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A Closer Look at A2L Refrigerants

www.opteon.com

Today's Presenter: Don Gillis

EXPERIENCE:

- 30 + years in HVACR industry (24 of those in the field)
- Service Tech,. Service Mgr., Territorial Manager, National Technical Trainer

Credentials:

- Licensed HVACR Journeyman (Allen County)
- EPA 608
- OSHA Managers 30-hour Certification
- BPI Certification
- RSES Member

National Speaking Events:

- RSES National Conference
- Bryan Orr's Symposium
- ESCO HVACR Educators/Trainers Conference
- Johnstone Supply National Sales Conference

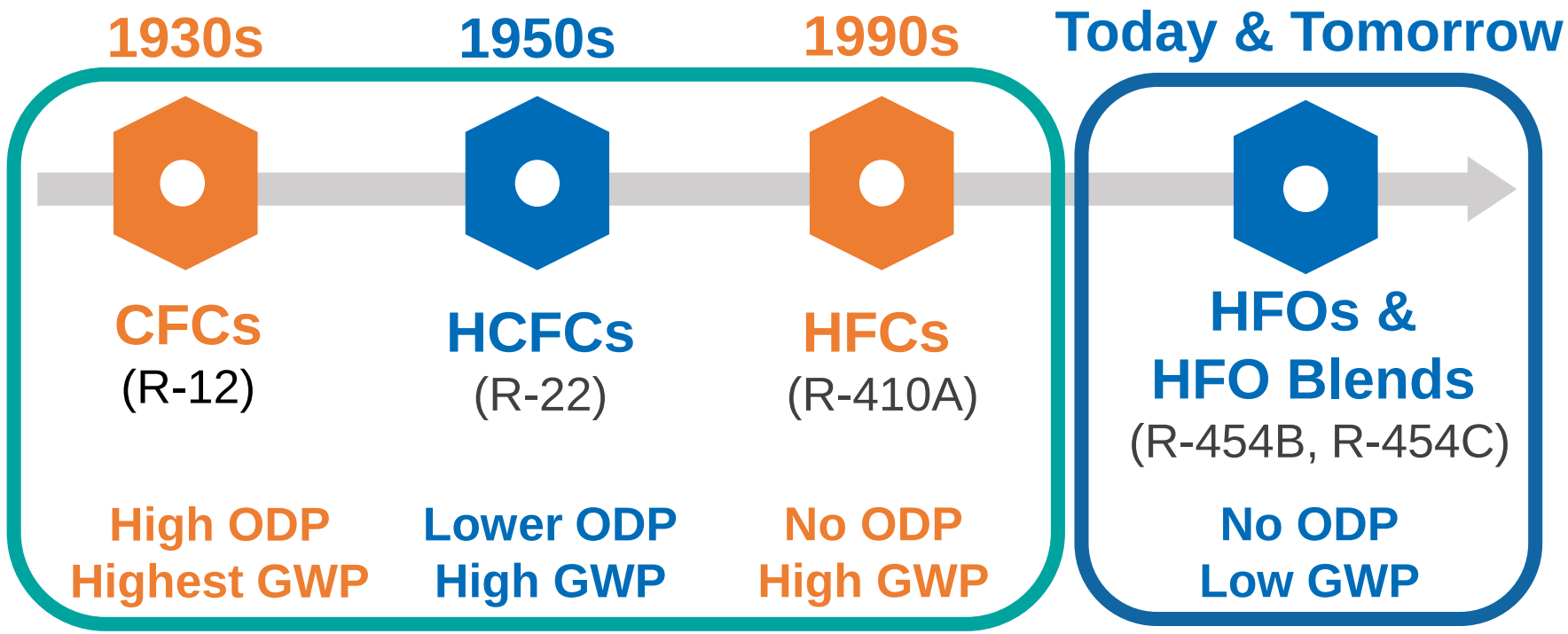
Boards and Committees:

- Skills USA National Committee
- PHCC Judges Committee
- UNOH College Heating/AC advisory
- Upper Valley Career Center
- OHIO Hi-Point Career Center
- IVY Tech.

Education:

- IVY Tech
- Vantage Career Center
- School of Hard Knocks

The Innovation of Refrigerants



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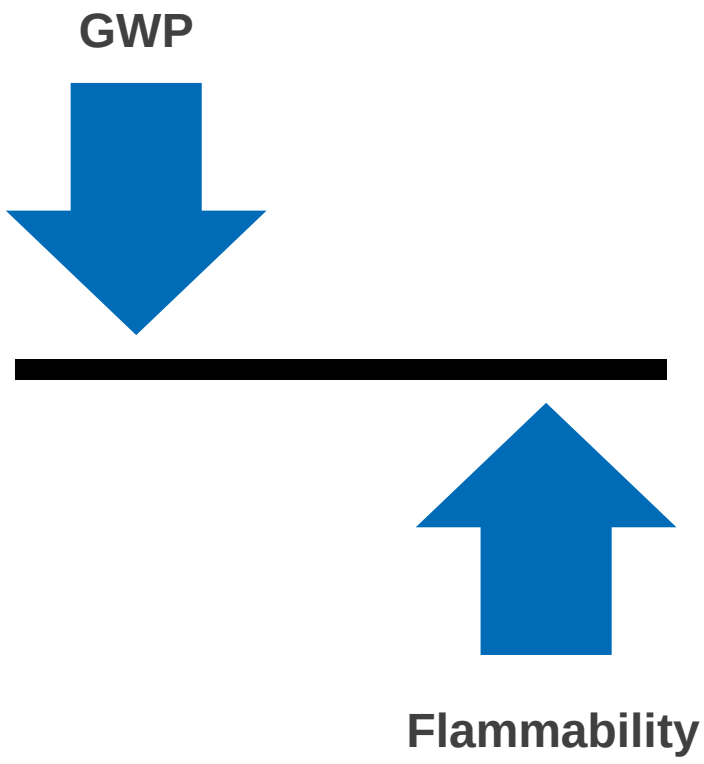
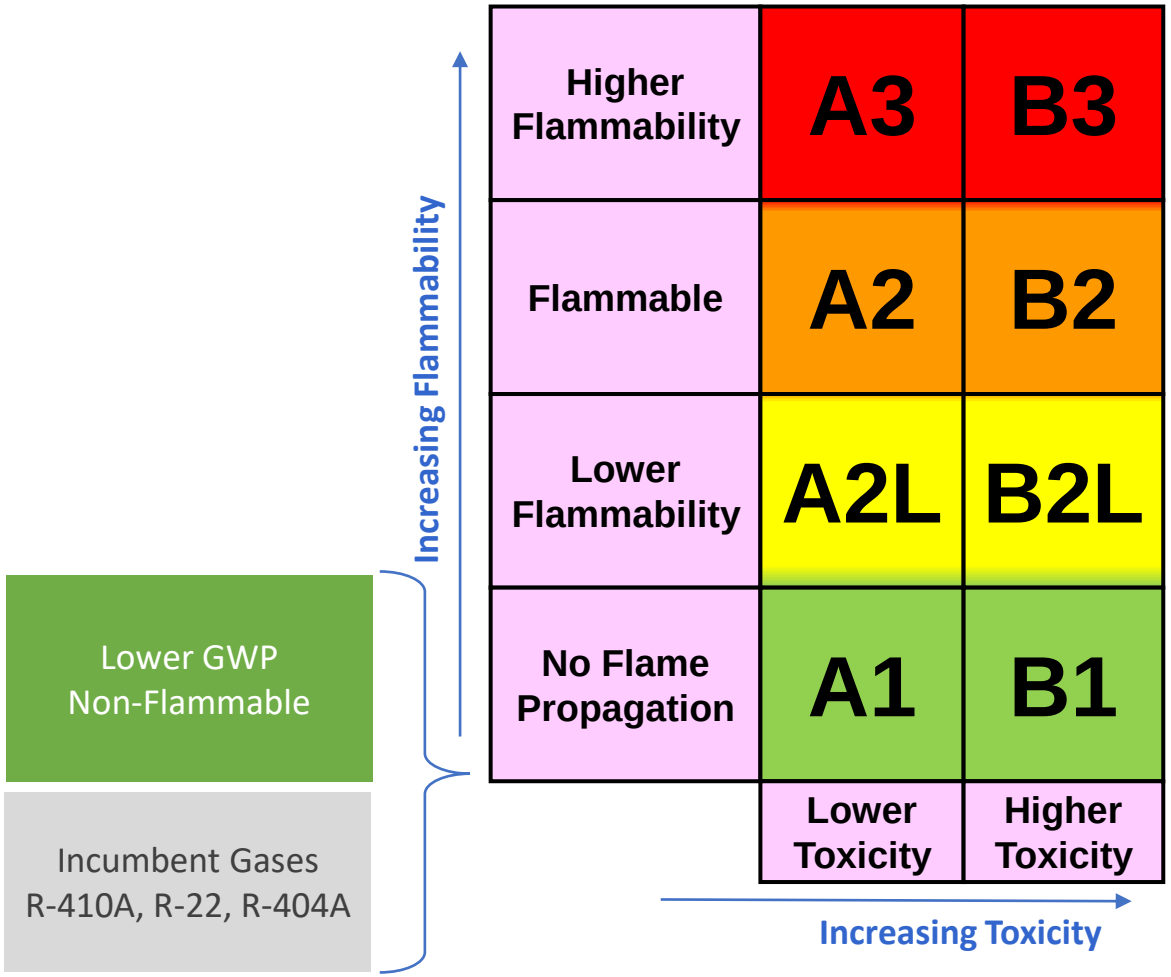
ASHRAE Standard 34

R-410A = 2,088 GWP (50% R-32 / 50% R-125)





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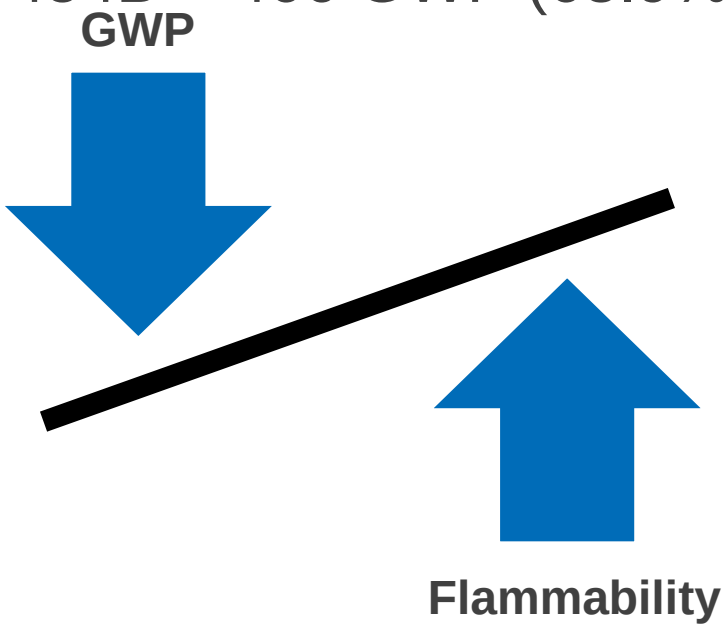
ASHRAE Standard 34

Lowering GWP, results in increasing flammability properties

R-410A = 2,088 GWP (50% R-32 / 50% R-125)

R-454B = 466 GWP (68.9% R-32 / 31.1% R-1234yf)



R-454A, R-454B, R-454C, R32, R-1234yf

Lower GWP Non-Flammable

Incumbent Gases R-410A, R-22, R-404A

Higher Flammability	A3	B3
Flammable	A2	B2
Lower Flammability	A2L	B2L
No Flame Propagation	A1	B1
	Lower Toxicity	Higher Toxicity

Increasing Flammability

Increasing Toxicity

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ASTM Industry tests for refrigerants E681, E582, D3065 Industry

American Society for Testing and Materials

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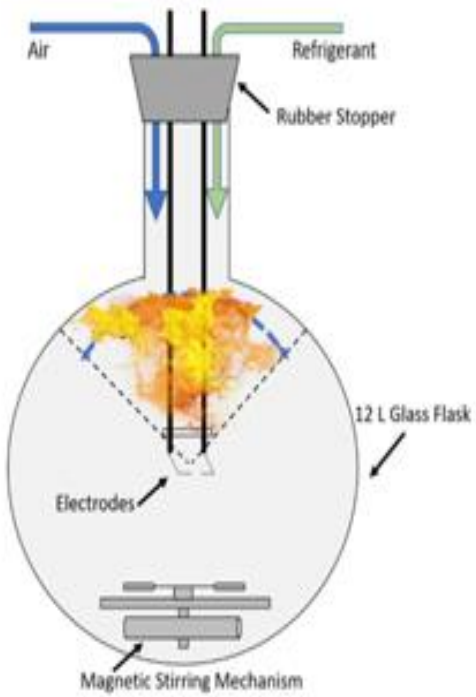
ASTM E681 Test Examples

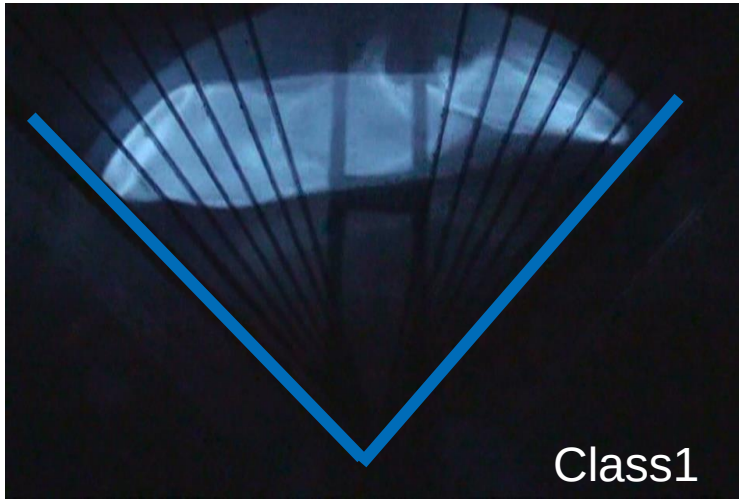
A1

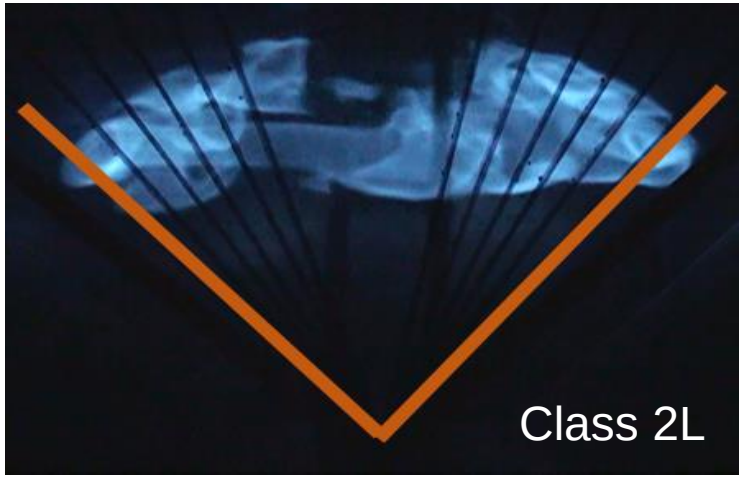
- Flame spread **< 90°** indicates “no flame propagation”

2L

- Flame spread **> 90°** indicates “flammability”
- **An A2L classification** means the flame exceeded the **90°** parameter and the flame spread is slow.







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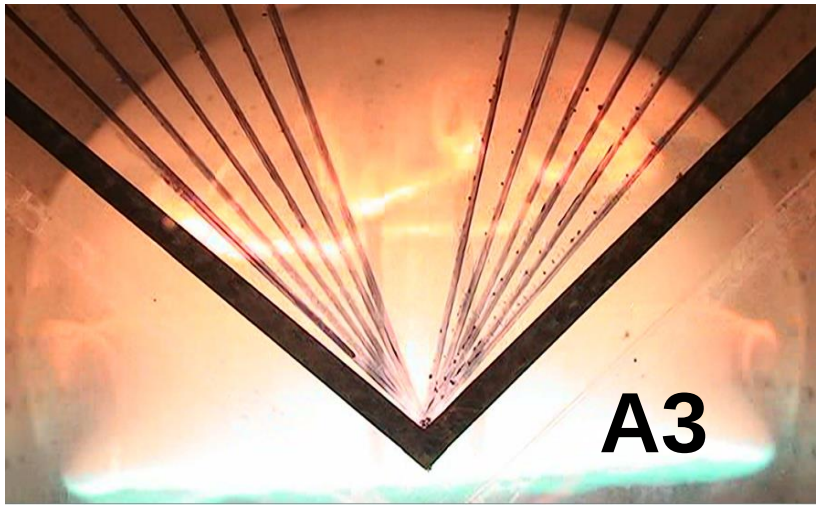
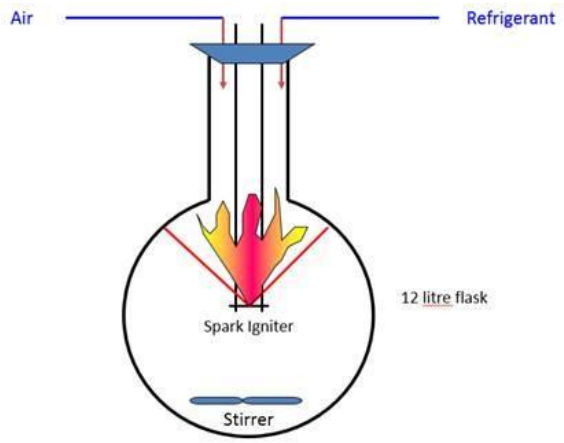
ASTM E681 Test Examples

- Flame spread **> 90°** indicates “flammability”
- Based on the spread beyond **90°**, as well as the **speed at which the flame spreads**, defines the degrees of ‘flammability’
  - 2L – lower flammability
  - 2 – flammable
  - 3 – higher flammability





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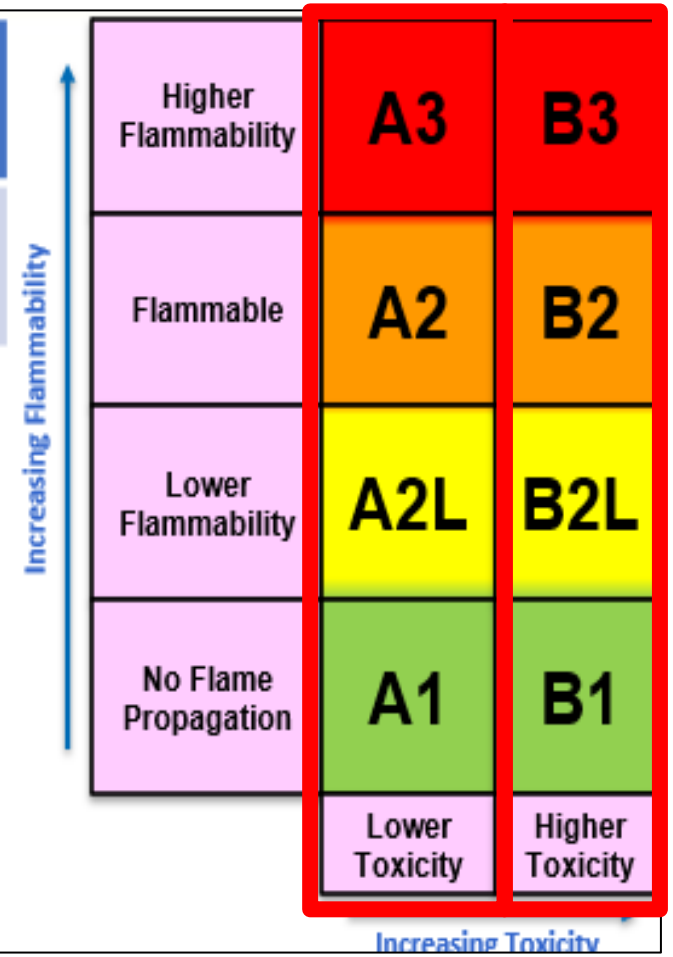
Comparison of Flammability Parameters

Refrigerant ASHRAE Designation	Opteon™ XL41 (R-454B)	Propane (R-290)
ASHRAE Safety Group	A2L	A3



ASHRAE Standard 34

- The First letter defines the toxicity.
- The second numeral is the flammability.

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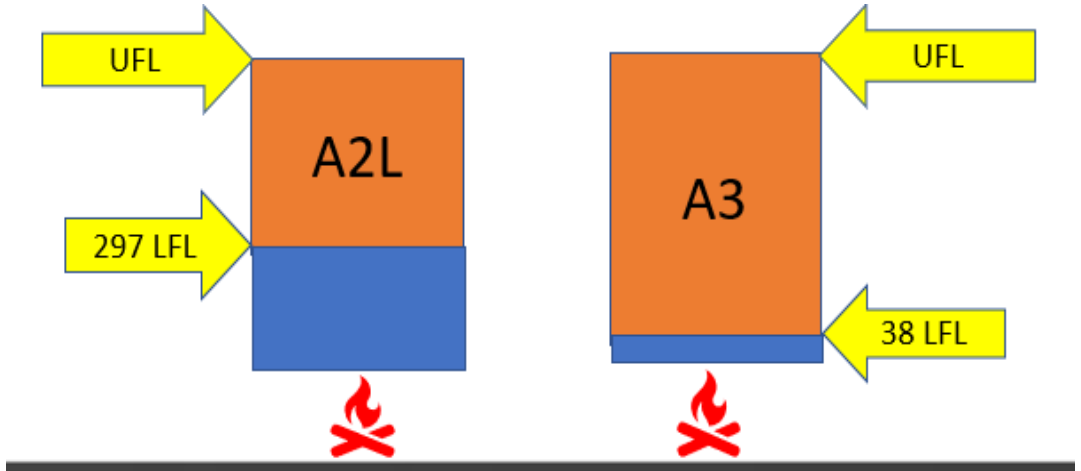
Comparison of Flammability Parameters

Refrigerant ASHRAE Designation	Opteon™ XL41 (R-454B)	Propane (R-290)	
ASHRAE Safety Group	A2L	A3	Risk Trend
Lower Flammability Limit (LFL) (g/m³)	297	38	LFL ↑, Risk ↓

NOTE: Simply put, outside the range of the UFL, and LFL, the mixture can not be ignited.



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Minimum Ignition Energy (MIE)

Refrigerant ASHRAE Designation	Opteon™ XL41 (R-454B)	Propane (R-290)	
ASHRAE Safety Group	A2L	A3	Risk Trend
Lower Flammability Limit (LFL) (g/m^3)	297	38	LFL ↑, Risk ↓
Minimum Ignition Energy (MIE) (mJ)	100 - 300	0.25	MIE ↑, Risk ↓

MIE: Is defined as the minimum electric energy it takes, to ignite a fuel-air mixture.

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Burning Velocity

Refrigerant ASHRAE Designation		Opteon™ XL41 (R-454B)	Propane (R-290)	Risk Trend
ASHRAE Safety Group		A2L	A3	
Lower Flammability Limit (LFL)	(g/m^3)	297	38	LFL ↑, Risk ↓
Minimum Ignition Energy (MIE)	(mJ)	100 - 300	0.25	MIE ↑, Risk ↓
Burning Velocity (S_u)	(cm/s)	5.2	46	S_u ↓, Risk ↓

Burning Velocity, the speed at which a flame propagates, relative to the unburned gas. *A2L's are a vary lazy flame*.

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Heat Of Combustion (HOC)

Refrigerant ASHRAE Designation		Opteon™ XL41 (R-454B)	Propane (R-290)	
ASHRAE Safety Group		A2L	A3	Risk Trend
Lower Flammability Limit (LFL)	(g/m^3)	297	38	LFL ↑, Risk ↓
Minimum Ignition Energy (MIE)	(mJ)	100 - 300	0.25	MIE ↑, Risk ↓
Burning Velocity (S_u)	(cm/s)	5.2	46	S_u ↓, Risk ↓
Heat of Combustion (HOC)	(kJ/g)	10.1	46.3	HOC ↓, Risk ↓

- More favorable flammability parameters, will lead to a lower risk.

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A2Ls and A3 Comparison

A2Ls' LFL is ~ 8x higher than that of R-290.

A2L are less likely to form flammable concentrations

Allowing larger charge size for larger applications

A2Ls' MIE is significantly higher (400-1,000x)

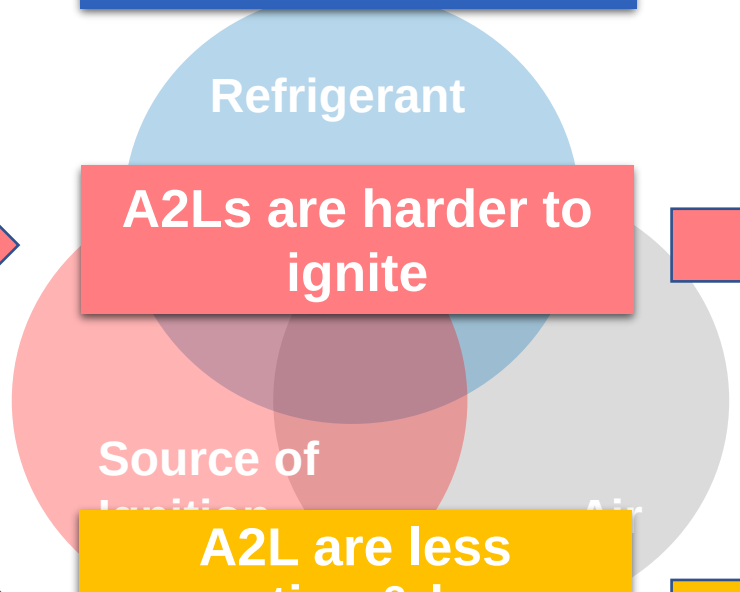
A2Ls are harder to ignite

Safer to use with many commonly used electrical components

A3s' HOC is 4 to 5x higher than that of an A2L refrigerant

A2L are less reactive & have lower combustion energy

Hence, A2L's generate "lower severity" ignition events



Dispose-A-Can (DAC)

What's Changing in new A2L DAC's?

- *Color, off grey body.*
- *Will have a red line around the top.*
- *Pressure relief instead of rupture disk.*

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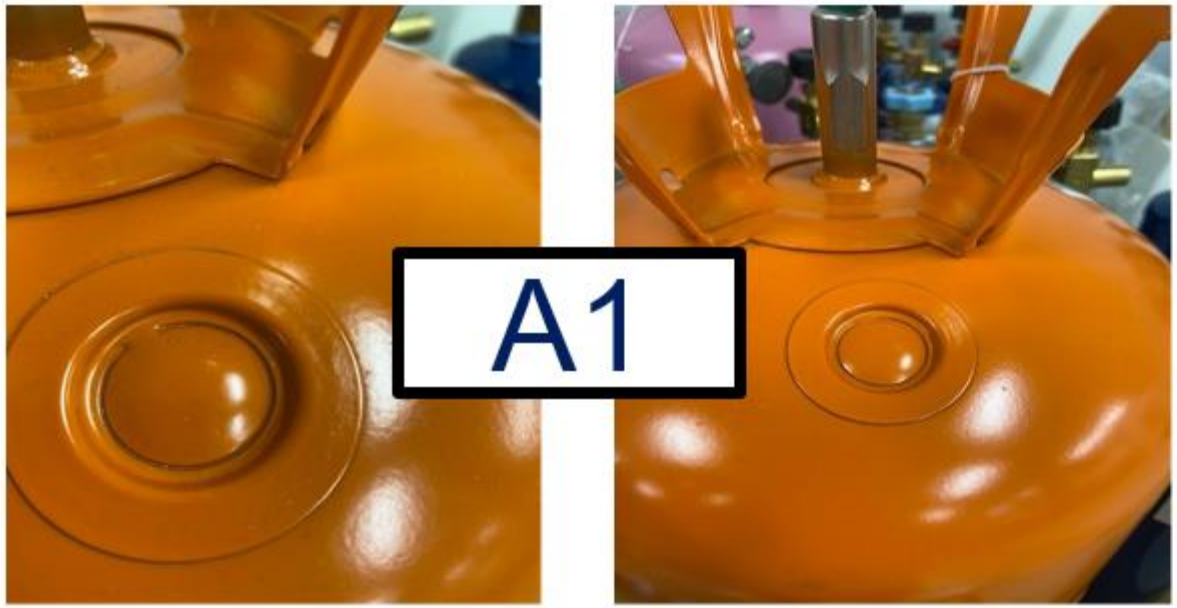
Tank Pressure Safety: What's New?

Rupture DISC (CG-1). Used for ASHRAE 34 A1. Set pressure defined by cylinder working pressure and **burst with all contents released.**

Spring-loaded relief (CG-7). Used for ASHRAE 34 A2L. Set pressure are defined by cylinder working pressures, and the **valve only releases enough gas to return below the cylinder's max pressure.**



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Transportation: DOT

Service Vehicles:

- **Under the “materials of trade,” it’s business as usual.**
- **Same restrictions in place 440 pounds, regardless of the hazard.**
- **Federally no placards are required for *service vehicles*. For transportation there is.**

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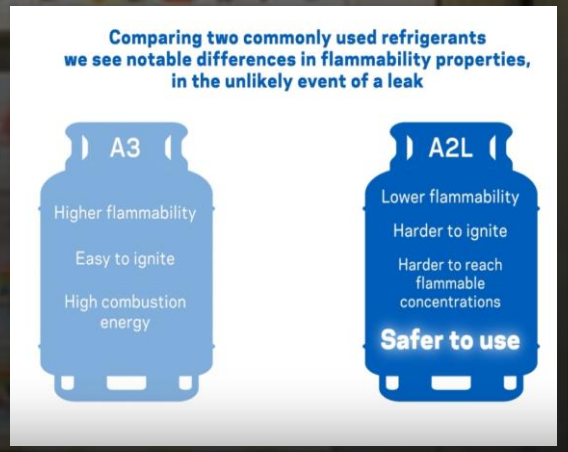
Opt for better

THANK YOU

Opteon™ Refrigerants

For more information, go to
www.opteon.com/gobeyond

https://pages.chemours.com/20-OPTEO-50TheBurningTruthFlammabilityCampaign_TY_EN.html



February 10, 2023

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