Refrigeration & Air Conditioning Technology
SIXTH EDITION

SECTION 4

ELECTRIC MOTORS

UNIT 20

TROUBLESHOOTING ELECTRIC MOTORS

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UNIT OBJECTIVES

After studying this unit, the reader should be able to

- Describe different types of electric motor problems.
- List common electrical problems in electric motors.
- Identify various mechanical problems in electric motors.
- Describe a capacitor checkout procedure.
- Explain the difference between troubleshooting a hermetic motor problem and troubleshooting an open motor problem.

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ELECTRIC MOTOR TROUBLESHOOTING

- Problems are either electrical or mechanical
- Mechanical problems may appear to be electrical
- Electrical problems may appear to be mechanical
- Technicians must be able to diagnose system problems correctly
- Technicians must locate the cause of the problem, which is not always the resulting effect

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MECHANICAL MOTOR PROBLEMS

- Most common problems involve the bearings or drive connections
- Bearing failure
  - Tight or worn bearings
  - Lack of lubrication
  - Excessive grit in the bearing
  - Over tightened belts
  - Not often repaired by the field technician

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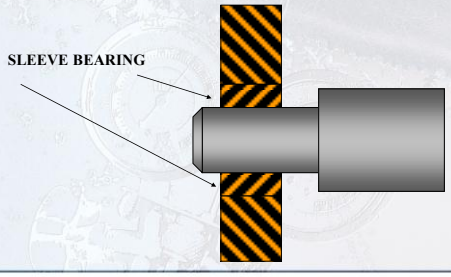
TOOL TO REMOVE SLEEVE BEARINGS



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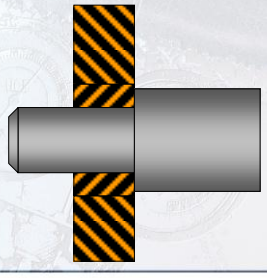
TOOL TO REMOVE SLEEVE BEARINGS



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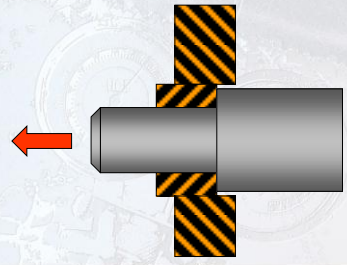
TOOL TO REMOVE SLEEVE BEARINGS



TOOL IS STRUCK WITH A SOFT FACE HAMMER

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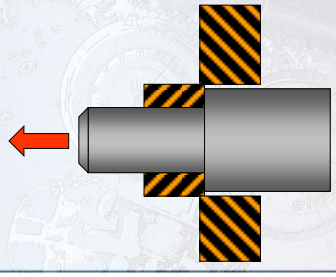
TOOL TO REMOVE SLEEVE BEARINGS



ONCE THE BEARING HAS BEEN REMOVED, THE SAME TOOL CAN BE USED TO INSTALL THE NEW BEARING

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REMOVING DRIVE ASSEMBLIES

- Pulley, coupling or blower or fan must be carefully removed from the motor shaft
- The assembly must not be damaged
- Special pulley pullers can be used
- Set screws are tightened to the motor shaft
- Set screws are made of hardened steel
- The end of the motor shaft should never be hammered in order to keep the shaft perfectly round

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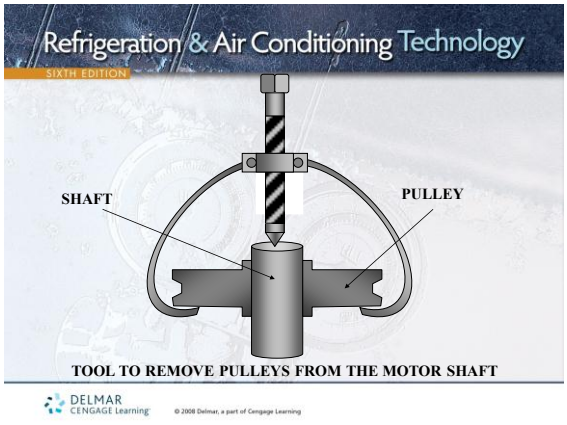
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SHAFT
PULLEY
TOOL TO REMOVE PULLEYS FROM THE MOTOR SHAFT
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AS THE SCREW IS TIGHTENED, THE PULLEY IS REMOVED FROM THE SHAFT
TOOL TO REMOVE PULLEYS FROM THE MOTOR SHAFT
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TOOL TO REMOVE PULLEYS FROM THE MOTOR SHAFT
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BELT TENSION AND PULLEY ALIGNMENT

- Over tightened belts can cause bearing damage
- Loose belts can result in slippage
- Belt tension gauges should be used
- Drive and driven pulleys should be aligned
  - Drive mechanisms can become damaged
  - Belt life can be reduced
  - Belts can slip off the pulleys

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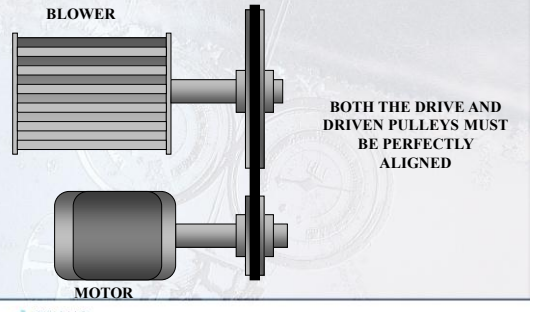

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ELECTRICAL MOTOR PROBLEMS

- Relatively easy to diagnose
- Motor may smell burned
- Common motor problems include
  - Open motor windings
  - Short circuit from winding to ground
  - Short circuit from winding to winding

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OPEN MOTOR WINDINGS

- Can be checked with an ohmmeter
- There should be a measurable resistance between Common, Start and Run terminals
- An infinite resistance reading indicates an open winding
- If the motor is hot, it should be permitted to cool in the event that an internal thermal overload is open

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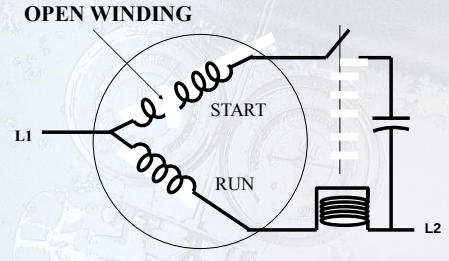

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SHORTED MOTOR WINDINGS

- Results from holes in the winding insulation
- Alternative path for current is created
- Current flow through the winding increases
- If the short is in the run winding, the motor may start, but the current draw will be high
- If the short is in the start winding, the motor may not start, but excessive current will be drawn

SHORT CIRCUIT TO GROUND

- Should be no continuity from a winding to ground
- Megohmmeters can be used to detect small, high resistance paths to ground
- In damp conditions, dirty motors may have a resistance reading from windings to ground
- If refrigerant oil is dirty, hermetic compressors may have resistance readings from a winding to ground

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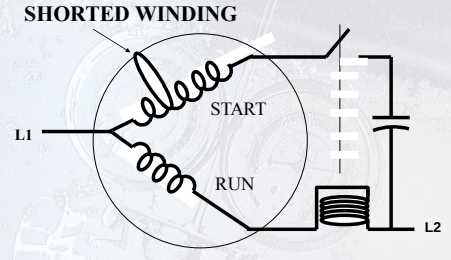

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MOTOR STARTING PROBLEMS

- Relatively easy to troubleshoot
- Check for full power to the motor
- Motor may hum but not start
- Motor may run for a short time and then shut down
- Motor may not attempt to start at all
- If motor turns freely, examine electrical circuits
- If motor hums but does not start, the starting components should be checked

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CHECKING CAPACITORS

- Capacitors can be checked with analog ohmmeters
- Always discharge capacitors before testing
- A good capacitor will register a resistance reading toward zero ohms and then the needle will move back towards infinity
- If there is no reading, reverse the meter leads
- No needle movement indicates an open capacitor
- A reading of zero ohms indicates a short circuit

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CAPACITOR IDENTIFICATION

- Run capacitors
  - Encased in metal, oil-filled
  - Swollen capacitors should be replaced
  - Range from 2 to 60 microfarads
- Start capacitors
  - Dry type, encased in bakelite
  - Over current can cause the “vent” to pop

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WIRING AND CONNECTIONS

- Wiring must be in good condition
- Loose connections can cause system problems
  - Can result in oxidation on electrical contacts
  - Oxidation increases circuit resistance
  - Resistance increases the amount of heat generated
  - Can result in low voltage being supplied to the motor
  - Low voltage can result in increased motor amperage

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TROUBLESHOOTING HERMETIC MOTORS

- Can only be checked electrically from outside the compressor shell
- Experience the same problems as open motors
  - Grounded circuit
  - Open circuit
  - Short circuit
  - Starting component problems

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UNIT SUMMARY

- Electrical motor problems can appear to be mechanical
- Common mechanical motor problems include defective bearings or drive connections
- Belt tension and pulley alignment must be correct
- Electrical motor problems include open windings, short circuits from winding to winding and short circuits from windings to ground
- Defective starting components can prevent motor starting
- All wiring and connections must be in good order to ensure proper motor operation

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