ABSTRACT

The general purpose of the occupational analysis is to provide workable, basic information dealing with the many and varied duties performed in the air conditioning, refrigerating, and heating occupation. The document opens with a brief introduction followed by a job description. The bulk of the document is presented in table form. Six duties are broken down into a number of tasks and for each task a two-page table is presented, showing on the first page: tools, equipment, materials, objects acted upon; performance knowledge (related also to decisions, cues and errors); safety--hazard; and on the second page: science; math--number systems; and communications (performance modes, examples, and skills and concepts). The duties include installing, troubleshooting, servicing, and repairing refrigeration and air conditioning equipment and warm air heating systems. Included are lists for a standard tool kit, test equipment, and standard supplies. An appendix relates the duties to air conditioning, refrigeration, and heating. (BP)
AN ANALYSIS OF THE AIR CONDITIONING,
REFRIGERATING AND HEATING OCCUPATIONS

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Occupational Analysis
E.P.D.A. Sub Project 73402
June 1, 1973 to December 30, 1974
Director: Tom L. Hindes
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The Instructional Materials Laboratory
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The Ohio State University
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# TABLE OF CONTENTS

Foreword ........................................................................................................................................... v
Preface ................................................................................................................................................... vii
Acknowledgment ................................................................................................................................. ix
Job Description ................................................................................................................................. xi

## Duties

1. Installing Refrigeration and Air Conditioning Equipment .......................................................... 1
2. Troubleshooting Refrigeration and Air Conditioning Equipment .............................................. 13
3. Servicing and Repairing Refrigeration and Air Conditioning Equipment ................................ 73
4. Installing Warm Air Heating Systems ......................................................................................... 125
5. Troubleshooting Warm Air Heating Systems ........................................................................... 139
6. Servicing and Repairing Warm Air Heating Systems ................................................................. 163

Index: Standard Tool Kit .................................................................................................................. 191
Index: Test Equipment ...................................................................................................................... 192
Index: Standard Supplies ................................................................................................................ 193
Appendix ........................................................................................................................................... 194
The occupational analysis project was conducted by The Instructional Materials Laboratory, Trade and Industrial Education, The Ohio State University in conjunction with the State Department of Education, Division of Vocational Education pursuant to a grant from the U.S. Office of Education.

The Occupational Analysis project was proposed and conducted to train vocational educators in the techniques of making a comprehensive occupational analysis. Instructors were selected from Agriculture, Business, Distributive, Home Economics and Trade and Industrial Education to gain experience in developing analysis documents for sixty-one different occupations. Representatives from Business, Industry, Medicine, and Education were involved with the vocational instructors in conducting the analysis process.

The project was conducted in three phases. Phase one involved the planning and development of the project strategies. The analysis process was based on sound principles of learning and behavior. Phase two was the identification, selection and orientation of all participants. The training and workshop sessions constituted the third phase. Two-week workshops were held during which teams of vocational instructors conducted an analysis of the occupations in which they had employment experience. The instructors were assisted by both occupational consultants and subject matter specialists.

The project resulted in producing one hundred two trained vocational instructors capable of conducting and assisting in a comprehensive analysis of various occupations. Occupational analysis data were generated for sixty-one occupations. The analysis included a statement of the various tasks performed in each occupation. For each task the following items were identified: tools and equipment; procedural knowledge; safety knowledge; concepts and skills of mathematics, science and communication needed for successful performance in the occupation. The analysis data provided a basis for generating instructional materials, course outlines, student performance objectives, criterion measures as well as identifying specific supporting skills and knowledge in the academic subject areas.
PREFACE

This occupational analysis conducted for the air conditioning, refrigeration, and heating occupations presented the writers with several difficult decisions and alternatives. Each area of the occupations has a separate identity and has functioned in this manner for many years. However, the growth of the refrigeration and air-conditioning industry has brought these identities closer together because many of the duties and tasks performed on the job are interrelated. Many of the skills are common to each area. Therefore, if we are to offer a training program, the entire scope of the air conditioning, refrigeration and heating occupations should be included in the course content. The list of tasks found in the appendix identifies the interrelationships of the tasks performed in each area of the occupations.

There are many job opportunities within the air conditioning, refrigeration and heating fields which specialize in one or several specific areas. Training individuals for entry level into these fields should be conducted to include all the basic skills of the refrigeration, air conditioning and heating occupations. The objective of this occupational analysis is to encompass all the duties and tasks of the technician in these fields. In the time available to complete the analysis, an in depth study was not possible. Therefore, an overview of the air conditioning, refrigeration and heating occupations was more realistic. Hopefully, it will provide some basis for future study.
ACKNOWLEDGMENT

We wish to acknowledge the valuable assistance rendered by the following subject matter specialists. They provided input to the vocational instructors in identifying related skills and concepts of each respective subject matter area and served as training assistants in the analysis process during the two-week workshops.

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The Ohio State University  
Columbus, Ohio

Glenn Mann, Communications  
Columbus, Ohio

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Columbus, Ohio

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Reynoldsburg, Ohio

Diana L. Buckeye, Mathematics  
University of Michigan  
Avon Lake, Ohio

Colleen Osinski, Psychology  
Columbus Technical Institute  
Columbus, Ohio

Rick Fien, Chemistry  
The Ohio State University  
Beachwood, Ohio

David Porteous, Communications  
University of Connecticut  
Colchester, Connecticut

N. S. Gidwani, Chemistry  
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Columbus, Ohio

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Columbus Technical Institute  
Columbus, Ohio

Bruce A. Hull, Biology  
The Ohio State University  
Columbus, Ohio

Jim VanArsdall, Mathematics  
Worthington High School  
Worthington, Ohio

Donald L. Hyatt, Physics  
Worthington High School  
Worthington, Ohio

Lillian Yontz, Biology  
The Ohio State University  
Caldwell, Ohio
Special thanks are given to Mr. Dwight Sweptson of the Atlas Butler Cooling and Heating, Inc. for providing us with five of his supervisors as occupational consultants. We wish to acknowledge the valuable input of these men to the analysis process:

Acy Blair, Jr.  
Nelson Evans  
Larry Hanes  
Douglas Murday  
Harold Hall

Acknowledgment is extended to the following I.M.L. staff members for their role in conducting the workshops; editing, revising, proofing and typing the analyses.

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Patti Nye  
Kathy Roediger  
Mary Salay  
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Administrative Assistant  
Editorial Consultant  
Typist  
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Typist
JOB DESCRIPTION

An air conditioning, refrigeration and heating technician engages in the installation of air conditioning, refrigeration and heating equipment such as window air conditioners; central air conditioning units; commercial refrigeration equipment; and gas, oil and electric warm air furnaces. A technician also troubleshoots and performs service and repairs on household refrigerators, freezers, dehumidifiers, window air conditioners, central air conditioning units, commercial refrigeration units and warm air heating systems.
Duty I Installing Refrigeration and Air Conditioning Equipment

1 Install window air conditioner
2 Install central air conditioner
3 Install self contained commercial refrigeration unit
4 Install remote condensing unit with single cabinet
5 Install remote commercial condensing unit with multiple cabinets
### Task Statement 1-1: Install Window Air Conditioner

#### Tools, Equipment, Materials, Objects Acted Upon
- STK
- VOM
- AP
- SS II

#### Performance Knowledge
- Check power supply
- Check air conditioner capacity in relation to what customer expects
- Install unit in window and seal any openings to outside
- Check unit for performance, instruct customer as to proper care, maintenance and operation

#### Safety - Hazard
- Safety:
  - Do not lift loads from a bending position. Always lift from a squatting position with back straight.
  - Ground power equipment and use with care.
  - Care in the use of hand tools
- Hazards:
  - Potential back injury or rupture
  - Electrical shock-burn or personal injury
  - Injury to oneself or others

#### Decisions
- Determine mounting position frame and/or cabinet centered on the window sill

#### Cues
- Window mounting frame and/or cabinet can be installed in window.

#### Errors
- Air conditioner not adaptable to window design resulting in faulty or no installation.
### SCIENCE

- Simple machines used to gain mechanical advantage
  - [STK]
- Forces acting on a body immersed or floating in a liquid
  - [Level]

**Behavioral Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- Rationals—Fractions
  - Use of Numbers: (without calculation)
    - [eyeballing floor area]
    - Ordering—[S.T.K.]
    - Coding—[mfg. data rate]
    - Fundamental Operations (Calculation)
      - Addition algorithm
      - Subtraction algorithm
- Basic Arithmetic Skills and Concepts—Rule of thumb
  - [approximation]
- Basic Geometry Skills and Concepts
  - Knowledge of geometric relationships—Symmetry
    - [center point]
  - Determination of area, perimeter and diagonals of polygons with more than 4 sides.
- Basic Arithmetic Skills and Concepts—Property of comparison
- Basic Measurement Skills and Concepts
  - Instruments—[tape]
- Measurement: Geometric
  - Linear
  - Area
- Reading and interpreting tables, charts, and graphs—[capacity chart]

### COMMUNICATIONS

#### PERFORMANCE MODES

| Reading | Instructions |
| Viewing | Position of mounting frame |
| Speaking | Verbal instructions |
| Writing | Service order |

#### EXAMPLES

| Process Report |
| Visual Analysis |
| Terminology/General Vocabulary |
| Clarity of Expression |

| Information report |
| Terminology |
| Clarity of expression |
# Task Statement

I-2 Install Central Air Conditioner

## Tools, Equipment, Materials, Objects Acted Upon

- STK
- Concrete forms
- Mixing pan
- SS-II
- VOM
- AP
- MG

## Performance Knowledge

- Form concrete pad for condensing unit and install
- Install cooling coil
- Hook up suction and liquid lines from condensing unit to evaporator coil
- Install power supply and revamp low voltage circuitry if necessary
- Check system and instruct customer

## Safety – Hazard

**Safety:**
- Do not lift loads from a bending position. Always lift from a squatting position and straight.
- Ground power equipment with care.

**Hazards:**
- Potential back injury or rupture
- Electrical shock, burn or personal injury
- Injury to oneself or others

## Decisions

- Determine location for condensing unit pad.
- Determine position of cooling coil in furnace plenum

## Cues

- Survey premises for adequate power supply and proper size unit

## Errors

- Inadequate utilities or improper size unit resulting in faulty installation
**TASK STATEMENT** 1-2 INSTALL CENTRAL AIR CONDITIONER

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage</td>
<td>Rationals—Fractions</td>
</tr>
<tr>
<td>[STK]</td>
<td>Use of Numbers: (without calculation)</td>
</tr>
<tr>
<td>Forces acting on a body immersed or floating in a liquid</td>
<td>[v=bl.ing floor area]</td>
</tr>
<tr>
<td>[Level]</td>
<td>Coding—[mfg. data plate]</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials</td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>Effect of heating and cooling on state of matter</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td>[refrigerant]</td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>Fluids under pressure</td>
<td>Basic Arithmetic Skills and Concepts—Rule of thumb</td>
</tr>
<tr>
<td>[refrigerant under pressure]</td>
<td>[approximation]</td>
</tr>
<tr>
<td>Behavioral Science:</td>
<td>Basic Geometry Skills and Concepts</td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and</td>
<td>Knowledge of geometric relationships—Symmetry</td>
</tr>
<tr>
<td>promote his employer whenever possible.</td>
<td>[center point]</td>
</tr>
<tr>
<td>He should consult with superiors when difficulty arises.</td>
<td>Determination of area, perimeter and diagonals of polygons with more than 4 sides.</td>
</tr>
<tr>
<td>He should answer questions which relates to the repair job at hand with honesty and integrity.</td>
<td>Basic Arithmetic Skills and Concepts—Property of comparison</td>
</tr>
<tr>
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<td>Basic Measurement Skills and Concepts</td>
</tr>
<tr>
<td>Emphasis should be placed upon performing the task at hand without unnecessarily</td>
<td>Instruments—[tape]</td>
</tr>
<tr>
<td>disrupting surrounding activities and he should show concern for the premises.</td>
<td>Measurement: Geometric</td>
</tr>
<tr>
<td>He should be cautioned to enter only into those customer relations which pertain to the job</td>
<td>Linear</td>
</tr>
<tr>
<td>at hand. Personal entanglements or arguments with customers should always be avoided.</td>
<td>Area</td>
</tr>
<tr>
<td>Billing and discussion of costs should be accurate, honest and performed in a straight</td>
<td>Reading and interpreting tables, charts, and graphs—[capacity chart]</td>
</tr>
<tr>
<td>forward manner. He should get along with his fellow employee and develop a relationship that will not</td>
<td></td>
</tr>
<tr>
<td>hurt each others professionalism.</td>
<td></td>
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</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Instructions</td>
<td>Process report</td>
</tr>
<tr>
<td>Viewing</td>
<td>Survey premises</td>
<td>Visual analysis</td>
</tr>
<tr>
<td>Speaking</td>
<td>Verbal instructions</td>
<td>Terminology/General Vocabulary</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Clarity of expression</td>
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</tbody>
</table>

<table>
<thead>
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<td>Survey premises</td>
<td>Visual analysis</td>
</tr>
<tr>
<td>Verbal instructions</td>
<td>Terminology/General Vocabulary</td>
</tr>
<tr>
<td>Service order</td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
# I-3 INSTALL SELF-CONTAINED COMMERCIAL REFRIGERATION UNIT

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

| STK | MG |

## PERFORMANCE KNOWLEDGE

- Level equipment and attach manifold and gauges
- Connect to power supply
- Operate unit and record pressures and temperatures

## SAFETY - HAZARD

**Safety:**
- Do not lift loads from a bending position. Always lift from a squatting position with back straight.
- Ground power equipment and use with care.
- Care in the use of hand tools

**Hazards:**
- Potential back injury or rupture
- Electrical shock, burn or personal injury
- Injury to oneself or others

## DECISIONS

- Determine position of equipment
- Determine adequate power supply

## CUES

- Survey shows adequate power supply and location of equipment

## ERRORS

- Equipment set up without proper checks could result in faulty operation of unit
### SCIENCE

Simple machines used to gain mechanical advantage

**[STK]**

Forces acting on a body immersed or floating in a liquid

**[Level]**

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

He should answer questions which relate to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.

He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.

Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH — NUMBER SYSTEMS

**U of Numbers** (without calculation)

- Eyeballing floor area
- Ordering
- Coding—[mfg. data plate]

**Fundamental Operations** (Calculation)

- Addition algorithm
- Subtraction algorithm
- Basic Arithmetic Skills and Concepts—Rule of thumb
- [approximation]
- Basic Geometry Skills and Concepts
  - Knowledge of geometric relationships—Symmetry
  - [center point]
- Determination of area, perimeter and diagonals of polygons with more than 4 sides.
- Basic Arithmetic Skills and Concepts—Property of comparison
- Basic Measurement Skills and Concepts
  - Instruments—[tape]
  - Measurement: Geometric
    - Linear
    - Area
  - Reading and interpreting tables, charts, and graphs—[capacity chart]

### COMMUNICATIONS

**PERFORMANCE MODES**

- Reading
- Viewing
- Speaking
- Writing

**EXAMPLES**

- Instructions
- Survey premises
- Verbal instructions
- Service order

**SKILLS/CONCEPTS**

- Process: report
- Visual analysis
- Terminology/General Vocabulary
- Clarity of expression
- Informational report
- Terminology
- Clarity of expression
### 1-4 INSTALL REMOTE COMMERCIAL CONDENSING UNIT WITH SINGLE CABINET

#### (TASK STATEMENT)

**TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON**

<table>
<thead>
<tr>
<th>STK</th>
<th>MG</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS-5-6-7-10-12-13-14-</td>
<td>SS-15 or SS-16 according to unit design</td>
</tr>
<tr>
<td>SS-25</td>
<td>SS-26</td>
</tr>
</tbody>
</table>

#### PERFORMANCE KNOWLEDGE

- Connect suction and liquid line installing, moisture indicator, sight glass and drier
- Connect power supply
- Evacuate and charge system
- Check pressures and temperatures
- Instruct customer—care operation

#### SAFETY — HAZARD

- **Safety:**
  - Do not lift loads from a bending position. Always lift from a squatting position with back straight
  - Ground power equipment and use with care
  - Always wear goggles when handling refrigerants and use care
  - Care and use of hand tools

- **Hazard:**
  - Potential back injury or rupture
  - Electrical shock-burn or personal injury
  - Injury to eyes or skin burn
  - Injury to oneself or others

#### DECISIONS

- Determine location of condensing unit. Set refrigeration equipment in desired location.

#### CUES

- Survey premises for logical placement of condensing unit and adequate power supply.

#### ERRORS

- Failure to perform standard procedures could result in faulty unit operation.
### SCIENCE

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on expansion of materials
- Fluids under pressure
  - Refrigerant under pressure
- Forces acting on a body immersed or floating in a liquid
- Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions relating to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straightforward manner. He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH – NUMBER SYSTEMS

- Rationals—Fractions
- Use of Numbers: (without calculation)
  - Eyeballing floor area
  - Ordering—[S.T.K.]
  - Coding—[mfg. data plate]
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts—Rule of thumb
  - Approximation
- Basic Geometry Skills and Concepts
  - Knowledge of geometric relationships—Symmetry
  - [Center point]
  - Determination of area, perimeter and diagonals of polygons with more than 4 sides.
- Basic Arithmetic Skills and Concepts—Property of comparison
- Basic Measurement Skills and Concepts
  - Instruments—[mm, cm, m]
  - Measurement: Geometric
    - Linear
    - Area
  - Reading and interpreting tables, charts, and graphs—[capacity chart]

### COMMUNICATIONS

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Reading</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing</td>
<td>Survey premises</td>
</tr>
<tr>
<td>Speaking</td>
<td>Verbal instructions</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
</tr>
</tbody>
</table>

#### EXAMPLES

| Process report |
| Visual analysis |
| Terminology/General Vocabulary |
| Clarity of expression |
| Informational report |
| Terminology |
| Clarity of expression |
## I-5 INSTALL REMOTE COMMERCIAL CONDENSING UNIT
### (TASK STATEMENT) WITH MULTIPLE CABINETS

### TOOLS, EQUIPMENT, MATERIALS. OBJECTS ACTED UPON

| STK    | MG    | SS-5-6-7-10-12-12-14 | SS-15 or SS-16 according to unit design | SS-25 | SS-26 |

### PERFORMANCE KNOWLEDGE

- Connect suction and liquid lines with hand valves to each evaporator.
- Install drier, sight glass and moisture indicator
- Connect power supply
- Evacuate and recharge
- Check pressures and temperatures
- Instruct customer in care operation

### SAFETY – HAZARD

- **Safety:**
  - Do not lift loads from a bending position. Always lift from a squatting position with back straight
  - Ground power equipment and use with care
  - Always wear goggles when handling refrigerants and use care
  - Care and use of hand tools
- **Hazard:**
  - Potential back injury or rupture
  - Electrical shock, burn or personal injury
  - Injury to eyes or skin burn
  - Injury to oneself or others

### DECISIONS

Determine location of condensing unit and cabinets

### CUES

Survey premises logical placement of equipment. Check for adequate power supply

### ERRORS

Failure to perform standard tasks would result in inefficient or no operation.
### SCIENCE

Simple machines used to gain mechanical advantage
- [STK]
- Effect of heating and cooling on expansion of materials
- Fluids under pressure
  - Refrigerant under pressure
- Forces acting on a body immersed or floating in a liquid
  - Level

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

He should answer questions which relate to the repair job at hand with honesty and integrity.

Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.

He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.

Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH – NUMBER SYSTEMS

- Rational
- Fractions
  - Use of Numbers: (without calculation)
  - [eyeballing floor area]
  - Ordering: [S.T.K.]
  - Coding – [mfg. data plate]
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts—Rule of thumb
    - Approximation
  - Basic Geometry Skills and Concepts
    - Knowledge of geometric relationships—Symmetry
      - Center point
    - Determination of area, perimeter and diagonals of polygons with more than 4 sides.
  - Basic Arithmetic Skills and Concepts—Property of comparison
  - Basic Measurement Skills and Concepts
    - Instruments—[tape]
    - Measurement: Geometric
    - Linear
    - Area
    - Reading and interpreting tables, charts, and graphs—[capacity chart]

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Speaking
- Writing

#### EXAMPLES

- Instructions
- Survey premises
- Verbal instructions
- Service order

#### SKILLS/CONCEPTS

- Process report
- Visual analysis
- Terminology/General Vocabulary
- Clarity of expression

- Informational report
- Terminology
- Clarity of expression
Duty II Troubleshooting Refrigeration and Air Conditioning Equipment

1. Hook hermetic compressor directly to power supply
2. Check circuitry of the compressor protector and relay
3. Check capacitor
4. Check circuitry of defrost system
5. Check circulation fan motors
6. Check and adjust control thermostat
7. Attach manifold and gauges to service valves and check pressures
8. Install in-line service valves and measure pressures
9. Check compressor efficiency
10. Locate leak in a refrigeration system using electronic leak detector
11. Locate leak in a refrigeration system using halide torch
12. Locate leak in a refrigeration system using bubble method
13. Check unit operation—oil level—sight glass—moisture indicator
14. Check and adjust an automatic expansion valve
15. Check, test and adjust thermostatic expansion valve
16. Check and adjust pressure motor control
17. Check and adjust low pressure safety control
18. Check and adjust high pressure safety control
19. Adjust and calibrate oil pressure control
20. Check ice maker for operation
21. Check and adjust water valve
22. Check hot gas defrost solenoid and valve
23. Check humidity with sling psychrometer
24. Check and adjust humidistat
25. Check condensate pump and drain
26. Check blower assembly and filter
27. Check heat pump reversing system
28. Check system for burnout and install cleanup kit
29. Service electronic air cleaner
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Hook up CS</td>
<td>Safety:</td>
</tr>
<tr>
<td>CS</td>
<td>Hook up watt meter</td>
<td>Always disconnect circuit and lock out breaker before</td>
</tr>
<tr>
<td>WM</td>
<td>Start compressor and observe wattage readings</td>
<td>working on electrical components</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Care in use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical shock, electrical burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Isolate compressor
- Determine compressor wattage

**CUES**
- Compressor starts and cuts out
- Compressor runs hot

**ERRORS**
- Failure to do so would result in faulty diagnosis
### Science

- Simple machines used to gain mechanical advantage
- Magnetic fields of force
- Resistance of materials to flow of electrical current
- Behavioral Science.

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relates to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### Math - Number Systems

- Rational Numbers:
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Measurement Skills and Concepts
- Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance

### Communications

#### Performance Modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>CS, WM</td>
</tr>
<tr>
<td>Viewing</td>
<td>CS, WM</td>
</tr>
<tr>
<td>Writing</td>
<td>Service Order</td>
</tr>
</tbody>
</table>

#### Skills/Concepts

- Detail inference
- Visual analysis
- Detail inference
- Informational report
- Terminology
- Clarity of expression
### II-2 CHECK CIRCUITRY OF THE COMPRESSOR, PROTECTOR AND RELAY

**TASK STATEMENT**

Determine defective circuit by probing each integral part independently

**TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON**

- STK
- VOM-Watt meter
- Wiring Diagram

**PERFORMANCE KNOWLEDGE**

- Isolate circuitry of compressor circuit on wiring diagram
- Check power supply
- Check continuity on compressor terminals, protector and relay

**DECISIONS**

- Determine defective circuit by probing each integral part independently

**CUES**

- Unit does not run
- Unit starts and stops

**ERRORS**

- Improper use of the rules of checking continuity will result in inaccurate reading and diagnosis

**SAFETY – HAZARD**

- Safety:
  - Always disconnect circuit and lock out breaker before working on electrical components
  - Care in use of hand tools
- Hazard:
  - Electrical shock, electrical burn
  - Injury to oneself or others
### II-2 CHECK CIRCUITRY OF THE COMPRESSOR, PROTECTOR AND RELAY

#### SCIENCE

- Simple machines used to gain mechanical advantage
  - [STK]
- Magnetic fields of force
- Resistance of materials to flow of electrical current
- Effect of heating and cooling on expansion of materials
  - [bi metal]

#### MATH — NUMBER SYSTEMS

- Rational Numbers
  - Uses of Numbers: (without calculation)
  - Coding—[mfg data plate]
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
  - Basic Measurement Skills and Concepts
  - Instruments
  - Given an instrument of measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance
  - Reading and interpreting tables, charts, and graphs
  - Representational graphs—[wiring diagram]
  - Basic Logic
  - Deductive, Inductive—[Deductive Diagnosis]

#### Behavioral Science.

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relates to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

#### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Schematic</td>
<td>Terminology</td>
</tr>
<tr>
<td>Viewing</td>
<td>VOM-Continuity</td>
<td>Wiring diagram</td>
</tr>
<tr>
<td>Writing</td>
<td>Components/Wiring Diagram</td>
<td>Detail/inference</td>
</tr>
<tr>
<td></td>
<td>Service Order</td>
<td>Visual analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recognition of symbols</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
**TASK STATEMENT**  II-3 CHECK CAPACITOR

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK Capacitor Analyzer</td>
<td>Remove capacitor</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td>Check capacitor</td>
<td>Always disconnect circuit and lock out breaker before working on electrical components</td>
</tr>
<tr>
<td></td>
<td>Replace if defective</td>
<td>Care in use of hand tools</td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine capacitor for open, short or proper rating in microfarads

**CUES**

Visual observation or improper reading determines faulty capacitor

**ERRORS**

Improper use of analyzer or not accounting for power factor would result in improper diagnosis

**Safety:**

- Electrical shock, electrical burn
- Injury to oneself or others
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage</td>
<td>Rational Numbers</td>
</tr>
<tr>
<td>Resistance of materials to flow of electrical current</td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>[flow of current thru capacitor]</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td>Behavioral Science'</td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions which relates to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand, Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straightforward manner. He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.</td>
<td>Basic Measurement Skills and Concepts</td>
</tr>
<tr>
<td></td>
<td>Instruments</td>
</tr>
<tr>
<td></td>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.—[CA]</td>
</tr>
<tr>
<td></td>
<td>Basic Logic—Deductive/Inductive</td>
</tr>
<tr>
<td></td>
<td>[deductive diagnosis]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMACE MODES</td>
</tr>
<tr>
<td>Reading</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
<tr>
<td>Writing</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
**TASK STATEMENT**  II-4 CHECK CIRCUITRY OF DEFROST SYSTEM

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Isolate circuitry of defrost system on wiring schematic</td>
<td>Safety:</td>
</tr>
<tr>
<td>VOM</td>
<td>Locate terminal board and identify each terminal coding, each component</td>
<td>Always disconnect circuit and lock out breaker before working on electrical components</td>
</tr>
<tr>
<td>Wiring Schematic</td>
<td>Check continuity of timer circuit, heater circuit and defrost terminator circuit</td>
<td>Care in use of hand tools</td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine defective circuit by probing each integral circuit independently

**CUES**
Defective circuit found when no continuity appears

**ERRORS**
Improper use of the rules of checking continuity will result in inaccurate reading and diagnosis

**SAFETY – HAZARD**
- Always disconnect circuit and lock out breaker before working on electrical components
- Care in use of hand tools
- Electrical shock, electrical burn
- Injury to oneself or others
### SCIENCE

Simple machines used to gain mechanical advantage

- **[STK]**

Effect of heating and cooling on expansion of materials

- **[Bi metal thermostat]**

Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consider appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

Rational Numbers

- Uses of Numbers: (without calculation)—
  - Coding—given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

Basic Measurement Skills and Concepts

- Reading and interpreting tables, charts, and graphs
- Representational graphs—[wiring diagram]
- Instruments—[VOM]

Basic Logic—Deductive/Inductive—[Deductive diagnosis]

### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
  - Schematic
  - VOM—Continuity

- **Viewing**
  - Components/Wiring diagram

- **Writing**
  - Service order

#### EXAMPLES

- **SKILLS/CONCEPTS**
  - Terminology
  - Wiring diagram
  - Detail/inference
  - Visual analysis
  - Logic
  - Recognition of symbols
  - Informational report
  - Terminology
  - Clarity of expression
**TASK STATEMENT**  II-5 CHECK CIRCULATION FAN MOTORS

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK, VOM, Wiring Diagram</td>
<td>Check power supply to motor</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td>Check continuity</td>
<td>Always disconnect circuit and lock out breaker before working on electrical components</td>
</tr>
<tr>
<td></td>
<td>Check for defective bearings</td>
<td>Care in use of hand tools</td>
</tr>
</tbody>
</table>

**DECISIONS**

- Determine if motor is defective
- Determine open circuit to motor

**CUES**

- Motor does not run
- Motor hums
- Motor noisy

**ERRORS**

If proper rules of checking continuity are not followed, it will result in an inaccurate diagnosis.
### SCIENCE

Simple machines used to gain mechanical advantage
(STK)
Magnetic fields of force
Resistance of materials to flow of electrical current

### MATH - NUMBER SYSTEMS

Rational Numbers
Fundamental Operations (Calculation)
Additional algorithm
Subtraction algorithm

Basic Measurement Skills and Concepts
Instruments:
Given an Instrument of Measure, determine precision and/or accuracy
with respect to relative error, significant digits, and tolerance. - [VOM]

Reading and interpreting tables, charts, and graphs — Representational graphs

Wiring Diagram

Basic Logic — Deductive/Inductive

[DD]

### Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
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### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Schematic VOM-Continuity</td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td>Components/Wiring Diagram</td>
<td>Wiring diagram</td>
</tr>
<tr>
<td></td>
<td>Service Order</td>
<td>Detail/inference</td>
</tr>
<tr>
<td>Writing</td>
<td></td>
<td>Visual analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recognition of symbols</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
## TASK STATEMENT) II-6 CHECK AND ADJUST CONTROL THERMOSTAT

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

| STK | TI |

### PERFORMANCE KNOWLEDGE

- Check cut in and cut out temperatures
- Check controls
- Adjust
- Remove, and replace

### SAFETY – HAZARD

- **Safety:**
  - Always disconnect circuit and lock out breaker before working on electrical components
  - Care in use of hand tools

- **Hazard:**
  - Electrical shock, electrical burn
  - Injury to oneself or others

### DECISIONS

- Determine if control can be adjusted or must be replaced
- Determine cut in and cut out settings according to mfg.'s specifications

### CUES

- Compressor does not run
- Compressor runs all the time
- Compressor runs too much
- Refrigerator experiences erratic temperatures

### ERRORS

- Improper adjustments will result in improper temperatures and possible food spoilage
**ASK STATEMENT**) II-6 CHECK AND ADJUST CONTROL THERMOSTAT

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Simple machines used to gain mechanical advantage [STK]  
Fluids under pressure  
(Refrigerant under pressure in power tube)  
Effect of heating and cooling on expansion of materials  
[Expansion of power tube] | Rational Numbers  
Uses of Numbers: (without calculation)  
Coding [Mfg data plate]  
Fundamental Operations (Calculation)  
Addition algorithm  
Subtraction algorithm  
Basic Measurement Skills and Concepts [TI]  
Instruments  
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.  
Basic Logic  
Deductive Inductive [Diagnosis] |

**Behavioral Science:**

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.  
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He should maintain a proper balance between pressure to complete job and pride in work.  
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<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE MODES</td>
</tr>
</tbody>
</table>
| Reading | Thermister thermometer  
Control adjustment  
Service order | Detail inference  
Visual analysis  
Informational report  
Terminology  
Clarity of expression |
### II-7 ATTACH MANIFOLD AND GAUGES TO SERVICE

**TASK STATEMENT**: Attach manifold and gauges to service valves and check pressures.

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK MG</td>
<td>Attach hose connections</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Open valve stem</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine between the high and low side valves

**CUES**
- Locate low side valve and high side valve

**ERRORS**
- Failure to attach gauges to the right valve will result in inadequate readings and possible damage to gauge.
### Science

- Fluids under pressure
  - Refrigerant
- Simple machines used to gain mechanical advantage
  - STK

### Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
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- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### Math - Number Systems

- Rational Numbers
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
    - Ratio and proportion
    - Property of comparison
- Basic Measurement Skills and Concepts
  - Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
    - Deductive

### Communications

#### Performance Modes

- Reading
- Viewing
- Writing

#### Examples

- MG: Detail inference
- Service order

#### Skills/Concepts

- Detail inference
- Informational report
- Terminology
- Clarity of expression
## II-8 INSTALL IN-LINE SERVICE VALVES AND MEASURE PRESSURES

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

- SIK
- MG
- SS-19

### PERFORMANCE KNOWLEDGE

- Clean area of tubing where valve will be installed
- Install valve

### SAFETY – HAZARD

- Safety
  - Always wear goggles and use care when handling refrigerants
  - Care and use of hand tools
- Hazard
  - Injury to eyes or skin burn
  - Injury to oneself or others

### DECISIONS

- Determine what is suction side or low side and high side

### CUES

- Locate lines (large one, low side—smaller one, high side) or trace lines back from compressor

### ERRORS

- Failure to identify valves on proper lines would result in obtaining wrong gauge reading, possible damage to gauges
Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
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Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

Math – Number Systems

- Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm
- Basic Arithmetic Skills and Concepts
- Ratio and proportion [Ref: refrigerant]
- Property of comparison [measure pressures]
- Basic Measurement Skills and Concepts [MG]
- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
- Deductive Inductive [DD]

Communications

<table>
<thead>
<tr>
<th>Performance Modes</th>
<th>Examples</th>
<th>Skills/Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Viewing</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Writing</td>
<td>Service Order</td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of expression</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY – HAZARD</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>STK, MG, WM</td>
<td>Install manifold and gauges</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Install watt meter</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Start unit and observe gauge reading and watt meter reading</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard</td>
</tr>
<tr>
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<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**

- Determine compressor operation by wattage check
- Determine compressor operation by compression

**CUES**

- Long running time of compressor
- Erratic system temperatures

**ERRORS**

- Failure to make proper checks would result in complaint not being satisfied
**ASK STATEMENT**  II-9 CHECK COMPRESSOR EFFICIENCY

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Science:</td>
<td></td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.</td>
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<td></td>
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<tr>
<td>He should maintain a proper balance between pressure to complete job and pride in work.</td>
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<td>Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.</td>
<td></td>
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<tr>
<td>He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.</td>
<td></td>
</tr>
<tr>
<td>Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.</td>
<td></td>
</tr>
<tr>
<td>He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rational Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses of Numbers: (without calculation)</td>
</tr>
<tr>
<td>Coding—[mfg data plate]</td>
</tr>
<tr>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>Addition algorithm</td>
</tr>
<tr>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td>Ratio and proportion—[refrigerant]</td>
</tr>
<tr>
<td>Property of comparison—[measuring]</td>
</tr>
<tr>
<td>Basic Measurement Skills and Concepts—[MG and WM]</td>
</tr>
<tr>
<td>Instruments</td>
</tr>
<tr>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.</td>
</tr>
<tr>
<td>Basic Logic</td>
</tr>
<tr>
<td>Deductive/Inductive—[DD]</td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td></td>
<td>WM</td>
<td></td>
</tr>
<tr>
<td>Viewing</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td></td>
<td>WM</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
**II-10 LOCATE LEAK IN REFRIGERATION SYSTEM USING ELECTRONIC LEAK DETECTOR**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK, MG, ELD, SS-15 or SS-16 according to manufacturer's specification</td>
<td>Fill system with type of refrigerant used in system</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Probe suspected areas with sensor of leak detector</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine probable area of leak

**CUES**

Locate leak when signal is detected from detector

**ERRORS**

Improper calibration of sensitivity control or failure to use search and pinpoint correctly, results in mistaken leak.
## II-10 LOCATE LEAK IN REFRIGERATION SYSTEM USING ELECTRONIC LEAK DETECTOR

### TASK STATEMENT

**Science**
- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on expansion of materials
- Effect of heating and cooling on state of matter
- Fluids under pressure
- Transfer of heat from one body to another

**Behavioral Science:**
- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relates to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### Mathematics - Number Systems

- Rational Numbers
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
    - Basic Arithmetic Skills and Concepts
    - Ratio and proportion
    - Property of comparison
    - Basic Measurement Skills and Concepts
    - Instruments
  - Given an Instrument of Measure, determine precision and accuracy with respect to relative error, significant digits, and tolerance.

### Communications

**Performance Modes**
- Reading
- Viewing
- Listening
- Writing

**Examples**
- MG
- MG
- ELD
- Service order

**Skills/Concepts**
- Detail inference
- Noise discrimination
- Sensor siren
- Informational report
- Terminology
- Clarity of expression
## II-11 Locate Leak in Refrigeration System

### Task Statement
Using Halide Torch

### Tools, Equipment, Materials, Objects Acted Upon
- STK
- MG
- HLD
- SS-15 or SS-16 according to mfg's specifications

### Performance Knowledge
- Fill system with type of refrigerant used in system
- Probe suspected areas with halide torch

### Safety - Hazard
- **Safety**
  - Always wear goggles and use care when handling refrigerants
  - Proper ventilation is a necessary precaution when checking with a HLD
- **Hazard**
  - Injury to eyes or skin burn
  - Irritating odor to nose and throat

### Decisions
- Determine probable area of leak

### Cues
- Detects leak when flame changes to a bright blue color

### Errors
- If improper flame color is mistaken for leak; leak would not be detected
### Science

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on expansion of materials
- Effect of heating and cooling on state of matter
- Fluids under pressure
- Transfer of heat from one body to another

### Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
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- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### Math - Number Systems

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion
  - Property of comparison
- Basic Measurement Skills and Concepts
  - Given an Instrument of Measurement, determine precision and/or accuracy with respect to relative error, significant digits and tolerance.
- Basic Logic
  - Deductive/Inductive

### Communications

#### Performance Modes

- Reading
- Viewing
- Writing

#### Examples

- MG
- HLD
- Service order

#### Skills/Concepts

- Detail inference
- Color discrimination (flame changes color)
- Informational report
- Terminology
- Clarity of expression
**II-12 LOCATE LEAK IN REFRIGERATION SYSTEM USING**
**TASK STATEMENT: BUBBLE METHOD**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Fill system with Nitrogen</td>
<td>Safety</td>
</tr>
<tr>
<td>MG</td>
<td>Swab joints and other possible areas where leaks occur</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>SS-17</td>
<td></td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
<tr>
<td><strong>DECISIONS</strong></td>
<td><strong>CUES</strong></td>
<td><strong>ERRORS</strong></td>
</tr>
<tr>
<td>Determine probable area of leak</td>
<td>Detects leak when bubble occurs</td>
<td>Failure to isolate possible source of leak, results in more time and expense required to locate source</td>
</tr>
</tbody>
</table>
### SCIENCE

Simple machines used to gain mechanical advantage
- STK
Effect of heating and cooling on expansion of materials
- Refrigerant
Effect of heating and cooling on state of matter
- Refrigerant under pressure
Fluids under pressure
- Refrigerant under pressure
Transfer of heat from one body to another
- Heat transfer from evaporator to condenser

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relate to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
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Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH - NUMBER SYSTEMS

Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion
  - Property of comparison
- Basic Measurement Skills and Concepts
  - Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive/Inductive

### COMMUNICATIONS

**PERFORMANCE MODES**

- Reading
- Viewing
- Writing

**EXAMPLES**

- MG
  - Bubble solution swabbed on leak determines area of leak
  - Service order

**SKILLS/CONCEPTS**

- Detail inference
- Visual analysis
- Informational report
- Terminology
- Clarity of expression
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK AP</td>
<td>Inspect</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Check power supply</td>
<td>Use care in checking power supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Care in use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe shock may occur</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine proper oil level, clear sight glass, and color on moisture indicator pad in dry zone

**CUES**

Locate, oil level, sight glass in separator or compressor base. Sight glass and moisture indicator in liquid line.

**ERRORS**

Failure to check out properly could result in a needed repair to be over looked
### SCIENCE

- Simple machines used to gain mechanical advantage
  - Simple Machines
- Effect of heating and cooling on expansion of materials
  - Refrigerant
- Effect of heating and cooling on state of matter
  - Refrigerant under pressure
- Transfer of heat from one body to another
  - Heat transfer evaporator to condenser

### Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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### MATH – NUMBER SYSTEMS

- Uses of Numbers: (without calculation)
  - Coding [mfg data plate]
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion
- Basic Measurement Skills and Concepts
  - Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive/Inductive

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- AP
- Oil level
- Sight glass
- Moisture indicator
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology
- Clarity of expression
### Task Statement

**Task Statement:** Check and adjust an automatic expansion valve.

### Tools, Equipment, Materials, Objects Acted Upon

| STK MG |

### Performance Knowledge

- Inspect expansion valve for ice buildup
- Check adjustment in relation to low side pressure

### Safety - Hazard

- **Safety:**
  - Always wear goggles and use care when handling refrigerants
  - Care and use of hand tools
- **Hazard:**
  - Injury to eyes or skin burn
  - Injury to oneself or others

### Decisions

- Adjust valve stem clockwise to increase pressure, counter clockwise to decrease pressure to record desired low side pressure

### Cues

- Normal low side pressures will be recorded

### Errors

- Failure to follow the proper adjustment technique would result in faulty performance
###II-14 CHECK AND ADJUST AN AUTOMATIC EXPANSION VALVE

####SCIENCE

- Simple machines used to gain mechanical advantage
  - [STK]
- Effect of heating and cooling on expansion of materials
- Effect of heating and cooling on state of matter
  - [refrigerant]
- Fluids under pressure
  - [refrigerant under pressure]
- Transfer of heat from one body to another
  - [heat transfer evaporator to condenser]

####BEHAVIORAL SCIENCE:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

####MATH – NUMBER SYSTEMS

- Rational Numbers:
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
    - Ratio and proportion—[refrigerant]
    - Property of comparison—[measuring]
  - Basic Measurement Skills and Concepts—[MG]
    - Instruments
      - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
    - Basic Logic
      - Deductive/Inductive—[DD]

####COMMUNICATIONS

#####PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Example</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>MG</td>
<td>Visual analysis</td>
</tr>
<tr>
<td>MG</td>
<td>Informational report</td>
</tr>
<tr>
<td>MG</td>
<td>Terminology</td>
</tr>
<tr>
<td>MG</td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reading</th>
<th>MG</th>
<th>Automatic expansion valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing</td>
<td>MG</td>
<td>Service order</td>
</tr>
<tr>
<td>Writing</td>
<td>MG</td>
<td></td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MG (Element tube check/used in conjunction with R-12-F-22)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check power element using element tube check and record pressures</td>
<td>Safety</td>
</tr>
<tr>
<td>Adjust to 10° superheat</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>Replace if necessary</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td>Check pressures for normal operation</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine if TEV is defective or out of adjustment</td>
<td>Normal low side temperatures and pressure will be recorded</td>
<td>Failure to diagnose problem accurately, would result in replacing part unnecessarily</td>
</tr>
</tbody>
</table>
### SCIENCE

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on expansion of materials
- Effect of heating and cooling on state of matter
- Fluids under pressure
- Transfer of heat from one body to another
- Refrigerant
- Heat transfer

**Behavioral Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
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- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- **Rational Numbers**
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
  - Ratio and proportion
  - Property of comparison
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
  - Deductive Inductive

### COMMUNICATIONS

**PERFORMANCE MODES**

- Reading
- Viewing
- Writing

**EXAMPLES**

- MG
- TEV
- Service order

**SKILLS/CONCEPTS**

- Detail inference
- Visual analysis
- Informational report
- Terminology
- Clarity of expression
**TASK STATEMENT** II-16 CHECK AND ADJUST PRESSURE MOTOR CONTROL

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK MG</td>
<td>Check gauge readings</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Check differential and range settings</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Check cut-in and cut-out settings</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Make necessary adjustments</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine control adjustments to mfg specifications

**CUES**

Correct control settings will provide for normal run time and down time

**ERRORS**

Failure to meet all adjustment requirements would result in short cycle or an extended run cycle
## TASK STATEMENT
11-16 CHECK AND ADJUST PRESSURE MOTOR CONTROL

### SCIENCE

Simple machines used to gain mechanical advantage  
[STK]
Fluids under pressure  
[refrigerant under pressure in bellows]
Effect of heating and cooling on expansion of materials  
[effect of refrigerant on bellows]

### MATH – NUMBER SYSTEMS

Rational Numbers:
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
- Ratio and proportion—[refrigerant]
- Property of comparison—[measuring]
- Basic Measurement Skills and Concepts—[MG]
- Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive/Inductive —[DD]

### Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions which relates to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner. He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### COMMUNICATIONS

### PERFORMANCE MODES

- Reading
- Viewing
- Writing

### EXAMPLES

<table>
<thead>
<tr>
<th>MG</th>
<th>Control adjustments</th>
<th>Service order</th>
</tr>
</thead>
</table>

### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology
- Clarity of expression
### TASK STATEMENT) II-17 CHECK AND ADJUST LOW PRESSURE SAFETY CONTROL

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK MG</td>
<td>Check gauge readings</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Check differential and range adjustments</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Check cut-in and cut-out points</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Make necessary adjustments</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

### DECISIONS

Determine adjustments according to mfg specifications

### CUES

If control is functioning, compressor will operate and low side pressures will be normal

### ERRORS

Failure to recognize low side operating pressures or make incorrect adjustments would cause compressor damage and poor system performance
**ASK STATEMENT**) II-17 CHECK AND ADJUST LOW PRESSURE SAFETY CONTROL

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage</td>
<td>Rational Numbers.</td>
</tr>
<tr>
<td>Fluids under pressure</td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>Refrigerant under pressure in bellows</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials</td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>bellows assembly</td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td><strong>Behavioral Science:</strong></td>
<td>Ratio and proportion—[Refrigerant]</td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions which relate to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, fast and performed in a straightforward manner. He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.</td>
<td>Property of comparison—[Measuring]</td>
</tr>
<tr>
<td>Basic Measurement Skills and Concepts—[MG]</td>
<td>Basic Logic</td>
</tr>
<tr>
<td>Instruments</td>
<td>Deductive/Inductive—[DD]</td>
</tr>
<tr>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Viewing</td>
<td>Control adjustments</td>
<td>Visual analysis</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Detail inference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of expression</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
<td>PERFORMANCE KNOWLEDGE</td>
<td>SAFETY – HAZARD</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>S1K, MG</td>
<td>Check gauge readings</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Check differential and range adjustments</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Check cut-in and cut-out points</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Make necessary adjustments</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine control adjustments to mfg specifications

**CUES**
If control is functioning compressor will operate and high side pressures will be normal

**ERRORS**
Failure to recognize high side operating pressures or make incorrect adjustments would create short cycling and inefficient performance
**ASK STATEMENT)** II-18 CHECK AND ADJUST HIGH PRESSURE SAFETY CONTROL

---

**SCIENCE**

- Simple machines used to gain mechanical advantage
  - [STK]
- Fluids under pressure
  - [refrigerant under pressure in bellows]
- Effect of heating and cooling on expansion of materials
  - [expansion of bellows]

**Behavioral Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

---

**MATH – NUMBER SYSTEMS**

- Rational Numbers:
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
    - Ratio and proportion—[refrigerant]
    - Property of comparison—[measuring]
  - Basic Measurement Skills and Concepts—[MG]
  - Instruments
  - Given an instrument of measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive/Inductive—[DD]

---

**COMMUNICATIONS**

**PERFORM/NCE MODES**

- Reading
- Viewing
- Writing

**EXAMPLES**

- MG
- MG
- Service order

**SKILLS/CONCEPTS**

- Detail inference
- Detail inference
- Informational report
- Terminology
- Clarity of expression
## TASK STATEMENT: II-19 ADJUST AND CALIBRATE OIL PRESSURE SAFETY CONTROL

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

<table>
<thead>
<tr>
<th>STK</th>
<th>MG</th>
</tr>
</thead>
</table>

### PERFORMANCE KNOWLEDGE

- Install manifold and gauges
- Locate control
- Adjust and calibrate
- Test and check

### SAFETY - HAZARD

- "Always wear goggles and use care when handling refrigerants"
- Care and use of hand tools

- **Hazard:**
  - Injury to eyes or skin burn
  - Injury to oneself or others

### DECISIONS

Determine adjustments to be made according to mfg. specifications

### CUES

- Unit shut-off
- Low oil level

### ERRORS

Improper adjustment and calibration may result in unit malfunction
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage (STK)</td>
<td>Rational Numbers</td>
</tr>
<tr>
<td>Fluids under pressure (refrigerant under pressure in bellows)</td>
<td>Uses of Numbers: (without calculation)</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials (expansion of bellows)</td>
<td>Coding—[mfg. data plate]</td>
</tr>
<tr>
<td><strong>Behavioral Science:</strong></td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td>He should consult appropriately when difficulty arises.</td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>He should answer questions which relates to the repair job at hand with honesty and integrity.</td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td>He should maintain a proper balance between pressure to complete job and pride in work.</td>
<td>Ratio and proportion—[refrigerant]</td>
</tr>
<tr>
<td>Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.</td>
<td>Basic Measurement Skills and Concepts</td>
</tr>
<tr>
<td>He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.</td>
<td>Instruments—[MG]</td>
</tr>
<tr>
<td>Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.</td>
<td>Measurement: Non-geometric</td>
</tr>
<tr>
<td>He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.</td>
<td>Liquid</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
</tr>
<tr>
<td></td>
<td>Liquid—[effect of refrigerant on control]</td>
</tr>
<tr>
<td></td>
<td>Basic Logic</td>
</tr>
<tr>
<td></td>
<td>Deductive/Inductive—[deductive diagnosis]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERFORMANCE MODES</strong></td>
</tr>
<tr>
<td>Reading</td>
</tr>
<tr>
<td>MG</td>
</tr>
<tr>
<td>Viewing</td>
</tr>
<tr>
<td>Writing</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### TASK STATEMENT II-20 CHECK ICE MAKER FOR OPERATION

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Check continuity of ice maker assembly</td>
<td>Safety:</td>
</tr>
<tr>
<td>VOM</td>
<td>Adjust assembly</td>
<td>Always disconnect circuit and lock out breaker before working on electrical components</td>
</tr>
<tr>
<td>Wiring Diagram</td>
<td>Remove and/or replace</td>
<td>Care in use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical shock, electrical burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

### DECISIONS
- Determine if there is continuity through components of assembly
- Determine what component is in operation

### CUES
- Water over flows
- Rotor does not revolve
- Cubes are not discharged from unit

### ERRORS
- Failure to find nonfunctioning component would result in erratic operation of ice maker
**SCIENCE**

Simple machines used to gain mechanical advantage.
- Magnetic fields of force
- Resistance of materials to flow of electrical current

Behavioral Science:
- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

**MATH – NUMBER SYSTEMS**

Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion—[refrigerant]
  - Property of comparison—[measure pressures]
- Basic Measurement Skills and Concepts—[MG]
- Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive Inductive—[DD]

**COMMUNICATIONS**

**PERFORMANCE MODES**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Schematic, VOM-Continuity</td>
</tr>
<tr>
<td>Viewing</td>
<td>Components/Wiring diagram</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
</tr>
</tbody>
</table>

**EXAMPLES**

**SKILLS/CONCEPTS**

- Terminology
- Wiring diagram
- Detail/inference
- Visual analysis
- Logic
- Recognition of symbols
- Informational report
- Terminology
- Clarity of expression
### TASK STATEMENT) II-21 CHECK AND ADJUST WATER VALVE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Check water inlet temperature</td>
<td>Safety</td>
</tr>
<tr>
<td>MG</td>
<td>Check water outlet temperature</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>TT</td>
<td>Adjust water valve stem to correct any temperature difference</td>
<td>Care and use of hand tools</td>
</tr>
</tbody>
</table>

#### DECISIONS
Determine adjustment according to mfg. specifications

#### CUES
Normal water temperatures will be maintained, allowing for operating pressures run normal

#### ERRORS
Failure to make correct adjustment would result in unit operating with excessive head pressure or excessive water consumption

Safety

Hazard

Injury to eyes or skin burn
Injury to oneself or others
### SCIENCE

Simple machines used to gain mechanical advantage
(STK)
Transfer of heat from one body to another
(conduction of condenser coil to water-measuring sensible heat by thermometer)
Effect of heating and cooling on expansion of materials
(expansion and contraction of a bellows)

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relate to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

Rational Numbers
Uses of Numbers: (without calculation)
Coding: [mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Effect of refrigerant pressure on bellows
Basic Measurement Skills and Concepts
Instruments—[thermometer]
Measurement: Non-geometric
Temperature
Weight
Liquid
(refrigerant in system)
Basic Logic
Deductive/Inductive—[deductive diagnosis]

### COMMUNICATIONS

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Mode</th>
<th>MG</th>
<th>TT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viewing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Touching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### EXAMPLES

<table>
<thead>
<tr>
<th>Service Order</th>
</tr>
</thead>
</table>

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Temperature
- Informational report
- Terminology
- Clarity of expression
**TASK STATEMENT** 11-22 CHECK HOT GAS DEFROST SOLENOID AND VALVE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
</table>
| SIK VOM                                       | Check mechanical operation of valve  
Check solenoid continuity               | Safety:  
Always disconnect circuit and lock out breaker before working on electrical components  
Hazard:  
Electrical shock – electrical burn          |

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
</table>
| Determine if hot gas defrost solenoid valve is cycling  
Determine if defrost trip mechanism is operative  | Cooling coil has frost build-up  
Cooling area has higher than normal temperatures | Improper diagnosis will result in continued defrost malfunction |
### Science

Simple machines used to gain mechanical advantage

[STK]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

He should answer questions which relate to the repair job at hand with honesty and integrity.

He should maintain a proper balance between pressure to complete job and pride in work.

Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.

He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.

Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### Math - Number Systems

Rational Numbers

Fundamental Operations (Calculation)

Addition algorithm

Subtraction algorithm

Basic Measurement Skills and Concepts

Instruments—[VOM]

Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance

Deductive/Inductive—[Deductive Diagnosis]

### Communications

**Performance Modes**

- Reading
- Viewing
- Writing

**Examples**

- Schematic
  - VOM-Continuity

- Components/Wiring diagram

- Service order

**Skills/Concepts**

- Terminology
- Wiring diagram
- Detail/inference

- Visual analysis
- Logic
- Recognition of symbols

- Informational report
- Terminology
- Clarity of expression
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP Distilled water</td>
<td>Operate sling psychrometer Record readings in several locations Record outside readings</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine humidity conditions

**CUES**

To record reading of 50-55% relative humidity

**ERRORS**

Inaccurate reading could result in improper diagnosis—unit too small
### Science

- Effect of heating and cooling on state of matter
  - (humidity effect on element)
- Resistance of materials to change in shape
- Hydroscopic elements expanding & contracting (stretching)
- Effect of heating and cooling on expansion of materials
  - (Spirit thermometers)

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### Math - Number Systems

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Property of comparison – [measurement of psychrometer scale]
- Basic Measurement Skills and Concepts
  - Instruments – [psychrometer]
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance – [psychrometer and instrument of measure]
- Measurement: Non-geometric
  - [thermometers in psychrometer]

### Communications

#### Performance Modes

- Reading
- Touch
- Writing

#### Examples

- SP
- Thermometers in SP
- Service order

#### Skills/Concepts

- Detail inference
- Temperature
- Informational report
- Terminology
- Clarity of expression
# TASK STATEMENT

II-24 CHECK AND ADJUST HUMIDISTAT

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

<table>
<thead>
<tr>
<th>STK</th>
</tr>
</thead>
</table>

## PERFORMANCE KNOWLEDGE

- Locate control
- Check hygroscopic element
- Adjust
test

## SAFETY - HAZARD

- Safety
- Always disconnect circuit and lock out breaker before working on electrical components
- Care in use of hand tools
- Hazard:
- Electrical shock, electric burn
- Injury to oneself or others

## DECISIONS

- Determine control needs, adjustment or replacement

## CUES

- Too much humidity in warm season
- Dryness in cold season

## ERRORS

- Failure to make proper adjustment or placement will cause uncomfortable air conditioning conditions
### SCIENCE

- Simple machines used to gain mechanical advantage
- Hydroscopic element expands and contracts due to moisture in air

### Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH - NUMBER SYSTEMS

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Logic
  - Deductive Inductive – [deductive diagnosis]

### COMMUNICATIONS

#### PERFORMANCE MODES

- Viewing
- Writing

#### EXAMPLES

- Humidistat
- Service order

#### SKILLS/CONCEPTS

- Visual analysis
- Informational report
- Terminology
- Clarity of expression
<table>
<thead>
<tr>
<th>TASK STATEMENT</th>
<th>II-25 CHECK CONDENSATE PUMP AND DRAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</strong></td>
<td><strong>PERFORMANCE KNOWLEDGE</strong></td>
</tr>
<tr>
<td>STK VOM</td>
<td>Check power supply to pump motor</td>
</tr>
<tr>
<td></td>
<td>Check motor for continuity</td>
</tr>
<tr>
<td></td>
<td>Check or adjust mechanical float and arm for proper level</td>
</tr>
<tr>
<td></td>
<td>Inspect drain</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DECISIONS</strong></td>
<td><strong>CUES</strong></td>
</tr>
<tr>
<td>Determine if pump or motor are faulty or drain plugged</td>
<td>Motor does not run</td>
</tr>
<tr>
<td></td>
<td>Motor runs but does not pump</td>
</tr>
</tbody>
</table>
### SCIENCE

Simple machines used to gain mechanical advantage
- [STK]
Magnetic fields of force
Resistance of materials to flow of electrical current

Behavioral Science.

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions which relate to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner. He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Measurement Skills and Concepts
  - Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive Inductive

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Schematic
  - VOM-Continuity
- Components/Wiring diagram
- Service order

#### SKILLS/CONCEPTS

- Terminology
- Wiring diagram
- Detail/inference
- Visual analysis
- Logic
- Recognition of symbols
- Informational report
- Terminology
- Clarity of expression
### Task Statement

11-26 Check Blower Assembly and Filter

**Tools, Equipment, Materials, Objects Acted Upon**

- STK
- VOM

**Performance Knowledge**

- Check filter
- Check and adjust belt
- Check motor bearings and oil
- Replace any defective components

**Safety-Hazard**

- Always disconnect circuit and lock out breaker before working on electrical components
- Care in use of hand tools
- Electrical shock, electrical burn
- Injury to oneself or others

**Safety: Failure to make proper diagnosis**

Electrical burn, electrical shock, injury to oneself or others

**Errors: Failure to make proper diagnosis**

- Result in replacing unnecessary parts and/or not solving the complaint

**Decisions**

- Determine if malfunction is mechanical or electrical
- Determine blower assembly specifications
- Determine blower motor specifications

**Cues**

- No heat or cooling
- Noisy
- Temperatures too high or too low

**Sequence of Actions**

1. Check filter
2. Check and adjust belt
3. Check motor bearings and oil
4. Replace any defective components

### Example of Correct Performance

- Check filter
- Adjust belt
- Check motor bearings and oil
- Replace any defective components
### Science

- Simple machines used to gain mechanical advantage
- Magnetic fields of force
- Resistance of materials to flow of electrical current

**Behavioral Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete the job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest, and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### Math - Number Systems

- Rational Numbers
- Functional Operations (Calculation)
  - Additional algorithm
  - Subtraction algorithm

**Basic Measurement Skills and Concepts**

- Instruments:
  - Given an instrument of measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Reading and interpreting tables, charts, and graphs—Representational graphs (Wiring Diagram)
  - Basic Logic—Deductive/Inductive (DD)

### Communications

**Performance Modes**

- Reading
- Viewing
- Writing

**Examples**

- Schematic
  - VOM-continuity
  - Components/Wiring diagram
  - Service order

**Skills/Concepts**

- Terminology
- Wiring diagram
- Deduction/reasoning
- Visual analysis
- Logic
- Recognition of symbols
- Informational report
- Terminology
- Clarity of expression
<table>
<thead>
<tr>
<th>TASK STATEMENT</th>
<th>II-27 CHECK HEAT PUMP REVERSING SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</strong></td>
<td><strong>PERFORMANCE KNOWLEDGE</strong></td>
</tr>
<tr>
<td>STK, VOM, MG</td>
<td>Check thermostat circuit to solenoid valves</td>
</tr>
<tr>
<td></td>
<td>Check operation of reversing and check valves</td>
</tr>
<tr>
<td></td>
<td>Check system pressures</td>
</tr>
<tr>
<td></td>
<td>Remove and replace any defective component according to mfg's specifications</td>
</tr>
<tr>
<td><strong>SAFETY – HAZARD</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td>Injury to oneself or others</td>
</tr>
<tr>
<td><strong>DECISIONS</strong></td>
<td><strong>CUES</strong></td>
</tr>
<tr>
<td>Determine if reversing valves are manual or electrically operated</td>
<td>Unit runs—no heat</td>
</tr>
<tr>
<td>Determine type of system according to mfg's specifications</td>
<td>Unit runs—no cooling</td>
</tr>
<tr>
<td><strong>ERRORS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Failure to properly identify proper reversing system would result in improper diagnosis and repair</td>
</tr>
</tbody>
</table>
Behavioral Science:
Technicians should talk only about the repair job and in a knowledgeable way, and
promote his employer whenever possible. He should consult appropriately when difficulty arises.
He should answer questions which relate to the repair job at hand with honesty and integrity.
Emphasis should be placed upon performing the task at hand without unnecessary
interruptions. He should stress the importance of performing the task at hand with
precision, and avoid unnecessary discussions and arguments with customers. Billing and
discussion of costs should be accurate, honest, and performed in a straightforward
manner. He should get along with his fellow employee and develop a relationship that
will not hurt each other's professionalism.

Rational Numbers
Uses of Numbers: (without calculation)
Coding (mfg data plate)
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion (refrigerant)
Property of comparison (measuring)
Basic Measurement Skills and Concepts (MG and WMI)
Given an instrument of measurement, determine precision and accuracy with respect to
Basic Logic (DD)
Deductive/Inductive

Communications
PERFORMANCE MODES
Reading
Viewing
Writing
Communication
MG
VOM
Service order
MG
VOM
Service order

SKILLS/CONCEPTS
Detail inference
Informational report
Terminology
Clarity of expression

## Task Statement

**KIT**

### Tools, Equipment, Materials, Objects Acted Upon

- STK
- System cleaner (sporlan)
- Acid test kit

### Performance Knowledge

- Remove compressor
- Install replacement compressor, system cleaner and drier
- Evacuate
- Recharge
- Test oil for color and acidity
- Remove system cleaner

### Safety - Hazard

- Safety
  - Always wear goggles and use care when handling refrigerants
  - Care and use of hand tools
- Hazard
  - Injury to eyes or skin burn
  - Injury to oneself or others

### Decisions

Determine if burnout has occurred by following the electrical tests recommended by the equipment mfg. Determine size of unit and the proper cleaning procedure to be used.

### Cues

- Compressor inoperative
- No refrigeration

### Errors

Failure to determine if a burnout has occurred, and a new compressor is installed without proper cleanout will result in future system and compressor failure.
### SCIENCE

Simple machines used to gain mechanical advantage

- Fluids under pressure
- Refrigerant

Behavioral Science

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH - NUMBER SYSTEMS

Rational Numbers

- Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm
- Basic Arithmetic Skills and Concepts
- Ratio and proportion—[refrigerant]
- Property of comparison—[measuring]

Basic Measurement Skills and Concepts—[MG]

- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### COMMUNICATIONS

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Reading</th>
<th>Viewing</th>
<th>Writing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data plate</td>
<td>MG</td>
<td>MG</td>
</tr>
<tr>
<td>Service order</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### EXAMPLES

<table>
<thead>
<tr>
<th>Detail inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail inference</td>
</tr>
<tr>
<td>Informational report</td>
</tr>
<tr>
<td>Terminology/general vocabulary</td>
</tr>
<tr>
<td>Clarity of expression</td>
</tr>
<tr>
<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
</tbody>
</table>
| STK VOM                                       | Check power supply and disconnect  
Remove filters and clean  
Replace any defective component according to mfg's specifications | Safety:  
Always disconnect circuit and lock out breaker before working on electrical components  
Care in use of hand tools  
Hazard:  
Electrical shock, electrical burn  
Injury to oneself or others |
| DECISIONS                                     | CUES                   | ERRORS          |
| Determine what type electronic air cleaner is installed on system  
If self cleaning, check water supply | Customer discomfort  
Air has high rate of pollen, dust  
Unit not functioning properly—short cycling | Failure to determine what type is installed would result in improper service or needless replacement of components |
### Behavioral Science

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions which relate to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete the job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straightforward manner. He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### Rational Numbers

Uses of Numbers: (without calculation)—
- Coding: Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal.
- Basic Measurement Skills and Concepts:
  - Reading and interpreting tables, charts, and graphs
  - Representational graphs—[wiring diagram]
  - Instruments—[VOM]
- Basic Logic—Deductive/Inductive—[Deductive diagnosis]

### Communications

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Schematic</td>
<td>Terminology</td>
</tr>
<tr>
<td>Viewing</td>
<td>VOM-Continuity</td>
<td>Wiring diagram</td>
</tr>
<tr>
<td>Writing</td>
<td>Components/Wiring Diagram</td>
<td>Detail/inference</td>
</tr>
<tr>
<td></td>
<td>Service order</td>
<td>Visual analysis</td>
</tr>
</tbody>
</table>

Logic
- Recognition of symbols
- Informational report
- Terminology
- Clarity of expression
Duty III Servicing and Repairing Refrigeration and Air Conditioning Equipment

1. Evacuate a refrigeration system
2. Pump system down into receiver tank
3. Recharge system using sight glass
4. Recharge system weighing in refrigerent
5. Fill dial a charge
6. Recharge a refrigeration system using dial a charge
7. Remove and replace control thermostat
8. Remove and replace defrost timer
9. Remove and replace motor overload protector
10. Remove and replace capacitor
11. Remove and replace defrost heater
12. Remove and replace defrost terminator
13. Remove and replace relay
14. Remove and replace fan motors
15. Repair leak in copper lines of system
16. Remove and replace compressor
17. Add oil to system
18. Remove restriction from capillary tube
19. Remove and replace capillary tube
20. Remove and replace automatic expansion valve
21. Remove and replace thermostatic expansion valve
22. Install a drier, sight glass or moisture indicator
23. Remove and replace high or low pressure safety control
24. Remove and replace high or low pressure motor control
25. Remove and replace oil pressure safety control
26. Remove and replace hot gas defrost solenoid and valve
27. Repair evaporator with epoxy
28. Remove and replace condensation pump motor
29. Remove and replace humidistat
30. Balance the air conditioning system

81
### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Set of Standard Tools
- Vacuum pump
- Manifold and gauge

### PERFORMANCE KNOWLEDGE
- Run pump until gauge reads and holds at 29.9° vacuum

### SAFETY – HAZARD
- Safety
  - Always wear goggles and use care when handling refrigerants
- Hazard
  - Injury to eyes or skin burn
  - Injury to oneself or others

### DECISIONS
- Attach vacuum pump and evacuate system

### CUES
- Remove all contaminants and moisture

### ERRORS
- Failure to completely evacuate the system would result in possible inefficient cooling when recharged
### SCIENCE

- Simple machines used to gain mechanical advantage
  - [STK]
- Fluids under pressure
  - [refrigerant]

**Behavioral Science:**

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### MATH - NUMBER SYSTEMS

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion
  - Property of comparison
- Basic Measurement Skills and Concepts
  - Measurement
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance

### COMMUNICATIONS

**PERFORMANCE MODES**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Data plate, MG</td>
</tr>
<tr>
<td>Viewing</td>
<td>MG's</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
</tr>
</tbody>
</table>

**SKILLS/CONCEPTS**

- Detail inference
- Detail inference
- Informational report
- Terminology/general vocabulary
  - Clarity of expression
### Task Statement
III-2 Pump System Down into Receiver Tank

### Tools, Equipment, Materials, Objects Acted Upon
- STK
- MG

### Performance Knowledge
- Locate receiver tank close valve to liquid line
- Start unit
- Observe gauges
- Close suction service valve

### Safety - Hazard
- Safety:
  - Proper care and use of hand tools
- Hazard:
  - Personal injury could occur

### Decisions
- Determine how to evacuate system to isolate component for repair

### Cues
- Component must be changed
- System must be evacuated

### Errors
- Failure to properly evacuate system would result in possible loss of refrigerant or exposing system to moisture
**SCIENCE**

- Simple machines used to gain mechanical advantage
  - [STK]
- Fluids under pressure
  - [refrigerant]

**Behavioral Science**

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**MATH - NUMBER SYSTEMS**

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion [refrigerant]
  - Property of comparison [measuring]
- Basic Measurement Skills and Concepts
  - Instruments
  - Given an Instrument of Measure determine precision and/or accuracy with respect to relative error, significant digits and tolerance.

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Viewing</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terminology, clarity of expression</td>
</tr>
</tbody>
</table>
## (Task Statement) III-3 Recharge System Using Sight Glass

### Tools, Equipment, Materials, Objects Acted Upon
- Set of Standard Tools
- Manifold and gauges
- Tank of refrigerant 12 or 22 (as specified for unit)

### Performance Knowledge
- Evacuate system
- Start unit
- Observe pressures
- Observe refrigerant flow through sight glass

### Safety - Hazard
- Safety
  - Always wear goggles and use care when handling refrigerants
  - Care and use of hand tools
- Hazard
  - Injury to eyes or skin burn
  - Injury to oneself or others

### Decisions
- Attach tank to low side and charge in vapor form

### Cues
- To charge the system by observing the sight glass until it clears

### Errors
- Failure to follow the prescribed method of charging with vapor with the unit running, would cause damage to the compressor
### Task Statement: III-3 Recharge System, Using Sight Glass

#### Science

Behavioral Science

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### Math – Number Systems

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion (refrigerant)
  - Property of comparison (measuring)
- Basic Measurement Skills and Concepts (MG)
  - Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive Inductive (Dl)

### Communications

#### Performance Modes

- **Reading**
  - Data plate
  - MG
- **Viewing**
  - MG
- **Writing**
  - Service order

#### Examples

- **Detail inference**
- **Informational report**
- **Terminology/general vocabulary**
- **Clarity of expression**
## Task Statement

### Hill-Recharge a System Weighing in Refrigerant

#### Tools, Equipment, Materials, Objects Acted Upon
- Set of Standard Tools
- Manifold and gauges
- Tank of refrigerant (as specified for unit)
- Scale

#### Performance Knowledge
- Evacuate system
- Purge line from tank to manifold
- Obtain total weight of tank
- Object: total weight should be full charge in system

#### Safety - Hazard
- Always wear goggles and use care when handling refrigerants
- Injury to eyes or skin burn

#### Errors
- Miscalculation could result in under charge or overcharge

#### Cues
- Charge the system with refrigerant by measuring in the correct weight as found on the manufacturer's nameplate located on the unit

#### Decisions
- Determine charge until specified amount is taken into system

---

*Note: The page contains a table with columns for Tools, Equipment, Materials, Objects Acted Upon, Performance Knowledge, Safety - Hazard, Errors, Cues, Decisions.*
Behavioral Science

Technicians should talk only about the repair job and in a knowledgeable way, and promote their employer whenever possible. They should answer questions which relate to the repair job at hand with honesty and integrity. They should maintain a proper balance between pressure to complete the job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and showing concern for the premises. They should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest, and performed in a straightforward manner. They should get along with their fellow employees and develop a relationship that will not hurt each other's professionalism.

Math - Number Systems

Rational Numbers

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion
- Property of comparison

Base Measurement Skills and Concepts [MG]
- Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive Inductive [DD]

Communications

Performance Modes

<table>
<thead>
<tr>
<th>Reading</th>
<th>Data plate</th>
<th>MG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing</td>
<td>MG</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td></td>
</tr>
</tbody>
</table>

Examples

<table>
<thead>
<tr>
<th>Detail inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informational report</td>
</tr>
<tr>
<td>Terminology/general vocabulary</td>
</tr>
<tr>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
(TASK STATEMENT) III-5 FILL DIAL A CHARGE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC SS-15 or SS-16 according to mfg's specifications</td>
<td>Set up dial and charger to hook-up supply tank Fill charger</td>
<td>Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine type and amount of refrigerant required</td>
<td>Amount of refrigerant required Type of refrigerant required</td>
<td>Improper amount or type would cause poor performance</td>
</tr>
</tbody>
</table>
### Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions which relate to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete the job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautious to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straightforward manner. He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### Rational Numbers

**Uses of Numbers (without calculation)**
- Coding [data plate]
- Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm
- Basic Arithmetic Skills and Concepts
- Ratio and proportion [refrigerant]
- Property of comparison [measuring]
- Basic Measurement Skills and Concepts
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

**Basic Measurement Skills and Concepts**
- Instrument: Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### Communications

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Reading</th>
<th>Data plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing</td>
<td>DC</td>
</tr>
<tr>
<td>Writing</td>
<td>π</td>
</tr>
<tr>
<td></td>
<td>Service order</td>
</tr>
</tbody>
</table>

#### EXAMPLES

<table>
<thead>
<tr>
<th>Detail inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail inference</td>
</tr>
</tbody>
</table>

#### SKILLS/CONCEPTS

<table>
<thead>
<tr>
<th>Informational report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminology</td>
</tr>
<tr>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
### III-6 RECHARGE A REFRIGERATION SYSTEM USING DIAL A CHARGE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set of Standard Tools</td>
<td>Evacuate system</td>
<td>Safety</td>
</tr>
<tr>
<td>Manifold and gauges</td>
<td>Purge line from dial a charge to manifold</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>Dial a charge (filled to mfg specified amount of refrigerant)</td>
<td>Start unit and observe gauges</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Check pressures and temperatures</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine correct charge for low side with specified amount of refrigerant

**CUES**
- Measure into the system the exact amount of refrigerant specified

**ERRORS**
- Failing to calculate the proper pressure of dial a charge and measuring scale would result in an over charge or an under charge
**ASK STATEMENT** III-6 RECHARGE A REFRIGERATION SYSTEM USING DIAL A CHARGE

---

**SCIENCE**

Simple machines used to gain mechanical advantage
- (STK, valve wrench)
- Effect of heating and cooling on expansion of materials
- Effect of heating and cooling on state of matter
  - [refrigerant]
- Fluids under pressure
  - [refrigerant under int. press]
- Transfer of heat from one body to another
  - [heat transfer evaporator condenser]

**Behavioral Science:**

Technician should talk only about the repair job and in a knowledgeable way, and note his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employees and develop a relationship that will not hurt each other's professionalism.

---

**MATH - NUMBER SYSTEMS**

**Rational Numbers**
- Uses of Numbers (without calculation)
  - Coding: [mlg. data plate]
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm

**Basic Arithmetic Skills and Concepts**
- Property of comparison [refrigerant]
- Property of comparison [dial a charge]

**Basic Measurement Skills and Concepts**
- Instruments (dial a charge manifold & gauges)
  - Given an Instrument of Measurement, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Measurement (Non-geometric)--[refrigerant]
    - Temperature
    - Weight
    - Liquid

---

**COMMUNICATIONS**

**PERFORMANCE MODES**

- Reading
- Writing
- Viewing

**EXAMPLES**

- Data plate
- Dial a charge
- Service order
- Dial a charge

**SKILLS/CONCEPTS**

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
- Detail inference
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Install manifold and gauges</td>
<td>Safety</td>
</tr>
<tr>
<td>MG</td>
<td>Locate and remove control</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Install replacement control</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Check and test control</td>
<td>Hazard</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine control in operative
- Select replacement according to mfg. model and serial number

**CUES**
- Adjustment can not be made with accuracy
- Power element has lost charge
- Open circuit

**ERRORS**
- Incorrect replacement will result in improper installation, and erratic cooling coil temperatures.
### SCIENCE

Simple machines used to gain mechanical advantage  
- [S1K]
- Fluids under pressure  
  - [refrigerant under pressure in bellows]
- Effect of heating and cooling on expansion of materials  
  - [power element in thermostat]

**Behavioral Science**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed on performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH -- NUMBER SYSTEMS

- Rational Numbers
- Uses of Numbers (without calculation)
- Coding [mg data plate]
- Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm
- Basic Measurement Skills and Concepts [MG]
- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### COMMUNICATIONS

### PERFORMANCE MODES

- **Reading**
- **Viewing**
- **Writing**

### EXAMPLES

- Data plate MG
- Service order

### SKILLS/CONCEPTS

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
### III-8 REMOVE AND REPLACE DEFROST TIMER

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
</table>
| [stk]
Wiring Diagram                                  | Locate defrost timer   | Safety:          |
Remove from mounting                            | Install and test       | Always disconnect circuit and lock out breaker before |
|                                                |                        | working on electrical components |
|                                                |                        | Care in use of hand tools |
|                                                |                        | Hazard |
|                                                |                        | Electrical shock, electrical burn |
|                                                |                        | Injury to oneself or others |

### DECISIONS
- Determine if defrost timer is defective
- Select replacement timer according to unit model and serial number

### CUES
- Defrost timer shorted
- Defrost timer has open circuit

### ERRORS
- Failure to make correct replacement would result in a longer or shorter defrost cycle
## SCIENCE

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on expansion of materials
- Resistance of materials to flow of electrical current

## MATH - NUMBER SYSTEMS

- Rational Numbers
- Use of Numbers: (without calculation)
  - Coding: (mfg data plate)
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
- Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Representational graphs

## Behavioral Science:

Technicians should talk only about the repair job and in a knowledgeable way, and
promote their employer whenever possible. He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily
disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job
at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight
forward manner.
He should get along with his fellow employee and develop a relationship that will not
hurt each other's professionalism.

## COMMUNICATIONS

### PERFORMANCE MODES

- Reading
- Viewing
- Writing

### EXAMPLES

- Data plate
- Wiring diagram
- Components
- Wiring diagram
- Service order

### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Recognition of symbols, codes, emblems
- Informational report
- Terminology/general vocabulary
- Clarity of expression
### (TASK STATEMENT) III-9 REMOVE AND REPLACE MOTOR OVERLOAD PROTECTOR

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK Wiring Diagram</td>
<td>Locate compressor and remove overload protector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check rating and reinstall replacement protector</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Always disconnect circuit and lock out breaker before working on electrical components</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Care in use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical shock, electrical burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

### DECISIONS
- Determine protector defective
- Select proper rated protector according to mfg. specifications

### CUES
- Overload protector weak
- Overload protector has open circuit

### ERRORS
- Failure to do so could cause unit damage
### TASK STATEMENT: III-9 REMOVE AND REPLACE MOTOR OVERLOAD PROTECTOR

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>

Behavioral Science.

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

He should answer questions which relate to the repair job at hand with honesty and integrity.

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Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Data plate Wiring diagram Components Writing diagram Service order</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Viewing</td>
<td></td>
<td>Visual analysis Recognition of symbols, codes, emblems Informational report</td>
</tr>
<tr>
<td>Writing</td>
<td></td>
<td>Terminology, general vocabulary Clarity of expression</td>
</tr>
</tbody>
</table>
### (TASK STATEMENT) III-10 REMOVE AND REPLACE CAPACITOR

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK Wiring Diagram</td>
<td>Locate motor</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td>Remove capacitor</td>
<td>Always disconnect circuit and lock out breaker before working on electrical components</td>
</tr>
<tr>
<td></td>
<td>Replace with new capacitor</td>
<td>Care in use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical shock, electrical burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

### DECISIONS
- Determine capacitor defective
- Select capacitor with correct mfg. rating

### CUES
- Capacitor leaks
- Motor does not start
- Capacitor shorted or has open circuit

### ERRORS
- Failure to do so would result in damage to motor or compressor
### SCIENCE

- Simple machines used to gain mechanical advantage
- Resistance of materials to flow of electrical current

### MATH - NUMBER SYSTEMS

- Rational Numbers
- Use of Numbers (without calculation)
  - Coding (mfg. data plate)
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
- Basic Measurement Skills and Concepts
  - Reading and interpreting tables, charts, and graphs
  - Represenational graphs

### Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Data plate
- Wiring diagram
- Components
- Wiring diagram
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Recognition of symbols, codes, emblems
- Informational report
- Terminology/general vocabulary
- Clarity of expression
## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

- STK
- Wiring Diagram

## PERFORMANCE KNOWLEDGE

- Remove heater from cooling coil assembly
- Install new heater
- Reinstall cooling coil assembly

## SAFETY – HAZARD

- Safety:
  - Always disconnect circuit and lock out breaker before working on electrical components
  - Care in use of hand tools
  - Hazard:
  - Electrical shock, electrical burn
  - Injury to oneself or others

## DECISIONS

- Determine defrost heater inoperative
- Select defrost heater according to model and serial number

## CUES

- Fresh food compartment warmer than normal
- Ice build-up in freezer near cooling coil

## ERRORS

- Failure to select correct heater would result in not being able to replace heater
### SCIENCE

Simple machines used to gain mechanical advantage

[STK]

### MATH – NUMBER SYSTEMS

- **Rational Numbers**
- Use of Numbers: (without calculation)
  - Coding [mfg. data plate]
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
- Basic Measurement Skills and Concepts
  - Reading and interpreting tables, charts, and graphs
  - Representational graphs

### BEHAVIORAL SCIENCE

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

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### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
</table>
| **Reading**       | Data plate  
                    Wiring diagram  
                    Components  
                    Wiring diagram  
                    Service order  | Detail inference  |
| **Viewing**       |           | Visual analysis  |
| **Writing**       |           | Recognition of symbols, codes emblems  |
|                   |           | Informational report  |
|                   |           | Terminology/general vocabulary  |
|                   |           | Clarity of expression  |
# (TASK STATEMENT) III-12 REMOVE AND REPLACE DEFROST TERMINATOR

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

- S1K Wiring Diagram

## PERFORMANCE KNOWLEDGE

- Locate defrost terminator in cooling coil section
- Remove defrost terminator
- Install new defrost terminator

## SAFETY - HAZARD

- **Safety:**
  - Always disconnect circuit and lock out breaker before working on electrical components
  - Care in use of hand tools
- **Hazard:**
  - Electrical shock, electrical burn
  - Injury to oneself or others

## DECISIONS

- Determine defrost terminator defective
- Select replacement according to model and serial number
- Check cut out temp on new terminator

## CUES

- Defrost terminator has open circuit

## ERRORS

- Failure to make correct replacement will result in a longer or shorted defrost cycle
**ASK STATEMENT: III-12 REMOVE AND REPLACE DEFROST TERMINATOR**

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| Simple machines used to gain mechanical advantage  
Effect of heating and cooling on expansion of materials  
[Stk]  
[In metal]  
Behavioral Science:  
Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.  
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism. | Rational Numbers  
Use of Numbers: (without calculation)  
Coding - [Mfg. data plate]  
Fundamental Operations (Calculation)  
Addition algorithm  
Subtraction algorithm  
Basic Measurement Skills and Concepts  
Reading and interpreting tables, charts, and graphs  
Representational graphs |

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
</table>
| Reading           | Data plate  
Wiring diagram | Detail inference |
| Viewing           | Components  
Wiring diagram | Visual analysis  
Recognition of symbols, codes emblems |
| Writing           | Service order | Informational report  
Terminology/general vocabulary  
Clarity of expression |
### (TASK STATEMENT) III-13 REMOVE AND REPLACE RELAY

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK Wiring Diagram</td>
<td>Locate relay</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td>Remove relay</td>
<td>Always disconnect circuit and lock out breaker before</td>
</tr>
<tr>
<td></td>
<td>Install relay</td>
<td>working on electrical components</td>
</tr>
<tr>
<td></td>
<td>Test and check</td>
<td>Care in use of hand tools</td>
</tr>
</tbody>
</table>

#### DECISIONS
- Determine relay inoperative
- Select relay rated to HP of compressor

#### CUES
- Relay has open circuit
- Compressor starts and stops

#### ERRORS
- Failure to install correct size relay would render unit inoperative

#### SAFETY - HAZARD
- Hazard: Electrical shock, electrical burn
- Injury to oneself or others
### SCIENCE

- Simple machines used to gain mechanical advantage
  - [STK]
- Effect of heating and cooling on expansion of materials
  - [Bi metal]

### Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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### MATH - NUMBER SYSTEMS

- Rational Numbers
- Use of Numbers: (without calculation)
  - Coding: [mfg. data plate]
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Measurement Skills and Concepts
  - Reading and interpreting tables, charts, and graphs
  - Representational graphs

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Data plate
- Wiring diagram
- Components
- Wiring diagram
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Recognition of symbols, codes emblems
- Informational report
- Terminology/general vocabulary
- Clarity of expression
## III-14 REMOVE AND REPLACE FAN MOTORS

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK Wiring Diagram</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate motor</td>
</tr>
<tr>
<td>Remove motor</td>
</tr>
<tr>
<td>Replace motor</td>
</tr>
<tr>
<td>Test and check</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety:</td>
</tr>
<tr>
<td>Always disconnect circuit and lock out breaker before working on electrical components</td>
</tr>
<tr>
<td>Care in use of hand tools</td>
</tr>
<tr>
<td>Hazard:</td>
</tr>
<tr>
<td>Electrical shock, electrical burn</td>
</tr>
<tr>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine motor inoperative</td>
</tr>
<tr>
<td>Select motor designed for application</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor shorted</td>
</tr>
<tr>
<td>Motor has open circuit</td>
</tr>
<tr>
<td>Motor has defective bearings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to replace with motor designed will result in inefficient unit operation</td>
</tr>
</tbody>
</table>
**TASK STATEMENT** III-14 REMOVE AND REPLACE FAN MOTORS

### SCIENCE

Simple machines used to gain mechanical advantage
(STK)
Magnetic fields of force
Resistance of materials to flow of electrical current

**Behavioral Science:**

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others' professionalism.

### MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without calculation)
Coding [mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

### COMMUNICATIONS

**PERFORMANCE MODES**

- **Reading**
  Data plate
  Wiring diagram
- **Viewing**
  Components
  Wiring diagram
- **Writing**
  Service order

**EXAMPLES**

**SKILLS/CONCEPTS**

- Detail inference
- Vis. analysis
- Read of symbols, codes, emblems
- Informal report
- Term: general vocabulary
- Clarity: expression
## TASK STATEMENT
III-15 REPAIR LEAK IN COPPER LINES OF SYSTEM

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

- STK
- MG
- VP
- PT
- SS-4
- SS-3
- SS-7
- SS-6

### PERFORMANCE KNOWLEDGE

- Repair copper line with flared mechanical fitting or with a swedge and; or brazed joint
- Evacuate
- Recharge

### SAFETY – HAZARD

**Safety:**
- Proper care and use of tools
- Ventilate room when operating
- Use care while torch operation
- Wear goggles when handling refrigerant

**Hazard:**
- Personal injury could occur
- Burn off irritating to eyes, nose and throat
- Severe burns or property damage may occur
- Loss of eyesight or skin burns

### DECISIONS

- Determine severity of leak
- Determine type of fitting needed to complete task

### CUES

- Oil sheen in area of leak
- Leak detector methods have isolated area of leak

### ERRORS

- Failure to determine severity of leak or make good repair would cause unit to continue leaking
**ASK STATEMENT** III-15 REPAIR LEAK IN COPPER LINES OF SYSTEM

### SCIENCE

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on state of matter
  - [brazing]
- Fluids under pressure
  - [refrigerant]
- Resistance of materials to change in shape
  - [tube bending, swedge, flare]

**Behavioral Science:**

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- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers
- Uses of Numbers: (without calculation)
  - Coding—[mfg. data plate]
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion—[refrigerant]
- Basic Measurement Skills and Concepts—[MG]
- Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive/Inductive—[deductive diagnosis]

### COMMUNICATIONS

#### PERFORMANCE MODES

| Reading          | MG |
| Writing          | MG |
| Viewing          | MG |

#### EXAMPLES

- MG
- Service order
- MG

#### SKILLS/CONCEPTS

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
- Detail inference
**TASK STATEMENT** III-16 REMOVE AND REPLACE COMPRESSOR

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Locate compressor and remove from mounting</td>
<td>Safety</td>
</tr>
<tr>
<td>MG</td>
<td>Install replacement compressor</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>VP</td>
<td>Evacuate</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td>SS-15 or SS-16 according to mfg's specifications</td>
<td>Recharge</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Text and check</td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine compressor defective</td>
<td>Compressor shorted</td>
<td>Failure to install proper sized compressor will result in no operation or ineffective operation of unit</td>
</tr>
<tr>
<td>Select replacement compressor according to mfg's specifications and model and serial number</td>
<td>Compressor has open winding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compressor has mechanical failure</td>
<td></td>
</tr>
</tbody>
</table>
### SCIENCE

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on state of matter
- Transfer of heat from one body to another
- Fluids under pressure

**Behavioral Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relates to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers
  - Uses of Numbers (without calculation)
  - Coding
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
    - Ratio and proportion
    - Property of comparison
  - Basic Measurement Skills and Concepts

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Data plate
  - MG
- MG
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
**TASK STATEMENT** 111-17 ADD OIL TO SYSTEM

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Fake system to vacuum on low side</td>
<td>Safety</td>
</tr>
<tr>
<td>Manifold &amp; gauges</td>
<td>Introduce oil into low side until operating wattage becomes normal or compressor quiets down</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>SS-15 or SS-16</td>
<td>Recharge</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td>WM</td>
<td></td>
<td>Hazard</td>
</tr>
<tr>
<td>Refrigeration oil</td>
<td></td>
<td>Injury to eyes or skin burn</td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine how much oil has been lost from compressor

**CUES**

- Unit runs excessively hot
- Unit has high wattage reading
- Unit short cycles

**ERRORS**

Too much or too little oil will render inefficient operation of unit

**SAFETY – HAZARD**

- Safety
- Always wear goggles and use care when handling refrigerants
- Care and use of hand tools
- Hazard
- Injury to eyes or skin burn
- Injury to oneself or others
### SCIENCE

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on expansion of materials
- Effect of heating and cooling on state of matter (refrigerant)
- Fluids under pressure (refrigerant under pressure)
- Transfer of heat from one body to another (heat)

#### Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

He should answer questions which relate to the repair job at hand with honesty and integrity.

He should maintain a proper balance between pressure to complete job and pride in work.

Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.

He should be cautious to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.

Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers
  - Fundamental Operations (Calculation):
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts:
    - Ratio and proportion (refrigerant)
    - Property of comparison (measuring)
  - Basic Measurement Skills and Concepts:
    - Instruments
    - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### COMMUNICATIONS

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Reading</th>
<th>Writing</th>
<th>Viewing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data plate</td>
<td>Service order</td>
<td>MG</td>
</tr>
<tr>
<td>MG</td>
<td></td>
<td>WM</td>
</tr>
</tbody>
</table>

#### EXAMPLES

<table>
<thead>
<tr>
<th>Data plate</th>
<th>Service order</th>
</tr>
</thead>
<tbody>
<tr>
<td>MG</td>
<td>WM</td>
</tr>
</tbody>
</table>

#### SKILLS/CONCEPTS

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
- Detail inference
**TASK STATEMENT** III-18 REMOVE RESTRICTION FROM CAPILLARY TUBE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK, MG, VP, SS-12, SS-15 or SS-17</td>
<td>Remove high side end of capillary tube</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Flush and back flush R-22 or nitrogen</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Install drive</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Evacuate</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Recharge</td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine if capillary tube is operative

**CUES**
Gauges read moderate restriction

**ERRORS**
No refrigerant passes through tube
### SCIENCE

Simple machines used to gain mechanical advantage  
[SSTK]
Effect of heating and cooling on state of matter  
[Soldering-refrigerant]
Fluids under pressure  
[refrigerant under pressure]
Transfer of heat from one body to another  
[heat conduction]
Effect of heating and cooling on expansion of materials  
[refrigerant]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion  
- Property of comparison  
- [measuring]

Basic Measurement Skills and Concepts  
- [MG]

Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
- **Viewing**
- **Writing**

#### EXAMPLES

- Data plate  
  - MG
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
## III-19 REMOVE AND REPLACE CAPILLARY TUBE

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- STK
- MG
- VP

### PERFORMANCE KNOWLEDGE
- Remove capillary tube
- Install replacement
- Evacuate
- Recharge

### SAFETY – HAZARD
- Safety
  - Always wear goggles and use care when handling refrigerants
  - Care and use of hand tools
- Hazard
  - Injury to eyes or skin burn
  - Injury to oneself or others

### DECISIONS
- Determine if capillary tube is inoperative
- Select correct capillary tube according to compressor capacity, and condenser design

### CUES
- Evaporator pressures reflect a restriction
- Capillary tube plugged

### ERRORS
- Failure to install correct capillary tube would result in higher or lower evaporator temperature
**Behavioral Science:**
Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult appropriately when difficulty arises. He should answer questions which relate to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straightforward manner. He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

**Rational Numbers**
Uses of Numbers: (without calculation)
- Coding [mig data plate]

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion - [refrigerant]
- Property of comparison - [measuring]

Basic Measurement Skills and Concepts - [MG]
- Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

**Communications**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Data plate</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Viewing</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Writing</td>
<td>MG</td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td>Service order</td>
<td>Terminology/general vocabulary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
**TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON**

- STK
- MG
- TI
- SS-15 or SS-16 according to mfg specifications

**PERFORMANCE KNOWLEDGE**

- Install manifold and gauges
- Isolate automatic expansion valve from system
- Remove automatic expansion valve
- Replace with new automatic expansion valve
- Purge and add refrigerant to system
- Adjust to cooling coil temperature

**SAFETY – HAZARD**

- Safety
- Always wear goggles and use care when handling refrigerants
- Care and use of hand tools
- Hazard
- Injury to eyes or skin burn
- Injury to oneself or others

**DECISIONS**

- Determine if automatic expansion valve is inoperative
- Select proper automatic expansion valve according to unit design

**CUES**

- AXV operates erratic
- AXV internal valve defective

**ERRORS**

- Failure to do so will result in system not functioning properly
### Behavioral Science:

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### Rational Numbers

- **Uses of Numbers:** (without calculation)
  - Coding—(mfg data plate)
- **Fundamental Operations (Calculation):**
  - Addition algorithm
  - Subtraction algorithm
- **Basic Arithmetic Skills and Concepts:**
  - Ratio and proportion—(refrigerant)
  - Property of comparison—(measuring)
- **Basic Measurement Skills and Concepts:**
  - Instruments
    - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### Communications

#### Performance Modes

- **Reading**
  - MG
  - TI

- **Writing**
  - Service order

- **Viewing**
  - MG
  - TT

#### Examples

- **Skills/Concepts**
  - Detail inference
  - Informational report
  - Terminology/general vocabulary
  - Clarity of expression
  - Detail inference
### Task Statement
III-21 REMOVE AND REPLACE THERMOSTATIC EXPANSION VALVE

### Tools, Equipment, Materials, Objects Acted Upon
- STK
- MG
- SS-15 or SS-16 according to mfg's specifications

### Performance Knowledge
- Install manifold and gauge
- Isolate thermostatic expansion valve from system
- Remove thermostatic expansion valve
- Install replacement thermostatic expansion valve
- Add additional charge to system
- Adjust super heat

### Safety - Hazards
- Safety
- Always wear goggles and use care when handling refrigerants
- Care and use of hand tools
- Hazard
- Injury to eyes or skin burn
- Injury to oneself or others

### Decisions
- Determine if thermostatic expansion valve is inoperative
- Select correct thermostatic expansion valve according to unit design

### Cues
- Cooling coil temperature erratic
- Sensor has lost its charge
- Internal valve sticking

### Errors
- Failure to install correct valve would result in improper evaporator temperature
**SCIENCE**

Simple machines used to gain mechanical advantage

-[K]

Effect of heating and cooling on expansion of materials

-Effect of heating and cooling on state of matter

-[refigerant]

Fluids under pressure

-[refigerant under pressure]

Transfer of heat from one body to another

-[heat transfer evaporator to condenser]

**Behavioral Science:**

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

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He should maintain a proper balance between pressure to complete job and pride in work.

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Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

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**MATH - NUMBER SYSTEMS**

Rational Numbers

Fundamental Operations (Calculation)

-Addition algorithm

-Subtraction algorithm

-Basic Arithmetic Skills and Concepts

-Ratio and proportion - [refigerant]

-Property of comparison – [measuring]

-Basic Measurement Skills and Concepts – [MG]

-Instruments

-Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

-Basic Logic

-Deductive Inductive [DD]

**COMMUNICATIONS**

**PERFORMANCE MODES**

-Reading

-Viewing

-Writing

**EXAMPLES**

-Data plate

-MG

-MG

-Service order

**SKILLS/CONCEPTS**

-Detail inference

-Detail inference

-Informational report

-Terminology/general vocabulary

-Clarity of expression
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Isolate area where component is to be installed</td>
<td>Safety</td>
</tr>
<tr>
<td>MG</td>
<td>Install component</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>SS-15 or SS-16 according to mfg's specifications</td>
<td>Purge component</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Recharge</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Check system pressures</td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine where component to be installed
- Check mfg. specifications

**CUES**
- System requires component
- Excessive moisture in system
- Extensive service performed on unit

**ERRORS**
- Failure to follow procedures will result in components not performing adequately
### Behavioral Science:

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- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete the job and pride in work.

Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.

He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.

Billing and discussion of costs should be accurate, honest, and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### Rational Numbers

- Uses of Numbers: (without calculation)
  - Coding: [mfg data plate]

### Basic Measurement Skills and Concepts

- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### Communications

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Data plate
- MG
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
### III-23 REMOVE AND REPLACE HIGH OR LOW PRESSURE
#### (TASK STATEMENT) SAFETY CONTROL

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
</table>
| STK, MG                                       | Install manifold and gauges  
Remove control  
Install new control  
Wire control  
Adjust control  | Safety:  
Use care in handling of refrigerants  
Disconnect power before replacing control  | Hazard:  
May cause eye injury or skin burn  
May cause service electrical supply |

### DECISIONS

- Determine control inoperative  
- Select control according to unit design

### CUES

- Cannot adjust low cut-out  
- Cannot adjust high cut-out

### ERRORS

- Improper unit operation will occur
### III-23 REMOVE AND REPLACE HIGH OR LOW PRESSURE

**TASK STATEMENT** SAFETY CONTROL

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH — NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage</td>
<td>Rational Numbers:</td>
</tr>
<tr>
<td>Fluids under pressure</td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>Refrigerant under pressure in bellows</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials</td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>[effect of expansion in bellows]</td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td>Behavioral Science:</td>
<td>Ratio and proportion—[refrigerant]</td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.</td>
<td>Property of comparison—[measuring]</td>
</tr>
<tr>
<td>He should answer questions which relate to the repair job at hand with honesty and integrity.</td>
<td>Basic Measurement Skills and Concepts—[MG]</td>
</tr>
<tr>
<td>He should maintain a proper balance between pressure to complete job and pride in work.</td>
<td>Instruments</td>
</tr>
<tr>
<td>Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.</td>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.</td>
</tr>
<tr>
<td>He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.</td>
<td>Basic Logic</td>
</tr>
<tr>
<td>He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.</td>
<td>Deductive Inductive—[DD]</td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Data plate</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Viewing</td>
<td>MG</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Writing</td>
<td>MG</td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td>Service order</td>
<td>Terminology/general vocabulary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
## III-24 REMOVE AND REPLACE HIGH OR LOW PRESSURE MOTOR CONTROL

**TASK STATEMENT**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK MG</td>
<td>Install manifold and gauges</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Remove control</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td></td>
<td>Install new control</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Wire control</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Adjust and calibrate control</td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

### DECISIONS

- Determine control inoperative
- Select control according to unit design

### CUES

- Control cannot be adjusted or calibrated with accuracy
- Control has open circuit

### ERRORS

- Incorrect control will result in improper cycling
### Science

Simple machines used to gain mechanical advantage
- [STK]
- Fluids under pressure
  - [refrigerant under pressure in bellows]
- Effect of heating and cooling on expansion of material
  - [effect of expansion in bellows]

**Behavioral Science:**

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

He should maintain a proper balance between pressure to complete job and pride in work.

Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.

He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.

Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### Math - Number Systems

- **Rational Numbers:**
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
  - Ratio and proportion
  - Property of comparison
  - Basic Measurement Skills and Concepts
  - Instruments

- **Basic Measurement Skills and Concepts**
  - [MG]

- **Basic Logic**
  - Deductive: Inductive

### Communications

#### Performance Modes

- **Reading**
  - Data plate
  - MG

- **Viewing**
  - MG

- **Writing**
  - Service order

#### Examples

- Data plate
- MG

#### Skills/Concepts

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
### Task Statement
III-25 Remove and Replace Oil Pressure Safety Control

### Tools, Equipment, Materials, Objects Acted Upon
- STK MG

### Performance Knowledge
- Install manifold and gauges
- Remove control
- Install new control
- Adjust and calibrate control

### Safety - Hazard
- Safety
  - Always wear goggles and use care when handling refrigerants
  - Care and use of hand tools
- Hazard
  - Injury to eyes or skin burn
  - Injury to oneself or others

### Decisions
- Determine control inoperative
- Select replacement according to mfg specifications

### Cues
- Adjustment or calibration cannot be made with accuracy
- Open circuit

### Errors
- Failure to install correct control may result in system failure
### SCIENCE

- Simple machines used to gain mechanical advantage
- Fluids under pressure
- Effect of heating and cooling on expansion of materials

**Behavioral Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relates to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
- Ratio and proportion
- Property of comparison
- Basic Measurement Skills and Concepts
- Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- Basic Logic
  - Deductive, Inductive

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Data plate
- MG
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
### III-26 REMOVE AND REPLACE HOT GAS DEFROST
(TASK STATEMENT) SOLENOID AND VALVE

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Install manifold and gauges</td>
<td>Safety</td>
</tr>
<tr>
<td>MG</td>
<td>Isolate HGDSV from system</td>
<td>Always wear goggles and use care when handling refrigerants</td>
</tr>
<tr>
<td>SS-15 or SS-16 according to mfg’s specification</td>
<td>Remove HGDSV</td>
<td>Care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Replace HGDSV</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Purge and add charge or refrigerant to system level</td>
<td>Injury to eyes or skin burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

### DECISIONS
- Determine HGDSV ineffectual
- Select correct replacement according to unit design or mfg specifications

### CUES
- HGDSV solenoid has open circuit
- Mechanical operation of valve is erratic

### ERRORS
- Incorrect replacement will result in continued defrost problems
### Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult appropriately when difficulty arises.

He should answer questions which relates to the repair job at hand with honesty and integrity.

He should maintain a proper balance between pressure to complete job and pride in work.

Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.

He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.

Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.

He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### Rational Numbers

- **Uses of Numbers:** (without calculation)
  - Coding: [mfg data plate]
- **Fundamental Operations (Calculation):**
  - Addition algorithm
  - Subtraction algorithm
- **Basic Arithmetic Skills and Concepts:**
  - Ratio and proportion: [refrigerant]
  - Property of comparison: [measuring]
- **Basic Measurement Skills and Concepts:** [MG]
- **Instruments:**
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

### Communications

#### PERFORMANCE MODES

<table>
<thead>
<tr>
<th>Reading</th>
<th>Data plate</th>
<th>Detail inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing</td>
<td>MG</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Informational report</td>
</tr>
</tbody>
</table>

#### SKILLS/CONCEPTS

- Detail inference
- Informational report
- Terminology/general vocabulary
- Clarity of expression
# III-27 Repair Evaporator with Epoxy

## Tools, Equipment, Materials, Objects Acted Upon
- STK
- Epoxy patch kit
- Heat Lamp
- MG
- DC
- SS-15 or SS-16 according to mg's specifications

## Performance Knowledge
- Clean area
- Apply epoxy
- Blow to dry
- Evacuate
- Recharge

## Safety – Hazard
- **Safety:**
  - Care while using epoxy patch
  - Use goggles while handling refrigerants
- **Hazard:**
  - Irritates skin
  - Eye injury or skin burn

## Decisions
- Determine size and area of puncture

## Cues
- Locate puncture in evaporator

## Errors
- Failure to cover entire area with epoxy will render job unsuccessful
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage</td>
<td>Rational Numbers</td>
</tr>
<tr>
<td>[STK] Effect of heating and cooling on expansion of materials</td>
<td>Uses of Numbers (without calculation)</td>
</tr>
<tr>
<td>Effect of heating and cooling on state of matter.</td>
<td>Coding - [mfg Data Plate]</td>
</tr>
<tr>
<td>[refrigerant] Fluids under pressure</td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>[refrigerant under pressure] Transfer of heat from one body to another</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td>[Heat transfer evaporator to condenser]</td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>Relationship of force to distortion in an elastic body</td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td>[epoxy]</td>
<td>Ratio and proportion - [refrigerant]</td>
</tr>
<tr>
<td></td>
<td>Property of comparison - [measure]</td>
</tr>
<tr>
<td></td>
<td>Basic Measurement Skills and Concepts - [MG, DC]</td>
</tr>
<tr>
<td></td>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.</td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

**PERFORMANCE MODES**

<table>
<thead>
<tr>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Writing</td>
<td>Informational report</td>
</tr>
<tr>
<td>Viewing</td>
<td>Terminology/general vocabulary</td>
</tr>
<tr>
<td></td>
<td>Clarity of expression</td>
</tr>
<tr>
<td></td>
<td>Detail inference</td>
</tr>
<tr>
<td>MG</td>
<td>MG</td>
</tr>
<tr>
<td>DC</td>
<td>DC</td>
</tr>
<tr>
<td>Service order</td>
<td></td>
</tr>
</tbody>
</table>
### Task Statement

**III-28 Remove and Replace Condensation Pump Motor**

### Tools, Equipment, Materials, Objects Acted Upon

- **STK**
- **Wiring Diagram**

### Performance Knowledge

- Locate pump
- Remove pump
- Replace pump
- Test float

### Safety - Hazard

- **Safety:**
  - Always disconnect circuit and lock out breaker before working on electrical components
  - Care in use of hand tools
- **Hazard:**
  - Electrical shock, electrical burn
  - Injury to oneself or others

### Decisions

- Determine pump design as a replacement

### Cues

- Float arm sticks from corrosion
- Pump motor has open circuit
- Pump motor shorted

### Errors

- Improper float adjustment can result in condensate pan overflowing with water
### SCIENCE

Simple machines used to gain mechanical advantage

- [STK]
- Resistance of materials to flow of electric current
- [Stock potential of current]

**Behavioral Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult appropriately when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.

**MATH – NUMBER SYSTEMS**

- Rational Numbers
- Use of Numbers: (without calculation)
  - Coding—[mfg. data plate]
- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Measurement Skills and Concepts
- Reading and interpreting tables, charts, and graphs
  - Representational graphs

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Data plate
- Wiring diagram
- Components
- Wiring diagram
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Recognition of symbols, codes, emblems
- Informational report
- Terminology/general vocabulary
- Clarity of expression
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK Wiring Diagram</td>
<td>Remove control</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td>Replace new control</td>
<td>Always disconnect circuit and lock out breaker before</td>
</tr>
<tr>
<td></td>
<td>Adjust</td>
<td>working on electrical components</td>
</tr>
<tr>
<td></td>
<td>Test</td>
<td>Care in use of hand tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical shock, electrical burn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine control inoperative
- Determine replacement control according to mfg. specification

**CUES**
- Triggering mechanism distorted
- Open circuit
- Failure to adjust control

**ERRORS**
- Failure to replace and adjust control will result in poor climate conditions
### SCIENCE

- Simple machines used to gain mechanical advantage
  - [STK] Effect of moisture on the Hyposcopic element

### MATH — NUMBER SYSTEMS

- Rational Numbers
- Use of Numbers: (without calculation)
  - Coding—[mfg data plate]
- Fundamental Operations: (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Measurement Skills and Concepts
  - Reading and interpreting tables, charts, and graphs
  - Representational graphs

### Behavioral Science:

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### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
  - Data plate
  - Wiring diagram
- **Viewing**
  - Components
  - Wiring diagram
- **Writing**
  - Service order

#### EXAMPLES

- Detail inference
- Visual analysis
- Recognition of symbols, codes, emblems
- Informational report
- Terminology/general vocabulary
- Clarity of expression
<table>
<thead>
<tr>
<th>SAFETY – HAZARD</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Safety -</td>
<td>- Failure to isolate area where air distribution is causing customer dissatisfaction</td>
</tr>
<tr>
<td>Observe proper use of hand tools and test equipment</td>
<td>- Could cause personal injury to oneself or others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure temperatures at supply and return ducts</td>
</tr>
<tr>
<td>Adjust fan speed</td>
</tr>
<tr>
<td>Adjust fan cut-in and cut-out and high limit switches</td>
</tr>
<tr>
<td>Adjust supply registers and dampers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine if air distribution is adequate</td>
</tr>
<tr>
<td>Determine proper control adjustments according to mfgs.</td>
</tr>
</tbody>
</table>

**Tools, Equipment, Materials, Objects Acted Upon**

<table>
<thead>
<tr>
<th>STK Thermometer</th>
<th>Humidity too high</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Inadequate heating or cooling comfort in certain areas</td>
<td></td>
</tr>
</tbody>
</table>

**SAFETY – HAZARD**

| - Observe proper use of hand tools and test equipment |
| - Failure to isolate area where air distribution is causing customer dissatisfaction |
| - Could cause personal injury to oneself or others |

**ERRORS**

| - Inadequate heating or cooling comfort in certain areas |
| - Humidity too high |

**CUES**

| - Determine if air distribution is adequate |
| - Determine proper control adjustments according to mfgs. |
### SCIENCE

- Indestructibility of energy and matter.
- Work input, work output, friction and efficiency in simple machines.
- Centrifugal forces developed by bodies in rotation.

### Behavioral Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers
- Use of numbers without calculation coding (mfg. data plate)
- Fundamental operations (Calculation)
- Addition algorithm
- Subtraction algorithm
- Basic measurement skills and concepts
- Instruments (thermometer)
- Measurement (non-geometric)
- Weight
- Temperature
- Basic geometry skills and concepts
- Geometric relationships (ducts)

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Schematic
- VOM-Continuity
- Components/Wiring diagram
- Service order

#### SKILLS & CONCEPTS

- Terminology
- Wiring diagram
- Detail inference
- Visual analysis
- Logic
- Recognition of symbols
- Informational report
- Terminology
- Clarity of expression
Duty IV Installing Warm Air Heating Systems

1 Install furnace gas—oil—electric
### Task Statement

**IV-1 Install Furnace Gas—Oil—Electric**

<table>
<thead>
<tr>
<th>Tools, Equipment, Materials, Objects Acted Upon</th>
<th>Performance Knowledge</th>
<th>Safety – Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK SS-1-5-6-7-8-9 25-26</td>
<td>Position furnace</td>
<td>Do not lift loads from a bending position. Always lift from a squatting position with back straight</td>
</tr>
<tr>
<td></td>
<td>Install blower package</td>
<td>Ground power equipment and use with care</td>
</tr>
<tr>
<td></td>
<td>Install duct work</td>
<td>Care in the use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Install plumbing</td>
<td>Care in working with gas, oil, electric power</td>
</tr>
<tr>
<td></td>
<td>Wire furnace</td>
<td>Potential back injury or rupture</td>
</tr>
<tr>
<td></td>
<td>Check operation</td>
<td>Electrical shock or personal injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injury to oneself or others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Explosion or fire</td>
</tr>
</tbody>
</table>

### Decisions

- Determine location for furnace
- Position furnace for accessibility to chimney and duct work

### Cues

- Survey premises for proper fuel supply, power supply and proper size unit

### Errors

- Inadequate utilities or improper positioning or adequate size unit would result in faulty installation
### SCIENCE

Simple machines used to gain mechanical advantage [STK]
Work input, work output friction and efficiency. [V belt drive on blower]
Effect of heating cooling on expansion of materials [bi metal]
Centrifugal forces developed by bodies in rotation [Blower blade]

Behavioral Science.
Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautious to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

Rationals—Fractions
Use of Numbers: (without calculation)
[eyeballing floor area]
[ordering—[S.T.K.]]
[ordering—[mfg. data plate]]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts—Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships—Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
[used for—lapse]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts, and graphs—[capacity chart]

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Instructions</td>
<td>Process report</td>
</tr>
<tr>
<td>Viewing</td>
<td>Survey premises</td>
<td>Visual analysis</td>
</tr>
<tr>
<td>Speaking</td>
<td>Give instructions</td>
<td>Terminology/general vocabulary</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>

137
Duty V  Troubleshooting Warm Air Heating Systems

1 Check oil supply
2 Check oil pump
3 Check ignition system
4 Check heat exchanger
5 Check pilotband thermocouple assembly
6 Check wall thermostat
7 Check gas valve assembly
8 Check and adjust fan control
9 Check and adjust limit control
10 Check and adjust oil burner
11 Check natural gas manifold pressure
**TASK STATEMENT** V-1 CHECK OIL SUPPLY

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK VG</td>
<td>Check storage tank</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Check filter</td>
<td>Proper care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Check nozzle</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td>Check suction line on pump</td>
<td>Injuries to oneself or others</td>
</tr>
<tr>
<td></td>
<td>Check pump</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check ignition components</td>
<td></td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine if oil is being supplied to chamber

**CUES**
- No heat
- Unit runs but cycles on safety

**ERRORS**
Failure to locate lack of oil supply could result in unnecessary time on the job.
**ASK STATEMENT/V-1 CHECK OIL SUPPLY**

### SCIENCE

- STK
  - Oil supply
  - Simple machines used to gain mechanical advantage [STK]
  - Effect of heating and cooling on expansion of materials [Bimetal]
  - Fluids under pressure [Oil]

- Behavior Science:
  - Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
  - He should consult with superiors when difficulty arises.
  - He should answer questions which relate to the repair job at hand with honesty and integrity.
  - He should maintain a proper balance between pressure to complete job and pride in work.
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  - Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
  - He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers:
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
  - Ratio and proportion—oil
  - Basic Measurement Skills and Concepts
  - Instruments
  - Given an instrument of measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
    - Deductive/Inductive

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Speaking
- Writing

#### EXAMPLES

- Instructions
- Survey premises
- Verbal instructions
- Service order

#### SKILLS/CONCEPTS

- Process report
- Visual analysis
- Terminology/General Vocabulary
  - Clarity of expression
- Informational report
- Terminology
  - Clarity of expression
### Tools, Equipment, Materials, Objects Acted Upon
- STK
- Vacuum gauge

### Performance Knowledge
- Locate pump
- Hook up vacuum gauge
- Determine proper pump

### Safety - Hazard
- Proper care and use of hand tools
- Hazard
- Injuries to oneself or others

### Decisions
Determine type of pump and possibility of component failure

### Cues
- No heat
- No oil in chamber
- Unit cycles on safety

### Errors
Failure to make proper diagnosis would result in replacing pump without cause
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
</table>
| STK
Oil supply
Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]
Fluids under pressure [Oil] | Rational Numbers:
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive |

Behavior Science:
Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible. He should consult with superiors when difficulty arises. He should answer questions which relate to the repair job at hand with honesty and integrity. He should maintain a proper balance between pressure to complete job and pride in work. Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises. He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straightforward manner. He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism. |

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORMANCE MODES</td>
<td>EXAMPLES</td>
</tr>
</tbody>
</table>
| Reading
Viewing
Speaking
Writing | Instructions
Survey premises
Verbal instructions
Service order |
| PROCESS report
Visual analysis
Terminology/General Vocabulary
Clarity of expression |
| Informational report
Terminology
Clarity of expression |
## Task Statement

V-3 CHECK IGNITION SYSTEM

### Tools, Equipment, Materials, Objects Acted Upon
- STK, VOM

### Performance Knowledge
- Check power supply to unit
- Check ignition transformer
- Check electrodes
- Check cad cell
- Clean and adjust
- Check operation

### Safety - Hazard
- Proper care and use of hand tools
- Use care in check of power supply
- Hazard
- Injury to oneself or others may occur

### Decisions
- Determine what electrical component is defective or may need adjustment

### Cues
- No heat

### Errors
- Failure to make correct diagnosis would result in improper repair
(TASK STATEMENT) V-3 CHECK IGNITION SYSTEM

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [STK]</td>
<td>Rational Numbers:</td>
</tr>
<tr>
<td>Effect of heating and cooling on expansion of materials [Bimetal]</td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>Fluids under pressure [Oil]</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td></td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>Behavior Science:</td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td>Technician should talk on about the repair job and in a knowledgeable way, and</td>
<td>Ratio and proportion—oil</td>
</tr>
<tr>
<td>promote his employer whenever possible.</td>
<td>Basic Measurement Skills and Concepts</td>
</tr>
<tr>
<td>He should consult with superiors when difficulty arises.</td>
<td>Instruments</td>
</tr>
<tr>
<td>He should answer questions which relates to the repair job at hand with honesty and integrity.</td>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect</td>
</tr>
<tr>
<td>He should maintain a proper balance between pressure to complete job and pride in work.</td>
<td>to relative error, significant digits, and tolerance.</td>
</tr>
<tr>
<td>Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.</td>
<td>Basic Logic</td>
</tr>
<tr>
<td>He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.</td>
<td>Deductive/Inductive</td>
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<tr>
<td>He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.</td>
<td></td>
</tr>
</tbody>
</table>

| COMMUNICATIONS                                                                 |
| PERFORMANCE MODES                                                                 |
| EXAMPLES                                                                          |
| SKILLS/CONCEPTS                                                                 |
| Reading                                                                          | Schematic VOM continuity | Terminology |
| Viewing                                                                          | Components—Wiring diagram | Detail inference |
| Writing                                                                          | Service order             | Visual analysis |
|                                                                                   |                         | Logic          |
|                                                                                   |                         | Recognition of symbols |
|                                                                                   |                         | Informational report |
|                                                                                   |                         | Terminology      |
|                                                                                   |                         | Clarity of expression |
# Task Statement V-4: Check Heat Exchanger

<table>
<thead>
<tr>
<th>Tools, Equipment, Materials, Objects Acted Upon</th>
<th>Performance Knowledge</th>
<th>Safety - Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Locate heat exchanger</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Inspect heat exchanger</td>
<td>Proper care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Test heat exchanger</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injuries to oneself or others</td>
</tr>
</tbody>
</table>

### Decisions
- Determine that problem exists in heat exchanger

### Cues
- Customer complains of smelling fumes

### Errors
- Failure to determine that heat exchanger is defective could result in serious injury or possible death to the occupants.
### SCIENCE

Simple machines used to gain mechanical advantage

| Forces acting on a body immersed or floating in a liquid |

#### Behavior Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
- He should answer questions which relates to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

#### Rationals—Fractions

| Use of Numbers: (without calculation) |
| [eyeballing floor area] |
| Ordering—[S.T.K.] |
| Coding—[mfg. data plate] |

#### Fundamental Operations (Calculation)

| Addition algorithm |
| Subtraction algorithm |

#### Basic Arithmetic Skills and Concepts

| Rule of thumb |
| [approximation] |

#### Basic Geometry Skills and Concepts

| Knowledge of geometric relationships—Symmetry |
| [center point] |
| Determination of area, perimeter and diagonals of polygons with more than 4 sides |

#### Basic Arithmetic Skills and Concepts

| Property of comparison |

#### Basic Measurement Skills and Concepts

| Instruments—[tape] |
| Measurement: Geometric Linear Area |
| Reading and interpreting tables, charts, and graphs—[capacity chart] |

### COMMUNICATIONS

#### PERFORMANCE MODES

| Reading |
| Viewing |
| Speaking |
| Writing |

#### EXAMPLES

| Instructions |
| Position of mounting frame |
| Verbal instructions |
| Service order |

#### SKILLS/CONCEPTS

<p>| Process report |
| Visual analysis |
| Terminology/General vocabulary |
| Clarity of expression |
| Informational report |
| Terminology |
| Clarity of expression |</p>
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK, MAVT</td>
<td>Check pilot flame and adjustment</td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Check thermocouple</td>
<td>Proper care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Clean or replace defective components and thermocouple assembly</td>
<td>Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injuries to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
- Determine if pilot flame out of adjustment or thermocouple is possibly defective
- Determine type and size of components in assembly according to mfg. specifications

**CUES**
- No heat

**ERRORS**
- Failure to clean pilot or replace thermocouple or other components in pilot assembly would result in the problem continuing
- Parts could be changed unnecessarily or not fit properly
**ASK STATEMENT** V-5 CHECK PILOT AND THERMOCOUPLE ASSEMBLY

<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect of heating and cooling on expansion of materials [Bimetal]</td>
<td>Rational Numbers:</td>
</tr>
<tr>
<td>Transfer of heat from one body to another [heat on thermocouple]</td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td></td>
<td>Addition algorithm</td>
</tr>
<tr>
<td></td>
<td>Subtraction algorithm</td>
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<tr>
<td>Behavior Science:</td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.</td>
<td>Ratio and proportion—oil</td>
</tr>
<tr>
<td>He should consult with superiors when difficulty arises.</td>
<td>Basic Measurement Skills and Concepts</td>
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<td>He should answer questions which relate to the repair job at hand with honesty and integrity.</td>
<td>Instruments</td>
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<tr>
<td>He should maintain a proper balance between pressure to complete job and pride in work.</td>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.</td>
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<td>Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.</td>
<td>Basic Logic</td>
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<td>He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.</td>
<td>Deductive/Inductive</td>
</tr>
<tr>
<td>Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.</td>
<td>Use of Numbers: (without calculation)</td>
</tr>
<tr>
<td>He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.</td>
<td>Coding—Mfg. data plate.</td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Schematic MAVT</td>
<td>Terminology</td>
</tr>
<tr>
<td>Viewing</td>
<td>Components schematic</td>
<td>Wiring diagram</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Detail inference</td>
</tr>
</tbody>
</table>

Terminology
Wiring diagram
Detail inference
Visual analysis
Logic
Informational report
Terminology
Clarity of expression
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
</table>
| STK                                           | Check calibration of thermostat  
 Adjust  
 Replace if necessary  
 Check operation | Safety:  
 Always disconnect circuit and lock out breaker before working on electrical components  
 Care in use of hand tools  
 Hazard:  
 Electrical shock, electrical burn  
 Injury to oneself or others |

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
</table>
| Determine location of wall thermostat          | Burnier shots off on high limit  
 No heat  
 Not enough heat | Failure to perform task properly would result in faulty operation of unit |
| Determine type and calibration setting of thermostat according to mfg. specifications | | |
### SCIENCE

- Simple machines used to gain mechanical advantage (STK)
- Effect of heating and cooling on expansion of materials (Bimetal)
- Fluids under pressure (Oil)

### Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.

He should consult with superiors when difficulty arises.

He should answer questions which relates to the repair job at hand with honesty and integrity.

He should maintain a proper balance between pressure to complete job and pride in work.

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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers:
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
    - Ratio and proportion — oil
  - Basic Measurement Skills and Concepts
    - Instruments
    - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
    - Deductive/Inductive

- Uses of numbers (without calculation)
  - Coding — (Mfg. data plate)

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Central settings
- Central adjustments
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology
- Clarity of expression
# V-7 CHECK GAS VALVE ASSEMBLY

## TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

- STK
- VOM

## PERFORMANCE KNOWLEDGE

- Check valve
- Remove plunger and clean valve seat
- Check valve operation

## SAFETY – HAZARD

**Safety:**
Always disconnect circuit and lock out breaker before working on electrical components

**Hazard:**
Electrical shock—electrical burn

## DECISIONS

- Determine if there is voltage to valve
- Determine type of valve used

## CUES

- No heat
- Valve chatters

## ERRORS

Failure to make proper decisions would result in changing a part or making improper repair
**ASK STATEMENT**) V-7 CHECK GAS VALVE ASSEMBLY

<table>
<thead>
<tr>
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<th>MATH — NUMBER SYSTEMS</th>
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<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td>Fluids under pressure [Oil]</td>
<td>Addition algorithm</td>
</tr>
<tr>
<td>Magnetic fields of force [Solenoid]</td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td>Behavior Science:</td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td>Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.</td>
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<tr>
<td>He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.</td>
<td>Uses of Numbers: (without calculation)</td>
</tr>
<tr>
<td>Coding—Mfg. data plate</td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Specifications VOM</td>
<td>Detail inference</td>
</tr>
<tr>
<td>Viewing</td>
<td>Components</td>
<td>Visual analysis</td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td>Logic</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Informational report</td>
</tr>
<tr>
<td></td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>

| | 153 | 159 |
# Task Statement

**V-8 Check and Adjust Fan Control**

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<tr>
<th>Tools, Equipment, Materials, Objects Acted Upon</th>
<th>Performance Knowledge</th>
<th>Safety - Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Locate control</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td>Adjust control</td>
<td>Proper care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Check operations</td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Injuries to oneself or others</td>
</tr>
</tbody>
</table>

## Decisions

Determine control adjustment settings according to mfg's. specifications

## Cues

- Fan runs continuously
- Insufficient heat
- No heat

## Errors

Improper adjustment would result in continued erratic operation
**ASK STATEMENT** V-8 CHECK AND ADJUST FAN CONTROL

### SCIENCE

- Simple machines used to gain mechanical advantage (STK)

### MATH – NUMBER SYSTEMS

- Rational Numbers:
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
  - Ratio and proportion—oil
  - Basic Measurement Skills and Concepts
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
    - Deductive/Inductive

- Uses of Numbers: (without calculation)
  - Coding—Mfg. data plate

### Behavior Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
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- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
- **Viewing**
- **Writing**

#### EXAMPLES

- Specifications
- Central adjustments
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology
- Clarity of expression
**TASK STATEMENT** V-9 CHECK AND ADJUST LIMIT CONTROL

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
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</thead>
<tbody>
<tr>
<td>STK</td>
<td>Locate control</td>
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<td>Proper care and use of hand tools</td>
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<td>Check operations</td>
<td>Hazard:</td>
</tr>
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<td></td>
<td></td>
<td>Injuries to oneself or others</td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine control adjustment settings according to mfg. specifications

**CUES**
Unit short cycle
No heat

**ERRORS**
Improper adjustment would result in continued erratic operations
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
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</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [STK]</td>
<td>Rational Numbers:</td>
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<td>Effective heating and cooling on expansion of materials</td>
<td>Fundamental Operations (Calculation)</td>
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<td>Basic Measurement Skills and Concepts</td>
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<td>Instruments</td>
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<tr>
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</tr>
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<td>Uses of Numbers: (without calculation)</td>
</tr>
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<td></td>
<td>Coding—Mfg. data plate</td>
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<tr>
<td>Writing</td>
</tr>
<tr>
<td>EXAMPLES</td>
</tr>
<tr>
<td>Specifications</td>
</tr>
<tr>
<td>Central adjustments</td>
</tr>
<tr>
<td>Service order</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SKILLS/CONCEPTS</th>
</tr>
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<tbody>
<tr>
<td>Detail inference</td>
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<tr>
<td>Visual analysis</td>
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<tr>
<td>Terminology</td>
</tr>
<tr>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
(TASK STATEMENT) V-10 CHECK AND ADJUST OIL BURNER

| TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON |
| Check pump pressure |
| Check nozzle size |
| Check stack temperature |
| Obtain CO₂ reading |
| Obtain smoke density reading |
| Obtain over five draft readings |

| PERFORMANCE KNOWLEDGE |
| Safety: |
| Proper care and use of hand tools |
| Use care when working with oil |
| Hazard: |
| Injury to oneself or others may occur |
| Fire or explosion may occur |

| DECISIONS |
| Determine proper fining rate |
| Determine proper draft and over fire in pipe |
| Determine according to mfg's. specifications |

| CUES |
| Maintenance check |
| Use too much fuel |
| Smoke odor |
| Insufficient heat |

<p>| ERRORS |
| Failure to check and accurately adjust burner would cause unit to operate inefficiently |</p>
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage [S, K]</td>
<td>Rational Numbers:</td>
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<td>Addition algorithm</td>
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<td>Transfer of heat from one body to another [oil]</td>
<td>Subtraction algorithm</td>
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<tr>
<td>Behavior Science:</td>
<td>Basic Arithmetic Skills and Concepts</td>
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<tr>
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<td>Basic Measurements Skills and Concepts Instruments—[DG, CO2K, DST, SGA] Given an instrument of measure, determine precision and or accuracy with respect to relative error, significant digits, and tolerance [DG, CO2K, DST, SGA]</td>
</tr>
<tr>
<td>Uses of Numbers: (without calculation) Coding—[Mfg. data plate] Basic Arithmetic Skills and Concepts Ratio and proportion [oil]</td>
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<table>
<thead>
<tr>
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</tr>
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<th>SKILLS/CONCEPTS</th>
</tr>
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<tbody>
<tr>
<td>Reading</td>
<td>Specifications Instruments Components Instruments Service order</td>
<td>Detail inference Visual analysis Logic Informational report Terminology Clarity of expression</td>
</tr>
<tr>
<td>Viewing</td>
<td></td>
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<tr>
<td>Writing</td>
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</tbody>
</table>
# Task Statement

**V-11 Check Natural Gas Manifold Pressure**

## Tools, Equipment, Materials, Objects Acted Upon
- Standard Tool Kit
- Manometer

## Performance Knowledge
- Connect manometer to manifold
- Take reading of the manometer
- Compare reading of manometer and gas meter dial to mfg. BTU rating
- Adjust regulator accordingly

## Safety - Hazard
- Safety:
  - Make sure area is clear and metering device securely mounted away from fire and hands away from flame
- Hazard:
  - Improper adjustment can cause back flash when burner lights or is extinguished

## Decisions
- Remove plug from manifold and connect manometer

## Cues
- Improper fire in unit causing loss of BTU input and insufficient operation

## Errors
- Regulator set too high will cause overfiring and burn out heat exchanger
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Ratio and Proportion</td>
</tr>
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<table>
<thead>
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| EXAMPLES |
| Instructions |
| Service order |

<table>
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<tr>
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</tbody>
</table>
Duty VI Servicing and Repairing Warm Air Heating Systems

1 Replace heat exchanger
2 Remove and replace oil pump
3 Remove and replace cad cell
4 Remove and replace oil nozzle
5 Remove and replace electrodes
6 Remove and replace limit control
7 Remove and replace fan control
8 Remove and replace gas valve
9 Remove and replace wall thermostat
10 Remove and replace pilot safety
11 Replace blower motor shaft and bearings
12 Replace belt drive blower motor
13 Replace direct drive blower motor
## Task Statement: VI-1 Replace Heat Exchanger

### Tools, Equipment, Materials, Objects Acted Upon

- STK

### Performance Knowledge

- Locate heat exchanger
- Remove heat exchanger
- Replace heat exchanger
- Check unit operations

### Safety - Hazard

**Safety:**
- Care and proper use of hand tools
- Use care when working with gas, oil, or electricity

**Hazard:**
- Injury to oneself or others may occur
- Fire or explosion may occur

### Decisions

Determine proper replacement according to mfg's. model and serial nos.

### Cues

Crack or hole found in heat exchanger

### Errors

Failure to install proper heat exchanger could result in unit not functioning properly and inefficiently.
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple machines used to gain mechanical advantage</td>
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<tr>
<td>Transfer of heat from one body to another</td>
<td></td>
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<tr>
<td>Relationship of force to distortion in an elastic body</td>
<td></td>
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</table>

| Rational Numbers: |
| Fundamental Operations (Calculation) |
| Addition algorithm |
| Subtraction algorithm |
| Basic Arithmetic Skills and Concepts |
| Basic Measurement Skills and Concepts |
| Instruments |
| Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance. |
| Basic Logic |
| Deductive/Inductive |

| Uses of Numbers: (without calculation) |
| Coding—(Mfg. data plate) |
| Basic Geometry Skills and Concepts |
| Knowledge of geometric relationships |

| COMMUNICATIONS |

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<tr>
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<td>Components</td>
<td></td>
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<tr>
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<td>Detail inference</td>
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<td></td>
<td>Clarity of expression</td>
<td></td>
</tr>
</tbody>
</table>
## TASK STATEMENT
**VI-2 REMOVE AND REPLACE OIL PUMP**

### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

- STK

### PERFORMANCE KNOWLEDGE

- Turn off oil supply
- Remove pump
- Replace pump
- Check operation

### SAFETY – HAZARD

- **Safety:**
  - Care and proper use of hand tools
  - Use care when working with gas, oil, or electricity
- **Hazard:**
  - Injury to oneself or others may occur
  - Fire or explosion may occur

### DECISIONS

- Determine replacement according to mfg's. model and serial Nos.

### CUES

- No suction of pump
- Leak in pump

### ERRORS

- Failure to make proper replacement could result in improper unit operation
**SCIENCE**

- Simple machines used to gain mechanical advantage [STK]
- Effect of heating and cooling on expansion of materials [Bimetal]
- Fluids under pressure [Oil]

**Behavior Science:**

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

**MATH – NUMBER SYSTEMS**

- Rational Numbers:
- Fundamental Operations (Calculations)
  - Addition algorithm
  - Subtraction algorithm
- Uses of Numbers: (without calculation)
  - Coding—Mfg. data plate
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion
  - [oil]

**COMMUNICATIONS**

**PERFORMANCE MODES**

- Reading
- Viewing
- Writing

**EXAMPLES**

- Data plate
- Mfg. instructions
- Components
- Service order

**SKILLS/CONCEPTS**

- Detail inference
- Visual analysis
- Informational report
- Terminology/General vocabulary
- Clarity of expression
### Task Statement
VI 3 REMOVE AND REPLACE CAD CELL

### Tools, Equipment, Materials, Objects Acted Upon
- STK
- VOM

### Performance Knowledge
- Disconnect power supply
- Locate CAD cell
- Remove CAD cell
- Replace CAD cell
- Check operation

### Safety - Hazard
- **Safety:**
  - Care and proper use of hand tools
  - Use care in checking power supply
- **Hazard:**
  - Injury to oneself or others may occur
  - Severe electrical shock may occur

### Decisions
Determine replacement according to mfg's. model and serial Nos.

### Cues
Cad cell shows open or no resistance

### Errors
Failure to make correct replacement could result in improper unit operation
<table>
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<tr>
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<tbody>
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<td>Subtraction algorithm</td>
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<tr>
<td>Ratio and proportion—oil</td>
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<tr>
<td>Basic Measurement Skills and Concepts</td>
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<tr>
<td>Uses of Numbers: (without calculation)</td>
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<tr>
<td>Coding—Mfg. data plate</td>
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</tr>
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<td></td>
</tr>
<tr>
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<td></td>
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<td>Purity of expression</td>
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<td>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</td>
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<td>SAFETY – HAZARD</td>
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<tr>
<td>STK</td>
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<td>Safety:</td>
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<td></td>
<td>Locate nozzle</td>
<td>Care and proper use of hand tools</td>
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<td></td>
<td>Remove nozzle</td>
<td>Use care when working with oil</td>
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<td>Replace nozzle</td>
<td>Hazard:</td>
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<td>Check operation</td>
<td>Injury to oneself or others may occur</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fire or explosion may occur</td>
</tr>
</tbody>
</table>

**DECISIONS**  
Determine correct nozzle replacement according to mfg's. model and serial Nos.

**CUES**  
No heat  
Nozzle plugged

**ERRORS**  
Failure to make correct replacement could result in improper unit operation
### SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]
Fluids under pressure [Oil]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- **Rational Numbers:**
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
    - Ratio and proportion—oil
  - Basic Measurement Skills and Concepts
  - Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
    - Deductive/Inductive
  - Uses of Numbers: (without calculation)
    - Coding—Mfg. data plate

### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
- **Viewing**
- **Writing**

#### EXAMPLES

- Data plate
- Mfg. instructions
- Components
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology/General vocabulary
- Clarity of expression
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY – HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Locate electrodes</td>
<td>Safety:</td>
</tr>
<tr>
<td></td>
<td>Remove electrodes</td>
<td>Proper care and use of hand tools</td>
</tr>
<tr>
<td></td>
<td>Replace electrodes</td>
<td>Use care in checking power supply</td>
</tr>
<tr>
<td></td>
<td>Make proper adjustments</td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td>Check operation</td>
<td>Injury to oneself or others may occur</td>
</tr>
</tbody>
</table>

**DECISIONS**

Determine if electrodes are defective

**CUES**

- No heat
- No spark

**ERRORS**

Failure to make proper replacement could result in improper unit operation

**SAFETY – HAZARD**

- Injury to oneself or others may occur
- Severe electrical shock may occur
**ASK STATEMENT:** VI-5 REMOVE AND REPLACE ELECTRODES

### SCIENCE

- Simple machines used to gain mechanical advantage [STK]
- Effect of heating and cooling on expansion of materials (Bimetal)

**Behavior Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer wherever possible.
- He should consult with superiors when difficulty arises.
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- He should maintain a proper balance between pressure to complete job and pride in work.
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- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH - NUMBER SYSTEMS

- **Rational Numbers:**
  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
  - Ratio and proportion—oil
  - Basic Measurement Skills and Concepts
  - Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
    - Deductive/Inductive
  - Uses of Numbers: (without calculation)
    - Coding—Mfg. data plate

### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
- **Viewing**
- **Writing**

- **EXAMPLES**
  - Data plate
  - Mfg. instructions
  - Components
  - Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology/General vocabulary
- Clarity of expression
<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>Disconnect power supply, Remove control, Install new control and adjust, Check operation</td>
<td>Safety: Disconnect power supply, Proper care and use of hand tools, Hazard: Electrical shock or burn may occur, Injury to oneself or others may occur</td>
</tr>
</tbody>
</table>

**DECISIONS**
Determine type of control according to mfg's. model and serial Nos.

**CUES**
Control defective

**ERRORS**
Failure to make proper replacement and adjustments would result in inefficient operation of the unit
### SCIENCE

- Simple machines used to gain mechanical advantage [S/K]
- Effect of heating and cooling on expansion of materials [Bimetal]

**Behavior Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
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- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

### MATH – NUMBER SYSTEMS

- **Rational Numbers:**
  - Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
  - Ratio and proportion—oil
  - Basic Measurement Skills and Concepts
  - Instruments
  - Given an instrument of measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  - Basic Logic
  - Deductive/Inductive
  - Uses of Numbers: (without calculations)
  - Coding—Mfg. data plate

### COMMUNICATIONS

#### PERFORMANCE MODES

- **Reading**
- **Viewing**
- **Writing**

#### EXAMPLES

- Data plate
- Mfg. instructions
- Components
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology/General vocabulary
- Clarity of expression
**TASK STATEMENT** VI-7 REMOVE AND REPLACE FAN CONTROL

**TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON**

| STK |

**PERFORMANCE KNOWLEDGE**

- Disconnect power supply
- Remove control
- Replace new control and adjust
- Check operation

**SAFETY - HAZARD**

- Safety:
  - Disconnect power supply
  - Proper care and use of hand tools
- Hazard:
  - Electrical shock or burn may occur
  - Injury to oneself or others may occur

**DECISIONS**

- Determine type of control according to mfg's. model and serial Nos.

**CUES**

- Control defective

**ERRORS**

- Failure to make proper replacement and adjustment would result in inefficient operation of the unit
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH - NUMBER SYSTEMS</th>
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</thead>
</table>
| Simple machines used to gain mechanical advantage [STK]  
Effect of heating and cooling on expansion of materials [Bimetal] | Rational Numbers:  
Fundamental Operations (Calculation)  
Addition algorithm  
Subtraction algorithm  
Basic Arithmetic Skills and Concepts  
Ratio and proportion—oil  
Basic Measurement Skills and Concepts  
Instruments  
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.  
Basic Logic  
Deductive/Inductive  
Uses of Numbers: (without calculation)  
Coding—Mfg. data plate |
| Behavior Science:  
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<td>PERFORMANCE MODES</td>
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</table>
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Mfg. instructions | Detail inference |
| Viewing | Components  
Service order | Visual analysis |
| Writing | Informational report  
Terminology/General vocabulary  
Clarity of expression | |
### TASK STATEMENT

**VI-8 REMOVE AND REPLACE GAS VALVE**

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
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<tbody>
<tr>
<td>STK</td>
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</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turn off fuel supply</td>
</tr>
<tr>
<td>Remove valve</td>
</tr>
<tr>
<td>Replace valve</td>
</tr>
<tr>
<td>Check valve operation</td>
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<tbody>
<tr>
<td>Safety:</td>
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<tr>
<td>Care and proper use of hand tools</td>
</tr>
<tr>
<td>Use care when working with gas</td>
</tr>
<tr>
<td>Hazard:</td>
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<td>Injury to oneself or others may occur</td>
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<tr>
<td>Fire or explosion may occur</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine type of valve and proper replacement according to mfg’s. specifications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas valve defective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to make proper replacement would result in unit not functioning properly</td>
</tr>
</tbody>
</table>
### TASK STATEMENT

**VI-8** REMOVE AND REPLACE GAS VALVE

**STK**

- Simple machines used to gain mechanical advantage
- Effect of heating and cooling on expansion of materials
- Magnetic fields of force
- Fluids under pressure

**BEHAVIORAL STANCE**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
- He should answer questions related to the repair job at hand with honesty and integrity.
- Emphasis should be placed upon performing the task at hand without unnecessary disruption of surrounding activities.
- He should enter only into those customer relations which pertain to the repair job at hand.
- Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and conducted in a straightforward manner.
- The technician should maintain a positive professional appearance to complete job and please customer.

### COMMUNICATIONS

**PERFORMANCE MODES**

<table>
<thead>
<tr>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SKILLS/CONCEPTS</strong></td>
</tr>
<tr>
<td><strong>READING</strong></td>
</tr>
<tr>
<td><strong>WRITING</strong></td>
</tr>
<tr>
<td><strong>VIEWING</strong></td>
</tr>
<tr>
<td><strong>LISTENING</strong></td>
</tr>
</tbody>
</table>

### MATH - NUMBER SYSTEMS

**RATIONAL NUMBERS**

- **Fundamental Operations (Calculation)**
  - Addition algorithm
  - Subtraction algorithm

- **Basic Arithmetic Skills and Concepts**
  - Ratio and proportion
  - Basic measurement skills and concepts
  - Inferences and conclusions

- **Basic Logic**
  - Deductive/Inductive

- **Uses of Numbers: (without calculation)**
  - Coding
  - Manufacturing data plate
  - Mfg. instructions
  - Components
  - Service order

- **Data plate**
  - Manufacturing information
  - General information
  - Intrusion detection
  - Intrusion prevention

- **Detailed inference**
  - Visual analysis
  - Informational report
  - Terminology/general vocabulary
  - Clarity of expression

### SCIENCE

**PERFORMANCE MODES**

<table>
<thead>
<tr>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SKILLS/CONCEPTS</strong></td>
</tr>
<tr>
<td><strong>READING</strong></td>
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<tr>
<td><strong>WRITING</strong></td>
</tr>
<tr>
<td><strong>VIEWING</strong></td>
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<tr>
<td><strong>LISTENING</strong></td>
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</tbody>
</table>

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- The technician should maintain a positive professional appearance to complete job and please customer.

**SIMPLE MACHINES**

- Simple machines used to gain mechanical advantage
- Simple machines used in simple machines

- Effect of force and distance on expansion of materials
<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine type and/or replacement thermostat according to mfg's. model and serial Nos.</td>
<td>Thermostat cannot be calibrated or adjusted</td>
<td>Failure to replace with proper thermostat would result in unit not performing to its capacity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORMANCE KNOWLEDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove thermostat</td>
</tr>
<tr>
<td>Replace thermostat and check calibration</td>
</tr>
<tr>
<td>Check operation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY -- HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety:</td>
</tr>
<tr>
<td>Proper care and use of hand tools</td>
</tr>
<tr>
<td>Hazard:</td>
</tr>
<tr>
<td>Injury to oneself or others may occur</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
### SCIENCE

- Simple machines used to gain mechanical advantage [STK]
- Effect of heating and cooling on expansion of materials [Bimetal]
- Transfer of heat from one body to another [Heat on bimetal]

### Behavior Science:

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete job and pride in work.
- Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
- He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
- Billing and discussion of costs should be accurate, honest and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

### MATH – NUMBER SYSTEMS

- Rational Numbers:

  - Fundamental Operations (Calculation)
    - Addition algorithm
    - Subtraction algorithm
  - Basic Arithmetic Skills and Concepts
    - Ratio and proportion—oil
  - Basic Measurement Skills and Concepts
    - Instruments
      - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
    - Basic Logic
      - Deductive/Inductive

- Uses of Numbers: (without calculation)
  - Coding-Mfg. data plate
  - Basic Measurement Skills and Concepts
    - Reading and interpreting representational graphs
      - [Wiring diagram]

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Viewing
- Writing

#### EXAMPLES

- Data plate
- Mfg. instructions
- Components
- Service order

#### SKILLS/CONCEPTS

- Detail inference
- Visual analysis
- Informational report
- Terminology/General vocabulary
- Clarity of expression
### Task Statement: VI-10 Remove and Replace Pilot Safety

#### Tools, Equipment, Materials, Objects Acted Upon
- STK

#### Performance Knowledge
- Turn off fuel supply
- Locate defective component
- Replace defective component
- Check for proper operation

#### Safety - Hazard
- **Safety:**
  - Proper care and use of hand tools
  - Use care when working with gas
- **Hazard:**
  - Injury to oneself or others may occur
  - Fire or explosion may occur

#### Decisions
- Determine what component in safety pilot assembly is defective
- Determine type and size or proper replacement according to mfg.'s model and serial Nos.

#### Cues
- No heat
- Customer must relight pilot or reset safety button

#### Errors
- Failure to replace proper component would result in complaint not being satisfied or continued erratic operation of the unit
**SCIENCE**

- Simple machines used to gain mechanical advantage (e.g., levers, pulleys, screws)
- Effect of heating and cooling on expansion of materials (e.g., metal, bimetal)
- Fluids under pressure (e.g., gas)

**Behavior Science:**

- Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
- He should consult with superiors when difficulty arises.
- He should answer questions which relate to the repair job at hand with honesty and integrity.
- He should maintain a proper balance between pressure to complete the job and pride in work.
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- Billing and discussion of costs should be accurate, honest, and performed in a straightforward manner.
- He should get along with his fellow employee and develop a relationship that will not hurt each other's professionalism.

**MATH – NUMBER SYSTEMS**

- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Uses of Numbers (Without Calculation)
  - Coding—Mfg. data plate
  - Basic Arithmetic Skills and Concepts
  - Ratio and proportion—Gas

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>PERFORMANCE MODES</th>
<th>EXAMPLES</th>
<th>SKILLS/CONCEPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Data plate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mfg. instructions</td>
<td></td>
</tr>
<tr>
<td>Viewing</td>
<td>Components</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Service order</td>
<td></td>
</tr>
</tbody>
</table>

**Examples:**

- Detail inference
- Visual analysis
- Informational report
- Terminology/General vocabulary
- Clarity of expression
(TASK STATEMENT) VI-11 REPLACE BLOWER MOTOR SHAFT AND BEARINGS

<table>
<thead>
<tr>
<th>TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON</th>
<th>PERFORMANCE KNOWLEDGE</th>
<th>SAFETY - HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Tool Kit</td>
<td>Disconnect blower from unit</td>
<td>Safety</td>
</tr>
<tr>
<td>Set blower bearings</td>
<td>Replace shaft and bearings in blower</td>
<td>Be sure cabinet or remaining parts are supported properly when repairing section is removed</td>
</tr>
<tr>
<td>Blower shaft</td>
<td>Reassemble blower in unit</td>
<td>Hazard:</td>
</tr>
<tr>
<td></td>
<td>Check rotation of blower to observe proper clearance</td>
<td>When disconnecting blower unit it can drop thus denting housing making it inoperable after repair</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DECISIONS</th>
<th>CUES</th>
<th>ERRORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>To replace bearings only or complete shaft and bearing unit</td>
<td>Noisy operation of blower unit</td>
<td>Improper location of shaft stops can cause enough friction to cause overloading of blower motor</td>
</tr>
</tbody>
</table>
### SCIENCE

Work input and work output, friction and efficiency in simple machines

### MATH – NUMBER SYSTEMS

Rational Numbers:

- Fundamental Operations (Calculation)
  - Addition algorithm
  - Subtraction algorithm
- Basic Arithmetic Skills and Concepts
  - Ratio and proportion—oil
- Basic Measurement Skills and Concepts
  - Instruments
    - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance
- Basic Logic
  - Deductive/Inductive

Uses of Numbers: (without calculation)
- Coding—Mfg. data plate

### COMMUNICATIONS

#### PERFORMANCE MODES

- Reading
- Writing

#### EXAMPLES

- Instructions
- Service order

#### SKILLS/CONCEPTS

- Process report
- Informational report
- Terminology
- Clarity of expression
### TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON
- Standard Tool Kit
- Rubber Mount Motor
- V-Belt
- Amprobe

### PERFORMANCE KNOWLEDGE
- Disconnect blower supply
- Remove motor and replace
- Rewire motor
- Install V-Belt—align and correct tension
- Check unit motor amp draw against motor rating

### SAFETY – HAZARD
- Safety
- Cover ends of disconnected wires
- Hazard:
  - Motor can be dropped causing injury to the workers feet or fingers due to the position while performing the task

### DECISIONS
- Proper HP motor

### CUES
- Inoperative blower

### ERRORS
- Improper wire connections motor runs wrong direction
<table>
<thead>
<tr>
<th>SCIENCE</th>
<th>MATH – NUMBER SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work input, work output, friction and efficiency in simple machines</td>
<td>Rational Numbers:</td>
</tr>
<tr>
<td></td>
<td>Fundamental Operations (Calculation)</td>
</tr>
<tr>
<td></td>
<td>Addition algorithm</td>
</tr>
<tr>
<td></td>
<td>Subtraction algorithm</td>
</tr>
<tr>
<td></td>
<td>Basic Arithmetic Skills and Concepts</td>
</tr>
<tr>
<td></td>
<td>Ratio and proportion—oil</td>
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<td></td>
<td>Instruments</td>
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<td></td>
<td>Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.</td>
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<td></td>
<td>Basic Logic</td>
</tr>
<tr>
<td></td>
<td>Deductive/Inductive</td>
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<td>EXAMPLES</td>
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<td>Instructions</td>
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<td>Service order</td>
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<tr>
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</tr>
<tr>
<td>Terminology</td>
</tr>
<tr>
<td>Clarity of expression</td>
</tr>
</tbody>
</table>
### Task Statement

**VI-13 Replace Direct Drive Blower Motor**

**To-Do List**
- Disconnect power supply
- Remove complete blower assembly
- Remove motor from mounting brackets and reinstall with previous H.P. and R.P.M. rated motor
- Check operation

**Safety:**
- Lifting in an unnatural position can cause back injury
- Keep hands free from blower compartment during checking operation—can cause cuts, bruises, and other injuries

**Hazards:**
- Lifting in an unnatural position can cause back injury
- Keep hands free from blower compartment during the checking operation—can cause cuts, bruises, and other injuries

**Decisions**
- Accessibility to the blower compartment

**Errors**
- Make wrong wiring connections

**Cues**
- Bent shaft on old motor
- Rotational speed of motor

**Tools, Equipment, Materials, Objects Acted Upon**
- Standard Tool Kit
- Direct Drive Motor
**SCIENCE**

- Work input, work output, friction and efficiency.

**MATH – NUMBER SYSTEMS**

- **Rational Numbers:**
- **Fundamental Operations (Calculation)**
  - Addition algorithm
  - Subtraction algorithm
- **Basic Arithmetic Skills and Concepts**
  - Ratio and proportion—oil
- **Basic Measurement Skills and Concepts**
  - Instruments
  - Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
- **Basic Logic**
  - Deductive/Inductive
- **Uses of Numbers: (without calculation)**
  - Coding—Mfg. data plate

**COMMUNICATIONS**

**PERFORMANCE MODES**

- Reading
- Writing

**EXAMPLES**

- Instructions
- Service order

**SKILLS/CONCEPTS**

- Process report
- Informational report
- Terminology
- Clarity of expression
Index: Standard Tool Kit

STK—Standard Tool Kit

1-Wire Brush
1-Scratch Awl
1-Needle Nose Pliers
1-Standard Screwdriver Set 12", 6", 4", Stubby, and Pocket Size
1-Allen Wrench Set
1-Phillips Screwdriver Set 8", 4", and Stubby
1-Set Open Adjustable Wrenches 12", 10", 8", 6", 4"
1-Channel Lock Pliers
1-Standard Pliers
1-Set 1/8" to 3/4"
1-Nut Driver Set 1/8" to 1/2"
1-Vaco Grip Pliers
1-Hand Drill
1-Nozzle Wrench
1-Inspection Mirror
1-Flashlight
1-Set Open Adjustable Wrenches 12", 10", 8", 6", 4"
Index: Test Equipment

TEST EQUIPMENT

AP
AMPROBE

AVI
AIR VELOCITY INDICATOR

AVM
AIR VELOCITY METER

CA
CAPACITOR ANALYZER

CO₂K
CO₂ KIT

CTK
COMBUSTION TEST KIT

DC
DIAL A CHARGE

DG
DRAFT GAUGE

DST
DIAL STACK THERMOMETER

ELD
ELECTRONIC LEAK DETECTOR

HLD
HALIDE LEAK DETECTOR

MAVT
MILLI AMP VOLT TESTER

MG
MANIFOLD AND GAUGES

PT
PRESTOLITE B TANK WITH TORCH HEAD

SGA
SMOKE GAUGE ANALYZER

SP
SLING PSYCHROMETER

TPT
TAYLOR PLENUM THERMOMETER

TT
THERMISTER THERMOMETER

UM
MANOMETER

VG
VACUUM GAUGE

VOM
VOLT OHM METER

VP
VACUUM PUMP

WM
WATT METER

196
Index: Standard Supplies

SS STANDARD SUPPLIES

1. PIPE JOINT COMPOUND
2. LEAK LOCK
3. SILVER SOLDER
4. SILVER SOLDER FLUX
5. COPPER TUBING
6. COPPER SWEAT FITTINGS
7. PIPE FITTINGS
8. GAS COCKS
9. REFRIGERATION VALVES
10. SEALING COMPPOUND
11. DRIERS
12. SIGHT GLASSES
13. MOISTURE INDICATORS
14. CYLINDER R-12
15. CYLINDER R-22
16. CYLINDER NITROGEN
17. REFRIGERATION OIL
18. IN LINE SERVICE VALVES
19. CAPACITORS
20. OVERLOAD PROTECTORS
21. RELAYS
22. BELTS
23. FILTERS
24. TAPE: ELECTRICIANS, FURNACE, ARMAFLEX, FRICTION
25. ASSORTED WIRE NUTS, SHEET METAL SCREWS, NUTS, BOLTS
APPENDIX

Duty I

1. Install Window Air Conditioner .......................................................... x
2. Install Central Air Conditioner ............................................................. x
3. Install Self Contained Commercial Refrigeration Unit ......................... x
4. Install Remote Condensing Unit with Single Cabinet ......................... x
5. Install Remote Commercial Condensing Unit with Multiple Cabinets .... x

Duty II

1. Hook Hermetic Compressor Direct to Power Supply ......................... x
2. Check Circuitry of the Compressor, Protector and Relay ..................... x
3. Check Capacitor ................................................................................. x
4. Check Circuitry of Defrost System .................................................... x
5. Check Circulation Fan Motors ............................................................ x
6. Check and Adjust Control Thermostat ............................................. x
7. Attach Manifold and Gauges to Service Valves and Check Pressure .... x
8. Check Compressor Efficiency ............................................................. x
9. Locate Leak in a Refrigeration System Using Electronic Leak Detector x
10. Locate Leak in a Refrigeration System Using Halide Torch ............... x
11. Locate Leak in a Refrigeration System Using Bubble Method .......... x
12. Check Unit Operation—Oil Level—Sight Glass—Moisture Indicator ... x
13. Check and Adjust Automatic Expansion Valve ................................. x
14. Check, Test, and Adjust Thermostatic Expansion Valve .................... x
15. Check and Adjust Pressure Motor Control ....................................... x
16. Check and Adjust Low Pressure Safety Control ................................ x
17. Check and Adjust High Pressure Safety Control .............................. x
18. Adjust and Calibrate Oil Pressure Control ...................................... x
19. Check Icemaker for Operation ......................................................... x
20. Check and Adjust Water Valve ........................................................ x
21. Check Hot Gas Defrost Solenoid and Valve ........................................ x
<table>
<thead>
<tr>
<th>Task</th>
<th>Refrigeration</th>
<th>Refrigeration</th>
<th>Conditioning</th>
<th>Heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>23. Check Humidity with Sling Psychrometer</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>24. Check and Adjust Humidstat</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>25. Check Condensate Pump and Drain</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>26. Check Blower Assembly and Filter</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>27. Check Heat Pump Reversing System</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>28. Check System for Burn Out and Install Cleanup Kit</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>29. Service Electronic Air Cleaner</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

**Duty III**

1. Evacuate a Refrigeration System                                     | x            | x            | x            |         |
2. Pump System Down into Receiver Tank                                  |               |               | x            | x       |
3. Recharge System Using Sight Glass                                    |               |               | x            | x       |
4. Recharge System Weighing in Refrigeration                            |               |               | x            | x       |
5. Fill Dial a Charge                                                    |               |               |              | x       |
6. Recharge a Refrigeration System Using Dial a Charge                  |               |               |              | x       |
7. Remove and Replace Control Thermostat                                 |               |               | x            | x       |
8. Remove and Replace Defrost Timer                                     |               |               | x            | x       |
9. Remove and Replace Motor Overload Protector                           |               |               | x            | x       |
10. Remove and Replace Capacitor                                         |               |               | x            | x       |
11. Remove and Replace Defrost Heater                                    |               |               | x            | x       |
12. Remove and Replace Defrost Terminator                                |               |               | x            | x       |
13. Remove and Replace Relay                                             |               |               | x            | x       |
14. Remove and Replace Fan Motors                                       |               |               | x            | x       |
15. Repair Leak in Copper Lines of System                                |               |               | x            | x       |
16. Remove and Replace Compressor                                       |               |               | x            | x       |
17. Add Oil to System                                                    |               |               | x            | x       |
18. Remove Restriction from Capillary Tube                              |               |               | x            | x       |
19. Remove and Replace Capillary Tube                                   |               |               | x            | x       |
20. Remove and Replace Automatic Expansion Valve                         |               |               | x            | x       |
21. Remove and Replace Thermostatic Expansion Valve                     |               |               | x            | x       |
22. Install a Drier, Sight Glass or Moisture Indicator                  |               |               | x            | x       |
23. Remove and Replace High or Low Pressure Safety Control              |               |               |              | x       |
24. Remove and Replace High or Low Pressure Motor Control               |               |               |              | x       |
25. Remove and Replace Oil Pressure Safety Control                      |               |               | x            | x       |
26. Remove and Replace Oil Pressure Safety Control                      |               |               | x            | x       |
27. Remove and Replace Oil Pressure Safety Control                      |               |               | x            | x       |
28. Repair Evaporator with Epoxy                                        |               |               | x            | x       |
29. Remove and Replace Condensation Pump Motor                           |               |               | x            | x       |
30. Remove and Replace Humidstat                                         |               |               | x            | x       |
31. Balance the Air Conditioning System                                  |               |               |              | x       |

199
Duty IV

1. Install Furnaces Gas—Oil—Electric ..............................................

Duty V

1. Check Oil Supply .................................................................
2. Check Oil Pump ......................................................................
3. Check Ignition System ..........................................................
5. Check Pilot and Thermocouple Assembly ............................
6. Check Gas Valve Assembly ....................................................
7. Check Wall Thermostat ..........................................................
8. Check and Adjust Fan Control ..............................................
9. Check and Adjust Limit Control .........................................
10. Check and Adjust Oil Burner ..............................................
11. Check Natural Gas Manifold Pressure ................................

Duty VI

1. Replace Heat Exchanger ......................................................
2. Remove and Replace Oil Pump .............................................
3. Remove and Replace Cad Cell ..............................................
4. Remove and Replace Oil Nozzle .........................................
5. Remove and Replace Electrodes ..........................................  
6. Remove and Replace Limit Control ....................................
7. Remove and Replace Fan Control ......................................
8. Remove and Replace Gas Valve ...........................................
9. Remove and Replace Wall Thermostat .................................
10. Remove and Replace Pilot Safety ........................................
11. Replace Blower Motor Shaft and Bearings ........................
12. Replace Belt Drive Blower Motor ......................................
13. Replace Direct Drive Blower Motor ...................................

200