

# **TRIDENT**

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Hygiene institute of the Ruhr area Germany  
Institute for Environmental Hygiene and Toxicology  
*Ecotoxicological assessment with regard to use in forest fires*

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# Hygiene-Institut des Ruhrgebiets

Institut für Umwelthygiene und Toxikologie

Director: Prof. Dr.rer.nat. Lothar Dunemann

Legal Entity: Verein zur Bekämpfung der Volkskrankheiten im Ruhrkohlengebiet e.V.



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Our reference: A-324878-20-Bi\_en  
Contact person: Mr Bien

Gelsenkirchen, 25.02.2020

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## Foam fire extinguishing agents "TRIDENT"

here: Ecotoxicological assessment with regard to use in forest fires

Your letters dated 06.02.2020 and 24.02.2020; Mr Clemens Widmayer

Dear Mr Widmayer,

as you state in the above-mentioned letters, the extinguishing agent "TRIDENT" is also used to fight forest fires. As a rule, an admixing rate of 0.2 % is selected as the application concentration of the extinguishing agent concentrate in these cases.

The foam fire extinguishing agent with the name "TRIDENT" was examined relating to biodegradability, for the content of fluoro-organic compounds, with regard to the behaviour towards higher and lower water organisms (aquatic toxicity), towards seed emergence and growth of higher plants as well as the behaviour of earthworms (terrestrial toxicity), with respect to irritation effect on skin and eyes as well as regarding oral toxicity to mammals.

The analytical work was carried out in accordance with the OECD Test Guidelines as well as the regulations laid down in the German standard methods for the examination of water, waste water and sludge (Deutsches Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung).

Our general terms and conditions apply (<http://www.hyg.de>). The results of our tests and assessments apply to the examined test objects and the statutory rules at the time of testing. The accreditation applies to the test procedures listed in the attachment to the accreditation certificate (<http://www.hyg.de>). This document shall not be reproduced, except in full, without written approval of the Institute.



As part of these examinations carried out on the extinguishing agent concentrate "TRIDENT" dated 15.09.2017 (Test reports A-292355-17-Bi dated 26.01.2018, A-294153-18-Bi dated 29.01.2018 and A-294188-18-Bi dated 29.01.2018), the subsequent summarised test data can be calculated:

Method	Unit	Toxicity value / test data concentrate
<b>Bacterial toxicity</b> (TTC / DIN 38412 - L3)	NOEC	<b>3.0 ml/l</b>
<b>Toxicity to fish</b> (OECD 203)	LC <sub>50</sub>	<b>1 600 mg/l</b>
<b>Daphnia toxicity</b> (OECD 202)	EC <sub>50</sub>	<b>1 400 mg/l</b>
<b>Algal toxicity</b> (OECD 201)	IC <sub>50</sub>	<b>800 mg/l</b>
<b>Biodegradability</b> (OECD 301f)	Degradation after 28 days	<b>95.6 %</b>
<b>Light bacterial toxicity</b> (DIN ISO 11348-2)	EC <sub>50</sub>	<b>580 mg/l</b>
<b>Fluoro-organic compounds content</b> (DIN 38407 - F42)	µg/l	<b>bld.</b>
<b>Toxicity to mammals</b> (OECD 420)	LD <sub>50</sub> rat	<b>&gt; 2 000 mg/kg</b> body weight
<b>Corrosivity and irritation to skin</b> (OECD 404)	-	<b>not skin irritating / corrosive</b>
<b>Eye Irritation / Corrosion</b> (OECD 405)	-	<b>not harmful to eyes / irritating</b>
<b>Earthworm toxicity</b> (DIN ISO 11268-1)	LOEC	<b>10 000 mg/kg</b>
<b>Plant growth test</b> (DIN ISO 11269-2)	LOEC	<b>100 mg/kg</b>

bld. = below limit of detection

LOEC = Lowest Observed Effect Concentration

With reference to the application concentration of 0.2 % mentioned at the beginning, the test data determined on the concentrate can be converted or transferred so that, in our opinion, the following data can be used to characterise a **0.2 % solution**:

<b>Method</b>	<b>Unit</b>	<b>Toxicity value / test data 0.2 % solution</b>
<b>Bacterial toxicity</b> (TTC / DIN 38412 - L3)	NOEC	<b>1 500 ml/l</b>
<b>Toxicity to fish</b> (OECD 203)	LC <sub>50</sub>	<b>800 000 mg/l</b>
<b>Daphnia toxicity</b> (OECD 202)	EC <sub>50</sub>	<b>700 000 mg/l</b>
<b>Algal toxicity</b> (OECD 201)	IC <sub>50</sub>	<b>400 000 mg/l</b>
<b>Biodegradability</b> (OECD 301f)	Degradation after 28 days	<b>95.6 %</b>
<b>Light bacterial toxicity</b> (DIN ISO 11348-2)	EC <sub>50</sub>	<b>290 000 mg/l</b>
<b>Fluoro-organic compounds content</b> (DIN 38407 - F42)	µg/l	<b>bld.</b>
<b>Toxicity to mammals</b> (OECD 420)	LD <sub>50</sub> rat	<b>&gt; 2 000 mg/kg</b> body weight
<b>Corrosivity and irritation to skin</b> (OECD 404)	-	<b>not skin irritating / corrosive</b>
<b>Eye Irritation / Corrosion</b> (OECD 405)	-	<b>not harmful to eyes / irritating</b>
<b>Earthworm toxicity</b> (DIN ISO 11268-1)	LOEC	<b>5 000 000 mg/kg</b>
<b>Plant growth test</b> (DIN ISO 11269-2)	LOEC	<b>50 000 mg/kg</b>

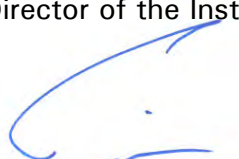
bld. = below limit of detection

LOEC = Lowest Observed Effect Concentration

With regard to the use of the product "**TRIDENT**" in a 0.2 % application solution as an extinguishing agent for fighting forest fires, it should be noted that due to the above mentioned test results on terrestrial organisms (acute earthworm toxicity and plant growth test), there are no objections to the use of the product if the application quantity of the 0.2 % extinguishing solution is selected in such a way that the input into the soil is below the mass concentration of 50 000 mg / kg soil and it can then be assumed that the growth of plants and the life cycle of soil organisms in the regeneration phase of the affected areas is not significantly disturbed.

Under the conservative assumption of a soil thickness of only 1 metre and a very low bulk density of the existing soil of only 1 000 kg/m<sup>3</sup>, the input of approx. 50 litres of extinguishing agent solution per m<sup>2</sup> of forest area would thus correspond to the above-mentioned harmless dosage.

Best regards  
The Director of the Institute  
p.p.



Dipl.-Umweltwiss. Sebastian Bien  
Deputy Head of Department  
Wastewater-, Soil- and Air-Hygiene

Hygiene institute of the Ruhr area Germany  
Institute for Environmental Hygiene and Toxicology  
*Testing and assessment of fire extinguishing agents based on E DIN EN 1568-1  
to -4 and in accordance with Appendix B of the VdS 3124 guideline*

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# Hygiene-Institut des Ruhrgebiets

Institut für Umwelthygiene und Toxikologie

Direktor: Prof. Dr.rer.nat. Lothar Dunemann

Träger: Verein zur Bekämpfung der Volkskrankheiten im Ruhrkohlengebiet e.V.



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Unser Zeichen: A-298272-18-Bi\_en  
Ansprechpartner: Herr Bien

Gelsenkirchen, den 28.05.2018

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**Foam fire extinguishing agents "TRIDENT" dated 15.09.2017**

**Inspection and evaluation of fire extinguishing agents as per references of DIN EN 1568-1 to 4 and as per Attachment B of the Guideline VdS 3124**

**here: Summary of the ecotoxicological, sewage-technical and occupational medicine inspection and evaluation**

Your letters dated 13.09.2017 and 26.10.2017; Mr Clemens Widmayr

Dear Mr Widmayer,

as part of the aforementioned order, the sample of a non-fluorinated foam fire extinguishing agent with the name "TRIDENT" relating to biodegradability, manufactured by your company, was examined for the content of fluoro-organic compounds, with regard to the behaviour towards higher and lower water organisms (aquatic toxicity), towards seed emergence and growth of higher plants as well as the behaviour of earthworms (terrestrial toxicity), with respect to irritation effect on skin and eyes as well as regarding oral toxicity to mammals.

The analytical work was carried out in accordance with the OECD Test Guidelines as well as the regulations laid down in the German standard methods for the examination of water, waste water and sludge (Deutschen Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung)

The results of our tests and assessments apply to the examined test objects and the statutory rules at the time of testing. The accreditation applies to the test procedures listed in the attachment to the accreditation certificate (<http://www.hyg.de>). Examinations which do not fall into the accredited area are marked.



Institute owner: Verein zur Bekämpfung der Volkskrankheiten im Ruhrkohlengebiet e.V., Gelsenkirchen, Association register: VR 519 District court Gelsenkirchen  
VAT ID: DE125018356, Board of directors: Prof. Dr. Werner Schlake (chairman), Prof. Dr. Jürgen Kretschmann, Dr. Emanuel Grün, Dr. Dirk Waider, Prof. Dr. Lothar Dunemann

As part of these examinations carried out on the extinguishing agent concentrate  
 "TRIDENT" dated 15.09.2017, the subsequent summarised test data can be calculated:

Method	Unit	Toxicity value / test data
<b>Bacterial toxicity</b> (TTC / DIN 38412 - L3)	NOEC	<b>3.0 ml/l</b>
<b>Toxicity to fish</b> (OECD 203)	LC <sub>50</sub>	<b>1600 mg/l</b>
<b>Daphnia toxicity</b> (OECD 202)	EC <sub>50</sub>	<b>1400 mg/l</b>
<b>Algal toxicity</b> (OECD 201)	IC <sub>50</sub>	<b>800 mg/l</b>
<b>Biodegradability</b> (OECD 301f)	Degradation after 28 days	<b>95.6 %</b>
<b>Light bacterial toxicity</b> (DIN ISO 11348-2)	EC <sub>50</sub>	<b>580 mg/l</b>
<b>Fluoro-organic compounds content</b> (DIN 38407 - F42)	µg/l	<b>bld.</b>
<b>Toxicity to mammals</b> (OECD 420)	LD <sub>50</sub> rat	<b>&gt; 2000 mg/kg</b> body weight
<b>Corrosivity and irritation to skin</b> (OECD 404)	-	<b>not skin irritating / corrosive</b>
<b>Eye-chafing effect</b> (OECD 405)	-	<b>Not eye chafing / irritating</b>
<b>Earthworm toxicity</b> (DIN ISO 11268-1)	LC <sub>50</sub>	<b>&gt; 10000 mg/kg</b>
<b>Plant growth test</b> (DIN ISO 11269-2)	EC <sub>50</sub>	<b>500 mg/kg</b>

bld. = below limit of detection

Refer to the corresponding detailed test reports for the detailed examination results.

*A-292355-17-Bi dated 26.01.2018:*

“Ecotoxicological and waste water inspection and evaluation”

*A-294153-18-Bi dated 29.01.2018:*

“Irritant effect on skin and eyes as well as determining oral toxicity to mammals”

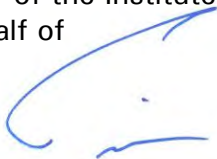
*A-294188-18-Bi dated 29.01.2018:*

“Biological soil examination and evaluation”

Kind regards

Director of the Institute

On behalf of



Dipl.-Umweltwiss. Sebastian Bien

Deputy Department Head  
Waste water, soil, air hygiene

MPA Dresden Germany

Testing, monitoring and certification body recognized by the building authorities Test center for fire extinguishing agents and equipment

*Confirmation of conformity foam concentrate - test basis: EN 1568-3 : 2008*

## CERTIFICATE OF CONFORMITY – FOAM CONCENTRATES

Certificate of conformity reference number: **KB 201/17**

Test specification: **EN 1568-3: 2008**

Test report no.: **20171230-1**

Requested by: **CW FIRE – SUPPORT GmbH  
Sprudelallee 14  
63628 Bad Soden Salmünster**

Manufacturer: **CW FIRE – SUPPORT GmbH  
Sprudelallee 14  
63628 Bad Soden Salmünster**

Name of the fire  
extinguishing medium: **TRIDENT**

Grade of foam concentrate: **Synthetic foam concentrate (S)  
according to annex A EN 1568**

Test fire performance: **Extinguishing performance and burn-back resistance:  
Low expansion foam according to EN 1568-3  
with potable water / with simulated sea water: III D / III D**

Freezing point: **- 9,7°C**

Notes: **–**

Conformity to the above mentioned test specification is attested. All applicable requirements have been met.

This certificate of conformity is valid solely for foam concentrates which correspond to the submitted test samples and to the confirmed documents.

Certificates of conformity of fire extinguishers are solely valid in conjunction with the fire extinguishing medium the type test of the fire extinguisher has been done with.

This certificate of conformity does not include surveillance.

20<sup>th</sup> November 2017



Grad. Eng. Jürgen Dittrich  
Laboratory Manager



MPA Dresden Germany

Testing, monitoring and certification body recognized by the building authorities Test center for fire extinguishing agents and equipment

***Confirmation of Conformity Foam Concentrate -  
Test Bases: ICAO Airport Services***

# Konformitätsbestätigung

## Declaration of conformity

**Nr./no. KB 202/17**

Hersteller: CW FIRE – SUPPORT GmbH  
Manufacturer: Sprudelallee 14  
Bad Soden Salmünster

Herstellwerk: CW FIRE – SUPPORT GmbH  
Manufacturing plant: Sprudelallee 14  
Bad Soden Salmünster

Produktname: TRIDENT  
Product name:

Prüfgrundlagen: ICAO Airport Services Manual, Teil 1 (Rettung und Brandbekämpfung),  
Test specification: Kapitel 8 (Eigenschaften von Feuerlöschmitteln), vierte Ausgabe, 2014  
Dokument 9137 – AN / 898, Teil 1  
ICAO Airport Services Manual, part 1 (Rescue and fire fighting), chapter 8  
(Extinguishing agent characteristics), fourth edition, 2014  
Doc. 9137 – AN / 898, part 1

Prüfbericht-Nr.: 20171230-2  
Test report no.:

Schaummittelklasse: Synthetisches Schaummittel  
Type of foam concentrate: Synthetic foam concentrate

Leistungsklasse: B  
Performance Level:

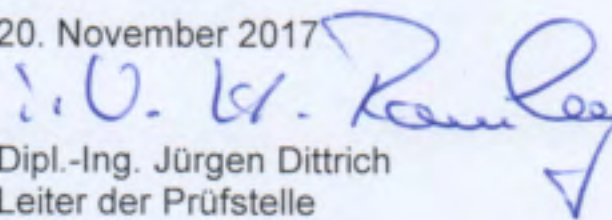
**Die Konformität des geprüften Schaummittels mit den oben genannten Prüfgrundlagen wird bestätigt.**

*The conformity of the tested foam concentrate with the above mentioned test specifications is confirmed.*

Diese Konformitätsbestätigung gilt nur für Schaummittel, die mit den zur Prüfung eingereichten Mustern übereinstimmen. Sie schließt keine Inspektion der werkseigenen Produktionskontrolle ein.

*This declaration is valid solely for foam concentrates which correspond to the submitted test samples. It does not include an inspection of the factory production control.*

20. November 2017

  
Dipl.-Ing. Jürgen Dittrich  
Leiter der Prüfstelle  
Laboratory Manager



Eine auszugsweise Vervielfältigung und Veröffentlichung von Konformitätsbestätigungen bedarf in jedem Einzelfalle der schriftlichen Genehmigung der MPA Dresden GmbH. *The reproduction and publication of extracts of the declaration of conformity requires the written authorisation of MPA Dresden GmbH in each individual case.*

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BIC WELADED1FGX

Trade name: TRIDENT - low expansion foam extinguishing agent according to EN 1568-3:2008

*Safety data sheet according to VO (EG) No. 1907/2006 Appendix II and TRGS 220*

**Page 17-34**



# SAFETY DATA SHEET

Safety Data Sheet according to Directive 1907/2006/EC (REACH),  
Article 31, Annex II, and TRGS 220 (Germany)

**CW Fire-Support GmbH**

Product name: **TRIDENT - Low Expansion Foam Extinguishing Agent According to EN 1568-3:2008**

Date of issue: 31 January 2018

Date of last revision:

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## SECTION 1: Product and Company Identification

<i>Trade name:</i>	<b>TRIDENT - Low Expansion Foam Extinguishing Agent according to EN 1568-3:2008</b>
<i>Product utilisation: (Identified use)</i>	As a 0.2% up to 1% additive to water (class A) or as a 3% additive to water (class B) used in fire-fighting, to reduce surface tension. It is suitable for use in fighting fires of class A (generally combustible substances), and as a 3% additive to water in fighting fires of class B (flammable liquids; tested by MPA Dresden). Particular suitable for fighting fires of organic fluids such as petrol, kerosine, alcohols etc. The toxicity for water organisms is very low (see also SECTION 12).
<i>Manufacturer/Supplier:</i>	<b>CW Fire-Support GmbH</b> Sprudelallee 14, D- 63628 Bad Soden Salmünster Ph.: +49-(0)6056 209313 ; Fax: +49-(0)6056 209312 E-Mail: <a href="mailto:c.widmayr@cwfire-support.de">c.widmayr@cwfire-support.de</a> Internet: <a href="http://www.cwfire-support.de">www.cwfire-support.de</a>
<i>Person in charge:</i>	Mr. Clemens Widmayr (speaks English and German) phone, fax and e-mail as aforementioned
<i>Emergency telephone code:</i>	+49 (0)151 23 503332

## SECTION 2: Hazards Identification

### 2.1 Classification and labelling according to Regulation (EC) No 1272/2008 (Directive 1272/2008/EC)

None, due to tests carried out by the Hygiene-Institut des Ruhrgebiets (HIR: Hygiene Institute of the Ruhrgebiet) according to OECD guidelines No. 404 and 405.

### 2.2 Information pertaining to particular dangers to man and the environment:

Contact of the product with eyes may cause slight eye irritation, and contact with injured skin may cause slight skin irritation. Ingestion may cause irritation of the oral cavity, of the oesophagus and the stomach. The product contains glycerin at a content of < 10% and 2-Phenoxyethanol at a content of < 1%, both may be resorbed through skin. No further harmful effects are expected. At the application concentrations up to 3% of the concentrate no harmful effects are to be expected at all.

Not combustible.

## SECTION 3: Composition / Information on Ingredients

3.1 *Characterization:* Aqueous concentrate of different surface-active agents, glycerin and a biocide.

### 3.2 Hazardous ingredients:

*Classification of the pure ingredients according to Directive 1272/2008/EC (GHS)*

*Common or chemical name:*

**Caprylyl/capryl oligoglucoside C8 - C10** (percentage by weight: < 6%; CAS No.: 68515-73-1; EC No.: 500-220-1; REACH Registration No.: 01-2119488530-36)

*Synonyms: (C8-C10)alkyl ether of corn sugar; D-Glucopyranose, oligomeric, decyl octyl glycosides*

# SAFETY DATA SHEET

Safety Data Sheet according to Directive 1907/2006/EC (REACH),  
Article 31, Annex II, and TRGS 220 (Germany)

CW Fire-Support GmbH

Product name: **TRIDENT - Low Expansion Foam Extinguishing Agent According to EN 1568-3:2008**

Date of issue: 31 January 2018

Date of last revision:

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Eye Dam. 1 (Serious eye damage/eye irritation, Hazard Category 1): H318



Signal word: "Danger"

*Wording of Hazard statements (H-Phrases):*

H318: Causes serious eye damage.

Note: Due to tests of the manufacturer an aqueous solution with  $\leq 10\%$  of Caprylyl/capryl oligoglucoside C8 - C10 need not to be classified as Eye Irrit. 2 (Skin corrosion/irritation, Hazard Category 2).

**2-Phenoxyethanol** (percentage by weight:  $< 1\%$ ; CAS No.: 122-99-6; EC No.: 204-589-7; REACH Registration No.: 01-2119488943-21-0000)

*Synonyms: Ethylene glycol monophenyl ether; Ethanol, 2-phenoxy-; Phenoxyethanol*

Acute tox. (oral) 4 (Acute toxicity if ingested, Hazard Category 4): H302

Eye Irrit. 2 (Eye irritation, Hazard Category 2): H319



Signal word: "Warning"

*Wording of Hazard statements (H-Phrases):*

H302: Harmful if swallowed

H319: Causes serious eye irritation

**1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-(C8-18 and C18-unsatd. acyl) derivs., inner salts** (percentage by weight:  $< 0.5\%$ ; CAS No.: 147170-44-3; EC No.: 604-575-4; REACH Registration No.: 01-2119489410-39 and 01-2119488533-30)

*Synonym: 1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl, N-C8-C18 (even numbered and C18 unsaturated) acyl derivs., hydroxides, inner salts; C8-18 & C18-unsatd. amido propyl betaine*

Eye Dam. 1 (Serious eye damage/eye irritation, Hazard Category 1): H318)

Aquatic Chron. 3 (Hazardous to the aquatic environment, Aquatic Chronic, Hazard Category 3): H412



Signal word: "Danger"

*Wording of Hazard statements (H-Phrases):*

H318: Causes serious eye damage.

H412: Harmful to aquatic life with long lasting effects.

# SAFETY DATA SHEET

Safety Data Sheet according to Directive 1907/2006/EC (REACH),  
Article 31, Annex II, and TRGS 220 (Germany)

CW Fire-Support GmbH

Product name: **TRIDENT - Low Expansion Foam Extinguishing Agent According to EN 1568-3:2008**

Date of issue: 31 January 2018

Date of last revision:

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## **Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-hydroxy-, C12-14-alkyl ethers, sodium salts**

(percentage by weight: < 0.1%; CAS No.: 68891-38-3; EC No.: 500-234-8; REACH Registration No.: 01-2119488639-16)

*Synonyms: Alcohols, (C12-C14), ethoxylated, sulfates, sodium salts; Polyethylene glycol mono-C12-14-alkyl ether sulfate sodium salt; Alcohols, (C12-14), ethoxylated, monoethers with sulfuric acid, sodium salts*

Eye Dam. 1 (Serious eye damage/eye irritation, Hazard Category 1): H318

Skin Irrit. 2 (Skin irritation, Hazard Category 2): H315

Aquatic Chron. 3 (Hazardous to the aquatic environment, Chronic, Hazard Category 3): H412



Signal word: "Danger"

### *Wording of Hazard statements (H-Phrases):*

H318: Causes serious eye damage.

H315: Causes skin irritation.

H412: Harmful to aquatic life with long lasting effects.

### 3.4 Other ingredients:

<i>Common or chemical name</i>	<i>CAS No.</i>	<i>EINECS No.</i>	<i>Chemical nature</i>	<i>Percentage by weight</i>
<b>Water</b>	7732-18-5	231-791-2	No comment	> 80
<b>Glycerin</b>	56-81-5	200-289-5	Anti-freezing agent, natural material	< 10

*Synonyms: Glycerol, 1,2,3-Propanetriol, 1,2,3-Trihydroxypropane*

## **SECTION 4: First Aid Measures**

**General information:** Most of all slight irritation of eyes is to be expected after contact. The following information is only relevant for the product upon delivery (concentrate). At the concentrations of application up to 3% no first-aid measures are expected to be necessary.

**Inhalation of aerosols:** If irritation occur immediately move the affected person into fresh air. If symptoms persist seek medical attention. (Not relevant for vapours, because almost only water evaporates.)

**Skin:** Wash skin with plenty of water and soap. Change contaminated clothing. If symptoms persist seek medical attention.

**Eyes:** Rinse with plenty of water for at least 15 minutes. If symptoms persist seek medical attention.

**Ingestion:** If the patient is conscious have him rinse his mouth with water, spit it out and then have him drink water. Do not induce vomiting. Seek medical attention.

**Information for doctor:** If injured skin is contaminated on a large scale apply polyethylene glycol (e. g. Lutrol, PEG 400), leave it for some minutes and then wash with water. After

# SAFETY DATA SHEET

Safety Data Sheet according to Directive 1907/2006/EC (REACH),  
Article 31, Annex II, and TRGS 220 (Germany)

CW Fire-Support GmbH

Product name: **TRIDENT - Low Expansion Foam Extinguishing Agent According to EN 1568-3:2008**

Date of issue: 31 January 2018

Date of last revision:

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inhalation of aerosols, inhalation of water vapour or application of aerosols of glucocorticoid are indicated. Symptoms should be treated otherwise. There is no specific antidote.

## SECTION 5: Fire Fighting Measures

- General information:* The product is a fire-fighting agent. Use a fire-fighting agent that is suitable for the burning materials. The product is not combustible, only after evaporation of water the organic residue is combustible.
- Extinguishing agents:* Adjust to burning materials. For the residue of the product after evaporation of water powder, foam and directed spray of water are suitable.
- Not suitable extinguishing agents for safety reasons:* Dependent on burning materials.
- Special exposure hazards:* Release of hydrocarbons and their products of combustion, carbon dioxide, carbon monoxide, nitrous oxides, and very small amounts of sulphur oxides. Most exposure hazards may arrive from other burning materials.
- Special protective equipment for fire-fighters:* Use self-contained breathing apparatus.
- Further notice:* Prevent fire-fighting water from entering surface water or groundwater. The product is tested as an additive to water used in fire-fighting.

## SECTION 6: Accidental Release Measures

- General information:* High risk of slipping due to leakage/spillage of product.
- Personal precaution:* Use chemical resistant gloves (refer to SECTION 8.3) and safety goggles with side shield. If aerosols are generated use fine dust respirator (P2 or P3) or a ventilated breathing hood.
- Environmental precaution:* Do not discharge the product into surface water, groundwater or soil, if possible.
- Methods for cleaning up:* Withdraw large quantities. Take up the rest with liquid-adsorbent material (sand, clay, cat litter or other adsorbent material for water). Discharge contaminated material according to SECTION 13.

## SECTION 7: Handling and Storage

- Handling:* Avoid contact with skin and eyes, and avoid inhalation of aerosols..
- Notes for prevention of fire and explosion:* Not applicable.
- Storage:* Appropriate containers: low density polyethylene, stainless steel. Keep containers closed. If possible store between 10°C to 50°C, but not below -10°C and not above 70°C. German VCI-class of storage: 12 (not combustible fluid, TRGS 510).

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## SECTION 8: Exposure Controls / Personal Protection

8.1 *Technical protection:* Avoid generation of aerosols.

8.2 *Ingredients with occupational exposure limit values:*

2-Phenoxyethanol

- CAS No.: 122-99-6
- Exposure limit value: 110 mg/m<sup>3</sup> (20ppm) (vapour and inhalable aerosols)
- Short term limit value: 2, I (refer to explanations)
- Origin: TRGS 900 (AGW)
- BLV: None
- Remarks: H, C
- Year: 2017

Glycerin

- CAS No.: 56-81-5
- Exposure limit value: 200 mg/m<sup>3</sup> (inhalable aerosol)
- Short term limit value: 2, I (refer to explanations)
- BLV: None
- Origin: TRGS 900 (AGW)
- Remarks: C
- Year: 2017

*Explanations:*

- AGW Exposure limit value (refer to TRGS 900, Germany)
- BLV Biological limit value
- Short term limit values: Exceeding factor X: Exposure may exceed the exposure limit value by the factor X for not longer than 15 minutes. 4 measurements at intervals of 1 hour.  
Exceeding factor =X=: Exposure must never exceed the exposure limit value by more than the factor X (instantaneous value).  
(I): Category I: substances for which the exposure limit value is based on local effects or sensitizing substances.  
(II): Category II: substances effective by resorption.
- Remarks: H : Substances effective by resorption through skin  
S = Sensitizing substance  
Y or C: There is no teratogenic risk if the exposure limit value and the BLV are maintained.

8.3 *Ingredients with DNEL:*

8.3.1 Caprylyl/capryl oligoglucoside C8 - C10 (CAS No.: 68515-73-1)

- Worker: long-term exposition - systematic effects, dermal: 595 g/kg
- Worker: long-term exposition - systematic effects, inhalation: 420 mg/m<sup>3</sup>
- Consumer: long-term exposition - systematic effects, dermal: 357 g/kg
- Consumer: long-term exposition - systematic effects, oral: 35.7 mg/kg
- Consumer: long-term exposition - systematic effects, inhalation: 124 mg/m<sup>3</sup>

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## 8.3.2 2-Phenoxyethanol (CAS No.: 122-99-6)

Worker: long-term exposition - systematic effects, dermal: 34.7 mg/kg  
Worker: long-term exposition - systematic effects, inhalation: 8.07 mg/m<sup>3</sup>  
Consumer: long-term exposition - systematic effects, dermal: 20.83 mg/kg  
Consumer: long-term exposition - systematic effects, oral: 17.43 mg/kg  
Consumer: long-term exposition - systematic effects, inhalation: 2.5 mg/m<sup>3</sup>

## 8.3.3 1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-(C8-18 and C18-unsatd. acyl) derivs., inner salts (CAS No.: 147170-44-3)

Worker: long-term exposition - systematic effects, dermal: 12.5 mg/kg  
Worker: long-term exposition - systematic effects, inhalation: 44 mg/m<sup>3</sup>  
Consumer: long-term exposition - systematic effects, dermal: 7.5 mg/kg  
Consumer: long-term exposition - systematic effects, oral: 7.5 mg/kg

## 8.3.4 Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-hydroxy-, C12-14-alkyl ethers, sodium salts (CAS No.: 68891-38-3)

Worker: long-term exposition - systematic effects, dermal: 2,750 mg/kg  
Worker: long-term exposition - local effects, dermal: 0.312 mg/cm<sup>2</sup>  
Worker: long-term exposition - systematic effects, inhalation: 175 mg/m<sup>3</sup>  
Consumer: long-term exposition - systematic effects, dermal: 1,650 mg/kg  
Consumer: long-term exposition - local effects, dermal: 0.079 mg/cm<sup>2</sup>  
Consumer: long-term exposition - systematic effects, oral: 15 mg/kg  
Consumer: long-term exposition - systematic effects, inhalation: 52 mg/m<sup>3</sup>

## 8.4 Personal Protection:

The following protection measures apply to the product upon delivery (concentrate):

<i>Respiratory protection:</i>	If aerosols are generated use fine dust respirator (P2 or P3) or a ventilated breathing hood.
<i>Hand protection:</i>	If contact with hands cannot be avoided use protection gloves tested according to DIN EN 374. Seek advice from manufacturers of protection gloves. If gloves cannot be used for safety reasons (e. g. while working at rotating machines) use skin-protective barrier cream. Consult the company medical officer for the type of barrier cream to be used. Comment: In contrary to the European ordinance 1907/2006/EC (REACH), it is not sufficient to specify only the protective glove material. The break-through-times are dependent not only on the material but also on the manufacturing technique. It is therefore essential to consult the manufacturers of protective gloves. For the product (concentrate) the following materials should be appropriate: polychloroprene - CR (0.5 mm), nitrile/latex rubber - NBR (0.35 mm), butyl rubber - Butyl (0.5 mm), polyvinyl chloride - PVC (0.5 mm).
<i>Eye protection:</i>	Safety glasses with side shield.
<i>Skin protection:</i>	Use waterproof protective clothing and gumboots if contamination of clothing cannot be avoided, e g. when aerosols are generated.
<i>General protective measures:</i>	Avoid contact with eyes and skin. Change contaminated clothing immediately.

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*Industrial hygiene:*

Do not eat, drink, smoke or take snuff at work.

## SECTION 9: Physical and Chemical Properties

### 9.1 Appearance

*Physical state:* Liquid.  
*Colour:* Amber  
*Odour:* Faint characteristic odour.

### 9.2 Relevant data for Safety and Health for the product (concentrate):

*Melting point/ range:* < -10°C (MPA)  
*Boiling point / range:* > 100°C (deduced from properties of the ingredients)  
*Flash range:* No inflammability  
*Ignition temperature:* Not applicable  
*Autoignition temperature:* Not applicable  
*Explosive range:* Not applicable  
*Vapour pressure:* Almost like water  
*Substance weight:* 1.01 - 1.05 g/ml (20°C; deduced from properties of the ingredients)  
*Bulk density:* Not applicable  
*Solubility in water:* Miscible  
*pH-Value:* 7.3 (measured by MPA, will be lowered by carbon dioxide from air.)  
*Volatile components:* Water  
*Solubility in other solvents:* Not determined  
*Partition coefficient n-octanol/water:* Not determined  
*Kinematic viscosity:* Not determined  
*Surface tension:* Not determined  
*Interfacial tension:* Not determined

## SECTION 10: Stability and Reactivity

*Thermal decomposition:* Not determined  
*Substances to be avoided:* Strong oxidizing agents (halogenes, nitriles, hydrogen peroxide, perchloric acid, aqua regia, etc.), strong acids.  
*Dangerous reactions:* No dangerous reactions are known.  
*Hazardous decomposition products:* After evaporation of water: carbon monoxide, carbon dioxide, different hydrocarbons and small amounts of sulfur compounds, mainly sulfur dioxide when burning.  
*Dangerous polymerisations:* None.

## SECTION 11: Toxicological Information

11.1 Product Tests according to OECD guidelines No. 404 and 405 carried out by the Hygiene-Institut des Ruhrgebiets (HIR: Hygiene-Institute of the Ruhrgebiet) showed no irritation of skin or eyes after contact. No further information on the toxicity of the product (concentrate) is available.

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## 11.1.1 *Toxikokinetics, metabolism and distribution:*

Inhalation of aerosols and absorption through the skin are the main routes of occupational exposure. Essentially, only the ingredient glycerin is resorbed via the skin. For glycerin an elimination rate of 2 g within 8 hours has been calculated (GESTIS). Less than 15% of orally administered glycerin is excreted unaltered. 85% is metabolized, mainly in the liver and the kidneys. The metabolites of glycerin serve to synthesize glucose, glycogen and fat. The exposure through skin of 2-Phenoxy-ethanol is usually marginal, but may contribute to the total exposure by contact with injured skin. The resorption of all other ingredients is insignificant. Slight irritation of eyes and of injured skin is the main hazard.

## 11.1.2 *Toxicity:*

If not otherwise mentioned the following toxicities of the product (concentrate) are estimated by the toxicities of the ingredients (refer to SECTION 11.2):

*Acute toxicity:* After contact the product may cause slight irritation of eyes and slight irritation of injured skin. Ingestion may cause irritation of the oral cavity, of the oesophagus and the stomach. No toxic effects are to be expected if industrial hygiene standards are maintained.

*Acute oral toxicity:* LD<sub>50</sub>: (rat, oral): > 2,000 mg/kg (HIR according to guideline OECD 420)  
LD<sub>50</sub>: (rat, oral): > 34,000 mg/kg (estimated due to the toxicities of the ingredients)

*Acute inhalative toxicity:* Due to low vapour pressures of the ingredients (with the exception of water) only inhalation of aerosols is relevant (refer to SECTION 11.1.1).

*Acute dermal toxicity:* LD<sub>50</sub> (rat or rabbit, dermal): > 30,000 mg/kg (estimated due to the toxicities of the ingredients)

*After inhalation:* Slight irritation of the respiratory tract may occur after inhaling aerosols.

*After skin contact:* Not irritant (HIR according to guideline OECD 404). Slight irritation of injured skin is possible.

*After eye contact:* Not irritant (HIR according to guideline OECD 404). Slight irritation is possible (also after contact with aerosols).

*After ingestion:* Ingestion may result in irritation of the oral cavity, of the oesophagus and the stomach.

*Sensitization:* No sensitizing effects are known.

*Mutagenicity:* No mutagenic effects are known.

*Cancer:* No carcinogenic effects are known. All ingredients are not mentioned as carcinogenic in the lists of ACGIH, NIOSH, IARC or TRGS 905.

*Reproductive toxicity:* No toxic effects on reproduction are known.

### *Toxic effects after repeated exposure (subacute to chronic toxicity):*

No symptoms after repeated occupational exposure (chronic or subchronic) are known.

*Practical experience:* There are no reports of symptoms of poisoning after using the product.



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## 11.2 Toxicological information on the pure ingredients:

Note: If not mentioned otherwise the following information originates from the Safety Data Sheets of the manufacturers.

### 11.2.1 Caprylyl/capryl oligoglucoside C8 - C10 (percentage by weight: < 6%)

#### *Toxicokinetics, metabolism and distribution:*

No information is available.

#### *Acute toxicity:*

LD<sub>50</sub> (rat, oral): > 5,000 mg/kg (OECD guideline 401)

LD<sub>50</sub> (dermal): > 5,000 mg/kg (OECD guideline 402)

*After skin contact:* Not irritant (rabbit, according to guideline OECD 404).

*After eye contact:* Risk of serious, irreversible eye damage (rabbit, according to guideline OECD 405). Not irritant for an aqueous solution containing ≤ 10% (statement of the manufacturer).

*Specific organ toxicity:* According to available information there is no specific organ toxicity after single exposure.

*Sensitization:* Not sensitizing (guinea pig, OECD guideline 406).

*Mutagenicity:* Tests on microorganisms and on cultures of cells of mammals showed no mutagenic effects.

*Cancer:* According to available information no carcinogenic effects are to be expected.

*Reproductive toxicity:* Animal tests showed no reproductive toxicity.

*Chronic toxicity:* Animal tests showed no toxic effects after repeated oral application.

### 11.2.2 2-Phenoxyethanol (percentage by weight: < 1%)

#### *Toxicokinetics, metabolism and distribution:*

2-Phenoxyethanol metabolises rapidly to phenoxy-acetic acid and is excreted via kidneys.

#### *Acute toxicity:*

LD<sub>50</sub> (rat, oral): 1,260 mg/kg (GESTIS)

LD<sub>50</sub> (rat, oral): 2,740 mg/kg (BASF-Test)

LD<sub>50</sub> (rat, dermal): 5,510 mg/kg (GESTIS)

IRT (rat, inhalativ): within 8 hours no mortality

*After skin contact:* Not irritant (rabbit, according to OECD guideline 404).

*After eye contact:* Irritating (rabbit, according to OECD guideline 405).

*Specific organ toxicity:* No information available.

*Sensitization:* Not sensitizing (guinea pig, maximation test, OECD guideline 406).

*Mutagenicity:* No mutagenic effects with bacteria. Tests on cells of mammals and on mammals showed no mutagenic effects.

*Cancer:* There is no information on carcinogenic effects.

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*Reproductive toxicity:* Animal tests showed no effects on fertility. Animal studies gave no indication of teratogenic effects at doses that were not toxic to the parental animals.

*Chronic toxicity:* There is no information available.

## 11.2.3 1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-(C8-18 and C18-unsatd. acyl) derivs., inner salts (percentage by weight: < 0.5%)

### *Toxikokinetics, metabolism and distribution:*

No information is available.

### *Acute toxicity:*

LD<sub>50</sub> (rat, oral): > 5,000 mg/kg

LD<sub>50</sub> (rat, dermal): > 2,000 mg/kg (OECD guideline TG 402)

*After skin contact:* Slightly irritant (rabbit, according to OECD guideline 404).

*After eye contact:* Risk of serious, irreversible eye damage (rabbit, according to OECD guideline 405).

*Specific organ toxicity:* According to available information there is no specific organ toxicity after single exposure.

*Sensitization:* Not sensitizing (guinea pig, maximation test, OECD guideline 406).

*Mutagenicity:* Tests on microorganisms and on cultures of cells of mammals showed no mutagenic effects. Ames-test: negative (Salmonella typhimurium, OECD guideline 471). Gene mutation: negative (lymphocytes of mice L5178Y, OECD guideline 476). Micronucleus-test: negative (bone marrow cells of mice, OECD guideline 474).

*Cancer:* According to available information no carcinogenic effects are to be expected.

*Reproductive toxicity:* Teratogenicity: NOEL (female rat, 15 days of exposure): 1,000 mg/kg (OECD guideline 414). Developmental toxicity: NOEL (female rat, 15 days of exposure): 300 mg/kg. There is no information on toxic effects of reproduction and development.

*Chronic toxicity:* After repeated oral exposure (90 days) no chronic toxic effects were observed in animal experiments. NOEL: 300 mg/kg (OECD guideline 408)

## 11.2.4 Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-hydroxy-, C12-14-alkyl ethers, sodium salts (percentage by weight: < 0.1%)

### *Toxikokinetics, metabolism and distribution:*

No information is available.

### *Acute toxicity:*

LD<sub>50</sub> (rat, oral): > 2,000 - 5,000 mg/kg (OECD guideline 401)

LD<sub>50</sub> (rat, dermal): > 2,000 mg/kg (OECD guideline TG 402)

*After skin contact:* Irritant (rabbit, according to OECD guideline 404).

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<i>After eye contact:</i>	Strongly irritant for aqueous solutions $\geq 10\%$ . Irritant for aqueous solutions $\geq 5\%$ to $< 10\%$ . Not irritant for aqueous solutions $< 5\%$ . (rabbit, according to OECD guideline 405).
<i>Specific organ toxicity:</i>	According to available information there is no specific organ toxicity after single exposure.
<i>Sensitization:</i>	Not sensitizing (guinea pig, maximation test, OECD guideline 406).
<i>Mutagenicity:</i>	In-vitro- und in-vivo tests showed no mutagenic effects.
<i>Cancer:</i>	According to available information no carcinogenic effects are to be expected.
<i>Reproductive toxicity:</i>	Teratogenicity: NOAEL: $> 1000$ mg/kg (OECD guideline 414).
<i>Chronic toxicity:</i>	After repeated oral exposure (90 days) no chronic toxic effects were observed in animal experiments. NOAEL: 225 mg/kg (OECD guideline 408)

## 11.2.5 Glycerin (percentage by weight: $< 10\%$ )

### *Toxicokinetics, metabolism and distribution:*

Refer to SECTION 11.1.1

### *Acute toxicity:*

LD <sub>50</sub> (rat, oral):	12,600 mg/kg (IUCLID, GESTIS)
LD <sub>50</sub> (rabbit, dermal):	18,700 mg/kg (IUCLID)
LD <sub>50</sub> (rabbit, dermal):	$>10,000$ mg/kg (GESTIS)

*After inhalation:* Slight irritation of the respiratory tract may occur after inhaling aerosols.

*After skin contact:* Not irritant (rabbit). Intense and long-time contact may result in dry skin. Slight irritation of injured skin, e. g. after sunburn, is possible. Glycerin is resorbed through skin.

*After eye contact:* Irritating (rabbit, according to guideline OECD 405).

*After ingestion:* The ingredient glycerin is rapidly resorbed in the gastrointestinal tract. Ingestion of very high doses of the product ( $> 700$  mg/kg body weight) may result in nausea and diarrhea. After a delay, headache, vertigo, kidney pains and enhanced urine production may occur. Ingestion may also result in irritation of the oral cavity, of the oesophagus and the stomach.

*Specific organ toxicity:* According to available information there is no specific organ toxicity after single exposure.

*Sensitization:* There is no information on sensitizing effects. Patch-tests on humans with glycerin were negative (IUCLID).

*Mutagenicity:* There is no information on sensitizing effects. Ames-test in vitro with glycerin was negative (IUCLID).

*Cancer:* According to available information no carcinogenic effects are to be expected.

*Reproductive toxicity:* In animal studies with rodents (rats, mice, rabbits, method similar to OECD guideline 414) no toxic effects to the mother nor to the descendants were found with the highest dose tested (NOEL: 1180 mg/kg body weight x days). In a study of 2 generations of mice (method

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*Chronic toxicity:*

slightly different from the OECD guideline) no reproductive effects were found (NOAEL: 2000 mg/kg body weight x days).  
Repeated intake of large amounts may result in damage of kidneys.

## SECTION 12: Ecological Information

### 12.1 Product upon delivery (concentrate):

The ecotoxic effects and ecotoxic data of the product were determined by the Hygiene-Institut des Ruhrgebiets (report A-292355-17-Bi of 14 Dec. 2017).

*Ecotoxic effects:* The product is weakly water polluting (WGK 1) according to the German AwSV, annex 1, chapter 5). Readily biodegradable according to Directive 1272/2008/EC, chapter 4.1.2.9.5. If the product is diluted with water or other waste water at a ratio of 1:400, respectively, no adverse effects to sewage plants are to be expected. On the bases of the information of the ingredients no noteworthy bioaccumulation is to be expected.

*Ecotoxic data:*

<i>Fish toxicity:</i>	Brachydanio rerio:	LC <sub>0</sub> :	1,000 mg/l / 96 h (24°C, OECD guideline 203)
	Brachydanio rerio:	LC <sub>50</sub> :	1,600 mg/l / 96 h <sup>1)</sup> (24°C, OECD guideline 203)
	Brachydanio rerio:	LC <sub>100</sub> :	2,000 mg/l / 96 h (24°C, OECD guideline 203)
<i>Daphnia toxicity:</i>	Daphnia magna Straus:	NOEC:	> 1 mg/l (OECD guideline 204)
	Daphnia magna Straus:	EC <sub>0</sub> :	200mg/l / 48h (20°C, OECD guideline 402)
	Daphnia magna Straus:	EC <sub>50</sub> :	1,400 mg/l / 48h <sup>1)</sup> (20°C, OECD guideline 402)
<i>Bacterial toxicity:</i>	Daphnia magna Straus:	EC <sub>100</sub> :	5,000 mg/l / 48h (20°C, OECD guideline 402)
		NOEC:	3 ml/l (TTC-test)
<i>Luminous bacterial toxicity:</i>	Vibrio fischeri:	EC <sub>50</sub> :	580 mg/l / 30 min (15°C, DIN-ISO 11348-2, 2009)
	Vibrio fischeri:	NOEC:	GL-value: 16 (DIN-ISO 11348-2, 2009)
<i>Algae toxicity:</i>	Desmodesmus subspic.:	IC <sub>10</sub> :	170 mg/l / 72 h (23°C, OECD guideline 201)
	Desmodesmus subspic.:	IC <sub>50</sub> :	800 mg/l / 72 h (23°C, OECD guideline 201)
<i>Earthling toxicity:</i>		LD <sub>50</sub> :	> 10,000 mg/kg (DIN-ISO 11268-1)

<sup>1)</sup>: graphically determined.

*Further information:*

Biodegradability: 95,6% after 25 d to 28 d

<i>COD:</i>	233,000 mg O <sub>2</sub> / L (Hygiene-Institut des Ruhrgebiets = HIR)
<i>BOD<sub>5</sub>:</i>	116,000 mg O <sub>2</sub> / L, 49,8% degradation (HIR)
<i>BOD<sub>10</sub>:</i>	168,000 mg O <sub>2</sub> / L, 72,1% degradation (HIR)
<i>BOD<sub>15</sub>:</i>	188,667 mg O <sub>2</sub> / L, 81,0% degradation (HIR)
<i>BOD<sub>20</sub>:</i>	206,667 mg O <sub>2</sub> / L, 88,7% degradation (HIR)
<i>BOD<sub>end</sub>:</i>	222,667 mg O <sub>2</sub> / L, 95,6% degradation (HIR)

*PBT- und vPvB:* The product contains no ingredients which meet the criteria of PTB (persistent, toxic, bioaccumulative), and vPvB (very persistent, very bioaccumulative) according to Directive 1907/2006/EC, annex XIV.

*Ozone:* No ingredients of the product are mentioned in Directive 1005/2009/EC to induce degradation of ozone.

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## 12.2 Information on the **pure ingredients**:

Note: If not mentioned otherwise the following information originates from the Safety Data Sheets of the manufacturers.

### 12.2.1 Caprylyl/capryl oligoglucoside C8 - C10 (percentage by weight: < 6%)

**Ecotoxic effects:** Readily biodegradable according to criteria of OECD. No noteworthy bioaccumulation is to be expected. The substance does not evaporate from water surfaces to the atmosphere. Adsorption onto solid particles is possible.

#### **Ecotoxic data:**

**Fish toxicity:** Brachydanio rerio LC<sub>50</sub>: > 100 mg/l / 96 h (OECD 203; ISO 7346)  
NOEC: > 1 mg/l (OECD guideline 204)

**Daphnia toxicity:** Daphnia magna: EC<sub>50</sub>: > 100 mg/l / 48h (directive 92/69/EEC)  
NOEC: > 1 mg/l (OECD guideline 202, Part 2)

**Bacterial toxicity:** Pseudomonas putida: EC<sub>0</sub>: > 100 mg/l / 6 h (Bringmann-Kuehn-Test)

**Algae toxicity:** Desmodesmus subspic.: EC<sub>50</sub>: > 10 - < 100 mg/l / 72 h (OECD gl. 201)

#### **PNEC-Values:**

Sweet water: 0.176 mg/l  
Seawater: 0.0176 mg/l  
Sporadic release: 0.26 mg/l  
Sewage plant: 560 mg/l  
Sediment sweet water: 1.516 mg/kg  
Sediment seawater: 0.152 mg/kg  
Soil: 0.654 mg/kg  
Oral Intake  
(secondary poisoning): 111.11 mg/kg

#### **Further information:**

##### **WGK (Water Pollution**

**Category, Germany):** 1 (slightly water polluting), (AwSV, annex 1, chapter 4)

### 12.2.2 2-Phenoxyethanol (percentage by weight: < 1%)

**Ecotoxic effects:** Readily biodegradable according to criteria of OECD. No noteworthy bioaccumulation is to be expected. The substance is slowly hydrolysed by water. The substance does not evaporate from water surfaces to the atmosphere. The substance does not adsorb onto solid particles.

#### **Ecotoxic data:**

**Fish toxicity:** LC<sub>50</sub>: 440 mg/l / 96 h (GESTIS)  
Pimephales promelas: LC<sub>50</sub>: > 100 mg/l / 96 h (flow through)  
Pimephales promelas: NOEC: > 1 mg/l / 34 d (OECD draft, flow through)

**Daphnia toxicity:** Daphnia magna: EC<sub>50</sub>: > 100 mg/l / 48 h (directive 79/831/EC)  
Daphnia magna: NOEC: > 1 mg/l / 21 d (OECD guideline 211, semistatic)

**Bacterial toxicity:** Pseudomonas putida: EC<sub>10</sub>: > 100 mg/l / 17 h (DIN 38412 Part 8)

**Algae toxicity:** Desmodesmus subspic.: EC<sub>50</sub>: > 100 mg/l / 72 h (DIN 38412 Part 9)

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## *PNEC-Values:*

Sweet water:	0.943 mg/l
Seawater:	0.0943 mg/l
Sporadic release:	3.44 mg/l
Sewage plant:	24.8 mg/l
Sediment sweet water:	7.2366 mg/kg
Sediment seawater:	0.152 mg/kg
Soil:	1.26 mg/kg

## *Further information:*

**Biodegradation:** > 70% / 15 d DOC-decrease (aerobic, activated sludge, new version of OECD guideline 301A)

## *WGK (Water Pollution*

*Category, Germany):* 2 (water polluting) (BAz. AT, identification no.: 1650)

12.2.3 1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-(C8-18 and C18-unsatd. acyl) derivs., inner salts (percentage by weight: < 0.5%)

**Ecotoxic effects:** Readily biodegradable according to 648/2004/EU for detergents. No noteworthy bioaccumulation is to be expected. Easily eliminable from water.

## *Ecotoxic data:*

<b>Fish toxicity:</b>	Pimephales promelas:	LC <sub>50</sub> :	> 1 - 10 mg/l (similar to OECD gl. 203)
	Archosargus probatocephalus:	LC <sub>50</sub> :	1.11 mg/l / 96 h (OECD guideline 203)
	Onchorhynchus mykiss:	NOEC:	0.135 mg/l / 100 d (OECD guideline 210)
<b>Daphnia toxicity:</b>	Daphnia magna:	EC <sub>50</sub> :	> 1 - 10 mg/l (OECD guidl. 201, Part 1)
	Daphnia magna:	EC <sub>50</sub> :	6.5 mg/l / 48 h (OECD guideline 202)
	Daphnia magna:	NOEC:	0.32 mg/l / 21 d (OECD guideline 211)
	Daphnia magna:	LOEC:	0.56 mg/l / 21 d (OECD guideline 211)
<b>Bacterial toxicity:</b>	Pseudomonas putida:	EC <sub>0</sub> :	> 100 mg/l (OECD guideline 209)
<b>Algae toxicity:</b>	Desmodesmus subspicatus:	EC <sub>50</sub> :	> 1 - 10 mg/l (OECD guideline 201)
	Desmodesmus subspic.:	EC <sub>50</sub> :	1.5 mg/l / 72 h (DIN 48412, Part 9)

## *PNEC-Values:*

Sweet water:	0.0135 mg/l mg/l
Seawater:	0.00135 mg/l
Sewage plant:	3,000 mg/l
Sediment sweet water:	1 mg/kg
Sediment seawater:	0.1 mg/kg
Soil:	0.8 mg/kg

## *Further information:*

**Biodegradation:** 92% / 28 d (aerobic, activated sludge, OECD guideline 301B)  
80 - 90% / 60 d (anaerobic, activated sludge, OECD guideline 311)

**CSB:** 1,000,000 mg/l (DIN 48409 Part 41)

**M-Faktor:** Aquatic toxicity: 1

## *WGK (Water Pollution*

*Category, Germany):* 1 (slightly water polluting), (AwSV, annex 1, chapter 4)

# SAFETY DATA SHEET

Safety Data Sheet according to Directive 1907/2006/EC (REACH),  
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CW Fire-Support GmbH

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## 12.2.4 Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-hydroxy-, C12-14-alkyl ethers, sodium salts (percentage by weight: < 0.1%)

**Ecotoxic effects:** Readily biodegradable according to 648/2004/EU for detergents.  
Bioaccumulation is not to be expected.

### Ecotoxic data:

<b>Fish toxicity:</b>	Brachydanio rerio:	LC <sub>50</sub> :	> 1 - 10 mg/l (OECD guideline 203)
	Onchorhynchus mykiss:	NOEC:	0.14 mg/l / 28 d (OECD guideline 204)
<b>Daphnia toxicity:</b>	Daphnia magna:	EC <sub>50</sub> :	> 1 - 10 mg/l / 48 h (OECD guideline 202)
	Daphnia magna:	NOEC:	0.27 mg/l / 21 d (OECD guideline 211)
<b>Bacterial toxicity:</b>	Pseudomonas putida:	EC <sub>10</sub> :	> 10,000 mg/l (cell proliferation inhibition test)
<b>Algae toxicity:</b>	Desmodesmus subspic.:	EC <sub>50</sub> :	> 10 - 100 mg/l / 72 h (OECD gl. 201)

### PNEC-Values:

Sweet water:	0.24 mg/l mg/l
Seawater:	0.024 mg/l
Sewage plant:	10,000 mg/l
Sediment sweet water:	0.9168 mg/kg
Sediment seawater:	0.0917 mg/kg
Soil:	7.5 mg/kg

### Further information:

**Biodegradation:** > 70% / 28 d (aerobic, activated sludge, OECD guideline 301A)  
**Mobility in soil:** Koc: 191 (calculated)

### WGK (Water Pollution

Category, Germany): 1 (slightly water polluting), (AwSV, annex 1, chapter 4)

## 12.2.5 Glycerin (percentage by weight: < 10%)

**Ecotoxic effects:** Readily biodegradable. No bioaccumulation is to be expected.

### Ecotoxic data:

<b>Fish toxicity:</b>	Carassius auratus:	LC <sub>50</sub> :	> 5,000 mg/l / 24 h (Merck)
	Leuciscus idus:	LC <sub>50</sub> :	> 10,000 mg/l / 24 h (Brenntag)
<b>Daphnia toxicity:</b>	Daphnia magna:	EC <sub>50</sub> :	> 10,000 mg/l / 24 h (Merck)
<b>Bacterial toxicity:</b>	Pseudomonas putida:	EC <sub>5</sub> :	> 10,000 mg/l / 16 h (Merck)
<b>Protozoa toxicity:</b>	Entosiphon sulcatum:	EC <sub>5</sub> :	3,200 mg/l / 72 h (Merck)
<b>Algae toxicity:</b>	Scenedesmus quadricauda:	IC <sub>5</sub> :	> 10,000 mg/l / 7 d (Merck)

### Further information:

**Biodegradation:** > 63% / 14 d (OECD guideline 301C)  
Decrease: DOC >70%, BOD >60% (old MSDS Merck)

**Distribution log P(o/w):** -1.76 (calculated, Merck)

**BOD:** 870 mg/g / 5 d (Merck)

**BOD<sub>5</sub>:** 71% of TOD / 5 d (Merck)

**COD:** 870 mg/g / 5 d, 95% of TOD (Merck)

**TOD:** 1.217 g/g (Merck)

# SAFETY DATA SHEET

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*WGK (Water Pollution*

*Category, Germany):* 1 (slightly water polluting), (BAnz. AT, identification no.: 116)

Do not allow the product to enter water supplies, waste water or soil (refer to SECTION 12.1 and 13.1).

## SECTION 13: Disposal Considerations

**13.1 Product:** Previous to recovery the product should be pretreated to remove water. For disposal the product has not to be supervised. Small amounts (< 1 l) diluted by water or other waste water at a ratio of 1:400, respectively, may be discarded into the sewage system.

*Waste code:* 16 10 04

*Waste name:* Aqueous concentrates with the exception of those included under waste code 16 10 03\*

**13.2 Wastes contaminated by the product (adsorbent materials, protective clothing):**

*Waste code:* 15 02 03

*Waste name:* Adsorbent and filter materials, wipes and protective clothing with the exception of those included under waste code 15 02 02\*

**13.3 Packing materials (completely emptied):**

a) Packing materials made of plastics:

*Waste code:* 15 01 02

*Waste name:* Packing materials made of plastics

b) Packing materials made of metal:

*Waste code:* 15 01 04

*Waste name:* Packing materials made of metal

Waste-codes in accordance with the European Waste Register Ordinance.

## SECTION 14: Transport Information

The product is not classified under international transport regulations in any way.

## SECTION 15: Regulatory Information

**15.1** For the product there is no safety report available, but for all ingredients there are safety reports available according to 1907/2006/EC (REACH).

**15.2 Substances of very high concern (SVHC):**

This product does not contain substances of very high concern according to directive 1907/2006/EC, article 57.

All other relevant regulations are mentioned elsewhere in this Safety Data Sheet.

**15.3 National Regulations, Germany:**

**15.3.1 StörfallV:** Not applicable



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15.3.2	TA-Luft:	Clause 5.2.5: Organic substances apart from particulate matter: max. mass concentration: 50 mg/m <sup>3</sup> or max. mass flow: 0.50 kg/h (calculated as total carbon)
15.3.3	VCI Storage Class:	12 (not combustible fluids, TRGS 510)
15.4.4	AwSV:	WGK 1 (Slightly water polluting, German Water Pollution Category 1)
15.3.5	Volatile components:	Water (VOC: 0%)
15.4	Further regulations and restrictions:	Occupational restrictions: Take note of Directive 94/33/EC on the protection of young people at work.

## SECTION 16: Other Information

### Abbreviations:

ACGIH: American Conference of Governmental Industrial Hygienists  
AwSV: Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen vom 18 April 2017 (ordinance about facilities for handling with substances hazardous to water of 18 April 2017)  
BAnz. AT: Liste der wassergefährdenden Stoffe, veröffentlicht im Bundesanzeiger AT vom 10.08.2017 (list of water polluting substances, published in Bundesanzeiger AT of 8 Aug. 2017)  
BOD: Biochemical oxygen demand  
ChemIDplus: Database of the United States National Library of Medicine  
COD: Chemical oxygen demand  
DNEL Derived No-Effect Level  
DIN; DIN/ISO: German standard  
DOC: Dissolved organic carbon  
EN: European standard  
EINECS: European Inventory of Existing Commercial Substances  
GESTIS: Data base of Berufsgenossenschaftliches Institut für Arbeitsschutz, Germany  
IARC: International Agency for Research on Cancer (World Health Organisation)  
IRT: Inhalation risk test  
IUCLID: International Uniform Chemical Information Database  
LOEC: Lowest Observed Effect Concentration  
MAK: Maximale Arbeitsplatzkonzentration (maximum concentration in the workplace, out of date)  
Merck, Brenntag etc.: Actuel MSDS of Merck, Darmstadt, Germany, Brenntag, Germany, etc.  
MITI: Ministry of International Trade and Industry, Japan  
MSDS: Material Safety Data Sheet  
NIOSH: National Institute for Occupational Safety and Health (USA)  
NOAEL: No Observed Adverse Effect Level  
NOEC: No Observed Effect Concentration  
NOEL: No Observed Effect Level  
OECD: Organisation for Economic Co-operation and Development  
OSHA: Occupational Safety and Health Administration (USA)  
PNEC: Predicted No-Effect Concentration  
RTECS: Register of Toxic Effects of Chemical Substances  
TG: Test-Guideline  
TOC: Total organic carbon  
TOD: Theoretical oxygen demand  
TRGS: Technische Regel für Gefahrstoffe (Technical rules for hazardous substances, Germany)  
TRK: Technische Richtkonzentration (technical concentration in the workplace to comply with [for cancerogenic substances], out of date)  
TTC: 2,3,5-Triphenyl, tetrazoliumchloride  
VCI: Verband der Chemischen Industrie e.V. (Chemical Industry Association, Germany)  
VwVwS: Ordinance on water polluting substances, Germany  
VOC: Volatile organic carbons

# SAFETY DATA SHEET

Safety Data Sheet according to Directive 1907/2006/EC (REACH),  
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WGK: Wassergefährdungsklasse (Water Pollution Category, Germany)

As of the date of issuance, we are providing available information relevant to the handling of this material in the workplace. All information contained herein is offered in good faith in the belief that it is accurate. This material safety data sheet shall not be deemed to constitute or imply any warranty of any kind. In the event of an adverse incident associated with this material, this safety data sheet is not intended as a substitute for consultation with appropriately trained personnel (refer to SECTION 1). Nor is this safety data sheet intended to be a substitute for any product literature which may accompany the finished product.

Fraunhofer Heinrich-Hertz-Institut Germany  
*Attempt to test a fire extinguishing agent for extinguishing a lithium ion  
fire occurring in the battery system*

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## Experimental report on the battery test by the company CWFire-Support on February 3rd, 2021

<b>Customer:</b>	CWFire-Support GmbH
<b>Offer number:</b>	145-614-2021-0041.2
<b>Test manager:</b>	Prof. Dr. rer. nat. Wolfgang Schade
<b>Test officer:</b>	Tim Oestreich, M. Sc. ; Madeleine Stahl
<b>Test date:</b>	03.02.2021
<b>Test location:</b>	Battery test center Goslar Schützenallee
<b>Test:</b>	Attempt to test a fire extinguishing agent to extinguish a fire occurring in a lithium-ion battery system
<b>Prüfling:</b>	Battery system with a total capacity of 1.8 kWh consisting of a module with cells of type 18650

### Test description

In the test carried out, the suitability of the fire extinguishing agent **TRIDENT** for fighting fires and for suppressing the propagation of other cells in a lithium-ion battery module was examined. For this purpose, Fraunhofer HHI provided a battery module with a nominal total capacity of 1.8 kWh. The module consisted of 18650 cells in a 13P14S configuration (Figure 1).

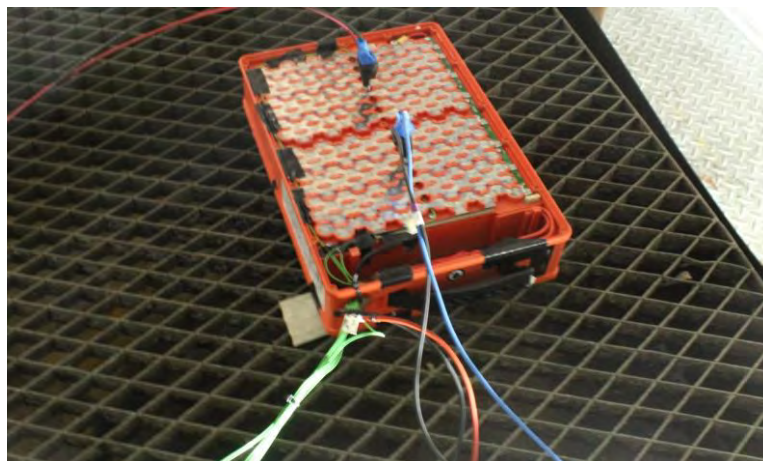
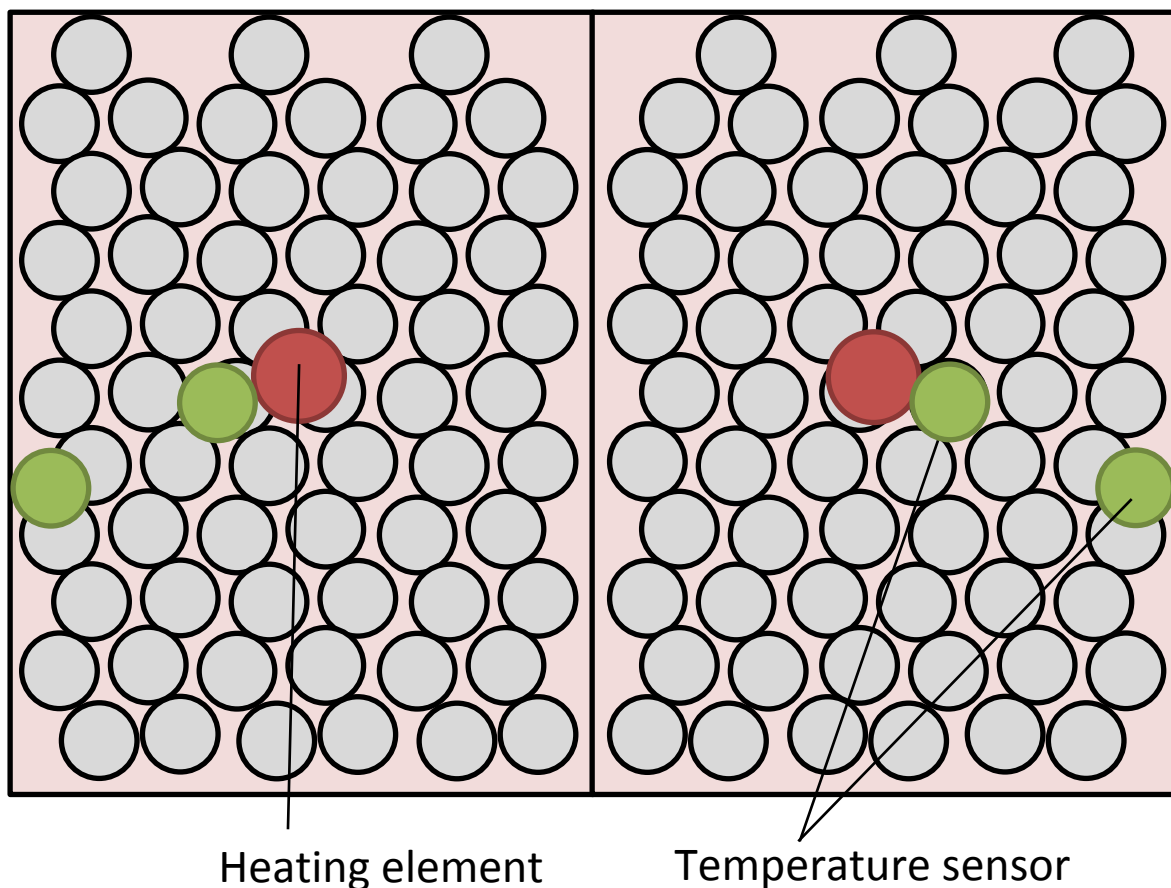


Figure 1: Battery system set up in the test chamber before the start of the test.

Graphite was used as the anode active material of the cells and the cathode active material consisted of lithium nickel manganese cobalt oxide. The nominal capacity of a cell is 2.64 Ah and the operating voltage is 3.7 V, resulting in a nominal capacity of 9.8 Wh per cell. The module consists of 182 individual cells. The state of charge of the battery was 100% before the start of the test.

For emergency initiation, the module's top cover was removed and it was equipped with two heating elements. One heating element each was positioned centrally in the sub-module of the lithium-ion module (Figure 2).



**Figure 2: Schematic arrangement of the temperature sensors (green) in the module and positioning of the two heating elements (red) to initiate the accident.**

In the experiment, a scenario should be simulated in which a fire breaks out in a lithium-ion battery in a room, which is extinguished from a distance of around one meter. The effectiveness and use of the **TRIDENT** extinguishing agent should be checked here. For this purpose, a frame was placed above the battery in the test chamber (Figure 3), which has two sprinkler systems. A sprinkler system was positioned above each heating element. The extinguishing agent for firefighting was located outside the test chamber. Eight temperature sensors and a thermal imaging camera were used to monitor the temperature. One sensor at a time was positioned near the heating element. Another sensor is placed on the outside to the left or right of the heating element (Figure 2). The sensors are labeled A through D from left to right. Four more sensors are attached to the same positions (E to H) on the underside of the battery module. The thermal imaging camera captures an image of the entire lithium-ion module (Figure 3). Furthermore, the experiment was filmed from three different camera positions.



Figure 3: Overall setup of the experiment consisting of the battery in the lower area of the figure and the frame with the two nozzles for firefighting (yellow). The temperature of the entire system is measured using an infrared camera (red).

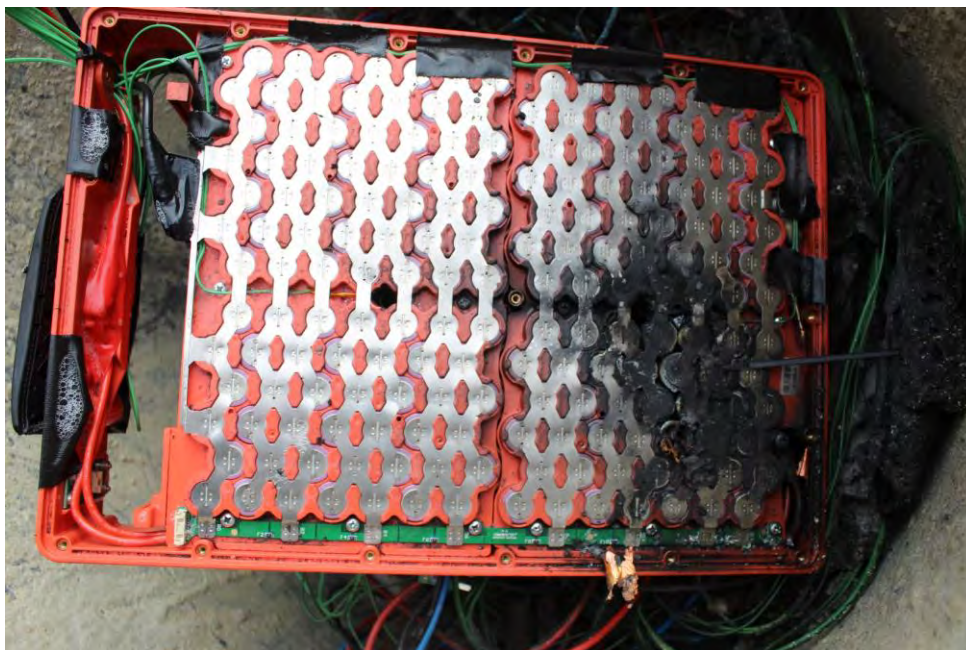
## Course of the experiment

### Attempt 1

At around 10:34 a.m. the heating elements were started and two minutes later smoke could be observed. Another two minutes later at 10:38 a.m., the first thermal runaway of cells occurred in the right half of the battery module. It is very likely that the cells in the immediate vicinity of the heating cartridges went through first. At intervals of ten to 30 seconds, the thermal runaway propagated to other cells. A first 5-second extinguishing attempt was made one minute after the first cell explosion (Table 1). The outside temperature was then 20 °C, but quickly rose again to over 100 °C. Two further quenchings, each lasting 5 seconds, also initially lead to cooling, followed by renewed heating due to the exothermic decomposition of the active material of the lithium-ion cell. 150 seconds after the third fire extinguishing, there is another one 6. Average followed by a 12-second extinguishment of the fire. As can be seen in the video recordings, there is no renewed open fire in the cell. However, there is still a slight smoke development for another 5 minutes.

**Table 1:** Time information on the course of the first attempt. The times of the primary thermal runaway, the propagation of further cells and the extinguishing of the fire with an indication of the extinguishing duration are given.

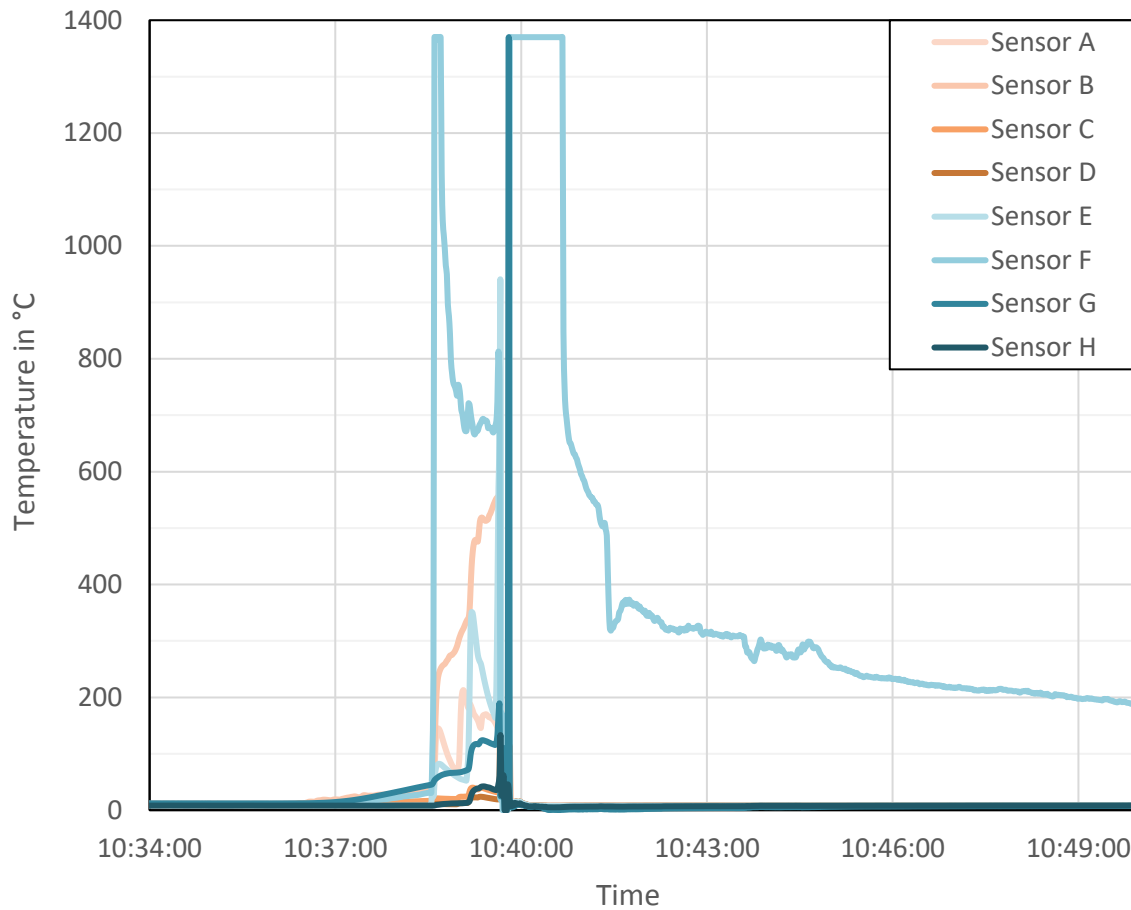
Incident	Time	Duration
Beginning of the experiment	10:33:45	
Smoke development	10:36:00	
1. General average	10:38:35	
2. General average	10:39:00	
3. General average	10:39:10	
4. General average	10:39:21	
5. General average	10:39:41	
1. Deletion	10:39:43	5 seconds
2. Deletion	10:40:17	5 seconds
3. Deletion	10:41:24	5 seconds
6. General average	10:44:00	
4. Deletion	10:44:05	12 seconds



**Figure 4:** Lithium-ion module after the fire test has been carried out. The cell fire only took place on one side of the module. The majority of the cells remained externally intact and did not propagate.

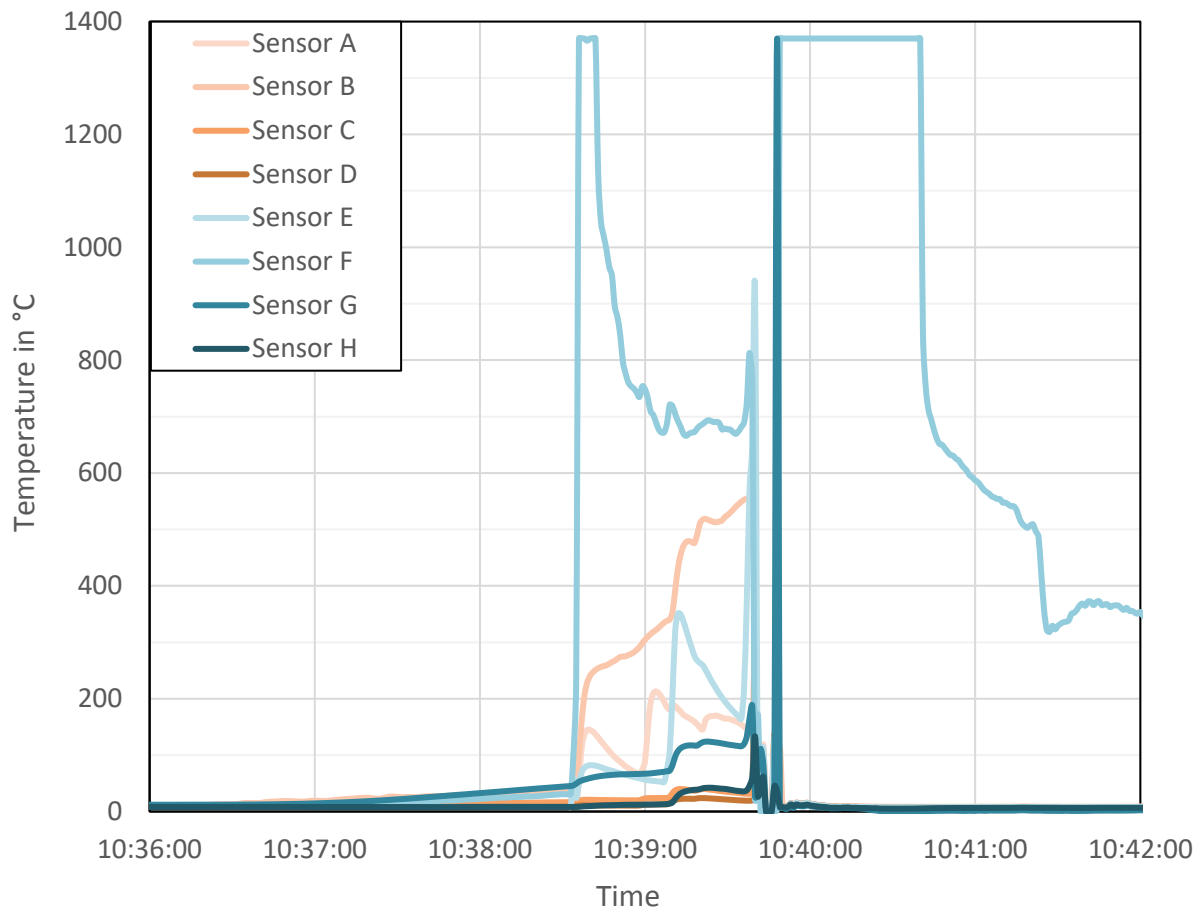
In this test, the cell fire was mainly limited to the right part of the module (Figure 4). The measured temperatures correspond well with the events that can be seen in the video image. As a result of the breakdown of several cells, the highest became

temperatures reached. The temperatures of the sensors measure local peaks of over 1000 °C (Figure 5 & Figure 6). The initially temporary cooling of the module can be seen with the help of the thermal imaging camera. After the last extinguishing attempt (4th extinguishing) there was no heating in a critical temperature range, as can be seen in the video of the thermal imaging camera.



**Figure 5: Temperature profile during the entire test period of the second test.**





**Figure 6:** Detailed view of the temperature curve at the time of the primary heating, the thermal runaway of the cells and the quenching attempts of the module.

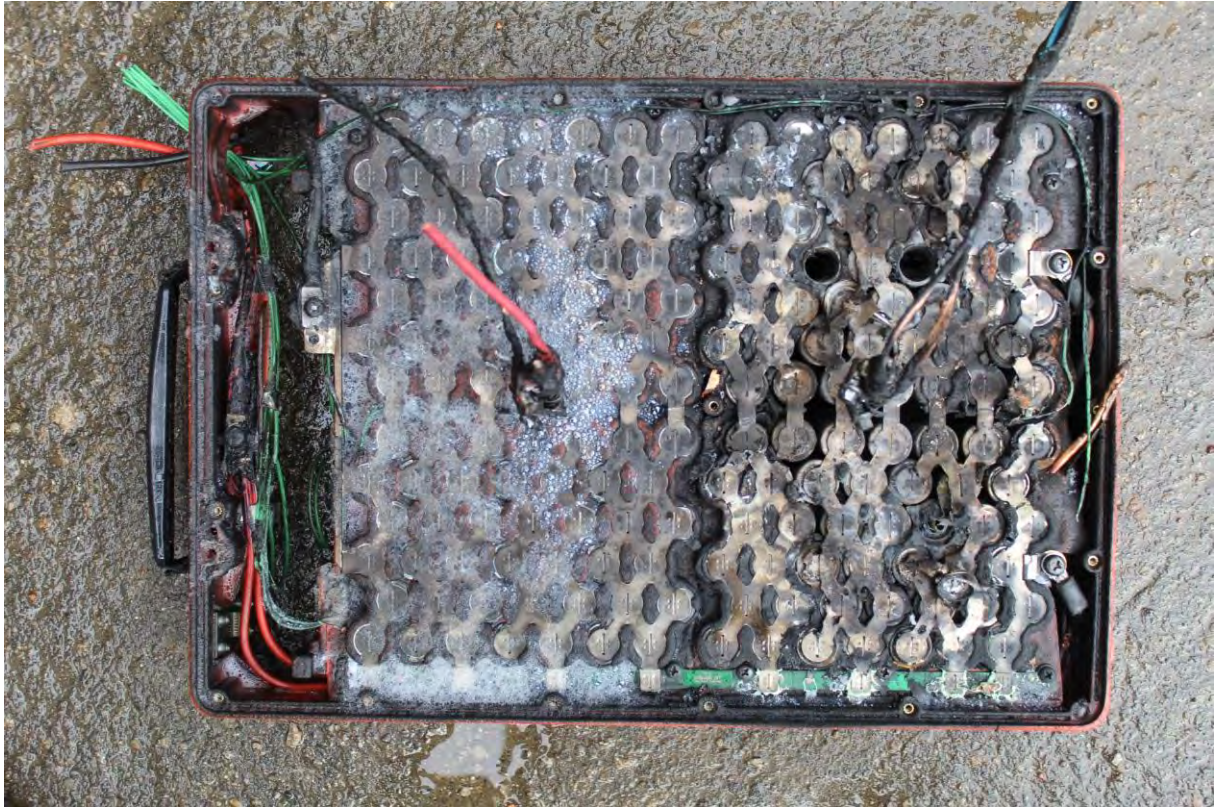
### Attempt 2

At around 12:35, the heating elements were started and smoke could be observed a minute later. A further minute later, at 12:36 p.m., a first thermal runaway of cells occurred (Table 2). Propagation of further cells and an open fire at several cells followed directly. 12 seconds after the start of the fire, there was a 6-second extinguishing immediately followed by another 7-second extinguishing with the **TRIDENT** extinguishing agent. The cell fire had not yet been extinguished at this point and it flared up again. After a third and fourth use of the extinguishing agent, heavy smoke continued to develop inside the module. 40 seconds after the fourth attempt to extinguish the fire, another open cell fire broke out. Another 12-second use of the extinguishing agent extinguished this open fire. As can be seen in the video material, there was no further open fire after the fifth use of the fire extinguishing agent the measured temperature has continuously decreased. A sixth use of the Trident extinguishing agent 15 minutes after the last accident in a cell further accelerated the cooling of the module.

**Table 2: Temporal information on the course of the second attempt. The times of the primary thermal runaway, the propagation into other cells and the extinguishing of the fire with an indication of the extinguishing duration are given.**

<b>Occurrence</b>	<b>Time</b>	<b>Duration</b>
<b>Versuchsbeginn</b>	12:35:00	
<b>Smoke development</b>	12:35:53	
<b>1. General average</b>	12:36:46	
<b>1. Deletion</b>	12:36:58	6 seconds
<b>2. Deletion</b>	12:37:05	7 seconds
<b>2. General average</b>	12:37:17	
<b>3. Deletion</b>	12:37:19	6 seconds
<b>4. Deletion</b>	12:37:55	8 seconds
<b>3. General average</b>	12:38:45	
<b>5. Deletion</b>	12:38:49	12 seconds
<b>6. Deletion</b>	12:53:16	6 seconds

In this test, the cell fire was more pronounced on the right side of the module. However, in contrast to the first attempt, the entire module was affected by the fire (Figure 7). The measured temperatures correspond well with the events that can be seen in the video image. As a result of the accident of several cells, the highest temperatures were reached. The temperatures of the sensors measure local peaks of up to 1000 °C (Figure 8 & Figure 9). The initially temporary cooling in the module can be seen with the help of the thermal imaging camera. After the penultimate extinguishing attempt (5th extinguishing) there was no heating in a critical temperature range, as can be seen from the video of the thermal imaging camera.



**Figure 7: Lithium-ion module after the fire test has been carried out. The fire spread across the entire module. In the right half, however, there was a more pronounced thermal runaway and strong propagation into the adjacent cells.**

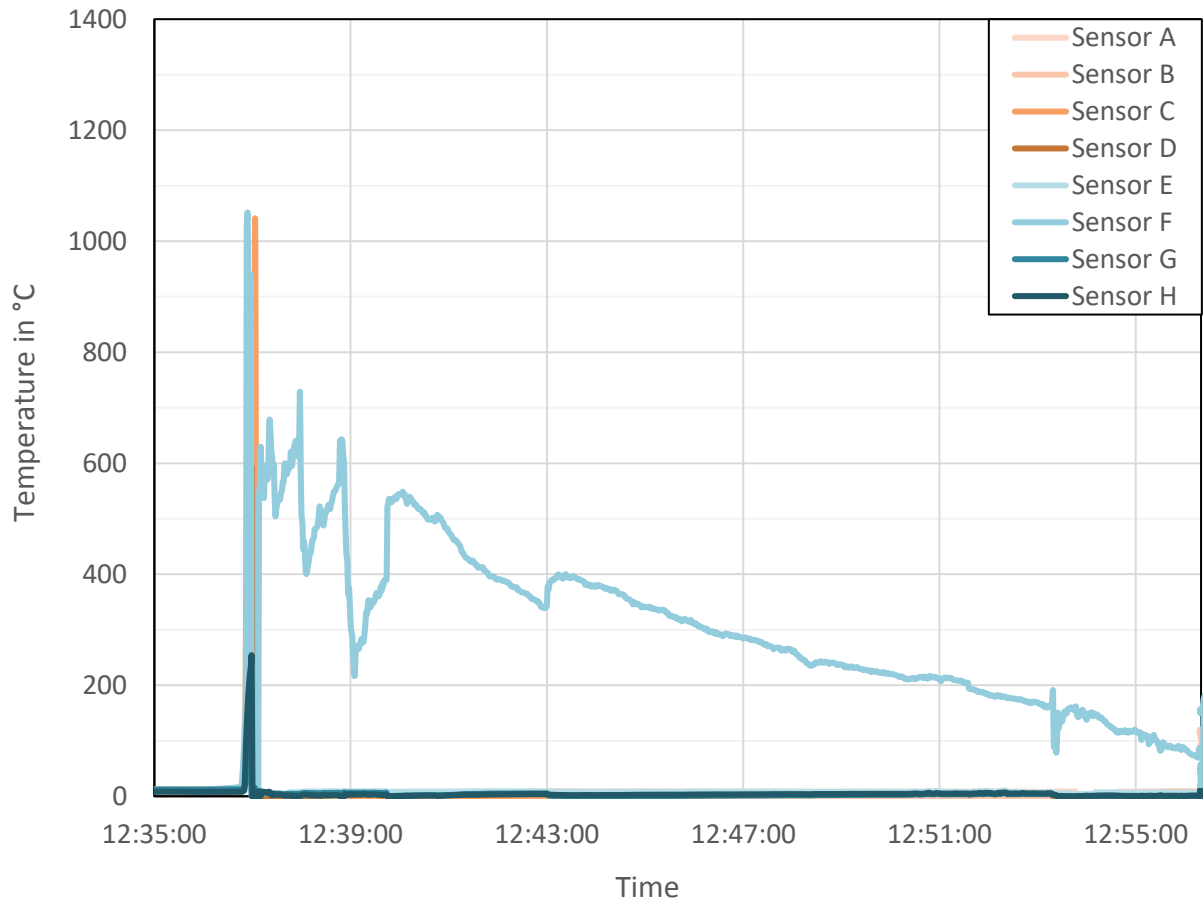
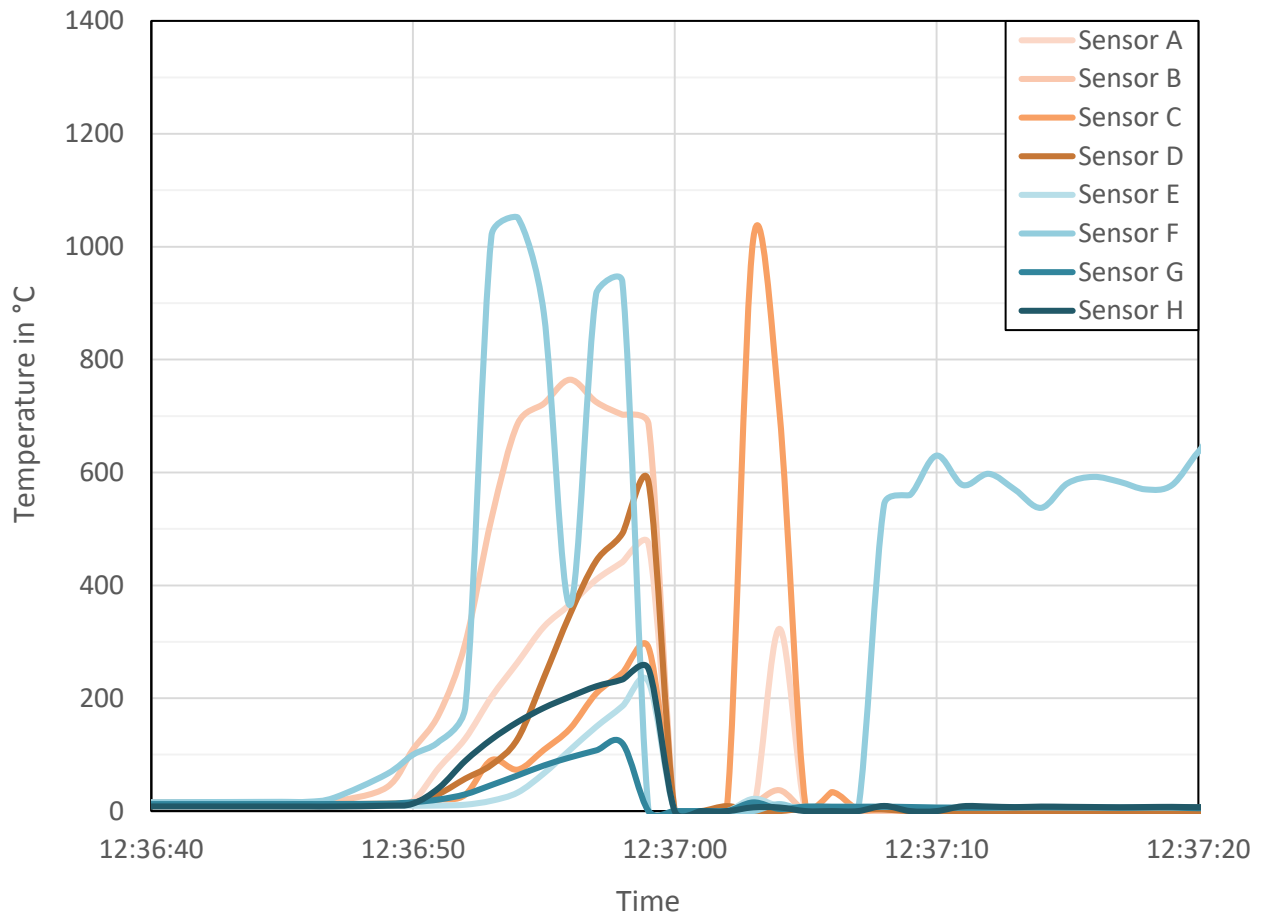


Figure 8: Temperature profile during the entire test period of the second test.



**Figure 9: Detailed view of the temperature curve at the time of the primary heating, the thermal runaway of the cells and the quenching attempts of the module.**

TRIDENT Product data sheet

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# TRIDENT

### **Product name**

TRIDENT

### **Manufacturer**

CWFIRE-SUPPORT GmbH  
Sprudelallee 14  
63628 Bad Soden Salmünster

### **Product description**

Aqueous product made from surfactants and a dibasic alcohol.  
Additional concentrate for water for extinguishing purposes of fire classes A, B and pyrotechnics with the P 3,5.

### **Characteristics**

TRIDENT is an aqueous solution based on surfactants, glycerine and biocide.

### **Composition on the concentrate (in weight):**

- Water content: > 80%
- Surfactants: see safety data sheet

### **Product characteristics**

TRIDENT is an extinguishing agent additive with the following advantages:

- Very high cooling effect
- Reduction of surface tension
- stable foam carpet
- Reaction with free radicals

### **Application**

Fire class A: Proportioning rate 0,2% to 1%

Fire class B: Proportioning rate 3%

TRIDENT is particularly suitable, for example, for wood, rubber tires, paper, hay, straw, carbon, fiberglass and non-polar solvents.

### **Compatibility with other extinguishing agents**

TRIDENT must **not** be mixed with other products.

### **Compatibility with extinguishing foams**

TRIDENT is also compatible with other pre-expanded extinguishing foams.

### **Powder compatibility**

TRIDENT is suitable for combined use with foam-compatible powder.

### **Storage**

TRIDENT can be stored in closed original containers for 10 years.

Storage temperature -10° to 50° C

High temperatures up to 50 ° C affect the effectiveness as little as temporary freezing.

### **Admission**

The fire extinguishing agent TRIDENT is approved for use in fire classes A and B burning water.

KB 201/17

### **TRIDENT Product specifications**

**Water hazard class:** 1

**PH value:** 7,3

**biodegradability:** Lightweight and fast biodegradable.

The biodegradability according to OECD 301 F results in a degradation rate of about 95.6% after 28 days.

**Surface tension mN/m:** ca.20

**Density:** 1,01 – 1,05 (bei 20 °C)

**Solubility in water at 20°C:** Completely

**Frost point:** -10°C

**Frost damage:** No

**Lowest operating temperature:** -5°C

**Colour:** Berin stone

**Smell:** neutral

### **Delivery container**

- 20 liter
- 1000 liter

**Special instructions:** If TRIDENT is used as intended, no health impairments are to be expected.

Extinguishing exercises must be coordinated with the local authorities. When spraying people with heavy or medium foam, it should be noted that there is no possibility of breathing in the foam.

Further information on health hazards an environmental compatibility can be found on our safety data sheet.



**TRIDENT**

**VIDEO Links**



**Pool Fire test with TRIDENT**

<https://www.youtube.com/watch?v=Dt2kfM306Sc>

**Car Fire with TRIDENT**

<https://www.youtube.com/watch?v=ueTtn8YnzkA>

**Wood Fire with TRIDENT**

[https://www.youtube.com/watch?v=lh\\_iN\\_rPoJE&t=173s](https://www.youtube.com/watch?v=lh_iN_rPoJE&t=173s)

**Tire Fire test with TRIDENT**

<https://www.youtube.com/watch?v=uRLiNFr5UIw>

**Preview Presentation Romania 2019**

[https://www.youtube.com/watch?v=yV\\_ak\\_v0zsg&t=9s](https://www.youtube.com/watch?v=yV_ak_v0zsg&t=9s)

**Extinguish magnesium fire with TRIDENT**

<https://www.youtube.com/watch?v=aGzljPVb62M>

**Extinguish pyrotechnics with TRIDENT**

<https://www.youtube.com/watch?v=Yq8387SEdF0&t=49s>