

WHITE PAPER

R290 Refrigerant Explained

What It Means for Your Chiller — and How PolyScience Leads with an Air-Shippable, Globally Compliant Platform

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Executive Summary

R290 — propane — is quickly becoming the refrigerant of choice for the next generation of lab and process chillers, and for good reason. It carries a global warming potential (GWP) of just 3, versus figures in the hundreds or thousands for the HFC and HFO/HFC-blend refrigerants most chillers still run on today. That single number is reshaping refrigerant choice across the industry, driven by regulations like the EU F-Gas Regulation, which sets a GWP ceiling most legacy refrigerants can't meet.

R290's tradeoff is that it's flammable — ASHRAE safety class A3, versus the non-flammable A1 classification of refrigerants like R134a and R513a. That's a real engineering constraint, not a footnote, and it's one PolyScience has spent years designing around: a minimized refrigerant charge, components built specifically for that reduced volume, and a system architecture built to the equipment safety standards that govern flammable-refrigerant equipment. The result is a chiller platform that is both globally compliant and, critically, still able to ship by air — something a larger flammable-refrigerant charge would make far harder. This paper explains what R290 is, why it matters, and how PolyScience has engineered around its one real complication.

What Is R290?

R290 is the refrigerant industry's designation for propane used as a working refrigerant — chemically identical to the propane used in countless other applications, but purified and packaged for refrigeration duty. Unlike R134a, R404A, R410A, or R513a, which are synthetic HFC compounds or engineered blends built specifically to be refrigerants, R290 is a naturally occurring hydrocarbon. It isn't a new or experimental choice for refrigeration: propane and other hydrocarbon refrigerants have been used in commercial and household cooling equipment internationally for decades, and their use is accelerating as manufacturers across the industry respond to the same low-GWP pressure described below.

Property	R290 (Propane)
Chemical identity	Pure hydrocarbon (C3H8) — a naturally occurring compound, not a synthetic
GWP (AR5, 100-yr)	3
ODP	0
ASHRAE 34 safety class	A3 — higher flammability, lower toxicity
Industry history	Decades of established use in commercial and household refrigeration

Table 1. R290 property snapshot. GWP is AR5, 100-year basis, the figure cited in current EU F-Gas regulatory text.

Why the Refrigeration Industry Is Moving to R290

The driver is climate impact, measured as GWP — a scale of how much a given mass of a gas warms the atmosphere relative to carbon dioxide over a set time horizon (100 years, in the figures used here and in

current EU regulatory text). Every refrigerant historically used in small-to-mid lab and process chillers scores far higher on that scale than R290 does.

Refrigerant	GWP (AR5, 100-yr)	ASHRAE Class	Meets EU F-Gas ≤150 (2027)?
R404A	3,922	A1	No
R410A	2,088	A1	No
R134a	1,430	A1	No
R513a	573	A1	No
R290 (propane)	3	A3	Yes

Table 2. GWP values are AR5, 100-year basis. R404A, R410A, R134a, and R513a are common refrigerants across the broader lab and process chiller market and do not represent any single competitor's product line. EU F-Gas Regulation (EU) 2024/573 requires new self-contained chillers ≤12kW to use a refrigerant with GWP ≤150, effective January 1, 2027.

R290's GWP of 3 doesn't just clear that threshold — it clears it by nearly two orders of magnitude, giving a chiller built on R290 substantial margin against further tightening, wherever future regulation lands.

Addressing the Flammability Question

R290's ASHRAE A3 classification means higher flammability than the A1 refrigerants it's replacing, and that deserves a direct answer rather than a footnote. Equipment safety standards for A3 refrigerants — including IEC/UL 60335-2-40 — exist precisely to manage that risk, and they govern total refrigerant charge, component sealing, ventilation, and ignition-source control. A chiller engineered to those standards is not an older A1 design with the refrigerant simply swapped in; it's a system built around the properties of the refrigerant it actually carries.

It's also worth putting the risk in context: propane and other hydrocarbon refrigerants have a long, well-understood safety record in commercial and household refrigeration internationally. The engineering challenge is well defined, and it's one refrigeration equipment manufacturers across the industry — PolyScience included — have been solving for years, not something newly discovered.

How PolyScience Engineers Around It

PolyScience's R290 chiller platform is built around a single governing design decision: minimize the total refrigerant charge, then build every component around that reduced volume. The DuraChill® R290 chillers carry a total charge of 99 grams, achieved through a reduced-internal-volume condenser, evaporator, and filter drier, paired with a new low-volume turbine pump designed specifically for the reduced-charge circuit.

Design Element	How PolyScience Addresses It
Total refrigerant charge	Engineered to 99 grams — reduced-internal-volume condenser, evaporator, and filter drier minimize the amount of R290 the system needs to carry
Circulation hardware	New low-volume turbine pump designed alongside the reduced-charge refrigeration circuit
Applicable safety standard	System architecture designed to equipment safety requirements for A3 refrigerants, including IEC/UL 60335-2-40 (charge limits, sealing, ventilation, ignition-source

Design Element	How PolyScience Addresses It
Shipping profile	Charge kept below the commonly applied thresholds for classifying flammable-refrigerant equipment as hazardous air cargo, enabling standard air-freight handling

Table 3. Key design elements of PolyScience's R290 chiller platform.

That low charge does double duty. It's central to meeting A3 equipment safety requirements, and — just as importantly for a global supplier — it keeps the unit under the commonly applied thresholds for classifying flammable-refrigerant equipment as hazardous air cargo, which is the subject of the next section.

Global Compliance, Not Just EU Compliance

PolyScience began investing in low-GWP natural refrigerant development in accordance with the F-Gas 2020 initiative put forth by the European Union — years before the current 2024/573 regulation and its 2027 deadline took shape. That head start means the R290 platform isn't a reaction to one region's deadline; it's a chiller built to the strictest GWP standard currently adopted anywhere in the world.

That distinction matters for a global buyer. GWP-based restrictions on this class of equipment are, at present, most fully codified in the EU, but similar regulatory direction is anticipated elsewhere as other regions continue tightening HFC policy. A chiller already compliant with the EU's threshold today is a chiller that doesn't need to be re-engineered to meet whatever comes next — wherever it's installed.

Built to Ship — Anywhere

A flammable refrigerant introduces an operational question most buyers never had to think about with A1 refrigerants: how does the chiller actually get to them, especially by air, where flammable gas cargo is tightly restricted? This is where PolyScience's low-charge engineering pays off a second time.

By keeping the R290 charge at 99 grams, the DuraChill® platform stays below the commonly applied thresholds for classifying flammable-refrigerant equipment as hazardous air cargo — rather than sitting above them the way a larger flammable charge would. In practical terms, that means these chillers can move through standard air-freight channels instead of requiring dangerous-goods handling, special routing, or the longer transit times that come with surface-only shipping for hazardous cargo.

A low-GWP refrigerant only helps a global lab if the chiller carrying it can still reach that lab quickly. PolyScience's 99-gram R290 charge is engineered to keep shipments below the commonly applied thresholds for hazardous air cargo classification, so units ship the way non-flammable-refrigerant equipment always has — by air, on a standard timeline.

What This Means for You

- A chiller built on R290 clears the EU F-Gas GWP ≤150 threshold with wide margin — R404A, R410A, R134a, and R513a do not.
- R290's A3 flammability classification is a real design consideration, and it should be backed by specifics: ask what total refrigerant charge a chiller carries and what safety standard its design meets, not just whether it "uses R290."
- Total refrigerant charge affects more than safety compliance — it determines whether a unit can ship by air or requires slower, more complex hazardous-goods freight.
- A platform engineered ahead of today's strictest regulatory threshold is a platform with margin against tomorrow's, wherever your lab or process facility is located.

Conclusion

R290 is not just a lower-GWP substitute dropped into an existing chiller design — done right, it's a different engineering starting point, one that has to account for flammability from the first component chosen. PolyScience's DuraChill® R290 platform was built that way from the outset: a minimized 99-gram charge, components engineered around that reduced volume, a system designed to the equipment safety standards that govern A3 refrigerants, and a shipping profile that keeps global delivery on a standard air-freight timeline. The result is a chiller that meets the strictest GWP standard currently adopted anywhere in the world, without asking a customer to accept a slower, more complicated path to get one.

Curious what R290 means for your specific application?

Contact PolyScience to talk through your cooling requirements, your regulatory environment, and which R290 chiller model fits your lab.

This white paper is provided for general informational purposes. It is not legal or regulatory compliance advice; regulatory dates and thresholds should be confirmed against official regulation text and, where applicable, qualified counsel. GWP figures are AR5, 100-year basis. Refrigerant charge, safety classification, and air-shipping information reflect PolyScience's current R290 chiller platform and are subject to change; confirm current specifications with PolyScience before quoting a customer.