

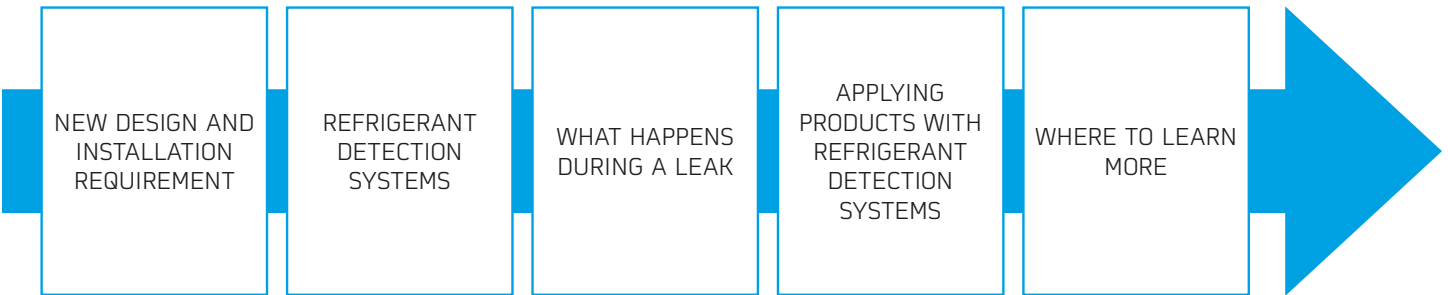


# A2L REFRIGERANT ENGINEERING GUIDE

## CONSIDERATIONS WHEN APPLYING PRODUCTS WITH MILDLY FLAMMABLE A2L REFRIGERANTS

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# CONSIDERATIONS WHEN APPLYING PRODUCTS WITH MILDLY FLAMMABLE A2L REFRIGERANTS



## BACKGROUND:

As the HVAC industry transitions to new lower global warming potential (GWP) refrigerants, it is essential to stay informed about the updated safety standards that accompany these changes. Some of these refrigerants, which are further designated as 'A2L' refrigerants, possess mild flammability, prompting the need for enhanced equipment safety measures. These changes also involve new requirements for buildings and system design. In this guide, we will explore some of the major considerations to be aware of when applying these new refrigerant products.

The focus for this document is Daikin Applied HVAC equipment for comfort cooling/heating applications and is not intended to cover all types and applications of equipment. As this topic is rapidly evolving, this content is subject to change without notice and is intended only for educational purposes and does not replace independent professional judgment and/or legal advice. Always consult your state and local codes which may take precedence over standards like ASHRAE Standards 15, 34, or other 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. When in doubt, contact the AHJ.



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# FIVE STEP APPROACH

## 1 NEW DESIGN AND INSTALLATION REQUIREMENTS:

Applying A2L refrigerants will require designers and installers to change the design and installation details to comply with the latest mechanical code requirements which often are based on the requirements from ASHRAE Standards 15 and 34, and which version or year of these standards can vary in adoption.

It is important to note that some codes may reference older versions of these standards or may not reference them at all, so always refer to your state and local requirements. The AHRI website has an interactive map that shows codes and standards adoption by state, which can be viewed [here](#). However, please note that even some states that have not directly adopted a specific standard may still need to comply with all or parts of that standard through references from other codes or laws.

This document focuses on the requirements laid out in ASHRAE Standard 15 – 2022 and ASHRAE Standard 34 – 2022, which are the most current versions referenced and will be abbreviated as “ASHRAE 15” and “ASHRAE 34” throughout the remainder of this document.



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# 2 REFRIGERANT DETECTION SYSTEMS

One of the major new requirements for equipment using A2L refrigerants (particularly high-probability systems for human comfort applications) is the need for factory-installed Refrigerant Detection Systems (RDS). High probability systems, as defined by ASHRAE 15, are those which, in the event of a leak, have a high probability of introducing refrigerant into the occupied space. Common examples would be packaged rooftop units, air handlers with DX coils, water-source heat pumps, and many other kinds of equipment. While not all equipment would be required to have RDS, many units will now be provided with them. It is critical to understand when to specify that RDS be included, and for the installing contractor to understand what actions these new devices will require when refrigerant is detected, including control sequences taking action in other parts of the system when there is a leak.

First, it is important to understand the definition of RDS. It is a device that can sense the presence of leaked refrigerant and output a signal to indicate there is a leak. Figure 1 below shows an example of an RDS. ASHRAE 15 lists specific requirements and actions for the RDS, but we will not fully elaborate on those here. What is important to know is that these devices must be factory installed and that the setpoint and calibration cannot be field adjusted. They are factory-set devices.

If the device detects refrigerant at a level above the setpoint, it must output a signal to indicate the presence of a leak. This signal must then be connected by the installing contractor to the other parts of the system that must take action when refrigerant is detected.

**Per Section 7.6.2.3 of ASHRAE Standard 15, the RDS must comply with all of the following requirements:**

- Setpoint is not field adjustable.
- Field recalibration shall not be permitted.
- Be capable of detecting the presence of the refrigerant used in the system.
- Have access for replacement of refrigerant detection system components.
- Have self-diagnostics to determine operational status of the sensing element.
- Energize air circulation fans of the equipment upon failure of a self-diagnostic check.
- Generate an output signal in no more than 30 seconds.

Among other requirements, the RDS must quickly identify the presence of a leak above the setpoint and promptly output a signal that indicates the presence of a leak. It is important to note that the requirements above apply to RDS used in high probability systems for human comfort. Other types of refrigerant detectors, such as those used in machinery rooms, have different requirements and are outside the scope of this document.

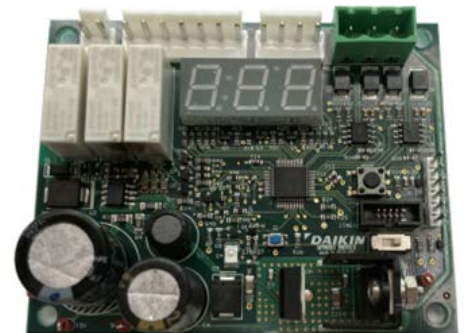
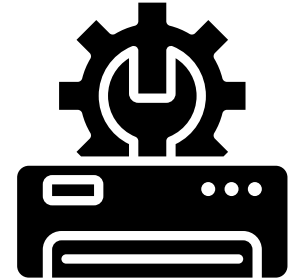


Figure 1: RDS intended for high probability systems for human comfort will typically consist of a control board to output the signal, and one or more sensors to detect the refrigerant.

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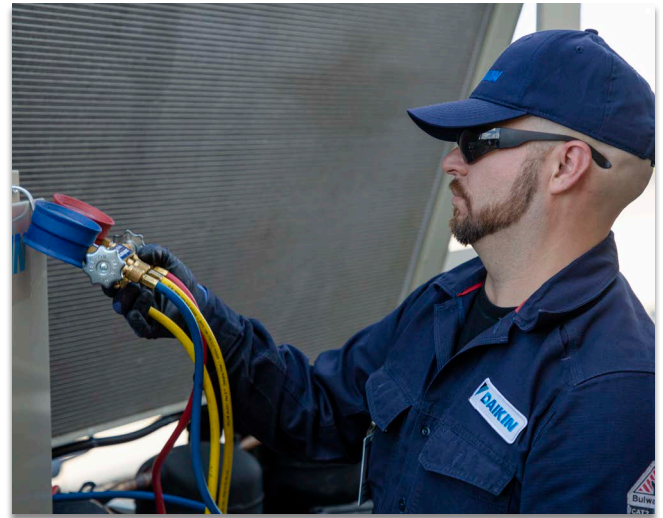
### 3 WHAT HAPPENS WHEN A REFRIGERANT LEAK OCCURS?

During a leak event, the signal from the RDS will then need to be received by the control system or Building Automation System (BAS) to ensure that certain actions are completed in order to mitigate the safety risks of the leak. Per Section 7.6.2.5 of ASHRAE Standard 15, once the RDS leak signal is generated, the following mitigation actions below must be completed promptly within 15 seconds:



#### Mitigation Actions

- Energize the air circulation fan(s) of the equipment per the manufacturer's instructions.
- Open zoning dampers or set zone damper to full airflow set point, that are installed in the air ducts connected to the refrigeration system.
- Activate mechanical ventilation if required by Section 7.6.4.
- De-energize electric resistance heat installed in air duct connected to refrigeration system.
- Activate safety shutoff valves utilized to reduce releasable refrigerant charge (if those devices are present).
- De-energize potential ignition sources, including open flames and unclassified electrical sources of ignition with apparent power rating greater than 1 kVA, where the apparent power is the product of the circuit voltage and current rating.



It is worth noting that many of the actions above would need to occur outside of the boundaries of the HVAC unit that is equipped with the RDS. Thus, the designers and installers of such systems must ensure that these measures, along with any others required by code or deemed to be necessary, are accounted for in the design and execution of the project.

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# 4 APPLYING PRODUCTS USING A2L AND RDS

Many Daikin Applied product platforms support onboard A2L mitigation with RDS. There can be up to eight sensors, depending on the product. Please refer to the applicable Installation and Maintenance manual (IM) for the specific details of that product. The following section provides two examples of how various products are configured.

## REBEL APPLIED® & REBEL® ROOFTOP SYSTEMS

For products that are provided with RDS and with MicroTech controls, they will have the A2L mitigation board connected directly to the MicroTech controller from the factory. The MicroTech controller will provide the sequence control outlined below. For specific product sequences, refer to product IMs on [page 7](#).

Units that are configured for third party non-Daikin Applied controls, will be configured similarly as the MicroTech controller is utilized in this configuration for refrigeration management.

Units with no factory provided controls will have the condenser and the third-party control board connect to the Relay A2LR1 control board for leak detection signals via a dry contact. The third-party unit controller board must be connected to the Relay Control Board AAR for a sensor fault signal. The A2L board looks for a 5V leak signal from the refrigerant sensor and acts as a relay.

### Example 1:

#### When a leak is detected, the A2L board will cause:

1. The leak alarm signal output to trigger similar to when factory controls are provided.
2. Compressor operation to be disabled regardless of the field 0-10VDC compressor capacity input.
3. The supply fan to run at least at the A2L minimum value (33%). Otherwise, the SAF will follow the field 0-10VDC SAF input command.
4. Outdoor air dampers on 100% OA units to be driven 100% open regardless of the field 0-10VDC OAD input command.



#### If a sensor problem is detected, the A2L board will cause:

1. The sensor problem alarm signal output will trigger similar to when factory controls are provided.
2. Compressor operation would allowed based on the field 0-10VDC compressor capacity input.
3. The supply fan will run at least at the A2L minimum value (33%). Otherwise, SAF will follow the field 0-10VDC SAF input command.
4. As noted, RDS must have self-diagnostics. If a sensor problem is detected, the A2L board will cause:
  - The sensor problem alarm signal output to trigger, similar to when factory controls are provided.
  - Compressor operation to be allowed based on the field 0-10VDC compressor capacity input.
  - The supply fan to run at least at the A2L minimum value (33%). Otherwise, the SAF will follow the field 0-10VD SAF input command.
  - Outdoor air dampers on 100% OA units to be driven 100% open regardless of the field 0-10VDC OAD input command. Unlike 100% OA units, air handlers configured with 0-100% OA economizer dampers will not operate the outside air dampers differently under an A2L sensor fault.

In the above example, the controller can take action on a number of the 'mitigation actions' required by ASHRAE Standard 15 – 2022 when an RDS detects a leak. However, some of the actions required may not be able to be addressed by the controller directly. Therefore, it is critical installers ensure that the signal from the RDS is properly interconnected with the other parts of the HVAC system to satisfy all the requirements noted in the previous [Mitigation Actions](#) section.

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# 4 APPLYING PRODUCTS...(CONTINUED):

## VISION® & SKYLINE® AIR HANDLING SYSTEMS

### Example 2: Modular units with shipping splits



For modular air handlers like Vision indoor and Skyline outdoor systems featuring shipping splits and utilizing A2L refrigerants, **Daikin Applied provides the RDS factory-installed.**

There may be cases where the control box that houses the RDS (A2L control box) ships loose either due to footprint limitations or by request. In these circumstances, a custom wiring harness should be used to remotely mount the control box as necessary. Contact your [Daikin Applied Sales Representative](#) for further information.

Unlike Rebel products with MicroTech® controls, since Vision and Skyline air handlers do not ship with controls, the RDS system is limited to the following actions:

1. The RDS will monitor for a leak above the factory setpoint.
2. In the event a leak exceeding the setpoint is detected, the system will output a signal via output relays. No Mitigation Actions are completed by the unit directly, so others must provide the control



3. The RDS will include self-diagnostics and will output a signal in the event there is an issue. Connecting this signal to the air handler terminal strip to enable the air circulation fan is by others. Refer to the [product-specific IM](#) for additional wiring details.

# 5 WHERE TO LEARN MORE

## Resources:

For more information on product specific solutions for A2L refrigerants please [contact](#) your local Daikin Applied Sales Representative.

You can find read-only copies of some ASHRAE standards, including ASHRAE 15, [here](#).

**For specific product details, please see the following relevant installation and maintenance manuals:**

- [MT6210 A2L Leak Mitigation Control](#)
- [Vision Air Handler IM 672](#)
- [Vision Air Handler Extended Sizes IM 915](#)
- [Skyline Outdoor Air Handler IM 777](#)
- [Rebel Applied Packaged Rooftop IM 1287](#)

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