



Why set up national legislation on labelling refrigerant cylinders?

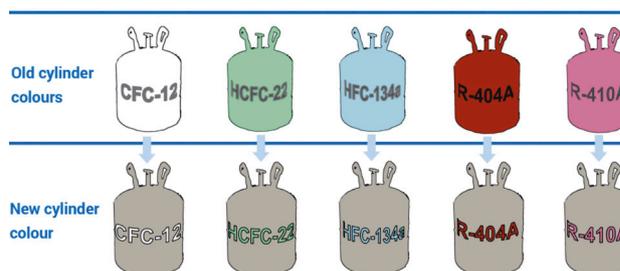
The Montreal Protocol on Substance that Deplete the Ozone Layer is phasing out ozone-depleting hydrochlorofluorocarbons (HCFCs) and has begun phasing down high global warming hydrofluorocarbons (HFCs) that are mainly used as refrigerants. Gradually, these controlled substances are being replaced by ozone- and climate-friendly refrigerants, some of which are flammable, toxic or operate at high pressures. Refrigerants are contained in different types of cylinders such as small cans or ISO containers, transport or recovery cylinders, refillable or non-refillable cylinders etc.

Labelling of refrigerant cylinders is needed to provide information about the cylinders and their contents, to allow easy identification of refrigerants and to ensure their safe and proper handling. Such information is relevant for importers, wholesalers, distributors, service companies / end-users and enforcement authorities throughout the life cycle of the cylinders and the refrigerants, e.g. during production, transport, trade, storage, use, recovery / recycling / reclaim and disposal. Labelling of refrigerant cylinders also facilitates the monitoring of trade, maintaining trade statistics and reporting the consumption of controlled substances as required under Article 7 of the Montreal Protocol.

Labels contain written and usually also graphic information. They can be affixed to, printed on, engraved on or glued to the cylinders and their packaging. Legislation on the labelling of refrigerant cylinders should provide the specific wording of the information and the layout of pictograms to ensure the safety of the cylinders and the durability of the labels.

Countries allowing the import or placing on the market of refrigerant cylinders without labelling, with incomplete or with misleading labelling might not be able to ensure the health and safety of users. They might also face challenges in monitoring and controlling trade in controlled substances as required by the Montreal Protocol.

Labelling is becoming even more important with the increasing number of new refrigerants and blends, which led to the discontinuation of the AHRI system of cylinder colours¹. As a result of this, labelling has become the principal identification method for refrigerant cylinders and their contents.



Discontinued AHRI colour system for refrigerant cylinders

UNEP OzonAction's publication "**Legislative and policy options for HFCs**"² recommends mandatory labelling of refrigerant cylinders to be implemented prior to the freeze of the HFC consumption at the baseline level. For most developing countries (i.e. those in Article 5 group 1), the HFC freeze will start on 1 January 2024.

This technical brief encourages Governments and National Ozone Officers to establish or amend national legislation requiring mandatory labelling of refrigerant cylinders and explains what information should be included in refrigerant cylinder labelling.



Grey refrigerant cylinders without labelling

Labelling contributes to safe transport, storage, handling and use of refrigerants

Refrigerants are subject to regulations on chemicals. Labelling of chemicals informs of the hazards, safety precautions, storage conditions and emergency responses associated with their transport, storage, handling and use. Ignoring these instructions might cause harmful effects on people and the environment. The content of the labels depends on the classification of the chemicals based on their physical and chemical properties, the risk of health hazards as well as transport and handling requirements. For refrigerant cylinders, the labels should provide safety advice, indicate the names of the refrigerants they contain and their environmental properties, and inform about the technical parameters of the cylinders.

When establishing national legislation on labelling, Governments might draw on

international guidance documents such as the "**UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)**"³ and the "**UN Recommendations on the Transport of Dangerous Goods Model Regulations (TDG)**"⁴. The UN Economic Commission for Europe's website provides comprehensive information on these guidance documents and an overview of national legislation based on them.⁵

These guidance documents define the labelling elements in accordance with the classification of the refrigerants. The globally harmonized system classifies chemicals by hazard types and assigns relevant signal words, pictograms, hazard and precautionary statements to be included on labels and in the Safety Data Sheets. Commonly traded refrigerants are classified as **pressurized gases (compressed, liquefied, refrigerated liquefied gases), flammable gases or toxic gases** and require a labelling that reflect their classification.

Concerning the transport of refrigerant cylinders, labelling should be based on the classification of the refrigerants and the means of transport. This can be achieved through the implementation of the "**Recommendations on the Transport of Dangerous Goods**" and separate international legal instruments depending on the means of transport (e.g. road, rail, air, maritime transport or on inland waterways). These include, for example:

- ▶ International Maritime Dangerous Goods Code (IMDG Code)
- ▶ International Civil Aviation Organisation Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO TI)
- ▶ European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)
- ▶ Regulations concerning the International Transport of Dangerous Goods by Rail (RID)
- ▶ European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN).

Under these regulations, refrigerants are classified as “**Class 2 dangerous goods**” with three sub-divisions “**2.1: Flammable gases**”, “**2.2: Non-flammable and non-toxic gases**”, or “**2.3: Toxic gases**”.



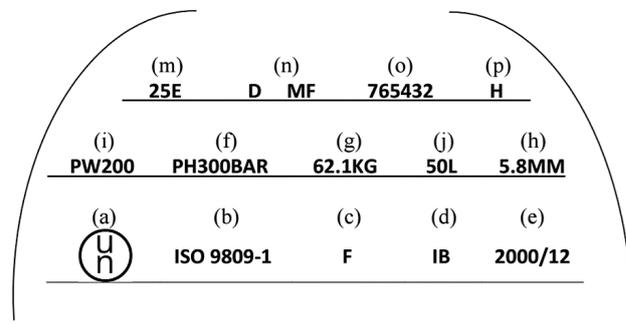
Labelling of cylinders containing HFC-227ea, a controlled chemical used as fire suppressant, foam blowing agent and increasingly in new refrigerant blends to suppress the flammability of the other components, e.g. R-461 or R-470. This labelling provides information on the safety of transport like the UN number and dangerous goods label. It also includes the chemical name and safety warning as required by the legislation on chemicals.

The table on page 4 shows examples of classification and labelling according to the “**UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)**” and the “**European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)**” for **HFC-32**, **HCFC-22** and **ammonia**. Information required by the globally harmonized system and the transport regulations are reflected in the cylinder labelling. The table has an indicative character. The responsibility of classifying and communicating hazards lies with manufacturers, importers and distributors.

Labelling informs about properties of refrigerant cylinders

Refrigerants need cylinders that are appropriate to the chemical and physical properties of different gases, in particular in terms of maximum operating and test pressures for safe transport, storage and use. The “**UN Model Regulations on the Transport of Dangerous Goods**” provide packing instructions for various classes

of dangerous goods. The packaging instructions normally require the use of **UN performance-tested and certified packaging** that should be marked accordingly.

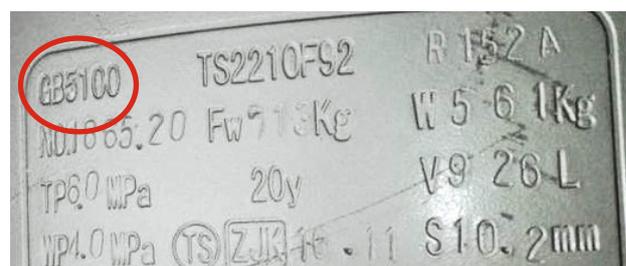


UN markings of pressure cylinders

UN markings for refillable pressurized cylinders include **manufacturing marks** at the top (m, n, o, p), **operational marks** in the middle (i, f, g, j, h) and **certification marks** on the bottom (a, b, c, d, e)⁶. Not all the markings are required at the same time and depend on the cylinder type and substance contained in the cylinder.

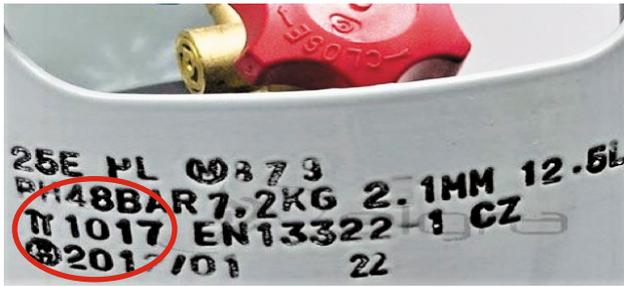
For non-refillable pressure cylinders, the same markings shall be applied except for g, h and m. The serial number (o) may be replaced by the batch number. In addition, the words “**DO NOT REFILL**” are required.

National legislation may require certification of pressurized cylinders in accordance with international or national standards. Some countries have national certification systems for pressurized gas cylinders. For example, the EU requires compliance of refrigerant cylinders with the “**Transportable Pressure Equipment Directive**”⁷ providing for the **π (Pi) marking**, the US with **DOT standards**⁸, and China with **GB standards**⁹.



Markings of a GB certified cylinder

GHS labelling					ADR labelling		
Six GHS labelling elements: 1) Product identifiers (of a substance or hazardous components in a mixture, i.e. CAS number, chemical name), 2) Hazard pictogram(s), 3) Signal word, 4) Hazard statements, 5) Precautionary statements and 6) Identity of the supplier (manufacturer or importer)					The labelling includes the relevant UN number and hazard class label.		
GHS classification	Hazard Pictograms there can be more than one pictogram for a given chemical	Signal words "DANGER" or "WARNING" if necessary	Hazard statements indicating the nature and degree of the risks	Precautionary statements indicating how the product should be handled to minimize risks to the user but also to other people and the environment	ADR classification	Hazard category	ADR label
HFC-32 (Difluoromethane, UN 3252)							
Flammable gas Cat. 1 Gases under pressure - liquefied gas	 	DANGER	H220: Extremely flammable gas H280: Contains gas under pressure; may explode if heated	P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely. P387: In case of leakage, eliminate all ignition sources. P403: Store in a well-ventilated place.	Class 2 Division 2.1: Flammable gases	Flammable gases	 Symbol flame: Black or white Background: red Figure '2' in bottom corner
HCFC-22 (Chlorodifluoromethane, UN 1018)							
Gases under pressure – liquefied gas	 	WARNING	H280: Contains gas under pressure; may explode if heated. H420: Harms public health and the environment by destroying ozone in the upper atmosphere.	P403: Store in a well-ventilated place. Other hazards: Contact with evaporating liquid may cause frostbite or freezing of skin. Dangerous for the ozone layer. Heat may cause the containers to explode.	Class 2 Division 2.2: Non-flammable, non-toxic gases	Non-flammable, non-toxic gases	 Symbol gas cylinder: Black or white Background: green Figure '2' in bottom corner
Ammonia (ammonia anhydrous, UN 1005)							
Flammable gases – Cat. 2 Gases under pressure - liquefied gas Acute toxicity (inhalation) – Cat. 4 Skin corrosion – Cat. 1 Serious eye damage – Cat. 1 Aquatic hazard (acute) – Cat. 1	   	DANGER	H280: Contains gas under pressure; may explode if heated. H221: Flammable gas. H331: Toxic if inhaled. H314: Causes severe skin burns and eye damage. H400: Very toxic to aquatic life.	P210: Keep away from heat/sparks/open flames/hot surfaces. No smoking. P280: Wear protective gloves/protective clothing/eye protection/face protection. P260: Do not breathe gas, vapours. P273: Avoid release to the environment. P377: Leaking gas fire: Do not extinguish, unless leak can be stopped safely. P381: Eliminate all ignition sources if safe to do so. (...)	Class 2 Division 2.3: Toxic gases	Toxic gases Corrosive substances	  Symbol (skull and crossbones): black Background: white Figure '2' in bottom corner Symbol (liquid, spilling from two glass vessels and attacking a hand and a metal): black Background: upper half white; lower half black with white border Figure '8' in bottom corner



Markings of a π (Pi) certified cylinder



Markings of a DOT certified ISO container

Labelling facilitates monitoring of trade in refrigerants

Setting up legislation on the labelling of refrigerant cylinders supports the Montreal Protocol objectives as it helps distinguish between controlled, exempted and non-controlled substances, facilitates the prevention of illegal trade, and provides an indication of the environmental properties of the controlled substances.

Some countries like the EU member states, Turkey and Bahrain have introduced labelling requirements for refrigerant cylinders. The EU member states and Turkey require specific information for controlled substances indicating either that they are “**hazardous to the ozone layer**” or “**contain fluorinated greenhouse gases**”. Where applicable, “**exempted uses**” must be indicated, e.g. whether the substance is reclaimed, recycled or destined for destruction, for use in military equipment, feedstock use, metered dose inhaler production, process agent use, essential laboratory or analytical use. For HFCs, including blends, also the **global warming potential (GWP)** and the **quantity in weight and CO₂ equivalent** must be indicated.

The following photo shows a cylinder containing R-143a intended for release onto the EU market without labelling. The cylinder lacked any certification markings that could have demonstrated its suitability for HFC-143a. The cardboard packaging provided information related to maritime transport of dangerous goods (see “IMO 2.1”).



R-143a refrigerant cylinder declared for release onto the EU market without labelling

In order to comply with the EU legislation, the labelling information related to safety of transport, safety of handling and storage, conformity of cylinder, and requirements of the F-gas legislation should have been displayed on the R-143a cylinder as shown in the table below.

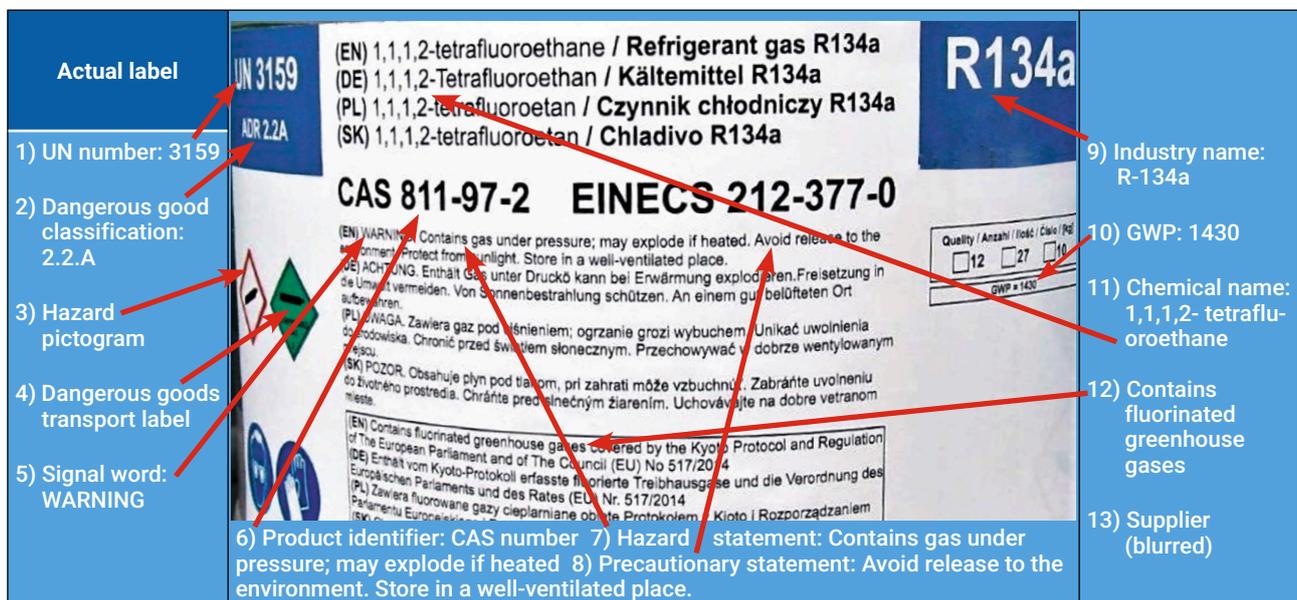
Safety of handling and storage (classification and hazard communication)	
Product identifier	1,1,1 trifluoroethane, R-143a and/or CAS 420-46-2
Hazard pictogram(s)	 
Signal word	DANGER
Hazard statements	H220: Extremely flammable gas. H280: Contains gas under pressure; may explode if heated.
Precautionary statements	P201: Keep away from heat, sparks, open flame, and hot surfaces. No smoking. P410: Protect from sunlight P403: Store in a well-ventilated place.
Supplier details	Supplier details

Safety of transport	
UN number	UN 2035
Dangerous goods classification	2.1
Relevant labels	
Conformity of cylinder (markings)	
Manufacturing, operational and certification marks	Cylinder-related markings Conformity marking, e.g. π (Pi)

F-gas regulation on controlled substances	
Industrial or chemical name	R-143a or 1,1,1 trifluoroethane
Contains fluorinated greenhouse gases	Contains fluorinated greenhouse gases
GWP	GWP 4470
Quantity in weight	12 kg
CO ₂ equivalent If relevant, the exempted use	53.64 CO ₂ -equivalent tonnes

The following photo shows the actual label of an HFC-134a cylinder declared for customs clearance to be released onto the EU market.

The text fields beside the photo explain the information contained in the label.



The image shows a photograph of an HFC-134a cylinder label with 13 numbered callouts pointing to various pieces of information:

- 1) UN number: 3159
- 2) Dangerous good classification: 2.2.A
- 3) Hazard pictogram
- 4) Dangerous goods transport label
- 5) Signal word: WARNING
- 6) Product identifier: CAS number
- 7) Hazard statement: Contains gas under pressure; may explode if heated
- 8) Precautionary statement: Avoid release to the environment. Store in a well-ventilated place.
- 9) Industry name: R-134a
- 10) GWP: 1430
- 11) Chemical name: 1,1,1,2-tetrafluoroethane
- 12) Contains fluorinated greenhouse gases
- 13) Supplier (blurred)

Actual label of an HFC-134a cylinder declared for customs clearance to be released onto the EU market

The label contains information as required by the provisions on **transport of dangerous goods**, the **“EU regulation on classification, labelling**

and packaging of substances and mixtures (CLP)”¹⁰ labelling requirements and the **EU F-gas legislation**:

Provisions on transport of dangerous goods	EU regulation on classification, labelling and packaging of substances and mixtures (CLP)	EU F-gas legislation
1) UN number: 3159	3) Hazard pictogram: Symbol of cylinder with red border	9) Accepted industry designation for F-gases: R-134a
2) Dangerous goods classification: 2.2.A	5) Signal word: WARNING	10) GWP: 1430
4) Dangerous goods transport label: Symbol of gas cylinder on green background	6) Product identifier: CAS number (811-97-2)	11) Chemical name: 1,1,1,2-tetrafluoroethane
	7) Hazard statement: Contains gas under pressure	12) Reference that it contains fluorinated greenhouse gases
	8) Precautionary statements: Avoid release to the environment. Store in a well-ventilated place	
	11) Hazardous components: 1,1,2-tetrafluoroethane	
	13) Supplier details (blurred)	

Information contained in the label of the HFC-134a cylinder

Concerning the EU requirements, the label lacks reference to the **quantity in weight and CO₂ equivalent**. The EU requires that the labelling should be in the **language of the member state of destination**, thus the cylinder could be placed on the market in Germany, Poland and Slovakia. The label contains reference to the Kyoto Protocol, which is not required by the EU legislation.

The same set of information would be required for such a cylinder by the Turkish legislation. It also requires that precautionary statements in the labelling are written in the national language.

As shown by the example above, even a detailed label might not meet all requirements. Label templates can assist industry to use compliant labelling and enforcement officers to verify conformity. The following label template was jointly drafted by Turkey's National Ozone Unit and industry. It is part of a brochure for customs officers on the requirements of the Turkish F-gas legislation. The template is used by some of the Turkish companies.

Marka / Ticari Logo Alanı	UN 3159 ADR Class: 2.2	1,1,1,2-TETRAFLUOROETHANE (R-134a)
<p>DİKKAT! Zararlılık H280 Basıncılı gaz içerir; ısıtıldığında patlayabilir.</p> <p>Önlem P410+P403 Güneş ışığından koruyun. İyi havalandırılmış bir alanda depolayın.</p> <p>Üreticinin önerilerini okuyun ve takip edin. Güvenlik Bilgi Formunun (SDS) 8.bölümündeki gösterilen şekilde koruyucu ekipmanlarını giyin. Deri ile temasında soğuk yanığına neden olabilir. Kullanmadan önce Bilgi Güvenlik Formunu (SDS) okuyun.</p> <p>Depolama Uyumsuz maddelerden uzak tutun. Güvenlik bilgi formundaki 10.bölüme bakınız. Sadece orijinal kabında muhafaza edin. Kabi sıkıca kapalı halde, serin ve iyi havalandırılan bir ortamda muhafaza edin. Kapları dik bir şekilde tutun. Kapları hasarlardan koruyun. Güneş ışığından koruyun. Isıdan, kıvılcım ve açık alevden uzak tutun. 45°C'yi aşmayan sıcaklıklarda muhafaza edin.</p> <p>Acil Sağlık Hizmetleri: 112 Ulusal Zehir Danışma Merkezi(UZEM): 114</p>	 <p>Florlu sera gazı içermektedir. Florlu sera gazlarına ilişkin yönetmelik 30291 kapsamındadır. Contains fluorinated greenhouse gases.</p>	<p>WARNING! Hazard H280- Contains gas under pressure ; may explode if heated</p> <p>Precautionary P410 + P403 Protect from sunlight. Store in a well-ventilated place</p> <p>Use personal protection recommended in Section 8. Avoid contact with skin, eyes or clothing.</p> <p>Contact with skin may cause cold burn. Please read the safety data sheet (SDS) before use.</p> <p>Storing Keep away from incompatible materials. See chapter 10 on the safety data sheet. Store only in the original container. Keep container tightly closed in a cool, well-ventilated place. Keep containers upright. Protect containers from damage. Protect from sunlight. Keep away from heat, sparks and open flames. Store at temperatures not exceeding 45 ° C.</p>
Üretici /Dağıtıcı Bilgisi	R-134a GWP/KIP: 1430 CO ₂ eq./Kg	CAS Nr. 811/97/2 EC Nr. 212-377-0

Label template jointly developed by Turkey's National Ozone Unit and industry

How to set up labelling requirements?

In general, labelling requirements regulate the following elements:

- 1) Compulsoriness:** Degree to which it is obligatory to provide information
- 2) Explicitness:** Degree of detail to which information must be presented
- 3) Standardisation:** Degree to which the information must be provided in a uniform format.

Compulsoriness of refrigerant cylinder labelling

Voluntary labelling allows producers, importers, distributors to decide what information, if any, will be displayed on the refrigerant cylinders and / or the packaging. **Mandatory labelling** requires that certain information must be displayed. Legislation needs to specify what is subject to mandatory labelling, the stage of the cylinder life cycle when mandatory labelling applies, and

sanctions for failure to comply with the labelling requirements.

Refrigerant cylinders are subject to labelling according to the legislation on chemicals and transport rules. Also, the packaging should be labelled according to the transport rules indicating UN numbers, proper shipping names¹¹, orientation arrows, hazard symbols, handling labels, etc.

Cylinders containing controlled substances might require additional labelling as per national legislation which should specify the type of cylinders to be labelled. In the EU, such requirements cover all “fluorinated greenhouse gases containers”.¹²

Controlled substances (such as ODS or HFCs) contained in products or equipment are not controlled under the Montreal Protocol, but countries may introduce provisions for products or equipment containing or relying on controlled substances, including labelling requirements. The EU and Turkey require the labelling of such products or equipment similar to that of bulk F-gases.

At which stage labelling might be checked?

Checking the compliance of labelling might be carried out on the market. Imported goods can also be inspected at the time of customs clearance, if customs authorities have relevant competencies. In the EU and in Turkey, they can check compliance of the cylinders as well as labelling related to the legislation on chemicals and the F-gas legislation.

Who should be responsible for ensuring compliance with the labelling requirements?

Refillable refrigerant cylinders can be used for different types of refrigerants and must provide necessary information about them during the life cycle (production, import, distribution / wholesale, servicing / end-use). Cylinder

manufacturers are best positioned to provide comprehensive and accurate information about their cylinders and know whether they comply with specific requirements. They are primarily responsible for providing conformity markings. Legislation might also impose certain obligations on importers and distributors, including obligations related to labelling. Their roles could be defined in the legislation on market surveillance, in the legislation on chemicals, or in the legislation for controlled substances. The possible roles of these stakeholders might be as follows:

- ▶ **Manufacturers of cylinders** destined for refrigerants ensure the compliance of cylinders under a chosen certification scheme and declare compliance through conformity markings on the cylinders, label the cylinders as suitable for particular refrigerants, and provides relevant conformity documentation.
- ▶ **Producers of refrigerants** ensure that refrigerants are filled into suitable cylinders that allow for safe storage, use and transport. If producers place refrigerants on the market they should provide relevant labelling.
- ▶ **Importers of refrigerants** ensure that the imported refrigerant cylinders are compliant under a certification scheme applicable in a given market and that cylinders are imported and labelled as required by the legislation on chemicals of the importing country. If specific labelling for controlled substances is required, the importer should meet these conditions as well.

There are also other stakeholders that perform operations such as recovery, recycling, reclaim or disposal / destruction of refrigerants. Such operations might require specific types of recovery or transport cylinders, and the national legislation should define the labelling requirements for these stages of the cylinder life cycles.

Explicitness of the information to be provided by the labelling

If refrigerants are already subject to legislation on chemicals, the labelling regulations for controlled substances should not duplicate such requirements. The legislation should specify the content of the labels. There may also be rules simplifying the content of the labels. For example, in the EU, there should not be more than six precautionary statements in the labelling of dangerous chemicals.

Standardisation of the labelling

The labelling requirements may specify to what extent the information should be provided in a uniform manner, i.e. using **specific wording**¹³, **language(s)** and **location**¹⁴ and **durable labels** to ensure that they are clearly readable, understandable and non-removable¹⁵. The EU and Turkey have specified durability requirements for labelling in their legislation on chemicals and that related to controlled substances, whereas Bahrain's durability requirements apply to all refrigerants. Generally, metal plates welded on the cylinder, engravings, and paint are considered indelible. Paper and glued labels do not meet these conditions.

Examples of labels with limited durability



Glued label (indicating "difluoromethane") on an ISO container



Glued paper and plastic labels



Glued paper label



Taped paper label on an ISO tank with an additional statement in Polish reading "Contains fluorinated greenhouse gases", which is a requirement of the EU F-gas legislation

Examples of more durable labels



Label fixed with metal rivets

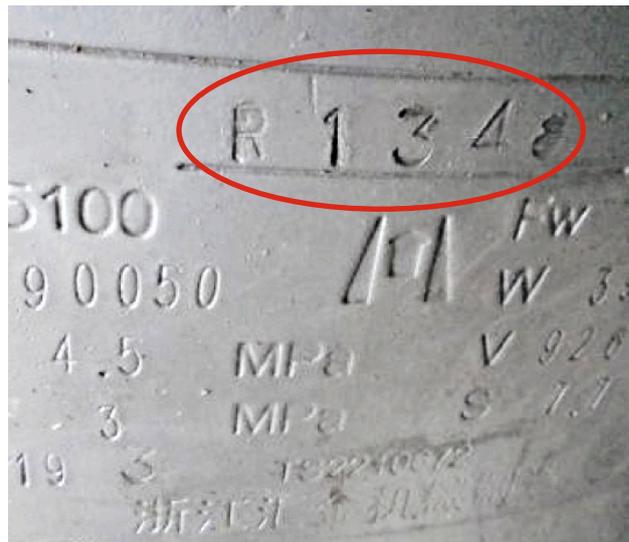


Painted label

Enforcement action related to refrigerant labelling

The following cases were detected by Polish Customs and show examples of non-compliance with the EU labelling requirements for HFC cylinders, posing risks related to the safety of transport and the use of refrigerant cylinders. Non-compliant labelling also undermined the goals of the EU F-gas legislation which requires labelling of HFCs to distinguish controlled substances, to inform on their environmental properties and to facilitate enforcement of the legislation. The existing EU and national legislation allowed taking enforcement measures.

Case 1: Non-compliant cylinders without labelling – refrigerant had to be filled into compliant cylinders with proper labelling



The lack of identification of the refrigerant on the cylinders posed risks for the safety of transport. As per the customs declaration, they contained HFC-125, whereas the cylinders were certified for HFC-134a. The cylinders did not comply with the directive on transportable pressure equipment and there was no documentation on multimodal transport that would allow the movement of non-compliant cylinders in the EU. The importer was required to fill the refrigerant into compliant cylinders that were labelled according to the EU F-gas legislation before they could enter the EU market.

Case 2: Non-compliant cylinder with ADR label only – the refrigerant had to be filled into compliant cylinders with proper labelling



The ADR label allowed for preliminary identification of safe transport requirements. The cylinders did not comply with the directive on transportable pressure equipment. In addition, there was no documentation on multimodal transport that would allow the movement of non-compliant cylinders in the EU. As per customs declaration, the cylinder contained HFC-134a but it was not labelled as required by the F-gas legislation. The importer was required to fill the refrigerant into compliant cylinders that were labelled according to the EU F-gas legislation before they could enter the EU market.

Case 3: Smuggled cylinders without labelling or mislabelled were sent back



Testing of the cylinders with a refrigerant identifier showed that the cylinder labelled "propane" actually contained HFC-134a, and the cylinder without labeling contained HFC-404A. Pursuant to the EU and national legislation, both cylinders were sent back to the country of dispatch.

Case 4: Refillable cylinders without labelling had to be properly labelled



As per the customs declaration, the green cylinders contained HFC-134a and the pink cylinders HFC-410A. Lack of labelling did not allow for the identification of the substances once the cylinders were taken out of the cardboard boxes. Before release for free circulation, the cylinders had to be labelled in compliance with the EU F-gas legislation and the legislation on chemicals.

Case 5: Smuggled non-refillable HFC cylinders were sent back or confiscated



The non-refillable cylinders were labelled HFC-404A and HFC-507, refrigerants controlled under the EU F-gas regulation and subject to import quota. As the EU prohibits customs clearance and placing on the market of non-refillable F-gas cylinders, which either contain or are designed for F-gases, the fact that they were non-refillable

cylinders with a F-gas labels was sufficient for customs to take enforcement measures. No testing was needed. The cylinder on the left had been smuggled and was sent back to the

country of dispatch. The bluish cylinders had been declared for release for free circulation and triggered a court case. The cylinders and refrigerants were confiscated by the State.

Conclusion

There are multiple benefits of mandatory labelling requirements for refrigerant cylinders related to identification, health, safety, environment protection, trade monitoring, enforcement, equipment operation and consumer protection.

As a starting point, interested Governments / National Ozone Officers could identify labelling requirements already applicable to chemicals in their countries, e.g. specific chemicals legislation on classification and labelling, and international legal instruments related to the transport of dangerous goods already signed. If not yet done, the implementation of such legal instruments might be considered.

Subsequently, the gaps in terms of labelling information to be provided on refrigerant cylinders should be analysed considering the international guidance documents such as the "UN Globally Harmonized System of Classification and Labelling of Chemicals" and the "UN Recommendations on the Transport of Dangerous Goods Model Regulations" and the specific national context.

National legislation might require certification of pressure cylinders in accordance with international or national standards. Examples of such national standards include the EU-wide system requiring the conformity π (Pi) marking,

the DOT standards in the US or the GB standards in China.

Additional labelling requirements supporting the implementation of the Montreal Protocol might be introduced in a new or revised environmental legislation, e.g. related to controlled ODS or F-gases. They might require information allowing the identification of controlled substances such as industrial or chemical names, specific wording such as "Contains ozone-depleting substances" or "Contains fluorinated greenhouse gases", environmental characteristics such as ODP or GWP, quantity in weight, CO₂ equivalent for HFCs, exempted uses, etc.

Competencies should be assigned to customs service, environmental inspectorate and other enforcement agencies and penalties be defined.

Relevant stakeholders such as importers, wholesalers, distributors, service companies / end-users and enforcement authorities should be aware of the labelling requirements. Stakeholder meetings, dedicated webpages of the government / national trade associations or a brochure like that produced in Turkey might be useful information tools. Generic labelling templates might be elaborated to facilitate compliant labelling by the industry and enforcement by the authorities.

Glossary

Carbon dioxide equivalent tonnes (CO₂-eq.t.):

Quantity that describes, for a given amount of greenhouse gas, the amount of carbon dioxide that would have the same global warming ability, when measured over a specified period of time.

Chemical Abstract Service Number

(CAS number):

Number assigned by the US Chemical Abstract Service to identify a chemical.

Cylinder:

In this technical brief, the term cylinder is used synonymously to the term container.

Controlled substances:

Chemicals listed in Annexes A, B, C, E and F to the Montreal Protocol, whether as pure substance or contained in mixtures.

Fluorinated gases (F-gases):

Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) are collectively called fluorinated gases. They are synthetic, powerful greenhouse gases.

Global warming potential (GWP):

Ratio of global warming caused by a specific amount of substance to the global warming caused by the same mass of carbon dioxide. Thus, the GWP of carbon dioxide is 1.

Hydrochlorofluorocarbons (HCFCs):

Ozone-depleting substances controlled under the Montreal Protocol with lower ozone-depleting potential than chlorofluorocarbons

(CFCs) and high global warming potential. They are banned in developed countries and currently being phased out in developing countries.

Hydrofluorocarbons (HFCs):

Global warming substances controlled by the Montreal Protocol. They do not deplete ozone layer and are widely used as alternatives to CFCs and HCFCs. They are currently phased down under the Kigali Amendment to the Montreal Protocol.

Ozone depleting substances (ODS):

Chemicals destroying the stratospheric ozone layer when leaking into the atmosphere. They are controlled under the Montreal Protocol and include substances already banned (chlorofluorocarbons, halons, carbon tetrachloride, methyl bromide) and substances currently being phased out (HCFCs).

Safety Data Sheet (SDS):

Document that provides information about the hazards of a chemical and advice about safety precautions. SDS provides more detailed information about the chemical and hazards than the label.

UN number:

Four-digit number that identifies dangerous goods and hazardous substances such as explosives, flammable liquids or toxic substances in the context of international transport.

Sources

Bahrain:

- ▶ Resolution No. 1 of 2020 with respect to Management of Refrigerants, Refrigeration Units and Air Conditioning Units

European Union:

- ▶ Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer:
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009R1005>

- ▶ Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006:
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0517>
- ▶ Commission Implementing Regulation (EU) 2015/2068 of 17 November 2015 establishing, pursuant to Regulation (EU) No 517/2014 of the European Parliament and of the Council, the format of labels

for products and equipment containing fluorinated greenhouse gases: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL_2015_301_R_0009

Turkey:

- ▶ By-Law on ODS in Official Gazette dated 7.4.2017 and numbered 30031
- ▶ By-law on F-gases in Official Gazette dated 1.1.2018 and numbered 30291

- ▶ Regulation on Classification, Labelling and Packaging of Substances and Mixtures entered into force upon publication in the Official Gazette No. 28848 of 11/12/2013
- ▶ Brochure of Turkey's National Ozone Unit prepared in cooperation with UNIDO and based on the joint publication of AREA, EPEE and EFCTC entitled "Protect your business – buy refrigerants from safe sources".

Endnotes

¹ OzonAction factsheet on refrigerant cylinder colours: www.unep.org/ozonaction/resources/factsheet/refrigerant-cylinder-colours-what-has-changed

² OzonAction publication "Legislative and policy options for HFCs": www.unep.org/ozonaction/resources/publication/legislative-and-policy-options-control-hydrofluorocarbons

³ UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS): <https://unece.org/about-ghs>

⁴ UN Recommendations on the Transport of Dangerous Goods Model Regulations (TDG): <https://unece.org/about-recommendations> and <https://unece.org/rev-21-2019>

⁵ Overview of national legislation based on the GHS and TDG guidance documents: <https://unece.org/ghs-implementation-0>

⁶ UN Recommendations on the Transport of Dangerous Goods - Model Regulations: <https://unece.org/rev-21-2019> (see Volume II, Part 6)

Certification marks (Section 6.2.2.7.2): **(a)** UN packaging symbol; **(b)** Technical standard used for design, manufacture and testing; **(c)** Character(s) identifying the country of approval; **(d)** Identity mark or stamp of the inspection body; **(e)** Date of the initial inspection.

Operational marks (see Section 6.2.2.7.3): **(f)** Test pressure in bar; **(g)** Mass of the empty pressure cylinder; **(h)** Minimum guaranteed wall thickness of the pressure cylinder; **(i)** In

the case of pressure cylinders for compressed gases, the working pressure in bar. **(j)** In the case of pressure cylinders for liquefied gases and refrigerated liquefied gases, the water capacity; **(k)** Relevant for UN 1001 acetylene, dissolved; **(l)** Relevant for UN 3374 acetylene, solvent free.

Manufacturing marks (see Section 6.2.2.7.4): **(m)** Identification of the cylinder thread (e.g. 25E). **(n)** Manufacturer's mark; **(o)** Serial number assigned by the manufacturer; **(p)** In the case of steel pressure cylinders and composite pressure cylinders with steel liner intended for the carriage of gases with a risk of hydrogen embrittlement, the letter "H" showing compatibility of the steel.

⁷ Directive 2010/35/EU of the European Parliament and of the Council of 16 June 2010 on transportable pressure equipment: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010L0035>

⁸ US Department of Transportation standards

⁹ Chinese Guobiao standards

¹⁰ Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures implementing GHS in the EU:

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008R1272>

¹¹ Proper shipping name is the standard technical name as provided by the "Dangerous Goods List" of the UN Recommendations on the Transport of Dangerous Goods – Model Regulations:

<https://unece.org/rev-21-2019> (see Volume I, Part 3).

¹² In the EU, “container” is defined as “a product which is designed primarily for transporting or storing fluorinated greenhouse gases”.

¹³ The EU regulation 2015/2068 provides exact wording for the labelling of substances for exempted uses, e.g. “For use in military equipment only”, “For feedstock use only”, “Imported for destruction only”, etc.

¹⁴ For example, the location might be adjacent to the service ports for charging or recovering the refrigerant or on that part of the product or equipment that contains refrigerant.

¹⁵ The EU F-gas legislation defines that the label should remain securely in place on the cylinder under normal operational conditions, throughout the entire period during which it contains refrigerants.

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