



*The Voice of European Air-Conditioning, Refrigeration and Heat Pumps Contractors*

# Low GWP Refrigerants

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## Guidance on minimum requirements for contractors' training & certification

**November 2014**

rev. 2 added training facilities list

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## BACKGROUND & OBJECTIVES

In June 2011, AREA issued a [guidance paper on low GWP refrigerants](#). The guidance pursues two objectives:

- Set the general AREA position on **use of low GWP refrigerants** in RAC installations: for what type of equipment are they best suited, under which conditions & requirements etc
- Set basic **competence requirements** for RACHP contractors dealing with low GWP refrigerants.

The guidance paper is available at [www.area-eur.be](http://www.area-eur.be).

Regulation (EU) No 517/2014<sup>1</sup> on fluorinated greenhouse gases aims at reducing emissions of these gases through a variety of measures: rules on containment, use, recovery and destruction of fluorinated greenhouse gases, conditions on the placing on the market of certain types of products or equipment containing or relying upon fluorinated greenhouse gases (bans), specific uses of these gases (service ban), quantitative limits for the placing on the market of HFCs (phase-down).

A future phase-down of HFCs will lead to a higher use of alternative refrigerants / low GWP refrigerants. Low GWP refrigerants have issues on safety, flammability, toxicity and high pressure which will need to be properly considered when handling those refrigerants. With this guidance document, AREA would like to recommend to worldwide and European decision-makers minimum requirements for training and certification of contractors handling low GWP refrigerants.

It is not AREA's intention to create a new certification scheme – only to add specific modules to the existing HFCs certification scheme based on [Regulation 303/2008](#). While HFC certification will be the basis for every contractor who wants to handle every refrigerant, each added module will focus on the specificities of the respective low GWP refrigerant (i.e. Hydrocarbons – Flammability).

Some training already exists in some EU Member States; this guidance document therefore takes into account existing schemes for European harmonisation. The following documents have also served as references for this guidance:

- The [AREA portfolio of qualifications and skills needed to work in the field of refrigeration and air conditioning](#) with excellent craftsmanship was established in 2002 based on the Leonardo da Vinci Project EUR/02/C/F/NT- 84604 / EC Agreement N° 2002-4549/001-001LE2X.
- EN standard 13313.

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<sup>1</sup> [http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2014.150.01.0195.01.ENG](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.150.01.0195.01.ENG)

## Alternative Refrigerants economically feasible and available for RACHP

Following the structure of the 2011 [guidance paper on low GWP refrigerants](#), the classes of low GWP refrigerants taken into account by this guidance documents are the following:

R717	Ammonia
R290 - R600a	Propane and Isobutane Hydrocarbons
R744	Carbon Dioxide
R1234yf -R1234ze	HFO Hydrofluoro-olefin

The table below shows the respective properties of the low GWP refrigerants under consideration

Refrigerant	HFC	Natural			HFO
		HCs	Ammonia	CO <sub>2</sub>	1234yf
GWP (100 years)	<b>XX</b> R134a 1300 – R410A 1900	✓ 3 - 5	✓✓ 0	✓✓ 1	✓ 4
Toxicity	✓✓	✓✓	<b>XX</b>	✓	✓✓
Flammability	✓✓	<b>XX</b>	<b>X</b>	✓✓	<b>X</b>
Materials	✓	✓	<b>X</b>	✓	✓
Pressure	✓	✓	✓	<b>XX</b> <sup>2</sup>	✓
Availability	✓✓	✓	✓	✓	<b>XX</b>
Familiarity	✓✓	✓	✓	<b>X</b>	<b>X</b>

Very poor **XX** Poor **X** Good ✓ Very Good ✓✓

Source: F-gas support Information Sheet - RAC7 alternatives

## Minimum requirements for training and training facilities

Training is important and it is the only method to transfer to the contractor the knowledge to install, maintain and repair RACHP systems containing alternative refrigerants considering both the technical and safety issues.

Additional training may be required to achieve the mandatory certification. Training should be both theoretical and practical.

For the training facilities AREA suggests that test rigs, equipment and components related to each alternative refrigerant are recommended to simulate best practices. Please refer to the Appendix for more details.

Access requirements: the candidate should have attended Basic Refrigeration Training (ex. F-Gas minimum requirements training).

## Minimum requirements for certification and certification schemes

AREA suggests that certification should be made mandatory.

<sup>2</sup> It should be noted that CO<sub>2</sub> has been categorised “very poor” in terms of pressure because the RAC industry will need to learn to cope with using a fluid at 120 bar, which is much higher than the current peak pressures of around 20 bar. However, the high pressure does deliver some desirable characteristics such as smaller pipe diameters and less compressor swept volume.

Each candidate who wants to handle alternative refrigerants should hold a certificate which that proves knowledge of the requirements of 303/08 and should take part in an assessment specifically for the alternative refrigerant he wants to handle.

The table below lists the minimum competences which the candidate should have to obtain the certification specific to each alternative refrigerant.

Minimum Requirements listed for the specific module HC – NH<sub>3</sub> – CO<sub>2</sub> – HFO\*

	HC	NH <sub>3</sub>	CO <sub>2</sub>
<b>BASIC THERMODYNAMICS AND PHYSICS</b>			
Thermodynamic properties of low GWP refrigerant: temperature, pressure, density, thermal capacity, p/h diagram	T	T	T
Differences between low GWP refrigerants and HFCs	T	T	T
Toxicity characteristics, grades and limits for the human body	-----	T	T
Characteristic of flammability of the substances, velocity of propagation, LFL, UFL, occupancy	T	T	-----
Specific components for that refrigerant in the refrigeration cycle	T	T	T
Material compatibility	-----	T	T <sup>3</sup>
Oil compatibility, requirements and oil return	T	T	T
<b>REGULATIONS AND STANDARDS</b>			
Knowledge of European and national regulations and standards	T	T	T
Storage of the refrigerant	T	T	T
Transport of the refrigerant	T	T	T
Describe the process for handing over system to customer, completing and passing on appropriate commissioning documentation <sup>6</sup>	P	P	P
<b>GOOD PRACTICE<sup>4</sup></b>			
Identify typical application of low GWP refrigerant RAC systems <sup>6</sup> (refer to AREA: <a href="#">Low GWP Refrigerants Guidance</a> )	P	P	P
State and identify the commonly used refrigerants' designation <sup>5</sup>	P	P	P
State the requirements for safely labelling low GWP refrigerant RAC systems <sup>6</sup>	P	P	P
Select appropriate tools, equipment and PPE for work on low GWP RAC systems <sup>6</sup>	P	P	P
Recovery of the refrigerant	P	P <sup>6</sup>	P <sup>7</sup>
Venting the refrigerant in a safe way (according to national legislation)	P	P	P
Calculate the safe fill weight for the recovery cylinder (density difference between HFCs and low GWP refrigerants) <sup>6</sup>	P	P	P
Leak check direct assessment with the correct equipment	P	P	P
Make vacuum of the refrigerant preventing moisture in the system and without refrigerant emissions	P	P	P
Make charge of the refrigerant with no emission relief	P	P	P
Make a connection without brazing with alternative connections	P	P	P
Check the correct functioning of the safety ventilation system		P	P

<sup>3</sup> For high pressures

<sup>4</sup> All practical trainings should include theoretical training

<sup>5</sup> City and Guilds, Level 2 and Level 3 Refrigeration and Air Conditioning CPD Pathways, March 2012 v1.0

<sup>6</sup> It is normally accepted to vent hydrocarbons with low charges (please refer to national legislation)

<sup>7</sup> It is normally accepted to vent CO<sub>2</sub> (please refer to national legislation)

Check the correct functioning of the safety system controls	P	P	P
<b>HEALTH AND SAFETY REQUIREMENTS</b>			
Safe system shutdown and isolation <sup>6</sup>	P	P	P
Extinguish a fire, identify the appropriate fire extinguisher	P	P	-----
First aid treatment for frostbite	P	P	P
First aid treatment for fire burn	P	P	-----
First aid treatment for suffocation due to breathing problems	-----	P	P
Safety issues related to high pressures	-----	-----	P
Calculate LFL (confined space)	T	T	-----
Calculate confined space risk for asphyxiation (heavier than air)	-----	-----	T
Check that Health and Safety rules in the refrigeration system location are respected (emergency exits, fire alarms, leak detectors...)	T	T	T
Correct use of Personal Protective Equipment	P	P	P

T= theoretical / P= practical

*\*HFO1234yf: same minimum requirements as Hydrocarbons*

*\*HFO1234ze: same minimum requirements as HFCs*

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## **About AREA**

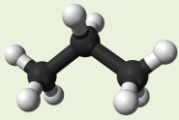
AREA ([www.area-eur.be](http://www.area-eur.be)) is the European organisation of refrigeration, air-conditioning and heat pump (RACHP) contractors. Established in 1988, AREA voices the interests of 21 national members from 19 European countries, representing more than 9,000 companies across Europe (mainly small to medium sized enterprises), employing some 125,000 people and with an annual turnover approaching €20 billion.

AREA members are the designers of RACHP systems, which they also install, service and maintain. For this purpose, RACHP contractors use every available solution with complete neutrality towards equipment and refrigerants, with the sole aim of ensuring the highest level of reliability, energy efficiency and cost-effectiveness.

## Annex I

### Training Recommendations

Following are the course details specific to each low GWP refrigerant; the duration of the training is left to the appreciation of each Member State.



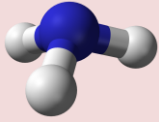
## Hydrocarbons

### **Course details**

- Thermodynamic characteristic of Hydrocarbons as refrigerant - p/h diagram
- Specific components for Hydrocarbons
- Electronic components suitable for flammable refrigerants
- Refrigeration and Air conditioning applications with HC
- Recovery or Venting Hydrocarbons
- Vacuum-Charging procedures
- Leak testing
- Mechanical/compression joint connections – avoid brazing
- Flammability and safety issues, first aid
- Conversion HCFC – HFC systems into HC
- National and European regulations and standards
- Transport and storage requirements
- Logbook

### **Necessary equipment and components (minimum)**

- Test Rig equipped with Pressure Gauges, sight glasses in key points, service valves for connections, temperature well - thermowell (Domestic/Commercial refrigerator or small packaged portable air conditioning unit)
- Mechanical/compression joint tool and connectors
- Nitrogen Regulator - Cylinder of High Purity Nitrogen
- Electronic Weighing Platform
- Hydrocarbon Cylinder
- Electronic or analogue Vacuum gauge
- Manifold set - Hoses with ball valves
- Vacuum Pumps and Hose
- Electronic Leak Detector (suit HC)
- Proprietary Leak Spray
- Temperature meter
- Ammeter
- Tools, Pipe Cutters, Pipe Deburring Tool, Pipework Expanders, Hacksaws, Brazing Rods
- Flaring Tool
- Personal protective equipment



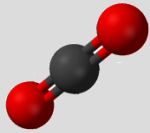
# Ammonia

## ***Course details***

- Thermodynamic characteristic of Ammonia as refrigerant - p/h diagram
- Specific components for Ammonia
- Compatibility with other materials, oil return and miscibility with water
- Refrigeration and Air conditioning applications with NH<sub>3</sub>
- Recovery of Ammonia
- Vacuum-Charging procedures
- Leak testing
- Flammability, Toxicity and safety issues, first aid
- National and European Regulations and standards
- Transport and storage requirements
- Logbook

## ***Necessary equipment and components (minimum)***

- Test Rig equipped with Pressure Gauges, sight glasses in key points, service valves for connections, temperature well - thermowell (industrial refrigerator)
- Nitrogen Regulator - Cylinder of High Purity Nitrogen
- Electronic Weighing Platform
- Ammonia Cylinder
- Electronic or analogue Vacuum gauge
- Manifold set - Hoses with ball valves
- Vacuum Pumps and Hose
- Recovery unit
- Electronic Leak Detector
- Proprietary Leak Spray
- Temperature meter
- Ammeter
- Tools
- Personal protective equipment



# Carbon Dioxide

## **Course details**

- Thermodynamic characteristic of carbon dioxide as refrigerant - p/h diagram
- Subcritical and Transcritical operations
- Specific components for carbon dioxide
- Refrigeration and Air conditioning applications with CO<sub>2</sub>
- Recovery or venting of CO<sub>2</sub>
- Vacuum-Charging procedures
- Leak testing
- High pressures and safety issues, first aid
- National and European Regulations and standards
- Transport and storage requirements
- Logbook

## **Necessary equipment and components (minimum)**

- Test Rig equipped with Pressure Gauges, sight glasses in key points, service valves for connections, temperature well - thermowell (Cascade System)
- Nitrogen Regulator - Cylinder of High Purity Nitrogen
- Electronic Weighing Platform
- CO<sub>2</sub> Cylinder
- Electronic or analogue Vacuum gauge
- Manifold set - Hoses with ball valves
- Vacuum Pumps and Hose
- Recovery unit
- Electronic Leak Detector (to suit CO<sub>2</sub>)
- Proprietary Leak Spray
- Temperature meter
- Ammeter
- Tools, Pipe Cutters, Pipe Deburring Tool, Pipework Expanders, Hacksaws, Brazing Rods
- Personal protective equipment

*HFO1234yf course and equipment details are as for Hydrocarbons*

*HFO1234ze course and equipment details are as for HFCs*



## ANNEX II

### Training facilities on low GWP refrigerants (in alphabetical order by country)

Disclaimer: The list is not exhaustive; any training facility wishing to be listed should send an email to [info@area-eur.be](mailto:info@area-eur.be). AREA is not liable for the service provided by the training facilities listed.

Country	Facility (name, city location, website)	Ammonia	HC	CO2	Other
<b>Belgium</b>	KHLim, Centrum Zuid 2413, 3530 Houthalen, <a href="http://www.khlim-inet.be">www.khlim-inet.be</a>	<b>X:</b> Cascade system NH <sub>3</sub> /CO <sub>2</sub>  LT: DX MT: pumped CO <sub>2</sub>	<b>X:</b> Small system (only Theory)	<b>X:</b> Supermarket Trancritical booster system  LT: DX MT: DX and pumped CO <sub>2</sub>	- HFC Basic and advanced Refrigeration Courses - Certification of personnel HFC - REAL Alternatives programme
	<b>both theoretical and practical training</b>				
<b>Czech Republic</b>	There are no official training facilities for low GWP refrigerants; if needed companies train their employees in-house				
<b>Denmark</b>	Den Jydske Haandværkerskole, Ellemosevej 25, DK-8370 Hadsten. <a href="http://www.djhhadsten.dk">www.djhhadsten.dk</a>	<b>X</b>	<b>X</b>	<b>X</b>	
	Danish Technological Institute, Teknologiparken, Kongsvang Allé 29, DK-8000 Aarhus C <a href="http://www.dti.dk/services/">http://www.dti.dk/services/</a>	<b>X</b>	<b>X</b>	<b>X</b>	
	Maskinmesterskolen København, Akademivej, Bygning 358, DK-2800 Kongens Lyngby <a href="http://www.kme.dk">www.kme.dk</a>	<b>X</b>	<b>X</b>	<b>X</b>	
	<b>all provide both theoretical and practical training</b>				
<b>Finland</b>	Edupoli, Vantaa, Finland <a href="http://www.edupoli.fi">www.edupoli.fi</a>		<b>X</b>		(propane < 150 g)
	Koulutuskeskus Salpaus, Lahti, Finland <a href="http://www.salpaus.fi">www.salpaus.fi</a>			<b>X</b>	
	<b>Both are practical but there is some theory included. Almost all other training centres in Finland have some theoretical lectures concerning alternatives – and because of the new F-gas regulation they are obliged to do so at the latest by the start of 2015.</b>				
<b>France</b>	Institut Français du Froid Industriel (IFFI) - Paris <a href="http://iffi.cnam.fr/">http://iffi.cnam.fr/</a> <b>both theoretical and practical training</b>	<b>X</b>	<b>X</b>	<b>X</b>	
	Centre des formations Industrielles (CFI) – Orly <a href="http://www.cfi-formations.fr/">http://www.cfi-formations.fr/</a>	<b>X</b>	<b>X</b>	<b>X</b>	

	COPROTEC – Colmar <a href="http://www.coprotec-elearning.com/">http://www.coprotec-elearning.com/</a> theoretical training	X		X	
	Cemafruid - Fresnes <a href="http://www.cemafruid.fr">www.cemafruid.fr</a> both theoretical and practical training	X			
	PROFROID - Aubagne <a href="http://www.profruid.com/profruid/cms/7225-7674/site-d-aubagne.dhtml">http://www.profruid.com/profruid/cms/7225-7674/site-d-aubagne.dhtml</a> both theoretical and practical training			X	
	Cofely AXIMA / GDF-Suez <a href="http://www.cofelyaxima-gdfsuez.com/">http://www.cofelyaxima-gdfsuez.com/</a> both theoretical and practical training	X		X	
	AFPA - Agen/Montauban/Alençon/Metz <a href="http://www.afpa.fr">www.afpa.fr</a> both theoretical and practical training	X		X	
	MATAL FORMATION - Nantes <a href="http://www.matal-formation.fr/">http://www.matal-formation.fr/</a> both theoretical and practical training	X		X	
	AF Consulting - Lyon both theoretical and practical training	X		X	
	CFTRN-Johnson Control - Nantes <a href="http://www.johnsoncontrols.fr/content/fr/fr/products/building_efficiency/nos-solutions/formation/training-center.html">http://www.johnsoncontrols.fr/content/fr/fr/products/building_efficiency/nos-solutions/formation/training-center.html</a> both theoretical and practical training	X		X	
	Lycée Maximilien Perret - Alfortville theoretical training	X	X	X	
	Université Marne la vallée theoretical training	X	X	X	
	Université Grenoble theoretical training	X	X	X	
	Lycée Mermoz - Montpellier theoretical training	X	X	X	
	Lycée La Martinière - Lyon theoretical training	X	X	X	
	Lycée Branly - Boulogne theoretical training	X	X	X	
	INSA - Lyon <a href="http://www.insa-lyon.fr/">http://www.insa-lyon.fr/</a> theoretical training	X	X	X	
	Lycée La Providence - Amiens theoretical training	X	X	X	
	Lycée la Fontaine des eaux - Dinan		X	X	
	Lycée d'Alzon - Nîmes theoretical training	X	X	X	
	Lycée CANTAU - Anglet theoretical training	X	X	X	
	COSTIC - Saint Rémy Les Chevreuses <a href="http://www.costic.com/">http://www.costic.com/</a> theoretical training	X		X	
	Université Rouen		X	X	
	LEZIN-FORMATION - Montauban theoretical training			X	
	Lycée Raspail - Paris both theoretical and practical training			X	
	Lycée Saint Joseph - Troyes both theoretical and practical training			X	
	GEFEN - Alfortville <a href="http://www.gefen.org/">http://www.gefen.org/</a> theoretical training	X	X	X	

	DANFOSS formation à distance <b>theoretical training</b>			X	
	Ecole des Mines - Paris <a href="http://www.mines-paristech.fr/">http://www.mines-paristech.fr/</a> <b>theoretical training</b>			X	
	AFP - Paris <a href="http://www.afp-formation.fr/">http://www.afp-formation.fr/</a> <b>theoretical training</b>			X	
	CIAT - Lyon <a href="http://www.ciat.fr/">http://www.ciat.fr/</a> <b>both theoretical and practical training</b>			X	
<b>Germany</b>	Ausbildungszentrum Innung der Feinwerktechnik Mittelfranken, Zweigstraße 11-13, 90439 Nürnberg <a href="http://www.innung-feinwerktechnik-mfr.de">www.innung-feinwerktechnik-mfr.de</a>	X	X	X	
	Bundesfachschule Kälte-Klima-Technik, Bruno-Dressler-Straße 14, 63477 Maintal <a href="http://www.bfs-kaelte-klima.de">www.bfs-kaelte-klima.de</a>	X	X	X	
	Bundesfachschule Kälte-Klima-Technik, Steinstraße 19, 63477 Harztor/Niedersachswerfen <a href="http://www.bfs-kaelte-klima.de">www.bfs-kaelte-klima.de</a>	X	X	X	
	IKKE gGmbH Informationszentrum für Kälte-, Klima- und Energietechnik Kruppstraße 184, 47229 Duisburg-Rheinhausen <a href="http://www.i-k-k-e.com">www.i-k-k-e.com</a>	X	X	X	
	Fachschule für Kälte- und Klimatechnik München, Bruckmannring 40, 85764 Oberschleißheim <a href="http://www.hamec.de">www.hamec.de</a>	X	X	X	
	Norddeutsche Kälte-Fachschule, Philipp-Reis-Straße 13, 31832 Springe <a href="http://www.nkf-springe.de">www.nkf-springe.de</a>	X	X	X	
	Sächsische Kältefachschule, Rathenaustraße 12, 08468 Reichenbach/Vogtland <a href="http://www.kaelteschule-sachsen.de">www.kaelteschule-sachsen.de</a>	X	X	X	
	TWK Test- und Weiterbildungszentrum Wärepumpen und Kältetechnik GmbH Floridastraße 1, 76149 Karlsruhe <a href="http://www.twk-karlsruhe.de">www.twk-karlsruhe.de</a>	X	X	X	
	Kältetechniklehrgänge Bremerhaven, Deichstraße 15, 27628 Sandstedt <a href="http://www.kaeltelehrgaenge-brhv.de">www.kaeltelehrgaenge-brhv.de</a>	X	X	X	
	<b>both theoretical and practical training</b>				
<b>Ireland</b>	CIT Cork <a href="http://www.cit.ie">www.cit.ie</a>	X			This facility has an Ammonia pumped training system filled with R507 for safety reasons
	DIT Dublin <a href="http://www.dit.ie">www.dit.ie</a>		X		
	SERC Lisburn <a href="http://www.serc.ac.uk">www.serc.ac.uk</a>	X			
<b>Italy</b>	CENTRO STUDI GALILEO - CASALE M.TO (AL) - <a href="http://www.centrogalileo.it">www.centrogalileo.it</a> Also in-house training courses for companies	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO – MILAN (N. 2 locations) at CENTRO PIAMARTA and at ANGELANTONI INDUSTRIES- <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO –BRUGINE (PADUA) at CAREL INDUSTRIES and PADUA at Consiglio Nazionale delle Ricerche of Padova - <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC

	CENTRO STUDI GALILEO – ROME (n.2 locations) “La Sapienza University” and RECIR - <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO - AGLIANA (TUSCANY) - <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO - BOLOGNA - <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO - PALERMO at UNIV. of PALERMO - <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO – NAPLES – <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO – BARI – <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO – VALLERMOSA (CA) SARDINIA – <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO STUDI GALILEO also organises in-house training courses for companies - <a href="http://www.centrogalileo.it">www.centrogalileo.it</a>	X	X	X	HFC Basic and advanced Refrigeration Courses Certification of personnel HFC
	CENTRO SERVIZI per IMPIANTISTI e MANUTENTORI srl – PADOVA (our technical training centre) <a href="http://www.centroserviziimpiantisti.it">www.centroserviziimpiantisti.it</a>	X	X	X	HFC Course & Assessment Body FGAS
	CENTRO SERVIZI per IMPIANTISTI e MANUTENTORI srl – PAVIA (our technical training centre) <a href="http://www.centroserviziimpiantisti.it">www.centroserviziimpiantisti.it</a>	X	X	X	HFC Course & Assessment Body FGAS
	CENTRO SERVIZI per IMPIANTISTI e MANUTENTORI srl – MODENA (our technical training centre) <a href="http://www.centroserviziimpiantisti.it">www.centroserviziimpiantisti.it</a>	X	X	X	HFC Course & Assessment Body FGAS
	CENTRO SERVIZI per IMPIANTISTI e MANUTENTORI srl – FIRENZE (our technical training centre) <a href="http://www.centroserviziimpiantisti.it">www.centroserviziimpiantisti.it</a>	X	X	X	HFC Course & Assessment Body FGAS
	CENTRO SERVIZI per IMPIANTISTI e MANUTENTORI srl – ROMA (technical training centre – at ELIS institute) <a href="http://www.centroserviziimpiantisti.it">www.centroserviziimpiantisti.it</a>	X	X	X	HFC Course & Assessment Body FGAS
	CENTRO SERVIZI per IMPIANTISTI e MANUTENTORI srl – with our training centre & mobile examination in many cities <a href="http://www.centroserviziimpiantisti.it">www.centroserviziimpiantisti.it</a>	X	X	X	HFC Course & Assessment Body FGAS
	<b>both theoretical and practical training</b>				

<b>Netherlands</b>	Education centre GO°, Zandlaan 27, Ede, <a href="http://www.opleidingscentrum-go.nl">http://www.opleidingscentrum-go.nl</a>	X	X	X	
	both theoretical and practical training				
<b>Norway</b>	Trondheim Fagskole, Trondheim, <a href="http://www.ladejarlen.vgs.no/Fagskolen/Fagtilbud/Kulde--og-Varmepumpeteknikk-/">http://www.ladejarlen.vgs.no/Fagskolen/Fagtilbud/Kulde--og-Varmepumpeteknikk-/</a>	X		X	
	Færder vgs, Tønsberg (established autumn 2014)			X	
<b>Poland</b>	Masta, Gdańsk, <a href="http://www.masta.com.pl">www.masta.com.pl</a>	X	X	X	
	Metalko, Bydgoszcz, <a href="http://www.metalko.com.pl">www.metalko.com.pl</a>	X		X	
	Instytut Biotechnologii Przemysłu Rolno-Spożywczego w Warszawie ODDZIAŁ CHŁODNICTWA I JAKOŚCI ŻYWNOSCI, Łódź, <a href="http://www.ibprs.pl">www.ibprs.pl</a>	X	X	X	
<b>Slovakia</b>	SZ CHKT, Rovinka, <a href="http://www.szchkt.org">www.szchkt.org</a>	X*	X*	X*	F gases
	SOST, Zlate Moravce, <a href="http://www.sostzm.edu.sk">www.sostzm.edu.sk</a>				F gases
	*Training on refrigerants Ammonia, HC, CO2 based on safety and health protection is organised in cooperation with organisations carrying out inspections on safety and health protection, eg TÜV, Technical Inspection. Specific courses on cooling circuits with refrigerants Ammonia, HC, CO2 are in preparation.				
<b>Spain</b>	“Installation Design with ammonia” (20 hours) Spanish Refrigeration Technologies Association, AEFYT, Madrid <a href="http://www.aefyt.com/?page_id=1706">http://www.aefyt.com/?page_id=1706</a>	X			
	“Installations with CO2 Design” CO2 (16 hours) Spanish Refrigeration Technologies Association, AEFYT, Madrid <a href="http://www.aefyt.com/?page_id=1706">http://www.aefyt.com/?page_id=1706</a>			X	
	“Ammonia Refrigeration installations” (8 hours) CNTA, Food Technology and Security National Centre, Navarra <a href="http://www.CNTA.es/formación">www.CNTA.es/formación</a>	X			
	“Installations with ammonia Design and Calculation” Industrial Refrigeration and Climatisation Professional Distribution (DISCO GRUPO) Madrid <a href="http://www.grupodisco.com/intranet/uploads/noticias/Amoniaco13.pdf">http://www.grupodisco.com/intranet/uploads/noticias/Amoniaco13.pdf</a>	X			
	“Refrigeration installations with CO2 and R507” (30 hours) National Unemployment Spanish service, INEM, Moratalaz Education Center <a href="http://www.cursosinemmadrid.es/desempleados/instalaciones-frigorificas-co2">http://www.cursosinemmadrid.es/desempleados/instalaciones-frigorificas-co2</a>			X	

	<p>“Refrigeration Systems with CO2 subcritical” ( 45 hours)  Metal companies Federation of Valencia, FEMEVAL, Valencia  <a href="http://www.femeval.es/departamentos/formacion/comunicacion/enviosmasivos/3_formation_20131029_164710408_ffideli_0_1.html">http://www.femeval.es/departamentos/formacion/comunicacion/enviosmasivos/3_formation_20131029_164710408_ffideli_0_1.html</a>  <a href="http://www.femeval.es/asociaciones/aviclima/comunicacion/Paginas/Tuesday635174301485652104.aspx">http://www.femeval.es/asociaciones/aviclima/comunicacion/Paginas/Tuesday635174301485652104.aspx</a></p>			X	
	<p>“Refrigeration installations with CO2” (19 hours) Valencia  TEWIS <a href="http://www.tewis.com/newtewis/curso_co2.pdf">http://www.tewis.com/newtewis/curso_co2.pdf</a></p>			X	
	<p>“Refrigeration installations with CO2” Madrid DANFOSS  <a href="http://www.danfoss.com/Spain/BusinessAreas/Refrigeration+and+Air+Conditioning/TrainingProgram/CO2InstallationsTrainingProgram.htm">http://www.danfoss.com/Spain/BusinessAreas/Refrigeration+and+Air+Conditioning/TrainingProgram/CO2InstallationsTrainingProgram.htm</a></p>			X	
	All Spanish courses are theoretical. Some of them have practical cases studies, but in the classroom and not “in situ”.				
Sweden	<p>Installatörernas Utbildningscentrum, IUC (Installers training centre)  Kungsgatan 2A, 641 30 Katrineholm, Sweden  Located 100 km west of Stockholm, 1 hour by train  Brand new training facility opened in 2013. Classes in Swedish and English  <a href="http://www.iuc-utbildning.se">www.iuc-utbildning.se</a></p>	X One unit makes Stal Refrigeration		X 6 trans-critical units make Advansor	Ground source heat pumps, Advanced remote control system, Danfoss
	Royal Institute of Technology, KTH Stockholm <a href="http://www.kth.se">www.kth.se</a>	Theoretical		Theoretical and practical	
	Utbildning Nord, Övertorneå , <a href="http://www.utbnord.se">www.utbnord.se</a>			Theoretical and practical Green & Cool unit	
UK	Cool Concerns <a href="http://www.coolconcerns.co.uk/">http://www.coolconcerns.co.uk/</a>		X	X	
	Eastleigh College/DCI refrigeration <a href="http://www.dciarefrigeration.co.uk/CarbonDioxideCO2Training.htm">http://www.dciarefrigeration.co.uk/CarbonDioxideCO2Training.htm</a>			X	
	EPTA <a href="http://www.eptarefrigeration.com/sites/default/files/body_images/files/Flayer_CO2-Training-Centre_WEB.pdf">http://www.eptarefrigeration.com/sites/default/files/body_images/files/Flayer_CO2-Training-Centre_WEB.pdf</a>			X	
	Integral (use the former WR Refrigeration training facilities) <a href="http://energytraininghub.co.uk/courses/refrigeration-training-courses/">http://energytraininghub.co.uk/courses/refrigeration-training-courses/</a>			X	
	Business Edge Ltd Portsmouth <a href="http://www.businessedgeltd.co.uk">www.businessedgeltd.co.uk</a>		X	X (only theory)	HFO/ A2L
	Business Edge Ltd Milton Keynes <a href="http://www.businessedgeltd.co.uk">www.businessedgeltd.co.uk</a>		X	X (only theory)	HFO/ A2L
	both theoretical and practical training				