



**PIONEER
INTERNATIONAL**
HYDROCARBON TECHNOLOGY

FLAMMABILITY SAFELY ADDRESSED

Historically, the main objection from competing chemical refrigerant interests was that hydrocarbon refrigerants are flammable.

All refrigerants can burn and hydrocarbon refrigerants have a lower auto-ignition temperature than high GWP refrigerants.

Additional facts provide a more accurate understanding and demonstrate why the difference in auto-ignition temperature has little relevance in real-life application.

Hydrocarbon refrigerants have a dangerous goods safety classification 2.1 - highly flammable.

R32 chemical refrigerant has the same dangerous goods safety classification 2.1 - highly flammable. They are treated the same as hydrocarbon refrigerants. Both should only be handled by properly trained and accredited professionals.

Many chemical refrigerant air conditioners are shifting to R32, which has a lower GWP relative to R410a and R22 refrigerants.

The fact that R32 has the same dangerous goods classification as hydrocarbon refrigerant has effectively nullified the competing focus on hydrocarbons being flammable.

Further, it is necessary to evaluate the application of refrigerants in practice:

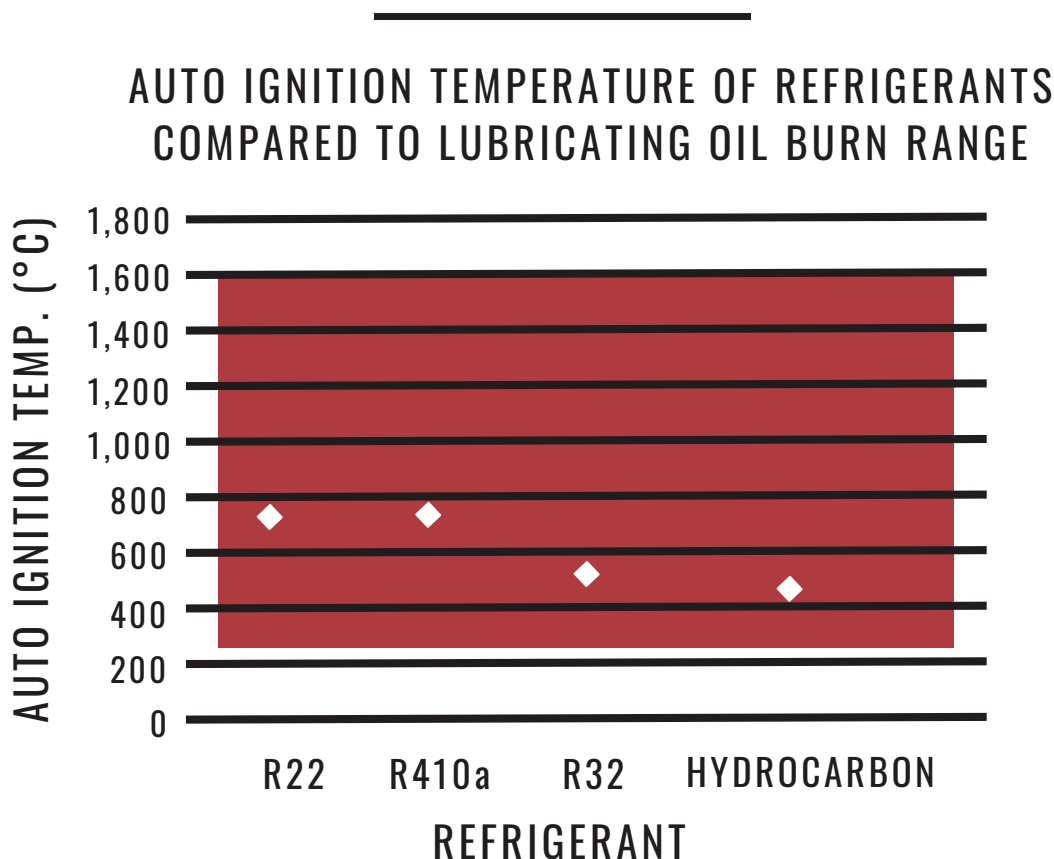
AUTO IGNITION TEMPERATURE	°C
R22	740
R410a	755
R32 ³⁸	530
HYDROCARBON ENGAS M60 ³⁹	480
LUBRICATING OIL	262

The auto ignition temperature of most lubricating oils under high pressure, being atomised as through a leak, is 262 °C.

Lubricating oil burns to 1600°C, igniting all refrigerants in the process.

Therefore, the actual auto-ignition temperature of all refrigerants mixed with lubricating oil is 262°C.

This chart displays the auto ignition temperature of refrigerants. The red is the temperature range at which lubricating oil burns.



Hydrocarbon refrigerants are only flammable when the ratio of refrigerant to air is in the range of 2-10% refrigerant to 90-98% air. Outside of this narrow range they are nonflammable.

“Subject to compliance with certain safety principles, the application of flammable hydrocarbon refrigerants can be done as safely as with any other type of refrigerant.”

*Bernhard Schrempf,
Head of Centre of Competence for Refrigeration and Air Conditioning,
TUV SUD (one of the world’s leading technical service organization with
22,000 employees across 800 locations).⁴⁰*

There are more than 700 million domestic refrigerators using hydrocarbon natural refrigerant, with few flammability incidents recorded.

A study comparing the risk of hydrocarbon domestic refrigerators (DR) with hydrocarbon split system air conditioners (SAC) concluded the following:

- The overall ignition frequency of split system air conditioners (SAC) is about one-hundredth of the domestic refrigerator (DR)
- The overall risk of overpressure and the risk of thermal intensity for the SAC was around 100 times lower than the DR
- The calculated ignition frequency of both appliances is extremely low, being less than one ignition event per 100 million SACs in 10 years, with the frequency of secondary fire is about 10 times lower than the ignition frequency
- The risk for enclosures should be very low, but it is notably higher for the DR cabinet because of the inability of the refrigerant to drain from it
- The reasons for lower ignition frequency risk of SACs are because of the use of a fan that helps to disperse the leaked refrigerant, and due to the fact that a high level release can easily disperse to below the flammable limits through the adoption of certain measures.

Pioneer air conditioners comply with the requirements of AS/NZS 5149 for the use of hydrocarbon refrigerants.

Additionally, Pioneer air conditioners with more than 500g of refrigerant (equating to units of 10 kW cooling capacity and above) have a built-in gas sensor. The sensor isolates power to the air conditioner when a prescribed level of gas is detected, to remove the potential ignition source.

All Pioneer units have additional patented safety systems.

This raises the standard of safety in the air conditioning industry.

If an ignition does occur, hydrocarbon natural refrigerants will combust with a 'flash' creating byproducts of carbon and steam.

This compares to chemical refrigerants detonating and creating toxic hydrogen fluoride as a byproduct.

'Comparative Risk Assessment of Hydrocarbon Refrigerant in Refrigerators and Split Air-Conditioners', Dr Daniel Colbourne, the leading member of the UK based Refrigerants Technical Options Committee. Dr Colbourne is one of the world's foremost experts on refrigeration and consults regularly for GIZ (German Agency for International Cooperation) and the United Nations Environmental Programme. ⁴¹