

## **SEMINAR 48 (ADVANCED)**

**International Codes and Standards Issues  
Impacting use of A2L Refrigerants in Unitary  
Heat Pump and Air-Conditioning Equipment**

**Standards Development for 2L Flammable  
Refrigerants**

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# Learning Objectives:

- Highlight the current changes under consideration to allow the use of 2L refrigerants in the product safety standard 60335-2-40
- Describe the differences in the draft requirements in 60335-2-40 of 2L refrigerants relative to class 2 and 3 refrigerants.
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# Developmental History

- 1990, most refrigerants were non-flammable
- Environmental concerns drove change
- In 2000, UL published flammable refrigerant requirements for household refrigerators in UL 250
- In 2011, UL published flammable refrigerant requirements for room air conditioners in UL 484
- In 2011, UL hosted the first meeting of the “Flammable Refrigerant Joint Task Group (JTG)” in Las Vegas, NV
- November, 2011 The First Meeting of IEC SC 61D WG09 Addition of coverage for A2L refrigerants.
- In 2014, ISO 5149 & ISO 817 was published with requirements for A2L refrigerants
- ASHRAE 15 may be ready to send out and preliminary public review document on A2L's after the Chicago meeting.

# ASHRAE 34 Background

- ASHRAE 34 – Designation and Safety Classification of Refrigerants
- Refrigerants are categorized for toxicity
  - “A” – Lower toxicity
  - “B” – Higher toxicity
- Refrigerants are classified with respect to flammability
  - “1” – No flammability
  - “2L” - with lower burning velocity
  - “2” – Lower Flammability
  - “3” – Higher Flammability
- Commonly used A2L flammable refrigerants
  - R-32
  - R-1234yf
  - R-1234ze

# Published requirements

- UL 250 Household Refrigerators – 225 & 57 gm (+)
  - UL 60335-2-24 Refrigerating Appliances, Ice Cream Appliances & Ice-Makers – 225 & 50 gm
  - UL 399 Drinking Water Coolers – 270 & 60 gm
  - UL 427 Refrigerating Units – 500 & 150-300 gm
  - UL 471 Commercial Refrigerators/Freezers – 500 & 150
  - UL 541 Refrigerated Vending Machines – 500 & 150 gm
  - UL 563 Ice Makers – 500 & 150 gm
  - UL 484 Room air conditioners – Requirements presently based on room size. Proposal to limit the charge it currently being voted on 225 & 114 gm
- + - A2 & A3 refrigerant charge limits
- UL 1995 Heating and Cooling equipment and UL 474 Dehumidifiers – No requirements planned (being superseded by UL 60335-2-40)
  - UL 60335-2-40 - Heat pumps, air conditioners & dehumidifiers – Requirements have been proposed for A2 and A3 refrigerants likely applicable to non-ducted, factory-charged and sealed equipment similar to UL 484

# IEC SC6D WG 9 Developing Requirements for A2L Refrigerants

- 2011 WG began developing requirements for air conditioning equipment covered by IEC 60335-2-40
- Issued 61D/212/DC July 2013
- Issued 61D/257DC July 2014
- Next two meetings Frankfurt Germany February 24-26, 2015  
Bruges Belgium April 21-23, 2015

# Key Proposed Requirements from 61D/212/DC and 61D/257/DC

- Refrigerant Detection System
- Refrigerant Piping
- Components That May Be A Source Of Ignition
- Hot Surfaces
- Increased Charge Limits

# Refrigerant Detection System

- For systems that have a charge above  $m_1$
- Two Options;
  - **Option 1 permanent dilution**
  - **Option 2 fan activated by a refrigerant detection system**
- This appliance is equipped with a **refrigerant detection system** for safety. To be effective, the appliance shall to be powered at all times during the installed period, other than short service intervals.



# Refrigerant Piping

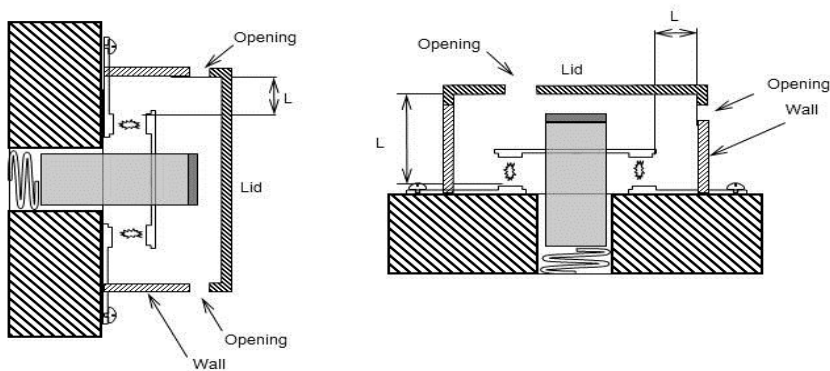
- Refrigerant pipes containing **A2L refrigerant** which connect **refrigeration system** components shall not be considered a source of leaked refrigerant within the unit enclosure
- no connecting joints
- no bends with bend radius less than 2.5 times the external pipe diameter
- protected from potential damage during normal operation, service or maintenance

# Components That May Be A Source Of Ignition

- All electric components that could be a source of ignition and which could function under normal conditions or in the event of a leak, shall comply with **at least one of** the following:
  - Shall comply with Clause 20 of IEC 60079-15 (leak proof enclosure)
  - Not be located in an area where a potentially flammable gas mixture will accumulate; (Perform the leak simulation test)
  - Components located in an enclosure which is in compliance with Annex NN (Flame arrest enclosure similar to and enclosure tested to IEC60079-15)
  - The device is capable of 100,000 cycles.
  - the switched electrical load ( $Le$ ) in kVA is less than or equal to:
    - $Le = 5 \times (6.7/BV)^4$  when breaking all phases
    - $Le = 2.5 \times (6.7/BV)^4$  when breaking two legs of a three phase load, or when breaking one or two legs of a single phase load

# Components That May Be A Source Of Ignition

- Annex JJ- Allowable opening of relays and similar components to prevent ignition of A2L refrigerants The effective diameter is an assumed diameter of a circular opening that has the same quenching effect to an opening of any shape.



# Hot Surfaces

- Temperatures on surfaces that may be exposed to leakage of **flammable refrigerants** shall not exceed the maximum allowable surface temperature given in Annex BB.
- For **A2L refrigerants** not listed in Table BB.1, the maximum allowable surface temperature is determined by the highest of **AIT** reduced by 100 K or if tested per annex KK, the **hot surface ignition temperature** reduced by 100 K, but not higher than 700 °C.

# Increased Charge Limits

- GG.1.1 Determine the case applicable based on the relationship of the mass charge amount employed and  $m_1$ ,  $m_2$ ,  $m_3$ , defined as follows:
  - $m_1 = (4 \text{ m}^3) * \text{LFL}$ :
  - $m_2 = (26 \text{ m}^3) * \text{LFL}$ :
  - $m_3 = (130 \text{ m}^3) * \text{LFL}$ :
- (Proposed) For class A2L,  $m_1$ ,  $m_2$ ,  $m_3$ , defined as
  - $m_1 = (6 \text{ m}^3) * \text{LFL}$ :
  - $m_2 = (52 \text{ m}^3) * \text{LFL}$ :
  - $m_3 = (260 \text{ m}^3) * \text{LFL}$ :
  - where LFL is the lower flammable limit in  $\text{kg}/\text{m}^3$  from Annex BB for the refrigerant used.

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**Questions/Comments**