

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 1 of 14

1. Identification

1.1 Product identifier

COMMERCIAL NAME: R600a
CHEMICAL DESCRIPTIONS: Isobutane, I-Butane
CHEMICAL FAMILY: Aliphatic hydrocarbon
CAS No.: 75-28-5
EINECS No: 200-857-2
CHEMICAL FORMULA: C₄H₁₀
SYNONYMS: 2-Methylpropane

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-conditioners systems
Application : Industrial and professional

1.3 Details of the supplier of the safety data sheet

NAME: Shan Dong Yue An Chemical Industry Co.,LTD
ADDRESS: Danyang intersection, Shanghai Road, Heze Development Zone, Shandong Province
PHONE NUMBER: 0530-5725117

1.4 Emergency telephone number

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

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 2 of 14



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

EYE EFFECTS: None anticipated as product is a gas at room temperature.

SKIN EFFECTS: None anticipated as product is a gas at room temperature.

INGESTION EFFECTS: Ingestion is unlikely.

INHALATION EFFECTS: Product is relatively nontoxic. Simple hydrocarbons can irritate the eyes, mucous membranes and respiratory system at high concentrations. Inhalation of high concentrations may cause dizziness, disorientation, in coordination, narcosis, or nausea or narcotic.

This product may displace oxygen if released in a confined space. Maintain oxygen levels above 19.5% at sea level to prevent asphyxiation. Effects of oxygen deficiency resulting from simple asphyxiate may include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgment, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma, and death.

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 3 of 14

Oxygen deficiency during pregnancy has produced development abnormalities in humans and experimental animals.

3.Composition/information on ingredients

3.1 Substances

INGREDIENT NAME	CONCENTRATION PERSENT BY WEIGHT	CAS NUMBER	INECS No	OSHA PEL -TWA	Classification Reg. (CE) 1272/2008 (CLP) and Directive 67/548/EEC
Isobutane	≥99.92%	75-28-5	200-857-2	Simple Asphyxiant	Flam. Gas 1, H220 Press. Gas (Liq.), H280 F+ ; R12

Water CAS No: 7732-18-5 ≤ 0.08%

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.

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4.1Description of first aid measures

Eye contact

Never introduce oil or ointment into the eyes without medical advice! 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 or refer the victim to ophthalmologist for further treatment and follow-up.

SKIN

In case of contact with skin, wash immediately with plenty of water. Remove contaminated clothing and flush affected area with cold water and soap. If irritation or blistering occurs, call a physician.

Ingestion

Remove patient from exposure to fresh air. Administer oxygen if necessary. Obtain immediate medical attention.

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 4 of 14

Inhalation

Remove patient from exposure to fresh air. Administer oxygen if necessary. 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

FLAMMABLE PROPERTIES

FLASH POINT: -117°F (-83°C) Closed Cup

AUTOIGNITION: -778°F (420°C)

LOWER EXPLOSIVE LIMIT (%): 1.8

UPPER EXPLOSIVE LIMIT (%): 8.4

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.

Use water spray to cool exposed containers.

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 5 of 14

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.
If fire is extinguished and flow of gas is continues, increase ventilation to prevent a build up of a flammable / explosive atmosphere.

Protective equipment Firefighters must use standard protective equipment including SCBA.
Avoid contact with eyes and skin. Don't breath the fumes.

Other information

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Be cautious of Boiling Liquid Evaporating Vapor Explosion, BLEVE, if flame is impinging on surrounding containers.
Direct a 500 GPM water stream onto containers above the liquid level with remote monitors.
Limit the number of personnel in proximity to the fire.
Evacuate surrounding area to at least 3000 feet in all directions.
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.
If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call Advanced Gas Tech. or CHEMTREC.

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.

6.4 Reference to other sections

For more information, see section 8 and 13

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 6 of 14

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. Do not remove or deface labels provided by the supplier for the identification of the container contents.
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.

Post “No Smoking” signs in storage or use areas.

Incompatible materials

Avoid storage with oxidizing products, acids and, in general, with chemicals.

Avoid storage with tools or equipment that may cause sparks.

Electrical equipment should be non-sparking and explosion proof.

7.2 Specific end use(s)

For professional and industrial use only.

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 7 of 14

8. Exposure controls/personal protection

8.1 Control parameters

OEL (Occupational Exposure Limit): No data available.

Components	CAS NO.	TLV-TWA	Control parameters	Font	Year
Isobutane	75-28-5	8 h	800 ppm 1900 mg/m ³	AGCIH	2010

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.

8.3 Individual protection measures, such as personal protective equipment

a) **Eye/face protection** Safety goggles or 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.

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 8 of 14

- 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).



OTHER/GENERAL PROTECTION

Safety shoes, safety shower, eyewash

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	-255.3 °F -159.6°C (experimental result, supporting study)
f) Initial boiling point	10.9°F - 11,73° C @ 1013 hPa (experimental result, supporting study)
g) Flash point	- 82.8° 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	(@70 F) 45 psia
l) Vapour density	2,06 (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

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 9 of 14

9.2 Other information

Critical temperture (° 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.

Avoid high temperatures. Product will start to decompose at 815°F (435°C)

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	CL50: 658 000 ppm
	Exposition time: 4 h
	Animal species: Rat

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 10 of 14

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

Fish	CL50: 27,98 mg/l Exposure time: 96 h Species: Various Remarks: QSAR, supporting study
Aquatic invertebrates	CL50: 14,22 mg/l Exposure time: 48 h Specied: Daphnia magna Remarks: QSAR, supporting study

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

Ozone Depletion Potential ODP (R-11=1) = 0

Global Warming Potential GWP (CO2=1) = 3

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 11 of 14

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

Waste directives and regulations: Directive 2006/12/CE, Directive 91/689/CE, Regulation (EC) no. 1013/2006.

Dispose of waste product in compliance with EC, state and/or local regulations. For more information, see section 8.

14. Transport information

14.1 UN Number UN 1969 2.1

14.2 UN proper shipping name Isobutane

Hazard labels

ADR/RID, IMDG, IATA/ICAO



2.1 Flammable gas

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 12 of 14

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

14.3 Transport hazard class(es) <i>Classification code</i> <i>Kemler number</i>	2 5F 23
14.4 Packing group <i>Packing instruction</i>	n.a. P200
14.5 Environmental hazards	No
Additional information <i>Tunnel restriction code of total load</i>	B/D: Passage forbidden through tunnels of category B and D

Transport by air (IATA/ICAO)

14.3 Transport hazard class(es) <i>Class/Division</i>	2 2.1
14.4 Packing group <i>Passengers and cargo flights</i> <i>Only cargo flights</i>	n.a. Forbidden 200
14.5 Environmental hazards	No
Additional information <i>Limited quantity (LQ)</i>	Forbidden

Transport by sea (IMDG)

14.3 Transport hazard class(es) <i>Class/Division</i> <i>Emergency Schedule (EmS)</i>	2 2.1 F-C, S-V
14.4 Packing group <i>Packing instruction</i>	n.a. 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.

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. 517/2014

Directive Seveso 96/82/EC: Not included

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 13 of 14

15.2 Chemical safety assessment

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

15.3 SARA TITLE

SARA TITLE NOTIFICATIONS AND INFORMATION

SARA TITLE - HAZARD CLASSES: Acute Health Hazard

Fire Hazard

Sudden release of Pressure Hazard

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	Version 4	Version 3	Version 2	Version 1
	Revision date: 05/2019	Date: 06/2015	Date: 05/2015	Date: 05/2011

a) Abbreviations and acronyms

ADR	Accord Dangerous Route
CAS	Chemical Abstracts Service
CE / EC	European Community
CLP	Classification, Labelling and Packaging
CSA	Chemical Safety Assessment

Safety Data Sheet

(REFRIGERANT R600a - ISOBUTANE)

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

Page 14 of 14

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
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 be considered as a guarantee of its properties.
