Chapter 2 – Professional Air-conditioning Systems

EXPERIMENT 2.3 – TROUBLESHOOTING TECHNIQUES FOR THE DIAGNOSIS AND REPAIR OF FAULTS AND FAULTS SIMULATION

Name	Class/Period	Date

1. Objectives:

At the end of this experiment session, you will be able to:

- Identify the air-conditioning systems faults.
- Approach a fault in a logic and systematic way.
- Troubleshooting and solve air-conditioning systems' faults.

2. Equipment Required:

- Main Platform Unit
- Professional Air Conditioning Panel

3. Discussion:

This experiment deals with troubleshooting and solving faults.

In order to locate faults, a technician must understand the cooling system operation theoretically as explained in previous experiments. Cooling systems are usually closed systems, thus understanding is very important.

Usually when troubleshooting, thermometers are used to measure the temperature in the evaporator and the condenser, but hand touch is also sometimes good enough. The sight glass is also used to check the cooling liquid quantity and its level of dryness.

Troubleshooting is based on logic and knowledge. The knowledge will enable us to understand processes occurring in the system. Each and every component in the system must be understood (its meaning and function) and also the relation between the components.

Further on the various faults will be described written as customer complaints with additional details from a technician's first observation. The possible causes of the fault will be examined and possible solutions noted.

4. Discussion: The recommended steps for fault solution

1. Identify the defective function.
2. Identify the part (of the unit which does not work).
3. Identify the fault.
4. Identify the solution.
5. Apply the solution.
6. General system check.

5. Discussion: Customer complaints

The customer complaints are shown in a table. The table includes the customer description, additional observation contributing to the understanding of the fault, possible fault causes, and suggested solutions.

1. Complaint – The room temperature is too high and the air-conditioning system is not working.

More observation	Possible cause of problem	Remedy
a) Suction pressure is above normal. The compressor Is not working.	1) Condensing unit (compressor or air condenser) do not have electrical connection due to: a) Open contactor. b) Broken fuse. c) Disconnected electrical line.	a) Shut down the breaker switch. b) Fix fuse. c) Fix line.
	2) Room thermostat or low pressure pressustat or high pressure pressustat have one of the following problems: a) Thermostat or low/high pressure pressustat.	a) Adjust.

	b) Control contactors are burned/broken.	b) Replace.
b) Suction pressure is higher than normal and high compression pressure. High evaporator temperature.	1) High pressure pressustat is in open position due to: a) High discharge pressure due to high ambient temperature (the outside air is used to cool the condenser). b) The condenser's fan is not working.	a) Check if the condenser is clean. b) Check the condenser fan. Replace.
c) The compressor works, but the suction and discharge pressures are almost the same.	The RV system is stuck and the refrigerant does not flow in the system.	a) Knock on the RV to free it. b) Replace the RV module.
d) Suction pressure lower than normal, starting point and low discharge pressure.	A block that presents refrigerant flow due to: a) Filter dryer is blocked. b) Malfunction of solenoid valve. Leakage of refrigerant out of the system.	a) Clean or replace filter. b) Fix or replace the valve. c) Find location of leakage, fix, and add refrigerant.

2. Complaint – The room temperature is too high and the compressor is short cycling.

More observation	Possible cause of problem	Remedy
a) Suction pressure is high, discharge pressure high, the compressor is hot.	Overload switch shuts off the power, due to: a) Input voltage is too low. b) Short circuit in the compressor.	a) Check the Electricity line. b) Fix or replace the compressor.
b) Suction pressure normal, discharge pressure high.	a) Air condenser is dirty. b) Ambient temperature is too high.	a) Clean. b) Increase size of air condenser.

3. Complaint – The room temperature is too high and the compressor is running a lot.

More observation	Possible cause of problem	Remedy
a) Suction pressure is higher than normal. Discharge pressure is high.	The compressor is over loaded due to storage of very hot products.	Instruct the operators to reduce the temperature of the products before they are stored in the room, or wait for the temperature to drop.

4. Complaint – The room temperature is too low and the compressor is running a lot.

More observation	Possible cause of problem	Remedy
a) Suction pressure is very low. Discharge pressure is low.	a) Thermostat or pressostat are not properly adjusted. b) Thermostat or pressostat are defective.	a) Adjust. b) Fix or replace.

5. Complaint – The room temperature is cold enough, but the compressor is running a lot.

More observation	Possible cause of problem	Remedy
a) Suction pressure is above normal. Discharge pressure is low. The compressor head temperature and liquid line temperature are low.	1) Malfunction in the compressor due to low voltage in the supply line.	a) Reduce the electrical loads in the supply line.
b) Noise from thermo static expansion valve.	2) Lack of gas.	b) Add gas.

6. Complaint – Noisy system (unusual noise).

More observation	Possible cause of problem	Remedy
a) Noise from the compressor.	Lower level of oil in the compressor, or malfunction.	a) Add oil as needed.
b) Noise from the compressor motor.	The motor bearings are malfunctioned.	b) Replace the motor.

7. Complaint – Stinking smell.

More observation	Possible cause of problem	Remedy
a) The refrigerated storage area stinks.	The coil in the air cooler is dirty.	a) Clean the coil with water and fat solvent.
b) The area near the compressor stinks.	The compressor is overheating.	b) Improve the ventilation around the compressor and install an overload switch.

8. Complaint – The air cooler located in the cold storage room is loaded with ice.

More observation	Possible cause of problem	Remedy
a) The water pan is full with ice.	Defrost cycle fail to work due to:	
	a) The de-freezing clock is broken.	a) Replace the clock.
	b) The heating body is not working.	b) Replace the electrical heating element.

6. Procedure:

General instructions for fault procedure:

- The faults are typical faults in air-conditioning and cooling systems.
- Most of the faults are mechanical because the panels in the training system cannot be disassembled for locating electrical short-cuts and disconnections.
- Read each fault carefully and monitor every event in the system.
- The faults are made by the software (ON/OFF reaction of the system's components). You cannot repair the fault, only observe its effects. The repair is done theoretically.
- It is recommended to perform the faults after completing the experiments (when the chamber is cold), in order to better diagnose the faults.
- Some of the faults will cause the system to disconnect resulting extreme working pressures. Thus, before each fault a theoretical and practical explanation about its nature and what is needed to take into consideration in order to notice the changes occurring in the system is written out.

- Some of the faults will cause a delay in the compressor's operation, thus attention must be paid to the times when the compressor is not working.
- Movement from one fault to another may be done immediately, but the earlier remarks must be taken into consideration; allow the system to get back to work for at least 5 minutes to give the chamber enough time to cool down.
- The system protects itself. The system's controller cancels the fault when the system reaches an unsafe situation or when the system can be damaged.

Step 1: Check that the Professional Air Conditioning Panel is properly installed on the refrigeration and air-conditioning general system MAIN PLATFORM UNIT according to the instructions described in the book's preface.

Step 2: Check that the MAIN PLATFORM UNIT MONITOR and PROGRAM switches are at OFF position.

A ground leakage relay, a semi-automatic switch, and a main power switch are installed in a main power box located on the rear panel.

Step 3: Connect the MAIN PLATFORM UNIT power supply cable to the Mains.

Step 4: Check that the high voltage ground leakage relay and the semi-automatic switch are ON.

Step 5: Set the Auto/Manual switch (located on the bottom left of the simulator) to the Manual position.

Step 6: Turn ON the main POWER switch located on the main power box on the rear panel.

Step 7: Turn ON the monitor power switch.

Step 8: The FAULT display should display the number 00. If not, use the keys above the FAULT display to display the number 00 (no fault condition) on the FAULT 7-SEG. display and press the ENTER key beneath this display.

Step 9: The STATE display should display the number 00 (no operation program).

Step 10: On the LCD display you should find the following table:

V1	V2	V3	V4	V5	V6	V7	RV	CM	OF

It doesn't matter which mode operates the faults. In this case, we work in TEV mode with thermostat control. This mode works with all the modules.

TEV mode:

Step 11: Change the STATE number to 11 (for °C) or 12 (for °F) and press ENTER

.

Step 12: Lower the PROGRAM switch and raise it.

Step 13: On the LCD display you should find the following tables:

V1	V2	V3	V4	V5	V6	V7	RV	CM	OF
ON	ON			ON	ON			ON	

S1	D1	S2	D2	SP	PD	E1	L1	E2	RT
20°C	5°C					LO			

LP	HP	T1	T2	T3	T4	T5	T6	HU	T8

Observe the sight glass and check that there are no bubbles and the SP value reached the stabilization point.

Step 14: The cooling chamber temperature should continue to go down even after the SP is stable.

Step 15: The chamber temperature T6 goes down as long as the system is cooling (the compressor works).

Inserting the faults:

Step 16: To insert a fault, type its number by changing the FAULT number and pressing ENTER. For example, changing the FAULT number to 01 and press ENTER will insert fault number 01.

Fault 1 – 8 should turn on the fault description LEDs, describing the fault in general.

Fault 9 – 99 should leave the fault description LEDs off.

Step 17: Observe the system's response, the temperature and pressure values, and study the fault.

At the end of the fault, write down the final values of the pressure and temperature and compare them with the fault description.

In some of the faults, the end of the fault will be stopping the system by the safety procedures because the pressures or temperatures.

Step 18: Fill in the following table:

Fault No.	Fault Observation	Fault Cause Options	How to Repair
01			
02			
03			
04			

05			
06			
07			
08			
15			

Step 19: If you wish to exit the fault state, change the STATE no. to 00 and press ENTER.

Lower the PROGRAM switch and raise it.

The system returns to working in its former state.

Wait before performing another fault.

Step 20: For inserting additional faults, repeat steps 16-19.