Prepared in the format conforming to the Commission Regulation (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (OJ of EU no L132 of 29 May 2015)

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifier

R 452a

The mixture of pentafluoroethane (HFC-125), difluoromethane (HFC-32), and 2,3,3,3-tetrafluoropropene (HCF-1234yf)

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses**:** Refrigerant.

Uses advised against: Not indentified.

1.3 Details of the supplier of the safety data sheet:

Supplier:

ENTALPIA EUROPE Sp. z o.o.

P.O.W 64a Str.

98-200 Sieradz, Poland

Tel.: + 48 668 628 739

E- mail address: l.baraniecki@entalpiaeurope.eu

1.4 Emergency telephone number

+ 48 668 628 739 (Poland); from 9:00 to 16:00

Date of compilation: 2018.11.24

SECTION 2: HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Gas under pressure (liquefied gas) ((Press. Gas).

Contains gas under pressure; may explode if heated (H280).

Harmful effects on human health:

Gas heavier than air gathering in the lower parts of the rooms can lead to unconsciousness and suffocation due to local lack of oxygen. Inhalation of high concentration of gas may cause nausea, headache and dizziness, irregular work of the heart. Prolonged exposure to gas vapors may adversely affect the central nervous system. As with all liquefied gases, contact with rapidly evaporating liquid can cause burns (frostbite) of skin and eyes. During thermal decomposition hydrogen fluoride can be formed, which has a corrosive effect, causing damage to the skin, mucous membranes of the eyes and airways.

Environmental effects:

Under normal conditions, there is no risk to the environment. Liquefied gas is characterized by high volatility. It does not pose a risk to the ozone layer.

Adverse effects associated with physico-chemical properties:

Not flammable mixture. When heating a closed container, there is a danger of increasing the pressure and bursting of the packaging.

2.2 Label elements

Pictograms:

Signal Word: **Warning**

Hazard Statements:
H280 - Contains gas under pressure; may explode if heated.

Precautionary Statements:
P410 + P403 - Protect from sunlight. Store in a well-ventilated place.

Additional labeling requirements: **The packaging shall be marked with a label containing the text "Contains fluorinated greenhouse gases";**
R 452a - quantity of gas expressed in kilograms and in CO_2 equivalent.
GWP (Greenhouse Warming Potential) = 2140

2.3 Other hazards

The mixture meets neither PBT nor vPvB criteria.

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

3.2 Mixture

Product identifier: *R452a*

Mixture components:

Substance name	Index No.	CAS No	EC No	% mass fraction	Hazard Classes and Category Codes	Hazard Statement Codes
Pentafluoroethane (HFC-125) Reg. Number: 01-2119485636-25-XXXX	-	354-33-6	206-557-8	59	Press Gas*	H280
2,3,3,3-tetrafluoropropene (HFC-1234yf) Reg. Number: 01-0000019665-61-XXXX	-	754-12-1	468-710-7	30	Flam. Gas 1 Press. Gas*	H220 H280
Difluoromethane (HFC-32) Reg. Number: 01-2119471312-47-XXXX	-	75-10-5	200-839-4	11	Flam. Gas 1 Press. Gas*	H220 H280

*** The term „Press. Gas" is placed on the label only.**

Full text of H statements and acronyms of symbols, hazard classes and category codes have been specified in the Section 16 of this safety data sheet

SECTION 4: FIRST AID MEASURES

4.1 Description of first aid measures

Inhalation:	Remove casualty from exposure site, place in reclining or sitting position, keep at rest and protect against heat loss. If necessary, call a physician. If breathing disorder occur, apply artificial respiration. If symptoms persists, consult a physician.
Eye contact:	Rinse immediately with plenty of lukewarm water, best running water for at least 15 min. Remove contact lenses. To avoid cornea damage, don't use jet stream. Cover with a sterile dressing. Get medical attention immediately.
Skin contact:	Wash the frozen part of body with cold water to normalize the temperature. Take off contaminated clothes, jewelry, watches, etc. If clothing permanently adheres to the skin, do not take off. Warm up the frozen body parts slowly. Cover with a sterile dressing. Do not use ointments and creams. Note: contaminated clothes moisten with water before taking them off. It must be washed before re-use.
Ingestion:	Unlikely route of exposure. Don't provoke vomiting. Rinse mouth with water, give a large amount of water to drink. If necessary consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

Gas heavier than air gathering in the lower parts of the rooms can lead to unconsciousness and suffocation due to local lack of oxygen. Inhalation of high concentration of gas may cause nausea, headache and dizziness, irregular work of the heart. Prolonged exposure to gas vapors may adversely affect the central nervous system. As with all liquefied gases, contact with rapidly evaporating liquid can cause burns (frostbite) of skin and eyes. During thermal decomposition hydrogen fluoride can be formed, which has a corrosive effect, causing damage to the skin, mucous membranes of the eyes and airways.

4.3 Indication of any immediate medical attention and special treatment needed

No special recommendations. Apply symptomatic treatment.

SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media:

Water- scattered currents, extinguishing powders, carbon dioxide, alcohol-resistant foam. Fire in the surroundings should be extinguished with agents suitable for burning media.

Unsuitable extinguishing media:

All available extinguishing media are allowed.

5.2 Special hazards arising from the substance or mixture

During fire, due to the thermal decomposition carbonyl fluoride, hydrogen fluoride, carbon oxide may form.

5.3 Advice for firefighters

Not flammable mixture. When heating a closed container, there is a danger of increasing the pressure and bursting of the packaging. Containers exposed to fire cool from a safe distance with a dispersed stream of water. If possible, remove them from endangered area. Wear gas-tight protective suit and breathing apparatus independent of ambient air.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Under industrial conditions wear protective clothing made of natural fabrics (cotton), or synthetic fiber, heat-insulating safety gloves and safety goggles. Do not drink, eat and smoke during handling. Provide proper local and general ventilation. Remove sources of ignition (extinguish open fire, announce a ban of smoking and using sparking tools). People not involved in the removal of the disaster remove from the affected area. Avoid direct contact with the mixture.

6.2 Environmental precautions

Protect from releasing to sewage system, surface and ground water, soil.

6.3 Methods and materials for containment and cleaning up

Protect sewers. Damaged packaging place in replacement packaging. Dilute the vapors with dispersed stream of water. Remove sources of ignition (extinguish open fire, announce a ban of smoking and using sparking tools). Wash contaminated surface with water.

6.4 Reference to other sections

Remove according to the recommendations listed in section 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling

Protect cylinders against mechanical damage. Do not exceed the temperature of 50 ° C in the storage place. Only properly trained and experienced persons should work with liquefied gases. To transfer the cylinders, even for short distances, use a trolley (manual, electric, etc.) intended for transporting cylinders. Before connecting the operation container, ensure that the return flow from the system to the container is impossible. Keep away from sources of high temperature and sources of ignition. Do not use sparking tools, avoid electrostatic discharges.
Avoid contact with skin and eyes. Do not eat, drink or smoke while handling. Take off contaminated clothing and wash it before reusing.

7.2 Conditions for safe storage, including any incompatibilities

Containers should be stored in a specially adapted separated area (preferably in the open space). Stored containers should be systematically checked for general condition and tightness. Containers stored in the open area protect against corrosive effect and extreme atmospheric conditions. Containers should be stored in a vertical position and properly secured against falling over. The containers valves should be screwed down firmly and where appropriate, valve outlets should be covered by a nut or blanking plate. Caps or valve covers should be used. Keep containers in a place not at risk of fire and away from sources of heat and ignitron. Protect against light, air and moisture. Do not exceed the temperature of 50 ° C in the storage place. In the storage area place signs of ban of smoking and use of open fire. Packaging material: carbon steel, aluminium alloys. Do not use plastic packaging. Do not store together with spontaneously flammable materials, combustible liquids or combustible solids, animal feedstuffs, explosives, infectious substances, radioactive material, toxic liquids or toxic solids, food and oxidizing liquids or oxidizing solids.

7.3 Specific end use(s)

No information about the applications other than those mentioned in subsection 1.2.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Controls parameters

Substance name	CAS No	Standard	Value	Unit
2,3,3,3-tetrafluoropropene	754-12-1	MAK**	950	mg/m^3

*Workplace Exposure Limit (British occupational exposure limit) - long-term exposure limit (8 hours time-weighted average (TWA) reference period);
**MAK - Maximale Arbeitsplatz-Konzentration (maximum workplace concentration; German occupational exposure limit).

2,3,3,3-tetrafluoropropene
$DNEL_{worker}$ (inhalation, chronic toxicity, systemic effect): 455 mg/m^3
$PNEC_{sediment, freshwater}$: 1,35 kg dw
$PNEC_{sediment\ marine\ water}$: 0.135 kg dw
$PNEC_{fresh\ water}$: 0.25 mg/l
$PNEC_{marine\ water}$: 0.025 mg/l
$PNEC_{soil}$: 0,72 mg/kg
$PNEC_{marine\ water}$: 0.01 mg/l
$PNEC_{water\ –\ intermittent\ release}$: 0,33 mg/l
Difluoromethane:
$DNEL_{worker}$(inhalation, chronic toxicity, systemic effect): 7035 mg/m^3
$DNEL_{consumer}$(inhalation, chronic toxicity, systemic effect) 750 mg/m^3
$PNEC_{sediment\ freshwater}$: 0.534 kg dw
$PNEC_{water\ –\ intermittent\ release}$: 1.42 mg/l
$PNEC_{freshwater}$: 0.142 mg/l
Pentafluoroethane:
$DNEL_{worker}$(inhalation, chronic toxicity, systemic effect): 16444 mg/m^3
$DNEL_{consumer}$(inhalation, chronic toxicity, systemic effect) 1753 mg/m^3
$PNEC_{freshwater}$: 0.1 mg/l
$PNEC_{water\ –\ intermittent\ release}$: 1,42 mg/l
$PNEC_{sediment\ freshwater}$: 0.6 mg/kg

8.2 Exposure controls

8.2.1 *Appropriate engineering controls*
Provide local and general ventilation at workplace. Suction holes for local ventilation at the working surface or below. Do not use close to high temperature sources and sources of ignition. In case of insufficient ventilation use respiratory protection.

8.2.2 *Individual protective measures such as personal protective equipment*

Respiratory protection:	In case of breakdown or insufficient ventilation, wear respiratory protection with vapours brown filter with AX symbol.
Skin and hands protection:	Under industrial conditions wear protective clothing made of natural fabrics (cotton), or synthetic fiber and heat-insulating safety gloves.
Eyes protection:	Under industrial conditions wear safety goggles protecting against drops of liquid.

Occupational hygiene: General industrial hygiene rules apply. Don't allow exceeding occupational exposure levels. After finishing work remove contaminated clothes. Wash hands and face before work breaks. Wash entire body after finishing work. Do not drink, eat and smoke during work.

8.2.3 *Environmental exposure controls*

Prevent from draining to a municipal sewage system and watercourses.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance
Colourless gas.
b) Odour
Ether odour.
c) Odour threshold
No data available.
d) pH
Not determinable.
e) Melting/freezing point
No data available.
f) Initial boiling point and boiling range
-47 °C
g) Flash point
Non-combustible gas.
h) Evaporation rate
No data available.
i) Flammability (solid, gas)
Non-combustible gas.
j) Upper/lower flammability or explosive limits
No data available.
k) Vapour pressure
13159 hPa at 25 °C
l) Vapour density
3,64 (air = 1)
m) Relative density
1,1296 (water = 1)
n) Solubility(ies)
o) 198 – 1680 mg/l (25 ^{0}C).
p) Partition coefficient: n-octanol/water
No data available.
q) Auto-ignition temperature
No data available.
r) Decomposition temperature
No data available.
s) Viscosity
0.15 mPas (20 °C) (liquid phase)
t) Explosive properties
Does not pose an explosive hazard.
u) Oxidising properties
Due to the molecular structure of mixture components, oxidising properties are not expected.

9.2 Other information

Gas heavier than air. It can accumulate in closed spaces, especially at or below ground level.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity

No reactivity if stored and used as intended.

10.2 Chemical stability

Stable in standard conditions of storage and use.

10.3 Possibility of hazardous reactions

When compressed with air or oxygen, the mixture can become flammable. The mixture with Cl_2 can become flammable or reactive.

10.4 Conditions to avoid

Contact with an open fire or surfaces heated to above 250 ° C may cause decomposition with the emission of toxic gases including hydrogen fluoride (HF) and carbon fluoroxide (COF_2).

10.5 Incompatible materials

Alkali metals and alkaline earth metals, magnesium powder, zinc, strong oxidants that can initiate product decomposition.

10.6 Hazardous decomposition products

Hydrogen fluoride, carbon fluoroxide.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity:

Based on available data, the classification criteria are not met. (Acute toxicity was determined using the ATE calculation method)

For the product:

LC_{50} – inhalation rat > 520000 ppm (4h)
ATE (estimated, oral) > 2000 mg/kg
ATE (estimated, skin) > 2000 mg/kg
ATE (estimated, inhalation) 5 mg/dm^3 (4h) (aerosol)

Component	CAS No	Dose	Value	Unit
Difluoromethane	75-10-5	LC_{50} - inhalation rat	2158	mg/l (4h)
Pentafluoroethane	354-33-6	LC_{50} - inhalation rat	> 3480	mg/l (4h)
2,3,3,3-tetrafluoropropene	754-12-1	LC_{50} - inhalation rat	20345	ppm (4h)

Skin corrosion/irritation:
Based on available data, the classification criteria are not met.
Serious eye damage/irritation:
Based on available data, the classification criteria are not met.
Respiratory or skin sensitisation:
Based on available data, the classification criteria are not met.
Germ cell mutagenicity:

Based on available data, the classification criteria are not met.
Carcinogenicity:
Based on available data, the classification criteria are not met.
Reproductive toxicity:
Based on available data, the classification criteria are not met.
STOT-single exposure:
Based on available data, the classification criteria are not met.
STOT-repeated exposure:
Based on available data, the classification criteria are not met.

NOAEL:

Difluoromethane (HFC-32)	> 40 000 ppm (rat (male), inhalation)
Pentafluoroethane (HFC-125)	> 50 000 ppm (rat (male and female), inhalation, 13 weeks)

Aspiration hazard:
Based on available data, the classification criteria are not met.

Health effects of local exposure:
Respiratory tract:
The product components do not pose a health hazard by inhalation. In the case of inhalation of large amounts, the product may cause loss of consciousness and cardiological disorders associated with oxygen deficiency in the air. In extreme cases, suffocation may occur.
Skin and eyes:
In case of contact with liquefied gas, burns (frostbite) may occur.

Other information:
Difluoromethane
Research of long-term effects on animals (oral) showed no sub-chronic toxic effect (rat, 52 weeks - dose: 280 mg/kg).
Pentafluoroethane
Research of long-term effects on animals (inhalation) showed no sub-chronic toxic effect (rat, 3 months - dose: 50 000 ppm).

SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity

Based on available data, the classification criteria are not met.

For the product:

LC_{50} - fish (*Oncorhynchus mykiss*)	1507 mg/l (96h)
EC_{50} - invertebrates (*Daphnia magna*)	652 mg/l (48h)
EC_{50} – algae	> 114 mg/l (72h)

Component	CAS No.	Dose	Value	Unit
Difluoromethane	75-10-5	LC_{50} - fish (*Oncorhynchus mykiss*)	> 100	mg/l (96h)
Pentafluoroethane	354-33-6	LC_{50} - fish (*Oncorhynchus mykiss*)	450	mg/l (96h)
		EC_{50} - invertebrates (*Daphnia magna*)	> 200	mg/l (48h)
2,3,3,3-tetrafluoropropene	754-12-1	EC_{50} - fish (*Cyprinus carpio*)	> 197	mg/l (96h)
		EC_{50} - invertebrates (*Daphnia magna*)	> 100	mg/l (24h)
		EC_{50} – algae	> 100	mg/l (72h)

12.2 Persistence and degradability

Not readily biodegradable: 5 % (28 days)

12.3 Bioaccumulative potential

Bioaccumulation is not expected.
Partition coefficient octanol/water (K_{ow}): No data available.
Pentafluoroethane: 1.48
Difluoroethane: 0,714

Bioconcentration factor (BCF): No data available.

12.4 Mobility in soil

Due to high volatility, the product is unlikely to cause soil or water pollution.

12.5 Results of PBT and vPvB assessment

The mixture meets neither PBT nor vPvB criteria.

12.6 Other adverse effects

The substances (mixture components) are included in the list of fluorinated greenhouse gases.
Regulation (EU) No 517/2014 on fluorinated greenhouse gases
Annex I: Fluorinated Greenhouse Gases referred to in point 1 of Article 2.
GWP (Greenhouse Warming Potential) = **2140**

GWP (Greenhouse Warming Potential) for the mixture:
Σ (59 % × 3500) + (11 % × 675) + (30 % x 4) = 2140
Difluoromethane
GWP (Greenhouse Warming Potential) = 675
Pentafluoroethane:
GWP (Greenhouse Warming Potential) = 3500
2.3.3.3-tetrafluoropropen:
GWP (Greenhouse Warming Potential) = 4

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Avoid release into the atmosphere. Do not empty the cylinder in places where gas could accumulate and pose danger. Follow manufacturer's or supplier's instructions regarding recovery or reuse

Wastes code:
14 06 01* Chlorofluorocarbons HCFC, HFC

Special precautions:
Dispose product and packaging in a safe way. Care should be taken when operating empty containers that have not been thoroughly cleaned. Do not cut, weld or grind used containers unless they have been thoroughly cleaned.

SECTION 14: TRANSPORT INFORMATION

ADR/RID, IMDG, IATA

14.1 UN number

1078

14.2 UN proper shipping name

ADR, RID, IMDG, IATA

REFRIGERANT GAS, N.O.S. (59 % Pentafluoroethane, 11 % difluoromethane, 30 % 2,3,3,3-tetrafluoropropene)

14.3 Transport hazard class(es)

2

14.4 Packing group

-

14.5 Environmental hazards

The product is not hazardous to the environment according to the UN Model Regulations.

14.6 Special precautions for user

Avoid transporting vehicles where the load space is not separated from the driver's cab. Ensure that the driver knows the hazards posed by the load and procedures in case of an accident or an emergency situation. Ensure secure fixing of portable tanks before transporting containers with the product.

14.7 Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable.

Classification code: 2A

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ EU L396 of December 30 2006 with later amendments);

REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCILof 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (OJ EU L353 of December, 31 2008, with later amendments ATP 1-9);

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 (OJ EU L150 of May, 20 2014);

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 (OJ EU L301 of November, 18 2015).

15.2 Chemical safety assessment

Supplier has not assessed the chemical safety of the mixture.

According to Article 4 of Regulation (EU) No 517/2014:

1. Operators of equipment that contains fluorinated greenhouse gases in quantities of 5 tonnes of CO 2 equivalent or more and not contained in foams shall ensure that the equipment is checked for leaks.

2. Hermetically sealed equipment that contains fluorinated greenhouse gases in quantities of less than 10 tonnes of CO 2 equivalent, shall not be subject to leak checks under this Article, provided the equipment is labelled as hermetically sealed.

SECTION 16: OTHER INFORMATION

This Safety Data Sheet was developed in the **Ignacy Mościcki' Industrial Chemistry Research Institute in Warsaw**.
Other data sources:
Registered substances data: http://echa.europa.eu/web/guest/information-on-chemicals/registered-substances

The information contained in this safety data sheet describes the product exclusively from the safety requirements perspective. The user is responsible for setting up the conditions for safe use of the product and bears a sole responsibility for the consequences of its incorrect use.
The employer should provide:
- training of employees in terms of health risk, knowledge of the content of the safety data sheet, application of personal protective equipment.

H statements (Hazard Statements) and acronyms of symbols, hazard classes and category codes used in section 3 of Safety Data Sheet

H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated
Flam. Gas 1	Flammable gas, Hazard Category 1.
Press. Gas	Gas under pressure (liquefied gas).
Abreviations:	
vPvB	very Persistent, very Bioaccumulative substance.
PBT	Persistent, Bioaccumulative and Toxic substance.
LC_{50}	Lethal concentration, median concentration where 50 % of test subjects dies.
EC_{50}	The effective concentration of substance that causes 50% of the maximum response.
DNEL	Derived No-Effect Level.
PNEC	Predicted No Effect Concentration.
ATE	Acute Toxicity Estimates.
OECD	Organization for Economic Co-operation and Development.
NOAEL	No observed Adverse Effect Level.
BCF	Bioconcentration factor.
ADR	Agreement on Dangerous Goods by Road.
RID	Regulations Concerning the International Transport of Dangerous Goods by Rail.
IMDG	International Maritime Dangerous Goods Code.
IATA	International Air Transport Association.
CAS number	number assigned to a chemical substance in *Chemical Abstracts Service* Registry.
EC number	seven-digit number, an identifier of substances commercially available within the European Union listed in EC Inventory (EINECS – *European Inventory of Existing Chemical Substances*, ELINCS - *European List of Notified Chemical Substances* or „*No-longer polymers*" list).
UN number	United Nations number - the four-digit identification number of the UN Dangerous Goods list, derived from the UN Model Regulations, to which the individual material, mixture or article is classified.