Custom Woolen Mills ltd.
R.R. 1, Carstairs, Alberta, Canada. T0M 0N0.
Phone/Fax: (403) 337-2221
www.customwoolenmills.com

Oct 25, 2016

To Whom It May Concern,

Our wool insulation is processed according to the following procedure advised to us by the International Wool Bureau: first, the raw wool is scoured at 145°F (62°C) in a water bath containing BIO-SOFT EC-639 (Stepan Company, Longford Mills ON, Canada) and then rinsed in a bath of just water at 145°F. Second, the scoured wool is soaked for 1 hr in a cold water bath containing Borax (LA1995, Univar Canada, Richmond BC, Canada) and Boric Acid (LA0378, Univar Canada). Third, the treated wool is dried and carded into woolen batts and roping. To the best of our knowledge, this process renders the wool insulation non-hazardous, non-infectious and non-toxic.

Should additional information be required, please contact Custom Woolen Mills via phone, (403) 337-2221, or e-mail, info@customwoolenmills.com.

Sincerely,

Maddy Purves-Smith

Custom Woolen Mill ltd.

SAFETY DATA SHEET

1. Identification

Product identifier **BIO-SOFT EC-639**

Other means of identification

Product code 6584

Recommended use Surfactant

Recommended restrictions For industrial use only.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name Stepan Company

Address 22 West Frontage Road
Northfield, IL 60093
USA

Telephone General 1-847-446-7500

E-mail Not available.

Emergency phone number Medical 1-800-228-5635
Chemtrec 1-800-424-9300
Chemtrec Int'l +1 703-527-3887

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards Skin corrosion/irritation Category 2

Serious eye damage/eye irritation Category 1

Environmental hazards Hazardous to the aquatic environment, acute hazard Category 2

Hazardous to the aquatic environment, long-term hazard Category 3

OSHA defined hazards Not classified.

Label elements

Signal word Danger

Hazard statement Causes skin irritation. Causes serious eye damage. Toxic to aquatic life. Harmful to aquatic life with long lasting effects.

Precautionary statement

Prevention Wear eye/face protection. Wash thoroughly after handling. Avoid release to the environment. Wear protective gloves.

Response If on skin: Wash with plenty of water. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Specific treatment (see this label). If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

Storage Store away from incompatible materials.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information Not applicable.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Alcohols, C10-16, ethoxylated		68002-97-1	80 - < 90
Water		7732-18-5	5 - < 10
Other components below reportable levels			< 0.1

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.

Ingestion Rinse mouth. Get medical attention if symptoms occur. Do not induce vomiting without advice from poison control center.

Most important symptoms/effects, acute and delayed Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Skin irritation. May cause redness and pain.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions Move containers from fire area if you can do so without risk.

Specific methods Use standard firefighting procedures and consider the hazards of other involved materials.

General fire hazards No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Prevent product from entering drains. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.

Environmental precautions Avoid release to the environment. Contact local authorities in case of spillage to drain/aquatic environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling Do not get this material in contact with eyes. Avoid contact with skin. Avoid prolonged exposure. Avoid contact with clothing. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices. Avoid release to the environment. Do not empty into drains.

Conditions for safe storage, including any incompatibilities Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles) and a face shield.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Wear appropriate chemical resistant clothing. Wear protective gloves.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state	Liquid.
Form	Liquid.
Color	Not available.
Odor	Not available.
Odor threshold	Not available.
pH	5.5 - 7.5 (5% in 1:1 IPA:H2O)
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	> 201.0 °F (> 93.9 °C)
Evaporation rate	Estimated slower than ethyl ether
Flammability (solid, gas)	Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not determined or unknown
Vapor density	Estimated heavier than air
Relative density	Not available.

Solubility(ies)

Solubility (water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	100 cP @ 25C

Other information

Density	8.50 lb/gal @ 25C
Percent volatile	9 - 11 %

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Upon decomposition, this product emits carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	Causes skin irritation.
Eye contact	Causes serious eye damage.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Not available.

Information on toxicological effects

Acute toxicity

Product	Species	Test Results
BIO-SOFT EC-639		
Acute		
Dermal		
LD50	Rabbit	> 2 g/kg
Oral		
LD50	Rat	2 - 3.34 g/kg

Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization	Not available.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not applicable.
Specific target organ toxicity - repeated exposure	Not applicable.
Aspiration hazard	Not applicable.

12. Ecological information

Ecotoxicity	Toxic to aquatic life. Harmful to aquatic life with long lasting effects.

Product		Species	Test Results
BIO-SOFT EC-639			
Aquatic			
Acute			
Algae	EC50	Algae	1 - 10 mg/l, 72 hours
Crustacea	EC50	Daphnia	1 - 10 mg/l, 48 Hours
Fish	LC50	Fish	1 - 10 mg/l, 96 hours

Persistence and degradability Readily biodegradable.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not available.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)	Hazardous substance
Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. Massachusetts RTK - Substance List

Not regulated.

US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

WARNING: This product may contain a chemical known to the State of California to cause cancer and birth defects or other reproductive harm: ethylene oxide (75-21-8).

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm: ethylene glycol (107-21-1).

WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Acetaldehyde (CAS 75-07-0) Listed: April 1, 1988

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory (NZIoC)	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	09-15-2014
Revision date	10-24-2016
Version #	03

Disclaimer

Terms and Conditions. This SDS is designed only as guidance for the products to which it applies. To the greatest extent permitted by applicable law, nothing contained herein creates any legal obligation including contractual obligations, expressed or implied warranties, including any warranties of merchantibility or fitness for particular purpose; or confers any intellectual property rights, including rights to use trademarks or a license to use patents, issued or pending. The information contained herein is based on the manufacturer's own study and the work of others, and is subject to change at any time without further notice. There is no warranty, expressed or implied, as to the accuracy, completeness or adequacy of the information contained herein, and neither the provider nor the manufacturer (nor the agents, directors, officers, contractors or employees of either) are liable to any party for any damages of any nature, including direct, special or consequential damages arising out of or in connection with the accuracy, completeness, adequacy or furnishing of any information in this SDS, or in any other way related (directly or indirectly) to this SDS. The receipt and use of this information constitutes consent to these terms and conditions.

Revision information

Hazard(s) identification: Prevention
Composition / Information on Ingredients: Ingredients
HazReg Data: International Inventories

20 MULE TEAM BORAX

Product Data Sheet

Borax Decahydrate

$Na_2B_4O_7 \cdot 10H_2O$
Sodium Tetraborate Decahydrate
Borax 10 Mol
Technical Grade: Granular and Powder
Technical Grade: 30/70 mesh and 40/200 mesh
European Pharmacopeia (EP): Granular and Powder
National Formulary (NF): Granular and Powder
Special Quality (SQ): Granular

CAS/TSCA Number 1303-96-4

Borax Decahydrate is the refined form of natural sodium borate. Composed of boric oxide (B_2O_3), sodium oxide, and water, it is a mild, alkaline salt, white and crystalline, with excellent buffering and fluxing properties. Available in powder or granular form, Borax Decahydrate is an important multifunctional source of B_2O_3, particularly for processes in which the simultaneous presence of sodium is beneficial.

Applications and benefits

Soap and detergents
Borax Decahydrate is incorporated in many cleaning products as a pH buffering agent, to aid in the emulsification of oils, and as a gentle abrasive. Borax Decahydrate is added to powdered hand soaps to remove medium to heavy soils encountered in industrial operations. It is gentle to the skin, yet highly effective in removing dirt. Borax Decahydrate is added to formulations to clean hard surfaces such as metals, glass and ceramics. It is also used as an additive in hand cleaners, polishes and waxes, and industrial/institutional cleaning compounds. In laundry detergents it facilitates the removal of oily soils from fabrics, and imparts alkalinity, pH buffering and softening of the wash water. It is also used to stabilize enzymes.

Personal care products
Borax Decahydrate is used in cosmetics, toiletries and pharmaceuticals. In contact lens solutions, it is used in conjunction with boric acid as a gentle cleaner and buffering agent. Borax is also used as a crosslinking agent to emulsify waxes and other paraffins used as a base for lotions, creams and ointments.

Metallurgical fluxes
The ability of Borax Decahydrate to dissolve metal oxides is exploited in the recovery of metals such as brass, copper, lead and zinc from scrap or smelting slag.

In ferrous metallurgy, Borax Decahydrate is used as a cover flux to prevent oxidation at the surface of the molten ingot. In welding, brazing, and soldering, Borax Decahydrate covers the metal surfaces, excluding air and preventing oxidation. It also acts as a solvent and cleaning agent.

Corrosion inhibition
Borax Decahydrate is incorporated in many aqueous systems requiring corrosion inhibition. It protects ferrous metals against oxidation and finds use in the manufacture of automotive and engine coolant formulations, and various water treatment chemicals.

The high solubility of Borax Decahydrate in ethylene glycol makes it especially useful in car antifreeze formulations. Borax Decahydrate neutralizes the acidic residue resulting from the decomposition of ethylene glycol and minimizes the rate of oxidation at the surface of the metal. Aqueous solutions of Borax Decahydrate have replaced chromates in railroad and other diesel engine coolants.

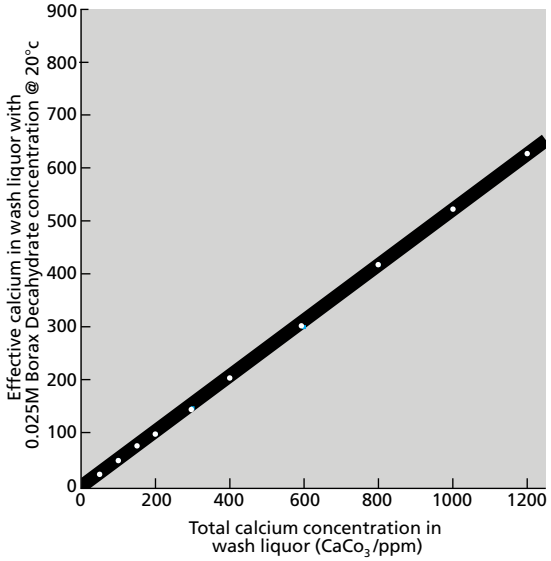
Adhesives
Borax Decahydrate is part of the starch adhesive formulation for corrugated paper and paperboard, and is a peptizing agent in the manufacture of casein-based and dextrin-based adhesives. It greatly improves the tack and green strength of the adhesive by crosslinking conjugated hydroxyl groups.

Wire drawing
Borax Decahydrate neutralizes the residual acid from the pickling stage, and the deposit of the salt remaining on the wire is valuable as a carrier of dry powdered lubricant.

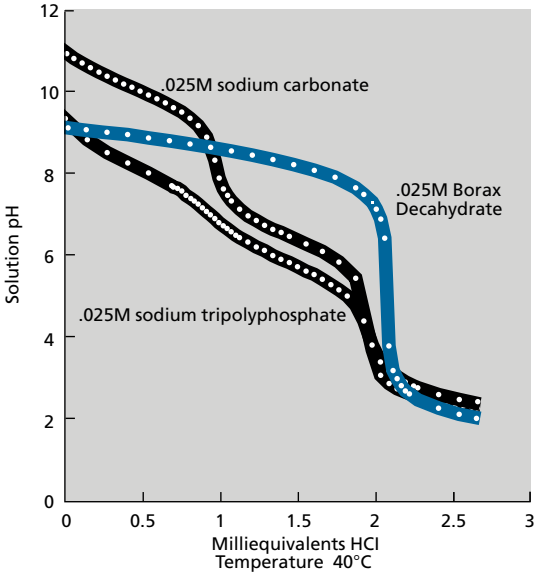
Refractories
Borate Decahydrate compounds are used as stabilizers and bonding agents in specialty abrasives. Borax Decahydrate gives an intermediate-temperature glassy bond prior to the establishment of the ceramic bond, at which point the borate compound is frequently volatilized from the system.

Some other applications
Borax Decahydrate is used as a flame retardant for cellulosic materials, a buffer and catalyst for organic dyes, a carrier for herbicides, a coolant for diesel engines, and a degreasing buffer in enamelling processes.

Water softening (calcium ion sequestration) by Borax Decahydrate in detergents



Borax Decahydrate maintains desired alkalinity in wash liquor by acting as pH buffer



Chemical and physical properties

Stability

Borax Decahydrate is chemically stable under normal storage conditions. It will slowly lose water of crystallisation if exposed to a warm, dry atmosphere. Conversely, exposure to a humid atmosphere can cause recrystallisation at particle contact points, resulting in caking. When storing the product, care should therefore be taken to avoid wide fluctuations in temperature and humidity, and to ensure that the packaging is not damaged.

Buffering action

Dissolved in water, Borax Decahydrate hydrolyzes to give a mildly alkaline solution. It is thus capable of neutralizing acids. It also combines with strong alkalis to form compounds of lower pH. The relatively constant pH of Borax Decahydrate solutions makes it an excellent buffering agent.

Characteristics

Molecular Weight	381.37
Specific Gravity	1.71
Melting Point	62°C (144°F) (enclosed space)
Heat of solution (absorbed) 1% @ 32°C (90°F)	4.94×10^5 J/kg (467 BTU/lb)

Solubility in water

Temperature °C (°F)		Borax Decahydrate % by weight in saturated solution
0	(32)	1.99
5	(41)	2.46
10	(50)	3.09
15	(59)	3.79
20	(68)	4.71
25	(77)	5.80
30	(86)	7.20
35	(95)	9.02
40	(104)	11.22
45	(113)	14.22
50	(122)	17.91
55	(131)	23.22
60	(140)	30.33
65	(149)	33.89
70	(158)	36.94
75	(167)	40.18
80	(176)	44.31
85	(185)	48.52
90	(194)	53.18
95	(203)	58.95
100	(212)	65.64

Solubility in some solvents

Organic solvent	Temp °C (°F)		Borax Decahydrate % by weight in saturated solution
Glycerol 98.5%	20	(68)	52.60
Glycerol 86.5%	20	(68)	47.10
Ethylene glycol	25	(77)	41.60
Diethylene glycol	25	(77)	18.60
Methanol	25	(77)	19.90
Aqueous ethyl alcohol	15.5	(60)	2.48
Acetone	25	(77)	0.60
Ethyl acetate	25	(77)	0.14

Comparative pH of some common alkalis @ 20°C (68°F)

Weight%	0.1	0.5	1.0	2.0	5.0
Caustic soda	11.90	12.70	13.10	13.30	13.80
Sodium metasilicate	11.30	12.10	12.30	12.70	13.10
Trisodium phosphate	11.50	11.55	11.60	11.70	11.80
Soda ash	10.70	11.30	11.40	11.50	11.60
Sodium metaborate	10.52	10.84	11.00	11.18	11.44
Borax Decahydrate	9.26	9.23	9.24	9.24	(9.32)*

*pH of Borax Decahydrate saturated solution (4.71%)

Product Data Sheet

Optibor® Boric Acids

H_3BO_3
Orthoboric Acid
Boric Acid
Technical Grade: Granular and Powder
National Formulary (NF): Granular and Powder
Special Quality (SQ): Granular

CAS/TSCA Number 10043-35-3

Optibor® Boric Acids are a pure, multifunctional source of boric oxide (B_2O_3). Apart from borax pentahydrate, they are the most widely used industrial borate.

Optibor Boric Acids (H_3BO_3) are theoretically composed of boric oxide and water. Crystalline in composition, white in appearance, they can be used as granules or as a powder. Both forms are stable under normal conditions, free-flowing, and easily handled by means of air or mechanical conveying. In solution, they are mildly acidic.

Glass type	Thermal Expansion	Melting Temperature	Melting Rate	Glass Viscosity	Surface Tension	Chemical Resistance
Textile Fiber Glass (E Glass)		X	X	X	X	
Borosilicate Glass	X	X	X	X		X
Glazes and Enamels	X	X	X	X	X	X

Applications and benefits

Glass and glass fiber
B_2O_3 is both a flux and a network former; it assists the melt and influences the final product properties. In fiber glass, for example, it reduces melting temperatures and helps the fiberizing process. Generally, B_2O_3 lowers viscosity, controls thermal expansion, inhibits devitrification, increases durability and chemical resistance, and reduces susceptibility to mechanical or thermal shock.

Optibor Boric Acids may be used in combination with a sodium borate (borax pentahydrate or anhydrous borax) in order to adjust the sodium to boron ratio in glasses which require low sodium levels. This is important in borosilicate glass where B_2O_3 provides essential fluxing properties at low sodium and high alumina levels.

Frits, glazes, and enamels
For the glassy surfaces of ceramics and enamels boric oxide acts as both network former and flux. It initiates glass formation (at low temperatures), ensures 'thermal fit' between glaze and body, reduces viscosity and surface tension, increases refractive index, enhances strength, durability and scratch resistance, and facilitates lead-free formulations. High boron frits mature rapidly, improve the speed at which smooth, even glaze surfaces develop, and provide good bases for coloring oxides.

Optibor Boric Acids are used as the B_2O_3 source in the formulation of fast fire frits for tiles because of their requirement for low sodium levels.

Flame retardancy
Incorporated into cellulose materials, borates change the oxidation reactions and promote the formation of 'char', thereby inhibiting combustion. *Optibor* Boric Acids, alone or in combination with borax, are particularly effective in reducing the flammability of cellulose insulation, wood composites, and the cotton batting used in mattresses.

Metallurgy
Optibor Boric Acids prevent the oxidation of metal surfaces in welding, brazing, or soldering. They are also used as a source of boron for strengthening metal alloys and steel.

Corrosion inhibition
Optibor Boric Acids are incorporated in many aqueous and non-aqueous systems requiring corrosion inhibition, lubrication or thermal oxidative stabilization. *Optibor* Boric Acids find use in the manufacture of lubricants, brake fluids, metalworking fluids, water treatment chemicals, and fuel additives.

Adhesives
As part of the starch adhesive formulation for corrugated paper and paperboard, and as a peptizing agent in the manufacture of casein-based and dextrin-based adhesives, *Optibor* Boric Acids greatly improve the tack and green strength of the adhesive by crosslinking conjugated hydroxyl groups.

Personal care products
NF grade *Optibor* Boric Acid finds applications in cosmetics, toiletries and pharmaceuticals. It is used in conjunction with sodium borates for pH buffering, and as a crosslinking agent to emulsify waxes and other paraffins.

Nuclear energy
Being a highly effective absorber of thermal neutrons, the boron-10 isotope is essential to the safety and control systems of nuclear power stations. *Optibor* SQ Boric Acid is made for the nuclear industry, and can be isotopically enriched to increase the available proportion of boron-10.

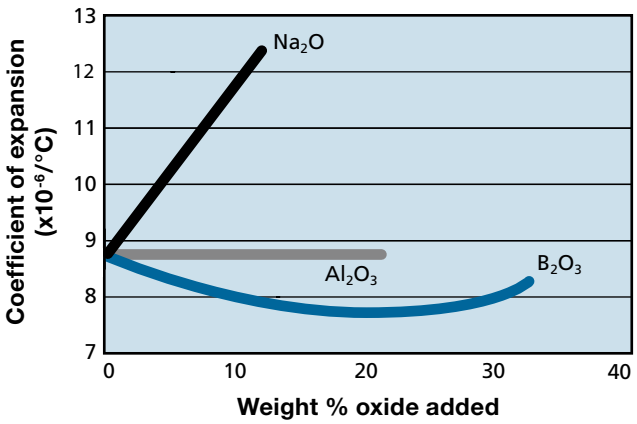
Chemical reactions
In the manufacturing of nylon intermediates, *Optibor* Boric Acids catalyzes the oxidation of hydrocarbons and increases the yield of alcohols by forming esters that prevent further oxidation of hydroxyl groups to ketones and carboxylic acids.

They are also used in preparing various important industrial products such as boron halides, borohydride, fluoborates, metallic borates, borate esters, and boron containing ceramics.

Some other applications

Dye stabilization	Electrolytic capacitors	Sand-casting (magnesium)
Electroplating	Leather processing and finishing	Textile finishing
		Paints

Effect of B_2O_3 on glass expansion



Reduction in linear coefficient of expansion in glass when silica is replaced proportionately by boric acid. This facilitates "thermal fit" in ceramic glazes ands heat resistance in borosilicate glass. *From Glass by Horst Scholze 1991*

Chemical and physical properties

When heated above 100°C (212°F) in the open, *Optibor* Boric Acids gradually lose water first changing to metaboric acid, HBO_2, of which three monotropic forms exist. These have melting points respectively of 176°C (348.8°F), 201°C (393.8°F), and 236°C (456.8°F). Dehydration stops at the composition HBO_2 unless the time of heating is extended or the temperature raised above 150°C (302°F). On continued heating and at higher temperatures all water is removed leaving the anhydrous oxide, B_2O_3, the crystalline form of which melts at 450°C (842°F). The amorphous form has no definite melting point, softening at about 325°C (617°F) and becoming fully fluid at about 500°C (932°F).

Stability
Optibor Boric acids are a stable crystalline product that does not change chemically under normal storage conditions. Wide fluctuations in temperature and humidity can cause recrystallisation at particle contact points, resulting in caking. Care should therefore be taken to avoid such fluctuations during storage of the product. Also, it is, of course, essential to maintain the integrity of the packaging.

Characteristics

Molecular Weight	61.83
Specific Gravity	1.51
Melting Point	171°C (340°F)
Heat of solution (absorbed) @18°C	3.64×10^5 J/kg (110.5 BTU/lb)

Solubility in water

Temp °C (°F)		Boric acid % by weight in saturated solution
0	(32)	2.52
5	(42)	2.98
10	(50)	3.49
20	(68)	4.72
25	(77)	5.46
30	(86)	6.23
35	(95)	7.12
40	(104)	8.08
45	(113)	9.12
50	(122)	10.27
55	(131)	11.55
60	(140)	12.97
65	(149)	14.42
70	(158)	15.75
80	(176)	19.10
85	(185)	21.01
90	(194)	23.27
95	(203)	25.22
100	(212)	27.53
103.3	(217.9)*	29.27

*Boiling point of solution

Solubility in other solvents

Organic solvent	Temp °C (°F)	Boric acid % by weight in saturated solution
Glycerol (98.5%)	20 (68)	19.90
Glycerol (86.5%)	20 (68)	21.10
Ethylene glycol	25 (77)	13.60
Diethylene glycol	25 (77)	13.60
Ethyl acetate	25 (77)	1.50
Acetone	25 (77)	0.60
Glacial acetic acid	30 (86)	6.30
Methanol	25 (77)	22.66
Ethanol	25 (77)	11.96
1-Propanol	25 (77)	7.34
2-Methyl-1-propanol	25 (77)	5.32
3-Methyl-1-butanol	25 (77)	4.36

Hydrogen ion concentration

Aqueous solutions of *Optibor* Boric Acids are mildly acidic, the pH decreasing with increasing concentration.

$\%H_3BO_3$ by weight of solution	pH @ 20°C (68°F)
0.1	6.1
0.5	5.6
1.0	5.1
2.0	4.5
3.0	4.2
4.0	3.9
4.72 (saturated)	3.7