

Differences in Safety Standards Related to A2L Usage in Air Conditioning

The OEM Task Force member companies provided a technical and a policy representative to discuss unresolvable conflicts or differences between the ASHRAE 15 (2019), UL/CSA 650335-2-20 (2019) and there are differences between the safety standards, but there was agreement that the most stringent

There is a reconciliation process underway to align the standards as much as possible. The list generally aligns the standards as much as possible, but since they are all updated on different schedules and they need to be followed.

	Detail	15	2-40
Charge Quantity	Concentration Factor / (Safety Factor)	25% (RCL) / (4.0) (7.2) [1] [2]	25% / (4.0) (GG)
			50% / (2.0) for VRF [5]
			(101.DVG)
	Room Volume – Height	Whole Room	Effective Volume (7.2ft max)
		-7.3	(GG)
	Room Volume – Connected spaces	Permanent opening required, minimal specifications	Permanent opening permitted, detailed specifications (e.g. door
		-7.3	
	Maximum Charge per circuit	Not restricted	m ₃ (4 x m ₂ for VRF) [9]
		(7.5.1.1)	
	Duct Work	Allowed to include duct work	Does not allow duct work
Equipment	Calculations	Room volume	Detailed calculations but requires table in IO (GG)
		-7.3	
		Listed	Listed
		(7.6.2)	
		Installed per IO	IO requirements provided (Annex DD)
		(7.6.2)	
		Symbol on nameplate (7.6.2.1)	Symbol details (Sec 7)
		Label near service ports (7.6.2.2)	Several (Sec 7)
	In product	<n/a>	Details
			(Sec 22)

Piping	Field, Protection	Protect/Cover Tubing longer than 6.6 ft (9.13.1.c)	Protect from accident (DD.3.1)
	Field, Material	Listed, ASME B31.5	Follow ASHRAE 15, IAPMO, ICC, B52
		-9.1	(DD.3.1)
	Field testing		Requires pressure and vacuum testing ISO 14903 joints or enclosed and vented to the indoor unit
	Field, Other	<general>	Some specifications (DD.3.1)
Refrigerant Detectors	When required, cml	m ₁ with exception [6] (50% of RCL or 12.5% LFL) for commercial only	m ₁ with exception [7,14] 1:1 system, quadratic equation for ductless product with wall o+D104r ceiling mount as long as floor area is sufficient
		(7.6.2.3a)	(Annex GG, 101.DVG)
	When required, res	m ₁	m ₁ with exception [7,14] indoor coil allows for no detector for less than m1
		(7.6.2.3b)	(Annex GG, 101.DVG)
	When required, insti	Always	m ₁ with exception [7,14]
		(7.6.2.3c)	(Annex GG, 101.DVG)
	When required, other	If compressor indoors (7.6.2.3e)	In equipment (Annex GG.4)
	Timing	15 seconds at 25% LFL (7.6.5.b)	10 seconds at 100% LFL
			(Annex LL.2DV)
	Location	Sense operating or not (7.6.5.c)	Sense operating or not (Annex MM.2)
	Location, ducted	In equipment	In equipment
		(7.6.5.c.1)	(Annex GG.9.1)

	Location, ductless	In equipment, or close [4] (7.6.5.c.2)	In equipment or field installed [13] (Annex GG)
	Remote sensors	Allowed	Must have sensor in equipment
	Self-check	Req'd, if fault mitigate (7.6.5.d)	Req'd, if fault mitigate (Annex LL.DV)
	Self-check failure	Alarm required (7.6.5.d)	Turn on circulation
	Installation check	Required (7.6.5.e)	<not required>
	Annual check	Required (7.6.5.e)	<not required>
	Evaluation / Details	Per Listing (7.6.5.a)	Detail requirements (Annex LL.DV)
Mitigation Action Required	Air circulation rate	Qmin = 1000 x m/LFL (IP) (7.6.2.4a)	Qmin = 60 x mc / LFL (SI) (GG.9.3DV.a) [10]
	Air circulation duration	5 minutes after no detection (7.6.2.4b)	5 minutes after clear (GG, 101.DVG.3.2)
	Action	Turn off compressor (7.6.2.4b)	Turn off compressor [11] (GG.9.3DV.b)
	Action	Turn off electrical devices [3] (7.6.2.4b)	Turn off elec heat (GG.9.3DV.e)
	Action	Zoning dampers open (7.6.2.4c)	Zoning dampers open (GG.9.3DV.c)
	Action	Turn off heaters/elec in duct (7.6.2.4d)	Turn off heat (GG.9.3DV.e)
	Ventilation	Only if compressor indoor	Permitted, activate if reqd (GG.4, GG8.3, 101.DVG)
Installation Restrictions	Ignition Sources	No open flame in duct (7.6.3.1)	Similar (Annex DD)
	Ignition Sources	No unclassified electrical in duct (7.6.3.2)	Similar (Annex DD)
	Ignition Sources	Max temp 1290F unless airflow 200 ft/min and proof of airflow	Similar (Annex DD)
	Evacuation level (splits only)	Compressed air without refrigerant - Evacuate to less than 1000 microns for compressed air without refrigerant.	Pull a vacuum
	Pressure Test	Design Pressure -10.1	Design Pressure (DD.3.1DV.2)
	Permitted – res / insti	6.6 lbs largest charge (7.6.4.a.1)	Depends on ventilation

Compressor Indoor	Permitted – cml	22 lbs largest charge (7.6.4.a.2)	Depends on ventilation
	Ventilation rate	Qmin = 1000 x m/LFL (7.6.4.c)	Depends on charge
	Ventilation duration	5 minutes after no detection (7.6.4.b)	5 minutes after no detection (several)
	Ventilation exhaust	Bottom <=12" from floor (7.6.4.d)	Bottom <= ~4" from floor (GG.8.3.3DV)
	Ventilation make up	Required (7.6.4.d)	Required (GG.8.3.3DV)
	Ventilation	Make up cause mixing (7.6.4.d)	3 m distance ex (GG.8.3.3DV)
	Ventilation air	Dump to outside/large indoor (7.6.4.e)	<not explicitly addressed>
	Compressor on/off	Compressor must be turned off	Allows option to evaluate compressor ability to reduce concentration.
	Hot surfaces - Duct Heaters - Electric Heat	No open flame or 1290F (7.6.4.f)	More details around velocity which allows for higher temperature - Must run test to prove that there is no ignition at high temperatures
	Hot surfaces	No open flame or 1290F (7.6.4.f)	Similar (Annex DD)
HPWH			
RETROFIT	Change safety class	OK if analysis / AHJ approval (5.3)	Not addressed

[1] Listed equipment having not more than 6.6 lbs, installed per OEM I/O

[2] Institutional occupancies reduce 50%

[3] Except control transformer, controls & supply fan

[4] <=12" from floor, 3.3 ft horizontal distance, line of sight.

[5] VRF & multi-split

[6] 4.0#, not required if released value results in less than 12.5% RCL

[7] 4.0#, may not be required if floor area adequate (quadratic equation)

[8] 3.7# using "shortcut" method, 4.0# using "detail" method for 15.2.

[9] more allowed if AHJ approves

[10] achieve within 15 seconds

[11] conditionally okay to not turn off compressor, if leak is on low side

[12] covered by poisoning test of 2-40

[13] not all products, only those serving a single room with minimum area met

[14] Detector is not required if continuous airflow is used, but that will negatively impact energy efficiency f

the air conditioning (AC) safety standards with AHRI staff and representatives from UL and ASHRAE 15.2(P). The group focused on direct (residential and light commercial, but not light commercial) and indirect (residential and light commercial) requirements. No unresolved requirements must be followed as identified in the attached spreadsheet. No unresolved requirements must be followed as identified in the attached spreadsheet. No unresolved requirements must be followed as identified in the attached spreadsheet.

ated by this working group will be provided to the standards review group to assist in the review. Since they serve different functions, it is unlikely that they will ever be exactly the same. Therefore, the standards review group will be provided to the standards review group to assist in the review.

15.2P (proposed)	Potential Manufacturer Solution For Residential	Most Conservative Std
Only allows 3-4 lbs more than 25% of LFL based on maximum of 200cfm ventilation	Use 25%	ASHRAE 15.2
Effective Volume (7.2' max with installed height used below 7.2)	Use 7.2-foot height	ASHRAE 15.2 and UL 60335-2-40
Only transfer fan allowed. No door grills or undercut allowed	Provide area in installation manual. Ducted mixes air through the whole space; however non-ducted limits connected spaces to	ASHRAE 15.2
m ₂	m ₂ for residential,	
	m ₃ for commercial	
Does not allow duct work	Do not use duct work in calculations	ASHRAE 15.2 and UL 60335-2-40
Detailed calculations, Simple table	Detailed calculations or use simple table	ASHRAE 15.2 and UL 60335-2-40
Listed	Certify to 2-40	ASHRAE 15.2 and UL 60335-2-40
Installed per IO	Follow 2-40	UL 60335-2-40
<none>	Follow 2-40	UL 60335-2-40
<none>	Follow 2-40	UL 60335-2-40
<n/a>	Follow 2-40	UL 60335-2-40

Protect/Cover Tubing longer than 6.6 ft	<no conflict>	<no conflict>
Combination of requirements in ASHRAE 15 and UL60335-2-40	ASHRAE 15.2 is a combination of ASHRAE 15 and UL-60335-2-40	ASHRAE 15.2 and UL 60335-2-40
(Sec 8)		
Requires pressure and vacuum testing ISO 14903 joints or enclosed and vented to the indoor unit	Requires pressure and vacuum testing ISO 14903 joints or enclosed and vented to the indoor unit	ASHRAE 15.2 and UL 60335-2-40
Joints, fittings, routing, etc.	Combine all	ASHRAE 15.2 and UL 60335-2-40
(Sec 8) See above		
NA commercial only	Always use detector	ASHRAE 15
m ₁ non-add on HP [8] always use detector integral to unit on >m1 except for split ducted where ID must have detector . HP must always have a detector	Always use detector	ASHRAE 15.2
Always, add-on HP		
<n/a>	Always use detector	ASHRAE 15
<not specified>	Follow 2-40	ASHRAE 15
<not specified>	Validate both	ASHRAE 15 and UL 60335-2-40
<not specified>	<no conflict>	ASHRAE 15 and UL 60335-2-40
<not specified>	<no conflict>	ASHRAE 15 and UL 60335-2-40

<not specified>	In equipment	ASHRAE 15 and UL 60335-2-40
	Must have sensor in equipment	UL 60335-2-40
<not specified>	<no conflict>	ASHRAE 15 and UL 60335-2-40
Turn on circulation	Must comply with both	ASHRAE 15
<not specified>	<no conflict> [12]	ASHRAE 15 and UL 60335-2-40
<not specified>	<no conflict> [12]	ASHRAE 15 and UL 60335-2-40
<not specified>	<no conflict>	ASHRAE 15 and UL 60335-2-40
must turn on indoor fan to supply airflow required by	<no conflict>	ASHRAE 15 and UL 60335-2-40
<not specified>	<no conflict>	ASHRAE 15 and UL 60335-2-40
Must be tested for proper operation after installation	<no conflict>	ASHRAE 15 and UL 60335-2-40
	<no conflict>	ASHRAE 15 and UL 60335-2-40
	<no conflict>	ASHRAE 15 and UL 60335-2-40
	<no conflict>	ASHRAE 15 and UL 60335-2-40
limited to 200cfm max and only when no safety ss valves are used	Must comply with circulation, ventilation, and air flow 2-40 (cml)	ASHRAE 15.2
No ignitions sources (Sec 5.1)	<no conflict>	ASHRAE 15 and UL 60335-2-40
No ignitions sources (Sec 5.1)	<no conflict>	ASHRAE 15 and UL 60335-2-40
No ignitions sources (Sec 5.1)	<no conflict>	ASHRAE 15 and UL 60335-2-40
500 microns (Sec 8.6.5)	500 microns	ASHRAE 15 and UL 60335-2-40
Design Pressure (Sec 8.6.5)	<no conflict>	ASHRAE 15 and UL 60335-2-40
m2 max charge if not over	Pick most conservative	Pick most conservative

RCL	Pick most conservative	Pick most conservative
must be listed--so same as 2-40	Pick most conservative	Pick most conservative
	<no conflict>	ASHRAE 15 and UL 60335-2-40
	Specify 4"	ASHRAE 15 and UL 60335-2-40
	<no conflict>	ASHRAE 15 and UL 60335-2-40
	IO specify 3 m and mixing	ASHRAE 15 and UL 60335-2-40
regardless of where compressor is max 200 cfm	<no conflict>	ASHRAE 15 (15.2?)
	Compressor must be turned off	ASHRAE 15
Must be listed so same as 2-40	Difference in the calculation	ASHRAE 15 and UL 60335-2-40
No ignitions sources (5.1)	<no conflict>	ASHRAE 15 and UL 60335-2-40
	<no conflict>	<no conflict>
Not permitted	Res – no change	ASHRAE 15.2
	Cml – if analyze / AHJ	

nd ASHRAE. The group noted that there are no (not applied) applications and concluded that no other issues were identified.

air reconciliation process. It will be helpful to
ore, the most stringent requirements will always

[illegible]

ASHRAE 15.2 is a combination of ASHRAE 15 and UL-60335-2-40
PEC PATH FORWARD FROM MONDAY's MEETING
<ul style="list-style-type: none"> • Split system indoor coil must always have a sensor • Split system with an air handler and package unit do not require detection with a charge less than 4 lbs* <p>* This was noted as being of limited practical significance because line-set would likely increase charge above 4lb limit which would require sensor for most systems</p> <ul style="list-style-type: none"> • UL Collaborated Standard Development System request has been submitted to add this requirement to UL60335-2-40 now
If you put the sensor in 25% LFL, mitigation measures must be activated
UL60335-2-50 requires a confirmation of location test per annex mm and others require listing

2-40 does not allow field installed. An additional sensor can be field installed
remote is an optional additional sensor
Self check is not a fault enabled. It is required all the time every hour
15 doesn't have a definition of an alarm, could argue that turning on ventilation is an alarm - visual, audible
Installation check button is required by 2-40
contaminates and reliability which are detailed in 2-40
UL60335-2-40 allows compressor to run if it reduces risk
Relevant to charge size limits above
UL6035-2-40 has details on what VA is an ignition source
2-40 does not require proof of airflow if there is a sensor
ASHRAE 15.2 installation requirements are a combination of ASHRAE 15 and UL60335-2-40
2-40 does not require a test at design pressure, it is 25%

Relevant to charge size limits above
More conservative must be followed 15; however only likely to be helpful in cooling only application with low side compressor - any high side components with heating would not make sense to turn off compressor
15 doesn't expand exemptions for electrostatic air cleaners - these topics are covered under 2-40
Could be a candidate for harmonization - must follow more conservative - well above unit operation due to limit switch test - electrostatic air cleaner only in use with air flow present
EPA does not allow retrofit to another class of refrigerant

- UL/CSA 60335-2-40 interpretation question: multi-split systems do not require safety shut-off valves to be closed to minimize releasable charge
- Will be submitted to UL CSDS system for resolution

