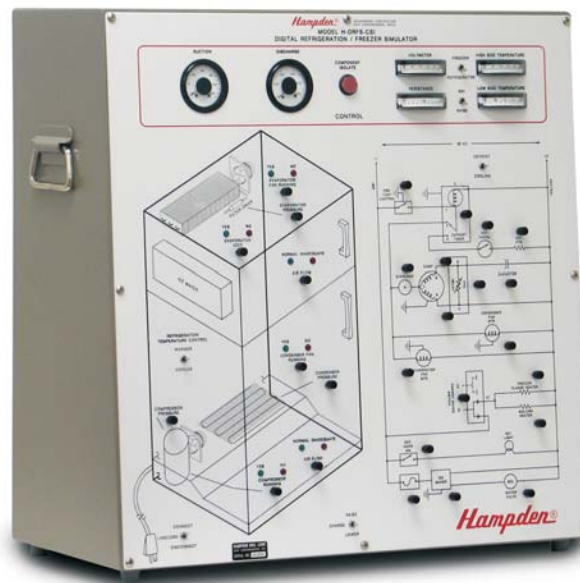


# INSTRUCTOR'S GUIDE



## HAMPDEN MODEL H-DRFS-CSI Digital Refrigerator/Freezer Simulator



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# SAFETY

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## READ INSTRUCTIONS COMPLETELY BEFORE STARTING TRAINER

Normal operation of the trainer is not considered hazardous. However, the RECOMMENDED PROCEDURES SHOULD BE FOLLOWED to be sure that the classroom instruction is performed under the safest possible conditions. If the operator knows and understands the construction and operation of the parts in the system, it will help one to operate it safely.

THE OPERATOR SHOULD ALWAYS BE ALERT to experimental procedures which may be a hazard to the operator or be injurious to the equipment. Every control device and switch has a specific operational application. Be certain that all connections and control settings are carefully managed. NO SETTINGS SHOULD BE MADE INDISCRIMINATELY.

STUDENT USE OF THE TRAINER SHOULD ALWAYS BE SUPERVISED. Even the most experienced student should never operate it while alone.

Always have good ventilation and good lighting when operating the system.

Instruments and equipment used in testing, while durable, are sensitive to abuse. When connecting an electrical instrument into a circuit, make sure that the instrument and its settings are within the voltage and current range which may be applied to the instrument. This will protect the trainer, the instrument, and the operator.

Use extreme CAUTION when making electrical measurements. Remember, it is too late to learn that a circuit is live after one has touched it. Be certain that the operator knows if the trainer is on or off at all times. Never handle live circuits when in contact with pipes, other wires, or damp floors.

Keep the floor clean of debris — oil, water, or other slippery material.

An electrical short across a ring or wristwatch can cause a severe burn. It is best to remove all watches and jewelry when working on electrical equipment.

Always disconnect the electrical power source before isolating any component, electrical or otherwise, from the trainer system. Lock the switches open to prevent someone from closing them during demonstration or test procedure.

Hands-on experience is an important teaching tool. However, most accidents are the result of CARELESSNESS—when students are concentrating on their lessons, they tend to momentarily neglect safety. Therefore, like the service technicians, the students must train themselves to do things safely. They must study the job for its safety problems before starting and think about the safety aspects before each step.

Refer all repairs to qualified personnel.

# TRAINER SET-UP

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## **I. Install Measurement Computings INSTACAL I/O Driver for MC PCI-DI096**

1. Insert Measurement Computings CD into CD-ROM drive.
2. Select the option to install “INSTACAL.”

## **II. Run Instacal Software**

1. Add the "Demo Board" as board #Ø.
2. Exit / Close Instead.

## **III. H-DRFS Software Installation**

1. Insert the Hampden H-DRFS-CSI CD. AutoRun will start the Hampden setup program. If AutoRun is disabled double click the "HECTRANS" icon on CD ROM drive.
2. Select “Install Hampden’s Digital Refrigerator / Freezer Simulator, (H-DRFS-CSI) from the drop down menu, then click “OK”.
3. Follow the instructions on the screen. If system files are outdated, click “OK” to update. Then restart the computer and continue with Step 1.
4. Keep all newer files when prompted during install.
5. Setup should take 1–2 minutes depending on computer system.
6. Click “EXIT” button on the “HECTRANS” screen.

## H-DRFS Program Operation

### Instructor Quick-Start

**NOTE:** Insure all cables are connected prior to starting the program.

1. Run Program from the “Start” button on the desktop, select:  
|START | PROGRAMS | HAMPDEN ENGINEERING | HDRFS V.---
2. The simulator starts up in “Normal” mode and will respond to all adjustments made to software or hardware switches.
  - a. The student menu is greyed-out until a student logs in.
  - b. Set and Clear Malfunction are greyed-out on the instructor menu until a student logs in.
3. Student Login
  - a. Click “Student | Login” on the menu bar.
  - b. At “Student ID” prompt, enter a unique “Alpha-Numeric” identifier (“123ABC”).
  - c. If not in database, the student is prompted to enter: Last Name, First Name, Student ID (unique), Current Grade (A+), Year of Graduation (2002). Click "OK".

**Note:** Remember the Student ID; this identifier is always used by the student to Login when using the simulator.
  - d. Verification; “Is this you ?”, displays student name and grad year. If in the database, the student will be asked to verify the name associated with the I.D. selecting “YES” will log-in the student, “NO” will return to the student Login screen to enter a different I.D.
3. Set Malfunction (enabled after a student is logged-in)
  - a. Password protected (unless Instructor Disabled in Maintenance/Options).
  - b. Click “Instructor | Set Malfunction” on the menu bar.
  - c. Select a malfunction (1–21) and click"OK" or double-click a malfunction.
  - d. Click “OK” at the start timer message.
4. Diagnose problem in complaint box.
  - a. Press test buttons on the H-DRFS panel to check system status.

- b. Analyze meter readings.
- c. Apply corrective action.

#### 5. Corrective Action

- a. Click “Student | Corrective Action” on the menu bar or press “Corrective Action” button in the Student Panel on screen.
- b. Select a corrective action and click “OK”. The corrective action is applied to the simulator.
- c. For each corrective action selected, student attempts increases by 1.

#### 6. Verify Corrective Action

Press test buttons on H-DRFS panel to check system status. If the corrective action fixed the fault, the H-DRFS will operate normally, the malfunction was corrected.

#### 7. Declare Working

- a. Click “Student | Declare Working” on the menu bar or press “Corrective Action” button in the Student Panel on screen.
- b. If the correct action fixed the fault, then a message stating “Your choice was correct” is displayed, and the system resets to normal operation mode.
- c. If incorrect, the student is directed to try again.

#### 8. Defrost Timer

- a. Increase (defrost) or decrease (cooling) the momentary toggle switch to move the defrost timer indicator into the 55 to 60 Red Zone to engage defrost mode.

#### 9. Panel Tests (any system mode)

- a. Meter Test—Select “Testing | Meters” on the menu bar. Selecting “All” slowly increases all meters. “Individual” will display the description of a meter in meter description and slowly increase and decrease the meter. Click “Start” to start testing and “Stop” to quit. Click “Next” button for next meter.
- b. Lamp Test—Select “Testing | Lamps” on the menu bar. Selecting “All” blinks all lamps on and off at one second intervals. “Individual” will display the description of a lamp in lamp description as it blinks. Click “Start” to start testing and “Stop” to quit. Click “Next” button for next lamp.
- c.

Switch Test — Select “Testing | Switches” on the menu bar displays switch pressed in “Last Switch Detected.” Press panel test buttons and watch screen for description. Click “Start” to start testing and “Stop” to quit.

#### 10. System Modes

- a. Normal—No malfunctions. AC works and operates normally. **Note:** The system must be in normal mode to exit program.
- b. Malfunction—Malfunction listed in complaint block is in control of the simulator.
- c. Testing—Meter, lamp or switch test in progress.

#### 11. Maintenance

- a. Password Protected.
- b. Students—New, Edit, Delete, Search.
- c. Progress—Time in seconds and attempts
- d. LogFiles—Displays student logfile of recorded actions during simulation.
- e. Print Summary—Prints a list of students, malfunction timing in seconds, and number of attempts.
- f. Options—Networking: Set central database on network.  
—Password Access: Enable or disable “Set Malfunction” password protection for student access.

#### 12. View Logfiles

Click “Student | View Log” on the menu bar. Presents a step-by-step log of simulator/student activity in operating the simulator.

## C H A P T E R

## 1

## INTRODUCTION

**Digital Refrigerator/Freezer**

Before you begin to solve problems in a refrigerator/freezer, you have to know how the system operates. Then you have to accumulate data, sort it out, and pinpoint the problem. The system uses a set of refrigeration gauges, a voltmeter, an ohmmeter, and temperature gauges.

The Hampden **MODEL H-DRFS** Digital Refrigerator/Freezer Simulator is designed for future service technicians to develop proper troubleshooting techniques, and become familiar with control components, systems and wiring diagrams. In addition, they learn how to test circuits and electrical components.

The faults create either open conditions for the electrical components and devices or simulate an abnormality in the refrigerant system. To create a specific fault, the fault is selected by clicking “Instructor | Set Malfunction” on the menu bar. To fix the fault, select “Student | Corrective Action” on the menu bar or press “Corrective Action” button, then, after confirming the corrective action, declare the system operational by clicking “Student | Declare Working” on the menu bar or press the “Declare Working Button.”

**Note:** To set a Malfunction, a student must be logged into the simulator.

## Temperature Control

The temperature control on the H-DRFS Refrigerator/Freezer Simulator is a toggle switch on the panel which increases (warmer) or decreases (cooler) the desired temperature setting for the refrigerator. The refrigerator temperature setting is displayed on the computer in the “Refrigerator Temperature Setting” box.

Note that the refrigerator control is a baffle type control which vents air from the freezer area to the refrigerator box. As such, it is based upon a freezer temperature of -2°F (-20°C). The box temperature will always equal or exceed the freezer temperature.

## Defrost Control Temperature

The defrost heater is activated once every hour simulated time for a period of 4 minutes. When the defrost thermostat senses a temperature of 115°F (45°C), it opens for the duration of the defrost cycle. It will close again at (approx.) 68°F (20°C). If the freezer temperature is below 68°F (20°C), the thermostat should show continuity. While the thermostat will open at a fixed temperature, the duration of the closure is temperature dependent. The temperature is affected by (among other causes):

1. Initial temperature (lower temperatures required a larger defrost time).
2. Ice on evaporator (higher temperature).
3. Refrigerant over charge.

Since the defroster control simulates a cam-driven timer, the defrost cycle (also the run cycle) can be interrupted by a line cord disconnect. From a timer point of view, when the line cord is re-connected, the defrost (run) cycle continues from the point of interruption.

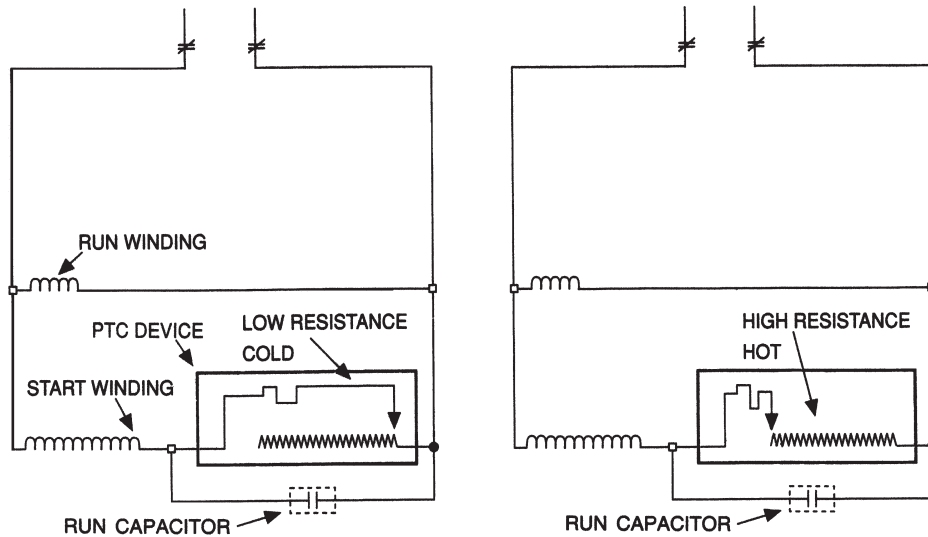
## System Charge

The raise/lower momentary toggle switch allows for an increase/decrease in refrigerant charge. The level of system charge will affect several simulator parameters. In general:

	Suction Pressure	Discharge Pressure	Charge Lamps
<b>Overcharge</b>	0.0	149	High
<b>Undercharge</b>	0.0	99	Low
<b>Normal</b>	0.0 psi	124 psi	Normal

## PTC Relay

The PTC Relay is a positive temperature coefficient device. It is used to stop the flow of current to the start winding of the compressor. When the temperature of the PTC resistor increases, the resistance increases, effectively stopping current flow through the start winding.



DRFS-CSI-F1.DXF.



**C H A P T E R**

**2**

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**PROCEDURE FOR STARTING  
THE SIMULATOR**

**Start the Simulator**

- Step 1. Click “Start” button on the desktop in Windows.
- Step 2. Select “Programs” from the pop-up “Start Menu”.
- Step 3. Select “Hampden Engineering” from the pop-up “Programs Menu”
- Step 4. Click “HDRFS” from the pop-up “Hampden Engineering Menu”.

**Inserting A Malfunction**

- Step 1. Click “Instructor | Set Malfunction” on the menu bar.
- Step 2. Enter Password, if protected. See Maintenance—Options Menu.
- Step 3. Select a malfunction from the list and click “OK” button.
- Step 4. Click “OK” button to start timer
- Step 5. The complaint changes from “None” to the malfunction number and the complaint.

## Clearing a Malfunction—Instructor

- Step 1. Click “Instructor | Clear Malfunction” on the menu bar.
- Step 2. Enter the instructor password and click “OK.”

## Clearing a Malfunction—Student

Clearing a malfunction for a student is a two-step process.

- Step 1. First, the student must analyze the complaint for the malfunction and select a “Corrective Action” by clicking “Student | Corrective Action” on the menu bar or “Corrective Action” button and selecting one of the listed actions. Then the student continues analysis to determine if the corrective action fixed the complaint.
- Step 2. The student must declare the H-DRFS working by clicking “Student | Declare Working” on the menu bar or “Declare Working” button. If the corrective action was correct, the student is notified and the simulator returns to “Normal” mode. If incorrect, the student is directed to select a different corrective action.

## Isolating a Component

After a malfunction has been entered, the student must troubleshoot the system to find the appropriate “Corrective Action.” It may be necessary to Isolate and test the resistance of a component. This is done by:

1. Disconnecting the line cord (setting “Line Cord” switch to Disconnect).
2. Isolating the component (pressing the “Component Isolate” button). The “Component Isolate” will light.
3. Testing the resistance of the isolated component (press the “Test” button next to the appropriate schematic symbol in the ladder diagram portion of the simulator). Resistance is read in ohms. If the meter reads full scale with the toggle in the RX1 position, place it in the RX100 position. If it still reads full scale, it is considered open or infinite resistance.
4. To test a capacitor, complete Steps 1 and 2. Next press the Test button next to the capacitor. If the capacitor is OK, you should see an upward deflection on the ohmmeter. If the capacitor is not OK, no deflection will be seen (Zero to infinite climb).

Once the line cord is re-connected, (toggle placed into the Connect position) the “Component Isolate” button lamp will shut off (pressing the “Isolate” button a second time will also shut off the component isolate lamp).

## **Increasing/Decreasing Refrigerant**

The toggle labeled CHARGE located on the bottom center of panel is a momentary toggle switch. If an increase in charge is desired, hold the toggle switch UP (raise). If a decrease is desired, hold the toggle switch to the DOWN (lower). Once the toggle is let go, the charge stops increasing or decreasing — and the low, normal and high lamps (on the computer screen) for refrigerant charge indicate the current state of the refrigerant.



**C H A P T E R**

**3**

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**SYSTEM TESTS**

**1. Testing Menu**

The testing menu contains three choices used to test the panel hardware: meters, lamps, and switches.

**2. Meter Testing**

- a. Click “Testing | Meters” on the menu bar.
- b. The Meters test screen appears.
- c. Select “All” or “Individual” option button for testing.
- d. “All” – increases/decreases all meters in unison with the percent meter on screen when “Start” button is pressed. Click “Stop” button to stop testing.
- e. “Individual” – increases/decreases individual meters in unison with the percent meter on screen when the “Start” button is pressed. Clicking “Next” button advances to the next meter in sequence. Proceed through all panel meters until all of them have been confirmed by their descriptive name on screen. Click “Stop” button to stop testing.
- f. Click “Close” button to return to main screen.

### 3. **Lamp Tests**

- a. Click “Testing | Lamps” on the menu bar.
- b. The lamps test screen appears.
- c. Select “All” or “Individual” option button for testing.
- d. “All” - blinks all lamps when the “Start” button is pressed. This ensures a general test that the outputs on the digital I/O card are functioning correctly. Click “Stop” button to stop testing.
- e. “Individual” – This test ensures that all of the connections for lamps are correctly configured and connected. It specifically identifies an individual lamp and blinks it on and off. Click “Start” button, the lamps description is displayed on screen and the corresponding lamp on the panel blinks in unison with the lamp image on the screen. Click “Next” to advance to the next individual lamp in the sequence. Proceed through all panel lamps until all of them have been confirmed by descriptive name on screen. Click “Stop” button to stop testing. Click “Close” to return to the main screen.

### 4. **Switch Testing**

- a. Click “Testing | Switches” on the menu bar.
- b. Click “Start” button.
- c. Press each button on the panel, the description of the button is displayed in the “Last Switch Detected” box. Verify the button pressed and the description displayed are the same for all switches on the panel.
- d. Click “Stop” button to stop testing.
- e. Click “Close” to close the switch testing window.

**C H A P T E R**

**4**

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**COMPUTERIZED H-DRFS-CSI TRAINER**

The Hampden H-DRFS-CSI Digital Refrigerator/Freezer Simulator demonstrates the principles of operation and troubleshooting techniques on a modern refrigerator/freezer. There are many types of systems in service, each with their own unique parts. This trainer assumes standard parts that might be encountered in the field, but the troubleshooting and repair techniques would be similar for all refrigerator/freezer systems.

The Hampden H-DRFS-CSI has a Time-Temperature Initiation, Temperature-Time Termination defrost system. This defrost system checks every 60 minutes for defrost operation. If the coils are 28°F (-2.2°C) or less when the timer checks, then defrost begins as follows:

1. The timer relay energizes which turns the fan off by changing the position of the switch.
2. The defrost relay energizes when the switch timer changes position.
3. The defrost heater is energized.

When the coils as sensed by the freezer temperature reach 5 minutes in defrost mode, the defrost will turn off.

The following is a sample of the possible malfunctions with the possible faulty components for the Hampden MODEL H-DRFS-CSI Refrigeration/Freezer Simulator..

1. All System Components Inoperative — This malfunction could be caused by any component malfunction. The first thing to do is to check the input power of the system. Is the cord connected?

Possible faulty components are:

- a) Freezer temperature control not closing, stuck open.
- b) Defrost timer motor not operating, open coil.
- c) Defrost timer switch not closing, broken cam.
- d) Compressor overload open due to short.
- e) Compressor start winding open.
- f) Compressor run winding open
- g) Condenser fan motor not operating
- h) Evaporator fan motor not operating
- i) Refrigerator door switch stuck open

2. No Cooling — This malfunction may be directly caused by an inoperative compressor or compressor motor. Other components that could indirectly cause the compressor to shut down are an inoperable condenser or evaporator fan which in turn would turn off the compressor.

Possible faulty components are:

- a) Compressor Motor Start or Run Windings or associated circuitry of the compressor, such as the run capacitor and thermal overload. An open condition in the start winding could result in the motor being unable to start because of insufficient starting torque. The motor tries to start on the run windings alone. An open in the run winding would cause an increase current in the start winding which results in the compressor shutting off when the thermal overload opens.
- b) Evaporator Fan Inoperable - Lack of air flow across the evaporator coils results in low suction pressure on the compressor.

- c) Condenser Fan Inoperable - Lack of air flow across the condenser coils results in high discharge pressure on the compressor.
  - d) Compressor main contacts and associated circuitry including an Open Circuit condition on the overload contact.
3. Does Not Defrost — This malfunction would cause a degradation of performance in the cooling mode eventually cooling to stop.

Possible faulty components are:

- a) Timer motor not operating.
  - b) Defrost temperature switch (thermometer) stuck open.
  - c) Defrost heater open.
  - d) Freezer temperature control open.
4. Evaporator fan not running.

Possible faulty components are:

- a) Evaporator Fan Motor faulty - Windings open
5. Condenser fan not running.

The possible faulty components are:

- a) Condenser fan motor faulty - Windings open
6. The compressor will not shut off - One condition that will cause the compressor not to shut off, is that the thermostat is faulty so the compressor remains energized and calls for cooling when it should be off. A faulty thermostat could easily be checked by turning the thermostat switch to the off position.

- a) Faulty thermostat, contact stuck in the closed position on the cooling side.
  - b) Faulty defrost timer.
7. Degraded Performance in Cooling Mode — Degraded performance in cooling mode may be caused by the following condition with a possible faulty component as follows:
- a) Decreased Evaporator Air Flow from Dirty Filters, resulting in high compressor discharge pressure.



**C H A P T E R**

**5**

**CORRECTIVE ACTIONS (CA)**

1. Replace Evaporator Fan
2. Replace Compressor Starting PTC Relay
3. Replace the Compressor
4. Replace Defrost Timer Control
5. Replace Compressor Overload
6. Replace Defrost Thermostat
7. Replace Freezer Temperature Control
8. Repair Refrigerant Leak
9. Replace Defrost Timer Control
10. Replace Refrigerator Door Switch
11. Replace the Compressor
12. Clean Condenser Coil
13. Repair Partially Plugged Capillary Tube at Drier
14. Replace Water Valve Solenoid
15. Replace Condenser Fan
16. Replace Defrost Heater
17. Replace Cabinet Mullion Heater
18. Repair Refrigerant Leak
19. Replace Ice Maker Fuse
20. Replace Defrost Limit Control
21. Replace Energy Saver Switch
22. Replace Freezer Temperature Control
23. Replace Ice Maker



**C H A P T E R**

**6**

**COMPLAINTS**

This malfunction list has been developed to represent typical functional problems. Some symptoms have been modified to present the student with a more strident indication of trouble in the system.

**Malfunction No. and Description**

- No. 1 Not cold enough in refrigerator compartment.
- No. 2 Not enough refrigeration.
- No. 3 No refrigeration.
- No. 4 Freezer too warm.
- No. 5 No refrigeration.
- No. 6 Food freezing in refrigerator.
- No. 7 No refrigeration.
- No. 8 Not cold enough. Unit runs continuously.
- No. 9 No refrigeration.
- No. 10 Not enough refrigeration.
- No. 11 Not enough refrigeration.
- No. 12 Runs continuously.

**Malfunction No. and Description**

- No. 13 No refrigeration.
- No. 14 No ice from ice maker.
- No. 15 Not enough refrigeration.
- No. 16 No refrigeration.
- No. 17 Condensation on cabinet.
- No. 18 No refrigeration.
- No. 19 No ice from ice maker.
- No. 20 Freezer too warm.
- No. 21 Condensation on cabinet.
- No. 22 Refrigerator temperature below normal.
- No. 23 No ice from ice maker.



# Malfunction #1

## Complaint

Not cold enough in refrigerator compartment.

## Meter Readings

Voltage to freezer fan	(115V)
Freezer temperature	(+10°F)

## Corrective Action

Replace evaporator fan.

## Procedure

- Step 1. Test for Volts at evaporator fan. (115V)
- Step 2. Disconnect evaporator fan.
- Step 3. Isolate fan.
- Step 4. Test fan motor resistance (reads infinite ohms).
- Step 5. Press CA replace evaporator fan.
- Step 6. No complaint.
- Step 7. Test resistance (reads approximately 20 ohms).
- Step 8. Reconnect line cord.

## Explanation

If the circulating fan is defective, the refrigerator compartment will increase. The fan moves air from the freezer compartment to the refrigerator. The freezer will still maintain temperature.



## Malfunction #2

### Complaint

Not enough refrigeration.

### Meter Readings

Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Compressor	(Off)
Condenser fan	(On)
Evaporator fan	(On)

### Corrective Action

Replace compressor starting PTC relay.

### Procedure

- Step 1. Check voltage across the compressor run winding (read 0V).
- Step 2. Check voltage across compressor start winding (read 0V).
- Step 3. Test voltage across relay (read 120V).
- Step 4. Press replace compressor starting PTC relay.
- Step 5. No complaint.

### Explanation

If the starting relay is defective, the compressor will try to start on the run windings. The run windings does not have the strength to start the compressor, so an over current occurs and the compressor overload opens.



## Malfunction #3

### Complaint

No refrigeration.

### Meter Readings

Compressor	(Off)
Voltage across compressor run winding	(120V)
Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Test the compressor. (Not Running)

### Corrective Action

Replace the compressor.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate compressor element.
- Step 3. Test resistance across compressor run winding (read open).
- Step 4. Press CA replace the compressor.
- Step 5. No complaint.
- Step 6. Test resistance across compressor run winding (now read approx 4 ohms).
- Step 7. Reconnect line cord.

## **Explanation**

If the compressor is defective, there will be no refrigeration. The condensing fan motor will operate as well as the evaporator fan.

## Malfunction #4

### Complaint

Freezer too warm.

### Meter Readings

Freezer temperature	(20°F)
Voltage across defrost timer	(120V)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(Insufficient)
Evaporator ice	(Yes)

### Corrective Action

Replace defrost timer control.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate defrost timer element.
- Step 3. Test resistance across timer element (infinite ohms).
- Step 4. Press CA replace defrost timer control.
- Step 5. Reconnect line cord.
- Step 6. No complaint.

## **Explanation**

If the evaporator does not get defrosted, ice will collect on it.

The evaporator fan will not be able to circulate enough air to keep the refrigerator compartment at its required temperature.

**NOTE:** On a normal operating refrigerator, the evaporator may have to be defrosted manually after a malfunction.

## Malfunction #5

### Complaint

No refrigeration.

### Meter Readings

Voltage across compressor run winding	(0 V)
Voltage from defrost timer	(120V)
Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Evaporator fan	(On)
Condenser fan	(On)
Compressor	(Off)

### Corrective Action

Replace compressor overload.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate overload.
- Step 3. Test resistance of overload (infinite ohms).
- Step 4. Press CA replace compressor overload.
- Step 5. No complaint.
- Step 6. Reconnect line cord.

### Explanation

If the compressor overload falls open the compressor common wire is interrupted.



## Malfunction #6

### Complaint

Food freezing in refrigerator.

### Meter Readings

Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Evaporator fan	(Off)
Evaporator ice	(Yes)

### Corrective Action

Replace defrost thermostat.

### Procedure

- Step 1. Test voltage across defrost heater (read 0V).
- Step 2. Test voltage across defrost thermostat (read 120V).
- Step 3. Disconnect line cord.
- Step 4. Isolate defrost thermostat element.
- Step 5. Read resistance across thermostat (read open).
- Step 6. Press CA replace defrost thermostat.
- Step 8. No complaint.
- Step 9. Reconnect line cord.

## **Explanation**

If the defrost thermostat is open, the defrost heater will not be energized. The ice will keep building up until the air flow through the evaporator is restricted.

**NOTE:** The evaporator may have to be defrosted manually.

## Malfunction #7

### Complaint

No refrigeration.

### Meter Readings

Freezer temperature	(20°F)
Refrigerator temperature	(50°F)
Voltage across freezer temperature control	(120V)
Voltage across defroster timer	(0V)

### Component Checks

Evaporator fan	(Off)
Condenser fan	(Off)
Compressor	(Off)

### Corrective Action

Replace freezer temperature control.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate freezer temperature control.
- Step 3. Check resistance across freezer temperature control (infinite ohms).
- Step 4. Press CA replace freezer temperature control.
- Step 5. No complaint.
- Step 6. Reconnect line cord.

### Explanation

If the thermostat is defective, the unit will be inoperable. The light will operate (when the door is opened). This is good indication that there is power to the unit.



## Malfunction #8

### Complaint

Not cold enough. Unit runs continuously.

### Meter Readings

Freezer temperature	(15°F)
Refrigerator temperature	(50°F)

### Component Checks

Freezer fan	(On)
Freezer air flow	(Normal)
Condenser fan	(On)
Compressor	(On)

### Corrective Action

Repair refrigerant leak.

### Procedure

- Step 1. Check voltage across defrost heater (read 0V).
- Step 2. Check compressor watts (read approx. 180 watts).
- Step 3. Check gas pressures with the low and high side meters (read 6 inches vacuum Hg and 85 psi).
- Step 4. Adjust charge control, increase refrigerant gas.
- Step 5. Re-check gas pressures (observe little or no change).
- Step 6. Press CA repair refrigerant leak.
- Step 7. No complaint.

## **Explanation**

If the unit is short of refrigerant the high side pressure will be low because the compressor does not have to work as hard. The low side pressure will be lower. The wattmeter will also be lower because the compressor is not operating at its rated capacity.

## Malfunction #9

### Complaint

No refrigeration.

### Meter Readings

Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Evaporator fan	(Off)
Condenser fan	(Off)
Compressor	(Off)

### Corrective Action

Replace defrost timer control.

### Procedure

- Step 1. Check voltage across temperature control (120V).
- Step 2. Check voltage at defrost thermostat (read 0V).
- Step 3. Press CA replace defrost timer control.
- Step 4. No complaint.

### Explanation

If the defrost timer control contact is open the compressor and fans will not operate.



## Malfunction #10

### Complaint

Not enough refrigeration.

### Meter Readings

Refrigerator temperature (50°F)

### Component Checks

Evaporator fan	(On)
Evaporator ice	(No)
Refrigerator light	(On)

### Corrective Action

Replace refrigerator door switch.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate refrigerator door switch element.
- Step 3. Check resistance across door switch (read 0 ohms).
- Step 4. Press CA replace refrigerator door switch.
- Step 5. No complaint.
- Step 6. Reconnect line cord.

### Explanation

If the light is on in the refrigerator cabinet the heat from the light may increase the temperature.



## Malfunction #11

### Complaint

Not enough refrigeration.

### Meter Readings

Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(Normal)
Condenser fan	(On)
Refrigerator light	(Off)

### Corrective Action

Replace the compressor.

### Procedure

- Step 1. Check voltage across defrost heater (read 0 volts).
- Step 2. Check watts across compressor (read 180 (too low)).
- Step 3. Check gas pressures (40 psi suction, 75 psi discharge).
- Step 4. Press CA replace the compressor.
- Step 5. No complaint.

### Explanation

Under normal operation, the suction pressure will be approximately 5 psi and the discharge pressure will be approximately 125 psi.

If the compressor valves do not seal properly, the discharge gases will enter the suction side – raising its pressure and temperature.



## Malfunction #12

### Complaint

Runs continuously.

### Meter Readings

Refrigerator temperature (42°F)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(Normal)
Condenser fan	(On)
Condenser air flow	(Inadequate)

### Corrective Action

Clean condenser coil.

### Procedure

Step 1. Press CA clean condenser coil.

Step 2. No complaint.

### Explanation

If the condenser is plugged up with dirt and dust it cannot remove as much heat from the refrigerant.

The compressor will also run hot because it is running more often. This may shorten the life of the compressor.

The design of many refrigerants are compact and are conducive to plugging with dirt or dust.



## Malfunction #13

### Complaint

No refrigeration.

### Meter Readings

Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Compressor	(On)
Freezer air flow	(Normal)
Condenser air flow	(Normal)
Evaporator fan	(On)
Condenser fan	(On)
Evaporator ice	(No)

### Corrective Action

Repair partially plugged capillary tube at drier.

### Procedure

- Step 1. Check discharge pressure.
- Step 2. Check suction pressure 29 inches Hg.
- Step 3. Press CA replace partially plugged capillary tube at drier.
- Step 4. No complaint.

### Explanation

If the capillary tube gets plugged, it will usually be at its entry. The entry is at the outlet of the dryer.

The suction pressure will be in a vacuum because no refrigerant is flowing to the evaporator. The discharge pressure may be higher than normal because it pumps the refrigerant into the condenser.



## Malfunction #14

### Complaint

No ice from ice maker.

### Meter Readings

Freezer temperature	(0°F)
Refrigerator temperature	(40°F)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(normal)

### Corrective Action

Replace water valve solenoid.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate Ice Maker Element and fuse.
- Step 3. Check ohms across fuse (read 0 ohms).
- Step 4. Check ohms across motor (read approx. 4400 ohms).
- Step 5. Check ohms across water valve solenoid (infinite ohms).
- Step 6. Press CA replace water valve solenoid.
- Step 7. No complaint.
- Step 8. Reconnect line cord.

### Explanation

If the water valve solenoid coil is defective, the water will not flow to the icemaker.



## Malfunction #15

### Complaint

Not enough refrigeration.

### Meter Readings

Freezer temperature	(10°F)
Refrigerator temperature	(45°F)
Voltage across condenser fan	(120V)
Suction pressure	(10 psi)
Discharge pressure	(175 psi)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(Normal)
Condenser fan	(Off)
Compressor	(On–Off)

### Corrective Action

Replace condenser fan

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate condenser fan element.
- Step 3. Check ohms across condenser fan (infinite ohms).
- Step 4. Press CA replace condenser fan.
- Step 5. No complaint.
- Step 6. Reconnect line cord.

## **Explanation**

A defective condensing fan will not cool the condenser. The discharge side pressure will overheat. The compressor may be damaged over a period of time because it is drawing more current and the motor windings are hotter than design temperature. The overload will open the circuit because of over current.

Also the compressor overload may open the circuit because it is mounted on the compressor. The condenser fan is sometimes positioned in a manner that moves air over the compressor, providing more cooling.

## Malfunction #16

### Complaint

No refrigeration.

### Meter Readings

Freezer temperature	(20°F)
Refrigerator temperature	(50°F)

### Component Checks

Freezer fan	(Off)
Condenser fan	(Off)
Compressor	(Off)

### Corrective Action

Replace defrost heater.

### Procedure

- Step 1. Check watts (read approx 500 (too high)).
- Step 2. Check voltage across defrost heater (120V).
- Step 3. Press CA replace defrost heater.
- Step 4. No complaint.

### Explanation

If the defrost timer control is defective and stuck in defrost, the compressor will not run and the defrost heater will be energized until the evaporator temperature reaches 50F and the defrost thermostat opens. When the defrost thermostat cools down, the defrost heater will be energized again.



## Malfunction #17

### Complaint

Condensation on cabinet.

### Meter Readings

Voltage across freezer Mullion heater	(120V)
Compressor may be	(Running)
Refrigerator temperature	(40°F)

### Corrective Action

Replace cabinet Mullion heater.

### Procedure

- Step 1. Test voltage at energy saver switch (120V).
- Step 2. Test voltage at mullion heater (120V).
- Step 3. Disconnect line cord.
- Step 4. Isolate cabinet (freezer) Mullion heater element.
- Step 5. Check resistance across heater Mullion (infinite ohms).
- Step 6. Press CA replace cabinet Mullion heater.
- Step 7. No complaint.
- Step 8. Reconnect line cord.

### Explanation

If water vapor (moisture) in the air comes in contact with the cooler cabinet, it condenses into a liquid and collects on it. It will only happen in humid weather. By heat the cabinet the water vapor does not condense.



## Malfunction #18

### Complaint

No refrigeration.

### Meter Readings

Freezer temperature	(20F)
Refrigerator temperature	(50F)
Suction pressure	(28 inches Hg)
Discharge pressure	(5 psi)

### Component Checks

Compressor	(On)
Evaporator fan	(On)
Condenser fan	(On)
Evaporator ice	(No)

### Corrective Action

Repair refrigerant leak.

### Procedure

- Step 1. Disconnect power cord.
- Step 2. Observe suction and discharge pressures 0 psi.
- Step 3. Press CA repair refrigerant leak.
- Step 4. No complaint.

### Explanation

If the unit has no refrigerant the compressor will operate to satisfy the thermostat.

The suction pressure will be in a vacuum and the discharge pressure may have a slight amount of pressure (air in the system).



## Malfunction #19

### Complaint

No ice from ice maker.

### Meter Readings

Voltage to ice maker (0V)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(Normal)
Compressor	(On)

### Corrective Action

Replace ice maker fuse.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate ice maker/fuse.
- Step 3. Check resistance across ice maker fuse (infinite ohms).
- Step 4. Press CA replace ice maker fuse.
- Step 5. No complaint.
- Step 6. Reconnect line cord.

### Explanation

If the fuse is defective, voltage will not be present at the ice maker.



## Malfunction #20

### Complaint

Freezer too warm.

### Meter Readings

Freezer temperature	(10°F)
Refrigerator temperature	(45°F)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(No)
Evaporator ice	(Yes)
Compressor	(On)

### Corrective Action

Replace defrost limit control.

### Procedure

- Step 1. Set defrost control to defrost.
- Step 2. Check voltage to defrost thermostat (0V).
- Step 3. Check voltage from line to freezer temperature control (read 120V).
- Step 4. Check voltage at defrost limit control (read 120V).
- Step 5. Press CA replace defrost limit control.
- Step 6. No complaint.
- Step 7. Reset defrost timer to cooling position.

## **Explanation**

If the system does not defrost every six hours, ice will build up on the evaporator coil. The evaporator fan velocity will be reduced because of the ice so the refrigerator section temperature will rise.

## Malfunction #21

### Complaint

Condensation on cabinet.

### Meter Readings

Freezer temperature	(0°F)
Refrigerator temperature	(40°F)

### Component Checks

Evaporator fan	(On)
Freezer air flow	(Normal)
Evaporator ice	(No)

### Corrective Action

Replace energy saver switch.

### Procedure

- Step 1. Check voltage across mullion heater (0V).
- Step 2. Check voltage across energy saver switch (120V).
- Step 3. Disconnect line cord.
- Step 4. Isolate energy saver element.
- Step 5. Check resistance across energy saver switch (infinite ohms).
- Step 6. Press CA replace energy saver switch.
- Step 7. No complaint.
- Step 8. Reconnect line cord.

## **Explanation**

If water vapor (moisture) in the air comes in contact with the cooler cabinet, it condenses into a liquid and collects on it. It will only happen in humid weather. By heating the cabinet the water vapor does not condense.

## Malfunction #22

### Complaint

Refrigerator temperature below normal.

### Meter Readings

Refrigerator temperature (30°F)

### Component Checks

Compressor	(On)
Evaporator fan	(On)
Condenser fan	(On)

### Corrective Action

Replace freezer temperature control.

### Procedure

- Step 1. Adjust temperature control to warmest setting (compressor does not shut off).
- Step 2. Press CA replace freezer temperature control.
- Step 3. No complaint.

### Explanation

If the unit runs continuously, the items in the refrigerator section will freeze. As we know, everything we eat contains water and 32°F is its freezing temperature.

The discharge pressure will be lower because there is less heat load on the evaporator.



## Malfunction #23

### Complaint

No ice from ice maker.

### Meter Readings

Voltage across ice maker (120V)

### Corrective Action

Replace ice maker.

### Procedure

- Step 1. Disconnect line cord.
- Step 2. Isolate ice maker.
- Step 3. Check resistance across ice maker (read open).
- Step 4. Press CA replace ice maker.
- Step 5. No complaint.
- Step 6. Reconnect line cord.

### Explanation

If voltage is present at the icemaker, it means that the rest of the electrical circuit is functioning properly.



# WORK SHEET

Date: \_\_\_/\_\_\_/\_\_\_

Instructor: \_\_\_\_\_ Student: \_\_\_\_\_

Ambient Temp.: \_\_\_\_\_

Complaint:

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Diagnostic Tests and Readings:

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Corrective Actions:

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Instructor Comments:

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Malfunction No. \_\_\_\_\_ Student Attempts: \_\_\_\_\_ Elapsed Time: \_\_\_\_\_

