A2L Refrigerants: Safety, Storage, & Transportation

Mingledorff’s Technical Services

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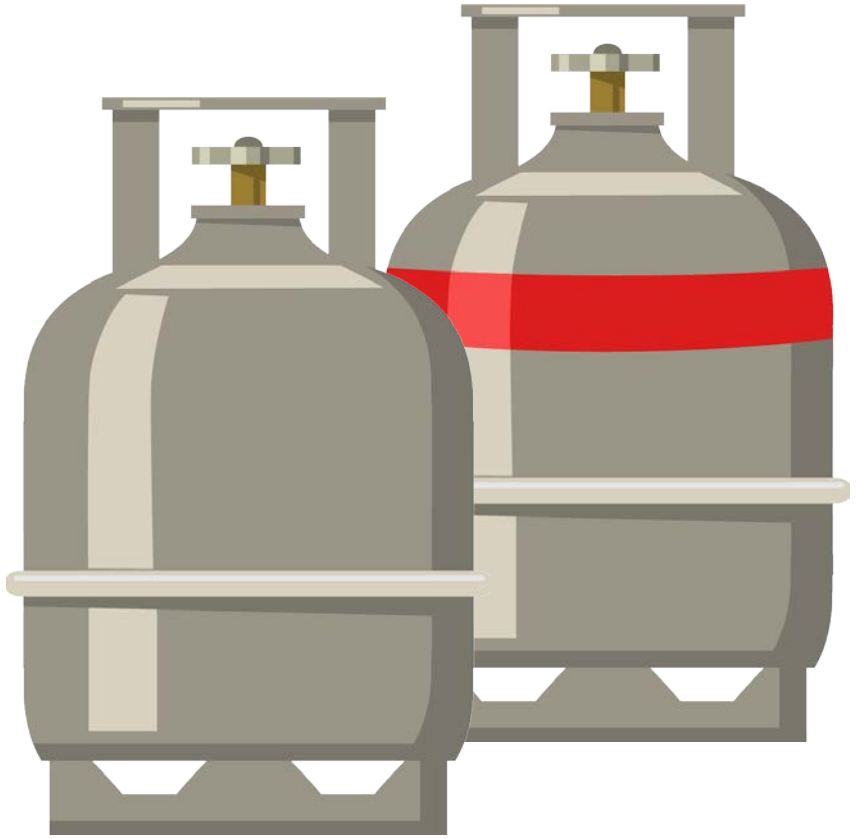
- How do we store the refrigerant safely in a warehouse?
- Do I need to make changes to my truck to carry this new refrigerant?
- Will my equipment be different when working with A2L refrigerant?
- Do any processes change when I charge or braze on an A2L system?

Cylinders for A2L Refrigerants

CYLINDERS REQUIREMENTS



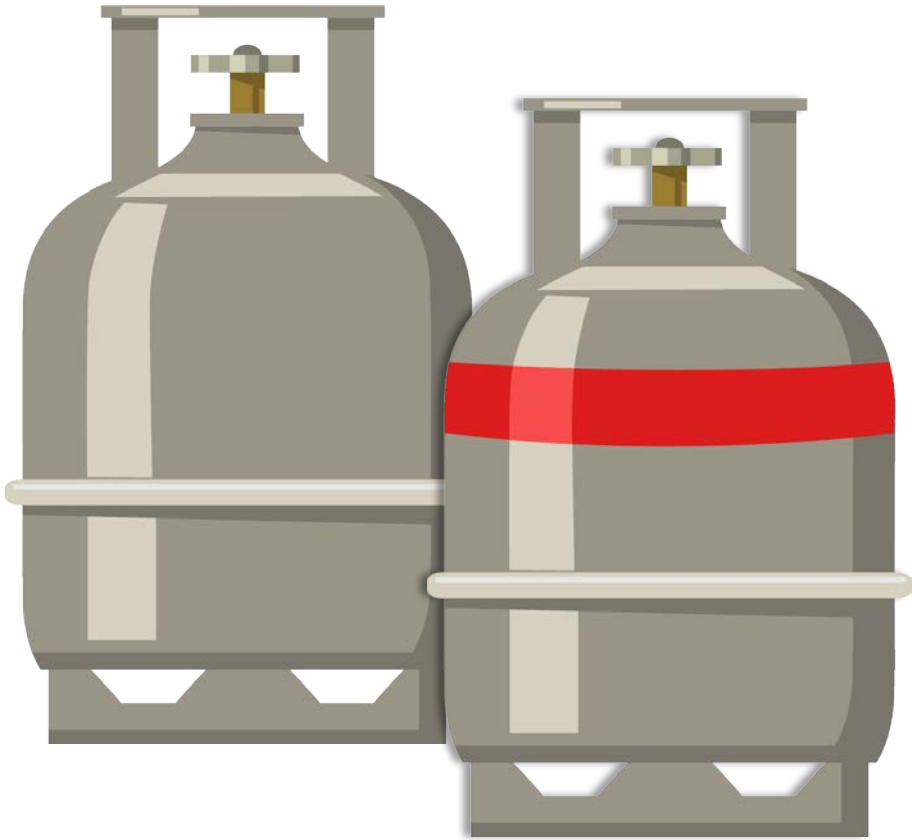
Service cylinder requirements

- Same?
- Different?

CYLINDERS REQUIREMENTS

Color

- A1: Light green gray
- A2L: Light green gray with red top
- Type of refrigerant is marked on cylinder and/or tag



CYLINDERS REQUIREMENTS

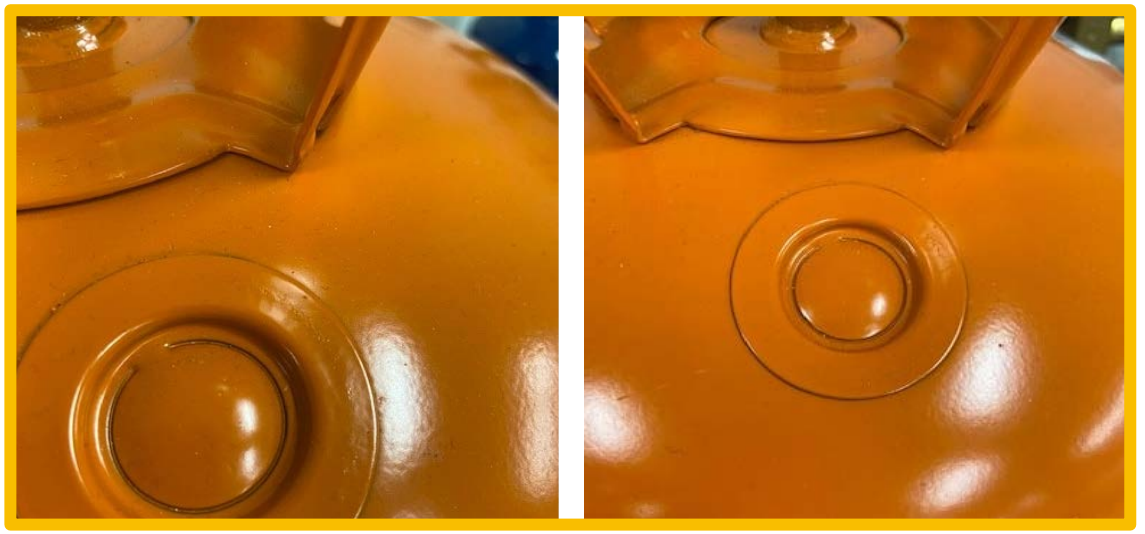
Threads (connections)

- A1: RH thread
- A2L: LH thread

CYLINDERS REQUIREMENTS

Pressure safety design features

A1: Rupture disc



A2L: Pressure relief valve

(155-160° / 600-640psi, aprox)

Store at 12 o’clock position

CYLINDERS REQUIREMENTS

Two warning labels are required for cylinders that contain A2L refrigerants.

Flammable

- Potentially flammable contents

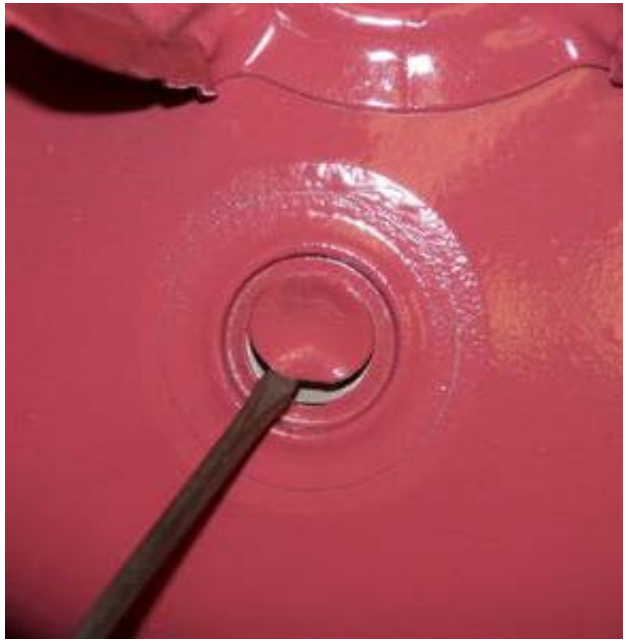
Compressed Gas

- High pressure gas that could explode when heated

CYLINDERS REQUIREMENTS

Cylinder end of life handling

- A1: Remove or puncture rupture disc



- A2L: Puncture side of cylinder
  - Use non-sparking tool

Source: https://www.ahrinet.org/sites/default/files/2022-11/AHRI_Guideline_Q_2016.pdf

CYLINDERS REQUIREMENTS

Recovery cylinders

- Yellow Top – A1 and A2L
- Yellow top with Red band – A2L
- Ensure that recovery cylinders meet DOT specifications.
  - DOT markings and serial number.
  - Valves should be positioned within the protective collar.

Storage & Transportation

SAFE STORAGE IN THE WAREHOUSE

How are cylinders of A2L refrigerants stored and transported safely?

SAFE STORAGE

Follow all standards & codes from IFC & NFPA

International Fire Code (IFC)
National Fire Protection Association (NFPA).

Logos and Trademarks are the property of their respective owners.

SAFE STORAGE

Maximum allowable quantity (MAQ)

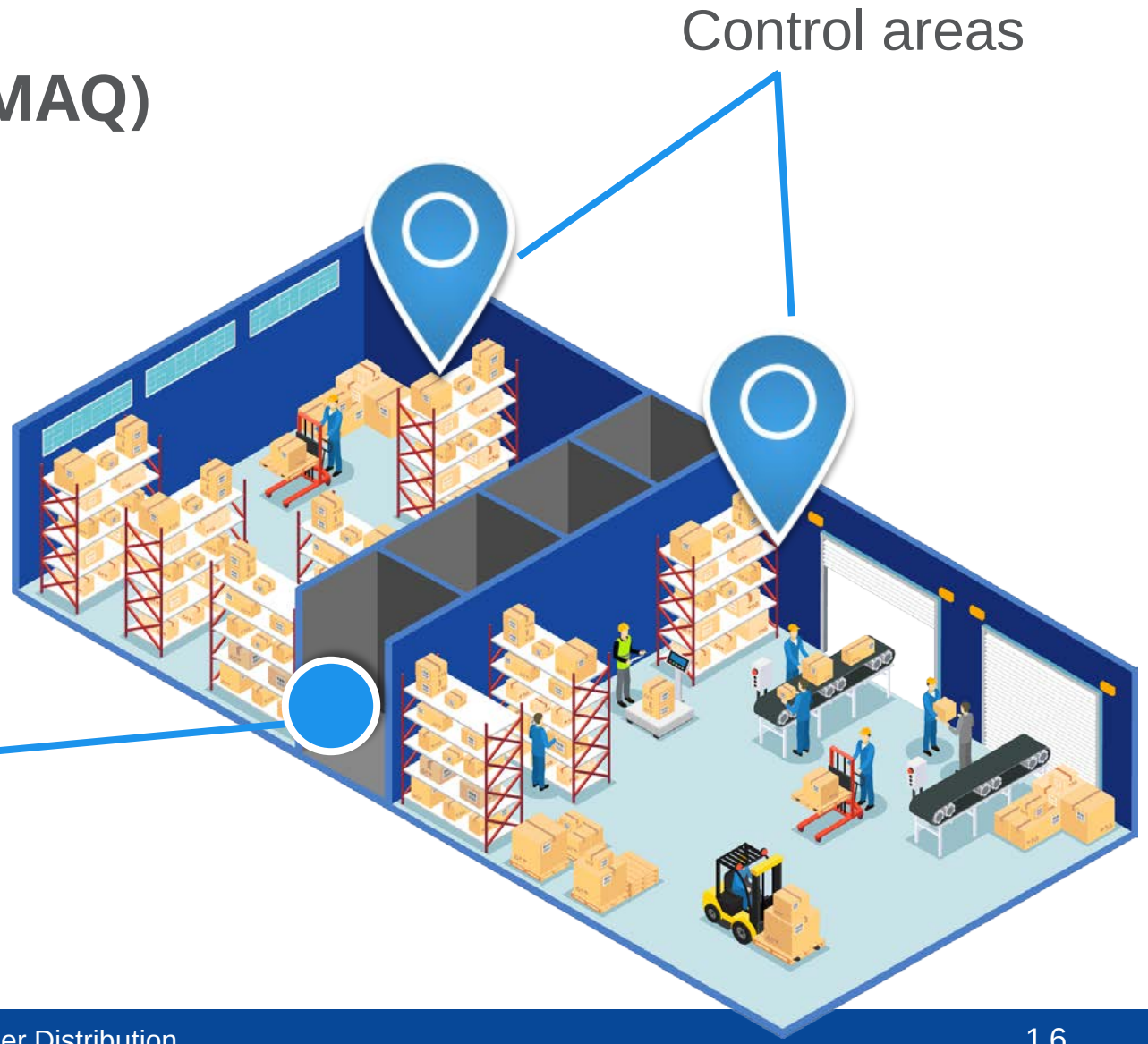
- Used to evaluate storage capacity

Maximum Allowable Quantity (MAQ) in a Single Control Area		
Occupancy Classification	Non-sprinklered	Sprinklered
	Liquefied gas in cylinders	Liquefied gas in cylinders
M – Mercantile	20,000 lbs.	40,000 lbs.
S – Storage/Warehouse	20,000 lbs.	40,000 lbs.
F – Factory/Filling facility	10,000 lbs.	20,000 lbs.

SAFE STORAGE

Maximum allowable quantity (MAQ)

- Used to evaluate storage capacity
- Type of occupancy
- Number of control areas
- Up to 4 control areas per building

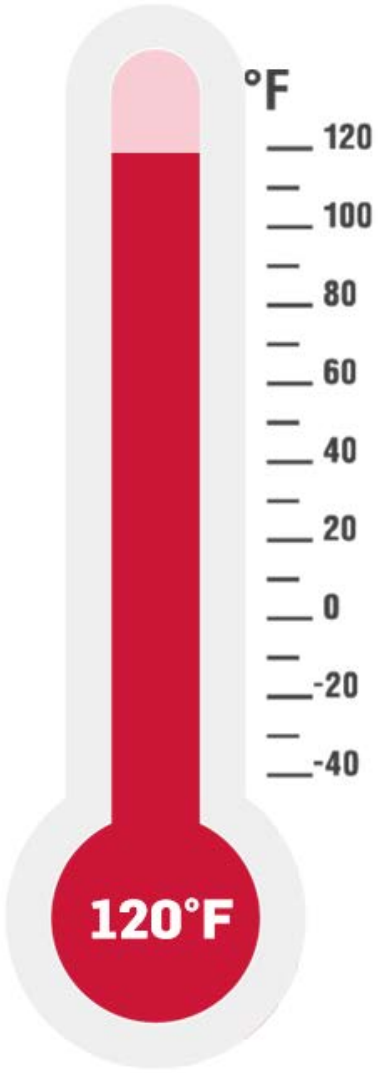


SAFE STORAGE

How are containers stored within control areas?

Characteristic	Shelf Storage	Rack Storage	Solid Pile
Storage design	Shelf cannot exceed 30" from front to back	Each level designed to hold pallet loads	Pallets stacked one upon another
Construction materials	Steel shelves	Steel rack	N/A
Storage height	Maximum 6' to top of product	Can exceed 6' (limited by sprinkler design)	Can exceed 6' (limited by sprinkler design)
Sprinkler system design	Ordinary Hazard Group 2	Extra Hazard Group 1	Extra Hazard Group 1
Separation from flammable liquids	Required	Required	Required
Storage of other flammable or combustible products above A2L refrigerants	Prohibited	Prohibited	Prohibited
Storage of flammable liquids adjacent to A2L refrigerants	20' separation	20' separation	20' separation
Storage of flammable liquids with secondary containment adjacent to A2L refrigerants	10' separation to containment area	10' separation to containment area	10' separation to containment area

SAFE STORAGE



Ambient temperature ≤ 125° F as is currently for R-410A

SAFE STORAGE

NFPA-required signage & documentation

Local fire code permit

HAZMAT management plan

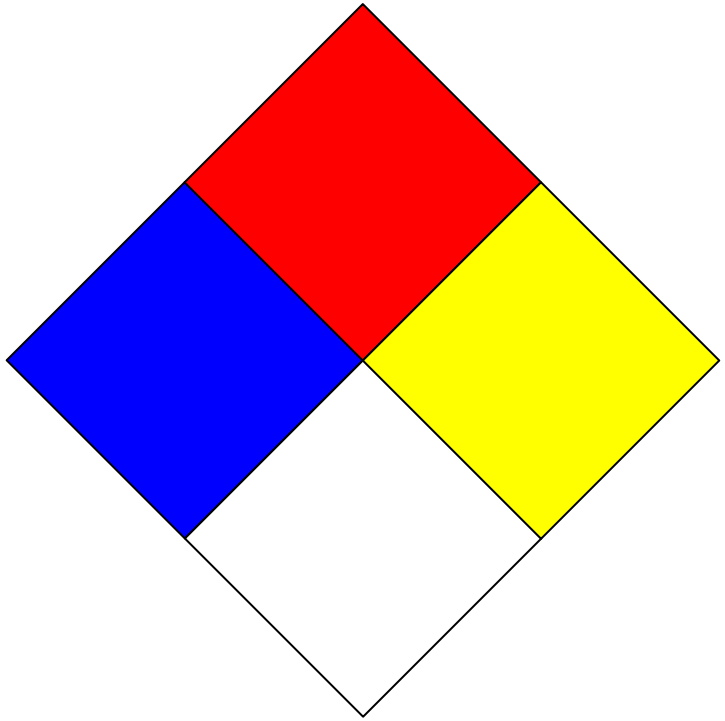
HAZMAT Inventory Statement

No Smoking signage

SAFE STORAGE

NFPA 704 placard:

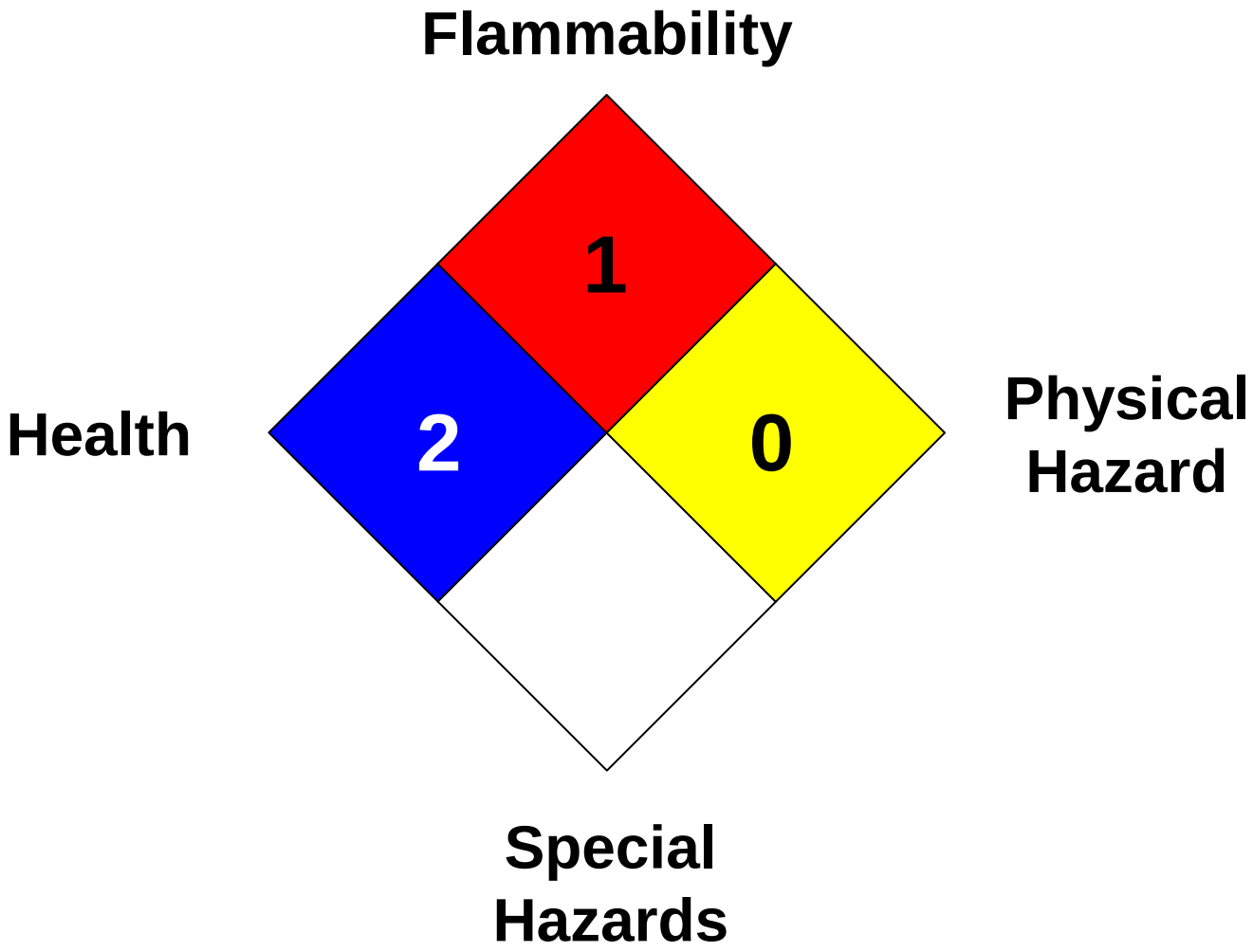
BLUE	**HEALTH**
RED	**FLAMMABILITY**
YELLOW	**CHEMICAL REACTIVITY**
WHITE	**SPECIAL HAZARDS**



SAFE STORAGE

NFPA 704 placard for R454-B

- Information can be found on the SDS



SAFE TRANSPORT

How are cylinders of A2L refrigerants stored and <u>transported</u> safely?

SAFE TRANSPORT

HAZMAT protocols not needed if ≤ 26.4 lbs (12 kg) of finished goods containing A2L refrigerant

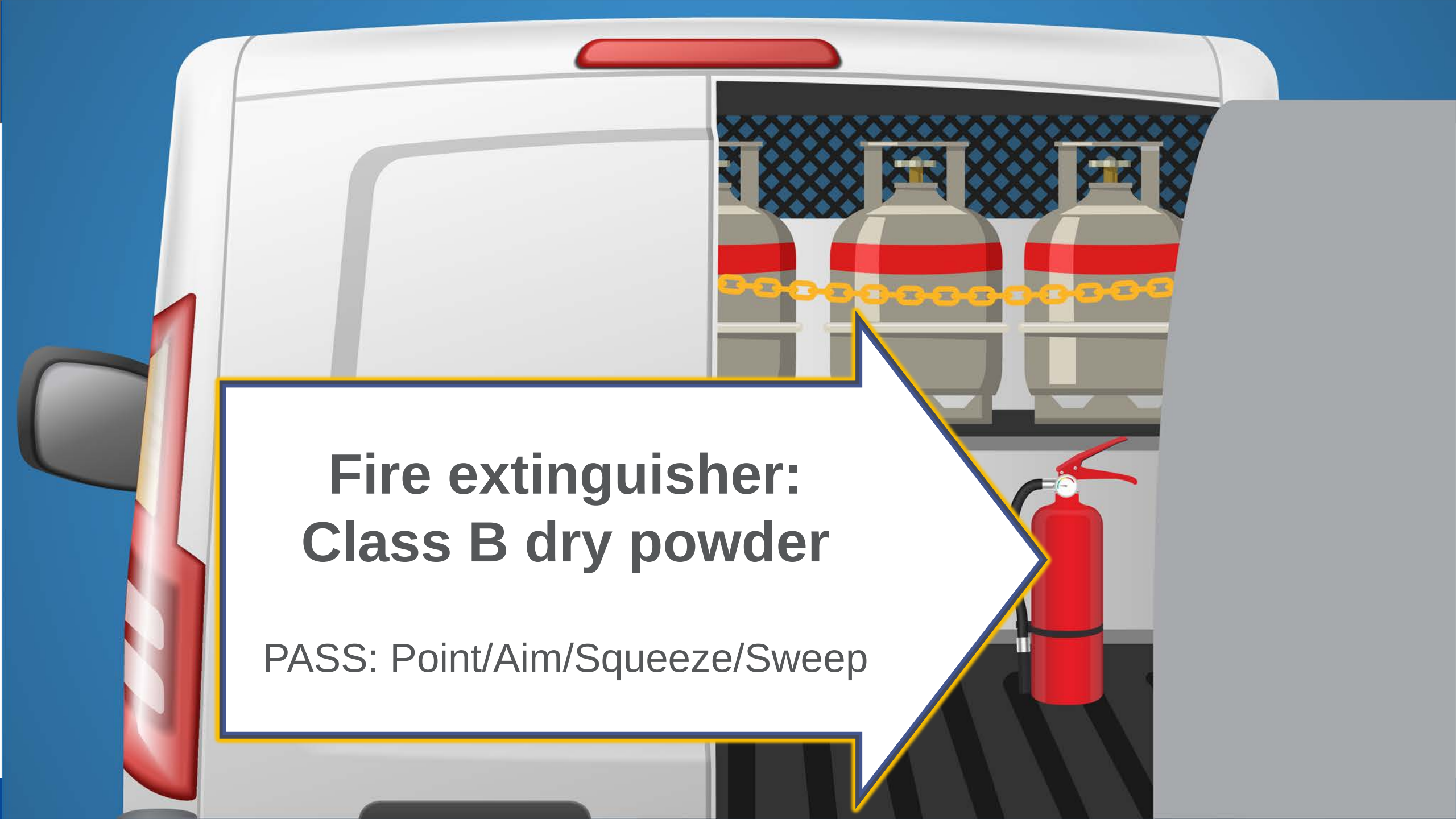
- Per US DOT
- Up to 440lb’s of A2L refrigerant cylinders can be transported without placards.

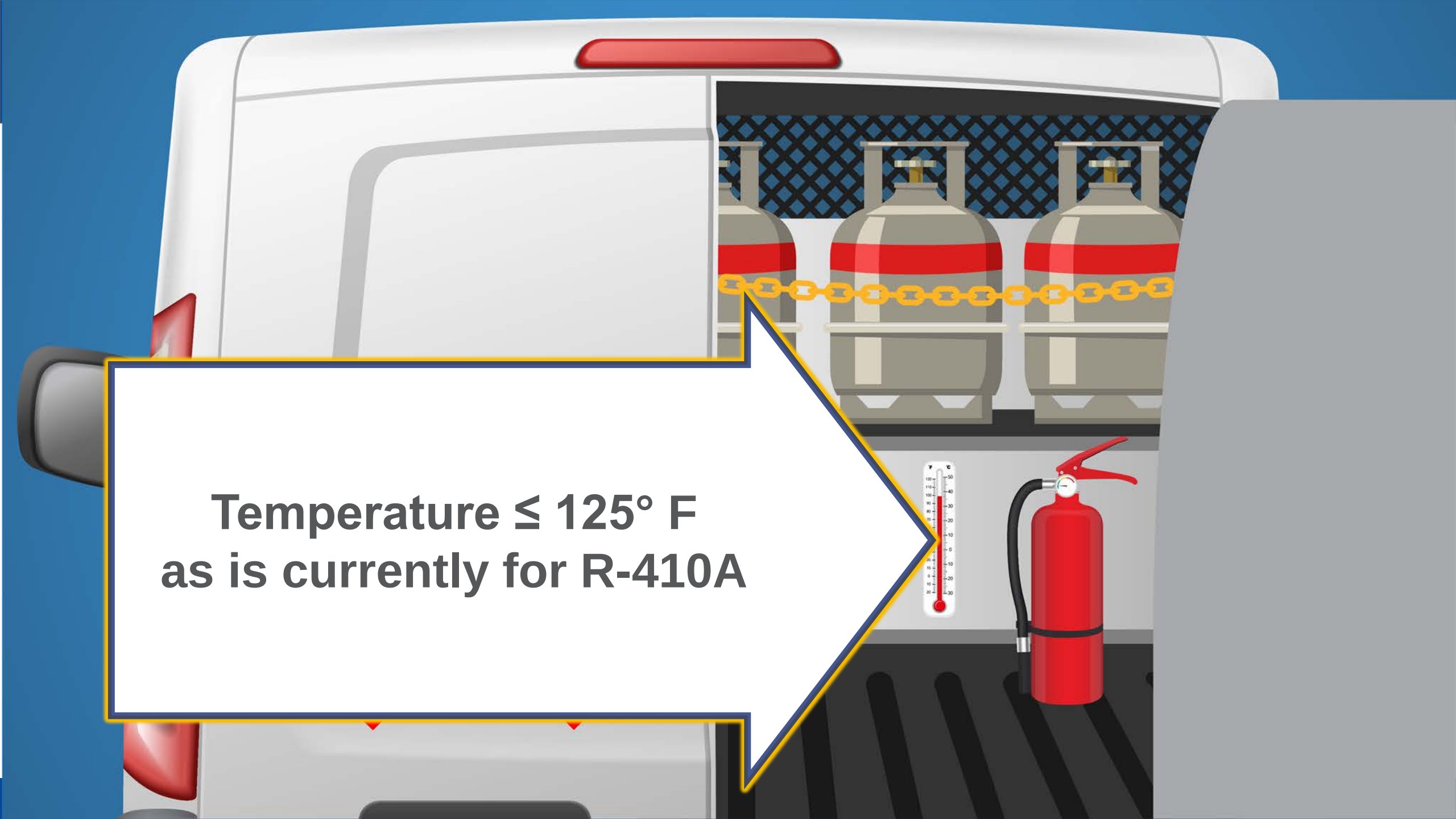
SAFE TRANSPORT

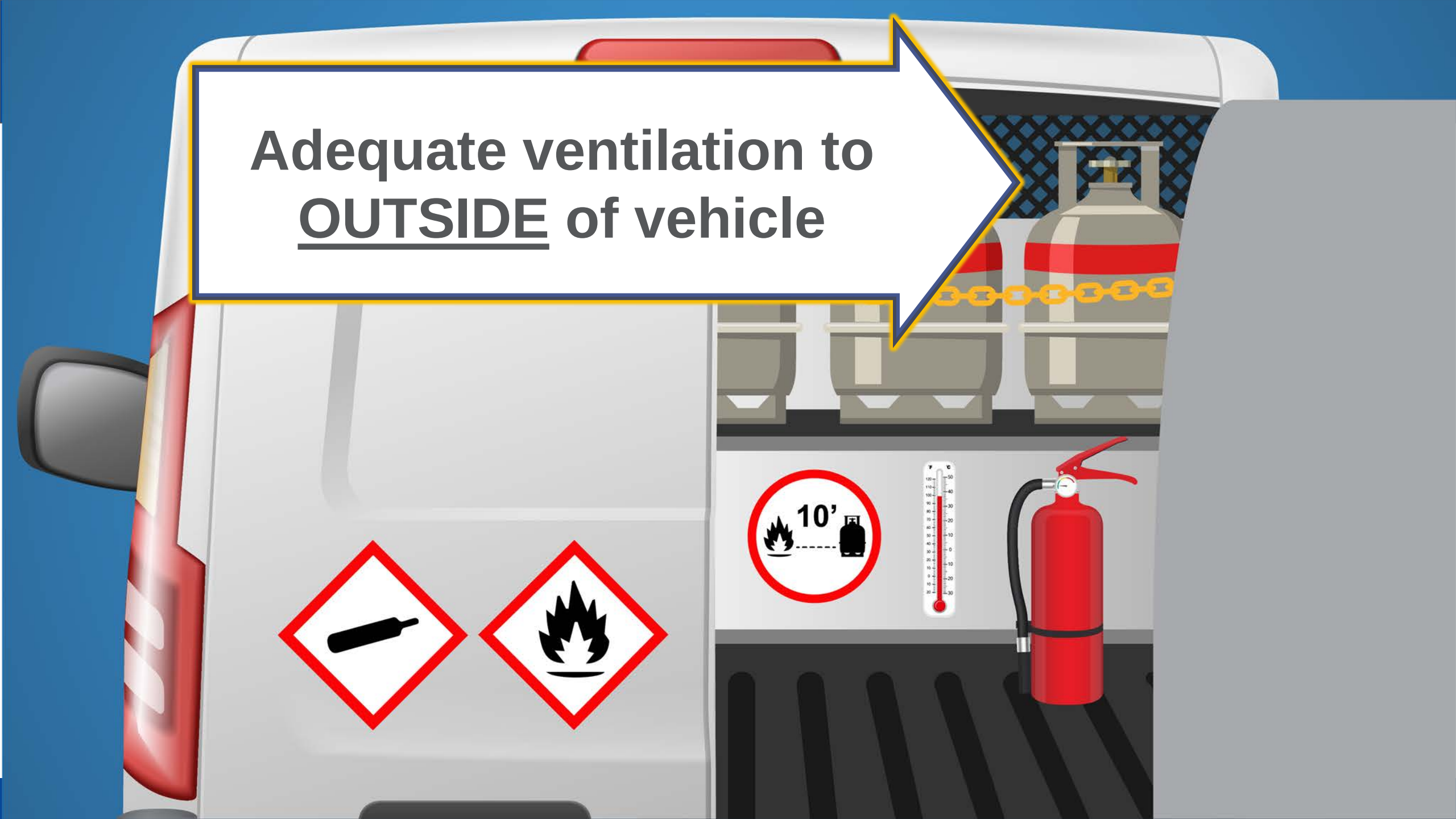
You already transport flammable gasses:

- **<u>oxygen</u>**
- **<u>acetylene</u>**

What's needed when transporting cylinders of A2L refrigerant and factory-charged-units?

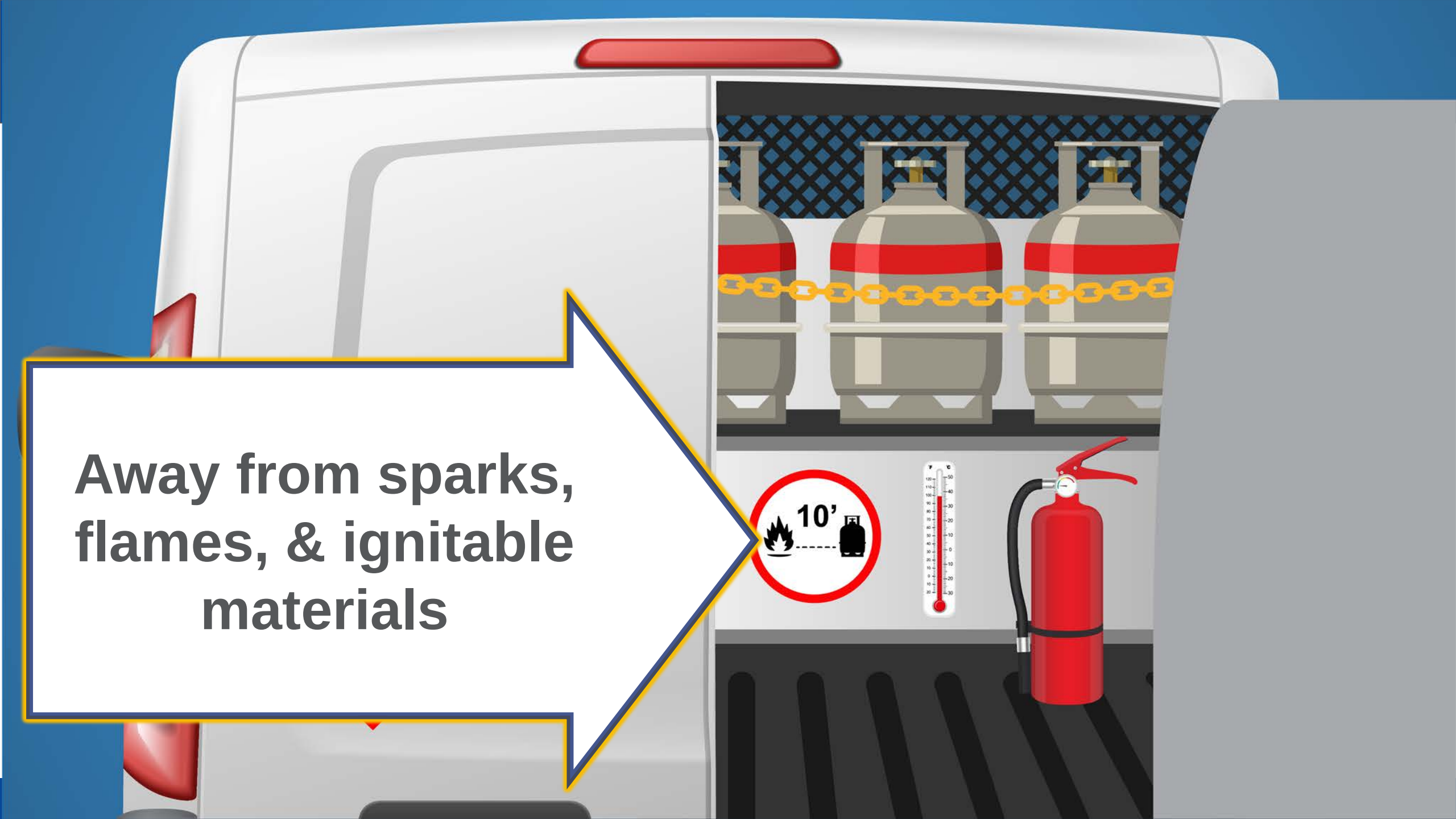

Fire extinguisher:
Class B dry powder
PASS: Point/Aim/Squeeze/Sweep


Temperature ≤ 125° F
as is currently for R-410A


Adequate ventilation to
OUTSIDE of vehicle
10’

Transport in same manner as A1

* Ruling to allow for transport in horizontal position is still pending. Canada cannot transport in horizontal position


Away from sparks, flames, & ignitable materials
10’

Restrain cylinders to prevent shifting

Inspect restraints **FREQUENTLY**

Worksite Safety

Worksite Safety

Staying safe at the jobsite:

- Logistics
- Same/different service items & tools
- Same/different field service processes

SAFE SERVICE PRACTICES

Safety considerations to be aware of when installing & servicing equipment with A2L refrigerants

SAFE SERVICE PRACTICES

BEFORE starting work:

- Ensure clear escape route

SAFE SERVICE PRACTICES

BEFORE starting work:

- Adequate ventilation
- Refrigerant leak detector as a personal alarm

SAFE SERVICE PRACTICES

Fire risk SLIGHTLY HIGHER with A2L than with A1

- Fire extinguisher (type) must suppress chemical fires

SAFE SERVICE PRACTICES

WEAR proper PPE

SAFE SERVICE PRACTICES

PROTECT from frostbite

SAFE SERVICE PRACTICES

Combustion of refrigerant ==> HF ==> Hydrofluoric acid (corrosive: DANGER)

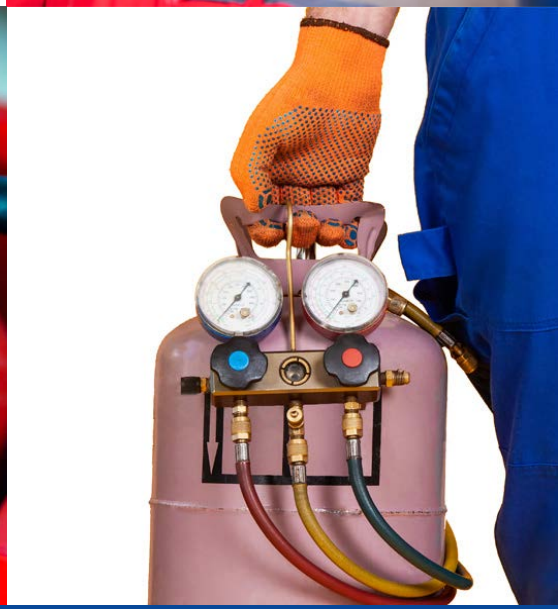
- Protect skin & eyes
- Can cause chemical burns

SAFE SERVICE PRACTICES

SAFELY TRANSFER tank to job site

SAFE SERVICE PRACTICES

- ✓ Common sense
- ✓ Basic safety principles



R454-B COMPATIBLE SERVICE ITEMS / TOOLS

This section specifically compares service items and tools that are safe for R454-B vs. what was used for R410a

SERVICE EQUIPMENT & TOOLS

- Inspect service tools & equipment for compatibility
- Verify compatibility with manufacturers or AHRI

www.ahrinet.org/saferefrigerant

SERVICE EQUIPMENT & TOOLS

Gauge manifold & charging hoses

- Dedicated set for R454-B prevents cross-contamination

Service Item (versus R410A)	R454b
Gauge Manifold	No Changes
Charging Hoses	No Changes

Remember, cylinders for A2L refrigerants like R454-B have a left-handed thread, so adapters may be needed.

SERVICE EQUIPMENT & TOOLS

Refrigerant leak detector

Service Item (versus R410A)	R454b
Refrigerant Leak Detector	Move to A2L Compatible

- A2L refrigerants have no stenching agents
- Ventilation and air circulation are required
- Use of a leak detector as a personal alarm is strongly recommended
- Ensure leak detector is approved for R454-B

SERVICE EQUIPMENT & TOOLS

Electrical hand tools

Service Item (versus R410A)	R454b
Electrical Hand Tools	Non-sparking available (AHRI-8017)

- Spark-proof
- Check with tool manufacturer

SERVICE EQUIPMENT & TOOLS

Ventilation fans / additional ventilation

Service Item (versus R410A)	R454b
Ventilation Fan	Similar (May be differences in machine rooms)

- Spark-proof

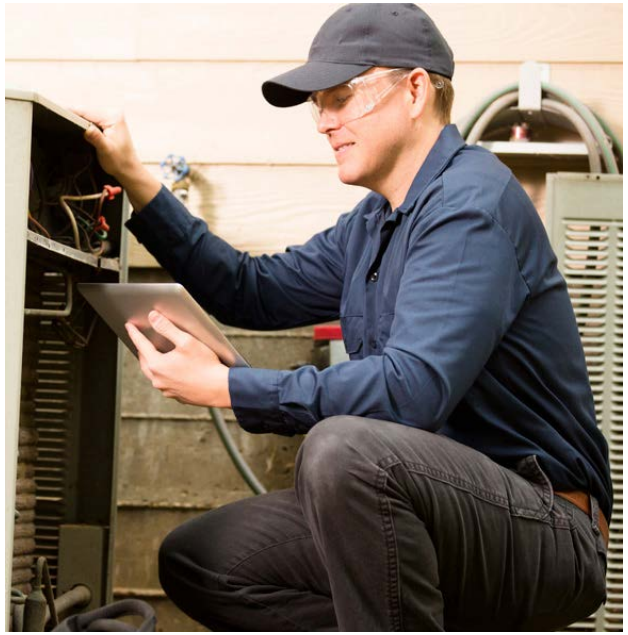
SERVICE EQUIPMENT & TOOLS

Service Item (versus R410A)	R454b
Gauge Manifold	No Changes
Charging Hoses	No Changes
Refrigerant Leak Detector	Move to A2L Compatible
Electrical Hand Tools	Non-sparking available (AHRI-8017)
Ventilation Fan	Similar (May be differences in machine rooms)
Dry Chemical/CO_2 Fire Extinguisher	Chemical Compatible
Scales	No Changes
Gas Detector	Move to A2L Compatible
Vacuum Pump	Check with Manufacturer
Recovery Machine	Move to A2L Compatible
Refrigerant Recovery Cylinder	Flammable (GHS label; left-handed threads)

If unsure, check the AHRI website or contact the manufacturer

FIELD SERVICE PROCEDURES

How does R454-B impact install & service tasks?



FIELD SERVICE PROCEDURES

Requirement	R410a	R454b
Remove refrigerant safely following local & national codes	Required	Required
Purge circuit with inert gas (nitrogen)	**Best Practice**	
Evacuate	**Best Practice**	
Purge with inert gas for 5 min.	**Best Practice**	
Evacuate again	**Best Practice**	
Open the circuit by cutting or brazing	Final Step	Final Step
For repairs, purge with nitrogen during brazing	Required	Required
Pressure test	**Best Practice**	
Leak test	**Best Practice**	
Evacuate system again after service	Required	Required
Charge system	Required	Required

With the new refrigerant ... Best practice? Required? Optional?

FIELD SERVICE PROCEDURES

Requirement	R410a	R454b
Remove refrigerant safely following local & national codes	Required	Required
Purge circuit with inert gas (nitrogen)	Best Practice	**Required** ✓
Evacuate	Best Practice	**Required** ✓
Purge with inert gas for 5 min.	Best Practice	**Required** ✓
Evacuate again	Best Practice	**Required** ✓
Open the circuit by cutting or brazing	Final Step	Final Step
For repairs, purge with nitrogen during brazing	Required	Required
Pressure test	Best Practice	**Required** ✓
Leak test	Best Practice	**Required** ✓
Evacuate system again after service	Required	Required
Charge system	Required	Required

Ensure ALL refrigerant is out of the system prior to opening for repair or replacement service

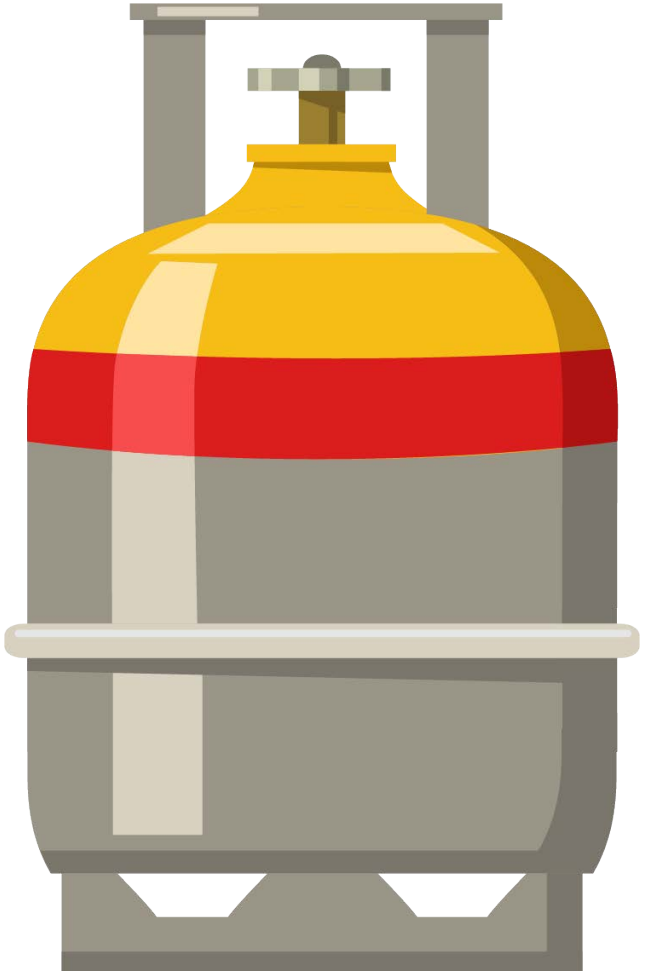
FIELD SERVICE PROCEDURES

Always refer to the installation manual for procedures that may have changed with R454-B

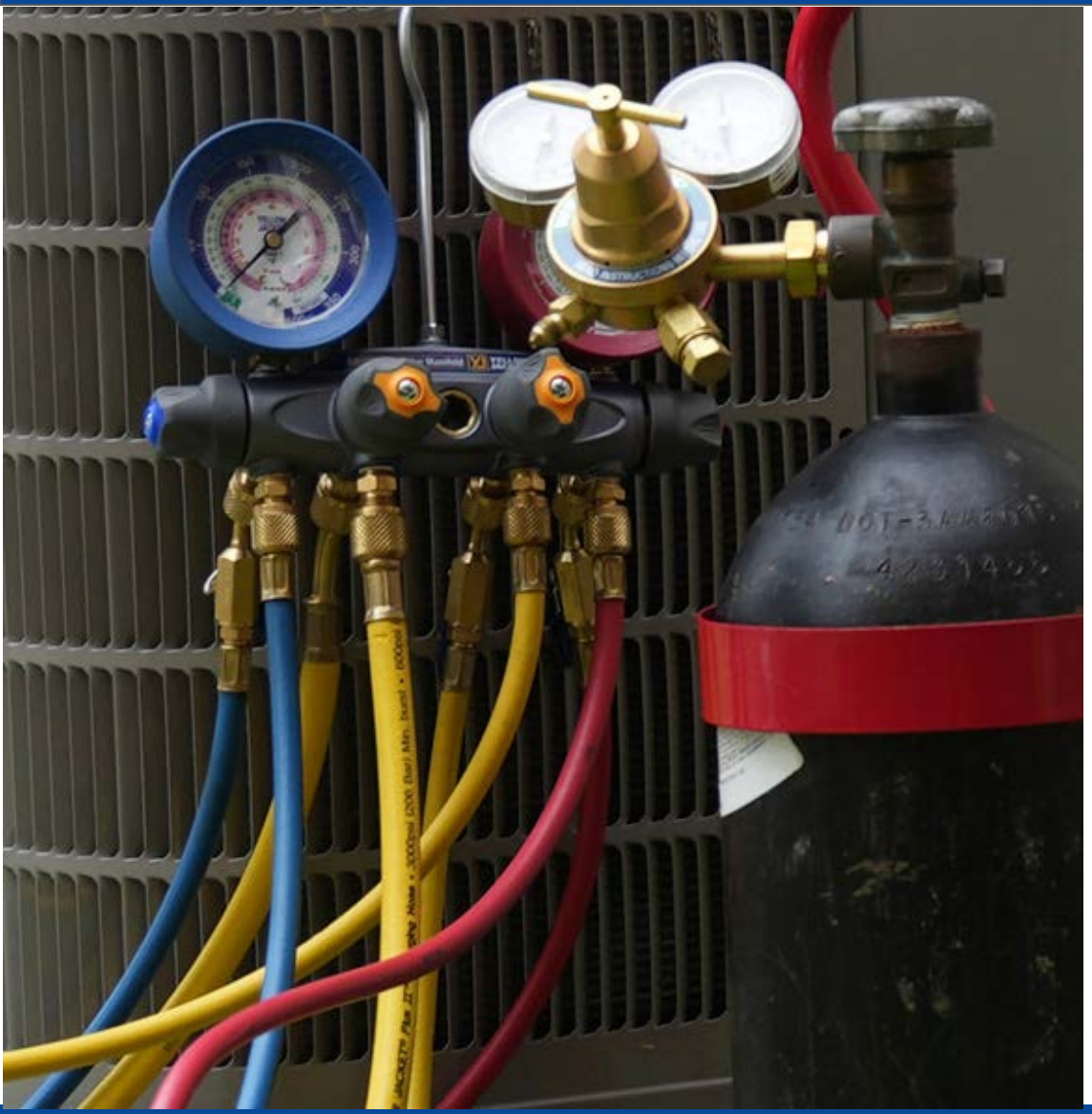
FIELD SERVICE PROCEDURES

Recovery

- Always recover refrigerants into an approved container
- Clearly mark the container for refrigerant type
- Never mix refrigerant types



FIELD SERVICE PROCEDURES



Inert gas purge

- Sweep system with inert gas to help release any trapped refrigerant
- What changed with R454-B inert gas purge?
  - Previously best practice – now required with R454-B
  - Additional inert gas purge required after 1st evacuation to ensure trapped refrigerant can be pulled out

FIELD SERVICE PROCEDURES

Evacuation

- Double evacuation PRIOR to service to ensure all refrigerant is out
- Triple evacuation AFTER service, prior to charging

FIELD SERVICE PROCEDURES

Pressure testing

- Pressure test with nitrogen
- Hold for 1 hour with no drop in pressure
- Required

FIELD SERVICE PROCEDURES

Leak test

- Required after repairs
- Trace gas test for leaks in hard-to-find locations
- Leak test prior to evacuations

FIELD SERVICE PROCEDURES

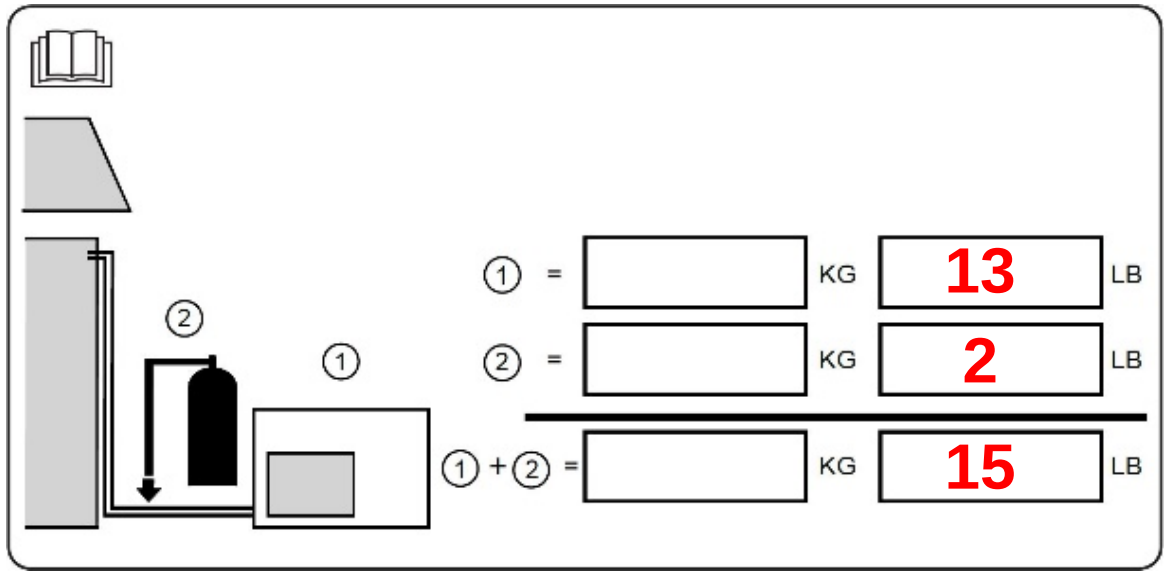
Charging

- NEVER exceed maximum allowable charge weight
- Always charge as liquid
- Never mix refrigerants
- Always charge by subcool/superheat
- Weigh in charge during winter as necessary
- Verify charge when temperature exceeds 60° F outside and 70° F inside

FIELD SERVICE PROCEDURES

Charging

- Complete charging label
- Compare current total charge to A_{min} table
- Verify total charge is within limits



FIELD SERVICE PROCEDURES

Install considerations

- A2L not a “drop-in” refrigerant
- Systems & equipment must be designed for R454-B

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THANK YOU