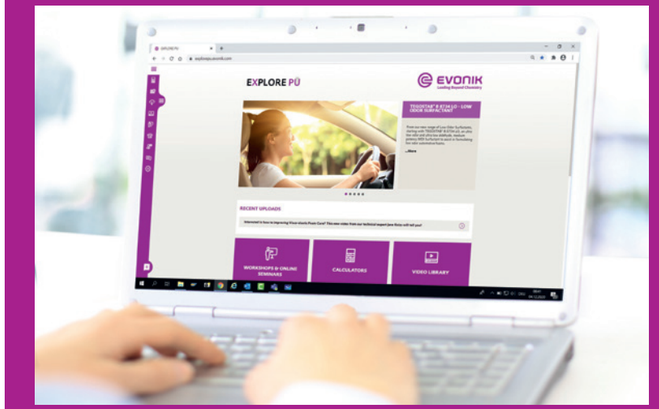
POLYURETHANE ADDITIVES FOR FLEXIBLE POLYETHER AND POLYESTER FOAM

SILICONE SURFACTANTS
CATALYSTS
PERFORMANCE ADDITIVES

AMERICAS

EVONIK
Leading Beyond Chemistry



EXPLORE PU – FAST ONLINE SERVICES AND SUPPORT WHENEVER YOU NEED IT!

EXPLORE PU takes our online service offering to the next level; a more personalized experience, with fast access to support from our polyurethane experts, wherever you are in the world.

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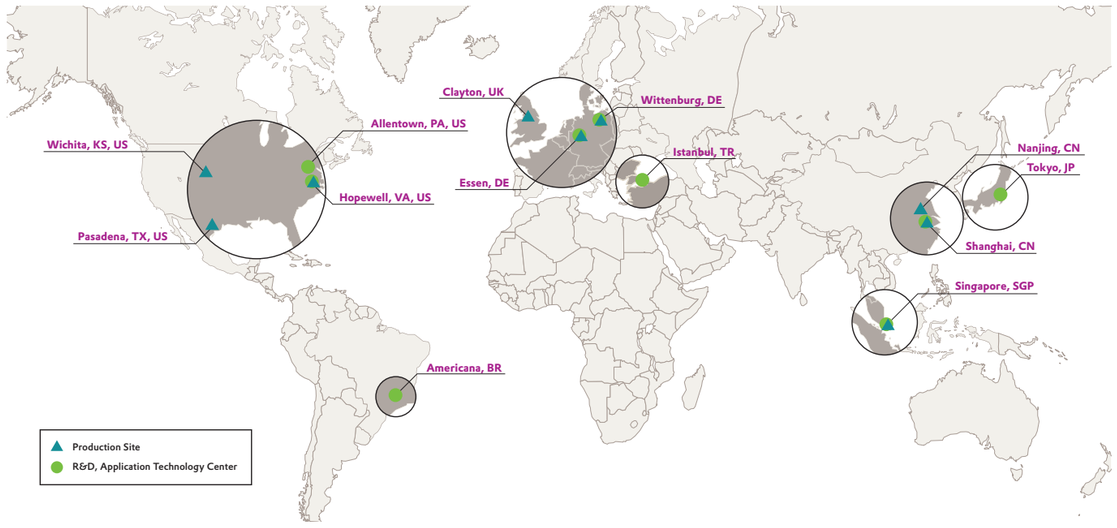
EVONIK – YOUR POLYURETHANE ADDITIVES PARTNER FOR ALL COMFORT FOAM APPLICATIONS

By working in close partnership with the comfort industry, we stay abreast of the latest trends and issues impacting the global market, helping us to meet changing market demands and provide optimized products with the lowest possible VOC emissions.

Over several decades, we have developed a large variety of different specialized products that generate ‘value’ for our customers, including emission optimized catalysts and low cyclic containing silicone surfactants.

WE ARE WHERE YOU ARE



SILICONE SURFACTANTS FOR CONVENTIONAL POLYETHER BLOCK FOAM

All our surfactants are VOC optimized; as a result, the cyclic siloxane (D4, D5 and D6) content is <0.1 wt % in total. For many grades (marked as "ultra-low cyclics"), we have further improved our processes and reduced the total D4, D5 and D6 content down to <0.03 wt %, helping formulators meet stringent IKEA IOS Mat 0010 V 15 emission targets, while producing high quality foam.

CONVENTIONAL SILICONE SURFACTANTS

Due to their tailored properties, conventional silicone surfactants are suitable for a broad range of different polyether foam grades. However, they are not recommended for FR (flame retardant) foam grades.

TEGOSTAB®	KEY FEATURES	STABILIZER POTENCY	DENSITY RANGE	NUCLEATION EFFICIENCY	PROCESSING LATITUDE	ULTRA-LOW CYCLICS[1]	CO_2 PROCESSING	SENSITIVE TO HYDROLYSIS
B 4900	Very broad processing latitude	•	M	••	•••		✓	✓
B 8002	Very broad processing latitude for high density foams with low stabilization requirements	◦	H	•	•••			✓
B 8040	Medium potency stabilizer with wide processing latitude	••	M	••	•••		✓	✓
B 8198	Broad processing latitude	•••	M-H	•••	••		✓	
BF 2370	Outstanding processing latitude to produce very open foam with fine cell structure. Can be used in an extensive variety of foams including Viscoelastic and Hypersoft foams.	••	L-H	•••	•••		✓	✓
BF 2470	Improved gas yield and excellent density distribution	••	L-M	••	••	✓		

L = Low
M = Medium
H = High

◦ = Low performance or narrow processing latitude
• = Medium performance or medium processing latitude
•• = High performance or wide processing latitude
••• = Very high performance or very wide processing latitude

[1] D4, D5 and D6 content < 0.03 wt % (in total)

UNIVERSAL SILICONE SURFACTANTS

Universal silicone surfactants combine high activity with medium FR properties. They are suitable to produce foams with FR requirements like TB 117-2013 and MVSS 302. Generally foam manufacturers also use these silicone surfactants for their conventional foam grades.

TEGOSTAB®	KEY FEATURES	STABILIZING POTENCY	DENSITY RANGE	NUCLEATION EFFICIENCY	PROCESSING LATITUDE	ULTRA-LOW CYCLICS (1)	CO_2 PROCESSING	SENSITIVE TO HYDROLYSIS
B 8158	Broad processing latitude and fine cell structure, specifically for more hydrophobic polyols including Natural Oil-based Polyols	••	L-M	•••	•••	✓	✓	
B 8227	Best combination of wide processing latitude, very fine cell structure, block height, gas yield and surface finish	••	M-H	••	•••	✓	✓	
B 8229	Broad processing latitude	•••	L-H	••	••	✓		
B 8244	Combination of high potency and good cell opening. Suitable for formulations with hydrophilic / EO-rich polyol	•••	L-M	••	•••	✓		
B 8252	Broad processing latitude and well suited for visco foams	••	M-H	••	••	✓		
B 8255	Strong nucleation support, fine cell structure and high potency for CO_2 foams	•••	L-M	•••	••	✓	✓	
B 8271 NEW	High activity surfactant for improved recovery after compression (compression set)	•••	L-M	••	••	✓	✓	
B 8275	Broad processing latitude and good nucleation for medium density foams and foam grades containing NOP	••	M	•••	••	✓	✓	

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••• = Very high performance or very wide processing latitude

✓ = suitable
N/A = not applicable
(1) D4, D5 and D6 content < 0.03 wt % (in total)

INTRODUCING ADDITIVES TO IMPROVE THE RECOVERY OF COMPRESSED FOAM

Particularly for 'mattress in a box', it is paramount that foam recovers well after being compressed. To assist, we have developed a number of additives that can help formulators meet all current performance tests.

TEGOSTAB® B 8271

Conventional ether foam

- Silicone surfactant designed to improve the rate and extent of recovery of original foam shape after compression
- Reduces height loss from compression set and wet compression set
- Provides superior recovery compared to other silicone surfactants, shown for a wide range of foam airflows and formulations
- Universal silicone surfactant, suitable for standard foam flammability tests

ORTEGOL® 70X SERIES

Conventional ether foam

- Additives developed to improve the recovery of flexible foam
- Can be added on top to existing formulations
- ORTEGOL® 700 and ORTEGOL® 702 recommended for bedding applications, with ORTEGOL 702 providing higher efficiency
- ORTEGOL® 701 is optimized to meet automotive emission requirements

FLAME RETARDANT SILICONE SURFACTANTS

Flame retardant silicone surfactants are particularly well-suited for the production of flame retardant foam grades since they enhance the efficiency of the flame retardants by their minimized contribution to the flammability of the foam. They are essential in Crib 5 formulations.

TEGOSTAB®	KEY FEATURES	STABILIZING POTENCY	DENSITY RANGE	NUCLEATION EFFICIENCY	PROCESSING LATITUDE	ULTRA-LOW CYCLICS (1)	CO_2 PROCESSING	SENSITIVE TO HYDROLYSIS	FR PERFORMANCE
B 8189	Very broad processing latitude	••	M-H	••	•••	✓	✓		•
B 8232	Medium potency combined with broad processing latitude for various FR formulations	•	M-H	••	•••	✓			••
B 8239	Excellent flammability test performance, fine and regular cell structure	•••	L-M	•••	••	✓	✓		•••

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••• = Very high performance or very wide processing latitude

✓ = suitable
(1) D4, D5 and D6 content < 0.03 wt % (in total)

SILICONE SURFACTANTS FOR HIGH RESILIENCE SLABSTOCK FOAM

Our surfactants for high resilience (HR) foams are specifically designed to cover all of a formulators needs for different cell regulating and stabilizing potencies. Additionally, all products listed below are phthalate free and provide very open foam.

TEGOSTAB®	ACTIVITY	PROCESSING LATITUDE	POLYMERPOLYOL	MDI	TDI	LOW VOC
B 8707 LF 2	••	••	SAN/PIPA	•••	•••	✓
B 8738 LF 2	••	••	SAN/PIPA	•••	•••	✓
B 8773 LF 2	••	•••	SAN/PHD/PIPA	••	•••	✓
B 8783 LF 2	•••	•••	SAN/PHD/PIPA	••	•••	✓
B 8790 LF 2	•••	••	SAN/PIPA	••	•••	✓

•• = High performance or wide processing latitude
••• = Very high performance or very wide processing latitude

✓ = suitable

INTRODUCING ORTEGOL® 720

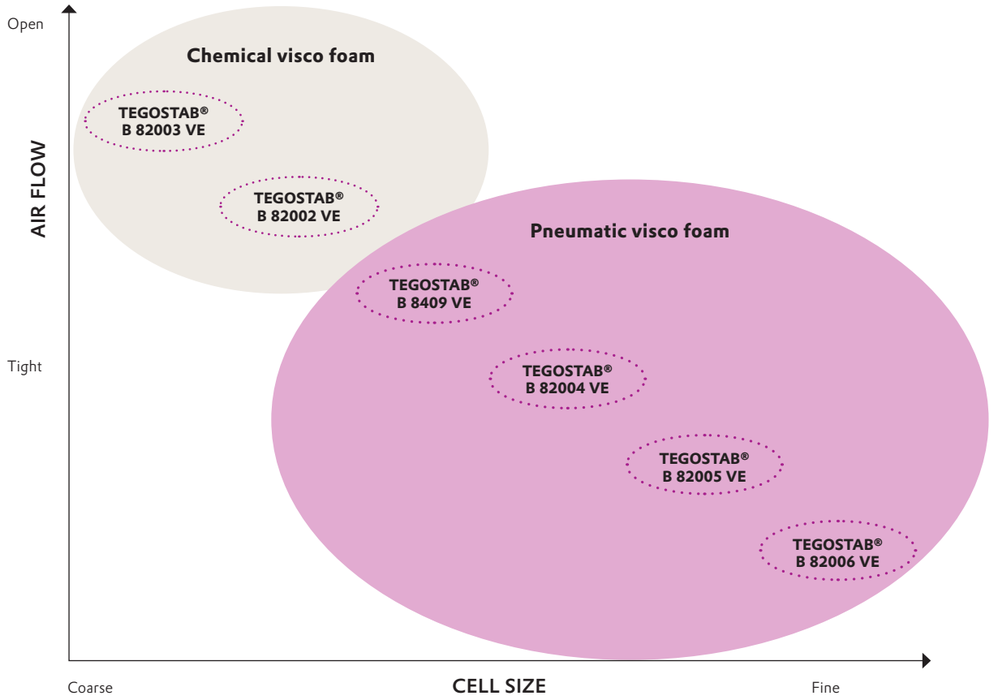
High resilient foam

- New crosslinker providing various benefits for the production of high resilient foam
- Improved dry and wet compression sets
- Improved foam resilience yielding similar hardness at lower levels of copolymer polyol
- Reduces cold flow, resulting in better block geometry and better distribution of physical properties in foam bun
- Improved EH&S profile compared to standard crosslinkers used in HR foam production
- Can be used in combination with ORTEGOL® 204

MDI VISCOELASTIC SURFACTANTS

The TEGOSTAB® B 8200X products are a range of silicone surfactants that are dedicated and qualified for use in MDI viscoelastic foam grades.

We have tailored the performance of these surfactants to suit the intended foam chemistry. TEGOSTAB® B 8409 VE is an ideal product in most MDI visco formulations, yielding a good balance between foam permeability and cell structure. TEGOSTAB® B 82003 VE is ideal for chemical viscoelastic foams as it provides open cell structures. TEGOSTAB® B 82006 VE is optimized to the production of pneumatic viscoelastic foams with very fine cell structure, while avoiding foam shrinkage. Additionally, all the surfactants in this range have an ultra-low cyclic siloxane content, enabling formulators to meet latest cyclic siloxane emission targets while producing high quality foam.



To learn more about our latest product portfolio for viscoelastic foams check out our latest online guide on Explore PU.

TDI VISCOELASTIC SURFACTANTS

Critical choice of surfactants for TDI based viscoelastic foam is necessary, as stabilization of the foam during rise and prevention of collapse is more difficult vs MDI based viscoelastic foam. Emulsification of raw materials, support of cell opening and control of cell size are also critical, in addition to stabilization. Different types of silicone surfactants for other foam types, predominantly standard ether, are preferred for various TDI viscoelastic foam formulations. To classify the silicone surfactants used for the different TDI viscoelastic foam formulations, the table below shows an overview of surfactants and additives.
Often, combinations of various foam surfactants are used to achieve the optimum performance of a viscoelastic foam formulation and enable property adjustments supporting specific market needs.

TDI 80

Chemical visco foam
Problem: cell opening required

Cell opening surfactants

or

Standard surfactants + cell opening processing additive

- TEGOSTAB ® B 8002, BF 2370
- TEGOSTAB® B 8244, B 8252
- ORTEGOL® VCO

TDI 65

Chemical visco foam
Benefit: smooth processing
Problem: unusual isocyanate

Conventional flexible foam surfactants

- TEGOSTAB® BF 2370
- TEGOSTAB® B 8244, B 8239, B 8198

CATALYSTS

Evonik is the undisputed global leader of polyurethane additives, offering the broadest range of catalysts to the flexible foam industry.

TRADITIONAL CATALYSTS

		DESCRIPTION
DABCO® 33 LV		Standard gel catalyst based on triethylenediamine in DPG
DABCO® BL 11		Standard blowing catalyst based on bis(2-dimethylaminoethyl)ether
DABCO® BLX 13		Blowing catalyst. Diluted version of DABCO® BL 11
DABCO® DMEA		Moderately active blowing catalyst with broad processing latitude
DABCO® BLV		Standard balanced catalyst
KOSMOS® T 9		Stannous octoate
KOSMOS® T 900	NEW	Alternative to stannous octoate, offering improved EH&S profile
KOSMOS® T 900 LV	NEW	Alternative to stannous octoate with comparable viscosity to KOSMOS® T 9
KOSMOS® 54		Co-catalyst for cold flow prevention in HR and viscoelastic foams

INTRODUCING KOSMOS® T 900 & T 900 LV

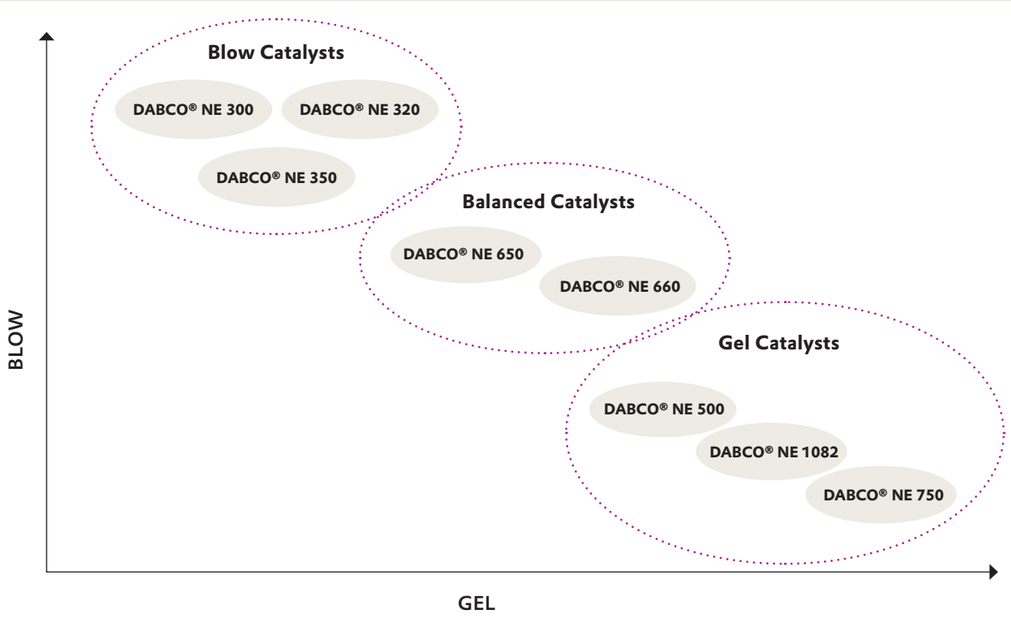
KOSMOS® T 900 is a tin catalyst for the manufacture of all types of polyurethane flexible foam.

- Strong gel catalyst
- Alternative to industry standard catalysts such as KOSMOS® T 9
- Improved EH&S profile
- Also available in a low viscosity version KOSMOS® T 900 LV

EMISSION OPTIMIZED CATALYSTS

Our latest Negligible Emissions (NE) grades offer reduced emissions compared to traditional amines, resulting in lower exposure to VOC's for both workers and consumers.

	DESCRIPTION
DABCO® NE 300	Low emission reactive blowing catalyst
DABCO® NE 320	Low emission, high purity, reactive blow catalyst
DABCO® NE 350	Low emission, reactive blow catalyst with improved pumping considerations
DABCO® NE 650	Low emission, reactive balanced catalyst that is biased towards the blow reaction
DABCO® NE 660	Low emission, reactive balanced catalyst that is biased towards the gel reaction
DABCO® NE 500	Low emission reactive gel catalyst
DABCO® NE 1082	Low emission reactive catalyst with improved gel selectivity
DABCO® NE 750 NEW	Low emission reactive gel catalyst with outstanding gel selectivity Recommended for viscoelastic and hyper soft foams
KOSMOS® EF	Emission optimized stannous catalyst



PERFORMANCE ADDITIVES

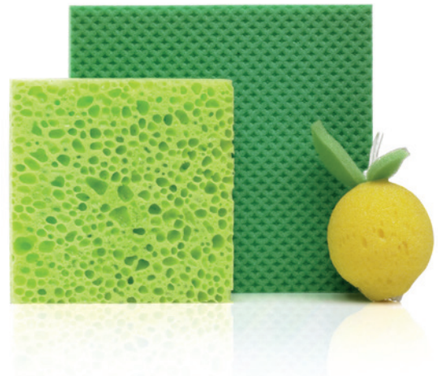
Evonik's portfolio of Performance Additives can help formulators to improve processing and foam physical properties.

ORTEGOL® CROSSLINKERS AND CHAIN EXTENDERS	PURPOSE
ORTEGOL® 720 NEW	Crosslinker for improved compression set properties of HR foams
ORTEGOL® 204	Additive for cold flow prevention in HR and visco foams
ORTEGOL® G	Highly efficient crosslinker for flexible foams containing fillers
ORTEGOL® CXT	Additive to reduce splits in low index and filled formulations. Also enhances the elongation properties of the foam.
ORTEGOL® HARDENERS AND SOFTENERS	
ORTEGOL® HA 1	Hardening additive with broad processing latitude
ORTEGOL® FS 2	Softening additive to prevent splits in low index formulations
ORTEGOL® 310	Softening additive
OTHER PROCESSING ADDITIVES	
ORTEGOL® NOP	Emulsifier for blends of Natural Oil-based Polyols and standard polyols

ORTEGOL® TO IMPROVE COMPRESSION SET	
ORTEGOL® 700 NEW	Improved foam recovery after compression and reduced curing time before compression
ORTEGOL® 701 NEW	Improved foam recovery after compression. Suitable for automotive applications with VOC specifications
ORTEGOL® 702 NEW	Improved foam recovery after compression and reduced curing time before compression. Provides excellent recovery in demanding applications
ADDITIVES FOR ANTI-SCORCH	
ORTEGOL® AO 1	Antioxidant for scorch prevention
ORTEGOL® AO 2	Antioxident for scorch prevention and delayed discoloration from foam storage
ORTEGOL® AO 7	Highly efficient antioxidant for scorch prevention, also low VOC in high temperature automotive VOC tests
DABCO® SCOBA AS 45	Anti-oxidant that prevents scorching caused by exothermic reaction during manufacturing process
OTHER PROCESSING ADDITIVES	
DABCO® BA 100	Acid-based blocking agent for delaying cream time to reduce or eliminate pinholes in foams
DABCO® PE 40	Additive to stabilize dispersions of solid powder particles in polyol and emulsifier for incompatible polyol blends
ORTEGOL® 500	Cell opening additive for technical flexible foams
ORTEGOL® AST	Antistatic additive
ORTEGOL® AST 2	Antistatic additive with reduced tendency for scorch
ORTEGOL® BS 1	Wetting agent for rebonded foam production to reduce binder level
ORTEGOL® CC 3 NEW	Cell coarsener for HR, visco and standard ether foams
ORTEGOL® HPH 1	Additives to enhance the wetting of foam by liquids, especially water
ORTEGOL® LA 2 **ORTEGOL® LA 3**	Aldehyde scavengers
ORTEGOL® VCO	Cell opener for viscoelastic foams
TEGOCOLOR® color pastes	Coloring additives

ADDITIVES FOR POLYESTER POLYURETHANE FOAM

SURFACTANTS
CATALSYTS
PERFORMANCE ADDITIVES



SURFACTANTS

Silicone surfactants are strong stabilizers, which help produce fine and regular cell structures over a wide range of densities.

Organic surfactants are recommended for formulations that need to pass flammability tests or must be clickable.

All our surfactants are VOC optimized.

TEGOSTAB®	KEY FEATURES	DENSITY RANGE	FR FORMULATIONS	SEMI RIGID	LOW VOC
B 8300 CL	Silicone surfactant for standard foams with open and regular cell structure	M			✓
B 8301 CL	Silicone surfactant for high density foams with extremely open and regular cell structure	M-H			✓
B 8325	Silicone surfactant with very high stabilizing efficiency for standard and semi rigid foams	L-M		✓	✓
B 8330	Silicone surfactant with high stabilizing efficiency for standard and semi rigid foams	L-M		✓	
B 8336 NEW	Silicone surfactant with high stabilizing efficiency for standard and semi rigid foams	L-M		✓	✓
B 8356	Organic surfactant for FR foams with improved die-cuttability	M	✓		✓
B 8357	Organic surfactant for FR foams with improved emulsification (compared to TEGOSTAB® B 8356).	M	✓		✓
B 8366	Organic surfactant for FR foams with improved die-cuttability, with higher cell opening efficiency	L-M	✓		✓
B 8383	Silicone surfactant for low density FR foams with very uniform fine cell structure	L-M	✓		✓

L = Low M = Medium H = High ✓= suitable

AMINE CATALYSTS

	DESCRIPTION
TEGOAMIN® E 5	Balanced catalyst promoting the cell opening
TEGOAMIN® E 10	Promotes the blow reaction; broad processing for open celled foam grades
TEGOAMIN® E 12	High potent, balanced catalyst with excellent surface curing properties
DABCO® 2039	Low odor, low VOC alternative to morpholine based amines
DABCO® NE 400	Emission optimized and low odor balanced amine catalyst
DABCO® B 16	Used as co-catalyst to promote the gel reaction

PERFORMANCE ADDITIVES

Evonik's portfolio of Performance Additives can help formulators to improve processing and foam physical properties.

PRODUCT	PROPERTIES
ORTEGOL®AO 2	Antioxidant optimized for ester foams, no textile staining
ORTEGOL® AO 7	High efficiency antioxidant with very low VOC contribution, no textile staining
ORTEGOL® 315	Improves emulsification, minimizes the physical property spread
ORTEGOL® 701	Improving foam recovery after compression. Suitable for automotive applications
ORTEGOL® CLA 2	Improving foam clickability
ORTEGOL® HPH 1	Additives to enhance the wetting of foam by liquids, especially water

AT EVONIK WE GO BEYOND CHEMISTRY TO CREATE INNOVATIVE AND SUSTAINABLE SOLUTIONS FOR OUR CUSTOMERS

TEGO® RISE SOFTWARE: APPLICATION TECHNOLOGY KNOW-HOW AVAILABLE 24 / 7

- New software tool from Evonik to improve block foam production by optimizing machine setting parameters
- TEGO® RISE helps to reduce production waste and costs
- High simulation quality based on advanced algorithms and experimental data
- TEGO® RISE can help foamers to introduce new formulations faster with reduced number of required trials

EVONIK SUSTAINABLE SOLUTION AREAS

FIGHTING CLIMATE CHANGE

- Products with **reduced carbon footprint**
- **Reduced scrap rate** during foam production

DRIVING CIRCULARITY

- **PU recycling** concepts and processes
- High performance additives and robust processes designed for **recycling PU components**
- **Bio-based products**

SAFEGUARDING ECOSYSTEMS

- **Environmentally benign** PU production processes
- **Reduction of critical components** in PU production

ENSURING HEALTH & WELLBEING

- **Reduced emission** levels in PU foam
- **Increased performance**

Sustainability is taken seriously at Evonik; to learn more about the areas we are focusing on, take a look at our Sustainability Corner at Explore PU.

EVONIK CONTINUES TO INVEST IN NEW SITES & EQUIPMENT, TO SUSTAINABLY DELIVER THE BEST SOLUTIONS AND SERVICES TO THE FLEXIBLE FOAM INDUSTRY

ISCC+ CERTIFICATION

Evonik is committed to helping you produce high-quality foams, whilst minimizing the impact on the environment!

- With our Low Carbon Footprint (LCF) surfactants, we support your portfolio transformation towards more sustainable solutions
- ISCC+ certification for our Essen surfactant production site provides you with traceability along the supply chain
- Certified products will be available from Q2-2024 onwards

INNOVATION HUB, ALLENTOWN, USA

- State-of-the-art labs support global Research, Development & Innovation strategy
- Best-in-class polyurethane spray foam testing and emission chamber helps Evonik customers meet environmental and emission standards.

TWO HIGH PRESSURE FOAMING MACHINES IN ESSEN, GERMANY

- One is dedicated to ester foam
- The second one is suitable for all other slab foam grades including conventional ether, CME, visco, HR, soft and CO_2 foam grades.
- Both machines are designed to help customers
  - develop new formulations
  - troubleshoot technical issues
  - transition smoothly to new materials or technologies from Evonik

OUR COMMITMENT

Evonik is committed to producing new additives that improve productivity, enhance performance and have a reduced impact on the environment and CO_2 footprint. We have strict quality management processes in place as well as many diversity initiatives.

Our products are backed by a global network of support services:

- Local sales & technical service personnel, with in-depth industry knowledge and understanding of your needs.
- Dedicated R&D centers of excellence.
- Analytical labs
- Worldwide manufacturing and warehouse capabilities.

We are the global leader in polyurethane additives offering you the broadest choice of catalysts and surfactants for your flexible slabstock foam applications.

From our TEGOSTAB®, DABCO®, TEGOAMIN®, KOSMOS®, ORTEGOL® and TEGOCOLOR® brands you will find the right additives for your foam formulation.

SAFETY IS PARAMOUNT AT EVONIK

- Evonik is one of the safest chemical manufacturers globally.
- An industry leader environmental, health and safety (EH&S) performance.
- Every employee is required to understand and adhere to our global EH&S policy. It is a condition of employment.

To further discuss your requirements for polyurethane additives for the comfort foam industry, or to learn more about regional product availability.
Please visit:
www.evonik.com/pu-contacts

Evonik Corporation
7001 Hamilton Boulevard
Trexlertown PA 18087
USA
oucustomerservice@evonik.com
www.evonik.com/pu-additives

https://explorepu.evonik.com

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EVONIK
Leading Beyond Chemistry