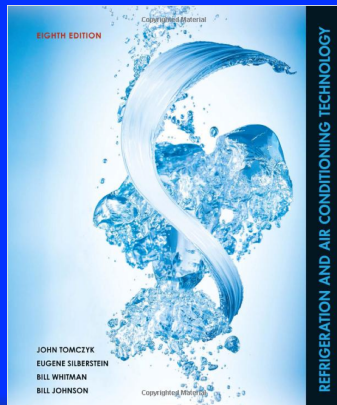


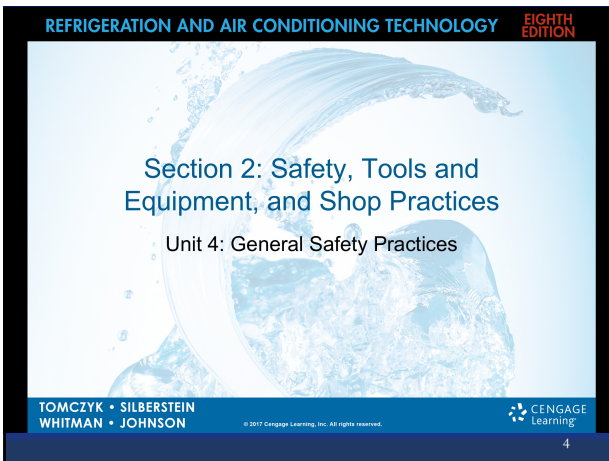
Air Conditioning Basics

- Download and study the material
- Take the quizzes
- Make sure you hit 70 % mark to pass the course
- Complete homework so you can be ready for next assigned Module

We will be using **Refrigeration and Air Conditioning Technology** book for this course.

We recommended you purchase this book either as a hard copy or as an eBook, then follow along and answer questions as assigned.





Unit 4 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

Pressure Vessels and Piping

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

Pressure Vessels and Piping

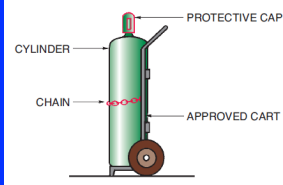


Figure 4-3 Pressurized cylinders should be chained to and moved safely on an approved cart. The protective cap must be secured.

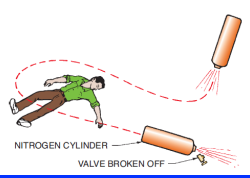


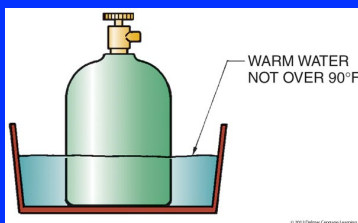
Figure 4-8 When a cylinder valve is broken off, the cylinder becomes a projectile until pressure is exhausted.

7

If you must heat up a bottle of refrigerant use a bucket of hot water, not a torch!!!

8

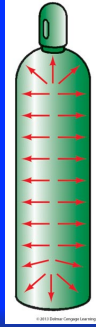
- The water should NOT be warmer than 90°



9

Refrigerant bottles and piping are under pressure

do not add heat to piping until you are sure it does have refrigerant inside



10

Protective cap on an R22 bottle



11



VAPOR LEAVING CYLINDER

CYLINDER PRESSURE RELIEF VALVE

250 psig

(A)

12

Do not lubricate regulator with OIL!!!!!!



13

Do not pressure test with oxygen, always use nitrogen with a regulator to lower the pressure



14

Electrical Safety

Electricity cannot be seen

it must be tested with a good working meter.

How do we know it is a working meter?

15

- We must test a meter on a known live circuit!!!
- Test it on something that is working to make sure you get a voltage reading.
- If you drop it you must re-test it again!!!

16

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, tag-out procedures
- Do not come in contact with energized conductors

17

Electrical Hazards

- Electrical shock occurs when you become part of a circuit
 - Severity of a shock is determined by voltage, current, and path of current
 - To help prevent shock, wear insulated boots and do not stand in water while working on equipment
 - Grounding wires provide protection
 - Battery-operated tools are convenient & safer

18

Electrical Hazards

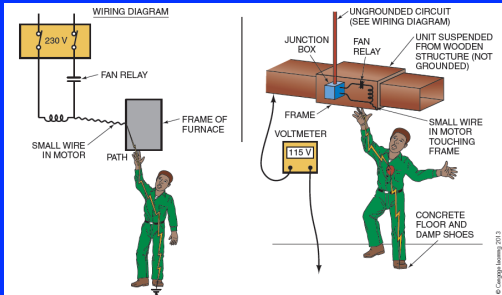


Figure 4-14 This figure shows ways that the technician can become part of the electrical circuit and receive an electrical shock

Electrical Hazards

Grounding wires provide protection

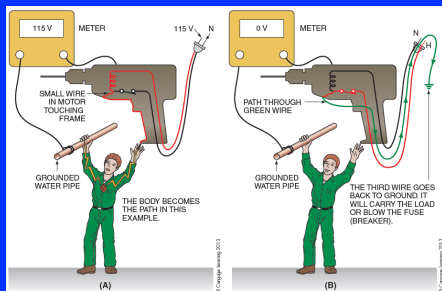


Figure 4-15 (A) An electrical circuit to ground from the metal frame of a drill
(B) Metal frame of a drill properly grounded

Electrical Hazards

- Electrical burns
 - Avoid wearing metallic jewelry while working on electric circuits because they can cause shock and possible burns

Electrical Burns

- Never use a screwdriver in an electrical panel when the power is on
- Burns can result from electric sparks

22

Electrical Short Circuit Hazards

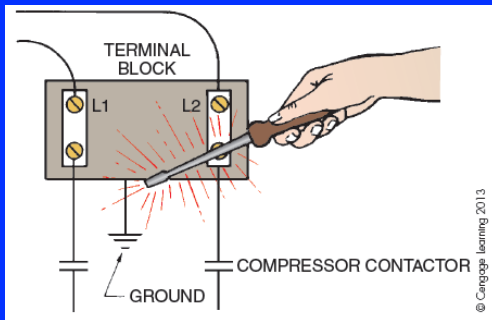


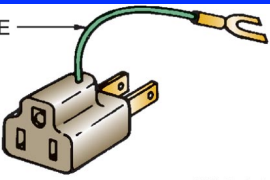
Figure 4-20 This wiring illustration shows a short circuit caused by the slip of a screwdriver

23

In case of an emergency cut power off and get the person off of the hot circuit.

24

GREEN WIRE

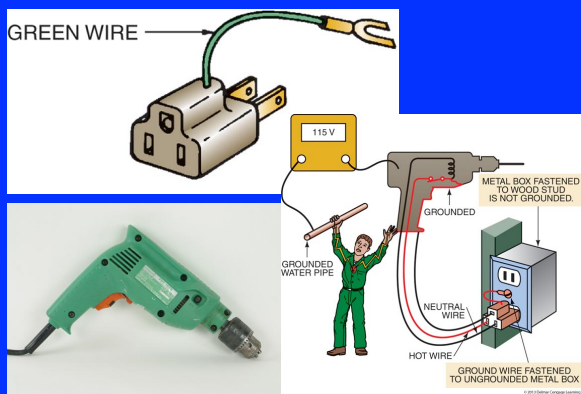


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Make sure tools and equipment have a ground wire
the ground wire is usually green or bare wire

25

GREEN WIRE



(A)

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26



(B)

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27

Ladder Safety

- Ladder safety
- Use nonconducting ladders (fiberglass, wood)
- Place ladders on level surfaces
- Do not use damaged ladders
- Keep ladders free of oil, grease, and other slipping hazards
- Ladders should have slip-resistant feet
- Secure the ladder in place whenever possible

28

Positioning a Portable Ladder

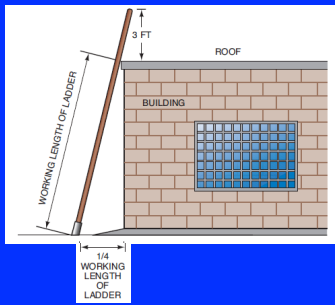


Figure 4-22(A) The side rails of a portable ladder should extend 3 ft above the upper landing surface. The angle of the ladder should be such that the horizontal space at the bottom is about one-fourth the distance of the working length of the ladder

29

If working length is 12' how far away should the ladder be from the wall?

$$\frac{12}{4} = 3'$$

Ladder should be 3 feet away from the wall.

30

Heat

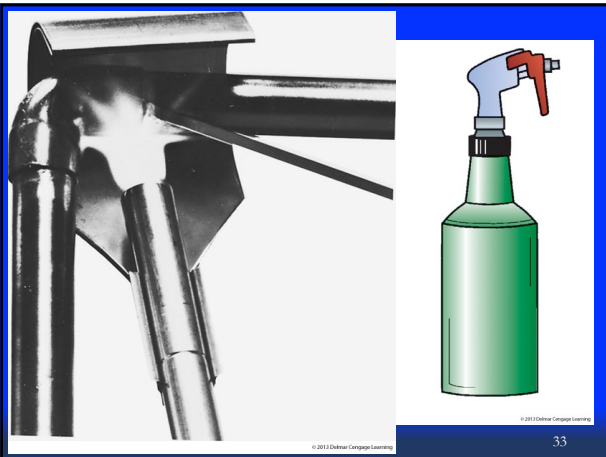
- Torches concentrate large amounts of heat
 - Always keep a fire extinguisher nearby
 - Use a fire shield when soldering near combustibles
 - Never solder tubing on a sealed system

31

Heat

- Hot pipes and motors can cause burns
- Working outdoors or in hot attics can cause injury
- Hot pipes and motors can cause burns

32



33

Fires A B C

- **Alpha:** when it burns, it leaves ash
- **Bravo:** oil, gasoline, grease, liquids
- **Charley:** an electrical fire

34



(A)

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35



(B)

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36

Fires are a triangle of fuel, oxygen and heat
If you remove one of those 3, the fire will go out
Fire extinguishers are designed to remove one of those 3 components

37

Fire plus refrigerant produces phosgene gas

38

Cold

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

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Mechanical Equipment

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

40

Mechanical Equipment Hazards



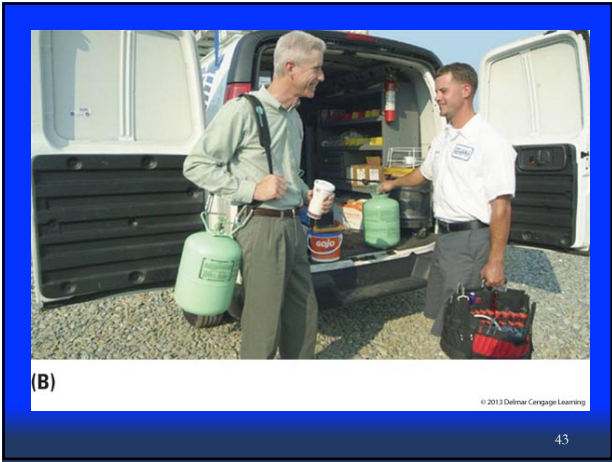
Figure 4-26 SAFETY PRECAUTION: Never wear a necktie or loose clothing when using or working around rotating equipment

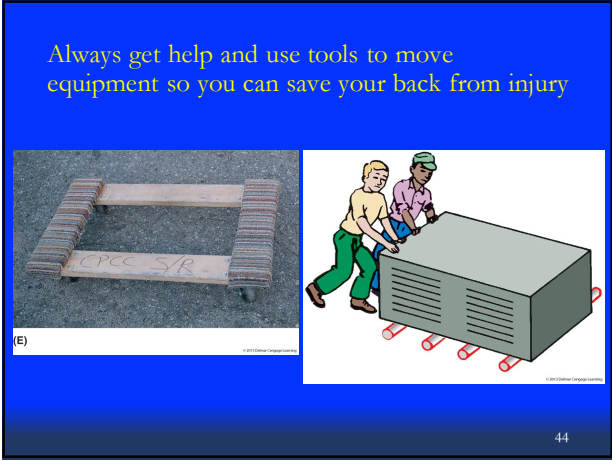
41

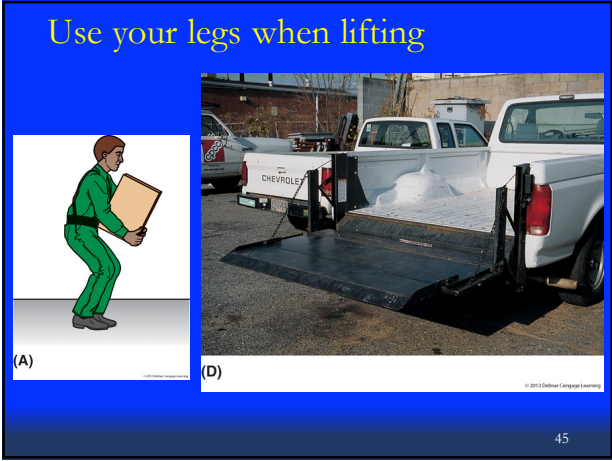
Moving Heavy Objects

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

42







Refrigerants In Your Breathing Space

- Refrigerant gases are heavier than air
 - These gases displace oxygen
 - Avoid breathing refrigerant vapors
 - Use proper ventilation

46

Refrigerants In Your Breathing Space

- Refrigerant gases are heavier than air
 - Special leak detectors and alarms are required in certain applications
 - ASHRAE Standard 34-1992 addresses refrigerant toxicity and flammability

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Refrigerants and Proper Ventilation

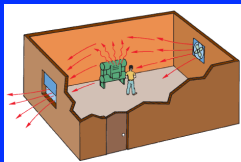


Figure 4-37 Cross ventilation with fresh air will help prevent fumes from accumulating

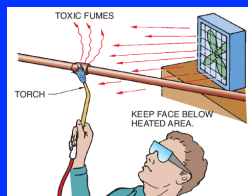


Figure 4-40 Keep your face below the heated area and ensure that the area is well ventilated

48

Using Chemicals

- Used to clean condensers, evaporators, and other pieces of equipment
 - Also 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!

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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

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- Download the material
- Review the material. Read over your notes
- Watch the presentation over and over again so you can be ready for the quiz
- You must pass the quiz with a 70% or higher score
- You may re-take the quiz up to 3 times
- Good luck!!!

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Home work

• In module 2 we will be discussing the principles of thermodynamics. It is suggested that you do the following reading:

- In unit # 1 Read : 1.1 to 1.15
- Answer questions: 1 through 14, 16 through 19

- in unit # 2 read : 2.1,2.6,2.7,2.8,2.9
- Skim over: 2.2,2.3,2.4, 2.5,2.6, 2.12 to 2.14
- Answer questions: 1 through 6, 16, 18, 21, 25 to 27

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