SAFETY DATA SHEET

R-600a

Issue: January 2023 Version 2.2 Date: 2 January 2023

SECTION 1. Identification of the substance or mixture and of the company or undertaking

1.1. Product identifier

Trade name: **R-600a (Isobutane)**

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

Use of the substance/mixture: Refrigerant

Restrictions on use: For professional use only.

1.3. Details of the supplier of the safety data sheet

Supplier name: GAS SERVEI S.A.
Address: C/ Motors, 151-155 nave nº 9 08038 Barcelona SPAIN

Telephone: +34 (93) 2231377
Fax: +34 (93) 2231479
www.gas-servei.com

Email address of the person responsible for the SDS: gas-servei@gas-servei.com

1.4. Emergency telephone number

Gas-servei: +34 619373605
National Institute of Toxicology and Forensic Sciences: +34 (91) 5620420

SECTION 2. Hazard identification

2.1. Classification of the substance or mixture

Criteria EC Regulation 1272/2008 (Classification, Labelling and Packaging):

2.2/1 2.2/1 Flam. Gas	H220: Extremely flammable gas.
Pressurised gases, Liquefied gas	H280: Contains gas under pressure; danger of explosion if heated.

2.2. Label elements

Hazard pictograms: Symbols: GHS02 / GHS04

Signal word: Danger

Hazard statements: H220: Extremely flammable gas.
H280: Contains gas under pressure; may explode if heated.

Precautionary statements: P210: Keep away from heat, sparks, open flames or hot surfaces—No smoking.
P377: Burning gas leak: Do not extinguish unless leak can be stopped without danger.

P381: Remove all sources of ignition if it is safe to do so. P410+P403: Protect from sunlight. Store in a well-ventilated place.

Special provisions: None

2.3. Other hazards

Vapours are heavier than air and may cause suffocation by reducing the oxygen in the air breathed.
Incorrect use or intentional inhalation abuse may cause death without warning symptoms due to cardiac effects.
May cause cardiac arrest.
Rapid evaporation of the product may cause frostbite. May displace oxygen and cause rapid asphyxiation.

SECTION 3. Composition/information on components

3.1. Substances

Chemical name	Concentration (% by weight)	CAS No.	EC No.	REACH Registration No.	EC Classification
					EC Regulation No. 1272/2008
Isobutane (R-600a)	100.0	75-28-5	200-857-2		2.2/1 Flam. Gas 1 H220 2.5 Gas pressure H280

SECTION 4. First aid

4.1. Description of first aid

General recommendations: In case of accident or illness, seek medical attention immediately.
If symptoms persist or in case of doubt, seek medical advice.

Protection of first responders: No special precautions are required for first responders.

In case of inhalation: If inhaled, move to fresh air.
If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
Consult a doctor immediately.

In case of skin contact: Thaw frozen parts with warm water. Do not rub the affected area.
Consult a doctor immediately.

In case of contact with eyes: Seek medical attention immediately.

If swallowed: Ingestion is not considered a potential route of exposure.

4.2. Main symptoms and effects, acute and delayed

May cause cardiac arrhythmia.
Other symptoms possibly related to misuse or abuse of inhalation are:

Cardiac sensitisation	Anaesthetic effects
Mild dizziness	Vertigo and nausea
Confusion	Lack of coordination
Drowsiness	Unconsciousness

The gas reduces the oxygen available for breathing.
Contact with the liquid or refrigerated gas may cause cold burns and frostbite.

4.3. Indication of any medical attention and special treatment that should be given immediately

Treatment: Symptomatic treatment and supportive therapy as indicated.
Due to possible cardiac arrhythmias, catecholamines, such as epinephrine, which may be used in emergency life-support situations, should be used with particular caution.

SECTION 5. Firefighting measures

5.1. Extinguishing media

Appropriate extinguishing media

Appropriate: Water spray
Foam
Dry powder

Extinguishing media

: Carbon dioxide (CO_2)
Water jet

5.2. Specific hazards arising from the substance or mixture

Specific hazards during firefighting: Exposure to combustion products may be a health hazard.
Do not inhale the gases produced.
Due to high vapour pressure, there is a risk of containers bursting if the temperature rises.

Combustion products:

Carbon monoxide

5.3. Recommendations for firefighting personnel

Special protective equipment for firefighting personnel

firefighting personnel: If necessary, use self-contained breathing apparatus for firefighting. Use personal protective equipment.

Specific for extinguishing: Use extinguishing measures that are appropriate to the local circumstances and surroundings.
Collect contaminated water used to extinguish the fire separately. Do not discharge it into the sewer system.
Fight the fire from a distance due to the risk of explosion. Use water spray to cool closed containers.
Remove intact containers from the fire area if it is safe to do so. Evacuate the area.

SECTION 6. Measures in case of accidental spillage

6.1. Personal precautions, protective equipment and emergency procedures

Evacuate personnel to safe areas.
Use self-contained breathing apparatus and appropriate personal protective equipment when cleaning up spills.
Avoid skin contact with dripping liquid (freezing hazard).
Ventilate the area.
Follow the safe handling advice (see Section 7) and personal protective equipment recommendations (see Section 8).

6.2. Environmental precautions

Do not disperse into the environment.
Prevent the product from entering the soil/subsoil.

Prevent it from entering surface water or drains. Safely contain any further spills or leaks.
Contain and dispose of contaminated water.
In the event of a gas leak or penetration into waterways, soil or sewage systems, inform the responsible authorities.

6.3. Containment and cleaning methods and materials

Clean-up methods: Ventilate the area.
Use non-sparking tools. Remove fumes/vapours/mists using water spray. Wash with plenty of water.

Containment and cleaning materials
containment and cleaning: Suitable collection material: absorbent material, organic material, sand.

Local or national regulations may apply to the release and disposal of this material and to the materials and items used in cleaning up spills. You should determine which regulations apply. Sections 13 and 15 of this safety data sheet provide information on certain local or national requirements.

6.4. Reference to other sections

See also sections 7, 8, 11, 12, and 13.

SECTION 7. Handling and storage

7.1. Precautions for safe handling

Technical measures: Use equipment rated for cylinder pressure. Use a backflow prevention device on the pipe. Close the valve after each use and after emptying.

Local/total ventilation: Use only with adequate ventilation.

Tips for
safe handling: Avoid contact with skin and eyes.
Avoid inhaling vapours and mists from the fluid.
Do not use empty containers that have not been previously cleaned. Handle in accordance with good industrial safety and hygiene practices, based on the results of the workplace exposure assessment.
Wear insulated gloves and protective equipment for the face/eyes. The protective valve caps and threaded plugs on the valve outlet must remain in place unless the container is secured with the valve outlet connected to the point of use.
Use a non-return valve or trap (exhaust, siphon trap interceptor) in the discharge line to prevent dangerous reverse flow into the cylinder.
Before carrying out transfer operations, ensure that there are no incompatible materials and/or residues in the containers.
Prevent gas from flowing back into the gas container.
Use a pressure regulator when connecting the cylinder to lower pressure systems or pipes.
Close the valve after each use and after emptying. DO NOT change or force connections.
Prevent water from seeping into the gas container. Never attempt to lift the cylinder by its cap.
Do not drag, slide or roll cylinders.
Use a suitable hand truck to move the cylinder. Keep away from heat and sources of ignition. Electrical equipment must be adequately protected.

	Use tools that do not produce sparks. The transfer of liquid refrigerant from refrigerant containers to systems and from systems may cause the generation of static electricity. Ensure that there is an adequate ground connection. Avoid the build-up of electrostatic charges. Take care to mitigate the risk of high pressures developing in systems, caused by temperature increases when liquid is trapped between closed valves or when containers have been overfilled. Avoid spillage and waste. Minimise release into the environment. Do not smoke.
Hygiene measures:	If exposure to chemicals is likely during normal use, provide eye wash stations and safety showers near the work area. Do not eat, drink or smoke during use. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

Technical requirements for storage facilities and containers:	Keep cylinders in a well-ventilated area away from fire hazards. Cylinders must be stored upright and securely fastened to prevent them from falling or being knocked over. Separate full containers from empty containers. Do not store near combustible materials. Avoid areas where salt and other corrosive materials are present. Store in properly labelled containers. Keep in a cool, well-ventilated place. Keep away from direct sunlight. Store in accordance with specific national regulations. Keep cylinders away from heat and sources of ignition.
Guidelines for joint storage:	Do not store with the following types of products: Self-reactive substances and mixtures Organic peroxides Oxidising agents Flammable liquids Flammable solids Pyrophoric liquids Pyrophoric solids Substances and mixtures that undergo spontaneous heating. Substances and mixtures which, in contact with water, emit flammable gases. Explosives Highly toxic mixtures and substances. Very toxic mixtures and substances. Mixtures and substances with chronic toxicity
Recommended storage temperature :	< 50
°C Storage time:	> 10
years	
Further information on stability during storage:	The product has an indefinite shelf life when stored properly.

7.3. Specific end uses

Subject to Member State regulations, the uses to which it may be applied are as follows: None in particular.

SECTION 8. Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Name of substance	CAS	VLE-MP value (8h ppm)	VLE-MP value (8h mg/m³)
Isobutane	75-28-5	1,000	1,900

Derived no-effect level (DNEL) according to Regulation (EC) No. 1907/2006:

Substance name	CAS	End use	Route of exposure	Potential health effects	Value
Isobutane	75-28-5	Workers	Inhalation	Data not available	
		Consumers	Inhalation		

Predicted no-effect concentration (PNEC) according to Regulation (EC) No. 1907/2006:

Substance name	CAS No.	Environmental compartment	Value
Isobutane	75-28-5	Data not available	

8.2. Exposure controls

Occupational exposure controls

Personal protective equipment must comply with current EN standards: Respiratory protection EN 137, 138, 269; Safety glasses/eye protection EN 166; Protective clothing EN 340, 463, 469, 943-1, 943-2; Protective gloves CEN 374, 511; Protective footwear EN-ISO 20345. Do not breathe vapours.

Engineering measures

Ensure adequate ventilation, especially in confined areas. Minimise exposure concentrations in the workplace.

Personal protection

Respiratory protection: If adequate exhaust ventilation is not available or exposure assessment shows exposure outside recommended limits, use self-contained breathing apparatus or a positive pressure air line and mask. Users of self-contained breathing apparatus must be trained.
The equipment must comply with UNE EN 14387.

Skin protection and body: Wash skin after all contact with the product.
When handling containers, the use of protective footwear is recommended.

Hand protection:
Material: Low temperature resistant gloves
Remarks: Select chemical protective gloves based on the quantity and concentration of hazardous substances to be handled in the workplace. It is recommended to check with the manufacturer of the above-mentioned protective gloves to ensure that they have the necessary resistance for applications with special chemicals. Wash hands before breaks and after finishing work. The break time is not determined for the product.
Change gloves frequently.

Eye protection: Use the following personal protective equipment: Chemical-resistant goggles must be worn. Face shield.
Equipment must comply with UNE EN 166.

Thermal risks: Wear heat-insulating gloves.

SECTION 9. Physical and chemical properties

Appearance:	Liquefied gas
Colour:	Colourless
Odour:	Sweet. Odourless at low concentrations.
Odour threshold:	No data available
pH:	No data available
Melting/freezing point:	-159 °C at 1013
hPa Initial boiling point and boiling range:	
:	-12 °C at 1013 hPa
Flash point:	-85 °C at 1013 hPa
Evaporation rate:	Not applicable
Flammability (solid, gas):	Extremely flammable in the presence of ignition sources or oxidising materials.
Upper explosion limit /Upper flammability limit :	Upper flammability limit Method: ASTM E681 8.5%
Lower explosive limit /Lower flammability limit :	Lower flammability limit Method: ASTM E681 1.8%
Vapour pressure:	3,022 hPa ap (20 °C)
Relative density:	2.01 (air=1)
Density:	0.557 g/cm³ (20 °C) (as saturated liquid)
Solubility	
Water solubility:	0.033 v/v (20 °C)
Partition coefficient (noctanol/water):	Log Pow: 2.76
Auto-ignition temperature:	460 °C
Decomposition temperature:	
decomposition:	Not applicable
Viscosity:	Not applicable
Explosive properties:	Vapours may form explosive mixtures with air. Oxidising
properties:	Not applicable.
Particle size:	Not applicable

Other data

Critical temperature:	134.85 °C
Critical pressure:	37.2 bar

SECTION 10. Stability and reactivity

10.1. Reactivity

There are no reaction hazards other than those described in other sections.

10.2. Chemical stability

Stable if used according to instructions. Follow the precautionary advice and avoid incompatible materials and conditions.

10.3. Possibility of hazardous reactions

Vapours may form an explosive mixture with air. May react violently with oxidising agents.
Extremely flammable gas.

10.4. Conditions to avoid

Avoid open flames, sparks and high temperatures. Do not spray onto a naked flame or incandescent body.
Pressurised container: do not pierce or burn, even after use. Store at a temperature below 50°C.

10.5. Incompatible materials

Air and oxidising agents.

10.6. Hazardous decomposition products

Under normal conditions of use and storage, no decomposition into hazardous products should occur.

SECTION 11. Toxicological information

11.1. Information on hazard classes defined in Regulation (EC) No 1272/2008

Information on possible routes of exposure: Inhalation
Skin contact Eye contact

a. Acute toxicity

Not classified according to available information.

Isobutane:

Acute inhalation toxicity: LC50 (Rat): > 570,000 ppm
Exposure time: 15 min Atmosphere test: gas

b. Skin corrosion or irritation

Not classified based on available information.

c. Serious eye damage or irritation

Not classified based on available information.

d. Respiratory or skin sensitisation

Skin sensitisation

Not classified according to available information.

Respiratory sensitisation

Not classified based on available information.

Components:

Isobutane:

The study is not technically feasible.

e. Germ cell mutagenicity

Not classified based on available information.

Components:

Isobutane:

In vitro genotoxicity: Test type: In vitro chromosomal aberration test
Method: OECD Test Guideline 473
Result: Negative
Observations: Based on data from similar materials

	Test type: Reverse mutation assay in bacteria (Ames test) Method: OECD Test Guideline 471 Result: Negative Observations: Based on data from similar materials
In vivo genotoxicity:	Test type: Micronucleus test in mammalian erythrocytes (in vivo cytogenetic assay). Species: Mouse Route of administration: inhalation (gas) Method: OECD Test Guideline 474 Result: Negative Observations: Based on data from similar materials
Mutagenicity in germ cells:	Assessment: The weight of evidence does not support classification as a germ cell mutagen.

f. Carcinogenicity

Not classified based on available information.

Isobutane:	Species: Rat Assessment: The weight of evidence does not support classification as a carcinogen.

g. Reproductive toxicity

Not classified based on available information.

Components:

Isobutane:

Effects on fertility:	Type of test: Repeated dose toxicity study combined with reproductive/developmental toxicity screening test. Species: Rat Route of administration: inhalation (gas) Method: OECD Test Guideline 422 Result: Negative
Effects on foetal development:	Test Type: Repeated dose toxicity study combined with reproductive/developmental toxicity screening test. Species: Rat Route of administration: inhalation (gas) Method: OECD Test Guideline 422 Result: Negative

Reproductive toxicity: Assessment: The weight of evidence does not support classification as a germ cell mutagen.

h. Specific target organ toxicity (STOT) - single exposure

Not classified based on available information.

Components:

Isobutane:	Assessment: May cause drowsiness or dizziness.

i. Specific target organ toxicity (STOT) – repeated exposure

Not classified based on available information.

j. Aspiration hazard

No data available.

11.2. Information on other hazards

a. Endocrine disrupting properties

Not available.

SECTION 12. Ecological information

12.1. Toxicity

Components:

Isobutane:

Toxicity to fish:	LC50 (Fish): > 24.11 mg/l Exposure time: 96 h Method: Estimated using QSAR calculation
Toxicity to daphnia and other aquatic invertebrates:	LC50 (Daphnia): > 7.02 mg/l Exposure time: 96 h Method: Estimated using QSAR calculation
Toxicity to Algae/aquatic plants:	LC50 (Algae): > 7.71 mg/l Exposure time: 96 h Method: Estimated using QSAR calculation

12.2. Persistence and degradability

Not readily biodegradable

Components:

Isobutane:

Biodegradability (in water): Easily biodegradable Stability (phototransformation in air):
DT50 (half-life): 1,906 days Result:
Approx. 10 years
Observations: Based on data from similar materials.

12.3. Bioaccumulation potential

Components: Isobutane:

Partition coefficient (n-octanol/water): log Pow: 2.76

12.4. Mobility in soil

No data available.

12.5. Results of PBT and mPmB assessment

Assessment: The substance is not considered to be persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB).

12.6. Endocrine-disrupting properties

Assessment: The substance is not considered to have endocrine-disrupting properties in accordance with Article 57(f) of REACH or Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7. Other adverse effects

Global warming potential

Regulation (EU) No 517/2014 on fluorinated greenhouse gases. R-600a gas is not a fluorinated gas.

Product:

Global warming potential over 100 years: 3

SECTION 13. Disposal considerations

13.1. Methods for waste treatment

Product: Do not discharge in areas where there is a risk of forming an explosive mixture with air. Dispose of in accordance with local regulations.

Contaminated containers: Empty pressure vessels must be returned to the supplier. Operate in accordance with current local and national regulations.
Empty containers may contain hazardous residues.
DO NOT pressurise, cut, weld, drill, crush or expose these containers to heat, flames, sparks or other sources of ignition. They may explode, causing damage and/or death.

13.2. Other information

Waste disposal provisions:

Directive 2006/12/EC; Directive 2008/98/EC
EC Regulation No. 1013/2006

Personal protective equipment, see section 8.

SECTION 14. Transport information

14.1. UN number

ADN:	1969
ADR:	1969
RID:	1969
IATA:	1969
IMDG:	1969

14.2. Official United Nations transport designation

ADR/ADN/RID:	ISOBUTANE (R-600a)
IMDG:	ISOBUTANE (R-600a)
IATA (cargo):	Isobutane (R-600a)
IATA (passengers):	Not permitted for transport

14.3. Transport hazard class(es)

	Class	Subsidiary risks	Classification code	Hazard identification no.	Tunnel Rest. Code
ADR:	2	2.1	2F	23	(B/D)
DNA:	2	2.1	2F	23	
RID:	2	2.1, (13)	2F	23	
IMDG:	2.1				
IATA:	2.1(Cargo)				
IATA:	Not permitted for transport (passengers)				

14.4. Packaging group

Not assigned by regulation.

Labels

ADR/ADN/RID/IMDG: 2.1

IMDG / IATA: Flammable Gas

ADR/RID/IMDG packaging instructions: P200
IATA (Cargo): 200
IATA (Passenger): Not permitted for transport

EmS Code
IMDG: F-D, S-U

14.5. Environmental hazards
No: (ADR/ADN/RID/IMDG)

14.6. Special precautions for users
The transport classification(s) listed are for informational purposes only and are based solely on the properties of the unpackaged material described in this Safety Data Sheet. Transport classifications may vary depending on the mode of transport, the size of the container/packaging, and variations in regional or country regulations.

14.7. Maritime bulk transport in accordance with IMO instruments
Not applicable.

SECTION 15. Regulatory information

15.1. Safety, health and environmental regulations and legislation specific to the substance or mixture
REACH - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles (Annex XVII):
The restrictions in the following entries must be considered:
List number 40

REACH-List of candidate substances of very high concern for authorisation (Article 59): Not applicable

Regulation (EC) 1005/2009 on substances that deplete the ozone layer:
Not applicable

Regulation (EU) 2019/1021 on persistent organic pollutants (recast): Not applicable

Regulation (EC) No 649/2012 of the European Parliament and of the Council concerning the export and import of dangerous chemicals:
Not applicable

REACH-List of substances subject to authorisation (Annex XIV):
Not applicable

Seveso III: Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances:

		Quantity 1	Quantity 2
P2	FLAMMABLE GASES	10t	50t

15.2. Chemical safety assessment
No chemical safety assessment has been carried out for this product.

SECTION 16. Other information

This document supersedes and replaces all previous editions.

Date of issue: 2 January 2023 Version: 2.2

This Safety Data Sheet has been prepared in accordance with:
Regulation (EC) No. 1907/2006 and its subsequent amendments: Regulation (EU) No. 2015/830 and Regulation (EU) No. 2020/878

Text of the phrases used in section 3:

H220: Extremely flammable gas
H280: Contains gas under pressure; danger of explosion if heated.

This document has been prepared by a competent person who has received adequate training.
The information provided herein is based on our knowledge as of the date indicated above. It refers exclusively to the product indicated and does not constitute a guarantee of particular qualities.

The user must ensure the suitability and accuracy of this information in relation to the specific use to be made of the product.

The information is considered correct but is not exhaustive and should be used for guidance only, based on current knowledge of the chemical substance or mixture and applicable to the appropriate safety precautions for the product.
The list of risks, legal, regulatory and administrative texts is not exhaustive. The recipient or user of the product is solely responsible for referring to the official regulations on the storage, handling and use of these products.

Glossary of abbreviations

ADN: European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways. ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.
CMR: Carcinogenic, mutagenic or toxic to reproduction. DIN: Standard of the German Institute for Standardisation.
CEx: Concentration associated with x% response.
EmS: Emergency procedure.
GHS: Globally Harmonised System of Classification and Labelling of Chemicals. IATA: International Air Transport Association.
IBC: International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk.
IMDG: International Maritime Dangerous Goods Code. LC50: Lethal concentration for 50% of a test population. NOAEL: No observed adverse effect level.
NOEL: No Observable Effect Level.
NOELR: No Observable Effect Rate. IMO: International Maritime Organisation.
RID: Regulations concerning the International Carriage of Dangerous Goods by Rail (COTIF). UN: United Nations.
VLA: Environmental Limit Values.
UNRTDG: United Nations Recommendations on the Transport of Dangerous Goods.