



## “Development of guideline and trainings for handling heat pumps containing refrigerants with higher flammability across Europe”

Nishant Karve<sup>a</sup>, Marcin Krupski<sup>b</sup>, Miranda Groot Zwaafink<sup>c</sup>, Marco Masini<sup>d</sup>

<sup>a</sup>Daikin Europe NV, Zandvoordestraat 300, Oostende 8400, Belgium

<sup>b</sup>European Heat Pump Association, Avenue de Cortenbergh 120, Brussels 1000, Belgium

<sup>c</sup>Nederlandse Vereniging van ondernemingen op het gebied van de Koudetechniek en Luchtbehandeling, Woerden, Netherlands

<sup>d</sup>Centro Servizi Impiantisti e Manutentori srl, Milano, Italy

---

### Abstract

As a result of the RePowerEU plan and the latest version of the F-gas regulation, more heat pumps containing refrigerants with higher flammability, such as R290, are being placed on the market. This leads to a need for improved and unified handling of such products during their lifecycle across Europe. Due to the currently fragmented and at times, incomplete, scenario about requirements for handling such heat pumps, a LIFE Project called SKILLSAFE EU, was initiated in July 2024 to prepare a unified guideline on handling such heat pumps during transportation, storage, installation, service, decommissioning and disposal and conduct pilot trainings to validate the same. The goal is to upskill professionals from the heat pump sector and reskill individuals from other sectors such as plumbers, electricians etc. in appropriately handling the heat pumps in scope. This study, therefore, will describe efforts already taken and ones planned over the course of the project to inform existing stakeholders and engage new ones. The project would, by May 2026, have hoped to achieve the publication of the first version of the mentioned guideline for air to water monoblock and split heat pumps for residential applications, conducted pilot trainings in multiple countries and performed on-site risk assessment studies. The results of these activities and future plans will be intended to be shared with the audience.

© HPC2026.

Selection and/or peer-review under the responsibility of the organizers of the 15<sup>th</sup> IEA Heat Pump Conference 2026.

*Keywords: Heat pumps; guideline; installers; manufacturers; flammability; trainings; safety; R-290; propane; refrigerants; PPE*

---

### 1. Introduction

The SKILLSAFE EU project was initiated with a high-level objective of increasing the adoption of heat pumps in Europe. This project has been partly funded by the LIFE Programme of the European Commission [1], a funding instrument aimed at supporting research initiatives within the European Union. In order to achieve the targets set by the RePower EU plan, a total of 60 million heat pumps would need to have been installed in Europe by 2030. However, with the trends observed over the past 2 years, the projections show only 45 million heat pumps might be installed by then. This increasing demand for heat pumps along with the changing landscape in refrigerants, with a switch to low-GWP refrigerants as a result of the F-gas regulation, has led to the adoption of refrigerants such as R-290, which has a higher flammability and poses a risk if not handled appropriately. Thus, to create an awareness among various stakeholders of society about the importance of safe handling and indirectly influencing the uptake of such heat pumps, SKILLSAFE EU was initiated with partners from Belgium, Italy and the Netherlands. The project involves three phases viz. development of a unified guideline with support from key players in the industry, pilot trainings to test the applicability of the guideline and on-site risk assessment templates to be integrated within the guideline. Besides these, the project also engages in various exhibitions, seminars/webinars and conferences to disseminate information and updates about the activities.

## 2. Approach

As the guideline was intended to be a unified document to be used by multiple stakeholders in the industry, a widespread participation of heat pump manufacturers and associations was necessary. This was brought about by the formation of the Joint Industry Expert Group (JIEG). A call for interest was distributed to members of relevant industry associations such as the European Heat Pump Association (EHPA), European Heating Industry (EHI) and APPLiA. After a kickoff meeting in August 2024, 55 participants registered for the JIEG.

The second phase in the SKILLSAFE EU project was intended to have pilot trainings conducted in various countries in the EU coordinated by the Dutch trade association NVKL. A pilot train-the-trainer session was held in September 2025, where the initial curriculum was tested among participants. The feedback from this pilot was used to improve the training content which will be used in future pilot trainings within the project. Pilots will be held in the Netherlands, Germany, Czech Republic, Italy, France, Austria by Q4 of 2026. Participating countries are expected to increase and be updated over the course of the project. Parallely, an on-site risk assessment study is also expected to be conducted by CSIM through simulations.

A similar JIEG was initiated within EHPA to work on a guideline extending the scope to air-to-air and air-to-water split systems. While the intention of the project was to address air-to-water monoblock units with highly flammable refrigerants, a guideline for the aforementioned product groups were initiated based on interest in the industry for the same. However, only outdoor installations and no indoor heat pumps have been included in the scope of the guideline. Thus, although they will not be addressed currently, they may be included in work building on the results of this project. The splits guideline is expected to be finalised by Q1 of 2026.

## 3. Results and Discussion

The document titled “Guideline on safe handling of self-contained air-to-water residential heat pumps with refrigerants with higher flammability installed outdoors in Europe” was published as a deliverable of the project in February, 2025 [2]. The chapters below briefly describe the content of the guideline.

### 3.1. Scope

The guideline was brought about as a consequence of fragmented requirements across product standards, safety standards and national/local legislation concerning handling of heat pumps. While standards provide instructions on the information manufacturers should provide to the different stakeholders handling heat pumps, important phases like transport and storage are not considered. The scope of the guideline was thus decided to address air-to-water monoblock systems using refrigerants with higher flammability throughout their lifecycle, from the factory to their disposal in a disposal facility. The application was maintained to be single family households to address the potential of a lower risk. The phases covered in the standard include installation location, qualification and certification, transport, storage, on-site handling of the unit, labelling and documentation and on-site risk assessment.

Since the focus of the guideline was products using R-290 as a refrigerant, the properties of the refrigerant such as classification according to ISO 817 [3] and Classification, Labelling and Packaging (CLP) of substances and mixtures (Global Harmonised System [GHS]) [4] was presented. While experienced Heating, Ventilation and Air-Conditioning (HVAC) technicians or installers are well versed with refrigerants and their properties, new installers may not be aware of the different categories of refrigerants and their associated risks. Especially, with regard to air-to-water self-contained (monoblock) heat pumps with R-290, plumbers have been expected to be largely involved in the installation process which was minimal in the past. This guideline, while helpful for all installers, was intended to serve as a single source of all information necessary for new entrants into the market of installing, servicing and disposing heat pumps with refrigerants with higher flammability.

### 3.2. Installation location

The installation location of such heat pumps has been discussed in reference to ignition sources, openings in the buildings and drains. While no numerical distances have been recommended, the guideline proposes the dimensions that should be provided by manufacturers in their instructions towards installers. This allows the manufacturers to provide instructions based on the design of their product and is not technologically prescriptive. Recommendations on installing heat pumps on the floor, mounted on walls or on rooftops have been covered in the document. Some examples of such dimensions are provided below in Figure 1, should manufacturers choose to provide so.

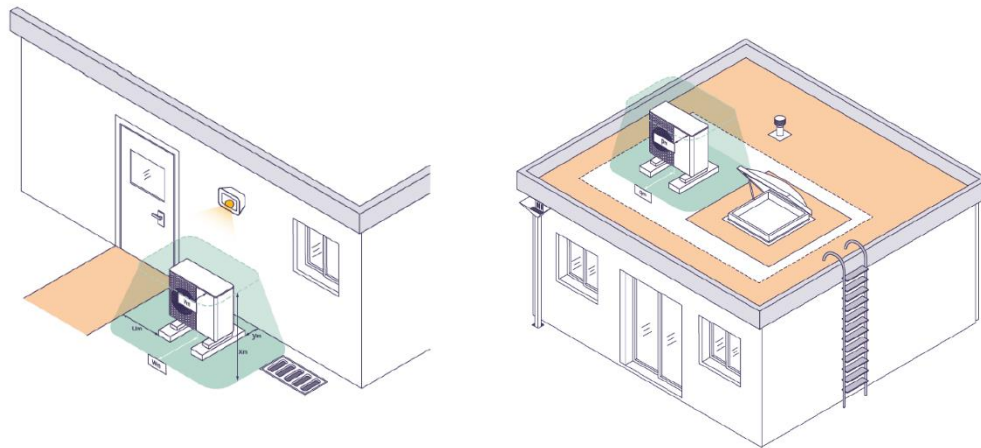


Figure 1. Installation location.

### 3.3. Qualification, certification and on-site handling

Based on the qualification and certification requirements in the F-gas regulation, recommendations on handling the unit on-site was divided into activities involving opening the refrigerant circuit or not. Activities such as installation, inspection and commissioning of air-to-water monoblock heat pumps normally do not require the opening of the refrigerant circuit and can thus be performed by installers without a certification for the same. For all tasks, the installers have been recommended to be in possession of a leak detector at all times to monitor leakage of refrigerant. In case of a leak, qualified persons without certification are recommended to step back and contact a certified person or a fire brigade. Figure 2 shows a recommended working zone for opening the refrigerant circuit.

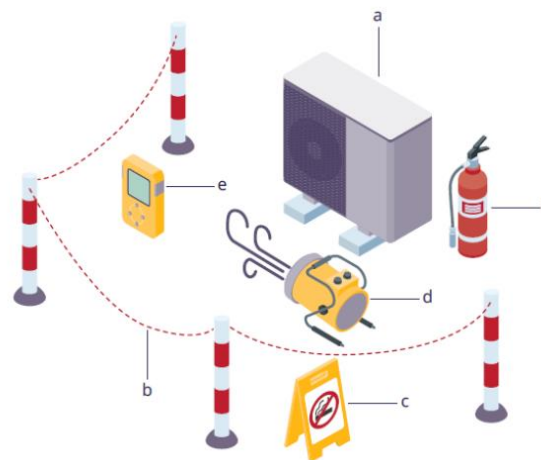


Figure 2. Working zone recommendations

A generic step-by-step procedure on recovering the refrigerant during service, repair or decommissioning, removal of refrigerant from the oil in the components, inert gas purging, cleaning, repairing or replacing

refrigerant components, handling removed components, testing tightness, charging refrigerant, has been discussed. The steps mentioned in the guideline were ensured to be non-product specific since every manufacturer includes specific instructions for their products in their manuals.

### 3.4. Transportation

Besides recommendations on labelling and documents to be provided, the guideline also provides information on safely transporting and storing units. The transportation requirements are focused on the vehicle used for transporting the unit and the measures the driver must take upon detecting a leak. Recommendations such as incorporating adequate ventilation at the top and lowest point of the van/vehicle and transporting charged units only in original packaging, have been stated in this section. Figure 3 shows examples of appropriately transporting units in vehicles.

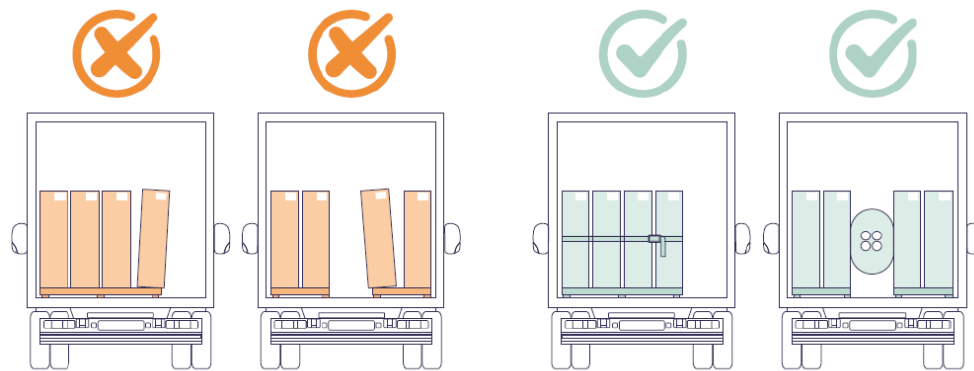


Figure 3. Example of recommendations for measures during transportation

It has also been emphasized that besides the instructions provided to the installers based on the manufacturer's risk assessment of the product, all parties involved in handling the heat pump must conduct their own risk assessment and share responsibility in managing risks. An on-site risk assessment checklist template has also been provided as an annex to the guideline to help installers through the process of handling the units easily. One of the objectives of the SKILLSAFE EU project is to develop an on-site risk assessment through a study and simulations, which will result in the checklist being updated at the end of the project. The annex further includes classification of refrigerants, examples of possible ignition sources and a list of examples of necessary Personal Protective Equipment (PPE), as shown in Figure 4 and tools and safety equipment. In addition to generic recommendations throughout the document, individual annexes of various countries within the EU were uploaded to the website along with the guideline for national/local requirements.

| Item                                                                                                                                                                                                                                                                                                  | Image                                                                                                                                                               |                                                                                                                                                                                                                                                                                                          |                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Personal Gas detector<br>Minimal detection of LEL + O <sub>2</sub>                                                                                                                                                                                                                                    |                                                                                    | Working Gloves<br>If only mechanical risk exists use work gloves according to EN388 and EN16530                                                                                                                                                                                                          |  |
| ESD Safety wristband for safe earthing (on outside of unit)                                                                                                                                                                                                                                           |   | Helmet in case of working in locations where debris can fall according to EN 50365                                                                                                                                                                                                                       |  |
| S3+ ESD working shoes according to EN ISO 20345:2022 and a resistance ranging between 0,1 MOhm and 100 MOhm according to ISO IEC 61340. (yellow ESD logo)                                                                                                                                             |   | Hearing Protection conform EN 352:2020                                                                                                                                                                                                                                                                   |  |
| Safety clothing in conformity with the provisions of PPE Regulation (EU) 2016/425 (Cat III) and satisfies the essential health and safety requirements set out in Annex II and the relevant harmonised standard(s):<br>EN ISO 11612 A1+A2, B1, C1, E3, F1<br>EN ISO 11611 Class 1 A1+A2<br>EN 1149 -5 |   | Fall protection                                                                                                                                                                                                                                                                                          |  |
| Non-Brazing Safety Glasses<br>DIN 166 minimal 2C - 1,2 for non-brazing                                                                                                                                                                                                                                |                                                                                    | Brazing Safety Glasses<br>DIN 166 + DIN 169 1.7 minimal for brazing                                                                                                                                                                                                                                      |  |
|                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                     | Working Gloves<br>Use when filling or draining refrigerant and during work involving pipes are opened in which refrigerant may be present Viton (viton-butyl) gloves as protection against the risk of frostbite and also against chemical risks, in accordance with EN 374:2016 and if possible EN16530 |  |

Figure 4. Examples of PPE

### 3.5. Training

Based on the instructions in the guideline, trainings have been prepared to guide not just experienced, but more importantly, newer installers in safely handling heat pumps with highly flammable refrigerants. The training has been developed to first provide information on basic safety training, covering the following:

- Explanation of highly flammable refrigerants.
- Identification of risk zones.
- Proper use of Personal Protective Equipment (PPE).
- Safety tools and procedures
- Risk assessment

While providing specific hands-on training relies on the manufacturer's instructions for its product and these can differ, it is the intention to provide as much practical experience as possible to the installer. Besides general information on the refrigerant, information on using the appropriate PPE and safety tools will also be provided. An example of information on using the personal gas detector and leak detector in relation to the flammability of the refrigerant has been shown below.

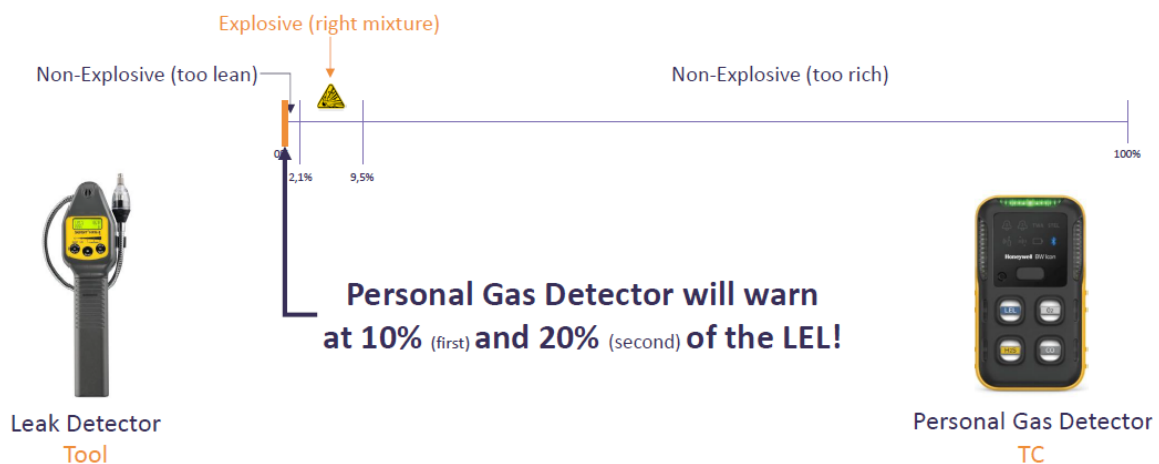


Figure 5. Principle of Personal Gas Detector/Leak Detector

The above example also highlights the differences between a personal gas detector and a leak detector. Following the safety training, the test group will move on to hands-on training with the guideline, focusing on the section on-site handling of the unit.

#### *3.5.1. Observations and checklists*

Installers will follow the guideline and document their actions in real-time. Key steps in the installation process will be verified using predefined checklists. Observers will assess compliance with the guideline, noting any difficulties, ambiguities, or areas requiring further clarification. The feedback will be collected through structured observation forms ensuring consistency in data collection.

#### *3.5.2. Surveys/Interviews*

Structured interviews and surveys will be conducted with installers post-test to gather detailed qualitative feedback. Participants will be asked about their experience using the guideline, any challenges encountered, and suggested improvements.

### **4. Conclusion**

The participation in the SKILLSAFE EU project, especially in the development of the guideline, shows the need of such a document in the rapidly evolving heat pump industry. The scope, as a result of the F-gas regulation and the trends, has proved to be crucial and attracted heavy participation from manufacturers, industry associations, national associations and installer associations. Through discussions within the JIEG, the guideline was published in February 2025. Through participation of individuals and national associations from various countries, national annexes including national and local requirements were also prepared for reference. Increased interest for the trainings that are expected to be conducted using the guideline as a reference will also help in validating the guideline in the field. This feedback can then be used to update the document in Q1 of 2027 along with results from the risk assessment studies conducted parallelly.

### **Acknowledgements**

The project consortium would like to acknowledge the support of the LIFE Programme of the EU for co-funding the project. Members of the JIEG and the trainings also deserve appreciation for their active participation and finalizing the guideline.

### **References**

- [1] European Climate, Infrastructure and Environment Executive Agency – LIFE Programme. [https://cinea.ec.europa.eu/programmes/life\\_en](https://cinea.ec.europa.eu/programmes/life_en).
- [2] Guideline on safe handling of self-contained air-to-water residential heat pumps with refrigerants with higher flammability installed outdoors in Europe - [https://skillsafe-eu.ehpa.org/wp-content/uploads/2025/05/SKILLSAFE-EU-Guideline-V1\\_compressed.pdf](https://skillsafe-eu.ehpa.org/wp-content/uploads/2025/05/SKILLSAFE-EU-Guideline-V1_compressed.pdf)
- [3] ISO 817. *Refrigerants- Designation and safety classification* 2024.
- [4] CLP Regulation - Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures