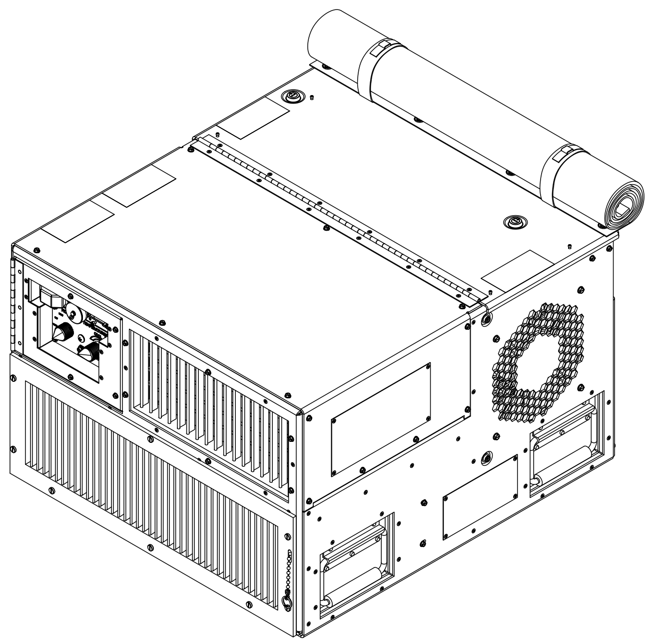
# TM 9-4120-432-13&P

TECHNICAL MANUAL

OPERATOR AND FIELD MAINTENANCE MANUAL
INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

FOR

# 9K BTU/HR IMPROVED ENVIRONMENTAL CONTROL UNIT (IECU) TYPE HD-1245/G, MODEL IECU-10-5000 (NSN 4120-01-592-7940) (EIC N/A)





HEADQUARTERS, DEPARTMENT OF THE ARMY
5 FEBRUARY 2014

# WARNING SUMMARY

## FIRST AID

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

**5** SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

**1** DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

**2** IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

**3** IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

**4** SEND FOR HELP AS SOON AS POSSIBLE

**5** AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

## SAFETY AND HAZARDOUS MATERIAL

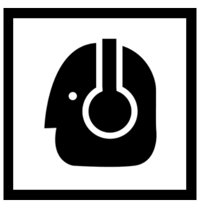
This manual describes physical and chemical processes that may require the use of chemicals, solvents, paints, or other commercially available material. Users of the manual should obtain the material safety data sheets (Occupational Safety and Health Act (OSHA) Form 20 or equivalent) from the manufacturers or suppliers of materials to be used. Users must be completely familiar with manufacturer/supplier information and adhere to their procedures, recommendations, warnings, and cautions for safe use, handling, storage, and disposal of these materials.

# WARNING SUMMARY – CONTINUED

## EXPLANATION OF SAFETY WARNING ICONS

ELECTRICAL - Electrical wire to hand with electricity symbol running through hand shows that shock hazard exists.

HOT AREA - Hand over object radiating heat indicates that part or area is hot and can burn.



EAR PROTECTION - Headphones over ears indicates that noise level will harm ears.

HEAVY OBJECT - Human figure stooping over heavy object indicates physical injury potential from improper lifting technique or failure to share lifting task with other persons.

HEAVY PARTS - Hand with heavy object on top indicates that heavy parts can crush and harm if dropped.

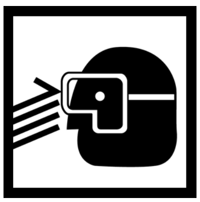
HEAVY PARTS - Foot with heavy object on top indicates that heavy parts can crush and harm if dropped.

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

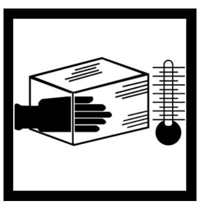
# WARNING SUMMARY – CONTINUED

SHARP OBJECT - Pointed object in hand indicates that a sharp object presents a danger to limb.

EXPLOSION - Flame and burst indicates that material can explode if subjected to high temperatures, sources of ignition, or high pressure.



EYE PROTECTION - Human figure with goggles indicates that material can injure eyes.



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

CORROSIVE - Liquids dripping from test tube indicate chemicals that attack or corrode metals or irritate, burn, or destroy human tissue.

SUFFOCATION - Slumped over human figure indicates danger of suffocation or asphyxiation.

## SAFETY WARNINGS DESCRIPTIONS

The following warnings appear in the text and are repeated here for emphasis.

# WARNING SUMMARY – CONTINUED

## WARNING

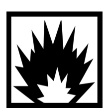
 

High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## WARNING

- Ensure the power source is disconnected. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## WARNING



- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

## WARNING

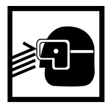
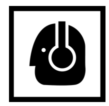
Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

# WARNING SUMMARY – CONTINUED

## WARNING

Coil fins are sharp. Wear gloves while handling a coil. Severe cuts can occur if hands are not protected.

## WARNING

If low pressure air is used to clean condenser coils, wear approved safety glasses and hearing protection. Do not use low pressure air if other personnel are in the area. Failure to comply can cause injury to personnel.

## WARNING



The IECU is heavy and awkward to maneuver. Always use four persons when attempting to move or set up the IECU for use. When lifting, be careful to avoid back injury. If the IECU is dropped, stand clear to avoid foot injury.

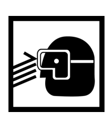
## WARNING

Do not operate the equipment without all grilles, guards, louvers, and covers in place and secure.

## WARNING

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## WARNING



- MIL-PRF-680 cleaning solvent is an environmentally compliant product, does not contain Hazardous Air Pollutant (HAP) materials, and meets National Emission Standard for Hazardous Air Pollutants (NESHAPs) requirements. However, it may be irritating to the

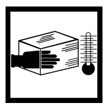
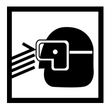
# WARNING SUMMARY – CONTINUED

eyes and skin. The use of protective gloves and goggles is required. Use in well-ventilated areas. Keep away from open flames and other sources of ignition. Failure to comply can cause injury to personnel.

- Cleaning solvent is flammable, toxic, and an irritant to eyes, skin, and respiratory system. Do not use near open flame or excessive heat. Do not breathe vapors. Use skin and eye protection and work in well-ventilated area. Failure to comply can cause injury to personnel.

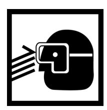
- Particles blown by compressed air are hazardous. Do not exceed 30 psi. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield when using compressed air. Failure to comply can cause injury to personnel.

## WARNING

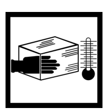
Sudden and irreversible tissue damage can result from freezing. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. Failure to comply can cause injury to personnel.

## WARNING

Compressor lubricating oil used in this equipment is caustic. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. If oil does contact skin, wash with soap and water. Failure to comply can cause injury to personnel.

## WARNING



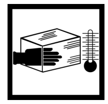
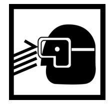

Refrigerant under pressure is used in this equipment. Use great care to avoid contact with liquid refrigerant. Work in well-ventilated area. Failure to comply can cause injury to personnel.

## WARNING

Heat may cause the refrigerant or lubricant to decompose and release irritating, toxic, and corrosive gases. Prevent contact of refrigerant with flame or hot surfaces. Failure to comply can cause injury to personnel.

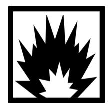
# WARNING SUMMARY – CONTINUED

## WARNING

The extremely low temperature resulting from the rapid expansion of liquid Refrigerant R410A, or Refrigerant R410A gas released under pressure, can cause sudden and irreversible tissue damage through freezing. As a minimum, all personnel must wear thermal protective gloves and a face shield or goggles when working in any situation where Refrigerant R410A contact with the skin or eyes is possible. Failure to comply can cause injury to personnel.

## WARNING



Never introduce high pressure into a refrigerant cylinder. This can cause the cylinder to rupture and cause injury to personnel.

## WARNING

Heaters (elements) are hot and can cause serious personal injury. Make sure heater assemblies are cooled to ambient temperature before performing maintenance. Failure to comply can cause injury to personnel.

## WARNING

After unit has been operating, the refrigeration tubing can become quite hot. Allow tubing to cool since hot surfaces can burn skin. Failure to do so may result in serious injury to personnel.

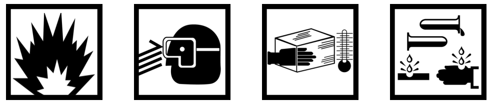
## WARNING

- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.

- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.

# WARNING SUMMARY – CONTINUED

## WARNING

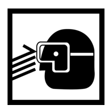


System is under high pressure. Use eye protection and gloves.

## WARNING

Capacitors store electrical energy. After disconnecting power, wait five minutes for capacitors to discharge before touching any electrical components. Failure to comply may result in severe personal injury or death by electrocution.

## WARNING



Wear eye protection when drilling to protect eyes from flying debris. Failure to do say may result in serious eye injury.

# 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 5 February 2014

**TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 31 AND TOTAL NUMBER OF WORK PACKAGES IS 94, CONSISTING OF THE FOLLOWING:**

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HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, D.C., 5 FEBRUARY 2014

**TECHNICAL MANUAL**

# OPERATOR AND FIELD MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR

# 9K BTU/HR IMPROVED ENVIRONMENTAL CONTROL UNIT (IECU) TYPE HD-1245/G, MODEL IECU-10-5000 (NSN 4120-01-592-7940) (EIC N/A)

**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 or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Communications-Electronics Command, 6001 Combat Drive, ATTN: AMSEL-LCL-ECM, Aberdeen Proving Ground, MD 21005-1846. You may also send in your recommended changes via electronic mail or by fax. Our fax number is 443-861-5521, DSN 848-5521. Our e-mail address is MONM-AMSELLEOPUBSCHG@conus.army.mil. Our online web address for entering and submitting DA Form 2028s is http://edm.apg.army.mil/pubs/2028.html. A reply will be furnished to you.

Current as of 5 February 2014

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# HOW TO USE THIS MANUAL

This manual contains operator and field maintenance instructions for the 9K Improved Enviromental Control Unit (IECU).

## NOTE

Throughout the family of manuals, directional orientation in relation to the equipment is described from the point of view of the operator facing the operator's controls looking out over the equipment. From this perspective, the end of the equipment containing the operator's controls will be referred to as the rear.

This manual provides operating procedures, troubleshooting, maintenance, and supporting information required to operate and maintain the 9K IECU. Listed below are some of the features included in this TM to help locate and use the provided information.

**WORK PACKAGES**

This TM has been organized using the Work Package (WP) format. Each chapter contains a series of WPs rather than sections and paragraphs. Each WP is designed to stand alone as a complete information module; if the user keeps the section(s) of this TM in a loose-leaf binder, the user will be able to remove just the WP needed to complete a specific task. Here are some WP features of which the user should be aware.

Each WP is numbered using a four-digit number beginning with WP 0001. WPs are numbered sequentially throughout the TM (ex. WP 0016. WP 0020. etc.). The Table of Contents lists each chapter and WP title as well as all figures and tables contained within each. Figures and tables are numbered sequentially for each WP.

The WP number is located at the top right of each page. It is also located at the bottom of the page with the WP page number included (0001-1 would be page 1 of the General Information WP (WP 0001, General Information)).

Each WP starts on a right-hand page. This is done so the user can remove a single WP from the paper TM if needed for a task. Blank pages are assigned a number, but it appears on the preceding or following page. For example, if page 0001-10 of a WP is blank, page 0001-9 will have the number 0001-9/10 blank; or if page 0001-1 of a WP is blank, page 0001-2 will have the number 0001-1 blank/2.

Each WP containing step-by-step maintenance or troubleshooting procedures will end with the words END OF TASK, and each WP ends with the statement END OF WORK PACKAGE. Think of each WP as a small, standalone TM.

Typographical conventions are as follows:
   [Unload] indicates a soft key or a switch.
   [Previous] + [Next] indicates two simultaneous key presses. [ + ] [ - ] indicates two sequential key presses.

References to equipment Data and Description Plates are printed as they appear on the equipment whenever possible.

**Warnings, Cautions and Notes Definitions**

Warnings, cautions, notes, chapter titles, and paragraph headings are printed in bold type.

The following definitions apply to WARNINGS, CAUTIONS and NOTES found throughout this publication. Warning, cautions and notes provide supplemental information. Personnel must understand and apply these warnings, cautions and notes during many phases of operation and maintenance to ensure personnel safety and health and the protection of property. Portions of this information may be repeated in certain chapters of this publication for emphasis.

## WARNING

A warning identifies a clear danger to the person doing that procedure.

# HOW TO USE THIS MANUAL – CONTINUED

## CAUTION

A caution identifies a clear danger to the equipment the person is using.

## NOTE

A note highlights essential procedures, conditions, or statements or conveys important instructional data to the user.

**CHAPTER OVERVIEW**

**Chapter 1 - General Information, Equipment Description and Theory of Operation**

Chapter 1 provides an introduction to the 9K IECU. It is divided into three work packages, as follows:

**General Information.** This work package provides general information about this manual and the related forms and records. Instructions are provided for making equipment improvement recommendations. Coverage includes a reference to the TM that contains instructions on destruction of materiel to prevent enemy use. Also, a list of abbreviations and acronyms and a nomenclature cross-reference list are provided.

**Equipment Description and Data.** This work package describes capabilities, characteristics, and features. It provides basic equipment data and shows the locations and descriptions of the major components.

**Theory of Operation.** This work package provides functional descriptions of the equipment.

**Chapter 2 - Operator Instructions**

Chapter 2 provides instructions for operating the 9K IECU. The chapter is divided into three work packages, as follows:

**Description and Use of Operator Controls and Indicators.** This work package provides references to the applicable equipment technical manuals which contains information on operator controls and indicators for the equipment.

**Operation Under Usual Conditions.** This work package contains instructions for preparing the equipment for use and operation under normal conditions. Coverage includes connection instructions and preparation instructions for movement to a new worksite.

**Operation Under Unusual Conditions.** This work package provides unusual operating procedures or references to the applicable accompanying technical manuals.

**Chapter 3 - Operator Troubleshooting Procedures**

Chapter 3 covers troubleshooting procedures for the 9K IECU to be performed by the operator. The chapter is divided as follows:

**Operator Troubleshooting Index.** This work package provides a troubleshooting introduction and malfunction/symptom index to direct you to the appropriate troubleshooting procedure.

**Operator Troubleshooting Procedures.** This work package provides troubleshooting procedures and corrective actions that are to be performed by the operator. It also provides references to the applicable technical manuals.

**Chapter 4 - Operator Maintenance Instructions**

Chapter 4 covers maintenance procedures for the 9K IECU to be performed by the operator. Its purpose is to provide you with the information that you need to keep the equipment in good operating condition. The chapter is divided as follows:

**Operator PMCS Introduction.** This work package provides a detailed explanation of each table entry in the PMCS table along with applicable warnings, cautions and notes prior to starting on the PMCS procedures.

**Operator PMCS, Including Lubrication Instructions.** This work package contains detailed instructions that the operator must perform before, during, and after Preventive Maintenance Checks and Services. Coverage includes all operator PMCS for the equipment. This work package also has a section which provides references to the applicable lubrication instructions.

## HOW TO USE THIS MANUAL – CONTINUED

**Operator Maintenance Procedures.** These work packages refer the operator to the Preventive Maintenance Checks and Services required by WP 0011.

**Chapter 5 - Field Troubleshooting Procedures**

Chapter 5 covers troubleshooting procedures of the 9K IECU to be performed by field level maintenance. The chapter is divided as follows:

**Field Troubleshooting Index.** This work package provides a troubleshooting introduction and malfunction/symptom index to direct you to the appropriate troubleshooting procedure at the field maintenance level.

**Field Troubleshooting Procedures.** This work package covers troubleshooting procedures and corrective actions that are to be performed at the field maintenance level.

**Chapter 6 - Field Maintenance Instructions**

Chapter 6 provides instructions covering the 9K IECU maintenance that must be performed at field level. The chapter is divided as follows:

**Service Upon Receipt.** This work package contains instructions for inspecting and servicing the equipment when it is received. It includes instructions for unpacking the equipment when it is received. The instructions also include unpacking and stowing the basic issue items that accompany the 9K IECU. Also included are instructions on positioning the equipment for operation and connecting an external power source.

**Field PMCS Introduction.** This work package provides a detailed explanation of each table entry in the PMCS table along with applicable warnings, cautions and notes prior to starting on the PMCS procedures.

**Field PMCS, Including Lubrication Instructions.** This work package contains instructions covering the PMCS that must be performed at the field maintenance level. A table provides information on maintenance intervals and actions required. This work package also lists the applicable references that contain lubrication instructions for your equipment.

**Field Maintenance Procedures.** These work packages list the applicable references that cover field maintenance of the equipment.

**Preparation for Storage or Shipment.** This work package provides information on short-term, intermediate-term, and long-term storage.

**Torque Limits.** This work package lists standard torque values for bolts and screws used in maintaining the equipment.

**Chapter 7 - Parts Information**

This chapter contains Repair Parts and Special Tools Lists (RPSTL) needed to perform operator and field maintenance of the equipment. The chapter is divided as follows:

**Repair Parts List.** These work packages contain illustrations and lists. The illustrations aid in identifying the parts. The lists include information that tells which maintenance levels are authorized to use the part, the part number that identifies the part, the name of the part, and the quantity used.

**Special Tools List.** This work package informs the user that no special tools are needed.

**National Stock Number (NSN) Index.** This work package lists all of the parts contained in Repair Parts Lists. The NSN index is in National Item Identification Number (NIIN) sequence.

**Part Number Index.** These work packages lists all of the parts contained in Repair Parts Lists. The part number index is in alphanumeric part number sequence.

**Chapter 8 - Supporting Information**

The chapter is divided as follows:

**References.** This work package lists all publications referenced in the various chapters of the technical manual. The listing includes the title and document number of each publication.

**Introduction for Standard Two-Level MAC.** This work package explains what is covered in the maintenance allocation chart.

# HOW TO USE THIS MANUAL – CONTINUED

**Standard Two-Level MAC.** This work package has three sections, as follows:

**Maintenance Allocation Chart (MAC).** Table 1 contains a tabular listing that assigns maintenance functions to specific maintenance levels. It lists the work time needed to perform each maintenance function at the assigned level. It also contains a column that has entries keyed to the tools and equipment listed in Table 2. Another column has entries keyed to the remarks in Table 3.

**Tool and Test Equipment Requirements.** Table 2 contains complete identification information for the items referenced in the tools and equipment column of Table 1.

**Remarks.** Table 3 provides additional information for each entry in the remarks column of Table 2.

**Components of End Item (COEI) and Basic Issue Items (BII) Lists.** This work package lists the items usually packaged separately but needed for installation and operation of the equipment. The work package has three sections, as follows:

**Introduction.** This section explains the entries in Tables 1 and 2.

**Components of End Item.** The equipment is normally shipped fully assembled, so this section is not applicable.

**Basic Issue Items.** This section contains a list of the accessories needed for installation and operation of the equipment.

**Additional Authorization List (AAL).** This work package lists additional items you are authorized for support of the equipment. This work package contains two sections, as follows:

**Introduction.** This section explains the entries in Tables 1.

**Additional Authorized Items List.** This table lists the Additional Authorized Items.

**Expendable and Durable Items List.** This work package lists expendable/durable supplies and materials needed to operate and maintain your equipment. The work package contains two sections, as follows:

**Introduction.** This section explains the entries in Tables 1.

**Expendable and Durable Items List.** The list indicates the maintenance level that needs each item and identifies the items by National Stock Number (NSN), description, and unit of measure.

## HOW TO FIX AN EQUIPMENT MALFUNCTION

### Determining the Cause

Finding the cause of a malfunction, troubleshooting, is the first step in fixing your equipment and returning it to operation. Follow these simple steps to determine the root of the problem:

1. Turn to the Table of Contents in this manual.
2. Locate "Troubleshooting" under the chapter that covers your level of maintenance. Turn to the page indicated.
3. For operator troubleshooting, follow the instructions in the references listed in Chapter 3.
4. For troubleshooting at the field level, find the malfunction listing in Chapter 5. Follow the instructions provided as indicated by the symptom index.

### Preparing for a Task

Be sure that you understand the entire maintenance procedure before beginning any maintenance task. Make sure that all parts, materials, and tools are handy. Read all steps before beginning.

Prepare to do the task as follows:

1. Carefully read the entire task before starting. It tells you what you will need and what you have to know to start the task. DO NOT START THE TASK UNTIL:
   a. You know what is needed
   b. You have everything you need
   c. You understand what to do
2. If parts are listed, they can be drawn from technical supply. Before you start the task, check to make sure you can get the needed parts. National stock numbers (NSNs) and part numbers for 9K IECU parts are listed in the Repair Parts and Special Tools List (RPSTL).
3. If expendable/durable supplies or materials are needed, get them before starting the task. Refer to WP 0108 for the correct nomenclature and NSN.

# HOW TO USE THIS MANUAL – CONTINUED

**How to Do the Task**

Before starting, read the entire task. Be sure that you understand the entire procedure before you begin the task. As you read, remember the following:

1. PAY ATTENTION TO WARNINGS, CAUTIONS, AND NOTES.
2. Use the List of Abbreviations/Acronyms if you do not understand the special abbreviations or unusual terms used in this manual.
3. The following are standard maintenance practices. Instructions about these practices are usually not included in task steps. When standard maintenance practices do not apply, the task steps will tell you:
    a. Tag electrical wiring before disconnecting it.
    b. Discard used preformed packing, retainers, gaskets, cotter pins, lock washers, and similar items. Install new parts to replace the discarded items.
    c. Coat packing before installation, in accordance with the task instructions.
    d. Disassembly procedures describe the disassembly needed for total authorized repair. You may not need to disassemble an item as far as described in the task. Follow the disassembly steps only as far as needed to repair/replace worn or damaged parts.
    e. Clean the assembly, subassembly, or part before inspecting it.
    f. Before installing components having mating surfaces, inspect the mating surfaces to make sure they are in serviceable condition.
    g. Hold the bolt (or screw) head with a wrench (or screwdriver) while tightening or loosening a nut on the bolt (or screw).
    h. Torque to the special torque cited when the task instructions include the words "torque to." Use standard torques at all other times.
    i. When a cotter pin is required, align the cotter pin holes within the allowable torque range.
    j. Inspect for foreign objects after performing maintenance.

# CHAPTER 1

# OPERATOR AND FIELD GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

## GENERAL INFORMATION

### SCOPE

**Type of Manual.** Operator and Field Maintenance Manual with Repair Parts and Special Tools List (RPSTL)

**Model Number and Equipment Name.** 9,000 BTU/hr (9K BTU/hr) Improved Environmental Control Unit (IECU)

**Purpose of Equipment.** The 9K BTU/hr IECU Figure 1 is used to cool, dehumidify, heat, and filter circulating air in shelters to meet equipment and personnel requirements. The 9K BTU/hr Improved Environmental Control Unit (IECU) is intended for use in worldwide military deployments.

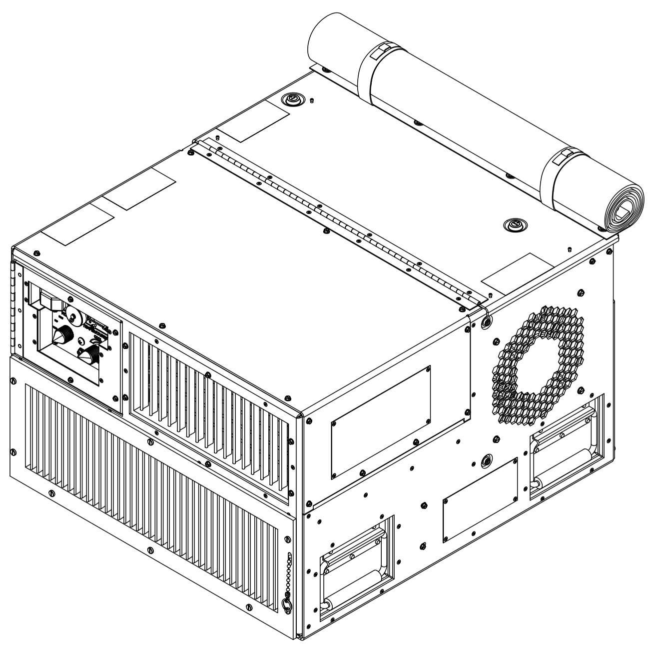


**Figure 1. 9K BTU/hr Imporved Environmental Control Unit (IECU).**

The 9K BTU/hr IECU is self-contained in a single case that is ideally suited for shelter type installations. The only external requirements are a source of 115 VAC (±10%), single-phase, 50/60 hertz electrical power, a suitable level site, and an entry to a suitable condensation drain up to 15 feet away. The drain must be lower than the base of the case, in its operating location, to allow for disposal of condensate water. It is designed to operate in almost any environmental condition from arctic to tropic and is fully portable for movement from one location to another.

The IECU has the capability of providing cooling or heating. The nominal cooling capacity is 9,000 BTU/hr. The nominal heating capacity is 7,000 BTU/hr.

The IECU is designed to circulate, filter, cool, or heat the air in the room or enclosure in which it is installed and automatically maintain the air at the desired temperature selected. The IECU is designed for operation compatible with biological and chemical warfare environments.

### MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be prescribed by DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

## REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your IECU 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 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 equipment be reported so 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, 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 below.

## OZONE-DEPLETING SUBSTANCES (ODS)

The IECU uses the environmentally friendly refrigerant, R410A. R410A refrigerant contains zero Ozone Depletion Potential (ODP).

## DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For destruction of materiel to prevent enemy use, refer to TM 750-244-7.

## PREPARATION FOR STORAGE OR SHIPMENT

Procedures to prepare the IECU for shipment and storage are contained in WP 0065.

## WARRANTY INFORMATION

The 9K BTU/hr IECU is warranted for a period of one year beginning on the date of acceptance by the Government Inspector, and as defined on the DD 250.

This warranty covers all components found throughout this manual and includes Components of End Item (COEI) (WP 0092) and provides for furnishing of new items to replace any that prove to be nonconforming and/or defective within the given time period. Any means of reimbursement will be determined by the warranty claim office found below.

**Warranty Limitations:**

Failure to recognize these limitations could potentially void the warranty and hold the unit fully accountable for reimbursement loss.

**WARRANTY INFORMATION – CONTINUED**

- This warranty does not apply to any components that have been subject to abuse, misuse, neglect, or accident, and/or have been repaired, maintained, or altered in any way that has adversely affected their condition.
- Warranty only applies to components which have been inspected, maintained, and operated IAW standard military service maintenance procedures as per this TM.
- Combat damage is not covered per this warranty to the extent that the defect/s in question are proximately caused by such combat damage.
- If the suspect component/s is found to be "False Pulls" or "No Evidence of Failure" (NEOF) after Government review, the unit will be held accountable for any costs incurred.
- Only components identified with CAGE code (94833 or 98255) and/or covered under contract number (W909MY-09-D-0002) are considered valid under this warranty.
- Warranty does not cover damage caused by acts of God or the public enemy to include fires, floods, unusually severe weather, and/or acts of the Government in its sovereign or contractual capacity.

**Warranty Claim Procedures:**

- DA Form 2407 (Maintenance Request) is the required form for filling out warranty claim actions. Ensure all pertinent data is filled out according to DA PAM 750-8 and in accordance with all limitations above.
- Failed component/s should also be accompanied with an "Exchange Tag", DA Form 2402.
- Contact CECOM 9K IECU warranty claims office for disposition of failed equipment:

  COMMANDER,
  U.S. Army Communications Electronics Life Cycle Maintenance
  Command (CECOM LCMC LCP-S)
  GMS Tower 6006, Combat Drive
  ATTN: AMSEL-LC-CCS-G
  Aberdeen PG, MD 21005
  Commercial: (443) 861-3048
  DSN: 848-3048

**NOMENCLATURE CROSS-REFERENCE LIST**

| Common Name | Official Nomenclature |
|---|---|
| 9K IECU | 9K BTU/hr Improved Environmental Control Unit (IECU) Type HD-1245/G, Model 9K IECU |
| Compressor | Compressor brazing assembly |
| Control box | Control box assembly |
| Evaporator fan | Impeller assembly |
| Filter cover | Grille |
| Remote box | Remote control box assembly |
| Reset switch | Momentary Switch |

**LIST OF ABBREVIATIONS/ACRONYMS**

| Abbreviations/Acronyms | Definition |
|---|---|
| A | Ampere |

## LIST OF ABBREVIATIONS/ACRONYMS – CONTINUED

| | |
|---|---|
| AAL | Additional Authorization List |
| AC | Alternating Current |
| AEPS | Army Electronic Product Support |
| BII | Basic Issue Items |
| BTU | British Thermal Unit |
| C | Celsius |
| CAGEC | Commercial and Government Entity Code |
| CB | Circuit Breaker |
| CFM | cubic feet per minute |
| CG | center-of-gravity |
| COEI | Component Of End Item |
| CPC | Corrosion Prevention and Control |
| CPOE | Compressor Polyester Oil |
| DA | Department of the Army |
| DA PAM | Department of the Army Pamphlet |
| DC | Direct Current |
| DOT | Department of Transportation |
| Deg | Degrees |
| EIR | Equipment Improvement Recommendation |
| EMI | Electromagnetic Interference |
| EPA | Environmental Protection Agency |
| F | Fahrenheit |
| FM | Field Manual |
| H2O | water |
| HPCO | High pressure cut-off |
| Hg | mercury |
| Hr | Hour |
| Hz | Hertz |
| IECU | Improved Environmental Control Unit |
| IMACA | International Mobile Air Conditioning Association |
| IUID | Item Unique Identification |
| LPCO | Low pressure cut-off |

## LIST OF ABBREVIATIONS/ACRONYMS – CONTINUED

| | |
|---|---|
| MAC | Maintenance Allocation Chart |
| MFD | Microfarads |
| NBC | Nuclear/Biological/Chemical |
| NESHAPs | National Emission Standard for Hazardous Air Pollutants |
| NO | Number |
| NPT | National Pipe Thread |
| NSN | National Stock Number |
| ODP | Ozone Depletion Potential |
| ODS | Ozone Depleting Substance |
| OEM | Original Equipment Manufacturer |
| OSHA | Occupational Health and Safety Act |
| PMCS | Preventive Maintenance Checks and Services |
| PQDR | Product Quality Deficiency Report |
| PSI | pounds per square inch |
| PSIA | pounds per square inch absolute |
| RMS | Root Mean Square |
| RPSTL | Repair Parts and Special Tools List |
| SAE | Society of Automotive Engineers |
| SATS | Standard Automotive Tool Set |
| SCFM | standard cubic feet per minute |
| SF | Standard Form |
| SMR | Source, Maintenance, and Recoverability |
| SOP | Standard Operating Procedures |
| TAMMS | The Army Maintenance Management System |
| TB | Technical Bulletin |
| TC | Temperature Controller |
| TM | Technical Manual |
| TO | Technical Order |
| TXV | Thermostatic Expansion Valve |
| V | Volts |
| VAC | Volts Alternating Current |
| VDC | Volts Direct Current |

## LIST OF ABBREVIATIONS/ACRONYMS – CONTINUED

| | |
|---|---|
| WCA | Warranty Claim Action |
| WP | Work Package |
| dBA | A-weighted decibel(s) |
| h | Hour |
| in.H2O | Inches of Water |
| in.Hg | Inches of Mercury |
| kW | kilowatts |
| kg | Kilogram |
| kg/cm² | Kilogram per square centimeter |
| kΩ | kilo ohm |
| lbs | pounds |
| mmHg | Millimeters of mercury |
| oz | Ounce |
| psig | pounds per square inch gauge |
| ųF | Microfarad |
| Ω | Ohm |

## QUALITY OF MATERIAL

Material used for replacement, repair, or modification must meet the requirements of this manual. If qualities of material requirements are not stated in this manual, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

## SAFETY, CARE, AND HANDLING

Always pay attention to the Warnings, Cautions, and Notes appearing throughout the manual. These notices appear prior to applicable procedures. Carefully read and understand their content to prevent serious injury to yourself and others, or damage to equipment.

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

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, located in Chapter 8 of this manual.

## END OF WORK PACKAGE

## EQUIPMENT DESCRIPTION AND DATA

### EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

#### Mechanical System

The IECU (Figure 1) is made up of two major sections: a condenser section and an evaporator section.

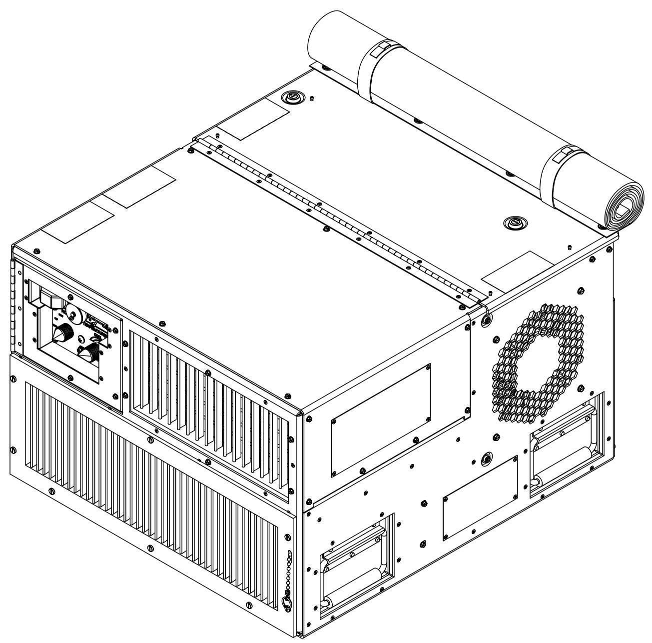


**Figure 1. 9K BTU/hr Improved Environmental Control Unit (IECU).**

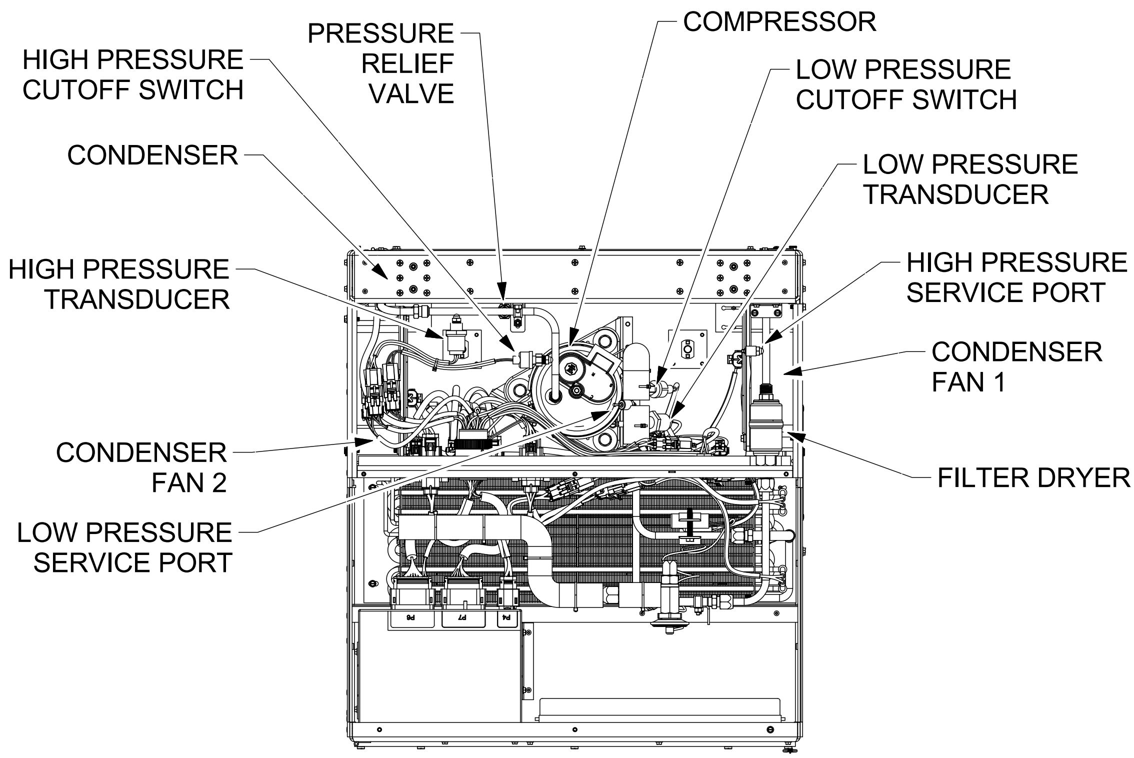
The condenser section (Figure 2) contains the following:

- Compressor
- Condenser
- Two condenser fans
- High pressure service ports
- Low pressure service ports
- High pressure transducer
- Low pressure transducer
- High pressure cut-off switch
- Low pressure cut-off switch
- Pressure relief valve
- Filter-drier

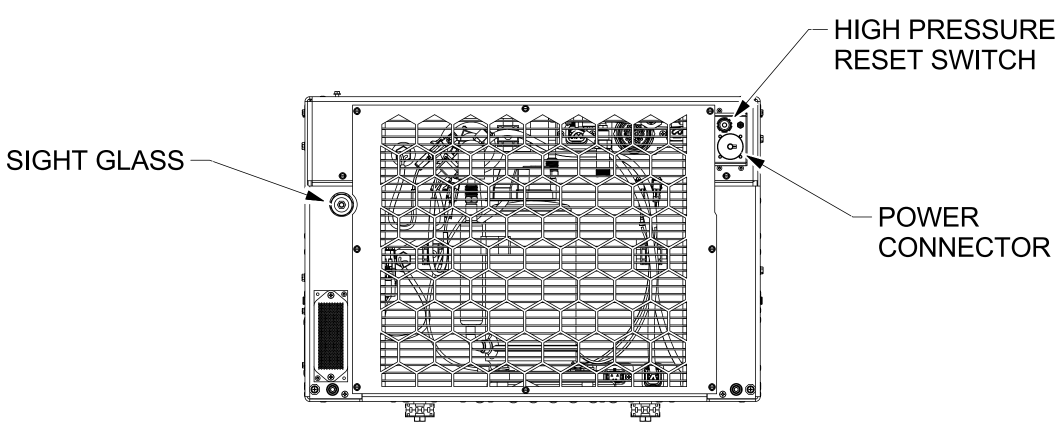
## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

- Power connector
- Sight glass
- Momentary reset switch

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED




TOP VIEW




REAR VIEW

**Figure 2. IECU Condenser Section.**

The evaporator section (Figure 3 and Figure 4) contains the following:

**EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED**

- Thermostatic expansion valve
- Evaporator
- Evaporator fan blower
- Two tubular heaters

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

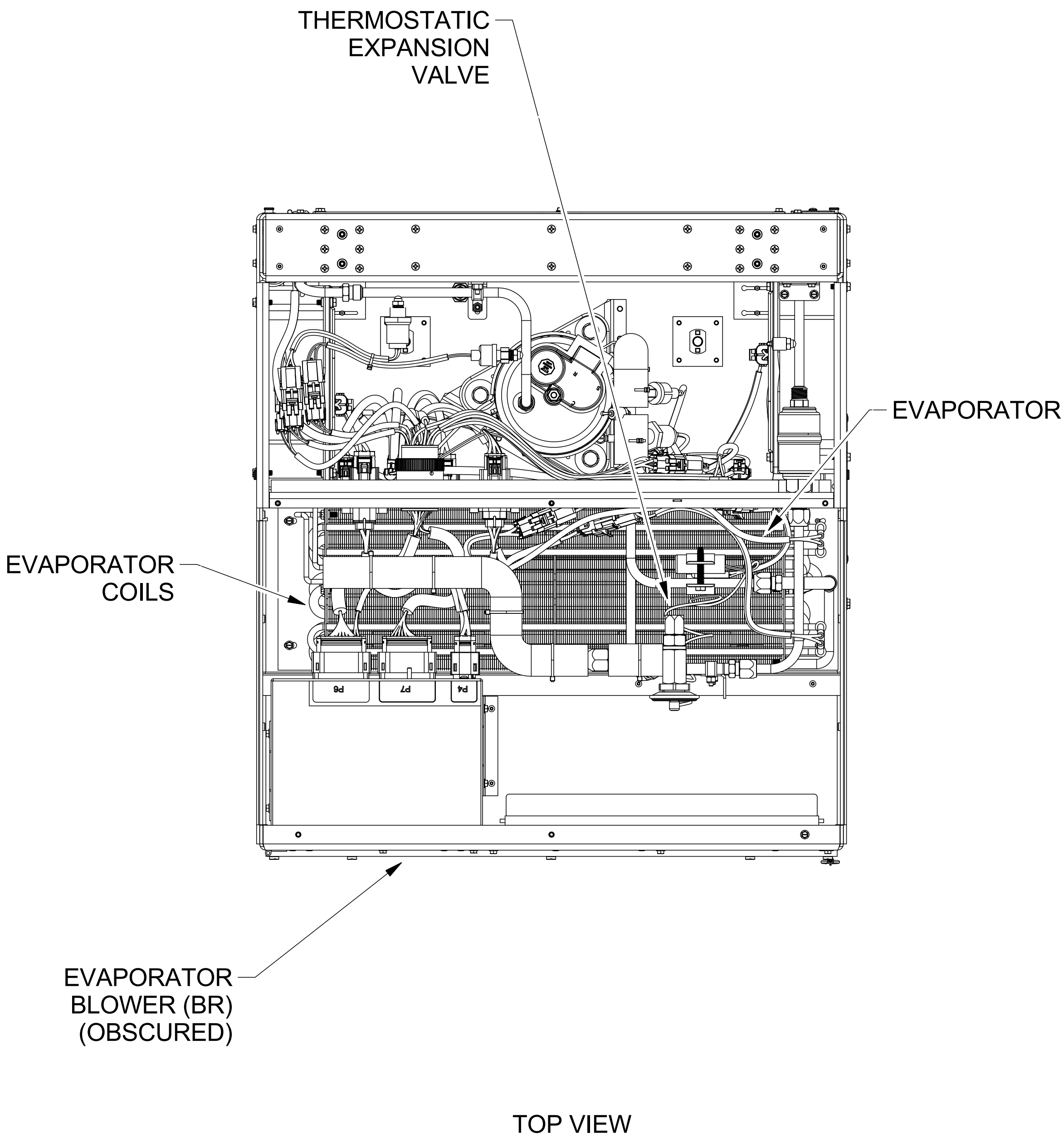



**Figure 3. Evaporator Section 1.**

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

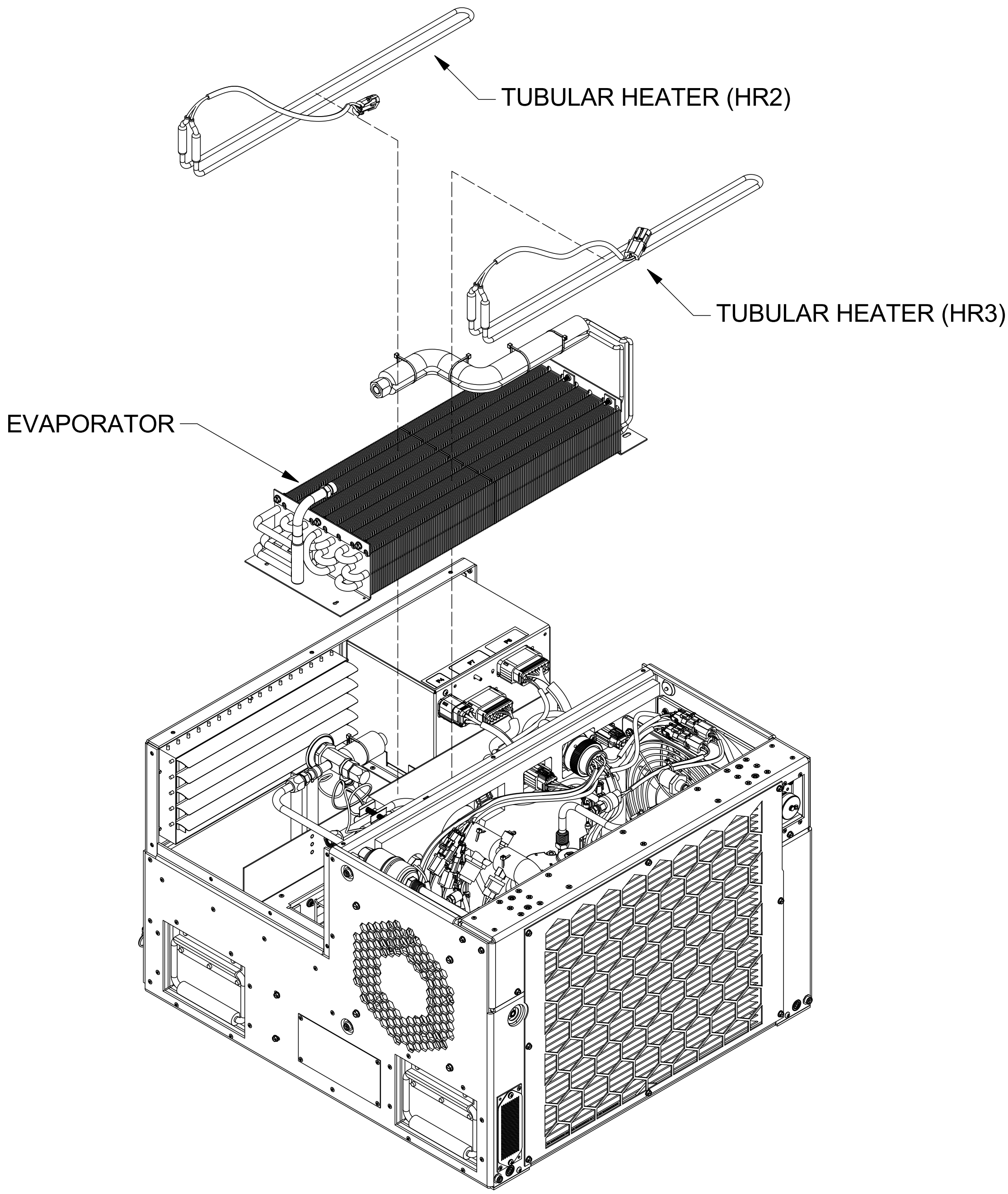



**Figure 4. Evaporator Section 2.**

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES – CONTINUED

### Refrigeration System

The refrigeration system is a traditional vapor-compression refrigeration cycle. Refrigerant is compressed by the compressor (Figure 2), whereby it becomes a super-heated vapor. As it passes through the condenser, heat is rejected and the refrigerant becomes sub-cooled. The sub-cooled refrigerant passes through a filter-drier to remove particulates and moisture.

In the evaporator section (Figure 3 and Figure 4), the filtered sub-cooled refrigerant passes through a thermostatic expansion valve (TXV) resulting in a simultaneous pressure and temperature drop. The refrigerant is now a mixture of vapor and liquid. Ambient air is drawn onto the evaporator section by the evaporator fan. This air passes over the evaporator and is cooled and expelled. The refrigerant evaporates as it absorbs heat from the air, vaporizing completely before returning to the compressor.

### Heater Section

The heaters are physically located within the evaporator section (Figure 3 and Figure 4). The two 1100-W electric heating elements of the 9K BTU/hr IECU are pressed into the evaporator fins. Shelter air is drawn into the evaporator section by the evaporator fan. This air passes over the heaters, is heated, and expelled.

### Electrical System

The IECU operates using 115 VAC (±10 %) (103.5 - 126.5 VAC), single-phase electrical input power at either 60 Hz or 50 Hz. The IECU has a maximum current load of 20 amps. The IECU utilizes a soft start assembly in order to limit inrush current caused by the startup torque. The soft start assembly's automatic starting feature will not allow inrush current to exceed the maximum current load.

The IECU uses electromechanical controls that provide simple maintenance and troubleshooting of the unit. A remote box assembly provides the operator with the capability to select mode of operation (COOL, VENT, OFF, or HEAT), as well as the capability to adjust (WARMER or COOLER) the thermostat to control shelter temperature. A DC power supply allows the remote box assembly to operate on 12 VDC power.

The IECU uses electronic circuitry to improve overall performance of the air conditioner. The use of electronic circuitry requires an enclosure assembly that is shielded to minimize the effects of Electromagnetic Interference (EMI). Various IECU components are utilized to achieve this effect. The soft starter is used to eliminate current inrush that would otherwise occur during the start-up of the compressor. Additional components of the IECU that contribute to this system include a EMI capacitors, EMI filters, shielding enclosure, ferrite beads, and ground straps.

The IECU is designed for operation compatible with biological and chemical warfare environments.

### Features

Refer to Figure 1 through Figure 13 and Table 1 and Table 2 of this work package for a complete view of the IECU and refer to callouts on the figures for locations and descriptions of the exterior and interior components and essential assemblies.

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

### Condenser and Evaporator

For location and description information about the condenser and evaporator, refer to Figure 1 and Figure 2 and the accompanying text (above).

Each unit is equipped with information plates, labels, and safety markings appropriate for the safe and effective operation and maintenance of the unit.

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS – CONTINUED

Each unit is equipped with an identification plate, a refrigeration system schematic plate, a wiring diagram label, and an electrical schematic plate attached to the outside of the unit for reference. The plates display component identifying nomenclature corresponding to the markings on all items.

There are also warning labels that call attention to the possibility of electric shock, burns, and injury from moving parts.

The location of the warning labels and information plates is depicted in Figure 5 and described in Table 1.

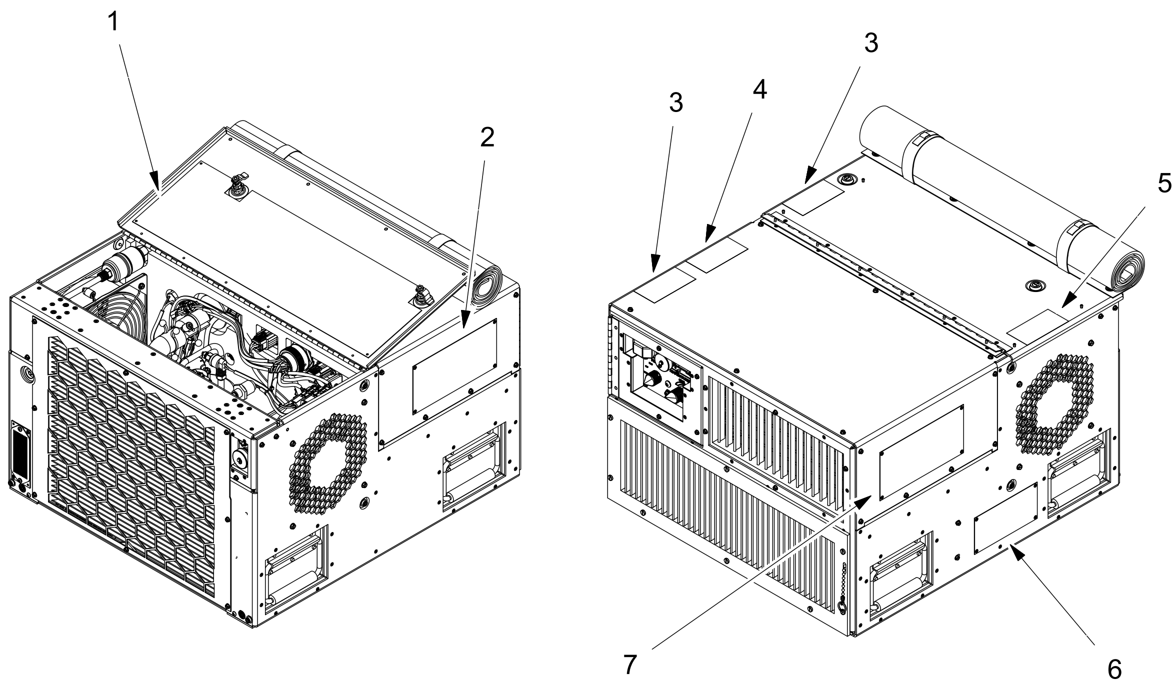



**Figure 5. Warning Label and Information Plate Locations.**

**Table 1. Warning Label and Information Plate Locations.**

| ITEM NO. | DESCRIPTION |
|---|---|
| 1 | Wiring diagram plate |
| 2 | Refrigeration system schematic plate |
| 3 | Hazardous voltage warning label |
| 4 | Hot surface warning label |
| 5 | Moving parts warning label |
| 6 | Identification plate |
| 7 | Electrical schematic plate |

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS – CONTINUED**

The identification plate (Figure 5, Item 6) is shown in Figure 6 and contains National Stock Number (NSN), serial number, part number, model number, and other identifying information.

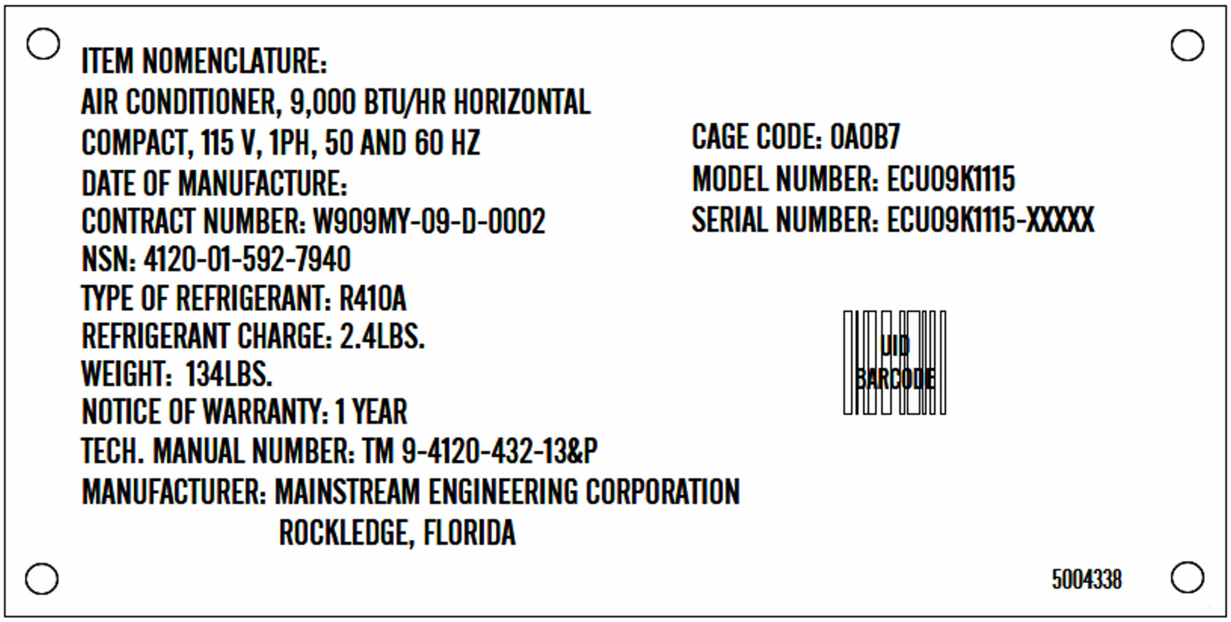



**Figure 6. Identification Plate.**

The refrigeration system schematic plate (Figure 5, Item 2) is shown in Figure 7. A full-size refrigeration schematic can be found in the foldout section of this manual.

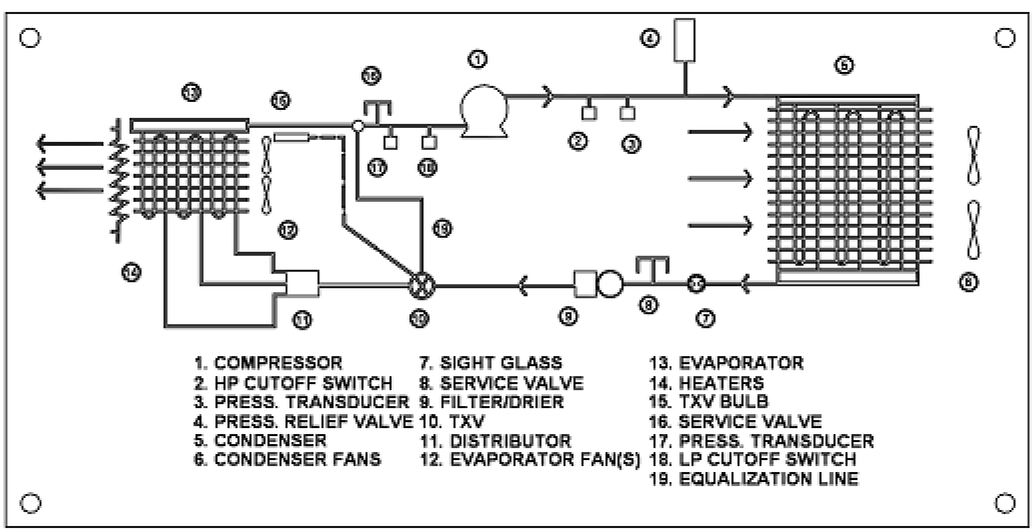



**Figure 7. Refrigeration Schematic Plate.**

The electrical schematic plate (Figure 5, Item 7) is shown in Figure 8. A full-size electrical schematic can be found in the foldout section of this manual.

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS – CONTINUED

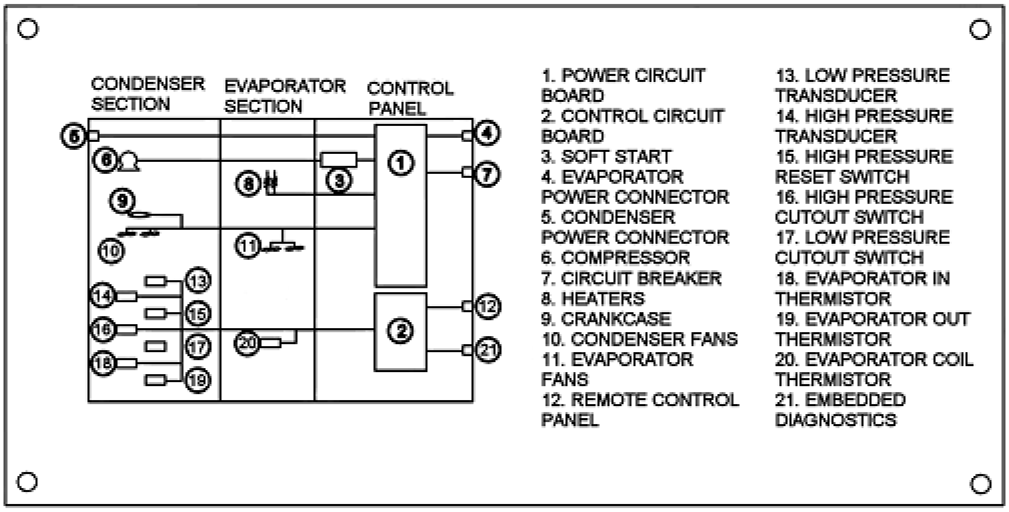



**Figure 8. Electrical Schematic Plate.**

The wiring diagram plate (Figure 5, Item 1) is shown in Figure 9. A full-size wiring diagram can be found in the foldout section of this manual.

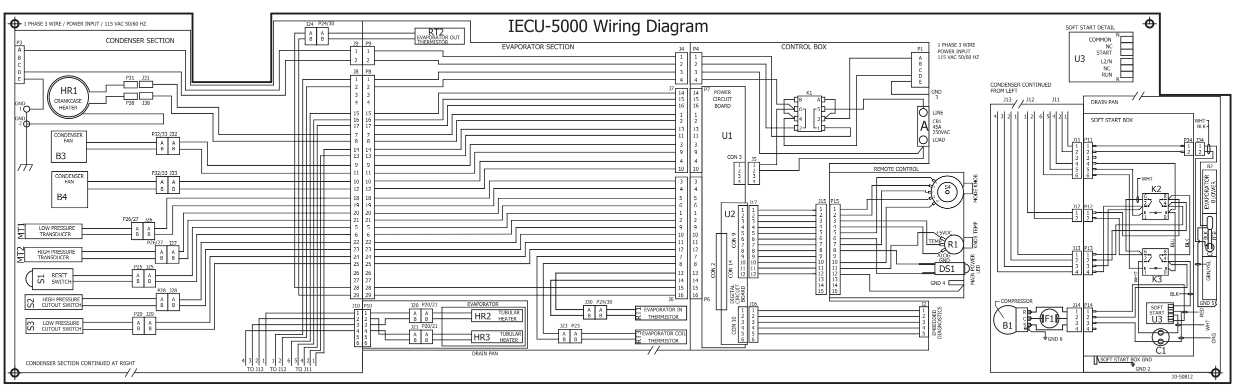



**Figure 9. Wiring Diagram Plate.**

The two hazardous voltage warning labels (Figure 5, Item 3) are shown in Figure 10. These warning labels call attention to the possibility of electric shock.

**LOCATION AND DESCRIPTION OF MAJOR COMPONENTS – CONTINUED**


**Figure 10. Hazardous Voltage Warning Label.**

The hot surface warning label (Figure 5, Item 5) is shown in Figure 11. This warning label calls attention to hot surfaces in the condenser section which can cause burn injuries.


**Figure 11. Hot Surface Warning Label.**

The moving parts warning label (Figure 5, Item 4) is shown in Figure 12. This warning label calls attention to moving parts in the condenser section which can cause injuries.

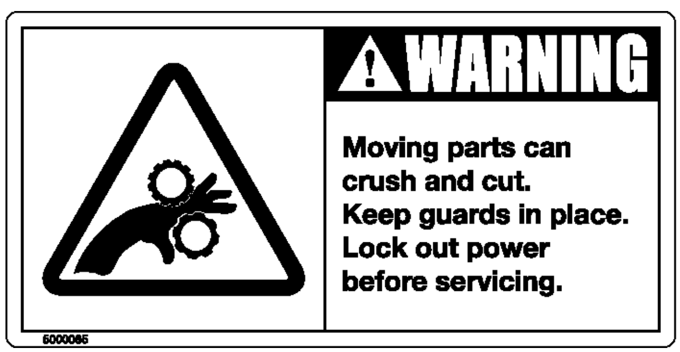



**Figure 12. Moving Parts Warning Label.**

**Control Box Assembly and Remote Control Box Assembly**

The remote control box assembly is mounted in the control box assembly (Figure 13) and together they provide remote and local control of the IECU. The remote control box can be located remotely from the IECU with the use of a cable. The remote control box contains the following:

## LOCATION AND DESCRIPTION OF MAJOR COMPONENTS – CONTINUED

- AC power connection
- Main circuit breaker
- Rotary MODE switch
- TEMPERATURE control thermostat
- POWER ON indicator
- Diagnostics connector

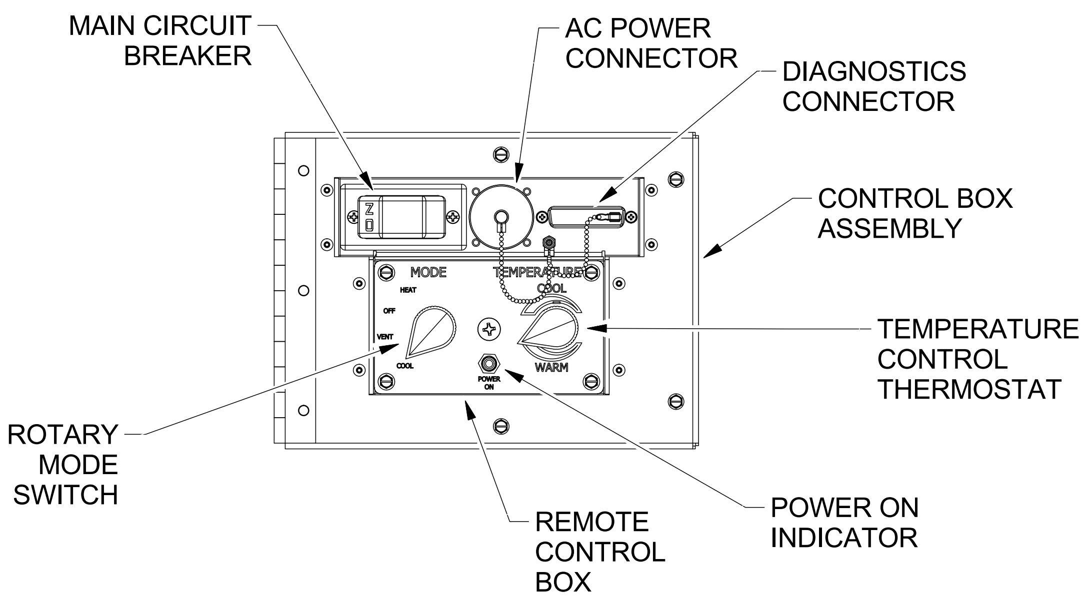



**Figure 13. Control Box and Remote Box Assemblies.**

a. The TEMPERATURE control thermostat. This control allows adjustment of the conditioned air temperature (from COOL to WARM) while operating in either the COOL or HEAT modes.

b. Rotary MODE switch. Provides selection of unit operating modes (COOL, VENT, OFF/ RESET, or HEAT).

## EQUIPMENT DATA

The 9K BTU/hr IECU system specifications are listed in Table 2.

**Table 2. 9K BTU/hr IECU System Specifications.**

| PARAMETER | SPECIFICATION |
|---|---|
| Operating Temperatures | Cooling = 0 to 125 °F |
| | Heating = -50 to 80 °F |
| Control | Internally or remotely mounted control box |

*** SCFM (Standard Cubic Feet per Minute)**

## EQUIPMENT DATA – CONTINUED

**Table 2. 9K BTU/hr IECU System Specifications. – Continued**

| | |
|---|---|
| Power Required: | |
| Voltage | 115 VAC ±10 % |
| Frequency | 50/60 Hertz |
| Phase | single-phase, 3 wire |
| Current | 20 amps at 115 VAC |
| Power Consumption Maximum | 2.2 kW |
| Heater | 2 x 1100 Watts |
| Minimum Power Factor | 0.85 |
| Dimensions (Max.) | 26 inches (L) x 23.75 inches (W) x 16 inches (H) |
| Weight | 134 lbs (60.8 kg) total |
| Refrigerant | R410A, 2.4 lbs (1.08 kg) total charge, non-ozone depleting |
| Minimum Evaporator Air Flow | 300 SCFM* |
| *** SCFM (Standard Cubic Feet per Minute)** | |

**END OF WORK PACKAGE**

## THEORY OF OPERATION

### GENERAL INFORMATION

#### Basic Vapor-Compression Refrigeration Principles

Basic vapor-compression refrigeration system consists of four major components: compressor, evaporator, condenser, and expansion device

Refrigerant absorbs heat energy (provides cooling) as it evaporates; that is, as it boils and turns from liquid to vapor. If the refrigerant evaporates at a constant pressure, then evaporation occurs at a constant temperature while both liquid and vapor are present. Likewise, refrigerant rejects heat energy (gives off heat) as it condenses from vapor to liquid. Once again, if the condensation occurs at a constant pressure, then the condensation will occur at a constant temperature until all the vapor has condensed to a liquid. Therefore, for evaporation or condensation, the temperature and pressure are related by the pressure/temperature saturation curve.

**NOTE**

When discussing pressure in PSI (pounds per square inch), PSIG means pounds per square inch gauge and PSIA means pounds per square inch absolute. The two numbers differ by approximately 14.7 PSI. A refrigeration gauge normally reads in units of PSIG, that is, in normal air it will read a pressure of zero. However, an absolute gauge would read a pressure of about 14.7 PSIA in this same location. Likewise, we normally use inches of mercury to discuss vacuum levels with 29.9 being a complete vacuum (0 PSIA). Some saturation charts for refrigerants are using the absolute pressure instead of the combination of gauge pressure and vacuum in inches of mercury.

To convert PSIA to PSIG, simply subtract 14.7 (or round to 15) from the PSIA reading to get the PSIG reading. For example, 14.7 PSIA is 0.0 PSIG; normal atmospheric pressure, 164.7 PSIA can be referred to as 150 PSIG. As a simple rule of thumb, to convert inches of mercury (the symbol for mercury is Hg) to PSIA, simply divide the value in inches of mercury by 2 and subtract it from 15 to get the approximate PSIA reading. For example, 5" Hg is about 12.5 PSIA (actually it is 12.2 PSIA), 10" Hg is about 10 PSIA (actually it is 9.8 PSIA), and finally 15" Hg is about 7.5 PSIA (actually it is 7.3 PSIA).

When using metric pressure measurements in Pa (pascals), pressure is always absolute pressure.

Slightly sub-cooled refrigerant leaves the condenser at high pressure, and the pressure is dropped via the thermostatic expansion valve (TXV) before it enters the evaporator.

The refrigerant enters the evaporator as a two-phase mixture (liquid and vapor) and evaporates or boils at low temperature, absorbing heat. Slightly superheated refrigerant vapor exits the evaporator. The TXV is an automatically adjusting valve that slightly increases or decreases its opening depending on the superheat of the refrigerant exiting the evaporator. If the superheat is too large, it will increase the valve opening to increase the flow rate. Alternatively if the superheat is too little, it will close the TXV valve slightly. After the evaporator, and the superheated vapor enters the compressor where the pressure and temperature are increased as the compressor compresses the refrigerant vapor.

The vapor leaving the compressor is a superheated vapor and the compressor discharge is the hottest point in the cycle. This refrigerant is cooled and condensed in the condenser where heat is dissipated, and the refrigerant condenses to liquid. Refrigerant leaves the condenser slightly sub-cooled to assure condensation has been complete. Any non-condensable vapors in the system will be unable to condense in the condenser and will appear as gas bubbles in the condensed liquid stream. These non-condensables may collect in the condenser and displace refrigerant from the condenser heat exchanger, thereby reducing the effective surface area of the condenser.

## GENERAL INFORMATION – CONTINUED

### Weights and Ratings

Weights and Ratings are listed in Table 1. Saturation Temperature/Pressure Data for HFC-410A Refrigerant is provided in Table 2. IECU Cooling Capacity is specified in Table 3.

**Table 1. Weight and Ratings.**

| PARAMETER | SPECIFICATION |
|---|---|
| Weight | 134 lbs. |
| Compressor | 13,500 BTU/hr |
| | Oil type: Polyvinyl Ester Oil (PVE) |
| | Capacity: 9.8 oz (290 cc) |
| Minimum Fresh Air Airflow | 35 SCFM |
| Noise Level (Evaporator Side) | <65 dBA |

**Table 2. Saturation Temperature/ Pressure Data for HFC-410A Refrigerant.**

| TEMPERATURE | | PRESSURE |
|---|---|---|
| DEG F | DEG C | PSIG |
| -40 | -40 | 10.8 |
| -38 | -38.9 | 12.1 |
| -36 | -37.8 | 13.4 |
| -34 | -36.7 | 14.8 |
| -32 | -35.6 | 16.3 |
| -30 | -34.4 | 17.8 |
| -28 | -33.3 | 19.4 |
| -26 | -32.2 | 21.0 |
| -24 | -31.1 | 22.7 |
| -22 | -30 | 24.5 |
| -20 | -28.9 | 26.3 |
| -18 | -27.8 | 28.2 |
| -16 | -26.7 | 30.2 |
| -14 | -25.6 | 32.2 |
| -12 | -24.4 | 34.3 |
| -10 | -23.3 | 36.5 |
| -8 | -22.2 | 38.7 |
| -6 | -21.1 | 41.0 |
| -4 | -20 | 43.4 |
| -2 | -18.9 | 45.9 |

## GENERAL INFORMATION – CONTINUED

### Table 2. Saturation Temperature/Pressure Data for HFC-410A Refrigerant. – Continued

| TEMPERATURE | | PRESSURE |
|---|---|---|
| DEG F | DEG C | PSIG |
| 0 | -17.8 | 48.4 |
| 2 | -16.7 | 51.1 |
| 4 | -15.6 | 53.8 |
| 6 | -14.4 | 56.6 |
| 8 | -13.3 | 59.5 |
| 10 | -12.2 | 62.4 |
| 12 | -11.1 | 65.5 |
| 14 | -10 | 68.6 |
| 16 | -8.9 | 71.9 |
| 18 | -7.8 | 75.2 |
| 20 | -6.7 | 78.7 |
| 22 | -5.6 | 82.2 |
| 24 | -4.4 | 85.8 |
| 26 | -3.3 | 89.6 |
| 28 | -2.2 | 93.4 |
| 30 | -1.1 | 97.4 |
| 32 | 0 | 101.4 |
| 34 | 1.1 | 105.6 |
| 36 | 2.2 | 109.9 |
| 38 | 3.3 | 114.3 |
| 40 | 4.4 | 118.8 |
| 42 | 5.6 | 123.4 |
| 44 | 6.7 | 128.2 |
| 46 | 7.8 | 133.0 |
| 48 | 8.9 | 138.0 |
| 50 | 10 | 143.2 |
| 52 | 11.1 | 148.4 |
| 54 | 12.2 | 153.8 |
| 56 | 13.3 | 159.3 |
| 58 | 14.4 | 164.9 |
| 60 | 15.6 | 170.7 |
| 62 | 16.7 | 176.6 |
| 64 | 17.8 | 182.7 |
| 66 | 18.9 | 188.9 |
| 68 | 20 | 195.2 |

## GENERAL INFORMATION – CONTINUED

**Table 2. Saturation Temperature/Pressure Data for HFC-410A Refrigerant. – Continued**

| TEMPERATURE | | PRESSURE |
|---|---|---|
| DEG F | DEG C | PSIG |
| 70 | 21.1 | 201.7 |
| 72 | 22.2 | 208.4 |
| 74 | 23.3 | 215.2 |
| 76 | 24.4 | 222.1 |
| 78 | 25.6 | 229.2 |
| 80 | 26.7 | 236.5 |
| 82 | 27.8 | 243.9 |
| 84 | 28.9 | 251.5 |
| 86 | 30 | 259.3 |
| 88 | 31.1 | 267.2 |
| 90 | 32.2 | 275.3 |
| 92 | 33.3 | 283.6 |
| 94 | 34.4 | 292.1 |
| 96 | 35.6 | 300.7 |
| 98 | 36.7 | 309.5 |
| 100 | 37.8 | 318.5 |
| 102 | 38.9 | 327.7 |
| 104 | 40 | 337.1 |
| 106 | 41.1 | 346.7 |
| 108 | 42.2 | 356.5 |
| 110 | 43.3 | 366.5 |
| 112 | 44.4 | 376.6 |
| 114 | 45.6 | 387.0 |
| 116 | 46.7 | 397.6 |
| 118 | 47.8 | 408.4 |
| 120 | 48.9 | 419.5 |
| 122 | 50 | 430.7 |
| 124 | 51.1 | 442.2 |
| 126 | 52.2 | 453.9 |
| 128 | 53.3 | 465.9 |
| 130 | 54.4 | 478.0 |
| 132 | 55.6 | 490.5 |
| 134 | 56.7 | 503.1 |
| 136 | 57.8 | 516.0 |
| 138 | 58.9 | 529.2 |

## GENERAL INFORMATION – CONTINUED

**Table 2. Saturation Temperature/Pressure Data for HFC-410A Refrigerant. – Continued**

| TEMPERATURE | | PRESSURE |
|---|---|---|
| DEG F | DEG C | PSIG |
| 140 | 60 | 542.6 |
| 142 | 61.1 | 556.3 |
| 144 | 62.2 | 570.3 |
| 146 | 63.3 | 584.5 |
| 148 | 64.4 | 599.1 |
| 150 | 65.6 | 613.9 |
| 152 | 66.7 | 629.0 |
| 154 | 67.8 | 644.4 |
| 156 | 68.9 | 660.2 |
| 158 | 70 | 676.3 |
| 160 | 71.1 | 692.7 |

**Table 3. IECU Cooling Capacity.**

| PARAMETER | SPECIFICATION |
|---|---|
| Minimum Cooling Capacity: | Total: 9,000 BTU/hr (Minimum) |
| | Sensible: 6,000 BTU/hr (Minimum) |
| Minimum Heating Capacity: | Total: 7,000 BTU/hr |

## AIRFLOW

There are two major paths for airflow:

1. Ambient outside air is drawn in and flows across the condenser coils to cool the refrigerant and is then returned to the outside.

2. Warm air from the shelter interior is drawn in and across the evaporator coils to cool the air. The cooled air is returned to the shelter interior.

## OPERATIONAL DESCRIPTION

The electrical wiring diagram (FO-1) and (FO-2), electric schematic (FO-3), and refrigeration schematic (FO-4), for the 9K BTU/hr IECU are provided at the end of this manual.

115 VAC power can be supplied to the IECU from either the control box on the evaporator side or from a power plug on the condenser side. If power is supplied from the condenser side at connector P3, power travels through the wiring harness W9 in the condenser section, then into wiring harness W17 through the evaporator section, and into wire harness W27 in the control panel were the power is supplied through a normally-closed relay K1 and then flows to connector CON3 on the power board (U1) as well as to heater and compressor relays K2 and K3.

Alternatively, if power is supplied from the evaporator side at connector P1, on the control panel, power travels through the wiring harness W32 in the control panel where the power is supplied to normally-open relay K1 as well as to the 120 VAC coil on the relay, to activate the relay, thus allowing the power to flow to connector CON3 of the power board (U1) as well as to heater and compressor relays K2 and K3 in the soft start box.

**OPERATIONAL DESCRIPTION – CONTINUED**

### OFF Mode Operation

When not being operated, the IECU should remain connected to power and the circuit breaker (CB1) powered ON so that the crankcase heater (HR1) can prevent refrigerant from absorbing into the oil during the compressor idle period. The crankcase heater (HR1) is actually activated at all times that the compressor (B1) is not being operated.

If the rotary MODE switch (S4) is set to OFF, thereby closing the connection between pin 10 and pin 2 in the remote control box or the same sockets on connector J17 in wiring harness W30, then the digital circuit board (U2) will turn on the crankcase heater (HR1). LED10 will illuminate, indicating that the digital circuit board (U2) is calling for power to the crankcase heater (HR1) by supplying 115 VAC to pins 1 and 2 of connector P7. Connector J6 plugs into connector P7 and the 115 VAC flows through wire harness W17 terminating at pins 7 and 8 on connector P8. Connector P8 connects to connector J8 and the 115 VAC flows through wire harness W1 terminating at connectors J31 (hot) and J38 (neutral). Single wire connectors J31 and J38 attach into connector P31 and P38 of the crankcase heater (HR1).

### VENT Mode Operation

If the rotary MODE switch (S4) is set to VENT, thereby closing the connection between pin 10 and pin 7 in the remote control box (or the same sockets on connector J17 in wiring harness W30), the digital circuit board (U2) will turn on the evaporator blower (B2) and the crankcase heater (HR1) as detailed below:

1. LED9 will light indicating that the digital circuit board (U2) is calling for power to the evaporator blower (B1) by supplying 115 VAC to pins 11 and 13 of connector P7. Connector J6 plugs into connector P7 and the 115 VAC flows through wire harness W17 terminating at pins 13 and 14 on connector P8. Connector P8 connects to connector J8 and the 115 VAC flows through wire harness W1 terminating at sockets 1 and 2 of connector J11 which is plugged into connector P11 of the soft start box. The evaporator blower (B2) power is routed through the soft start box by wire harness W44 and exits the soft start box at pins 1 and 2 of connector P34. Connector J34 of the evaporator blower (B2) assembly connects to connector P34 and supplies 115 VAC to the terminals of the blower motor.

2. LED10 will illuminate, indicating that the digital circuit board (U2) is calling for power to the crankcase heater (HR1) by supplying 115 VAC to pins 1 and 2 of connector P7. Connector J6 plugs into connector P7 and the 115 VAC flows through wire harness W17 terminating at pins 7 and 8 on connector P8. Connector P8 connects to connector J8 and the 115 VAC flows through wire harness W1 terminating at connectors J31 (hot) and J38 (neutral). Single wire connectors J31 and J38 attach into connector P31 and P38 of the crankcase heater (HR1).

### COOL Mode Operation

The IECU will enter COOL mode if the following conditions are met:

1. The rotary MODE switch (S4) is set to COOL, thereby closing the connection between pin 10 and pin 1 in the remote control box or the same sockets on connector J17 in wiring harness W30.

2. The thermostat is calling for cooling and the TEMPERATURE control thermostat (R1) on the remote control box is set to full cooling (full counter-clockwise), indicating that the evaporator-in thermistor assembly (RT1) has a resistance below 18.9kΩ as measured on connector P6, pins 13 and 14, of wiring harness W17.

3. The low-pressure cutoff switch (S3) is closed, indicating normal pressure, thereby closing the connection between sockets 11 and 12 on connector J5 of wiring harness W17.

4. The high-pressure cutoff switch (S2) is closed, indicating normal pressure, thereby closing the connection between sockets 9 and 10 on connector J5 of wiring harness W17.

## OPERATIONAL DESCRIPTION – CONTINUED

5. The compressor has been idle for 116 seconds to allow the condenser and evaporator pressure to equalize.

If the above conditions are met, the digital circuit board (U2) will turn on the compressor (B1), evaporator blower (B2), and condenser fans (B3 and B4), and turn off the crankcase heater (HR1) as detailed below:

1. LED10 will extinguish, indicating the digital circuit board (U2) is calling for the crankcase heater (HR1) to turn off by removing 115 VAC power from pins 1 and 2 of connector P7 (also in wiring harness W17).

2. LED11 will illuminate, indicating that the digital circuit board (U2) is calling for power to the soft starter by supplying 12 VDC control signal to the soft start box via wiring harness W17 and W1. The 12 VDC compressor control signal is sent to pins 14 and 16 of connector P7. Connector J6 plugs into connector P7 and the 12 VDC flows through wire harness W17 terminating at pins 15 and 17 on connector P8. Connector P8 connects to connector J8 and the 12 VDC flows through wire harness W1 terminating at sockets 4 and 6 of connector J11 which is plugged into connector P11 of the soft start box. The 12 VDC compressor control signal is routed through the soft start box by wire harness W44 to spade terminals 0 and 1 of the coil of relay K3 (the compressor relay). 115 VAC power to compressor relay K3 is always being supplied from the control box, from pins 3 and 4 of connector P4 on the back of the control box. Connector J4 of wiring harness W17 carries this 115 VAC power to pins 1 and 2 of connector P8. Connector J8 of wire harness W1 connects to P8 and carries this 115 VAC power to sockets 1 and 2 of connector J12. J12 connects into P12 on the soft start box and supplies 115 VAC to the soft start box for both heater assemblies (HR2 and HR3) and compressor (B1) power.

3. If the compressor fails to start on the first attempt, the control board will remove the 12 VDC signal from pins 14 and 16 in connector P7 on the power circuit board. The removal of the 12 VDC signal will de-energize the coil in relay K3, thus removing power from the compressor and soft starter. Then after a 116 second time delay, the control board will try to restart the compressor by reapplying the 12 VDC signal to pins 14 and 16 in connector P7 on the control board. The unit will keep trying to start the compressor in 116 second intervals until it has started successfully.

4. 4. Once the compressor has started, the unit waits for three seconds. Then, LED8 will illuminate, indicating that the control board (U2) is requesting power to the condenser fan assembly (B3 and B4) by supplying 115 VAC power to the fans via pins 3 and 9 of connector P7 for fan B3 and pins 4 and 10 of P7 for fan B4. Wire harness W17 carries this power from P7 to pins 9 and 11 of connector P8 for fan B3 and to pins 10 and 12 for fan B4. Wire harness W1 connects to connector P8 of wire harness W17 and then wire harness W1 routes the power to sockets A and B of connector J32 and sockets A and B of connector J33. Fan B3 is connected to J32 and fan B4 is connected to J33. The condenser fan assembly (B3 and B4) are identical and either assembly can be connected to either connector J32 or J33. The connection on the fan assembly is therefore labeled P32/P33 denoting that the fan assembly can be connected to either J32 or J33.

5. After two more seconds (five seconds total) time delay, LED9 will illuminate indicating that the digital circuit board (U2) is calling for power to the evaporator blower (B2) by supplying 115 VAC to pins 11 and 13 of connector P7. Connector J6 plugs into connector P7 and the 115 VAC flows through wire harness W17 terminating at pins 13 and 14 on connector P8. Connector P8 connects to connector J8 and the 115 VAC flows through wire harness W1 terminating at sockets 1 and 2 of connector J11, which is plugged into connector P11 of the soft start box. The evaporator blower (B2) power is routed through the soft start box by wire harness W44 and exits the soft start box at pins 1 and 2 of connector P34. Connector J34 of the evaporator blower (B2) connects to connector P34 and supplies 115 VAC to the terminals of the evaporator blower assembly (B2).

6. The control board (U2) will turn on the crankcase heater assembly (HR1) anytime the compressor cycles off and the soft start box assembly is not trying to start the compressor:

   a. LED10 will illuminate, indicating that the control board (U2) is calling for the crankcase heater (HR1) to turn on by applying AC power to pins 1 and 2 of connector P7.

## OPERATIONAL DESCRIPTION – CONTINUED

b. LED11 will extinguish, indicating that the control board (U2) is calling for the compressor to turn off by removing the 12 VDC control signal from pins 14 and 16 in connector P7 on the power board (U1). Removal of the 12 VDC control signal will de-energize the compressor relay coil and remove AC power from the soft starter and compressor.

c. After a ten second time delay, LED8 will extinguish, indicating that the control board (U2) is calling for the condenser fans (B3 and B4) to turn off by removing AC power from pins 3 and 9, and pins 4 and 10 in connector P7 on the power board (U1). LED9 will also extinguish, indicating that the control board (U2) is calling for the evaporator blower assembly (B2) to turn off by removing 115 VAC power from pins 11 and 13 of connector P7 on the power board (U1).

d. The unit will remain in an idle state similar to the OFF mode, with the exception that the high and low pressure switches (S2 and S3 respectively) are still enabled and capable of producing faults if tripped.

### HEAT Mode Operation

The IECU will enter HEAT mode if the following conditions are met:

1. The rotary MODE Switch (S4) is set to HEAT, thereby closing the connection between pin 10 and pin 5 in the remote control box or the same sockets on connector J17 in wiring harness W30.
2. The TEMPERATURE control thermostat (R1) is calling for heating and the temperature knob on the remote is set to the highest possible temperature, indicates that the evaporator-in thermistor on connetor P6 pins 13 and 14 of wiring harness W17 has a resistance greater than 6.13KΩ.
3. The low-pressure (cutoff) switch assembly (S3) is closed indicating normal pressure, thereby closing the connection between sockets 11 and 12 on connector J5 of wiring harness W17.
4. The high-pressure (cutoff) switch assembly (S2) is closed indicating normal pressure, thereby closing the connection between sockets 9 and 10 on connector J5 of wiring harness W17.

Then the control board (U2) will turn on the evaporator blower (B2), the heater assemblies (HR2 and HR3), and the crankcase heater (HR1) as detailed below:

1. LED9 will illuminate and LED10 will light or remain lit indicating that the control board (U2) is calling for power to the evaporator blower (B2) by supplying 115 VAC to pins 11 and 13 of connector P7. Connector J6 plugs into connector P7 and the 115 VAC flows through wire harness W17 terminating at pins 13 and 14 on connector P8. Connector P8 connects to connector J8 and the 115 VAC flows through wire harness W1 terminating at sockets 1 and 2 of connector J11 which is plugged into connector P11 of the soft start box. The evaporator blower (B2) power is routed through the soft start box by wire harness W44 and exits the soft start box at pins 1 and 2 of connector P34. Connector J34 of the evaporator blower (B2) connects to connector P34 and supplies 115 VAC to the terminals of the evaporator blower (B2).
2. The control board (U2) will call for the crankcase heater (HR1) to turn on by supplying 115 VAC power to pins 1 and 2 of connector P7 also in wiring harness W17.
3. After a three second delay, LED12 will light indicating that the control board (U2) is calling for power to the heater assemblies (HR2 and HR3) by supplying 12 VDC control signal to the soft start box via wiring harness W17 and W1. The 12 VDC heater control signal is sent to pins 15 and 16 of connector P7. Connector J6 plugs into connector P7 and the 12 VDC flows through wire harness W17 terminating at pins 16 and 17 on connector P8. Connector P8 connects to connector J8 and the 12 VDC flows through wire harness W1 terminating at sockets 4 and 5 of connector J11 which is plugged into connector P11 of the soft start box. The 12 VDC heater control signal is routed through the soft start box by wire harness W44 to spade terminals 0 and 1 of the coil of relay K2 (the heater relay). 115 VAC power to heater relay K2 is always being supplied from the control box assembly, from pins 3 and 4 of connector P4 on the back of the control box

**OPERATIONAL DESCRIPTION – CONTINUED**

assembly. Connector J4 of wiring harness W17 carries this 115 VAC power to pins 1 and 2 of connector P8. Connector J8 of wire harness W1 connects to P8 and carries this 115 VAC power to sockets 1 and 2 of connector J12. J12 connects into P12 on the soft start box and supplies 115 VAC to the soft start box and feeds the 115 VAC to both the heater and compressor relays (K2 and K3 respectively).

## THEORY OF OPERATION OF THE CONTROL ELECTRONICS

### Connectivity

The electrical control of the IECU, including all safety shut-downs, is controlled by the power board (U1) and the control board (U2). In addition the compressor has a current/temperature safety device which will automatically trip if either the current or the compressor temperature is excessive. This safety device is located in the wiring junction box of the compressor. In addition a circuit breaker is located in the electrical box. These two circuit boards are used in all variants of the Mainstream IECUs ranging from 9,000 BTU/hr through 36,000 BTU/hr.

Connector P6 carries the low voltage control and sensing information from thermistors, transducers, cut-outs and the high pressure momentary reset switch (S1) to the power board (U1), via wiring harness W17. Connector CON2 connects the control board (U2) to the power board (U1).

Connector CON3 is used to supply 115 VAC power to the power board (U1), via pins 1 and 2. For this 115 VAC 9,000 BTU IECU application, the three-phase jumper is not used and the 240 VAC jumper is not used.

Connector P7 supplies 115 VAC line power to the condenser fans (B3 and B4), the crankcase heater (HR1), and evaporator blower (B2). (Evaporator blower power passes through the soft start box but is controlled by the power board (U1).) Connector J4 (pins 3 and 4 and wiring harness W17) provides 115 VAC line power to the soft start box. The soft start box then directs this line power to the heater and compressor/soft starting circuits via relays (relays) K2 and K3. Connector P7 also supplies low-voltage control signals for activating the heater and compressor relays in the soft start box.

Connector CON9 communicates with the remote control box via wire harness W30. Connector CON10 communicates with the diagnostic connector (J2) on the evaporator side of the IECU, via wire harness W31.

### Initial Power Up - Phase Sequence Check

1. When the power board (U1) initially receives power, the evaporator blower (B2), condenser fans (B3 and B4), compressor, heater assemblies (HR 2 and HR 3), and crankcase heater (HR1) controls are set to off.

2. A check is made to determine if proper phasing of the neutral and hot legs exists and if a proper electrical ground is detected. If the ground is not connected or the ground is missing or the neutral and hot legs have improper phasing, the green LED on the remote control box flashes and the RED LED6 or RED LED7 will illuminate for a missing ground or phase fault respectively. The IECU is forced into OFF mode until the electrical fault is corrected.

3. LED1 is illuminated green to indicate the 5 volt power supply is functioning properly. If not illuminated, the IECU will not operate.

4. LED2 is illuminated green to indicate the 12 volt power supply is functioning properly. If not illuminated, the IECU will not operate (other board LEDs may light but unit will not function).

5. LED6 and LED7 must not be illuminated if the IECU is to operate. However, the IECU will operate in COOL mode with diagnostic thermistor or pressure transducer faults (LED17 through LED21). However, HEAT mode will be disabled if LED19 illuminates, since this the evap in thermistor (thermistor assembly (RT1)) is used to prevent a heater over-temperature condition. A fault with this thermistor results in a heater over-temperature condition that would not be detectable.

## THEORY OF OPERATION OF THE CONTROL ELECTRONICS – CONTINUED

6. If the phase sequence check passes, the control board (U2) waits four seconds before continuing operations. The next step depends of the position of the rotary MODE switch (S4), either in HEAT, OFF/RESET, VENT, or COOL position.

### When the Rotary MODE Switch (S4) is set to OFF

1. When the user selects OFF/RESET mode, the unit enters the OFF mode.
2. LED10 is illuminated green indicating the crankcase heater (HR1) is powered, and 115 VAC is supplied to pins 1 and 2 of connector P7.
3. The evaporator blower (B2), compressor, and condenser fans (B3 and B4) are all turned OFF or remain off.
4. The unit stays in the OFF mode until the user selects a different mode using the rotary MODE switch (S4) on the remote control box. The user can select between the other modes of HEAT, VENT, and COOL.
5. If the mode is changed, the unit remains in the OFF mode for 2 addition seconds before continuing onto the newly selected mode.

### When the Rotary MODE Switch (S4) is set to VENT

1. When the user selects VENT mode by setting the rotary MODE switch (S4) to the VENT position, the unit is automatically placed in the OFF mode for two seconds. Then it is placed into the VENT mode.
2. In the VENT mode, the crankcase heater (HR1) and evaporator blower (B2) are both turned on, and the other controls are turned off.
3. LED9 is illuminated green indicating the evaporator blower (B2) is powered, and 115 VAC is supplied to pins 11 and 13 of connector P7.
4. LED10 is illuminated green indicating the crankcase heater (HR1) is powered, and 115 VAC is supplied to pins 1 and 2 of connector P7.
5. The unit stays in this mode until the user selects a different mode using the rotary MODE switch (S4) on the remote control box. The user can select between the other modes of HEAT, OFF, and COOL.
6. If the mode is changed, the unit returns to OFF mode for 2 seconds before continuing on to the newly selected mode.

### When the Rotary MODE Switch (S4) is set to COOL

1. When the user selects COOL mode by setting the rotary MODE switch (S4) to the COOL position, the unit is automatically placed in the OFF mode for 2 seconds. Then it is placed into the COOL mode.
2. If the evaporator inlet air temperature, measured by thermistor assembly (RT1), is greater than the remote temperature setting and the compressor has been off for 116 seconds, then:
   a. The compressor is turned on and the crankcase heater (HR1) is turned off:
      (1) LED11 is illuminated Green.
      (2) Low Voltage 12 VDC control power to the soft start box is supplied to pins 14 and 16 of connector P7 to activate the soft start relay (K3).
      (3) LED10 is turned off.
      (4) Line power to the crankcase heater (HR1) via pins 1 and 2 of connector P7 is deactivated.

## THEORY OF OPERATION OF THE CONTROL ELECTRONICS – CONTINUED

(5) The compressor is forced to run for at least 2 minutes each time it is turned on unless a fault occurs.

(6) If the compressor fails to start or stops running (not caused by a fault), an attempt every 116 seconds will be made to restart it. While the compressor is off, the evaporator blower (B2) and condenser fans (B3 and B4) will also be off.

b. Three seconds after the compressor starts, the condenser fans (B3 and B4) are activated:

(1) LED8 is illuminated Green.

(2) Line power is supplied to pins 3 and 9 of connector P7 to activate condenser fan (B3) and line power is supplied to pins 4 and 10 of connector P7 to activate condenser fan (B4). If the refrigerant temperature measured by the bullet thermistor assembly (RT3) is less than 37 °F the condenser fans are turned off and only turned back on when the measured temperature is greater than or equal to 42 °F.

(3) After a delay of 2 seconds, the evaporator blower B2 is activated. If the evaporator inlet air temperature, measured by thermistor assembly (RT1), is less than 110 °F the evaporator blower (B2) is activated continuously. If the evaporator inlet air temperature is greater than 110 °F and less than 120 °F, then the evaporator fan (B2) is activated for 10 seconds on and 20 seconds off. If the evaporator inlet air temperature is greater than 120 °F, then the evaporator fan is activated for 5 seconds on and 20 seconds off. LED9 is illuminated Green when the evaporator blower (B2) is on.

(4) Line power is supplied to pins 11 and 13 of connector P7 to power the evaporator blower (B2) fan.

(5) The compressor, condenser fan, and evaporator blower remain powered (but compressor may cycle due to high side pressure and evaporator coil temperature (Table 6), evaporator blower (B2) may cycle due to evaporator air inlet temperatures (Table 4), and the condenser fans (B3 and B4) may cycle due to high side pressure (Table 5)) until the thermostat, an alarm condition, or a change in the rotary MODE switch (S4) turn them all off.

**Table 4. Evaporator Blower Cycling in COOL Mode.**

| Indoor Temperature Range | < 110 °F | | 110 - 120 °F | | > 120 °F | |
|---|---|---|---|---|---|---|
| | ON Time (seconds) | OFF Time (seconds) | ON Time (seconds) | OFF Time (seconds) | ON Time (seconds) | OFF Time (seconds) |
| | Continuous | N/A | 10 | 20 | 5 | 20 |

**Table 5. Condenser Fan Cycling in COOL Mode.**

| | High Side Pressure | |
|---|---|---|
| Cycling | ON (PSIG) | OFF (PSIG) |
| | > 550 | < 200 |

## THEORY OF OPERATION OF THE CONTROL ELECTRONICS – CONTINUED

**Table 6. Compressor Cycling in COOL Mode.**

| | High Side Pressure/Evaporator Coil Temp °F | |
|---|---|---|
| Cycling | ON (PSIG) | OFF (PSIG/Evaporator Coil Temp) |
| | > 83 | < 82/40 |

### NOTE

If the compressor failed to start, the condenser fans are not activated, the compressor is turned off and the crankcase heater (HR1) is turned back on. The unit will wait in this mode for another 116 seconds before attempting to restart the compressor.

c. If the evaporator inlet temperature drops 2 degrees below the remote temperature setting:

(1) The compressor turns off and crankcase heater (HR1) turns on:

(a) LED11 is turned off.

(b) Low voltage 12 VDC control power to the soft start box is removed from pins 14 and 16 of connector P7.

(c) LED10 is illuminated Green.

(d) Line power to the crankcase heater (HR1) via pins 1 and 2 of connector P7 is activated.

(2) After a delay of 10 seconds, the evaporator blower (B2) and condenser fans (B3 and B4) are turned off:

(a) LED9 is turned off.

(b) Line power is removed from pins 11 and 13 of connector P7 to turn off the evaporator blower (B2) fan.

(c) LED8 is turned off.

(d) Line power is removed from pins 3 and 9 of connector P7 to deactivate condenser fan (F1) and line power is removed from pins 4 and 10 of connector P7 to deactivate condenser fan (F2).

(e) The unit remains in COOL mode. The unit will start up again once thermistor assembly (RT1) (evaporator air inlet temperature sensor) measures an inlet air temperature above the remote temperature setting.

d. If the High-Pressure or Low-Pressure Cut Out fault lights, namely red LED15 or LED16 are illuminated, the compressor will not operate. The unit will place itself in VENT mode until the fault is cleared or another mode is selected.

**When the Rotary MODE Switch (S4) is set to HEAT**

1. When the user selects HEAT mode, by rotating the selector switch to the HEAT mode position, the unit is automatically placed in the OFF mode for 2 seconds. Then it is placed into HEAT mode.

2. The unit enters HEAT mode:

**THEORY OF OPERATION OF THE CONTROL ELECTRONICS – CONTINUED**

a. The crankcase heater (HR1) is either activated or remains activated:

(1) LED10 is illuminated green indicating the crankcase heater (HR1) is powered.

(2) 115 VAC is supplied to pins 1 and 2 of connector P7 to power the crankcase heater (HR1).

b. If the evaporator inlet air temperature, measured by thermistor assembly (RT1), indicates an air temperature that is less than the remote setpoint temperature, the evaporator fan is turned on:

(1) LED9 is illuminated green indicating the evaporator fan is turned on.

(2) 115 VAC is supplied to pins 11 and 13 of connector P7 to power the evaporator blower (B2).

c. After the 3 seconds, the heater assemblies (HR2 and HR3) are turned on:

(1) LED12 is illuminated green indicating the heaters are turned on.

(2) Low voltage 12 VDC control power is supplied to pins 15 and 16 of connector P7 to activate the heater relay (K2) which is located in the soft start box.

d. If the evaporator inlet air temperature, measured by thermistor assembly (RT1), indicates an air temperature that is greater than the set point temperature by 2 degrees, the heater assemblies (HR2 and HR3) are turned off.

e. 10 seconds later, the evaporator fans (B3 and B4) are turned off.

f. If an alarm occurs or the user changes modes, both the heater and evaporator fan are turned off together.

3. If LED14 heater overheat alarm is present, HEAT mode will not operate. The unit will be forced to run in VENT mode until another mode is selected or the fault is cleared.

**Summary of LED Indicators**

LED1 illuminated Green - Normal - Denotes 5 VDC power supply output is good.

LED2 illuminated Green - Normal - Denotes 12 VDC power supply output is good.

LED3 illuminated Green - Normal - Denotes 115 VAC hot is detected.

LED4 off - Normal - Denotes no phase B detected.

LED5 off - Normal - Denotes no phase C detected.

LED6 illuminated RED - Fault - Denotes no ground detected.

LED7 illuminated RED - Fault - Phase Error - Denotes hot and neutral reversed.

LED8 illuminated Green - Denotes condenser fans should be operating.

LED9 illuminated Green - Denotes evaporator blower (B2) should be operating.

LED10 illuminated Green - Denotes crankcase heater (HR1) should be powered on.

LED11 illuminated Green - Denotes compressor should be operating.

LED12 illuminated Green - Denotes heater should be operating.

LED13 - Not Used.

LED14 illuminated RED - Heater Overheat - Denotes air temperature around heaters is too hot indicating that the evaporator blower (B2) is not operating or evaporator air flow is restricted, during heater operation.

LED15 illuminated RED - Fault - If in COOL mode and the low pressure switch assembly (S3) opens. The low pressure switch assembly opens at 15 PSIG +/- 5 PSIG and automatically resets (closes) at 42 PSIG +/- 5 PSIG.

## THEORY OF OPERATION OF THE CONTROL ELECTRONICS – CONTINUED

LED16 illuminated RED - Fault - If in COOL mode and the high pressure switch assembly (S2) opens. The high pressure switch assembly (S2) opens at 725 PSIG. Fault is not reset until pressure drops below 490 PSIG and manual reset button (momentary switch assembly (S1)) on condenser side of IECU is depressed.

LED17 illuminated RED - Fault - If Low Pressure transducer is indicating unrealistic pressures less than 37.5 PSIG or above 712.5 PSIG. Will not prevent IECU from operating in cool mode as long as LED21 is not illuminated as well.

LED18 illuminated RED - Fault - If high pressure transducer assembly (MT2) is indicating unrealistic pressures (less than 37.5 PSIG or above 712.5 PSIG). Will not prevent IECU from operating.

LED19 illuminated RED - Fault - If evaporator air inlet temperature thermistor assembly (RT1) is indicating unrealistic temperature (under -50 °F or above 300 °F). Will only prevent IECU from operating in HEAT mode.

LED20 illuminated RED - Fault - If evaporator air outlet temperature thermistor assembly (RT2) is indicating unrealistic temperature (under -50 °F or above 300 °F). Will prevent IECU from operating.

LED21 illuminated RED - Fault - If bullet thermistor assembly (RT3) is indicating unrealistic temperature under -50 °F or above 300 °F. Will not prevent IECU from operating in COOL mode as long as LED17 is not also illuminated.

**END OF WORK PACKAGE**

# CHAPTER 2

# OPERATOR INSTRUCTIONS

## OPERATOR MAINTENANCE

## DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

### CONTROLS AND INDICATORS

The following tables and illustrations provide the description and use of the controls and indicators pertaining to the 9K IECU.

### VENT CONTROLS

The 9K BTU/hr IECU vent controls are depicted in Figure 1 and described in Table 1.

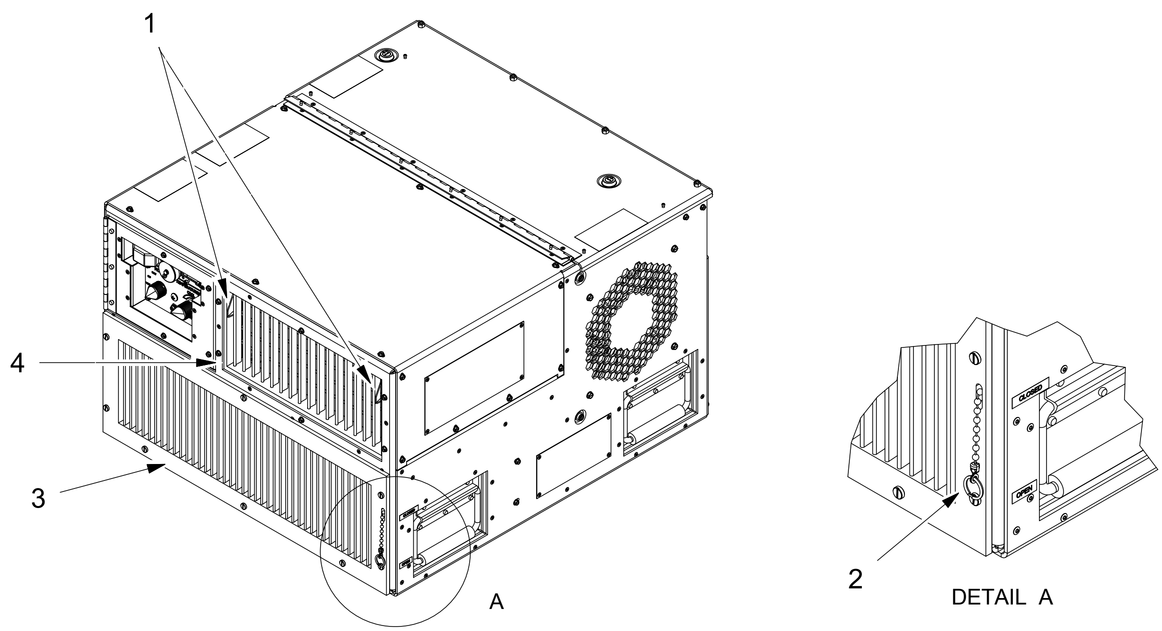



**Figure 1. 9K BTU/hr IECU Vent Controls.**

**Table 1. 9K BTU/hr IECU Vent Controls.**

| KEY | CONTROL/INDICATOR | FUNCTION |
|---|---|---|
| 1 | Vent control lever | Adjusts volume and direction of cooling air. |
| 2 | Fresh air duct door ball chain | Adjusts fresh air duct duct door. In CLOSED position, no outside air is mixed with shelter air, and shelter air recirculates. In OPEN position, fresh outside air is introduced. OPEN position is adjustable. |
| 3 | Return grille | Adjusts volume and direction of conditioned air. |
| 4 | Supply grille | Adjusts direction of inlet air. |

### OPERATING CONTROLS AND INDICATORS

The 9K BTU/hr IECU operating controls and indicators are depicted in Figure 2 and described in Table 2.

## OPERATING CONTROLS AND INDICATORS – CONTINUED

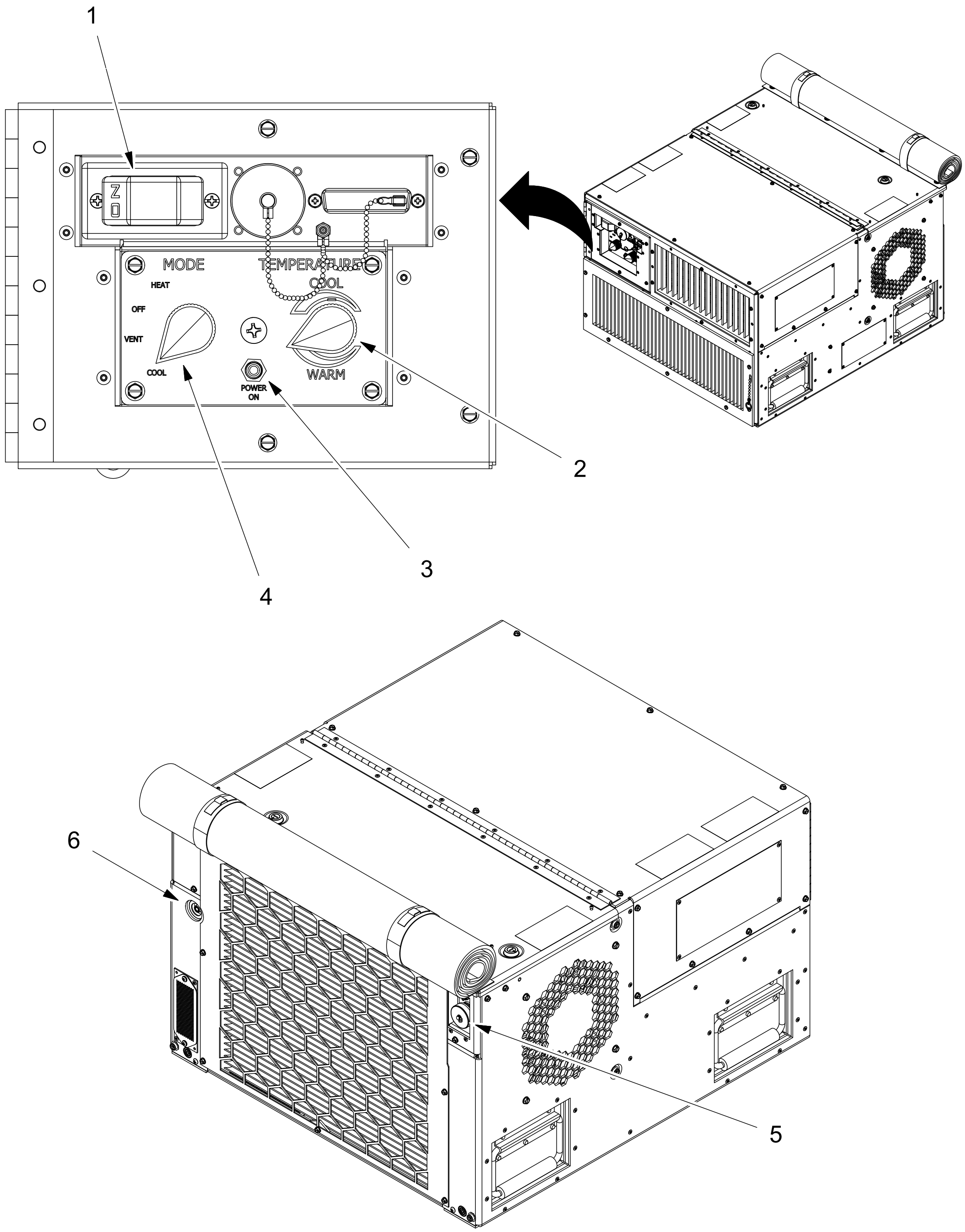



Figure 2. 9K BTU/hr IECU Operating Controls and Indicators.

## OPERATING CONTROLS AND INDICATORS – CONTINUED

### Table 2. 9K BTU/hr IECU Operating Controls and Indicators.

| KEY | CONTROL/INDICATOR | FUNCTION |
|---|---|---|
| 1 | Main circuit breaker (CB1) | Connects and disconnects power. Protects IECU from excessive current. |
| 2 | TEMPERATURE control thermostat (R1) | Provides adjustment of the conditioned air temperature (from COOL to WARM) while operating in either the COOL or HEAT modes. |
| 3 | POWER ON indicator | Indicates power is ON. When blinking, may indicate occurrence of some malfunctions. |
| 4 | Rotary MODE switch (S4) | Provides selection of unit operating modes (COOL, VENT, OFF/ RESET, or HEAT). |
| 5 | High pressure reset switch | Allows the system to restart after pressure has returned to a safe operating level. |
| 6 | Sight glass | Indicates condition of the refrigerant. |

**END OF WORK PACKAGE**

## OPERATOR MAINTENANCE

## OPERATION UNDER USUAL CONDITIONS

**INITIAL SETUP:**

**Personnel Required**

Operator (1)

**References**

WP 0004
WP 0007
WP 0008

### OPERATING PROCEDURES

**Power Up**

**CAUTION**

Operate the IECU in the OFF, VENT, or HEAT mode for a minimum of four hours before the unit is placed into COOLING service if left disconnected from power for more than four hours. This is necessary for the compressor crankcase heater assembly to heat the compressor oil, to remove dissolved refrigerant that accumulates in the oil during long periods of storage or when not connected to power. Any mode other than COOL will provide heating of the crankcase oil during this warm-up period.

1. Ensure that input power cable is connected to proper voltage source.
2. Ensure that an input power cable is connected to at least one of the two input power receptacles on the IECU.
3. Set the rotary MODE switch (S4) to OFF.
4. Set the circuit breaker (CB1) to ON.

**NOTE**

- It is normal for the compressor to be cycling ON and OFF during low outdoor temperature operation in COOL mode ONLY. This is to prevent evaporator coil frost. Two minute minimum ON time and two minute minimum OFF time applies.
- It is normal for the evaporator fan to be cycling ON and OFF during high indoor temperature operation in COOL mode ONLY. It is independent of outdoor temperature. In COOL mode the entire unit will shut down (including the evaporator fan) any time the room temperature reaches the thermostat set point.
- It is normal for the condenser fans to be cycling ON and OFF during low outdoor temperature operation in COOL mode ONLY.
- In HEAT and VENT mode, the evaporator fan should never turn off.

5. Set the rotary MODE switch (S4) to the proper position for necessary mode of operation, as follows:
   a. **VENT Mode.** Evaporator blower assembly (B2) and crankcase heater assembly (HR1) are each energized and condenser fan assembly (B3 and B4), compressor (B1), and heater assemblies (HR2 and HR3) are always de-energized. TEMPERATURE control thermostat (R1) does not control evaporator blower (B2). If evaporator blower assembly (B2) is not operating, refer to WP 0008.

**OPERATING PROCEDURES – CONTINUED**

## NOTE

- A time delay of approximately 2 seconds should be allowed for compressor (B1) to start in COOL mode.
- Allow compressor to operate for a minimum of five minutes in COOL mode before changing modes.

b. **COOL Mode.** Evaporator blower (B2), condenser fans (B3 and B4), and compressor (B1) are energized and crankcase heater assembly (HR1) is de-energized when the evaporator inlet air temperature is warmer than the setpoint temperature prescribed by the TEMPERATURE control thermostat (R1). Heater assemblies (HR2 and HR3) are always de-energized. Condenser fan assembly (B3 and B4), compressor (B1), and evaporator blower assembly (B2) are each de-energized and crankcase heater assembly (HR1) is energized when the evaporator inlet air temperature is cooler than the setpoint temperature prescribed by the TEMPERATURE control thermostat (R1).

c. **HEAT Mode.** Evaporator blower (B2) and heater assemblies (HR2 and HR3) are energized when the evaporator inlet air temperature is cooler than the setpoint temperature prescribed by the TEMPERATURE control thermostat (R1). Condenser fan assembly (B3 and B4) and compressor (B1) are always de-energized while crankcase heater assembly (HR1) is always energized. Evaporator blower assembly (B2) and heater assemblies (HR2 and HR3) are each de-energized when the evaporator inlet air temperature is warmer than the setpoint temperature prescribed by the TEMPERATURE control thermostat (R1).

d. **OFF Mode.** All operating functions of IECU are de-energized except for crankcase heater assembly (HR1), which is always energized.

6. Adjust the setpoint temperature by turning the TEMPERATURE control thermostat (R1) on the remote box assembly to COOL or WARM. The coolest setting corresponds to 60 °F and the warmest setting to 90 °F. The midpoint corresponds to approximately 75 °F.
7. If unit fails to operate as specified during normal operating procedures, refer to Troubleshooting Index (WP 0007).

**Shut Down**

1. Set the rotary MODE switch (S4) to OFF.
2. Set the circuit breaker (CB1) to OFF.
3. Disconnect power cable from power source.
4. Disconnect power cable from power recepticle on IECU (P1 or P3).

**END OF TASK**

**END OF WORK PACKAGE**

## OPERATOR MAINTENANCE
## OPERATION UNDER UNUSUAL CONDITIONS

**INITIAL SETUP:**

**Personnel Required**

Operator (1)

**Equipment Condition**

IECU is powered up (WP 0005)

### UNUSUAL ENVIRONMENT/WEATHER

#### Operation in Extreme Heat

When operating the IECU in temperatures of 120 °F or higher, extra care should be taken to minimize the cooling load. Some of the precautions that may be taken are:

1. Check all openings in the shelter or enclosure, especially doors and windows, to make sure they are tightly closed.
2. Limit in and out traffic, if possible.
3. When possible, use shades or awning to shut out direct rays of the sun.
4. Limit the use of electric lights and other heat producing equipment.

   If the shelter temperature exceeds 110 °F, and the IECU is in COOL mode, the evaporator blower will cycle on and off to prevent the condensing pressure from becoming too high. This is normal operation, and the shelter temperature will steadily drop. Once the shelter temperature drops below 110 °F, normal evaporator blower operation will resume.

   In extreme heat, temperatures exceeding 120 °F, the compressor may fail to start on the first attempt. The unit will try to restart the compressor indefinitely at a preset interval until it starts. The periodic starting of the compressor is completely normal and does not indicate that the compressor is broken.

#### Operation In Extreme Cold

When operating the IECU in temperatures of 20 °F or lower, extra care should be taken to minimize the heating load. Some of the precautions that may be taken are:

1. Check all openings in the shelter or enclosure, especially doors and windows, to make sure they are tightly closed.
2. Limit in and out traffic, if possible.
3. Do not try to maintain a shelter temperature any higher than is necessary.

   In extremely cold environments, the condenser fans may cycle on and off when the IECU is operated in COOL mode. This is to prevent the evaporator coil from freezing. The IECU will still provide sufficient cooling to the shelter in this condition.

#### Operation in Dusty Conditions

Operating the IECU in dusty and sandy conditions can seriously reduce efficiency by clogging the air filters, which will restrict the volume of airflow. Accumulation of dust or sand in the condenser coil and/or in the compressor compartment may cause overheating of the refrigeration system. Dust or sand may also clog the condensate water drain lines. When operating the IECU in dusty and sandy conditions, perform the following steps:

## UNUSUAL ENVIRONMENT/WEATHER – CONTINUED

1. Frequently clean air filter, condenser coil, evaporator coil, and all other areas of dust and sand accumulation.
2. Limit the amount of outside air introduced into the shelter through the fresh air duct door.

### Nuclear, Biological, and Chemical (NBC) Conditions

1. Check all openings in the shelter or enclosure, especially doors and windows, to make sure they are tightly closed.
2. Close and secure the fresh air duct door.
3. Perform other locally prescribed procedures as required.

**END OF TASK**

**END OF WORK PACKAGE**

# CHAPTER 3

# OPERATOR TROUBLESHOOTING PROCEDURES

# OPERATOR MAINTENANCE

# OPERATOR TROUBLESHOOTING INDEX

## INTRODUCTION

This work package contains operator (field) troubleshooting information for locating and correcting most of the operating troubles that may develop in the 9K BTU/hr IECU. Each symptom for a part, assembly, or subassembly is followed by a list of malfunctions, which will help you to determine the corrective actions to take. You should perform the corrective actions in the order listed.

This manual cannot list all possible malfunctions that may occur, nor all tests nor inspections and corrective actions. If a malfunction is not listed (except when the malfunction or cause is obvious) or is not corrected by the listed corrective actions, notify Field Maintenance. IECU malfunctions are indexed below to provide a quick reference to corrective actions located in WP 0008.

## SYMPTOM TROUBLESHOOTING PROCEDURES INDEX

**Malfunction/Symptom** **Troubleshooting Procedure**

**IECU FAILS TO OPERATE IN VENT MODE**



**IECU RUNS BUT WILL NOT COOL OR HEAT SHELTER AS NEEDED**



**END OF WORK PACKAGE**

## OPERATOR MAINTENANCE
## TROUBLESHOOTING PROCEDURES

**INITIAL SETUP:**

**Personnel Required**

Operator (1)

**References**

WP 0004

**References - cont'd**

WP 0012

**Equipment Condition**

IECU is powered up (WP 0005)

### TROUBLESHOOTING PROCEDURE(S)

**Operator**

**SYMPTOM**

IECU FAILS TO OPERATE IN VENT MODE

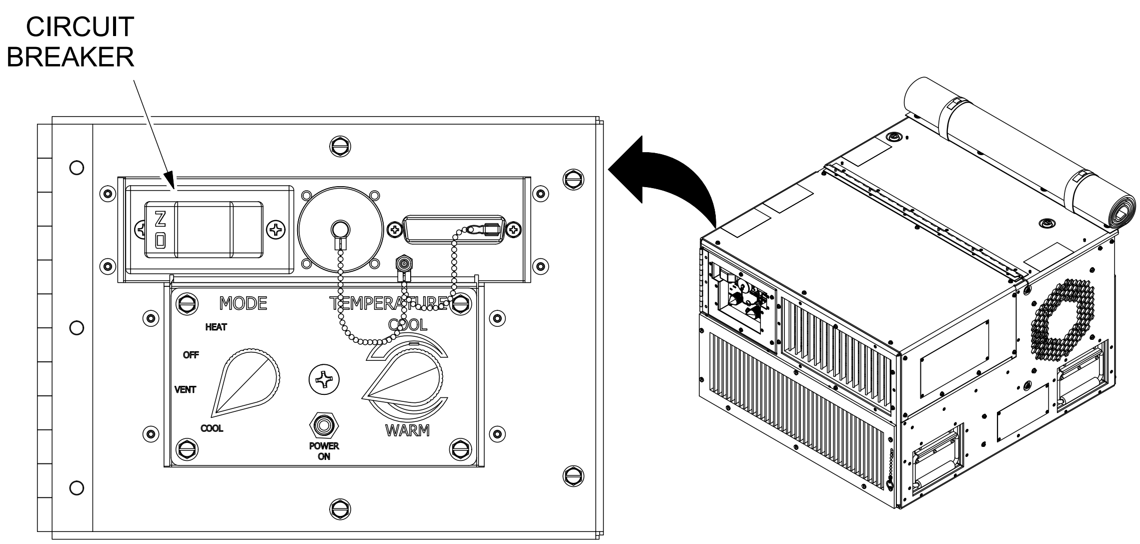



**Figure 1. Circuit Breaker CB1.**

**MALFUNCTION**

No Input Power to Unit

**CORRECTIVE ACTION**

STEP 1. Inspect the power cable for frayed wires or any visible damage. If any damage is observed, notify Field level Maintenance.

## TROUBLESHOOTING – CONTINUED

STEP 2. Verify that the power cable is securely connected to the IECU at either the condenser or evaporator side of IECU.

STEP 3. If the IECU does not operate, continue to next malfunction.

**MALFUNCTION**

Main Circuit Breaker (CB1) OFF or TRIPPED

**CORRECTIVE ACTION**

STEP 1. Verify circuit breaker (CB1) (Figure 1) is ON by resetting it.

STEP 2. Verify the unit is properly powered as indicated by a steady green light on the remote control box:

a. If the green light is not illuminated, contact Field Maintenance for repair. If possible, you can try switching the power connection from one side of the IECU to the other (from the condenser side to evaporator side or vice-versa) as follows:

(1) Set the circuit breaker (CB1) to OFF.

(2) Unplug the power cable from the power source.

(3) Switch the power connection at the IECU. For example, if it is connected at the evaporator side, then connect it at the condenser side.

(4) Plug the power cable into the power source.

(5) Set the circuit breaker (CB1) to ON.

(6) If the green light is illuminated and not blinking, then the unit can be safely operated from this power connection until Field Maintenance can repair the unit.

b. If the green light is blinking, the power source may be improperly wired. Set the circuit breaker (CB1) to OFF and notify Field Maintenance.

STEP 3. If circuit breaker (CB1) is ON and IECU does not operate, continue to next malfunction.

STEP 4. If circuit breaker (CB1) trips again, notify Field Maintenance.

**MALFUNCTION**

Air Flow Is Restricted

**CORRECTIVE ACTION**

STEP 1. Inspect the exterior of the condenser and evaporator to be certain the condenser and evaporator air flow paths are clear.

STEP 2. Verify the evaporator supply and return grille louvers are open and unrestricted.

STEP 3. Verify the evaporator outlet grille louvers are open and unrestricted.

STEP 4. Clean and replace the air filter if necessary (WP 0012).

STEP 5. If problem persists notify Field Maintenance.

**SYMPTOM**

IECU RUNS BUT WILL NOT COOL OR HEAT SHELTER AS NEEDED

## TROUBLESHOOTING – CONTINUED

### MALFUNCTION

Fresh Air Duct Door Fully Open

#### CORRECTIVE ACTION

STEP 1. Close fresh air duct door (WP 0004). If cooling or heating remains inadequate, continue to Step 2.

STEP 2. Set the rotary MODE switch (S4) to VENT:

a. If the evaporator blower starts after 10 seconds, continue to step 3.

b. If the evaporator blower does not start after 10 seconds, turn the rotary MODE switch (S4) to OFF position and notify Field Maintenance.

STEP 3. Set the rotary MODE switch (S4) to HEAT or COOL. If the system does not properly heat or cool, then set the rotary MODE switch (S4) to OFF and notify Field Maintenance.

### MALFUNCTION

Shelter Is Not Well Sealed

#### CORRECTIVE ACTION

Seal shelter as required at the IECU connection:

1. If the system does not properly heat or cool notify Field Maintenance.
2. If condition is corrected no further action.

**END OF WORK PACKAGE**

# CHAPTER 4

# OPERATOR MAINTENANCE INSTRUCTIONS

## OPERATOR MAINTENANCE

## OPERATOR PMCS INTRODUCTION

**INITIAL SETUP:**

**Personnel Required**

Operator (1)

**References**

WP 0010

### GENERAL

A Preventive Maintenance Checks and Services (PMCS) table is provided in WP 0010. Following the procedures in the table ensures the equipment is kept in good operating condition and ready for its primary mission.

Always observe the WARNINGS and CAUTIONS appearing in the PMCS tables. WARNINGS and CAUTIONS appear before applicable procedures. These WARNINGS and CAUTIONS must be observed to prevent serious personal injury or to prevent equipment damage.

### PMCS PROCEDURES TABLE

**Item Number Column.** Numbers in this column are for reference. When completing DA Form 2404/5988E, Equipment Inspection and Maintenance Worksheet, include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for the intervals listed.

**Interval Column.** This column describes when the procedure in the Procedure column must be done.

BEFORE (B) - Checks and services performed prior to the equipment leaving its containment area or performing its intended mission.

WEEKLY (W) - Checks and services to be performed on a weekly basis.

MONTHLY (M) - Checks and services to be performed on a monthly basis.

DURING (D) - Checks and services begin when the equipment is being used in its intended mission.

**Item to be Checked or Serviced Column.** This column provides the item to be checked or serviced.

**Procedure Column.** This column provides the procedure to check or service the item listed in the Item to be Checked or Serviced column to know if the equipment is ready or available for its intended mission or for operation. The procedure must be done at the time stated in the Interval column.

**Equipment NOT READY/AVAILABLE IF Column.** Information in this column describes what faults will keep the equipment from being capable of performing its primary mission. If check and service procedures are accomplished that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

### Order in Which PMCS Will be Done

The ITEM NO. column of WP 0010, Table 1. shows the corresponding order in which to perform the PMCS.

### FLUID LEAKAGE

It is necessary for you to know how fluid leakage affects the status of the 9K IECU. Following are type/classes of leakage you need to know to be able to determine the status of the 9K IECU. Learn these leakage definitions and remember - when in doubt, notify your supervisor. Equipment operation is allowed with minor leakage (Class I or II). Consideration must be given to fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

## GENERAL – CONTINUED

When operating with Class I or II leaks, continue to check fluid levels as required in the PMCS. Class III leaks should be reported immediately to your supervisor.

1. Class I. Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
2. Class II. Leakage of fluid great enough to form drops, but not enough to cause drops to drip from the item being checked/inspected.
3. Class III. Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

Consider the equipment's capacity for the fluid that is leaking. If the capacity is small, the fluid level may soon become too low for continued operation. If in doubt, notify your supervisor. Check the fluid level more often than required in the PMCS table. Add fluid as needed.

## 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 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.

**END OF WORK PACKAGE**

## OPERATOR MAINTENANCE

## OPERATOR PMCS, INCLUDING LUBRICATION INSTRUCTIONS

**INITIAL SETUP:**

**Personnel Required**

Operator (1)

**References**

WP 0002
WP 0005
WP 0011

**References - cont'd**

WP 0012
WP 0013

**Equipment Condition**

IECU is shut down (WP 0005)

**Table 1. Operator Preventive Maintenance Checks and Services (PMCS).**

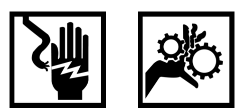
| ITEM NO. | INTERVAL | MAN-HOUR | ITEM TO BE CHECKED OR SERVICED | PROCEDURE | EQUIPMENT NOT READY/ AVAILABLE IF: |
|---|---|---|---|---|---|
| **WARNING**<br><br>High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution. | | | | | |
| 1 | Before<br>Weekly<br>Monthly | 0.2 | Air filter | **NOTE**<br>If operating the IECU in extremely dusty conditions, it is likely that weekly cleaning of the air filter will be required.<br>Inspect the inlet air filter (WP 0012). | Air filter dirty or damaged. |
| 2 | Before | 0.1 | IECU housing | 1. Check exterior surfaces of IECU for cracks, dents, chips, corrosion, or other obvious damage to the unit (WP 0011).<br>2. Inspect frame weldment for cracks, dents, chips, broken welds, and corrosion.<br>3. Inspect enclosure for loose or missing fasteners (WP 0013).<br>4. Check to make sure that identification plate, refrigeration schematic plate, and electrical schematic plate are secure and can be easily read (WP 0002). | Broken or cracked welds, loose or missing fasteners, cracks in IECU housing, damaged or missing hardware are found. If any of the above are found, notify Field Maintenance. |

Table 1. Operator Preventive Maintenance Checks and Services (PMCS). – Continued

| ITEM NO. | INTERVAL | MAN-HOUR | ITEM TO BE CHECKED OR SERVICED | PROCEDURE | EQUIPMENT NOT READY/ AVAILABLE IF: |
|---|---|---|---|---|---|
| | | | | 5. Inspect for damaged threads, bends, broken, missing hardware, or oxidation. | |
| 3 | Before | 0.6 | Cabling/wiring | 1. Inspect power cable/wiring for frayed or damaged insulation, or signs of burning.<br>2. If installed, inspect interconnecting remote box assembly cable for frayed or damaged insulation, or signs of burning. | Frayed or damaged insulation. If damaged or frayed, notify Field Maintenance. |
| 4 | Before | 0.1 | Control box assembly | 1. Check for damage to circuit breaker exterior or circuit breaker boot seal (WP 0002).<br>2. Inspect control box assembly exterior for cracks, dents, or corrosion.<br>3. Check for loose or missing hardware. | Circuit breaker is damaged. Damage to contol box assembly is identified. Loose or missing hardware is identified. If any of the above are found, notify Field Maintenance. |
| 5 | Before | 0.1 | Remote box assembly | 1. Check for damage to knob or selector switch (WP 0002).<br>2. Inspect remote box assembly for cracks, dents, or corrosion.<br>3. Check for loose or missing hardware. | Knob or selector switch is damaged or missing. Damage to remote box assembly is identified. Loose or missing hardware is identified. If any of the above are found, notify Field Maintenance. |
| 6 | Before | 0.1 | Condensate drain hoses | 1. Inspect external condensate drain hose connections to IECU in two locations (Figure 1, Item 2). If loose or disconnected, reconnect hose fittings.<br>2. If installed, inspect external condensate drain hoses for cracks, cuts, kinks, or blockages.<br>3. If installed, inspect length of condensate drain hose to make sure it extends 15 feet away from IECU and is sloped downhill from the unit. Reposition as required. | Loose or disconnected hose. Damage to hoses is identified if found, notify Field Maintenance. Drain hose not correctly positioned. |

**Table 1. Operator Preventive Maintenance Checks and Services (PMCS). – Continued**

| ITEM NO. | INTERVAL | MAN-HOUR | ITEM TO BE CHECKED OR SERVICED | PROCEDURE | EQUIPMENT NOT READY/ AVAILABLE IF: |
|---|---|---|---|---|---|
| 7 | During | 0.1 | Sight glass | 1. Power up unit and allow unit to run for ten minutes in COOL mode (WP 0005).<br>**CAUTION**<br>If sight glass indicator is yellow, shut down immediately. Refrigeration system damage may occur.<br>2. Check sight glass (Figure 1, Item 1) for center indicator color and for constant bubbling or foaming while operating in cooling mode. | Sight glass indicator color is yellow or constant bubbling or foaming. If found, notify Field Maintenance. |

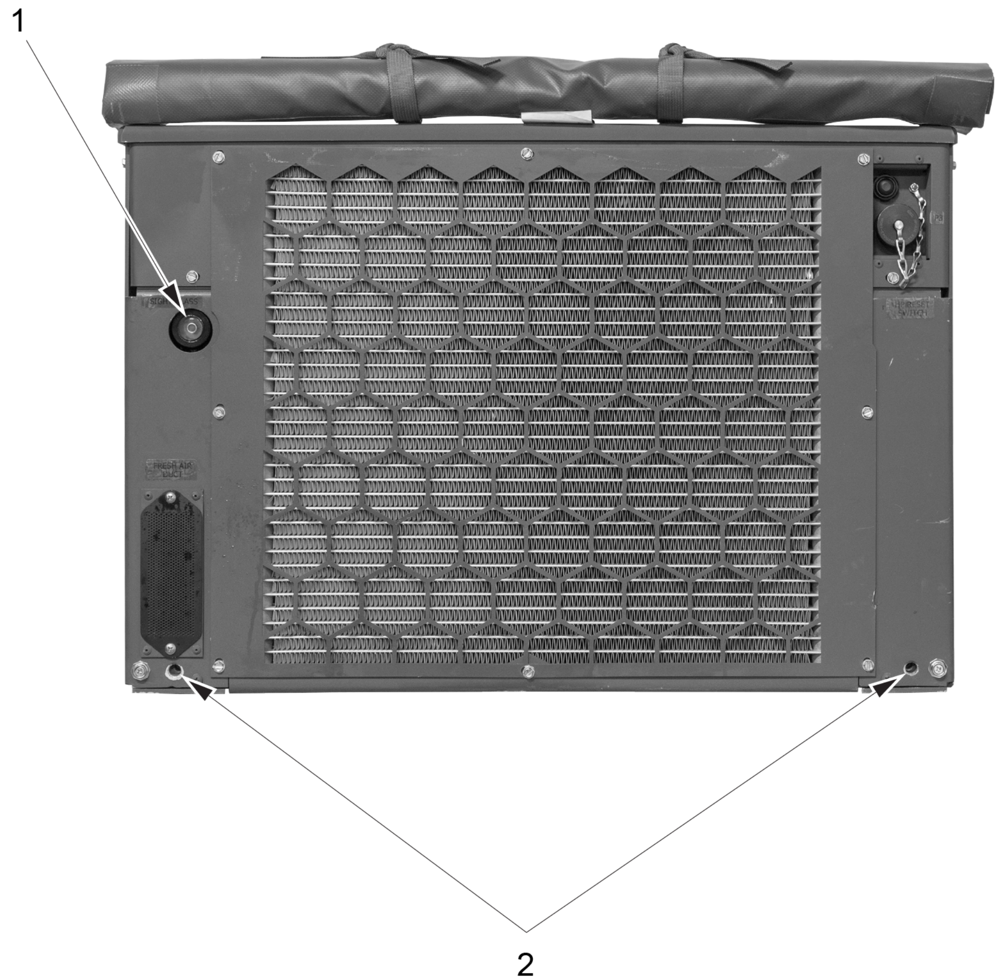



**Figure 1. Condensate Drains and Sight Glass.**

## MANDATORY REPLACEMENT PARTS

There are no replacement parts required for these PMCS procedures.

## LUBRICATION INSTRUCTIONS

There are no lubrication requirements for the 9K IECU.

## END OF WORK PACKAGE

## OPERATOR MAINTENANCE

## AIR CONDITIONER - INSPECT, TEST

**INITIAL SETUP:**

**Personnel Required**

Operator (1)

**References**

WP 0005

**References - cont'd**

WP 0012

**Equipment Condition**

IECU is shut down (WP 0005)

### INSPECT

**Inspect Air Conditioner**

Inspection of the air conditioner consists of inspecting the cover assembly, housing assembly, data plates, bridge plate assembly, condenser grille, remote control box assembly, fresh air screen, and fresh air duct door assembly (this work package).

**Inspect Cover Assembly**

1. Check exterior surfaces of the cover assembly for cracks, dents, chips, corrosion, bare spots in paint, missing hardware, or other obvious damage to the cover. If damaged, notify Field Maintenance.
2. Inspect weldments for cracks, dents, chips, broken welds, and corrosion. If damage is found, notify Field Maintenance.

**Inspect Housing Assembly**

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Visually inspect sheet metal exterior for nicks, gouges, corrosion, and bare spots in paint and other defects which can be repaired.
2. Notify Field Maintenance if any of the above is observed.

**Inspect Data Plates**

Visually inspect data plates for damaged or missing rivets or cracks. Contact Field Maintenance for repair if either is observed.

**Inspect Condenser Grille**

1. Visually inspect the condenser grille (Figure 1) for damage including corrosion, cracks, fractures, or deformation.

**INSPECT – CONTINUED**

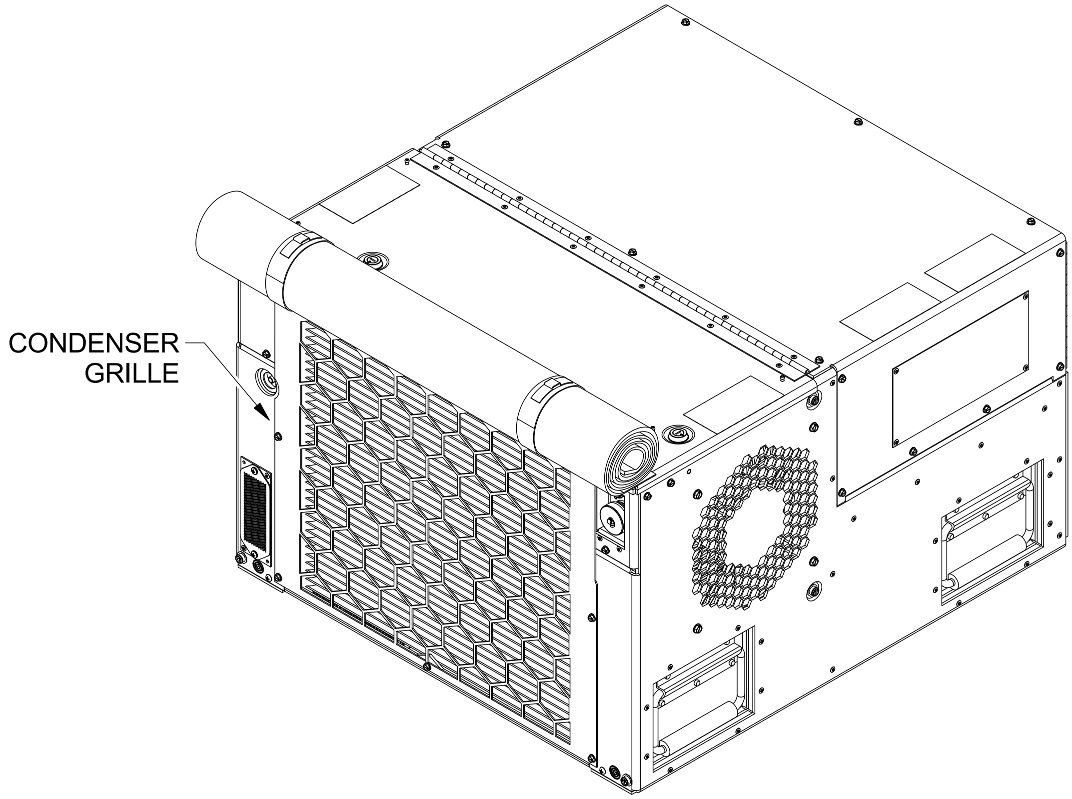



**Figure 1. Condenser Grille.**

2. If the condenser grille is damaged or can no longer protect the condenser coil it must be replaced. Notify field maintenance.

**Inspect Remote Control Box Assembly**

1. Visually inspect the remote box for damage to the face plate which impairs the ability to read the wording on the face plate. Also look for missing screws in the corners of the face plate

**INSPECT – CONTINUED**

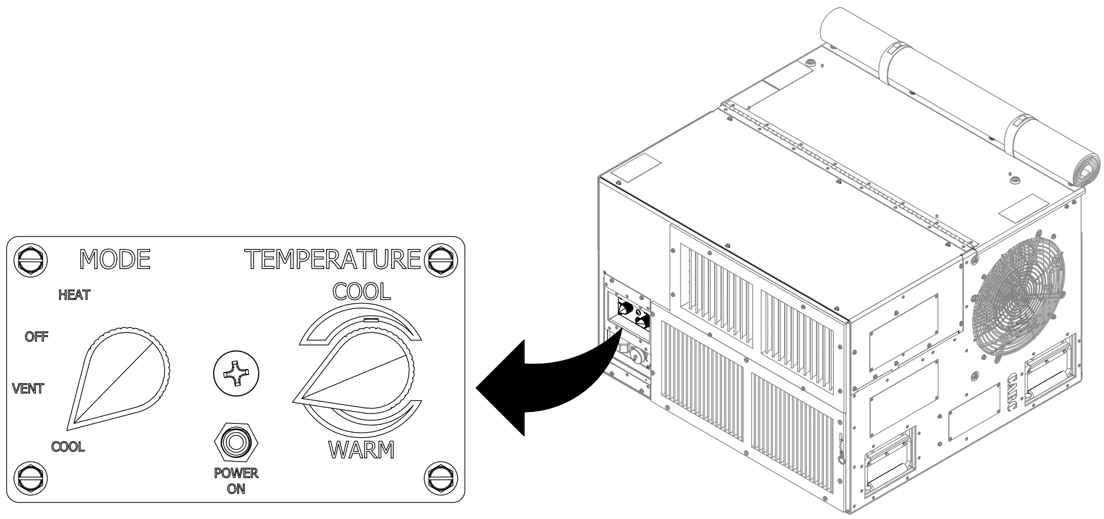



**Figure 2. Remote Control Box.**

2. Check the control knobs to determine if they are loose
3. If there is damage to the face plate, missing fasteners, or loose knobs, a maintainer should be notified so that repairs can be made.

**Inspect Fresh Air Screen Assembly**

1. Visually inspect the fresh air screen (Figure 3) for any of the following:

## INSPECT – CONTINUED

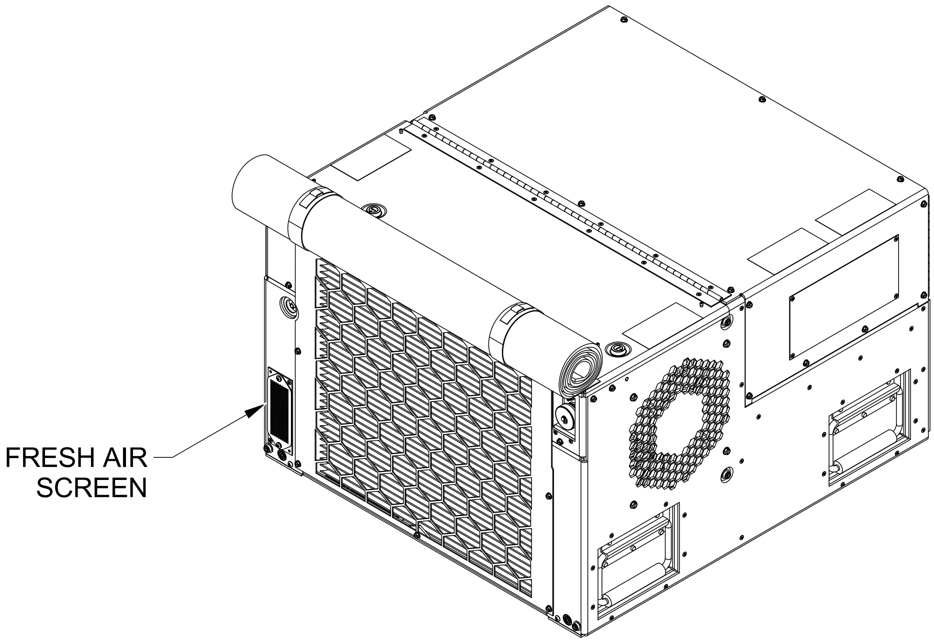



**Figure 3. Fresh Air Screen.**

a. Damage.

b. Corrosion.

c. Nicks.

d. Gouges.

e. Bare spots in paint.

2. If any of the above are observed, notify field maintenance.

### Inspect Supply Grille

1. Visually inspect supply grille's (Figure 4) vertical louvers for bends or other damage.

**INSPECT – CONTINUED**

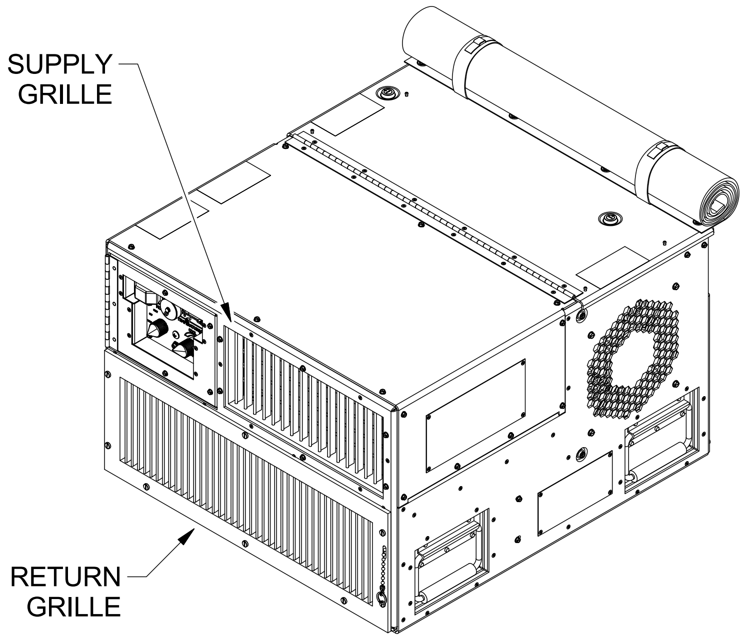



**Figure 4. Supply and Return Grilles.**

2. Adjust the vertical louvers side-to-side by hand, ensuring smooth movement.
3. Visually inspect horizontal louvers for bends or other damage.
4. Adjust the horizontal fins up and down using the levers on the right and left sides of the grille, ensuring smooth movement.

**Inspect Fresh Air Duct Door Assembly**

1. Remove inlet air filter (WP 0012) to access fresh air duct door.

**INSPECT – CONTINUED**

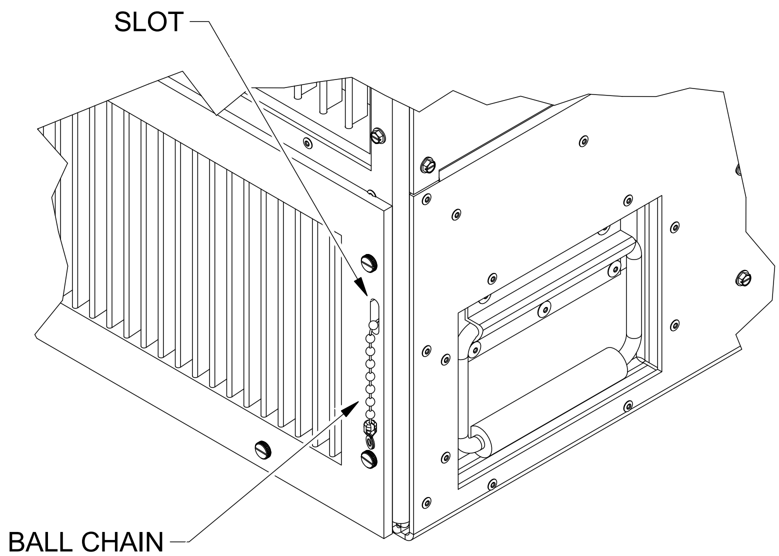



**Figure 5. Ball Chain.**

2. Contact Field Maintenance for repair if any of the following is observed:
    a. Extension springs no longer exhibit tension for sealing of fresh air door.
    b. Extension springs are broken or bent.
    c. Sheet metal door is corroded, cracked, or damaged.
    d. Sealing gasket on back of door is cracked, faded, torn or does not facilitate proper sealing of duct.
    e. Ball chain (Figure 5) is broken or does not lock into sheet metal fresh air keyway.
    f. Missing chain end fitting.
3. Install the inlet air filter (WP 0012).

**END OF TASK**

**TEST**

Power up the IECU in each Vent, Heat, and Cool mode to verify the unit is functioning (WP 0005).

**END OF TASK**

**END OF WORK PACKAGE**

## OPERATOR MAINTENANCE

## INLET AIR FILTER - INSPECT, SERVICE, REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Materials/Parts**

Replacement inlet air filter (WP 0076, Item 1)

**Personnel Required**

Operator (1)

**References**

WP 0013
WP 0076

**Equipment Condition**

IECU is shut down (WP 0005)
Return grille is removed (WP 0013)

### INSPECT

1. Remove inlet air filter (this work package).
2. Visually inspect the inlet air filter for excessive debris, damaged filter media and support screen, deformation in the frame, and corrosion:
   a. If the inlet air filter is damaged or significantly corroded, it must be replaced (this work package).
   b. If the inlet air filter is holding debris, but not damaged, it may be serviced (this work package).
3. Install inlet air filter (this work package).

**END OF TASK**

### SERVICE

1. Replace filters having breaks, torn or deformed media, or excess accumulations of dirt or grease (this work package).
2. Clean filter with warm water and soap solution. Hose with water in both directions.

**END OF TASK**

### REMOVE

Remove inlet air filter (Figure 1, Item 1) by pulling forward and lifting filter out of IECU Housing.

**REMOVE – CONTINUED**

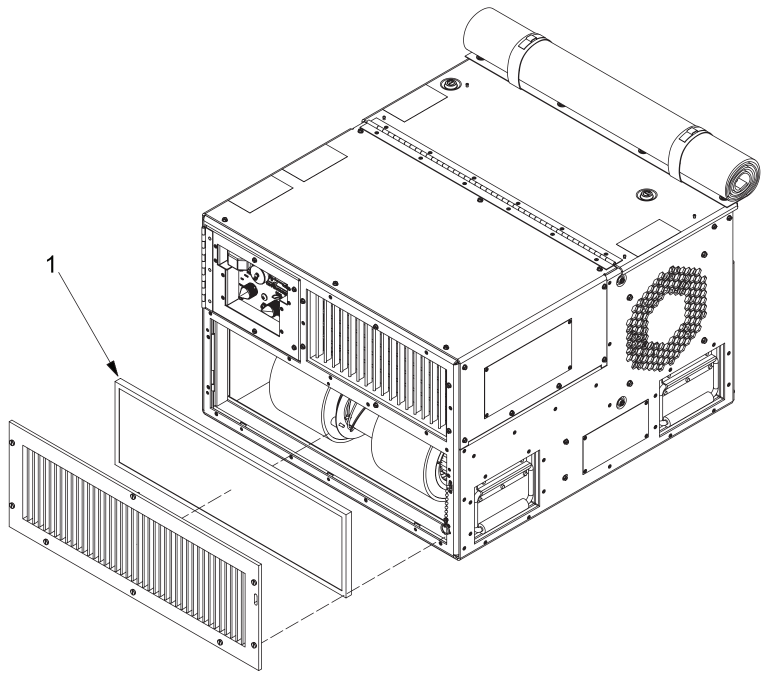



**Figure 1. Inlet Air Filter.**

**END OF TASK**

**REPLACE**

1. Remove inlet air filter (this work package).
2. Install replacement inlet air filter (this work package).

**END OF TASK**

**INSTALL**

**NOTE**

When installing inlet air filter, arrow (Figure 2) should be oriented away from inlet grille, toward the IECU.

1. Install inlet air filter (Figure 1, Item 1) into filter holder brackets on IECU, and ensure that the arrow on the filter is pointing into the unit for correct flow direction (Figure 2).

## INSTALL – CONTINUED

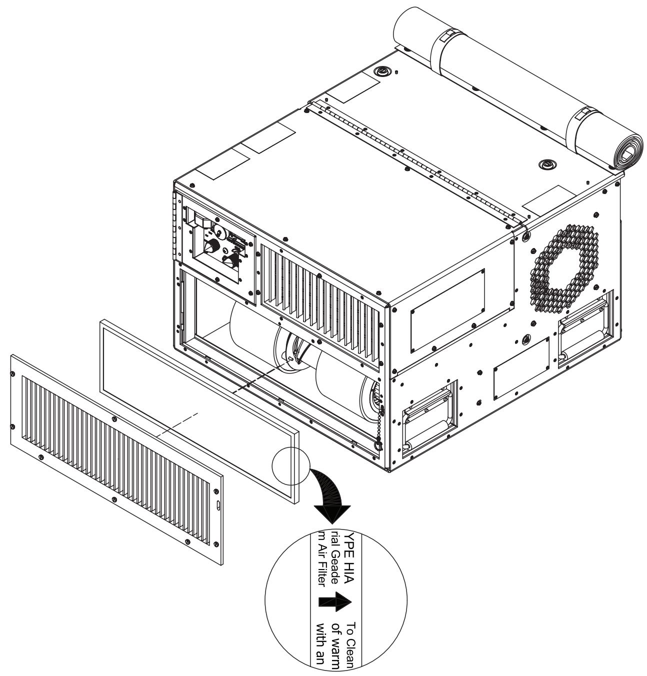



**Figure 2. Air Filter Remove/Install.**

2. Place IECU back into normal operation (WP 0005).

## END OF TASK

## FOLLOW-ON MAINTENANCE

1. Install return grille (WP 0013).
2. Place IECU back into normal operation (WP 0005).

## END OF TASK

## END OF WORK PACKAGE

## OPERATOR MAINTENANCE

## RETURN GRILLE - INSPECT, REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Materials/Parts**

Replacement return grille (WP 0077, Item 6)

**Personnel Required**

Operator (1)

**References**

WP 0077

**Equipment Condition**

IECU is shut down (WP 0005)

### INSPECT

1. Visually inspect vertical louvers for bends or other damage.
2. Adjust the vertical louvers side-to-side by hand, ensuring smooth movement.

### END OF TASK

### REMOVE

1. Loosen eight thumbscrews (Figure 1, Item 3) securing return grille (Figure 1, Item 1) to IECU housing.

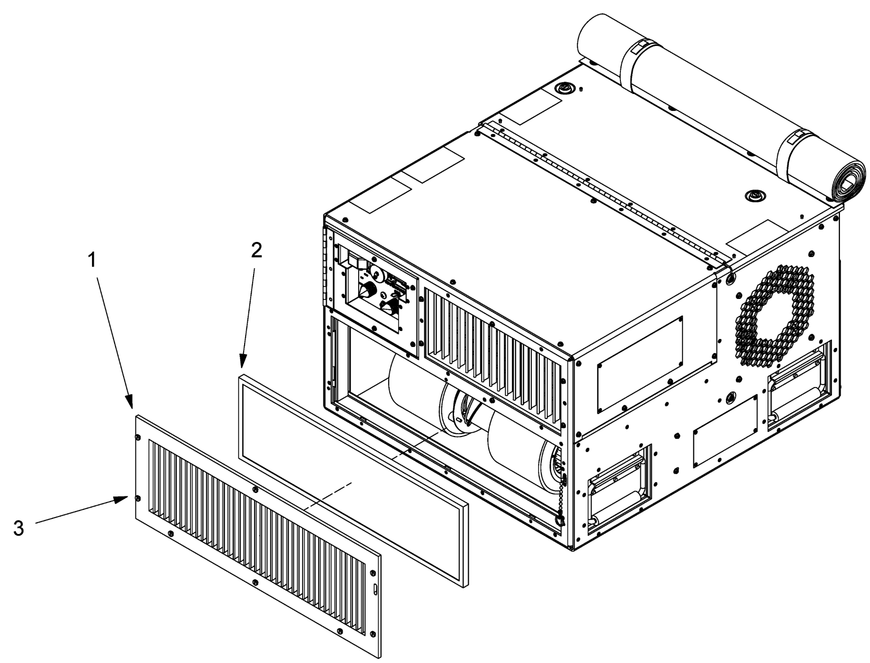



**Figure 1. Return Grille.**

**REMOVE – CONTINUED**

## CAUTION

Ensure not to damage the inlet air filter (Figure 1, Item 2).

2. Feed fresh air duct door chain through the slot on the right side of the grille (Figure 2).

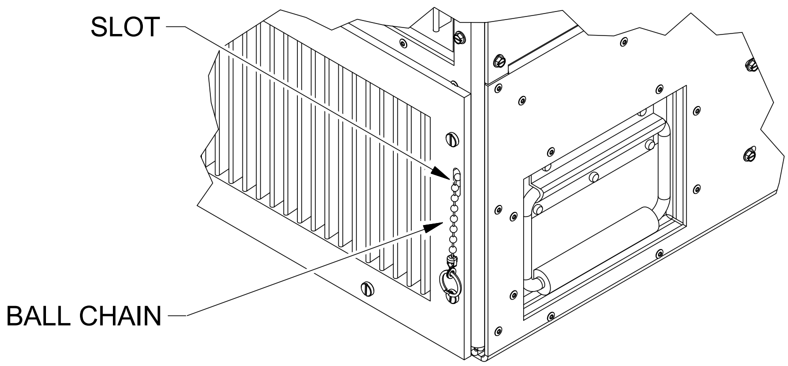



**Figure 2. Fresh Air Duct Door Ball Chain.**

3. Remove return grille (Figure 1, Item 1) from IECU housing.

**END OF TASK**

**REPLACE**

1. Remove return grille (Figure 1, Item 1) (this work package).
2. Install replacement return grille (Figure 1, Item 1) (this work package).

**END OF TASK**

**INSTALL**

1. Feed fresh air duct door chain through the slot on the right side of the grille (Figure 2).

## CAUTION

Ensure not to damage the inlet air filter (Figure 1, Item 2).

2. Install return grille (Figure 1, Item 1) and secure with eight thumbscrews (Figure 1, Item 3).
3. Reposition louvers on return grille to desired position, and verify that at least 3/4 of the louvers are fully opened.
4. Place IECU back into normal operation (WP 0005).

**END OF TASK**

**END OF WORK PACKAGE**

# CHAPTER 5

# FIELD TROUBLESHOOTING PROCEDURES

# FIELD MAINTENANCE

# FIELD TROUBLESHOOTING INDEX

## INTRODUCTION

This work package contains field troubleshooting information for locating and correcting most of the operating troubles that may develop in the 9K BTU/hr IECU. Each symptom for a part, assembly, or subassembly is followed by a list of malfunctions, which will help you to determine corrective actions to take. You should perform the corrective actions in the order listed.

This manual cannot list all possible malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed (except when the malfunction or cause is obvious) or is not corrected by listed corrective actions, notify your supervisor. General troubleshooting procedures will be found in WP 0015. IECU malfunctions are indexed below to provide a quick reference to corrective actions located in WP 0015–WP 0020.

Refer to WP 0001 for warranty information.

## USING THE TROUBLESHOOTING WORK PACKAGES

Field Troubleshooting procedures have been carefully designed to match the anticipated problems. For the most efficient and fastest troubleshooting, it is best to begin with the basic functional test found in WP 0015 to better diagnose and correct the problem.

## USING THE MODULARITY FEATURES

A key feature of the IECU is modularity, including plug-and-play electronics and refrigeration components. Wire harness and refrigeration components can be quickly connected or disconnected without soldering, brazing, or any complex field procedures. This allows an entire component, such as the soft start box or the control box to be swapped out and then serviced later on the bench if it is necessary to get a unit back online quickly. The use of plug-and-play plumbing and electrical components that do not require soldering, brazing or special tools to remove/replace means they can be easily swapped out, and no special tools are required.

The control box assembly can be disconnected from the wiring harnesses and easily removed from the IECU (as a complete assembly), simplifying service and allowing rapid swap-out repairs. All wiring is marked to indicate points of origin and termination, using nomenclature, numbering, and color codes consistent with the wiring diagrams and electrical schematics. All wires outside the control box assembly are color coded and bundled in nylon shrouding.

Refrigeration circuit pressures and saturation temperatures can be determined using a traditional manifold gauge set. Coil temperature can be measured with a thermometer or other temperature measuring device. However, the IECU is also equipped with a diagnostic connector that will provide high and low side pressures and system temperatures by measuring voltage. WP 0026 (Refrigerant Pressure Test) provides information on using the diagnostics connector.

## SYMPTOM TROUBLESHOOTING PROCEDURES INDEX

**Malfunction/Symptom** **Troubleshooting Procedure**

### IECU MAY NOT BE OPERATING PROPERLY



### INSUFFICIENT POWER IN ONE OR ALL MODES OF OPERATION



### IECU FAILS TO OPERATE IN VENT MODE

## SYMPTOM TROUBLESHOOTING PROCEDURES INDEX – CONTINUED

## SYMPTOM TROUBLESHOOTING PROCEDURES INDEX – CONTINUED



**END OF WORK PACKAGE**

**FIELD MAINTENANCE**

**TROUBLESHOOTING PROCEDURES - IECU MAY NOT BE OPERATING PROPERLY**

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0004
WP 0010
WP 0016
WP 0017
WP 0018
WP 0019

**References - cont'd**

WP 0020
WP 0026
WP 0038
WP 0055
WP 0063
WP 0064
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)

## INTRODUCTION

This Work Package provides initial guidance for troubleshooting the IECU. If this procedure is completed without being directed to another work package for additional troubleshooting or component repair or replacement, the IECU should be functioning normally. After any component is repaired or replaced this test should be started again from the beginning to verify normal operation of the IECU.

When troubleshooting electrical malfunctions, refer to the IECU 5000 Wiring Diagram (FO-1 – FO-2). For cable assembly information, refer to WP 0038 for procedures to disconnect and re-connect the various types of connectors, and to WP 0064 for connector pin assignments.

### General

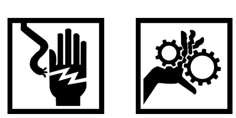
This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner. Each malfunction is followed by a list of probable causes and actions to take to remedy the malfunction.

You should perform the tests/inspections and corrective actions in the order listed. This manual cannot list all malfunctions that may occur nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

## TROUBLESHOOTING PROCEDURE(S)

### IECU May Not Be Operating Properly

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## TROUBLESHOOTING – CONTINUED

### SYMPTOM

IECU MAY NOT BE OPERATING PROPERLY

#### MALFUNCTION

Proper Operation Not Verified

##### CORRECTIVE ACTION

**NOTE**

Before evaluating fault procedures, be sure you have performed all applicable Operator PMCS checks (WP 0010).

STEP 1. Set the circuit breaker (CB1) to OFF (WP 0004).

STEP 2. Set the rotary MODE switch (S4) to OFF (WP 0004).

STEP 3. Inspect the exterior of the condenser and evaporator to be certain the condenser and evaporator air flow paths are clear.

STEP 4. Verify that the condenser fans rotate freely.

STEP 5. Verify that power cable is connected to proper 115 VAC source.

STEP 6. Verify that power cable is securely connected to the IECU at either the condenser or evaporator side of IECU.

STEP 7. Set the circuit breaker (CB1) to ON (WP 0004):

a. If the power source circuit breaker or circuit breaker (CB1) trips, continue to troubleshoot, Symptom INSUFFICIENT POWER IN ONE OR ALL MODES OF OPERATION (WP 0016).

b. If circuit breaker (CB1) is working properly, continue to Step 8.

STEP 8. Verify the unit is properly powered as indicated by a steady green POWER ON light on the remote control box:

a. If the light is steady, continue to Step 9.

b. If the light is not illuminated, continue to troubleshoot, Symptom POWER ON LIGHT NOT ILLUMINATED, Malfunction Power Board Circuit Breaker Tripped (WP 0020).

c. If the light is blinking, continue to troubleshoot, Symptom GREEN POWER ON LIGHT BLINKING, Malfunction Fault LED(s) Illuminated (WP 0020).

STEP 9. Unlock two quarter-turn latches on cover assembly and open.

STEP 10. Disconnect connector P38 from J38 on wire harness W1.

STEP 11. Disconnect connector P31 from J31 on wire harness W1.

STEP 12. Measure the voltage between connector J38 and J31:

a. If the voltage is not 115 VAC, continue to troubleshoot, Symptom FAILED CRANKCASE HEATER SUPPLY VOLTAGE TEST, Malfunction Broken Crankcase Heater Assembly Connecting Wire Harness (WP 0018).

b. If the voltage is 115 VAC, continue to Step 13.

STEP 13. Test the crankcase heater (WP 0055).

STEP 14. Reconnect connector P38 to J38 on wire harness W1.

STEP 15. Reconnect connector P31 to J31 on wire harness W1.

**TROUBLESHOOTING – CONTINUED**

STEP 16. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

STEP 17. Verify the evaporator outlet grille is open and unrestricted.

STEP 18. Set the rotary MODE switch (S4) to VENT. If the evaporator blower assembly (B2) does not start after two seconds, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE (WP 0017). If it starts, proceed to Step 19.

STEP 19. Allow the unit to run for a short duration to ensure the evaporator blower assembly (B2) fully spins up. Set the rotary MODE switch (S4) to OFF.

STEP 20. Test the evaporator air inlet thermistor (RT1) (WP 0063).

STEP 21. Set the rotary MODE switch (S4) to HEAT and set the TEMPERATURE control thermostat (R1) to max heat (rotate clockwise):

a. If the evaporator blower assembly (B2) does not start after about ten seconds, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE (WP 0017).

b. If the evaporator blower assembly (B2) starts after about ten seconds, continue to Step 22.

STEP 22. Wait two minutes for the heating elements to warm up.

STEP 23. Measure the temperature of the air entering and exiting the evaporator by inserting a temperature measuring device into the inlet and out registers of the IECU:

a. If the temperature difference between the evaporator outlet air temperature and evaporator inlet air temperature is less than 16 °F continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT HEAT (WP 0019).

b. If the difference between the evaporator outlet air temperature and evaporator inlet air temperature is more than 16 °F, continue to Step 24.

STEP 24. Verify that the compressor crankcase oil has been warmed for an extended period of time to remove dissolved refrigerant that accumulates in the oil when the crankcase heater is not working or when the IECU is not properly powered:

a. If the compressor has been operating in COOL mode for at least one hour of the last 8 hours, continue to Step 25.

b. If the unit has been connected to power with the main circuit breaker (CB1) ON, the power board (U1) circuit breaker closed, and the crankcase heater properly functioning and powered for at least 4 of the last 8 hours, continue to Step 25.

c. If neither of these conditions are true set the rotary MODE switch (S4) to OFF for four hours before continuing to Step 25.

STEP 25. Set the rotary MODE switch (S4) to COOL and set the TEMPERATURE control thermostat (R1) to max cool (rotate counter clockwise). The evaporator inlet air temperature must be above 55 °F for cool mode to begin:

a. If the compressor does not start after two seconds, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING, Malfunction Power Fault or Sensor Fault (WP 0018).

b. If the compressor is unusually noisy on startup, continue to troubleshoot, Symptom COMPRESSOR IS NOISY ON START-UP, Malfunction Compressor Liquid Slugging (WP 0018).

## TROUBLESHOOTING – CONTINUED

c. If the condenser fans do not start after another three seconds, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING, Malfunction Power Fault or Sensor Fault (WP 0018).

d. If the evaporator blower (B2) does not start after another two seconds, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE (WP 0017).

e. If none of these occur, continue to Step 26.

STEP 26. Wait two minutes for the system to begin cooling.

STEP 27. Measure the temperature of the air entering and leaving the evaporator by inserting a temperature measuring device into the inlet and outlet registers of the IECU:

a. If the temperature difference between the evaporator inlet air temperature and evaporator outlet air temperature is less than 10 °F, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING Malfunction Inadequate Airflow (WP 0018).

b. If the measured temperature difference is 10 °F or more continue to Step 28.

STEP 28. Test the refrigerant pressures, using the manifold gauge set (WP 0026)

STEP 29. Inspect the sight-glass indicator:

a. If the moisture indicator color is yellow, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING Malfunction Moisture In System (WP 0018).

b. Vapor bubbles will be seen on start up and will settle down after a short period (depending on ambient conditions). If bubbles persist, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING, Malfunction Refrigerant Problem (WP 0018).

c. If the moisture indicator color is green, continue to Step 30.

STEP 30. Place IECU back into service.

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## TROUBLESHOOTING PROCEDURES - SYSTEM INPUT POWER

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0017
WP 0018
WP 0019
WP 0037
WP 0038

**References - cont'd**

WP 0042
WP 0043
WP 0044
WP 0064
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)

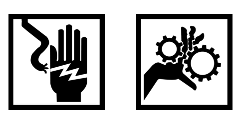
### INTRODUCTION

This Work Package provides guidance for troubleshooting the IECU for system input power on the unit itself and various components.

### TROUBLESHOOTING PROCEDURE(S)

**System Input Power**

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**SYMPTOM**

INSUFFICIENT POWER IN ONE OR ALL MODES OF OPERATION

**MALFUNCTION**

Main Relay (K1), Main Power Connection

**TROUBLESHOOTING – CONTINUED**

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to OFF.

STEP 2. If the power source circuit breaker trips, but not circuit breaker (CB1) on the IECU control box:

a. If the power is hooked up to the evaporator side of the IECU, continue to Step 4.

b. If the power is hooked up to the condenser side of the IECU, continue to Step 7.

STEP 3. If the power source circuit breaker does not trip, continue to Step 11.

STEP 4. With power disconnected on the evaporator side and the circuit breaker (CB1) OFF, remove and open the control box (WP 0042).

STEP 5. Disconnect wire harness W32 from relay K1.

a. Remove the wire from pin A on connector P1 from terminal 3 on relay K1.

b. Remove the wire from pin D on connector P1 from terminal 4 on relay K1.

STEP 6. Measure the resistance across terminal A and B on relay K1:

a. If the measured resistance is less than 500 Ω or an open circuit is measured, replace relay K1 (WP 0042).

b. If the measured resistance is greater than 500 Ω and less than 3 kΩ, replace wire harness W32 inside the control box (WP 0038).

STEP 7. Disconnect connector J9 on wire harness W9 from connector P9 on wire harness W17.

STEP 8. Check for continuity on connector P3 between pins A and D, A and E, and D and E:

a. If continuity is present between any set of pins, replace wire harness W9 (WP 0038).

b. If continuity is not present, continue to Step 9.

STEP 9. Disconnect connector J4 on wire harness W17 from connector P4 on the back of the control box.

STEP 10. Check for continuity between pins 1 and 2 in connector P9 on wire harness W17:

a. If continuity is present, replace wire harness W17 (WP 0038).

b. If continuity is not present, replace wire harness W27 (WP 0038).

STEP 11. Set the circuit breaker (CB1) to ON:

a. If circuit breaker (CB1) trips while it is in OFF mode, continue to next malfunction.

b. If circuit breaker (CB1) trips while in VENT mode, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE (WP 0017).

**TROUBLESHOOTING – CONTINUED**

c. If circuit breaker (CB1) trips while in HEAT mode, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT HEAT (WP 0019).

d. If circuit breaker (CB1) trips while in COOL mode continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING (WP 0018).

**MALFUNCTION**

Electrical Short In Soft Start or Control Box Circuit

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Remove the cover assembly (WP 0032).

STEP 2. Disconnect connector J4 on wire harness W17 from connector P4 on the back of the control box.

STEP 3. Disconnect P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 4. Check for continuity between pins 1 and 2 in connector P8:

a. If continuity is present, replace wire harness W17 (WP 0038).

b. If continuity is not present, continue to Step 5.

STEP 5. Disconnect connector J12 on wire harness W1 from connector P12 on the soft start box.

STEP 6. Check for continuity between sockets 1 and 2 in connector J12:

a. If continuity is present, replace wire harness W1 (WP 0038).

b. If continuity is not present, continue to Step 7.

STEP 7. Check for continuity between pins 1 and 2 in connector P12 on wire harness W43 of the soft start box:

a. If continuity is present, continue to Step 8.

b. If continuity is not present, continue to Step 14.

STEP 8. Remove and open the soft start box (WP 0037).

STEP 9. Disconnect wires from terminal 8 of relay K2, terminal 8 of relay K3, and terminal 4 of relay K3.

STEP 10. Check again for continuity between pins 1 and 2 on connector P12. Ensure that the disconnected wires are not touching the soft start box case:

a. If continuity is present, replace wire harness W43 (WP 0038).

b. If continuity is not present, continue to Step 11.

STEP 11. Continue to troubleshoot, Symptom HEATER ASSEMBLY (HR2 OR HR3) IS NOT OPERABLE, Malfunction A Short In Heater Assembly (HR2 or HR3) or Heater Wire Harness (WP 0019).

**TROUBLESHOOTING – CONTINUED**

STEP 12. Continue to troubleshoot, Symptom COMPRESSOR FAILS TO START, Malfunction Short In Compressor / Soft Start Wire Harness or Soft Start Box (WP 0018).

STEP 13. Reconnect all disconnected cables in the soft start box, and install soft start box (WP 0037).

STEP 14. Remove and open the control box (WP 0042).

STEP 15. Remove the wire from pin 3 in connector P4 on wire harness W27 from the load side of the control box circuit breaker (CB1).

STEP 16. Remove the wire from pin 4 in connector P4 on wire harness W27 from terminal 6 on relay K1.

STEP 17. Ensure the uninsulated ends on the disconnected wires are not touching the control box case.

STEP 18. Check for continuity between pins 3 and 4, 3 and chassis ground, and 4 and chassis ground in connector P4 on the back of the control box:

a. If continuity is present, replace wire harness W27 (WP 0038).

b. If continuity is not present, continue to Step 19.

STEP 19. With pins 3 and 4 in connector P4 on wire harness W27 disconnected from relay K1, check the continuity across sockets 1 and 2, 1 and chassis ground, and 2 and chassis ground in connector J5 on wire harness W29:

a. If continuity is present, replace wire harness W29 (WP 0038).

b. If continuity is not present, continue to Step 20.

STEP 20. Check for continuity between pins 1 and 2 in CON3 on the power board (U1):

a. If continuity is present, first replace the power board (U1) (WP 0043) and retest. If the problem persists, replace the control board (U2) (WP 0044).

b. If fault still remains, replace the circuit breaker (CB1) (WP 0042).

c. If the fault still remains, replace the control box assembly (WP 0042)

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## TROUBLESHOOTING PROCEDURES - VENT MODE INOPERABLE

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0005
WP 0012
WP 0015
WP 0020
WP 0032
WP 0037

**References - cont'd**

WP 0038
WP 0042
WP 0043
WP 0058
WP 0064
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is powered up (WP 0005)

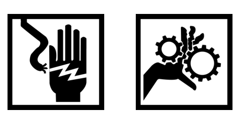
### INTRODUCTION

This Work Package provides guidance for troubleshooting the IECU when VENT mode and/or the Evaporator Blower (B2) fails to operate properly.

### TROUBLESHOOTING PROCEDURE(S)

### Vent Mode Inoperable

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**SYMPTOM**

IECU FAILS TO OPERATE IN VENT MODE

## TROUBLESHOOTING – CONTINUED

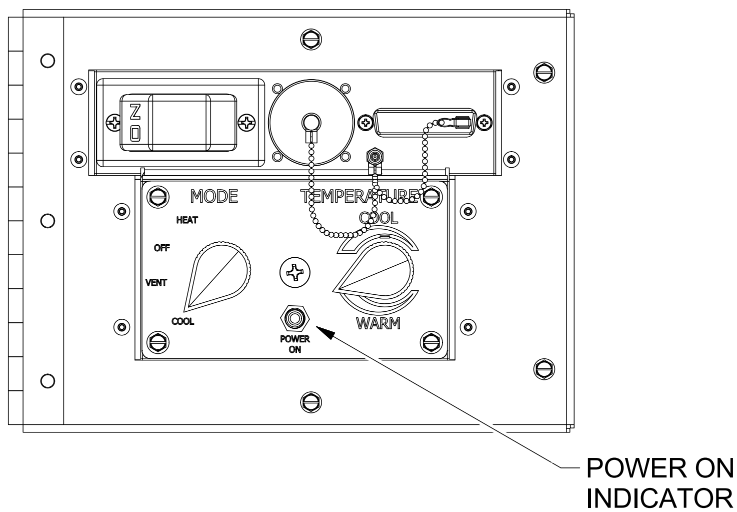



**Figure 1. Power On LED.**

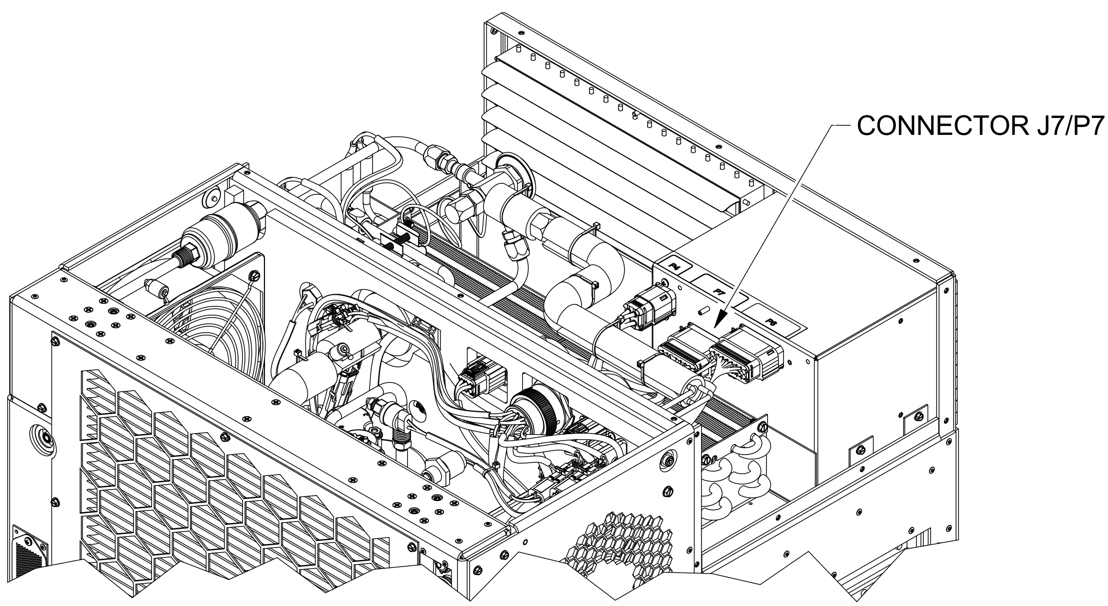



**Figure 2. Connector P7/J7.**

## TROUBLESHOOTING – CONTINUED

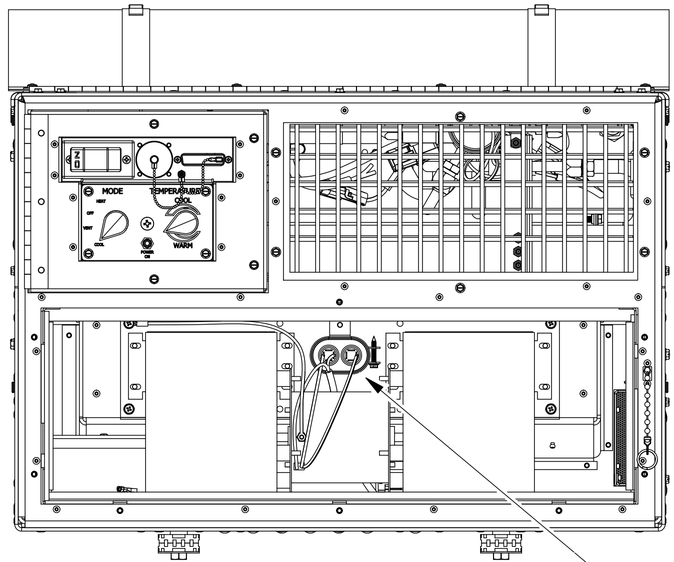



**Figure 3. Evaporator Run Capacitor.**

### MALFUNCTION

Power Fault

#### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Look at the Power LED (Figure 1) on the remote control box:

a. If the LED is illuminated green, continue to Malfunction Evaporator Blower (B2) Not Powered (this work package).

b. If the LED is not illuminated green, continue to Malfunction Short in Evaporator Blower (B2) or Associated Circuitry (this work package).

### MALFUNCTION

Evaporator Blower (B2) Not Powered

**TROUBLESHOOTING – CONTINUED**

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Ensure the rotary MODE switch (S4) is set to VENT.

STEP 2. Remove inlet air filter (WP 0012).

STEP 3. Remove the black rubber cover from the evaporator blower (B2) run capacitor.

**WARNING**

- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.

STEP 4. Check for 115 VAC between the capacitor terminal (C2) where the black (hot) evaporator blower wire is connected and the ground stud where the green (ground) evaporator blower wire is connected:

a. If 115 VAC is present, then continue to Step 11.

b. If 115 VAC is not present, then continue to Step 5.

STEP 5. Remove cover assembly (WP 0032).

STEP 6. Disconnect connector P7 from J7.

STEP 7. Remove four screws that secure the control box inside the IECU and slide the control box forward.

STEP 8. Measure the voltage across pins 11 and 13 of P7 (Figure 2) on the back of the control box:

a. If 115 VAC is not present, continue to troubleshoot, Symptom POWER ON LIGHT NOT ILLUMINATED, Malfunction Control Board (U2) or Power Board (U1) Inoperative (WP 0020).

b. If 115 VAC is present, continue to Step 9.

STEP 9. Check for continuity between the following sets on wire harness W17:

- Socket 13 in connector J7 and pin 14 in connector P8.
- Socket 11 in connector J7 and pin 13 in connector P8.

a. If continuity is present between both sets, continue to Step 10.

**TROUBLESHOOTING – CONTINUED**

b. If continuity is missing from one or both sets, replace wire harness W17 (WP 0038).

STEP 10. Check for continuity between the following sockets on wire harness W1:

- Socket 14 in connector J8 and socket 1 in connector J11.
- Socket 13 in connector J8 and socket 2 in connector J11.

a. If continuity is present between both sets of sockets, replace wire harness W44 (WP 0038).

b. If continuity is missing from one or both sets of sockets, replace wire harness W1 (WP 0038).

STEP 11. Shut down the IECU (WP 0005).

**NOTE**

Ensure multimeter selected can measure capacitance.

STEP 12. Check the capacitance of the evaporator blower run capacitor. Remove the blue and black wires from the capacitor during the test (Figure 3):

a. If the capacitance is not in the range of 5.64 MFD (μF) to 6.36 MFD (μF), replace the run capacitor (WP 0058).

b. If the run capacitor is good, continue to Step 13.

STEP 13. Remove the evaporator blower (B2) from the unit (WP 0058).

STEP 14. Remove the soft start box (WP 0037).

STEP 15. Check the continuity between pin 1 in connector P11 and pin 1 in connector P34 (Neutral Line):

a. If continuity is present, replace the evaporator blower (B2) (WP 0058).

b. If continuity is not present, replace wire harness W44 (WP 0038).

**MALFUNCTION**

Short In Evaporator Blower (B2) or Associated Circuitry

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Disconnect connector J11 on wire harness W1 from connector P11 on the soft start box.

STEP 2. Check for continuity between sockets 1 and 2 in connector J11:

a. If continuity is present, continue to Step 3.

b. If continuity is missing, continue to Step 7.

**TROUBLESHOOTING – CONTINUED**

STEP 3. Disconnect connector J8 on wire harness W1 from connector P8 on wire harness W17.

STEP 4. Check the continuity between pins 14 and 13 in connector P8 on wire harness W17:

a. If continuity is present, continue to Step 5.

b. If continuity is missing, replace wire harness W1 (WP 0038).

STEP 5. Disconnect connector J7 from connector P7 on the control box.

STEP 6. Check for continuity between, pins 13 and 11 in connector P7 on the control box:

a. If continuity is present, replace the power board (U1) (WP 0043).

b. If continuity is missing, replace wire harness W17 (WP 0038).

STEP 7. Remove the soft start box (WP 0037).

STEP 8. Check for continuity between pins 1 and 2 in connector P11 on the soft start box (J34 should be disconnected):

a. If continuity is present, replace wire harness W44 in the soft start box (WP 0038).

b. If continuity is missing, continue to Step 9.

STEP 9. Remove the black rubber cover from the evaporator blower run capacitor.

STEP 10. Remove the blue and black wires from the run capacitor.

STEP 11. Measure the capacitance of the run capacitor:

a. If the measured capacitance is not in the range of 5.64 MFD (μF) to 6.36 MFD (μF), replace the run capacitor (WP 0058).

b. If the measured capacitance is between 5.64 MFD (μF) to 6.36 MFD (μF), continue to Step 12.

STEP 12. Reconnect the blue wire to one side of the run capacitor and the back wire to the other side of the run capacitor.

STEP 13. Measure the resistance between sockets 1 and 2 in connector J34 on the evaporator blower assembly:

a. If the measured resistance is 10 ohms or less, replace the evaporator blower assembly (B2) (WP 0058).

b. If the measured resistance is greater than 10 ohms, continue to Step 14.

STEP 14. Measure the resistance between the blue wire on the run capacitor (C2) and socket 1 in connector J34 on the evaporator blower assembly (B2):

a. If the measured resistance is 16 ohms or less, replace the evaporator blower assembly (WP 0058).

b. If the measured resistance is greater than 16 ohms, reconnect all disconnected connectors. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## TROUBLESHOOTING PROCEDURES - LACK OF COOLING

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0004
WP 0010
WP 0012
WP 0015
WP 0017
WP 0020
WP 0026
WP 0031
WP 0032
WP 0037
WP 0038
WP 0039
WP 0042
WP 0043

**References - cont'd**

WP 0046
WP 0047
WP 0053
WP 0054
WP 0055
WP 0056
WP 0057
WP 0058
WP 0059
WP 0060
WP 0061
WP 0063
WP 0064
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is powered up (WP 0005)

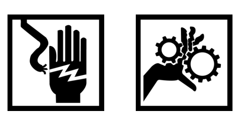
### INTRODUCTION

This Work Package provides guidance for troubleshooting the following symptoms: IECU fails to provide any cooling; system initially provides adequate cooling, then stops cooling; compressor troubleshooting; compressor is noisy on startup; high system pressure, low system pressure, crankcase heater assembly (HR1) inoperative; and condenser fan assembly (B3 and B4) inoperative.

### TROUBLESHOOTING PROCEDURE(S)

### Lack Of Cooling

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**SYMPTOM**

IECU FAILS TO PROVIDE SUFFICIENT COOLING

## TROUBLESHOOTING – CONTINUED

### MALFUNCTION

Power Fault or Sensor Fault

#### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

Look at the Power LED on the remote control box:

a. If the LED is blinking, continue to troubleshoot, Symptom GREEN POWER ON LIGHT BLINKING, Malfunction Fault LED(s) Illuminated (WP 0020).

b. If the LED is not illuminated green and there is a problem with the compressor (B1), and circuit breaker (CB1) is ON, continue to troubleshoot, Symptom COMPRESSOR FAILS TO START, Malfunction Short In Compressor / Soft Start Wire Harness or Soft Start Box (this work package).

c. If the LED is illuminated green and there is a problem with the compressor (B1), continue to troubleshoot, Symptom COMPRESSOR FAILS TO START, Malfunction Power Loss At or In Compressor / Soft Start Box Assembly (this work package).

d. If the LED is illuminated green and there is a problem with the condenser fan assembly (B3 and B4), continue to troubleshoot, Symptom CONDENSER FAN ASSEMBLY (B3 AND B4) IS INOPERABLE, Malfunction Electrical Failure (this work package).

e. If the LED is not illuminated green and there is a problem with the condenser fan assembly, and circuit breaker (CB1) has tripped, continue to troubleshoot, Symptom CONDENSER FAN ASSEMBLY (B3 AND B4) IS INOPERABLE, Malfunction A Short In the Condenser Fan Assembly (B3 and or B4), or Wire Harness (this work package).

f. Continue to next malfunction.

### MALFUNCTION

Inadequate Airflow

#### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Inspect the exterior of the condenser and evaporator to be certain the condenser and evaporator air flow paths are clear.

STEP 2. Verify the evaporator outlet grille louvers are open and unrestricted.

STEP 3. Close the fresh air duct door (WP 0004).

## TROUBLESHOOTING – CONTINUED

STEP 4. Inspect the inlet air filter (WP 0012).

STEP 5. Set the rotary MODE switch (S4) to VENT if not already done.

STEP 6. Place a piece of paper in front of the evaporator return grille. The paper should be held against the louver by the air flow:

a. If airflow is not sufficient, continue to troubleshoot, VENT MODE INOPERABLE (WP 0017).

b. If airflow is sufficient, continue to next malfunction.

**MALFUNCTION**

Mechanical Problem

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Test the evaporator air outlet thermistor (RT2) (WP 0063).

STEP 2. Test the bullet thermistor (RT3) (WP 0047).

STEP 3. Set the rotary MODE switch (S4) to COOL.

STEP 4. Set the TEMPERATURE control thermostat (R1) to max cool by rotating the TEMPERATURE knob fully counter clockwise. The evaporator inlet air temperature must be above 55 °F:

a. If the compressor does not start after two seconds, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING, Malfunction Power Fault or Sensor Fault (this work package).

b. If the condenser fan does not start after another 3 seconds, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT COOLING, Malfunction Power Fault or Sensor Fault (this work package).

c. If the evaporator blower assembly (B2) does not start after two seconds, continue to troubleshoot, VENT MODE INOPERABLE (WP 0017).

d. Continue to Step 5.

STEP 5. Place a piece of paper at the center of the condenser inlet grille. The paper should be held against the grille by the suction of the fans:

a. If airflow is not sufficient, identify the fan that is not operational and continue to troubleshoot, Symptom CONDENSER FAN ASSEMBLY (B3 AND B4) IS INOPERABLE, Malfunction Electrical Failure (this work package).

b. If airflow is sufficient, continue to next malfunction.

**MALFUNCTION**

Refrigerant Problem

**TROUBLESHOOTING – CONTINUED**

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Inspect the sight-glass for signs of low refrigerant charge or moisture in the refrigerant (WP 0010).

STEP 2. Test the refrigerant pressures (WP 0026).

STEP 3. Test the TXV (WP 0046).

STEP 4. If the system still does not provide sufficient cooling, continue to next malfunction.

**MALFUNCTION**

Moisture In System

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**NOTE**

If the system loses cooling after operating for some time the problem is likely moisture in the system, which is freezing at the TXV and blocking the refrigerant flow. Once the system stops cooling the ice blockage melts and the system once again behaves normally, until the ice blockage reforms.

Replace the filter-drier (WP 0053) and recharge the system with new refrigerant (WP 0031).

**SYMPTOM**

COMPRESSOR FAILS TO START

**MALFUNCTION**

Short In Compressor / Soft Start Wire Harness or Soft Start Box Assembly

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Test the compressor (WP 0054).

**TROUBLESHOOTING – CONTINUED**

a. If fault persists, remove and open the soft start box (WP 0037).

b. If fault does not persist, verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 2. Disconnect all connections from capacitor C1 and check for continuity between each terminal and the body of the capacitor:

a. If continuity is present, replace capacitor C1 (WP 0037).

b. If continuity is not present, continue to Step 3.

STEP 3. Check for continuity between pin 2 in connector P14 on the soft start box and the case of the soft start box:

a. If continuity is present, replace wire harness W41 (WP 0038).

b. If continuity is not present, continue to Step 4.

STEP 4. Remove the following wires:

- Remove pin 2 wire in connector P14 on W41 from terminal 6 on relay K3.
- Remove pin 1 wire in connector P14 on W41 from terminal R on the soft starter (U3).
- Remove pin 3 wire in connector P14 on W41 from terminal on capacitor (C1).

STEP 5. Place a wire nut on the end of the bare disconnected wires or place them on an insulator.

STEP 6. Check for continuity between the following pins in connector P14:

- Pin 1 and 2.
- Pin 1 and 3.
- Pin 2 and 3.

a. If continuity is found between any set of pins, replace wire harness W41 (WP 0038).

b. If continuity is not present, continue to Step 7.

STEP 7. Remove wires from terminal 8 and 6 on relay K3.

STEP 8. Check for continuity between terminals 8 and 6:

a. If continuity is present, replace relay K3 (WP 0037).

b. If continuity is not present, continue to Step 9.

STEP 9. Remove wires from terminals 4 and 2 on relay K3.

STEP 10. Check for continuity between terminals 4 and 2:

a. If continuity is present, replace relay K3 (WP 0037).

b. If continuity is not present, continue to Step 11.

STEP 11. Reconnect the following wires:

- Connect pin 2 wire in connector P14 to terminal 6 on relay K3.
- Connect pin 1 wire in connector P14 to terminal R on the soft starter.
- Connect pin 3 wire in connector P14 to a open capacitor terminal.

## TROUBLESHOOTING – CONTINUED

- Connect wire W37 to the same capacitor terminal as the pin 3 wire in connector P14
- Connect wire W36 to the remaining free terminal on capacitor C1.
- Connect wire W46 to the same capacitor terminal as wire W36.
- Connect wire W50 to terminal 8 on relay K3.
- Connect wire W38 to terminal 6 on relay K3.
- Connect wire W49 and pin 2 wire in connector P12 to terminal 4 on relay K3.
- Connect wire W46 to terminal 2 on relay K3.

STEP 12. If the breaker is still tripping and no components in the soft start box have been replaced, replace the soft start box (WP 0037).

### MALFUNCTION

Power Loss At or In Compressor / Soft Start Box Assembly

#### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**NOTE**

- In the event that the compressor fails to start on the first attempt or stops running, the soft starter will handle restart attempts for a stopped compressor. If the first start attempt is unsuccessful, another two attempts will be made at five second intervals. If the compressor still has failed to start, the soft starter will perform restart attempts indefinitely at three minute intervals.
- Ensure power is connected at the evaporator side power connector (P1).

STEP 1. Remove cover assembly (WP 0032).

**WARNING**

- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.

**TROUBLESHOOTING – CONTINUED**

- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.

STEP 2. Disconnect connector J4 on wire harness W17 from connector P4 on the back of the control box.

STEP 3. Set the circuit breaker (CB1) to ON.

STEP 4. Check that 115 VAC is being supplied to pins 3 and 4 of connector P4 on wiring harness W27:

a. If voltage is present, continue to Step 9.

b. If voltage is not present, continue to Step 5.

STEP 5. Set the circuit breaker (CB1) to OFF and disconnect the power cable.

STEP 6. Remove the control box and control box cover (WP 0042).

STEP 7. Check the continuity between pin 3 on connector P4 (back of control box) and the load terminal on circuit breaker (CB1).

STEP 8. Check the continuity between pin 4 on connector P4 (back of the control box) and terminal 6 on relay K1 in the control box:

a. If continuity is not present in either connection, replace wire harness W27 (WP 0038).

b. If continuity is present in both connections, continue to troubleshoot, Symptom POWER ON LIGHT NOT ILLUMINATED, Malfunction Broken Power Distribution Components and or Wire/Wire Harnesses (WP 0020).

STEP 9. Disconnect connector J8 from P8 and check the continuity between the following sockets on W17 wiring harness:

- Socket 3 on connector J4 and pin 1 on connector P8.
- Socket 4 of connector J4 and pin 2 of connector P8.

a. If continuity is present in both, continue to Step 10.

b. If continuity is not present in either set, replace wire harness W17 (WP 0038).

STEP 10. Disconnect connector J12 to co check wire harness W1. Check for continuity between:

- Socket 1 on connector J8 and socket 1 on connector J12.
- Socket 2 on connector J8 and socket 2 on connector J12.

a. If continuity is present in both, continue to Step 11.

b. If continuity is not present in both, replace wire harness W1 (WP 0038).

STEP 11. Remove the compressor (B1) terminal cover and check for continuity between the following sockets on wire harness W13:

- Socket 1 on connector J14 and the compressor Run terminal.
- Socket 2 and the compressor Common terminal.
- Socket 3 and the compressor Start terminal.

**TROUBLESHOOTING – CONTINUED**

a. If continuity is missing from any connection, replace wire harness W13 (WP 0038).

b. If continuity is present, continue to Step 12.

STEP 12. Test the compressor (WP 0054).

STEP 13. Connect the power cable and set the circuit breaker (CB1) to ON.

STEP 14. Set the rotary MODE switch (S4) to COOL.

STEP 15. Set the TEMPERATURE control thermostat (R1) to max cool by rotating the TEMPERATURE knob fully counterclockwise. The air entering the evaporator must be at least 55 °F.

STEP 16. Check for compressor power at the compressor, by measuring the voltage between the compressor Common terminal and ground (Ground Stud):

a. If 115 VAC is present at the compressor, test the soft start box assembly (WP 0037).

b. If 115 VAC power is not present at the compressor, continue to next malfunction.

c. If the compressor still fails to start, replace the soft start box (WP 0037).

**MALFUNCTION**

Control Signal Does Not Reach Soft Start Box Assembly

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Disconnect connector J11 from P11 on the soft start box.

STEP 2. Set the rotary MODE switch (S4) to COOL.

STEP 3. Measuring the control voltage across sockets 4 and 6 of connector J11 on wiring harness W1:

a. If 12 VDC power is not present, then continue to Step 4.

b. If 12 VDC is present, test the soft start box (WP 0037).

STEP 4. Check for 12 VDC on control box pins 14 and 16 in P7 on the control box:

a. If 12 VDC is present, continue to Step 5.

b. If 12 VDC power is not being supplied to pins 14 and 16 of P7, continue to troubleshoot, Symptom LIGHT NOT ILLUMINATED, Malfunction Broken Power Distribution Components and or Wire/Wire Harnesses (WP 0020).

STEP 5. Check for continuity between the following:

- Socket 14 on connector J7 and pin 15 on connector P8.

**TROUBLESHOOTING – CONTINUED**

- Socket 16 on connector J7 and pin 17 on connector P8.

a. If continuity is missing from either set, replace wire harness W17 (WP 0038).

b. If continuity is present, replace wire harness W1 (WP 0038).

**SYMPTOM**

COMPRESSOR IS NOISY ON START-UP

**MALFUNCTION**

Compressor Liquid Slugging

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Inspect the exterior of the condenser and evaporator to be certain the condenser and evaporator airflow paths are clear.

STEP 2. Verify the evaporator inlet and outlet grille louvers are open and unrestricted.

STEP 3. Verify that the inlet air filter is clean. Remove debris and clean if necessary (WP 0012).

STEP 4. Test the TXV (WP 0046).

**SYMPTOM**

HIGH SYSTEM PRESSURE

**MALFUNCTION**

Pressure Relief Valve Has Vented

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Leak Check the Pressure Relief valve, since this may leak once it has released. Replace if leaks are found (WP 0061).

STEP 2. Test the high pressure switch assembly (S2) (WP 0039).

## TROUBLESHOOTING – CONTINUED

STEP 3. Verify that the cover assembly lid is shut and that the quarter-turn latches are locked so that the lid is secure.

STEP 4. Continue to next malfunction.

**MALFUNCTION**

Refrigerant System Problem

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**NOTE**

These tests require the IECU to operate. If the high-pressure switch immediately stops the system, connect a manifold gauge set to the IECU (WP 0026). Crack the high and low side hand valves to allow some refrigerant flow from the high-side to the low-side and prevent a high pressure cut off. Bypass as little refrigerant as possible to prevent a high-pressure cut off.

STEP 1. Set the IECU to COOL mode and set the thermostat to maximum cooling. Ensure the TEMPERATURE control thermostat (R1) is set to full cooling (full counterclockwise). The air entering the evaporator must be at least 55 °F.

STEP 2. Test the TXV (WP 0046).

STEP 3. Allow the unit to run in COOL MODE for up to 15 minutes.

STEP 4. Turn the IECU OFF and quickly feel the exterior of the filter-drier:

a. If filter-drier is colder than the refrigerant piping feeding it, the filter-drier is obstructed and flashing refrigerant. Replace the filter-drier (WP 0053).

b. If the unit operates properly then the high-side pressure increases suddenly after operating for a while, there is moisture in the system, freezing at the TXV and blocking the refrigerant flow. Once the system stops cooling, the ice blockage melts and the system once again behaves normally until the ice blockage forms again. To remedy the problem replace the filter-drier (WP 0053) and recharge the system with new R-410A (WP 0031).

c. If the symptoms persist, continue to next malfunction.

**MALFUNCTION**

Insufficient Airflow

**TROUBLESHOOTING – CONTINUED**

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. With the IECU OFF, verify the condenser air flow path is not blocked and that the condenser fans rotate freely.

STEP 2. With the IECU set to COOL mode, verify sufficient airflow at each condenser fan by placing a piece of paper in front of the condenser inlet grille. The paper should be held against the grille by the suction of the fan:

a. If airflow is not sufficient, continue to troubleshoot, Symptom CONDENSER FAN ASSEMBLY (B3 AND B4) IS INOPERABLE, Malfunction Electrical Failure (this work package).

b. If the airflow is sufficient continue to Step 3.

STEP 3. The IECU should be functioning properly:

a. If the problem remains, replace the compressor to condenser tube assembly (WP 0060).

b. If the problem remains, replace the condenser brazing assembly (WP 0057).

**SYMPTOM**

LOW SYSTEM PRESSURE

**MALFUNCTION**

Low Pressure

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Inspect the exterior of the evaporator side of the IECU to be certain the evaporator inlet and outlet air flow paths are clear.

STEP 2. Verify the evaporator inlet and outlet grille louvers are open and unrestricted.

STEP 3. Close the fresh air duct door.

STEP 4. Inspect the inlet air filter (WP 0012).

STEP 5. Inspect the evaporator (WP 0059).

**TROUBLESHOOTING – CONTINUED**

**NOTE**

These tests require the IECU to operate. If the low pressure switch assembly (S3) immediately stops the system, connect a manifold gauge set to the IECU (WP 0026). Crack the high and low side hand valves to allow some refrigerant flow from the high-side to the low-side and prevent a low pressure cut off. Bypass as little refrigerant as possible to prevent a low-pressure cut off.

STEP 6. Set the IECU to COOL mode and set the thermostat to maximum cooling. The evaporator inlet air temperature must be at least 55 °F.

a. If the evaporator blower assembly (B2) does not start, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE, Malfunction Evaporator Blower (B2) Not Powered (WP 0017).

b. If the evaporator blower assembly (B2) starts, continue to Step 7.

STEP 7. Verify sufficient airflow at the evaporator outlet grille by holding a piece of paper in the air flow. The paper should be deflected by the discharge of the blower:

a. If airflow is not sufficient, replace the evaporator blower assembly (B2) (WP 0058).

b. If airflow is sufficient, continue to Step 8.

STEP 8. Set the rotary MODE switch (S4) to OFF.

STEP 9. Open the condenser section and feel the exterior of the filter-drier. If it is colder than the refrigerant piping feeding it, the filter-drier is obstructed and flashing refrigerant. Replace the filter-drier (WP 0053) and recharge the system (WP 0031).

STEP 10. Set the rotary MODE switch (S4) to COOL.

STEP 11. Inspect the sight-glass for signs of improper refrigerant charge (WP 0010).

STEP 12. Check the moisture indicator for signs of water in the refrigerant. If moisture is present, replace the filter-drier (WP 0053), re-charge the system with new refrigerant (WP 0031).

STEP 13. Test the TXV (WP 0046).

STEP 14. If the problem remains, remove the evaporator-to-bulkhead wall tubing and bulkhead wall-to-compressor tubing (WP 0060) and check for restrictions in the piping. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**SYMPTOM**

FAILED CRANKCASE HEATER ASSEMBLY (HR1) SUPPLY VOLTAGE TEST

**MALFUNCTION**

Broken Crankcase Heater Assembly (HR1) Connecting Wire Harness

## TROUBLESHOOTING – CONTINUED

### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to OFF. If the unit has been operating, let the IECU cool down to room temperature before proceeding.

STEP 2. Remove cover assembly (WP 0032).

**WARNING**

- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.

- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.

STEP 3. Remove connector J7 from the P7 connector on the rear of the control box.

STEP 4. Measure for 115 VAC across pins 1 and 2 of connector P7:

a. If 115 VAC is present, continue to Step 5.

b. If 115 VAC is not present, continue to troubleshoot, Symptom POWER ON LIGHT NOT ILLUMINATED, Malfunction Control Board (U2) or Power Board (U1) Inoperative (WP 0020).

STEP 5. Reconnect connector J7 to the rear of the control box.

STEP 6. Disconnect connector P8 of wiring harness W17 from connector J8 of wiring harness W1.

STEP 7. Measure the voltage across pins 7 and 8 in connector P8:

a. If 115 VAC is present, replace wire harness W1 (WP 0038) and install the cover assembly (WP 0032).

b. If 115 VAC is not present, replace wire harness W17 (WP 0038) and install the cover assembly (WP 0032).

### MALFUNCTION

Short In Crankcase Heater Circuit

## TROUBLESHOOTING – CONTINUED

### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Remove power from the IECU.

STEP 2. Disconnect the following connectors:

a. Connector J7 on wire harness W17 from P7 on the back of the control box.

b. Connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 3. Check for continuity between pins 7 and 8 in connector P8 on wire harness W17:

a. If continuity is present, replace wire harness W17 (WP 0038).

b. If continuity is not present, continue to Step 4.

STEP 4. Reconnect all disconnected connectors.

STEP 5. Disconnect the following connectors:

a. Connector J31 on wire harness W1 from connector P31 on the crankcase heater assembly (HR1).

b. Connector J38 on wire harness W1 from connector P38 on the crankcase heater assembly (HR1).

STEP 6. Check the continuity between connectors J31 and J38 on wire harness W1:

a. If continuity is present, replace wire harness W1 (WP 0038).

b. If continuity is not present, continue to Step 7.

**NOTE**

Chassis ground is at the stud located in the condenser section of the unit.

STEP 7. Check for continuity between the following connectors and ground:

- Connector P31 on crankcase heater assembly (HR1) and chassis ground.
- Connector P38 on crankcase heater assembly (HR1) and chassis ground.

a. If there is continuity between either connector P31 or P38 and ground, replace the crack case heater assembly (WP 0055).

b. If there is no continuity between either connector P31 or P38 and ground, test the crank case heater (WP 0055).

STEP 8. If fault still remains, replace the power board (U1) (WP 0043).

### SYMPTOM

CONDENSER FAN ASSEMBLY (B3 AND B4) INOPERABLE

## TROUBLESHOOTING – CONTINUED

### MALFUNCTION

Electrical Failure

#### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Remove cover assembly (WP 0032).

STEP 2. Disconnect connector P28 on the high pressure switch assembly from connector J28 on wire harness W1.

STEP 3. Set the rotary MODE switch (S4) to COOL.

STEP 4. Set the TEMPERATURE control thermostat (R1) to max cool (rotate counter clockwise). The evaporator inlet air temperature must be at least 55 °F.

STEP 5. Visually check to see which fan is inoperable.

STEP 6. Remove connector P7 from J7.

STEP 7. Check for 115 VAC across pins 3 and 9 and pins 4 and 10 of connector P7:

a. If 115 VAC is not present at both set of pins, continue to troubleshoot, Symptom POWER ON LIGHT NOT ILLUMINATED, Malfunction Control Board (U2) or Power Board (U1) Inoperative (WP 0020).

b. If 115 VAC is not present at one set of pins but not both, replace the power board (U1) (WP 0043).

c. If 115 VAC is present at P7, reconnect connector J7 and continue to Step 8.

STEP 8. Measure the voltage at sockets A and B of connector J32 or J33 (fan that is not working):

a. If 115 VAC is present, replace the applicable fan (B3 or B4) (WP 0056).

b. If voltage is not present for J32, continue to Step 9.

c. If voltage is not present for J33, continue to Step 11.

STEP 9. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 10. Check the voltage between pins 9 and 11 of connector P8 on wiring harness W17:

a. If 115 VAC is present, replace the wiring harness W1 (WP 0038).

b. If 115 VAC is not present, replace wiring harness W17 (WP 0038).

STEP 11. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 12. Check the voltage between pins 10 and 12 of connector P8 of wiring harness W17:

a. If 115 VAC is present, replace the wiring harness W1 (WP 0038) and install the cover assembly (WP 0032).

TROUBLESHOOTING – CONTINUED

b. If 115 VAC is not present, replace wiring harness W17 (WP 0038) and install the cover assembly (WP 0032).

MALFUNCTION

A Short In the Condenser Fan Assembly (B3 and or B4) or Wire Harness

CORRECTIVE ACTION

NOTE

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Disconnect connector J32 on wire harness W1 from condenser fan assembly B3.

STEP 2. Disconnect connector J33 on wire harness W1 from condenser fan assembly B4.

STEP 3. Check for continuity between the following sockets:

- Sockets A and B in connector J32 on wire harness W1.
- Sockets A and B in connector J33 on wire harness W1.

a. If continuity is present between the sockets in connector J32, continue to Step 4.

b. If continuity is present between the sockets in connector J33, continue to Step 8.

c. If continuity is missing between the sockets in connector J32, continue to Step 12.

d. If continuity is missing between the sockets in connector J33, continue to Step 13.

STEP 4. Disconnect connector J8 on wire harness W1 from connector P8 on wire harness W17.

STEP 5. Check for continuity between pins 9 and 11 in connector P8 on wire harness W17:

a. If continuity is present, continue to Step 6.

b. If continuity is missing, replace wire harness W1 (WP 0038).

STEP 6. Disconnect connector J7 on wire harness W17 from connector P7 on the control box.

STEP 7. Check for continuity between pins 3 and 9 in connector P7 on the control box:

a. If continuity is found, replace the power board (U1) (WP 0043).

b. If continuity is missing, replace wire harness W17 (WP 0038).

STEP 8. Disconnect connector J8 on wire harness W1 from connector P8 on wire harness W17.

STEP 9. Check for continuity between pins 10 and 12 in connector P8 on wire harness W17:

a. If continuity is present, continue to Step 10.

## TROUBLESHOOTING – CONTINUED

b. If continuity is missing, replace wire harness W1 (WP 0038).

STEP 10. Disconnect connector J7 on wire harness W17 from connector P7 on the control box.

STEP 11. Check for continuity between pins 4 and 10 in connector P7 on the control box:

a. If continuity is found, replace the power board (U1) (WP 0043).

b. If continuity is missing, replace wire harness W17 (WP 0038).

STEP 12. Measure the resistance between pins A and B in P32:

a. If the measured resistance is 16 ohms or less, replace condenser fan assembly (B3) (WP 0056).

b. If the measured resistance is greater than 16 ohms, continue to Step 13.

STEP 13. Measure the resistance between pins A and B in P33:

a. If the measured resistance is 16 ohms or less, replace condenser fan assembly (B4) (WP 0056).

b. If the measured resistance is greater than 16 ohms, reconnect all disconnected connectors. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## TROUBLESHOOTING PROCEDURES - LACK OF HEATING

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0004
WP 0005
WP 0012
WP 0017
WP 0020
WP 0037

**References - cont'd**

WP 0038
WP 0042
WP 0052
WP 0063
WP 0064
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)

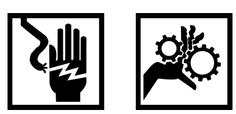
### INTRODUCTION

This Work Package provides guidance for troubleshooting the IECU, specifically when it fails to provide sufficient heat, and/or heater assembly (HR2 or HR3) are not operable.

### TROUBLESHOOTING PROCEDURE(S)

#### Lack Of Heating

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**SYMPTOM**

IECU FAILS TO PROVIDE SUFFICIENT HEAT

**MALFUNCTION**

Power Fault, or Sensor Fault

## TROUBLESHOOTING – CONTINUED

### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Look at the Power LED on the remote control box:

a. If the LED is illuminated solid green, continue to next malfunction.

b. If the LED is not illuminated green, continue to troubleshoot, Symptom HEATER ASSEMBLY (HR2 OR HR3) IS NOT OPERABLE, Malfunction Short In Heater Assembly (HR2 or HR3) or Heater Wire Harness (this work package).

c. If the LED is blinking, continue to troubleshoot, Symptom GREEN POWER ON LIGHT BLINKING, Malfunction Fault LED(s) Illuminated (WP 0020).

### MALFUNCTION

Obstructed Air Path or Faulty Blower

### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Inspect the exterior of evaporator to be certain the evaporator air flow paths are clear.

STEP 2. Verify the evaporator outlet grille louvers are open and unrestricted.

STEP 3. Close the fresh air duct door assembly (WP 0004).

STEP 4. Inspect the inlet air filter (WP 0012).

STEP 5. Set the rotary MODE switch (S4) to HEAT.

STEP 6. Verify sufficient airflow at the evaporator by placing a piece of paper in front of the evaporator inlet grille. The paper should be held against the louver by the air:

a. If airflow is sufficient, continue to next malfunction.

b. If airflow is not sufficient, continue to troubleshoot, VENT MODE INOPERABLE (WP 0017).

### MALFUNCTION

Improper Temperature Control

**TROUBLESHOOTING – CONTINUED**

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Test the evaporator air outlet thermistor (RT2) (WP 0063).

STEP 2. Test the bullet thermistor (RT3) (WP 0047).

STEP 3. Power up the IECU (WP 0005).

STEP 4. Set the rotary MODE switch (S4) to HEAT.

STEP 5. Let the system run for two minutes to allow the heating elements to warm up.

STEP 6. If the system still does not provide sufficient heating, continue to troubleshoot, Symptom HEATER ASSEMBLY (HR2 OR HR3) IS NOT OPERABLE, Malfunction Heater Not Powered (this work package).

**SYMPTOM**

HEATER ASSEMBLY (HR2 OR HR3) IS NOT OPERABLE

**MALFUNCTION**

A Short In Heater Assembly (HR2 or HR3) or Heater Wire Harness

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Test heater assemblies (HR2 and HR3) (WP 0052).

STEP 2. Disconnect J10 on wire harness W19 from connector P10 on wire harness W21.

STEP 3. Disconnect connector J13 on wire harness W19 from connector P13 on the soft start box assembly.

STEP 4. Check for continuity between the following sockets:

- Sockets A and B in connector J20 on wire harness W21.
- Sockets A and B in connector J21 on wire harness W21.
- Socket A in connector J21 and socket B in connector J20.

a. If continuity is present for any set of sockets, replace wire harness W21 (WP 0038).

b. If continuity is not present, continue to Step 5.

## TROUBLESHOOTING – CONTINUED

STEP 5. Check for continuity between the following sockets:

- Sockets 1 and 2 in connector J10.
- Sockets 2 and 3 in connector J10.
- Sockets 3 and 4 in connector J10.

a. If continuity is present between any set of sockets, replace wire harness W19 (WP 0038).

b. If continuity is missing between all sets of sockets, continue to Step 6.

STEP 6. Remove and open the soft start box assembly (WP 0037).

STEP 7. Remove wires from terminals 8 and 6 on relay K2.

STEP 8. Check for continuity between terminals 8 and 6:

a. If continuity is present, replace relay K2 (WP 0037).

b. If continuity is not present, continue to Step 9.

STEP 9. Remove wires from terminals 4 and 2 on relay K2.

STEP 10. Check for continuity between terminals 4 and 2:

a. If continuity is present, replace relay K2 (WP 0037).

b. If continuity is not present, continue to Step 11.

STEP 11. Check for continuity between pins 2 and 3 in connector P13 on wire harness W42:

a. If continuity is present, replace wire harness W42 (WP 0038).

b. If continuity is not present, continue to Step 12.

STEP 12. Reconnect the wire from pin 1 in connector P12 on wire harness W43 and wire W50 to terminal 8 on relay K2. Also reconnect wires from pins 1 and 2 in connector P13 on wire harness W42 to terminal 6 on relay K2.

STEP 13. Reconnect wire W46 to terminal 4 on relay K2. Also reconnect wires from pins 3 and 4 in connector P13 on wire harness W42 to terminal 2 on relay K2.

STEP 14. Close and install the soft start box assembly (WP 0037).

### MALFUNCTION

Heater Not Powered

### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Disconnect connector J4 on wire harness W17 and connector P4 on wire harness W27.

STEP 2. Apply power and measure the voltage between pins 3 and 4 in connector P4 on wire harness W27:

**TROUBLESHOOTING – CONTINUED**

a. If 115VAC is present, continue to Step 6.

b. If 115VAC is not present, continue to Step 3.

STEP 3. Disconnect power from the IECU.

STEP 4. Remove the control box and control box cover (WP 0042).

STEP 5. Check the continuity between the follow locations:

- Pin 3 in connector P4 on wire harness W27 and circuit breaker (CB1) load terminal.
- Pin 4 in connector P4 on wire harness W27 and terminal 6 of relay K1.

a. If continuity is not present in either connection, replace wire harness W27 (WP 0038).

b. If continuity is present in both connections, continue to troubleshoot, Symptom POWER ON LIGHT NOT ILLUMINATED, Malfunction Broken Power Distribution Components and or Wire/Wire Harnesses (WP 0020).

STEP 6. Check the continuity between the following sockets and pins:

- Socket 3 in connector J4 and pin 1 in connector P8 on wiring harness W17.
- Socket 4 in connector J4 and pin 2 in connector P8 on wiring harness W17.

a. If continuity is present between all sets, continue to Step 7.

b. If continuity is not present in any one set, replace wire harness W17 (WP 0038).

STEP 7. Check the continuity between the following sockets:

- Socket 1 in connector J8 and socket 1 in connector J12 on wire harness W1.
- Socket 2 in connector J8 and socket 2 in connector J12 on wire harness W1.

a. If continuity is present between all sets of sockets, continue to Step 8.

b. If continuity is not present in any one set of sockets, replace wire harness W1 (WP 0038).

STEP 8. Disconnect the following connectors:

- Connector J13 on wire harness W19 from connector P13 on the soft start box.
- Connector J10 on wire harness W19 from connector P10 on wire harness W21.
- Connector J20 on wire harness W21 from connector P20 on tubular heater assembly (HR2).
- Connector J21 on wire harness W21 from connector P21 on tubular heater assembly (HR3).

STEP 9. Check for continuity between matching socket numbers in connector J10 and J13 on wire harness W19.

a. If continuity is missing from any connection, replace wire harness W19 (WP 0038).

b. If continuity is present in every connection, continue to Step 10.

**TROUBLESHOOTING – CONTINUED**

STEP 10. Check for continuity between the following sets:

- Socket A connector J20 and pin 1 connector P10.
- Socket B connector J20 and pin 3 connector P10.
- Socket A connector J21 and pin 2 connector P10.
- Socket B connector J21 and pin 4 connector P10.

a. If continuity is missing from any connection on wire harness W21, replace wire harness W21 (WP 0038).

b. If continuity is present in all connections on wire harness W21, continue to Step 11.

STEP 11. Reconnect all disconnected connectors.

STEP 12. Continue to next malfunction.

**MALFUNCTION**

Fault In Heater Control Circuit

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to HEAT.

STEP 2. Set the TEMPERATURE control thermostat (R1) to max heat by rotating the TEMPERATURE knob fully clockwise. The evaporator inlet air temperature must be below 90 °F for the heater to activate.

STEP 3. Measure for 12 VDC control voltage across sockets 4 and 5 of connector J11 on wiring harness W1. This is to check if the proper heater relay (K2) control voltage is being sent to the soft start box:

a. If 12 VDC power is being supplied to sockets 4 and 5 at the soft start box, continue to test the soft start box assembly (WP 0037).

b. If 12 VDC power is not being supplied at the soft start box, continue to Step 4.

STEP 4. Measure for 12 VDC voltage output from pins 15 and 16 on connector P7 of the control box:

a. If 12 VDC is available at pins 15 and 16 on connector P7, continue to Step 5.

b. If 12 VDC is not available at pins 15 and 16 of connector P7, continue to troubleshoot, Symptom POWER ON LIGHT NOT ILLUMINATED, Malfunction Control Board (U2) or Power Board (U1) Inoperative (WP 0020).

STEP 5. Check for continuity between the following sockets on W1 and W17 wiring harnesses:

## TROUBLESHOOTING – CONTINUED

a. Socket 16 of connector J8 should have continuity with socket 5 of connector J11 on wire harness W1. If no continuity, replace wire harness W1 (WP 0038).

b. Socket 17 of connector J8 should have continuity with socket 4 of connector J11 on wire harness W1. If no continuity, replace wire harness W1 (WP 0038).

c. Pin 16 of connector P8 should have continuity with socket 15 of connector J6 in wire harness W17. If no continuity, replace wire harness W17 (WP 0038).

d. Pin 17 of connector P8 should have continuity with socket 16 of connector J6 in wire harness W17. If no continuity, replace wire harness W17 (WP 0038).

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## TROUBLESHOTING PROCEDURES - ELECTRICAL COMPONENTS

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0003
WP 0015
WP 0017
WP 0018
WP 0019
WP 0024
WP 0026
WP 0027
WP 0032
WP 0038

**References - cont'd**

WP 0039
WP 0040
WP 0041
WP 0042
WP 0043
WP 0044
WP 0045
WP 0062
WP 0063
WP 0064
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)

### INTRODUCTION

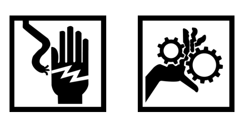
This Work Package provides guidance for troubleshooting symptoms identified with a blinking green POWER ON light on the front of the remote control box instead of illuminating solid green. If the light is blinking, a power or sensor-based fault has occurred which influences the current operating mode of the unit.

Potential malfunctions include but not limited to: thermistors assembly (RT1, RT2, or RT3) inoperative, pressure transducer assembly (MT1 or MT2) inoperative, control box inoperative, and circuit board U1 or U2 inoperative.

### TROUBLESHOOTING PROCEDURE(S)

#### Electrical Components

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**NOTE**

Before using fault procedures, be sure you have performed all applicable operating checks.

**SYMPTOM**

POWER ON LIGHT NOT ILLUMINATED

**TROUBLESHOOTING – CONTINUED**

**MALFUNCTION**

Power Board Circuit Breaker Tripped

**CORRECTIVE ACTION**

**WARNING**

Circuit breaker (CB1) is mounted on the hinged control box door. When the unit is plugged in, be sure not to touch the rear of the control box door around the circuit breaker.

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Open the control box assembly (WP 0042):

a. If the circuit breaker on power board (U1) has tripped, continue to Step 2.

b. If the circuit breaker on power board (U1) is still closed, continue to next malfunction.

STEP 2. Set the rotary MODE switch (S4) to OFF.

STEP 3. Close the power board (U1) breaker:

a. If the power board (U1) breaker trips, continue to troubleshoot, Symptom FAILED CRANKCASE HEATER ASSEMBLY SUPPLY VOLTAGE TEST, Malfunction Short In Crankcase Heater Assembly Circuit (WP 0018).

b. If the power board (U1) breaker remains closed, continue to Step 4.

STEP 4. Set the rotary MODE switch (S4) to VENT:

a. If the power board (U1) breaker trips, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE, Malfunction Short In Evaporator Blower (B2) or Associated Circuitry (WP 0017).

b. If the power board (U1) breaker remains closed, continue to Step 5.

STEP 5. Set the rotary MODE switch (S4) to COOL:

a. If the power board (U1) breaker trip, continue to troubleshoot, Symptom CONDENSER FAN ASSEMBLY (B3 AND B4) IS INOPERABLE, Malfunction Short In The Condenser Fan Assembly (B3 and or B4), or Wire Harness (WP 0018).

b. If the power board (U1) breaker remains closed, reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**TROUBLESHOOTING – CONTINUED**

**MALFUNCTION**

Broken Power Distribution Components or Wire/Wire Harnesses

**CORRECTIVE ACTION**

**WARNING**

- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.

**CAUTION**

Each time an AC voltage measurement is taken inside the control box, disconnect power to IECU, position the voltage probes, and then reapply power.

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Verify the unit is properly connected to a power source and that power is available to the control box by measuring for 115 VAC input voltage at the power connection to the unit. Verify a proper ground and proper neutral.

STEP 2. Disconnect connector J5 on wire harness W29 from connector CON3 on the power circuit board (U1).

STEP 3. Set the circuit breaker (CB1) to ON.

STEP 4. Measure the voltage across sockets 1 and 2 in connector J5 on wire harness W29:

a. If 115 VAC is not present, continue to Step 5.

b. If 115 VAC is present, reconnect all disconnected connectors and continue to next malfunction.

STEP 5. Remove K1 by removing lock nut on holddown (WP 0042).

STEP 6. Measure the voltage across terminals 5 and 6 of relay K1:

a. If 115 VAC is not present (on terminals 5 and 6 of K1) and the power is being supplied by the connector on the evaporator-side of the unit, continue Step 7.

**TROUBLESHOOTING – CONTINUED**

b. If 115 VAC is not present, (on terminals 5 and 6 of K1) and the power is being supplied by the connector on the condenser-side of the unit, continue Step 9.

c. If 115 VAC is present, continue to Step 15.

STEP 7. Measure the voltage across terminals 3 and 4 of K1:

a. If the voltage is 115 VAC, continue to Step 8.

b. If voltage is not 115 VAC, replace wiring harness W32 (WP 0038).

STEP 8. Measure the voltage across terminals A and B of relay K1:

a. If it is 115 VAC, replace relay (K1) (WP 0042).

b. If voltage is not 115 VAC, replace wires W28 and W34 (WP 0038).

STEP 9. Move the power cord connection to the evaporator-side of the system:

a. If the green power indicator now illuminates, continue to Step 10.

b. If the green POWER ON indicator does not illuminate, continue to Step 17.

STEP 10. Set the circuit breaker (CB1) to OFF and then remove the power cable from the IECU.

STEP 11. Disconnect connector J4 on wire harness W17 from connector P4 on the back of the control box.

STEP 12. Disconnect connector J9 on wire harness W9 from connector P9 on wire harness W17.

STEP 13. Check for continuity between the following sets:

a. Pin 1 in connector P9 and socket 1 in connector J4.

b. Pin 2 in connector P9 and socket 2 in connector J4:

(1) If continuity is missing from either connection, replace wire harness W17 (WP 0038).

(2) If continuity is present, continue to Step 13.

STEP 14. Check for continuity between the following sets:

a. Pin A in connector P3 and socket 1 in connector J9.

b. Pin D in connector P3 and socket 2 in connector J9:

(1) If continuity is not present from either connection, replace wire harness W9 (WP 0038).

(2) If continuity is present, continue to Step 14.

STEP 15. Check for continuity between the following sets:

Pin 1 in connector P4 and terminal 1 on relay K1.

Pin 2 in connector P4 and terminal 2 on relay K1:

a. If continuity is missing from either connection, replace wire harness W27 (WP 0038).

b. If continuity is present on both connections, replace relay K1 (WP 0042).

STEP 16. Set the circuit breaker (CB1) to OFF and then remove the power cable from the IECU.

**TROUBLESHOOTING – CONTINUED**

STEP 17. Set the circuit breaker (CB1) to ON and verify that circuit breaker (CB1) is functioning properly by checking for continuity between the line and load terminals on circuit breaker (CB1):

a. If continuity is not present, then replace circuit breaker (CB1) (WP 0042).

b. If continuity is present, continue to Step 17.

STEP 18. Check for continuity between the line terminal on circuit breaker (CB1) and terminal 5 on relay K1:

a. If continuity is present, replace wire harness W29 (WP 0038).

b. If continuity is missing, replace wire W33 (WP 0038).

**MALFUNCTION**

Remote Control Box or Wiring Harness Fault

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Open the control box so that the LEDS can be seen (WP 0042).

STEP 2. Set Rotary MODE switch (S4) to OFF mode.

STEP 3. Remove the remote control box from the IECU (WP 0045).

STEP 4. Connect power to the IECU and turn on unit using circuit breaker (CB1):

a. If green LED1 and LED2 are not solidly illuminated, install the remote control box (WP 0045 and continue to next malfunction.

b. If green LED1 and LED2 are both solidly illuminated, continue to Step 5.

**CAUTION**

Each time a DC voltage measurement is taken inside the control box, disconnect power to IECU, position the voltage probes and then reapply power.

STEP 5. Measure the voltage between sockets 6 and 8 in connector J15 on wiring harness W30.

a. If the voltage is 12 VDC, replace the remote control box (WP 0045).

b. If the voltage is not 12 VDC, continue to Step 6.

STEP 6. Measure the voltage between pins 6 and 8 in CON9 on the control board.

a. If the voltage is 12 VDC, replace the wiring harness W30 (WP 0038).

b. If the voltage is not 12 VDC, replace the control board (U2) (WP 0044).

**MALFUNCTION**

Sensor or Control Signal Based Short

## TROUBLESHOOTING – CONTINUED

### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Remove cover assembly (WP 0032).

STEP 2. Disconnect connector J6 on wire harness W17 from connector P6 on the control box:

a. If LED1 and LED2 are both illuminated solid green, continue to Step 3.

b. If green LED1 and LED2 are not solidly illuminated, continue to Step 9.

STEP 3. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 4. Disconnect connector J26 on wire harness W1 from the low pressure transducer assembly (MT1):

a. If LED1 and LED2 are both illuminated solid green, replace the low pressure transducer assembly (MT1) (WP 0062).

b. If green LED1 and LED2 are not solidly illuminated, continue to Step 5.

STEP 5. Disconnect connector J27 on wire harness W1 from the high pressure transducer assembly (MT2):

a. If LED1 and LED2 are both illuminated solid green, replace the high pressure transducer assembly (MT2) (WP 0062).

b. If green LED1 and LED2 are not solidly illuminated, continue to Step 6.

STEP 6. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 7. Set the circuit breacker (CB1) to OFF and disconnect power cable.

STEP 8. Check for continuity between the following sockets:

- Sockets A and B in connector J27 on wire harness W1.
- Sockets A and B in connector J26 on wire harness W1.

a. If continuity is present between either set of sockets, replace wire harness W1 (WP 0038).

b. If continuity is not present between either set of sockets, replace wire harness W17 (WP 0038).

STEP 9. Remove connector J6 on wire harness W17 from connector P6 on the control box:

a. If LED1 and LED2 are both illuminated solid green, continue to Step 10.

b. If green LED1 and LED2 are not solidly illuminated, replace the control board (U2) first (WP 0044).

c. If green LED1 and LED2 are not solidly illuminated after replacing the control board (U2), replace the power board (U1) (WP 0043).

**TROUBLESHOOTING – CONTINUED**

STEP 10. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 11. Disconnect connector J11 on wire harness W1 from connector P11 on the soft start box:

a. If LED1 and LED2 are both illuminated solid green, replace wire harness W44 and wire W53 in the soft start box (WP 0038).

b. If green LED1 and LED2 are not solidly illuminated, continue to Step 12.

STEP 12. Reconnect connector J11 on wire harness W1 to connector P11 on the soft start box assembly.

STEP 13. Disconnect connector J8 on wire harness W1 from connector P8 on wire harness W17:

a. If LED1 and LED2 are both illuminated solid green, replace wire harness W1 (WP 0038).

b. If green LED1 and LED2 are not solidly illuminated, replace wire harness W17 (WP 0038).

**MALFUNCTION**

Control Board (U2) or Power Board (U1) Inoperative

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Remove cover assembly (WP 0032).

STEP 2. Disconnect connector P7 on wire harness W17 from connector J7 on the control box.

STEP 3. Access the LEDs on the control board (WP 0042).

STEP 4. Set the rotary MODE switch (S4) to OFF.

STEP 5. Compare the LEDs 8 through 12 on the control board (U2) with the corresponding MODE switch (S4) setting column in Table 1:

a. If LEDs 8 through 12 on control board (U2) do not match Table 1, continue to Step 6.

b. If LEDs 8 through 12 on control board (U2) do match, continue to Step 8.

STEP 6. Test the remote control box (WP 0045).

STEP 7. Replace the control board (U2) (WP 0044).

STEP 8. Check the voltage between each set of the pins identified in Table 1:

a. If the LED for the set of pins being tested is not illuminated, and anything but zero or a low changing voltage is measured, replace the power board (WP 0043).

**TROUBLESHOOTING – CONTINUED**

b. If the LED for the set of pins being tested is illuminated, but the voltage found in Table 1 is not measured, replace the power board (WP 0043).

c. If the LED for the set of pins being tested is illuminated and the voltage found in Table 1 is measured, set the rotary MODE switch (S4) to another mode that has not had this test performed and repeat Step 5.

**Table 1. IECU Modes and State of Green LEDS.**

| CIRCUIT | CORRECT VOLTAGE | LED | OFF MODE | VENT MODE | HEAT MODE | COOL MODE | P7 PINS |
|---|---|---|---|---|---|---|---|
| Condenser Fans | 115 VAC | 8 | Off | Off | Off | ON | 3 and 9; 4 and 10 |
| Evaporator Blower | 115 VAC | 9 | Off | ON | ON | ON | 11 and 13 |
| Crankcase Heater | 115 VAC | 10 | ON | ON | ON | Off | 1 and 2 |
| Compres-sor | 12 VDC | 11 | Off | Off | Off | ON | 16 and 14 |
| Heaters | 12 VDC | 12 | Off | Off | ON | Off | 16 and 15 |

**SYMPTOM**

GREEN POWER ON LIGHT BLINKING

**MALFUNCTION**

Fault LED(s) Illuminated

**CORRECTIVE ACTION**

## NOTE

Field Maintenance Troubleshooting begins with WP 0015.
If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

## NOTE

Ensure IECU is connected to power source.

STEP 1. Access the LEDs on the control board (WP 0042).

STEP 2. Starting at the top of Table 2 and working to the bottom clear any fault conditions that may exist by proceeding to the following Symptom to troubleshoot any LED fault condition (this work package).

**TROUBLESHOOTING – CONTINUED**

**Table 2. Troubleshooting Quick Reference.**

| LED | COLOR | FAULT CONDITION | BASIC DESCRIPTION | REFER TO: SYMPTOM |
|---|---|---|---|---|
| 06 | Red | Illuminated | Ground Fault--Ground connection to the unit is missing or broken. | LED6 is illuminated |
| 07 | Red | Illuminated | Phase Fault—Phase A and neutral connection to the unit have been swapped, the wrong voltage has been applied to the unit, or board jumpers have been configured incorrectly | LED7 is illuminated |
| 14 | Red | Illuminated | Heater Overheat Fault | LED14 is illuminated |
| 15 | Red | Illuminated | Low Pressure Cutout Fault | LED15 is illuminated |
| 16 | Red | Illuminated | High Pressure Cutout Fault | LED16 is illuminated |
| 17 | Red | Illuminated | Low Pressure Transducer Fault | LED17 |
| 18 | Red | Illuminated | High Pressure Transducer Fault | LED18 is illuminated |
| 19 | Red | Illuminated | Evaporator Air Inlet Thermistor Fault (RT1) | LED19 is illuminated |
| 20 | Red | Illuminated | Evaporator Air Outlet Thermistor Fault (RT2) | LED20 is illuminated |
| 21 | Red | Illuminated | Bullet Thermistor (RT3) Fault | LED21 is illuminated |

## TROUBLESHOOTING – CONTINUED

### SYMPTOM

LED6 IS ILLUMINATED

#### MALFUNCTION

Faulty Ground Connection

##### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the circuit breaker (CB1) to OFF.

STEP 2. Open the control box and ensure that the two screws securing the control board (U2) to the control box are tight (WP 0044).

STEP 3. Check and repair the broken ground connection between the IECU and the power source.

STEP 4. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

### SYMPTOM

LED7 IS ILLUMINATED

## TROUBLESHOOTING – CONTINUED

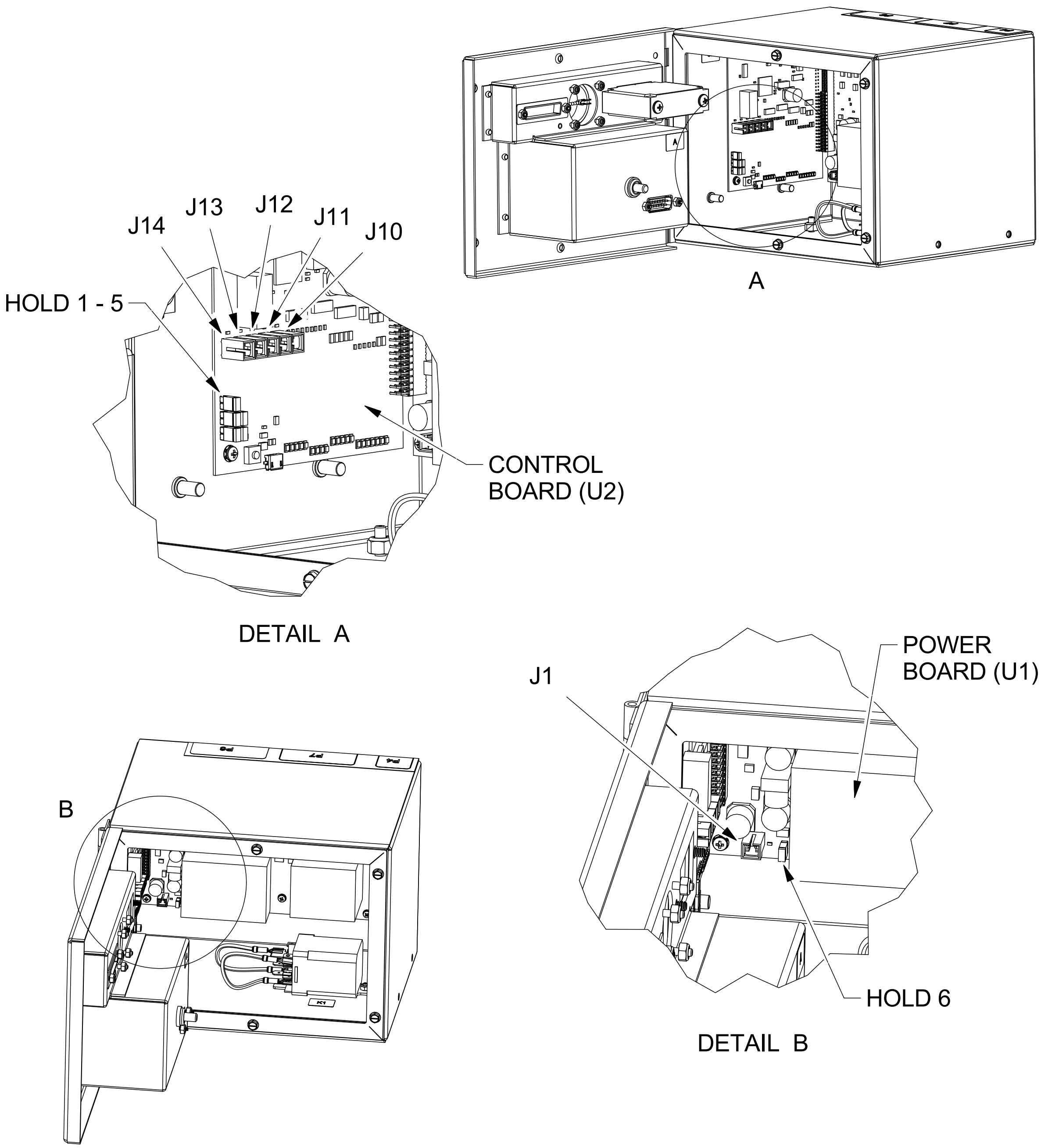



**Figure 1. Jumper Location.**

### MALFUNCTION

Hot Neutral, Applied Voltage Is Wrong, or a Jumper Configured Incorrectly

## TROUBLESHOOTING – CONTINUED

### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Ensure the IECU is shut down (WP 0005).

STEP 2. Look at headers (J10 through J14) (Figure 1) located closest to the control box door on control board (U2):

a. If a jumper is installed in header J14, remove the jumper and place in holder HOLD5, right next to header J14, continue to Step 3.

b. If a jumper is not installed in header J14, continue to Step 3.

STEP 3. Look at header J1 (Figure 1) located in the bottom left corner on the power board (U1):

a. If a jumper is installed in header J1, remove the jumper and place in holder HOLD6. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

b. If a jumper is not installed in header J1, continue to Step 4.

**WARNING**

Circuit breaker CB1 is mounted underneath the remote control box inside the control box. When the unit is plugged in, be sure not to place your hand inside the control box.

STEP 4. Disconnect connector J5 on wire harness W29 from connector CON3 on power board (U1).

STEP 5. Power up the IECU (WP 0005).

STEP 6. Place voltage probes in connector J5 on wire harness W29 and measure the voltage across sockets 1 and 2 in connector J5 on wire harness W29:

a. If the measured voltage is 115 VAC, set the circuit breaker (CB1) to OFF and swap Phase-A and the neutral connection at the power source. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

b. If the measured voltage is not 115 VAC, set the circuit breaker (CB1) to OFF and check and correct the voltage delivered from the power source. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 7. If the fault persists, replace the power board (U1) (WP 0043).

**TROUBLESHOOTING – CONTINUED**

STEP 8. If the fault remains after replacing the power board (U1), replace the control board (U2) (WP 0044).

**SYMPTOM**

LED14 IS ILLUMINATED

**MALFUNCTION**

Heater Overheat

**CORRECTIVE ACTION**

**WARNING**

After unit has been operating, the refrigeration tubing can become quite hot. Allow tubing to cool since hot surfaces can burn skin. Failure to do so may result in serious injury to personnel.

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**NOTE**

The unit should stop heating and vent the evaporator compartment when this fault is triggered.

STEP 1. Set the rotary MODE switch (S4) to HEAT.

STEP 2. The evaporator blower should be on and venting the evaporator compartment:

a. If evaporator blower assembly (B2) is not operating, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE, Malfunction Evaporator Blower (B2) Not Powered (WP 0017).

b. If evaporator blower assembly (B2) is operating, continue to Step 3.

STEP 3. Let the unit continue to vent the evaporator compartment for up to 15 minutes:

a. If LED14 turns off during this 15 minute interval, continue to troubleshoot, Symptom IECU FAILS TO PROVIDE SUFFICIENT HEAT, Malfunction Obstructed Air Flow Path or Faulty Blower (WP 0019).

b. If LED14 is still on after 15 minutes has passed, continue to Step 4.

STEP 4. Test the evaporator air outlet thermistor (RT2) (WP 0063).

STEP 5. Unlock two quarter-turn latches on cover assembly and open.

STEP 6. Disconnect connector J30 on wire harness W17 from the evaporator In assembly (RT1).

**TROUBLESHOOTING – CONTINUED**

STEP 7. Measure the voltage between sockets A and B in connector J30 on wire harness W1:

a. If the measured voltage is 5 VDC, continue to Step 14.

b. If the measured voltage is not 5 VDC, continue to Step 8.

STEP 8. Remove connector J6 on wire harness W17 from connector P6 on the control box.

STEP 9. Measure the voltage between pins 13 and 14 in connector P6:

a. If the measured voltage is 5 VDC, continue to Step 11.

b. If the measured voltage is not 5 VDC, continue to Step 10.

STEP 10. Look at LED1 on the control board (U2):

a. If LED1 is illuminated, replace the control board (U2) (WP 0044).

b. If the fault continues, replace the power board (U1) (WP 0043).

STEP 11. Reconnect all disconnected connectors.

STEP 12. Disconnect connector J24 on wire harness W1 from the evaporator air outlet thermistor assembly (RT2).

STEP 13. Measure the voltage between sockets A and B in connector J24 on wire harness W1:

a. If the measured voltage is 5 VDC, continue to Step 19.

b. If the measured voltage is not 5 VDC, continue to Step 14.

STEP 14. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 15. Measure the voltage between pins 15 and 16 in connector P6:

a. If the measured voltage is 5 VDC, continue to Step 19.

b. If the measured voltage is not 5 VDC, continue back to Step 10.

STEP 16. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 17. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 18. Measure the voltage between pins 28 and 29 in connector P8 on wire harness W17:

a. If the measured voltage is 5 VDC, replace wire harness W1 (WP 0038).

b. If the measured voltage is not 5 VDC, replace wire harness W17 (WP 0038).

c. If the fault persists continue to Step 19.

STEP 19. Reconnect all disconnected connectors and see if LED14 is still illuminated:

a. If the fault persists and the control board (U2) has not been replaced, replace the control board (U2) (WP 0044).

b. If the fault persists and the control board has been replaced, replace the power board (U1) (WP 0043).

**SYMPTOM**

LED15 IS ILLUMINATED

## TROUBLESHOOTING – CONTINUED

### MALFUNCTION

Low Pressure Switch

#### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Look and see if the evaporator blower assembly (B2) is on:

- a. If the evaporator blower assembly (B2) is not on, continue to troubleshoot, Symptom IECU FAILS TO OPERATE IN VENT MODE, Malfunction Power Fault (WP 0017).
- b. If the evaporator blower assembly (B2) is on, continue to Step 2.

STEP 2. Set the rotary MODE switch (S4) to OFF (LED15 will remain illuminated until the fault is cleared).

STEP 3. Determine the low side refrigerant pressure by checking the system pressure (WP 0026):

- a. If the low side refrigerant pressure is below 55 psig, continue to troubleshoot, Symptom LOW SYSTEM PRESSURE, Malfunction Low Pressure (WP 0018).
- b. If low side refrigerant pressure is normal, continue Step 4.

STEP 4. Unlock two quarter-turn latches on cover assembly and open.

STEP 5. Disconnect the low pressure switch assembly (S3) from wire harness W1, by disconnecting connector P29 from J29.

STEP 6. Test low pressure switch (S3) (WP 0040).

STEP 7. Measure the voltage across sockets A and B of connector J29:

- a. If 5 VDC is measured, continue to Step 14.
- b. If 5 VDC is not measured, continue to Step 8.

STEP 8. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 9. Measure the voltage between pins 11 and 12 in connector P6 on the control box:

- a. If the measured voltage is not 5 VDC, continue to Step 10.
- b. If the measured voltage is 5 VDC, continue to Step 11.

STEP 10. Look at LED1 on the control board (U2):

- a. If LED1 is illuminated, replace the control board (U2) (WP 0044).
- b. If the fault continues, replace the power board (U1) (WP 0043).

STEP 11. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

**TROUBLESHOOTING – CONTINUED**

STEP 12. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 13. Measure the voltage between pins 24 and 25 in connector P8 on wire harness W17:

a. If the measured voltage is 5 VDC, replace wire harness W1 (WP 0038).

b. If the measured voltage is not 5 VDC, replace wire harness W17 WP 0038).

STEP 14. Reconnect all disconnected connectors:

a. If LED17 is still illuminated, replace the control board (U2) WP 0044).

b. If fault still remains, replace power board (U1) (WP 0043).

**SYMPTOM**

LED16 IS ILLUMINATED

**MALFUNCTION**

High Pressure Switch

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to COOL.

STEP 2. Look at the condenser fan assemblies (B3 and B4):

a. If both condenser fans are not on, continue to troubleshoot, Symptom CONDENSER FAN ASSEMBLY (B3 AND B4) IS INOPERABLE, Malfunction Insufficient Airflow (WP 0018).

b. If both condenser fans (B3 and B4) are on, continue to Step 3.

STEP 3. Set the rotary MODE switch (S4) to OFF (LED16 will remain illuminated until the fault is cleared).

STEP 4. Press the momentary (reset) switch assembly (S1) on the condenser side of the unit:

a. If LED16 is no longer illuminated, continue to troubleshoot, Symptom HIGH SYSTEM PRESSURE, Malfunction Pressure Relief Valve Has Vented (WP 0018).

b. If LED16 is still illuminated, continue to Step 5.

STEP 5. Determine the condensing pressure (high side) Measurement (WP 0026):

a. If the High Side refrigerant pressure is above 725 psig, continue to troubleshoot, Symptom HIGH SYSTEM PRESSURE, Malfunction Pressure Relief Valve Has Vented (WP 0018).

**TROUBLESHOOTING – CONTINUED**

b. If pressure is normal (WP 0003), continue to Step 6.

STEP 6. Test momentary switch assembly (S1) (WP 0041).

STEP 7. Disconnect connector J25 on wire harness W1 from momentary switch assembly (S1).

STEP 8. Power up the IECU (WP 0005) and measure the voltage between sockets A and B in connector J25 on wire harness W1:

a. If the measured voltage is 5 VDC, continue to Step 15.

b. If the measured voltage is not 5 VDC, continue to Step 9.

STEP 9. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 10. Measure the voltage between pins 1 and 2 in connector P6 on the control box:

a. If the measured voltage is 5 VDC, continue to Step 12.

b. If the measured voltage is not 5 VDC, continue to Step 11.

STEP 11. Look at LED1 on the control board (U2):

a. If LED1 is illuminated, replace the control board (U2) (WP 0044).

b. If the fault continues, replace the power board (U1) (WP 0043).

STEP 12. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 13. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 14. Measure the voltage between pins 5 and 6 in connector P8 on wire harness W17:

a. If the measured voltage is 5 VDC, replace wire harness W1 (WP 0038).

b. If the measured voltage is not 5 VDC, replace wire harness W17 (WP 0038).

STEP 15. Test high pressure switch assembly (S2) (WP 0039).

STEP 16. Disconnect the high pressure switch assembly (S2) from connector J28 on wire harness W1.

STEP 17. Measure the voltage between sockets A and B in connector J28:

a. If the measured voltage is 5 VDC, continue to Step 23.

b. If the measured voltage is not 5 VDC, continue to Step 18.

STEP 18. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 19. Measure the voltage between pins 9 and 10 in connector P6 on the control box:

a. If the measured voltage is 5 VDC, continue to Step 20.

b. If the measure voltage is not 5 VDC, continue to Step 23.

STEP 20. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 21. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 22. Measure the voltage between pins 22 and 23 in connector P8 on wire harness W17:

**TROUBLESHOOTING – CONTINUED**

a. If the measured voltage is not 5V, replace wire harness W17 (WP 0038).

b. If the measured voltage is 5 VDC, replace wire harness W1 (WP 0038).

STEP 23. Reconnect all disconnected connectors.

STEP 24. Press momentary switch assembly (S1):

a. If the LED16 remains illuminated, replace the control board (U2) (WP 0044).

b. If the LED16 remain illuminated after the control board (U2) has been replaced, replace power board (U1) (WP 0043).

**SYMPTOM**

LED17 IS ILLUMINATED

**MALFUNCTION**

Faulty Transducer Assembly (MT1) Circuit

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to OFF.

STEP 2. Disconnect connector J26 on wire harness W1 from the low pressure transducer assembly (MT1).

STEP 3. Check the continuity between pins A and B on the low pressure transducer assembly (MT1):

a. If continuity is present, replace the low pressure transducer assembly (MT1) (WP 0062).

b. If continuity is not present, continue to Step 4.

STEP 4. Measure the voltage between sockets A and B in connector J26 on wire harness W1:

a. If the measured voltage is 12V, continue to Step 10 .

b. If the measured voltage is not 12V, continue to Step 5.

STEP 5. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 6. Measure the voltage between pins 3 and 4 in connector P6 on the control box:

a. If the measured voltage is not 12V, replace the power board (U1) (WP 0043).

b. If the measured voltage is not 12V and the power board (U1) has already been replaced, replace control board (U2) (WP 0044).

**TROUBLESHOOTING – CONTINUED**

c. If the measured voltage is 12V, continue to Step 7.

STEP 7. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 8. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 9. Measure the voltage between pins 18 and 19 in connector P8 on wire harness W17:

a. If the measured voltage is 12V, replace wire harness W1 (WP 0038).

b. If the measured voltage is not 12V, replace wire harness W17 (WP 0038).

STEP 10. Look at LED17 on control board (U2):

a. If LED17 is still illuminated, replace the control board (U2). (WP 0044).

b. If LED17 is still illuminated after replacing the control board (U2), replace the power board (U1) (WP 0043).

c. If LED17 is not illuminated continue to Step 11.

STEP 11. Reconnect all disconnected connectors.

STEP 12. Measure the low side system pressure with a manifold gauge set as well as the voltage at the diagnostic connector (J2) for the low pressure transducer (MT1) (WP 0026).

STEP 13. Compare the measured voltage from the diagnostic connector (J2) and the measured pressure from the gauge set using Table 2 in (WP 0026):

a. If the measurements are within +/- 15 psig of one another, remove gauge set. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

b. If the measurements differ by more than +/- 15 psig, replace the low pressure transducer assembly (MT1) (WP 0062).

**SYMPTOM**

LED18 IS ILLUMINATED

**MALFUNCTION**

Faulty High Pressure Transducer Assembly (MT2) Circuit

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015.
If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to OFF.

STEP 2. Disconnect connector J27 on wire harness W1 from the high pressure transducer assembly (MT2).

**TROUBLESHOOTING – CONTINUED**

STEP 3. Check the continuity between pins A and B on the high pressure transducer assembly (MT2):

a. If continuity is present, replace the high pressure transducer assembly (MT2) (WP 0062).

b. If continuity is not present, continue to Step 4.

STEP 4. Measure the voltage between sockets A and B in connector J27 on wire harness W1:

a. If the measured voltage is 12V, continue to Step 10.

b. If the measured voltage is not 12V, continue to Step 5.

STEP 5. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 6. Measure the voltage between pins 5 and 6 in connector P6 on the control box:

a. If the measured voltage is not 12V, replace the power board (U1) (WP 0043).

b. If the measured voltage is not 12V and the power board (U1) has already been replaced, replace control board (U2) (WP 0044).

c. If the measured voltage is 12V, continue to Step 7.

STEP 7. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 8. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 9. Measure the voltage between pins 20 and 21 in connector P8 on wire harness W17:

a. If the measured voltage is 12V, replace wire harness W1 (WP 0038).

b. If the measured voltage is not 12V, replace wire harness W17 (WP 0038).

STEP 10. Look at LED18 on control board (U2):

a. If LED18 is still illuminated, replace the control board (U2) (WP 0044).

b. If LED18 is still illuminated after replacing the control board (U2), replace the power board (U1) (WP 0043).

c. If LED18 is not illuminated continue to Step 11.

STEP 11. Reconnect all disconnected connectors.

STEP 12. Measure the high side system pressure with a manifold gauge set as well as the voltage at the diagnostic connector (J2) for the high pressure transducer (MT2) (WP 0026).

STEP 13. Compare the measured voltage from the diagnostic connector (J2) and the measured pressure from the gauge set using Table 2 in (WP 0026):

a. If the measurements are within +/- 15 psig of one another, remove gauge set. Reassemble the IECU and verify normal operation by restarting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

b. If the measurements differ by more than +/- 15 psig, replace the high pressure transducer assembly (MT2) (WP 0062).

## TROUBLESHOOTING – CONTINUED

### SYMPTOM

LED19 IS ILLUMINATED

#### MALFUNCTION

Faulty Evaporator Air Inlet Temperature Thermistor Assembly (RT1)

##### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to OFF.

STEP 2. Test the evaporator air inlet thermistor (RT1) (WP 0063).

STEP 3. Disconnect connector J30 on wire harness W17 from the evaporator In assembly (RT1).

STEP 4. Measure the voltage between sockets A and B in connector J30 on wire harness W17:

- a. If the measured voltage is 5 VDC, continue to Step 8.
- b. If the measured voltage is not 5 VDC, continue to Step 5.

STEP 5. Remove connector J6 on wire harness W17 from connector P6 on the control box.

STEP 6. Measure the voltage between pins 13 and 14 in connector P6:

- a. If the measured voltage is 5 VDC, replace wire harness W17 (WP 0038).
- b. If the measured voltage is not 5 VDC, continue to Step 7.
- c. If fault persists continue to Step 8.

STEP 7. Look at LED1 on the control board (U2):

- a. If LED1 is illuminated, replace the control board (U2) (WP 0044).
- b. If the fault continues, replace the power board (U1) (WP 0043).

STEP 8. Reconnect all disconnected connectors and see if LED19 is still illuminated:

- a. If the fault persists and the control board (U2) has not been replaced, replace the control board (U2) (WP 0044).
- b. If the fault persists and the control board has been replaced, replace the power board (U1) (WP 0043).

### SYMPTOM

LED20 IS ILLUMINATED

#### MALFUNCTION

Faulty Evaporator Air Outlet Temperature Thermistor Assembly (RT2)

**TROUBLESHOOTING – CONTINUED**

**CORRECTIVE ACTION**

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to OFF.

STEP 2. Test the evaporator air outlet thermistor (RT2) (WP 0063).

STEP 3. Disconnect connector J24 on wire harness W1 from the evaporator air outlet thermistor assembly (RT2).

STEP 4. Measure the voltage between sockets A and B in connector J24 on wire harness W1:

a. If the measured voltage is 5 VDC, continue to Step 11.

b. If the measured voltage is not 5 VDC, continue to Step 5.

STEP 5. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 6. Measure the voltage between pins 15 and 16 in connector P6:

a. If the measured voltage is 5 VDC, continue to Step 8.

b. If the measured voltage is not 5 VDC, continue to Step 7.

STEP 7. Look at LED1 on the control board (U2):

a. If LED1 is illuminated, replace the control board (U2) (WP 0044).

b. If the fault continues, replace the power board (U1) (WP 0043).

STEP 8. Reconnect connector J6 on wire harness W17 to connector P6 on the control box.

STEP 9. Disconnect connector P8 on wire harness W17 from connector J8 on wire harness W1.

STEP 10. Measure the voltage between pins 28 and 29 in connector P8 on wire harness W17:

a. If the measured voltage is 5 VDC, replace wire harness W1 (WP 0038).

b. If the measured voltage is not 5 VDC, replace wire harness W17 WP 0038).

c. If the fault persists continue to Step 11.

STEP 11. Reconnect all disconnected connectors and see if LED20 is still illuminated:

a. If the fault persists and the control board (U2) has not been replaced, replace the control board (U2) (WP 0044).

b. If the fault persists and the control board has been replaced, replace the power board (U1) (WP 0043).

**SYMPTOM**

LED21 IS ILLUMINATED

## TROUBLESHOOTING – CONTINUED

### MALFUNCTION

Faulty Bullet Thermistor (RT3) Circuit

#### CORRECTIVE ACTION

**NOTE**

Field Maintenance Troubleshooting begins with WP 0015. If you reached this malfunction without starting in WP 0015, reassemble the IECU and continue to Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

STEP 1. Set the rotary MODE switch (S4) to OFF.

STEP 2. Test the bullet thermistor (RT3) (WP 0047).

STEP 3. Disconnect connector J23 on wire harness W17 from bullet thermistor assembly (RT3).

STEP 4. Measure the voltage between sockets A and B in connector J23 on wire harness W17:

a. If the measured voltage is 5 VDC, continue to Step 7.

b. If the measured voltage is not 5 VDC, continue to Step 5.

STEP 5. Disconnect connector J6 on wire harness W17 from connector P6 on the control box.

STEP 6. Measure the voltage between pins 7 and 8 in connector P6:

a. If the measured voltage is 5 VDC, replace wire harness W17 (WP 0038).

b. If the measured voltage is not 5 VDC, continue to Step 7.

STEP 7. Reconnect all disconnected connectors and see if LED21 is still illuminated:

a. If the fault persists and the control board (U2) has not been replaced, replace the control board (U2) (WP 0044).

b. If the fault persists and the control board has been replaced, replace the power board (U1) (WP 0043).

**END OF WORK PACKAGE**

# CHAPTER 6

# FIELD MAINTENANCE INSTRUCTIONS

## FIELD MAINTENANCE
## SERVICE UPON RECEIPT

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigertion Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)
Assistant (3)

**References**

WP 0004

**References - cont'd**

WP 0012
WP 0015
WP 0092
DD FORM 361
AR 735-11-2

**Equipment Condition**

IECU is shut down (WP 0005)

### SITING REQUIREMENTS

When installing the IECU, every effort should be made to ensure the installation is flat, level, and stable. Assure the condensate line placement will provide adequate water drainage away from the equipment. Route power and condensate drainage lines so they do not present an obstruction or tripping hazard. While the 9K BTU/hr IECU will be unaffected by operation in an orientation inclined up to 10 degrees from horizontal in any plane, it is always good practice to attempt to level the unit as best as practical.

**END OF TASK**

### SHELTER REQUIREMENTS

The IECU does not require any special sheltering. Storing the equipment under cover - without blocking any of the air inlets and outlets during operation - if available, will minimize routine maintenance and improve overall temperature control.

**END OF TASK**

### SERVICE UPON RECEIPT OF MATERIEL

#### Unpacking

The IECU is shipped strapped to a standard wooden pallet with a corrugated cardboard overbox.

1. Remove staples securing corrugated cardboard overbox to wooden pallet.
2. Remove and retain overbox.
3. Cut shipping straps securing IECU to shipping pallet. Retain corner protectors.
4. Lift and remove IECU from shipping pallet.

#### Checking Unpacked Equipment

Perform service upon receipt of the Improved Environmental Control Unit in the following manner:

1. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 361, Transportation Discrepancy Report.

## SERVICE UPON RECEIPT OF MATERIEL – CONTINUED

2. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with applicable service instructions in AR 735-11-2.

3. Check provided components against Components of End Item (COEI) and Basic Issue Items (BII) lists (WP 0092).

**END OF TASK**

## INSTALLATION/MOUNTING INSTRUCTIONS

### Installation

**WARNING**

The IECU is heavy and awkward to maneuver. Always use four persons when attempting to move or set up the IECU for use. When lifting, be careful to avoid back injury. If the IECU is dropped, stand clear to avoid foot injury.

Perform the following to assemble and prepare the 9K BTU/hr IECU for field use.

1. Remove IECU from transport vehicle and place IECU in position near shelter on ground. Always use four person lifting means to move 9K BTU/hr IECU.

2. If mounting on a shelf, install resilient mounting hardware (Figure 1).

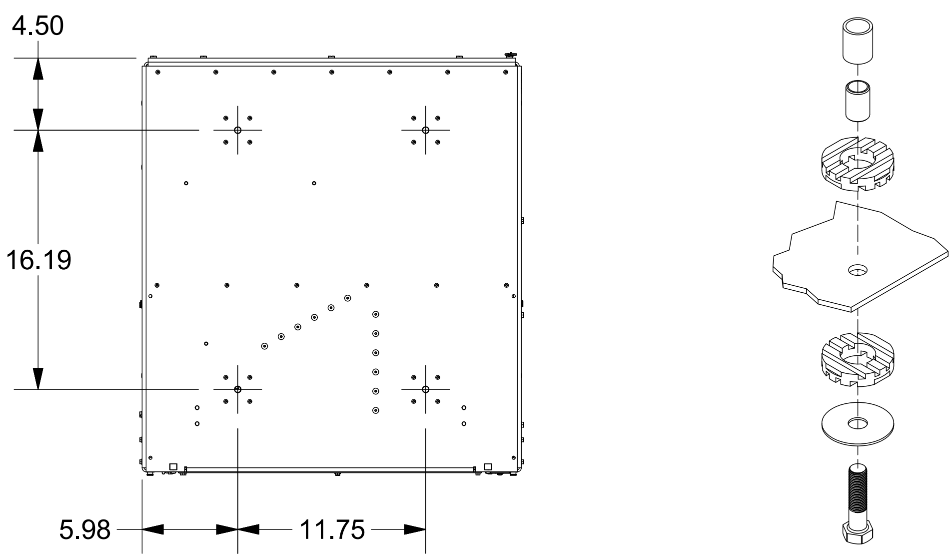



**Figure 1. Resilient Mounting Hardware.**

3. Place IECU in position and secure in accordance with local installation requirements.

## INSTALLATION/MOUNTING INSTRUCTIONS – CONTINUED

4. Unfasten six condenser cover snap fasteners (Figure 1). Pull from side of snap fastener that is opposite of dot marking. Fold in side covers and roll up. Secure with straps provided.

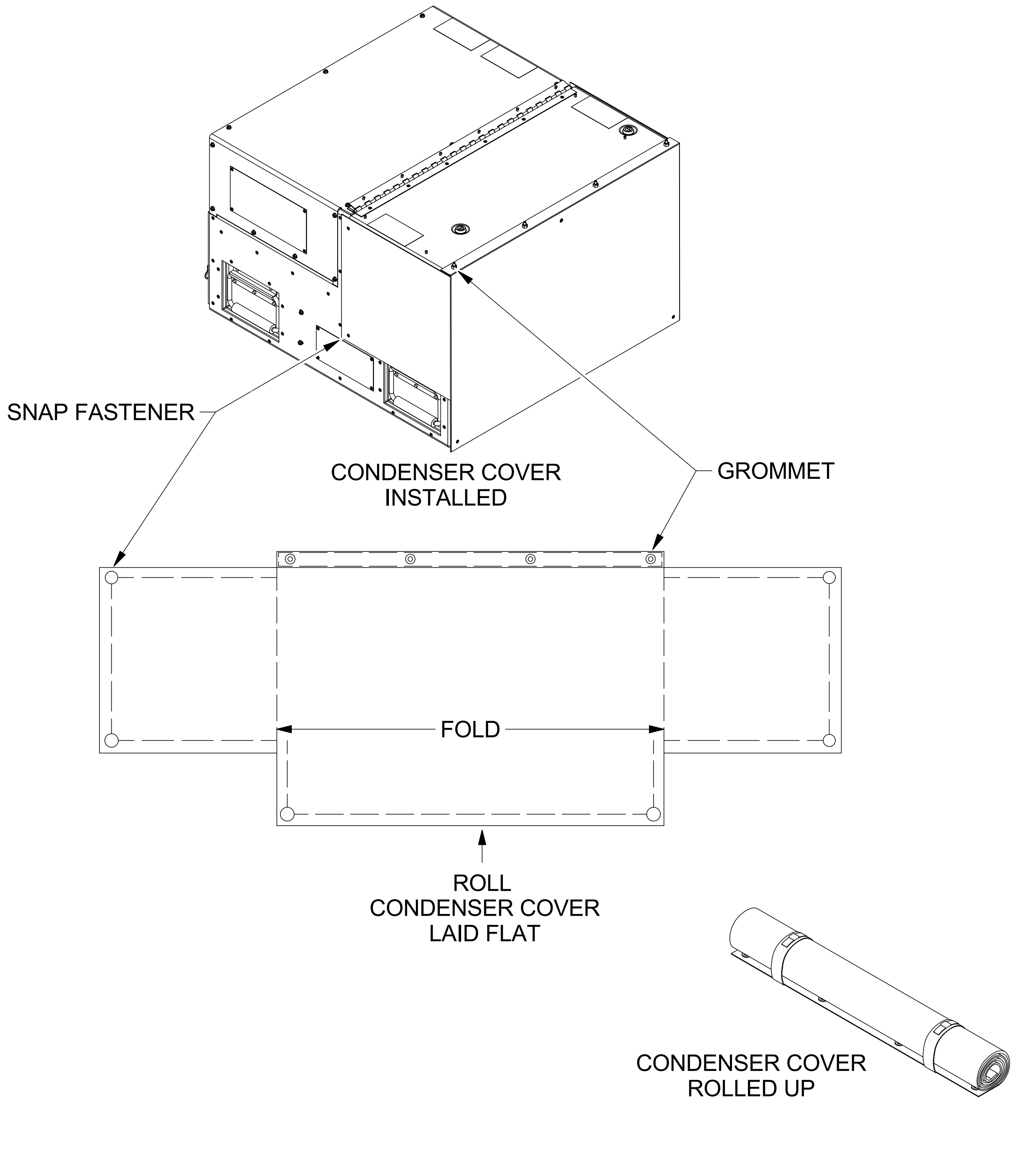



**Figure 2. Condenser Cover.**

5. Inspect the air filter, clean if necessary (WP 0012).

6. Set the rotary MODE switch (S4) (Figure 3) to OFF.

## INSTALLATION/MOUNTING INSTRUCTIONS – CONTINUED

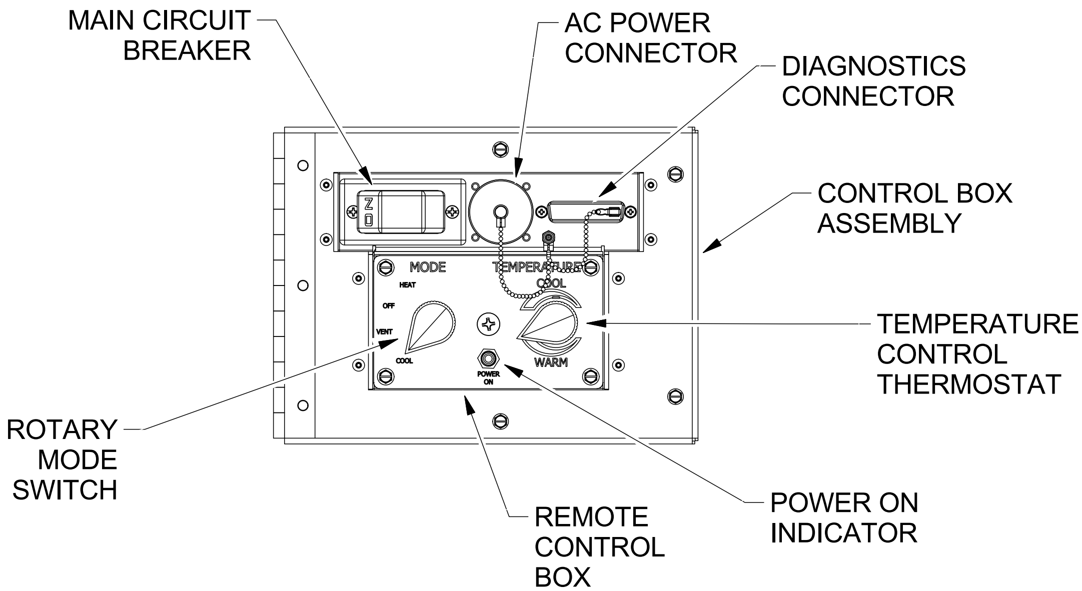



**Figure 3. Control Box and Remote Box Assemblies.**

7. Set the circuit breaker (CB1) (Figure 3) to OFF.
8. Connect power cable to receptacle (P1 or P3) at either condenser or evaporator side of IECU.
9. Verify that power cable is connected to proper voltage.
10. Reset the circuit breaker (CB1) (Figure 3) to ON position. Verify that POWER ON lamp is illuminated steadily. If not, troubleshoot IECU May Not Be Operating Properly (WP 0015).
11. Inspect the exterior of the condenser and evaporator sides of the unit to be certain the condenser and evaporator air flow paths are clear of obstruction and debris.
12. Verify the evaporator supply and return grilles are open and unrestricted.
13. Adjust fresh air duct door as needed, then secure ball chain in slot (WP 0004).

**NOTE**

To ensure a continuous supply of inlet air to the IECU, at least 3/4 of the inlet louvers on the inlet grille should be fully opened.

14. Open back row of outlet louvers with vent control levers and angle front row of outlet louvers to desired position (WP 0004).
15. If IECU is to operated remotely, remove remote box assembly from control box assembly. Install extension cable between remote box assembly and control box assembly.
16. Remove plug from condensate outlet at rear base of equipment (Figure 3). Retain plug. Install barbed hose fitting. Connect one condensate hose to barbed fitting.

## INSTALLATION/MOUNTING INSTRUCTIONS – CONTINUED

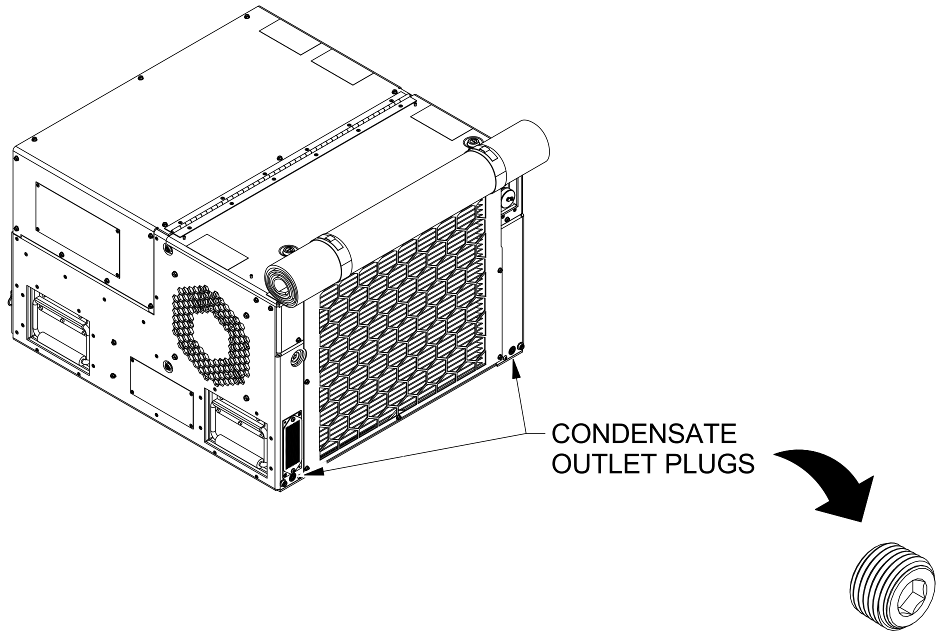



**Figure 4. Condensate Outlet Plugs.**

17. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## FIELD PMCS INTRODUCTION

**INITIAL SETUP:**

| **Personnel Required** | **References** |
|---|---|
| Utilities Equipment Repairer 91C (1) | WP 0023 |

### GENERAL

The PMCS table in WP 0023 has been provided so you can keep your equipment in good operating condition and ready for its primary mission.

Always observe the WARNINGS and CAUTIONS appearing in your PMCS table. WARNINGS and CAUTIONS appear before applicable procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or to prevent your equipment from being damaged.

### PMCS PROCEDURES TABLE

**Item Number Column.** Numbers in this column are for reference. When completing DA Form 5988-E, Equipment Inspection and Maintenance Worksheet, include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for the intervals listed.

**Interval Column.** This column describes when the procedure in the Procedure column must be done.

QUARTERLY (Q) - Checks and services to be performed on a quarterly basis.

SEMIANNUALLY (S) - Checks and services to be performed on a semiannual basis.

**Item to be Checked or Serviced Column.** This column provides the item to be checked or serviced.

**Procedure Column.** This column provides the procedure to check or service the item listed in the Item to be Checked or Serviced column to know if the equipment is ready or available for its intended mission or for operation. The procedure must be done at the time stated in the INTERVAL column.

**Equipment NOT READY/AVAILABLE IF Column.** Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## PMCS, INCLUDING LUBRICATION INSTRUCTIONS

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0005
WP 0012
WP 0015
WP 0032

**References - cont'd**

WP 0038
WP 0052
WP 0056
WP 0057
WP 0059
WP 0060
WP 0091

**Equipment Condition**

IECU is powered up (WP 0005)

**Table 1. PMCS.**

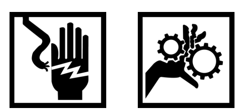
<table>
<tr><th>ITEM NO.</th><th>INTERVAL</th><th>ITEM TO BE CHECKED OR SERVICED</th><th>PROCEDURE</th><th>EQUIPMENT NOT READY/ AVAILABLE IF:</th></tr>
<tr><td colspan="5">**WARNING**<br><br>High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.</td></tr>
<tr><td>1</td><td>Quarterly</td><td>Evaporator compartment</td><td>1. Ensure the IECU is shut down (WP 0005).<br>2. Remove cover assembly (WP 0032).<br>3. Check for cracks or other damage to compartment interior.<br>4. Check for cleanliness of compartment. Clean inside compartment of evaporator as required to make sure adequate air flow is always possible.<br>5. Remove inlet air filter (WP 0012).<br>6. Check evaporator blower assembly (B2) for cleanliness, loose or missing hardware, and any damage. Clean evaporator blower assembly (B2) as required. Tighten or replace hardware as required.</td><td>Frame cracked or welds broken. Evaporator blower assembly (B2) hardware is loose or missing. Evaporator blower assembly (B2) is cracked or damaged. Any evidence of overheating or arcing wires is present. Obstructed by dirt or other debris. Compressor mounts are loose.</td></tr>
</table>

Table 1. PMCS. – Continued

| ITEM NO. | INTERVAL | ITEM TO BE CHECKED OR SERVICED | PROCEDURE | EQUIPMENT NOT READY/ AVAILABLE IF: |
|---|---|---|---|---|
| | | | 7. Check electrical wiring inside evaporator compartment for any evidence of overheating or arcing. If damaged wiring is found, repair or replace (WP 0038).<br><br>8. **NOTE** If operating the IECU in extremely dusty conditions, it is likely that weekly cleaning of the evaporator coil will be required.<br>Inspect the evaporator (WP 0059).<br><br>9. Inspect the compressor mounts to be certain the compressor is securely mounted to the base of the IECU. Tighten mounting hardware if necessary. | |
| 2 | Quarterly | Condenser | 1. **NOTE** If operating the IECU in extremely dusty conditions, it is likely that weekly cleaning of the condenser coil will be required.<br>Clean condenser fan assembly (B3 and B4) as necessary.<br><br>2. Check each condenser fan (B3 and B4) for loose or missing hardware, cracks, or other damage. Tighten or replace hardware as required. If either fan (B3 or B4) is damaged, replace (WP 0056).<br><br>3. Inspect condenser coil (WP 0057).<br><br>4. Service the condenser (WP 0057). | Either fan (B3 or B4) is dirty enough to cause reduced air flow or is damaged. Obstructed or dirty to point of insufficient air flow over coil. |
| 3 | Semi-annually | Air Conditioner | 1. Perform the initial troubleshooting procedures test (WP 0015). | IECU fails to provide cooling or heat. |
| 4 | Semi-annually | Electrical components | 1. Verify remote control box rotary MODE switch (S4) operates.<br><br>2. Check wires, cables, and harnesses in condenser section and compressor compartment for breaks, cuts, or frayed insulation.If damaged, replace (WP 0038). | Test fails. Any wire, cable, or harness is damaged. Any electrical connection is loose, missing, or damaged. |

Table 1. PMCS. – Continued

| ITEM NO. | INTERVAL | ITEM TO BE CHECKED OR SERVICED | PROCEDURE | EQUIPMENT NOT READY/ AVAILABLE IF: |
|---|---|---|---|---|
| | | | 3. Check wires, cables, and harnesses in evaporator compartment for breaks, cuts, or frayed insulation.If damaged, replace (WP 0038). | |
| 5 | Semi-annually | Heater assemblies | 1. Inspect heater assembly (HR2 and HR3) for corrosion and cracks. Replace if required (WP 0052).<br>2. Inspect heater assembly (HR2 and HR3) for dirt, dust, or debris accumulation.Clean as required.<br>3. If corrosion, cracks, or arcing are present where heater assembly (HR2 and HR3) attach to power source, replace heater assembly.(HR2 and HR3) (WP 0052). | Either heater assembly (HR2 or HR3) shows signs of overheating or damage. |
| 6 | Semi-annually | Refrigeration system components | 1. Visually inspect the following refrigeration components for evidence of damage, corrosion, oil residue, or refrigerant leakage.<br>• High pressure switch assembly (S2)<br>• Low pressure switch assembly (S3)<br>• Compressor (B1)<br>• Filter-drier<br>• Thermostatic expansion valve (TXV)<br>2. Visually inspect tubing and fittings for damage, kinks, pinches, and evidence of refrigerant leakage (oil residue).Repair or replace as required (WP 0060). | Any refrigeration system component is damaged or leaking. Any tube or fitting is damaged or leaking. |

## MANDATORY REPLACEMENT PARTS

There are no replacement parts required for these PMCS procedures.

## LUBRICATION INSTRUCTIONS

Field lubrication instructions are not applicable.

## END OF WORK PACKAGE

## FIELD MAINTENANCE

## GENERAL MAINTENANCE INSTRUCTIONS - SERVICE, INSPECT, REPAIR

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cleaning solvent (WP 0094, Table 1, Item 1)
Coil cleaner (WP 0094, Table 1, Item 4)
Detergent (WP 0094, Table 1, Item 5)
Wiping rags (WP 0094, Table 1, Item 9)
Industrial rubber gloves (SATS) (WP 0091, Table 2, Item 6)
Safety glasses (WP 0091, Table 2, Item 11)

**Personnel Required**

Utilities Equipment Repair 91C (1)

**References**

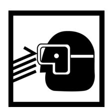
WP 0028
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)

### SERVICE

**WARNING**



- MIL-PRF-680 cleaning solvent is an environmentally compliant product, does not contain Hazardous Air Pollutant (HAP) materials, and meets National Emission Standard for Hazardous Air Pollutants (NESHAPs) requirements. However, it may be irritating to the eyes and skin. The use of protective gloves and goggles is required. Use in well-ventilated areas. Keep away from open flames and other sources of ignition. Failure to comply can cause injury to personnel.
- Cleaning solvent is flammable, toxic, and an irritant to eyes, skin, and respiratory system. Do not use near open flame or excessive heat. Do not breathe vapors. Use skin and eye protection and work in well-ventilated area. Failure to comply can cause injury to personnel.
- Particles blown by compressed air are hazardous. Do not exceed 30 psi. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield when using compressed air. Failure to comply can cause injury to personnel.

**CAUTION**

- Pressure must not exceed 30 PSI (2.1 kg/cm²) when using compressed air for drying/cleaning purposes.
- Do not use MIL-PRF-680 cleaning solvent on evaporator or condenser coils. Use only soap (or detergent) and water.

**SERVICE – CONTINUED**

## NOTE

Use a moist cloth for all general wiping/cleaning conditions. Refrain from using excess water when ample drying time is not available in order to further eliminate possible dirt accumulation or freezing of wet surfaces. If necessary, use soft brush and cleaning solvent to dislodge dirt from areas of build-up.

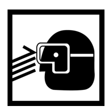
Cleaning instructions will be the same for the majority of parts and components which make up the IECU.

The importance of cleaning must be thoroughly understood by maintenance personnel. Great care and effort are required during cleaning. Dirt and foreign material are a constant threat to satisfactory maintenance. The following should apply to all cleaning, inspection, repair, and assembly operations:

1. Use cleaning solvent to clean metal surfaces.
2. Use detergent and water to clean evaporator and condenser coils as well as rubber or plastic material.
3. Clean exterior of system with detergent and water.
4. Keep hands free of any accumulation of grease which can collect dust, dirt, and grit.
5. Never clean the refrigerant passages of any component.
6. Never attempt to clean or reuse a filter-drier.

### Metal Parts

## WARNING



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- Cleaning solvent is flammable, toxic, and an irritant to eyes, skin, and respiratory system. Do not use near open flame or excessive heat. Do not breathe vapors. Use skin and eye protection and work in well-ventilated area. Failure to comply can cause injury to personnel.

- Particles blown by compressed air are hazardous. Do not exceed 30 psi. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield when using compressed air. Failure to comply can cause injury to personnel.

1. Clean outer surfaces with cleaning solvent. Never put cleaning solvent into the refrigerant passages.
2. Remove exterior grease and accumulated deposits with a scrub brush.
3. Blow out all tapped (threaded) holes with compressed air to remove dirt and cleaning fluids. Never blow compressor air into the refrigerant passages. If it becomes necessary, purge these lines (WP 0028).

**SERVICE – CONTINUED**

**Electrical Cables and Rubber Components**

## CAUTION

Do not wash rubber components and electrical cables with cleaning solvents or mineral spirits. Failure to comply will cause serious damage or destroy material. Wash electrical cables and rubber components with water and mild soap solution and wipe dry with a wiping rag.

**END OF TASK**

**INSPECT**

1. Inspect machined surfaces for nicks, burrs, raised metal, wear, or other damage.
2. Check all inner and outer surfaces for breaks or cracks.
3. Mark all damaged material for replacement.

**END OF TASK**

**REPAIR**

Any repair procedure pertaining to a specific part or component is covered in the work package relating to that item. After repair, clean all parts thoroughly to prevent dirt, metal chips, or other foreign material from entering working parts.

1. Repair minor damage to machined surfaces with a fine mill file or crocus cloth dipped in cleaning solvent.
2. Surfaces that are severely damaged could affect assembly operation and should be replaced.
3. Minor damage to threaded capscrew holes should be repaired with thread tap of same size to prevent cutting an oversized hole or further damaging the threads.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERATION SYSTEM GENERAL MAINTENANCE - OPENING AND CLOSING THE REFRIGERATION SYSTEM, BREAKING THE VACUUM, REFRIGERANT FITTING ASSEMBLY AND DISASSEMBLY, PREPARING THE SYSTEM TO BE OPENED, PREPARING THE REFRIGERATION SYSTEM TO BE RETURNED TO SERVICE AFTER MAINTENANCE

### INITIAL SETUP:

**Tools and Special Tools**

Crows Foot Wrench Set (SATS) (WP 0091, Table 2, Item 2)
Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)
Torque Wrench (SATS) (WP 0091, Table 2, Item 14)

**Materials/Parts**

Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)
New o-rings (0.438") (WP 0083, Item 12)
New filter-drier (WP 0080, Item 7)
Cork tape (WP 0094, Table 1, Item 12)
Nylog (WP 0094, Table 1, Item 7)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0005
WP 0015
WP 0026
WP 0027
WP 0029
WP 0030
WP 0031
WP 0053
WP 0060
WP 0080
WP 0083
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)

### OPENING AND CLOSING THE REFRIGERATION SYSTEM

The refrigerants in the new hydrofluorocarbon/ Polyvinyl Ester (HFC/PVE) systems such as this IECU (which uses HFC-410A), are more thermally stable than the older chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) refrigerants. However, the new synthetic oils are less stable than the mineral oils used in CFC or HCFC systems and they have a much greater attraction for moisture (water). POE (Polyolester), PVE (polyvinyl ether), and PAG (polyalkylene glycols) have water saturation values of 2500, 6500, and 10000 parts per million (ppm) water compared to just 25 ppm for mineral oil. This means proper handling of open oil containers and deep evacuations to remove moisture are very important in this R-410A system.

The effect of the moisture is also different in these HFC systems, such as the R-410A IECU system. Rather than the moisture accelerating the formation of acids as the primary failure mechanism, the moisture causes the oil to thicken into sludge and the compressor fails due to lack of lubrication. This sludge-forming reaction can be stopped by removing the water from the system. Therefore, a filter-drier change and deep triple evacuation must be performed every time the refrigeration circuit is opened, and the crankcase heater should be operated (whenever practical) when the system is being evacuated. This aids in the evaporation of water from the oil during the evacuation process. Follow the procedures to Prepare the System to be Opened and Prepare the Refrigeration System to be Returned to Service in this work package anytime the refrigerant circuit is opened.

**END OF TASK**

## BREAKING THE VACUUM

**CAUTION**

Ensure the rotary MODE switch (S4) is in the OFF position. The crankcase heater should stay in operation while the IECU is in a deep vacuum but the compressor should never be started. Keep the IECU in the OFF mode. Starting a hermetic compressor while it is in a deep vacuum will damage or destroy the compressor almost instantly, since there is no refrigerant flow to cool the motor windings.

All reasonable efforts should always be made to prevent the introduction of air and therefore moisture to a system. Opening the system after it has been evacuated will allow ambient air to enter the system. This will draw in air and moisture as the system stabilizes at atmospheric pressure. You should always “break the vacuum” by introducing dry nitrogen into an evacuated system, raising the pressure to just slightly above atmospheric pressure before the system is opened up.

## END OF TASK

## REFRIGERANT FITTING ASSEMBLY AND DISASSEMBLY

The IECU uses re-sealable, IMACA fittings. These fittings are commonly referred to as Tube-O fittings or IMACA (International Mobile Air Conditioning Association) fittings in the H VAC industry. A complete IMACA fitting is comprised of two threaded brass parts: one female threaded swivel nut and one male threaded rigid fitting (Figure 1). The female nut floats on a copper tube that has a rolled end form bead and a neoprene o-ring.

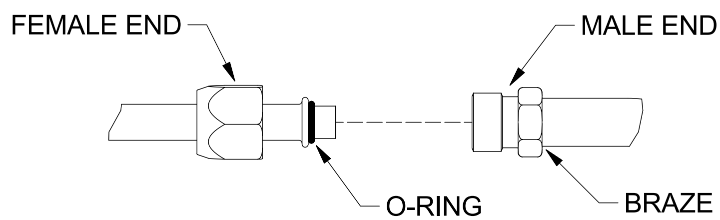



**Figure 1. Disassembled IMACA Fitting.**

The female nut moves freely on a tube with a rolled end form bead and neoprene o-ring. When the fitting is assembled, the female nut presses the beaded tube and o-ring into the male fitting, which has a tapered internal contour. As the fitting is tightened to the proper torque, the o-ring deforms and compresses into a gap created by the tapered male fitting. If properly assembled, the fitting can withstand pressures greater than 700 psig at temperatures over 225 °F without leaking refrigerant.

IECU refrigeration system IMACA fittings are stamped with a fitting identifying number on one of the hex flats of the female threaded swivel nut. The female-side IMACA fittings are also coded with a color ring that associates the fitting by tube outside diameter, wrench sizes, correct torque, and o-ring size and part number extension (Table 1). This is a band of colored ink surrounding the copper tube on the female side of the IMACA fitting. It may be necessary to remove some of the tubing insulation to view the color ring.

## REFRIGERANT FITTING ASSEMBLY AND DISASSEMBLY – CONTINUED

Table 1. Tube Fitting Coding.

| TORQUE RING COLOR (FEMALE SIDE) | TUBE OD (FEMALE SIDE), IN. | WRENCH SIZE MALE | FEMALE | TORQUE FT.-LBS. | O-RING OD (IN.) | O-RING P/N |
|---|---|---|---|---|---|---|
| White | 0.375 | 5/8 | 3/4 | 13 | 0.438 | -11 |
| Blue | 0.5 | 3/4 | 7/8 | 20 | 0.563 | -13 |
| Yellow | 0.875 | 7/8 | 1-1/16 | 27 | 0.688 | -15 |

To ensure leak-free operation, it is vital that IMACA fitting disassemble and assemble procedures are followed whenever the IECU refrigeration system is serviced.

### Disassemble

1. If not already done, prepare the refrigeration system to be opened (this work package).
2. Remove cover assembly (WP 0032).
3. Remove cork tape and insulation as needed.
4. Verify that the correct IMACA fitting is being serviced by referencing the fitting identifying number stamped on the female threaded swivel nut.
5. Identify the fitting torque color ring (Table 1) to determine the wrench sizes needed for disassembly. If the fitting torque color ring is not visible or discernible for any reason use Table 1 to determine the fitting size by measuring the female fitting tube diameter.
6. Obtain the pair of appropriately-sized combination wrenches or adjustable wrenches to disassemble the fitting (Table 1).
7. Grip the male and female IMACA fittings simultaneously with the appropriate wrenches.
8. While holding the wrench on the male fitting unmoving and steady, turn the wrench on the female swivel nut counter-clockwise to loosen.
9. When the female swivel nut is sufficiently loose, continue to turn the fitting by hand until completely removed from the male fitting.
10. Pull the IMACA fitting apart, carefully releasing the copper tube from the male fitting. The copper tubes are flexible enough to safely allow this motion.
11. Remove the o-ring and discard. O-rings cannot be reused.

### Assemble

1. Inspect the disassembled fitting for tubing or brass fittings cracks or damage. Check for cracks around the copper bead on the female fitting. If any damage is discovered, replace the entire tube (WP 0060).
2. Inspect the disassembled fitting for debris around the copper tube bead on the female fitting. Inspect the brass fitting threads for debris. Remove any debris, no matter how small. Failure to do so will compromise the IMACA fitting seal.
3. If a used o-ring is found on the copper tube bead on the female fitting, discard it. It cannot be reused.
4. Obtain a new o-ring sized correctly for the IMACA fitting (Table 1).
5. Lubricate the new o-ring with a liberal application of Nylog.
6. Place the o-ring onto the end of the copper tube and slide it against the bead (Figure 1).

**REFRIGERANT FITTING ASSEMBLY AND DISASSEMBLY – CONTINUED**

7. Insert the copper tube into the threaded male fitting until the o-ring makes contact with the male fittings internal tapered contour.
8. Pull the female swivel nut to the threaded male fitting and begin threading the fitting by hand. Use care so that the fitting is not cross-threaded. If there is excessive resistance in the threads, gently apply force with one hand to the male fitting tube.
9. Apply force in different directions while threading the female nut with the other hand until the threading motion becomes less difficult.
10. Thread the fitting together by hand as much as possible.
11. When the fitting is hand-tight, obtain the appropriate combination wrench, torque wrench, and crow's-foot wrench for applying torque to the fitting (Figure 1).
12. Set the torque wrench to the prescribed torque setting for the fitting (Figure 1).
13. Attach the crow's-foot wrench to the torque wrench.
14. Grip the male fitting with the combination wrench, and grip the female fitting with the torque wrench.
15. While holding the wrench on the male fitting unmoving and steady, turn the torque wrench on the female swivel nut clockwise until the torque wrench indicates that the proper torque has been achieved.
16. Install cork tape as needed.
17. Install the cover assembly (WP 0032).

**END OF TASK**

**PREPARING THE SYSTEM TO BE OPENED**

1. Attach a manifold gauge set (WP 0026).
2. Power up the IECU (WP 0005).
3. Measure the low side and high side system pressures:
   a. If the low-side system pressure is above 40 psig and the system is operational:
      (1) Operate the system in COOL mode for about 10 minutes (with the TEMPERATURE control thermostat (R1) turned to max cool). This will allow the compressor to heat the oil in the compressor and speed refrigerant recovery.
      (2) Recover the refrigerant (WP 0027).
   b. If the low-side pressure is not above 40 psig or the system is not operational then:
      (1) Allow the system to be powered and in the OFF position. This allows the crankcase heater time to heat the oil to speed the refrigerant recovery.
      (2) If the pressure is at or below atmospheric pressure (0 psig) then:
         (a) No recovery is necessary.
         (b) If the pressure is below atmospheric (that is, the system is in a vacuum), then attach a nitrogen source to the center hose of the manifold gauge set and break the vacuum before opening the system.
      (3) If the pressure is above atmospheric pressure that is above 0 psig, recover the refrigerant (WP 0027).
4. Otherwise if the system does not contain refrigerant, then:

**PREPARING THE SYSTEM TO BE OPENED – CONTINUED**

a. If either pressure is above 10 psig, crack the low-side and high-side refrigerant hoses at the manifold gauge set. Allow the nitrogen in the system to exit, until the system pressure on both sides is between 5 and 10 psig.

b. If either pressure is at or below atmospheric pressure (0 psig), attach a nitrogen source to the center hose of the manifold gauge set and break the vacuum before opening the system

5. The system is now ready for opening.
6. Shut down IECU (WP 0005).
7. Remove gauges.

**END OF TASK**

**PREPARING THE REFRIGERATION SYSTEM TO BE RETURNED TO SERVICE AFTER MAINTENANCE**

1. Verify that all repairs have been made.
2. Install new filter-drier (WP 0053).
3. Leak test the refrigeration system (WP 0029).
4. Perform a triple evacuation to a deep vacuum (WP 0030).
5. Charge the IECU with refrigerant (WP 0031).
6. Verify the condensate drain lines are clear and that the drain line plugs have been removed.
7. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERATION SYSTEM PRESSURE TEST - USING THE DIAGNOSTICS CONNECTOR, USING A MANIFOLD GAUGE SET, PRESSURE TEST USING A MANIFOLD GAUGE SET, INSTALL, REMOVE

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Industrial rubber gloves (SATS) (WP 0091, Table 2, Item 6)
Safety glasses (WP 0091, Table 2, Item 11)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0005
WP 0015
WP 0038
WP 0091

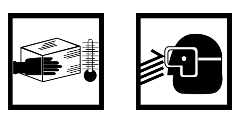
**Equipment Condition**

IECU is powered up (WP 0005)

### USING THE DIAGNOSTICS CONNECTOR

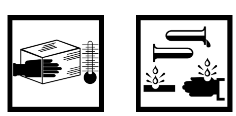
This Work Package provides the steps necessary to test the refrigerant pressures. Two methodologies have been provided for testing the refrigerant pressures, either using the embedded diagnostics connector (J2) or using a manifold gauge set. Unless specifically called out by a referring procedure it is preferred to check the pressures using the diagnostics connector (J2). Instructions for using the diagnostics connector and using the manifold gauge set are provided in this Work Package.

**WARNING**



Sudden and irreversible tissue damage can result from freezing. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. Failure to comply can cause injury to personnel.

**WARNING**



Refrigerant under pressure is used in this equipment. Use great care to avoid contact with liquid refrigerant. Work in well-ventilated area. Failure to comply can cause injury to personnel.

## USING THE DIAGNOSTICS CONNECTOR – CONTINUED

### WARNING

Heat may cause the refrigerant or lubricant to decompose and release irritating, toxic, and corrosive gases. Prevent contact of refrigerant with flame or hot surfaces. Failure to comply can cause injury to personnel.

### NOTE

Connector pins are numbered right to left from pin 1 to pin 5, pin 1 at the right. Use the remote box center screw for the chassis ground (Figure 1).

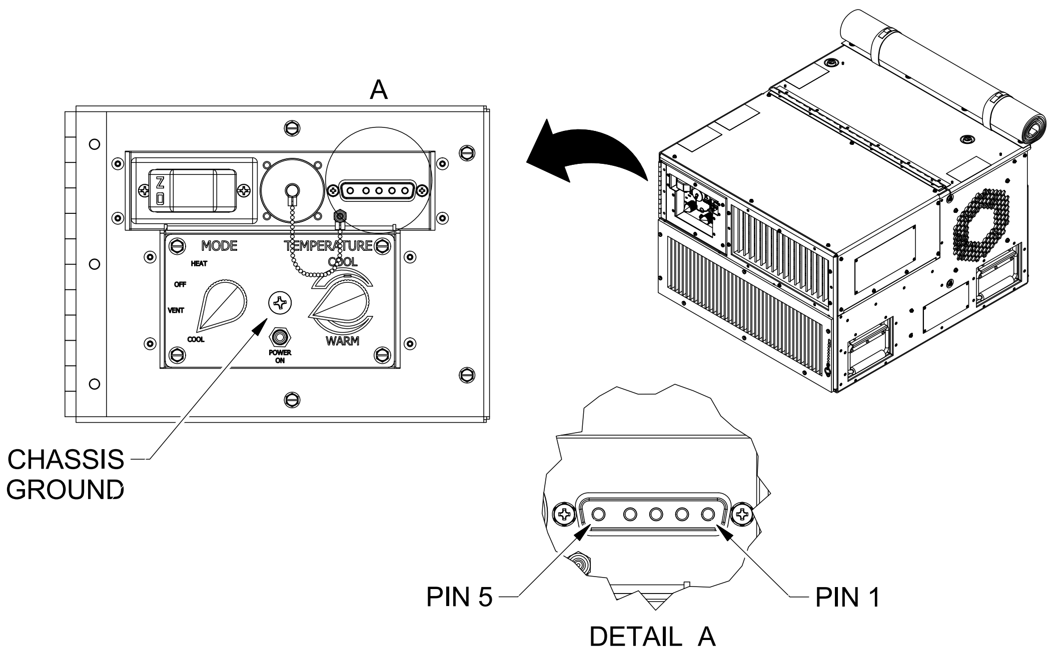



**Figure 1. Diagnostics Connector.**

A 5-pin diagnostics connector (Figure 1) is provided for troubleshooting without the need to connect a manifold gauge set or measure any temperatures. It is located on the front of control box for convenient access.

The diagnostics connector provides a means to measure the high-side (condensing) pressure and the low-side (evaporating) pressure. It also provides a means to measure the evaporator coil temperature at the TXV sensor bulb location, evaporator air inlet temperature, and evaporator air outlet temperature.

The diagnostics connector pin-out is shown in Table 1.

**Table 1. Diagnostics Connector Pin-Out.**

| PIN | SIGNAL |
|---|---|
| 1 | Condensing (high-side) Pressure |
| 2 | Evaporating (low-side) Pressure |

## USING THE DIAGNOSTICS CONNECTOR – CONTINUED

**Table 1. Diagnostics Connector Pin-Out. – Continued**

| PIN | SIGNAL |
|---|---|
| 3 | Evaporator Air Inlet Temperature |
| 4 | Evaporator Air Outlet Temperature |
| 5 | Evaporator Refrigerant Outlet Temperature (at the TXV sensor bulb location) |
| Ground | Remote Box center screw |

### Condensing Pressure (High-Side) Measurement

1. To measure the high-side pressure transducer output signal, connect a multimeter between pin 1 (+) and the chassis ground (remote box center screw) (Figure 1). Round the output to the nearest 0.1 VDC.
2. If the voltage is 0 VDC, test the diagnostics cable (W31) (WP 0038).
3. To convert the pressure transducer's output voltage signal into a pressure reading in psig, use the measured voltage to find the corresponding pressure in Table 2.

**Table 2. Pressure Transducer Voltages.**

| DC VOLTAGE | PRESSURE (PSIG) | DC VOLTAGE | PRESSURE (PSIG) | DC VOLTAGE | PRESSURE (PSIG) |
|---|---|---|---|---|---|
| 1 | 1 | 2.4 | 264 | 3.8 | 528 |
| 1.1 | 20 | 2.5 | 283 | 3.9 | 547 |
| 1.2 | 38 | 2.6 | 302 | 4 | 566 |
| 1.3 | 57 | 2.7 | 321 | 4.1 | 584 |
| 1.4 | 76 | 2.8 | 340 | 4.2 | 603 |
| 1.5 | 95 | 2.9 | 358 | 4.3 | 622 |
| 1.6 | 114 | 3 | 377 | 4.4 | 641 |
| 1.7 | 133 | 3.1 | 396 | 4.5 | 660 |
| 1.8 | 151 | 3.2 | 415 | 4.6 | 678 |
| 1.9 | 170 | 3.3 | 434 | 4.7 | 697 |
| 2 | 189 | 3.4 | 453 | 4.8 | 716 |
| 2.1 | 208 | 3.5 | 471 | 4.9 | 735 |
| 2.2 | 227 | 3.6 | 490 | 5 | 754 |
| 2.3 | 245 | 3.7 | 509 | | |

### Evaporating Pressure (Low-Side) Measurement

1. To measure the low-side pressure transducer output signal, connect a multimeter between pin 2 (+) and the chassis ground (remote box center screw) (Figure 1). Round the output to the nearest 0.1 VDC.
2. If the voltage is 0 VDC, test the diagnostics cable (W31) (WP 0038).
3. To convert the pressure transducer's output voltage signal into a pressure reading in psig, use the measured voltage to find the corresponding pressure in Table 2.

## USING THE DIAGNOSTICS CONNECTOR – CONTINUED

### Evaporator Air Inlet Temperature Measurement

1. To measure the Evaporator Air Inlet temperature from the thermistor output signal, connect a multimeter between pin 3 (+) and the chassis ground (remote box center screw) (Figure 1). Round the output to the nearest 0.1 VDC.
2. If the voltage is 0 VDC, test the diagnostics cable (W31) (WP 0038).
3. To convert the thermistor output voltage signal into a temperature reading in degrees Fahrenheit, use the measured voltage to find the corresponding Fahrenheit temperature in Table 3.

**Table 3. Thermistor Voltages (RT1 and RT2).**

| DC VOLTAGE | TEMP. (F) | DC VOLTAGE | TEMP. (F) | DC VOLTAGE | TEMP. (F) | DC VOLTAGE | TEMP. (F) |
|---|---|---|---|---|---|---|---|
| 0.4 | 132 | 1.7 | 56 | 3.0 | 17 | 4.3 | -26 |
| 0.5 | 120 | 1.8 | 52 | 3.1 | 15 | 4.4 | -31 |
| 0.6 | 111 | 1.9 | 49 | 3.2 | 12 | 4.5 | -37 |
| 0.7 | 103 | 2.0 | 46 | 3.3 | 9 | 4.6 | -43 |
| 0.8 | 96 | 2.1 | 43 | 3.4 | 6 | - | - |
| 0.9 | 90 | 2.2 | 40 | 3.5 | 3 | - | - |
| 1.0 | 84 | 2.3 | 37 | 3.6 | 0 | - | - |
| 1.1 | 79 | 2.4 | 35 | 3.7 | -3 | - | - |
| 1.2 | 75 | 2.5 | 31 | 3.8 | -6 | - | - |
| 1.3 | 71 | 2.6 | 29 | 3.9 | -10 | - | - |
| 1.4 | 67 | 2.7 | 26 | 4.0 | -14 | - | - |
| 1.5 | 63 | 2.8 | 23 | 4.1 | -17 | - | - |
| 1.6 | 59 | 2.9 | 20 | 4.2 | -22 | - | - |

### Evaporator Air Outlet Temperature Measurement

1. To determine the Evaporator Air Outlet temperature from the thermistor output signal, connect a multimeter between pin 4 (+) and the chassis ground (remote box center screw) (Figure 1). Round the output to the nearest 0.1 VDC.
2. If the voltage is 0 VDC, test the diagnostics cable (W31) (WP 0038).
3. To convert the thermistor output voltage signal into a temperature reading in degrees Fahrenheit, use the measured voltage to find the corresponding Fahrenheit temperature in Table 3.

### Evaporator Refrigerant Outlet Temperature Measurement (at TXV bulb location)

1. To determine the temperature of the refrigerant exiting the evaporator at the TXV bulb location from the thermistor output signal, connect a multimeter between pin 5 (+) and the chassis ground (remote box center screw) (Figure 1). Round the output to the nearest 0.1 VDC.
2. If the voltage is 0 VDC, test the diagnostics cable (W31) (WP 0038).
3. To convert the thermistor output voltage signal into a temperature reading in degrees Fahrenheit, use the measured voltage to find the corresponding Fahrenheit temperature in Table 4.

## USING THE DIAGNOSTICS CONNECTOR – CONTINUED

Table 4. Bullet Thermistor (RT3) Voltages.

| DC VOLTAGE | TEMP. (F) | DC VOLTAGE | TEMP. (F) | DC VOLTAGE | TEMP. (F) | DC VOLTAGE | TEMP. (F) |
|---|---|---|---|---|---|---|---|
| 0.1 | 295 | 1.4 | 118 | 2.7 | 70 | 4.0 | 25 |
| 0.2 | 243 | 1.5 | 114 | 2.8 | 67 | 4.1 | 21 |
| 0.3 | 216 | 1.6 | 110 | 2.9 | 64 | 4.2 | 16 |
| 0.4 | 197 | 1.7 | 105 | 3.0 | 61 | 4.3 | 11 |
| 0.5 | 183 | 1.8 | 102 | 3.1 | 58 | 4.4 | 5 |
| 0.6 | 172 | 1.9 | 98 | 3.2 | 54 | 4.5 | -2 |
| 0.7 | 162 | 2 | 94 | 3.3 | 51 | 4.6 | -9 |
| 0.8 | 154 | 2.1 | 91 | 3.4 | 48 | 4.7 | -18 |
| 0.9 | 146 | 2.2 | 87 | 3.5 | 44 | 4.8 | -31 |
| 1.0 | 140 | 2.3 | 84 | 3.6 | 41 | 4.9 | -50 |
| 1.1 | 134 | 2.4 | 80 | 3.7 | 37 | - | - |
| 1.2 | 128 | 2.5 | 77 | 3.8 | 33 | - | - |
| 1.3 | 123 | 2.6 | 74 | 3.9 | 29 | - | - |

**END OF TASK**

## USING A MANIFOLD GAUGE SET

Manifold gauge sets use both a high-pressure gauge (typically colored red) and a dual-scale, low-pressure compound gauge (typically blue). The manifold gauge set (Figure 2) allows the simultaneous measuring of both high- and low-side system pressures during system operation or during servicing.

## USING A MANIFOLD GAUGE SET – CONTINUED

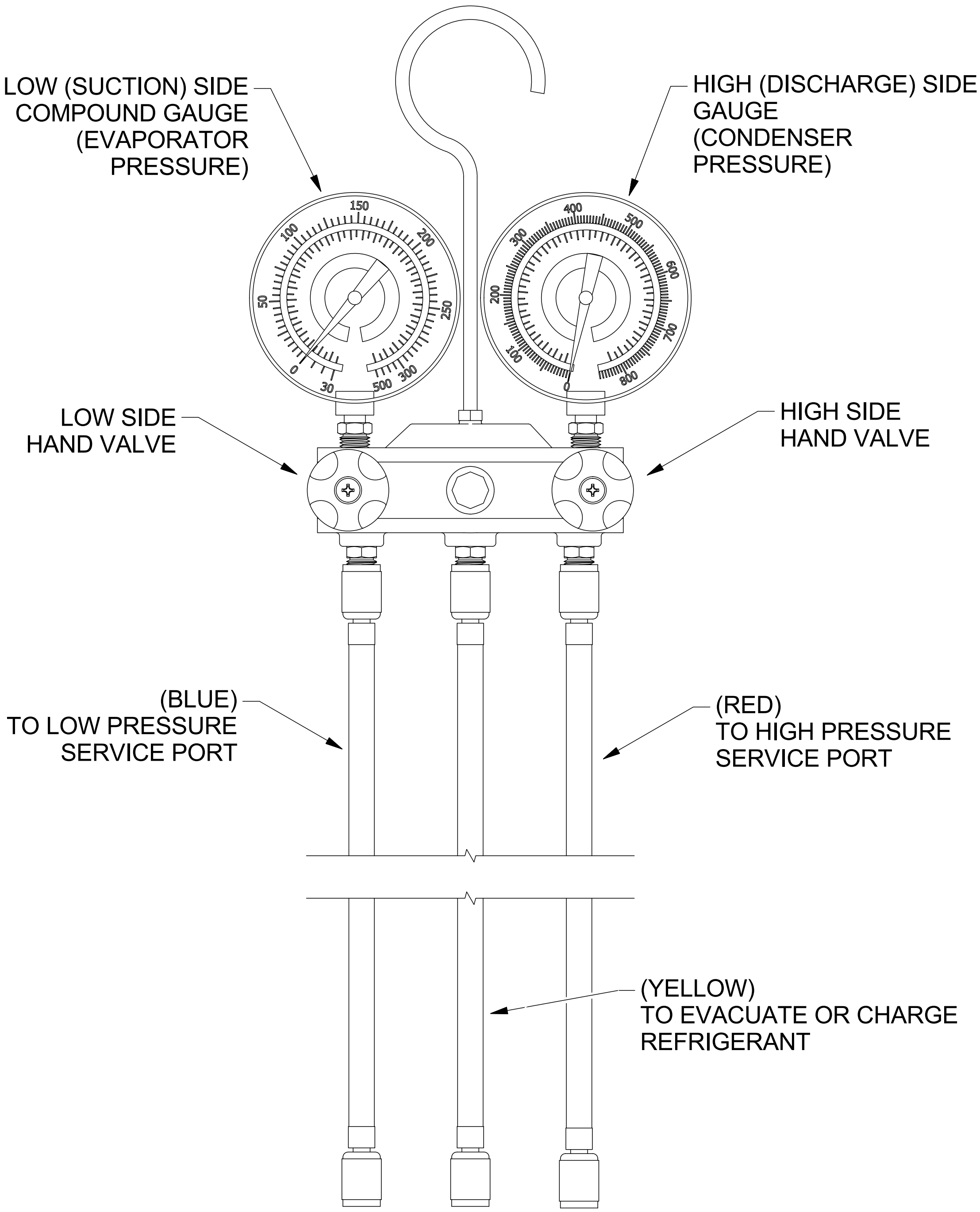
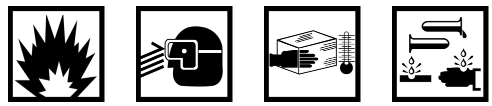



**Figure 2. Three Hose (Two Valve) Manifold Gauge Set.**

**END OF TASK**

## PRESSURE TEST USING A MANIFOLD GAUGE SET

### WARNING



System is under high pressure. Use eye protection and gloves.

### CAUTION

- The high-pressure gauge on a manifold gauge set has a continuous scale that is usually calibrated to read from 0 to 800 psig or 0 to 500 psig. The numbers on the scale do not mean the gauge set is actually rated for use up to these maximum pressures. On older gauge sets and/or hoses, a typical rating is only 340 psig, even though scales on the gauges may show values to 500 psig.
- When working with R-410A refrigerant, you must use a manifold gauge set rated for at least 800 psig with a 4,000 psig burst pressure on the manifold and the hoses.
- Be careful not to trap liquid refrigerant in sealed hoses or the manifold gauge because increased ambient temperatures will cause the liquid refrigerant in these sealed components (which do not contain a pressure relief device like a recovery tank does) to expand. If the component is filled with all liquid (without a vapor space to accommodate the expansion), very high pressures would be created bursting the device. The procedures outlined in this work package for removing the manifold gauge set assures that all liquid is never trapped in the system.

### NOTE

- The three-hose, two-valve type of manifold is constructed so that the high-pressure gauge displays the pressure in the high-pressure hose even if the high-pressure valve is closed. Opening the high-pressure valve opens the path between the high-pressure hose and the center hose.
- Likewise, the low-pressure gauge displays the pressure in the low-pressure hose even if the low-pressure valve is closed. Opening the low-pressure valve opens the path between the low-pressure hose and the center hose.
- Opening both the low-pressure and high-pressure valves allows refrigerant to flow between the high-pressure, low-pressure, and center hoses. Typically, the high-pressure hose is connected to the high-pressure side of the system, the low-pressure hose is connected to the low-pressure side of the system, and the center hose is connected to a refrigerant recovery device, vacuum pump, or refrigerant source.
- The low-pressure (left-side) of the manifold gauge set contains the low-pressure gauge, which is a compound gauge. That is, the gauge displays both a positive pressure scale in pounds-per-square-inch-gauge (psig) and the vacuum in Inches of Mercury. While the high-pressure gauge on the right-side of the manifold gauge set does not have a vacuum scale, it is designed to be exposed to vacuums without damage to the gauge.

1. Install the manifold gauges (this work package).
2. Set the rotary MODE switch (S4) to COOL and set the TEMPERATURE control thermostat (R1) to max cool (rotate counter clockwise).

**PRESSURE TEST USING A MANIFOLD GAUGE SET – CONTINUED**

## CAUTION

If the manifold gauges are installed on the system, seal the gap between the top of the sheet metal housing and the condenser cover with tape. This will ensure proper airflow through the condenser section of the IECU and prevent a high pressure fault.

3. Allow the IECU to run in COOL mode for approximately five minutes for the pressures to stabilize.
4. Measure the low-side and high-side operating pressures. Record the pressures.
5. Measure the evaporator air inlet temperature by inserting a temperature measuring device into the inlet air register. Record the indoor air temperature.
6. Measure the outdoor air temperature (the condenser inlet air temperature) by inserting a temperature measuring device near the condenser inlet air region. Record the temperature of the outdoor air.
7. Using the indoor and outdoor temperatures, determine the normal low-side and high-side operating pressures from Table 5:
   a. If the pressures are not within 15 psig, verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).
   b. If the low-side and high-side pressures are close, the compressor is not functioning properly.
   c. If the measured low-side pressure is more than 20 psig below the normal low side pressure (from Table 5) the IECU is not functioning properly and will not be able to provide sufficient cooling. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).
   d. If the measured high-side pressure is more than 20 psig above the normal high-side pressures (from Table 5) the IECU is not functioning properly and will not be able to provide sufficient cooling. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

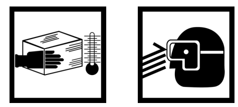
**Table 5. Nominal Operating Pressure at Low Pressure and High Pressure Service Valves.**

| COOLING MODE | | | |
|---|---|---|---|
| AIR TEMPERATURES | | PRESSURE AT SERVICE VALVES | |
| INDOOR | OUTDOOR | LOW PRESSURE | HIGH PRESSURE |
| 70 °F | 80 °F | 118 psig | 370 psig |
| 70 °F | 90 °F | 118 psig | 440 psig |
| 80 °F | 100 °F | 143 psig | 502 psig |
| 90 °F | 110 °F | 150 psig | 573 psig |

8. Remove gauges.

**INSTALL**

## WARNING



Sudden and irreversible tissue damage can result from freezing. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. Failure to comply can cause injury to personnel.

1. Shut down (WP 0005).
2. Unlock two quarter-turn latches on cover assembly and open.
3. Remove captive protective caps from low pressure service port (Figure 3, Item 1) and high pressure service port (Figure 3, Item 2).

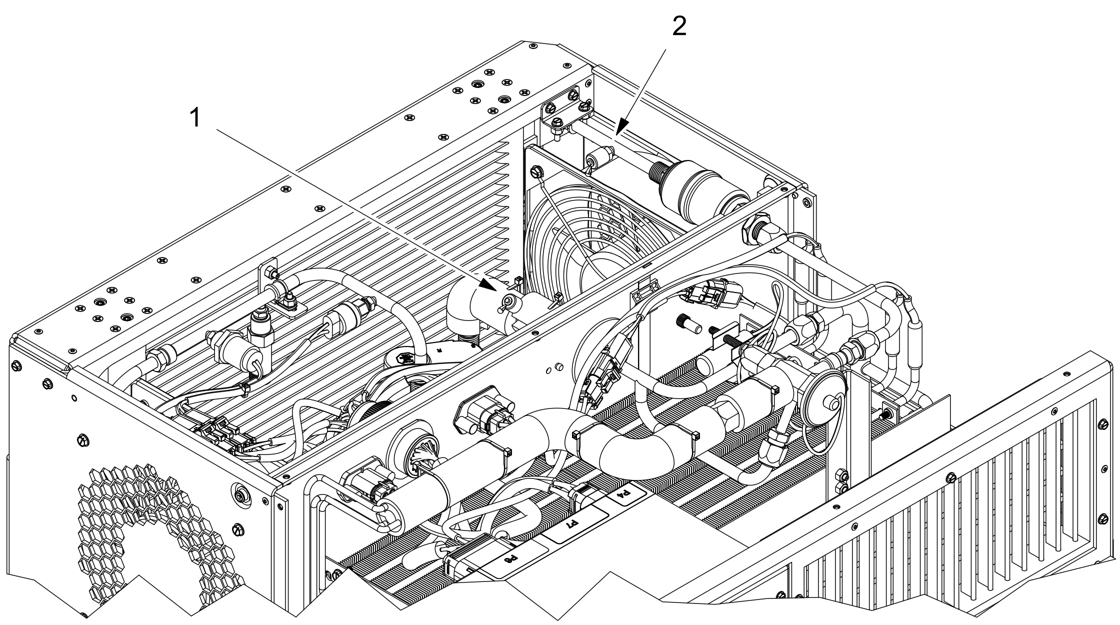



**Figure 3. Low and High Side Service Ports.**

## NOTE

When not in use, always attach the service end of the hoses to the sealed threaded holder on the back side of the manifold (Figure 4) for storage.

## INSTALL – CONTINUED

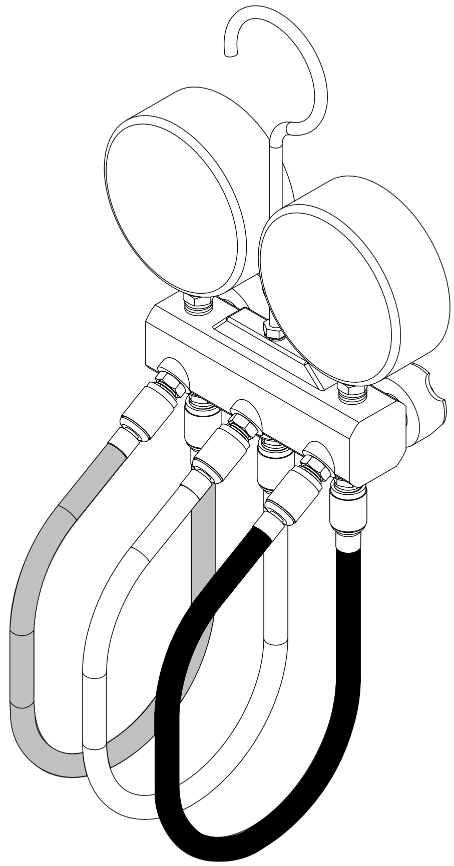


**Figure 4. Hose Ends Properly Stored on Back Side of Manifold Gauge Set.**

4. Ensure both the high-side and low-side manifold gauge set hand valves are closed.
5. If hoses are not already connected to the manifold gauge set, connect the blue low-pressure service hose to the low-side (left-side) of the manifold gauge set. If low-pressure service hose is already connected, then remove the service-port end from the sealed threaded holder on the back-side of the manifold gauge set (Figure 4).
6. If hoses are not already connected to the manifold gauge set, connect the red high-pressure service hose to the high-side (right-side) of the manifold gauge set. If high-pressure service hose is already connected, then remove the service-port end from the sealed threaded holder on the back-side of the manifold gauge set.

**NOTE**

Do not remove the center hose from the storage location if it will not be used. It is typically used for evacuation, nitrogen purging, leak checking, refrigerant recovery, or refrigerant charging.

7. If hoses are not already connected to the manifold gauge set, connect the remaining yellow hose to the center-port of the manifold gauge set, if it is to be used. If the center hose is already connected, then remove the service-port end from the sealed threaded holder on the back-side of the manifold gauge set if it is to be used.
8. Position manifold gauge set outside unit.

**INSTALL – CONTINUED**

9. Connect blue low-pressure service hose (Figure 2) to low pressure service port (Figure 3, Item 1). When the IECU is operating, the low-side service gauge will display the evaporating pressure, even with the low-side hand valve closed.
10. If connecting to a refrigerant charged system, bleed air from the system, through the low-pressure service hose at the manifold gauge set connection, by cracking the service hose where it connects to the manifold gauge set. Allow air to bleed from hoses for 2 to 5 seconds, then retighten the connection.
11. Connect red high-side service hose (Figure 2) to high pressure service port (Figure 3, Item 2). When the IECU is operating, the high-side service gauge will display the condensing pressure, even with the high-side hand valve closed.

**CAUTION**

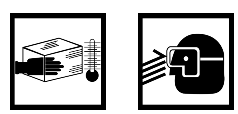
If the manifold gauge set is installed on the system while it is operating, seal the gap between the top of the sheet metal housing and the condenser cover with tape. This will ensure proper airflow through the condenser section of the IECU and prevent a high pressure fault.

12. If connecting to a refrigerant charged system, bleed air from the system, through the high-pressure service hose at the manifold gauge set, by cracking the service hose where it connects to the manifold gauge set. Allow air to bleed from hoses for 2 to 5 seconds, then retighten the connection.

**END OF TASK**

**REMOVE**

**WARNING**



Sudden and irreversible tissue damage can result from freezing. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. Failure to comply can cause injury to personnel.

1. Close the high-side and low-side manifold gauge set hand valves if not already closed.
2. If the center hose of the manifold gauge set was used, then quickly disconnect the center hose from the device to which it was connected. (It is typically connected to a vacuum pump, nitrogen regulator, recovery unit, or refrigerant tank.) Immediately connect the end of this hose to the center sealed threaded holder on the back-side of the manifold (Figure 4).
3. Quickly disconnect the red high-pressure service hose from the high-side service port on the IECU. Immediately connect the end of this hose to the right-side sealed threaded holder on the back-side of the manifold (Figure 4).
4. Quickly disconnect the blue low-pressure service hose from the low-side service port on the IECU. Immediately connect the end of this hose to the left-side sealed threaded holder on the back-side of the manifold (Figure 4).
5. Open both hand valves.
6. Inspect both pressure gauges. While the low-pressure gauge is more accurate at low pressures both gauges should display approximately the same pressure. If a serious difference in reading is displayed, replace the manifold gauge set, recalibrate the gauges, or replace the gauges on the gauge set.

## REMOVE – CONTINUED

7. If the pressure shown on the low-side service gauge is greater than 5 psig, then loosen the center hose and bleed the pressure in the manifold gauge set down to just below 5 psig and retighten the center hose connection.
8. Close both hand valves on the manifold gauge set.
9. Install the protective caps on the low and high pressure service ports (Figure 3, Item 1) and (Figure 3, Item 2).
10. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.
11. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERATION SYSTEM RECOVERY - REFRIGERANT RECOVERY PROCEDURES

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)
Industrial rubber gloves (SATS) (WP 0091, Table 2, Item 6)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

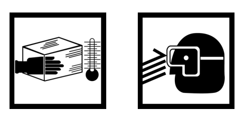
WP 0004
WP 0026
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open
Manifold gauge set is installed (WP 0026)

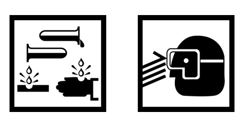
### REFRIGERANT RECOVERY PROCEDURES

**WARNING**



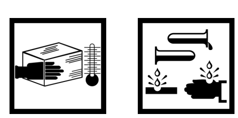
Sudden and irreversible tissue damage can result from freezing. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. Failure to comply can cause injury to personnel.

**WARNING**



Compressor lubricating oil used in this equipment is caustic. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. If oil does contact skin, wash with soap and water. Failure to comply can cause injury to personnel.

**WARNING**



Refrigerant under pressure is used in this equipment. Use great care to avoid contact with liquid refrigerant. Work in well-ventilated area. Failure to comply can cause injury to personnel.

## REFRIGERANT RECOVERY PROCEDURES – CONTINUED

### WARNING

Heat may cause the refrigerant or lubricant to decompose and release irritating, toxic, and corrosive gases. Prevent contact of refrigerant with flame or hot surfaces. Failure to comply can cause injury to personnel.

### CAUTION

- Follow instructions for specific refrigerant recovery unit being used to avoid compressor oil loss. Loss of oil could result in compressor damage.
- It is recommended that refrigeration system not be opened up for more than 15 minutes, to avoid excess moisture in lubricating oil. Excess moisture in oil can cause problems when pumping down (evacuating) refrigeration system before recharging.
- Never leave a system open to the air or under a vacuum for long periods of time. If service is being postponed and the system is under a vacuum then charge with 5 to 10 psig nitrogen from a dry nitrogen gas source using a nitrogen regulator.
- When sealing a system and charging with some nitrogen is not possible, then make sure all open tubes, ports, etc. are sealed off with plugs or tape to prevent moisture, and dirt intrusion. Failure to close off openings can cause problems when evacuating refrigeration system before recharging and problems during operation such as accelerated acid formation and thickening of the oil, resulting in premature compressor failures.

### NOTE

- Refrigeration system repairs must be performed by technician certified to perform such duties in accordance with EPA restrictions. Performing repairs without proper certification may be a violation of public law and subject to severe penalties.
- The system refrigerant must be totally removed and recovered before any maintenance is performed on system components. Leak testing and filter-drier replacements are required after any system component has been removed and replaced. After repair, the system must be properly evacuated and charged to function correctly.
- You should always “break the vacuum” by introducing dry nitrogen into evacuated system, raising the pressure to just slightly above atmospheric pressure before the system is opened up. All reasonable efforts should be made to prevent the introduction of air and therefore moisture to a system. Opening the system after it has been evacuated will allow ambient air to enter the system and will draw air and moisture in as the system stabilizes at atmospheric pressure.
- This procedure requires two recovery cylinders to recover the refrigerant and any oil that may accompany the refrigerant. The oil will be separated out in the first recovery cylinder (oil separation cylinder) and the refrigerant will be recovered in the second (recovery cylinder).

**Recovery Using a 3-Hose Gauge Set**

1. Connect the left (blue) service hose of the manifold gauge set to the low-side service port of the IECU (Figure 1).

**REFRIGERANT RECOVERY PROCEDURES – CONTINUED**

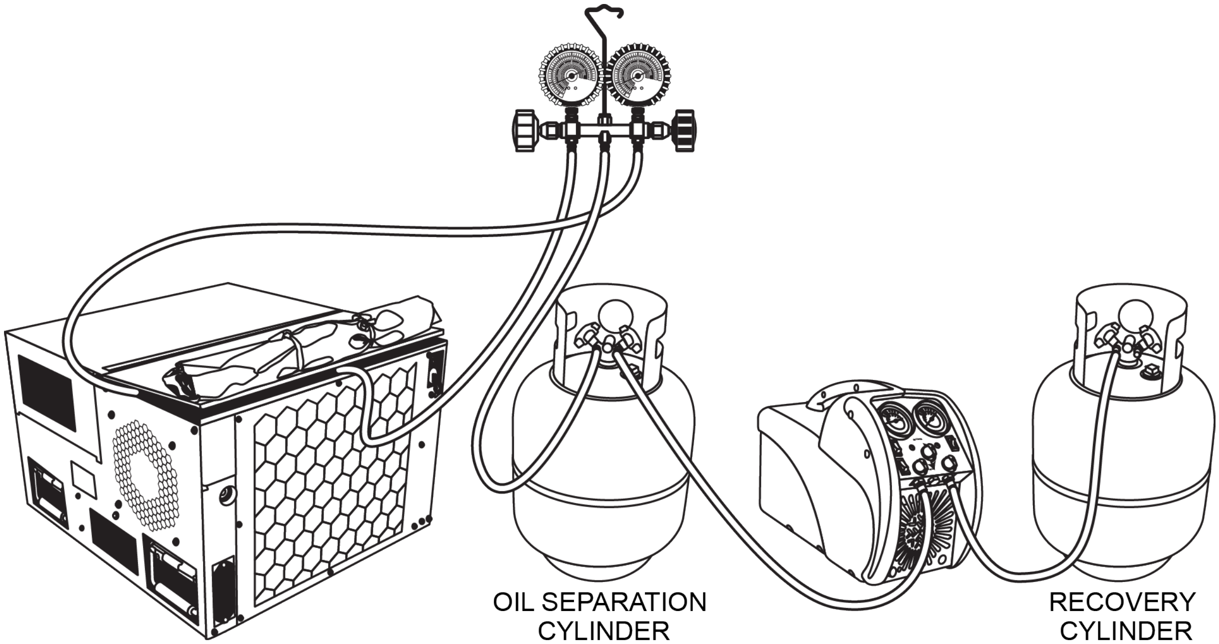



**Figure 1. Refrigerant Recovery Setup.**

2. Connect the right (red) service hose of the manifold gauge set to the high-side service port of the IECU (Figure 1).
3. Connect the center (yellow) service hose of the manifold gauge set to the liquid (L) port of the oil separation cylinder.
4. Connect a hose from the vapor (V) port of the oil separation cylinder to the recovery unit suction port per recovery unit manufacturer's instructions.
5. Connect the recovery unit discharge port to the recovery cylinder per recovery unit manufacturer's instructions.
6. On the manifold gauge set, open the high-pressure (right side) and low-pressure (left-side) hand valves.
7. Open the valves of the oil separation and recovery cylinders as well as the suction and discharge valves on the recovery unit per recovery unit manufacturer's instructions.
8. Turn on the recovery unit per recovery unit manufacturer's instructions.
9. Operate recovery unit until the system has been evacuated to at least 10 inches of mercury vacuum as indicated on the recovery unit's compound gauge or the compound gauge on the manifold gauge set. 10 inches of mercury vacuum is depicted on a manifold gauge set is shown in Figure 2.

## REFRIGERANT RECOVERY PROCEDURES – CONTINUED

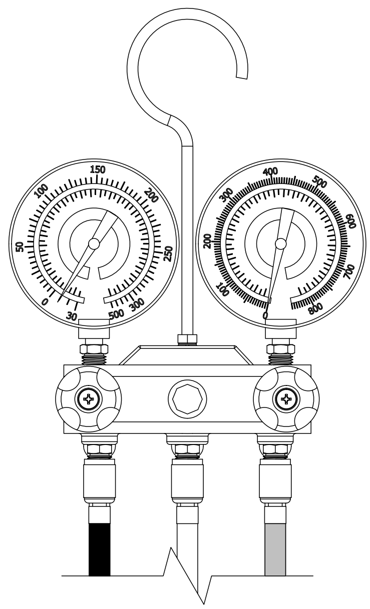
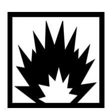


**Figure 2. 10 Inches of Mercury Vacuum.**

10. Close both hand valves on the manifold gauge set and the oil separation cylinder to isolate the recovery unit from the system, and follow the manufacturer's procedure to shut off the recovery unit.

### WARNING



- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

### CAUTION

Never open system while under vacuum.

11. Disconnect all hoses from the recovery unit and the recovery cylinder.
12. Remove the yellow hose from the oil separation cylinder liquid (L) port and move it to the vapor (V) port (Figure 3).

## REFRIGERANT RECOVERY PROCEDURES – CONTINUED

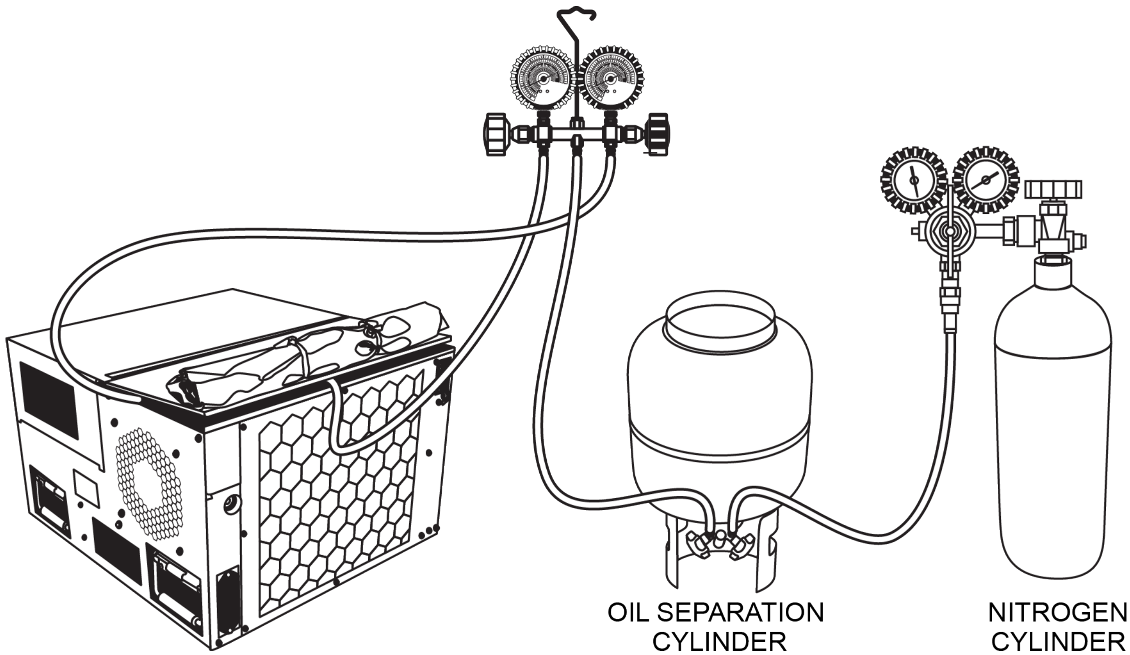



**Figure 3. Nitrogen Setup.**

13. Connect a hose from the oil separation cylinder liquid (L) port to a nitrogen cylinder pressure regulator. Only use gaseous nitrogen.
14. Open the nitrogen valve on the nitrogen cylinder and set the pressure regulator to 5 to 10 psig pressure.
15. Crack the service hose at the oil separation cylinder vapor valve and bleed nitrogen for 2 to 5 seconds before retightening.
16. Open both valves on the oil separation cylinder and invert the cylinder so that the ports are at the lowest point.
17. Increase the pressure set point on the nitrogen cylinder regulator to between 40 and 50 psig.
18. Open only the right (red) hand valve on the manifold gauge set to allow nitrogen gas and oil to flow into the high-pressure port of the evacuated IECU and "break the vacuum."
19. Keep the nitrogen flowing into the system until the pressure stabilizes at 40-50 psig, then close the right (red) hand valve on the manifold gauge set.
20. Open the left (blue) hand valve on the manifold gauge set and allow the pressure to stabilize at 40-50 psig. Close the left (blue) hand valve on the manifold gauge set.
21. Close the valve on the nitrogen cylinder.
22. Return the oil separation cylinder to the upright position.
23. Close both hand valves on the oil separation cylinder.
24. Remove all hoses.

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

1. Remove the manifold gauge set (WP 0026).

## FOLLOW-ON MAINTENANCE – CONTINUED

2. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERATION SYSTEM PURGING - PURGING REFRIGERANT SYSTEM

### INITIAL SETUP:

**Tools and Special Tools**

Drain Pan (SATS) (WP 0091, Table 2, Item 3)
Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0026
WP 0027
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open
Manifold gauge set is installed (WP 0026)

### PURGING REFRIGERANT SYSTEM

**WARNING**

- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

**WARNING**

Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

**CAUTION**

Make sure that approximately 20 psig (137.9 kPa) nitrogen is flowing during purging operations.

1. If the system is charged or partially charged, remove and recover system refrigerant (WP 0027).
2. Connect service hose to nitrogen tank. Use the center (yellow) hose of a 3-hose manifold gauge set.
3. Fully open the right-side discharge (high-pressure) valve on gauge set.
4. Open the valve on the nitrogen tank and adjust the pressure regulator to 20 psig (238 kPa).

## PURGING REFRIGERANT SYSTEM – CONTINUED

5. Crack the center service hose at the manifold gauge set to bleed air from the hose for 2-5 seconds then retighten.
6. Disconnect suction hose from suction side (low side) and place in a suitable waste container to catch any waste from the purging operation. Discard the waste as you would used refrigerant oil into drip pan.
7. Open suction valve on manifold gauge set.
8. Check suction hose to make sure nitrogen is flowing into the waste container.

**NOTE**

If oil discharge is present, reduce nitrogen flow.

9. Allow the nitrogen to purge through the system until the nitrogen stream is flowing without any entrained contaminates.
10. Close the valve on the nitrogen tank and close manifold guage set.
11. Disconnect the center hose from the nitrogen regulator and store it on the threaded post on the manifold gauge set.
12. Properly discard the contaminants caught in the container in the same fashion as waste oil is discarded.

**END OF TASK**

## FOLLOW-ON MAINTENANCE

1. Remove the manifold guage set (WP 0026).
2. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERATION SYSTEM LEAK TESTING - LEAK TESTING, LEAK CHECKING AN OPERATING SYSTEM, NITROGEN PRESSURE DECAY LEAK TESTING OF UNCHARGED SYSTEMS

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)
Refrigerant gas mixture (WP 0094, Table 1, Item 10)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0008
WP 0025

**References - cont'd**

WP 0026
WP 0027
WP 0030
WP 0031
WP 0032
WP 0053
WP 0060
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)

### LEAK TESTING

**NOTE**

Never use a system evacuation as a leak test. A vacuum test is not the best method of leak testing a system for many reasons:

- A vacuum test allows air and moisture to enter the system if there is a leak.
- When you are working on a system, you cannot determine from the vacuum where the leak is located, only the existence of a leak.
- When you check for a leak using a vacuum, you are using a reverse pressure, which is the atmosphere trying to get into the system, of only 14.7 PSI. However, under normal operating conditions, the system could be operating under an operating pressure of several hundred psig, which is 10 to 20 times the vacuum pressure difference.
- A vacuum test could actually hide a leak. For example, if a pin-sized hole is in a solder connection that has a flux buildup on it, the vacuum could pull the flux into the pinhole so that a deep vacuum is achieved. However, when pressure is applied to the system, the flux will blow out of the pinhole, and the leak will be back.

#### Visual Inspection for Oil Residue

Sometimes the simplest way to find the source of a refrigerant leak is to look for traces of oil on the exterior surface of a system that has been operating recently. This method is especially good for the IECU since the most probable location of any leak is at the IMACA fittings, and they may only need to be tightened to resolve the problem. At the site of a refrigerant leak, the refrigerant vaporizes and enters the air while any entrained refrigerant oil is left at the surface of the leak because the oil cannot vaporize.

## LEAK TESTING – CONTINUED

### Soap Bubble Tests

Since the most probable location of a leak in the IECU unit is the IMACA fittings, a soap bubble test (along with the use of dry nitrogen to pressurize the system if it is not a charged system) can be very effective. Where a leak is suspected, coat the exterior surfaces with a liquid-soap solution (soap bubble solution) and then look for signs of bubbles indicating the source of the leak.

### Electronic Leak Testers

An electronic leak detector can detect leak rates of about 0.5 oz per year. After sampling the air, the electronic leak detector makes a clicking sound (or lights up) if refrigerant is detected. This type of electronic leak detector works by drawing the vapor into the probe and heating it. To draw the air into the leak tester and test for trace amounts of refrigerant, a small air pump is used inside the leak tester to draw the air into the leak tester probe. As the air sample is heated, the electrical conductivity increases, indicated by an increased clicking sound. There is typically a replaceable filter, to prevent dirt from entering the leak tester. A severely clogged or dirty filter will reduce the effectiveness of the leak tester.

### Procedure for Using an Electronic Leak Detector

**CAUTION**

Electronic leak detectors are very sensitive, and the probe can be easily damaged by too much exposure to refrigerant in high concentrations. Never put the electronic leak detector probe near a high concentration of refrigerant, such as the direct refrigerant stream from a refrigerant bottle, to verify the detector is working. This can destroy the probe.

Always operate a device according to its Operator's Manual. However, a general procedure is as follows:

1. If the detector has a sensitivity setting, start with the lowest sensitivity first. Only switch to the higher sensitivities if you cannot find the leak on the lowest sensitivity setting.
2. Sweep the probe slowly back and forth working toward the area to be checked. Keep the probe moving to prevent the probe from ingesting a large leak for too long, which may ruin the detector's probe. Moving the probe too quickly may result in a false positive. The recommended rate is no more than one to two inches per second.
3. If a leak has still not been detected with the probe no farther than a quarter of an inch from the area being leak checked, then switch to a higher sensitivity level (if possible) or move the probe even slower and repeat the process starting again with the sweeps of one to two inches per second.

**END OF TASK**

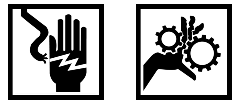
## LEAK CHECKING AN OPERATING SYSTEM

This procedure is used on charged systems that are suspected of having a refrigerant leak (and there is sufficient refrigerant in the system to provide a pressure differential to detect the leak).

1. Check the sight glass moisture indicator. If it is yellow, indicating moisture in the system, the filter-drier must be replaced (WP 0053).
2. Set the rotary MODE switch (S4) to OFF.

## LEAK CHECKING AN OPERATING SYSTEM – CONTINUED

### WARNING



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

3. Set the circuit breaker (CB1) to OFF.
4. Disconnect power cable from receptacle at either condenser or evaporator side of IECU.
5. Remove cover assembly (WP 0032).
6. Install a manifold gauge (WP 0026) and determine the low-side and high-side system pressures. If both pressures are above 100 psig, continue to step 7. If either the low or high side pressure is below 100 psig, then:
   a. Perform a refrigerant recovery (WP 0027).
   b. Replace the filter-drier (WP 0053).
   c. Perform a high-pressure Nitrogen leak test (this work package).
   d. Perform an evacuation (WP 0030).
   e. Charge the evacuated system (WP 0031).
7. Inspect the exterior of the IMACA fittings for signs of oil residue that may indicate potential leakage sites:
   a. If a leak is suspected then use an electronic leak detector or soap bubble test to check these suspected leakage locations.
   b. If a leak is detected with the electronic detector, verify the location with the soap bubble test (this work package).
   c. Tighten IMACA fittings (WP 0060) at the source of the leak and retest for leaks.
   d. If the leak remains, the o-ring in the IMACA fitting or the leaking component must be replaced (WP 0060):
      (1) Perform a refrigerant recovery (WP 0027).
      (2) Disassemble the IMACA fitting(s), replace the o-ring(s) or the leaking components, and reassemble the IMACA fitting(s) (WP 0025).
      (3) Replace the filter-drier (WP 0053).
      (4) Perform a high-pressure Nitrogen leak test (this work package).
      (5) Perform an evacuation (WP 0030).
      (6) Charge the evacuated system (WP 0031).
8. Using the electronic leak detector, sniff for signs of refrigerant leakage at all joints following the Procedure for Using the Leak Detector (this work package):
   a. If leaks are suspected, verify with the soap bubble test to identify the exact location.
   b. If a leak is discovered at a IMACA fitting, tighten IMACA fitting (WP 0060), and then retest for leaks.
   c. If the leak remains, the o-ring in the IMACA fitting or the leaking component must be replaced:
      (1) Perform a refrigerant recovery (WP 0027).

## LEAK CHECKING AN OPERATING SYSTEM – CONTINUED

(2) Disassemble the IMACA fitting(s), replace the o-ring(s) or the leaking components, and re-assemble the IMACA fitting(s) (WP 0025).

(3) Replace the filter-drier (WP 0053).

(4) Perform a high-pressure Nitrogen leak test (this work package).

(5) Perform an evacuation (WP 0030).

(6) Charge the evacuated system (WP 0031).

9. After removing the guage set (WP 0026), replace the cover assembly (WP 0032).
10. Connect a power cable to the front or rear IECU power receptacle. Verify that the power source is the proper voltage.
11. Set the circuit breaker (CB1) to ON.
12. Perform the initial troubleshooting procedures test (WP 0008).

**END OF TASK**

## NITROGEN PRESSURE DECAY LEAK TESTING OF UNCHARGED SYSTEMS

This procedure is used on uncharged systems after all repairs have been made and a new filter-drier has been installed. In this case, the system is ready to be evacuated and charged, but a leak free system must be verified prior to proceeding.

### Nitrogen Pressure Decay Leak Testing with a 3-Hose Manifold Gauge Set

**WARNING**

- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

1. Verify that all repairs have been made.
2. Verify that a new filter-drier has been installed (WP 0053).
3. Connect a manifold gauge set to the high and low sides of the system (WP 0026).
4. Verify both hand valves are closed.
5. If nitrogen is present in the system, bleed the nitrogen down to 5 to 10 psig, by cracking the low-side and high-side service hoses at the manifold.
6. Otherwise, if nitrogen is not present in the system:

   a. Connect the free end of the (yellow) center hose to the vacuum pump.

   b. Follow the procedure to start the vacuum pump (WP 0030).

   c. Open both hand valves to evacuate the system and all hoses.

## NITROGEN PRESSURE DECAY LEAK TESTING OF UNCHARGED SYSTEMS – CONTINUED

d. Stop evacuation at a vacuum of at least 20 inches of mercury, as determined from the low-side compound gauge.

e. Close both hand valves and turn off vacuum pump.

f. Disconnect the service hose from the vacuum pump and connect it to the pressure regulator of a nitrogen tank

g. Open the valve on the nitrogen tank and set the pressure regulator to 5 to 10 psig.

h. Crack the center service hose at the manifold gauge set to bleed nitrogen from the hose for 2-5 seconds. Retighten after bleeding.

i. Open the high-side and low-side hand valves on the manifold gauge set.

j. Allow nitrogen to flow into the system until the pressure stabilizes at some pressure between 5 and 10 psig.

k. Close both hand valves on the manifold.

7. If not already connected, connect the free-end of the center (yellow) hose of the manifold gauge set to the R-410A tank.
8. Orient the refrigerant tank to supply vapor.
9. Open the valve on the R-410A tank.
10. Crack the center hose connection at the manifold gauge and bleed air for 2-5 seconds, then retighten.
11. Open the high-side and low-side hand valves on the manifold gauge set and raise the pressure in the system to 40 – 50 psig.
12. Close the high-side and low-side hand valves on the manifold gauge.
13. Close the valve on the refrigerant tank.
14. Crack the center (yellow) hose, to bleed air from the hose, then disconnect the center hose from the R-410A tank and connect the service end to the nitrogen pressure regulator on the nitrogen tank.
15. Open the valve on the nitrogen tank and set the pressure regulator to between 425 and 450 psig.
16. Crack the center hose at the manifold gauge to bleed air from the hose for 1-2 seconds, then retighten.
17. Open the low-pressure and high-pressure hand valves on the manifold gauge set and let the nitrogen fill the system. Keep the nitrogen flowing into the system, until the pressure stabilizes at between 425 and 450 psig, then close both hand valves on the manifold gauge set.
18. Close the valve on the nitrogen tank.
19. Crack the hose on the nitrogen tank and bleed the pressure down to atmospheric pressure then disconnect the center hose from the nitrogen regulator and connect the service end to the threaded storage post on the manifold gauge set.

**NOTE**

If you see a pressure drop, remember the manifold gauge set and connections could be leaking, not the system.

20. The high-side and low-side pressures should be equal. Tap the gauges slightly to make sure the needles are free, and record the pressure. If the pressure falls over time, the system has a leak.
21. Use the electronic leak detector, sniff for signs of refrigerant leakage at all joints and components, including the manifold gauge set:

a. If leaks are suspected, verify with the soap bubble test to identify the exact location.

b. If a leak is discovered at a IMACA fitting, tighten the fitting (WP 0060), and then retest for leaks.

## NITROGEN PRESSURE DECAY LEAK TESTING OF UNCHARGED SYSTEMS – CONTINUED

c. If the leak cannot be fixed, the o-ring in the IMACA fitting or the component must be replaced (WP 0025).

22. If other leaks are discovered:

a. Crack the both service hose connections at the high and low side connections to the manifold and let the pressure bleed down to atmospheric pressure. Recover the refrigerant (WP 0027).

b. Make the necessary repairs.

c. Repeat the entire leak test procedure.

23. If no leaks are found:

a. Crack both service hose connections at the high and low side connections to the manifold and let the pressure bleed down to 5-10 psig. Recover the refrigerant (WP 0027).

b. Perform an evacuation (WP 0030).

c. Charge the evacuated system (WP 0031).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERATION SYSTEM CIRCUIT EVACUATION - TRIPLE EVACUATION OF REFRIGERANT CIRCUIT, PROCEDURE FOR USING A VACUUM PUMP WITH GAS BALLAST VALVE, PROCEDURE FOR SHUTTING OFF A VACUUM PUMP, TRIPLE EVACUATION PROCEDURE USING A 3-HOSE MANIFOLD GAUGE SET

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0005
WP 0015

**References - cont'd**

WP 0026
WP 0029
WP 0053
WP 0062
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open
Manifold gauge set is installed (WP 0026)

### TRIPLE EVACUATION OF REFRIGERANT CIRCUIT

The goal of a triple evacuation is to completely remove any air, moisture or other non-condensable gases from the refrigeration system. When pulling a deep vacuum, the lack of any gasses in the system can prevent a complete dehydration by the vacuum pump. With a triple evacuation, the evacuation operations are alternated with filling the system with nitrogen to help flush moisture and non-condensable gases into the vacuum pump.

The eventual goal is to reach a final deep vacuum, at least 500 microns, 0.5 mmHg absolute. The process is to draw a deep vacuum, see if the vacuum can hold, and then refill the system with dry nitrogen and repeat until a deep vacuum is achieved and held.

During each vacuum decay test, isolate the system from the vacuum pump and wait to see if the pressure rises (water is boiling off). Because the quantity of gas trapped in the system is essentially zero, you don’t need to make any compensation for temperature changes.

If an increase in pressure is observed, the system could have a leak, but this is very doubtful since it has already passed the pressure decay leak test (WP 0029) with the system at a much higher pressure difference. If the pressure increases to a point and then stops at some point either above or below 0 psig, this indicates that water (if below 0 psig) or refrigerant (if above 0 psig) is still evaporating. Only if the system had a leak would the pressure increase stop at 0 psig (atmospheric pressure).

If the pressure increases above 0 psig, refrigerant is still trapped in the system. The refrigerant could be trapped in or under any oil in the system, so the crankcase heater is activated during this process.

**Required Tools**

The tools needed to perform a triple evacuation are a two-stage vacuum pump, a gaseous nitrogen supply (nitrogen tank and regulator), and a micron vacuum gauge.

**Vacuum Pump**

## TRIPLE EVACUATION OF REFRIGERANT CIRCUIT – CONTINUED

- A vacuum pump removes fluids such as air, other non-condensable gases, and water from a system, drawing the system pressure to below atmospheric pressure, or below 0 psig. A vacuum pump can consist of a single- or two-stage design. The two-stage vacuum pump is necessary for H VAC/R appliances.
- The vacuum pump has a gas ballast valve (Figure 1), which helps to prevent moisture that is being evacuated in the system from condensing into the vacuum pump oil and reducing the vacuum level the vacuum pump can achieve.

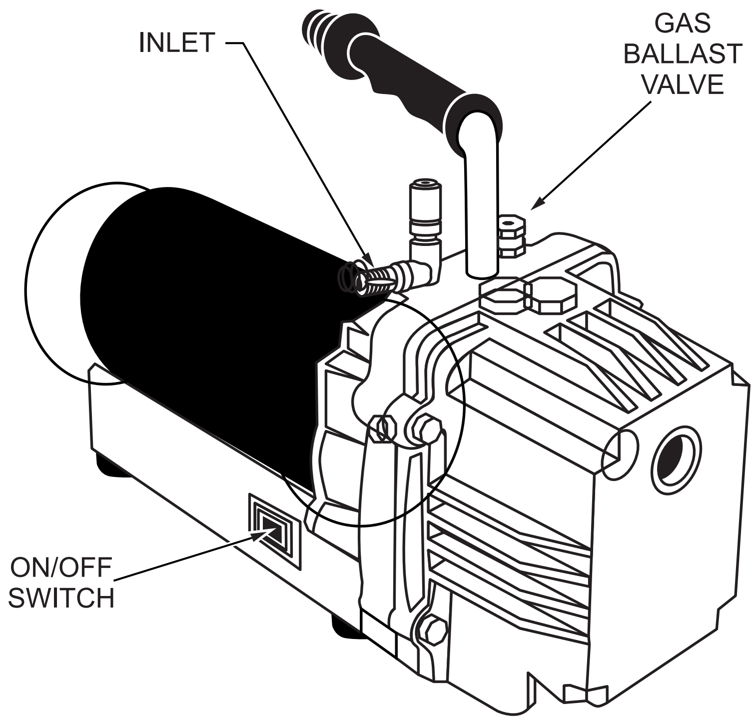



**Figure 1. Typical Two-Stage H VAC Vacuum Pump.**

- During the first stages of evacuation, refrigerant or moisture vapors are more highly concentrated. The Gas Ballast Valve allows some ambient air into the vacuum pump to dilute the impurities and reduce the condensation of refrigerant and/or moisture into the vacuum pump oil. When a vacuum pump is unable to pull a deep vacuum, occasionally it is not due to a leak but due to moisture or impurities in the vacuum pump oil. Change the vacuum pump oil frequently and always use the gas ballast valve properly.

**TRIPLE EVACUATION OF REFRIGERANT CIRCUIT – CONTINUED**

**Electronic Vacuum Gauge (Micron Gauge)**

**CAUTION**

The micron vacuum gauge typically has a maximum positive pressure of 5 psig, so great care must be used when purging with nitrogen to avoid damaging the gauge. Set the nitrogen regulator to 2-3 psig and never pressurize the system to any higher pressure if a micron vacuum gauge is connected.

- An electronic vacuum gauge or micron gauge (Figure 2) displays the vacuum level directly in microns and is the only accurate field method to determine the evacuation level of a deep vacuum. The micron gauge is much more accurate at measuring very deep vacuums (very low pressures) when compared to a manifold gauge.


**Figure 2. Typical Micron Gauge.**

- The compound (blue) low-side pressure gauge on a manifold set measures evacuation levels using an inaccurate scale based on inches of mercury. This scale ranges from 0 inches of mercury (no vacuum) to 30 inches of mercury (full vacuum). By comparison, a micron gauge (Figure 2) expands this scale tremendously at the deeper vacuum levels, providing much greater measurement resolution. There are 25,000 microns between 29 inches of mercury and 30 inches of mercury.

- The system should be evacuated to a vacuum level of between 300 and 500 microns. A manifold gauge does not provide sufficient accuracy for this type of measurement. When a system is evacuated, accurate readings are needed from the micron gauge. For the most accurate readings, connect the vacuum gauge close to

**TRIPLE EVACUATION OF REFRIGERANT CIRCUIT – CONTINUED**

the system to be evacuated (ideally directly on a service port) and as far as possible from the vacuum pump. Never connect the gauge in-line between the vacuum pump and the system. Always measure the vacuum with the vacuum pump shut off and isolated.

**END OF TASK**

**PROCEDURE FOR USING A VACUUM PUMP WITH GAS BALLAST VALVE**

1. Keep the Gas Ballast Valve closed when the vacuum pump is not being used.
2. After connecting the vacuum pump and starting evacuation, open the Gas Ballast Valve (1/4 turn to fully opened) during the initial evacuation.
3. Once the vacuum pressure has dropped into a vacuum of at least 20 to 25 inches of mercury, close the gas ballast valve and continue the evacuation procedure to reach ultimate vacuum. If you forget to close the gas ballast valve, a deep vacuum will not be achieved.

**END OF TASK**

**PROCEDURE FOR SHUTTING OFF A VACUUM PUMP**

1. Shut off or isolate the service hose that is being used to evacuate the system, isolating the pump from the system.
2. Break the vacuum in the line between the vacuum pump and the system.
3. Shut off the vacuum pump. If you simply shut off the vacuum pump without isolating the vacuum pump or without breaking the vacuum in the connecting hose, the vacuum in the system or the hose will draw vacuum pump oil into the system or hose. This may result in contamination of the system or hose.

**NOTE**

Always measure the system vacuum with the system isolated and the vacuum pump turned off.

4. Close the gas ballast valve completely

**END OF TASK**

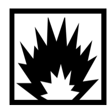
**TRIPLE EVACUATION PROCEDURE USING A 3-HOSE MANIFOLD GAUGE SET**

1. Verify that all refrigerant system repairs have been made.
2. Verify that a new filter-drier has been installed (WP 0053).
3. Verify that a leak check has been performed (WP 0029).
4. Verify that power cable is connected to 115 VAC single-phase 50/60 hertz.
5. Connect power cable to receptacle at either condenser or evaporator side of IECU.
6. Verify the circuit breaker (CB1) is ON by resetting it. The unit is being powered to activate the crankcase heater and speed the evacuation.
7. Verify the unit is properly powered as indicated by a steady green light on the remote control box. If the light is not steady green, verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**TRIPLE EVACUATION PROCEDURE USING A 3-HOSE MANIFOLD GAUGE SET – CONTINUED**

8. Remove the high pressure transducer from the Schrader valve mounting (WP 0062) and install the micron gauge onto this connection.
9. Connect the the center hose of the manifold to the vacuum pump connection.
10. Open both hand valves on the manifold gauge set.
11. Turn on the vacuum pump following the Procedure for Using a Vacuum Pump (this work package) and evacuate the system to a vacuum less than 2,000 microns as shown on the micron gauge. If the vacuum pump does not achieve this vacuum level in 15 minutes, proceed to the next step anyway.
12. Close the high-side and low-side hand valves on the manifold gauge set, to isolate the vacuum pump, and follow the procedure to shut down the vacuum pump and disconnect the center hose from the vacuum pump.

**WARNING**



- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

13. Disconnect micron guage.

**WARNING**

Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

14. Connect the center (yellow) hose to the regulator of a nitrogen source.

**CAUTION**

Applying a pressure of 5 psig or higher will damage the vacuum gauge. Never allow the system pressure to rise to 5 psig with the vacuum gauge installed.

15. Open the nitrogen valve on the nitrogen tank and set the pressure regulator to 2-3 psig pressure.
16. Crack the center hose at the manifold and bleed the nitrogen from the center (yellow) hose. Let the nitrogen bleed out for 2-5 seconds before retightening.
17. Verify the pressure regulator is supplying nitrogen at a pressure between 2-3 psig.
18. Open both manifold hand valves and let the nitrogen fill the system. Keep the nitrogen flowing into the system, until the pressure stabilizes, then close both manifold hand valves. Close the valves and close nitrogen tank immediately, if the pressure is rising above 3 psig.
19. Turn nitrogen off.
20. Remove the center hose from the nitrogen regulator and connect it to the vacuum pump.
21. Turn on the vacuum pump.
22. Connect micron guage to Schraeder valve.

**TRIPLE EVACUATION PROCEDURE USING A 3-HOSE MANIFOLD GAUGE SET – CONTINUED**

23. Open both hand valves on the manifold gauge set (open the right-side and left-side hand valves).
24. Evacuate the system to a vacuum less than 1,500 microns as shown on the micron gauge. If the vacuum pump does not achieve this vacuum level verify the vacuum pump gas ballast valve is closed. If the gas ballast valve is closed, verify the vacuum pump does not need an oil change.
25. Close the high-side and low-side hand valves on the manifold gauge set to isolate the vacuum pump. Follow the Procedure For Shutting Off A Vacuum Pump (this work package) and disconnect the center (yellow) hose from the vacuum pump.
26. Disconnect micron guage.
27. Connect the center hose to the regulator of a nitrogen source.
28. Open the nitrogen valve on the nitrogen tank. The pressure regulator should still be set to provide a nitrogen pressure of 2-3 psig.
29. Crack the center hose at the manifold and bleed the nitrogen from the center hose. Let the nitrogen bleed out for 2-5 seconds before retightening.
30. Verify the pressure regulator is supplying nitrogen at a pressure between 2 – 3 psig.
31. Open both manifold hand valves and let the nitrogen fill the system. Keep the nitrogen flowing into the system, until the pressure stabilizes, then close both manifold hand valves. Close the valves and close nitrogen tank immediately, if the pressure is rising above 3 psig.
32. Turn nitrogen off.
33. Remove the center hose from the nitrogen regulator and connect it to the vacuum pump.
34. Turn on the vacuum pump.
35. Connect micron guage to Schraeder valve.
36. Open both hand valves on the manifold gauge set.
37. Evacuate the system to a vacuum less than 500 microns as shown on the micron gauge. If the vacuum pump does not achieve this vacuum level, verify the vacuum pump gas ballast valve is closed. If the gas ballast valve is closed, verify the vacuum pump does not need an oil change.
38. Close both hand valves on the manifold gauge set, to isolate the vacuum pump, and watch the vacuum level for 1-2 minutes, if the pressure rises then repeat the prior step. If the vacuum level holds then continue to the next step with the vacuum pump still operating but isolated.
39. Disconnect the vacuum pump from the center hose.
40. Shut down the vacuum pump.
41. Once again, connect the center hose to the regulator of a nitrogen source.
42. Open the nitrogen valve on the nitrogen tank. The pressure regulator should still be set to provide a nitrogen pressure of 2-3 PSIG.
43. Crack the center hose at the manifold and bleed the nitrogen from the center hose. Let the nitrogen bleed out for 2-5 seconds before retightening.
44. Verify the pressure regulator is supplying nitrogen at a pressure between 2-3 PSIG.
45. Open both manifold hand valves and let the nitrogen fill the system. Close the valves immediately, if the pressure is rising above 3 psig.
46. Remove the micron gauge from the Schrader valve mounting and install the high pressure transducer onto the Schrader valve port.
47. Adjust the nitrogen pressure regulator to supply between 5 and 10 psig into the system. Keep the nitrogen flowing into the system, until the pressure stabilizes, then close both manifold hand valves.

## TRIPLE EVACUATION PROCEDURE USING A 3-HOSE MANIFOLD GAUGE SET – CONTINUED

48. Shut off the nitrogen and remove the center hose.
49. Disconnect the manifold gauge set (WP 0026).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

1. Remove the manifold guage set (WP 0026).
2. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERATION SYSTEM CHARGING - CHARGING AN EMPTY REFRIGERANT SYSTEM, TOPPING OFF A SYSTEM

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Refrigerant gas mixture (WP 0094, Table 1, Item 10)
Industrial rubber gloves (SATS) (WP 0091, Table 2, Item 6)
Safety glasses (WP 0091, Table 2, Item 11)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0012
WP 0015

**References - cont'd**

WP 0024
WP 0026
WP 0027
WP 0029
WP 0030
WP 0053
WP 0057
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open
Manifold gauge set is installed (WP 0026)

### CHARGING AN EMPTY REFRIGERANT SYSTEM

**WARNING**

- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

1. Inspect the exterior of the condenser and evaporator to be certain the condenser and evaporator air flow paths are clear.
2. Verify the supply grille louvers are open and unrestricted.
3. Close the fresh air duct door assembly.
4. Verify the inlet air filter is clean. Clean if necessary (WP 0012).
5. Verify that all refrigerant system repairs have been made.
6. Verify that a new filter-drier has been installed (WP 0053).
7. Verify that a leak check has been performed (WP 0029).

**CHARGING AN EMPTY REFRIGERANT SYSTEM – CONTINUED**

## CAUTION

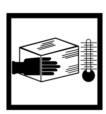
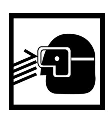
The system must be evacuated before charging. Moisture in the system will prevent refrigeration unit from operating properly.

## NOTE

If a triple evacuation was performed properly, the system should have a 5 - 10 psig nitrogen holding charge.

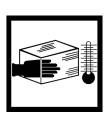
8. Verify that a triple evacuation has been performed (WP 0030).
9. Verify that power cable is connected to 115 VAC single-phase power source.
10. Connect power cable to receptacle at either condenser or evaporator side of IECU
11. Verify the circuit breaker (CB1) is ON by resetting it.
12. Verify the unit is properly powered as indicated by a steady green light on the remote control box assembly. If the light is not steady green, verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).
13. The system should contain a nitrogen holding charge and the pressure should be above 0 psig. If not, repeat the leak testing (WP 0029) and evacuation procedures (WP 0030).
14. Crack the high-side and low-side service hoses connected to the IECU at the manifold gauge and bleed the pressure down to 0 psig.
15. Connect the center (yellow) hose of the manifold gauge set to a vacuum pump.
16. Turn on the Vacuum Pump (WP 0030) and evacuate the center (yellow) hose and manifold.
17. Open the high-side and low-side hand valves on the manifold gauge set to evacuate the IECU.
18. After achieving a vacuum of 29 inches of mercury, close the high-side and low-side hand valves on the manifold gauge set. If 29 inches of mercury vacuum cannot be achieved, repeat the leak testing (WP 0029) and evacuation procedures (WP 0030).
19. Turn the vacuum pump OFF.
20. Disconnect the center (yellow) hose from the vacuum pump and attach it to the threaded storage post on the manifold gauge set.

## WARNING

Sudden and irreversible tissue damage can result from freezing. Wear gloves, face protector and safety glasses in any situation where skin or eye contact with refrigerant is possible. Failure to comply can cause injury to personnel.

## WARNING




Refrigerant under pressure is used in this equipment. Use great care to avoid contact with liquid refrigerant. Work in well-ventilated area. Failure to comply can cause injury to personnel.

## CHARGING AN EMPTY REFRIGERANT SYSTEM – CONTINUED

**WARNING**

Heat may cause the refrigerant or lubricant to decompose and release irritating, toxic, and corrosive gases. Prevent contact of refrigerant with flame or hot surfaces. Failure to comply can cause injury to personnel.

**WARNING**

Never introduce high pressure into a refrigerant cylinder. This can cause the cylinder to rupture and cause injury to personnel.

**CAUTION**

The system must be evacuated before charging. Moisture in the system will prevent refrigeration unit from operating properly.

21. Attach the center (yellow) hose of the manifold gauge set to the refrigerant R-410A tank and position the tank to supply vapor.
22. Open the hand valve on the refrigerant tank.
23. Crack the center (yellow) hose at the manifold gauge and bleed air from the hose for 2-5 seconds then retighten.
24. Orient the refrigerant tank to supply liquid R-410A and place the refrigerant tank on calibrated scale to measure and record weight (Figure 1).

## CHARGING AN EMPTY REFRIGERANT SYSTEM – CONTINUED


**Figure 1. Calibrated Refrigerant Scale.**

25. Begin charging by fully opening the right-side high-pressure hand valve on the manifold gauge allowing refrigerant to enter into the IECU.
26. Crack the left-hand low-pressure hand valve slightly, to allow refrigerant to flash as it enters the suction side of the IECU.
27. Close both the high-pressure (right-side) and low-pressure (left-side) hand valves after proper charge of 2.4 lbs (0.45 kg) liquid is obtained. If the system will not draw the complete charge into the system then:
    a. Close the high side and low side hand valves on the manifold gauge set.
    b. Close lid by resting it on gauge set hoses.
    c. Set the rotary MODE switch (S4) to COOL and activate the system.
    d. After the compressor starts, crack open the low-side hand valve on the manifold gauge set and use the suction created by the compressor to draw the remaining refrigerant into the system.
    e. Close the low-side hand valve when the proper charge is obtained. Close the valve on the refrigerant tank.
28. Monitor the high pressure gauge on the manifold set to ensure that the condenser pressure does not exceed the normal values indicated in Table 5 of Pressure Test Using Manifold Gauge Set (WP 0026).
29. If the system is not already operating then set the rotary MODE switch (S4) to COOL and activate the system.

## CHARGING AN EMPTY REFRIGERANT SYSTEM – CONTINUED

30. After the compressor starts, crack the low-side hand valve on the manifold gauge set and use the suction created by the compressor to draw some of the remaining refrigerant out of the manifold gauge set.
31. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

## END OF TASK

## TOPPING OFF A SYSTEM

This procedure is only for functioning systems in operation. If refrigerant circuit repairs have been made, moisture is indicated in the system, or a filter-drier has been changed, then a complete refrigerant charge must be introduced.

1. Check the sight glass moisture indicator. If it is yellow, indicating moisture in the system, perform a refrigerant recovery (WP 0027), filter-drier change (WP 0057), triple evacuation (WP 0030), and complete system charging (this work package). In this case do not top off the refrigerant.
2. Inspect the exterior of the condenser and evaporator to be certain the condenser and evaporator air flow paths are clear.
3. Verify the supply grille louvers are open and unrestricted.
4. Close the fresh air duct door assembly.
5. Verify the air filter is clean. Clean if necessary (WP 0012).
6. Verify that power cable is connected to 115 VAC single-phase power source.
7. Connect power cable to receptacle at either condenser or evaporator side of IECU
8. Verify the circuit breaker (CB1) is ON by resetting it.
9. Verify the unit is properly powered as indicated by a steady green light on the remote control box assembly. If the light is not steady green, verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).
10. Connect the center hose to the R-410A refrigerant tank. Keep the valve on the tank closed. Position to supply refrigerant vapor and open the valve on the R-410A tank.
11. Bleed air through the center hose from the refrigerant tank to the manifold gauge set, by cracking both center hose where it connects to the manifold gauge set. Allow air to bleed from hoses for 2 to 5 seconds, and then retighten the connection.
12. Close lid by resting it on gauge set hoses.
13. Set the rotary MODE switch (S4) to COOL.
14. Prepare refrigerant tank to deliver liquid refrigerant per instructions on tank.

**CAUTION**

The following steps require the maintainer to slowly open (crack) the low-side service valve on the manifold gauge set in order to ensure liquid converts to vapor before entering the compressor. Liquid entering the compressor can cause damage. Therefore, it is essential to allow the liquid to vaporize. Failure to recognize this CAUTION may cause damage to the compressor.

15. After the compressor (B1) starts, crack-open the low-side manifold gauge set hand valve to allow liquid refrigerant to flash as it enters the low side of the system:
    a. The valve must be only slightly cracked to allow the refrigerant to flash into vapor before entering the compressor.

**TOPPING OFF A SYSTEM – CONTINUED**

b. If the compressor begins producing an unusual noise, close the valve more.

16. With the compressor brazing assembly (B1) operating, monitor the refrigerant in the sight glass. Slowly add refrigerant, until bubbles in the sight glass disappear. The best procedure it to add some charge, and then let the system equilibrate, by letting it operate for 10 minutes before proceeding.
17. When the sight glass appears completely liquid with no bubbles, close the low-side hand valve on the manifold gauge set.
18. Monitor the high pressure gauge on the manifold set to ensure that the condenser pressure does not exceed the normal values indicated in Table 5 of Pressure Test Using Manifold Gauge Set (WP 0026).
19. If operation is normal, and no additional charge needs to be added:
    a. Close the valve on the refrigerant tank.
    b. Open the low-pressure hand valve on the manifold gauge set to draw any liquid refrigerant in the manifold set into the IECU.
    c. Keep the low-pressure hand valve open for 2 to 4 minutes, or until the low side pressure has returned to normal operating pressure.
20. Close the low-side hand valve.
21. Crack the center (yellow) service hose at the refrigerant tank to slowly vent any remaining refrigerant. Remove the hose and store it on the threaded storage post on the manifold.
22. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

1. Remove the manifold guage set (WP 0026).
2. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

FIELD MAINTENANCE

COVER ASSEMBLY - INSPECT, REMOVE, REPAIR, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Rivet Gun (SATS) (WP 0091, Table 2, Item 10)
Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Paint, green 383 (MIL-DTL-53039D) (WP 0094, Table 1, Item 8)
Paint brush (WP 0094, Table 1, Item 3)
Sandpaper, 240 grit (WP 0094, Table 1, Item 11)
Replacement condenser cover assembly (WP 0072, Item 3)
Replacement cover assembly (WP 0072, Item 2)
Rivets (WP 0072, Item 7)
Replacement strap assembly (WP 0072, Item 4)
Replacement electric schematic (WP 0072, Item 14)
Replacement refrigeration schematic (WP 0072, Item 8)
Replacement wiring diagram (WP 0072, Item 15)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0069
WP 0072
WP 0091
WP 0094
TM 43-0139

**Equipment Condition**

IECU is shut down (WP 0005)

**INSPECT**

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove cover assembly (this work package).
2. Visually inspect sheet metal exterior for nicks, gouges, corrosion, and bare spots in paint and other defects that can be repaired.
3. Visually inspect schematic plates and wiring diagram plate for damaged or missing rivets or cracks. Replace missing or cracked plates (this work package).
4. Visually inspect cover for loose, frayed, cracked, or missing insulation (Figure 1).
5. Install the cover assembly (this work package).

**INSPECT – CONTINUED**

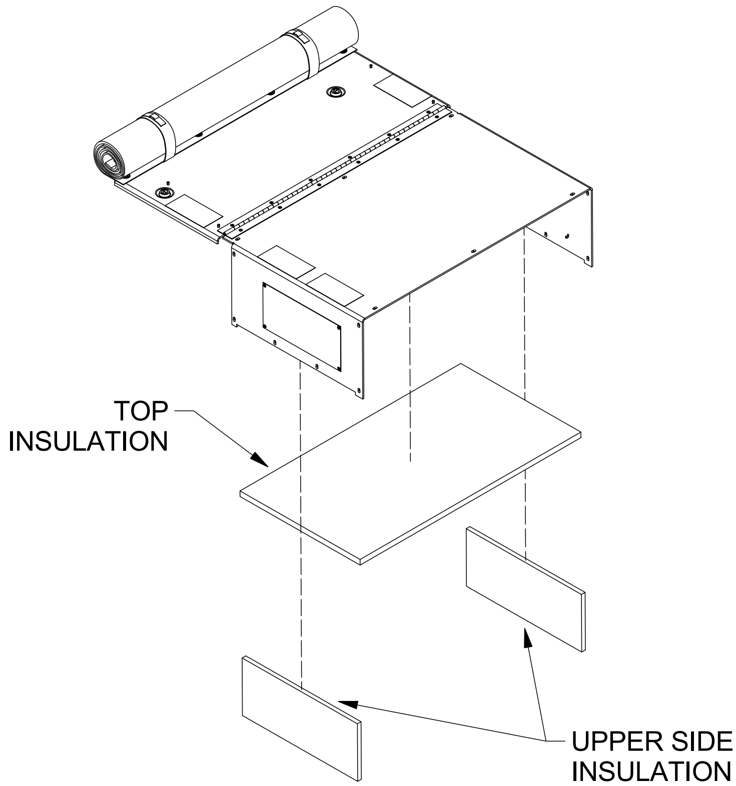
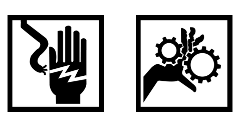



**Figure 1. Cover Insulation.**

**END OF TASK**

**REMOVE**

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Unfasten two quarter-turn rim latches (Figure 2, Item 3).

**REMOVE – CONTINUED**

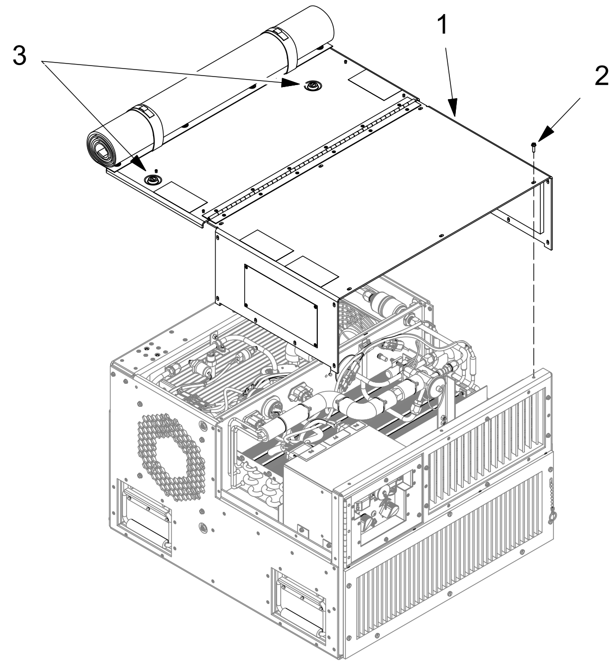



**Figure 2. Cover Assembly.**

2. Remove 18 hex-head screws (Figure 2, Item 2) from the cover assembly.
3. Fold condenser side of the cover (Figure 2, Item 1) on top of the evaporator side
4. Lift the cover assembly (Figure 2, Item 1) off the IECU housing.

**END OF TASK**

**REPAIR**

**Repair Sheet Metal**

1. Sand and paint any repaired area in housing (TM 43-0139).
2. Remove corrosion on the sheet metal by sanding it away. Paint the sanded area.
3. Repair areas where paint is damaged or worn away by first sanding the affected area to the bare aluminum. Then, repaint the sanded area.

**Replace Damaged Schematic Plate or Wiring Diagram Plate**

1. Remove all rivets securing schematic plate or wiring diagram plate to sheet metal assembly by drilling them out with an electric drill and drill bit no larger than 0.13" in diameter.
2. Position replacement schematic plate or wiring diagram plate on the sheet metal and insert new 1/8" aluminum rivets into each of the mounting holes.
3. Permanently install new rivets with hand-operated rivet gun.

## REPAIR – CONTINUED

### Replace Rim Latch

1. Remove jam nuts (Figure 3, item 4), lock washers (Figure 3, item 5), and cam (Figure 3, item 6) from latch housing (Figure 3, Item 1).

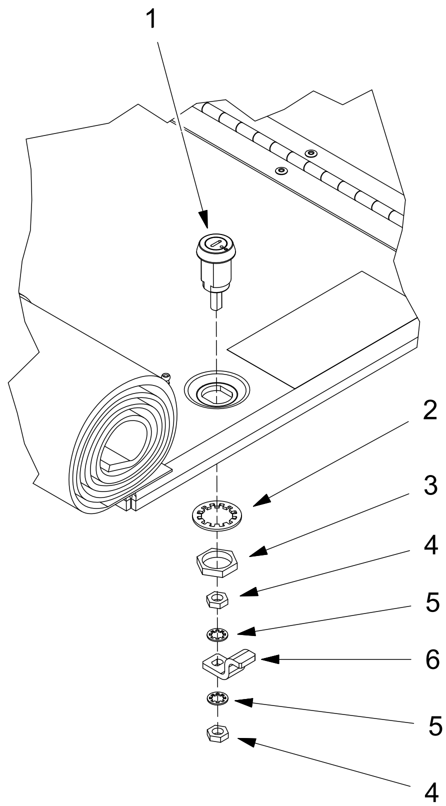



**Figure 3. Rim Latch.**

2. Remove mounting nut (Figure 3, item 3) and mounting lock washer (Figure 3, item 2) from latch housing (Figure 3, Item 1).
3. Remove latch housing (Figure 3, item 1) from cover assembly (Figure 2, Item 1).
4. Install latch housing (Figure 3, item 1) in cover assembly (Figure 2, Item 1).
5. Secure latch housing with mounting lock washer (Figure 3, item 2) and mounting nut (Figure 3, Item 3).
6. Install one jam nut (Figure 3, item 4), lock washer (Figure 3, item 5), and cam (Figure 3, item 6) on latch housing (Figure 3, Item 1).
7. Loosely install remaining jam nut (Figure 3, item 4) and lock washer (Figure 3, item 5).
8. Adjust for secure closure of the cover assembly by moving jam nuts up (to tighten cover assembly) or down (to loosen cover assembly).
9. Secure adjustment by tightening outer jam nut.

### Replace Condenser Cover Assembly

1. Untie two straps securing the condenser cover assembly in the rolled position.

## REPAIR – CONTINUED

2. Un-fasten six pull-the-dot tabs securing the condenser cover to the IECU.
3. Remove four nylon lock nuts securing the condenser cover assembly to the IECU.
4. Remove the old condenser cover assembly and position a replacement cover assembly in its place. Ensure that the pull-the-dot fasteners are oriented so that they mate with the studs on the IECU.
5. Install four nylon lock nuts to secure the condenser cover assembly to the IECU.

### Replace Strap Assembly

1. Remove condenser cover assembly (this work package).
2. Remove two strap assemblies from the IECU and place two replacement strap assemblies in their place.
3. Install condenser cover assembly (this work package).

### Replace Insulation

1. Instructions for replacing insulation are provided in (WP 0069).

**END OF TASK**

## REPLACE

1. Remove cover assembly (this work package).
2. Install replacement cover assembly onto IECU (this work package).

**END OF TASK**

## INSTALL

1. Begin with condenser side of cover (Figure 2, Item 1) folded over, on top of evaporator side.
2. Set evaporator side of cover assembly into place. Properly align the lid with the evaporator mounting brackets being careful not to tear insulating foam on the inside surface of the cover.
3. Unfold condenser side of cover (Figure 2, Item 1). It should lay flat onto the housing. If cover does not lay flat, ensure rim latches (Figure 2, Item 3) are in the open position.
4. Install 18 hex-head screws (Figure 2, Item 2) securing cover assembly.
5. Fasten two quarter-turn rim latches (Figure 2, Item 3).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## DATA PLATE – REPLACE

**INITIAL SETUP:**

**Tools and Special Tools**

Rivet Gun (SATS) (WP 0091, Table 2, Item 10)
Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement data plate (WP 0072, Item 23)
Rivets (WP 0072, Item 7)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

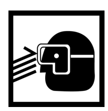
WP 0072
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

**REPLACE**

**WARNING**



Wear eye protection when drilling to protect eyes from flying debris. Failure to do say may result in serious eye injury.

1. Replace missing data plate rivets by permanently installing new 1/8-inch aluminum rivet in the existing hole with a hand-operated rivet gun.
2. Replace damaged data plates:
   a. Remove all rivets securing data plate to sheet metal assembly by drilling them out with an electric drill and drill bit no larger than 0.13-inch” in diameter.
   b. Position replacement data plate on the sheet metal and insert new 1/8-inch aluminum rivets into each of the mounting holes.
   c. Permanently install new rivets with rivet gun.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## HOUSING ASSEMBLY - REPAIR

### INITIAL SETUP:

**Tools and Special Tools**

Rivet Gun (SATS) (WP 0091, Table 2, Item 10)
Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Paint, green 383 (MIL-DTL-53039D) (WP 0094, Table 1, Item 8)
Paint brush (WP 0094, Table 1, Item 3)
Rivets (WP 0072, Item 7)
Rivets (WP 0072, Item 22)
Rivets (WP 0072, Item 30)
Replacement fresh air keyway (WP 0072, Item 27)
Replacement handle (WP 0072, Item 21)
Sandpaper, 240 grit (WP 0094, Table 1, Item 11)
Insulation (WP 0072, Item 19)
Insulation (WP 0072, Item 25)
Insulation (WP 0072, Item 31)
Insulation (WP 0072, Item 33)
Insulation (WP 0072, Item 38)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

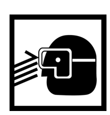
WP 0012
WP 0042
WP 0048
WP 0058
WP 0069
WP 0072
WP 0091
WP 0094
TM 43-0139

**Equipment Condition**

IECU is shut down (WP 0005)

### REPAIR

**WARNING**



When drilling or using spray paint use safety glasses. Eye injury could occur.

**Repair Sheet Metal**

Sand and paint any repaired area in housing (TM 43-0139):

a. Remove corrosion on the sheet metal by sanding it away. Paint the sanded area.

b. Repair areas where paint is damaged or worn away by first sanding the affected area to the bare aluminum. Then, repaint the sanded area.

**Replace Damaged or Missing Insulation**

Instructions for replacing insulation are provided in WP 0069.

## REPAIR – CONTINUED

### Replace Handle

1. Remove control box assembly (WP 0042) to minimize risk of damage when drilling out rivets.
2. Locate the damaged handle (Figure 1, Item 2) and identify the five stainless steel rivets (Figure 1, Item 1) that must be removed to replace the handle. These rivets secure the handle pad to the handle recess.

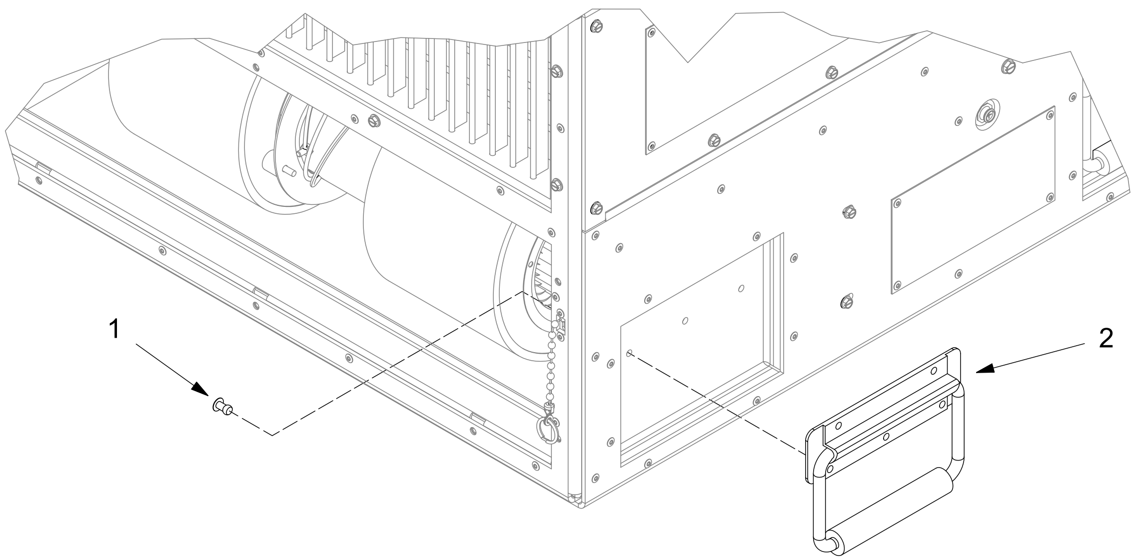



**Figure 1. Handle Rivets.**

**NOTE**

Use care when drilling out the stainless steel rivets not to widen or deform the rivet clearance holes. This will make it unsafe to install replacement handles.

3. Drill out each of the five stainless steel rivets. Be careful not to push the drill through the wall of the handle recess into the IECU interior. This could cause damage to other components.

**NOTE**

If the rivet clearance holes have been widened or deformed during the drilling process DO NOT PROCEED. It is unsafe to install replacement handles with rivets in widened or deformed clearance holes.

4. Remove any debris from the drilling process to clear the rivet holes.
5. Remove damaged handle.
6. Position replacement handle so that all five holes on the handle pad line up with the holes on the handle box.

**REPAIR – CONTINUED**

**NOTE**

The rivets used to install the replacement handle must be stainless steel, 3/16-inch diameter, closed-end with a 1/4-inch to 3/16-inch grip length. SUBSTITUTIONS ARE NOT ACCEPTABLE.

7. Ensuring domed rivet head is inside the unit (Figure 1, Item 1), permanently install five new rivets to secure the replacement handle to the handle box.
8. Install the control box (WP 0042).

**Replace Fresh Air Keyway**

1. Remove evaporator blower assembly (WP 0058).
2. Drill two rivets (Figure 2, Item 1) that secure fresh air keyway (Figure 2, Item 2) onto housing with 0.13-inch or smaller drill bit.

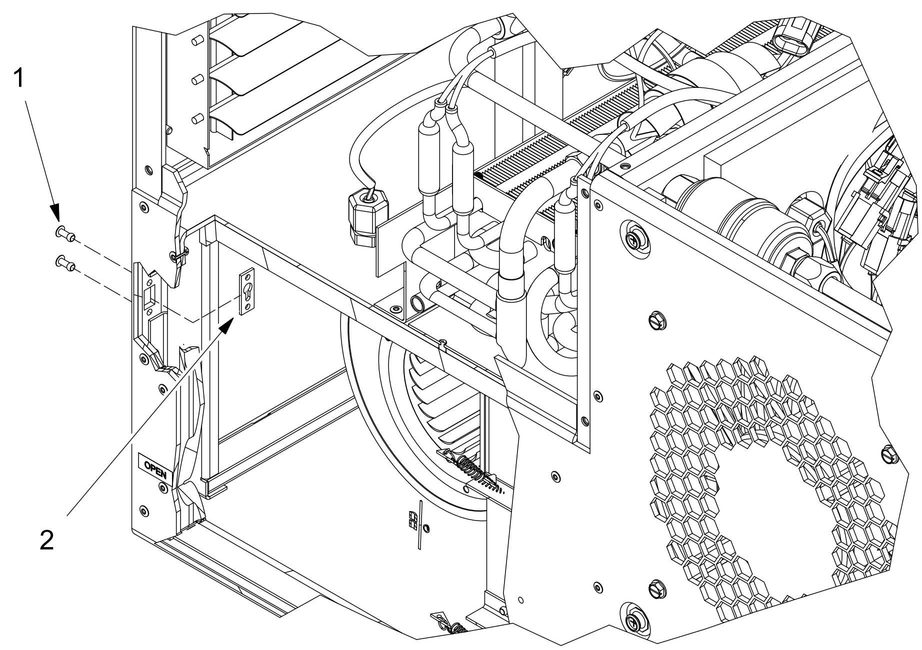



**Figure 2. Fresh Air Keyway.**

3. Remove fresh air keyway (Figure 2, Item 2) from sheet metal.
4. Position replacement fresh air keyway (Figure 2, Item 2) behind rivet holes, making sure that the keyway slot is pointing downward.
5. Insert new 1/8-inch aluminum rivets (Figure 2, Item 1) into mounting hole, and permanently install rivets.
6. Install evaporator blower assembly (WP 0058).

**Replace Weld Nut Plate**

1. Locate the damaged weld nut plate assembly (Figure 3, Item 2) on the underside of the IECU.

**REPAIR – CONTINUED**

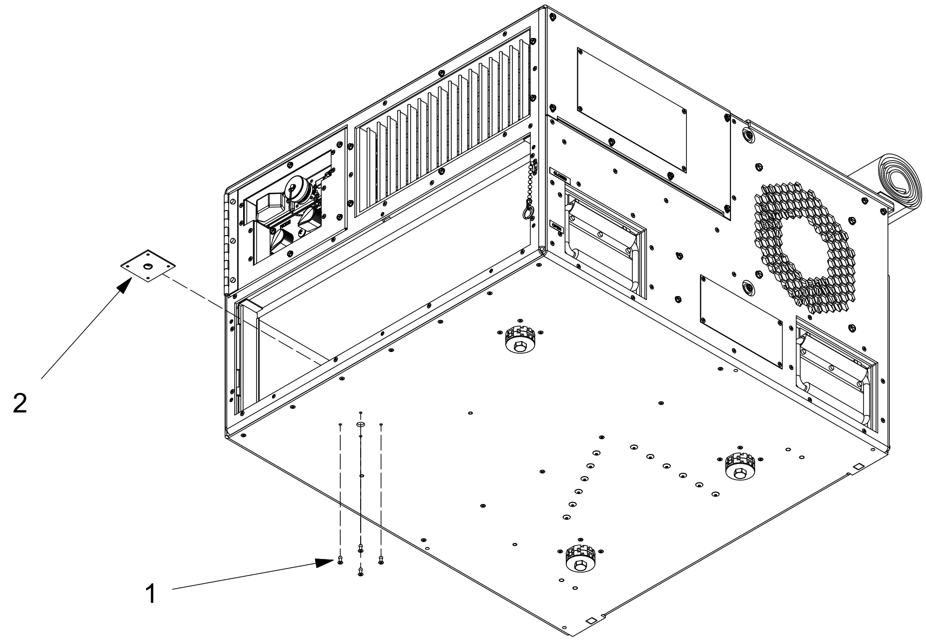



**Figure 3. Weld Nut Plates From Bottom.**

2. Unlock two quarter-turn latches on cover assembly and open, remove inlet air filter (WP 0012), or remove fresh air screen (WP 0048) to gain access to the damaged weld nut plate.
3. Cut back insulation.
4. Drill four rivets (Figure 3, Item 1) that secure weld nut plate onto housing with 0.13 inch or smaller drill bit.

**REPAIR – CONTINUED**

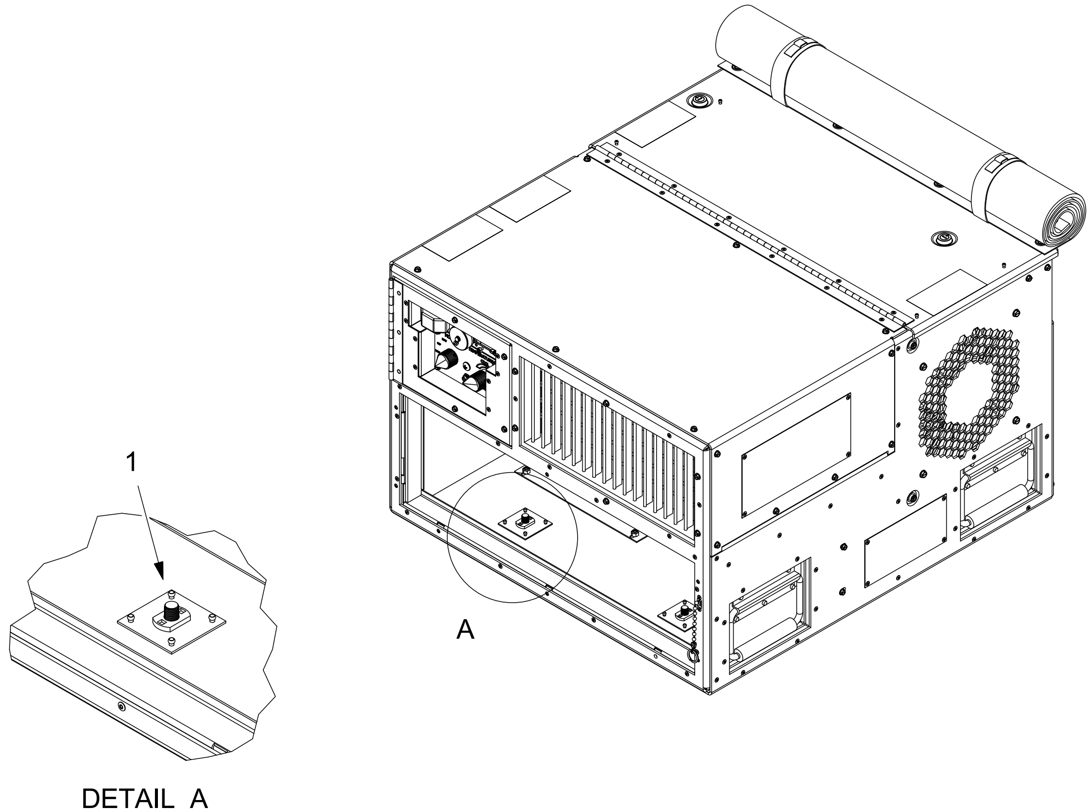



**Figure 4. Weld Nut Plate.**

5. Remove weld nut plate (Figure 4, Item 1) from sheet metal.
6. Position replacement weld nut plate (Figure 4, Item 1) behind rivet holes, making sure that the weld nut in center is positioned behind clearance hole.
7. Insert four new 1/8-inch aluminum rivets into mounting hole, and permanently install rivets with hand-operated rivet gun.
8. Replace insulation (this work package).
9. Install removed components or close the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## BRIDGE PLATE ASSEMBLY – REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement bridge plate assembly (WP 0072, Item 35)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0072
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### REMOVE

1. Remove four locking set screws on bridge plate (Figure 1, Item 11).
2. Remove eight hex-head screws (Figure 1, Item 18) from bridge plate.
3. Remove four hex-head screws (Figure 1, Item 19) from bridge plate.
4. Remove two hex-head screws (Figure 1, Item 2) from bracket (Figure 1, Item 3) securing condenser outlet tube.

**NOTE**

Loosen nuts, screws, and loop clamp (Figure 1, Item 5, 6, 7, and 10) as required.

5. Remove lock nut (Figure 1, Item 8) securing line tube clamp bracket (Figure 1, Item 9) to bridge plate.

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

6. Disconnect electrical connectors P25, from momentary switch assembly (S1) (Figure 1, Item 12), and J9, from power cable (W32) (Figure 1, Item 15).
7. Remove lock nut and washer that secures ground strap (Figure 1, Item 13) to IECU.
8. Lift and remove bridge plate assembly (Figure 1, Item 1) from the condenser.

## REMOVE – CONTINUED

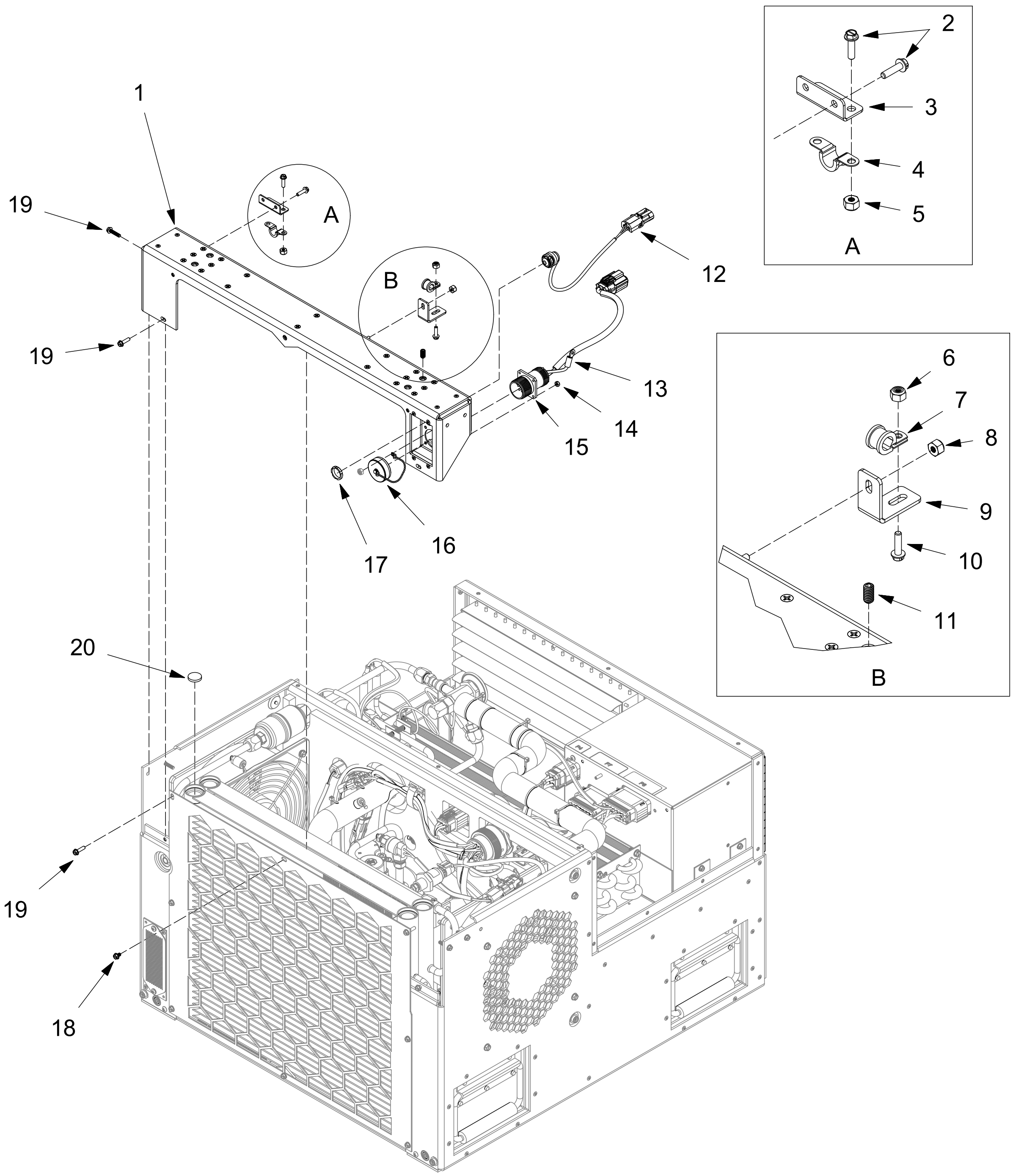



**Figure 1. Bridge Plate Assembly.**

**END OF TASK**

**REPLACE**

1. Remove bridge plate (this work package).
2. Remove dust cap (Figure 1, Item 16) from power connector J9 (Figure 1, Item 15) on cable W32 and remove lock nut securing cap.
3. Remove four lock nuts (Figure 1, Item 14) securing power connector J9 (Figure 1, Item 15) of cable W32. Slide connector out of bridge plate and remove cable.
4. Remove lock nut (Figure 1, Item 17) from the momentary switch assembly (S1) (Figure 1, Item 12) and slide switch out of bridge plate.
5. Remove the momentary switch assembly (S1) (Figure 1, Item 12) from the bridge plate.
6. Install momentary switch assembly (S1) (Figure 1, Item 12) onto replacement bridge plate using lock nut (Figure 1, Item 17).
7. Install power connector J9 (Figure 1, Item 15) of cable W32 onto replacement bridge plate (Figure 1, Item 1) by sliding connector into clearance hole, making sure that the four mounting holes on the connector are positioned on the four threaded mounting studs on the bridge plate. Tighten four lock nuts onto mounting studs.
8. Install dust cap (Figure 1, Item 16) onto replacement bridge plate using lock nut and cap the power connector.
9. Install replacement bridge plate (this work package).
10. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**INSTALL**

1. Install ground strap (Figure 1, Item 13).
2. Verify bushings (Figure 1, Item 20) are installed.
3. Position bridge plate assembly (Figure 1, Item 1) onto housing, making sure that face of bridge plate is flush with housing condenser face.
4. Install two hex-head screws (Figure 1, Item 2) to bracket securing condenser outlet tube.

**NOTE**

Tighten nuts, screws, and loop clamp (Figure 1, Item 5, 6, 7, and 10) as required.

5. Install lock nut (Figure 1, Item 2) securing line tube clamp bracket (Figure 1, Item 4) to bridge plate.
6. Install eight hex-head screws (Figure 1, Item 18) onto bridge plate.
7. Install four hex-head screws (Figure 1, Item 19) to bridge plate.
8. Connect electrical connectors from momentary switch assembly (S1) (Figure 1, Item 12) and power connector J9 (Figure 1, Item 15) of cable (W32).
9. Tighten four locking set screws (Figure 1, Item 11) on bridge plate:
   a. Turn each screw until it makes contact with the condenser bushing (Figure 1, Item 20).

**INSTALL – CONTINUED**

b. Turn each screw an additional quarter-turn.

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## CONDENSER GRILLE – REPLACE

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)
Standard Automotive Tool Set (SATS) (WP 0091, Table 2, Item 13)

**Materials/Parts**

Replacement condenser grille (WP 0072, Item 40)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0072
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

### REPLACE

1. Remove six long screws (Figure 1, Item 3) and two short center screws (Figure 1, Item 2) that secure the condenser grille (Figure 1, Item 1) to the base sheet metal assembly.

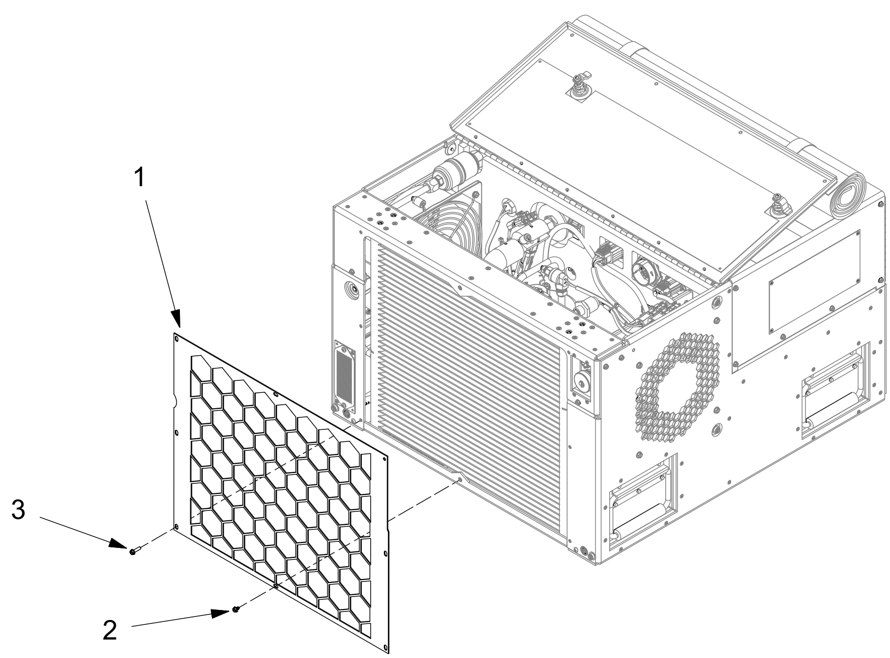



**Figure 1. Condenser Grille Removed.**

2. Remove condenser grille (Figure 1, Item 1).

## REPLACE – CONTINUED

3. Position replacement condenser grille (Figure 1, Item 1) onto the base sheet metal assembly.
4. Install six long screws (Figure 1, Item 3) and two short center screws (Figure 1, Item 2) that secure the replacement condenser grille (Figure 1, Item 1) to the base sheet metal assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## SOFT START BOX ASSEMBLY - TEST, REMOVE, REPAIR, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)
Standard Automotive Tool Set (SATS) (WP 0091, Table 2, Item 13)

**Materials/Parts**

Replacement soft start box (WP 0073, Item 3)
Replacement capacitor (C1) (WP 0073, Item 18)
Replacement relay (K2, K3) (WP 0073, Item 11)
Replacement soft start (U3) (WP 0073, Item 14)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0038
WP 0058
WP 0064
WP 0073
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Evaporator blower assembly is removed (WP 0058)
Cover assembly is open

### TEST

**WARNING**

High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**WARNING**

Capacitors store electrical energy. After disconnecting power, wait five minutes for capacitors to discharge before touching any electrical components. Failure to comply may result in severe personal injury or death by electrocution.

**NOTE**

Tag all wires before removing to identify their location. This will aid in ensuring the wires are reconnected to the proper terminal.

1. Remove the soft start box assembly (Figure 1, Item 1) (this work package).
2. Remove 11 screws (Figure 1, Item 3) securing soft start box assembly cover (Figure 1, Item 2).

**TEST – CONTINUED**

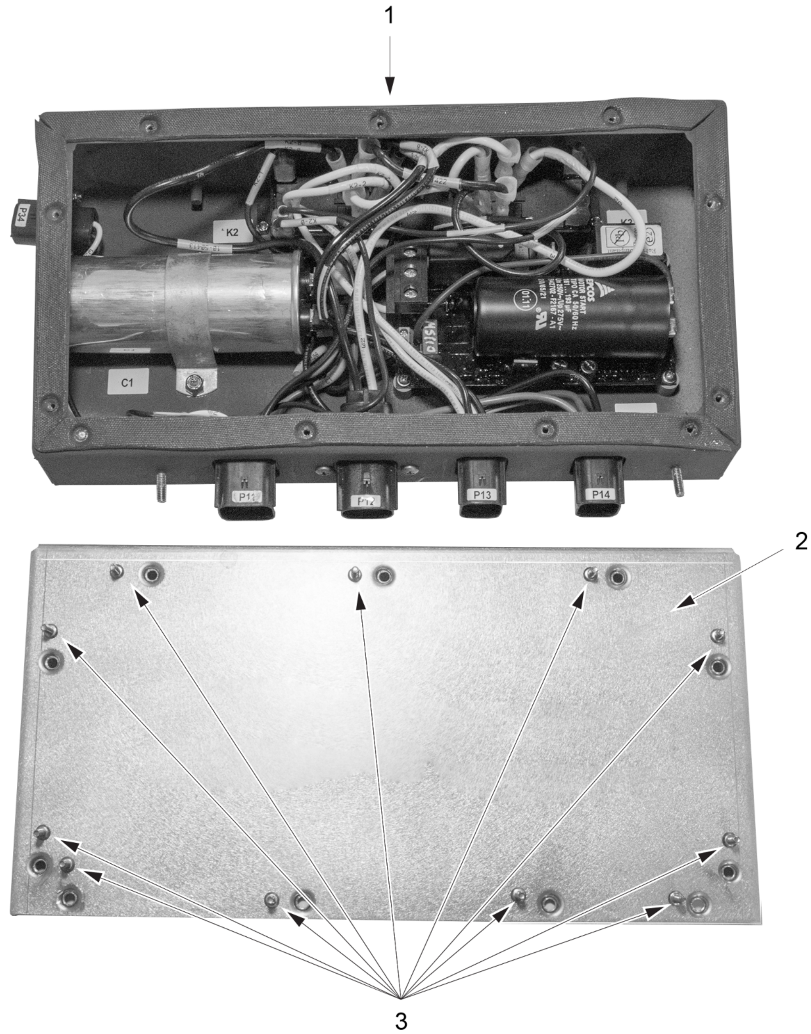



**Figure 1. Soft Start Box Cover.**

3. Replace any visually damaged wires or components in the soft start box assembly (WP 0038).
4. Reconnect any loose wires or replace if necessary.
5. Verify continuity between pin 1 of connector P11 and pin 1 of connector P34. If no continuity is indicated, replace wiring harness W44 (WP 0038) (refer to WP 0064 for pin locations).
6. Verify continuity between pin 2 of connector P11 and pin 2 of connector P34. If no continuity is indicated, replace wiring harness W44 (WP 0038) (refer to WP 0064 for pin locations).
7. Disconnect run capacitor (C1) (Figure 2, Item 1) from wiring harness W41 and wires W46, W36, and W37.
8. Using a multimeter, measure the capacitance. If greater than 44 MFD or less than 36 MFD replace the run capacitor (C1) (Figure 2, Item 1) (this work package).

**TEST – CONTINUED**

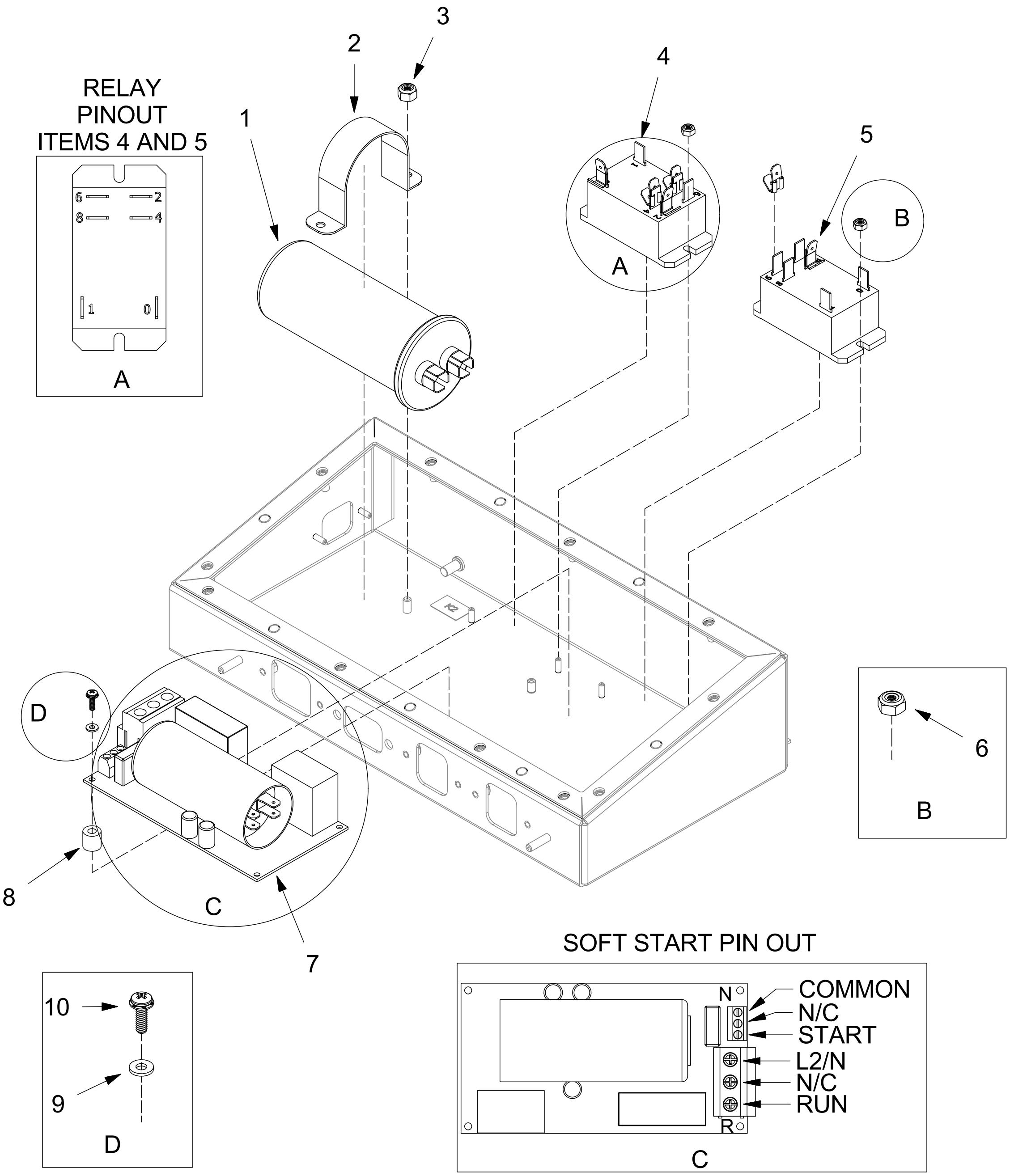



**Figure 2. Soft Start Box Assembly Components.**

**TEST – CONTINUED**

9. Reconnect the run capacitor (C1) (Figure 2, Item 1) to wiring harness W41 and wire W37 using one of the two terminals on the run capacitor (C1).
10. Reconnect wires W46 and W36 to the remaining terminal on the run capacitor (Figure 2, Item 1).
11. Measure the resistance of the coil of heater relay K2 (Figure 2, Item 4) from the exterior of the soft start box assembly by measuring the resistance between pin 4 and pin 5 of connector P11: (refer to WP 0064 for pin locations)
    a. If the measured resistance is between 77.4Ω and 94.6Ω continue to Step 15.
    b. If the measured resistance is less than 77.4Ω or greater than 94.6Ω continue to Step 12.
12. Disconnect the coil of heater relay K2 (Figure 2, Item 4) from the circuit by removing the receptacle connectors from terminal 0 and terminal 1 on relay K2 (Figure 2).
13. Measure the resistance across the coil:
    a. If the measured resistance is less than 77.4Ω or greater than 94.6Ω, replace the relay K2 (Figure 2, Item 4) (this work package).
    b. If the measured resistance is between 77.4Ω and 94.6Ω, replace wiring harness W44 (WP 0038).
14. Reinstall the receptacle connectors to terminal 0 and terminal 1 on relay K2 (Figure 2, Item 4).
15. Measure the resistance of the coil of compressor relay K3 (Figure 2, Item 5) from the exterior of the soft start box assembly by measuring the resistance between pin 4 and pin 6 of connector P11: (refer to WP 0064 for pin locations)
    a. If the measured resistance is between 77.4Ω and 94.6Ω continue to Step 21.
    b. If the measured resistance is less than 77.4Ω or greater than 94.6Ω continue to Step 16.
16. Disconnect the coil of compressor relay K3 (Figure 2, Item 5) from the circuit by removing the receptacle connectors from terminal 1 on relay K3 and terminal 0 on relay K2 (Figure 2, Item 4).
17. Measure the resistance between terminal 0 on relay K2 (Figure 2, Item 4) and terminal 1 on relay K3 (Figure 2, Item 5):
    a. If the measured resistance is between 77.4Ω and 94.6Ω, replace wiring harness W44 (WP 0038).
    b. If the measured resistance is less than 77.4Ω or greater than 94.6Ω, continue to Step 18.
18. Remove the receptacle connector from terminal 0 on relay K3 (Figure 2, Item 5).
19. Measure the resistance between terminal 0 and 1 on relay K3 (Figure 2, Item 5):
    a. If the measured resistance is less than 77.4Ω or greater than 94.6Ω, replace the relay K3 (this work package).
    b. If the measured resistance is between 77.4Ω and 94.6Ω, replace wire W53. (WP 0038).
20. Reinstall the receptacle connectors to terminal 0 and terminal 1 on relay K3 (Figure 2, Item 5).

**NOTE**

The following tests of power connections to and from heater relay K2 are only to be performed if the heater function of the soft start box assembly is not operating properly.

21. Test the wiring supplying power to heater relay K2 (Figure 2, Item 4):
    a. Check for continuity between pin 1 of connector P12 (WP 0064) and terminal 8 of relay K2 (Figure 2, Item 4) (this test can be performed with relay K2 (Figure 2, Item 4) connected in the circuit). If no continuity is indicated, replace wire harness W43 (WP 0038).
    b. Check for continuity between pin 2 of connector P12 (WP 0064) and terminal 4 of relay K2 (Figure 2, Item 4) (this test can be performed with relay K2 (Figure 2, Item 4) connected in the circuit). If no continuity is indicated, replace wire harness W43 (WP 0038).

## TEST – CONTINUED

22. Test the wiring supplying power from heater relay K2 (Figure 2, Item 4):
    a. Check for continuity between pin 1 of connector P13 (WP 0064) and terminal 6 of relay K2 (Figure 2, Item 4) (this test can be performed with relay K2 (Figure 2, Item 4) connected in the circuit). If no continuity is indicated, replace wire harness W42 (WP 0038).
    b. Check for continuity between pin 2 of connector P13 (WP 0064) and terminal 6 of relay K2 (Figure 2, Item 4) (this test can be performed with relay K2 (Figure 2, Item 4) connected in the circuit). If no continuity is indicated, replace wire harness W42 (WP 0038).
    c. Check for continuity between pin 3 of connector P13 (WP 0064) and terminal 2 of relay K2 (Figure 2, Item 4) (this test can be performed with relay K2 (Figure 2, Item 4) connected in the circuit). If no continuity is indicated, replace wire harness W42 (WP 0038).
    d. Check for continuity between pin 4 of connector P13 (WP 0064) and terminal 2 of relay K2 (Figure 2, Item 4) (this test can be performed with relay K2 (Figure 2, Item 4) connected in the circuit). If no continuity is indicated, replace wire harness W42 (WP 0038).

**NOTE**

The following tests of power connections to and from compressor relay K3 are only to be performed if the compressor starting function of the soft start box assembly is not operating properly.

23. Test the wiring supplying power to compressor relay K3 (Figure 2, Item 5):
    a. Check for continuity between pin 1 of connector P12 (WP 0064) and terminal 8 of relay K3 (Figure 2, Item 5) (this test can be performed with relay K3 (Figure 2, Item 5) connected in the circuit). If no continuity is indicated, replace wire harness W43 (WP 0038).
    b. Check for continuity between pin 2 of connector P12 (WP 0064) and terminal 4 of relay K3 (Figure 2, Item 5) (this test can be performed with relay K3 (Figure 2, Item 5) connected in the circuit). If no continuity is indicated, replace wire harness W43 (WP 0038).
24. Test the wiring supplying power from the compressor relay K3 (Figure 2, Item 5) to the soft start control board (U3) (Figure 2, Item 7):
    a. Check for continuity between the N terminal of the soft start control board (U3) (Figure 2, Item 7) with terminal 6 of relay K3 (Figure 2, Item 5). Continuity is to be verified on wire W38 for this test. If no continuity is indicated, replace wire W38 (WP 0038).
    b. Check for continuity between pin 2 of connector P14 (WP 0064) and terminal 6 of relay K3 (Figure 2, Item 5) (this test can be performed with relay K3 (Figure 2, Item 5) connected in the circuit). If no continuity is indicated, replace wire harness W41 (WP 0038).
    c. Check for continuity between the R terminal of the soft start control board (U3) (Figure 2, Item 7) and capacitor (C1) (Figure 2, Item 1) terminal with the white wire W36 connected. Continuity is to be verified on wire W36 for this test. If no continuity is indicated, replace wire W36 (WP 0038).
    d. Check for continuity between the R terminal of the soft start control board (U3) (Figure 2, Item 7) with terminal 2 of relay K3 (Figure 2, Item 5). Continuity is to be verified on wire W46 for this test. If no continuity is indicated, replace wire W46 (WP 0038).
    e. Check for continuity between pin 1 of connector P14 (WP 0064) and the R terminal of the soft start control board (U3) (Figure 2, Item 7). If no continuity is indicated, replace wire harness W41 (WP 0038).
    f. Check for continuity between the N terminal of the soft start control board (Figure 2, Item 7) and the capacitor (C1) (Figure 2, Item 1) terminal with the white wire W37 connected. Continuity is to be verified on wire W37 for this test. If no continuity is indicated, replace wire W37 (WP 0038).

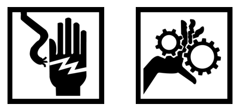
**TEST – CONTINUED**

g. Check for continuity between pin 3 of connector P14 (WP 0064) and the N terminal of the soft start control board (U3) (Figure 2, Item 7). If no continuity is indicated, replace wire harness W41 (WP 0038).

**END OF TASK**

**REMOVE**

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**NOTE**

Lock nuts must be accessed from the condenser side of the IECU bulkhead.

1. Remove two lock nuts securing the soft start box assembly to the bulkhead wall (Figure 3, Item 1). The outboard stud will have a ground wire mounted to it that will also be removed.

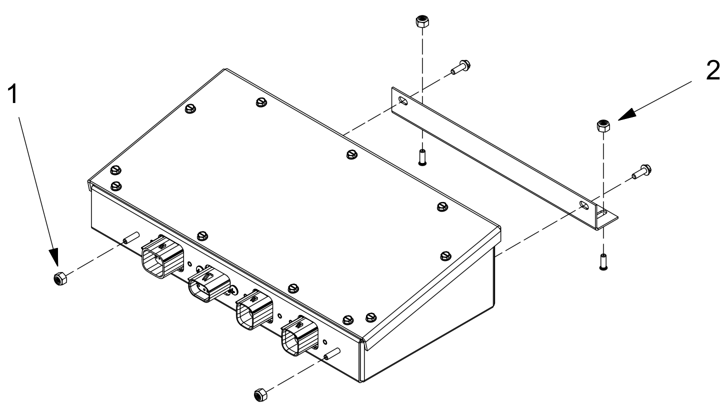



**Figure 3. Soft Start Box Bracket Mounting Hardware.**

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2. Remove two lock nuts (Figure 3, Item 2) securing the soft start box bracket to the floor of the sheet metal housing.

**NOTE**

Connectors must be accessed from the condenser side of the IECU bulkhead.

3. Disconnect connectors J11, J12, J13, and J14 from the soft start box assembly (Figure 4).

**REMOVE – CONTINUED**

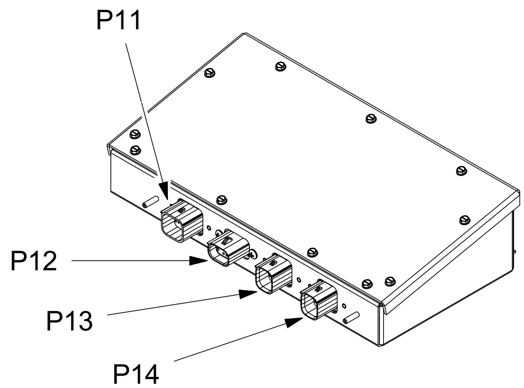



**Figure 4. Soft Start Connectors.**

4. Remove the soft start box assembly (Figure 5, Item 1) through the evaporator side air inlet.

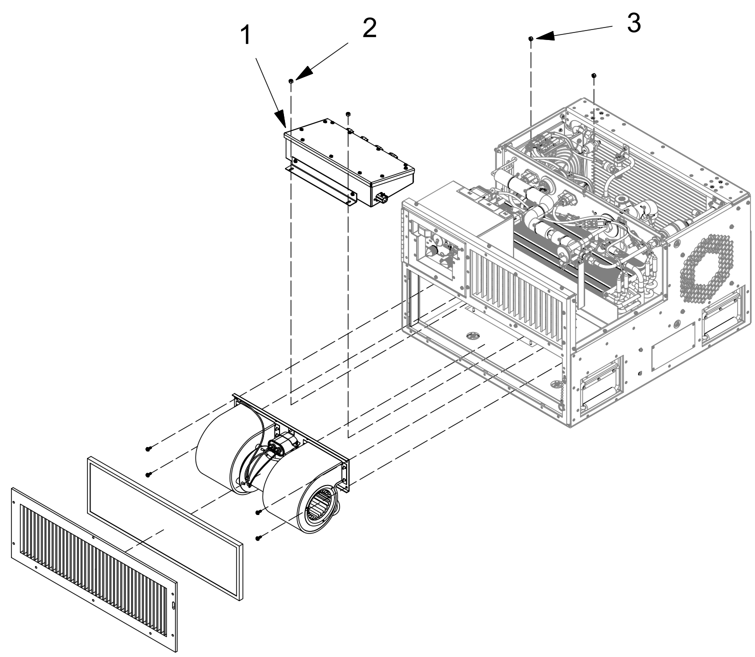



**Figure 5. Soft Start Box Removal and Installation.**

**END OF TASK**

## REPAIR

### Replace Power Factor Correction Capacitor (C1)

**WARNING**

- Ensure the power source is disconnected. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove the soft start box assembly from the IECU (this work package).
2. Remove 11 screws (Figure 1, Item 3) from the soft start box cover to remove the cover (Figure 1, Item 2).
3. Remove two nylon lock nuts (Figure 2, Item 3) from the D-clamp (Figure 2, Item 2) securing the power factor correction capacitor C1 (Figure 2, Item 1) and remove the D-clamp (Figure 2, Item 2).
4. Tag and remove the four 90 degree quick disconnect fittings from the capacitor terminals (W36 and W46, and W37 and W41).
5. Remove the old capacitor and position replacement capacitor in its place.
6. Connect wires W46 and W36 to one of the two terminal banks on the capacitor C1 (Figure 2, Item 1).
7. Connect wire W37 and the orange wire on harness W41 to the opposite terminal bank on capacitor C1 (Figure 2, Item 1).
8. Place the D-clamp (Figure 2, Item 2) over the capacitor C1 (Figure 2, Item 1) and secure it to the soft start box assembly with two nylon lock nuts (Figure 2, Item 3).
9. Place the soft start box cover on the soft start box assembly.
10. Install 11 screws securing the cover to the box.
11. Install the soft start box assembly into the IECU (this work package).

### Replace 120 VAC Relay (K2)

1. Remove the soft start box assembly from the IECU (this work package).
2. Remove 11 screws (Figure 1, Item 3) from the soft start box cover to remove the cover (Figure 1, Item 2).
3. Remove all wires from terminals on relay K2 (Figure 2, Item 4) (W42, W43, W44, W49, W50, and W53).
4. Remove two lock nuts (Figure 2, Item 6) to release relay K2 (Figure 2, Item 4) from the soft start box assembly.

**REPAIR – CONTINUED**

5. Discard the relay and position new relay in its place.
6. Install two lock nuts (Figure 2, Item 6) securing relay K2 (Figure 2, Item 4) to the soft start box assembly box.
7. Connect white wire W49 to terminal 4 on relay K2 (Figure 2, Item 4).
8. Connect the two white wires on harness W42 to terminal 2 on relay K2 (Figure 2, Item 4).
9. Connect the blue wire from pin 5 on connector P11 (WP 0064) (harness W44) to terminal 1 on relay K2 (Figure 2, Item 4).
10. Connect the black wire on harness W43 and wire W50 to terminal 8 on relay K2 (Figure 2, Item 4).
11. Connect the two black wires on harness W42 to terminal 6 on relay K2 (Figure 2, Item 4).
12. Connect wire W53 and the blue wire from pin 4 on connector P11 (WP 0064) (harness W44) to terminal 0 on relay K2 (Figure 2, Item 4).
13. Connect the blue wire on terminal 0 on relay K3 (Figure 2, Item 5) to terminal 0 on relay K2 (Figure 2, Item 4).
14. Place the soft start box cover on the soft start box assembly.
15. Install 11 screws securing the cover to the box.
16. Install the soft start box assembly into the IECU (this work package).

**Replace 120 VAC Relay (K3)**

1. Remove the soft start box assembly from the IECU (this work package).
2. Remove 11 screws (Figure 1, Item 3) from the soft start box cover to remove the cover (Figure 1, Item 2).
3. Remove all wires from terminals on relay K3 (Figure 2, Item 5) (W38, W41, W43, W44, W46, W49, and W53).
4. Remove two lock nuts (Figure 2, Item 6) to release relay K3 (Figure 2, Item 5) from the soft start box assembly box.
5. Discard the relay and position new relay in its place.
6. Install two nylon lock nuts (Figure 2, Item 6) securing relay K3 (Figure 2, Item 5) to the soft start box assembly box.
7. Connect the white wire from W43 and wire W49 to terminal 4 on relay K3 (Figure 2, Item 5).
8. Connect wires W46 to terminal 2 on relay K3 (Figure 2, Item 5).
9. Connect the blue wire from pin 6 on connector P11 (WP 0064) (harness W44) to pin 1 on relay K3 (Figure 2, Item 5).
10. Connect wire W50 to terminal 8 on relay K3 (Figure 2, Item 5).
11. Connect wire W38 and the black wire on harness W41 to terminal 6 on relay K3 (Figure 2, Item 5).
12. Connect wire W53 to terminal 0 on relay K3 (Figure 2, Item 5).
13. Connect the blue wire on terminal 0 on relay K2 to terminal 0 on relay K3 (Figure 2, Item 5).
14. Place the soft start box cover on the soft start box assembly.
15. Install 11 screws securing the cover to the box.
16. Install the soft start box assembly into the IECU (this work package).

**REPAIR – CONTINUED**

**Replace Soft Start (U3)**

## WARNING

- Ensure the power source is disconnected. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove the soft start box assembly from the IECU (this work package).
2. Remove 11 screws (Figure 1, Item 3) from the soft start box cover to remove the cover (Figure 1, Item 2).
3. Tag and remove four wires from soft start (U3) (Figure 2, Item 7) terminal blocks.
4. Remove four screws and washers (Figure 2, Item 9 and 10) securing the soft start (U3) (Figure 2, Item 7).
5. Position replacement soft start (U3) over standoffs (Figure 2, Item 8).
6. Install four screws and washers (Figure 2, Item 9 and 10) to secure the soft start (U3) (Figure 2, Item 7). Screws (Figure 2, Item 10) must pass through the standoffs (Figure 2, Item 8).
7. Install four wires to soft start (U3) (Figure 2, Item 7) terminal blocks.
8. Place the soft start box cover on the soft start box assembly.
9. Install 11 screws securing the cover to the box.
10. Install the soft start box assembly into the IECU (this work package).

**END OF TASK**

**REPLACE**

1. Remove soft start box assembly (this work package).
2. Install replacement soft start assembly (this work package).

**END OF TASK**

**INSTALL**

1. Position soft start box assembly into unit aligning back side connectors and locating studs with mating holes on IECU bulkhead wall (Figure 3, Item 1).
2. Connect two lock nuts (Figure 5, Item 2) securing the soft start box bracket to the floor of the sheet metal housing.

**INSTALL – CONTINUED**

## NOTE

Connectors must be accessed from the condenser side of the IECU bulkhead.

3. Connect connectors J11, J12, J13, and J14 to the soft start box assembly (Figure 4).

## NOTE

Lock nuts must be accessed from the condenser side of the IECU bulkhead.

4. Install two lock nuts (Figure 5, Item 3) securing the soft start box assembly to the bulkhead wall. Install the ground wire on the outboard side stud.
5. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

1. Install the evaporator blower assembly (WP 0058).
2. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## CABLE ASSEMBLIES - INSPECT, TEST, REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement cable assembly (W46) (WP 0073, Item 19)
Replacement cable assembly (W50) (WP 0073, Item 32)
Replacement cable assembly (W53) (WP 0073, Item 36)
Replacement cable assembly (W49) (WP 0073, Item 40)
Replacement cable assembly (W41) (WP 0073, Item 48)
Replacement cable assembly (W43) (WP 0073, Item 50)
Replacement cable assembly (W44) (WP 0073, Item 51)
Replacement cable assembly (W42) (WP 0073, Item 52)
Replacement cable assembly (W1) (WP 0073, Item 53)
Replacement cable assembly (W13) (WP 0073, Item 54)
Replacement cable assembly (W19) (WP 0073, Item 55)
Replacement cable assembly (W17) (WP 0073, Item 56)
Replacement cable assembly (W9) (WP 0073, Item 61)
Replacement cable assembly (W21) (WP 0073, Item 70)
Replacement cable assembly (W14) (WP 0073, Item 71)
Replacement cable assembly (W30) (WP 0074, Item 22)
Replacement cable assembly (W36) (WP 0073, Item 44)

**Materials/Parts - cont'd**

Replacement cable assembly (W37) (WP 0073, Item 24)
Replacement cable assembly (W38) (WP 0073, Item 28)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0064
WP 0068
WP 0073
WP 0074
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)

## INSPECT

### WARNING

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

Inspect wire harness and replace if necessary when:

1. Any conductor has been severed.
2. Any conductor has separated from a connector.
3. Abrasion resistant sheathing or heat shrink tubing is cracked, torn, burned or otherwise damaged.
4. Wire insulation is cracked, torn, burned, or otherwise damaged.
5. Connectors are cracked, wires are not inserted into connector properly, or connector is otherwise damaged.
6. Pins/sockets are damaged, bent, or missing.
7. Wire harness labeling is not legible.
8. Terminal lugs are burned, corroded, or unsecure.

**END OF TASK**

## TEST

1. Test wire harnesses terminated at non-connector components per procedure in their respective work packages.
2. For wire harnesses terminated with connectors on both ends:
   a. Test for continuity by using a multimeter set on resistance (ohm) measurement or continuity measurement and measure across two ends of wire and/or corresponding pins of connectors, or designated pins and wires as indicated in their respective work packages.

   ### CAUTION

   Do not bend the stripped ends in order to avoid the solid wire breaking off inside the connector.

   b. When measuring continuity or resistance, if the connector is female and inaccessible to probe tips, place a small length solid wire (22 AWG) stripped at both ends into the desired socket.
   c. Continuity can be identified when either the multimeter is set to continuity and makes an audible beep or when a resistance measurement is below 20 ohms.
   d. If continuity is not indicated, replace damaged wire harness (this work package).

**END OF TASK**

## REMOVE

Remove cable harness from unit by disconnecting all ends of connectors. Disconnection procedure for each connector type follows.

### Weather Pack Connector Disconnection

1. Lift up locking tab on male connector (Figure 1).

**NOTE**

Two-wire Weather Pack connector shown. Weather Pack connectors with other terminal arrangements are similar.

2. Pull connector apart.

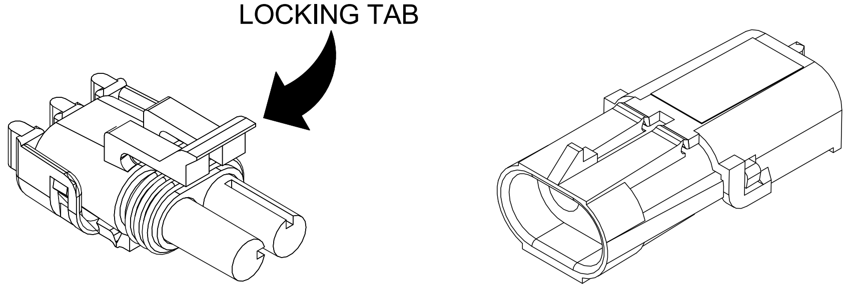



**Figure 1. Weather Pack Connector.**

### MIL-DTL-5015 Type Connector Disconnection

1. Remove four lock nuts (Figure 2).

**NOTE**

All MIL-DTL-5015 connectors internal to IECU are panel-mount style.

2. Slide connector out of sheet metal pass-through.

**REMOVE – CONTINUED**

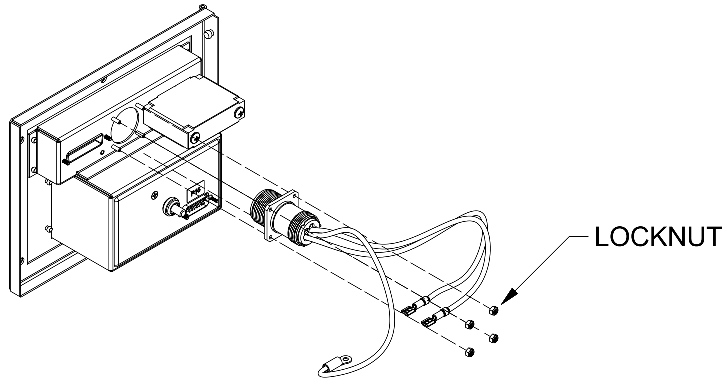



**Figure 2. MIL-DTC-5015 Type Connector.**

**Cable-Mount Molex Connector Disconnection**

1. Pull white sliding locking tab back towards the back of the connector (Figure 3).
2. Press down on the locking tab and then pull connector back (Figure 3).

**REMOVE – CONTINUED**

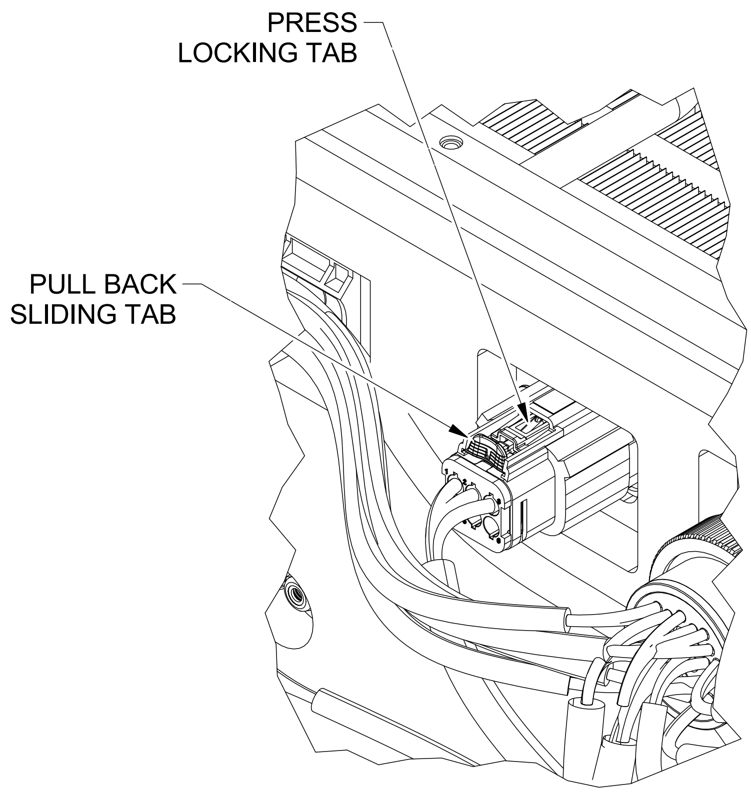



**Figure 3. Cable Mount Molex Connector.**

**Back Panel Mount Molex Connector Disconnection**

1. Remove cable-mount connector from panel mount connector using the procedure above.
2. Remove two lock nuts from panel mount connector mounting flange (Figure 4).
3. Slide connector out of sheet metal pass-through.

## REMOVE – CONTINUED

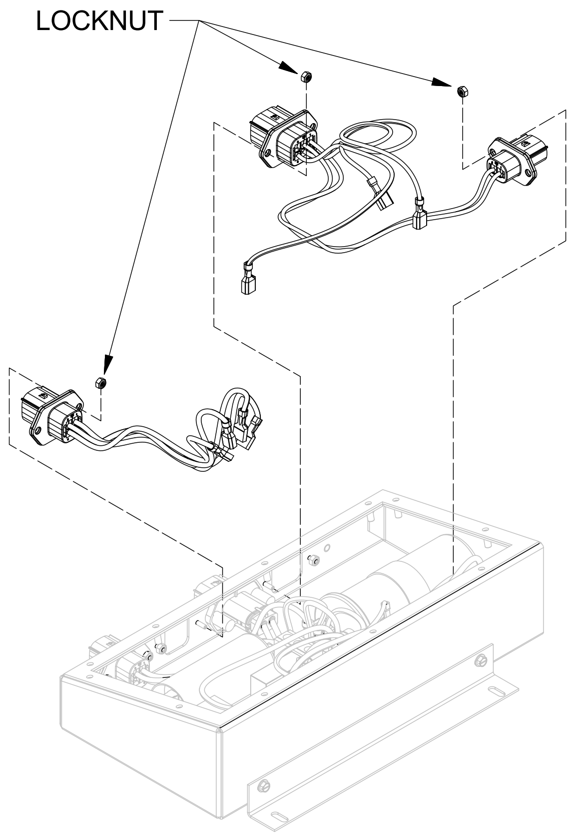



**Figure 4. Back Panel Mount Molex Connector.**

### Front Panel Mount Molex Connector Disconnection

1. Remove cable-mount connector from panel mount connector using the procedure above (this work package).
2. Remove two thread forming screws from panel mount connector mounting flange (Figure 5).

**REMOVE – CONTINUED**

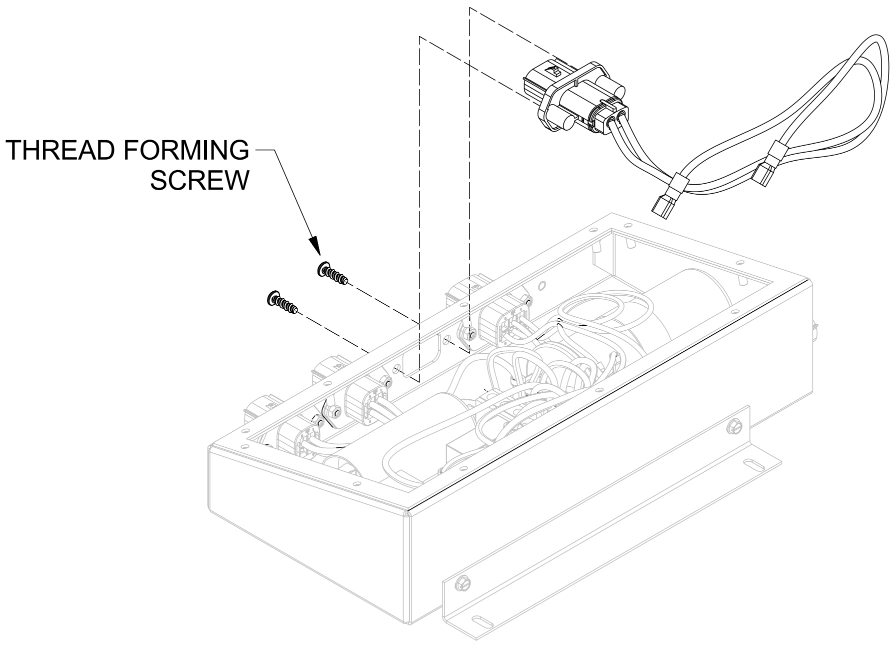



**Figure 5. Front Panel Mount Molex Connector.**

3. Slide connector out of sheet metal pass-through.

**Cable-Mount Deutsch Connector Disconnection**

1. Grasp and unthread connector's collar (Figure 6).

**REMOVE – CONTINUED**

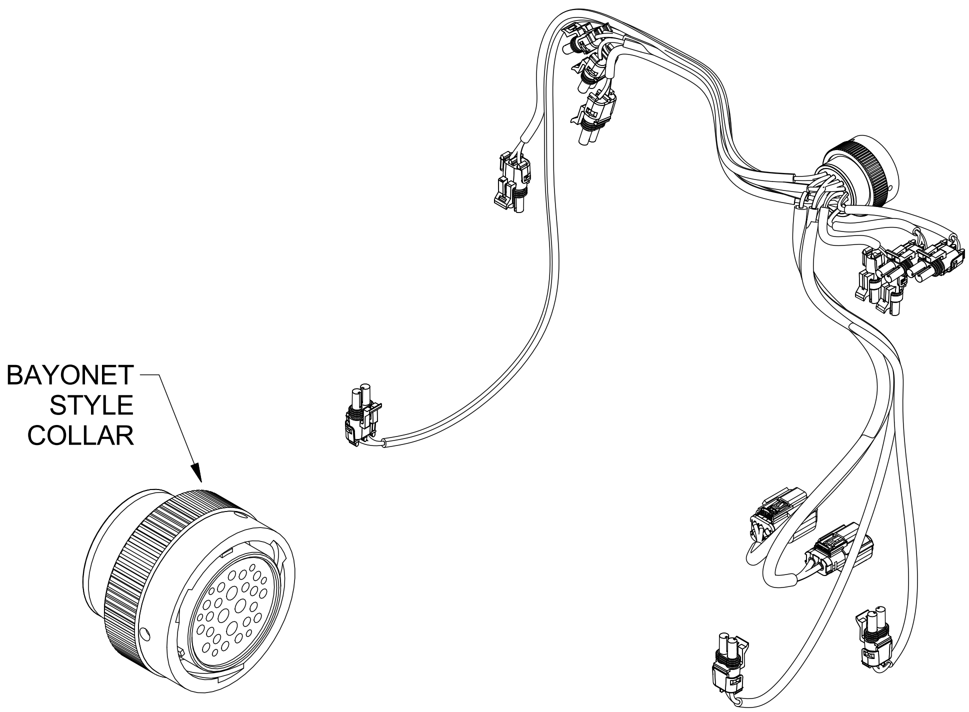



**Figure 6. Cable Mount Deutsch Connector.**

2. Pull apart.

**Panel Mount Deutsch Connector Disconnection**

**NOTE**

The 29-pin connector shown. Deutsch Type connectors with other pin arrangements are similar.

1. Remove cable-mount connector from panel mount connector using the procedure above (this work package).
2. Grasp jam nut and unthread from connector (Figure 7). Slide connector out of sheet metal pass-through.

**REMOVE – CONTINUED**

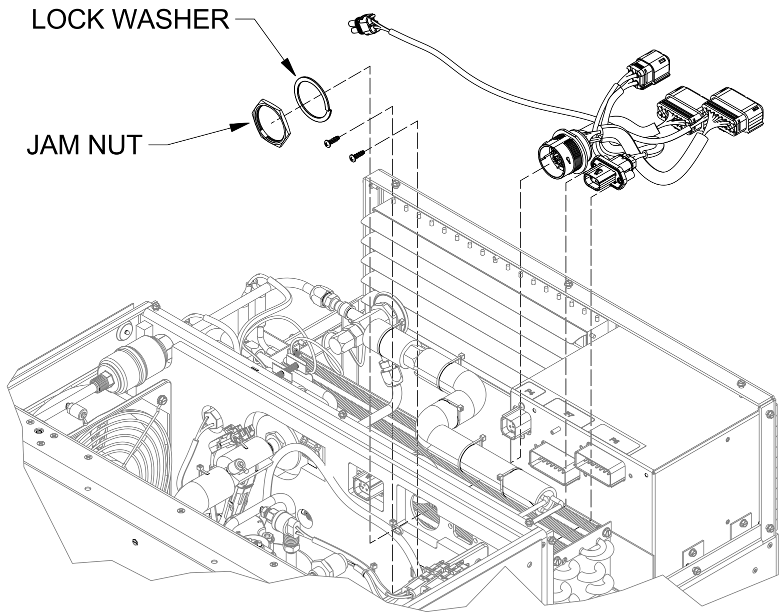



**Figure 7. Panel Mount Deutsch Connector.**

**Ground Lug Connector Disconnection**

**NOTE**

More than one ground lug may be secured to a single terminal stud.

1. Remove locking nut securing ground lug to threaded terminal stud (Figure 9).

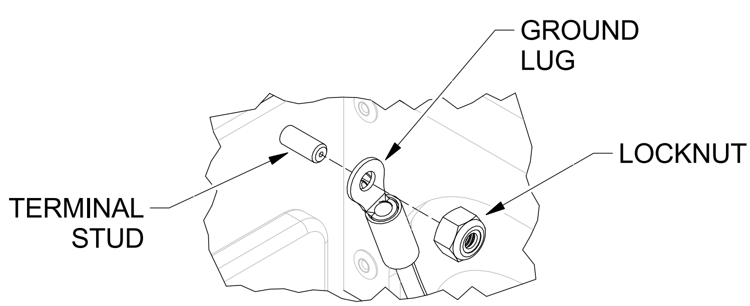



**Figure 8. Ground Lug.**

**END OF TASK**

## REPLACE

1. Follow connection instructions for each connector (this work package). Be sure to match connectors based on the plug and receptacle label number (e.g. J28 mates to P28). Use a wiring diagram to check your work (FO-1 and FO-2).
2. Cable assemblies W28, W33, W34, W36, W37, W38, W46, W49, W50, W53, and W61 are locally fabricated. Refer to WP 0068 for fabrication instruction.
3. Remove the wiring harness (this work package).
4. To install the replacement wiring harness follow connection instructions for each connector (this work package).
5. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

## END OF TASK

## INSTALL

Install cable harness into unit by connecting all ends of connectors. Be sure to match connectors based on the plug and receptacle label number (e.g. J28 mates to P28). Use a wiring diagram to check your work. Connection procedure for each connector type follows (FO-1 and FO-2).

### Weather Pack Connector Connection

**CAUTION**

When replacing the evaporator side bulkhead cable (W17) be sure that J5 connector is connected to P6 and J6 connector is connected to P7. Improperly connecting these connectors will damage the IECU.

**NOTE**

Connectors are keyed and/or labeled to reduce likelihood of improper installation.

1. Connect Weather Pack connector (Figure 1).

**NOTE**

Two-wire Weather Pack connector shown. Weather Pack connectors with other terminal arrangements are similar.

2. Push connector together. An audible click is heard.

### MIL-DTL-5015 Type Connector Connection

1. Slide connector through sheet metal pass-through.

**NOTE**

All MIL-DTL-5015 connectors internal to IECU are panel-mount style.

2. Install four lock nuts (Figure 2).

### Free-Hanging Molex Connector Connection

1. Insert connector into panel mount connector (Figure 3). An audible click is heard.
2. Push white sliding locking clip towards panel mount connector.

## INSTALL – CONTINUED

### Back Panel Mount Molex Connector Connection

1. Slide connector into sheet metal pass-through.
2. Install cable mount Molex connector (Figure 3) into front panel mount connector (Figure 5) using the procedure above (this work package).
3. Install two lock nuts for back panel mount connector mounting flange (Figure 4).

### Front Panel Mount Molex Connector Connection

1. Slide connector into sheet metal pass-through.
2. Install two thread-forming screws into front panel mount connector mounting flange (Figure 5).
3. Install free-hanging connector from panel mount connector using the procedure above (this work package).

### Free-Hanging Deutsch Connector Connection

1. Grasp and thread connector's collar into panel mount connector (Figure 6).

### Panel Mount Deutsch Connector Connection

1. Slide connector into sheet metal pass-through. Grasp jam nut and thread onto connector (Figure 7).
2. Install cable-mount connector to panel mount connector using the procedure above (this work package).

### Faston Connector Connection

1. Push receptacle (female) into blade (male) (Figure 9).

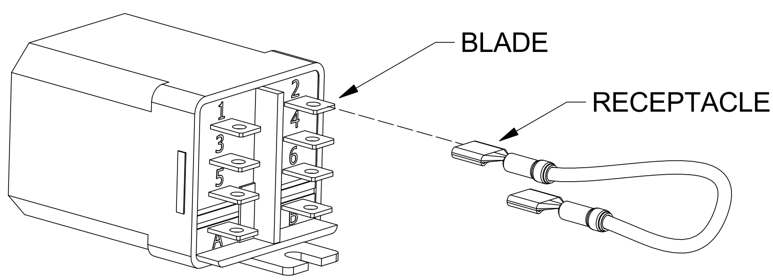



**Figure 9. Faston Connector (Typical Application).**

### Ground Lug Connector Connection

1. Install ring terminal onto ground stud (Figure 8).
2. Install lock nut securing ground lug to threaded terminal stud.

**END OF TASK**

## CONNECTOR-WIRE HARNESS ASSOCIATIONS

Table 1 provides a description of each cable assembly used in the 9K IECU. The center column lists the cable assemblies numerically by reference designator. The left column specifies the originating connector, GND, pin, or component. The right column specifies the destination connector(s), GND(s), and components(s). Pinouts for each connector are located in WP 0064. Routed views of each cable assembly are located in Figures 10 through 15.

**Table 1. Connector-Wire Harness Associations.**

| From | Cable Assembly | To |
|---|---|---|
| J8 | W1 | J11, J12, J24 – J29, J31 – J33, J38 |
| P3 | W9 | J9, GND-1 |
| J14 | W13 | B1-R, F1, B1-S |
| B1 | W14 | GND-6 |
| P8 | W17 | P9, J4, J6, J7, J23, J30 |
| J13 | W19 | J10 |
| P10 | W21 | J20, J21 |
| P4 | W27 | K1-1, K1-2, CB1-Load, K1-6 |
| P5 | W28 | K1-6, CB1-Load |
| J5 | W29 | K1-6, CB1-Load |
| J15 | W30 | J17 |
| J2 | W31 | J16 |
| P1 | W32 | K1-3, K1-4 |
| K1-5 | W33 | CB1-Line |
| K1-A | W34 | K1-3 |
| C1 | W36 | U3-L2/N |
| C1 | W37 | U3-Start |
| K3-6 | W38 | U3-Common |
| P15 | W40 | S4, R1, DS1, GND-4 |
| P14 | W41 | U3-Run, K3-6, C1 |
| P13 | W42 | K2-6, K2-2 |
| P12 | W43 | K2-8, K3-4 |
| P11 | W44 | P34, K2-0, K2-1, K3-1 |
| C1 | W46 | K3-2 |
| K2-4 | W49 | K3-4 |
| K2-8 | W50 | K3-8 |
| K2-0 | W53 | K3-0 |
| GND-2 Stud | W61 | GND-2 |

**END OF TASK**

**CABLE LOCATIONS**

The location of each replaceable cable in the 9K IECU is described in Table 2 and depicted in Figures 10 through 15.

**Table 2. IECU Cable Locations.**

| CABLE | NAME | LOCATION |
|---|---|---|
| W1 | Condenser Side Bulkhead Cable | Figure 10 |
| W9 | Rear Power Cable | Figure 11 |
| W13 | Compressor Power Cable | Figure 10 |
| W14 | Compressor Ground Cable | Figure 11 |
| W17 | Evaporator Side Bulkhead Cable | Figure 11 |
| W19 | Relay to Heat Power cable | Figure 10 |
| W21 | Heat Power Cable | Figure 11 |
| W27 | Control Box Rear Power Cable | Figure 12 |
| W30 | Control Module Cable | Figure 13 |
| W31 | Diagnostics Cable | Figure 13 |
| W32 | Front Power Cable | Figure 13 |
| W41 | Soft Start Power-Out Cable | Figure 14 |
| W42 | Soft Start Heater Power Cable | Figure 15 |
| W43 | Soft Start Box Power-In Cable | Figure 14 |
| W44 | Relay Control and Fan Power Cable | Figure 15 |

**CABLE LOCATIONS – CONTINUED**

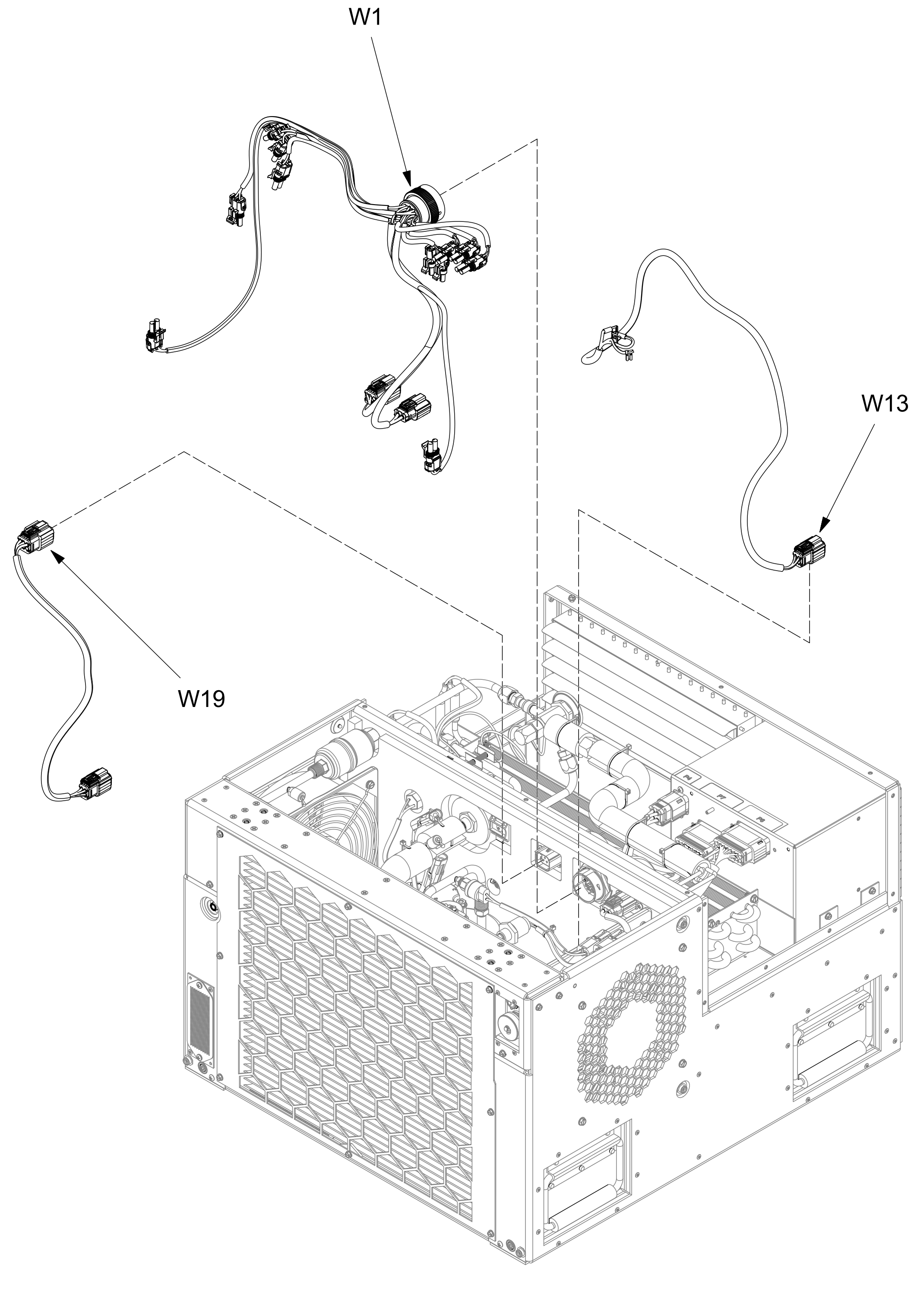



**Figure 10. W1, W13, and W19 Locations.**

## CABLE LOCATIONS – CONTINUED

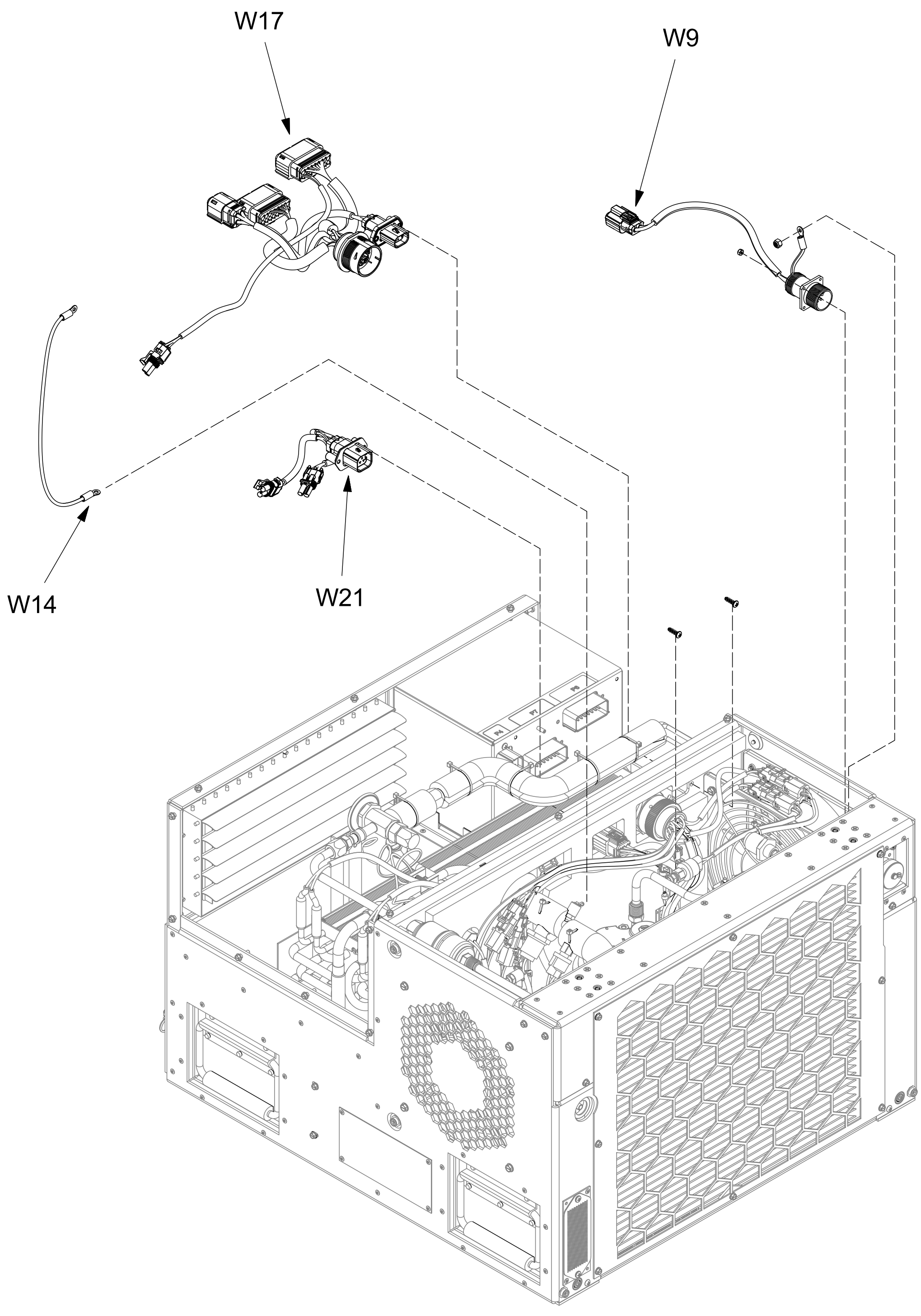



**Figure 11. W9, W14, W17, and W21 Locations.**

**CABLE LOCATIONS – CONTINUED**

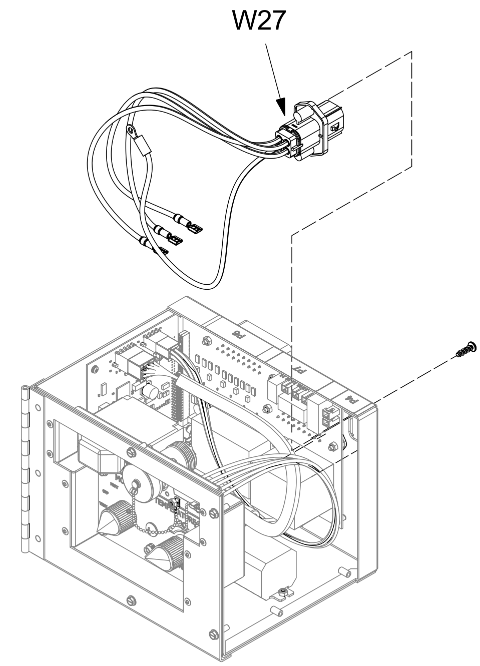



**Figure 12. W27 Location.**

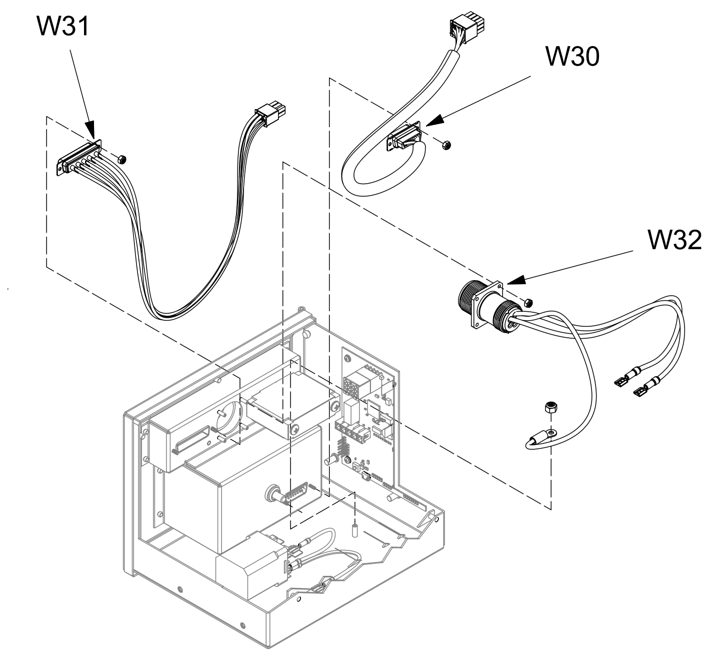



**Figure 13. W30, W31, and W32 Locations.**

## CABLE LOCATIONS – CONTINUED

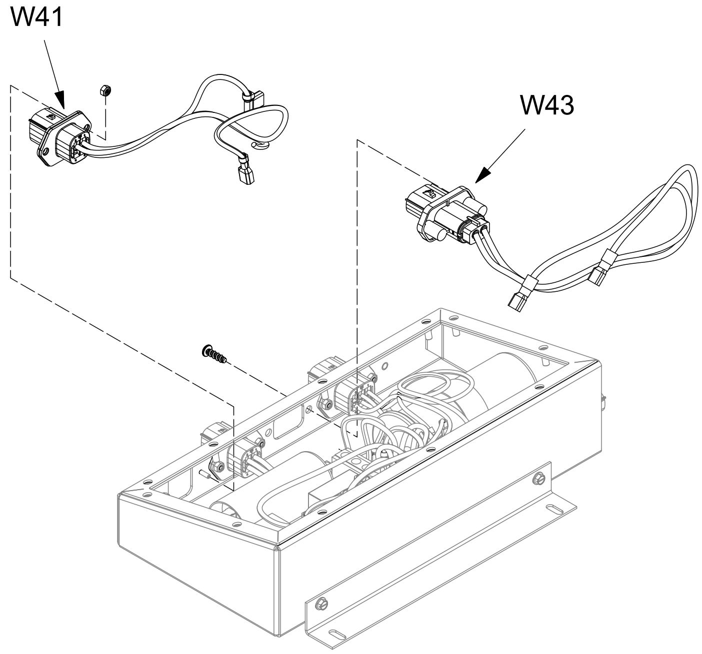



Figure 14. W41 and W43 Locations.

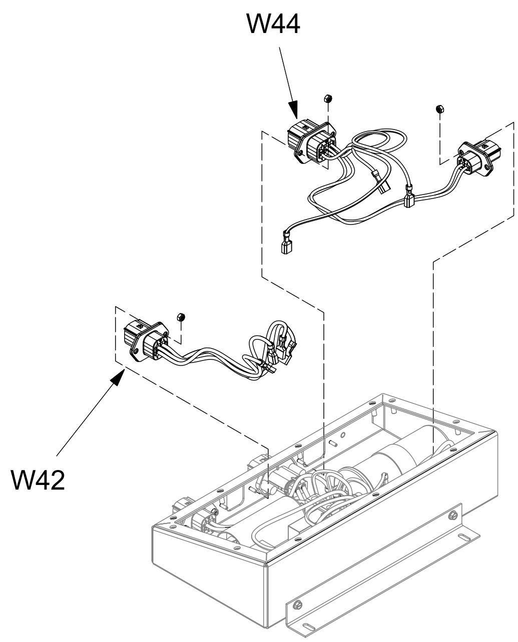



Figure 15. W42 and W44 Locations.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## HIGH PRESSURE SWITCH ASSEMBLY (S2) – TEST, REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)
Replacement high pressure switch (WP 0074, Item 1)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

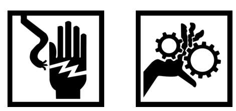
WP 0015
WP 0074
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### TEST

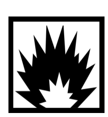
**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove the high pressure switch assembly (S2) (this work package).
2. Test for continuity across pins A and B of the high pressure switch assembly (S2). If there is no continuity across the pins, replace the high pressure switch assembly (S2) (this work package).
3. Using a manifold gauge set (rated for at least 800 psig), connect the high pressure switch assembly (S2) to the pressure regulator.

**WARNING**



- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

## TEST – CONTINUED

### WARNING

Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

4. Using the nitrogen regulator, apply a pressure of 725 to the high pressure switch assembly (S2).

   Test for continuity.

   a. If continuity remains, when exposed to a pressure of 725 psig, replace the high pressure switch assembly (S2) (this work package).

   b. If there is no continuity when exposed to a pressure of 725 psig, continue to next Step.

5. Readjust the nitrogen regulator, to supply a pressure of 450 to 475 psig to the high pressure switch assembly (S2). You may have to crack the hose to bleed the pressure down and reset the regulator.

   Test for continuity.

   a. If continuity is not present when exposed to a pressure of 450 psig, replace the high pressure switch assembly (S2) (this work package).

   b. If continuity is present when exposed to a pressure of 450 psig, continue to next Step.

6. Shut off the nitrogen supply, bleed the hose, and disconnect the high pressure switch assembly (S2) from the nitrogen source.
7. Install the high pressure switch assembly (S2) (this work package).

**END OF TASK**

## REMOVE

### WARNING


High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

### NOTE

This can be performed with a charged system, since the high pressure switch assembly is mounted on a self-sealing Schrader valve.

1. Disconnect high pressure switch assembly (S2) connector P28 from wire harness connector J28 (Figure 1).

**REMOVE – CONTINUED**

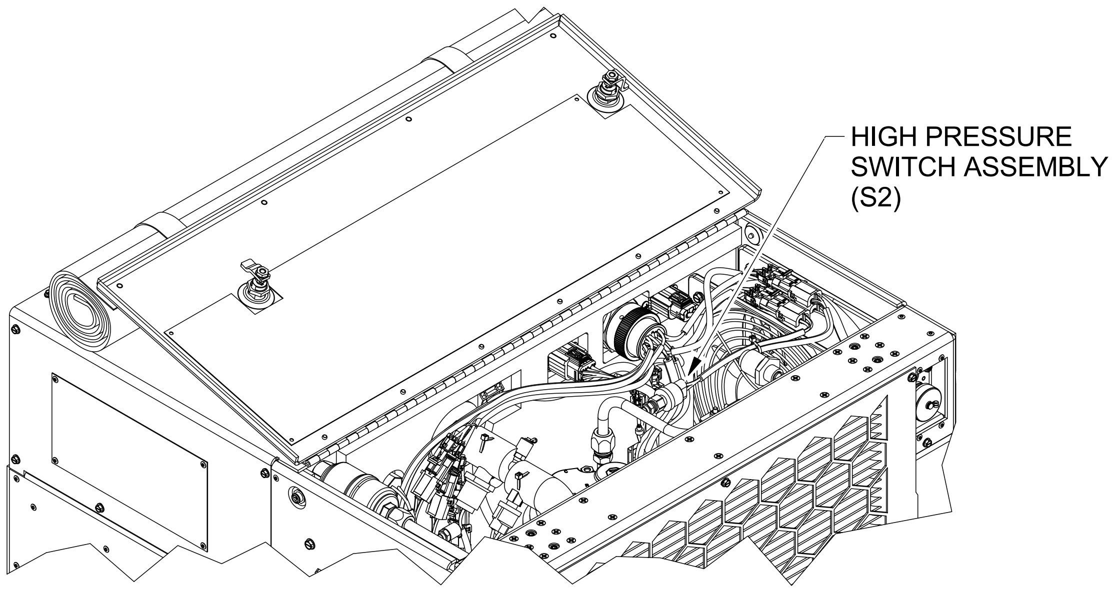



**Figure 1. High Pressure Switch Assembly (S2).**

2. Secure Schrader port with a wrench (Figure 2, Item 1).

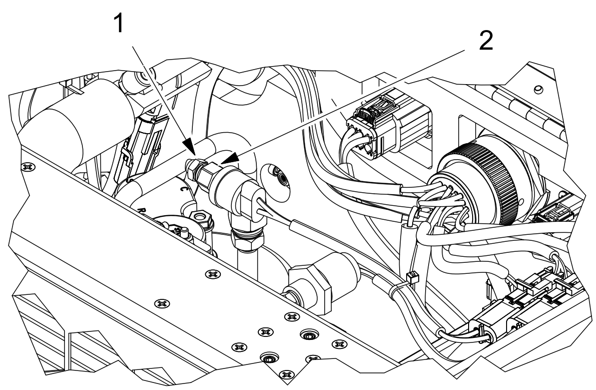



**Figure 2. Securing Schrader Valve.**

**NOTE**

A minimal amount of air will be discharged while the high pressure switch assembly is being removed from the Schrader valve.

3. Remove high pressure switch assembly (S2) from Schrader port of tube assembly (Figure 2, Item 2) using another wrench.
4. Remove the high pressure switch assembly (S2) from IECU.

**END OF TASK**

**REPLACE**

1. Remove the high pressure switch assembly (S2) (this work package).
2. Install replacement high pressure switch assembly (S2) (this work package).

**END OF TASK**

**INSTALL**

1. Thread high pressure switch assembly (S2) onto Schrader port of copper tube by hand until it is hand tight. Be careful not to cross-thread.
2. Secure Schrader port with a wrench (Figure 2, Item 1).
3. Turn the high pressure switch assembly (S2) 1/4 turn clockwise (Figure 2, Item 2) using another wrench.
4. Connect connector P28 to wire harness connector J28 (Figure 1).
5. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## LOW PRESSURE SWITCH ASSEMBLY (S3) – TEST, REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)
Replacement low pressure switch (WP 0074, Item 2)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

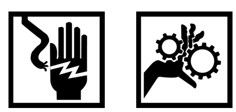
WP 0015
WP 0074
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### TEST

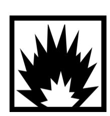
**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove the low pressure switch assembly (this work package).
2. Test for continuity across pins A and B of connector P29 of the low pressure switch assembly (S3). If there is continuity across the pins, replace the low pressure switch assembly (S3).
3. Using a manifold gauge set (rated for at least 800 psig), connect the low pressure switch assembly (S3) to the high side (right) part of the gauge set.

**WARNING**



- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

**TEST – CONTINUED**

## WARNING

Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

4. Using the nitrogen regulator, apply a pressure of 160 to 175 psig to the low pressure switch assembly (S3). If no continuity exists, when exposed to a pressure of at 160 psig, replace the low pressure switch assembly (S3).
5. Readjust the nitrogen regulator, to supply a pressure of 12 to 27 psig to the low pressure switch assembly (S3). You may have to crack the hose to bleed the pressure down and reset the regulator. If continuity is present when exposed to a pressure below 12 psig, replace the low pressure switch assembly (S3) (this work package).
6. Shut off the nitrogen supply, bleed the hose, and disconnect the low pressure switch assembly (S3) from the nitrogen source.
7. Install the low pressure switch assembly (S3) (this work package).

**END OF TASK**

**REMOVE**

## WARNING


High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## NOTE

This can be performed with a charged system, since the low pressure switch assembly is mounted on a self-sealing Schrader valve.

1. Disconnect low pressure switch assembly (S3) (Figure 1) connector P29 from wire harness connector J29. Cut tie wraps as required.

**REMOVE – CONTINUED**

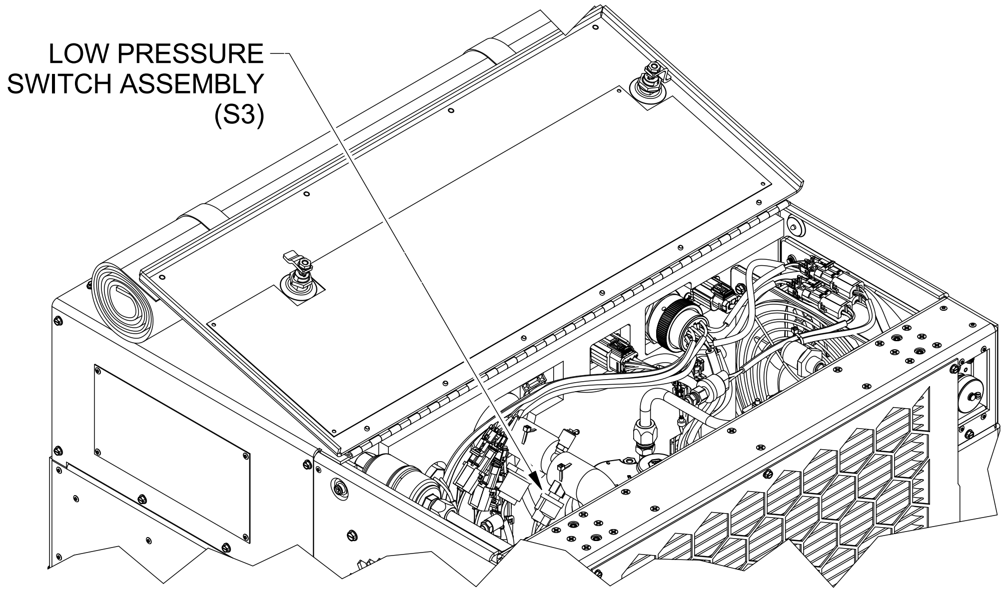



**Figure 1. Low Pressure Switch Assembly (S3).**

2. Secure Schrader port with a wrench (Figure 2, Item 1).

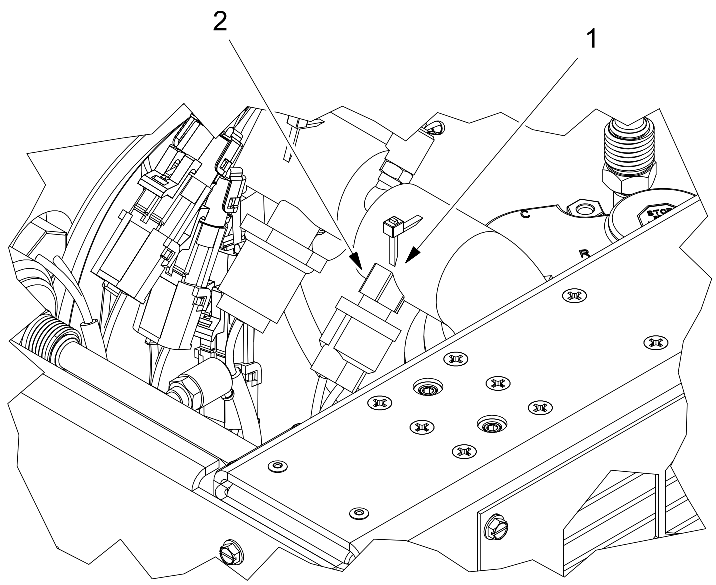



**Figure 2. Securing Schrader Valve.**

**REMOVE – CONTINUED**

3. Remove low pressure switch assembly (S3) from Schrader port of tube assembly (Figure 2, Item 2) with another wrench.
4. Remove low pressure switch assembly (S3) from IECU.

**END OF TASK**

**REPLACE**

1. Remove the low pressure switch assembly (this work package).
2. Install replacement low pressure switch assembly (this work package).

**END OF TASK**

**INSTALL**

1. Thread replacement low pressure switch assembly (S3) onto Schrader port of copper tube by hand until it is hand tight. Be careful not to cross-thread.
2. Secure Schrader port with a wrench (Figure 2, Item 1).
3. Turn the low pressure switch assembly (S3) 1/4 turn clockwise using another wrench.
4. Connect connector P29 to wire harness connector J29.
5. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## MOMENTARY SWITCH ASSEMBLY (S1) - TEST, REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement momentary switch (WP 0074, Item 3)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0074
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

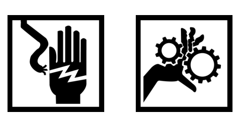
### TEST

1. Disconnect the momentary switch assembly (S1) from the W1 wiring harness by disconnecting connector J25 from P25 on the momentary switch assembly (S1).
2. Measure continuity between pins A and B of connector P25 when the momentary switch assembly (S1) (Figure 2) button is depressed and held in:
    a. If no continuity, then replace the momentary switch assembly (S1) (this work package).
    b. If continuity is present reconnect connector J25 to P25.

**END OF TASK**

### REMOVE

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Disconnect connector P25 of momentary switch assembly (S1) from wire harness J25.
2. Remove lock nut, freeing momentary switch assembly (S1) from the bridge plate sheet metal (Figure 1).

**REMOVE – CONTINUED**

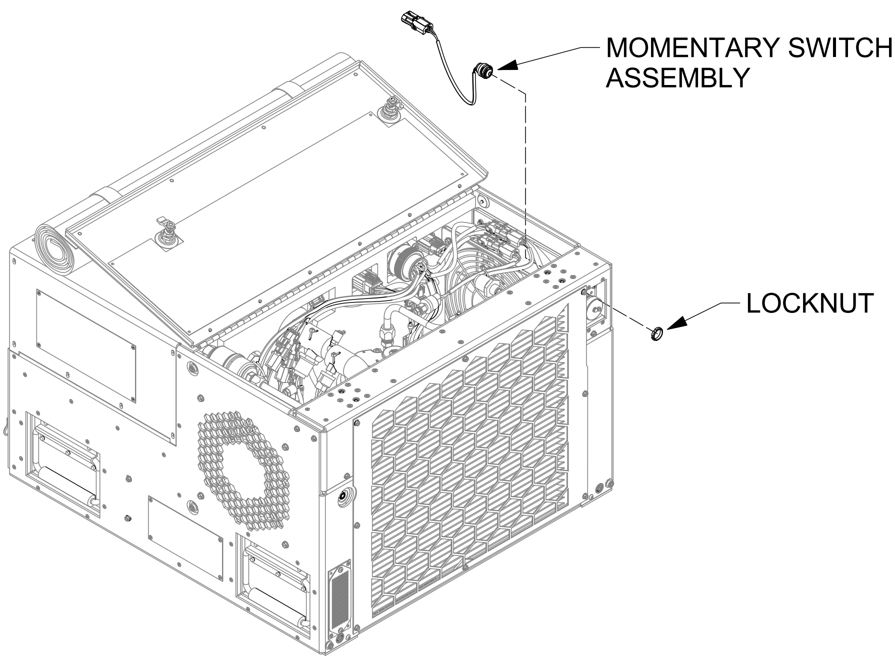



**Figure 1. Momentary Switch Assembly Lock Nut.**

3. Remove momentary switch assembly (S1) from IECU from inside the IECU (Figure 2).

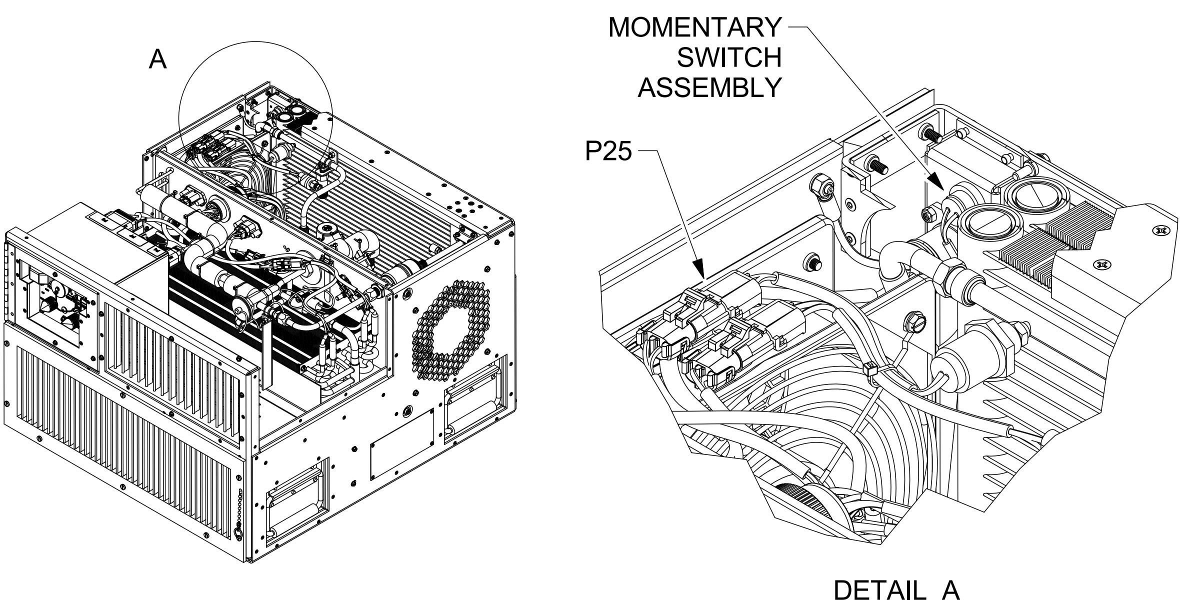



**Figure 2. Momentary Switch Assembly (S1).**

**END OF TASK**

**REPLACE**

1. Remove momentary switch assembly (S1) (this work package).
2. Install replacement momentary switch assembly (S1) (this work package).
3. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**INSTALL**

1. Place momentary switch assembly (S1) into position in cutout of bridge plate sheet metal.
2. Install lock nut securing momentary switch assembly (S1) to bridge plate sheet metal
3. Connect connector P25 of momentary switch assembly (S1) to wire harness J25

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## CONTROL BOX ASSEMBLY - TEST, REMOVE, REPAIR, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement control box (WP 0074, Item 5)
Replacement diagnostics cable (W31) (WP 0074, Item 20)
Replacement relay (K1) (WP 0074, Item 9)
Replacement circuit breaker (CB1) (WP 0074, Item 14)
Replacement circuit breaker (CB1) boot seal (WP 0074, Item 17)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0005
WP 0015
WP 0032
WP 0043
WP 0044
WP 0074
WP 0091

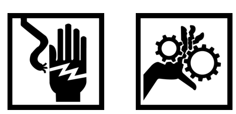
**Equipment Condition**

IECU is shut down (WP 0005)

### TEST

**Access the LEDs**

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**CAUTION**

Never touch control boards without static electricity protection. Never discharge static electric charge by touching the chassis. Damage to the equipment may result.

1. Remove four screws (Figure 1, Item 2) to unfasten control box hinged cover (Figure 1, Item 1) from control box housing.

**TEST – CONTINUED**

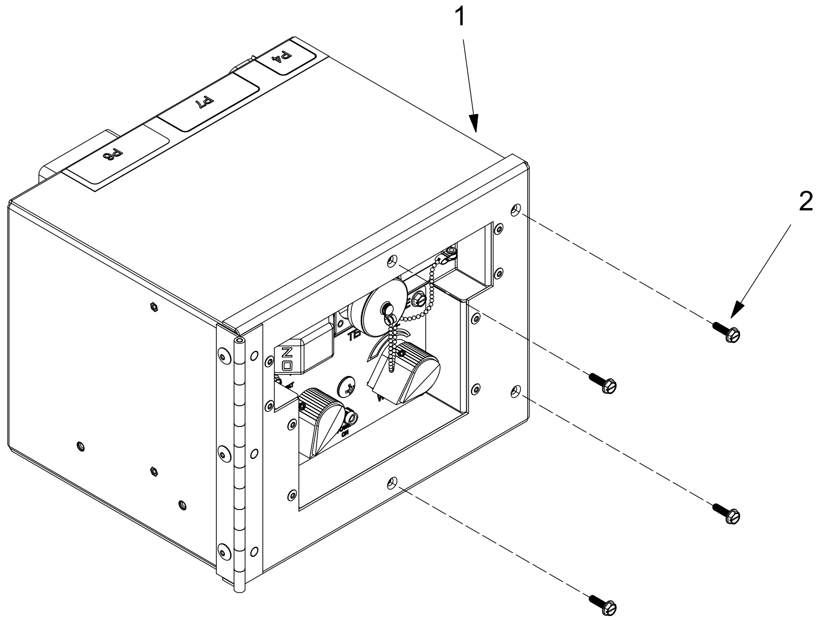



**Figure 1. Opening the Control Box Cover.**

## WARNING

- Ensure the power source is disconnected. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact electrical components when installing, operating, or troubleshooting this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- Be careful not to contact high voltage connections of input connectors when installing or operating this equipment. Failure to comply may result in severe personal injury or death by electrocution.
- High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## NOTE

- Diagnostic LEDs are located on the control board (U2) (Figure 2).
- Properly return the IECU to the mode in which the fault occurred (WP 0005).

2. Carefully startup the IECU (WP 0005).

**TEST – CONTINUED**

3. After completing diagnostics, close the control box hinged cover and install four screws (Figure 1, Item 2) securing the cover (Figure 1, Item 1) to the control box housing and shut down the IECU (WP 0005).

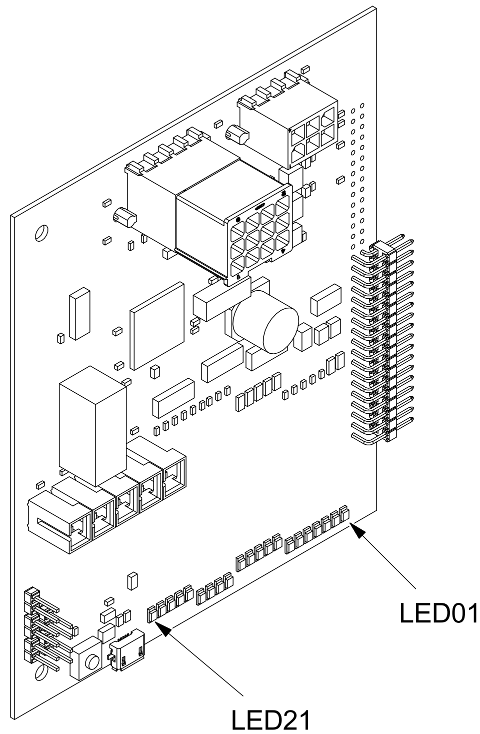



**Figure 2. Location of LEDs.**

**Test Diagnostics Cable (W31)**

1. Set the rotary MODE switch (S4) to OFF.
2. Remove the control box from the IECU (this work package).
3. Open the control box cover.
4. Disconnect connector J16 of wiring harness W31 from CON 10 on the control board (U2).
5. Check for continuity between the following sockets and ground in wiring harness W31 and every other pin in the wiring harness:
   - J2 socket 1, and J16 sockets 1,2,3,4,5
   - J2 socket 2, and J16 sockets 1,2,3,4,5
   - J2 socket 3, and J16 sockets 1,2,3,4,5
   - J2 socket 4, and J16 sockets 1,2,3,4,5
   - J2 socket 5, and J16 sockets 1,2,3,4,5

**TEST – CONTINUED**

6. If continuity is missing between sockets with the same socket number, for example J2 socket 1 and J16 socket 1, (broken connection) replace wiring harness W31 (this work package).
7. If there is continuity between sockets with different socket numbers, for example J2 socket 1 and J16 socket 3, (shorted wires) replace wiring harness W31 (this work package).

**END OF TASK**

**REMOVE**

1. Remove cover assembly (WP 0032)
2. Disconnect connectors J4, J6, and J7 of wire harness W17 from connectors P4 (Figure 3, Item 1), P6 (Figure 3, Item 2), and P7 (Figure 3, Item 3) on the rear of the control box assembly.

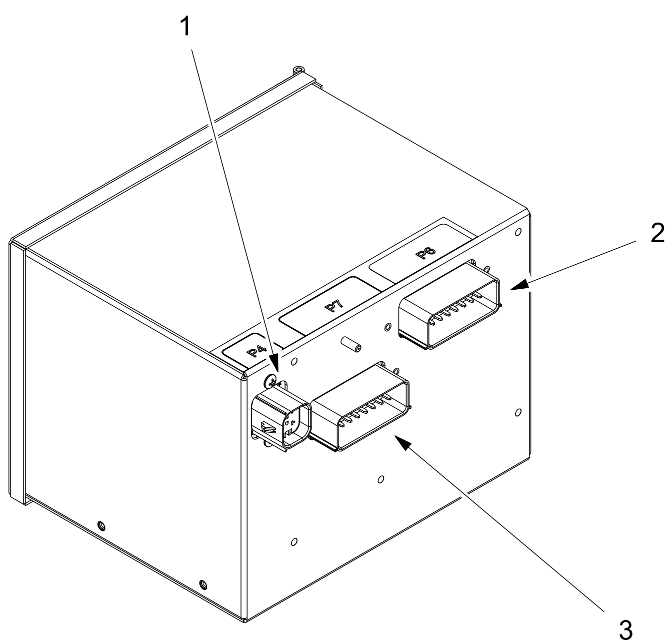



**Figure 3. Control Box Assembly Connectors.**

3. Remove four hex-head screws (Figure 4, Item 1) freeing control box assembly from sheet metal mounting brackets on interior.

## REMOVE – CONTINUED

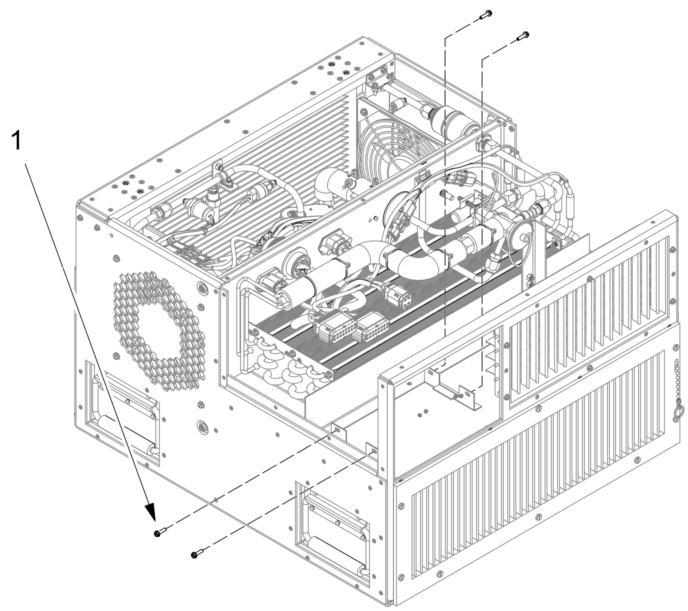



**Figure 4. Control Box Assembly Mounting Screws.**

4. Pull control box assembly through opening on IECU face to remove.

## END OF TASK

## REPAIR

### Replace Diagnostics Cable (W31)

1. Remove control box from IECU (this work package).
2. Remove four screws securing the control box hinged lid and open the lid.
3. Remove dust cover from diagnostics connector J2.
4. Remove two screws securing diagnostics connector J2 to the control box lid.
5. Disconnect connector J16 from connector CON 10 on the control board.
6. Discard the old diagnostics cable and position new one in its place.
7. Connect replacement diagnostics cable (W31) connector J16 to connector CON 10 on the control board.
8. Install two screws and two nuts securing the diagnostics connector J2 to the control box lid.
9. Place dust cap on the diagnostics connector J2.
10. Close the control box hinged lid and install four screws securing the lid.
11. Install the control box into IECU (this work package).

### Replace Relay (K1)

1. Remove four hex-head screws (Figure 1, Item 2) allowing hinged control box door to be opened.

**REPAIR – CONTINUED**

2. Open hinged door of control box.
3. Remove lock nut (Figure 5, Item 2), allowing relay (Figure 5, Item 1) to be removed from control box base.

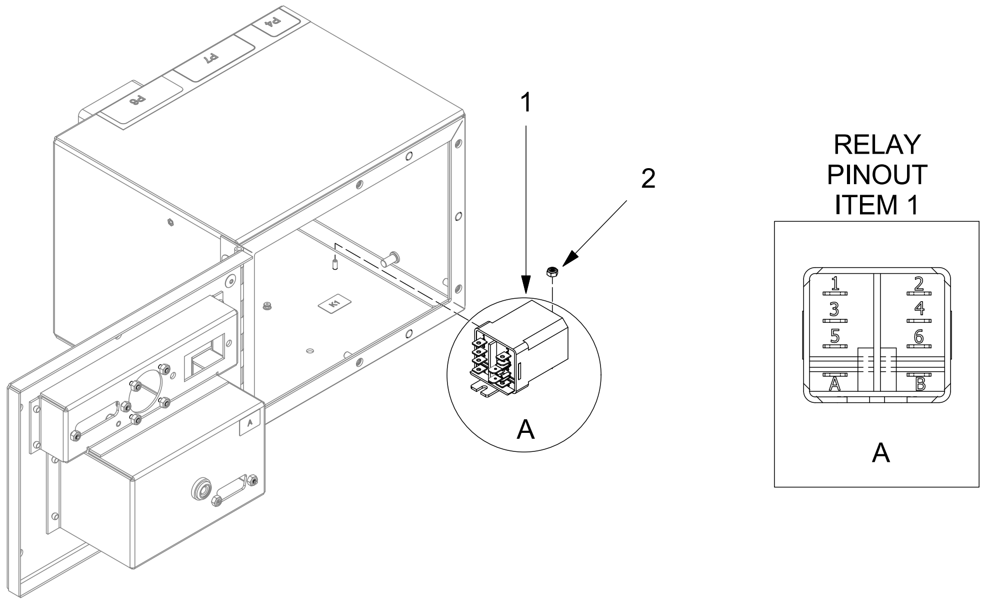



**Figure 5. Relay K1.**

4. Slide relay (Figure 5, Item 1) off control box relay mounting stud.

**NOTE**

Before moving wires tag for proper installation.

5. Disconnect all wires from relay terminals.
6. Remove relay from control box.
7. Remove three 3-way quick-disconnect terminals from relay and save for use on replacement relay.
8. Install three 3-way quick-disconnect terminals onto replacement relay terminals 3, 4, and 6.
9. Connect wires to relay according to Table 1.

**Table 1. Control Box Relay Connections.**

| WIRE COLOR | WIRE ORIGINATION | WIRE TERMINATION (RELAY TERMINAL) |
|---|---|---|
| Black | P4, pin #1 (W27) | Terminal 1 |
| White | P4, pin #2 (W27) | Terminal 2 |
| White | P4, pin #4 (W27) | Terminal 6 |
| White | J7, socket #1 (W29) | Terminal 6 |
| White | Terminal 4 (W28) | Terminal B |

**REPAIR – CONTINUED**

**Table 1. Control Box Relay Connections. – Continued**

| WIRE COLOR | WIRE ORIGINATION | WIRE TERMINATION (RELAY TERMINAL) |
|---|---|---|
| Black | P1, pin A (W32) | Terminal 3 |
| White | P1, pin D (W32) | Terminal 4 |
| Black | Circuit breaker (CB1) line (W33) | Terminal 5 |
| Black | Terminal 3 (W34) | Terminal A |

10. Slide relay (Figure 5, Item 1) onto control box relay mounting stud.
11. Install lock nut (Figure 5, Item 2), securing relay (Figure 5, Item 1) to control box base.
12. Close hinged door of control box.
13. Install four hex-head screws (Figure 1, Item 2) securing hinged control box door closed.

**Replace Circuit Breaker (CB1)**

1. Remove four hex-head screws (Figure 1, Item 2) allowing hinged control box door to be opened.
2. Open hinged door of control box.
3. Remove two circuit breaker mounting screws (Figure 6, Item 4) from front of control box.

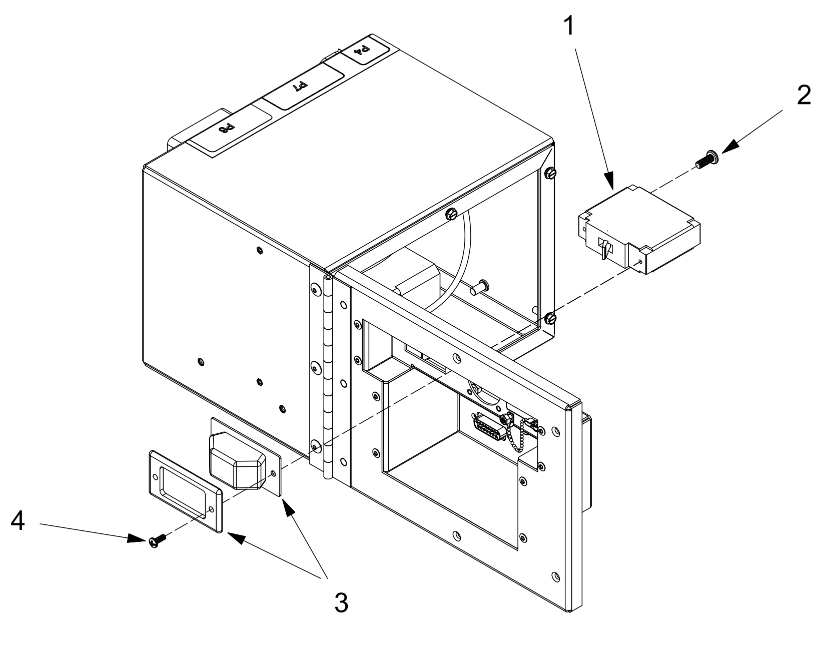



**Figure 6. Removing Circuit Breaker.**

4. Remove circuit breaker (CB1) boot seal (Figure 6, Item 3) from control box.
5. Pull circuit breaker (CB1) (Figure 6, Item 1) free from control box door.
6. Remove two circuit breaker (CB1) line and load terminal screws (Figure 6, Item 2).

## REPAIR – CONTINUED

7. Obtain replacement circuit breaker.
8. Install new circuit breaker by connecting the line and load wires to terminal screws (Figure 6, Item 2) on replacement circuit breaker (CB1):
    a. Black wire from relay terminal 5 to circuit breaker (CB1) line.
    b. Black wire from P4, pin 3 and black wire from J7, socket 2 to circuit breaker (CB1) load.
9. Place circuit breaker (CB1) in position into cutout in door of control box.
10. Install circuit breaker boot seal (Figure 6, Item 3) onto control box face.
11. Install two circuit breaker mounting screws (Figure 6, Item 4) from front of control box, securing circuit breaker (CB1) and boot seal.
12. Close hinged door of control box.
13. Install four hex-head screws (Figure 1, Item 2) securing hinged control box door closed.

### Replace Circuit Breaker (CB1) Boot Seal

1. Remove two circuit breaker mounting screws (Figure 6, Item 4) from front of control box.
2. Remove circuit breaker (CB1) boot seal (Figure 6, Item 3) from control box face.
3. Install replacement circuit breaker boot seal (Figure 6, Item 3) onto control box face.
4. Install two circuit breaker mounting screws (Figure 6, Item 4) from front of control box, securing circuit breaker (CB1) and boot seal.

### Replace Control Board (U2)

Replace the control board (U2) (WP 0044).

### Replace Power Board (U1)

Replace the power board (U1) (WP 0043).

**END OF TASK**

## INSTALL

1. Remove cover assembly (WP 0032).
2. Place control box assembly into position through opening on IECU face.
3. Install four hex-head screws (Figure 4, Item 1) securing control box assembly to sheet metal mounting brackets on interior.
4. Connect connectors J4 to P4, J6 to P6, and J7 to P7.
5. Install the cover assembly (WP 0032).
6. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## POWER BOARD (U1) – REPLACE

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement power board (U1) (WP 0074, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0042
WP 0044
WP 0074
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open
Control board (U2) is removed (WP 0044)

### REPLACE

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**CAUTION**

Never touch control boards without static electricity protection. Damage to the equipment may result.

1. Disconnect connector J5 from power board (U1) (Figure 1, Item 2).
2. Disconnect J6 from P6 and J7 from P7.
3. Remove five mounting screws (Figure 1, Item 2) freeing power board (U1) (Figure 1, Item 1) from mounting standoffs.

## REPLACE – CONTINUED

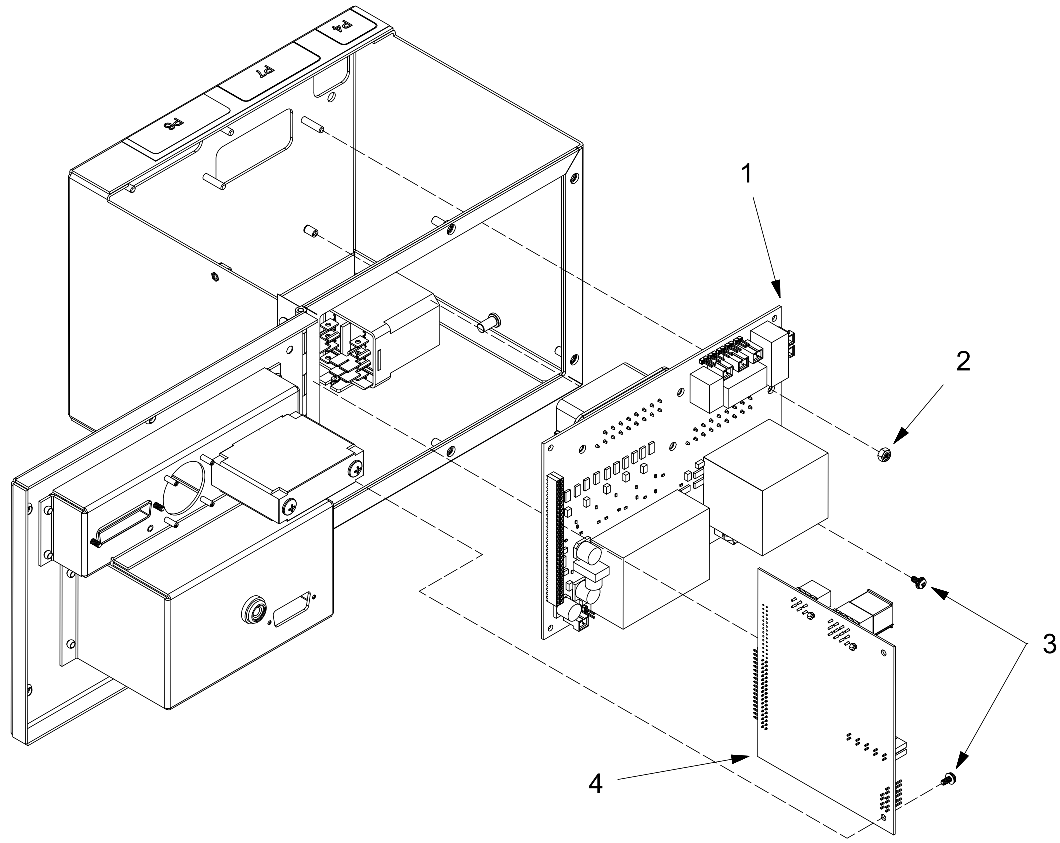



**Figure 1. Power Board (U1) Mounting.**

4. Remove four lock nuts (Figure 1, Item 3) that secure power board (U1) (Figure 1, Item 1) to mounting studs.
5. Remove relay (K1) (WP 0042).
6. Carefully navigate power board (U1) (Figure 1, Item 1) around other control box components to remove from control box assembly.
7. Configure jumpers on replacement power board (U1) (Figure 1, Item 1) using existing board as a guide. If a jumper is installed on any header J1 through J6, remove the jumpers and place them on a holder HOLD1 through HOLD5.
8. Install relay (K1) (WP 0042).
9. Carefully navigate power board (U1) (Figure 1, Item 1) around other components to place into position.
10. Install four lock nuts (Figure 1, Item 3) that secure power board (U1) (Figure 1, Item 1) to mounting studs.
11. Install five mounting screws (Figure 1, Item 2) securing power board (U1) (Figure 1, Item 1) to mounting standoffs.
12. Connect connector J5 to power board (U1) (Figure 1, Item 1).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

Install the control board (U2) (Figure 1, Item 4) (WP 0044).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## CONTROL BOARD (U2) - REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement control board (U2) (WP 0074, Item 13)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0074
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

### REMOVE

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**CAUTION**

Never touch control boards without static electricity protection. Damage to the equipment may result.

1. Remove four screws (Figure 1, Item 2) allowing hinged control box door (Figure 1, Item 1) to be opened.

## REMOVE – CONTINUED

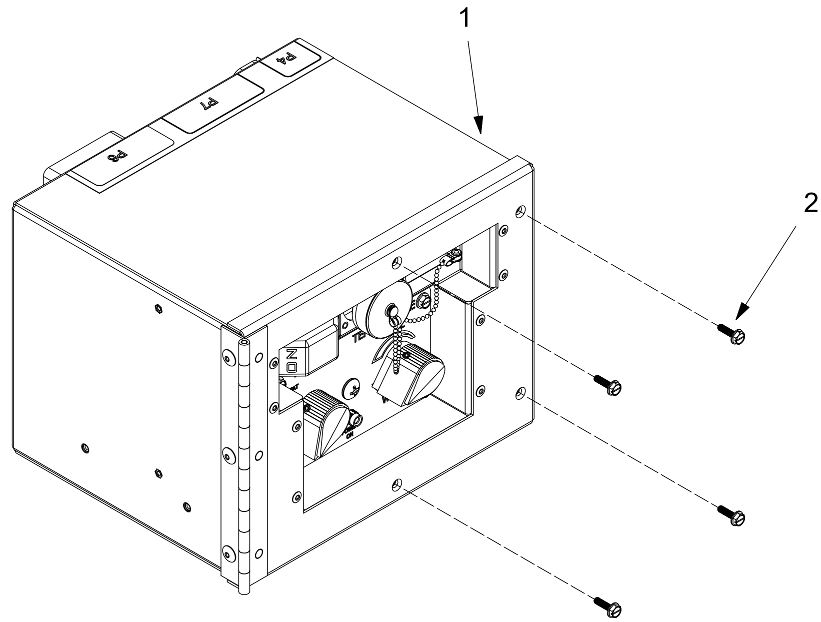



**Figure 1. Opening the Control Box Assembly Cover.**

2. Disconnect cable connectors J16 and J17 from control board (U2) (Figure 2, Item 1).

**REMOVE – CONTINUED**

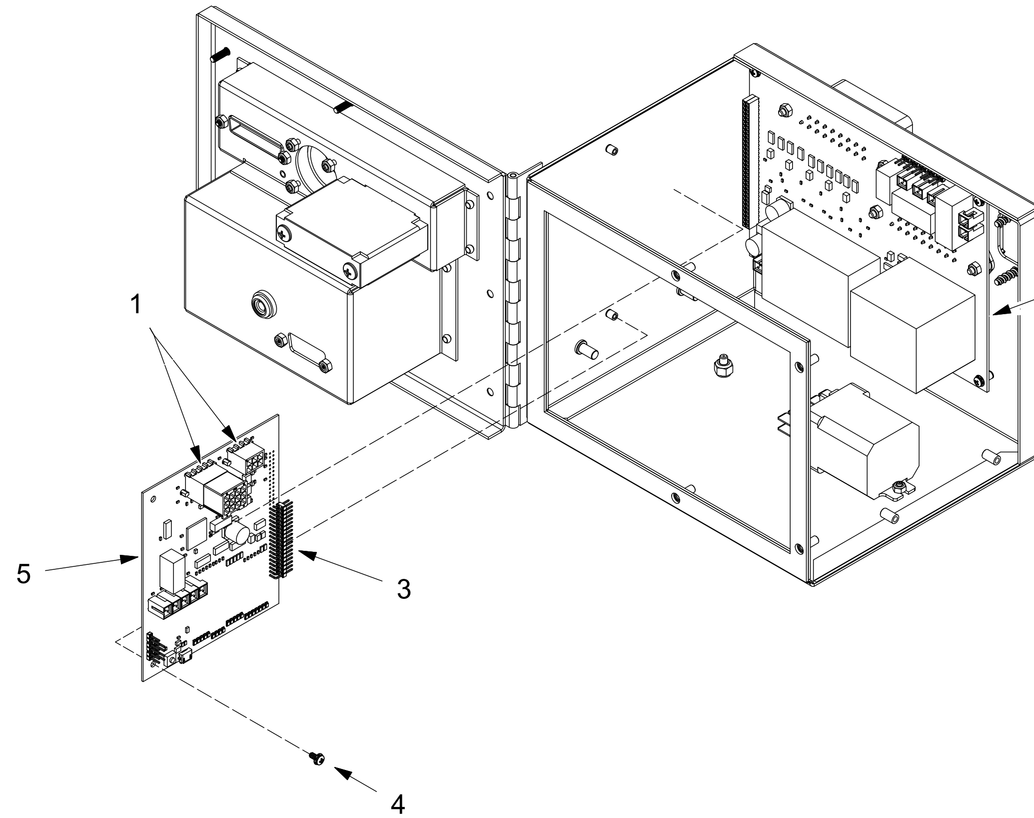



**Figure 2. Control Board Mounting.**

3. Remove two mounting screws (Figure 2, Item 4) freeing control board (U2) (Figure 2, Item 5) from mounting standoffs.
4. Pull the control board (U2) (Figure 2, Item 5) toward control box door opening to disconnect the board-to-board connector (Figure 2, Item 3) from power board (U1) (Figure 2, Item 2).
5. Remove control board (U2) (Figure 2, Item 5) board from control box.

**END OF TASK**

**REPLACE**

1. Remove control board (U2) (this work package).
2. Configure jumpers on replacement control board (U2) (Figure 2, Item 5) using existing board as a guide. If a jumper is installed on header J14, remove the jumper and place it on a holder HOLD6, located next to the header.
3. Install replacement control board (U2) (this work package).

**END OF TASK**

## INSTALL

1. Insert control board (U2) (Figure 2, Item 5) into control box.
2. Place control board (U2) (Figure 2, Item 5) into position.
3. Install two mounting screws (Figure 2, Item 4) securing control board (U2) (Figure 2, Item 5) to mounting standoffs.
4. Connect cable connectors J16 and J17 (Figure 2, Item 5) to control board (U2) (Figure 2, Item 1).
5. Close hinged door of control box.
6. Install four screws (Figure 1, Item 2) securing hinged control box door (Figure 1, Item 1) closed.
7. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REMOTE CONTROL BOX ASSEMBLY – TEST, REMOVE, REPAIR, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement remote control box (WP 0074, Item 45)
Replacement remote control box knob (WP 0074, Item 54)
Replacement remote control box cover (WP 0074, Item 46)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0038
WP 0042
WP 0064
WP 0074
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

### TEST

**NOTE**

Refer to WP 0064 for electrical connector pin assignments.

1. Remove the remote control box (this work package).
2. Rotate the TEMPERATURE control thermostat (R1) clockwise until it stops.
3. Measure the resistance between pin 3 and pin 4 of connector P15 on the remote control box. If the measured resistance is not between 9kΩ and 11kΩ, replace the remote control box (this work package).
4. Measure the resistance between pin 3 and pin 11 of connector P15. If the measured resistance is not between 0Ω (no resistance) and 115Ω, replace the remote control box (this work package).
5. Rotate the TEMPERATURE control thermostat (R1) counter clockwise until it stops.
6. Measure the resistance between pin 3 and pin 4 of connector P15. If the measured resistance is not between 0Ω (no resistance) and 115Ω, replace the remote control box (this work package).
7. Measure the resistance between pin 3 and pin 11 of connector P15. If the measured resistance is not between 9kΩ and 11kΩ, replace the remote control box (this work package).
8. Set the rotary MODE switch (S4) to OFF.
9. Verify continuity between pin 2 and pin 10 of connector P15. If no continuity is indicated, replace the remote control box (this work package).
10. Verify open circuit condition (no continuity) between pin 1 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
11. Verify open circuit condition (no continuity) between pin 5 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
12. Verify open circuit condition (no continuity) between pin 7 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
13. Set the rotary MODE switch (S4) to HEAT.

## TEST – CONTINUED

14. Verify continuity between pin 5 and pin 10 of connector P15. If no continuity is indicated, replace the remote control box (this work package).
15. Verify open circuit condition (no continuity) between pin 1 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
16. Verify open circuit condition (no continuity) between pin 2 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
17. Verify open circuit condition (no continuity) between pin 7 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
18. Set the rotary MODE switch (S4) to VENT.
19. Verify continuity between pin 7 and pin 10 of connector P15. If no continuity is indicated, replace the remote control box (this work package).
20. Verify open circuit condition (no continuity) between pin 1 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
21. Verify open circuit condition (no continuity) between pin 2 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
22. Verify open circuit condition (no continuity) between pin 5 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
23. Set the rotary MODE switch (S4) to COOL.
24. Verify continuity between pin 1 and pin 10 of connector P15. If no continuity is indicated, replace the remote control box (this work package).
25. Verify open circuit condition (no continuity) between pin 2 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
26. Verify open circuit condition (no continuity) between pin 5 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
27. Verify open circuit condition (no continuity) between pin 7 and pin 10 of connector P15. If continuity is indicated, replace the remote control box (this work package).
28. Disconnect connector J17 from connector CON9 on the control board.
29. Test for continuity between connector J15 and connector J17. The connectors are a socket-for-socket match, e.g. socket 1 of connector J15 is connected to socket 1 of connector J17, socket 2 of connector J15 is connected to socket 2 of connector J17, etc. Test for continuity between socket sets 1-12, if any socket set test indicates no continuity, replace wire harness W30 (WP 0038).
30. Reconnect connector J17 (Figure 1, Item 2) to connector CON9 (Figure 1, Item 1) on the digital control board.
31. Set the rotary MODE switch (S4) to OFF.
32. Install the remote control box.
33. Install the control box (WP 0042).

## TEST – CONTINUED

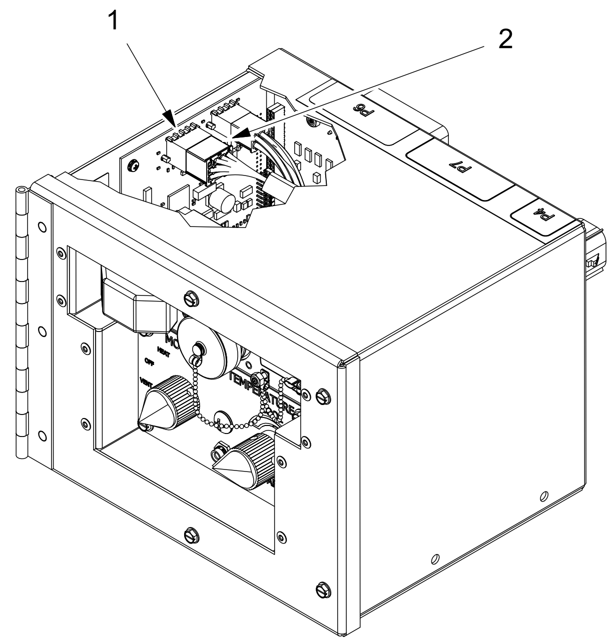



**Figure 1. Connector J17 To Control Board.**

## END OF TASK

## REMOVE

1. Loosen the remote control box mounting screw (Figure 2, Item 1) until the remote control box assembly (Figure 2, Item 2) can be withdrawn.

**REMOVE – CONTINUED**

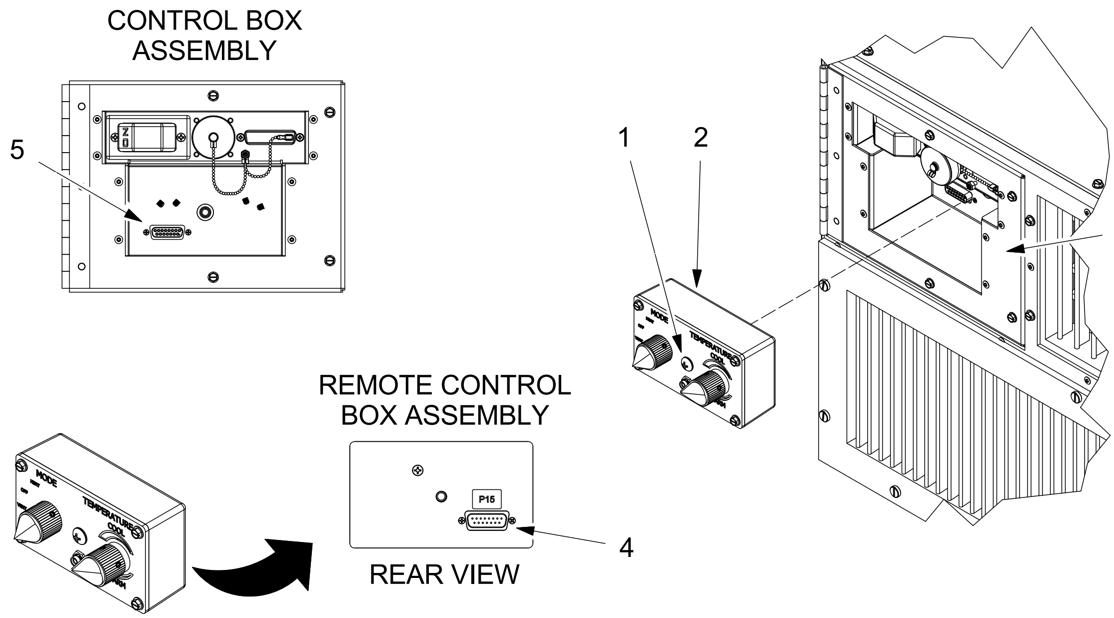



**Figure 2. Remote Control Box Assembly.**

2. Remove remote control box assembly (Figure 2, Item 2) from control box assembly (Figure 2, Item 3).

**END OF TASK**

**REPAIR**

**Replace Knob**

1. Loosen two setscrews (Figure 3, Item 2) from the knob to be replaced.

**REPAIR – CONTINUED**

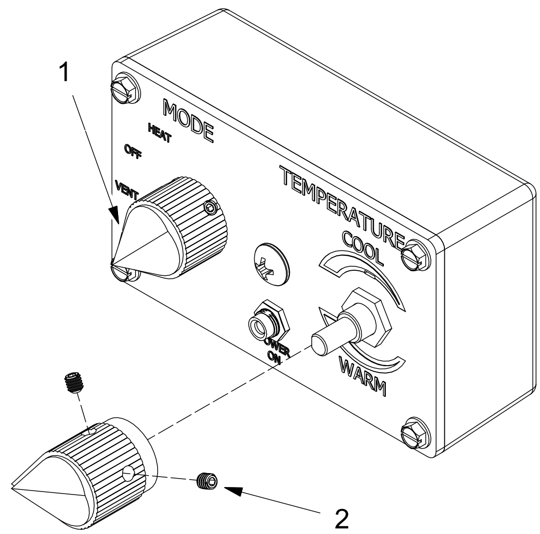



**Figure 3. Knob and Setscrew.**

2. Pull knob (Figure 3, Item 1) forward to remove.
3. Install replacement knob on shaft.
4. Tighten both setscrews (Figure 3, Item 2).

**Replace Remote Control Box Cover**

1. Remove the remote control box (this work package)
2. Remove knobs (this work package).
3. Remove the POWER ON indicator LED lock nut (Figure 4, Item 6).

## REPAIR – CONTINUED

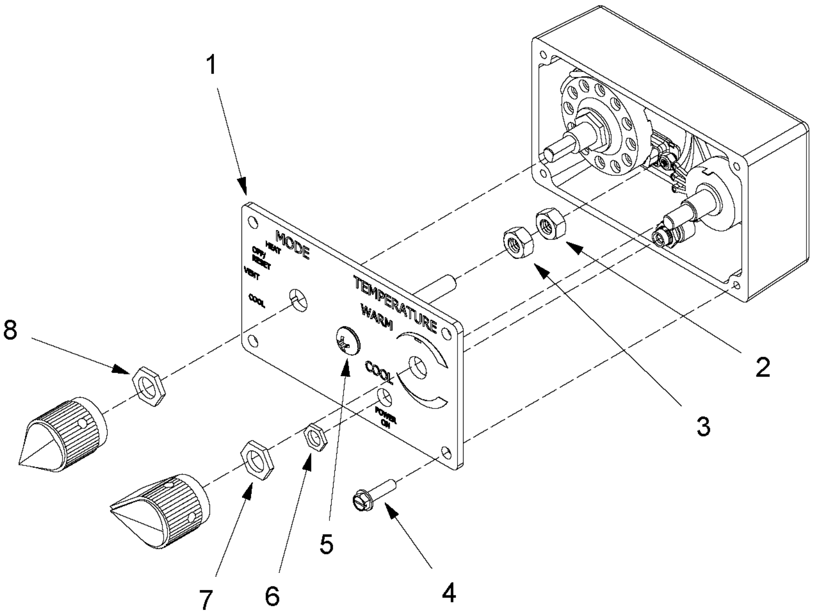



**Figure 4. Remote Control Box Cover.**

### NOTE

Use care not to scratch the faceplate of the remote control box.

4. Remove the jam nut securing the rotary MODE switch (S4) to the cover plate (Figure 4, Item 8).
5. Remove the jam nut securing the TEMPERATURE control thermostat (R1) to the cover plate (Figure 4, Item 7).
6. Remove four screws (Figure 4, Item 4) securing remote control box cover (Figure 4, Item 1) to remote control box assembly.
7. Remove remote control box cover (Figure 4, Item 1) from remote control box assembly.
8. Remove the POWER ON indicator LED from the remote control box cover.
9. Remove jam nuts (Figure 4, Items 2 and 3) from remote control box mounting screw (Figure 4, Item 5).
10. Install remote control box mounting screw (Figure 4, Item 5) into replacement remote control box cover (Figure 4, Item 1).
11. Thread first lock nut (Figure 4, Item 3) by hand until approximately 1/2-inch from the back of replacement remote control box cover (Figure 4, Item 1).
12. Thread the second lock nut (Figure 4, Item 2) by hand until it touches the first lock nut (Figure 4, Item 3).
13. Tighten the second lock nut (Figure 4, Item 2) against the first (Figure 4, Item 3).
14. Place the POWER ON indicator LED into its hole in replacement remote control box cover.
15. Install the POWER ON indicator LED lock nut (Figure 4, Item 6).

**REPAIR – CONTINUED**

**NOTE**

The posts are keyed for orientation into the cover.

16. Install the rotary MODE switch (S4) and temperature control thermostat in the replacement remote control box cover holes.
17. Install the jam nut (Figure 4, Item 8) onto the rotary MODE switch (S1).
18. Install the jam nut (Figure 4, Item 7) onto the TEMPERATURE control thermostat (R1).
19. Position replacement remote control box cover (Figure 4, Item 1) on remote control box assembly and secure with four screws (Figure 4, Item 4).

**NOTE**

The knobs are sized for the switch shafts.

20. Install knobs (this work package).
21. Install the remote control box.

**END OF TASK**

**REPLACE**

1. Remove the remote control box (this work package).
2. Install replacement remote control box (this work package).

**END OF TASK**

**INSTALL**

1. Place remote box assembly (Figure 2, Item 2) into its cavity in the control box assembly (Figure 2, Item 3). Ensure remote box connector (Figure 2, Item 4) mates properly with control box connector (Figure 2, Item 5).
2. Align and start the remote control box mounting screw (Figure 2, Item 1).
3. Screw in and tighten the remote control box mounting screw (Figure 2, Item 1).
4. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## TXV BRAZING ASSEMBLY – TEST, REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Crows Foot Wrench Set (SATS) (WP 0091, Table 2, Item 2)
Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)
Torque Wrench (SATS) (WP 0091, Table 2, Item 14)

**Materials/Parts**

Replacement TXV brazing assembly (WP 0075, Item 4)
Cork tape (WP 0094, Table 1, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0004
WP 0005
WP 0012
WP 0025
WP 0026
WP 0032
WP 0075
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)

### TEST

1. Verify the condenser and evaporator air flow paths are clear.
2. Verify the evaporator outlet grille louvers are open and unrestricted.
3. Close the fresh air duct.
4. Verify the air filter is clean (WP 0012).
5. Power up the IECU (WP 0005).
6. Verify the rotary Mode switch (S4) is in the COOL mode, TEMPERATURE control thermostat (R1) is set to full cooling (full counter-clockwise), and the IECU is operating (WP 0004).
7. Verify the evaporator blower (B2) is operating.
8. Verify the condenser fans (B3 and B4) are both operating.
9. Verify that the compressor (B1) is operating.
10. Let the system to run in cool mode for at least five minutes.
11. Check and record the evaporating pressure (WP 0026).
12. Check and record the evaporator refrigerant outlet temperature (WP 0026).
13. Use the measured evaporator saturation pressure (low pressure transducer, recorded in Step 11) to determine the acceptable TXV bulb temperature from Table 1:
    a. If the measured TXV bulb temperature is within the range of acceptable temperatures determined from Table 1, then the TXV is operating properly.
    b. If the measured TXV bulb temperature is not within the range of acceptable temperatures, continue to Step 14.

**TEST – CONTINUED**

**Table 1. Acceptable TXV Bulb Temperatures.**

| EVAPORATOR SATURATION PRESSURE (PSIG) | ACCEPTABLE TXV TEMPERATURE RANGE DEGREES FAHRENHEIT | EVAPORATOR SATURATION PRESSURE (PSIG) | ACCEPTABLE TXV TEMPERATURE RANGE DEGREES FAHRENHEIT |
|---|---|---|---|
| 90 | 28 - 38 | 200 | 72 - 82 |
| 95 | 31 - 41 | 205 | 73 - 83 |
| 100 | 33 - 43 | 210 | 75 - 85 |
| 105 | 36 - 46 | 215 | 77 - 87 |
| 110 | 38 - 48 | 220 | 78 - 88 |
| 115 | 41 - 51 | 225 | 79 - 89 |
| 120 | 43 - 53 | 230 | 80 - 90 |
| 125 | 45 - 55 | 235 | 82 - 92 |
| 130 | 47 - 57 | 240 | 83 - 93 |
| 135 | 49 - 59 | 245 | 84 - 94 |
| 140 | 51 - 61 | 250 | 86 - 96 |
| 145 | 53 - 63 | 255 | 87 - 97 |
| 150 | 55 - 65 | 260 | 88 - 98 |
| 155 | 57 - 67 | 265 | 90 - 100 |
| 160 | 58 - 68 | 270 | 91 - 101 |
| 165 | 60 - 70 | 275 | 92 – 102 |
| 170 | 62 - 72 | 280 | 93 – 103 |
| 175 | 64 - 74 | 285 | 95 – 105 |
| 180 | 65 - 75 | 290 | 96 – 106 |
| 185 | 67 - 77 | 295 | 97 – 107 |
| 190 | 69 - 79 | 300 | 98 – 108 |
| 195 | 70 - 80 | | |

14. Inspect the TXV bulb to determine if it is securely attached to the Evaporator to Bulkhead Wall Tube Assembly. The TXV bulb should be located at the 4-o'clock or 8-oclock position on the tube (Figure 1), and insulated with cork tape (Figure 2):

    a. If the bulb is securely attached, properly positioned, and insulated replace the TXV (this work package).

    b. If the bulb is not securely attached, properly positioned, or insulated, then reposition the TXV bulb, rewrap the cork tape (Figure 2), and retest.

## TEST – CONTINUED

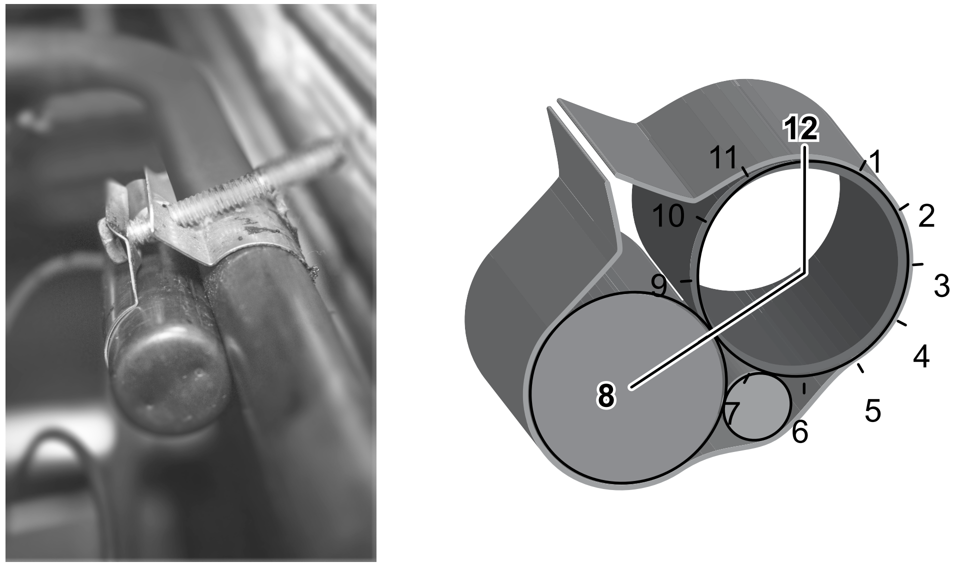



**Figure 1. TXV Bulb Orientation.**

**TEST – CONTINUED**

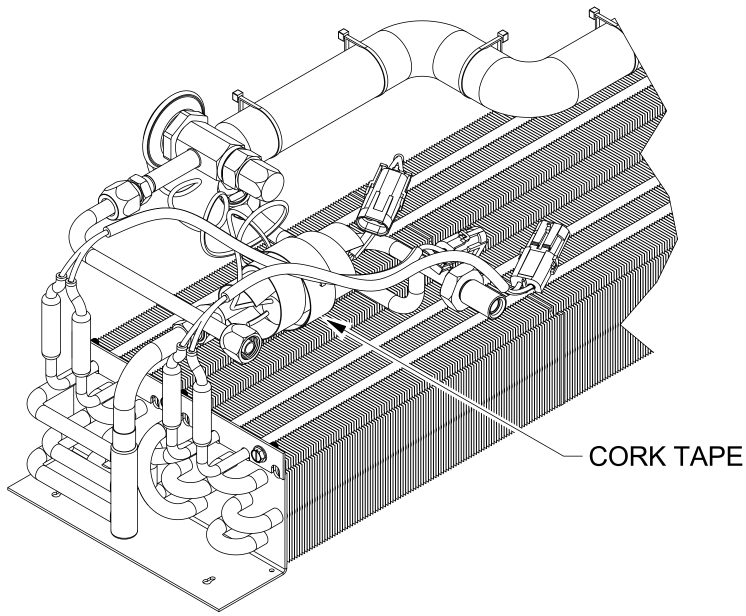
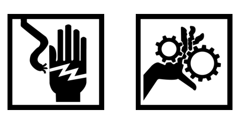



**Figure 2. Cork Insulating Tape.**

**END OF TASK**

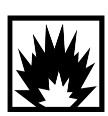
**REMOVE**

## WARNING



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## WARNING



- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

**REMOVE – CONTINUED**

## WARNING

Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

1. Prepare the refrigeration system to be opened (WP 0025).
2. Remove tubing insulation as required.
3. Remove insulating cork tape from TXV brazing assembly (Figure 1).
4. Observe orientation of sensor bulb on evaporator tube (Figure 1).
5. Loosen strap (Figure 4, Item 4) that holds TXV sensing bulb (Figure 4, Item 6) to tube and remove TXV bulb (Figure 4, Item 6) from strap (Figure 4, Item 4).
6. Disassemble the IMACA fitting from the TXV to bulkhead wall tube assembly (Figure 3, Item 2) (WP 0025).

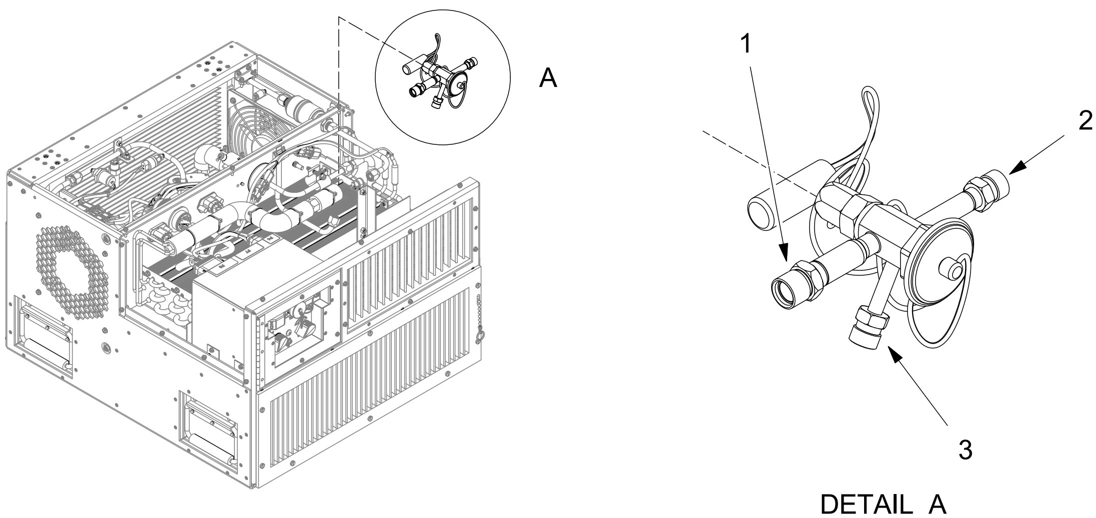



**Figure 3. TXV Piping Connections.**

7. Disassemble the IMACA fitting from the TXV to evaporator tube assembly (Figure 3, Item 1) (WP 0025).
8. Disassemble the IMACA fitting from the compressor to condenser tube assembly (Figure 3, Item 3) (WP 0025).
9. Remove the lock nut (Figure 4, Item 1) on the loop clamp (Figure 4, Item 2) securing TXV (Figure 4, Item 3) to the TXV mount.
10. Remove the TXV brazing assembly.

**END OF TASK**

## REPLACE

1. Remove the TXV brazing assembly (Figure 4, Item 3) (this work package).
2. Install replacement TXV brazing assembly (Figure 4, Item 3) (this work package).
3. Prepare the refrigeration system to be returned to service (WP 0025).
4. Install the cover assembly (WP 0032).

## END OF TASK

## INSTALL

1. Position TXV brazing assembly into the IECU.
2. Loosely install the lock nut (Figure 4, Item 1) on the loop clamp (Figure 4, Item 2) securing the TXV (Figure 4, Item 3) to the TXV mount.
3. Loosely assemble the IMACA fitting connecting the TXV to bulkhead wall tube assembly (Figure 3, Item 2) (WP 0025).
4. Loosely assemble the IMACA fitting on the compressor to condenser tube assembly (Figure 3, Item 3) (WP 0025).
5. Loosely assemble the IMACA fitting on the TXV to evaporator tube assembly (Figure 3, Item 1) (WP 0025).
6. Torque all refrigerant fittings to required torque setting (WP 0025).
7. Secure TXV bulb and thermistor to evaporator outlet line using copper strap provided with TXV. Orientation should be as shown in Figure 1. Orient bullet thermistor (RT3) with connector on side nearest the control box. Tighten the screw securing the strap.
8. Wrap the entire TXV sensing bulb (Figure 4, Item 6), thermistor (Figure 4, Item 5), and adjacent section of tubing with cork tape. Ensure that the TXV bulb (Figure 4, Item 6) is not exposed to ambient air.

**INSTALL – CONTINUED**

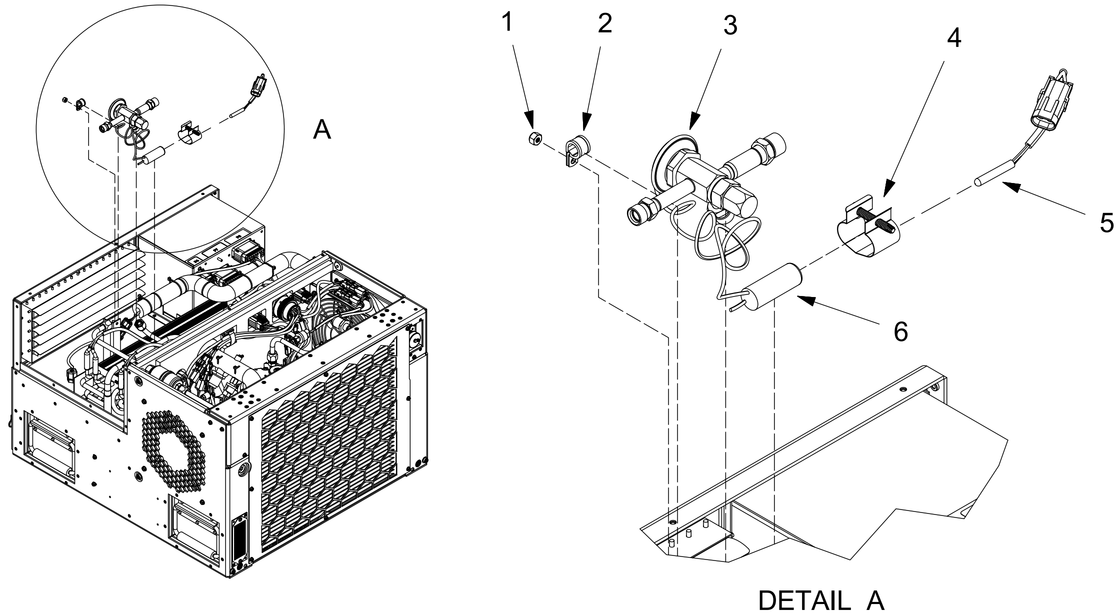



**Figure 4. TXV Removal.**

9. Install tubing insulation as required.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## BULLET THERMISTOR ASSEMBLY (RT3) – TEST, REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement bullet thermistor (RT3) (WP 0075, Item 1)
Cork tape (WP 0094, Table 1, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0026
WP 0032
WP 0046
WP 0075
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is removed (WP 0032)

### TEST

1. Disconnect P23 (Figure 1, Item 2) of the bullet thermistor assembly (RT3) from the connector J23 on wire harness W17.

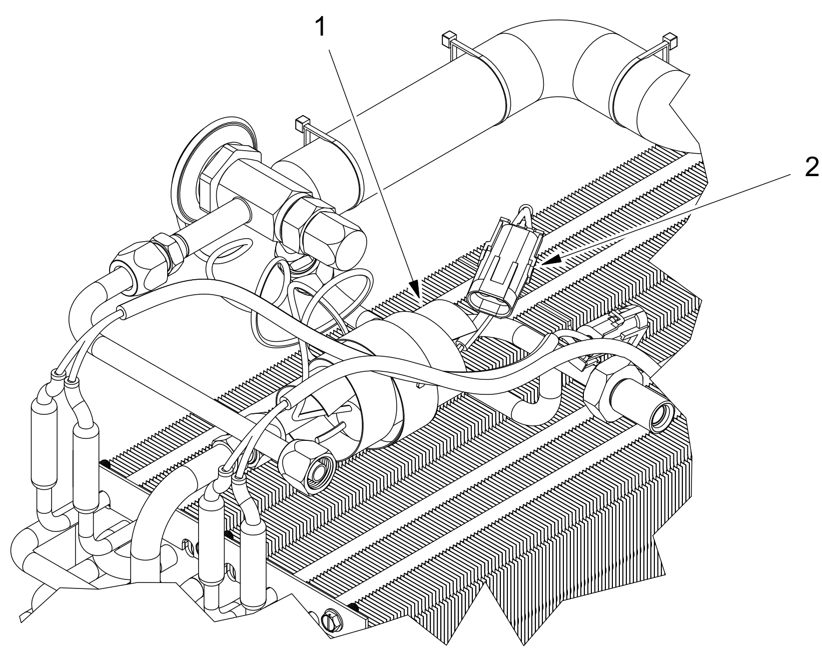



**Figure 1. Bullet Thermistor Connector P32.**

2. Measure the resistance between pins A and B on connector P23.

## TEST – CONTINUED

3. Measure the ambient temperature near the thermistor, in degrees F.
4. Compare the measured temperature and resistance to Table 1.

**Table 1. Thermistor Resistance versus Temperature.**

| (KΩ) | TEMP. (F) | (KΩ) | TEMP. (F) | (KΩ) | TEMP. (F) | (KΩ) | TEMP. (F) |
|---|---|---|---|---|---|---|---|
| 0.2 | 295 | 3.9 | 118 | 11.7 | 70 | 40 | 25 |
| 0.4 | 243 | 4.3 | 114 | 12.7 | 67 | 45.6 | 21 |
| 0.6 | 216 | 4.7 | 110 | 13.8 | 64 | 52.5 | 16 |
| 0.9 | 197 | 5.2 | 105 | 15 | 61 | 61.4 | 11 |
| 1.1 | 183 | 5.6 | 102 | 16.3 | 58 | 73.3 | 5 |
| 1.4 | 172 | 6.1 | 98 | 17.8 | 54 | 90 | -2 |
| 1.6 | 162 | 6.7 | 94 | 19.4 | 51 | 115 | -9 |
| 1.9 | 154 | 7.2 | 91 | 21.3 | 48 | 156.7 | -18 |
| 2.2 | 146 | 7.9 | 87 | 23.3 | 44 | 240 | -31 |
| 2.5 | 140 | 8.5 | 84 | 25.7 | 41 | 490 | -50 |
| 2.8 | 134 | 9.2 | 80 | 28.5 | 37 | | |
| 3.2 | 128 | 10 | 77 | 31.7 | 33 | | |
| 3.5 | 123 | 10.8 | 74 | 35.5 | 29 | | |

5. If the measured resistance is not within 5 degrees of the measured temperature, replace the bullet thermistor assembly (RT3) (this work package).
6. Connect P23 (Figure 1, Item 2) to J23 on wire harness W59.

## END OF TASK

## REMOVE

1. Disconnect bullet thermistor connector P23 (Figure 1, Item 2) from wire harness connector J23.
2. Remove cork tape (Figure 1, Item 1) around TXV bulb and bullet thermistor.
3. Loosen the screw (Figure 2, Item 1) securing the copper strap (Figure 2, Item 2) that holds the TXV sensing bulb and the bullet thermistor (Figure 2, Item 3) together.

**REMOVE – CONTINUED**

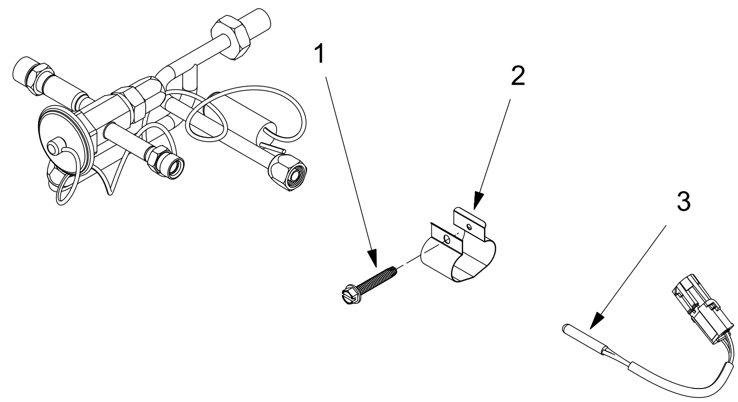



**Figure 2. Copper Strap Securing Bullet Thermistor.**

4. Remove bullet thermistor (RT3) (Figure 2, Item 3) from IECU.

**END OF TASK**

**REPLACE**

1. Remove thermistor (this work package).
2. Install replacement thermistor (this work package).

**END OF TASK**

**INSTALL**

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Loosen the screw (Figure 2, Item 1) securing the copper strap (Figure 2, Item 2) that holds the TXV sensing bulb and the thermistor.
2. Slide thermistor into copper strap (Figure 2, Item 2) and ensure that TXV bulb is contacting copper tubing and that TXV bulb is situated in a 4 or 8 o'clock position on tube (WP 0046).
3. Tighten the screw (Figure 2, Item 1) securing the copper strap (Figure 2, Item 2) that holds the TXV sensing bulb and the thermistor.
4. Connect thermistor connector P23 to wire harness connector J23.
5. Wrap subassembly in cork tape (Figure 1, Item 1).

## INSTALL – CONTINUED

6. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

Install the cover assembly (WP 0032).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## FRESH AIR SCREEN ASSEMBLY – SERVICE, REPLACE

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement fresh air screen assembly (WP 0076, Item 2)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0076
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

**SERVICE**

1. Remove two screws (Figure 1, Item 1) and remove fresh air screen (Figure 1, Item 2).

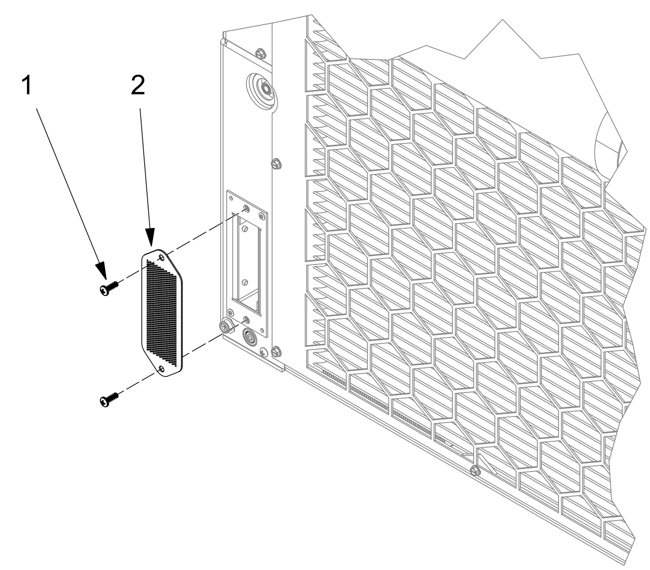



**Figure 1. Fresh Air Screen.**

2. Spray water onto screen to remove dust and debris.
3. Allow to air dry.
4. Install two screws (Figure 1, Item 1) securing fresh air screen.

**END OF TASK**

**REPLACE**

1. Remove two screws (Figure 1, Item 1) securing fresh air screen.
2. Remove fresh air screen (Figure 1, Item 2) from IECU.
3. Position replacement fresh air screen over the fresh air inlet opening.
4. Install two screws (Figure 1, Item 1) securing fresh air screen.

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

Return to service.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## SUPPLY GRILLE - REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Rivet Gun (SATS) (WP 0091, Table 2, Item 10)
Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement supply grille (WP 0077, Item 1)
Rivets (WP 0077, Item 3)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0077
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

### REMOVE

1. Drill out six rivets (Figure 1, Item 3) securing the supply grille (Figure 1, Item 1) to the IECU housing (Figure 1, Item 2).

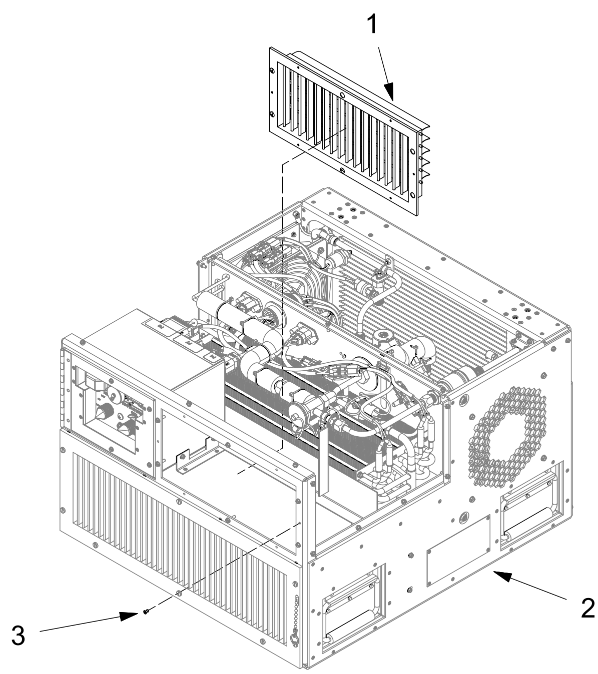



**Figure 1. Supply Grille Removal.**

2. Remove supply grille (Figure 1, Item 1).

**END OF TASK**

## REPLACE

1. Remove supply grille (this work package).
2. Install replacement supply grille (this work package).

**END OF TASK**

## INSTALL

1. Position the supply grille (Figure 1, Item 1) in place on the IECU housing (Figure 1, Item 2) and permanently install six new rivets (Figure 1, Item 3).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## FRESH AIR DUCT DOOR ASSEMBLY - REPLACE

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement fresh air duct door (WP 0077, Item 8)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0012
WP 0077
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Inlet air filter is removed (WP 0012)

### REPLACE

1. Remove ball chain end fitting (Figure 1, Item 7) and feed ball chain (Figure 1, Item 6) through fresh air keyway (Figure 1, Item 4).

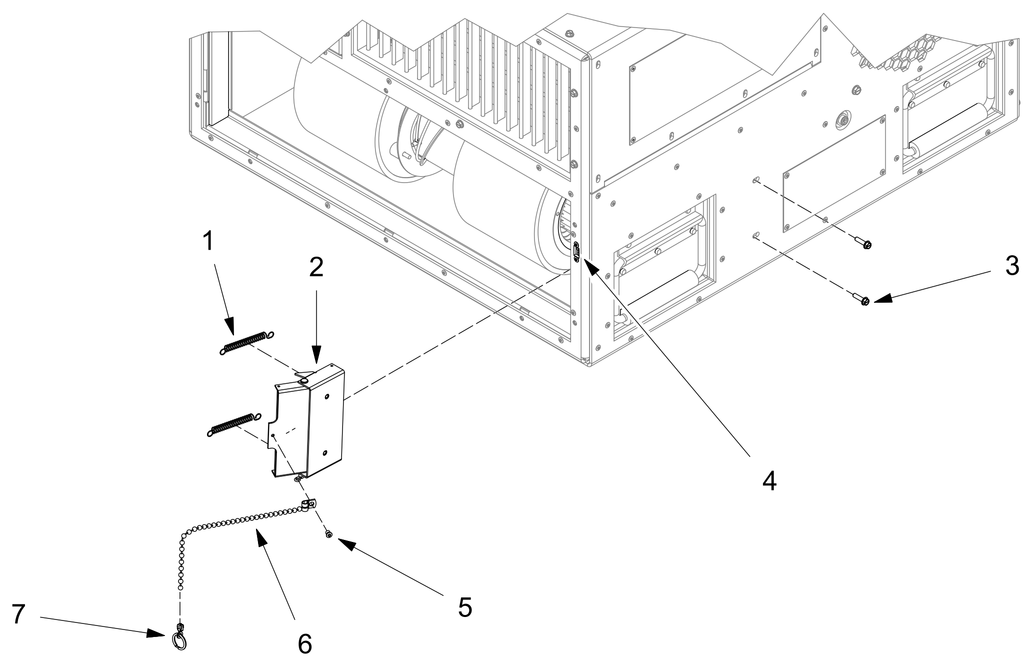



**Figure 1. Fresh Air Duct Door Assembly.**

2. Remove the two screws (Figure 1, Item 3) securing the fresh air duct door to the IECU sheet metal assembly.

## REPLACE – CONTINUED

3. Remove extension springs (Figure 1, Item 1) by pressing spring ends out of sheet metal mounting holes in fresh air duct door (Figure 1, Item 2) and fresh air duct mount.
4. Remove fresh air duct door assembly from IECU.
5. Install extension springs (Figure 1, Item 1) by inserting spring ends into sheet metal mounting holes in fresh air duct door (Figure 1, Item 2) and fresh air duct mount.
6. Position replacement fresh air duct door assembly onto sheet metal housing mounting inline with holes.
7. Insert two screws (Figure 1, Item 3) and install fresh air duct door assembly into IECU.
8. Feed ball chain (Figure 1, Item 6) through fresh air keyway (Figure 1, Item 4) in housing and add ball chain end fitting (Figure 1, Item 7) to end of chain.

## END OF TASK

## FOLLOW-ON MAINTENANCE

1. Install the inlet air filter (WP 0012).
2. Return to service.

## END OF TASK

## END OF WORK PACKAGE

## FIELD MAINTENANCE

## CONDENSATE TUBE - INSPECT, REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement condensate tube (WP 0078, Item 1)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0067
WP 0078
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### INSPECT

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Locate condensate drain hoses (there are 2 on the condenser side of the unit).
2. Lightly tug the connection point of each hose, checking for a secure fit.
3. Visually examine each hose for cuts, frays, clogs, or signs of wear.
4. Visually examine the floor of the unit for pooling water underneath each drain line, indicating a leak. If a leak is detected, replace hose (this work package).

**END OF TASK**

### REMOVE

1. Loosen hose clamps.
2. Reach into unit and pull drain hose off of barbed fittings.
3. If hose will not come loose, use a pair of pliers to grip the hose near the barbed fitting and use a twisting motion to pull the hose off.
4. Remove drain hose from unit.
5. Wipe the area dry of any spilled condensate water, including the barbed fittings.

**END OF TASK**

## REPLACE

1. Remove condensate drain hose (this work package).
2. Fabricate replacement drain hose (WP 0067).
3. Install replacement condensate drain hose (this work package).

**END OF TASK**

## INSTALL

1. Reach into unit, push each end of drain hose onto barbed fitting until secure.
2. Tighten hose clamps.

**END OF TASK**

## FOLLOW-ON MAINTENANCE

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## HEATER ASSEMBLY (HR2, HR3) - TEST, REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement heater assembly (HR2, HR3) (WP 0079, Item 1)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0032
WP 0079
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is removed (WP 0032)

### TEST

This is an electrical resistance test performed on the heater assemblies (HR2 and HR3) after they are disconnected from the electrical circuit. The heater assembly (HR2 or HR3) does not need to be removed from the evaporator, to perform this test.

1. Disconnect both connectors P20/21 (Figure 1, Item 2) on the heater assemblies and measure the resistance across pins A and B of both (FO-1 and FO-2).
2. If the resistance is not between 11.4 ohms and 12.6 ohms then replace the heater assembly (this work package).
3. Check for continuity between pin A on both the heater assembly connectors P20/21 and the external metallic surface of the heater assembly. If there is continuity, replace the heater assembly (HR2 or HR3) (this work package).
4. Check for continuity between pin B on both the heater assembly connectors P20/21 and the external metallic surface of the heater assembly. If there is continuity, replace the heater assembly (HR2 or HR3) (this work package).

**NOTE**

Connectors are interchangeable.

5. Connect heater assembly connectors P20/21 to connectors J20 and J21 on wire harness W21.

**TEST – CONTINUED**

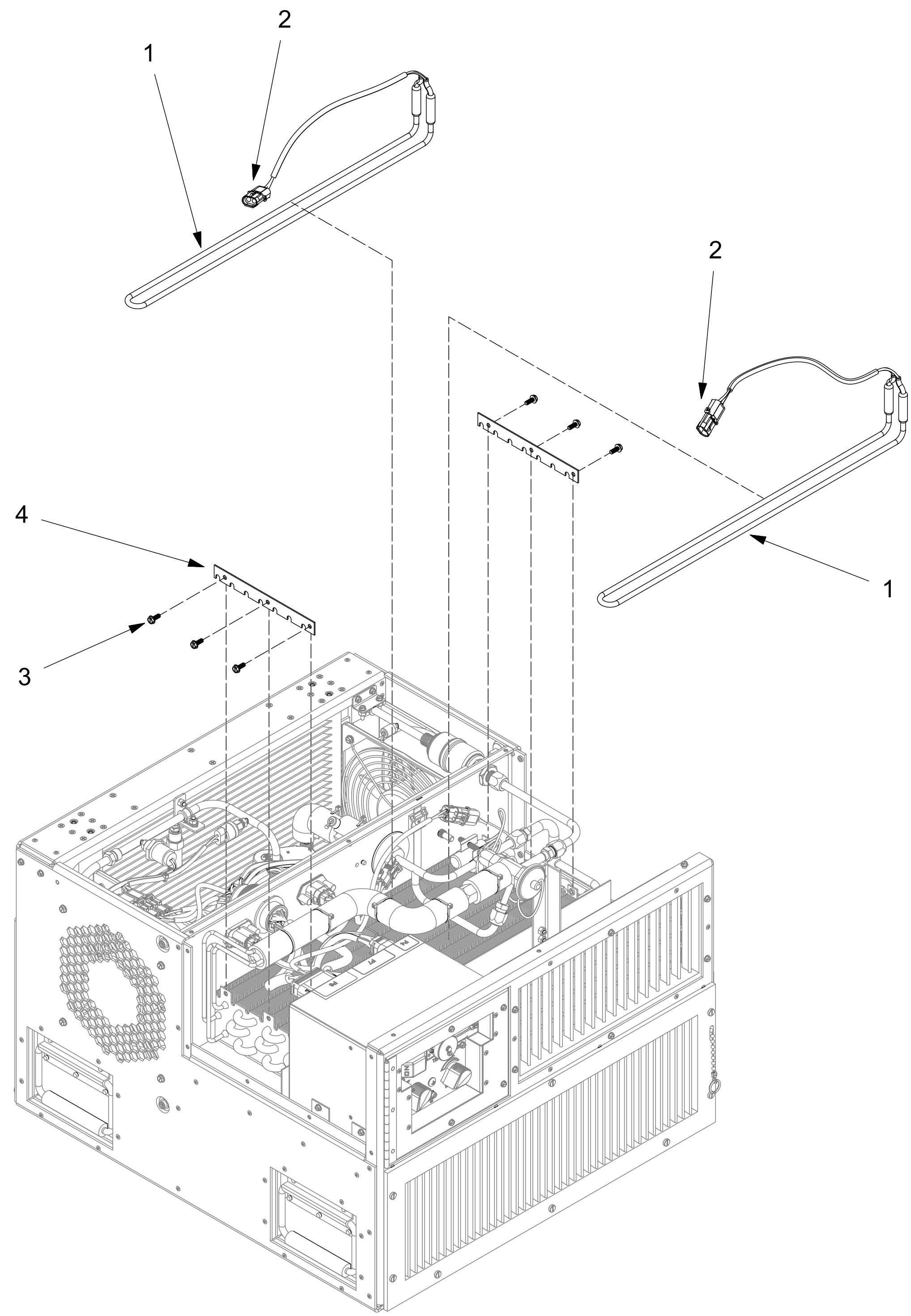



**Figure 1. Heater Assemblies.**

**END OF TASK**

## REMOVE

**WARNING**

High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**WARNING**

Coil fins are sharp. Wear gloves while handling a coil. Severe cuts can occur if hands are not protected.

**WARNING**

Heaters (elements) are hot and can cause serious personal injury. Make sure heater assemblies are cooled to ambient temperature before performing maintenance. Failure to comply can cause injury to personnel.

1. Disconnect electrical connector P20/21 (Figure 1, Item 2) of heater assembly (HR2 or HR3) wire harness (FO-1 and FO-2).

**NOTE**

- Heater assemblies (HR2 and HR3) are pressed in by hand and secured with a friction fit.
- If heater assembly (HR2 or HR3) cannot easily be removed from the evaporator by hand, lightly tap with hammer to free from evaporator.
- Evaporator coil has seven grooves (Figure 2, Item 2) cut into its fins. Heater assemblies (HR2 and HR3) are installed in groove pair 1 and 2 and pair 5 and 6 (counting from front of IECU toward bulkhead.

2. Remove six screws (Figure 2, Item 2) and two brackets (Figure 2, Item 1) securing heater assemblies.
3. Carefully remove heater assembly (Figure 1, Item 1) from groove in evaporator coil by hand.

## REMOVE – CONTINUED

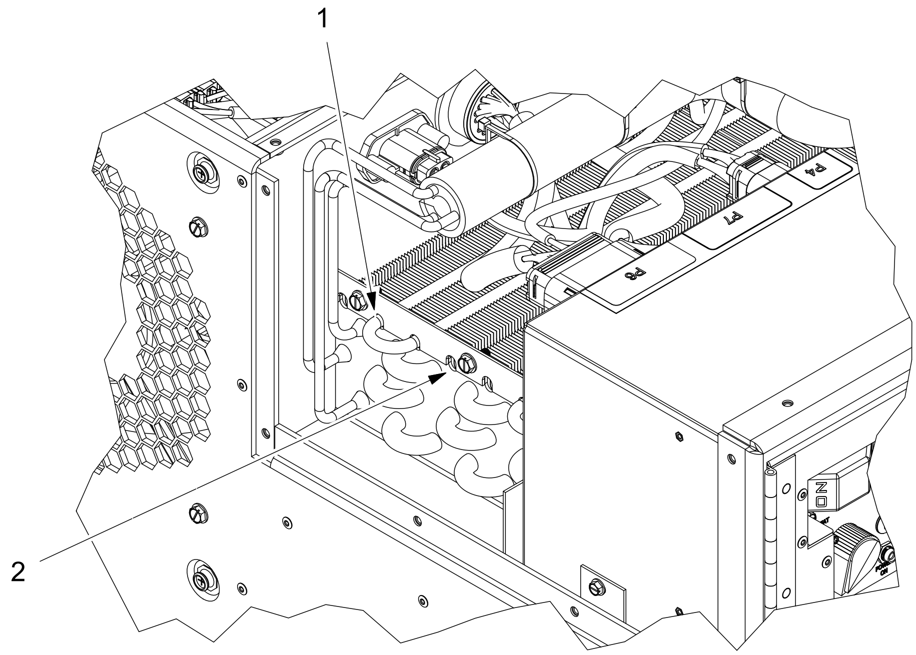



**Figure 2. Heater Installation.**

## END OF TASK

## REPLACE

1. Remove heater assembly (HR2 or HR3) (Figure 1, Item 1) (this work package).

2. Install replacement heater assembly (Figure 1, Item 1) (this work package).

## END OF TASK

## INSTALL

### NOTE

- Heater assemblies are pressed in by hand and secured with a friction fit.
- Evaporator coil has six grooves (Figure 1, Item 2) cut into its fins. Heater assemblies are installed in outboard pairs of grooves.

1. Firmly press heater assembly (Figure 1, Item 1) into evaporator grooves.

2. If heater assembly (Figure 1, Item 1) is not flush with evaporator fins, lightly tap along the length of the heater with a ball peen hammer until it is entirely installed.

3. If evaporator fins have been bent during installation of the heater assembly, straighten with fin comb.

4. Install two brackets (Figure 1, Item 4) and six screws (Figure 1, Item 3) securing heater assemblies.

**INSTALL – CONTINUED**

5. **NOTE**

   Connectors are interchangeable.

   Connect connector P20/21 (Figure 1, Item 2) of heater assembly (Figure 1, Item 1) to wire harness (FO-1 and FO-2).

6. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

Install the cover assembly (WP 0032).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## FILTER-DRIER - REPLACE

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

New Filter-Drier (WP 0080, Item 7)
Nylog (WP 0094, Table 1, Item 7)
New O-Rings (WP 0083, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

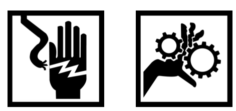
WP 0025
WP 0032

**Equipment Condition**

IECU is shut down (WP 0005)
Refrigeration system is prepared to be opened (WP 0025)
Cover assembly is removed (WP 0032)

### REPLACE

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**WARNING**

- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.
- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

**WARNING**

Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

**REPLACE – CONTINUED**

## WARNING

Coil fins are sharp. Wear gloves while handling a coil. Severe cuts can occur if hands are not protected.

1. Disassemble IMACA fittings (Figure 1 Items 1 and 3) from filter-drier (Figure 1, Item 2) (WP 0025).

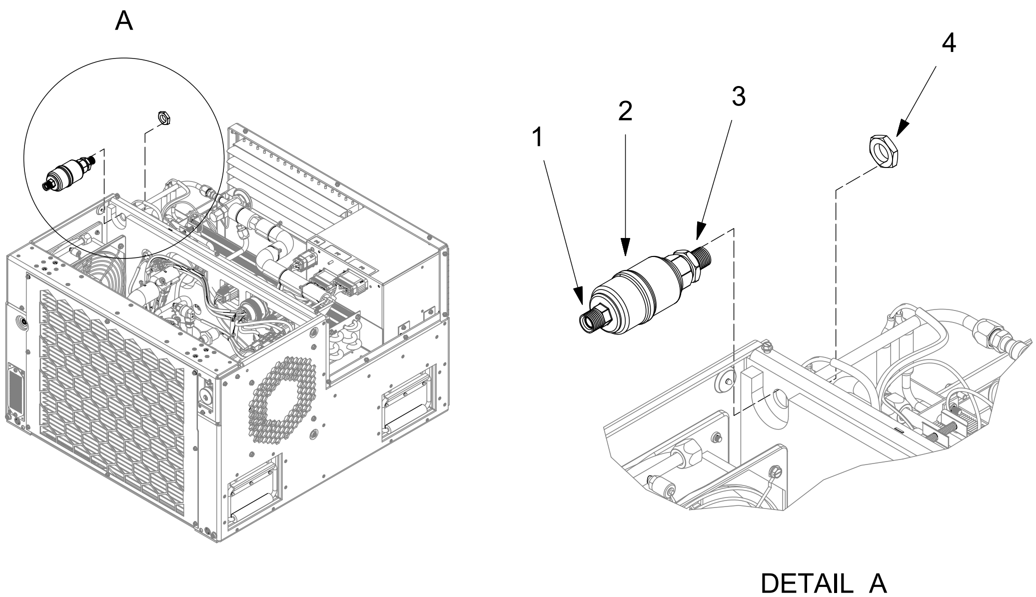



**Figure 1. Filter-Drier.**

2. Loosen nuts (Figure 2, Item 1) securing tube to liquid line tube bracket (Figure 2, Item 3).

**REPLACE – CONTINUED**

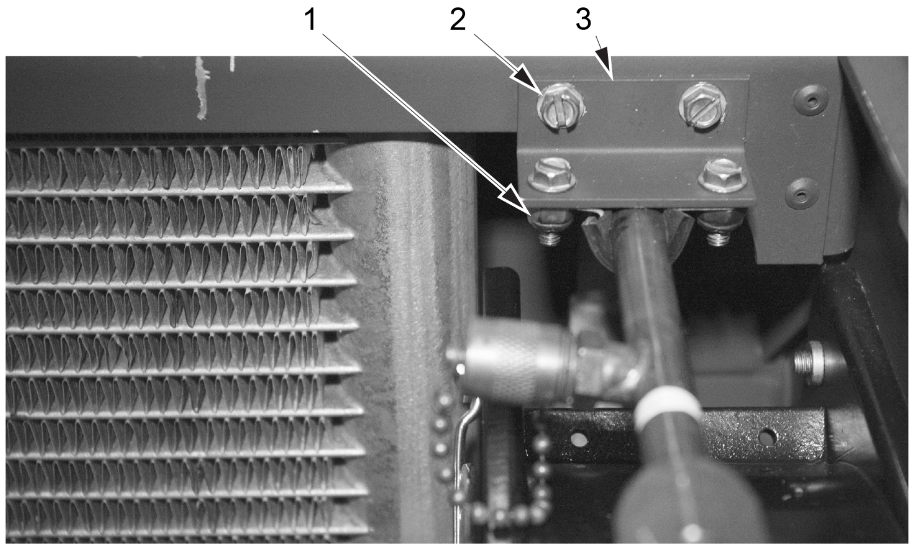



**Figure 2. Liquid Line Tube Support Bracket .**

3. Remove screws (Figure 2, Item 2) attaching liquid line tube bracket (Figure 2, Item 3).
4. Rotate liquid line tube bracket (Figure 2, Item 3) 180-degrees.
5. Gently slide pipe away from filter-drier (Figure 1, Item 2) so it does not obstruct movement of the filter-drier.
6. Remove jam nut (Figure 1, Item 4) on bulkhead on evaporator side of the housing, freeing the filter-drier from the bulkhead wall.
7. Remove filter-drier (Figure 1, Item 2) and discard old o-rings.

**NOTE**

Do not uncap new filter-drier until you have all tools required for this procedure and are ready to begin. Leaving the filter-drier uncapped for longer than a few minutes will render it useless.

8. Remove shipping caps from replacement filter-drier
9. Place filter-drier (Figure 1, Item 2) into position through bulkhead.
10. Install jam nut (Figure 1, Item 4) gasket side towards bulkhead wall. Do not tighten.
11. Assemble IMACA fittings (Figure 1, Item 1 and 3) to filter-drier and tighten to torque specification (WP 0025).
12. Tighten jam nut.
13. Rotate liquid line tube bracket (Figure 2, Item 3) 180-degrees back into original position.
14. Install screws (Figure 2, Item 2) securing liquid line tube bracket (Figure 2, Item 3).
15. Tighten nuts (Figure 2, Item 1) securing tube to liquid line tube bracket (Figure 2, Item 3).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

1. Prepare the system to be returned to service (WP 0025).
2. Install the cover assembly (WP 0032).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## COMPRESSOR BRAZING ASSEMBLY - TEST, REPAIR, REPLACE

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement compressor (WP 0080, Item 12)
Replacement over-current protector (WP 0080, Item 13)
Cable ties (WP 0082, Figure 12)
New lock nut (2) (WP 0080, Item 11)
New lock washer (4) (WP 0080, Item 15)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0025
WP 0038
WP 0053
WP 0055
WP 0064
WP 0080
WP 0091
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### TEST

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Disconnect the compressor wire harness from the soft start box by removing connector J14 from connector P14 (Figure 1, Item 1).

**TEST – CONTINUED**

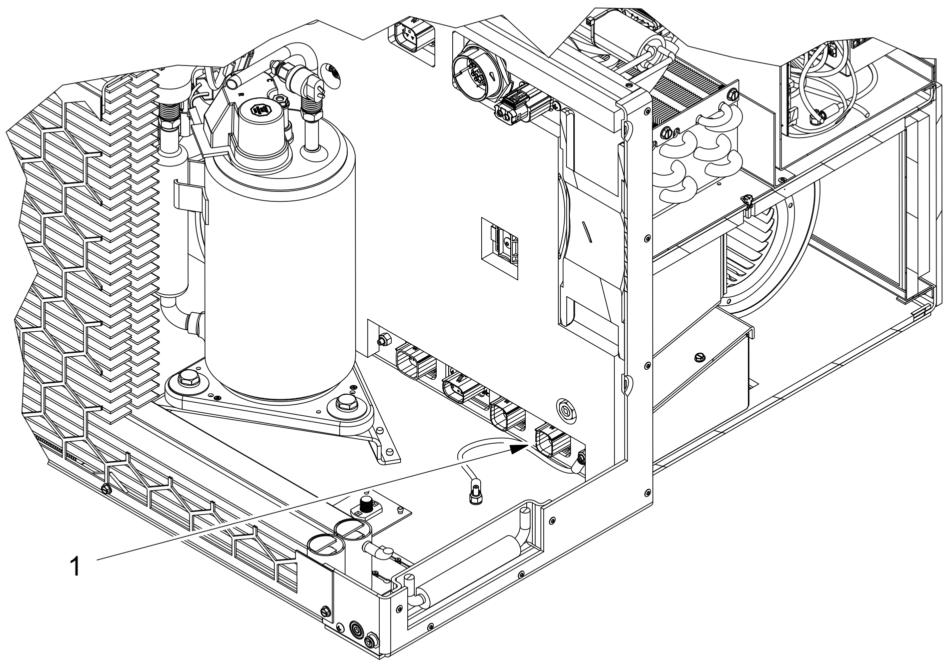



**Figure 1. Soft-start Cable Connections.**

## NOTE

The IECU ground stud GND2 may be used for a grounding location when performing resistance test measurements.

2. Check for electrical continuity between socket 1 of connector J14 and ground (WP 0064):
    a. If electrical continuity is found, continue to Step 3.
    b. If electrical continuity is not found, continue to Step 7.
3. Remove nut (Figure 2, Item 1) and compressor electrical terminal cover (Figure 2, Item 2) covering compressor terminals (Figure 2, Item 6).

**TEST – CONTINUED**

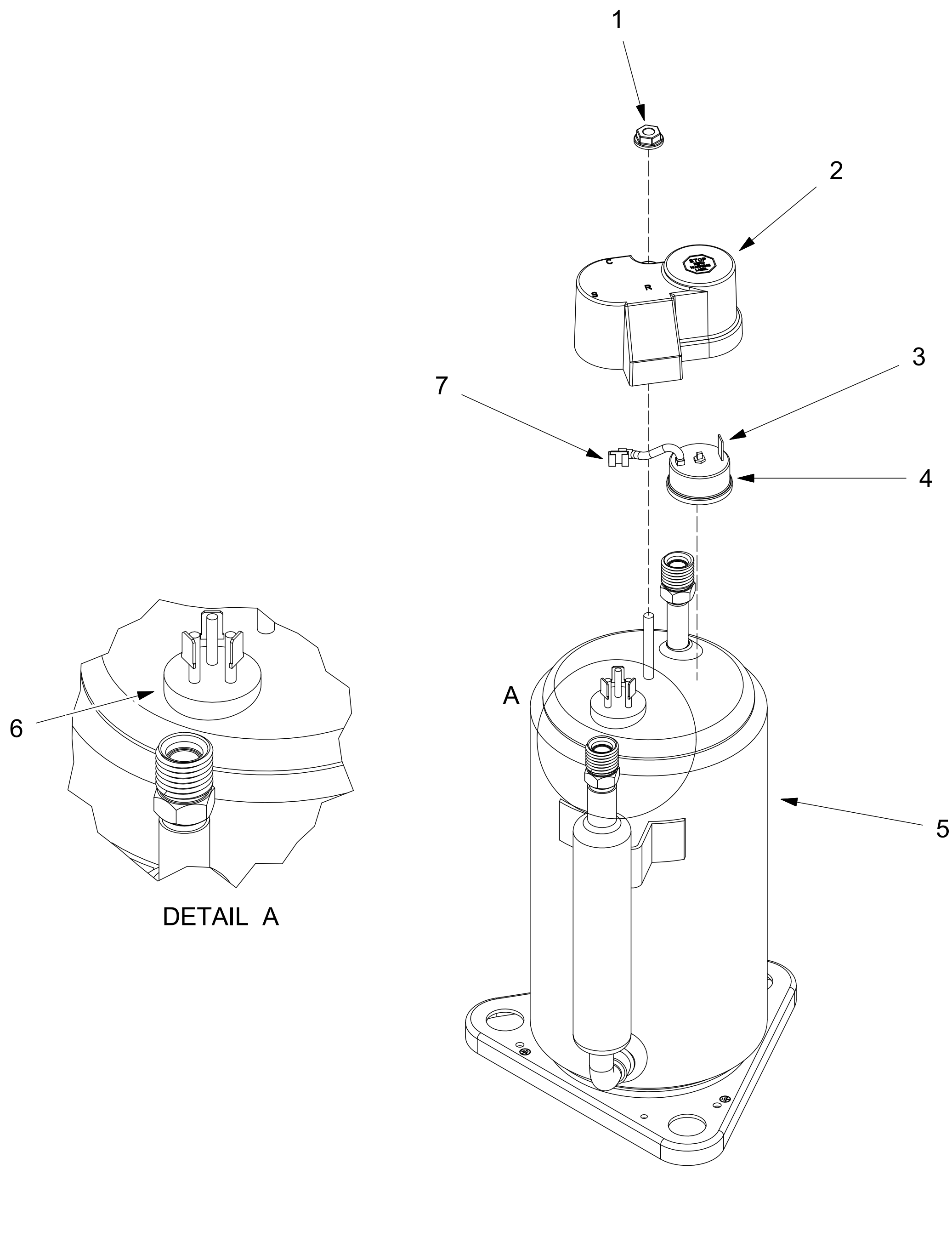



**Figure 2. Compressor Electrical Terminal Components.**

**TEST – CONTINUED**

4. Verify that wires are routed correctly and are mechanically sound.
5. Remove the wire harness from the compressor R terminal (Figure 3).

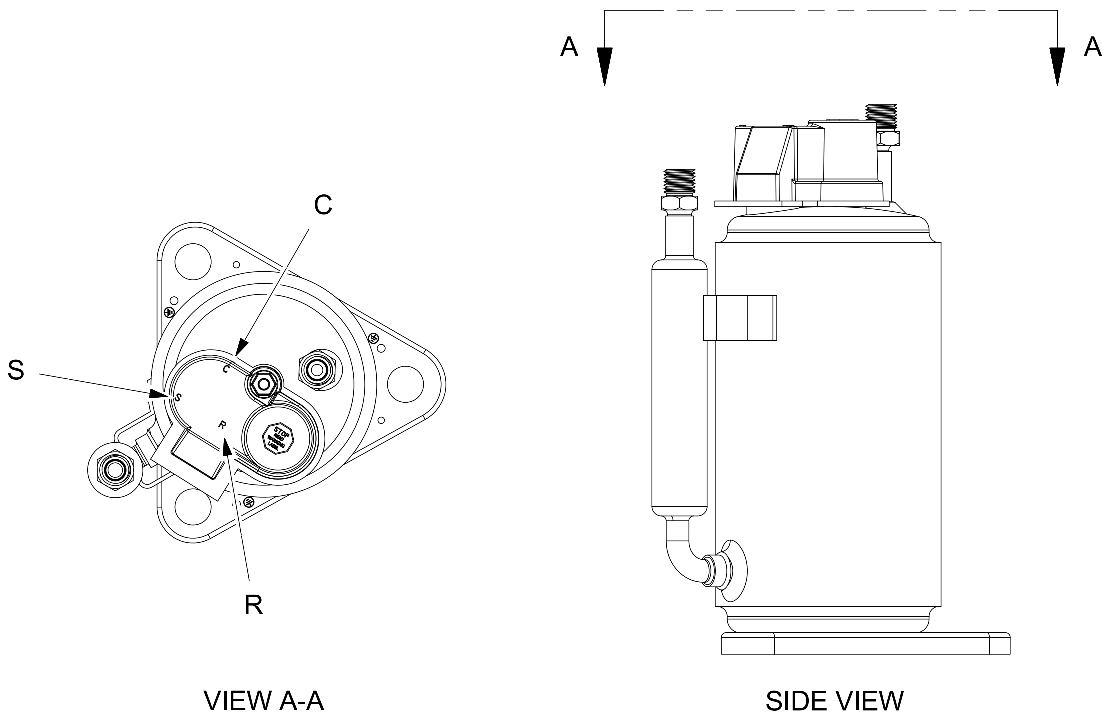



**Figure 3. Compressor C, R, and S Terminals.**

6. Check for electrical continuity between the compressor R terminal (Figure 3) and ground:
   a. If electrical continuity is found, replace the compressor (this work package).
   b. If no electrical continuity is found, replace wiring harness (W13) (WP 0038).
7. Check for electrical continuity between socket 2 of connector J14 and ground (WP 0064):
   a. If electrical continuity is found, continue to Step 8.
   b. If electrical continuity is not found, continue to Step 13.
8. Remove nut (Figure 2, Item 1) and compressor electrical terminal cover (Figure 2, Item 2) covering compressor terminals (Figure 2, Item 6).
9. Verify that wires are routed correctly and are mechanically sound.
10. Remove the wire harness from the compressor C terminal (Figure 3).
11. Check for electrical continuity between the compressor C terminal (Figure 3) and ground:
    a. If electrical continuity is found, replace the compressor (this work package).
    b. If no electrical continuity is found, replace wiring harness (W13) (WP 0038).

**TEST – CONTINUED**

12. Check for electrical continuity between the input terminal of the over-current protector (Figure 2, Item 4) and ground:
    a. If electrical continuity is found, follow repair procedure to replace the over-current protector (this work package).
    b. If no electrical continuity is found, replace wiring harness (W13) (WP 0038).
13. Check for electrical continuity between socket 3 of connector J14 and ground (WP 0064):
    a. If electrical continuity is found continue to Step 14.
    b. If electrical continuity is not found continue to Step 18.
14. Remove nut (Figure 2, Item 1) and compressor electrical terminal cover (Figure 2, Item 2) covering compressor terminals (Figure 2, Item 6).
15. Verify that wires are routed correctly and are mechanically sound.
16. Remove the wire harness from the compressor S terminal (Figure 3).
17. Check for electrical continuity between the compressor S terminal (Figure 3) and ground:
    a. If electrical continuity is found, replace the compressor (this work package).
    b. If no electrical continuity is found, replace wiring harness (W13) (WP 0038).
18. Measure the electrical resistance between socket 2 and socket 3 of connector J14 (WP 0064):
    a. If the measured resistance is less than 3.1Ω or an open circuit condition exists continue to Step 19.
    b. If the measured resistance is greater than 3.1Ω and an open circuit condition does not exist continue to Step 22.
19. Remove the wire harness from the compressor C, S, and R wire terminals (Figure 3).
20. Measure the electrical resistance between compressor terminals C and S:
    a. If the measured resistance is less than 3.1Ω or an open circuit condition exists, replace the compressor (this work package).
    b. If the measured resistance is 3.1Ω or higher and an open circuit condition does not exist, follow repair procedure to replace the over-current protector (this work package).
21. Reconnect wires to S, R, and C terminals of compressor.
22. Measure the electrical resistance between socket 1 and socket 3 of connector J14 (WP 0064). The minimum resistance measured should be 3.63Ω:
    a. If the measured resistance is less than 3.6Ω or an open circuit condition exists, replace the compressor (this work package).
    b. If the measured resistance is 3.6Ω or higher and an open circuit condition does not exist continue to Step 23.
23. Measure the electrical resistance between socket 1 and socket 2 of connector J14 (WP 0064):
    a. If the measured resistance is less than .5Ω or an open circuit condition exists, replace the compressor (this work package).
24. Reconnect all disconnected wires.
25. Install compressor electrical terminal cover.

**END OF TASK**

## REPAIR

### WARNING

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove the hex nut (Figure 2, Item 1) securing the compressor electrical terminal cover (Figure 2, Item 2) to the compressor (Figure 2, Item 5).
2. Remove nut (Figure 4, Item 2) and compressor electrical terminal cover (Figure 4, Item 1) covering compressor terminals (Figure 2, Item 6).
3. Remove over-current protector wire connector (Figure 2, Item 7) from compressor C terminal (Figure 3).
4. Remove the black wire (F1) on wire harness (W13) from the compressor over-current protector spade terminal (Figure 2, Item 3).
5. Remove the over-current protector (Figure 2, Item 4) (Figure 4, Item 14).
6. Position replacement over-current protector (Figure 2, Item 4) on the compressor (Figure 2, Item 5).
7. Install the black wire (F1) on wire harness (W13) onto the spade terminal (Figure 2, Item 3) on the over-current protector (Figure 2, Item 4).
8. Install the over-current protector wire connector (Figure 2, Item 7) onto compressor terminal C (Figure 3).
9. Position compressor electrical cover (Figure 2, Item 2) onto threaded stud, making sure to feed wires under cover pass-through.
10. Install hex nut (Figure 2, Item 1) onto threaded stud.

**END OF TASK**

## REPLACE

### WARNING

High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

### WARNING

- Never pressurize refrigerant lines with oxygen gas; mixture with oil could cause an explosion. Failure to comply can cause injury to personnel.

**REPLACE – CONTINUED**

- The pressure in a nitrogen cylinder can exceed 2,000 PSI (13,790 kPa). A nitrogen pressure regulator must be used to limit pressure to 700 PSI (4,826.5 kPa). Failure to comply can cause injury to personnel.

**WARNING**

Nitrogen is an inert gas that can cause suffocation and must be discharged in well-ventilated area. Failure to comply can cause injury to personnel.

1. Prepare the refrigeration system to be opened (WP 0025).
2. Disconnect the compressor wire harness from the soft start box by removing connector J14 from connector P14 (Figure 1, Item 1).
3. Remove compressor “U” bolt (Figure 4, Item 6).
4. Release the compressor wire harness (W13) from the cable tie strap on the bulkhead wall by depressing the button on the strap and pulling the strap back through the locking mechanism.
5. Remove three bolts (Figure 4, Item 11), lock washers (Figure 4, Item 10), and flat washers (Figure 4, Item 9) securing compressor (Figure 2, Item 5) to compressor mounting bracket in base of IECU housing.
6. Disassemble the IMACA fitting on the compressor discharge port (Figure 4, Item 4) (WP 0025).
7. Disassemble the IMACA fitting on the compressor suction port (Figure 4, Item 8) (WP 0025).
8. Disassemble the IMACA fitting from compressor to bulkhead wall tubing at bulkhead wall (WP 0025). Set tubing aside.
9. Disconnect connector P31 from connector J31 and connector P38 from connector J38.
10. Disconnect crankcase heater ground from ground stud.
11. Disconnect ground wire from compressor.

**CAUTION**

Carefully remove compressor to avoid damage to equipment.

12. Lift and remove compressor.
13. Remove the crankcase heater (WP 0055). Then, remove terminal cover and disconnect compressor wiring harness by removing F1, R, and S.
14. Obtain replacement compressor, leave all shipping caps on the compressor fittings to prevent air and moisture from entering the compressor.

**REPLACE – CONTINUED**

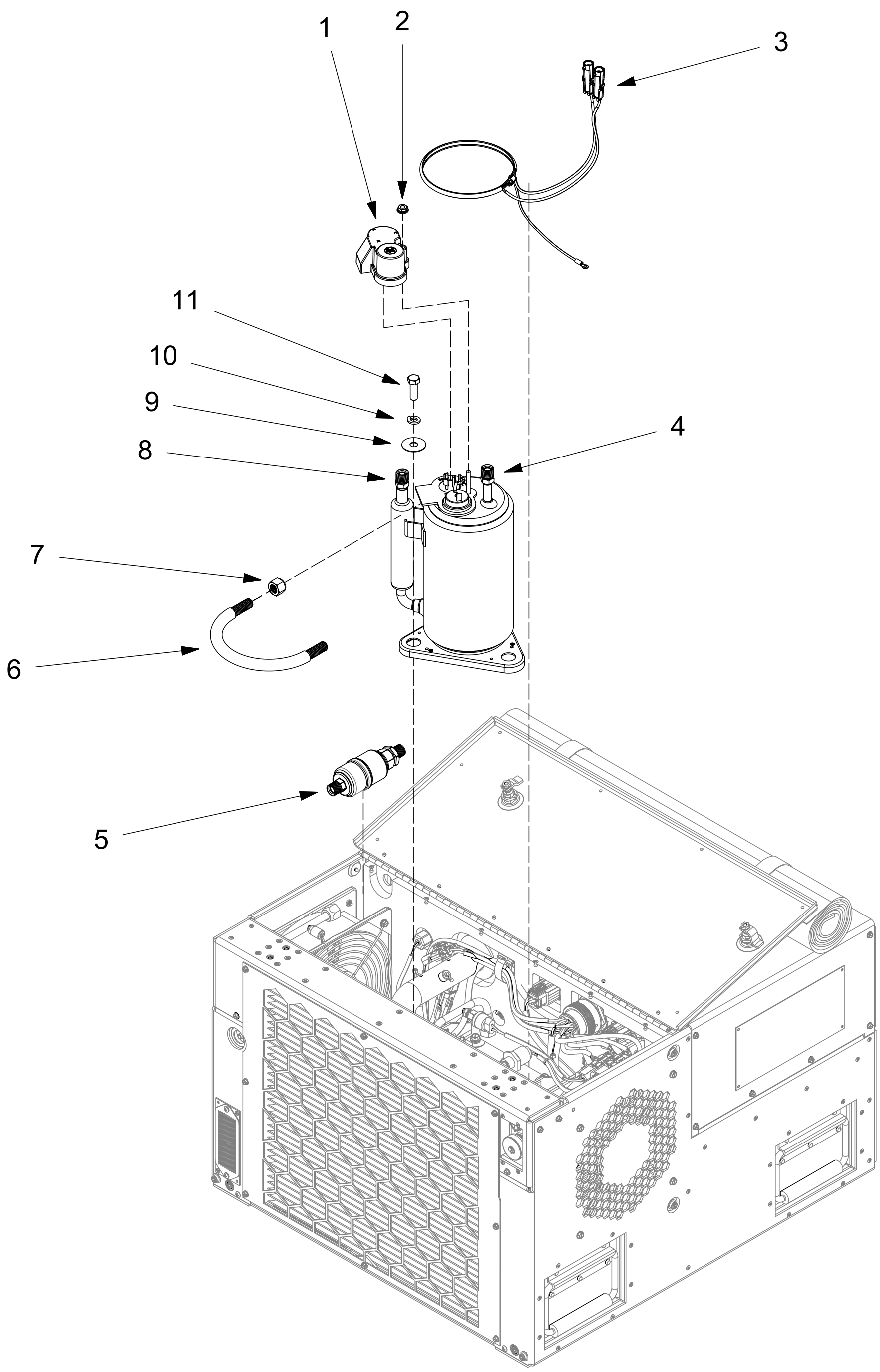



**Figure 4. Compressor.**

**REPLACE – CONTINUED**

15. Install the crankcase heater (Figure 4, Item 3) (WP 0055). Then, connect compressor wiring harness by connecting F1, R, and S (Figure 3) (FO-2, Sheet 2) and install terminal cover.
16. Place replacement compressor (Figure 2, Item 5) into position on compressor mounting bracket.
17. Remove shipping cap from compressor suction fitting (Figure 4, Item 9).

**NOTE**

Replace and lubricate o-rings (WP 0025).

18. Loosely assemble the IMACA fitting on the compressor suction port (Figure 4, Item 8) (WP 0025).
19. Remove shipping cap from compressor discharge fitting (Figure 4, Item 4).
20. Loosely assemble IMACA fittings at bulkhead wall.
21. Connect connector P31 to connector J31 and connector P38 to connector J38.
22. Connect crankcase heater ground connector to ground stud.
23. Loosely assemble the IMACA fitting on the compressor discharge port (Figure 4, Item 4) (WP 0025).
24. Connect the J14 connector to P14 on the compressor wire harness (W13).
25. Re-bundle wire harness (W13) along the bulkhead wall. Tighten the cable tie straps by feeding the strap back through the locking mechanism and pulling it until the cable harnesses are snug against the bulkhead wall.
26. Connect ground wire to compressor.
27. Install three bolts (Figure 4, Item 11), lock washers (Figure 4, Item 10), and flat washers (Figure 4, Item 9) securing compressor to compressor mounting bracket. Hand-tighten each bolt, and then turn each bolt an additional three turns clockwise with a wrench.
28. Disconnect connector J10 from connector P10.
29. Install compressor brazing assembly “U” bolt (Figure 4, Item 6) and lock nuts (Figure 4, Item 7).
30. Connect connector J10 to connector P10.
31. Torque all IMACA fittings (WP 0025, Table 1).
32. Replace filter-drier (Figure 4, Item 5) (WP 0053).
33. Prepare the refrigeration system to be returned to service (WP 0025).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

1. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.
2. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## CRANKCASE HEATER ASSEMBLY (HR1) - TEST, REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement crankcase heater (HR1) (WP 0080, Item 1)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0080
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### TEST

1. Disconnect connector P31 (Figure 1, Item 4) on the crankcase heater (HR1) (Figure 1, Item 1) from connector J31 on wire harness W1.

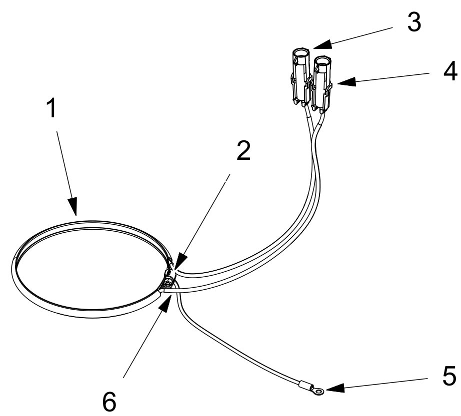


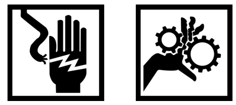

**Figure 1. Crankcase Heater (HR1).**

2. Disconnect connector P38 (Figure 1, Item 3) on the crankcase heater (HR1) (Figure 1, Item 1) from connector J38 on wire harness W1.
3. Measure the resistance across pins P31 and P38, if it is less than 324 ohms or greater than 396 ohms, replace the crankcase heater (HR1) (this work package). If it is in range, proceed to next step.
4. Reconnect connector P31 on the crankcase heater (HR1) to connector J31 on wire harness W1.
5. Reconnect connector P38 on the crankcase heater (HR1) to connector J38 on wire harness W1.

**END OF TASK**

## REMOVE

### WARNING



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

### NOTE

The crankcase heater (HR1) is located at the base of the compressor (Figure 2).

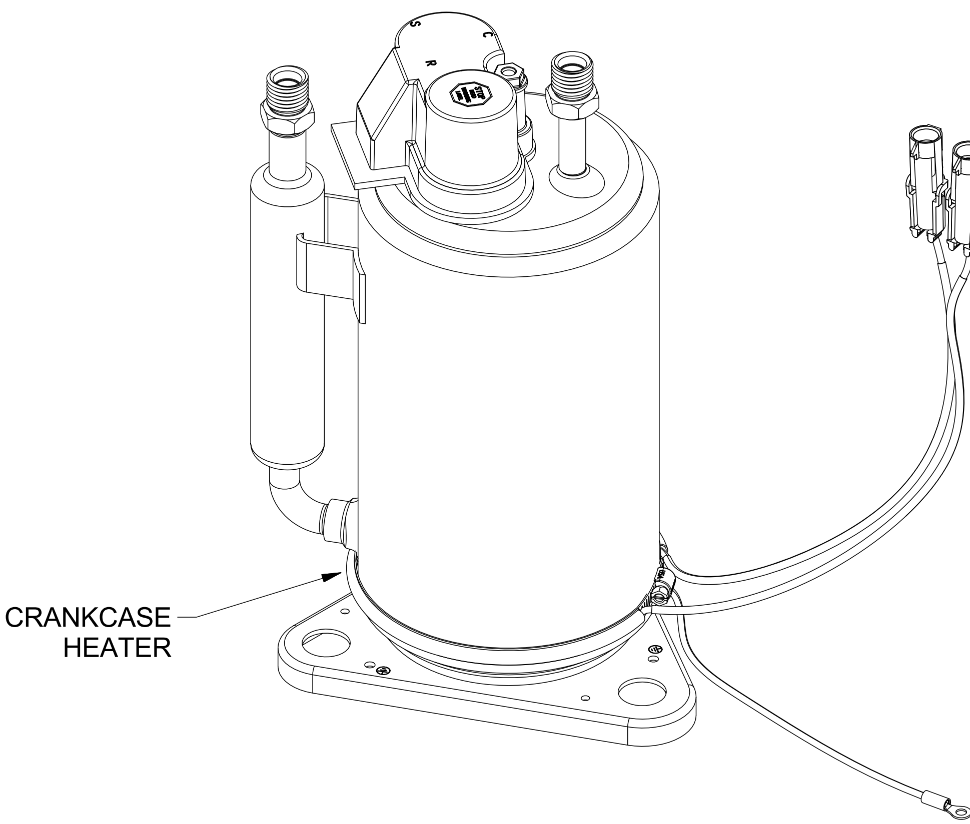



**Figure 2. Crankcase Heater (HR1) Location.**

1. Disconnect electrical connectors P38 (Figure 1, Item 3) and P31 (Figure 1, Item 4) of crankcase heater (HR1) (Figure 1, Item 1) from J38 and J31 on wire harness W1.
2. Remove nut on ground post GND2 and disconnect ground lug (Figure 1, Item 5).
3. Back out clamp screw (Figure 1, Item 6) until clamp (Figure 1, Item 2) separates.
4. Further separate the crankcase heater clamp ends and remove crankcase heater (HR1) (Figure 1, Item 1).

**END OF TASK**

**REPLACE**

1. Remove crankcase heater (Figure 2) (this work package).
2. Install replacement crankcase heater (Figure 2) (this work package).

**END OF TASK**

**INSTALL**

1. Wrap crankcase heater (Figure 1, Item 1) around base of compressor approximately 0.5" (Figure 2) above the compressor mounting plate. Make sure that the heater wraps flush around the compressor can, avoiding welds and surface irregularities as much as possible.
2. Engage clamp screw (Figure 1, Item 6) and tighten clamp (Figure 1, Item 2).
3. Connect ground lug (Figure 1, Item 5) and install nut on ground post.
4. Connect crankcase heater (HR1) wire harness electrical connectors P38 (Figure 1, Item 3) and P31 (Figure 1, Item 4) to J38 and J31 on wire harness W1.
5. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## CONDENSER FAN ASSEMBLY (B3, B4) – INSPECT, REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement condenser fan (WP 0081, Item 4)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0035
WP 0057
WP 0063
WP 0081
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### INSPECT

1. Visually inspect the condenser fans (Figure 1, Item 4) for:
   a. Loose, frayed, or severed wire harness or broken connector.
   b. Cracked or bent housings.
   c. Cracked, bent, or missing fan blades.
2. If any of the conditions listed in Step 1 are present, replace the fan (this work package).
3. Spin the fan blade and:
   a. Look for excessive run-out.
   b. Feel for unusual resistance in the bearings
   c. Feel for unusual axial play in the rotor hub
   d. Listen for the sound of debris that could be trapped in the rotor bearing
4. If any of the conditions listed in Step 3 are present, replace the fan (this work package).

## INSPECT – CONTINUED

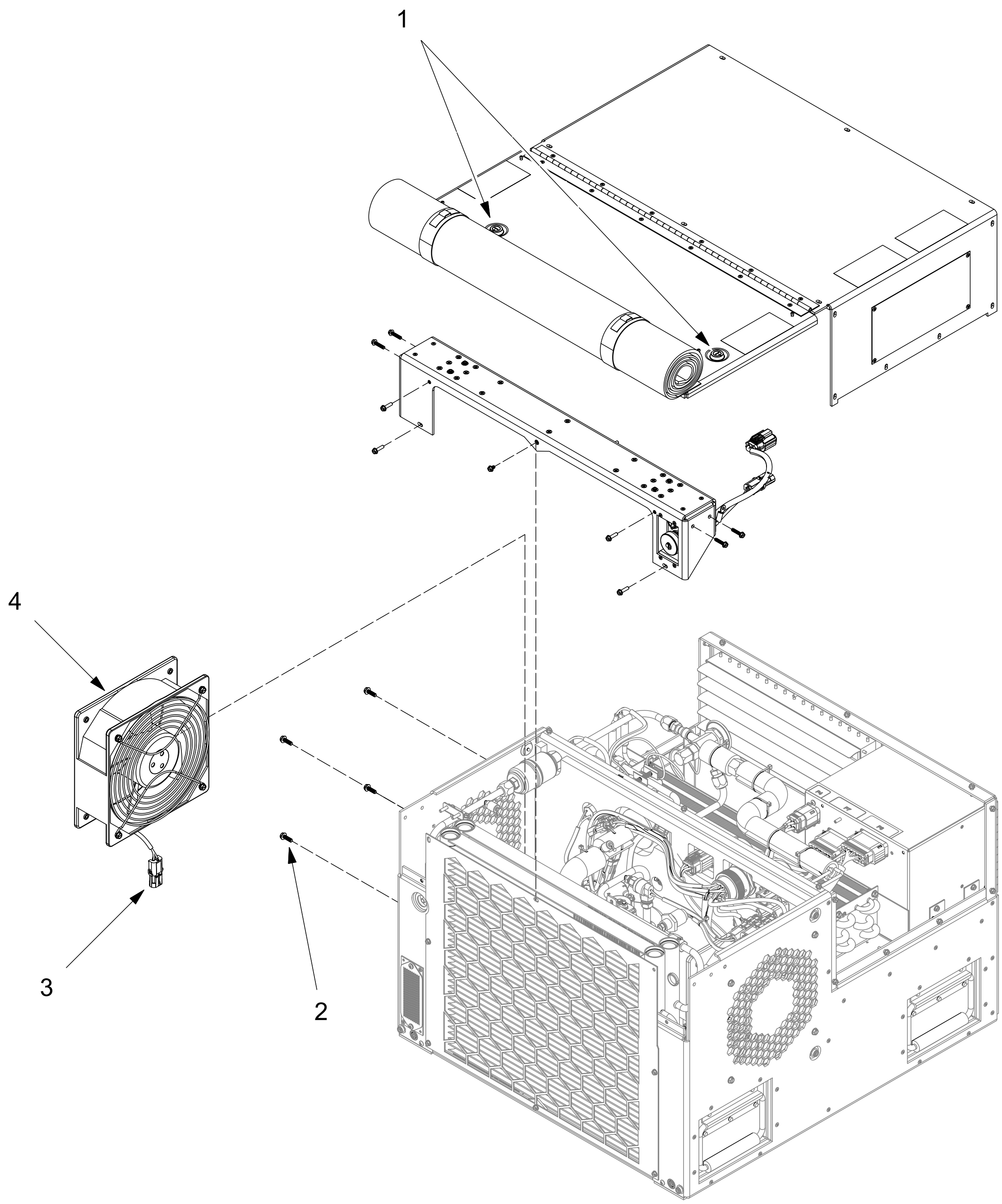
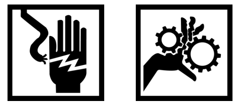



Figure 1. Condenser Fan Removal.

**END OF TASK**

**REMOVE**

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**WARNING**

After unit has been operating, the refrigeration tubing can become quite hot. Allow tubing to cool since hot surfaces can burn skin. Failure to do so may result in serious injury to personnel.

1. Disconnect the appropriate condenser fan connector (Figure 1, Item 3) (P32/33) from wire harness (J32 or J33).
2. Remove the bridge plate (WP 0035) or condenser coil (WP 0057) as necessary.
3. Remove thermistor (RT2) (WP 0063) as necessary.
4. Remove the four screws (Figure 1, Item 2) that secure the condenser fan to the sheet metal assembly.
5. Navigate condenser fan (Figure 1, Item 4) around other components and remove from unit.

**END OF TASK**

**REPLACE**

1. Remove condenser fan (this work package).
2. Install replacement condenser fan (this work package).

**END OF TASK**

**INSTALL**

1. Position condenser fan assembly (Figure 1, Item 4) into sheet metal cutout.
2. Insert four condenser fan mounting screws (Figure 1, Item 2) into sheet metal housing and hand thread them into the condenser fan.
3. Tighten four screws (Figure 1, Item 2) that secure the condenser fan to sheet metal base (Figure 1, Item 2).
4. Install thermistor (RT2) (WP 0063) if removed.
5. Install the bridge plate assembly (WP 0035) or condenser coil (WP 0057) if removed.
6. Connect the appropriate condenser fan connector (P32/33) (Figure 1, Item 3) to wire harness (J32 or J33).

## INSTALL – CONTINUED

7. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

## END OF TASK

## FOLLOW-ON MAINTENANCE

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

## END OF TASK

## END OF WORK PACKAGE

## FIELD MAINTENANCE

## CONDENSER BRAZING ASSEMBLY - INSPECT, SERVICE, REMOVE, REPAIR, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Took Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement condenser brazing assembly (WP 0081, Item 7)
Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)
Cleaner, coil (WP 0094, Table 1, Item 4)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0025
WP 0029
WP 0035
WP 0036
WP 0081
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### INSPECT

1. Visually inspect the condenser coil (Figure 2, Item 3) for excessive dust, dirt, or debris on both faces of the condenser. If necessary, service the condenser coil (this work package).
2. Visually inspect the condenser coil for the following:
   a. Oil residue (possible leak) at the inlet and outlet IMACA refrigerant fittings (Figure 2, Item 2 and 4), perform a refrigerant leak check (WP 0029).
   b. Bent fins or extrusions, repair condenser coil (this work package).
   c. Cracked tubes or cracked manifold, replace condenser coil (this work package).
   d. Kinks in the condenser inlet or outlet tube, replace condenser coil (this work package).

**END OF TASK**

### SERVICE

**WARNING**

Coil fins are sharp. Wear gloves while handling a coil. Severe cuts can occur if hands are not protected.

1. Verify both condenser fans are free to rotate and that there are no obstructions in the condenser air flow path.

**SERVICE – CONTINUED**

2. Verify the interior of the condenser section is clean and does not contain dirt, debris, or other contaminants. Vacuum out the condenser section if necessary.
3. Verify the condenser section weep holes (Figure 1) are clear and unobstructed.

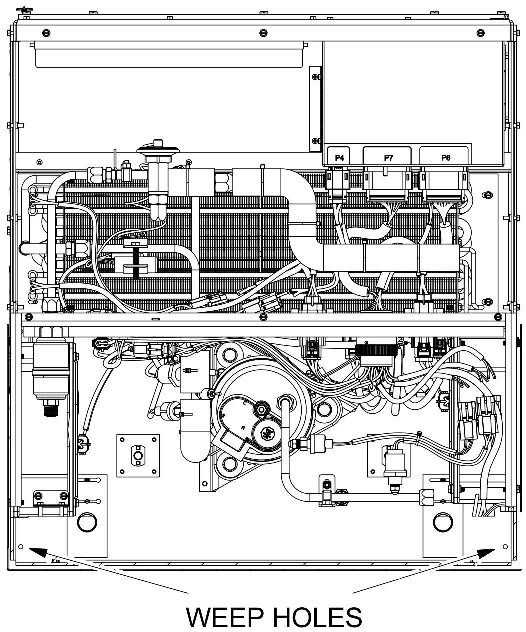
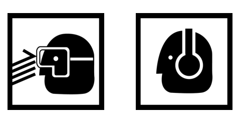



**Figure 1. Condenser Section Weep Holes.**

4. Prepare a commercial foaming coil cleaner and apply to condenser fins from both the outside and inside surfaces of the condenser coil.

## WARNING



If low pressure air is used to clean condenser coils, wear approved safety glasses and hearing protection. Do not use low pressure air if other personnel are in the area. Failure to comply can cause injury to personnel.

## NOTE

Direct compressed air or nitrogen stream through the condenser (Figure 2, Item 3) from inside the IECU toward the outside.

5. Using a nitrogen source with a pressure regulator set to 10 PSI or a compressed air source, blow any contaminates, dirt and water through the condenser coil.

SERVICE – CONTINUED

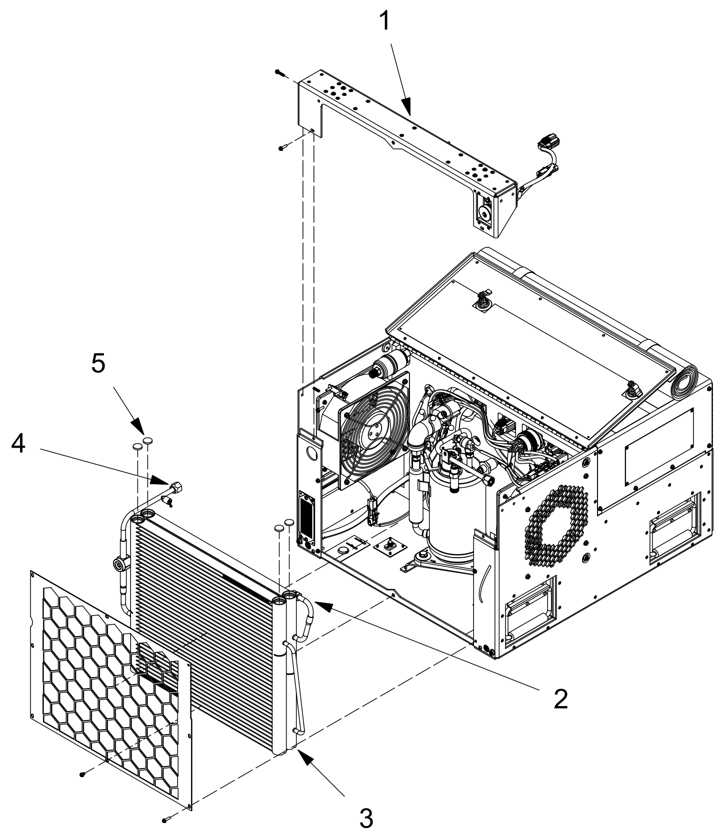


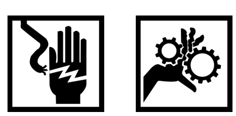

Figure 2.  Condenser Components.

6. Using a nitrogen source with a pressure regulator set to 10 PSI or a compressed air source, clear the condenser section weep holes (Figure 1) of any obstructions.
7. Rinse the condenser with clear water.

END OF TASK

REMOVE

WARNING



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

**REMOVE – CONTINUED**

## WARNING

After unit has been operating, the refrigeration tubing can become quite hot. Allow tubing to cool since hot surfaces can burn skin. Failure to do so may result in serious injury to personnel.

## NOTE

Remove and retain four condenser bushings (Figure 2, Item 5) when removing bridge plate assembly (Figure 2, Item 1).

1. Remove bridge plate assembly (WP 0035).
2. Prepare the refrigeration system to be opened (WP 0025).
3. Disassemble the IMACA fitting number 2 (Figure 2, Item 2) (Figure 3) (WP 0025).

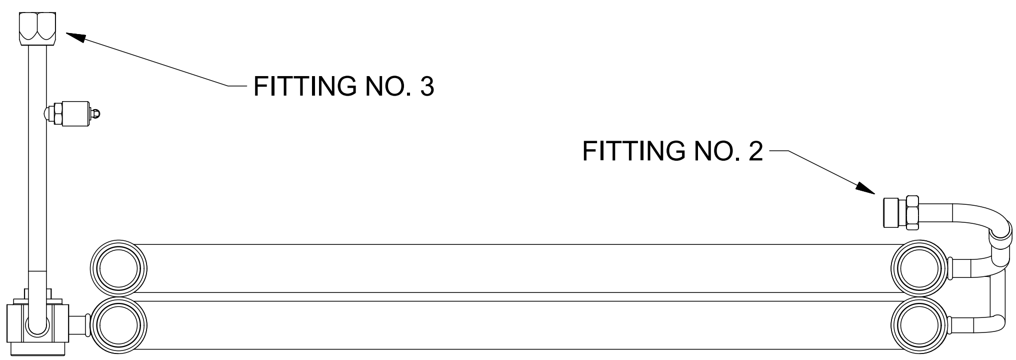



**Figure 3. Top View Condenser IMACA fittings.**

4. Disassemble the IMACA fitting number 3 (Figure 2, Item 4) (Figure 3) (WP 0025).
5. Lift and remove condenser coil (Figure 2, Item 3) from unit.

**END OF TASK**

**REPAIR**

**Repair Damaged Internal Condenser Fins**

1. Unlock two quarter-turn latches on cover assembly and open.
2. Repair damaged fins by re-aligning them with the properly sized fin comb.
3. Insert the fin comb into the finned surface at a location where the fins are properly aligned. While applying slight pressure, slowly pull the fin comb through the damaged fins until they are aligned.
4. If the fins are crushed severely, a utility knife may be required to individually bend the fins back into alignment.

## REPAIR – CONTINUED

### Repair Damaged External Facing Condenser Fins

1. Remove the condenser grille (WP 0036).
2. Repair damaged fins by re-aligning them with the properly sized fin comb.
3. Insert the fin comb into the finned surface at a location where the fins are properly aligned. While applying slight pressure, slowly pull the fin comb through the damaged fins until they are aligned.
4. If the fins are crushed severely, a utility knife may be required to individually bend the fins back into alignment.
5. Install the condenser grille (WP 0036).

### Replace Sight Glass Indicator Paper

1. Remove condenser coil (this work package)
2. The moisture indicator must be unthreaded from the back of the sight glass. Secure the sight glass body with a wrench. Using another wrench remove the moisture indicator cylinder from the sight glass.
3. Install new moisture indicator into the back of the sight glass, threading it by hand until hand tight.
4. Secure the sight glass body with a wrench. Tighten the indicator with a socket and torque wrench. The indicator should be tightened to 17 ft-lbs.
5. Install condenser coil (this work package)

**END OF TASK**

## REPLACE

1. Remove condenser coil (this work package).
2. Install replacement condenser coil (this work package).

**END OF TASK**

## INSTALL

1. Place condenser coil (Figure 2, Item 3) into unit. Ensure condenser is positioned onto embossed feet on the floor of the sheet metal compartment. Reposition feet if necessary so that embossment fits into the condenser header.
2. Loosely assemble the IMACA fitting number 2 (Figure 2, Item 2) (Figure 3) (WP 0025)
3. Loosely assemble the IMACA fitting number 3 (Figure 2, Item 4) (Figure 3) (WP 0025).

**NOTE**

Condenser bushings cushion the condenser mounting studs. It is important that the installed condenser mounting studs do not come into direct contact with the condenser header.

4. Torque all IMACA fittings (WP 0025).
5. Position four plastic condenser bushings (Figure 2, Item 5) on top of the condenser manifolds.
6. Install bridge plate assembly (WP 0035).

## INSTALL – CONTINUED

7. Prepare the refrigeration system to be returned to service (WP 0025).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## EVAPORATOR BLOWER ASSEMBLY (B2) - INSPECT, REMOVE, REPAIR, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement evaporator blower (B2) (WP 0082, Item 9)
Replacement run capacitor (WP 0082, Item 10)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0012
WP 0015
WP 0082
WP 0091
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)
Inlet air filter removed (WP 0012)

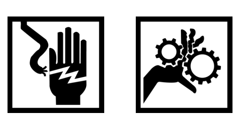
### INSPECT

1. Set the rotary MODE switch (S4) to OFF and set the circuit breaker (CB1) to OFF.
2. With one hand, apply force to the evaporator blower to ensure that it is securely fastened to the base sheet metal. If it is not, install any missing screws.
3. Visually inspect for the following:
   a. Cracks in the blower housing or the blower mounting flange.
   b. Check the wire harness for fraying, severed wires, or broken connectors.
   c. Check the blower wheel (inside housing) for excess debris, corrosion, missing or damaged blades.
4. If any of the items listed in Step 3 are present, replace the evaporator blower (this work package).

**END OF TASK**

### REMOVE

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove the screw securing ground wire to blower motor and bulkhead wall.
2. Remove three screws (Figure 1, Item 3) securing evaporator blower assembly (B2) (Figure 1, Item 5) to bulkhead wall.

## REMOVE – CONTINUED

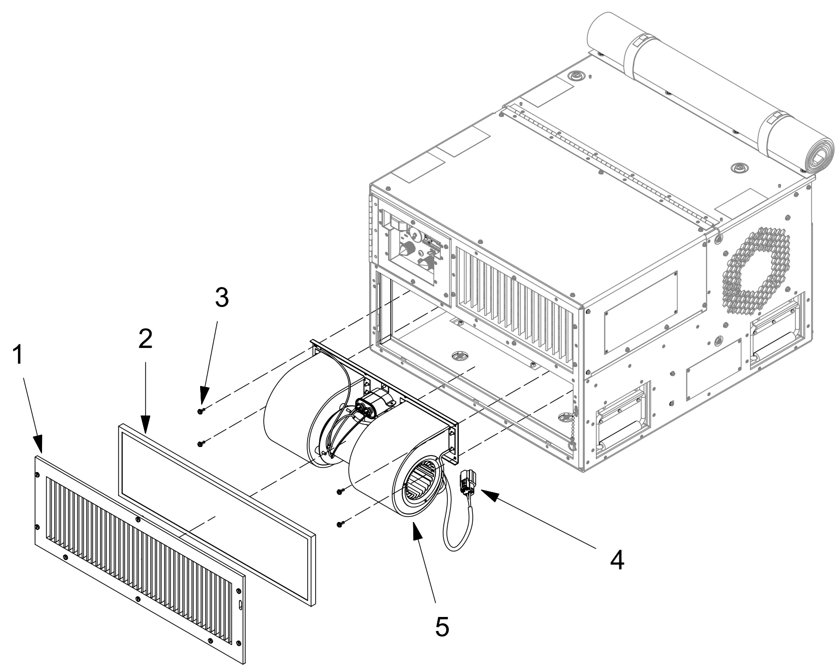



**Figure 1. Evaporator Blower Access.**

3. Pull evaporator blower assembly (B2) (Figure 1, Item 5) forward enough to gain access to the electrical connector J34 (Figure 1, Item 4).
4. Disconnect electrical connector J34 (Figure 1, Item 4) from P34 connector on soft start box.
5. Remove evaporator blower assembly (B2) (Figure 1, Item 5) through air filter opening.

## END OF TASK

## REPAIR

1. Remove evaporator blower assembly (this work package).
2. Disconnect and tag connectors (Figure 2, Item 4 and 5) from run capacitor (Figure 2, Item 3) (FO-2, Sheet 2).

**REPAIR – CONTINUED**

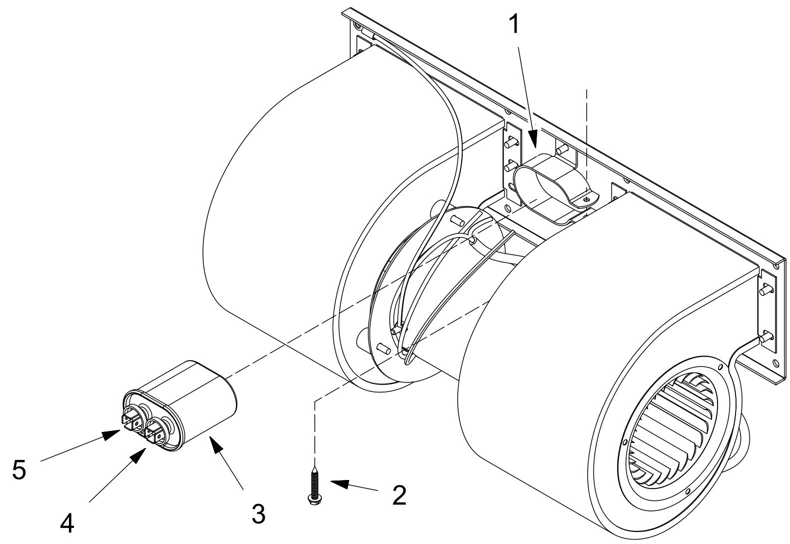



**Figure 2. Run Capacitor Replacement.**

3. Remove rubber boot.
4. Remove screw (Figure 2, Item 2) securing capacitor clamp (Figure 2, Item 1).
5. Withdraw run capacitor (Figure 2, Item 3) from capacitor clamp (Figure 2, Item 1).
6. Install replacement run capacitor (Figure 2, Item 3) in capacitor clamp (Figure 2, Item 1).
7. Install screw (Figure 2, Item 2) securing capacitor clamp (Figure 2, Item 1).
8. Connect connectors (Figure 2, Item 4 and 5) to run capacitor (Figure 2, Item 3) (FO-2, Sheet 2).
9. Install rubber boot.
10. Install the evaporator blower assembly (this work package).

**END OF TASK**

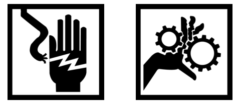
**REPLACE**

1. Remove evaporator blower assembly (B2) (Figure 1, Item 5) (this work package).
2. Install replacement evaporator blower assembly (B2) (Figure 1, Item 5) (this work package).

**END OF TASK**

## INSTALL

### WARNING



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Connect electrical connector J34 (Figure 1, Item 4) to soft start box.
2. Position evaporator blower assembly (B2) (Figure 1, Item 5) in place and install screw securing ground wire to blower motor and bulkhead wall.
3. Install three screws (Figure 1, Item 3) securing evaporator blower assembly (B2) to bulkhead wall.
4. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

Install the inlet air filter (Figure 1, Item 2) and return grille (Figure 1, Item 1) (WP 0012).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## EVAPORATOR - INSPECT, SERVICE, REMOVE, REPAIR, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Cleaner, coil (WP 0094, Table 1, Item 4)
Cylinder, compressed gas, nitrogen gas (WP 0094, Table 1, Item 6)
Replacement evaporator (WP 0082, Item 4)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0025

**References - cont'd**

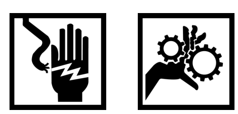
WP 0028
WP 0032
WP 0042
WP 0046
WP 0052
WP 0059
WP 0063
WP 0082
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is removed (WP 0032)

### INSPECT

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Set the rotary MODE switch (S4) to OFF and set the circuit breaker (CB1) to OFF.

**WARNING**

Coil fins are sharp. Wear gloves while handling a coil. Severe cuts can occur if hands are not protected.

2. Visually inspect the evaporator coil for excessive dust, dirt, or debris on both faces. If necessary, clean the evaporator coil per this work package.
3. Visually inspect the evaporator coil for bent fins. If any bent fins are discovered, repair the evaporator (this work package).
4. Visually inspect the inlet and outlet fittings for oil residue, which could indicate a leak. If a leak is suspected, perform a refrigerant leak check (WP 0029).

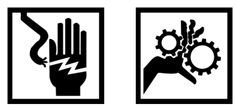
## INSPECT – CONTINUED

5. Check the evaporator mounting flanges for cracks. If the flanges are cracked, replace the evaporator coil per this work package.
6. Check the evaporator tubes and end turns for kinks, holes, and cracks. If any of these defects are discovered, replace the evaporator coil per this work package.

## END OF TASK

## SERVICE

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove condensate drain line plugs (Figure 1).

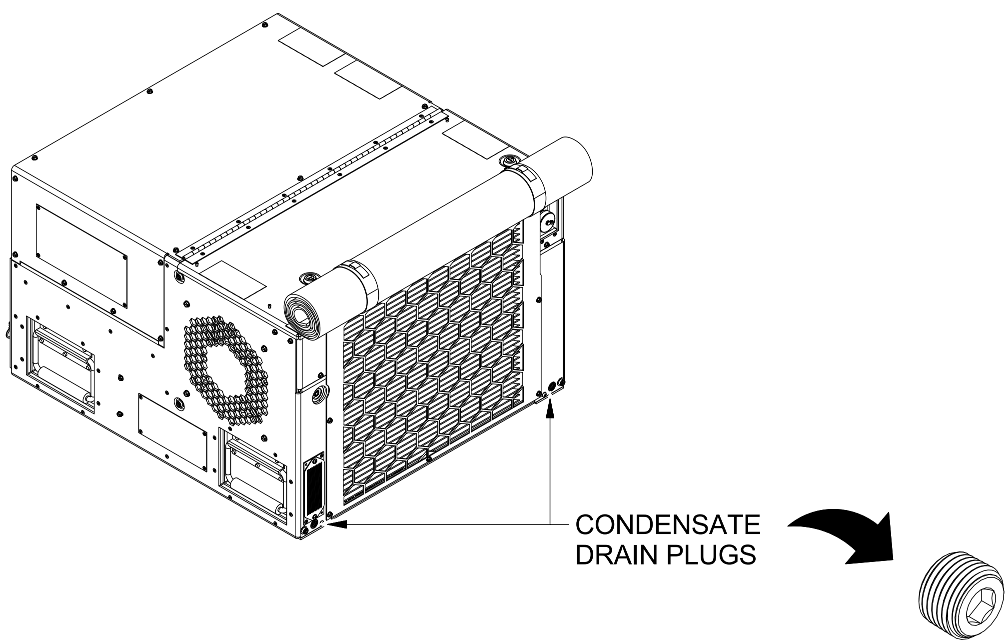


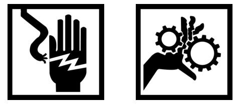

**Figure 1. Condensate Drain Plugs.**

2. Prepare a commercial evaporator foaming coil cleaner and apply to the evaporator fins. Using a nitrogen source with a pressure regulator set to 10 PSI or a compressed air source, blow any contaminants, dirt and water from the evaporator coil and into the condensate drain pan.
3. Verify the condensate drain line is clear and the water is flowing from the condensate drain.
4. Rinse the evaporator coil with clear water.

**END OF TASK**

**REMOVE**

**WARNING**



High voltage and rotating parts are present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Prepare refrigeration system to be opened (WP 0025).

**WARNING**

Coil fins are sharp. Wear gloves while handling a coil. Severe cuts can occur if hands are not protected.

2. Disconnect the two heater assembly electrical connectors (Figure 2, Item 9 and 10) (WP 0052).

## REMOVE – CONTINUED

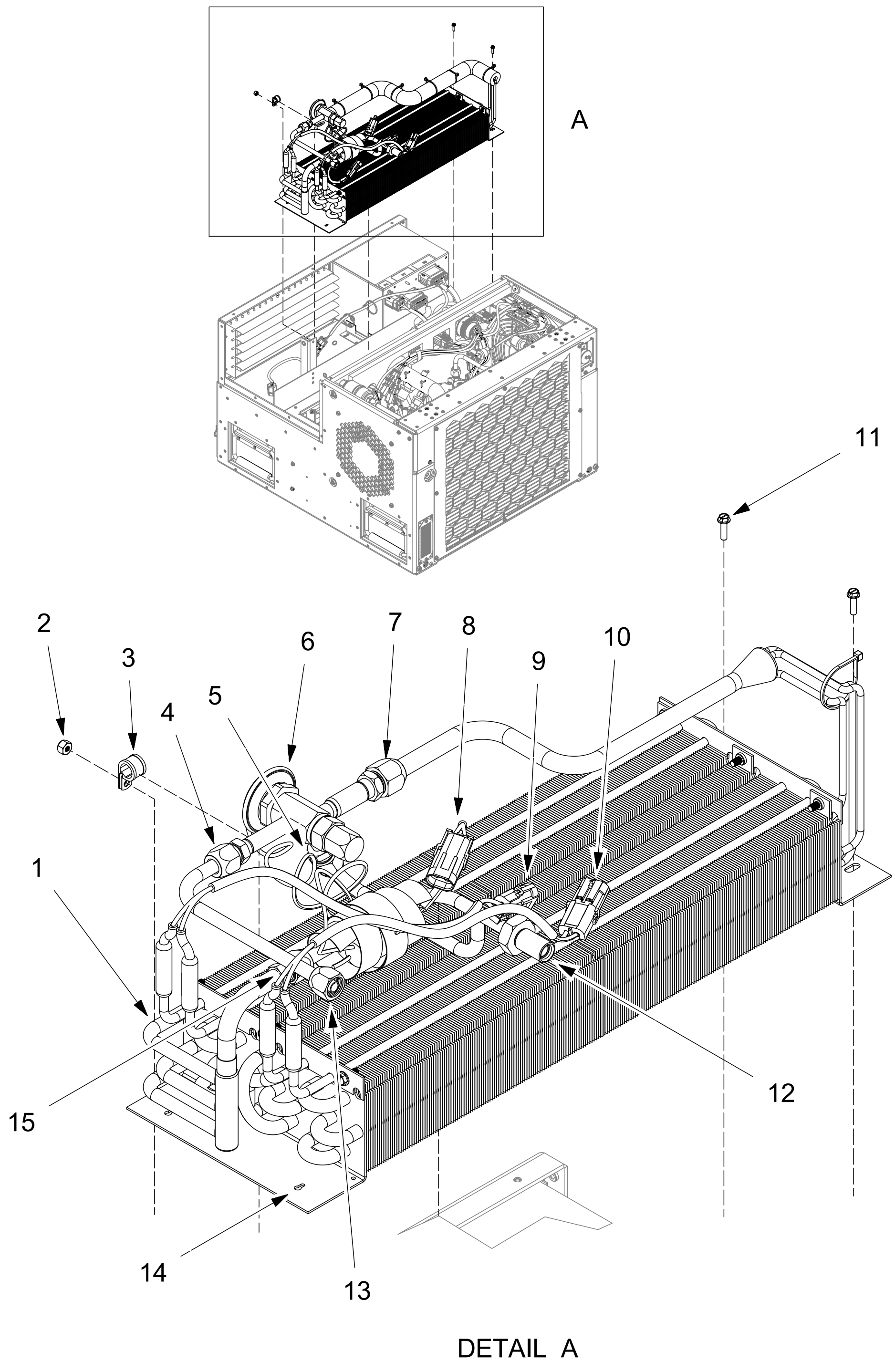



**Figure 2. Evaporator.**

**REMOVE – CONTINUED**

3. Disconnect evaporator thermistor electrical connector J23 from connector P23 (Figure 2, Item 8).
4. Release the heater and evaporator wire harnesses from the wall-mounted cable tie (Figure 3). Depress the button on the cable tie and push the tab back through the locking mechanism until the cable tie is opened.

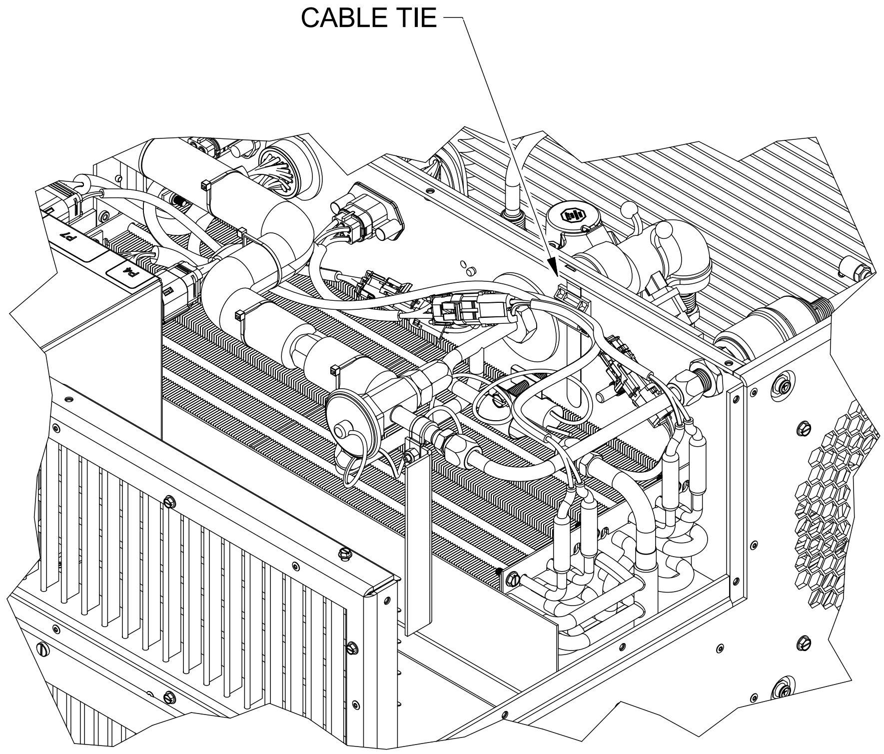



**Figure 3. Wall-Mounted Cable Tie.**

5. Disconnect electrical connector J8 from P8 at the bulkhead wall (Figure 4).

**REMOVE – CONTINUED**

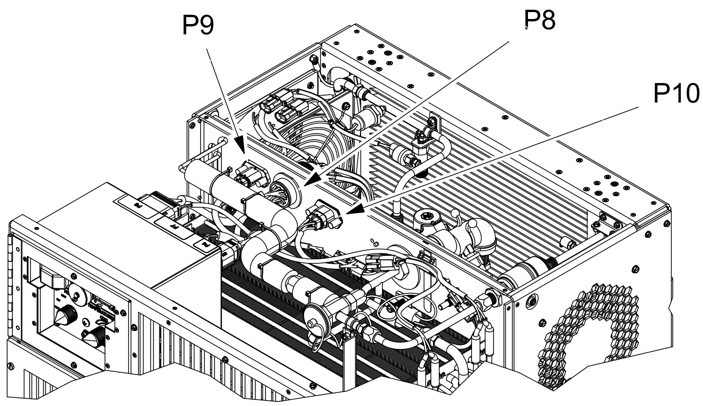



**Figure 4. P8, P9, and P10 Connections.**

6. Disconnect electrical connector J9 from P9 at the bulkhead wall (Figure 4).
7. Disconnect electrical connector J10 from P10 at the bulkhead wall (Figure 4).
8. Remove the lock nut securing P8 to the bulkhead wall.
9. Remove two screws securing P9 and P10 to the bulkhead wall.
10. Remove control box assembly (WP 0042).
11. Remove the evaporator air outlet thermistor (RT2) (WP 0063).
12. Remove evaporator air outlet thermistor (RT2) from the threaded hole in the bulkhead wall (Figure 5) (WP 0063).

## REMOVE – CONTINUED

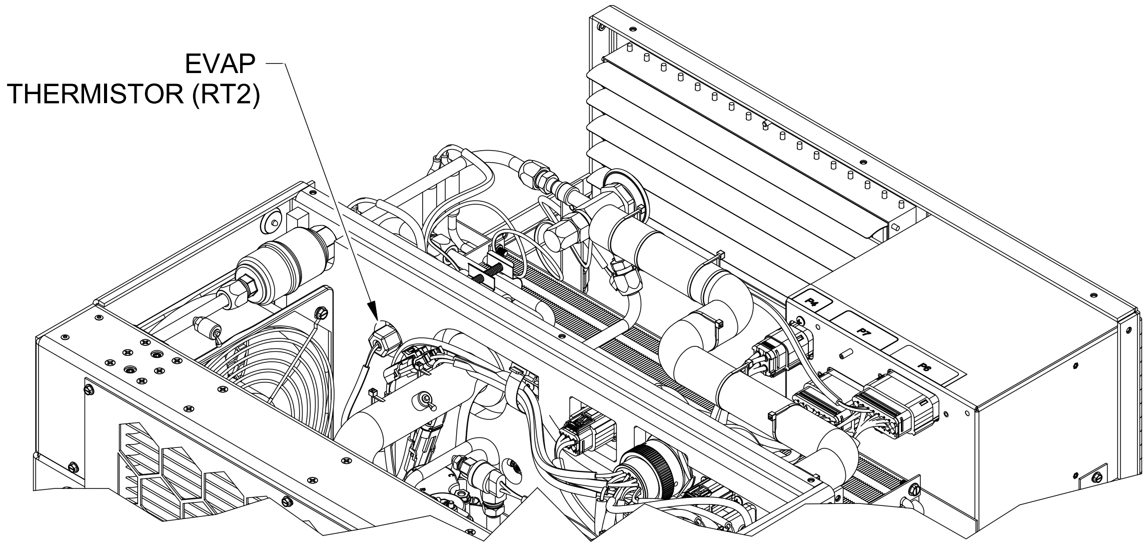



**Figure 5. Evaporator Air Outlet Thermistor.**

13. Remove cable ties, tubing insulation, and wiring harnesses from evaporator tubing.
14. Remove the lock nut (Figure 2, Item 2) from the TXV support loop clamp (Figure 2, Item 3) to release the TXV from the support (this work package).
15. Disassemble IMACA fitting (Figure 2, Item 12) between evaporator and evaporator-to-bulkhead wall tube assembly at the bulkhead (WP 0025).
16. Disassemble IMACA fitting (Figure 2, Item 13) between TXV (Figure 2, Item 6) and TXV-to-bulkhead wall tube assembly at the bulkhead (WP 0025).
17. Disassemble IMACA fitting (Figure 2, Item 4) between bulkhead and TXV-to-bulkhead wall tube assembly at the TXV (Figure 2, Item 6) (WP 0025).
18. Disassemble IMACA fitting (Figure 2, Item 7) between evaporator and TXV-to-evaporator wall tube assembly at the TXV (Figure 2, Item 6) (WP 0025).
19. Remove TXV (Figure 2, Item 6) from evaporator (WP 0046). Ensure the tubing (Figure 2, Item 5) from the TXV to the TXV bulb does not become kinked.
20. Disassemble IMACA fitting (Figure 2, Item 15) between bulkhead and evaporator-to-bulkhead wall tube assembly at the evaporator (WP 0025).
21. Pull the evaporator to bulkhead wall fitting (Figure 2, Item 12) out of the hole in the bulkhead wall so that it is free to move.
22. Remove three lock nuts securing the TXV mount.
23. Remove TXV mount.
24. Remove two screws (Figure 2, Item 11) that secure the evaporator (Figure 2, Item 1) to evaporator shelf in the IECU housing.
25. Remove evaporator (Figure 2, Item 1) by disengaging keyholes (Figure 2, Item 14) and (Figure 6, Item 1) from keyhole standoffs (Figure 6, Item 2).

**REMOVE – CONTINUED**

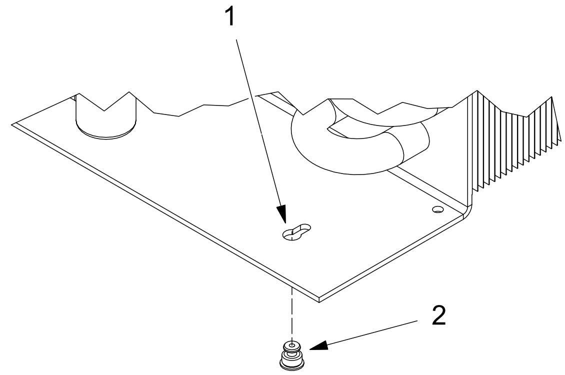



**Figure 6. Keyhole Standoff.**

**END OF TASK**

**REPAIR**

1. Set the IECU mode selector switch to OFF.
2. Repair damaged fins by re-aligning them with the properly sized fin comb.
3. Insert the fin comb into the finned surface at a location where the fins are properly aligned. While applying slight pressure, slowly pull the fin comb through the damaged fins until they are aligned.
4. If the fins are crushed severely, a utility knife may be required to individually bend the fins back into alignment.

**END OF TASK**

**REPLACE**

1. Remove evaporator (this work package).
2. Remove heater assemblies from evaporator (WP 0052).
3. Install heater assemblies on replacement evaporator (WP 0052).
4. Install replacement evaporator (this work package).
5. Prepare the refrigeration system to be returned to service (WP 0025).

**END OF TASK**

**INSTALL**

1. Guide evaporator keyholes (Figure 2, Item 14) and (Figure 6, Item 1) over keyhole standoffs (Figure 6, Item 2) and engage keyhole.
2. Install two screws (Figure 2, Item 11) securing evaporator (Figure 2, Item 1) to evaporator shelf in the IECU housing.

**INSTALL – CONTINUED**

3. Secure the TXV mount with three lock nuts.
4. Insert evaporator to bulkhead wall fitting (Figure 2, Item 12) through the hole in the bulkhead wall.
5. Assemble IMACA fitting (Figure 2, Item 12) between evaporator and evaporator-to-bulkhead wall tube assembly at the bulkhead (WP 0025).
6. Assemble IMACA fitting (Figure 2, Item 15) between bulkhead and evaporator-to-bulkhead wall tube assembly at the evaporator (WP 0025).
7. Install TXV (Figure 2, Item 6) to evaporator (WP 0046). Ensure the tubing (Figure 2, Item 5) from the TXV to the TXV bulb does not become kinked.
8. Assemble IMACA fitting (Figure 2, Item 4) between bulkhead and TXV-to-bulkhead wall tube assembly at the TXV (Figure 2, Item 6) (WP 0025).
9. Assemble IMACA fitting (Figure 2, Item 7) between evaporator and TXV-to-evaporator wall tube assembly at the TXV (Figure 2, Item 6) (WP 0025).
10. Assemble IMACA fitting (Figure 2, Item 13) between TXV (Figure 2, Item 6) and TXV-to-bulkhead wall tube assembly at the bulkhead (WP 0025).
11. Install the lock nut onto the TXV support loop clamp to secure the TXV to the support.
12. Install the evaporator air outlet thermistor (RT2) (Figure 5) into the threaded hole in the bulkhead wall (WP 0063).
13. Install the evaporator air outlet thermistor (RT2) (WP 0063).
14. Install the control box assembly (WP 0042).
15. Install two screws securing P9 and P10 to bulkhead wall.
16. Install lock nut securing P8 to the bulkhead wall.
17. Connect electrical connector J8 to P8 (Figure 4).
18. Connect electrical connector J9 to P9 (Figure 4).
19. Connect electrical connector J10 to P10 (Figure 4).
20. Connect heater assembly electrical connectors P20/21 (Figure 2, Item 9 and 10).
21. Connect evaporator thermistor electrical connector J23 to connector P23 (Figure 2, Item 8).
22. Secure wiring harnesses and tubing insulation with cable ties on evaporator tubing.
23. Secure the heater and evaporator wire harnesses to the bulkhead wall with the wall-mounted cable tie (Figure 3). Bundle wire harnesses with the cable tie tab, and push the tab through the locking mechanism. Pull the tab until the cable harness is snug.
24. Prepare the refrigeration system to be returned to service (WP 0025).

**END OF TASK**

**FOLLOW-ON MAINTENANCE**

1. Install the cover assembly (WP 0032).

## FOLLOW-ON MAINTENANCE – CONTINUED

2. Return to service.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## REFRIGERANT PIPING GROUP - INSPECT, REPAIR, REPLACE

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)
Core Removal Tool (SATS) (WP 0091, Table 2, Item 1)

**Materials/Parts**

Replacement tubing insulation (WP 0083, Item 6)
Replacement evaporator to bulkhead wall tube assembly (WP 0083, Item 15)
Replacement compressor to condenser tube assembly (WP 0083, Item 1)
Replacement bulkhead wall to compressor tube assembly (WP 0083, Item 8)
Replacement TXV to bulkhead wall tube assembly (WP 0083, Item 16)
New o-ring (0.438) (WP 0083, Item 12)
Nylog (WP 0094, Table 1, Item 7)
Refrigerant Schrader valve cap (WP 0083, Item 11)
Refrigerant Schrader valve core (WP 0083, Item 10)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0025
WP 0028
WP 0029
WP 0032
WP 0039
WP 0040
WP 0061
WP 0062
WP 0083
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

### INSPECT

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

## INSPECT – CONTINUED

### WARNING

After unit has been operating, the refrigeration tubing can become quite hot. Allow tubing to cool since hot surfaces can burn skin. Failure to do so may result in serious injury to personnel.

1. Remove any insulation that may be present on the refrigerant tubing.
2. Inspect the outside surfaces of the refrigerant tubing for cracks, kinks, or bulging. If any of these defects are present, replace the tube assembly (this work package).
3. Inspect the outside surfaces of the tubing for excessive corrosion, as indicated by a white or green powdery residue. If the corrosion has begun to penetrate the tubing wall (thinning of the tubing's outer diameter) replace the tube assembly (this work package).
4. Inspect the tubing for oil residue, which could indicate a leak. If a leak is suspected, follow the leak detection and repair procedure (WP 0029).
5. Inspect the IMACA fittings for cracks or corrosion. If a fitting is damaged, replace the entire tube assembly (this work package). If the fitting has oil residue present, this could indicate a leak. Follow the leak detection and repair procedure (WP 0029).
6. Ensure that all Schrader fittings are securely covered with a captive threaded flare fitting cap or the appropriate transducer, switch, or relief valve.
7. Replace any tubing insulation that was removed for inspection (this work package).

## END OF TASK

## REPLACE

1. Prepare refrigeration system to be opened (WP 0025).
2. Identify the tube assembly to be replaced by verifying the part number (printed on the tube assembly) or the fitting number stamped on the female swivel nut flats.
3. Remove insulation from tube assembly as necessary to allow access to IMACA fittings (WP 0025).
4. Remove any pressure transducer (WP 0062), pressure cut off switch (WP 0039 or WP 0040), or pressure relief valve (WP 0061) from tubing if present.
5. Loosen wire harnesses.
6. Remove any loop clamps which may be securing the tubing to the sheet metal assembly. These can be removed by loosening the lock nut on the loop clamp with a hex driver, and then pulling the loop clamp apart to release the tube assembly.
7. Disassemble the IMACA fittings (WP 0025). There are two or three fittings on all tube assemblies.
8. Remove the tube assembly from IECU.
9. Position refrigerant tube assembly in the IECU.
10. Assemble the IMACA fittings (WP 0025). There are two or three fittings on all refrigerant tube assemblies.
11. Replace any loop-clamps which may secure the tubing to the sheet metal assembly:
    a. Pull apart the loop clamp and secure it around the tube.
    b. Feed the appropriate threaded stud through the holes in the loop clamp tabs.
    c. Thread a lock nut onto the stud and tighten with a hex driver to compress the loop clamp.

## REPLACE – CONTINUED

12. Tighten wire harnesses.
13. Install any pressure transducer (WP 0062), pressure cut off switch (WP 0039 or WP 0040), or pressure relief valve (WP 0061) that belong on the tube assembly being installed.
14. Replace any tubing insulation that may have been removed during service (this work package).
15. Prepare the system for use after service (WP 0025).

**END OF TASK**

## REPAIR

### Replace O-ring

1. Follow the IMACA fitting disassembly procedure (WP 0025).

### Replace Tubing Insulation

1. Remove the plastic clips securing the insulation to the tube assembly by gently twisting apart.
2. Cut the tubing insulation along the length of the tube assembly parallel to the insulation adhesive seam. It may require multiple passes with a blade to cut completely through the thickness of the insulation.
3. Once the insulation has been cut, peel it off the tubing and discard. It cannot be reused.
4. Remove any debris or moisture from the tubing that may have accumulated under the insulation.
5. Obtain a new piece of insulation and position it on the tube with the seam facing downward where possible. Do not remove the adhesive backing on the insulation before placing the insulation on the tubing.
6. If replacing insulation on a tube with Schrader valves, position the insulation so that the valves are in the seam.
7. Peel off the adhesive backing on one half of the seam.
8. Begin peeling back the adhesive backing on the other half of the seam. Start at one end of the insulation and press the two halves of the seam together. Ensure the two halves of the insulation are aligned as force is applied to the adhesive seam.
9. Continue gradually peeling off the adhesive backing and pressing the seam together along the length of the tube. Move from one end to the other until the entire piece of insulation is sealed around the tube.
10. Install the plastic clips that secure the insulation to the tube. Gently spread the clip apart, place it around the tube, then twist the tabs together to lock into place. Clips should be positioned evenly along the length of the tube, avoiding Schrader ports, wire harnesses, and other obstacles.

### Replace Schrader Valve and Valve Core

1. If the Schrader valve thread has been damaged, or the Schrader valve braze joint has failed, replace tube assembly (this work package).
2. Remove the captive threaded valve cap (if present) on the valve to be serviced. Turn the cap counter-clockwise by hand until completely removed.
3. Remove any pressure transducer (WP 0062), pressure cut off switch (WP 0039 and WP 0040), or pressure relief valve (WP 0061) from tubing (if present).
4. Install valve core removal tool (Figure 2) on service valve (Figure 1) snugly, by hand only.

**REPAIR – CONTINUED**

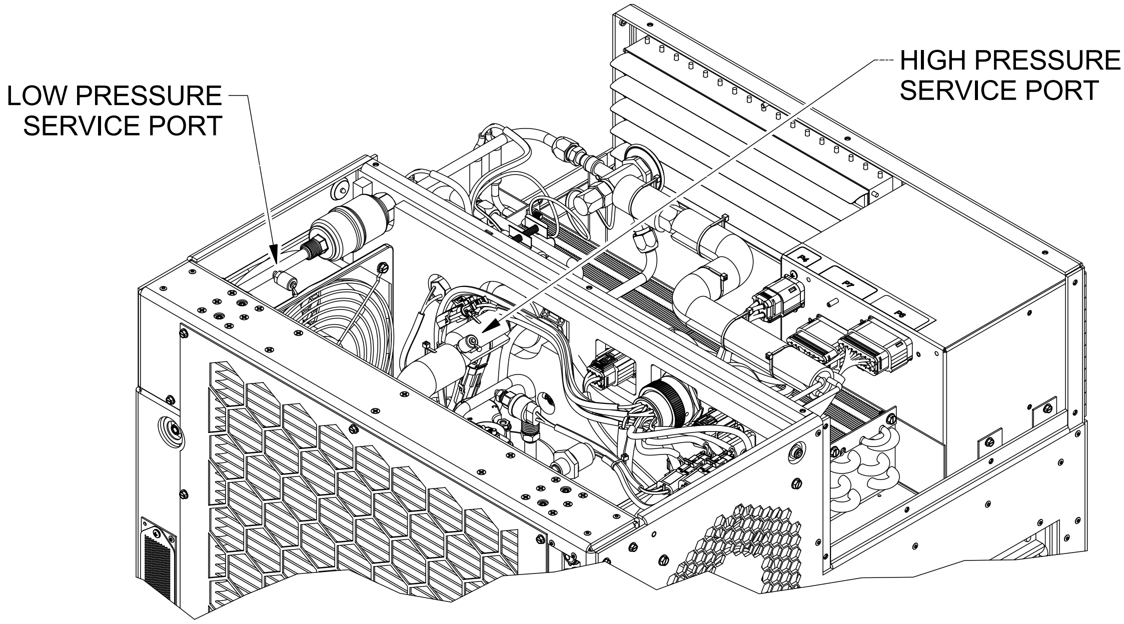



**Figure 1. Services Valves.**

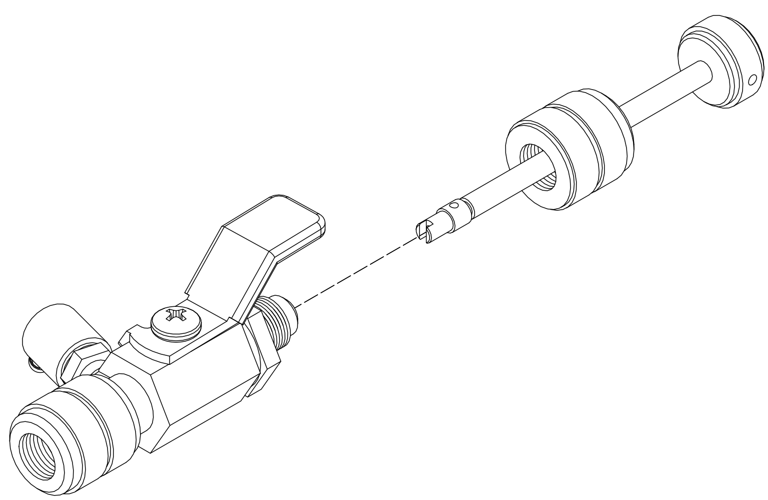


**Figure 2. Core Removal Tool.**

5. With the service valve (Figure 1) completely open, push the extractor rod (Figure 2) inward until it captivates the valve core head.

**REPAIR – CONTINUED**

6. Turn the extractor knob counter-clockwise to unscrew the valve core.
7. Pull extractor knob back as far as possible to close the valve.
8. Turn the valve clockwise to close the valve.
9. Remove the rear coupler and extractor rod (with old valve core attached).
10. Install new valve core on extractor rod.
11. With extractor rod pulled out, attach coupler on valve core removal tool snugly, by hand only.
12. Open valve completely by turning handle counter-clockwise.
13. Push in extractor rod and install new valve core in service valve (Figure 1) by turning extractor rod clockwise.
14. Unscrew valve core removal tool from service valve (Figure 1).
15. Install any pressure transducer (WP 0062), pressure cut off switch (WP 0039 or WP 0040), valve caps, or pressure relief valve (WP 0061) that may have been removed for service.

**Replace Valve Cap**

1. Remove valved cap (if present).
2. Install ring securing replacement valve cap.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## PRESSURE RELIEF VALVE - INSPECT, REMOVE, REPLACE, INSTALL

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)
Metric Socket Set (SATS) (WP 0091, Table 2, Item 8)

**Materials/Parts**

Replacement relief valve (WP 0084, Item 1)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0025
WP 0029
WP 0084
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is open

### INSPECT

1. Visually inspect the pressure relief valve for oil residue, which could indicate a leak. If a leak is suspected, perform a refrigerant leak check (WP 0029).
2. Visually inspect the pressure relief valve for excessive corrosion or cracks. If these defects are found, replace the valve (this work package).

**END OF TASK**

### REMOVE

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Prepare refrigeration system to be opened (WP 0025).
2. Secure the access port with a wrench (Figure 1, Item 2).

**REMOVE – CONTINUED**

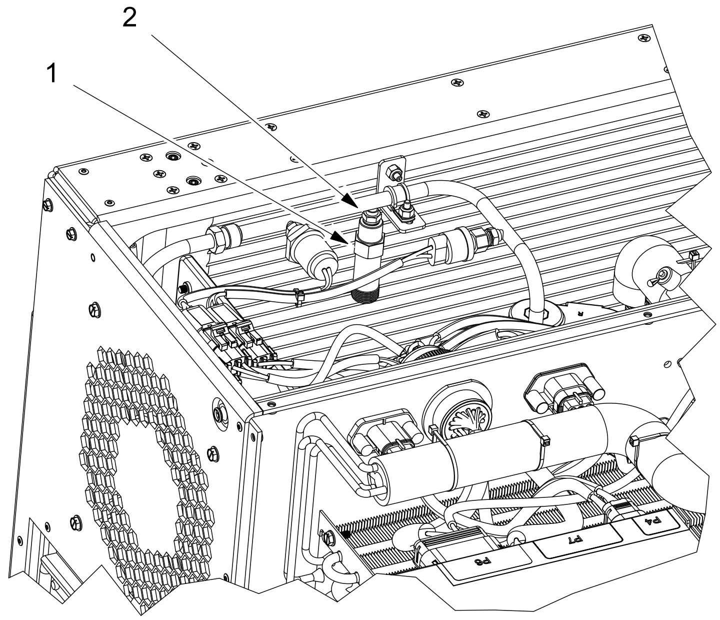



**Figure 1. Pressure Relief Valve Removal.**

## CAUTION

Make sure wrench does not impact condenser coil as damage to fins or tubes could result.

3. Remove pressure relief valve (Figure 1, Item 1) from Schrader port of copper tube assembly using another wrench.
4. Remove relief valve from IECU.

**END OF TASK**

**REPLACE**

1. Remove pressure relief valve (this work package).
2. Install replacement pressure relief valve (this work package).

**END OF TASK**

## INSTALL

### WARNING

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Thread pressure relief valve onto access port of copper tube assembly by hand until it is hand-tight. Be careful not to cross-thread.
2. Secure the access port with a wrench (Figure 1, Item 2).
3. Turn the pressure relief valve (Figure 1, Item 1) one-quarter turn clockwise past hand tight with another wrench.
4. Prepare the refrigeration system to be returned to service (WP 0025).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## PRESSURE TRANSDUCER ASSEMBLY (MT1, MT2) – REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement transducer (MT1 or MT2) (WP 0085, Item 1)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0032
WP 0085
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)
Cover assembly is removed (WP 0032)

### REMOVE

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Disconnect high pressure transducer assembly (Figure 1, Item 1) or low pressure transducer assembly (Figure 1, Item 2) connector P26/27 from wire harness connector J26 or J27 (depending on which transducer assembly is being removed).

**REMOVE – CONTINUED**

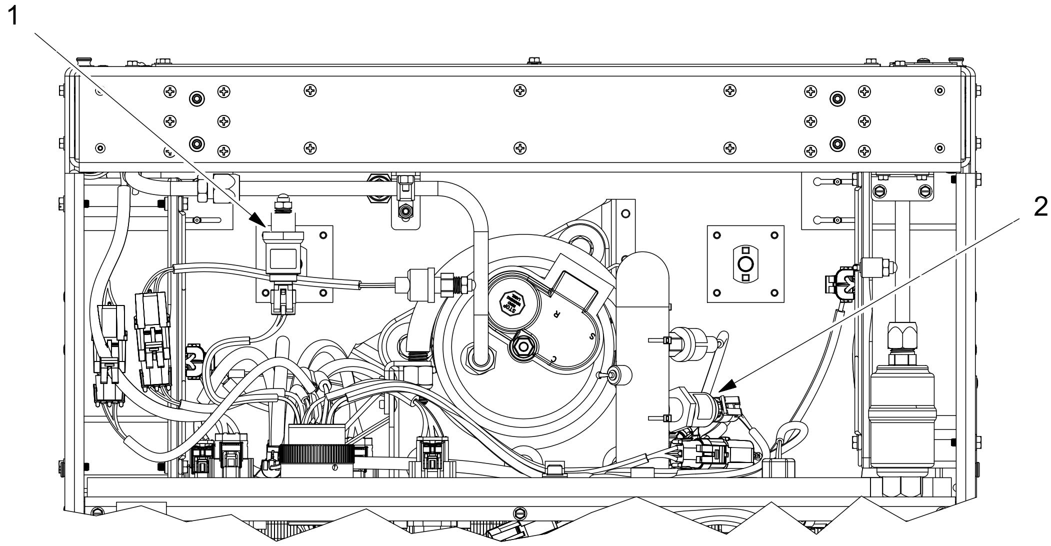



**Figure 1. High And Low Pressure Transducers.**

2. Secure the access port with a wrench.

## CAUTION

Make sure wrench does not impact condenser coil as damage to fins or tubes could result causing equipment damage.

3. Remove transducer assembly from Schrader port of copper tube assembly.
4. Remove transducer from IECU.

**END OF TASK**

**REPLACE**

1. Remove pressure transducer (this work package).
2. Install replacement pressure transducer (this work package).
3. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

## INSTALL

### WARNING

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Thread high pressure transducer assembly (Figure 1, Item 1) or low pressure transducer assembly (Figure 1, Item 2) onto access port of the copper tube assembly by hand until it is hand-tight. Be careful not to cross-thread.
2. Secure the access port with a wrench.

### CAUTION

Make sure wrench does not impact condenser coil as damage to fins or tubes could result.

3. Turn the transducer one-quarter turn clockwise using another wrench.
4. Connect transducer connector P26/27 to J26 or J27 (depending on which transducer assembly is being installed).

**END OF TASK**

## FOLLOW-ON MAINTENANCE

Install the cover assembly (WP 0032).

**END OF TASK**

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## THERMISTOR ASSEMBLY (RT1, RT2) – TEST, REMOVE, REPLACE, INSTALL

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Replacement thermistor assembly (RT1 or RT2) (WP 0085, Item 2)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

**References**

WP 0015
WP 0026
WP 0032
WP 0085
WP 0091
FO-1
FO-2

**Equipment Condition**

IECU is shut down (WP 0005)

### TEST

**Test Evaporator Air Inlet Thermistor (RT1)**

1. Remove cover assembly (WP 0032).
2. Disconnect P24/30 of the thermistor assembly (Figure 1) from the connector J30 (FO-1 and FO-2).

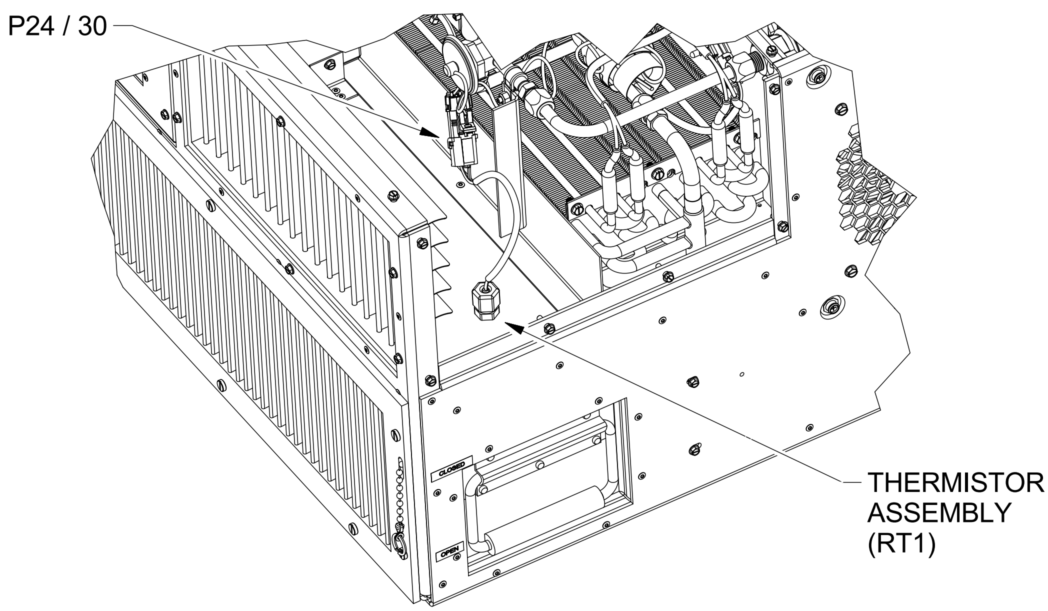



**Figure 1. Thermistor Assembly.**

## TEST – CONTINUED

3. Measure the resistance between pins A and B of the thermistor assembly (RT1) connector P24/30.
4. Measure the ambient temperature near the thermistor, in degrees F.
5. Compare the measured temperature and resistance to Table 1.

**Table 1. Thermistor Resistance versus Temperature.**

| (KΩ) | TEMP. (F) | (KΩ) | TEMP. (F) | (KΩ) | TEMP. (F) |
|---|---|---|---|---|---|
| 0.748 | 140 | 3.159 | 75 | 18.828 | 10 |
| 0.827 | 135 | 3.575 | 70 | 21.981 | 5 |
| 0.916 | 130 | 4.054 | 65 | 25.735 | 0 |
| 1.016 | 125 | 4.608 | 60 | 30.217 | -5 |
| 1.129 | 120 | 5.248 | 55 | 35.586 | -10 |
| 1.257 | 115 | 5.991 | 50 | 42.036 | -15 |
| 1.402 | 110 | 6.854 | 45 | 49.881 | -20 |
| 1.566 | 105 | 7.860 | 40 | 59.214 | -25 |
| 1.752 | 100 | 9.035 | 35 | 70.624 | -30 |
| 1.964 | 95 | 10.410 | 30 | 84.518 | -35 |
| 2.205 | 90 | 12.025 | 25 | 101.497 | -40 |
| 2.481 | 85 | 13.927 | 20 | 122.321 | -45 |
| 2.797 | 80 | 16.171 | 15 | 147.959 | -50 |

6. If the measured resistance is not within 5 degrees of the measured temperature, replace the thermistor assembly (this work package).
7. Connect P24/30 of the thermistor assembly to connector J30.
8. Install the cover assembly (WP 0032).

### Test Evaporator Air Outlet Thermistor (RT2)

1. Unlock two quarter-turn latches on cover assembly and open.
2. Disconnect P24/30 of the thermistor assembly (Figure 2) from the connector J24 (FO-1 and FO-2).

**TEST – CONTINUED**

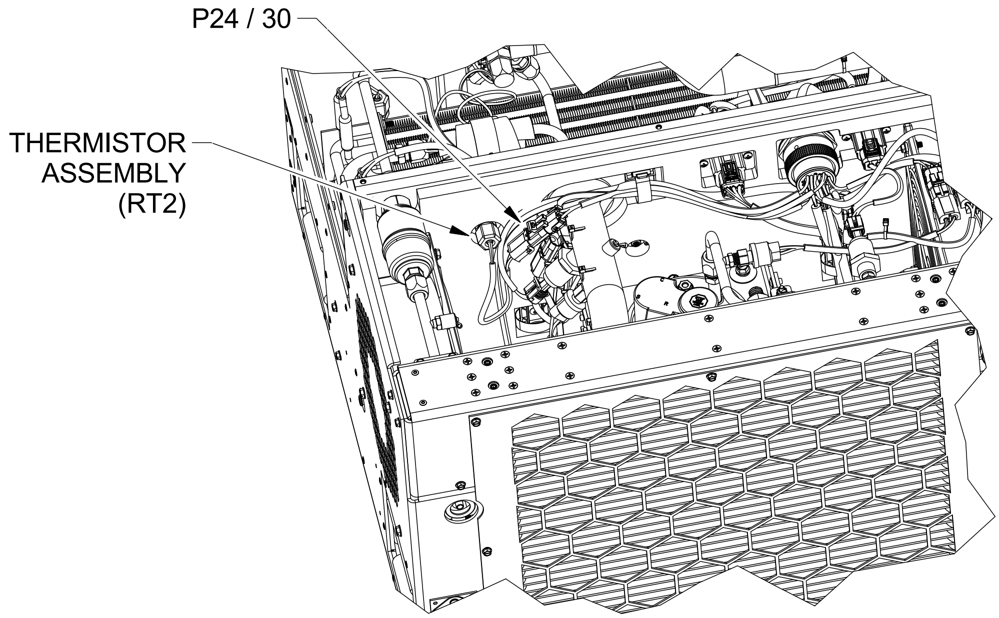



**Figure 2. Thermistor Assembly.**

3. Measure the resistance between pins A and B of the thermistor assembly (RT2) connector P24/30.
4. Measure the ambient temperature near the thermistor, in degrees F.
5. Compare the measured temperature and resistance to Table 1.
6. If the measured resistance is not within 5 degrees of the measured temperature, replace the thermistor assembly (this work package).
7. Connect P24/30 of the thermistor assembly to connector J24 (Figure 2).
8. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.

**END OF TASK**

**REMOVE**

**Remove Evaporator Air Inlet Thermistor (RT1)**

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Remove cover assembly (WP 0032).

**REMOVE – CONTINUED**

2. Disconnect P24/30 of the thermistor assembly (Figure 1) from connector J30 (FO-1 and FO-2).
3. Remove thermistor assembly (Figure 3) from drain pan panel.

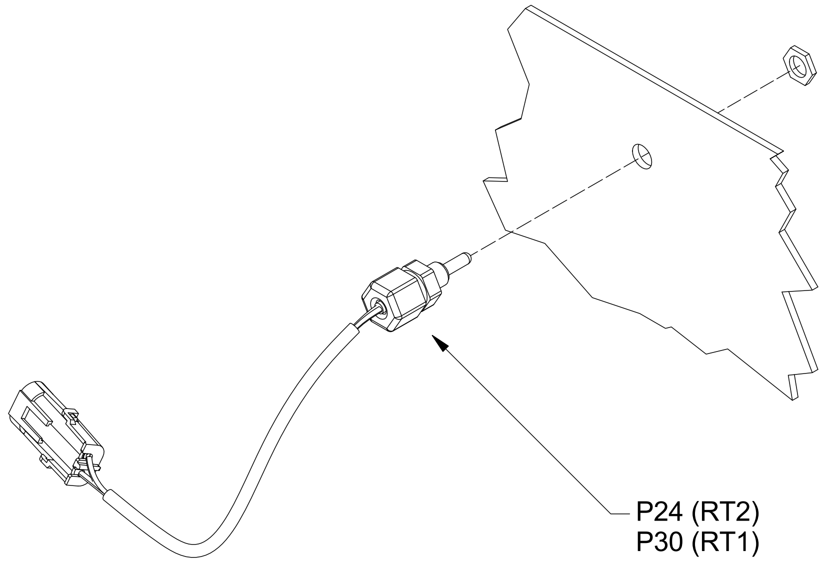



**Figure 3. Thermistor Assembly Connector.**

**Remove Evaporator Air Outlet Thermistor (RT2)**

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Unlock two quarter-turn latches on cover assembly and open.
2. Disconnect P24/30 of the thermistor assembly (Figure 2) from connector J24 (FO-1 and FO-2).
3. Remove thermistor assembly (Figure 3) from bulkhead wall panel.

**END OF TASK**

**REPLACE**

1. Remove thermistor assembly (this work package).

**REPLACE – CONTINUED**

2. Install replacement thermistor assembly (this work package).

**END OF TASK**

**INSTALL**

**Install Evaporator Air Inlet Thermistor (RT1)**

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Thread thermistor assembly (Figure 1) by hand into drain pan panel. Carefully tighten the thermistor. Do not overtighten.
2. Connect P24/30 of the thermistor assembly (Figure 1) to connector J30 (FO-1 and FO-2).
3. Install the cover assembly (WP 0032).
4. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**Install Evaporator Air Outlet Thermistor (RT2)**

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

1. Thread thermistor assembly (Figure 2) by hand into bulkhead wall panel. Carefully tighten the thermistor. Do not overtighten.
2. Connect P24/30 (Figure 2) of the thermistor assembly to connector J24 (FO-1 and FO-2).
3. Close the cover assembly and lock the two quarter-turn rim latches to secure the cover assembly.
4. Verify normal operation by starting troubleshooting, Symptom IECU MAY NOT BE OPERATING PROPERLY, Malfunction Proper Operation Not Verified (WP 0015).

**END OF TASK**

**END OF WORK PACKAGE**

**FIELD MAINTENANCE**

**GENERAL MAINTENANCE - ELECTRICAL CONNECTOR PIN-OUTS**

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)

## ELECTRICAL CONNECTOR PIN-OUTS

Connector pin outs for 9K BTU/hr IECU are illustrated in this work package. Table 1 lists the figure number for each connector.

**Table 1. Connector Pin Out Figures.**

| CONNECTOR | FIGURE | CONNECTOR | FIGURE |
|---|---|---|---|
| P1 | Fig. 1 | J2 | Fig. 4 |
| P3 | Fig. 1 | J4 | Fig. 6 |
| P4 | Fig. 1 | J5 | Fig. 4 |
| P6 | Fig. 8 | J6 | Fig. 6 |
| P7 | Fig. 8 | J7 | Fig. 6 |
| P8 | Fig. 3 | J8 | Fig. 7 |
| P9 | Fig. 1 | J9 | Fig. 4 |
| P10 | Fig. 1 | J10 | Fig. 4 |
| P11 | Fig. 1 | J11 | Fig. 4 |
| P12 | Fig. 1 | J12 | Fig. 4 |
| P13 | Fig. 2 | J13 | Fig. 6 |
| P14 | Fig. 2 | J14 | Fig. 6 |
| P15 | Fig. 2 | J15 | Fig. 4 |
| P20 | Fig. 2 | J16 | Fig. 5 |
| P21 | Fig. 2 | J17 | Fig. 5 |
| P23 | Fig. 2 | J20 | Fig. 5 |
| P24 | Fig. 2 | J21 | Fig. 5 |
| P25 | Fig. 2 | J23 | Fig. 5 |
| P26 | Fig. 2 | J24 | Fig. 5 |
| P27 | Fig. 2 | J25 | Fig. 5 |
| P28 | Fig. 2 | J26 | Fig. 5 |
| P29 | Fig. 2 | J27 | Fig. 5 |
| P30 | Fig. 2 | J28 | Fig. 5 |

## ELECTRICAL CONNECTOR PIN-OUTS – CONTINUED

**Table 1. Connector Pin Out Figures. – Continued**

| CONNECTOR | FIGURE | CONNECTOR | FIGURE |
|---|---|---|---|
| P31 | Fig. 2 | J29 | Fig. 5 |
| P32 | Fig. 2 | J30 | Fig. 5 |
| P33 | Fig. 2 | J31 | Fig. 5 |
| P34 | Fig. 1 | J32 | Fig. 5 |
| P38 | Fig. 2 | J33 | Fig. 5 |
| | | J34 | Fig. 4 |
| | | J38 | Fig. 5 |

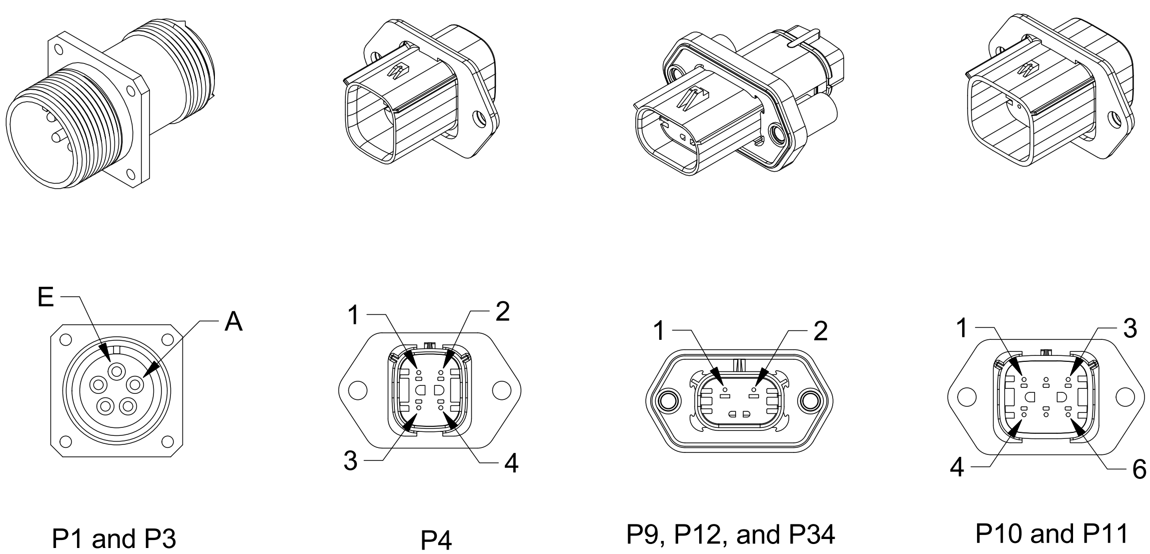



**Figure 1. P1, P3, P4, P9-P12, P34 Connectors.**

## ELECTRICAL CONNECTOR PIN-OUTS – CONTINUED

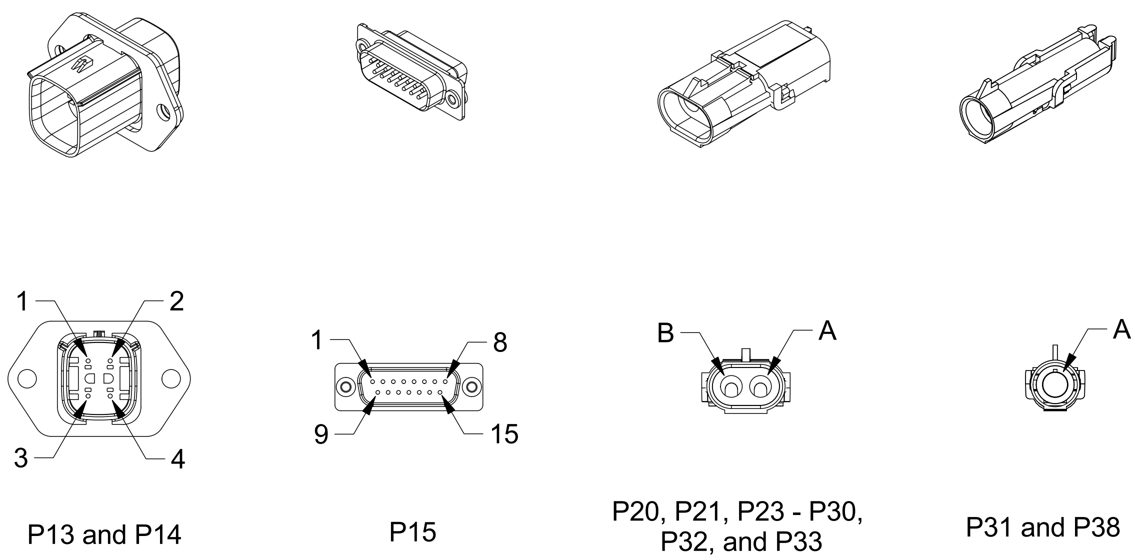



**Figure 2. P13-P15, P20, P21, P23-P33, P38 Connectors.**

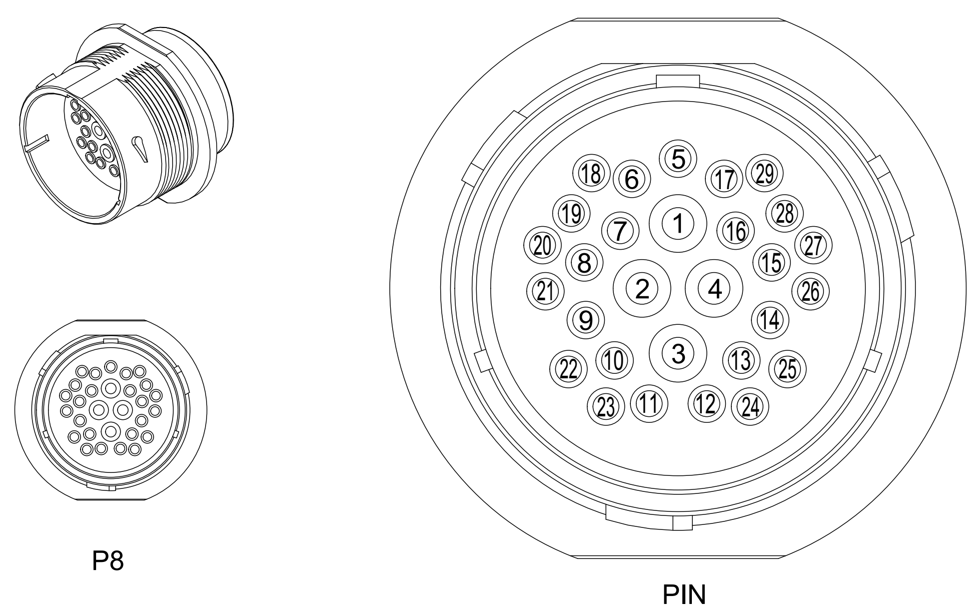



**Figure 3. P8 Connector.**

## ELECTRICAL CONNECTOR PIN-OUTS – CONTINUED

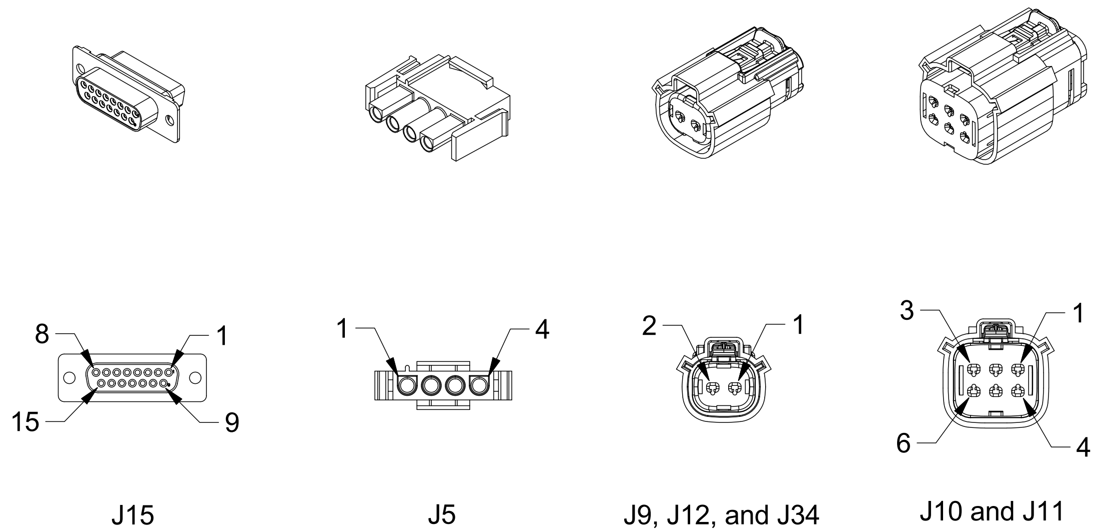



**Figure 4. J5, J9-J12, J15, J34 Connectors.**

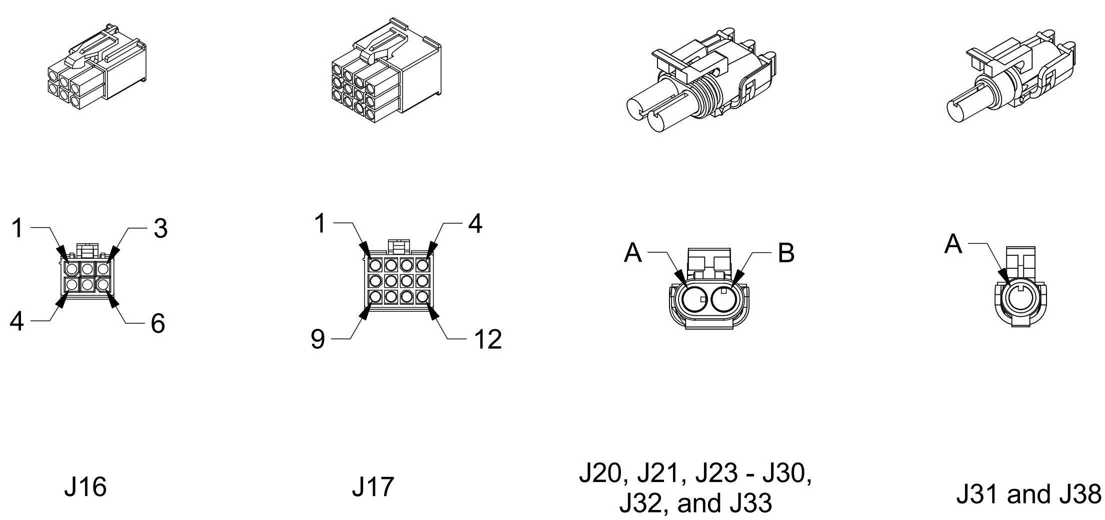



**Figure 5. J16, J17, J20, J21, J23-33, J38 Connectors.**

## ELECTRICAL CONNECTOR PIN-OUTS – CONTINUED

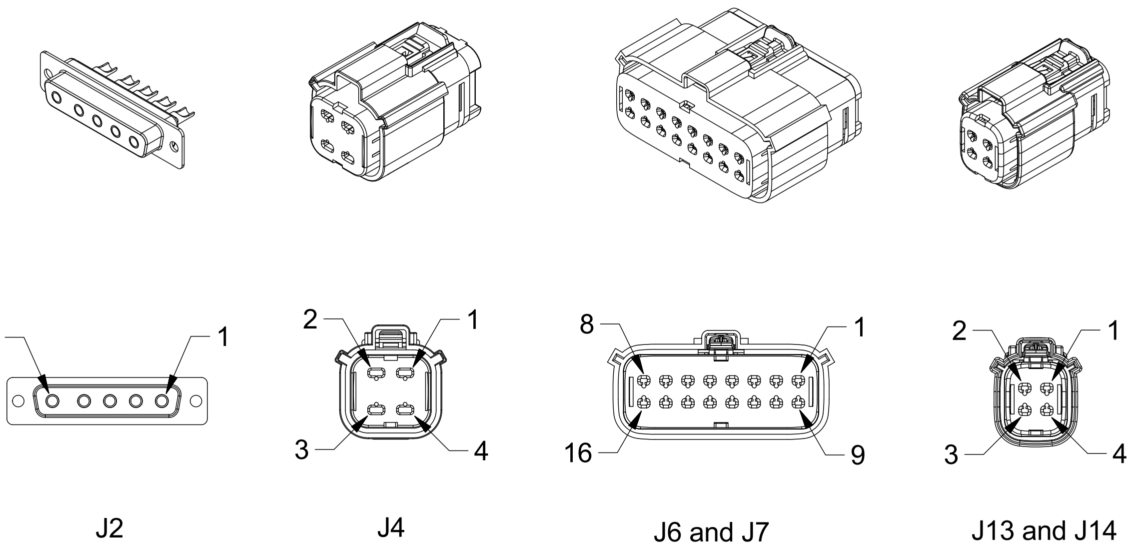



**Figure 6. J2, J4, J6, J7, J13, J14 Connectors.**

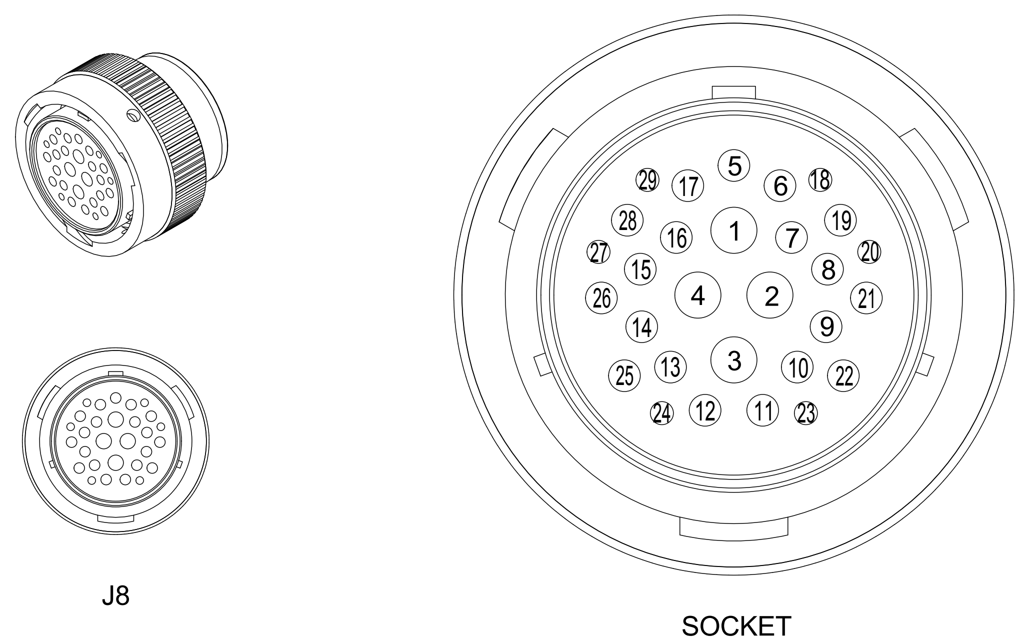



**Figure 7. J8 Connector.**

## ELECTRICAL CONNECTOR PIN-OUTS – CONTINUED

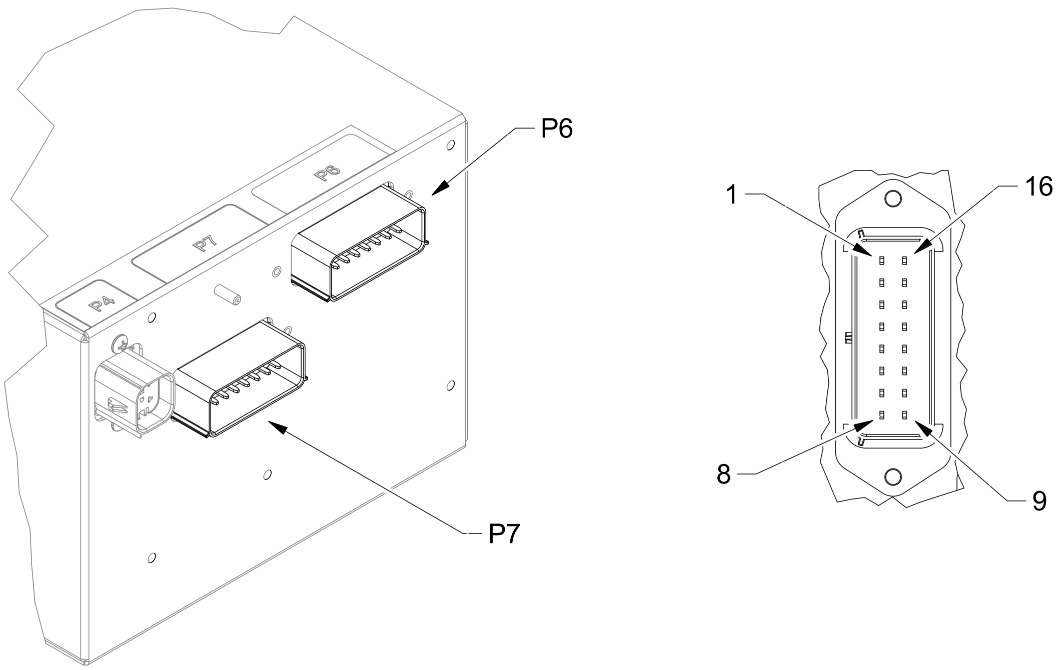



Figure 8. P6 and P7 Connectors.

## END OF TASK

## END OF WORK PACKAGE

## FIELD MAINTENANCE

## PREPARATION FOR SHIPMENT AND STORAGE

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Took Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

Utilities Equipment Repairer 91C (1)
General Purpose User (3)

**References**

WP 0005

**References - cont'd**

WP 0010
WP 0012
WP 0023
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)

### PREPARATION FOR SHIPMENT AND STORAGE

1. Operate IECU in VENT mode (WP 0005) for approximately one hour to ensure that any condensate is drained from unit and to dry out evaporator coil and air filter.
2. Shut down IECU (WP 0005).
3. Inspect the inlet air filter. Clean if necessary (WP 0012).

**WARNING**

High voltage is present when IECU is in operation. Make sure power cable is disconnected from power source before working on or inside IECU. Failure to comply may result in severe personal injury or death by electrocution.

4. Disconnect power cable from power source and disconnect power cable from front and/or rear IECU power input receptacle.
5. If attached, remove condensate hose from threaded fittings on the condenser side of the IECU.
6. Install condensate drain outlet plugs.
7. If remotely operated, remove the extension cable from the remote control box and the control box. Install remote control box in control box assembly (WP 0005).
8. Close the evaporator side inlet and outlet grille louvers and close the fresh air duct duct door.
9. Install condenser cover:
    a. Unroll condenser cover from IECU top cover assembly and secure with snap fasteners at bottom rear of IECU (Figure 1). Push from side of snap fastener that has dot marking.

## PREPARATION FOR SHIPMENT AND STORAGE – CONTINUED

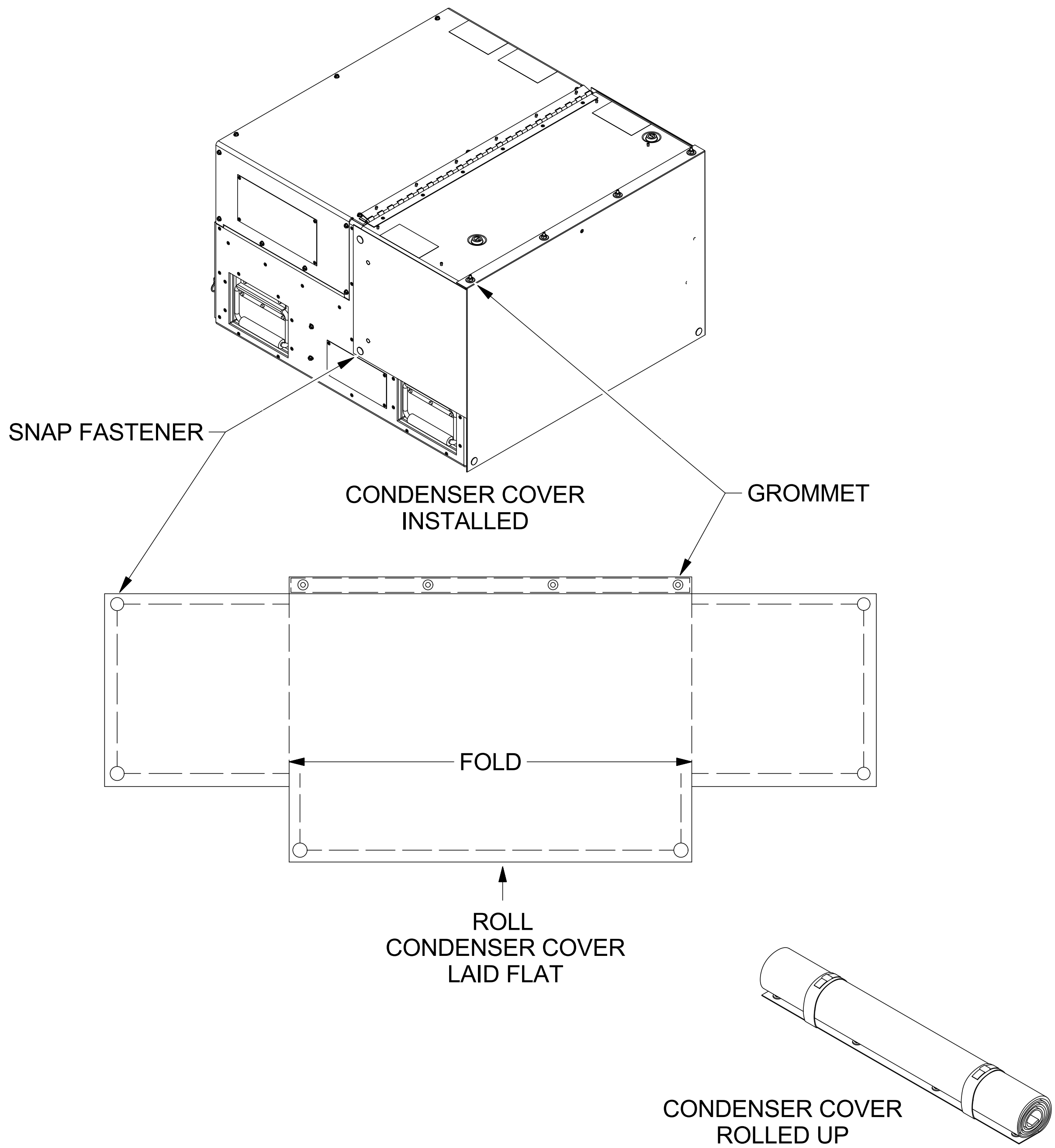



**Figure 1. Preparation For Shipment And Storage.**

b. Fold cover sides against IECU and secure with two snap fasteners.

10. Remove IECU from mounting position in accordance with local procedures.

11. Place IECU on shipping pallet.

## PREPARATION FOR SHIPMENT AND STORAGE – CONTINUED

12. Place corner protectors on IECU and secure IECU to shipping pallet with shipping straps.
13. Place overbox onto IECU and secure to shipping pallet with staples.

**END OF TASK**

## FOLLOW ON MAINTENANCE

Systematic, periodic, preventive maintenance checks and services (PMCS) are essential to ensure that the IECU is ready for operation in any mode at all times. The purpose of a preventive maintenance program is to discover and correct defects and deficiencies before they can cause serious damage or complete failure of the equipment. Any effective preventive maintenance program must begin with the training of operators to report all unusual conditions noted during daily checks or actual operation to unit maintenance. All defects and deficiencies discovered during maintenance inspections must be recorded, together with the corrective action taken on DA Form 5988E, Equipment Inspection and Maintenance Worksheet.

## INSPECTION AND SERVICE SCHEDULING

1. A schedule for preventive maintenance inspection and service should be established immediately after installation of the IECU. A quarterly interval, equal to three calendar months or 250 hours of operation, whichever occurs first, is recommended for usual operating conditions. When operating under unusual conditions, such as a very dusty or sandy environment, it may be necessary to reduce the interval to monthly or even less if conditions are extreme.
2. WP 0010 lists the operator Preventive Maintenance Checks and Services and WP 0023 lists the field maintenance Preventive Maintenance Checks and Services that should be performed at regularly scheduled intervals. The PMCS tasks listed have been arranged and numbered in a logical sequence to provide for greater personnel efficiency and least amount of required maintenance downtime.

**END OF TASK**

**END OF WORK PACKAGE**

# FIELD MAINTENANCE

# ILLUSTRATED LIST OF MANUFACTURED ITEMS INTRODUCTION

## ILLUSTRATED LIST OF MANUFACTURED ITEMS INTRODUCTION

### Scope

WP 0067 through WP 0069 include complete instructions for making items authorized to be manufactured or fabricated at the field.

### How to Use the Index of Manufactured Items

A part number index in alphanumeric order is provided for cross-referencing the part number of the item to be manufactured to the information which covers fabrication criteria.

### Explanation of the Illustrations of Manufactured Items

All instructions needed by maintenance personnel to manufacture the item are included on the illustrations. All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustration.

## INDEX OF MANUFACTURED ITEMS

| P/N AND/OR DWG NO | PART DESCRIPTION | REFERENCE |
|---|---|---|
| 10-50405 | W36 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-50406 | W37 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-50407 | W38 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-50415 | W46 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-50800 | TOP INSULATION | WP 0069, WP 0072, Figure 2 Housing Group |
| 10-50801 | LOWER LEFT INSULATION | WP 0069, WP 0072, Figure 2 Housing Group |
| 10-50802 | UPPER SIDE INSULATION | WP 0069, WP 0072, Figure 2 Housing Group |
| 10-50803 | BULKHEAD INSULATION | WP 0069, WP 0072, Figure 2 Housing Group |
| 10-50804 | BOTTOM INSULATION | WP 0069, WP 0072, Figure 2 Housing Group |

**INDEX OF MANUFACTURED ITEMS – CONTINUED**

| P/N AND/OR DWG NO | PART DESCRIPTION | REFERENCE |
|---|---|---|
| 10-50805 | LOWER RIGHT INSULATION | WP 0069, WP 0072, Figure 2 Housing Group |
| 10-50814 | INLET TOP INSULATION | WP 0069, WP 0072, Figure 2 Housing Group |
| 10-51408 | W34 | WP 0068, WP 0074, Figure 4 Power Controls Group |
| 10-51409 | W33 | WP 0068, WP 0074, Figure 4 Power Controls Group |
| 10-51421 | W49 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-51422 | W50 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-52425 | W28 | WP 0068, WP 0074, Figure 4 Power Controls Group |
| 10-52440 | W53 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-52448 | W61 | WP 0068, WP 0073, Figure 3 Power Distribution/Conditioning Group |
| 10-52841-06 | CONDENSATE TUBE | WP 0067, WP 0078, Figure 8 Water Connections Group |
| 10-52841-07 | CONDENSATE TUBE | WP 0067, WP 0078, Figure 8 Water Connections Group |
| 10-52844-07 | RUGGED HEAT SHRINK TUBING | WP 0069, WP 0080, Figure 10 Compressor Group |
| 10-52854-07 | TUBE INSULATION | WP 0069, WP 0082, Figure 12 Evaporator Group |
| 10-52854-09 | TUBE INSULATION | WP 0069, WP 0083, Figure 13 Refrigerant Piping Group |
| 10-52857 | COMPRESSOR BRACE TRIM | WP 0069, WP 0080, Figure 10 Compressor Group |

**END OF WORK PACKAGE**

## FIELD MAINTENANCE

## MANUFACTURING PROCEDURE - CONDENSATE TUBES

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

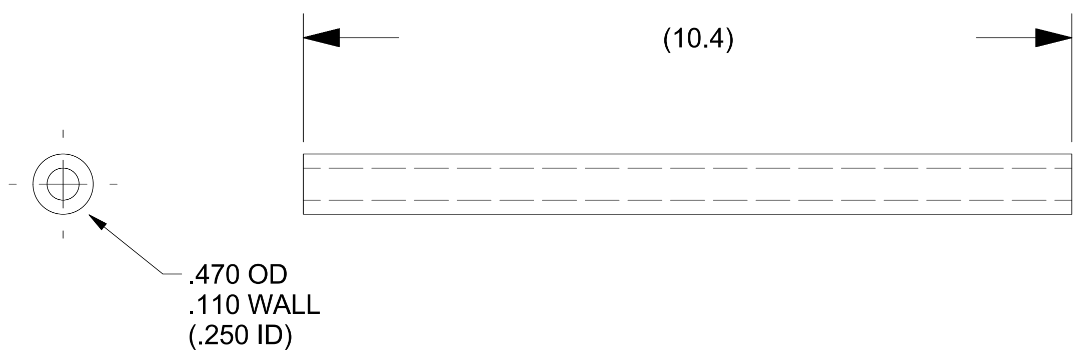
Utilities Equipment Repairer 91C (1)

**References**

WP 0051
WP 0086
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)



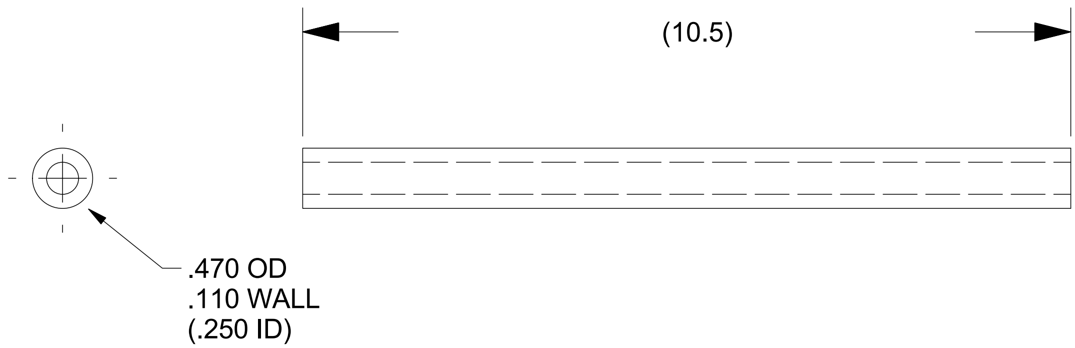

**Procedure**

1. Remove condensate tube from IECU (WP 0051).
2. Cut new tube to length of existing tube (10 2/5-inches).
3. Install new condensate tube (WP 0051).

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Condensate Tube | A.R. | P/N 220-0072 (06034) | WP 0086, Item 11 |

**Figure 1. Condensate Tube.**




**Procedure**

1. Remove condensate tube from IECU (WP 0051).
2. Cut new tube to length of existing tube (10 1/2-inches).
3. Install new condensate tube (WP 0051).

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Condensate Tube | A.R. | P/N 220-0072 (06034) | WP 0086, Item 11 |

**Figure 2. Condensate Tube.**

**END OF WORK PACKAGE**

# FIELD MAINTENANCE

## MANUFACTURING PROCEDURE - JUMPER CABLES

**INITIAL SETUP:**

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Personnel Required**

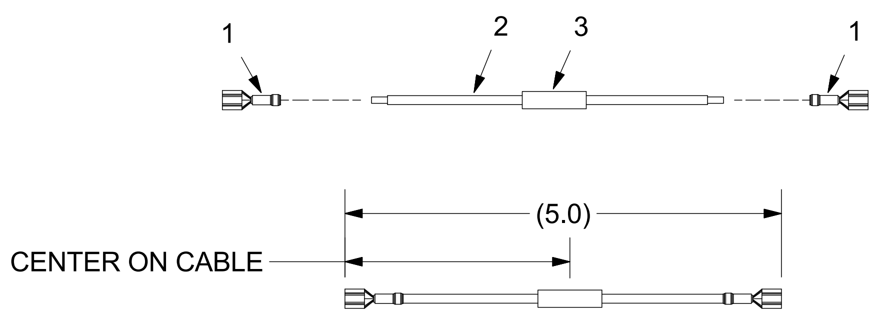
Utilities Equipment Repairer 91C (1)

**References**

WP 0086
WP 0091

**Equipment Condition**

IECU is shut down (WP 0005)



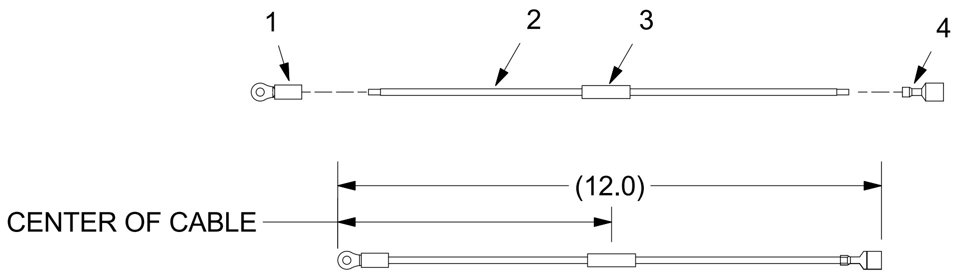

**Procedure**

1. Cut wire (Figure 1, Item 2) to length (5-inches).
2. Strip 3/8-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 1, Item 1) to each end of wire (Figure 1, Item 2).
4. Mark label (Figure 1, Item 3) with part number 10-52425.
5. Install label (Figure 1, Item 3) on wire (Figure 1, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| SELF-INSULATED QUICK DISCONNECT | 2 | P/N 10-52549 (0A0B7) | WP 0074, Item 42 |
| WIRE, 18 AWG, WHITE | A.R. | P/N M16878G/03-BHE9 (81349) | WP 0074, Item 43 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0074, Item 44 |

**Figure 1. Cable W28.**



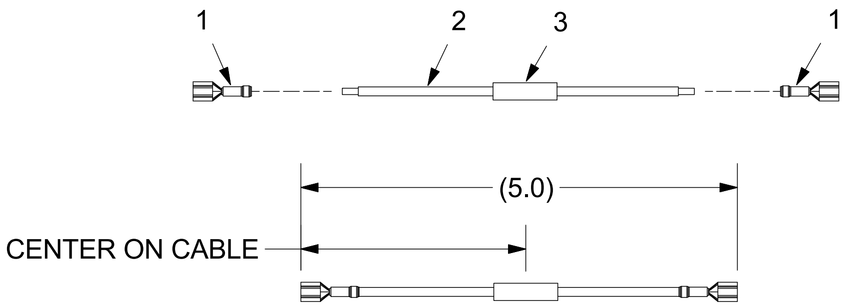

**Procedure**

1. Cut wire (Figure 2, Item 2) to length (12-inches).
2. Strip 1/4-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 2, Item 1) and ring terminal (Figure 2, Item 4) to opposite ends of wire (Figure 2, Item 2).
4. Mark label (Figure 2, Item 3) with part number 10-51409.
5. Install label (Figure 2, Item 3) on wire (Figure 2, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| RING TERMINAL, 10-12 AWG, #10 STUD | 1 | P/N MS25036-112 (81343) | WP 0074, Item 33 |
| WIRE, 12 AWG, BLACK | A.R. | P/N M16878G/03-BLJ0 (81349) | WP 0074, Item 34 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0074, Item 35 |
| QUICK DISCONNECT, 10-12 AWG | 1 | P/N 10-52520 (0A0B7) | WP 0074, Item 36 |

**Figure 2. Cable W33.**



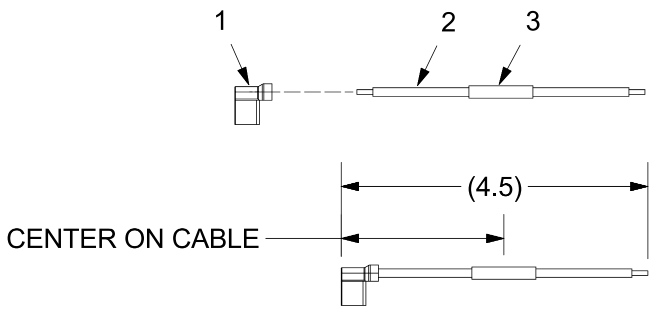

**Procedure**

1. Cut wire (Figure 3, Item 2) to length (5-inches).
2. Strip 3/8-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 3, Item 1) to each end of wire (Figure 3, Item 2).
4. Mark label (Figure 3, Item 3) with part number 10-51408.
5. Install label (Figure 3, Item 3) on wire (Figure 3, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| SELF-INSULATED QUICK DISCONNECT | 2 | P/N 10-52565-01 (0A0B7) | WP 0074, Item 38 |
| WIRE, 18 AWG, BLACK | A.R. | P/N M16878G/03-BHE0 (81349) | WP 0074, Item 39 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0074, Item 40 |

**Figure 3. Cable W34.**



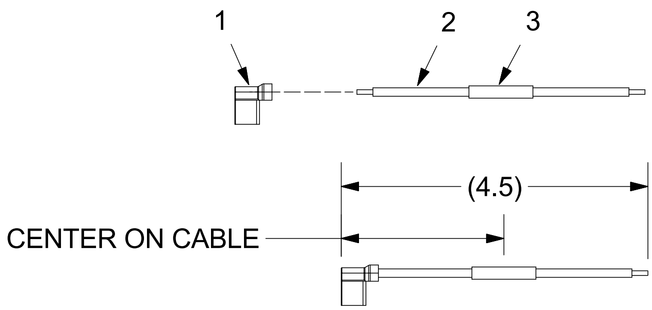

**Procedure**

1. Cut wire (Figure 4, Item 2) to length (4 1/2-inches).
2. Strip 3/8-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 4, Item 1) on one end of wire (Figure 4, Item 2).
4. Mark label (Figure 4, Item 3) with part number 10-50405.
5. Install label (Figure 4, Item 3) on wire (Figure 4, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| QUICK DISCONNECT, 14-16 AWG | 1 | P/N 10-51500 (0A0B7) | WP 0073, Item 45 |
| WIRE, 14 AWG, WHITE | A.R. | P/N M16878G/03-BKH9 (81349) | WP 0073, Item 46 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 47 |

**Figure 4. Cable W36.**



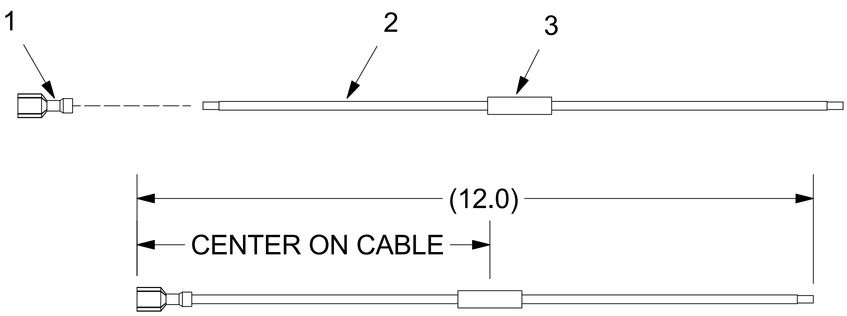

**Procedure**

1. Cut wire (Figure 5, Item 2) to length (4 1/2-inches).
2. Strip 3/8-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 5, Item 1) on one end of wire (Figure 5, Item 2).
4. Mark label (Figure 5, Item 3) with part number 10-50406.
5. Install label (Figure 5, Item 3) on wire (Figure 5, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| QUICK DISCONNECT, 14-16 AWG | 1 | P/N 10-51500 (0A0B7) | WP 0073, Item 25 |
| WIRE, 14 AWG, ORANGE | A.R. | P/N M16878G/03-BKH3 (81349) | WP 0073, Item 26 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 27 |

**Figure 5. Cable W37.**



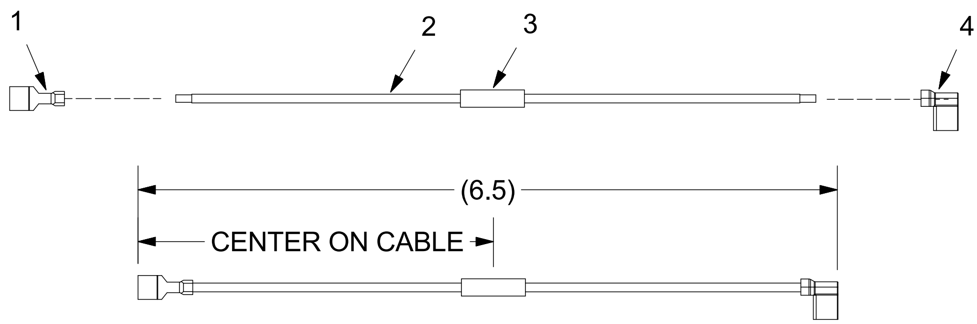

**Procedure**

1. Cut wire (Figure 6, Item 2) to length (12-inches).
2. Strip 3/8-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 6, Item 1) on one end of wire (Figure 6, Item 2).
4. Mark label (Figure 6, Item 3) with part number 10-50407.
5. Install label (Figure 6, Item 3) on wire (Figure 6, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| QUICK DISCONNECT, 14-16 AWG | 1 | P/N 10-52521 (0A0B7) | WP 0073, Item 29 |
| WIRE, 14 AWG, BLACK | A.R. | P/N M16878G/3-BLJ0 (81349) | WP 0073, Item 30 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 31 |

**Figure 6. Cable W38.**



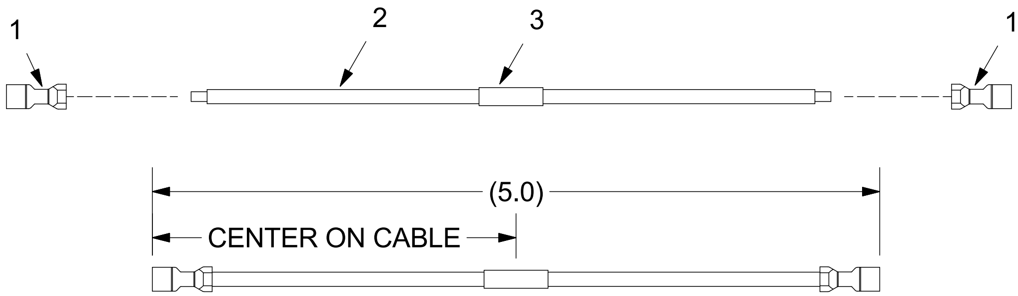

**Procedure**

1. Cut wire (Figure 7, Item 2) to length (6 1/2-inches).
2. Strip 3/8-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 7, Item 1) and disconnect (Figure 7, Item 4) to opposite ends of wire (Figure 7, Item 2).
4. Mark label (Figure 7, Item 3) with part number 10-50415.
5. Install label (Figure 7, Item 3) on wire (Figure 7, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| QUICK DISCONNECT, 14-16 AWG | 1 | P/N 10-51500 (0A0B7) | WP 0073, Item 20 |
| WIRE, 14 AWG, WHITE | A.R. | P/N M16878G/03-BKH9 (81349) | WP 0073, Item 21 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 22 |
| QUICK DISCONNECT, 14-16 AWG | 1 | P/N 10-52521 (0A0B7) | WP 0073, Item 23 |

**Figure 7. Cable W46.**



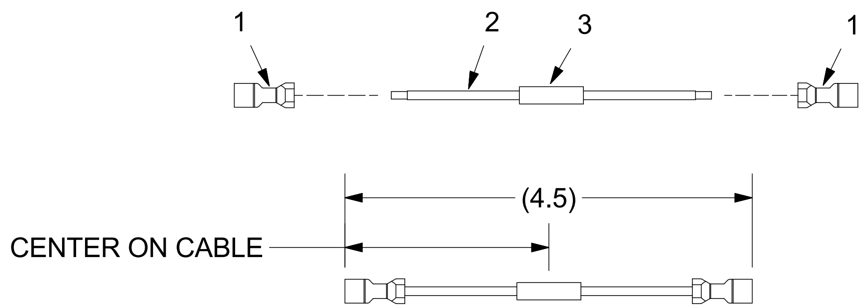

**Procedure**

1. Cut wire (Figure 8, Item 2) to length (5-inches).
2. Strip 1/4-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 8, Item 1) to each end of wire (Figure 8, Item 2).
4. Mark label (Figure 8, Item 3) with part number 10-51421.
5. Install label (Figure 8, Item 3) on wire (Figure 8, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| QUICK DISCONNECT, 10-12 AWG | 2 | P/N 10-52520 (0A0B7) | WP 0073, Item 43 |
| WIRE, 12 AWG, WHITE | A.R. | P/N M16878G/03-BLJ9 (81349) | WP 0073, Item 41 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 42 |

**Figure 8. Cable W49.**



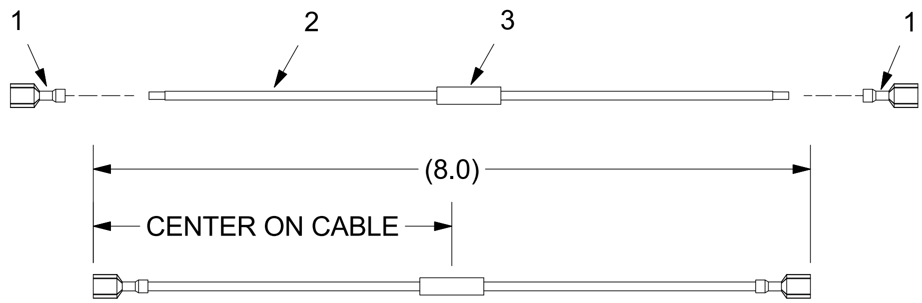

**Procedure**

1. Cut wire (Figure 9, Item 2) to length (4 1/2-inches).
2. Strip 1/4-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 9, Item 1) to each end of wire (Figure 9, Item 2).
4. Mark label (Figure 9, Item 3) with part number 10-51422.
5. Install label (Figure 9, Item 3) on wire (Figure 9, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| QUICK DISCONNECT, 10-12 AWG | 2 | P/N 10-52520 (0A0B7) | WP 0073, Item 33 |
| WIRE, 12 AWG, BLACK | A.R. | P/N M16878G/03-BLJ0 (81349) | WP 0073, Item 34 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 35 |

**Figure 9. Cable W50.**



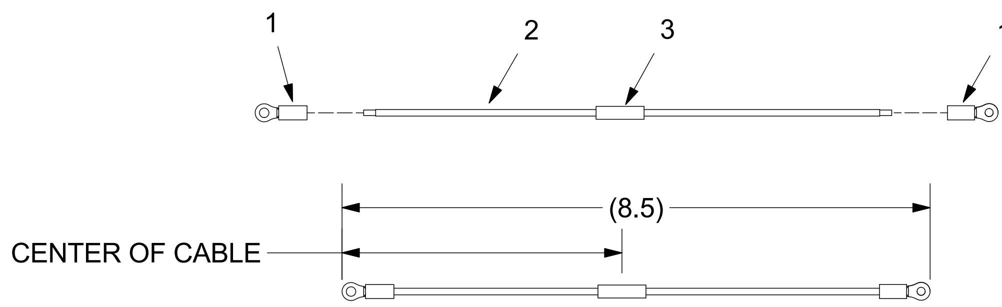

**Procedure**

1. Cut wire (Figure 10, Item 2) to length (8-inches).
2. Strip 3/8-inch of insulation from each end of wire.
3. Crimp disconnect (Figure 10, Item 1) to each end of wire (Figure 10, Item 2).
4. Mark label (Figure 10, Item 3) with part number 10-52440.
5. Install label (Figure 10, Item 3) on wire (Figure 10, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| QUICK DISCONNECT, 22-18 AWG | 2 | P/N 10-52549 (0A0B7) | WP 0073, Item 39 |
| WIRE, 18 AWG, BLUE | A.R. | P/N M16878G/03-BHE6 (81349) | WP 0073, Item 38 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 37 |

**Figure 10. Cable W53.**




**Procedure**

1. Cut wire (Figure 11, Item 2) to length (8 1/2-inches).
2. Strip 1/4-inch of insulation from each end of wire.
3. Crimp ring terminal (Figure 11, Item 1) to each end of wire (Figure 11, Item 2).
4. Mark label (Figure 11, Item 3) with part number 10-52448.
5. Install label (Figure 11, Item 3) on wire (Figure 11, Item 2) at center of cable. The label overlaminate material should cover the printed area of the label.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| RING TERMINAL, #8 STUD | 2 | P/N MS25036-156 (96906) | WP 0073, Item 67 |
| WIRE, 12 AWG, G/Y | A.R. | P/N M16878G/03-BLJ5 (81349) | WP 0073, Item 69 |
| SELF LAMINATING LABEL | 1 | P/N 10-52524 (0A0B7) | WP 0073, Item 68 |

**Figure 11. Cable W61.**

**END OF WORK PACKAGE**

# FIELD MAINTENANCE

## MANUFACTURING PROCEDURE - INSULATION

### INITIAL SETUP:

**Tools and Special Tools**

Service Refrigeration Ordnance Tool Kit (WP 0091, Table 2, Item 12)

**Materials/Parts**

Acetone (WP 0094, Table 1, Item 1)

**Personnel Required**

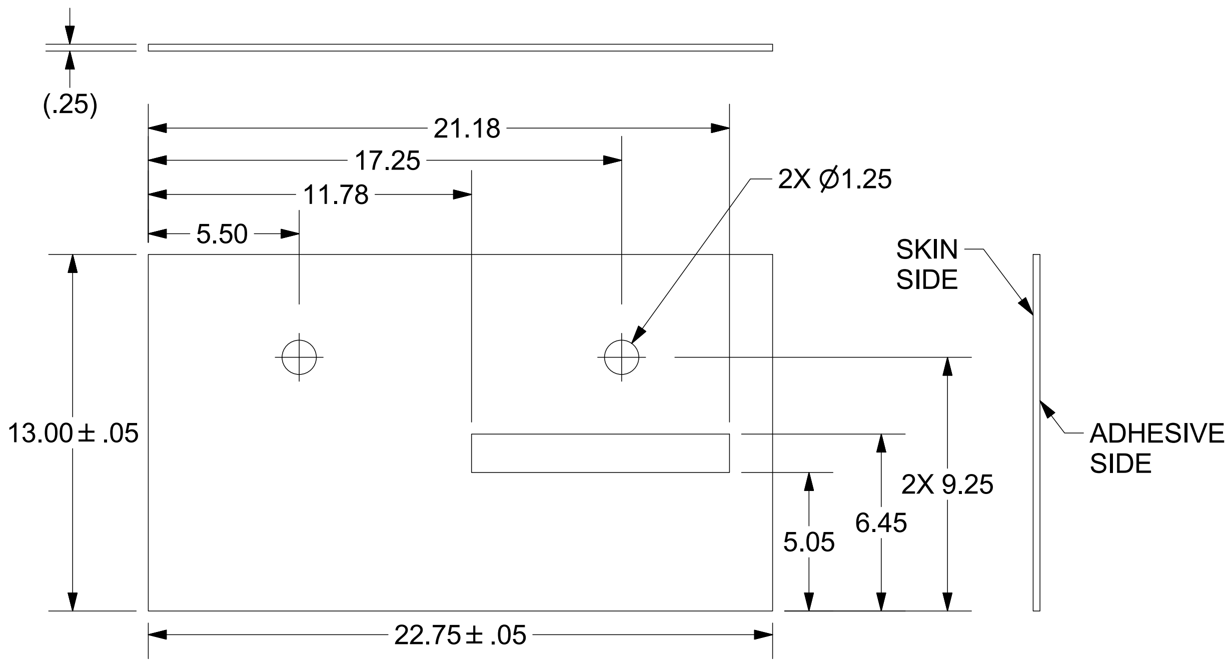
Utilities Equipment Repairer 91C (1)

**References**

WP 0012
WP 0032
WP 0086
WP 0091
WP 0094

**Equipment Condition**

IECU is shut down (WP 0005)



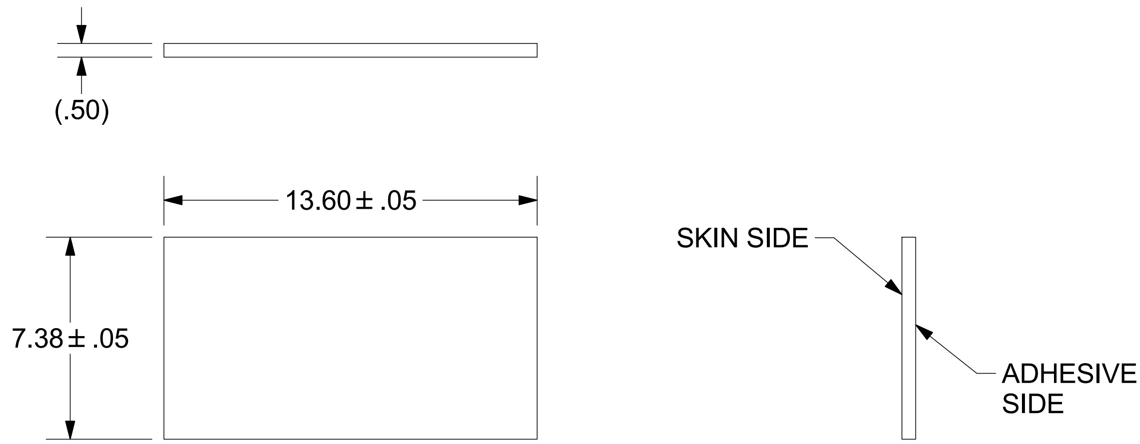

**Procedure**

1. Remove cover assembly (WP 0032) or air filter (WP 0012) as necessary to access insulation (Figures 1 through 7).
2. Cut loose, frayed, or cracked insulation away from sheet metal.
3. Cut sheet of insulation material to match shape of panels, cutouts, or voids.
4. Ensure that sheet metal surface is free of debris and remove residual adhesive material with acetone. Clean area with acetone.
5. Carefully peel adhesive covering off insulation and press onto sheet metal.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Panel Insulation | A.R. | P/N SAS14043 (1T5T4) | WP 0086, Item 4 |

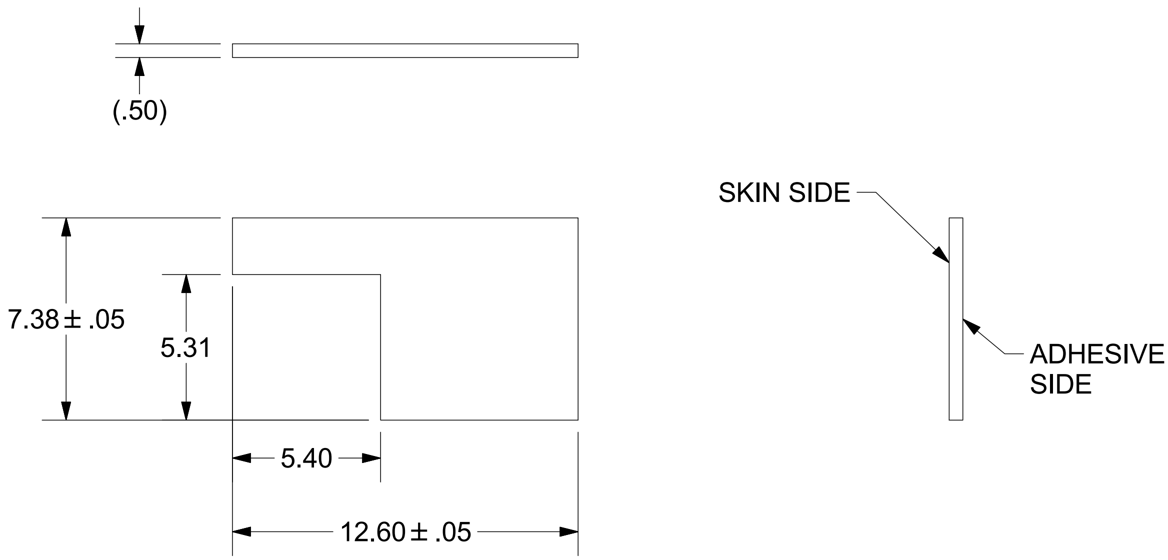
**Figure 1.  Bottom Insulation.**




**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Panel Insulation | A.R. | P/N SAS12043 (1T5T4) | WP 0086, Item 15 |

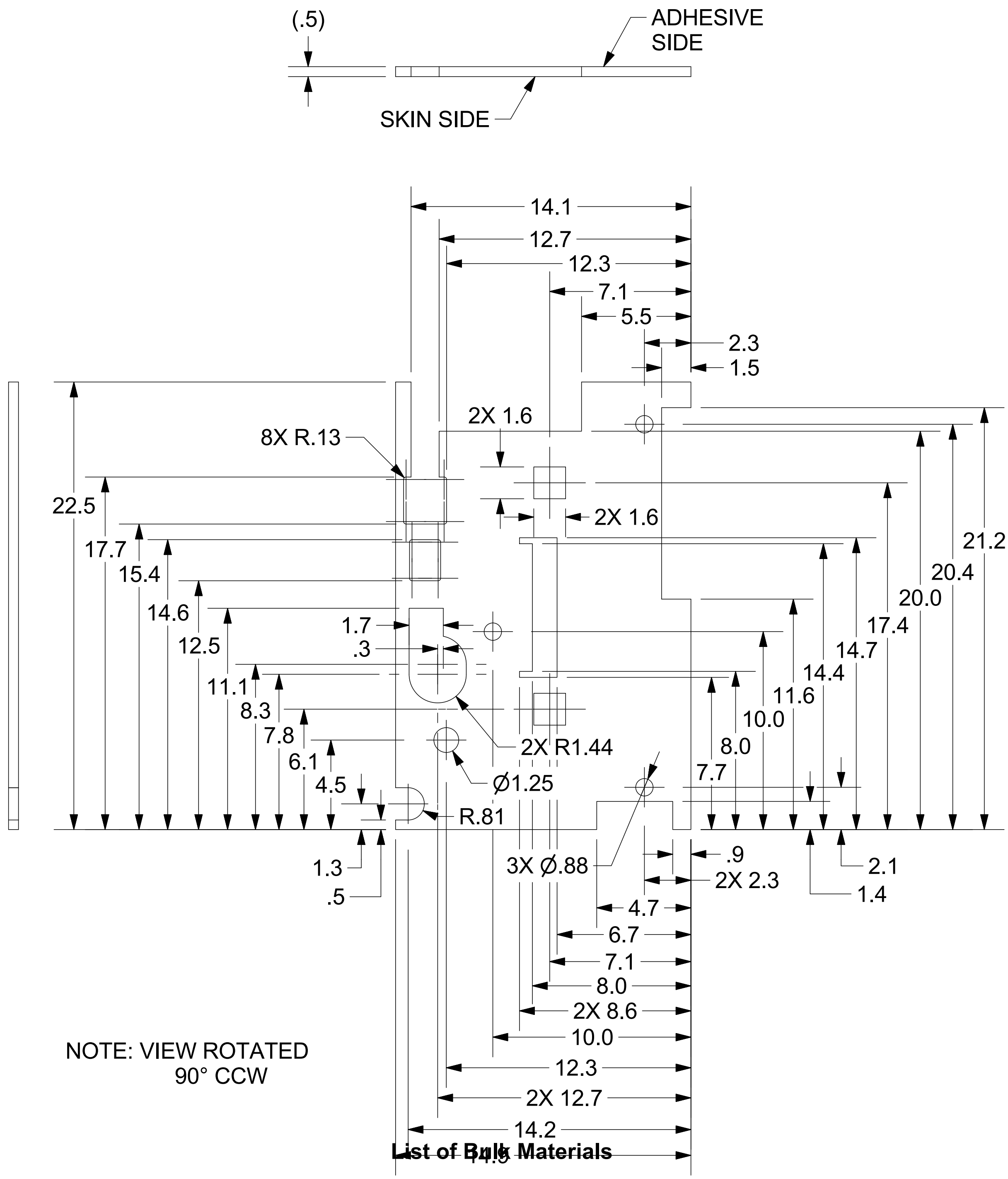
**Figure 2. Lower Left Insulation.**




**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Panel Insulation | A.R. | P/N SAS12043 (1T5T4) | WP 0086, Item 15 |

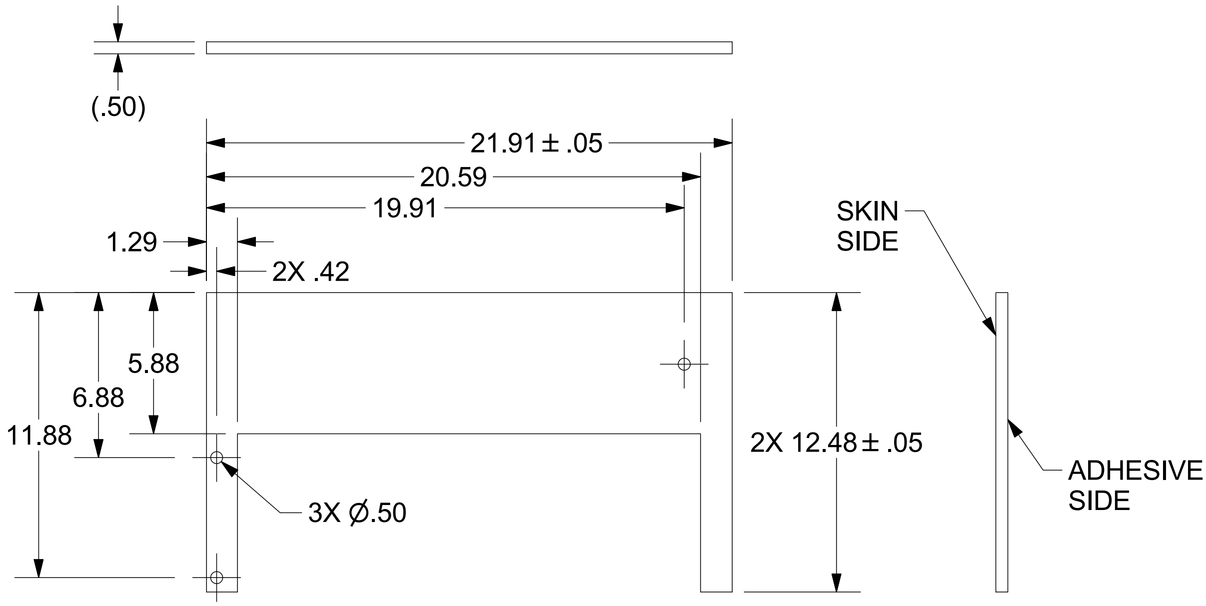
**Figure 3. Lower Right Insulation.**




**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Panel Insulation | A.R. | P/N SAS12043 (1T5T4) | WP 0086, Item 15 |

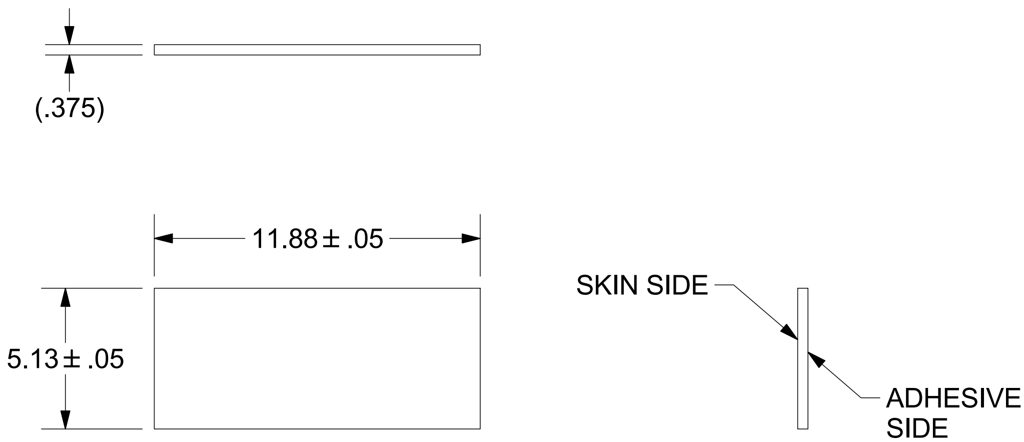
**Figure 4. Bulkhead Insulation.**




**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Panel Insulation | A.R. | P/N SAS12043 (1T5T4) | WP 0086, Item 15 |

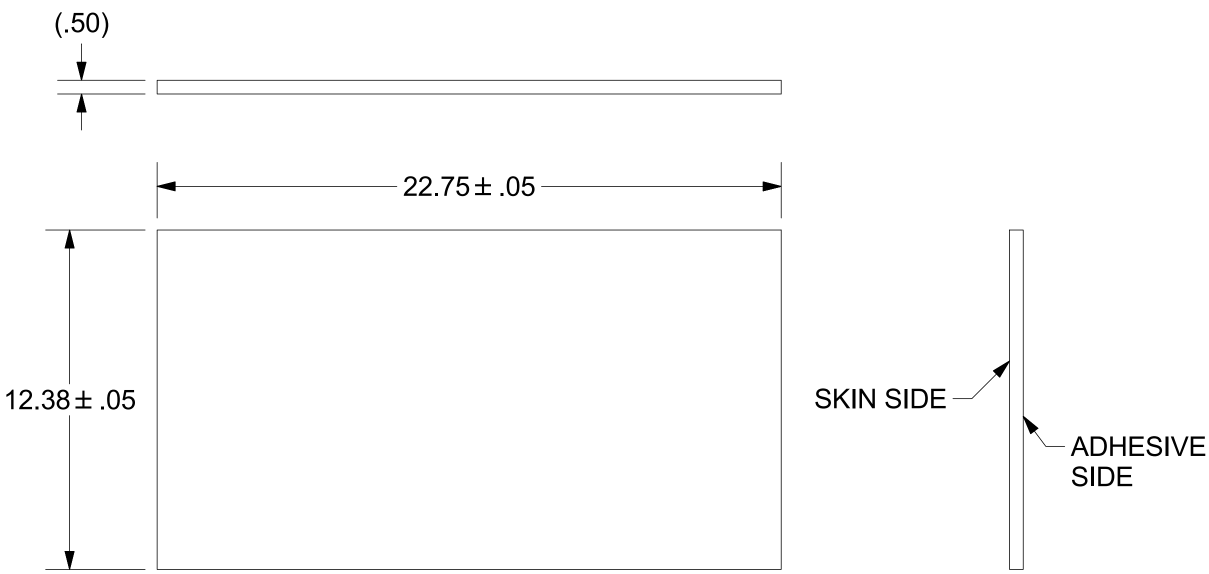
**Figure 5. Inlet Top Insulation.**




**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Panel Insulation | A.R. | P/N SAS12043 (1T5T4) | WP 0086, Item 15 |

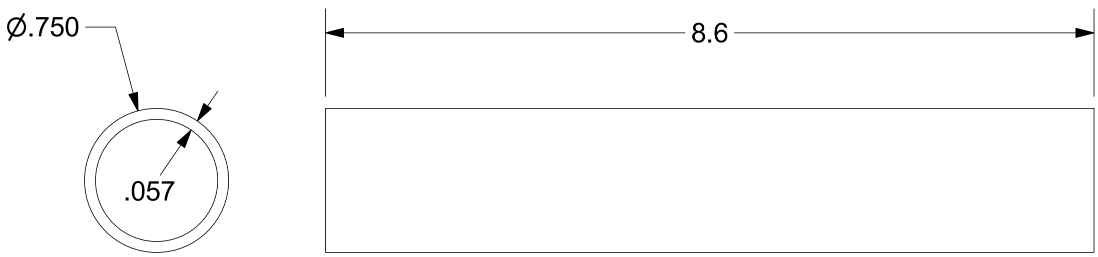
**Figure 6. Upper Side Insulation.**




**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Panel Insulation | A.R. | P/N SAS12043 (1T5T4) | WP 0086, Item 15 |

**Figure 7. Top Insulation.**



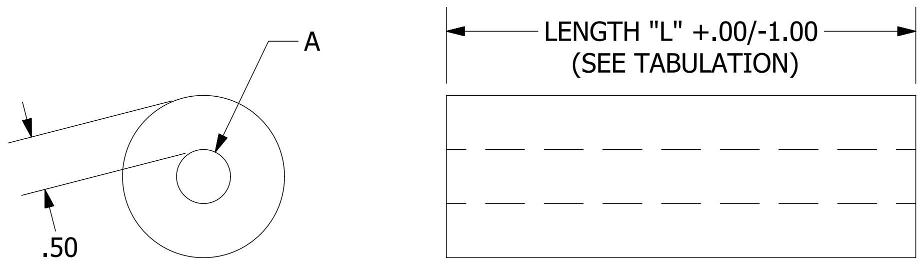

| TABULATION | | | | |
|---|---|---|---|---|
| PART NUMBER | Ø D (MIN) DIAMETER SUPPLIED | MAX DIAMETER RECOVERED AFTER HEATING | WALL THICKNESS | |
| | | | AFTER HEATING | TOLERANCE |
| 10-52844-07 | .750 | .428 | .057 | +/-.015 |

1. Cut tubing to 8.6".
2. Slide tubing over compressor U-bolt.
3. Using a heat gun, heat tubing until it shrinks.
   a. To ensure that the tubing shrinks evenly and without air bubbles, rotate the U-bolt while applying heat.
   a. Evenly apply heat over the length and around the diameter of the tubing, until it is uniformly shrunken and conforms to the shape of the U-bolt.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Rugged Heat Shrink Tubing | A.R. | P/N NT-MIL 3/4-0 (06090) | WP 0086, Item 17 |

**Figure 8. Rugged Heat Shrink Tubing.**



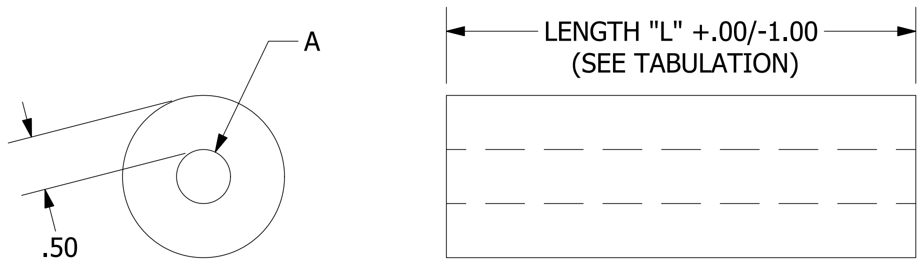

| TABULATION | | |
|---|---|---|
| PART NUMBER | LENGTH "L" (IN) | A |
| 10-52854-01 | 19.00 | 1/2" |
| 10-52854-02 | 14.50 | 5/8" |
| 10-52854-03 | 30.00 | 5/8" |
| 10-52854-04 | 7.50 | 5/8" |
| 10-52854-05 | 9.75 | 1/2" |
| 10-52854-06 | 6.50 | 1/2" |
| 10-52854-07 | 19.75 | 1/2" |
| 10-52854-08 | 2.50 | 1/2" |
| 10-52854-09 | 9.00 | 3/8" |
| 10-52854-10 | 2.00 | 3/8" |

1. Cut insulation sleeving to 19.75".
2. Slide insulation sleeving over refrigerant pipe.
3. Secure with electrical tiedown straps.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Insulation Sleeving | A.R. | P/N 6RXL048048 (3HJD1) | WP 0086, Item 13 |
| Electrical Tiedown Strap | 6 | P/N MS3367-5-0 (80205) | WP 0082, Item 3 |

**Figure 9. Evaporator Tube Insulation.**



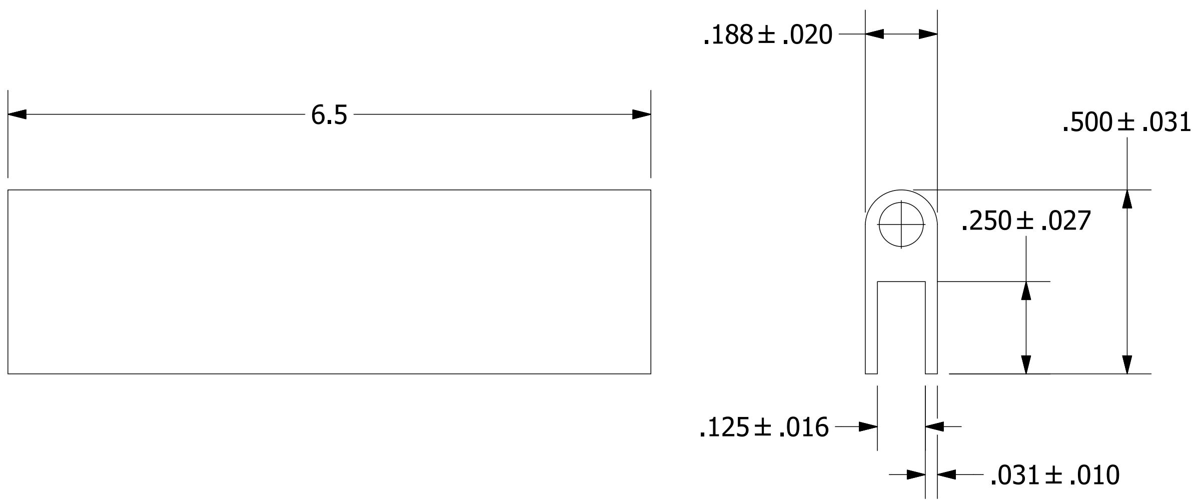

| TABULATION | | |
|---|---|---|
| PART NUMBER | LENGTH "L" (IN) | A |
| 10-52854-01 | 19.00 | 1/2" |
| 10-52854-02 | 14.50 | 5/8" |
| 10-52854-03 | 30.00 | 5/8" |
| 10-52854-04 | 7.50 | 5/8" |
| 10-52854-05 | 9.75 | 1/2" |
| 10-52854-06 | 6.50 | 1/2" |
| 10-52854-07 | 19.75 | 1/2" |
| 10-52854-08 | 2.50 | 1/2" |
| 10-52854-09 | 9.00 | 3/8" |
| 10-52854-10 | 2.00 | 3/8" |

1. Cut insulation sleeving to 9.0".
2. Slide insulation sleeving over refrigerant pipe.
3. Secure with electrical tiedown straps.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Insulation Sleeving | A.R. | P/N 6RXL048038 (3HJD1) | WP 0086, Item 13 |
| Electrical Tiedown Strap | 6 | P/N MS3367-5-0 (80205) | WP 0083, Item 7 |

**Figure 10. Bulkhead Wall to Compressor Tube Insulation.**




1. Cut brace trim to 6.5".
2. Position brace trim between compressor mounting bracket and compressor brazing assembly.

**List of Bulk Materials**

| DESCRIPTION | QUANTITY | IDENTIFYING NUMBER | REFERENCE INFORMATION |
|---|---|---|---|
| Seal, Non-metallic | A.R. | P/N RWPD-1 (1X147) | WP 0086, Item 16 |

**Figure 11. Compressor Brace Trim .**

**END OF WORK PACKAGE**

# CHAPTER 7

# OPERATOR AND FIELD PARTS INFORMATION

# OPERATOR AND FIELD MAINTENANCE

# INTRODUCTION

## INTRODUCTION

## SCOPE

This RPSTL lists and authorized spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of operator and field maintenance of the 9K IECU. 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 spare and repair parts authorized for use in the performance of maintenance at the levels determined by the MAC/SMR code. 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 the Bulk Items work package which follows 0085 work package. 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. Bulk Items Work Package. This work package lists all items identified as ‘bulk’ in the parts lists. Due to the nature of bulk items, this work package does not include a Figure.

3. Cross-Reference Indexes Work Packages. There are 2 cross-reference indexes work packages in this RPSTL. The National Stock Number (NSN) Index work package refers you to the Figure and item number for each NSN listed in the RPSTL. The Part Number Index work package refers you to the figure and item number for each part number listed in the RPSTL.

## EXPLANATION OF ENTRIES IN THE REPAIR PARTS LIST AND SPECIAL TOOLS LIST WORK PACKAGES

ITEM NO. (Entry 1). Indicates the number used to identify items called out in the illustration.

SMR CODE (Entry 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 Explanation.**

| SOURCE CODE XX | MAINTENANCE CODE XX | | RECOVERABILITY CODE 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 | Who determines disposition action on unserviceable items. |

INTRODUCTION – CONTINUED

**NOTE**

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:

**Table 2. Source Code Explanation.**

| SOURCE CODE | APPLICATION/EXPLANATION |
|---|---|
| PA<br>PB<br>PC<br>PD<br>PE<br>PF<br>PG<br>PH<br>PR<br>PZ | 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.<br>**NOTE**<br>Items coded PC are subject to deterioration. |
| KD<br>KF<br>KB | Items with these codes are not to be requested/requisitioned individually. They are part of a kit that is authorized to the maintenance level indicated in the third position of the SMR code. The complete kit must be requisitioned and applied. |
| MF-Made at maintainer class<br>MH-Made at below depot sustainment class<br>ML-Made at SRA<br>MD-Made at depot<br>MG-Navy only | Items with these codes are not to be requisitioned/requested individually. They must be made from bulk material which is identified by the P/N in the DESCRIPTION AND USABLE ON CODE (UOC) entry 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. |
| AF-Assembled by maintainer class<br>AH-Assembled by below depot sustainment class<br>AL-Assembled by SRA<br>AD-Assembled by depot<br>AG | 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. |
| 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 P/N. |

**INTRODUCTION – CONTINUED**

**Table 2. Source Code Explanation. – Continued**

| SOURCE CODE | APPLICATION/EXPLANATION |
|---|---|
| XC | Installation drawings, diagrams, instruction sheets, field service drawings; identified by manufacturer's P/N. |
| XD | Item is not stocked. Order an XD-coded item through local purchase or normal supply channels using the CAGEC and P/N 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 class authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to the following classes of maintenance:

| MAINTENANCE CODE | APPLICATION/EXPLANATION |
|---|---|
| C - | Crew. |
| F - | Maintainer maintenance can remove, replace, and use the item. |
| H - | Below Depot Sustainment maintenance can remove, replace, and use the item. |
| L - | Specialized repair activity 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 will use C in the third position. However, for joint service publications, other services may 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 class with the capability to do complete repair (perform all authorized repair functions).

| MAINTENANCE CODE | APPLICATION/EXPLANATION |
|---|---|
| C - | Crew (operator) is the lowest class that can do complete repair. |
| F - | Maintainer is the lowest class that can do complete repair of the item. |
| H - | Below Depot Sustainment is the lowest class that can do complete repair of the item. |

**INTRODUCTION – CONTINUED**

| MAINTENANCE CODE | APPLICATION/EXPLANATION |
|---|---|
| L - | Specialized repair activity (enter specialized repair activity designator) is the lowest class that can do complete repair of the item. |
| D - | Depot is the lowest class 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 CODE | APPLICATION/EXPLANATION |
|---|---|
| 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. |
| F - | Reparable item. When uneconomically reparable, condemn and dispose of the item at the field level. |
| H - | Reparable item. When uneconomically reparable, condemn and dispose of the item at the below depot sustainment. |
| D - | Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item are not authorized below depot. |
| L - | Reparable item. Condemnation and disposal not authorized below Specialized Repair Activity (SRA). |
| 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. |

NSN (Column (3)). The NSN(s) 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:

**INTRODUCTION – CONTINUED**

1. The federal item name, and when required, a minimum description to identify the item.
2. Part numbers of any bulk materials required if the item is to be locally manufactured or fabricated.
3. Hardness Critical Item (HCI). Items that require special handling or procedures to ensure protection against electromagnetic pulse (EMP) damage are marked with the letters ‘HCI.’
4. The statement END OF FIGURE appears below the last item description in column (6) for each Figure in the repair parts list, special tools repair parts, kits, bulk items, 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. 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. This column 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. This 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. Examples of the UOCs used in the RPSTL are:

| CODE | USED ON |
|---|---|
| 6QD | 9K BTU/HR IMPROVED ENVIRONMENTAL CONTROL UNIT (IECU) TYPE HD-1245/G |

Fabrication Instructions. Bulk materials required to manufacture items are listed in the bulk material work package 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 TM 9-4120-432-13&P.

## INTRODUCTION – CONTINUED

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 bulk items work package.

## 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 sub functional 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 for which you are looking.

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.

## ABBREVIATIONS

| Abbreviation | Explanation |
|---|---|
| A | AMPERE |
| AC | ALTERNATING CURRENT |
| AP | ATTACHING PART |
| AR | AS REQUIRED |
| AS | DRIVING SIDE |
| BL | BLUE |
| BR | BROWN |
| D | DIAMETER |
| DC | DIRECT CURRENT |
| ES | EXCITER SIDE |
| FIG | FIGURE |
| GRD | GROUND |
| Hz | HERTZ |
| INC | INCORPORATED |

**INTRODUCTION – CONTINUED**

| | |
|---|---|
| L | LITER |
| LH | LEFT HAND |
| M | METER |
| N | NEUTRAL |
| NI | NOT ILLUSTRATED |
| NO. | NUMBER |
| NR | NUMBER |
| NSN | NATIONAL STOCK NUMBER |
| P/O | PART OF |
| PDU | POWER DISTRIBUTION UNIT |
| PH | PHASE |
| QTY | QUANTITY |
| RH | RIGHT HAND |
| SEC | SECONDS |
| SW | BLACK |
| V | VOLT |
| VA | VOLTAMPERE |
| W | WATT |
| WT | WHITE |
| kW | KILOWATT |
| kΩ | KILO OHM |
| mV | MILLIVOLT |
| mm | MILLIMETER |
| ųF | MICROFARAD |

**END OF WORK PACKAGE**

## OPERATOR AND FIELD MAINTENANCE

## GROUP 00 AIR CONDITIONER

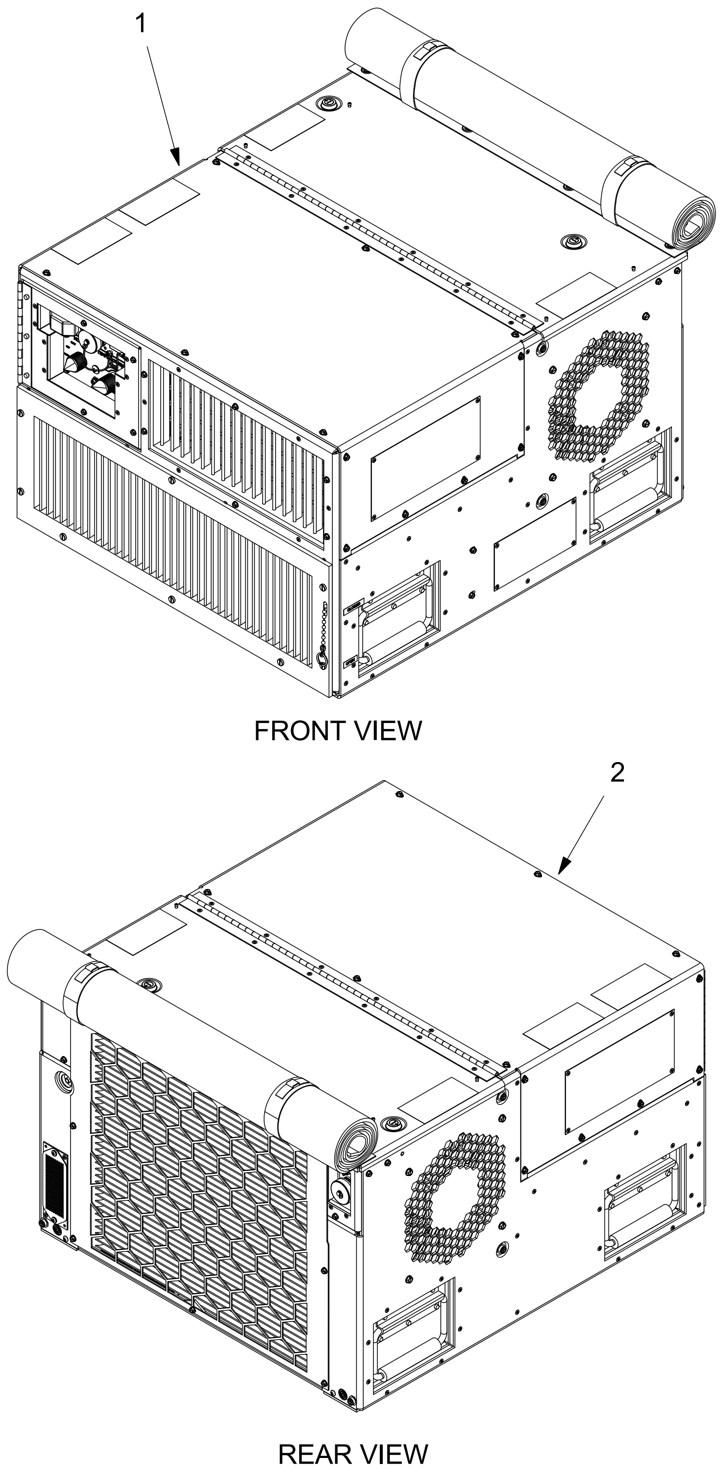



**Figure 1. Air Conditioner.**

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 00 AIR CONDITIONER** | |
| 1 | PDFFF | 4120-01-592-7940 | 0A0B7 | 10-5000 | AIR CONDITIONER ................................ | 1 |
| 2 | XBFFF | | 0A0B7 | 10-50001 | . BASE ...................................................... | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 01 HOUSING GROUP

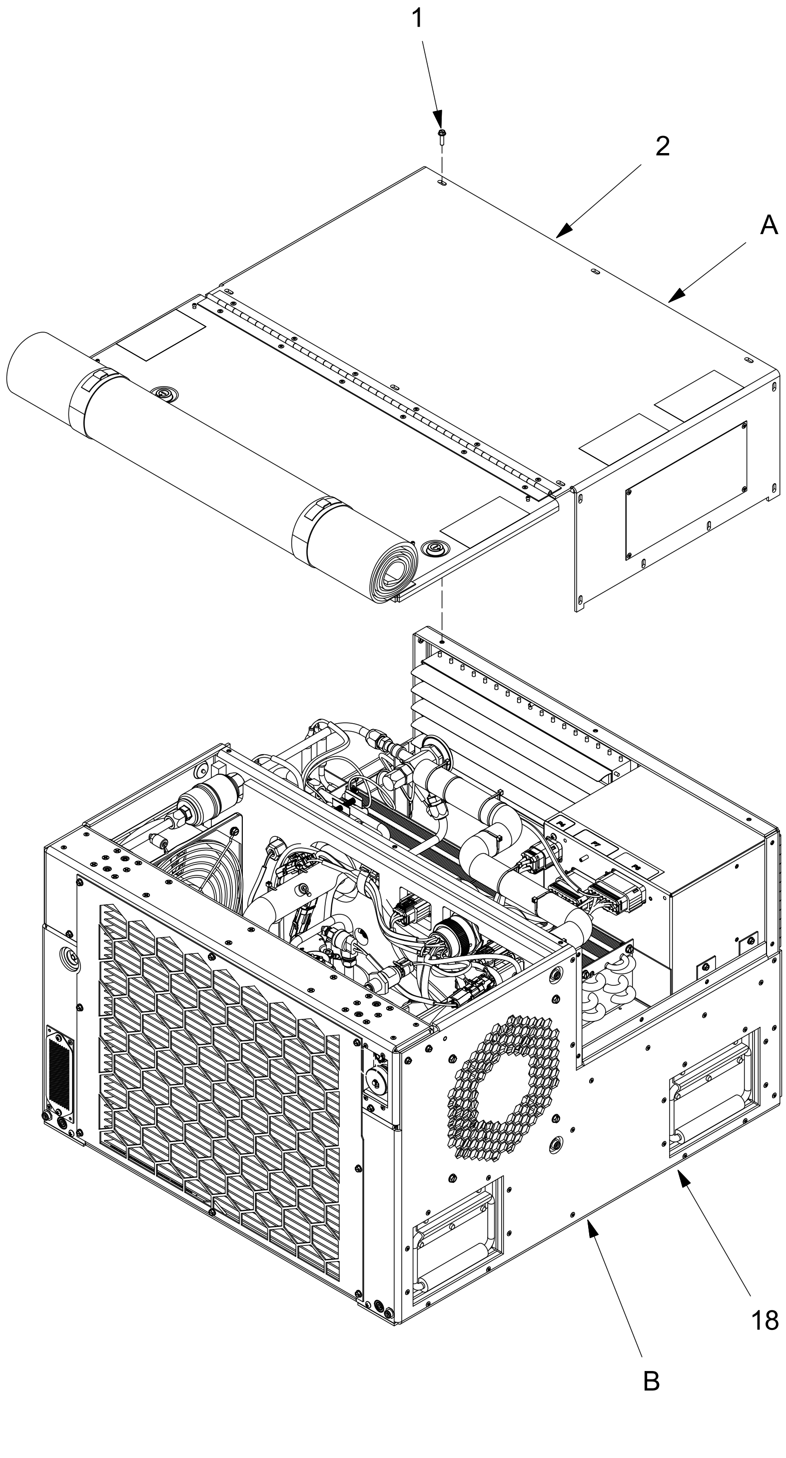



**Figure 2. Housing Group (Sheet 1 of 4).**

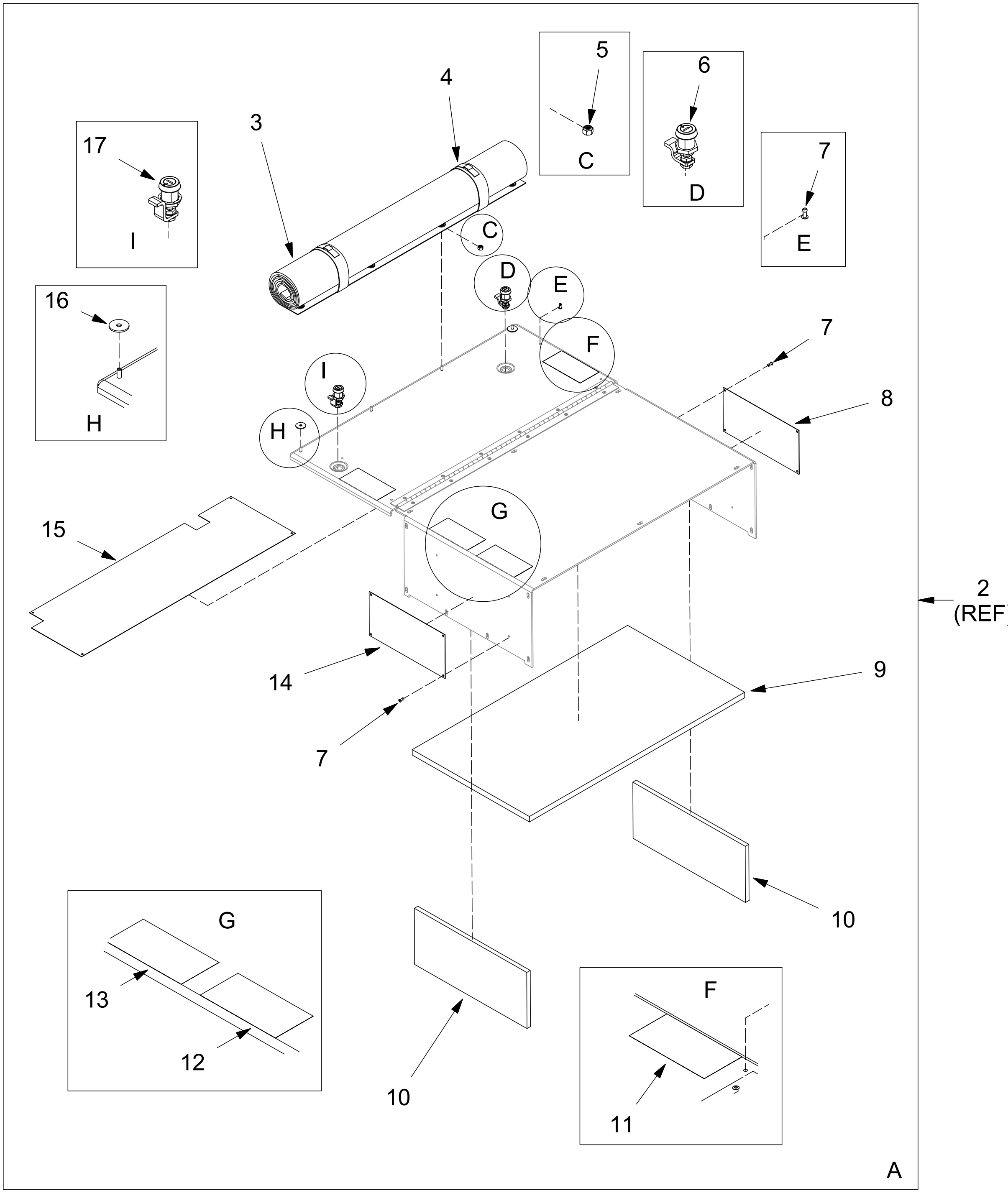



Figure 2. Housing Group (Sheet 2 of 4).

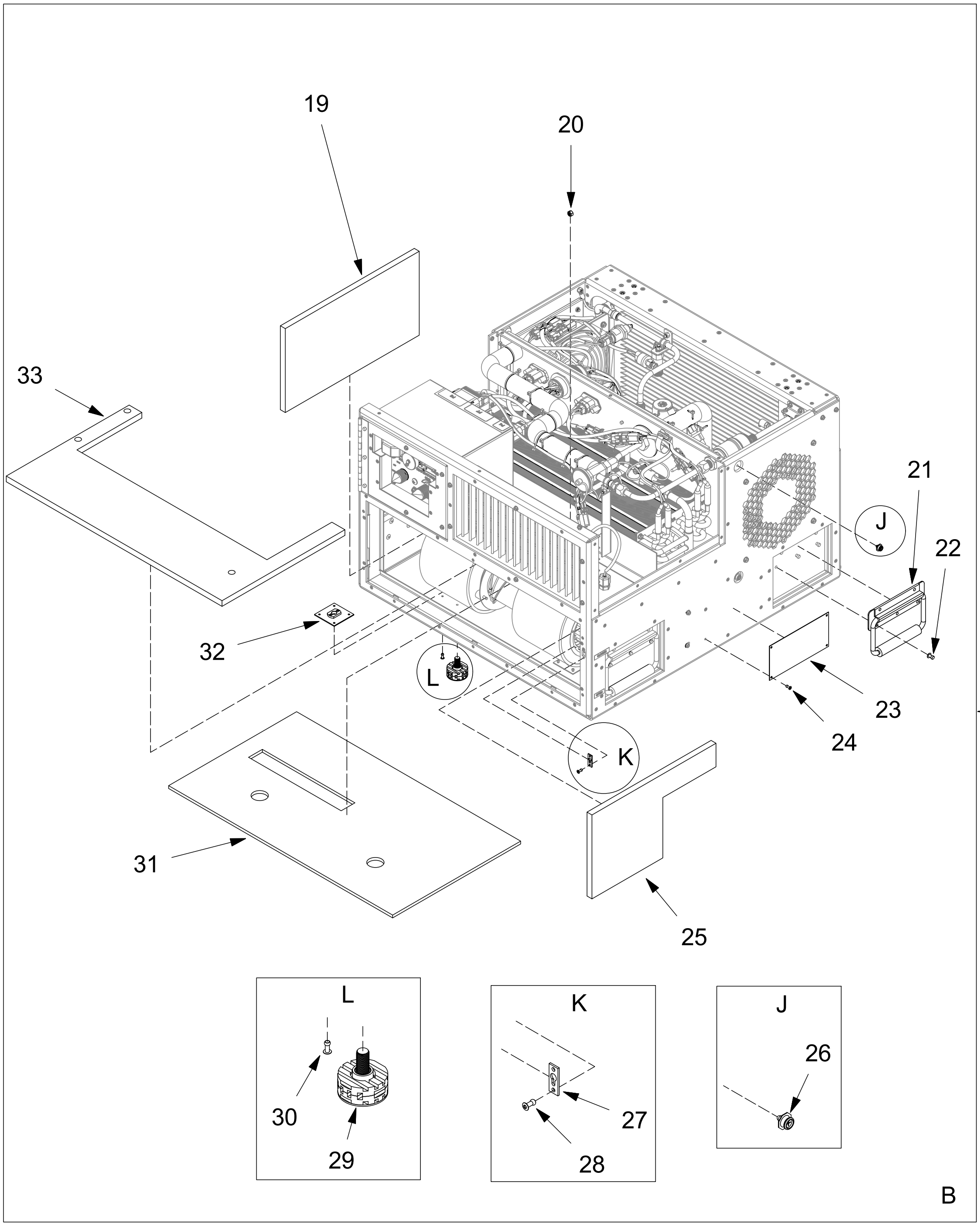



Figure 2. Housing Group (Sheet 3 of 4).

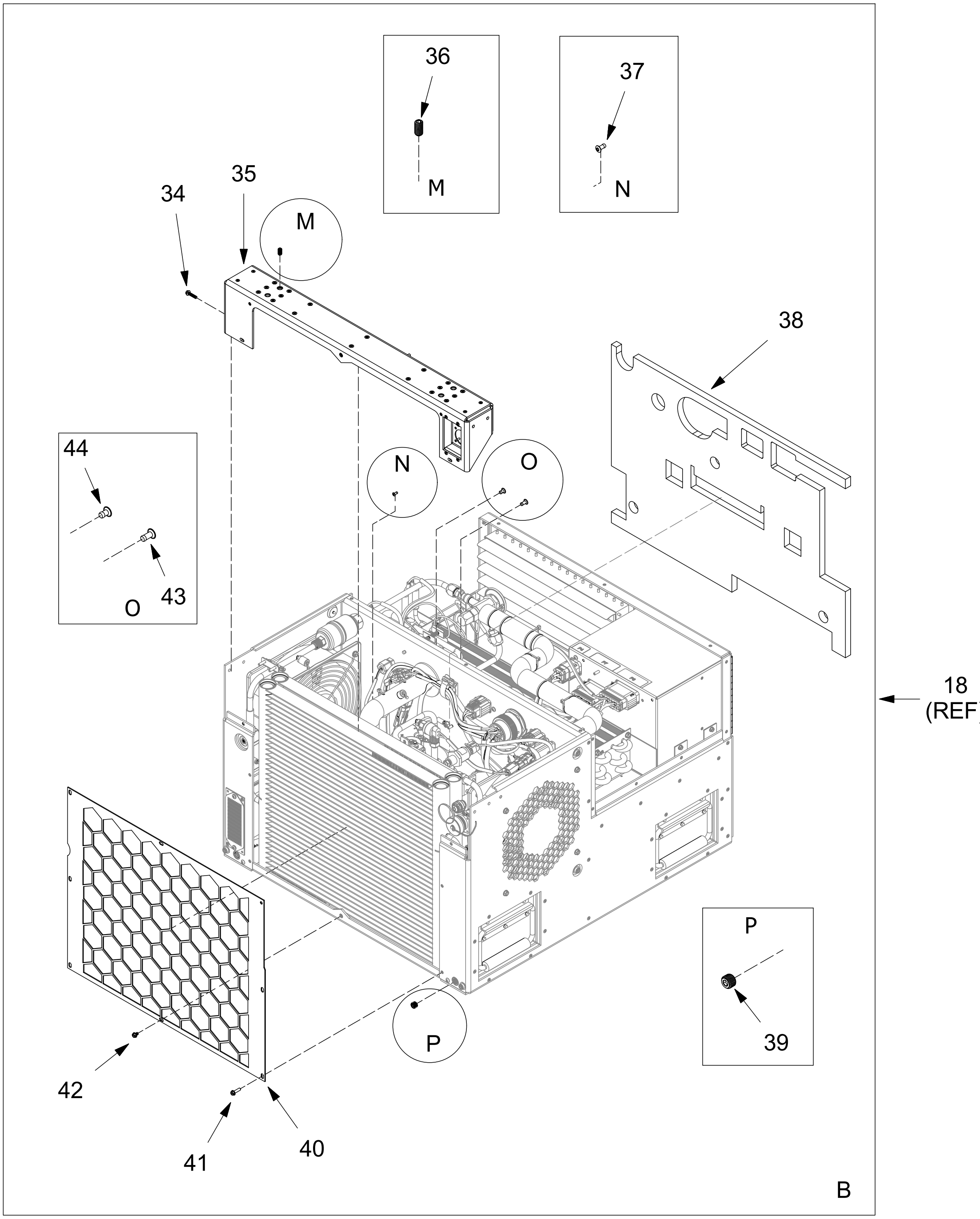



Figure 2. Housing Group (Sheet 4 of 4).

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 01 HOUSING GROUP** | |
| | | | | | **GROUP 0101 COVER ASSEMBLY** | |
| | | | | | **GROUP 0102 HOUSING ASSEMBLY** | |
| | | | | | **GROUP 0103 DATA PLATE** | |
| | | | | | **GROUP 0104 BRIDGE PLATE ASSEM-BLY** | |
| | | | | | **GROUP 0105 CONDENSER GRILLE** | |
| | | | | | **FIGURE 2 HOUSING GROUP** | |
| 1 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . SCREW,MACHINE ................................ | 18 |
| 2 | PBFFF | 5340-01-612-8320 | 0A0B7 | 10-50020 | . COVER,ACCESS .................................. | 1 |
| 3 | PAFZZ | 5340-01-613-7732 | 0A0B7 | 10-52036-01 | . . COVER,ACCESS ................................ | 1 |
| 4 | PAFZZ | 5340-01-610-4930 | 0A0B7 | 10-52035 | . . STRAP,RETAINING ............................. | 2 |
| 5 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . NUT,SELF-LOCKING,HE .................... | 4 |
| 6 | PAFZZ | | 0A0B7 | 10-52252-05 | . . LATCH,RIM ......................................... | 1 |
| 7 | PAFZZ | 5320-01-015-6896 | 0A0B7 | 10-52251-04 | . . RIVET,BLIND ....................................... | 12 |
| 8 | XBFZZ | | 0A0B7 | 10-52812 | . . LABEL ................................................. | 1 |
| 9 | MFFZZ | | 0A0B7 | 10-50800 | . . INSULATION SHEET,TH (MAKE FROM CAGE 1T5T4, P/N SAS12043) ..... | 1 |
| 10 | MFFZZ | | 0A0B7 | 10-50802 | . . INSULATION SHEET,TH (MAKE FROM CAGE 1T5T4, P/N SAS38043) ..... | 2 |
| 11 | PAFZZ | 7690-01-610-7160 | 0A0B7 | 10-52800 | . . MARKER,IDENTIFICATI ...................... | 1 |
| 12 | PAFZZ | 7690-01-610-5202 | 0A0B7 | 10-52802 | . . MARKER,IDENTIFICATI ...................... | 2 |
| 13 | PAFZZ | 7690-01-610-5518 | 0A0B7 | 10-52801 | . . MARKER,IDENTIFICATI ...................... | 1 |
| 14 | XBFZZ | | 0A0B7 | 10-50815 | . . LABEL ................................................. | 1 |
| 15 | PBFZZ | 7690-01-618-6737 | 0A0B7 | 10-50812 | . . MARKER,IDENTIFICATI ...................... | 1 |
| 16 | PAFZZ | | 0A0B7 | 10-52924-05 | . . WASHER,FLAT ................................... | 2 |
| 17 | PAFZZ | 5340-01-505-1814 | 0A0B7 | 10-52252-04 | . . LATCH,RIM ......................................... | 1 |
| 18 | XBFFF | | 0A0B7 | 10-50027 | . . HOUSING ........................................... | 1 |
| 19 | MFFZZ | | 0A0B7 | 10-50801 | . . INSULATION,THERMAL, (MAKE FROM CAGE 1T5T4, P/N SAS12043) ..... | 1 |

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| 20 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . . NUT,SELF-LOCKING,HE .................. | 6 |
| 21 | PAFZZ | 5340-01-610-4936 | 0A0B7 | 10-52200 | . . . HANDLE,BAIL .................................. | 4 |
| 22 | PAFZZ | 5320-01-618-3114 | 0A0B7 | 10-52260-03 | . . . RIVET,BLIND ..................................... | 20 |
| 23 | XBFZZ | | 0A0B7 | 10-50809 | . LABEL .................................................. | 1 |
| 24 | PAFZZ | 5320-00-882-8386 | 0A0B7 | 10-52258-04 | . RIVET,BLIND ........................................ | 4 |
| 25 | MFFZZ | | 0A0B7 | 10-50805 | . . INSULATION,THERMAL, (MAKE FROM CAGE 1T5T4, P/N SAS12043) ..... | 1 |
| 26 | PAFZZ | 5325-01-610-4860 | 0A0B7 | 10-52900 | . . STUD,SNAP FASTENER .................... | 6 |
| 27 | PAFZZ | 5325-01-610-4938 | 0A0B7 | 10-52207 | . . . CHAIN,INTERLOCKING, .................. | 1 |
| 28 | PAFZZ | 5320-00-882-8386 | 0A0B7 | 10-52258-04 | . . . RIVET,BLIND ..................................... | 99 |
| 29 | PAFZZ | 5340-01-611-7801 | 0A0B7 | 10-52031 | . MOUNT,RESILIENT,GEN ...................... | 4 |
| 30 | PAFZZ | 5320-01-612-4759 | 0A0B7 | 10-52846-04 | . . . RIVET,BLIND ..................................... | 16 |
| 31 | MFFZZ | | 0A0B7 | 10-50814 | . . INSULATION SHEET,TH (MAKE FROM CAGE 1T5T4, P/N SAS12043) ..... | 1 |
| 32 | PAFZZ | 5310-01-610-6436 | 0A0B7 | 10-52018 | . . . NUT,PLAIN,PLATE ............................ | 4 |
| 33 | MFFZZ | | 0A0B7 | 10-50804 | . . INSULATION SHEET,TH (MAKE FROM CAGE 1T5T4, P/N SAS14043) ..... | 1 |
| 34 | PAFZZ | 5305-01-612-8297 | 0A0B7 | 10-52923-05 | . . SCREW,MACHINE .............................. | 4 |
| 35 | PBFZZ | 5340-01-612-8323 | 0A0B7 | 10-50015 | . . COVER,ACCESS ................................ | 1 |
| 36 | PAFZZ | 5305-01-590-9684 | 0A0B7 | 10-52931-06 | . . SETSCREW ........................................ | 4 |
| 37 | PAFZZ | | 0A0B7 | 10-52271-01 | . . . RIVET,BLIND ..................................... | 7 |
| 38 | MFFZZ | | 0A0B7 | 10-50803 | . . INSULATION,THERMAL, (MAKE FROM CAGE 1T5T4, P/N SAS12043) ..... | 1 |
| 39 | PAFZZ | 4730-01-610-5001 | 0A0B7 | 10-52907 | . . PLUG,PIPE ......................................... | 2 |
| 40 | PAFZZ | 4140-01-612-3486 | 0A0B7 | 10-50202 | . . COVER,VENTILATORY ...................... | 1 |
| 41 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . SCREW,MACHINE .............................. | 8 |
| 42 | PAFZZ | 5305-01-610-6444 | 0A0B7 | 10-52915 | . . SCREW,SHOULDER .......................... | 2 |
| 43 | PAFZZ | | 0A0B7 | 10-52272-01 | . . . RIVET,BLIND ..................................... | 22 |
| 44 | PAFZZ | | 0A0B7 | 10-52271-02 | . . . RIVET,BLIND ..................................... | 2 |

**END OF FIGURE**

## OPERATOR AND FIELD MAINTENANCE

## GROUP 02 POWER DISTRIBUTION/CONDITIONING GROUP

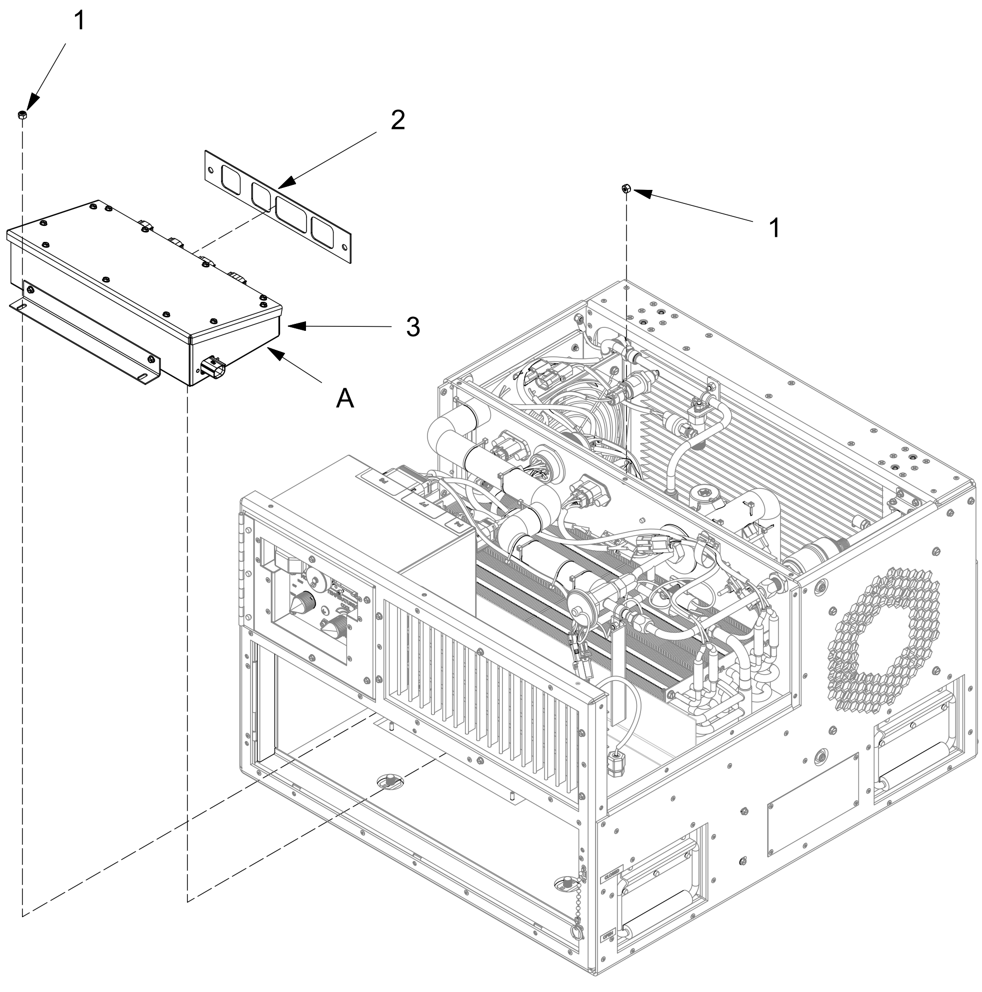



Figure 3. Power Distribution/Conditioning Group (Sheet 1 of 8).

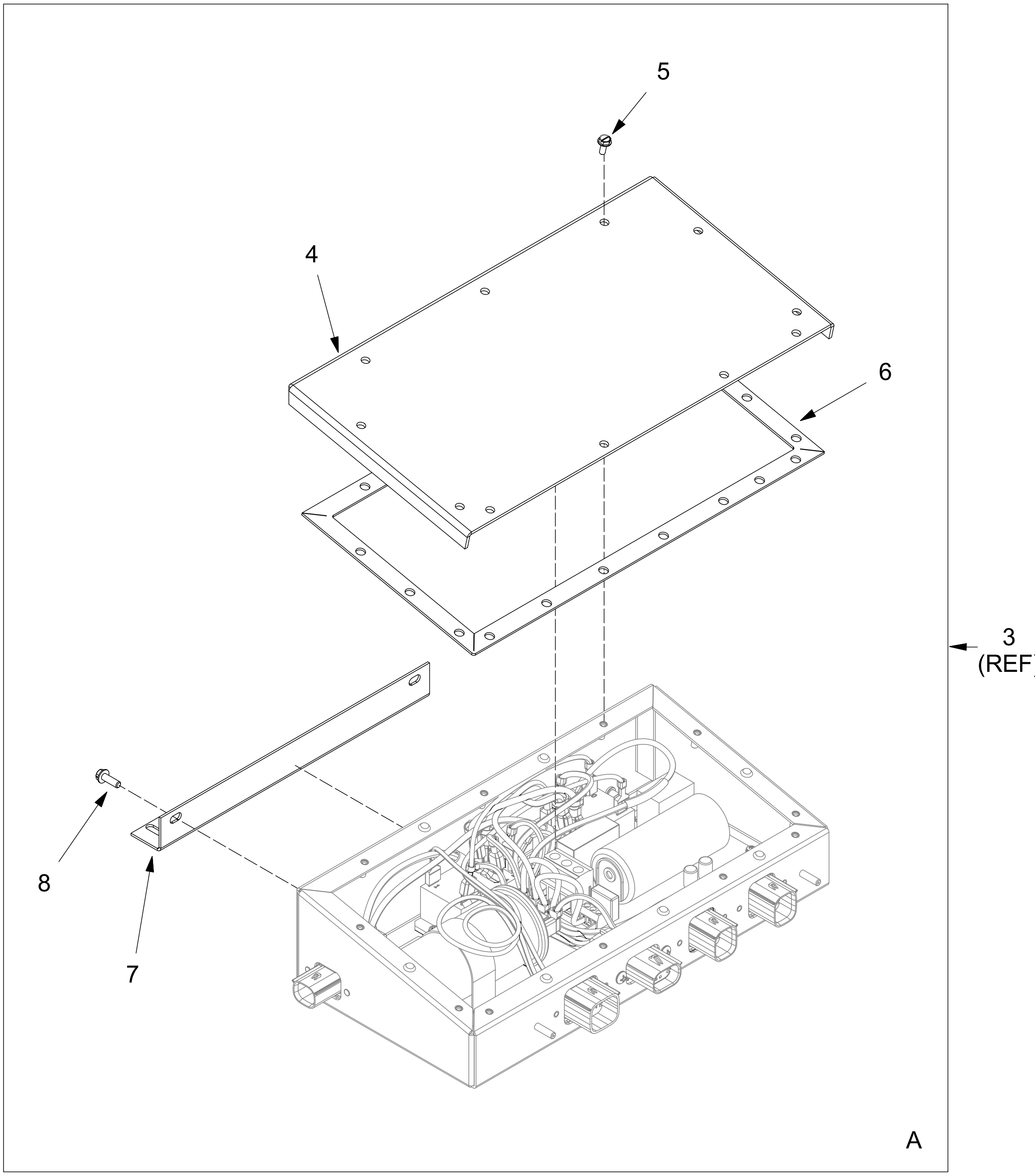



Figure 3. Power Distribution/Conditioning Group (Sheet 2 of 8).

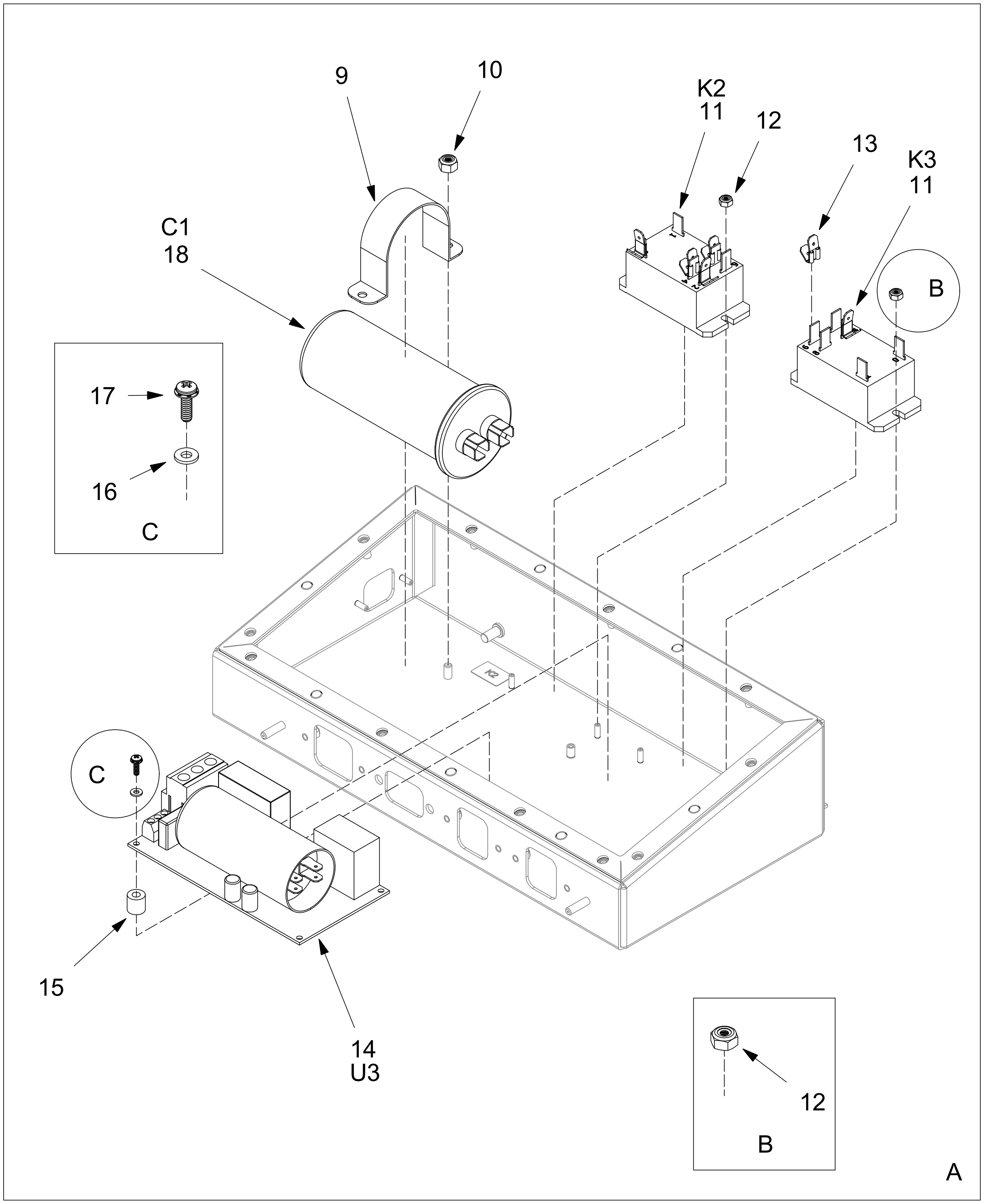



Figure 3. Power Distribution/Conditioning Group (Sheet 3 of 8).

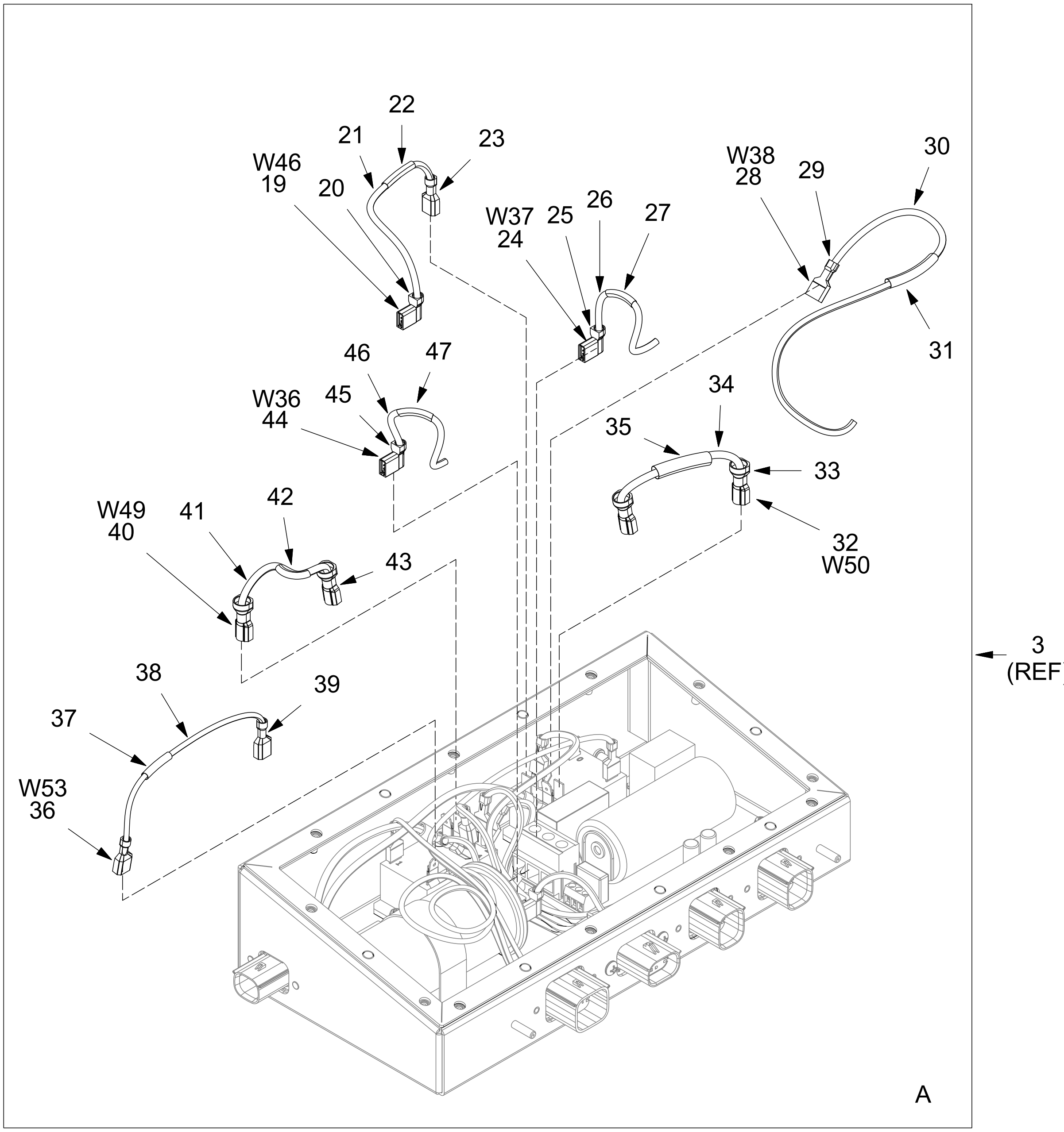



Figure 3. Power Distribution/Conditioning Group (Sheet 4 of 8).

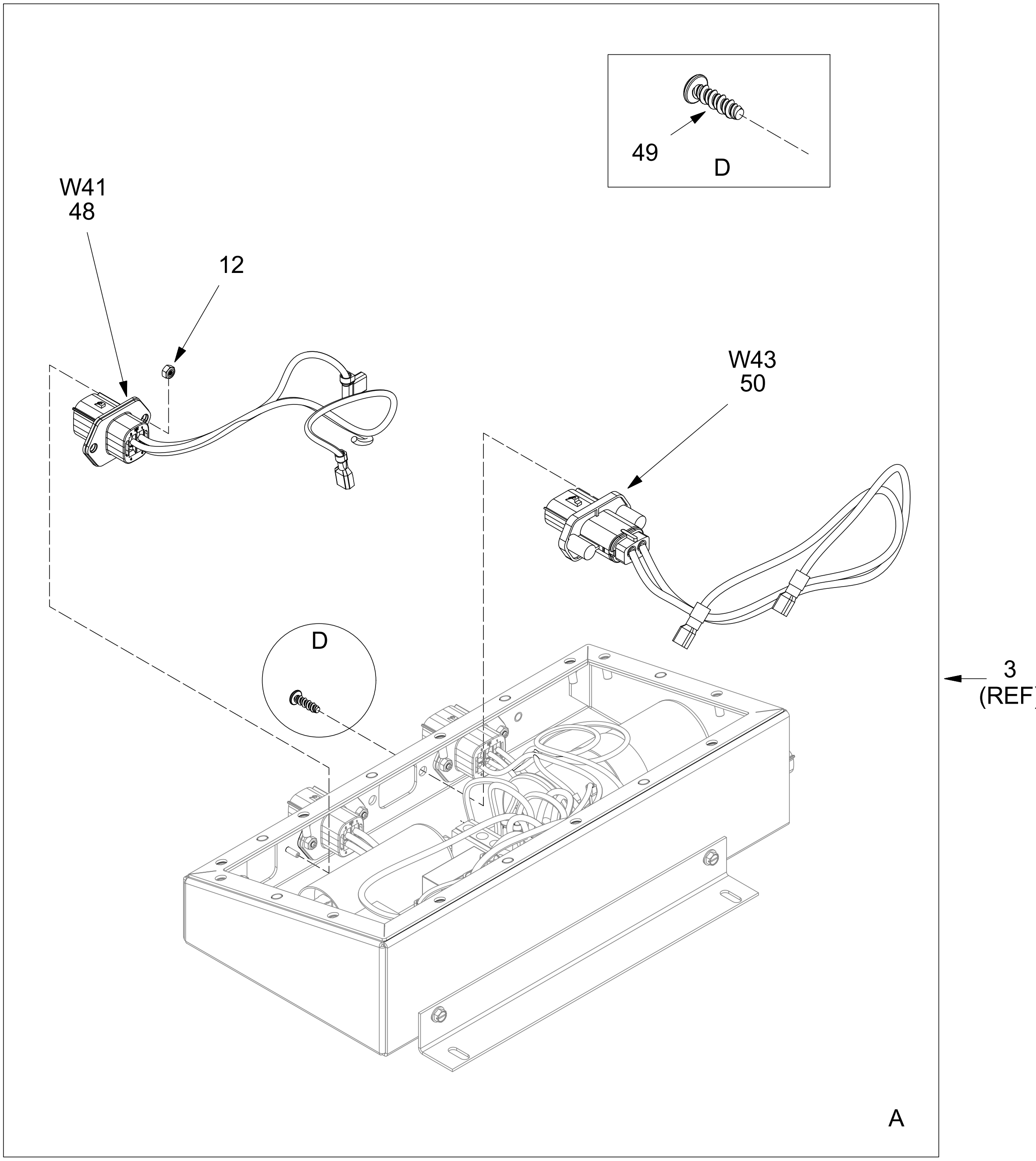



Figure 3. Power Distribution/Conditioning Group (Sheet 5 of 8).

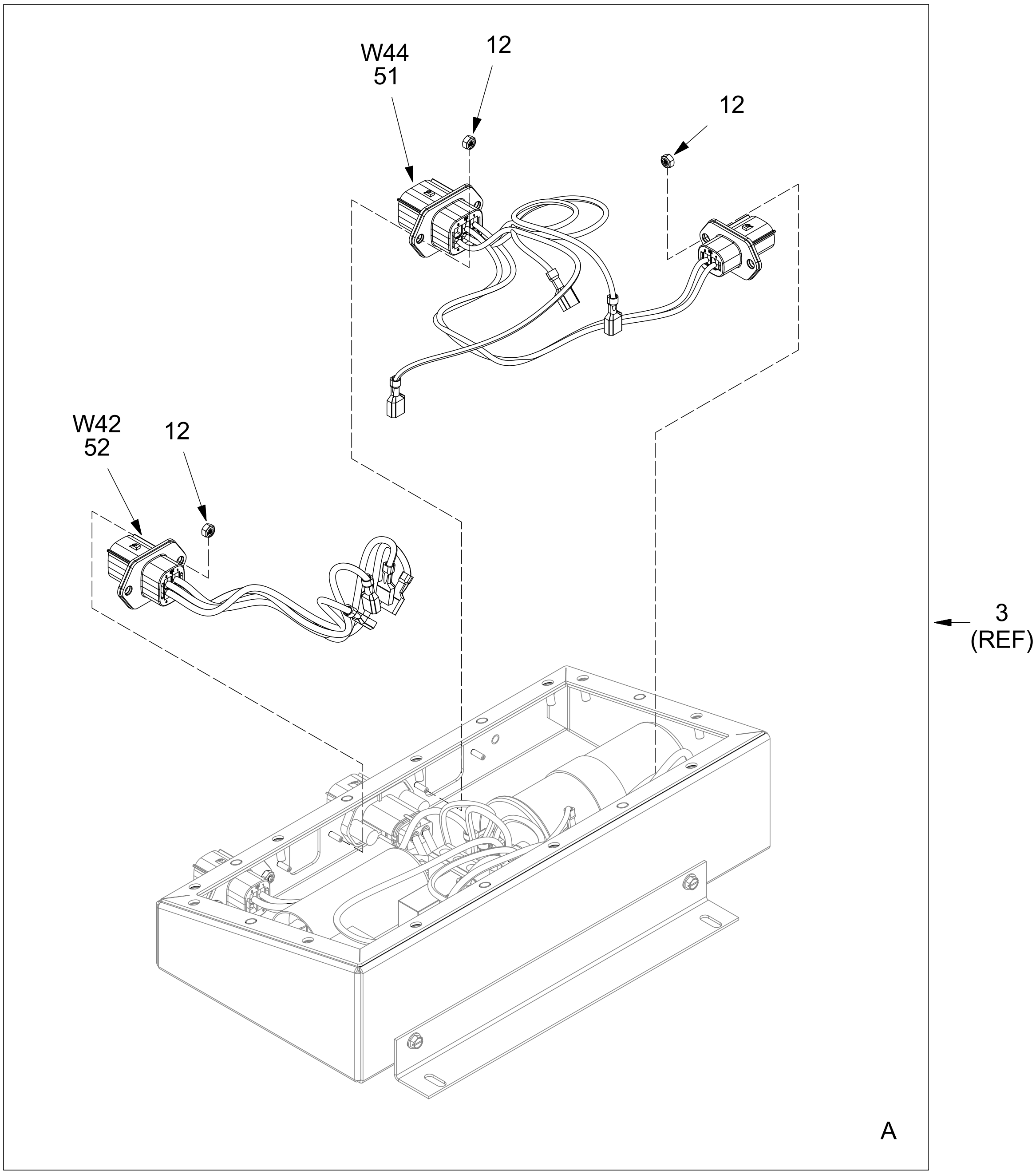



Figure 3. Power Distribution/Conditioning Group (Sheet 6 of 8).

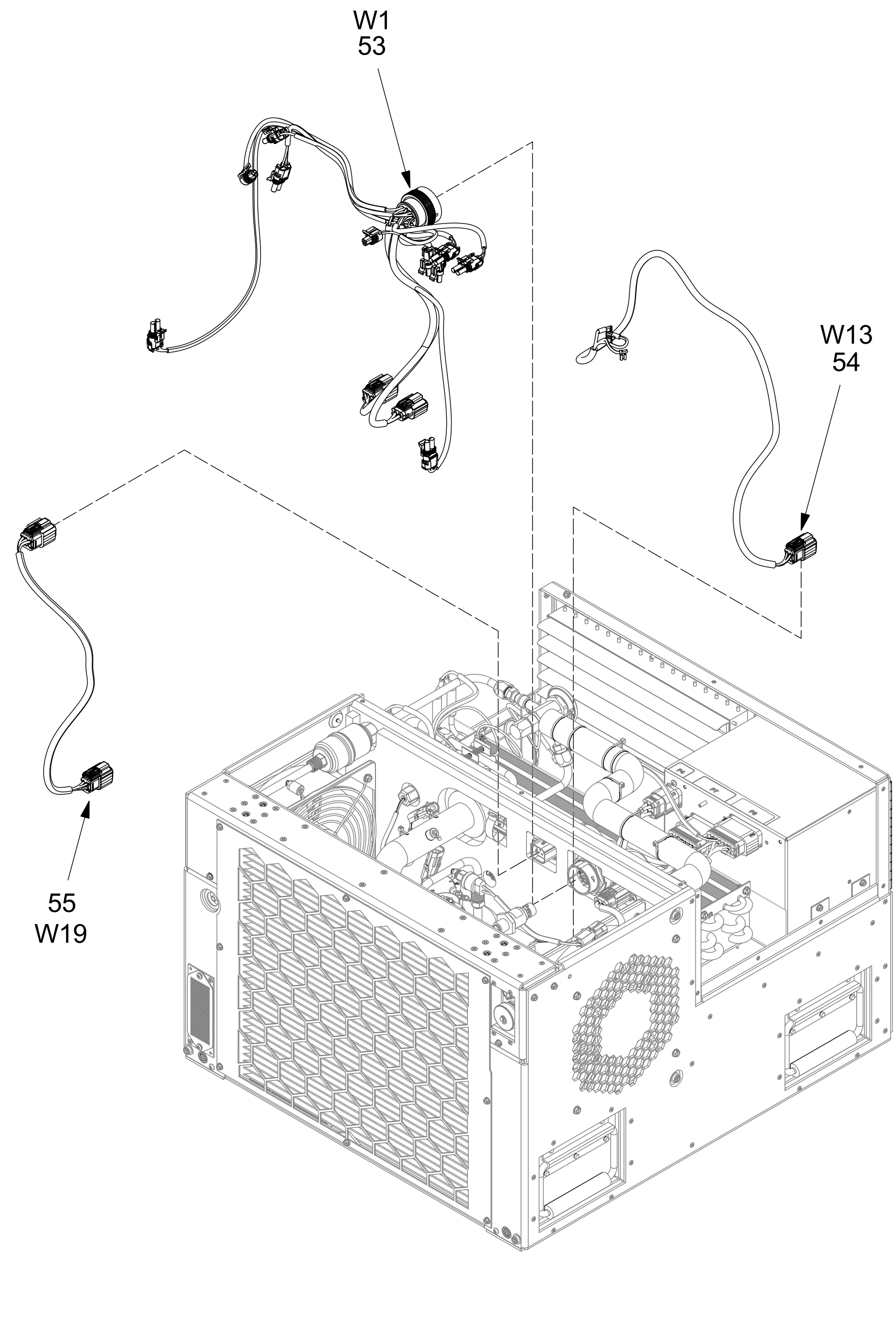



Figure 3. Power Distribution/Conditioning Group (Sheet 7 of 8).

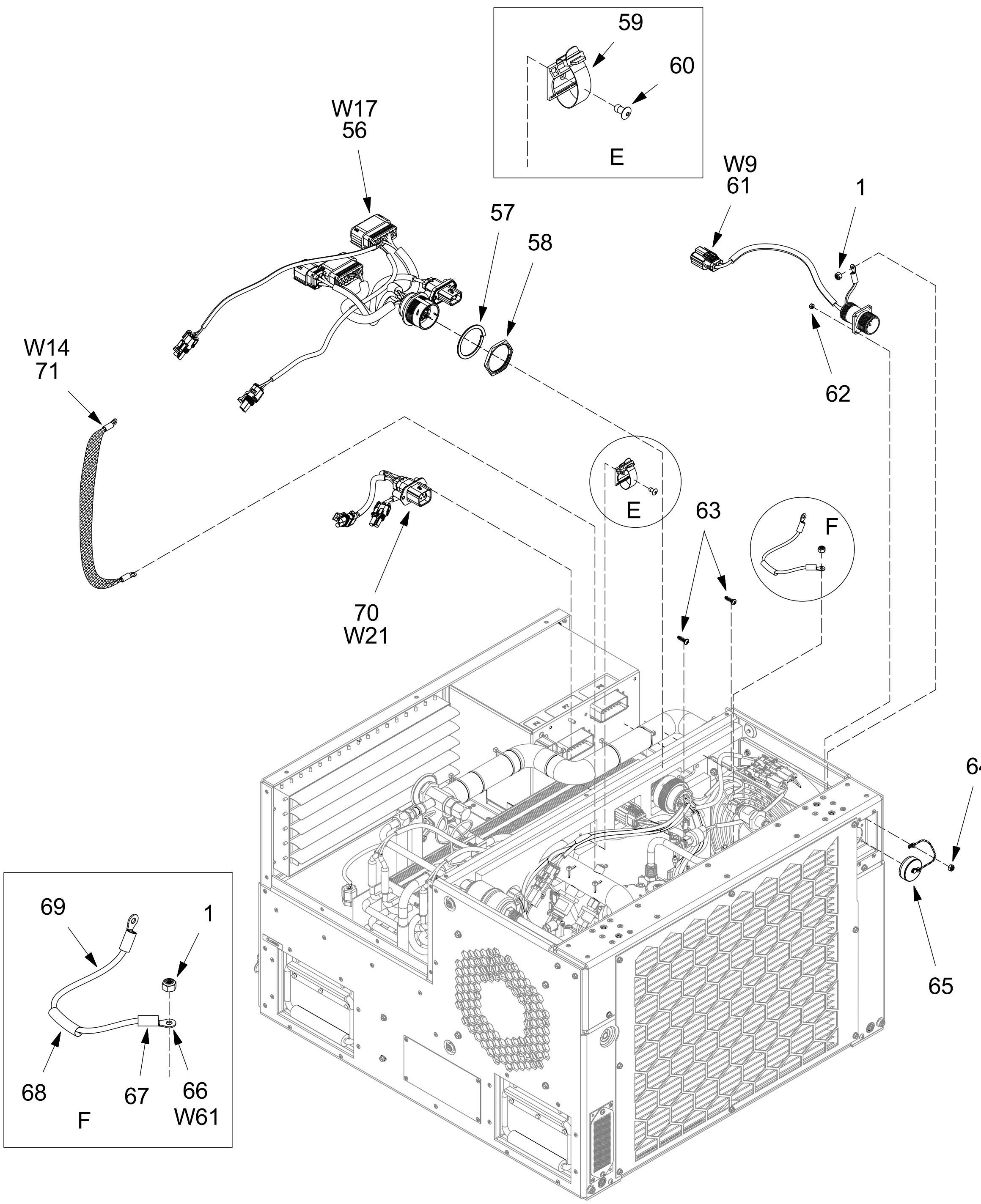



Figure 3. Power Distribution/Conditioning Group (Sheet 8 of 8).

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 02 POWER DISTRIBU-TION/CONDITIONING GROUP** | |
| | | | | | **GROUP 0201 SOFT START BOX ASSEMBLY** | |
| | | | | | **GROUP 0202 CONDENSER SIDE BULKHEAD CABLE (W1)** | |
| | | | | | **GROUP 0203 COMPRESSOR POWER CABLE (W13)** | |
| | | | | | **GROUP 0204 RELAY TO HEATER POWER CABLE (W19)** | |
| | | | | | **GROUP 0205 EVAPORATOR SIDE BULKHEAD CABLE (W17)** | |
| | | | | | **GROUP 0206 REAR POWER CABLE (W9)** | |
| | | | | | **GROUP 0207 HEAT POWER CABLE (W21)** | |
| | | | | | **FIGURE 3 POWER DISTRIBU-TION/CONDITIONING GROUP** | |
| 1 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . NUT,SELF-LOCKING,HE ..................... | 7 |
| 2 | PAFZZ | 5330-01-612-6668 | 0A0B7 | 10-50813 | . . GASKET .............................................. | 1 |
| 3 | PBFFF | 5998-01-612-2187 | 0A0B7 | 10-50007 | . . ELECTRONIC COMPONEN ................ | 1 |
| 4 | PAFZZ | 5935-01-612-2656 | 0A0B7 | 10-50201 | . . . COVER,ELECTRICAL-EL .................. | 1 |
| 5 | PAFZZ | | 0A0B7 | 10-53902-02 | . . . SCREW,ASSEMBLED WAS .............. | 11 |
| 6 | PAFZZ | 5330-01-612-7693 | 0A0B7 | 10-50808 | . . . GASKET ............................................ | 1 |
| 7 | XBFZZ | | 0A0B7 | 10-50200 | . . . BRACKET,MOUNTING ...................... | 1 |
| 8 | PAFZZ | 5305-01-610-6792 | 0A0B7 | 10-52923-03 | . . . SCREW,MACHINE ............................. | 2 |
| 9 | XBFZZ | | 0A0B7 | 10-50602 | . . . RETAINER,CAPACITOR .................... | 1 |
| 10 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . . NUT,SELF-LOCKING,HE ................... | 2 |
| 11 | PAFZZ | 5945-01-525-2918 | 0A0B7 | 10-52610 | . . . RELAY,ELECTROMAGNET (K2, K3) . | 2 |
| 12 | PAFZZ | 5310-01-494-0206 | 0A0B7 | 10-52934-03 | . . . NUT,SELF-LOCKING,HE ................... | 12 |
| 13 | PAFZZ | 5935-01-610-7179 | 0A0B7 | 10-52611 | . . . TERMINAL,QUICK DISC ................... | 6 |
| 14 | PBFZZ | 5998-01-618-9897 | 0A0B7 | 10-51604-01 | . . . ELECTRONIC COMPONEN (U3) ...... | 1 |

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| 15 | PAFZZ | 5365-01-069-0718 | 0A0B7 | 10-51899 | . . . SPACER, SLEEVE ............................ | 4 |
| 16 | PAFZZ | 5310-01-610-5278 | 0A0B7 | 10-51900-05 | . . . WASHER,FLAT ................................. | 4 |
| 17 | PAFZZ | | 0A0B7 | 10-52935-03 | . . . SCREW,ASSEMBLED WAS .............. | 4 |
| 18 | PAFZZ | 5910-01-612-5346 | 0A0B7 | 10-50601 | . . . CAPACITOR,FIXED,MET (C1) ........... | 1 |
| 19 | AFFFF | | 0A0B7 | 10-50415 | . . . CABLE ASSEMBLY,SPEC (W46) ...... | 1 |
| 20 | PAFZZ | 5935-01-068-1879 | 0A0B7 | 10-51500 | . . . . TERMINAL,QUICK DISC ................. | 1 |
| 21 | MFFZZ | 6145-01-612-9590 | 81349 | M16878G/03-BKH9 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F14037-WHT) ............ | 1 |
| 22 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................ | 1 |
| 23 | PAFZZ | 5940-01-317-0441 | 0A0B7 | 10-52521 | . . . . TERMINAL,QUICK DISC ................. | 1 |
| 24 | AFFFF | | 0A0B7 | 10-50406 | . . . WIRE (W37) ...................................... | 1 |
| 25 | PAFZZ | 5935-01-068-1879 | 0A0B7 | 10-51500 | . . . . TERMINAL,QUICK DISC ................. | 1 |
| 26 | MFFZZ | 4010-01-610-5376 | 81349 | M16878G/03-BKH3 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F14037-ORG) ............ | 1 |
| 27 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................ | 1 |
| 28 | AFFFF | 5995-01-612-2180 | 0A0B7 | 10-50407 | . . . CABLE ASSEMBLY,SPEC (W38) ...... | 1 |
| 29 | PAFZZ | 5940-01-317-0441 | 0A0B7 | 10-52521 | . . . . TERMINAL,QUICK DISC ................. | 1 |
| 30 | MFFZZ | | 81349 | M16878G/03-BKH0 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F14037-BLK) ............. | 1 |
| 31 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................ | 1 |
| 32 | AFFFF | | 0A0B7 | 10-51422 | . . . WIRE (W50) ...................................... | 1 |
| 33 | PAFZZ | 5940-01-264-6657 | 0A0B7 | 10-52520 | . . . . TERMINAL,QUICK DISC ................. | 2 |
| 34 | MFFZZ | 4010-01-610-4993 | 81349 | M16878G/03-BLJ0 | . . . . WIRE CORD (MAKE FROM CAGE 3V9L1, P/N F12024-BLK) ....................... | 1 |
| 35 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................ | 1 |
| 36 | AFFFF | | 0A0B7 | 10-52440 | . . . WIRE (W53) ...................................... | 1 |
| 37 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................ | 1 |
| 38 | MFFZZ | 4010-01-612-9893 | 81349 | M16878G/03-BHE6 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F18054-BLU) ............. | 1 |
| 39 | PAFZZ | 5940-01-327-0917 | 0A0B7 | 10-52549 | . . . . CONNECTOR,RECEPTACL ............ | 2 |
| 40 | AFFFF | | 0A0B7 | 10-51421 | . . . WIRE (W49) ...................................... | 1 |
| 41 | MFFZZ | | 81349 | M16878G/03-BLJ9 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F12024-WHT) ............ | 1 |

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| 42 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................ | 1 |
| 43 | PAFZZ | 5940-01-264-6657 | 0A0B7 | 10-52520 | . . . . TERMINAL,QUICK DISC ................ | 2 |
| 44 | AFFFF | | 0A0B7 | 10-50405 | . . . CABLE,POWER,ELECTRI (W36) ...... | 1 |
| 45 | PAFZZ | 5935-01-068-1879 | 0A0B7 | 10-51500 | . . . . TERMINAL,QUICK DISC ................ | 1 |
| 46 | MFFZZ | 6145-01-612-9590 | 81349 | M16878G/03-BKH9 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F14037-WHT) ............ | 1 |
| 47 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................ | 1 |
| 48 | PAFZZ | 6150-01-612-2654 | 0A0B7 | 10-50411 | . . . CABLE ASSEMBLY,POWE (W41) ..... | 1 |
| 49 | PAFZZ | 5305-01-610-4867 | 0A0B7 | 10-52933-03 | . . . SCREW,TAPPING ............................ | 2 |
| 50 | PAFZZ | 6150-01-612-2659 | 0A0B7 | 10-50413 | . . . CABLE ASSEMBLY,POWE (W43) ..... | 1 |
| 51 | PAFZZ | 6150-01-612-0777 | 0A0B7 | 10-50414 | . . . CABLE ASSEMBLY,SPEC (W44) ...... | 1 |
| 52 | PAFZZ | 6150-01-612-2144 | 0A0B7 | 10-50412 | . . . CABLE ASSEMBLY,POWE (W42) ..... | 1 |
| 53 | PAFZZ | 5995-01-612-2141 | 0A0B7 | 10-50408 | . . CABLE ASSEMBLY,SPEC (W1) .......... | 1 |
| 54 | PAFZZ | 6150-01-612-2145 | 0A0B7 | 10-50410 | . . CABLE ASSEMBLY,POWE (W13) ....... | 1 |
| 55 | PAFZZ | 6150-01-612-0570 | 0A0B7 | 10-50401 | . . CABLE ASSEMBLY,SPEC (W19) ........ | 1 |
| 56 | PAFZZ | 5995-01-612-2178 | 0A0B7 | 10-50409 | . . CABLE ASSEMBLY,SPEC (W17) ........ | 1 |
| 57 | PAFZZ | 5310-01-081-0799 | 0A0B7 | 10-52947 | . . WASHER,LOCK .................................. | 1 |
| 58 | PAFZZ | 5310-01-086-7726 | 0A0B7 | 10-52946 | . . NUT,PLAIN, HEXAGON ...................... | 1 |
| 59 | PAFZZ | 5340-01-456-1308 | 0A0B7 | 10-52858 | . . CLAMP,LOOP ..................................... | 4 |
| 60 | PAFZZ | 5320-00-956-7355 | 0A0B7 | 10-52261-03 | . . RIVET,BLIND ....................................... | 4 |
| 61 | PAFZZ | 6150-01-612-2143 | 0A0B7 | 10-50400 | . . CABLE ASSEMBLY,POWE (W9) ......... | 1 |
| 62 | PAFZZ | 5310-01-494-0206 | 0A0B7 | 10-52934-03 | . . NUT,SELF-LOCKING,HE .................... | 4 |
| 63 | PAFZZ | 5305-01-610-4867 | 0A0B7 | 10-52933-03 | . . SCREW,TAPPING ............................... | 4 |
| 64 | PAFZZ | 5310-01-483-2638 | 0A0B7 | 10-52934-05 | . . NUT,SELF-LOCKING,HE .................... | 1 |
| 65 | PAFZZ | 5935-01-590-1601 | 81343 | MS25043-18DA | . . COVER,ELECTRICAL CO .................. | 1 |
| 66 | AFFFF | | 0A0B7 | 10-52448 | . . WIRE (W61) ........................................ | 1 |
| 67 | PAFZZ | 5940-00-143-4775 | 96906 | MS25036-156 | . . . TERMINAL,LUG ................................ | 2 |
| 68 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . LABEL ............................................... | 1 |
| 69 | MFFZZ | 6145-01-612-9608 | 81349 | M16878G/03-BLJ5 | . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F12024-G/Y) .............. | 1 |
| 70 | PAFZZ | 6150-01-612-8681 | 0A0B7 | 10-50402 | . . CABLE ASSEMBLY,POWE (W21) ....... | 1 |

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| 71 | PAFZZ | 6150-01-610-5784 | 0A0B7 | 10-52421 | . . CABLE ASSEMBLY,POWE (W14) ....... | 1 |
| | | | | | END OF FIGURE | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 03 POWER CONTROLS GROUP

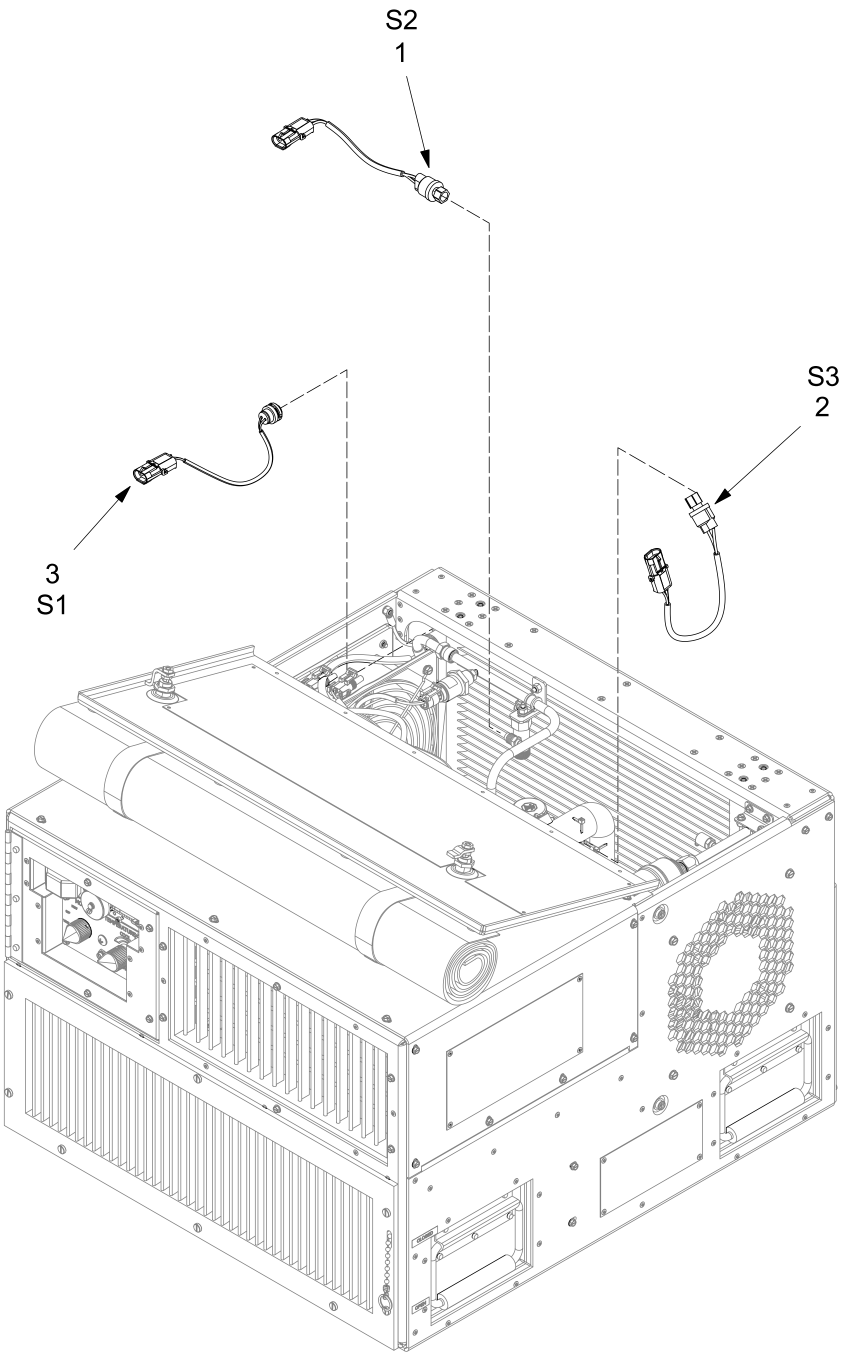



Figure 4. Power Controls Group (Sheet 1 of 7).

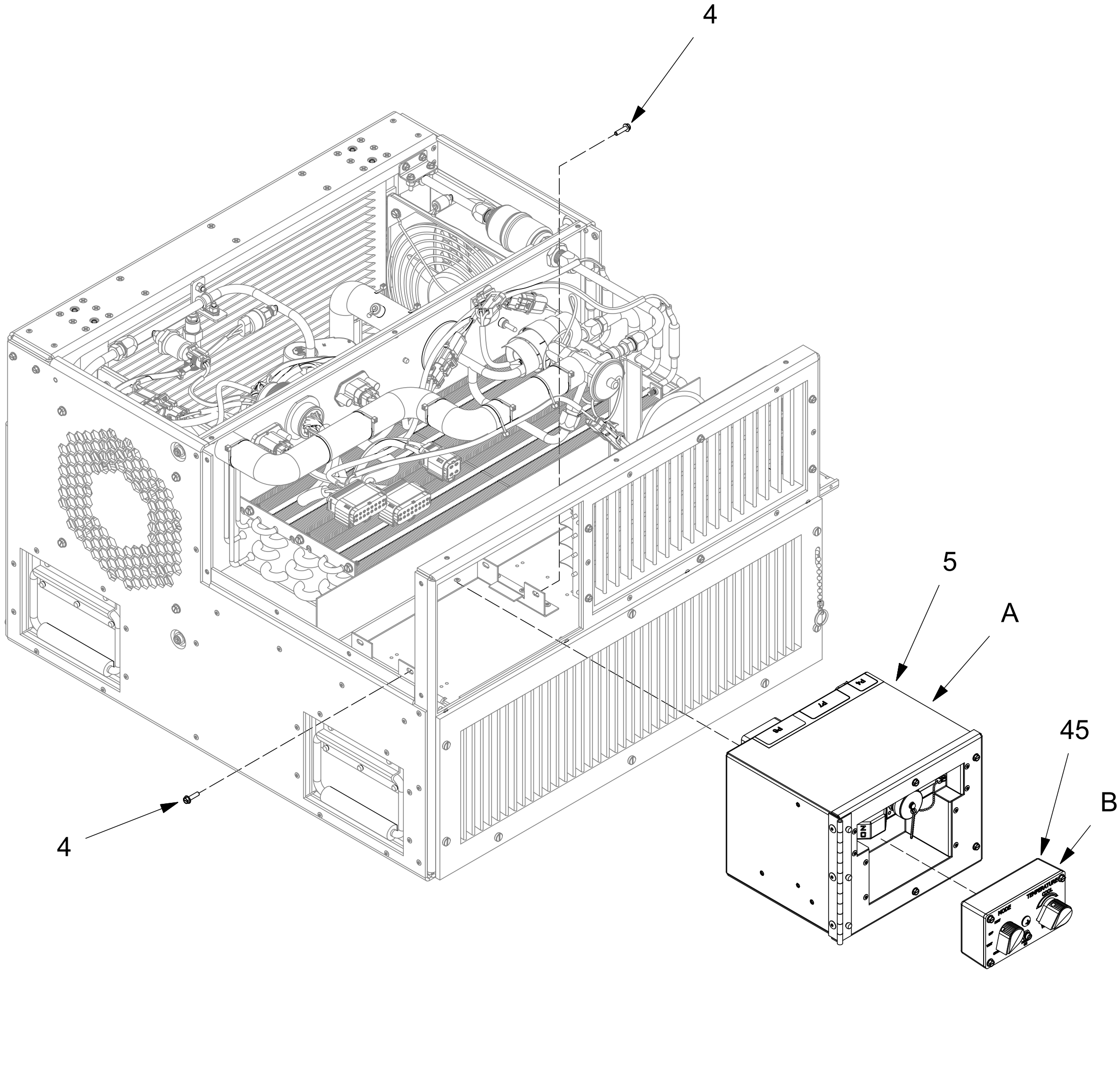



Figure 4. Power Controls Group (Sheet 2 of 7).

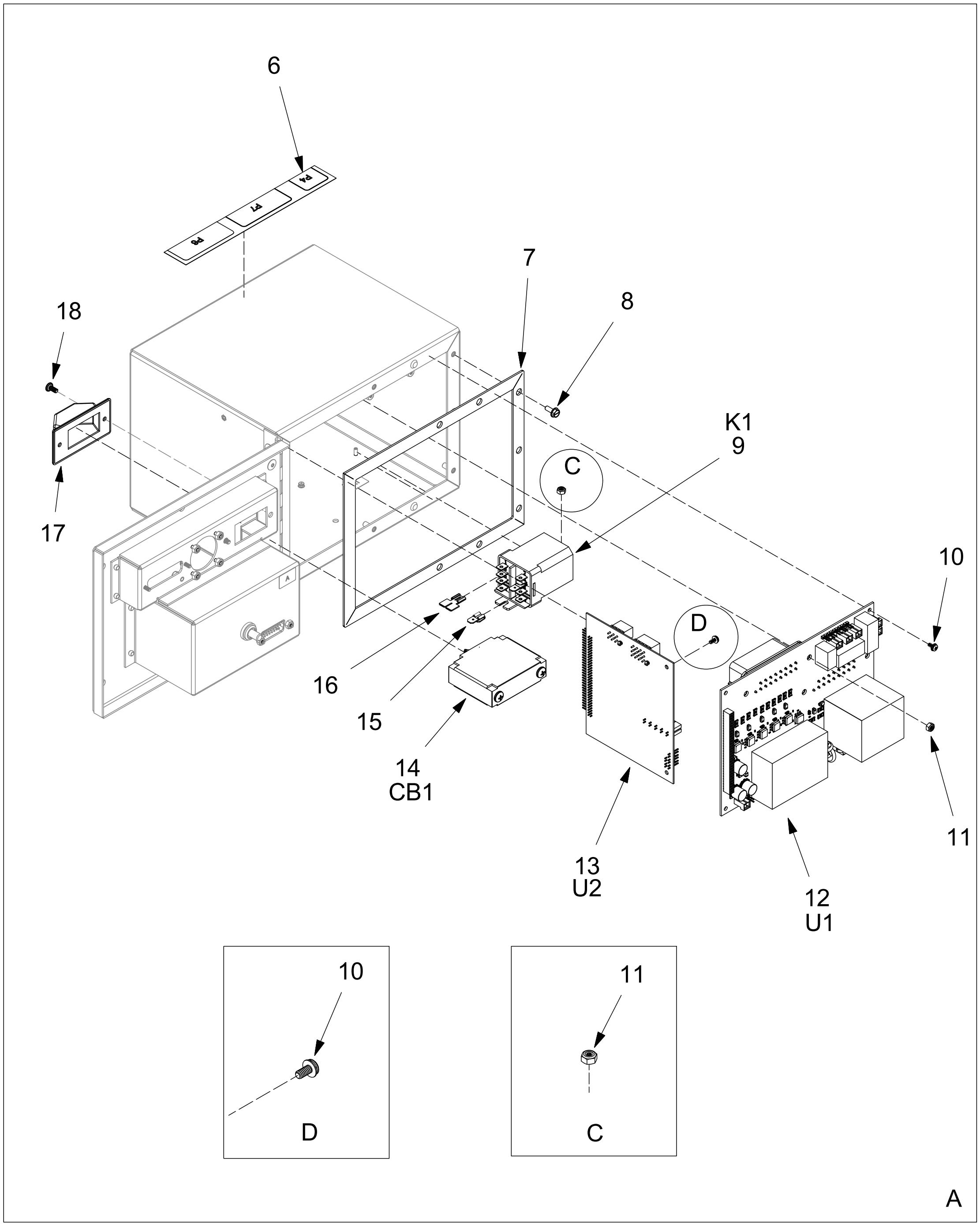



Figure 4. Power Controls Group (Sheet 3 of 7).

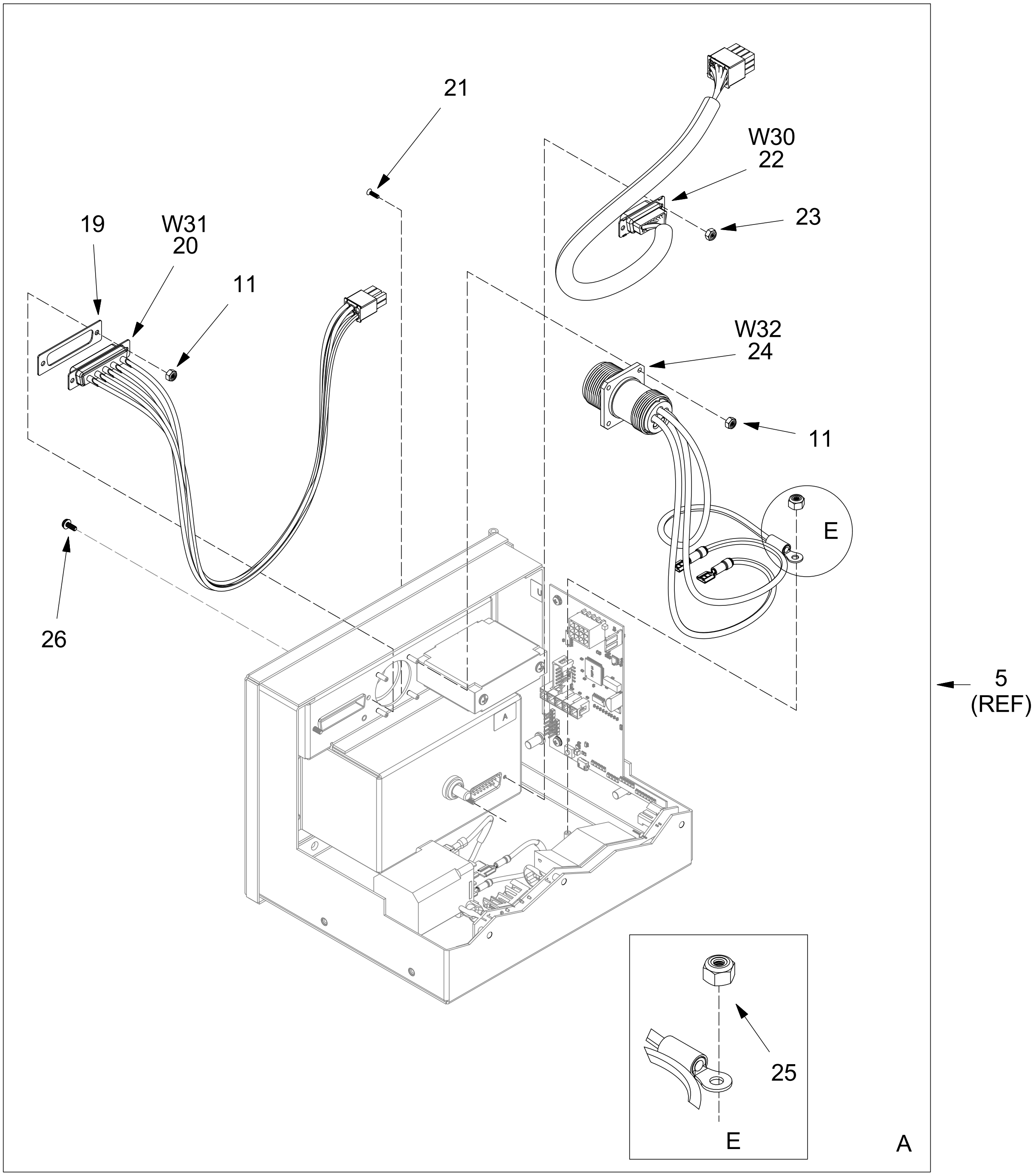



**Figure 4. Power Controls Group (Sheet 4 of 7).**

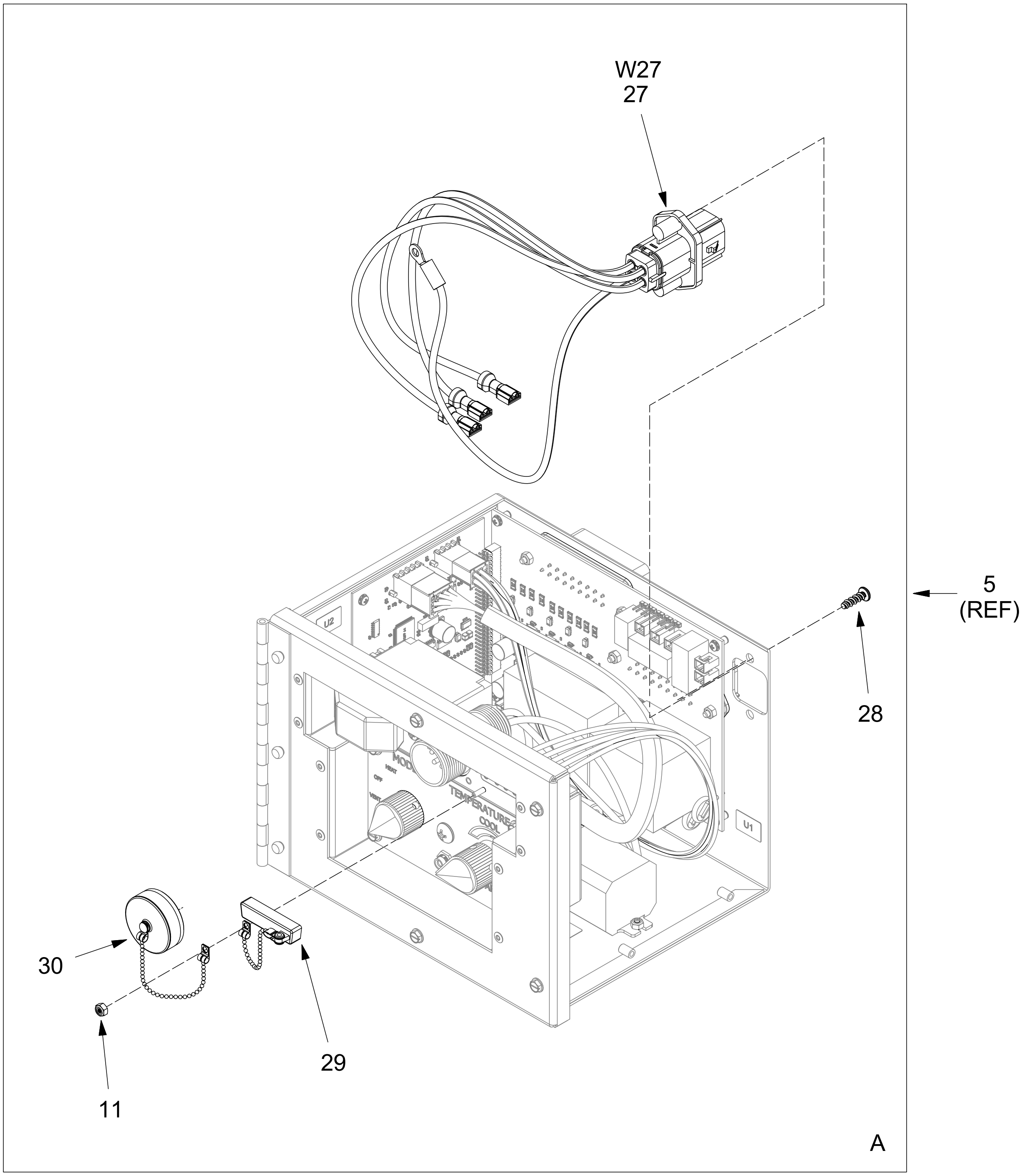



Figure 4. Power Controls Group (Sheet 5 of 7).

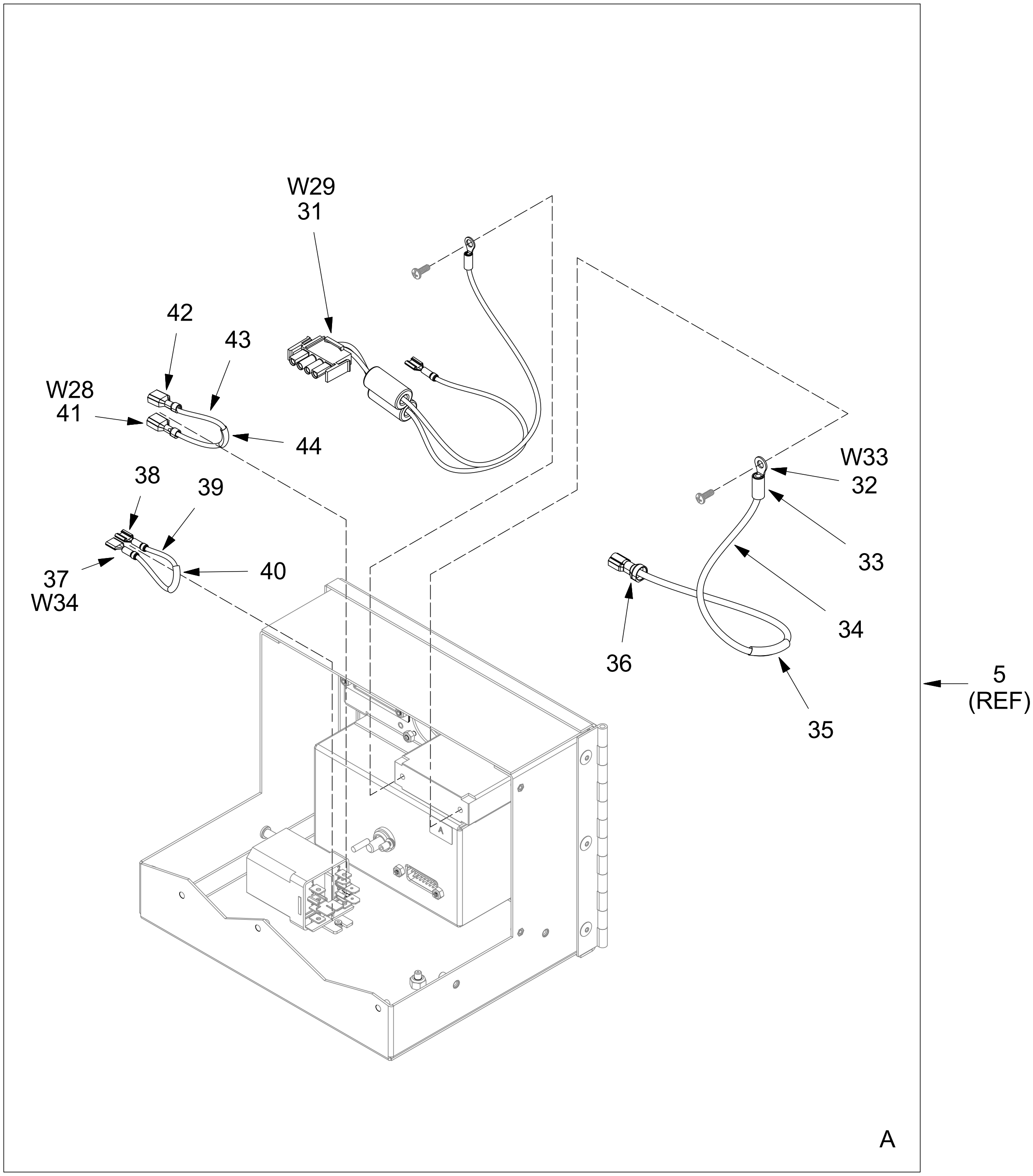



**Figure 4. Power Controls Group (Sheet 6 of 7).**

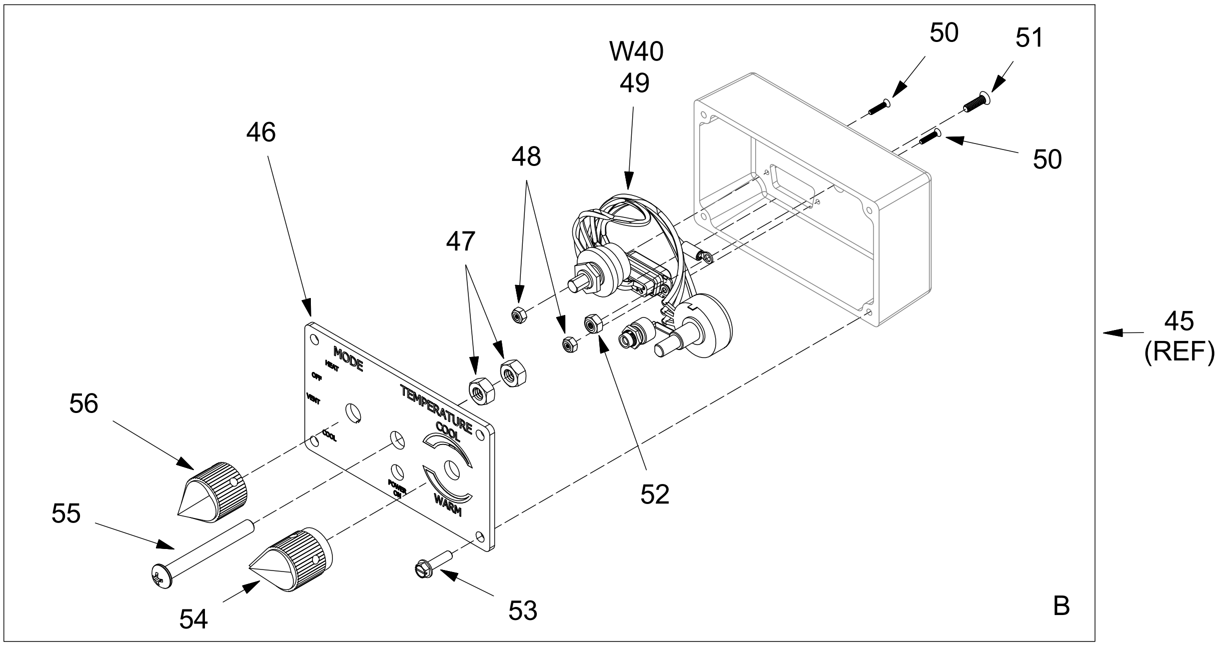



Figure 4. Power Controls Group (Sheet 7 of 7).

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 03 POWER CONTROLS GROUP** | |
| | | | | | **GROUP 0301 HIGH PRESSURE SWITCH ASSEMBLY (S2)** | |
| | | | | | **GROUP 0302 LOW PRESSURE SWITCH ASSEMBLY (S3)** | |
| | | | | | **GROUP 0303 MOMENTARY SWITCH ASSEMBLY (S1)** | |
| | | | | | **GROUP 0304 CONTROL BOX ASSEM-BLY** | |
| | | | | | **GROUP 030401 REMOTE CONTROL BOX ASSEMBLY** | |
| | | | | | **FIGURE 4 POWER CONTROLS GROUP** | |
| 1 | PAFZZ | 5930-01-610-7099 | 0A0B7 | 10-52620 | . . SWITCH,PRESSURE (S2) ................... | 1 |
| 2 | PAFZZ | | 0A0B7 | 10-52630 | . . SWITCH,PRESSURE (S3) ................... | 1 |
| 3 | PAFZZ | 5930-01-610-7094 | 0A0B7 | 10-52403 | . . SWITCH,PUSH (S1) ............................ | 1 |
| 4 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . SCREW,MACHINE ............................... | 4 |
| 5 | PBFFF | 4935-01-612-4835 | 0A0B7 | 10-50002 | . . CONTROL,AIR CONDITI ..................... | 1 |
| 6 | PAFZZ | | 0A0B7 | 10-50817 | . . . LABEL ............................................... | 1 |
| 7 | PAFZZ | 5330-01-612-7682 | 0A0B7 | 10-50807 | . . . GASKET ............................................ | 1 |
| 8 | PAFZZ | | 0A0B7 | 10-53902-02 | . . . SCREW,ASSEMBLED WAS .............. | 4 |
| 9 | PAFZZ | 5945-01-612-9938 | 0A0B7 | 10-52618-01 | . . . RELAY,ELECTROMAGNET (K1) ....... | 1 |
| 10 | PAFZZ | 5305-01-610-7116 | 0A0B7 | 10-52935-01 | . . . SCREW,ASSEMBLED WAS .............. | 7 |
| 11 | PAFZZ | 5310-01-494-0206 | 0A0B7 | 10-52934-03 | . . . NUT,SELF-LOCKING,HE ................... | 12 |
| 12 | PBFZZ | 5998-01-610-6417 | 0A0B7 | 10-52607 | . . . PRINTED CIRCUIT BOA (U1) ........... | 1 |
| 13 | PBFZZ | 5998-01-610-6420 | 0A0B7 | 10-52608 | . . . PRINTED CIRCUIT BOA (U2) ........... | 1 |
| 14 | PAFZZ | 5925-01-612-3037 | 0A0B7 | 10-50600 | . . . CIRCUIT, BREAKER (CB1) ............... | 1 |
| 15 | PAFZZ | 5935-01-610-7179 | 0A0B7 | 10-52611 | . . . TERMINAL,QUICK DISC ................... | 2 |
| 16 | PAFZZ | 5940-01-610-9144 | 0A0B7 | 10-52613 | . . . TERMINAL,QUICK DISC ................... | 1 |
| 17 | PAFZZ | 5340-01-614-7444 | 0A0B7 | 10-52600 | . . . BOOT,DUST AND MOIST .................. | 1 |
| 18 | PAFZZ | | 0A0B7 | 10-52949 | . . . SCREW,MACHINE ............................. | 2 |

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| 19 | PAFZZ | 5330-01-610-6121 | 0A0B7 | 10-52849 | . . . GASKET ............................................ | 1 |
| 20 | PBFZZ | 6150-01-610-5626 | 0A0B7 | 10-52419 | . . . CABLE ASSEMBLY,POWE (W31) ..... | 1 |
| 21 | PAFZZ | 5305-01-610-5101 | 0A0B7 | 10-52941-03 | . . . SCREW,MACHINE ............................ | 2 |
| 22 | PBFZZ | 6150-01-610-5603 | 0A0B7 | 10-52420 | . . . CABLE ASSEMBLY,POWE (W30) ..... | 1 |
| 23 | PAFZZ | 5310-01-494-2013 | 0A0B7 | 10-52934-01 | . . . NUT,PLAIN, HEXAGON ..................... | 2 |
| 24 | PBFZZ | 6150-01-610-7312 | 0A0B7 | 10-50417 | . . . CABLE ASSEMBLY,POWE (W32) ..... | 1 |
| 25 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . . NUT,SELF-LOCKING,HE ................... | 1 |
| 26 | PAFZZ | 5305-01-610-5505 | 0A0B7 | 10-52935-02 | . . . SCREW,ASSEMBLED WAS .............. | 2 |
| 27 | PAFZZ | 6150-01-612-2667 | 0A0B7 | 10-50404 | . . . CABLE ASSEMBLY,POWE (W27) ..... | 1 |
| 28 | PAFZZ | 5305-01-610-4867 | 0A0B7 | 10-52933-03 | . . . SCREW,TAPPING .............................. | 2 |
| 29 | PAFZZ | 5340-01-610-5287 | 0A0B7 | 10-52851 | . . . CAP,PROTECTIVE,DUST .................. | 1 |
| 30 | PAFZZ | 5935-01-590-1601 | 81343 | MS25043-18DA | . . . COVER,ELECTRICAL CO ................. | 1 |
| 31 | PAFZZ | 6150-01-612-2658 | 0A0B7 | 10-50403 | . . . CABLE ASSEMBLY,POWE (W29) ..... | 1 |
| 32 | AFFFF | | 0A0B7 | 10-51409 | . . . CABLE,SPECIAL PURPO (W33) ....... | 1 |
| 33 | PAFZZ | 5940-00-143-4794 | 81343 | MS25036-112 | . . . . TERMINAL,LUG .............................. | 1 |
| 34 | MFFZZ | 4010-01-610-4993 | 81349 | M16878G/03-BLJ0 | . . . . WIRE CORD (MAKE FROM CAGE 3V9L1, P/N F12024-BLK) ........................ | 1 |
| 35 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................. | 1 |
| 36 | PAFZZ | 5940-01-264-6657 | 0A0B7 | 10-52520 | . . . . TERMINAL,QUICK DISC ................. | 1 |
| 37 | AFFFF | | 0A0B7 | 10-51408 | . . . CABLE ASSEMBLY,SPEC (W34) ...... | 1 |
| 38 | PAFZZ | 5940-01-470-0694 | 0A0B7 | 10-52565-01 | . . . . TERMINAL,QUICK DISC ................. | 2 |
| 39 | MFFZZ | 4010-01-610-6069 | 81349 | M16878G/03-BHE0 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE WIRE 3V9L1 P/N F18054-BLK) .... | 1 |
| 40 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................. | 1 |
| 41 | AFFFF | | 0A0B7 | 10-52425 | . . . WIRE (W28) ...................................... | 1 |
| 42 | PAFZZ | 5940-01-327-0917 | 0A0B7 | 10-52549 | . . . . TERMINAL,QUICK DISC ................. | 2 |
| 43 | MFFZZ | 4010-01-611-0364 | 81349 | M16878G/03-BHE9 | . . . . WIRE,ELECTRICAL (MAKE FROM CAGE 3V9L1, P/N F18054-WHT) ............ | 1 |
| 44 | PAFZZ | 7690-01-610-6058 | 0A0B7 | 10-52524 | . . . . LABEL ............................................. | 1 |
| 45 | PAFFF | 5998-01-611-7647 | 0A0B7 | 10-52003 | . . . CONTROLLER,ENVIRONM .............. | 1 |
| 46 | PAFZZ | 5935-01-610-9696 | 0A0B7 | 10-52201 | . . . . COVER ASSEMBLY,ELEC ............... | 1 |

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| 47 | PAFZZ | 5310-01-439-5917 | 0A0B7 | 10-52937 | . . . . NUT,PLAIN,HEXAGON .................... | 2 |
| 48 | PAFZZ | 5310-01-494-2013 | 0A0B7 | 10-52934-01 | . . . . NUT,PLAIN, HEXAGON ................... | 2 |
| 49 | PAFZZ | 6150-01-610-9690 | 0A0B7 | 10-52427 | . . . . CABLE ASSEMBLY,SPEC (W40) .... | 1 |
| 50 | PAFZZ | 5305-01-610-7153 | 0A0B7 | 10-52941-05 | . . . . SCREW,MACHINE ........................... | 2 |
| 51 | PAFZZ | 5305-01-590-3191 | 0A0B7 | 10-52925-05 | . . . . SCREW,MACHINE ........................... | 1 |
| 52 | PAFZZ | 5310-01-483-2638 | 0A0B7 | 10-52934-05 | . . . . NUT,SELF-LOCKING,HE ................. | 1 |
| 53 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . . . SCREW,MACHINE ........................... | 4 |
| 54 | PAFZZ | 5305-00-899-9014 | 80205 | MS91528-2K4B | . . . . KNOB ............................................... | 1 |
| 55 | PAFZZ | 5305-01-610-4360 | 0A0B7 | 10-52944-13 | . . . . SCREW,MACHINE ........................... | 1 |
| 56 | PAFZZ | 5355-00-916-2060 | 96906 | MS91528-2P4B | . . . . KNOB ............................................... | 1 |

**END OF FIGURE**

# OPERATOR AND FIELD MAINTENANCE

## GROUP 04 THERMAL GROUP

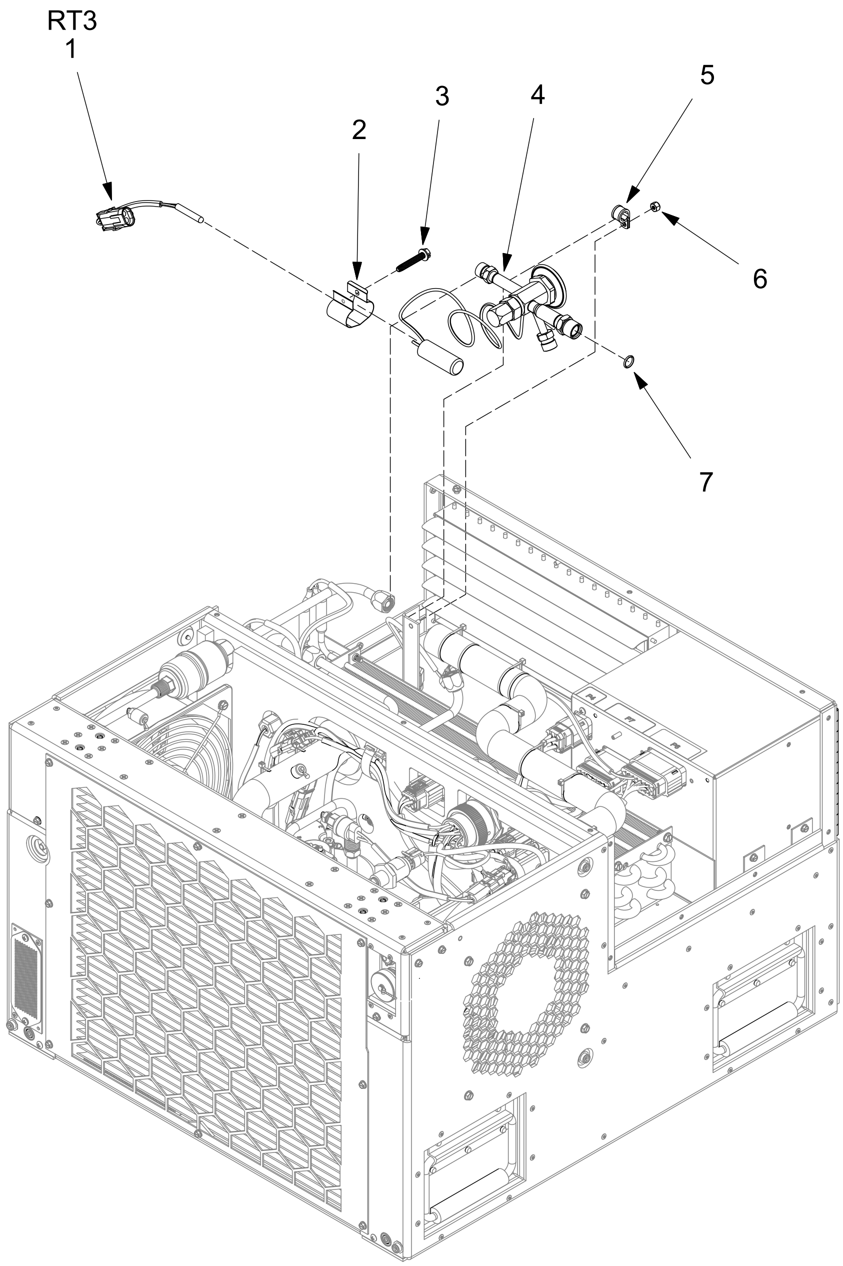



Figure 5. Thermal Group.

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 04 THERMAL GROUP** | |
| | | | | | **GROUP 0401 TXV BRAZING ASSEMBLY** | |
| | | | | | **GROUP 0402 BULLET THERMISTOR ASSEMBLY (RT3)** | |
| | | | | | **FIGURE 5 THERMAL GROUP** | |
| 1 | PAFZZ | 5905-01-610-7103 | 0A0B7 | 10-52622 | . . . RESISTOR,THERMAL (RT3) ............. | 1 |
| 2 | PAFZZ | 5340-01-612-6423 | 0A0B7 | 10-52837 | . . . CLAMP,LOOP .................................... | 1 |
| 3 | PAFZZ | 5305-01-610-5432 | 0A0B7 | 10-52920 | . . . SCREW,ASSEMBLED WAS ............. | 1 |
| 4 | PAFZZ | 4820-01-612-5242 | 0A0B7 | 10-52028-01 | . . . VALVE,REGULATING,SY .................. | 1 |
| 5 | PAFZZ | 5340-01-608-9489 | 81343 | AS21919WCH07 | . . CLAMP,LOOP ...................................... | 1 |
| 6 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . NUT,SELF-LOCKING,HE ..................... | 1 |
| 7 | PAFZZ | | 0A0B7 | 10-52954-013 | . . O-RING ................................................ | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 05 AIR FILTERS GROUP

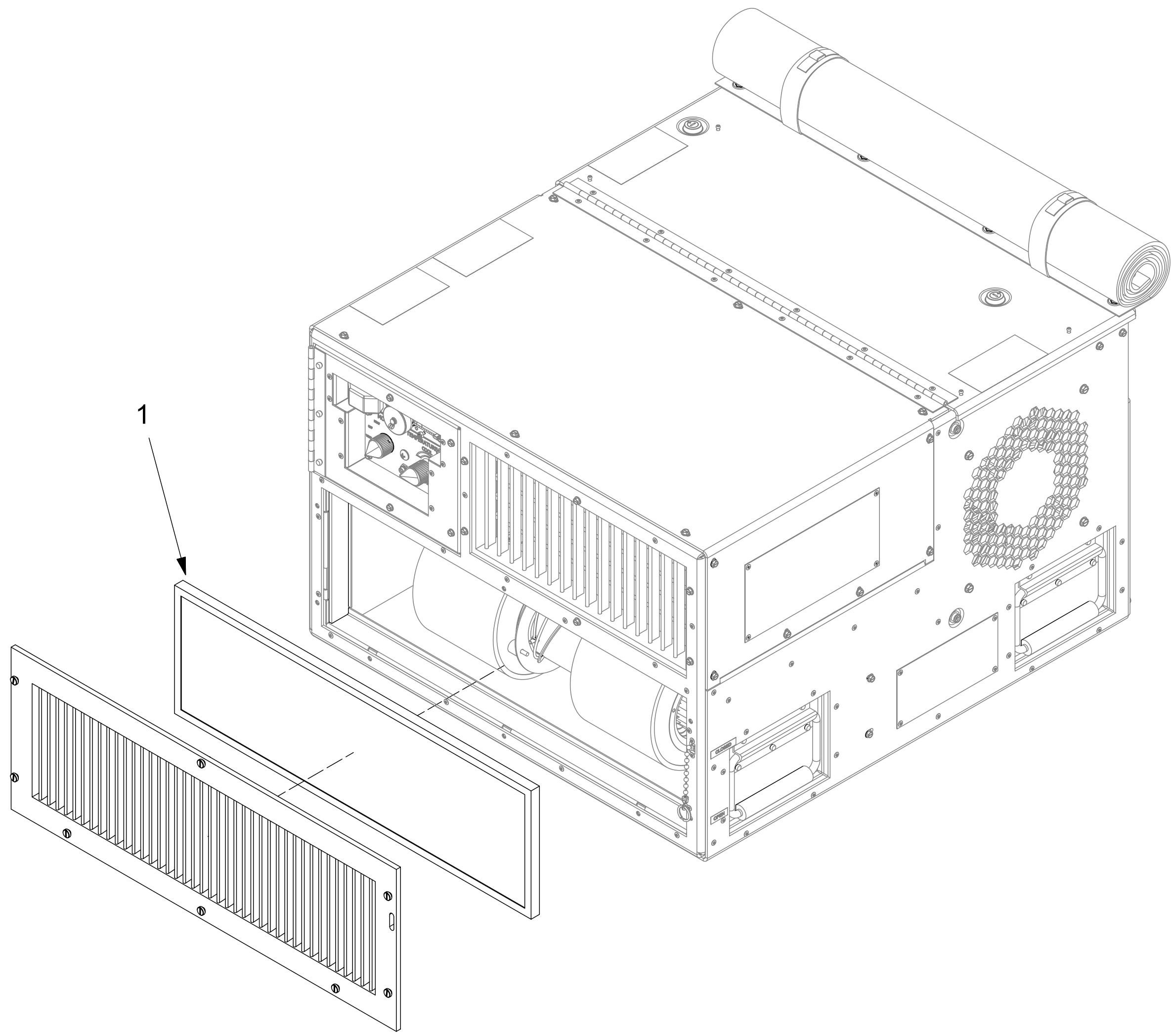



Figure 6. Air Filters Group (Sheet 1 of 2).

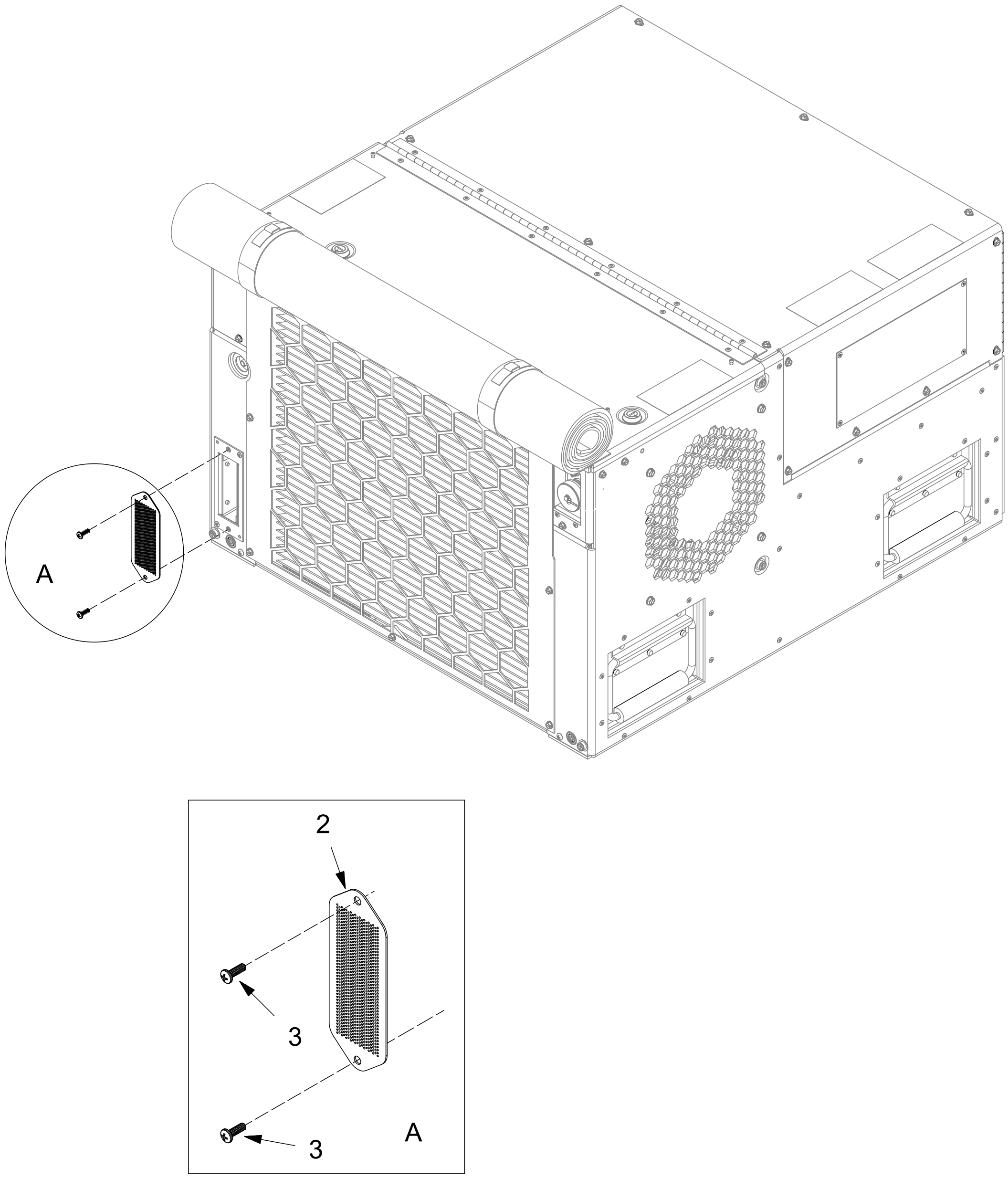



**Figure 6. Air Filters Group (Sheet 2 of 2).**

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 05 AIR FILTERS GROUP** | |
| | | | | | **GROUP 0501 INLET AIR FILTER** | |
| | | | | | **GROUP 0502 FRESH AIR SCREEN ASSEMBLY** | |
| | | | | | **FIGURE 6 AIR FILTERS GROUP** | |
| 1 | PAFZZ | 4130-01-612-0924 | 0A0B7 | 10-52704-3 | . . FILTER ELEMENT,AIR ......................... | 1 |
| 2 | PAFZZ | 4130-01-611-9172 | 0A0B7 | 10-50012 | . . FILTER ELEMENT,AIR ......................... | 1 |
| 3 | PAFZZ | 5305-01-523-0202 | 80205 | MS51957-45 | . . SCREW,MACHINE ............................... | 2 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 06 AIR DISTRIBUTION GROUP

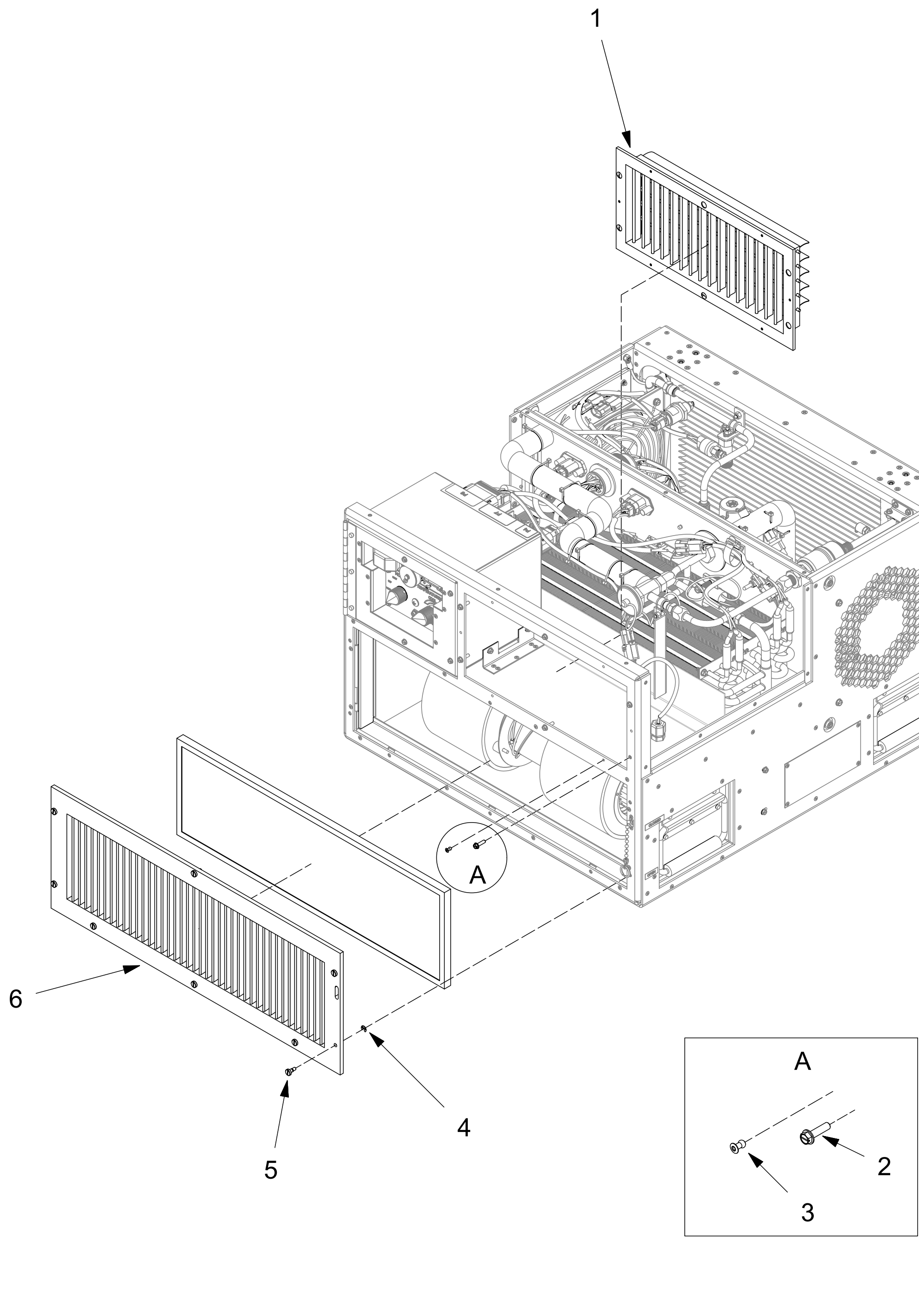



Figure 7. Air Distribution Group (Sheet 1 of 2).

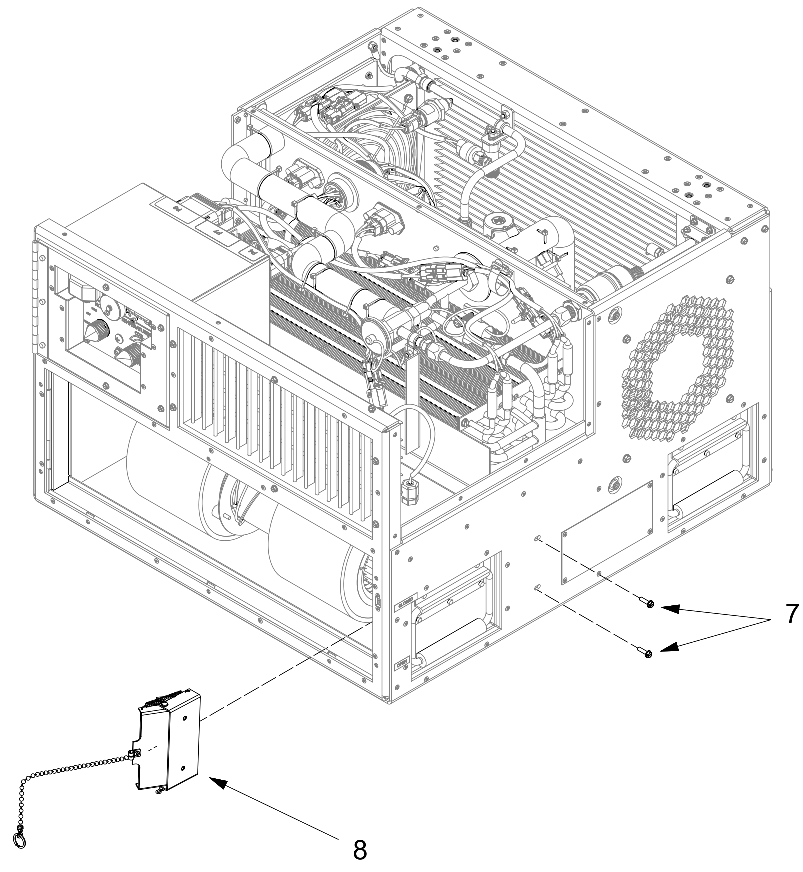



Figure 7.  Air Distribution Group (Sheet 2 of 2).

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 06 AIR DISTRIBUTION GROUP** | |
| | | | | | **GROUP 0601 SUPPLY GRILLE** | |
| | | | | | **GROUP 0602 RETURN GRILLE** | |
| | | | | | **GROUP 0603 FRESH AIR DUCT DOOR ASSEMBLY** | |
| | | | | | **FIGURE 7 AIR DISTRIBUTION GROUP** | |
| 1 | PAFZZ | 4140-01-612-3621 | 0A0B7 | 10-50706 | . . COVER,VENTILATORY ....................... | 1 |
| 2 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . SCREW,MACHINE ............................... | 6 |
| 3 | PAFZZ | 5320-00-882-8388 | 0A0B7 | 10-52258-03 | . . RIVET,BLIND ....................................... | 6 |
| 4 | PAFZZ | 5340-01-615-0883 | 0A0B7 | 10-52843 | . . CLIP,SPRING TENSION ...................... | 8 |
| 5 | PAFZZ | 5305-01-610-5235 | 0A0B7 | 10-52948 | . . THUMBSCREW .................................. | 8 |
| 6 | PAFZZ | 4140-01-612-3630 | 0A0B7 | 10-50705 | . . COVER,VENTILATORY ....................... | 1 |
| 7 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . SCREW,MACHINE ............................... | 2 |
| 8 | PAFZZ | 5340-01-612-6650 | 0A0B7 | 10-50025 | . . DOOR,ACCESS,GENERAL ................. | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 07 WATER CONNECTIONS GROUP

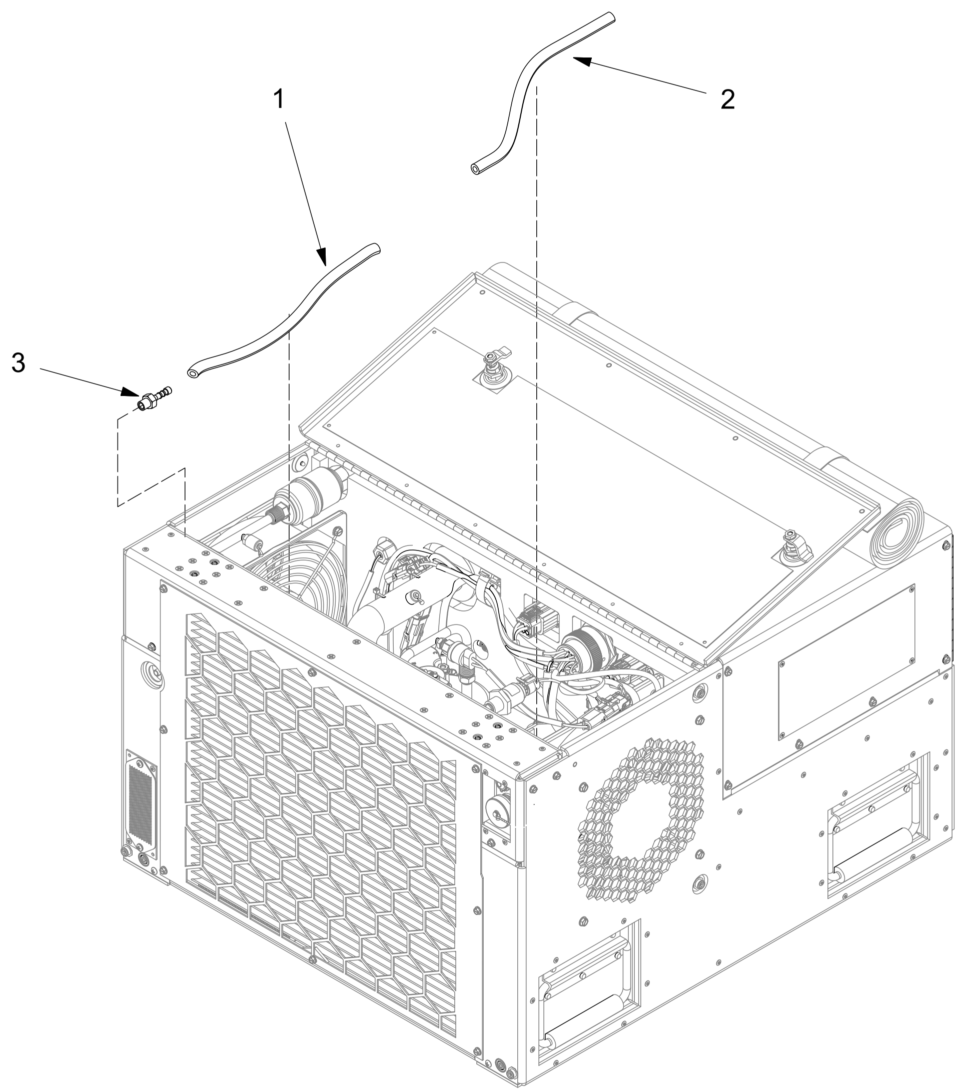



Figure 8.  Water Connections Group.

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 07 WATER CONNECTIONS GROUP** | |
| | | | | | **GROUP 0701 CONDENSATE TUBE** | |
| | | | | | **FIGURE 8 WATER CONNECTIONS GROUP** | |
| 1 | MFFZZ | 4720-01-583-3959 | 0A0B7 | 10-52841-06 | . . HOSE,NONMETALLIC (MAKE FROM CAGE 06034, P/N 220-0072) .................. | 1 |
| 2 | MFFZZ | | 0A0B7 | 10-52841-07 | . . HOSE,NONMETALLIC (MAKE FROM CAGE 06034, P/N 220-0072) .................. | 1 |
| 3 | PAFZZ | 4730-01-610-0904 | 0A0B7 | 10-52856-01 | . . ADAPTER,STRAIGHT,PI ..................... | 4 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 08 HEATING GROUP

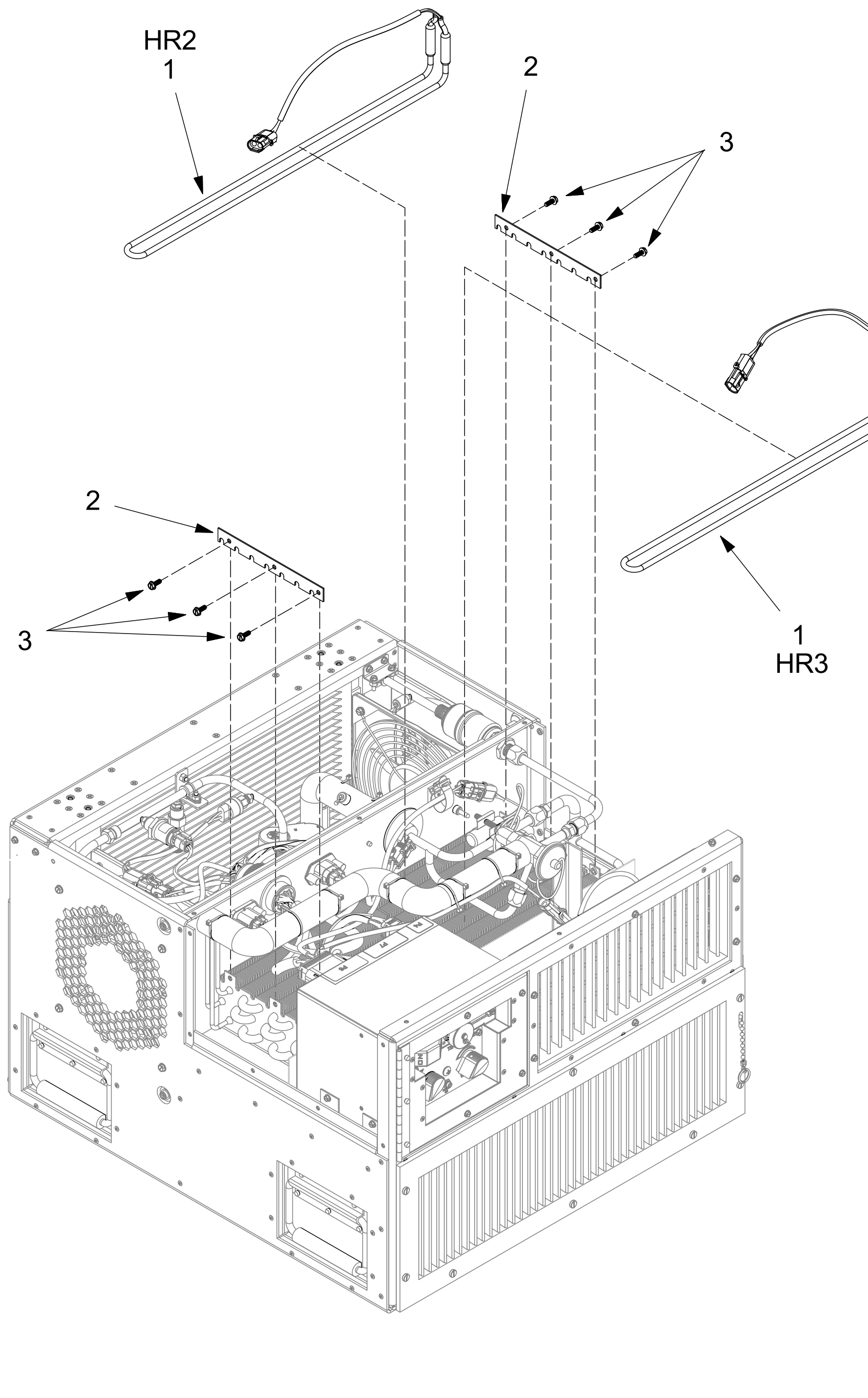



Figure 9. Heating Group.

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 08 HEATING GROUP** | |
| | | | | | **GROUP 0801 HEATER ASSEMBLY (HR2, HR3)** | |
| | | | | | **FIGURE 9 HEATING GROUP** | |
| 1 | PAFZZ | 4520-01-612-5129 | 0A0B7 | 10-50708 | . . . HEATER ELEMENT,ELE (HR2, HR3) | 2 |
| 2 | PAFZZ | | 0A0B7 | 10-50238 | . . . RETAINER ........................................ | 2 |
| 3 | PAFZZ | | 0A0B7 | 10-52904-03 | . . . SCREW,MACHINE ............................ | 6 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 09 COMPRESSOR GROUP

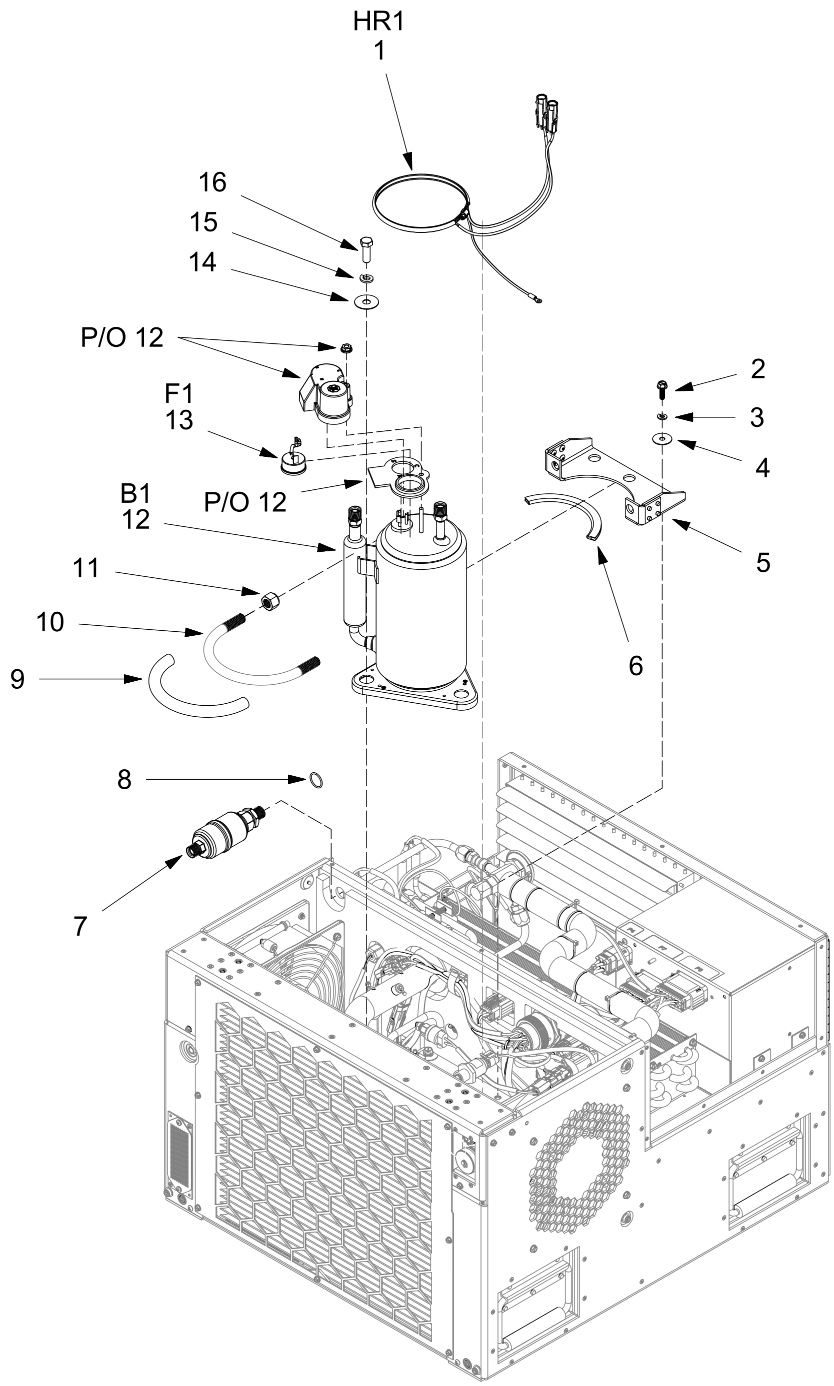



Figure 10. Compressor Group.

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 09 COMPRESSOR GROUP** | |
| | | | | | **GROUP 0901 CRANKCASE HEATER ASSEMBLY (HR1)** | |
| | | | | | **GROUP 0902 FILTER-DRIER** | |
| | | | | | **GROUP 0903 COMPRESSOR BRAZING ASSEMBLY** | |
| | | | | | **FIGURE 10 COMPRESSOR GROUP** | |
| 1 | PAFZZ | 4520-01-612-5086 | 0A0B7 | 10-50709 | . . HEATING ELEMENT,ELE (HR1) .......... | 1 |
| 2 | PAFZZ | 5935-01-582-6781 | 0A0B7 | 10-52936 | . . SCREW,MACHINE .............................. | 3 |
| 3 | PAFZZ | 5310-01-229-6260 | 0A0B7 | 10-52930-06 | . . WASHER,LOCK .................................. | 3 |
| 4 | PAFZZ | 5310-01-523-1031 | 0A0B7 | 10-52924-16 | . . WASHER,FLAT ................................... | 3 |
| 5 | PAFZZ | | 0A0B7 | 10-50031 | . . BRACKET ........................................... | 1 |
| 6 | MFFZZ | 5330-01-617-9645 | 0A0B7 | 10-52857 | . . SEAL,NONMETALLIC SP (MAKE FROM CAGE 1X147, P/N RWPD-1) ........ | 1 |
| 7 | PAFZZ | 4310-01-610-6656 | 0A0B7 | 10-52700 | . . FILTER-DRIER,REFRIG ...................... | 1 |
| 8 | PAFZZ | 5310-01-616-9294 | 80205 | AS568A-018 | . . O-RING ............................................... | 1 |
| 9 | MFFZZ | | 0A0B7 | 10-52844-07 | . . HEAT SHRINK (MAKE FROM CAGE 06090, P/N NT-MIL 3/4-0) ........................ | 1 |
| 10 | PAFZZ | | 0A0B7 | 10-50819 | . . COMPR U-BOLT ................................. | 1 |
| 11 | PAFZZ | 5310-01-475-9155 | 0A0B7 | 10-52934-18 | . . NUT,SELF-LOCKING,HE ..................... | 2 |
| 12 | PBFFF | 4310-01-612-4087 | 0A0B7 | 10-50009 | . . COMPRESSOR,REFRIGER (B1) ........ | 1 |
| 13 | PAFZZ | 6110-01-612-0943 | 0A0B7 | 10-50603 | . . . REGULATOR,CURRENT (F1) ........... | 1 |
| 14 | PAFZZ | | 0A0B7 | 10-52924-29 | . . WASHER,FLAT ................................... | 3 |
| 15 | PAFZZ | 5310-01-524-7994 | 0A0B7 | 10-52930-08 | . . WASHER,LOCK .................................. | 3 |
| 16 | PAFZZ | 5305-01-529-7271 | 0A0B7 | 10-52929-07 | . . SCREW,CAP,HEXAGON H .................. | 3 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 10 CONDENSER GROUP

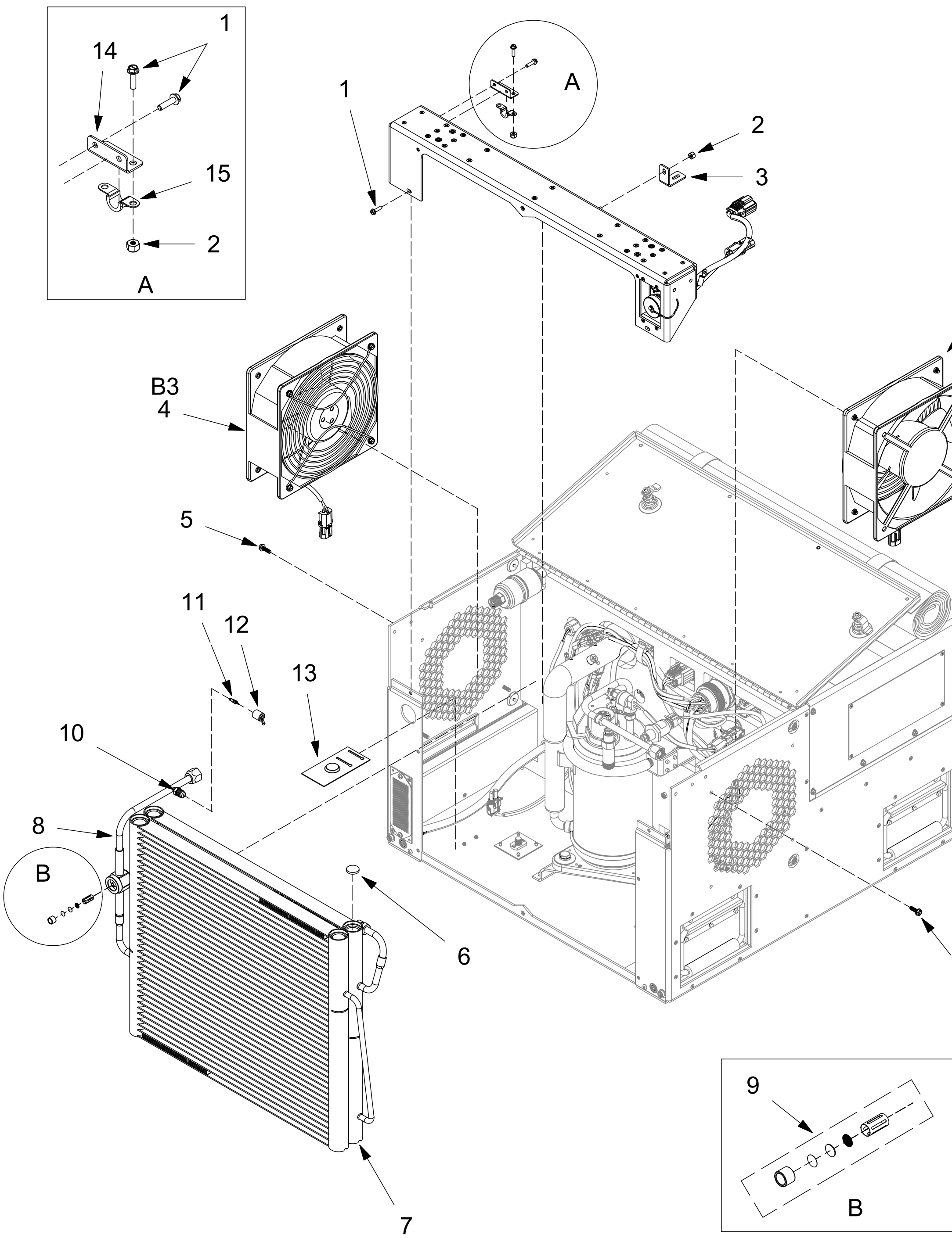



Figure 11. Condenser Group.

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 10 CONDENSER GROUP** | |
| | | | | | **GROUP 1001 CONDENSER FAN ASSEMBLY (B3, B4)** | |
| | | | | | **GROUP 1002 CONDENSER BRAZING ASSEMBLY** | |
| | | | | | **FIGURE 11 CONDENSER GROUP** | |
| 1 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . SCREW,MACHINE ............................... | 4 |
| 2 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . NUT,SELF-LOCKING,HE ..................... | 3 |
| 3 | PAFZZ | 5340-01-612-6229 | 0A0B7 | 10-50235 | . . BRACKET,MOUNTING ........................ | 1 |
| 4 | PAFZZ | 4140-01-612-4049 | 0A0B7 | 10-50011 | . . IMPELLER,FAN,AXIAL (B3, B4) .......... | 2 |
| 5 | PAFZZ | 5305-01-568-1575 | 0A0B7 | 10-52904-04 | . . SCREW,CAP,HEXAGON H .................. | 8 |
| 6 | PAFZZ | 5365-01-610-4241 | 0A0B7 | 10-52820 | . . BUSHING ............................................ | 4 |
| 7 | PAFFF | 4130-01-612-3779 | 0A0B7 | 10-50010 | . . CONDENSER COIL,REFR .................. | 1 |
| 8 | XAFZZ | | 0A0B7 | 10-50301 | . . . COUPLING ASSEMBLY,T .................. | 1 |
| 9 | PAFZZ | 6680-00-085-8248 | 0A0B7 | 10-52338 | . . . . INDICATOR,SIGHT,LIQ .................... | 1 |
| 10 | XAFFF | | 0A0B7 | 10-52337 | . . . . COUPLING,CLAMP,PIPE ................. | 1 |
| 11 | PAFZZ | 4820-01-612-3711 | 0A0B7 | 10-52336 | . . . . . STEM,FLUID VALVE ...................... | 1 |
| 12 | PAFZZ | 4820-01-610-0924 | 0A0B7 | 10-52321 | . . . . CAP,VALVE ..................................... | 1 |
| 13 | PAFZZ | 5340-01-610-6386 | 0A0B7 | 10-52224 | . . . BRACKET,MOUNTING ...................... | 2 |
| 14 | XBFZZ | | 0A0B7 | 10-50231 | . . BRACKET,MOUNTING ........................ | 1 |
| 15 | PAFZZ | 5340-01-612-1024 | 0A0B7 | 10-52848-06 | . . STRAP,RETANING .............................. | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 11 EVAPORATOR GROUP

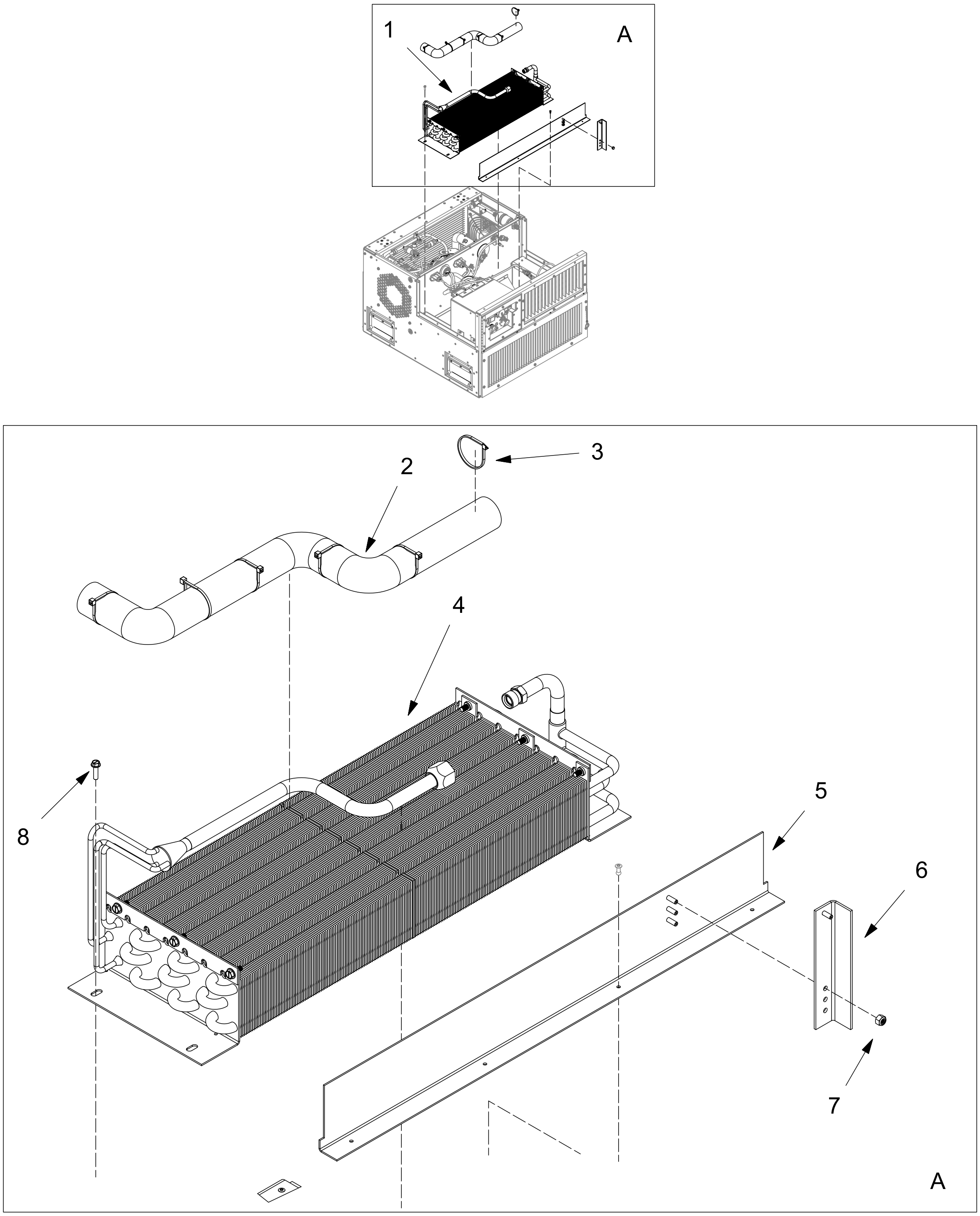



Figure 12. Evaporator Group (Sheet 1 of 2).

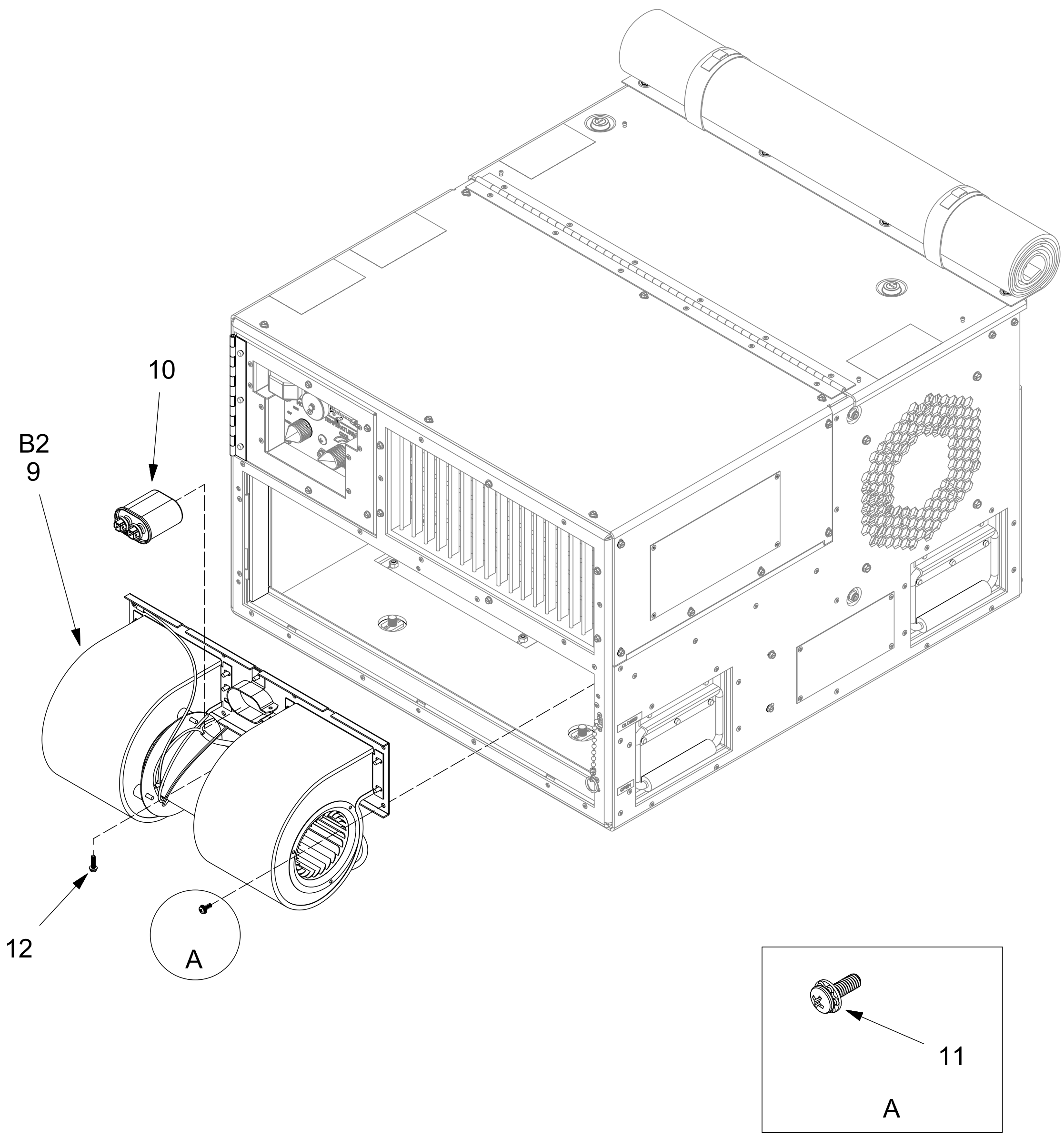



**Figure 12. Evaporator Group (Sheet 2 of 2).**

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 11 EVAPORATOR GROUP** | |
| | | | | | **GROUP 1101 EVAPORATOR** | |
| | | | | | **GROUP 1102 EVAPORATOR BLOWER ASSEMBLY (B2)** | |
| | | | | | **FIGURE 12 EVAPORATOR GROUP** | |
| 1 | PAFFF | 4130-01-612-3743 | 0A0B7 | 10-50022 | . . EVAPORATOR COIL,REF ................... | 1 |
| 2 | MFFZZ | | 0A0B7 | 10-52854-07 | . . . INSULATION SLEEVING (MAKE FROM CAGE 3HJD1, P/N 6RXL048048) | 1 |
| 3 | PAFZZ | 5975-00-133-8687 | 96906 | MS3367-5-0 | . . . STRAP,TIEDOWN,ELEC ................... | 6 |
| 4 | PAFZZ | 4130-01-612-0813 | 0A0B7 | 10-50702 | . . . EVAPORATOR COIL,REF ................. | 1 |
| 5 | PAFZZ | | 0A0B7 | 10-50237 | . . EVAP FLANGE ASSY .......................... | 1 |
| 6 | PAFZZ | | 0A0B7 | 10-50236 | . . . TXV SUPPORT BRKT ....................... | 1 |
| 7 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . . NUT,SELF-LOCKING,HE ................... | 3 |
| 8 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . SCREW,MACHINE ............................... | 2 |
| 9 | PAFFF | 4140-01-612-3723 | 0A0B7 | 10-50014 | . . BLOWER,EXHAUST (B2) .................... | 1 |
| 10 | PAFZZ | | 0A0B7 | 10-50604 | . . . CAPACITOR ....................................... | 1 |
| 11 | PAFZZ | 5305-01-610-6256 | 0A0B7 | 10-52935-14 | . . SCREW,ASSEMBLED WAS ................ | 4 |
| 12 | PAFZZ | 5305-01-610-7147 | 0A0B7 | 10-52945 | . . SCREW,TAPPING ................................ | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 12 REFRIGERANT PIPING GROUP

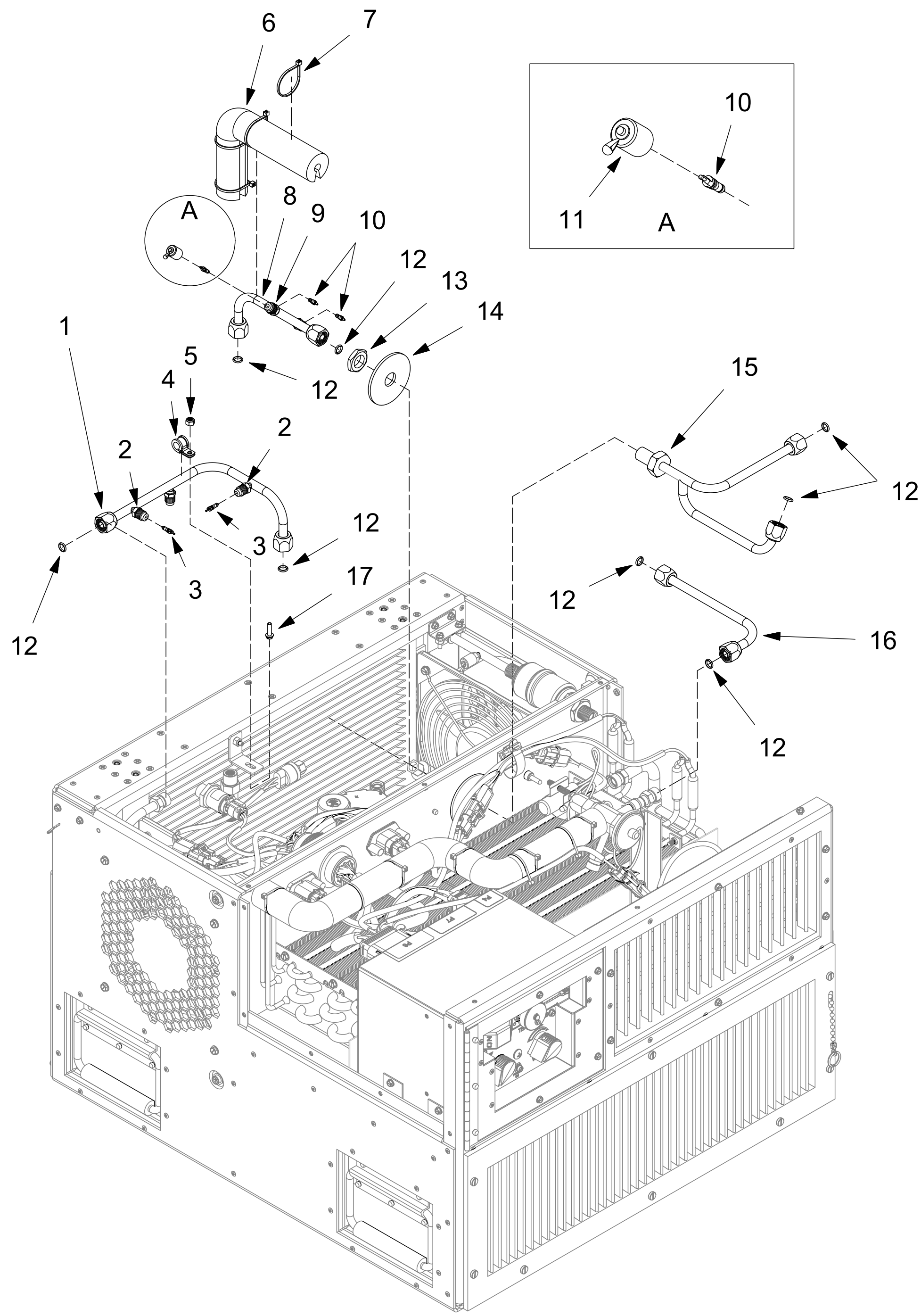



**Figure 13. Refrigerant Piping Group.**

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 12 REFRIGERANT PIPING GROUP** | |
| | | | | | **GROUP 1201 BULKHEAD WALL TO COMPRESSOR TUBE ASSEMBLY** | |
| | | | | | **GROUP 1202 COMPRESSOR TO CON-DENSER TUBE ASSEMBLY** | |
| | | | | | **GROUP 1203 EVAPORATOR TO BULK-HEAD WALL TUBE ASSEMBLY** | |
| | | | | | **GROUP 1204 TXV TO BULKHEAD WALL TUBE ASSEMBLY** | |
| | | | | | **FIGURE 13 REFRIGERANT PIPING GROUP** | |
| 1 | PBFFF | 4730-01-612-5317 | 0A0B7 | 10-50303 | . . COUPLING ASSEMBLY,T .................... | 1 |
| 2 | XAFFF | | 0A0B7 | 10-52337 | . . . COUPLING,CLAMP,PIPE .................. | 2 |
| 3 | PAFZZ | 4820-01-612-3711 | 0A0B7 | 10-52336 | . . . . STEM,FLUID VALVE ........................ | 1 |
| 4 | PAFZZ | 5340-01-528-0384 | 81343 | AS21919WCH06 | . . CLAMP,LOOP ..................................... | 1 |
| 5 | PAFZZ | 5310-01-359-2589 | 0A0B7 | 10-52934-06 | . . NUT,SELF-LOCKING,HE ..................... | 1 |
| 6 | MFFZZ | | 0A0B7 | 10-52854-09 | . . INSULATION SLEEVING (MAKE FROM CAGE 3HJD1, P/N 6RXL048038) | 1 |
| 7 | PAFZZ | 5975-00-133-8687 | 96906 | MS3367-5-0 | . . STRAP,TIEDOWN,ELEC ..................... | 6 |
| 8 | XAFFF | 4730-01-612-5310 | 0A0B7 | 10-50302 | . . COUPLING ASSEMBLY,T .................... | 1 |
| 9 | XAFFF | | 0A0B7 | 10-52337 | . . . COUPLING,CLAMP,PIPE .................. | 3 |
| 10 | PAFZZ | 4820-01-612-3711 | 0A0B7 | 10-52336 | . . . . STEM,FLUID VALVE ........................ | 1 |
| 11 | PAFZZ | 4820-01-610-0924 | 0A0B7 | 10-52321 | . . . CAP,VALVE ....................................... | 1 |
| 12 | PAFZZ | | 0A0B7 | 10-52954-011 | . . O-RING ................................................ | 9 |
| 13 | PAFZZ | 4730-01-612-5201 | 0A0B7 | 10-52331-06 | . . NUT,TUBE COUPLING ........................ | 1 |
| 14 | PAFZZ | | 0A0B7 | 10-52919-01 | . . WASHER,FLAT .................................... | 2 |
| 15 | PBFZZ | 4730-01-612-5330 | 0A0B7 | 10-50304 | . . . COUPLING,TUBE ............................. | 1 |
| 16 | PAFZZ | 4710-01-612-5226 | 0A0B7 | 10-50300 | . . . TUBE ASSEMBLY,METAL ................. | 1 |

| (1)<br>ITEM NO. | (2)<br>SMR CODE | (3)<br>NSN | (4)<br>CAGEC | (5)<br>PART NUMBER | (6)<br>DESCRIPTION AND USABLE ON CODE (UOC) | (7)<br>QTY |
|---|---|---|---|---|---|---|
| 17 | PAFZZ | 5305-01-610-6796 | 0A0B7 | 10-52923-04 | . . SCREW,MACHINE ............................... | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 13 SUCTION AND DISCHARGE GROUP

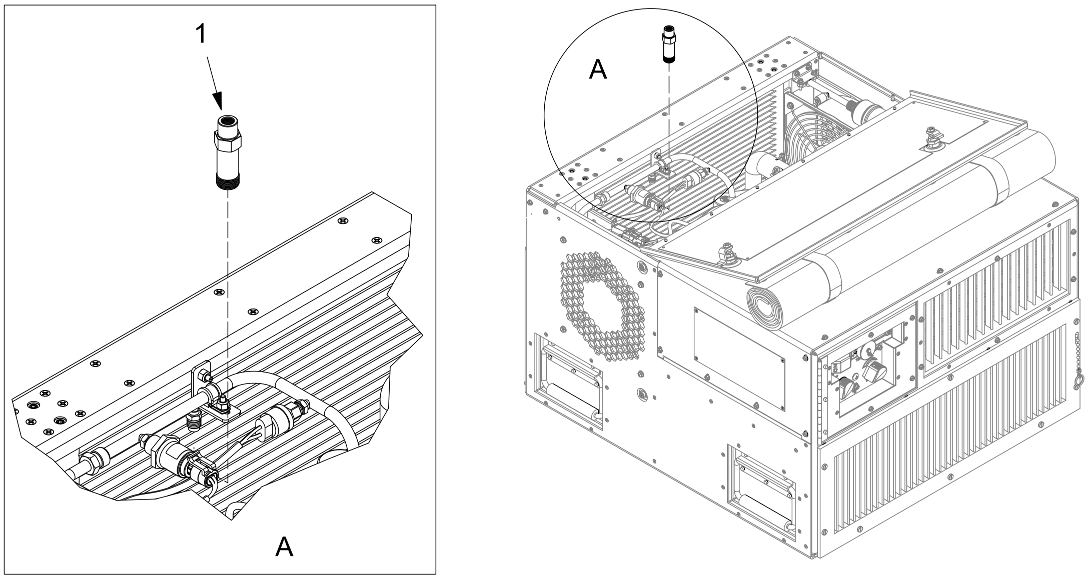



Figure 14. Suction and Discharge Group.

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 13 SUCTION AND DISCHARGE GROUP** | |
| | | | | | **GROUP 1301 VALVE, PRESSURE RELIEF** | |
| | | | | | **FIGURE 14 SUCTION AND DISCHARGE GROUP** | |
| 1 | PAFZZ | 4820-01-612-5410 | 0A0B7 | 10-52701 | VALVE,SAFETY RELIEF .......................... | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 14 DIAGNOSTICS GROUP

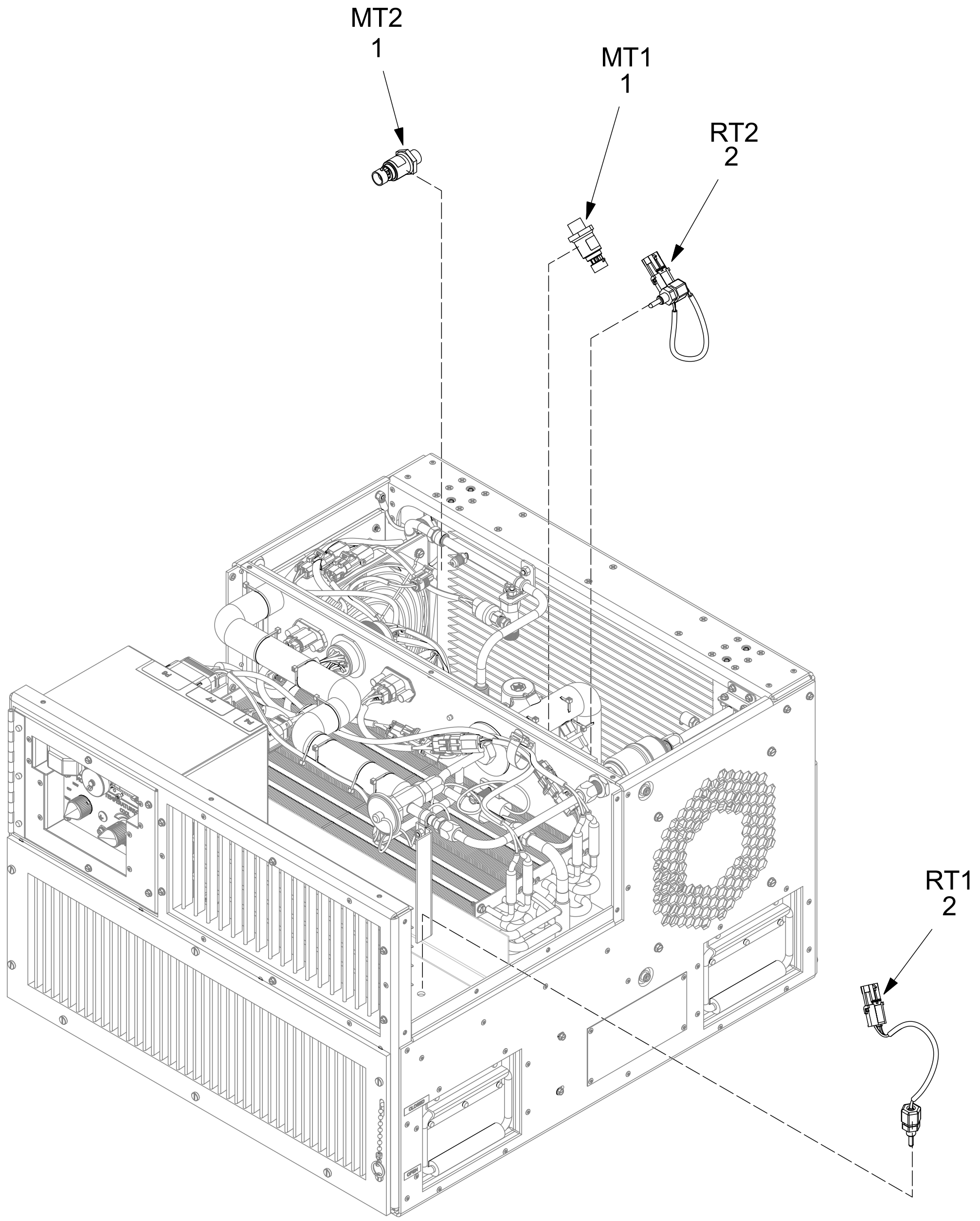



Figure 15. Diagnostics Group.

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 14 DIAGNOSTICS GROUP** | |
| | | | | | **GROUP 1401 PRESSURE TRANSDUCER ASSEMBLY (MT1, MT2)** | |
| | | | | | **GROUP 1402 THERMISTOR ASSEMBLY (RT1, RT2)** | |
| | | | | | **FIGURE 15 DIAGNOSTICS GROUP** | |
| 1 | PAFZZ | | 0A0B7 | 10-52634 | . . TRANSMITTER,PRESSUR (MT1, MT2) ......................................................... | 2 |
| 2 | PAFZZ | | 0A0B7 | 10-52632 | . . RESISTOR,THERMAL (RT1, RT2) ...... | 2 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## GROUP 15 BULK MATERIAL

| (1) ITEM NO. | (2) SMR CODE | (3) NSN | (4) CAGEC | (5) PART NUMBER | (6) DESCRIPTION AND USABLE ON CODE (UOC) | (7) QTY |
|---|---|---|---|---|---|---|
| | | | | | **GROUP 15 BULK MATERIALS FIG. BULK** | |
| 1 | PAFZZ | | 3V9L1 | F12024-BLK | . WIRE CORD .......................................... | 1 |
| 2 | PAFZZ | | 3V9L1 | F18054-BLK | . WIRE,ELECTRICAL ............................... | 1 |
| 3 | PAFZZ | | 3V9L1 | F18054-WHT | . WIRE,ELECTRICAL ............................... | 1 |
| 4 | PAFZZ | | 1T5T4 | SAS14043 | . INSULATION SHEET,TH ........................ | 1 |
| 5 | PAFZZ | | 3V9L1 | F14037-WHT | . WIRE,ELECTRICAL ............................... | 1 |
| 6 | PAFZZ | | 3V9L1 | F14037-ORG | . WIRE,ELECTRICAL ............................... | 1 |
| 7 | PAFZZ | | 3V9L1 | F14037-BLK | . WIRE CORD .......................................... | 1 |
| 8 | PAFZZ | | 3V9L1 | F18054-BLU | . WIRE,ELECTRICAL ............................... | 1 |
| 9 | PAFZZ | | 3V9L1 | F12024-G/Y | . WIRE,ELECTRICAL ............................... | 1 |
| 10 | PAFZZ | | 3V9L1 | F12024-WHT | . WIRE,ELECTRICAL ............................... | 1 |
| 11 | PAFZZ | 4720-01-583-3959 | 06034 | 220-0072 | . HOSE,NONMETALLIC ........................... | 1 |
| 12 | PAFZZ | 5640-01-614-0294 | 3HJD1 | 6RXL048048 | . INSULATION SLEEVING ....................... | 1 |
| 13 | PAFZZ | 5640-01-619-3410 | 3HJD1 | 6RXL048038 | . INSULATION SLEEVING ....................... | 1 |
| 14 | PAFZZ | | 1T5T4 | SAS38043 | . INSULATION SHEET,TH ........................ | 1 |
| 15 | PAFZZ | 5640-00-237-4781 | 1T5T4 | SAS12043 | . INSULATION SHEET,TH ........................ | 1 |
| 16 | PAFZZ | 5330-01-617-9645 | 1X147 | RWPD-1 | . SEAL,NONMETALLIC SP ...................... | 1 |
| 17 | PAFZZ | | 06090 | NT-MIL 3/4-0 | . HEAT SHRINK ....................................... | 1 |
| | | | | | **END OF FIGURE** | |

## OPERATOR AND FIELD MAINTENANCE

## NSN INDEX

| STOCK NUMBER | FIG. | ITEM |
|---|---|---|
| 5305-01-610-6256 | 12 | 11 |
| 5340-01-610-6386 | 11 | 13 |
| 5998-01-610-6417 | 4 | 12 |
| 5998-01-610-6420 | 4 | 13 |
| 5310-01-610-6436 | 2 | 32 |
| 5305-01-610-6444 | 2 | 42 |
| 4310-01-610-6656 | 10 | 7 |
| 5305-01-610-6792 | 3 | 8 |
| 5305-01-610-6796 | 11 | 1 |
| | 12 | 8 |
| | 13 | 17 |
| | 2 | 1 |
| | 2 | 41 |
| | 4 | 4 |
| | 4 | 53 |
| | 7 | 2 |
| | 7 | 7 |
| 5930-01-610-7094 | 4 | 3 |
| 5930-01-610-7099 | 4 | 1 |
| 5905-01-610-7103 | 5 | 1 |
| 5305-01-610-7116 | 4 | 10 |
| 5305-01-610-7147 | 12 | 12 |
| 5305-01-610-7153 | 4 | 50 |
| 7690-01-610-7160 | 2 | 11 |
| 5935-01-610-7179 | 3 | 13 |
| | 4 | 15 |
| 6150-01-610-7312 | 4 | 24 |
| 5940-01-610-9144 | 4 | 16 |
| 6150-01-610-9690 | 4 | 49 |
| 5935-01-610-9696 | 4 | 46 |
| 4010-01-611-0364 | 4 | 43 |
| 5998-01-611-7647 | 4 | 45 |
| 5340-01-611-7801 | 2 | 29 |
| 4130-01-611-9172 | 6 | 2 |
| 6150-01-612-0570 | 3 | 55 |
| 6150-01-612-0777 | 3 | 51 |
| 4130-01-612-0813 | 12 | 4 |
| 4130-01-612-0924 | 6 | 1 |
| 6110-01-612-0943 | 10 | 13 |
| 5340-01-612-1024 | 11 | 15 |
| 5995-01-612-2141 | 3 | 53 |
| 6150-01-612-2143 | 3 | 61 |
| 6150-01-612-2144 | 3 | 52 |
| 6150-01-612-2145 | 3 | 54 |
| 5995-01-612-2178 | 3 | 56 |
| 5995-01-612-2180 | 3 | 28 |
| 5998-01-612-2187 | 3 | 3 |
| 6150-01-612-2654 | 3 | 48 |
| 5935-01-612-2656 | 3 | 4 |
| 6150-01-612-2658 | 4 | 31 |
| 6150-01-612-2659 | 3 | 50 |
| 6150-01-612-2667 | 4 | 27 |
| 5925-01-612-3037 | 4 | 14 |
| 4140-01-612-3486 | 2 | 40 |
| 4140-01-612-3621 | 7 | 1 |
| 4140-01-612-3630 | 7 | 6 |
| 4820-01-612-3711 | 11 | 11 |

| STOCK NUMBER | FIG. | ITEM |
|---|---|---|
| | 13 | 3 |
| | 13 | 10 |
| 4140-01-612-3723 | 12 | 9 |
| 4130-01-612-3743 | 12 | 1 |
| 4130-01-612-3779 | 11 | 7 |
| 4140-01-612-4049 | 11 | 4 |
| 4310-01-612-4087 | 10 | 12 |
| 5320-01-612-4759 | 2 | 30 |
| 4935-01-612-4835 | 4 | 5 |
| 4520-01-612-5086 | 10 | 1 |
| 4520-01-612-5129 | 9 | 1 |
| 4730-01-612-5201 | 13 | 13 |
| 4710-01-612-5226 | 13 | 16 |
| 4820-01-612-5242 | 5 | 4 |
| 4730-01-612-5310 | 13 | 8 |
| 4730-01-612-5317 | 13 | 1 |
| 4730-01-612-5330 | 13 | 15 |
| 5910-01-612-5346 | 3 | 18 |
| 4820-01-612-5410 | 14 | 1 |
| 5340-01-612-6229 | 11 | 3 |
| 5340-01-612-6423 | 5 | 2 |
| 5340-01-612-6650 | 7 | 8 |
| 5330-01-612-6668 | 3 | 2 |
| 5330-01-612-7682 | 4 | 7 |
| 5330-01-612-7693 | 3 | 6 |
| 5305-01-612-8297 | 2 | 34 |
| 5340-01-612-8320 | 2 | 2 |
| 5340-01-612-8323 | 2 | 35 |
| 6150-01-612-8681 | 3 | 70 |
| 6145-01-612-9590 | 3 | 21 |
| | 3 | 46 |
| 6145-01-612-9608 | 3 | 69 |
| 4010-01-612-9893 | 3 | 38 |
| 5945-01-612-9938 | 4 | 9 |
| 5340-01-613-7732 | 2 | 3 |
| 5640-01-614-0294 | BULK | 12 |
| 5340-01-614-7444 | 4 | 17 |
| 5340-01-615-0883 | 7 | 4 |
| 5310-01-616-9294 | 10 | 8 |
| 5330-01-617-9645 | BULK | 16 |
| | 10 | 6 |
| 5320-01-618-3114 | 2 | 22 |
| 7690-01-618-6737 | 2 | 15 |
| 5998-01-618-9897 | 3 | 14 |
| 5640-01-619-3410 | BULK | 13 |

**END OF WORK PACKAGE**

## OPERATOR AND FIELD MAINTENANCE

## P/N INDEX

| PART NUMBER | FIG. | ITEM |
|---|---|---|
| 10-5000 | 1 | 1 |
| 10-50001 | 1 | 2 |
| 10-50002 | 4 | 5 |
| 10-50007 | 3 | 3 |
| 10-50009 | 10 | 12 |
| 10-50010 | 11 | 7 |
| 10-50011 | 11 | 4 |
| 10-50012 | 6 | 2 |
| 10-50014 | 12 | 9 |
| 10-50015 | 2 | 35 |
| 10-50020 | 2 | 2 |
| 10-50022 | 12 | 1 |
| 10-50025 | 7 | 8 |
| 10-50027 | 2 | 18 |
| 10-50031 | 10 | 5 |
| 10-50200 | 3 | 7 |
| 10-50201 | 3 | 4 |
| 10-50202 | 2 | 40 |
| 10-50231 | 11 | 14 |
| 10-50235 | 11 | 3 |
| 10-50236 | 12 | 6 |
| 10-50237 | 12 | 5 |
| 10-50238 | 9 | 2 |
| 10-50300 | 13 | 16 |
| 10-50301 | 11 | 8 |
| 10-50302 | 13 | 8 |
| 10-50303 | 13 | 1 |
| 10-50304 | 13 | 15 |
| 10-50400 | 3 | 61 |
| 10-50401 | 3 | 55 |
| 10-50402 | 3 | 70 |
| 10-50403 | 4 | 31 |
| 10-50404 | 4 | 27 |
| 10-50405 | 3 | 44 |
| 10-50406 | 3 | 24 |
| 10-50407 | 3 | 28 |
| 10-50408 | 3 | 53 |
| 10-50409 | 3 | 56 |
| 10-50410 | 3 | 54 |
| 10-50411 | 3 | 48 |
| 10-50412 | 3 | 52 |
| 10-50413 | 3 | 50 |
| 10-50414 | 3 | 51 |
| 10-50415 | 3 | 19 |
| 10-50417 | 4 | 24 |
| 10-50600 | 4 | 14 |
| 10-50601 | 3 | 18 |
| 10-50602 | 3 | 9 |
| 10-50603 | 10 | 13 |
| 10-50604 | 12 | 10 |
| 10-50702 | 12 | 4 |
| 10-50705 | 7 | 6 |

| PART NUMBER | FIG. | ITEM |
|---|---|---|
| 10-50706 | 7 | 1 |
| 10-50708 | 9 | 1 |
| 10-50709 | 10 | 1 |
| 10-50800 | 2 | 9 |
| 10-50801 | 2 | 19 |
| 10-50802 | 2 | 10 |
| 10-50803 | 2 | 38 |
| 10-50804 | 2 | 33 |
| 10-50805 | 2 | 25 |
| 10-50807 | 4 | 7 |
| 10-50808 | 3 | 6 |
| 10-50809 | 2 | 23 |
| 10-50812 | 2 | 15 |
| 10-50813 | 3 | 2 |
| 10-50814 | 2 | 31 |
| 10-50815 | 2 | 14 |
| 10-50817 | 4 | 6 |
| 10-50819 | 10 | 10 |
| 10-51408 | 4 | 37 |
| 10-51409 | 4 | 32 |
| 10-51421 | 3 | 40 |
| 10-51422 | 3 | 32 |
| 10-51500 | 3 | 20 |
| | 3 | 25 |
| | 3 | 45 |
| 10-51604-01 | 3 | 14 |
| 10-51899 | 3 | 15 |
| 10-51900-05 | 3 | 16 |
| 10-52003 | 4 | 45 |
| 10-52018 | 2 | 32 |
| 10-52028-01 | 5 | 4 |
| 10-52031 | 2 | 29 |
| 10-52035 | 2 | 4 |
| 10-52036-01 | 2 | 3 |
| 10-52200 | 2 | 21 |
| 10-52201 | 4 | 46 |
| 10-52207 | 2 | 27 |
| 10-52224 | 11 | 13 |
| 10-52251-04 | 2 | 7 |
| 10-52252-04 | 2 | 17 |
| 10-52252-05 | 2 | 6 |
| 10-52258-03 | 7 | 3 |
| 10-52258-04 | 2 | 24 |
| | 2 | 28 |
| 10-52260-03 | 2 | 22 |
| 10-52261-03 | 3 | 60 |
| 10-52271-01 | 2 | 37 |
| 10-52271-02 | 2 | 44 |
| 10-52272-01 | 2 | 43 |
| 10-52321 | 11 | 12 |
| | 13 | 11 |
| 10-52331-06 | 13 | 13 |

| PART NUMBER | FIG. | ITEM |
|---|---|---|
| 10-52336 | 11 | 11 |
| | 13 | 3 |
| | 13 | 10 |
| 10-52337 | 11 | 10 |
| | 13 | 2 |
| | 13 | 9 |
| 10-52338 | 11 | 9 |
| 10-52403 | 4 | 3 |
| 10-52419 | 4 | 20 |
| 10-52420 | 4 | 22 |
| 10-52421 | 3 | 71 |
| 10-52425 | 4 | 41 |
| 10-52427 | 4 | 49 |
| 10-52440 | 3 | 36 |
| 10-52448 | 3 | 66 |
| 10-52520 | 3 | 33 |
| | 3 | 43 |
| | 4 | 36 |
| 10-52521 | 3 | 23 |
| | 3 | 29 |
| 10-52524 | 3 | 22 |
| | 3 | 27 |
| | 3 | 31 |
| | 3 | 35 |
| | 3 | 37 |
| | 3 | 42 |
| | 3 | 47 |
| | 3 | 68 |
| | 4 | 35 |
| | 4 | 40 |
| | 4 | 44 |
| 10-52549 | 3 | 39 |
| | 4 | 42 |
| 10-52565-01 | 4 | 38 |
| 10-52600 | 4 | 17 |
| 10-52607 | 4 | 12 |
| 10-52608 | 4 | 13 |
| 10-52610 | 3 | 11 |
| 10-52611 | 3 | 13 |
| | 4 | 15 |
| 10-52613 | 4 | 16 |
| 10-52618-01 | 4 | 9 |
| 10-52620 | 4 | 1 |
| 10-52622 | 5 | 1 |
| 10-52630 | 4 | 2 |
| 10-52632 | 15 | 2 |
| 10-52634 | 15 | 1 |
| 10-52700 | 10 | 7 |
| 10-52701 | 14 | 1 |
| 10-52704-3 | 6 | 1 |
| 10-52800 | 2 | 11 |
| 10-52801 | 2 | 13 |
| 10-52802 | 2 | 12 |
| 10-52812 | 2 | 8 |
| 10-52820 | 11 | 6 |
| 10-52837 | 5 | 2 |
| 10-52841-06 | 8 | 1 |

| PART NUMBER | FIG. | ITEM |
|---|---|---|
| 10-52841-07 | 8 | 2 |
| 10-52843 | 7 | 4 |
| 10-52844-07 | 10 | 9 |
| 10-52846-04 | 2 | 30 |
| 10-52848-06 | 11 | 15 |
| 10-52849 | 4 | 19 |
| 10-52851 | 4 | 29 |
| 10-52854-07 | 12 | 2 |
| 10-52854-09 | 13 | 6 |
| 10-52856-01 | 8 | 3 |
| 10-52857 | 10 | 6 |
| 10-52858 | 3 | 59 |
| 10-52900 | 2 | 26 |
| 10-52904-03 | 9 | 3 |
| 10-52904-04 | 11 | 5 |
| 10-52907 | 2 | 39 |
| 10-52915 | 2 | 42 |
| 10-52919-01 | 13 | 14 |
| 10-52920 | 5 | 3 |
| 10-52923-03 | 3 | 8 |
| 10-52923-04 | 11 | 1 |
| | 12 | 8 |
| | 13 | 17 |
| | 2 | 1 |
| | 2 | 41 |
| | 4 | 4 |
| | 4 | 53 |
| | 7 | 2 |
| | 7 | 7 |
| 10-52923-05 | 2 | 34 |
| 10-52924-05 | 2 | 16 |
| 10-52924-16 | 10 | 4 |
| 10-52924-29 | 10 | 14 |
| 10-52925-05 | 4 | 51 |
| 10-52929-07 | 10 | 16 |
| 10-52930-06 | 10 | 3 |
| 10-52930-08 | 10 | 15 |
| 10-52931-06 | 2 | 36 |
| 10-52933-03 | 3 | 49 |
| | 3 | 63 |
| | 4 | 28 |
| 10-52934-01 | 4 | 23 |
| | 4 | 48 |
| 10-52934-03 | 3 | 12 |
| | 3 | 62 |
| | 4 | 11 |
| 10-52934-05 | 3 | 64 |
| | 4 | 52 |
| 10-52934-06 | 11 | 2 |
| | 12 | 7 |
| | 13 | 5 |
| | 2 | 5 |
| | 2 | 20 |
| | 3 | 1 |
| | 3 | 10 |
| | 4 | 25 |
| | 5 | 6 |

**END OF WORK PACKAGE**

# CHAPTER 8

# OPERATOR AND FIELD SUPPORTING INFORMATION

# REFERENCES

## SCOPE

This work package lists all pamphlets, field manuals, forms, military specifications, miscellaneous publications, technical bulletins, and technical manuals referenced in this manual.

## DA PAMPHLETS

| | |
|---|---|
| DA PAM 25-30 | Consolidated Index of Publications and Blank Forms |
| DA PAM 385-10 | Army Safety Program |
| DA PAM 750-8 | The Army Maintenance Management System (TAMMS) Users Manual |

## FIELD MANUALS

| | |
|---|---|
| FM 20-3 | Camouflage, Concealment, and Decoys |
| FM 3-11.3 | Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Contamination Avoidance |
| FM 3-11.4 | Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection |
| FM 3-11.5 | Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination |
| FM 3-97.6 | Mountain Operations |
| FM 31-70 | Basic Cold Weather Manual |
| FM 31-71 | Northern Operations |
| FM 4-25.11 | First Aid |
| FM 9-207 | Operation and Maintenance of Ordnance Materiel in Cold Weather (0 °F to -65 °F) |

## FORMS

| | |
|---|---|
| DA Form 2028 | Recommended Changes to Publications and Blank Forms |
| DA Form 2028-2 | Recommended Changes to Equipment Technical Publications |
| DA Form 2028-E | Recommended Changes to Publications and Blank Forms |
| DA Form 2062 | Hand Receipt |
| DA Form 2408 | Equipment Log Assembly (Records) DA |
| DA Form 2408-9 | Equipment Control Record |
| DA Form 5988E | Equipment Inspection and Maintenance Worksheet |
| DD Form 314 | Preventive Maintenance Schedule and Record |
| SF Form 361 | Transportation Discrepancy Report |
| SF Form 364 | Report of Discrepancy |
| SF Form 368 | Product Quality Deficiency Report |

## MISCELLANEOUS PUBLICATIONS

| | |
|---|---|
| AR 385-10 | The Army Safety Program |
| AR 420-1 | Army Facilities Management |
| AR 700-138 | Army Logistics Readiness and Sustainability |
| AR 735-11-2 | Reporting of Supply Discrepancies |
| AR 750-1 | Army Materiel Maintenance Policy |
| AWS C3.4 | Specification for Torch Brazing |
| CTA 50-909 | Field and Garrison Furnishings and Equipment |
| CTA 50-970 | Expendable/Durable Items (Except Medical Class V, Repair Parts, and Heraldic Items) |
| CTA 8-100 | Army Medical Department Expendable/Durable Items |
| TC 9-237 | Operator’s Circular, Welding Theory and Application |

## TECHNICAL BULLETINS

| | |
|---|---|
| TB 43-0213 | Corrosion Prevention and Control for Tactical Vehicles |

## TECHNICAL MANUALS

| | |
|---|---|
| TM 750-244-3 | Procedures for Destruction of Equipment to Prevent Enemy Use |
| TM 750-244-7 | Procedures for Destruction of Equipment in Federal Supply classification |
| TM 9-214 | Inspection, Care, and Maintenance of Antifriction Bearings |
| TM 9-243 | Use and Care of Hand Tools and Measuring Tools |
| TM 9-4940-435-14&P | Leak Detector, Refrigerant Gas |
| TM-43-0139 | Painting Instructions for Army Materiel |

**END OF WORK PACKAGE**

## INTRODUCTION FOR STANDARD TWO-LEVEL MAC

### INTRODUCTION

#### The Army Maintenance System MAC

This introduction provides a general explanation of the maintenance and repair functions.

The MAC (immediately following this introduction) designates overall authority and responsibility for the performance of maintenance tasks on the identified end item or component. The application of the maintenance tasks to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels/classes, which are shown in the MAC in column (4). Column (4) is divided into two secondary columns. These columns indicate the maintenance levels/classes of ‘Field’ and ‘Sustainment’. Each maintenance level column is further divided into two sub-columns. These sub-columns identify the maintenance classes and are as follows:

1. Field level maintenance classes:

   a. Crew (operator) maintenance. This is 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. Items with a “C” (“O” for joint service reporting) in the third position of the Source, Maintenance, and Recoverability (SMR) code may be replaced at the crew(operator) class. A code of “C” (“O” for joint service) in the fourth position of the SMR code indicates complete repair is authorized at the crew (operator) class.

   b. Maintainer maintenance. This is maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion by field level units. This maintenance is performed either on the system or after it is removed. An “F” in the third position of the SMR code indicates replacement of assemblies, subassemblies, or other components is authorized at this level. An “F” in the fourth position of the SMR code indicates complete repair of the identified item is allowed at the Maintainer class. Items repaired at this level are normally returned to the user after maintenance is performed.

2. Sustainment level maintenance classes:

   a. Below depot sustainment. This is maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion either on the system or after it is removed. The item subject to maintenance has normally been forwarded to a maintenance facility away from the field level supporting units. An “H” in the third position of the SMR code indicates replacement of assemblies, subassemblies, or other components is authorized at this class. An "H" appearing in the fourth position of the SMR code indicates complete repair is possible at this class. Items are normally returned to the supply system after maintenance is performed at this class.

   b. Depot. This is maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion either on the system or after it is removed. Assets to be repaired at this class are normally returned to an Army Depot or authorized contractor facility. The replace function for this class of maintenance is indicated by the letter "D" or "K" appearing in the third position of the SMR code. A "D" or "K" appearing in the fourth position of the SMR code indicates complete repair is possible at the depot sustainment maintenance level. Items are returned to the supply system after maintenance is performed at this class.

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 task 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 task.

#### Maintenance tasks

Maintenance tasks are limited to and defined as follows:

**INTRODUCTION – CONTINUED**

1. Inspect. A function 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).
2. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards, e.g., load testing of lift devices or hydrostatic testing of pressure hoses.
3. Service. Operations required periodically to keep an item in proper operating condition such as replenishing fuel, lubricants, chemical fluids, or gases.
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. It 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. The act of taking a sub-component off an asset to allow repair or replacement of that sub-component, or to facilitate other maintenance.
8. Install. The act of placing, positioning, or otherwise locating a component or sub-component to make it part of a higher level end item. Install can be to install a new asset for the first time or reinstall an asset previously removed. The maintenance level/class allowed to perform an installation is determined by the third position in the SMR code.
9. Replace. To install a serviceable component in place of one that is unserviceable or a required time change asset. “Replace” is authorized by the MAC and the assigned maintenance class is shown as the third position code of the SMR code.
10. Repair. The application of maintenance actions, including fault location/troubleshooting, removal, installation, disassembly, assembly, or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in the item.
11. Paint. This is a function to prepare and apply coats of paint. When used with munitions, the paint is applied so the ammunition can be identified and protected.

**NOTE**

The following definitions are applicable to the “repair” maintenance task: 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).

Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

12. Overhaul. This is the maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in the appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to a like new condition.
13. Rebuild. This 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.

**INTRODUCTION – CONTINUED**

14. Lubricate. The act of applying a material (e.g., oil or grease) to reduce friction and allow a component to operate in a more efficient manner.
15. Mark. The process of restoring obliterated identification on an asset.
16. Pack. To place an item into a container for either storage or shipment after service and other maintenance operations have been completed.
17. Unpack. The act or removing an asset from a storage or shipping container in preparation to perform further maintenance (e.g., repair or install).
18. Preserve. The action required to treat systems and equipment whether installed or stored, to ensure a serviceable condition.
19. Prepare for use. Those steps required to make an asset ready for other maintenance (e.g., remove preservatives, lubricate, etc.).
20. Assemble. The step-by-step instructions to join the component pieces of an asset together to make a complete serviceable asset.
21. Disassemble. 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).
22. Clean. Step-by-step instructions on how to remove dirt, corrosion or other contaminants from equipment.
23. Non destructive inspection. Step-by-step instructions on preparation and accomplishment inspections which do not destroy or damage the equipment.
24. Radio interference suppression. Step-by-step instructions to ensure installed equipment, either communication or other electronics, does not interfere with installed communication equipment.
25. Place in service. Step-by-step instructions required to place an item into service that are not covered in the service upon receipt work package.
26. Towing. The step-by-step instructions to connect one vehicle to another for the purpose of having one vehicle moved through the motive power of the other vehicle.
27. Jacking. The step-by-step instructions to mechanically raise or lift a vehicle to facilitate maintenance on the vehicle.
28. Parking. Step-by-step instructions to safely place a vehicle in a lot, ramp area or other designated location.
29. Mooring. Step-by-step instructions to secure a vehicle by chains, ropes or other means to protect the vehicle from environmental conditions or secure for transportation.
30. Covering. Step-by-step instructions to place a protective wrapping over a vehicle to protect it from environmental conditions or to hide (e.g., camouflage) it.
31. Hoisting. Step-by-step instructions to allow a vehicle to be raised by cables or ropes through attaching points.
32. Sling loading. Step-by-step instructions to place a sling around a vehicle to allow it to be raised.
33. External power. Step-by-step instructions on how to apply electrical power from any authorized power source (e.g., external generator or facility power).
34. Preparation for storage or shipment. Step-by-step instructions for preparing the equipment for placement into administrative storage or for special transportation requirements.

**INTRODUCTION – CONTINUED**

35. Arm. Detailed instructions on activating munitions prior to use.

36. Load. This may be one of two tasks:

    a. For transportation, the act of placing assets onto a transportation medium (e.g., pallet, truck, container).

    b. For weapons/weapons systems, the act of placing munitions into the weapon/weapons system.

37. Unload. This may be one of two tasks:

    a. For transportation, the act of removing assets from a transportation medium (e.g., pallet, truck, container).

    b. For weapons/weapons systems, the act of removing munitions from the weapon/weapons system.

38. Software maintenance. Step-by-step instructions for software maintenance (e.g., installing, un-installing, etc.).

**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 task. 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 tasks” outlined previously).

Column (4) Maintenance Level. Column (4) specifies each level/class of maintenance authorized to perform each function listed in column (3), by indicating work time required in the appropriate sub-column. This work time figure represents the active time required to perform that maintenance task at the indicated level/class of maintenance. If the number or complexity of the tasks within the listed maintenance task varies at different maintenance classes, appropriate work time figures are to be shown for each class.

The work time figure represents the average time required to perform the prescribed task (assembly, subassembly, component, module, end item, or system) on the item under typical operating conditions for that maintenance level/class. 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 tasks authorized in the MAC. The symbol designations for the various maintenance levels/classes and classes are as follows:

<u>Field:</u>

C Crew maintenance

F Maintainer maintenance

<u>Sustainment:</u>

L Specialized Repair Activity (SRA)

H Below depot maintenance

D Depot maintenance

**INTRODUCTION – CONTINUED**

**NOTE**

The "L" maintenance class is not included in column (4) of the MAC. Functions to this class 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 a number 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 (6) 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 class 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 task being performed as indicated in the MAC.

**END OF WORK PACKAGE**

## STANDARD TWO-LEVEL MAC

### Table 1. Maintenance Allocation Chart (MAC).

| (1) GROUP NUMBER | (2) COMPONENT/ ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL FIELD CREW (C) | FIELD MAINTAINER (F) | SUSTAINMENT BELOW DEPOT (H) | SUSTAINMENT DEPOT (D) | (5) TOOLS AND EQUIPMENT REFERENCE CODE | (6) REMARKS CODE |
|---|---|---|---|---|---|---|---|---|
| 00 | Air Conditioner | Inspect | 0.25 | | | | None | A |
| | | Inspect | | 0.50 | | | 10 | B |
| | | Test | 0.33 | | | | None | C |
| | | Test | | 0.50 | | | 5,7,9,10 | C |
| | | Repair | | 0.33 | | | 1,2,3,4,5, 6,7,8,9,10, 11,12 | D |
| 01 | Housing Group | | | | | | | |
| 0101 | Cover Assem-bly | Inspect | 0.10 | | | | None | A |
| | | Inspect | | 0.25 | | | None | B |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Repair | | 0.50 | | | 8,10 | D,E |
| | | Replace | | 0.50 | | | 10 | D |
| | | Install | | 0.25 | | | 10 | |
| 0102 | Housing Assembly | Inspect | 0.10 | | | | None | A |
| | | Repair | | 0.75 | | | 6,8,10 | D,F |
| 0103 | Data Plate | Inspect | 0.05 | | | | None | A |
| | | Replace | | 0.25 | | | 8,10 | D |
| 0104 | Bridge Plate Assembly | Remove/Install | | 0.30 | | | 6,10 | |
| | | Replace | | 0.60 | | | 6,10 | D |
| | | Install | | 0.30 | | | 6,10 | |
| 0105 | Condenser Grille | Inspect | 0.05 | | | | 10 | A |
| | | Replace | | 0.25 | | | 10 | D |
| 02 | Power Distribu-tion/Condition-ing Group | | | | | | | |
| 0201 | Soft Start Box Assembly | Test | | 0.50 | | | 10 | |
| | | Remove/Install | | 0.10 | | | 10 | |
| | | Repair | | 1.00 | | | 10 | C,D,G |
| | | Replace | | 0.50 | | | 10 | C,D |
| | | Install | | 0.10 | | | 10 | |
| 0202 | Condenser Side Bulkhead Cable (W1) | Inspect | | 0.10 | | | None | B |

Table 1. Maintenance Allocation Chart (MAC). – Continued

| (1) GROUP NUMBER | (2) COMPONENT/ ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL FIELD CREW (C) | FIELD MAINTAINER (F) | SUSTAINMENT BELOW DEPOT (H) | SUSTAINMENT DEPOT (D) | (5) TOOLS AND EQUIPMENT REFERENCE CODE | (6) REMARKS CODE |
|---|---|---|---|---|---|---|---|---|
| | | Test | | 0.20 | | | 10 | H |
| | | Replace | | 0.77 | | | 10 | C,D |
| 0203 | Compressor Power Cable (W13) | Inspect | | 0.10 | | | None | B |
| | | Test | | 0.20 | | | 10 | H |
| | | Replace | | 0.30 | | | 10 | C,D |
| 0204 | Relay to Heater Power Cable (W19) | Inspect | | 0.10 | | | None | B |
| | | Test | | 0.20 | | | 10 | H |
| | | Replace | | 0.25 | | | 10 | C,D |
| 0205 | Evaporator Side Bulkhead Cable (W17) | Inspect | | 0.10 | | | None | B |
| | | Test | | 0.20 | | | 10 | H |
| | | Replace | | 0.25 | | | 10 | C,D |
| 0206 | Rear Power Cable (W9) | Inspect | | 0.10 | | | None | B |
| | | Test | | 0.20 | | | 10 | H |
| | | Replace | | 0.50 | | | 10 | C,D |
| 0207 | Heat Power Cable (W21) | Inspect | | 0.10 | | | None | B |
| | | Test | | 0.33 | | | 10 | H |
| | | Replace | | 0.62 | | | 10 | C,D |
| 03 | Power Controls Group | | | | | | | |
| 0301 | High Pressure Switch Assembly (S2) | Test | | 0.33 | | | 5,7,9,10 | H |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Replace | | 0.77 | | | 10 | C,D |
| | | Install | | 0.25 | | | 10 | |
| 0302 | Low Pressure Switch Assembly (S3) | Test | | 0.25 | | | 5,7,9,10 | H |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Replace | | 0.50 | | | 10 | C,D |
| | | Install | | 0.25 | | | 10 | |
| 0303 | Momentary Switch Assembly (S1) | Test | | 0.25 | | | 10 | H |

Table 1. Maintenance Allocation Chart (MAC). – Continued

| (1) GROUP NUMBER | (2) COMPONENT/ ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL FIELD CREW (C) | MAINTAINER (F) | SUSTAINMENT BELOW DEPOT (H) | DEPOT (D) | (5) TOOLS AND EQUIPMENT REFERENCE CODE | (6) REMARKS CODE |
|---|---|---|---|---|---|---|---|---|
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Replace | | 0.50 | | | 10 | C,D |
| | | Install | | 0.25 | | | 10 | |
| 0304 | Control Box Assembly | Test | | 0.25 | | | 10 | H |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Repair | | 1.65 | | | 10 | C,D,I |
| | | Replace | | 0.75 | | | 10 | C,D |
| | | Install | | 0.25 | | | 10 | |
| 030401 | Remote Control Box Assembly | Inspect | 0.10 | | | | None | A |
| | | Test | | 0.25 | | | 10 | |
| | | Remove/Install | | 0.05 | | | 10 | |
| | | Repair | | 0.25 | | | 10 | C,D,J |
| | | Replace | | 0.10 | | | 10 | C,D |
| | | Install | | 0.05 | | | 10 | |
| 04 | Thermal Group | | | | | | | |
| 0401 | TXV Brazing Assembly | Test | | 1.00 | | | 10 | B |
| | | Remove/Install | | 1.00 | | | 2,3,4,5,7, 9,10 | |
| | | Replace | | 2.50 | | | 2,3,4,5,7, 9,10 | C,D |
| | | Install | | 1.50 | | | 2,3,4,5,7, 9,10,12 | |
| 0402 | Bullet Thermistor Assembly (RT3) | Test | | 0.25 | | | 10 | H |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Replace | | 0.50 | | | 10 | C,D |
| | | Install | | 0.25 | | | 10 | |
| 05 | Air Filters Group | | | | | | | |
| 0501 | Inlet Air Filter | Inspect | 0.10 | | | | None | A |
| | | Service | 0.20 | | | | None | A |
| | | Remove/Install | 0.10 | | | | None | A |
| | | Replace | 0.20 | | | | None | A |
| | | Install | 0.10 | | | | None | A |
| 0502 | Fresh Air Screen Assembly | Inspect | 0.10 | | | | None | A |
| | | Service | | 0.25 | | | 10 | B |

**Table 1. Maintenance Allocation Chart (MAC). – Continued**

| (1) GROUP NUMBER | (2) COMPONENT/ ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL FIELD CREW (C) | FIELD MAINTAINER (F) | SUSTAINMENT BELOW DEPOT (H) | SUSTAINMENT DEPOT (D) | (5) TOOLS AND EQUIPMENT REFERENCE CODE | (6) REMARKS CODE |
|---|---|---|---|---|---|---|---|---|
| | | Replace | | 0.25 | | | 10 | D |
| 06 | Air Distribution Group | | | | | | | |
| 0601 | Supply Grille | Inspect | 0.10 | | | | None | A |
| | | Remove/Install | | 0.16 | | | 10 | |
| | | Replace | | 0.25 | | | 8,10 | D |
| | | Install | | 0.16 | | | 8,10 | |
| 0602 | Return Grille | Inspect | 0.10 | | | | None | A |
| | | Remove/Install | 0.10 | | | | None | A |
| | | Replace | 0.16 | | | | None | A |
| | | Install | 0.10 | | | | None | A |
| 0603 | Fresh Air Duct Door Assembly | Inspect | 0.10 | | | | None | A |
| | | Replace | | 0.25 | | | 10 | |
| 07 | Water Connections Group | | | | | | | |
| 0701 | Condensate Tube | Inspect | | 0.10 | | | 10 | B |
| | | Remove/Install | | 0.15 | | | 10 | |
| | | Replace | | 0.30 | | | 10 | D |
| | | Install | | 0.15 | | | 10 | |
| 08 | Heating Group | | | | | | | |
| 0801 | Heater Assembly (HR2, HR3) | Test | | 0.60 | | | 10 | H |
| | | Remove/Install | | 0.60 | | | 10 | |
| | | Replace | | 1.20 | | | 10 | D |
| | | Install | | 0.60 | | | 10 | |
| 09 | Compressor Group | | | | | | | |
| 0901 | Crankcase Heater Assembly (HR1) | Test | | 0.25 | | | 10 | B,H |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Replace | | 0.50 | | | 10 | C,D |
| | | Install | | 0.25 | | | 10 | |
| 0902 | Filter-Drier | Replace | | 1.68 | | | 2,3,4,5,7, 8,9,10,12 | C,D |

## Table 1. Maintenance Allocation Chart (MAC). – Continued

| (1) GROUP NUMBER | (2) COMPONENT/ ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL FIELD CREW (C) | FIELD MAINTAINER (F) | SUSTAINMENT BELOW DEPOT (H) | SUSTAINMENT DEPOT (D) | (5) TOOLS AND EQUIPMENT REFERENCE CODE | (6) REMARKS CODE |
|---|---|---|---|---|---|---|---|---|
| 0903 | Compressor Brazing Assembly | Test | | 0.10 | | | 10 | B,H |
| | | Repair | | 0.50 | | | 10 | C,D,K |
| | | Replace | | 2.42 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| 10 | Condenser Group | | | | | | | |
| 1001 | Condenser Fan Assembly (B3, B4) | Inspect | | 0.10 | | | 10 | B |
| | | Remove/Install | | 0.15 | | | 10 | |
| | | Replace | | 0.25 | | | 10 | D |
| | | Install | | 0.15 | | | 10 | |
| 1002 | Condenser Brazing Assembly | Inspect | | 0.50 | | | 10 | B |
| | | Service | | 0.50 | | | 7,9,10 | B |
| | | Remove/Install | | 1.00 | | | 2,3,4,5,7, 8,9,10 | C,D |
| | | Repair | | 2.05 | | | 10 | C,D,L |
| | | Replace | | 2.25 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| | | Install | | 1.25 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| 11 | Evaporator Group | | | | | | | |
| 1101 | Evaporator | Inspect | | 0.50 | | | 10 | B |
| | | Service | | 0.50 | | | 7,9,10 | B |
| | | Remove/Install | | 1.00 | | | 2,3,4,5,7, 8,9,10 | C,D |
| | | Repair | | 0.25 | | | 10 | D,M |
| | | Replace | | 2.25 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| | | Install | | 1.25 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| 1102 | Evaporator Blower Assembly (B2) | Inspect | | 0.10 | | | None | B |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Repair | | 0.50 | | | 10 | |
| | | Replace | | 0.50 | | | 10 | D |
| | | Install | | 0.25 | | | 10 | |
| 12 | Refrigerant Piping Group | | | | | | | |

Table 1. Maintenance Allocation Chart (MAC). – Continued

| (1) GROUP NUMBER | (2) COMPONENT/ ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL FIELD CREW (C) | FIELD MAINTAINER (F) | SUSTAINMENT BELOW DEPOT (H) | SUSTAINMENT DEPOT (D) | (5) TOOLS AND EQUIPMENT REFERENCE CODE | (6) REMARKS CODE |
|---|---|---|---|---|---|---|---|---|
| 1201 | Bulkhead Wall to Compressor Tube Assembly | Inspect | | 0.05 | | | None | B |
| | | Repair | | 0.25 | | | 1,2,3,4,5, 7,8,9,10,12 | D,N,O |
| | | Replace | | 1.86 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| 1202 | Compressor to Condenser Tube Assembly | Inspect | | 0.05 | | | None | B |
| | | Repair | | 0.25 | | | 1,2,3,4,5, 7,8,9,10,12 | D,N,O |
| | | Replace | | 1.90 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| 1203 | Evaporator to Bulkhead Wall Tube Assembly | Inspect | | 0.05 | | | 10 | B |
| | | Replace | | 1.82 | | | 2,3,4,5,7, 8,9,10,12 | C,D,O |
| 1204 | TXV to Bulk-head Wall Tube Assembly | Inspect | | 0.05 | | | 10 | B |
| | | Replace | | 1.76 | | | 2,3,4,5,7, 8,9,10,12 | C,D,O |
| 13 | Suction and Discharge Group | | | | | | | |
| 1301 | Valve, Pressure Relief | Inspect | | 0.10 | | | None | B |
| | | Remove/Install | | 1.00 | | | 2,3,4,5,7, 8,9,10,12 | D |
| | | Replace | | 1.63 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| | | Install | | 1.00 | | | 2,3,4,5,7, 8,9,10,12 | C,D |
| 14 | Diagnostics Group | | | | | | | |
| 1401 | Pressure Transducer Assembly (MT1, MT2) | Remove/Install | | 0.15 | | | 10 | C,D |
| | | Replace | | 0.25 | | | 10 | C,D |
| | | Install | | 0.15 | | | 10 | C,D |
| 1402 | Thermistor Assembly (RT1, RT2) | Test | | 0.25 | | | 10 | H |
| | | Remove/Install | | 0.25 | | | 10 | |
| | | Replace | | 0.50 | | | 10 | C,D |

**Table 1. Maintenance Allocation Chart (MAC). – Continued**

| (1) GROUP NUMBER | (2) COMPONENT/ ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL FIELD CREW (C) | MAINTAINER (F) | SUSTAINMENT BELOW DEPOT (H) | DEPOT (D) | (5) TOOLS AND EQUIPMENT REFERENCE CODE | (6) REMARKS CODE |
|---|---|---|---|---|---|---|---|---|
| | | Install | | 0.25 | | | 10 | |

**Table 2. Tools and Test Equipment Requirements for 9K IECU.**

| TOOLS OR TEST EQUIPMENT | MAINTE-NANCE LEVEL | NOMENCLATURE | NATIONAL STOCK NUMBER | TOOL NUMBER |
|---|---|---|---|---|
| 1 | F | Core Removal Tool | 5120-01-569-3665 | CD3930 |
| 2 | F | Crows Foot Wrench Set (SATS) | | |
| 3 | F | Drain Pan (SATS) | | |
| 4 | F | Forward Repair System (FRS) | 4940-01-533-1621 | SC4940-95-E42 |
| 5 | F | Heat Gun (FRS) | | |
| 6 | F | Industrial Rubber Gloves (SATS) | | |
| 7 | F | Manifold Gauge Set | 4130-01-570-9752 | 59161 |
| 8 | F | Metric Socket Set (SATS) | | |
| 9 | F | Nitrogen Regulator | | |
| 10 | F | Rivet Gun (SATS) | | |
| 11 | F | Safety Glasses | | |
| 12 | F | Service Refrigeration Ordnance Tool Kit | 5180-00-596-1474 | 5180-95-CL-N18 |
| 13 | F | Standard Automotive Tool Set (SATS) | 4910-01-490-6453 | 4910-95 A81 |
| 14 | F | Torque Wrench (SATS) | | |

**Table 3. Remarks for 9K IECU.**

| REMARK CODE | REMARKS |
|---|---|
| A | Consists of the crew/operator PMCS. |
| B | Consists of the field maintenance PMCS. |
| C | Consists of the verification of the functionality of IECU. |

Table 3. Remarks for 9K IECU. – Continued

| REMARK CODE | REMARKS |
|---|---|
| D | Consists of corrective field maintenance (replace). |
| E | Repair of the cover assembly consists of replacement of rim latches, condenser cover assembly, strap assembly, electrical schematic, refrigeration schematic, and IECU 5000 wiring diagram plate. |
| F | Repair of the housing assembly consists of replacement of the handles, and fresh air key way. |
| G | Repair of the Soft Start box assembly consists of replacement of the Soft Start (U3), power factor correction capacitor (C1), 120 VAC relays (K2 and K3), Soft Start power-out cable (W41), Soft Start heater power cable (W42), Soft Start box power-in cable (W43), relay control and fan power cable (W44), Soft Start mounting bracket, and Soft Start box cover; local fabrication of Soft Start to capacitor cable (W36 and W37), relay to Soft Start Cable (W38), relay to capacitor cable (W46), relay contact jumper cable (W49 and W50), and relay coil jumper cable (W53). |
| H | Consists of continuity, voltage, and/or resistance check of component or wiring harness. |
| I | Repair of the control box assembly consists of replacement of the power board (U1), control board (U2), 120 VAC relay (K1), circuit breaker (CB1), circuit breaker boot seal, diagnostics cable (W31), control module cable (W30), front power cable (W32), control box rear box power cable (W27), circuit board power cable (W29), and the control box cover assembly and local fabrication of neutral relay jumper cable (W28), control box relay jumper cable (W34), and phase A to circuit breaker cable (W33). |
| J | Repair of the remote control box assembly consists of replacing the control knobs and the remote box cover. |
| K | Repair of the compressor brazing assembly consists of replacing the over-current protector and local fabrication of the compressor ground cable (W14). |
| L | Repair of the condenser brazing assembly consists of replacing the indicator paper in the sight glass and straightening the coil fins. |
| M | Repair of the evaporator consists of straightening the coil fins. |
| N | Repair of this tube assembly consists of replacing the Schrader valve cap and core. |
| O | Repair of this tube assembly consists of replacing o-ring(s). |

**END OF WORK PACKAGE**

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

### INTRODUCTION

#### Scope

This work package lists COEI and BII for the 9K IECU 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 9K IECU. 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 9K IECU in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the 9K IECU 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) Item Number. Gives you the reference number of the item listed.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes and provides an illustration of the item.

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 part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

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.

Column (5) 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 (2).

Column (6) Qty Rqr. Indicates the quantity required.

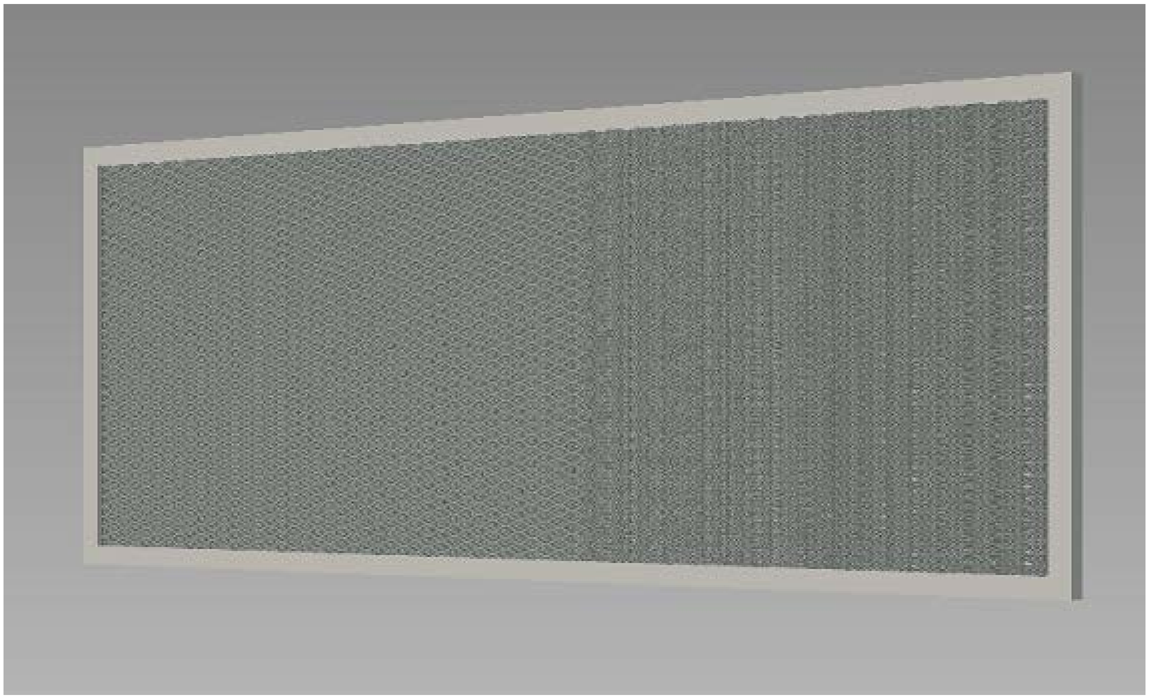
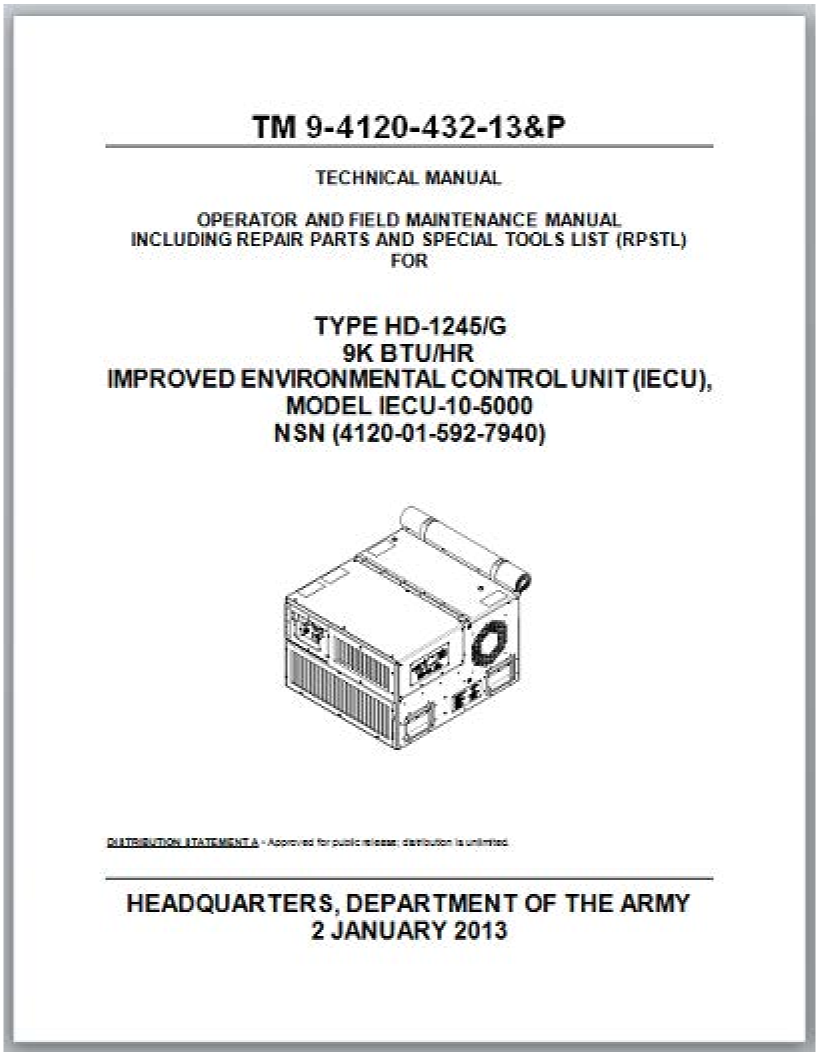


Figure 1. FILTER, INLET AIR.

Table 1. Component of End Items (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 | 1660-01-610-0924 | FILTER, INLET AIR (installed) HIA-S10150 (053X0) | | EA | 1 |
| 2 | 5342-01-611-7801 | RESILIENT MOUNT ASSEMBLY (over pack) 10-52031 (0A0B7) | | EA | 4 |



TM 9-4120-432-13&P

TECHNICAL MANUAL

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

TYPE HD-1245/G
9K BTU/HR
IMPROVED ENVIRONMENTAL CONTROL UNIT (IECU),
MODEL IECU-10-5000
NSN (4120-01-592-7940)

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

HEADQUARTERS, DEPARTMENT OF THE ARMY
2 JANUARY 2013

**Figure 2. Technical Manual.**

**Table 2. Basic Issue Items (BII).**

| (1) ILLUS NUMBER | (2) NATIONAL STOCK NUMBER (NSN) | (3) DESCRIPTION, PART NUMBER/(CAGEC) | (4) USABLE ON CODE | (5) U/I | (6) QTY RQR |
|---|---|---|---|---|---|
| 1 | | MANUAL, TECHNICAL (on top of unit)<br>TM 9-4120-432-13&P | | EA | 1 |

**END OF WORK PACKAGE**

## ADDITIONAL AUTHORIZATION LIST (AAL)

### INTRODUCTION

#### Scope

This work package lists additional items you are authorized for the support of the 9K IECU.

#### General

This list identifies items that do not have to accompany the 9K IECU and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

#### Explanation of Entries 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.

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.

**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 |
|---|---|---|---|---|
| | THERE ARE NO ADDITIONAL AUTHORIZED ITEMS | | | - |

**END OF WORK PACKAGE**

## EXPENDABLE AND DURABLE ITEMS LIST

### EXPENDABLE AND DURABLE ITEMS LIST INTRODUCTION

#### Scope

This work package lists expendable and durable items that you will need to operate and maintain the IECU. 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.

#### Explanation of Columns in the 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 identifies the lowest level of maintenance that requires the listed item F = Maintainer.

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.

**Table 1. Expendable and Durable Items List.**

| (1) ITEM NO. | (2) LEVEL | (3) NATIONAL STOCK NUMBER (NSN) | (4) ITEM NAME, DESCRIPTION, PART NUMBER/(CAGEC) | (5) U/I |
|---|---|---|---|---|
| 1 | C | 6665-01-535-2924 | Acetone, Cleaning Solvent | GL |
| 2 | C | | Adhesive, Thread | EA |
| 3 | C | 8020-00-297-6657 | Brush, Paint | EA |
| 4 | F | 7930-01-071-2507 | Cleaner, Coil, Foaming | EA |
| 5 | C | 7930-00-068-1669 | Detergent, General Purpose, 1/2 Gallon<br>7930-00-068-1669 (83421) | BX |
| 6 | F | | Nitrogen, Cylinder, Compressed Gas, Nitrogen Gas | LB |
| 7 | F | 8030-01-600-7707 | Nylog, O-Ring Lubricant<br>RT201B (1UZB4) | BO |
| 8 | C | 8010-01-229-9561 | Paint, Green 383<br>MIL-DTL-53039D | GL |
| 9 | C | 7920-00-205-1711 | Rags, Wiping<br>7920-00-205-1711 (64067) | BE |

**Table 1. Expendable and Durable Items List. – Continued**

| (1) ITEM NO. | (2) LEVEL | (3) NATIONAL STOCK NUMBER (NSN) | (4) ITEM NAME, DESCRIPTION, PART NUMBER/(CAGEC) | (5) U/I |
|---|---|---|---|---|
| 10 | F | 6830-01-588-9477 | Refrigerant Gas Mixture, R410A<br>SUVA 410A-25 LBS (2S827) | CY |
| 11 | C | 5350-01-520-8513 | Sandpaper, 240 Grit | SH |
| 12 | F | 9320-01-493-4555 | Tape, Cork Insulation 2" X 1/8”<br>13502570 (18876) | ROLL |
| 13 | F | 5975-01-261-2576 | Tie, Cable<br>ty524m (3RVM4) | PK |

**END OF WORK PACKAGE**

| | | |
|---|---|---|
| **RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS**<br>For use of this form, see AR 25-30; the proponent agency is OAASA | Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM). | DATE<br>21 Nov 2011 |

| | |
|---|---|
| **TO:** *(Forward to proponent of publication or form) (Include ZIP Code)*<br>Commander, U.S. Army Communications-Electronics Command, 6001 Combat Drive, ATTN: AMSEL-LCL-ECM, Aberdeen Proving Ground, MD 21005-1846 | **FROM:** *(Activity and location) (Include ZIP Code)*<br>Jane Q. Doe, SFC<br>1234 Any Street<br>Anytown, AL 34565 |

**PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| TM 11-1234-567-14 | 15 Jan 2011 | Operator, Field and Sustainment Support Maintenance Manual for Radio, AN/ABC-123 |

| ITEM | PAGE | PARA-GRAPH | LINE | FIGURE NO. | TABLE | RECOMMENDED CHANGES AND REASON |
|---|---|---|---|---|---|---|
| 1 | WP0005 PG 3 | | 2 | | | Test or Corrective Action [illegible] hould identify a different WP number. |

EXAMPLE

| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |
|---|---|---|
| Jane Q. Doe, SFC | 123-4567 | |

**DA FORM 2028, FEB 74** REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.

| | | |
|---|---|---|
| **TO:** *(Forward to proponent of publication or form) (Include ZIP Code)* | **FROM:** *(Activity and location) (Include ZIP Code)* | **DATE** |

**PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

| | | |
|---|---|---|
| PUBLICATION/FORM NUMBER | DATE | TITLE |

| PAGE NO. | COLM NO. | LINE NO. | NATIONAL STOCK NUMBER | REFERENCE NO. | FIGURE NO. | ITEM NO. | TOTAL NO. OF MAJOR ITEMS SUPPORTED | RECOMMENDED ACTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |



**PART III - REMARKS** *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

| | | |
|---|---|---|
| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |

| RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS<br>For use of this form, see AR 25-30; the proponent agency is OAASA | Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM). | DATE |
|---|---|---|

| **TO:** *(Forward to proponent of publication or form) (Include ZIP Code)* | **FROM:** *(Activity and location) (Include ZIP Code)* |
|---|---|

**PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| | | |

| ITEM | PAGE | PARA-GRAPH | LINE | FIGURE NO. | TABLE | RECOMMENDED CHANGES AND REASON |
|---|---|---|---|---|---|---|
| | | | | | | |

| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |
|---|---|---|
| | | |

| **TO:** *(Forward to proponent of publication or form) (Include ZIP Code)* | **FROM:** *(Activity and location) (Include ZIP Code)* | **DATE** |
|---|---|---|
| | | |

**PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| | | |

| PAGE NO. | COLM NO. | LINE NO. | NATIONAL STOCK NUMBER | REFERENCE NO. | FIGURE NO. | ITEM NO. | TOTAL NO. OF MAJOR ITEMS SUPPORTED | RECOMMENDED ACTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**PART III - REMARKS** *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |
|---|---|---|
| | | |

| **RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS**<br>For use of this form, see AR 25-30; the proponent agency is OAASA | Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM). | DATE |
|---|---|---|
| **TO:** *(Forward to proponent of publication or form) (Include ZIP Code)* | **FROM:** *(Activity and location) (Include ZIP Code)* | |

**PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| | | |

| ITEM | PAGE | PARA-GRAPH | LINE | FIGURE NO. | TABLE | RECOMMENDED CHANGES AND REASON |
|---|---|---|---|---|---|---|
| | | | | | | |

| TYPED NAME, GRADE OR TITLE | TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION | SIGNATURE |
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**PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

| PUBLICATION/FORM NUMBER | DATE | TITLE |
|---|---|---|
| | | |

| PAGE NO. | COLM NO. | LINE NO. | NATIONAL STOCK NUMBER | REFERENCE NO. | FIGURE NO. | ITEM NO. | TOTAL NO. OF MAJOR ITEMS SUPPORTED | RECOMMENDED ACTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

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|---|---|---|
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| PUBLICATION/FORM NUMBER | DATE | TITLE |
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| | | |

| ITEM | PAGE | PARA-GRAPH | LINE | FIGURE NO. | TABLE | RECOMMENDED CHANGES AND REASON |
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|---|---|---|
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**PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS**

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|---|---|---|
| | | |

| PAGE NO. | COLM NO. | LINE NO. | NATIONAL STOCK NUMBER | REFERENCE NO. | FIGURE NO. | ITEM NO. | TOTAL NO. OF MAJOR ITEMS SUPPORTED | RECOMMENDED ACTION |
|---|---|---|---|---|---|---|---|---|
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| | | |

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*Administrative Assistant to the*
*Secretary of the Army*
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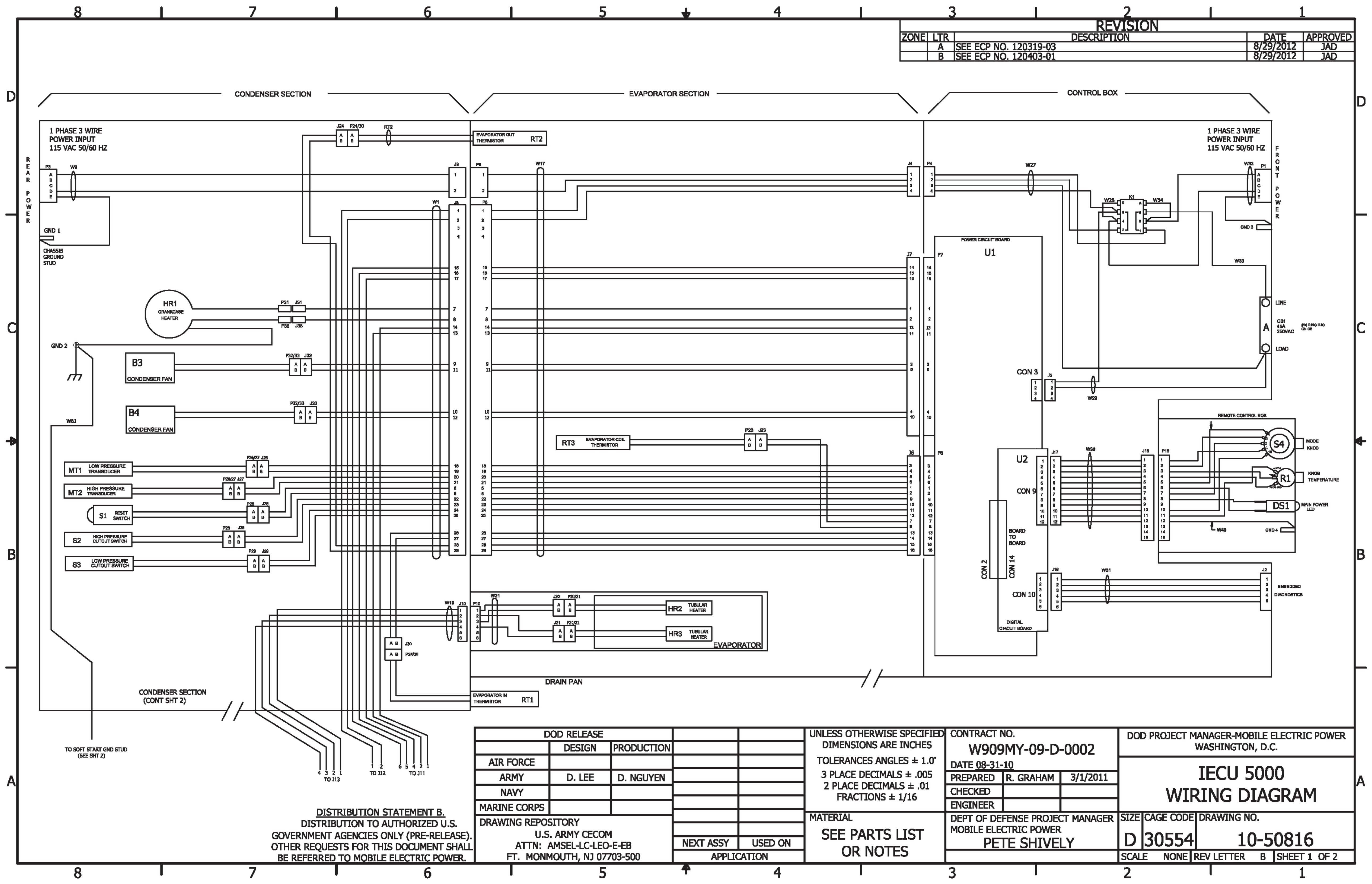
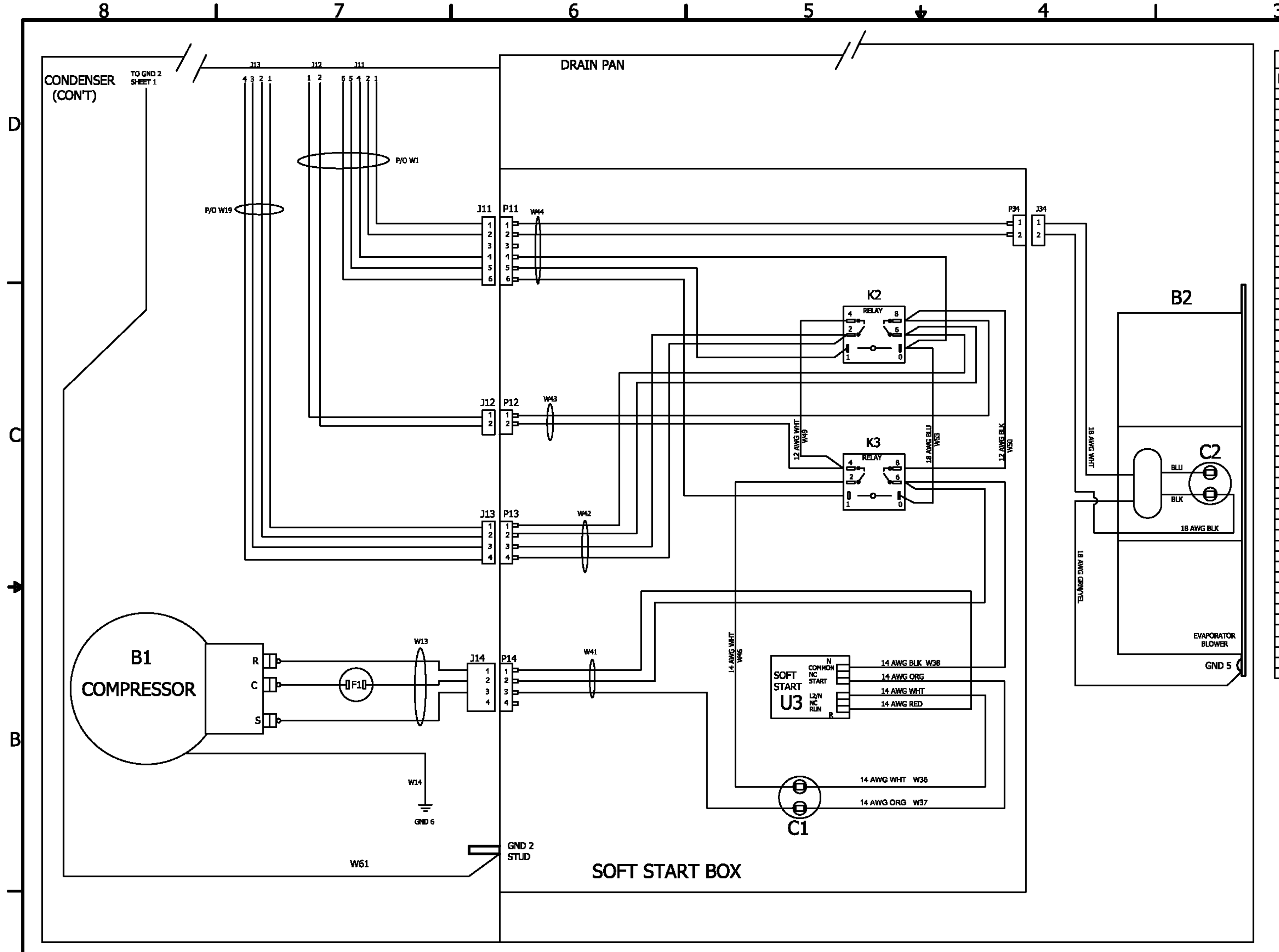



FO-1. IECU 5000 Wiring Diagram (Sheet 1 of 2).




WIRING DIAGRAM REFERENCE TABLE

| REFERENCE DESIGNATOR | PART NUMBER | DESCRIPTION | ZONE |
|---|---|---|---|
| W1 | 10-50408 | CONDENSER SIDE BULKHEAD CABLE | SH1 D6 |
| MT1 | 10-52624 | PRESSURE TRANSDUCER ASSY | SH1 B7 |
| MT2 | 10-52624 | PRESSURE TRANSDUCER ASSY | SH1 B7 |
| S1 | 10-52403 | MOMENTARY SWITCH ASSY | SH1 B7 |
| S2 | 10-52620 | HIGH PRESSURE SWITCH ASSY | SH1 B7 |
| S3 | 10-52621 | LOW PRESSURE SWITCH ASSY | SH1 B7 |
| RT1 | 10-52623 | THERMISTOR ASSY | SH1 A6 |
| B2 | 10-50014 | EVAPORATOR BLOWER ASSY | SH2 D3 |
| W9 | 10-50400 | REAR POWER CABLE | SH1 D8 |
| HR1 | 10-50709 | CRANKCASE HEATER ASSY | SH1 C7 |
| B3 | 10-50011 | CONDENSER FAN ASSY | SH1 C7 |
| B4 | 10-50011 | CONDENSER FAN ASSY | SH1 C7 |
| W13 | 10-50410 | COMPRESSOR POWER CABLE | SH2 B7 |
| W14 | 10-52421 | COMPRESSOR GROUND CABLE | SH2 B7 |
| W17 | 10-50409 | EVAPORATOR SIDE BULKHEAD CABLE | SH1 D5 |
| W19 | 10-50401 | RELAY TO HEAT POWER CABLE | SH1 B6 |
| W21 | 10-50402 | HEAT POWER CABLE | SH1 B5 |
| HR2 | 10-50708 | HEATER ASSY | SH1 B5 |
| HR3 | 10-50708 | HEATER ASSY | SH1 B5 |
| RT3 | 10-52622 | BULLET THERMISTOR ASSY | SH1 B5 |
| RT2 | 10-52623 | THERMISTOR ASSY | SH1 D6 |
| W27 | 10-50404 | CONTROL BOX REAR BOX POWER CABLE | SH1 D3 |
| W28 | 10-52425 | NEUTRAL RELAY JUMPER CABLE | SH1 D2 |
| W29 | 10-50403 | CIRCUIT BOARD POWER CABLE | SH1 D2 |
| W30 | 10-52420 | CONTROL MODULE CABLE | SH1 B2 |
| W31 | 10-52419 | DIAGNOSTICS CABLE | SH1 B2 |
| W32 | 10-50417 | FRONT POWER CABLE | SH1 D1 |
| W33 | 10-51409 | RELAY TO CIRCUIT BREAKER CABLE | SH1 C1 |
| W34 | 10-51408 | CONTROL BOX RELAY JUMPER CABLE | SH1 D2 |
| W36 | 10-50405 | SOFT START TO CAPACITOR CABLE | SH2 B5 |
| W37 | 10-50406 | SOFT START TO CAPACITOR CABLE | SH2 B5 |
| W38 | 10-50407 | RELAY TO SOFT START CABLE | SH2 B4 |
| W40 | 10-52427 | REMOTE CONTROL CABLE ASSY | SH1 B2 |
| W41 | 10-50411 | SOFT START POWER-OUT CABLE | SH2 B6 |
| W42 | 10-50412 | SOFT START HEATER POWER CABLE | SH2 C6 |
| W43 | 10-50413 | SOFT START BOX POWER-IN CABLE | SH2 C6 |
| W44 | 10-50414 | RELAY CONTROL AND FAN POWER CABLE | SH2 D6 |
| W46 | 10-50415 | RELAY TO CAPACITOR CABLE | SH2 B5 |
| W49 | 10-51421 | RELAY CONTACT JUMPER CABLE | SH2 C5 |
| W50 | 10-51422 | RELAY CONTACT JUMPER CABLE | SH2 C4 |
| W53 | 10-52440 | RELAY COIL JUMPER CABLE | SH2 C4 |
| W61 | 10-52448 | SOFT START GROUND CABLE | SH2 B7 |
| B1 | 10-50700 | ROTARY COMPRESSOR | SH2 B8 |
| U1 | 10-52607 | POWER BOARD | SH1 C3 |
| U2 | 10-52608 | CONTROL BOARD | SH1 B3 |
| U3 | 10-51604-01 | SOFT START | SH2 B5 |
| K1 | 10-52618-01 | RELAY | SH1 D2 |
| K2 | 10-52610 | RELAY, 120VAC | SH2 D5 |
| K3 | 10-52610 | RELAY, 120VAC | SH2 C5 |
| S4 | 10-52603 | ROTARY SWITCH | SH1 C1 |
| R1 | 10-52602 | POTENTIOMETER | SH1 B1 |
| DS1 | 10-52619 | LED | SH1 B1 |
| C1 | 10-50601 | RUN CAPACITOR | SH2 B5 |
| C2 | 10-50604 | BLOWER RUN CAPACITOR | SH2 C4 |
| CB1 | 10-50600 | CIRCUIT BREAKER | SH1 C1 |
| F1 | 10-50603 | OVER-CURRENT PROTECTOR | SH2 B7 |

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES
TOLERANCES ANGLES ± 1.0°
3 PLACE DECIMALS ± .005
2 PLACE DECIMALS ± .01
FRACTIONS ± 1/16

MATERIAL
SEE PARTS LIST OR NOTES

CONTRACT NO.
W909MY-09-D-0002
DATE 08-31-10

| PREPARED | R. GRAHAM | 3/1/2011 |
|---|---|---|
| CHECKED | | |
| ENGINEER | | |

DEPT OF DEFENSE PROJECT MANAGER MOBILE ELECTRIC POWER
PETE SHIVELY

DOD PROJECT MANAGER-MOBILE ELECTRIC POWER
WASHINGTON, D.C.

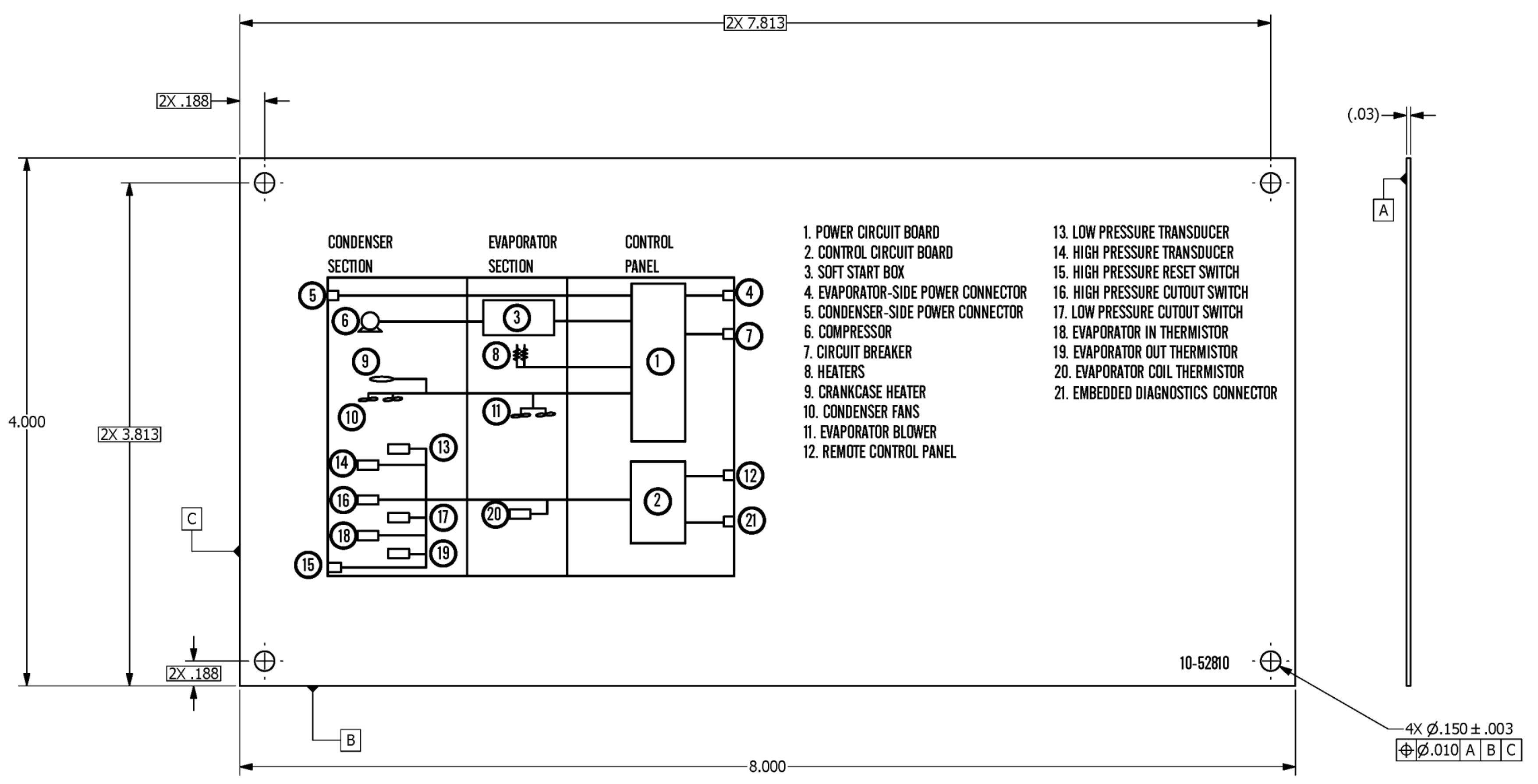
IECU 5000
WIRING DIAGRAM

| SIZE | CAGE CODE | DRAWING NO. |
|---|---|---|
| D | 30554 | 10-50816 |

SCALE NONE | REV LETTER B | SHEET 2 OF 2

FO-2. IECU 5000 Wiring Diagram (Sheet 2 of 2).

| ZONE | LTR | REVISION DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | | | 7/22/2011 | |




NOTES:

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2. MUST CONFORM TO A-A-50271 COMPOSITION C.
3. MATERIAL: .032" ALUMINUM
4. GENERATE GEOMETRY VIA CUSTOMER SUPPLIED CAD MODEL. ALL TEXT GOTHIC #2 FONT OR EQUIVALENT AND TO HAVE A MINIMUM HEIGHT OF 1/8". TEXT SHALL BE SILVER ON A BLACK BACKGROUND.
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| 10-52032 | 10-5200 |
| 10-51007 | 10-5100 |
| 10-50020 | 10-5000 |

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES
TOLERANCES ANGLES ± 1.0°
3 PLACE DECIMALS ± .005
2 PLACE DECIMALS ± .01
FRACTIONS ± 1/16

MATERIAL
SEE PARTS LIST OR NOTES

CONTRACT NO.
W909MY-09-D-0002
DATE 08-31-10

| | | |
|---|---|---|
| PREPARED | J. DIXON | 7/22/2011 |
| CHECKED | | |
| ENGINEER | G. COLE | |

DEPT OF DEFENSE PROJECT MANAGER MOBILE ELECTRIC POWER
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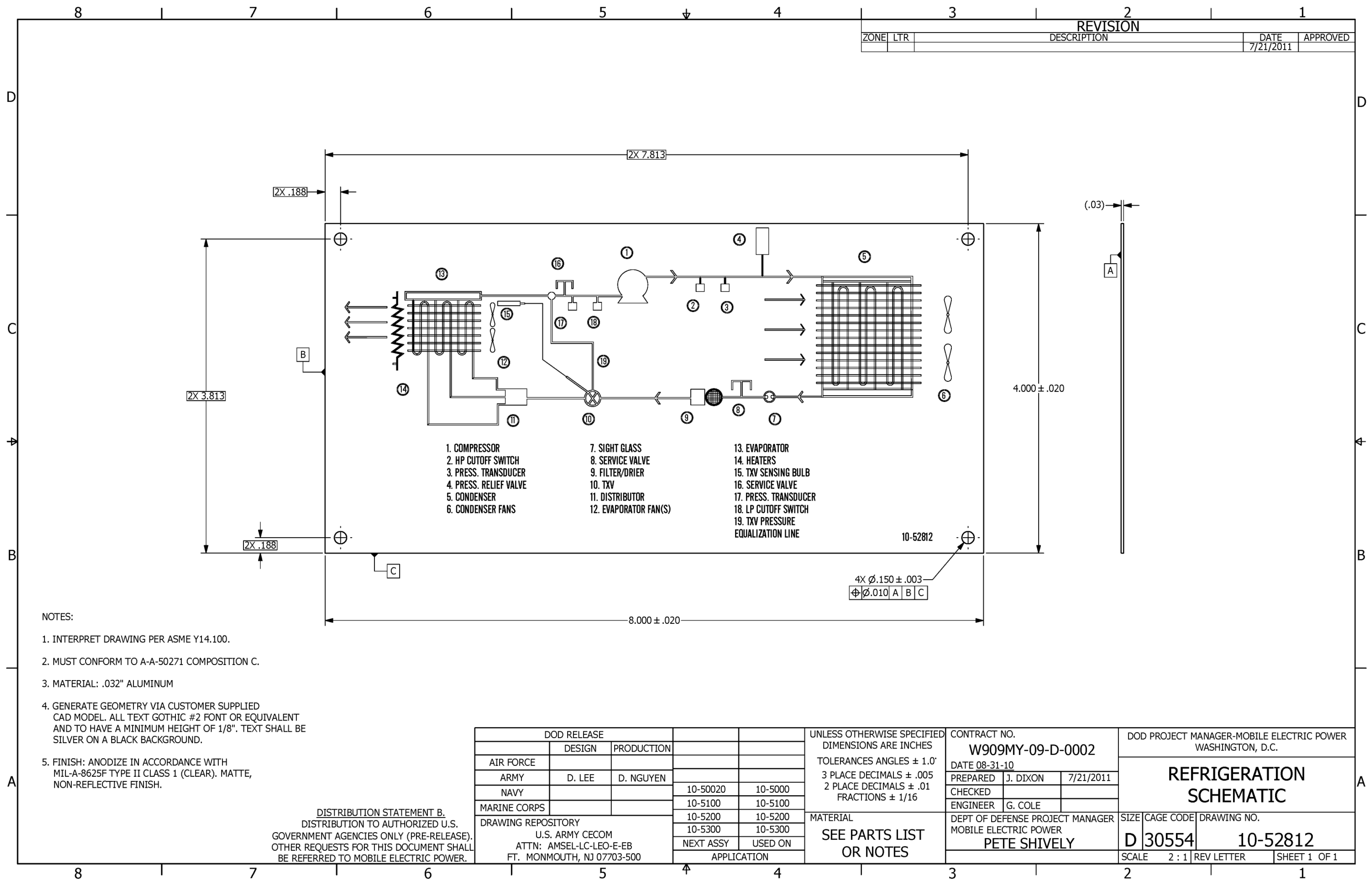
WASHINGTON, D.C.

ELECTRIC SCHEMATIC

| SIZE | CAGE CODE | DRAWING NO. |
|---|---|---|
| D | 30554 | 10-52810 |

SCALE 2 : 1 | REV LETTER | SHEET 1 OF 1

FO-3. Electric Schematic.




FO-4. Refrigeration Schematic.

# THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE
1 Centimeter = 10 Millimeter = 0.01 Meters = 0.3937 inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 inches
1 kilometer = 1000 Meters = 0.621 Miles

WEIGHTS
1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 100 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE
1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.81 Fluid Ounces

SQUARE MEASURE
1 Sq. Centimeter = 100 Sq. Millimeter = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE
1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE
5/9 (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 °C + 32 = °F

## APPROXIMATE CONVERSION FACTORS

| TO CHANGE | TO | MULTIPLY BY |
|---|---|---|
| Inches | Centimeters | 2.540 |
| Feet | Meters | 0.305 |
| Yards | Meters | 0.914 |
| Miles | Kilometers | 1.609 |
| Square Inches | Square Centimeters | 6.451 |
| Square Feet | Square Meters | 0.093 |
| Square Yards | Square Meters | 0.836 |
| Square Miles | Square Kilometers | 2.590 |
| Acres | Square Hectometers | 0.405 |
| Cubic Feet | Cubic Meters | 0.028 |
| Cubic Yards | Cubic Meters | 0.765 |
| Fluid Ounces | Milliliters | 29.573 |
| Pints | Liters | 0.473 |
| Quarts | Liters | 0.946 |
| Gallons | Liters | 3.785 |
| Ounces | Grams | 28.350 |
| Pounds | Kilograms | 0.454 |
| Short Tons | Metric Tons | 0.907 |
| Pound-Feet | Newton-Meters | 1.356 |
| Pounds per Square Inch | Kilo pascals | 6.895 |
| Miles per Gallon | Kilometers per Liter | 0.425 |
| Miles per Hour | Kilometers per Hour | 1.609 |

| TO CHANGE | TO | MULTIPLY BY |
|---|---|---|
| Centimeters | Inches | 0.394 |
| Meters | Feet | 3.280 |
| Meters | Yards | 1.094 |
| Kilometers | Miles | 0.621 |
| Square Centimeters | Square Inches | 0.155 |
| Square Meters | Square Feet | 10.763 |
| Square Meters | Square Yards | 1.196 |
| Square Kilometers | Square Miles | 0.386 |
| Square Hectometers | Acres | 2.471 |
| Cubic Meters | Cubic Feet | 35.714 |
| Cubic Meters | Cubic Yards | 1.307 |
| Milliliters | Fluid Ounces | 0.034 |
| Liters | Pints | 2.113 |
| Liters | Quarts | 1.057 |
| Liters | Gallons | 0.264 |
| Grams | Ounces | 0.035 |
| Kilograms | Pounds | 2.204 |
| Metric Tons | Short Tons | 1.102 |
| Newton-Meters | Pound-Feet | 0.738 |
| Kilo pascals | Pounds per Square Inch | 0.145 |
| Kilometers per Liter | Miles per Gallon | 2.352 |
| Kilometers per Hour | Miles per Hour | 0.621 |