ACEC New York

American Council of Engineering Companies of New York

Recommendations to FDNY
Re: addressing A2L Refrigerants in the Fire Code

December 2023

About ACEC New York: The American Council of Engineering Companies of New York (ACEC New York) is an association representing nearly 300 engineering and affiliate firms with 30,000 employees across New York, with a concentrated presence in New York City. Founded in 1921, our association is one of the oldest continuing organizations of professional consulting engineers in the United States. Our members are the professionals who design the mechanical, fire protection, electrical, structural, energy, plumbing, and other systems for buildings and infrastructure across New York and the world.

The 2022 NYC Fire Code Chapter 6 lists Refrigerating System Operating Engineer Requirements for various types of refrigerants in Table 606.1. Group A2L refrigerants are not included in the table, as these refrigerants were added to ASHRAE Standards 15 and 34 after the version of the standards incorporated in the 2022 NYCMC and NYCFC. The NYCMC was amended by Local Law 77 of 2023 to incorporate the 2022 editions ASHRAE Standards 15 and 34. These standards now include Group A2L refrigerants.

We recommend the following changes to Table 606.1 be considered for the addition of Group A2L refrigerants to the table.

1) **<u>Increase Quantity Threshold of A2L for Personal Supervision Above 200 lb</u>**

   Based on the difference in burning velocity and flammability of A2L vs. A2, we request that a study be performed or ASHRAE be consulted to determine if the 200 lb threshold for personal supervision of A2L systems can be increased without reduction in safety.

   Per ASHRAE 34-2019, A2L refrigerants are defined as those having a burning velocity less than or equal to 3.9 inches/second (10 cm/sec). A2 has no defined limit, so is likely to spread faster. The slow burning rate is assumed to reduce the hazard of A2L, so an increase in allowable quantities could be warranted while maintaining the same level of safety.

   The table below was provided by Daikin, and shows the difference in actual burning velocity between A2L and A2 (and A3) refrigerants. Note that the BV of the 2 most commonly applied A2L refrigerants is less than 1/3 that of a typical A2 refrigerant.

Type	Refrigerant	Toxicity	Flammability	ODP	GWP
HFC	R-410A	A	1	0	2088
HFC	R-32	A	2L – BV 6.7	0	675
HFC	R-454B	A	2L – BV 5.2	0	466
HFC	R-152a	A	2 – BV 23	0	138
	R-290 (Propane)	A	3 – BV 40	0	5

Table 6-1 Flammability Classifications

Class	Single-Component Refrigerant	WCF of a Refrigerant Blend	WCFF of a Refrigerant Blend
1	No flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa)	No flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa)	No flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa)
2L	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] > 0.0062 lb/ft^3 (0.10 kg/m^3) *and* heat of combustion < 8169 Btu/lb (19,000 kJ/kg) *and* burning velocity ≤ 3.9 in./s (10 cm/s) when tested at 73.4°F (23°C), 14.7 psia (101.3 kPa) in dry air	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] > 0.0062 lb/ft^3 (0.10 kg/m^3) *and* heat of combustion <8169 Btu/lb (19,000 kJ/kg) *and* burning velocity ≤ 3.9 in./s (10 cm/s) when tested at 73.4°F (23°C) and 14.7 psia (101.3 kPa) in dry air	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] > 0.0062 lb/ft^3 (0.10 kg/m^3) *and* heat of combustion <8169 Btu/lb (19,000 kJ/kg) *and* burning velocity ≤ 3.9 in./s (10 cm/s) when tested at 73.4°F (23°C) and 14.7 psia (101.3 kPa) in dry air
2	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] > 0.0062 lb/ft^3 (0.10 kg/m^3) *and* heat of combustion < 8169 Btu/lb (19,000 kJ/kg)	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] > 0.0062 lb/ft^3 (0.10 kg/m^3) *and* heat of combustion < 8169 Btu/lb (19,000 kJ/kg)	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* *LFL[a] > 0.0062 lb/ft^3 (0.10 kg/m^3)* *and* heat of combustion < 8169 Btu/lb (19,000 kJ/kg)
3	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] ≤ 0.0062 lb/ft^3 (0.10 kg/m^3) *or* heat of combustion ≥ 8169 Btu/lb (19,000 kJ/kg)	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] ≤ 0.0062 lb/ft^3 (0.10 kg/m^3) *or* heat of combustion ≥ 8169 Btu/lb (19,000 kJ/kg)	Flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa) *and* LFL[a] ≤ 0.0062 lb/ft^3 (0.10 kg/m^3) *or* heat of combustion ≥ 8169 Btu/lb (19,000 kJ/kg)

a. Lower flammability limit (LFL) is determined at ambient temperature and pressure. If an LFL does not exist at 73.4°F (23.0°C) and 14.7 psia (101.3 kPa), refer to Section 6.1.3.5.

Clodic [16,17]. Measurements shall be conducted starting from the LFL to at least 125% of the stoichiometric concentration. Measurements shall be conducted with increments of, at most, 10% of the stoichiometric concentration, and each measurement shall be repeated at least two times. The burning velocity is the maximum value obtained from a least-squares fit to the measured data. The gas mixture shall be made by any method that produces a blend of air/refrigerant that is accurate to ±0.1% in the test chamber. Dry air (less than 0.00015 g of water vapor per gram of dry air) containing 21.0% ± 0.1% O_2 shall be used as the oxidant. The flammable gas shall have a minimum purity of 99.5% by weight.

Informative Note: Methods that have been used include (a) a pressurized mixture made by using partial pressure and (b) quantitative flow methods like volumetric flowmeters and mass flow controllers fixing the ratio of air and refrigerant.

6.1.3.1 Class 1 (No Flame Propagation)

a. A single-compound refrigerant shall be classified as Class 1 if the refrigerant does not show flame propagation when tested in air at 140°F (60°C) and 14.7 psia (101.3 kPa).
b. The WCF of a refrigerant blend shall be classified as Class 1 if the WCF of the blend does not show flame propagation when tested in air at 140°F (60°C) and 14.7 psia (101.3 kPa).
c. The WCFF of a refrigerant blend shall be classified as Class 1 if the WCFF of the blend, as determined from a fractionation analysis specified by Normative Appendix B, Section B2, does not show flame propagation when tested at 140°F(60.0°C) and 14.7 psia (101.3 kPa).

6.1.3.2 Class 2L (Lower Flammability)

a. A single-compound refrigerant shall be classified as Class 2L if the refrigerant meets all four of the following conditions:
   1. Exhibits flame propagation when tested at 140°F (60°C) and 14.7 psia (101.3 kPa)

2) **We request that no supervision be required for Outdoor Packaged equipment in *indirect systems* (as per section 5.1.2 of ASHRAE 15-2022). Outdoor Packaged equipment is defined as a system where the refrigeration cycle is completely contained in the outdoor unit, with no possibility of refrigerant in indoor spaces. Such equipment shall be listed and labeled in accordance with the NYC Mechanical Code. Outdoor packaged refrigeration equipment presents no additional risk to building occupants from refrigerant leaks or other refrigeration system failures.**

   Our rationale for this request is based primarily on the need for electrification of space heating systems driven by Local Law 97. The imminent need for decarbonization requires a means of providing for electrically driven heating systems, and the technology which is coming to the fore for this purpose is primarily the Air Source Heat Pump (ASHP). Unlike primary cooling systems, ASHP's providing space heat need to be available 24 hours/day. With the use of this technology, heat recovery and other energy saving techniques also become possible, allowing for greater energy reduction of buildings, allowing the city's decarbonization goals to become achievable.