* SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Trade name/designation	R 600a - Profi/Mini
Art-Nr(n).	0081, 0082
Substance name	isobutane
INDEX No.	601-004-00-0
EC No.	200-857-2
REACH No.	01-2119485395-27
CAS No.	75-28-5

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

Sector of uses [SU]
SU3 Industrial uses
SU4 Manufacture of food products
SU5 Manufacture of textiles, leather, fur
SU6b Manufacture of pulp, paper and paper products
SU7 Printing and reproduction of recorded media
SU8 Manufacture of bulk, large scale chemicals (including petroleum products)
SU9 Manufacture of fine chemicals
SU10 Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
SU11 Manufacture of rubber products
SU12 Manufacture of plastics products, including compounding and conversion
SU13 Manufacture of other non-metallic mineral products, e.g. plasters, cement
SU19 Building and construction work
SU21 Consumer uses: Private households (= general public = consumers)
SU22 Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
SU24 Scientific research and development

Process categories [PROC]
PROC1 Use in closed process, no likelihood of exposure
PROC2 Use in closed, continuous process with occasional controlled exposure
PROC3 Use in closed batch process (synthesis or formulation)
PROC4 Use in batch and other process (synthesis) where opportunity for exposure arises
PROC5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC6 Calendering operations
PROC7 Industrial spraying
PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC10 Roller application or brushing
PROC11 Non industrial spraying
PROC12 Use of blowing agents in manufacture of foam
PROC13 Treatment of articles by dipping and pouring
PROC14 Production of preparations or articles by tabletting, compression, extrusion, pelletisation
PROC15 Use as laboratory reagent
PROC16 Use of fuels
PROC17 Lubrication at high energy conditions in metal working operations
PROC18 General greasing /lubrication at high kinetic energy conditions
PROC20 Use of functional fluids in small devices
PROC21 Low energy manipulation and handling of substances bound in/on materials or articles
PROC24 High (mechanical) energy work-up of substances bound in /on materials and/or articles

Environmental release categories [ERC]
ERC1 Manufacture of substances
ERC2 Formulation into mixture
ERC3 Formulation into solid matrix
ERC4 Industrial use of processing aids in processes and products, not becoming part of articles
ERC5 Use at industrial site leading to inclusion into/onto article
ERC6a Industrial use resulting in manufacture of another substance (use of intermediates)
ERC6c Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article)
ERC6d Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article)
ERC7 Use of functional fluid at industrial site
ERC8a Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)
ERC8c Widespread use leading to inclusion into/onto article (indoor)
ERC8d Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)
ERC8e Widespread use of reactive processing aid (no inclusion into or onto article, outdoor)
ERC8f Widespread use leading to inclusion into/onto article (outdoor)
ERC9a Widespread use of functional fluid (indoor)
ERC9b Widespread use of functional fluid (outdoor)
ERC10a Widespread use of articles with low release (outdoor)
ERC11a Widespread use of articles with low release (indoor)

Product Categories [PC]
PC1 Adhesives, sealants
PC3 Air care products
PC4 Anti-Freeze and de-icing products
PC8 Biocidal products
PC9a Coatings and paints, thinners, paint removers
PC9b Fillers, putties, plasters, modelling clay
PC9c Finger paints
PC12 Fertilizers
PC13 Fuels
PC15 Non-metal-surface treatment products
PC18 Ink and toners
PC21 Laboratory chemicals
PC23 Leather treatment products
PC24 Lubricants, greases, release products
PC25 Metal working fluids
PC26 Paper and board treatment products
PC27 Plant protection products
PC28 Perfumes, fragrances
PC29 Pharmaceuticals
PC31 Polishes and wax blends
PC32 Polymer preparations and compounds
PC34 Textile dyes, and impregnating products
PC35 Washing and cleaning products
PC36 Water softeners
PC37 Water treatment chemicals
PC38 Welding and soldering products, flux products
PC39 Cosmetics, personal care products

* 1.3 Details of the supplier of the safety data sheet

Supplier
GHC Gerling, Holz & Co. Handels GmbH
Ruhrstraße 113
D-22761 Hamburg
Telephone +49 40 853 123 0
E-mail hamburg@ghc.de
Website www.ghc.com

Department responsible for information:
GHC Gerling, Holz & Co. Handels GmbH
Telephone +49 40 853 123 0

E-mail (competent person):
msds@ghc.de

* 1.4 Emergency telephone number

EN: Poison Information Center Mainz +49 6131 19240

* SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [CLP]	Classification procedure
Aerosol 1, H222 H229	

Hazard statements for physical hazards
H222 Extremely flammable aerosol.
H229 Pressurised container: May burst if heated.

* 2.2 Label elements

* Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms

GHS02

Signal word
Danger

Hazard statements
H222 Extremely flammable aerosol.
H229 Pressurised container: May burst if heated.

* **Precautionary statements**
P101 If medical advice is needed, have product container or label at hand.
P102 Keep out of reach of children.
P103 Read carefully and follow all instructions.
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211 Do not spray on an open flame or other ignition source.
P251 Do not pierce or burn, even after use.
P410 + P412 Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F.

* **Supplemental hazard information**
For professional users only.

* 2.3 Other hazards

* **Adverse human health effects and symptoms**
Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.
The inhalation of gas / vapour in high concentrations may cause cardiac arrhythmia.
Contact with liquid may cause cold burns/frostbite.

* **Other adverse effects**
The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

* **Results of PBT and vPvB assessment**
The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

SECTION 3: Composition / information on ingredients

3.1 Substances

Substance name	isobutane
INDEX No.	601-004-00-0
EC No.	200-857-2
REACH No.	01-2119485395-27
CAS No.	75-28-5
ATE	ATE(inhalation gas): 520400 ppm

Additional information
Content: > 95 %

3.2 Mixtures

not applicable

* SECTION 4: First aid measures

* 4.1 Description of first aid measures

* **General information**
Remove contaminated, saturated clothing immediately.
In the event of persistent symptoms obtain medical treatment.
First aider: Pay attention to self-protection!

Following inhalation
Remove casualty to fresh air and keep warm and at rest.
In case of respiratory standstill give artificial respiration by respiratory bag (Ambu bag) or respirator. Obtain medical assistance.

* **Following skin contact**
In case of skin contact rinse with warm water.
In case of frostbite, wash with plenty of water; do not remove clothing.
In case of frostbite rinse with lukewarm (not hot) water for at least 15 minutes. Do not remove clothing frozen to the skin.
Thaw with lukewarm water. Apply a sterile dressing. Obtain medical assistance.

After eye contact
Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical assistance.

Following ingestion
Ingestion is not considered a potential route of exposure.

* 4.2 Most important symptoms and effects, both acute and delayed

Symptoms
The following symptoms may occur in case of strong exposition:
Unconsciousness
Cardiac arrhythmias
Dyspnoea
Nausea
Headache

* 4.3 Indication of any immediate medical attention and special treatment needed

* **Notes for the doctor**
Treat symptomatically.
Do not apply drugs of the adrenaline ephedrine group.

* SECTION 5: Firefighting measures

* 5.1 Extinguishing media

* **Suitable extinguishing media**
Extinguishing powder
Water spray jet

Unsuitable extinguishing media
Carbon dioxide (CO_2)
Full water jet

* 5.2 Special hazards arising from the substance or mixture

* **Hazardous combustion products**
In case of fire formation of dangerous gases possible.
Formation of explosive gas mixtures in contact with air.
Carbon monoxide
Carbon dioxide (CO_2)

* **5.3 Advice for firefighters**

* **Special protective equipment for firefighters**
Wear a self-contained breathing apparatus and chemical protective clothing.

* **Additional information**
If possible, shut off gas valves and move containers to a safe location.
Use water spray jet to protect personnel and to cool endangered containers.
Exposure to fire may cause rupture / explosion of the containers.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Dispose of fire residues and contaminated extinguishing water in accordance with local, official regulations.

* SECTION 6: Accidental release measures

* 6.1 Personal precautions, protective equipment and emergency procedures

* **For non-emergency personnel**
Use personal protection equipment.
Leave the danger area.
Keep people away and stay on the upwind side.

* **For emergency responders**
Personal protection by wearing close-fitting protective clothing and breathing apparatus.
Pay attention to extension of gas especially at ground (heavier than air) and in direction of the wind.
Remove persons to safety.
Eliminate all ignition sources if safe to do so.

* 6.2 Environmental precautions

If possible, stop flow of product.
Do not allow to enter into soil/subsoil.
Do not allow to enter into surface water or drains.

* 6.3 Methods and material for containment and cleaning up

* **For containment**
If necessary, secure leaky pressure receptacles using a salvage container.
Prevent the liquid from spreading over a wide area (set up barriers, cover sewage systems).
Limit expansion of the gas (water spray jet).

* **For cleaning up**
Leave to vapourize.
Provide adequate ventilation.

6.4 Reference to other sections

Disposal: see section 13
Personal protection equipment: see section 8

* SECTION 7: Handling and storage

* 7.1 Precautions for safe handling

* **Protective measures**
Use only in well-ventilated areas.
Usual measures for fire prevention.
Containers' temperature should not be increased above 50 °C.
The working pressure in the receptacle must not exceed the saturation vapour pressure of the pure product resulting at a temperature of 50 °C.
Take precautionary measures against static discharges. Ground barrels and installations. Use only antistatically equipped (spark-free) tools.
Use explosion-proof machinery, apparatus, ventilation facilities, tools etc.
Open valve slowly to avoid pressure shock.
Entering of water into the container must be prevented.
No water to valves, flanges and other fittings.

Advices on general occupational hygiene
When using do not eat, drink, smoke, sniff.
Wash hands before breaks and after work.
Remove contaminated clothing and protective equipment before entering eating areas.

*** 7.2 Conditions for safe storage, including any incompatibilities**

*** Requirements for storage rooms and vessels**
All regulations and local requirements for the storage of containers have to be respected.
Keep container tightly closed and in a well-ventilated place.
Containers' temperature should not be increased above 50 °C.
Information on suitable materials for receptacles and valves see ISO 11114.

*** Storage class**
2B Aerosol dispensers and lighters

*** Materials to avoid**
Do not store together with explosives.
Do not store together with flammable solids.
Do not store together with pyrophoric and self-heating substances.
Do not store together with oxidizing liquids or oxidizing solids.
Do not store together with infectious substances.
Do not store together with radioactive material.
Do not store together with food or feed.

*** 7.3 Specific end use(s)**

*** Recommendation**
Exposure scenarios (ES) see annex to this safety data sheet.

* SECTION 8: Exposure controls/personal protection

*** 8.1 Control parameters**

*** Occupational exposure limit values**

CAS No.	EC No.	Substance name	occupational exposure limit value
75-28-5	200-857-2	isobutane	Short-term(ml/m³) 1000 (1) (1) 15 minutes average value (IE)

*** 8.2 Exposure controls**

Appropriate engineering controls

Technical measures to prevent exposure
Transfer and handle only in enclosed systems.

*** Personal protection equipment**

Eye/face protection
Protective goggles according to EN 166, in case of increased risk add protective face shield.

*** Hand protection**
Safety gloves according to EN 388:
Chromate-free leather

*** Body protection:**
Safety shoes with steel toecap.
Body covering work clothing or chemical resistant suit at increased risk.

*** Respiratory protection**
Keep self contained breathing apparatus readily available for emergency use.
Respiratory protection necessary at:
high concentrations
Respiratory protection complying with EN 137.
Short term: filter apparatus, filter AX
In case of rescue and maintenance activities in storage containers use environment-independent breathing apparatus because of risk of suffocation due to displacement of oxygen.

* **Thermal hazards**
Use cold-resistant protective equipment.

* **Environmental exposure controls**

* **Remark**
Prevent release to the environment.

* SECTION 9: Physical and chemical properties

* 9.1 Information on basic physical and chemical properties

Physical state
Gaseous / liquefied under pressure.

Colour
colourless

Odour
like:
Gasoline

Safety relevant basis data

	Value	Method	Source, Remark
Odour threshold:			not determined
Melting point/freezing point			not applicable
Boiling point or initial boiling point and boiling range	-11.7 °C pressure 1013 hPa		
flammability			inflammable
Lower and upper explosion limit	Upper explosion limit 9.4 Vol-%		
Lower and upper explosion limit	Lower explosion limit 1.5 Vol-%		
Flash point			not applicable
Auto-ignition temperature	460 °C		
Decomposition temperature			No decomposition if used as directed.
pH			not applicable
Viscosity			not applicable
Solubility(ies)	Water solubility 49 mg/L (20°C)		
Partition coefficient n-octanol/water (log value)	2.76		
Vapour pressure	3019 hPa (20°C)		
Density and/or relative density			not applicable
Relative vapour density	2.07		air = 1
particle characteristics			not applicable

* 9.2 Other information

* **Information with regard to physical hazard classes**

* **Gases under pressure**

Safety characteristics

	Value	Method, Result	Source, Remark
Critical temperature	135 °C		

* **Other information**
Vapours are heavier than air.

* SECTION 10: Stability and reactivity

* 10.1 Reactivity

May form an explosive mixture with air.

* 10.2 Chemical stability

The substance is chemically stable under recommended conditions of storage, use and temperature.

* 10.3 Possibility of hazardous reactions

Violent reaction with:
Acetylene
Nitrogen oxides (NOx)

* 10.4 Conditions to avoid

Heat sources / heat - risk of bursting.
Ignition sources, open flames, glowing metal surfaces, etc.

* 10.5 Incompatible materials

Oxidising agent

10.6 Hazardous decomposition products

When handled and stored appropriately, no dangerous decomposition products are known.

* SECTION 11: Toxicological information

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

*** Acute toxicity**

*** Animal data**

	Effective dose	Method,Evaluation	Source, Remark
Acute oral toxicity			Study technically not feasible.
Acute dermal toxicity			Study technically not feasible.
Acute inhalation toxicity	CAS No.75-28-5 isobutane Acute inhalation toxicity (gas) LC50: 520400 ppm Species Mouse Exposure time 2 h		

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

*** Skin corrosion/irritation**

*** Other information**
Study technically not feasible.

*** Serious eye damage/irritation**

*** Other information**
Study technically not feasible.

*** Sensitisation to the respiratory tract**

*** Other information**
No data available

* **Skin sensitisation**

* **Other information**
Study technically not feasible.

* **Germ cell mutagenicity**

	Value	Method	Result / Evaluation	Remark
In vitro mutagenicity/genotoxicity		OECD 471	negative	
In vivo mutagenicity/genotoxicity	Inhalation Species Rat	OECD 474	negative	Analogous to a similar product.

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

* **Carcinogenicity**

* **Assessment/classification**
No data available

* **Reproductive toxicity**

Animal data

	Value	Method	Result / Evaluation	Remark
Reproductive toxicity	inhalative NOAEC 3000 ppm Species Rat	OECD 422		

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

* **STOT-single exposure**

* **STOT SE 1 and 2**

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

* **STOT-repeated exposure**

* **Animal data**

	Effective dose	Method	Specific effects:	Organs affected:	Source, Remark
Inhalative specific target organ toxicity (repeated exposure)	NOAEL(C): 10000 ppm Species Rat Exposure duration 91 d	OECD 413			Analogous to a similar product.

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

* **Aspiration hazard**

* **Assessment/classification**
Study technically not feasible.

11.2 Information on other hazards

Symptoms related to the physical, chemical and toxicological characteristics

* **Additional information**
The inhalation of gas / vapour in high concentrations may cause cardiac arrhythmia.
Inhalation causes narcotic effects/intoxication.

* SECTION 12: Ecological information

* 12.1 Toxicity

* **Aquatic toxicity**

	Effective dose	Method,Evaluation	Source, Remark
Acute (short-term) fish toxicity	LC50: 24.11- 147.54 mg/L Test duration 96 h	QSAR	
Chronic (long-term) fish toxicity	not determined		
Acute (short-term) toxicity to crustacea	LC50 7.02- 69.43 mg/L Test duration 96 h	QSAR	
Chronic (long-term) toxicity to aquatic invertebrate	not determined		
Acute (short-term) toxicity to algae and cyanobacteria	EC50 7.71- 16.5 mg/L Test duration 96 h	QSAR	
Chronic (long-term) toxicity to aquatic algae and cyanobacteria	not determined		
Toxicity to other aquatic plants/organisms	not determined		
Toxicity to microorganisms	not determined		

* 12.2 Persistence and degradability

	Value	Method	Source, Remark
Biodegradation	Degradation rate 100 % Test duration 385.5 h	OECD + QSAR	Analogous to a similar product.

* **Assessment/classification**
Readily biodegradable (according to OECD criteria).

* 12.3 Bioaccumulative potential

* **Assessment/classification**
Based on the n-octanol/water partition coefficient accumulation in organisms is not expected.

* 12.4 Mobility in soil

* **Assessment/classification**
No data available

* 12.5 Results of PBT and vPvB assessment

The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

* 12.6 Endocrine disrupting properties

	Effective dose	Method,Evaluation	Source, Remark
Endocrine disrupting properties			See section 2.3

* 12.7 Other adverse effects

	Value	Method	Source, Remark
Global warming potential (GWP)	3		

* SECTION 13: Disposal considerations

* 13.1 Waste treatment methods

Waste codes/waste designations according to EWC/AVV

Waste code product	Waste name
160504 *	gases in pressure containers (including halons) containing hazardous substances

* **Appropriate disposal / Product**
Waste disposal according to directive 2008/98/EC, covering waste and dangerous waste.
Prevent release to the environment. No disposal via the sewage.

Appropriate disposal / Package
Disposal according to local regulations.

* SECTION 14: Transport information

	Land transport (ADR/RID)	Sea transport (IMDG)	Air transport (ICAO-TI / IATA-DGR)
14.1 UN number or ID number	UN 2037	UN 2037	UN 2037
14.2 UN proper shipping name	GAS CARTRIDGES	GAS CATRIDGES	Gas cartridges
14.3 Transport hazard class(es)	2.1	2.1	2.1
14.4 Packing group	-	-	-
14.5 Environmental hazards	No	No	No

14.6 Special precautions for user

The protective measures listed in Sections 6, 7 and 8 of the Safety Data Sheet have to be considered.

14.7 Maritime transport in bulk according to IMO instruments

No carriage in bulk.

Land transport (ADR/RID)

UN number or ID number	UN 2037
UN proper shipping name	GAS CARTRIDGES
Transport hazard class(es)	2.1
Hazard label(s)	2.1
Classification code	5F
Packing group	-
Environmental hazards	No
Limited quantity (LQ)	1 L
Special provisions	191, 303, 327, 344
Tunnel restriction code	D

*** Sea transport (IMDG)**

UN number or ID number	UN 2037
UN proper shipping name	GAS CATRIDGES
Transport hazard class(es)	2.1
Packing group	-
Environmental hazards	No
Limited quantity (LQ)	1 L
Marine pollutant	No
EmS	F-D, S-U

Air transport (ICAO-TI / IATA-DGR)

UN number or ID number	UN 2037
UN proper shipping name	Gas cartridges
Transport hazard class(es)	2.1
Packing group	-
Environmental hazards	No

* SECTION 15: Regulatory information

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

*** EU legislation**

* **Restrictions of occupation**
Observe employment restrictions under the Maternity Protection Directive (92/85/EEC) for expectant or nursing mothers.
Observe restrictions to employment for juvenils according to the 'juvenile work protection guideline' (94/33/EC).

*** Other regulations (EU)**

* **To follow:**
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 40.
Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances.
National and local regulations concerning chemicals shall be observed.

* **Directive 2010/75/EU on industrial emissions [Industrial Emissions Directive] VOC**
VOC-value ≥ 95 %

15.2 Chemical Safety Assessment

*** National regulations**

For this substance a chemical safety assessment has been carried out.

* SECTION 16: Other information

Key literature references and sources for data
Information from our suppliers and data from the "GESTIS Substances Database" and the "Registered Substances" database of the European Chemicals Agency (ECHA) were used to create this safety data sheet.

* **Additional information**
The information contained herein is based on the state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

Relevant H- and EUH-phrases (Number and full text)

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

Indication of changes
* Data changed compared with the previous version

ANNEX

Exposure scenarios according to Regulation REACH CE n. 1907/2006

Substance: ***Isobutane***
EC number: ***200-857-2***
CAS number: ***75-28-5***

Short description of exposure scenarios

0. Background

Isobutane is classified as hazardous to safety. In particular, the following classification has been established in accordance with CLP Regulation:

- Flam. Gas 1 H220 (Extremely flammable gas)
- Gases under pressure H280 (Contains gas under pressure; may explode if heated)

According to Article 14 of REACH Regulation, the risk assessment and the generation of exposure scenario were performed for flammability; by contrast, the hazard class “gas under pressure” does not require neither the risk assessment nor the generation of scenarios.

1. Uses

1.1. Identified uses

The overall identified uses of the substance are listed in the following Table:

Brief description of exposure scenarios with relative use descriptors and life cycle phases

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
1	Manufacture of substance	-	x	-	x	-	-	-	3, 4, 8, 9, 10, 12, 24	1, 2, 3, 4, 7, 8a, 8b, 9, 12, 14, 15	-	1, 2, 3, 4, 5, 7, 8a, 9a, 10a, 11a
2	Distribution of substance	-	-	-	x	-	-	-	3, 4, 8, 9, 10, 12, 24	1, 2, 3, 4, 7, 8a, 8b, 9, 12, 14, 15	-	1, 2, 3, 4, 5, 7, 8a, 8c, 8d, 9a, 10a, 11a
3	Propellants	-	-	-	x	-	-	-	3, 4, 10	3, 7, 9	-	2, 8a, 8d
4	Use as a fuel	-	-	-	x	-	-	-	3	1, 2, 3, 4, 8a, 8b, 16	-	7
5	Blowing agents	-	-	-	x	-	-	-	3, 4, 12	1, 2, 3, 4, 8b, 9, 12, 14	-	3, 4, 5

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
6	Formulation and (re)-packaging of substances and mixtures	-	-	x	-	-	-	-	3, 10	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15	-	2
7	Polymer production	-	-	-	x	-	-	-	3, 8, 9, 10	1, 2, 3, 4, 8a, 8b, 16	-	4, 6c
8	Polymer processing	-	-	-	x	-	-	-	3, 10	1, 2, 3, 4, 5, 6, 8a, 8b, 9, 13, 14	-	4
9	Functional fluids	-	-	-	x	-	-	-	3	1, 2, 3, 4, 8a, 8b, 9	-	7
10	Use as an intermediate	-	-	-	x	-	-	-	8, 9, 3	1, 2, 3, 4, 8a, 8b, 15	-	6a
11	Use in adhesives	-	-	-	x	-	-	-	-	7	-	4
12	Use in laboratories	-	-	-	x	-	-	-	3	10	-	2, 4
13	Metal working fluids/rolling oils	-	-	-	x	-	-	-	3	1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 17	-	4

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
14	Mining chemicals	-	-	-	x	-	-	-	3	1, 2, 3, 4, 5, 8a, 8b, 9	-	4
15	Rubber production and processing	-	-	-	x	-	-	-	10, 3	1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 13, 14, 15, 21	-	1, 4, 6d
16	Use as binders and release agents	-	-	-	x	-	-	-	3	1, 2, 3, 4, 6, 7, 8b, 10, 13, 14	-	4
17	Industrial use in coatings/primers	-	-	-	x	-	-	-	-	7	-	4
18	Foaming agent	1, 9a, 9b, 26	-	-	x	-	-	-	5, 6b, 7, 9, 11, 12, 13, 19, 24	1,5, 8b, 10, 11, 12, 13, 15, 24	-	5
19	Use in Oil and Gas field drilling and production operations	-	-	-	x	-	-	-	3	1, 2, 3, 4, 8a, 8b	-	4

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
20	Water treatment chemicals	-	-	-	x	-	-	-	3	1, 2, 3, 4, 8a, 8b, 13	-	3, 4
21	Use in cleaning agents	-	-	-	x	-	-	-	3	1, 2, 3, 4, 7, 8a, 8b, 10, 13	-	4
22	Use as a fuel	-	-	-	-	x	-	-	22	1, 2, 3, 4, 8a, 8b, 16	-	9a, 9b
23	Propellants	-	-	-	-	x	-	-	22	11	-	8a, 8d
24	Polymer processing	-	-	-	-	x	-	-	22	1, 2, 3, 4, 5, 6, 8a, 8b, 14, 21	-	8a
25	Functional fluids	-	-	-	-	x	-	-	22	1, 2, 3, 8a, 9, 20	-	9a, 9b
26	De-icing and anti-icing applications	-	-	-	-	-	x	-	22	1, 2, 8a, 8b, 11	-	8d
27	Road and construction applications	-	-	-	-	-	x	-	22	8a, 8b, 9, 10, 11, 13	-	8d, 8f
28	Use in adhesives	-	-	-	-	-	x	-	22	11	-	8a, 8d

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
29	Use in cleaning agents	-	-	-	-	x	-	-	22	1, 2, 3, 4, 8a, 8b, 10, 11, 13	-	8a, 8d
30	Water treatment chemicals	-	-	-	-	x	-	-	22	1, 2, 3, 4, 8a, 8b, 13	-	8f
31	Explosives manufacture & use	-	-	-	-	x	-	-	22	1, 3, 5, 8a, 8b	-	8e
32	Use in Agrochemicals	-	-	-	-	x	-	-	22	1, 2, 4, 8a, 8b, 11, 13	-	8a, 8d
33	Metal working fluids/rolling oils	-	-	-	-	x	-	-	22	1, 2, 3, 5, 8a, 8b, 9, 10, 11, 13, 17	-	8a, 8d
34	Use in Oil and Gas field drilling and production operations	-	-	-	-	x	-	-	22	1, 2, 3, 4, 8a, 8b	-	8d
35	Use as binders and release agents	-	-	-	-	x	-	-	22	1, 2, 3, 4, 6, 8a, 8b, 10, 11, 14	-	8a, 8d

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
36	Lubricants	-	-	-	-	x	-	-	22	1, 2, 3, 4, 6, 8a, 8b,9, 10, 11, 13, 17, 18, 20	-	8a, 8d, 9a, 9b
37	Industrial use in coatings/primers	-	-	-	-	x	-	-	-	11	-	8a, 8d
38	Foaming agent	9a, 9b, 26	-	-	-	x	-	-	5, 9, 11, 19	1, 5, 8b, 10, 11, 12, 13, 15, 24	-	8a
39	Use as a fuel	13	-	-	-	x	-	21		-	-	9a, 9b

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
40	Propellants	1, 3, 4, 6, 8, 9a, 12, 23, 24, 25, 28, 29, 31, 32, 34, 35, 39	-	-	-	-	x	-	21	-	-	8a, 8d, 9a, 10a
41	Functional fluids	21	-	-	-	-	x	-	21	-	-	9a, 9b
42	Blowing agents	32	-	-	-	-	x	-	21	-	-	10a,11a
43	Use in cosmetic products	28, 39	-	-	-	-	x	-	21	-	-	8a
44	Water treatment chemicals	36, 37	-	-	-	-	x	-	21	-	-	8f
45	Use in Agrochemicals	12, 27	-	-	-	-	x	-	21	-	-	8a, 8d
46	Foaming agent	9a, 9b, 26	-	-	-	-	x	-	21	-	-	8a, 8b
47	Lubricants	1, 24, 31	-	-	-	-	x	-	21	-	-	8a, 8b, 9a, 9b

Number (ES)	Brief description of use process	Product Category (PC)	Manufacture	Formulation	Uses at industrial sites	Uses by professional workers	Consumer uses	Article service life	Sector of use (SU)	Process Category (PROC)	Article Category (AC)	Environmental Release Category (ERC)
48	Use in cleaning agents	3, 4, 8, 9a, 9b, 9c, 24, 35, 38	-	-	-	-	x	-	21	-	-	8a, 8d
49	Other Consumer Uses	28, 39	-	-	-	-	x	-	21	-	-	8a, 8d
50	Use in biocidal products	-	-	-	-	-	x	-	-	-	-	8a, 8d
51	Uses in coatings	1, 4, 8, 9a, 9b, 9c, 15, 18, 23, 24, 31, 34	-	-	-	-	x	-	21	-	-	8a, 8d
52	De-icing and anti-icing applications	4	-	-	-	-	x	-	21	-	-	8d

1.2. Uses advised against

Other uses are not recommended unless an assessment is completed, prior to commencement of that use, which demonstrates that the risk will be controlled.

2. Exposure assessment

In the Chemical Safety Assessment (CSA) carried out according to Article 14(3) of REACH Regulation and referring to Annex I section 1-3 (human health hazard, physico-chemical hazard assessment and environmental hazard assessment) and section 4 (PBT/vPvB assessment) of the Regulation it was not detected any hazard.

The substance, as well as the other members of the same category, is not classified for human health or the environment, is not a CMR and is not PBT or vPvB. Therefore, the quantitative human and environmental exposure assessment was not performed. A qualitative approach was used in order to define the operational conditions that ensure the control of risks related to physical hazards (flammability).

3. Risk characterization

The substance, as well as the other members of the same category, is not classified for human health or the environment, is not a CMR and is not PBT or vPvB. Therefore, the calculation of risk characterization ratios (RCR) was not performed. A qualitative approach was used in order to define the operational conditions that ensure the control of risks related to physical hazards (flammability), as described below.

The accident scenarios relevant for REACH are minor accidents which might occur in the workplace and those related to consumer use. Major accidents caused by chemicals and the requirements to manage these risks are regulated under the Seveso II Directive and do not need to be considered.

Risks from the physicochemical hazards of substances can be controlled by implementing risk management measures tailored to each specific risk. These measures need to be implemented to control the risks and to show that safe use can be accomplished; moreover, safety data sheets should be made available in which the appropriate risk management measures are identified and communicated.

For flammable substances the organizational and technical measures listed in Table 1 should be taken to avoid ignition of flammable substances. These measures are suitable to prevent minor accidents which might occur at the workplace or during consumer use. Larger facilities manufacturing or using substances with flammable properties in significant quantities should follow the ATEX Directive (94/9/EC and 99/92/EC) to control risks arising from flammable substances and explosive atmospheres.

Based on the implementation of a selection of handling and storage risk management measures for the identified uses, it is possible to conclude that there is no immediate concern as the risk is controlled to an acceptable level.

The exposure scenario attached are referred to the substance Isobutane in a gaseous state at standard pressure and temperature.

Table 1. Risk management measures for liquid materials

Hazard	Risk / Hazard Phrase	P Phrase	Qualitative Risk Assessment
Extremely Flammable	R12 / H224 (Extremely flammable liquid and vapour)	**Prevention** ▪ P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking. ▪ P233 Keep container tightly closed. ▪ P240 Ground/bond container and receiving equipment. ▪ P241 Use explosion-proof electrical/ventilating/lighting/…/equipment . ▪ P242 Use only non-sparking tools. ▪ P243 Take precautionary measures against static discharge. ▪ P280 Wear protective gloves/eye protection/face protection. **Response** ▪ P303 + P361 + P353 IF ON SKIN (or hair): Remove/Take off	**Substance Handling and Transfer Preventative Measures** *Industrial uses* ▪ Avoid splash filling (N/A for gases). ▪ ▪ Electrostatic charges may be generated during pumping. ▪ Electrostatic discharge may cause fire. ▪ Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (< 1m.sec-1 until fill pipe submerged to twice its diameter, then < 7m.sec-1). ▪ Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<10m.sec-1). ▪ The vapour is heavier than air, spreads along the ground and distant ignition is possible. ▪ If positive displacement pumps are used, these must be fitted with a non-integral pressure relief valve. ▪ Use explosion-proof electrical/ventilating/lighting and other equipment. ▪ Use appropriate equipment for filling IBCs and other containers. ▪ IBCs and other containers must be constructed of appropriate material. ▪ Ensure electrical continuity by bonding and grounding (earthing) all equipment. ▪ Keep away from oxidising agents.

Hazard	Risk / Hazard Phrase	P Phrase	Qualitative Risk Assessment
		immediately all contaminated clothing. Rinse skin with water/shower. ▪ P370 + P378 In case of fire: use water spray, water fog or foam, dry powder or CO_2 for extinction. **Storage** ▪ P403 + P235 Store in a well ventilated place. Keep cool. ▪ P501 Dispose of contents/container as special waste.	▪ Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. ▪ Handle and open container with care in a well-ventilated area. ▪ Avoid overfilling. ▪ Do NOT empty into drains. *Professional uses* ▪ Ensure electrical continuity by bonding and grounding (earthing) all equipment. ▪ Keep away from oxidising agents. ▪ Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. ▪ Handle and open container with care in a well-ventilated area. ▪ Avoid overfilling. ▪ Do NOT empty into drains. *Consumer uses* ▪ Use only with adequate ventilation. ▪ Avoid all possible sources of ignition (spark or flame). ▪ Do not puncture or incinerate container. ▪ Empty pressure vessels should be returned to the supplier. **Storage** ▪ Must be stored in a dike (bunded) and well-ventilated area, away from sunlight, ignition sources and other sources of heat. ▪ Storage temperature: ambient. ▪ Keep away from flames, sources of ignition and hot surfaces. No smoking. ▪ Take precautionary measures against static discharges.

Hazard	Risk / Hazard Phrase	P Phrase	Qualitative Risk Assessment
			▪ Keep container in a well-ventilated place. ▪ Keep container tightly closed.
Highly Flammable	R11 / H224 (Extremely flammable liquid and vapour) R11 / H225 (Highly flammable liquid and vapour)	**Prevention** ▪ P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking. ▪ P233 Keep container tightly closed. ▪ P240 Ground/bond container and receiving equipment. ▪ P241 Use explosion-proof electrical/ventilating/lighting/…/equipment. ▪ P242 Use only non-sparking tools. ▪ P243 Take precautionary measures against static discharge. ▪ P280 Wear protective gloves/eye protection/face protection. **Response** ▪ P303 + P361 + P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.	**Substance Handling and Transfer Preventative Measures** *Industrial uses* ▪ Avoid splash filling (N/A for gases). ▪ Do NOT use compressed air for filling, discharging or handling operations. ▪ Electrostatic charges may be generated during pumping. ▪ Electrostatic discharge may cause fire. ▪ Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (< 1m.sec-1 until fill pipe submerged to twice its diameter, then < 7m.sec-1). ▪ Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<10m.sec-1). ▪ The vapour is heavier than air, spreads along the ground and distant ignition is possible. ▪ If positive displacement pumps are used, these must be fitted with a non-integral pressure relief valve. ▪ Use explosion-proof electrical/ventilating/lighting and other equipment. ▪ Use appropriate equipment for filling IBCs and other containers. ▪ IBCs and other containers must be constructed of appropriate material. ▪ Ensure electrical continuity by bonding and grounding (earthing) all equipment. ▪ Keep away from oxidising agents. ▪ Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks.

Hazard	Risk / Hazard Phrase	P Phrase	Qualitative Risk Assessment
		▪ P370 + P378 In case of fire: use water spray, water fog or foam, dry powder or CO_2 for extinction. **Storage** ▪ P403 + P235 Store in a well ventilated place. Keep cool. ▪ P501 Dispose of contents/container as special waste.	▪ Handle and open container with care in a well-ventilated area. ▪ Avoid overfilling. ▪ Do NOT empty into drains. *Professional uses* ▪ Ensure electrical continuity by bonding and grounding (earthing) all equipment. ▪ Keep away from oxidising agents. ▪ Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. ▪ Handle and open container with care in a well-ventilated area. ▪ Avoid overfilling. ▪ Do NOT empty into drains. *Consumer uses* ▪ Use only with adequate ventilation. ▪ Avoid all possible sources of ignition. ▪ Do not puncture or incinerate container. ▪ Empty pressure vessels should be returned to the supplier. **Storage** ▪ Must be stored in a dike (bunded) and well-ventilated area, away from sunlight, ignition sources and other sources of heat. ▪ Storage temperature: ambient. ▪ Keep away from flames, sources of ignition and hot surfaces. No smoking. ▪ Take precautionary measures against static discharges. ▪ Keep container in a well-ventilated place. ▪ Keep container tightly closed.

4. Guidance how the DU can evaluate whether he operates within the conditions set in the exposure scenarios

4.1. Workers

The risk assessment for the flammability was performed in a qualitative way. As a result, some operative conditions (OC) and risk management measures (RMM) are required to control the identified risks.

Since these OCs and RMMs are applicable also on a small scale (i.e. by industries, professional users), it is recommended to operate according to them and to avoid significant deviations which could downgrade the safety.