

## SAFETY DATA SHEET

FR4-45 HARDENER

### Section 1. Identification

FR4-45 HARDENER : Product identifier  
64000000D : SDS code

#### Recommended use of the chemical and restrictions on use

##### Identified uses

Paint. Professional use Industrial use

All other uses

Filler for interior use : Product use

#### Supplier's details

MAPAERO SAS  
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09103 PAMIERES Cedex  
France

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: Importer  
: e-mail address of person responsible for this SDS  
: Emergency telephone number

### Section 2. Hazard identification

FLAMMABLE LIQUIDS - Category 4 : Classification of the substance or mixture  
ACUTE TOXICITY (inhalation) - Category 4  
SKIN SENSITIZATION - Category 1  
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3

#### GHS label elements



: Hazard pictograms

Warning : Signal word  
Combustible liquid. : Hazard statements  
May cause an allergic skin reaction.  
Harmful if inhaled.  
May cause respiratory irritation.

#### Precautionary statements

Wear protective gloves. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Avoid breathing vapor. : Prevention

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## Section 2. Hazard identification

IF INHALED: Call a POISON CENTER or doctor if you feel unwell. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention.

: Response

Store in a well-ventilated place. Keep container tightly closed.

: Storage

Dispose of contents and container in accordance with all local, regional, national and international regulations.

: Disposal

None known.

: Other hazards which do not result in classification

## Section 3. Composition/information on ingredients

Mixture

: Substance/mixture

Not available.

: Other means of identification

CAS number	%	Ingredient name
28182-81-2	≥25 - ≤50	Hexamethylene diisocyanate, oligomers
129217-88-5	≥10 - <25	1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3,5-tris(6-isocyanatohexyl)-, reaction products with polyethylene glycol monomethyl ether
-	≤10	Polyisocyanate, aliphatic
123-86-4	≤3	n-butyl acetate

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

## Section 4. First aid measures

### Description of necessary first aid measures

Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

: Eye contact

Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

: Inhalation

Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

: Skin contact

## Section 4. First aid measures

Wash out mouth with water. Remove dentures if any. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

: Ingestion

### **Most important symptoms/effects, acute and delayed**

#### **Potential acute health effects**

No known significant effects or critical hazards.

: Eye contact

Harmful if inhaled. May cause respiratory irritation.

: Inhalation

May cause an allergic skin reaction.

: Skin contact

No known significant effects or critical hazards.

: Ingestion

#### **Over-exposure signs/symptoms**

No specific data.

: Eye contact

Adverse symptoms may include the following:  
respiratory tract irritation  
coughing

: Inhalation

Adverse symptoms may include the following:  
irritation  
redness

: Skin contact

No specific data.

: Ingestion

### **Indication of immediate medical attention and special treatment needed, if necessary**

In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

: Notes to physician

No specific treatment.

: Specific treatments

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

: Protection of first-aiders

See toxicological information (Section 11)

## Section 5. Fire-fighting measures

### **Extinguishing media**

Use dry chemical, CO<sub>2</sub>, water spray (fog) or foam.

: Suitable extinguishing media

Do not use water jet.

: Unsuitable extinguishing media

Combustible liquid. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

: Specific hazards arising from the chemical

Decomposition products may include the following materials:

carbon dioxide  
carbon monoxide  
nitrogen oxides  
metal oxide/oxides

: Hazardous thermal decomposition products

## Section 5. Fire-fighting measures

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. : **Special protective actions for fire-fighters**

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. : **Special protective equipment for fire-fighters**

## Section 6. Accidental release measures

### **Personal precautions, protective equipment and emergency procedures**

No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment. : **For non-emergency personnel**

If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel". : **For emergency responders**

Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). : **Environmental precautions**

### **Methods and materials for containment and cleaning up**

Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor. : **Small spill**

Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal. : **Large spill**

## Section 7. Handling and storage

### **Precautions for safe handling**

Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not reuse container. : **Protective measures**

## Section 7. Handling and storage

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

: **Advice on general occupational hygiene**

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

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

## Section 8. Exposure controls/personal protection

### Control parameters

#### Occupational exposure limits

Exposure limits	Ingredient name
<b>EU OEL (Europe, 1/2022). Notes: list of indicative occupational exposure limit values</b> STEL: 150 ppm 15 minutes. STEL: 723 mg/m <sup>3</sup> 15 minutes. TWA: 241 mg/m <sup>3</sup> 8 hours. TWA: 50 ppm 8 hours.	n-butyl acetate

Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

: **Appropriate engineering controls**

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

: **Environmental exposure controls**

### Individual protection measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

: **Hygiene measures**

Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

: **Eye/face protection**

### Skin protection

## Section 8. Exposure controls/personal protection

Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

: **Hand protection**

Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

: **Body protection**

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

: **Other skin protection**

Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

: **Respiratory protection**

## Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

### Appearance

Liquid.

: **Physical state**

Colorless.

: **Color**

Characteristic.

: **Odor**

Not available.

: **Odor threshold**

Not available. [DIN EN 1262]

: **pH**

Not available.

: **Melting point/freezing point**

Not available.

: **Boiling point, initial boiling point, and boiling range**

Closed cup: 66°C (150.8°F) [Pensky-Martens]

: **Flash point**

Not available.

: **Flammability**

Not available.

: **Lower and upper explosion limit/flammability limit**: **Vapor pressure**

Vapor pressure at 50°C			Vapor Pressure at 20°C			Ingredient name
Method	kPa	mm Hg	Method	kPa	mm Hg	
				<110	<825	Polyisocyanate, aliphatic
			DIN EN 13016-2	1.5	11.25	n-butyl acetate
				0.93	7	DPG-DME
				0.93	6.98	pentane-2,4-dione
				0.0013	0.01	hexamethylene-diisocyanate
				0.000071	0.00053	[3-(2,3-epoxypropoxy)propyl]triethoxysilane
			EU A.4	0.0000024	0.000018	Hexamethylene diisocyanate, oligomers
			OECD 104	0.000000077	0.000000058	dibutyltin dilaurate

## Section 9. Physical and chemical properties and safety characteristics

Not available.

1.065 g/cm<sup>3</sup> [DIN EN ISO 2811-1]

Media	Result
Cold water	Not soluble [OESO (TG 105)]

Not available.

Not applicable.

Method	°F	°C	Ingredient name
	329	165	DPG-DME
	644	340	pentane-2,4-dione
EU A.15	752	400	dibutyltin dilaurate
EU A.15	779	415	n-butyl acetate
	849.2	454	hexamethylene-di-isocyanate

Not available.

Kinematic (room temperature): 56 mm<sup>2</sup>/s (56 cSt) [DIN EN ISO 3219]

Kinematic (40°C (104°F)): 101 mm<sup>2</sup>/s (101 cSt) [DIN EN ISO 3219]

### Particle characteristics

Not applicable.

: Relative vapor density

: Density

: Solubility(ies)

: Solubility in water

: Partition coefficient: n-octanol/water

: Auto-ignition temperature

: Decomposition temperature

: Viscosity

: Median particle size

## Section 10. Stability and reactivity

No specific test data related to reactivity available for this product or its ingredients.

The product is stable.

Under normal conditions of storage and use, hazardous reactions will not occur.

Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Reactive or incompatible with the following materials:  
oxidizing materials

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

: Reactivity

: Chemical stability

: Possibility of hazardous reactions

: Conditions to avoid

: Incompatible materials

: Hazardous decomposition products

## Section 11. Toxicological information

### Information on toxicological effects

#### Acute toxicity

Exposure	Dose	Species	Result	Product/ingredient name
1 hours	18500 mg/m <sup>3</sup>	Rat	LC50 Inhalation Dusts and mists	Hexamethylene diisocyanate, oligomers n-butyl acetate
4 hours	390 ppm	Rat	LC50 Inhalation Gas.	
2 hours	6 g/m <sup>3</sup>	Mouse	LC50 Inhalation Vapor	
-	>17600 mg/kg	Rabbit	LD50 Dermal	
-	1230 mg/kg	Mouse	LD50 Intraperitoneal	
-	4700 mg/kg	Guinea pig	LD50 Oral	
-	6 g/kg	Mouse	LD50 Oral	

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## Section 11. Toxicological information

-	3200 mg/kg	Rabbit	LD50 Oral	
-	10768 mg/kg	Rat	LD50 Oral	

### Irritation/Corrosion

Observation	Exposure	Score	Species	Result	Product/ingredient name
✓	100 mg	-	Rabbit	Eyes - Moderate irritant	Hexamethylene diisocyanate, oligomers
-	500 mg	-	Rabbit	Skin - Moderate irritant	
-	100 mg	-	Rabbit	Eyes - Moderate irritant	n-butyl acetate
-	24 hours 500 mg	-	Rabbit	Skin - Moderate irritant	

### Sensitization

Not available.

### Mutagenicity

Not available.

### Carcinogenicity

Not available.

### Reproductive toxicity

Not available.

### Teratogenicity

Not available.

### Specific target organ toxicity (single exposure)

Target organs	Route of exposure	Category	Name
Respiratory tract irritation	-	Category 3	Hexamethylene diisocyanate, oligomers
Narcotic effects	-	Category 3	n-butyl acetate

### Specific target organ toxicity (repeated exposure)

Not available.

### Aspiration hazard

Not available.

Not available.

: Information on the likely routes of exposure

### Potential acute health effects

No known significant effects or critical hazards.

: Eye contact

Harmful if inhaled. May cause respiratory irritation.

: Inhalation

May cause an allergic skin reaction.

: Skin contact

No known significant effects or critical hazards.

: Ingestion

### Symptoms related to the physical, chemical and toxicological characteristics

No specific data.

: Eye contact

Adverse symptoms may include the following:  
respiratory tract irritation  
coughing

: Inhalation

Adverse symptoms may include the following:  
irritation  
redness

: Skin contact



## Section 11. Toxicological information

No specific data.

: Ingestion

### Delayed and immediate effects and also chronic effects from short and long term exposure

#### Short term exposure

Not available.

: Potential immediate effects

Not available.

: Potential delayed effects

#### Long term exposure

Not available.

: Potential immediate effects

Not available.

: Potential delayed effects

#### Potential chronic health effects

Not available.

Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

: General

No known significant effects or critical hazards.

: Carcinogenicity

No known significant effects or critical hazards.

: Mutagenicity

No known significant effects or critical hazards.

: Reproductive toxicity

## Section 12. Ecological information

### Toxicity

Exposure	Species	Result	Product/ingredient name
48 hours	Crustaceans - Artemia salina	Acute LC50 32 mg/l Marine water	n-butyl acetate
96 hours	Fish - Danio rerio	Acute LC50 62000 µg/l Fresh water	
96 hours	Fish - Lepomis macrochirus	Acute LC50 100000 µg/l Fresh water	
96 hours	Fish - Menidia beryllina	Acute LC50 185000 µg/l Marine water	
96 hours	Fish - Pimephales promelas	Acute LC50 18000 µg/l Fresh water	

### Persistence and degradability

Not available.

### Bioaccumulative potential

Potential	BCF	LogP <sub>ow</sub>	Product/ingredient name
low	367.7	5.54	Hexamethylene diisocyanate, oligomers
low	-	2.3	n-butyl acetate

### Mobility in soil

Not available.

: Soil/water partition coefficient (K<sub>oc</sub>)

No known significant effects or critical hazards.

: Other adverse effects

## Section 13. Disposal considerations

The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

: Disposal methods

## Section 14. Transport information

IATA	IMDG	UN	
Not regulated.	Not regulated.	Not regulated.	UN number
-	-	-	UN proper shipping name
-	-	-	Transport hazard class(es)
-	-	-	Packing group
No.	No.	No.	Environmental hazards

### Additional information

**IMDG Code Segregation group** Not applicable

: IMDG

**Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

: Special precautions for user

Not available.

: Transport in bulk according to IMO instruments

## Section 15. Regulatory information

### Inventory list

Not determined.

: Australia

At least one component is not listed in DSL but all such components are listed in NDSL.

: Canada

Not determined.

: China

**Russian Federation inventory:** Not determined.

: Eurasian Economic Union

**Japan inventory (CSCL):** Not determined.

: Japan

**Japan inventory (ISHL):** Not determined.

Not determined.

: New Zealand

Not determined.

: Philippines

## Section 15. Regulatory information

Not determined.	: Republic of Korea
Not determined.	: Taiwan
Not determined.	: Thailand
Not determined.	: Turkey
All components are active or exempted.	: United States
Not determined.	: Viet Nam

## Section 16. Other information

### History

9 December 2022	: Date of printing
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1.02	: Version
	: Unique ID
	: Key to abbreviations

ATE = Acute Toxicity Estimate

BCF = Bioconcentration Factor

GHS = Globally Harmonized System of Classification and Labelling of Chemicals

IATA = International Air Transport Association

IBC = Intermediate Bulk Container

IMDG = International Maritime Dangerous Goods

LogPow = logarithm of the octanol/water partition coefficient

MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)

N/A = Not available

SGG = Segregation Group

UN = United Nations

### Procedure used to derive the classification

Justification	Classification
On basis of test data	FLAMMABLE LIQUIDS - Category 4
Calculation method	ACUTE TOXICITY (inhalation) - Category 4
Calculation method	SKIN SENSITIZATION - Category 1
Calculation method	SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3

Indicates information that has changed from previously issued version.

### Notice to reader

FOR PROFESSIONAL USE ONLY

IMPORTANT NOTE The information in this data sheet is not intended to be exhaustive and is based on the present state of our knowledge and on current laws: any person using the product for any purpose other than that specifically recommended in the technical data sheet without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at his own risk. It is always the responsibility of the user to take all necessary steps to fulfill the demands set out in the local rules and legislation. Always read the Material Data Sheet and the Technical Data Sheet for this product if available. All advice we give or any statement made about the product by us (whether in this data sheet or otherwise) is correct to the best of our knowledge but we have no control over the quality or the condition of the substrate or the many factors affecting the use and application of the product. Therefore, unless we specifically agree in writing otherwise, we do not accept any liability whatsoever for the performance of the product or for any loss or damage arising out of the use of the product. All products supplied and technical advice given are subject to our standard terms and conditions of sale. You should request a copy of this document and review it carefully. The information contained in this data sheet is subject to modification from time to time in the light of experience and our policy of continuous development. It is the user's responsibility to verify that this data sheet is current prior to using the product.

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## Section 16. Other information