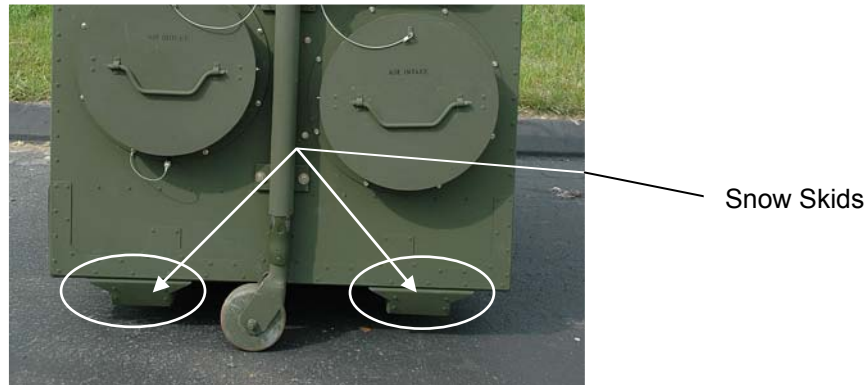
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**SERVICE MAINTENANCE****JACK ASSEMBLY  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.**REPLACE**

1. Place heater on snow skids to take weight off the jack assembly (Figure 1, Item 10).
2. Remove the bolts, lockwashers, and flat washers securing the heat exchanger top cover (Figure 1, Item 1) and the fan top cover (Figure 1, Item 2) in order to gain access to the heater interior. Set the covers as well as all bolts, lockwashers, and flat washers aside.
3. Remove the locknut (Figure 1, Item 7), hex head bolt (Figure 1, Item 3), and two flat washers (Figure 1, Items 4 and 6), from each of four locations securing the jack assembly (Figure 1, Item 10) to the cabinet (Figure 1, Item 9).
4. Remove the jack assembly (Figure 1, Item 10).
5. Install a new jack assembly by aligning the holes in the mounting flanges (Figure 1, Item 5) with the holes in the cabinet (Figure 1, Item 8).
6. Install a flat washer (Figure 1, Item 4) and hex head bolt (Figure 1, Item 3) through the mounting flange (Figure 1, Item 5) and cabinet (Figure 1, Item 8) from the outside of the heater. Secure using a flat washer (Figure 1, Item 6) and locknut (Figure 1, Item 7) on the interior of the heater in four locations. Tighten all fasteners securely.

REPLACE - Continued

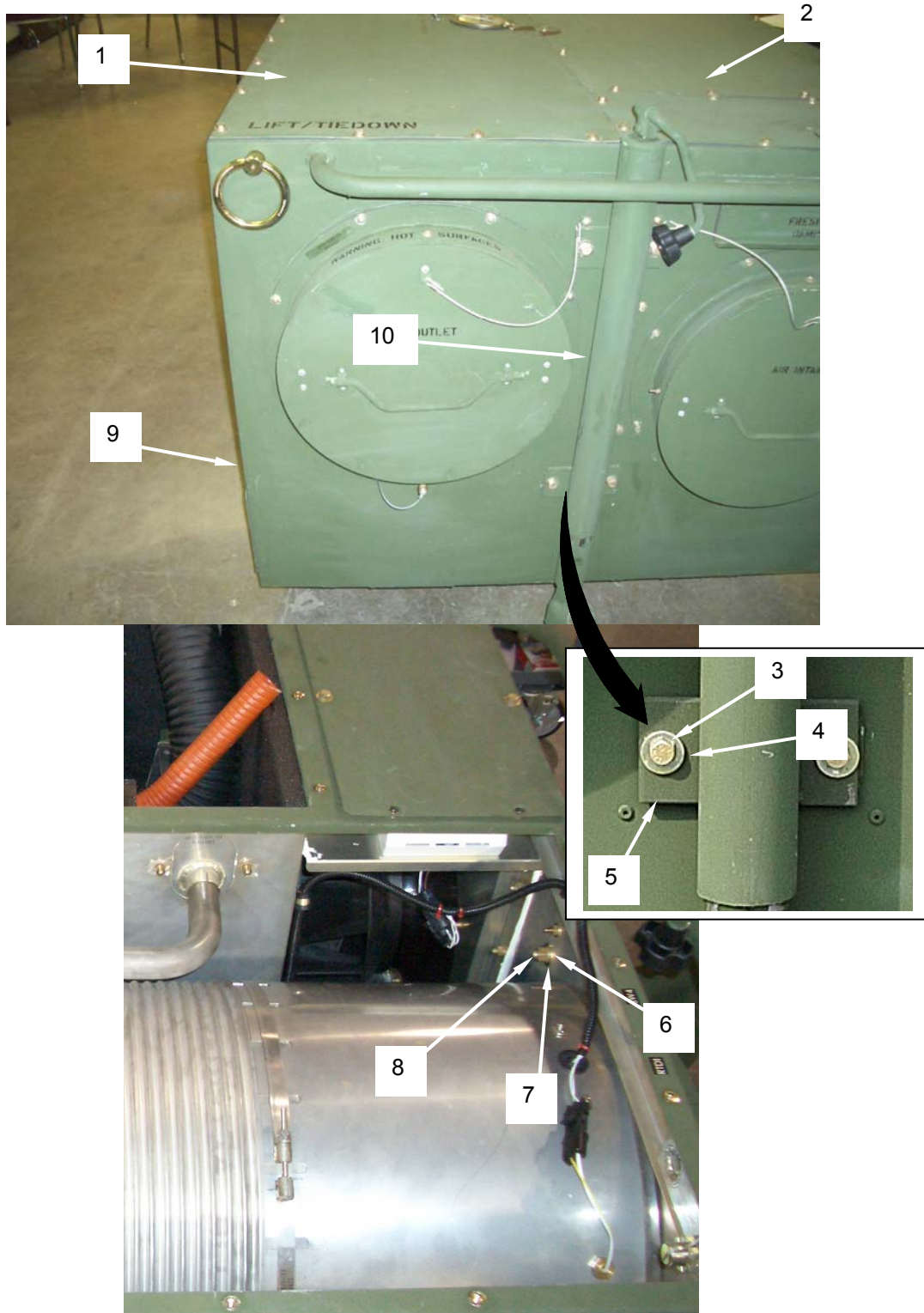


Figure 1. Replace Jack Assembly.

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE****CABINET  
INSPECT, SERVICE, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**Lubricant, Cleaning, Greaseless (Silicone) (WP  
0123, Item 8)**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

---

**INSPECT**

Inspect the cabinet and ensure that there are no dents, cuts, or other damage that could prevent the heater from operating safely.

**END OF TASK**

**SERVICE**

1. Lubricate slide portion (Figure 1, Item 1) and pivot (Figure 1, Item 2) of all locking fasteners (Figure 1, Item 3) with silicone lubricant.
2. Lubricate all door latches (Figure 1, Item 4) and hinges (Figure 1, Item 5) with silicone lubricant.



Figure 1. Lubricate All Latches and Hinges.

**END OF TASK****REPAIR**

Use common tools (pliers, mallets, etc.) to remove, to the extent possible, any dents which impair operation of the heater.

Dent removal should be done short of replacing the item or items if and only if equipment operation will not be reduced.

**END OF TASK****END OF WORK PACKAGE**

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**SERVICE MAINTENANCE****DOOR LATCH  
SERVICE, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**Lubricant, Cleaning, Greaseless (Silicone) (WP  
0123, Item 8)**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

---

**SERVICE**

Lubricate the pivot portion (Figure 1, Item 1) of the various door latches with a silicone lubricant.

**REPLACE****CAUTION**

Ensure that the door latch is replaced in the same position as originally installed.

1. Take note of the orientation of the door latch to ensure that it is replaced in the same position as before.
2. Remove the screw (Figure 1, Item 3) and bracket (Figure 1, Item 2) that secures the door latch (Figure 1, Item 6) to the cabinet (Figure 1, Item 4).
3. Remove the door latch (Figure 1, Item 6).
4. Install a new door latch in the same orientation as noted earlier.
5. Align the bracket (Figure 1, Item 2) over the hole (Figure 1, Item 5) in the door latch and install screw (Figure 1, Item 3). Tighten securely.

REPLACE - Continued

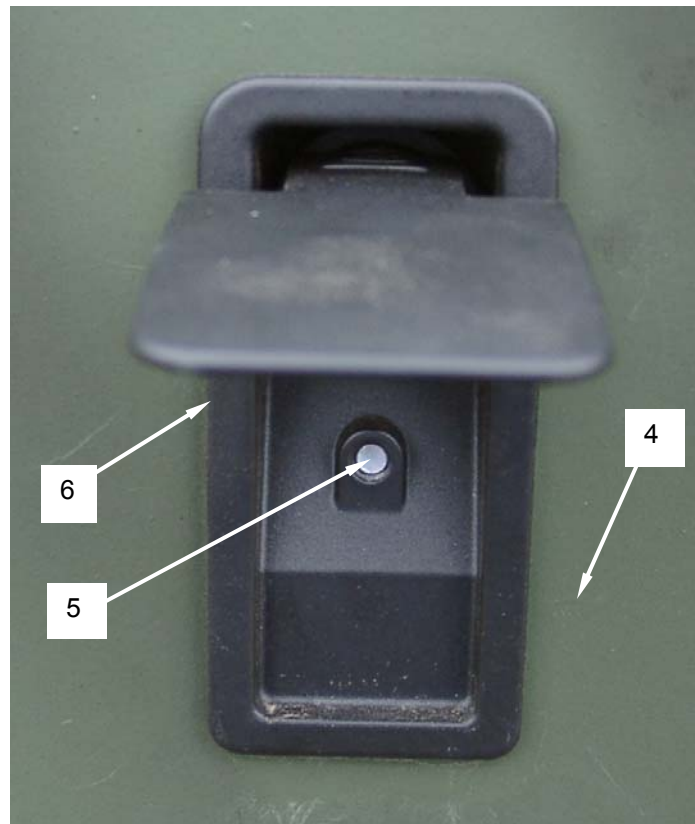
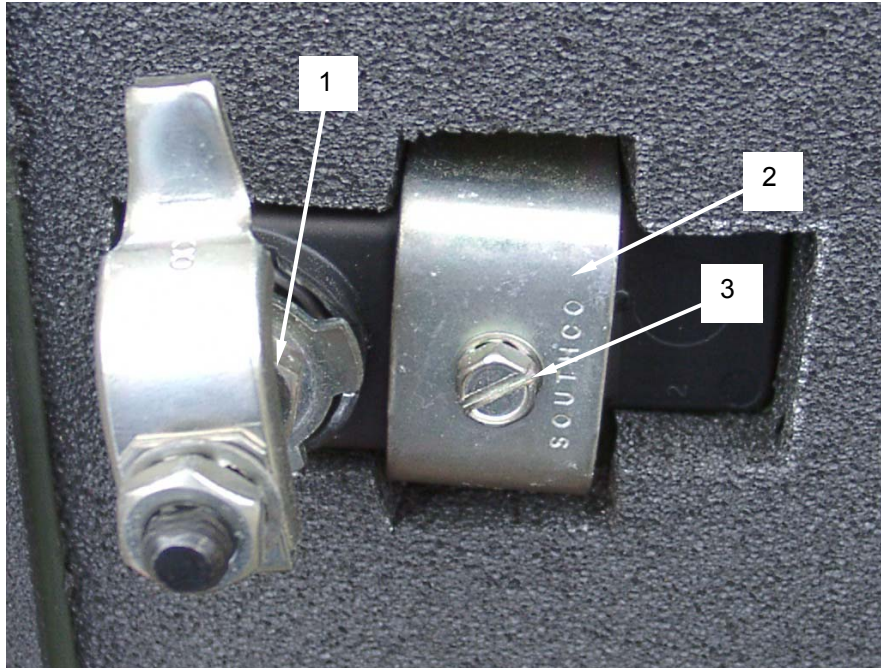


Figure 1. Replace Door Latch.

END OF TASK

END OF WORK PACKAGE



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**SERVICE MAINTENANCE**
**OPERATOR BOX MOUNTING BRACKET  
REPLACE**


---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
 Riveter, Blind Hand St, Straight Head (WP 0124, Item 10)  
 Automotive Maintenance and Repair, Field Basic, Less Power (WP 0120, Item 4)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rivet, Blind (WP 0123, Item 16)

**Equipment Condition**

Heater shut down and cool (WP 0005).

---

**REPLACE (UPPER BRACKET)**

1. To replace the upper operator box mounting bracket (Figure 1, Item 1), drill out the rivets (Figure 1, Item 2) that secure the bracket with an appropriately sized drill bit that removes the head of the rivet without enlarging the mounting hole.
2. Remove the damaged bracket (Figure 1, Item 1).
3. Install a new bracket (Figure 1, Item 1) by aligning the holes in the bracket with the holes in the cabinet (Figure 1, Item 3).
4. Install new rivets (Figure 1, Item 2) using a hand riveter.

**REPLACE (LOWER LOCKING FASTENER)**

1. To replace the lower locking fastener (Figure 1, Item 4), drill out the rivets (Figure 1, Item 5) that secure the fastener (Figure 1, Item 4) with an appropriately sized drill bit that removes the head of the rivet without enlarging the mounting hole.
2. Remove the damaged fastener (Figure 1, Item 4).
3. Install a new fastener (Figure 1, Item 4) by aligning the holes in the fastener with the holes in the cabinet (Figure 1, Item 6).
4. Install new rivets (Figure 1, Item 5) using a hand riveter.

REPLACE - Continued

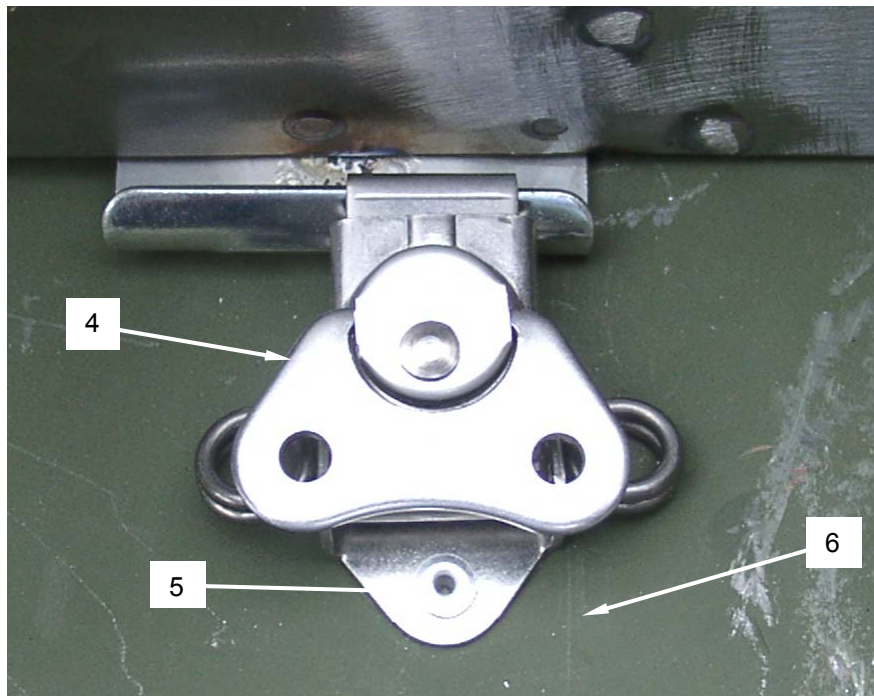
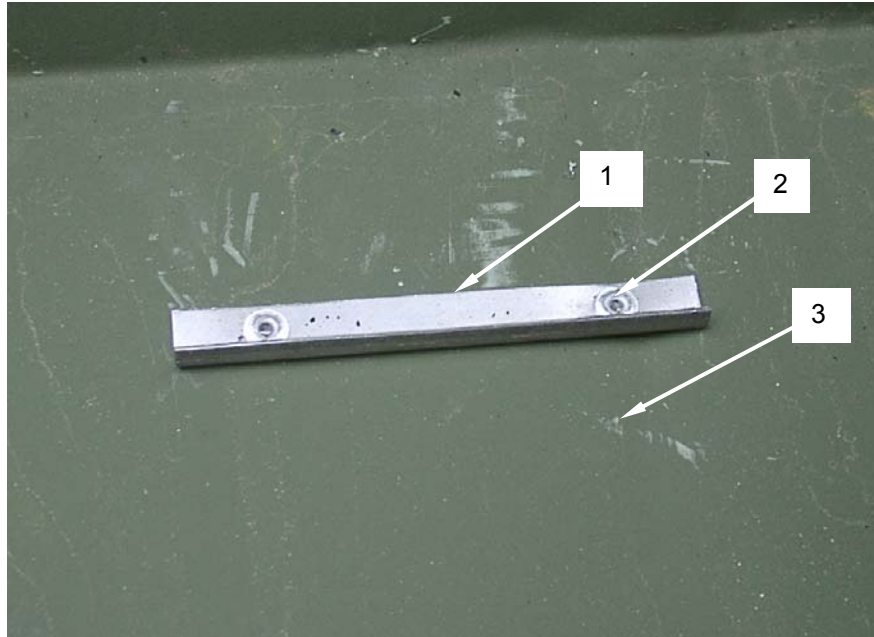


Figure 1. Replace Operator Box Mounting Brackets.

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE****CARBON MONOXIDE DETECTOR – CABINET  
INSPECT, TEST, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.

---

**INSPECT****NOTE**

The cabinet mounted carbon monoxide detector must be replaced every 5 years regardless of the results of inspection or test. Refer to the section of this work package entitled "REPLACE" for complete details on replacement.

1. Remove the eight hex head bolts (Figure 1, Item 3) and washers (Figure 1, Item 4) securing the fan compartment cover (Figure 1, Item 2) to the LCFH Type II cabinet (Figure 1, Item 1).
2. Remove the fan compartment cover (Figure 1, Item 2) to expose the carbon monoxide detector (Figure 2, Item 1).

**INSPECT - Continued**

3. Inspect the carbon monoxide detector (Figure 2, Item 1) enclosure for cracks, punctures, or any other damage that would prevent the detector from operating properly. If damaged, replace the detector as detailed in the section of this work package entitled "REPLACE."

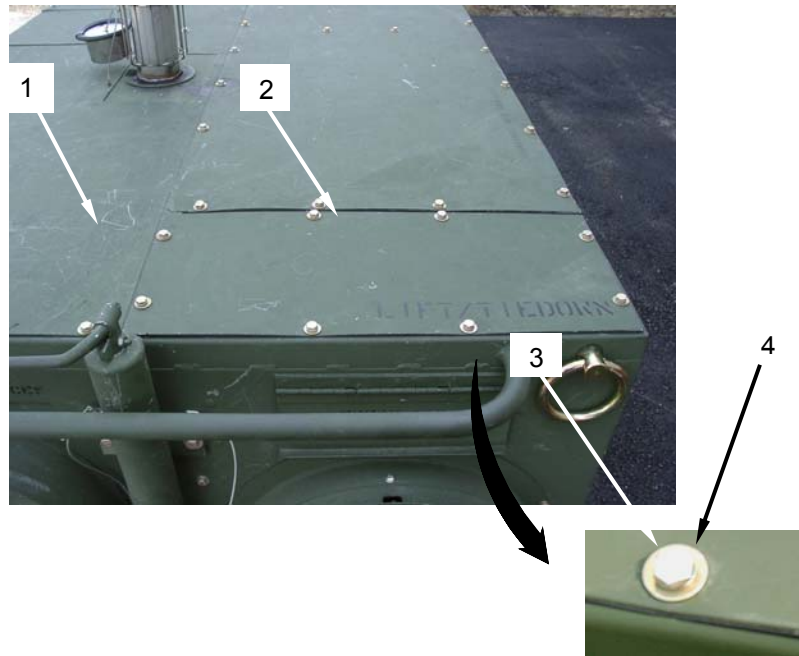


Figure 1. Open Fan Compartment Cover.

**INSPECT - Continued**

4. Inspect the carbon monoxide detector (Figure 2, Item 1) and ensure that it has not been damaged in any way. Ensure that the louvers (Figure 2, Item 4) are not blocked or damaged in such a way as to prevent proper airflow into the detector. Remove top cover (Figure 2, Item 1). Ensure that the indicator lamp (Figure 2, Item 2) is not broken or missing. If the carbon monoxide detector is damaged, replace as detailed in the section of this work package entitled "REPLACE."
5. Replace top cover (Figure 2, Item 1).
6. Replace the fan compartment cover (Figure 1, Item 1).
7. Install the eight hex head bolts (Figure 1, Item 3) and washers (Figure 1, Item 4) to secure the fan compartment cover to the LCFH Type II cabinet (Figure 1, Item 1).

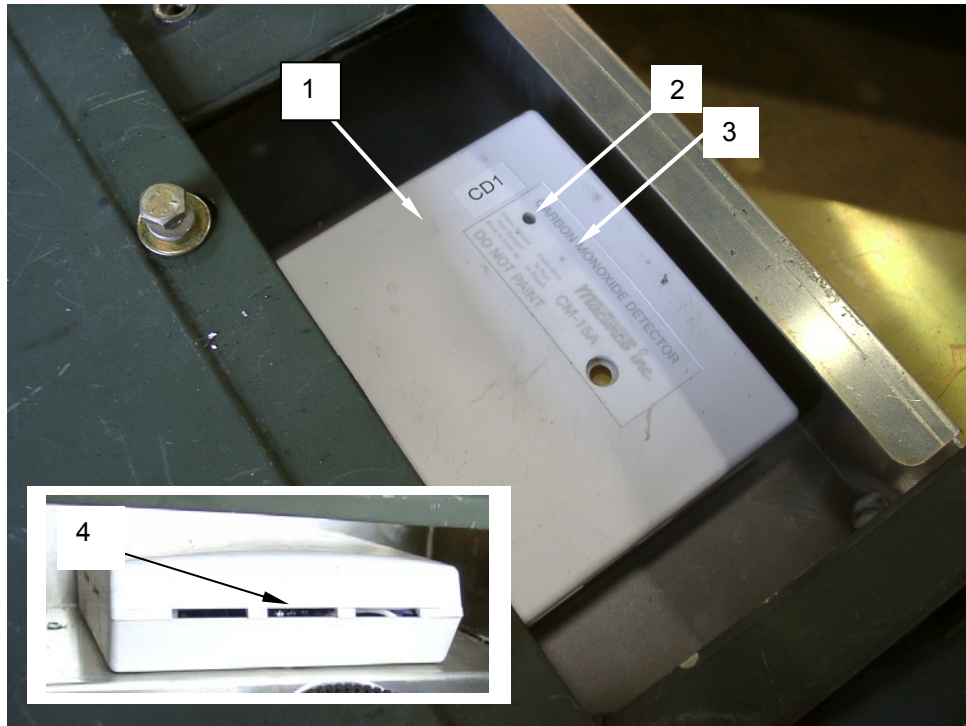


Figure 2. Inspect the Carbon Monoxide Detector.

**TEST**

1. Remove the fan compartment cover as detailed in the "INSPECT" section of this procedure.

**WARNING**

The heater engine must run briefly to perform the next task.

2. The carbon monoxide detector performs a self test during the startup sequence. The detector may also be directly tested by pressing the "PUSH TO TEST OR RESET" switch (Figure 3, Item 1), while system is running.
3. Set up heater IAW WP 0005.
4. To test the CO detector, ensure that the power switch on the operator control box is in the ON position.

**TEST - Continued**

5. Within a few seconds of placing the power switch in the ON position, the carbon monoxide detector will produce a series of four chirps followed by a delay of a few seconds, and then four more chirps. During this sequence, the indicator lamp will alternate between green and red. This indicates that the carbon monoxide detector is operating properly.
6. The switch (Figure 3, Item 1) on the front of the CO detector labeled "PUSH HERE TO TEST OR RESET" performs a dual function. During normal operations, one push will place the unit into self-test mode. The status light will turn red for five seconds, and then it will alternate slowly between green and amber while the self test executes. The controlling software rapidly simulates a 300 ppm CO environment and will cause the unit to alarm after one minute has elapsed. When this happens, the status light will turn red, the alarm relay will close, and the buzzer will sound two complete cycles. The unit will then return to normal operation. If the CO detector is in an alarm condition due to detection of carbon monoxide, one push of the switch will cause the alarm buzzer to turn off and the self test to start. After the one-minute test, if CO is still present, the status light will again switch to RED; the alarm relay will close; and the buzzer will sound.
7. If the detector does not chirp as described in steps 5 or 6, it should be replaced as described in the section of this work package entitled "REPLACE."
8. Replace the fan compartment cover by installing the eight hex head bolts (Figure 1, Item 3) and washers (Figure 1, Item 4) to secure the fan compartment cover to the LCFH Type II cabinet (Figure 1, Item 1), as described in steps 7 and 8 of the "INSPECT" section of this WP.

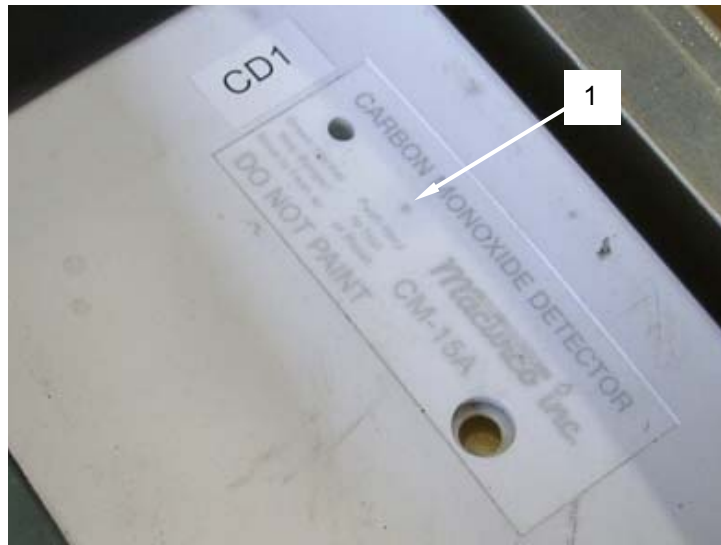


Figure 3. Test the Carbon Monoxide Detector.

**REPLACE**

1. To replace the carbon monoxide detector, remove the fan cover as detailed in the section entitled "INSPECT."
2. Pry the top cover (Figure 4, Item 1) off the CO detector with a screwdriver.
3. Remove the two screws (Figure 4, Item 2) that secure the inner assembly (Figure 4, Item 3) to the lower portion (Figure 4, Item 6) of the plastic case.
4. Partially remove the inner assembly (Figure 4, Item 3) from the lower portion (Figure 4, Item 6) of the plastic case.
5. Remove the two screws and washers (Figure 4, Item 5) that secure the lower portion (Figure 4, Item 6) of the plastic case to the mounting plate (Figure 4, Item 4).
6. Partially remove the lower portion (Figure 4, Item 6) of the plastic case from the mounting plate (Figure 4, Item 4).
7. Disconnect the wiring harness connector (Figure 4, Item 7) connecting the carbon monoxide detector to the heater.

**NOTE**

It will be necessary to partially disassemble the new carbon monoxide detector before it can be installed in the heater.

8. Connect the wiring harness connector (Figure 4, Item 7) of the new carbon monoxide detector to the wiring harness in the heater.
9. Pry the top cover (Figure 4, Item 1) off the new carbon monoxide detector with a screwdriver.
10. Remove the two screws (Figure 4, Item 2) that secure the inner assembly (Figure 4, Item 3) to the lower portion (Figure 4, Item 6) of the plastic case.
11. Partially remove the inner assembly (Figure 4, Item 3) to gain access to the lower portion (Figure 4, Item 6) of the plastic case.
12. Position the lower portion (Figure 4, Item 6) of the plastic case over the holes in the mounting plate (Figure 4, Item 4).
13. Install the two screws and washers (Figure 4, Item 5) that secure the lower portion (Figure 4, Item 6) of the plastic case to the mounting plate (Figure 4, Item 4).
14. Install the inner assembly (Figure 4, Item 3) into the lower portion (Figure 4, Item 6) of the plastic case aligning the holes on the inner assembly with mounting studs on the lower portion of the plastic case.
15. Install two screws (Figure 4, Item 2) and secure the inner assembly (Figure 4, Item 3).
16. Install the top cover (Figure 4, Item 1) and snap into place.
17. Repeat the TEST procedure as detailed under "TEST" in this work package to ensure that CO detector is fully operational.

REPLACE - Continued

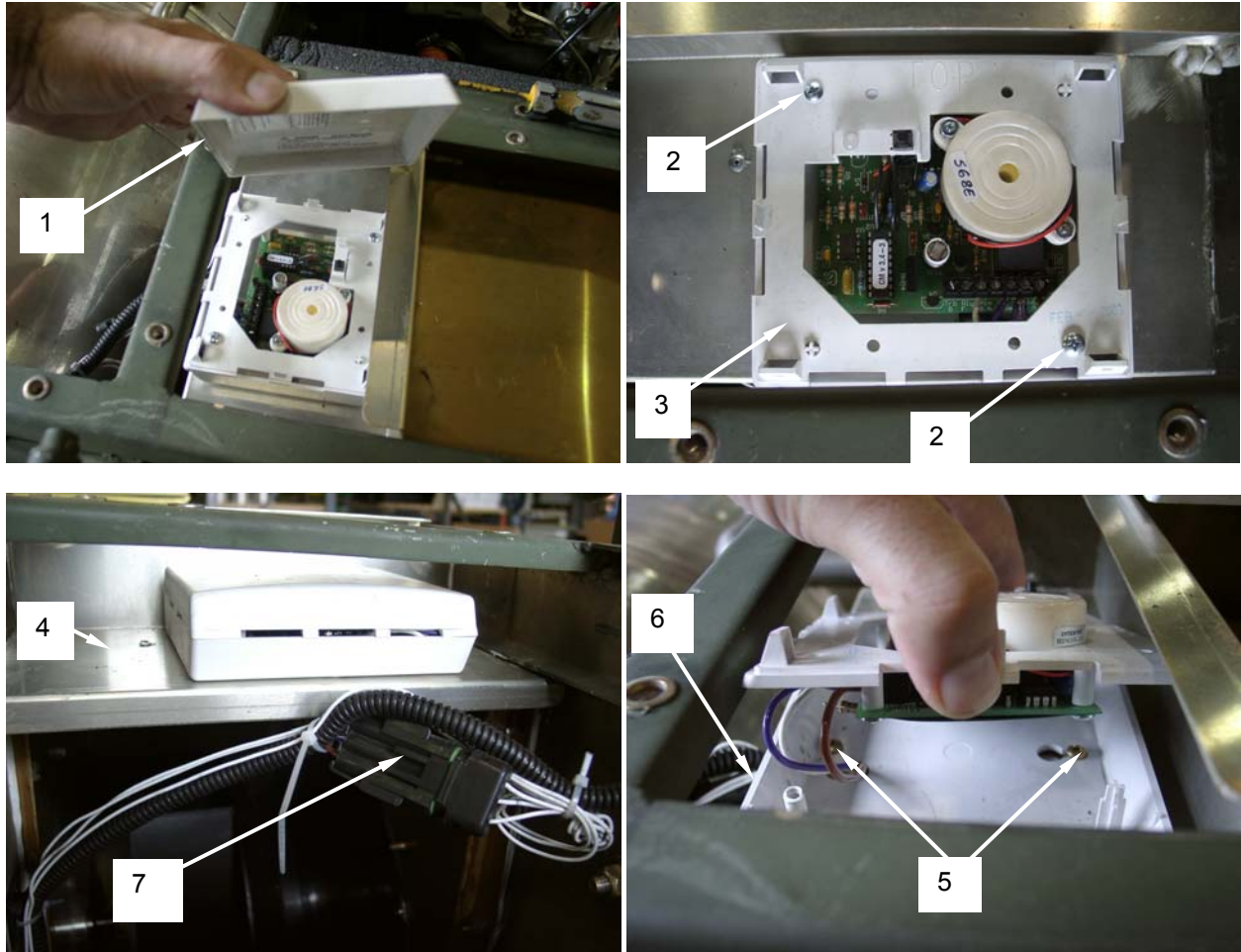


Figure 4. Replace the Carbon Monoxide Detector.

END OF TASK

END OF WORK PACKAGE



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**SERVICE MAINTENANCE****EXHAUST TUBE  
INSPECT, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0134, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

---

**INSPECT**

1. Inspect the exhaust tube (Figure 1, Item 2) to ensure that there is not extensive carbon buildup on the inside surface.
2. Ensure that it is not dented or bent in such a way as to prevent a secure and leakproof connection between the exhaust tube and the exhaust pipe port on the top of the heater.
3. Ensure that the top rain guard (Figure 1, Item 1) is present and has not been damaged in such a way as to prevent the proper flow of exhaust gases from the exhaust tube.
4. Ensure that the burn guard (Figure 1, Item 3) is not bent or damaged and that it would adequately protect an operator from coming in contact with a hot exhaust tube during operation.

**END OF TASK****REPAIR**

Repair any dents or bends in the exhaust tube by tapping from the inside with a hammer or other tool. If a dent prevents the proper flow of exhaust gases from the heater and the dent cannot be properly repaired, the exhaust tube should be replaced.

## REPAIR - Continued

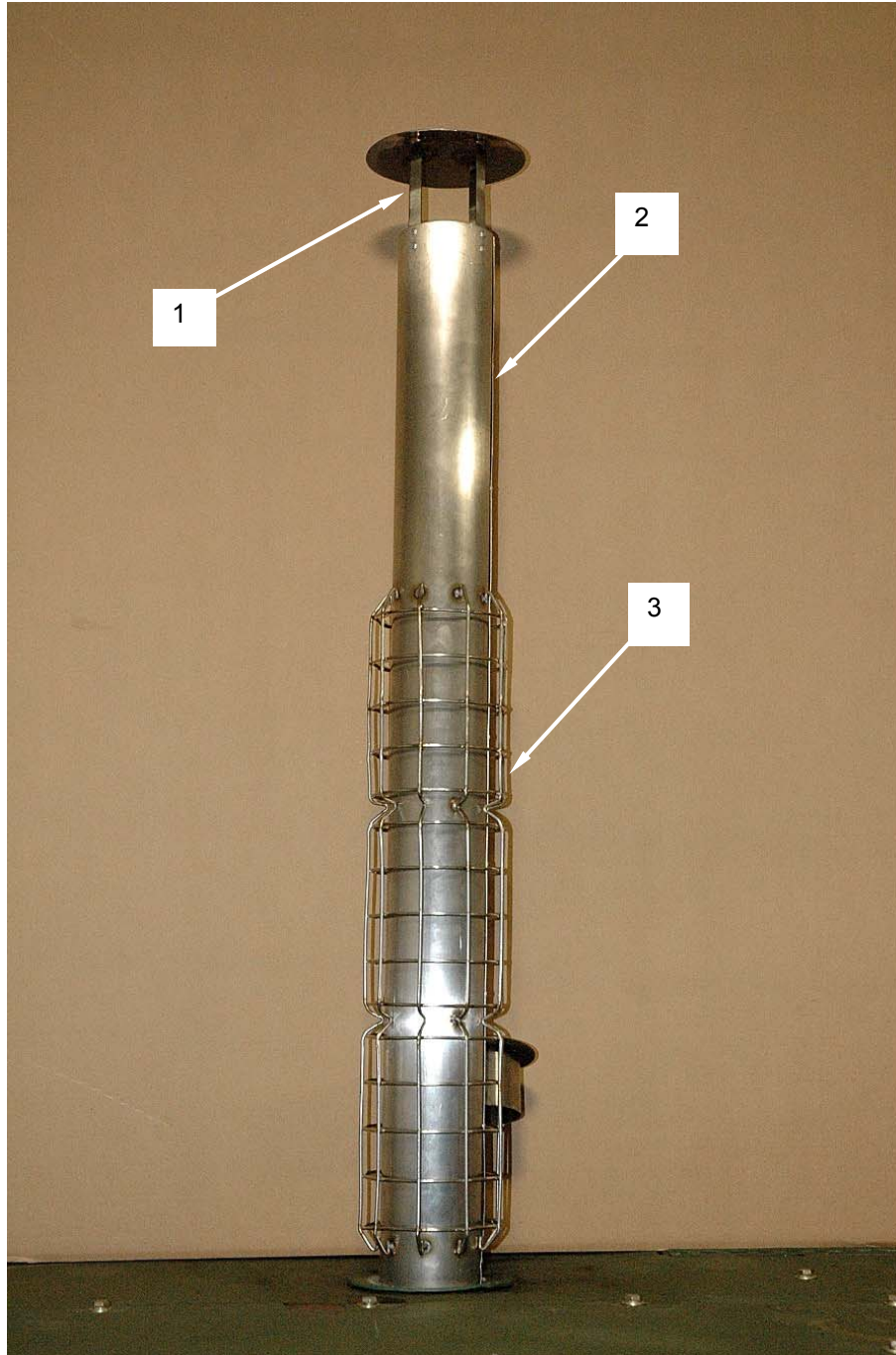


Figure 1. Inspect and Repair Heat Exchanger Exhaust Tube.

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE****MOBILITY HANDLE  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1 or 2) or  
Utilities Equipment Repairer 52C (1 or 2)**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

---

**REPLACE****Replacing the Front Mobility Handle****CAUTION**

Lift the corner of the heat exchanger cover only enough to gain access to the interior of the heater. Do not lift the heat exchanger cover so much that it becomes creased and cannot be resealed.

**NOTE**

The front mobility handle is located closest to the jack assembly.

1. Remove the bolts, lockwashers, and flat washers that secure the cabinet mounted carbon monoxide detector cover (Figure 1, Item 1) to the heater cabinet. Set the cover and all hardware aside.



Figure 1. Removing the Carbon Monoxide Detector Cabinet Cover.

**REPLACE - Continued****NOTE**

For ease in performing the next step, it is recommended that one person support the cover while the second person remove the mobility handle mounting bolt inside the heater.

- Remove the seven bolts, lockwashers, and flat washers (Figure 2, Item 1) along the edge of the heat exchanger cover (Figure 2, Item 2) closest to the front mobility handle (Figure 2, Item 3). This will permit the cover to be lifted in order to access the bolt securing the handle. Set the hardware aside. Carefully lift the heat exchanger cover at the front corner.

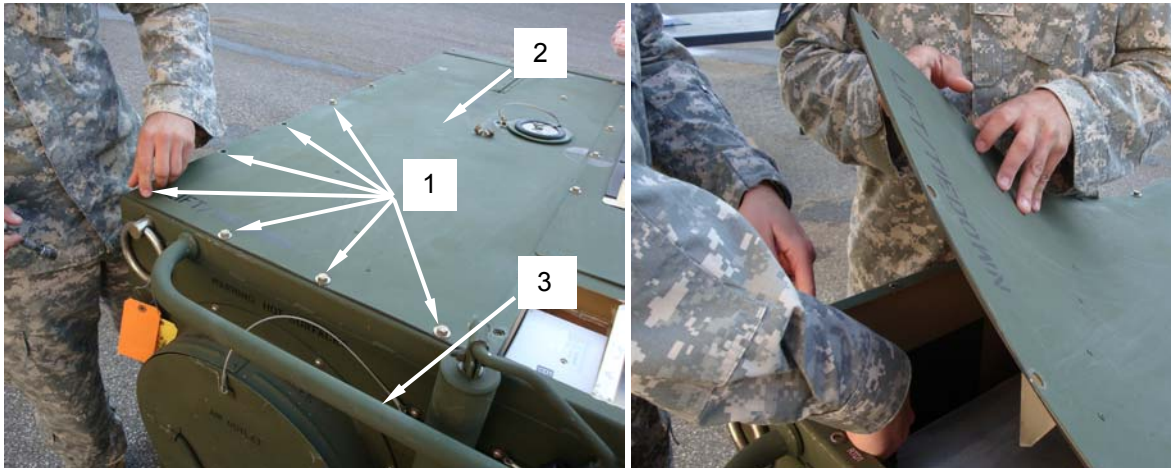


Figure 2. Removing Bolts Along Edge of Heat Exchanger Cover.

- Remove the bolt (Figure 3, Item 1), lockwashers (Figure 3, Item 2), and flat washers (Figure 3, Item 3) that secure the mobility handle on the inside of the heater. Remove the damaged mobility handle (Figure 3, Item 4) from cabinet.



Figure 3. Removing the Damaged Mobility Handle.

**REPLACE - Continued**

4. Position the new front mobility handle (Figure 4, Item 1) in the holes on the cabinet. Secure the handle to the cabinet with flat washers (Figure 4, Item 2), lockwashers (Figure 4, Item 3), and bolts (Figure 4, Item 4). Tighten bolts securely.

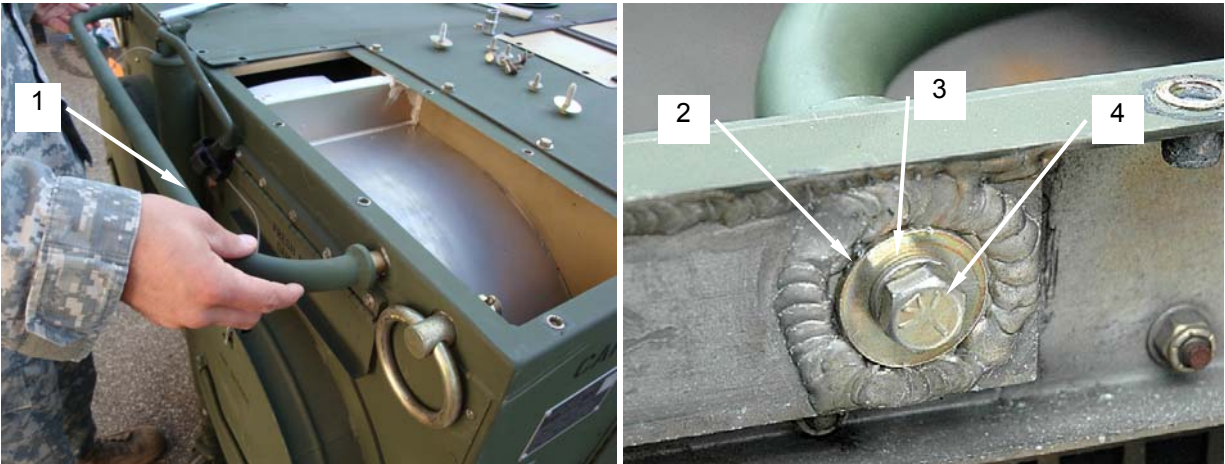


Figure 4. Installing the New Mobility Handle.

5. Install the seven bolts, lockwashers, and flat washers (Figure 5, Item 1) along the edge of the heat exchanger cover (Figure 5, Item 2) closest to the front mobility handle. Tighten securely.

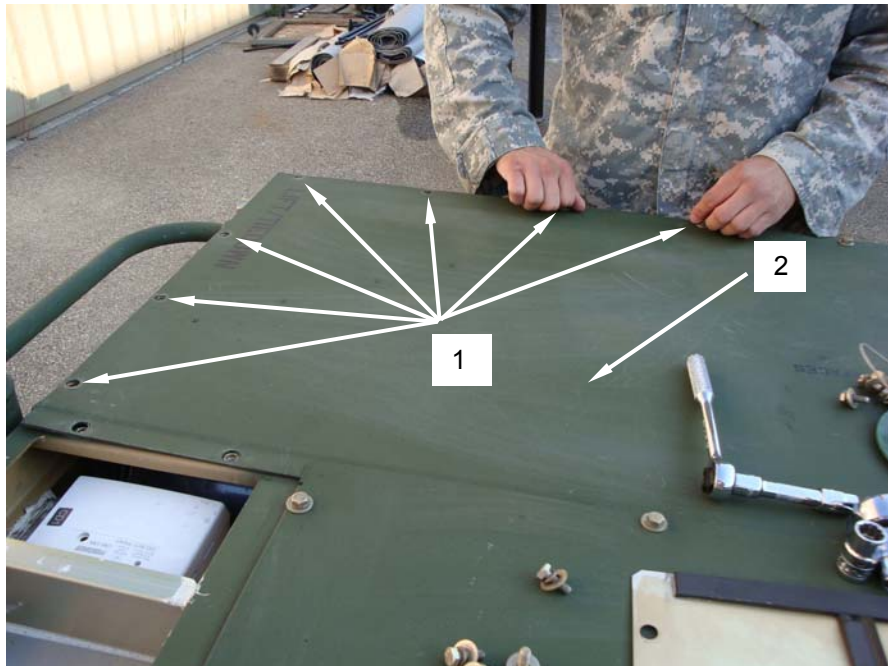


Figure 5. Reinstalling Bolts in Heat Exchanger Cover.

**REPLACE - Continued**

6. Position the cabinet mounted carbon monoxide detector cover (Figure 6, Item 1) on the heater cabinet. Install the bolts, lockwashers, and flat washers that secure the cabinet mounted carbon monoxide detector cover to the heater cabinet. Tighten securely.



Figure 6. Installing the Covers on the Cabinet.

**END OF TASK**

**REPLACE - Continued****Replacing the Rear Mobility Handle****NOTE**

The rear mobility handle is located closest to the fuel tank filler cap end of the heater.

1. Open the fuel system access door (Figure 7, Item 1) and burner system access door (Figure 7, Item 2).
2. Remove the bolts (Figure 7, Item 3), lockwashers (Figure 7, Item 4), and flat washers (Figure 7, Item 5) that secure the rear mobility handle on the inside of the heater. Remove the damaged rear mobility handle from the cabinet (Figure 7, Item 6).

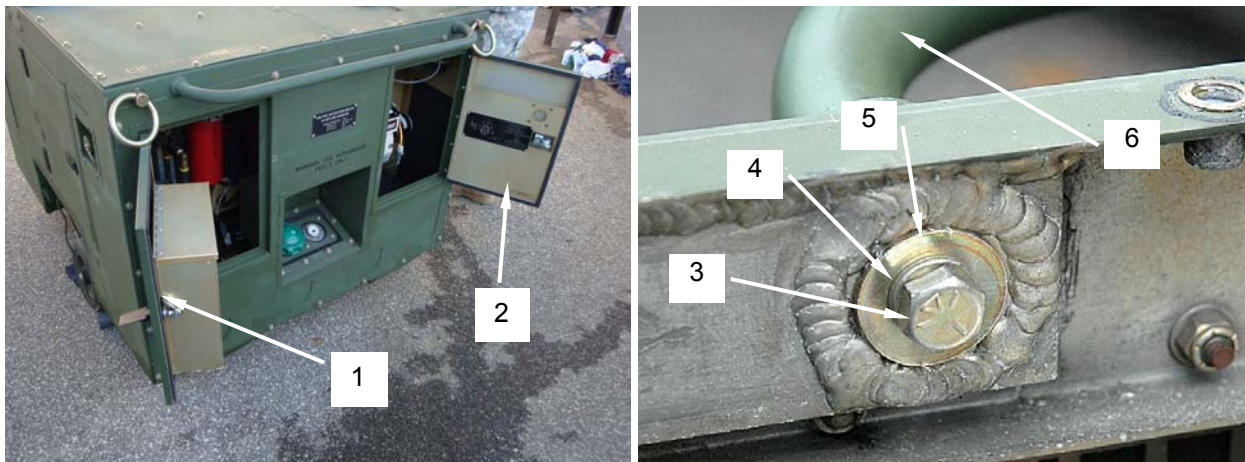


Figure 7. Removing the Damaged Rear Mobility Handle.

**REPLACE - Continued**

3. Position the new rear mobility handle (Figure 8, Item 1) in the holes on the cabinet. Secure the handle to the cabinet with flat washers (Figure 8, Item 2), lockwashers (Figure 8, Item 3), and bolts (Figure 8, Item 4). Tighten bolts securely.

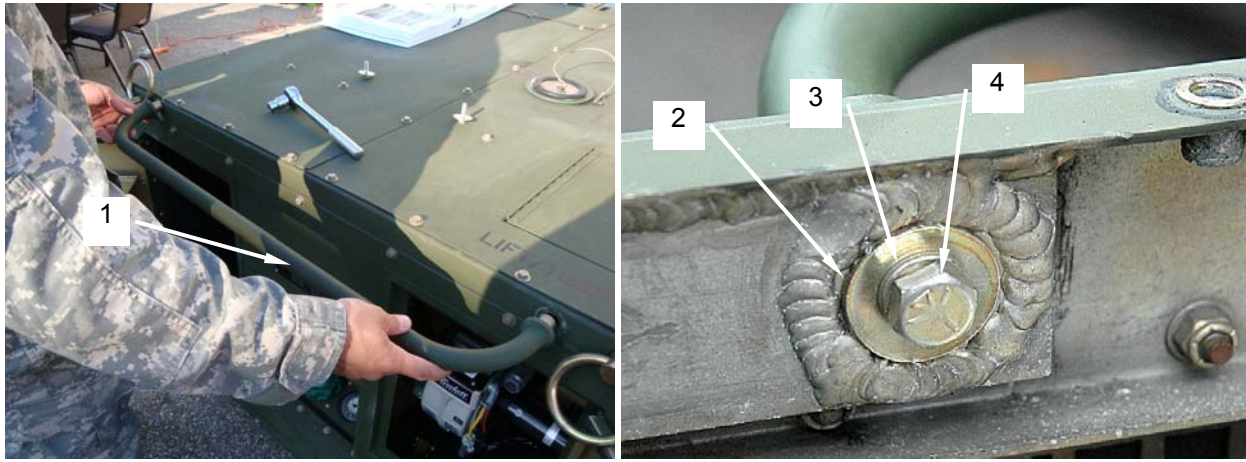


Figure 8. Installing New Rear Mobility Handle.

4. Close the fuel system access door (Figure 9, Item 1) and burner system access door (Figure 9, Item 2).



Figure 9. Closing Fuel System and Burner Access Doors.

**END OF TASK**

**END OF WORK PACKAGE**



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**SERVICE MAINTENANCE****10- MICRON FUEL FILTER  
SERVICE, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Oil Filter (WP 0124, Item 16)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 17) or,  
Tape, Antiseizing (WP 0123, Item 23)  
Gloves, Chemical and Oil Protective (WP 0123,  
Item 6)

**References**

WP 0022

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.

---

**WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel pump to collect any fuel. Be sure to wipe up any spills with a rag and dispose of properly IAW with local SOP.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**SERVICE**

1. To service the fuel filter, unscrew the fuel filter cartridge (Figure 1, Item 1) with an oil filter wrench. Wipe up any spilled fuel with a rag.
2. Discard old fuel filter cartridge (Figure 1, Item 1) in accordance with Unit SOP and local environmental regulations.

**NOTE**

Do not over tighten the fuel filter cartridge to prevent gasket deformation.

3. Install a new fuel filter cartridge (Figure 1, Item 1) by engaging the opening on the top of the fuel filter cartridge with the threaded filter fitting. Hand tighten only.

**END OF TASK**

**CAUTION**

Prime the fuel system after installing the filter IAW WP 0022, procedure step 13. Failure to properly prime the fuel system prior to operation will damage diesel engine mounted fuel pump.

**NOTE**

Do not apply thread sealant to compression fittings.

**REPLACE**

1. Loosen compression fitting (Figure 1, Item 10) and remove hose (Figure 1, Item 9) from the fuel filter housing (Figure 1, Item 12).
2. Remove fitting (Figure 1, Item 11); clean any residual pipe joint compound or thread sealant and set aside.
3. Loosen compression fitting (Figure 1, Item 4) and remove hose (Figure 1, Item 5) from fuel filter housing (Figure 1, Item 12).
4. Note orientation and remove the elbow fitting (Figure 1, Item 3); clean any residual pipe joint compound or thread sealant and set aside.
5. Remove reducing fitting (Figure 1, Item 2 and 19), clean any residual pipe joint compound or antiseize tape and set aside.
6. Loosen compression fitting (Figure 1, Item 7) and remove hose (Figure 1, Item 8) from fuel filter housing (Figure 1, Item 12).
7. Note orientation and remove the elbow fitting (Figure 1, Item 6); clean any residual pipe joint compound or antiseize tape and set aside.
8. Remove fuel filter housing mounting bolt (Figure 1, Item 13), nut (Figure 1, Item 15), lockwasher (Figure 1, Item 18), and flat washer (Figure 1, Item 16) on right side of housing.
9. Remove fuel filter housing mounting bolt (Figure 1, Item 14), nut (Figure 1, Item 15), lockwasher (Figure 1, Item 18), and flat washer (Figure 1, Item 15) on left side of housing.
10. Remove fuel filter housing (Figure 1, Item 12).
11. Position new fuel filter housing (Figure 1, Item 12) and install the right mounting bolt (Figure 1, Item 13), flat washer, lockwasher (Figure 1, Item 18), and nut (Figure 1, Item 15).
12. Install left mounting bolt (Figure 1, Item 14), flat washer (Figure 1, Item 16), lockwasher (Figure 1, Item 18) and nut (Figure 1, Item 15). Tighten both bolts securely.
13. Apply new thread sealant and install the elbow fitting (Figure 1, Item 6) in the same orientation as noted earlier.
14. Install hose (Figure 1, Item 8) on fuel filter housing (Figure 1, Item 12) and tighten compression fitting (Figure 1, Item 7).
15. Apply new pipe joint compound and install reducing fitting (Figure 1, Item 2 and 19) that was set aside earlier.
16. Apply new pipe joint compound and install the elbow fitting (Figure 1, Item 3) in the same orientation as noted earlier.

**REPLACE - Continued**

17. Install hose (Figure 1, Item 5) on fuel filter housing (Figure 1, Item 12) and tighten compression fitting (Figure 1, Item 4).
18. Apply new pipe joint compound and install fitting (Figure 1, Item 11) set aside earlier.
19. Install hose (Figure 1, Item 9) and tighten compression fitting (Figure 1, Item 10) on the fuel filter housing (Figure 1, Item 12).
20. Install new fuel filter cartridge (Figure 1, Item 1) if not already installed on fuel filter housing (Figure 1, Item 12).
21. Prime the fuel system after replacing the filter IAW WP 0022, procedure step 13.

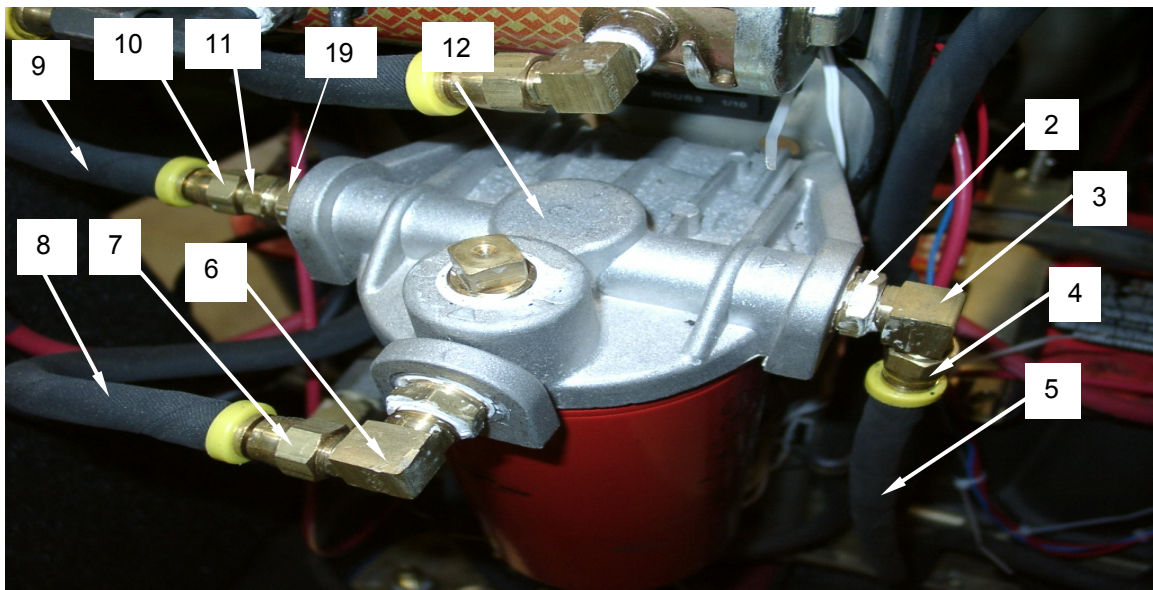


Figure 1. Service and Replace Fuel Filter (Sheet 1 of 2).

REPLACE - Continued

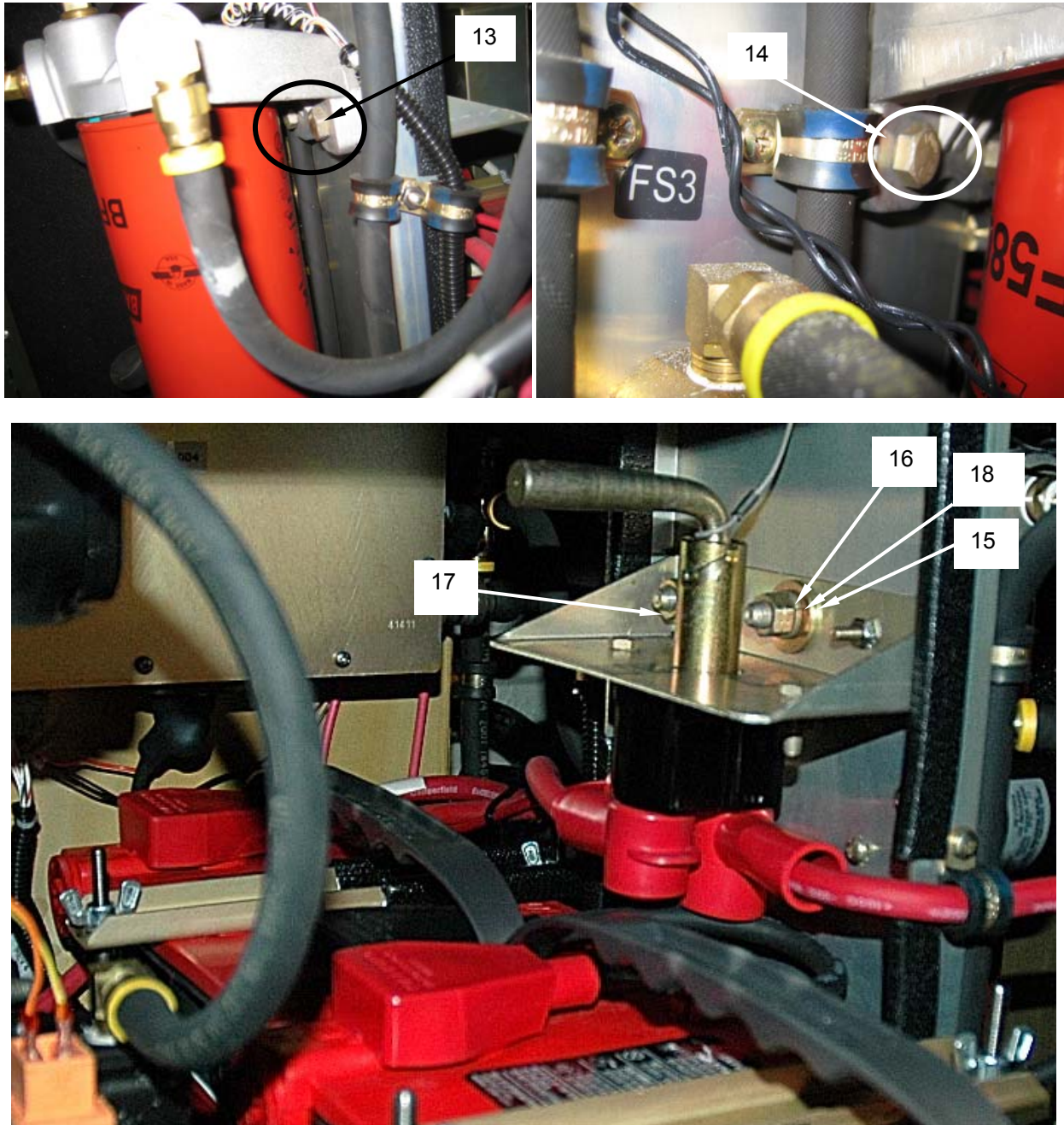


Figure 1. Service and Replace Fuel Filter (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE****ELECTRICAL FUEL PUMP  
SERVICE, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 17) or,  
Tape, Antiseizing (WP 0123, Item 23)  
Solvent, Degreasing (WP 0123, Item 20)  
Gloves, Chemical and Oil Protective (WP 0123,  
Item 6)

**References**

WP 0022

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle removed.

---

**WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel pump to collect any fuel. Be sure to wipe up any spills with a rag. Properly dispose of fuel soaked rags IAW local SOP.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**SERVICE**

1. To gain access to service electrical fuel pump, remove engine access cover.
2. To service the electrical fuel pump (Figure 1, Item 2), rotate the base cover (Figure 1, Item 5) counterclockwise until it unlocks.
3. Carefully remove the base cover (Figure 1, Item 5) taking care to catch any fuel that may spill.
4. Remove the fuel pump strainer (Figure 1, Item 4), noting orientation, and clean using clean fuel or solvent. Clean pump body and magnet in cap.
5. After servicing, install the fuel pump strainer (Figure 1, Item 4), in the orientation noted earlier (Figure 1, Item 16), into the fuel pump (Figure 1, Item 2).
6. Install the base cover (Figure 1, Item 5) and rotate clockwise to lock in position.

**END OF TASK**

**REPLACE**

1. To gain access to replace electrical fuel pump, remove engine access cover.
2. Disconnect the electrical connector (Figure 1, Item 14) by pulling the two halves of the connector apart.
3. Loosen the fitting (Figure 1, Item 12) on the fuel outlet hose (Figure 1, Item 6) and remove, taking care to catch any fuel that may spill.
4. Loosen the fitting (Figure 1, Item 8) on the fuel inlet hose (Figure 1, Item 9) and remove, taking care to catch any fuel that may spill.
5. Take note of the orientation of the elbow fitting (Figure 1, Item 13) on the outlet port (Figure 1, Item 15) of the fuel pump and remove. Clean any residual thread sealant that may be on the threads of the elbow fitting and set aside.
6. Take note of the orientation of the brass elbow fitting (Figure 1, Item 7) on the inlet port (Figure 1, Item 11) of the fuel pump and remove. Clean any residual thread sealant that may be on the threads of the elbow fitting and set aside.
7. Remove the bolt securing the cable retaining clamp (Figure 1, Item 10), and remove the clamp.
8. Remove the upper bolt (Figure 1, Item 3) securing the fuel pump by removing the nut (Figure 1, Item 16) and lockwasher (Figure 1, Item 17) on engine side. Then remove bolt and star washer. Star washer is located between pump bracket and fuel pump mounting panel.
9. Remove the lower bolt securing the fuel pump by removing the nut (Figure 1, Item 19) and lockwasher (Figure 1, Item 18) on the rear of the fuel pump mounting panel (Figure 1, Item 1). Remove bolt and star washer on rear of the fuel pump mounting bracket.

**NOTE**

Remove main power disconnect handle and set aside. Push hour meter grounding wire connector to the side.

10. Remove the defective fuel pump (Figure 1, Item 2). Note orientation.
11. With new pump (Figure 1, Item 2) in hand, insert the two mounting bolts through mounting bracket. Place star washers over bolts. Then install pump onto fuel pump mounting panel (Figure 1, Item 1), in the orientation noted earlier. Place lockwasher (Figure 1, Item 18) and nut (Figure 1, Item 16) onto rear side of fuel pump mounting panel (Figure 1, Item 1).
12. On the lower mounting bolt, reinstall hour meter ground cable. Reinstall pump handle, lockwasher (Figure 1, Item 18), and nut (Figure 1, Item 19) from the rear side of the fuel pump mounting panel (Figure 1, Item 1).
13. Install the cable retaining clamp (Figure 1, Item 10) and secure tightly with bolt, lockwasher, and flat washers.
14. Apply new thread sealant to the threads of the brass elbow fitting (Figure 1, Item 7) and install in the fuel inlet port (Figure 1, Item 11) of the fuel pump taking care to orient the fitting as before.
15. Apply new thread sealant to the threads of the elbow fitting (Figure 1, Item 13) and install in the fuel outlet port (Figure 1, Item 15) of the fuel pump taking care to orient the fitting as before.
16. Install the compression fitting (Figure 1, Item 8) of the fuel inlet hose (Figure 1, Item 9) on the brass elbow fitting (Figure 1, Item 7) located at the fuel inlet port, tightening securely.

**REPLACE - Continued**

17. Install the compression fitting (Figure 1, Item 12) of the fuel outlet hose (Figure 1, Item 6) on the elbow fitting located at the fuel outlet port, tightening securely.
18. Reconnect the electrical connector (Figure 1, Item 14) by engaging the two halves of the connector until they are firmly seated. Confirm operation by priming the fuel system IAW WP 0022, procedure step 13.

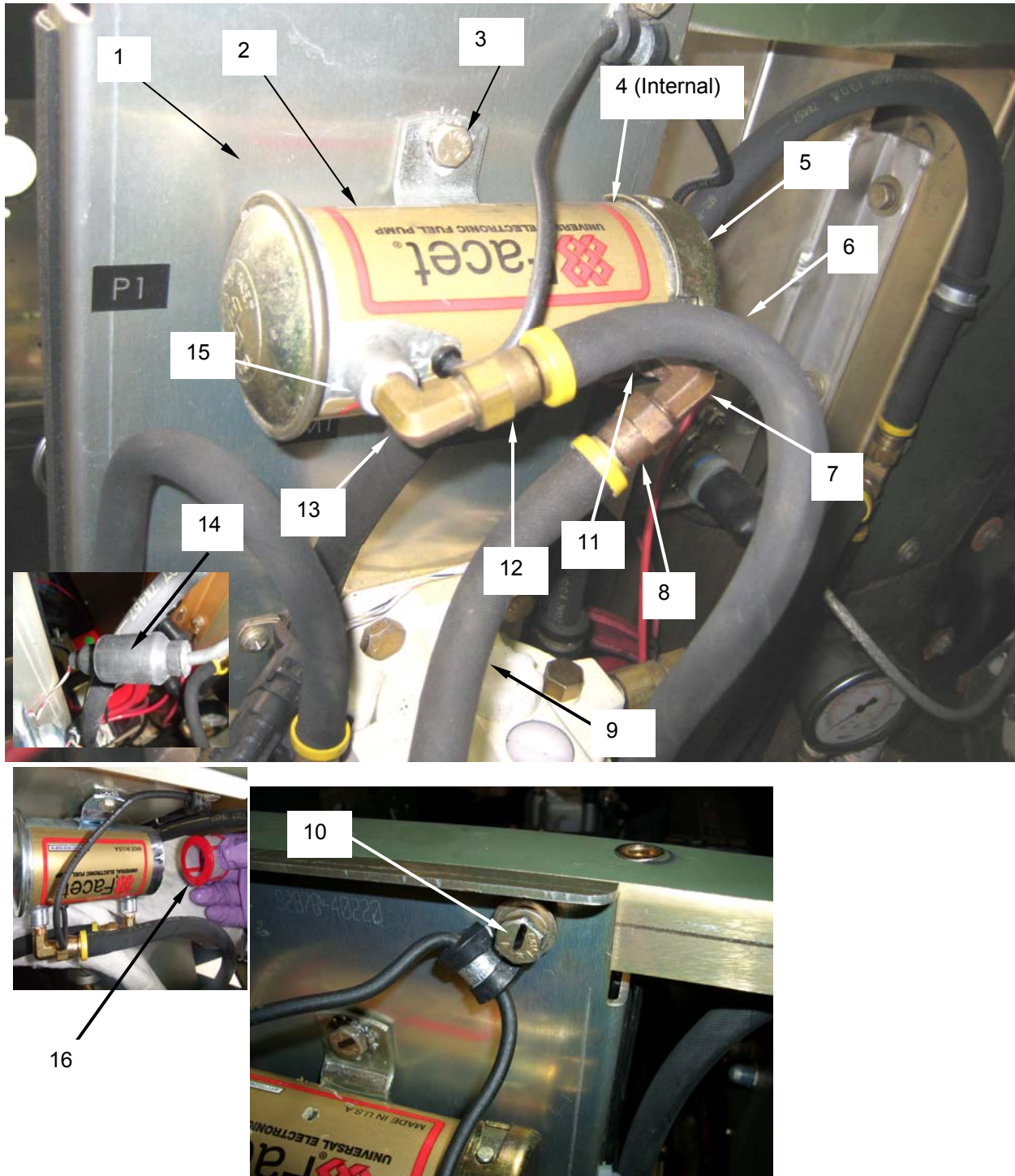


Figure 1. Service and Replace Electronic Fuel Pump (Sheet 1 of 2).

REPLACE - Continued

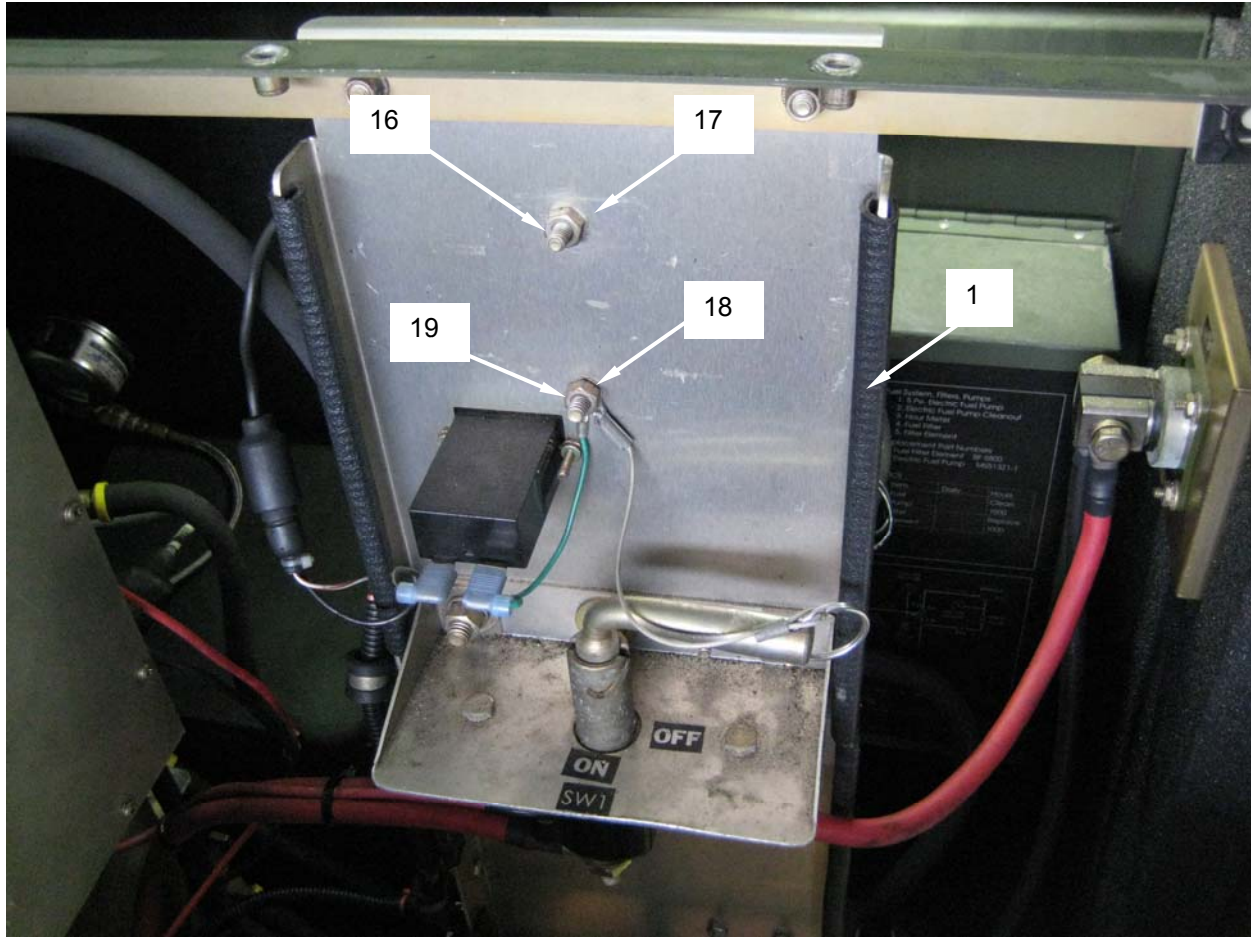


Figure 1. Service and Replace Electronic Fuel Pump (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE



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**SERVICE MAINTENANCE****3-WAY FUEL SOLENOID VALVE  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Sealing Compound (WP 0123, Item 17) or,  
Tape, Antiseizing (WP 0123, Item 23)  
Rags, Wiping (WP 0123, Item 15)  
Mat, Petroleum Absorbent (WP 0123, Item 14)  
Tray, Petroleum Absorbent (WP 0123, Item 26)  
Tags, Marking (WP 0123, Item 22)  
Gloves, Chemical and Oil Protective (WP 0123,  
Item 6)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.  
Fuel system access door open.  
Fuel access door open.

---

**WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel solenoid valve to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of fuel soaked rags IAW local SOP.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**REPLACE**

1. Tag and mark the three fuel hoses that are connected to the solenoid valve.
2. Disconnect the solenoid valve electrical connector (Figure 1, Item 9) by separating the two halves.
3. Loosen the compression fitting (Figure 1, Item 12) and remove fuel hose #1 (Figure 1, Item 10).
4. Loosen the compression fitting (Figure 1, Item 3) and remove fuel hose #2 (Figure 1, Item 4).
5. Loosen the compression fitting (Figure 1, Item 7) and remove fuel hose #3 (Figure 1, Item 8).
6. Clean up any spilled fuel with a rag.
7. Remove the two mounting screws (Figure 1, Item 17) and lockwashers (Figure 1, Item 16), on the engine side of the mounting panel.
8. Remove the defective solenoid valve (Figure 1, Item 15).
9. Remove the elbow fitting (Figure 1, Item 2), noting its orientation and set aside. Clean all residual thread sealant from the fitting.

**REPLACE - Continued**

10. Remove the male-to-male threaded fitting (Figure 1, Item 13) and set aside. Clean all residual thread sealant from the fitting.
11. Remove elbow (Figure 1, Item 6) from solenoid fitting (Figure 1, Item 5) and set aside. Clean all residual thread sealant from the fitting.
12. Apply thread sealant and install elbow (Figure 1, Item 6) on solenoid fitting (Figure 1, Item 5), taking care to align the elbow fitting as noted earlier.
13. Apply thread sealant to one end of the male-to-male threaded fitting (Figure 1, Item 13).
14. Install the end of the male-to-male threaded fitting (Figure 1, Item 13) with the applied thread sealant into the fitting (Figure 1, Item 14) on the Normally Open (NO) port of the solenoid valve (Figure 1, Item 15). Tighten securely.
15. Apply new thread sealant to one end of elbow fitting (Figure 1, Item 2).
16. Install end of elbow fitting (Figure 1, Item 2) with thread sealant into the fitting (Figure 1, Item 1) on the Common (COM) port of the solenoid valve (Figure 1, Item 15) taking care to align the elbow as noted previously.
17. Install a new solenoid valve (Figure 1, Item 15) by aligning the holes in the rear of the solenoid valve with the holes in the mounting panel (Figure 1, Item 11).
18. Install the lockwashers (Figure 1, Item 16) and mounting screws (Figure 1, Item 17). Tighten securely.
19. Install fuel hose #3 (Figure 1, Item 8) on compression fitting (Figure 1, Item 7). Tighten securely.
20. Install fuel hose #2 (Figure 1, Item 4) on compression fitting (Figure 1, Item 3). Tighten securely.
21. Install fuel hose #1 (Figure 1, Item 10) on compression fitting (Figure 1, Item 12). Tighten securely.
22. Reconnect the solenoid valve electrical connector (Figure 1, Item 9) by mating the two halves and pushing together until locked.
23. Remove all tags and markings.

REPLACE - Continued

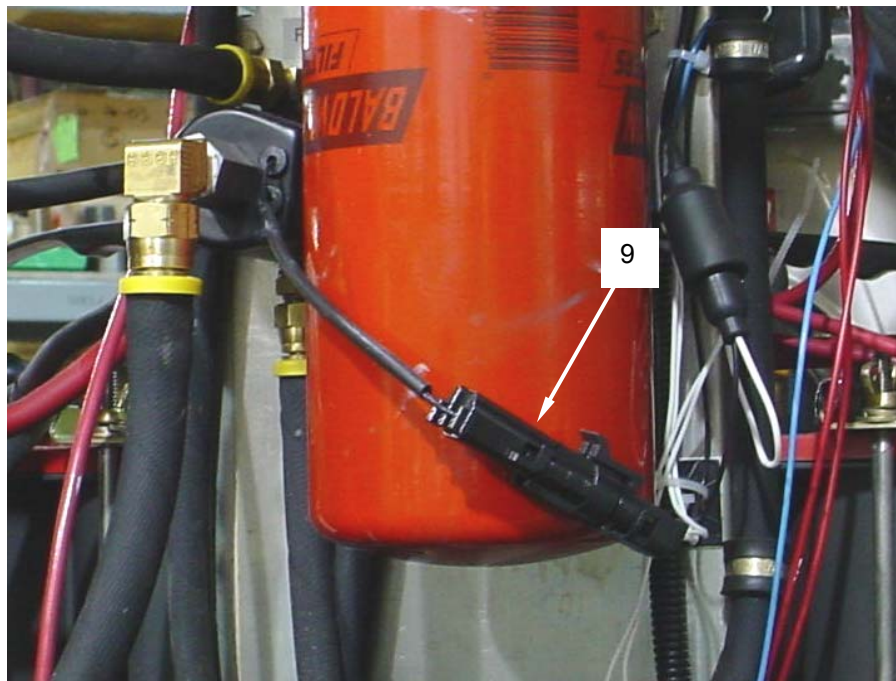
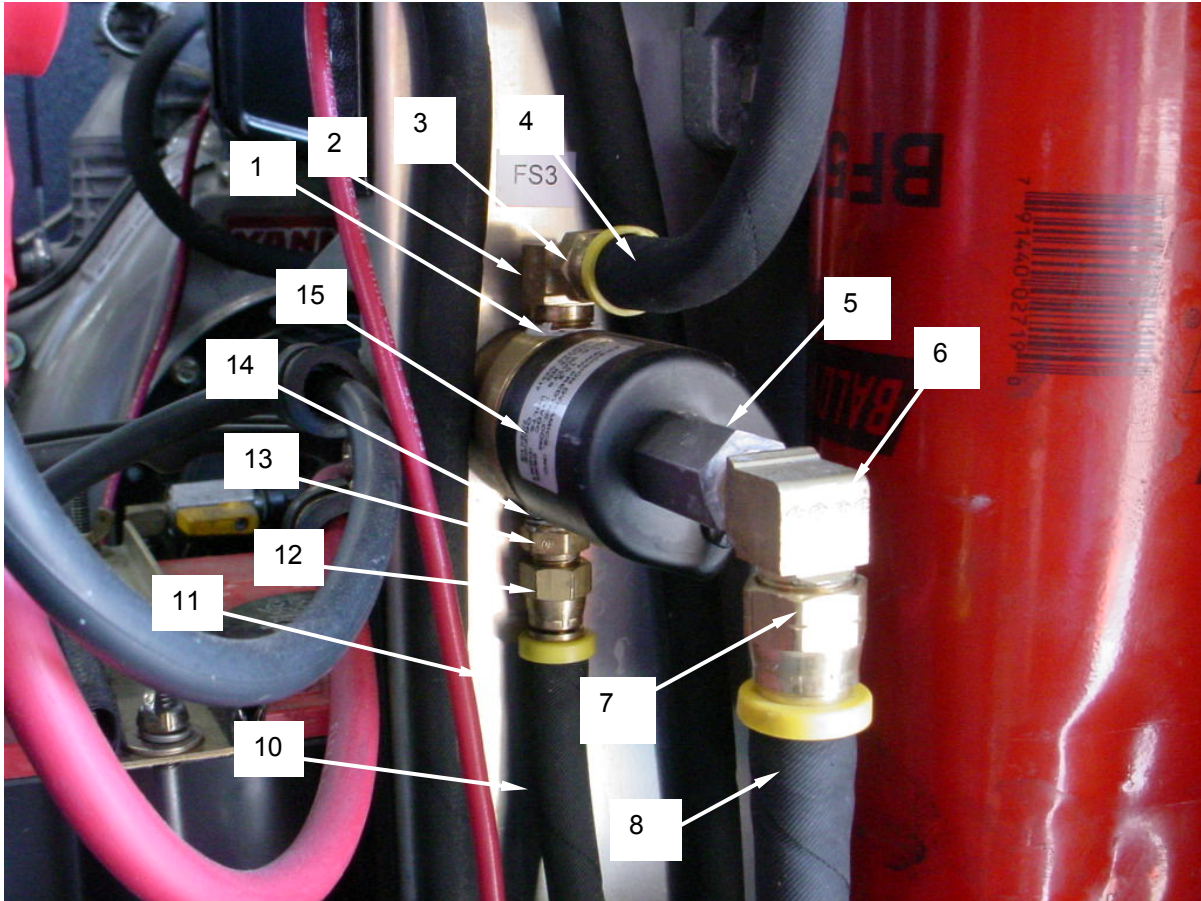


Figure 1. Replace 3-Way Fuel Solenoid Valve (Sheet 1 of 2).

## REPLACE - Continued

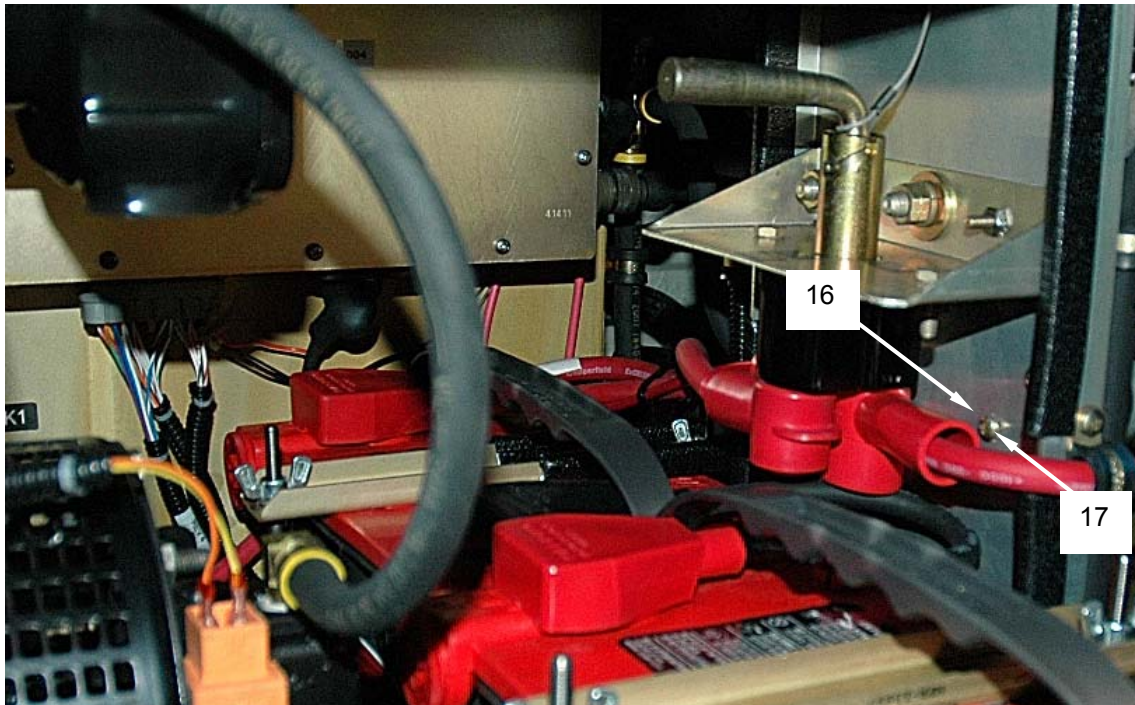


Figure 1. Replace 3-Way Fuel Solenoid Valve (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE**
**MAIN BATTERY SHUT-OFF SWITCH  
TEST, REPLACE**


---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Tags, Marking (WP 0123, Item 22)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.  
Engine access door open.

---

**TEST**

1. Remove cables from main battery shut-off switch (Figure 1, Item 9) as detailed in steps 1 through 5 below.
2. Set multimeter to read continuity and place leads of multimeter across the front (Figure 1, Item 13) and rear (Figure 1, Item 12) studs on the main battery shut-off switch (Figure 1, Item 9).
3. Verify that when the main battery shut-off switch (Figure 1, Item 9) is in the ON position, the multimeter reads as a short circuit (continuity) through the main battery shut-off switch.
4. Verify that, when the main battery shut-off switch (Figure 1, Item 9) is in the OFF position, the multimeter reads as an open circuit through the main battery shut-off switch.

**END OF TASK****REPLACE**

1. Open the engine access door (Figure 1, Item 1) to gain access to the main battery shut-off switch (Figure 1, Item 8) on the rear of the fuel assembly panel (Figure 1, Item 3).
2. Remove the negative battery cable from negative terminal of outboard battery.
3. Tag and mark wires connected to main battery shut-off switch (Figure 1, Item 9).
4. Remove rubber insulating boot (Figure 1, Item 5), and then remove nut (Figure 1, Item 11) and wires (Figure 1, Item 15) from the rear stud (Figure 1, Item 12) of the main battery shut-off switch (Figure 1, Item 9).
5. Remove the nut (Figure 1, Item 14) and wire (Figure 1, Item 15) from the front stud (Figure 1, Item 13) of the main battery shut-off switch (Figure 1, Item 9).
6. Remove the two nuts (Figure 1, Item 7), bolts (Figure 1, Item 4), and lockwashers (Figure 1, Item 6) that secure the main battery shut-off switch (Figure 1, Item 9) to the fuel assembly panel mounting bracket (Figure 1, Item 16).
7. Remove main battery shut-off switch handle.

**REPLACE - Continued**

8. Remove the defective main battery shut-off switch (Figure 1, Item 9).
9. Install a new main battery shut-off switch (Figure 1, Item 9) by aligning the holes in the switch mounting plate (Figure 1, Item 8) with the holes in the fuel assembly panel mounting bracket (Figure 1, Item 16).
10. Install main battery shut-off switch handle. Ensure that the handle (Figure 1, Item 2) faces towards the engine access door and that the switch is in the OFF position.
11. Install the two bolts (Figure 1, Item 4), lockwashers (Figure 1, Item 6), and nuts (Figure 1, Item 7) that secure the main battery shut-off switch (Figure 1, Item 9) to the fuel assembly panel mounting bracket (Figure 1, Item 16) and tighten securely.
12. Install cables (Figure 1, Item 10) to the rear stud (Figure 1, Item 12) of the main battery shut-off switch (Figure 1, Item 9). Install nut (Figure 1, Item 11). Tighten securely.
13. Install the cable (Figure 1, Item 15) to the front stud (Figure 1, Item 13) of the main battery shut-off switch (Figure 1, Item 9). Install nut (Figure 1, Item 14). Tighten securely, and install rubber insulation boot (Figure 1, Item 5).
14. Remove all tags and markings from wires.
15. Reconnect negative battery cable to negative terminal of outboard battery.
16. Close and latch engine access door (Figure 1, Item 1).



Figure 1. Replace Main Battery Shut-off Switch (Sheet 1 of 2).

REPLACE - Continued

NOTE

Rubber insulating boots removed from photo for clarity.

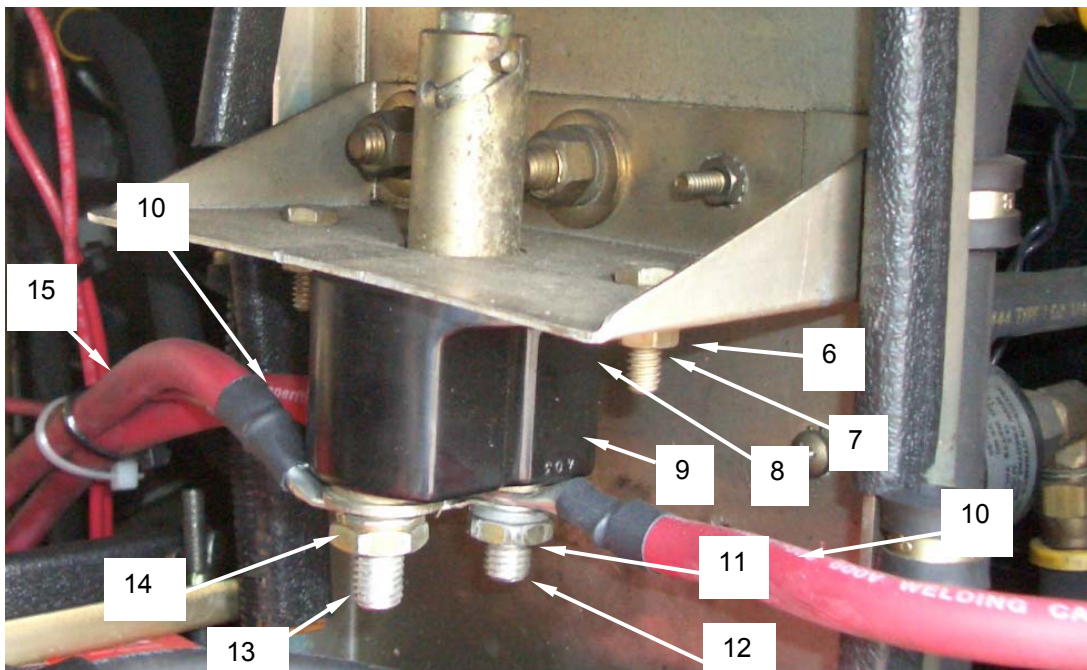
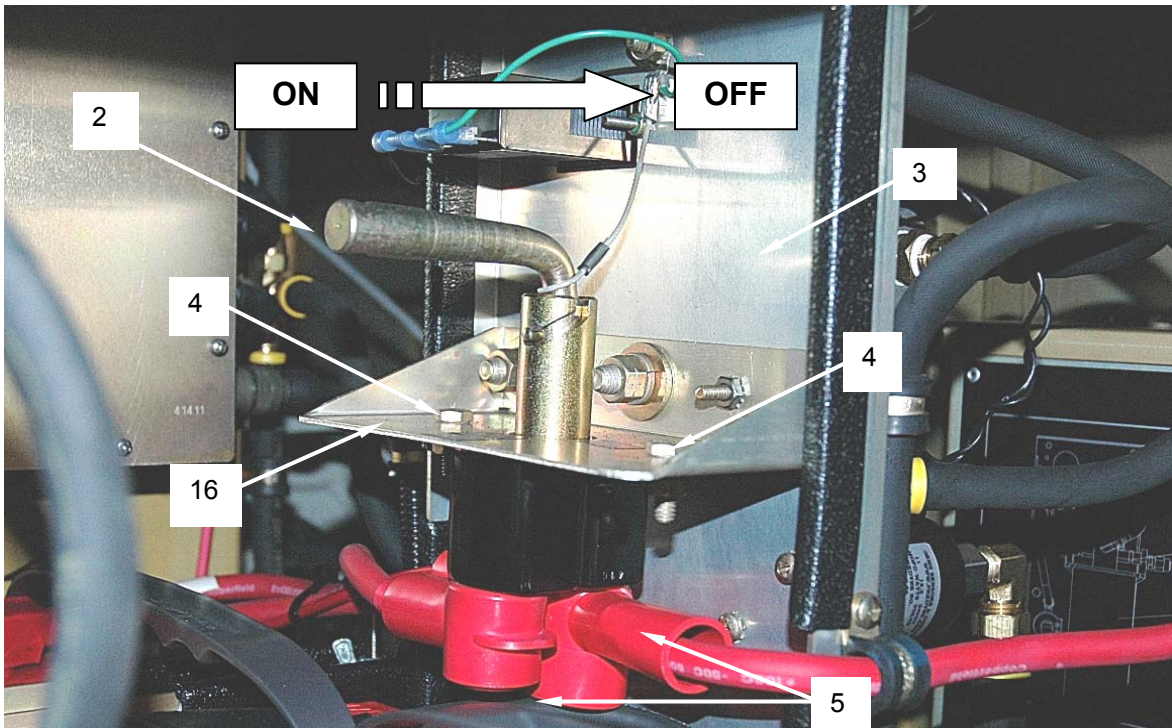


Figure 1. Replace Main Battery Shut-off Switch (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE





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**SERVICE MAINTENANCE**  
**MECHANICAL HOUR METER**  
**TEST, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124 Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Tags, Marking (WP 0123, Item 22)

**Equipment Condition**

Heater shut down and cool, except during TEST.  
Main battery switch OFF and handle removed, except during TEST.  
Engine access door open, except during TEST.

---

**TEST**

1. With the heater off, open the fuel system access door and record the number of hours displayed on the hour meter.
2. Close fuel system access door and start heater. Allow heater to run at least 1 hour and 15 minutes as measured on a wristwatch or other timepiece.
3. Shut heater down and allow to cool.
4. Open fuel system access door and record number or hours displayed on hour meter. If the number of hours has not increased by one hour, replace the hour meter as detailed in the section of this work package entitled "REPLACE."

**END OF TASK****REPLACE****NOTE**

Write down the total number of hours displayed on the front of the hour meter and report this information to your supervisor so that an accurate record can be maintained of the total hours operated for the heater.

1. Tag and/or mark the two wires leading to the rear of the hour meter (Figure 1, Item 1) on the back side of the fuel panel assembly (Figure 1, Item 3).
2. Remove the two spade connectors (Figure 1, Item 6) that attach to the rear of the hour meter (Figure 1, Item 1).
3. Remove the two screws (Figure 1, Item 5) and locknuts (Figure 1, Item 2) that secure the hour meter (Figure 1, Item 1) to the fuel panel assembly (Figure 1, Item 3).
4. Remove the defective hour meter (Figure 1, Item 1).

**REPLACE - Continued**

5. Install a new hour meter (Figure 1, Item 1) through the opening in the fuel panel assembly (Figure 1, Item 3).
6. Install two screws (Figure 1, Item 5) and locknuts (Figure 1, Item 2). Tighten securely.
7. Install the two spade connectors (Figure 1, Item 6) on the rear terminals (Figure 1, Item 4) of the hour meter.

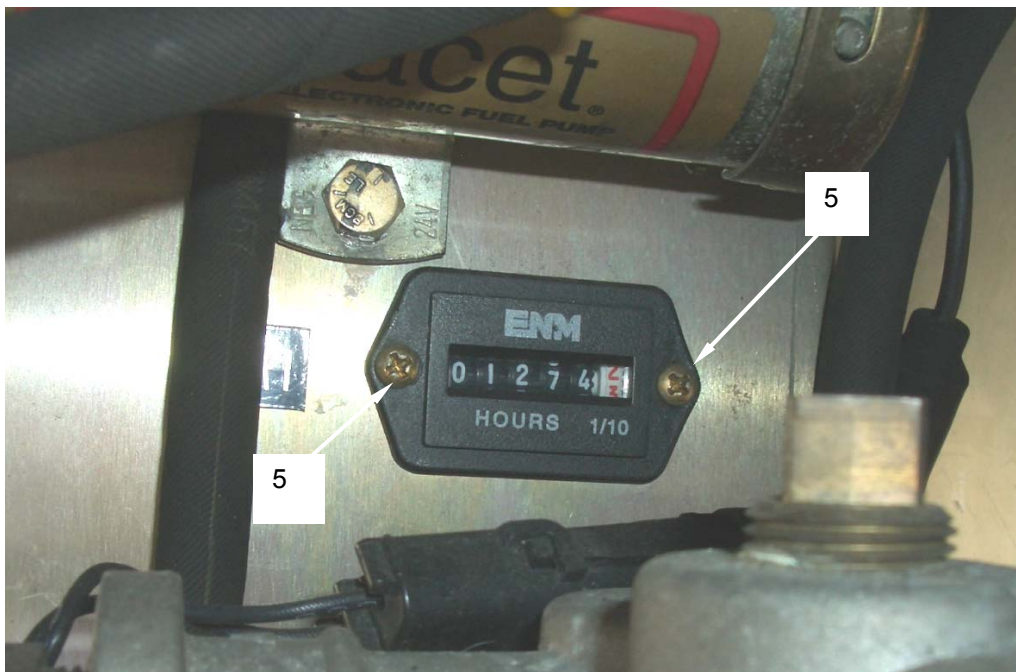
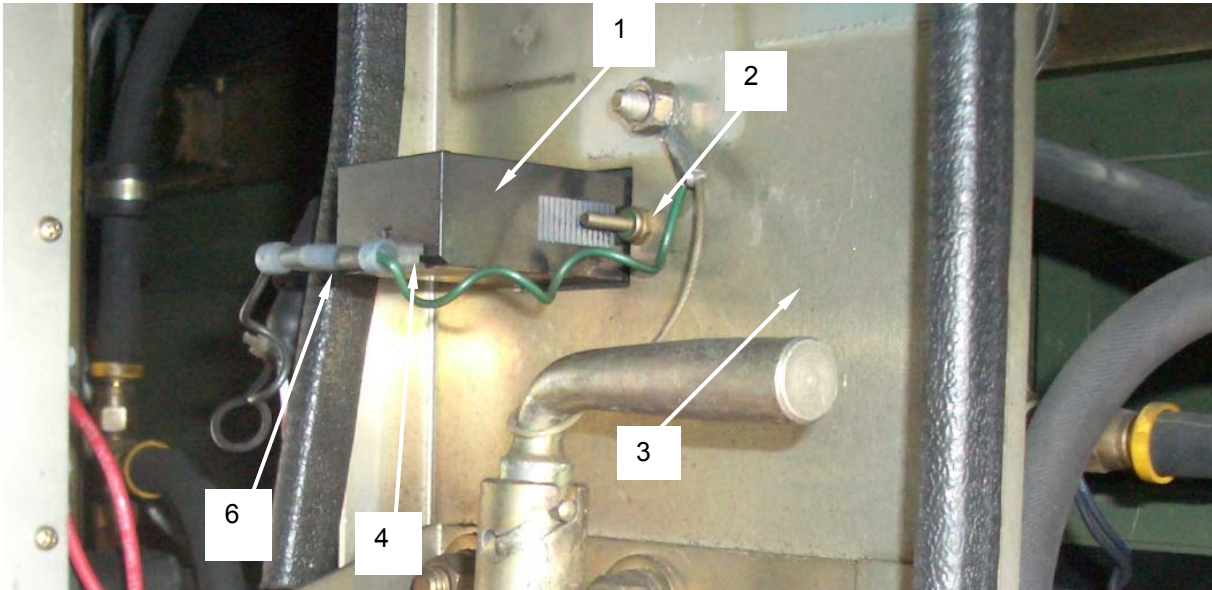


Figure 1. Test and Replace Mechanical Hour Meter.

**END OF TASK**

**END OF WORK PACKAGE**

**SERVICE MAINTENANCE****2-WAY FUEL SOLENOID VALVE  
REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Brush, Wire, Scratch (WP 0123, Item 4)  
Mat, Petroleum Absorbent (WP 0123, Item 14)  
Sealing Compound (WP 0123, Item 17), or  
Tape, Antiseizing (WP 0123, Item 23)  
Tags, Marking (WP 0123, Item 22)  
Gloves, Chemical and Oil Protective (WP 0123,  
Item 6)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.

**REPLACE****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel solenoid valve to collect any fuel. Be sure to wipe up any spills with a rag. Properly dispose of fuel soaked rags IAW local SOP.

Be sure to wear protective gloves when performing procedures where skin can come in contact with fuel. Failure to do so may result in skin irritation.

1. Remove the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 1). Set all hardware aside.



Figure 1. Removing Hardware Securing Retaining Plate.

**REPLACE - Continued**

2. Remove the fuel filler cap and strainer and set aside on a petroleum absorbent mat (Figure 2).



Figure 2. Remove Fuel Filler Cap and Strainer.

3. Remove the retaining plate and set aside (Figure 3).



Figure 3. Remove Retaining Plate.

**REPLACE - Continued**

4. Remove the bolts, lockwashers, and flat washers from the perimeter of the end panel. Set hardware aside (Figure 4).



Figure 4. Remove Hardware from Perimeter of End Panel.

5. Move the end panel away from the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 5).



Figure 5. Move End Panel from Heater to Gain Access to Fuel Hose.

**REPLACE - Continued**

6. Place a petroleum absorbent mat under the external fuel hose fitting on the inboard side of the end panel.
7. Tag and remove the external fuel hose from fitting on inboard side of end panel (Figure 6).



Figure 6. Remove External Fuel Hose from Fitting.

8. Set the end panel aside (Figure 7).



Figure 7. Set End Panel Aside.

**REPLACE - Continued**

9. Install the fuel strainer and fuel filler cap on the fuel tank to ensure that debris or other foreign objects do not fall into the fuel tank.
10. Remove burner feed line from elbow fitting on the side of the 2-way solenoid valve labeled "OUT" (Figure 8).



Figure 8. Remove Burner Feed Line from Elbow Fitting.

11. Remove the burner fuel pump fuel hose connected to the elbow and Tee at the "IN" side of the solenoid valve (Figure 9).

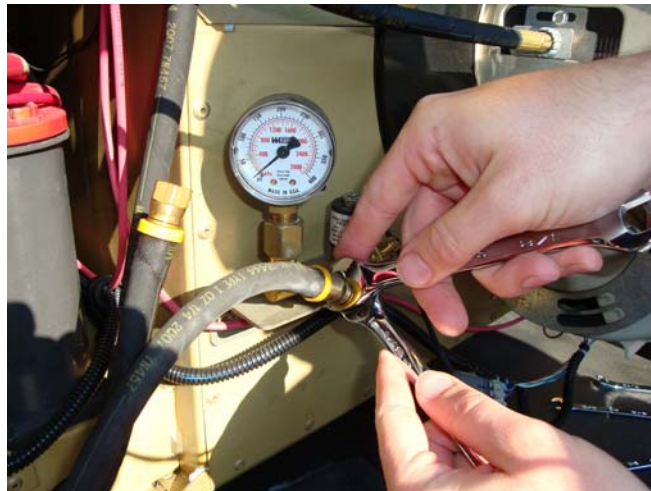


Figure 9. Remove Burner Fuel Pump Fuel Hose Connected to Elbow and Tee.

**REPLACE - Continued**

12. Disconnect the solenoid wire harness connector from the 2-way solenoid valve (Figure 10).

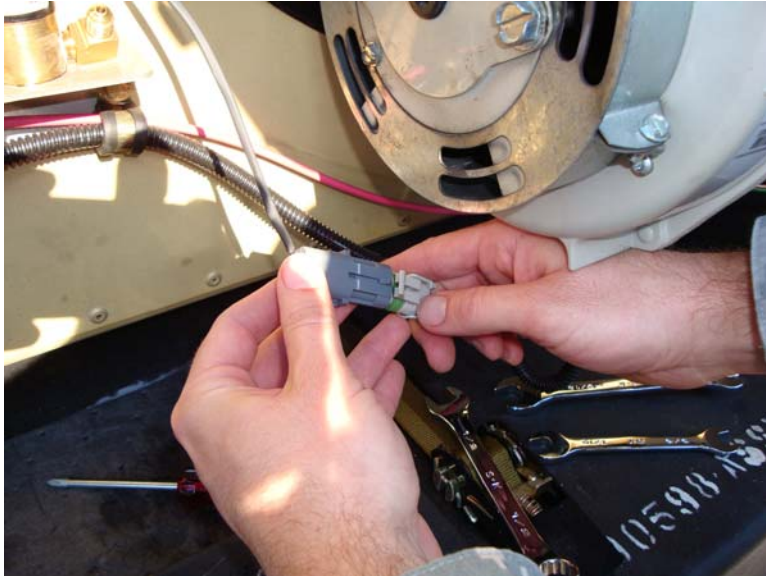


Figure 10. Disconnect Solenoid Wire Harness Connector.

13. Remove the two screws at the base of the 2-way solenoid valve (Figure 11). Set the screws aside.

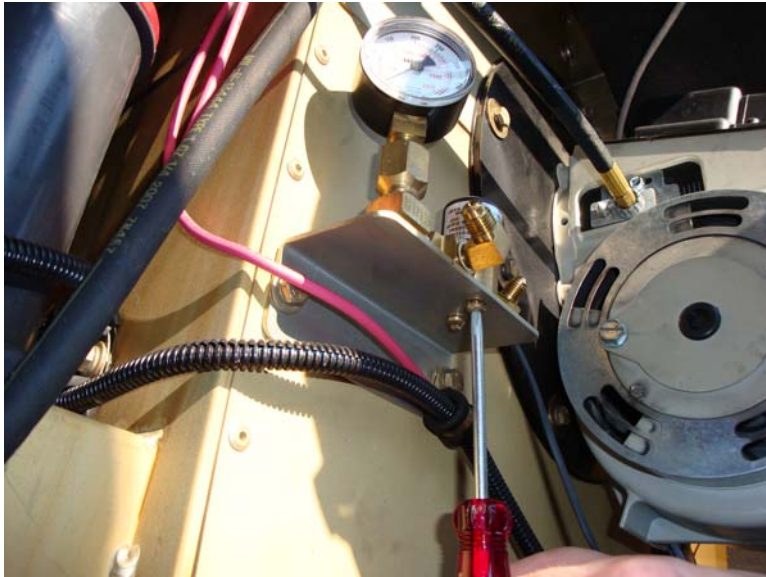


Figure 11. Remove Screws at Base of 2-Way Solenoid Valve.



**REPLACE - Continued**

14. Remove the entire pressure gauge and defective 2-way solenoid valve (Figure 12) assembly and place on a convenient work surface.



Figure 12. Remove Assembly and Place on Work Surface.

15. Note the orientation of the elbow fitting, and remove the elbow fitting from the side of the 2-way solenoid valve labeled "OUT." Clean residual thread sealant or tape from the fitting and set aside (Figure 13).



Figure 13. Remove Elbow Fitting from Side of Solenoid Valve.

**REPLACE - Continued**

16. Note the orientation of the tee fitting mounted to the side of the solenoid valve labeled "IN" and remove the defective solenoid valve. Clean any residual thread sealant or tape from the tee fitting and pressure gauge assembly and set aside (Figure 14).

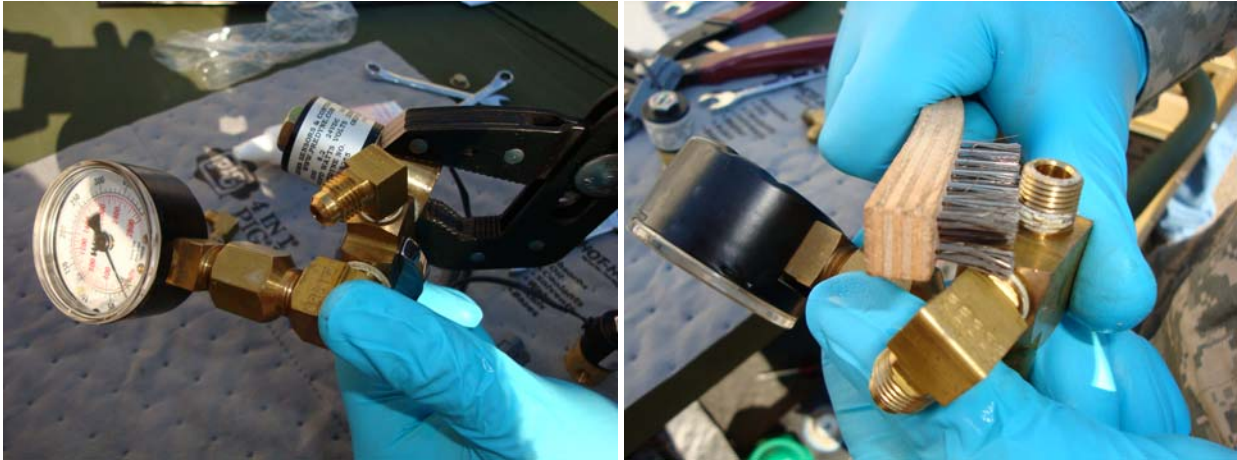


Figure 14. Remove Defective Solenoid Valve and Clean Fittings.

17. Apply fresh thread sealant to the threads of the tee fitting and install the tee fitting to the side of the new 2-way solenoid valve labeled "IN." Ensure the tee fitting and new solenoid valve are secure and correctly aligned as noted earlier (Figure 15).



Figure 15. Apply Thread Sealant and Install Tee Fitting to New Solenoid Valve.

**REPLACE - Continued**

18. Apply fresh thread sealant to the threads of the elbow fitting set aside earlier and install the elbow fitting to the side of the new 2-way solenoid valve labeled "OUT." Ensure the fitting is secure and correctly aligned as noted earlier (Figure 16).



Figure 16. Apply Thread Sealant and Install Elbow Fitting on Solenoid Valve.

19. Install the reassembled pressure gauge and 2-way solenoid valve assembly onto the burner valve mounting bracket by aligning the holes in the base of the 2-way solenoid valve with the holes in the burner valve mounting bracket. Install the two screws set aside earlier. Tighten securely (Figure 17).



Figure 17. Install Reassembled Assembly onto Burner Valve Mounting Bracket.

**REPLACE - Continued**

20. Install the burner fuel pump fuel hose to the elbow and Tee fitting at the “IN” side of the solenoid valve (Figure 18).

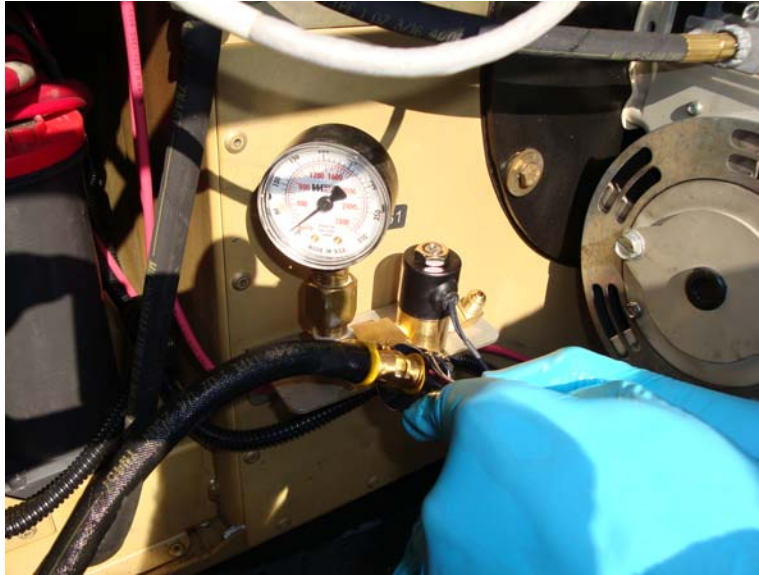


Figure 18. Install Burner Fuel Pump Hose on Elbow and Tee Fitting.

21. Install burner feed line on elbow fitting on the side of the 2-way solenoid valve labeled “OUT” (Figure 19).



Figure 19. Install Burner Feed Line on Elbow Fitting.

**REPLACE - Continued**

22. Connect the solenoid wire harness to the 2-way solenoid valve (Figure 20).

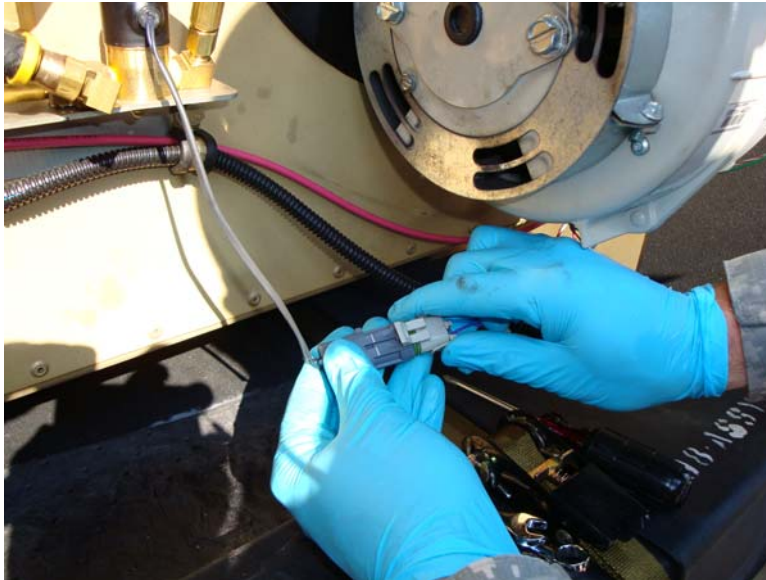


Figure 20. Connect Solenoid Wire Harness Connector.

23. Remove the fuel filler cap and strainer and set aside on a petroleum absorbent mat.
24. Remove any petroleum absorbent mat that was placed inside the heater. Dispose of IAW local environmental regulations and/or Unit SOP.
25. Move the end panel set aside earlier into position near the fuel tank end of the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 21).

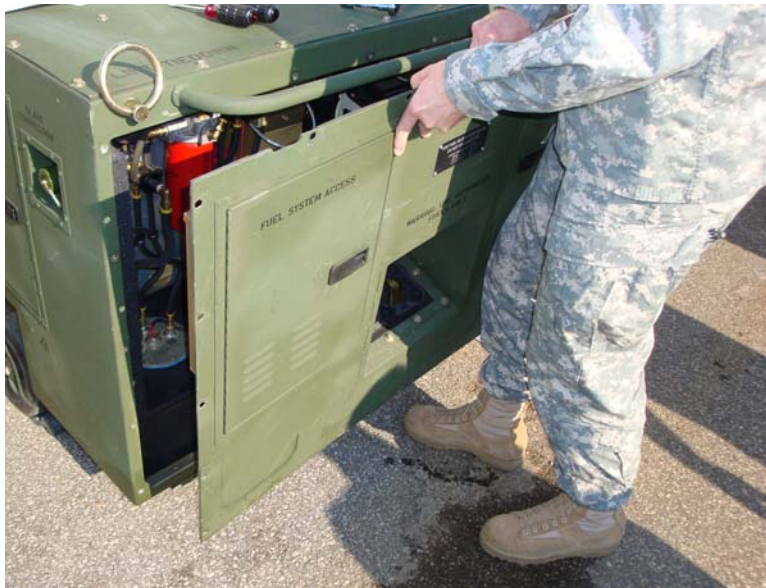


Figure 21. Move End Panel into Position Near Fuel Tank End of Heater.

**REPLACE - Continued**

26. Install the external fuel hose, tagged earlier, on the fitting mounted to the inboard side of end panel (Figure 22).
27. Remove fuel strainer and fuel filler cap from the fuel tank.



Figure 22. Install External Fuel Hose to Fitting.

28. Position the retaining plate, set aside earlier, over the fuel tank filler neck and fuel gauge (Figure 23).
29. Install the fuel strainer and fuel filler cap on the fuel tank.



Figure 23. Position Retaining Plate Over Fuel Tank Filler Neck and Fuel Gauge.

**REPLACE - Continued**

30. Install all bolts, lockwashers, and flat washers around the perimeter of the end panel. Tighten securely (Figure 24).



Figure 24. Install Hardware Around Perimeter of End Panel.

31. Install the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 25).



Figure 25. Install Hardware to Secure Retaining Plate.

**END OF TASK**

**END OF WORK PACKAGE**





**SERVICE MAINTENANCE****PRESSURE GAGE  
REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 17), or  
Tape, Antiseizing (WP 0123, Item 23)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle removed.

**REPLACE****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the pressure gage to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of a fuel soaked rag IAW Unit SOP and/or local environmental regulations.

1. Remove the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 1). Set all hardware aside.



Figure 1. Removing Hardware Securing Retaining Plate.

**REPLACE - Continued**

2. Remove the fuel filler cap and strainer and set aside on a petroleum absorbent mat (Figure 2).



Figure 2. Remove Fuel Filler Cap and Strainer.

3. Remove the retaining plate and set aside (Figure 3).



Figure 3. Remove Retaining Plate.

**REPLACE - Continued**

4. Remove the bolts, lockwashers, and flat washers from the perimeter of the end panel. Set hardware aside (Figure 4).



Figure 4. Remove Hardware from Perimeter of End Panel.

5. Move the end panel away from the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 5).



Figure 5. Move End Panel from Heater to Gain Access.

**REPLACE - Continued**

6. Place a petroleum absorbent mat under the external fuel hose fitting on the inboard side of the end panel.
7. Tag and remove the external fuel hose from fitting on inboard side of end panel (Figure 6).



Figure 6. Remove External Fuel Hose from Fitting.

8. Set the end panel aside (Figure 7).



Figure 7. Set End Panel Aside.

**REPLACE - Continued**

9. Install the fuel strainer and fuel filler cap on the fuel tank to ensure that debris or other foreign objects do not fall into the fuel tank.

**CAUTION**

Be sure to hold the nut on the union fitting with a wrench when removing the defective pressure gauge. Failure to support the fitting may result in damage.

10. While holding the nut of the fitting with a wrench, unscrew the defective pressure gauge (Figure 8, Item 1) from fitting (Figure 8, Item 2).
11. Apply thread sealant on the threads of the new pressure gage.
12. Screw the new pressure gage (Figure 8, Item 1) into the fitting (Figure 8, Item 2).

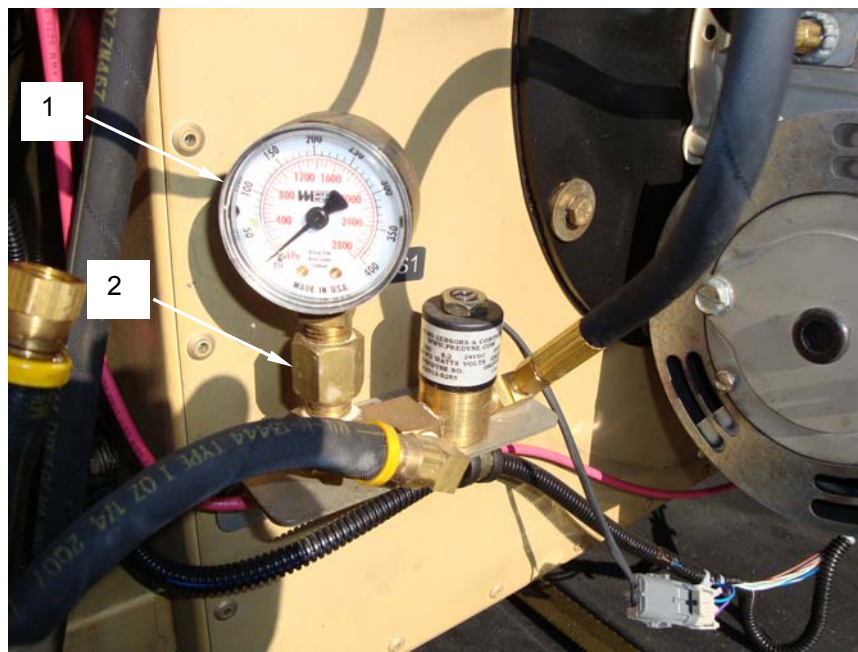


Figure 8. Install New Pressure Gauge.

13. Remove the fuel filler cap and strainer and set aside on a petroleum absorbent mat.
14. Remove any petroleum absorbent mat that was placed inside the heater. Dispose of IAW local environmental regulations and/or Unit SOP.

**REPLACE - Continued**

15. Move the end panel set aside earlier into position near the fuel tank end of the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 9).



Figure 9. Move End Panel into Position Near Fuel Tank.

16. Install the external fuel hose, tagged earlier, on the fitting mounted to the inboard side of end panel (Figure 10).



Figure 10. Install External Fuel Hose to Fitting.

**REPLACE - Continued**

17. Position the retaining plate, set aside earlier, over the fuel tank filler neck and fuel gauge (Figure 11).
18. Install the fuel strainer and fuel filler cap on the fuel tank.



Figure 11. Position Retaining Plate Over Fuel Tank Filler Neck.

19. Install all bolts, lockwashers, and flat washers around the perimeter of the end panel. Tighten securely (Figure 12).



Figure 12. Install Hardware Around Perimeter of End Panel.

**REPLACE - Continued**

20. Install the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 13).



Figure 13. Install Hardware to Secure Retaining Plate.

**END OF TASK**

**END OF WORK PACKAGE**



**SERVICE MAINTENANCE****FUEL TANK  
REPAIR, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Container, Fuel (Unit Asset; Fuel Capacity 35 gallons or more)  
Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 18)  
Tags, Marking (WP 0123, Item 22)  
Gloves, Chemical and Oil Protective (WP 0123, Item 6)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle removed.

**References**

WP 0042

**REPAIR****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel tank to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of fuel soaked rags IAW local SOP.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**CAUTION**

The fuel tank can be repaired only by replacing defective components such as the fuel tank level switch IAW WP 0042. A fuel tank that has been punctured cannot be repaired and must be replaced IAW the section of this work package entitled "REPLACE."

1. Remove the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 1). Set all hardware aside.

**REPAIR - Continued**

Figure 1. Removing Hardware Securing Retaining Plate.

2. Remove the fuel filler cap and strainer and set aside on a petroleum absorbent mat (Figure 2).



Figure 2. Remove Fuel Filler Cap and Strainer.

3. Remove the retaining plate and set aside (Figure 3).



Figure 3. Remove Retaining Plate.

**REPAIR - Continued**

4. Remove the bolts, lockwashers, and flat washers from the perimeter of the end panel. Set hardware aside (Figure 4).



Figure 4. Remove Hardware from Perimeter of End Panel.

5. Move the end panel away from the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 5).



Figure 5. Move End Panel from Heater to Gain Access to Fuel Hose.

**REPAIR - Continued**

6. Place a petroleum absorbent mat under the external fuel hose fitting on the inboard side of the end panel.
7. Tag and remove the external fuel hose from fitting on inboard side of end panel (Figure 6).



Figure 6. Remove External Fuel Hose from Fitting.

8. Set the end panel aside (Figure 7).



Figure 7. Set End Panel Aside.

**REPAIR - Continued**

9. Drain the fuel tank (Figure 8, Item 1) completely into an approved container capable of holding up to 35 gallons. Ensure that petroleum absorbent mats are placed under the heater to catch any fuel that may spill.
10. Remove all components from fuel tank as described in the "REPLACE" section of this work package and inspect for serviceability. Discard any defective components and install new ones in accordance with WP 0042.
11. Install all serviceable components as described in the "REPLACE" procedures in this work package.



Figure 8. Repairing the Fuel Tank.

12. Install the fuel filler cap and strainer and set aside on a petroleum absorbent mat.
13. Remove any petroleum absorbent mat that was placed inside the heater. Dispose of IAW local environmental regulations and/or Unit SOP.

**REPAIR - Continued**

14. Move the end panel set aside earlier into position near the fuel tank end of the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 9).



Figure 9. Move End Panel into Position Near Fuel Tank End of Heater.

15. Install the external fuel hose, tagged earlier, on the fitting mounted to the inboard side of end panel (Figure 10).



Figure 10. Install External Fuel Hose to Fitting.

**REPAIR - Continued**

16. Position the retaining plate, set aside earlier, over the fuel tank filler neck and fuel gauge (Figure 11).
17. Install the fuel strainer and fuel filler cap on the fuel tank.



Figure 11. Position Retaining Plate Over Fuel Tank Filler Neck and Fuel Gauge.

18. Install all bolts, lockwashers, and flat washers around the perimeter of the end panel. Tighten securely (Figure 12).



Figure 12. Install Hardware Around Perimeter of End Panel.

**REPAIR - Continued**

19. Install the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 13).



Figure 13. Install Hardware to Secure Retaining Plate.

**END OF TASK**



**REPLACE****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel tank to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of fuel soaked rags IAW Unit SOP and/or local environmental regulations.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

1. Remove heater end panel and external fuel hose at fuel filler cap end of heater as described in the "REPAIR" section of this work package.
2. Drain the fuel tank (Figure 14, Item 1) completely into an approved container. Ensure that petroleum absorbent mats are placed under the heater to catch any fuel that may spill.
3. Release the quick release mechanisms on the two fuel tank mounting straps (Figure 14, Item 6) in order to free the fuel tank (Figure 14, Item 1) from the fuel tank mounting plate (Figure 14, Item 7).
4. Locate the tank vent hose (Figure 14, Item 2), fuel supply hose (Figure 14, Item 3), and fuel return hose (Figure 14, Item 4).
5. Tag each hose as to its function and location.
6. Loosen and remove the fittings securing hoses, and remove hoses.
7. Disconnect the fuel tank level switch wire harness connector (Figure 14, Item 5).
8. Lift fuel tank (Figure 14, Item 1) and slide out through the rear of the heater.
9. Discard the defective fuel tank and any petroleum absorbent mats in accordance with Unit SOP and/or local environmental regulations.
10. Install a new fuel tank (Figure 14, Item 1) by positioning the tank on the fuel tank mounting plate between the mounting straps (Figure 14, Item 6).
11. Engage the two straps (Figure 14, Item 6) and lock the two quick release mechanisms.
12. Connect the fuel hoses (Figure 14, Item 2, 3, and 4) to the new fuel tank (Figure 14, Item 1) as tagged, and tighten fittings.
13. Connect the fuel tank level switch wire harness connector (Figure 14, Item 5).
14. Reinstall external fuel hose (Figure 14, Item 8), and heater end panel as described in the section of this work package entitled "REPAIR."
15. If necessary, fill fuel tank with fuel IAW WP 0005.

REPLACE - Continued

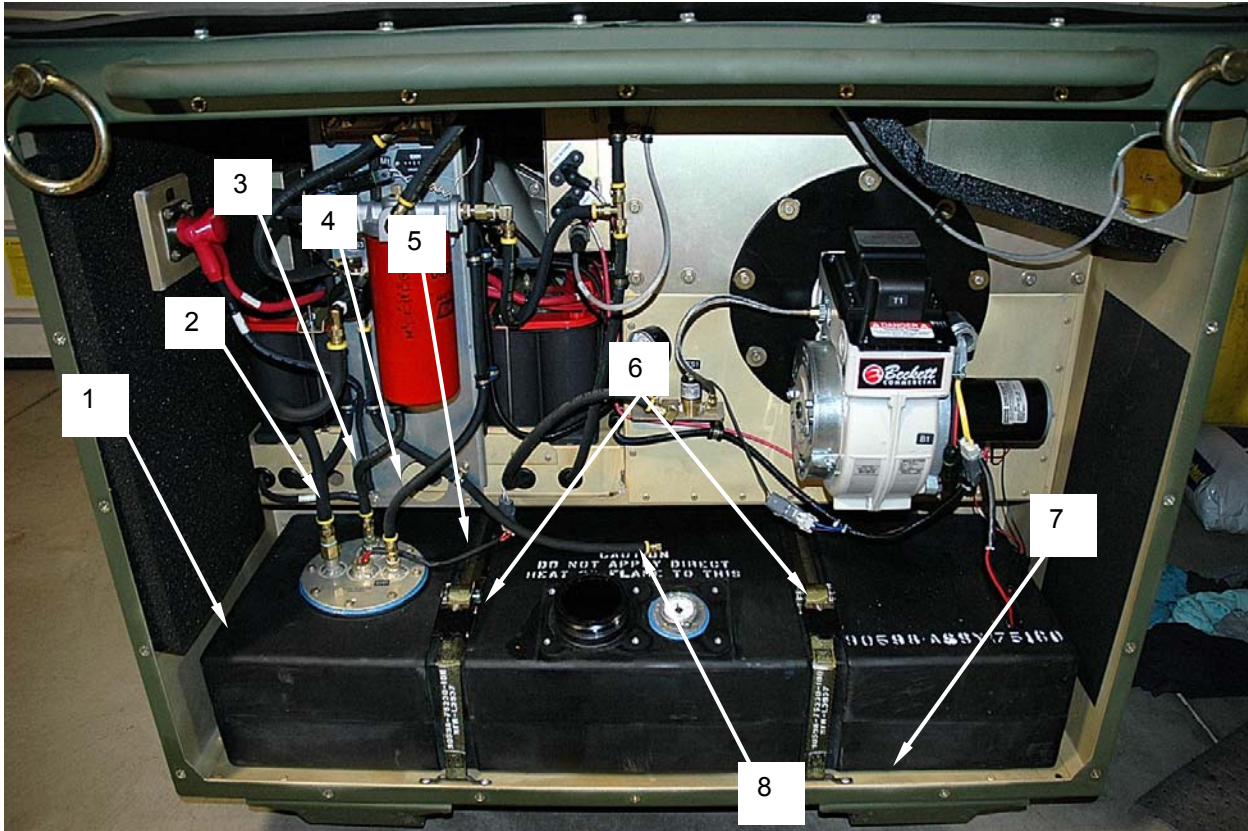


Figure 14. Replace Fuel Tank.

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE**  
**FUEL TANK LEVEL SWITCH**  
**REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Container, Fuel (Unit Asset, Fuel Capacity 35  
gallons or more)  
Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Tags, Marking (WP 0123, Item 22)  
Sealing Compound (WP 0123, Item 18)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.

---

**REPLACE****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel tank to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of fuel soaked rags and mats IAW Unit SOP and/or local environmental regulations.

1. Remove the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 1). Set all hardware aside.



Figure 1. Removing Hardware Securing Retaining Plate.

**REPLACE - Continued**

2. Remove the fuel filler cap and strainer and set aside on a petroleum absorbent mat (Figure 2).



Figure 2. Remove Fuel Filler Cap and Strainer.

3. Remove the retaining plate and set aside (Figure 3).



Figure 3. Remove Retaining Plate.

**REPLACE - Continued**

4. Remove the bolts, lockwashers, and flat washers from the perimeter of the end panel. Set hardware aside (Figure 4).



Figure 4. Remove Hardware from Perimeter of End Panel.

5. Move the end panel away from the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 5).



Figure 5. Move End Panel from Heater to Gain Access to Fuel Hose.

**REPLACE - Continued**

6. Place a petroleum absorbent mat under the external fuel hose fitting on the inboard side of the end panel.
7. Tag and remove the external fuel hose from fitting on inboard side of end panel (Figure 6).



Figure 6. Remove External Fuel Hose from Fitting.

8. Set the end panel aside (Figure 7).



Figure 7. Set End Panel Aside.

**REPLACE - Continued**

9. Drain the fuel tank (Figure 8, Item 1) completely into an approved container capable of holding 35 gallons of fuel. Ensure that petroleum absorbent mats are placed under the heater to catch any fuel that may spill.
10. Tag and/or mark each of the fuel hoses and their respective locations.
11. Loosen the fitting (Figure 8, Item 5) and remove the tank vent hose (Figure 8, Item 4).
12. Loosen the fitting (Figure 8, Item 2) and remove the fuel pickup to remote/external solenoid hose (Figure 8, Item 3).
13. Loosen the fitting (Figure 8, Item 8) and remove the return from fuel filter hose (Figure 8, Item 7).
14. Disconnect fuel tank level switch connector (Figure 8, Item 10).
15. Remove the eight screws (Figure 8, Item 11) and lockwashers (Figure 8, Item 12) that secure the fuel tank level switch assembly (Figure 8, Item 13) to the fuel tank (Figure 8, Item 1). Set the hardware aside.
16. Note the orientation of the fuel tank level switch assembly (Figure 8, Item 13) so that the new assembly can be installed in the same position. Remove the defective fuel tank level switch assembly (Figure 8, Item 13). Clean any residual fuel tank sealant (Figure 8, Item 16) ensuring no debris falls into tank.
17. Apply a bead of new fuel tank sealant (Figure 8, Item 16) to the underside perimeter of the new fuel tank level switch assembly. Install a new fuel tank level switch assembly (Figure 8, Item 13) so that the assembly is oriented as noted earlier. Align the holes in the assembly with the captive fasteners (Figure 8, Item 15) in the fuel tank (Figure 8, Item 1).
18. Install the eight screws (Figure 8, Item 11) and lockwashers (Figure 8, Item 12) that secure the fuel tank level switch assembly (Figure 8, Item 13) to the fuel tank (Figure 8, Item 1). Tighten all hardware securely.
19. Connect fuel tank level switch connector (Figure 8, Item 10).
20. Install the return from fuel filter hose (Figure 8, Item 7) on fuel tank level switch assembly fitting (Figure 8, Item 9). Tighten fitting (Figure 8, Item 8) securely.
21. Install fuel pickup to remote/external solenoid hose (Figure 8, Item 3) on fuel tank level switch assembly fitting (Figure 8, Item 14). Tighten fitting (Figure 8, Item 2) securely.
22. Install tank vent hose (Figure 8, Item 4) on fuel tank level switch assembly fitting (Figure 8, Item 6). Tighten fitting (Figure 8, Item 5) securely.
23. Remove all tags and/or markings.

REPLACE - Continued

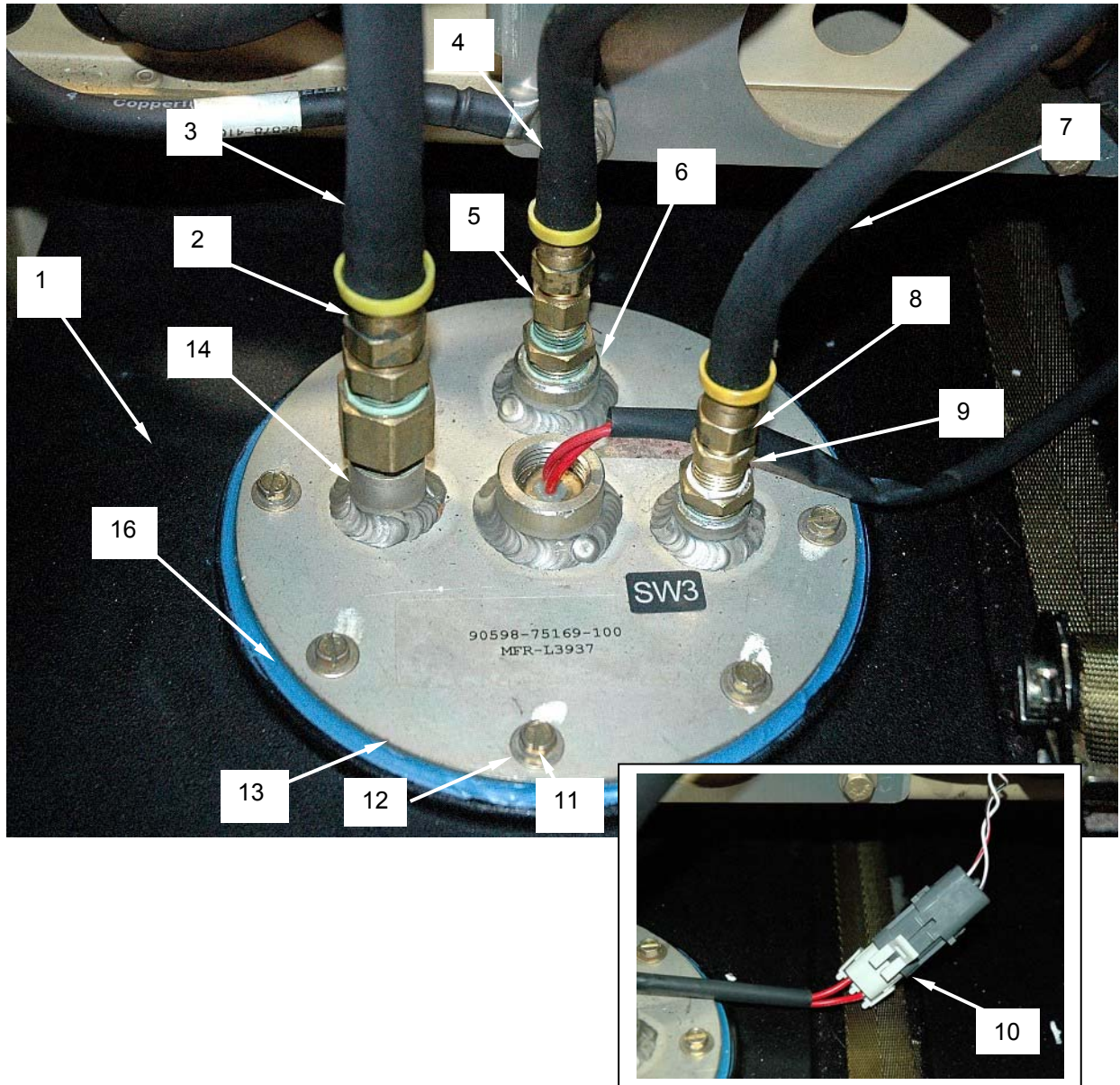


Figure 8. Replace Fuel Tank Level Switch (Sheet 1 of 2).



## REPLACE - Continued

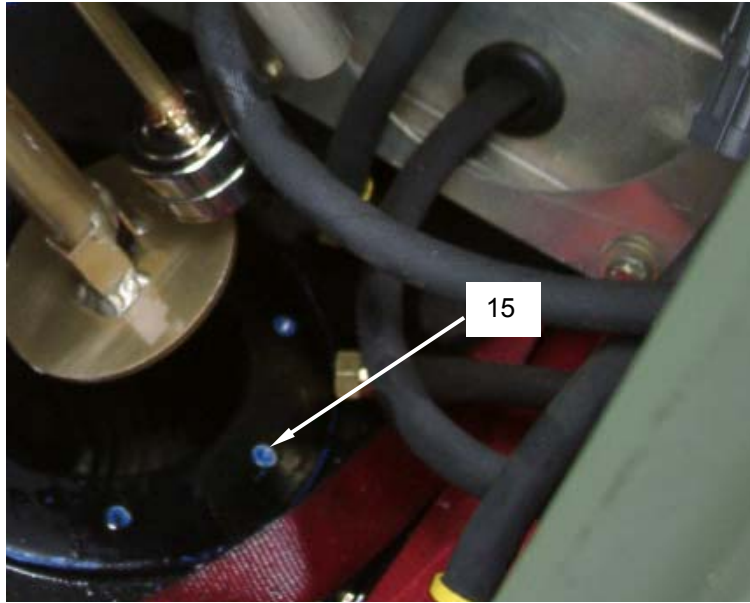


Figure 8. Replace Fuel Tank Level Switch (Sheet 2 of 2).

24. Remove any petroleum absorbent mat that was placed inside the heater. Dispose of IAW local environmental regulations and/or Unit SOP.

**REPLACE - Continued**

25. Move the end panel set aside earlier into position near the fuel tank end of the heater in order to gain access to the hose leading to the external fuel hose fitting (Figure 9).



Figure 9. Move End Panel into Position Near Fuel Tank End of Heater.

26. Install the external fuel hose, tagged earlier, on the fitting mounted to the inboard side of end panel (Figure 10).



Figure 10. Install External Fuel Hose to Fitting.

**REPLACE - Continued**

27. Position the retaining plate, set aside earlier, over the fuel tank filler neck and fuel gauge (Figure 11).
28. Install the fuel strainer and fuel filler cap on the fuel tank.



Figure 11. Position Retaining Plate Over Fuel Tank Filler Neck and Fuel Gauge.

29. Install all bolts, lockwashers, and flat washers around the perimeter of the end panel. Tighten securely (Figure 12).



Figure 12. Install Hardware Around Perimeter of End Panel.

**REPLACE - Continued**

30. Install the six cross-tip screws, lockwashers, and flat washers securing the retaining plate near the fuel filler cap and fuel gauge (Figure 13).



Figure 13. Install Hardware to Secure Retaining Plate.

**END OF TASK**

**END OF WORK PACKAGE**

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**SERVICE MAINTENANCE****EXTERNAL FUEL SUPPLY CONNECTOR  
INSPECT, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**Rag, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 17), or  
Tape, Antiseizing (WP 0123, Item 23)**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.

---

**INSPECT****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel tank to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of fuel soaked rags IAW local SOP.

Inspect the external fuel supply connector (Figure 1, Item 5) and ensure that it is not damaged in any way. Ensure that there is no dust, dirt, or other debris on the interior or exterior surfaces. Ensure that the outer collar (Figure 1, Item 4) operates smoothly and springs back correctly.

**END OF TASK****REPLACE**

1. Remove the external fuel supply connector (Figure 1, Item 5) by placing a wrench or similar tool on the large hex-shaped fitting (Figure 1, Item 2) mounted to the cabinet (Figure 1, Item 1).
2. While holding the large hex-shaped fitting (Figure 1, Item 2) section stationary, grasp the hex-shaped section (Figure 1, Item 3) at the rear of the connector with a wrench or similar tool and rotate counter clockwise. Remove the connector (Figure 1, Item 5).
3. Clean any residual thread sealant from the threads on the large hex-shaped fitting (Figure 1, Item 2).
4. Apply new thread sealant to the threads of the large hex-shaped fitting (Figure 1, Item 2).
5. Install a new external fuel supply connector (Figure 1, Item 5) onto the large hex-shaped fitting (Figure 1, Item 2).
6. While holding the large hex-shaped fitting (Figure 1, Item 2) stationary, grasp the hex-shaped section (Figure 1, Item 3) at the rear of the connector with a wrench or similar tool and rotate clockwise. Tighten securely.

## REPLACE - Continued

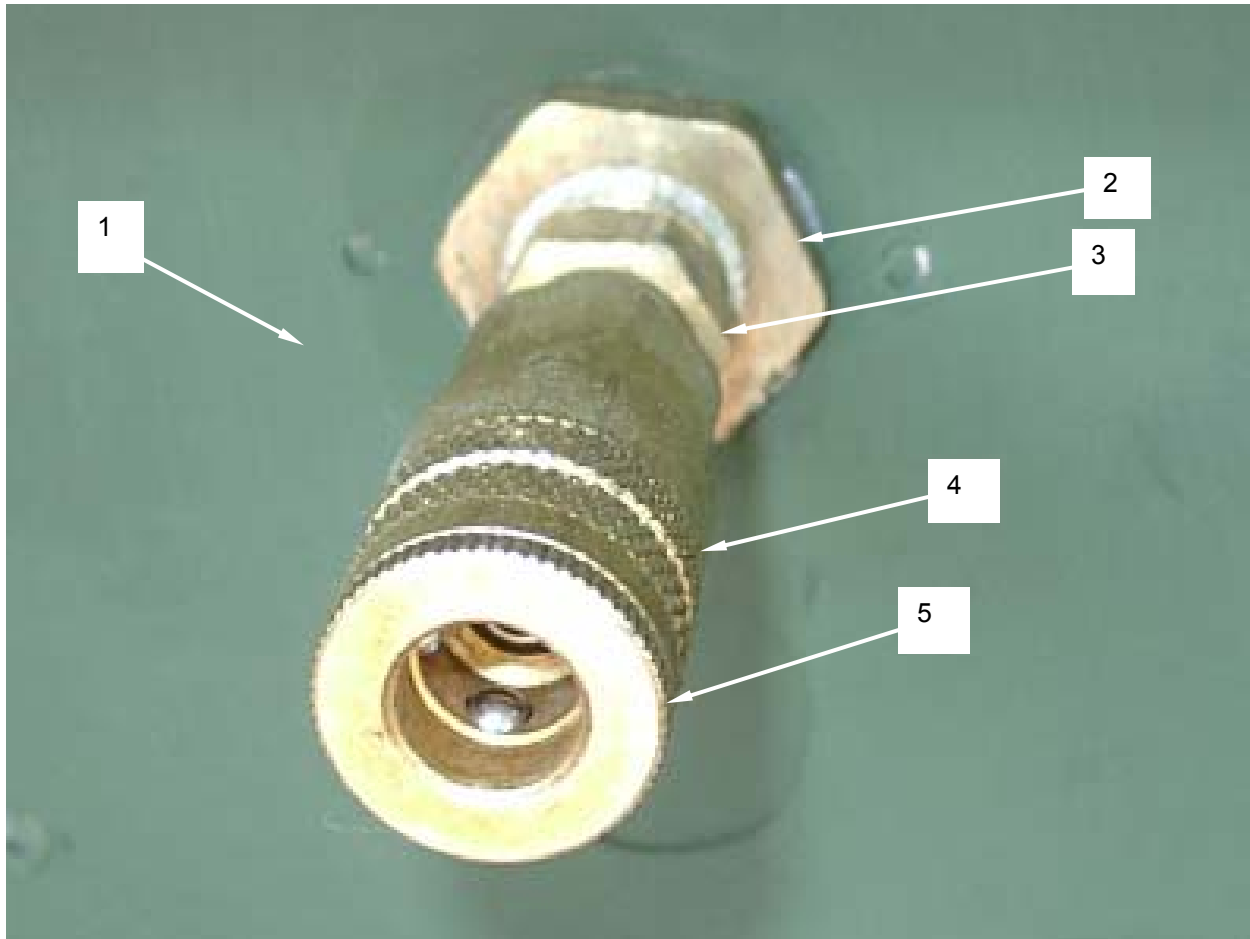


Figure 1. Inspect and Replace External Fuel Supply Connector.

**END OF TASK**

**END OF WORK PACKAGE**

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**SERVICE MAINTENANCE****EXTERNAL FUEL HOSE ASSEMBLY  
INSPECT, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**Rags, Wiping, Clean (WP 0123, Item 15)  
Clamp, Hose (WP 0123, Item 5)  
Strap, Tiedown, Electrical Components (WP 0123,  
Item 21)**Equipment Condition**Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

---

**INSPECT****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel tank to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of fuel soaked rags IAW local SOP.

1. Inspect the fuel hose (Figure 1, Item 1) and fittings (Figure 1, Item 2) for any cuts, abrasions, dents, or other damage that may cause the fuel hose to leak.
2. Ensure that all dust caps (Figure 1, Item 3, bottom illustration) are present, undamaged, and installed when the external fuel hose is not in use.

INSPECT - Continued

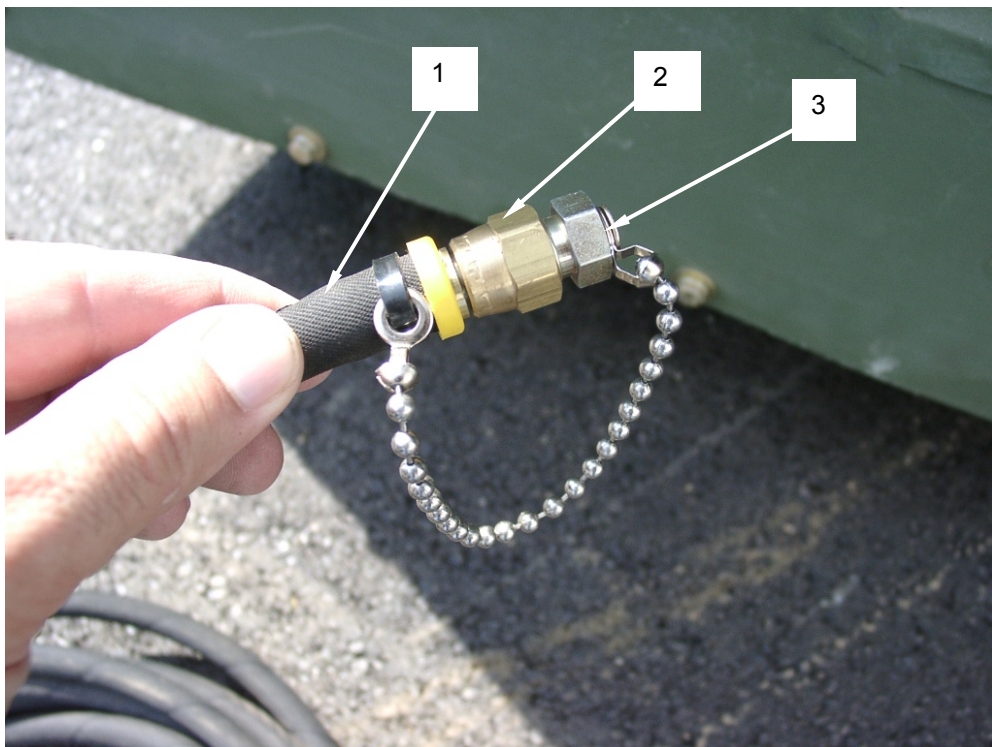
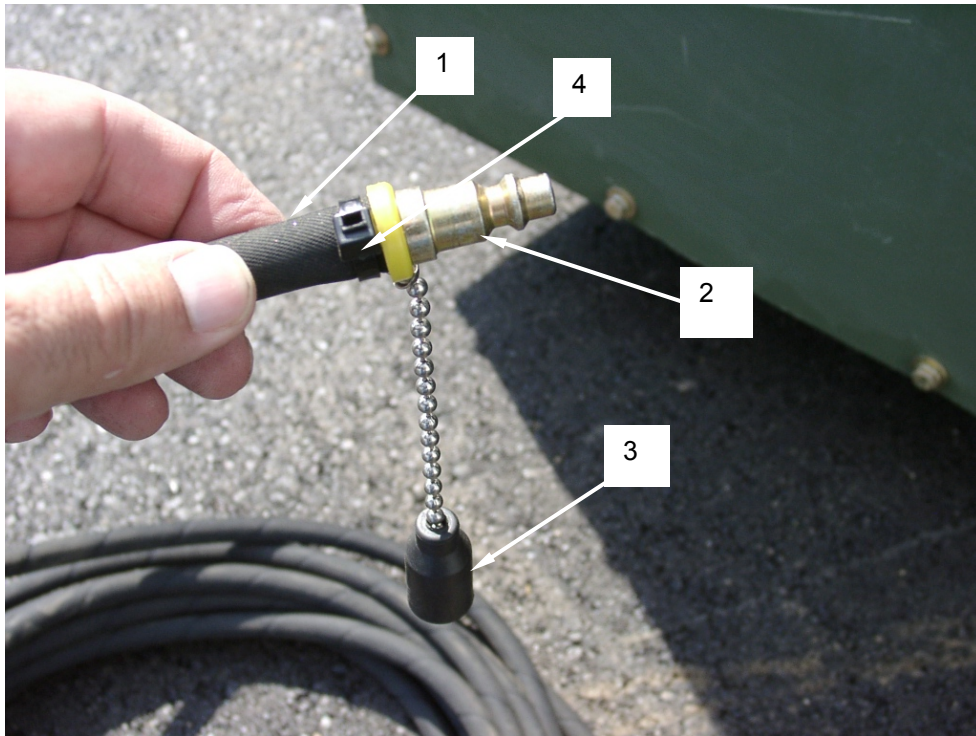


Figure 1. Inspect and Repair External Fuel Hose Assembly.

END OF TASK



**REPAIR****NOTE**

There are two types of fittings used on the ends of the external fuel hose. The replace of either fitting follows the same procedure.

1. Cut the nylon tie wrap that secures the dust cap and chain assembly to the fuel hose. Inspect the dust cap and chain; if in good condition, set aside for reuse. If damaged, replace with new assembly from stock.
2. Remove the damaged fuel hose fitting (Figure 2, Item 1) by cutting the fuel hose approximately 1 inch below the fitting to be replaced. Discard the defective fitting.
3. Slide a new hose clamp (Figure 2, Item 2) over the cleanly cut end of the fuel hose.
4. Install a new fitting (Figure 2, Item 1) by inserting the barbed end of the fitting into the end of the fuel hose and pushing in until the fitting is fully inserted.
5. Secure new fitting to fuel hose by tightening hose clamp securely.
6. Install the dust cap and chain assembly onto the fuel hose using a new nylon tie wrap.

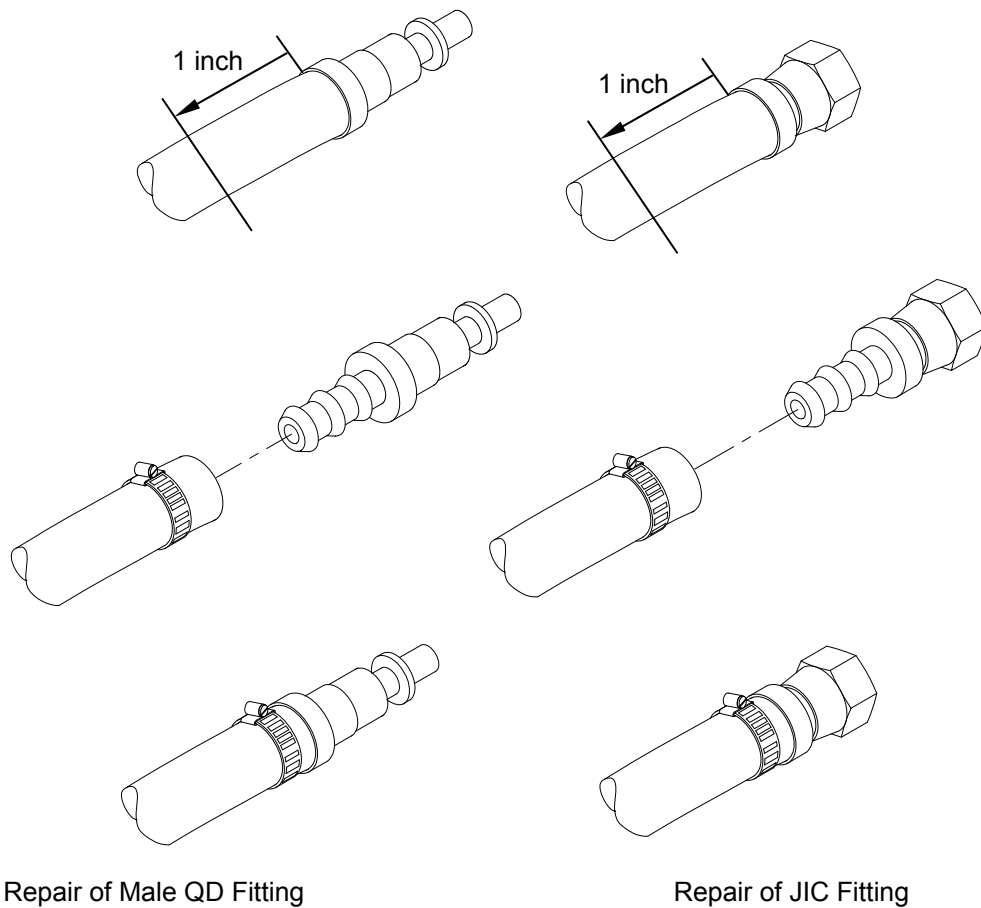


Figure 2. Repairing the External Fuel Hose by Replacing Fittings.

**END OF TASK**

**END OF WORK PACKAGE**



**SERVICE MAINTENANCE****BURNER FUEL PUMP ASSEMBLY  
INSPECT, REPLACE, ADJUST****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 17), or  
Tape, Antiseizing (WP 0123, Item 23)  
Tags, Marking (WP 0123, Item 22)  
Grease, General Purpose (WP 0123, Item 7)  
Gloves, Chemical and Oil Protective (WP 0123,  
Item 6)

**References**

WP 0071

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch in the OFF position and handle  
removed.

**INSPECT**

1. Turn the motor shaft (Figure 1, Item 2) of the diesel engine by placing the left hand on the flexible shaft coupling (Figure 1, Item 1) and rotate it back and forth. While rotating the motor shaft, visually inspect the burner fuel pump shaft (Figure 1, Item 3) through the engine flywheel cover (Figure 1, Item 4) and ensure that the burner fuel pump shaft (Figure 1, Item 3) is also turning. There should not be any slippage of the drive shaft coupling (Figure 1, Item 5) while turning the motor shaft (Figure 1, Item 2).
2. If the drive shaft coupling (Figure 1, Item 5) is slipping on the pump shaft (Figure 1, Item 3), the burner fuel pump should be removed to determine whether the drive shaft coupling (Figure 1, Item 5) or the burner fuel pump is defective. Based on that determination, replace a defective drive shaft coupling or burner fuel pump as necessary.

INSPECT - Continued

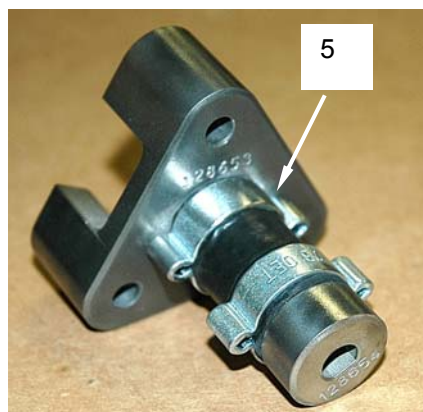
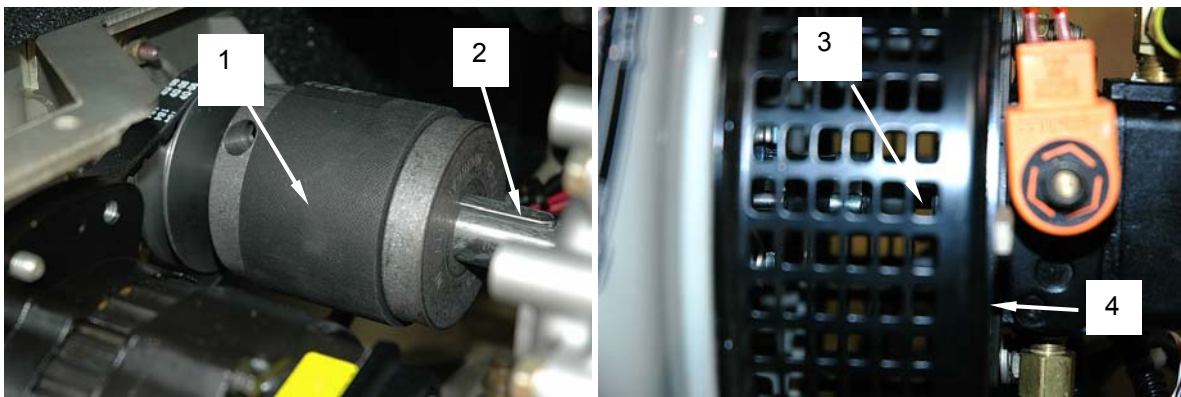


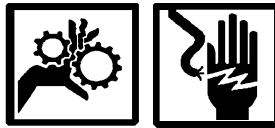
Figure 1. Inspect Burner Fuel Pump Assembly and Flexible Shaft.

END OF TASK

**REPLACE****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel pump to collect any fuel. Be sure to wipe up any spills with a rag and dispose of properly IAW with local SOP.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**WARNING**

Jewelry can conduct electricity and become entangled in the LCFH Type II. Failure to remove jewelry can cause injury or death.

**NOTE**

In order to gain access to the burner fuel pump, it will be necessary to remove the batteries.

To make battery terminal removal easier, it may be necessary to force the terminal open a bit using the blade of a flat blade screwdriver in the gap between the arms of the terminal. Pry the terminal connector off the battery terminal. If the terminal connector is damaged in the removal process, it should be replaced in accordance with WP 0071.

1. Loosen the nut (Figure 2, Item 1) on the negative terminal of the battery closest to the engine access door opening and remove the terminal (Figure 2).

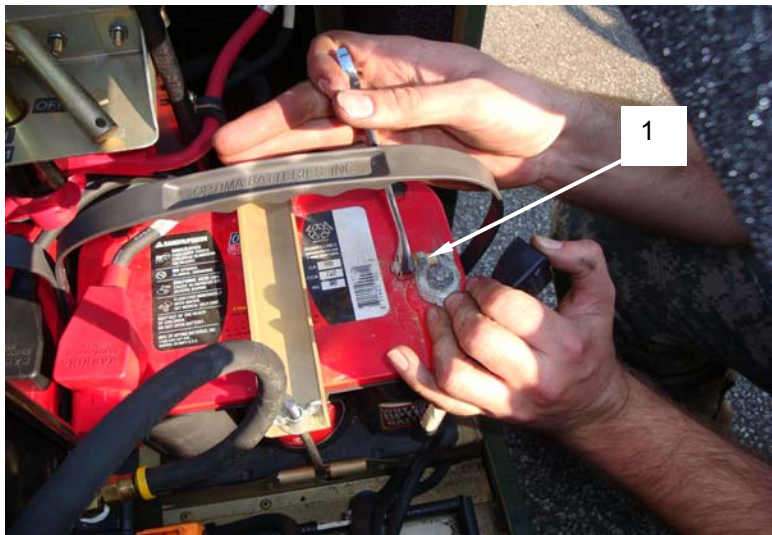


Figure 2. Remove Negative Terminal of Battery Closest to Engine Access Door.

2. Loosen and remove the terminals of the jumper cable connecting the two batteries, remove the cable and set aside (Figure 3).

**REPLACE - Continued**

Figure 3. Remove Jumper Cable Between Batteries.

3. Remove the wingnuts and lockwashers that secure the battery T-bar on the battery closest to the engine access door opening and set aside (Figure 4).



Figure 4. Remove Hardware Securing Battery T-bar Closest to Access Door.

4. Remove the battery hold-down bracket that extends over the top of the battery and set aside (Figure 5).

## REPLACE - Continued



Figure 5. Remove Battery Hold-down Bracket.

5. Remove the battery closest to the engine access door opening and set aside (Figure 6).

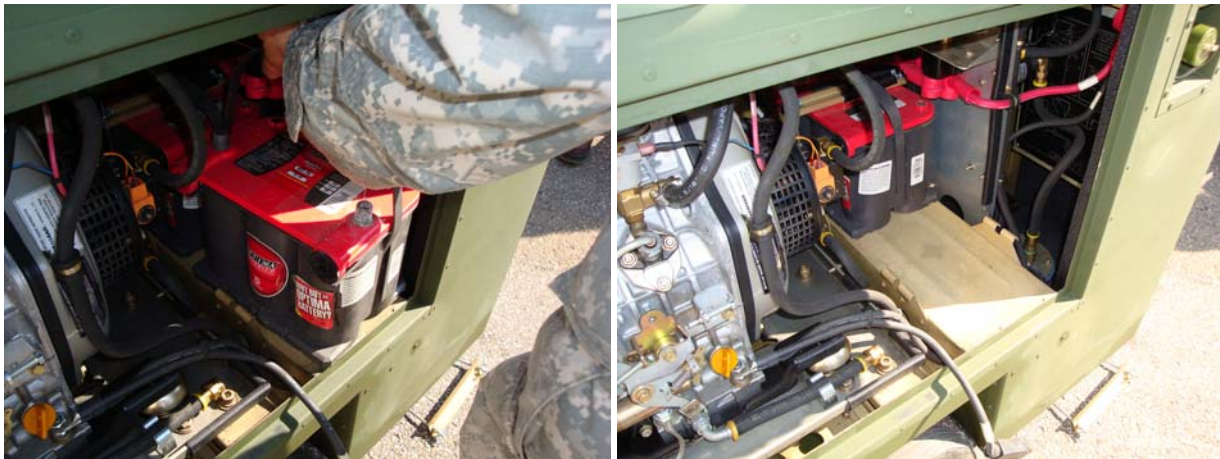


Figure 6. Remove Battery Closest to Engine Access Door.

**REPLACE - Continued**

6. Remove the wingnuts and lockwashers that secure the battery T-bar on the battery farthest from the engine access door opening and set aside (Figure 7).



Figure 7. Remove Hardware Securing Battery T-bar Farthest from Access Door.

7. Remove the battery hold-down bracket that extends over the top of the battery and set aside (Figure 8).



Figure 8. Remove Battery Hold-down Bracket of Battery Farthest from Access Door.



**REPLACE - Continued**

8. Loosen the nut on the positive terminal of the battery farthest from the engine access door opening and remove the terminal (Figure 9).

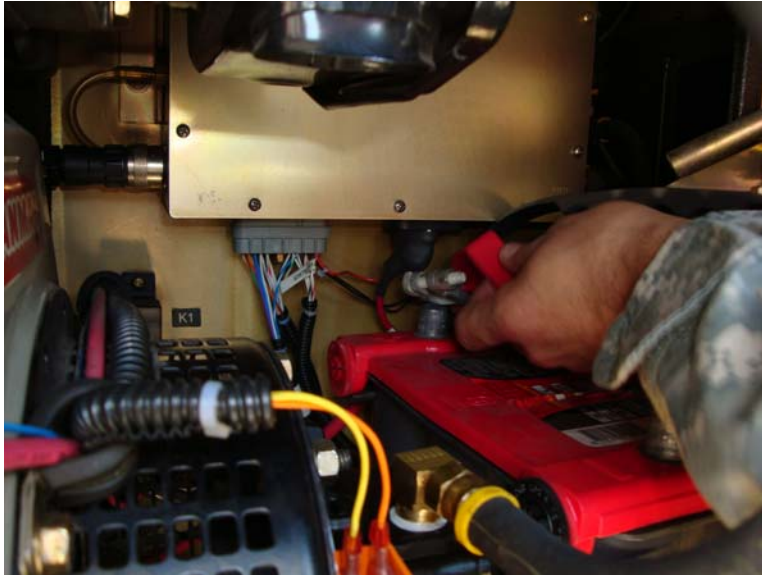


Figure 9. Remove Positive Battery Cable of Battery Farthest from Access Door.

9. Remove the battery farthest from the engine access door opening and set aside (Figure 10).



Figure 10. Remove Battery Farthest from Access Door.

**REPLACE - Continued**

10. Tag and remove wires connected to burner fuel pump (Figure 11).



Figure 11. Remove Wires Connected to Burner Fuel Pump.

11. Tag and mark all fuel hoses connected to burner fuel pump (Figure 12).



Figure 12. Tag and Mark All Fuel Hoses.

**REPLACE - Continued**

12. Loosen fitting on fuel hose at rear of burner fuel pump (Figure 13, Item 1) and remove hose. Wipe up any spilled fuel with a rag (Figure 13).



Figure 13. Remove Fuel Hose at Back of Burner Fuel Pump.

13. Loosen fitting on fuel hose at bottom of burner fuel pump (Figure 14, Item 1) and remove hose. Wipe up any spilled fuel with a rag (Figure 14).

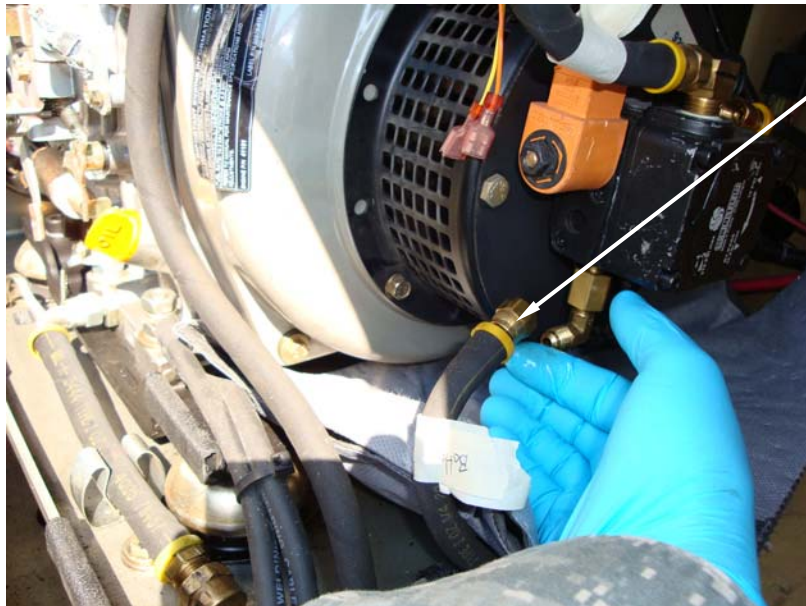


Figure 14. Remove Fuel Hose at Bottom of Burner Fuel Pump.

**REPLACE - Continued**

14. Loosen fitting on fuel hose at top of burner fuel pump (Figure 15, Item 1) and remove hose. Wipe up any spilled fuel with a rag (Figure 15).



Figure 15. Remove Fuel Hose at Top of Burner Fuel Pump.

15. Remove nuts and lockwashers on the top and bottom of burner fuel pump that secure it to the engine flywheel cover (Figure 16).



Figure 16. Remove Hardware Securing Burner Fuel Pump to Flywheel Cover.

**REPLACE - Continued**

16. Using a pry bar placed between the defective burner fuel pump and the engine flywheel cover, carefully pry the defective burner fuel pump from the drive shaft coupling. Remove defective burner fuel pump (Figure 17).



Figure 17. Remove Burner Fuel Pump from Flywheel Cover.

17. Apply a small amount of Advanced Multi-purpose Airframe Grease or equivalent to the shaft of the burner fuel pump and to the inside of the drive shaft coupling (Figure 18).

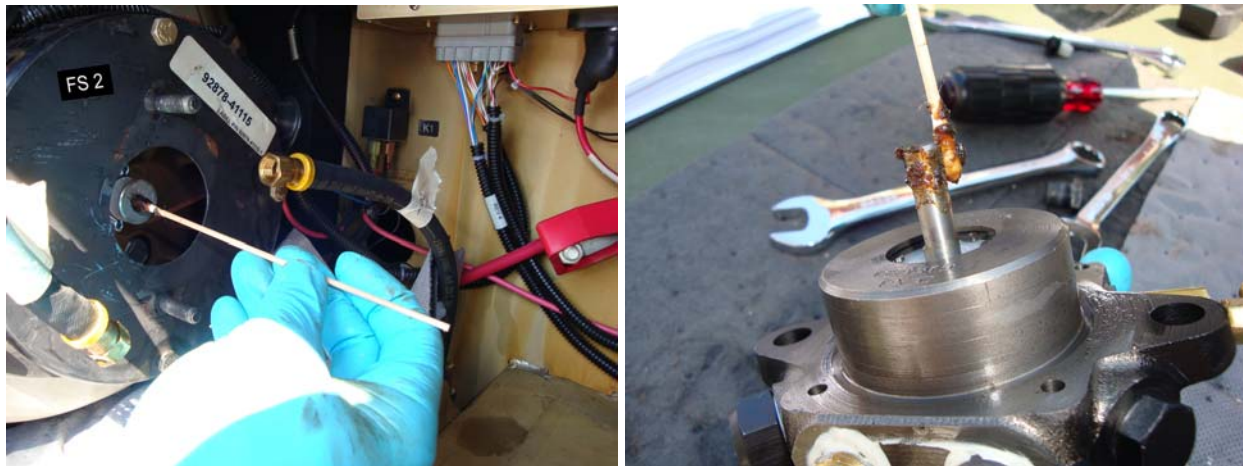


Figure 18. Apply Grease to Burner Fuel Pump Shaft and Drive Shaft Coupling.

**REPLACE - Continued**

18. Align the holes on the new burner fuel pump with the studs on engine flywheel cover and install the new burner fuel pump by aligning the shafts on the pump and drive shaft coupling. Note that shaft on the drive shaft coupling is "D" shaped and will only engage with pump shaft when properly oriented (Figure 19).

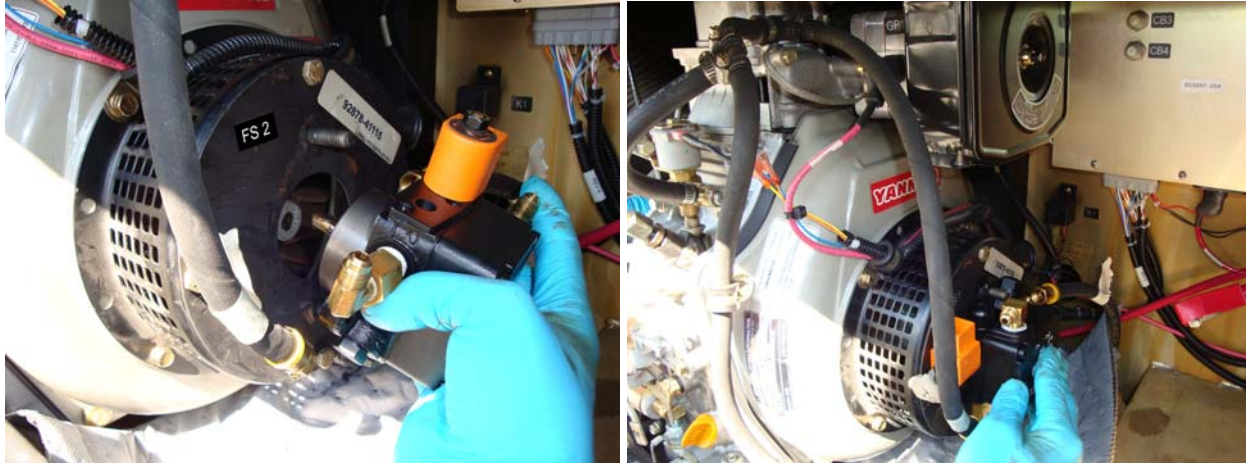


Figure 19. Engage Burner Fuel Pump Shaft into Drive Shaft Coupling.

19. Install lockwashers and nuts on studs and tighten securely (Figure 20).



Figure 20. Secure Burner Fuel Pump to Flywheel Cover.

**REPLACE - Continued**

20. In accordance with the tags and markings made earlier, install fuel hoses to fittings on burner fuel pump. Tighten all fittings securely (Figure 21).



Figure 21. Reinstall Fuel Hoses onto Burner Fuel Pump Fittings.

**REPLACE - Continued**

21. Reconnect wires (Figure 22).



Figure 22. Reconnect Wires to Burner Fuel Pump.

22. Remove all tags and/or markings.

23. Remove any petroleum absorbent mat from the engine compartment and dispose of IAW local environmental regulations and Unit SOP.

24. Position the battery farthest from the engine access door opening onto the battery tray with the positive terminal facing the main control box (Figure 23).

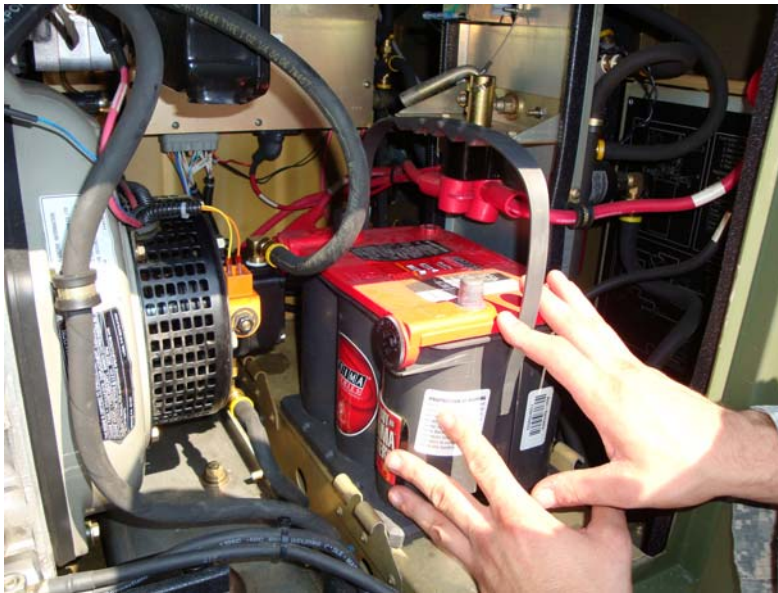


Figure 23. Install Battery Farthest from Access Door.



**REPLACE - Continued**

25. Install the positive terminal of the battery farthest from the engine access door opening and secure the terminal by tightening the terminal nut (Figure 24).

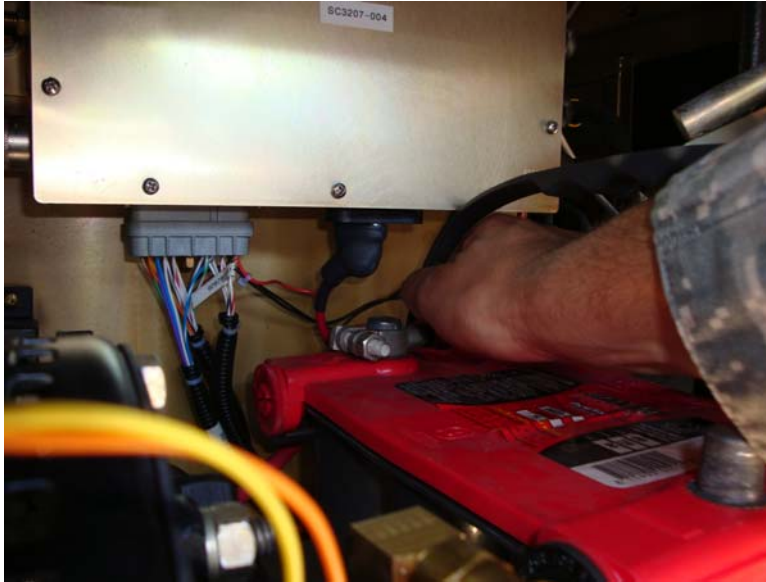


Figure 24. Install Positive Battery Terminal of Battery Farthest from Access Door.

26. Install the battery hold-down bracket that extends over the top of the battery.
27. Install the wingnuts and lockwashers that secure the battery T-bar on the battery farthest from the engine access door opening (Figure 25).

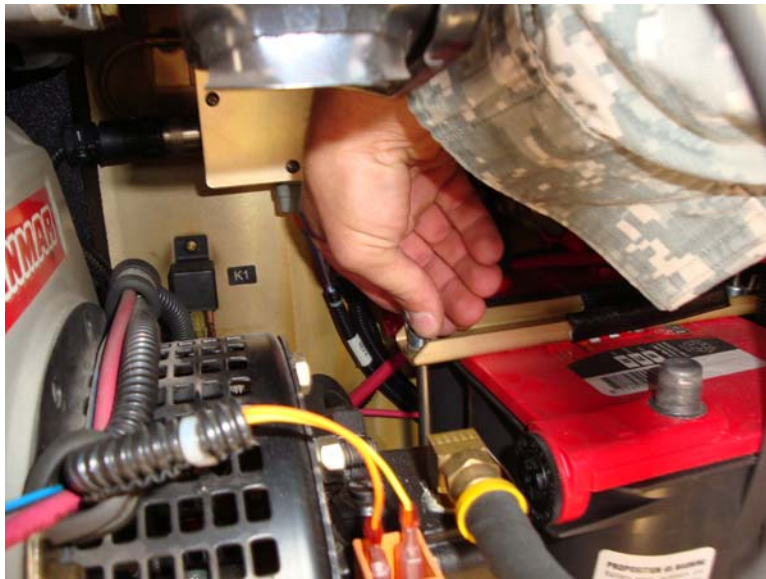


Figure 25. Install Battery Hold-down Bracket and Secure with Hardware.

**REPLACE - Continued**

28. Position the second battery closest to the engine access door opening ensuring that the negative terminal is closest to the door opening (Figure 26).



Figure 26. Install Battery Closest to Access Door.

29. Install the battery hold-down bracket that extends over the top of the battery (Figure 27).



Figure 27. Install Battery Hold-down Bracket on Battery Farthest from Access Door.

**REPLACE - Continued**

30. Install the wingnuts and lockwashers that secure the battery T-bar on the battery closest to the engine access door opening (Figure 28).



Figure 28. Secure Battery Hold-down Bracket with Hardware.

31. Install the terminals of the jumper cable connecting the two batteries ensuring that the red terminal is mounted to the positive battery terminal and the black terminal is mounted to the negative battery terminal (Figure 29).



Figure 29. Install Jumper Cable Between Batteries.

**REPLACE - Continued**

32. Install the negative terminal of the final cable on the battery closest to the engine access door opening. Tighten the terminal nut securely (Figure 30).



Figure 30. Install Negative Terminal on Battery Closest to Access Door.

33. Close all access panels and start the LCFH Type II in VENT mode as described in WP 0005. Let the heater run for 2 minutes and shut heater down. Open the engine access door and inspect the area around the burner fuel pump for fuel leaks. If evidence of leaks are observed, ensure that all burner fuel pump fittings are secure. If there are no leaks, proceed with the burner fuel pump pressure adjustment procedure detailed in the section of this work package entitled ADJUST.
34. Once the new burner fuel pump is installed, check and adjust the system fuel pressure IAW "ADJUST" section of this work package.

**END OF TASK**

**ADJUST****Prime the Fuel System****CAUTION**

The fuel system must be primed after installing a new burner fuel pump. Failure to properly prime the fuel system prior to operation will damage the burner fuel pump.

1. Place the main battery shutdown switch in the ON position.
2. Switch the power switch located on the operator control box to ON. When a series of audible beeps is heard, place the switch in the OFF position.
3. Repeat above procedure three times. This will allow the fuel filter to be filled with fuel and prime the remainder of the system.
4. Once the unit has been primed, adjust the burner fuel pump pressure in accordance with the procedures below.

**NOTE**

Burner pump comes preset as original equipment and as a repair part. However, pressure should be checked and, if needed, adjusted after pump replacement. This is a two stage pump and both Low and High pressures need to be checked before placing the LCFH Type II in service.

The burner fuel pressure must be adjusted to match local altitude conditions.

**Low Altitude Adjustment (below 6000 feet)**

1. Prepare the LCFH Type II for operation by removing the inlet and outlet duct covers and installing the exhaust stack.
2. Close all access panels except the fuel system access panel and start the LCFH Type II in MANUAL mode as described in WP 0005.
3. Monitor the system pressure gage (Figure 31, Item 1) located inside the fuel system access door and ensure that it reads 120 +/- 5 psi. If the system pressure is exactly 120 +/- 5 psi, no further action is required for the Low pressure setting. If system pressure is not 120 +/- 5 psi, take note of whether the system pressure is greater than 120 psi or lower than 120 psi as well as the difference between the measured pressure and 120 psi.
4. Shut the heater down and wait for the shut down sequence to complete. Open the engine access panel. Place the main battery shut down switch in the OFF position and remove the handle.

## ADJUST - Continued

**WARNING**

Do not attempt the burner fuel pump system pressure adjustment with the heater running. Attempting to perform this procedure with heater running may result in severe injury to personnel.

**NOTE**

The Low fuel pressure adjusting screw (Figure 31, Item 3) is a vertically aligned screw on the top of the fuel pump adjacent to the solenoid (Figure 31, Item 4).

5. Make an initial adjustment to the low pressure adjustment screw in accordance with the information shown in Table 1. Turn the adjustment screw no more than 1/4-turn clockwise or counterclockwise in each subsequent adjustment attempt.

**Table 1. Initial Low Pressure Adjustment.**

Pressure Difference Between Measured Pressure and 120 psi	Number of Initial Adjustment Turns
50 psi	1 turn
30 to 40 psi	3/4 turn
20 psi	1/2 turn
10 psi	1/4 turn

6. If the system pressure monitored in the previous step was less than 120 psi, rotate the adjustment screw clockwise to increase system pressure.
7. If the system pressure monitored in the previous step was greater than 120 psi, rotate the adjustment screw counterclockwise to decrease system pressure.
8. After making the necessary adjustment, place the main battery shutdown switch in the ON position and close all access panels except the fuel system access panel. Start the LCFH Type II and monitor the system pressure as detailed in step 2. Ensure that system pressure is 120 psi +/- 5 psi. If it is not, perform steps 2 through 5 as necessary until a system pressure of 120 +/- 5 psi is reached.
9. Once the Low system pressure has been adjusted and verified, ensure that the Mode switch of the operator control box is set to MANUAL.

**NOTE**

It may not be possible to perform the high pressure adjustment if the heater is operating in ambient temperatures above 55°F. If temperatures are above 55°F, move the heater to a cooler area or perform the procedure at a time of day when the temperature is below 55°F.

10. After the burner has ignited wait approximately 90 seconds for the LCFH Type II to cycle into High burner operation, designated by B-HI on the operator control box LED display.

**ADJUST - Continued**

11. Monitor the system pressure gage (Figure 31, Item 1) located inside the fuel access door and ensure that it reads 180 +/- 5 psi. If the system pressure is exactly 180 +/- 5 psi, no further action is required for the High pressure setting. If system pressure is not 180 +/- 5 psi, take note of whether the system pressure is greater than 180 +/- 5 psi or lower than 180 +/- 5 psi as well as the difference between the measured pressure and 180 psi.
12. Shut the heater down and wait for the shut down sequence to complete. Place the main battery shut down in the OFF position and remove the handle. Open the engine access panel.

**WARNING**



Do not attempt the burner fuel pump system pressure adjustment with the heater running. Attempting to perform this procedure with heater running may result in severe injury to personnel.

**NOTE**

The High fuel pressure adjusting screw (Figure 31, Item 2) is a 45-degree aligned screw on the top of the fuel pump farthest from the solenoid (Figure 31, Item 4).

13. Make an initial adjustment to the high pressure adjustment screw in accordance with the information shown in Table 2. Turn the adjustment screw no more than 1/4-turn clockwise or counterclockwise in each subsequent adjustment attempt.

**Table 1. Initial High Pressure Adjustment.**

Pressure Difference Between Measured Pressure and 120 psi	Number of Initial Adjustment Turns
50 psi	1 turn
30 to 40 psi	3/4 turn
20 psi	1/2 turn
10 psi	1/4 turn

14. If the system pressure monitored in the previous step was less than 180 +/- 5 psi, rotate the adjustment screw clockwise to increase system pressure.
15. If the system pressure monitored in the previous step was greater than 180 +/- 5 psi, rotate the adjustment screw counterclockwise to decrease system pressure.
16. After making the necessary adjustment, place the main battery shutdown switch in the ON position and close all access panels except the fuel system access panel. Start the LCFH Type II and monitor the system pressure as detailed in step 11. Ensure that system pressure is 180 +/- 5 psi. If it is not, perform steps 11 thru 15 as necessary until a system pressure of 180 +/- 5 psi is reached.
17. Once the High and Low system pressure has been adjusted and verified, shut the heater down and allow to cool completely. Stow the exhaust stack as well as the inlet and outlet duct covers.
18. The LCFH Type II is ready to be put back in service.

**END OF TASK**

**ADJUST - Continued****High Altitude Adjustment (6000 feet or above)****NOTE**

Excessive smoke observed during burner High Fire operation ( B-Hi ) will require an adjustment in burner fuel pressure. Excessive smoke observed during vent mode indicates an engine problem such as a dirty or faulty fuel injector or dirty air cleaner.

It may not be possible to perform the high pressure adjustment if the heater is operating in ambient temperatures above 55°F. If temperatures are above 55°F, move the heater to a cooler area or perform the procedure at a time of day when the temperature is below 55°F.

At altitudes above 6000 feet, excessive smoke may be seen in the exhaust, and it may be necessary to reduce the burner High fuel pressure to facilitate proper burner operation. Do not adjust the burner fuel pump pressure if excessive smoke is not being emitted in the exhaust. Do not reduce the system fuel pressure any more than is necessary to eliminate the excessive smoke and do not reduce the fuel pressure to a setting below 120 +/- 5 psi under any condition.

If excessive burner smoke is present during high altitude operation (6000 feet or above), perform the following steps:

**WARNING**

Do not attempt the burner fuel pump system pressure adjustment with the heater running. Attempting to perform this procedure with heater running may result in severe injury to personnel.

1. If running, shut the heater down and wait for the shut down sequence to complete. Open the engine access panel. Place the main battery shut down in the OFF position and remove the handle.

**NOTE**

The high fuel pressure adjusting screw (Figure 31, Item 2) is a 45-degree aligned screw on the top of the fuel pump farthest from the solenoid.

2. To reduce the fuel pressure, adjust the burner High fuel pump pressure adjustment screw (Figure 31, Item 2) no more than 1/4-turn counterclockwise per adjustment. To raise fuel pressure, adjust the burner fuel pump pressure adjustment screw (Figure 31, Item 2) no more than 1/4-turn clockwise per adjustment.
3. Close all access panels except the fuel system access panel and start the LCFH Type II in MANUAL mode as described in WP 0005.
4. Visually check exhaust for evidence of excessive smoke. If no smoke exists, no further adjustments need to be made. If excessive smoke exists, repeat steps 1 through 4 until excessive smoke is no longer present.

**NOTE**

System pressure should be set to 180 psi in HIGH at altitudes below 6000.

5. Be sure to return the High fuel pressure back to 180 +/- 5 psi when operating at altitudes below 6000 feet IAW Low Altitude Adjustment (below 6000 feet) section of this work package.



ADJUST - Continued

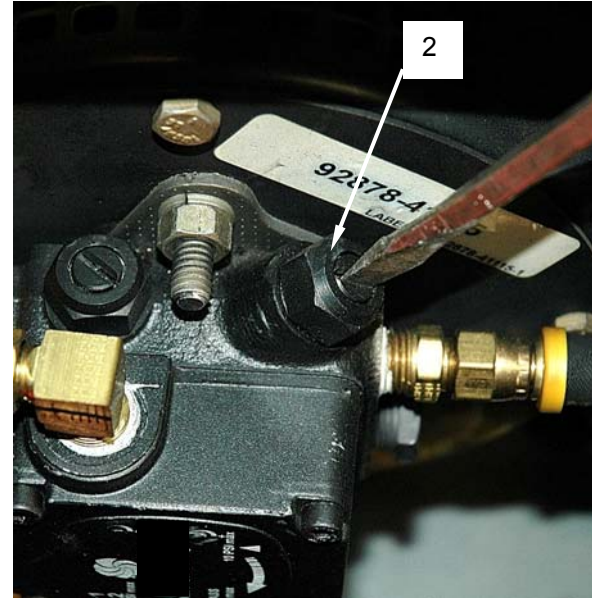
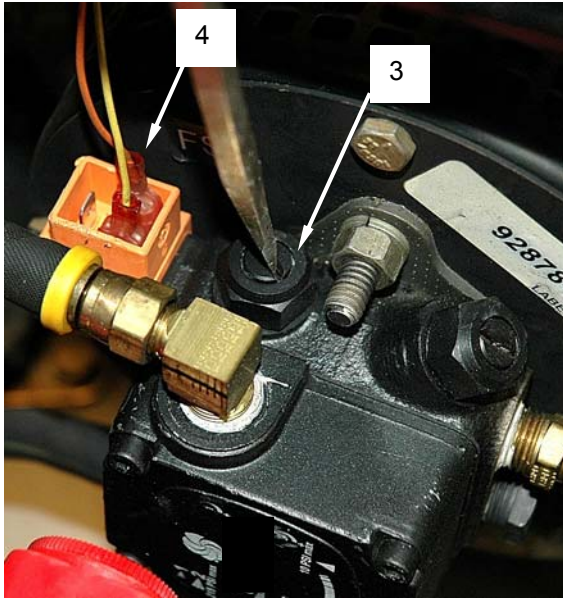
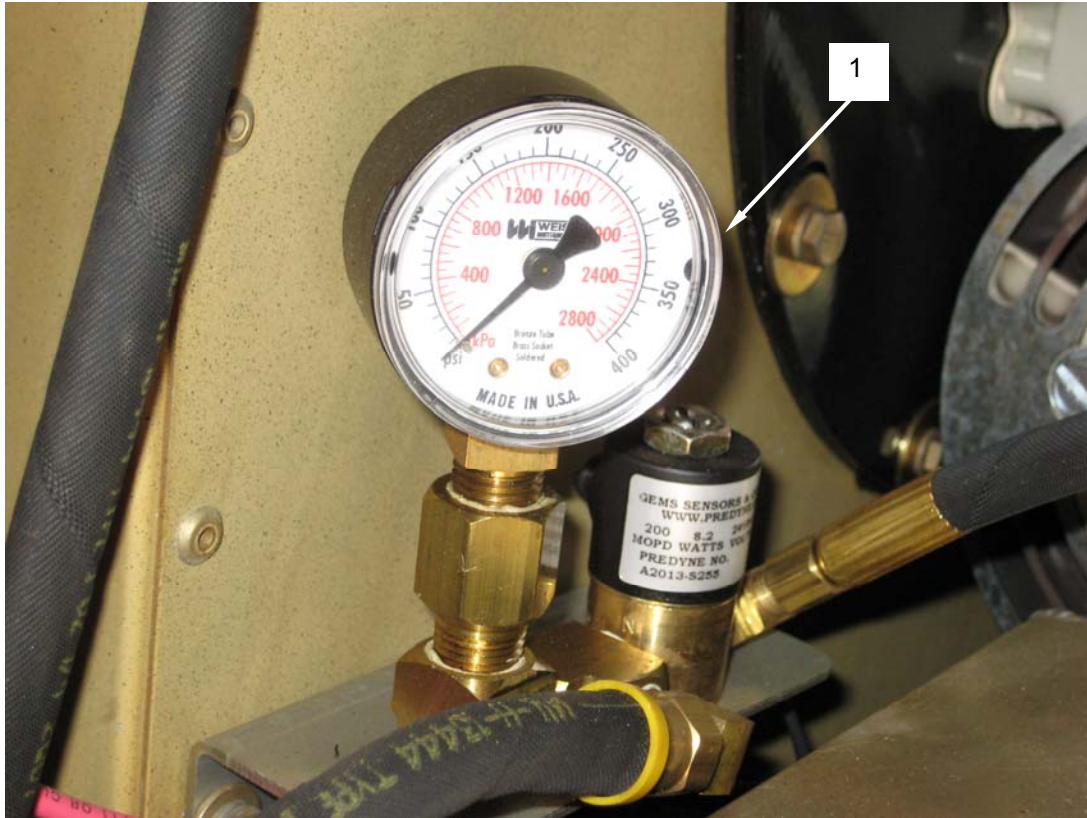


Figure 31. Adjust Burner Fuel Pump Assembly.

END OF TASK

END OF WORK PACKAGE



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**SERVICE MAINTENANCE****INLET FAN ASSEMBLY  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.

---

**REPLACE**

1. Remove inlet duct cover and set aside.
2. Remove the bolt-on duct inlet collar (Figure 1, Item 2) by removing eight screws (Figure 1, Item 3), lockwashers (Figure 1, Item 4), and flat washers (Figure 1, Item 5). Set duct inlet collar and mounting hardware aside.
3. Remove the fan inlet cone (Figure 1, Item 14) by removing the six screws (Figure 1, Item 6), lockwashers (Figure 1, Item 7), and flat washers (Figure 1, Item 8). Set inlet cone and mounting hardware aside.
4. Remove the two bolts (Figure 1, Item 10) from the fan QD hub (Figure 1, Item 13).
5. Thread the bolts (Figure 1, Item 10) into the "remove" holes (Figure 1, Item 11) in the QD hub (Figure 1, Item 13). Note that these screws work like jack screws to break it loose from the fan and shaft.
6. Tighten bolts (Figure 1, Item 10) evenly while threaded into "remove" holes (Figure 1, Item 11) until the fan (Figure 1, Item 12) breaks loose from the shaft.
7. Remove the two bolts that work like jack screws.
8. Grasp hub and pull outward to remove.
9. Remove defective fan assembly. Locate nuts (Figure 1, Item 16) on fan rear and set aside.
10. Insert QD hub inside new fan assembly and place the bolts into the "retaining" holes. Insert nuts (Figure 1, Item 16), set aside earlier, onto new fan assembly. Thread bolts into nuts (Figure 1, Item 16). Ensure machine key (Figure 1, Item 15) is inserted onto shaft.
11. Install new fan (Figure 1, Item 12), aligning machine key with QD hub. Be sure that only ¼ inch of shaft protrudes through QD hub. Do not push fan all the way onto shaft.
12. Tighten bolts securely on the QD hub.
13. Install the fan inlet cone (Figure 1, Item 14) and align so that it does not rub on the fan (holes are oversized).

**REPLACE - Continued**

14. Secure the fan inlet cone (Figure 1, Item 9) with screws (Figure 1, Item 6), lockwashers (Figure 1, Item 7), and flat washers (Figure 1, Item 8).
15. Install the bolt-on duct inlet collar (Figure 1, Item 2) and secure with screws (Figure 1, Item 3), lockwashers (Figure 1, Item 4), and flat washers (Figure 1, Item 5). Ensure that the rod that spans the inlet collar is parallel with the ground.

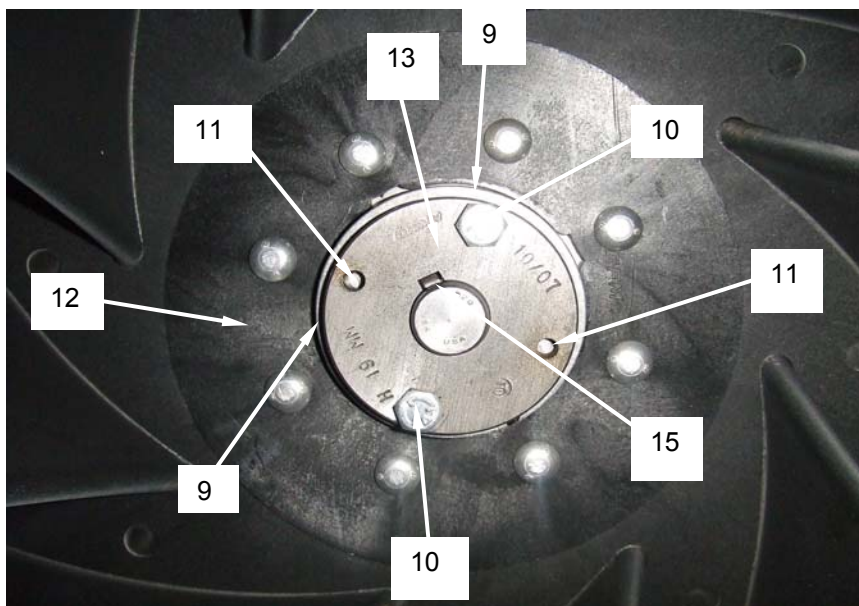
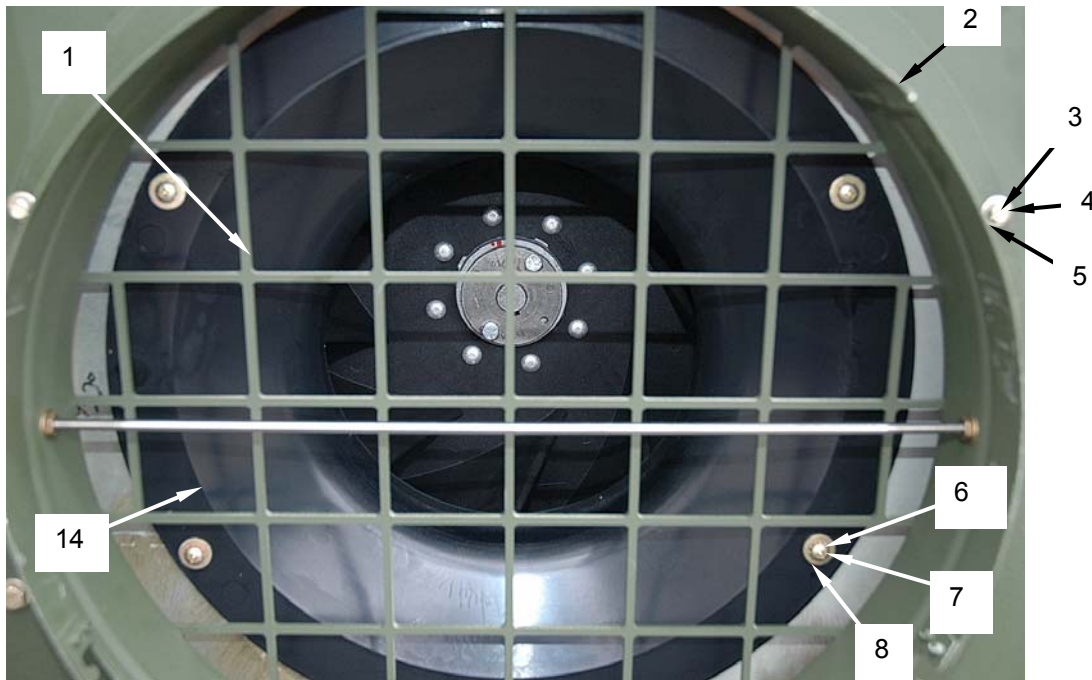


Figure 1. Replace Inlet Fan Assembly (Sheet 1 of 2)

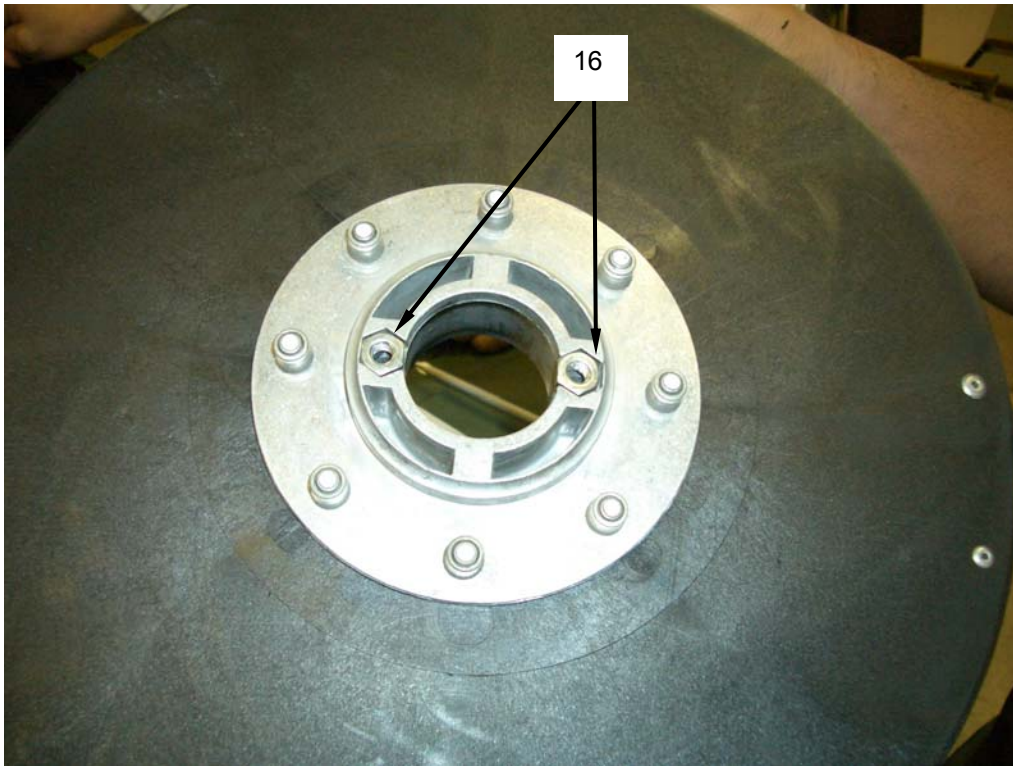
**REPLACE - Continued**

Figure 1. Replace Inlet Fan Assembly (Sheet 2 of 2).

**END OF TASK**

**END OF WORK PACKAGE**



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**SERVICE MAINTENANCE****SAFETY SCREEN  
INSPECT, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle  
removed.

---

**INSPECT**

Inspect the safety screens (Figure 1, Item 2 and 4) at the inlet (Figure 1, Item 3) and outlet (Figure 1, Item 11) duct housings, and ensure that they are present and are not damaged in such a way as to make it possible to get a hand or other limb into the inlet or outlet duct during operation.

**REPLACE**

1. Remove eight screws (Figure 1, Item 1) and lockwashers (Figure 1, Item 9), securing duct housing (Figure 1, Item 7) to body of heater.
2. Remove duct housing (Figure 1, Item 7).
3. Install eight screws (Figure 1, Item 1) and lockwashers (Figure 1, Item 9) securing duct housing (Figure 1, Item 7) and safety screen (Figure 1, Item 2 and 4) to body of heater.

**END OF TASK**

**REPLACE - Continued****Replacing Threaded Rod**

1. Remove nuts (Figure 1, Item 6), lockwashers (Figure 1, Item 9), flat washers (Figure 1, Item 10), protective caps (Figure 1, Item 8) and threaded rod (Figure 1, Item 5) from the duct housing (Figure 1, Item 7).
2. Install the threaded rod (Figure 1, Item 5), nuts (Figure 1, Item 6), flat washers (Figure 1, Item 10), lockwashers, (Figure 1, Item 9) and protective caps (Figure 1, Item 8). Tighten securely.

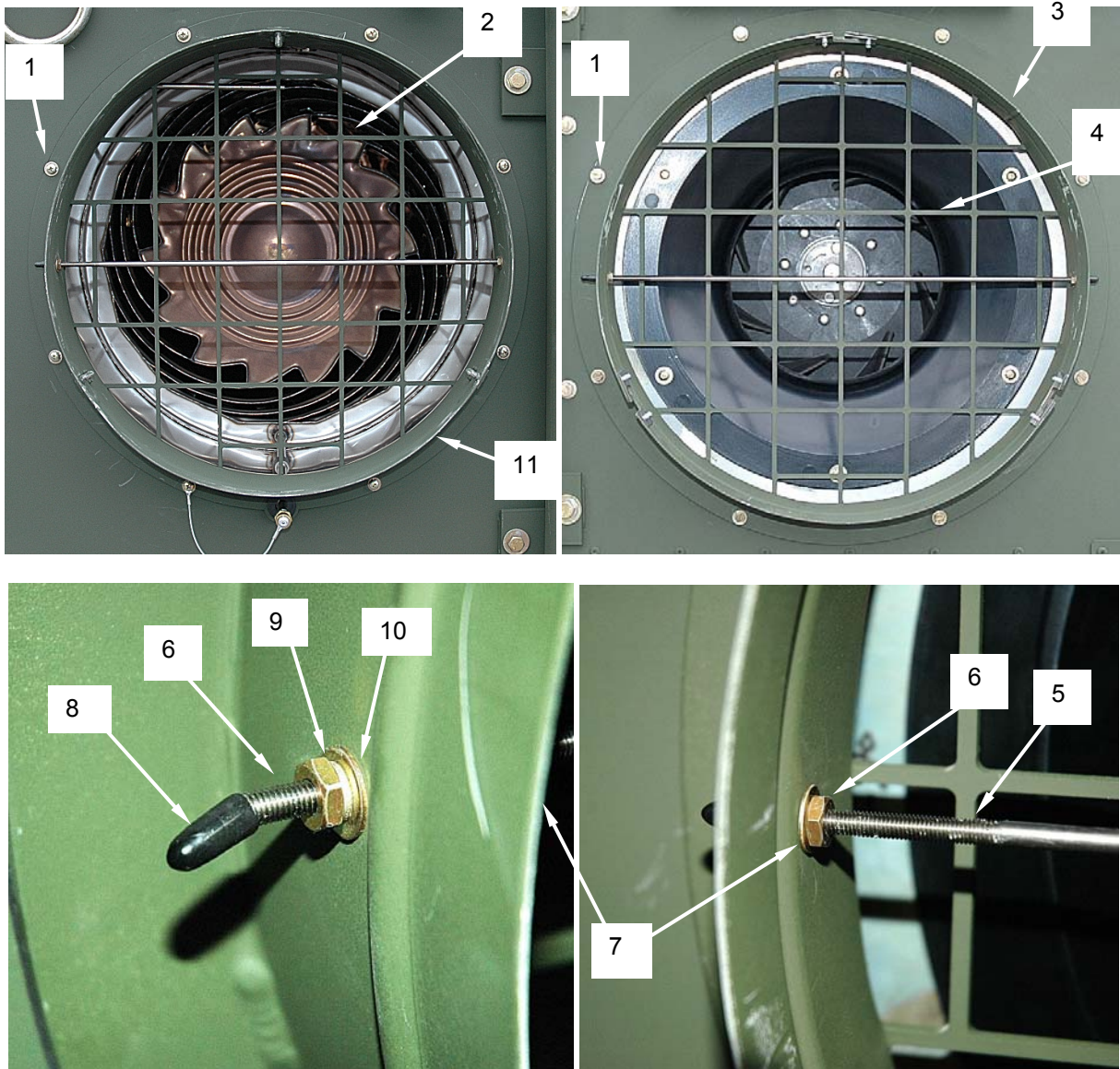


Figure 1. Inspect and Replace Safety Screens.

**END OF TASK****END OF WORK PACKAGE**



**SERVICE MAINTENANCE**  
**ENGINE SYSTEM ASSEMBLY**  
**REPAIR**

**INITIAL SETUP:**

**Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**References**

WP 0049  
WP 0050  
WP 0051

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle removed.

**REPAIR**

The repair of the engine involves repair or replacement of one or more of the subcomponents as shown in Table 1. Procedures for the repair or replacement of the subcomponents can be found in the referenced work packages.

**Table 1. Replaceable Components Used To Repair Engine System Assembly.**

<b>Component</b>	<b>Work Package</b>
24V Alternator Assembly with Pulley	WP 0049
Coupling Assembly	WP 0050
Diesel Engine	WP 0051

**END OF TASK**

**END OF WORK PACKAGE**



**SERVICE MAINTENANCE****24V ALTERNATOR ASSEMBLY WITH PULLEY  
INSPECT, TEST, ADJUST, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**References**

WP 0050, WP 0072

**Equipment Condition**

Heater shut down and cool (WP 0005), except during TEST function.  
Main Battery Power Switch in the OFF position and handle removed, except during TEST function.  
Engine access door open, except during TEST function.  
Negative battery cable closest to engine access door removed from battery when performing INSPECT, ADJUST, or REPLACE functions.

**Materials/Parts**

Tags, Marking (WP 0123, Item 22)

**INSPECT**

1. Inspect the alternator belt (Figure 1, Item 1) for damage or wear. Replace as required IAW procedures detailed in section of this work package entitled "REPLACE BELT."
2. Ensure that the alternator belt (Figure 1, Item 1) is not loose, slipping, or can be deflected more than 1/4 inch up or down. If alternator belt requires adjustment, re-tension belt in accordance with section of this work package entitled "ADJUST."

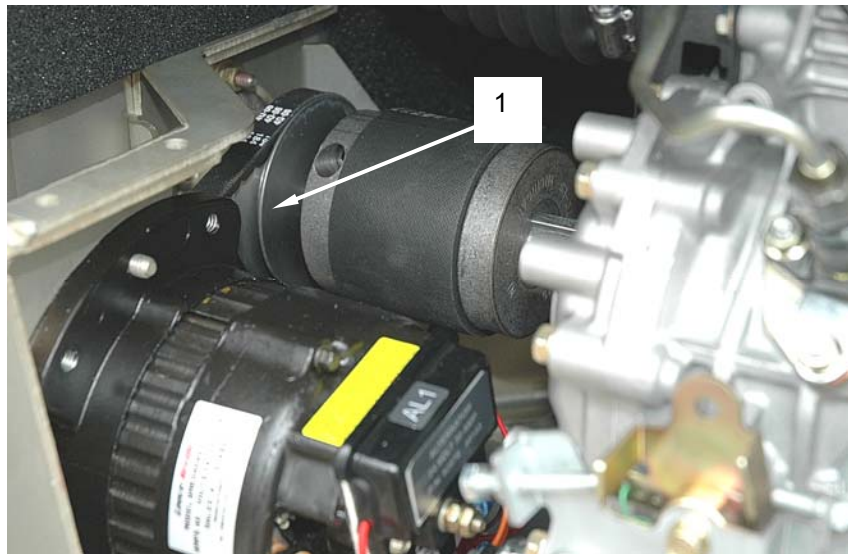


Figure 1. Inspect the Alternator Belt for Damage or Wear.

**END OF TASK**

**TEST**

1. With the heater off, place the positive (+) lead of a multimeter on the center terminal (Figure 2, Item 2) of the NATO connector (Figure 2, Item 1) and the negative lead (-) on the outer metal housing (Figure 2, Item 3). Make note of the voltage measured. The voltage displayed is the true condition of the batteries' charge. The voltage measured should be very close to 24 VDC.
2. Ensure that all access doors are closed and start the heater. The main control board will delay the charging until the engine is warmed up; therefore, there will be a delay of approximately 15 seconds.

**NOTE**

The main control board in the heater is designed to monitor the engine RPM. If the main control board senses that the engine is loaded down and is slowing in RPM, the main control board first disables the charging system for 60 seconds to conserve engine RPM. After the 60 seconds, the main control board will enable the charging system and perform an internal test to determine if the engine can handle the load. If the engine can handle the load, the main control board will leave it enabled. All voltage measurements need to be viewed with this understanding.

3. After the engine starts, wait approximately 15 seconds and measure the voltage on the batteries via the NATO connector (Figure 2, Item 1) as detailed in Step 1. If the batteries require charging, the voltage as measured at the NATO connector (Figure 2, Item 1) will slowly increase from the voltage that was measured with the heater OFF and noted in step 1. If the voltage increases as described, the alternator is operating properly. Alternatively, if the batteries are fully charged, the voltage would jump (after the 15 seconds) immediately to approximately 28 VDC which would indicate that the alternator is operating properly.
4. Replace the alternator as detailed in the section of this work package entitled "REPLACE" if the alternator is not operating within operational limits as described in the previous two steps.

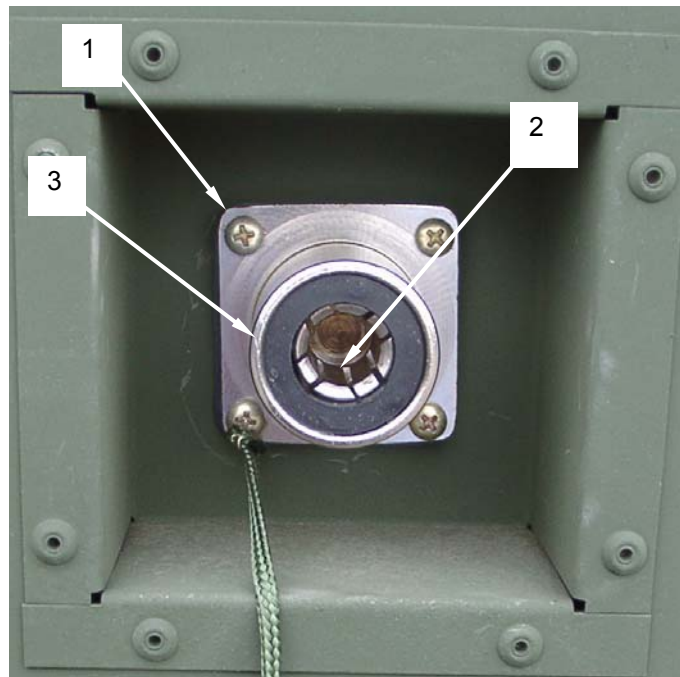


Figure 2. Test the Alternator.

**END OF TASK**

**ADJUST****WARNING**

Be sure the negative battery terminal on the battery closest to the engine access door is disconnected and main battery shutdown switch is OFF with handle removed, before performing maintenance involving the alternator. Note that power is still applied to the alternator even when the main battery shutdown switch is in the OFF position. Failure to disconnect battery terminal may result in shock or other serious injury.

1. Ensure that the main battery shutdown switch is in the OFF position.
2. Ensure that the negative battery terminal on the battery closest to the engine access door is disconnected IAW WP 0072.

**NOTE**

Use of the pry bar in the general mechanics tool kit is recommended for the adjustment of the alternator belt.

3. To readjust the alternator belt (Figure 3, Sheet 1, Item 6), loosen the two bolts (Figure 3, Sheet 1, Item 1 and 2) that maintain tension on the alternator belt. Do not remove bolts.
4. Place a pry bar between the alternator (Figure 3, Sheet 1, Item 3) and the engine mounting bracket (Figure 3, Sheet 1, Item 4) and apply pressure to the alternator so as to tension the belt (Figure 3, Sheet 1, Item 6). When there is no more than 1/4 inch of up and down deflection in the belt, tighten the two tensioning bolts (Figure 3, Sheet 1, Item 1 and 2).
5. Reconnect the negative battery terminal on the battery closest to the engine access door IAW WP 0072.

**END OF TASK****REPLACE****Replace Belt**

1. Loosen alternator and remove tension from belt as described in the section of this work package entitled "ADJUST."
2. Remove the rubber center portion of the coupling assembly as described in WP 0050.
3. Remove defective alternator belt.
4. Install new alternator belt, engaging the belt on the alternator and the fan drive pulley.
5. Install rubber center portion of the coupling assembly as described in WP 0050. Be sure to allow a 1/8-inch gap between the right side of the rubber center portion of the flexible coupler and the left rim of the right coupling assembly flange.
6. Tension new alternator belt as described in the section of this work package entitled "ADJUST."

**END OF TASK**

**REPLACE - Continued****Replace Alternator****WARNING**

Be sure the negative battery terminal on the battery closest to the engine access door is disconnected and main battery shutdown switch is OFF with handle removed, before performing maintenance involving the alternator. Note that power is still applied to the alternator even when the main battery shutdown switch is in the OFF position. Failure to disconnect battery terminal may result in shock or other serious injury.

1. Ensure that the main batter shutdown switch is in the OFF position.
2. Ensure that the negative battery terminal on the battery closest to the engine access door is disconnected IAW WP 0072.
3. Tag the wires on the rear of the alternator (Figure 3, Sheet 1, Item 3) as to their location and function.
4. Disconnect the D+ regulator trio terminal (Figure 3, Sheet 2, Item 11), excitation terminal (Figure 3, Sheet 2, Item 14), A/C terminal (Figure 3, Sheet 2, Item 13), negative output terminal (Figure 3, Sheet 2, Item 12), and positive output terminal (Figure 3, Sheet 3, Item 15).
5. Remove top tensioning bolt (Figure 3, Sheet 1, Item 1 and Item 2) and loosen lower bolt to relieve the belt tension on the alternator (Figure 3, Sheet 1, Item 3).
6. Remove the belt (Figure 3, Sheet 1, Item 6) from the alternator pulley (Figure 3, Sheet 1, Item 5).

**NOTE**

To improve access to the alternator, it is suggested that the end of the engine air intake hose connected to the engine be removed and pushed off to the side.

**NOTE**

To ease removal of the lower bolt, it is suggested that a ratchet and socket be used on the head of the bolt and a box end wrench be used to hold the nut on the opposite side in place.

7. Remove the bolt (Figure 3, Sheet 2, Item 9) and nut (Figure 3, Sheet 2, Item 8) at the base of the alternator (Figure 3, Sheet 1, Item 3) and remove the defective alternator by first backing the alternator away from the mounting plate and rotating the alternator 90 degrees so that the pulley faces the engine access opening. Pull the alternator straight out of the engine access.
8. Install a new alternator (Figure 3, Sheet 1, Item 3) by inserting the back of the alternator first and rotating the pulley end of the alternator 90 degrees into position on the mounting plate. Align the hole (Figure 3, Sheet 2, Item 7) at the base of the alternator with the hole (Figure 3, Sheet 2, Item 8) in the alternator mounting bracket.
9. Install the bolt (Figure 3, Sheet 2, Item 9) and lock nut (Figure 3, Sheet 2, Item 9) at the base of the alternator (Figure 3, Sheet 1, Item 3). Do not tighten securely at this time.
10. Swing the alternator (Figure 3, Sheet 1, Item 3) up into position and install the alternator belt (Figure 3, Sheet 1, Item 6) on the alternator pulley (Figure 3, Sheet 1, Item 5).

**REPLACE - Continued**

11. Install the top tensioning bolt (Figure 3, Sheet 1, Item 1) but do not tighten completely at this time.
12. Place a pry bar between the alternator (Figure 3, Sheet 1, Item 3) and the engine mounting bracket (Figure 3, Sheet 1, Item 4) and apply pressure to the alternator so as to tension the belt. When there is no more than 1/4 inch of deflection in the belt, tighten the two tensioning bolts (Figure 3, Sheet 1, Item 1 and 2).
13. Connect the D+ regulator trio terminal (Figure 3, Sheet 2, Item 11), excitation terminal (Figure 3, Sheet 2, Item 14), A/C terminal (Figure 3, Sheet 2, Item 13), negative output terminal (Figure 3, Sheet 2, Item 12), and positive output terminal (Figure 3, Sheet 1, Item 15) as tagged earlier.
14. Remove all tags and markings.
15. Reinstall engine air intake hose if removed earlier.

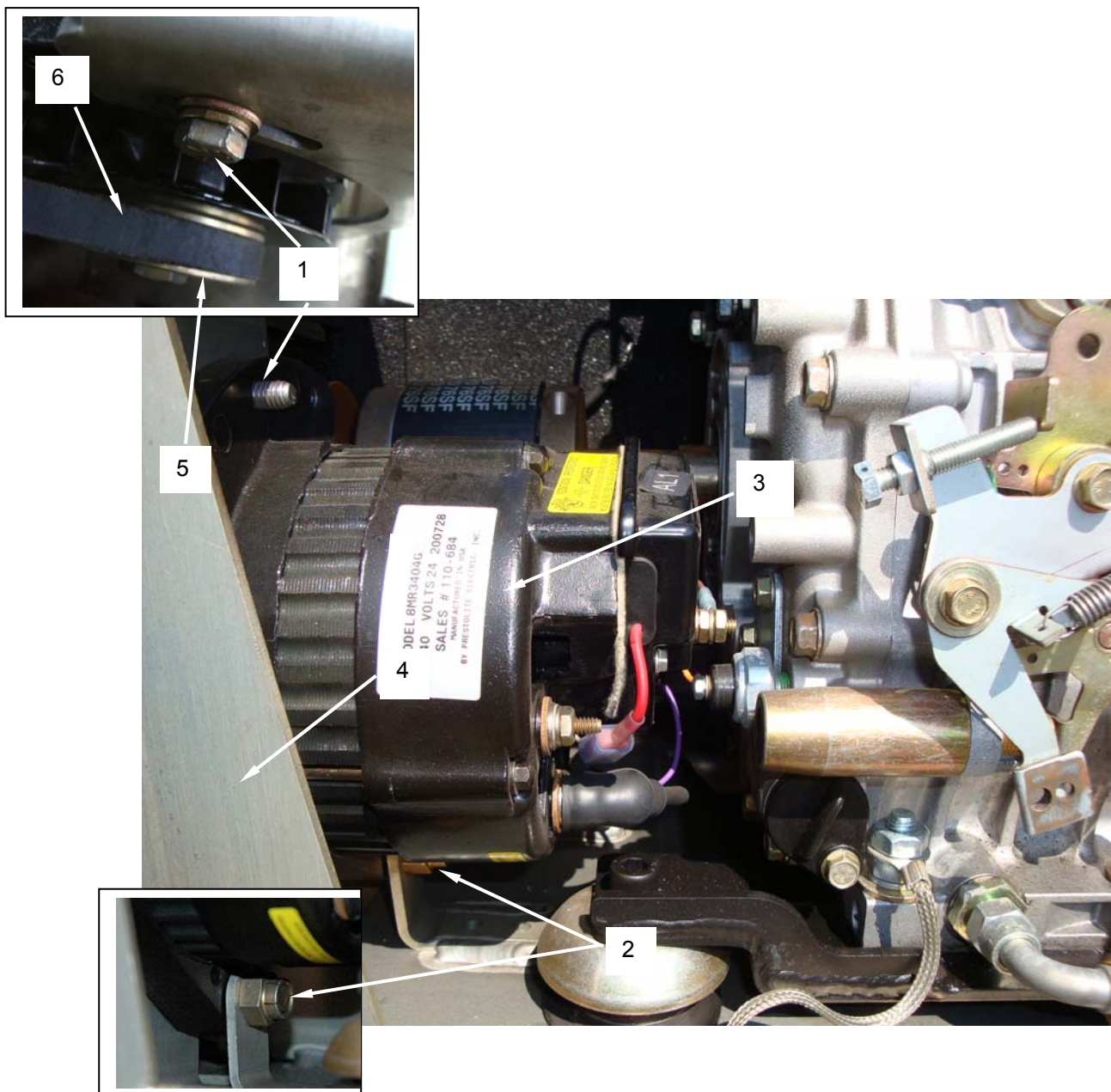


Figure 3. Adjust and Replace 24V Alternator Assembly and Drive Belt (Sheet 1 of 3).

REPLACE - Continued

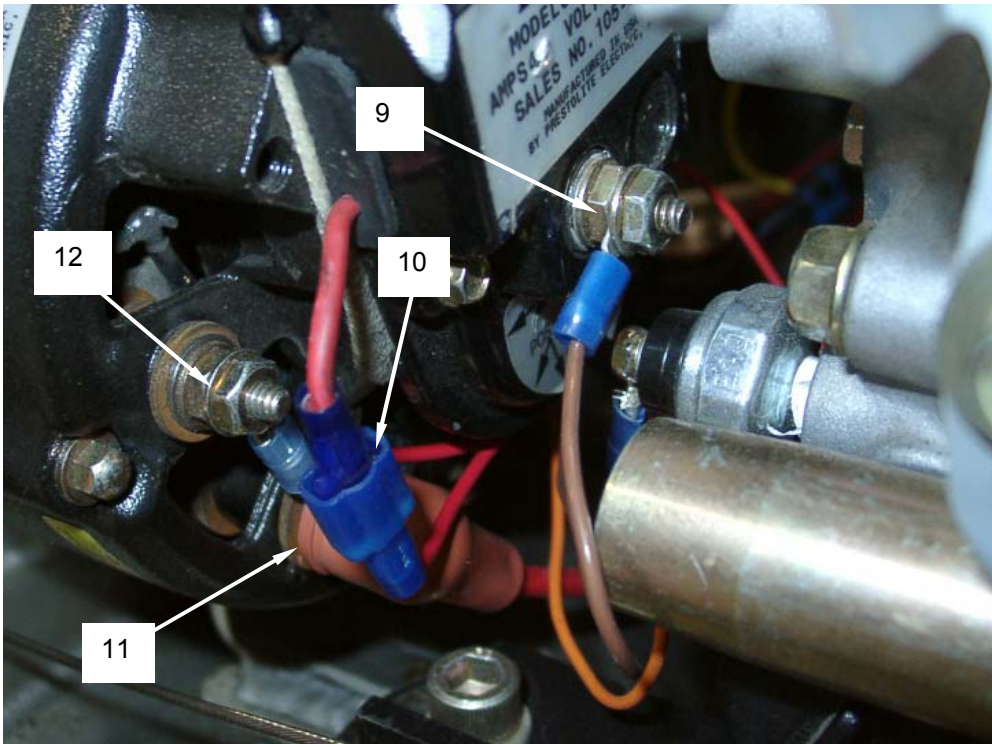
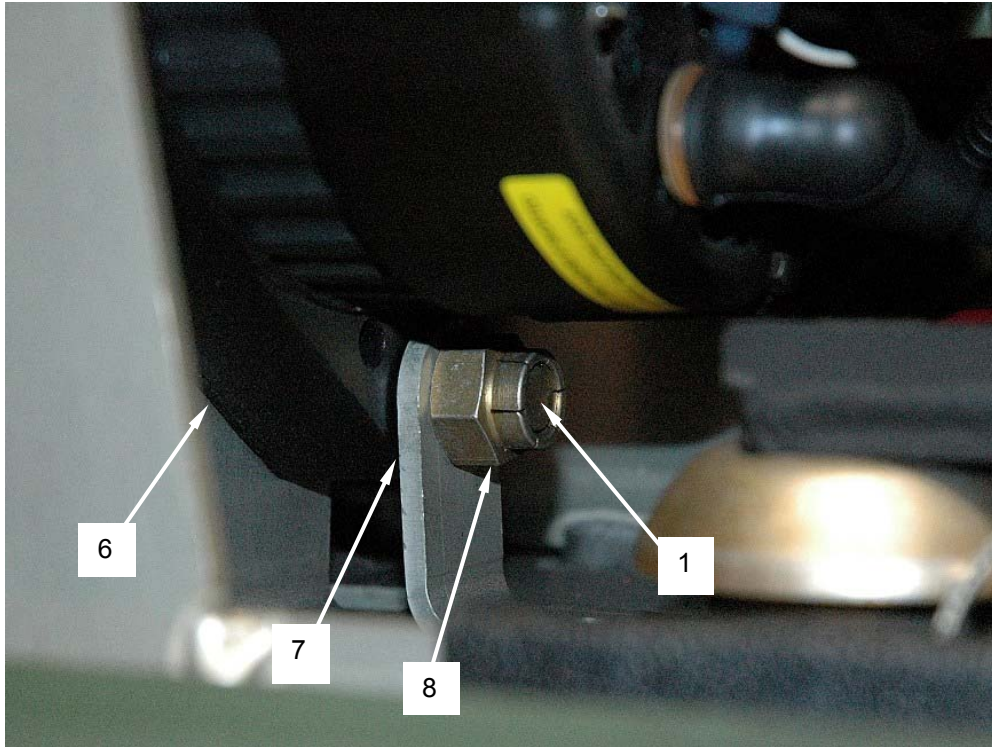


Figure 3. Adjust and Replace 24V Alternator Assembly and Drive Belt (Sheet 2 of 3).



## REPLACE - Continued

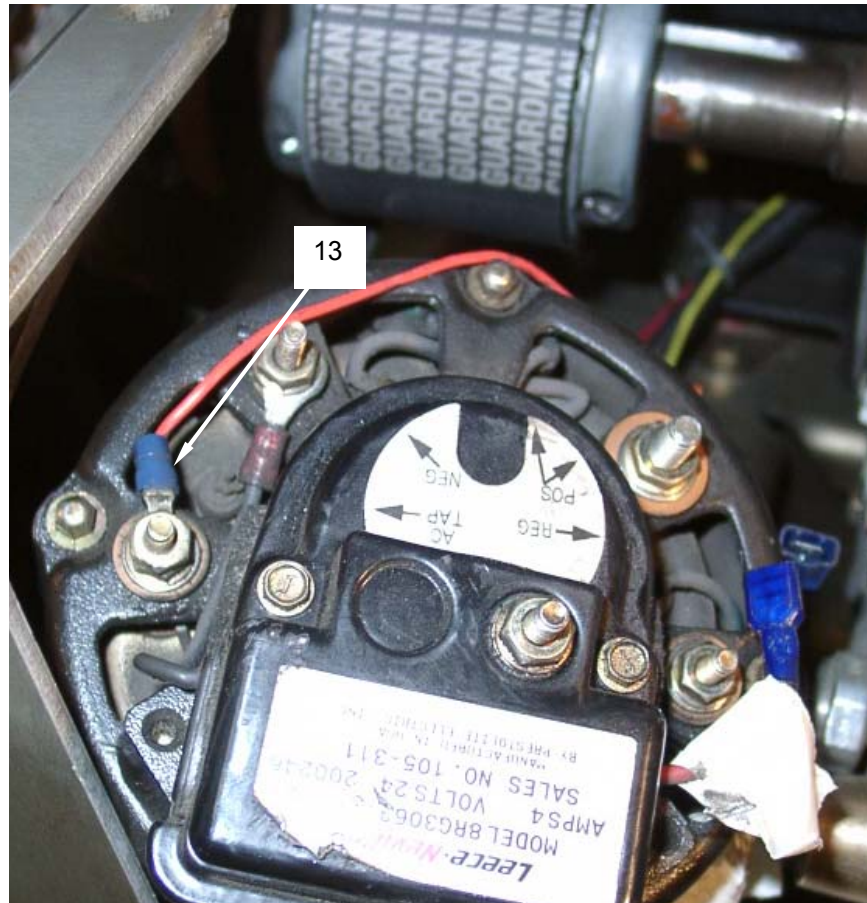


Figure 3. Adjust and Replace 24V Alternator Assembly and Drive Belt (Sheet 3 of 3).

**END OF TASK**

**END OF WORK PACKAGE**



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**SERVICE MAINTENANCE****COUPLING ASSEMBLY  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17)  
Adapter, 3/8 Inch Socket to 1/4 Inch Hex Key (WP  
0124, Item 1)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main Battery Power Switch in the OFF position and  
handle removed.

---

**REPLACE**

1. Open the engine access door to gain access to the coupling assembly.

**NOTE**

Set screws that secure coupling assembly are torqued to 26 ft-lbs and may require an aid to improve torque and assist in removal.

2. Completely remove the hex cap screw (Figure 1, Item 10) of the coupling assembly (Figure 1, Item 3) located on the inlet fan shaft (Figure 1, Item 1).
3. Insert flat screwdrivers (Figure 1, Item 11) into the slot (Figure 1, Item 12) on each portion (Figure 1, Item 9 and 6) of the coupling assembly to assist in releasing the grip on the fan and engine shafts. Tap screwdriver into slot with a hammer. Take care not to damage the shoulder (Figure 1, Item 7) on the left and right portions of the coupling assembly.
4. Tap the left hand portion (Figure 1, Item 9) and right hand portion (Figure 1, Item 6) of the flexible coupling assembly to break the bond between the sealant that has been applied between the coupling assembly hubs and their respective shafts.
5. Remove the center rubber section (Figure 1, Item 8) of the coupling assembly. Since there is minimum clearance between the ends of the two shafts and it will require rotating the rubber portion down so that the edge fits between the ends of the shafts in order to remove.

**REPLACE - Continued****NOTE**

It will be necessary to push the entire engine assembly to the right slightly in order to gain the necessary clearance between the shafts in order to remove and install portions of the coupling assembly.

6. Slide the right hand portion (Figure 1, Item 6) of the coupling assembly (Figure 1, Item 3) left along the engine drive shaft (Figure 1, Item 5) and remove.
7. Slide the left hand portion (Figure 1, Item 9) of the coupling assembly (Figure 1, Item 3) to the right off the fan drive shaft (Figure 1, Item 1) and remove.
8. Completely remove the hex-cap screw (Figure 1, Item 10) on the left hand portion of the new coupling assembly.
9. Slide one portion (Figure 1, Item 9) of the new coupling assembly (Figure 1, Item 3) onto the fan drive shaft (Figure 1, Item 1) taking care to align the slot (Figure 1, Item 12) on the left portion (Figure 1, Item 9) of the coupling assembly (Figure 1, Item 3) and the woodruff key (Figure 1, Item 4) mounted on the fan drive shaft (Figure 1, Item 1).
10. Slide the left portion (Figure 1, Item 9) of the coupling assembly (Figure 1, Item 3) onto the fan drive shaft (Figure 1, Item 1) until the left edge is 1/2 inch from the fan drive pulley (Figure 1, Item 2).
11. Slide the right portion (Figure 1, Item 6) of the new coupling assembly (Figure 1, Item 3) onto the engine shaft drive (Figure 1, Item 5) taking care to align the slot (Figure 1, Item 12) on the right portion (Figure 1, Item 6) of the coupling assembly and the woodruff key (Figure 1, Item 4) mounted on the engine drive shaft (Figure 1, Item 5).
12. Slide the right portion (Figure 1, Item 6) of the coupling assembly onto the engine shaft (Figure 1, Item 5) allowing sufficient room to insert the center rubber section (Figure 1, Item 8).
13. Install the center rubber section (Figure 1, Item 8) of the coupling assembly between the left (Figure 1, Item 9) and right (Figure 1, Item 6) portions of the coupling assembly (Figure 1, Item 3).
14. Slide the right portion (Figure 1, Item 6) of the coupling assembly left along the engine drive shaft (Figure 1, Item 5) until the gap between the right edge of the rubber section and the shoulder (Figure 1, Item 7) of the right portion (Figure 1, Item 6) is 1/8 inch. The gap is provided to allow for the expansion of the coupling due to heating.
15. Ensure that the "teeth" (Figure 1, Item 13) on the center rubber section (Figure 1, Item 8) mate properly with the "teeth" (Figure 1, Item 14) on the left and right portion of the coupling assembly (Figure 1, Item 7).
16. Using a torque wrench equipped with a 1/2 inch socket to 1/4 inch hex key adapter, install and torque the hex-head cap screw (Figure 1, Item 10) on the left (Figure 1, Item 9) portion of the coupling assembly to 26 ft-lbs.
17. Close the engine access door.

**REPLACE - Continued**

18. Operate the heater for one hour. Check for “walk” left or right of the coupling assembly. Check the torque on the hex head cap screw (Figure 1, Item 9) and verify that it is still 26 ft-lbs. Re-torque as required.

**NOTE**

Allow 1/8-inch gap between shoulder and rubber section.

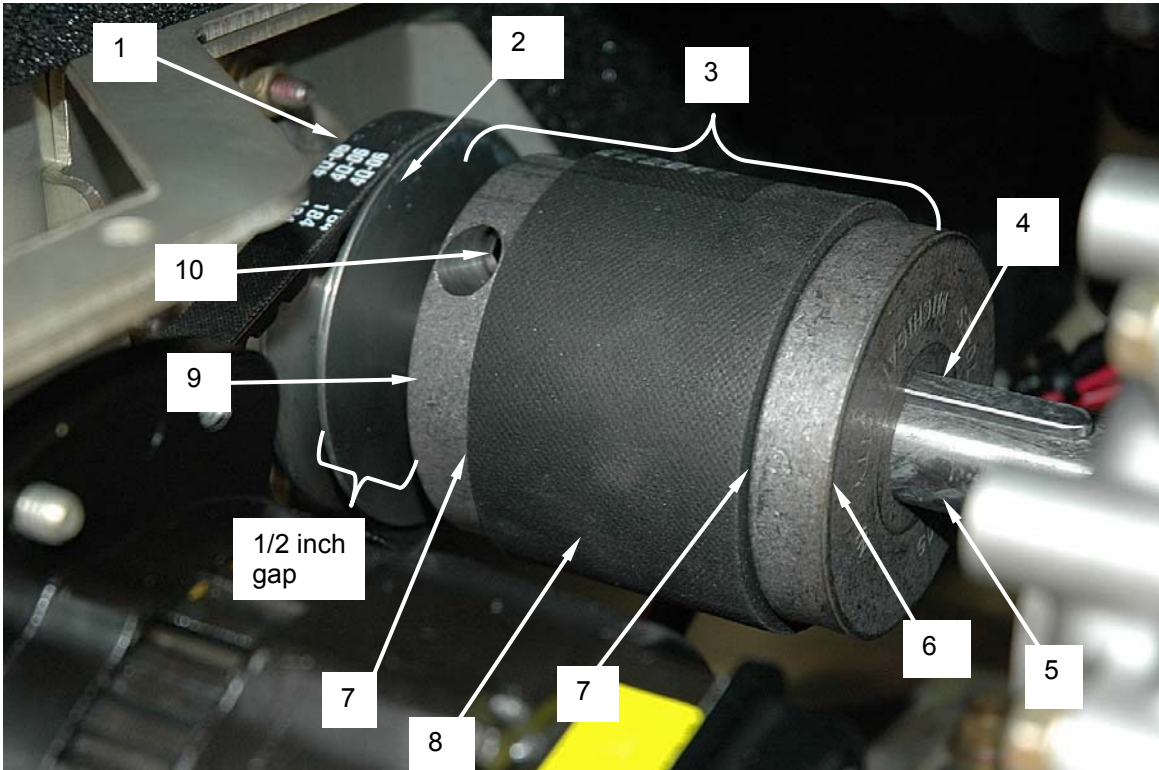


Figure 1. Replace Flexible Coupling Assembly (Sheet 1 of 2).

REPLACE - Continued

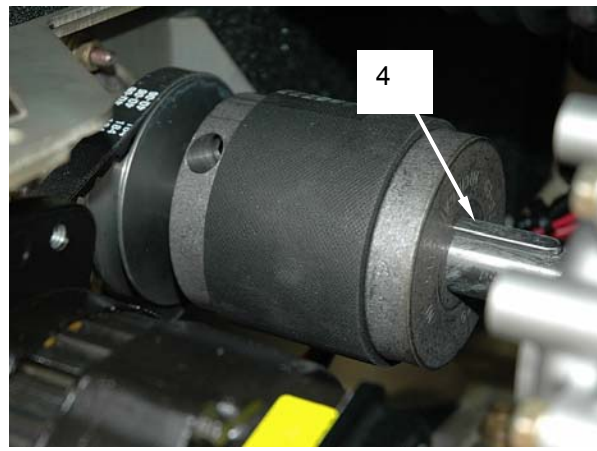
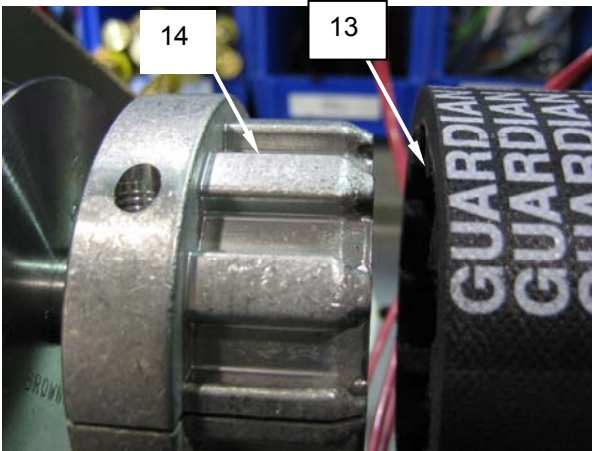
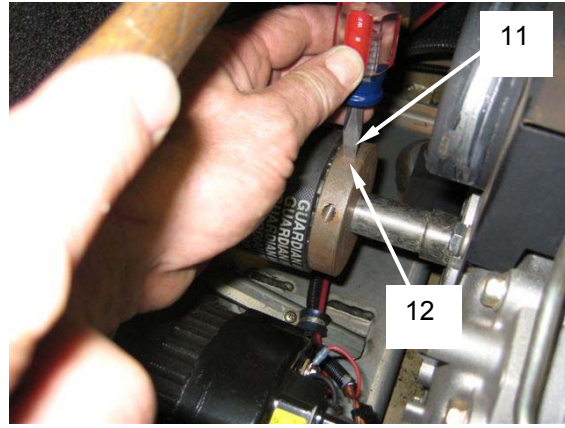
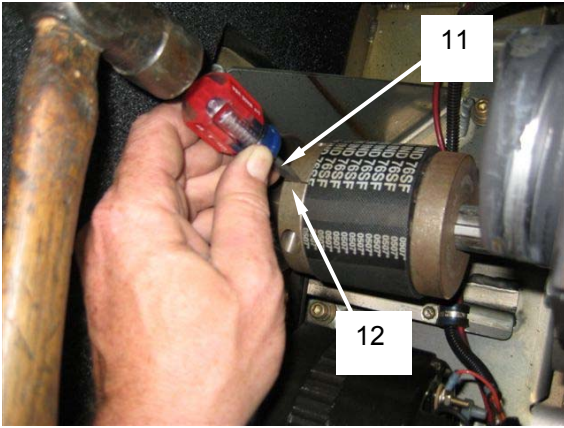


Figure 1. Replace Flexible Coupling Assembly (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE

**SERVICE MAINTENANCE****DIESEL ENGINE  
SERVICE, ADJUST, REPAIR****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
 Oil, Engine Lubricating (WP 0123, Item 9, 10, 11,  
 or 12) (Oil selection dependent on temperature;  
 refer to WP 0002 for details)  
 Rags, Wiping, Clean (WP 0123, Item 15)  
 Tray, Petroleum Absorbent (WP 0123, Item 26)  
 Container, Fuel (Unit asset; Fuel Capacity 35  
 gallons or more)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**References**

WP 0002  
 WP 0052, WP 0053  
 WP 0054, WP 0055  
 WP 0056, WP 0057  
 WP 0058, WP 0060

**Equipment Condition**

Heater shutdown and cool (WP 0005).  
 Main battery switch OFF and handle removed.

**SERVICE****Change Oil****WARNING**

Allow the engine to cool for approximately 30 minutes before changing oil. Engine oil is hot and presents a burn hazard. Coming in contact with hot engine oil may cause burns and severe injury.

**NOTE**

The engine must be standing level and be switched off. Be sure to change the oil when the engine is warm (not hot) so that the engine oil remains easy to drain. Be sure to collect the used oil and dispose of in accordance with Unit SOP and local regulations.

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

1. Remove engine oil drain hose (Figure 1, Item 2) from clamp (Figure 1, Item 1).
2. Direct oil drain hose (Figure 1, Item 2) into an approved container and remove oil drain plug (Figure 1, Item 3) and allow the oil to drain out.

**SERVICE - Continued**

3. Clean the oil drain plug (Figure 1, Item 3) and install on oil drain hose (Figure 1, Item 2).
4. Return engine oil drain hose (Figure 1, Item 2) to clamp (Figure 1, Item 1).

**CAUTION**

Only the lubricating oils specified in WP 0002, Table 1. Equipment Data, are approved for use with the LCFH Type II diesel engine. It is imperative that the lubricating oil used in the diesel engine adhere to the types and compression classifications shown for the temperature range of use. Failure to do so may result in irreparable damage to the diesel engine and a voiding of the LCFH Type II warranty.

5. Add 1.2 quarts (1.1 liters) of an approved lubricating oil IAW WP 0002, Table 1. Equipment Data, via the oil level dipstick opening (Figure 1, Item 5). Check oil level by inserting, but not screwing in, the dipstick into the dipstick opening. Fill to the upper mark (Figure 1, Item 4) on the dipstick.

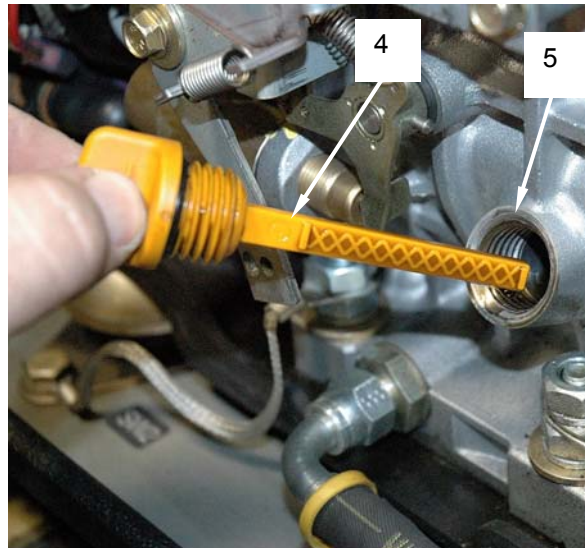
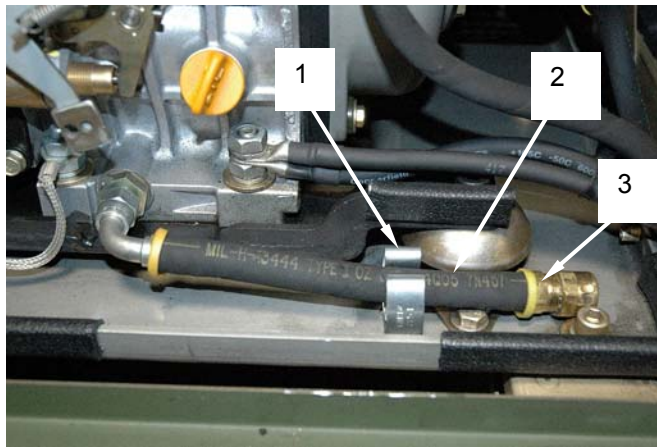


Figure 1. Check Oil.

**END OF TASK**

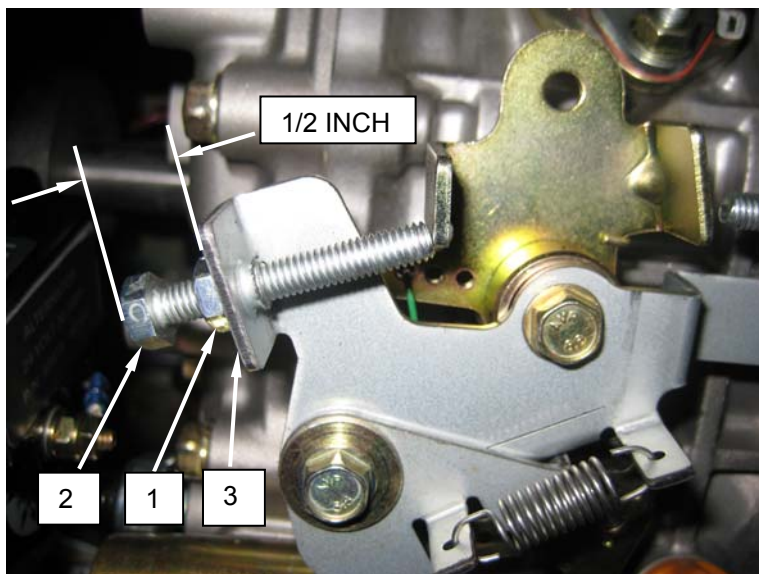


**ADJUST**

**CAUTION**

Before loosening the diesel engine throttle adjustment bolt, check the measurement from the top of the bolt to the face of the adjustment plate. If this measurement is 1/2 inch, do not change the adjustment; it is properly set to 3,000 RPM.

1. To adjust the diesel engine to 3,000 RPM, loosen the locking nut (Figure 2, Item 1) on the diesel engine throttle adjustment bolt (Figure 2, Item 2).
2. Rotate the adjustment bolt clockwise or counterclockwise as needed so that the measurement from the top of the head of the adjustment bolt to the face of the throttle adjustment plate (Figure 2, Item 3) is exactly 1/2 inch.
3. Hold the adjustment bolt in place and tighten the locking nut.



**END OF TASK**

**REPAIR**

The repair of the diesel engine involves repair or replacement of one or more of the subcomponents as shown below. Procedures for the repair or replacement of the subcomponents can be found in the referenced work packages.

**Table 1. Replaceable Components Used to Repair Diesel Engine.**

<b>Replaceable Component</b>	<b>Work Package</b>
Crankcase Cover	WP 0052
Cylinder Head	WP 0053
Air Cleaner Assembly	WP 0054
Oil Pump and Strainer	WP 0055
Fuel Injector	WP 0056
Electric Starter Assembly	WP 0057
Flywheel Assembly	WP 0058
Engine Shutdown Solenoid	WP 0060

**END OF TASK**

**END OF WORK PACKAGE**



## FIELD MAINTENANCE

**CRANKCASE COVER  
REMOVE, SERVICE, INSPECT, INSTALL**
**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)  
Grease, General Purpose (WP 0123, Item 7)  
Oil, Engine Lubricating (WP 0123, Item 9, 10, 11,  
or 12) (Oil selection dependent on temperature;  
refer to WP 0002 for details)

**References**

WP 0005  
WP 0045  
WP 0081  
WP 0051

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Remove diesel engine from heater (WP 0081).

**REMOVE****CAUTION**

When removing crankcase cover, be careful not to damage oil seal.

**NOTE**

Burner Fuel Pump Assembly must be removed prior to performing this procedure IAW WP 0045.

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

1. Note attachment location of engine lifting cable (Figure 1, Item 2). Release crankcase cover (Figure 1, Item 3) and lifting cable from cylinder block by removing fifteen screws (Figure 1, Item 1). Carefully pry crankcase cover from cylinder block by tapping on cover tabs (Figure 1, Item 5) with a metal punch.
2. Remove cover gasket (Figure 1, Item 4). Discard gasket if damaged or deformed. Remove pipe (Figure 1, Item 7), two guide pins (Figure 1, Item 6), and sensor (Figure 1, Item 8) only if replacement is required.

REMOVE - Continued

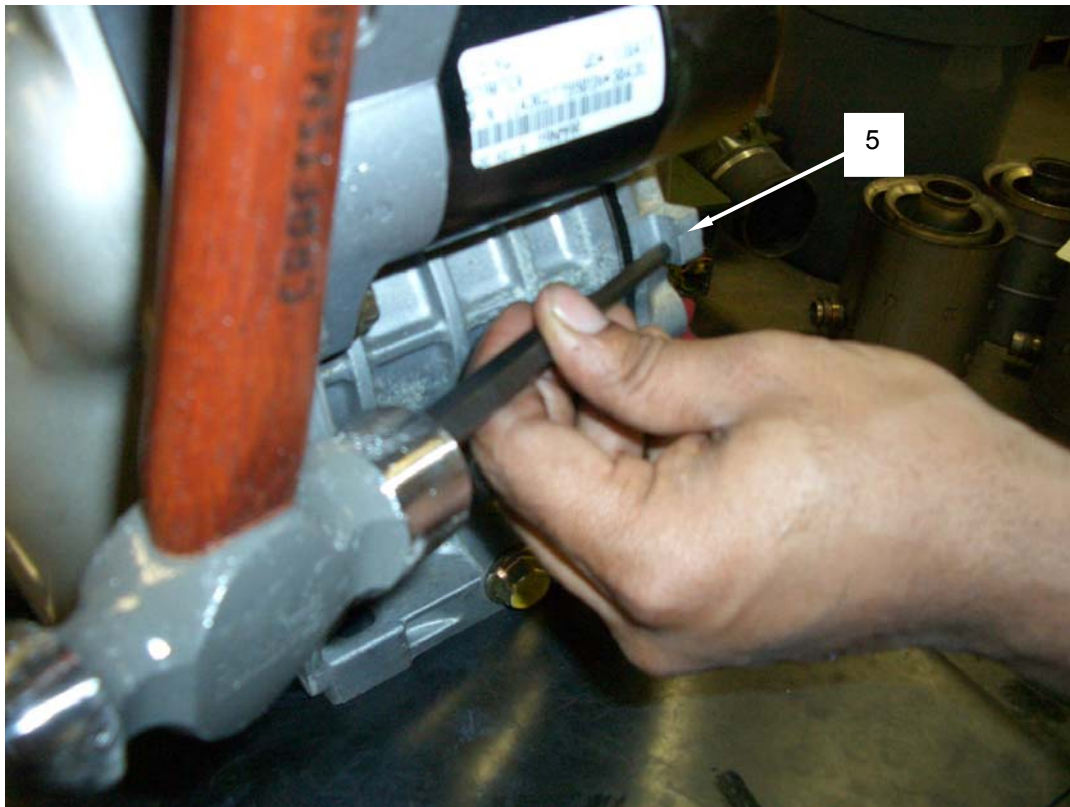
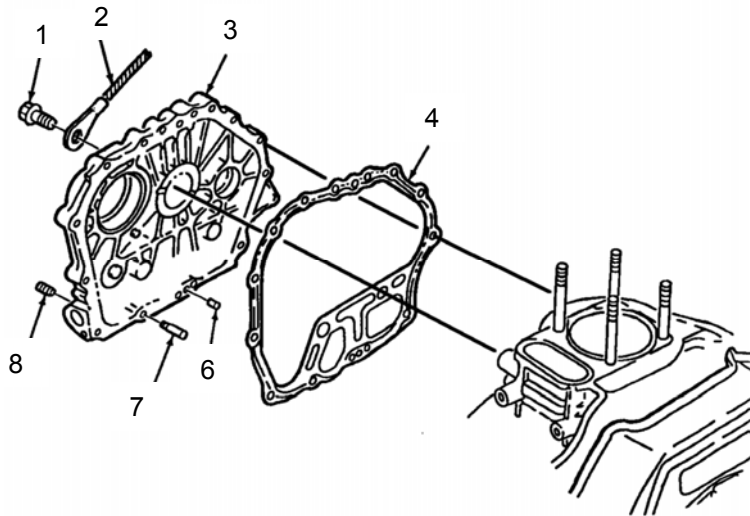


Figure 1. Remove Crankcase Cover.

END OF TASK

**SERVICE****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

1. Clean crankcase cover with cleaning solvent and a clean rag. Allow to air dry.
2. Remove any old gasket material or grease from crankcase cover and engine crankcase mating surfaces.

**END OF TASK****INSPECT**

1. Inspect crankcase cover (Figure 1, Item 3) for cracks, deformation, or obvious damage. Inspect cover mating surfaces for scratches, burrs, or blemishes. Replace cover if damaged.
2. Inspect cover gasket (Figure 1, Item 4) for damage or deformation. Replace if damaged in any way.

**END OF TASK****INSTALL**

1. If removed, install threaded plug (Figure 2, Item 7), pipe (Figure 2, Item 6), and two guide pins (Figure 2, Item 5) into crankcase cover (Figure 2, Item 3).
2. Apply grease to lips of crankshaft oil seal (housed in crankcase cover (Figure 1, Item 3)).
3. Apply oil to crankshaft and camshaft. Make sure that oil pump drive gears are properly engaged.
4. Mate cover gasket (Figure 2, Item 4) to cylinder block.

**NOTE**

It will be easier to install the crankcase cover by lightly pushing down on the cover while slowly rotating the flywheel.

5. Mate crankcase cover (Figure 2, Item 3) to cylinder block and secure using fifteen screws (Figure 2, Item 1). Make sure to attach lifting cable (Figure 2, Item 2) at position noted during removal. Tighten screws in criss-cross sequence as shown in accompanying illustration (See Figure 2, Upper). Torque all screws to 174 to 199 inch-pounds (200 to 230 kg-cm).
6. Service engine oil (WP 0051).

INSTALL - Continued

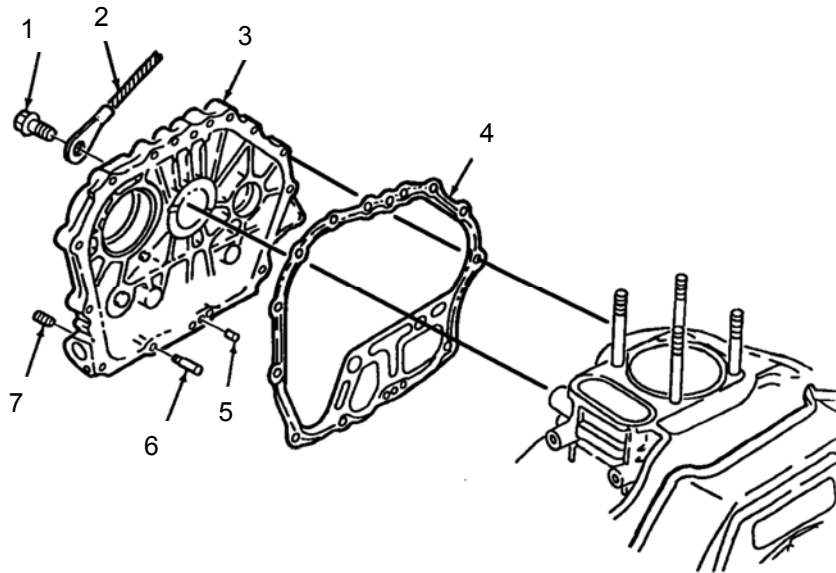
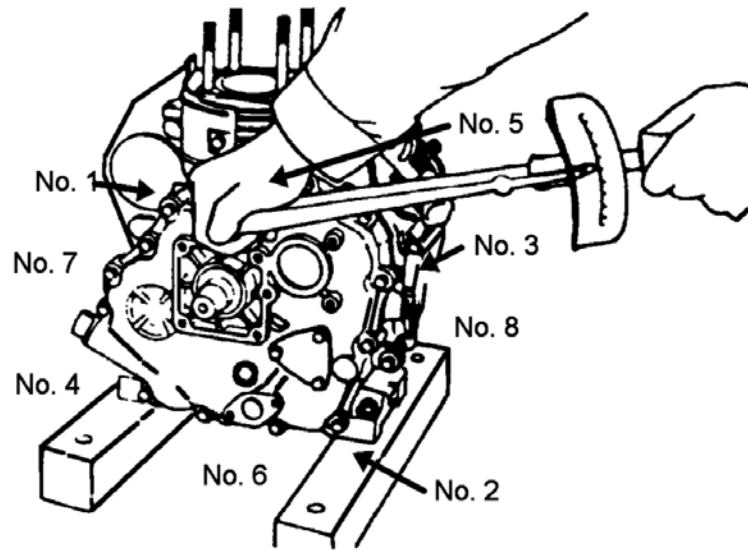


Figure 2. Inspect and Install Crankcase Cover.

END OF TASK

**REPLACE****CAUTION**

When removing crankcase cover, be careful not to damage oil seal.

1. Note attachment location of engine lifting cable (Figure 3, Item 2). Release crankcase cover (Figure 3, Item 3) and lifting cable from cylinder block by removing fifteen screws (Figure 3, Item 1). Carefully pry unserviceable crankcase cover from cylinder block by tapping on cover tabs (Figure 3, Item 5) with a metal punch.
2. Remove cover gasket (Figure 3, Item 4). Discard gasket if damaged or deformed. Remove pipe (Figure 3, Item 7), two guide pins (Figure 3, Item 6), and sensor (Figure 3, Item 8) only if replacement is required.

REPLACE - CONTINUED

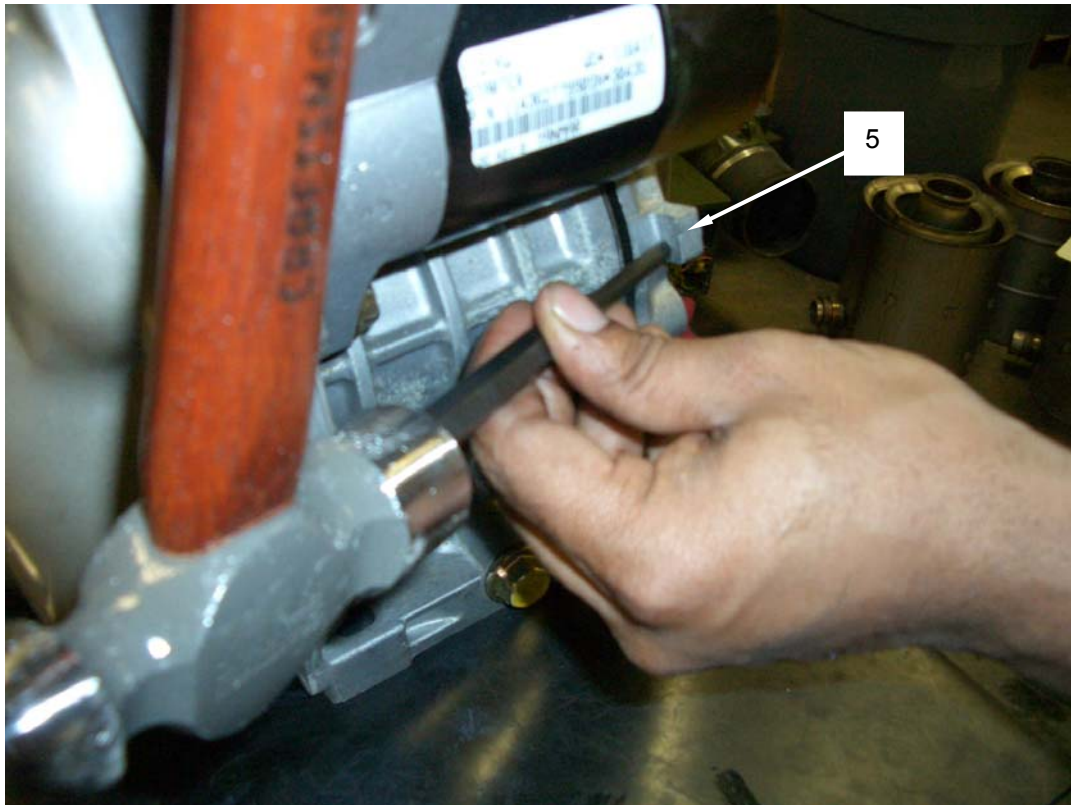
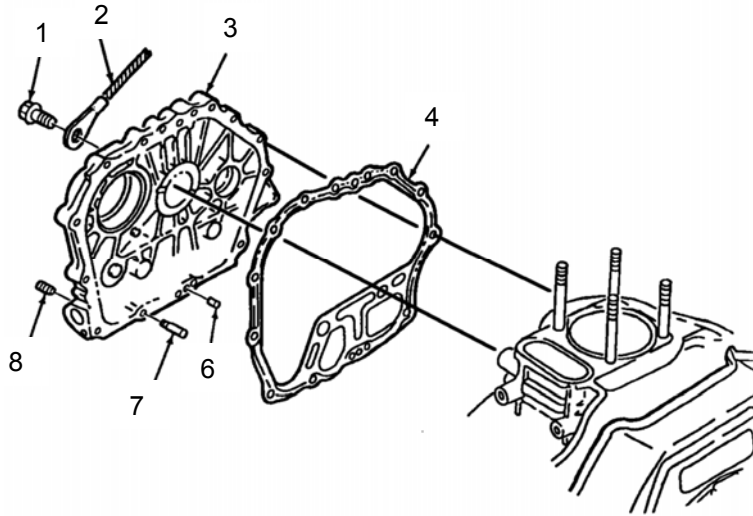


Figure 3. Remove Crankcase Cover.



**REPLACE - Continued**

3. Install threaded plug (Figure 4, Item 7), pipe (Figure 4, Item 6), and two guide pins (Figure 4, Item 5) into serviceable crankcase cover (Figure 4, Item 3).
4. Apply grease to lips of crankshaft oil seal (housed in crankcase cover (Figure 4, Item 3)).
5. Apply oil to crankshaft and camshaft. Make sure that oil pump drive gears are properly engaged.
6. Mate cover gasket (Figure 4, Item 4) to cylinder block.

**NOTE**

It will be easier to install the crankcase cover by lightly pushing down on the cover while slowly rotating the flywheel.

7. Mate crankcase cover (Figure 4, Item 3) to cylinder block and secure using fifteen screws (Figure 4, Item 1). Make sure to attach lifting cable (Figure 4, Item 2) at position noted during removal. Tighten screws in criss-cross sequence as shown in accompanying illustration (Figure 4, Upper). Torque all screws to 174 to 199 inch-pounds (200 to 230 kg-cm).
8. Service engine oil (WP 0051).

REPLACE - Continued

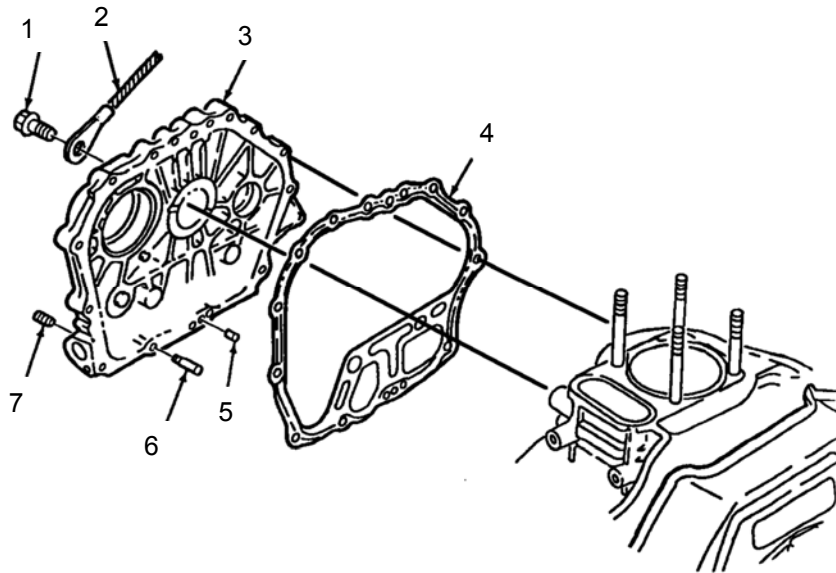
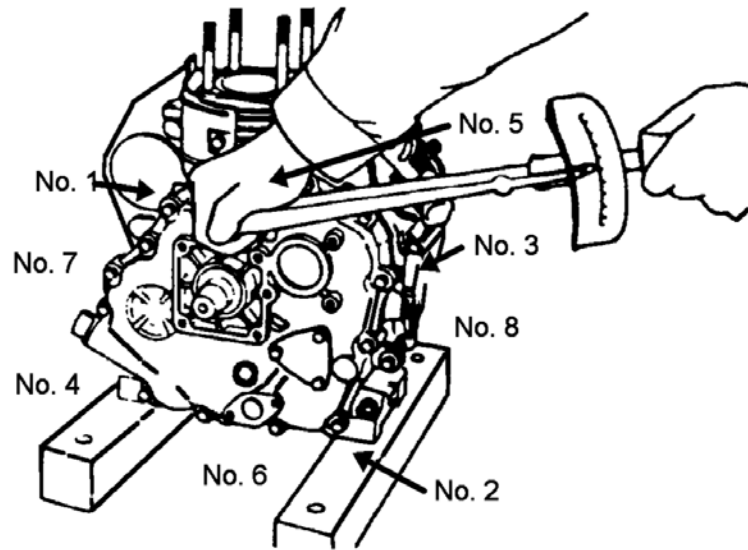


Figure 4. Install Crankcase Cover.

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE**  
**ROCKER ARM ASSEMBLY**  
**REMOVE, ADJUST, INSTALL**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or Utilities Equipment Repairer 52C (1)

**References**

WP 0045  
WP 0072  
WP 0058

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main Battery Power Switch in the OFF position and handle removed.  
Remove diesel engine from heater (WP 0081).

---

**REMOVE****NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**Remove Components for Adjustment of Rocker Arm Assembly**

1. Remove batteries IAW WP 0072 and set aside.
2. Remove burner fuel pump IAW WP 0045 and set aside.
3. Remove flywheel housing IAW WP 0058.
4. Remove head cover (Figure 1, Item 2) from cylinder head (Figure 1, Item 3) by removing bolts (Figure 1, Item 1). Remove cover gasket (Figure 1, Item 6) only if replacement is required.

**END OF TASK****ADJUST**

1. Rotate flywheel in the clockwise direction until T mark (Figure 1, Item 4) on flywheel matches V mark (Figure 1, Item 5) on cylinder body fin. This is the top dead center (TDC) position. Intake and exhaust valves will be in closed position.
2. Using a gap setting gauge (Figure 1, Item 10), check rocker arm (Figure 1, Item 7) to valve (Figure 1, Item 11) clearance. Clearance shall be 0.004 to 0.008 inch (0.10 to 0.20 mm). The amount of drag on the gap setting gauge when passing through the gap shall be minimal.
3. If adjustment is required, loosen lock nut (Figure 1, Item 9) and rotate adjusting screw (Figure 1, Item 8) clockwise/counter-clockwise to expand/reduce gap. Tighten lock nut (Figure 1, Item 9) and recheck clearance.
4. Repeat steps 2 and 3 above until proper clearance is attained.

**END OF TASK**

**INSTALL****Install Components after Adjustment of Rocker Arm Assembly**

1. Install head cover (Figure 1, Item 2) on cylinder head (Figure 1, Item 3) using bolts (Figure 1, Item 1).
2. Install flywheel cover set aside earlier IAW WP 0058.
3. Install burner fuel pump set aside earlier IAW WP 0045.
4. Install batteries set aside earlier IAW WP 0072.

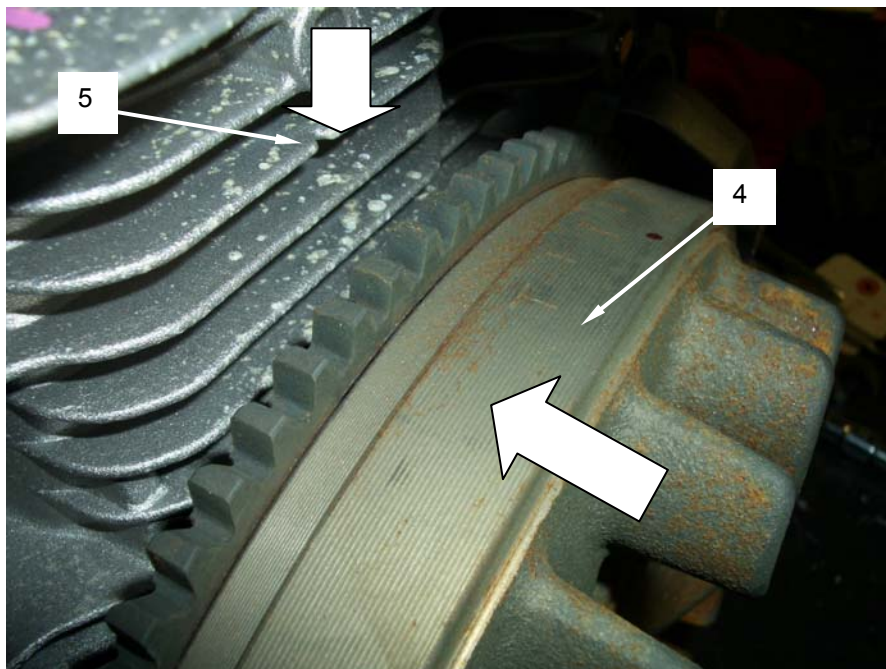
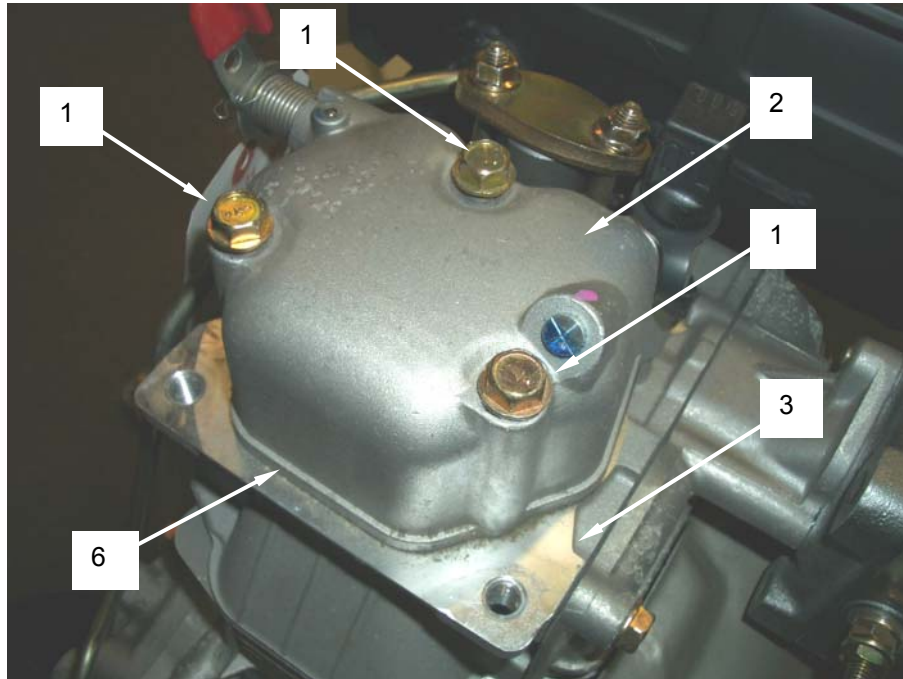


Figure 1. Remove, Adjust, and Install Rocker Arm Assembly (Sheet 1 of 2).

INSTALL - Continued

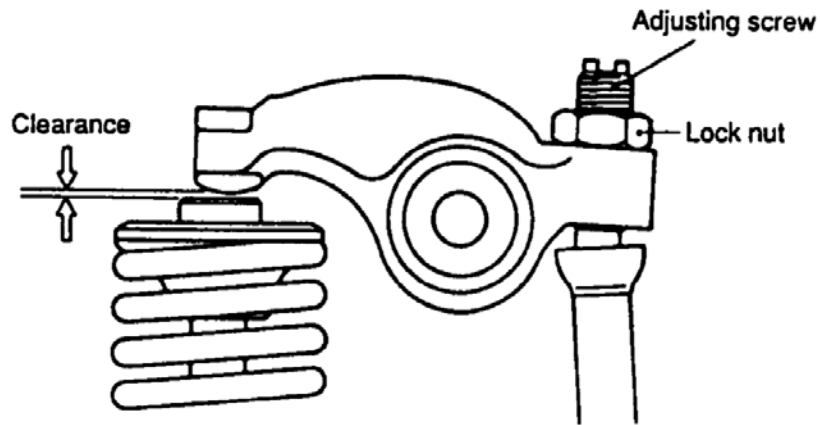
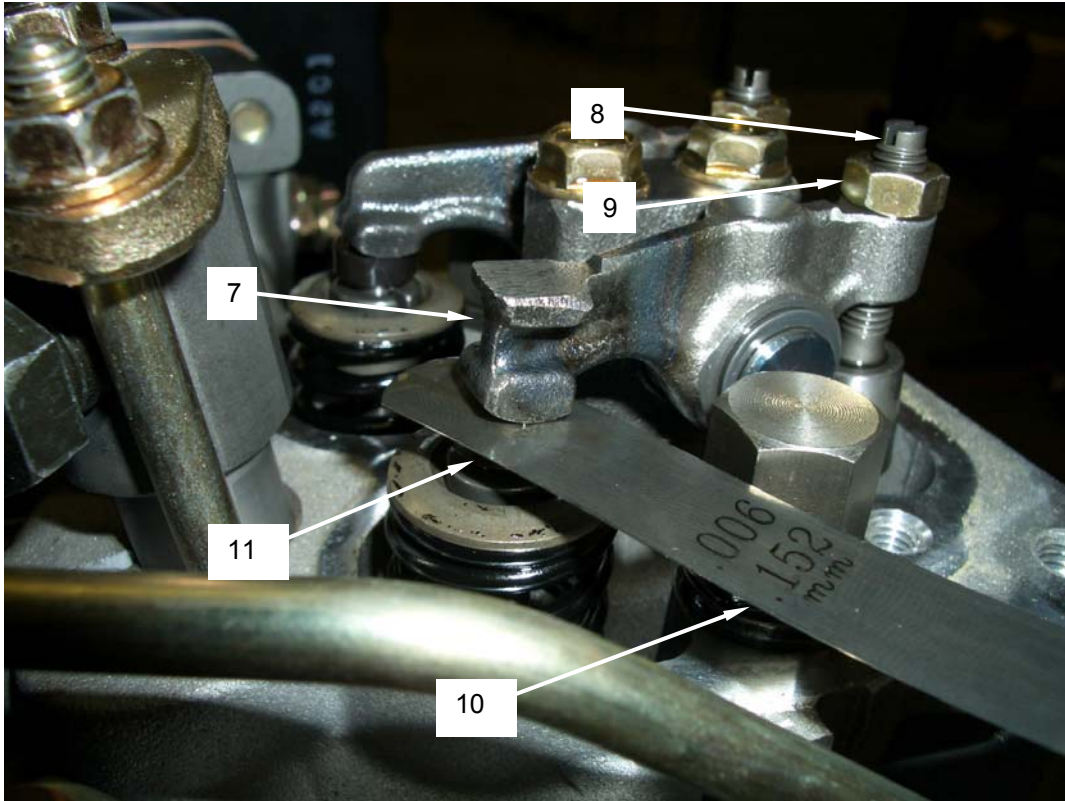


Figure 1. Remove, Adjust, and Install Rocker Arm Assembly (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE



---

**SERVICE MAINTENANCE**  
**AIR CLEANER ASSEMBLY**  
**REMOVE, INSPECT, INSTALL, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Brush, Wire, Scratch (WP 0123, Item 4)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)

**Equipment Condition**

Heater shut down and engine cool (WP 0005).  
Main Battery Power Switch in the OFF position and handle removed.

---

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Remove cover (Figure 1, Item 14) from air filter housing (Figure 1, Item 10) by removing wing nut (Figure 1, Item 13) and washer (Figure 1, Item 12).
2. Remove air filter element (Figure 1, Item 15) from housing (Figure 1, Item 10). Remove housing from adapter (Figure 1, Item 7) by removing three screws (Figure 1, Item 11).
3. If replacement of air heaters (Figure 1, Item 6) is required, disconnect electrical wire leads from heaters by removing two nuts (Figure 1, Item 18) and washers (Figure 1, Item 17). Reinstall nuts and washers to prevent loss.
4. Remove adapter (Figure 1, Item 7), air heaters (Figure 1, Item 6), and gaskets (Figure 1, Item 5) from adapter (Figure 1, Item 20) by removing four screws (Figure 1, Item 9) and washers (Figure 1, Item 8).
5. Remove adapter (Figure 1, Item 20) from air intake duct (Figure 1, Item 1) by removing three nuts (Figure 1, Item 19). Remove gasket (Figure 1, Item 16). Remove studs (Figure 1, Item 3) from duct only if replacement is required.
6. Remove air intake duct (Figure 1, Item 1) from cylinder head by removing two screws (Figure 1, Item 4). Remove gasket (Figure 1, Item 2).

REMOVE - Continued

**WARNING**



Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

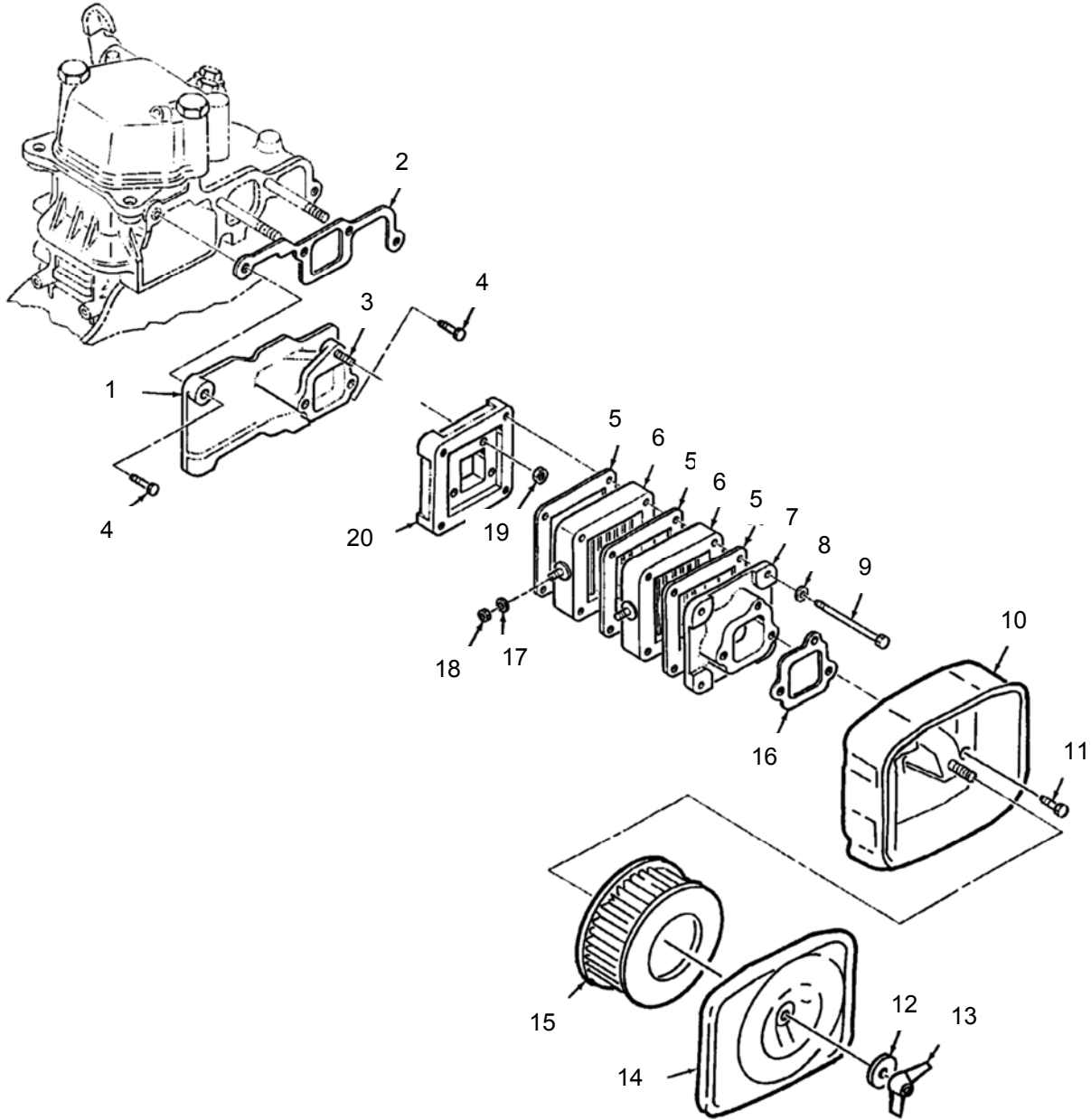


Figure 1. Remove Diesel Engine Air Cleaner Components.



**REMOVE - Continued****NOTE**

Do not clean air filter element. Do not tap or hit to remove dirt. If element is clogged or dirty, replace it.

7. Clean electrical connection studs on air heaters with a stiff wire brush.
8. Clean remaining components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

1. Inspect cover (Figure 2, Item 14), housing (Figure 2, Item 10), adapters (Figure 2, Item 7, 20), and air intake duct (Figure 2, Item 1) for cracks, dents, or corrosion. Replace component if damaged to the extent that it will effect proper operation of the air filtering system.
2. Inspect air heaters (Figure 2, Item 6) for obvious damage. Replace if damaged is suspected.
3. Inspect gaskets (Figure 2, Item 2, 5, 16) for cuts, tears, or deformation. Replace if damaged or deformed.

**END OF TASK****INSTALL**

1. If removed, install air intake duct (Figure 2, Item 1) and gasket (Figure 2, Item 2) using two screws (Figure 2, Item 4). Install studs (Figure 2, Item 3).
2. Install adapter (Figure 2, Item 20) and gasket (Figure 2, Item 16) using three nuts (Figure 2, Item 19).
3. Install adapter (Figure 2, Item 7), air heaters (Figure 2, Item 6) and gaskets (Figure 2, Item 5) using four screws (Figure 2, Item 9) and washers (Figure 2, Item 8). Connect electrical wire leads to heaters using nuts (Figure 2, Item 18) and washers (Figure 2, Item 17).
4. Install filter housing (Figure 2, Item 10) using three screws (Figure 2, Item 11). Install filter element (Figure 2, Item 15) into housing.
5. Install cover (Figure 2, Item 14) onto housing (Figure 2, Item 10) and secure using wing nut (Figure 2, Item 13) and washer (Figure 2, Item 12).

**INSTALL - Continued**

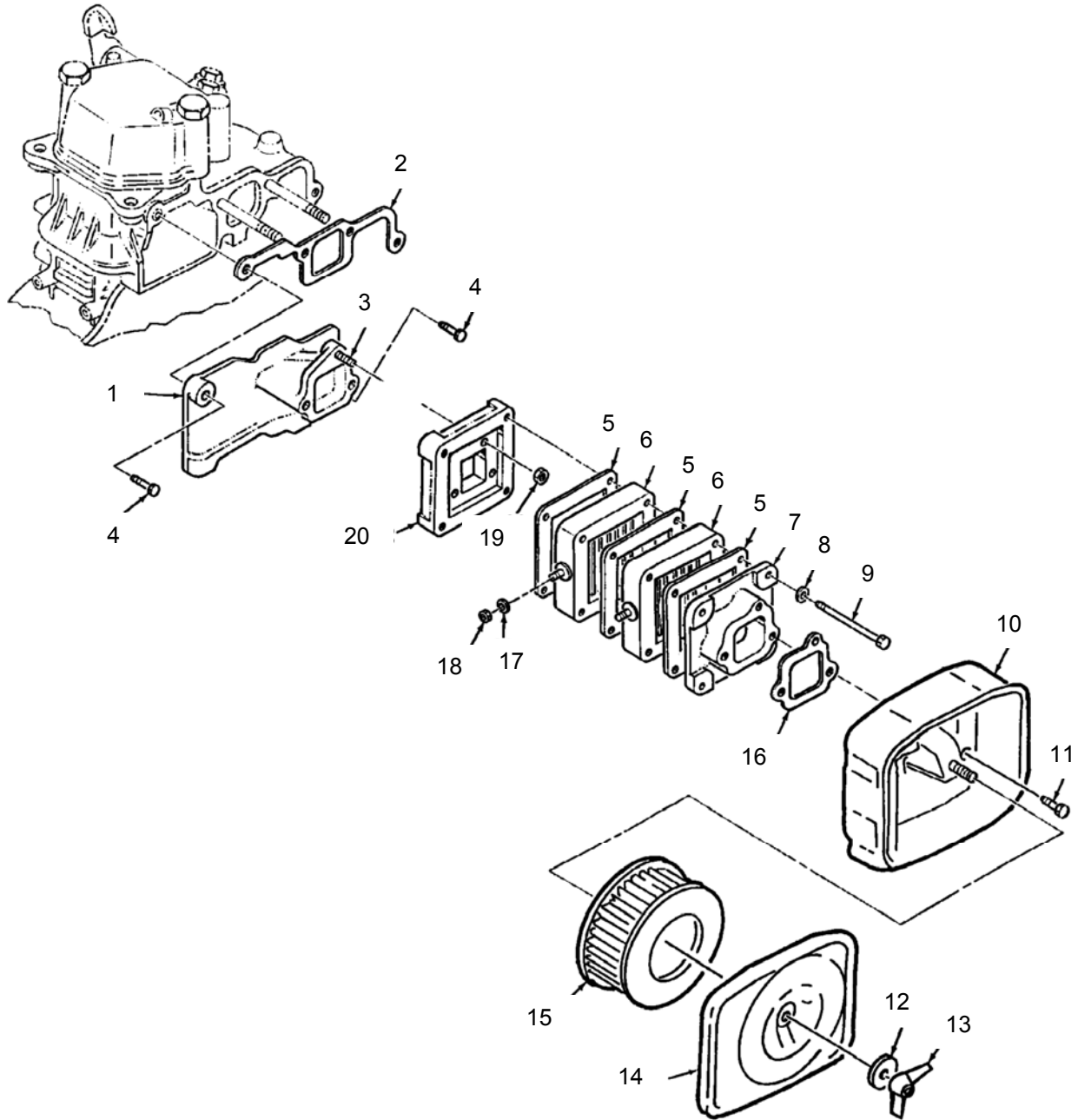


Figure 2. Inspect and Install Diesel Engine Air Cleaner Components.

**END OF TASK**

**REPAIR**

Repair is limited to replacement of damaged parts.

**END OF TASK**

**END OF WORK PACKAGE**

**SERVICE MAINTENANCE****OIL STRAINER  
REMOVE, INSPECT, INSTALL****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
Oil, Engine Lubricating (WP 0123, Item 9, 10, 11, or 12) (Oil selection dependent on temperature, refer to WP 0002 for details)  
Rag, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Engine oil drained (WP 0051).

**WARNING**

Allow the engine to cool for approximately 30 minutes before changing oil. Engine oil is hot and presents a burn hazard. Coming in contact with hot engine oil may cause burns and severe injury.

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**NOTE**

The oil strainer must be cleaned at the same time as the engine oil is changed, since oil escapes when the strainer is removed.

**REMOVE**

Remove oil strainer (Figure 1, Item 4) from crankcase (Figure 1, Item 1) by removing bolt (Figure 1, Item 2) and pulling straight out.

**END OF TASK****INSPECT**

1. Inspect oil strainer (Figure 1, Item 4) for obvious damage. Check strainer's mesh material for damage. Clean out clogging dirt and residue. Replace oil strainer as required.
2. Inspect O-ring for serviceability. Replace as needed.
3. Inspect area around oil strainer port for evidence of leakage. Clean area of dirt and accumulated grime using a clean rag and solvent.

**END OF TASK**

**INSTALL**

1. Apply a light coat of lubricating oil to O-ring (Figure 1, Item 3) and install O-ring onto oil strainer (Figure 1, Item 4).
2. Slide oil strainer (Figure 1, Item 4) into crankcase (Figure 1, Item 1) and secure using bolt (Figure 1, Item 2).
3. Refill oil IAW WP 0051.

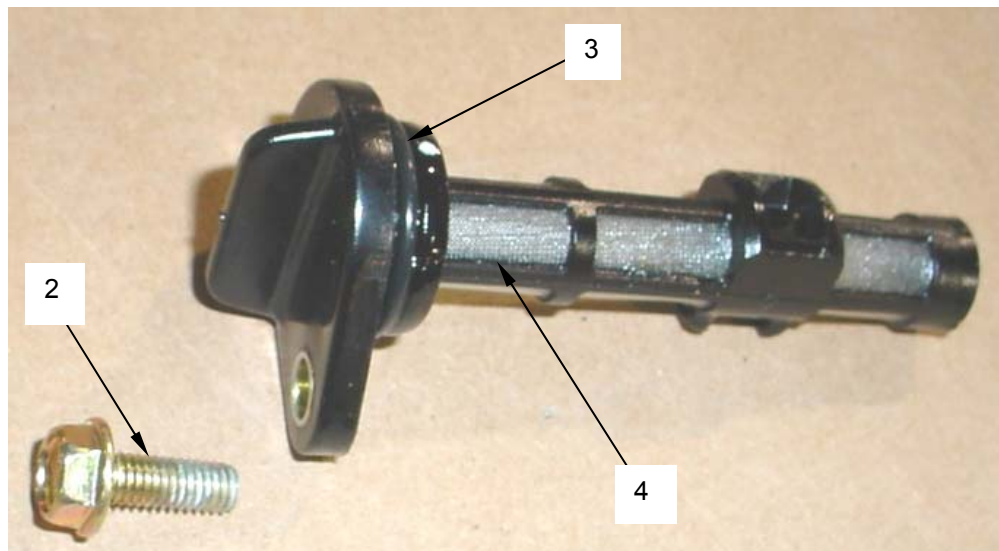
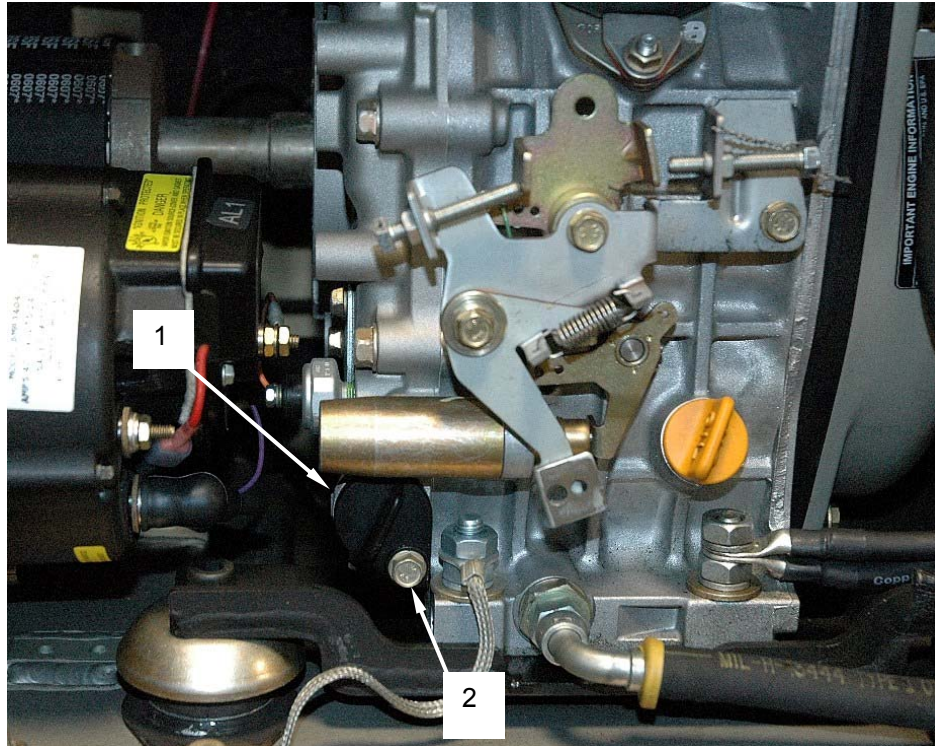


Figure 1. Remove, Inspect, Install Oil Strainer.

**END OF TASK**

**END OF WORK PACKAGE**

---

**SERVICE MAINTENANCE**  
**DIESEL ENGINE FUEL INJECTOR**  
**REMOVE, INSPECT, INSTALL, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 18)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rag, Wiping, Clean (WP 0123, Item 15)

**Equipment Condition**

Heater shut down and engine cool (WP 0005).  
Main Battery Power Switch in the OFF position and  
handle removed.

---

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Disconnect rigid fuel supply line (Figure 1, Item 5) from fuel injector (Figure 1, Item 7). Disconnect fuel return hose (Figure 1, Item 1) by loosening clamp (Figure 1, Item 8).
2. Remove opposite end of rigid fuel line (Figure 1, Item 9) on fuel injector pump (Figure 1, Item 10).
3. Remove two nuts (Figure 1, Item 4) and nozzle retainer (Figure 1, Item 3) from studs (Figure 1, Item 6).

**CAUTION**

When removing fuel injector, wrap it in a clean cloth to protect injector nozzle. Do not place nozzle tip directly onto a hard surface, as damage will result.

4. Carefully remove fuel injector (Figure 1, Item 7) from injection port (Figure 1, Item 11) in cylinder head.
5. Remove injector spacer (Figure 1, Item 12, Sheet 3 of 3) and gasket (Figure 1, Item 13, Sheet 3 of 3) from injector port (Figure 1, Item 11). Discard gasket.

**END OF TASK****INSPECT**

1. Inspect fuel injector (Figure 1, Item 7, Sheet 3 of 3) for obvious damage. Check for clogged or dirty injector nozzle. Replace injector if nozzle is damaged.
2. Inspect return rigid fuel line (Figure 1, Item 5) for cuts, kinks, or crimping. Replace rigid fuel line if damaged.
3. Inspect return fuel hose (Figure 1, Item 1) for cuts, tears, kinks, or crimping. Replace fuel hose if damaged.

**END OF TASK**

**INSTALL**

1. Install new gasket (Figure 1, Item 12, Sheet 3 of 3) into cylinder head injector port (Figure 1, Item 11). Ensure proper seating. Install fuel spacer (Figure 1, Item 13, Sheet 3 of 3).

**CAUTION**

When installing fuel injector, use care to prevent damage to injector nozzle.

2. Carefully position and insert fuel injector (Figure 1, Item 7, Sheet 3 of 3) into cylinder head. Ensure fuel pipe fitting (Figure 1, Item 14, Sheet 3 of 3) is facing the correct direction.
3. Install nozzle retainer (Figure 1, Item 3) onto studs (Figure 1, Item 6). Install nuts (Figure 1, Item 4) and torque to 87 to 104 inch-pounds (100 to 120 kg-cm).
4. Connect fuel return hose (Figure 1, Item 1) to fuel injector (Figure 1, Item 7, Sheet 3 of 3) and tighten clamp (Figure 1, Item 8).
5. Connect rigid fuel supply line (Figure 1, Item 5) to fuel injector (Figure 1, Item 7).
6. Connect opposite end of rigid fuel line (Figure 1, Item 9) to fuel injector pump (Figure 1, Item 10).

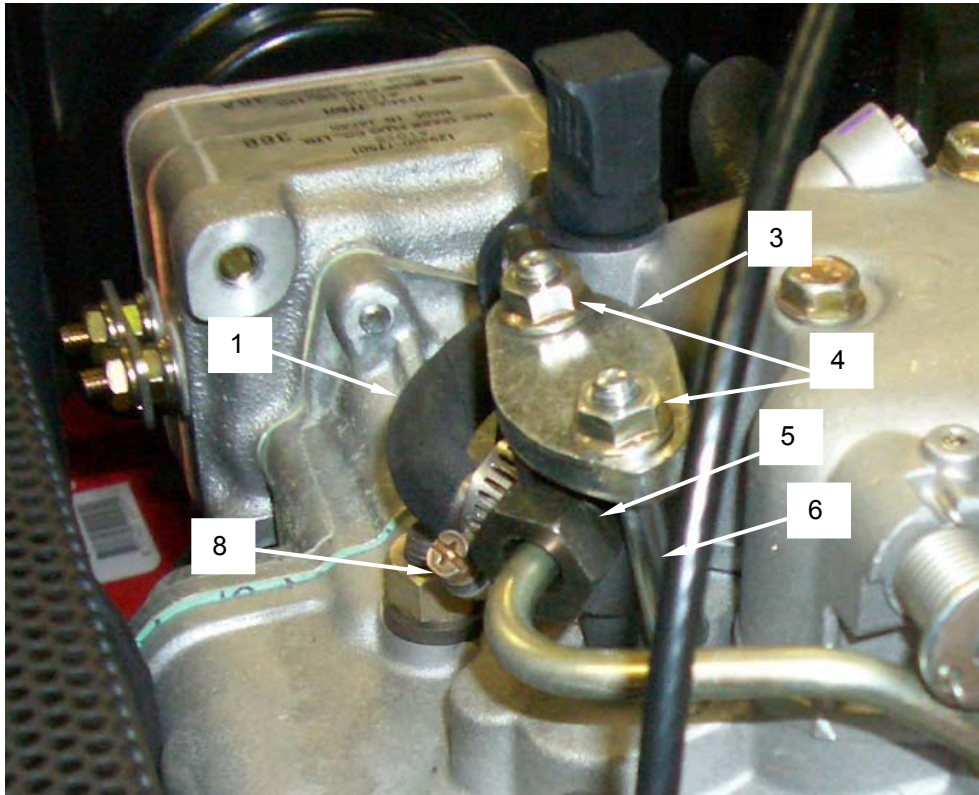


Figure 1. Remove, Inspect, and Install Diesel Engine Fuel Injector (Sheet 1 of 3).

INSTALL - Continued

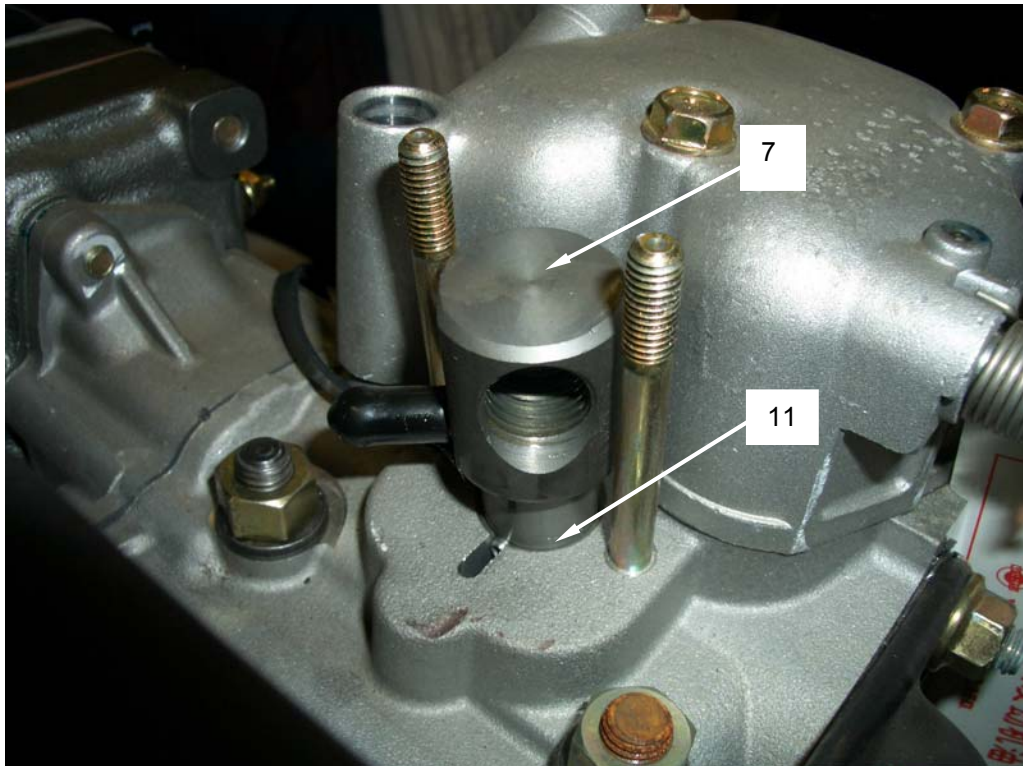
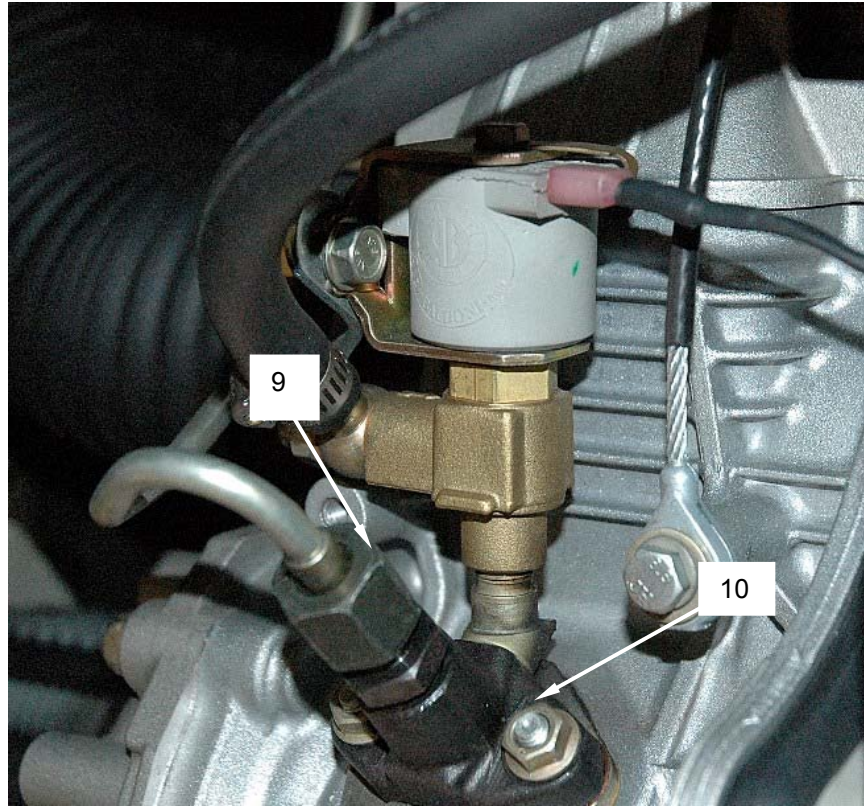


Figure 1. Remove, Inspect, and Install Diesel Engine Fuel Injector (Sheet 2 of 3).

INSTALL - Continued

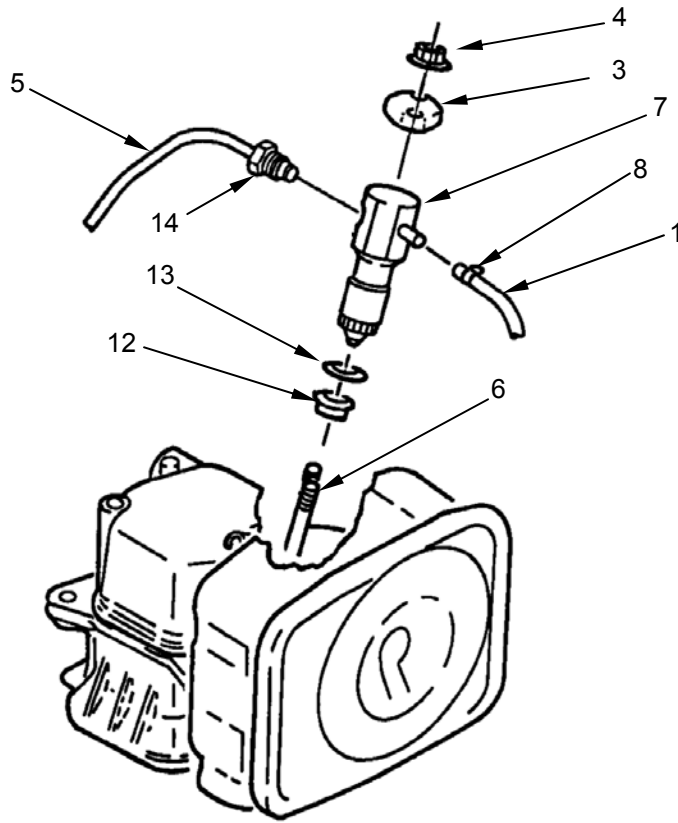


Figure 1. Remove, Inspect, and Install Diesel Engine Fuel Injector (Sheet 3 of 3).

**END OF TASK**

**REPAIR**

Repair is limited to replacement of damaged parts.

**END OF TASK**

**END OF WORK PACKAGE**



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**SERVICE MAINTENANCE****ELECTRIC STARTER ASSEMBLY  
REMOVE, SERVICE, INSPECT, INSTALL**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Solvent, Degreasing (WP 0123, Item 20)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Tags, Marking (WP 0123, Item 22)

**Equipment Condition**

Heater shut down and engine cool (WP 0005).  
Engine access door open.  
Remove negative battery cable closest to engine  
access door opening.  
Remove engine cabinet cover over engine  
Main Battery Power Switch in the OFF position and  
handle removed.

---

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Remove engine muffler (Figure 1, Item 1) by removing the two nuts (Figure 1, Item 4) on the left side engine exhaust studs (Figure 1, Item 2).
2. Remove two bolts (Figure 1, Item 3) retaining the lower rear muffler bracket to the engine.
3. Once muffler has been removed, place the muffler (Figure 1, Item 1) out of the way on top of the heater cabinet. Remove gasket (Figure 1, Item 5) and set aside.
4. Tag and disconnect electrical wires (Figure 1, Items 6, 10) from connection stud (Figure 1, Item 9) by removing nut (Figure 1, Item 8) and washer (Figure 1, Item 7). Reinstall nut (Figure 1, Item 8) and washer (Figure 1, Item 7) to prevent loss.
5. Tag and disconnect electrical wire (Figure 1, Item 11) from starter solenoid lug.
6. Remove starter motor (Figure 1, Item 12) from cylinder block by removing the lower bolt (Figure 1, Item 14) followed by the upper bolt (Figure 1, Item 13).

**END OF TASK**

**SERVICE****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean starter motor with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

1. Inspect starter motor body for deformation, dents, cracks, deformation, or obvious damage. Replace starter motor if damaged.
2. Inspect solenoid for evidence of electrical short. Inspect electrical connection studs for corrosive damage. Replace starter motor if any damage is suspected.

**END OF TASK****INSTALL**

1. Install starter motor (Figure 1, Item 12) into cylinder block. Install upper bolt (Figure 1, Item 13) followed by lower bolt (Figure 1, Item 14). Tighten bolts with torque wrench to 336 inch-pounds.
2. Connect electrical wire (Figure 1, Item 11) to start solenoid lug.
3. Connect electrical wires (Figure 1, Item 6, 10) to connection stud (Figure 1, Item 9) using nut (Figure 1, Item 8) and washer (Figure 1, Item 10). Hand tighten nut until resistance is met. Tighten nut one additional quarter turn with open end wrench.
4. Install muffler gasket (Figure 1, Item 5) in position on engine muffler studs (Figure 1, Item 3).
5. Position muffler (Figure 1, Item 1) on engine and install on engine muffler studs (Figure 1, Item 3).
6. Install two bolts (Figure 1, Item 3) retaining the lower rear muffler bracket to the engine.
7. Install two nuts (Figure 1, Item 4) on engine muffler studs (Figure 1, Item 3). Tighten securely.

INSTALL - Continued

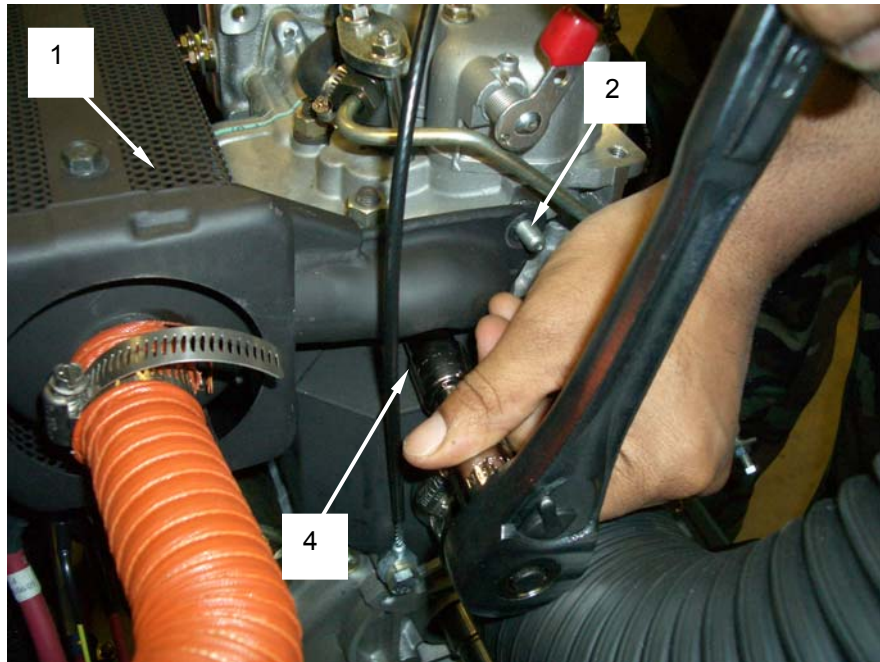


Figure 1. Remove, Service, Inspect, and Install Diesel Engine Electric Starter (Sheet 1 of 3).

INSTALL - Continued

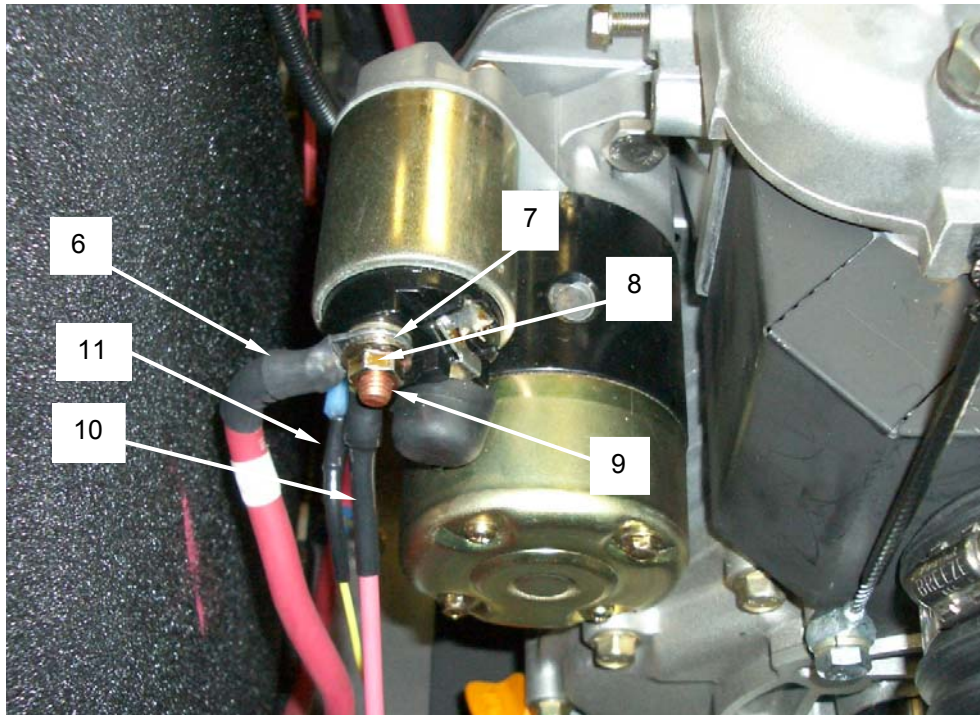
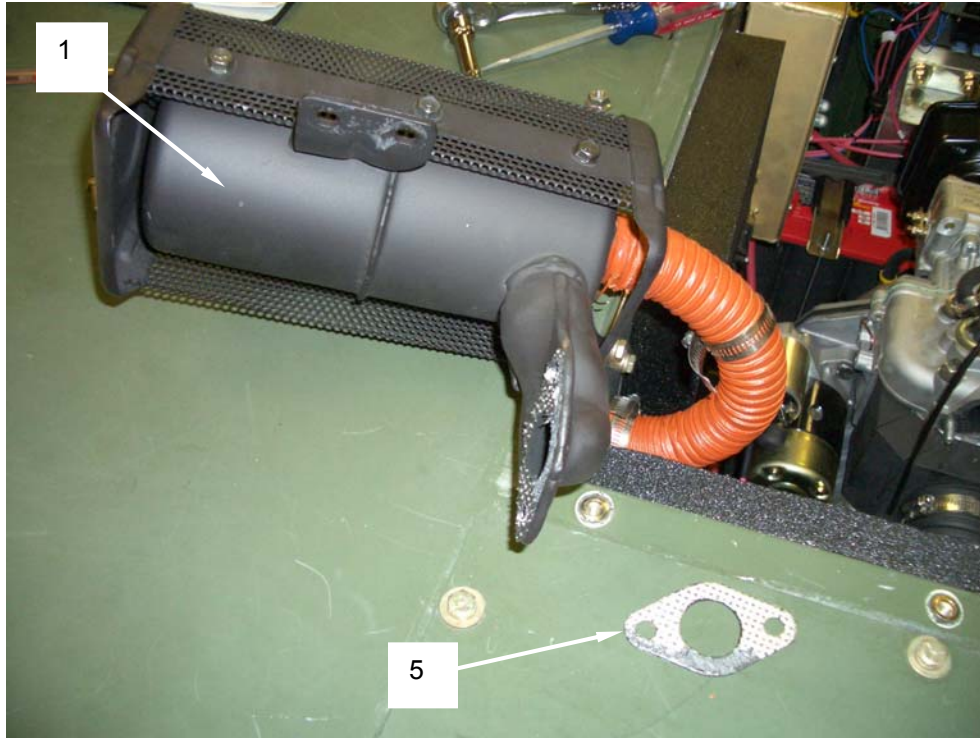


Figure 1. Remove, Service, Inspect, and Install Diesel Engine Electric Starter (Sheet 2 of 3).

**INSTALL - Continued**

Figure 1. Remove, Service, Inspect, and Install Diesel Engine Electric Starter (Sheet 3 of 3).

**END OF TASK**

**REPAIR**

Repair is limited to replacement of damaged parts.

**END OF TASK**

**END OF WORK PACKAGE**



---

**SERVICE MAINTENANCE**
**FLYWHEEL HOUSING AND FLYWHEEL  
REMOVE, ADJUST, INSPECT, INSTALL, REPAIR**


---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
 Handle, Flywheel Locking (WP 0124, Item 4) (a  
 Screwdriver, Large can also be used)  
 Remover, Flywheel (WP 0124, Item 8)  
 Wrench, Torque (WP 0124, Item 19)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Solvent, Degreasing (WP 0123, Item 20)  
 Rags, Wiping, Clean (WP 0123, Item 15)

**Equipment Condition**

Heater shut down and engine cool (WP 0005).  
 Engine access door open.  
 Main Battery Power Switch in the OFF position and  
 handle removed.  
 Engine removed from heater (WP 0081).  
 Remove burner housing with burner fuel pump  
 attached (WP 0081).

---

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. With the engine on a rugged work surface, align one of the large holes (Figure 1, Item 1) in the flywheel (Figure 1, Item 2) with the matching hole in the engine block. Insert a long screwdriver (Figure 1, Item 3) into both holes to prevent the flywheel from turning during the next step.
2. Remove three bolts (Figure 1, Item 4) securing pump drive coupling (Figure 1, Item 5) and remove coupling from engine flywheel. Set coupling aside. Remove long screwdriver used to lock flywheel.
3. Remove flywheel housing (Figure 1, Item 6) from cylinder block by removing four bolts and washers (Figure 1, Item 7).

## REMOVE - Continued

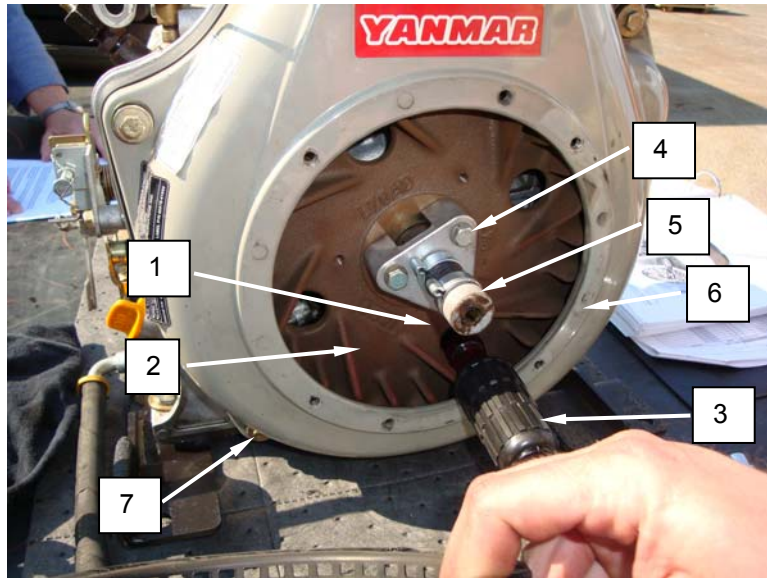


Figure 1. Remove the Burner Fuel Pump Coupling and Flywheel Housing.

4. With the flywheel housing removed, again align one of the large holes in the flywheel (Figure 2, Item 2) with the matching hole in the engine block. Insert a long screwdriver into both holes to prevent the flywheel from turning during the next step.
5. Using the long screwdriver, hold the flywheel in place and remove nut (Figure 2, Item 1) and washer.
6. Carefully remove flywheel (Figure 1, Item 2) from crankshaft using flywheel remover. Use care to prevent damage to flywheel fins.

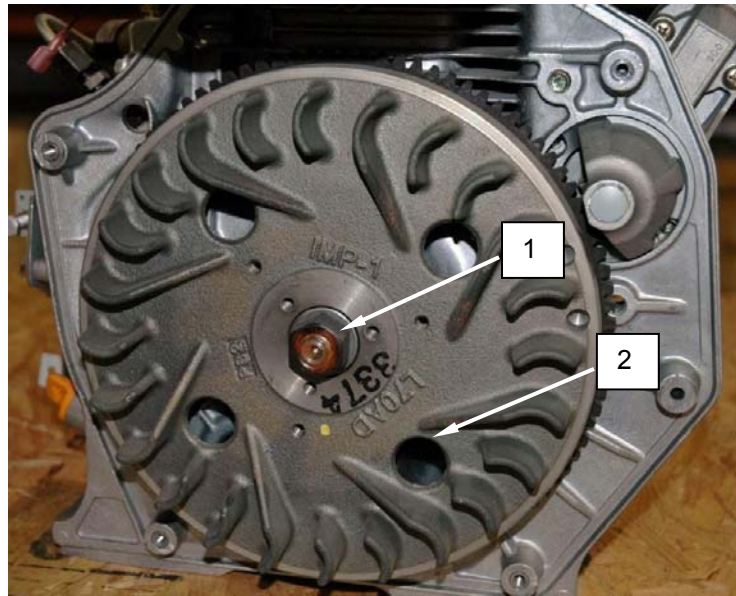


Figure 2. Remove Flywheel.



**REMOVE - Continued****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

7. Clean components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

Inspect flywheel housing (Figure 3, Item 1) and gasket (Figure 3, Item 2) for cracks, deformation, or obvious damage. Replace gasket and/or flywheel housing if damaged.

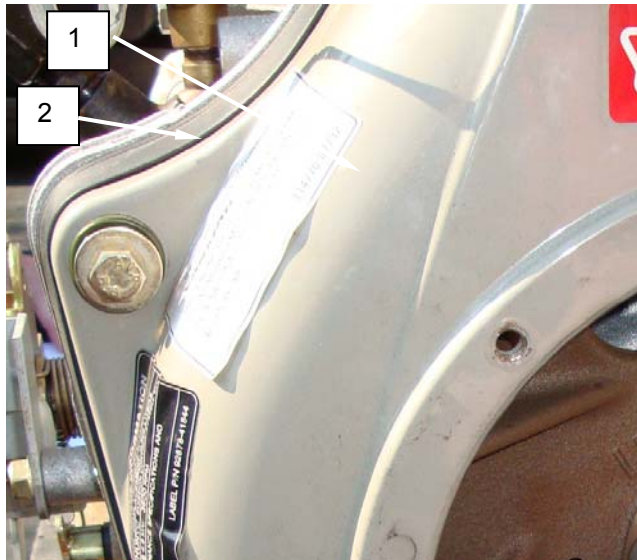


Figure 3. Inspect Flywheel Housing.

**END OF TASK**

**INSTALL**

1. Carefully mate the flywheel (Figure 4, Item 2) to the engine crankshaft. Tap the flywheel to seat it completely on the crankshaft. Use care to prevent damage to flywheel fins.
2. Using the long screwdriver, align one of the large holes in the flywheel (Figure 4, Item 2) with the matching hole in the engine block. Insert a long screwdriver into both holes to prevent the flywheel from turning during the next step.
3. Hold the flywheel in place and install nut (Figure 4, Item 1) and washer. Tighten nut with a torque wrench to 87-94.0 ft-lbs (1200-1300 kg-cm).

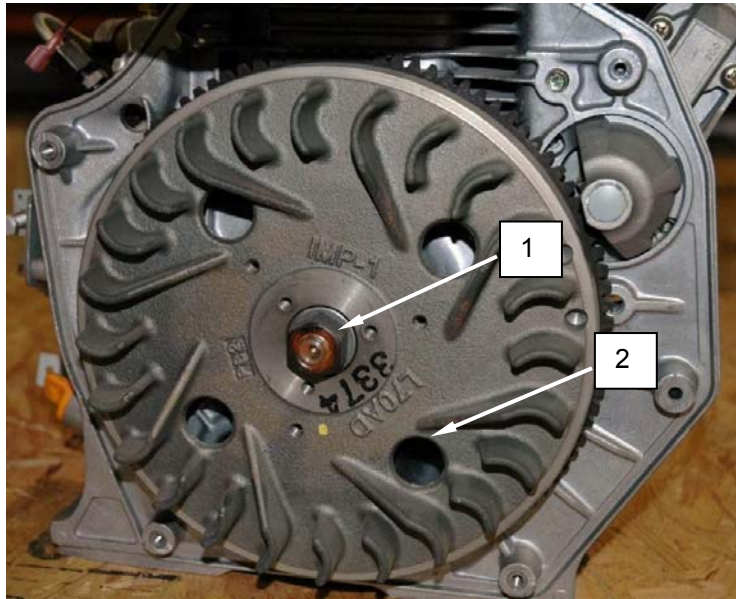


Figure 4. Install Flywheel.

**INSTALL - Continued**

4. Install the flywheel housing (Figure 5, Item 6) on the cylinder block by installing four bolts and washers (Figure 5, Item 7).
5. Align one of the large holes (Figure 5, Item 1) in the flywheel (Figure 5, Item 2) with the matching hole in the engine block. Insert a long screwdriver (Figure 5, Item 3) into both holes to prevent the flywheel from turning during the next step.
6. Position the burner pump coupling on the engine flywheel aligning the holes on the coupling with those on the flywheel. Secure the coupling to the flywheel using three bolts (Figure 5, Item 4). Remove long screwdriver used to lock flywheel.

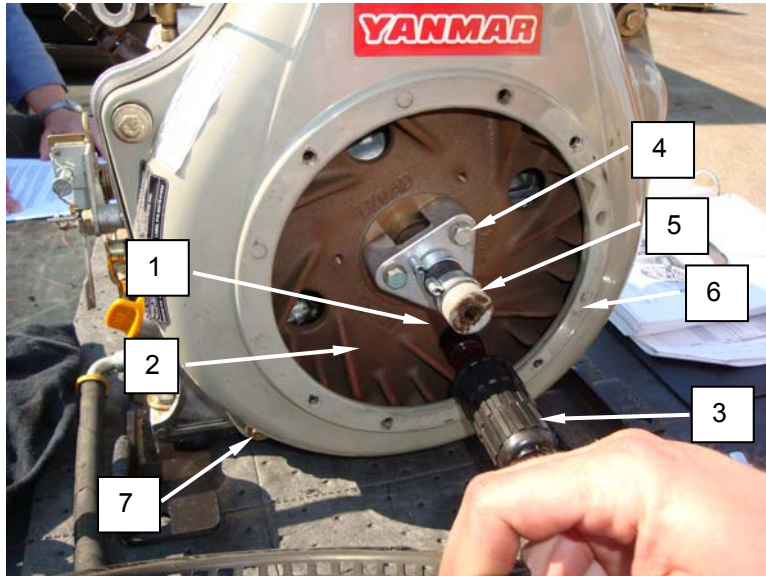


Figure 5. Install the Flywheel Housing and Burner Fuel Pump Coupling.

7. Install the burner pump housing with attached burner fuel pump onto the engine IAW WP 0081.
8. Install the engine into heater IAW WP 0081.

**END OF TASK****REPAIR**

Repair is limited to replacement of damaged parts as required.

**END OF TASK****END OF WORK PACKAGE**



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**SERVICE MAINTENANCE****OIL FILL CAP  
REMOVE, INSPECT, INSTALL**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Materials/Parts**

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11, or 12) (Oil selection dependent on temperature, refer to WP 0002 for details)

Rags, Wiping, Clean (WP 0123, Item 15)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or

Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).

Engine access door open.

Main battery switch OFF and handle removed.

---

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

Remove engine oil fill cap (Figure 1, Item 1) from engine block (Figure 1, Item 2).

**END OF TASK****INSPECT**

1. Inspect oil fill cap (Figure 1, Item 1) for obvious damage.
2. Inspect O-ring (Figure 1, Item 3) for cuts, tears, or permanent set. Replace O-ring if it will not allow a proper seal.
3. Inspect area around oil fill port for evidence of leakage. Clean area of dirt and accumulated grime using a clean rag.

**END OF TASK****INSTALL**

1. Apply a light coat of lubricating oil to O-ring (Figure 1, Item 3) and install into oil fill port.
2. Insert engine oil fill cap (Figure 1, Item 1) into engine block (Figure 1, Item 2).

## INSTALL - Continued

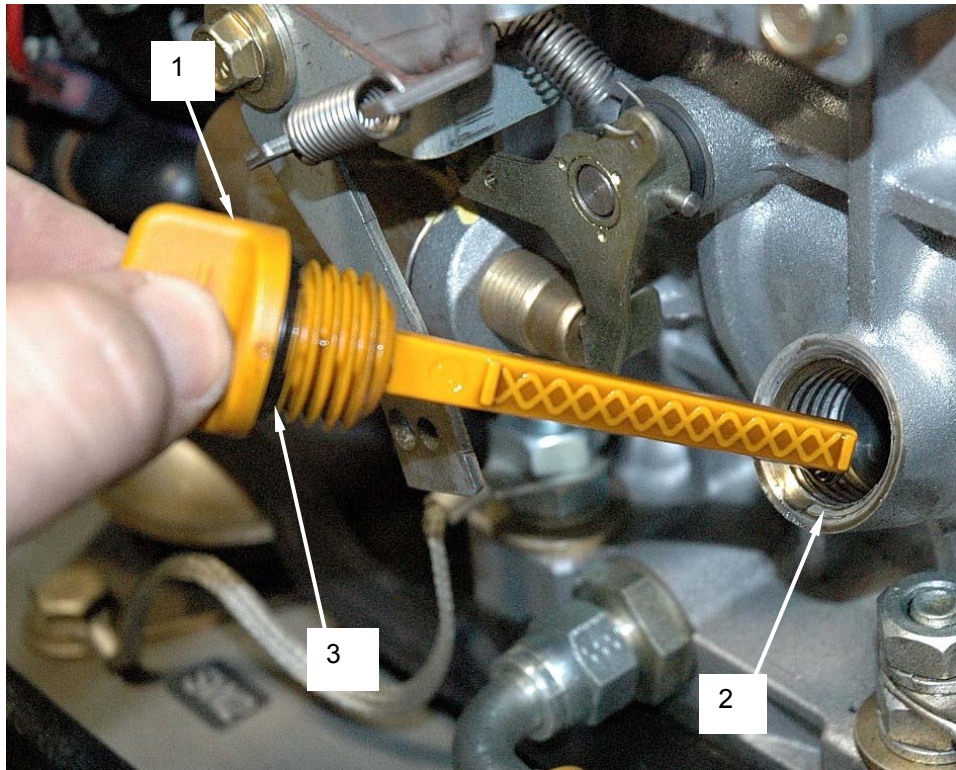


Figure 1. Remove, Inspect, Install Oil Fill Cap.

END OF TASK

END OF WORK PACKAGE

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**SERVICE MAINTENANCE**  
**SOLENOID, ENGINE SHUTDOWN**  
**REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch in the OFF position and handle removed.  
Engine access door open.

---

**REPLACE**

1. Disconnect solenoid wire (Figure 1, Item 2).
2. Remove bolt (Figure 1, Item 5) and nut (Figure 1, Item 1) securing engine shutdown solenoid assembly (Figure 1, Item 3) to mounting bracket (Figure 1, Item 4).

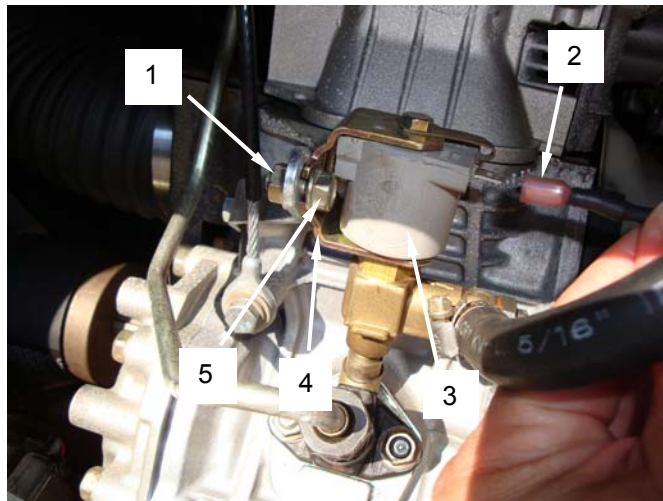


Figure 1. Removing Solenoid Wire and Bolt Securing Solenoid Bracket.

**REPLACE - Continued**

3. Remove hex head screw (Figure 2, Item 1) on the top of the engine shutdown solenoid assembly (Figure 2, Item 2) and set aside.
4. Remove the defective engine shutdown solenoid assembly (Figure 2, Item 2) by sliding upward off fitting (Figure 2, Item 3) and discard.

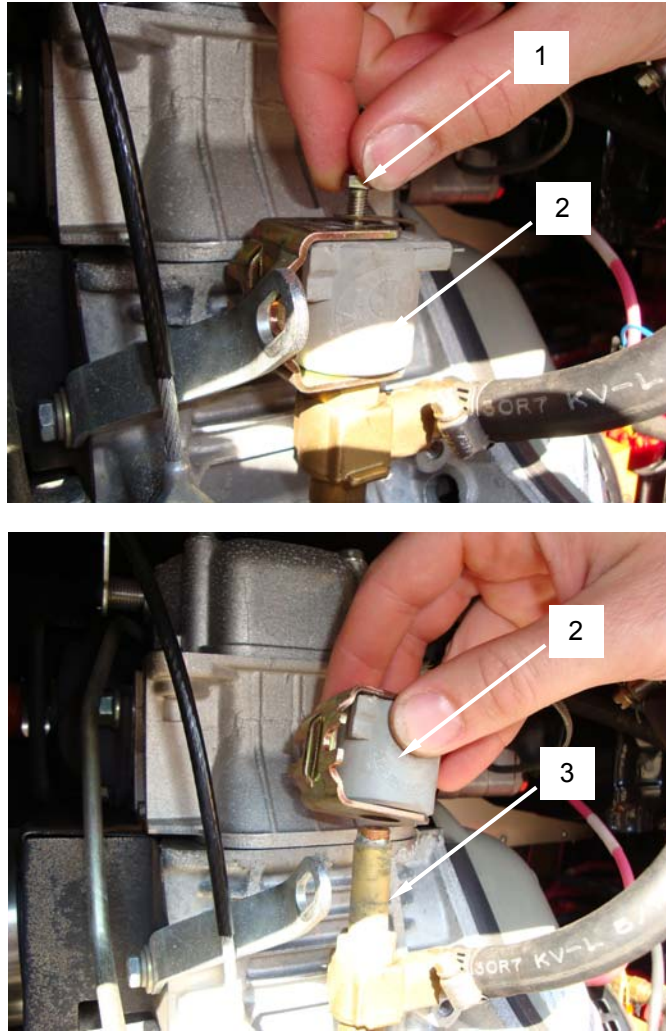


Figure 2. Removing the Defective Engine Shutdown Solenoid from Fitting.



**REPLACE - Continued**

5. Install a new engine shutdown solenoid (Figure 3, Item 3) by sliding it over the fitting (Figure 3, Item 4). Orient the solenoid so that the solenoid bracket (Figure 3, Item 2) aligns with the mounting bracket (Figure 3, Item 1).

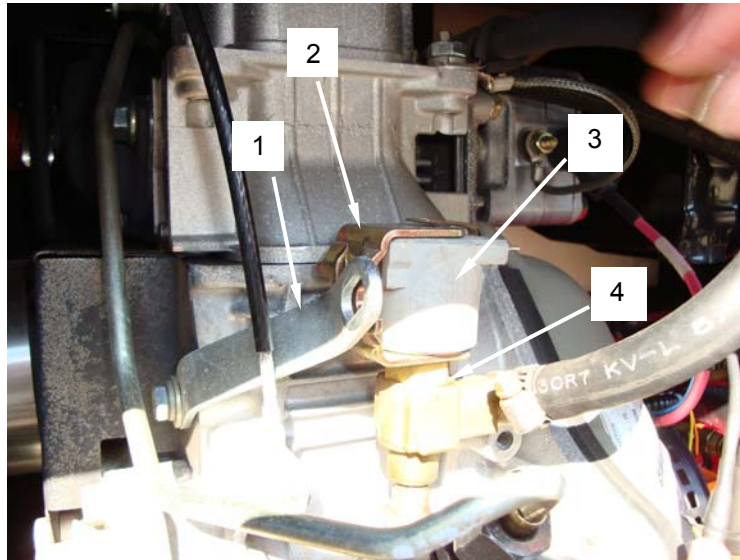


Figure 3. Installing a New Engine Shutdown Solenoid over Fitting.

6. Install the hex head screw (Figure 4, Item 1) set aside earlier on the top of the engine shutdown solenoid (Figure 4, Item 2) and tighten.

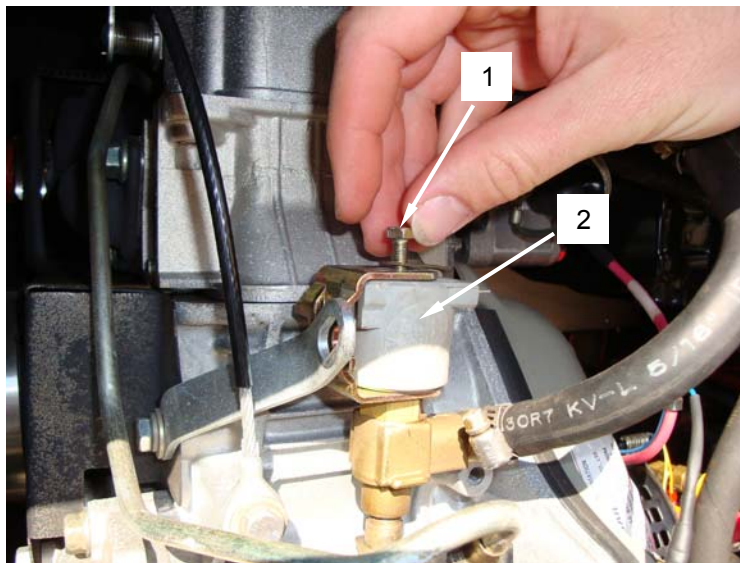


Figure 4. Installing Hex Head Screw on Engine Shutdown Solenoid.

**REPLACE - Continued**

7. Secure the engine shutdown solenoid bracket (Figure 5, Item 3) to the mounting bracket (Figure 5, Item 1) and secure with bolt (Figure 5, Item 5) and nut (Figure 5, Item 2).
8. Connect solenoid wire (Figure 5, Item 4).

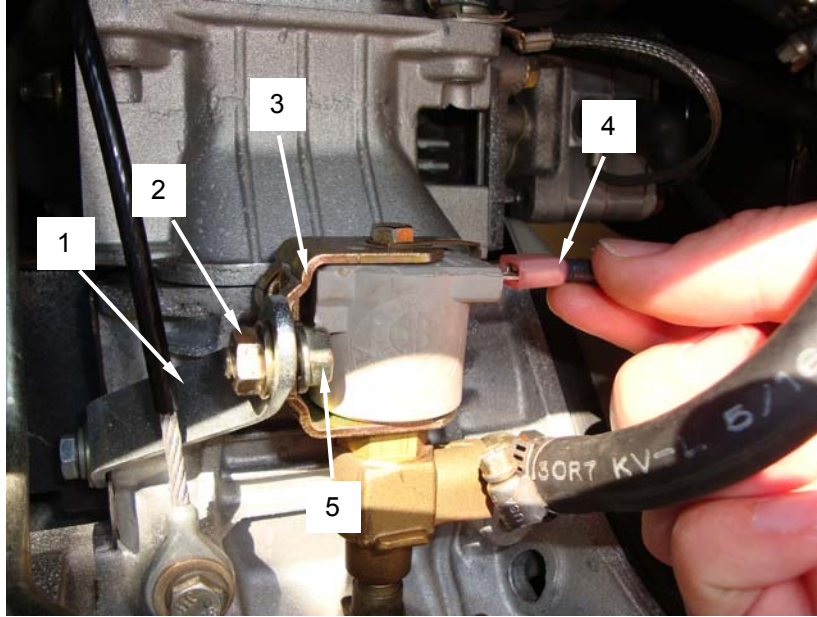


Figure 5. Securing Engine Shutdown Solenoid to Mounting Bracket and Connecting Wire.

**END OF TASK**

**END OF WORK PACKAGE**

---

**SERVICE MAINTENANCE****BURNER ASSEMBLY  
SERVICE, ADJUST, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Tool, Electrode Adjusting (WP 0124, Item 14)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Brush, Wire, Scratch (WP 0123, Item 4)  
Gloves, Chemical and Oil Protective (WP 0123,  
Item 6)

**References**

WP 0062, WP0063,  
WP 0064, WP 0065  
WP 0066, WP 0067  
WP 0068, WP 0069

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.  
Burner access door open.

---

**SERVICE****Clean Swirlers**

1. Disconnect electrical connectors (Figure 1, Item 1) from burner assembly.

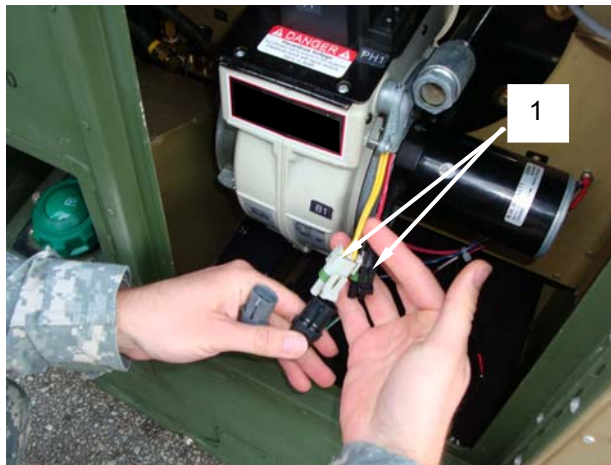


Figure 1. Disconnecting Electrical Connectors from Burner Assembly.

**SERVICE - Continued**

2. Remove four screws (Figure 2, Item 1) securing ignition assembly (Figure 2, Item 2). Move ignition assembly and gasket away from burner body.

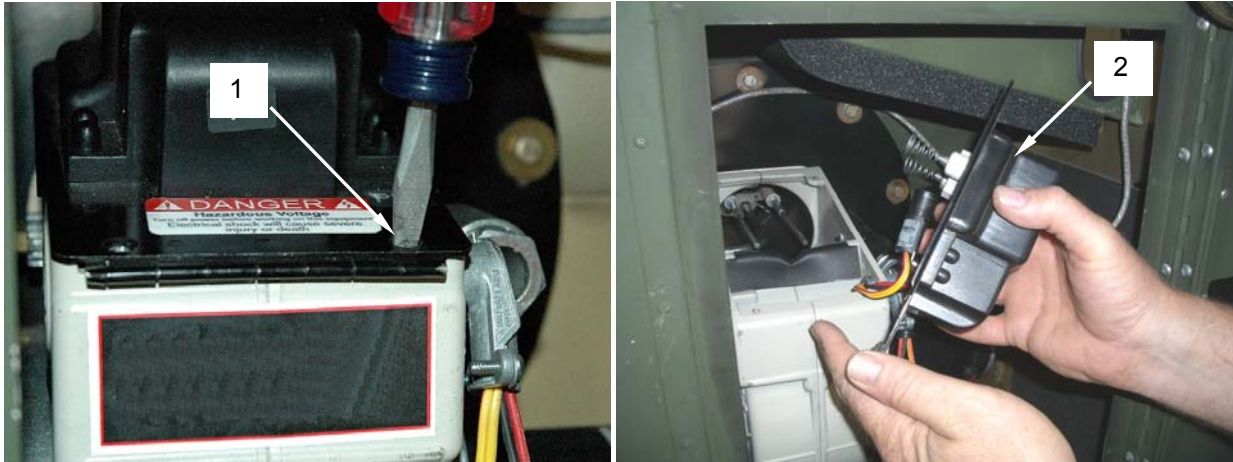


Figure 2. Removing the Ignition Assembly.

**WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel pump to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of rag in accordance with Unit SOP and local environmental regulations.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**CAUTION**

During the removal of the burner head, do not loosen any other hardware other than the spline nut. Proper alignment of the burner combustion head is critical to the performance of the burner. Do not loosen any of the hardware associated with the burner shutter plate on the side of the burner assembly. If the shutter plate is moved accidentally, there are small punch marks (Figure 3, Item 3) on the shutter plate that will allow the plate to be reset to its proper location.

3. Disconnect fuel line (Figure 3, Item 1) from fuel line tube (Figure 3, Item 2).
4. Remove spline nut (Figure 3, Item 4) from fuel line tube (Figure 3, Item 2).

SERVICE - Continued

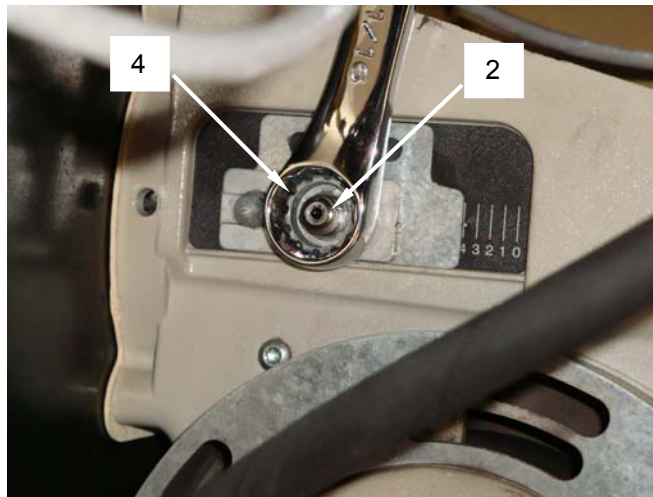
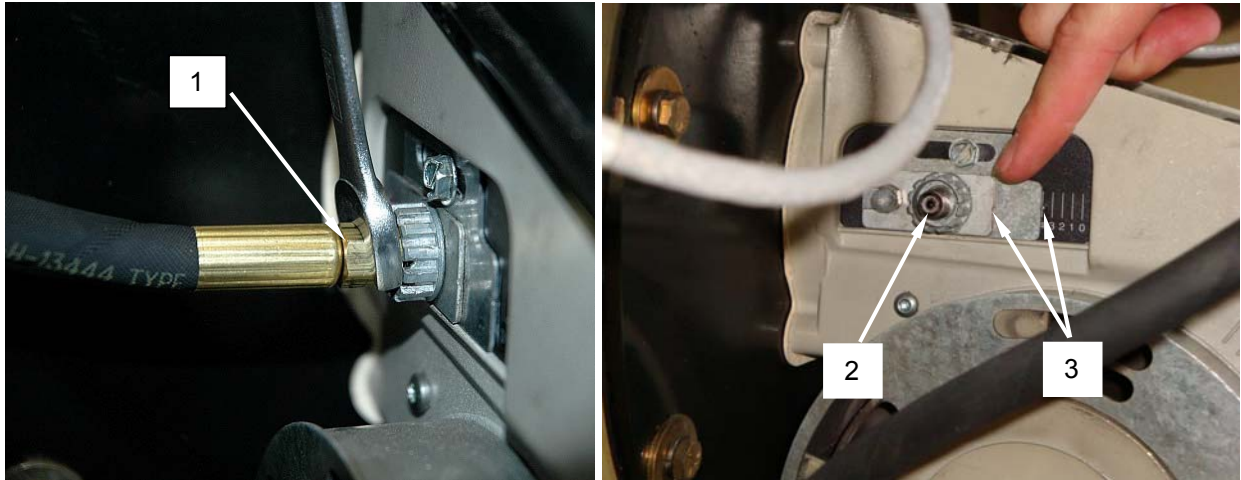


Figure 3. Removing Fuel Line and Spline Nut from Fuel Line Tube.

5. Pull fuel line tube (Figure 4, Item 2) from housing assembly (Figure 4, Item 1).

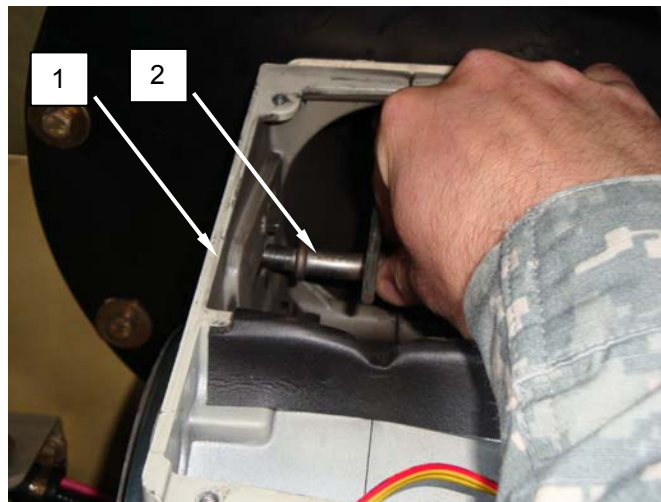


Figure 4. Removing Fuel Line Tube from Housing Assembly.

**SERVICE - Continued**

6. Remove nozzle assembly (Figure 5, Item 1) from housing assembly (Figure 5, Item 2) by grasping nozzle assembly and pulling straight back while tilting nozzle assembly upward.
7. Wipe contaminants from head assembly swirlers (Figure 5, Item 3).

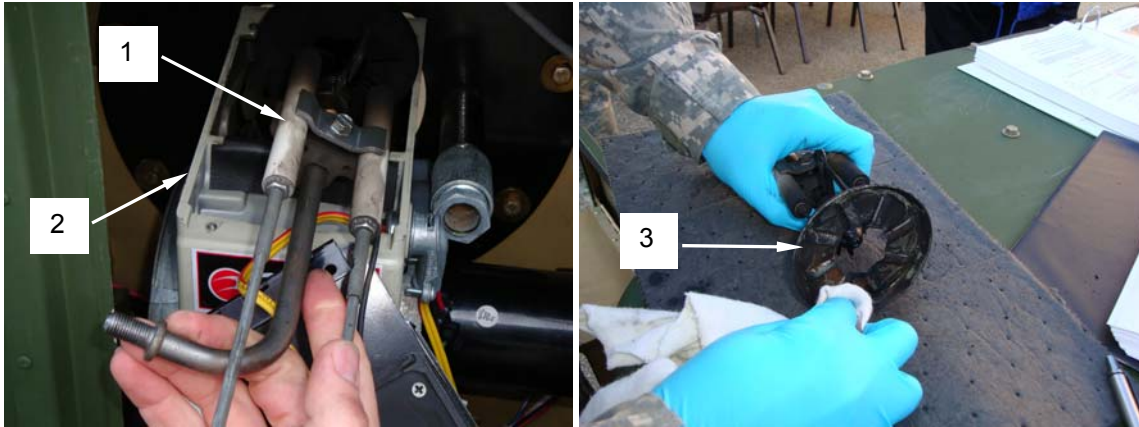


Figure 5. Removing Nozzle Assembly and Cleaning Swirlers.

8. Install nozzle assembly (Figure 6, Item 1) in housing assembly (Figure 6, Item 2).

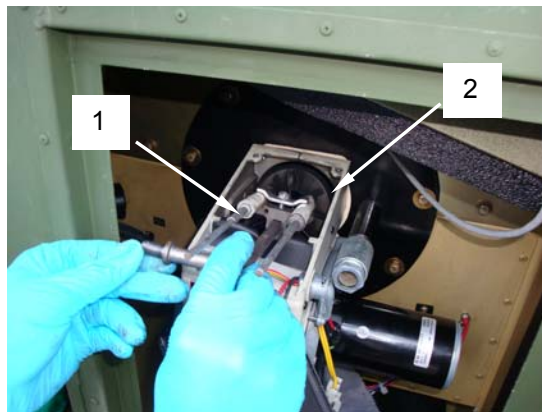


Figure 6. Installing the Nozzle Assembly in Housing Assembly.

9. Push fuel tube (Figure 7, Item 2) through housing assembly (Figure 7, Item 1).

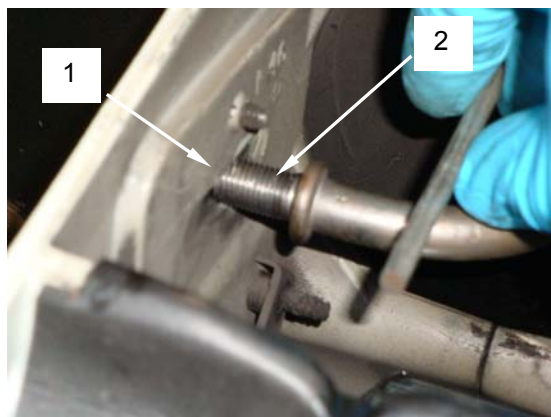


Figure 7. Installing the Fuel Tube.

**SERVICE - Continued**

10. Install spline nut (Figure 8, Item 1) on fuel line tube (Figure 8, Item 2). Ensure that hollow side of spline nut faces outward.

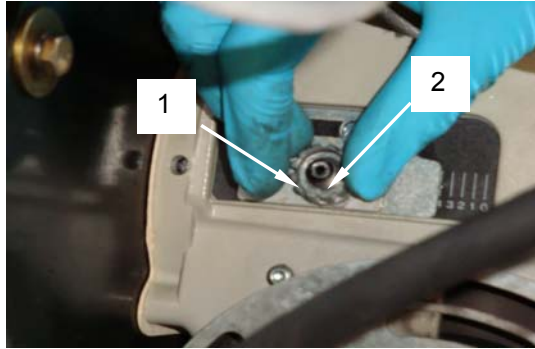


Figure 8. Installing the Spline Nut.

11. Connect fuel line (Figure 9, Item 1) onto fuel line tube (Figure 9, Item 2).

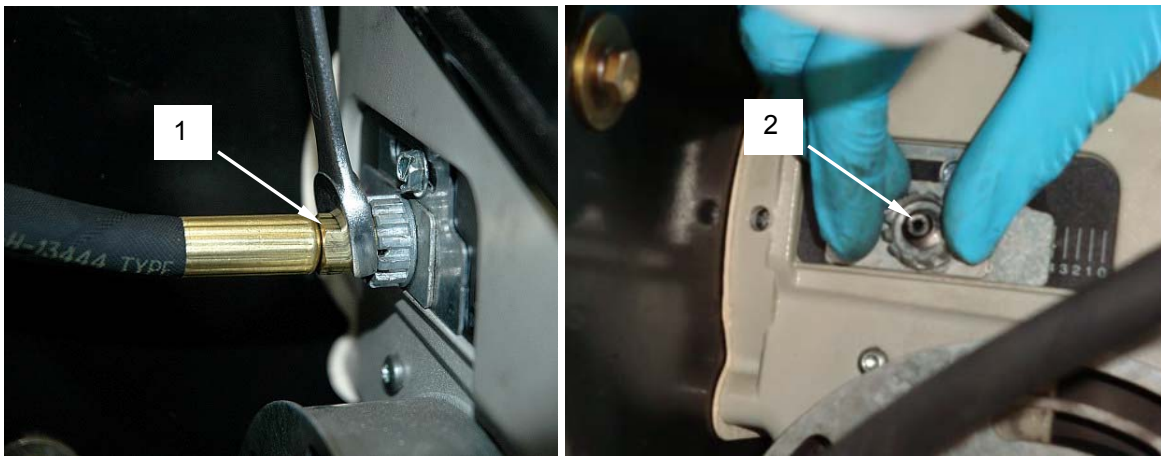


Figure 9. Installing Fuel Line onto Fuel Line Tube.

12. Position the ignition assembly (Figure 10, Item 1) on the burner housing aligning the four holes on the ignition assembly with the four holes on the burner housing. Install the ignition assembly with the four screws (Figure 10, Item 2) set aside earlier.

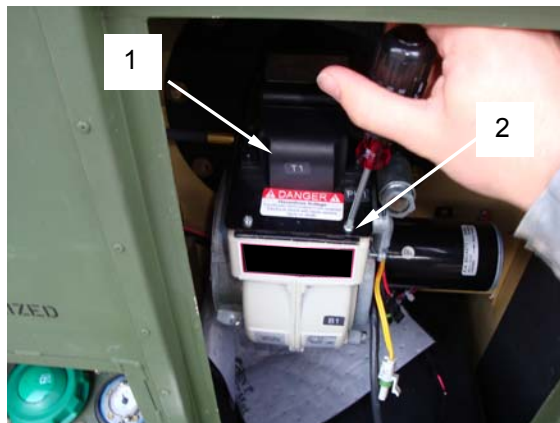


Figure 10. Installing the Ignition Assembly on Burner Housing.

**SERVICE - Continued**

13. Reconnect electrical connectors (Figure 11, Item 1 and 2) to burner assembly.

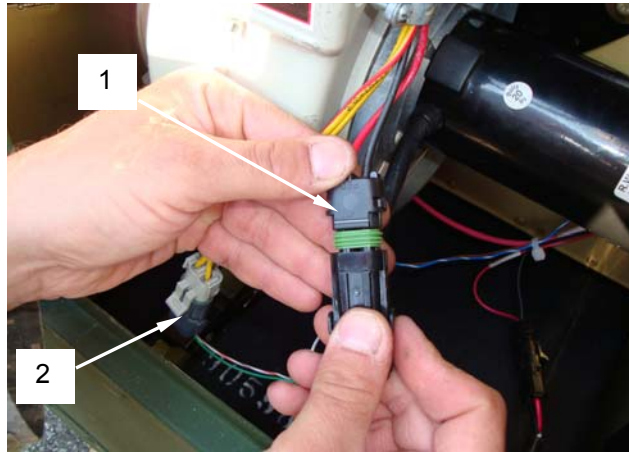


Figure 11. Reconnecting Electrical Connectors.

**END OF TASK**



**ADJUST**

1. Disconnect electrical connectors (Figure 12, Items 1 and 2) from burner assembly.

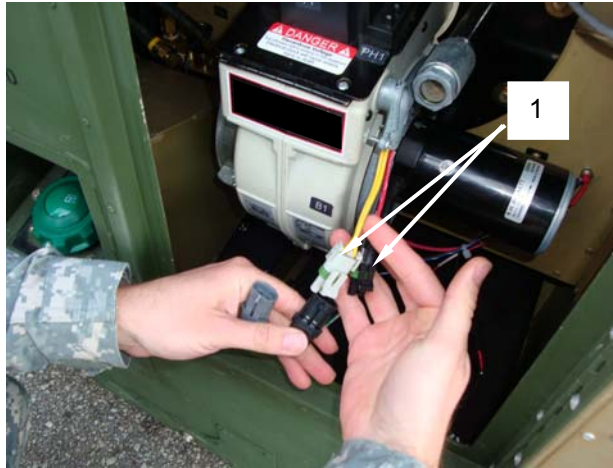


Figure 12. Disconnecting Electrical Connectors from Burner Assembly.

2. Remove four screws (Figure 13, Item 1) securing ignition assembly (Figure 13, Item 2). Move ignition assembly and gasket away from burner body.

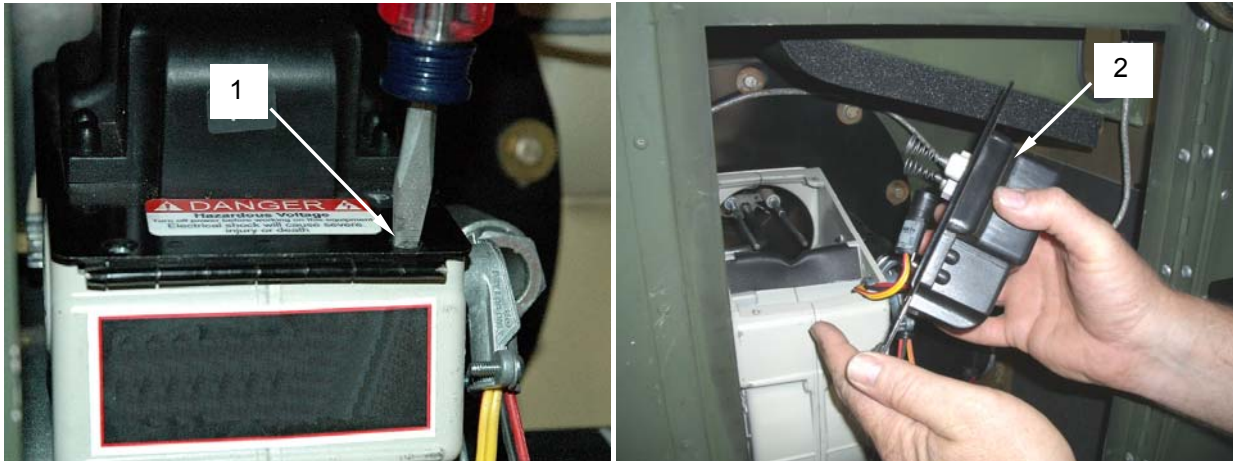


Figure 13. Removing the Ignition Assembly.

**CAUTION**

During the removal of the burner head, do not loosen any other hardware other than the spline nut. Proper alignment of the burner combustion head is critical to the performance of the burner. Do not loosen any of the hardware associated with the burner shutter plate on the side of the burner assembly. If the shutter plate is moved accidentally, there are small punch marks (Figure 14, Item 3) on the shutter plate that will allow the plate to be reset to its proper location.

3. Disconnect fuel line (Figure 14, Item 1) from fuel line tube (Figure 14, Item 2).
4. Remove spline nut (Figure 14, Item 4) from fuel line tube (Figure 14, Item 2).

ADJUST - Continued

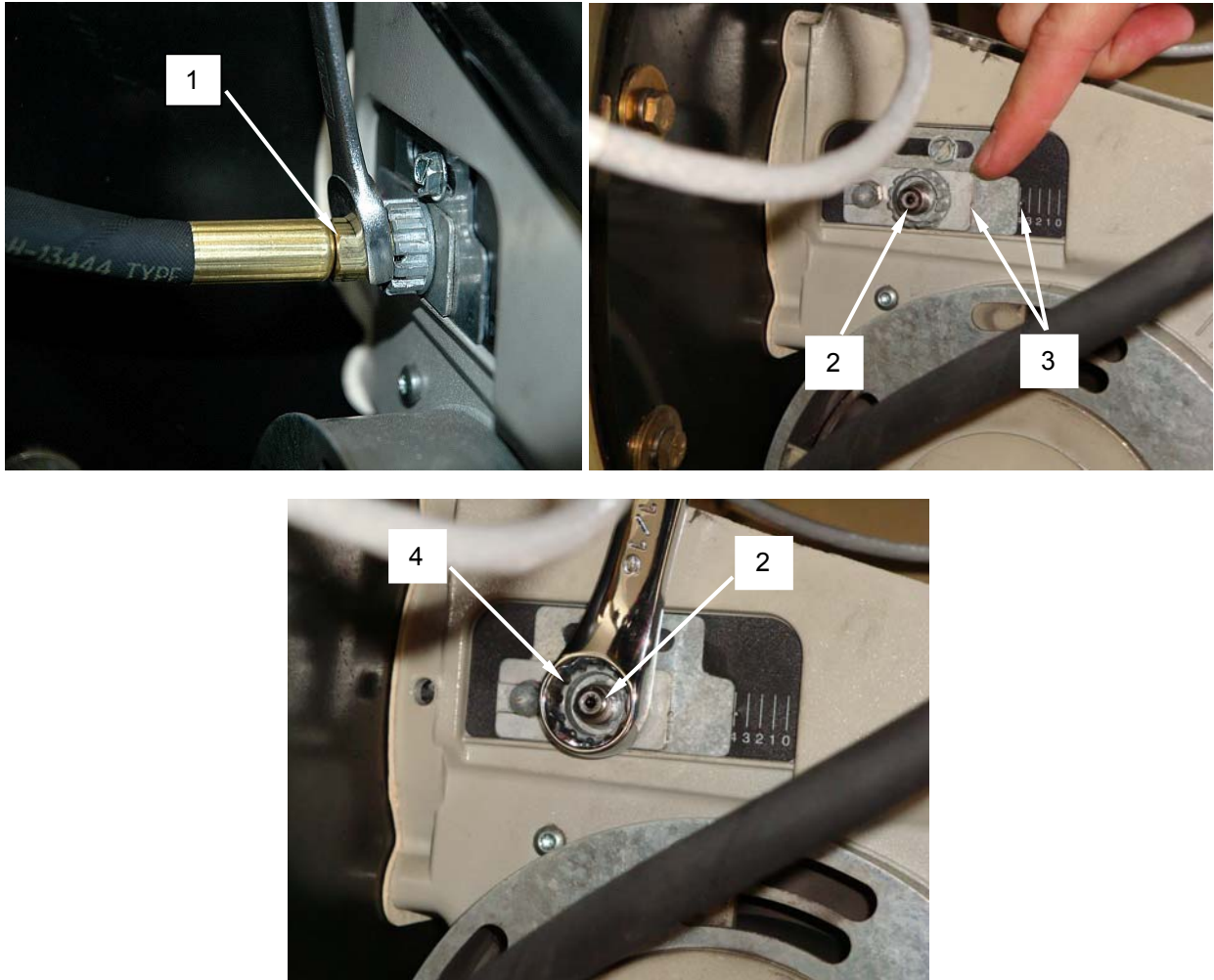


Figure 14. Removing Fuel Line and Spline Nut from Fuel Line Tube.

5. Pull fuel line tube (Figure 15, Item 2) from housing assembly (Figure 15, Item 1).

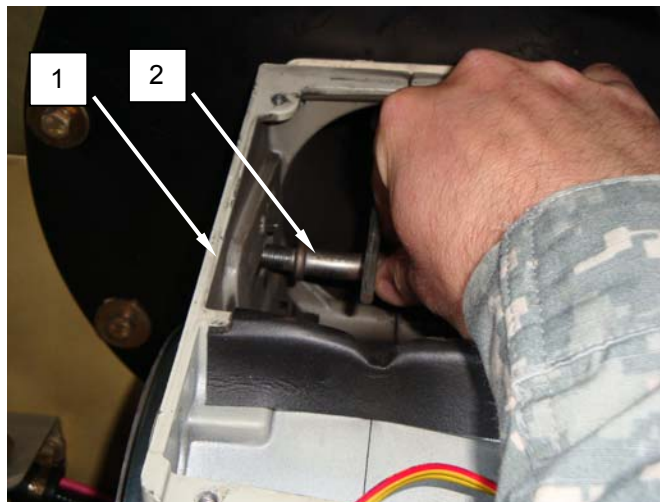


Figure 15. Removing Fuel Line Tube from Housing Assembly.

**ADJUST - Continued**

6. Remove nozzle assembly (Figure 16, Item 1) from housing assembly (Figure 16, Item 2) by grasping nozzle assembly and pulling straight back while tilting nozzle assembly upward.
7. Wipe contaminants from head assembly swirlers (Figure 16, Item 3).

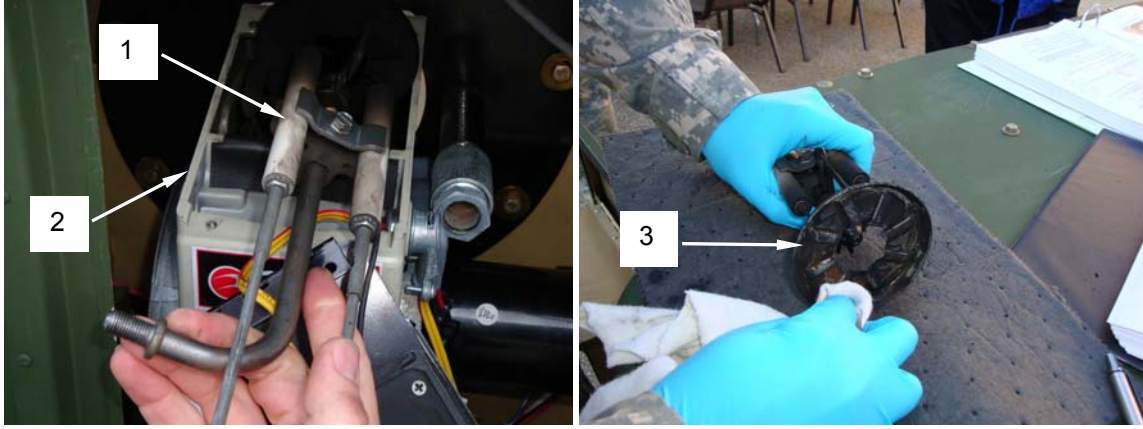


Figure 16. Removing Nozzle Assembly and Cleaning Swirlers.

8. Loosen screw (Figure 17, Item 1) on electrode clamp (Figure 17, Item 2) just enough to allow the electrodes (Figure 17, Item 3) to be moved for adjustment.

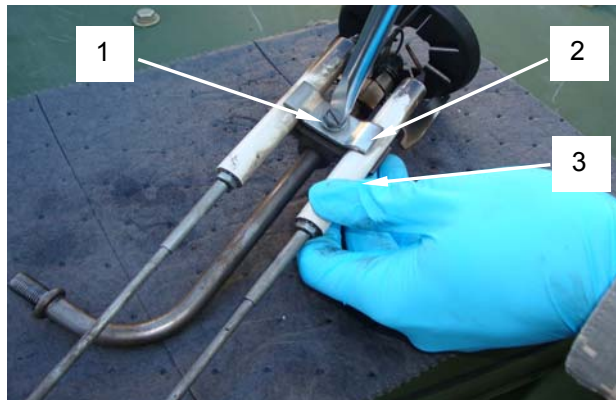


Figure 17. Loosening Screw on Electrode Clamp.

9. Adjust electrodes by using the electrode and nozzle gap adjustment tool (Figure 18, Item 1) that is located inside the fuel access door, tethered to the technical manual storage compartment.

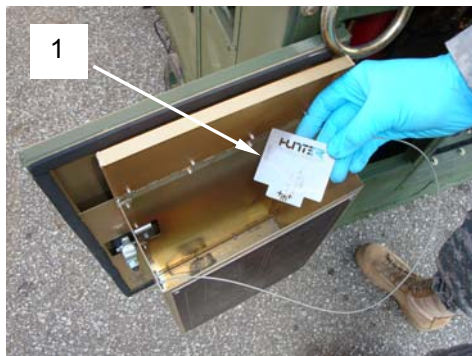


Figure 18. Electrode and Nozzle Gap Adjustment Tool.

**ADJUST - Continued**

10. Position the electrode and nozzle adjustment tool (Figure 19, Item 1) between the electrodes so that the edge of the tool with the crosshair marks is touching the front surface of the nozzle (Figure 19, Item 4). Ensure that the center of the nozzle is aligned with the center line mark (Figure 19, Item 5) on the tool.
11. Move the electrodes so that each electrode tip (Figure 19, Item 2) is aligned with the horizontal crosshair mark (Figure 19, Item 3) on the tool.

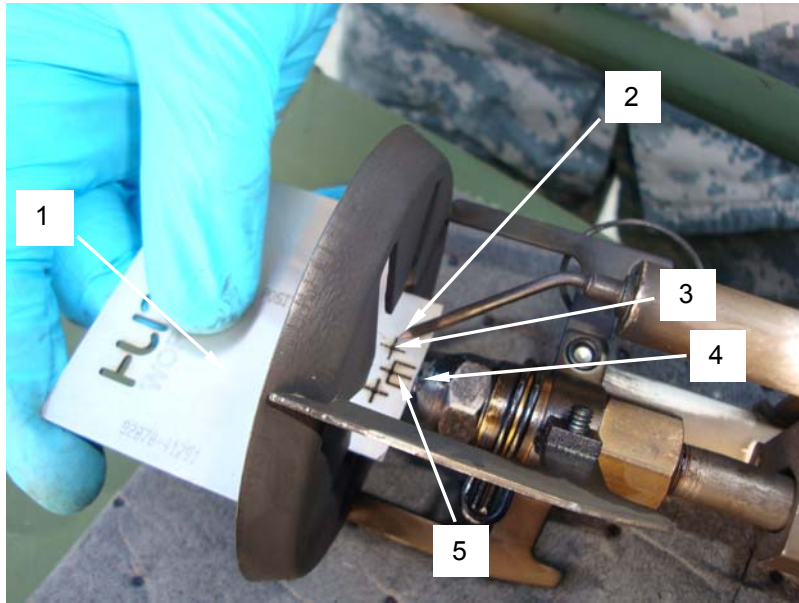


Figure 19. Adjusting Electrode Tip Distance from Nozzle Tip.

12. Reposition the electrode and nozzle gap adjustment tool so that the center line (Figure 20, Item 4) on the tool is aligned with the center of the nozzle (Figure 20, Item 3), with the electrode tips (Figure 20, Item 2) touching the “pitch fork” shaped marks (Figure 20, Item 1) on the tool. Adjust the electrode tip spacing so that the tips align with the vertical marks (Figure 20, Item 1) on each side of the center line (Figure 20, Item 4).

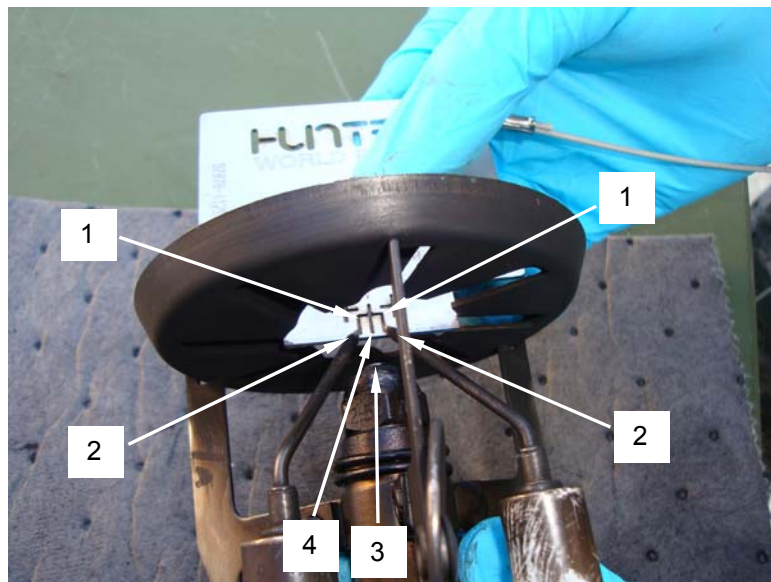


Figure 20. Adjusting the Electrode Tip Spacing.

**ADJUST - Continued**

13. Tighten screw (Figure 21, Item 1) on electrode clamp (Figure 21, Item 2).

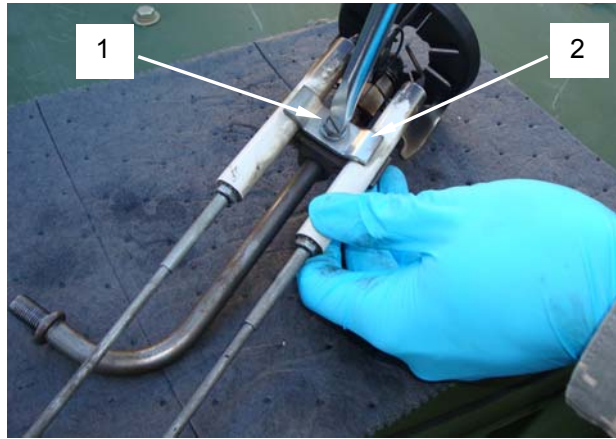


Figure 21. Tightening Screw on Electrode Clamp.

14. Install nozzle assembly (Figure 22, Item 1) in housing assembly (Figure 22, Item 2).

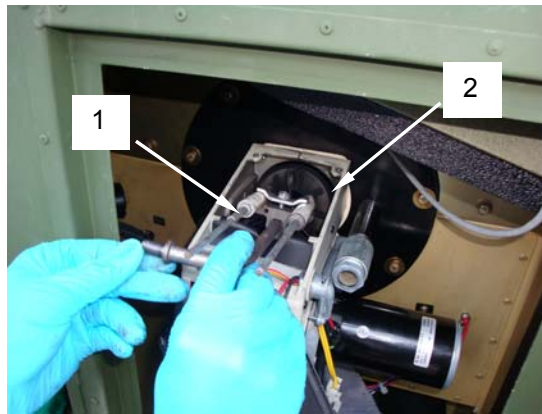


Figure 22. Installing the Nozzle Assembly in Housing Assembly.

15. Push fuel tube (Figure 23, Item 2) through housing assembly (Figure 23, Item 1).

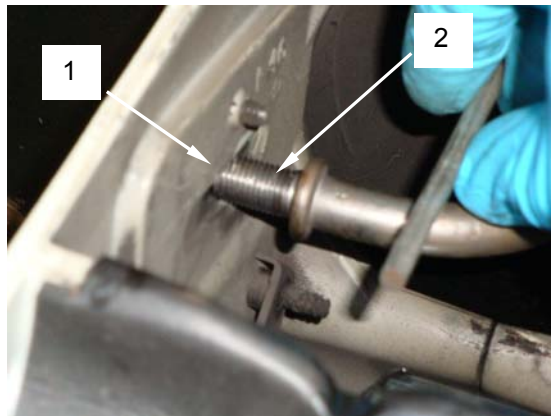


Figure 23. Installing the Fuel Tube.

**ADJUST - Continued**

16. Install spline nut (Figure 24, Item 1) on fuel line tube (Figure 24, Item 2). Ensure that hollow side of spline nut faces outward.

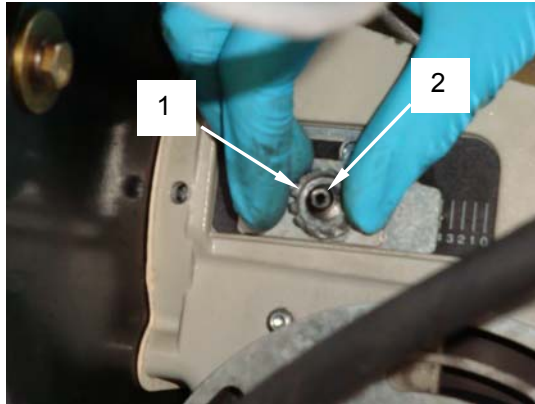


Figure 24. Installing the Spline Nut.

17. Connect fuel line (Figure 25, Item 1) onto fuel line tube (Figure 25, Item 2).

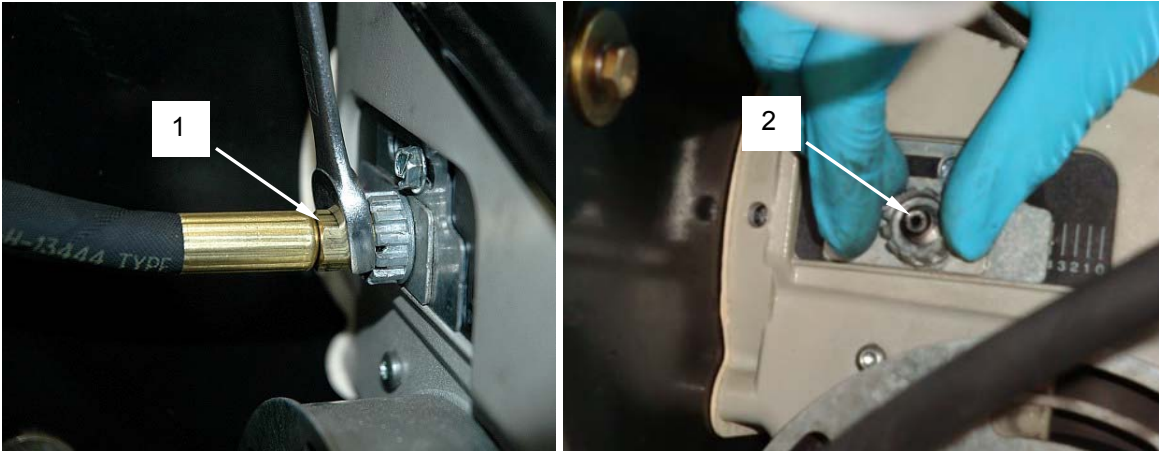


Figure 25. Installing Fuel Line onto Fuel Line Tube.

18. Position the ignition assembly (Figure 26, Item 1) on the burner housing aligning the four holes on the ignition assembly with the four holes on the burner housing. Install the ignition assembly with the four screws (Figure 26, Item 2) set aside earlier.

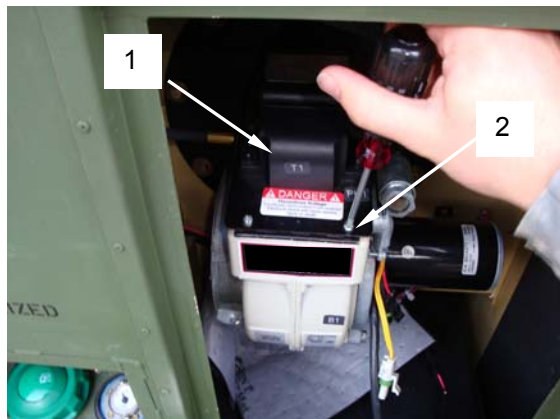


Figure 26. Installing the Ignition Assembly on Burner Housing.

**ADJUST - Continued**

19. Reconnect electrical connectors (Figure 27, Item 1 and 2) to burner assembly.

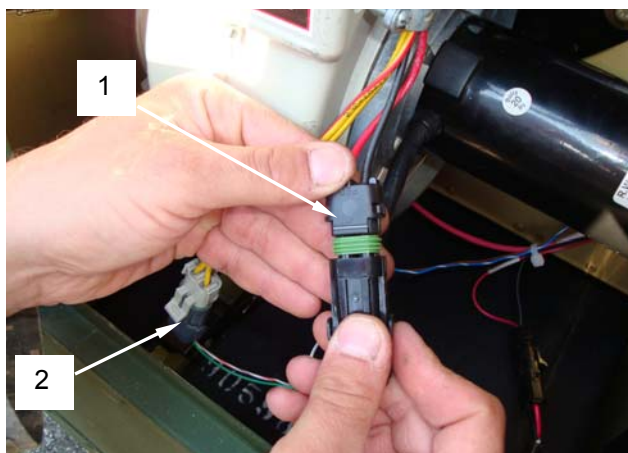


Figure 27. Reconnecting Electrical Connectors.

**END OF TASK**

**REPAIR**

The repair of the burner assembly involves the replacement of one or more subcomponents as shown below. Procedures for the replacement of the subcomponents can be found in the referenced work packages.

1. To replace the combustion blower, refer to WP 0062.
2. To replace the flame sensor, refer to WP 0063.
3. To replace the ignition assembly, refer to WP 0064.
4. To replace the nozzle line assembly, refer to WP 0065.
5. To replace the burner tube assembly and heat exchanger, refer to WP 0066.

**END OF TASK**



**ELECTRODE AND NOZZLE GAP ADJUSTMENT TOOL TEMPLATE**

The template below is provided in the event that the electrode and nozzle adjustment tool permanently tethered to the heater inside the burner access door has been damaged or lost. It is preferable to reorder the adjusting tool using information provided in the RPSTL portion of this TM or to fabricate the tool locally using the engineering drawing provided in the rear matter section of this TM. If the paper template is used, it should be printed on card stock to improve rigidity and reproduced at its actual size. Once printed, verify that the tool has been reproduced correctly by measuring the distance between the points identified below. The distance between the points indicated should be exactly 0.187 inches.

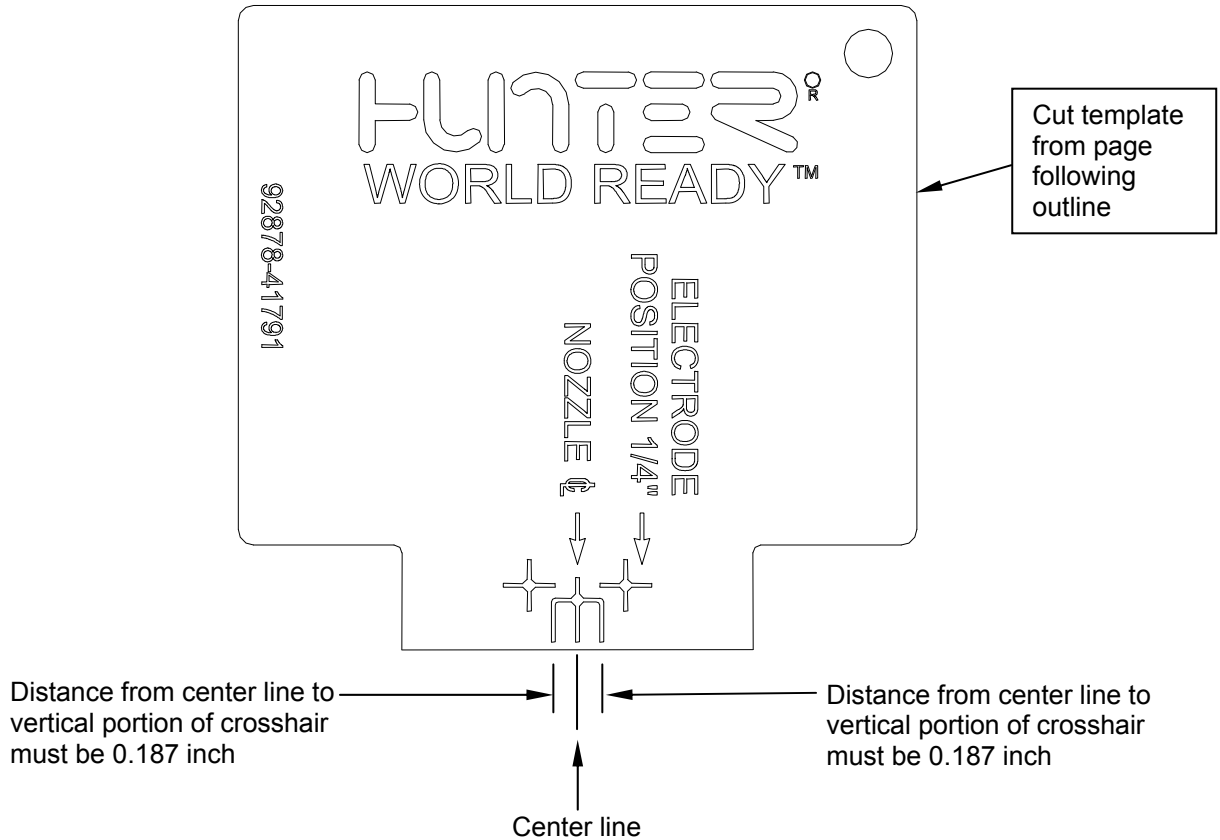


Figure 28. Electrode and Nozzle Gap Adjustment Tool Template.

**END OF WORK PACKAGE**



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**SERVICE MAINTENANCE****COMBUSTION BLOWER  
INSPECT, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)

**Equipment Condition**Heater shut down and cool (WP 0005).  
Burner system access door open.  
Main battery switch OFF and handle removed.

---

**CAUTION**

Be careful when removing and installing the blower assembly to avoid damaging the black, plastic, inverted cone located inside the burner housing.

**INSPECT**

1. Remove the combustion blower assembly as detailed in steps 1 through 3 of the section of this work package entitled "REPLACE."
2. Inspect the combustion blower wheel for excessive amounts of carbon or other combustion debris. If found, clean the combustion blower wheel with a rag.
3. Rotate the combustion blower wheel by hand and ensure that it rotates freely and that there is no binding or scraping.
4. Inspect the combustion blower wheel and combustion blower motor and ensure that it is not cracked or otherwise damaged. If damage is found, replace the components as detailed in the section of this work package entitled "REPLACE."
5. Install the combustion blower assembly as detailed in steps 6, 7, and 8 in the section of this work package entitled "REPLACE."

**END OF TASK**

**REPLACE**

1. Disconnect the combustion blower wiring harness by separating the two halves of the connector (Figure 1).



Figure 1. Disconnect Combustion Blower Wiring Harness Connector.

2. Remove combustion blower from housing assembly by removing the two bolts securing combustion blower to housing assembly (Figure 2). Set the bolts aside.



Figure 2. Remove Combustion Blower from Burner Housing.

**REPLACE - Continued**

3. Loosen the allen screw (Figure 3, Item 1) that secures the blower wheel to the motor shaft and remove the blower wheel (Figure 3, Item 2) from the defective blower motor assembly (Figure 3, Item 3).
4. Inspect the blower wheel for excessive amounts of carbon or other combustion debris. If carbon or debris are found, clean the blower wheel before installing on the new combustion blower motor.
5. Install the blower wheel (Figure 3, Item 2) on the new blower motor assembly (Figure 3, Item 3) and tighten the allen screw (Figure 3, Item 1). Be sure to leave gap of 1/16 inch (Figure 3, Item 4) between the combustion blower wheel (Figure 3, Item 2) and the blower motor (Figure 3, Item 3).

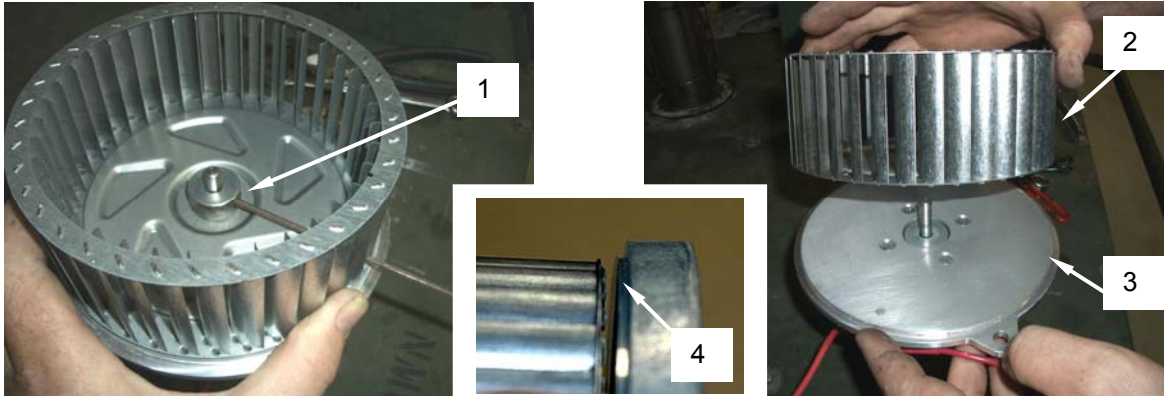


Figure 3. Remove, Clean, and Install Combustion Blower Wheel.

6. Place combustion blower in the housing assembly (Figure 4).

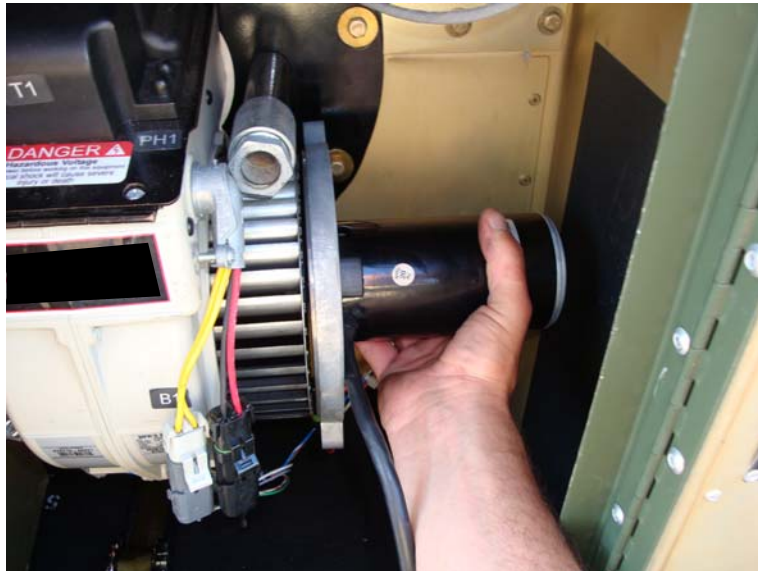


Figure 4. Install the Combustion Blower to Burner Housing.

**REPLACE - Continued**

7. Secure combustion blower with two bolts set aside earlier (Figure 5).

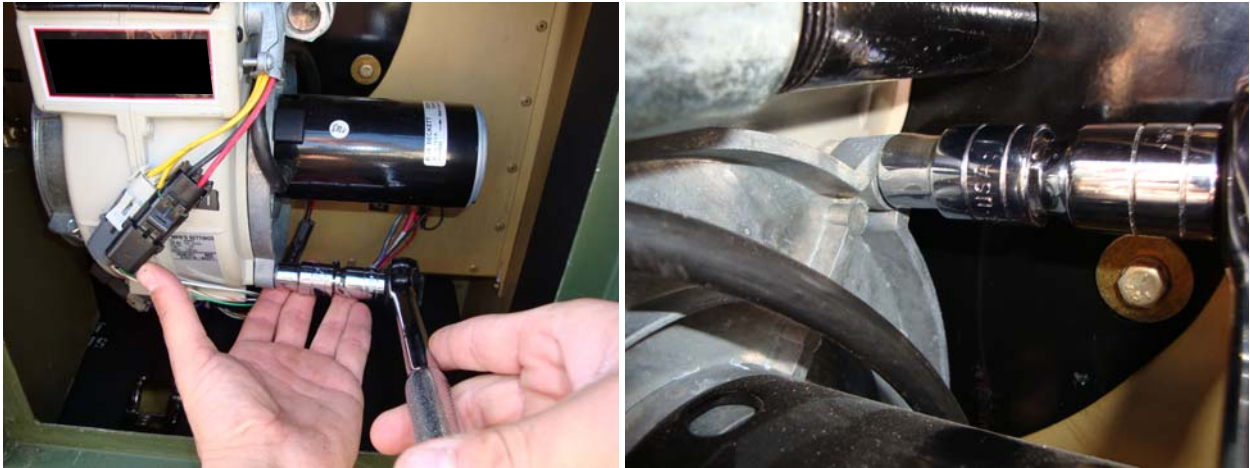


Figure 5. Secure Combustion Blower to Burner Housing with Bolts.

8. Connect combustion blower wiring harness connector (Figure 6).

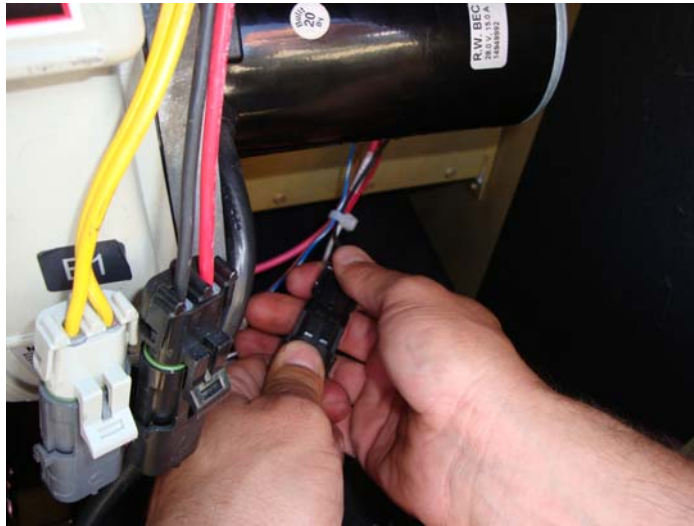


Figure 6. Connect Combustion Blower Wiring Harness Connector.

**END OF TASK**

**END OF WORK PACKAGE**

---

**SERVICE MAINTENANCE**  
**FLAME SENSOR**  
**INSPECT, TEST, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**References**

WP 0064

**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.  
Burner access door open.

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

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**INSPECT**

1. Inspect the flame sensor wiring harness to ensure that the wires are not damaged in any way and that the insulation has not been scraped away. Ensure that the connector is firmly engaged (Figure 1).

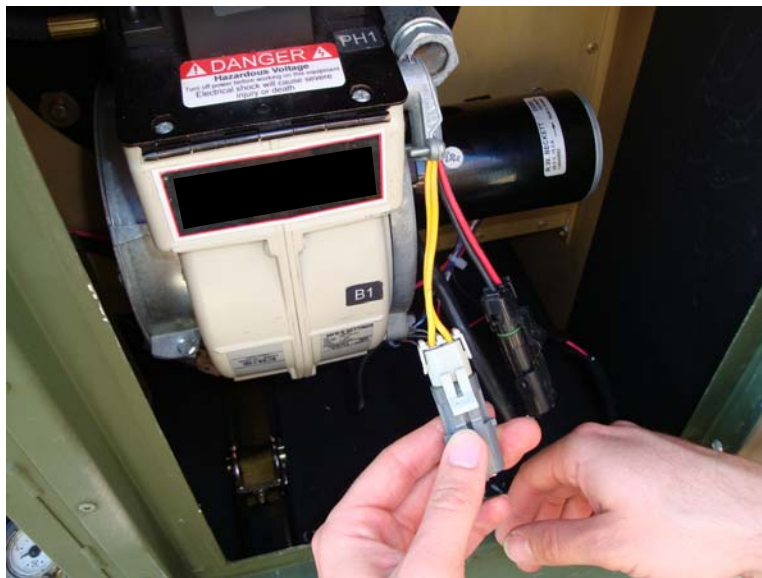


Figure 1. Inspect the Flame Sensor Wiring Harness and Connector.

2. Remove the four screws securing the ignition transformer to the top of the burner housing. Set the screws aside (Figure 2).

INSPECT - Continued

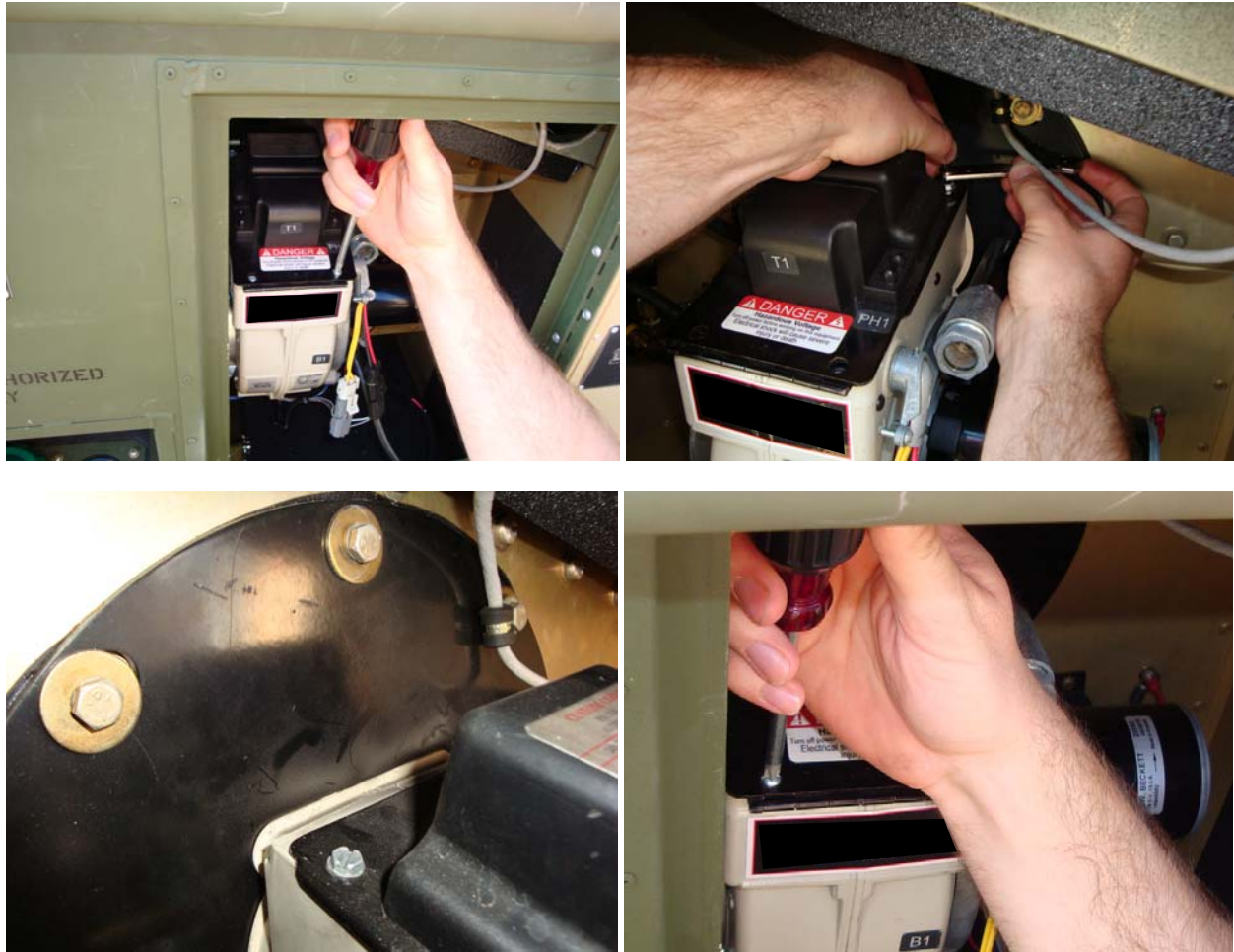


Figure 2. Remove Hardware Securing Ignition Assembly.

3. Partially remove the ignition transformer and turn it over to expose the flame sensor (Figure 3, Item 1).

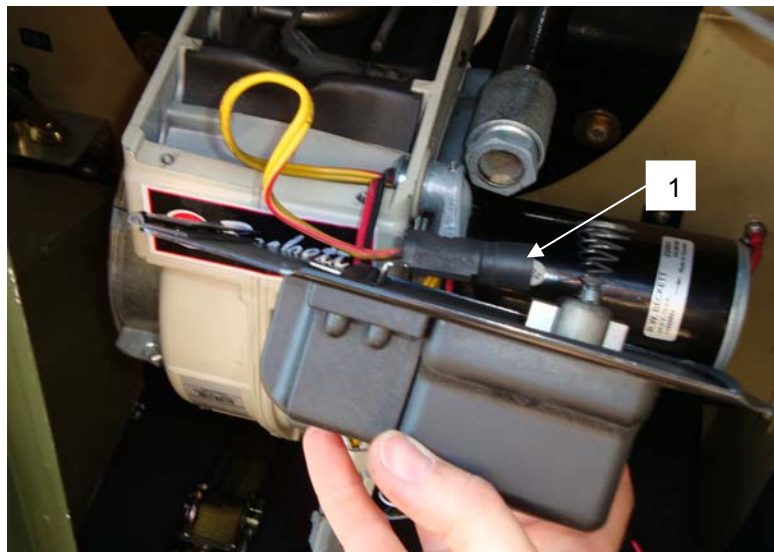


Figure 3. Partially Remove Ignition Assembly to Expose Flame Sensor.



**INSPECT - Continued**

4. Inspect the glass face of the flame sensor (Figure 4, Item 1). If dirty, wipe with clean soft cloth.

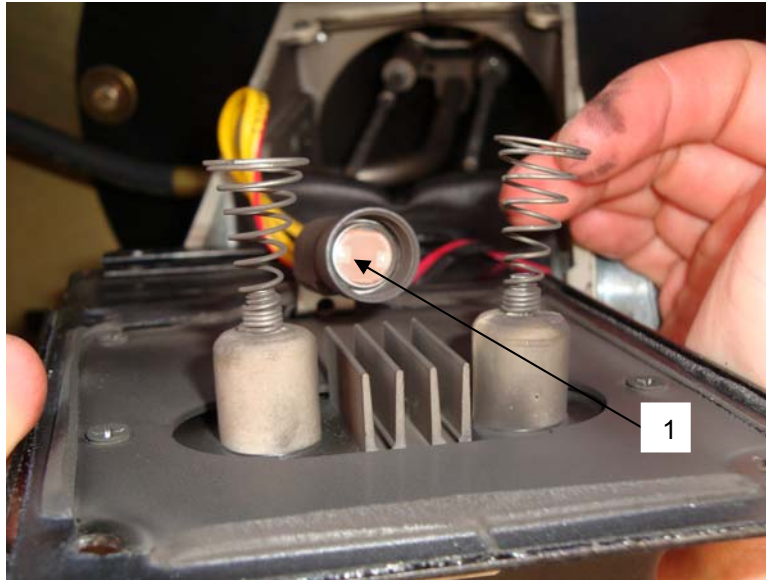


Figure 4. Inspect the Flame Sensor.

5. Position the ignition transformer on the burner housing aligning the four holes on the ignition transformer with the four holes on the burner housing. Install the ignition transformer with the four screws set aside earlier (Figure 5).



Figure 5. Position Ignition Assembly on Burner Housing and Secure with Hardware.

**END OF TASK**

**TEST**

1. Remove the four screws securing the ignition transformer (Figure 1, Item 5) to the top of the burner housing (Figure 6). Set the screws aside.

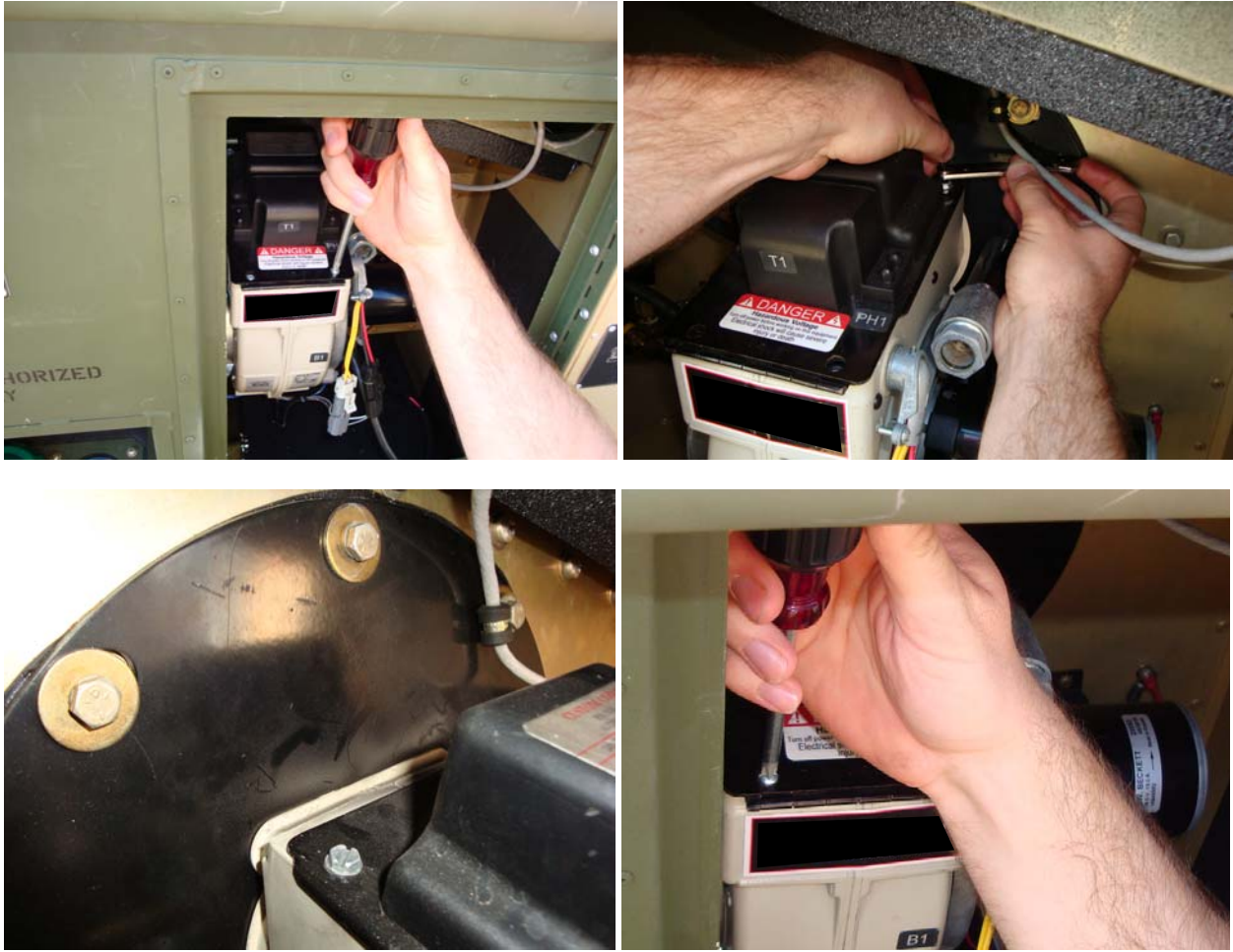


Figure 6. Remove Screws Securing Ignition Assembly.

**TEST - Continued**

2. Partially remove the ignition transformer (Figure 7, Item 2) and turn it over to expose the flame sensor (Figure 7, Item 1).

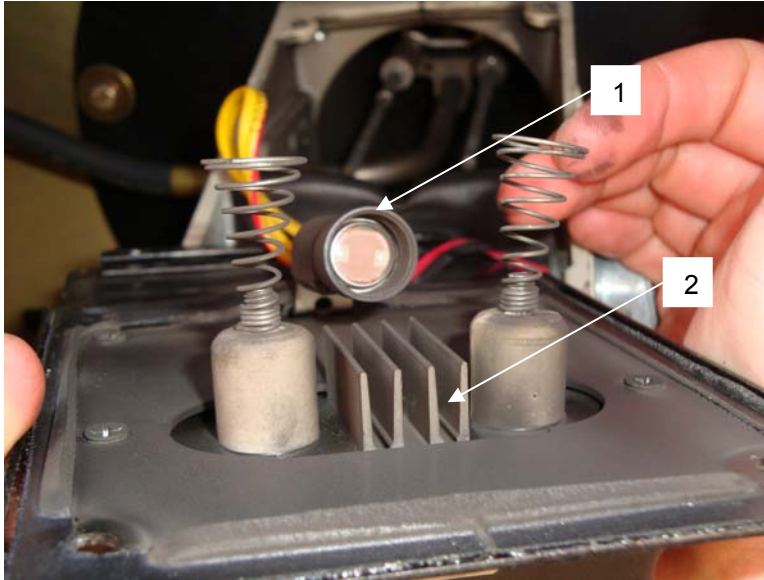


Figure 7. Partially Remove Ignition Assembly to Expose Flame Sensor.

3. Disconnect the flame sensor connector (Figure 8).



Figure 8. Disconnect Flame Sensor Connector.

**TEST - Continued**

4. Set multimeter to read resistance. Connect the multimeter test leads to the yellow flame sensor leads (Figure 9).

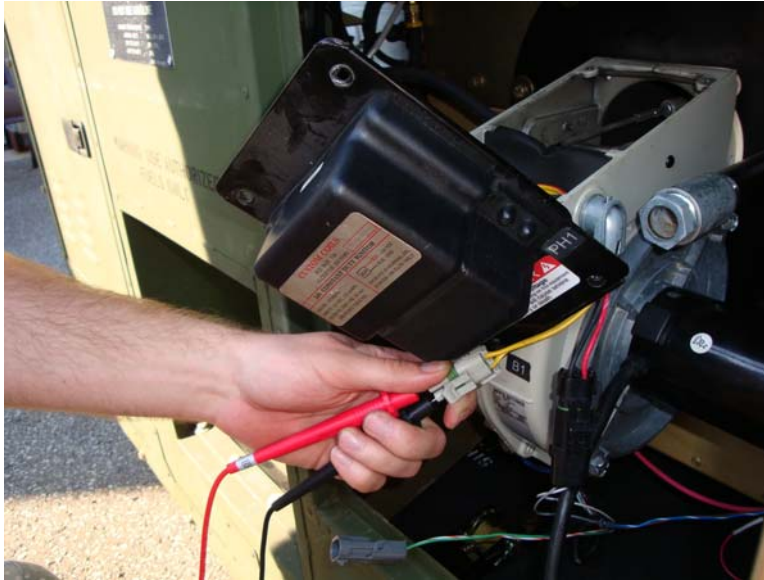


Figure 9. Connect Multimeter Leads to Flame Sensor Connector.

5. Hold the photocell end of flame sensor towards a light source (a 60 watt light bulb or direct sunlight). The resistance indicated on the ohmmeter should be very low.
6. Block off light completely by covering the photocell end of the flame sensor (Figure 10). Within 10 seconds the resistance indicated should be very high.



Figure 10. Block Light from Flame Sensor.

**TEST - Continued**

7. If there is no change in resistance during this procedure, replace the photocell IAW the section of this work package entitled "REPLACE."
8. If flame sensor photocell meets above tests, reconnect flame sensor connector (Figure 11).



Figure 11. Reconnect Flame Sensor Connector.

9. Position the ignition transformer on the burner aligning the four holes on the ignition transformer with the four holes on the burner housing. Install the ignition transformer with the four screws set aside earlier (Figure 12).



Figure 12. Position Ignition Assembly on Burner Housing and Secure with Screws.

**END OF TASK**

**REPLACE****NOTE**

In most cases, only the plug-in photocell of the flame sensor assembly will require replacement. If this is the case, remove the plug-in photocell of the new flame sensor assembly and use it to replace the defective photocell. If it is necessary to replace the entire flame sensor assembly, follow the instructions detailed in WP 0064 entitled "Ignition Assembly" related to the removal and installation of the wire harness and connector through the elbow fitting mounted on the side of the burner housing.

1. Disconnect the flame sensor wiring harness by separating the connector (Figure 13).



Figure 13. Disconnect Flame Sensor Connector.

2. Remove the four screws securing the ignition transformer to the top of the burner housing (Figure 14). Set the screws aside.

## REPLACE - Continued



Figure 14. Remove Screws Securing Ignition Assembly.

3. Partially remove the ignition transformer and turn it over to expose the flame sensor (Figure 15).

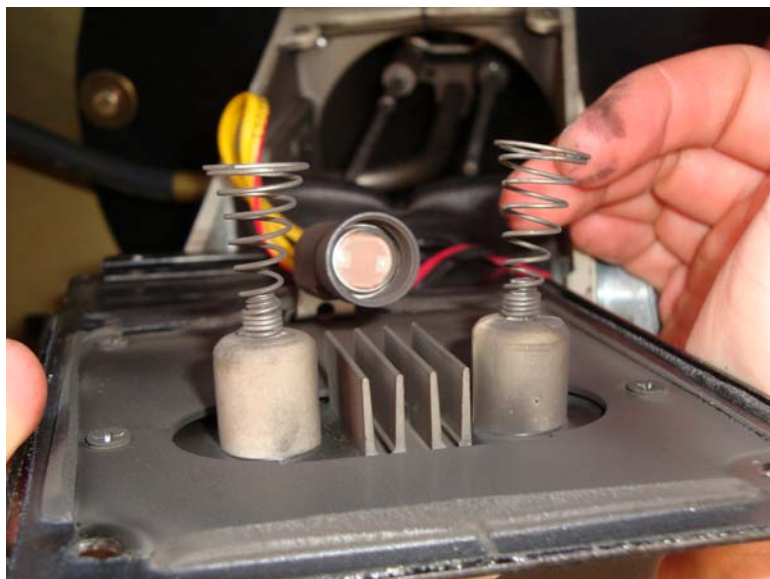


Figure 15. Partially Remove Ignition Assembly to Expose Flame Sensor.

**REPLACE - Continued**

4. Unplug and remove the defective photocell (Figure 16, Item 1) from the flame sensor (Figure 16).

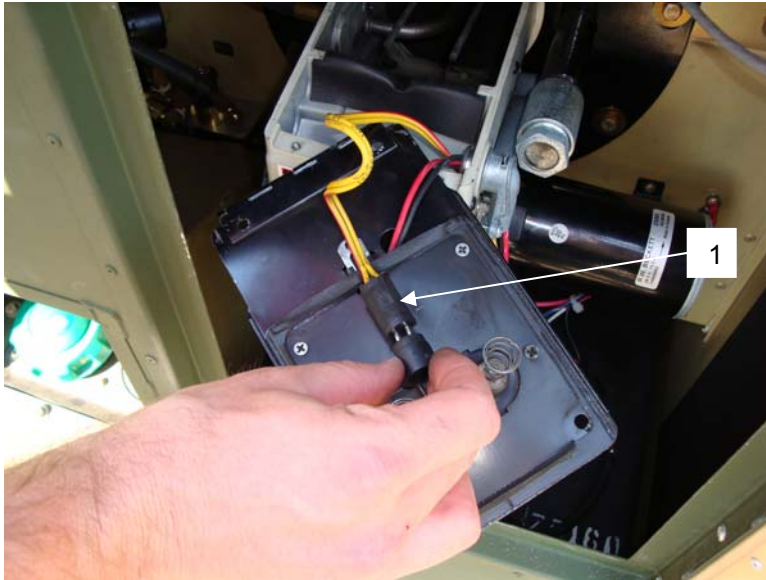


Figure 16. Unplug and Remove Defective Photocell from Flame Sensor.

5. Install a new photocell by plugging it into the flame sensor.
6. Press the photocell (Figure 17, Item 1) into the end of the flame sensor securely (Figure 17).

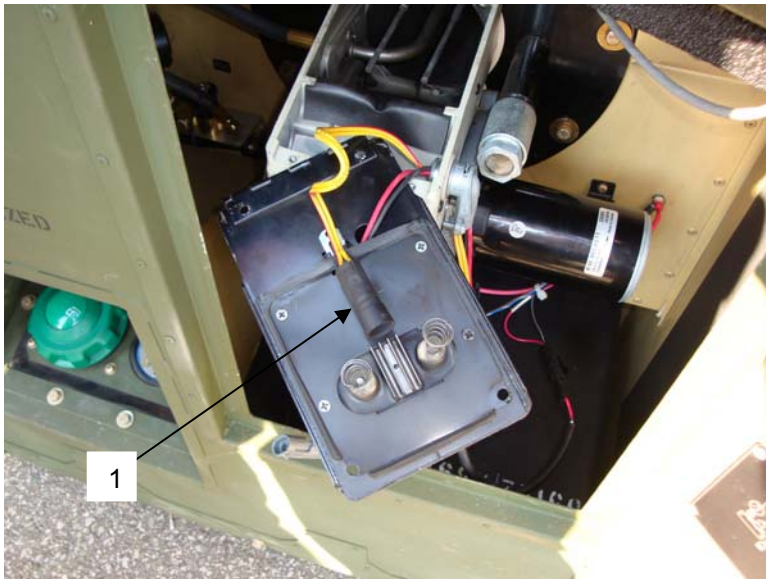


Figure 17. Install New Flame Sensor Photocell.



**REPLACE - Continued**

7. Position the ignition transformer on the burner aligning the four holes on the ignition transformer with the four holes on the burner housing. Install the ignition transformer with the four screws set aside earlier (Figure 18).



Figure 18. Position Ignition Assembly on Burner Housing and Secure with Screws.

8. Reconnect the flame sensor wiring harness connector (Figure 19).



Figure 19. Reconnect Flame Sensor Connector.

**END OF TASK**

**END OF WORK PACKAGE**



---

**SERVICE MAINTENANCE****IGNITION TRANSFORMER  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0134, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

None required.

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.  
Burner access door open.

---

**REPLACE**

1. Remove the four screws securing the ignition transformer to the top of the burner (Figure 1). Set the screws aside.

## REPLACE - Continued



Figure 1. Remove Screws Securing Ignition Assembly.

2. Pull the defective ignition transformer partially out from the heater and turn over to expose the flame sensor assembly (Figure 2).

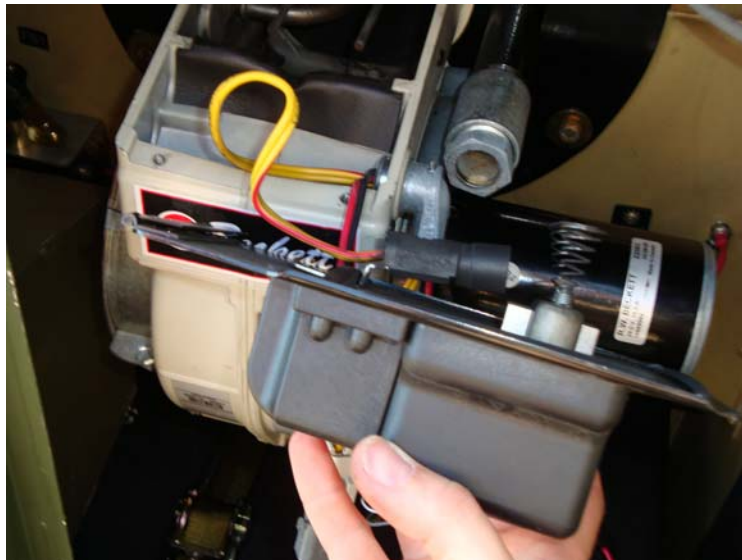


Figure 2. Partially Remove Ignition Assembly to Expose Flame Sensor.

**REPLACE - Continued**

3. Slide the flame sensor bracket from the slot on the ignition transformer (Figure 3).



Figure 3. Remove Flame Sensor Bracket from Slot on Ignition Transformer.

4. Disconnect the ignition transformer connector, and cut its wires just above the connector at the point where they pass through the burner housing (Figure 4).

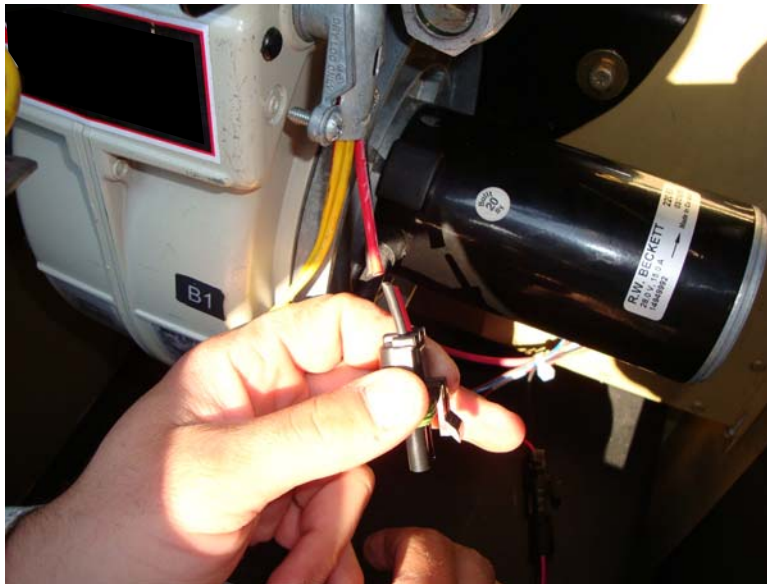


Figure 4. Disconnect Ignition Transformer Connector and Cut Wires.

**REPLACE - Continued**

5. Remove the two screws on the cover of the conduit on the side of the burner housing, and feed the ignition transformer wires through the conduit, and remove the defective ignition transformer (Figure 5).

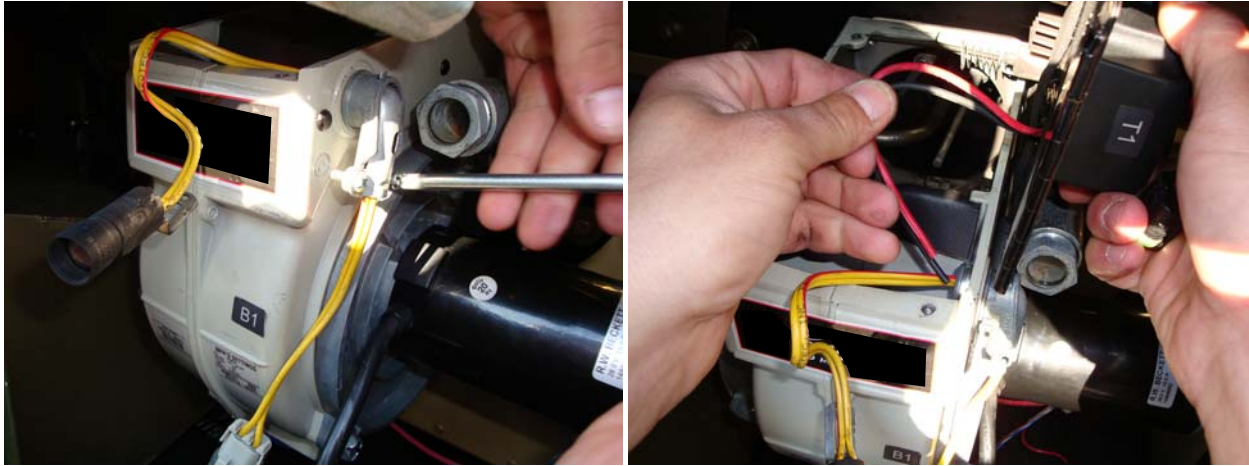


Figure 5. Remove Conduit Cover and Remove Defective Ignition Transformer.

6. Install a new ignition transformer by passing the ignition transformer wires (Figure 6, Item 1) through the conduit on the side of the burner housing (Figure 6, Item 2).

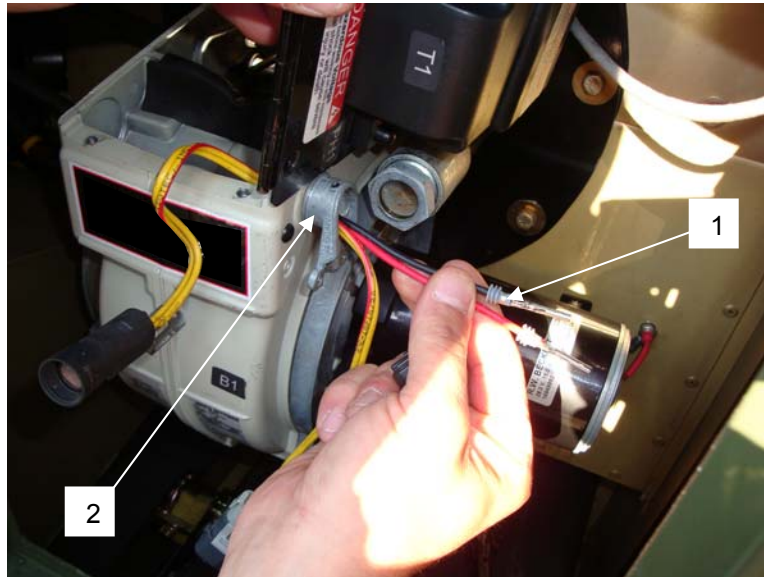


Figure 6. Install New Ignition Transformer.

**REPLACE - Continued**

7. Install the ignition transformer wire pins into the electrical connector provided with the new ignition transformer. Note that RED wire goes into pin slot marked "B" and the BLACK wire goes in the "A" slot. Pull wires to ensure that they are properly installed. Close the outer portion of the connector and press until it snaps in place (Figure 7).

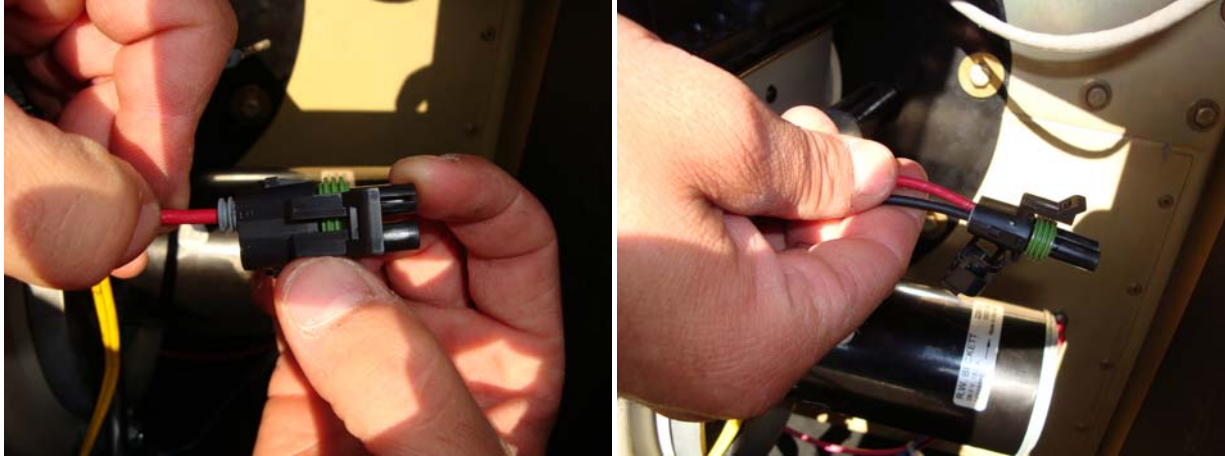


Figure 7. Install Wire Pins into Connector Body.

8. Re-install the flame sensor assembly bracket into the slot on the underside of the ignition transformer (Figure 8).



Figure 8. Reinstall Flame Sensor Assembly Bracket into Slot on Ignition Transformer.

**REPLACE - Continued**

9. Position the ignition transformer on the burner housing aligning the four holes on the ignition transformer with the four holes on the burner housing. Install the ignition transformer with the four screws set aside earlier (Figure 9).

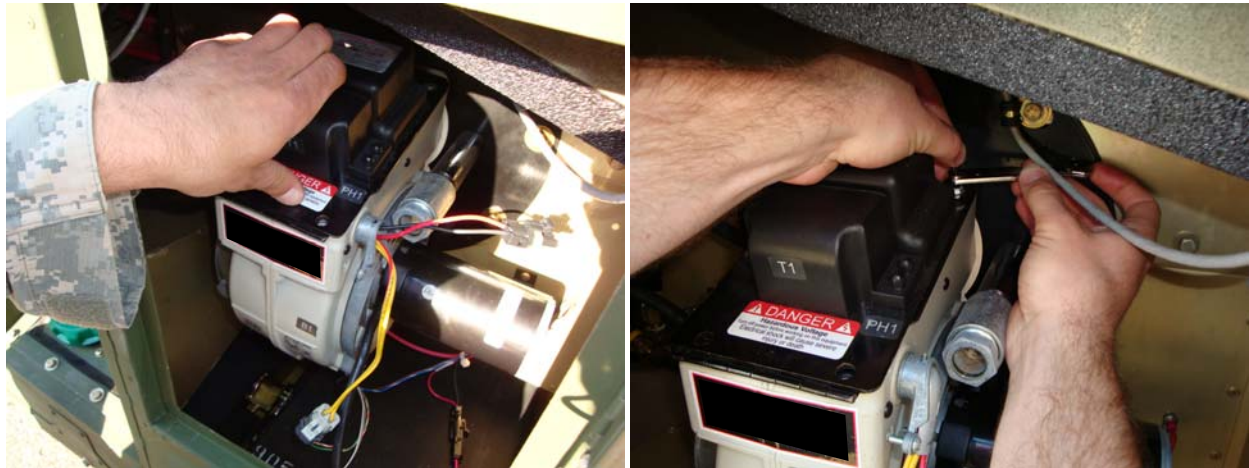


Figure 9. Position Ignition Transformer on Burner Housing and Secure with Screws.

10. Re-install conduit cover with two screws set aside earlier (Figure 10). Tighten securely.

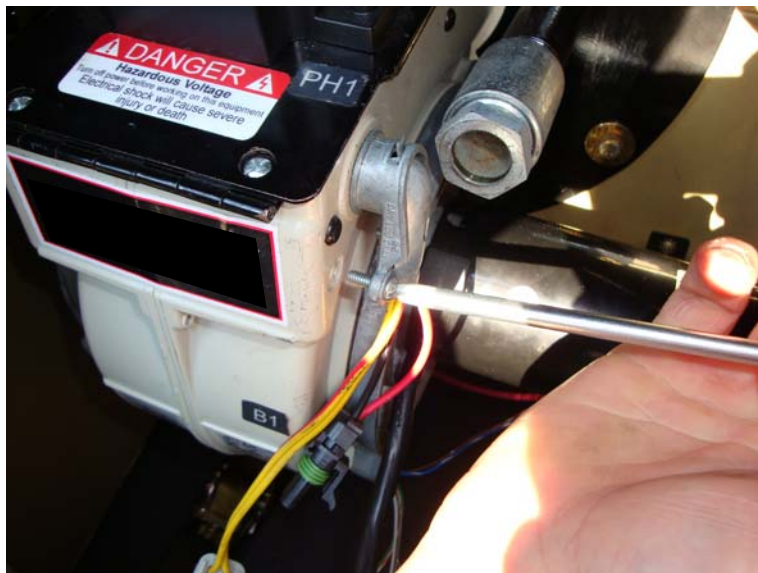


Figure 10. Reinstall Conduit Cover.



**REPLACE - Continued**

11. Connect the ignition transformer connector (Figure 11).

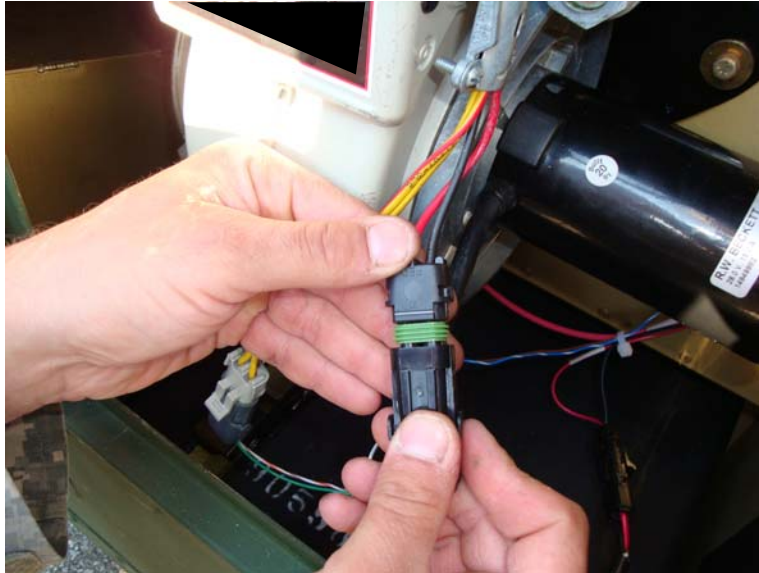


Figure 11. Reconnect Ignition Transformer Connector.

**END OF TASK**

**END OF WORK PACKAGE**



---

**SERVICE MAINTENANCE****BURNER NOZZLE AND ELECTRODE ASSEMBLY  
REPAIR, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Pads, Knee (WP 0124, Item 7)  
Tool, Electrode Adjusting (WP 0124, Item 14)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rag, Wiping, Clean (WP 0123, Item 15)  
Sealing Compound (WP 0123, Item 17), or  
Tape, Antiseizing (WP 0123, Item 23)  
Tags, Marking (WP 0123, Item 22)  
Gloves, Chemical and Oil Protective (WP 0123,  
Item 6)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Burner access door open.  
Main battery switch OFF and handle removed.

---

**REPAIR**

1. Tag and disconnect electrical connectors (Figure 1, Item 1 and 2) from burner assembly.

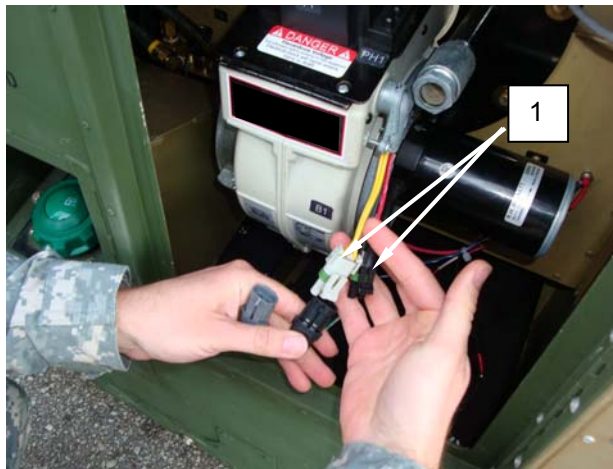


Figure 1. Disconnecting Electrical Connectors from Burner Assembly.

**REPAIR - Continued**

2. Remove four screws (Figure 2, Item 1) securing ignition assembly (Figure 2, Item 2). Remove ignition assembly and gasket.

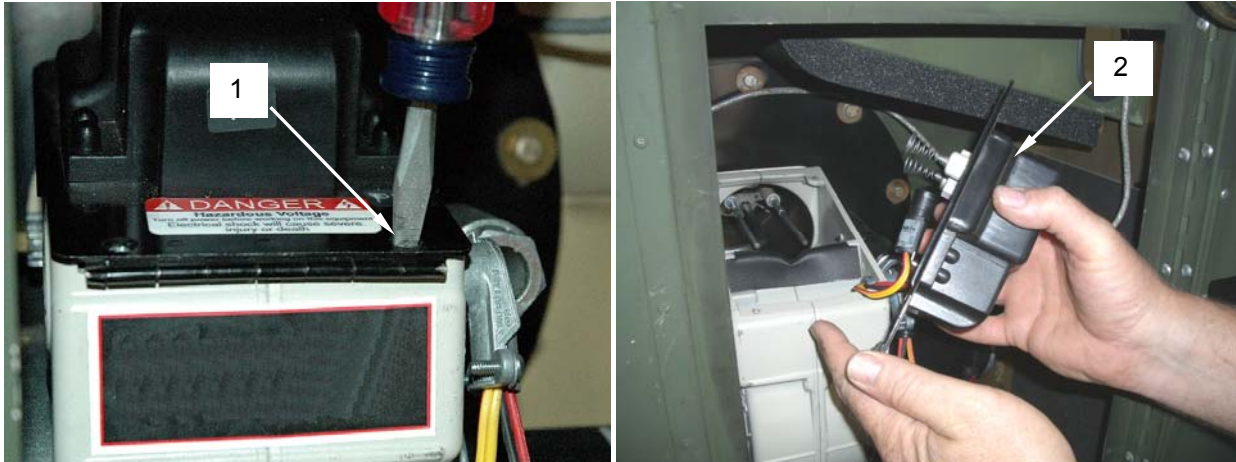


Figure 2. Removing the Ignition Assembly.

## REPAIR - Continued

**WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel pump to collect any fuel. Be sure to wipe up any spills with a rag. Dispose of rag in accordance with Unit SOP and local environmental regulations.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**CAUTION**

Do not loosen any other hardware other than the spline nut. Proper alignment of the burner combustion head is critical to the performance of the burner. Do not loosen any of the hardware associated with the burner shutter plate on the side of the burner assembly. If the shutter plate is moved accidentally, there are small punch marks (Figure 3, Item 3) on the shutter plate that will allow the plate to be reset to its proper location.

3. Disconnect fuel line (Figure 3, Item 1) from fuel line tube (Figure 3, Item 2).
4. Remove spline nut (Figure 3, Item 4) from fuel line tube (Figure 3, Item 2).

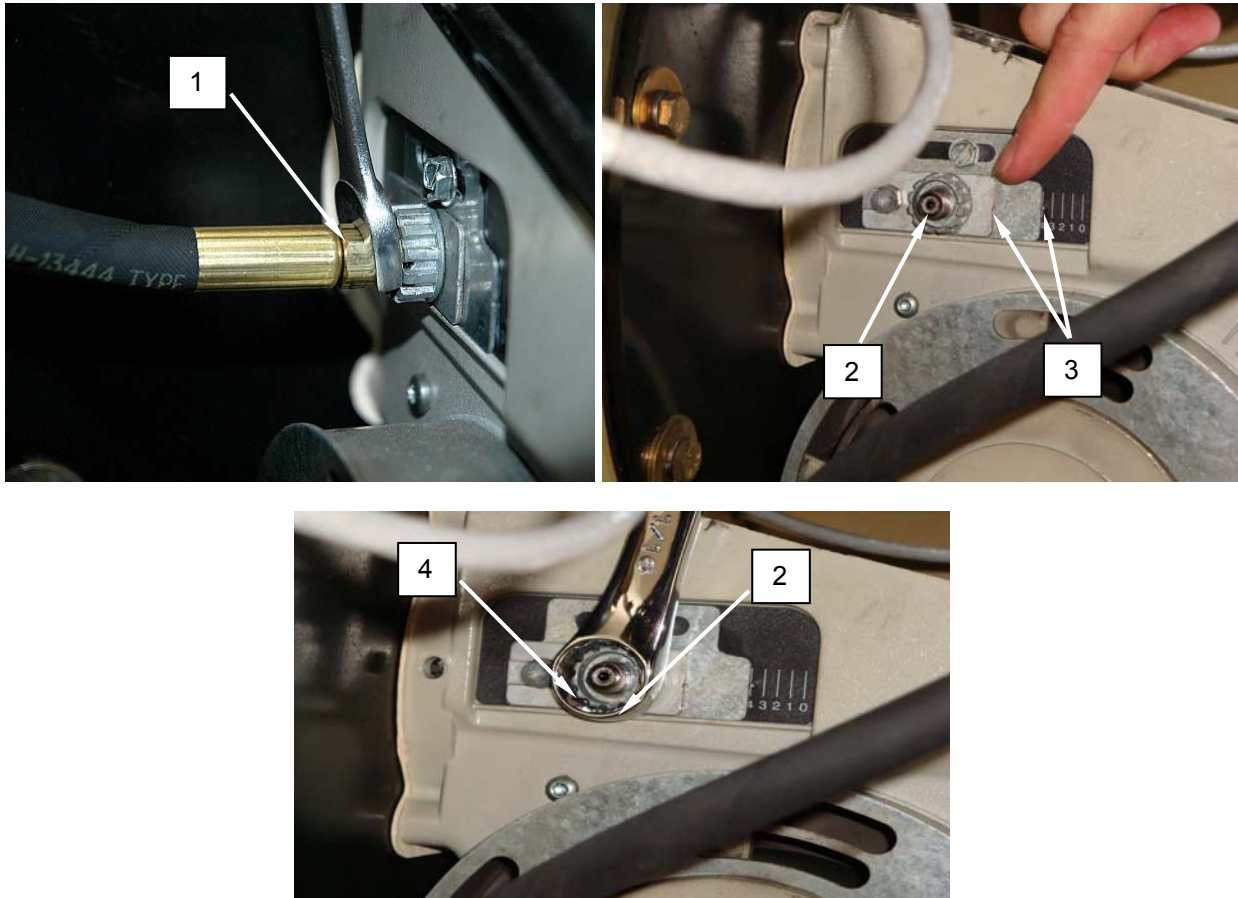


Figure 3. Removing Fuel Line and Spline Nut from Fuel Line Tube.

**REPAIR - Continued**

5. Pull fuel line tube (Figure 4, Item 2) from housing assembly (Figure 4, Item 1).

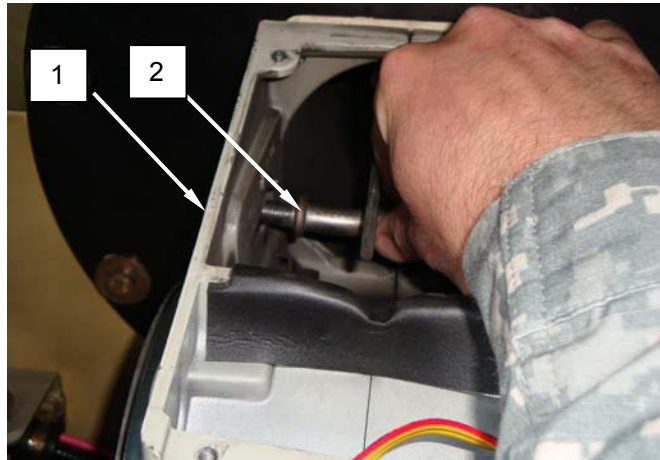


Figure 4. Removing Fuel Line Tube from Housing Assembly.

6. Remove nozzle assembly (Figure 5, Item 1) from housing assembly (Figure 5, Item 2) by grasping nozzle assembly and pulling straight back while tilting nozzle assembly upward.

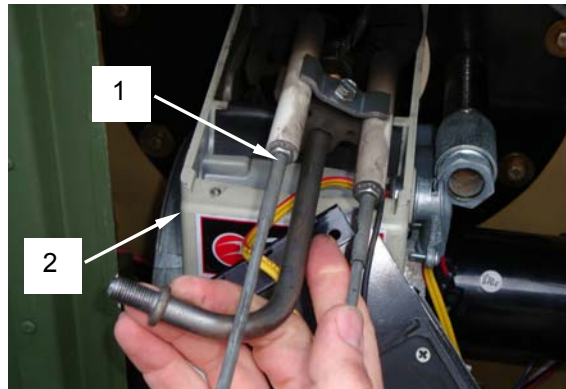


Figure 5. Removing Nozzle Assembly.

**NOTE**

Disassemble nozzle and electrode assembly only to the level necessary to replace the defective part.

As the burner nozzle and electrode assembly is disassembled, inspect each component for serviceability. Components deemed serviceable should be set aside and used for reassembly.

7. Remove screw (Figure 6, Item 2) securing electrode clamp (Figure 6, Item 6) and electrode spacer (Figure 6, Item 7).
8. Remove electrodes (Figure 6, Item 1).
9. Remove spring clamp (Figure 6, Item 3).
10. Loosen screw (Figure 6, Item 8) and remove head assembly (Figure 6, Item 9).
11. Hold nozzle adapter (Figure 6, Item 5) and remove nozzle (Figure 6, Item 4).

**REPAIR - Continued**

12. Install nozzle (Figure 6, Item 4) onto nozzle adapter (Figure 6, Item 5).

**CAUTION**

Ensure tension spring of the burner head is directly aligned with screw on electrode bracket.

13. Install head assembly (Figure 6, Item 9) onto nozzle adapter (Figure 6, Item 5). Ensure head assembly is completely on nozzle adapter and contacts hex-shaped shoulder. Secure with screw (Figure 6, Item 8).
14. Install spring clamp (Figure 6, Item 3).
15. Install electrodes (Figure 6, Item 1) onto electrode spacer (Figure 6, Item 7) and electrode clamp (Figure 6, Item 6). Tighten screw (Figure 6, Item 2) only enough to hold electrodes in place.

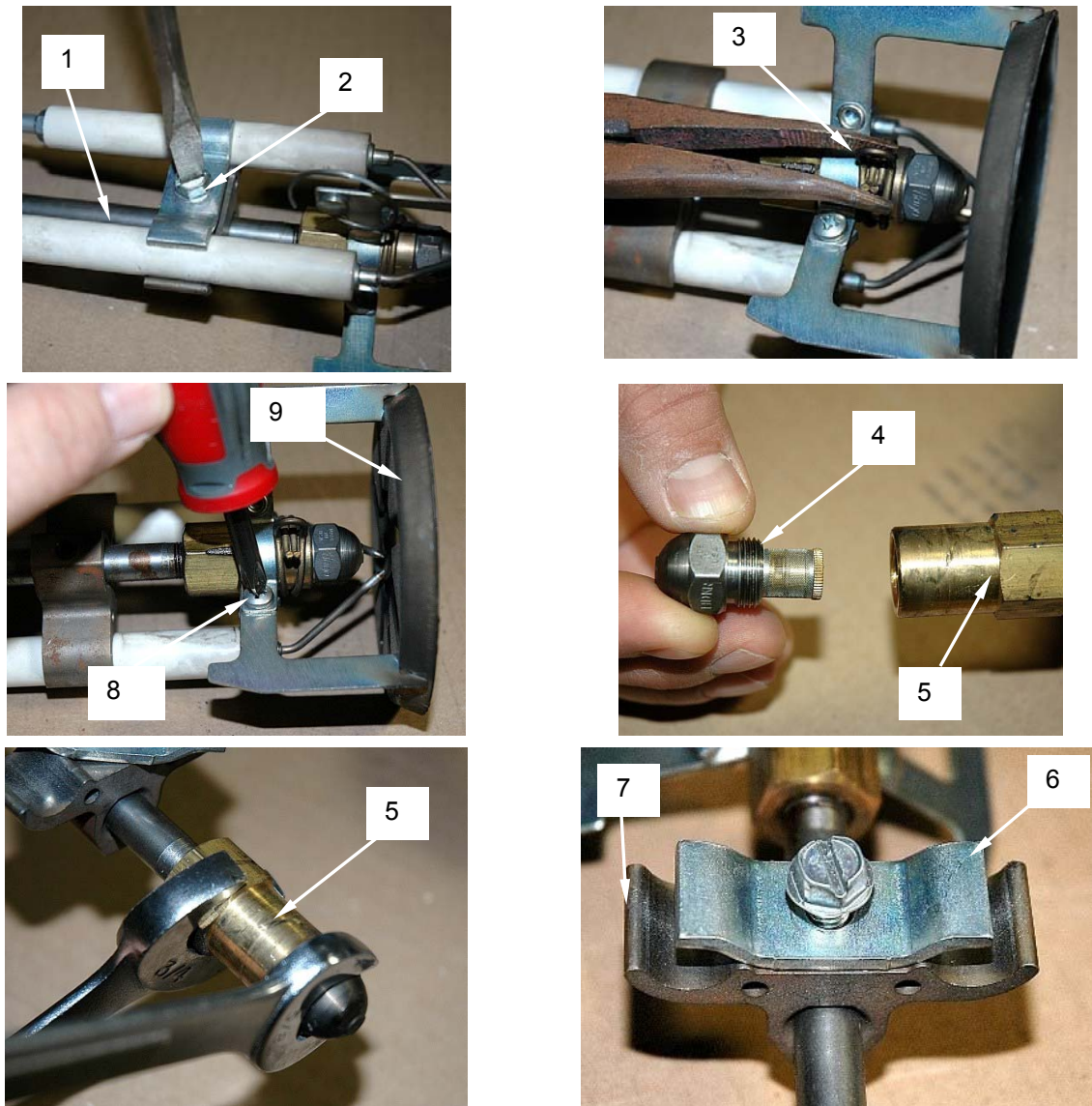


Figure 6. Replace Burner Nozzle and Electrode Assembly.

**REPAIR - Continued**

16. Wipe contaminants from head assembly swirlers (Figure 7, Item 1).



Figure 7. Cleaning Swirlers.

17. Loosen screw (Figure 8, Item 1) on electrode clamp (Figure 8, Item 2) just enough to allow the electrodes (Figure 8, Item 3) to be moved for adjustment.

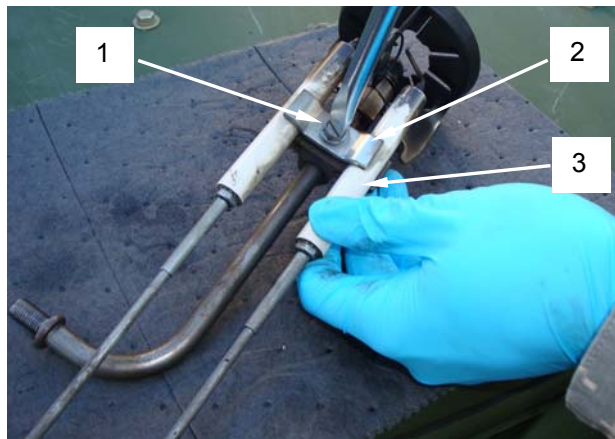


Figure 8. Loosening Screw on Electrode Clamp.

18. Adjust electrodes by using the electrode and nozzle gap adjustment tool (Figure 9, Item 1) that is located inside the fuel access door, tethered to the technical manual storage compartment.

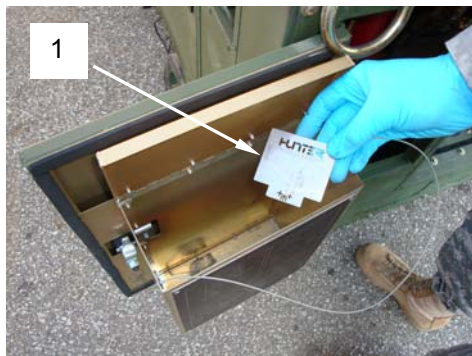


Figure 9. Electrode and Nozzle Gap Adjustment Tool.



**REPAIR - Continued**

19. Position the electrode and nozzle adjustment tool (Figure 10, Item 1) so that the edge of the tool with the crosshair marks is touching the front surface of the nozzle (Figure 10, Item 4). Ensure that the center of the nozzle is aligned with the center line mark (Figure 10, Item 5) on the tool.
20. Move the electrodes so that each electrode tip (Figure 10, Item 2) is aligned with the horizontal crosshair mark (Figure 10, Item 3) on the tool.

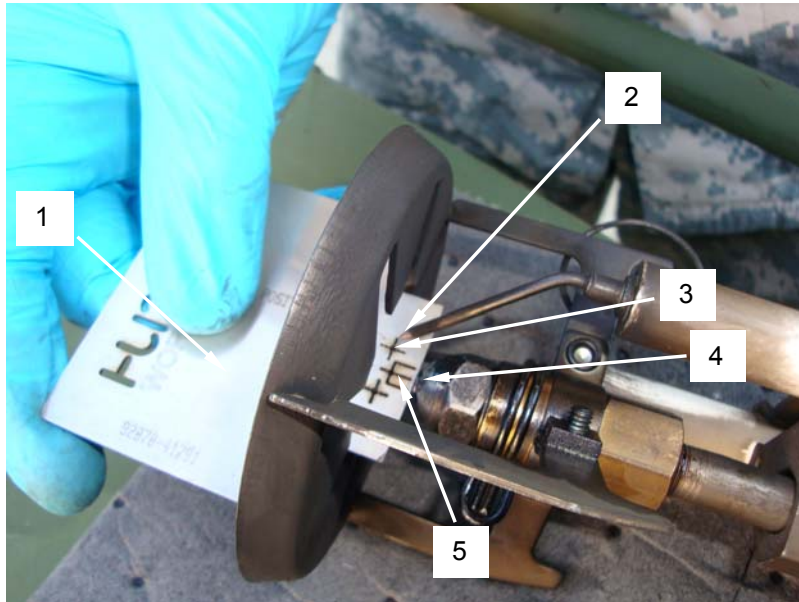


Figure 10. Adjusting Electrode Tip Distance from Nozzle Tip.

21. Reposition the electrode and nozzle gap adjustment tool so that the center line (Figure 11, Item 4) on the tool is aligned with the center of the nozzle (Figure 11, Item 3), with the electrode tips (Figure 11, Item 2) touching the “pitch fork” shaped marks (Figure 11, Item 1) on the tool. Adjust the electrode tip spacing so that the tips align with the vertical marks (Figure 11, Item 1) on each side of the center line (Figure 11, Item 4).

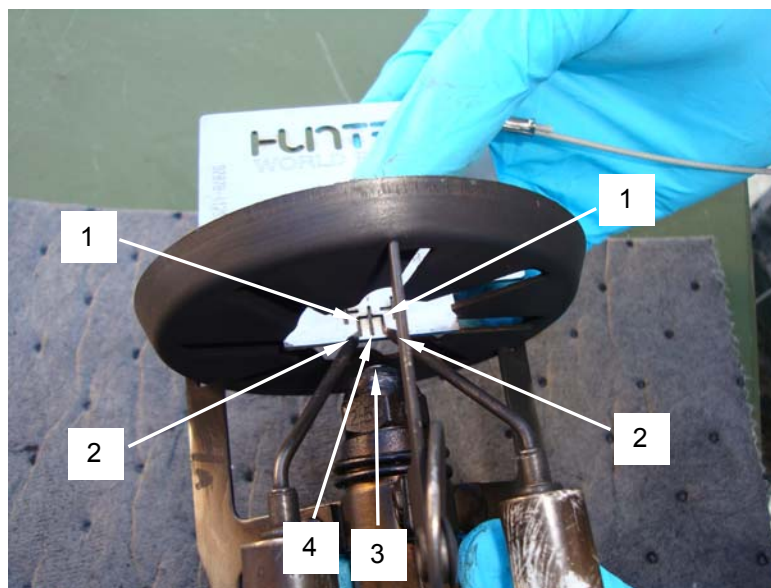


Figure 11. Adjusting the Electrode Tip Spacing.

**REPAIR - Continued**

22. Tighten screw (Figure 12, Item 1) on electrode clamp (Figure 12, Item 2).

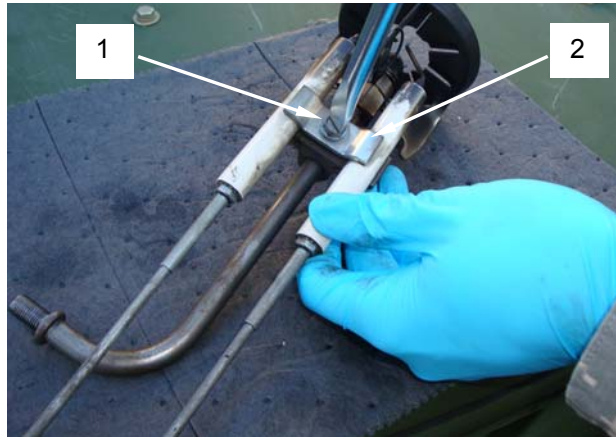


Figure 12. Tightening Screw on Electrode Clamp.

23. Install nozzle assembly (Figure 13, Item 1) in housing assembly (Figure 13, Item 3).

24. Push fuel tube (Figure 13, Item 2) through housing assembly (Figure 13, Item 3).

25. Install nut spline (Figure 13, Item 6) on fuel line tube (Figure 13, Item 2).

26. Connect fuel line (Figure 13, Item 7) onto fuel line tube (Figure 13, Item 2).

27. Install screws (Figure 13, Item 5) securing ignition assembly (Figure 13, Item 4).

28. Reconnect electrical connectors to burner assembly.

REPAIR - Continued

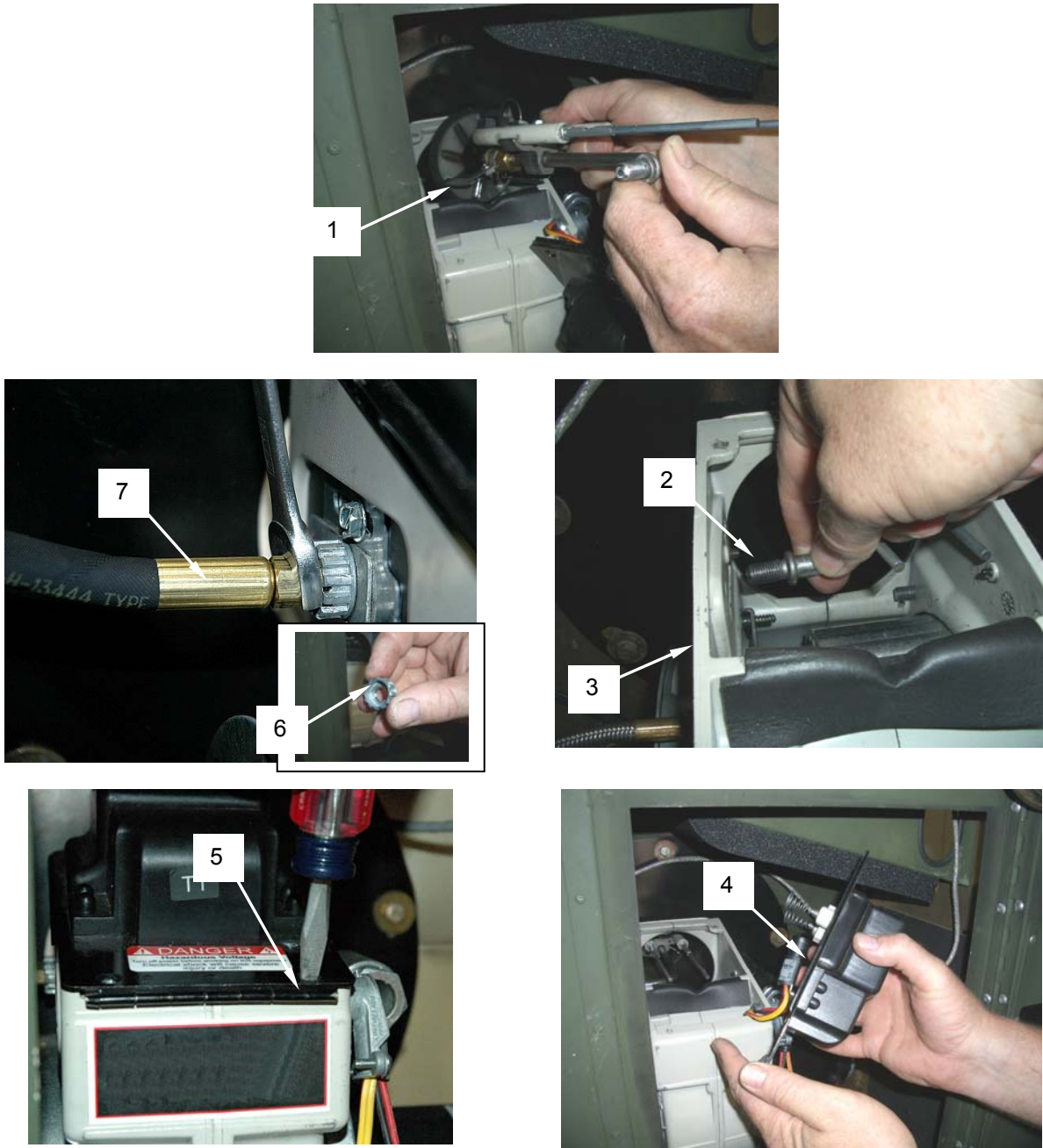


Figure 13. Install Burner Nozzle and Electrode Assembly.

END OF TASK

END OF WORK PACKAGE



**SERVICE MAINTENANCE**

**HEAT EXCHANGER ASSEMBLY  
INSPECT, SERVICE, REPLACE**

**INITIAL SETUP:**

**Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (2) or  
Utilities Equipment Repairer 52C (2)

**Materials/Parts**

Brush, Wire, Scratch (WP 0123, Item 4)  
Mat, Petroleum Absorbent (WP 0123, Item 14)  
Rag, Wiping, Clean (WP 0123, Item 15)  
Tags, Marking (WP 0123, Item 22)  
Gloves, Chemical and Oil Protective (WP 0123, Item 22)

**References**

WP 0061

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

**INSPECT**

1. Remove the heat exchanger access cover (Figure 1, Item 2) by removing the bolts, lockwashers, and flat washers (Figure 1, Item 1) that secure the top of the access cover. This includes the two bolts, lockwashers, and flat washers (Figure 1, Item 3) that are located just under the operator control box stowage door.
2. Open the burner access panel and also remove the six screws, lockwashers, and flat washers (Figure 1, Item 4) that secure the access cover underneath the operator control box stowage area.

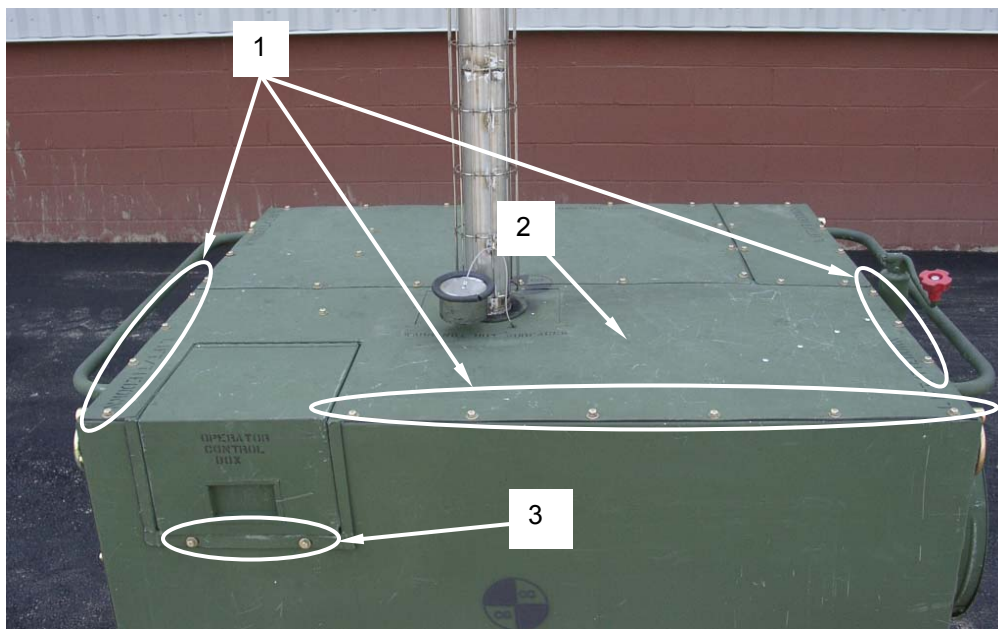


Figure 1. Inspect Heat Exchanger (Sheet 1 of 2).

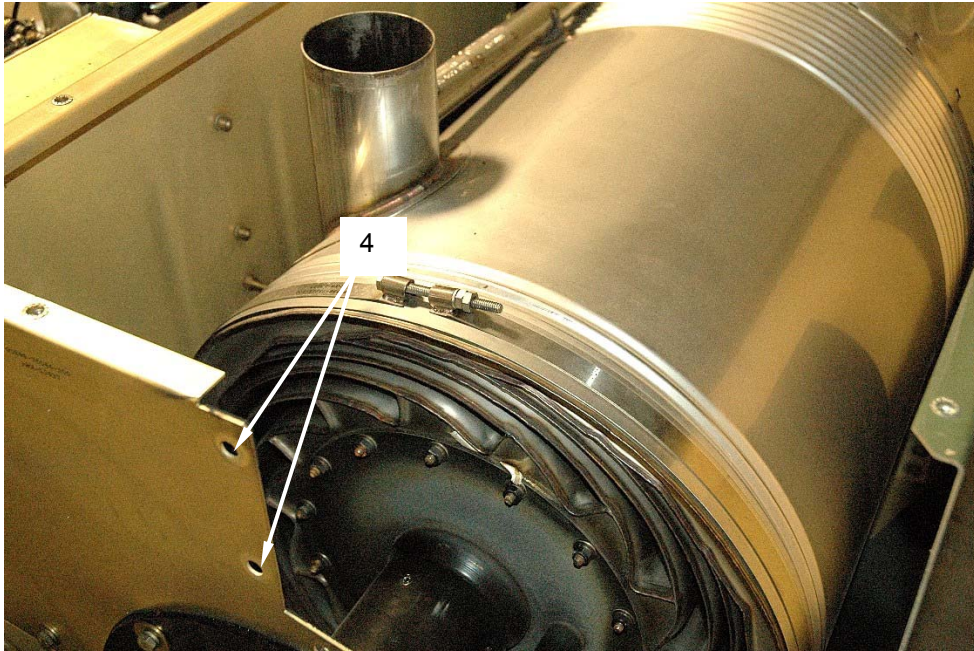
**INSPECT - Continued**

Figure 1. Inspect Heat Exchanger (Sheet 2 of 2).

3. Remove operator control box from housing. Then remove quick disconnect cable by passing cable through cable opening on housing.
4. Remove heat exchanger access cover and set aside.
5. Inspect the band clamps (Figure 2, Item 1) that secure the heat exchanger (Figure 2, Item 2) to the cabinet (Figure 2, Item 6). Ensure that clamps (Figure 2, Item 1) are not damaged. Ensure that clamp bolts (Figure 2, Item 5) are securely tightened.
6. Inspect the weld seams on the heat exchanger (Figure 2, Item 2) and ensure that they are not cracked or corroded in any way.
7. Inspect the overall surface of the heat exchanger (Figure 2, Item 2) and ensure that there is no corrosion, holes, or other damage that would affect the overall integrity of the assembly.
8. Inspect the exhaust tube (Figure 2, Item 3) that connects the heat exchanger with the cabinet side wall (Figure 2, Item 4). Ensure exhaust tube is attached securely and is not damaged in any way.
9. Inspect burner tube assembly (Figure 2, Item 7) weld seams for cracks and corrosion. Inspect surface for corrosion, holes, or other damage.
10. Replace heat exchanger access cover using hardware set aside during removal.
11. Reroute operator control cable through cable opening on housing. Replace operator control box. Reconnect quick connect cable to operator control box.

INSPECT - Continued

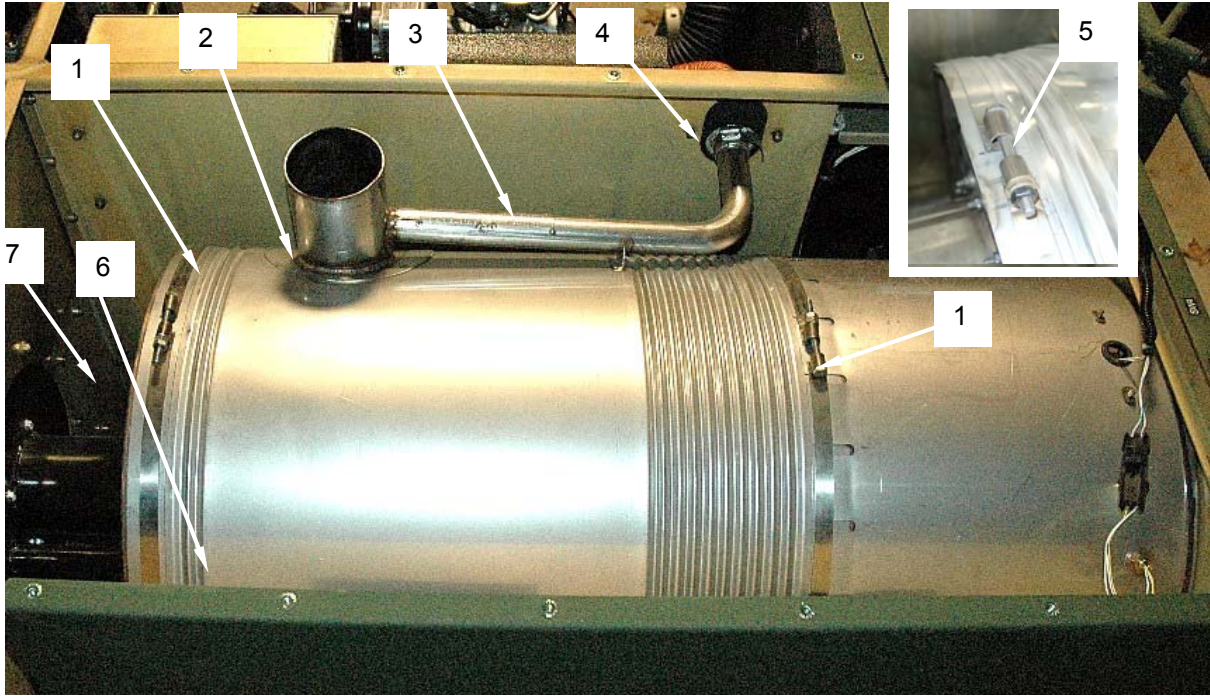


Figure 2. Heat Exchanger Inspection.

END OF TASK

**SERVICE****Drain Condensation**

1. Drain condensation from heat exchanger every 250 hours of operation by loosening the drain valve (Figure 3, Item 1) located at the end of the heat exchanger to the left of the jack assembly.
2. Drain any condensation that may have accumulated.
3. Tighten drain valve (Figure 3, Item 1) securely.

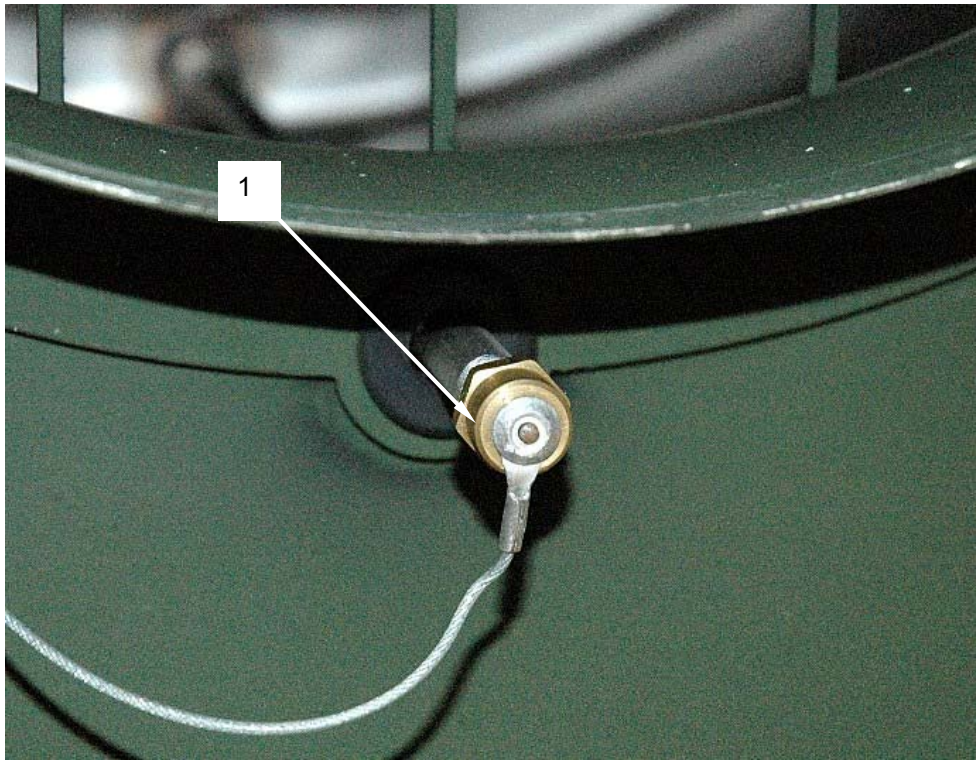


Figure 3. Drain Condensation from Heat Exchanger.

**END OF TASK**



**SERVICE - Continued****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the fuel pump to collect any fuel. Be sure to wipe up any spills with a rag and dispose of properly IAW with local SOP.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

**Clean Burner Tube Assembly**

1. Remove heat exchanger access cover IAW steps 1-3 in "INSPECT" in this WP.
2. Tag and disconnect connectors (Figure 4, Item 6) from burner assembly (Figure 4, Item 4).

**NOTE**

Follow "SERVICE" in WP 0061, steps 1-6, before proceeding.

3. Remove four bolts (Figure 4, Item 2) securing burner onto burner tube assembly. Remove burner assembly and set aside.
4. Clean inside of the burner tube assembly (Figure 4, Item 5) to remove of carbon buildup. Scrape with a screwdriver, wire brush, or similar tool, taking care not to damage burner tube assembly.
5. Collect any debris in a rag and dispose of properly.
6. Replace burner by reinstalling bolts onto burner back plate.
7. Perform steps 8-12 from "SERVICE" in WP 0061.
8. Connect connectors (Figure 4, Item 6) to burner assembly (Figure 4, Item 4) and remove tags.
9. Replace heat exchanger access cover IAW steps 10-11 in "INSPECT" in this WP.

SERVICE - Continued

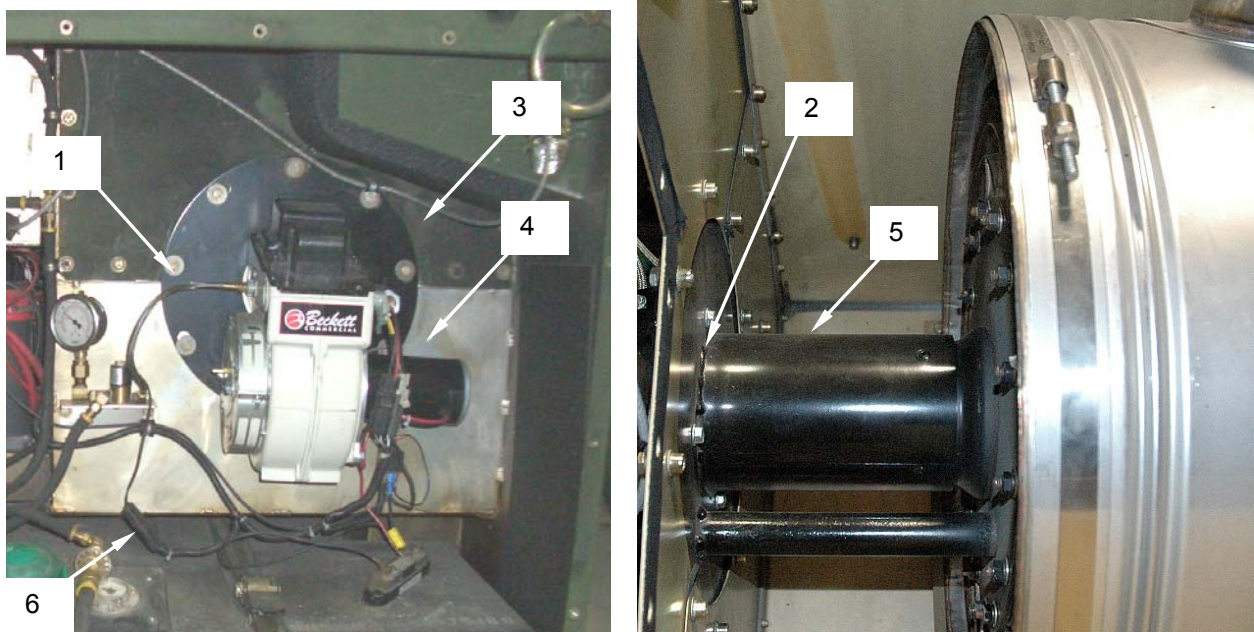


Figure 4. Clean Burner Tube Assembly.

END OF TASK

**SERVICE - Continued****Clean the Heat Exchanger**

1. Remove burner back plate and entire burner assembly as described above.
2. Clean large cone deposits from bottom of heat exchanger.
3. Use a long, thin brush to brush the inside surfaces of the heat exchanger.
4. Clean carbon brushed from heat exchanger surfaces that will fall to the bottom of the heat exchanger.

**NOTE**

After cleaning heat exchanger, it is not unusual to see a small amount of light smoke when unit is started. The smoke should clear within 30 minutes. If smoke is heavy and black after cleaning heat exchanger, shut unit off and troubleshoot for excessive fuel or low combustion airflow.

5. Install burner back plate and entire burner assembly as described above.

**END OF TASK**

**REPLACE****WARNING**

The heat exchanger weighs approximately 85 lbs (38.5 kg). A minimum of two personnel are required to lift the heat exchanger out of the heater cabinet. A mechanical lift using a strap positioned under the centerline of the heat exchanger is preferred to using manpower. Failure to lift the heat exchanger properly may result in serious injury.

1. Remove burner back plate and entire burner assembly (Figure 5, Item 5, Sheet 1 of 2) as described in the section of this work package entitled "SERVICE." Set aside assembly.
2. Remove nuts, lockwashers, and flat washers (Figure 5, Item 3) securing burner tube assembly (Figure 5, Item 4) on inlet of heat exchanger (Figure 5, Item 1) and remove burner tube assembly (Figure 5, Item 4). Set aside.
3. Loosen clamp and remove diesel engine exhaust tube (Figure 5, Item 6, Sheet 2 of 2).
4. Loosen and separate the two band clamps (Figure 5, Item 2) that encircle the heat exchanger (Figure 5, Item 1).
5. Lift the heat exchanger from the heater with a minimum of 2 persons or with a block and tackle lifting device (or equivalent) rated for at least 85 lbs (38.5 kg).
6. Install a new heat exchanger (Figure 5, Item 1) by lowering into position onto the saddles at the base of the heater.
7. Engage the two band clamps (only one showing in illustration) (Figure 5, Item 5, Sheet 2 of 2) around the heat exchanger (Figure 5, Item 1) and tighten.
8. Install the diesel engine exhaust tube (Figure 5, Item 6, Sheet 2 of 2).
9. Install burner tube assembly (Figure 5, Item 4).
10. Install flat washers, lockwashers, and nuts (Figure 5, Item 3) on inlet of heat exchanger (Figure 5, Item 1).
11. Install burner back plate and entire burner assembly (Figure 5, Item 5, Sheet 1 of 2) as described in the section of this work package entitled "SERVICE."
12. Install top cover on heater.

REPLACE - Continued

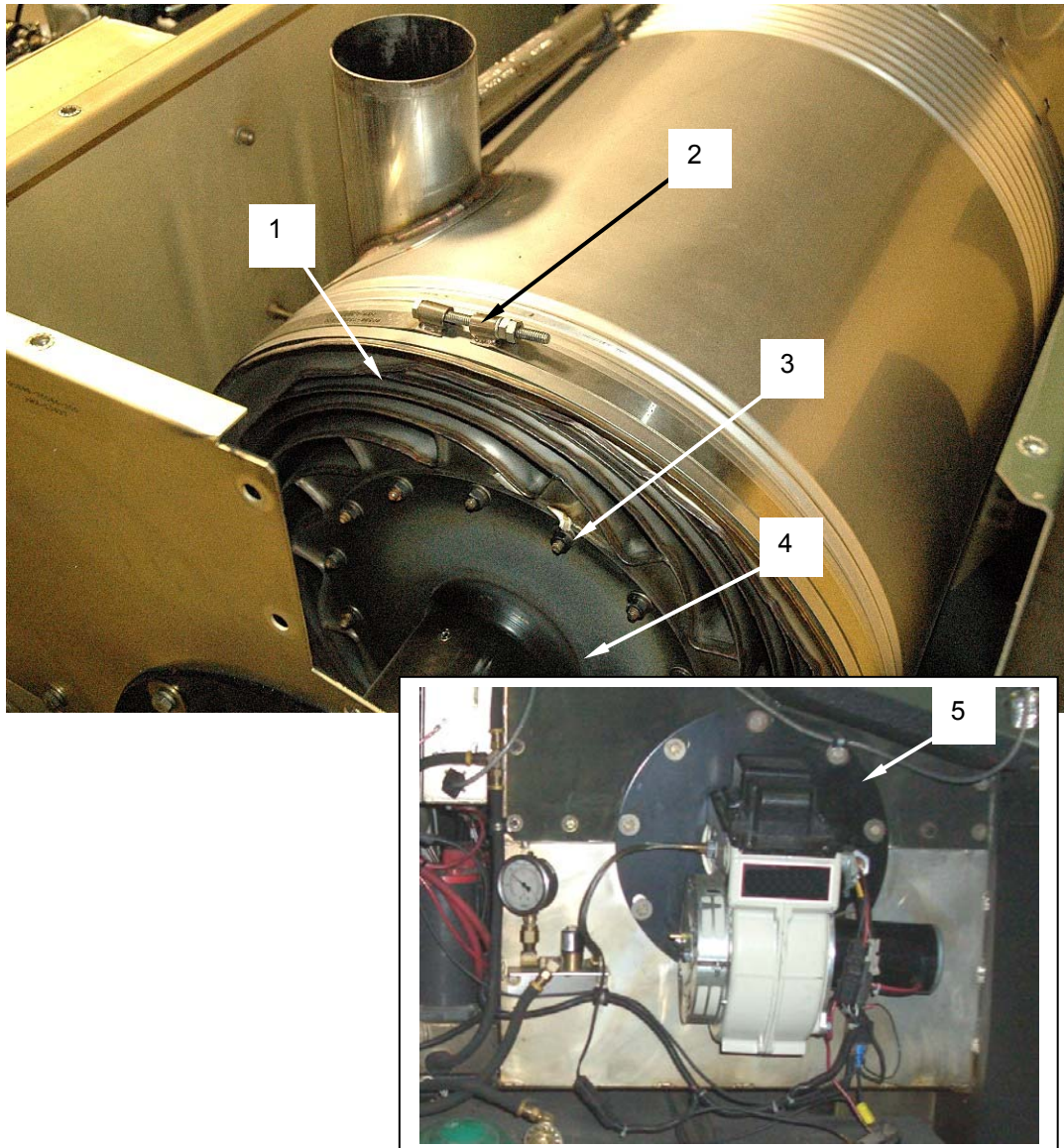


Figure 5. Replace Heat Exchanger (Sheet 1 of 2).

REPLACE - Continued

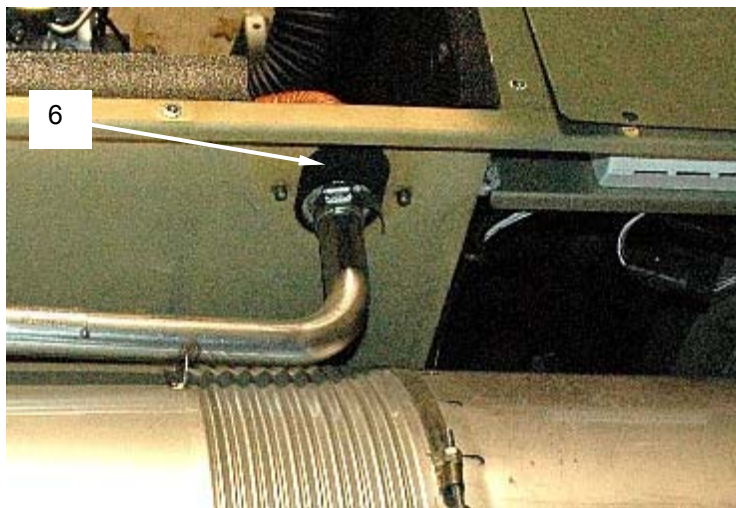
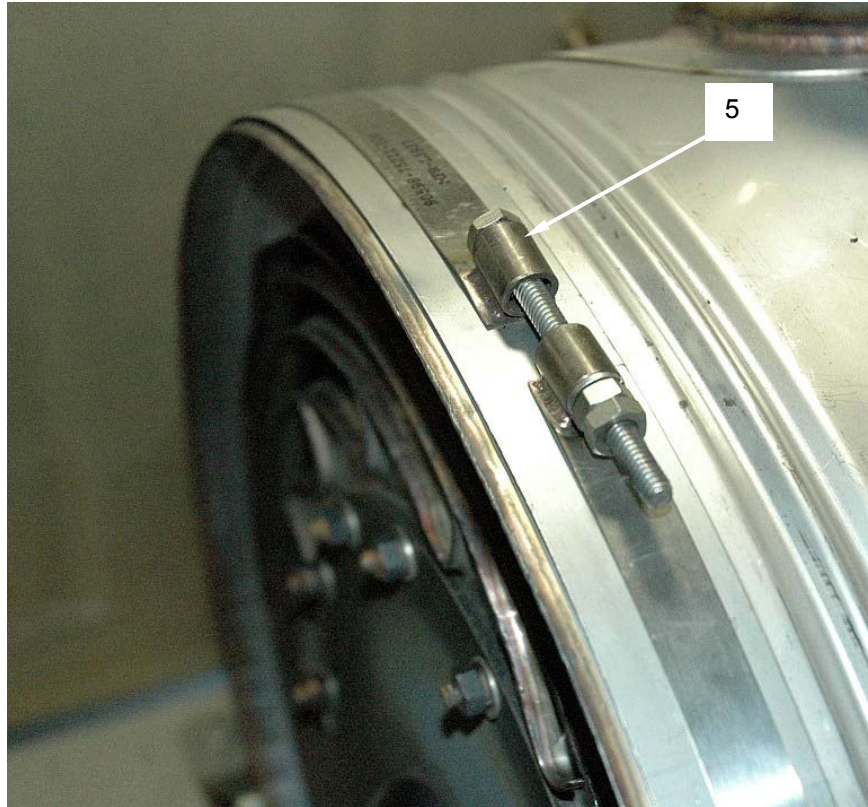


Figure 5. Replace Heat Exchanger (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE

**SERVICE MAINTENANCE****HIGH TEMPERATURE CUTOUT SENSOR  
TEST, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (2) or  
Utilities Equipment Repairer 52C (2)**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.**REMOVE**

Remove the safety screen (Figure 1, Item 1) by removing the eight screws, lockwashers, and flat washers (Figure 1, Item 2). Set safety screen and mounting hardware aside.

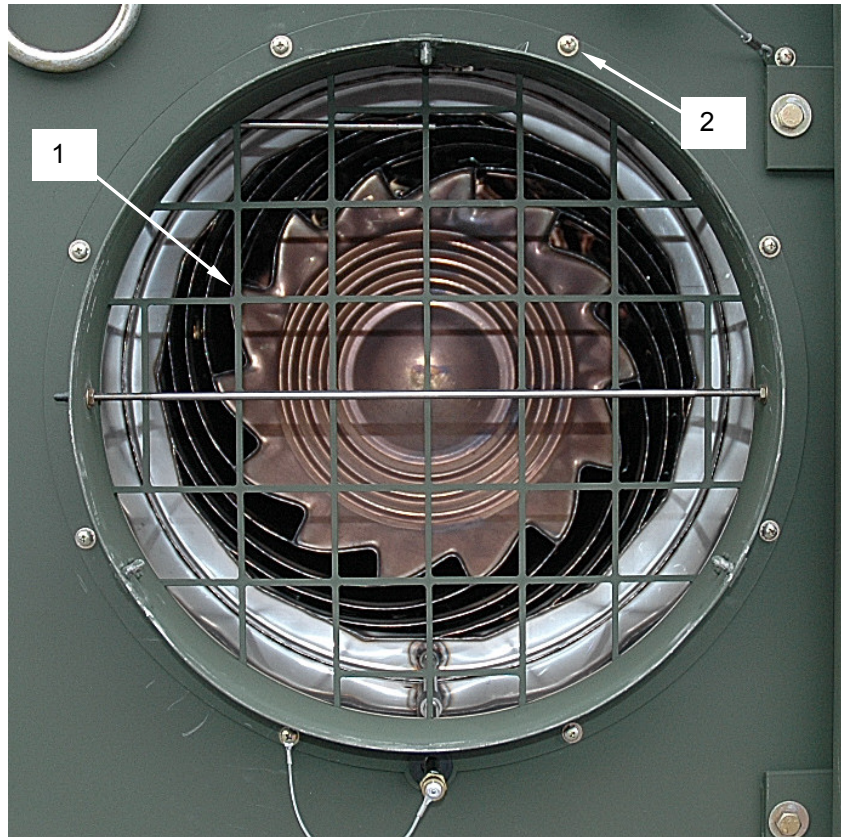


Figure 1. Remove the Safety Screen.

**END OF TASK**

**TEST**

1. Disconnect the two spade terminals (Figure 2, Item 2) from either side of the high temperature cutout sensor (Figure 2, Item 5).
2. Using a multimeter, test for continuity across the high temperature cutout sensor terminals (Figure 2, Item 1). If continuity is not verified (i.e. open circuit), replace the high temperature cutout sensor (Figure 2, Item 5) as detailed in the next section.

**END OF TASK****REPLACE**

1. Remove the two spade terminals (Figure 2, Item 2) from either side of the high temperature cutout sensor (Figure 2, Item 5).
2. Remove the two screws (Figure 2, Item 4), lockwashers, and flat washers that secure the high temperature cutout sensor to the sensor bracket (Figure 2, Item 6) mounted to the transition tube assembly (Figure 2, Item 3).
3. Remove the defective high temperature cutout sensor (Figure 2, Item 5).
4. Install a new high temperature cutout sensor (Figure 2, Item 5) on the sensor bracket (Figure 2, Item 6).
5. Install the two screws (Figure 2, Item 4), lockwashers, and flat washers and tighten securely.
6. Install the two spade terminals (Figure 2, Item 2) on both sides of the high temperature cutout sensor (Figure 2, Item 5).

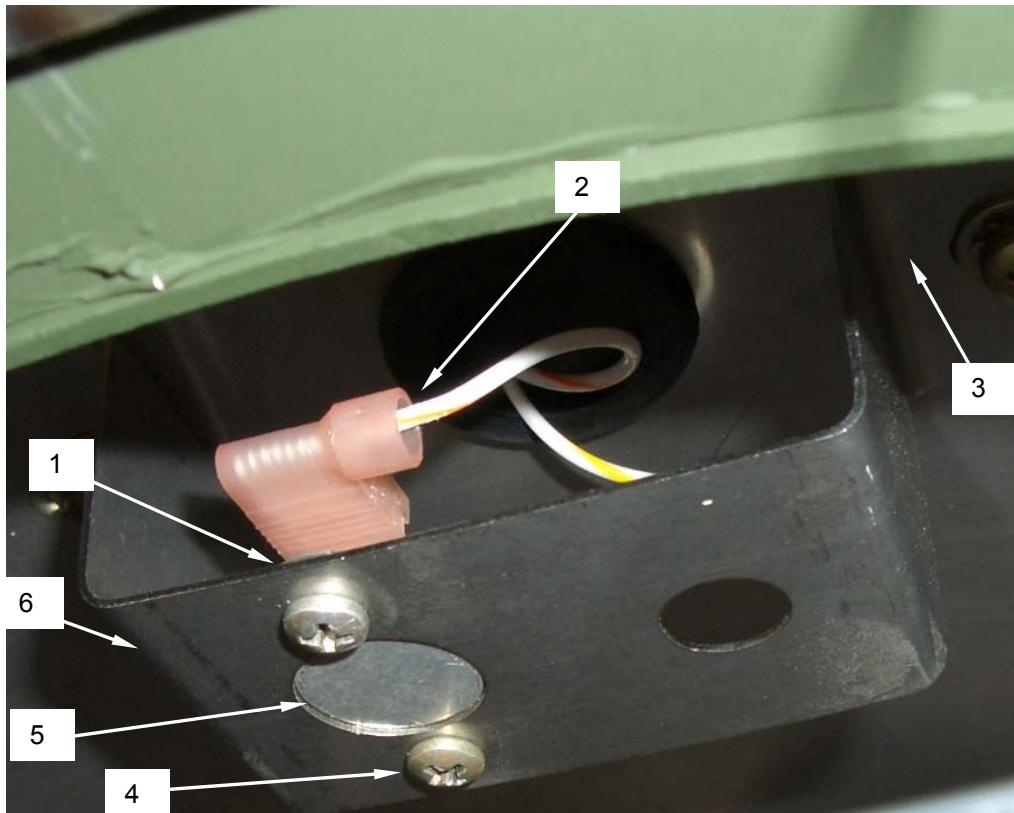


Figure 2. Test and Replace High Temperature Cutout Sensor.



**REPLACE - Continued**

7. Install the safety screen (Figure 3, Item 1) by installing the eight screws, lockwashers, and flat washers (Figure 3, Item 2).

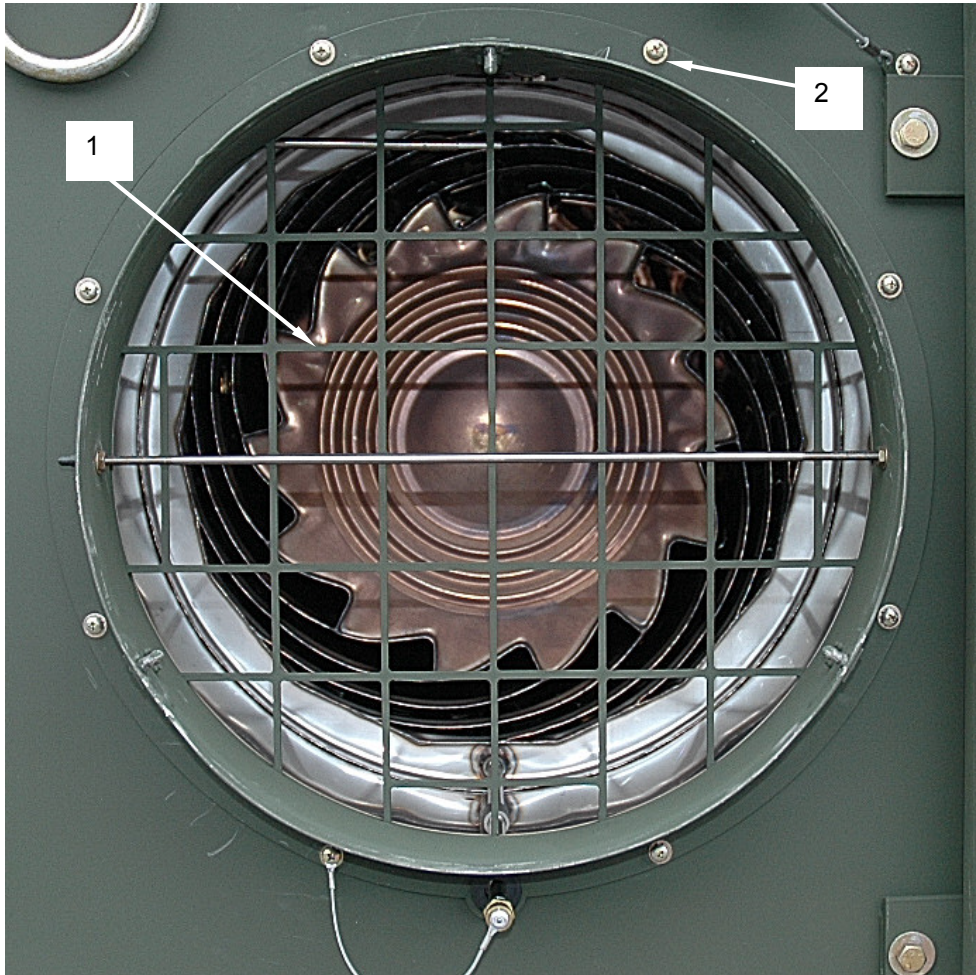


Figure 3. Install the Safety Screen.

**END OF TASK**

**END OF WORK PACKAGE**



**SERVICE MAINTENANCE****OUTLET TEMPERATURE SENSOR  
TEST, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (2) or  
Utilities Equipment Repairer 52C (2)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

**TEST**

1. Remove three bolts (Figure 1, Item 1) from the front edge of the heat exchanger top cover, along with four bolts (Figure 1, Item 2) down the outside edge, and the two bolts (Figure 1, Item 3) common to the fan inlet top, to gain access to the connector at the rear of the outlet temperature sensor.

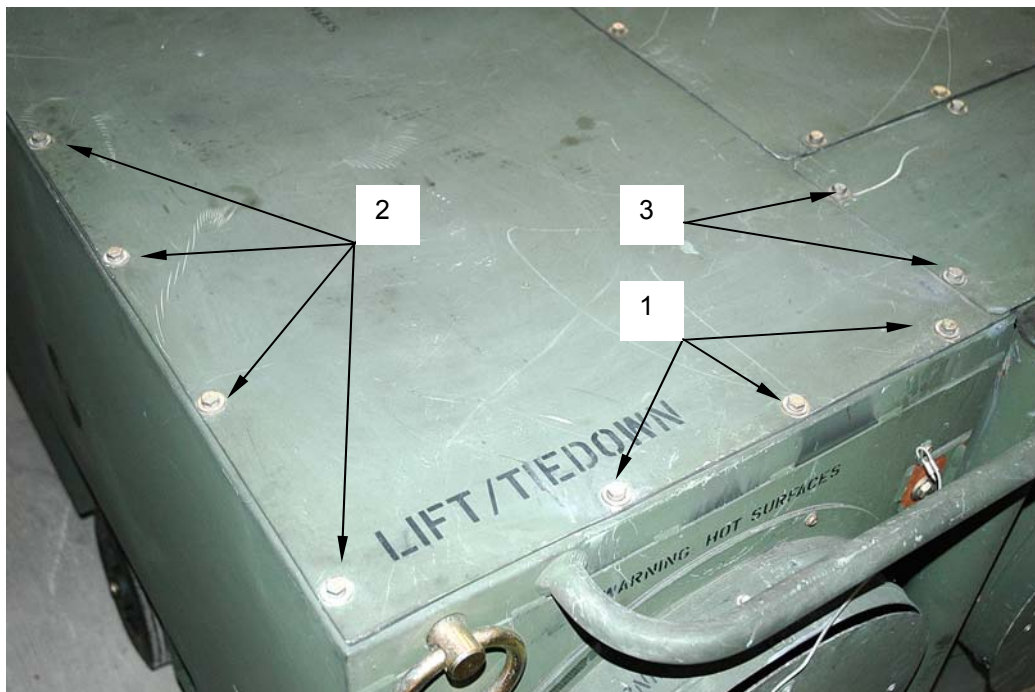


Figure 1. Remove Heat Exchanger Panels.

**TEST - Continued**

2. Disconnect the connector (Figure 2, Item 1) attaching the outlet temperature sensor to the main wire harness by unclipping the two halves.
3. Using a multimeter, test for continuity across the outlet temperature sensor terminals. If a resistance reading between 75 and 120 ohms is not verified (i.e. open circuit), or 0 ohms (i.e. shorted circuit), replace the outlet temperature sensor as detailed in the next section. If the continuity reading is between 75 and 120 ohms, reconnect the connector and reinstall cover, using the three bolts from the front edge of the heat exchanger top cover, four bolts down the outside edge, and the two bolts common to the fan inlet top.

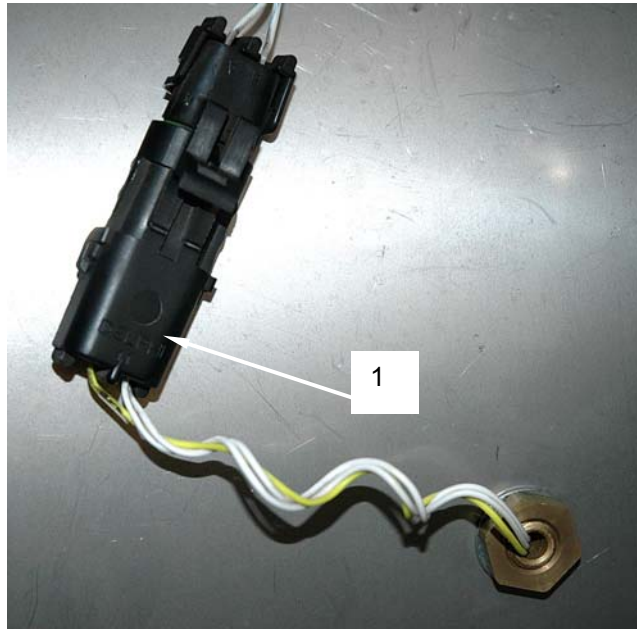


Figure 2. Test for Continuity Across the Outlet Temperature Sensor Terminals.

**END OF TASK****REPLACE**

1. Remove the safety screen (Figure 3, Item 1) by removing the eight screws, lockwashers, and flat washers (Figure 3, Item 2).
2. Cut the white and yellow wires between the connector and the outlet temperature sensor and discard connector end.
3. Remove the nut and lockwasher (Figure 3, Item 4) mounting the elbow of the outlet temperature sensor (Figure 3, Item 3) to the heat exchanger extension tube and remove sensor (Figure 3, Item 3).
4. Install new outlet temperature sensor horizontally, and parallel to the face of the heat exchanger. Use the nut and lockwasher previously removed to remount the sensor. Do not place pins into connector housing until the sensor is mounted.
5. Push wires into connector provided with temperature sensor and clip the rear of the connector shut after wires are seated.
6. Connect the two connector ends and bolt heat exchanger top back down.
7. Install the safety screen (Figure 3, Item 1) by installing the eight screws, lockwashers, and flat washers (Figure 3, Item 2).

REPLACE - Continued

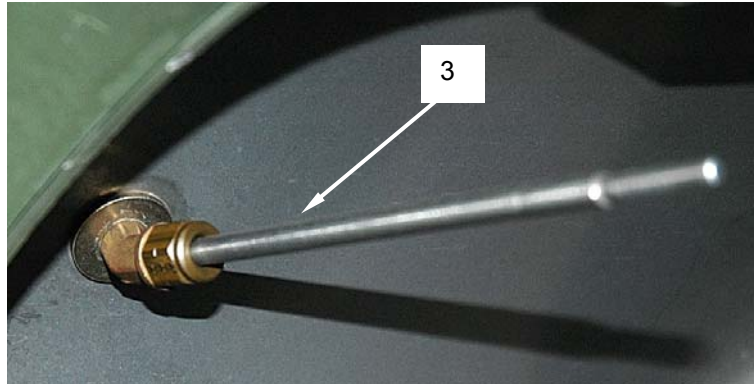
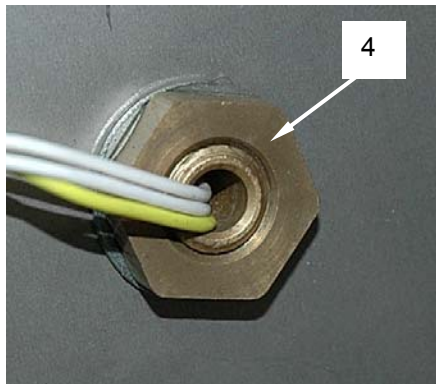
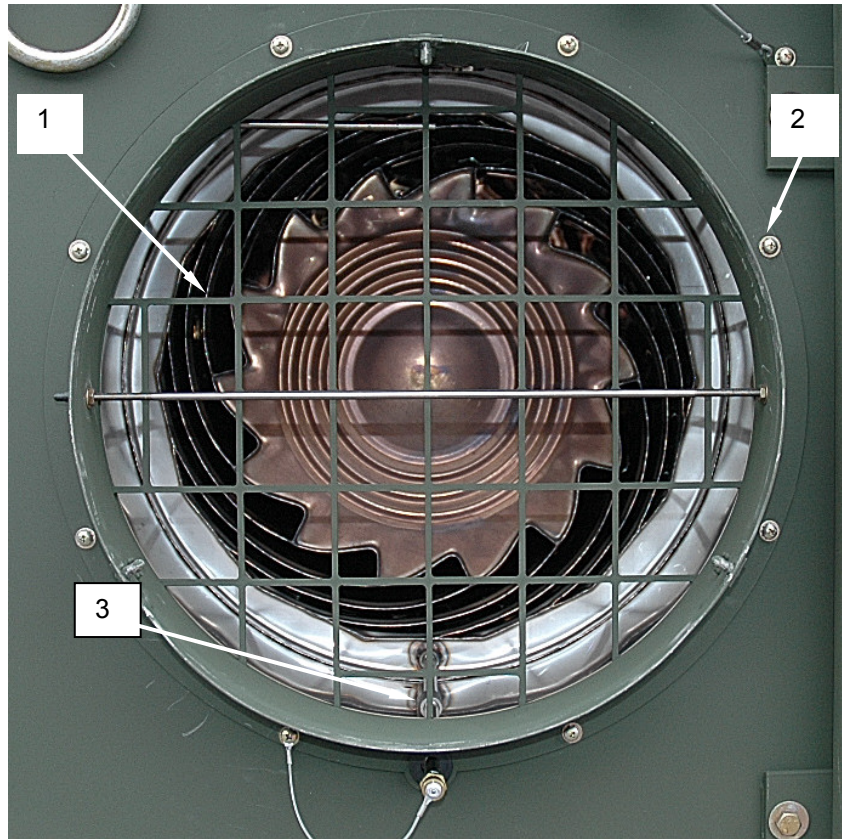


Figure 3. Replace Outlet Temperature Sensor.

END OF TASK

END OF WORK PACKAGE



**SERVICE MAINTENANCE****BURNER RELAY (K2)  
REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**

Tags, Marking (WP 0123, Item 22)

**Equipment Condition**Heater shut down and cool (WP 0005).  
Burner access door open.  
Main battery switch OFF and handle removed.**REPLACE****NOTE**

Burner relay, K2, is located inside the burner access compartment on the bulkhead, behind the combustion blower motor.

1. Loosen and remove screw (Figure 1, Item 1), and remove defective burner relay (Figure 1, Item 2).

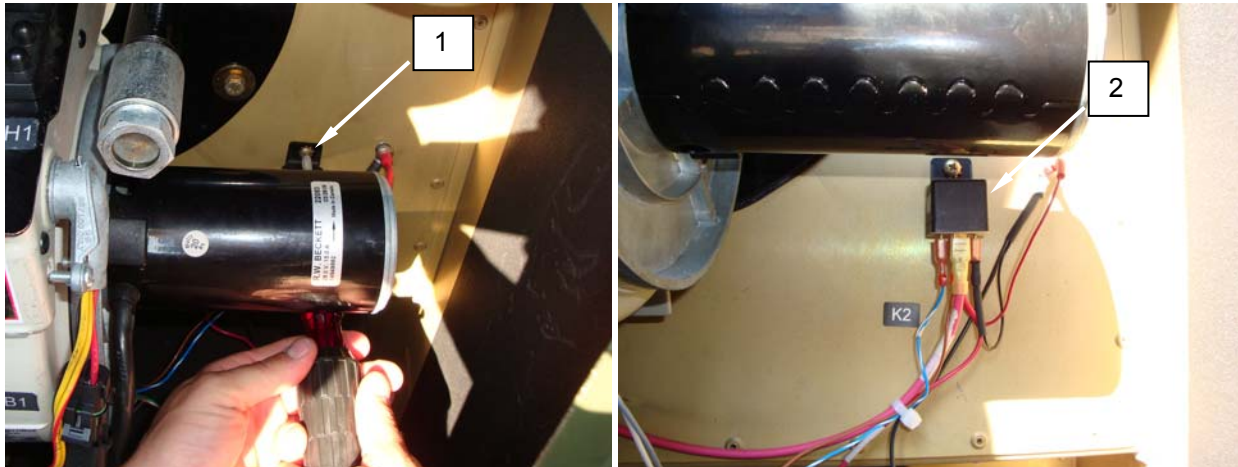


Figure 1. Remove Defective Burner Relay K2.

**REPLACE - Continued****NOTE**

The underside of the relay is marked with terminal locations. It is recommended that these terminal locations be used when tagging wires before removal.

2. Tag and remove wires (Figure 2).

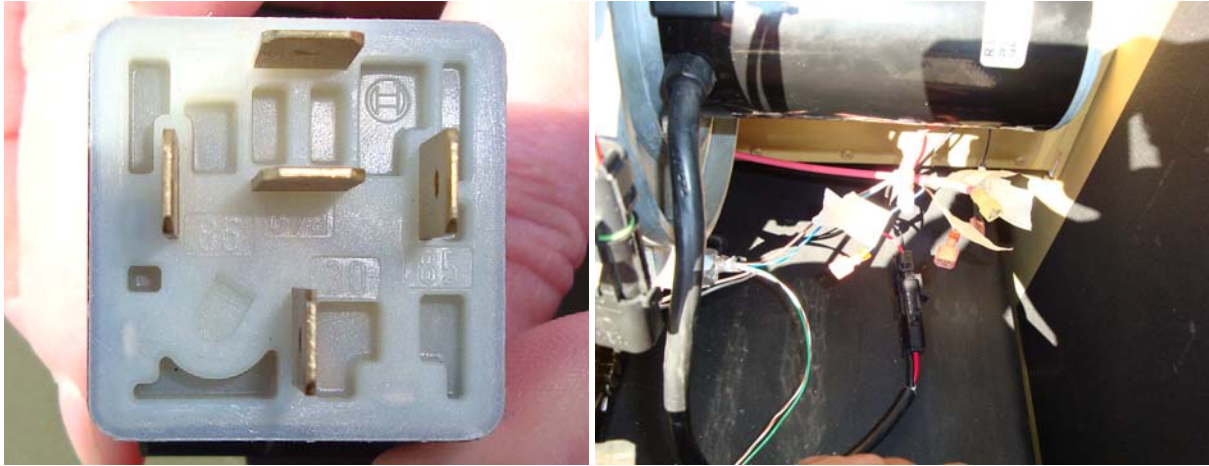


Figure 2. Tag and Remove Wires from Burner Relay.

3. Connect wires to new burner relay as tagged (Figure 3). Remove all tags.

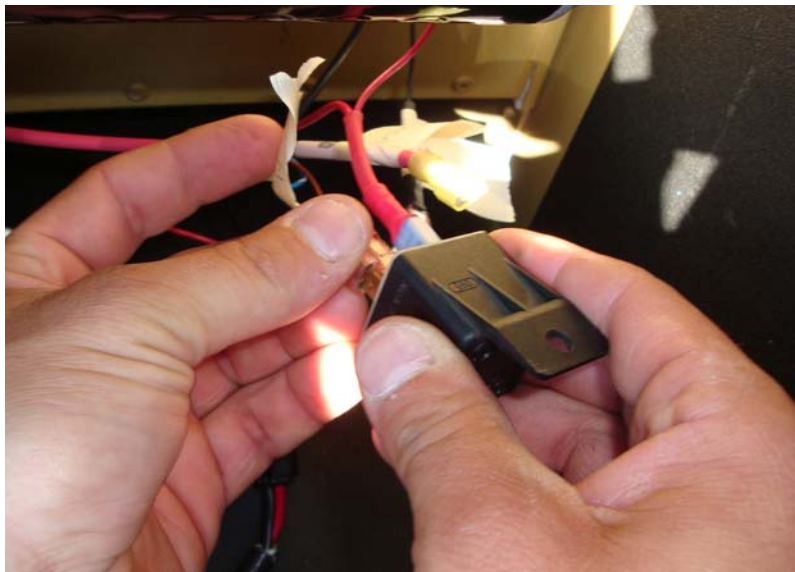


Figure 3. Connect Wires to New Burner Relay.



**REPLACE - Continued**

4. Install new burner relay (Figure 4, Item 2) on bulkhead and secure with screw (Figure 4, Item 1).

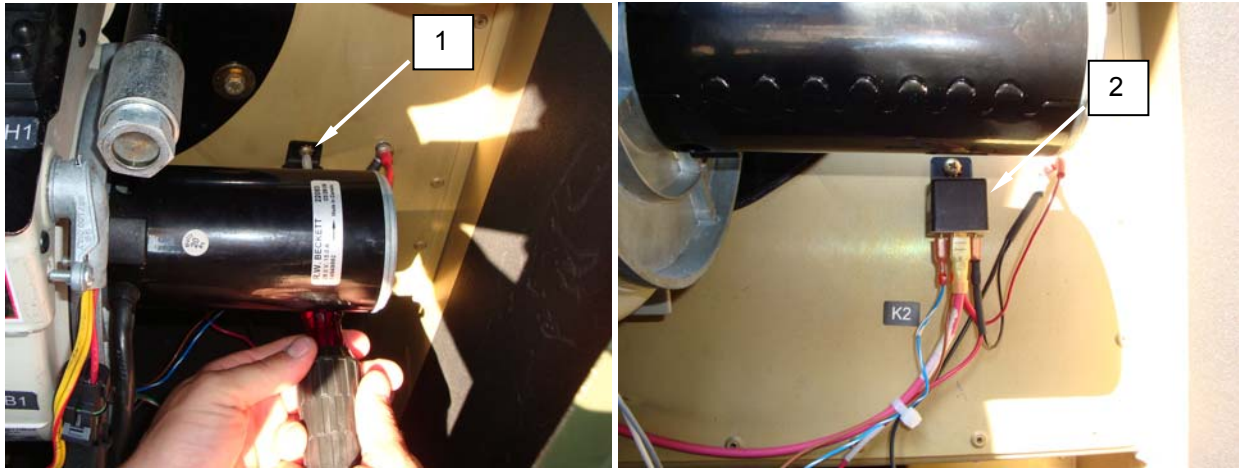


Figure 4. Install New Burner Relay on Bulkhead and Secure with Screw.

**END OF TASK**

**END OF WORK PACKAGE**



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**SERVICE MAINTENANCE**  
**WIRE HARNESS ASSEMBLIES**  
**INSPECT, REPAIR**

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**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Tape, Insulation, Electrical (WP 0123, Item 25)  
Strap, Tiedown, Electrical Components (WP 0123,  
Item 21)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

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**NOTE**

There are a number of wiring harness assemblies and cables used throughout the LCFH Type II. The inspection and repair processes for all are identical. Photos shown are representative of all wire harnesses, connectors, and tiedown straps throughout the heater.

**INSPECT**

1. Inspect the connectors (Figure 1, Item 4) on the wire harness to ensure that all connectors are securely mated and locked together.
2. Inspect the wire (Figure 1, Item 1) for any cuts or abrasions to the insulation that would expose bare wire. Repair any breaks or abrasions as detailed below.
3. Inspect the tiedown straps (Figure 1, Item 3), and ensure that none are broken or cut. Replace any tiedown straps that are damaged.

**END OF TASK****REPAIR**

1. Repair any cuts or abrasions on the wires (Figure 1, Item 1) with electrical tape, wrapping each repaired area with at least two layers of tape.
2. Repair tiedown straps (Figure 1, Item 3) by removing any broken pieces and installing a new tiedown strap.
3. Repair any broken or damaged terminal lugs (Figure 1, Item 2) by replacing with new lug.

REPAIR - Continued

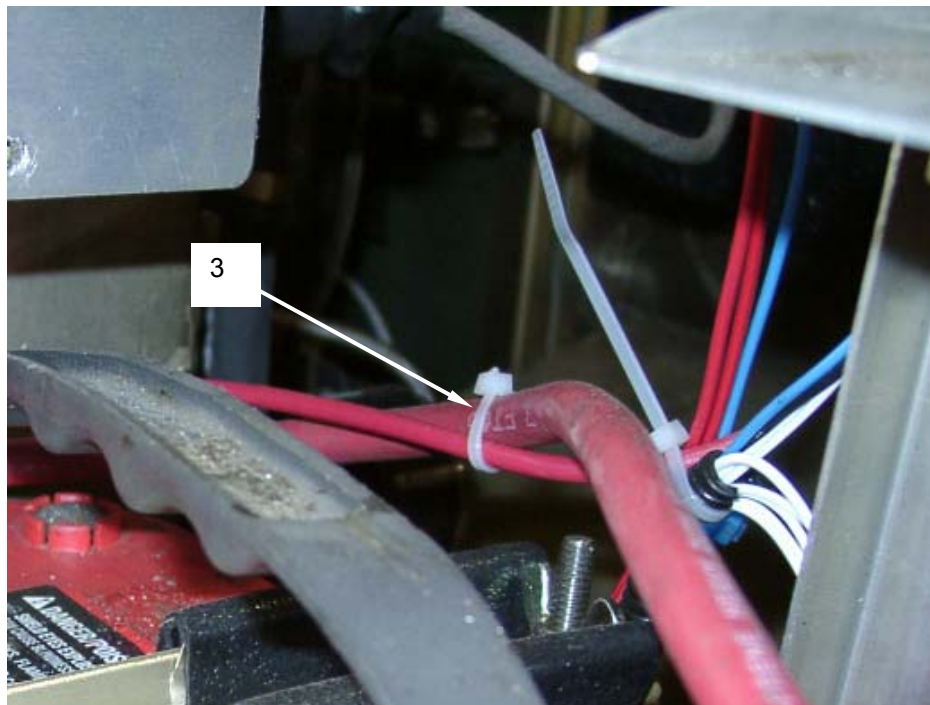
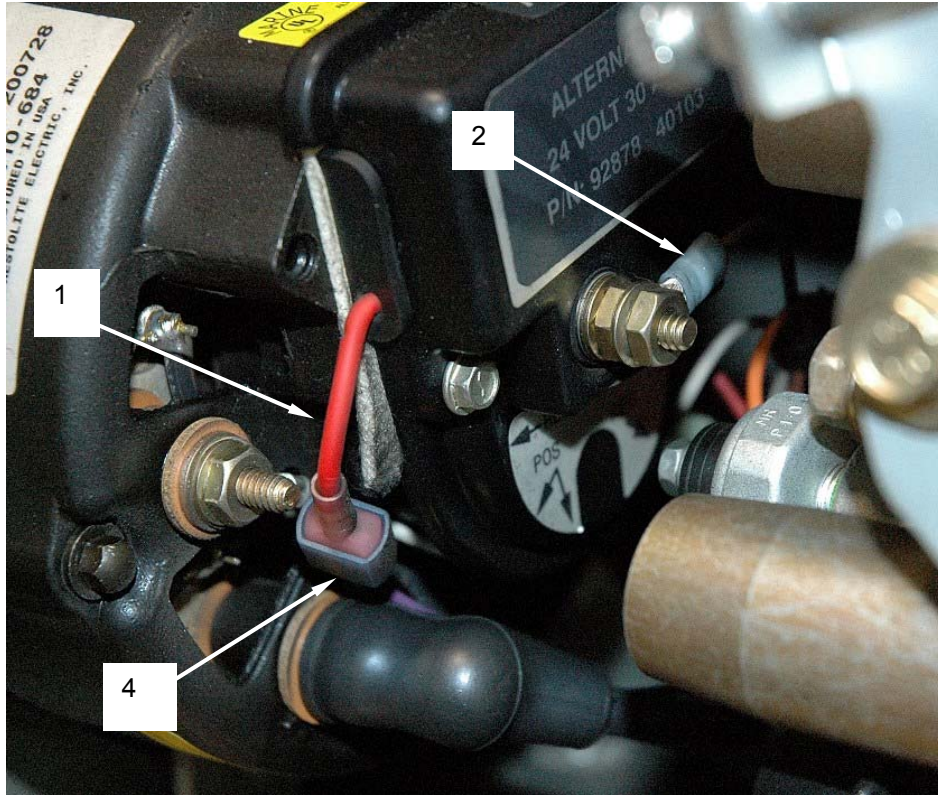


Figure 1. Inspect and Repair Wire Harness Assemblies.

END OF TASK

END OF WORK PACKAGE

**SERVICE MAINTENANCE****BATTERY CABLE ASSEMBLIES  
INSPECT, SERVICE, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Brush, Wire, Scratch (WP 0123, Item 4)  
Rags, Wiping, Clean (WP 0123, Item 15)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

**WARNING**

Leather gloves and eye protection must be worn when performing maintenance involving batteries. Failure to do so could result in serious injury to eyes or hands.

**WARNING**

Disconnect the negative battery terminal on the battery closest the engine access door before performing maintenance involving the batteries. Failure to do so may result in shock or other serious injury.

**INSPECT**

Inspect the terminal connector (Figure 1, Item 4) to ensure that there is no corrosion that would prevent a good electrical connection. Clean any corroded terminal connections as detailed in the section of this work package entitled "SERVICE."

**END OF TASK**

**SERVICE****NOTE**

Slide flexible protective covering off terminal before beginning service on battery terminal.  
Replace the covering when maintenance is complete.

1. To clean a corroded battery terminal connector (Figure 1, Item 4), loosen the nut (Figure 1, Item 3) that secures the terminal connector to the battery terminal post (Figure 1, Item 1).
2. Remove the battery terminal connector (Figure 1, Item 4) from the battery terminal post (Figure 1, Item 1). To make removal easier, it may be necessary to force the terminal open a bit using the blade of a flat blade screwdriver in the gap (Figure 1, Item 2) between the arms of the terminal. Pry the terminal connector (Figure 1, Item 4) off the battery terminal post (Figure 1, Item 1). If the terminal connector is damaged in the removal process, it should be replaced in accordance with the section of this work package entitled "REPLACE."
3. Once the battery terminal connector has been removed from the battery terminal post (Figure 1, Item 1), clean the battery terminal connector (Figure 1, Item 4) and battery terminal post with a wire brush.
4. Install the battery terminal connector (Figure 1, Item 4) on the battery terminal post (Figure 1, Item 1) and secure the nut (Figure 1, Item 3).

**END OF TASK**

**REPLACE**

1. To replace a damaged cable, remove the terminal connector (Figure 1, Item 4) from the battery terminal post (Figure 1, Item 1) as described in the "SERVICE" section above.
2. Follow the cable from the battery to the connection at the opposite end of the cable.
3. Remove the cable from the stud at the opposite end by removing the retaining nut. Set aside retaining nut.
4. Secure replacement cable to lug with the nut.
5. Install the terminal connector (Figure 1, Item 4) onto the battery terminal post (Figure 1, Item 1) and secure with the nut (Figure 1, Item 3).

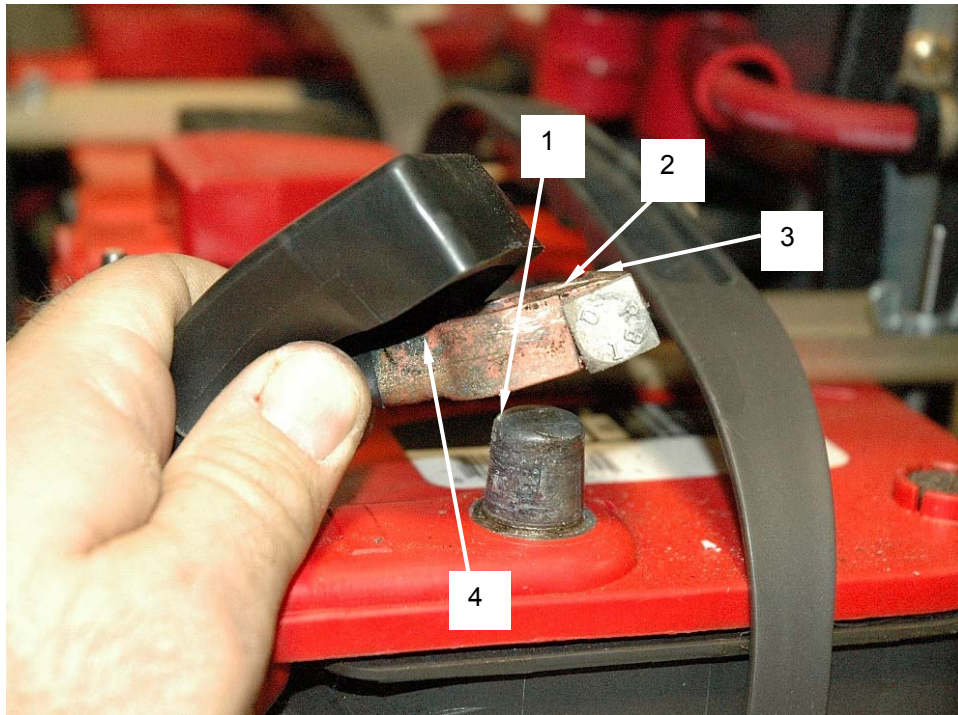


Figure 1. Inspect, Service, Replace Battery Terminal Connector.

**END OF TASK**

**END OF WORK PACKAGE**





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**SERVICE MAINTENANCE**
**BATTERY  
INSPECT, TEST, REPLACE**


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**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Test Set, Battery (WP 0124, Item 12)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)  
Tags, Marking (WP 0123, Item 22)

**References**

WP 0071

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

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**WARNING**

Leather gloves and eye protection must be worn when performing maintenance involving batteries. Failure to do so could result in serious injury to eyes or hands.

**WARNING**

Disconnect the negative battery terminal on the battery closest the engine access door before performing maintenance involving the batteries. Failure to do so may result in shock or other serious injury.

**INSPECT**

1. Inspect the batteries for any cracks or breaks that would allow battery fluid to leak from the batteries. Replace any damaged batteries.
2. Inspect the terminal connections (Figure 1, Item 1) to ensure that there is no corrosion that would prevent a good electrical connection. Clean any corroded terminal connections as detailed in WP 0071.
3. Inspect the battery cables (Figure 1, Item 7) going into the terminal connections to ensure that all conductors in the cable are unbroken and not corroded. Clean or replace cable as detailed in WP 0071, or replace battery cable IAW WP 0071.

**END OF TASK**

**TEST**

Before replacing a battery, test using battery test set IAW the instructions included with the set.

**END OF TASK****REPLACE**

1. To replace a defective or damaged battery, tag and mark the battery cables (Figure 1, Item 7) of the battery being replaced. Mark the positive and negative cables as shown.
2. Loosen the nut (Figure 1, Item 3) on each terminal of the battery being replaced and remove the terminal. To make removal easier, it may be necessary to force the terminal open a bit using the blade of a flat blade screwdriver in the gap (Figure 1, Item 2) between the arms of the terminal. Pry the terminal connector (Figure 1, Item 1) off the battery terminal (Figure 1, Item 4). If the terminal connector is damaged in the removal process, it should be replaced in accordance with WP 0071.
3. Remove the wingnuts (Figure 1, Item 8) and lockwashers (Figure 1, Item 9) that secure the battery T-bar (Figure 1, Item 10) and set aside.
4. Remove the battery holddown bracket (Figure 1, Item 12) that extends over the top of the battery and set aside.
5. Take note of the position of the battery being replaced. The new battery must be installed in the same position. The negative side ( - ) (Figure 1, Item 11) of both batteries must face the engine access door side of the heater. The positive side ( + ) (Figure 1, Item 5) of both batteries must face the heat exchanger side of the heater.
6. Remove the battery from the battery tray and discard in accordance with unit SOP and local environmental regulations.
7. Install a new battery in the same position as the one removed earlier. Refer to the previous step to ensure the negative and positive sides of the battery are positioned properly.
8. Install the battery hold-down bracket (Figure 1, Item 12) set aside earlier that extends over the top of the battery.
9. Install the wingnuts (Figure 1, Item 8) and lockwashers (Figure 1, Item 9) that secure the battery T-bar (Figure 1, Item 10).
10. Install the terminal connector on the appropriate battery terminal as tagged and marked earlier. Tighten the bolt (Figure 1, Item 3) on each terminal of the battery securely.
11. Install the battery master switch handle (Figure 1, Item 6). Place battery master switch in the ON position.

REPLACE - Continued

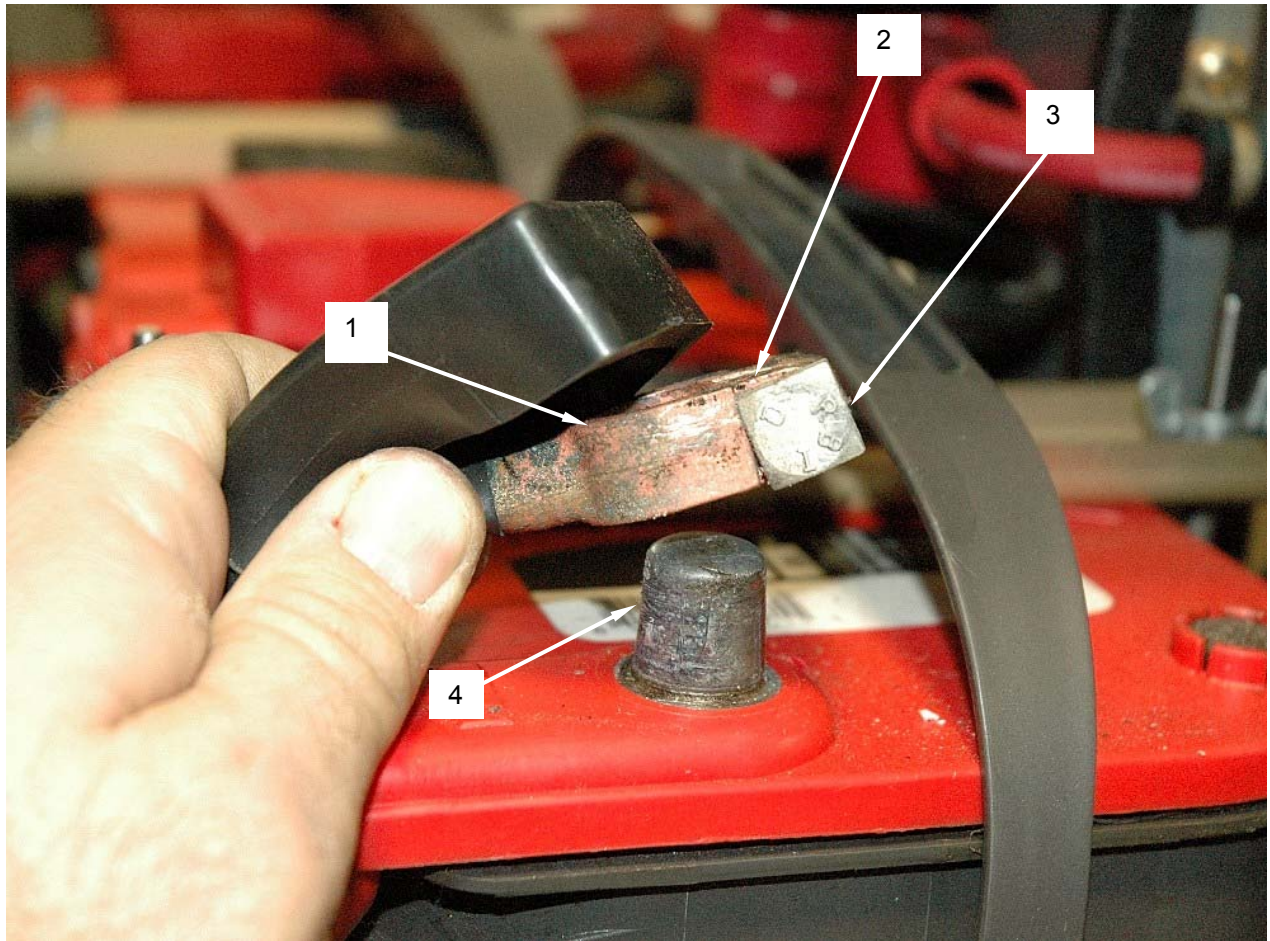


Figure 1. Inspect and Replace Battery (Sheet 1 of 2).

REPLACE - Continued

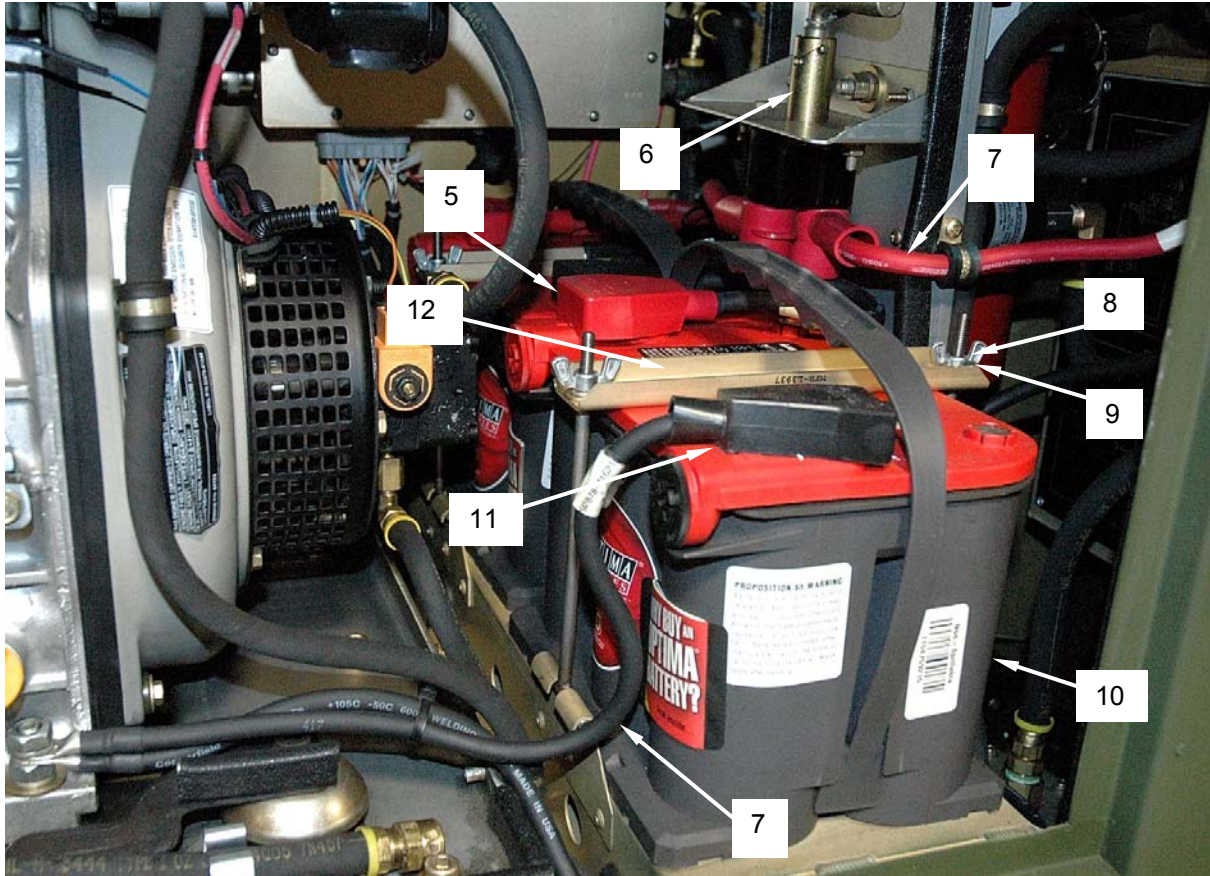


Figure 1. Inspect and Replace Battery (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE

---

**SERVICE MAINTENANCE****BATTERY T-BAR AND HOLD-DOWN PLATE ASSEMBLY  
INSPECT, REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Equipment Condition**Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

---

**INSPECT**

Inspect the battery T-bar assemblies (Figure 1, Item 8) and hold down plate (Figure 1, Item 2) to ensure that they are not bent, corroded, or otherwise damaged in such a way that it would prevent the assemblies from securing the batteries to the battery mounting tray. Replace if T-bar or plate hold down assemblies are damaged.

**END OF TASK****REPLACE**

1. To replace the battery T-bar assemblies (Figure 1, Item 8) and hold-down plate (Figure 1, Item 2), hold down assembly, loosen and remove the wing nut (Figure 1, Item 7), lock washer (Figure 1, Item 6), and flat washer (Figure 1, Item 9) on both sides of the battery (Figure 1, Item 3).
2. Slide the battery hold-down plate (Figure 1, Item 2) off the threaded ends (Figure 1, Item 1) of the T-bar assemblies.
3. Remove both T-bar assemblies (Figure 1, Item 8) by disengaging from the lower lip (Figure 1, Item 4) of the battery mounting tray (Figure 1, Item 5).
4. Install two new T-bar assemblies (Figure 1, Item 8) by engaging in the lower lip (Figure 1, Item 4) of the battery mounting tray (Figure 1, Item 5).
5. Install the battery hold-down plate (Figure 1, Item 2) over the threaded ends of the two T-bar assemblies (Figure 1, Item 1).
6. Install the flat washer (Figure 1, Item 9), lock washer (Figure 1, Item 6), and wing nut (Figure 1, Item 7) on both T-bar assemblies (Figure 1, Item 8) and tighten securely.

REPLACE - Continued

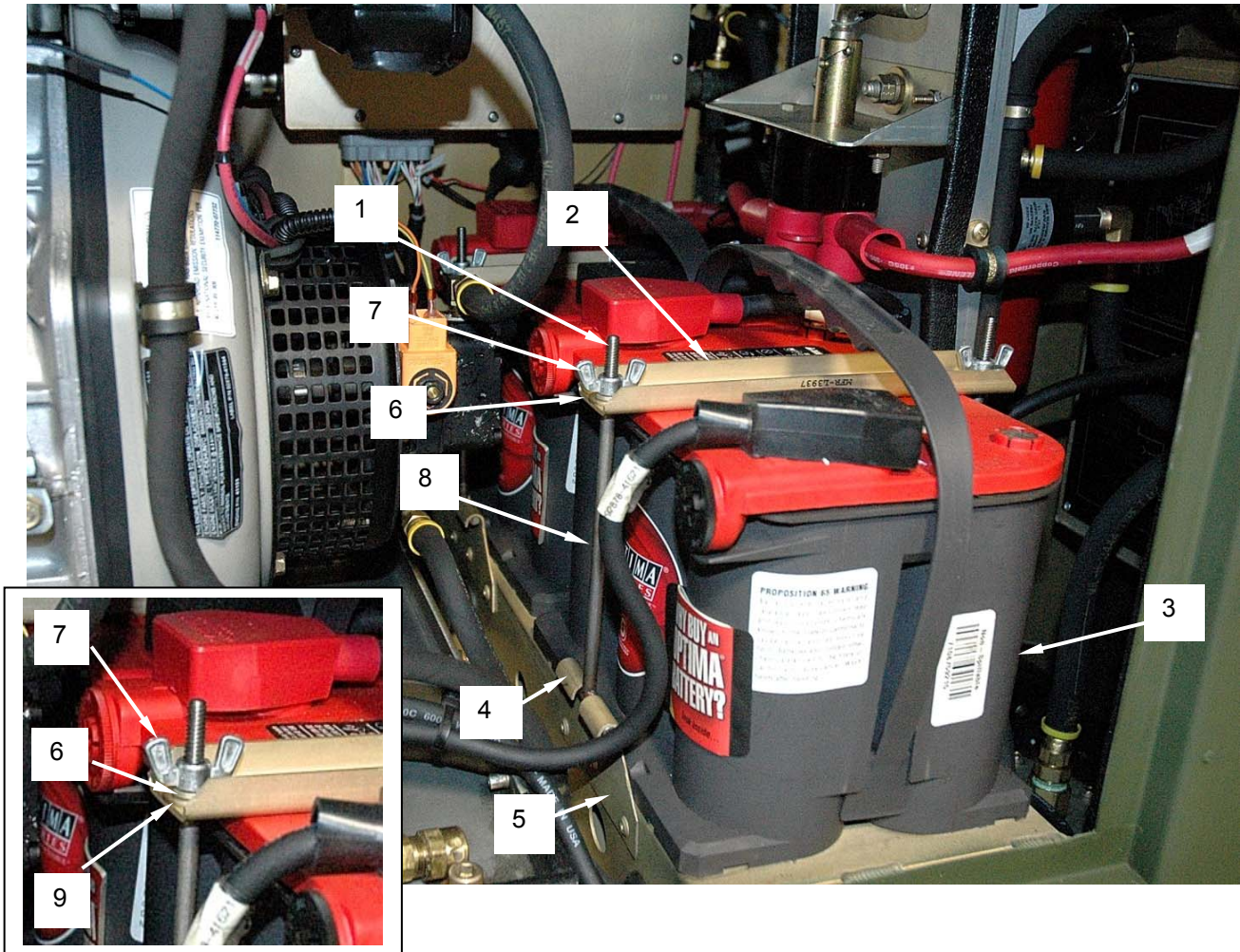


Figure 1. Inspect and Replace Battery T-Bar and Hold-Down Plate Assembly.

END OF TASK

END OF WORK PACKAGE

---

**SERVICE MAINTENANCE****MAIN CONTROL BOX ASSEMBLY  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**

Tags, Marking (WP 0123, Item 22)

**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

---

**REPLACE**

1. Tag and disconnect wire connections (Figure 1, Item 1).
2. Remove screws (Figure 1, Item 3) securing unserviceable main control box (Figure 1, Item 2) to cabinet assembly.
3. Secure serviceable main control box (Figure 1, Item 2) to cabinet assembly with screws (Figure 1, Item 3).
4. Connect wires (Figure 1, Item 1) as tagged.

REPLACE - Continued

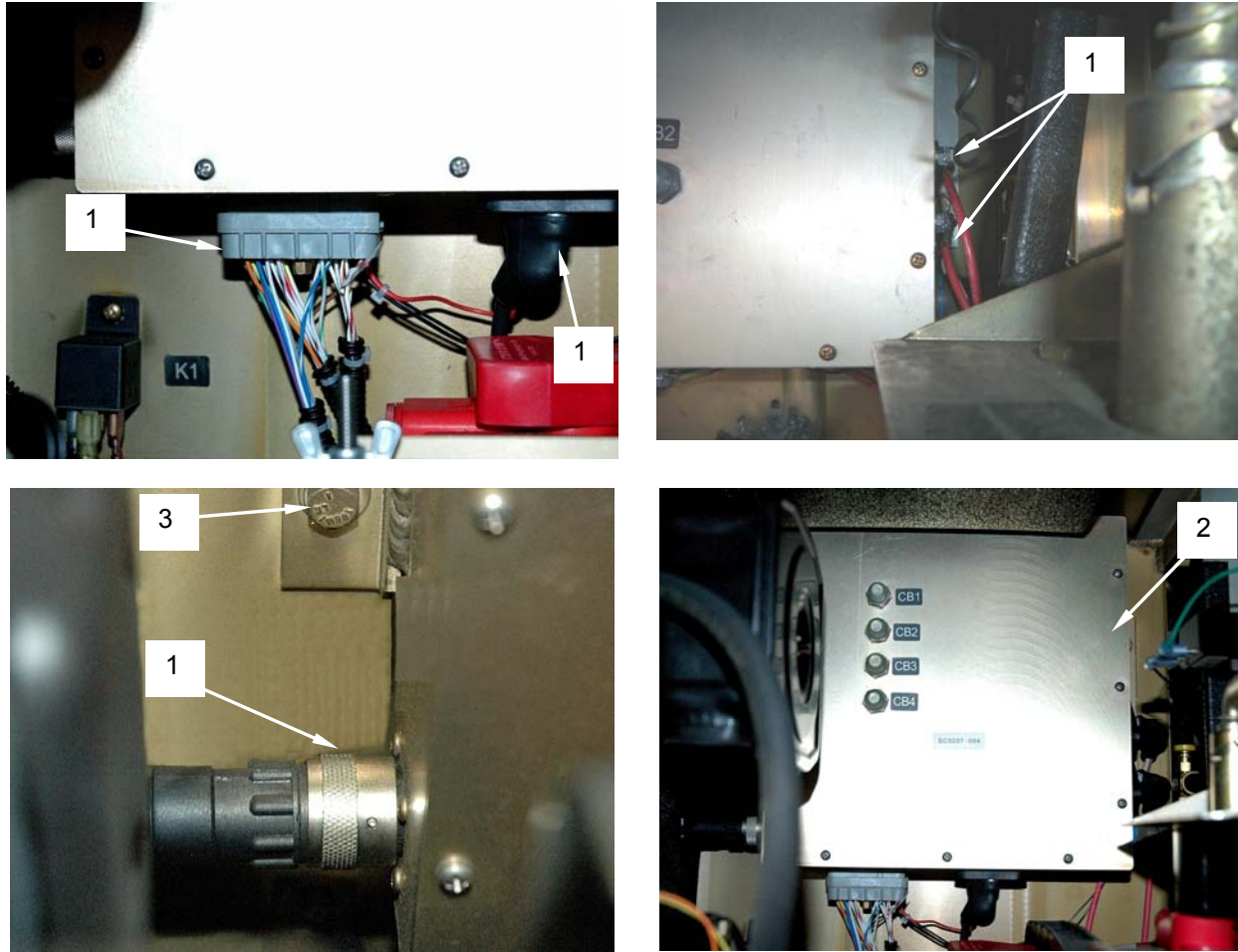


Figure 1. Replace Main Control Box Assembly.

END OF TASK

END OF WORK PACKAGE



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**SERVICE MAINTENANCE****NATO CONNECTOR  
REMOVE, INSPECT, INSTALL**

---

**INITIAL SETUP:****Tools and Special Tools**

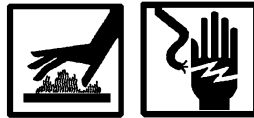
Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**

Tags, Marking (WP 0123, Item 22)

**Equipment Condition**Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

---

**REMOVE****WARNING**

Be sure to shut down the heater and allow to cool before servicing. Failure to allow the heater to cool completely may result in severe burns or other injury.

Be sure to place the main battery power switch to the OFF position before removing the NATO connector. Failure to do so may result electrical shock and/or damage to the equipment.

1. Unlock engine access door (Figure 1, Item 1) and open door to gain access to NATO connector (Figure 1, Item 4).
2. Remove outer protective cap (Figure 1, Item 10) to gain access to NATO connector mounting screws (Figure 1, Item 2).
3. Slide flexible protective covering (Figure 1, Item 3) off wire connections on rear of NATO connector to gain access to wire connection bolts.
4. Tag and disconnect electrical wiring (Figure 1, Item 7) from the rear of NATO connector (Figure 1, Item 4) by removing hex head bolt (Figure 1, Item 6) and washer (Figure 1, Item 5).
5. Remove NATO connector (Figure 1, Item 4) and attached outer protective cap (Figure 1, Item 10) from heater cabinet by removing screws (Figure 1, Item 2), washers (Figure 1, Item 9), and nuts (Figure 1, Item 8).

**END OF TASK**

**INSPECT**

1. Inspect connector for corrosion, evidence of electrical short, and obvious damage. Check terminal connectors for damage.
2. Inspect electrical wiring for cuts, crimps, bare wire, or other damage. Ensure terminal lugs are securely attached.
3. Remove and replace any component that is damaged to the extent that it will effect the safe operation of the heater.

**END OF TASK****INSTALL**

1. Mate NATO connector (Figure 1, Item 4) and attached outer protective cap (Figure 1, Item 10) to heater cabinet. Secure using screws (Figure 1, Item 2), washers (Figure 1, Item 9), and nuts (Figure 1, Item 8).
2. Connect electrical wiring as tagged earlier to rear of NATO connector (Figure 1, Item 4) using hex-head bolt (Figure 1, Item 6) and washer (Figure 1, Item 5).
3. Slide flexible protective covering (Figure 1, Item 3) up and onto wire connections on rear of NATO connector to cover wire connection bolts.
4. Install main battery power switch handle (Figure 1, Item 11) and rotate to the ON position.
5. Close engine access door (Figure 1, Item 1) and lock in place using latch.



Figure 1. Remove, Inspect, and Install NATO Connector (Sheet 1 of 3).

INSTALL - Continued

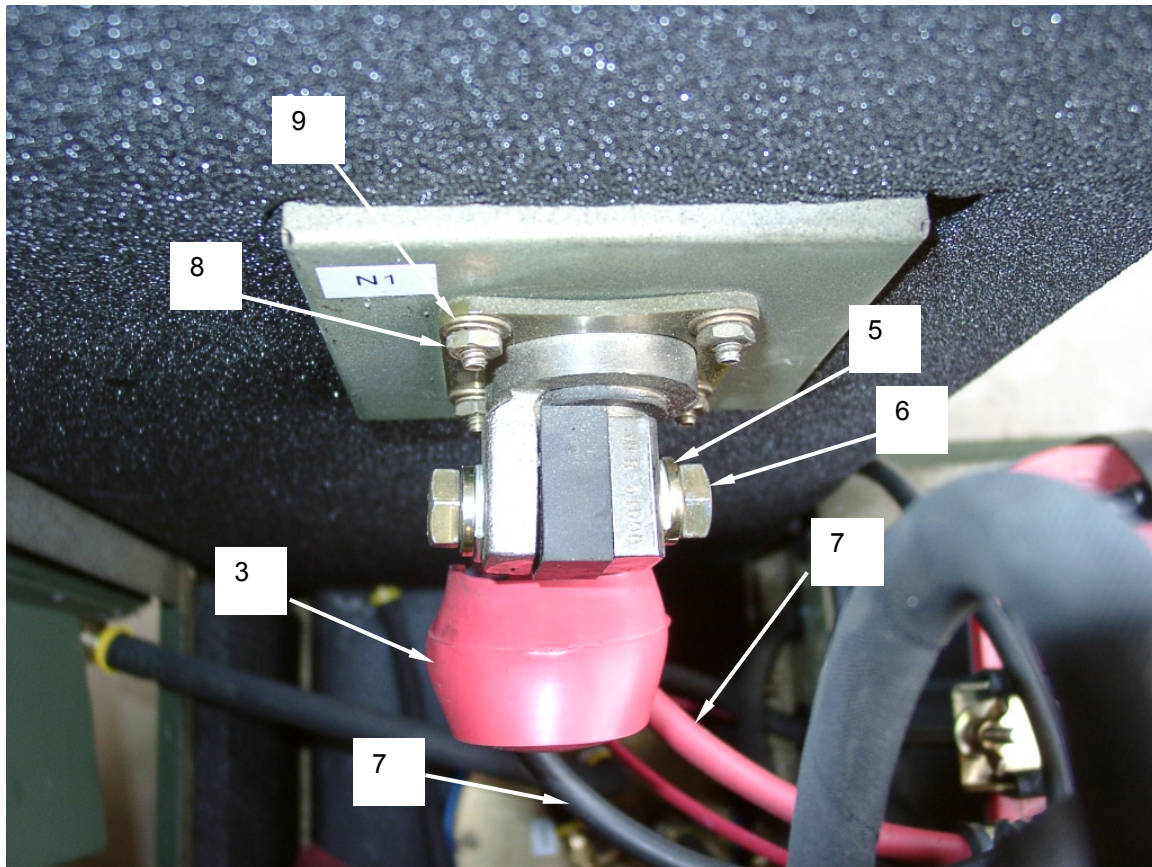
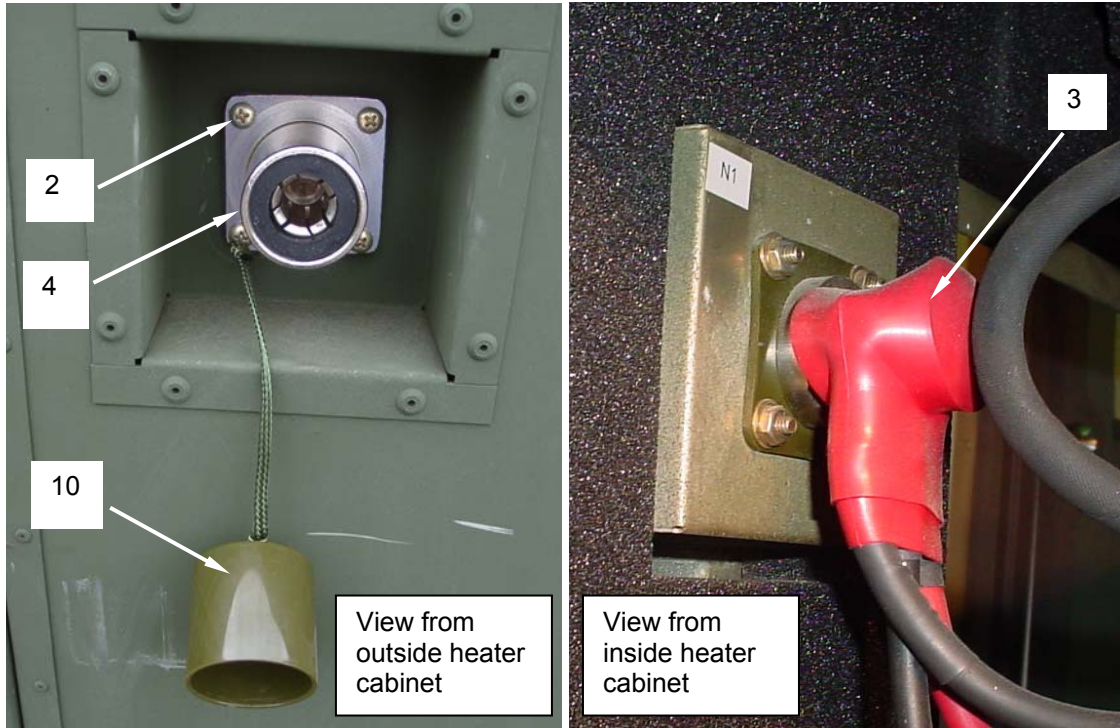


Figure 1. Remove, Inspect, and Install NATO Connector (Sheet 2 of 3).

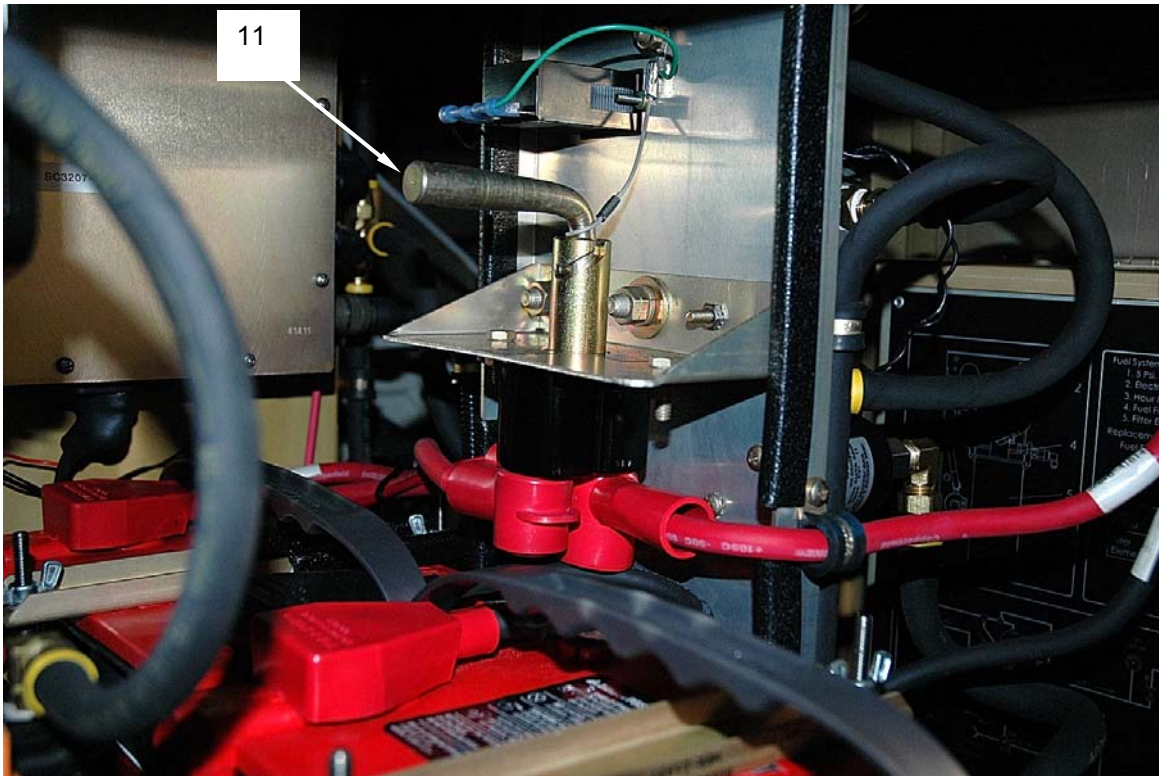
**INSTALL - Continued**

Figure 1. Remove, Inspect, and Install NATO Connector (Sheet 3 of 3).

**END OF TASK**

**END OF WORK PACKAGE**

**SERVICE MAINTENANCE****OPERATOR CONTROL BOX CABLE ASSEMBLY  
INSPECT, TEST, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Equipment Condition**Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Burner access door open.  
Fuel access door open.**INSPECT**

Inspect the operator control box cable connector (Figure 1, Item 2) for cracks, dents to the outer collar, dirt in the contacts, or any other damage that would prevent the connector (Figure 1, Item 2) from making a good electrical connection with the operator control box connector (Figure 1, Item 1).

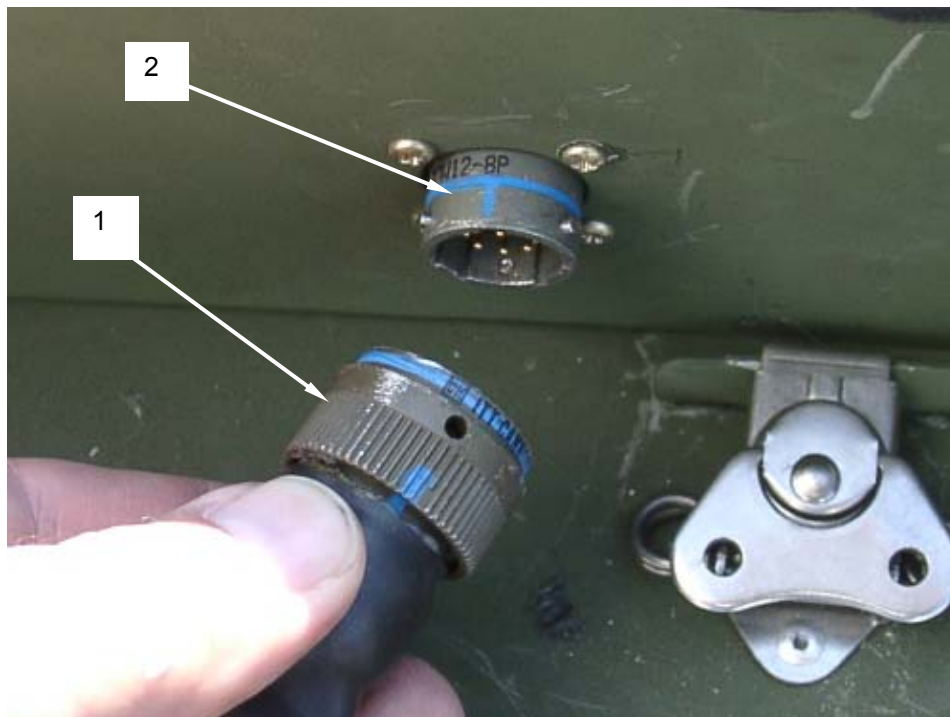


Figure 1. Inspect Operator Control Box Cable Assembly.

**END OF TASK**

**TEST**

1. Using a multimeter, perform a continuity check from pin A (Figure 2, Item 1) at one end of cable to pin A at opposite end of cable. Repeat for all pins. Ensure that there is continuity through the cable.
2. Using a multimeter, perform a short circuit test, across all terminals of the connector. For example, test from pin A (Figure 2, Item 1) to pin B (Figure 2, Item 2), A to C, A to D, etc., followed by B to A, B to C, B to D, etc. There should not be shorts across any of the pins. If shorts exist, replace the operator control box cable assembly.
3. If there is a lack of continuity through the cable or shorts within either of the connectors, replace the operator control box cable assembly.



Figure 2. Test Operator Control Box Cable Assembly.

**END OF TASK****REPLACE**

1. Disconnect the operator control box cable assembly connector (Figure 3, Item 2) from the operator control box connector (Figure 3, Item 1).
2. Remove the nuts or bolts (Figure 3, Item 5) and lockwashers (Figure 3, Item 4) that secure the two clamps (Figure 3, Item 6) that secure the operator box cable assembly (Figure 3, Item 3) inside the heater.
3. Remove operator control box cable assembly (Figure 3, Item 3) from the clamps (Figure 3, Item 6) and set the clamps, screws, and lockwashers aside.

**REPLACE - Continued**

4. Disconnect the operator control box cable assembly (Figure 3, Item 3) from the connector (Figure 3, Item 8) located at the lower right corner of the main control box (Figure 3, Item 7).
5. Install a new operator control box cable assembly (Figure 3, Item 3) by connecting one of the cable connectors (Figure 3, Item 11) to the main control box connector (Figure 3, Item 8). Tighten securely.
6. Slip clamps (Figure 3, Item 6) over the cable and secure to the two locations in the heater with screws (Figure 3, Item 5) and lockwashers (Figure 3, Item 4). Tighten securely.
7. Slide the remaining cable connector (Figure 3, Item 1) through the hole (Figure 3, Item 9) near the operator control box (Figure 3, Item 10).
8. Secure the operator control box cable assembly connector (Figure 3, Item 2) to the operator control box connector (Figure 3, Item 1).

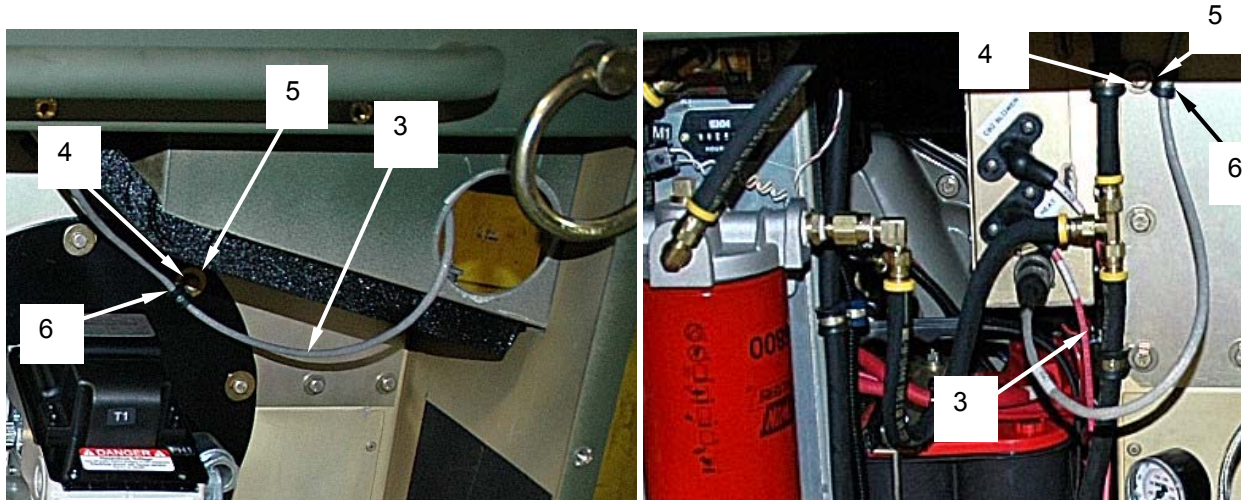
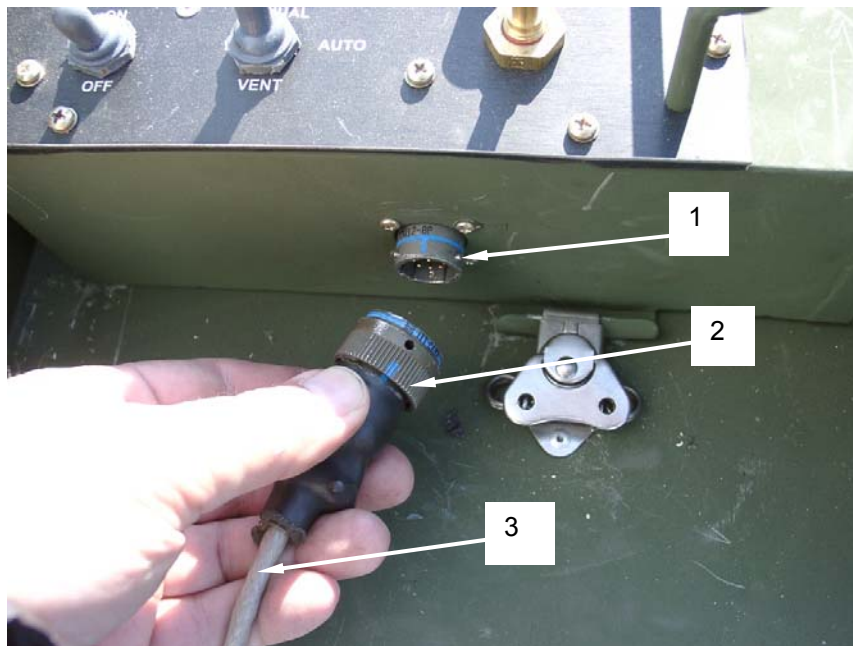


Figure 3. Replace Operator Control Box Cable Assembly (Sheet 1 of 2).

REPLACE - Continued

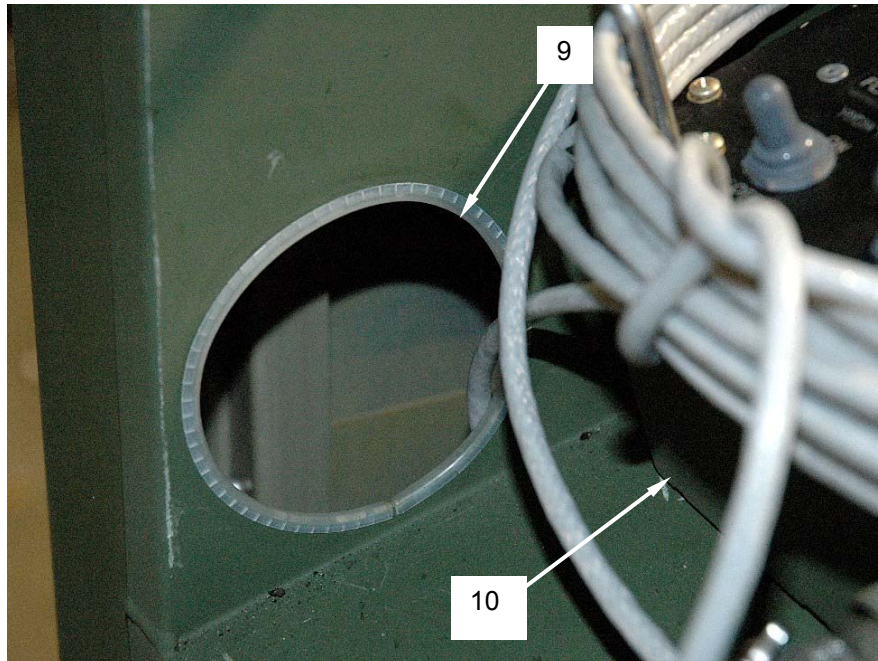
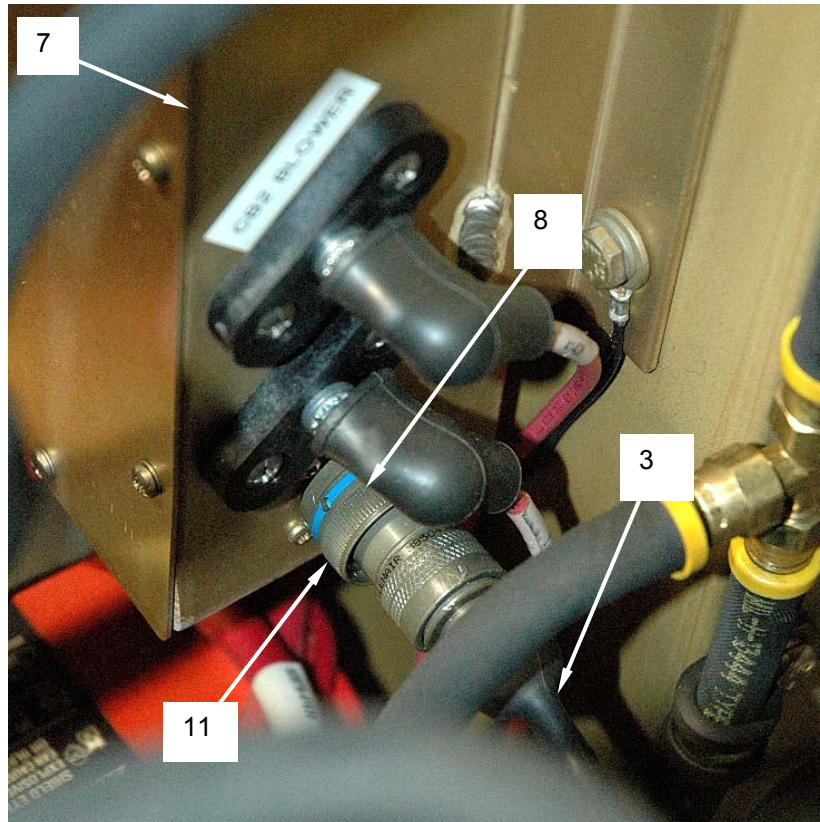


Figure 3. Replace Operator Control Box Cable Assembly (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE



**SERVICE MAINTENANCE****CARBON MONOXIDE DETECTOR - OPERATOR CONTROL BOX  
INSPECT, TEST, REPLACE****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Tags, Marking (WP 0123, Item 22)

**Equipment Condition**

Heater powered up and operational for TEST PORTION ONLY (WP 0005).  
Heater shut down and cool for REPLACE function (WP 0005).  
Main battery switch OFF and handle removed, except for TEST.

**INSPECT****NOTE**

The operator control box mounted carbon monoxide detector must be replaced every five years regardless of the results of inspection or test. Refer to the section of this work package entitled "REPLACE" for complete details on replacement.

Inspect the carbon monoxide detector and cover assembly (Figure 1, Item 2), and ensure that it has not been damaged in any way. Ensure that the louvers (Figure 1, Item 3) are not blocked or damaged in such a way as to prevent proper airflow into the detector. Ensure that the hinged outer cover (Figure 1, Item 11) operates properly. Ensure that the indicator lamp (Figure 1, Item 7) is not broken or missing. If the carbon monoxide detector is damaged, replace immediately.

**END OF TASK****TEST**

To test the carbon monoxide detector (Figure 1, Item 2), turn the heater on IAW WP 0005. The heater will go through a self test. If a fault is detected with the carbon monoxide detector in the operator control box, a fault code of either H331 or H332 will be displayed on the operator control panel display. Replace a defective carbon monoxide detector as detailed in the section of this work package entitled "REPLACE."

**END OF TASK****REPLACE**

1. Remove four screws (Figure 1, Item 1) and set aside. Lift the carbon monoxide detector and cover assembly (Figure 1, Item 2) from the operator control box (Figure 1, Item 5) taking care not to damage the wires.
2. Remove cover (Figure 1, Item 6) by removing four screws (Figure 1, Item 4).
3. Tag and mark the three wires (Figure 1, Item 9, 10, and 13) that connect to the CO detector terminal strip.

**REPLACE - Continued**

4. Loosen the three screws (Figure 1, Item 8) on the terminal strip and remove the three wires (Figure 1, Item 9, 10, and 13).
5. Remove the defective carbon monoxide detector and cover assembly (Figure 1, Item 2) from the operator control box (Figure 1, Item 5).
6. If damaged, remove the rubber gasket (Figure 1, Item 12) and discard.
7. If necessary, install a new rubber gasket (Figure 1, Item 12), aligning the holes in the gasket with the holes in the operator control box hinged cover (Figure 1, Item 11).
8. Install a new carbon monoxide detector and cover assembly (Figure 1, Item 2) by connecting the three wires (Figure 1, Item 9, 10, and 13) to the three screws (Figure 1, Item 8) on the terminal strip. Be sure to match the labels on the wires to the labels on the terminal strip. Tighten screws (Figure 1, Item 8) on terminal strip securely.
9. Mount cover (Figure 1, Item 6) by installing four screws (Figure 1, Item 4).
10. Install the carbon monoxide detector and cover assembly (Figure 1, Item 2) in position on the operator control box (Figure 1, Item 5), aligning the holes on the assembly with the holes in the control box (Figure 1, Item 5).
11. Install the four screws (Figure 1, Item 1) removed earlier and tighten securely.

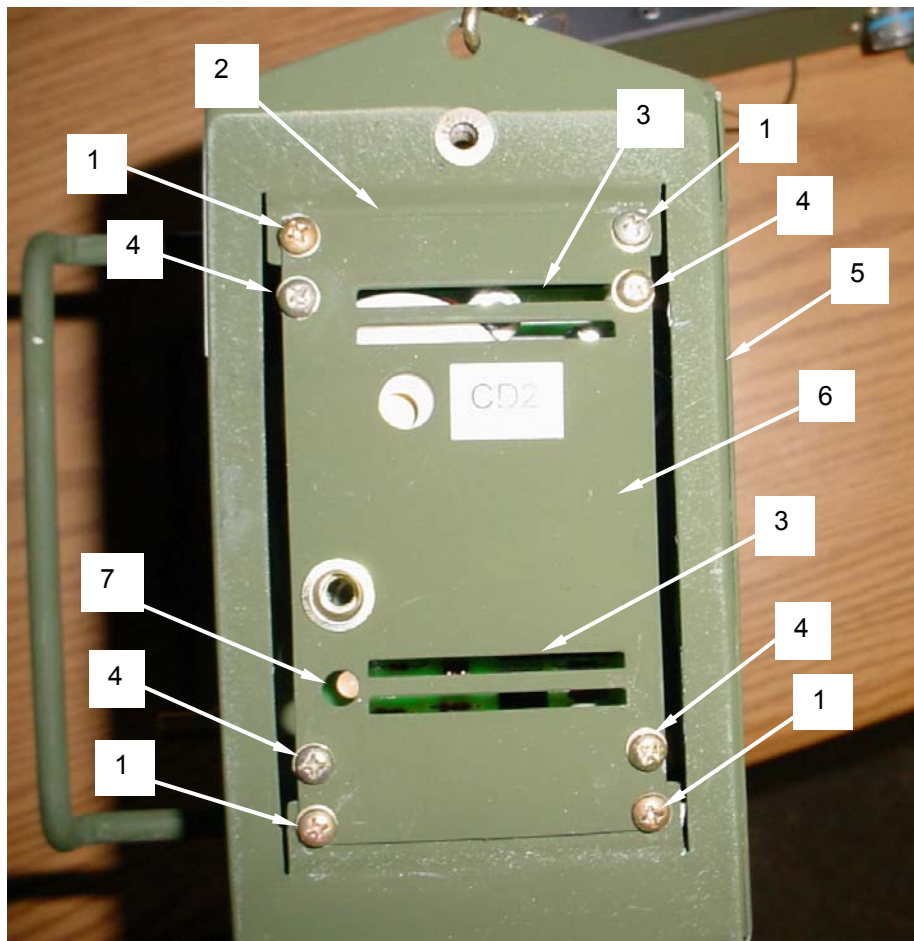


Figure 1. Operator Control Box Mounted Carbon Monoxide Detector (Sheet 1 of 2).

REPLACE - Continued

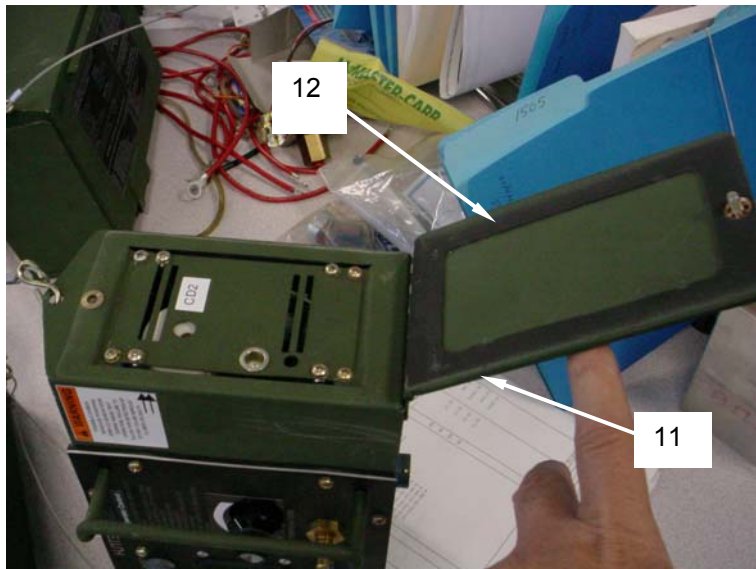
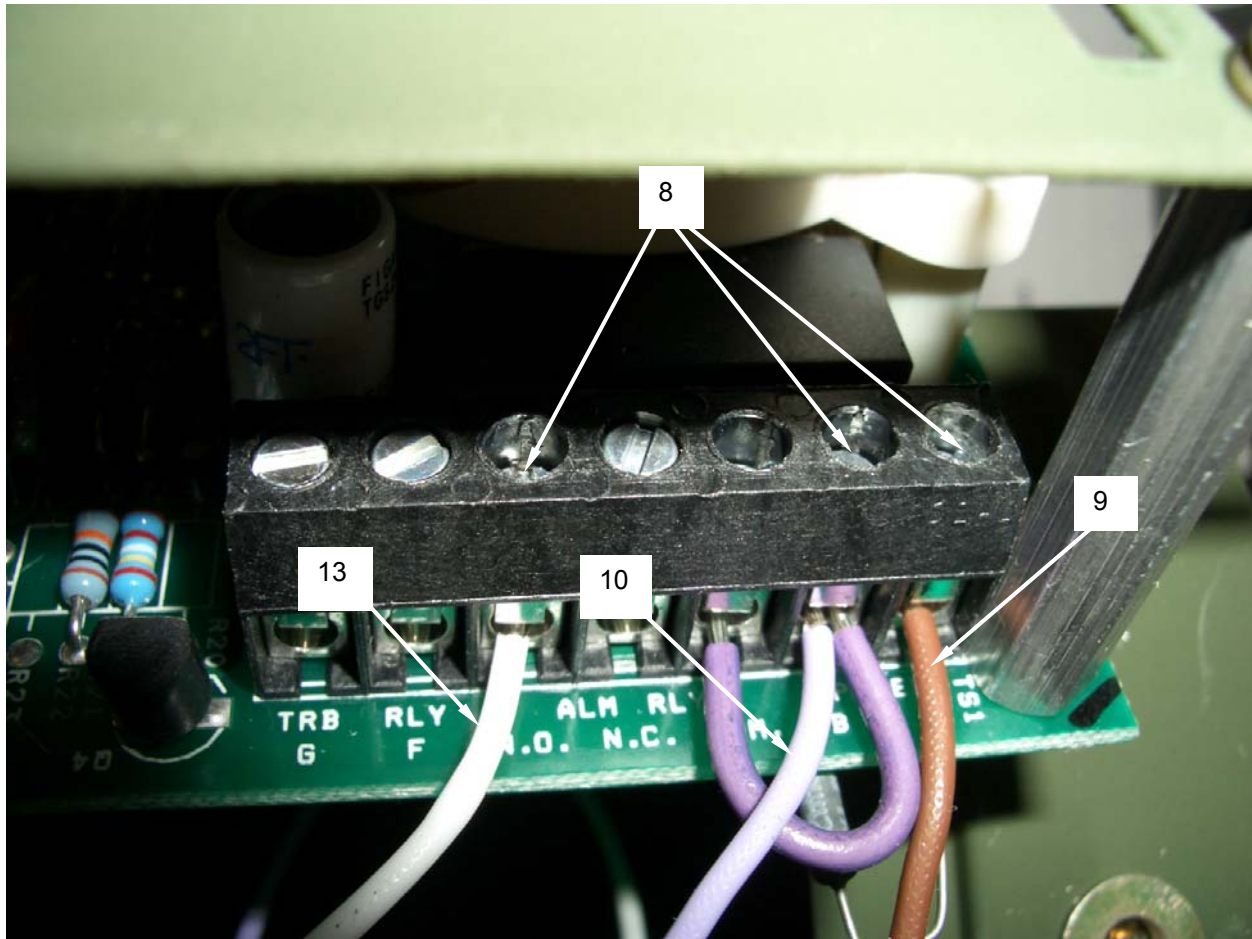


Figure 1. Operator Control Box Mounted Carbon Monoxide Detector (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE



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**SERVICE MAINTENANCE****PREPARATION FOR SHIPMENT AND STORAGE**

---

**INITIAL SETUP:****Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**References**

AR 750-1  
WP 0051  
WP 0053  
MIL-STD-129

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**GENERAL**

This section provides instructions for short term and immediate storage, or shipment, of the engine assembly.

**ADMINISTRATIVE STORAGE**

Administrative storage shall be in accordance with AR 750-1.

**SHORT-TERM STORAGE (30 Days or Less)**

1. Check engine oil level and service as required.
2. Cap all disconnected fuel lines.
3. Conduct a general inspection of the engine assembly to ensure all components are present and securely fastened.
4. Store the engine on a level surface in an area protected from the elements. Cover as required, depending upon weather conditions.

**END OF TASK****INTERMEDIATE-TERM STORAGE (More Than 30 Days)**

1. Start the engine and allow it to operate for three minutes. Shut down engine.
2. Drain engine oil while engine is still warm in accordance with WP 0051.
3. Fill engine crankcase with fresh oil in accordance with WP 0051.
4. Remove head cover IAW WP 0053. Add 2 cubic centimeters (cc) of engine oil to the cylinder head; then reinstall head cover.
5. Conduct a general inspection of the engine assembly to ensure all components are present and securely fastened.

---

**INTERMEDIATE-TERM STORAGE (More Than 30 Days) - Continued**

6. Store the engine on a level surface in an area protected from the elements. Cover as required depending upon weather conditions.

**END OF TASK****PREPARATION FOR SHIPMENT**

1. Prepare engine for short- or intermediate-term storage, as applicable.
2. Attach all forms, tags, and records to engine assembly.
3. Mark for shipment in accordance with MIL-STD-129.

**END OF TASK****END OF WORK PACKAGE**

**CHAPTER 8**

**FIELD MAINTENANCE  
FOR  
LARGE CAPACITY FIELD HEATER,  
TYPE II (LCFH TYPE II)**





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**FIELD MAINTENANCE**
**CABINET  
REPAIR**


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**INITIAL SETUP:****Tools and Special Tools**

Shop Equipment, Automotive Maintenance and Repair (WP 0124, Item 11)  
 Tool Kit, General Mechanics (WP 0124, Item 13)  
 Riveter, Blind Hand Straight Head (WP 0124, Item 10)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rags, Wiping (WP 0123, Item 15)  
 Rivet, Blind (WP 0123, Item 16)  
 Polyacrylic Sponge, Adhesive Backed (WP 0115, Item 6)

**References**

WP 0026  
 WP 0028

**Equipment Condition**

Heater shut down and cool (WP 0005).  
 Engine access door open.  
 Main battery switch OFF and handle removed.

---

**REPAIR**

Repair is limited to replacement of defective parts.

**Top Panel Repair**

Repair the cabinet top panel by replacing damaged panel gasket as follows:

1. Remove screws (Figure 1, Item 2), lockwashers (Figure 1, Item 4), and washers (Figure 1, Item 3) from top panel (Figure 1, Item 1).
2. Remove top panel (Figure 1, Item 1) from frame.
3. Note the location of the gasket and remove damaged gasket.
4. If insulation has been damaged, replace insulation IAW WP 0026.
5. Install replacement gasket in same pattern as damaged gasket.
6. Position top panel (Figure 1, Item 1) on top of frame.
7. Install washers (Figure 1, Item 3), lockwashers (Figure 1, Item 4), and screws (Figure 1, Item 2).

REPAIR - Continued



Figure 1. Repair Top Panel Assembly.

## REPAIR - Continued

### Rear Panel Repair

Repair the cabinet rear panel by replacing damaged panel gasket as follows:

1. Remove screws (Figure 2, Item 2), lockwashers (Figure 2, Item 4), and washers (Figure 2, Item 3).
2. Remove rear panel assembly (Figure 2, Item 1) from frame.
3. Note the location of the gasket and remove damaged gasket.
4. If insulation is damaged, replace insulation IAW WP 0026.
5. Install replacement gasket in same pattern as damaged gasket.
6. Install rear panel assembly (Figure 2, Item 1) onto frame.

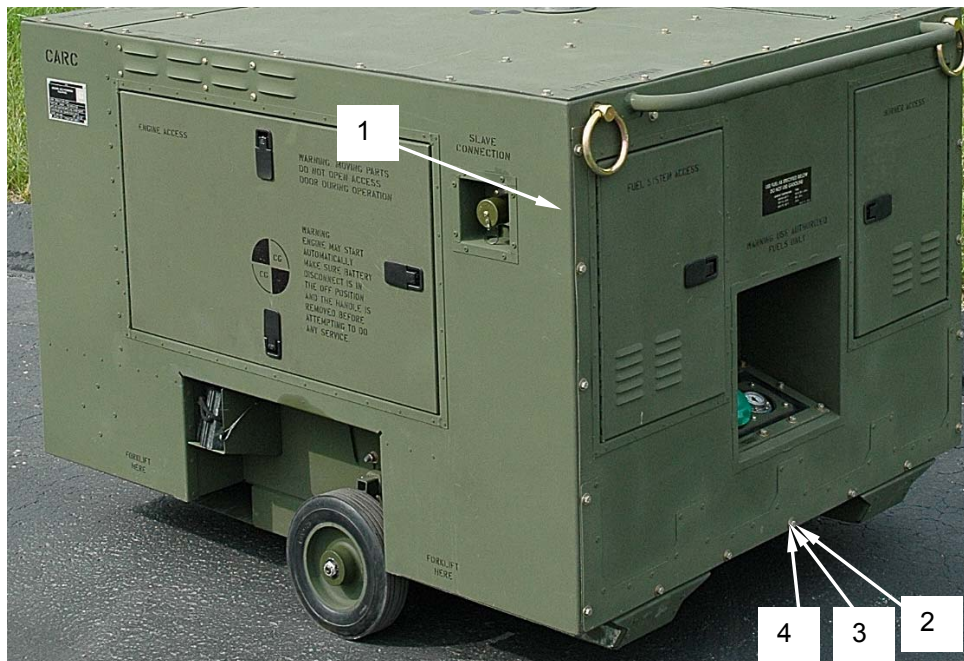


Figure 2. Repair Rear Panel Assembly.

**REPAIR - Continued****Door Hinge Replacement**

Repair the cabinet by replacing damaged door hinges as follows:

**NOTE**

Side door and front door assemblies are similar in construction. The differences are in the size and the number of rivets used to secure the hinges. Procedures are typical for both door assemblies.

1. Open door (Figure 3, Item 1).
2. Remove insulation.
3. Drill out rivets from hinge (Figure 3, Item 3) and frame (Figure 3, Item 2).
4. Drill out rivets and remove hinge (Figure 3, Item 3) from door (Figure 3, Item 1).
5. Install hinge (Figure 3, Item 3) and rivets onto door (Figure 3, Item 1).
6. Install hinge (Figure 3, Item 3) with rivets onto frame (Figure 3, Item 2).
7. If insulation has been removed, install new insulation IAW WP 0028.
8. Close door (Figure 3, Item 1).

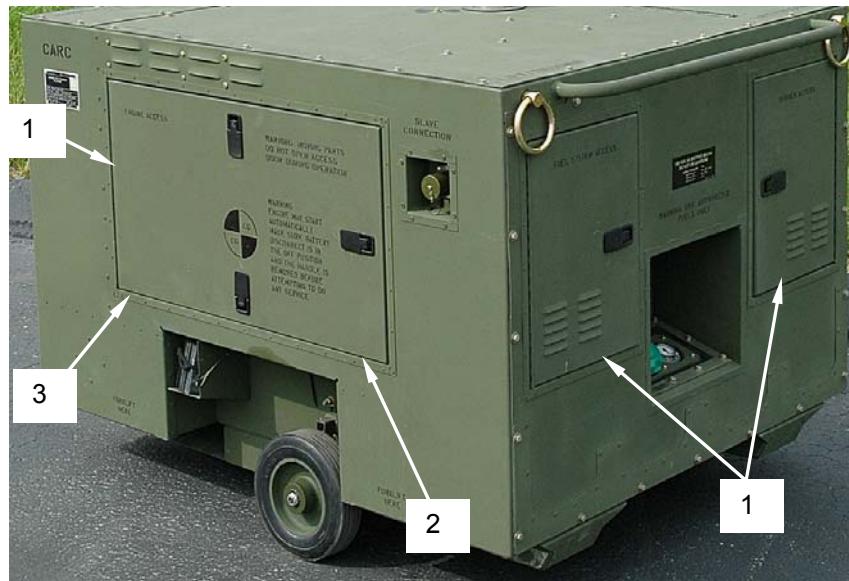


Figure 3. Repair Side and Front Door Assemblies.

**END OF TASK**

**END OF WORK PACKAGE**

**FIELD MAINTENANCE**  
**ENGINE SYSTEM ASSEMBLY**  
**REPLACE**

**INITIAL SETUP:**

**Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 19)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**References**

WP 0081  
WP 0087

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Main battery switch OFF and handle removed.

**REPLACE**

The replacement of the entire engine system assembly involves the replacement and/or repair of one or more of the subcomponents as shown in Table 1. Procedures for the repair or replacement of the subcomponents can be found in the referenced work packages.

Table 1. Replaceable Components of Engine System Assembly.

<b>Component</b>	<b>Work Package</b>
Diesel Engine	WP 0081
Diesel Engine Vibration Mounts	WP 0087

**END OF TASK**

**END OF WORK PACKAGE**



**FIELD MAINTENANCE**

**DIESEL ENGINE  
REPAIR, REPLACE**

**INITIAL SETUP:**

**Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
 Wrench, Torque (WP 0124, Item 17)  
 Lift, Chain (WP 0124, Item 6)  
 Adapter, 3/8 Inch Socket to 1/4 Inch Hex Key (WP 0124, Item 1)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or (2)  
 Utilities Equipment Repairer 52C (1) or (2)

**Materials/Parts**

Grease, General Purpose (WP 0123, Item 7)  
 Rags, Wiping, Clean (WP 0123, Item 15)  
 Container, Engine Oil Disposal (Unit Asset)  
 Tags, Marking (WP 0123, Item 22)  
 Marker, Permanent (WP 0123, Item 13)  
 Gloves, Chemical and Oil Protective (WP 0123, Item 6)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
 Engine access door open.  
 Main battery switch OFF and handle removed.  
 Drain all fuel from fuel tank.

**References**

WP 0016, WP 0071, WP 0082, WP 0083, WP 0084  
 WP 0085, WP 0086, WP 0087

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REPAIR**

Repair to the diesel engine involves replacement of defective components as shown in Table 1.

**Table 1. Replaceable Components Used to Repair Diesel Engine.**

<b>COMPONENT</b>	<b>WORK PACKAGE</b>
Cylinder Head	WP 0082
Oil Pump	WP 0083
Rocker Arm Assembly	WP 0084
Fuel Injection Pump	WP 0085
Governor Control	WP 0086
Vibration Mounts	WP 0087

**END OF TASK**

**REPLACE****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below the hoses being removed to collect any fuel. Be sure to wipe up any spills with a rag. Properly dispose of fuel soaked rags IAW local SOP.

Personnel should wear gloves when performing any task in which fuel may come in contact with bare skin. Fuel coming into contact with bare skin may cause irritation or if under arctic conditions may cause frostbite or other serious injury.

1. Drain engine oil into a suitable container prior to replacement of engine IAW WP 0016.
2. Remove the top engine compartment cover (Figure 1, Item 1) by removing the eighteen hex head bolts, lockwashers and flat washers (Figure 1, Item 2). Set hardware and top engine compartment cover aside.



Figure 1. Remove the Top Engine Compartment Cover.



**REPLACE - Continued****NOTE**

In order to provide room for the diesel engine to be removed from the engine compartment, it will be necessary to remove the batteries.

To make battery terminal removal easier, it may be necessary to force the terminal open a bit using the blade of a flat blade screwdriver in the gap between the arms of the terminal. Pry the terminal connector off the battery terminal. If the terminal connector is damaged in the removal process, it should be replaced in accordance with WP 0071.

3. Loosen the nut on the negative terminal of the battery closest to the engine access door opening and remove the terminal (Figure 2).



Figure 2. Remove Negative Terminal of Battery Closest to Engine Access Door.

**REPLACE - Continued**

4. Loosen and remove the terminals of the jumper cable connecting the two batteries, remove the cable and set aside (Figure 3).



Figure 3. Remove Jumper Cable Between Batteries.

5. Remove the wingnuts and lockwashers that secure the battery T-bar on the battery closest to the engine access door opening and set aside (Figure 4).

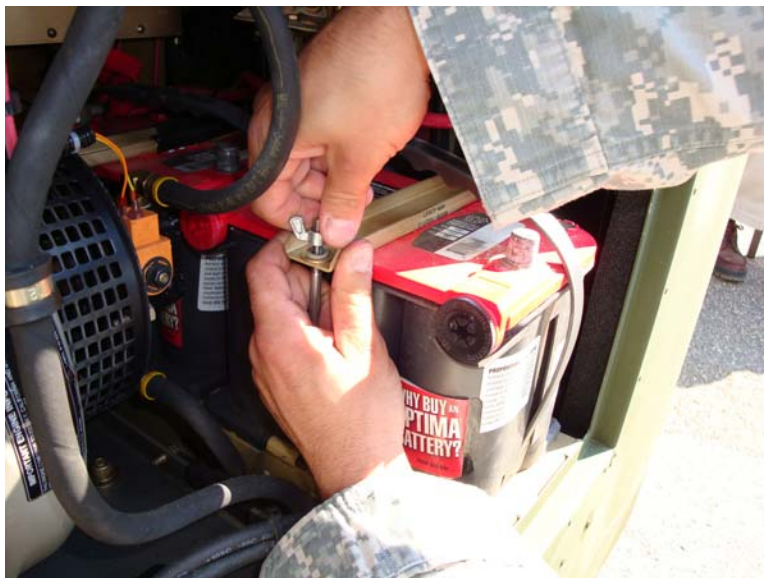


Figure 4. Remove Hardware Securing Battery T-bar Closest to Access Door.

**REPLACE - Continued**

6. Remove the battery hold-down bracket that extends over the top of the battery and set aside (Figure 5).



Figure 5. Remove Battery Hold-down Bracket.

7. Remove the battery closest to the engine access door opening and set aside (Figure 6).



Figure 6. Remove Battery Closest to Engine Access Door.

**REPLACE - Continued**

8. Remove the wingnuts and lockwashers that secure the battery T-bar on the battery farthest from the engine access door opening and set aside (Figure 7).



Figure 7. Remove Hardware Securing Battery T-bar Farthest from Access Door.

9. Remove the battery hold-down bracket that extends over the top of the battery and set aside (Figure 8).



Figure 8. Remove Battery Hold-down Bracket of Battery Farthest from Access Door.

**REPLACE - Continued**

10. Loosen the nut on the positive terminal of the battery farthest from the engine access door opening and remove the terminal (Figure 9).



Figure 9. Remove Positive Battery Cable of Battery Farthest from Access Door.

11. Remove the battery farthest from the engine access door opening and set aside (Figure 10).



Figure 10. Remove Battery Farthest from Access Door.

**REPLACE - Continued**

12. Mark and disconnect wires connected to the starter (Figure 11, Item 1) and oil pressure switch (Figure 11, Item 3) on engine (Figure 11, Item 2).

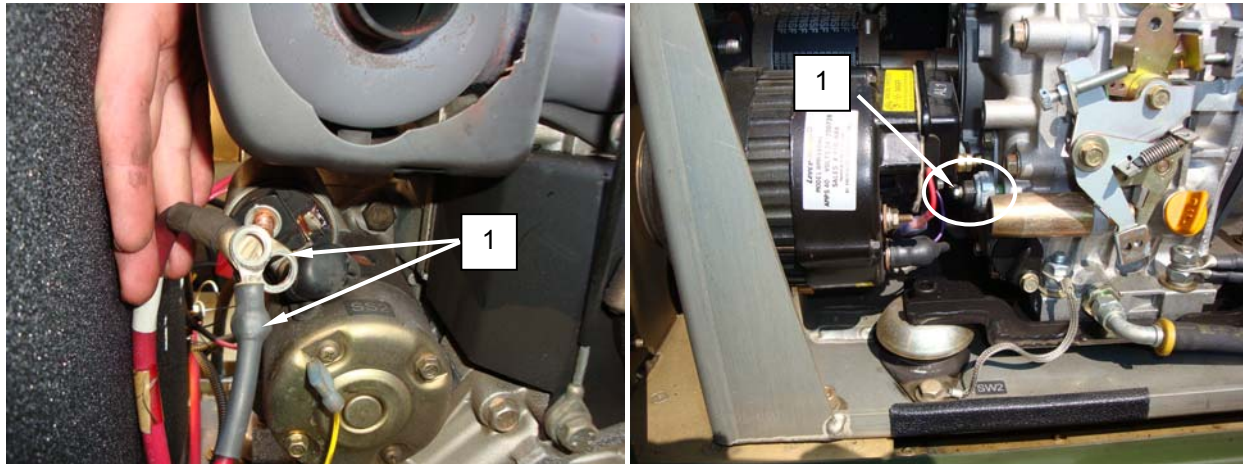


Figure 11. Remove Starter and Oil Pressure Switch Wires.

**NOTE**

The flexible exhaust tube must be replaced each time the diesel engine is removed from the heater.

13. Loosen clamps (Figure 12, Item 1) and disconnect flexible exhaust tube (Figure 12, Item 3) from engine muffler (Figure 12, Item 2) and the bulkhead fitting mounted to the wall of the heat exchanger compartment. Discard the exhaust tube but retain clamps for later use if serviceable; replace defective clamps as necessary.

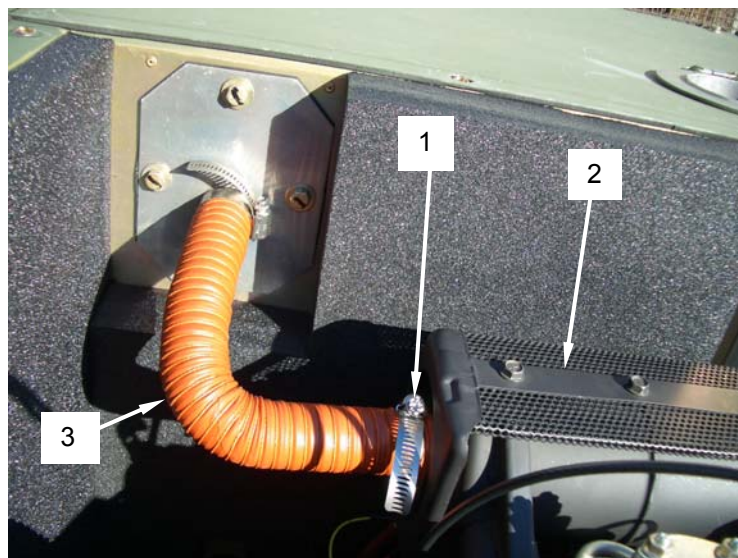


Figure 12. Disconnect Flexible Exhaust Tube.

**REPLACE - Continued**

14. Mark and disconnect the wires from the engine shutdown solenoid (Figure 13, Item 1) and the burner fuel pump solenoid (Figure 13, Item 2).

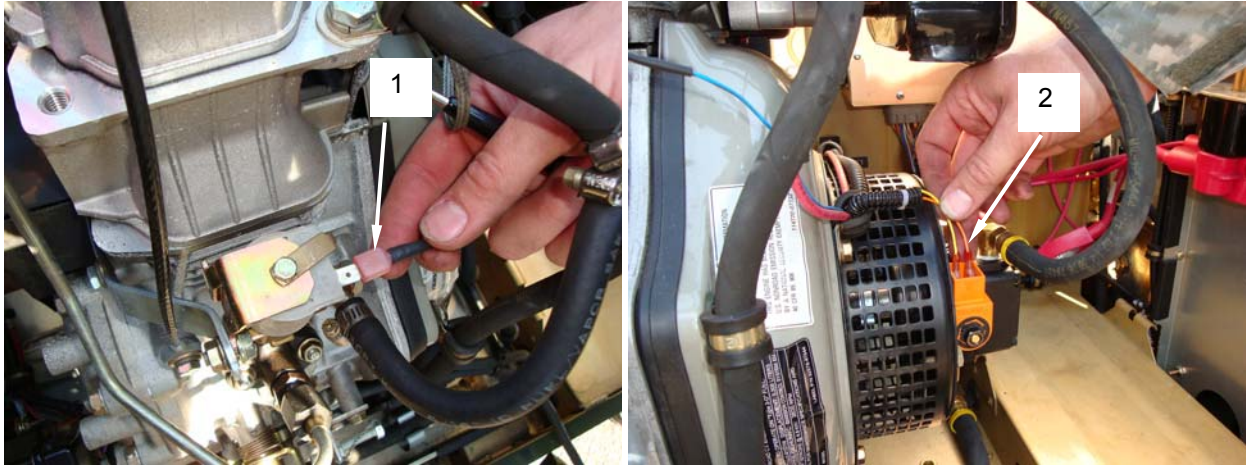


Figure 13. Disconnect Wiring from Engine Shutdown Solenoid and Burner Fuel Pump Solenoid.

**REPLACE - Continued****NOTE**

When removing hardware or clamps from the engine, reinstall washers, nuts, and bolts onto engine, finger tight, so that they are not lost.

15. Loosen the clamp (Figure 14, Item 1) and remove the fuel supply hose (Figure 14, Item 3) from the arm of the Tee connector (Figure 14, Item 2). Catch any fuel in approved container. Wipe up any spilled fuel with a rag.
16. Remove the clamp (Figure 14, Item 1) that secures the fuel supply hose to the engine housing. Reinstall the bolt (Figure 14, Item 4) into the housing, finger tight. Leave the clamp on the hose.

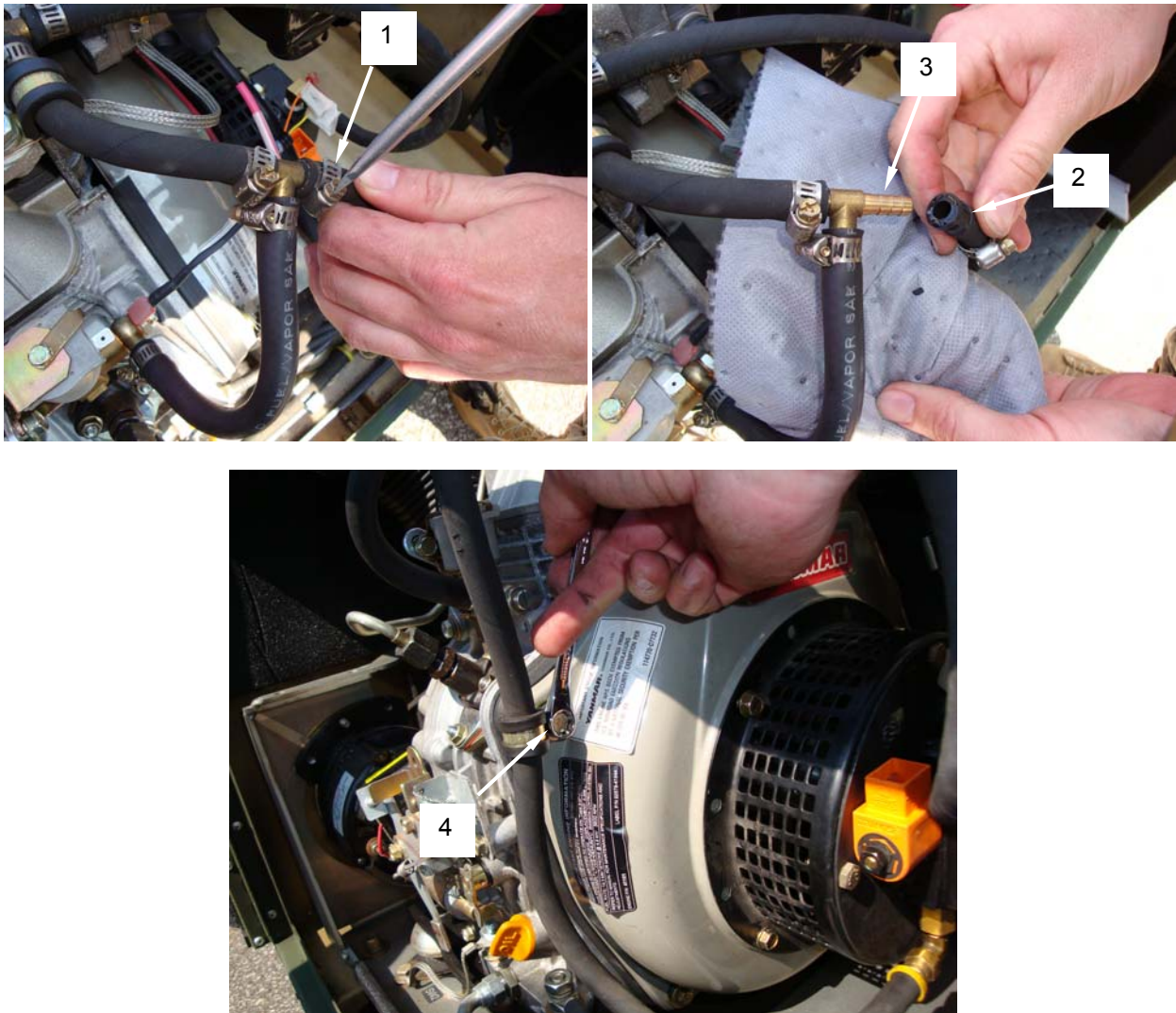


Figure 14. Remove Fuel Supply Hose from Tee and Clamp from Flywheel Housing.



**REPLACE - Continued**

17. Remove the dust boot (Figure 15, Item 1) and disconnect the wire (Figure 15, Item 3) attached to the threaded stud labeled GP1 (Figure 15, Item 2) on the side of the engine air preheater.

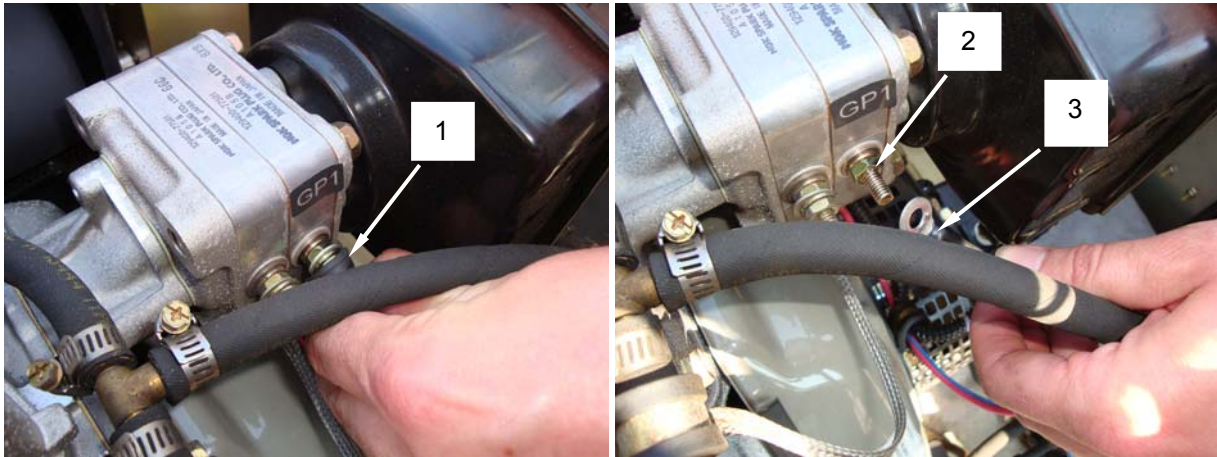


Figure 15. Remove Dust Boot and Disconnect Wire from GP1.

18. Remove the bolts holding two clamps (Figure 16, Item 1) across the top of the burner pump housing so that the harness can be removed from the engine. Reinstall the bolts back into the housing at this time, finger tight. Leave the clamps looped around the wires.

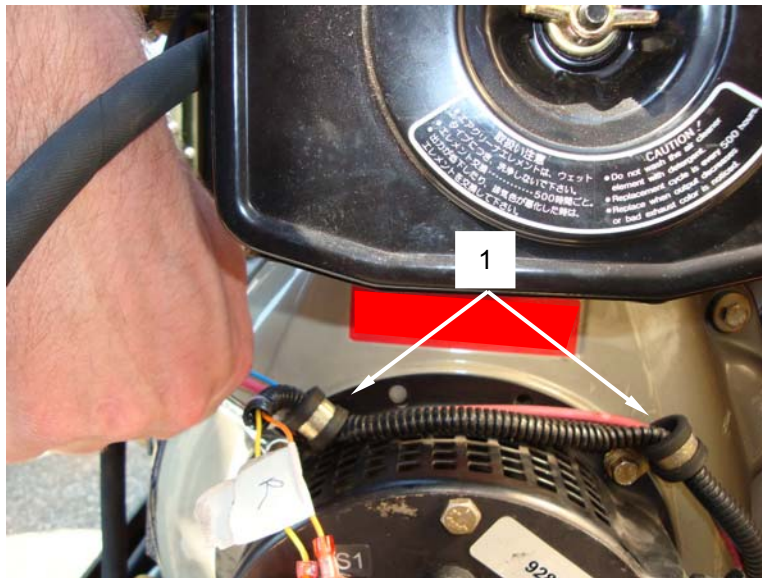


Figure 16. Remove Harness from Burner Fuel Pump Housing.

**REPLACE - Continued**

19. Remove nuts (Figure 17, Item 1) and remove black battery cables (Figure 17, Item 2) and grounding strap (Figure 17, Item 3) from mounting stud at base of engine. Push battery cable and grounding strap off to the side of the engine compartment.

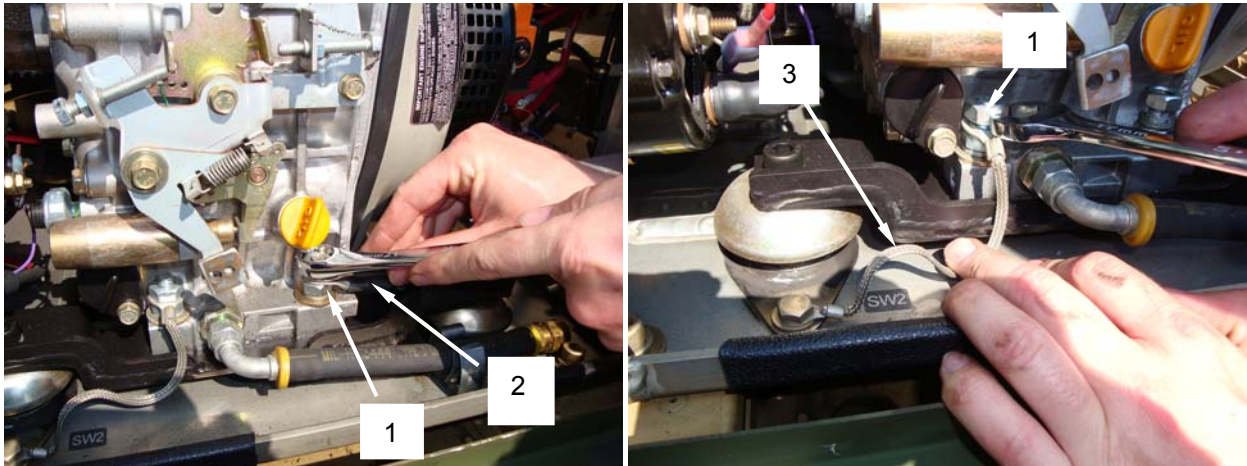


Figure 17. Remove Cables and Grounding Strap from Base of Engine.

20. Disconnect the remaining two fuel lines from the burner pump (Figure 18, Item 1 and Item 2).

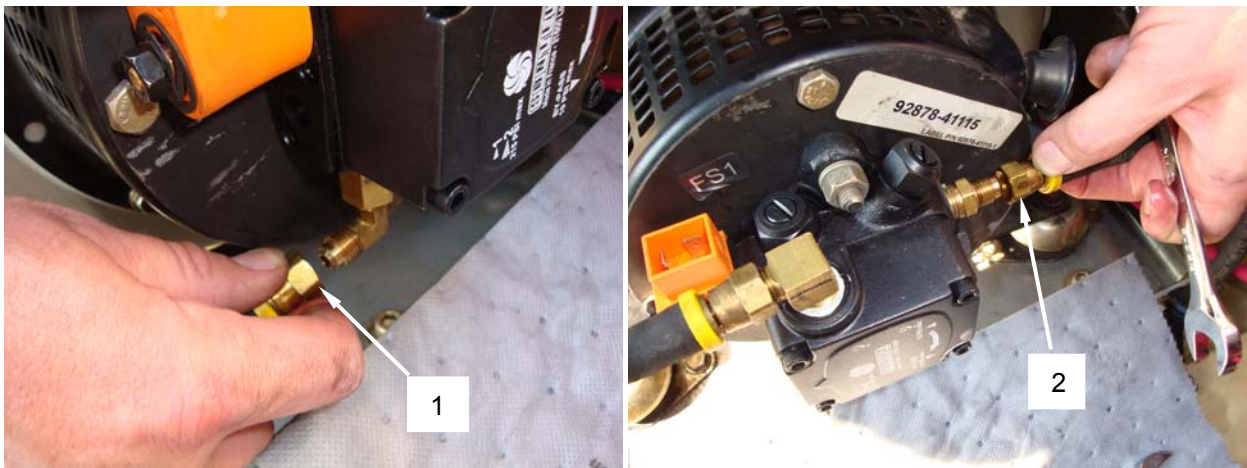


Figure 18. Disconnect Remaining Two Fuel Lines from Burner Pump.

**REPLACE - Continued**

21. Remove the four socket cap head screws (Figure 19, Item 1) that secure the engine mounting bracket (Figure 19, Item 2) to the engine vibration mounts (Figure 19, Item 3).

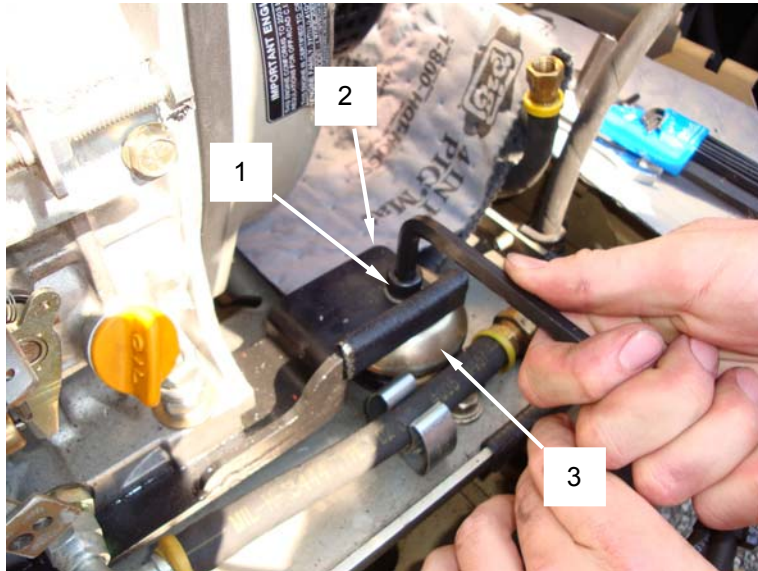


Figure 19. Remove Screws Securing Mounting Bracket to Engine Vibration Mounts.

22. Loosen clamp and remove engine head cooling air inlet hose (Figure 20, Item 1) from engine. Move hose off to side.

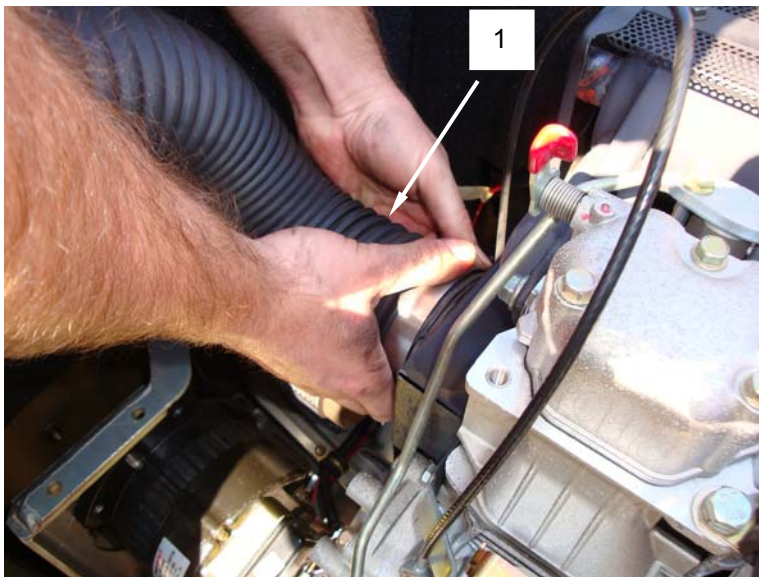


Figure 20. Remove Engine Head Cooling Air Inlet Hose.

**REPLACE - Continued**

23. Remove engine oil drain hose (Figure 21, Item 1) from spring clamp (Figure 21, Item 2).

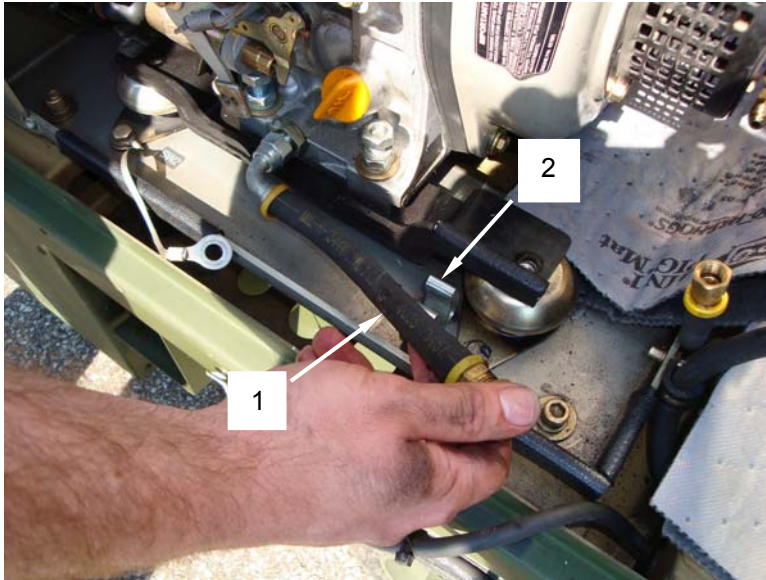


Figure 21. Remove Engine Oil Drain Hose from Spring Clamp.

**NOTE**

It is recommended that the next step be performed by two personnel. One person controls the chain lift while the other guides the engine out of the engine compartment.

24. Attach a chain lift through the top of the heater engine compartment to the engine lifting cable (Figure 22, Item 1) located on the inboard side of the engine.



Figure 22. Attach Chain Lift to Engine Lifting Cable.

**REPLACE - Continued**

25. Carefully lift the engine slightly and guide to the right while continuing to remove engine from the engine compartment. Take care not to snag any of the fuel hoses or wires. Remove the engine from the heater and place on a rugged work surface (Figure 23).

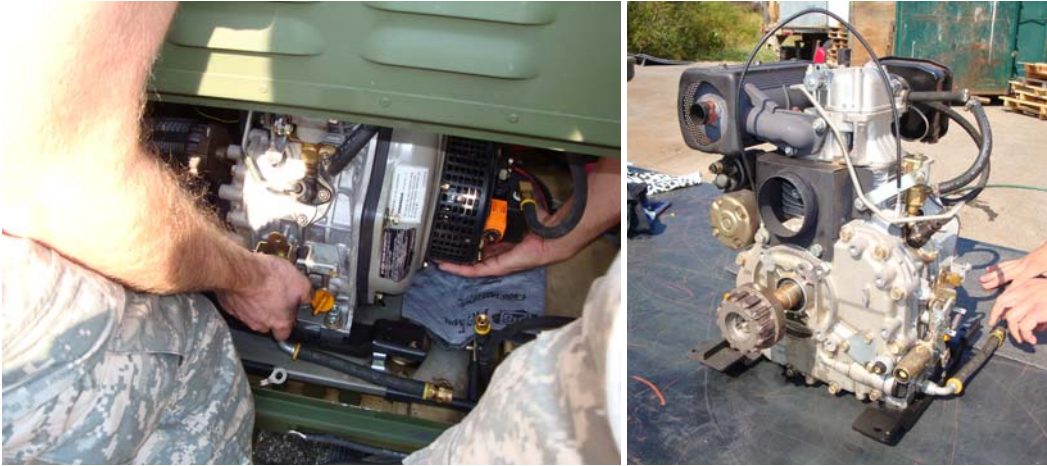


Figure 23. Remove Engine from Heater and Place on Rugged Work Surface.

**REPLACE - Continued**

26. Remove engine head cooling air inlet box (Figure 24, Item 1) from the front of the engine's cylinder head, by removing the three bolts securing it to the engine and set aside. Loosen the fuel engine solenoid bracket bolt and nut (Figure 24, Item 2) to allow removal.



Figure 24. Remove Engine Head Cooling Air Inlet Box.

27. Remove the fuel hose (Figure 25, Item 2) from the fuel injector pump (Figure 25, Item 4). Catch any fuel in approved container. Wipe up any spilled fuel with a rag.



Figure 25. Remove Fuel Hose from Fuel Injector Pump.

**REPLACE - Continued**

28. Loosen clamps and remove hose (Figure 26, Item 1) from engine shutdown solenoid fitting.



Figure 26. Remove Hose from Engine Shutdown Solenoid Fitting.

29. Remove bolt, clamp, and lockwasher (Figure 27, Item 1) that secures the fuel hose assembly with Tee's (Figure 27, Item 2) to the cylinder head. Set hose assembly with clamp attached aside. Reinstall bolt in cylinder head, finger tight.

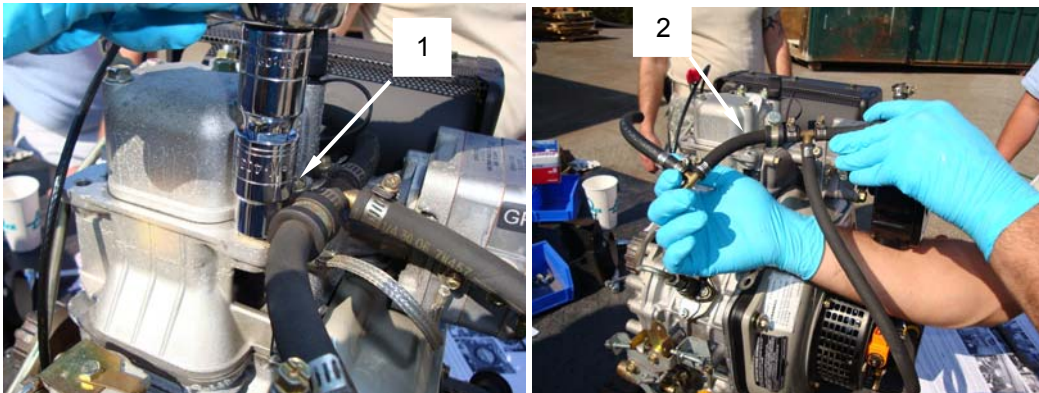


Figure 27. Remove Fuel Hose from Fuel Injector Pump.

30. Remove four bolts (Figure 28, Item 1) that secure the burner pump housing (Figure 28, Item 2) to the engine flywheel cover. Remove burner pump housing with burner fuel pump attached and set aside.

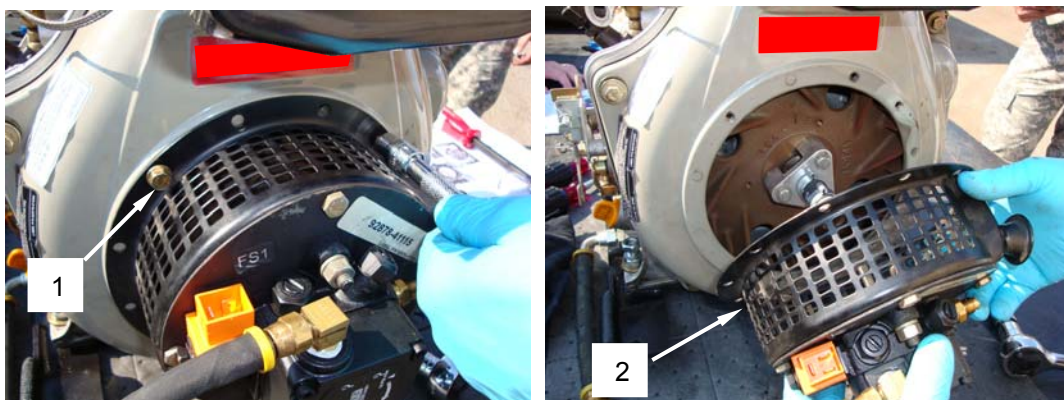


Figure 28. Remove Burner Pump Housing with Burner Fuel Pump Attached.

**REPLACE - Continued**

31. Align one of the large holes (Figure 29, Item 1) in the flywheel (Figure 29, Item 2) with the matching hole in the engine block. Insert a long screwdriver into both holes to prevent the flywheel from turning during the next step.

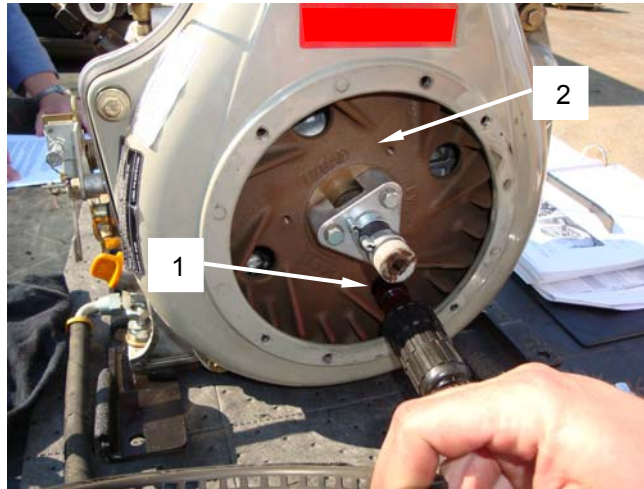


Figure 29. Prevent the Flywheel from Turning.

32. Remove three bolts (Figure 30, Item 1) securing pump drive coupling (Figure 30, Item 2) and remove coupling from engine flywheel. Set coupling aside. Remove long screwdriver used to lock flywheel.

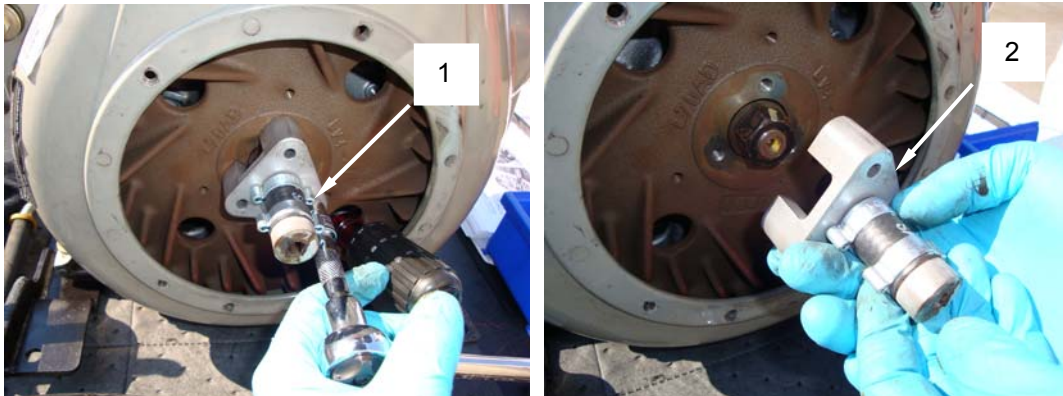


Figure 30. Remove Pump Drive Coupling from Engine Flywheel.



**REPLACE - Continued****NOTE**

Make a mark on the engine shaft to the right of the flexible coupling flange before performing the next step. After removing the flexible coupling flange in the next steps, measure and take note of how far the flexible coupling hub extends onto the shaft. This is done so that flexible coupling hub can be installed on the new diesel engine in the same position.



Figure 31. Mark the Engine Shaft.

33. Remove socket head screw (Figure 32, Item 1) on the engine's flexible coupling hub (Figure 32, Item 2). If necessary, place a flat blade screwdriver (Figure 32, Item 3) in gap on coupling flange and tap into place so as to loosen the coupler grip on the engine shaft (Figure 32, Item 4).



Figure 32. Loosen the Coupler Grip on Engine Shaft.

**REPLACE - Continued****NOTE**

When the engine is removed from the heater engine compartment, the rubber coupling may remain attached to the portion of the coupling hub installed on the inlet fan shaft, or it may remain attached to the portion of the coupling hub installed on the engine shaft.

34. Slide the coupling hub (Figure 33, Item 1) and rubber coupling (if attached) off engine drive shaft. If used, leave the screwdriver tapped into the coupling hub (Figure 33, Item 1) in place. Set hub and rubber coupling aside.



Figure 33. Remove Coupling Hub and Rubber Coupling (if attached).

35. Taking note of orientation of oil drain hose for later installation on new engine, remove engine drain hose (Figure 34, Item 1) from engine drain fitting (Figure 34, Item 2). Then remove engine drain fitting (Figure 34, Item 2) from engine block.

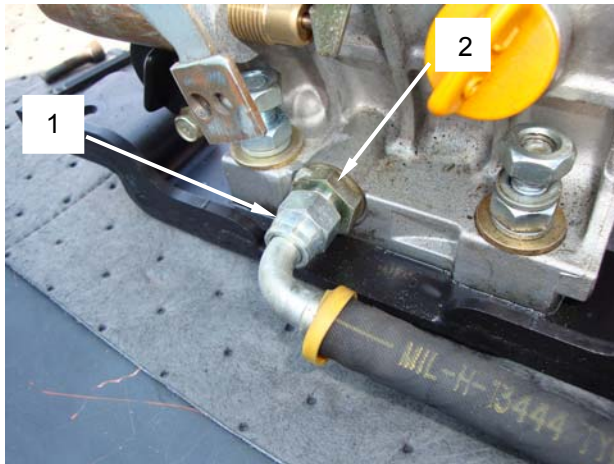


Figure 34. Remove Engine Drain Hose and Drain Fitting.

**REPLACE - Continued**

36. Remove jumper (Figure 35, Item 1) from the rear of air preheater and set aside.

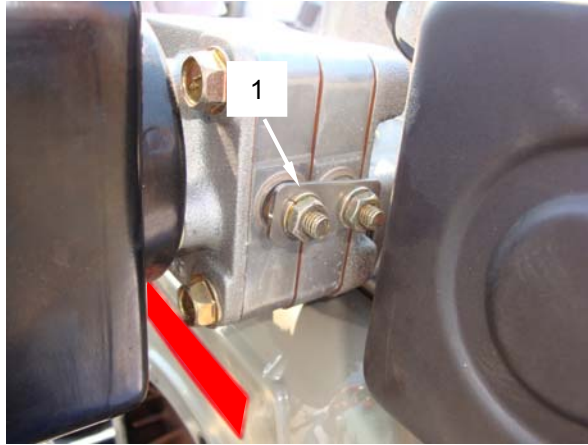


Figure 35. Remove Jumper from Rear of Air Preheater.

37. Remove ground strap (Figure 36, Item 1) from threaded stud on side of air preheater and set aside.

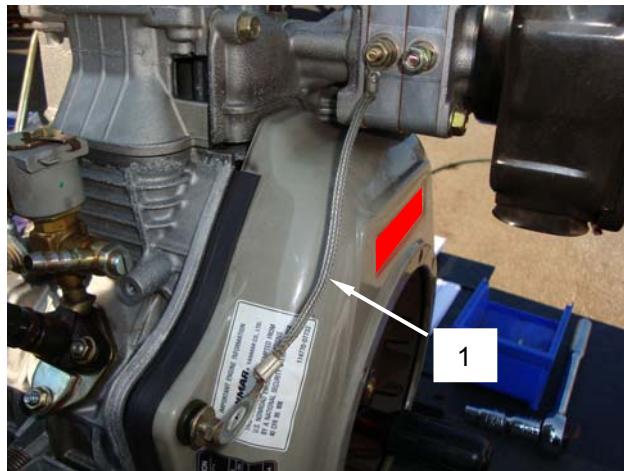


Figure 36. Remove Ground Strap from Air Preheater.

**REPLACE - Continued**

38. Remove bolts (Figure 37, Item 1) and lift cable (Figure 37, Item 2) and set aside.



Figure 37. Remove Lift Cable.

**NOTE**

The following steps are performed on the new replacement diesel engine.

39. With the new diesel engine positioned on the work surface, remove oil drain plug (Figure 38, Item 1) from fuel injector pump side of the engine block. Catch any oil in approved container. Wipe up any spilled oil with a rag. Install oil drain fitting (Figure 38, Item 2) and hose (Figure 38, Item 3) into engine block. Ensure that oil drain hose is oriented as noted earlier.

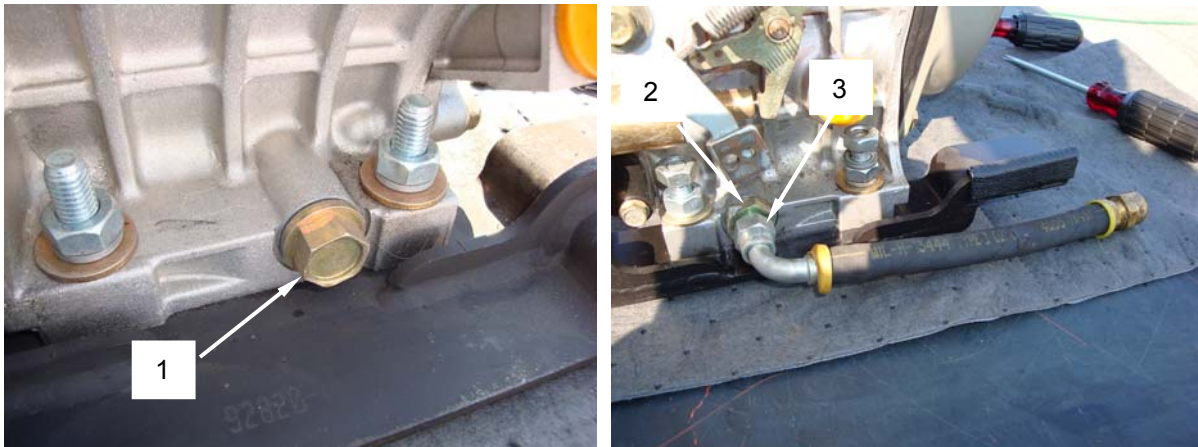


Figure 38. Install Oil Drain Hose.

**REPLACE - Continued**

40. Align the key (Figure 39, Item 1) on the shaft with the slot in the coupling hub (Figure 39, Item 2) and slide the coupling hub (with screwdriver tapped into slot, if needed) on the drive shaft of the engine to the measurement noted prior to removal from the defective engine. Install the rubber coupling if set aside earlier. Tighten the socket head screw (Figure 39, Item 3) on the coupling flange to a torque of 264 to 300 inch-pounds.



Figure 39. Install Coupling Hub on Drive Shaft.

41. Align the large hole in the flywheel (Figure 40, Item 1) with the matching hole in the engine block. Insert a long screwdriver into both holes to prevent the flywheel from turning during the next step.

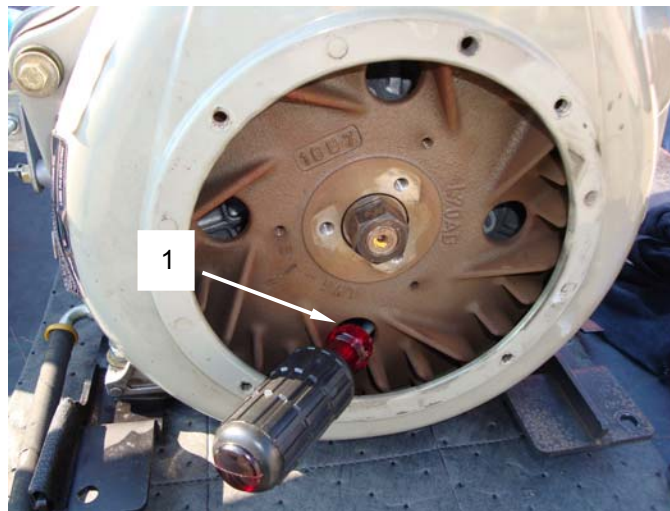


Figure 40. Align Large Hole In Flywheel with Matching Hole in Engine Block.

**REPLACE - Continued**

42. Install burner fuel pump drive coupling (Figure 41, Item 1) with the three bolts (Figure 41, Item 2) set aside earlier. Tighten securely.

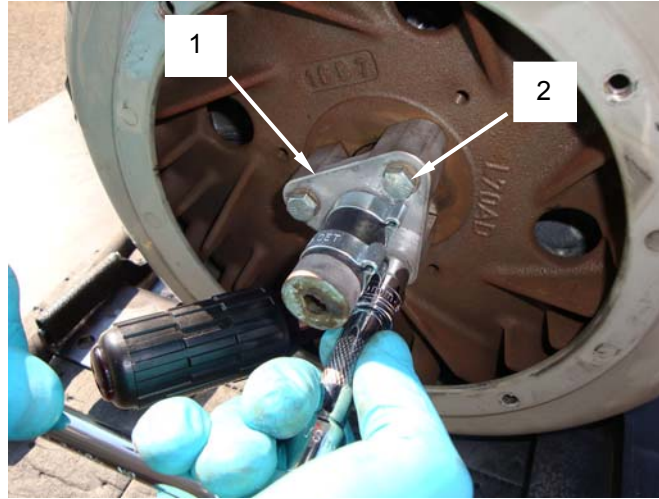


Figure 41. Install Fuel Pump Coupling.

43. Apply high performance steel mill grease or equivalent to the shaft of the burner fuel pump and to the hole on the pump drive coupling (Figure 42).

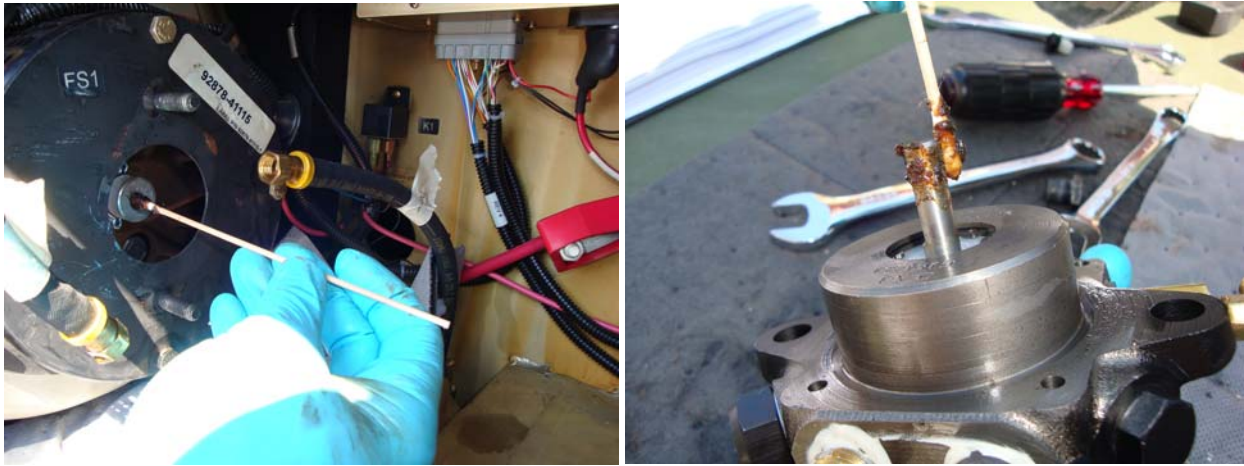


Figure 42. Apply Grease to Burner Fuel Pump and Pump Drive Coupling.

**REPLACE - Continued**

44. Rotate engine shaft with installed burner fuel pump coupling so that flat of the “D” (Figure 43, Item 1) on coupling is at the 9 o'clock position. Orient the flat portion of the burner fuel pump shaft to the 9 o'clock position.
45. Slide burner fuel pump shaft (Figure 43, Item 1) into coupling (Figure 43, Item 2) ensuring that the flat on the shaft aligns with the flat on coupling.

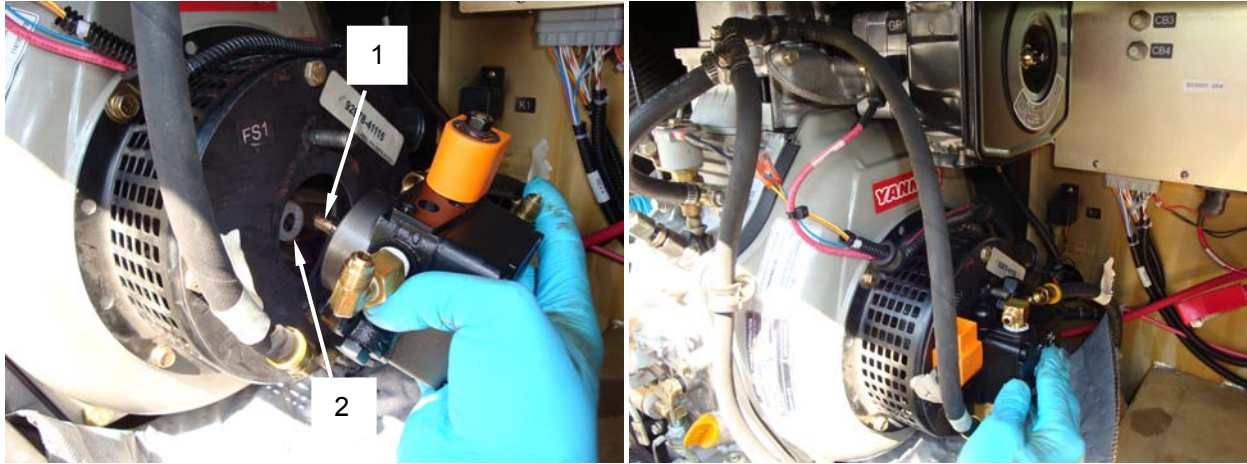


Figure 43. Orient Engine Shaft and Burner Fuel Pump Shaft.

46. Install burner pump housing (Figure 44, Item 1) with four bolts (Figure 44, Item 2) removed earlier. Leave the top two bolts, finger tight, at this time.

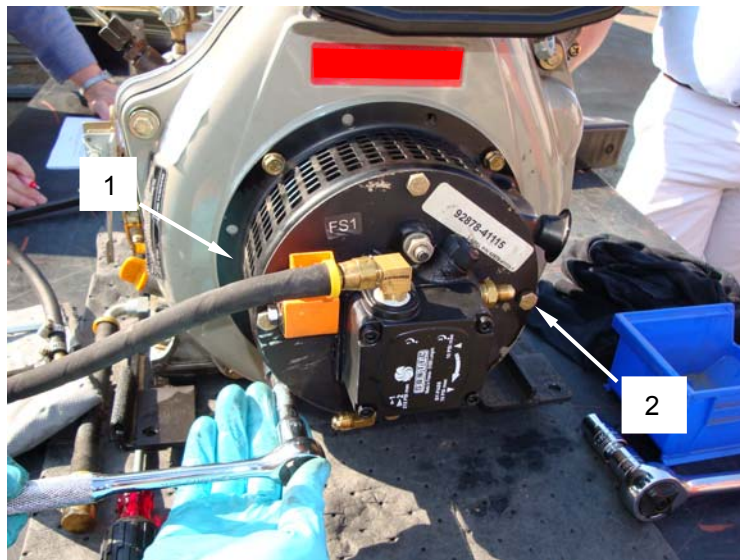


Figure 44. Install Burner Fuel Pump Housing.

**REPLACE - Continued**

47. Install engine head cooling air inlet box (Figure 45, Item 1) on the front of the engine's cylinder head, using the three bolts set aside earlier. Ensure that bracket from the block to engine shutdown solenoid (Figure 45, Item 2) remains on top of engine head cooling air inlet box. Ensure that engine lift cable lug (Figure 45, Item 3) is installed and remains on top of engine head air inlet cooling box. Tighten securely.



Figure 45. Install Engine Head Cooling Air Inlet Box.



**REPLACE - Continued**

48. Install the ground strap (Figure 46, Item 1) removed earlier onto the inboard threaded stud (Figure 46, Item 2) on the engine air preheater and to the bolt on the engine head.

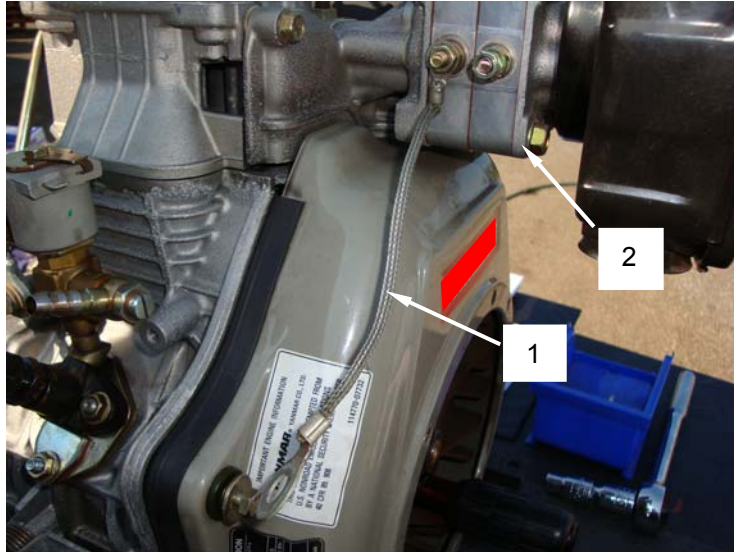


Figure 46. Install Engine Air Preheater Ground Strap.

49. Install jumper (Figure 47, Item 1) removed earlier on the rear of engine air preheater (Figure 47, Item 2).

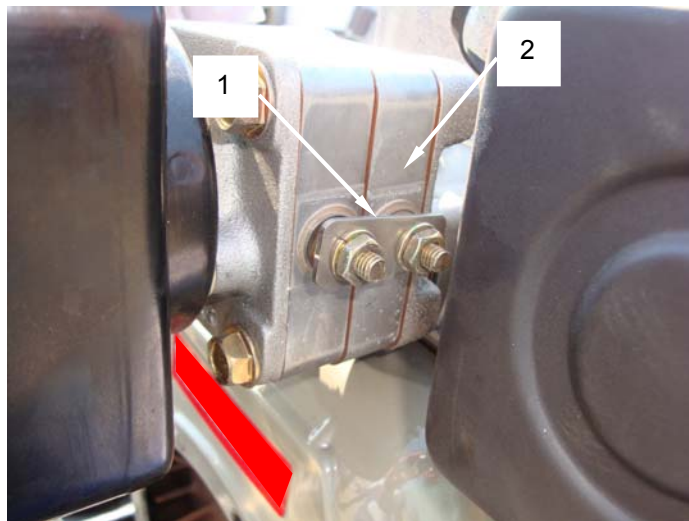


Figure 47. Install Jumper on Engine Air Preheater.

**REPLACE - Continued**

50. Install fuel hose assembly with Tee's (Figure 48, Item 1) and secure with bolt, clamp, and lockwasher (Figure 48, Item 2) to the cylinder head. Ensure that strap is installed on cylinder head before installing hose clamp and bolt.

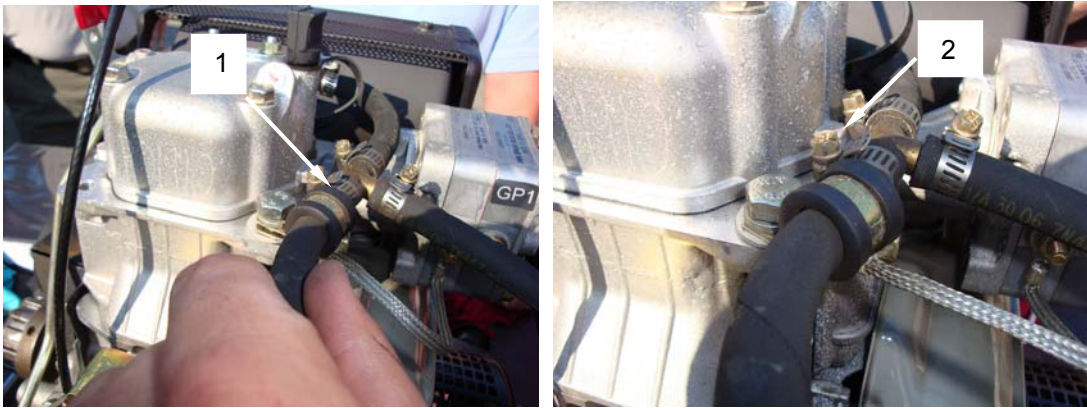


Figure 48. Install Fuel Hose onto Fuel Injector Pump.

51. Install fuel hose (Figure 49, Item 1) on engine shutdown solenoid fitting. Tighten hose clamps.

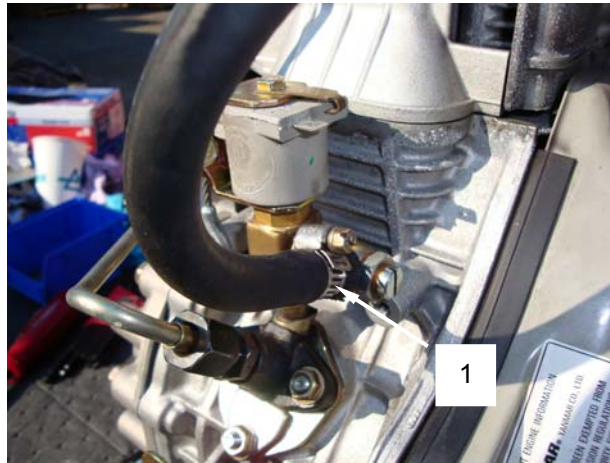


Figure 49. Install Hose on Engine Shutdown Solenoid Fitting.

**REPLACE - Continued**

52. Install the fuel hose (Figure 50, Item 1) onto fuel injector pump (Figure 50, Item 2).

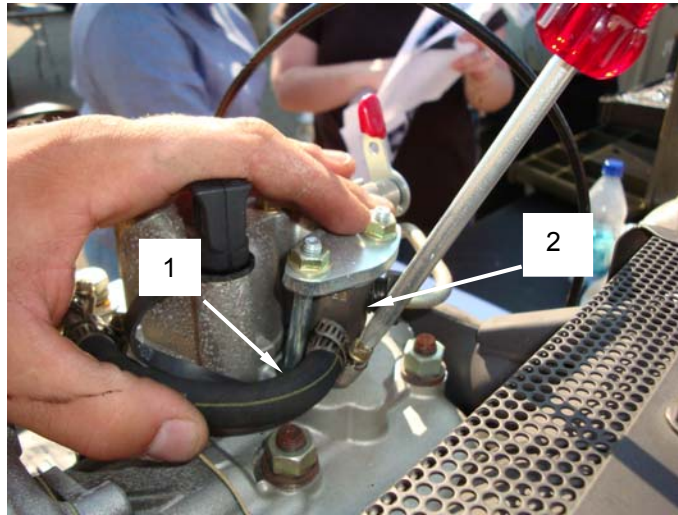


Figure 50. Remove Fuel Hose from Fuel Injector Pump.

53. The new diesel engine has now been prepared for installation in the heater.

54. Attach the chain lift to the engine lifting cable and raise the diesel engine off the work surface. Carefully lower into position into the engine compartment. Lower it toward the right side near the battery compartment and then toward the left to engage the rubber coupling onto the coupling hub from the inlet fan and alternator belt pulley. Do not fully install the engine on the coupling at this time (Figure 51).

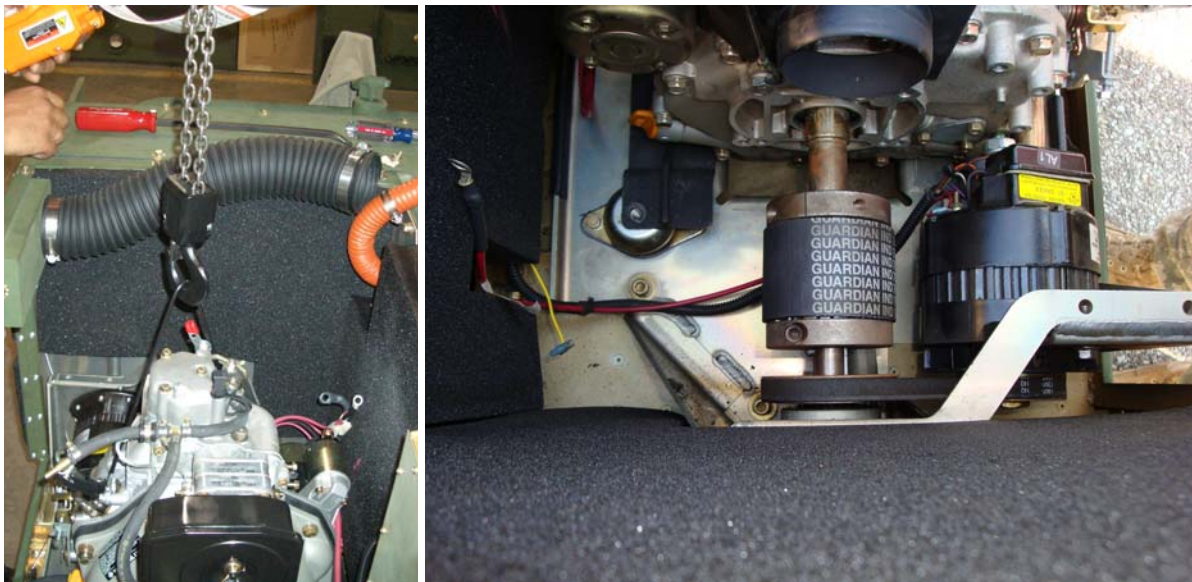


Figure 51. Reinstalling the Engine into the Heater.

**REPLACE - Continued**

55. Once the engine is positioned close enough but before easy access is lost, reinstall the engine oil pressure wire (Figure 52, Item 1).

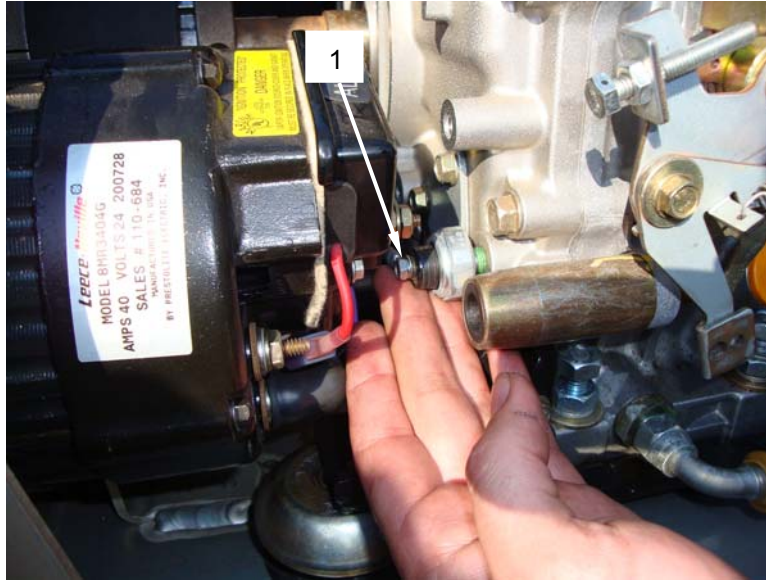


Figure 52. Reinstalling Engine Oil Pressure Wire.

**REPLACE - Continued**

56. Continue to completely engage the rubber coupling and position the engine over the vibration mounts. Ensure that the four mounting holes on the mounting brackets align with the four vibration mounts. Install the four socket cap head bolts removed earlier and secure the mounting bracket to the vibration mounts (Figure 53). Tighten securely.

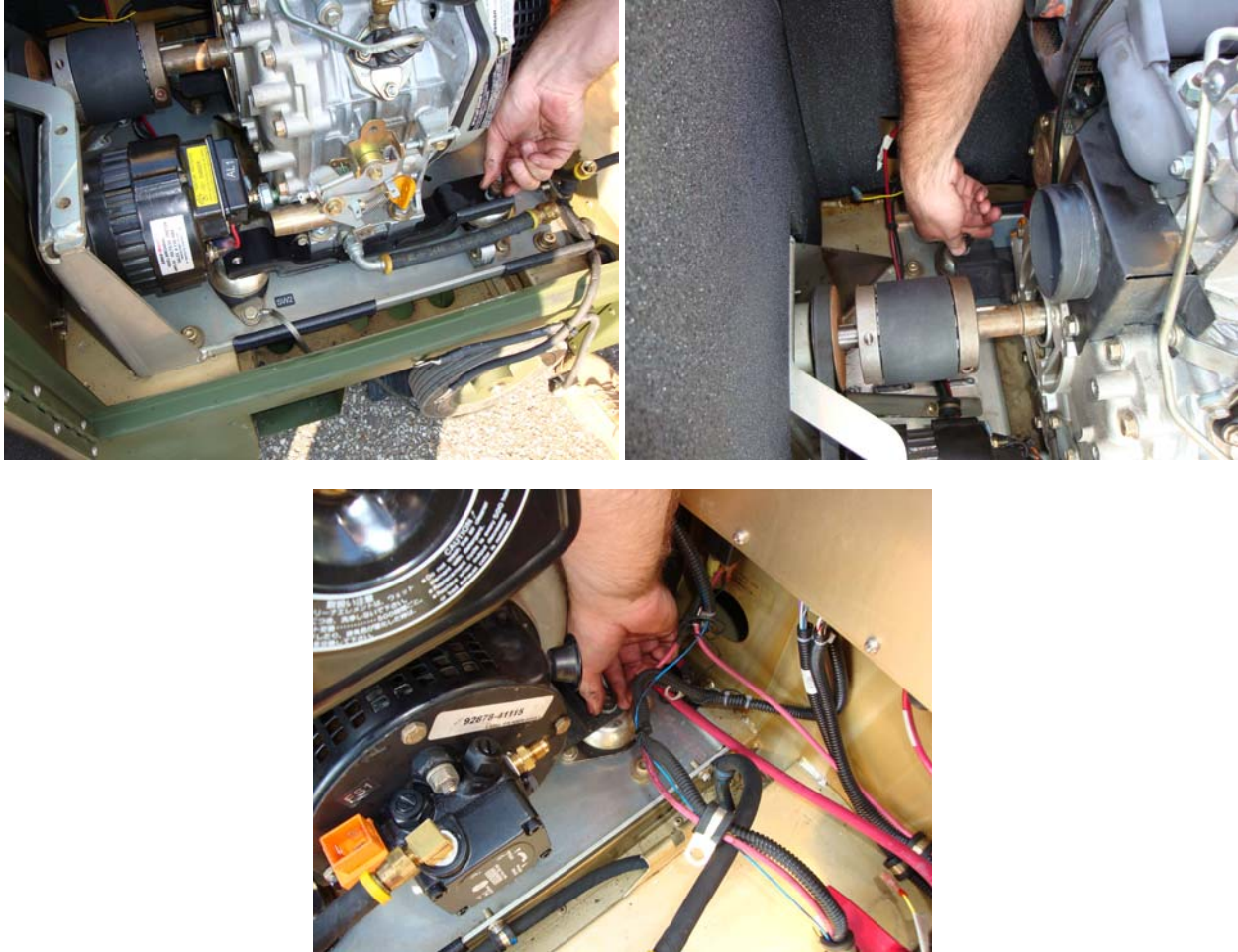


Figure 53. Securing Mounting Brackets to Vibration Mounts.

**REPLACE - Continued**

57. Install harness over the burner pump housing and attach using the two top bolts holding the burner pump housing cover to the flywheel housing. (Figure 54).

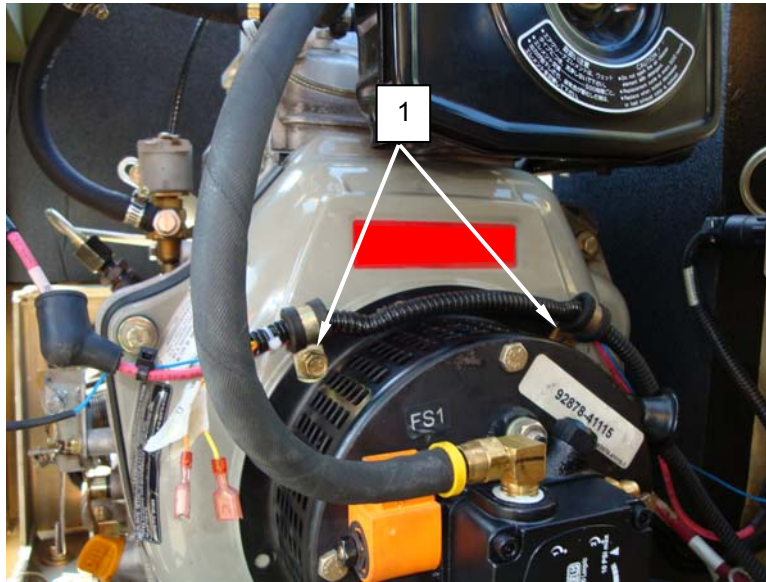


Figure 54. Install Harness Over Burner Pump Housing.

58. Install engine oil drain hose in spring clamp (Figure 55).



Figure 55. Install Engine Oil Hose in Spring Clamp.

**REPLACE - Continued**

59. Install engine head cooling air inlet hose on engine cooling air inlet box (Figure 56). Slide clamp into position and tighten securely.

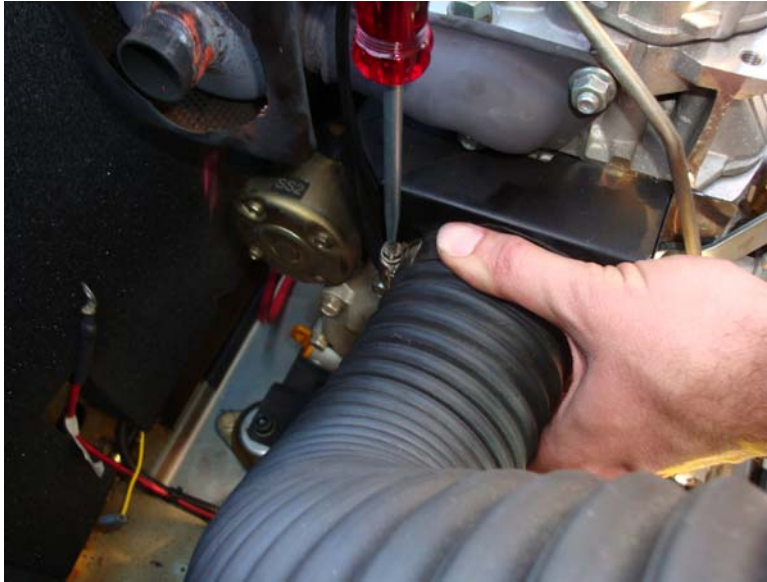


Figure 56. Install Engine Head Cooling Air Inlet Hose.

60. Connect the two fuel hoses to the burner fuel pump in the locations tagged earlier (Figure 57, Item 1 and 2).

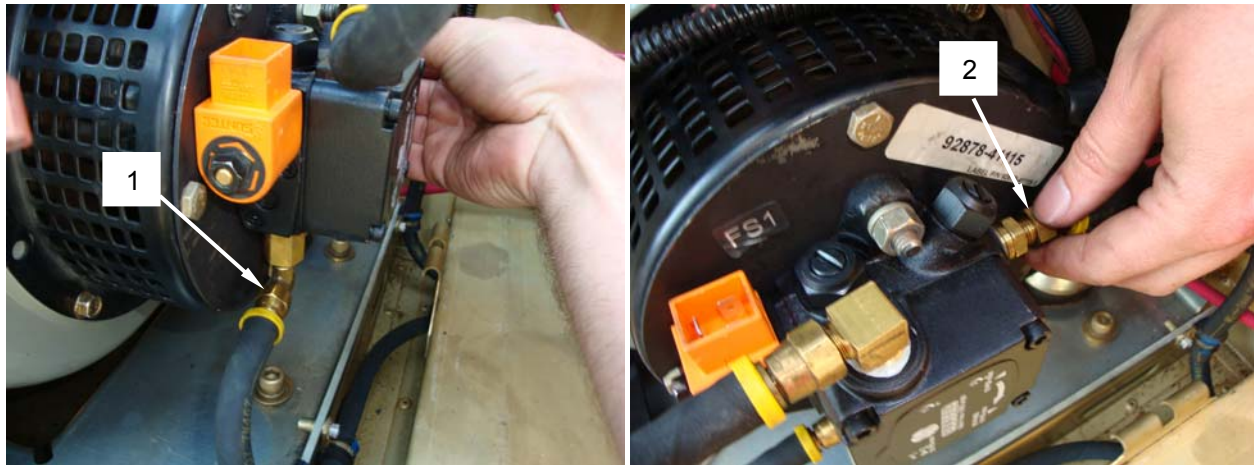


Figure 57. Connect Two Fuel Hoses to Burner Fuel Pump.

**REPLACE - Continued**

61. Connect the wire to the threaded stud labeled GP1 on the side of the engine air preheater (Figure 58, Item 1). Tighten securely. Install the dust boot (Figure 58, Item 2).



Figure 58. Install Wire to Threaded Stud Labeled GP1.

62. Install black battery cables and grounding strap onto studs mounting the engine to the engine rails. Install hex nut and washer (Figure 59). Tighten securely.



Figure 59. Install Battery Cables and Grounding Straps.



**REPLACE - Continued**

63. Install fuel line clamp (Figure 60, Item 1) of fuel hose assembly to bolt at midpoint of engine flywheel housing.

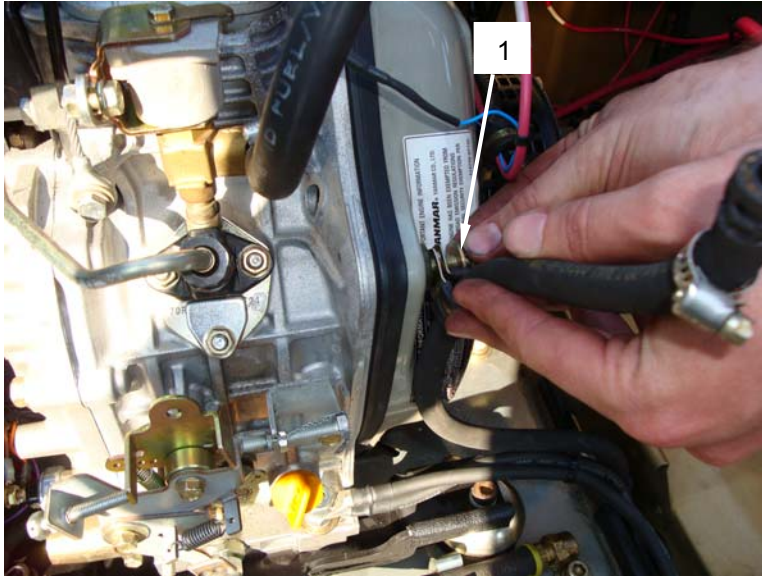


Figure 60. Install Fuel Line Clamp to Midpoint of Flywheel Housing.

64. Connect the fuel supply hose to the arm of the Tee connector and secure the clamp (Figure 61).



Figure 61. Connect Fuel Supply Hose to Arm of Tee Connector.

**REPLACE - Continued**

65. Connect wire to engine shutdown solenoid (Figure 62, Item 1) and burner fuel pump solenoid (Figure 62, Item 2) as previously tagged.

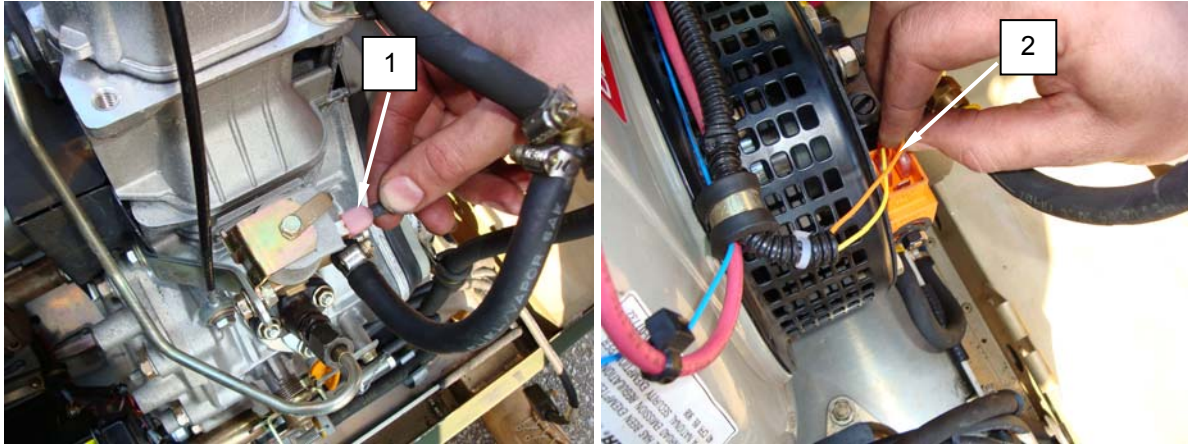


Figure 62. Connect Wires to Engine Shutdown and Burner Fuel Pump Solenoid.

66. Connect the two wires to starter solenoid (Figure 63). Remove markings and tags placed earlier.



Figure 63. Connect Wires to Starter Solenoid.

**REPLACE - Continued****NOTE**

A new flexible exhaust tube must be installed each time the diesel engine is removed from the heater.

67. Connect a new flexible exhaust tube to the engine muffler and to the bulkhead fitting on the wall of the heat exchanger compartment. Install clamps set aside earlier or new clamps as required (Figure 64). Tighten securely.



Figure 64. Install New Flexible Exhaust Tube.

68. Position the battery farthest from the engine access door opening onto the battery tray with the positive terminal facing the main control box (Figure 65).



Figure 65. Install Battery Farthest from Access Door.

**REPLACE - Continued**

69. Install the positive terminal of the battery farthest from the engine access door opening and secure the terminal by tightening the terminal nut (Figure 66).



Figure 66. Install Positive Battery Terminal of Battery Farthest from Access Door.

70. Install the battery hold-down bracket that extends over the top of the battery.
71. Install the wingnuts and lockwashers that secure the battery T-bar on the battery farthest from the engine access door opening (Figure 67).

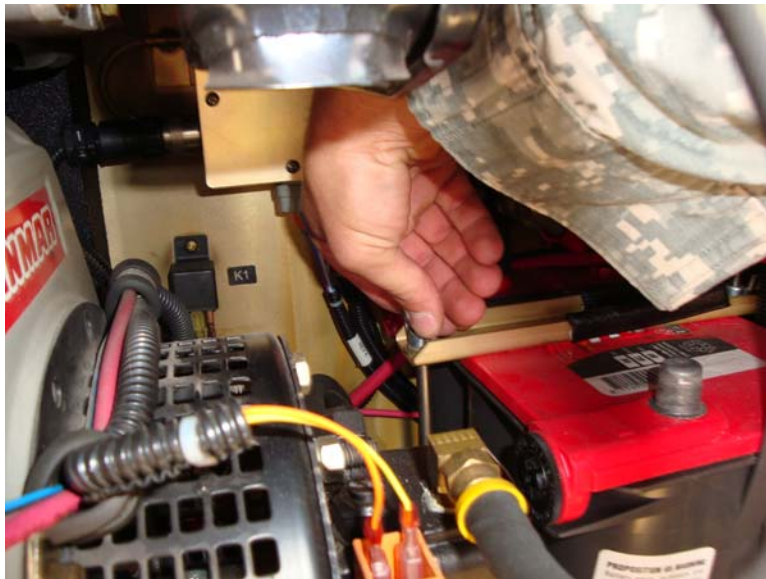


Figure 67. Install Battery Hold-down Bracket and Secure with Hardware.

**REPLACE - Continued**

72. Position the second battery closest to the engine access door opening ensuring that the negative terminal is closest to the door opening (Figure 68).



Figure 68. Install Battery Closest to Access Door.

73. Install the battery hold-down bracket that extends over the top of the battery (Figure 69).



Figure 69. Install Battery Hold-down Bracket on Battery Farthest from Access Door.

**REPLACE - Continued**

74. Install the wingnuts and lockwashers that secure the battery T-bar on the battery closest to the engine access door opening (Figure 70).



Figure 70. Secure Battery Hold-down Bracket with Hardware.

75. Install the terminals of the jumper cable connecting the two batteries ensuring that the red terminal is mounted to the positive battery terminal and the black terminal is mounted to the negative battery terminal (Figure 71).



Figure 71. Install Jumper Cable Between Batteries.

**REPLACE - Continued**

76. Install the negative terminal of the final cable on the battery closest to the engine access door opening. Tighten the terminal nut securely (Figure 72).



Figure 72. Install Negative Terminal on Battery Closest to Access Door.

77. Install top engine compartment cover (Figure 73, Item 1) by installing eighteen hex head bolts and lockwashers (Figure 73, Item 2) set aside earlier.

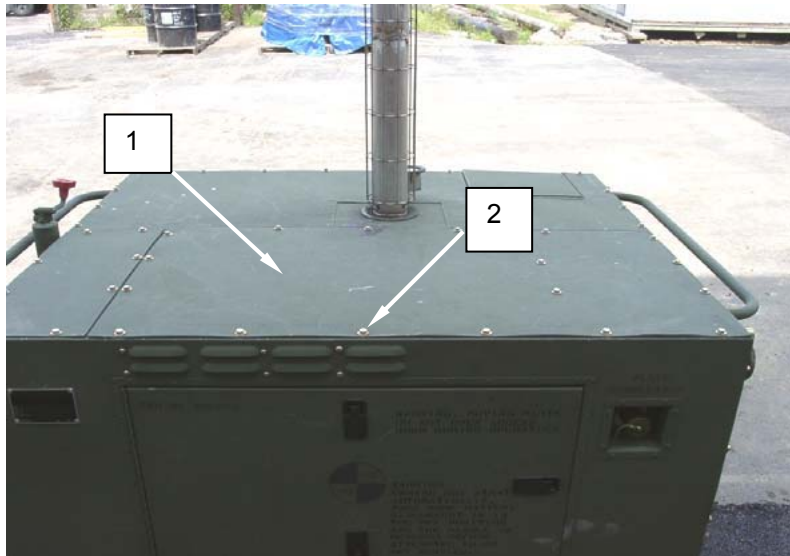


Figure 73. Install Top Engine Compartment Cover.

**REPLACE - Continued****NOTE**

“Walk” is defined as a side-to-side movement of the rubber coupling as the diesel engine runs.

78. Operate the heater for one hour. Check for “walk” on the right side of the coupling assembly. Check the torque on the hex head cap screw and verify that it is still between 264 and 300 inch-pounds. Re-torque as required.

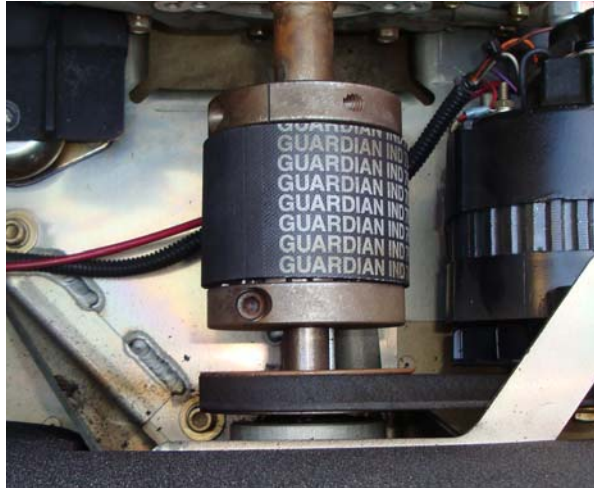


Figure 74. Install Top Engine Compartment Cover.

**END OF TASK**

**END OF WORK PACKAGE**



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**FIELD MAINTENANCE****CYLINDER HEAD  
REMOVE, SERVICE, INSPECT, INSTALL, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17 or Item 18)  
Caliper, Digital Display (WP 0124, Item 2)  
Tool, Spring Compression (WP 0124, Item 15)

**Materials/Parts**

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11, or 12) (Oil selection dependent on temperature; refer to WP 0002 for details)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)  
Brush, Wire, Scratch (WP 0123, Item 4)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Engine removed from heater (WP 0081).  
Air cleaner removed (WP 0058).  
Fuel injector removed (WP 0060).  
Rocker arm assembly removed (WP 0057).

---

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Remove muffler assembly from engine.
2. Release cylinder head (Figure 1, Item 16) from studs (Figure 1, Item 13) by removing nuts (Figure 1, Item 1, 8) and washers (Figure 1, Item 9, 17). Carefully remove cylinder head from studs and place on a clean work surface.
3. Remove and discard O-ring (Figure 1, Item 14) and cylinder head gasket (Figure 1, Item 12).
4. Compress spring (Figure 1, Item 6) using compression tool and carefully remove spring retainer (Figure 1, Item 5). Slowly release hold on compression tool to release spring tension. Remove spring.
5. Slide exhaust valve (Figure 1, Item 15) and inlet valve (Figure 1, Item 11) out of cylinder head (Figure 1, Item 16).
6. Remove valve cap (Figure 1, Item 3) and cotter assembly (Figure 1, Item 4) from inlet valve (Figure 1, Item 11).

**REMOVE - Continued****WARNING**

Valve springs are under high pressure. Be sure to wear eye protection while working with valve springs. Use caution and remove spring retainers slowly. Failure to observe this warning can cause serious injury to personnel.

7. Remove valve stem seal (Figure 1, Item 7) and washer (Figure 1, Item 2) from inlet valve.
8. Repeat steps 4 through 6 for exhaust valve (Figure 1, Item 15)
9. Remove air intake pipe studs (Figure 1, Item 10) from cylinder head (Figure 1, Item 16) only if replacement is required.

REMOVE - Continued

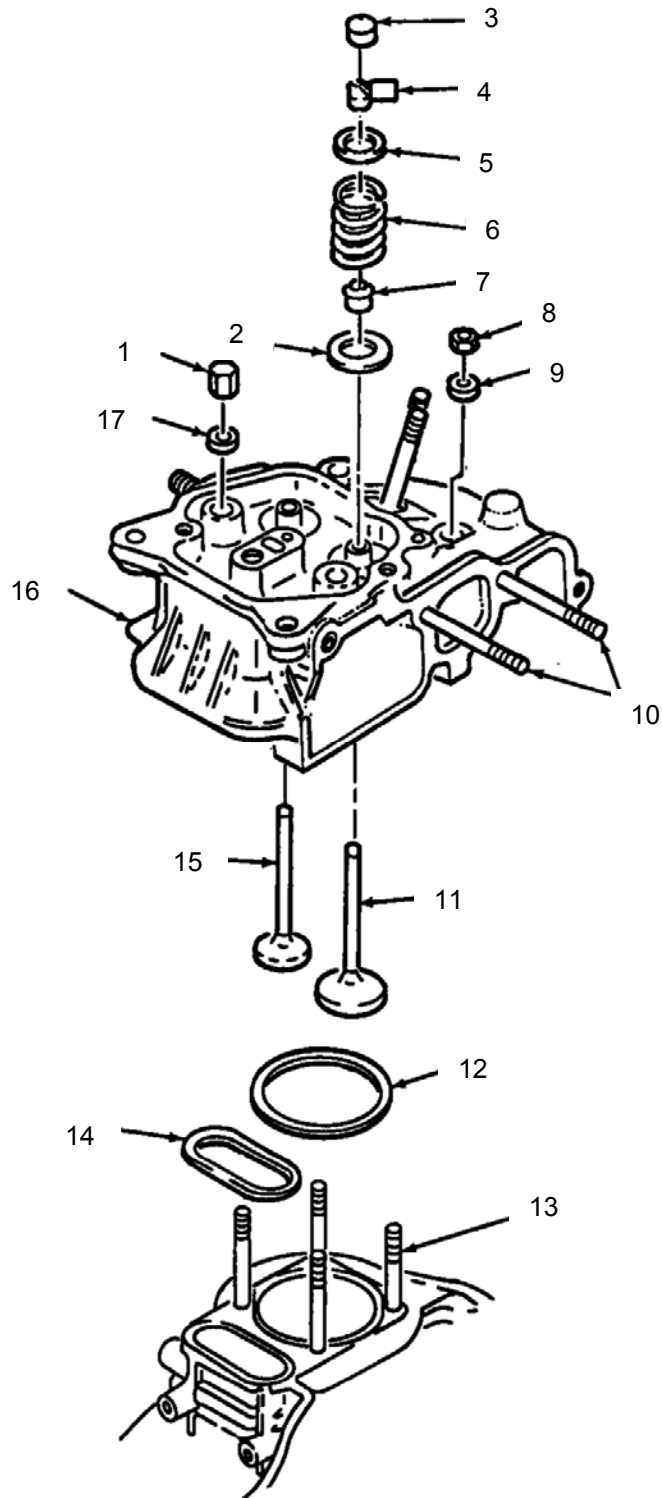


Figure 1. Remove Cylinder Head, O-Ring, Cylinder Head Gasket, Valve Cap, Cotter Assembly, Spring, Valve Stem Seal, and Air Intake Pipe Studs.

END OF TASK

**SERVICE****Clean Cylinder Head Components****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

1. Clean cylinder head components with cleaning solvent and a clean rag. Allow to air dry.
2. Remove carbon deposits from cylinder head (Figure 2, Item 1) and valves (Figure 2, Item 2, 3) using a wire brush. Use care to prevent damage to surfaces.
3. Remove all old gasket material from crankcase and cylinder head mating surfaces.

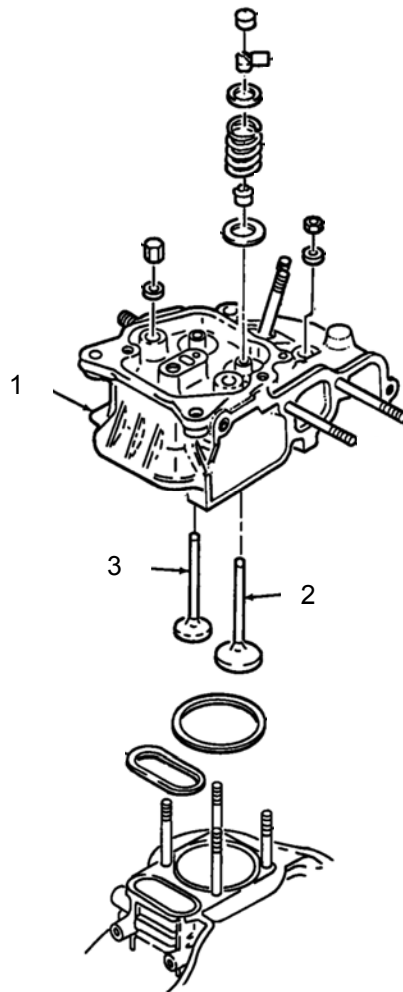


Figure 2. Service Cylinder Head Components.

**END OF TASK**

**INSPECT**

1. Inspect cylinder head (Figure 4, Item 1) for cracks and deformation. Replace cylinder head if damaged or deformed in any manner
2. Inspect stems of valves (Figure 4, Item 3, 4) for wear or distortion. Measure the outside diameter (OD) of the stems as shown. OD shall be 0.2323 inch (5.90 mm), minimum. Replace valve if stem is out of limits.
3. Measure the internal diameter (ID) of the valve guides (installed in cylinder head). ID shall be 0.2394 inch (6.08 mm), maximum. Replace cylinder head (Figure 4, Item 1) if valve guide ID is out of limits.
4. Inspect valve springs (Figure 4, Item 2) for cracks, broken sections, or deformation. Replace spring if damaged or deformed in any way.
5. Measure free length (non-compressed) of valve springs as shown. Length must be 1.240 inch (31.5 mm), minimum. Replace valve spring if less than required length.
6. Insert valves (Figure 4, Item 3, 4) into cylinder head (Figure 4, Item 1). Measure valve sinkage as shown. Sinkage shall be 0.043 inch (1.1 mm), maximum. If sinkage exceeds limit, discard valves.

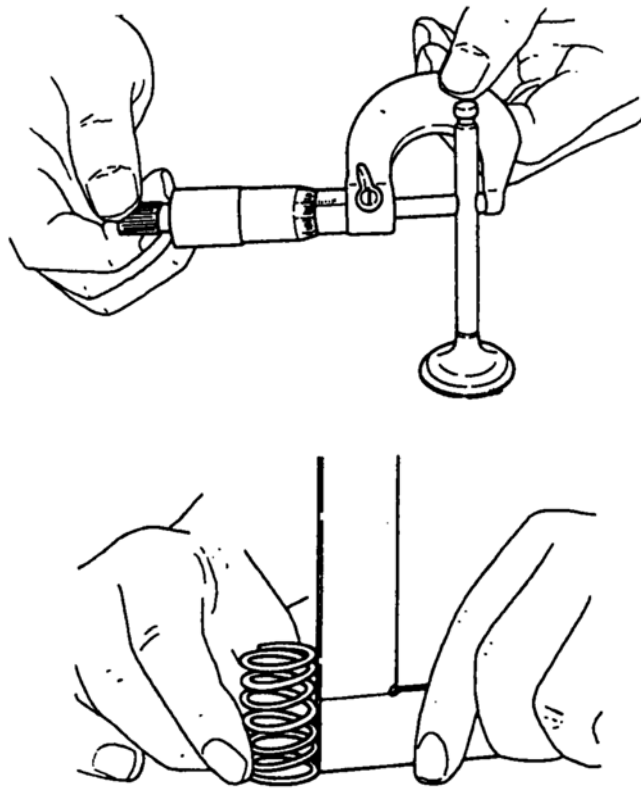


Figure 3. Measure Stems, Valves, and Springs.

INSPECT - Continued

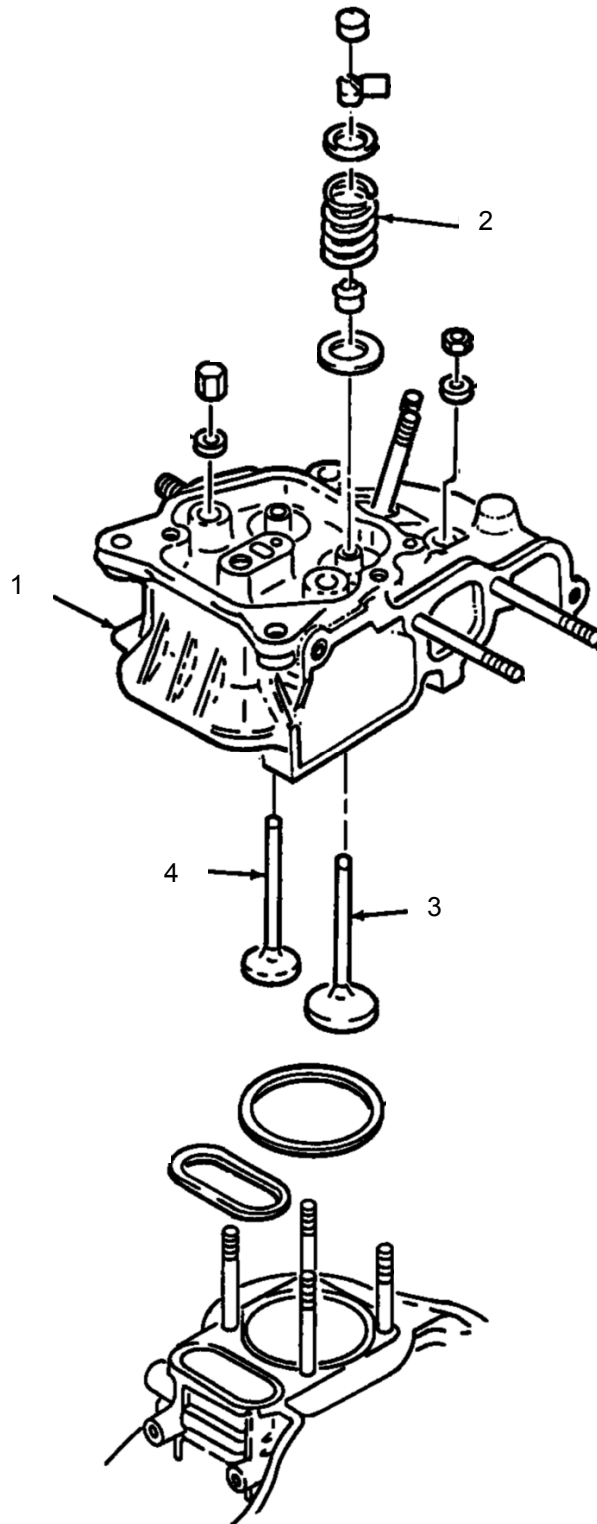


Figure 4. Inspect Stems, Valves, and Springs.

END OF TASK

**INSTALL**

1. Install air intake pipe studs (Figure 5, Item 10) into cylinder head (Figure 5, Item 16).
2. Lubricate the stems of exhaust valve (Figure 5, Item 15) and inlet valve (Figure 5, Item 11) with a light coat of lubricating oil. Slide valves into cylinder head (Figure 5, Item 16).
3. Install valve stem seal (Figure 5, Item 7) and washer (Figure 5, Item 2) onto inlet valve (Figure 5, Item 11).
4. Install and compress valve spring (Figure 5, Item 6) using compression tool. Carefully install spring retainer (Figure 5, Item 5). Slowly release hold on compression tool to release spring tension.
5. Install cotter assembly (Figure 5, Item 4) and valve cap (Figure 5, Item 3).
6. Repeat steps 3 through 5 for exhaust valve (Figure 5, Item 15).
7. Mate new O-ring (Figure 5, Item 14) and cylinder head gasket (Figure 5, Item 12) to crankcase.
8. Carefully slide cylinder head (Figure 5, Item 16) over studs (Figure 5, Item 13) and mate to crankcase.
9. Install nuts (Figure 5, Item 1, 8) and washers (Figure 5, Item 9, 17). Torque nuts in a criss-cross pattern to 157 to 182 inch-lbs. (180 to 210 kg-cm). Tighten a second time to ensure a snug fit of cylinder head to crankcase.
10. Install air cleaner (WP 0058).
11. Install fuel injector (WP 0060).
12. Install rocker arm assembly (WP 0057).

INSTALL - Continued

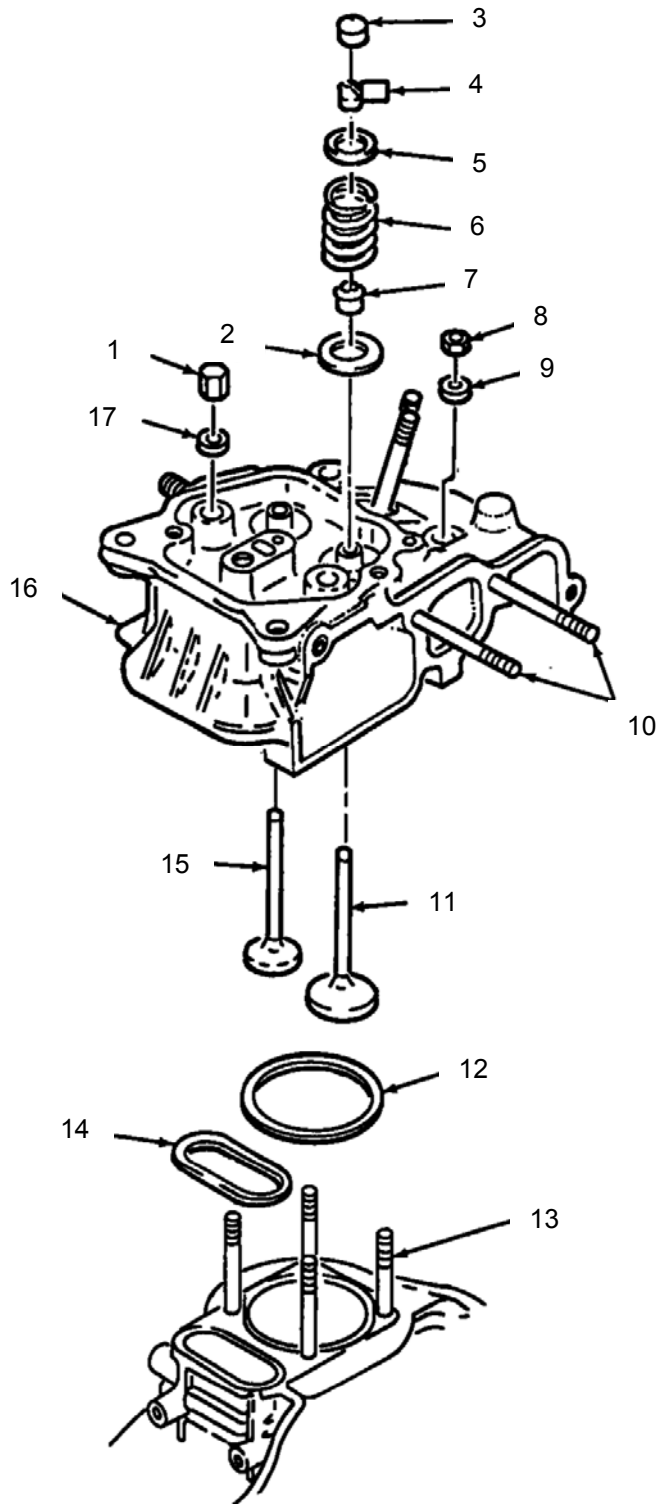


Figure 5. Install Air Intake Pipe Studs, Valves, Valve Stem Seal, Valve Spring, Cotter Assembly, and Cylinder Head.

END OF TASK



**REPAIR**

The repair of the cylinder involves replacement of one or more subcomponents.

**END OF TASK**

**END OF WORK PACKAGE**



## FIELD MAINTENANCE

OIL PUMP  
REMOVE, INSPECT, INSTALL, REPAIR

## INITIAL SETUP:

## Tools and Special Tools

Tool Kit, General Mechanics (WP 0124, Item 13)  
Caliper, Digital Display (WP 0124, Item 2)

## Personnel Required

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

## Materials/Parts

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11,  
or 12) (Oil selection dependent on temperature,  
refer to WP 0002 for details)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)  
Grease, General Purpose (WP 0123, Item 7)

## Equipment Condition

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Engine oil drained (WP 0054).  
Engine removed from heater (WP 0081).

## References

WP 0052, WP 0051

## NOTE

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

## REMOVE

## CAUTION

When removing crankcase cover, be careful not to damage oil seal.

1. Release crankcase cover from cylinder block and remove cover gasket IAW WP 0052. Discard gasket if damaged or deformed.
2. Remove oil pump cover (Figure 1, Item 1) from crankcase cover (Figure 1, Item 2) by removing three screws (Figure 1, Item 4). Remove and discard O-ring (Figure 1, Item 3).

## REMOVE - Continued

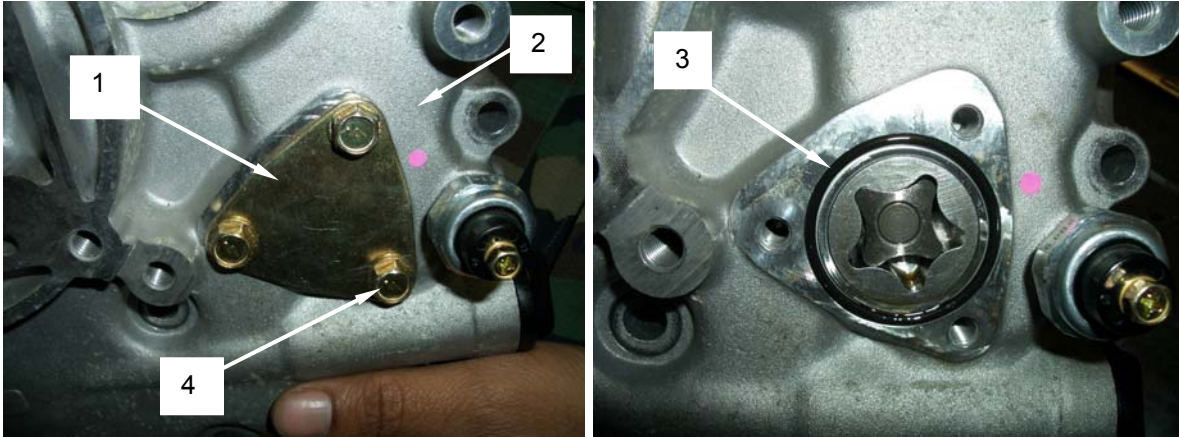


Figure 1. Remove Oil Pump.

3. Remove the two arms (Figure 1, Item 5) of the governor assembly (Figure 1, Item 10) by removing two pins (Figure 1, Item 7).
4. Remove cap (Figure 1, Item 6) on end of shaft (Figure 1, Item 9).
5. Remove governor assembly (Figure 1, Item 10) by pulling from shaft (Figure 1, Item 9).
6. Remove pin (Figure 1, Item 8) that extends through shaft (Figure 1, Item 9).
7. Slide oil pump assembly (Figure 1, Item 13) out through front of crankcase cover (Figure 1, Item 11). Remove outer rotor (Figure 1, Item 12). Discard governor assembly (Figure 1, Item 10) and cap (Figure 1, Item 6).

REMOVE - Continued

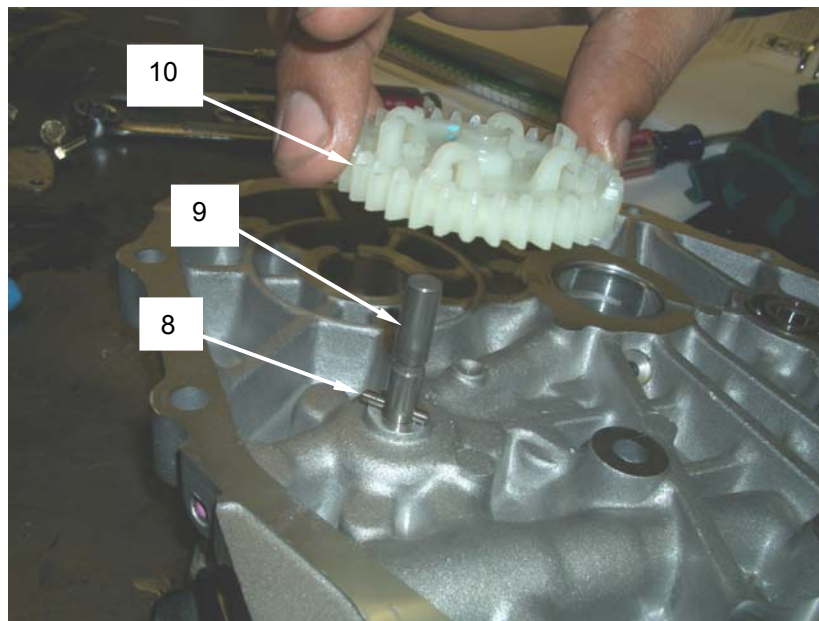
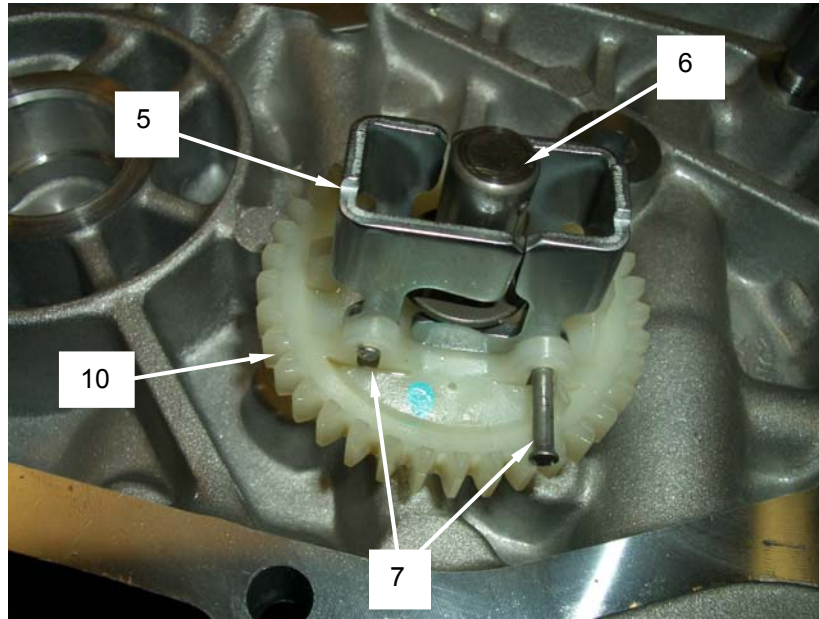


Figure 2. Remove Oil Pump (Sheet 1 of 2).

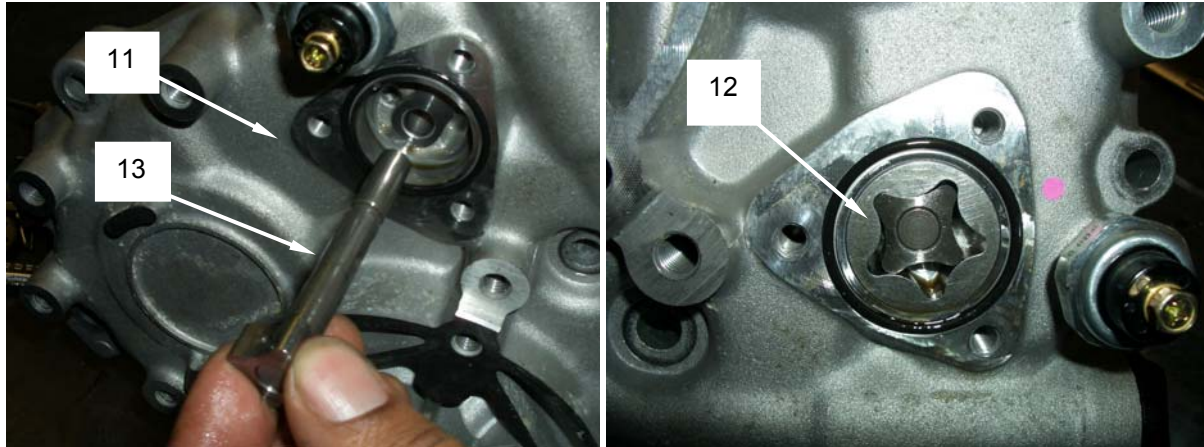
**REMOVE - Continued**

Figure 2. Remove Oil Pump (Sheet 2 of 2).

**WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

**INSPECT**

1. Inspect crankcase cover (Figure 1, Item 1) for cracks, deformation, or obvious damage. Inspect mating surfaces for scratches, burrs, or blemishes. Replace cover if damaged.
2. Inspect cover gasket for damage or deformation. Replace if damaged in any way.
3. Inspect outer rotor (Figure 1, Item 2) and inner rotor portion (Figure 1, Item 3) of oil pump (Figure 1, Item 4) for signs of excessive or uneven wear. Fit inner rotor into outer rotor and measure gap at various points. Gap between inner and outer rotors must not exceed 0.0098 inch (0.25 mm). Replace outer rotor (Figure 1, Item 2) and oil pump (Figure 1, Item 4) as an assembly if excessively worn, damaged, or out of limits.
4. Measure the outside diameter (OD) of outer rotor (Figure 1, Item 2). OD must be 1.1378 inches (28.90 mm), minimum. Replace outer rotor (Figure 1, Item 2) and oil pump (Figure 1, Item 4) as an assembly if out of limits.
5. Measure the internal diameter (ID) of outer rotor port in crankcase cover (Figure 1, Item 1). ID must not exceed 1.1488 inches (29.18 mm). Replace crankcase cover (Figure 1, Item 1) if out of limits.

**INSPECT - Continued**



Figure 3. Inspect Oil Pump.

**INSTALL**

1. Insert oil pump (Figure 1, Item 5) into crankcase cover (Figure 1, Item 1) and install pin (Figure 1, Item 9) through shaft (Figure 1, Item 10). Coat oil pump inner rotor (Figure 1, Item 3) with oil, and install outer rotor (Figure 1, Item 2).
2. Coat new O-ring (Figure 1, Item 4) with oil and install into crankcase cover (Figure 1, Item 1). Install oil pump cover (Figure 1, Item 6) using three screws (Figure 1, Item 8).
3. Install new governor assembly (Figure 1, Item 11) and cap (Figure 1, Item 13) onto shaft (Figure 1, Item 10).
4. Install the two arms (Figure 1, Item 12) of the governor assembly (Figure 1, Item 11) by installing two pins (Figure 1, Item 14).
5. Apply grease to lips of crankshaft oil seal (installed in crankcase cover (Figure 1, Item 1)).
6. Apply oil to crankshaft and camshaft. Make sure that oil pump drive gears are properly engaged.
7. Mate cover gasket to cylinder block.
8. Install crankcase cover (Figure 1, Item 1) and gasket IAW WP 0052.
9. Service engine oil IAW WP 0051.

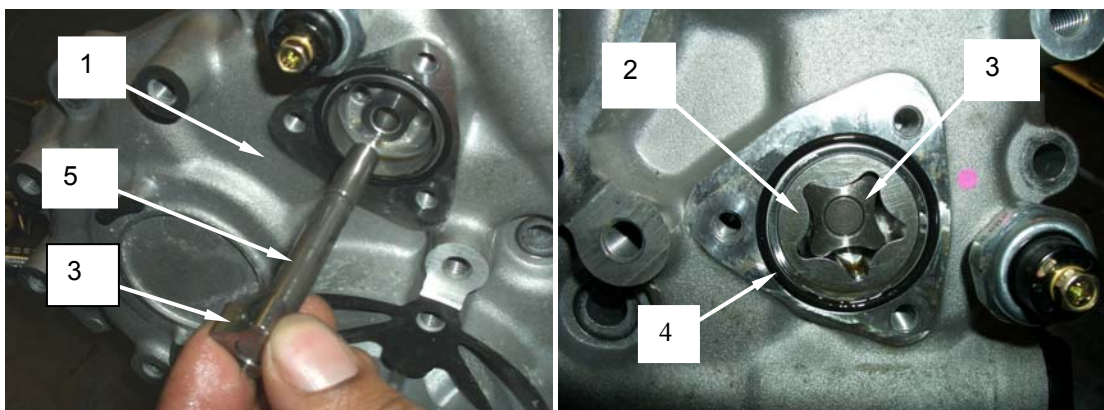


Figure 4. Install Oil Pump (Sheet 1 of 3).

INSTALL - Continued

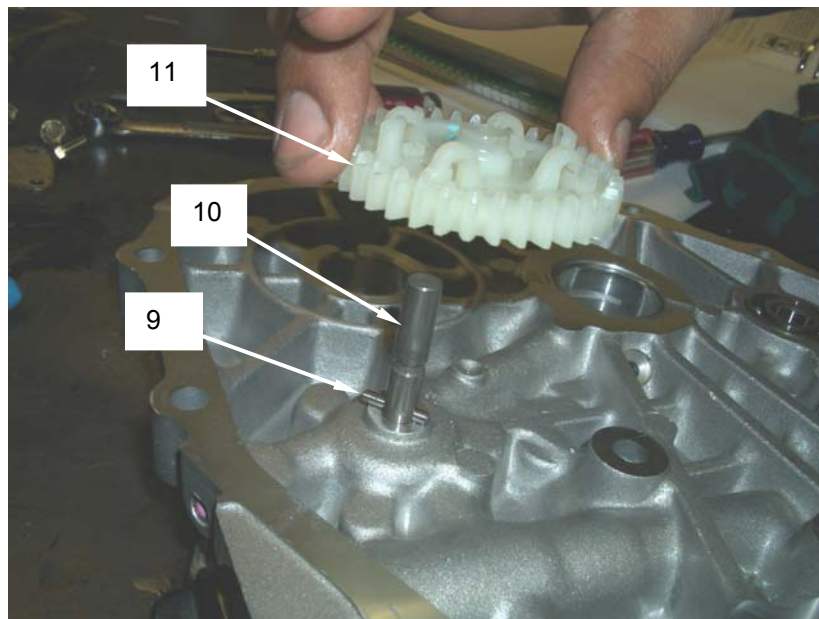
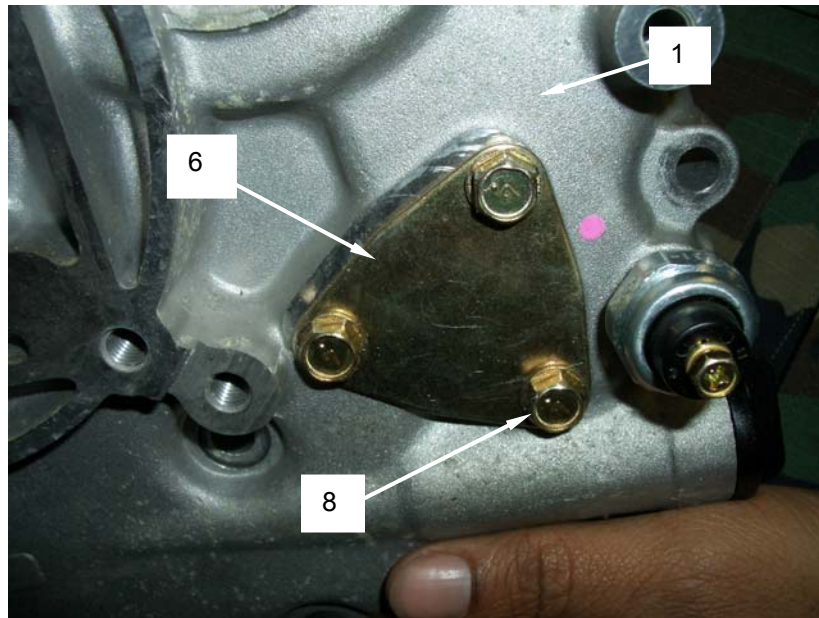


Figure 4. Install Oil Pump (Sheet 2 of 3).



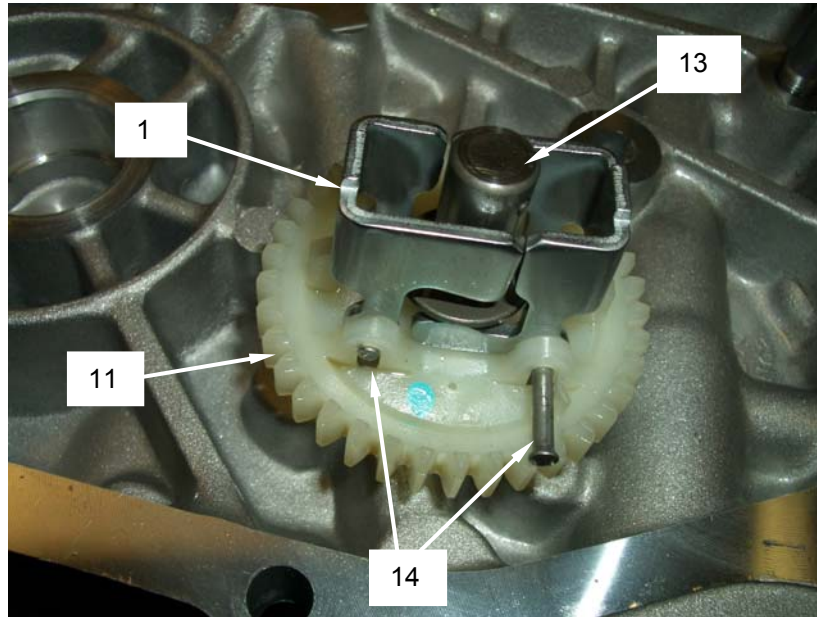
**INSTALL - Continued**

Figure 4. Install Oil Pump (Sheet 3 of 3).

**END OF TASK****REPAIR**

The repair of the oil pump involves replacement of one or more subcomponents. Inspect each component for serviceability as it is disassembled. Replace defective or worn components as necessary.

**END OF TASK****END OF WORK PACKAGE**



## FIELD MAINTENANCE

ROCKER ARM ASSEMBLY  
REMOVE, INSPECT, INSTALL, REPAIR

## INITIAL SETUP:

## Tools and Special Tools

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 18)  
Caliper, Digital Display (WP 0124, Item 2)

## Personnel Required

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

## Materials/Parts

Rags, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)

## Equipment Condition

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Engine removed from heater (WP 0081).  
Rocker cover removed (WP 0053).

## NOTE

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

## REMOVE

1. Remove rocker arm support (Figure 1, Item 4) from cylinder head (Figure 1, Item 10) by removing two bolts (Figure 1, Item 3). Place assembled support and rocker arms on a clean work surface for further disassembly.
2. Remove rocker arms (Figure 1, Item 5 and 8) from rocker arm support (Figure 1, Item 4). Remove lock nuts (Figure 1, Item 1), adjusting screws (Figure 1, Item 2), and valve cap (Figure 1, Item 6).
3. Ensure that intake and exhaust valve components (Figure 1, Item 7) remain together.

## Clean Rocker Arm Assembly

## WARNING



Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean rocker arm components with cleaning solvent and a clean rag. Allow to air dry.

**INSPECT**

1. Measure the outside diameter (OD) of the rocker arm support shaft (Figure 1, Item 9) (Figure 2). OD must be 0.4685 inch (11.90 mm), minimum. Replace support (Figure 1, Item 4) if out of limits.
2. Measure the internal diameter (ID) of the rocker arms. ID must be 0.4764 in (12.10 mm), maximum. Replace rocker arm (Figure 1, Item 5 and 8) if out of limits.

**INSTALL**

1. Install lock nuts (Figure 1, Item 1) and adjusting screws (Figure 1, Item 2) onto rocker arms (Figure 1, Item 5 and 8). Install valve caps (Figure 1, Item 6). Install rocker arms onto rocker arm support (Figure 1, Item 4).
2. Install rocker arm support (Figure 1, Item 4) onto cylinder head (Figure 1, Item 10) using two bolts (Figure 1, Item 3). Torque bolts to 174 to 199 inch-pounds. (200 to 230 kg-cm).
3. Adjust valve clearance IAW WP 0053.
4. Install rocker cover IAW WP 0053.

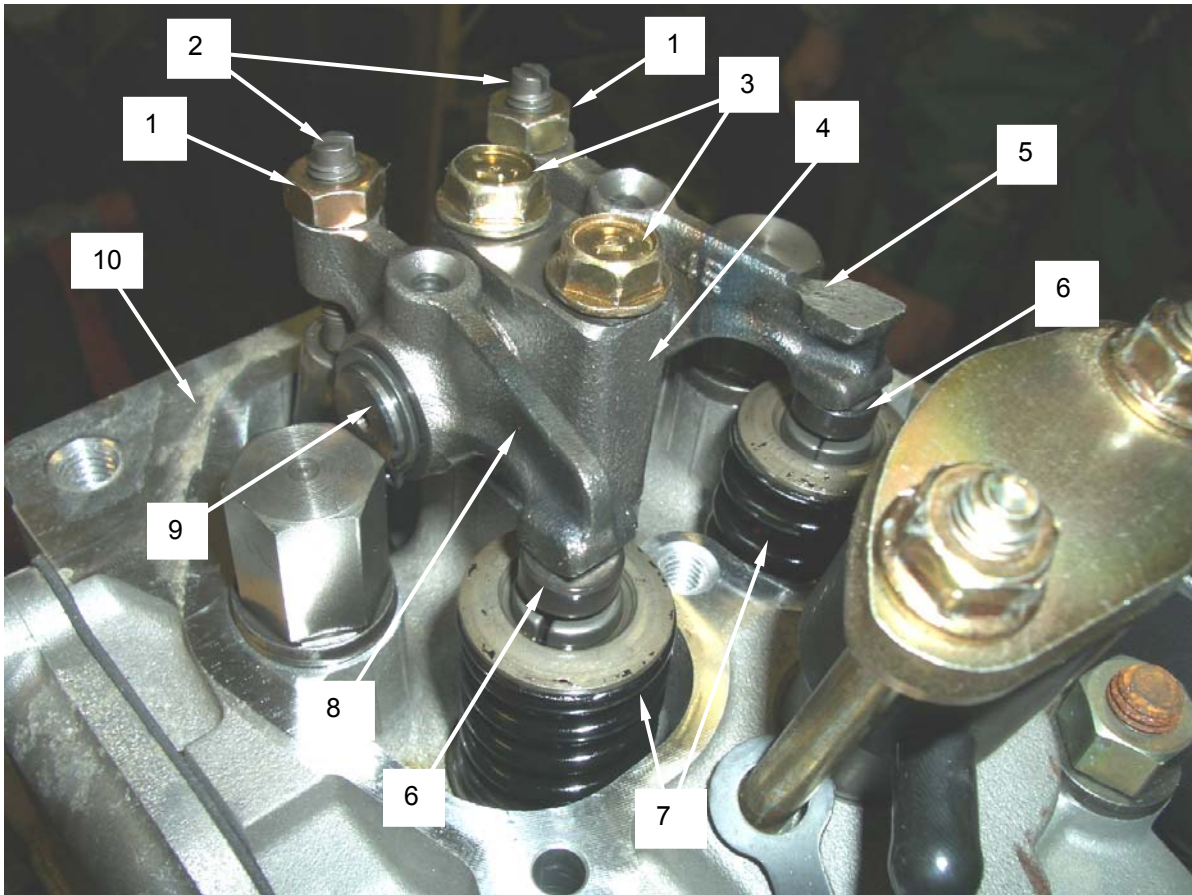
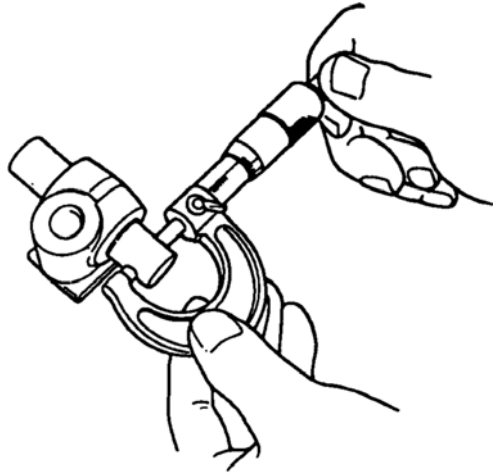


Figure 1. Remove, Inspect, and Install Rocker Arm Assembly.

**INSTALL - Continued**

Measuring outside diameter of rocker arm support shaft.



Measuring internal diameter of rocker arms.

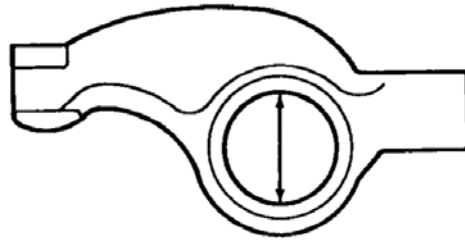


Figure 2. Measure Rocker Arm Assembly.

**END OF TASK****REPAIR**

The repair of the rocker arm assembly involves replacement of one or more subcomponents.

**END OF TASK****END OF WORK PACKAGE**



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**FIELD MAINTENANCE****FUEL INJECTION PUMP ASSEMBLY  
REMOVE, INSPECT, INSTALL, ADJUST**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 18)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11,  
or 12) (Oil selection dependent on temperature,  
refer to WP 0002 for details)  
Rags, Wiping (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)  
Shim Pack (WP 0123, Item 19)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

**References**

WP 0058

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**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Disconnect rigid fuel line (Figure 1, Item 3) and fuel hose (Figure 1, Item 2) from fuel injection pump (Figure 1, Item 1).
2. Remove nut (Figure 1, Item 8), inspection cover (Figure 1, Item 4), and gasket (Figure 1, Item 9) from lower pump stud (Figure 1, Item 5).
3. Remove fuel injection pump (Figure 1, Item 1) from upper pump studs (Figure 1, Item 11) by removing two nuts (Figure 1, Item 10). Remove shim(s) (Figure 1, Item 7). Note number of shims utilized.
4. Remove fuel tappet (Figure 1, Item 6) from engine crankcase.

REMOVE - Continued

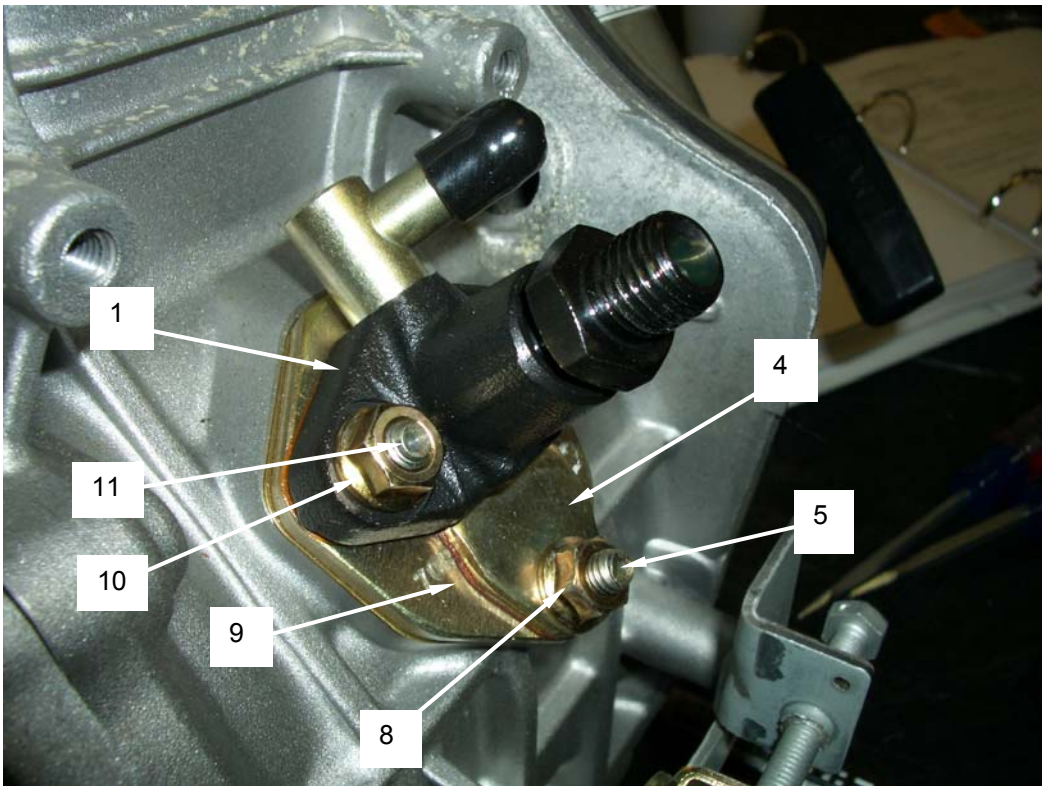
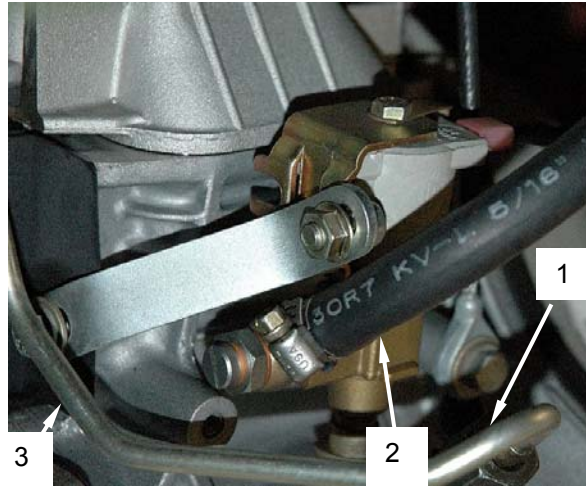


Figure 1. Remove Fuel Injection Pump (Sheet 1 of 2).



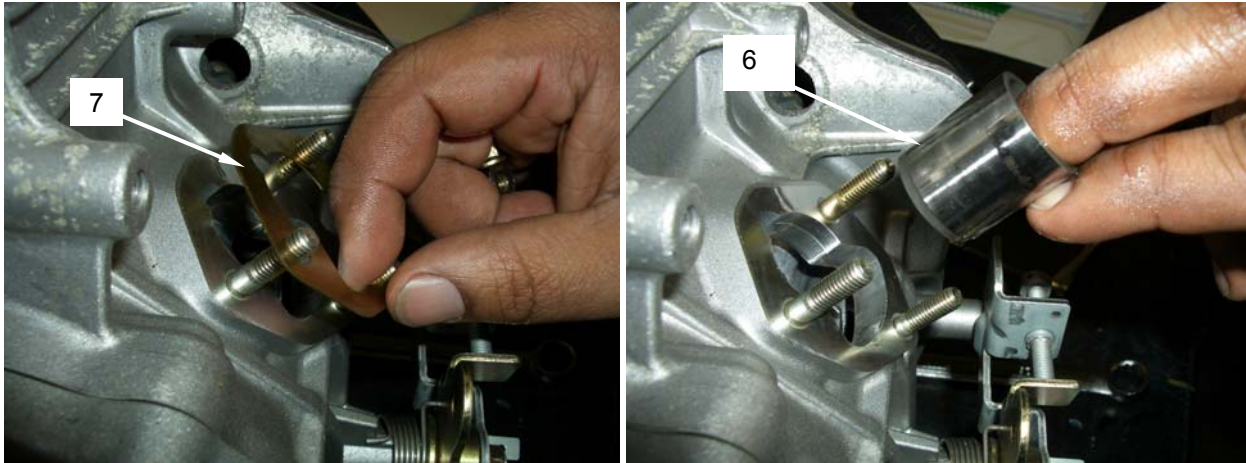
**REMOVE - Continued**

Figure 1. Remove Fuel Injection Pump (Sheet 2 of 2).

**END OF TASK**

## Clean Components

### WARNING



Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

### END OF TASK

### INSPECT

1. Inspect rigid fuel line (Figure 2, Item 1) and fuel hose (Figure 2, Item 2) for cracks, kinks, and leaks. Inspect injection pump (Figure 2, Item 3) for crossed, stripped, or damaged threads. Replace if damaged.
2. Inspect fuel tappet (Figure 2, Item 4) for scores, pitting, or wear. Replace if damaged or worn.

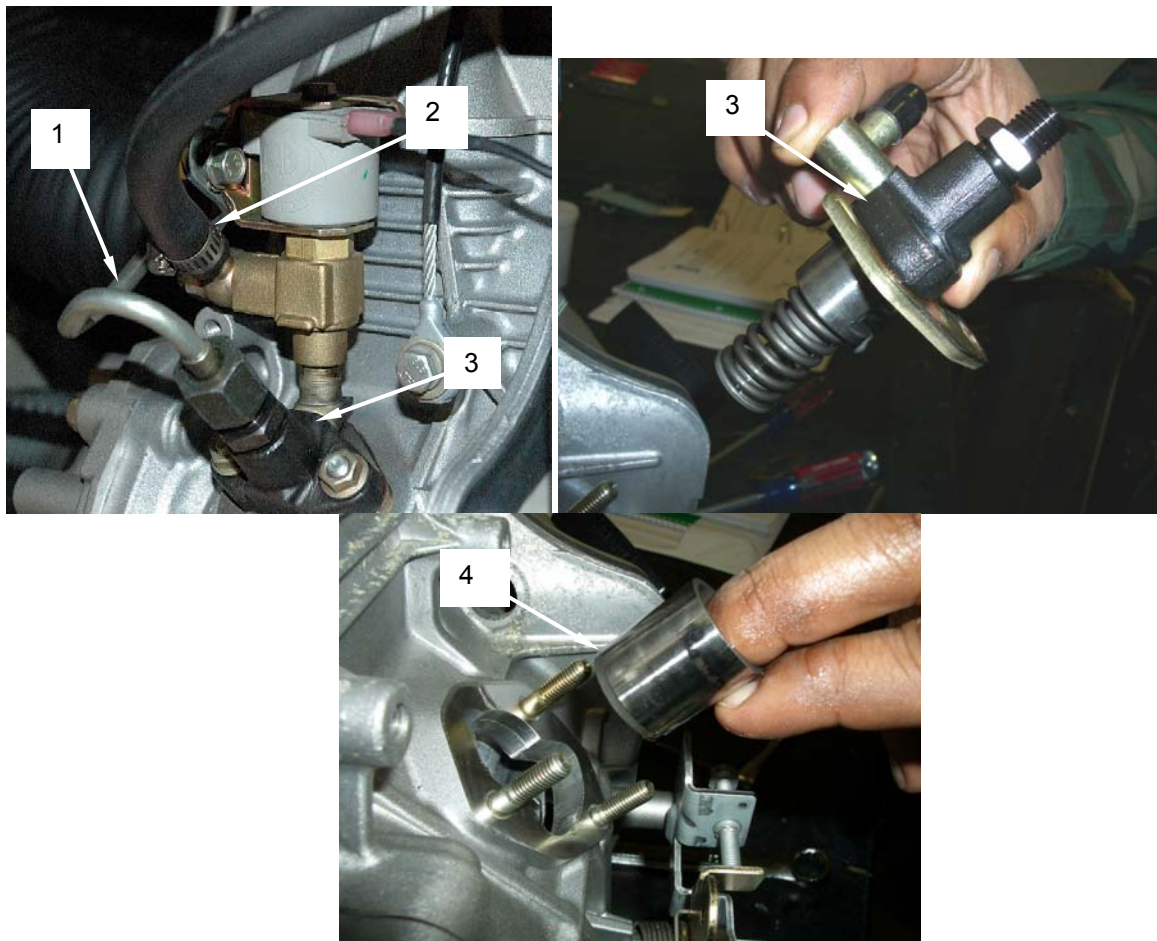


Figure 2. Inspect Fuel Injection Pump.

### END OF TASK

**INSTALL**

1. Install fuel tappet (Figure 3, Item 2) into engine crankcase.
2. Install shim(s) (Figure 3, Item 1) onto injection pump studs (Figure 3, Item 5, 7, and 8).
3. Install injection pump (Figure 3, Item 3) onto upper studs (Figure 3, Item 5), aligning tooth (Figure 3, Item 4) on control lever with slot on governor lever (Figure 3, Item 11). Governor lever must be set so slot is in the center of opening in housing. Install nuts (Figure 3, Item 10) and tighten to 87 to 104 inch-pounds (100 to 120 kg-cm).
4. Install gasket (Figure 3, Item 9), cover (Figure 3, Item 6), and nut (Figure 3, Item 8) on lower stud (Figure 3, Item 7). Torque to 87 to 104 inch-pounds (100 to 120 kg-cm).

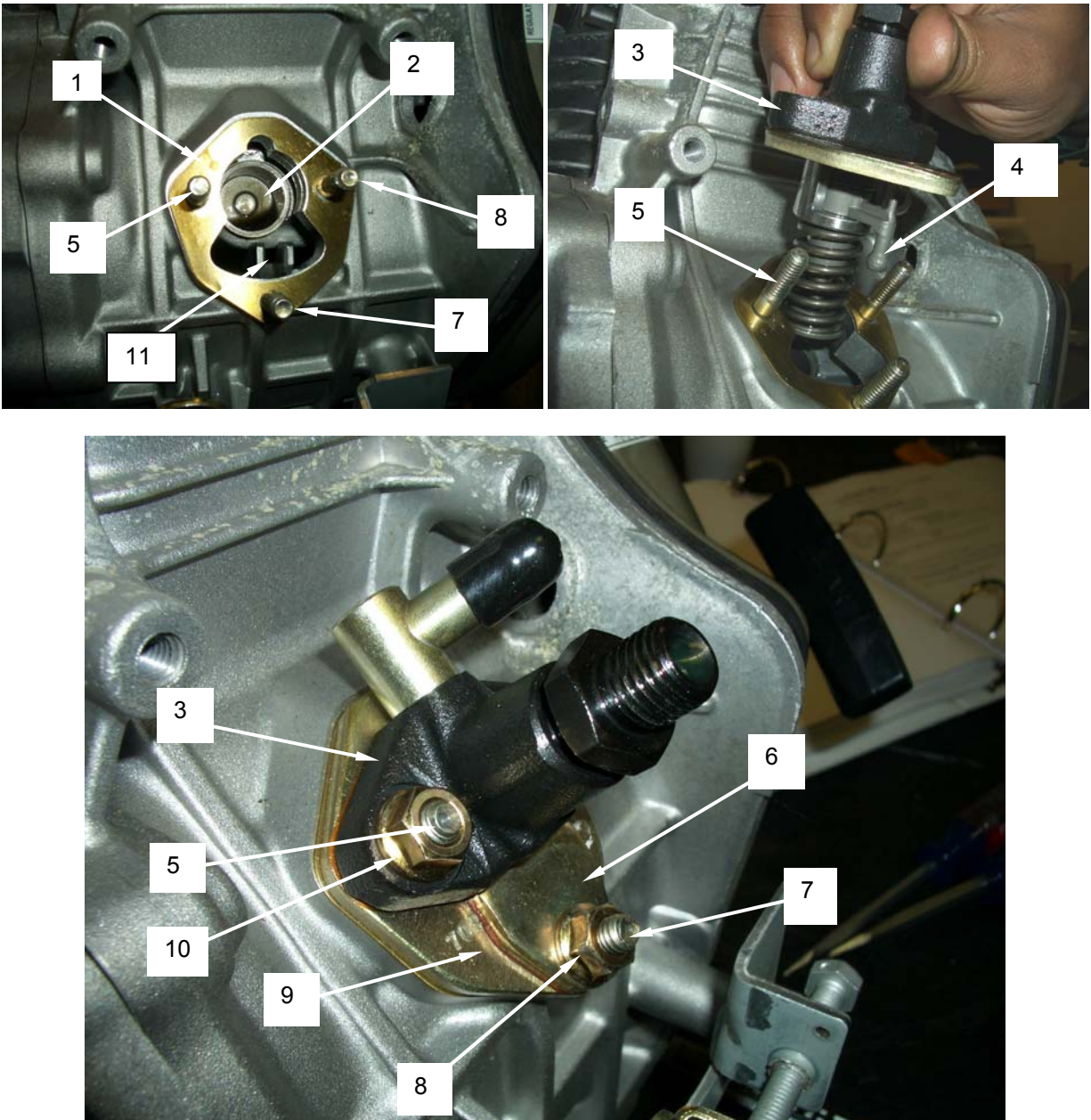


Figure 3. Install Fuel Injection Pump.

**END OF TASK**

---

**ADJUST**

Adjust fuel injection timing in accordance with section of this work package entitled "FUEL INJECTION TIMING ADJUSTMENT" before connecting rigid fuel pipe (Figure 4, Item 3) and fuel hose (Figure 4, Item 4) to injection pump (Figure 4, Item 5).

**Fuel Injection Timing Adjustment**

1. Remove flywheel housing (WP 0058). Disconnect rigid fuel pipe (Figure 4, Item 3) and fuel hose (Figure 4, Item 4) from injection pump (Figure 4, Item 5) if not removed earlier.
2. Rotate flywheel one revolution in the clockwise direction until T position mark (Figure 4, Item 2) on flywheel matches V mark (Figure 4, Item 1) off line on cylinder body fin. This is the top dead center (TDC) position. There should be some fuel coming out of the fuel injection pump. If fuel is not present, rotate the flywheel another revolution clockwise.
3. Turn flywheel counter-clockwise about 30 degrees from T position mark.
4. Slowly turn flywheel clockwise until fuel flows from injection pump, then stop rotation.
5. Use timing marks on flywheel to determine flywheel position. Marks are 5 degrees apart. Flywheel should be 16 to 18 degrees before TDC position. Therefore, the V mark off line should be aligned between the third and fourth flywheel timing marks before the TDC position mark.
6. Repeat steps 4 through 6 two or three times to make sure reading is accurate. Fuel injection should begin when flywheel is rotated 16 to 18 degrees from TDC position mark.
7. Injection timing can be adjusted by adding or removing injection pump shims (Figure 4, Item 6). If fuel is injected before a 16 degree rotation, add shims. If fuel is not injected until after an 18-degree rotation, subtract shims. Each 0.1 mm (0.0039 inch) shim changes timing by 1 degree.
8. Add or subtract shims (Figure 4, Item 6) as required and retest to ensure proper timing. Install rigid fuel pipe (Figure 4, Item 3) and fuel hose (Figure 4, Item 4) onto injection pump (Figure 4, Item 5). Install flywheel housing (WP 0058).

ADJUST - Continued

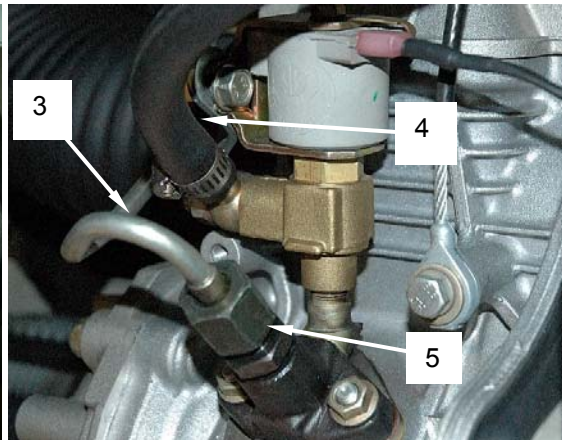
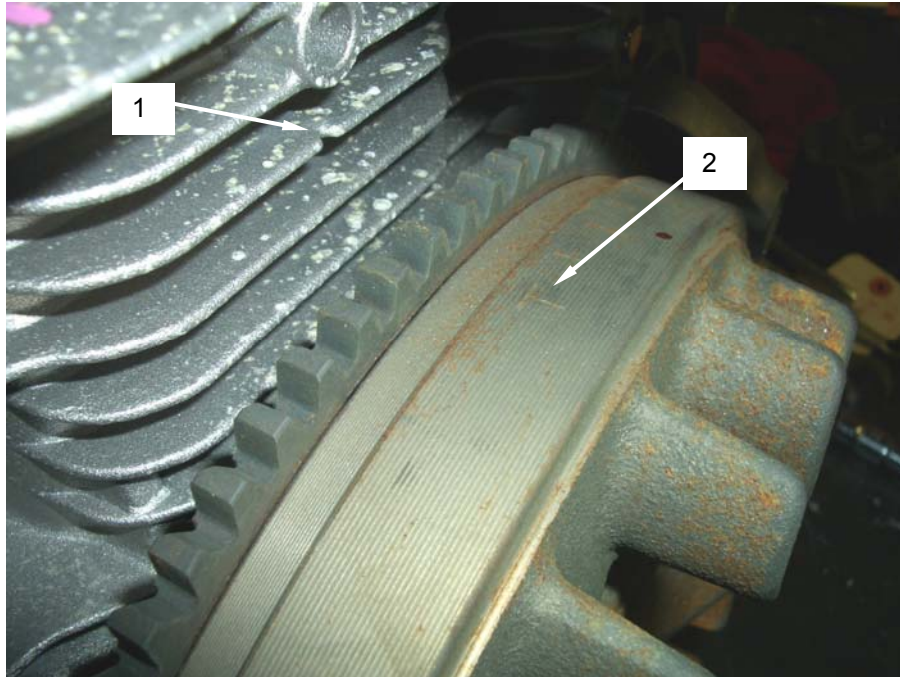


Figure 4. Fuel Injection Timing Adjustment.

END OF TASK

END OF WORK PACKAGE



## FIELD MAINTENANCE

GOVERNOR CONTROL  
REMOVE, INSPECT, INSTALL

## INITIAL SETUP:

## Tools and Special Tools

Tool Kit, General Mechanics (WP 0124, Item 13)

## Materials/Parts

Solvent, Degreasing (WP 0123, Item 20)

Rags, Wiping (WP 0123, Item 15)

Marker, Permanent (WP 0123, Item 13)

## Personnel Required

Quartermaster and Chemical Equipment Repairer  
63J (1) or

Utilities Equipment Repairer 52C (1)

## Equipment Condition

Heater shut down and cool (WP 0005).

Engine access door open.

Main battery switch OFF and handle removed.

## NOTE

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

## REMOVE

## CAUTION

Governor lever (Figure 1, Item 9) and torque spring are factory preset. Do not adjust locking nut or cut lockwire.

1. Remove adjusting screw (Figure 1, Item 1) and nut (Figure 1, Item 2) and set bolt (Figure 1, Item 10) from stop lever (Figure 1, Item 5).
2. Mark position of springs (Figure 1, Item 7, 13) and disconnect springs (Figure 1, Item 7,13) from governor lever (Figure 1, Item 9) and stop lever (Figure 1, Item 5).
3. Disconnect spring (Figure 1, Item 8) from stop lever (Figure 1, Item 5) and engine stop lever (Figure 1, Item 12).
4. Remove screw (Figure 1, Item 14) and washer (Figure 1, Item 15) and engine stop lever (Figure 1, Item 12).
5. Remove two screws (Figure 1, Item 4, 6) and stop lever (Figure 1, Item 5).
6. Remove regulator lever (Figure 1, Item 3) and spring (Figure 1, Item 11).

REMOVE - Continued

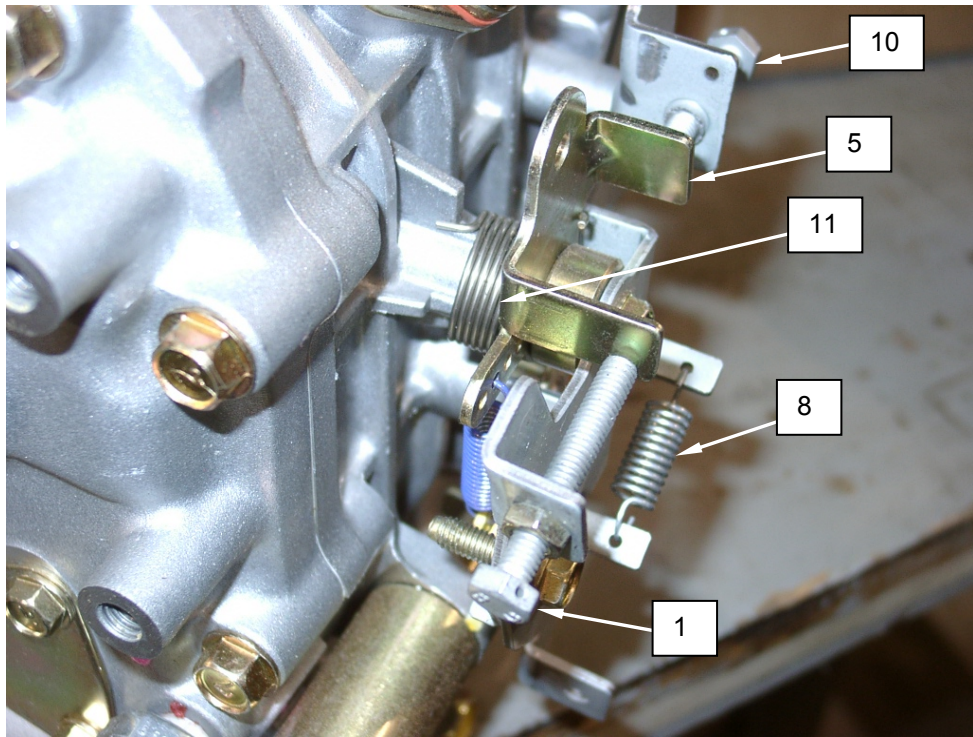
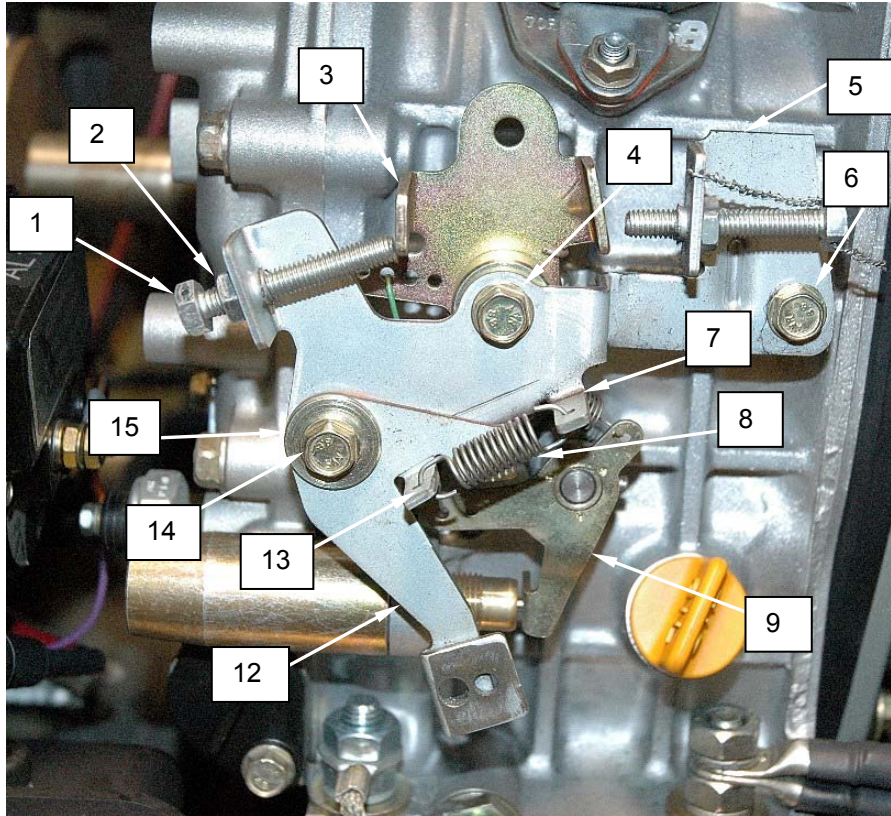


Figure 1. Remove Governor Control.



**REMOVE - Continued****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

Inspect governor control components for damage. Replace any part that is damaged in any way.

**END OF TASK****INSTALL**

1. Install spring (Figure 2, Item 11) and regulator lever (Figure 2, Item 3).
2. Install stop lever (Figure 2, Item 5) and secure with two screws (Figure 2, Item 4,6).
3. Install engine stop lever (Figure 2, Item 12), washer (Figure 2, Item 15) and secure with screw (Figure 2, Item 14).
4. Connect spring (Figure 2, Item 8) to stop lever (Figure 2, Item 5) and engine stop lever (Figure 2, Item 12).
5. Connect springs (Figure 2, Item 7,13) to governor lever (Figure 2, Item 9) and stop lever (Figure 2, Item 5).
6. Install adjusting screw (Figure 2, Item 1) and nut (Figure 2, Item 2) and set bolt (Figure 2, Item 10) onto stop lever (Figure 2, Item 5).

INSTALL - Continued

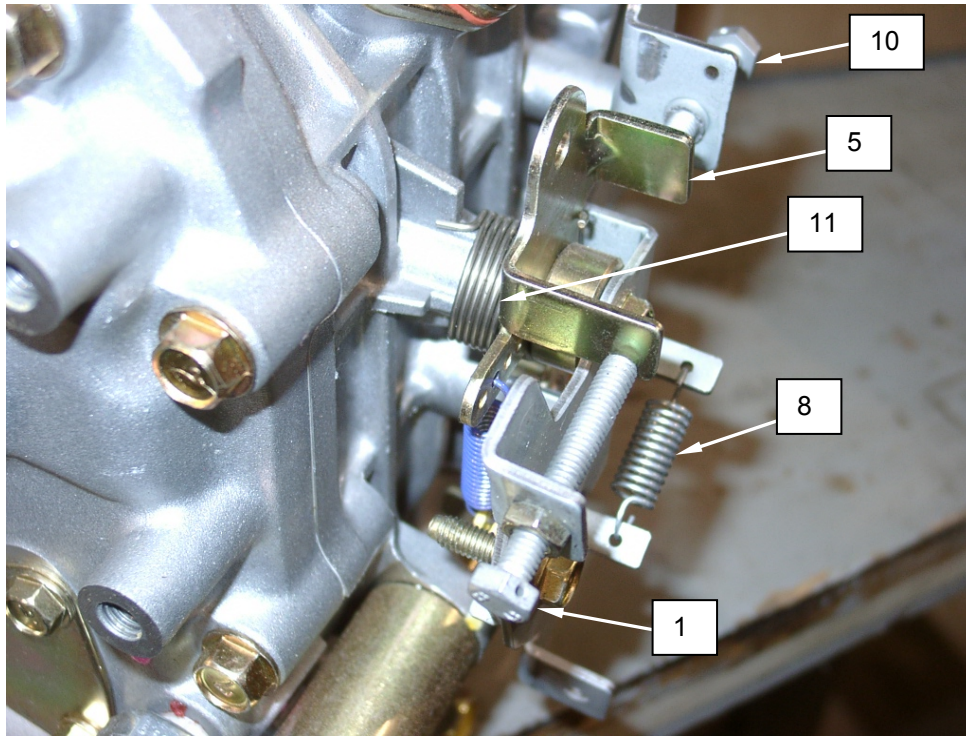
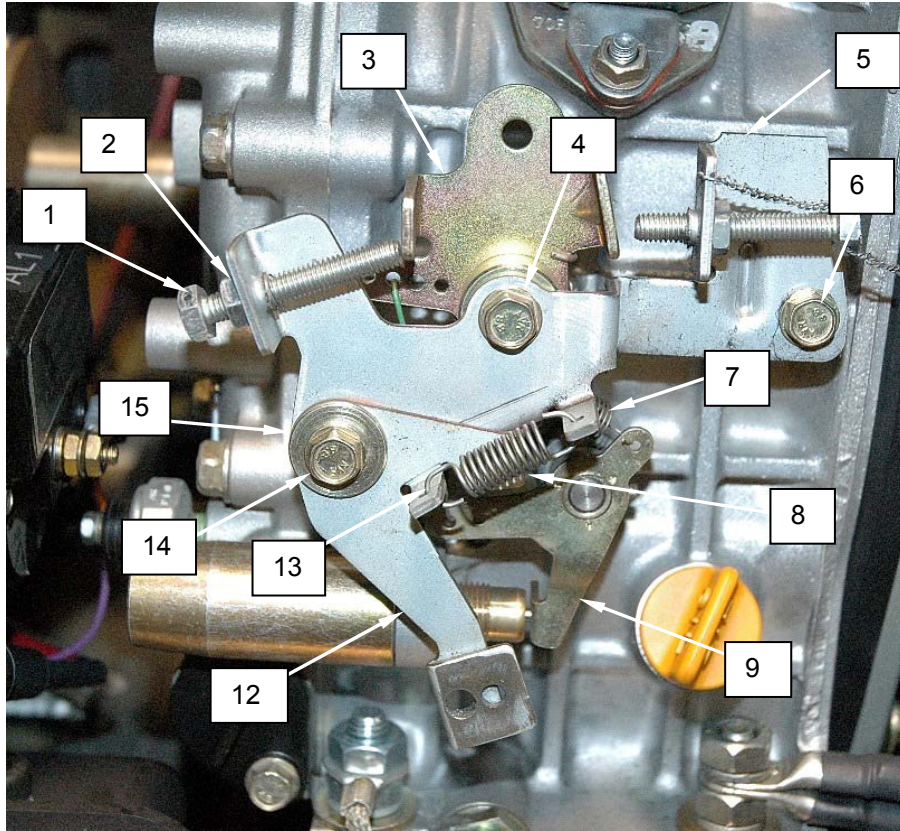


Figure 2. Install Governor Control.

END OF TASK

END OF WORK PACKAGE

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**FIELD MAINTENANCE****DIESEL ENGINE VIBRATION MOUNTS  
REPLACE**

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**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17)  
Lift, Chain (WP 0124, Item 6)  
Adapter, 3/8 Inch Socket to 1/4 Inch Hex Key (WP  
0124, Item 1)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1 or 2)  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)  
Tags, Marking (WP 0123, Item 22)  
Marker, Permanent (WP 0123, Item 13)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.

**References**

WP 0071

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**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

Replacement procedure begins on the following page.

**REPLACE****WARNING**

Fuel is toxic. Be sure to place a petroleum absorbent mat or tray below to collect any fuel. Be sure to wipe up any spills with a rag. Properly dispose of fuel soaked rags IAW local SOP.

1. Remove the top engine compartment cover (Figure 1, Item 1) by removing the 18 hex-head bolts, lockwashers and flat washers (Figure 1, Item 2). Set hardware and top engine compartment cover aside.

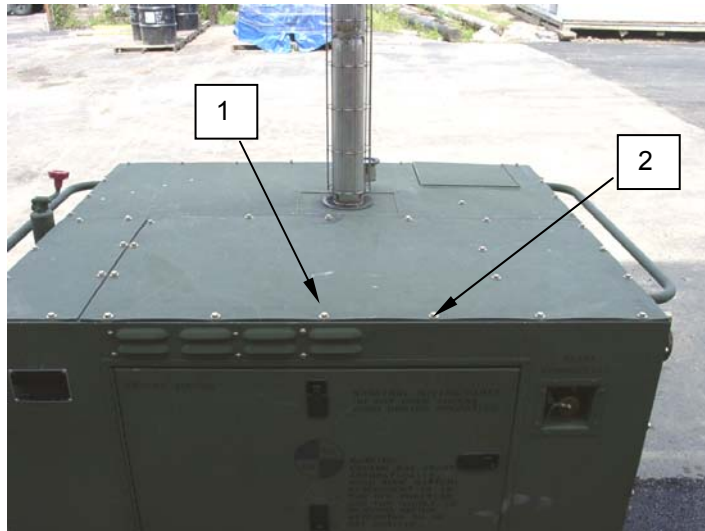


Figure 1. Remove the Top Engine Compartment Cover.

**NOTE**

In order to provide room for the diesel engine to be removed from the engine compartment, it will be necessary to remove the batteries.

To make battery terminal removal easier, it may be necessary to force the terminal open a bit using the blade of a flat blade screwdriver in the gap between the arms of the terminal. Pry the terminal connector off the battery terminal. If the terminal connector is damaged in the removal process, it should be replaced in accordance with WP 0071.

**REPLACE - Continued**

2. Loosen the nut on the negative terminal of the battery closest to the engine access door opening and remove the terminal (Figure 2).



Figure 2. Remove Negative Terminal of Battery Closest to Engine Access Door.

3. Loosen and remove the terminals of the jumper cable connecting the two batteries, remove the cable and set aside (Figure 3).



Figure 3. Remove Jumper Cable Between Batteries.

**REPLACE - Continued**

4. Remove the wingnuts and lockwashers that secure the battery T-bar on the battery closest to the engine access door opening and set aside (Figure 4).



Figure 4. Remove Hardware Securing Battery T-bar Closest to Access Door.

5. Remove the battery hold-down bracket that extends over the top of the battery and set aside (Figure 5).

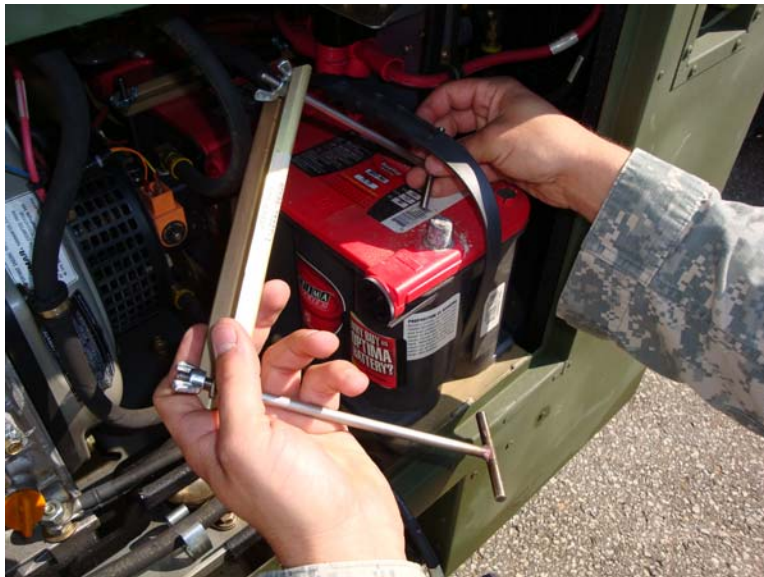


Figure 5. Remove Battery Hold-down Bracket.

**REPLACE - Continued**

6. Remove the battery closest to the engine access door opening and set aside (Figure 6).

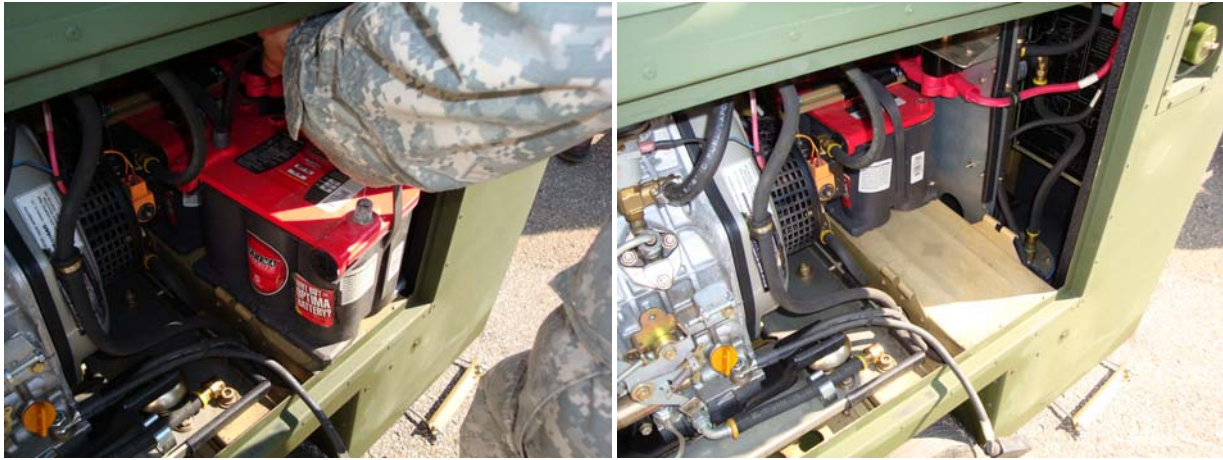


Figure 6. Remove Battery Closest to Engine Access Door.

7. Remove the wingnuts and lockwashers that secure the battery T-bar on the battery farthest from the engine access door opening and set aside (Figure 7).

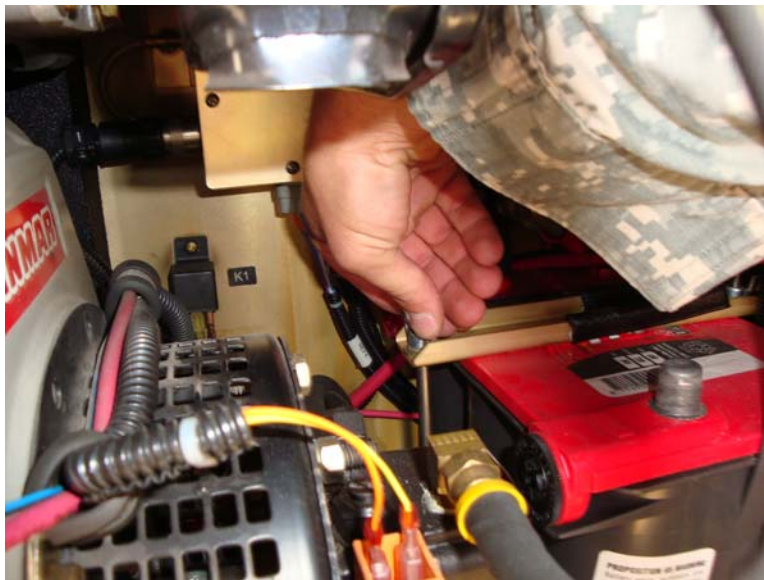


Figure 7. Remove Hardware Securing Battery T-bar Farthest from Access Door.

**REPLACE - Continued**

8. Remove the battery hold-down bracket that extends over the top of the battery and set aside (Figure 8).



Figure 8. Remove Battery Hold-down Bracket of Battery Farthest from Access Door.

9. Loosen the nut on the positive terminal of the battery farthest from the engine access door opening and remove the terminal (Figure 9).



Figure 9. Remove Positive Battery Cable of Battery Farthest from Access Door.



**REPLACE - Continued**

10. Remove the battery farthest from the engine access door opening and set aside (Figure 10).



Figure 10. Remove Battery Farthest from Access Door.

11. Mark and disconnect wires connected to the starter (Figure 11, Item 1) and oil pressure switch (Figure 11, Item 2) on engine.

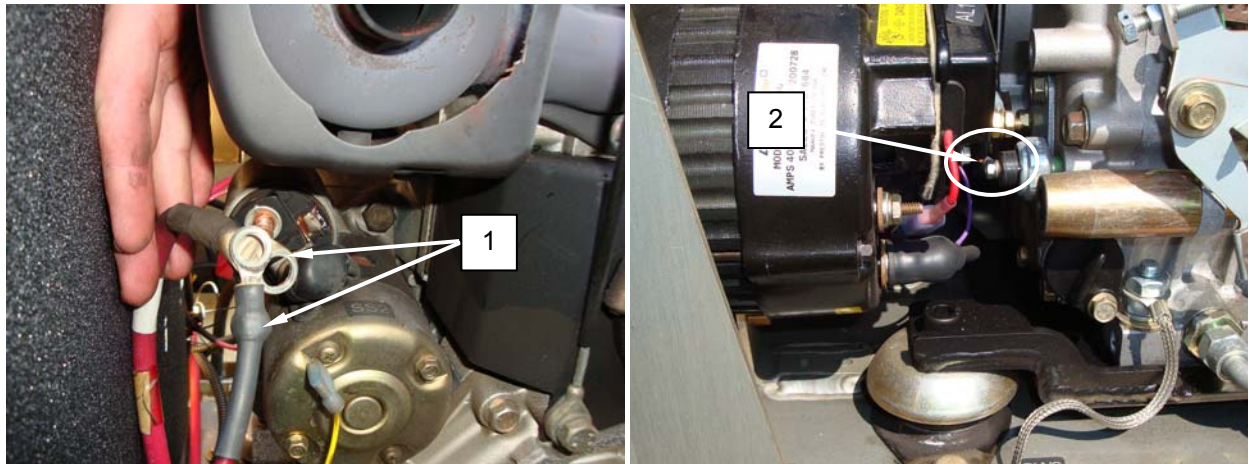


Figure 11. Starter and Oil Pressure Switch Wires.

**REPLACE - Continued****NOTE**

The flexible exhaust tube must be replaced each time the diesel engine is removed from the heater.

- Loosen clamps (Figure 12, Item 1) and remove flexible exhaust tube (Figure 12, Item 3) from engine muffler (Figure 12, Item 2) and bulkhead fitting to heat exchanger compartment (Figure 12, Item 4). Discard exhaust tube but retain clamps for later use if serviceable; replace as necessary.

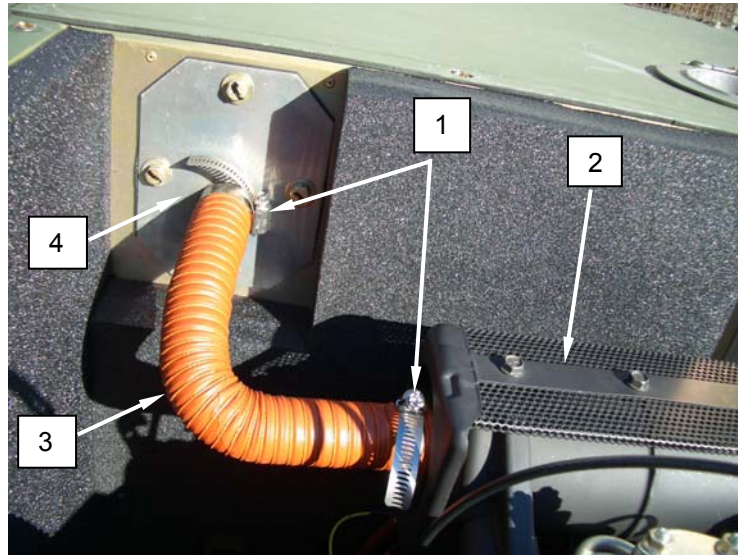


Figure 12. Disconnect Flexible Exhaust Tube.

- Mark and disconnect the wires from the engine shutdown solenoid (Figure 13, Item 1) and the burner fuel pump solenoid (Figure 13, Item 2).

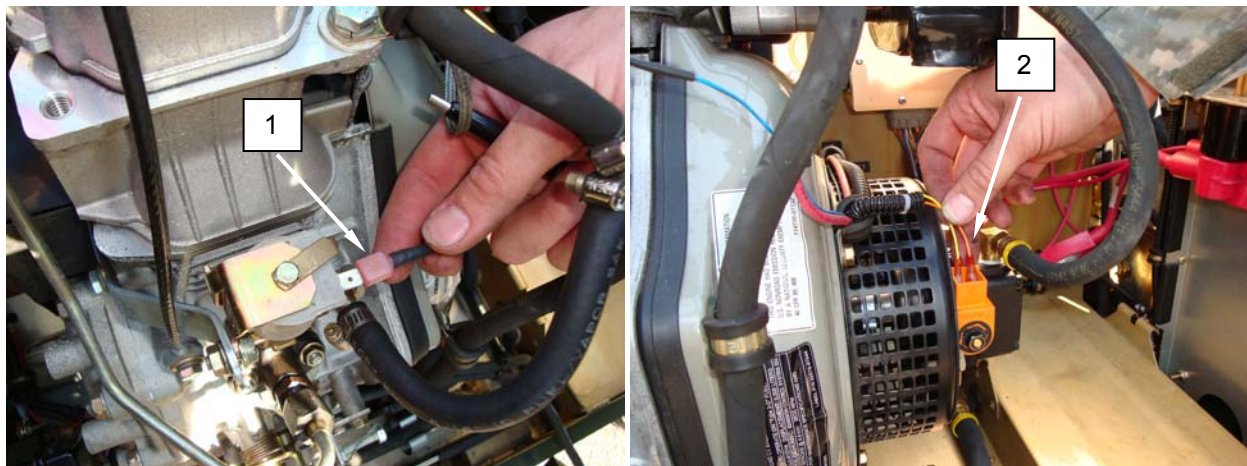


Figure 13. Remove Wires from Engine Shutdown Solenoid and Burner Fuel Pump Solenoid.

**REPLACE - Continued****NOTE**

When removing hardware or clamps from the engine, reinstall washers, nuts and bolts onto engine, finger tight, so that they are not lost.

14. Loosen the clamp and remove the fuel supply hose from the arm of the Tee connector. Catch any fuel in approved container (Figure 14). Wipe up any spilled fuel with a rag.



Figure 14. Remove Fuel Supply Hose from Arm of Tee Connector.

15. Remove the clamp that secures the fuel supply hose to the engine flywheel housing. Reinstall the bolt into the housing, finger tight (Figure 15). Leave the clamp on the hose.



Figure 15. Remove Clamp Securing Fuel Supply Hose to Engine Flywheel Housing.

**REPLACE - Continued**

16. Remove the dust boot (Figure 16, Item 1) and disconnect the wire (Figure 16, Item 3) attached to the threaded stud labeled GP1 (Figure 16, Item 2) on the side of the engine intake manifold.

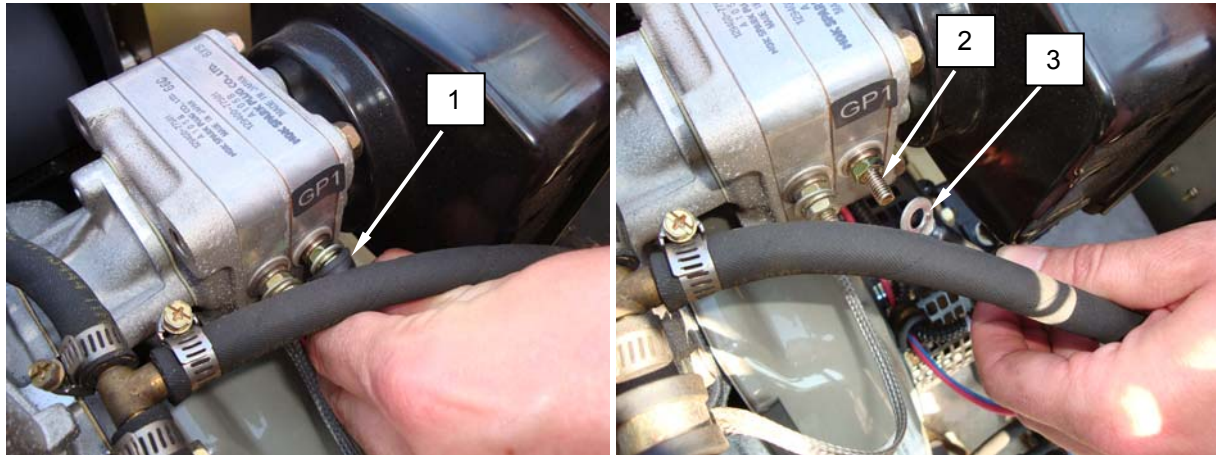


Figure 16. Remove Wire Connected to Threaded Stud Labeled GP1.

17. Remove the bolts holding two clamps (Figure 17, Item 1) across the top of the burner pump housing so that the harness can be removed from the engine. Reinstall the bolts back into the housing at this time, finger tight. Leave the clamps looped around the wires.

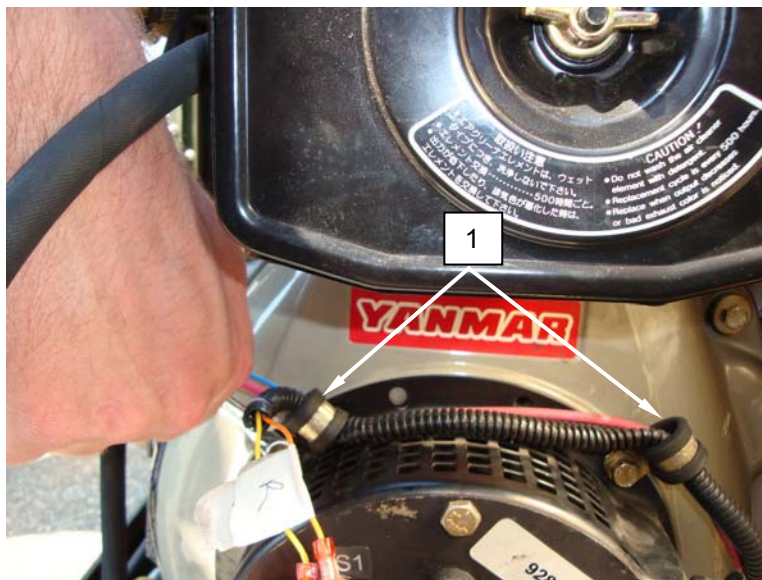


Figure 17. Remove Bolts Securing Clamps on Burner Pump Housing.

**REPLACE - Continued**

18. Remove nuts (Figure 18, Item 1) and remove black battery cables (Figure 18, Item 2) and grounding strap (Figure 18, Item 3) from mounting stud at base of engine. Push battery cable and grounding strap off to the side of the engine compartment.

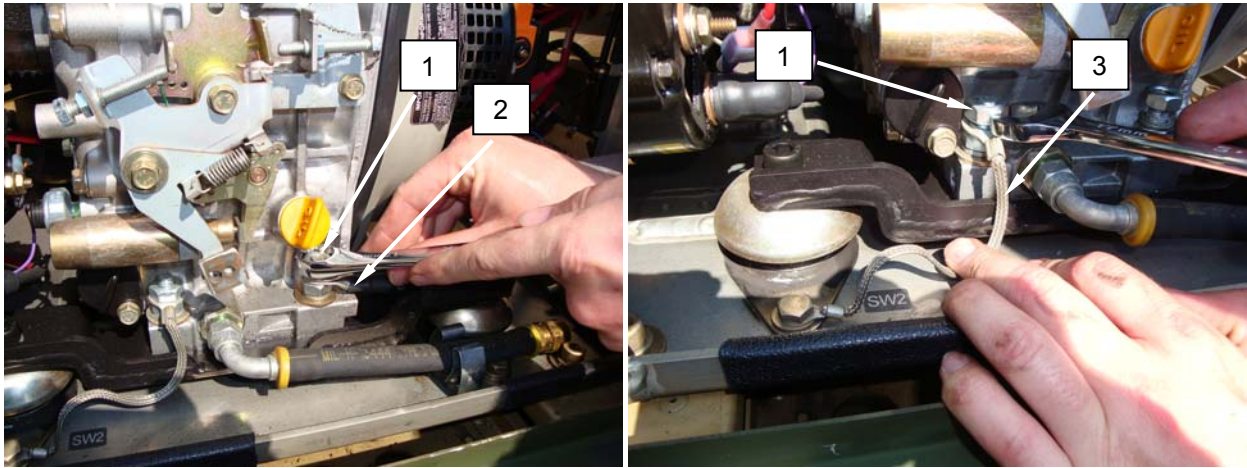


Figure 18. Remove Battery Cables and Grounding Strap.

19. Disconnect the remaining two fuel lines from the burner fuel pump (Figure 19).

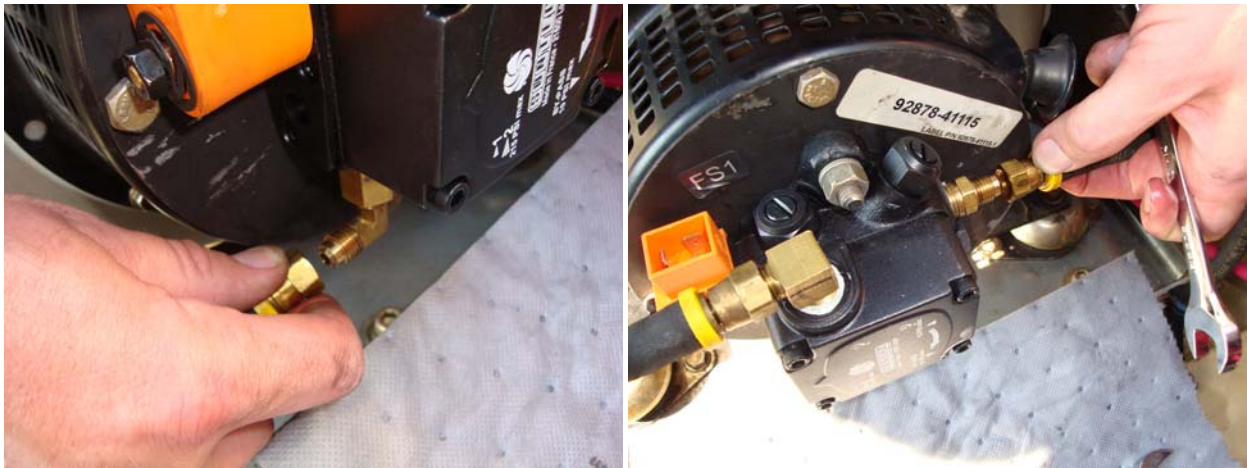


Figure 19. Disconnect Two Remaining Fuel Lines from Burner Fuel Pump.

**REPLACE - Continued**

20. Remove the four socket cap head screws that secure the engine mounting bracket to the engine vibration mounts (Figure 20).



Figure 20. Remove Socket Cap Head Screws Securing Engine Mounting Bracket to Vibration Mounts.

21. Loosen clamp and remove engine header exhaust hose from engine (Figure 21). Move hose off to side.



Figure 21. Remove Engine Header Exhaust Hose.

**REPLACE - Continued**

22. Remove engine oil drain hose from spring clamp (Figure 22).



Figure 22. Remove Engine Oil Drain Hose from Spring Clamp.

**NOTE**

It is recommended that the next step be performed by two personnel. One person controls the chain lift while the other guides the engine out of the engine compartment.

23. Attach a chain lift through the top of the heater engine compartment to the engine lifting cable located on the inboard side of the engine (Figure 23).



Figure 23. Attach Chain Lift to Engine Lifting Cable.

**REPLACE - Continued**

24. Carefully lift the engine slightly and guide to the right while continuing to remove engine from the engine compartment. Take care not to snag any of the fuel hoses or wires. Remove the engine from the heater and place on a rugged work surface (Figure 24).



Figure 24. Remove Engine from Heater.

25. Before removing vibration mounts, use a permanent marker to mark the location in relationship to the engine plate. Trace the engine mount(s) that will be replaced (Figure 25).



Figure 25. Marking Location of Vibration Mount.



**REPLACE - Continued****CAUTION**

Nut and flat washer are mounted on the underside and will drop onto the unit's engine bay floor. They will need to be retrieved for later use.

26. Using a ½-inch box wrench, locate the nuts underneath the engine plate and secure the nut within the boxed end. Use a ½-inch socket to loosen and remove the bolt (Figure 26).



Figure 26. Removing Defective Vibration Mount.

27. Clean the area where engine vibration mount is to be mounted before installing the new vibration mount (Figure 27).



Figure 27. Cleaning the Area Below the Vibration Mount.

**REPLACE - Continued**

28. Place the new engine vibration mount in position and install the bolt through the hole on the vibration mount closest to the center of the engine plate (Figure 28).



Figure 28. Place New Vibration Mount in Position and Install Bolt.

**NOTE**

Hold flat washer on top of the nut and align with hole of vibration mount, before inserting bolt.

29. Slide washer and nut under engine plate and install the nut on the bolt, finger tight (Figure 29).



Figure 29. Installing Nut on Vibration Mount Bolt.

**REPLACE - Continued****NOTE**

When replacing the vibration mount closest to the alternator, install the grounding strap on the outboard bolt before installing bolt.

30. Place second washer and nut together and align to the hole closest to the outside edge of the engine plate, working it in from between the engine plate edge and the cabinet's edge. Insert bolt and run nut on, finger tight.

**NOTE**

As the vibration mount is tightened into place, ensure the mount stays within the marked area. Minor positional adjustments may be needed before the mount is fully secured.

31. Using a ½-inch box wrench locate the nuts underneath the engine plate and secure the nut within the boxed end and use a ½-inch socket to tighten the bolts (Figure 30).



Figure 30. Installing the New Vibration Mount.

**REPLACE - Continued**

32. Attach the chain lift to the engine lifting cable and raise the diesel engine off the work surface. Carefully lower into position into the engine compartment. Lower it toward the right side near the battery compartment and then toward the left to engage the rubber coupling onto the coupling hub from the inlet fan and alternator belt pulley. Do not fully install the engine on the coupling at this time (Figure 31).

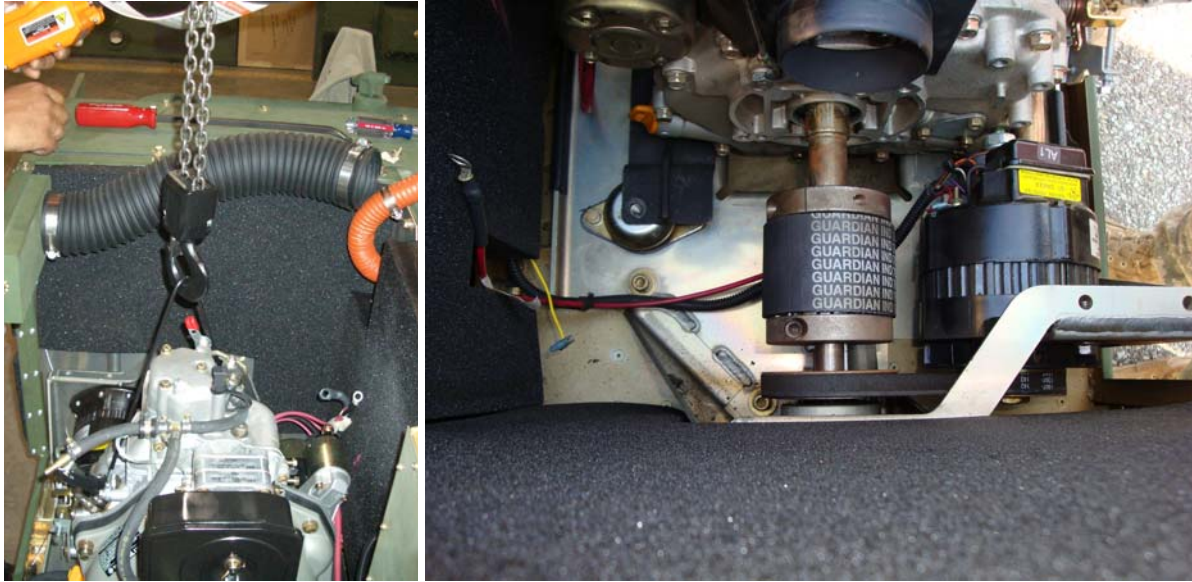


Figure 31. Reinstalling the Engine into the Heater.

33. Once the engine is positioned close enough but before easy access is lost, reinstall the engine oil pressure wire (Figure 32).

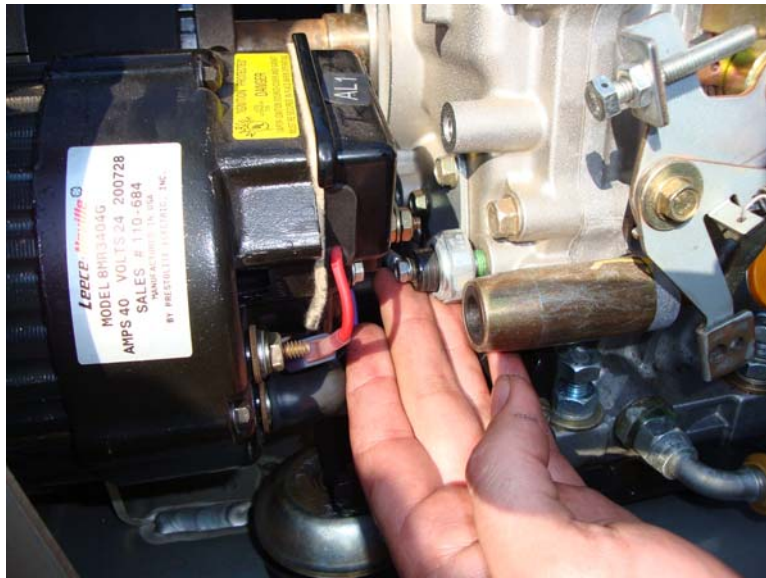


Figure 32. Reinstalling Engine Oil Pressure Wire.

**REPLACE - Continued**

34. Continue to completely engage the rubber coupling and position the engine over the vibration mounts. Ensure that the four mounting holes on the mounting brackets align with the four vibration mounts. Install the four socket cap head bolts removed earlier and secure the mounting bracket to the vibration mounts (Figure 33). Tighten securely.

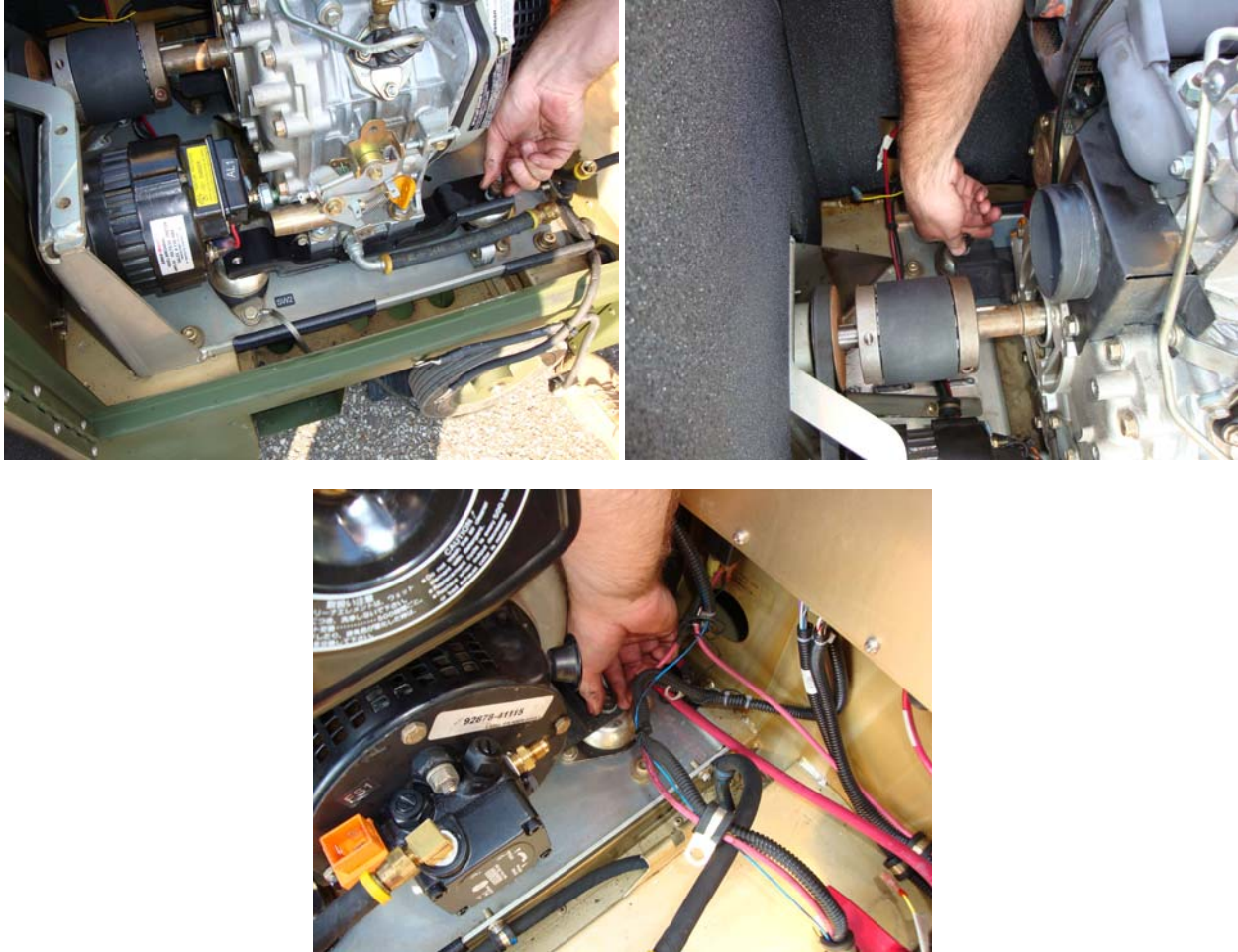


Figure 33. Securing Mounting Brackets to Vibration Mounts.

**REPLACE - Continued**

35. Install harness over the burner pump housing and attach using the two top bolts (Figure 34, Item 1) holding the burner pump housing cover to the flywheel housing. (Figure 34).

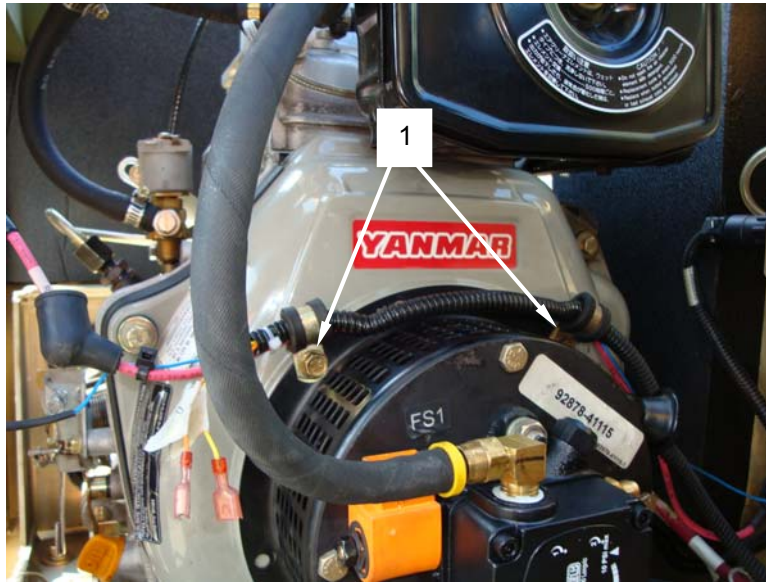


Figure 34. Install Harness Over Burner Pump Housing.

36. Install engine oil drain hose in spring clamp (Figure 35).



Figure 35. Install Engine Oil Hose in Spring Clamp.

**REPLACE - Continued**

37. Install engine head cooling hose on engine (Figure 36). Slide clamp into position and tighten securely.

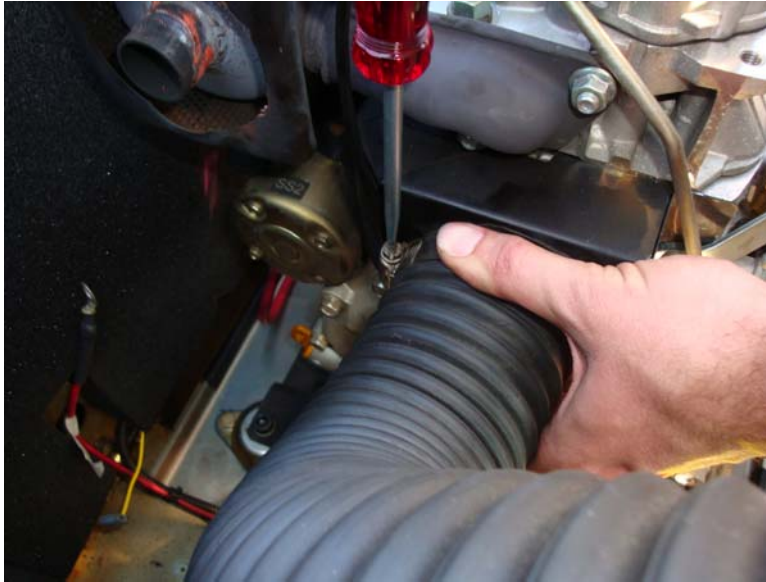


Figure 36. Install Engine Head Cooling Hose.

38. Connect the two fuel hoses to the burner fuel pump in the locations tagged earlier (Figure 37).

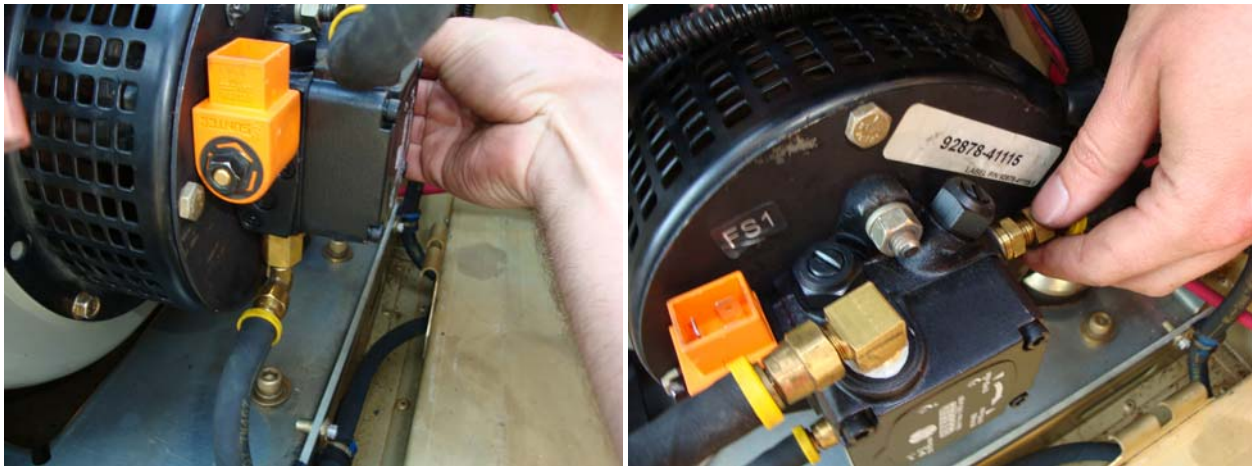


Figure 37. Connect Two Fuel Hoses to Burner Fuel Pump.

**REPLACE - Continued**

39. Connect the wire to the threaded stud labeled GP1 on the side of the engine intake manifold (Figure 38). Tighten securely. Install the dust boot.



Figure 38. Install Wire to Threaded Stud Labeled GP1.

40. Install black battery cables and grounding strap onto studs mounting the engine to the engine rails. Install hex nut and washer (Figure 39). Tighten securely.



Figure 39. Install Battery Cables and Grounding Straps.



**REPLACE - Continued**

41. Install fuel line clamp (Figure 40, Item 6) at midpoint of engine flywheel housing (Figure 40).

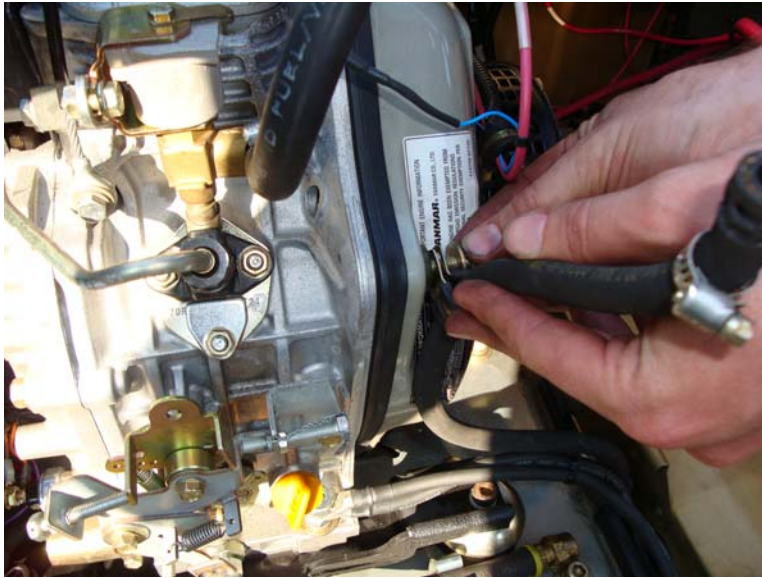


Figure 40. Install Fuel Line Clamp to Midpoint of Flywheel Housing.

42. Connect the fuel supply hose to the arm of the tee connector and secure the clamp (Figure 41).

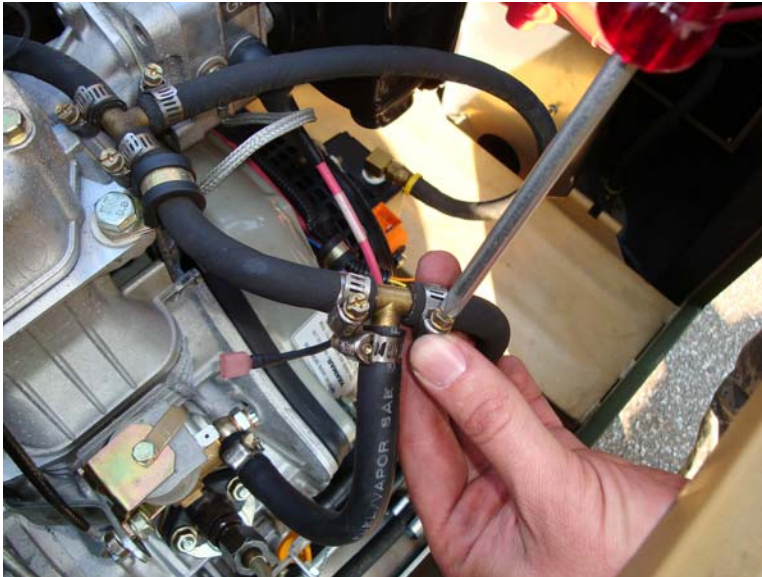


Figure 41. Connect Fuel Supply Hose to Arm of Tee Connector.

**REPLACE - Continued**

43. Connect wire to engine shutdown solenoid (Figure 42, Item 1) and burner fuel pump solenoid (Figure 42, Item 2) as previously tagged.

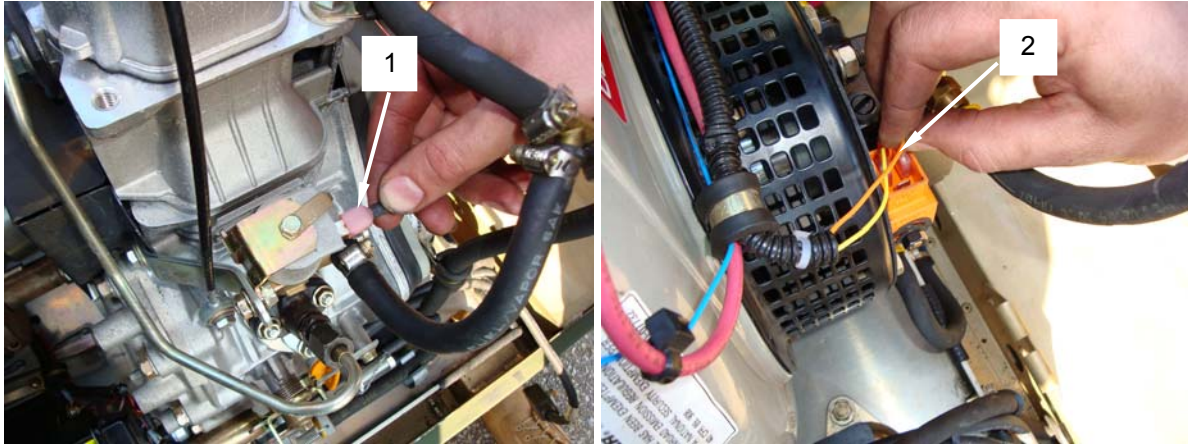


Figure 42. Connect Wires to Engine Shutdown and Burner Fuel Pump Solenoid.

44. Connect all wires to starter solenoid (Figure 43). Remove markings and tags placed earlier.



Figure 43. Connect Wires to Starter Solenoid.

**REPLACE - Continued****NOTE**

A new flexible exhaust tube must be installed each time the diesel engine is removed from the heater.

45. Connect a new flexible exhaust tube to the engine muffler. Install clamps set aside earlier or new clamps as required (Figure 44). Tighten securely.



Figure 44. Connect Flexible Exhaust Tube to Engine Muffler.

46. Position the battery farthest from the engine access door opening onto the battery tray with the positive terminal facing the main control box (Figure 45).



Figure 45. Install Battery Farthest from Access Door.

**REPLACE - Continued**

47. Install the positive terminal of the battery farthest from the engine access door opening and secure the terminal by tightening the terminal nut (Figure 46).



Figure 46. Install Positive Battery Terminal of Battery Farthest from Access Door.

48. Install the battery hold-down bracket that extends over the top of the battery.
49. Install the wingnuts and lockwashers that secure the battery T-bar on the battery farthest from the engine access door opening (Figure 47).

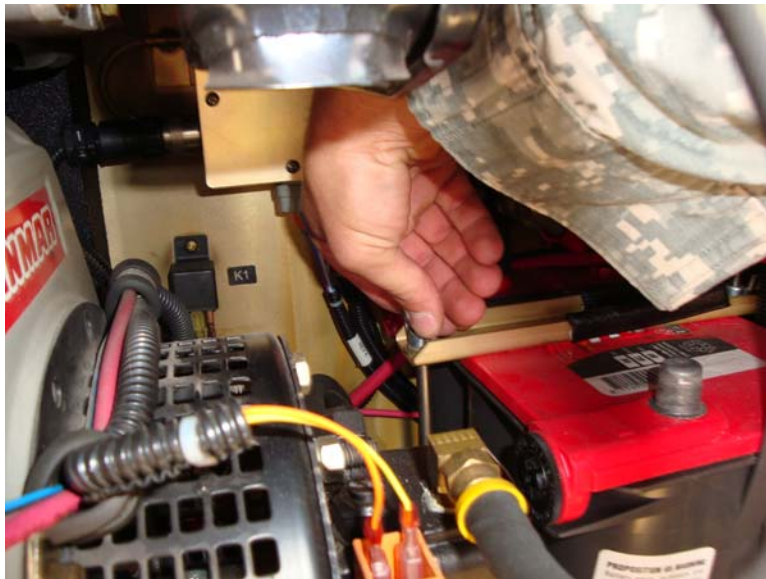


Figure 47. Install Battery Hold-down Bracket and Secure with Hardware.

**REPLACE - Continued**

50. Position the second battery closest to the engine access door opening ensuring that the negative terminal is closest to the door opening (Figure 48).



Figure 48. Install Battery Closest to Access Door.

51. Install the battery hold-down bracket that extends over the top of the battery (Figure 49).



Figure 49. Install Battery Hold-down Bracket on Battery Farthest from Access Door.

**REPLACE - Continued**

52. Install the wingnuts and lockwashers that secure the battery T-bar on the battery closest to the engine access door opening (Figure 50).



Figure 50. Secure Battery Hold-down Bracket with Hardware.

53. Install the terminals of the jumper cable connecting the two batteries ensuring that the red terminal is mounted to the positive battery terminal and the black terminal is mounted to the negative battery terminal (Figure 51).



Figure 51. Install Jumper Cable Between Batteries.

**REPLACE - Continued**

54. Install the negative terminal of the final cable on the battery closest to the engine access door opening. Tighten the terminal nut securely (Figure 52).



Figure 52. Install Negative Terminal on Battery Closest to Access Door.

55. Install top engine compartment cover (Figure 53, Item 1) by installing eighteen hex head bolts and lockwashers (Figure 53, Item 2) set aside earlier.

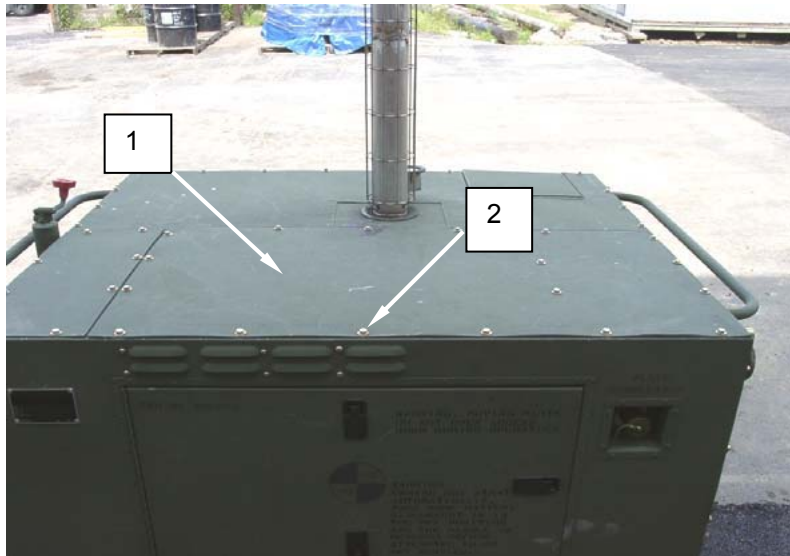


Figure 53. Install Top Engine Compartment Cover.

**REPLACE - Continued****NOTE**

“Walk” is defined as a side-to-side movement of the rubber coupling as the diesel engine runs.

56. Operate the heater for one hour. Check for “walk” on the right side of the coupling assembly. Check the torque on the hex head cap screw and verify that it is still between 264 and 300 inch-pounds. Re-torque as required.

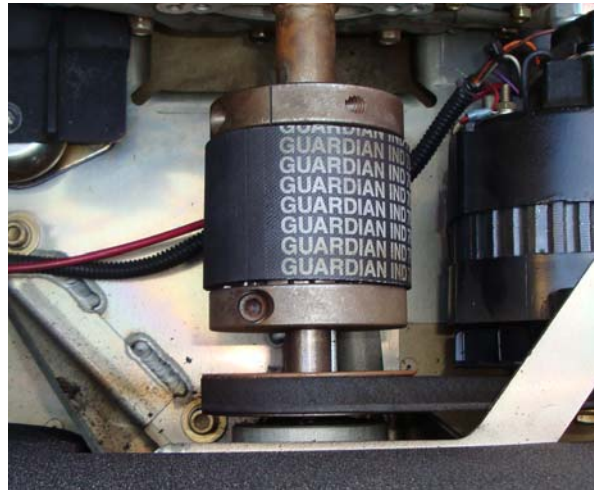


Figure 54. Checking for Movement of the Rubber Coupling After Installation.

**END OF TASK**

**END OF WORK PACKAGE**



**CHAPTER 9**

**SUSTAINMENT MAINTENANCE  
FOR  
LARGE CAPACITY FIELD HEATER,  
TYPE II (LCFH TYPE II)**



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**SUSTAINMENT MAINTENANCE****DIESEL ENGINE  
REPAIR**

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**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Engine oil drained (WP 0051).  
Engine removed from heater (WP 0081).

**References**

WP 0052, WP 0089  
WP 0090, WP 0092  
WP 0093, WP 0094

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**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REPAIR**

Repair to the diesel engine involves replacement of unserviceable components. Procedures for the repair or replacement of the subcomponents can be found in the referenced work packages.

1. Repair crankcase cover IAW WP 0052.
2. Repair crankshaft assembly IAW WP 0089.
3. Repair balancer shaft IAW WP 0090.
4. Repair piston and connecting rod IAW WP 0093.
5. Repair fuel injection pump IAW WP 0092.
6. Repair governor control IAW WP 0094.

**END OF TASK****END OF WORK PACKAGE**



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**SUSTAINMENT MAINTENANCE**
**CRANKSHAFT  
REMOVE, SERVICE, INSPECT, INSTALL**


---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
 Handle, Flywheel Locking (WP 0124, Item 4)  
 Remover, Flywheel (WP 0124, Item 8)  
 Wrench, Torque (WP 0124, Item 19)  
 Caliper, Digital Display (WP 0124, Item 2)  
 Hammer, Hand (WP 0124, Item 3)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11,  
 or 12) (Oil selection dependent on temperature,  
 refer to WP 0002 for details)  
 Rags, Wiping, Clean (WP 0123, Item 15)  
 Solvent, Degreasing (WP 0123, Item 20)  
 Grease, General Purpose (WP 0123, Item 7)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
 Engine access door open.  
 Main battery switch OFF and handle removed.  
 Burner fuel pump removed (WP 0045).  
 Remove diesel engine from heater (WP 0081).

**References**

WP 0090  
 WP 0091  
 WP 0093

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**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Remove flywheel housing (Figure 1, Item 7) from cylinder block (Figure 1, Item 1) by removing four screws (Figure 1, Item 11), washers (Figure 1, Item 10), collars (Figure 1, Item 9), and spacers (Figure 1, Item 8). Remove seal (Figure 1, Item 6).
2. Using flywheel locking handle, hold flywheel (Figure 1, Item 3) in place and remove nut (Figure 1, Item 5) and washer (Figure 1, Item 4).
3. Carefully remove flywheel (Figure 1, Item 3) from crankshaft using flywheel remover. Use care to prevent damage to flywheel fins.
4. Remove key (Figure 1, Item 2). Remove bearing holder (Figure 1, Item 14) and screw (Figure 1, Item 15).
5. Remove camshaft (WP 0091), balancer shaft (WP 0090), and connecting rod (WP 0093).
6. Carefully remove assembled crankshaft (Figure 1, Item 16) from cylinder block, taking care not to damage oil seal (Figure 1, Item 20). Remove key (Figure 1, Item 17).

**REMOVE - Continued**

7. Drive crankshaft out of crankcase using a hammer.
8. Remove bolt (Figure 1, Item 22) and washer (Figure 1, Item 21). Remove oil seal (Figure 1, Item 20) and bearing (Figure 1, Item 19) only if replacement is required.

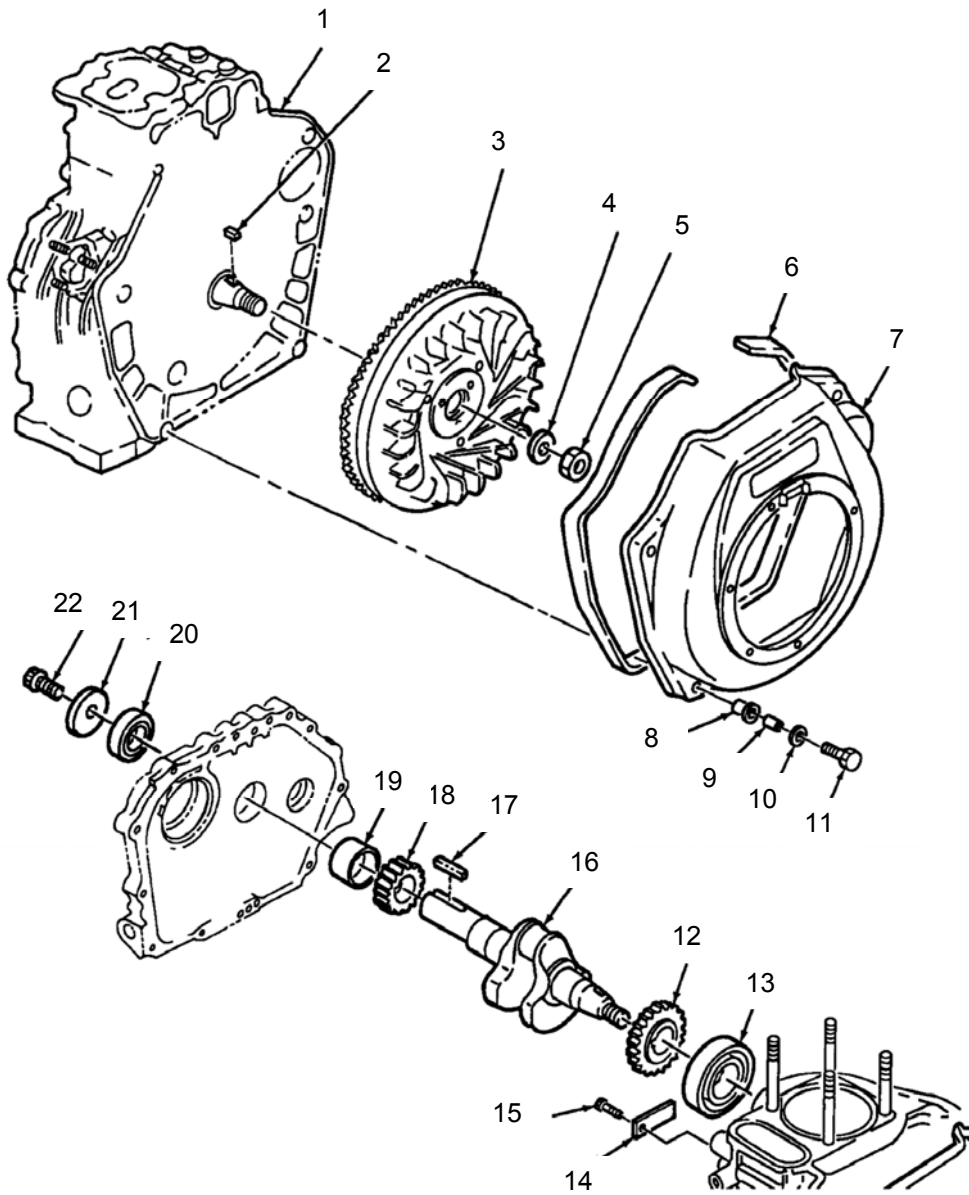


Figure 1. Remove Crankshaft Assembly.

**END OF TASK**

**SERVICE****Clean Components****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well-ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

1. Inspect flywheel (Figure 2, Item 4) for cracks, deformation, or obvious damage. Inspect for broken, chipped, or cracked flywheel fins. Replace flywheel if damaged.
2. Inspect flywheel housing seal (Figure 2, Item 7) for deterioration or permanent set. Replace if damaged or deformed.
3. Inspect crankshaft (Figure 2, Item 17, Sheet 1 of 2) for cracks, deformation, or obvious damage. Replace crankshaft if cracked or damaged.
4. Inspect gears (Figure 2, Item 13, 19, Sheet 1 of 2) for broken, chipped, or worn teeth. Replace gears and crankshaft (Figure 2, Item 17, Sheet 1 of 2) as an assembly if a gear is damaged or worn.
5. Measure the outside diameter (OD) of crankshaft crank pin. OD must be 1.4134 inches (35.90 mm), minimum. Replace crankshaft assembly if out of limits.
6. Measure the OD of crankshaft where crankshaft mates to crankcase cover plain bearing. OD must be 1.3744 inches (34.91 mm), minimum. Replace crankshaft assembly if out of limits.
7. Measure the OD of crankshaft where it mates to flywheel side ball bearing. OD must be 1.3782 inches (35.01 mm), minimum. Replace crankshaft assembly if out of limits.
8. Bearing (Figure 2, Item 20) is press fit onto crankshaft (Figure 2, Item 17, Sheet 1 of 2). Check bearing for looseness. Replace crankshaft assembly if bearing is loose.
9. Inspect bearing (Figure 2, Item 20) for discoloration, separation, or any other obvious damage. Remove and replace bearing if damaged in any way.

**END OF TASK**

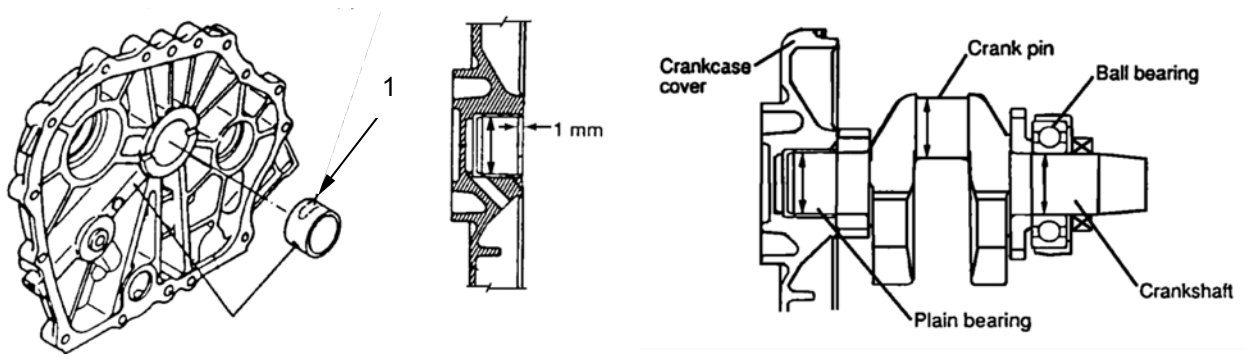
**INSTALL****NOTE**

Carefully fit the main bearing metal so that the oil groove is on the upper half. Align the oil hole in the bearing metal with the oil groove.

1. If installing a new bearing (Figure 2, Item 20), mount bearing so that oil groove (Figure 2, Item 1) in bearing faces up. Press fit bearing so that sinkage between face of bearing and face of crankcase cover is 0.0394 inch (1.0 mm).
2. Install a new oil seal (Figure 2, Item 21). Apply grease to oil seal and press into crankcase cover.
3. Install bolt (Figure 2, Item 23) and washer (Figure 2, Item 22).
4. Apply grease to lips of oil seal (Figure 2, Item 21). Apply a light coat of oil to crankshaft (Figure 2, Item 17, Sheet 2 of 2) journal and pin.
5. Install key (Figure 2, Item 18) into crankshaft (Figure 2, Item 17, Sheet 2 of 2). Carefully insert assembled crankshaft into cylinder block. Ensure timing marks (Figure 2, Item 19, Sheet 2 of 2) align properly and that crankshaft is inserted as far as it will go.
6. Tap into panel using a "soft face" hammer.
7. Install bearing holder (Figure 2, Item 15) using screw (Figure 2, Item 14).
8. Install key (Figure 2, Item 3). Mate flywheel (Figure 2, Item 4) to crankshaft, taking care not to damage crankshaft threads. Install washer (Figure 2, Item 5) and nut (Figure 2, Item 6). Lock flywheel in place using locking handle and tighten nut to 87 to 94 ft-lbs. (1200 to 1300 kg-cm).
9. Install seal (Figure 2, Item 7) onto flywheel housing (Figure 2, Item 8).
10. Mate flywheel housing (Figure 2, Item 8) to cylinder block (Figure 2, Item 2). Secure using four spacers (Figure 2, Item 9), collars (Figure 2, Item 10), washers (Figure 2, Item 11), and screws (Figure 2, Item 12).
11. Install connecting rod (WP 0093).
12. Install balancer shaft (WP 0090).
13. Install camshaft (WP 0091).
14. Install burner fuel pump (WP 0045).
15. Reinstall diesel engine in heater (WP 0081).



INSTALL - Continued



Bearing Installation

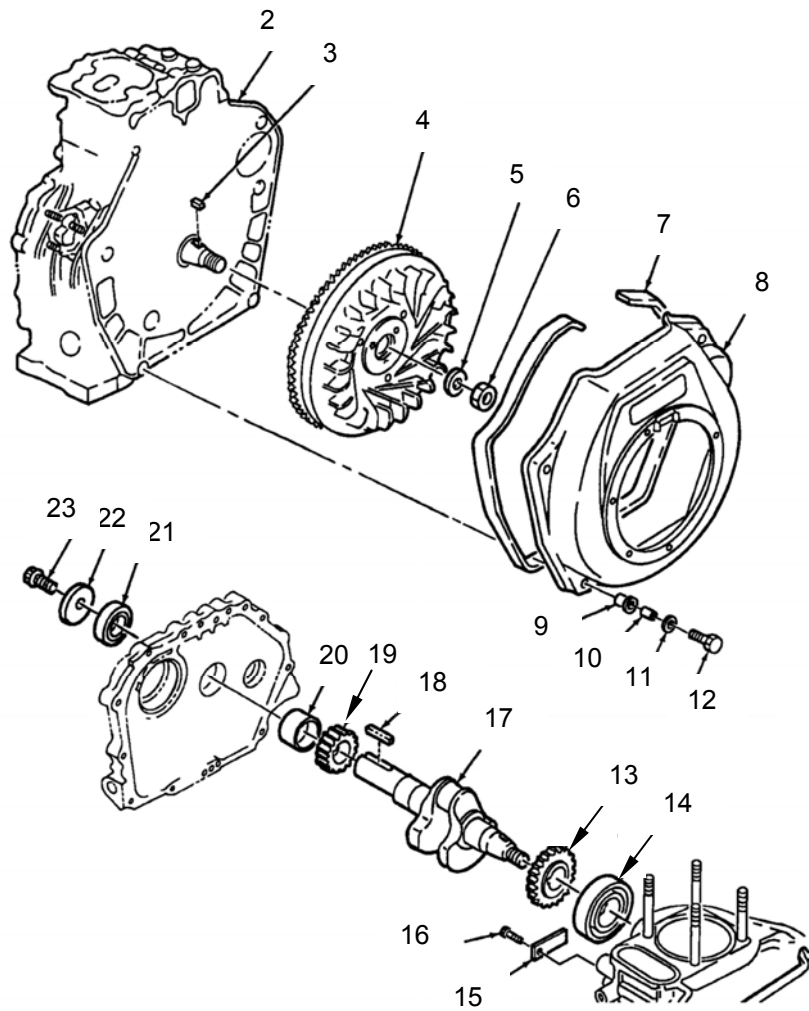


Figure 2. Inspect and Install Crankshaft Assembly (Sheet 1 of 2).

## INSTALL - Continued

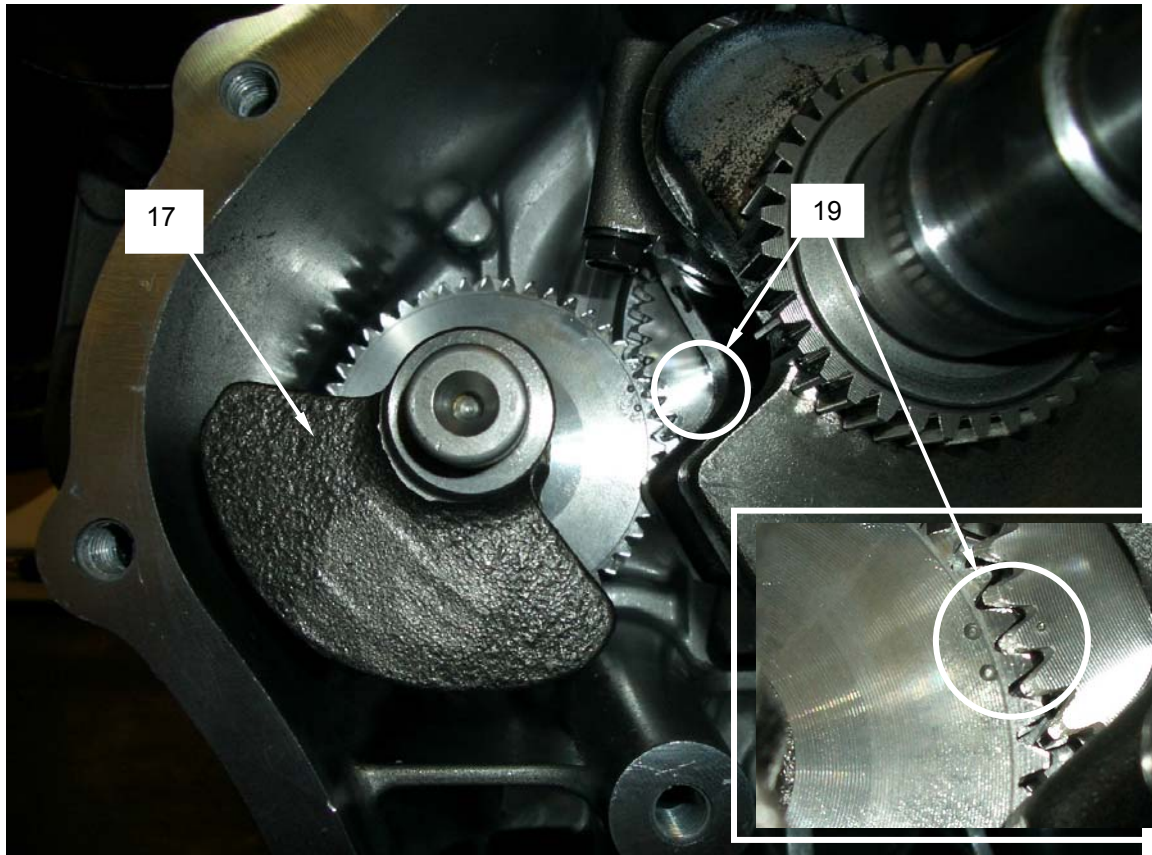


Figure 2. Inspect and Install Crankshaft Assembly (Sheet 2 of 2).

**END OF TASK**

**END OF WORK PACKAGE**

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**SUSTAINMENT MAINTENANCE****BALANCER SHAFT  
REMOVE, SERVICE, INSPECT, INSTALL**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17)

**Materials/Parts**

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11, or 12) (Oil selection dependent on temperature, refer to WP 0002 for details)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)  
Grease, General Purpose (WP 0123, Item 7)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Engine oil drained (WP 0051).  
Remove diesel engine from heater (WP 0081).

**References**

WP 0051

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**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE****CAUTION**

When removing crankcase cover, be careful not to damage oil seal.

1. Release crankcase cover (Figure 1, Item 8) from cylinder block (Figure 1, Item 6) by removing 15 screws (Figure 1, Item 1). Carefully pry crankcase cover from engine crankcase.
2. Remove cover gasket (Figure 1, Item 7). Discard if damaged or deformed.
3. Carefully remove assembled balancer shaft (Figure 1, Item 3) and gear (Figure 1, Item 4) from cylinder block (Figure 1, Item 6).
4. Remove bearing (Figure 1, Item 2) from crankcase cover (Figure 1, Item 8) and bearing (Figure 1, Item 5) from cylinder block (Figure 1, Item 6) only if replacement is required.

**END OF TASK**

**SERVICE****Clean Components****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

1. Inspect crankcase cover (Figure 1, Item 8) for cracks, deformation, or obvious damage. Inspect mating surfaces for scratches, burrs, or blemishes. Replace cover if damaged.
2. Inspect cover gasket (Figure 1, Item 7) for damage or deformation. Replace if damaged in any way.
3. Inspect gear (Figure 1, Item 4) for broken, chipped, or worn teeth. Replace gear and balancer shaft (Figure 1, Item 3) as an assembly if gear is damaged or worn.
4. Inspect balancer shaft for signs of unusual or uneven wear. Check for obvious damage. Replace if any damage or excessive wear is suspected.

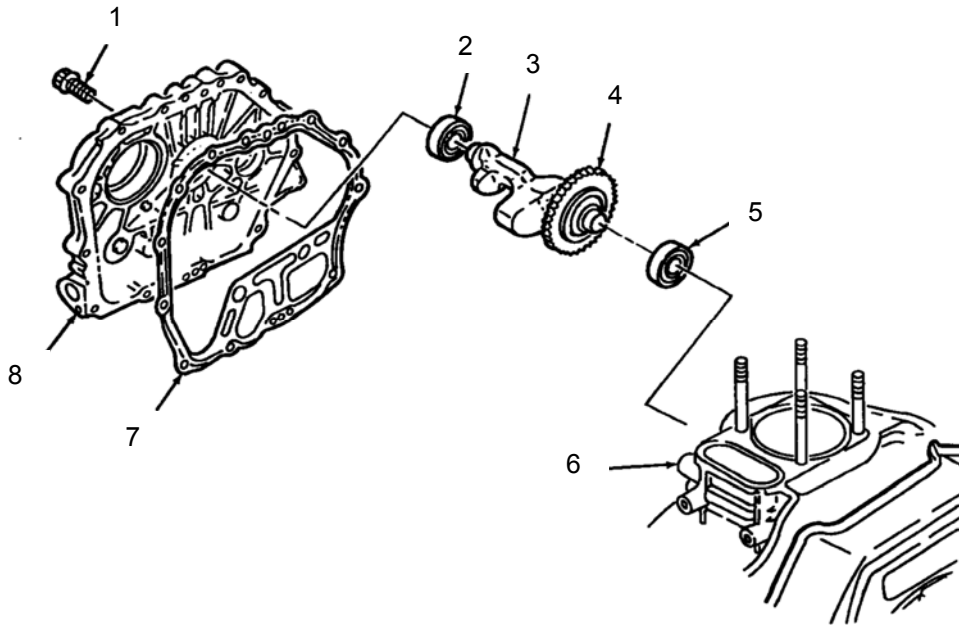


Figure 1. Inspect Balancer Shaft (Sheet 1 of 2).

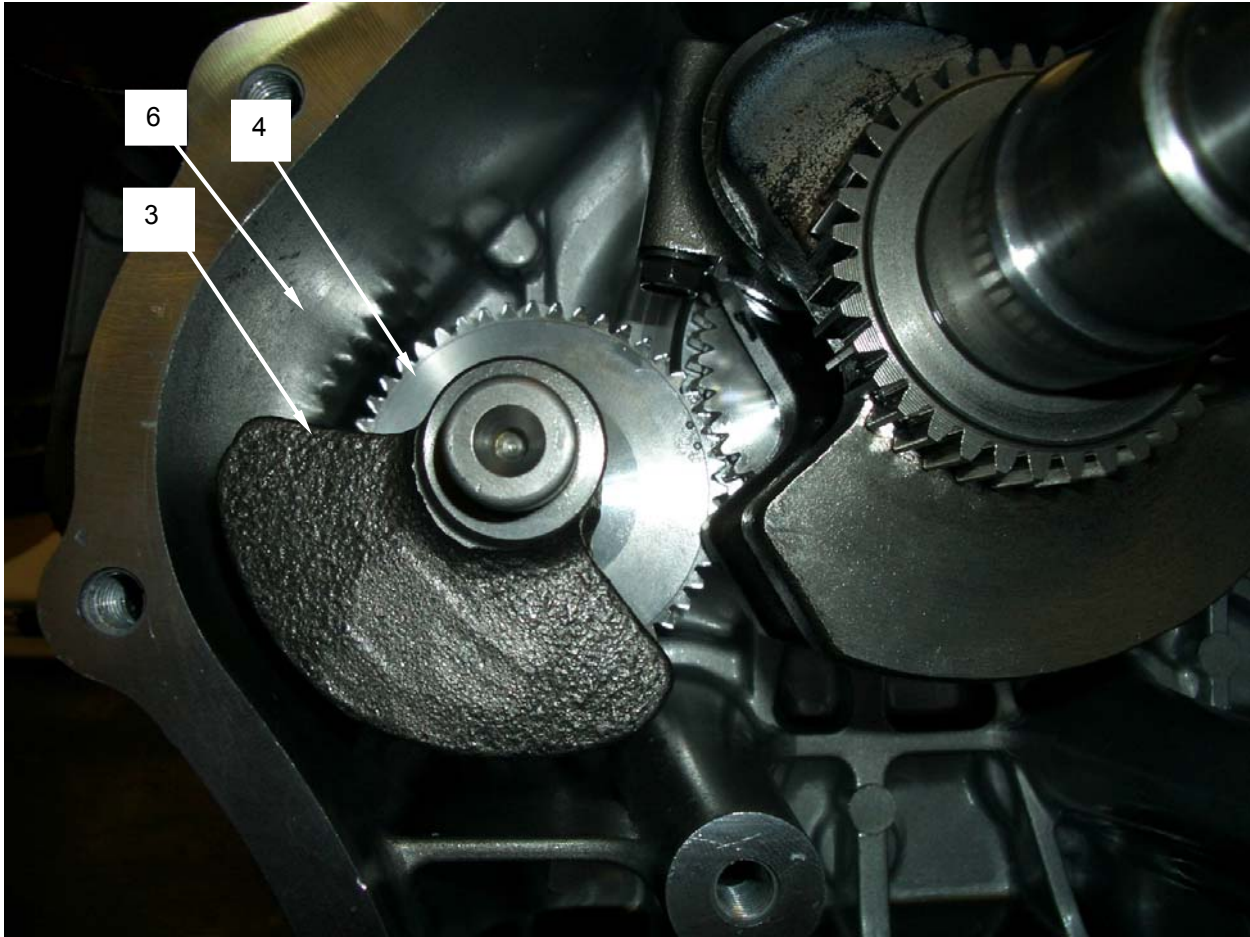
**INSPECT - Continued**

Figure 1. Inspect Balancer Shaft (Sheet 2 of 2).

**END OF TASK****INSTALL**

1. If removed, install bearings (Figure 2, Item 2, 5).
2. Carefully insert assembled balancer shaft (Figure 2, Item 3) and gear (Figure 2, Item 4) into cylinder block (Figure 2, Item 6). Align match-marks (Figure 2, Item 7) on balancer gear and crankshaft gear, then press balancer shaft (Figure 2, Item 3) into bearing (Figure 2, Item 5).
3. Apply grease to lips of crankshaft oil seal (located in crankcase cover (Figure 2, Item 9)).
4. Apply oil to crankshaft and camshaft. Make sure that oil pump drive gears are properly engaged.
5. Mate cover gasket (Figure 2, Item 8) to cylinder block (Figure 2, Item 6).
6. Mate crankcase cover (Figure 2, Item 9) to cylinder block (Figure 2, Item 6) and secure using fifteen screws (Figure 2, Item 1). Tighten screws in criss-cross sequence as shown. Torque all screws to 174 to 199 inch-pounds (200 to 230 kg-cm).
7. Service engine oil (WP 0051).

INSTALL - Continued

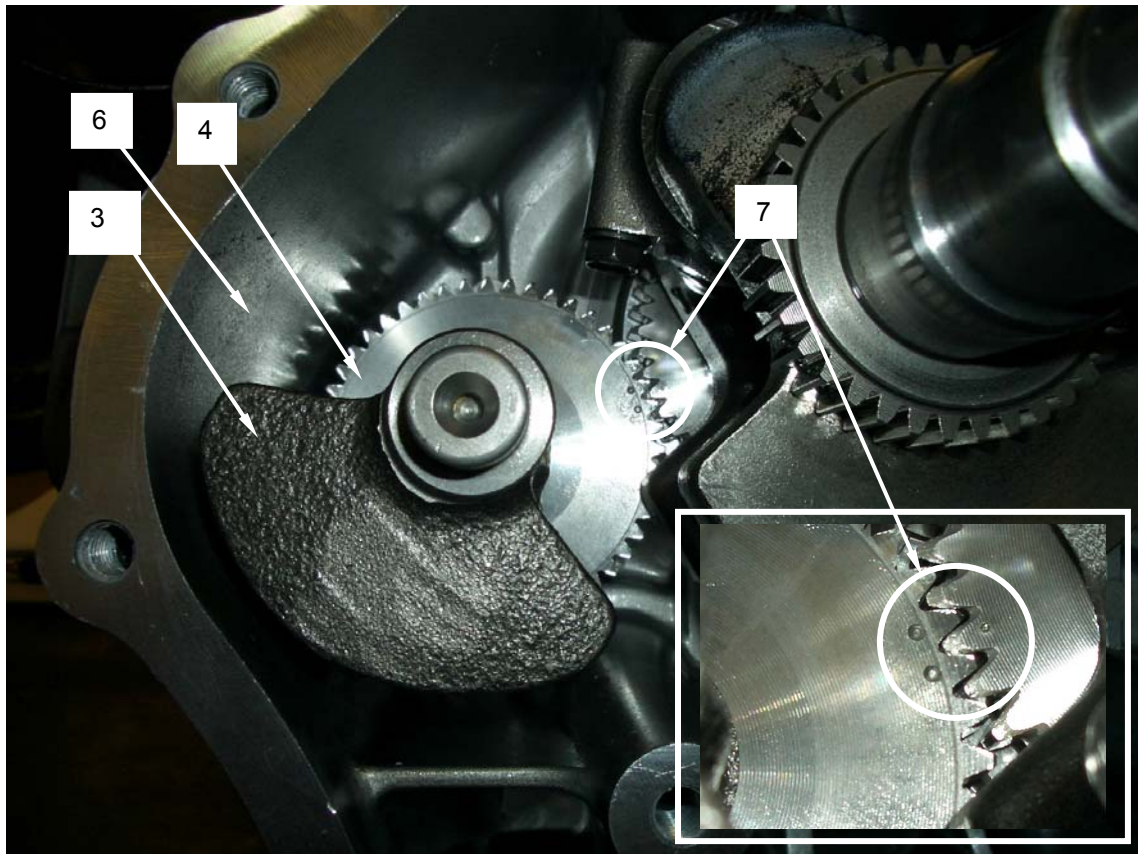
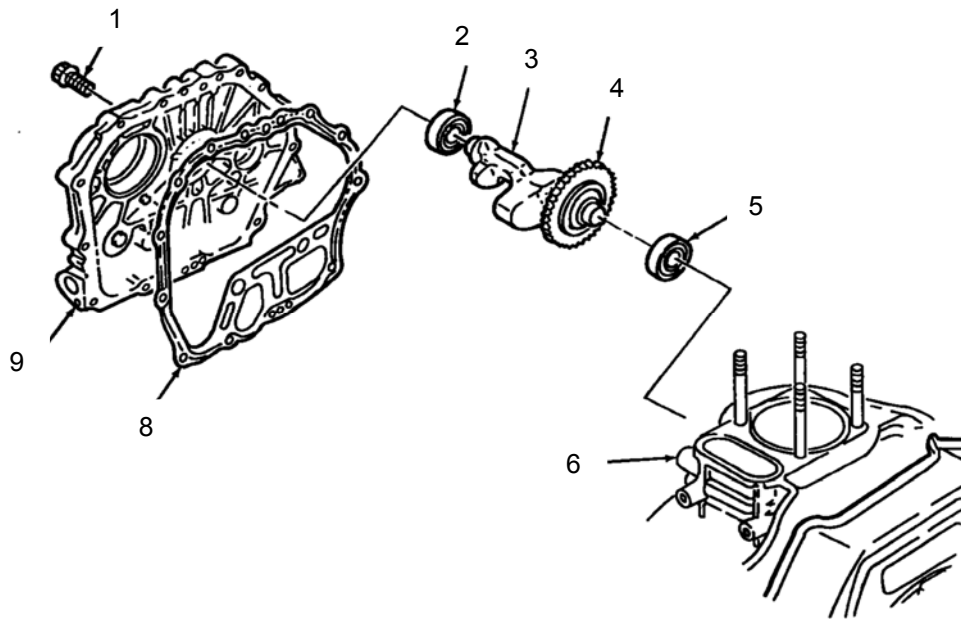


Figure 2. Install Balancer Shaft (Sheet 1 of 2).

INSTALL - Continued

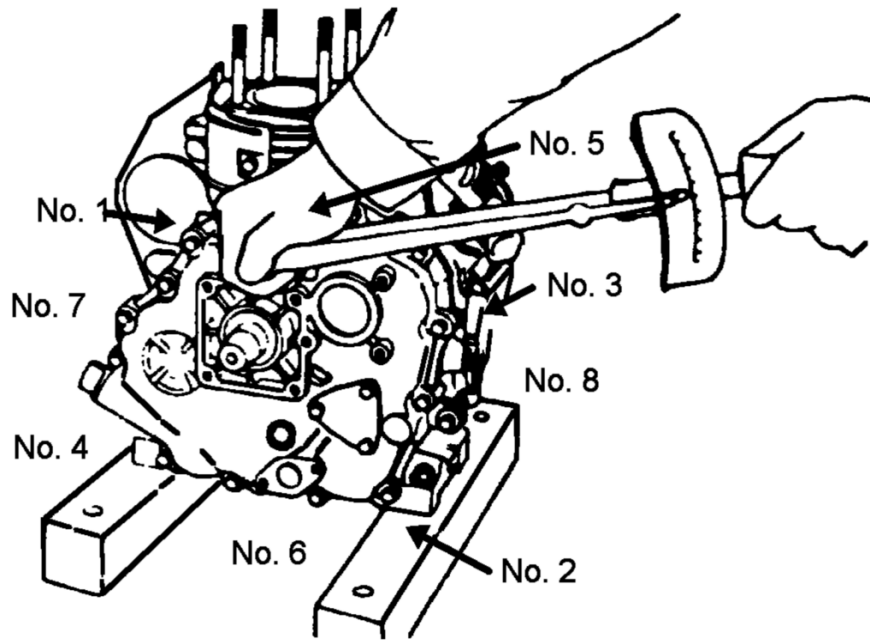


Figure 2. Install Balancer Shaft (Sheet 2 of 2).

END OF TASK

END OF WORK PACKAGE





**SUSTAINMENT MAINTENANCE****CAMSHAFT ASSEMBLY  
REMOVE, SERVICE, INSPECT, INSTALL****INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17)  
Caliper, Digital Display (WP 0124, Item 2)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Oil, Engine Lubricating (WP 0123, Item 9, 10, 11,  
or 12) (Oil selection dependent on temperature,  
refer to WP 0002 for details)  
Rags, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)  
Grease, General Purpose (WP 0123, Item 7)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Engine oil drained (WP 0051).  
Fuel injection pump removed (WP 0085).  
Remove diesel engine from heater (WP 0081).

**References**

WP 0053

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE****CAUTION**

When removing crankcase cover, be careful not to damage oil seal.

1. Release crankcase cover (Figure 1, Item 2) from cylinder block by removing fifteen screws (Figure 1, Item 1). Carefully pry crankcase cover from engine crankcase.
2. Remove cover gasket (Figure 1, Item 3). Discard if damaged or deformed.

**NOTE**

Exhaust and intake tappets (Figure 1, Item 5 and 7) may fall down when pulling out camshaft assembly. Keep tappets separate to avoid confusion.

3. Remove valve cover (Figure 1, Item 11) by removing three bolts (Figure 1, Item 10).
4. Remove rocker arm assembly by removing two bolts (Figure 1, Item 8) retaining rocker arm support (Figure 1, Item 9). Carefully place rocker arm assembly and hardware aside.
5. Remove push rods (Figure 1, Item 4 and 6) and set aside.
6. Lay engine on side and push lifter out of the way.

**REMOVE - Continued**

7. Carefully remove assembled camshaft components from cylinder block.
8. Remove bearing (Figure 1, Item 12) from crankcase cover (Figure 1, Item 2) only if replacement is required.

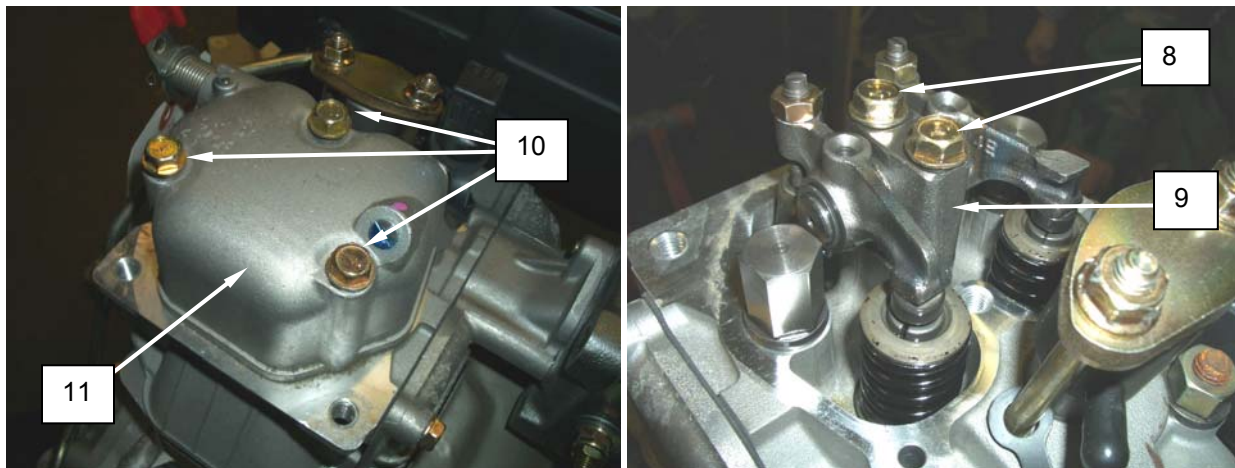
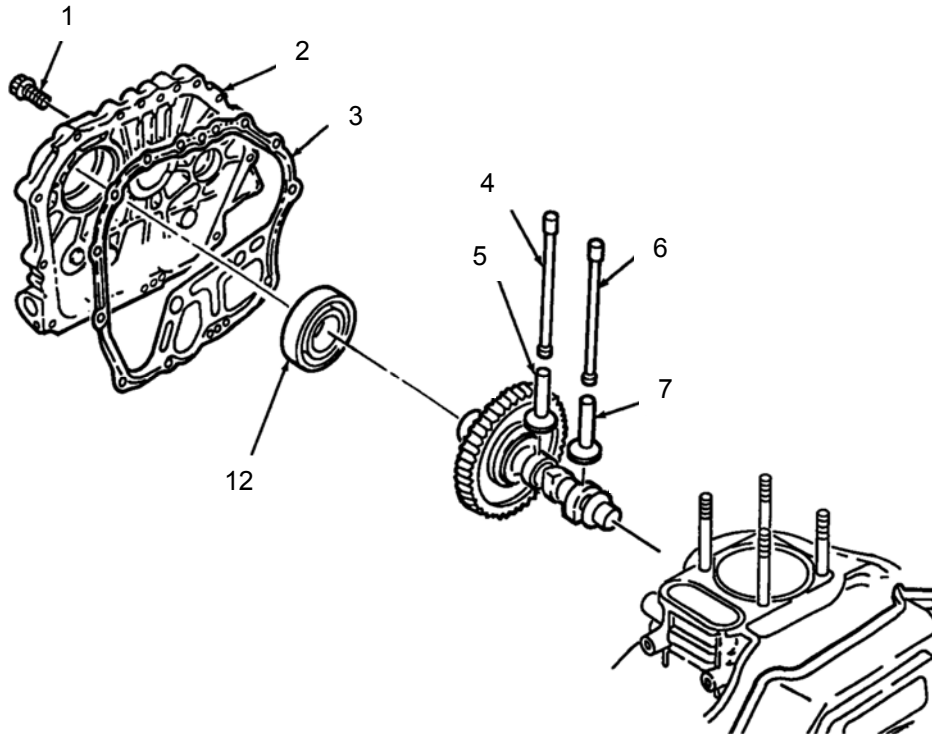


Figure 1. Remove Camshaft Assembly.

**END OF TASK**

**SERVICE****Clean Camshaft Components****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

1. Inspect crankcase cover (Figure 2, Item 3) for cracks, deformation, or obvious damage. Inspect mating surfaces for scratches, burrs, or blemishes. Replace cover if damaged.
2. Inspect cover gasket (Figure 2, Item 4) for damage or deformation. Replace if damaged in any way.
3. Inspect gear (Figure 2, Item 5) for broken, chipped, or worn teeth. Replace gear and camshaft (Figure 2, Item 10) as an assembly if gear is damaged or worn.
4. Inspect outer surfaces of tappets (Figure 2, Item 6, 9) for wear or damage. Check condition of tappet contact point. Measure the outside diameter (OD) of tappet stems. OD must be 0.2705 inch (6.87 mm), minimum. Replace tappet if damaged, worn, or out of limits.
5. Measure the OD of camshaft (Figure 2, Item 10) where it mates to crankcase cover bearing (Figure 2, Item 15). OD must be 1.1772 inches (29.90 mm), minimum. Replace camshaft (Figure 2, Item 10) and gear (Figure 2, Item 5) if out of limits.
6. Measure the OD of camshaft (Figure 2, Item 10) on opposite end (where it mates to cylinder block needle bearing). OD must be 0.5874 inch (14.92 mm), minimum. Replace camshaft (Figure 2, Item 10) and gear (Figure 2, Item 5) if out of limits.
7. Measure the internal diameter (ID) of bearing (Figure 2, Item 15). ID must be 1.1808 inches (29.993 mm), maximum. Replace bearing if out of limits.

**END OF TASK****INSTALL**

1. Lay engine on side and push lifter out of the way. Return engine to upright position.
2. Insert tappets (Figure 2, Item 7, 8) into cylinder block.
3. Carefully insert assembled camshaft (Figure 2, Item 10) and gear (Figure 2, Item 5) into cylinder block. Align match-marks (Figure 2, Item 1) on camshaft gear with those on crankshaft gear, then press camshaft (Figure 2, Item 10) into crankcase needle bearing.
4. Install push rods (Figure 2, Item 7, 8) removed earlier.

**INSTALL - Continued**

5. Install rocker arm assembly set aside earlier by installing two bolts (Figure 2, Item 11) retaining rocker arm support (Figure 2, Item 12). Torque bolts to 174 to 199 inch-pounds. (200 to 230 kg-cm).
6. Readjust rocker arm assembly IAW WP 0053.
7. Install valve cover (Figure 2, Item 14) by installing three bolts (Figure 2, Item 13).
8. Apply grease to lips of crankshaft oil seal (located in crankcase cover (Figure 2, Item 3)).
9. Apply oil to crankshaft and camshaft. Make sure that oil pump drive gears are properly engaged.
10. Mate cover gasket (Figure 2, Item 4) to cylinder block.
11. Mate crankcase cover (Figure 2, Item 3) to cylinder block and secure using fifteen screws (Figure 2, Item 2). Tighten screws in crisscross sequence as shown. Torque all screws to 174 to 199 inch-pounds (200 to 230 kg-cm).
12. Install fuel injection pump (WP 0085).
13. Service engine oil (WP 0051).
14. Reinstall diesel engine (WP 0081).

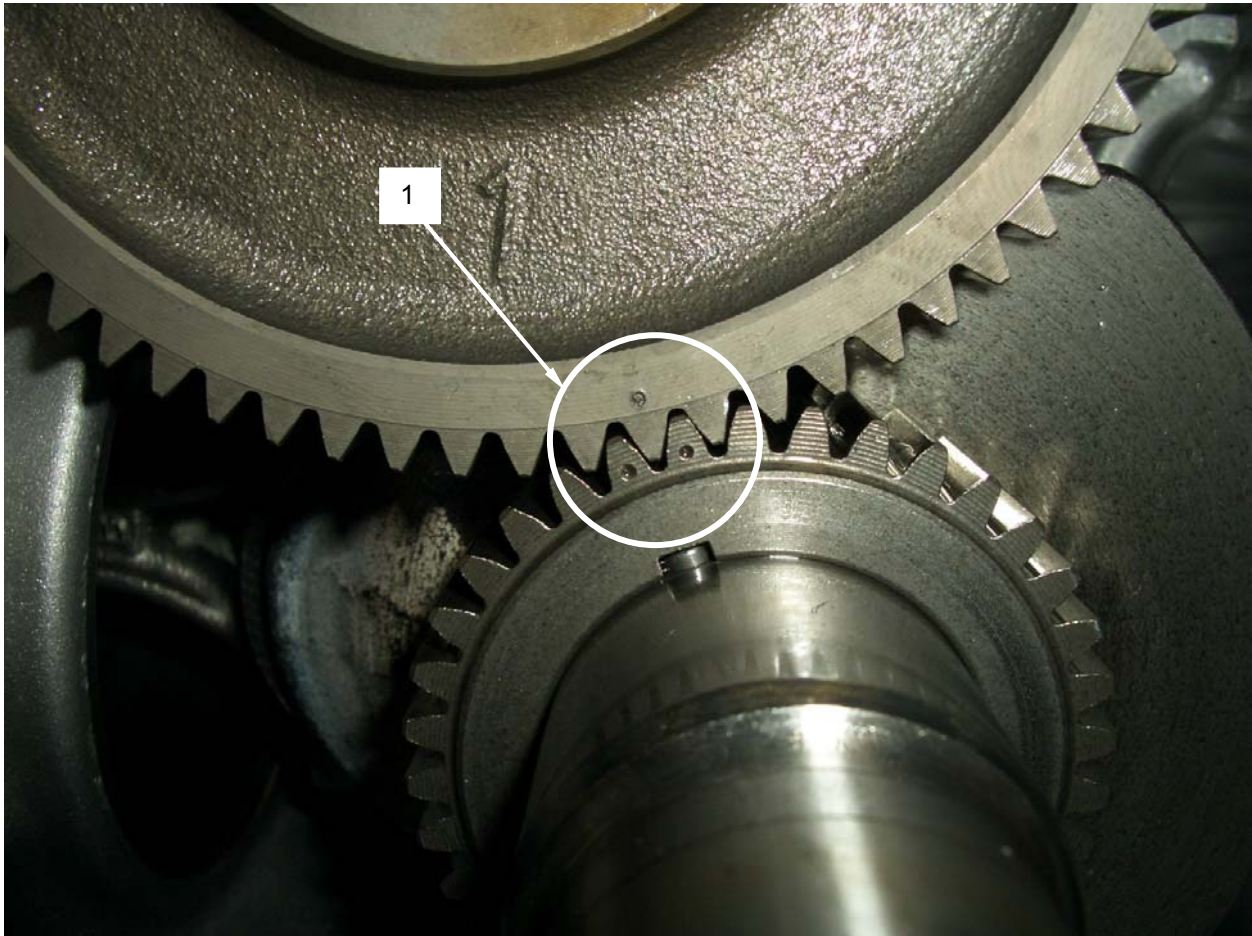


Figure 2. Inspect and Install Camshaft Assembly (Sheet 1 of 3).

INSTALL - Continued

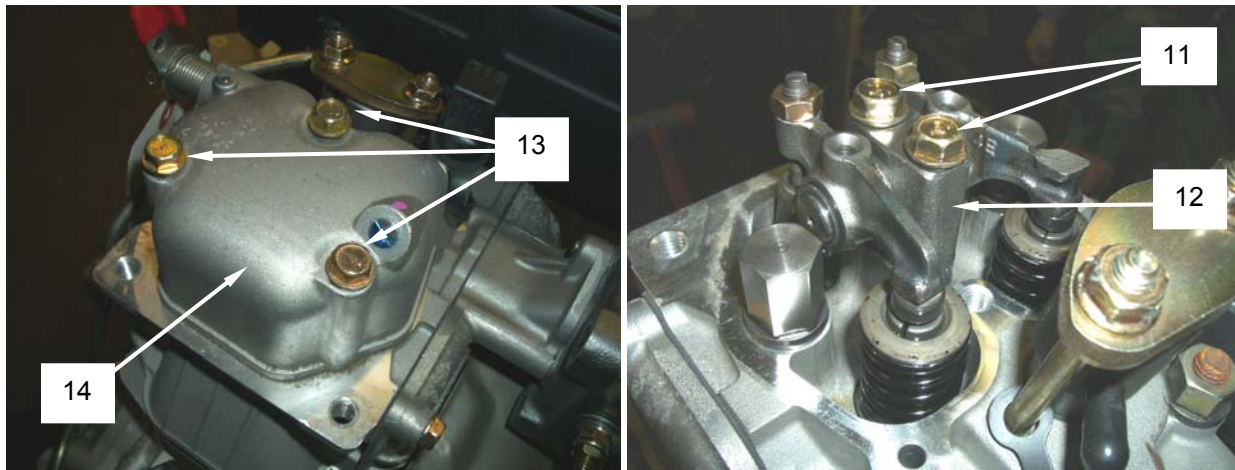
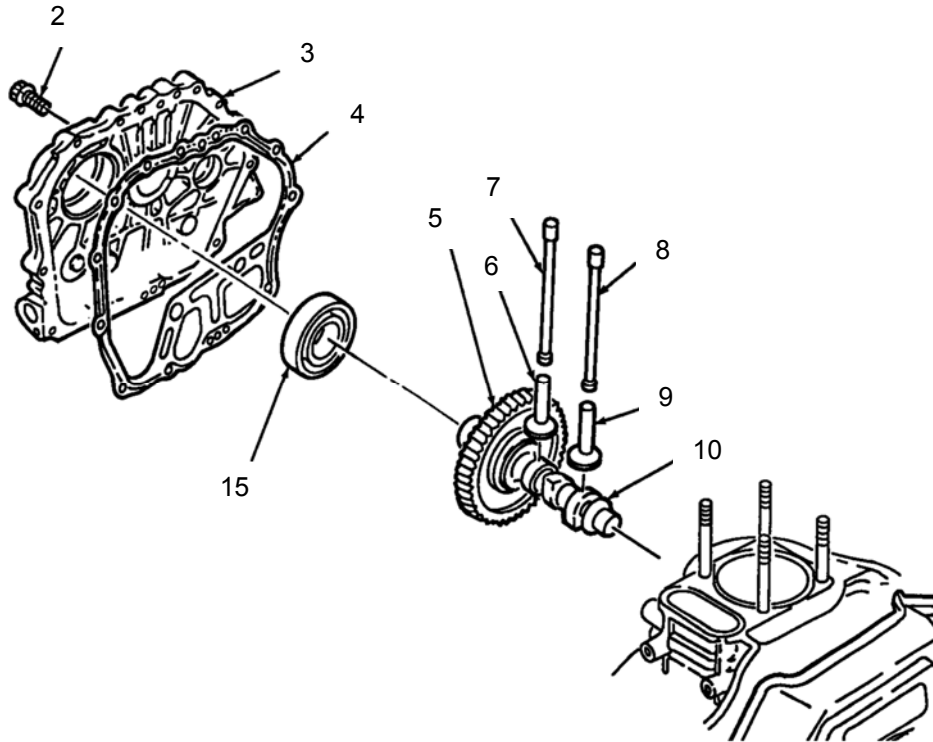


Figure 2. Inspect and Install Camshaft Assembly (Sheet 2 of 3).

## INSTALL - Continued

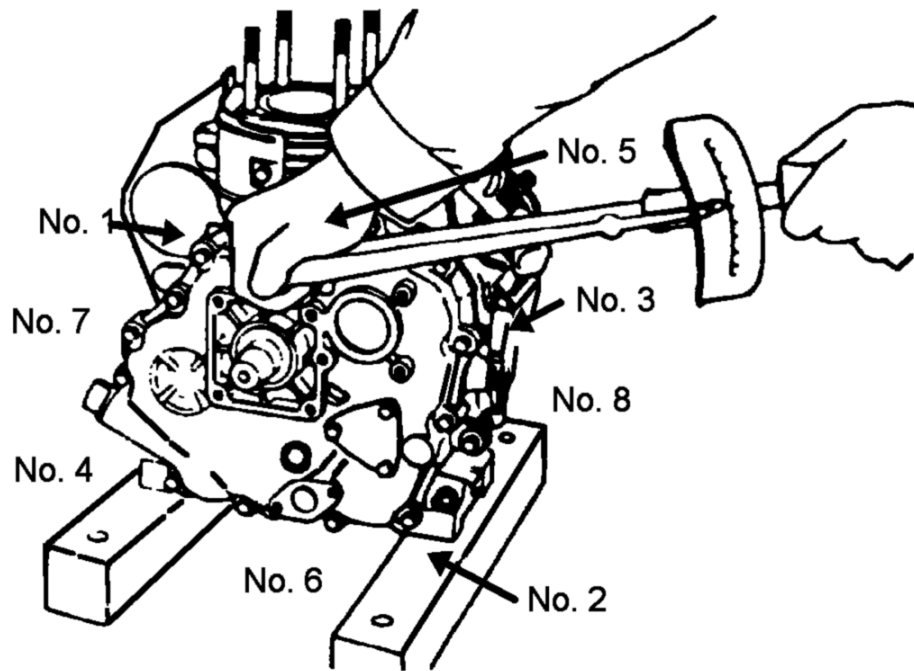


Figure 2. Inspect and Install Camshaft Assembly (Sheet 3 of 3).

END OF TASK

END OF WORK PACKAGE

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**SUSTAINMENT MAINTENANCE**  
**FUEL INJECTION PUMP ASSEMBLY**  
**DISASSEMBLY, SERVICE, INSPECT, ASSEMBLY**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)  
Wrench, Torque (WP 0124, Item 17)

**Materials/Parts**

Rag, Wiping, Clean (WP 0123, Item 15)  
Solvent, Degreasing (WP 0123, Item 20)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Fuel injection pump removed (WP 0085).

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**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**DISASSEMBLY**

1. Remove valve holder (Figure 1, Item 1) from body (Figure 1, Item 6). Remove delivery spring (Figure 1, Item 2).
2. Remove delivery valve (Figure 1, Item 4) and gaskets (Figure 1, Item 3, 5) from body (Figure 1, Item 6). Discard gaskets.
3. Disengage spring seat (Figure 1, Item 14) from control lever (Figure 1, Item 10). Remove spring (Figure 1, Item 13), pin (Figure 1, Item 11), spring seat (Figure 1, Item 12), and control lever (Figure 1, Item 10) from body (Figure 1, Item 6).
4. Remove plate (Figure 1, Item 9), gasket (Figure 1, Item 8), and plunger (Figure 1, Item 7) from body (Figure 1, Item 6). Discard gasket.

**END OF TASK**

**SERVICE - Continued****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK****INSPECT**

1. Inspect delivery valve (Figure 1, Item 4) and plunger (Figure 1, Item 7) for scores, pitting, or wear. Replace if damaged or worn.
2. Inspect springs (Figure 1, Item 2, 13) for damage or deformation. Replace if damaged or deformed in any way.

**END OF TASK****ASSEMBLY**

1. Insert plunger (Figure 1, Item 7) into body (Figure 1, Item 6).
2. Install new gasket (Figure 1, Item 8) and plate (Figure 1, Item 9) onto body (Figure 1, Item 6). Install control lever (Figure 1, Item 10) with tab on lever mating to hole on plate (Figure 1, Item 9).
3. Install spring seat (Figure 1, Item 12) and pin (Figure 1, Item 11). Install spring (Figure 1, Item 13) and spring seat (Figure 1, Item 14).
4. Install new gaskets (Figure 1, Item 3, 5) onto delivery valve (Figure 1, Item 4). Insert spring (Figure 1, Item 2) and delivery valve into valve holder (Figure 1, Item 1).
5. Install valve holder (Figure 1, Item 1) into body (Figure 1, Item 6). Torque holder to 261 to 303 inch-pounds (300 to 350 kg-cm).
6. Install fuel injection pump (WP 0085).



ASSEMBLY - Continued

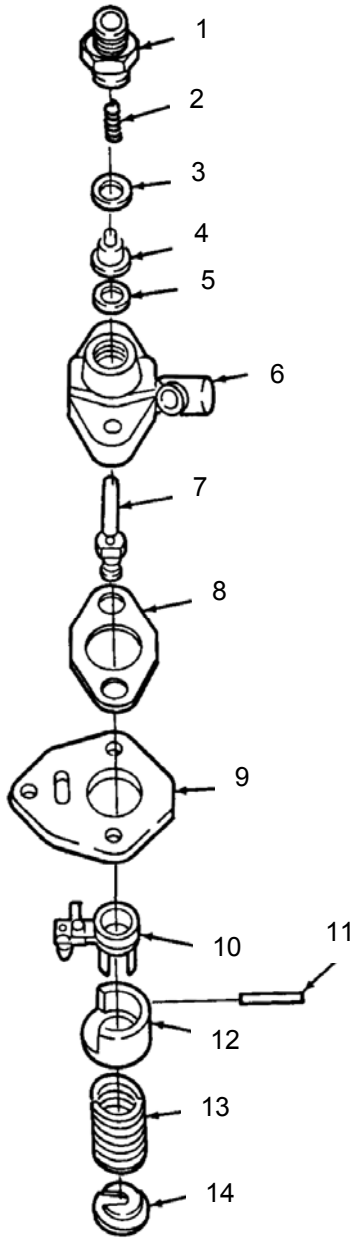


Figure 1. Disassembly, Service, Inspect, Assembly Fuel Injection Pump.

END OF TASK

END OF WORK PACKAGE



**SUSTAINMENT MAINTENANCE**  
**PISTON AND CONNECTING ROD**  
**REMOVE, SERVICE, INSPECT, INSTALL, REPAIR**

**INITIAL SETUP:****Tools and Special Tools**

Ring Compressor (WP 0124, Item 9)  
 Shop Equipment, Automotive Maintenance and Repair (WP 0124, Item 11)  
 Tool Kit, General Mechanics (WP 0124, Item 13)  
 Wrench, Torque (WP 0124, Item 17 or 18)  
 Caliper, Digital Display (WP 0124, Item 2)  
 Heat Gun, Electric (WP 0124, Item 5)

**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)  
 Solvent, Degreasing (WP 0123, Item 20)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer  
 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**Equipment Condition**

Heater shut down and cool (WP 0005).  
 Engine access door open.  
 Main battery switch OFF and handle removed.  
 Cylinder head removed (WP 0082).  
 Camshaft removed (WP 0091).  
 Balancer shaft removed (WP 0090).  
 Remove diesel engine from heater (WP 0081).

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Remove connecting rod nuts (Figure 1, Item 7) and washers (Figure 1, Item 8) from rod bolts (Figure 1, Item 4, 12).
2. Remove connecting rod cap (Figure 1, Item 9) and lower bearing half (Figure 1, Item 11) from crankshaft journal. Remove pins (Figure 1, Item 10) only if replacement is required.
3. Rotate crankshaft to the top of its stroke so that piston (Figure 1, Item 13) rises out of cylinder block. Remove assembled piston (Figure 1, Item 13) and connecting rod (Figure 1, Item 5) from crankcase. Remove upper bearing half (Figure 1, Item 6).

**WARNING**

Use extreme caution when handling hot components. Wear protective gloves. Failure to observe this warning can result in injury to personnel.

4. Remove two circlips (Figure 1, Item 3) from piston pin (Figure 1, Item 2). Discard circlips. To remove piston pin from piston (Figure 1, Item 13), heat components to 158 to 176° F (70 to 80° C). Drive pin from piston and connecting rod (Figure 1, Item 5).

**REMOVE - Continued**

5. Remove piston rings (Figure 1, Item 1) from piston (Figure 1, Item 13). Discard rings.
6. Remove rod bolts (Figure 1, Item 4, 12) from connecting rod (Figure 1, Item 5).

**END OF TASK****SERVICE****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well-ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

1. Clean all components with cleaning solvent and a clean rag. Allow to air dry.
2. Remove carbon deposits from ring grooves of piston (Figure 1, Item 13) by scraping with discarded ring. Rinse with cleaning solvent and allow to air dry.

**CAUTION**

Use care to prevent scratching of surface.

3. Remove carbon deposits from top of piston (Figure 1, Item 13).

SERVICE - Continued

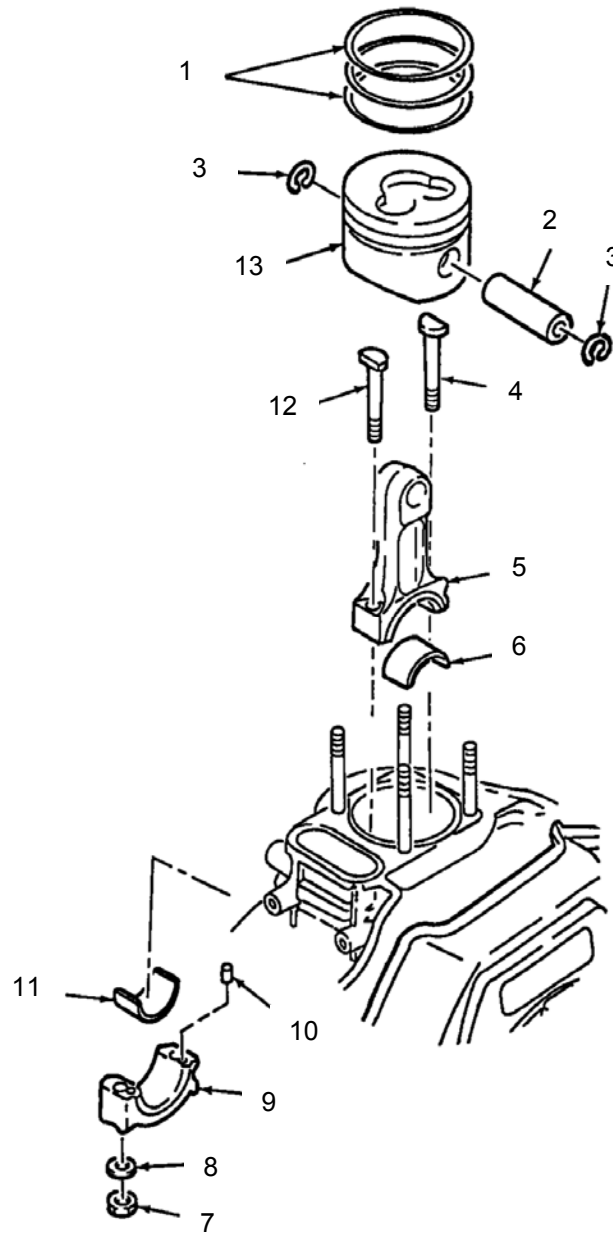


Figure 1. Remove and Clean Piston and Connecting Rod.

END OF TASK

**INSPECT**

1. Inspect piston (Figure 1, Item 13) and connecting rod (Figure 1, Item 5) for cracks, deformation, or obvious damage. Inspect for uneven or excessive wear. Replace component if any damage is suspected.
2. Measure the outside diameter (OD) of piston, approximately 1/2 inch from the bottom. OD must be 3.0591 inches (77.70 mm), minimum. Replace piston if out of limits.
3. Measure the internal diameter (ID) of the piston pin hole in piston. ID must be 0.8295 inch (21.07mm), maximum. Replace piston if out of limits.
4. Measure the OD of piston pin (Figure 1, Item 2) along the length of the pin. OD must be 0.8232 inch (20.91 mm), minimum. Replace piston pin if out of limits.
5. Using new piston ring set, measure the clearance between piston rings and piston grooves. Side clearance must be 0.0059 inch (0.15 mm), maximum. If clearance exceeds limit, replace piston.

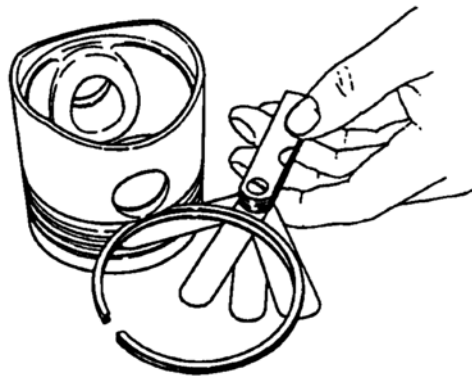
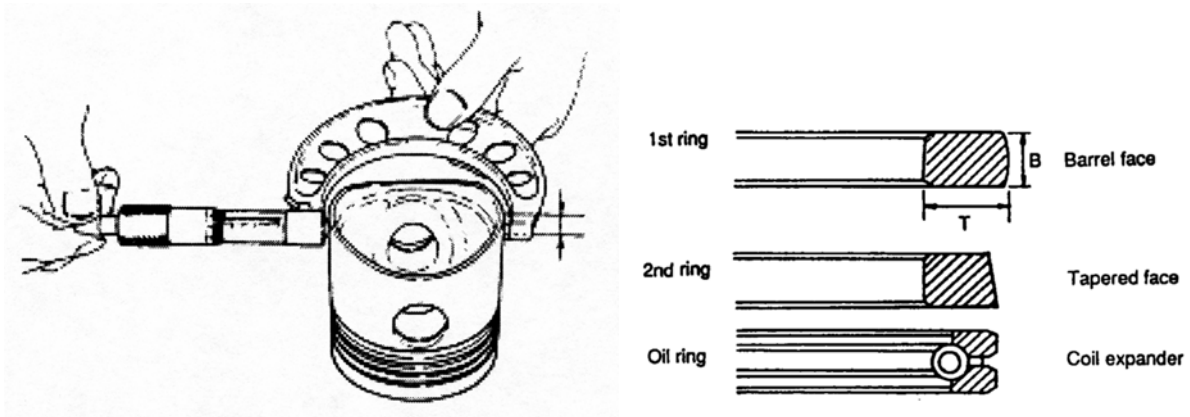


Figure 2. Measure Piston.

**END OF TASK**

**INSTALL**

1. Install new ring set into piston ring grooves. Mount rings with end gaps staggered 120° apart (Figure 4). Make sure that rings move smoothly in grooves.

**WARNING**

Use extreme caution when handling hot components. Wear protective gloves. Failure to observe this warning can result in injury to personnel.

2. To install piston pin (Figure 3, Item 2) into piston (Figure 3, Item 13) and connecting rod (Figure 3, Item 5), heat components to 158 to 176° F (70 to 80° C). Match marks on piston and connecting rod and install connecting rod into piston. Install piston pin (Figure 3, Item 2) and allow components to cool.
3. Install new circlips (Figure 3, Item 3) onto piston pin (Figure 3, Item 2). Insert rod bolts (Figure 3, Item 4, 12) into connecting rod (Figure 3, Item 5).
4. Apply oil to the outer surface of piston (Figure 3, Item 13), the inner surface of the piston sleeve, and crankshaft crank pin. Using a ring compressor tool, carefully install upper bearing half (Figure 3, Item 6), piston (Figure 3, Item 18), and connecting rod (Figure 3, Item 5) into cylinder block. Piston top mark must face crankcase cover side of cylinder block.
5. Install pins (Figure 3, Item 7) into connecting rod cap (Figure 3, Item 8).
6. Install lower bearing half (Figure 3, Item 11). Mate connecting rod cap (Figure 3, Item 8) to connecting rod (Figure 3, Item 5), ensuring match marks are aligned. Install nuts (Figure 3, Item 10) and washers (Figure 3, Item 9). Torque nuts to 157 to 182 inch-pounds (180 to 210 kg-cm).
7. Install balancer shaft (WP 0090).
8. Install camshaft (WP 0091).
9. Install cylinder head (WP 0082).

INSTALL - Continued

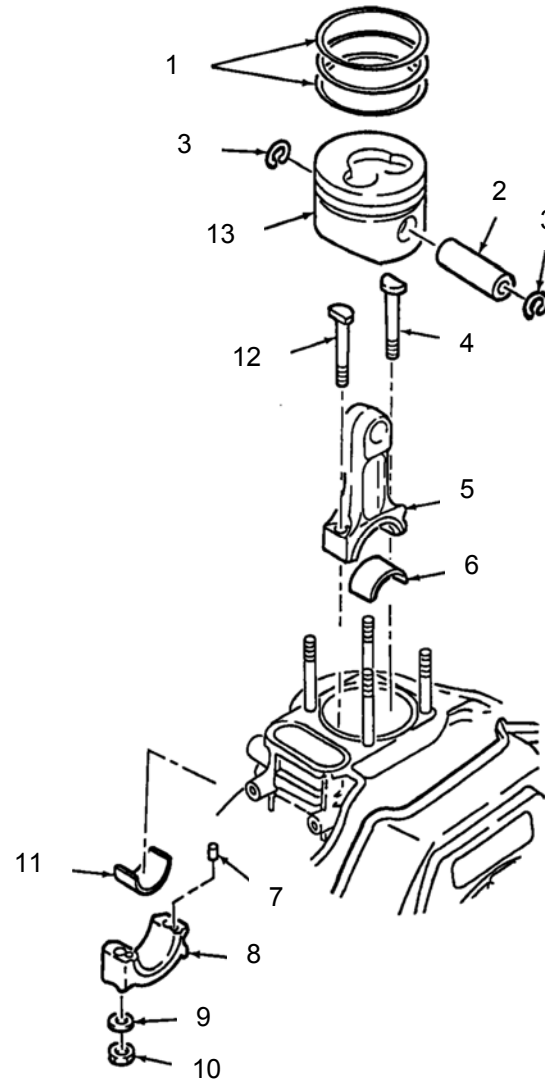


Figure 3. Remove, Service, Inspect, and Install Piston and Connecting Rod.



INSTALL - Continued

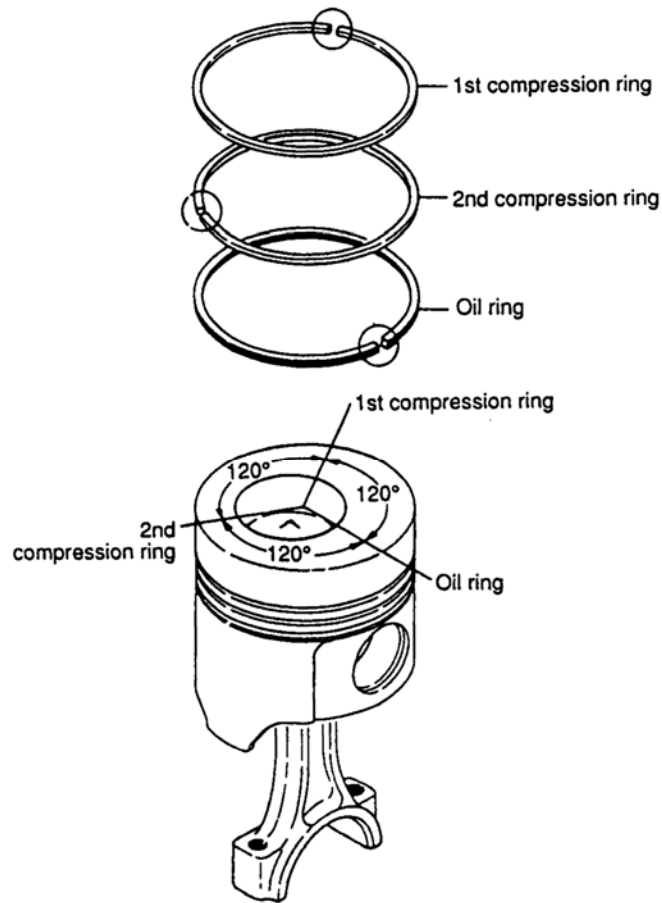


Figure 4. Placement of Rings.

**END OF TASK**

**REPAIR**

Repair to the piston and connecting rod involves replacement of defective components.

**END OF TASK**

**END OF WORK PACKAGE**



**SUSTAINMENT MAINTENANCE**  
**GOVERNOR CONTROL**  
**REMOVE, SERVICE, INSPECT, INSTALL, REPAIR**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**

Quartermaster and Chemical Equipment Repairer 63J (1) or  
 Utilities Equipment Repairer 52C (1)

**Materials/Parts**

Rags, Wiping, Clean (WP 0123, Item 15)  
 Solvent, Degreasing (WP 0123, Item 20)

**References**

WP 0091  
 WP 0094

**Equipment Condition**

Heater shut down and cool (WP 0005).  
 Engine access door open.  
 Main battery switch OFF and handle removed.  
 Remove diesel engine from heater (WP 0081).  
 Governor control removed (WP 0086).  
 Camshaft assembly removed (WP 0091).

---

**NOTE**

Engine maintenance requires metric tools for the removal of all hardware and assemblies.

**REMOVE**

1. Reach into cylinder block and disengage governor (Figure 1, Item 3) from governor lever assembly (Figure 1, Item 4). Remove governor lever assembly from lever (Figure 1, Item 7) by removing pin (Figure 1, Item 6).
2. Remove washer (Figure 1, Item 2), bearing (Figure 1, Item 1), and bush (Figure 1, Item 5).

**END OF TASK****SERVICE****WARNING**

Cleaning solvents are flammable and toxic to eye, skin, and respiratory tract. Skin and eye protections are required when working in contact with cleaning solvents. Avoid repeated or prolonged contact. Work in well-ventilated area only. Keep away from heat, sparks, and open flame. Do not smoke while using cleaning solvent. Failure to observe this warning can result in injury or death to personnel.

Clean components with cleaning solvent and a clean rag. Allow to air dry.

**END OF TASK**

**INSPECT**

Inspect governor components for damage. Replace any part that is damaged in any way.

**END OF TASK****INSTALL**

1. Install governor lever assembly (Figure 1, Item 4), washer (Figure 1, Item 2), and bearing (Figure 1, Item 1) into cylinder block. Engage governor (Figure 1, Item 3).
2. Install bushing (Figure 1, Item 5). Mate lever (Figure 1, Item 7) onto governor lever assembly (Figure 1, Item 4) and secure using pin (Figure 1, Item 6).
3. Install camshaft assembly (WP 0091).
4. Install governor control (WP 0094).

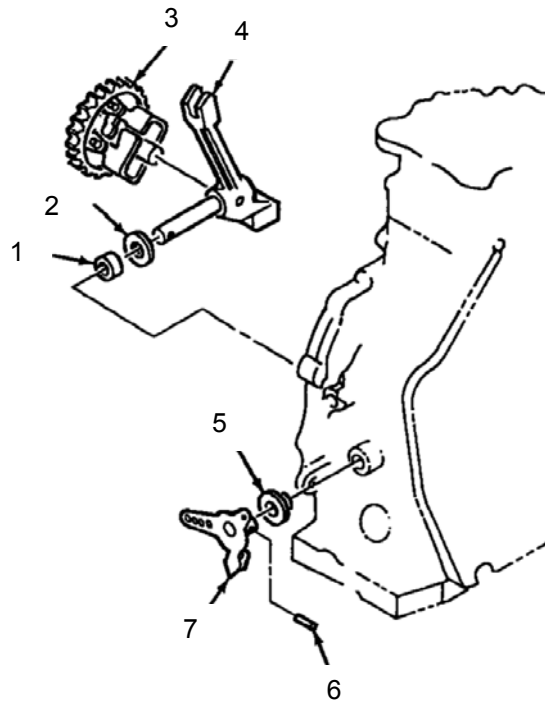


Figure 1. Remove, Service, Inspect, and Install Governor.

**END OF TASK****REPAIR**

Repair to the governor control involves replacement of defective components.

**END OF TASK****END OF WORK PACKAGE**

---

**SUSTAINMENT MAINTENANCE****MAIN WIRING HARNESS ASSEMBLY  
REPLACE**

---

**INITIAL SETUP:****Tools and Special Tools**

Tool Kit, General Mechanics (WP 0124, Item 13)

**Personnel Required**Quartermaster and Chemical Equipment Repairer  
63J (1) or  
Utilities Equipment Repairer 52C (1)**Materials/Parts**Tags, Marking (WP 0123, Item 22)  
Tape, Insulation, Electrical (WP 0123, Item 25)  
Strap, Tiedown, Electrical Components (WP 0123,  
Item 21)**Equipment Condition**Heater shut down and cool (WP 0005).  
Engine access door open.  
Main battery switch OFF and handle removed.  
Negative cable on battery closest to engine  
access door disconnected.

---

**REPLACE****NOTE**

If it is determined that the entire main wiring harness requires replacement, then there is a high probability that additional damage has been caused to other components within the system. Therefore, it may be necessary to inspect or test other components in the system to ensure that they are in good working order.

1. Tag and/or mark all connectors on the main wiring harness to ensure that the new main wire harness is connected correctly.
2. Disconnect all connectors on the main wiring harness.
3. Take note of all tie wraps locations that secure the main wiring harness to the heater chassis.
4. Clip all tie wraps that secure the wiring harness to the heater chassis. Do not clip the tie wraps that secure wires to the main wiring harness as a whole.
5. Take note of the position of the main wiring harness in the heater and carefully remove the defective main wiring harness.
6. Install the new main wiring harness in the same position as the defective main wiring harness.
7. Tie wrap the new main wiring harness, using tiedown straps, to all previously noted locations along the heater chassis.
8. Reconnect all connectors according to tags and markings made earlier.
9. Remove all tags and/or markings.

**END OF TASK****END OF WORK PACKAGE**



**CHAPTER 10**

**PARTS INFORMATION**  
**FOR**  
**LARGE CAPACITY FIELD HEATER,**  
**TYPE II (LCFH TYPE II)**





**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**

**REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)**

**INTRODUCTION**

**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 performance of field and sustainment maintenance of the Large Capacity Field Heater, Type II, (LCFH Type II). It authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the source, maintenance, and recoverability (SMR) codes.

**GENERAL**

In addition to the Introduction work package, this RPSTL is divided into the following work packages.

1. Repair Parts List Work Packages. Work packages containing lists of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. These work packages also include 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. Sending units, brackets, filters, and bolts are listed with the component they mount on. Bulk materials are listed by item name in FIG. BULK at the end of the work packages. Repair parts kits are listed at the end of the individual work packages. Repair parts for reparable special tools are also listed in a separate work package. Items listed are shown on the associated illustrations.
2. Special Tools List Work Packages. Work packages containing lists of special tools, special TMDE, and special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in the DESCRIPTION AND USABLE ON CODE (UOC) column). Tools that are components of common tool sets and/or Class VII are not listed.
3. Cross-Reference Indexes Work Packages. There are two cross-reference indexes work packages in this RPSTL: the National Stock Number (NSN) Index work package, and the Part Number (P/N) Index work package. The National Stock Number Index work package refers you to the figure and item number. The Part Number Index work package refers you to the figure and item number.

**EXPLANATION OF COLUMNS IN THE REPAIR PARTS LIST AND SPECIAL TOOLS LIST WORK PACKAGES**

ITEM NO. (Column (1)). Indicates the number used to identify items called out in the illustration.

SMR CODE (Column (2)). The SMR code containing supply/requisitioning information, maintenance level authorization criteria, and disposition instruction, as shown in the following breakout. This entry may be subdivided into 4 subentries, one for each service.

**TABLE 1. SMR Code**

Source <u>Code</u>		Maintenance <u>Code</u>	Recoverability <u>Code</u>
XX		XX	X
1st two 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 on the item.	Who determines disposition action on unserviceable items.

\*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.

Source Code. The source code tells you how you get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source codes follow:

<u>Source Code</u>	<u>Application/Explanation</u>
PA	
PB	
PC	<b>NOTE</b>
PD	Items coded PC are subject to deterioration.
PE	
PF	Stock items; use the applicable NSN to requisition/request items with these source codes. They are authorized to the level indicated by the code entered in the third position of the SMR code.
PG	
PH	
PR	
PZ	
KD	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance level indicated in the third position of the SMR code. The complete kit must be requisitioned and applied.
KF	
KB	
MO-Made at service/AMC level	Items with these codes are not to be requisitioned/requested individually. They must be made from bulk material which is identified by the part number in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the bulk material group work package of the RPSTL. If the item is authorized to you by the third position code of the SMR code, but the source code indicates it is made at higher level, order the item from the higher level of maintenance.
MF-Made at field /ASB level	
MH-Made at below depot/sustainment level	
ML-Made at SRA/TASMG	
MD-Made at depot	
MG-Navy only	
AO-Assembled by service/AMC 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 third position of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order the item from the higher level of maintenance.
AF-Assembled by field/ASB level	
AH-Assembled by below depot sustainment level	
AL-Assembled by SRA/TASMG	
AD-Assembled by depot	
AG-Navy only	
XA	Do not requisition an "XA" coded item. Order the next higher assembly.(Refer to NOTE below.)
XB	If an item is not available from salvage, order it using the CAGEC and part number.
XC	Installation drawings, diagrams, instruction sheets, field service drawings; identified by manufacturer's part number.
XD	Item is not stocked. Order an XD-coded item through local purchase or 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 items source coded "XA" or those aircraft support items restricted by requirements of AR 750-1.

Maintenance Code. Maintenance codes tell you the level(s) of maintenance authorized to use and repair support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

Third Position. The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to the following levels of maintenance:

**Maintenance Code**

**Application/Explanation**

O* -	Field (Service) level/AMC maintenance can remove, replace, and use the item.
F -	Field/ASB maintenance can remove, replace, and use the item.
H -	Below Depot Sustainment maintenance can remove, replace, and use the item.
L -	Specialized repair activity/TASMG can remove, replace, and use the item.
G -	Afloat and ashore intermediate maintenance can remove, replace, and use the item (Navy only)
K -	Contractor facility can remove, replace, and use the item
Z -	Item is not authorized to be removed, replace, or used at any maintenance level
D -	Depot can remove, replace, and use the item.

\*NOTE - Army may use C in the third position. However, for joint service publications, Army will use O.

Fourth Position. The maintenance code entered in the fourth position tells you whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (perform all authorized repair functions).

**NOTE**

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.

**Maintenance Code**

**Application/Explanation**

O -	Field (Service)/AMC is the lowest level that can do complete repair of the item.
F -	Field/ASB is the lowest level that can do complete repair of the item.
H -	Below Depot Sustainment is the lowest level that can do complete repair of the item.
L -	Specialized repair activity/TASMG (enter specialized repair activity or TASMG designator) 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.
G -	Both afloat and ashore intermediate levels are capable of complete repair of item. (Navy only)
K -	Complete repair is done at contractor facility
Z -	Nonreparable. No repair is authorized.
B -	No repair is authorized. No parts or special tools are authorized for maintenance of "B" coded item. However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is shown in the fifth position of the SMR code as follows:

### Recoverability

<u>Recoverability Code</u>	<u>Application/Explanation</u>
Z -	Nonreparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in the third position of the SMR code.
O -	Reparable item. When uneconomically repairable, condemn and dispose of the item at the service/AMC level.
F -	Reparable item. When uneconomically repairable, condemn and dispose of the item at the field level/ASB.
H -	Reparable item. When uneconomically repairable, condemn and dispose of the item at the below depot sustainment level.
D -	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item are not authorized below depot level.
L -	Reparable item. Condemnation and disposal not authorized below Specialized Repair Activity (SRA) or theater aviation sustainment maintenance group (TASMG).
A -	Item requires special handling or condemnation procedures because of specific reasons (such as precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.
G -	Field level repairable item. Condemn and dispose at either afloat or ashore intermediate levels. (Navy only)
K -	Reparable item. Condemnation and disposal to be performed at contractor facility

NSN (Column (3)). The NSN for the item is listed in this column.

CAGEC (Column (4)). The Commercial and Government Entity Code (CAGEC) is a five-digit code which is used to identify the manufacturer, distributor, or Government agency/activity that supplies the item.

PART NUMBER (Column (5)). 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 you use an NSN to requisition an item, the item you receive may have a different part number from the number listed.

DESCRIPTION AND USABLE ON CODE (UOC) (Column (6)). This column includes the following information:

1. The federal item name, and when required, a minimum description to identify the item.
2. Part numbers of bulk materials are referenced in this column in the line entry to be manufactured or fabricated.
3. Hardness Critical Item (HCI). A support item that provides the equipment with special protection from electromagnetic pulse (EMP) damage during a nuclear attack.
4. The statement END OF FIGURE appears just below the last item description in column (6) for a given figure in both the repair parts list and special tools list work packages.

QTY (Column (7)). The QTY (quantity per figure) column indicates the quantity of the item used in the breakout shown on the illustration/figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column instead of a quantity indicates that the quantity is variable and quantity may change from application to application.

## EXPLANATION OF CROSS-REFERENCE INDEXES WORK PACKAGES FORMAT AND COLUMNS

1. National Stock Number (NSN) Index Work Package. NSNs in this index are listed in National Item Identification Number (NIIN) sequence.

STOCK NUMBER Column. This column lists the NSN in NIIN sequence. The NIIN consists of the last nine digits of the NSN. When using this column to locate an item, ignore the first four digits of the NSN. However, the complete NSN should be used when ordering items by stock number. For example, if the NSN is 5385-01-574-1476, the NIIN is 01-574-1476.

FIG. Column. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in the repair parts list and special tools list work packages.

ITEM Column. 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.

2. Part Number (P/N) Index Work Package. Part numbers in this index are listed in ascending alphanumeric sequence (vertical arrangement of letter and number combinations 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).

PART NUMBER Column. Indicates the part number assigned to the item.

FIG. Column. This column lists the number of the figure where the item is identified/located in the repair parts list and special tools list work packages.

ITEM Column. The item number is the number assigned to the item as it appears in the figure referenced in the adjacent figure number column."

### SPECIAL INFORMATION

UOC. The UOC appears in the lower left corner of the Description Column heading. Usable on codes are shown as "UOC:..." in the Description Column (justified left) on the first line under the applicable item/nomenclature. Uncoded items are applicable to all models. Identification of the UOCs used in the RPSTL are:

<u>Code</u>	<u>Used On</u>
FXG	Large Capacity Field Heater, Type II (LCFH Type II)

Fabrication Instructions. Bulk materials required to manufacture items are listed in the bulk material functional group of this RPSTL. Part numbers for bulk material are also referenced in the Description Column of the line item entry for the item to be manufactured/fabricated. Detailed fabrication instructions for items source coded to be manufactured or fabricated are found in WP 0106 of this technical manual.

Index Numbers. Items which have the word BULK in the figure column will have an index number shown in the item number column. This index number is a cross-reference between the NSN / Part Number (P/N) Index work packages and the bulk material list in the repair parts list work package.

Illustrations List. The illustrations in this RPSTL contain field authorized items. The tabular list in the repair parts list work package contains only those parts coded "O" in the third position of the SMR code, therefore, there may be a break in the item number sequence.

---

## HOW TO LOCATE REPAIR PARTS

### 1. When NSNs or Part Numbers Are Not Known.

First. Using the table of contents, determine the assembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and lists are divided into the same groups.

Second. Find the figure covering the functional group or the subfunctional group to which the item belongs.

Third. Identify the item on the figure and note the number(s).

Fourth. Look in the repair parts list work packages for the figure and item numbers. The NSNs and part numbers are on the same line as the associated item numbers.

### 2. When NSN Is Known.

First. If you have the NSN, look in the STOCK NUMBER column of the NSN index work package. The NSN is arranged in NIIN sequence. Note the figure and item number next to the NSN.

Second. Turn to the figure and locate the item number. Verify that the item is the one you are looking for.

### 3. When Part Number Is Known.

First. If you have the part number and not the NSN, look in the PART NUMBER column of the part number index work package. Identify the figure and item number.

Second. Look up the item on the figure in the applicable repair parts list work package.

## END OF WORK PACKAGE

OPERATOR, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, CABINET

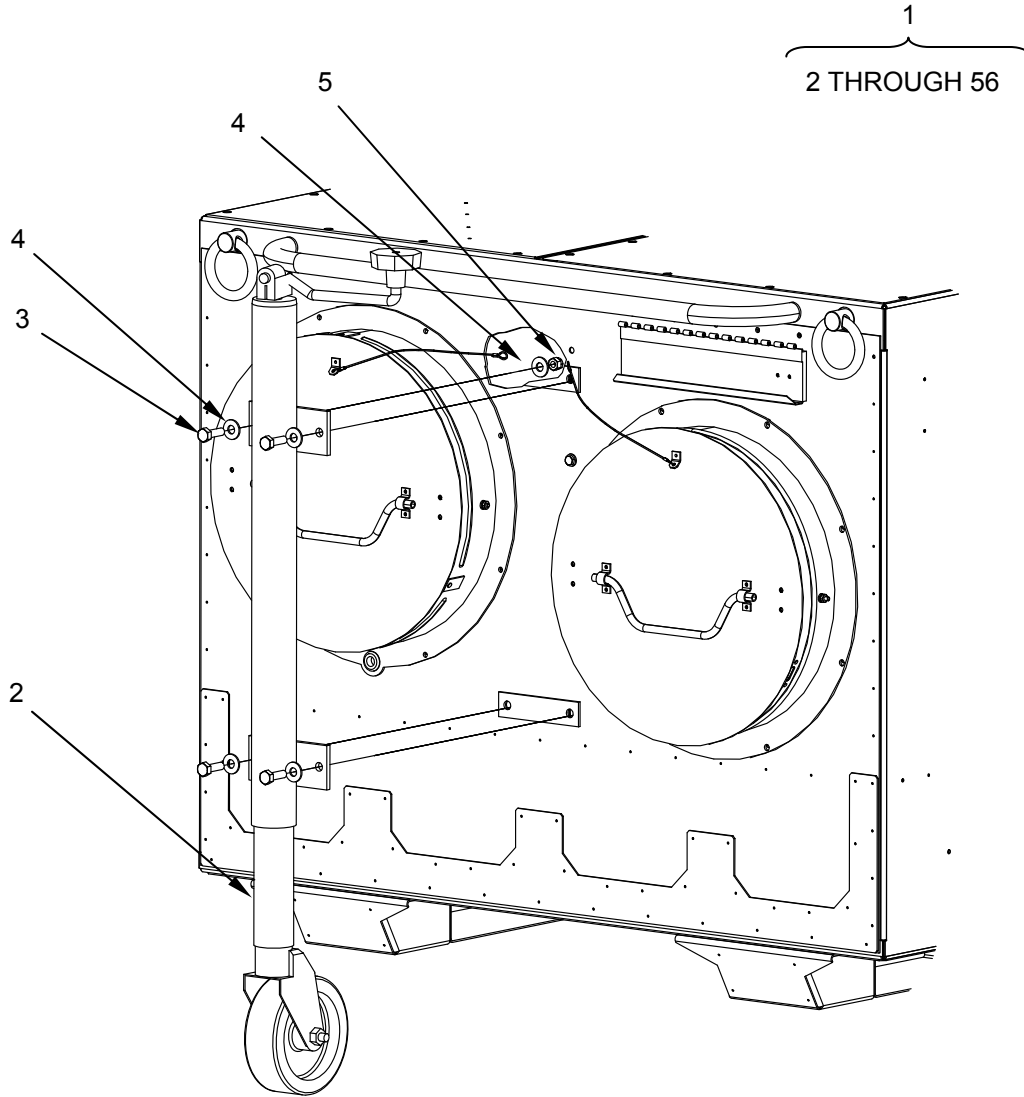


Figure 1. Cabinet Assembly (Assembly, Jack) (Sheet 1 of 8).

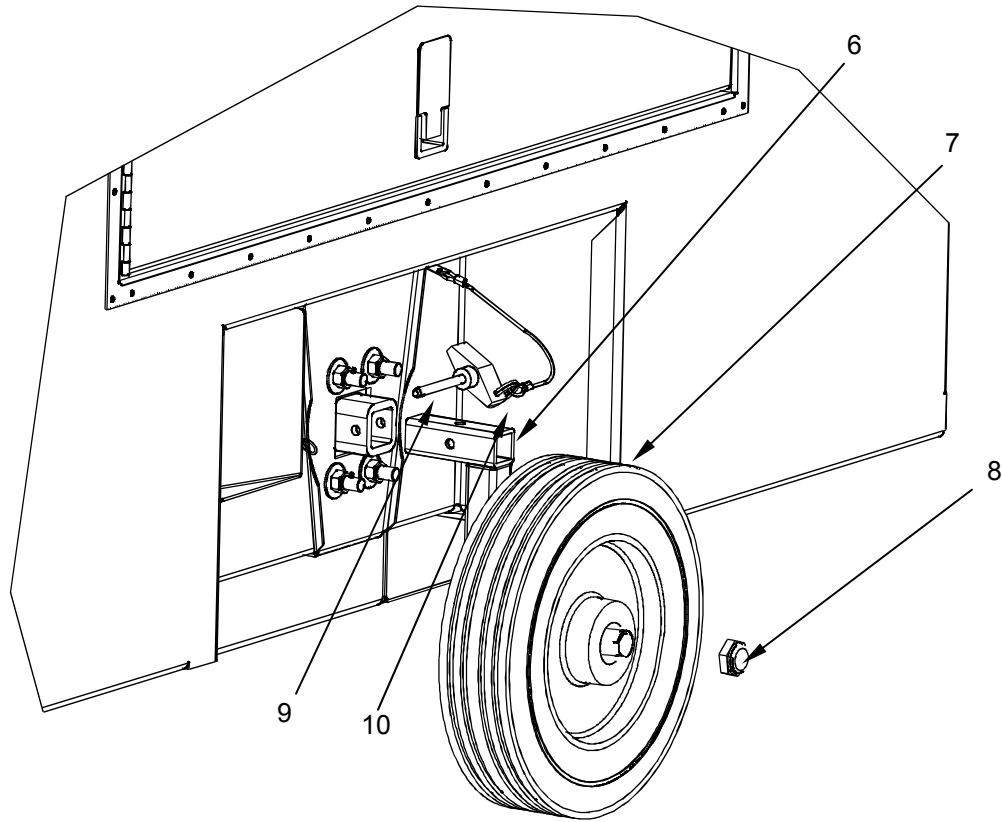


Figure 1. Installation, Wheel Retraction Assembly (Sheet 2 of 8).



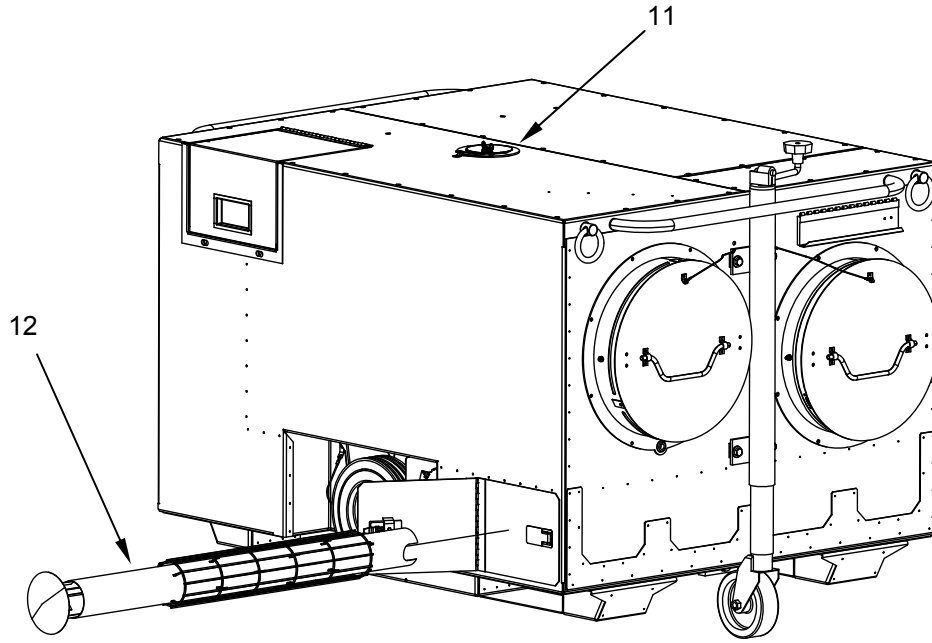


Figure 1. Exhaust Tube, Heat Exchanger (Sheet 3 of 8).

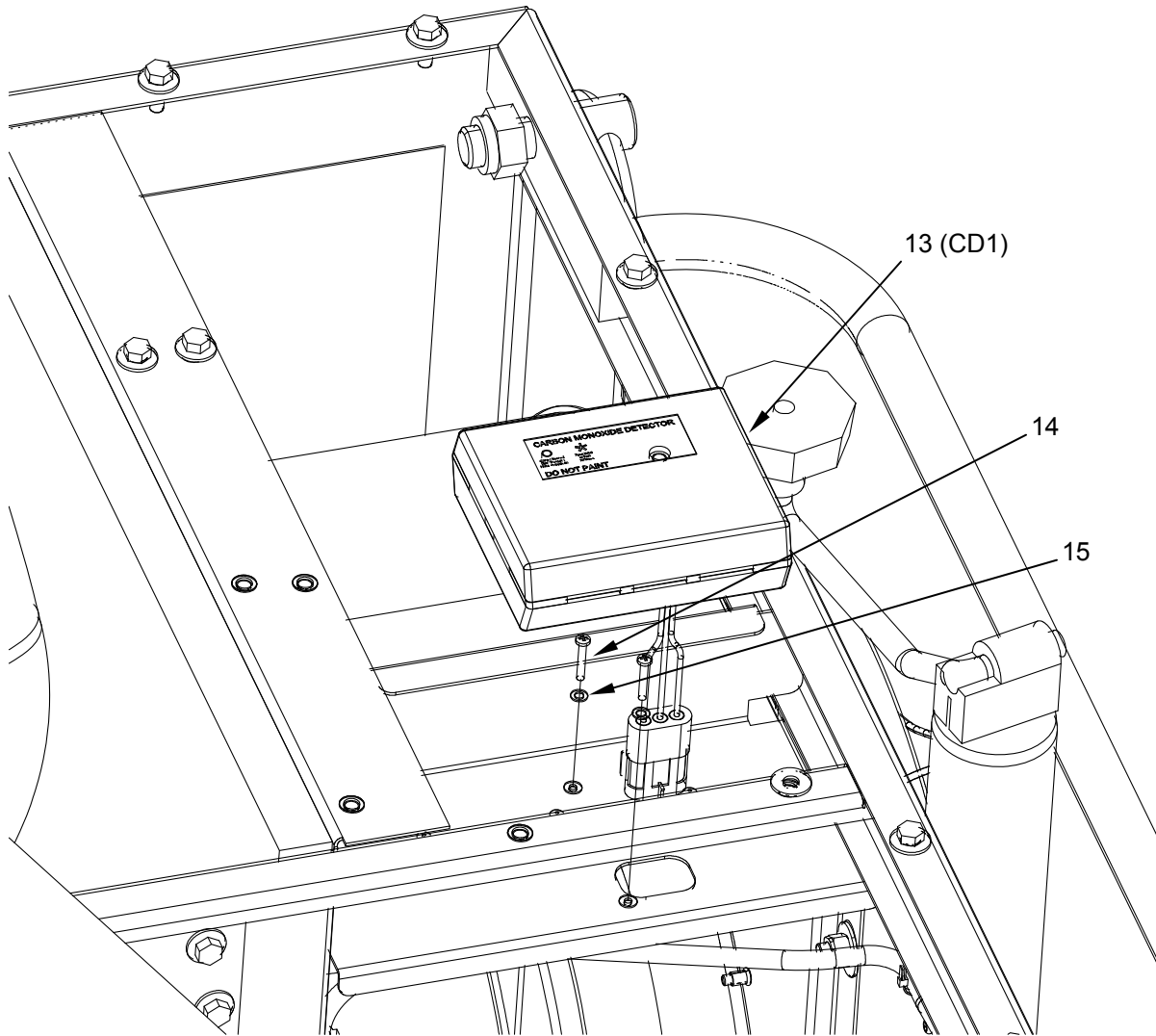


Figure 1. CO Detector, Cabinet Mounted (Sheet 4 of 8).

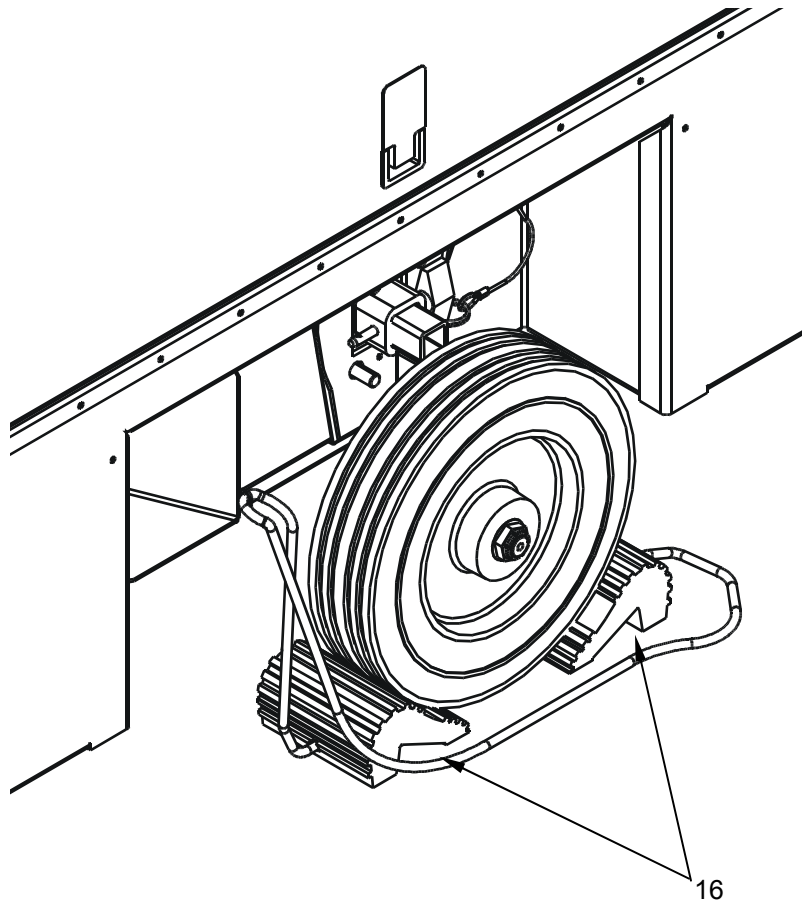


Figure 1. Wheel Chock Assembly (Sheet 5 of 8).

17  
18 THROUGH 21

NOTE: All panel assembly fasteners are identical.

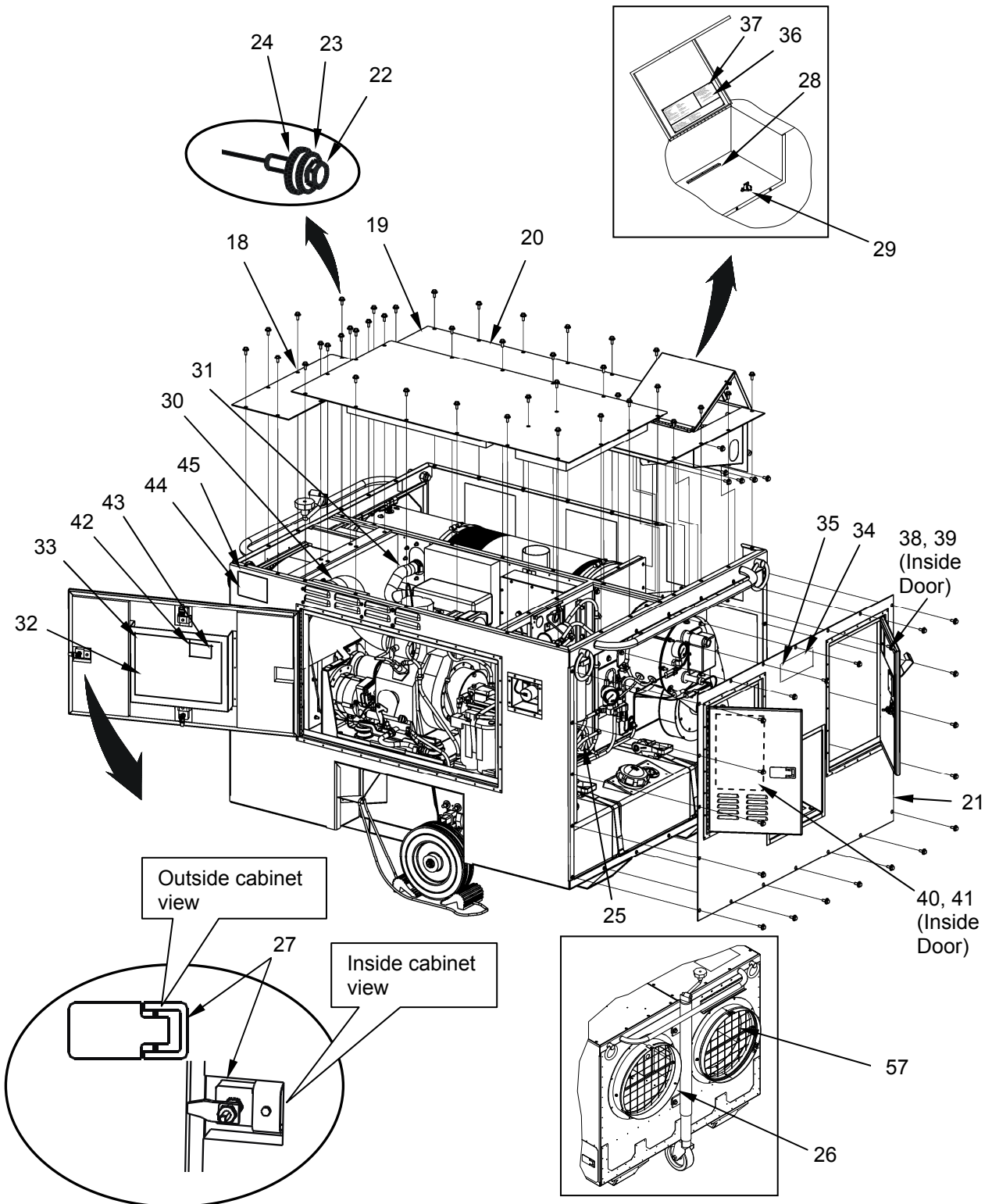


Figure 1. Access Covers (Sheet 6 of 8).

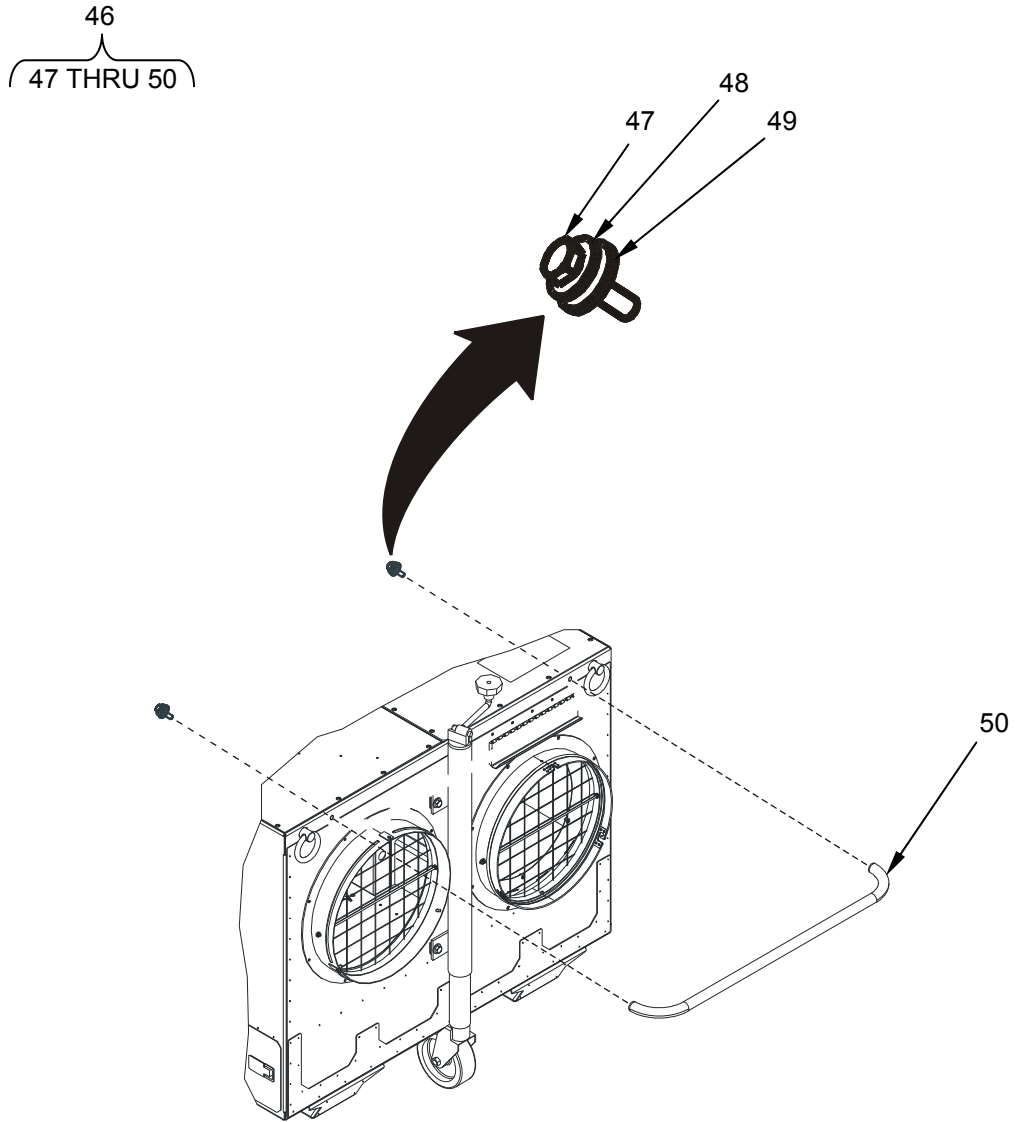


Figure 1. Mobility Handle (Sheet 7 of 8).

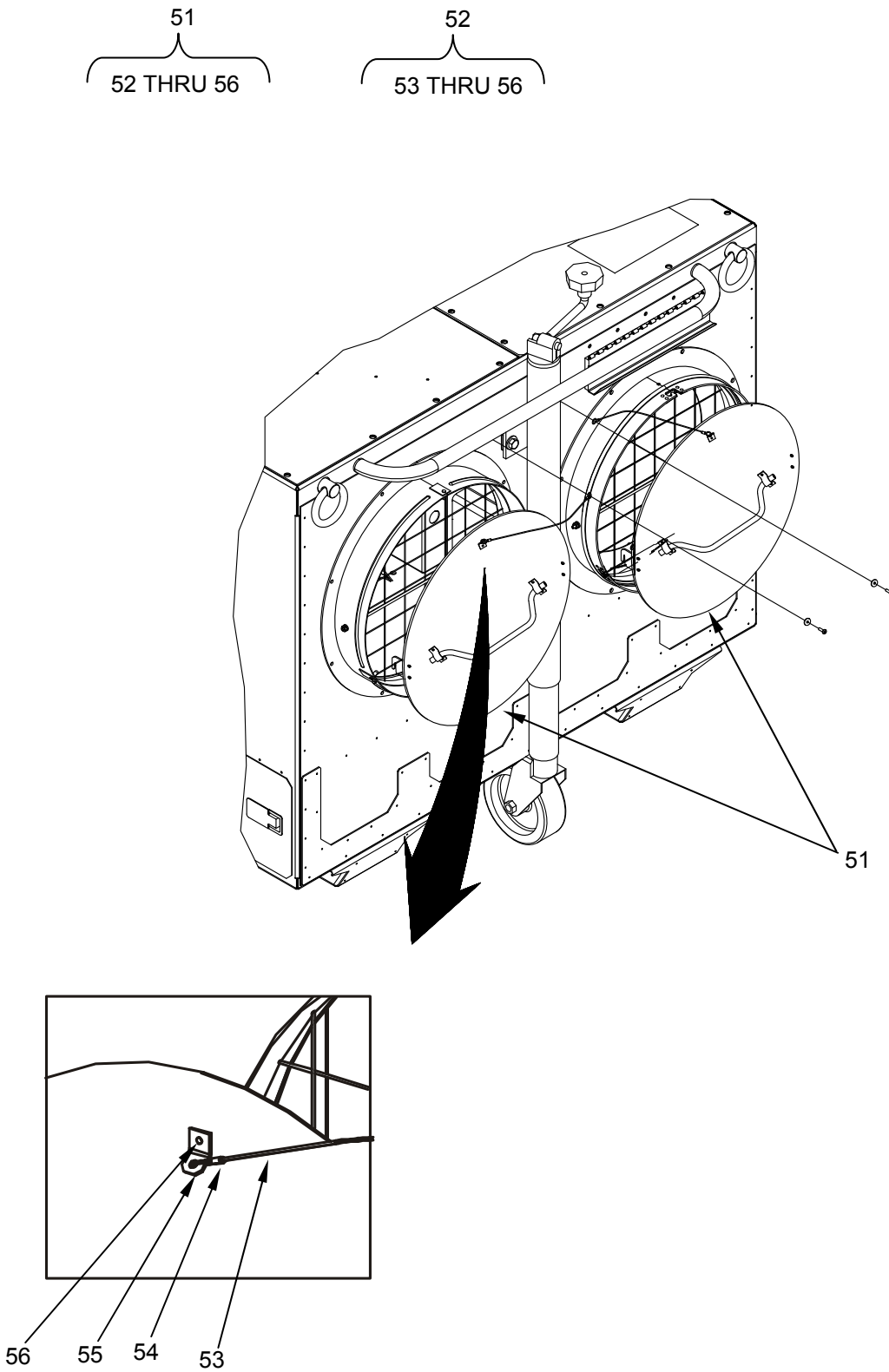


Figure 1. Duct Covers (Sheet 8 of 8).

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 01</b>						
<b>FIG. 1 ASSEMBLY, CABINET</b>						
1	XCOOO		92878	41050	ASSEMBLY, CABINET	1
2	PAOZZ	4520-01-539-7184	92878	40510	. ASSEMBLY, JACK	1
3	PAOZZ	5305-00-068-0511	80204	B1821BH038C1 25N	. SCREW, CAP, HEXAGON HEAD	4
4	PAOZZ	5310-00-809-4061	45152	110380A	. WASHER, FLAT	8
5	PAOZZ	5310-00-087-4652	27687	F51N7582-616	. NUT, SELF-LOCKING, HEX	4
6	PAOOO	4520-01-539-7186	92878	40502	. WHEEL RETRACTION ASSEMBLY	2
7	XDOZZ		92878	40520	. . WHEEL, SOLID RUBBER TIRE	2
8	XDOZZ		0E328	94830A560	. . NUT, LOCK	2
9	PAOZZ	5315-01-481-2030	4X630	863-000553	. PIN, QUICK RELEASE	2
10	XDOZZ		92878	40528	. . LANYARD, WHEEL QUICK RELEASE	2
11	PAOZZ	2990-01-539-7187	92878	40586	. CAP ASSEMBLY, PROTECTIVE, MUFFLER-EXHAUST PIPE	1
12	PAOZZ	4520-01-568-4546	92878	41505-SV	. PIPE EXHAUST	1
13	PCOZZ	6665-01-539-8270	92878	40489	. INDICATOR, CARBON MONOXIDE	1
14	PAOZZ	5305-00-984-4984	80205	MS35206-227	. SCREW, MACHINE	2
15	PAOZZ	5310-00-809-8544	80063	MS27183-7	. WASHER, FLAT	2
16	PAOZZ	2540-01-539-8271	92878	40507	. ASSEMBLY, WHEEL CHOCKS	2
17	XCOOO		92878	41501	. CABINET	1
18	XDOZZ		92878	75056-100	. . COVER, ACCESS	1
19	XDOZZ		92878	75012-100	. . COVER, ACCESS	1
20	XDOZZ		92878	75011-100	. . COVER, ACCESS	1
21	XDOZZ		92878	75005-100	. . COVER, ACCESS	1
22	PAOZZ	5305-00-068-0502	00365	F98	. SCREW, CAP, HEXAGON HEAD	60
23	PAOZZ	5310-00-582-5965	99539	CBM21389	. WASHER, LOCK	60
24	PAOZZ	5310-01-274-3255	96906	MS27183-52	. WASHER, FLAT	60
25	MOOZZ		92878	40196	. MOULDING, PLASTIC (MAKE FROM BULK P/N 8451A53 CAGEC 0E328)	3
26	XDOZZ		92878	41517-SV	. COLLAR ASSEMBLY, AIR DISCHARGE	1
27	PAOZZ	5340-01-479-5255	94222	62-40-151-3	. CATCH, FRICTION	6
28	XDOZZ		92878	40432-01	. BRACKET, CABINET MOUNT, OPERATOR CONTROL	1
29	PAOZZ	5340-01-467-7561	94222	K3-1735-52	. CATCH, CLAMPING	1
30	PAOZZ	4720-01-539-7189	92878	40566	. FLEXIBLE COOLING DUCT	1
31	PAOZZ	2835-01-540-2887	92878	40114	. DUCT, EXHAUST, NONAIRCRAFT, GAS TURBINE	1
32	XDOZZ		92878	41041	. PLACARD, WIRING DIAGRAM	1
33	PAOZZ	5320-01-023-2529	54402	AD44BS	. RIVET, BLIND	4
34	XDOZZ		92878	40022	. PLACARD, FUEL SPECIFICATION	1
35	PAOZZ	5320-01-172-5602	06888	AD42BS	. RIVET, BLIND	4
36	XDOZZ		92878	40051-01	. PLACARD, OPERATING PROCEDURES AND FAULT CODES	1
37	XDOZZ		92878	40051-02	. PLACARD, OPERATING PROCEDURES AND FAULT CODES	1
38	PAOZZ	5320-01-023-2529	54402	AD44BS	. RIVET, BLIND	4
39	XDOZZ		92878	41031	. PLACARD, BURNER COMPARTMENT	1
40	PAOZZ	5320-01-023-2529	54402	AD44BS	. RIVET, BLIND	4
41	XDOZZ		92878	41021	. PLACARD, FUEL SYSTEM	1
42	PAOZZ	5320-01-023-2529	54402	AD44BS	. RIVET, BLIND	4
43	XDOZZ		92878	40838	. LABEL, WARNING, ROTATING MACHINERY	1

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
44	XDOZZ		92878	41052	. LARGE CAPACITY FIELD HEATER PLATE, IDENTIFICATION	1
45	PAOZZ	5320-01-023-2529	54402	AD44BS	. RIVET, BLIND	4
46	PAOZZ	5340-01-568-5154	92878	41850-SV	. ASSEMBLY, MOBILITY HANDLE	2
47	PAOZZ	5305-00-225-9091	80205	MS90726-36	.. SCREW, HHC 5/16-24 X 1 1/4 IN LG	4
48	PAOZZ	5310-01-130-9065	80205	MS35338-46	.. WASHER, SPLIT LOCK, 3/8	4
49	XDOZZ		92878	41852	.. WASHER, FLAT	4
50	XAOZZ		92878	41849	.. HANDLE	2
51	XDOZZ		92878	40514	DUCT COVER	2
52	XDOOO		92878	75263-100	. LANYARD ASSEMBLY, COVER	2
53	MOOZZ		39428	8923T32	.. CABLE (MAKE FROM BULK SUPPLY NSN 4010-00-575-6233)	2
54	PAOZZ	4030-00-145-5721	96906	MS51844-64	.. SLEEVE, SWAGING, WIRE ROPE	4
55	XAOZZ		92878	75262-1	.. BRACKET, LANYARD	2
56	PAOZZ	5320-00-956-7355	81349	M24243/6A604 H	.. RIVET, BLIND	2
57	XDOZZ		92878	41516-SV	. COLLAR ASSEMBLY, AIR INLET	1

**END OF FIGURE**



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OPERATOR, FIELD, AND SUSTAINMENT MAINTENANCE

INSULATION, SHEET SOUND

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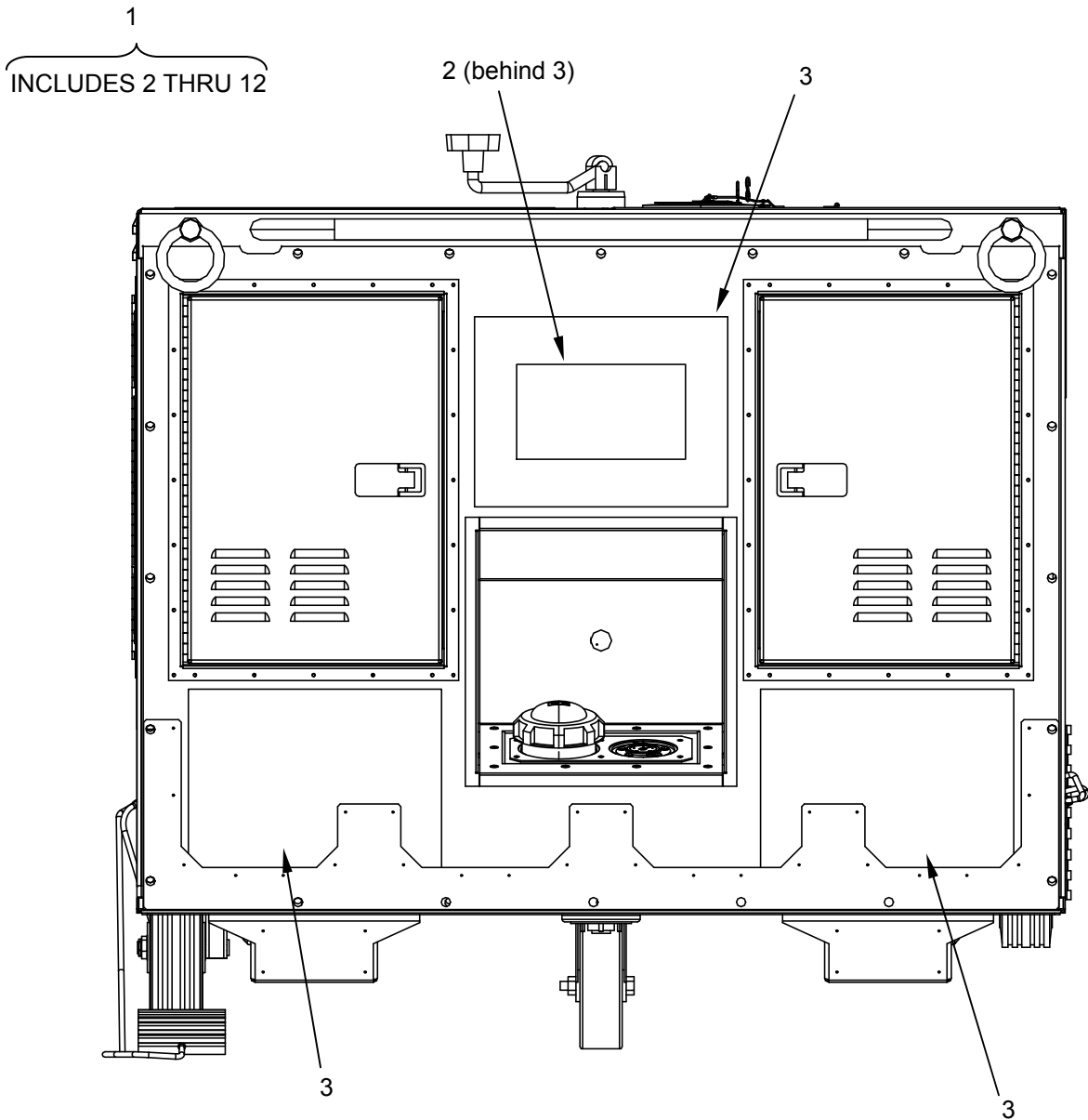


Figure 2. Insulation, Sheet Sound (Sheet 1 of 5).

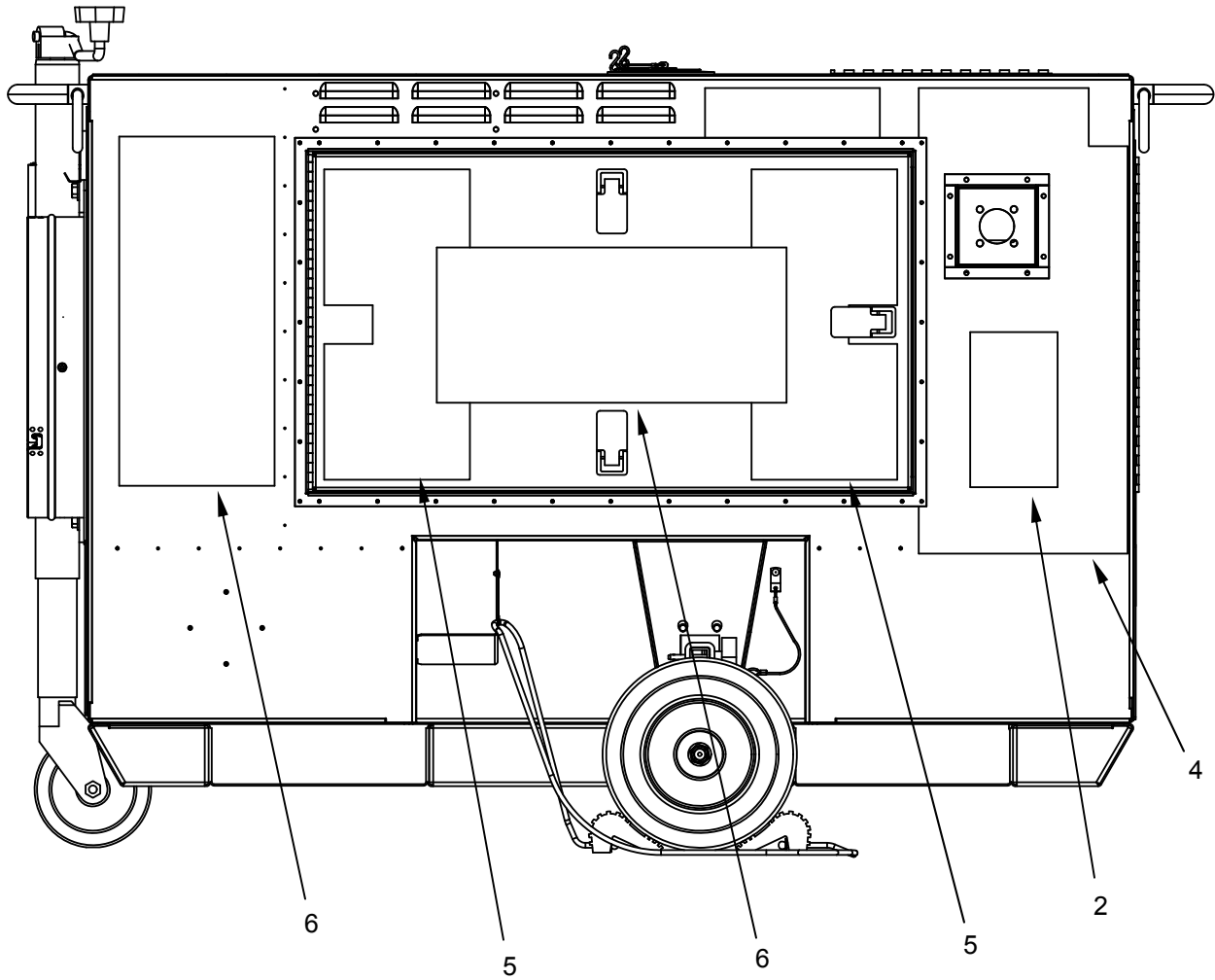


Figure 2. Insulation, Sheet Sound (Sheet 2 of 5).

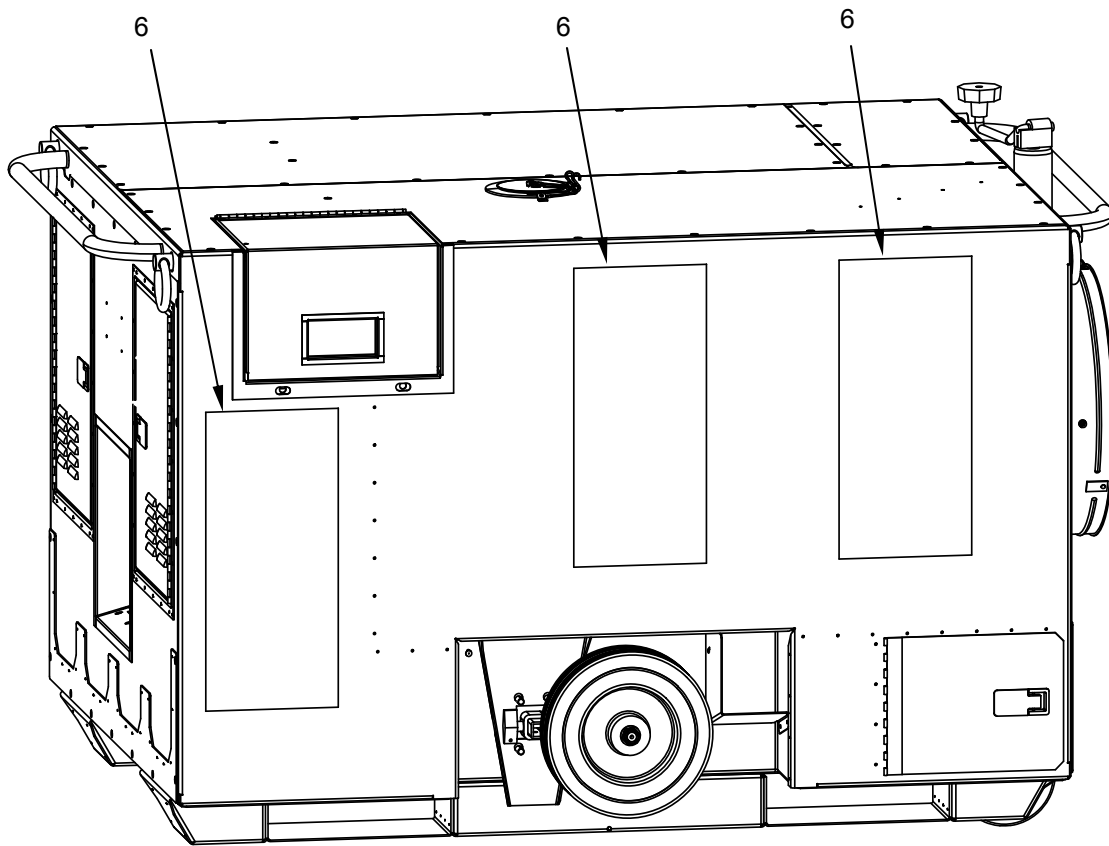


Figure 2. Insulation, Sheet Sound (Sheet 3 of 5).

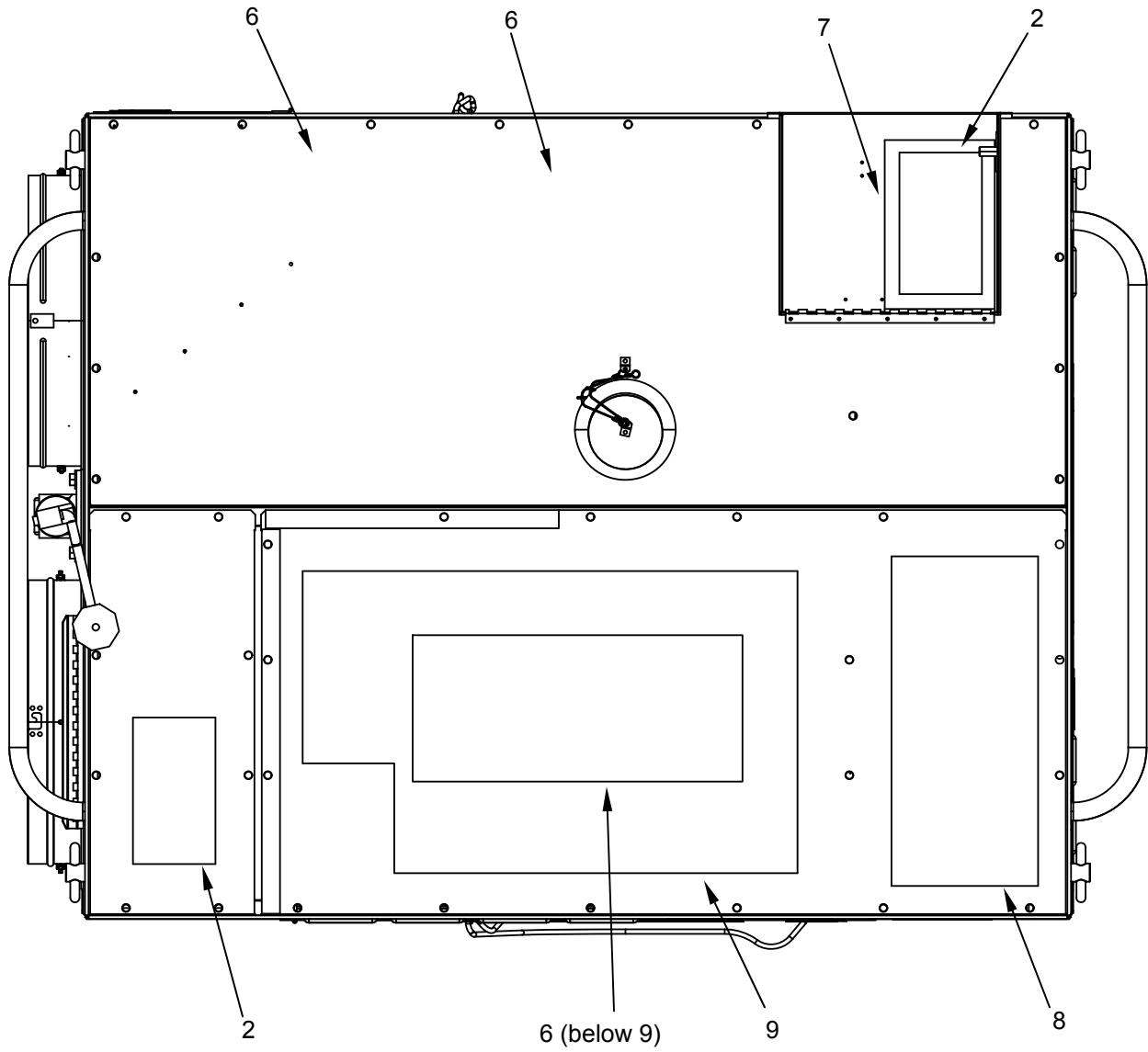


Figure 2. Insulation, Sheet Sound (Sheet 4 of 5).

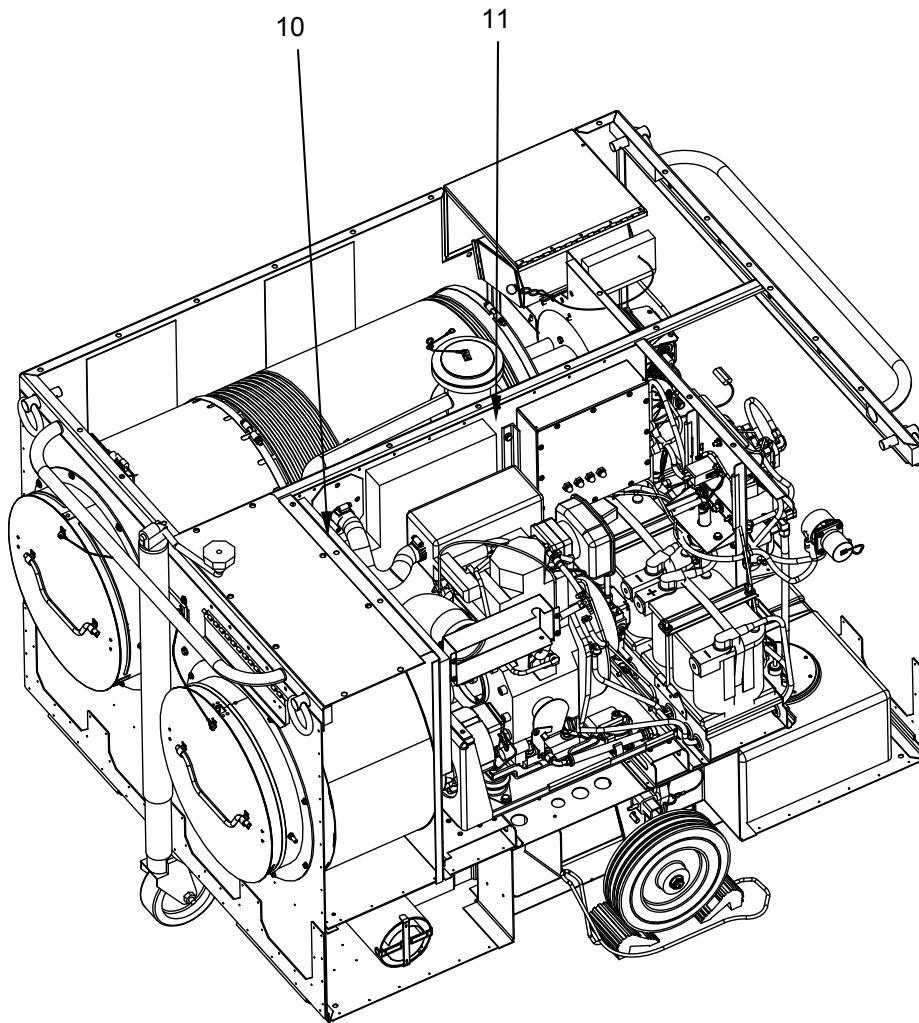


Figure 2. Insulation, Sheet Sound (Sheet 5 of 5).

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 01</b>						
<b>FIG. 2 INSULATION, SHEET SOUND</b>						
1	XCOOO		92878	41050	ASSEMBLY, CABINET	1
2	XDOZZ		92878	40533-01	. SOUND CONTROLLING, BATT	4
3	XDOZZ		92878	40530-03	. SOUND CONTROLLING, BATT	3
4	XDOZZ		92878	40531-03	. SOUND CONTROLLING, BATT	3
5	XDOZZ		92878	40530-04	. SOUND CONTROLLING, BATT	2
6	XDOZZ		92878	40533-02	. SOUND CONTROLLING, BATT	7
7	XDOZZ		92878	40530-01	. SOUND CONTROLLING, BATT	1
8	XDOZZ		92878	40531-02	. SOUND CONTROLLING, BATT	1
9	XDOZZ		92878	40531-01	. SOUND CONTROLLING, BATT	1
10	XDOZZ		92878	40530-02	. SOUND CONTROLLING, BATT	1
11	XDOZZ		92878	40531-04	. SOUND CONTROLLING, BATT	1

**END OF FIGURE**





OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

FUEL SYSTEM ASSEMBLY

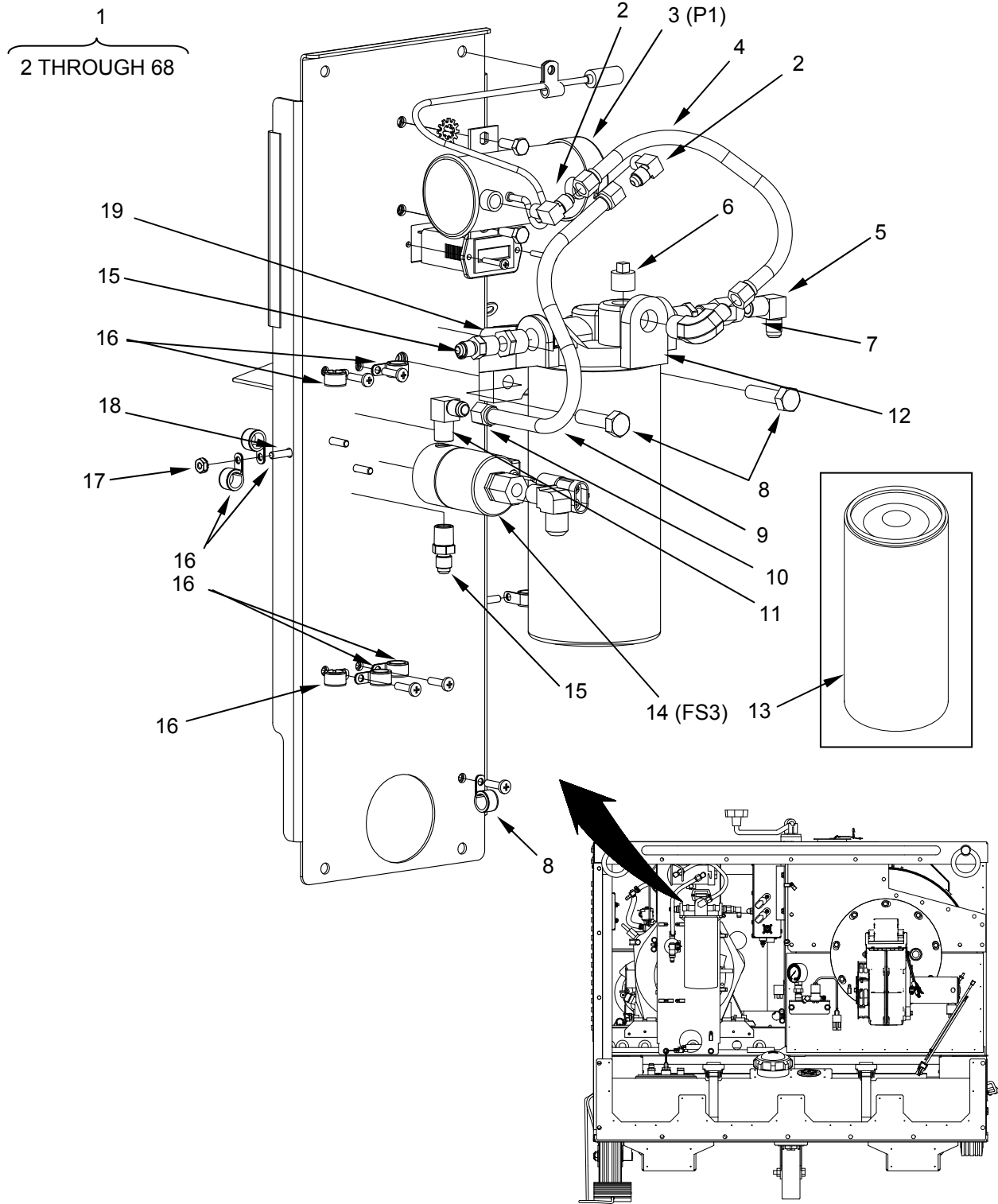


Figure 3. Fuel System Assembly (Sheet 1 of 4).

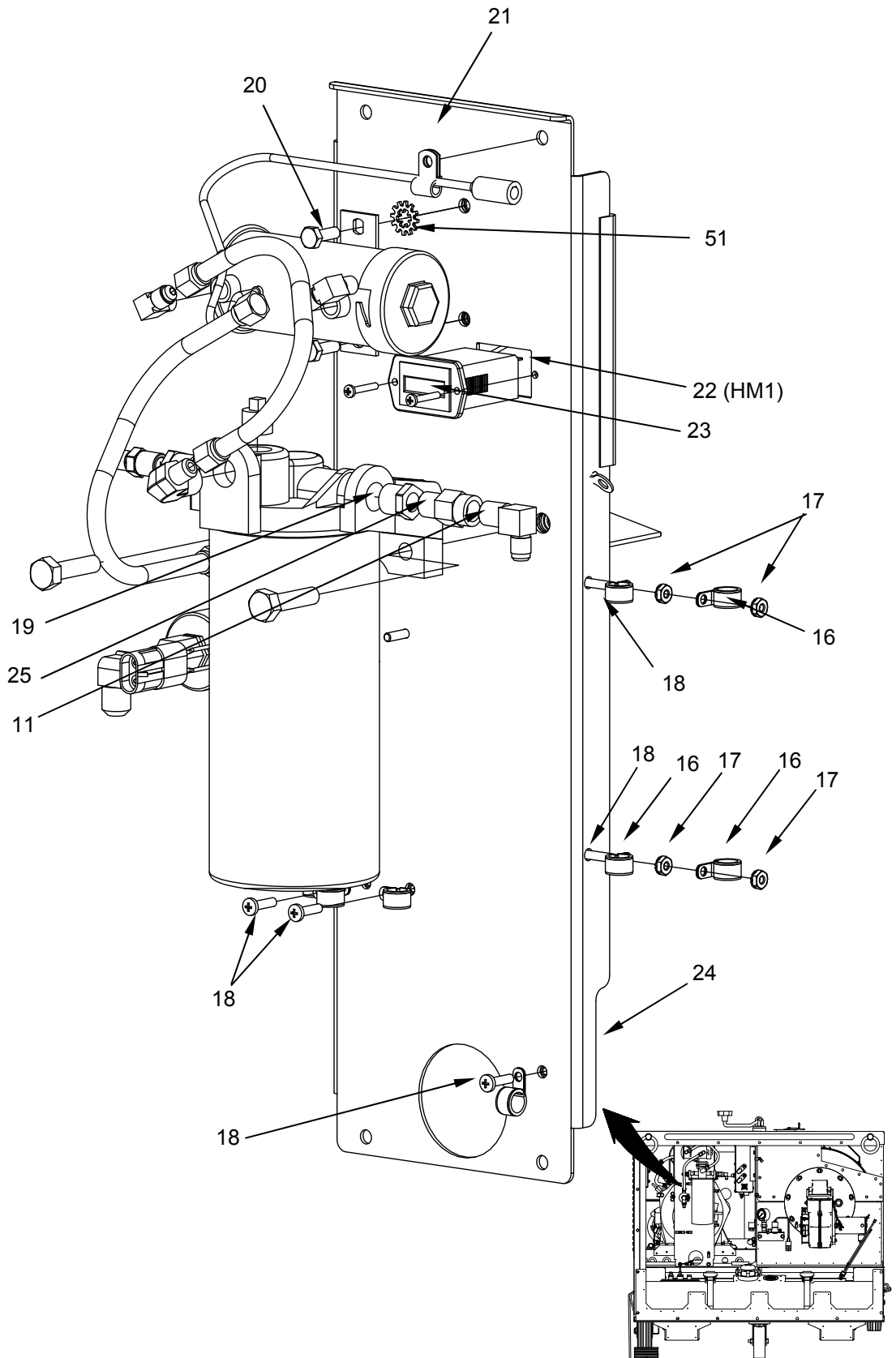


Figure 3. Fuel System Assembly (Sheet 2 of 4).

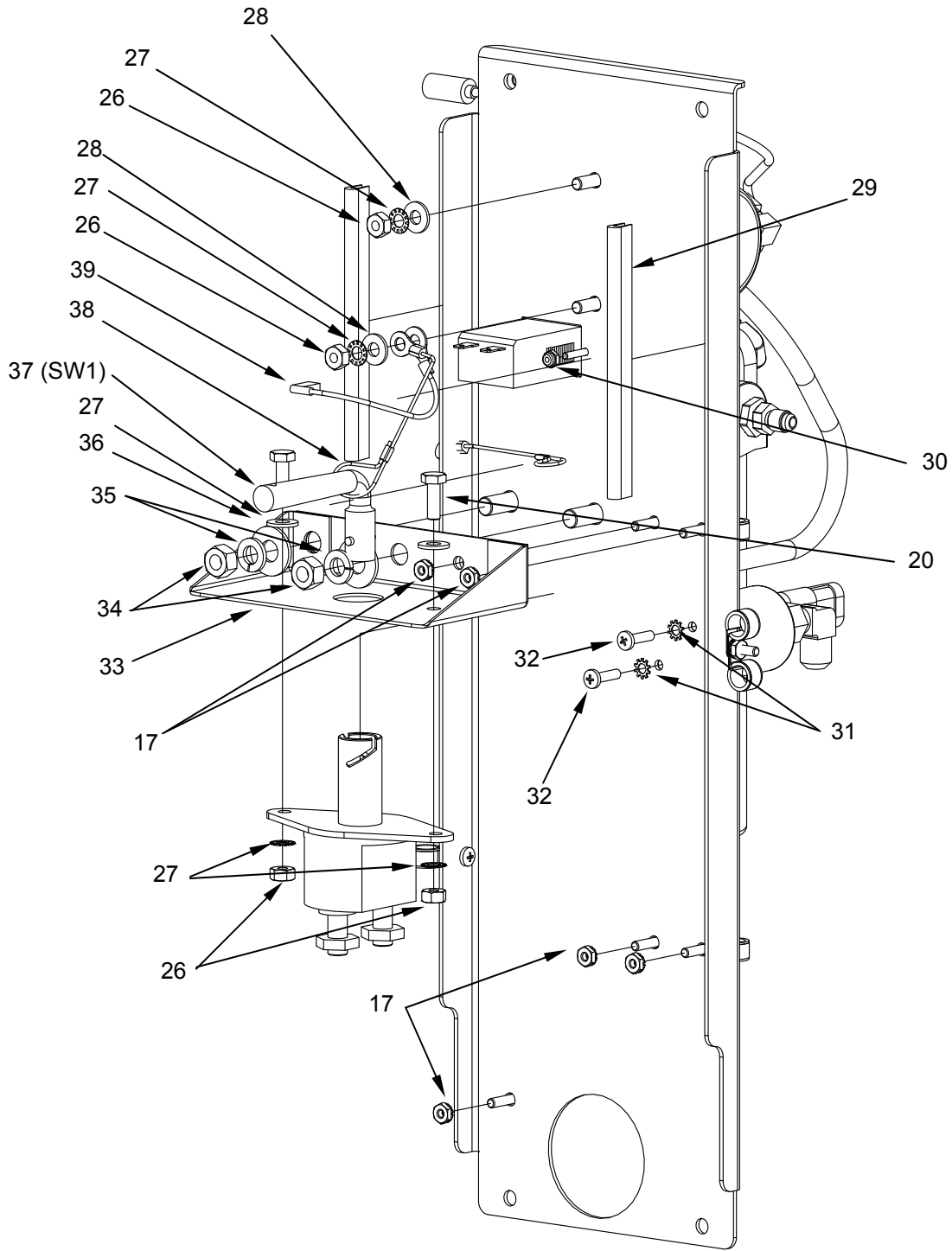


Figure 3. Fuel System Assembly (Sheet 3 of 4).

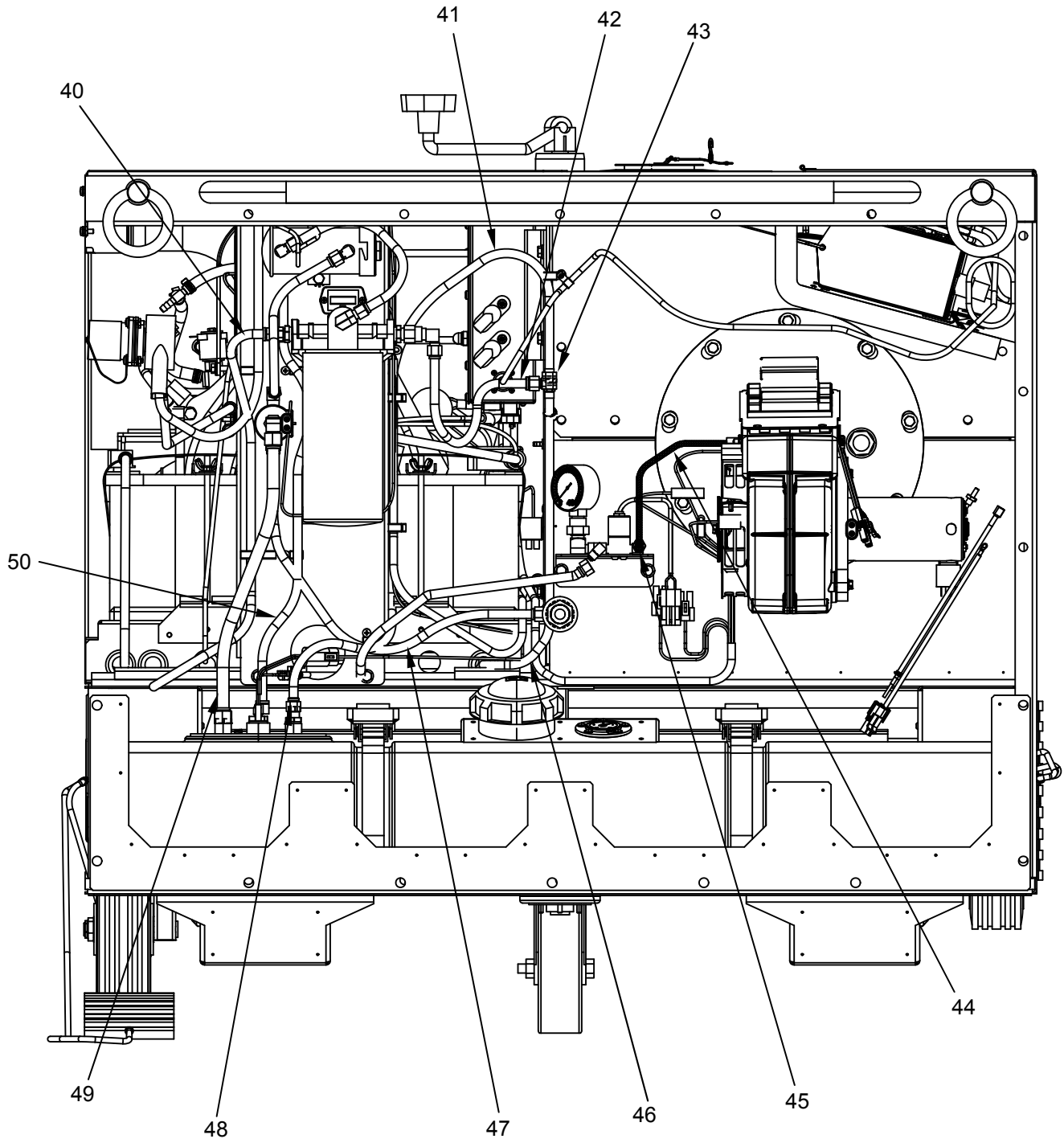


Figure 3. Fuel System Assembly (Sheet 4 of 4).

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 02</b>						
<b>FIG. 3 FUEL SYSTEM ASSEMBLY</b>						
1	XCOOO		92878	41202	ASSEMBLY, FUEL PANEL	1
2	PAOZZ	4730-00-254-6211	81343	J5124- 2010202B	. ELBOW, PIPE TO TUBE	2
3	PAOZZ	2910-01-539-7197	92878	40221	. PUMP, FUEL, METERING AND DISTRIBUTING	1
4	XDOOO		92878	40224	. HOSE ASSEMBLY, NONMETALLIC	1
5	PAOZZ	4730-00-555-1152	70281	2203B510	. . ADAPTER, STRAIGHT, TUBE TO HOSE	2
6	XDOZZ		39428	50785K253	. PLUG, MACHINE THREAD	1
7	PAOZZ	4730-00-235-1482	93061	249-F-4-6	. ELBOW, PIPE TO TUBE	1
8	PAOZZ	5305-01-325-8387	96906	MS90725-64	. SCREW, CAP, HEXAGON HEAD	2
9	XDOOO		92878	40198	. HOSE ASSEMBLY, NONMETALLIC	1
10	PAOZZ	4730-00-555-1152	70281	2203B510	. . ADAPTER, STRAIGHT, TUBE TO HOSE	2
11	PAOZZ	4730-00-366-3011	79470	49X4X4	. ELBOW, PIPE TO TUBE	2
12	XDOZZ		12658	FB1301	. FILTER BODY, FLUID	1
13	PAOZZ	2910-01-025-6853	12658	BF-580	. FILTER ELEMENT, FLUID	1
14	PAOZZ	4810-01-539-7199	92878	40223	. VALVE ASSEMBLY, MANIFOLD	1
15	PAOZZ	4730-00-723-5549	29215	JD659	. ADAPTER, STRAIGHT, PIPE TO TUBE	2
16	PAOZZ	5340-00-291-5347	81343	AS21919DG8	. CLAMP, LOOP HOSE	12
17	XDOZZ		39428	90675A011	. NUT, SELF-LOCKING, EXTENDED WASHER, HEXAGON	10
18	PAOZZ	5305-00-984-6212	80205	MS35206-265	. SCREW, MACHINE	8
19	PAOZZ	4730-00-202-6491	01276	3220X6X4	. BUSHING, PIPE	2
20	PAOZZ	5305-00-068-0502	96906	MS90725-6	. SCREW, CAP, HEXAGON HEAD	4
21	PAOZZ	5340-00-809-1490	80205	MS21333-98	. CLAMP, LOOP	1
22	PAOZZ	4520-01-493-2780	92878	60384	. SHC HOUR METER	1
23	PAOZZ	5305-00-984-4993	96906	MS35206-233	. SCREW, MACHINE	2
24	XDOZZ		92878	40220	. PLATE, MOUNTING	1
25	XDOZZ		92878	40211	. VALVE, CHECK	1
26	PAOZZ	5310-00-761-6882	96906	MS51967-2	. NUT, PLAIN, HEX	4
27	PAOZZ	5310-00-209-0786	96906	MS35335-33	. WASHER, LOCK	4
28	PAOZZ	5310-00-809-4058	96906	MS27183-10	. WASHER, FLAT	4
29	MOOZZ		92878	40196	. MOLDING, PLASTIC	2
30	PAOZZ	5310-00-081-8087	96906	MS21044N06	. NUT, SELF-LOCKING, HEXAGON	2
31	PAOZZ	5310-00-596-7691	96906	MS35335-32	. WASHER, LOCK	2
32	PAOZZ	5305-00-989-7435	80205	MS35207-264	. SCREW, MACHINE	2
33	XDOZZ		92878	40661	. BRACKET, MOUNTING	1
34	PAOZZ	5310-00-732-0558	96906	MS51967-8	. NUT, PLAIN, HEXAGON	2
35	PAOZZ	5310-00-637-9541	80205	MS35338-46	. WASHER, LOCK	2
36	PAOZZ	5310-00-809-4061	96906	MS27183-15	. WASHER, FLAT	2
37	PAOZZ	5930-01-485-9200	1CW22	62471	. SWITCH, ROTARY, MAIN BATTERY SHUTOFF	1
38	XDOZZ		92878	40662	. WIRE ROPE ASSEMBLY, SINGLE LEG	1
39	XDOZZ		92878	40202-01	. WIRE, ELECTRICAL GROUNDING	1
40	XDOOO		92878	40260	. HOSE ASSEMBLY, NONMETALLIC	1
41	XDOOO		92878	40263	. HOSE ASSEMBLY, NONMETALLIC	1
42	XDOZZ		92878	40279	. HOSE ASSEMBLY, NONMETALLIC	1
43	XDOZZ		97111	144F-4	. . FITTING, TEE, 1/4 FLARE X 1/4 FLARE X 1/4 FLARE	1
44	PAOZZ	4720-01-569-2752	92878	41250	. HOSE ASSEMBLY, NONMETALLIC	1

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
45	PAOZZ	4730-00-555-1152	70281	2203B510	. . ADAPTER, STRAIGHT, TUBE TO HOSE	2
46	XDOOO		92878	40260	. HOSE ASSEMBLY, NONMETALLIC	1
47	XDOOO		92878	40265	. HOSE ASSEMBLY, NONMETALLIC	1
48	XDOZZ		92878	40231	. . FITTING, 1/4 FLARE X 1/4 MALE NPT, REGULATOR	1
49	XDOOO		92878	40266	. HOSE ASSEMBLY, NONMETALLIC	1
50	XDOOO		92878	40232	. HOSE ASSEMBLY, NONMETALLIC	1
51	XDOZZ		92878	47834	. LOCK WASHER, INT. & EXT. TOOTH, SS	2

END OF FIGURE

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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

BURNER FUEL VALVE ASSEMBLY

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1  
2 THROUGH 9

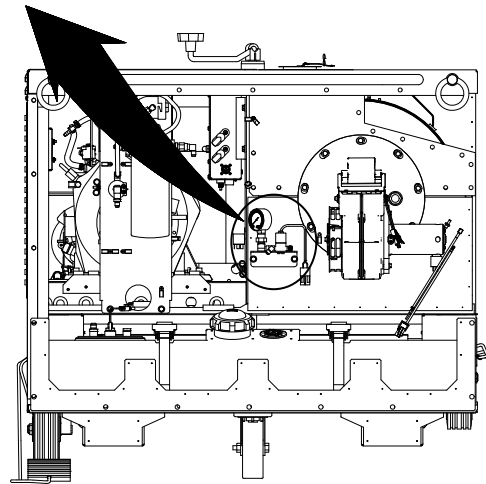
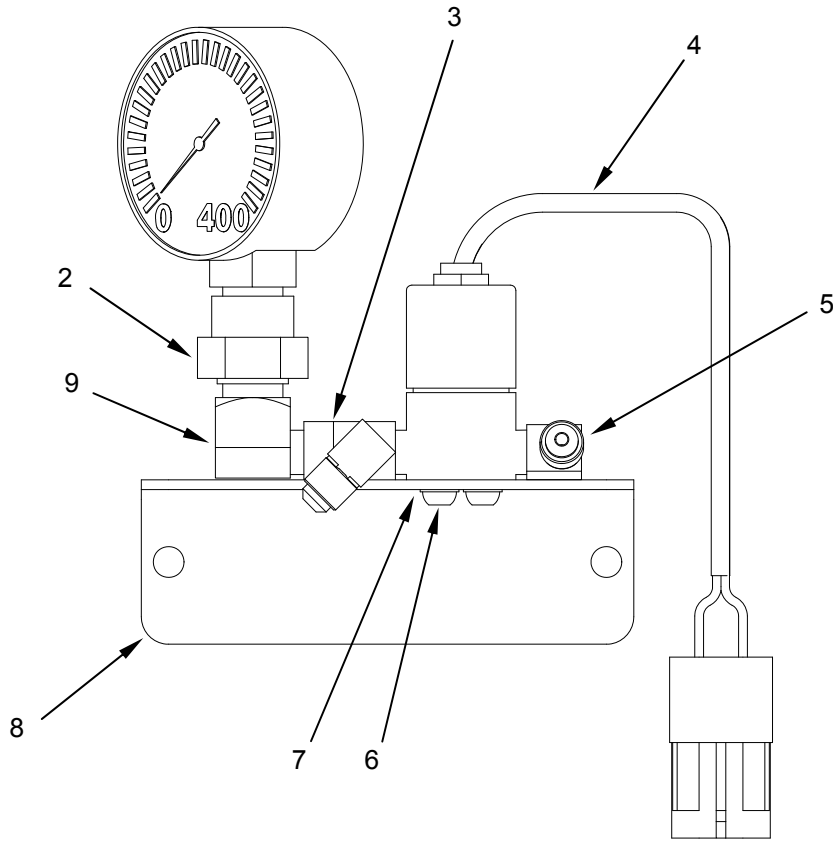


Figure 4. Burner Fuel Valve Assembly.



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 02</b>						
<b>FIG. 4 BURNER FUEL VALVE ASSEMBLY</b>						
1	XDOOO		92878	41208	BURNER FUEL VALVE ASSEMBLY	1
2	PAOZZ	6685-01-539-8272	92878	40252	. GAGE, PRESSURE, DIAL INDICATING	1
3	PAOZZ	4730-00-263-2733	93061	VS2225P-2	. TEE, PIPE	1
4	PAOZZ	4810-01-540-2889	92878	40282	. VALVE, SOLENOID	1
5	PAOZZ	4730-00-541-8100	92878	22319	. ELBOW, PIPE TO TUBE	1
6	PAOZZ	5305-00-889-3002	96906	MS35206-242	. SCREW, MACHINE	2
7	PAOZZ	5310-00-559-0070	80205	MS35333-38	. WASHER, LOCK	2
8	XDOZZ		92878	41280	. BRACKET, MOUNTING	1
9	PAOZZ	4730-00-289-2368	01276	3400X4X2	. ELBOW, PIPE TO TUBE	1

**END OF FIGURE**



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

FUEL TANK ASSEMBLY

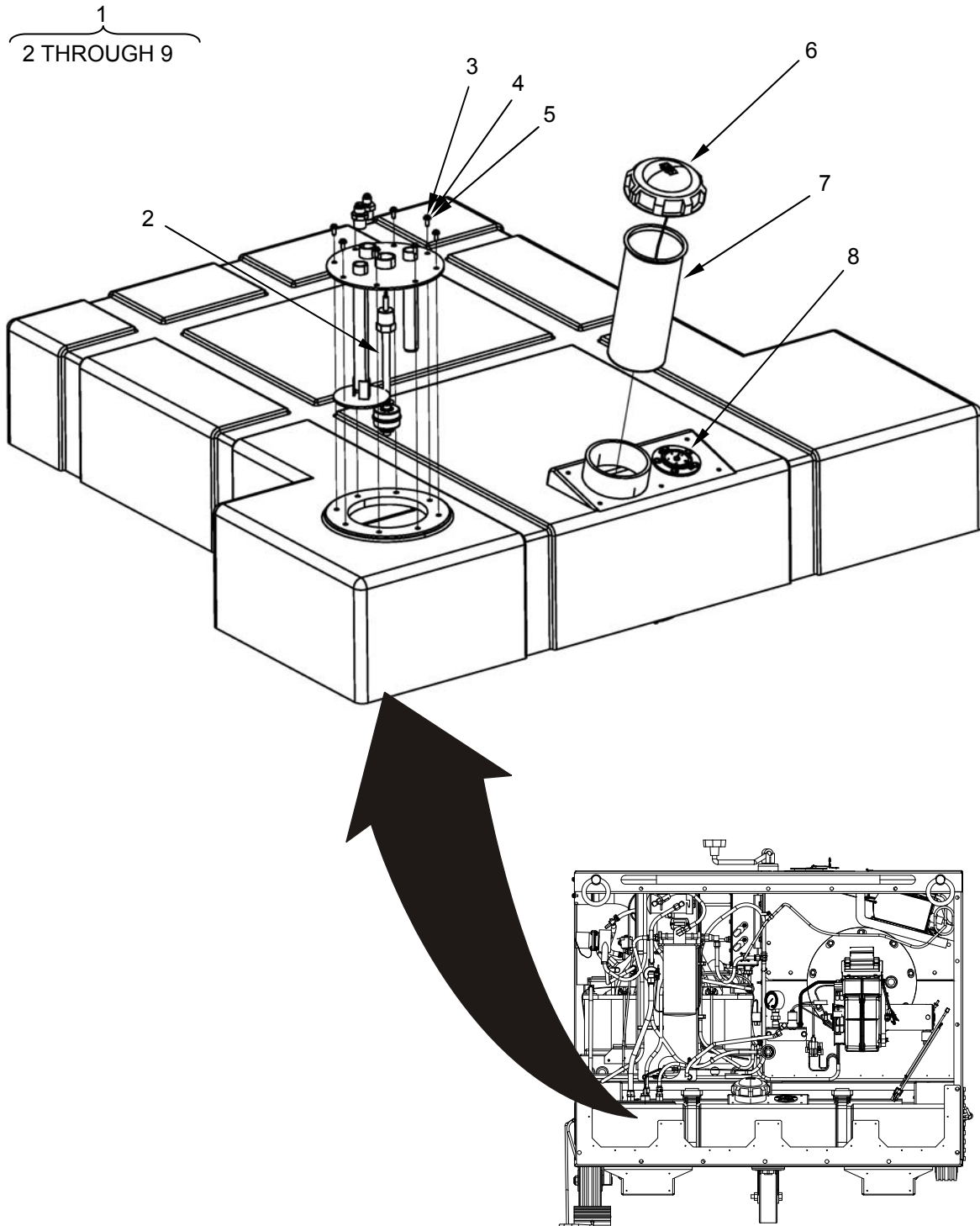


Figure 5. Fuel Tank Assembly (Sheet 1 of 5).

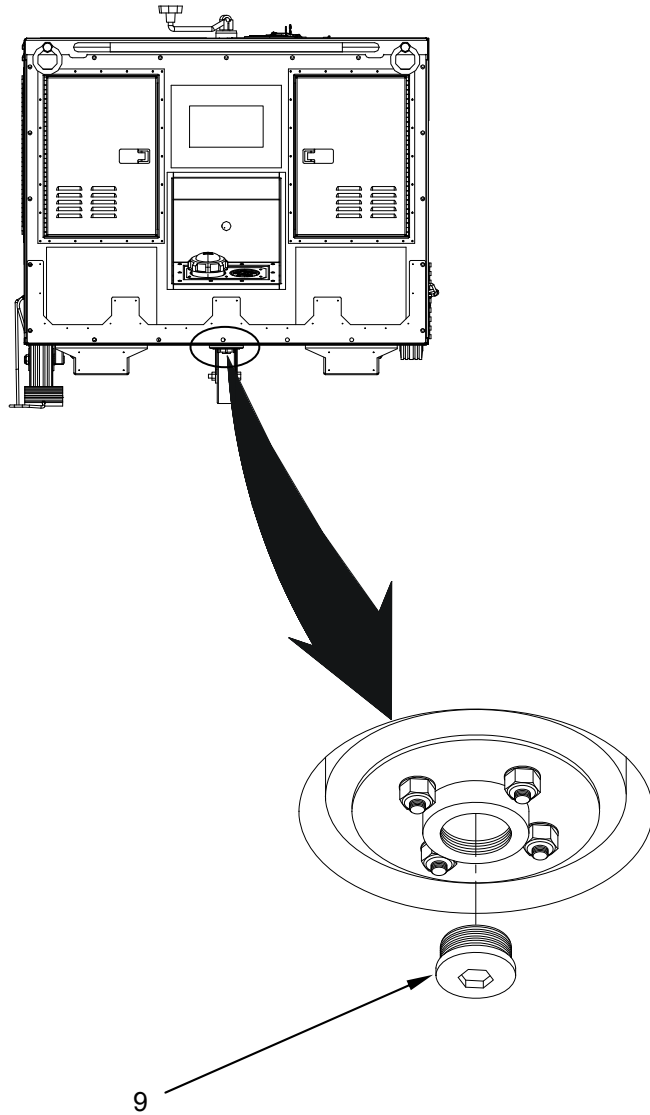


Figure 5. Fuel Tank Assembly (Sheet 2 of 5).

10  
11 THROUGH 13

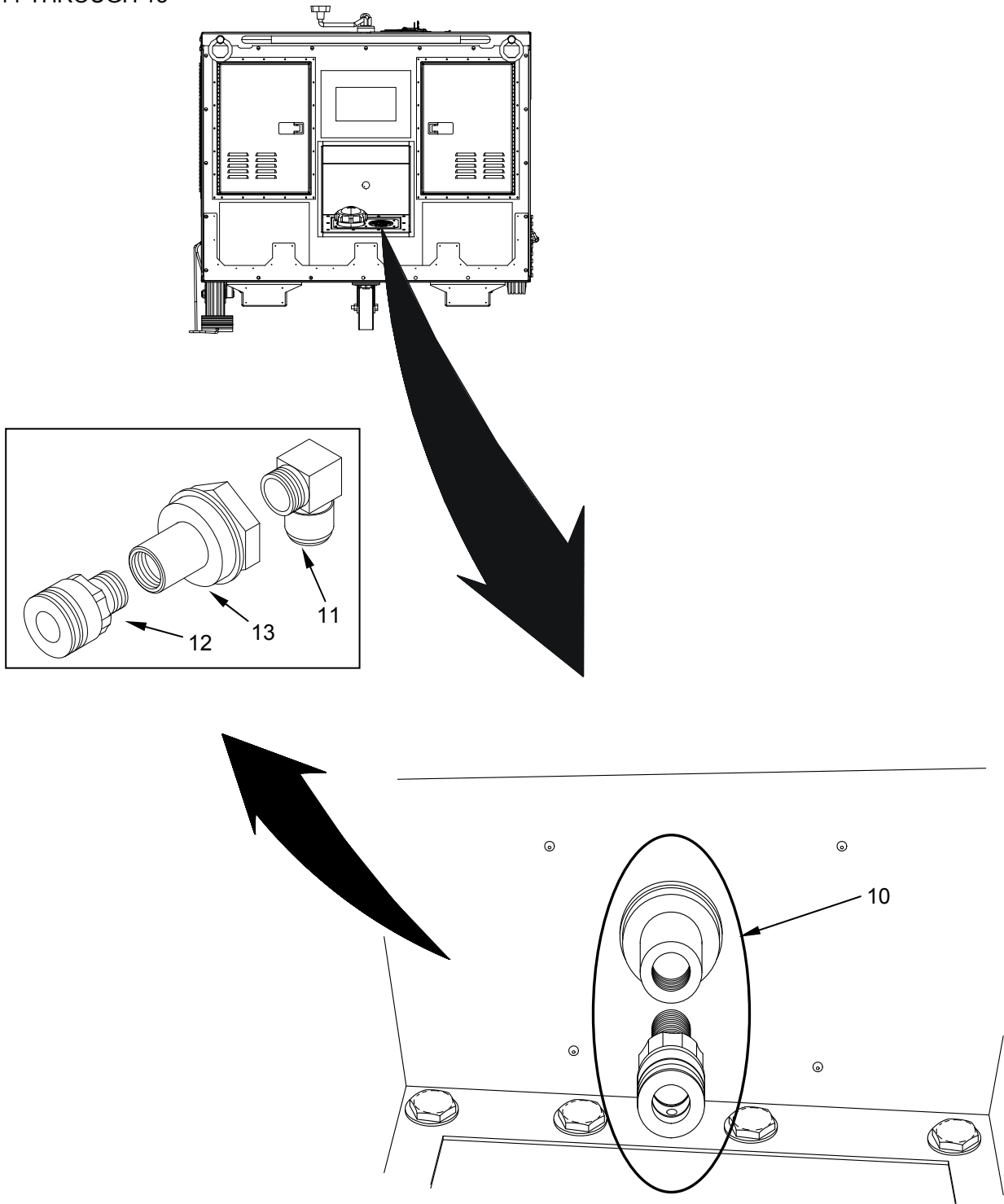


Figure 5. Fuel Tank Assembly (Sheet 3 of 5).

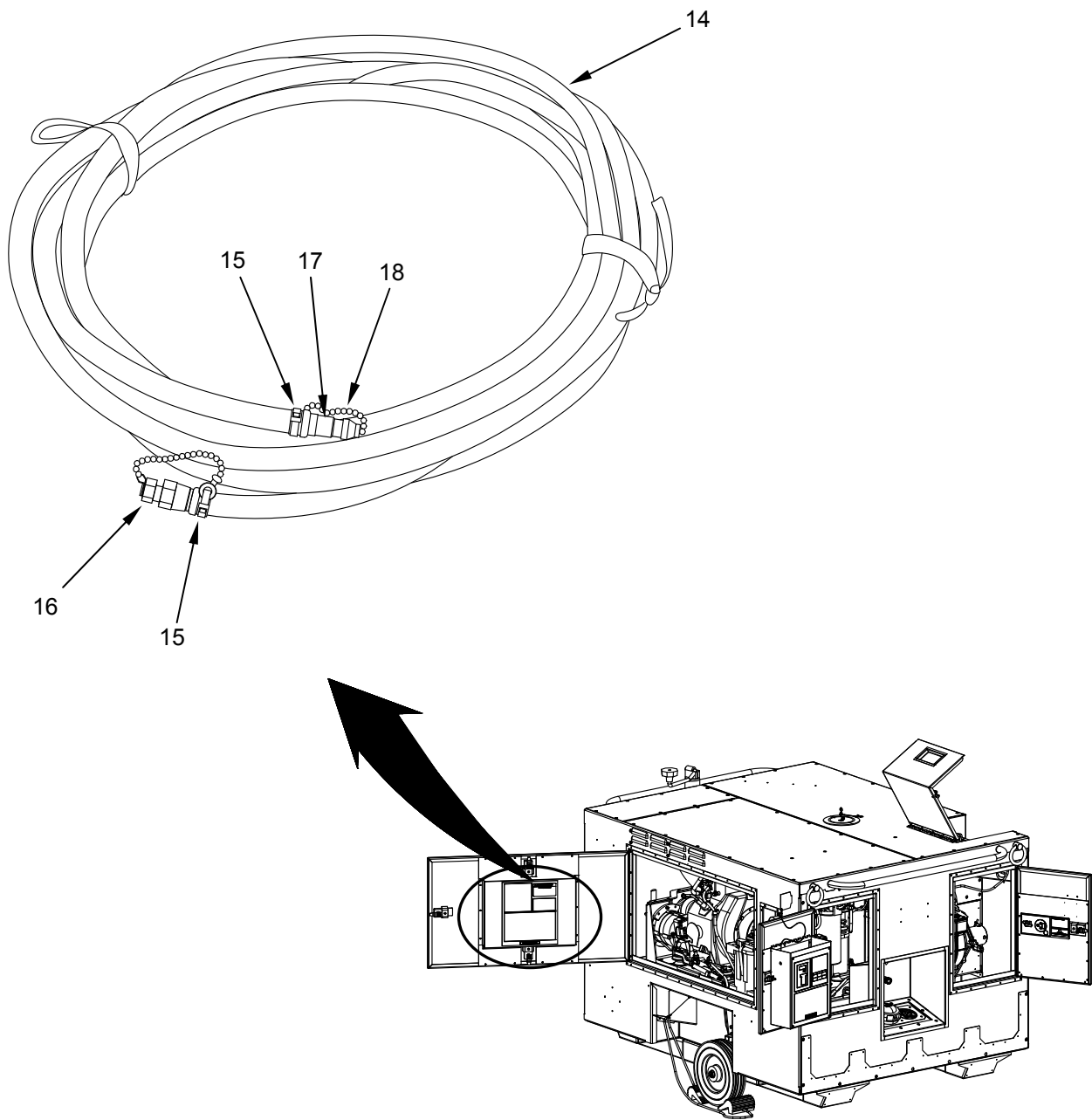


Figure 5. Fuel Tank Assembly (Sheet 4 of 5).

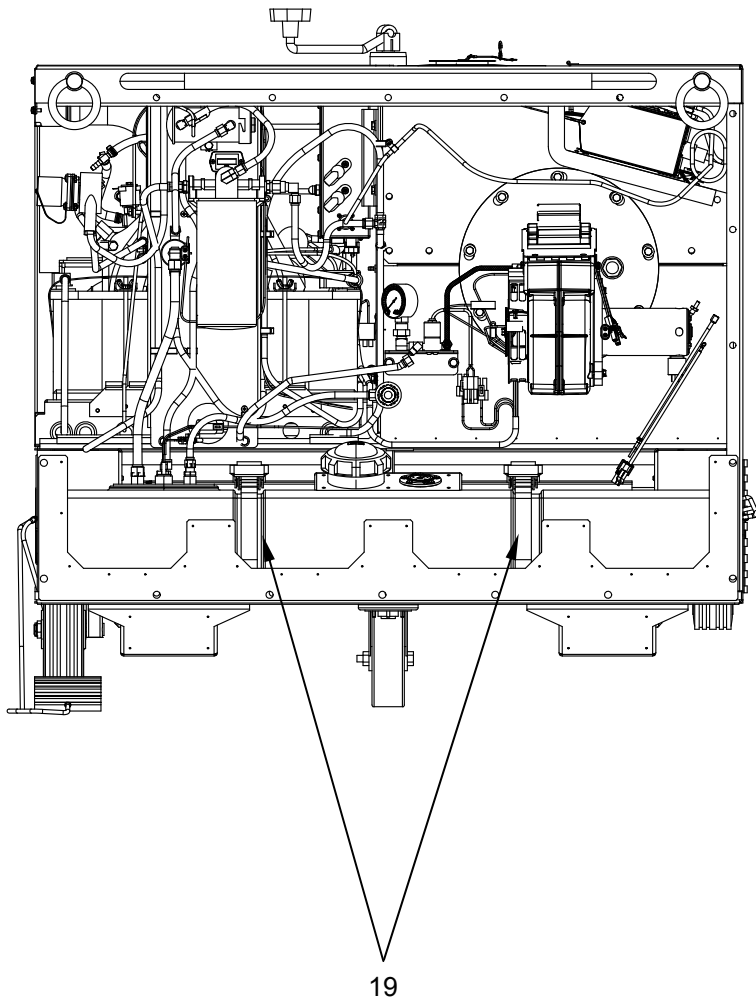


Figure 5. Fuel Tank Assembly (Sheet 5 of 5).

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 02</b>						
<b>FIG. 5 FUEL TANK ASSEMBLY</b>						
1	XDOOO		92878	40508	TANK, FUEL	1
2	PAOZZ	6680-01-539-7185	92878	40240	. SWITCH, LIQUID LEVEL	1
3	PAOZZ	5305-00-470-3321	96906	MS51849-74	. SCREW, MACHINE	8
4	PAOZZ	5310-00-014-5850	96906	MS27183-42	. WASHER, FLAT	8
5	PAOZZ	5310-00-045-3296	96906	MS35338-43	. WASHER, LOCK	8
6	PAOZZ	5342-01-539-7195	23224	202498	. CAP, FILLER OPENING	1
7	PAOZZ	4730-01-540-3594	92878	75116-100	. STRAINER, SEDIMENT	1
8	PAOZZ	6680-01-220-2936	09393	6781-S5.120- F5.7	. GAUGE, LIQUID QUANTITY, FLOAT TYPE	1
9	XDOZZ		87373	05-HP8	. PLUG, MACHINE THREAD	1
10	PAOZZ	4520-01-539-7200	92878	41207	ASSEMBLY, EXTERNAL FUEL SUPPLY PORT	1
11	PAOZZ	4730-00-254-6225	81343	4-4010202B	. ELBOW, PIPE TO TUBE	1
12	PAOZZ	4730-00-894-5574	39425	6536K18	. COUPLING HALF, QUICK DISCONNECT	1
13	PAOZZ		92878	41271	. FITTING, BULKHEAD 1/4 FEMALE NPT TO 1/4 FEMALE NPT	1
14	MOOOO		92878	40720	HOSE ASSEMBLY, NONMETALLIC (MAKE FROM HOSE, NONMETALLIC, 1/4 IN ID, P/N MIL-DTL-1344TY1SZ4, NSN 4720-00-913-5910, 25 FT LENGTH)	1
15	XDOZZ	5975-01-509-3916	39428	7130K59	. STRAP, TIEDOWN, ELECTRICAL COMPONENTS	2
16	PAOZZ	4730-01-539-7172	92878	40724	. CAP, HOSE	1
17	PAOZZ	4730-00-073-2151	01276	4797-5-4B	. ADAPTER, STRAIGHT, TUBE TO HOSE	1
18	PAOZZ	4520-01-493-2785	92878	5-13-5616	. FUEL CAP ASSEMBLY, SHC	1
19	XDOZZ		92878	75229	STRAPS, RESTRAINING	2

**END OF FIGURE**



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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, INLET FAN

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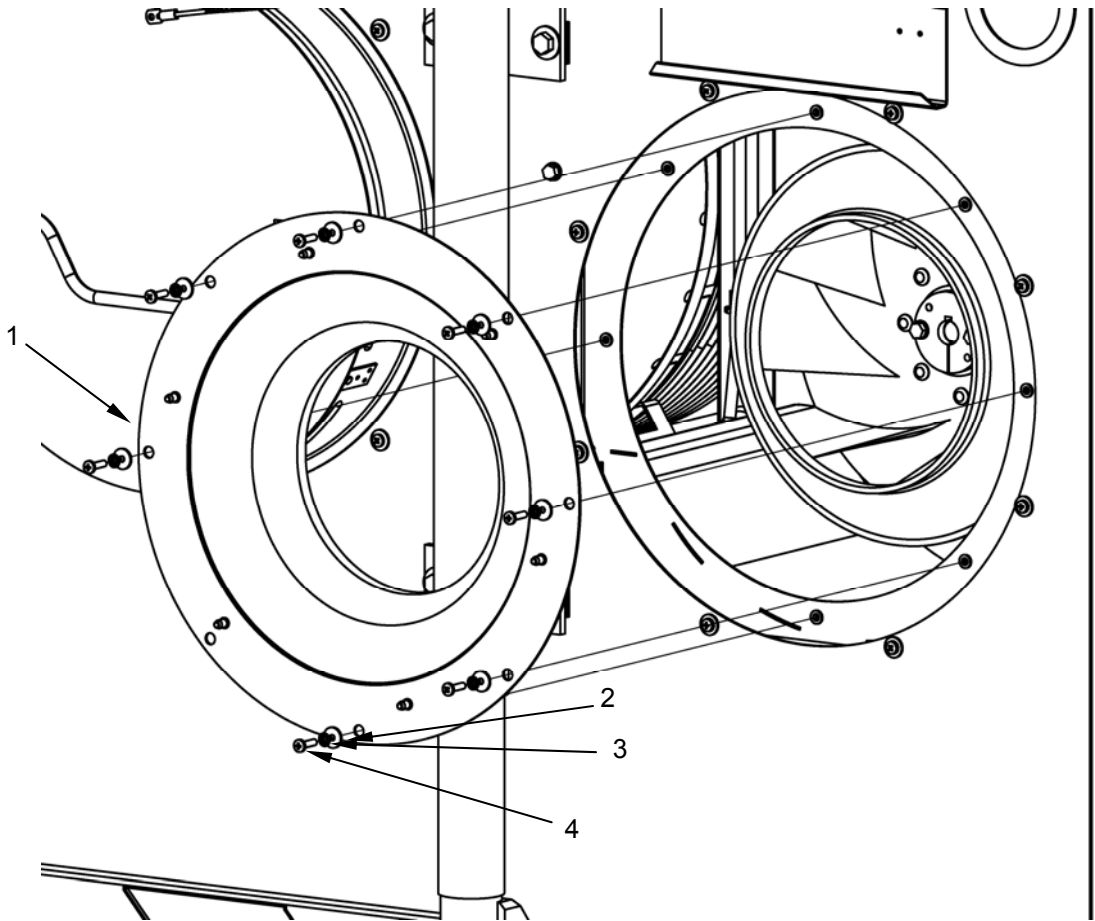


Figure 6. Assembly, Inlet Fan (Sheet 1 of 3).

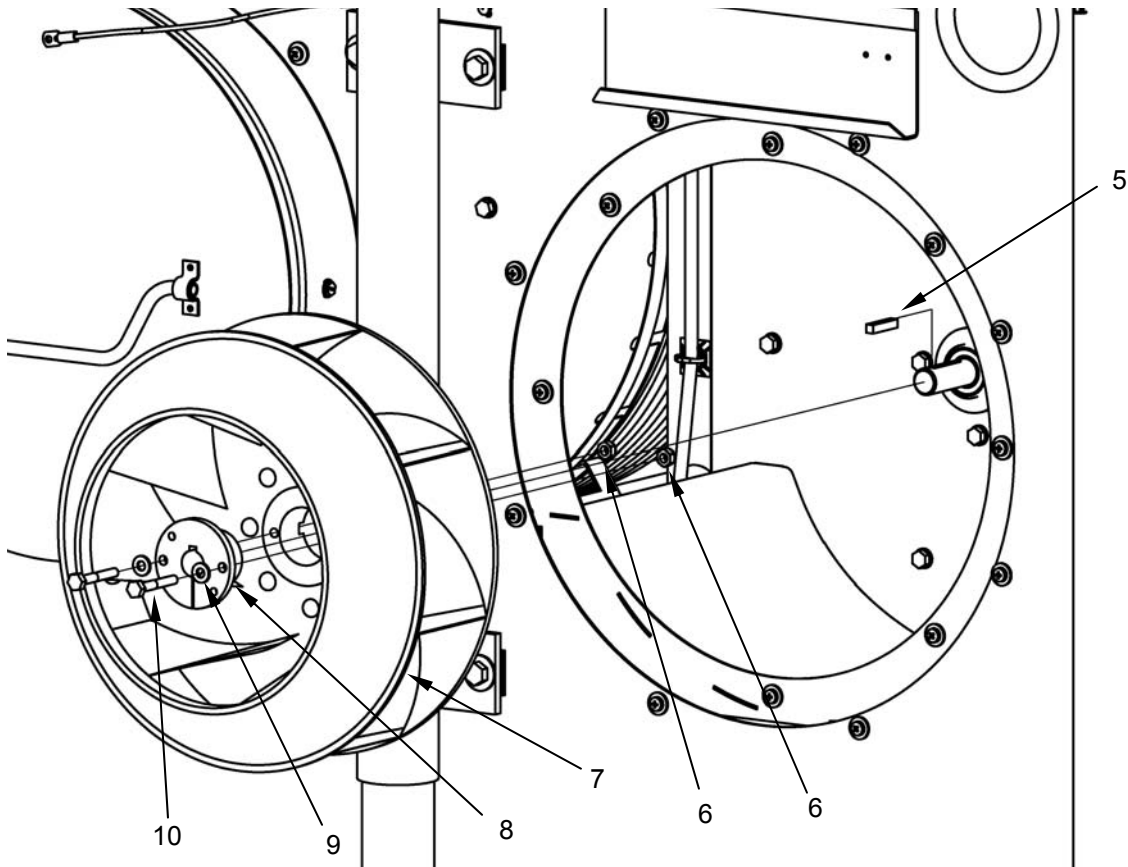


Figure 6. Assembly, Inlet Fan (Sheet 2 of 3).

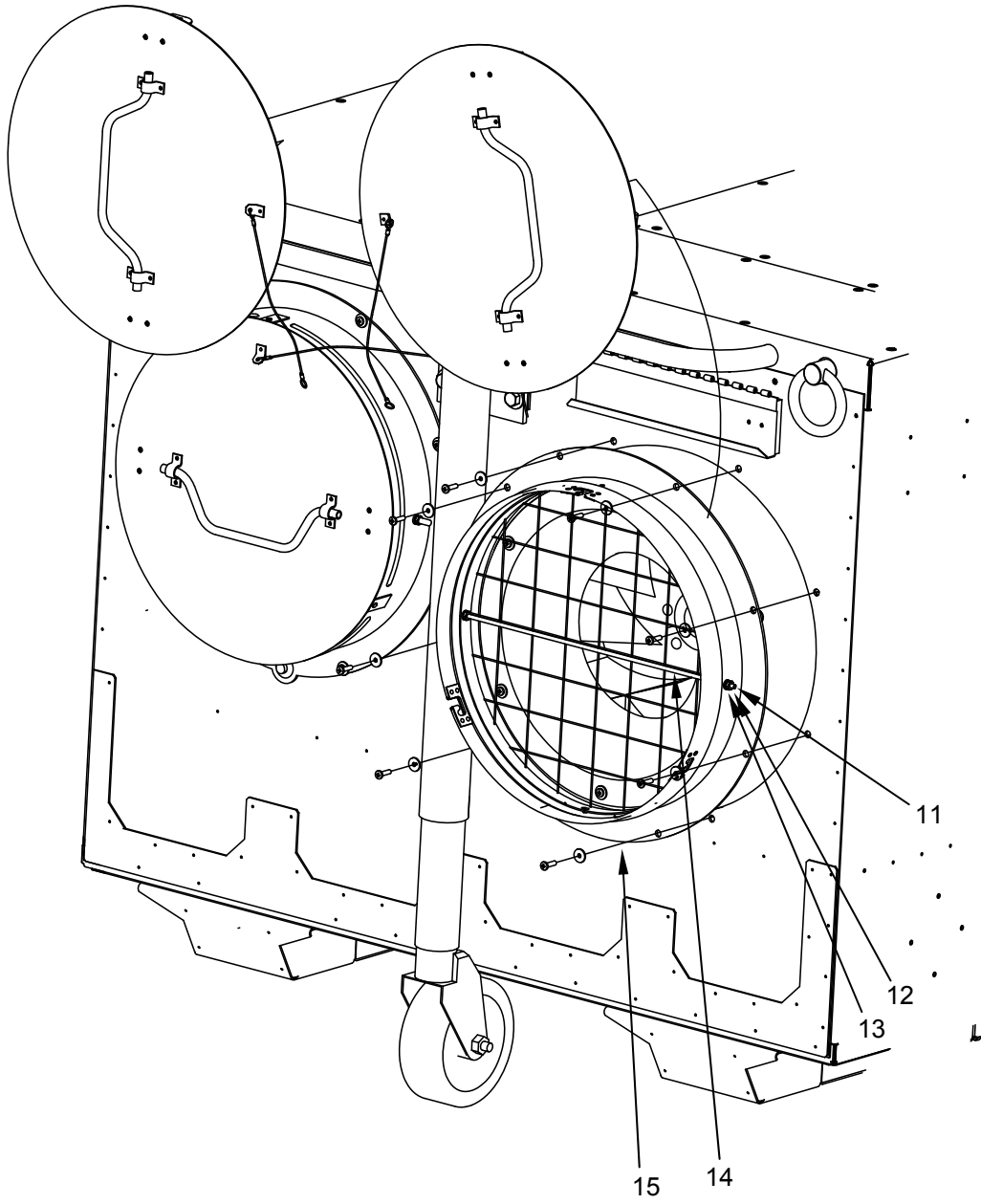


Figure 6. Assembly, Inlet Fan (Sheet 3 of 3).

1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 03</b>						
<b>FIG. 6 ASSEMBLY, INLET FAN</b>						
1	XDOZZ		92878	40185	ASSEMBLY, INLET FAN	1
2	PAOZZ	5310-00-637-9221	25612	GW10U606SC2	. WASHER, FLAT	6
3	PAOZZ	5310-00-596-7691	80020	NAF1058-10E	. WASHER, LOCK	6
4	PAOZZ	5305-00-989-7435	80205	MS35207-264	. SCREW, MACHINE	6
5	XDOZZ		92878	40162	. KEY, MACHINE	1
6	PAOZZ	5310-00-061-7325	96906	MS21045-4	. NUT, SELF-LOCKING, HEXAGON	2
7	XDOZZ		92878	40184	. IMPELLER, FAN, CENTRIFUGAL	1
8	XDOZZ		92878	40186	. HUB, FAN, CLUTCH	1
9	PAOZZ	5310-00-809-4058	96906	MS27183-10	. WASHER, FLAT	24
10	PAOZZ	5306-01-303-2815	80205	MS90725-13	. BOLT, MACHINE	2
11	PAOZZ	5310-00-934-9758	80205	MS35649-202	. NUT, PLAIN, HEXAGON	9
12	PAOZZ	5310-00-045-3296	96906	MS35338-43	. WASHER, LOCK	4
13	PAOZZ	5310-00-014-5850	96906	MS27183-42	. WASHER, FLAT	8
14	XDOZZ		92878	75259-1	. ROD, THREADED END	1
15	XDOZZ		92878	41516	. AIR INLET CONNECTION	1

**END OF FIGURE**



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, ENGINE SYSTEM

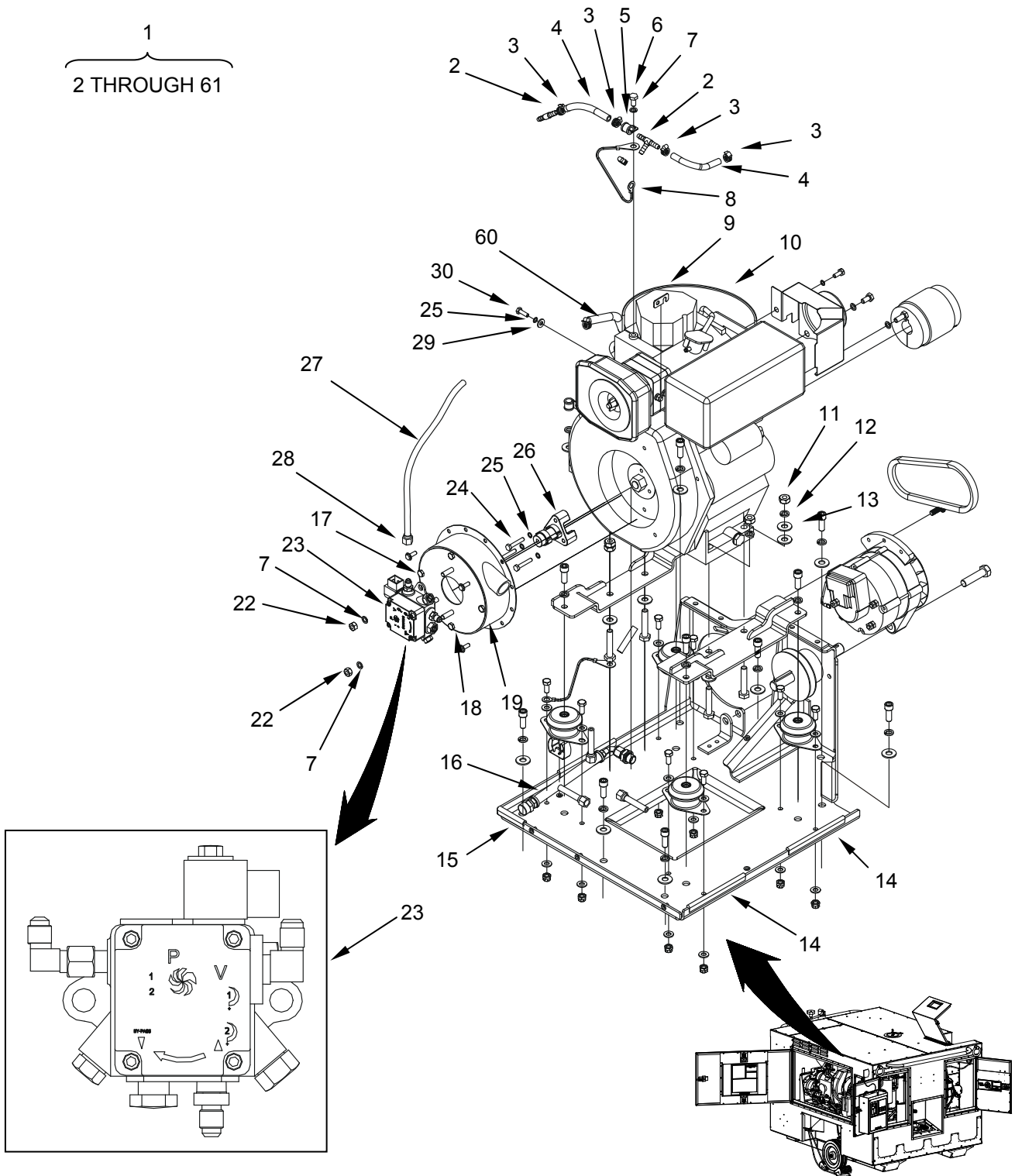


Figure 7. Assembly, Engine System (Rear View) (Sheet 1 of 2).

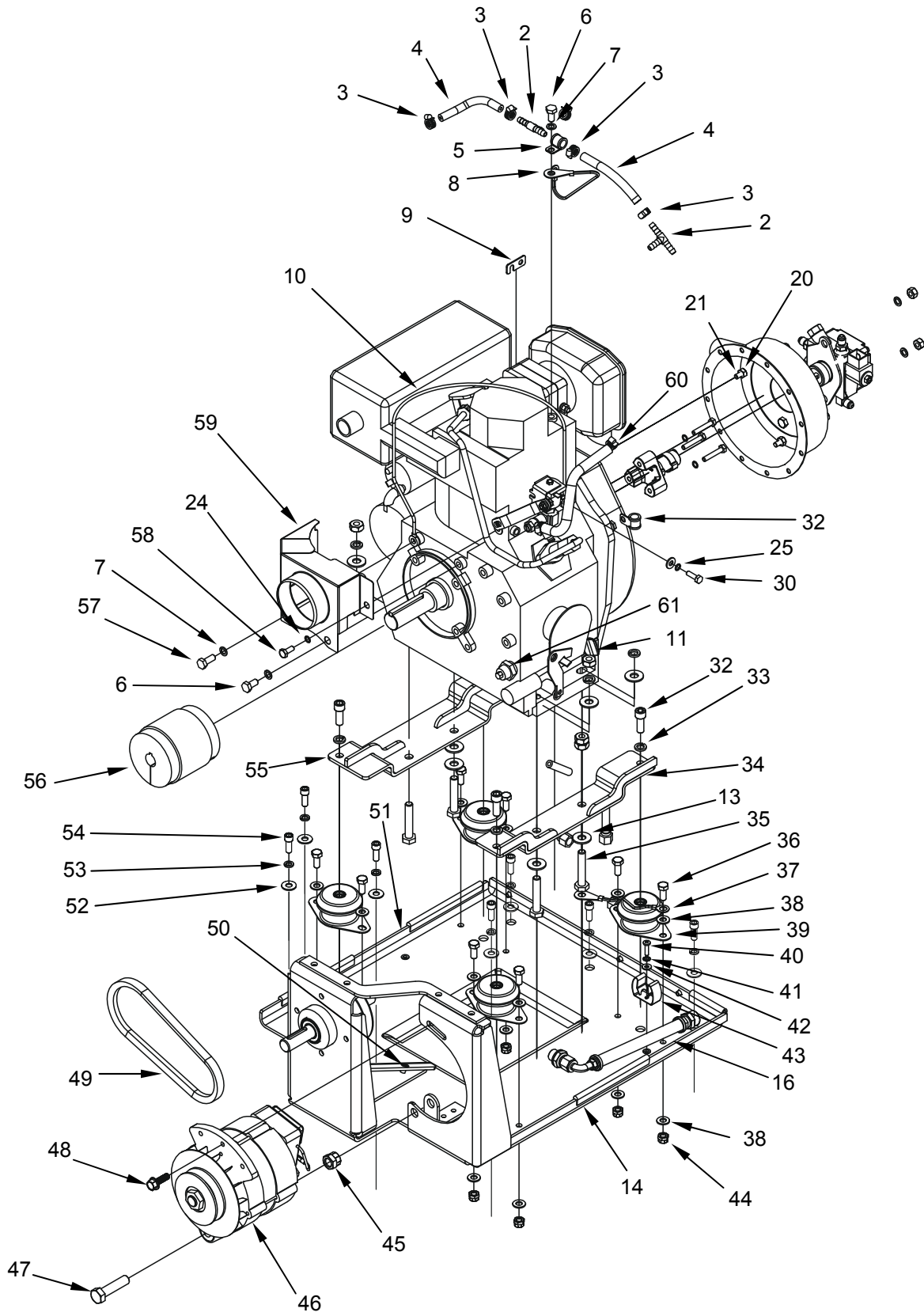


Figure 7. Assembly, Engine System (Front View) (Sheet 2 of 2).



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 03</b>						
<b>FIG. 7 ASSEMBLY, ENGINE SYSTEM</b>						
1	XDOOO		92878	41100	ASSEMBLY, ENGINE SYSTEM	1
2	PAOZZ	4730-01-058-9758	93061	224-4	. TEE, HOSE	2
3	PAOZZ	4730-01-424-5432	39428	5321K14	. CLAMP, HOSE	7
4	MOOZZ		92878	40191	. HOSE, NONMETALLIC (MAKE FROM BULK NSN 4720-00-913-5910)	2
5	PAOZZ	5340-00-057-3043	96906	MS21333-112	. CLAMP, LOOP	2
6	PAOZZ	5310-01-465-7108	39428	91280A524	. SCREW, CAP, HEXAGON HEAD	2
7	PAOZZ	5310-00-407-9566	80205	MS35338-45	. WASHER, LOCK	6
8	XDOZZ		92878	52161	. STRIP, ELECTRICAL GROUNDING	1
9	XDOZZ		92878	40195	. BUS, CONDUCTOR	1
10	XDOZZ		92878	40119	. STRAP, ENGINE LIFT	1
11	PAOZZ	5310-01-137-4830	72741	430-010	. NUT, PLAIN, HEXAGON	5
12	PAOZZ	5310-00-637-9541	81718	H2525M	. WASHER, LOCK	4
13	PAOZZ	5310-00-809-4061	96906	MS27183-15	. WASHER, FLAT	8
14	MOOZZ		92878	40196	. MOLDING, PLASTIC (MAKE FROM BULK P/N 8451A53, CAGEC 0E328)	3
15	MOOZZ		92878	40199	. MOLDING, PLASTIC (MAKE FROM BULK P/N 8451A53, CAGEC 0E328)	1
16	XDOZZ		92878	41107	. HOSE ASSEMBLY	1
17	XDOZZ		92878	41115	. ASSEMBLY, PUMP MOUNT	1
18	XAOZZ		92878	40112	. . PLATE, MOUNTING, FUEL PUMP	1
19	XAOZZ		92878	40111	. . HOUSING, PULL START, MODIFIED	1
20	PAOZZ	5310-00-543-2410	80205	MS35338-40	. . WASHER, LOCK	4
21	PAOZZ	5305-00-068-0502	96906	MS90725-6	. . SCREW, CAP, HEXAGON HEAD	4
22	PAOZZ	5310-00-880-7744	96906	MS51967-5	. NUT, PLAIN, HEXAGON	2
23	PAOZZ	2910-01-568-5116	92878	41201-SV	. ASSEMBLY, FUEL PUMP	1
24	XDOZZ		39428	91280A340	. SCREW, CAP, HEX HEAD	3
25	PAOZZ	5310-00-582-5965	99539	CBM21389	. WASHER, LOCK	4
26	PAOZZ	3010-01-569-6036	92878	41213-SV	. COUPLING, DRIVE SHAFT	1
27	XDOZZ		96906	40197	. HOSE ASSEMBLY, NONMETALLIC	1
28	PAOZZ	4730-00-555-1152	70281	2203B510	. . ADAPTER, STRAIGHT, TUBE TO HOSE	1
29	PAOZZ	5310-00-809-4058	96906	MS27183-10	. WASHER, FLAT	1
30	PAOZZ	5305-01-542-7318	39428	91280A330	. SCREW, CAP, HEX HEAD	1
31	PAOZZ	5340-00-291-5347	81343	AS21919DG8	. CLAMP, LOOP	2
32	PAOZZ	5305-00-876-4828	80205	NAS1352-6-20P	. SCREW, CAP, SOCKET HEAD	4
33	PAOZZ	5310-00-637-9541	80205	MS35338-46	. WASHER, LOCK	4
34	XDOZZ		92878	41146	. BRACKET, MOUNTING	1
35	XDOZZ	5305-01-542-7318	39428	91280A643	. BOLT, MACHINE	4
36	PAOZZ	5306-00-050-1238	80204	B1821BH031F0 75N	. BOLT, MACHINE	8
37	XDOZZ		92878	52161	. STRIP, ELECTRICAL GROUNDING	1
38	PAOZZ	5310-00-081-4219	96906	MS27183-12	. WASHER, FLAT	17

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
39	PAOZZ	5340-01-568-5127	92878	41104-SV	. MOUNT, ENGINE	4
40	PAOZZ	5305-00-989-7435	80205	MS35207-264	. SCREW, MACHINE	1
41	PAOZZ	5310-00-596-7691	96906	MS35335-32	. WASHER, LOCK	1
42	PAOZZ	5310-00-014-5850	96906	MS27183-42	. WASHER, FLAT	1
43	PAOZZ	5340-01-153-0578	39428	1723A22	. CLIP, SPRING TENSION	1
44	PAOZZ	5310-00-880-7744	96906	MS21045-5	. NUT, PLAIN, HEXAGON	8
45	PAOZZ	5310-00-062-4954	80205	MS21045-8	. NUT, SELF-LOCKING, HEXAGON	1
46	PAOZZ	4520-01-539-7194	92878	40103	. ALTERNATOR, 24V	1
47	PAOZZ	5305-00-226-7768	96906	MS90726-115	. SCREW, CAP, HEXAGON HEAD, 1/2 X 2.00 IN GRD 5	1
48	XDOZZ		07BY4	92323A537	. BOLT, MACHINE	1
49	PAOZZ	3030-01-539-7196	92878	40132	. BELT, V	1
50	PAOZZ	5310-01-046-5371	96906	MS27130-S27	. NUT, PLAIN, BLIND RIVET	6
51	XDOZZ		92878	41102	. PLATE, MOUNTING, ENGINE	1
52	PAOZZ	5305-00-876-4828	80205	NAS1352-6-20P	. SCREW, CAP, SOCKET HEAD	7
53	PAOZZ	5310-00-004-5033	80205	MS35338-46	. WASHER, LOCK	7
54	PAOZZ	5310-00-809-4061	96906	MS27183-15	. WASHER, FLAT	7
55	XDOZZ		92878	41147	. BRACKET, ENGINE MOUNT	1
56	PAOZZ	3010-01-539-7198	92878	40105	. COUPLING,SHAFT,FLEXIBLE	1
57	PAOZZ	5305-12-156-4863	39428	91280A530	. SCREW, CAP, HEX HEAD	1
58	PAOZZ	5305-00-068-0501	80205	MS90725-5	. SCREW, CAP, HEXAGON HEAD	1
59	XDOZZ		92878	40563	. BAFFLE, AIRFLOW, ENGINE	1
60	XDOZZ		92878	40192	. HOSE, FUEL (ENGINE INLET)	1
61	PAOZZ	5930-01-416-0372	0AK42	183250-39450	.SWITCH,PRESSURE,OIL	1

END OF FIGURE

OPERATOR, SERVICE, FIELD AND SUSTAINMENT MAINTENANCE

ENGINE, DIESEL

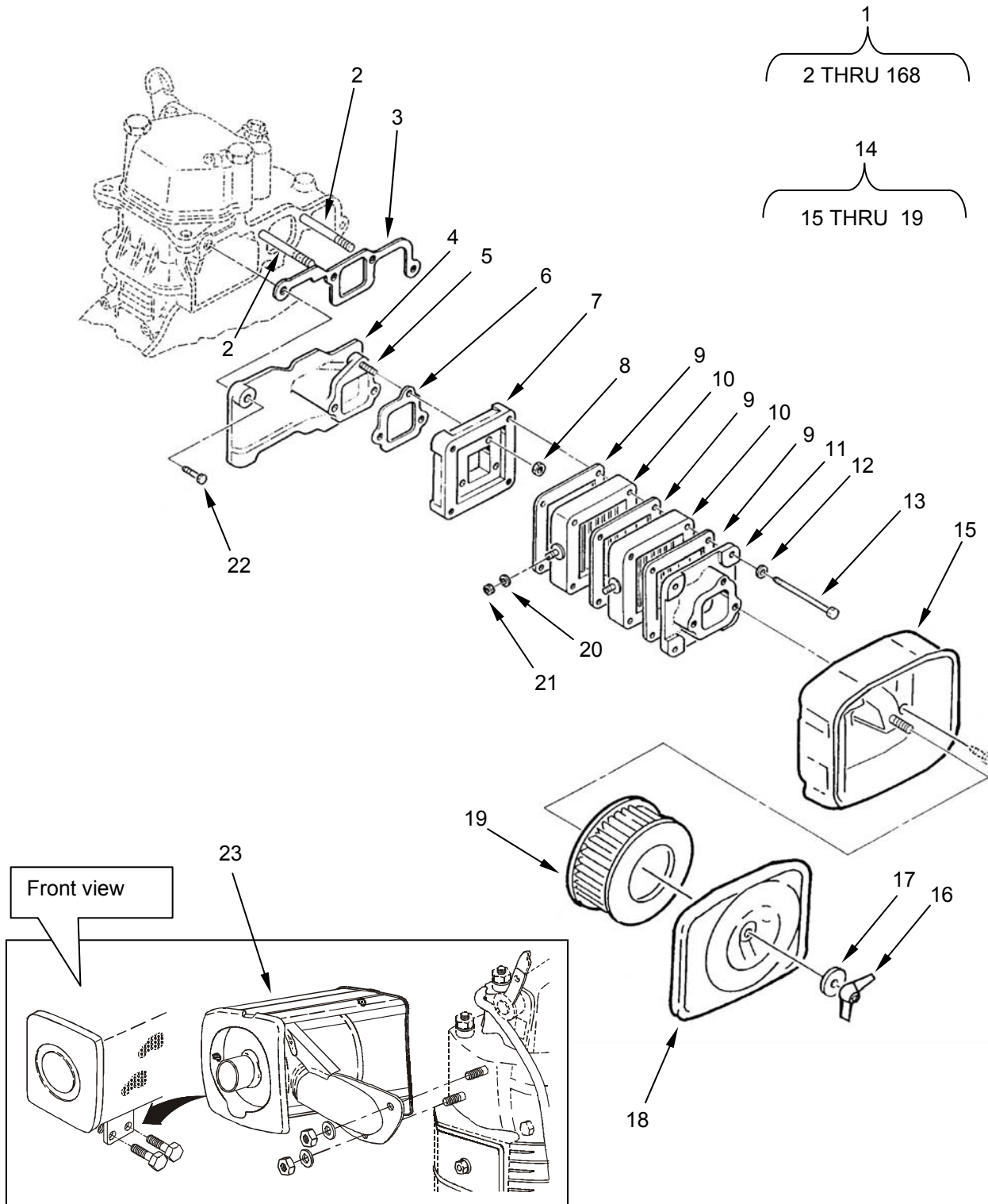


Figure 8. Engine, Diesel (Sheet 1 of 10)  
(Air Cleaner, Air Preheater, and Muffler Assemblies).

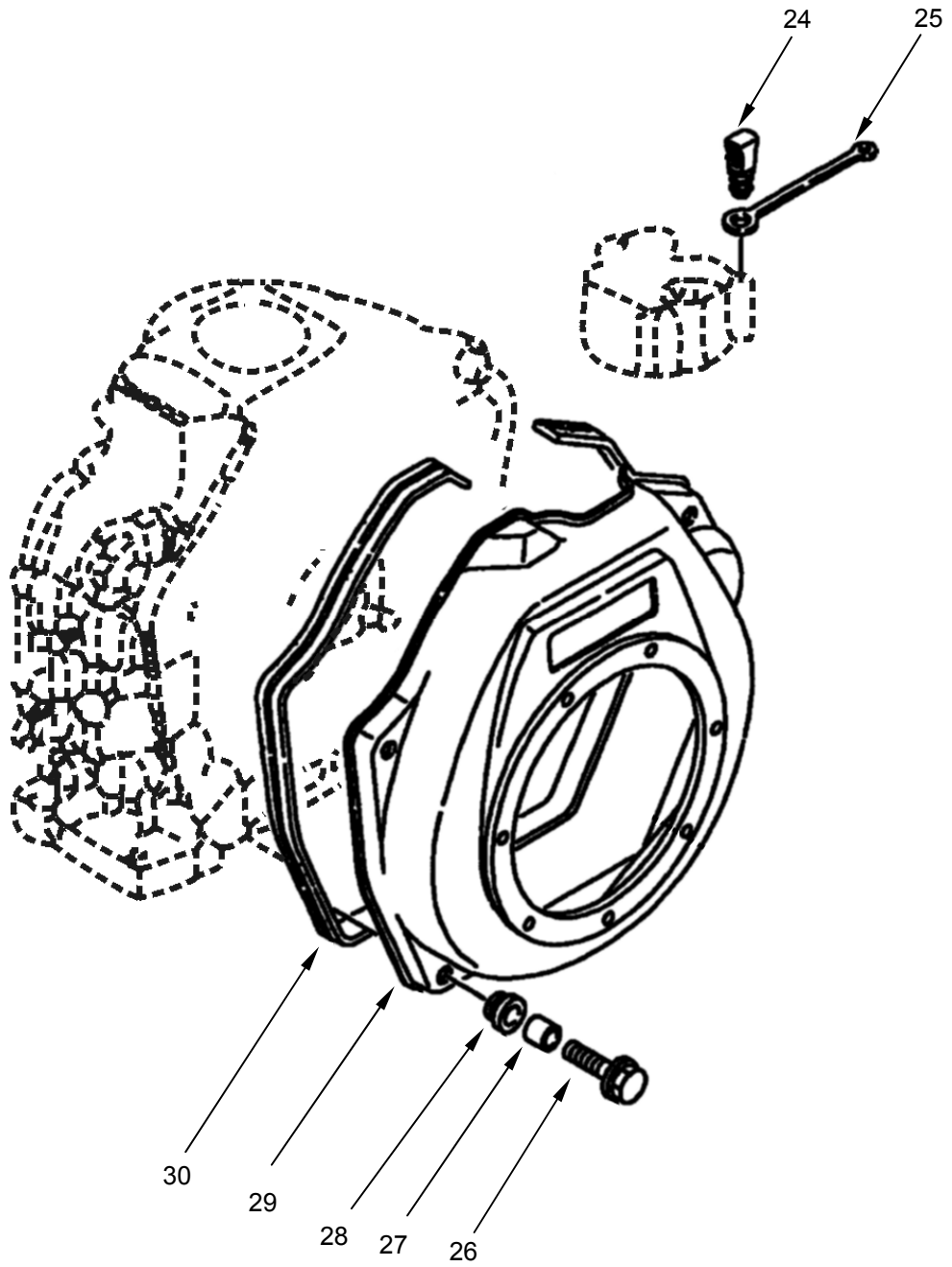


Figure 8. Engine, Diesel (Sheet 2 of 10)  
(Cooling and Starting Device).

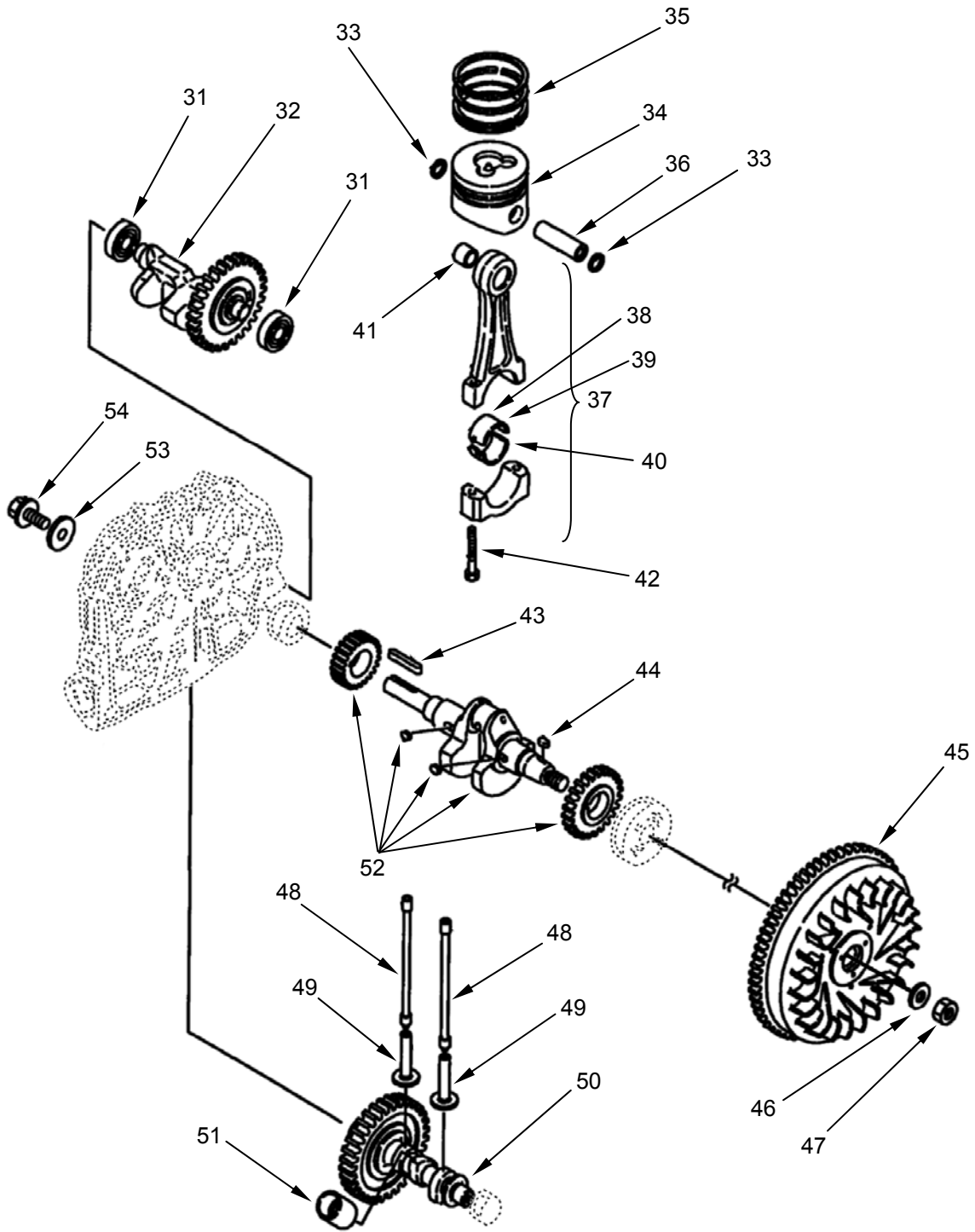


Figure 8. Engine, Diesel (Sheet 3 of 10)  
(Crankshaft, Piston, and Camshaft).  
0104-3

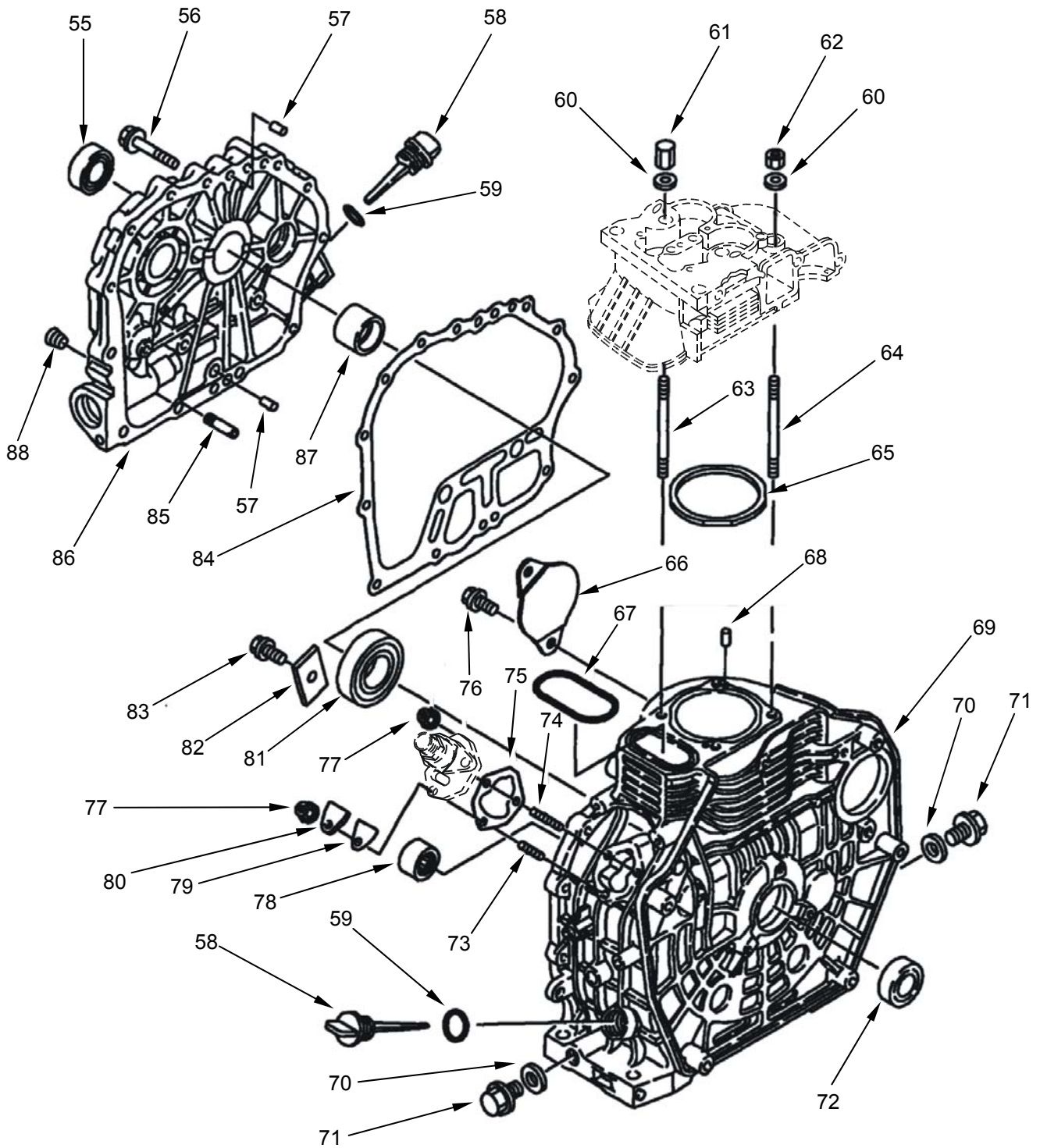


Figure 8. Engine, Diesel (Sheet 4 of 10)  
(Cylinder Block).

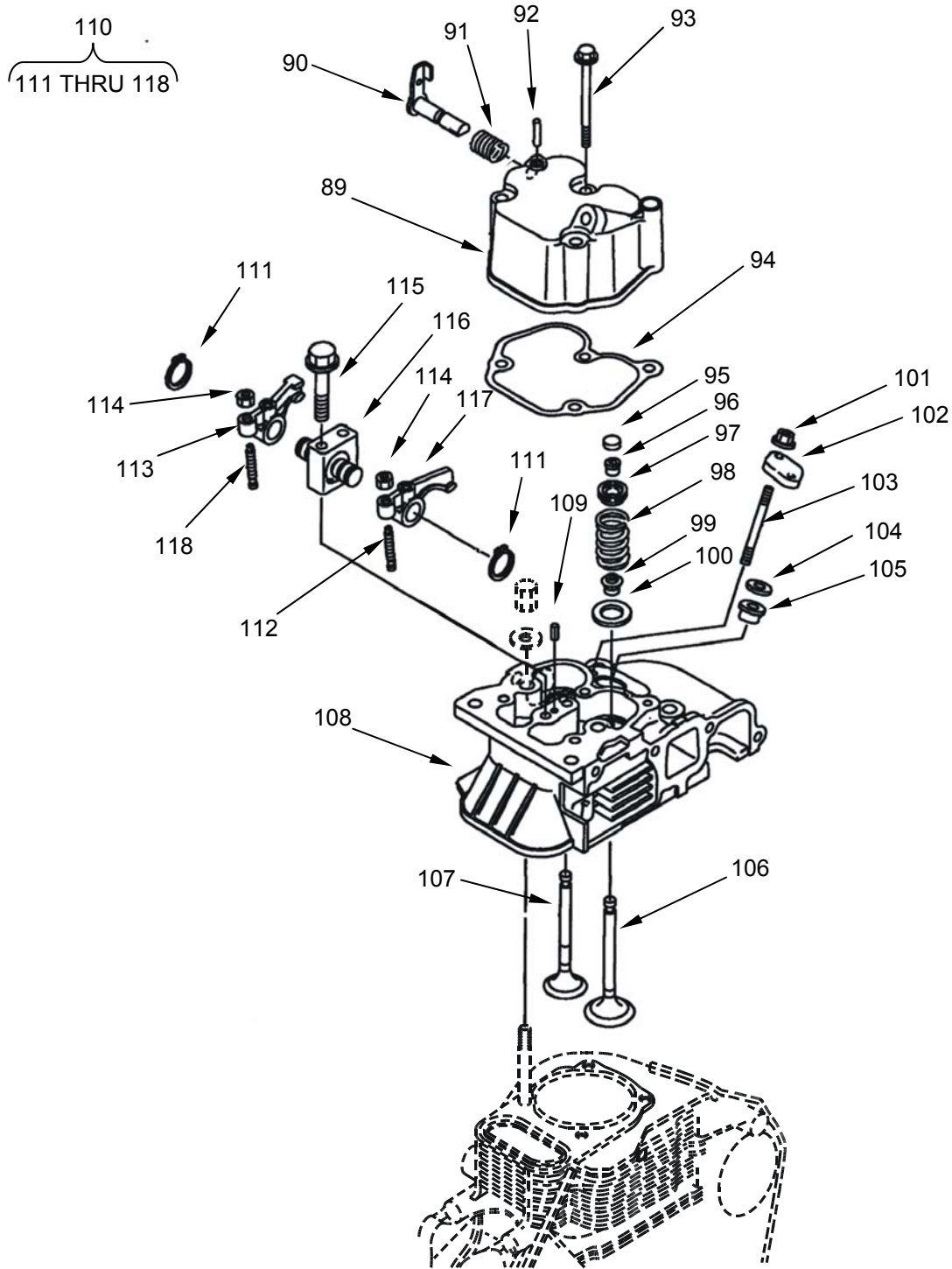


Figure 8. Engine, Diesel (Sheet 5 of 10)  
(Cylinder Head and Bonnet).

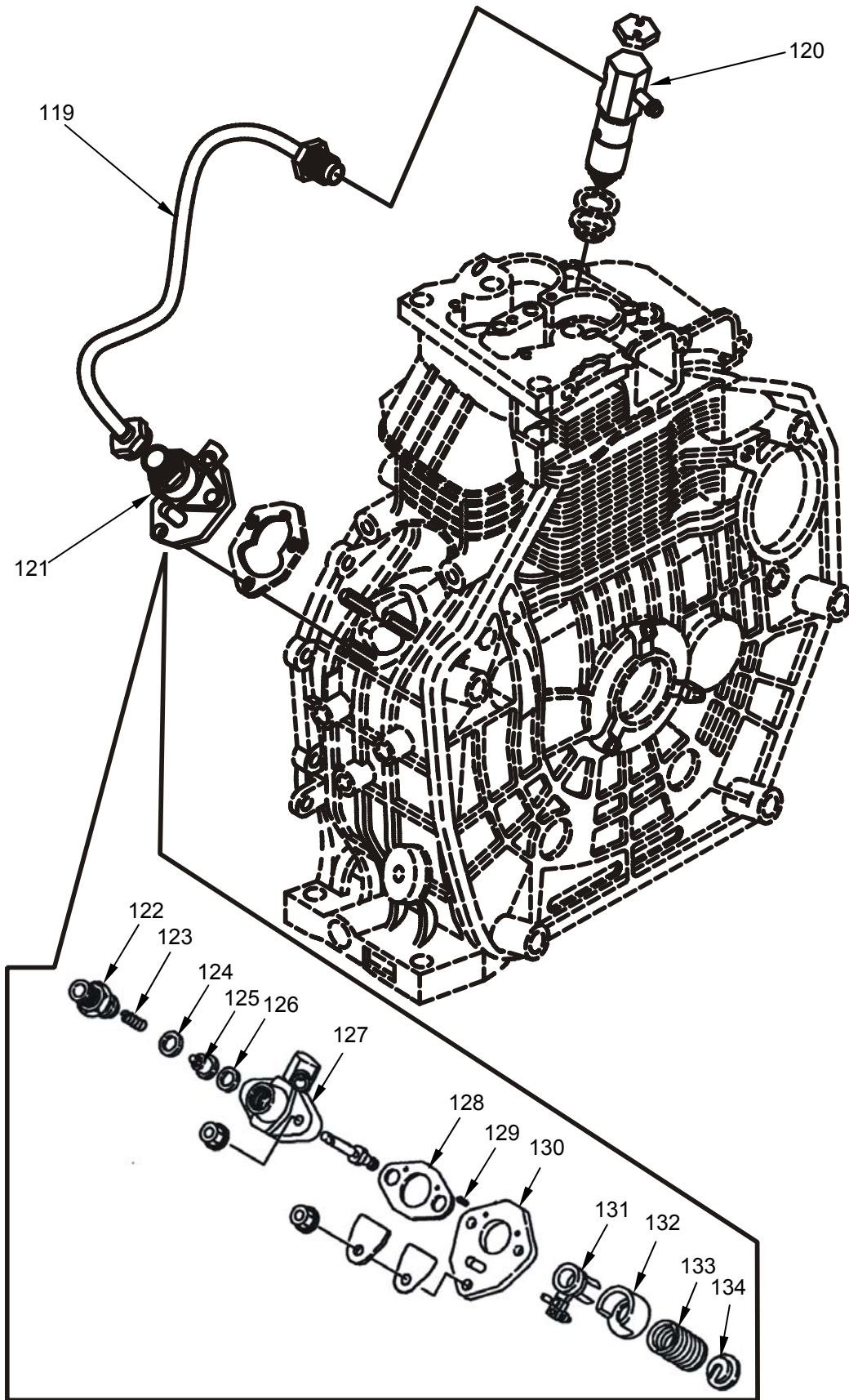


Figure 8. Engine, Diesel (Sheet 6 of 10)  
(Fuel Injection Pump).



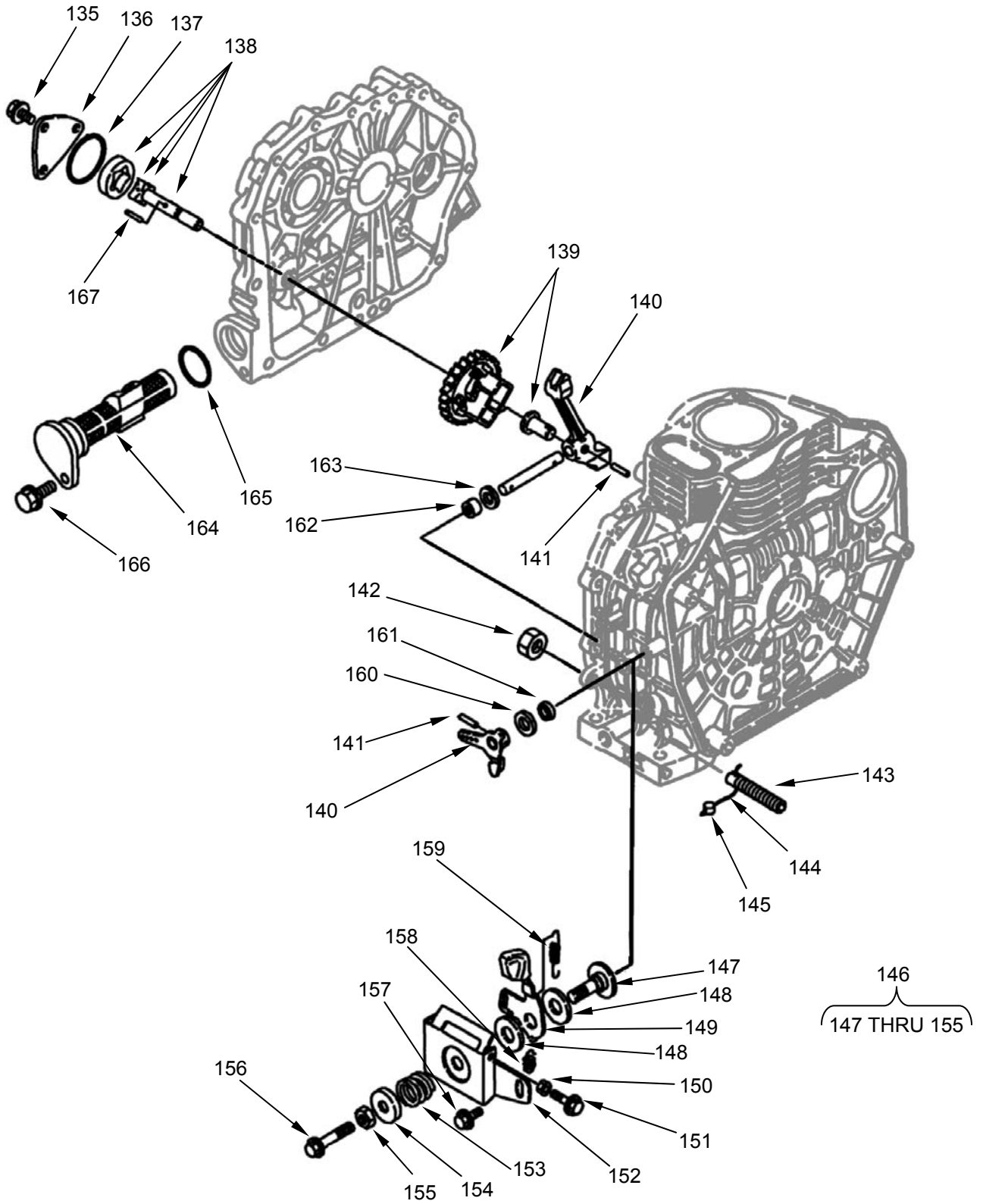


Figure 8. Engine, Diesel (Sheet 7 of 10)  
 (Lubrication Oil Pump Assembly and Governor).

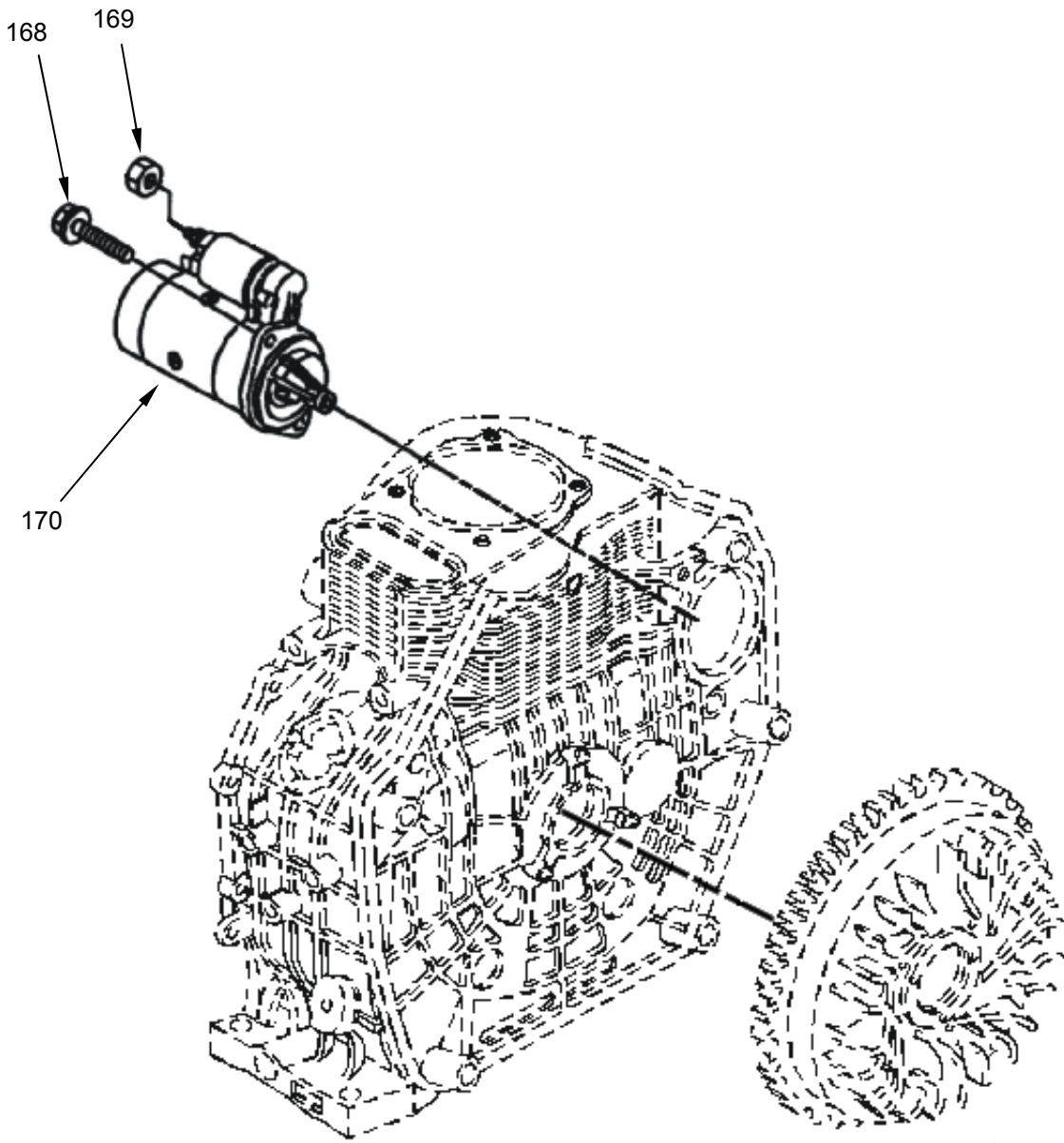


Figure 8. Engine, Diesel (Sheet 8 of 10)  
(Starting Motor and Dynamo).

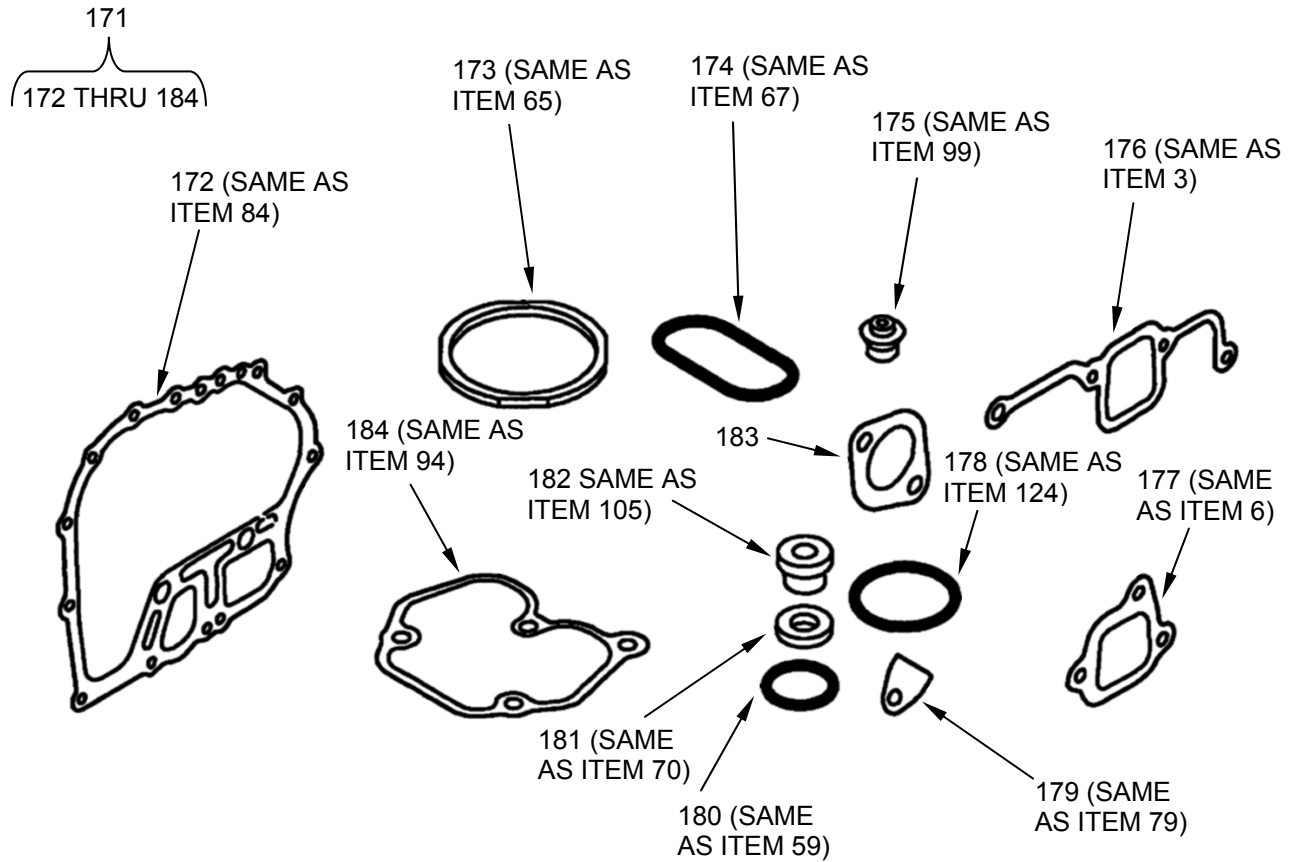


Figure 8. Engine, Diesel (Sheet 9 of 10)  
(Gasket Set).

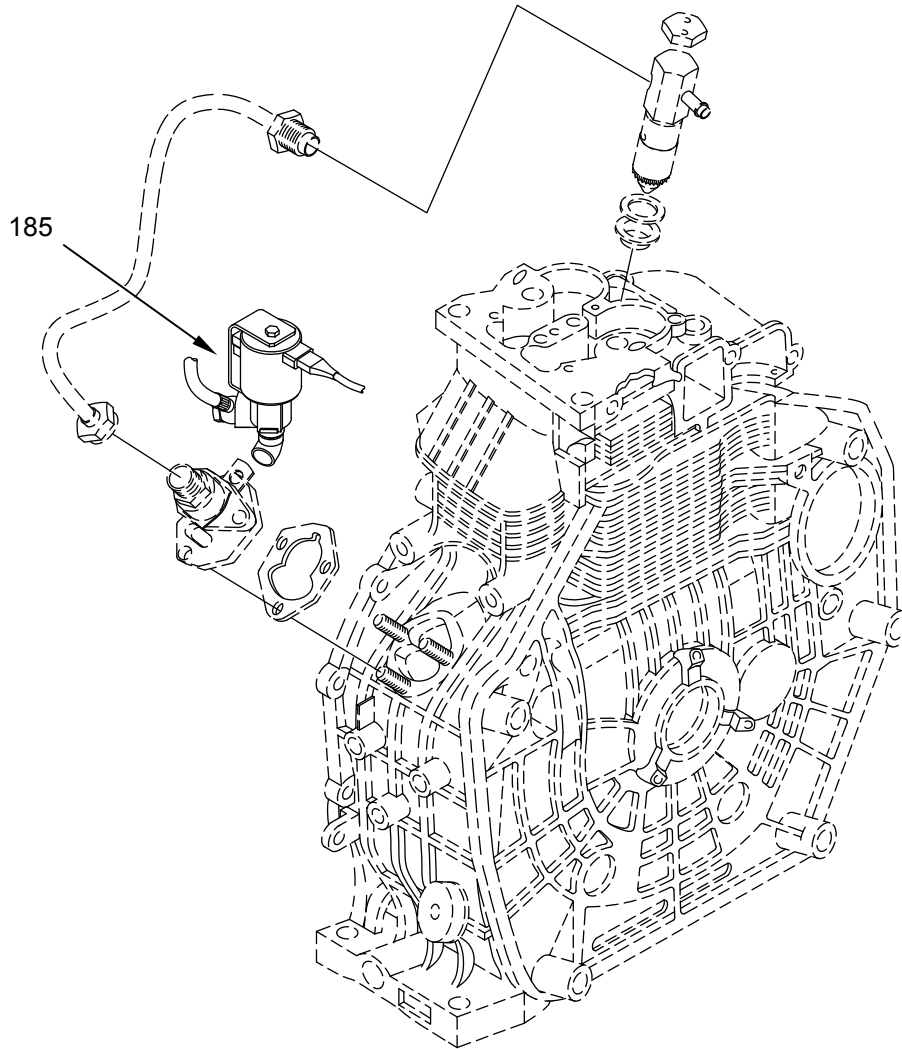


Figure 8. Engine, Diesel (Sheet 10 of 10)  
(Engine Shutdown Solenoid).  
**0104-10**

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 03</b>						
<b>FIG. 8 ENGINE, DIESEL</b>						
1	PAFHH	2815-01-569-4627	92878	41101-10-SV	ENGINE, DIESEL	1
2	PAOZZ	5307-01-323-5504	0AK42	26226-060552	. STUD, PLAIN	2
3	PAOZZ	5330-01-466-0701	0AK42	114350-12202	. GASKET	1
4	XDOZZ		S4163	114399-12011	. PIPE, INTAKE	1
5	PAOZZ	5307-01-323-5505	0AK42	26226-060142	. STUD, PLAIN, M6 X 14 PLATED	3
6	PAOZZ	5330-01-526-5104	0AK42	114250-12211	. GASKET	1
7	PAOZZ	5365-01-419-5477	0AK42	183375-77560	. SPACER, PLATE	1
8	PAOZZ	5310-01-388-8826	0AK42	26366-060002	. NUT, PLAIN, HEXAGON	3
9	PAOZZ	5330-01-477-4043	0AK42	129100-77510	. GASKET	3
10	PAOZZ	4520-01-424-6353	0AK42	129400-77501	. HEATING ELEMENT,ELECTRICAL,NONIM	2
11	XDOZZ		0AK42	183375-77570	. ADAPTER	1
12	PAOZZ	5310-01-477-0607	0AK42	22217-080000	. WASHER, FLAT	4
13	PAOZZ	5305-01-477-3508	0AK42	26106-080552	. SCREW, CAP, HEXAGON HEAD	4
14	PAOZZ	2940-01-323-3289	0AK42	714250-12560	. AIR CLEANER, INTAKE	1
15	PAOZZ	2940-01-389-9942	0AK42	114250-12530	. . CASE, AIR CLEANER INTAKE	1
16	PAOZZ	5310-01-327-0778	0AK42	114250-12550	. . NUT, WING	1
17	PAOZZ	5310-01-322-8747	0AK42	114250-12560	. . WASHER, SEAL	1
18	PAOZZ	5340-01-323-7879	0AK42	114250-12520	. . COVER, ACCESS	1
19	PAOZZ	2940-01-310-4495	0AK42	114250-12581	. . FILTER ELEMENT, INTAKE AIR CLEANER	1
20	PAOZZ	5310-01-477-0603	S4163	22217-060000	. WASHER, FLAT	2
21	PAOZZ	5310-01-477-0606	S4163	26716-060002	. NUT, PLAIN, HEXAGON	2
22	PAOZZ	5305-01-255-6548	70655	10512	. SCREW, CAP, HEXAGON HEAD	1
23	PAOZZ	2990-01-539-8276	0AK42	114368-13500	. MUFFLER, EXHAUST-INTAKE	1
24	PAOZZ	5340-01-433-5460	0AK42	114250-76600	. PLUNGER, DETENT	1
25	PAOZZ	5340-01-449-3915	0AK42	114250-76610	. PLUNGER, QUICK RELEASE	1
26	XDOZZ		0AK42	114370-45351	. BOLT, HEX HEAD	4
27	PAOZZ	5342-01-323-7866	0AK42	114250-45310	. COUPLING, CLAMP, GROOVED	4
28	PAOZZ	5340-01-526-5277	0AK42	114250-45301	. BUMPER, NON METALLIC	4
29	XDOZZ		0AK42	114360-45101	. CASE, FAN, NONAIRCRAFT GAS TURBINE ENGINE	1
30	PAOZZ	5330-01-330-9564	0AK42	114250-45330	. SEAL, PLAIN ENCASED	1
31	PAHZZ	3110-01-322-9532	0AK42	24101-062024	. BEARING, BALL, ANNULAR	2
32	XDHZZ		0AK42	714350-28520	. BALANCER SHAFT ASSEMBLY	1
33	PAHZZ	2910-01-465-8277	S4163	22252-000210	. CLAMP	2
34	PAHZZ	2815-01-530-1527	0AK42	714872-22720	. PISTON, INTERNAL COM	1
35	PAHZZ	2815-01-477-0536	0AK42	714870-22500	. . RING SET, PISTON	1
36	PAHZZ	2815-01-465-6393	0AK42	114399-22300	. PIN, PISTON	1
37	PAHZZ	2805-01-465-7528	0AK42	714380-23700	. CONNECTING ROD, PISTON	1
38	PAHZZ	3110-01-530-1167	0AK42	714380-23600	. . BEARING, BALL, ANNULAR	1

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
39	XDHZZ		0AK42	714380-23620	. . BEARING, SLEEVE U.S.=0.50	1
40	XDHZZ		0AK42	714380-23610	. . BEARING, SLEEVE U.S.=0.25	1
41	XAHHZ		0AK42	114380-23100	. . BUSHING, PISTON PIN	1
42	XAHHZ		0AK42	118200-23200	. . BOLT, MACHINE	2
43	PAHZZ	5305-01-465-9934	0AK42	160842-21150	. KEY, MACHINE	1
44	PAHZZ	5315-01-432-1210	0AK42	22512-040120	. KEY, MACHINE	1
45	PAHZZ	2815-01-465-6703	S4163	114881-21590	. FLYWHEEL, ENGINE	1
46	PAHZZ	5310-01-431-4070	0AK42	114250-21550	. FLAT WASHER	1
47	PAHZZ	5310-01-398-0737	0AK42	103854-01221	. NUT, PLAIN, HEXAGON	1
48	PAHZZ	2815-01-465-9578	0AK42	114350-14450	. ROD, PUSH	2
49	PAHZZ	2815-01-323-0352	0AK42	114250-14200	. TAPPET, ENGINE POPPET VALVE	2
50	PAHZZ	2815-01-465-9616	S4163	714880-14580	. CAMSHAFT, ENGINE	1
51	PAHZZ	2815-01-323-0353	0AK42	114771-14260	. TAPPET, ENGINE POPPET VALVE	1
52	XDHZZ		0AK42	714876-21730	. CRANKSHAFT, ENGINE	1
53	PAHZZ	5310-01-466-4888	0AK42	160842-21260	. WASHER, FLAT	1
54	PAHZZ	5306-01-471-6051	0AK42	160842-21250	. BOLT, MACHINE	1
55	PAHZZ	5330-01-324-8254	0AK42	160110-02220	. SEAL, PLAIN, ENCASED	1
56	PAHZZ	5306-01-431-7461	0AK42	26106-080352	. BOLT, MACHINE	15
57	PAHZZ	5315-98-205-1859	S4163	114270-01600	. PIN, STRAIGHT, HEADLESS	2
58	PAHZZ	5342-01-415-3792	0AK42	114699-01760	. CAP, FILLER OPENING	2
59	PAHZZ	5331-01-323-2728	0AK42	24311-000180	. . O-RING	2
60	PAHZZ	5310-01-477-0596	S4163	105225-01240	. WASHER, FLAT	4
61	PAHZZ	5310-01-477-0592	S4163	114350-01250	. NUT, PLAIN, HEXAGON	2
62	PAHZZ	5310-01-477-0582	0AK42	114350-01220	. NUT, PLAIN, HEXAGON	2
63	PAHZZ	5307-01-477-4029	S4163	114350-01200	. STUD, PLAIN	2
64	PAHZZ	5307-01-477-4022	S4163	114350-01210	. STUD, PLAIN	2
65	PAHZZ	5330-01-530-6327	0AK42	114871-01330	. GASKET	1
66	PAHZZ	5340-98-205-1855	S4163	114350-01700	. COVER, ACCESS	1
67	PAHZZ	5331-01-466-0712	0AK42	114350-01380	. O-RING	1
68	PAHZZ	5315-01-526-8491	0AK42	22312-040080	. PIN, STRAIGHT HEADLE	2
69	PAHZZ	2815-01-524-7056	0AK42	714871-01560	. ENGINE BLOCK, DIESEL	1
70	PAHZZ	5330-01-326-2669	0AK42	22190-160002	. GASKET	2
71	PAHZZ	4730-01-322-4956	0AK42	105425-01690	. PLUG, PIPE	2
72	PAHZZ	5330-01-324-8254	0AK42	160110-02220	. SEAL, PLAIN ENCASED	1
73	PAHZZ	5307-14-469-7400	S4163	26226-060182	. STUD, PLAIN	1
74	PAHZZ	5307-14-469-7440	S4163	26226-060222	. STUD, PLAIN	2
75	PAHZZ	5365-01-415-6744	0AK42	114250-01800	. SHIM SET	1
76	PAHZZ	5306-98-205-1856	S4163	26106-100122	. BOLT, ASSEMBLED WASHER	2
77	PAHZZ	5310-01-388-8826	0AK42	26366-060002	. NUT, PLAIN, HEXAGON	3
78	PAHZZ	3110-01-324-8817	0AK42	24162-152112	. BEARING, ROLLER, NEEDLE	1
79	PAHZZ	5330-01-328-4171	0AK42	114250-01841	. GASKET	1
80	PAHZZ	5340-01-415-3789	0AK42	114250-01830	. COVER, ACCESS	1
81	PAHZZ	3110-01-465-3598	0AK42	114350-02113	. BALL BEARING	1

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
82	PAHZZ	4820-01-526-7409	0AK42	114299-02030	. RETAINER, DISK, VALVE	1
83	PAHZZ	5305-14-469-7436	S4163	26106-080122	. SCREW	1
84	PAHZZ	5330-01-466-0713	0AK42	114350-01412	. GASKET	1
85	PAHZZ	5310-01-477-3930	S4163	114250-35150	. PIPE, L.O. INLET	1
86	XDHZZ		0AK42	114368-01453	. CRANKCASE COVER	1
87	PAHZZ	3110-01-465-3473	0AK42	114350-02100	. . BEARING, BALL ANNULAR	1
87	PAHZZ	3120-01-545-7839	0AK42	114350-02200	. . MAIN BEARING .25	1
87	XDHZZ		0AK42	114350-02210	. . MAIN BEARING .50	1
88	PAOZZ	5365-01-526-7332	0AK42	23876-010000	. PLUG, MACHINE THREAD	1
89	PAOZZ	4810-01-526-5186	0AK42	114771-11950	. COVER PLATE, VALVE	1
90	PAOZZ	3040-01-323-3294	0AK42	114250-03591	. . LEVER, REMOTE CONTROL	1
91	PAOZZ	5360-01-322-8623	0AK42	114250-03640	. . SPRING, HELICAL, COMPRESSION	1
92	PAOZZ	5315-01-431-8229	15852	2BE10YDN TABLE 7-3 REF 37	. . PIN, STRAIGHT, HEADLESS	1
93	PAOZZ	5306-01-323-5440	0AK42	26106-060552	. BOLT, MACHINE	3
94	PAOZZ	5330-01-526-5339	0AK42	114771-11310	. GASKET	1
95	PAFZZ	4820-01-477-0283	0AK42	105010-11490	. CAP, VALVE	2
96	PAFZZ	2815-01-465-6745	S4163	27310-060001	. COTTER ASSEMBLY	2
97	PAFZZ	5340-01-470-3631	0AK42	101158-11180	. RETAINER, HELICAL COMPRESSION SPRING	2
98	PAFZZ	5360-01-477-0602	0AK42	114350-11120	. SPRING, HELICAL COMPRESSION	2
99	PAFZZ	4820-01-477-0277	0AK42	114350-11340	. SEAL, VALVE	2
100	PAFZZ	5310-01-431-4064	0AK42	114250-11600	. WASHER, FLAT	2
101	PAFZZ	5310-01-388-8826	0AK42	26366-060002	. NUT, PLAIN, HEXAGON	2
102	PAFZZ	2815-01-324-6801	0AK42	114250-11901	. RETAINER, DIESEL ENGINE	1
103	XDFZZ		0AK42	26226-060602	. STUD, PLAIN	2
104	PAFZZ	5365-01-486-3251	0AK42	114771-11470	. SPACER, SLEEVE	1
105	PAFZZ	5330-01-486-4449	0AK42	114771-11461	. GASKET	1
106	PAFZZ	2815-01-530-1259	0AK42	114871-11100	. VALVE, POPPET, ENGINE	1
107	PAFZZ	2815-01-530-1293	0AK42	114871-11110	. VALVE, POPPET, ENGINE	1
108	PAFZZ	2815-01-530-1252	0AK42	114871-11020	. CYLINDER HEAD, DIESEL ENGINE	1
109	PAFZZ	5315-01-431-8230	15852	2BE10YDN TABLE 7-3 REF 26	. PIN, SPRING	1
110	PAFZZ	2815-01-526-5197	0AK42	114771-11250	. ROCKER ARM ASSEMBLY	1
111	XDFZZ		0AK42	22242-000120	. . RING, RETAINING	2
112	PAFZZ	2815-01-416-3333	0AK42	114250-11240	. . SCREW, VALVE, ADJUSTING TAPPET	1
113	PAFZZ	2815-01-544-8757	0NH46	114771-11660	. . ROCKER ARM, ENGINE POPPET VALVE	1
114	XDFZZ	5310-01-544-8734	0NH46	26856-060002	. . NUT, SELF-LOCKING, EXTENDED WASHER HEXAGON	1
115	PAFZZ	5305-14-469-8502	S4163	26106-060452	. . SCREW	2
116	PAFZZ	2815-01-544-8732	0NH46	114771-11260	. . BRACKET, ROCKER ARM ENGINE POPPET VALVE	1
117	PAFZZ	2815-01-544-8733	0NH46	114771-11650	. . ROCKER ARM, ENGINE POPPET VALVE	1

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
118	PAFZZ	2815-01-416-3333	0AK42	114250-11240	. . SCREW, VALVE, ADJUSTING TAPPET	1
119	XDOZZ		0AK42	114871-59802	. TUBE ASSEMBLY, METAL	1
120	PAOZZ	2910-01-530-0758	0AK42	714871-53100	. INJECTOR ASSEMBLY, FUEL	1
121	PAFHH	2910-01-530-0749	0AK42	714650-51100	. PUMP, FUEL, CAM ACTUATED	1
122	PAHZZ	4820-14-469-8518	0AK42	114250-51340	. HOLDER, VALVE	1
123	PAHZZ	5360-01-322-8629	0AK42	105546-51330	. SPRING	1
124	PAHZZ	5330-01-328-4169	0GUY0	124550-51350	. GASKET	2
125	PAHZZ	2910-01-416-3350	0AK42	114650-51300	. VALVE ASSEMBLY	1
126	XDHZZ		0AK42	114650-51100	. BODY, PUMP	1
127	PAHZZ	5330-01-323-1551	0AK42	105546-51020	. GASKET	1
128	PAHZZ	5315-01-416-3131	0AK42	22351-020006	. PIN, STRAIGHT, HEADLE	2
129	XBHZZ	5340-01-526-6927	0AK42	114250-51080	. PLATE, METAL	1
130	PAHZZ	5340-14-469-8519	0AK42	114250-51600	. LEVER ASSEMBLY	1
131	PAHZZ	5340-01-415-3807	0AK42	114250-51640	. SEAT, SPRING	1
132	PAHZZ	5315-01-416-3128	0AK42	22351-030008	. PIN, STRAIGHT, HEADLE	1
133	PAHZZ	5360-01-322-8628	0AK42	114250-51160	. SPRING	1
134	PAHZZ	5340-01-415-3810	0AK42	114250-51650	. SEAT, SPRING	1
135	PAOZZ	5306-01-388-7402	0AK42	26476-060142	. BOLT, MACHINE	3
136	PAOZZ	5340-01-433-5457	0AK42	114250-32070	. COVER, ACCESS	1
137	PAOZZ	5331-01-324-8279	0AK42	103338-32570	. O-RING	1
138	PAFZZ	4320-01-323-0298	0AK42	114250-32010	. PUMP, ROTARY	1
139	PAFZZ	2910-01-545-0015	0AK42	714770-61100	. GOVERNOR ASSEMBLY, CONSTANT SPEED DRIVE	1
140	PAFZZ	2990-01-465-5995	S4163	714350-61500	. LEVER ASSY, POWER-SPEED CONTROL	1
141	PAFZZ	5315-01-546-4565	0NH46	22322-030200	. . PIN, TAPERED, PLAIN	1
142	PAFZZ	5310-01-431-4066	0AK42	26696-100002	. NUT, PLAIN, HEXAGON	1
143	XDFZZ		0AK42	114871-66550	. SPRING, SPIRAL, TORSION	1
144	PAFZZ	4320-01-457-0232	15852	22451-060000	. 0.6 WIRE	2
145	PAFZZ	5340-01-433-5458	0AK42	135210-61090	. WIRE, LOCKING, ANTIPILFERAGE SEAL	2
146	XDFZZ		0AK42	183250-66500	. STAY, HANDLE	1
147	PAOZZ	3040-01-466-0786	0AK42	183250-66070	. . SHAFT, HANDLE	1
148	PAOZZ	5310-01-466-5116	0AK42	104200-66830	. . PLATE, FRICTION	2
149	PAOZZ	3040-01-466-0793	0AK42	183250-66050	. . HANDLE, REGULATOR	1
150	PAFZZ	5310-01-457-0222	0AK42	26757-060002	. . NUT 6	1
151	PAFZZ	5306-01-431-7459	0AK42	114250-66440	. . BOLT, MACHINE	1
152	PAFZZ	2990-14-469-8499	0AK42	183250-66100	. . BRACKET, REGULATOR	1
153	PAFZZ	5360-01-418-7397	0AK42	104200-66820	. . SPRING	1
154	PAFZZ	5310-01-465-6458	0AK42	104200-66850	. . WASHER (B)	1
155	PAFZZ	5310-01-431-4066	0AK42	26696-100002	. . NUT, PLAIN, HEXAGON	1
156	PAFZZ	5305-14-469-8502	0AK42	26106-060452	. BOLT M 6X 45 PLATED	1
157	PAFZZ	5306-01-388-7402	0AK42	26476-060142	. BOLT, MACHINE	1
158	PAFZZ	5360-01-322-8631	0AK42	114250-66200	. SPRING, HELICAL, EXTENDED	1
159	PAFZZ	5360-01-477-0601	0AK42	114870-66010	. SPRING, REGULATOR	1



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
160	PAFZZ	3010-01-389-9003	0AK42	114770-61610	. WASHER, THRUST	1
161	PAFZZ	5330-01-415-3802	0AK42	114770-61600	. SEAL, OIL	1
162	PAFZZ	3110-01-545-0018	0NH46	114770-61520	. BEARING, NEEDLE	2
163	XDFZZ		0AK42	114770-61190	. WASHER	1
164	PAOZZ	2815-01-353-7523	0AK42	114250-35110	. STRAINER, OIL PUMP	1
165	PAOZZ	5331-01-326-8017	0AK42	24341-000224	. . O-RING	1
166	PAOZZ	5305-01-388-6229	0AK42	26106-060162	. SCREW, CAP, HEXAGON HEAD	1
167	PAFZZ	5315-01-431-8229	15852	2BE10YDN TABLE 7-3 REF 37	. PIN, STRAIGHT, HEADLESS	1
168	PAOZZ	5306-01-431-7460	0AK42	26106-100302	. BOLT, MACHINE	2
169	XDOZZ		0AK42	26716-080002	. NUT, PLAIN, HEXAGON	1
170	PAOZZ	2920-01-452-8409	0AK42	114362-77990	. STARTER, ENGINE ELECTRIC	1
171	PAHZZ	5330-01-530-6424	0AK42	714871-92600	. GASKET SET	1
172	PAHZZ	5330-01-466-0713	0AK42	114350-01412	. . GASKET	1
173	PAHZZ	5330-01-530-6327	0AK42	114871-01330	. . GASKET	1
174	PAHZZ	5331-01-466-0712	0AK42	114350-01380	. . GASKET	1
175	PAFZZ	4820-01-477-0277	0AK42	114350-11340	. . SEAL, VALVE	2
176	PAOZZ	5330-01-466-0701	0AK42	114350-12202	. . GASKET	1
177	XDOZZ	5330-01-526-5104	0AK42	114250-12211	. . GASKET	1
178	PAOZZ	5331-01-324-8279	0AK42	103338-32570	. . O-RING	1
179	PAHZZ	5330-01-328-4171	0AK42	114250-01841	. . GASKET	1
180	PAHZZ	5331-01-323-2728	0AK42	24311-000180	. . O-RING	2
181	PAHZZ	5330-01-326-2669	0AK42	22190-160002	. . GASKET	2
182	PAHZZ	5330-01-486-4449	0AK42	114771-11461	. . GASKET	1
183	PAOZZ	5330-01-326-4780	0AK42	114250-13201	. . GASKET	1
184	PAOZZ	5330-01-526-5339	0AK42	114771-11310	. . GASKET	1
185	PAOZZ	4810-01-568-7755	0AK42	40101-01-SV	. FUEL SHUT-OFF SOLENOID KIT	1

END OF FIGURE



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, BURNER

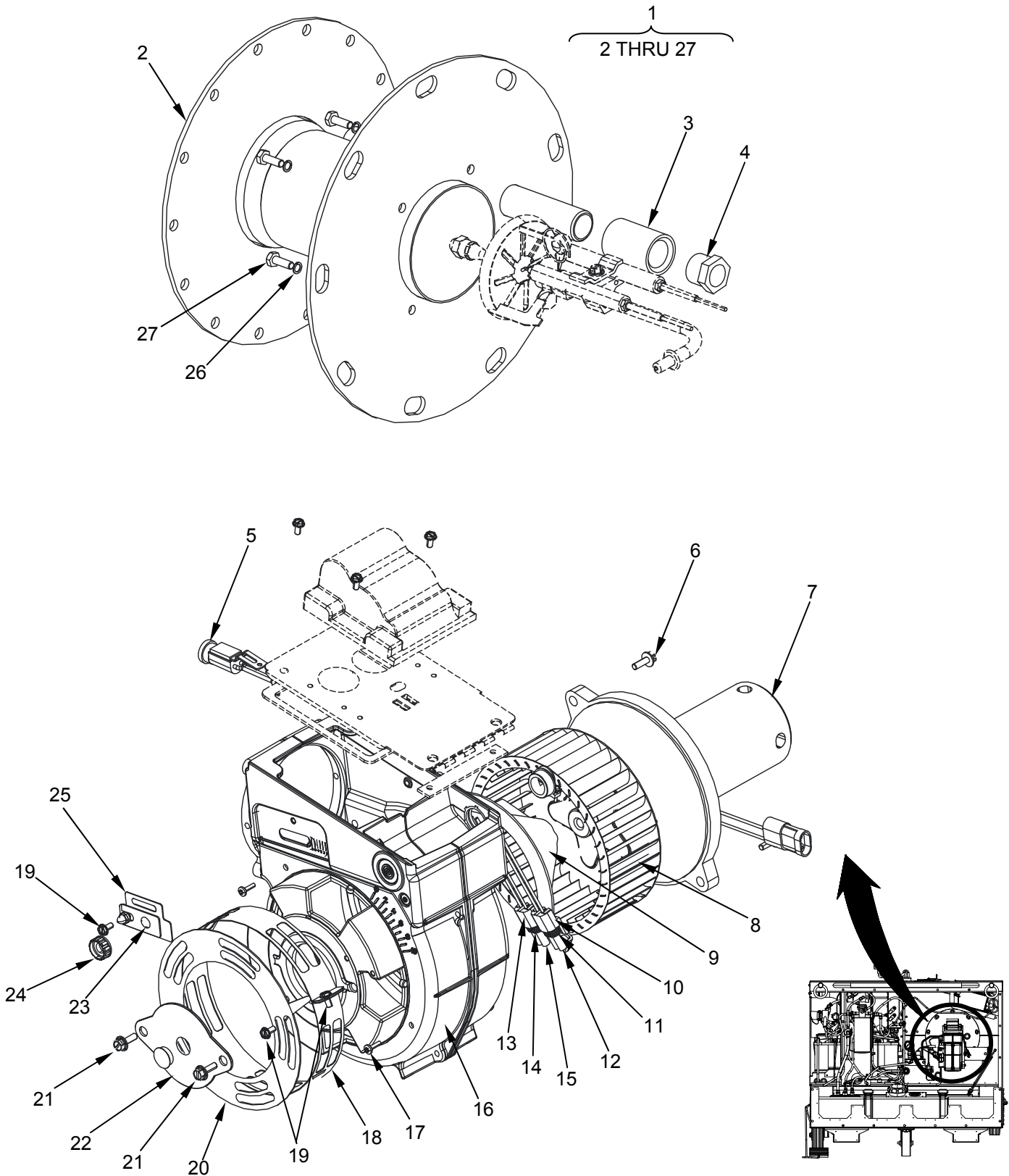


Figure 9. Assembly, Burner (Sheet 1 of 2).

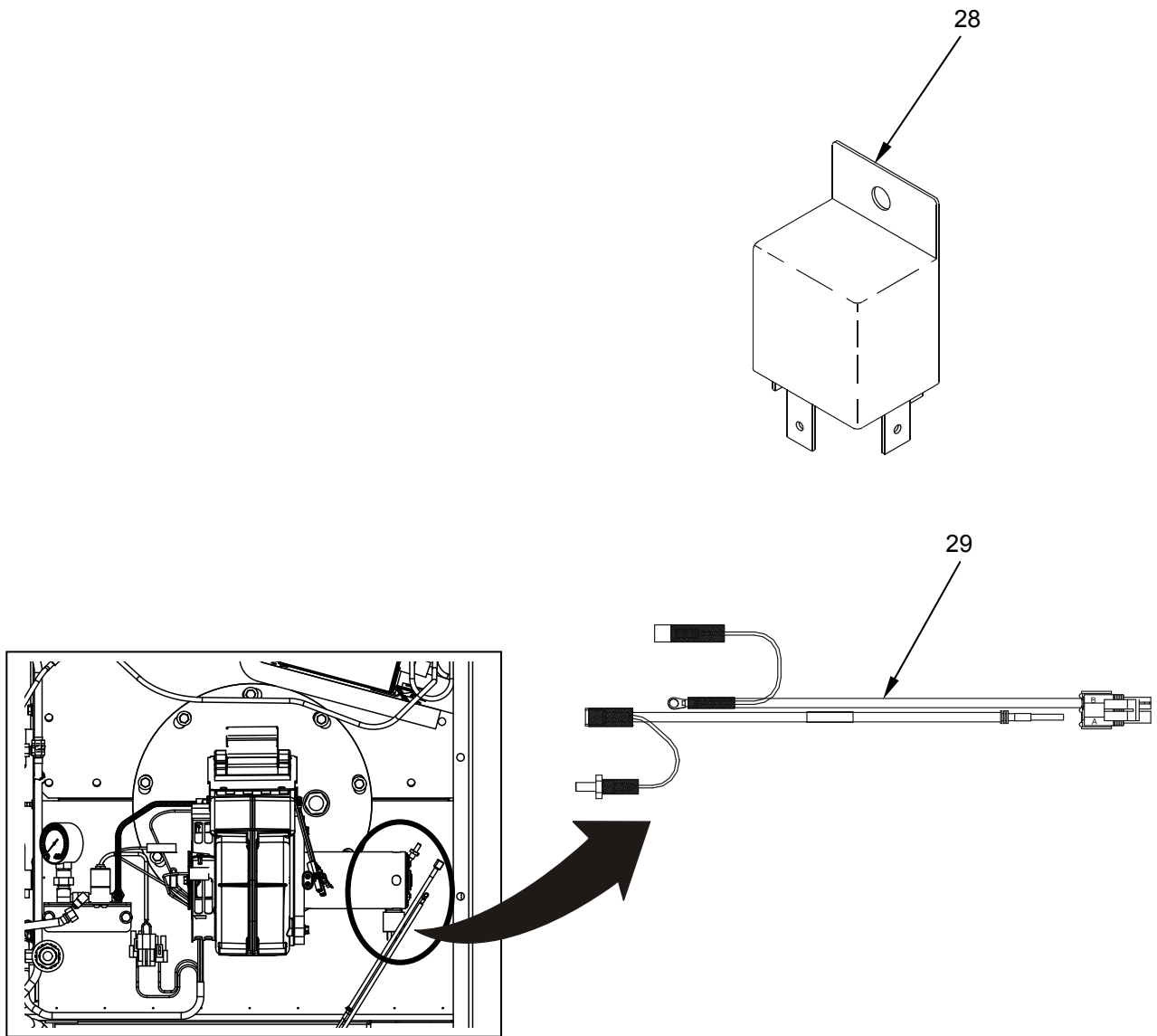


Figure 9. Assembly, Burner (Sheet 2 of 2).

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 04</b>						
<b>FIG. 9 ASSEMBLY, BURNER</b>						
1	PAFHH		92878	41036	ASSEMBLY, BURNER	1
2	XDOZZ		92878	41062	. ASSEMBLY, BURNER TUBE	1
3	XDOZZ		0E328	4452K345	. COUPLING, PIPE, S.S., 3/4 INCH NPT	1
4	XDOZZ		0E328	3277K16	. SIGHT GLASS, STEEL PLATED, 3/4 IN NPT	1
5	PAOZZ	5961-01-568-5195	92878	41078	. CAD CELL, FLAME SENSOR	1
6	XDOZZ		92878	41073	. SCREW	4
7	PAOZZ	6105-01-568-7564	92878	41065-SV	. BLOWER MOTOR ASSEMBLY	1
8	PAOZZ	4140-01-568-6677	92878	41066	. WHEEL, BLOWER	1
9	PAOZZ	3040-01-569-6044	92878	41060-02-SV	. AIR GUIDE	1
10	PAOZZ	5935-01-214-5259	77060	12015792	. CONNECTOR BODY, PLUG, ELECTRICAL	1
11	PAOZZ	5975-01-226-8078	77060	12010293	. . BOOT, DUST AND MOISTURE SEAL	2
12	PAOZZ	5999-01-323-4929	77060	12089188	. . CONTACT, ELECTRICAL	2
13	PAOZZ	5935-01-503-0815	77060	12103784	. CONNECTOR, PLUG, ELECTRICAL	1
14	PAOZZ	5975-01-226-8078	77060	12010293	. . BOOT, DUST AND MOISTURE SEAL	2
15	PAOZZ	5999-01-323-4929	77060	12089188	. . CONTACT, ELECTRICAL	2
16	XDOZZ		92878	41060	. HOUSING ASSEMBLY	1
17	XDOZZ		92878	41060-03	. SCREW	2
18	XDOZZ		92878	41076	. AIR BAND	1
19	XDOZZ		92878	41075	. SCREW	7
20	XDOZZ		92878	41077	. SHUTTER PLATE	1
21	XDOZZ		92878	41073	. SCREW	4
22	XDOZZ		92878	41071	. COVER, PUMP HOLE	1
23	XDOZZ		92878	41068	. PLATE, SECOND ADJUSTMENT	1
24	PAOZZ	5310-01-568-5156	92878	41070-SV	. NUT, SPLINE	1
25	XDOZZ		92878	41067	. ASSEMBLY, ADJ SCALE	1
26	PAOZZ	5310-00-582-5965	80205	MS35338-44	. WASHER, LOCK	4
27	PAOZZ	5305-00-068-0502	80205	MS90725-6	. SCREW, CAP, HEX HD	4
28	PAOZZ	5945-01-170-6666	53867	0 332 209 203	RELAY,ELECTROMAGNETIC,BURNER (K2)	1
29	PAOZZ	6150-01-570-9598	92878	41081-SV	ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL, BRANCHED	1

**END OF FIGURE**



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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

TRANSFORMER, IGNITION

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1  
2 THRU 4

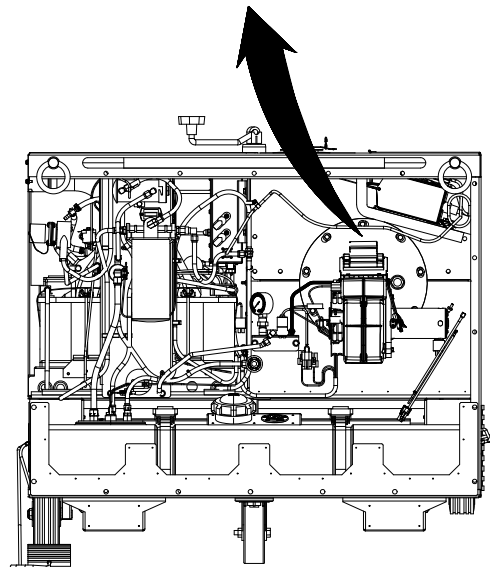
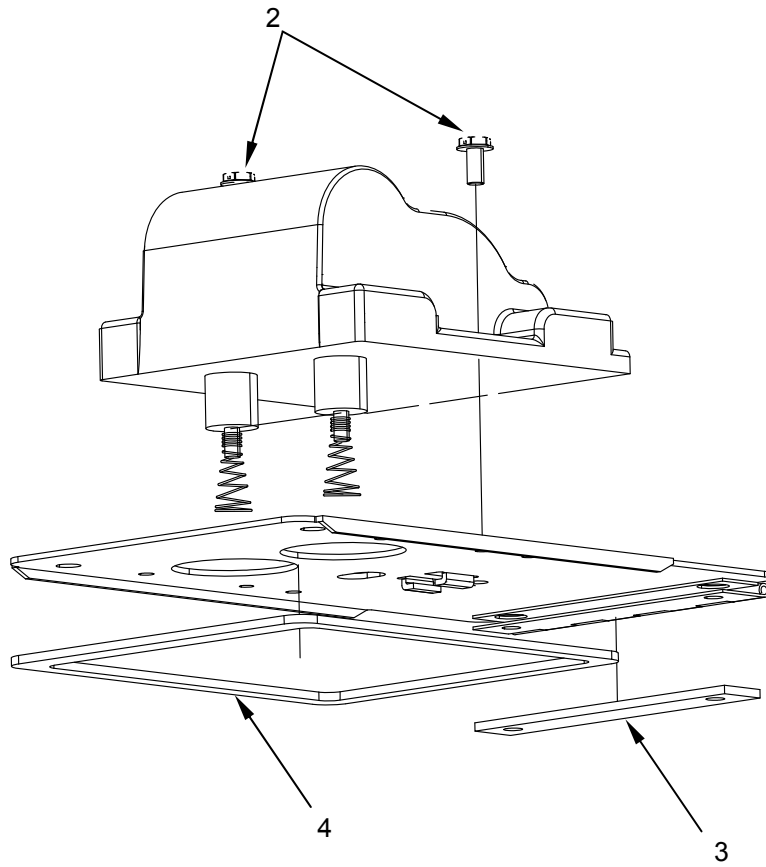


Figure 10. Transformer, Ignition.



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 04</b>						
<b>FIG. 10 TRANSFORMER, IGNITION</b>						
1	PAOOO	5950-01-569-0504	92878	41063-SV	TRANSFORMER, IGNITION	1
2	XDOZZ		92878	41075	. SCREW	2
3	XDOZZ		92878	41063-02	. GASKET	1
4	XDOZZ		92878	41063-04	. GASKET, HINGE	1

**END OF FIGURE**



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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, NOZZLE LINE

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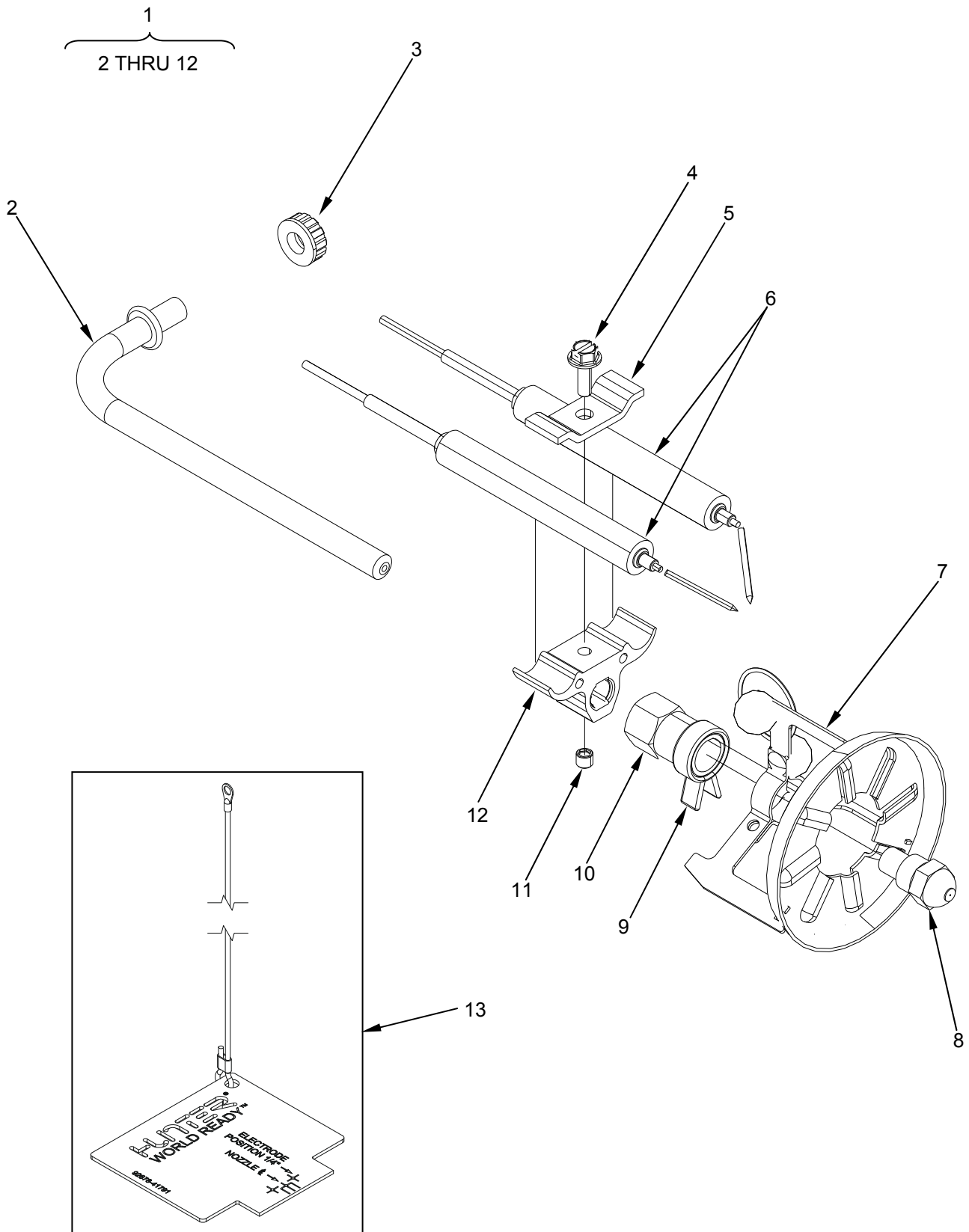


Figure 11. Assembly, Nozzle Line.

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 04</b>						
<b>FIG. 11 ASSEMBLY, NOZZLE LINE</b>						
1	PAOOO	4530-01-568-5694	92878	41061	ASSEMBLY, NOZZLE LINE	1
2	XDOZZ		92878	41061-02	. TUBE, FUEL LINE	1
3	PAOZZ	5310-01-568-5156	92878	41070-SV	. NUT, SPLINE	1
4	XDOZZ		92878	41061-07	. SCREW	1
5	XDOZZ		92878	41061-06	. CLAMP, ELECTRODE	1
6	PAOZZ	5977-01-569-2045	92878	41061-05-SV	. ELECTRODE	2
7	XDOZZ		92878	41061-01	. ASSEMBLY, HEAD (MODIFIED "KHH")	1
8	PAOZZ	4530-01-568-5698	92878	41072-SV	. NOZZLE, OIL BURNER	1
9	XDOZZ		92878	41061-09	. CLAMP, SPRING	1
10	XDOZZ		92878	41061-03	. ADAPTER, NOZZLE	1
11	XDOZZ		92878	41061-08	. SCREW, SET, ALLEN	1
12	XDOZZ		92878	41061-04	. SPACER, ELECTRODE	1
13	PAOZZ	5220-01-569-0418	92878	41790-SV	ASSEMBLY, ELECTRODE SETTING TOOL	1

**END OF FIGURE**



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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, HEAT EXCHANGER

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1  
2 THRU 4

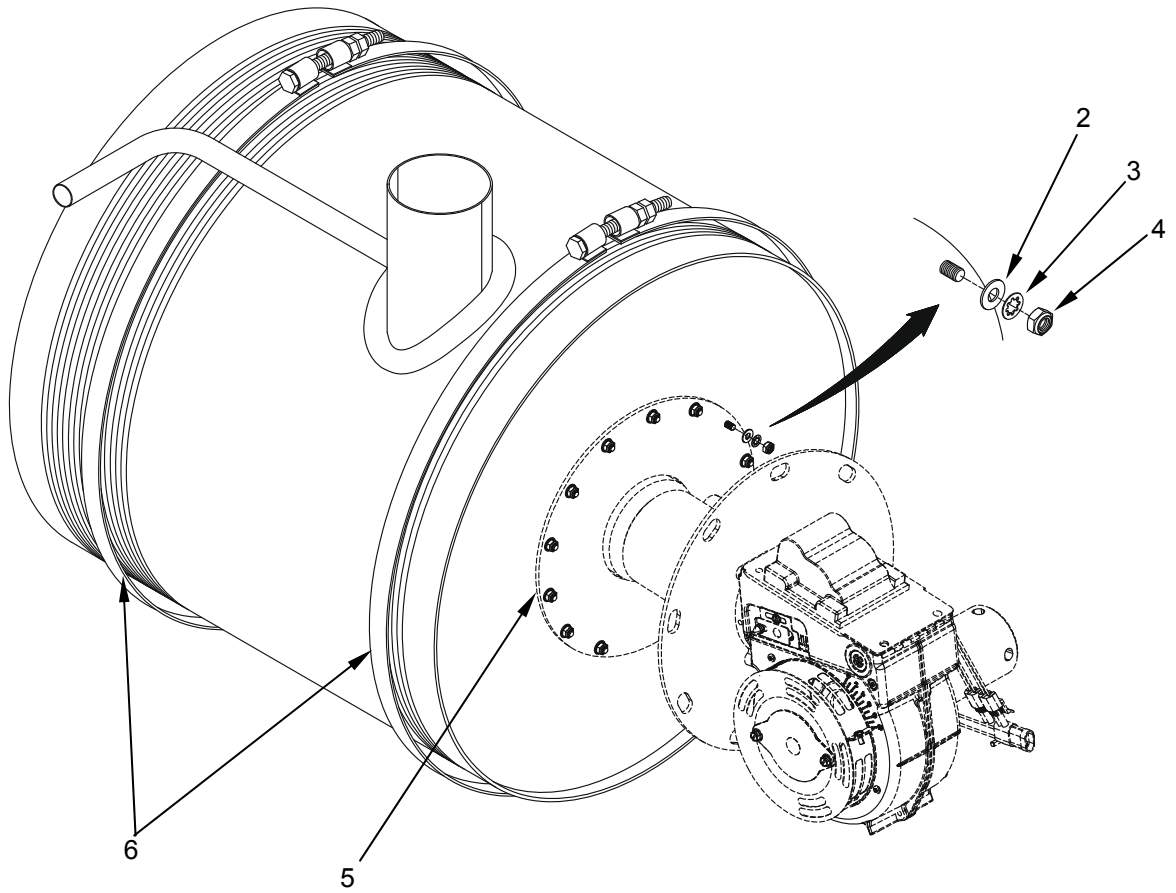


Figure 12. Assembly, Heat Exchanger.



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 04</b>						
<b>FIG. 12 ASSEMBLY, HEAT EXCHANGER</b>						
1	PAFHH		92878	41035	ASSEMBLY, HEAT EXCHANGER	1
2	PAOZZ	5310-00-809-4058	96906	MS27183-10	. WASHER, FLAT	14
3	PAOZZ	5310-00-543-2410	80205	MS35338-44	. WASHER, LOCK	14
4	PAOZZ	5310-00-997-1888	96906	MS35649-2252	. NUT, HEX PLAIN	14
5	PAOZZ	5330-01-568-5151	96906	41069	. GASKET, GUILLOTINE PLATE	1
6	XDOZZ		92878	40301	STRAP, HEAT EXCHANGER	2

**END OF FIGURE**



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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, TRANSITION TUBE

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1  
2 THRU 19

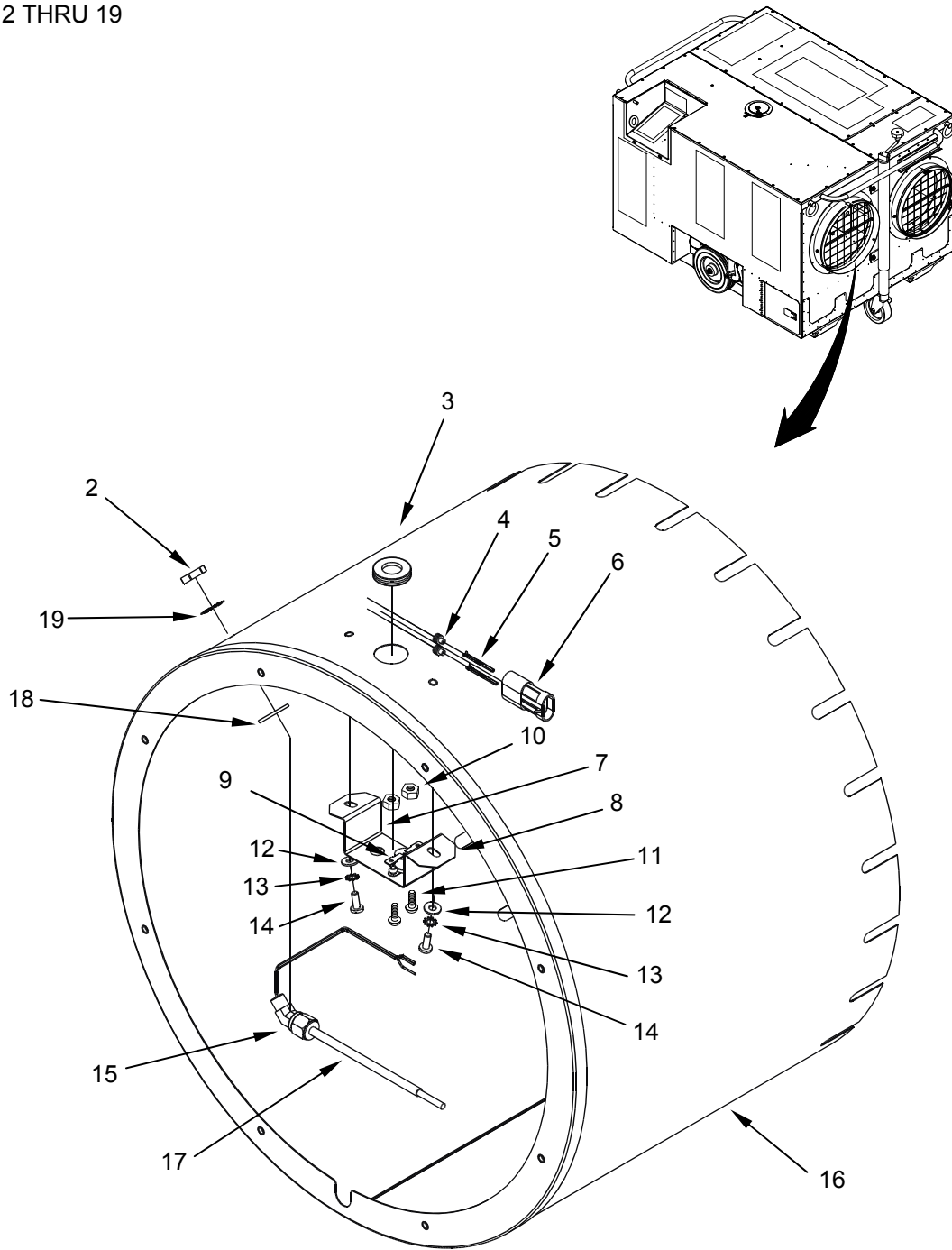


Figure 13. Assembly, Transition Tube.

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 04</b>						
<b>FIG. 13 ASSEMBLY, TRANSITION TUBE</b>						
1	XDOOO		92878	40303	ASSEMBLY, TRANSITION TUBE	1
2	PAOZZ	4730-00-350-9619	93061	210P-2	. LOCKNUT, PIPE	1
3	PAOZZ	4520-01-492-9125	92878	5914	. GROMMET	1
4	PAOZZ	2530-01-503-5000	77060	12089679	. BOOT, VEHICULAR COMPONENTS	2
5	PAOZZ	5940-01-234-7272	77060	12089040	. PIN TERMINAL	2
6	PAOZZ	5935-01-214-4163	22785	12010973	. CONNECTOR BODY, PLUG, ELECTRICAL	1
7	XDOZZ		92878	40331	. ASSY, OUTLET SENSOR BRACKET	1
8	XDOZZ		92878	40332	. . BRACKET, MOUNTING	1
9	PAOZZ	5310-01-539-7169	92878	40482	. . SWITCH, THERMOSTATIC	1
10	PAOZZ	5310-00-081-8087	80205	MS21044N06	. . NUT, SELF-LOCKING, HEXAGON	2
11	PAOZZ	5305-00-984-4984	80205	MS35206-227	. . SCREW, MACHINE	2
12	PAOZZ	5310-00-014-5850	96906	MS27183-42	. WASHER, FLAT	2
13	PAOZZ	5310-00-596-7691	96906	MS35335-32	. WASHER, LOCK	2
14	PAOZZ	5305-00-984-6210	96906	MS35206-263	. SCREW, MACHINE	2
15	PAOZZ	4730-01-534-4664	39428	50385K31	. ELBOW, PIPE	1
16	XDOZZ		92878	40333	. TUBE, TRANSITION	1
17	PAOZZ	6685-01-539-7173	92878	40481	. SENSOR, OUTLET TEMPERATURE	1
18	PAOZZ	5310-00-809-4061	96906	MS27183-15	. WASHER, FLAT	1
19	PAOZZ	5310-00-685-3228	96906	MS35333-43	. WASHER, LOCK	1

**END OF FIGURE**



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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

BATTERY AND BATTERY CABLE ASSEMBLIES

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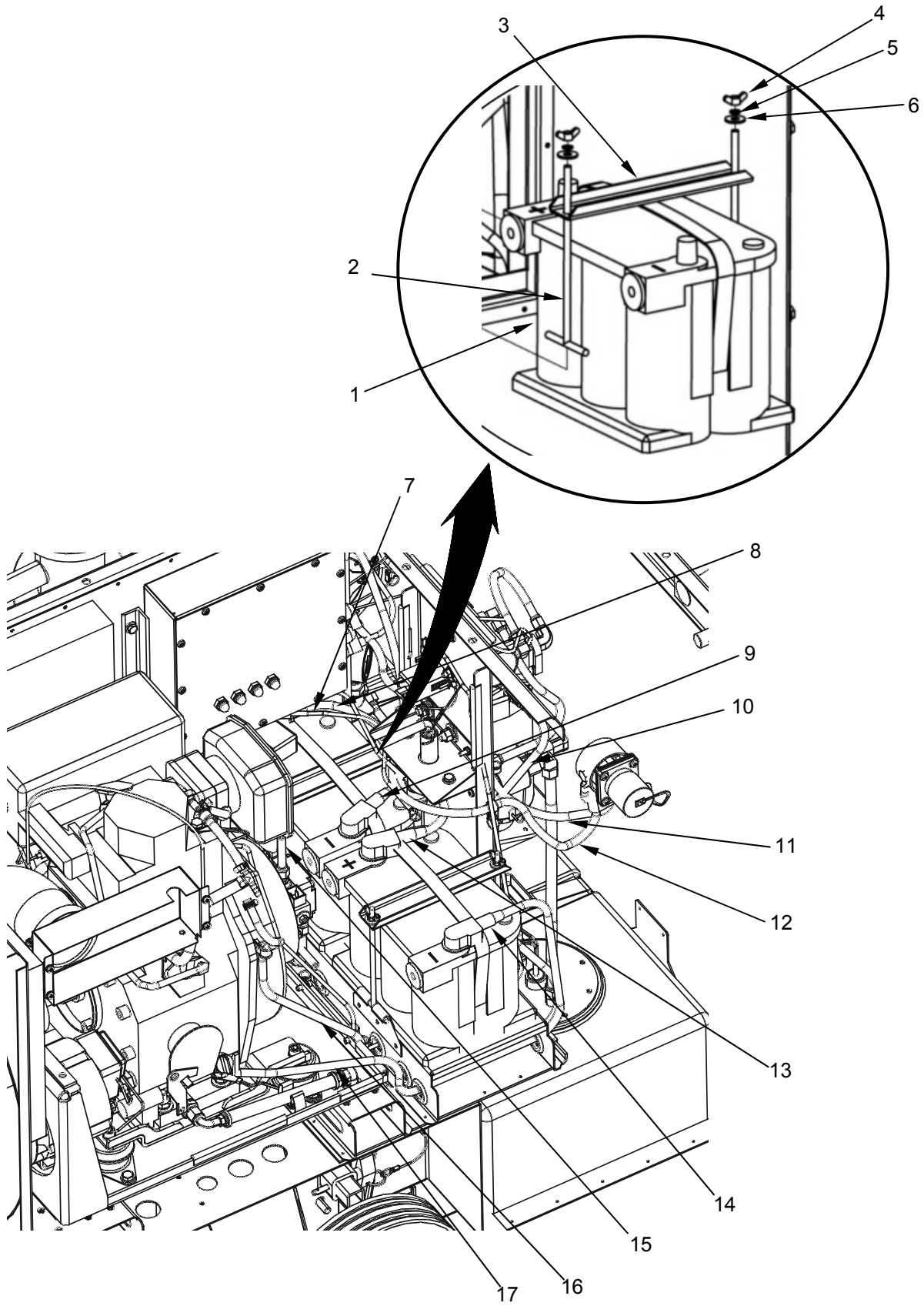


Figure 14. Battery and Battery Cable Assemblies.



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 05</b>						
<b>FIG. 14 BATTERY AND BATTERY CABLE ASSEMBLIES</b>						
1	PCOZZ	6140-01-475-9361	0UJ55	75/35	BATTERY, STORAGE	2
2	XDOZZ		92878	40610	RETAINER, BATTERY	2
3	XDOZZ		92878	40611	RETAINER, BATTERY	2
4	PAOZZ	5310-01-384-2546	96906	MS51553-420	NUT, SELF-LOCKING, WING	4
5	PAOZZ	5310-01-274-3255	96906	MS27183-52	WASHER, FLAT	4
6	PAOZZ	5310-00-582-5965	99539	CMB21389	WASHER, LOCK	4
7	XDOZZ		92878	40617	LEAD, STORAGE BATTERY (SWITCH TO MAIN CONTROL, RED)	1
8	XDOZZ		92878	41630-SV	LEAD, STORAGE BATTERY (BATTERY POSITIVE TO STARTER)	1
9	XDOZZ		92878	40616	LEAD, STORAGE BATTERY (BATTERY POSITIVE TO SWITCH, RED)	1
10	XDOZZ		92878	41623-SV	LEAD, STORAGE BATTERY (CHASSIS GROUND TO NATO CONNECTOR)	1
11	XDOZZ		92878	41622-SV	LEAD, STORAGE BATTERY (ENGINE GROUND TO CHASSIS GROUND)	1
12	XDOZZ		92878	41632-SV	LEAD, STORAGE BATTERY (STARTER TO ON/OFF SWITCH)	1
13	XDOZZ		92878	41613-SV	LEAD, STORAGE BATTERY (BATTERY POSITIVE TO BATTERY NEGATIVE)	1
14	XDOZZ		92878	41621-SV	LEAD, STORAGE BATTERY (BATTERY NEGATIVE POST TO ENGINE GROUND)	1
15	XDOZZ		92878	41619-SV	ASSEMBLY, WIRE (K1 RELAY TO ENGINE PRE-HEATER)	1
16	XDOZZ		92878	40634	LEAD, STORAGE BATTERY (STARTER TO ALTERNATOR, RED)	1
17	XDOZZ		92878	41614-SV	LEAD, STORAGE BATTERY (ON/OFF SWITCH TO NATO CONNECTOR)	1

**END OF FIGURE**

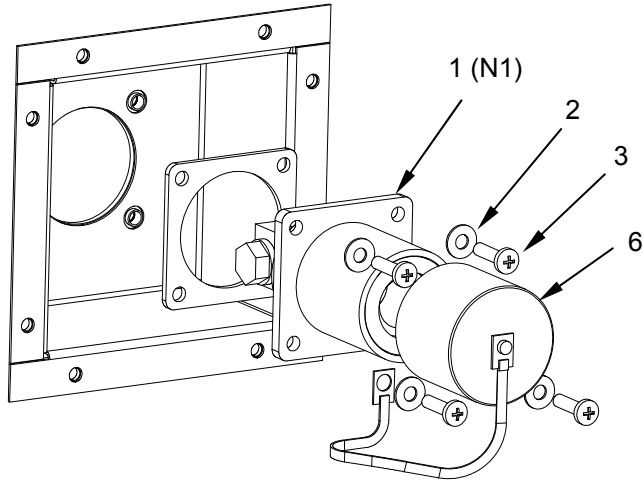


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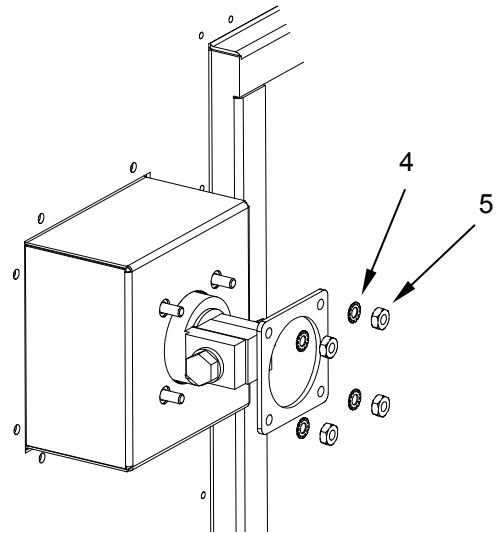
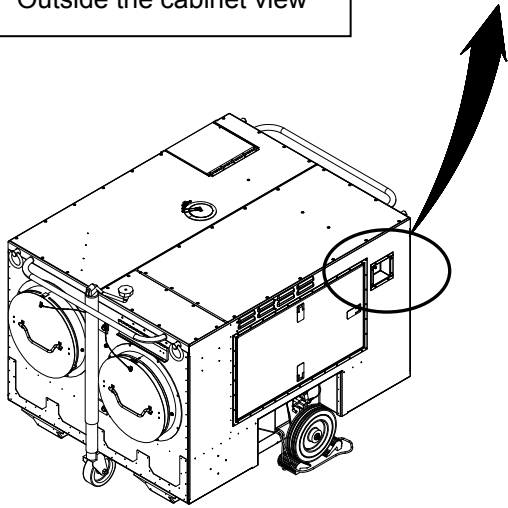
OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

CONNECTOR, NATO

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Outside the cabinet view



Inside the cabinet view

Figure 15. Connector, NATO.

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 05</b>						
<b>FIG. 15 CONNECTOR, NATO</b>						
1	PAOZZ	5935-01-097-9974	19207	11674728	CONNECTOR, NATO	1
2	PAOZZ	5310-00-727-8353	96906	MS27183-43	. WASHER, FLAT	4
3	PAOZZ	5305-00-984-6212	80205	MS35206-265	. SCREW, MACHINE	4
4	PAOZZ	5310-00-596-7691	96906	MS35335-32	. WASHER, LOCK	4
5	PAOZZ	5310-00-934-9758	80205	MS35649-202	. NUT, PLAIN, HEXAGON	4
6	PAOZZ	5340-01-059-0114	19207	11675004	.CAP, PROTECTIVE, DUST AND MOISTURE	1
<b>END OF FIGURE</b>						



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, MAIN CONTROL BOX

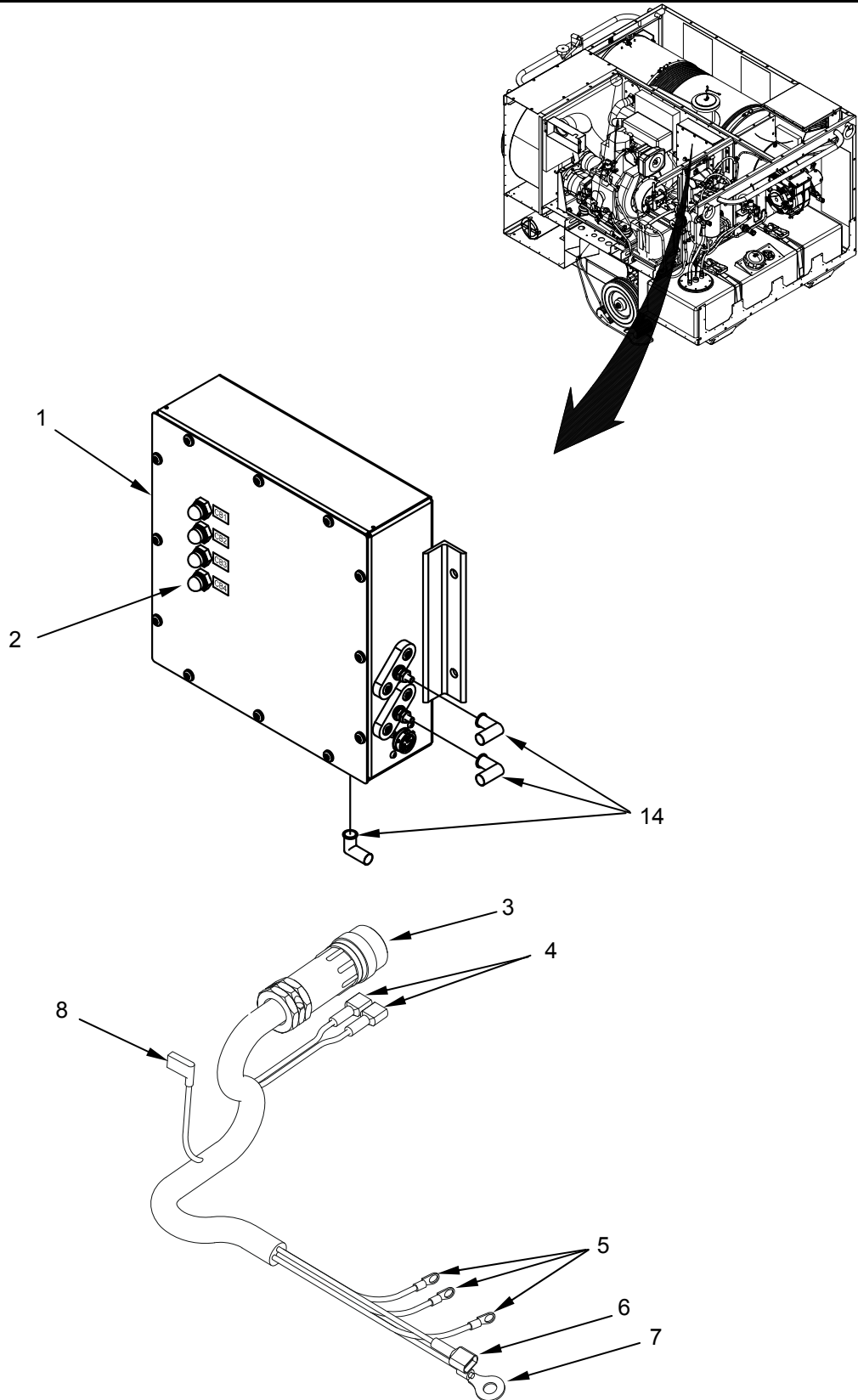


Figure 16. Assembly, Main Control Box (Sheet 1 of 2).

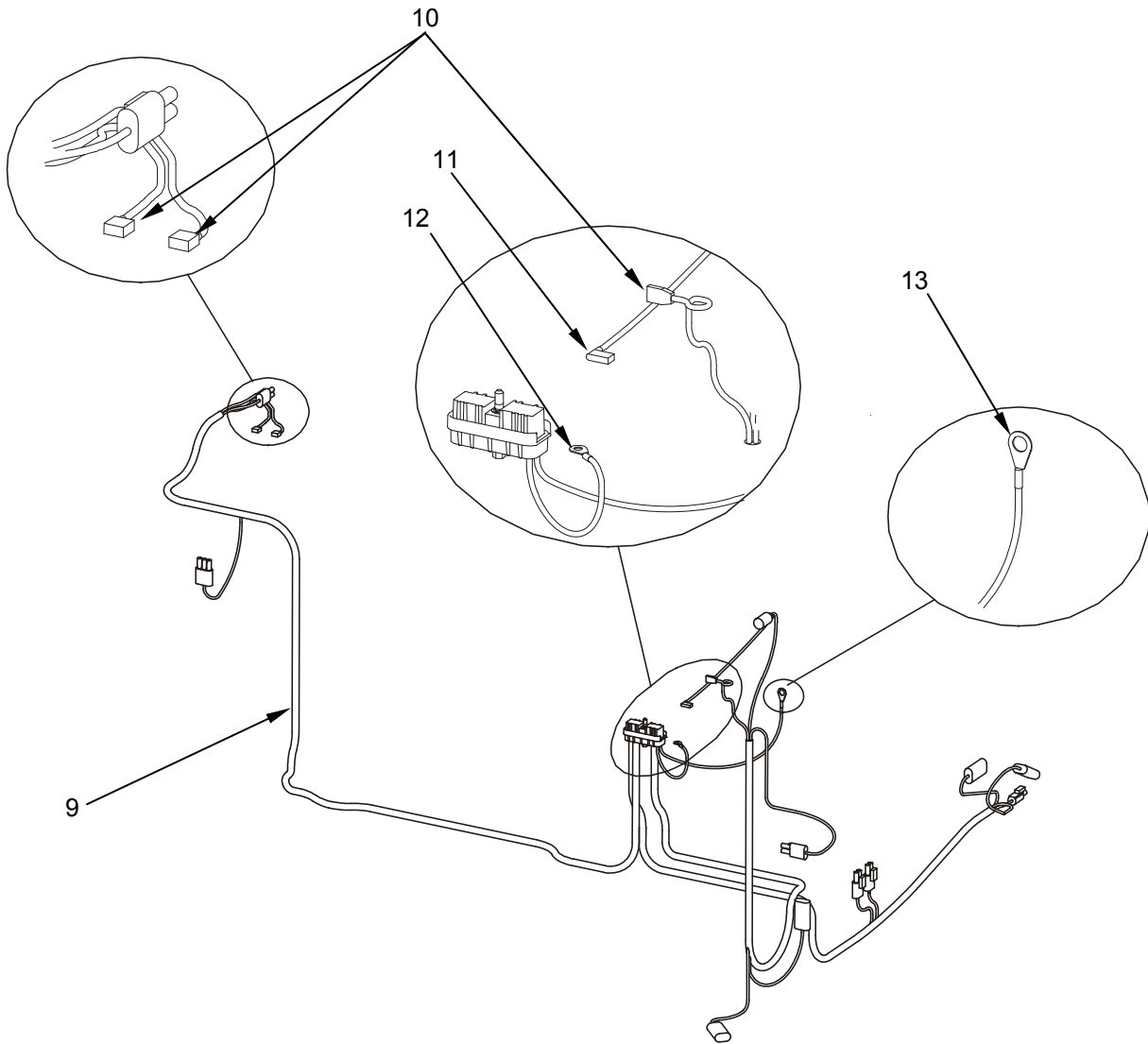


Figure 16. Assembly, Main Control Box (Sheet 2 of 2).



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 05</b>						
<b>FIG. 16 ASSEMBLY, MAIN CONTROL BOX</b>						
1	PAOKK	5998-01-569-8580	92878	41401-SV	ASSEMBLY, MAIN CONTROL BOX	1
2	PAOZZ	2530-01-461-7601	97539	NC3030 7/16-28	. BOOT, VEHICULAR COMPONENTS	4
3	XDOZZ		92878	41491	WIRING HARNESS	1
4	XDOZZ		1CF23	SO5075	. TERMINAL, QUICK DISCONNECT	2
5	PAOZZ	5940-00-534-0991	58961	31503	. TERMINAL, QUICK DISCONNECT	3
6	XDOZZ		1CF23	SO5076	. TERMINAL, QUICK DISCONNECT	1
7	XDOZZ		58961	31204	. TERMINAL, LUG	1
8	XDOZZ		1CF23	SO5363SFT	. TERMINAL, QUICK DISCONNECT	1
9	XDOZZ		92878	41494	MAIN WIRING HARNESS	1
10	PAOZZ	5940-01-184-7273	00779	2-520129-2	. TERMINAL, LUG	3
11	PAOZZ	5940-01-530-4760	58961	31535	. TERMINAL, QUICK DISCONNECT	1
12	PAOZZ	5940-00-143-4771	00779	32949	. TERMINAL, LUG	1
13	PAOZZ	5940-00-113-8184	81343	MS25036-150	. TERMINAL, LUG	1
14	PAOZZ	5930-01-486-3028	53214	2292	BOOT, DUST AND MOISTURE SEAL	3

**END OF FIGURE**



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

ASSEMBLY, OPERATOR CONTROL BOX

NOTE

If Operator Control Box placard (Item 7) requires replacement, entire Operator Control Box must be returned to contractor for refurbishment.

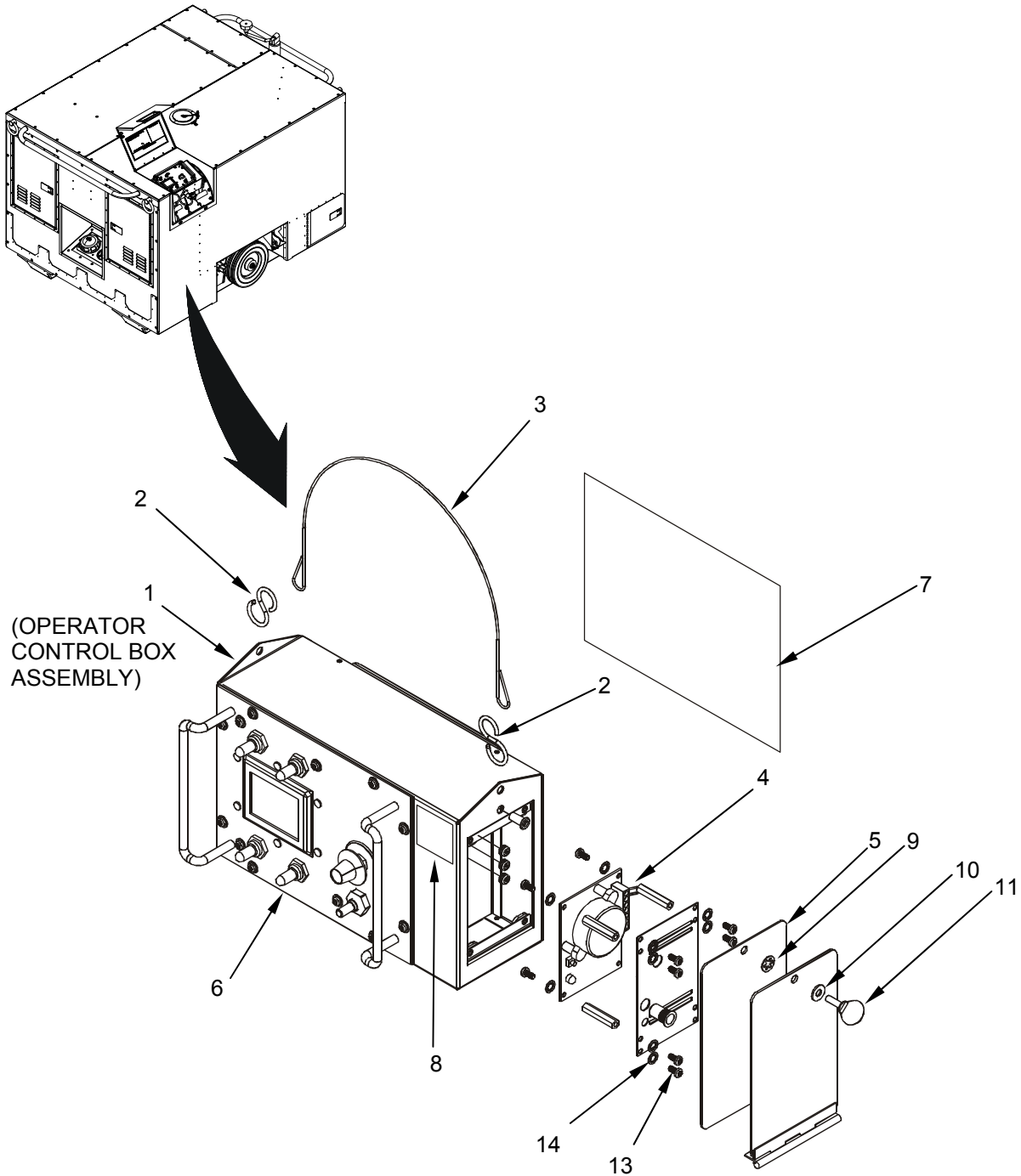


Figure 17. Assembly, Operator Control Box (Sheet 1 of 2).

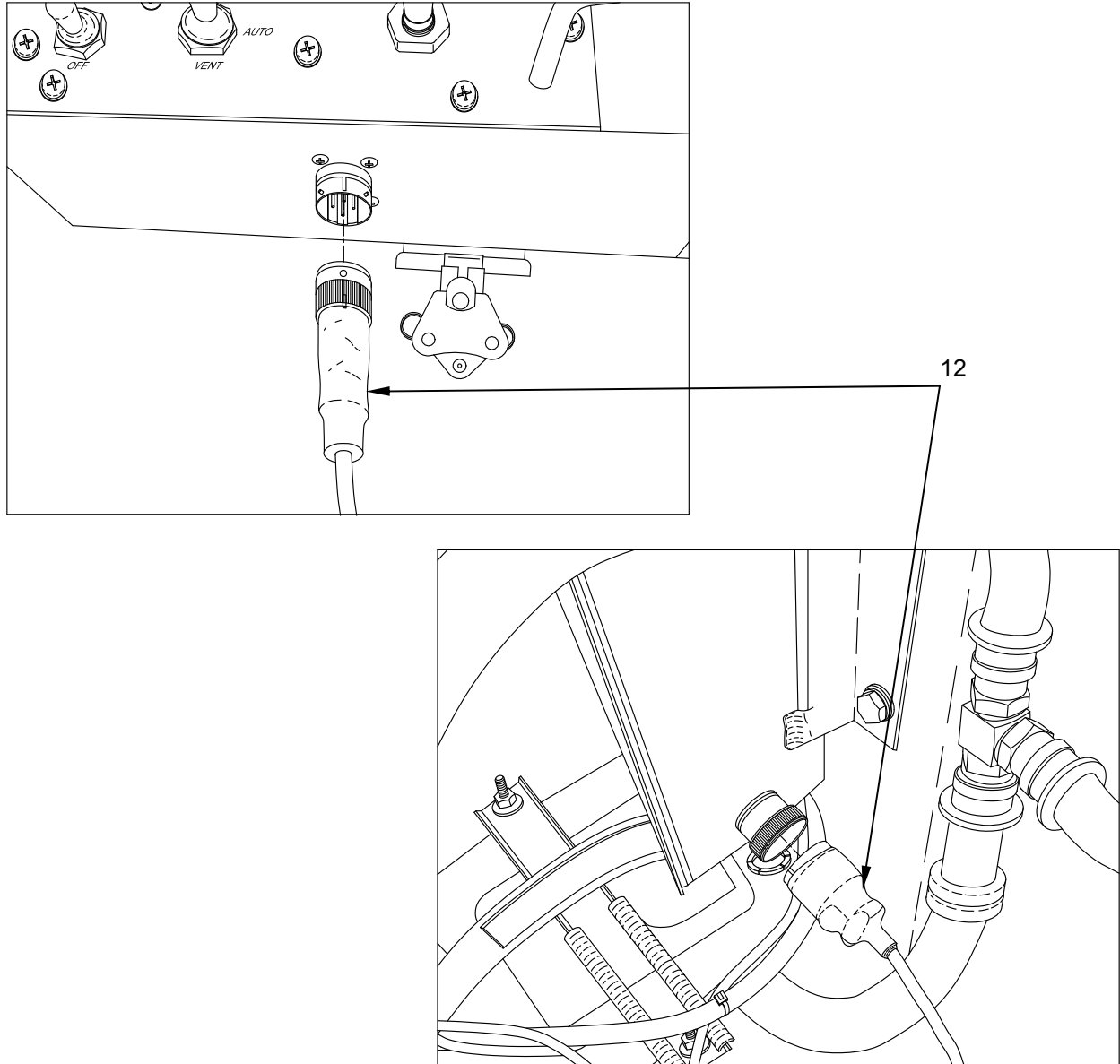


Figure 17. Assembly, Operator Control Box (Control Cable) (Sheet 2 of 2).

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 05</b>						
<b>FIG. 17 ASSEMBLY, OPERATOR CONTROL BOX</b>						
1	PAOOO	4520-01-539-7164	92878	40405	ASSEMBLY, OPERATOR CONTROL BOX	1
2	PAOZZ	4030-00-780-9350	96906	MS87006-13	. HOOK, CHAIN-S	2
3	XDOZZ		92878	40430	. WIRE ROPE ASSEMBLY, SINGLE LEG	1
4	PCOZZ	6665-01-539-7171	92878	40480	. INDICATOR, CARBON MONOXIDE	1
5	XDOZZ		92878	40458	. GASKET	1
6	PAOZZ	5930-01-486-4755	097M6	SSB1	. BOOT, DUST AND MOISTURE SEAL	1
7	XDKZZ		92878	40051-02	. PLACARD, OPERATING PROCEDURES AND FAULT CODES	1
8	XDOZZ		92878	40841	. LABEL, CARBON MONOXIDE DETECTOR	1
9	XDOZZ		89462	5115-18-015	. #10 RETAINING RING	1
10	PAOZZ	5310-00-014-5850	96906	MS27183-42	. WASHER, FLAT, #10 STUD, 1/2" OD	1
11	PAOZZ	5305-01-027-5239	96906	MS21316-24	. THUMBSCREW, FLAT POINT, 10-24UNC-2A X 5/8" LG	1
12	PAOZZ	6150-01-539-7170	92878	41490-SV	CABLE, POWER, ELECTRICAL	1
13	PAOZZ	5305-00-984-4984	80205	MS35206-227	.SCREW,MACHINE	12
14	PAOZZ	5310-00-579-0079	80205	MS35333-37	.WASHER,LOCK	12

**END OF FIGURE**



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OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

DUCT, AIR, INSULATED, 16 IN. X 15 FT.

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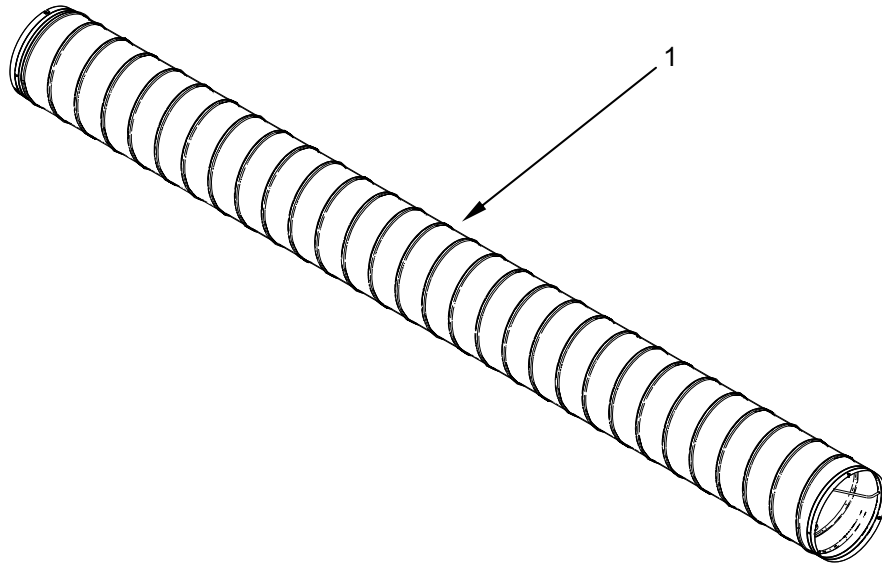


Figure 18. Duct, Air, Insulated, 16 IN. X 15 FT.



(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
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**GROUP 06**

**FIG. 18 DUCT, AIR, INSULATED, 16  
IN. X 15 FT.**

1	PAOZZ	4720-01-539-7168	92878	40700	AIR DUCT, INSULATED, 16 INCH DIA X 15 FEET LONG	2
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**END OF FIGURE**



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

BULK MATERIAL

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
<b>GROUP 99 GENERAL USE STANDARDIZED PARTS</b>						
<b>GROUP 99 BULK MATERIAL</b>						
<b>FIG. 99 BULK</b>						
1	PAOZZ	4720-00-913-5910	81349	MIL-DTL- 1344TY1SZ4	HOSE, NONMETALLIC (1/4 IN ID)	YD
2	PAOZZ	4720-00-273-9514	19207	839981	HOSE, NONMETALLIC (3/8 IN ID)	YD
3	PAOZZ	4720-01-499-3769	81343	J30R7-5	HOSE, NONMETALLIC (5/16 IN ID)	YD
4	XDOZZ		0E328	8451A53	MOLDING, PLASTIC	FT
5	PAOZZ	4010-00-575-6233	39428	8923T32	ROPE, WIRE	FT
6	XDOZZ		0YZF2	42-14-A	POLYACRYLIC SPONGE, ADHESIVE BACKED	RL

**END OF FIGURE**



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5310-00-004-5033	7	53	5305-00-470-3321	5	3
5310-00-014-5850	5	4	5940-00-534-0991	16	5
	6	13	4730-00-541-8100	4	5
	7	42	5310-00-543-2410	7	20
	13	12	4730-00-555-1152	3	5
	17	10		3	10
5310-00-045-3296	5	5		3	45
	6	12		7	28
5306-00-050-1238	7	36	5310-00-559-0070	4	7
5340-00-057-3043	7	5		BULK	5
5310-00-061-7325	6	6	5310-00-579-0079	17	14
5310-00-062-4954	7	45	5310-00-582-5965	1	23
5305-00-068-0501	7	58		7	25
5305-00-068-0502	1	22		9	26
	3	20		12	3
	7	21		14	3
	9	27	5310-00-596-7691	3	31
5305-00-068-0511	1	3		6	3
4730-00-073-2151	5	18		7	41
5310-00-081-4219	7	38		13	13
5310-00-081-8087	3	30		15	4
	13	10	5310-00-637-9221	6	2
5310-00-087-4652	1	5	5310-00-637-9541	3	35
5940-00-113-8184	16	13		7	12
5940-00-143-4771	16	12		7	33
4030-00-145-5721	1	54	5310-00-685-3228	13	19
4730-00-202-6491	3	19	4730-00-723-5549	3	15
5310-00-209-0786	3	27	5310-00-727-8353	15	2
5305-00-225-9091	1	47	5310-00-732-0558	3	34
5305-00-226-7768	7	47	5310-00-761-6882	3	26
4730-00-235-1482	3	7	4030-00-780-9350	17	2
4730-00-254-6211	3	2	5340-00-809-1490	3	21
4730-00-254-6225	5	11	5310-00-809-4058	3	28
4730-00-263-2733	4	3		6	9
4720-00-273-9514	BULK	2		7	29
4730-00-289-2368	4	9		12	2
5340-00-291-5347	7	31	5310-00-809-4061	1	4
	3	16		3	36
4730-00-350-9619	13	2		7	13
4730-00-366-3011	3	11		7	54
5310-00-407-9566	7	7	5310-00-809-8544	1	15
			5310-00-80-4061	13	18

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5305-00-876-4828	7	32	5310-01-274-3255	1	24
	7	52		14	5
5310-00-880-7744	7	22	5306-01-303-2815	6	10
	7	44	2940-01-310-4495	8	19
5305-00-889-3002	4	6	4730-01-322-4956	8	71
4730-00-894-5574	5	12	5360-01-322-8623	8	91
4720-00-913-5910	BULK	1	5360-01-322-8629	8	123
5310-00-934-9758	6	11	5360-01-322-8631	8	158
	15	5	5310-01-322-8747	8	17
5320-00-956-7355	1	56	3110-01-322-9532	8	31
5305-00-984-4984	1	14	4320-01-323-0298	8	138
	13	11	2815-01-323-0352	8	49
	17	13	2815-01-323-0353	8	51
5305-00-984-4993	3	23	5330-01-323-1551	8	127
5305-00-984-6210	13	14	5331-01-323-2728	8	59
5305-00-984-6212	3	18		8	180
	15	3	2940-01-323-3289	8	14
5305-00-989-7435	3	32	3040-01-323-3294	8	90
	6	4	5999-01-323-4929	9	12
	7	40		9	15
5310-00-997-1888	12	4	5306-01-323-5440	8	93
5320-01-023-2529	1	33	5307-01-323-5504	8	2
	1	38	5307-01-323-5505	8	5
	1	40	5342-01-323-7866	8	27
	1	42	5340-01-323-7879	8	18
	1	45	2815-01-324-6801	8	102
2910-01-025-6853	3	13	5330-01-324-8254	8	55
5305-01-027-5239	17	11		8	72
5310-01-046-5371	7	50	5331-01-324-8279	8	137
4730-01-058-9758	7	2		8	178
5340-01-059-0114	15	6	3110-01-324-8817	8	78
5935-01-097-9974	15	1	5305-01-325-8387	3	8
5310-01-130-9065	1	48	5330-01-326-2669	8	70
5310-01-137-4830	7	11		8	181
5340-01-153-0578	7	43	5330-01-326-4780	8	183
5945-01-170-6666	9	28	5331-01-326-8017	8	165
5320-01-172-5602	1	35	5310-01-327-0778	8	16
5940-01-184-7273	16	10	5330-01-328-4169	8	124
5935-01-214-4163	13	6	5330-01-328-4171	8	79
5935-01-214-5259	9	10		8	179
6680-01-220-2936	5	8	5330-01-330-9564	8	30
5975-01-226-8078	9	11	2815-01-353-7523	8	164
	9	14	5310-01-384-2546	14	4
5940-01-234-7272	13	5	5305-01-388-6229	8	166
5305-01-255-6548	8	22	5306-01-388-7402	8	157

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5306-01-388-7402	8	135	2815-01-465-6393	8	36
5310-01-388-8826	8	8	5310-01-465-6458	8	154
	8	77	2815-01-465-6703	8	45
	8	101	2815-01-465-6745	8	96
3910-01-389-9003	8	160	5310-01-465-7108	7	6
2940-01-389-9942	8	15	2805-01-465-7528	8	37
5310-01-398-0737	8	47	2910-01-465-8277	8	33
5340-01-415-3789	8	80	2815-01-465-9578	8	48
5342-01-415-3792	8	58	2815-01-465-9616	8	50
5330-01-415-3802	8	161	5305-01-465-9934	8	43
5340-01-415-3807	8	131	5330-01-466-0701	8	3
5340-01-415-3810	8	134		8	176
5365-01-415-6744	8	75	5331-01-466-0712	8	67
5930-01-416-0372	7	61		8	174
5315-01-416-3128	8	132	5330-01-466-0713	8	84
5315-01-416-3131	8	128		8	172
2815-01-416-3333	8	112	3040-01-466-0786	8	147
	8	118	3040-01-466-0793	8	149
2910-01-416-3350	8	125	5310-01-466-4888	8	53
5360-01-418-7397	8	153	5310-01-466-5116	8	148
5365-01-419-5477	8	7	5340-01-467-7561	1	29
4730-01-424-5432	7	3	5340-01-470-3631	8	97
4520-01-424-6353	8	10	5306-01-471-6051	8	54
5310-01-431-4064	8	100	6140-01-475-9361	14	1
5310-01-431-4066	8	155	4820-01-477-0277	8	99
	8	142		8	175
5310-01-431-4070	8	46	4820-01-477-0283	8	95
5306-01-431-7459	8	151	2815-01-477-0536	8	35
5306-01-431-7460	8	168	5310-01-477-0582	8	62
5306-01-431-7461	8	56	5310-01-477-0592	8	61
5315-01-431-8229	8	92	5310-01-477-0596	8	60
	8	167	5360-01-477-0601	8	159
5315-01-431-8230	8	109	5360-01-477-0602	8	98
5315-01-432-1210	8	44	5310-01-477-0603	8	20
5340-01-433-5457	8	136	5310-01-477-0606	8	21
5340-01-433-5458	8	145	5310-01-477-0607	8	12
5340-01-433-5460	8	24	5305-01-477-3508	8	13
5340-01-449-3915	8	25	5310-01-477-3930	8	85
2920-01-452-8409	8	170	5307-01-477-4022	8	64
5310-01-457-0222	8	150	5307-01-477-4029	8	63
4320-01-457-0232	8	144	5330-01-477-4043	8	9
2530-01-461-7601	16	2	5340-01-479-5255	1	27
3110-01-465-3473	8	87	5315-01-481-2030	1	9
3110-01-465-3598	8	81	5930-01-485-9200	3	37
2990-01-465-5995	8	140	5930-01-486-3028	16	14

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5365-01-486-3251	8	104	2990-01-539-7187	1	11
5330-01-486-4449	8	105	4720-01-539-7189	1	30
	8	182	4520-01-539-7194	7	46
5930-01-486-4755	17	6	5342-01-539-7195	5	6
4520-01-492-9125	13	3	3030-01-539-7196	7	49
4520-01-493-2780	3	22	2910-01-539-7197	3	3
4520-01-493-2785	5	19	3010-01-539-7198	7	56
4720-01-499-3769	BULK	3	4810-01-539-7199	3	14
5935-01-503-0815	9	13	6665-01-539-8270	1	13
2530-01-503-5000	13	4	2540-01-539-8271	1	16
5975-01-509-3916	5	16	6685-01-539-8272	4	2
2815-01-524-7056	8	69	2990-01-539-8276	8	23
5330-01-526-5104	8	6	2835-01-540-2887	1	31
	8	177	4810-01-540-2889	4	4
4810-01-526-5186	8	89	4730-01-540-3594	5	7
2815-01-526-5197	8	110	4720-01-540-3595	5	14
5340-01-526-5277	8	28	5305-01-542-7318	7	35
5330-01-526-5339	8	94	2815-01-544-8732	8	116
	8	184	2815-01-544-8733	8	117
5340-01-526-6927	8	129	5310-01-544-8734	8	114
5365-01-526-7332	8	88	2815-01-544-8757	8	113
4820-01-526-7409	8	82	2910-01-545-0015	8	139
5315-01-526-8491	8	68	3110-01-545-0018	8	162
2910-01-530-0749	8	121	3120-01-545-7839	8	87
2910-01-530-0758	8	120	5315-01-546-4565	8	141
3110-01-530-1167	8	38	5305-01-559-5838	7	30
2815-01-530-1252	8	108	4520-01-568-4546	1	12
2815-01-530-1259	8	106	2910-01-568-5116	7	23
2815-01-530-1293	8	107	5340-01-568-5127	7	39
2815-01-530-1527	8	34	5330-01-568-5151	12	5
5940-01-530-4760	16	11	5340-01-568-5154	1	46
5330-01-530-6327	8	65	5310-01-568-5156	11	3
	8	173		9	24
5330-01-530-6424	8	171	5961-01-568-5195	9	5
4730-01-534-4664	13	15	4730-01-568-5574	5	10
4520-01-539-7164	17	1	4530-01-568-5694	11	1
4720-01-539-7168	18	1	4530-01-568-5698	11	8
5310-01-539-7169	13	9	4140-01-568-6677	9	8
6150-01-539-7170	17	12	6105-01-568-7564	9	7
6665-01-539-7171	17	4	4810-01-568-7755	8	185
4730-01-539-7172	5	17	5220-01-569-0418	11	13
6685-01-539-7173	13	17	5950-01-569-0504	10	1
4520-01-539-7184	1	2	5977-01-569-2045	11	6
6680-01-539-7185	5	2	4720-01-569-2752	3	44
4520-01-539-7186	1	6			



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STOCK NUMBER	FIG.	ITEM
2815-01-569-4627	8	1
3010-01-569-6036	7	26
3040-01-569-6044	9	9
5998-01-569-8580	16	1
6150-01-570-9598	9	29
5305-12-156-4863	7	57
5307-14-469-7400	8	73
5305-14-469-7436	8	83
5307-14-469-7440	8	74
2990-14-469-8499	8	152
5305-14-469-8502	8	156
4820-14-469-8518	8	122
5340-14-469-8519	8	130
5340-98-205-1855	8	66
5306-98-205-1856	8	76
5315-98-205-1859	8	57



OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE

PART NUMBER INDEX

PART NUMBER	FIG.	ITEM	PART NUMBER	FIG.	ITEM
0 332 209 203	9	28	114250-45310	8	27
101158-11180	8	97	114250-45330	8	30
103338-32570	8	137	114250-51080	8	129
	8	178	114250-51160	8	133
103854-01221	8	47	114250-51600	8	130
104200-66820	8	153	114250-51640	8	131
104200-66830	8	148	114250-51650	8	134
104200-66850	8	154	114250-66200	8	158
105010-11490	8	95	114250-66440	8	151
10512	8	22	114250-76600	8	24
105225-01240	8	60	114250-76610	8	25
105425-01690	8	71	114270-01600	8	57
105546-51020	8	127	114299-02030	8	82
105546-51330	8	124	114350-01200	8	63
	8	123	114350-01210	8	64
106534	5	16	114350-01220	8	62
110380A	1	4	114350-01250	8	61
114250-01800	8	75	114350-01380	8	67
114250-01830	8	80		8	174
114250-01841	8	79	114350-01412	8	84
	8	179		8	172
114250-03591	8	90	114350-01700	8	66
114250-03640	8	91	114350-02100	8	87
114250-11240	8	112	114350-02113	8	81
	8	118	114350-02200	8	87
114250-11600	8	100	114350-02210	8	87
114250-11901	8	102	114350-11120	8	98
114250-12211	8	6	114350-11340	8	99
	8	177		8	175
114250-12520	8	18	114350-12202	8	3
114250-12530	8	15		8	176
114250-12550	8	16	114350-14450	8	48
114250-12560	8	17	114360-45101	8	29
114250-12581	8	19	114362-77990	8	170
114250-13201	8	183	114368-01453	8	86
114250-14200	8	49	114368-13500	8	23
114250-21550	8	46	114370-45351	8	26
114250-32010	8	138	114380-23100	8	41
114250-32070	8	136	114399-12011	8	4
114250-35110	8	164	114399-22300	8	36
114250-35150	8	85	114650-51100	8	126
114250-45301	8	28	114650-51300	8	125

PART NUMBER	FIG.	ITEM	PART NUMBER	FIG.	ITEM
114699-01760	8	58	1723A22	7	43
114770-61190	8	163	183250-39450	7	61
114770-61520	8	162	183250-66050	8	149
114770-61600	8	161	183250-66070	8	147
114770-61610	8	160	183250-66100	8	152
114771-11250	8	110	183250-66500	8	146
114771-11260	8	116	183375-77560	8	7
114771-11310	8	94	183375-77570	8	11
	8	184	202498	5	6
114771-11461	8	105	210P-2	13	2
	8	182	2203B510	3	5
114771-11470	8	104		3	10
114771-11650	8	117		3	45
114771-11660	8	113		7	28
114771-11950	8	89	22190-160002	8	70
114771-14260	8	51		8	181
114870-66010	8	159	22217-060000	8	20
114871-01330	8	65	22217-080000	8	12
	8	173	22242-000120	8	111
114871-11020	8	108	22252-000210	8	33
114871-11100	8	106	22312-040080	8	68
114871-11110	8	107	22319	4	5
114871-59802	8	119	22322-030200	8	141
114871-66550	8	143	22351-020006	8	128
114881-21590	8	45	22351-030008	8	132
11674728	15	1	224-4	7	2
11675004	15	6	22451-060000	8	144
118200-23200	8	42	22512-040120	8	44
12010293	9	11	2292	16	14
	9	14	23876-010000	8	88
12010973	13	6	24101-062024	8	31
12015792	9	10	24162-152112	8	78
12089040	13	5	24311-000180	8	59
12089188	9	12		8	180
	9	15	24341-000224	8	165
12089679	13	4	249-F-4-6	3	7
12103784	9	13	2-520129-2	16	10
129100-77510	8	9	26106-060162	8	166
129400-77501	8	10	26106-060452	8	115
135210-61090	8	145	26106-060552	8	93
144F-4	3	43	26106-080122	8	83
160110-02220	8	55	26106-080352	8	56
	8	72	26106-080552	8	13
160842-21150	8	43	26106-100122	8	76
160842-21250	8	54	26106-100302	8	168
160842-21260	8	53	26226-060142	8	5

PART NUMBER	FIG.	ITEM	PART NUMBER	FIG.	ITEM
26226-060182	8	73	40195	7	9
26226-060222	8	74	40196	1	25
26106-060452	8	156		3	29
26226-060552	8	2		7	14
26226-060602	8	103	40197	7	27
26366-060002	8	8	40198	3	9
	8	77	40199	7	15
	8	101	40202-01	3	39
26476-060142	8	157	40211	3	25
	8	135	40220	3	24
26696-100002	8	142	40221	3	3
	8	155	40223	3	14
26716-060002	8	21	40224	3	4
26716-080002	8	169	40231	3	48
26757-060002	8	150	40232	3	51
26856-060002	8	114	40240	5	2
27310-060001	8	96	40252	4	2
2BE10YDN TABLE 7-3 REF 26	8	109	40260	3	40
2BE10YDN TABLE 7-3 REF 37	8	92		3	46
	8	167	40263	3	41
	8	150	40265	3	47
31204	16	7	40266	3	49
31503	16	5	40279	3	42
31535	16	11	40282	4	4
3220X6X4	3	19	40301	12	6
3277K16	9	4	40303	13	1
32949	16	12	40331	13	7
3400X4X2	4	9	40332	13	8
40022	1	34	40333	13	16
40051-01	1	36	40405	17	1
40051-02	1	37	40430	17	3
40051-02	17	7	40432-01	1	28
40101-01-SV	8	185	40458	17	5
40103	7	46	40480	17	4
40105	7	56	40481	13	17
40111	7	19	40482	13	9
40112	7	18	40489	1	13
40114	1	31	40502	1	6
40119	7	10	40507	1	16
40132	7	49	40508	5	1
40162	6	5	40510	1	2
40184	6	7	40514	1	51
40185	6	1	40520	1	7
40186	6	8	40528	1	10
40191	7	4	40530-01	2	7
40192	7	60	40530-02	2	10

PART NUMBER	FIG.	ITEM	PART NUMBER	FIG.	ITEM
40530-03	2	3	41063-SV	10	1
40530-04	2	5	41063-02	10	3
40531-01	2	9	41063-04	10	4
40531-02	2	8	41065-SV	9	7
40531-03	2	4	41066	9	8
40531-04	2	11	41067	9	25
40533-01	2	2	41068	9	23
40533-02	2	6	41069	12	5
40563	7	59	41070-SV	11	3
40566	1	30		9	24
40586	1	11	41071	9	22
40610	14	2	41072-SV	11	8
40611	14	3	41073	9	6
40616	14	9		9	21
40617	14	7	41075	9	19
40634	14	16		10	2
40661	3	33	41076	9	18
40662	3	38	41077	9	20
40700	18	1	41078	9	5
40702	5	14	41080	9	3
40720	5	15	41081-SV	9	29
40724	5	17	41100	7	1
40838	1	43	41101-10-SV	8	1
40841	17	8	41102	7	51
41021	1	41	41104-SV	7	39
41031	1	39	41107	7	16
41035	12	1	41115	7	17
41036	9	1	41146	7	34
41041	1	32	41147	7	55
41050	1	1	41201-SV	7	23
	2	1	41202	1	21
41052	1	44		3	1
41060	9	16	41207-SV	5	10
41060-02-SV	9	9	41208	4	1
41060-03	9	17	41213-SV	7	26
41061	11	1	41250	3	44
41061-01	11	7	41271	5	13
41061-02	11	2	41280	4	8
41061-03	11	10	41401-SV	16	1
41061-04	11	12	41490-SV	17	12
41061-05-SV	11	6	41491	16	3
41061-06	11	5	41494	16	9
41061-07	11	4	41501	1	17
41061-08	11	11	41505-SV	1	12
41061-09	11	9	41516	6	15
41062	9	2	41516-SV	1	57

PART NUMBER	FIG.	ITEM	PART NUMBER	FIG.	ITEM
41517-SV	1	26	714871-92600	8	171
41619-SV	14	15	714872-22720	8	34
41613-SV	14	13	714876-21730	8	52
41614-SV	14	17	714880-14580	8	50
41621-SV	14	14	75/35	14	1
41622-SV	14	11	75005-100	1	21
41623-SV	14	10	75011-100	1	20
41630-SV	14	8	75012-100	1	19
41632-SV	14	12	75056-100	1	18
41790-SV	11	13	75116-100	5	7
41849	1	50	75229	5	9
41850-SV	1	46	75259-1	6	14
41852	1	49	75262-1	1	55
42-14-A	BULK	6	75263-100	1	52
430-010	7	11	839981	BULK	2
4-4010202B	5	11	8451A53	BULK	4
4452K345	9	3	863-000553	1	9
4797-5-4B	5	18	8923T32	1	53
47834	3	51		BULK	5
49X4X4	3	11	90675A011	3	17
50385K31	13	15	91280A330	7	30
50785K253	3	6	91280A340	7	24
5115-18-015	17	9	91280A524	7	6
5-13-5616	5	19	91280A530	7	57
52161	7	8	91280A643	7	35
	7	37	92323A537	7	48
5321K14	7	3	94830A560	1	8
5914	13	3	AD42BS	1	35
60384	3	22	AD44BS	1	33
62-40-151-3	1	27		1	38
62471	3	37		1	40
6536K18	5	12		1	42
6781-S5.120-F5.7	5	8		1	45
7130K59	5	16	AS21919DG8	3	16
714250-12560	8	14		7	31
714350-28520	8	32	B1821BH031F075N	7	36
714350-61500	8	140	B1821BH038C125N	1	3
714380-23600	8	38	BF-580	3	13
714380-23610	8	40	CBM21389	7	25
714380-23620	8	39		1	23
714380-23700	8	37	CMB21389	14	6
714650-51100	8	121	F51N7582-616	1	5
714770-61100	8	139	F98	1	22
714870-22500	8	35	FB1301	3	12
714871-01560	8	69	GW10U606SC2	6	2
714871-53100	8	120	H2525M	7	12

PART NUMBER	FIG.	ITEM	PART NUMBER	FIG.	ITEM
J30R7-5	BULK	3	S35333-38	4	7
J5124-2010202B	3	2	MS35333-43	13	19
JD659	3	15	MS35335-32	3	31
K3-1735-52	1	29		7	41
M24243/6A604H	1	56		13	13
MIL-DTL-1344TY1SZ4	BULK	1		15	4
MS21044N06	3	30	MS35335-33	3	27
	13	10	MS35338-40	7	20
MS21045-4	6	6	MS35338-43	5	5
MS21045-5	7	44		6	12
MS21045-8	7	45	MS35338-44	9	26
MS21316-24	17	11		12	3
MS21333-112	7	5	MS35338-45	7	7
MS21333-98	3	21	MS35338-46	1	48
MS25036-150	16	13		3	35
MS27130-S27	7	50		7	33
MS27183-10	3	28		7	53
	6	9	MS35649-202	6	11
	7	29		15	5
	12	2	MS35649-2252	12	4
MS27183-12	7	38	MS51553-420	14	4
MS27183-15	3	36	MS51844-64	1	54
	7	13	MS51849-74	5	3
	7	54	MS51967-2	3	26
	13	18	MS51967-5	7	22
MS27183-42	5	4	MS51967-8	3	34
	6	13	MS87006-13	17	2
	7	42	MS90725-13	6	10
	13	12	MS90725-5	7	58
	17	10	MS90725-6	3	20
MS27183-43	15	2		7	21
MS27183-52	1	24		9	27
	14	5	MS90725-64	3	8
MS27183-7	1	15	MS90726-115	7	47
MS35206-227	1	14	MS90726-36	1	47
	13	11	NAF1058-10E	6	3
	17	13	NAS1352-6-20P	7	32
MS35206-233	3	23		7	52
MS35206-242	4	6	NC3030 7/16-28	16	2
MS35206-263	13	14	SO5075	16	4
MS35206-265	3	18	SO5076	16	6
	15	3	SO5363SFT	16	8
MS35207-264	3	32	SSB1	17	6
	6	4	VS2225P-2	4	3
	7	40			
MS35333-37	17	14			



**CHAPTER 11**

**SUPPORTING INFORMATION  
FOR  
LARGE CAPACITY FIELD HEATER,  
TYPE II (LCFH TYPE II)**



**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE****REFERENCES****SCOPE**

This work package lists all field manuals, forms, technical manuals, and miscellaneous publications referenced throughout this manual.

**DA PAMPHLETS**

DA PAM 738-751	Functional Users Manual for The Army Maintenance Management System (TAMMS-A)
DA PAM 750-8	The Army Maintenance Management System (TAMMS) Users Manual

**FIELD MANUALS**

FM 4-25.11	First Aid
FM 3-11.5	Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination

**FORMS**

DA Form 368	Product Quality Deficiency Report
DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2028-2	Recommended Changes to Equipment Technical Publications
DA Form 2404	Equipment Inspection & Maintenance Worksheet
DA Form 2408-9	Equipment Control Record
DD Form 361	Transportation Discrepancy Report (TDR)
SF 362	US. Government Freight Loss, Damage Claim
SF 364	Report of Discrepancy (ROD)
SF 368	Product Quality Deficiency Report (PQDR)

**TECHNICAL BULLETINS**

TB 5-4200-200-10	Noise and Conservation of Hearing
TB 43-0002-43	Hand Portable Fire Extinguishers Approved for Army Use
	Maintenance Expenditure Limits for FSC Group 16, (FSC Class 1670)

**TECHNICAL MANUALS**

TM 9-214	Inspection, Care, and Maintenance of Antifriction Bearings
TM 43-0139	Painting Instructions for Army Materiel
TM 750-244-3	Destruction of Army Materiel to Prevent Enemy Use

**PAINTING REQUIREMENTS**

MIL-STD-129	Marking for Shipment & Storage
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**MISCELLANEOUS**

AR 750-1	Army Materiel Maintenance Policy
CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 50-909	Field and Garrison Furnishings and Equipment
CTA 50-970	Expendable/Durable Items (Except Medical, Class V Repair Parts and Heraldic Items)
MIL-L-46167/MIL-PRF-46267	Lubricating Oil, Internal Combustion Engine, Arctic
UL Standard 2034	Single and Multiple Station Carbon Monoxide Alarms

**SPECIFICATIONS**

Fed. Spec. P-D-680	Dry Cleaning Solvent
MIL-PRF-680	Degreasing Solvent

**END OF WORK PACKAGE**

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**OPERATOR, FIELD, AND SUSTAINMENT MAINTENANCE****MAINTENANCE ALLOCATION CHART (MAC)**

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**MAINTENANCE ALLOCATION CHART (MAC)****INTRODUCTION****The Army Maintenance System MAC**

This introduction provides a general explanation of all maintenance and repair functions authorized at the two maintenance levels under the Two-Level Maintenance System concept.

This MAC (immediately following the introduction) 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 shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

- Field – includes three subcolumns, Crew (C), Service (O), and Field (F).
- Sustainment – includes two subcolumns, Below Depot (H) and Depot (D).

The maintenance to be performed below depot and in the field is described as follows:

1. Service maintenance. The responsibility of a using organization to perform maintenance on its assigned equipment. It normally consists of inspecting, servicing, lubricating, adjusting, and replacing parts, minor assemblies, and subassemblies. The replace function for this level of maintenance is indicated by the letter "O" in the third position of the SMR code. An "O" appearing in the fourth position of the SMR code indicates complete repair is possible at the Service Maintenance level.
2. Field maintenance. Maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion either on the system or after it is removed. The replace function for this level of maintenance is indicated by the letter "F" appearing in the third position of the SMR code. An "F" appearing in the fourth position of the SMR code indicates complete repair is possible at the Field Maintenance level. Items are returned to the user after maintenance is performed at this level.
3. Below Depot sustainment. Maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion, either on the system or after it is removed. The replace function for this level of maintenance is indicated by the letter "H" appearing in the third position of the SMR code. An "H" appearing in the fourth position of the SMR code indicates complete repair is possible at the below depot sustainment maintenance level. Items are returned to the supply system after maintenance is performed at this level. The tools and test equipment requirements table (immediately following the MAC) lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC. The remarks table (immediately following the tools and test equipment requirements) contains supplemental instructions and explanatory notes for a particular maintenance function.

**Maintenance Functions**

Maintenance functions are limited to and defined as follows:

1. 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). This includes scheduled inspection and gauging and evaluation of cannon tubes.
2. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

3. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms. The following are examples of service functions:
  - a. Unpack. To remove from packing box for service or when required for the performance of maintenance operations.
  - b. Repack. To return item to packing box after service and other maintenance operations.
  - c. Clean. To rid the item of contamination.
  - d. Touch up. To spot paint scratched or blistered surfaces.
  - e. Mark. To restore obliterated identification.
4. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.
5. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.
6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of 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.
7. 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.
8. Paint (ammunition only). To prepare and spray color coats of paint so that the ammunition can be identified and protected. The color indicating primary use is applied, preferably, to the entire exterior surface as the background color of the item. Other markings are to be repainted as original so as to retain proper ammunition identification.
9. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.
10. 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.

## NOTE

The following definitions are applicable to the “repair” maintenance function:

Services. Inspect, test, service, adjust, align, calibrate, and/or replace.

Fault location/troubleshooting. 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).

Disassembly/assembly. The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

11. 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. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.
12. 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 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.

### Explanation of Columns in the MAC

Column (1) Group Number. Column (1) lists Functional Group Code (FGC) numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

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

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, refer to “Maintenance Functions” outlined above).

Column (4) Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as man hours in whole hours or decimals) in the appropriate subcolumn. This work time 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 varies at different maintenance levels, appropriate work time figures are to be shown for each level. 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 time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

Field:

- C Crew maintenance
- O Service maintenance
- F Field maintenance

Sustainment:

- L Specialized Repair Activity (SRA)
- H Below depot maintenance
- D Depot maintenance

**NOTE**

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by work time figure in the "H" column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks, and the SRA complete repair application is explained there.

Column (5) Tools and Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

Column (6) Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

**Explanation of Columns in the Tools and Test Equipment Requirements**

Column (1) - Tool or Test Equipment Reference Code. The tool or test equipment reference code correlates with a code used in column (5) of the MAC.

Column (2) - Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

Column (3) - Nomenclature. Name or identification of the tool or test equipment.

Column (4) - National Stock Number (NSN). The NSN of the tool or test equipment.

Column (5) - Tool Number. The manufacturer's part number.

**Explanation of Columns in the Remarks**

Column (1) - Remarks Code. The code recorded in column (6) of the MAC.

Column (2) - Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC.



**OPERATOR, FIELD, AND SUSTAINMENT MAINTENANCE  
MAINTENANCE ALLOCATION CHART (MAC)**

**Table 1. Maintenance Allocation Chart for Large Capacity Field Heater, Type II, (LCFH Type II).**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS CODE
			FIELD			SUSTAINMENT			
			CREW	SERVICE	FIELD	BELOW DEPOT	DEPOT		
			C	O	F	H	D		
00	LARGE CAPACITY FIELD HEATER, TYPE II, (LCFH TYPE II)								
01	ASSEMBLY, CABINET	INSPECT SERVICE	.2	.1			2	A	
0101	INSULATION, SHEET SOUND	INSPECT REPAIR REPLACE	.1	.2 .5			2, 8	A	
0102	ASSEMBLY, JACK	INSPECT REPLACE	.1	.4			2	A	
0103	CABINET	INSPECT REPAIR	.1	.2	.5		2		
0104	INSTALLATION, WHEEL RETRACTION ASSEMBLY	INSPECT REPLACE	.1 .2					A	
0105	LATCH, DOOR	INSPECT SERVICE REPLACE	.1	.1 .3			2, 10	A	
0106	BRACKET, MOUNTING, OPERATOR BOX	INSPECT REPLACE	.1	.3			2, 10	A	
0107	DETECTOR, CABINET MOUNTED CO	INSPECT TEST REPLACE		.3 .3 .5			2 2 2		
0108	EXHAUST TUBE, HEAT EXCHANGER	INSPECT REPAIR	.1	.2			2	A	
0109	COVERS, DUCT	INSPECT	.1					A	
0110	HANDLE, MOBILITY	INSPECT REPLACE	.1	.5			2	A	
02	SUBSYSTEM, FUEL	INSPECT REPAIR REPLACE	.1	.7 1.5			2 2		
0201	FILTER, 10-MICRON FUEL	INSPECT SERVICE REPLACE	.1	.2 .5			9 2	A	

**Table 1. Maintenance Allocation Chart for Large Capacity Field Heater, Type II, (LCFH Type II).  
- Continued**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS CODE
			FIELD			SUSTAINMENT			
			CREW	SERVICE	FIELD	BELOW DEPOT	DEPOT		
			C	O	F	H	D		
0202	PUMP, FUEL, ELECTRICAL	INSPECT SERVICE REPLACE	.1	2 .5				2	A
0203	VALVE, 3-WAY FUEL PUMP SOLENOID	REPLACE		.5				2	
0204	SWITCH, MAIN BATTERY SHUTOFF	INSPECT TEST REPLACE	.1	.3 .7				2 2	A
0205	METER, MECHANICAL HOUR	TEST REPLACE		1.0 .4				2	E
0206	ASSEMBLY, BURNER FUEL VALVE	INSPECT REPAIR REPLACE		.3 .5 .7				2 2	A
020601	VALVE, 2-WAY SOLENOID FUEL	REPLACE		.5				2	
020602	GAUGE, PRESSURE	REPLACE		.5				2	
0207	TANK, FUEL	INSPECT SERVICE REPAIR REPLACE	.1 .3	.5 1.0				2 2	A
020701	SWITCH, FUEL TANK LEVEL	REPLACE		.5				2	
0208	CONNECTOR, EXTERNAL, FUEL SUPPLY	INSPECT REPLACE	.1	.1 .4				2	A
0209	ASSEMBLY, EXTERNAL FUEL HOSE	INSPECT REPAIR	.1	.3				2	A
0210	ASSEMBLY, BURNER FUEL PUMP	INSPECT ADJUST REPLACE		.2 .3 .5				2 2	A
0211	COUPLING, PUMP DRIVE	INSPECT REPLACE	.1	.5				2	A
03	SUBSYSTEM, POWER PLANT	INSPECT REPAIR REPLACE							

**Table 1. Maintenance Allocation Chart for Large Capacity Field Heater, Type II, (LCFH Type II).  
- Continued**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS CODE
			FIELD			SUSTAINMENT			
			CREW	SERVICE	FIELD	BELOW DEPOT	DEPOT		
			C	O	F	H	D		
0301	ASSEMBLY, INLET FAN	INSPECT REPLACE	.1	.1 1.0				2	A
0302	SCREEN, SAFETY	INSPECT REPLACE	.1	.3				2	
0303	ASSEMBLY, ENGINE SYSTEM	INSPECT REPAIR REPLACE	.1	1.0	2.0			2 2	A
030301	ASSEMBLY, 24V ALTERNATOR WITH PULLEY	INSPECT TEST ADJUST REPLACE	.1	.5 2 8				2 2 2	A
030302	ASSEMBLY, COUPLING	INSPECT REPLACE	.1	.5				2,12	A
030303	ENGINE, DIESEL	INSPECT SERVICE TEST REPLACE REPAIR	.1	.1 2 2 1.2	3.0 1.0	2.0		1,2 1-4 1-5,12 1-6	A A, C
030303 01	COVER, CRANKCASE	INSPECT SERVICE REMOVE/INSTALL	.1	.1	1.0			1-6,12	A D
030303 0101	CRANKSHAFT	INSPECT REMOVE/INSTALL SERVICE				.5 2.0 .5		3,4 3-6,20 3,4	D
030303 0102	ASSEMBLY, BALANCER SHAFT	INSPECT REMOVE/INSTALL SERVICE				.4 1.5 1.0		3,4 3,4,,12 3,4	D
030303 0103	ASSEMBLY, CAMSHAFT	INSPECT REMOVE/INSTALL REPAIR				.4 1.5 1.0		3,4 3,4,12 3,4	D
030303 0104	ROD, PISTON AND CONNECTING	INSPECT SERVICE REMOVE/INSTALL REPAIR				.5 1.5 1.5 .5		3,4 3,4 3,4,12 3,4	A D

**Table 1. Maintenance Allocation Chart for Large Capacity Field Heater, Type II, (LCFH Type II).  
- Continued**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS CODE
			FIELD			SUSTAINMENT			
			CREW	SERVICE	FIELD	BELOW DEPOT	DEPOT		
			C	O	F	H	D		
030303 0105	HEAD, CYLINDER	INSPECT		.1				1,2	
		REMOVE/INSTALL		.8	2.0			3,4,12	
		SERVICE			1.0				D
		REPAIR			2.8				
030303 010501	ASSEMBLY, ROCKER ARM	INSPECT			.4			3,4	
		ADJUST		.5				1,2	A
		REMOVE/INSTALL		1.0	1.0			3,4,12	
		REPAIR			1.3			3,4	D
030303 02	ASSEMBLY, AIR CLEANER	INSPECT	.1	.1					A
		SERVICE	.1	.3					A,B
		REMOVE/INSTALL		.5				1,2	
		REPAIR		.5				1,2	D
030303 03	PUMP AND FILTER, OIL	INSPECT			.4			3,4	
		REMOVE/INSTALL		.4	1.5			3,4	A
		REPAIR			1.5			3,4	D
030303 04	ASSEMBLY, FUEL INJECTION PUMP	INSPECT	.1		.2				A
		ADJUST			.5			3,4	
		SERVICE							
		REMOVE/INSTALL			.8			3,4,19	
030303 05	INJECTOR, FUEL	INSPECT	.1	.2				3,4	A
		SERVICE		.5				3,4,19	
		REMOVE/INSTALL		.8				3,4	
030303 06	ASSEMBLY, ELECTRIC STARTER	INSPECT	.1			.2			A
		ADJUST			.5			3,4	
		REMOVE/INSTALL			.8			3,4,	
		REPAIR				1.0		3,4	D
030303 07	HOUSING, FLYWHEEL AND FLYWHEEL	INSPECT	.1						A
		ADJUST		.5				3,4	
		REMOVE/INSTALL		.8				3,4	
		REPAIR		1.0				3,4	D
030303 08	CONTROL, GOVERNOR	INSPECT	.1		.2	.2			A
		SERVICE				.5		3,4	
		REMOVE/INSTALL			.8	.8		3,4	
		REPAIR				1.0		3,4	D
030303 09	SOLENOID, ENGINE SHUTDOWN	INSPECT		.1					
		REPLACE		.5				2	

**Table 1. Maintenance Allocation Chart for Large Capacity Field Heater, Type II, (LCFH Type II).  
- Continued**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS CODE
			FIELD			SUSTAINMENT			
			CREW	SERVICE	FIELD	BELOW DEPOT	DEPOT		
			C	O	F	H	D		
030303 10	SWITCH, OIL PRESSURE	INSPECT		.1					
		TEST		.1				2	
		REPLACE		.5				2	
030304	MOUNTS, DIESEL ENGINE VIBRATION	REPLACE		.5				2	
04	SUBSYSTEM, HEATING	INSPECT							
		SERVICE							
		REPAIR							
		REPLACE							
0401	ASSEMBLY, BURNER	INSPECT		.2				2	
		SERVICE		.3					
		ADJUST		.3					
		REPAIR		.7					
040101	BLOWER, COMBUSTION	INSPECT		.1					A
		REPLACE		.7				2	
040102	TRANSFORMER, IGNITION	INSPECT		.1					A
		REPLACE		.4				2	
040103	SENSOR, FLAME	INSPECT		.1					A
		TEST		.3				2	
		REPLACE		.4				2	
040104	ASSEMBLY, NOZZLE LINE	REMOVE		.2				2	A
		INSTALL		.2				2	
		REPLACE		.2				2	
040104 01	ASSEMBLY, ELECTRODE	REMOVE		.2				2	
		INSTALL		.2				2	
		REPLACE		.2				2	
040104 02	NOZZLE, BURNER	REMOVE		.2				2	
		INSTALL		.2				2	
		REPLACE		.2				2	
0402	ASSEMBLY, HEAT EXCHANGER	INSPECT		.1					A
		SERVICE		.5				2	
		REPLACE		1.5				2	
040201	SENSOR, OUTLET TEMPERATURE	TEST		.3				7	
		REPLACE		.5				2	
040202	SENSOR, HIGH TEMPERATURE CUTOUT	TEST		.3				7	
		REPLACE		.5				2	

**Table 1. Maintenance Allocation Chart for Large Capacity Field Heater, Type II, (LCFH Type II).  
- Continued**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS CODE
			FIELD			SUSTAINMENT			
			CREW	SERVICE	FIELD	BELOW DEPOT	DEPOT		
			C	O	F	H	D		
0403	RELAY (K2), BURNER	REPLACE		.7				2	
05	SUBSYSTEM, ELECTRICAL	INSPECT		.2					A
		SERVICE		.3				2	
		TEST		.3				7	
		REPAIR		.2				2	
		REPLACE		.4				2	
0501	ASSEMBLIES, BATTERY CABLE	INSPECT		.1					A
		SERVICE		.2				2	
		REPLACE		.4				2	
0502	BATTERY	INSPECT		.1				7	A
		TEST		.5				14	
		REPLACE		.5				2	
0503	ASSEMBLY, BATTERY T- BAR AND HOLD DOWN	INSPECT	.1						A
		REPLACE		.2				2	
0504	ASSEMBLY, WIRE HARNESS	INSPECT		.3					A
		REPAIR		.2				2	
		REPLACE				3		2	
0505	CONNECTOR, NATO	REMOVE		.3					
		INSPECT		.1				7	
		INSTALL		.5				2	
0506	ASSEMBLY, MAIN CONTROL BOX	REPLACE		.5				2	
0507	ASSEMBLY, OPERATOR CONTROL BOX	INSPECT	.1	.1					A
		REPAIR	.5	.5				2	
		REPLACE	.2	.2				2	
050701	DETECTOR, OPERATOR CONTROL BOX CO	INSPECT	.1						A
		TEST	.1						A
		REPLACE		.3				2	
0508	CABLE, OPERATOR CONTROL BOX	INSPECT	.1						A
		TEST		.4				7	
		REPLACE		.2				2	
06	DUCT, AIR, INSULATED, 16 IN. X 15 FT.	INSPECT	.1						A
		REPAIR	.1						

**Table 2. Tools and Test Equipment for Large Capacity Field Heater, Type II, (LCFH Type II).**

TOOL OR TEST EQUIPMENT	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
1	O	Shop Equipment, Automotive Maintenance And Repair	4910-00-754-0654	5C491 0-95-CL-A74
2	O	Tool Kit, General Mechanic's Automotive	5180-00-177-7033	SCSI 80-90-CL-N26
3	F, H	Tool Kit, Master Mechanic's	5180-00-699-5273	SCSI 80-90-CL-N05
4	F, H	Shop Equipment, Automotive Maintenance And Repair, Field Basic, Less Power	4910-00-754-0705	5C4910-95-CL-A31
5	H	Handle, Flywheel Locking	5120-01-415-8266	114250-92101
6	H	Remover, Flywheel	5120-01-416-0424	114250-92130
7	O, F	Multimeter	6625-00-999-6282	
8	O, F	Heat Gun, Electric	4940-01-215-0985	
9	O, F	Wrench, Oil Filter	5120-01-197-6721	
10	O, F, H	Riveter, Blind Hand St Straight Head; For 1/8, 9/64, & 0.188 In Rivet Sizes	5120-00-357-6065	
11	O, F, H	Tool, Electrode Adjusting	5220-01-569-0418	41790-SV
12	O, F, H	Wrench, Torque	5120-01-394-4295	810748
13	O, F, H	Micrometer, Caliper	5210-00-255-7564	
14	O, F, H	Test Set, Battery	6625-00-295-1902	
15	O, F, H	Adapter, 3/8 In Drive Socket To 1/4 In Hex Key	LOCAL PURCHASE	
16	O, F, H	Pads, Knee	LOCAL PURCHASE	
17	O, F, H	Hammer, Hand	5120-00-902-0089	B753F
18	O, F, H	Lift, Chain	LOCAL PURCHASE	
19	O, F, H	Wrench, Torque	5120-01-394-4291	810761
20	O, F, H	Wrench, Torque	5120-01-394-4299	810757

**Table 3. Remarks for Large Capacity Field Heater, Type II, (LCFH Type II).**

REMARK CODE	REMARKS
A	Preventive Maintenance Checks and Services (PMCS).
B	Service consists of air filter change.
C	Service in accordance with Lubrication Instructions, WP 0110.
D	Repair is limited to replacement of damaged parts.
E	Test time includes operation of heater to verify correct operation.

**END OF WORK PACKAGE**





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**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**
**COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS**


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**INTRODUCTION****Scope**

This work package lists COEI and BII for the Large Capacity Field Heater, Type II, (LCFH Type II) to help you inventory items for safe and efficient operation of the equipment.

**General**

The COEI and BII information is divided into the following lists:

**Components of End Item (COEI).** This list is for information purposes only and is not authority to requisition replacements. These items are part of the Large Capacity Field Heater. 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.

**Basic Issue Items (BII).** These essential items are required to place the Large Capacity Field Heater, Type II, (LCFH Type II) in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the Large Capacity Field Heater, Type II, (LCFH Type II) during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

**Explanation of Columns in the COEI List and BII List**

Column (1) Illus Number. Gives you the number of the item illustrated.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (3) Description, Part Number/(CAGEC). Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The stowage location of COEI and BII is also included in this column. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parentheses) and the part number.

Column (4) Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment. These codes are identified below:

<u>Code</u>	<u>Used on</u>
FXG	LCFH Type II

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (2).

Column (6) Qty Rqr. Indicates the quantity required.

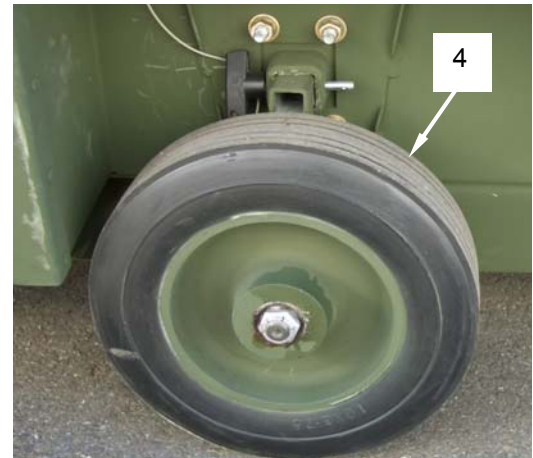
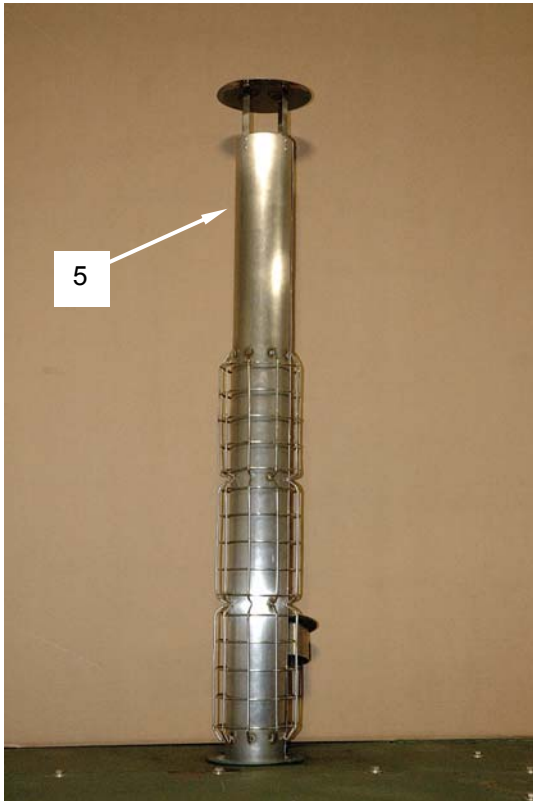
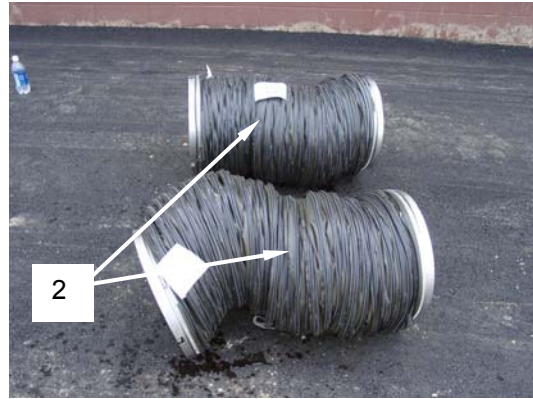


Table 1. Components Of End Item (COEI) List.

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) (U/I)	(6) Qty Rqr.
1	4520-01-539-7164	Assembly, Operator Control Box 40405(92878)	FXG	EA	1
2	4720-01-539-7168	Air Duct, Insulated, 16 IN. x 15 FT. 40700(92878)	FXG	EA	2
3	4720-01-540-3595	Assembly, Fuel Hose, External 40702(92878)	FXG	EA	1
4	4520-01-539-7186	Wheel Retraction Assembly 40502(92878)	FXG	EA	2
5	4520-01-568-4546	Exhaust Stack 41505-SV(92878)	FXG	EA	1

**TM 10-4520-265-14&P**

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TECHNICAL MANUAL  
 OPERATOR, FIELD, AND SUSTAINMENT  
 MAINTENANCE MANUAL  
 INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)  
 FOR

LARGE CAPACITY FIELD HEATER,  
 TYPE II, (LCFH TYPE II)  
 350,000 BTU, INCLUDING DIESEL ENGINE

NSN: 4520-01-559-8737 (EIC: VYG)



DISTRIBUTION STATEMENT A. - Approved for public release; distribution is unlimited.

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 XX XXXXX 2009

**Table 2. Basic Issue Items (BII).**

(1) Illus Number	(2) National Stock Number (NSN)	(3) Description, Part Number/(CAGEC)	(4) Usable On Code	(5) Unit of Issue (U/I)	(6) Qty Rqr.
1		Operator, Field, and Sustainment Maintenance Manual Including Repair Parts and Special Tools List (RPSTL) for Large Capacity Field Heater, Type II, (LCFH TYPE II) 40002(92878)	FXG	EA	1

**END OF WORK PACKAGE**



**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**

**ADDITIONAL AUTHORIZATION LIST (AAL)**

**INTRODUCTION**

**Scope**

This work package lists additional items that are authorized for the support of the Large Capacity Field Heater, Type II, (LCFH Type II).

**General**

This list identifies items that do not have to accompany the Large Capacity Field Heater, Type II, (LCFH Type II), and do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA, or JTA.

**Explanation of Columns in the AAL.**

Column (1) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (2) Description, Part Number/(CAGEC). Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

Column (3) Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment. These codes are identified below:

Code	Used On
FXG	Large Capacity Field Heater, Type II (LCFH Type II)

Column (4) U/I. Unit of Issue (U/I) indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (1).

Column (5) Qty Recm. Indicates the quantity recommended.

**ADDITIONAL AUTHORIZED LIST ITEMS**

Table 1. Additional Authorization List.

(1) National Stock Number (NSN)	(2) Description, Part Number/(CAGEC)	(3) Usable On Code	(4) U/I	(5) Qty Recm
5342-00-066-1235	CONTAINER, ADAPTER, DRUM FILL 13211E7541/(06076)	FXG	EA	1

**END OF WORK PACKAGE**



**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**

**EXPENDABLE AND DURABLE ITEMS LIST**

**INTRODUCTION**

**Scope**

This work package lists expendable and durable items that you will need to operate and maintain the Large Capacity Field Heater, Type II, (LCFH Type II). This list is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment, or CTA 8-100, Army Medical Department Expendable/Durable Items.

**Explanations of Columns in Expendable/Durable Items List**

Column (1) Item No. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., Use brake fluid (WP 0098, Item 5)).

Column (2) Level. This column includes the lowest level of maintenance that requires the listed item (include as applicable: C=Operator/Crew, O=Service/AVUM, F=Field/AVIM, H=Below Depot, D=Depot).

Column (3) National Stock Number (NSN). This is the NSN assigned to the item which you can use to requisition it.

Column (4) Item Name, Description, Part Number/(CAGEC). This column provides the other information you need to identify the item. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

Column (5) U/I. Unit of Issue (U/I) code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

<b>Table 1. Expendable and Durable Items List.</b>				
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
<b>Item No.</b>	<b>Level</b>	<b>National Stock Number (NSN)</b>	<b>Item Name, Description, Part Number/(CAGEC)</b>	<b>U/I</b>
1	O	8040-00-973-4870	ADHESIVE, 1357 (04963)	EA
2	O	6810-00-286-5435	ALCOHOL, ISOPROPYL, TT-I-735 (81348)	GL
3	O	7920-00-240-7174	BRUSH, SCRUB	EA
4	O	7920-00-291-5815	BRUSH, WIRE, SCRATCH, 7920-00-291-5815 (83421)	EA
5	O	4730-01-424-5432	CLAMP, HOSE, 5321K14 (39428)	EA
6	O	8415-00-009-1900	GLOVES, CHEMICAL AND OIL PROTECTIVE, N36, (86523)	BX
7	O	9150-00-663-1770	GREASE, GENERAL PURPOSE, 630AA (73219)	CN
8	O	7930-01-380-9028	LUBRICANT, CLEANING, GREASELESS (SILICONE), LPS-1 GREASELESS LUBRICANT (66724)	BX
9	O		LUBRICATING OIL, ENGINE (-10 °C TO 40 °C), 20W40 A.P.I. ENGINE SERVICE CLASSIFICATION CC, CD, OR CF, ROTELLA X SAE 20W-40 (0D679)	CN
10	O	9150-01-227-8210	LUBRICATING OIL, ENGINE (-20 °C TO 30 °C), 10W30 A.P.I. ENGINE SERVICE CLASSIFICATION CC, CD, OR CF, J2362 (81343)	BX
11	O	9150-01-320-3706	LUBRICATING OIL, ENGINE (-30 °C TO 10 °C), 5W30 A.P.I. ENGINE SERVICE CLASSIFICATION CC, CD, OR CF, J2362 (81343)	BX
12	O	9150-00-402-2372	LUBRICATING OIL, ENGINE (-50 °C TO 0 °C), ARCTIC, MIL-PRF-46167 (81349)	CN
13	O	7520-00-973-1059	MARKER, FELT TIP, BLACK, PERMANENT	BX
14	C,O	7930-01-363-8631	MAT, PETROLEUM ABSORBENT, GOV106 (1JA49)	RL

<b>Table 1. Expendable and Durable Items List. - Continued</b>				
(1)	(2)	(3)	(4)	(5)
Item No.	Level	National Stock Number (NSN)	Item Name, Description, Part Number/(CAGEC)	U/I
15	C	7920-00-205-1711	RAGS, WIPING, CLEAN, A-A-2522 (58536)	DZ
16	O	5320-01-023-2529	RIVET, BLIND (1/8 IN DIA X .25 IN GRIP LENGTH), M24243/1A404 (81349)	HD
17	O	8030-01-166-0675	SEALING COMPOUND (PIPE JOINT COMPOUND), 56747 (05972)	OZ
18	O	8030-01-323-4503	SEALING COMPOUND (FUEL TANK SEALANT), 80022 (1PBQ8)	OZ
19	F	5365-01-486-3255	SHIM PACK, 114250-53400 (0AK42)	PK
20	O	6850-00-274-5421	SOLVENT, DEGREASING MIL-PRF-680	OZ
21	O	5975-00-727-5153	STRAP, TIEDOWN, ELECTRICAL COMPONENTS, 88-20018-2 (30554)	EA
22	O	9905-00-537-8954	TAGS, MARKING, MIL-T-12755 (81349)	BX
23	O	8030-00-889-3534	TAPE, ANTISEIZING (PTFE JOINT SEALING TAPE) AA58092-2-1 (58536)	RL
24	O	5640-00-103-2254	TAPE, DUCT, 1791K70 (39428)	RL
25	O	5970-00-788-4901	TAPE, INSULATION, ELECTRICAL, 33T (53387)	FT
26	C,O	7930-01-316-6008	TRAY, PETROLEUM ABSORBENT, GOV103 (1JA49)	EA

**END OF WORK PACKAGE**



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**OPERATOR, SERVICE, FIELD, AND SUSTAINMENT MAINTENANCE**


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**TOOL IDENTIFICATION LIST**


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**INTRODUCTION****Scope**

This work package lists all common tools and supplements and special tools/fixtures needed to maintain the Large Capacity Field Heater, Type II, (LCFH Type II).

**Explanation of Columns in the Tool Identification List**

Column (1) Item No. This number is assigned to the entry in the list and is referenced in the initial setup to identify the item (e.g., "Extractor (WP 0091, Item 17)").

Column (2) Item Name. This column lists the item by noun nomenclature and other descriptive features (e.g., "Gage, belt tension").

Column (3) National Stock Number (NSN). This is the National Stock Number (NSN) assigned to the item; use it to requisition the item.

Column (4) Part Number/(CAGEC). 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. The manufacturer's Commercial and Government Entity Code (CAGEC) is also included.

Column (5) Reference. This column identifies the authorizing supply catalog or RPSTL for items listed in this work package.

**Table 1. Tool Identification List.**

(1) Item No.	(2) Item Name	(3) National Stock Number (NSN)	(4) Part Number/ (CAGEC)	(5) Reference
1	Adapter, 3/8 In Drive Socket to 1/4 In Hex Key	LOCAL PURCHASE		TM 10-4520-265-14&P
2	Caliper, Digital Display	5210-01-229-7626	38-20-18 (ONEL3)	TM 10-4520-265-14&P
3	Hammer, Hand	5120-00-902-0089	B753F (42380)	TM 10-4520-265-14&P
4	Handle, Flywheel Locking	5120-01-415-8266	114250-92101 (OAK42)	TM 10-4520-265-14&P
5	Heat Gun, Electric	4940-01-215-0985	M83521/5-01 (81349)	TM 10-4520-265-14&P
6	Lift, Chain	LOCAL PURCHASE		TM 10-4520-265-14&P
7	Pads, Knee	LOCAL PURCHASE		TM 10-4520-265-14&P
8	Remover, Flywheel	5180-14-469-8558	114250-92130 (S4163)	TM 10-4520-265-14&P
9	Ring Compressor	LOCAL PURCHASE		TM 10-4520-265-14&P
10	Riveter, Blind Hand Straight Head; For 1/8, 9/64, & 0.188 In Rivet Sizes	5120-00-357-6065	5120003576065 (80244)	TM 10-4520-265-14&P

<b>Table 1. Tool Identification List. - Continued</b>				
(1)	(2)	(3)	(4)	(5)
Item No.	Item Name	National Stock Number (NSN)	Part Number/ (CAGEC)	Reference
11	Shop Equipment, Automotive Maintenance and Repair	4910-00-754-0654	SC491 0-95-CL-A74 (19204)	TM 10-4520-265-14&P
12	Test Set, Battery	6625-00-295-1902	628/CASE (1RQH9)	TM 10-4520-265-14&P
13	Tool Kit, General Mechanic's Automotive	5180-00-177-7033	SCSI 80-90-CL-N26 (50980)	TM 10-4520-265-14&P
14	Tool, Electrode Adjusting	5220-01-569-0418	41790-SV (92878)	TM 10-4520-265-14&P
15	Tool, Spring Compression	LOCAL PURCHASE		TM 10-4520-265-14&P
16	Wrench, Oil Filter	5120-01-197-6721	3083 (08292)	TM 10-4520-265-14&P
17	Wrench, Torque (100 to 600 in-lbs)	5120-01-394-4295	810748 (64334)	TM 10-4520-265-14&P
18	Wrench, Torque (40 to 200 in-lbs)	5120-01-394-4291	810761 (64334)	TM 10-4520-265-14&P
19	Wrench, Torque (30 to 150 ft-lbs)	5120-01-394-4299	810757 (64334)	TM 10-4520-265-14&P

**END OF WORK PACKAGE**

ALPHABETICAL INDEX

<u>Subject</u>	<u>WP Sequence No.</u>
<b>A</b>	
Additional Authorization List (AAL) .....	WP 0122
Assembly and Preparation for Use .....	WP 0005
<b>B</b>	
Before Operation PMCS .....	WP 0015, WP 0016
<b>C</b>	
Capabilities, Features, and Equipment Characteristics .....	WP 0002
Carbon Monoxide Detector, Deploying the .....	WP 0005
Checks and Services (PMCS):	
Common Checks and Cleaning .....	WP 0015
Corrosion Prevention and Control (CPC) .....	WP 0001
Chemical Decontamination Procedures .....	WP 0006
Components of End Item and Basic Issue Items .....	WP 0121
Controls and Indicators .....	WP 0004
<b>D</b>	
Data, Equipment .....	WP 0002
Decals and Instruction Plates .....	WP 0005
Decontamination Procedures, Interim Nuclear, Biological, and Chemical (NBC) .....	WP 0006
Definitions, Leakage:	
for Operator PMCS .....	WP 0016
Deploying Wheel Chocks .....	WP 0005
Description:	
and Location of Major Components .....	WP 0002
and Use of Operator's Controls and Indicators .....	WP 0004
Destruction of Army Materiel to Prevent Enemy Use .....	WP 0001
Dust or Sand, Operation in Extreme .....	WP 0006
<b>E</b>	
Equipment:	
Characteristics, Capabilities, and Features .....	WP 0001
Data .....	WP 0002
Improvement Recommendations (EIR), Reporting .....	WP 0001
Exhaust Stack .....	WP 0002
Exhaust Stack, Deploying the .....	WP 0005
Expendable and Durable Items List .....	WP 0123
<b>F</b>	
Features, Equipment Characteristics, and Capabilities .....	WP 0002
Field Maintenance:	
Cabinet .....	WP 0079
Crankcase .....	WP 0081
Cylinder Head .....	WP 0082
Diesel Engine .....	WP 0081
Engine System Assembly .....	WP 0080
Fuel Injection Pump Assembly .....	WP 0085
Governor Control .....	WP 0086
Oil Pump .....	WP 0083
Rocker Arm Assembly .....	WP 0084
Flexible Ducts, Installing the .....	WP 0005

Fresh Air Damper ..... WP 0002, WP 0005  
 Fueling the LCFH Type II ..... WP 0005  
 Fueling the Internal Fuel Tank ..... WP 0005

**G**

General Information ..... WP 0001

**H**

Heater Controls and Indicators ..... WP 0004  
 Heat Exchanger ..... WP 0066  
 Humidity, Extreme, or Rain, Operation in ..... WP 0006  
 How to Use This Manual .....xxv

**I**

Identification Plate ..... WP 0004  
 Improvement Recommendations (EIR), Reporting Equipment ..... WP 0001  
 Indicators and Controls ..... WP 0004  
 Information Plate Locations ..... WP 0004  
 Information Plates and Decals ..... WP 0004  
 Initial Operator Control Box Settings ..... WP 0005  
 Inlet and Outlet Duct Covers, Removing the ..... WP 0005  
 Interim Nuclear, Biological, and Chemical (NBC) Decontamination Procedures ..... WP 0006  
 Internal Fuel Tank ..... WP 0002  
 Internal Fuel Tank, Fueling the ..... WP 0005

**L**

Labels and Data Plates ..... WP 0004  
 LCFH Type II Startup Codes ..... WP 0005  
 LCFH Type II Startup Time versus Outside Ambient Temperature ..... WP 0005  
 Leakage Definitions:  
     for Operator PMCS ..... WP 0015  
 List of Abbreviations and Acronyms ..... WP 0001  
 Location and Description of Major Components ..... WP 0002  
 Locations, Information Plate ..... WP 0004

**M**

Maintenance Allocation Chart Introduction ..... WP 0119  
 Maintenance Allocation Chart ..... WP 0120  
 Maintenance Checks and Services (PMCS):  
     Operator Preventive ..... WP 0015  
 Maintenance Forms and Procedures ..... WP 0001  
 Major Components:  
     Description and Location of ..... WP 0002  
 Malfunction Symptom Index ..... WP 0007

**N**

National Stock Number Index ..... WP 0116  
 Nomenclature:  
     Cross-Reference ..... WP 0001  
     Official ..... WP 0001  
 Normal Operation, Stopping, and Starting ..... WP 0005  
 Nuclear Decontamination Procedures ..... WP 0006

**O**

Official Nomenclature ..... WP 0001  
 Operating Procedures ..... WP 0005

Operating the Carbon Monoxide Detector ..... WP 0005  
 Operating the Fresh Air Damper ..... WP 0005  
 Operation:  
     in Extreme Dust or Sand ..... WP 0006  
     in High Winds ..... WP 0006  
     in Rain or Extreme Humidity ..... WP 0006  
     Principles of ..... WP 0003  
     Under Unusual Conditions ..... WP 0006  
     Under Usual Conditions ..... WP 0005  
 Operator Control Box ..... WP 0002, WP 0005  
 Operator Maintenance:  
     Air Cleaner ..... WP 0018  
     CO Detector – Operator Control Box ..... WP 0019  
     Wheel Retraction Assembly ..... WP 0017  
     Use and Description of ..... WP 0004

**P**

PMCS Procedures ..... WP 0015  
 PMCS Table ..... WP 0016  
 Plate:  
     Identification ..... WP 0004  
 Positioning Heater Outside Shelter ..... WP 0005  
 Preparation:  
     and Assembly for Use ..... WP 0005  
     for Storage or Shipment ..... WP 0078  
     for Movement ..... WP 0005  
 Principles of Operation ..... WP 0003

**R**

References ..... WP 0118  
 Repair Parts and Special Tools List:  
     Air Ducts, Insulated, 16 IN. X 15 FT. .... WP 0114  
     Assembly, Engine System ..... WP 0103  
     Battery ..... WP 0110  
     Bulk Material ..... WP 0124  
     Burner Assembly ..... WP 0115  
     Burner Fuel Valve Assembly ..... WP 0100  
     Burner Nozzle ..... WP 0107  
     Cabinet Assembly ..... WP 0097  
     Sheet Sound Insulation ..... WP 0098  
     Diesel Engine ..... WP 0104  
     Fuel System Assembly ..... WP 0099  
     Fuel Tank Assembly ..... WP 0101  
     Heat Exchanger Assembly ..... WP 0108  
     Ignition Transformer ..... WP 0106  
     Inlet Fan Assembly ..... WP 0102  
     Introduction ..... WP 0096  
     Main Control Box Assembly ..... WP 0112  
     National Stock Number Index ..... WP 0116  
     NATO Connector ..... WP 0111  
     Operator Control Box Assembly ..... WP 0113  
     Part Number Index ..... WP 0117  
     Transition Tube Assembly ..... WP 0109  
 Reporting Equipment Improvement Recommendations (EIR) ..... WP 0001  
 Resetting the Heater ..... WP 0004

S

Sand or Dust, Operation in Extreme ..... WP 0006

Service Maintenance:

    24V Alternator Assembly with Pulley ..... WP 0049

    Battery T-Bar and Hold Down Assembly ..... WP 0073

    Battery Terminal Cable and Power Assemblies ..... WP 0071

    Battery ..... WP 0072

    Burner Assembly ..... WP 0061

    Burner Electrode and Nozzle Assembly ..... WP 0065

    Burner Fuel Pump Assembly ..... WP 0045

    Burner Fuel Valve Assembly 2-Way Solenoid Valve ..... WP 0039

    Burner Relay ..... WP 0069

    Cabinet ..... WP 0028

    Carbon Monoxide Detector - Cabinet ..... WP 0031

    Carbon Monoxide Detector - Operator Control Box ..... WP 0077

    Combustion Blower ..... WP 0062

    Coupling Assembly ..... WP 0050

    Diesel Engine ..... WP 0051

    Diesel Engine Air Cleaner ..... WP 0054

    Diesel Engine Electric Starter Assembly ..... WP 0057

    Diesel Engine Flywheel Assembly ..... WP 0058

    Diesel Engine Fuel Injector ..... WP 0056

    Diesel Engine Oil Fill Cap ..... WP 0059

    Diesel Engine Oil Filter ..... WP 0055

    Diesel Engine Rocker Arm Assembly ..... WP 0053

    Diesel Engine Shutdown Solenoid ..... WP 0060

    Door Latch ..... WP 0029

    Electrical Fuel Pump 3-Way Fuel Solenoid Valve ..... WP 0036

    Electrical Fuel Pump ..... WP 0035

    External Fuel Hose Assembly ..... WP 0044

    External Fuel Supply Connector ..... WP 0043

    Exhaust Tube ..... WP 0032

    Flame Sensor ..... WP 0063

    Fuel Filter ..... WP 0034

    Fuel Tank Level Switch ..... WP 0042

    Fuel Tank ..... WP 0041

    Heat Exchanger ..... WP 0066

    High Temperature Cutout Sensor ..... WP 0067

    Ignition Assembly ..... WP 0064

    Inlet Fan Assembly ..... WP 0046

    Introduction ..... WP 0023

    Jack Assembly ..... WP 0027

    Main Battery Power Switch ..... WP 0037

    Main Control Box Assembly ..... WP 0074

    Mechanical Hour Meter ..... WP 0038

    NATO Receptacle ..... WP 0075

    Oil Pressure Switch ..... WP 0025

    Operator Box Mounting Bracket ..... WP 0030

    Operator Control Box Cable Assembly ..... WP 0076

    Outlet Temperature Sensor ..... WP 0068

    Pressure Gage ..... WP 0040

    Safety Screen ..... WP 0047

    Sound Sheet Installation ..... WP 0026

    Wire Harness Assemblies ..... WP 0070

Service Maintenance Preparation for Shipment and Storage ..... WP 0078

Service Preventive Maintenance Checks and Services (PMCS) ..... WP 0015, WP 0023

Setup, Heater ..... WP 0005

Shelter Requirements .....	WP 0005
Shipment, Preparation for .....	WP 0078
Shutdown Procedures.....	WP 0005
Siting Requirements.....	WP 0005
Special Tools.....	WP 0096
Starting, Normal Operation, and Stopping .....	WP 0005
Stopping, Starting, and Normal Operation .....	WP 0005
Storage:	
Administrative.....	WP 0078
Preparation for .....	WP 0078
Sustainment Maintenance:	
Crankcase Cover .....	WP 0088
Diesel Engine .....	WP 0088
Diesel Engine Piston and Connecting Rod .....	WP 0093
Diesel Engine Balancer Shaft .....	WP 0090
Diesel Engine Camshaft.....	WP 0091
Diesel Engine Crankshaft.....	WP 0089
Diesel Engine Fuel Injection Pump Assembly .....	WP 0092
Diesel Engine Governor Control .....	WP 0094
Main Wiring Harness Assembly .....	WP 0095
Exhaust Stack .....	WP 0005
External Fuel Supply .....	WP 0005
Inlet and Outlet Duct Covers .....	WP 0005
Flexible Inlet and Outlet Ducts .....	WP 0005
Operator Control Box .....	WP 0005
Wheel Chocks .....	WP 0005

**T**

Theory of Operation .....	WP 0003
Tool Identification List .....	WP 0124
Troubleshooting, Field.....	WP 0013
Troubleshooting, Operator .....	WP 0009, WP 0008
Troubleshooting, Service .....	WP 0010, WP 0011, WP 0012
Troubleshooting, Sustainment .....	WP 0014

**U**

Unusual Conditions, Operation Under .....	WP 0006
Use and Description of Operator's Controls and Indicators.....	WP 0004
Usual Conditions, Operation Under .....	WP 0005

**W**

Warnings, Cautions, and Notes .....	WP 0001
Warning Summary .....	a
Winds, Operation in High .....	WP 0006
Wheels, Lowering the Side .....	WP 0005
Wheel Chocks, Deploying .....	WP 0005





## 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](mailto:whomever@avma27.army.mil)

To: [TACOMLCMC.DAForm2028@us.army.mil](mailto:TACOMLCMC.DAForm2028@us.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. **PublicationDate:** 04-JUL-85
11. **Change Number:** 7
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.



<b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b> 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) TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal Rock Island, IL 61299-7630						FROM: (Activity and location) (Include ZIP Code)  PFC Jane Doe CO A 3 <sup>rd</sup> Engineer BR Ft. Leonardwood, MO 63108	
<b>PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS</b>							
PUBLICATION/FORM NUMBER TM 10-1670-296-23&P				DATE 30 October 2002	TITLE Unit Manual for Ancillary Equipment for Low Velocity Air Drop Systems		
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	<b>RECOMMENDED CHANGES AND REASON</b> (Provide exact wording of recommended changes, if possible).	
	0036 00-2				1	<p><i>In table 1, Sewing Machine Code Symbols, the second sewing machine code symbol should be MD ZZ not MD 22.</i></p> <p><i>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.</i></p>	
*Reference to line numbers within the paragraph or subparagraph.							
TYPED NAME, GRADE OR TITLE  Jane Doe, PFC				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION  508-233-4141		SIGNATURE  Jane Doe <i>Jane Doe</i>	

<b>TO:</b> <i>(Forward direct to addressee listed in publication)</i> TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal Rock Island, IL 61299-7630	<b>FROM:</b> <i>(Activity and location) (Include ZIP Code)</i> <i>PFC Jane Doe</i> <i>CO A 3<sup>rd</sup> Engineer BR</i> <i>Ft. Leonardwood, MO 63108</i>	<b>DATE</b> 21 October 2003
--	---	--------------------------------

**PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

<b>PUBLICATION NUMBER</b> TM 10-1670-296-23&P	<b>DATE</b> 30 October 2002	<b>TITLE</b> 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			<i>Callout 16 in figure 4 is pointed to a <u>D-Ring</u>. In the Repair Parts List key for figure 4, item 16 is called a <u>Snap Hook</u>. Please correct one or the other.</i>

**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.)*

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
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<p align="center"><b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b></p> <p align="center">For use of this form, see AR 25-30; the proponent agency is ODISC4.</p>						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
<b>TO:</b> (Forward to proponent of publication or form) (Include ZIP Code) TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630						<b>FROM:</b> (Activity and location) (Include ZIP Code)	
<b>PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS</b>							
PUBLICATION/FORM NUMBER TM 10-4520-265-14&P						DATE 01 JUNE 2009	TITLE Operator, Field, and Sustainment Maintenance Manual Including Repair Parts and Special Tools List for Large Capacity Field Heater, Type II, (LCFH Type II)
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON <i>(Provide exact wording of recommended changes, if possible).</i>	
<i>*Reference to line numbers within the paragraph or subparagraph.</i>							
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

<b>TO:</b> <i>(Forward direct to addressee listed in publication)</i> TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	<b>FROM:</b> <i>(Activity and location) (Include ZIP Code)</i>	<b>DATE</b>
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**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
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<p align="center"><b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b></p> <p align="center">For use of this form, see AR 25-30; the proponent agency is ODISC4.</p>						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
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TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

<b>TO:</b> (Forward direct to addressee listed in publication) TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	<b>FROM:</b> (Activity and location) (Include ZIP Code)	<b>DATE</b>
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**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
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By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.  
*General, United States Army*  
*Chief of Staff*

Official:

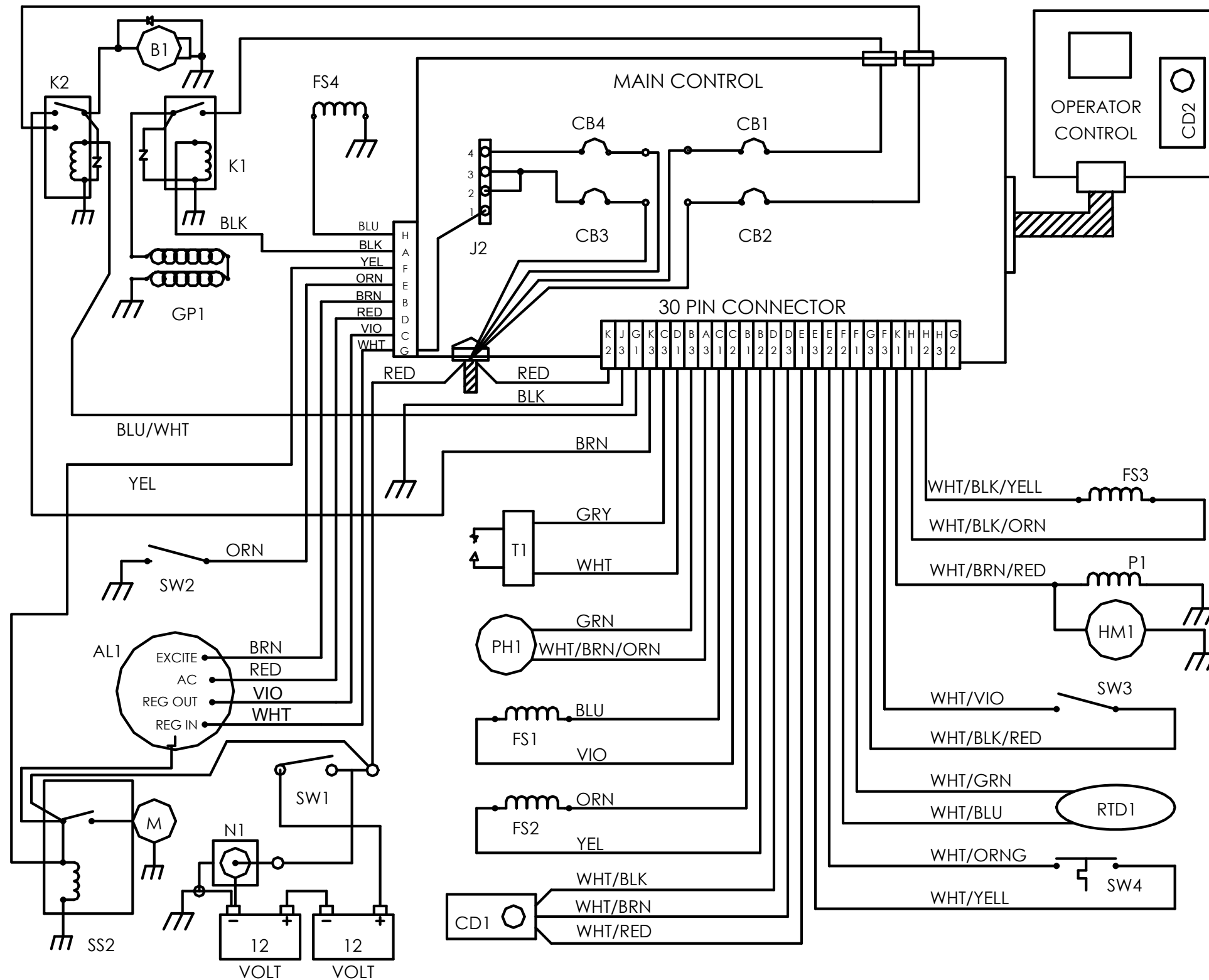


JOYCE E. MORROW  
*Administrative Assistant to the*  
*Secretary of the Army*  
0916201

**DISTRIBUTION:**

To be distributed in accordance with initial distribution number (IDN) 257002 requirements for TM 10-4520-265-14&P.





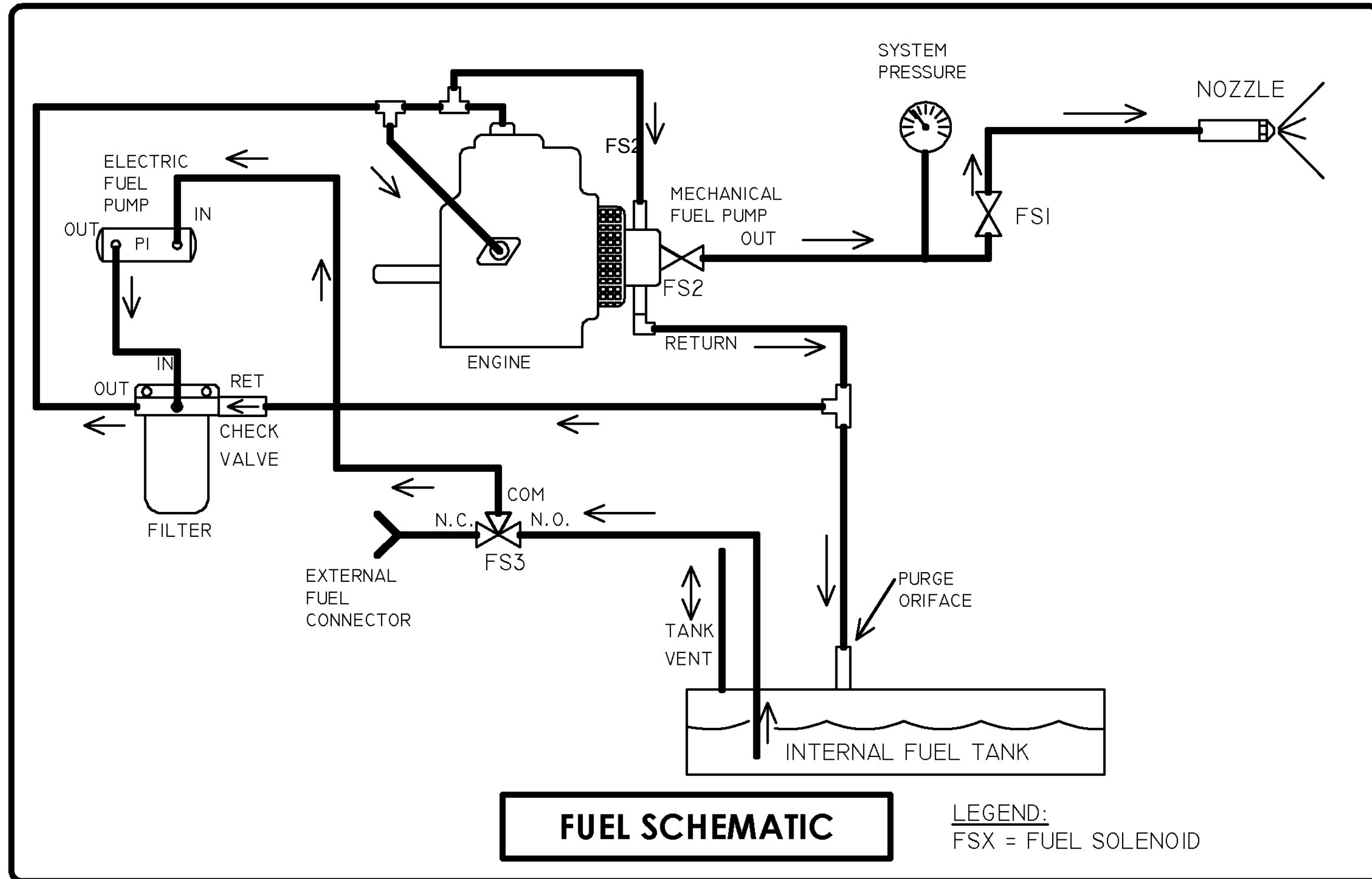
KEY	ITEM
AL1	ALTERNATOR
B1	COMBUSTION BLOWER
CB1	CRKT BRKR (PREHEATER) 45 AMP
CB2	CRKT BRKR (COMB MOTOR) 25 AMP
CB3	CRKT BRKR (POWER PCB) 15 AMP
CB4	CRKT BRKR (POWER PCB) 15 AMP
CD1	CO DETECTOR (HEATER MOUNT)
CD2	CO DETECTOR (OP CONTROL BOX)
FS1	SOLENOID (BURN ON-OFF)
FS2	SOLENOID (BURN HI-LO)
FS3	SOLENOID (INT-EXT)
FS4	SOLENOID (ENGINE FUEL SHUT-OFF)
GP1	GLOW PLUG
HM1	HOUR METER
K1	RELAY (ENGINE PREHEAT)
K2	RELAY (MOTOR ENABLE)
N1	NATO CONNECTOR
P1	ENGINE FUEL + SYSTEM PRIME
PH1	PHOTOCELL
RTD1	OUTLET AIR TEMP SENSOR
SS2	ENGINE STARTER SOLENOID
SW1	BATTERY DISCONNECT SWITCH
SW2	ENGINE OIL PRESSURE SWITCH
SW3	FUEL LEVEL SWITCH
SW4	OVER TEMP SWITCH
T1	IGNITION TRANSFORMER

FO 1. LCFH Type II Wiring Diagram









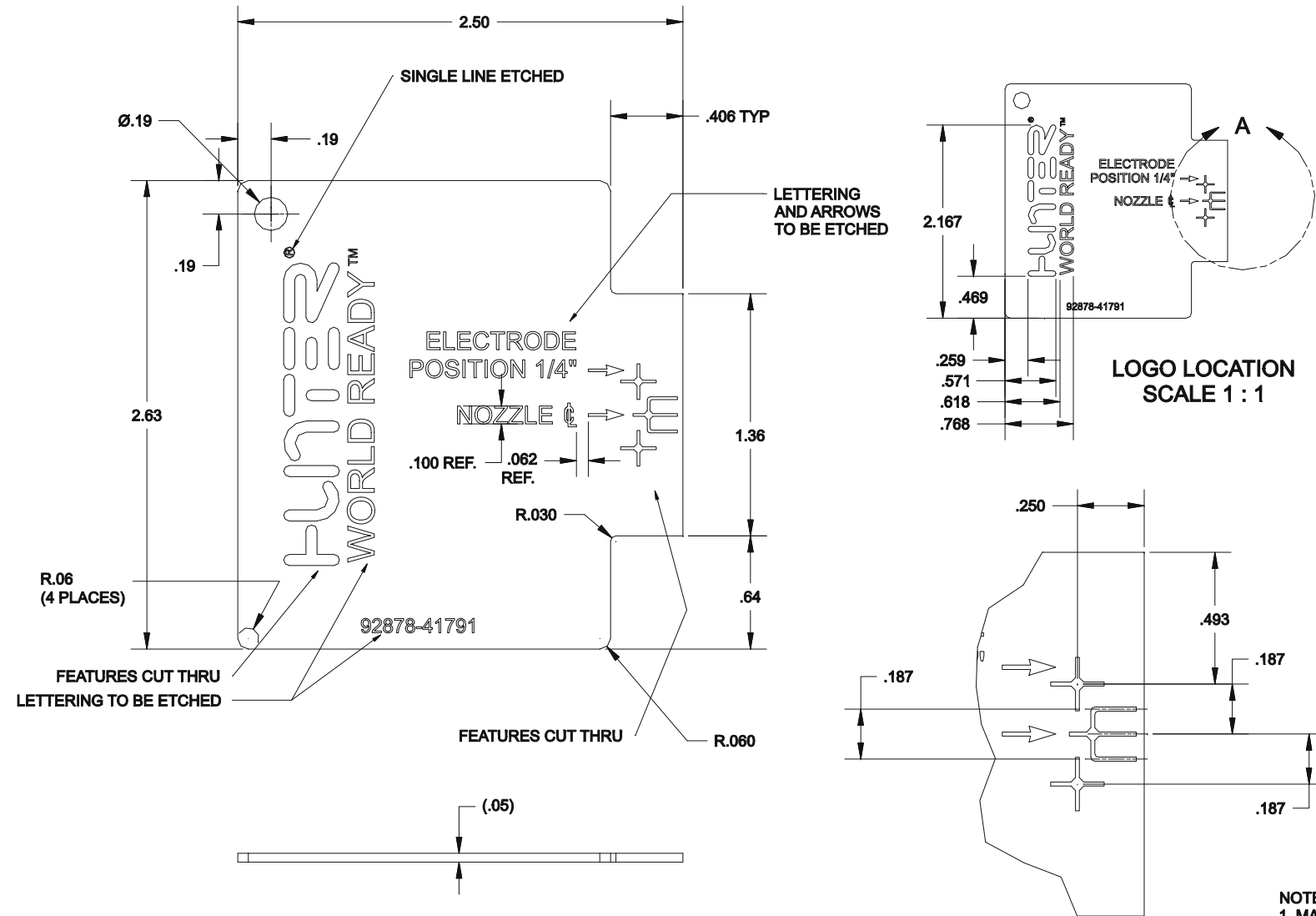
FO 3. LCFH Type II Fuel System Schematic Diagram





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REVISIONS			
NO	DESCRIPTION	DATE	CHANGE DOC
1	RELEASED FOR PRODUCTION	06/19/07	8298 R1
2	REV LAYOUT, REM ANGLES, INCREASE DEPTH .406 TYP. WAS .272 TYP.; ADD .03 & .06 RADII	9/24/07	8395



41791 2

NOTES:  
1. MATERIAL: 18ga 310 STAINLESS STEEL

STATUS				RELEASED FOR PRODUCTION			
TOLERANCES ALL DIMENSIONS EXCEPT WHERE OTHERWISE SPECIFIED				CONTRACT NO. DAAB15-02-C-0019			
FRACTS 1/8"	DECIMALS XX .010" XXX .005"	ANGLES 1.0°		HUNTER Hunter Manufacturing Company 30525 Aurora Road Cleveland, OH 44139			
DR. ADAMIK	DATE 6/19/2007	TITLE ELECTRODE SETTING TOOL		HMC CODE IDENT. NO. 92878		DRAWING NO. 41791	REV. 2
CHK.	RELEASED	NEXT ASSY. 40790		SCALE 2:1		SHEET 1 OF 1	

FO 4. LCFH Type II Electrode Alignment Tool



# 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 feet

## Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
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  $\times \frac{5}{9}$  (after subtracting 32) = Celsius temperature   °C

**PIN: 085583-000**