SECTION 4

ELECTRIC MOTORS

UNIT 20

TROUBLESHOOTING ELECTRIC MOTORS

DELMAR CENGAGE Learning

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.

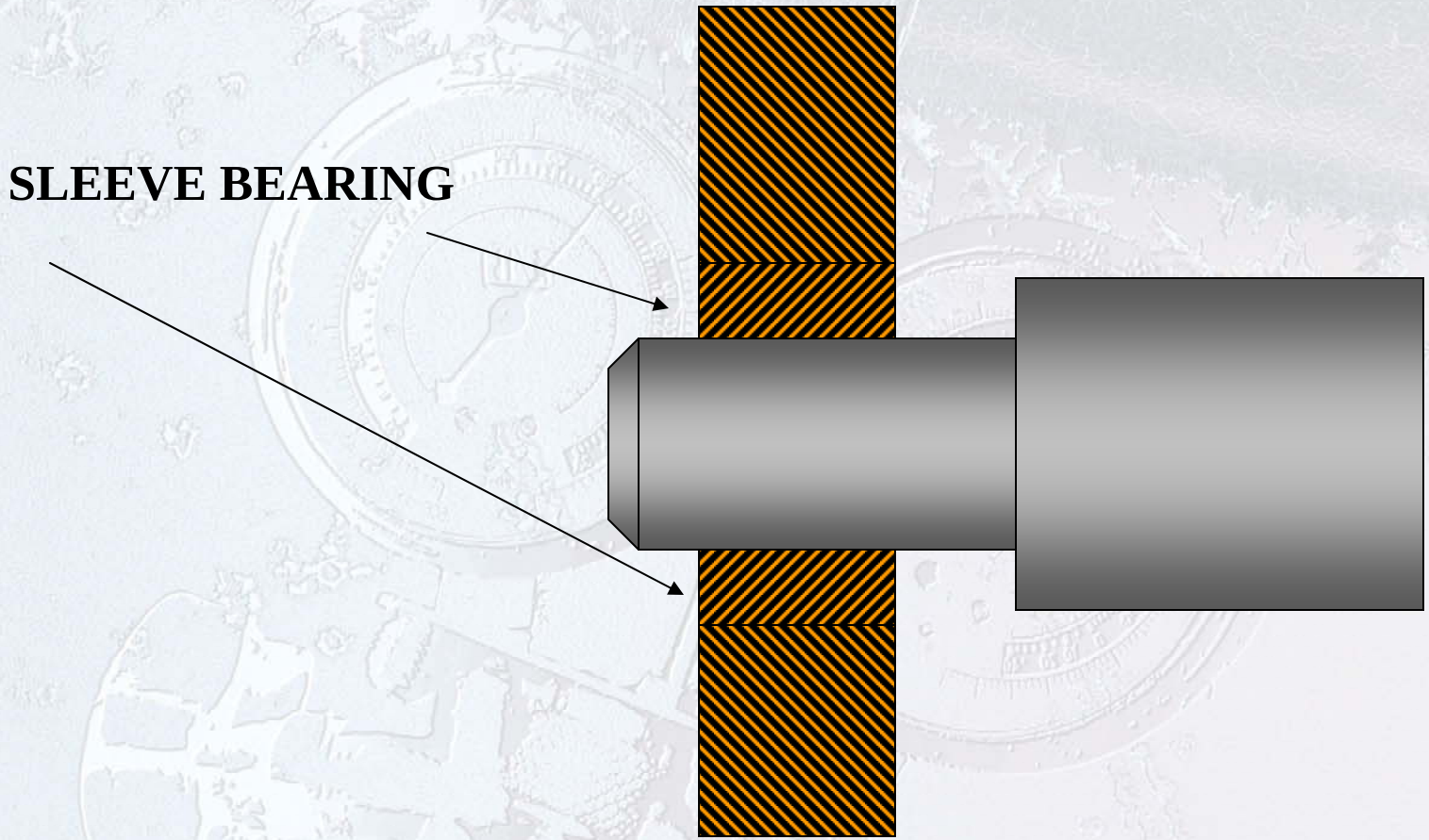
ELECTRIC MOTOR TROUBLESHOOTING

- 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

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

TOOL TO REMOVE SLEEVE BEARINGS



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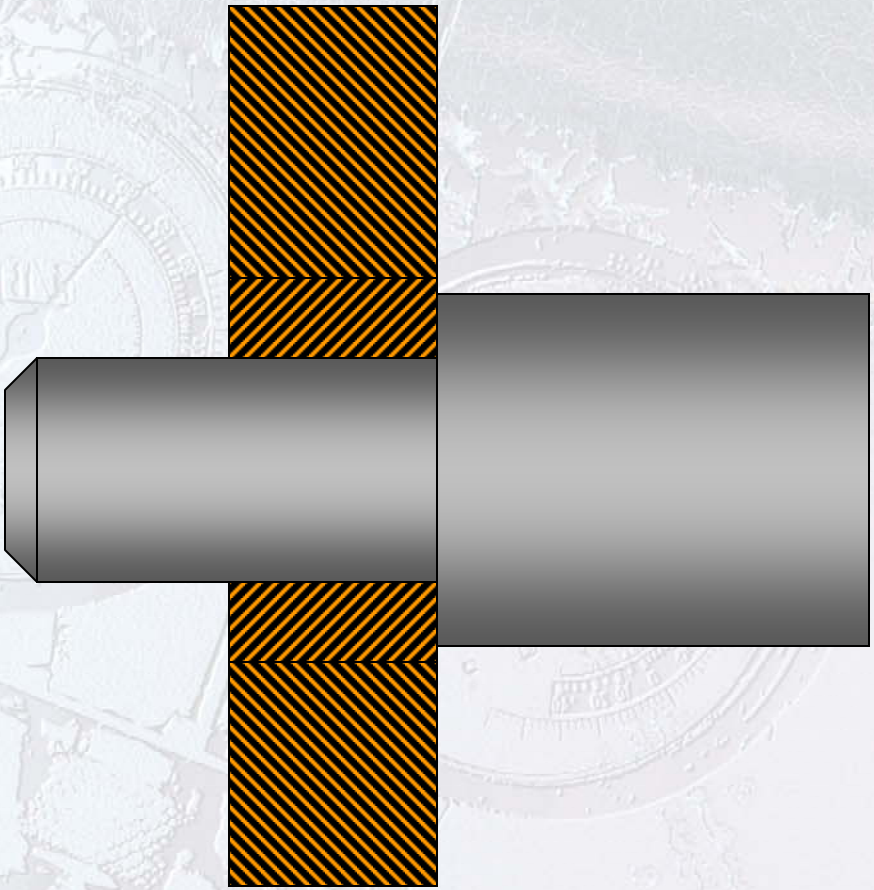

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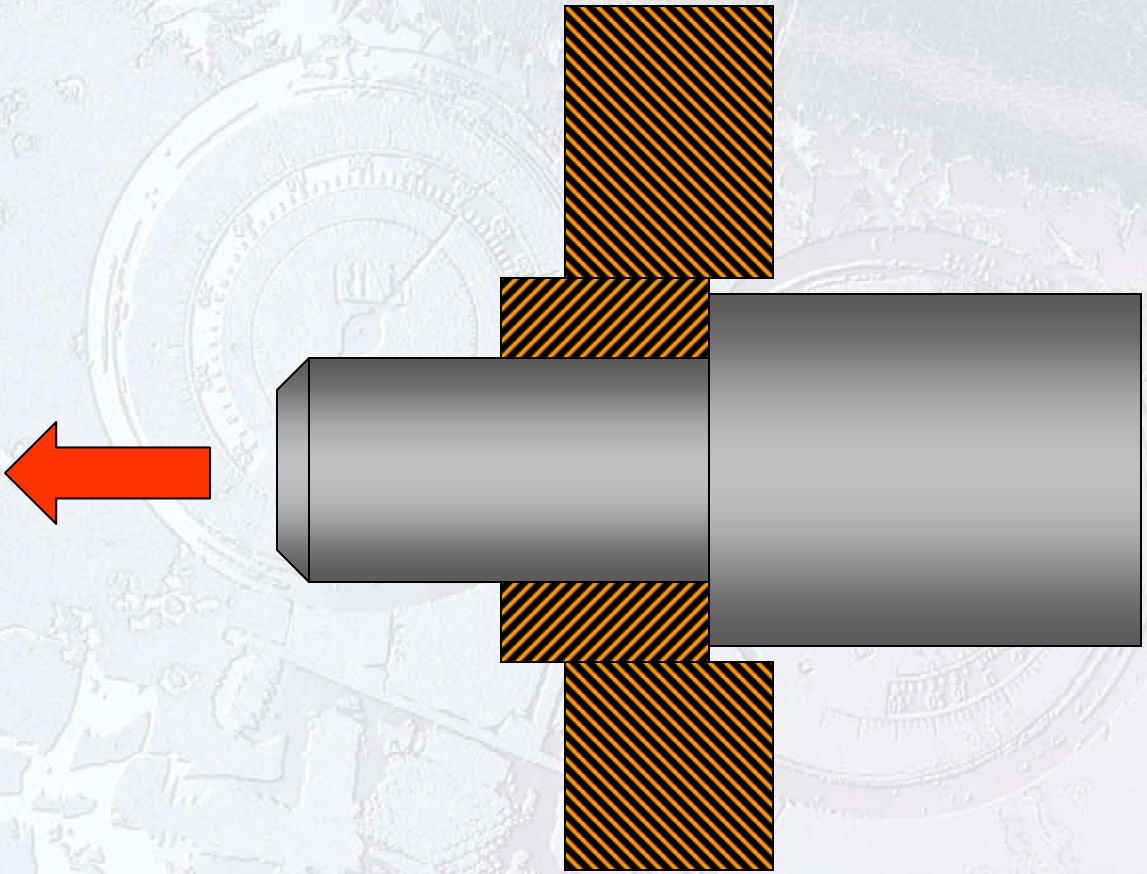
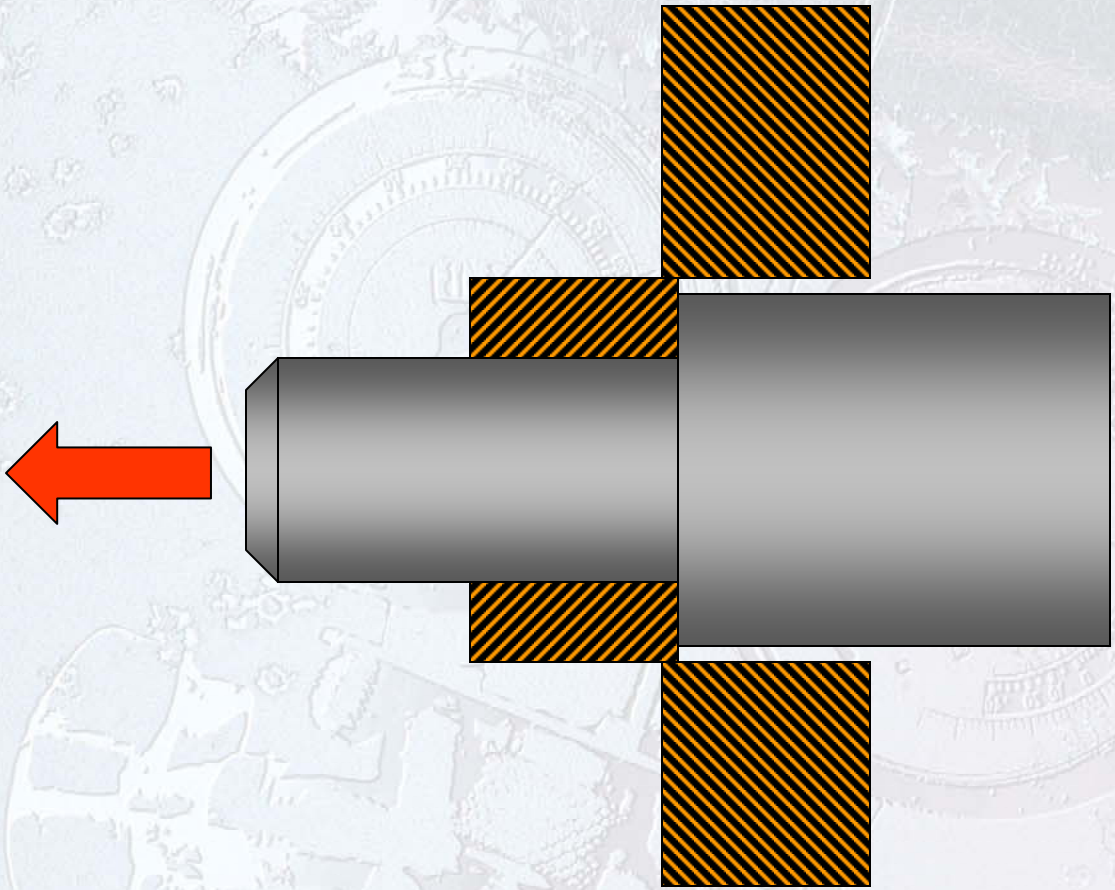


TOOL IS STRUCK WITH A SOFT FACE HAMMER

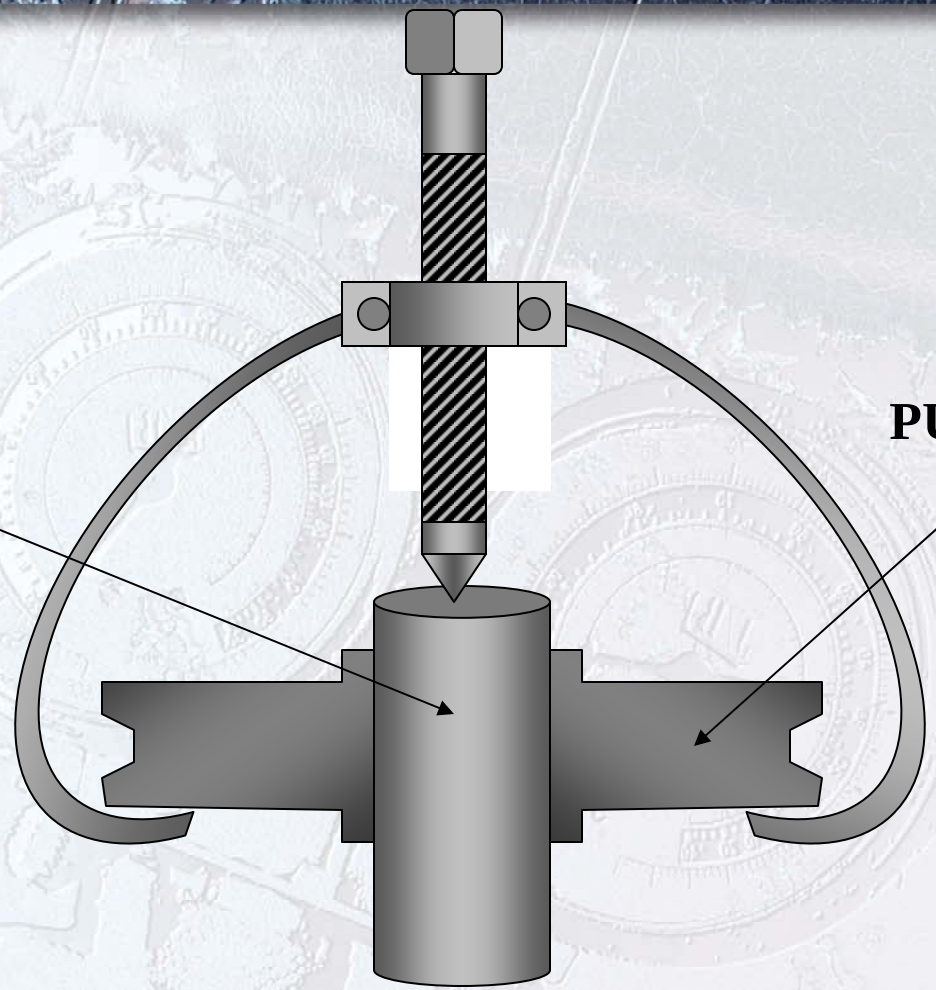
TOOL TO REMOVE SLEEVE BEARINGS



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

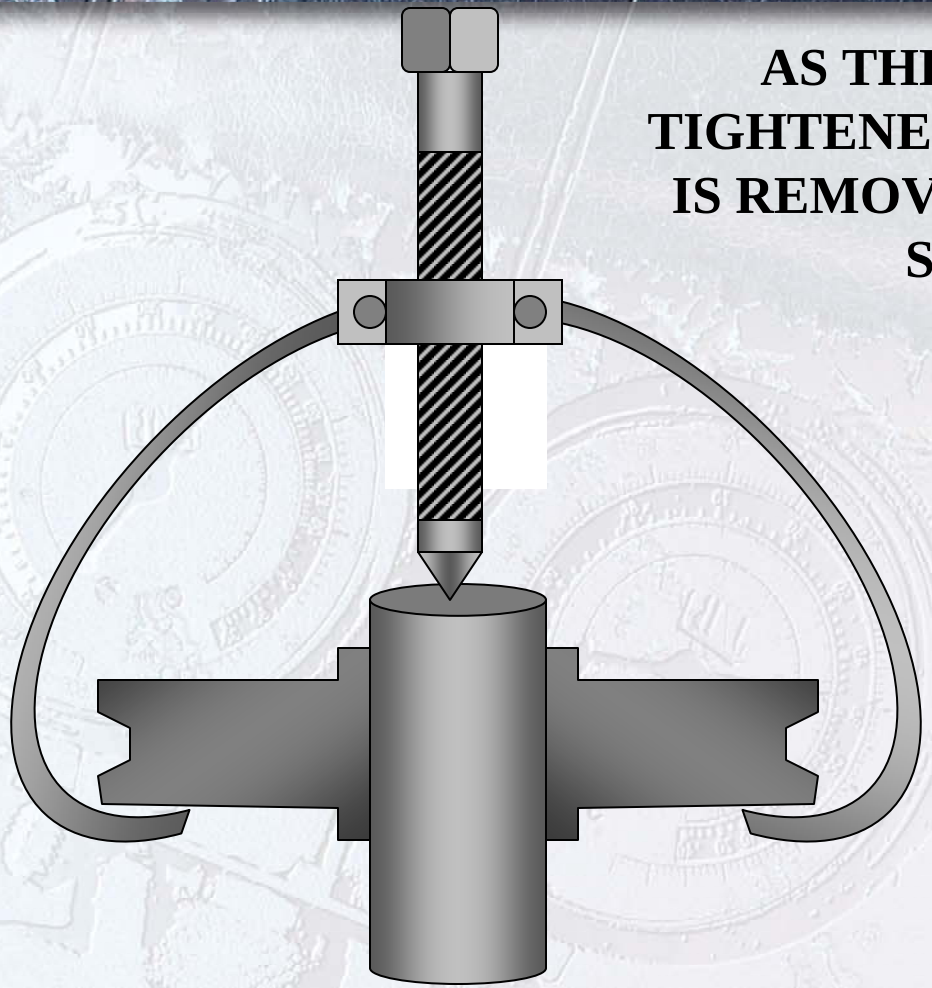
REMOVING DRIVE ASSEMBLIES

- 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

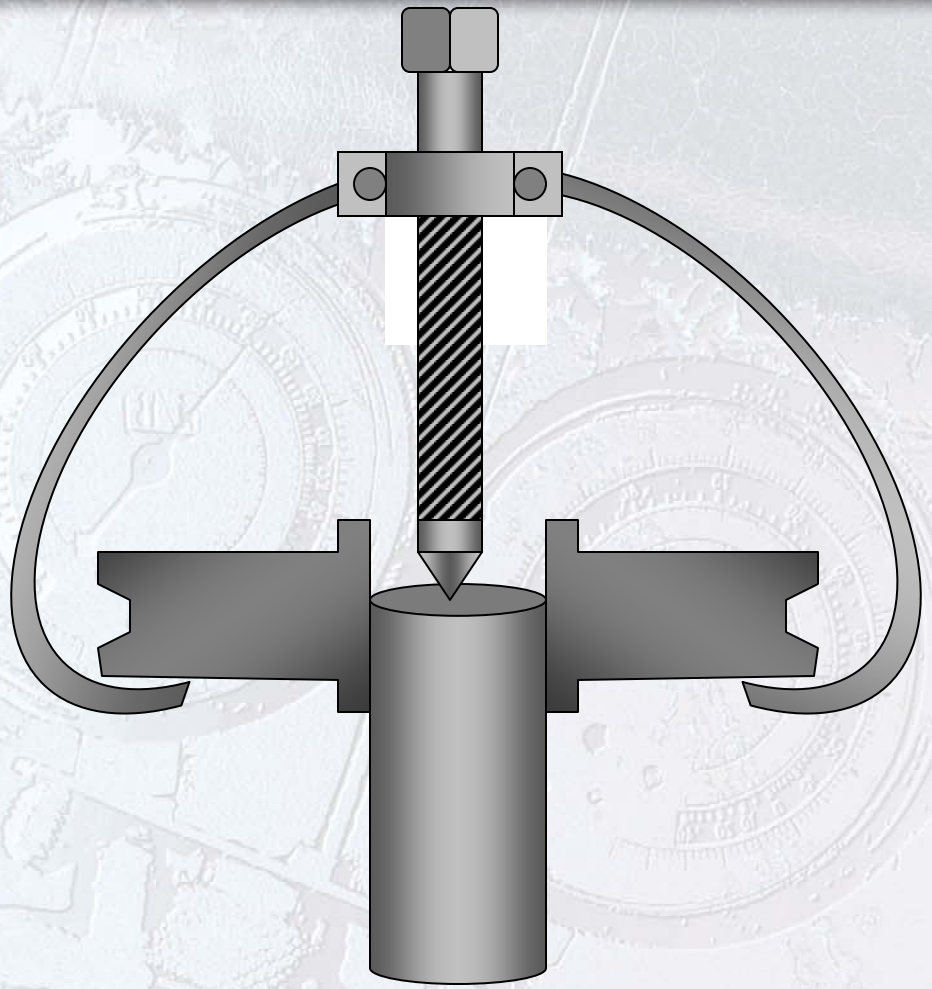


TOOL TO REMOVE PULLEYS FROM THE MOTOR SHAFT

AS THE SCREW IS TIGHTENED, THE PULLEY IS REMOVED FROM THE SHAFT



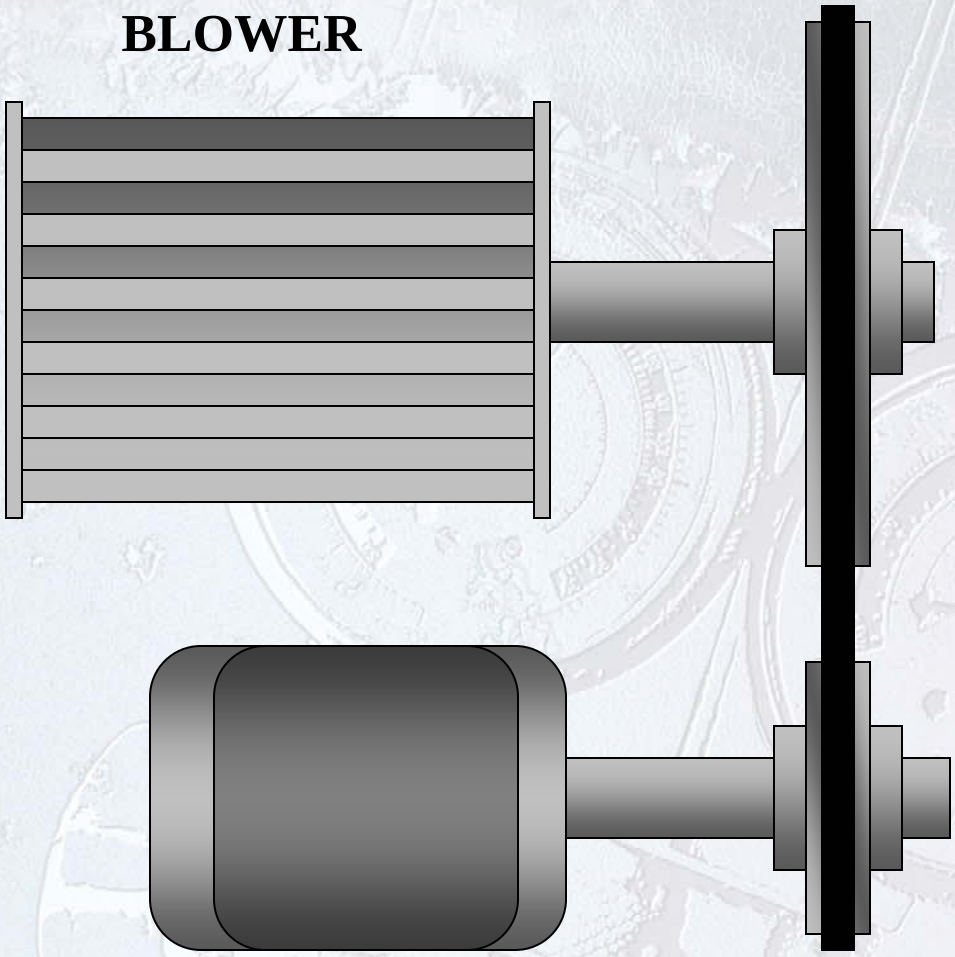
TOOL TO REMOVE PULLEYS FROM THE MOTOR SHAFT



TOOL TO REMOVE PULLEYS FROM THE MOTOR SHAFT

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



BOTH THE DRIVE AND DRIVEN PULLEYS MUST BE PERFECTLY ALIGNED

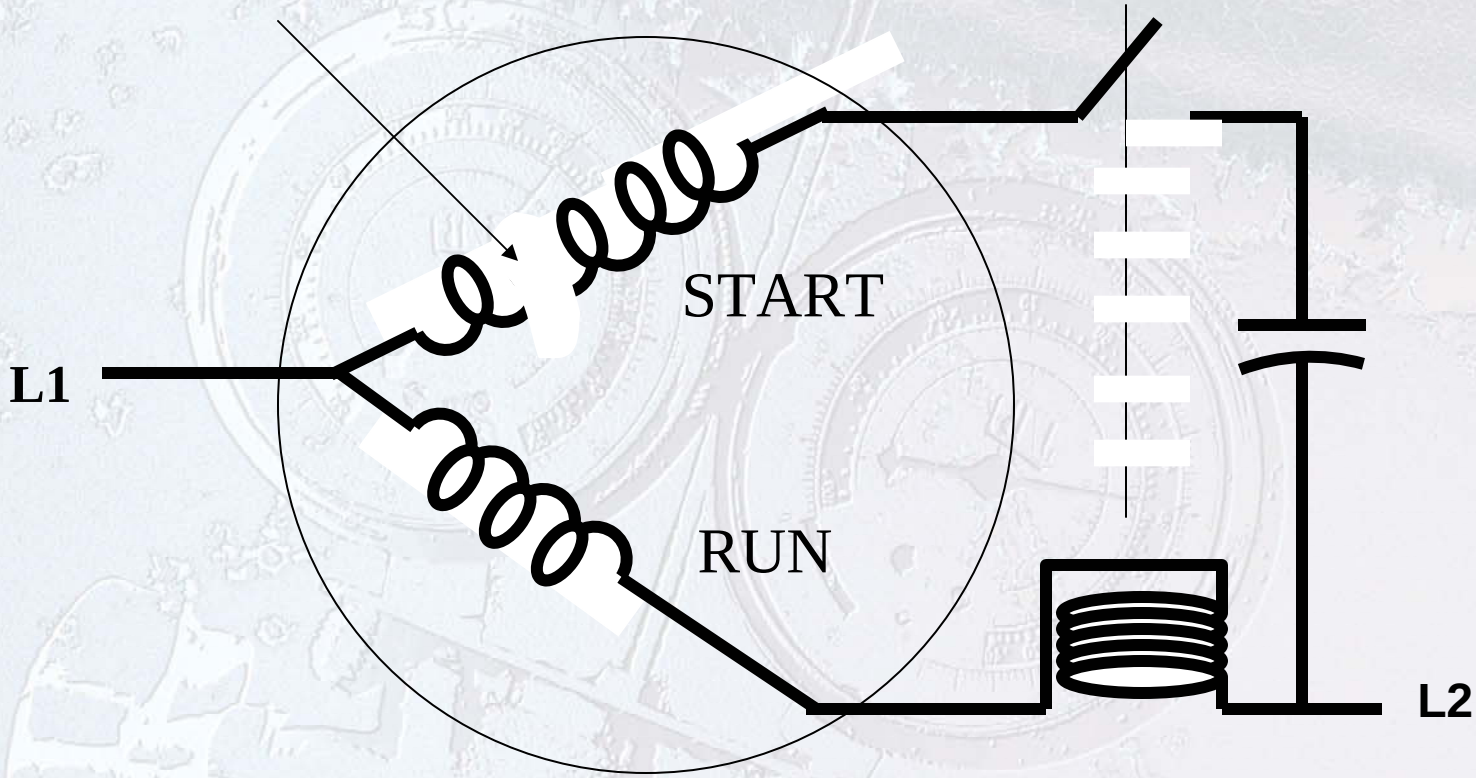
ELECTRICAL MOTOR PROBLEMS

- 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

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

OPEN WINDING



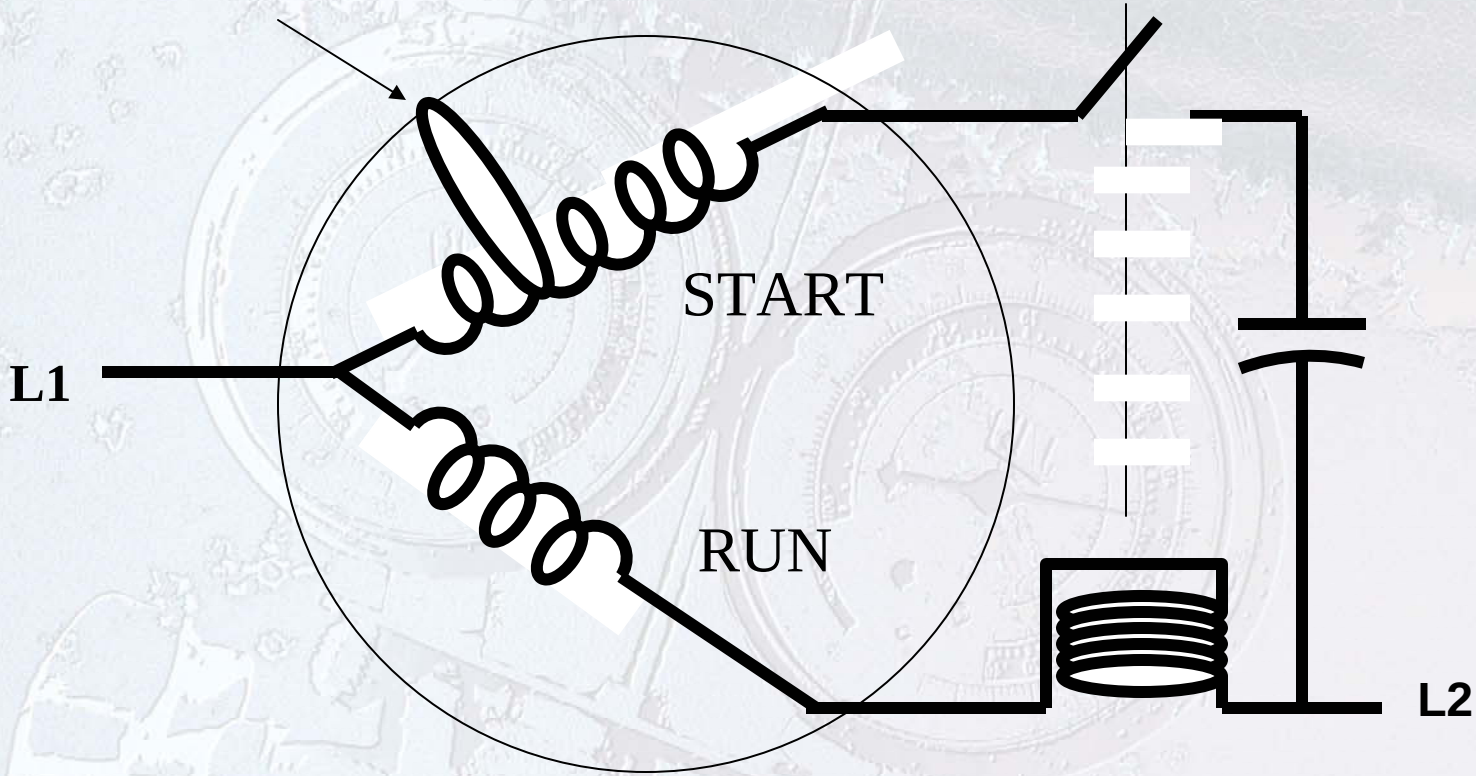
SHORTED MOTOR WINDINGS

- 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

SHORTED WINDING



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

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

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

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

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

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