SAFE LADDER PRACTICES FOR HVACR TECHNICIANS

Objective:
Learn OSHA requirements regarding ladder safety and fall protection as well as the best techniques to safely move tools and equipment to rooftops. Learn the proper techniques to select, inspect, set-up, use and care for fixed ladders (service ladders), single and extension ladders.

Why: Per the U.S Consumer Product Safety Commission, each year over 160,000 people are injured as the result of falls from ladders due to not following safety precautions. Most injuries are cuts, bruises and broken bones, but nearly 300 result in death.

Unique risks exist in the HVACR industry: Vacuum pumps, refrigerant, tools can be awkward to transport to rooftop units and special care must be taken to minimize the unique risks associated with transporting special service tools. This course will cover the options available, and the decision process to determine the safest method for transporting tools and equipment to rooftop units.

OSHA REGULATIONS

OSHA 1926 – “Safety and Health Regulations for Construction” covers ladder safety as well as fall protection. Since much of the content of this course is governed by this OSHA 1926 regulation, we’ll cover some of the basic OSHA definitions here.

- **Leading Edge** - the edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed, or constructed. A leading edge is considered to be an "unprotected side and edge" during periods when it is not actively and continuously under construction.
- **Unprotected sides and edges** - any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches (1.0 m) high. Hatches and holes in the working surface must be protected the same as any other edge.
- **Walking/working surface** - any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

For HVAC technicians, unless you’re involved in the construction of a new building where “leading edges” exist, your primary exposure will be on rooftops which may be considered “unprotected edges” if the wall or guardrail surrounding the roof (or hatch) is not 39 inches high or greater.

Key Regulations:

OSHA 1926.501 states that each employee on a walking/working surface with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

OSHA 1926.1053 states that when ascending or descending a ladder, the user shall face the ladder. Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder. An employee shall not carry any object or load that could cause the employee to lose balance and fall.

These two OSHA requirements present some unique challenges to HVAC technicians who often need to move equipment and tools to rooftop jobsites in the course of completing a service call.

In a typical situation, 2 options exist for a technician to transport tools and equipment to a rooftop site; carrying items up or roping items up.

- Based on OSHA 1926.501, Roping tools and equipment to the rooftop is permitted where
    - The roof edge is protected with an approved wall or guardrail at least 39 inches high or…
    - If the edge is unprotected, the technician must use an approved personal fall arrest system (eg. Harnesses, body belts, lifelines etc.)
    - Rope can accumulate on the roof and present a potential tripping hazard and care must be taken to prevent this risk when roping up items.
- Where the roof edge is unprotected and approved personal fall arrest systems are not available, equipment and tools should be carried to the roof while following the requirements of OSHA 1926.1053.
    - “Equipment and tools should be attached to a tool belt so that both hands are free to grasp the ladder”, and
    - “The load should not cause the employee to lose balance”. This means more than one trip may be necessary depending on the amount of tools and equipment you are required to move.
    - Note that hatches are considered “holes” per OSHA 1926 and are thus considered unprotected edges. Hatch openings must be protected by a guardrail or wall at least 39 inches high, or employees on a working surface containing a hatch must be protected by personal fall arrest system.

Given there are many situations where rooftops or hatch edges are not protected by guardrails, and personal fall arrest systems are not an option, carrying tools and equipment to the roof while complying with OSHA 1926.1053 is often the only alternative.

To help technician comply with OSHA regulations and maintain 3 points of contact with the ladder while transporting tools and equipment, we suggest the use of a relatively new device called a “refrigerant strap”. This device is available at many HVAC wholesalers and catalogs.

A refrigerant strap is a heavy duty shoulder strap designed specifically to carry gas canisters, reclaim pumps, and other tools.

- It is designed to handle the weight of a full gas canister
- It has locking snap links to assure the item being carried is secure
- It has non-slip fabric on the underside of the shoulder padding to maintain the load securely on the shoulder.

Safe Use of a Refrigerant Strap

With any tool, proper use is essential to prevent accident and injury and it's no different with a refrigerant strap. Follow these steps to assure maximum safety:

1. Always inspect your strap before use. Make sure webbing is not damaged or frayed, and that stitching is not pulling loose. Check snap links to assure they are not bent, rusted or otherwise damaged. The snap links must close to a "locked" position to assure to load does not become unsecured during the climb.
2. Develop a plan to get your equipment to the roof. Do not attempt to carry too much in one trip. OSHA 1926.1053 states that "the load should not cause the employee to lose balance". Multiple trips may be necessary to safely move all tools and equipment to the rooftop
3. Decide the most comfortable and balanced way to carry your load. Refrigerant straps typically allow length adjustment. The strap can be lengthened to allow the strap to cross over the head to the opposite shoulder, or can be shortened so the load can be carried on the near shoulder. Determine which configuration is best based on the load you intend to carry.

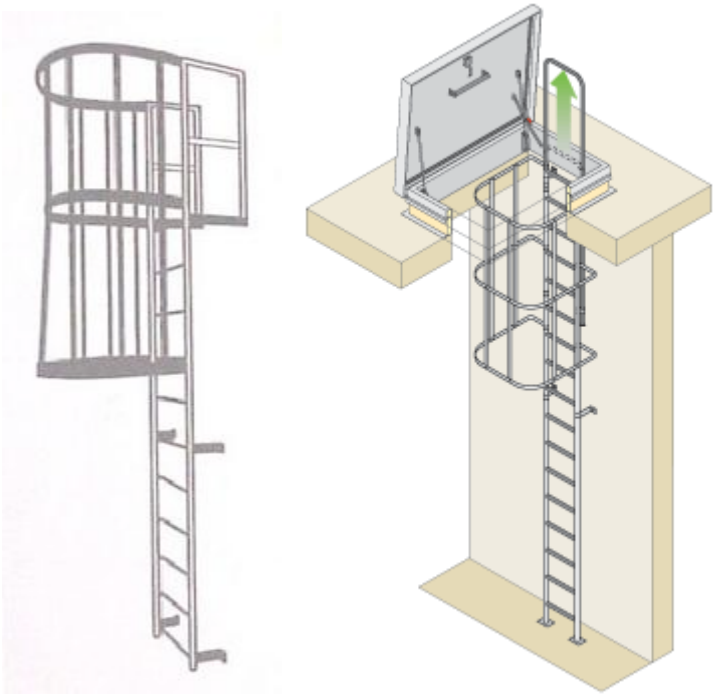
4. Attach the load to the strap. Attach the snap link at each end of the strap to the handles of the refrigerant cylinder or secure attachment points of reclaim pumps or other equipment. Make sure the links are locked prior to lifting.

5. Perform a trial lift of the load. Lift the item to the carrying position. Make sure the load is secured near your body and the weight is properly balanced. Excessive movement of the load while climbing can cause you to lose balance while climbing. Adjust the strap length and shoulder pad position until you are comfortable the load is secure and balance is proper.
6. Clear the area below the ladder. Always make sure no one is below the ladder while climbing. Falling objects are always a danger when transporting tools and equipment on ladders.
7. Always follow the proper ladder safety procedures detailed below regardless of whether you are carrying equipment or not.

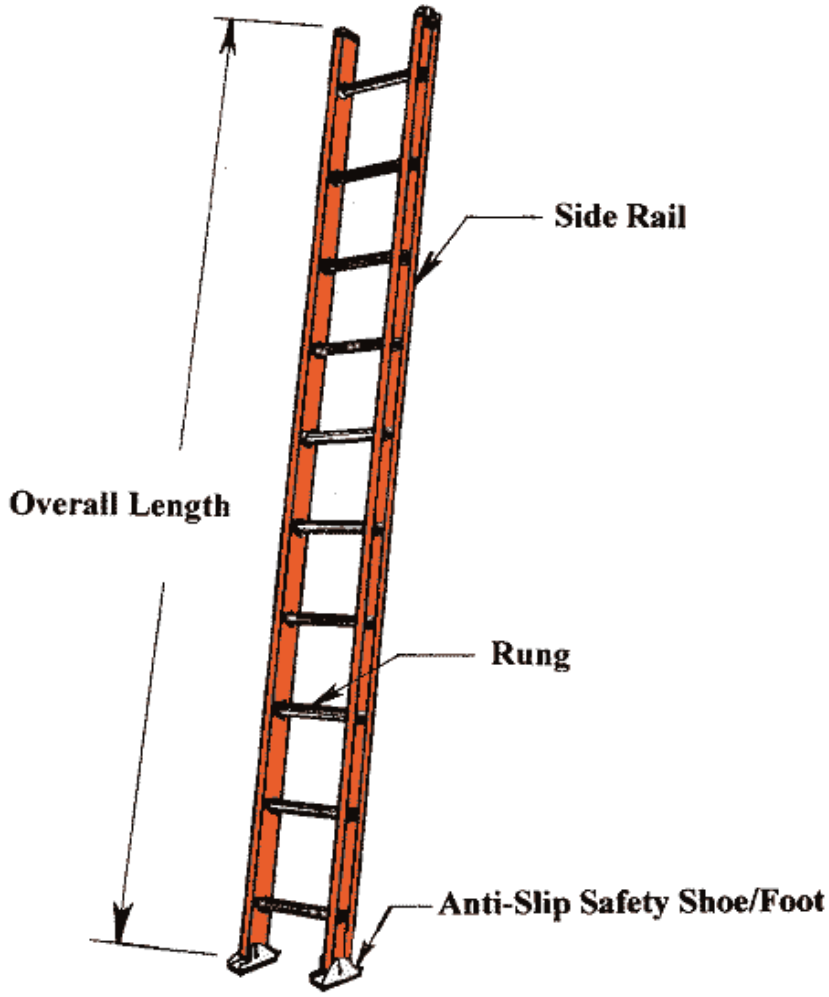
LADDER BASIC DEFINITIONS

A Fixed Ladder or Service Ladder is a non-self-supporting ladder that is non-adjustable in length and permanently attached to a structure at a Pitch ranging from 60 degrees to 90 degrees from the horizontal. The Preferred Pitch of a Fixed Ladder is between 75 degrees and 90 degrees from the horizontal. Fixed Ladders having a Pitch greater than 90 degrees are not allowed.

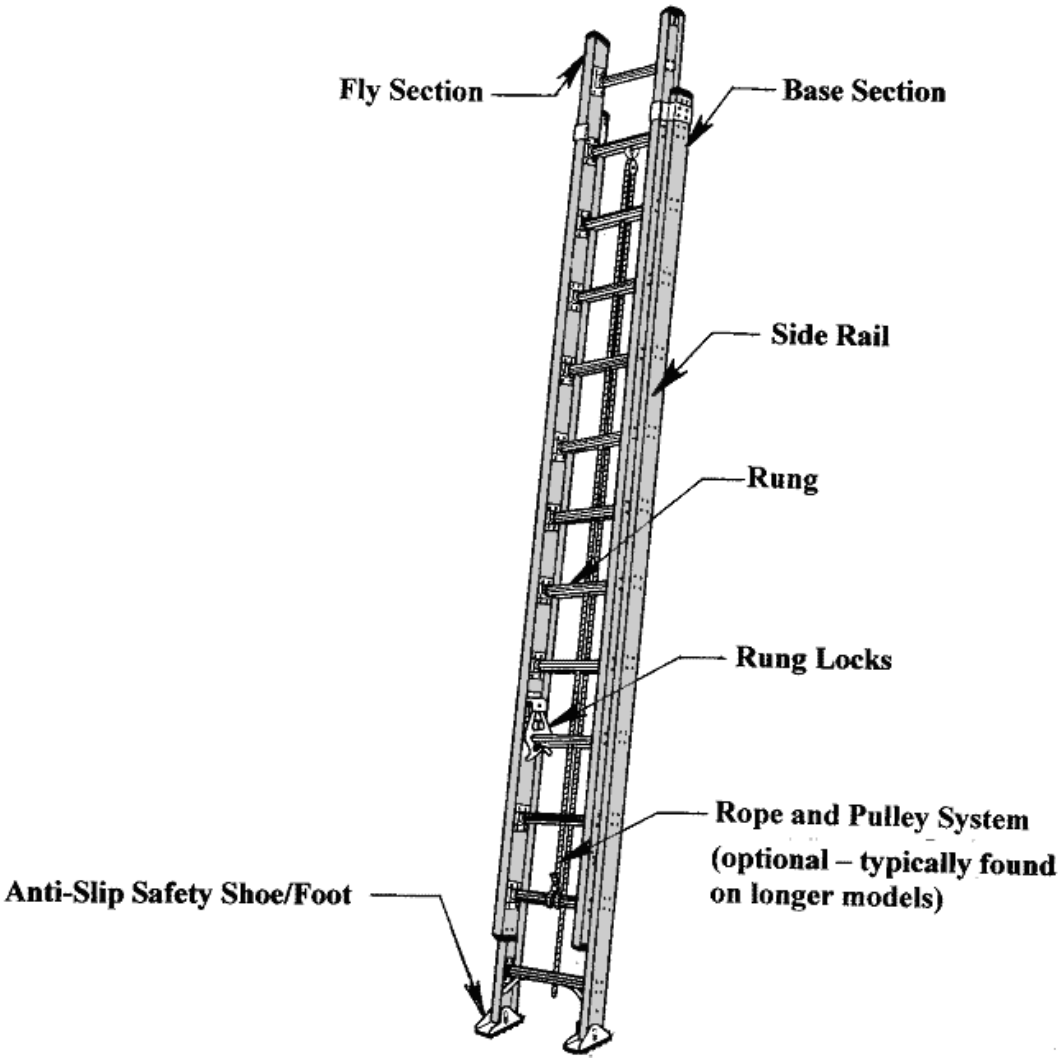
The risk of having the ladder move when in use is eliminated in the fixed ladder design; however, fixed ladders pose a unique risk for HVAC technicians because in most cases the ladder leads to a roof hatch that has to be opened before the technician can gain access to the roof of the building to service HVACR equipment. Below are illustrations of both an external building fixed ladder as well as fixed ladder / roof hatch system.



A Single ladder is a one piece non self supporting portable ladder, not adjustable in length. It is virtually identical to the base section of an extension ladder.



An extension ladder is a multiple piece, non self supporting portable ladder that is adjustable in length. It consists of a base section and one or two telescoping sections called fly sections that move up and down within guides.



Because the majority of commercial building have Fixed or Service Ladders for rooftop access, we will begin by covering Fixed Ladder safety. However, there will be times when fixed ladders are not an option. You will be required to use a

Single or Extension Ladder which brings the added danger of understanding how to select and properly set up these non-fixed type ladders. Single and extension ladder safety is covered after Fixed ladder Safety.

1) INTRODUCTION TO BASIC FIXED LADDER SAFETY

Ladders are tools. Many of the basic safety rules that apply to most tools also apply to the safe use of a ladder:

- If you feel tired or dizzy, or are prone to losing your balance, stay off the ladder.
- Users who tire easily or who have physical limitations that inhibit safe climbing such as fainting and/or under medication or prescription drugs which may cause physical impairment are not permitted to use Fixed Ladders.
- Do not use ladders in high winds or storms.
- Wear clean slip-resistant shoes. Shoes with leather soles are not appropriate for ladder use since they are not considered sufficiently slip-resistant. Flat-soled shoes are not appropriate, and footwear with heels when climbing Fixed Ladders is mandatory.
- Wearing greasy or slippery gloves and/or footwear is not permitted during climbing.
- Steps, rungs, gripping surfaces and platforms must be kept free of oil, grease or slippery materials. When ice or frost conditions are present, the ladder must not be used.
- Only one person at a time is permitted on a ladder.
- Continually face the ladder as you climb, or descend.
- Always keep 3 points of contact with the ladder when climbing, holding on with 2 hands and one foot or 2 feet and one hand.
- When climbing a ladder, you MUST keep you hands free for climbing. Items must be secured to your body in such a way as they do not cause a loss of balance, placed in your tool belt, roped up, or handed up.
- Never jump or slide down from a ladder or climb more than one rung/step at a time.

2) FIXED LADDER MAINTENANCE

Fixed Ladders exposed to the elements are required to be maintained with protective finishes. The effects of corrosion must be minimized in the case of carbon-steel ladders and the effects of rot must be minimized in the case of wooden ladders. Special attention should be given to portions of ladders in contact with dissimilar metals or embedded in masonry or concrete to avoid accelerated deterioration.

While inspections of Fixed Ladders and Ladder Safety Systems must be made at least annually, individuals should do a personal inspection to identify signs of rust, corrosion and deterioration prior to climbing. The inspection should include all the major components rungs, side rails, supports, fasteners, anchors, Ladder Safety System, backside and front side clearances /obstructions, hatches, hatch opening arms, grab bars, platforms, and side rail extension anchors.

- The Fixed Ladder must not be used if any bolts or welds are not secure or missing or if the joints between the rungs and the side rail are not tight.
- Where structural defects or defects are identified, the ladder shall be taken out of service, blocked, fenced or removed until repairs are completed by a competent person. Repair materials should be at least the equivalent of the original construction.
- Records of annual or regularly scheduled inspections as well as repairs should be kept.
- If electrical grounding protection has been provided for the ladder, a continuity inspection of the ground connection(s) must be performed at least annually.

Fixed Ladder Safety Standards **-** Safety requirements for Construction, Performance, Use and Care of Fixed Ladders can be found in the following standard:

- ANSI A14.3 (American National Standard for Ladders – Fixed – Safety Requirements)

3) SINGLE & EXTENSION LADDER SELECTION

Single and extension ladders are manufactured in a variety of materials, lengths and duty ratings. To select the proper ladder the following must be considered:

- Work site environment is the first factor in selecting the ladder material.
    - Three materials are typically available: Wood, aluminum, and fiberglass

- If the work to be done is near sources of electricity or electric tool are to be used, aluminum ladders should be rejected due to risk of electric shock. If there are no electrical hazards in the area, an aluminum ladder may be lighter in weight and a satisfactory option.

- Size of the ladder
  - Single ladders are available in sizes from 10 to 30 feet.
  - Extension ladders range from 16 to 60 feet.
  - Extension ladders require an overlap of 3 ft for ladders from 16 to 32 feet, and up to 6 feet overlap for ladders taller than 48 feet.
  - Choosing the right ladder length requires knowing the height of the top support point (where the top of the ladder will be supported)
    - If the top support point is a roof eave, the ladder must extend at least 3 feet above the roof eave if the climber's intent is to access the roof.
  - The highest standing level should also be considered. The highest standing level is the rung which is at least 3 feet down from the top of the ladder. This height is always shown on a label on the side of the ladder. Never step or stand above the highest standing level of any ladder…this increases the risk of loosing balance and falling. GENERAL RULE – NEVER STEP ON THE TOP 3 RUNGS OF A LADDER!
  - The maximum work height is calculated by adding your height and reach to the highest standing level of the ladder.

- Total weight the ladder is to support
  - Calculate the total weight by adding your weight, the weight of your clothing and protective equipment you are wearing, the weight of any tools and supplies you will be carrying, and the weight of any tools or supplies stored on the ladder.
  - Compare this weight to the duty rating of the ladder shown on a label on the side rail of the ladder.
  - There are 5 categories of ladder duty ratings;
    - Type 1AA Special Duty max 350 lbs.,
    - Type 1A Extra Heavy Duty max 300 lbs,
    - Type 1 Heavy Duty max 250 lbs
    - Type 2 Medium Duty max 225 lbs.
    - Type 3 Light Duty max 200 lbs

- There is no relationship between ladder length and ladder weight capacity!

The key to ladder safety begins with inspection of the work site and the ladder. To properly inspect and secure the worksite:

- Check overhead for electrical hazards or obstructions
- Clear clutter from where the base of the ladder will be placed and be sure the location where the base of the ladder will be placed is clean of anything slippery such as water, ice or oil.
- Be aware of environmental conditions, rain, snow, or ice increase slipping hazards, while wind may cause instability.
- Block off the area around the base of the ladder to prevent being knocked from the ladder by people or equipment. If you are working around a corner, put up signs to alert people of your presence. Ladders should never be placed in front of closed doors. The door must be blocked open, locked or guarded.

4) LADDER INSPECTION

Although durable, ladders can become damaged. A thorough inspection should always be made prior to use. NEVER USE A DAMAGED LADDER!

- First inspect the ladder for loose, damaged or missing parts.
- Start the inspection at the bottom of the ladder, make sure the feet are not damaged or malfunctioning and that the shoes are secure.
- Work your way up the ladder inspect the side rail for dents, cracks, or bends.
- Along the way, check each rung to make sure the rail to rung connections are free from damage.
- Inspect all hardware and accessories… make sure extension ladder rung locks are in working order.
- Rivets, joints, nuts and bolts must be tightly secured.
- Test for smooth operation of the rope and pulley system on extension ladders. Replace the rope if frayed or cut.
- Clean all surfaces of oil, grease or any other slippery or sticky materials.

5) LADDER SET-UP

- First place the ladder on the ground with the base against the wall.
- Lift the ladder by walking it up with your hands one rung at a time, starting at the top and moving inwards towards the base.
- If using an extension ladder, while holding the ladder completely upright, use the pulley system to raise the fly section to the desired height and then allow the rung locks to properly engage. IT IS EXTREMELY IMPORTANT TO MAKES SURE THE RUGH LOCKS ARE FULLY ENGAGED. NEVER ASSUME THE RUNG LOCKS ARE ENGAGED!
- Move the base of the ladder away from the wall until the ladder is at approximately a 75 degree angle.
- To check the angle, place your toes against the bottom of the ladder side rails, stand erect and extend your arms straight out. If your palms touch the rung closest to your shoulder level, the angle is correct.
- Another check of ladder angle recognize that the distance from the wall to the ladder base should be approximately one quarter of the total working length of the ladder or the ladders base should be 1 ft from the wall for every 4 ft. of ladder height. The working length of the ladder is the distance along the rail from the base to the top support point.

When setting up a ladder the following rules should always be followed:

- Make sure the shoes are on a firm level surface. Use spur plates on penetrable surfaces. Use a ladder leveler to adjust for uneven surfaces.

- The top of the ladder must be placed with the two side rails equally supported.
- Tie off the ladder whenever practical particularly when preparing to do work on the ladder.
- Remember, if using a ladder to access a roof, the ladder must extend at least 3 feet above the roof eaves and the ladder should be tied or secured against sideways motion. For maximum safely have someone hold the ladder while climbing on or off.

6) SAFE USE OF LADDERS

Proper use of Ladders will contribute greatly to your safety. Common factors contributing to falls include:

- Haste
- Sudden Movements
- Poor Quality Footwear
- Lack of Attention.

Follow these guidelines:

- Make sure of your condition to climb before stepping onto the ladder
    - If you are tired or dizzy or prone to loosing balance…STAY OFF!
    - Do not use a ladder if you are impaired due to illness, drugs, alcohol, age, or physical handicap.
- Wear slip resistant shoes with heavy soles to prevent foot fatigue. For maximum traction clean your shoes of sticky or slick substances.
- Always read instructions and warning labels on the ladder prior to use.
- Before climbing, inspect the work area for slipping, tripping, or overhead hazards.
- Continually face the ladder as you climb, or descend.
- Always keep 3 points of contact with the ladder when climbing, holding on with 2 hands and one foot or 2 feet and one hand.
- When climbing a ladder, you MUST keep you hands free for climbing. Items must be secured to your body in such a way as they do not cause a loss of balance, placed in your tool belt, roped up, or handed up.

- As you climb and reach the bottom of the fly section, makes sure you again check to makes sure the rung locks are fully engaged before climbing on the fly section.
- Keep the middle of you body positioned between the side rails and do not overreach or lean. OVERREACH IS ONE OF THE MOST COMMON CAUSES OF LADDER ACCIDENTS!
- Climb and descend slowly and surely avoiding sudden movements.
- To move the ladder, first descend then re-inspect the work area for slipping, tripping, or overhead hazards If using an extension ladder, disengage the rung locks and completely retract the fly section. Keep fingers away from moving and sliding parts when lowering the ladder.
- Never jump from, slide down or descend more than one rung at a time.
- A ladder must never be placed upon other items such as boxes, barrels or scaffolds or other unstable bases in an effort to obtain additional height.

7) PROPER LADDER CARE

To maximize the life of a ladder the following techniques should be observed:

- Regularly lubricate the ladders moving parts being careful not to get lubricant onto rungs and side rails.
- Keep the ladder clean, particularly of any matter that is conductive.
- Protect ladders from heat, weather, and corrosive materials.
- Do not use a ladder as a storage shelf
- Store ladders out of the reach of children.

References Cited:

OSHA 1926.1053 & 1926.501

American Ladder Safety Institute

Referigeration & Air Conditioning Technology, Seventh Edition, p 129

Ladder Safety Unit Test:

1) A hatchway roof entrance is not considered an unprotected edge under OSHA 1926 and therefore fall protection is not necessary when an open hatchway exists on a working surface.
    a. True
    b. False
2) What is the correct angle of inclination for single and extension ladders?
    a. 90 degrees
    b. 85 degrees
    c. 60 degrees
    d. 75 degrees
3) If you feel tired or dizzy or are prone to loosing balance
    a. Tie off the ladder before climbing
    b. Have someone hold the ladder as you climb
    c. Take your time when using the ladder
    d. Stay off the ladder
4) What is the minimum height of the wall or guardrail around a roof edge or hatch edge in order for that edge to be considered a “Protected Edge”
    a. 24 inches
    b. 39 inches
    c. 42 inches
    d. 48 inches
5) Ladders must not be placed in front of closed doors
    a. True
    b. False
6) Why is ladder safety of increased importance to HVACR Service Technicians?
    a. AC equipment is frequently located on the roof of commercial buildings
    b. Rooftop access is sometimes via a fixed service ladder, but at times portable ladder selection is necessary
    c. HVACR Service Technicians often must carry tools and equipment to rooftops to complete required service increasing the risk.
    d. Roping equipment to a rooftop is not always permissible under OSHA standards.
    e. All of the above
7) Over 160,000 people are injured using ladders each year as a result of not following safety precautions
    a. True
    b. False

8) When accessing a roof, the top of a single or extension ladder must extend
    a. 2 feet above the roof eave
    b. 3 feet below the roof eave
    c. 2 feet below the roof eave
    d. 3 feet above the roof eave
9) How many points of contact should you keep when climbing a single or extension ladder
    a. 2
    b. 1
    c. 4
    d. 3
10) The rope and pulley of an extension ladder is used to perform what action?
    a. Provides balance for the user
    b. Locks the fly section in place
    c. Aides in ladder storage
    d. Raises the fly section in place
11) Roping equipment to a rooftop job site is only permitted by OSHA 1926 when the roof edge is protected by a wall or guardrail at least 39 inches high, or the technician is protected by a personal fall protection system (harness, bodybelt, lifeline, etc)
    a. True
    b. False
12) What is the minimum overlap for ladders taller than 48 ft.
    a. 12 ft
    b. 3 ft
    c. 16 ft
    d. 6 ft
13) How is the maximum work height on a ladder established?
    a. Adding your weight plus the weight of all tools and equipment
    b. Adding the ladders length minus your height and reach
    c. Adding the height of the ladder plus your height
    d. Adding your height and reach to the highest standing level
14) If climbing onto a roof, how should you exit onto the rooftop
    a. Step from the top rung onto the roof
    b. Step over the ladder onto the roof
    c. Keep three points of contact with the roof eave
    d. Step sideways onto the roof
15) If working near a source of electricity, which ladder material should be rejected?
    a. Wood
    b. Fiberglass
    c. All types
    d. Aluminum

16) Which part of the extension ladder locks the fly section into place?
    a. Side rails
    b. Brackets
    c. Guides
    d. Rung locks
17) To ensure safe footing on penetrable surfaces, use:
    a. Single support attachment
    b. Ladder leveler
    c. Stabilizer
    d. Spur plates
18) When calculating the total weight the ladder is to support, you must include:
    a. The weight of clothing and equipment
    b. The weight of tools used and stored on the ladder
    c. Your weight
    d. All of the above
    e. None of the above
19) In using a Refrigerant Strap as a means to carry gas cylinders or equipment up a ladder it is critical to make sure the load is secured close to your body and is properly balanced.
    a. True
    b. False
20) Single and extension ladders may be used by more than one person at a time?
    a. True
    b. False

Quiz Answers

1. b. False
2. d. 75 degrees
3. d. Stay of the ladder
4. b. 39 inches
5. a. True
6. e. All of the above
7. a. True
8. d. 3 feet above the roof eave
9. d. 3
10. d Raises the fly section in place
11. a. True
12. d. 6 ft
13. d. Adding your height and reach to the highest standing level
14. d. Step sideways onto the roof
15. d. Aluminum
16. d. Rung locks
17. d. Spur plates
18. d. All of the above
19. a. True
20. a. True

Certification:

I have received ladder safety instructions. I fully understand all the safety practices and guidelines stated above and will abide by them.

Student (signature) _____

Student (printed name) _____