Technical Training Associates
Presents

20 HVACR TROUBLESHOOTING Problems

By Jim Johnson

A Practical Approach To Troubleshooting HVACR Equipment
This troubleshooting handbook contains 20 separate troubleshooting scenarios designed to test the skills of HVACR technicians. In each situation, all the information necessary to arrive at a diagnosis is provided.

The solutions to the problems are presented in a separate section at the end of the book.

If you are working individually with this handbook, use it to test yourself. Review the problem and any related graphics or wiring diagrams, then, record your diagnosis before checking your answer in the solutions section.

If you are a service manager conducting in-house training sessions, or an instructor facilitating a classroom or lab training exercise, you may print and photocopy the problems and diagrams for classroom distribution. Digital copying of this CD is prohibited as noted in the copyright notice above.
Troubleshooting Problem #1

In this situation, you are the follow-up technician on a callback. The equipment is a standard 3-ton package unit, A/C with gas heat, 208/230, single-phase residential installation.

The original complaint was a "no cooling" call and the technician who preceded you on this job (we'll call him Technician #1) has only limited experience, but he reported correctly that he found a bad transformer and replaced it.

He's only been gone for an hour-and-a-half, and the customer is calling back to say that the unit is out again and the house is warming up.

When you arrive, you find the following conditions:

1. An irate, overheated customer.
2. The thermostat sub-base is set to the cooling mode and the fan switch is in the auto position.
3. No air flow and no apparent noise from the roof.

Escaping from the irate customer and going to the roof, you find:

1. The outdoor fan motor, compressor, and indoor fan motor are not running.
2. The unit is sitting quietly, making no attempt to start.

Removing the access panel and using your volt-meter, you find:

1. A 230-volt reading at L1 and L2 of the contactor.
2. The contactor is not pulled down.
3. No voltage reading (24-VAC at the contactor coil.

Even though you would not normally do so, something prompts you to push down on the contactor. When you do, the compressor, outdoor fan motor and indoor fan motor start and run normally. When you let go of the contactor, everything continues to run.

You decide to turn off the disconnect switch, and after a wait to allow the system to equalize, you turn the switch back on, and nothing happens until you once again push manually on the contactor assembly, overcoming the spring pressure that holds the contacts apart. Once again, the unit performs perfectly.

In a moment, you realize what technician #1 did wrong. Your diagnosis is confirmed when he arrives and says he thought something might not have been quite right, since the unit didn’t start at first when he turned the disconnect switch back on after replacing the transformer, and that once he pushed on the contactor (he assumed some kind of time delay), everything seemed to run OK.

Your troubleshooting question: What wiring error did technician #1 commit?
Figure One: Problem #1
Troubleshooting Problem #2

This problem centers around an older, standard 208/230-volt, single-phase, roof-mounted gas pack, and the customer has called to say that the unit has stopped cooling. A standard, electromechanical thermostat is in use in this application. Their report to the dispatcher is that “nothing is happening” and that the temperature in the house is rising quickly.

Upon your arrival at the job site, you find the following conditions:

1. The thermostat is set in the “COOL” and “AUTO” positions and it’s turned all the way down, calling for cooling.
2. The temperature in the house is 85 degrees.
3. There is no air flow from the supply registers.
4. A low noise level (something you can hear, but the customer couldn’t) indicates that there is something functioning on the roof.

As you approach the unit on the roof, you can immediately determine that the condenser fan motor is running. On closer inspection of the unit and removing an access panel, you find:

1. The compressor is running.
2. The suction line is frosted and sweating.
3. The squirrel cage on the direct drive motor is not turning.

With your visual inspection complete, you turn your attention to the wiring of the unit (refer to the wiring diagram on the next page) and using a voltmeter, you determine the following factors:

1. 240-volts is not present at the high speed winding of the indoor fan motor.
2. 24-volts is not present at the IFR coil.
3. 24-volts is present at C.

Your troubleshooting question: What is the specific failure and which component has to be replaced in order to get the unit back on line?

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Figure One: Problem #2
Troubleshooting Problem #3

This troubleshooting situation centers around an A/C unit that, according to the customer, “isn’t cooling properly.”
Upon your arrival, you find the following conditions:

1. The outdoor temperature is 90-degrees F.
2. The indoor fan is running and blowing warm air.
3. The thermostat is set in the cooling mode with the fan switch in the AUTO position. The thermostat set point is 65-degrees.

You decide to begin the troubleshooting process by performing an overall observation of the unit, and you find the following:

1. The condenser fan motor is not running.
2. The compressor is not running.

While you’re checking the wiring diagram (shown in Figure One) the compressor and condenser fan motor start, running for about 30-seconds, then they both shut down. After a brief time lapse, the sequence described above repeats.

Switching from electrical to sealed system diagnosis, you connect your gauges to the unit. The next time the unit (which is a multiple capillary tube metering device system charged with R-22) starts, you observe that the low side pressure drops to approximately 20 PSIG after the compressor runs for a short time frame, then shuts down again. During the off cycle, the pressure rises and the unit starts again, then, with an accompanying pressure drop, the unit shuts off again.

Your troubleshooting question: What is the likely problem with this unit and what steps must be taken to correct the situation?
Troubleshooting Problem #4

In this situation we’re bringing you inside, into a kitchen of a restaurant. The customer’s complaint is they keep finding thawed items “from time to time” in their reach in freezer. This particular unit uses a hot gas system to accomplish defrosting of the coil.

When the solenoid of the defrost valve is energized, it allows the hot gas from the compressor discharge to flow directly to the evaporator. In the refrigeration cycle, the solenoid is closed and refrigerant flow follows the normal path to accomplish cooling.

Upon your arrival the customer reports that every so often, the open the freezer to find that the temperature seems higher than it should be, and some items are almost thawed. At the moment though, the unit is working properly and everything is frozen.

You decide that you’ll need to manually initiate a defrost cycle so you can check that segment of operation, and when you do so, you find that line voltage is present at the hot gas solenoid valve, and the evaporator fan. (Refer to the diagram in Figure Two)

Your two-part troubleshooting question: What is causing the higher-than-normal temperatures, and which component needs to be replaced?
Figure Two: Problem #4
Troubleshooting Problem #5

In this troubleshooting situation, the equipment that needs servicing is a condensing gas furnace in a relatively small home of approximately 1200 square feet. The capacity of the unit is 40,000 BTU's and it is equipped with an LED readout system.

When you arrive at the customer's home to respond to the complaint of “not heating”, you find the LED sequence flashing…one short flash, then three long flashes.

Observing the LED sequence, you're prompted to take three steps in accordance with the wiring diagram shown in Figure One and consulting the troubleshooting procedure guide.

1. Make a visual inspection of the FRS (Flame Rollout Switch), and it indicates it is closed.
2. Use an ohmmeter on FRS, which shows that it is closed.
3. Use an ohmmeter on LS (Limit Switch), which shows infinity.

These checks lead you to a further investigation, and the component at the top of your suspect list is the indoor blower motor.

You find it cool to the touch, and after isolating the wiring connections to the motor (COM (Common), HEAT, COOL, and SPARE1), your ohmmeter shows a reading of infinity when checking from the white wire to any other color.

Your troubleshooting question: Which component failed and caused the situation you found on your arrival?
Figure One: Problem #5
Troubleshooting Problem #6

In this situation we have a customer who has called about their older package unit that’s not heating. In describing the problem with their gas pack, they are reporting that all they are getting is cold air.

This particular unit uses a spark ignition system to light the pilot, then once the pilot is proven, the main gas valve coil is energized and the indoor air handler is operated on a time delay.

The unit is wired for low speed fan operation in the heating mode and high speed for the cooling mode.

When you arrive, you find the following conditions and get the following results from your survey and troubleshooting procedures;

1. The temperature in the building is 50-degrees.
2. Up on the roof, you disconnect the control voltage wiring and place a jumper between R and W.
3. The electrode spark ignites the pilot flame.
4. After a brief wait, you note that the fan time delay system functions normally.
5. Your voltage reading at the main coil of the three-coil, five-wire gas valve is 24-volts.

Your troubleshooting question:

Which component needs replacing in order to get this unit heating again?
Troubleshooting Problem #7

In this troubleshooting situation, you are going to be an advisor to another technician who has called you for advice about a heat pump situation. It’s July and your colleague has called to say that he is performing a maintenance check on a heat pump (no problems reported, just a seasonal check-up requested by the customer) and in the process, he is monitoring both the temperature differential across the indoor coil and outdoor coil, while simultaneously checking the refrigerant pressures of the unit. (See the illustration in Figure One that shows the sealed system design.)

The reason you’re being asked for advice is because something just isn’t adding up for your friend. He tells you:

1. The temperature drop across the coil is normal, keeping the indoor conditions comfortable.
2. The temperature rise across the outdoor coil also seems normal.
3. With gauges connected to the true suction line leading back to the compressor downstream from the reversing valve, and to the high side discharge line, both gauges are reading the same pressure.

Your troubleshooting question: What advice do you offer your friend in regard to proper service procedures and refrigerant pressure testing?

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Figure One: Problem #7
Troubleshooting Problem #8

In this troubleshooting situation, you have been called to a restaurant to check an ice machine that, according to the customer, “isn’t dispensing cubes properly.”

When you arrive, you find that the unit you’re dealing with is a 240-volt, single-phase machine that employs a remote condenser. The wiring diagram in Figure One shows you the electrical system.

Upon your initial evaluation of the machine, you find:

1. The refrigeration system is operating properly and the unit has no problem manufacturing cubes.
2. There is no problem with the quality or filtration of the water supply to the machine.
3. This particular machine uses a small air compressor to momentarily provide a small amount of air to assist in freeing the cubes from the evaporator in the harvest mode.

Upon further review of the schematic diagram and evaluation of the equipment, you note:

1. That this model employs a control board containing a series of relays that make and break circuits to various components during the freeze and harvest cycles.
2. That during the harvest sequence implemented by the control board, the water purge, water pump, harvest valve, water valve, dump valve and contactor control system function normally.
3. There is no air from the air compressor and no voltage is read at any time at the 25/26 connector.

Your troubleshooting question: Which component needs to be replaced?

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Figure One: Problem #8
Troubleshooting Problem #9

In this troubleshooting situation, you have a starting problem with a particular type of compressor... a 4-pin compressor that uses both an internal and external overload protector.

Two other factors in regard to this particular piece of equipment are that a single-pole contactor is used in the compressor circuit, and that it is also equipped with high and low pressure switches that act as protective devices.

Upon your arrival and conducting an initial inspection of the equipment, you find the following conditions:

1. The compressor is cool to the touch.
2. The condenser fan motor is not operating.

As you begin your troubleshooting process, you make two quick voltage checks (see the partial diagram in Figure One) and find the following:

1. 230-volts at L1 and L2 of the contactor.
2. 0-volts at the contactor coil.

With these voltage tests accomplished, the next step you decide to take is to disconnect the power supply, remove the appropriate wiring, and use an ohmmeter to make resistance and continuity checks, which reveal the following:

1. Infinity from C to T.
2. 2.5 Ohms from C to R.
3. 3.5 Ohms from C to S.
4. 6 Ohms from S to R.

Your troubleshooting question: What is the specific failure relative to this compressor not operating?

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Figure One: Problem #9
Troubleshooting Problem #10

In this troubleshooting situation, you are dealing with a customer who has called to say that their electric heat system isn’t keeping them warm. This particular unit, which can be used in conjunction with a heat pump, or only as an electric furnace, is not paired with a refrigeration system, so it depends on resistance heat only. The unit has been in service for several years with no previous service performed on it.

When you arrive, you note that the temperature in the building is mildly chilly, and that the unit is operating with the fan motor on low speed.

The thermostat is set to call for heat, but the temperature rise is insufficient. Removing the access panel of the unit, you locate the schematic diagram (see Figure One) and begin troubleshooting with a voltmeter.

Noting that the three heating elements (HE1, HE2 and HE3) are controlled by two relays (HR1 and HR2), and that a limit control (LC1, LC2 and LC3) is wired in series with each element, you get the following readings with your voltmeter:

1. 240-VAC at the terminal connections for HE1
2. 240-VAC at the terminal connections for HE2
3. 240-VAC at the terminal connections for HE3

When testing the circuits with a clamp-on ammeter, you note:

1. 0 Amps on the wiring connection to HE2
2. 0 Amps on the wiring connection to HE1
3. The manufacturer’s listed current draw on the wiring to HE3.

Your troubleshooting question: What needs to be done in order to get this unit performing normally?
Figure One: Troubleshooting Problem #10
Troubleshooting Problem #11

In this troubleshooting situation, it’s the middle of the cooling season and you have been called upon to service a small cooling unit typical of those found in home offices and moderately-priced hotels. The customer has called to say that their wall-through PTAC (Packaged Terminal Air Conditioner) is “not blowing cool air.” At least that’s the way this customer, who has used this unit since purchasing it new about three years ago, is interpreting an apparent lack of performance.

When you arrive at the customer’s home office, you find that the refrigeration system is actually a heat pump (see Figure One) and that the unit is running in the cooling mode. The particular design of this unit uses a standard reversing valve such as you would find on larger HVACR systems, and a metering device system that forces the refrigerant through a capillary tube in either direction, depending on the cycle selected.

You quickly eliminate the possibility of an air flow or electrical system problem and begin to focus on the refrigeration system itself. With an access valve installed on the true suction line of the compressor, and the discharge line, you note the pressures as we’re showing them in the illustration. The indoor coil is shown on the left and the outdoor coil is shown on the right.

Along with using refrigerant pressures to diagnose the problem, you also note:

1. That there is a slight gurgling sound at the entrance of the tubing entrance of the indoor coil.
2. That when you disconnect the power supply, the refrigeration system pressures equalize, but very slowly.

Your troubleshooting question: What is causing this unit to perform at less than its rated capacity?
Figure One: Troubleshooting Problem #11
Troubleshooting Problem #12

It's July. It's 3PM. Your customer has a roof-mounted package unit heat pump that's not running. You've got too many calls to run already. You're going on this one anyway.

While the scenario we've set up for this troubleshooting situation seems difficult, we're going to make it easy on you by saying that there is no problem with the refrigeration or air flow systems in this unit. When you arrive at the customer's home, you find that they were correct in reporting that the unit isn't running. What you find is that it is sitting totally dead.

Heading to the roof, you make your first voltage check at the disconnect switch and find 240-VAC on both the line and load sides of the fuses.

Moving on to the equipment and consulting the schematic (see Figure One), you make the following checks and get the following results:

1. Equipment operating voltage is read at points 1 and 2.
2. Control voltage is read at points 3 and 4.
3. 0-volts is read at points 3 and 5.

Your troubleshooting question: What is the next step you need to take in order to get this unit back on line?

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Figure One: Troubleshooting Problem #12
Troubleshooting Problem #13

In this troubleshooting situation, we have a gas furnace that the customer says “is not working.”
When you call them to discuss their problem, you get more information from them. They report that, not only is the unit not heating, they’ve pulled the plug because it was actually blowing cool air, and wouldn’t shut off no matter what they did with the thermostat.

Upon your arrival at the house, you find the following conditions:

1. The temperature in the house is 50-degrees.
2. The furnace, which is a standard upflow model, is unplugged.

As your first step in solving this situation, you plug the power cord into the wall and note that the fan motor starts up immediately, operating on low speed.
When you remove the access door of the furnace, the motor shuts off and you find the diagram shown in Figure One on the inside of the access door.
After you review the diagram, you use a voltmeter and get the following results:

1. With the door switch pushed in, you read 120-volts at PR1 and PR2.
2. With the door switch pushed in, you read 0-volts at SEC1 and SEC2.

Your two-part troubleshooting question:

1. Which component has failed?
2. Why does the blower motor run constantly?

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Figure One: Troubleshooting Problem #13
Troubleshooting Problem #14

In this troubleshooting situation, we have a split system that’s not delivering in the cooling mode.

Your customer has called to say that their A/C unit is blowing nothing but warm air, and when you arrive on the scene, you find a split system with a layout such as we’re showing below.

Since the customer turned the unit off before you arrived because they feared that running it while not cooling would cause more damage, your first action is to check the thermostat operation. Turning the thermostat to the cooling mode and leaving the fan switch in the AUTO position, you find that the air handler starts immediately. In a short time, you confirm that the unit is blowing warm air.

Once you’ve established that the unit isn’t working properly, you check at the condensing unit outside and find that neither the compressor nor condenser fan motor are operating. (See the diagram in Figure Two for an example of the electrical components that govern the operation of this type of unit) Checking with a voltmeter, you find 240-volts at the wiring connections L1 and L2 of the contactor, and 24-volts at the control voltage harness as it connects to the condensing unit contactor coil. A voltage measurement at T1 and T2 shows 0-volts.

Your troubleshooting question: Which component has failed?

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Figure One: Troubleshooting Problem #14
Troubleshooting Problem #15

In this troubleshooting situation, the equipment in question is a heat pump with a one-stage cooling and two-stage heating system. Your customer has called to say that the unit is not delivering enough heat through the night, and even sometimes seems to be blowing cool air from time to time. The ambient temperature overnight is below 30 degrees and this particular unit uses a simple air pressure sensing switch to initiate the defrost cycle.

Acting on the customer’s description of the problem, you suspect a supplemental heat strip problem and proceed with your tests: (Refer to the diagram in Figure One)

1. Initiating a heat mode, the compressor, outdoor fan motor and indoor fan motor start and run normally.
2. When initiating a second stage heat and placing a jumper across OTS1 to simulate the cooler overnight conditions, you find 24-volts at HC1.
3. Testing further, you find a 0-volt reading at the SH1 connections.

Your troubleshooting question: Which component has failed?

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Figure One: Problem #15
Troubleshooting Problem #16

In this situation we have been handed a service call from our dispatcher that reads “Not Cooling.” A phone conversation with the customer provides is with a bit more information. We are told that the unit is “blowing warm air” which means that we can now eliminate the possibility of a fuse or power supply problem from the equation as we track down the source of the problem with this package unit.

When we arrive at the customer’s home, we find the following conditions:

1. The thermostat is set to the cooling mode with a set point as low as possible.
2. The indoor fan motor is running.
3. The fan switch is set to the AUTO position.
4. The indoor temperature is 90-degrees.

With our assessment complete inside the home, we go to the unit and find that the condenser fan motor is running. Removing the access panel, we find that the compressor is not running and is warm to the touch.

Narrowing our focus down to the CSR compressor, we disconnect the power supply, and where necessary, disconnect the appropriate wiring to enable us to use an ohmmeter to test components. Our tests show the following results: (refer to Figure One)

1. A reading of 7.5 Ohms from #2 to #3.
2. A reading of 3 Ohms from #1 to #3.
3. A reading of 4.5 Ohms from #1 to #2.
4. A reading of infinity from #4 to #5.
5. A reading of approximately 7500 Ohms at #6 and #7.

Your two-part troubleshooting question:

1. What is the specific failure?
2. What condition did this failure cause?
Figure One; Troubleshooting Problem #16
Troubleshooting Problem #17

In this situation we find ourselves dealing with a customer whose home is in Oregon. They report that they have “water down the inside of the furnace.” The customer also reports when the call that this isn’t the first time they’ve had trouble with water. As a matter of fact, they experience the problem every time there is a heavy rain or snow melt.

To be more specific about what this equipment is not, here is some more information:

1. This is a furnace that serves as the air handler for a split system.
2. It’s an 80% upflow furnace.
3. It’s not a condensing gas furnace.

Upon your arrival at the customer’s home, you find the following conditions and draw the following conclusions:

1. There is no water coming down the flue pipe.
2. There is no evidence that water is leaking from the supply plenum of the furnace.
3. There is absolutely no evidence of water leaking from the roof anywhere.
4. The condensing unit is not running constantly so as to cause an ice build-up of the coil during the cooling mode.

With those conditions established, you look further for the answer, and in doing so, peel away a piece of tape where the line-set enters the coil cabinet. What you see is a condensate pan full of water.

As your next step, you disconnect the drain pipe, and when you do, water rushes out of the drain opening in the pan. As a matter of fact, not only does water rush out of the opening, pine needles do too.

Your troubleshooting question: What caused the water build-up in the condensate pan?

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Troubleshooting Problem #18

In this troubleshooting situation, you are called out to a hotel to service an individual wall-through unit, and the complaint is that “it’s not cooling.”

Upon your arrival, you find that the room temperature is at 90-degrees and that the temperature control of the unit has been turned up as high as it will go in an effort to provide the necessary cooling. Since the unit wouldn’t deliver, the power cord has been pulled from the wall outlet.

When you turn the unit on to the heating mode, the fan starts normally, but the unit blows cool air. Since you can see that the light in the room dims slightly, then returns to normal, and that the fan motor slows slightly, then returns to normal, you correctly decide that the compressor is not starting.

As your next step, you disconnect the unit from the power supply, then slide it out of its wrapper. When you get the unit out, you see debris laying near the compressor, and had the component not wound up in pieces as you see it, it would have looked like Figure One.

Your troubleshooting question: What is that thing and what does it do?
Figure One: Troubleshooting Problem #18
Troubleshooting Problem #19

In this situation, you are responding to a customer’s complaint that their A/C system “isn’t cooling enough.”
This is a residential unit that’s set up as a package unit shown in Figure One.

Upon your arrival at the customer’s home, you find the following conditions:

1. The indoor temperature is 80 degrees.
2. The thermostat is set at 70-degrees and the fan switch is in the AUTO position.

After confirming with the customer that the unit has been operating for over two hours, you proceed in checking the operation of the system. As you approach the unit, you note that the outdoor fan motor is running, and when you remove the access panel, you find that the compressor is running and that the suction line is sweating and frosted.

Moving to the air handler side of the unit, you find that the design of this system is such that the filter is located in the return air duct assembly on the roof. Removing the cover on the filter slot, you find there is no filter in place.

As your next step, you go back inside the house and check air flow at a bedroom supply register with a velocity meter. You find the total air flow from the register to be 80 CFM. Next you back to the unit and remove the access panel to the air handler. With the air handler remaining in operation, you check the same supply register and find that the air flow is now 120 CFM.

Your Troubleshooting question: What must you do to restore the unit to full operating capacity?

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Figure One: Troubleshooting Problem #19
Troubleshooting Problem #20

This troubleshooting situation involves a complaint from a restaurant manager that one of the ice machines in his high volume establishment isn't producing enough ice. There are two identical machines in this installation. Both are remote condenser type and are of the same age, having been installed eight years ago in the same section of the kitchen. The remote condensers are located on the same area of the roof. The climate area is mild and the month of the year is November.

The restaurant manager reports that from the middle of the day through the afternoon, the cubes from the problem ice machine are nearly as plentiful as the identical unit that's operating properly, but the cubes that are being produced are being produced seem incomplete.

In the evening hours, the situation gets worse. The suspect machine simply doesn’t produce enough cubes. The manger is able to determine this capacity problem based on his experience with this particular machine and the ability to compare the operating efficiency of both units.

The history of both units is that periodic maintenance has been performed on a regular schedule since installation, and cleaning has been accomplished according to manufacturer’s specifications and recommendations. Neither unit has been checked at a time other than the periodic maintenance schedule.

Upon arrival, you find the following conditions and factors:

1. There is adequate water supply throughout the ice machine system.
2. Proper voltage, well within tolerance specifications, is being applied to both units.
3. Ambient temperature at the remote condenser location is 60-degrees.
4. The system head pressure is lower than normal, and the low side pressure is near normal.
5. The liquid line pressure between the head pressure control valve and the receiver (refer to Figure One) is cold to the touch.

Your troubleshooting question: What component in the refrigeration system is at fault?
Figure One: Troubleshooting Problem #20
Troubleshooting Problem Solutions

Problem #1: Technician #1 became confused after disconnecting the primary winding of the transformer form the extra spade terminals on L1 and L2 of the contactor. When installing the replacement transformer, he wired the primary to T1 and T2 on the contactor. As a result, no low voltage could be applied to the contactor coil until the contactor itself was pushed down and the primary voltage was delivered to the transformer. Once the primary voltage was applied, secondary voltage would be applied to the contactor coil, resulting in the unit running until the thermostat was satisfied. Upon the need for re-start, however, the unit couldn’t cycle back on until the contactor was manually activated. Switching the primary wires from T1 and T2 to L1 and L2 as shown in Figure One, solves the problem.

![Figure One: Troubleshooting Problem #1 Solution](image_url)
Problem #2: The specific failure is related to the sub-base of the thermostat. Current is not being carried through the AUTO contact points of the sub-base. This is apparent because the diagram shows a parallel circuit to the “CC” and “IFR” coils. The temperature sensing section of the thermostat is functioning properly, providing 24-volts to the “C” coil, with the end result being that the compressor and condenser fan are running.
Problem #3: The unit is short on refrigerant. We can arrive at this conclusion by focusing on the low voltage segment of the diagram. Wired in series with the contactor coil are both a low-pressure and high-pressure switch. With the conditions we observed, the low-pressure switch was doing its job of shutting the compressor down when the low side pressure dropped too low. To complete a repair on this unit, we would have to locate the leak, then follow necessary recovery procedures, repair the leak, install a new filter drier, and evacuate and recharge the system.
Problem #4: The NC contacts of the timer are not opening when the defrost cycle is initiated. In this unit, the evaporator fan motor is supposed to be shut off when the hot gas is being routed to the evaporator coil to accomplish defrost. The fact that the fan continued to run during the defrost cycle contributed to the erratic temperatures and thawing of food items.
Problem #5: The failed component is the blower motor. Our ohmmeter tests showed a reading of infinity from the white wire, which is the common connection, to all other colors that represented the individual windings for the various motor speeds. Since the motor was cool to the touch, either the internal overload protector is (and will remain) open, or there is a break at some point in the internal wiring of the motor. The LED readout we encountered on our arrival indicated either an open flame rollout switch or limit switch. Our physical inspection and ohmmeter tests indicated that it was the limit switch that was open. The underlying cause of the underlying cause of the open limit switch was the failure of the indoor blower motor.
Problem #6: The component that needs replacing is the gas valve. Although the pick and hold coils are operating to provide the pilot flame, the main gas valve coil is not operating. The pilot assembly is operating properly and providing 24-volts to the coil and the fan time delay system.
Problem #7: The advice you need to give your colleague is that the valves on his compound gauge set are not closed, allowing the high side pressure to bleed over to the low side gauge. There’s nothing wrong with the heat pump.

Problem #8: The component that needs replacing is the control board. Since all the other control relays on the board were providing operation to the other components needed during the harvest sequence, and no voltage was applied to the connector at the air compressor, it proved that the control board was the problem.
Problem #9: The specific failure of the compressor is the internal overload protector. We proved this when we read a normal resistance reading between the run and start windings, but got a reading of infinity between the C and T terminals on the compressor. Without continuity between these two terminals, there can be no complete circuit to the coil of the single-pole contactor. The circuit to the contactor coil can be traced from L1, on through the external overload, to C on the compressor, then on through the internal overload. The circuit then continues from T on the compressor, on through the pressure switches, and back to the coil connection on the contactor.
Problem #10: In order to get this unit back on line, two heating elements, HE1 and HE2, will have to be replaced. As sometimes happens in electric heating units, customers don’t realize that one element has gone out, and may not call for service until the heating capacity drops low enough for them to notice. Both elements were proven to have failed since proper voltage was applied, but the measured current draw in the circuit was zero.

Problem #11: The refrigeration system is partially restricted. This was proven out by the lower-than-normal pressures on both the high and low sides of the system, and also by the partial frost pattern and slow equalization of pressures when the system was shut down.

Problem #12: The next step we need to take in repairing this unit involves the blown fuse on the control side of the diagram. When we tested at points 3 and 4 on our diagram, we read 24-volts, but moving to points 3 and 5 showed a 0-volt reading, indicating a blown fuse. Check all connections and check the control wiring for a possible short before replacing the fuse.
Problem #13: The transformer has failed. A reading of 120 VAC at PR-1 and PR-2, and a reading of 0-volts at SEC-1 and SEC-2 proves this. The reason the fan motor runs constantly is because the failure of the transformer provides no power to the 2A coil (see Figure One), which keeps the normally closed 2A contacts (shown in Figure Two) on the relay open until the time delay circuit is energized upon ignition of the burners.
Problem #14: The contactor has failed. The points that proved this to be the failure are:

1. The compressor and condenser fan motor were both not running.
2. 240-volts was read at L1 and L2, which are the wiring connections directly at the contactor.
3. 24-volts was read at the contactor coil.
4. 0-volts was read at T1 and T2 of the contactor.

Problem #15: The failed component is Heating Coil 1, identified as HC1 in the partial diagram shown below. Since the supplemental heat strips weren’t coming on in the colder situations and in the defrost mode, the customer’s complaint was that the unit wasn’t heating enough and blowing chilly air from time to time. In the defrost mode and during a call for two-stage heating, the supplemental heat strips are supposed to be operating. When 24-volts is applied to the HC1 coil, the contact points should close to allow a complete circuit to SH1. Since we read 24-volts at the coil and 0-volts at the strip heater SH1 we isolated the problem as the HC1 relay.

Problem #16: The failed component is the contact point section of the potential relay. We proved this when our ohmmeter showed a reading of infinity at points 4 and 5. The reading of 7500 Ohms at the relay coil and the resistance readings at the compressor terminals all showed normal. The situation that the failed component was creating was failure to make the circuit through the starting circuit and the start capacitor. The end result was a compressor that would not start, kicking off on overload.
Problem #17: The answer to our problem furnace is related to water backing up from below, not running in from above. When the furnace was installed, the condensate drain was terminated to a gutter downspout location about 8 inches above the grade. The downspout was connected to an underground drain pipe. The downspout was blocked with debris. Because of the blockage, the water that ran down the roof gutter during a rain or snow melt couldn’t go down the blocked underground pipe and instead, backed up and followed the condensate pipe back to the drain pan, causing it to fill up with water and pine needles. The problem was corrected by cutting the condensate pipe off before it entered the downspout, allowing the condensate water to drain onto the ground.

Problem #18: The debris found near the compressor is the remains of a solid state start device referred to as a soft start PTC device. These devices are often spool-shaped, a PTC (Positive Temperature Coefficient) device that is wired into the PSC compressor circuit to overcome starting problems. When wired in parallel with the run capacitor as shown in the diagram, it acts to decrease the microfarad rating of the run capacitor just enough to make the phase shift the capacitor creates just a little bit wider. The purpose of the run capacitor is to split the phase of the current to the start winding and cause the magnetic field of the motor start windings to be slightly out of sync with the field of the run windings. Adding the soft start device which has a low resistance when cold and high resistance when it quickly heats up during the motor start up, allows the current flow around the run capacitor long enough to reduce the microfarad rating of the capacitor. This provides increased starting torque because of the temporary wider phase shift. The soft start device takes itself out of the circuit when it heats up and increases in resistance, which allows the run capacitor microfarad rating to return to normal and it can then again do the job of creating the narrower phase shift necessary for motor operating efficiency.
Problem #19: In order to get this unit back to full operating capacity, the indoor coil needs to be cleaned. In the unit we illustrated, the air handler discharge is directly into the supply duct, which means that the squirrel cage fan draws air through the indoor coil. When we removed the access panel to the air handler, we provided an alternate air supply other than the path of air flow that was through the dirty indoor coil. The frosting and sweating suction line, the missing filter and the increased air volume at the register once the air handler access panel was removed, all contributed to the diagnosis that the problem is a dirty coil.

Problem #20: The component at fault is the head pressure control valve, sometimes referred to as a mixing valve or headmaster. The function of the head pressure control valve is to maintain proper high side pressure in low ambient conditions. On most machines, when the ambient temperature is above 70-degrees, the refrigerant flow from the compressor is directed by the mixing valve in a route through the condenser and into the receiver. In below-70-degree ambient conditions, however, the headmaster is supposed to partially restrict the flow of refrigerant from the condenser while at the same time allow discharge gas to bypass the condenser and flow directly into the receiver, mixing with the liquid refrigerant from the condenser. This restriction/bypass action by the headmaster maintains the proper head pressure necessary for proper operation of the refrigeration system, and ultimately, ensures that the ice machine will perform at intended production levels. In our troubleshooting problem, the restaurant manager reported that the ice production, while still below standard, was better in the middle of the day, but became worse in the evening. When the temperature dropped, the head pressure control valve malfunction was even more apparent in the lower temperatures occurring later in the day.
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