Section 2
Safety, Tools and Equipment, Shop Practices

Unit 4
General Safety Practices

Unit Objectives

After studying this chapter, you should be able to:

- Describe proper procedures for working with pressurized systems and vessels, electrical energy, heat, cold, rotating machinery, and chemicals; for moving heavy objects; and for utilizing proper ventilation.
- Work safely, avoiding safety hazards.

Pressure Vessels and Piping (1 of 2)

- The pressure in a vessel increases as the temperature of the vessel increases.
  - This pressure is a potential danger.
- Refrigerant cylinders should be stored in the upright position.
- Larger cylinders should be moved only when the protective cap is in place.
- Larger cylinders should be secured to carts designed for moving cylinders.
- Always wear gloves and eye protection.

Pressure Vessels and Piping (2 of 2)

- Take all precautions to prevent tanks from falling over…

- the valve stem may break off, causing the tank to become a projectile

Electrical Hazards

- Exercise caution when working on or around electrical circuits.
- Uncontrolled electric current flow can result in electrical shocks or burns.
- Follow lock-out and tag procedures.
- Exercise caution when working on live circuits.
- Do not come in contact with energized conductors.

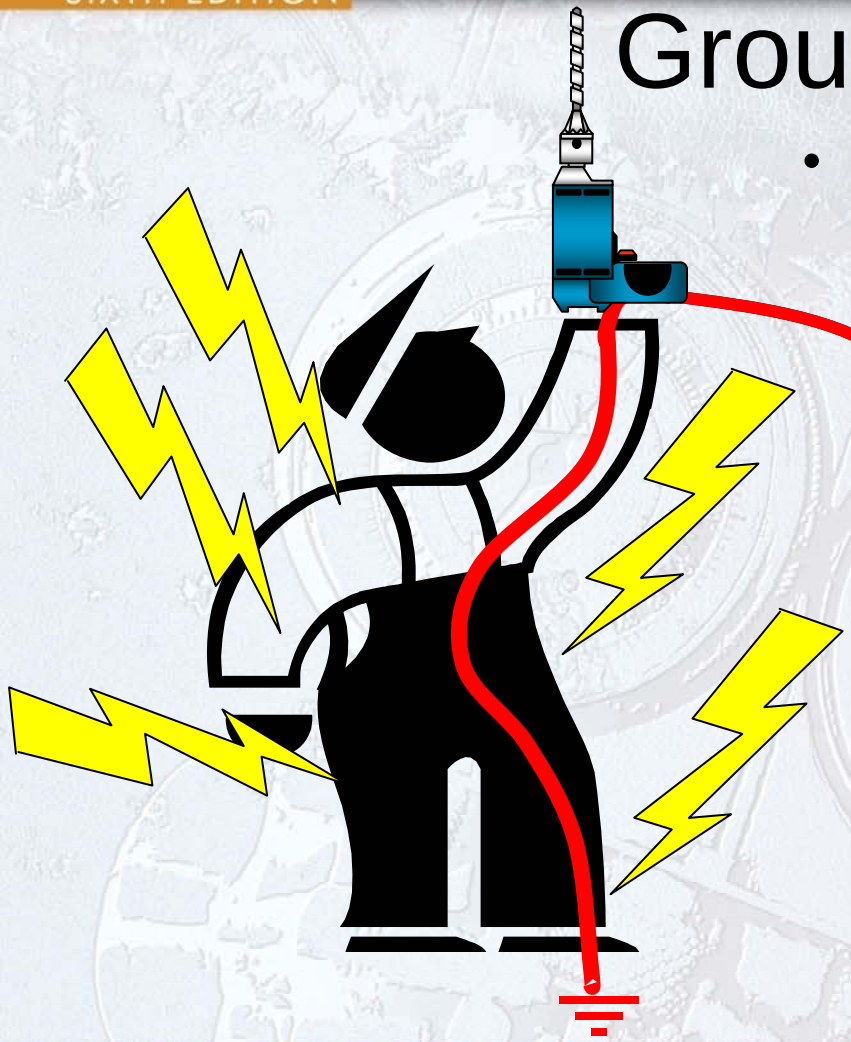
Electric Shock

- Shock occurs when you become a part of a circuit.
- Severity of a shock is determined by voltage, current, and the path the current takes as it flows through the body.
- Current flow through the heart can be fatal.
- To help prevent shock, wear insulated boots and do not stand in water while working on equipment.

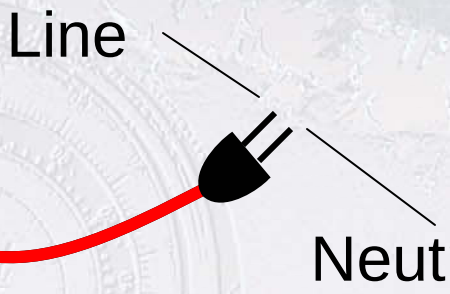
Ground Protection

- Grounding wires provide protection from electric shock.
- The ground wire provides an alternative path for current to take.
- All tools should be properly grounded.
- Do not use tools that have damaged or missing ground prongs.

Ground Protection

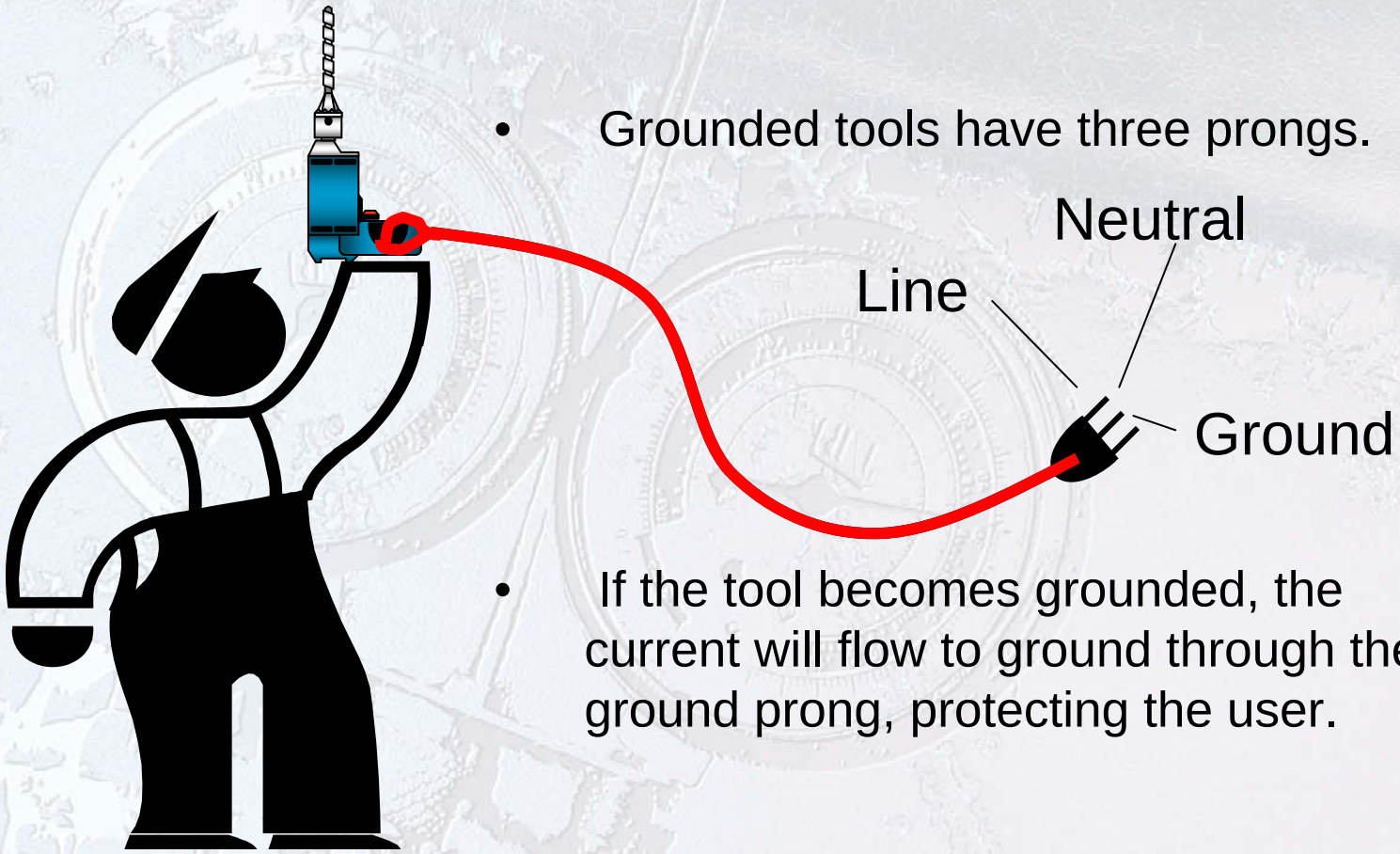


- Ungrounded tools have two prongs: One supplies line voltage to the tool and the other is neutral.



- If the tool becomes grounded, current can flow through the tool and through the user to ground causing shock.

Ground Protection



- Grounded tools have three prongs.
- If the tool becomes grounded, the current will flow to ground through the ground prong, protecting the user.

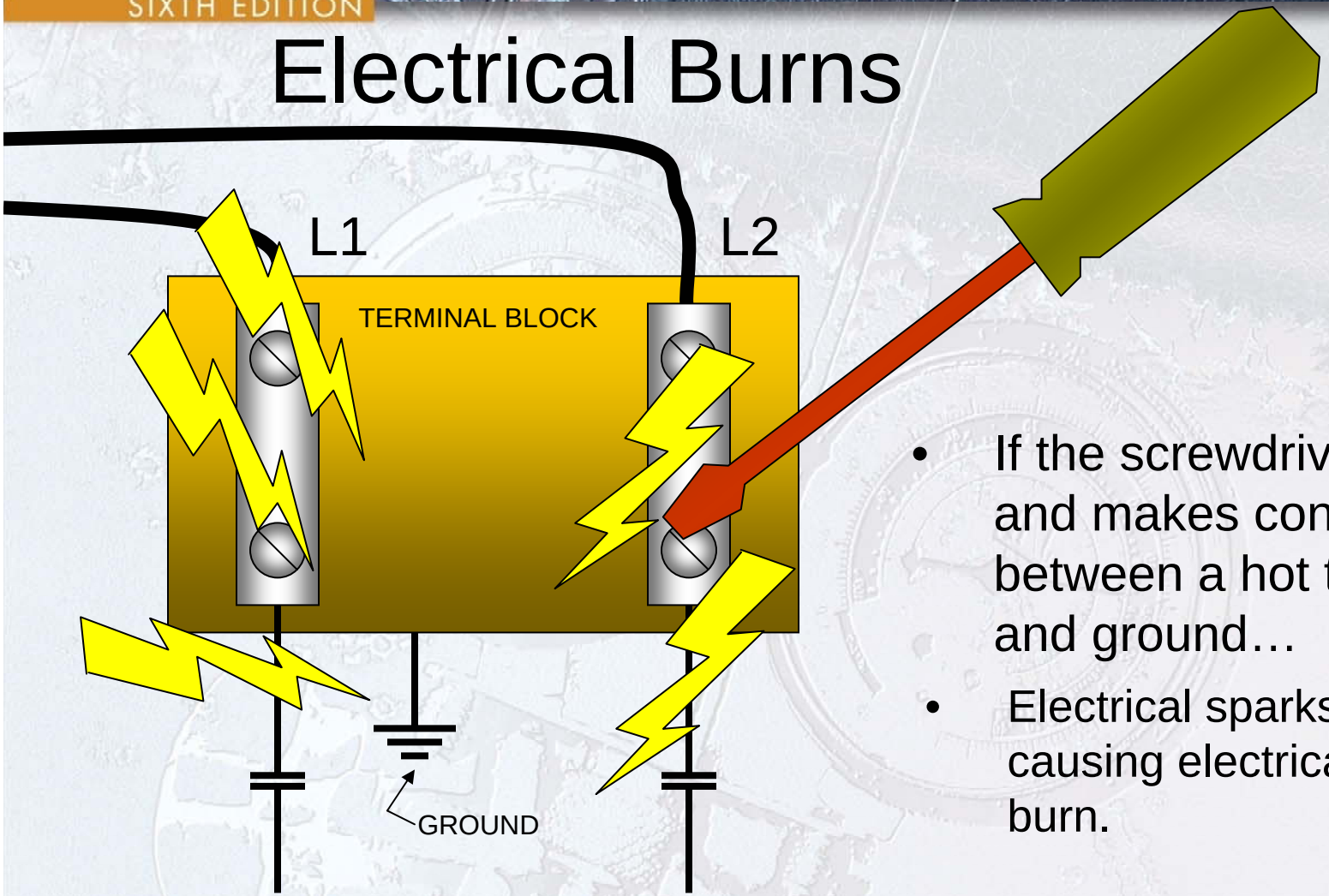
Other Grounding Tidbits…

- If wall outlets have only two connections and the tool has three prongs, use an adapter.
- Plastic-cased tools are double-insulated and often have only two prongs.
- Battery-operated tools are convenient and safer.
- Ground fault circuit interrupters (GFCI) sense small electrical leaks to ground.

Electrical Burns

- Avoid wearing metallic jewelry while working on electric circuits.
  -Metallic jewelry conducts electricity.
- Never use a screwdriver in an electrical panel when the power is on.
- Burns can result from electric sparks.

Electrical Burns



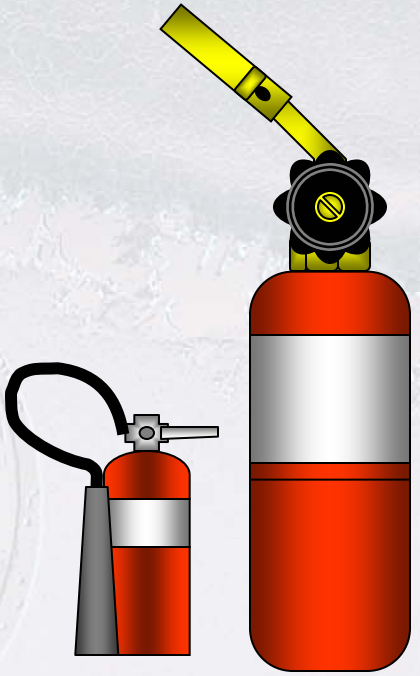
- If the screwdriver slips and makes contact between a hot terminal and ground…
- Electrical sparks can result, causing electrical shock or burn.

Ladder Safety

- Nonconducting ladders should be used.
- Fiberglass or wooden ladders are preferred.
- Ladders should be placed on level surfaces.
- Damaged ladders should not be used.
- Ladders should be free of oil, grease, and other slipping hazards.
- Ladders should have slip-resistant feet.
- Secure the ladder in place whenever possible.

Heat-related Safety Issues

- Torches concentrate large amounts of heat.
- Keep torches away from combustible materials.
- Always keep a fire extinguisher nearby.
- Use a fire shield when soldering near combustibles.
- Never solder tubing on a sealed system.
- Hot pipes and motors can cause burns.
- Working outdoors or in hot attics can cause injury.



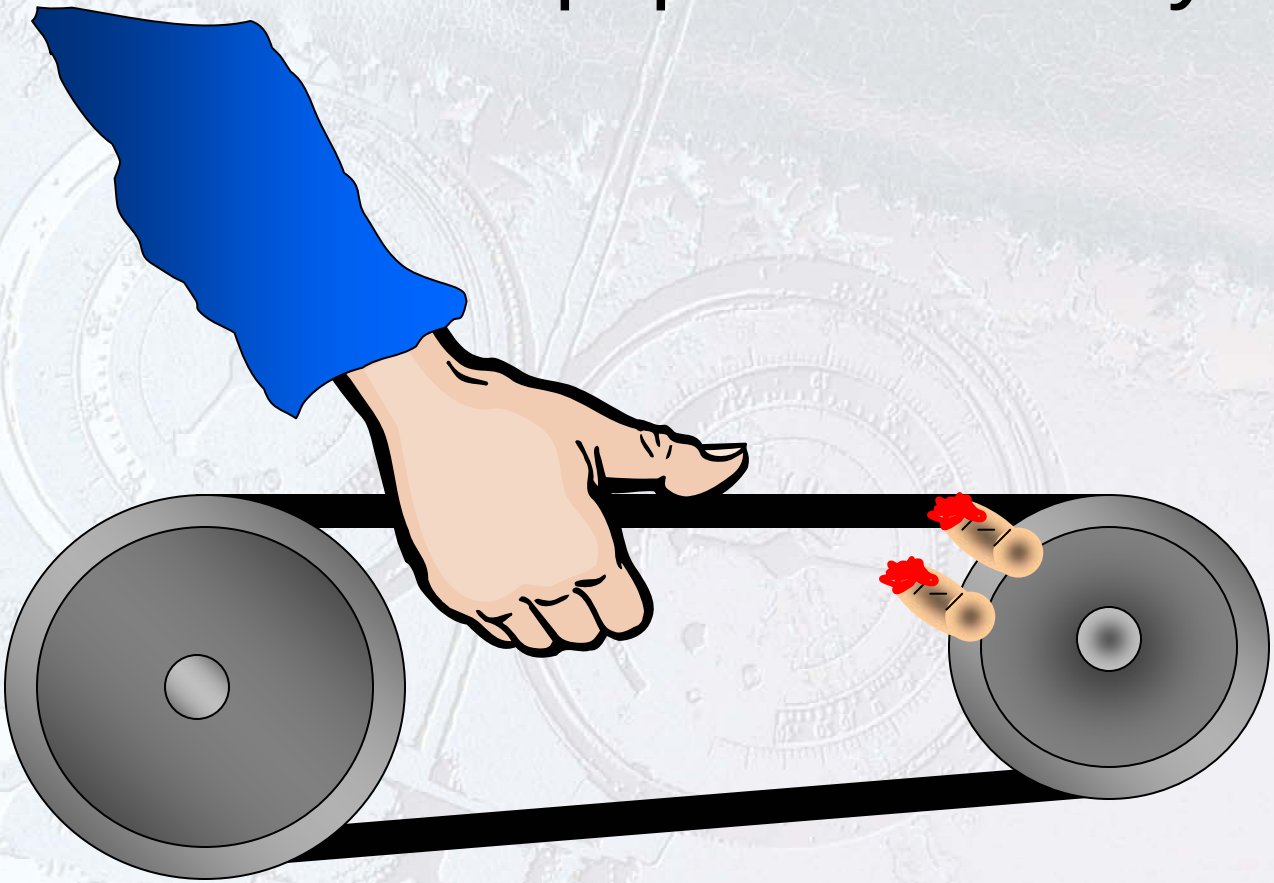
Cold-related Safety Issues

- Cold can be as dangerous as heat.
- Liquid refrigerant can cause frostbite.
- R-22 boils at -41°F at atmospheric pressure.
- Wear warm clothing and waterproof boots when working in cold, wet environments.
- Cold-weather gear should be worn when working in low-temperature freezers.

Mechanical Equipment Safety

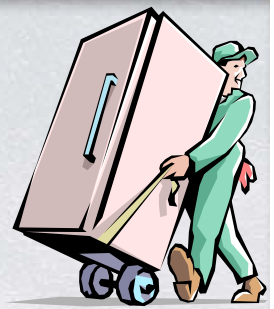
- Rotating machinery can cause injury.
- Loose fitting clothing can get caught in rotating machinery including, fans, belts, and pulleys.
- Never try to stop rotating machinery by hand.
- Jewelry can get caught on machinery.
- Always use eye protection when working on or around rotating machinery.

Mechanical Equipment Safety



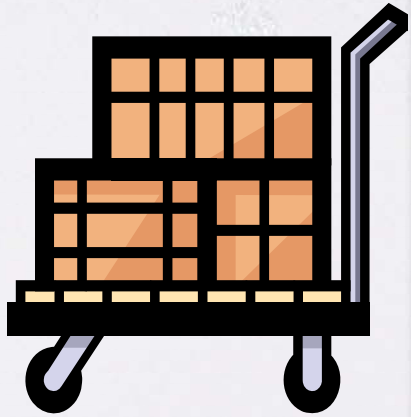
- Never try to stop rotating machinery by hand!

Moving Heavy Objects



- Use the safest method to move heavy objects.
- Get help from others when the object is heavy.
- Lift with your legs, not your back.

- Use hand trucks whenever possible.
- Pry bars and dollies can be used.
- Use a back brace
- Pry bars can also be used



Refrigerants in the Breathing Space

- Refrigerant gases are heavier than air.
- These gases displace oxygen.
- Avoid breathing refrigerant vapors.
- Use proper ventilation.
- Special leak detectors and alarms are required in certain applications.
- ASHRAE Standard 34-1992 addresses refrigerant toxicity and flammability.

Chemical Safety

- Used to clean condensers, evaporators, and other pieces of equipment
- Used for water treatment
- Should be handled according to manufacturer's directions
  - Follow manufacturer's first aid procedures.
- Can cause irritation to the eyes, throat, and skin.
  - Be very careful!

Unit Summary

- Use every precaution when working with pressure, electricity, heat, cold, machinery, chemicals, and when moving heavy objects.
- Lockout and tag electrical circuits.
- Electric circuits must be properly grounded.
- Excessive heat or cold can cause injury.
- Exercise caution when working on rotating machinery.
- Observe all safety rules to prevent personal injury.