

LAMPIRAN 11

Butanes

Appearance	Colourless	SYNONYMS
Odour	Practically odourless	BUT i-butane iso-butane n-butane Methyl ethyl methane
UN Number	1011	
MFAG Table	310	

**The Main Hazard
FLAMMABLE**

EMERGENCY PROCEDURES

STOP GAS SUPPLY. Do not extinguish flame until gas or liquid supply has been shut off, to avoid possibility of explosive re-ignition. Extinguish with dry powder, halon or carbon dioxide. Cool tanks and surrounding areas with water spray.

Liquid in eye	DO NOT DELAY. Flood eye gently with clean fresh water. Force eye open if necessary. Continue washing for at least 15 minutes. Obtain medical advice or assistance as soon as possible.	4
Liquid on skin	DO NOT DELAY. Remove contaminated clothing. Handle patient gently. Do not rub affected area. Flood water until thawed. Obtain medical advice or assistance as soon as possible.	
Vapour inhaled	REMOVE VICTIM TO FRESH AIR. Remove contaminated clothing. If breathing has stopped or is weak or irregular, give mouth to mouth/nose resuscitation or oxygen, as necessary. Guard against self-injury if victim is confused or anaesthetised. Be alert to possibility of victim vomiting and then choking. Obtain medical advice or assistance as soon as possible.	
Spillage	STOP THE FLOW. Avoid contact with liquid or vapour. Extinguish sources of ignition. Flood with large amounts of water to disperse the spill, and to prevent brittle fracture. Inform port authorities or coastguard of spill.	

Effect of liquid	ON EYES Tissue damage due to frost-bite. ON SKIN Tissue damage due to frost-bite. BY SKIN ABSORPTION Nothing known. BY INGESTION Slight systemic effect.	Personal protection Splash-resistant suit, goggles or face shield, gloves and boots.
Effect of vapour	ON EYES Cold vapour could possibly cause frost-bite. ON SKIN Cold vapour could possibly cause frost-bite. WHEN INHALED Acute effect Asphyxiation at high concentrations; headaches, dizziness and drowsiness. Chronic effect May act as a narcotic.	

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Butanes

Fire and Explosion Data		
Flashpoint -60°C	Explosion Hazards Vapour can form a flammable mixture with air which, if ignited, may release explosive force causing structural damage.	
Auto-ignition Temperature n-butane 365°C, iso-butane 460°C		
Flammable Limits 1.5-9% by volume		
Chemical Data		
Formula C ₄ H ₁₀ n-butane C ₄ H ₉ CH ₂ CH ₃ iso-butane CH ₃ CH(CH ₃) ₂ CH ₃	Chemical Family Hydrocarbon (saturated, aliphatic).	
Reactivity Data		
Water, fresh or salt Insoluble. No dangerous reaction. May form solid hydrates. Air No reaction.	Other liquids or gases Dangerous reaction possible with chlorine.	
Physical Data		
Boiling Point at Atmospheric Pressure n-butane at -0.5°C iso-butane at -1.2°C	Coefficient of Cubic Expansion 0.002 per °C at 15°C.	Molecular Weight 58.12Kg/Kmole.
Vapour Pressure Bar (A) 1.04 at -4°C	Freezing Point n-butane at -138°C iso-butane at -160°C	Enthalpy (KJ/Kg) Not available
Specific Gravity 0.58 at 20°C.	Relative Vapour Density 2.0.	Latent Heat of Vaporisation (KJ/Kg) 364.8 at -0.5°C, 365.5 at 20°C.
Conditions of Carriage		
Normal Carriage Condition Pressurised. Fully refrigerated.	Control of Vapour within Cargo Tank Oxygen content of tank to be maintained at not more than 2% by volume.	Vapour Detection Flammable. Gauging Closed, indirect or restricted.
Ship Type 2G/2PG	Independent Tank required No	
Materials of Construction		
Unsuitable Certain plastics.	Suitable Mild steel, stainless steel, most normal metals.	
Notes and special requirements 1 Normally shipped as a mixture of n- and iso-butanes. Obtain advice from shipper.		

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MARITIME SAFETY GUIDE (LIQUEFIED GAS) DATA SHEET

Propane

Appearance: Colourless
 Odour: Odourless
 UN Number: 1978
 MFAG Table: 310

Synonyms:
 Dimethylmethane
 Petroleum gas
 Proyl hydride
 prop

The Main Hazard
FLAMMABLE

EMERGENCY PROCEDURES

Fire: STOP GAS SUPPLY. Do not extinguish flame until gas or liquid supply has been shut off, to avoid possibility of explosive re-ignition. Extinguish with dry powder, halon or carbon dioxide. Cool tanks and surrounding areas with water spray.

Liquid in eye: DO NOT DELAY. Flood eye gently with clean fresh water. Force eye open if necessary. Continue washing for at least 15 minutes. Obtain medical advice or assistance as soon as possible.

Liquid on skin: DO NOT DELAY. Remove contaminated clothing. Flood affected area with water. Handle patient gently. Continue washing for at least 15 minutes. Immerse frost-bitten area in warm water until thawed. Obtain medical advice or assistance as soon as possible.

Vapour inhaled: REMOVE VICTIM TO FRESH AIR. Remove contaminated clothing. If breathing has stopped or is weak or irregular, give mouth to mouth/nose resuscitation or oxygen, as necessary. Obtain medical advice or assistance as soon as possible.

Spillage: STOP THE FLOW. Avoid contact with liquid or vapour. Extinguish sources of ignition. Flood with large amounts of water to disperse the spill, and to prevent brittle fracture. Inform port authorities or coastguard of spill.

Health Data: TLV 1000 ppm
 Odour threshold: Odourless but may be stretched to aid detection

Effect of liquid:
ON EYES: Tissue damage due to frost-bite.
ON SKIN: Tissue damage due to frost-bite.
BY SKIN ABSORPTION: Not absorbed through skin.
BY INGESTION: Not permitted.

Effect of vapour:
ON EYES: Cold vapour could cause frost-bite.
ON SKIN: Cold vapour could cause frost-bite.

Personal protection:
 Splash-resistant suit, goggles or face shield, gloves and boots.

WHEN INHALED:
Acute effect: Asphyxiation, Headaches, dizziness, unconsciousness and even death.
Chronic effect: Slight narcotic effect.

Propane

Fire and Explosion Hazards:
Flashpoint: -105°C
Auto-ignition Temperature: 450°C
Flammable Limits: 2-10% by volume

Explosion Hazards:
 Vapour can form a flammable mixture with air which, if ignited, may release explosive force causing structural damage.

Chemical Data:
Formula: C₃H₈ (CH₃CH₂CH₃)
Chemical Family: Hydrocarbon (saturated, aliphatic)

Reactivity Data:
Water, fresh or salt: Insoluble. No dangerous reaction; can freeze to form ice or hydrates.
Air: No reaction.
Other liquids or gases: Dangerous reaction possible with chlorine.

Physical Data:
Boiling Point at Atmospheric Pressure: -42°C
Vapour Pressure Bar (A): 1.1 at -42°C 4.8 at 0°C
Specific Gravity: 0.58 at -42°C
Coefficient of Cubic Expansion: 0.003 per °C at 15°C
Freezing Point: -188°C
Relative Vapour Density: 1.55
Molecular Weight: 44.1Kg/Kmole
Enthalpy (KJ/Kg): Liquid 75KJ/Kg at -42°C Vapour 176KJ/Kg at -42°C
Latent Heat of Vaporisation (KJ/Kg): 425 at -43°C 348 at -20°C
Electrostatic Generation:

Conditions of Carriage:
Normal Carriage Condition: Pressurised. Fully refrigerated.
Ship Type: 2G/2PG.
Independent Tank required No.
Control of Vapour within Cargo Tank: Oxygen content to be maintained at not more than 2% by volume.
Vapour Detection: Flammable.
Gauging: Closed, indirect or restricted.

Materials of Construction:
Unsuitable: Mild steel below 0°C.
Suitable: Mild steel above 0°C, aluminium, stainless steel.

Notes and special requirements

GAUGE (LIQUEFIED GAS) DAT

NAMA : DESIMA AYUNINGTYAS
NIT : 51145144 N
JUDUL SKRIPSI : UPAYA PENCEGAHAN *HIGH PRESSURE TANK*
KAPAL LPG/C PADA SAAT MUAT DI KAPAL GAS
NURI ARIZONA
PENGUJI I : Dr. Capt. MASHUDI ROFIK, M.Sc.
PENGUJI II : Dr. Capt. SUWIYADI, M.Pd., M.Mar
PENGUJI III : Dr. A. AGUS TJAHJONO, MM., M

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