A2L REFRIGERANT

What you need to know

HISTORY OF REFRIGERANTS

Did you know?

The first commercial refrigerant was a flammable refrigerant. In 1850, an ethyl ether vapor compression system for ice making was developed

AGENDA

- What is A2L
- Industry Changing to A2L
- Safety
- Charging and handling A2L’s

OBJECTIVES

- Describe what an A2L refrigerant is
- Identify two major factors for changing to A2L refrigerants
- Explain the safety measures when working with A2L refrigerants

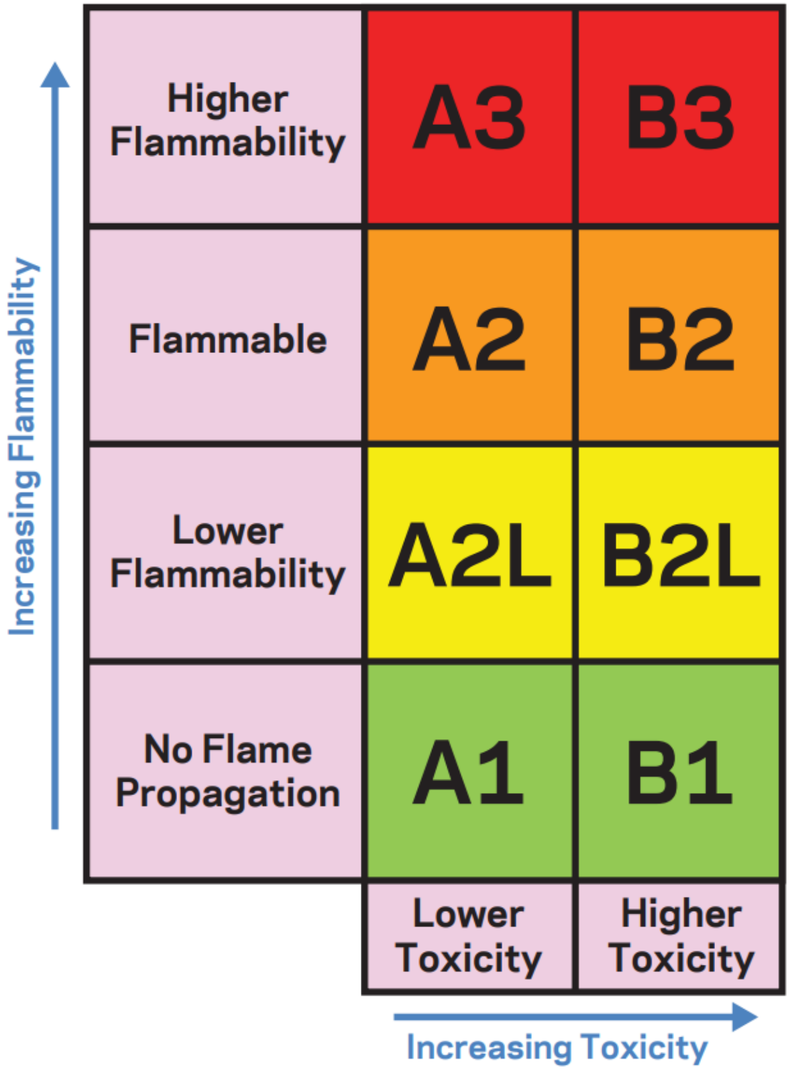
WHAT IS A2L

GREENHOUSE GASES

CHANGE IN THE WAY WE DO BUSINESS

- A2L mildly-flammable refrigerants will be phased into the HVACR industry to replace Hydroflourocarbon (HFC) refrigerants in the residential marketplace.
- While mildly-flammable refrigerants are seemingly better for the environment, the handling and safety precautions that go along with their use are different than HFC or CFC refrigerants.

Refrigerant classifications



A2L refrigerants

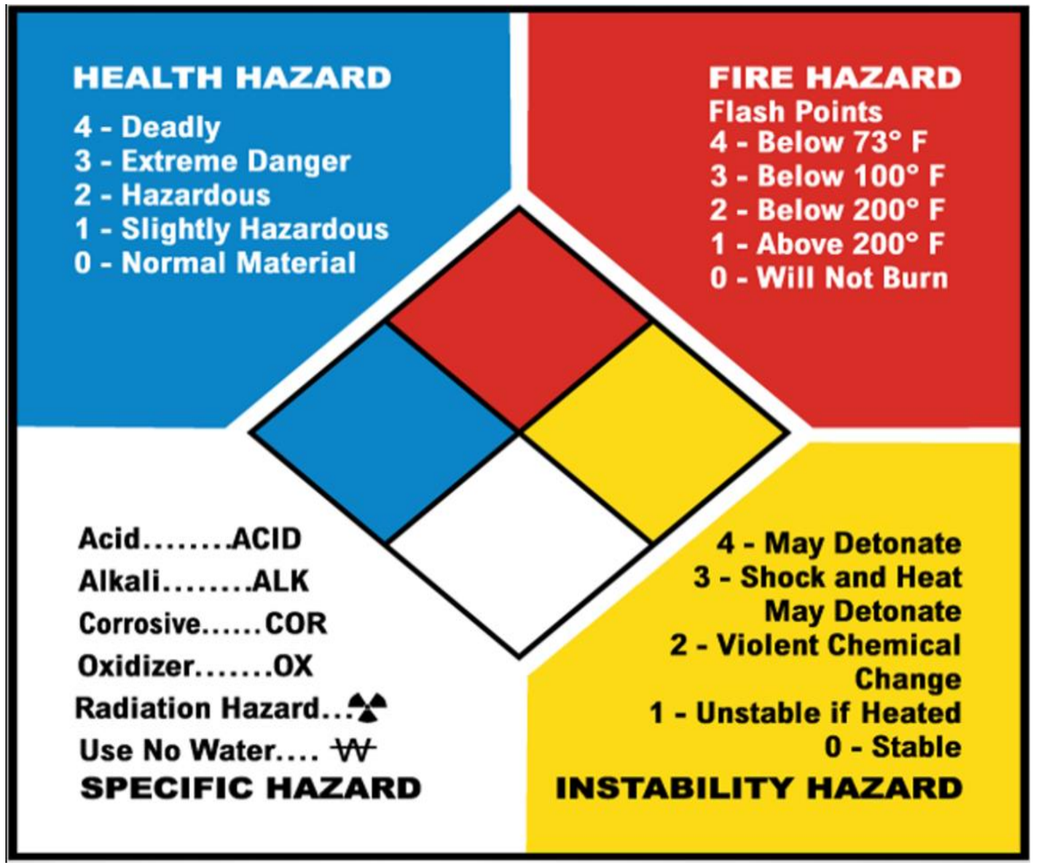
What are they and how are they categorized

- A2L is also known as an HFO (Hydrofluoroolefin) refrigerant that is not new to the industry.
- A2Ls are key components found in common refrigerants such as R-410A.
- A2Ls are a low flammable refrigerant.

ASHRAE Standard 34 Safety Classifications		
No Flame Propagation (1)	R-22 A1	R-123 B1
Lower Flammability (2L)	R-1234yf A2L	R-717 B2L
Low Flammability (2)	R-152a A2	R-611 B2
High Flammability (3)	R-290 & R-600a A3	R-40-B3
Note: ASHRAE B designations not covered in this book	Lower Toxicity (A)	Higher Toxicity (B)

Refrigerant Categories

- Health Hazard
- Fire Hazard
- Specific Hazard
- Instability Hazard



Definitions

- LFL Lower Flammability Limit –The minimum concentration of the refrigerant that is capable of propagating a flame.
- UFL Upper Flammability Limit – The maximum concentration of the refrigerant that is capable of propagating a flame.
- AIT Auto-Ignition Temperature – The lowest temperature at which a refrigerant will spontaneously ignite in a normal atmosphere without an external source of ignition (flame or spark).
- Since a flame can be propagated in the range between LFL-UFL, one should avoid the concentration of refrigerant in the work area reaching the LFL and the temperature of refrigerant from reaching the auto-ignition temperature.

Residential Occupancy Classifications

A premise or that portion of that premise provides the occupants with complete independent living facilities, including permanent provisions for living, sleeping, eating, cooking, and sanitation. Residential occupancies include, among others, dormitories, hotels, multiunit apartments, and private residences.

UL-60335-2-40

Household Electrical Heat Pumps, Air Conditioners, and dehumidifiers, Commonly referred to as UL-240

2019 edition contains requirements for products using flammable refrigerants

UL 2-40 Summary

One of the risks associated with UL60335-2-40 equipment is refrigerant leakage. An integral component to mitigate this risk is a refrigerant leak detection system.

Note: This standard is targeted toward the manufacture of the equipment.

UL-60335-2-40

Household Electrical Heat Pumps, Air Conditioners, and dehumidifiers, Commonly referred to as UL-240

2019 edition contains requirements for products using flammable refrigerants

- Refrigerant leak detectors that sense loss of pressure are required for all systems in occupied spaces exceeding a prescribed charged limit.
- Typically consists of approximately four pounds of refrigerant for most permanently installed applications.
- Refrigerant leak detection systems are required to have both sensors and control logic electronics.

UL-60335-2-40

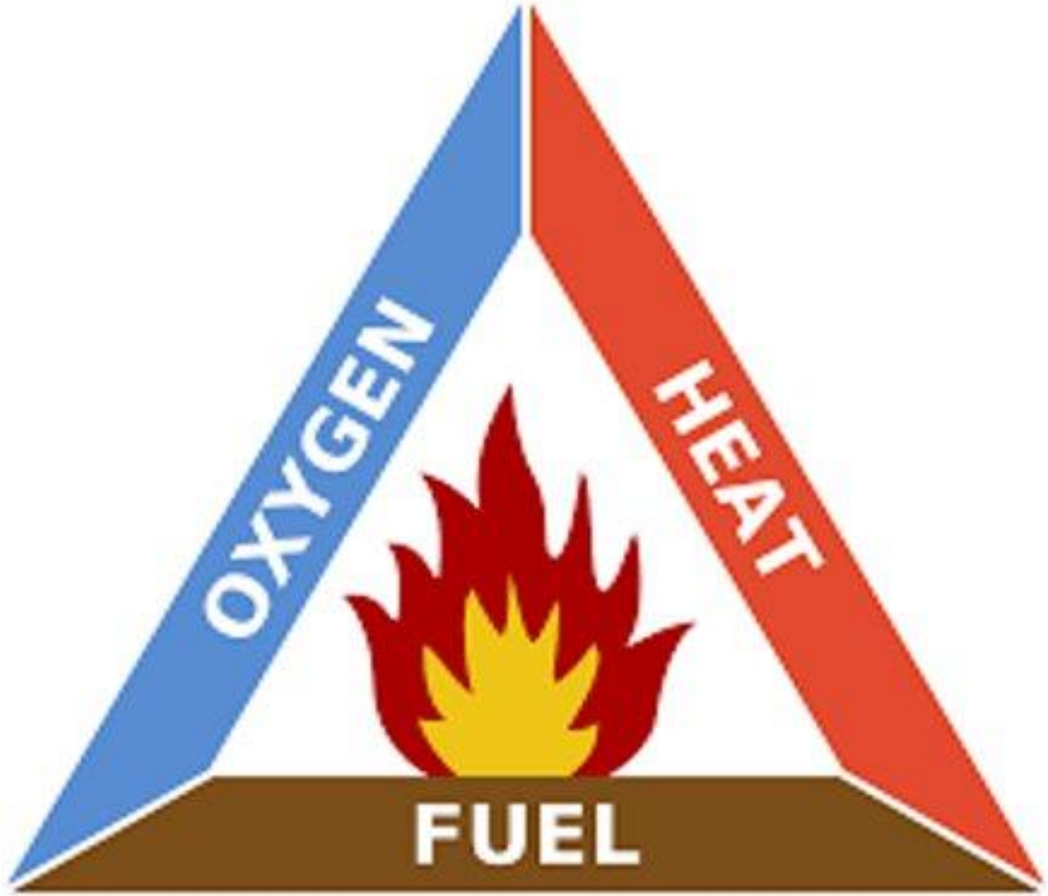
Household Electrical Heat Pumps, Air Conditioners, and dehumidifiers, Commonly referred to as UL-240

2019 edition contains requirements for products using flammable refrigerants

- These devices activate the evaporator fan and use circulated air to quickly disperse and dilute refrigerant in the event of a leak.
- This is intended to prevent the formation of refrigerant in concentrations.
- The charge limit requirements includes a safety factor of four to ensure any leaked refrigerant is diluted to well below the lower flammability limit based on the room size.
- Requires appliances to be free of potential internal ignition sources to mitigate the risk of fire due to a leak.

THE FIRE TRIANGLE

- Heat
- Oxygen
- Fuel

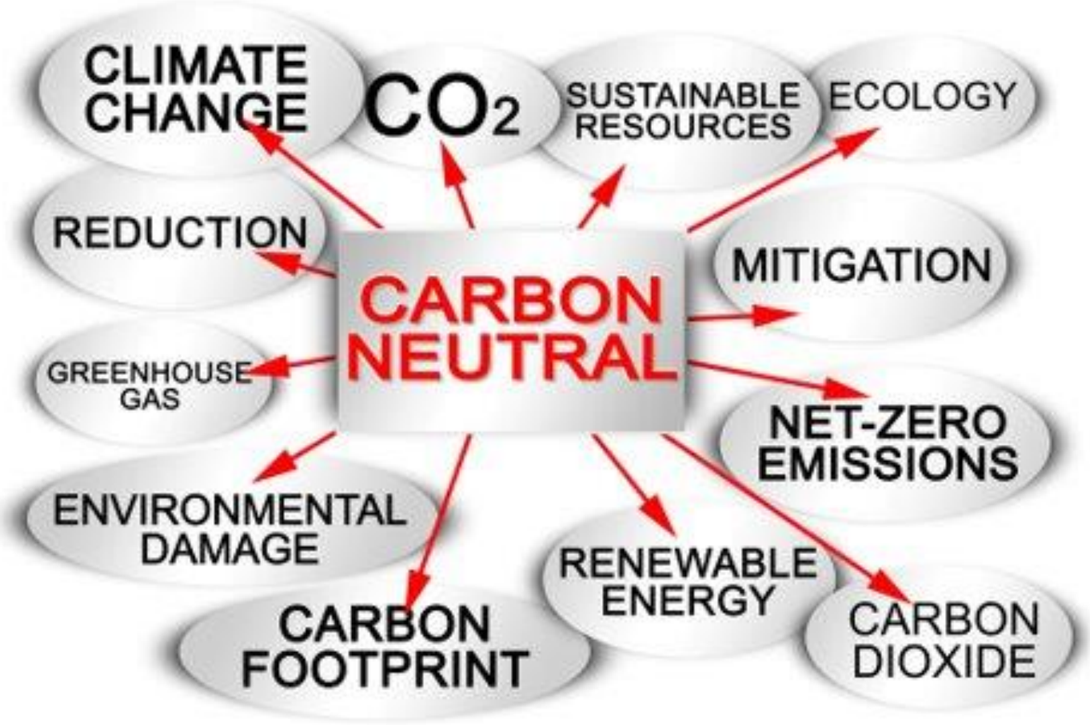


INDUSTRY CHANGING TO A2L

SNAP

- Significant New Alternative Policy
- Evaluates
- Generates
- Promotes

- Evaluate Substitutes For The Ozone Depleting Substances.
- Generates Lists of acceptable and unacceptable substitutes.
- Promote a smooth transition to safer alternatives.



WHY ARE WE MOVING INTO A2L REFRIGERANTS?

- Montreal protocol – Finalized in 1987, is a global agreement to protect the stratospheric ozone layer by phasing out the production and consumption of ozone-depleting substances.

- The Kyoto Protocol – In the period from 2008 to 2012 specified targets for reducing carbon dioxide and five other greenhouse gases.

- The Kigali Amendment – On October 15th, 2016, parties to the Montreal Protocol adopted the Kigali amendment to phase down production and consumption of hydrofluorocarbons (HFC’s) worldwide.

OZONE DEPLETING POTENTIAL

U.S. Schedule

- 2010 – 75% reduction consumption and production. No production or importing of HCFC 142b and HCFC 22, except for use in equipment manufactured before 2010.

- 2015 – 90% reduction, consumption, and production. No production or importing of any HCFC’s, except for use in equipment manufactured before 2020.

OZONE DEPLETING POTENTIAL

U.S. Schedule

- 2020 – 99.5% reduction, consumption, and production. No production or importing of any HCFC 142b and HCFC 22.

- 2030 – 90% reduction, consumption, and production. No production or importing of any HCFC’s.

ENVIRONMENTAL PROTECTION AGENCY

- Established in 1970 to enforce environmental laws adopted and amended by the federal government during the 1970’s. This was a result by public pressure to clean up the environment.
- Administers laws that protect natural resources such as air, water, and land.
- They enforce regulations regarding air and water pollutants, oversee programs that promote energy efficiency and conservation, and participates in the cleanup of sites where toxic materials have polluted the natural environment.

LOW GWP

R32

- R32 has zero ozone depletion
- R32 has 1/3 GWP (Global Protentional Warming) than that of 410A
- R32 has a superior energy efficiency
- R32 has a high refrigeration capacity & thermal conductivity

R32

- R32 has a low-pressure drop
- R32 is a single component refrigerant making it easy to handle and recover
- R32 is readily available (R32 is used in the manufacturing of R410A which is 50% R32 and 50% R-125)
    - The primary negative characteristic of R32 is that it is classified as a “mildly flammable” or “lower flammability”

R454b

- Class A2L refrigerant – Mildly flammable
- Blend of 68.9% of R32 and 31.1% 1234yf
- GWP of 466
- Alternate for R410A
- ODP of zero
- R410 in new equipment designs
- Commercial chillers and heat pumps
- 2% efficiency improvement vs. refrigerant R410A

R1234yf

- R1234yf is a hydrofluoroolefin (HFO) refrigerant
- Low toxicity
- Low GWP; GWP = < 1
- Class A2L refrigerant – Mildly flammable
- Same operating pressures as R134a system
- Boiling point -20.2 ° F (-29 ° c)
- Does not damage the ozone layer

ASHRAE SAFETY CLASSIFICATIONS

- ASHRAE 15-2019
  - **Section 4**
  - **Section 5**
  - **Section 6**

- Flammable refrigerants are refrigerants that burn at the temperatures and pressures associated with standard air.
- Any refrigerant that burns when ignited in 700 F air at sea level, are considered flammable.
- Based on flammability, refrigerants have been categorized into classes. Since technicians in the field will not have the tools to measure the lbs of refrigerants per cubic foot of air, we'll focus on the flammability classes covered in the chart, additionally toxicity is based on the lbs per cubic foot of air that would make the refrigerant dangerous to breath.

FLAME PROPERTIES OF R32

- Flashpoint – not applicable
- Auto ignition temperature – not applicable
- Upper flame limit - 31% volume concentration
- Lower flame limit – 14% volume concentration

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SAFETY

Purpose and Scope

- This training specifies safe design, construction, installation, and operation of refrigeration A2L systems
- This training establishes safeguards for life, limb, health, and property and prescribes safety requirements
- Training Application

Goal for Training

- Keep contractors and clients safe
- Improve knowledge of flammable refrigerants
- Help reduce liability
- Build a better skill set to flammable refrigerants

Training Application

- The design, construction, test, installation, operation, and inspection of mechanical and absorption refrigeration systems, including heat-pump systems used in stationary applications.
- Modifications, including replacement of parts or components if they are not identical in function and capacity.
- Substitutions of refrigerants having a different designation.

Non-Matched Labels

- What do you do if you come in contact with non-matched labels on a system?

1. Stop work on the system immediately.
2. Contact the owner.
3. Educate the owner of equipment violation.
4. Decline service.
5. Propose to replace the system with the correct system.

Labeling Requirements

OEM Requirements

- Requirement 1 – Refrigeration systems shall be listed and shall be installed in accordance with listing, the manufacturer’s instructions, and any marking on the equipment restricting the installation.

- Requirement 2 – The nameplate required by ASHRAE 15-2019 section 9.15 shall include a symbol indicating that a flammable refrigerant is used, as specified by the product listing.

Labeling Requirements

OEM Requirements

- Requirement 3 – A label indicating a flammable refrigerant is used shall be placed adjacent to service ports and other locations where service involving components containing refrigerant is performed, as specified by the product listing.
- Requirement 4 – Contact information of the responsible company that installed the refrigeration system.
- Requirement 5 – The total amount of refrigerant contained in the system after the installation is complete.
- Special Note – Each refrigeration system shall have the following information permanently legibly on the label provided by the OEM.

Technician Safety

- ACCA’s best practices when working with A2L Refrigerants

1. Always wear the correct PPE.
2. Keep your work area clean and clear.
3. Ensure your work area contains adequate air circulation.
4. Keep your refrigerant monitor on as you enter the work area.
5. Use equipment that is rated for A2L refrigerants.
6. Do you have training for handling and servicing A2L refrigerants and systems?
7. Know how to reduce the risk of fire and explosions and keep a class B and or CO2 fire extinguisher.

Refrigerant Concentration Limits

- **BTU Rating**
- **Refrigerant Charge determined by the OEM**
- **The Quantity of the Refrigerant Charge**
- **Occupancy Location**
- **The Room Size**

- 6.6lbs for residential and institutional occupancies
- Mechanical Ventilation system and a refrigerant detector
- The mechanical ventilation system will start when the refrigerant detector senses refrigerant.

Refrigerant Safety Checklist

It is a good idea to have a refrigerant safety checklist

When working with A2L Refrigerants. A safety checklist can be used as a tool to bring any potential hazards to installers and technicians' attention when working with A2L refrigerants

- Application and location requirements
- Minimize risk of leaks
- Ventilation
- Circulation
- Hazardous area requirements
- Signage
- Training

Labeling	Y	N	N/A	Comments
Do all A2L cylinders have their contents and precautionary labeling clearly marked on their exteriors?				
Nameplate information includes manufacturer's name, manufacturer's model or type, manufacturer's serial number, refrigerant number, approximate refrigerant charge, correct technical name.				
All refrigeration and A/C units containing flammable refrigerants must be labeled with a "Class label."				
The nameplate or serial plate must also identify refrigerant by 'R' number and include the class label				
Interconnecting pipework should be marked with a class label every two meters where pipework is visible includes ceiling spaces or any voids.				
Standard HFC/HCFC reclaim cylinders have the correct pressure rating or flammable gas labeling.				
Label with date, name, and contact of company, technician, type of refrigerant				
Proper Storage	-	-	-	-
The workplace is clean and orderly				
Hazardous objects/chemicals are clearly labeled.				
Hazardous objects/chemicals are properly stored.				
The storage area is well ventilated and free of combustible materials.				
Cylinders stored on the ground floor and above, but not in basements and other enclosed rooms.				
Cylinders stored away from sources of heat and direct sun				
Are potential ignition sources stored at least 3 meters away from the cylinder(s)?				
Are the cylinders protected from being knocked over and or punctured?				
Are storage of empty cylinders segregated from that of filled-up cylinders?				
Flammable gas alarm fitted in the bulk storage area?				

EPA Regarding Training

- **Component Manufacturers**
- **Refrigerant Suppliers**
- **ASHRAE Standards**
- **Manufacturers of System Equipment**
- **ACCA, AHRI, and HARDI**

- Component Manufacturers
- Refrigerant Suppliers
- ASHRAE Standards
- Manufacturers of System Equipment
- ACCA, AHRI, and HARDI
- Only Technicians specifically trained in handling flammable refrigerants should service these systems

- Technicians and installers should be familiar with safety precautions for flammable refrigerants. For example, fire and explosion hazards

Material Safety Data Sheet

- **Warns fire fighters**
- **Labeled on equipment**

- MSDS’s are mandated by OSHA
- This diagram is the Hazard Diamond and found outside of buildings to warn fire fighter but isn’t required on homes.

- You may also find it on the safety data sheet but isn’t required.

NATIONAL REFRIGERANTS, INC.

R-32

Safety Data Sheet

R-32

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: R-32
OTHER NAME: 1,1- Difluoroethane
USE: Refrigerant Gas
DISTRIBUTOR: National Refrigerants, Inc.
661 Kenyon Avenue
Bridgeton, New Jersey 08302

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-262-0012

IN CASE OF EMERGENCY CALL:
CHEMTREC: 1-800-424-9300

2. HAZARDS IDENTIFICATION

CLASSIFICATION: Flammable Gas, Gas under pressure, Compressed Gas
SIGNAL WORD: DANGER
HAZARD STATEMENT(S): Extremely flammable gas, Contains gas under pressure, may explode if heated
SYMBOL(S): Flames, Gas Cylinder

PRECAUTIONARY STATEMENT(S):
Prevention: Keep away from heat, sparks, open flame, and hot surfaces. No Smoking
Response: Leaking gas fire: Do not extinguish unless leak can be stopped immediately. Eliminate all ignition sources if safe to do so.
Storage: Protect from sunlight, store in a well ventilated place.

EMERGENCY OVERVIEW:
Flammable gas. Liquid under high pressure.

POTENTIAL HEALTH EFFECTS:
Effects of Overexposure:

Eye Contact
Eye Contact with the rapidly evaporation liquid may cause frostbite.

JOBSITE SAFETY

SAFETY

- PPE
- Priority

- Everyone's first priority.
- Everyone is responsible for safety.
- PPE should be work when working on refrigeration systems containing A2L refrigerants (Safety Glasses and Gloves).
- Other types of PPE, such as steel toe shoes, hearing protection, and hard hats, are recommended.

AWARENESS

- **Hazards**
- **Servicing**
- **Installing**

- Gas Hazards – Exposure to non-flammable and flammable gasses.
- Flame – Hazards that involve the presence of a flame or the risk of an uncontrolled fire.
- Suffocation – Extreme decrease in the concentration of oxygen in the body accompanied by an increase in the concentration of carbon dioxide that leads to loss of consciousness or death.
- Toxic – Capable of causing damage to living tissues, impairment of the central nervous system, severe illness or, in extreme cases, death when it is ingested, inhaled or absorbed by the skin or eyes.

PERSONNEL AWARENESS

Personnel Hazards

- Acid Gasses
- Electrical Shock
- Frostbite
- Mechanical Hazards

- Acid Gases – Particularly hydrogen fluoride gas and hydrogen fluoride acid.
- Electrical Shock – Contact with an electrical energy source.
- Frostbite – Freezing of the skin and underlying tissues.
- Mechanical Hazards – Contact and or entanglement with unguarded moving parts on a machine.

ENVIRONMENTAL AWARENESS

- Refrigerant Gases
- Decomposition
- Combustion
- Corrosive

- Refrigerant Gases – Release of refrigerant gases.
- Decomposition – Can be toxic and corrosive.
- Combustion – Products that were expected to be toxic and corrosive.
- Corrosive – Causing damage to metal or other materials through a chemical process.

PREVENTIVE METHODS

- Elimination
- PPE
- Controls
- Administrative

- Elimination – Most effective way to control a risk, because the hazard is no longer present.
- PPE – Equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses.
- Controls – A reliable way to control worker exposures as long as the controls are designed, used and maintained properly.

PREVENTIVE METHODS

- Elimination
- PPE
- Controls
- Administrative

- Administrative – Changes in work procedures such as written safety policies, rules, supervision, schedules, and training with the goal of reducing the duration, frequency, and severity of exposure to hazardous chemicals or situations.

A2L CONDENSER TECH TIP CHECKLIST

- Level
- Wire Connections
- Coil Fins
- Easy Access
- Clearance
- Grounding
- Shrubs and Brushes

- Level – Ensure that the condensing unit is level.
- Wire Connections – Be sure to tighten all wire connections.
- Coil Fins – Check the condition of the condenser coil fins.
- Easy Access – Turn the condenser away from the wall for easy access.
- Clearance – Inspect the required clearance around the cabinet.
- Grounding – Ensure proper equipment grounding.
- Shrubs and Brushes – Make sure shrubs and bushes are cut back from the condenser.

OEM REQUIREMENTS

OEM DOCUMENTATION

- Owner's Manual
- Service Manual
- Installation Manual

- Review OEM documents with the homeowner or building owner.
- Leave the service manual and OEM documents with the homeowner or building owner.
- Provide the homeowner or building owner with your company’s contact information.
- Attach a service record document at the indoor unit.

CHANGING AND HANDLING OF A2L

SERVICING PROCEDURES

Prior to accessing the refrigerant circuit to make repairs there are two questions to ask yourself:

1. Have you been properly trained to handle A2L refrigerants?
2. Do you have matching labels at the condenser and the compressor identifying A2L Refrigerants?

Installers and technicians are exposed to many different safety Hazards while working in the field

If something goes wrong on the jobsite, are you prepared to handle any situation on the jobsite?

- Is your current PPE enough if something goes wrong?
- Where is your fire extinguisher?
- Is there an unobstructed exit route for evacuation in case of an emergency?

LEAK TESTING

- Have the required A2L reclaiming and leak testing equipment.
- Consult the component OEM for the correct selection and use of leak testing equipment.
- Recommended that the leak detector stay on during service work.
- Ensure that the probe is sensing the area being serviced.

TOOL REQUIREMENTS

- Many suppliers are already providing flammable refrigerant ready gauges.
- Ask your supplier for a gauge that has flammable refrigerants included on the dial.
- Over the next period all gauges will have flammable refrigerants on the dial as R410A only gauges are phased out.

RECOVERY TOOLS

- Tools needed to work with A2L refrigerants safely.
- Any recovery equipment used must be designed for A2L refrigerants.
- Never use a recovery cylinder past its retest date.
- Venting of refrigerant is prohibited except for hydrocarbons and CO2.
- Use refrigerant recovery unit that is rated for A2L refrigerant.
- Use a calibrated weight scale to measure weight of recovered refrigerants.

Refrigerants shall not be reused except in the system from which they were removed, or as provided in ASHRAE 15-2019 Section 7.5.1.5 or 7.5.1.6. When contamination is evident by discoloration, odor, acid test results, or system history, recovered refrigerants shall be reclaimed in accordance with section 7.5.1.6 before reuse.

RECYCLE

Whenever a technician opens an air conditioning or refrigeration system for service or dismantle for disposal, they are required by law to recover the refrigerant which means removing the refrigerant from the system using an EPA certified recovery device also moves it into a separate container. Once the refrigerant is removed from the system into a separate container, the HVAC contractor can decide to recycle the refrigerant or reuse by the owner of the equipment or send it to a certified reclaimer to restore it an AHRI 700 purity specifications.

RECYCLE

- Recycled refrigerants shall not be reused except in systems using the same refrigerant and compatible lubricant and belonging to the same owner as the system from which they were removed.
- When contamination is evident by discoloration, odor, acid test results out of manufacturers specification, or system history, recycled refrigerants shall be reclaimed shall be reclaimed in accordance with ASHRAE 15-2019 Section 7.5.1.6.

RECLAIM

ASHRAE 15-2019

- Section 4
- Section 5
- Section 6

The act of processing used refrigerant gas that has been previously used in some type of refrigeration loop such that it meets the specifications for new refrigerant gas. In the US, the clean air act of 1990, requires that used refrigerant be processed by a certified reclaimer licensed by the US EPA, the refrigerant must be recovered and reclaimed by certified Technicians.

RECLAIM

ASHRAE 15-2019

- Section 4
- Section 5
- Section 6

- An A2L-reclaimer must be rated for use with specific flammable refrigerants.
- Once the A2L refrigerant is removed/reclaimed it must be stored in an approved cylinder.
- Refrigerant hoses should be leak free, and it’s recommended to use leak free disconnect plugs.
- EPA certified equipment reclaiming equipment must be used.

EVACUATION

ASHRAE 15-2019

- Section 4
- Section 5
- Section 6

These procedures should be used each time a technician is removing and evacuating and HVAC system containing A2L refrigerants.

- Change the vacuum pump oil after each use.
- Some manufacturers require a triple vacuum procedure for equipment containing A2L refrigerants.
- The system is ready for charging once the vacuum holds for 10 minutes.
- Flammable refrigerant systems must be pulled down to a 500-micron vacuum, or lower when specified by the OEM.

CHARGING

Self-contained systems will be factory charged

- Only trained personnel should perform the charging procedures.
- Read and re-read the equipment label.
- Ventilate the area prior to and during charging.

CHARGING

- Have a dry powder fire extinguisher for flammable gases nearby.
- Always use tools and equipment specifically designed for use with A2L refrigerants.
- No service containers shall be left connected to a system except while charging or withdrawing refrigerant.
- Refrigerant circuit access ports located outdoors shall be secured to prevent unauthorized access.

CHARGING

Self contained systems will be factory charged.

- Use a calibrated scale with an accuracy of +/- 0.1 grams is required to charge the system.
- Use dedicated hoses to service A2L systems.
- As with zeotropic blends, always charge from the cylinder with liquid refrigerant.

CHARGING

- Additives to the refrigerant or lubricant systems should not be used without OEM approval.
- Do not mix refrigerants.
- Before charging, make sure the refrigerant system is properly grounded.
- Recharge by weighing in the proper refrigerant amount and type specified by the OEM.

CHARGING

- To decrease amount vented, and to increase the accuracy for weighing in refrigerant, use the shortest hose possible for charging.
- Once recharged, all components containing refrigerant, and lines should be tested for leaks before electrical power is restored.
- For sealing access valves, follow the OEM directions.
- One solution to sealing a system would be to install a permanent refrigerant valve with an attached Schrader valve.

COMPONENTS

When servicing and installing components, it’s important to follow these practices.

- Verify that the replacement components match the unit being removed.
- Install and connect new electrical components as approved by the OEM.

COMPONENTS

- Electrical components for use with flammable refrigerants must be encapsulated or fire and explosion proof.
- Make sure components and wiring are installed in a way that does not allow them to rub against each other when the equipment is operating.
- Components containing refrigerant and lines should be tested for leaks before electrical power is restored.

INSTALLATION RESTRICTIONS

ASHRAE 15-2019

- 8.1
- 8.2
- 8.3

- 8.1 Foundations – Foundations and supports for condensing units or compressor units shall be of noncombustible construction and capable of supporting loads imposed by such units.
- 8.2 Guards – Moving machinery shall be guarded in accordance with approved safety standards.
- 8.3 Safe Access – A clear and unobstructed approach and space shall be provided for inspection, service, and emergency shutdown of condensing units, compressor units, condenser, stop valves, and other serviceable components.

INSTALLATION RESTRICTIONS

ASHRAE 15-2019

- 8.9
- 8.10.3

- 8.9 Refrigerant Pipe Joint Inspection – Refrigerant pipe joints erected on the premises shall be exposed to view for visual inspection prior to being covered or enclosed.
- 8.10.3 – Refrigerant piping shall not penetrate floors, ceilings, or roofs.

RESTRICTIONS ON REFRIGERANT USE

- RECOVERED REFRIGERANTS
- RECYCLED REFRIGERANTS
- RECLAIMED REFRIGERANTS

- Recovered Refrigerants – Shall not be reused except in the system from which they were removed, or as provided in ASHRAE 7.5.1.5 or 7.5.1.6.
  - When contamination is evident by discoloration, odor, acid test results, or system history, recovered refrigerants shall be reclaimed in accordance with ASHRAE 7.5.1.6 before reuse.

RESTRICTIONS ON REFRIGERANT USE

- RECOVERED REFRIGERANTS
- RECYCLED REFRIGERANTS
- RECLAIMED REFRIGERANTS

- Recycled Refrigerants – Shall not be reused except in systems using the same refrigerant and lubrication designation and belonging to the same owner as the systems from which they were removed.
  - When contamination is evident by discoloration, odor, acid test results, or system history, recycled refrigerants shall be reclaimed in accordance with ASHRAE 7.5.1.6.

RESTRICTIONS ON REFRIGERANT USE

- RECOVERED REFRIGERANTS
- RECYCLED REFRIGERANTS
- RECLAIMED REFRIGERANTS

- Reclaimed Refrigerants – Used refrigerants shall not be reused in different owner's equipment unless tested and fond to meet the requirements of AHRI 700.
  - Contaminated refrigerants shall not be used unless reclaimed and found to meet the requirements of AHRI 700. Send reclaimed refrigerants to an authorized EPA reclaimer.

HANDLING CYLINDERS AND SAFETY

- Ensure all cylinders are properly labeled.
- Close valve after each use and when empty.
- Protect cylinders from physical damage.
- Inspect thread to ensure it is not dirty or damaged.
- Never fill a recovery cylinder more than 80% full.

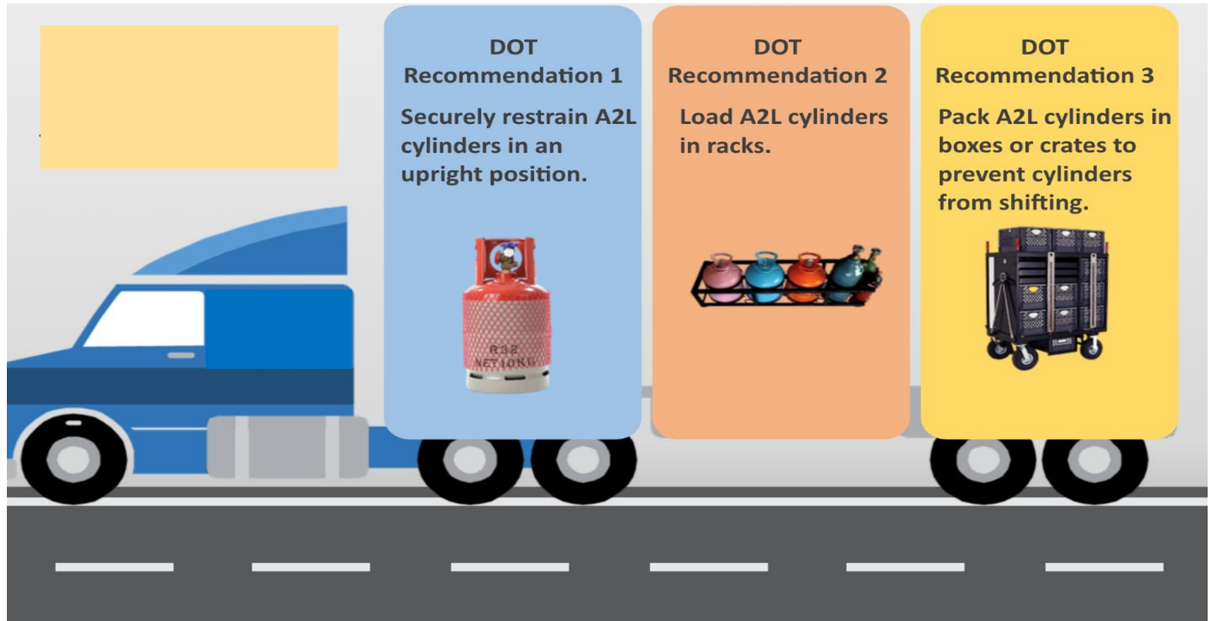
NOTE: The minimum fire protection for storage facility of flammable refrigerants where the aggregate capacity is less than 1,000 liters (water capacity) is a water hose connected and ready for use.

HANDLING CYLINDERS AND SAFETY

- Keep ignitable material at least 10 feet from Cylinders.
- Keep away from sparks and flames.
- Use only with adequate ventilation.
- Temperatures during transportation and storage should not exceed 125 F.
- Never use water or electric blanket exceeding 100 F.

TRANSPORTATION

- Secure any material that can shift on any vehicle and/or transportation device.
- Use regularly inspected chains, straps, or cables to secure material/loads properly.
- Keep ignitable material at least 10 feet from cylinders.
- Keep away from sparks and flames.



TRANSPORTATION

- Ensure all cylinders are properly labeled.
- Monitor cylinders for leakage.
- Use only with adequate ventilation.
- Explosion-proof electrical equipment (ventilation, lighting & material handling).
- The cylinders are high pressure gas. Do not puncture or incinerate containers. Use properly rated cylinder pressure.
- Close valve after each use and when empty.

TRANSPORTATION

- Protect cylinders from physical damage (store upright, never roll and secure to prevent falling).
- Temperatures during transportation and storage should not exceed 125 F.
- Do not throw empty cylinders in the trash.
- Never use water or eclectic blanket exceeding 100 F.
- Never refill single-trip (disposable) cylinders.
- Never fill a recovery cylinder more than 80% full.
- Never use a recovery cylinder past its retest date.
- Never expose cylinders to a corrosive environment.
- Check the AHJ for any local requirements.

BEST PRACTICES

Safety for pressurized refrigerant cylinders.
How to properly handle and transport refrigerant cylinders.

- A2L cylinders should not be stored on the vehicle near a source of heat.
- The A2L cylinder valve should always be shut, and any regulator removed before loading.
- Ventilate the vehicle to prevent the build-up of vapors.

BEST PRACTICES

- Ventilation to the A2L cylinder in a cabinet is by having the cabinet vented externally and not vented into the vehicle.
- Use a locked cage to prevent theft of A2L if the vehicle is left unattended.
- It is recommended that the vehicle be fitted with fire extinguisher.

DOT RECOMMENDATIONS

LoadingA2L refrigerants dot recommendations these recommendations on transporting A2L refrigerant.

- DOT Recommendation 1 securely restrain A2L cylinders in an upright position.
- DOT Recommendation 2 Load A2L cylinders in racks.
- DOT Recommendation 3 Pack A2L cylinders in boxes or crates to prevent cylinders from shifting.

STENCHING

- Stenching agents give it a “rotten egg” smell so it can be easily detected by humans.
- Flammable refrigerants do not contain these agents as they are corrosive in nature.

A2L COURSE OVERVIEW

Course overview 1

- Technician safety
- U.S schedule
- System Efficiency
- Snap rules

A2L COURSE OVERVIEW

Course overview 2

- UL 2-40
- Approved A2L’s
- Installation Restrictions
- Labelling Requirements

A2L COURSE OVERVIEW

Course overview 3

- OEM Requirements
- Tools
- Transportation
- Industry best practices

CONCLUSION

- Safety trumps everything
- Consult the manufacturer’s literature
- Gather 3rd party Information
- Learn something new everyday