Carrier
TRANSICOLD
United Technologies

Essential information for temperature controlled fleet operators

cool by Carrier

[1] This guide aims at highlighting some requirements provided by Regulation EU/517/2014, Regulation EU/2016/1628, PIEK label, and ATP regulations. However, this guide is for information purposes only and we do not make any warranty or representation on the completeness, correctness, accurateness, adequacy, usefulness or reliability of such information. Therefore, neither Carrier Transicold, nor any of its affiliates, will accept any liability whatsoever based on any information provided in this document, or any use of or reliability on any such information.

Major global events such as the 2015 Paris Climate Conference (COP21)[1] and the Montreal Protocol 2016 Kigali Agreement[2] have focused the international spotlight on a more rapid move towards low emissions and cleaner energy.

As a result, the pace of change in the transport refrigeration sector is high, and fleet owners must understand important new legislation being introduced to improve environmental protection.

At Carrier Transicold it is our mission to help make the world a better place to live. Our transport refrigeration systems have long served an important need, delivering food and other temperature-sensitive goods. It's a heritage we're proud of and one that we intend to build further with more sustainable and innovative transport refrigeration solutions.

Our teams are working hard to develop new technologies and services to meet the challenges ahead. From an operations perspective, we believe that reducing the environmental impact needs to be done while maintaining efficiency levels. As not every new solution brought to market will suit every fleet, we are focused on providing a range of solutions which can be mission-matched to each customer's individual requirements.

To help you gain a better understanding of some of the key areas of new legislation, and to find out how it may impact your fleet, we have produced this compliance guide covering:

- F-Gas Regulation EU/517/2014
- EU Stage V Engine Emissions Regulation EU/2016/1628
- PIEK label
- ATP Regulations

You can also contact your local Carrier Transicold representative for free advice on your future fleet requirements, via **www.carriertransicold.eu**.

We hope this information proves helpful to you.

Carrier Transicold Europe

[1] www.cop21paris.org
[2] www.ozone.unep.org

F-Gas Regulation EU/517/2014

Since 1 January 2015, F-Gases have been subject to a strict new European Union legislation which aims to significantly reduce the emissions from the use of fluorinated gases.

This 'new' F-Gas Regulation EU/517/2014 maintains many measures of the previous F-Gas Regulation EC/842/2006, particularly in relation to:

- Leak prevention
- F-Gas recovery
- Certification of technicians
- Selected restrictions on the use and marketing of F-Gases

However, the latest legislation aims to bring about large reductions in the use of F-Gases and emissions from the use of those fluorinated gases, by progressively phasing-down permitted supplies of hydrofluorocarbons (HFCs) into the EU market.

In the transport refrigeration sector, this has meant new controls on the use and emissions of HFCs as refrigerants in transport refrigeration units installed on vehicles above 3.5 tonnes.

The legislation covers measures which include:

- Refrigerant charge is now referred to in terms of CO_2 equivalent, rather than kilograms of refrigerant.

WHAT IS F-GAS?

- Fluorinated Gas (F-Gas) is a greenhouse gas and the name given to a group of chemicals containing fluorine, which trap heat in the atmosphere and contribute to global warming.
- HFCs are one of the four main categories of F-Gases.

WHAT IS GLOBAL WARMING POTENTIAL (GWP)?

- GWP is a relative measure of how much heat a greenhouse gas traps in the atmosphere.
- It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide.
- A GWP is calculated over a specific time interval, commonly 20, 100, or 500 years.
- GWP is expressed as a factor of carbon dioxide (whose GWP is standardised to 1).

- A planned phase-down to reduce the quantity of CO_2 equivalent related to HFCs supplied into the EU, with a 79% cut by 2030.
- A ban on the intentional release of F-Gases into the atmosphere. Where leaks are detected, repairs must be carried out without undue delay.

HFC EU Market Allowances

YEAR	% OF BASELINE
2015	100
2016 & 2017	93
2018, 2019 & 2020	63
2021, 2022 & 2023	45
2024, 2025 & 2026	31
2027, 2028 & 2029	24
2030	21

- Refrigerant handling operations on commercial trucks and trailers with a gross vehicle weight of 3.5 tonnes and above, which use HFC refrigerants in their transport refrigeration unit, must be carried out by trained technicians holding an F-Gas handling certificate – from 1 July 2017.
- A requirement for mandatory leak checks on refrigerated commercial trucks and trailers above a certain threshold. If a leak is detected then it must be repaired without undue delay and the leak test must be repeated within one month to ensure the repair was successful.
- A requirement for operators of refrigerated commercial trucks and trailers, and service contractors, to keep specified records for five years for each piece of equipment subject to a mandatory leak check.

F-Gas Leak Check Frequencies & Thresholds

Maximum interval between leak checks	Threshold for all HFC refrigerants	Kg threshold for R404A	Kg threshold for R452A	Kg threshold for R134a
Annual	5 tonnes CO_2 equivalent	1.27kg	2.34kg	3.50kg
Every six months	50 tonnes CO_2 equivalent	12.7kg	23.4kg	35.0kg
Every three months	500 tonnes CO_2 equivalent	127kg	234kg	350kg

THE FUTURE OF REFRIGERANTS

Carrier Transicold believes that R452A is only an intermediate mid-term solution and consequently Carrier's vision is to develop sustainable alternative transport refrigeration units that would deliver significant benefits to the environment, while being safe and energy efficient in the long-term.

Carrier Transicold is currently running customer trials in the UK and Germany with transport refrigeration units that use the natural refrigerant CO_2 (also known as R744). R744 is a non-flammable and non-ozone depleting refrigerant and has a GWP of just one – thousands of times lower than traditional refrigerants:

GWP Comparison of R744

REFRIGERANT	GWP
R404A	3,922
R452A	2,141
R134a	1,430
R744	1

TRUE OR FALSE?

1. R404A will be completely banned in 2025.

FALSE: *There are bans planned for other sectors (e.g. new stationary refrigeration systems), but NO ban for refrigerated transport systems. Nevertheless, prices are expected to rise as availability reduces.*

2. After 2020, only recycled R404A refrigerant can be used for maintenance.

FALSE: *This restriction only applies to stationary and mobile systems with CO_2 equivalent charges of 40 tonnes and above, which equates to 10.2kg of R404A. All Carrier Transicold transport refrigeration units sold in Europe have refrigerant charges below this limit.*

3. Refrigerated transport is a key contributor to global warming related to its F-Gas usage.

FALSE: *The transport sector contributes approximately 2% to the emissions from the use of F-Gases.*

PURCHASING CONSIDERATIONS

If specifying new transport refrigeration units now, R452A might be a solution to help limit the impact of potential gas price increases that are envisaged for R404A as the HFC phase-down levels become progressively more aggressive.

Carrier Transicold already offers R452A as an option on new transport refrigeration units. Units using R404A can also be retrofitted to operate with R452A in the field with no major component changes required.

Fleets managers are also encouraged to compare the specification of transport refrigeration units before investing in new equipment, as selecting units which require lower quantities of F-Gas, and using technology proven to significantly reduce the risk of leaks, can have a major impact on the greenhouse gas emissions from their use.

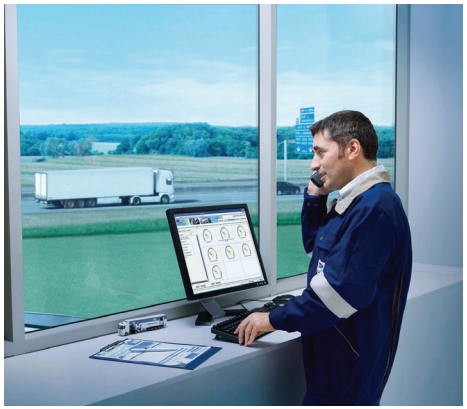
Improved refrigerant containment offered by Carrier's patented E-Drive™ all-electric technology helps reducing refrigerant leak rates by as much as 55% over conventional belt-driven systems, thanks to key containment-improving features including:

- A hermetic compressor
- Fewer joints
- Copper tubing between the condensing unit and evaporator, instead of flexible hosing
- Electrical heating instead of hot gas heating – which requires fewer joints and valves

The refrigerant charge in many latest-generation Carrier Transicold units is also as much as 25% lower thanks to the use of micro-channel heat exchanger coils, instead of standard heat exchangers.

KEEPING YOUR FLEET COMPLIANT

Carrier Transicold can support fleets in being compliant with the EU F-Gas Regulation with its everCOLD™ flexible maintenance packages, which include all required maintenance and system leak checks performed by F-Gas certified engineers.



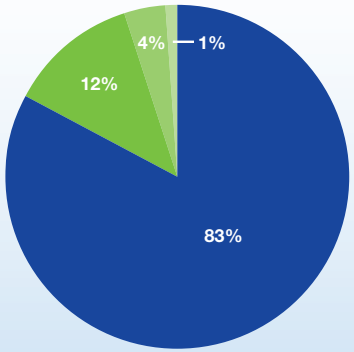
These include leak checks carried out directly following any repair of a refrigeration circuit. Carrier also provides customers with duplicate records following every repair or leak check completed within the network.

GREENHOUSE GAS EMISSIONS AND ROAD TRANSPORT

Most greenhouse gas emissions from transportation are emissions resulting from the combustion of petroleum-based products, like petrol and diesel, used in internal combustion engines.

Amongst the largest sources of these within the transport sector are passenger cars, vans, SUVs and pickup trucks.

Looking at a standard tractor unit and temperature controlled trailer, the key areas responsible for greenhouse gas emissions are:



Assumption with Vector™ 1550 equipped with E-Drive all-electric technology

- Vehicle diesel engine fuel burn: **83%**
- Refrigeration unit diesel engine fuel burn: **12%**
- Refrigeration unit refrigerant charge: **4%**
- Refrigeration unit refrigerant leak: **1%**

EU Stage V Engine Emissions Regulation EU/2016/1628

Commercial vehicles used in road transport are subject to strict regulations which keep their emissions levels in check, with the latest vans and trucks meeting Euro VI standards.

However, the engines powering transport refrigeration units have typically been regulated differently until now.

NEW LEGISLATION FROM 2017

From 1 January 2017, the new non-road mobile machinery (NRMM) regulation defines tough new emission limits for NRMM engines, known as EU Stage V, replacing Stage IIIa. It also lays down the procedures engine manufacturers must follow to obtain type-approval for their engines – which is a prerequisite for placing their engines on the EU market.

By 2018, all manufacturers are required to have their engines type approved, and from January 2019 it is expected that new diesel-powered transport refrigeration units will be EU Stage V compliant.

A GAME CHANGER

Currently, most Carrier Transicold diesel-powered transport refrigeration units have a power rating of less than 19kW, low enough to be exempt from the existing EU NRMM Stage IIIa emissions regulations. However, the new EU Stage V Emissions Regulation requires **all** NRMM diesel engines, regardless of capacity, to comply.

Additionally, operators must comply with local initiatives applicable in particular cities and regions across Europe, such as Low Emissions Zones, Traffic Limited Zones and Traffic Restrictions. To access a list of restrictions in local markets visit www.urbanaccessregulations.eu. Additional challenges also lie ahead, including the mayors of London, Paris, Madrid and Athens planning to stop all use of diesel cars and trucks by 2025.

NRMM Engine Power Rating Emissions Limits (g/kWh)

Above 19kW	Emissions	EU Stage IIIa before 2019	EU Stage V from 2019
	PM	0.600	0.015
	PN		$1x10^{12}$
	CO	5.50	5.00
	HC+NOX	7.50	4.70

Below 19kW	Emissions	EU Stage IIIa before 2019	EU Stage V from 2019
	PM	Out of scope	0.40
	CO		6.60
	HC+NOX		7.50

Below 8kW	Emissions	EU Stage IIIa before 2019	EU Stage V from 2019
	PM	Out of scope	0.40
	CO		8.00
	HC+NOX		7.50

EU STAGE V ENGINE EMISSIONS REGULATION EU/2016/1628

HOW WILL CARRIER TRANSICOLD REFRIGERATION UNITS COMPLY?

Carrier Transicold is developing solutions to ensure all its diesel-powered units will be EU Stage V compliant.

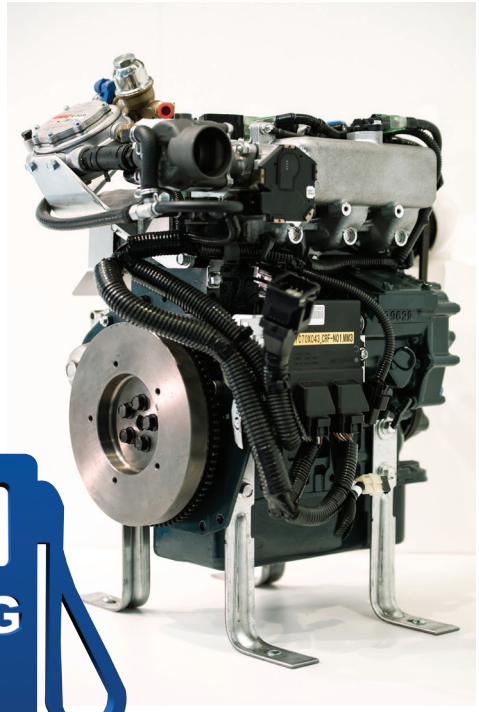
Indeed, Carrier can already offer a Low Emissions Pack on its Supra® unit featuring an engine which meets EPA Tier 4 requirements in North America, and complies with the EU Stage V NRMM regulations, reducing PM by up to 50% versus the standard engine.

Carrier is also continuing to offer new and innovative solutions which do not require NRMM diesel engine technology, including:

- Engineless refrigeration units running entirely on hydro-electric power generated by a truck's ultra-clean Euro VI diesel engine or natural gas engine. This technology, available through the ECO-DRIVE GenSet, became part of Carrier Transicold's offering in 2016 and is being used by fleets across Europe. This engineless technology is also ideally suited to new generations of hybrid or fully-electric commercial vehicles as the refrigeration unit can be run directly from electrical power.

- Compressed natural gas (CNG)-powered engines are in the development stage to be fitted on truck refrigeration units, and will enable a reduction by up to 95% in particulate emissions and a reduction by up to 70% in NO_x.

ECO-DRIVE GenSet



CNG engine

PIEK Label

When it comes to urban delivery vehicles, particularly those fitted with transport refrigeration units, operators need to consider noise emissions by timing their deliveries accordingly, or attempting to lower the noise through improved latest generation systems which offer better acoustics.

Urban noise can have a serious effect on quality of life; it can make hearing, concentrating, and working more difficult, as well as potentially disturbing sleep, which can result in stress and fatigue.

WHAT ARE THE LIMITS?

There is no global legislation on urban noise levels, although many European countries have set guidelines to minimise persistent noise, particularly in towns and cities, which can affect urban deliveries.

The Dutch Government first embarked on finding a standard for quiet delivery vehicles in 1999, developing the PIEK certification scheme in 2004.

To achieve the standard, all transport refrigeration units must be fully-functional while emitting a noise level below 60dB(A)* from 7.5 metres. This level is deemed suitable for out-of-hours delivery and should not cause any residential disturbance.

These standards are being adopted by a growing number of European countries, such as local initiatives currently operating in France, Spain and the UK.

QUIET CARRIER

Carrier Transicold already offers several systems that meet the 60dB(A) criteria.

These systems include:

- Vector™ 1950 MT City
- Vector 1550 City
- Supra City
- Engineless refrigeration units

(*sound pressure)

UNDERSTANDING NOISE LEVELS

60dB(A) – the required noise level by PIEK certification – is equivalent to a conversation in a restaurant, background music or an air conditioning unit at 30 metres.

70dB(A), whilst only 10dB(A) louder, is perceived to have a noise level twice that of 60dB(A). Any louder noise becomes uncomfortable and is the equivalent of fast moving traffic, living room music, radio or TV-audio or a standard domestic vacuum cleaner.

ATP Regulations

This is not new legislation, but is worthy of reminder for all operators which need to transport perishable foodstuffs across international boundaries by road.

ATP is the name given to the agreement on the International Transport of Perishable Foodstuffs, which was originated by the Inland Transport Committee of the United Nations Economic Committee for Europe (UNECE) in 1970-71.

ATP makes it illegal to transport perishable foodstuffs across international boundaries between countries which are signatories to the agreement, unless the vehicle has an ATP certificate. Failure to have an ATP certificate could mean a driver is stopped, turned back or possibly issued with a substantial fine.

Only non-processed fruit and vegetables are not covered within the scope of the agreement.

Countries which have signed the ATP agreement include:

Albania, Andorra, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Monaco, Montenegro, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Republic of Moldova, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Tajikistan, The former Yugoslav Republic of Macedonia, Tunisia, Turkey, Ukraine, United Kingdom, United States of America, Uzbekistan.

BUYING A PRODUCT WHICH MEETS ATP STANDARDS

The simplest way to get a vehicle with an ATP certificate is to purchase one that already has it, either new or second hand. When the vehicle is collected, it should have its unique ATP certificate and the official testing centre will have a record of:

- the chassis/box number
- the registration number
- the registered keeper
- type of refrigeration unit fitted

A single ATP certificate covers both the insulated body and the refrigeration unit and can be awarded in one of two ways. This can either be as the result of a one-off test or as a serially produced design accepted through Type Approval. The ATP certificate expires after six years, in which case an 'in service' examination can be carried out to ensure re-certification. This renewal certificate lasts for a further three years.

If you have a vehicle or trailer that does not have an ATP certificate, and no type approvals have been issued on the body or the refrigeration unit, then the only option is a one-off test at an official test centre.

For road transport companies, which only deliver foodstuffs domestically in certain countries, including the UK and Germany, there is no legislative requirement for ATP.

OUR ENGAGEMENT TOWARDS **SUSTAINABILITY**

"At Carrier Transicold, we consider sustainability a high priority to optimize resources for future generations. Drawing on our culture of continuous improvement and innovation, backed by a talented and engaged workforce, we are committed to providing our customers with high-performing solutions for cold chain integrity, offering the optimal balance between environmental footprint and total economic value - for now and in the future."

Carrier Transicold Europe

Carrier TRANSICOLD United Technologies

Web: **www.carriertransicold.eu** Twitter: **@Smartcoldchain**