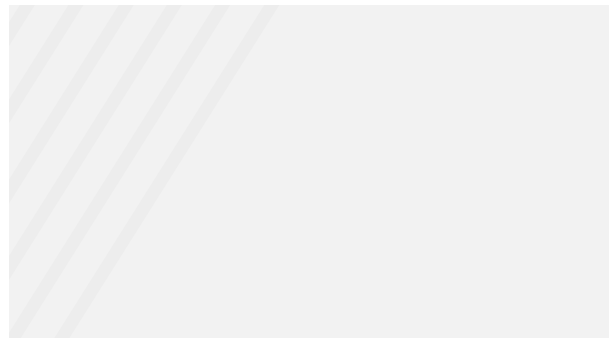


# Navigating the Hurdles of Low GWP Refrigerant Retrofits

Sharon Haeg



# Disclaimer

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- Always consult your state & local codes, which may take precedence over standards which vary in adoption, complete or partial, by state. Also note that a state may adopt a different year of the standard than the latest version.
- The local Authority Having Jurisdiction (AHJ) has the final authority in interpreting code requirements.

# Agenda

## Address Common Questions

How do refrigerants align with the goal of decarbonization

Low GWP refrigerant alternatives

Evaluating existing high GWP systems – Navigating potential speedbumps

- Understanding the EPA SNAP Final Rule 23
- UL 60335-2-40 listing requirements
- Common challenges complying with ASHRAE Standard 15
- Refrigerant pipe shaft requirements
- Operations and maintenance considerations



# Agenda

What are we really getting into today...

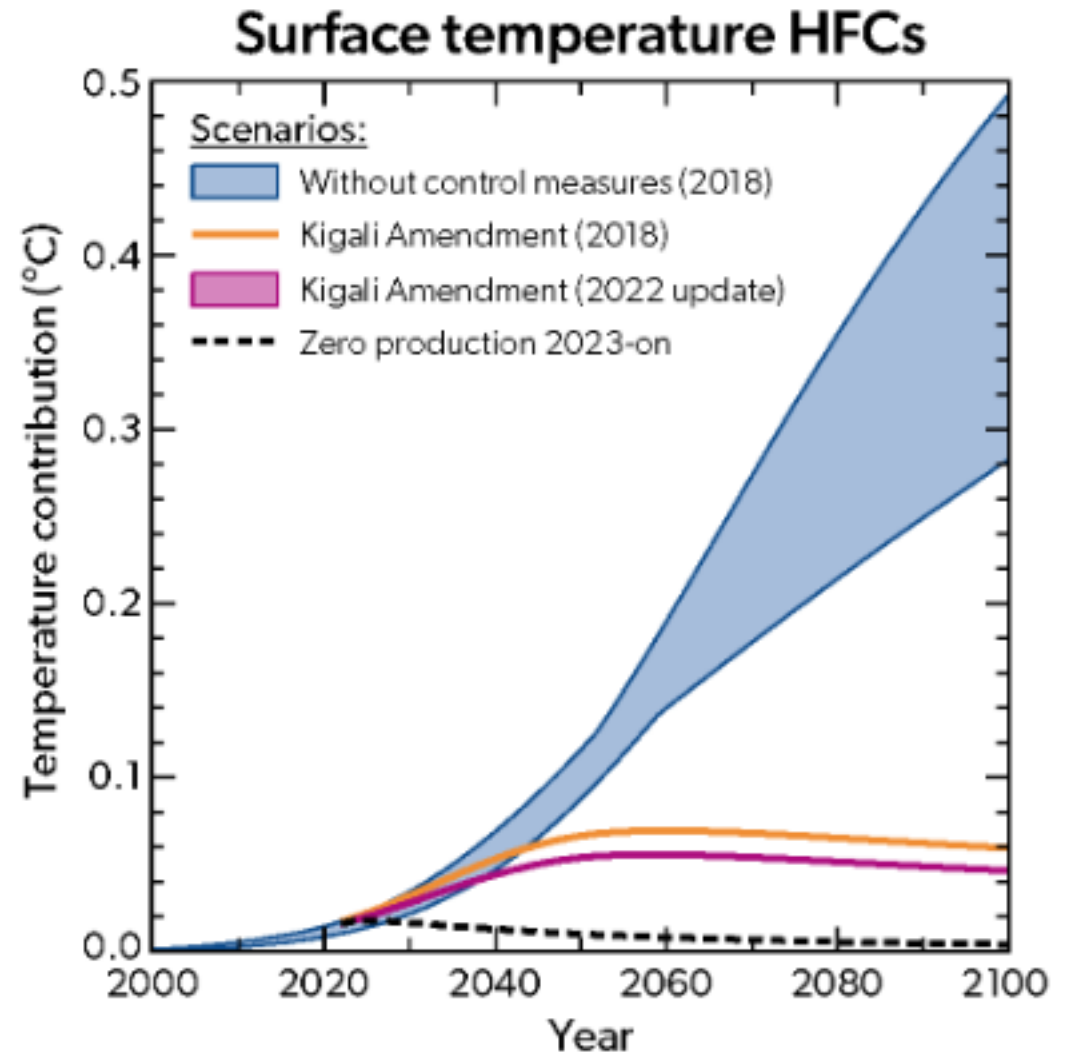
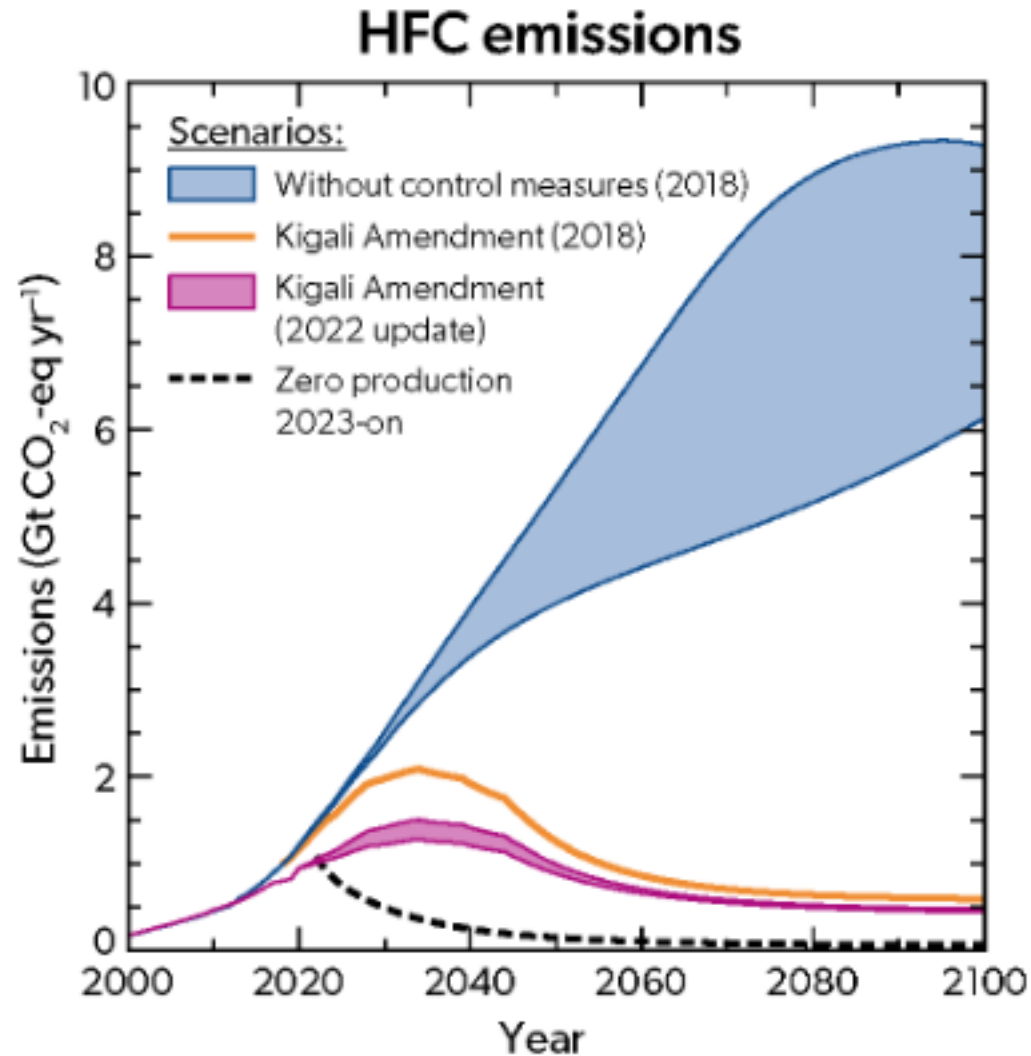
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- Can I service my existing R-410A system?
- Can I replace my existing R-410A system with new R-410A?
- What other options do I have if I don't want to replace my air handling system?
- What can I do if my refrigerant charge is too high?
- What refrigerant is the best choice for my project or building?

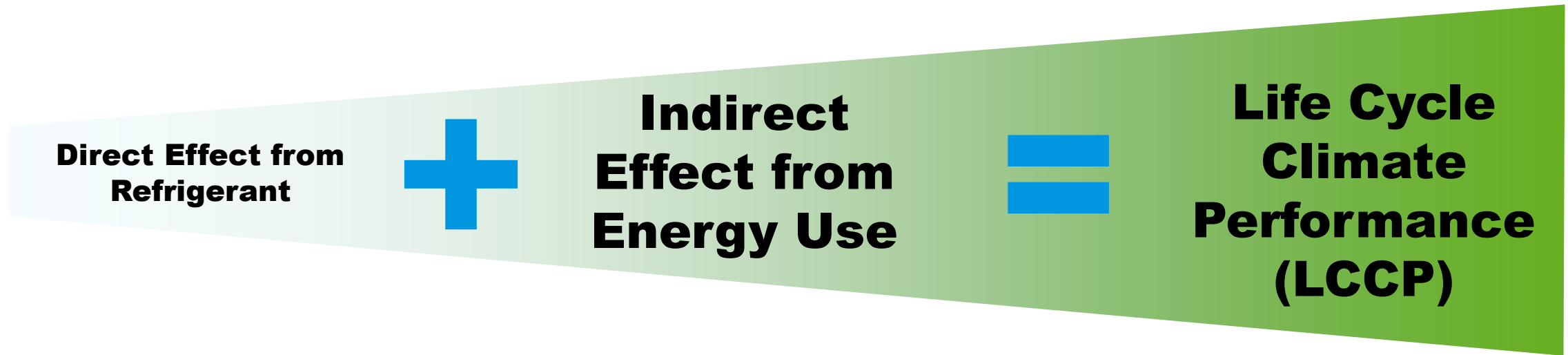


# Why are Refrigerants Important to Decarbonization?

# Kigali Amendment to Montreal Protocol

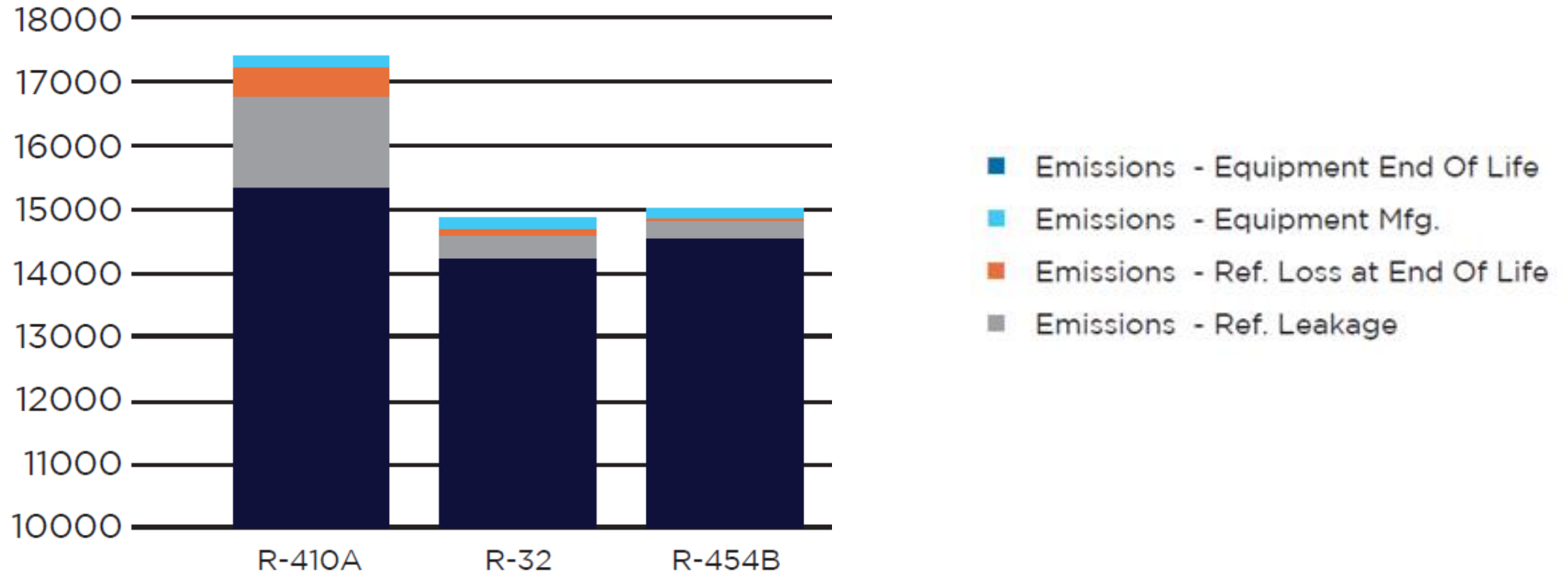


# GWP is Not the Full Measure of Emissions



- Majority of climate impact from HVAC is electrical power generation over equipment lifetime
- A lower GWP refrigerant with lower efficiency could actually create more global warming!

## Lifetime Emissions from an HVAC System\* R-410A vs R-32 vs R-454B



\*Comparison is made using the Life Cycle Climate Performance (LCCP) metric, measured in kg-CO2.eq. LCCP analysis was performed using a high efficiency HP (24+ SEER), using performance gains claimed by respective refrigerant manufacturer, for a residential sized (9000 Btu/h cooling capacity), installed in Houston, TX climate zone, with an assumed annual leakage rate of 4% and end of life refrigerant leakage of 15% with a 15 year lifetime. The heating COP and SEER were adjusted based on refrigerant characteristics and performance. The physical system size, trim charge requirements and capacity were kept consistent to ensure a like-to-like comparison.



# How will the AIM Act Affect Applied HVAC Systems?

# AIM Act: Law Passed Dec. 2020 | EPA Rulemaking Status



The AIM Act gives authority to the EPA to phase down HFC refrigerants in the US

**Old news:** EPA must write rules to phase down production and consumption of bulk HFCs to 15% of baseline, maximize reclamation, minimize releases from equipment and facilitate transition through sector-based restrictions

## PHASEDOWN

via CO<sub>2</sub>eq Allocations of Bulk HFCs  
(Supply Side constraints)

## TECHNOLOGY TRANSITIONS

Sector based controls  
SNAP restrictions

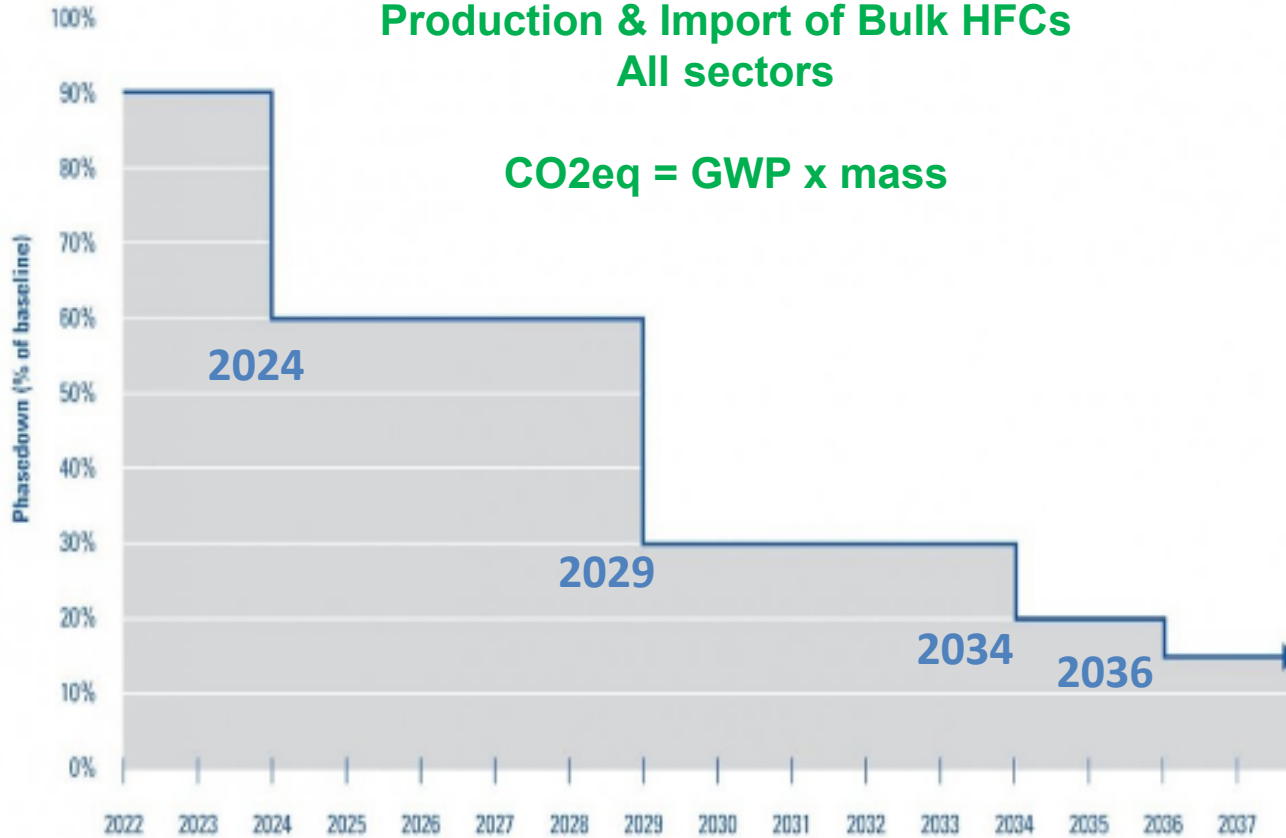
## REFRIGERANT MANAGEMENT

Minimizing leaks  
Maximizing recovery & reclamation

# AIM Act: EPA Phasedown and Allocations

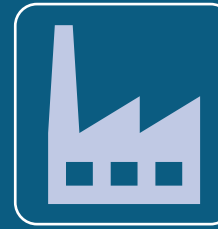
## Phasedown Schedule Production & Import of Bulk HFCs All sectors

$$\text{CO2eq} = \text{GWP} \times \text{mass}$$



### CO2eq Phasedown

- Baseline over 300 million metric tonnes CO2 equivalency
- Phases down creating supply shortage of HFCs



### Not refrigerant specific – not a phaseout

- All bulk virgin HFCs in all sectors
- Produced in USA and imported



### Existing equipment may be serviced

- Installed base can be serviced
- Will need to transition to lower GWP refrigerants

# AIM Act: EPA Technology Transition

**Products - Factory-Charged Equipment**  
 Chillers, RTUs, WSHP, PTAC  
 3-year sell-through period

**Air conditioning equipment, including AC & HP, Chillers (comfort cooling), and ice rinks**

MFG and Import Deadline

Sell-through Deadline

**Data Centers**

MFG and Import Deadline

Sell-through Deadline

**\*Installation deadline means charging the refrigeration circuit to full charge**

1/1/2030

1/1/2028

1/1/2027

**You Are Here**

1/1/2026

MFG and Import Deadline

~~\*\*\*Installation Deadline~~

**Residential / Light Commercial Split system HPs and AC**

MFG and Import Deadline

\*Installation Deadline  
 \*\*Potential Extension

**VRF**

**Systems - Field-charged equipment:**  
 Split systems, knock-down units  
 Installation deadline instead of sell-through

1/1/2025

1/1/2024

**Select states require chillers with GWP limit of 750**

\*\*For projects that were issued a building permit which approved the use of an HFC or blend containing an HFC in a VRF system prior to October 5, 2023, installation is allowed until January 1, 2028.

\*\*\*Installation deadline for Residential / Light Commercial removed per Final Rule May 2026.



# What will Replace R-410A?

# What is Replacing R-410A?

## Examples of announced products using R-32



All products previously using R-410A



Air-cooled scroll chillers



Mini-split products



Most products except 'Hylex



All split-system products

## Examples of announced products using R-454B



Residential, light commercial and commercial ducted HVAC applications



Ducted and ductless residential and light commercial applications



Residential HPs and AC; commercial rooftop units and ducted split systems



MITSUBISHI ELECTRIC TRANE HVAC US

Light commercial and residential heating and AC products

# Why is R-32 the Right Choice to Replace R-410A?

## PROVEN

- In over 280 million units installed around the world

## EASY

- Top off and recharge R-32 in the field

## EFFICIENT

- Up to 12% more efficient than comparable R-410A systems

## AVAILABLE

- A commodity with no active patents on the refrigerant

# R-32 is Proven

Refrigerant	Composition
R-410A	50% R-32 / 50% R-125
R-32	PURE 100% R-32
R-454B	68.9% R-32 / 31.1% R-1234yf

## R-32 Dissemination in the World

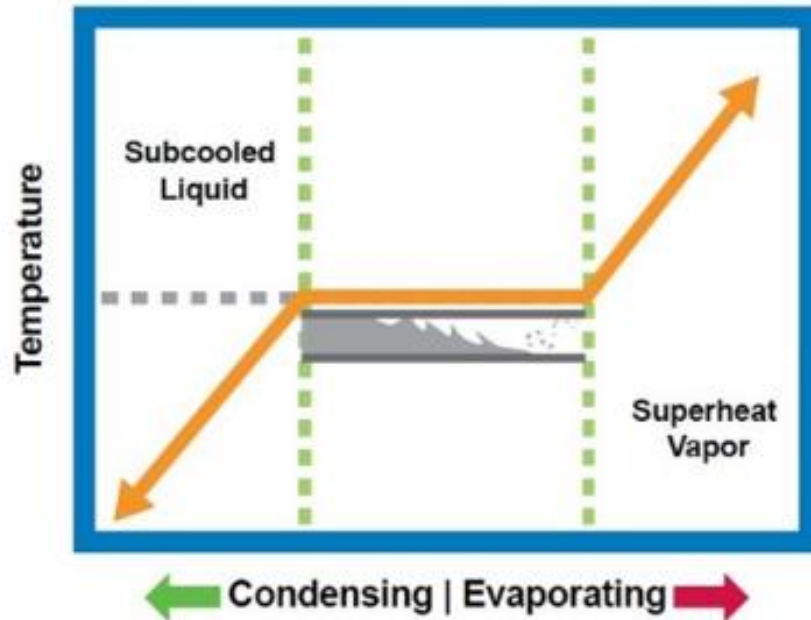


\*1 Daikin's estimation as of March 2025.

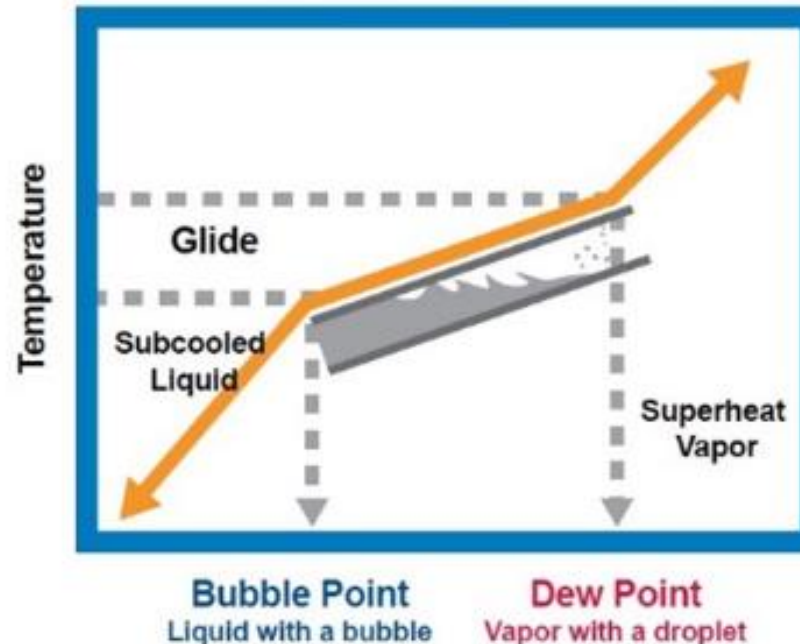
# R-32 is Easy - Understanding Refrigerant Glide

## Refrigerant Glide

Single Component  
or Azeotropic Blends



Non-Azeotropic Blends  
(typically called "Blends")



A **Non-Azeotropic mixture** is a mixture with liquid components that have different boiling points.

**R32 is a Pure Refrigerant.**  
**R454B is a Non-Azeotropic blend.**

# R-32 is Efficient

Cost savings for an  
**R-32** air cooled chiller vs.  
**R-454B** air cooled chiller  
range from \$41,000-\$117,000  
depending on the climate zone,  
making R-32 a highly  
cost-effective choice

## Why A New Generation Of Refrigerants Is Not Just Good For The Planet, But Also For The Wallet

Estimated cumulative operating cost savings  
over 15 years utilizing R-32 vs. R-454B refrigerant  
in a simulated elementary school building

# R-32 is Available - Intellectual Property & Patents

## R-32

- No active patents on the chemical itself – used in R-410A
- Technology patents have been released to allow easier adoption

## R-454B

- Proprietary and patented

**2011**

Patent owner offered free access to 93 patents for emerging countries

**2019**

Additional non-assertion pledge to patents filed since 2011

**2022**

Added 120 new patents, bringing the total to 419 to be used free of charge

## R-32 TECHNOLOGY PATENT TIMELINE

**2015**

Expanded free access worldwide

**2021**

Released 123 further patents

**The underlying concern is really cost, not patents, right...?**

## R-32 is Available - Cost

Is R-32 more expensive than R-454B?



**R-410A 25lb Cylinder**  
**\$11.56 / lb**



**R-32A 20lb Cylinder**  
**\$14.95 / lb**



**R-454B 20lb Cylinder**  
**\$26.45 / lb**

# R-32: Common Misconceptions – ‘Is it as simple as GWP?’

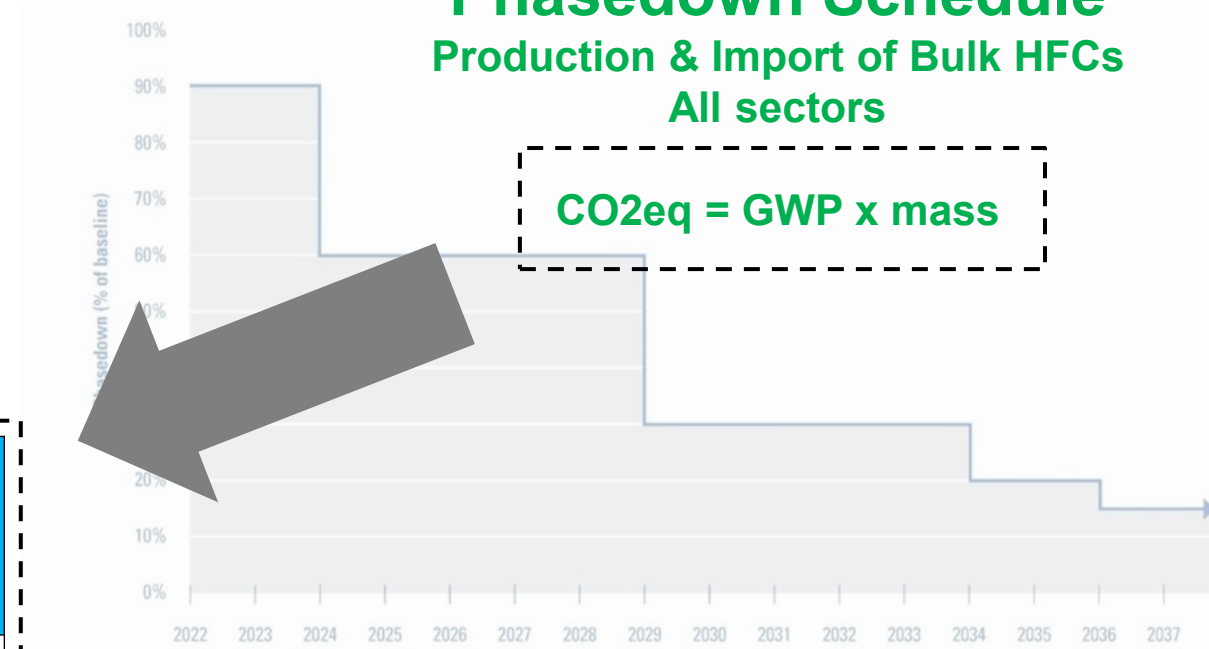
Does the higher GWP of R-32 relative to R-454B mean R-32 is worse for the environment or will be phased down sooner?

-R-32’s GWP is higher than R-454B’s GWP but...

- Charge/ton is typically lower for R-32
- R-32 efficiency is superior
- Produced Mass \* GWP is what matters
- Less mass of R-32 per ton of cooling is needed

Refrigerant	Safety Class	GWP100 (AR4)	Refrigerant charge level (R-410A baseline)	'Adjusted' GWP vs R-410A
R-410A	A1	2088	1	<b>2088</b>
R-32	A2L	675	~0.65	<b>~435</b>
R-454B	A2L	466	~0.9	<b>~419</b>

## Phasedown Schedule Production & Import of Bulk HFCs All sectors

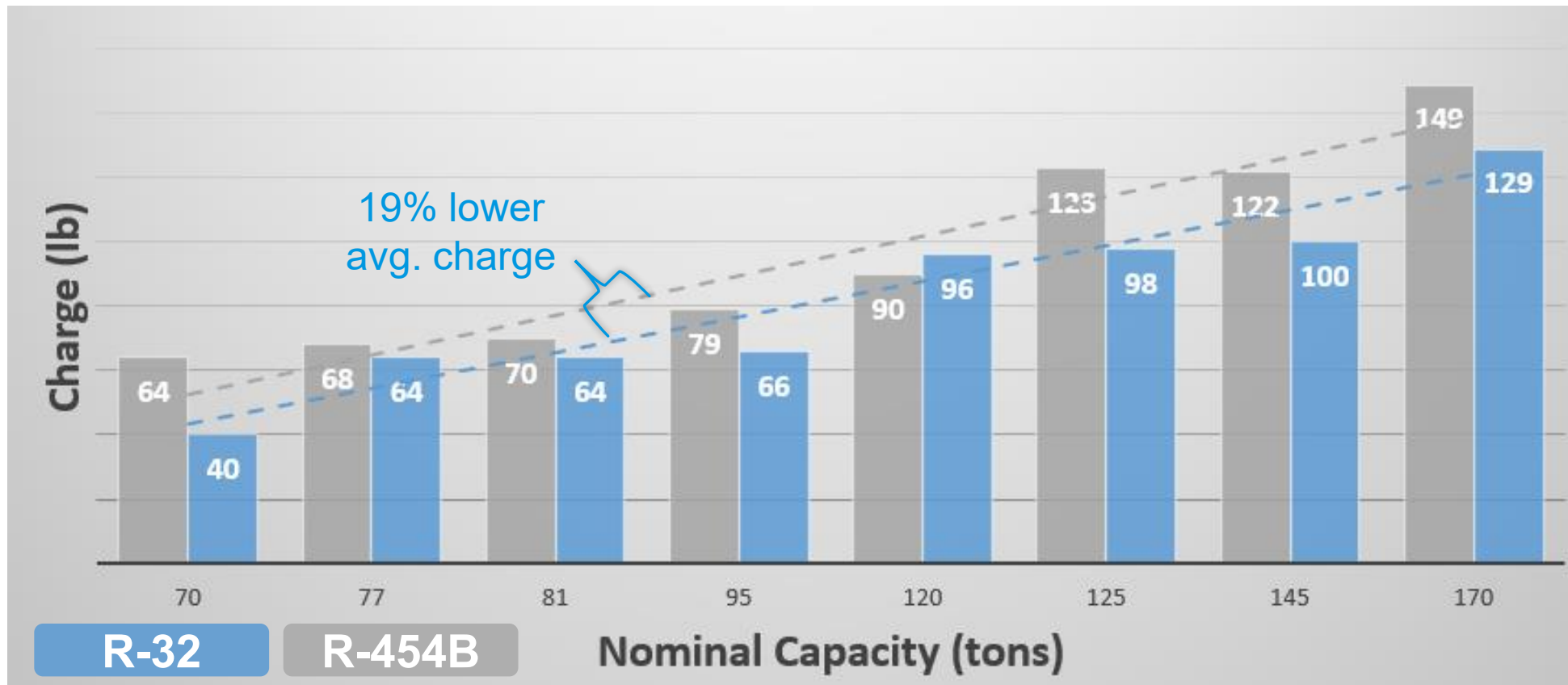


Source: US EPA

# Efficiency and Refrigerant Charge

R-32 air-cooled scroll chiller vs. comparable R-454B scroll chiller

- Actual side-by-side comparisons will vary due to non-refrigerant design factors
- Tradeoff between efficiency and charge – maximizing efficiency would limit charge savings and vice-versa



R-32  
Charge

19%  
Less

R-32  
Efficiency

5%  
higher

# Reduce, Reuse, Recycle

## Recycle

- Extract refrigerant from an appliance and clean it for reuse in equipment for the same owner without meeting all the requirements for reclamation. Recycling normally takes place at the field job site.

## Reclamation

- Used refrigerant reprocessed to meeting new product specifications (AHRI Standard 700-2016). Reclaimed refrigerant must meet strict purity standards, often requiring specialized, off-site equipment operation by EPA-certified reclaimers.

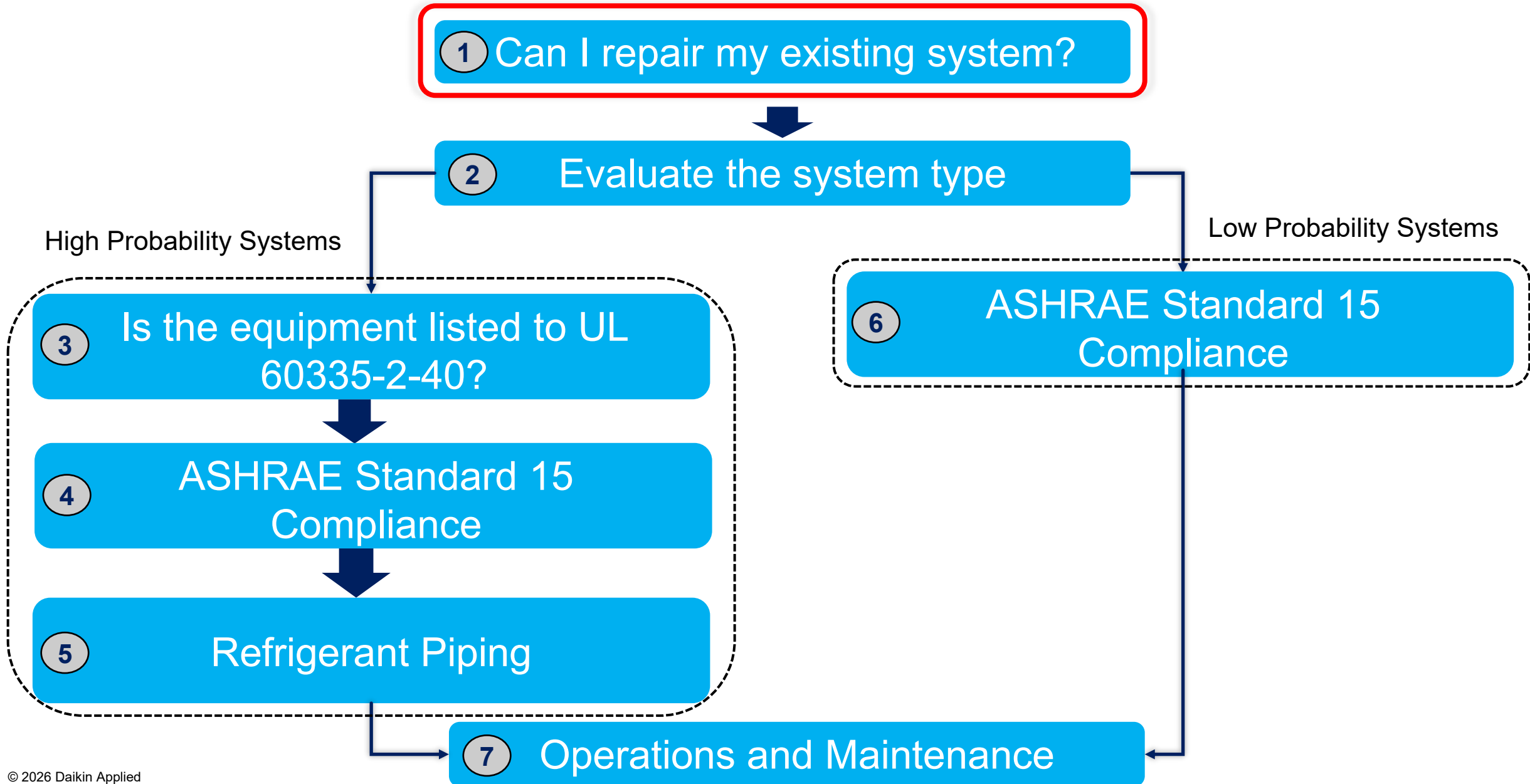
# Reduce, Reuse, Recycle

	R-32	R-454B
Recycle	As a single component refrigerant, recycling is easily done without concern of refrigerant composition.	Recycled refrigerant composition is unknown which can affect system performance.
Reclamation	With no patents on the components itself and as a single component refrigerant reclamation efforts are easy.	Patents on R-454B limit reclamation efforts to distilling down to base components which is time consuming and costly.



# Evaluating Existing Systems

# Evaluating Existing Systems



# Can I Repair My Existing System?

1

## EPA Technology Transition provides regulation on what is considered service on an existing system vs a new installation subject to GWP restrictions

**Components (condensing units, condensers, compressors, evaporator units, & evaporators)** needed to repair existing RACHP equipment can be serviced as long as the repair doesn't consist of a new system installation and the service parts that are specified components are labeled appropriately.

To distinguish between routine maintenance and what qualifies as a new system installation, the EPA has issued specific criteria in its October 2023 Final Rule – Phasedown of Hydrofluorocarbons: Restrictions on the Use of Certain Hydrofluorocarbons under Subsection (i) of the American Innovation and Manufacturing Act of 2020 Facts Sheet.

**“Specifically, the following actions, upon charging the system to full charge, are considered a new installation of a RACHP system and thus subject to the relevant HFC use restrictions:**

- ***Assembling a system for the first time from used or new components;***
- ***Increasing the cooling capacity, in BTU per hour, of an existing system; or***
- ***Replacing 75 percent or more of evaporators (by number) and 100 percent of the compressor racks, condensers, and connected evaporator loads of an existing system.”***

Any system modifications meeting these criteria are treated as new installations rather than maintenance and must comply with refrigerant GWP restrictions.

# Evaluating existing High GWP Refrigerant DX Systems (Figure 1)

## Simplifying assumptions:

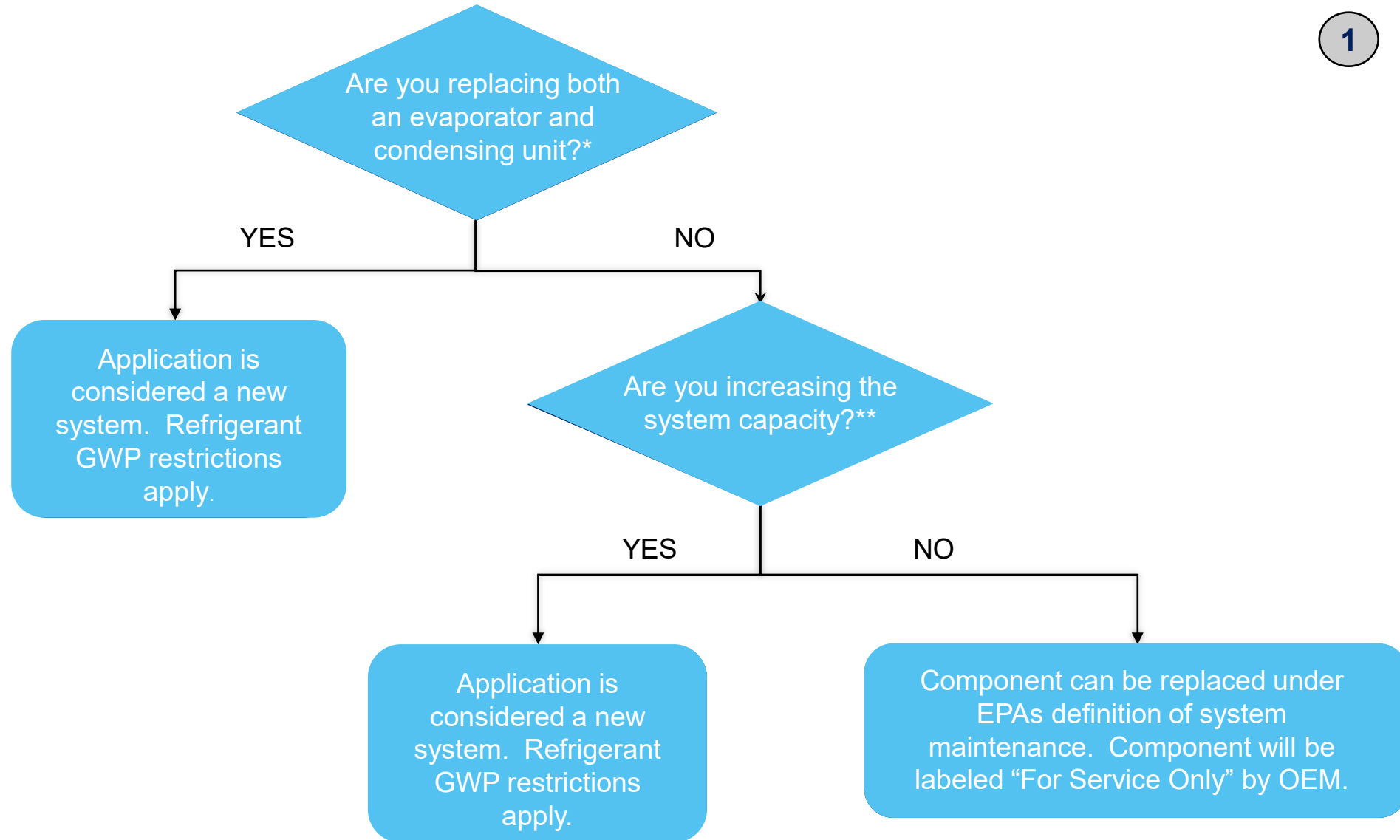
- Equipment is not a Variable Refrigerant Flow or commercial refrigerating system.
- The application is a high probability system

**Figure 1:** EPA defines the distinction between maintenance of a system and installation of a new system in the October 2023 Final Rule – Phasedown of Hydrofluorocarbons: Restrictions on the Use of Certain Hydrofluorocarbons under Subsection (i) of the American Innovation and Manufacturing Act of 2020 facts sheet. “Specifically, the following actions, upon charging the system to full charge, are considered a new installation of a RACHP system and thus subject to the relevant HFC use restrictions:

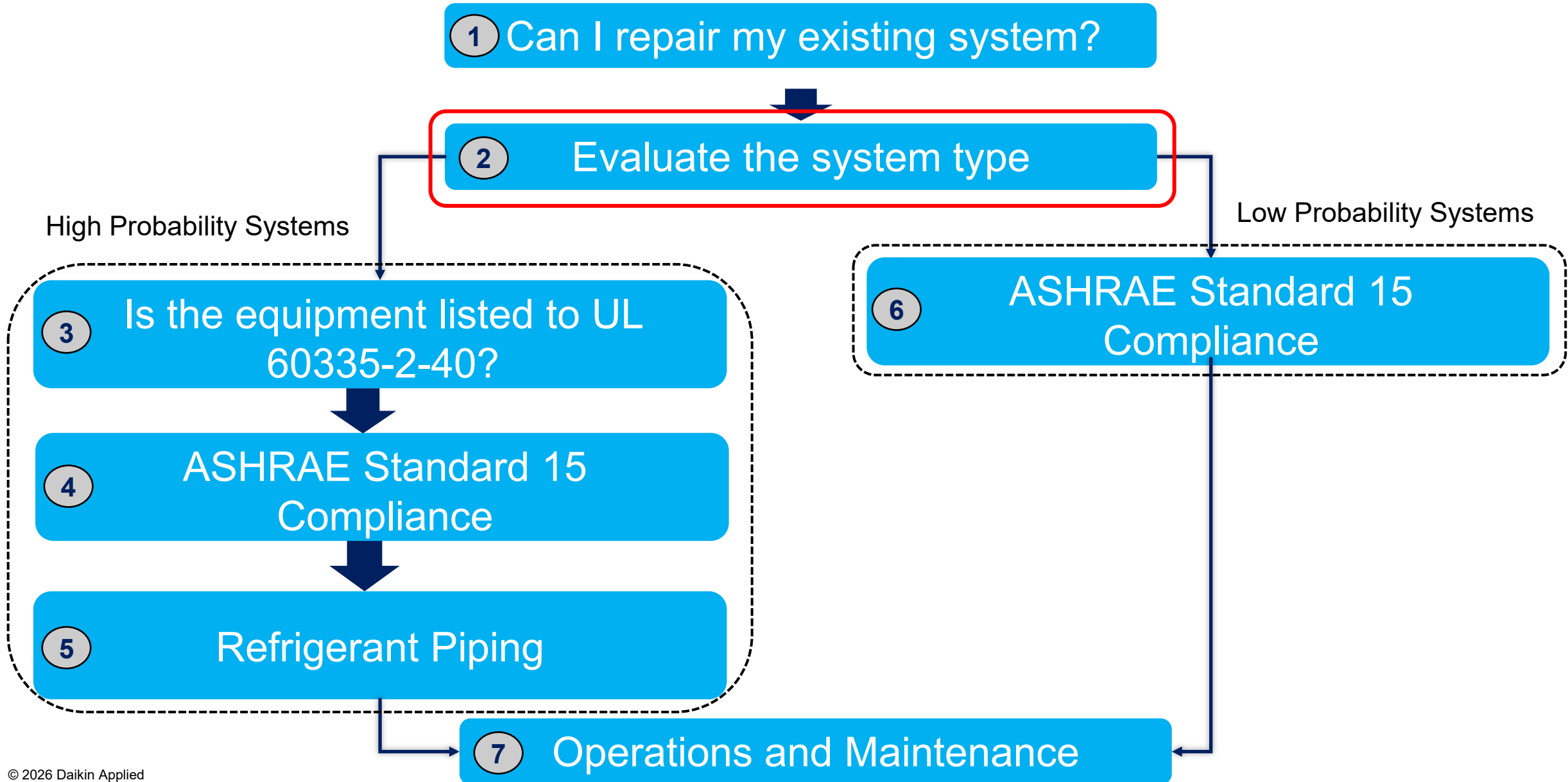
\*Assembling a system for the first time from used or new components;

\*\*Increasing the cooling capacity, in BTU per hour, of an existing system; or

Replacing 75 percent or more of evaporators (by number) and 100 percent of the compressor racks, condensers, and connected evaporator loads of an existing system.”



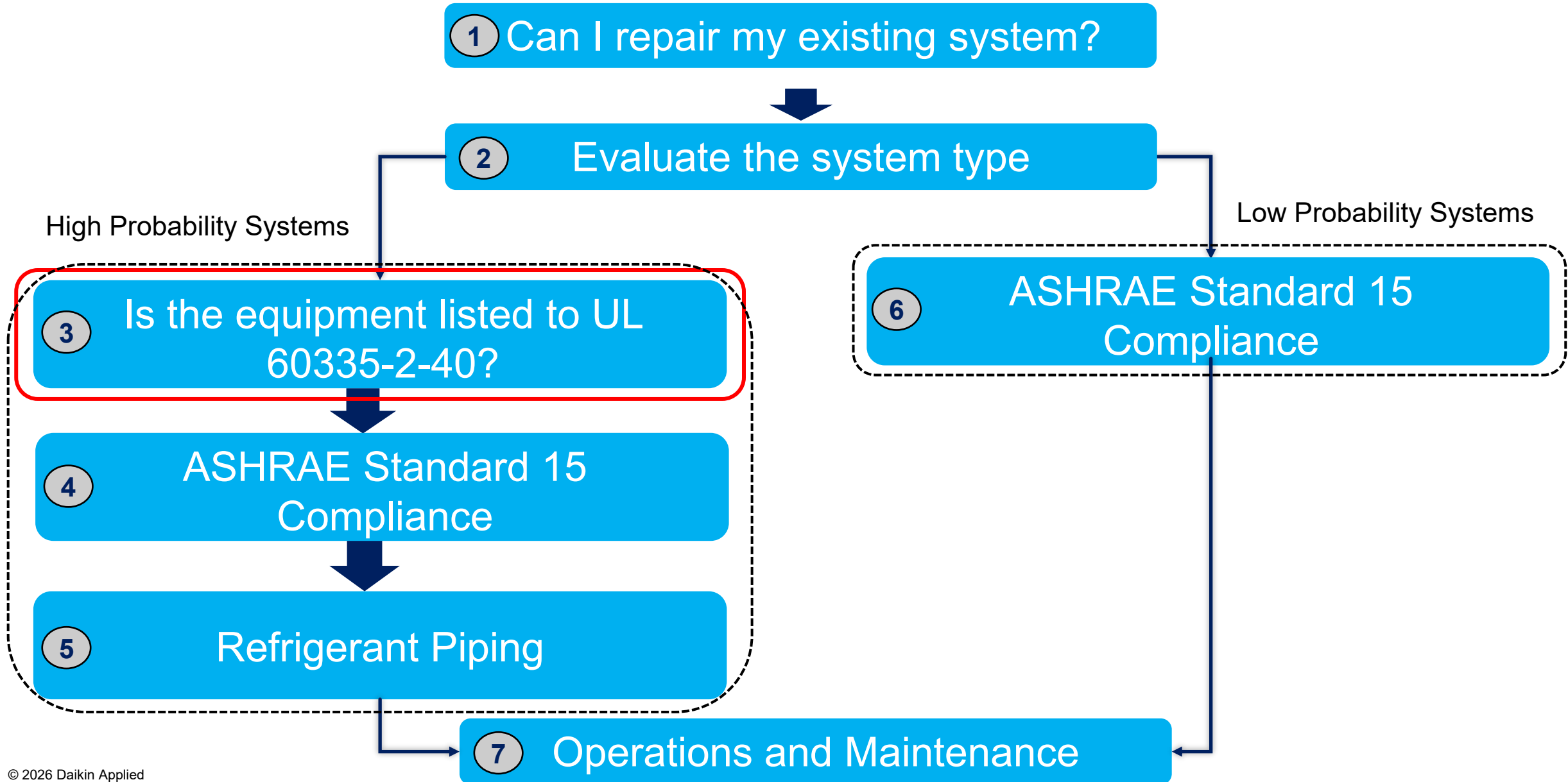
# Evaluating Existing Systems



# Evaluate the System Type

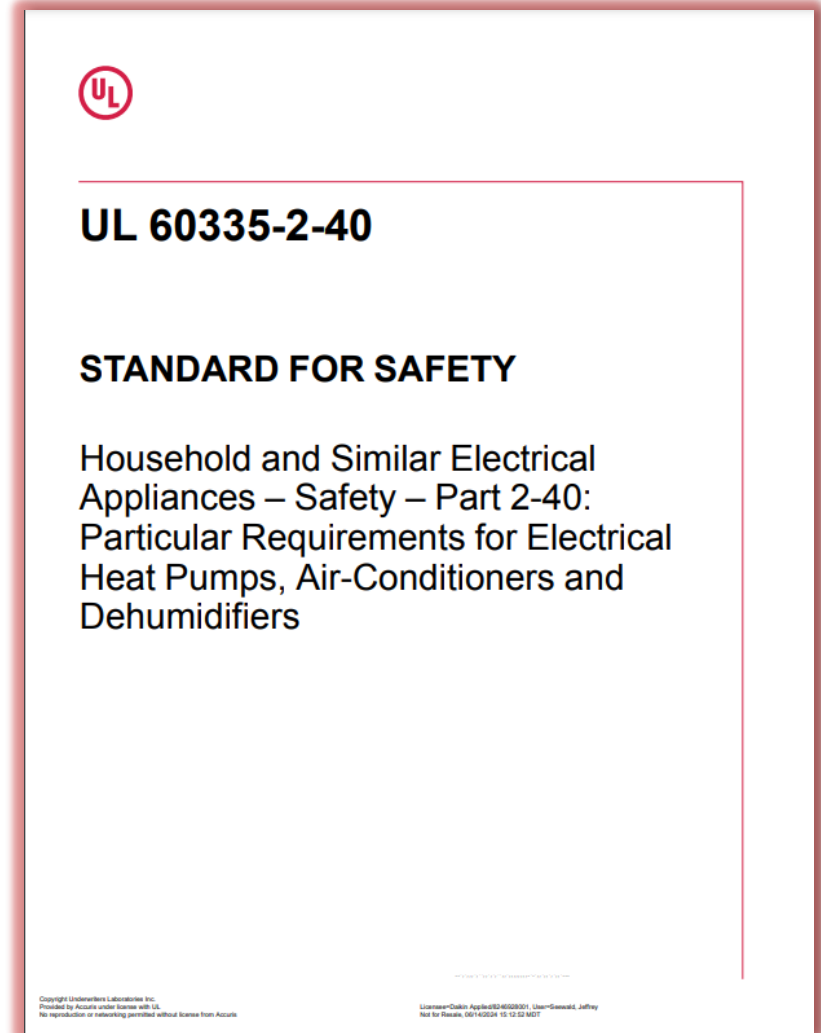
Classification	Definition	Examples
<b>High Probability</b>	Any system where leakage of refrigerant has <b>high probability to enter the occupied space.</b>	<b>Direct Systems</b> <ul style="list-style-type: none"><li>• Direct expansion (DX) split system</li><li>• Packaged RTU</li><li>• Water source heat pump</li><li>• VRF</li><li>• PTAC</li></ul>
<b>Low Probability</b>	Any system where leakage of refrigerant <b>cannot enter the occupied space.</b>	<b>Indirect closed systems</b> <ul style="list-style-type: none"><li>• Water-cooled chiller in machinery room</li><li>• Air-cooled chiller outdoors</li><li>• Water-to-water heat pump in machinery room</li></ul>

# Evaluating Existing Systems



## Product Safety Standard(s)

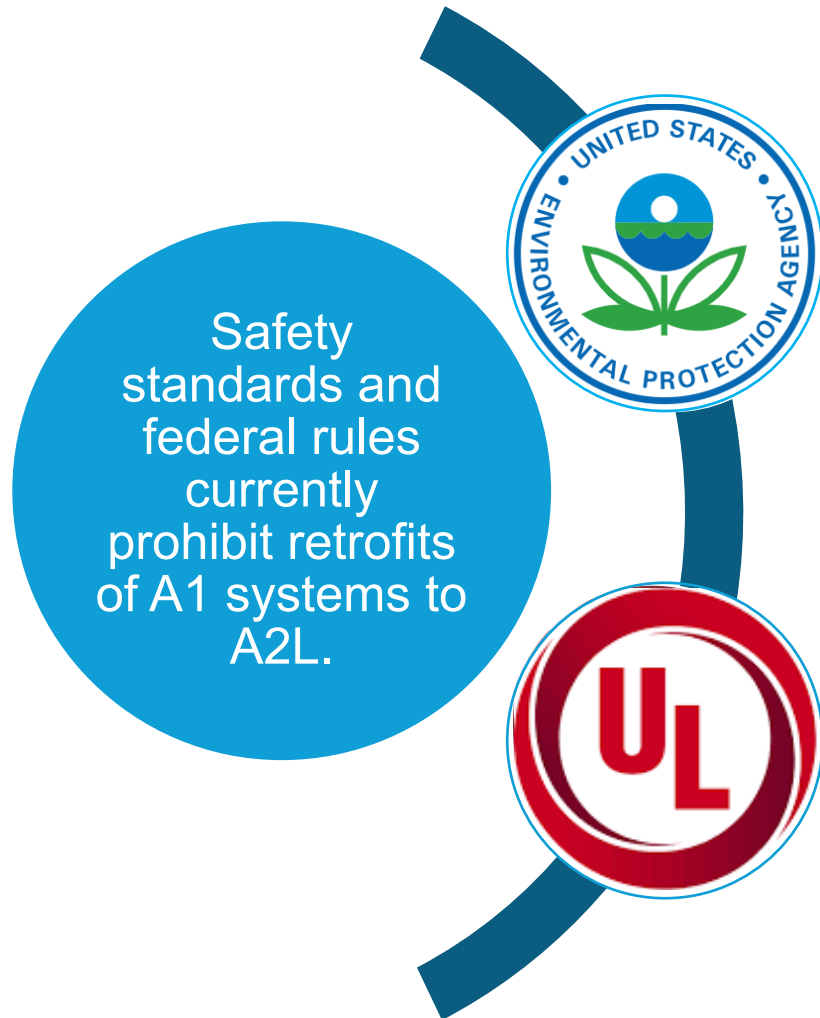
- Refrigeration systems **must be listed** in accordance with **UL 60335-2-40** for HVAC equipment with A2L refrigerants
- Sets safety requirements for equipment manufacturers
  - Leak testing
  - Ignition source restrictions
  - Equipment markings
- Requires certain information that **OEMs must include in IOMs**. For example:
  - Instructions for installation including refrigerant piping and SSOVs
  - Handling, installation, cleaning, servicing and disposal of refrigerant
- **Always refer to the manufacturer's IOM for specific installation requirements!**



# Is the Equipment Listed to UL 60335-2-40?

Most retrofits are prohibited due to the requirement for a UL 60335-2-40 listing

3



## The EPA prohibited retrofits in the SNAP Final Rule 23

“in new equipment designed specifically and clearly identified for the refrigerant; i.e., none of these substitutes are being listed for use as a conversion or “retrofit” refrigerant for existing equipment. “New” equipment to include a new compressor, evaporator, condenser and refrigerant tubing.”

## UL prohibits retrofitting equipment from A1 to A2L

Existing equipment has not been certified to UL 60335-2-40 containing the requirements for safety testing, charge sizes, ventilation requirements, identification, etc. when utilizing an A2L.

# Alternatives to Retrofitting Existing Equipment with A2L Refrigerant

If a replacement isn't feasible for financial and/or technical reasons, what are alternatives?

3



## Repair the existing system

- Existing high GWP systems can continue to operate throughout their useful life and can be serviced if following the guidelines of the EPA

## Investigate a hydronic solution

- Is it technically feasible
  - Is there space in the AHU for a CHW coil
  - Is there routing in the building for CHW piping
  - Accounting for the additional static pressure drop
- Modular chiller plant or chiller
  - Is there physical space
  - Is there power available at the location
  - Is there any weight concerns (for roof installations)

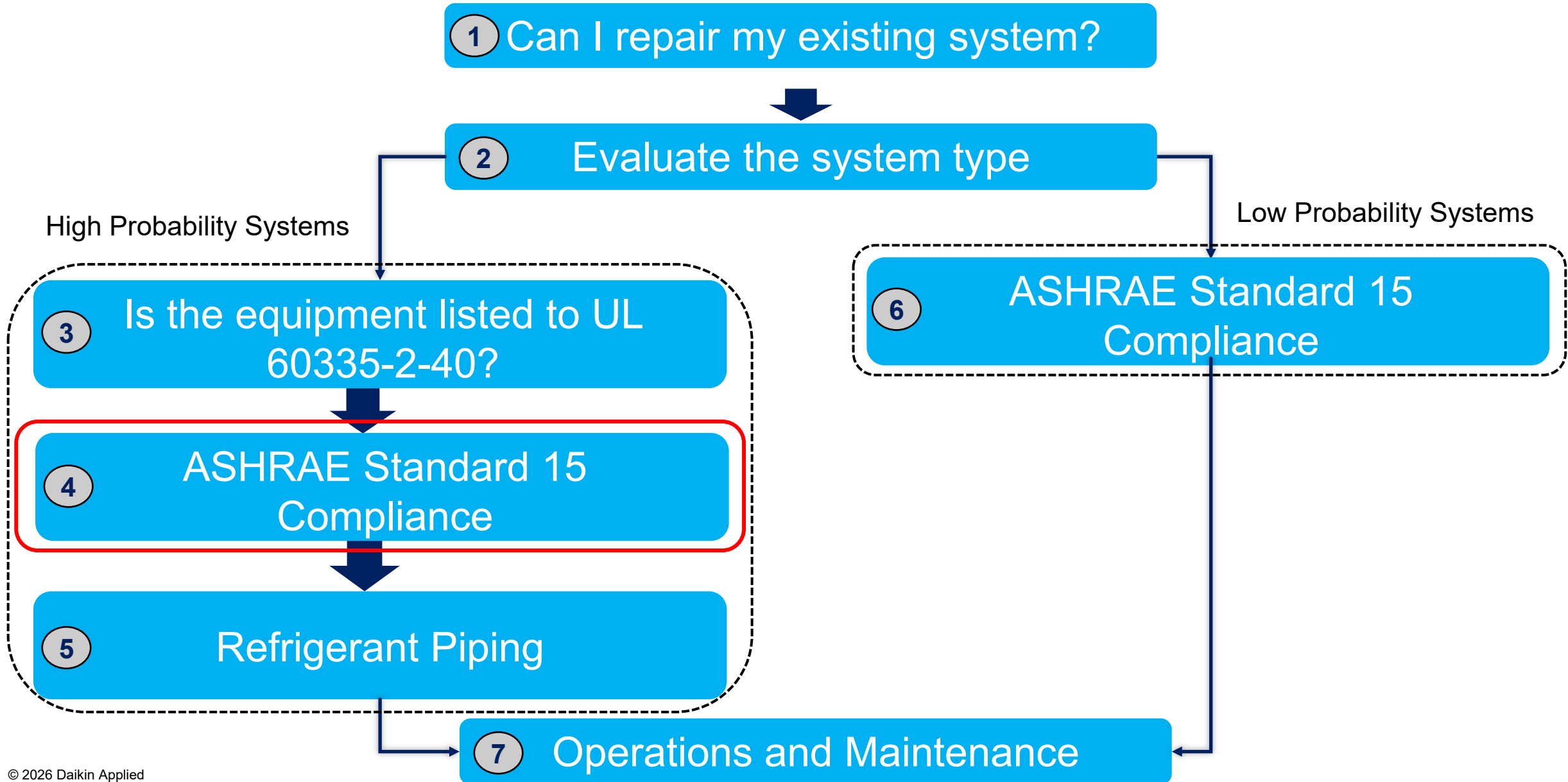
## Evaluate a rooftop unit solution

- Solution for interior space restrictions
- Is there structural support for the unit

## Talk to the Authority Having Jurisdiction

- Would the AHJ accept an alternative compliance path

# Evaluating Existing Systems



## Safety Standard for Refrigeration Systems

ASHRAE Standard 15 specifies requirements for the safe design, construction, installation, and operation of refrigeration systems.

- Changes to **refrigerant use restrictions**, especially for A2Ls
- Refrigerant overpressure protection and **pipng**
- Volume and **refrigerant charge limit** calculations
- **Refrigerant detector**/detection and mitigation actions
- Machinery room requirements

\*ASHRAE website has errata sheet corrections and interpretation available for download



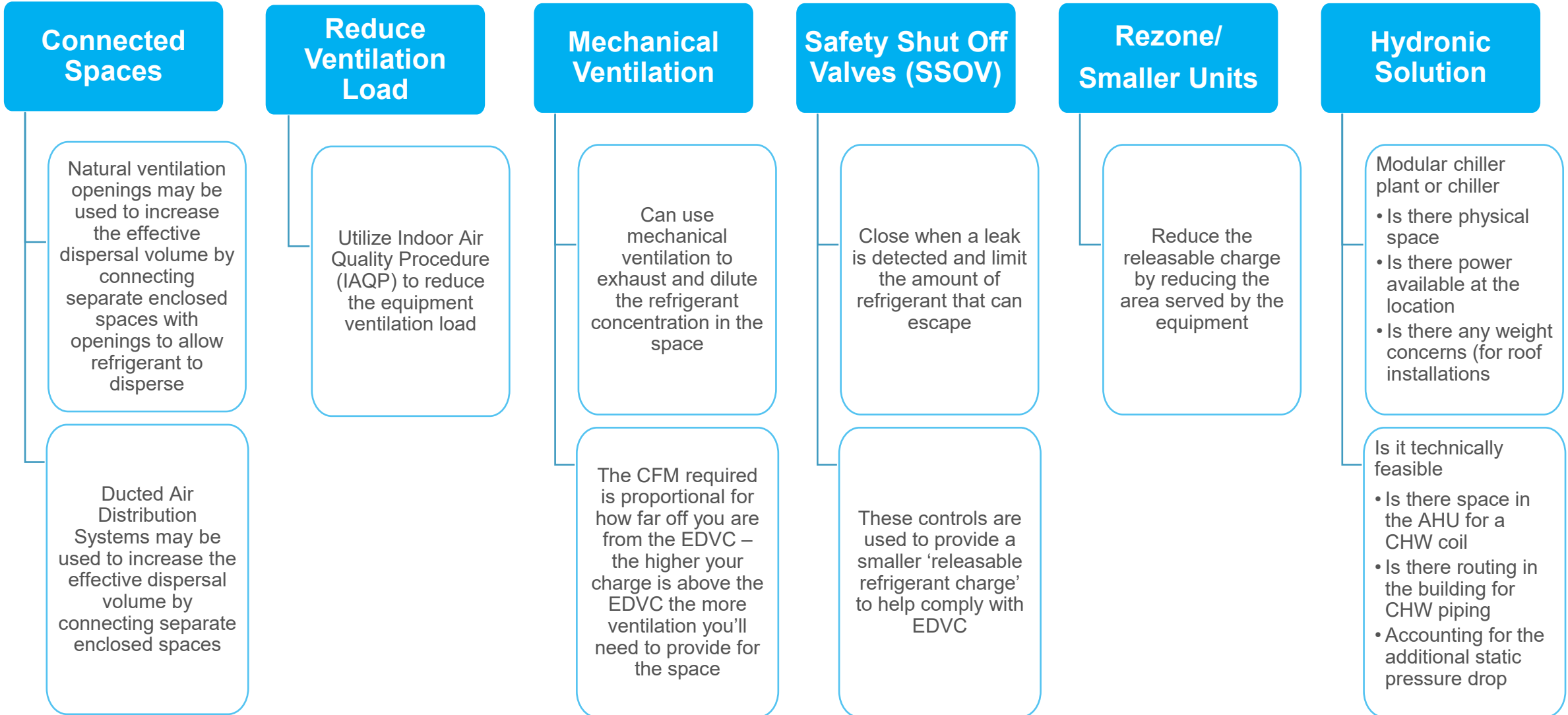
- Check the **releasable refrigerant charge ( $M_{rel}$ )** against the **Effective Dispersal Volume Charge (EDVC)**
  - The **smallest volume into which refrigerant disperses shall be used** when determining EDVC

$$M_{rel} \leq EDVC$$

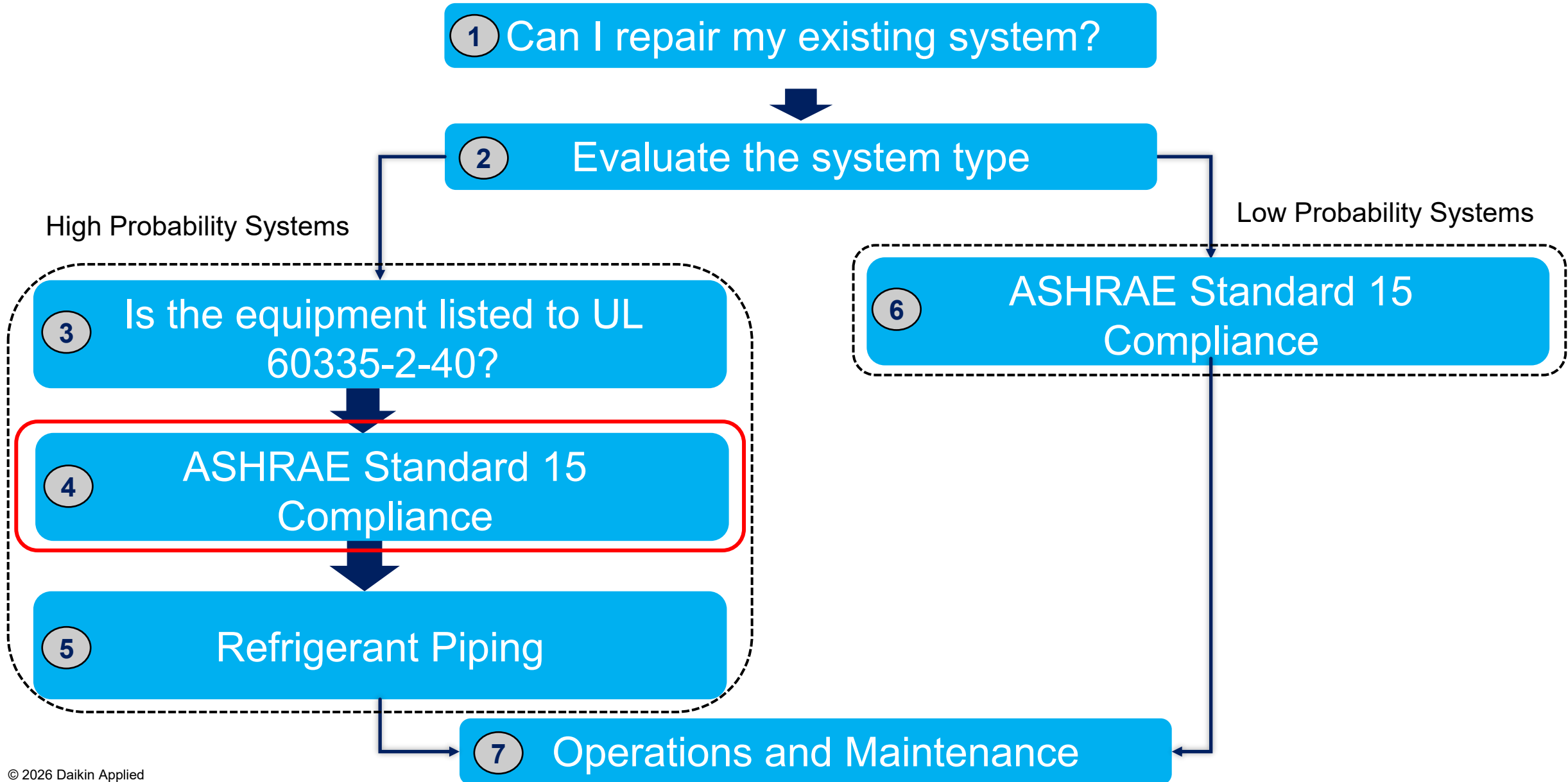
**If you don't comply initially, you can consider additional mitigation strategies**

# ASHRAE Standard 15 Compliance - EDVC

If you are over the EDVC, what are the alternatives?



# Evaluating Existing Systems



## 7.6.2.5\* Mitigation Action Requirements.

The following *mitigation actions shall* be completed in not more than 15 seconds after the initiation of the output signal of Section 7.6.2.4(h), and *shall* be maintained for at least five (5) minutes after the output signal has reset:



# ASHRAE Standard 15 Compliance – Mitigation Actions

*De-energizing ignition sources and electric resistance heat during a mitigation event requires additional controls programming*



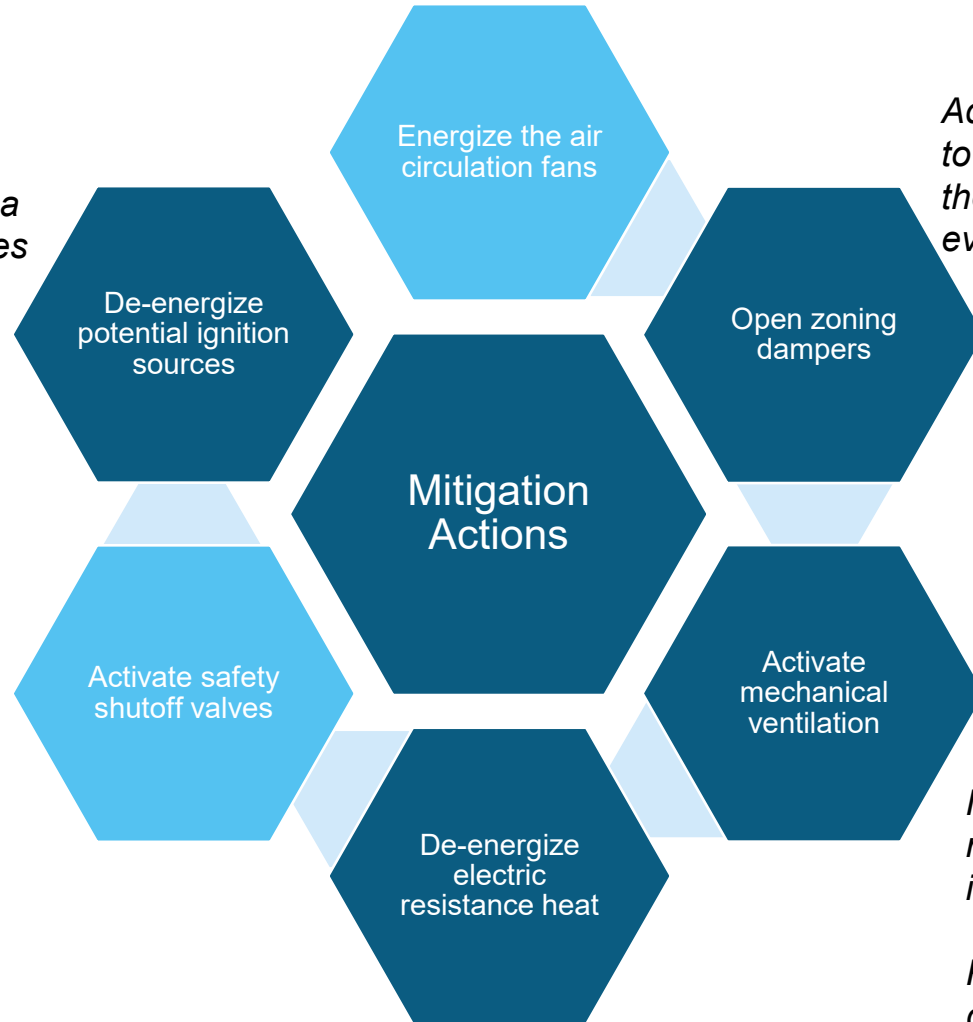
*Additional controls required to control ancillary devices in the event of a mitigation event*

*Mechanical ventilation may not be easily installed in the building.*

*Requires additional controls programming*

# ASHRAE Standard 15 Compliance – Mitigation Actions

*De-energizing ignition sources and electric resistance heat during a mitigation event requires additional controls programming*



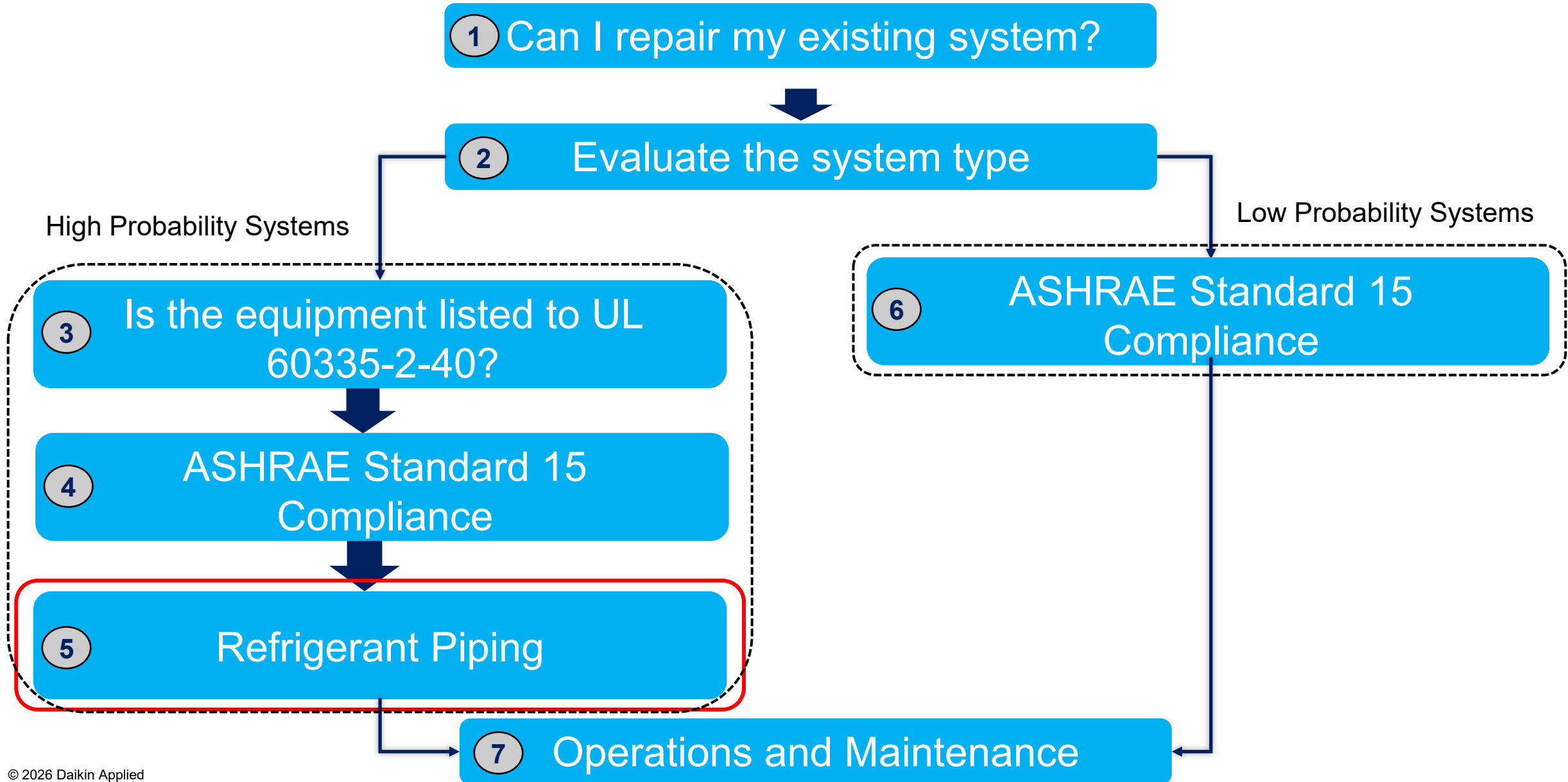
*Additional controls required to control ancillary devices in the event of a mitigation event*

**If performing mitigation actions is cost prohibitive, consider repairing the existing system or a hydronic solution**

*Mechanical ventilation may not be easily installed in the building.*

*Requires additional controls programming*

# Evaluating Existing Systems



# Refrigerant Piping

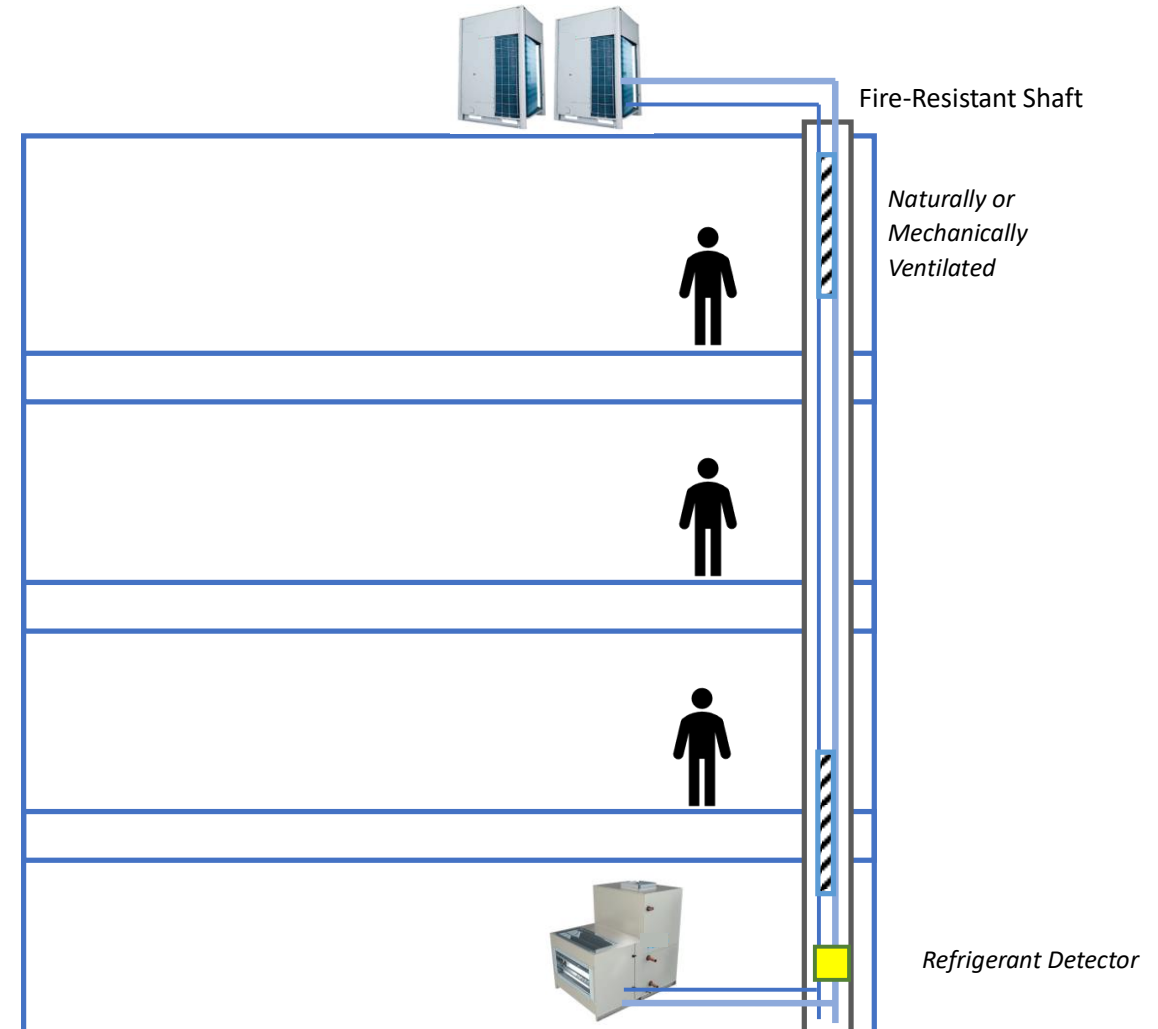
## Are you penetrating two or more floor/ceiling assemblies?

Refrigerant piping requires special construction per ASHRAE Standard 15 Section 9.12. Some examples (there are more):

- Refrigerant piping that penetrates multiple floor/ceiling assemblies shall be permitted to be enclosed in a fire-resistance-rated shaft enclosure.
- Refrigerant pipe shafts with systems using only Group A2L or B2L refrigerants shall be naturally or mechanically ventilated.

### IMC 1109.2.5 Refrigerant pipe shafts

- Refrigerant piping that penetrates two or more floor/ceiling assemblies shall be enclosed in a fire-resistant rated shaft enclosure. The fire-resistance-rated shaft enclosure shall comply with Section 713 of the *International Building Code*.

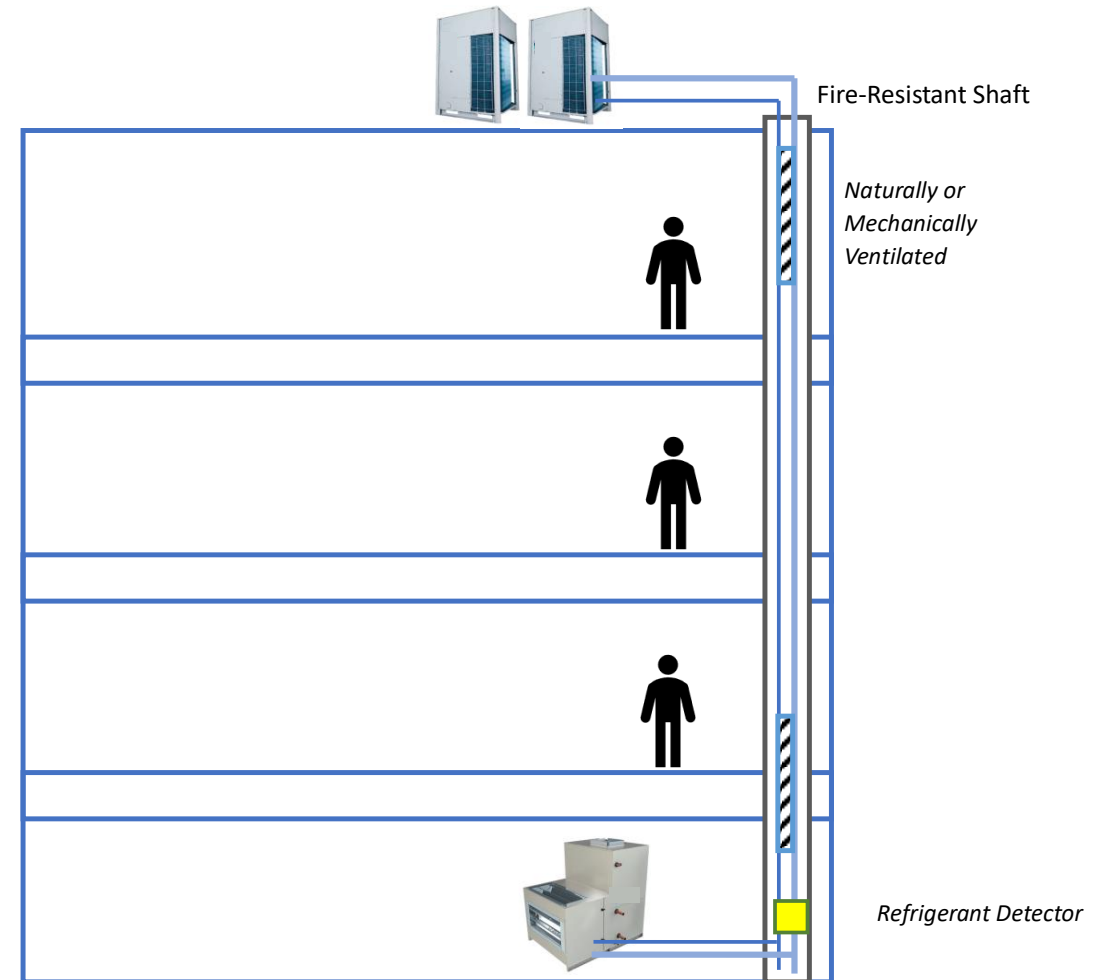


# Refrigerant Piping

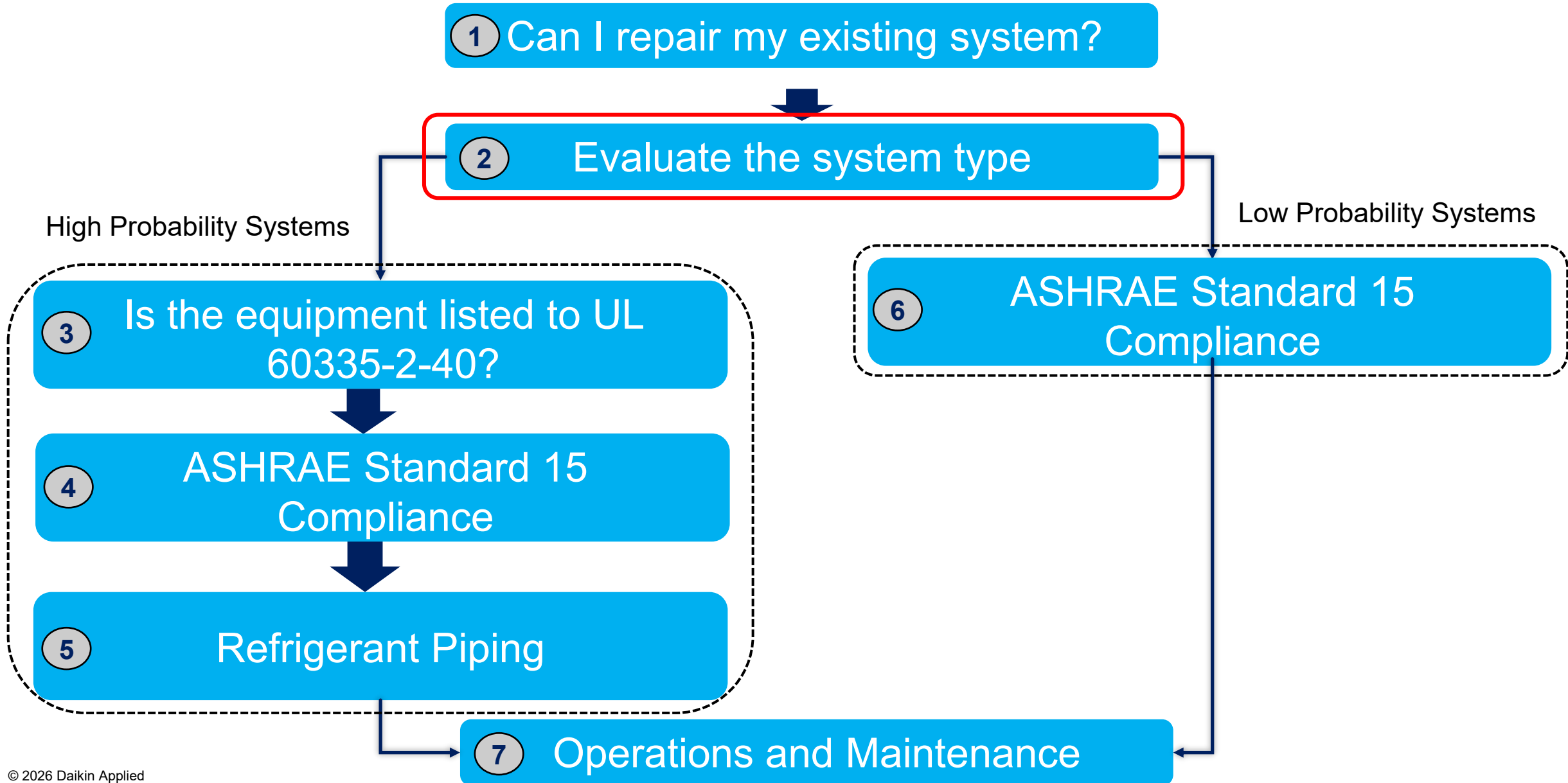
## Are you penetrating two or more floor/ceiling assemblies?

### What can be done if installing a ventilated shaft is not feasible?

- Talk to the AHJ
  - Use ASHRAE Standard 15 Addendum b as a reference
- Investigate alternate pipe routing/locations
  - Can the indoor and outdoor units be located to avoid refrigerant piping pass through 2 or more floor/ceiling assemblies
- Investigate a hydronic solution
  - Modular chiller plant or chiller
    - Is there physical space
    - Is there power available at the location
    - Is there any weight concerns (for roof installations)
  - Is it technically feasible
    - Is there space in the equipment for a CHW coil
    - Is there routing in the building for CHW piping
    - Accounting for the additional static pressure drop



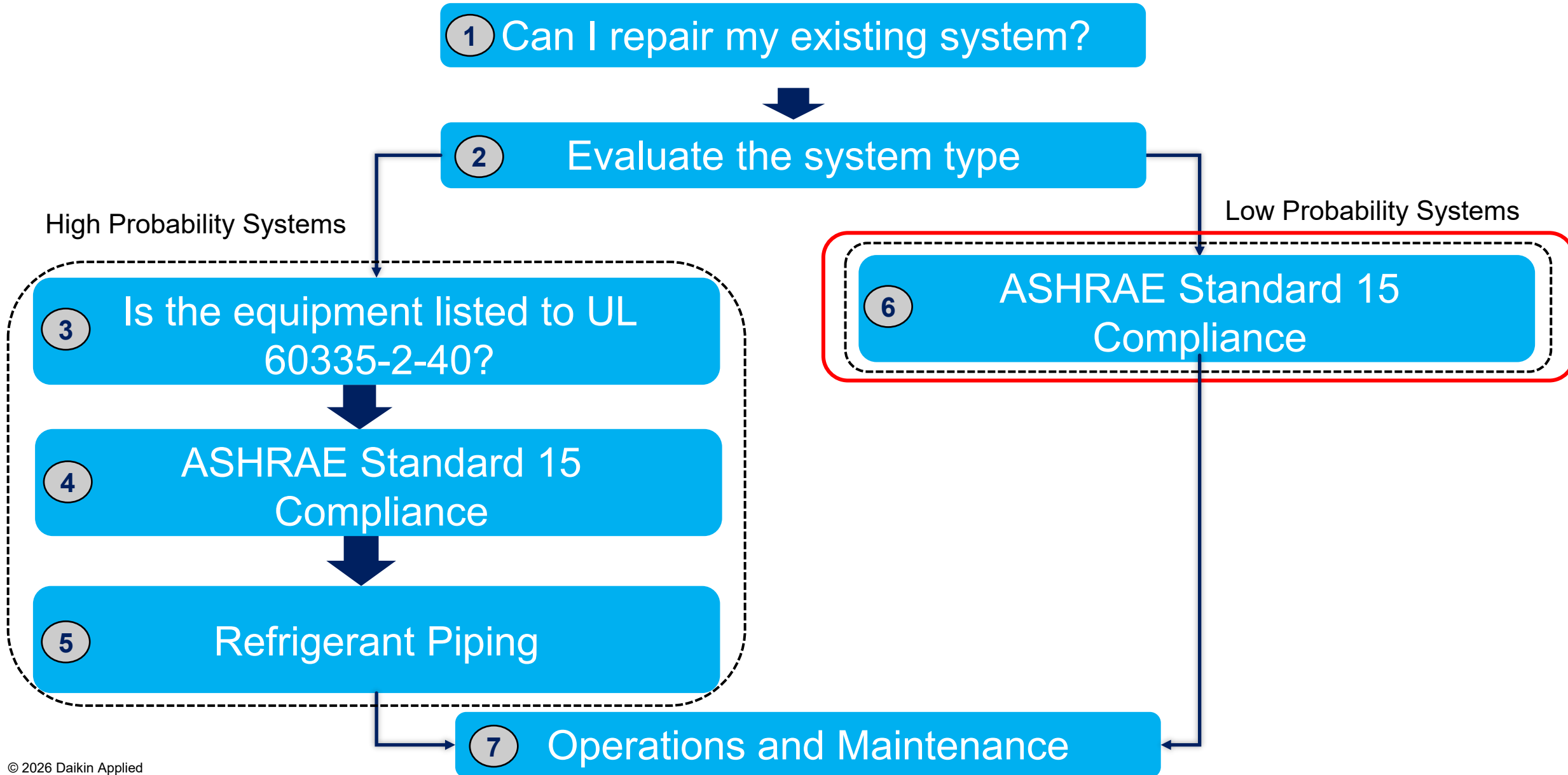
# Evaluating Existing Systems



# Evaluate the System Type

Classification	Definition	Examples
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# Evaluating Existing Systems



# ASHRAE Standard 15 - Machinery Rooms

- **Some notable requirements:**
  - Tight fitting doors
  - Access restriction to authorized personnel
  - No airflow to or from an occupied space
  - Refrigerant detectors that can actuate an alarm and mechanical ventilation
- **8.11.1 to 8.11.7** define special requirements for A2L and B2L refrigerants.
- **Elimination or interlocks** of ignition sources
- Ventilation for 2 different alarm states
  - **Trouble** (set point  $\leq$  OEL): respond within 300 seconds, automatic reset of alarm and ventilation is permissible
  - **Emergency** (set point  $\leq$  RCL): respond within 15 seconds, manual reset required for alarm and ventilation, higher CFM requirements

## Machinery Room Requirements

Machinery Room Requirement	A1, B1	A2, B2, A3, B3	A2L, B2L
Equipment clearances with clear head room	Required (Section 8.9.1)	Required (Section 8.9.1)	Required (Section 8.9.1)
Tight-fitting, self-closing doors	Required (Section 8.9.2)	Required (Sections 8.9.2, 8.10.b)	Required (Sections 8.9.2, 8.11.2)
Exterior doors must not open under a fire escape or stairway	Not Required	Required (Section 8.10.d)	Required (Section 8.11.4)
No openings to building, tightly-sealed penetrations	Required (Section 8.9.2)	Required (Sections 8.9.2, 8.10.e)	Required (Sections 8.9.2, 8.11.5)
Gasketed ductwork/AHU panels and doors	Required (Section 8.9.3)	Required (Section 8.9.3)	Required (Section 8.9.3)
Restricted access, door signs	Required (Sections 8.9.4, 10.1.3)	Required (Sections 8.9.4, 10.1.3)	Required (Sections 8.9.4, 10.1.3)
Refrigerant detector	Required (Section 8.9.5)	Required (Section 8.9.5)	Required (Sections 8.11.8 - 8.11.10)
Mechanical ventilation to the outdoors	Required (Section 8.9.6 - 8.9.8)	Required (Sections 8.9.6- 8.9.8)	Requirement Varies (Sections 8.9.6 – 8.9.8 or 8.11.11)
No open flames or hot surfaces	Exceptions Allowed (Section 8.9.9)	No Exceptions (Section 8.10a)	Exceptions Allowed (Section 8.11.1)
Non-combustable construction (walls, floor, ceiling)	Not Required	Required (Section 8.10.c)	Required (Section 8.11.3)
Conform to NEC Class 1, Division 2	Not Required	Required (Section 8.10.f)	May Not Be Required (comply with Section 8.11.6)
Remote control for shutting down equipment	Not Required	Required (Section 8.10.g)	Required (Section 8.11.7)

## Refrigerant Detector Set Points, Response Times, Alarms, and Ventilation Levels

*Only for A2L and B2L refrigerants*

Limit Value	Response Time (s)	Alarm Type	Alarm Reset Type	Ventilation Level	Ventilation Reset Type
Set point $\leq$ OEL	$\leq 300$	Trouble	Automatic	Level 1	Automatic
Set point $\leq$ RCL	$\leq 15$	Emergency	Manual	Level 2	Manual

## Alternatives if providing required ventilation is not feasible

### Smaller Equipment

- Is there space for additional equipment
- Additional compressors to maintain

### Lower Pressure Refrigerant

- Is there space for a larger machine

### A1 Chiller Solution

- There are A1 solutions for both screw and centrifugal machines

### Modular Chiller Plant

- Is there space onsite
- Is the structure adequate for a roof installation
- Is there power and/or water available for installation location

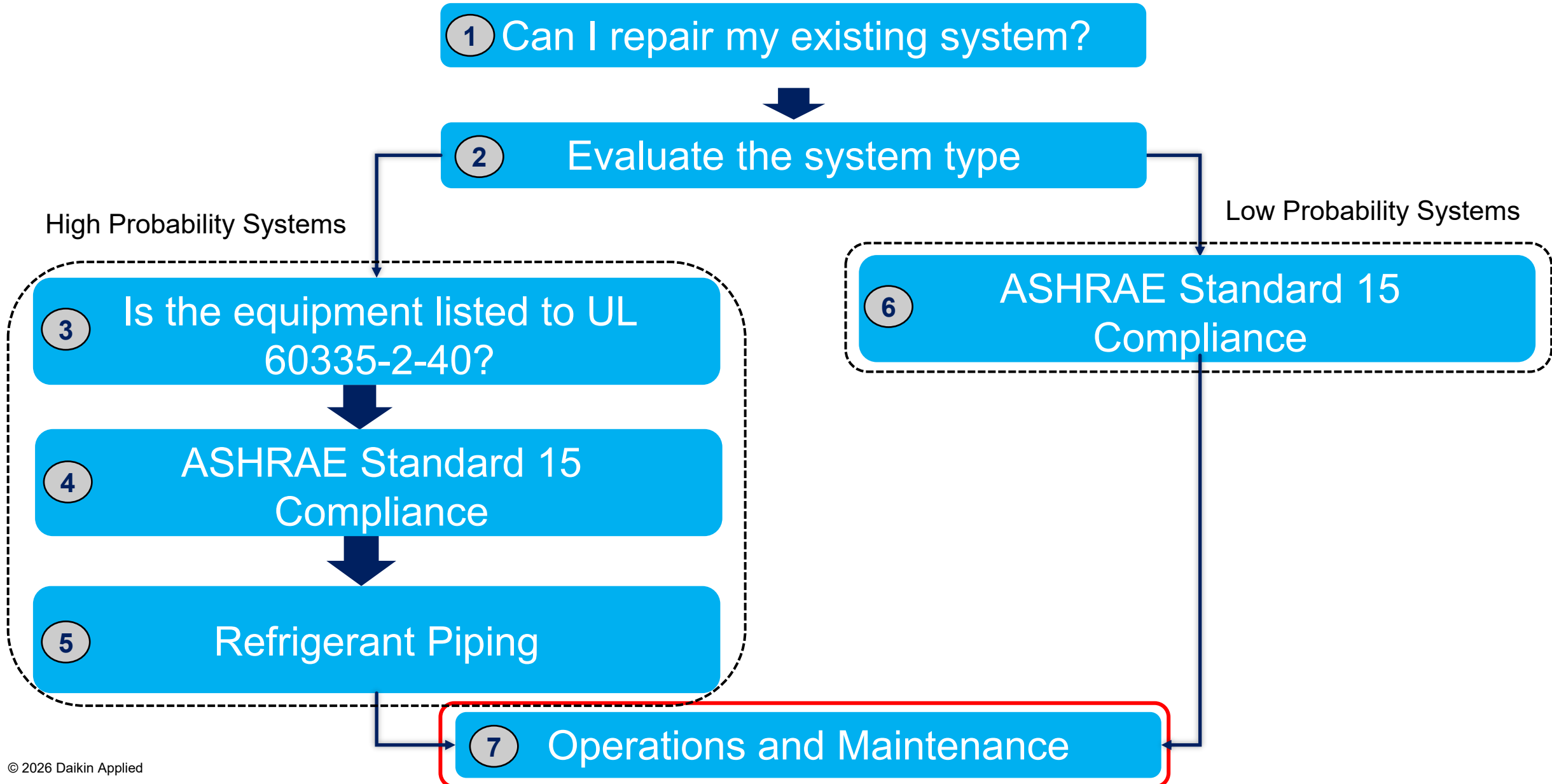
### Air-Cooled Chiller

- Is there space onsite
- Is the structure adequate for a roof installation
- Is there sound level concerns
- Is there power available at installation location

### Class 1 Div 2 Designation

- In accordance with NFPA 70
- Comply with ventilation requirements in section 8.9.6 and refrigerant detection requirements in section 8.11.6.2

# Evaluating Existing Systems



## What to consider when evaluating a potential refrigerant



### Availability

- Will downtime be an issue
- Will impact maintenance costs

### Serviceability

- Single component refrigerants can be charged in both the liquid and gas phases
- Will impact maintenance costs

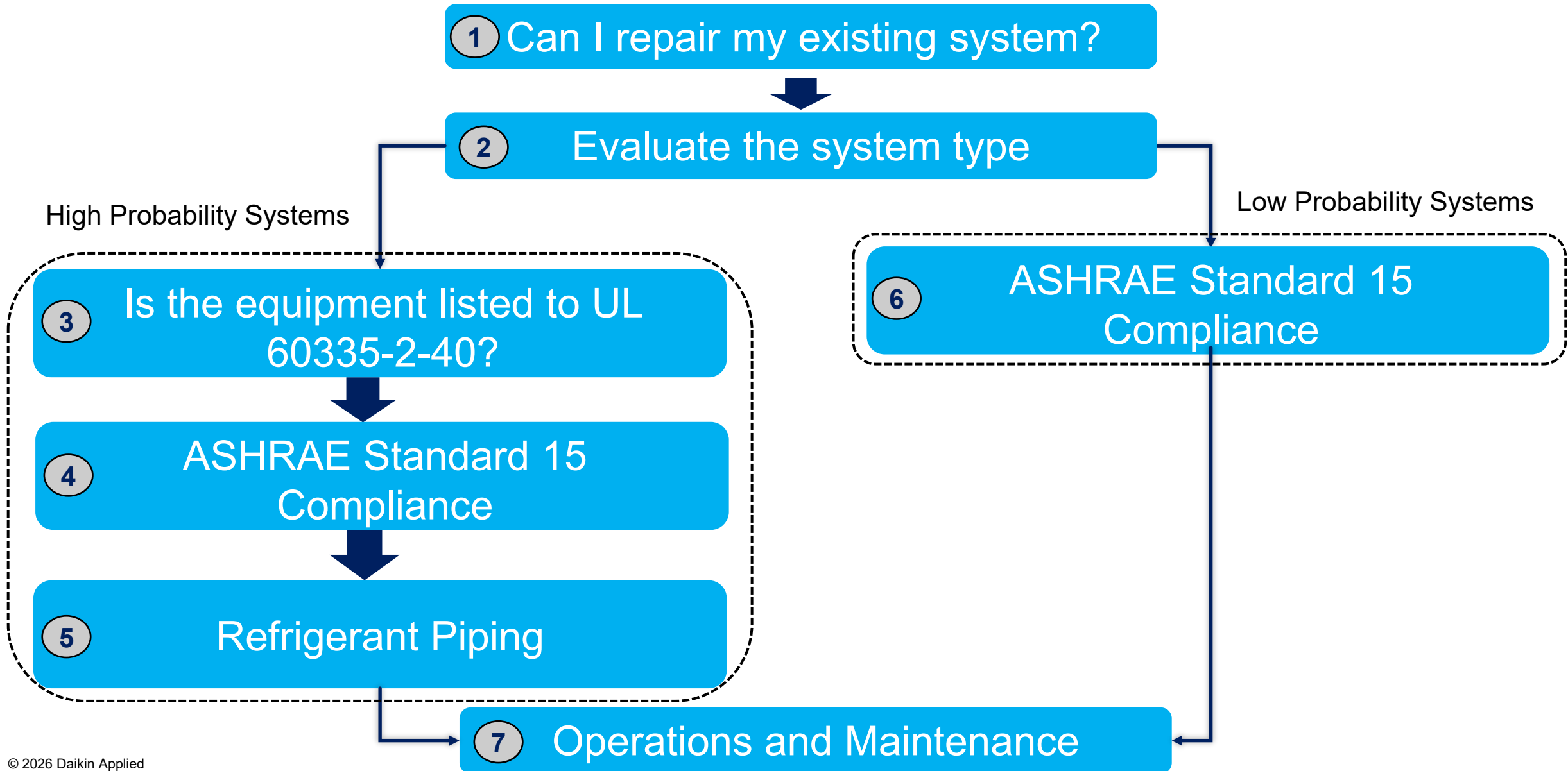
### Refrigerant Cost

- Historic \$/lb
- Charge needed for the equipment utilized
- Will impact up front and maintenance costs

### Efficiency

- Utility savings can add up over the lifetime of the equipment

# Evaluating Existing Systems



# Summary

Transition is Underway	Evaluating Existing Systems
<ul style="list-style-type: none"><li>• New Low GWP refrigerants are here supporting the goal of decarbonization</li><li>• Standards impacting the safe application of A2Ls</li><li>• Low GWP alternatives, it isn't all about GWP</li></ul>	<ul style="list-style-type: none"><li>• EPA's definition of for service vs. a new system</li><li>• Requirements for equipment to be listed to UL 60335-2-40</li><li>• Overcoming ASHRAE 15 speedbumps – EDVC, mitigation actions, and machinery room ventilation</li><li>• Refrigerant piping shaft requirements and alternatives</li><li>• Operation and maintenance considerations when evaluating refrigerants</li></ul>



# Where Can I Learn More?

# Where Can I Go for Information?

## Applying A2L Refrigerants:

- [A2L Refrigerant Engineering Guide](#)
- [Navigating Retrofits and Replacements for High GWP Refrigerants Engineering Guide](#)
- [Navigating Retrofits and Replacements for High GWP Refrigerants Video](#)
- [Navigating the Hurdles of Low GWP Refrigerant Retrofits](#)

## Building Codes:

- [ASHRAE Standards 15 and 34](#)
- <https://www.ashrae.org/technical-resources/bookstore/ashrae-refrigeration-resources>
- <https://www.ashrae.org/technical-resources/standards-and-guidelines/read-only-versions-of-ashrae-standards>

## General Guidance:

- [Preparing Buildings for A2L Refrigerants](#)
- <https://www.daikinapplied.com/decarbonization/refrigerants>



# Where Can I Go for Information?

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## General Guidance:

- [AHRI Webcast Series](#)
  - [An Introduction to A2L Refrigerants](#)
  - [A2L Refrigerants Webinar Series Part 2 - Updates to Standards and Model Codes](#)
  - [A2L Refrigerants Webinar Series Part 3: State and Local Codes and Available Resources](#)
- <https://www.iccsafe.org/products-and-services/i-codes/a2l-refrigerants-transition/>
- <https://www.ashrae.org/news/ashraejournal/ashrae-journal-podcast-episode-37>
- <https://www.ahrinet.org/saferefrigerant>
- <https://www.acca.org/education/a2l-refrigerants>
- <https://www.rses.org/training/>
- <https://www.achrnews.com/articles/153195-understanding-a2l-refrigerants>
- <https://www.esmagazine.com/articles/99996-a2l-refrigerants-safely-addressing-refrigerant-flammability-concerns>

# Where Can I Go for Information?

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**Thank you!**

