SAFETY DATA SHEET R600a
Code: TR600 / TR600BB5P / TR600BB25P

Material safety data sheet according regulation (UE) 2015/830
Version 4 – Date: 22nd May, 2019

1. Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Commercial name: R600a
Chemical description: Isobutane, I-Butane
No. CAS: 75-28-5
No. CE: 200-857-2
EU Index number: 601-004-00-0
REACH registration number: 01-2119485395-27

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

Industrial sector: Refrigeration and air-conditioning
Relevant identified uses: Refrigerant gas for refrigeration and air-conditioner systems
Application: Industrial and professional

1.3 Details of the supplier of the safety data sheet

REFRIGERANT BOYS S.R.L.
Corso XX Settembre
21052 - Busto Arsizio VA
tel: +39 329 1858456
mail: service@refrigerantboys.it

1.4 Emergency telephone number

CAV-CNIT Anti-Poison (toxicological) National Information Centre +39 0382 24444 Hours: 24 h / 24 h

2. Hazards identification

2.1 Classification of the substance or mixture

Classification under Regulation (EC) 1272/2008 (CLP)
Flammable gases – Category 1 – Danger (H220)
Gases under pressure – Liquefied gas – Warning (H280)

Classification under Directive EC 67/548/EEC and 1999/45/EC
F+; R12

2.2 Label elements

Dangerous pictogram

GHS04 - GHS02

Signal word: Warning - Danger
Hazard statements (H): H220: Extremely flammable gas
H280: Contains gas under pressure; may explode if heated
Precautionary statements (P): P210: Keep away from heat/sparks/open flames/hot surfaces – No smoking
P377: Leaking gas fire: Do not extinguish unless leak can be stopped safely
P381: Eliminate all ignition sources if safe to do so
P403: Store in a well ventilated place
P410+P403: Protect from sunlight. Store in a well ventilated place.
Symbol(s)  F+: Extremely flammable
List of R-phrases  R12: Extremely flammable
List of S-phrases  S2: Keep out of the reach of children
  S9: Keep container in a well-ventilated place
  S16: Keep away from sources of ignition - No smoking

2.3 Other hazards
Contact with liquid can cause frostbite and severe damage to the eyes.

3. Composition/information on ingredients

3.1 Substances

<table>
<thead>
<tr>
<th>Substance name</th>
<th>%</th>
<th>CAS No.</th>
<th>EC No.</th>
<th>REACH No.</th>
<th>Classification Reg. (CE) 1272/2008 (CLP) and Directive 67/548/EEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isobutano</td>
<td>&gt; 97%</td>
<td>75-28-5</td>
<td>200-857-2</td>
<td>01-2119485395-27</td>
<td>Flam. Gas 1, H220 Press. Gas (Liq.), H280 F+ ; R12</td>
</tr>
</tbody>
</table>

For more information, see sections 8, 11, 12 and 16.

4. First aid measures

General information: If the person is unconscious, place it in the recovery position and get immediately medical attention. Do not give anything to an unconscious person. If breathing is irregular, give oxygen. If breathing stopped, administer artificial respiration. If symptoms persist, call a physician.

Note to physician: Do not give adrenaline-ephedrine or similar drugs group.

4.1 Description of first aid measures

Inhalation  Remove patience from exposure to fresh air. Administer oxygen if necessary. Obtain immediate medical attention.
Skin contact  In case of contact with skin, warm immediately with plenty of water. Remove contaminated clothing. If irritation or blistering occurs, call a physician.
Eye contact  Remove contact lenses, if present. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.
Ingestion  Unlikely route of exposure. As this product is a gas, refer to the section “Inhalation”. Do not induce vomiting without medical advice. Obtain immediate medical attention.

4.2. Most important symptoms and effects, both acute and delayed
In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. In low concentrations may cause narcotic effects. Symptoms may include dizziness, headache, nausea and loss of coordination.

5. Firefighting measures

5.1 Extinguishing media
Suitable extinguishing media  Dry powder, water spray, alcohol-resistant foam and CO2
No suitable extinguishing media  High water jet.

5.2 Special hazards arising from the substance or mixture
Specific hazards  Contents under pressure.
  On heating: heating will cause a rise in pressure with a risk of bursting.
  Toxic and corrosive vapours are released.
  Cool down the containers exposed to heat with a water spray.
  Vapours are heavier than air and can cause rapid suffocation by reducing oxygen available for breathing.
Hazardous combustion  In case of fire, decomposition products may include the following materials: carbon dioxide and monoxide.
5.3 Advice for firefighters

Specific methods
- Coordinate fire measure to the surrounding fire.
- Exposure to flames and heat can cause the container to rupture.
- From protected position, cool endangered containers with water spray jet.
- Do not discharge contaminated water into drains.
- If possible, stop flow of the product.
- If possible, use water spray to knock down the fumes.
- Explosive re-ignition may occur, turn off all the other fire.
- Move containers from fire area if this can be done without risk.

Protective equipment
- Firefighters must use standard protective equipment including SCBA.
- Avoid contact with eyes and skin. Do breath the fumes.

Other information
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
For more information, see section 10.

6. Accidental release measure

6.1 Personal precautions, protective equipment and emergency procedures
- Immediately contact emergency personnel.
- Immediately evacuate personnel to safe areas. Unprotected persons must be kept away.
- Wear personal protective equipment refer to section 8 "Exposure controls/personal protection".
- Remove all sources of ignition.
- Avoid contact with skin (possible frostbite).
- Ventilate the area/local. In case of insufficient ventilation, wear self-contained breathing apparatus.

6.2 Environmental precautions
- Do not allow product to spread into the environment.
- Avoid spillage and prevent possible losses.

6.3 Methods and material for containment and cleaning up
- Ventilate / aerate the area or local.

6.4 Reference to other sections
For more information, see section 8 and 13.

7. Handling and storage

7.1 Precautions for safe handling
Technical measures
- Use only properly specified equipment that is suitable for this product, its supply pressure and temperature.
- In case of doubt, refer to supplier’s handling instructions.
- Only experienced and properly instructed persons should handle gases under pressure.
- Service technician must check regularly your entire gas system to ensure that it is leak-free.

Safe handling
- The substance must be handled in accordance with good industrial hygiene and safety procedures.
- Refer to supplier’s / manufacturer’s handling instructions.
- Handle and open container with care. Caution when opening, pressurized container.
- Protect from sunlight and do not expose to temperatures exceeding 50° C (122 °F).
- Do not spray on a naked flame or any incandescent material.
- Do not use in area without adequate ventilation.
- Protect containers from physical damage; do not drag, roll, slide or drop.
- Do not pierce or burn, even after use.
- Leave valve protection caps in place until the container is ready for use.
- Close container valve after each use and when empty, even if still connected to equipment.

Industrial hygiene
- Ensure adequate ventilation of the working area.
- Do not drink, eat or smoke in the working area.
7.2 Conditions for safe storage, including any incompatibility

Requirements for storage areas and containers
Keep containers tightly closed in a dry, cool and well-ventilated place, away from any ignition or heat sources. Store in original container. Container valves or caps should be in place.

Incompatible materials
Avoid storage with oxidizing products, acids and, in general, with chemicals. Avoid storage with tools or equipment that may cause sparks.

7.3 Specific end use(s)
For professional and industrial use only.

8. Exposure controls/personal protection

8.1 Control parameters
OEL (Occupational Exposure Limit): No data available.

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS Nr.</th>
<th>TLV-TWA</th>
<th>Control parameters</th>
<th>Font</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isobutane</td>
<td>75-28-5</td>
<td>8 h</td>
<td>800 ppm 1900 mg/m³</td>
<td>AGCIH</td>
<td>2010</td>
</tr>
</tbody>
</table>

DNEL and DMEL = the substance have no harmful effect on human health.
PNEC = the substance have no harmful effect on the environmental.

8.2 Exposure controls
Ensure adequate ventilation. In case of insufficient ventilation, wear self-contained breathing apparatus. Wash the hands before and after using the gas. Do not smoke.

Personal protective equipment must comply with EU directives: respiratory protective equipment EN 136, 140, 149; eye protection (protective goggles or safety glasses) EN 166; skin protection EN 340, 463, 468, 943-1, 943-2; hands protection (protective gloves) EN374, safety boots EN ISO 20345.

8.2.2 Individual protection measures, such as personal protective equipment

a) Eye/face protection
Safety glasses with side-shields (according to directive EN 166).

b) Skin protection
i) Hand protection
It is recommended to use protective gloves against cold (EN 511). The penetration time of the gloves must be greater than the period of expected use. Gloves should be replaced immediately if they show signs of wear or deterioration.

ii) Other
Evaluate the need for flame resistant workwear.
EN ISO 14116 Protective clothing - Protection against heat and flame - Limited flame spread materials.
EN ISO 1149-5 Protective clothing – Electrostatic properties.
Wear safety shoes while handling containers.
EN ISO 20345 Personal protective equipment - Safety shoes.

Apron or protective clothing are not necessary.

c) Respiratory protection
The vapours are heavier than air and can cause asphyxia caused to an reduction of oxygen level. In case of insufficient ventilation, wear self-contained breathing apparatus (EN 133).

8.2.3. Environmental exposure controls
Handling in accordance with good industrial hygiene and safety practice. Prevent spillage or leakage of the product in watercourse or sewers (explosion danger). Avoid air emissions.
For more information, see section 7.
9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance: Liquefied gas
   Colour: Colourless
b) Odour: Odourless
c) Odour threshold: Odour threshold is subjective and is inadequate to warn of over exposure.
d) pH: n.a.
e) Melting point: -182,47 °C (experimental result, supporting study)
f) Initial boiling point: -11,73 °C @ 1013 hPa (experimental result, supporting study)
g) Flash point: -88,6 °C
h) Evaporation rate: Not applicable to gas and gas mixtures
i) Flammability (solid, gas): Not applicable to gas and gas mixtures
j) Upper/lower flammability: 12,5 % (V) (experimental result, supporting study) / 1,50 % (V)
k) Vapour pressure: 2.200 Pa @ 20° C
l) Vapour density: 2,01 (air = 1)
m) Relative density: 0,59
n) Solubility (in the water): 54 mg/l
o) Partition coefficient: n-Octanol/water: 2,76 log Kow
p) Auto-ignition temperature: 287 °C (experimental result, supporting study)
q) Decomposition temperature: Not available data
r) Viscosity (at 100° C): Not available data
s) Explosive properties: Not available data
t) Oxidising properties: Not oxidising according with EU criteria

9.2 Other information

Critical temperature (°C): 135 °C
Vapour pressure: 347,97 kPa @ 25 °C
Molecular weight: 58,12 g/mol (C4H10)

10. Stability and reactivity

10.1 Reactivity
Stable under normal handling and storage conditions.

10.2 Chemical stability
Stable under normal handling and storage conditions.

10.3 Possibility of hazardous reactions
May react violently with oxidants.
Can form explosive mixture with air.

10.4 Conditions to avoid
Contains gas under pressure, may explode if heated.
Protect from sunlight and do not expose to temperatures exceeding 50 °C.
Keep away from heat, sparks, open flame or other sources of ignition. Do not smoke.
Do not pierce or burn, even after use.
Do not spray on a naked flame or any incandescent material.

10.5 Incompatible materials
Air, oxidizing agents.

10.6 Hazardous decomposition products
Under normal conditions of storage and use, hazardous decomposition products should not be produced.
In case of combustion, toxic compositions, may be formed: carbon monoxide (CO) and carbon dioxide (CO₂).
11. Toxicological information

11.1 Information on toxicological effects

a) Acute toxicity

Inhalation

<table>
<thead>
<tr>
<th>Substance</th>
<th>CL50</th>
<th>Exposition time</th>
<th>Animal species</th>
</tr>
</thead>
<tbody>
<tr>
<td>R600a</td>
<td>658 000 ppm</td>
<td>4 h</td>
<td>Rat</td>
</tr>
</tbody>
</table>

b) Skin corrosion/Skin irritation

Based on available data the classification criteria are not met.

c) Serious eye damage/irritation

Based on available data the classification criteria are not met.

d) Respiratory sensitisation

Based on available data the classification criteria are not met.

e) Germ cell mutagenicity

Based on available data the classification criteria are not met.

f) Carcinogenicity

Based on available data the classification criteria are not met.

g) Reproductive toxicity

Based on available data the classification criteria are not met.

h) STOT-single exposure

Based on available data the classification criteria are not met.

i) STOT-repeated exposure

Based on available data the classification criteria are not met.

j) Aspiration hazard

Based on available data the classification criteria are not met.

Other information

High concentrations may cause drowsiness, headache and dizziness. If the amount of oxygen in the air drops below 17% may cause unconsciousness, asphyxia and / or CNS depression.

Inhalation at high concentrations of decomposition products may cause respiratory failure (pulmonary edema).

Contact with compressed gas may cause frostbite and serious ocular injury.

12. Ecological information

12.1 Toxicity

<table>
<thead>
<tr>
<th>Substance</th>
<th>CL50</th>
<th>Exposition time</th>
<th>Species</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>27.98 mg/l</td>
<td>96 h</td>
<td>Various</td>
<td>QSAR, supporting study</td>
</tr>
<tr>
<td>Aquatic invertebrates</td>
<td>14.22 mg/l</td>
<td>48 h</td>
<td>Daphnia magna</td>
<td>QSAR, supporting study</td>
</tr>
</tbody>
</table>

12.2 Persistence and degradability

The substance will be readily biodegradable and it is not expected to persist in the environment.

12.3 Bioaccumulative potential

The substance are not considered to be persistent in the environment due to its low log Kow (log Kow < 4).

12.4 Mobility in soil

Because of its high volatility, the product is unlikely to cause ground or water.

12.5 Results of PBT and vPvB assessment

Not classified as PBT or vPvB.

12.6 Other adverse effects

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone Depletion Potential</td>
<td>ODP (R-11=1) = 0</td>
</tr>
<tr>
<td>Global Warming Potential</td>
<td>GWP (CO2=1) = 3</td>
</tr>
</tbody>
</table>
13. Disposal consideration

13.1 Waste treatment methods

Product: Take all necessary measures to prevent the production of residuals, value the possible methods of regeneration or recycling. Dispose in accordance with local, state, and federal regulations. Do not discharge into drains or environment.

Packaging: Reuse and recycle the packaging after its reclaim. Dispose of non-reusable packaging in accordance with local, state, and federal regulations.

European Waste Code (EWC)

Product: 16 05 04: gases in pressure containers (including halons) containing dangerous substances.
Packaging: 15 01 11: metallic packaging containing a hazardous solid porous matrix (for example asbestos), including empty pressure containers.

Additional information


14. Transport information

14.1 UN Number

UN 1969

14.2 UN proper shipping name

Isobutane

Hazard labels

ADR/RID, IMDG, IATA/ICAO

2.1 Flammable gas

ADR (Transport by road) / RID (Transport by rail)

<table>
<thead>
<tr>
<th>14.3 Transport hazard class(es)</th>
<th>Classification code</th>
<th>Kemler number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5F</td>
<td>23</td>
</tr>
</tbody>
</table>

14.4 Packing group

Packing instruction: n.a.

Packing instruction: P200

14.5 Environmental hazards

No

Additional information

Tunnel restriction code of total load: B/D: Passage forbidden through tunnels of category B and D

Transport by air (IATA/ICAO)

<table>
<thead>
<tr>
<th>14.3 Transport hazard class(es)</th>
<th>Class/Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2.1</td>
</tr>
</tbody>
</table>

14.4 Packing group

Passengers and cargo flights: n.a.

Only cargo flights: Forbidden 200

14.5 Environmental hazards

No

Additional information

Limited quantity (LQ): Forbidden

Transport by sea (IMDG)

<table>
<thead>
<tr>
<th>14.3 Transport hazard class(es)</th>
<th>Class/Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2.1</td>
</tr>
</tbody>
</table>

14.4 Packing group

Emergency Schedule (EmS): F-C, S-V

Packing instruction: n.a.

Packing instruction: P200

14.5 Environmental hazards

No

14.6 Special precautions for user

Avoid transport on vehicles where the load space is not separated from the driver’s compartment.

Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Ensure that containers are firmly secured.
Ensure there is adequate ventilation.

14.7 Transport in bulk according in Annex II of MarPol and the IBC Code
Not applicable.

15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
Ozone Depletion Potential ODP (R-11=1) = 0
Global Warming Potential GWP (CO2=1) = 3

Additional regulations/legislations
Regulation (EU) No. S17/2014
Directive Seveso 96/82/EC: Not included

15.2 Chemical safety assessment
A Chemical Safety Assessment (CSA) has been made for this product.

16. Other information
This Material Safety Data Sheet has been made according European Directive in force.

Text of H and P phrases in section 2 and 3
H220: Extremely flammable gas
H280: Contains gas under pressure; may explode if heated
P210: Keep away from heat/sparks/open flames/hot surfaces – No smoking
P377: Leaking gas fire: Do not extinguish unless leak can be stopped safely
P381: Eliminate all ignition sources if safe to do so
P403: Store in a well ventilated place

Text of R and S phrases in section 2
R12: Extremely flammable
S2: Keep out of the reach of children
S9: Keep container in a well-ventilated place
S16: Keep away from sources of ignition - No smoking

Text of “Security code” in section 3; under Regulation (EC) 1272/2008 (CLP) and Classification n. 67/548/EEC
Flam. Gas 1 Flammable gas Category 1
Press. Gas (Liq.) Pressurized gas : Liquefied gas
F+ Extremely Flammable
R12 Extremely flammable: liquids having a boiling point lower or equal to 35 °C

History
<table>
<thead>
<tr>
<th>Version</th>
<th>Revision date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 4</td>
<td>05/2019</td>
</tr>
<tr>
<td>Version 3</td>
<td>11/2015</td>
</tr>
<tr>
<td>Version 2</td>
<td>05/2015</td>
</tr>
<tr>
<td>Version 1</td>
<td>03/2011</td>
</tr>
</tbody>
</table>

b) Abbreviations and acronyms
ADR Accord Dangerous Route
CAS Chemical Abstracts Service
CE / EC European Community
CLP Classification, Labelling and Packaging
CSA Chemical Safety Assessment
DNEL Derived No Effect Level
DMEL Derived Minimum Effect Level
EC50 Effective Concentration 50%
EmS Emergency Schedule
EWS European Waste System
GHS Globally Harmonized System
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GWP    Global Warming Potential
HCFC   Hydro-Chloro-Fluoro-Carbons
HFC    Hydro-Fluoro-Carbons
IATA   International Air Transport Association
IBC Code International Bulk Chemical code
ICAO   International Civil Aviation Organization
IMDG code International Maritime Dangerous Goods code
LC50   Lethal Concentration 50%
Log Kow Logarithm Partition coefficient N-octanol /Water
MARPOL MARitime POLLution (Inquinamento Marittimo)
n.a.    not applicable
n.d.a.   no data available
ODP    Ozone Depletion Potential
OEL    Occupational Exposure Limit
PBT    Persistent, Bioaccumulative, Toxic
PNEC   Predicted No Effect Concentration
REACH Registration, Evaluation, Authorisation and Restriction of Chemicals
RID    Rail International transport Dangerous Goods
STOT-RE Specific Target Effect Concentration (Repeated Exposure)
STOT-SE Specific Target Effect Concentration (Single Exposure)
TLV    Threshold Limit Value
TWA    Time Weighted Average
UE / EU European Union
VOC    Volatile Organic Compounds
vPvB   very Persistent very Bioaccumulative

Notice of liability
This information should not constitute a guarantee for any specific product properties. This information are only a guidance for safe handling, use, processing, storage, transportation, disposal and release and are not to be considered a warranty or a quality specification.

The information contained in this safety data sheet are based on our current knowledge and EU and national laws; they describe the product only with regard to safety requirements. The conditions of the user are beyond our knowledge and control. The product should not be used for purpose other than those specified. It is always the responsibility of the user to take all the necessary measures to comply with the requirements of current legislation. The information contained in this form should not considered as a guarantee of its properties.