

ADDITIVES FOR POLYURETHANE CASE APPLICATIONS – EMEA

CATALYSTS, CURATIVES, PERFORMANCE ADDITIVES,
SURFACTANTS & RELEASE AGENTS

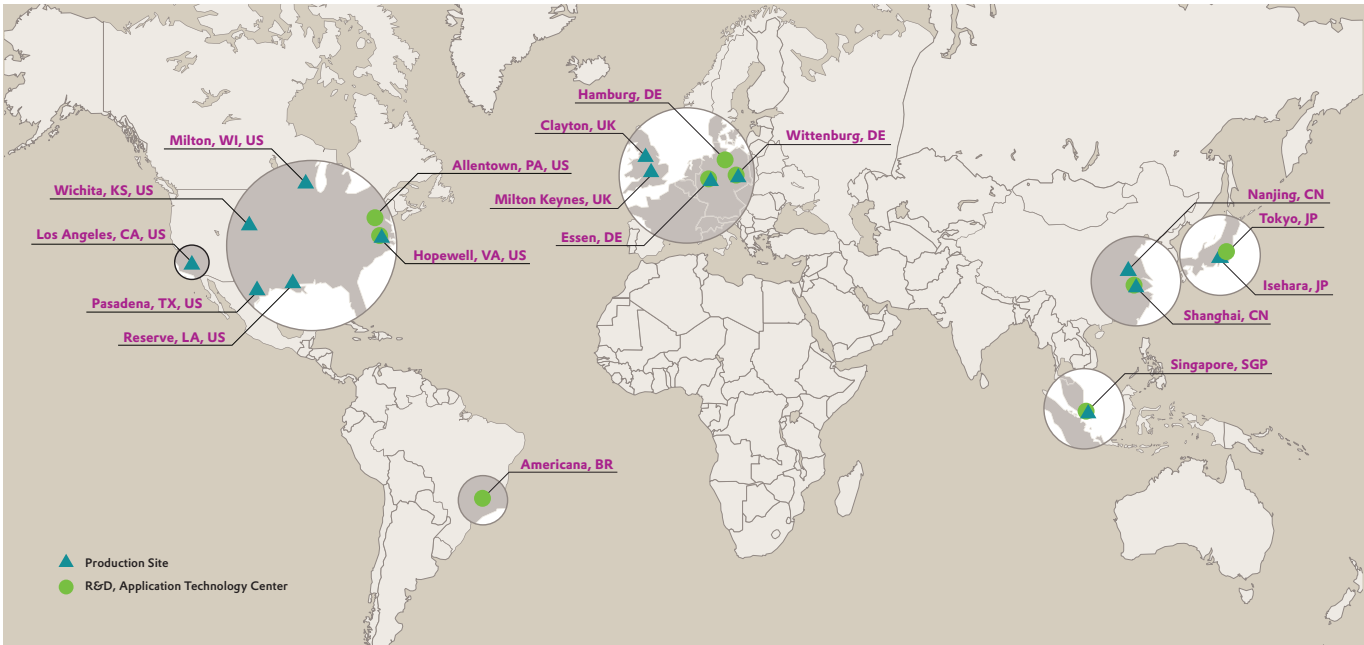




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EVONIK – YOUR PARTNER FOR POLYURETHANE CASE APPLICATIONS



Polyurethane is a versatile material that is ideally suited for a wide range of CASE (Coatings, Adhesives, Sealants, and Elastomers) applications. As the leading supplier of additives to the polyurethane industry, Evonik offers a wide array of advanced technologies for CASE formulations.

Our solutions enable you to optimize formulation performance by controlling

reaction profile and pot life, shortening return to service time, improving surface appearance and adhesion, as well as helping to enhance the physical properties of the final product.

As a dedicated partner to the industry, Evonik continuously provides innovative additive solutions. Our extensive product portfolio includes Catalysts (amine and metal), Surfactants (silicone and

organic), Release Agents, Performance Additives, and Curatives.

Building on our deep understanding of polyurethane chemistry and with manufacturing sites and laboratories across the globe, we are well positioned to meet your current and future development needs with tailored solutions.

HIGH-PERFORMANCE CATALYSTS

- DABCO® DC 1
- DABCO® DC 2
- DABCO® DC 5 LE
- POLYCAT® SA 20
- POLYCAT® SA 5

Catalyst solutions from our high-performance range combine the typical benefits of metal and amine-based catalysts. They allow for extended front-end delay while preserving an efficient back-end curing profile and short tack-free times. These catalysts help formulators to avoid the separate use of toxic dibutyltin grades in production.

DABCO® DC 1 is a delayed-action catalyst for use in all castable (foamed and compact) polyurethane systems.

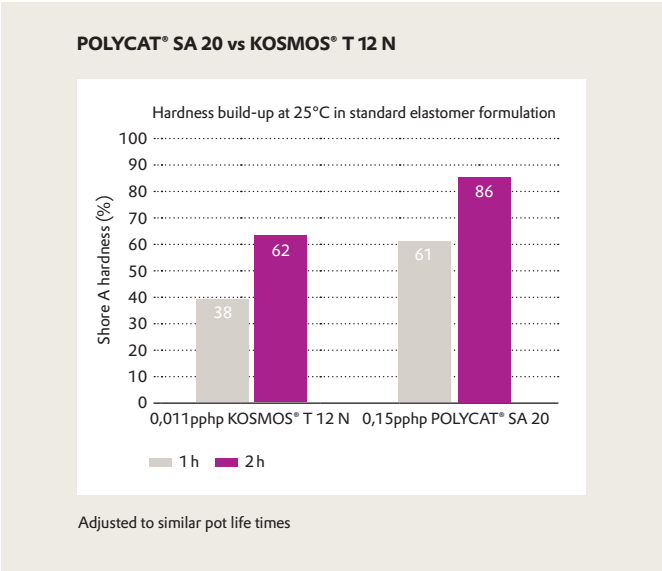
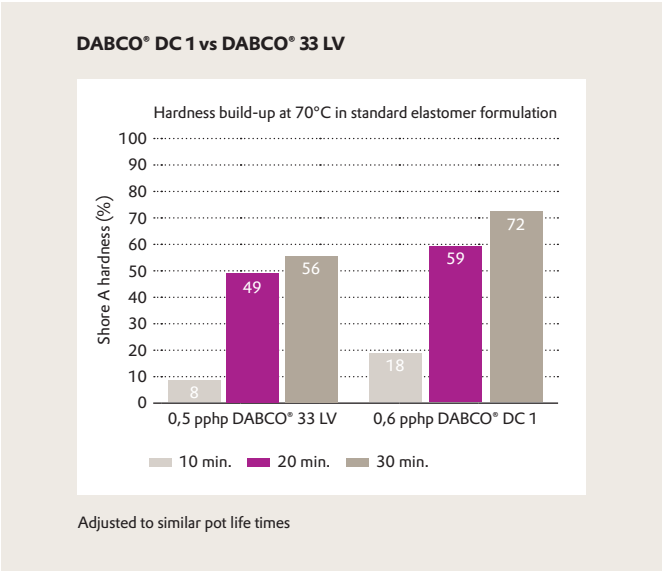
- Gel catalysts for extended pot life times with short tack-free time
- Effective curing and hardness build-up
- Reduces the use of toxic dibutyltin derivatives
- Low-emissive grades available

It has a reactivity similar to standard amine catalysts such as DABCO® 33 LV while also providing a more efficient hardness build-up. DABCO® DC 2 shows a higher reactivity compared to DABCO® DC 1 with shorter pot life and shorter return-to-service times. DABCO® DC 5 LE provides a similar reaction profile as DABCO® DC 1 with lower emissions.

POLYCAT® SA 20 exhibits a similar front-end reactivity as DABCO® DC 1, while meeting low emission requirements and is

free of dibutyltin. For situations that require both 100% tin-free and low emission solutions, we offer POLYCAT® SA 5 as a high-performance delayed-action catalyst.

DABCO® DC 1, DABCO® DC 2, and POLYCAT® SA 5 can also be used at lower levels as co-catalysts in existing formulations to help increase the cure speed of the system, without affecting the front-end of the reaction, thus maintaining working life.

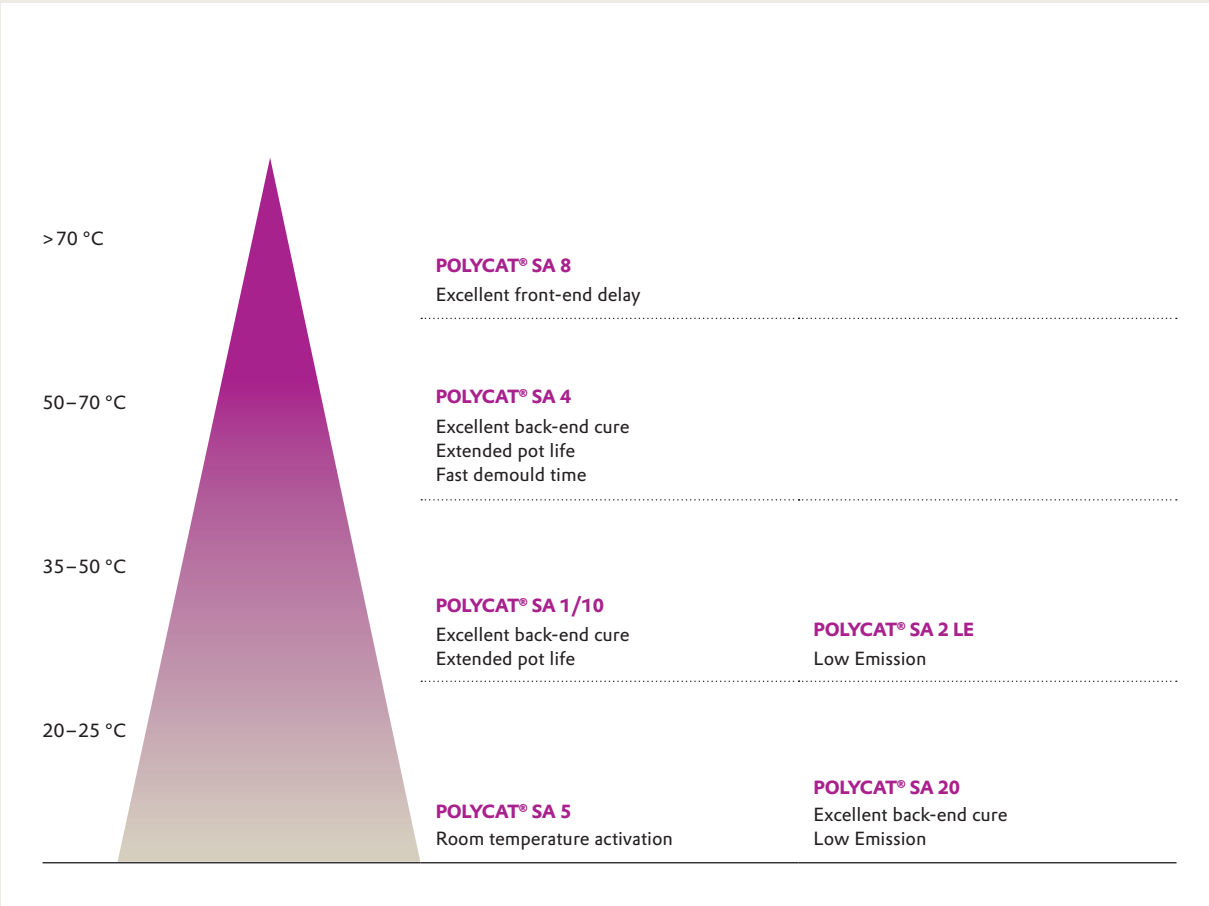


THERMOLATENT CATALYSTS – POLYCAT® SA SERIES

Traditional polyurethane catalysts accelerate a polyol-isocyanate reaction at ambient condition. However, when a delayed reaction is preferred, we offer our POLYCAT® SA series catalysts.

The natural exotherm generated during the polyurethane reaction, or an external heat source can activate POLYCAT® SA catalysts at different temperatures (as shown in the

illustration below). By choosing the right catalyst you can help to tailor a delayed reaction to optimize the formulation.

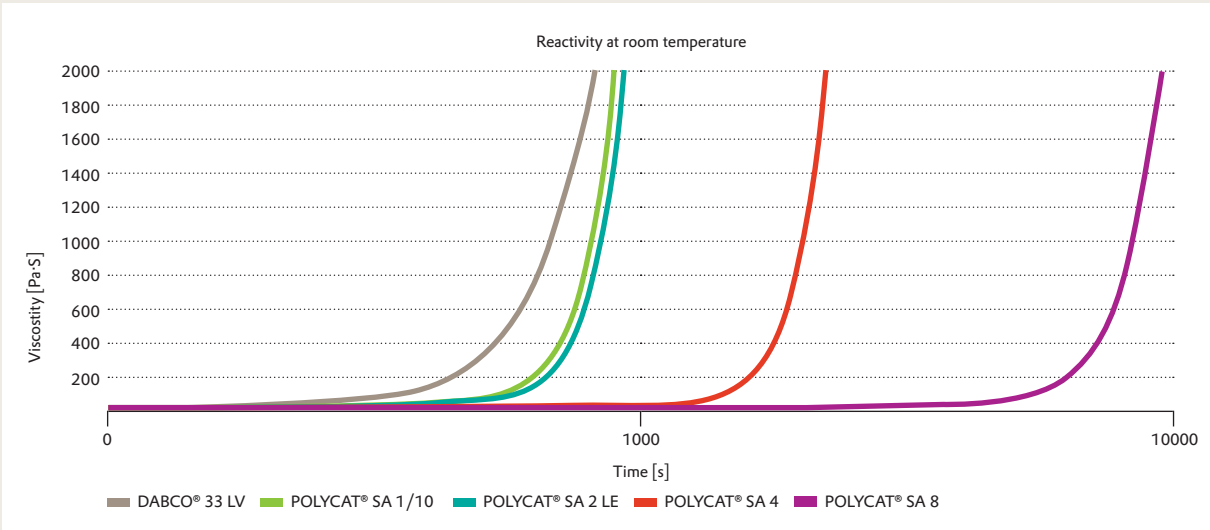


The graphic below depicts the delayed action performance at ambient conditions of POLYCAT® SA 1/10, POLYCAT® SA 2 LE, POLYCAT® SA 4 and POLYCAT® SA 8. POLYCAT® SA 1/10 and POLYCAT® SA 2 LE have a more

subtle delay. Due to its unique composition, POLYCAT® SA 2 LE can also be utilized to help reduce amine emissions. POLYCAT® SA 8 provides the most delay as this catalyst offers the highest de-blocking temperature.

Additionally, the POLYCAT® SA series catalysts can also be combined with other catalysts in our portfolio to optimize material properties and curing behavior.

Viscosity profiles in a standard aromatic elastomer formulation



MERCURY ALTERNATIVE CATALYSTS

We provide a range of catalyts that can work in combination to offer many of the benefits associated with mercury catalysts. This approach enables formulators to fine-tune the required front-end, and back-end cure profile based on processing

requirements. In the example shown here, an 80/20 ratio blend of POLYCAT® SA 20 and POLYCAT® SA 8 offers excellent back-end cure and pot life balance similar to that offered by a mercury catalyst.

We recommend an individual formulation dependent on the approach taken to substitute mercury. Please talk to us for a tailored solution – visit www.evonik.com/pu-contacts to find your local Evonik representative.

NON-EMISSIVE CATALYSTS – DABCO® NE SERIES



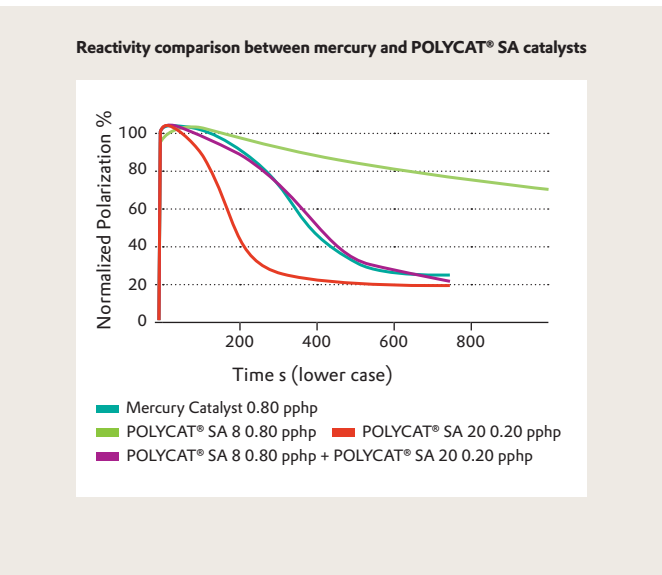
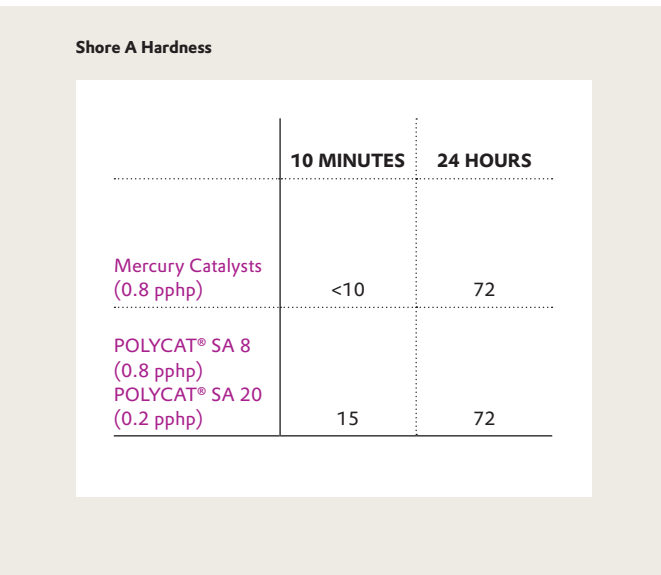
From automotive to flooring applications – emissions matter. Evonik is the industry leader in non-emissive, reactive catalyst technology.

Our innovative DABCO® NE catalysts have excellent catalytic activity and are

proven to help meet strict emissions standards, such as VDA 278.

Conventional amine catalysts do not react into the polymer matrix and contribute to emissions. Instead, when using DABCO® NE 300 for blowing

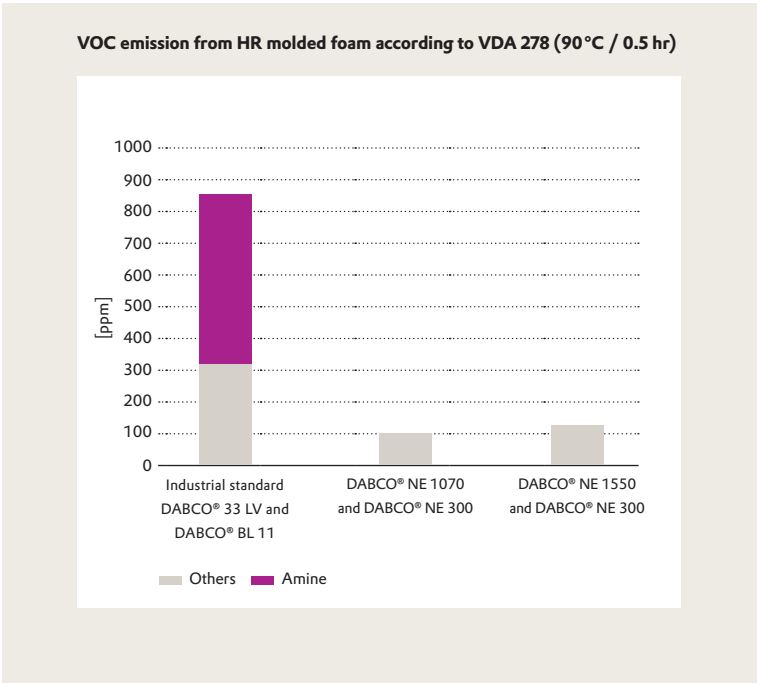
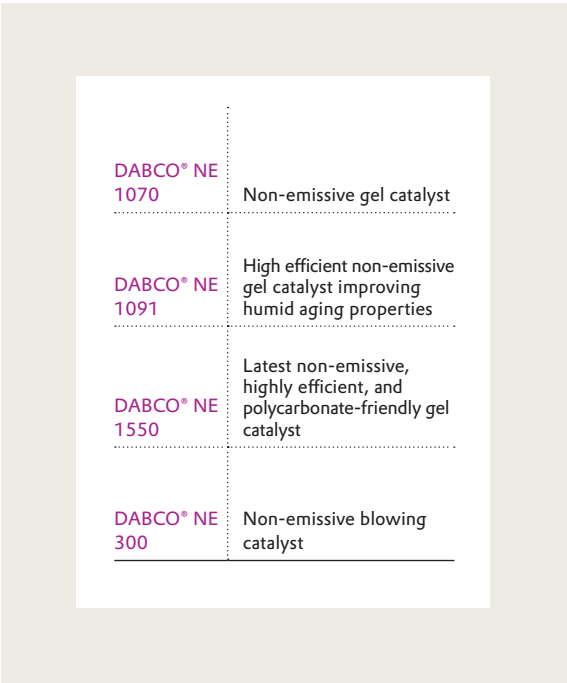
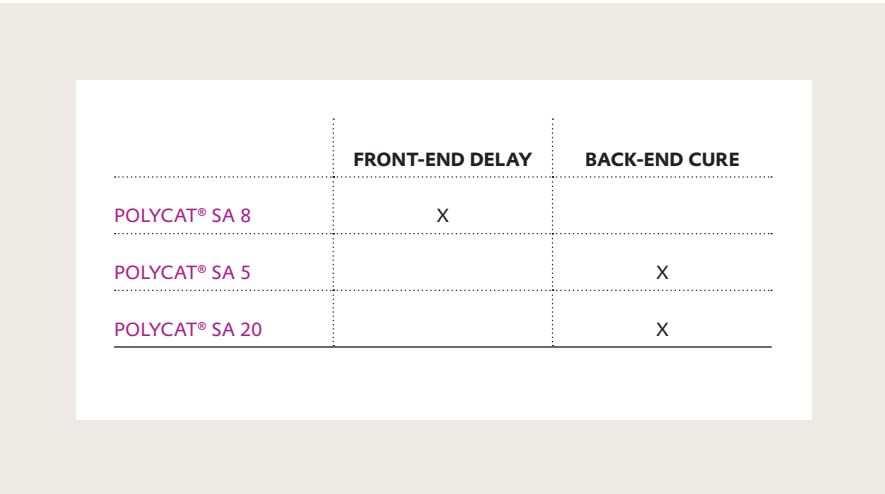
catalysis and DABCO® NE 1070, DABCO® NE 1091, or DABCO® NE 1550 for gelling, the amine emissions drop to non-detectable levels and the total emissions are dramatically reduced.



TYPICAL COMBINATIONS:

- POLYCAT® SA 8 : POLYCAT® SA 20 (0.8 : 0.2 pphp)
- POLYCAT® SA 8 : POLYCAT® SA 5 (0.8 : 0.2 pphp)

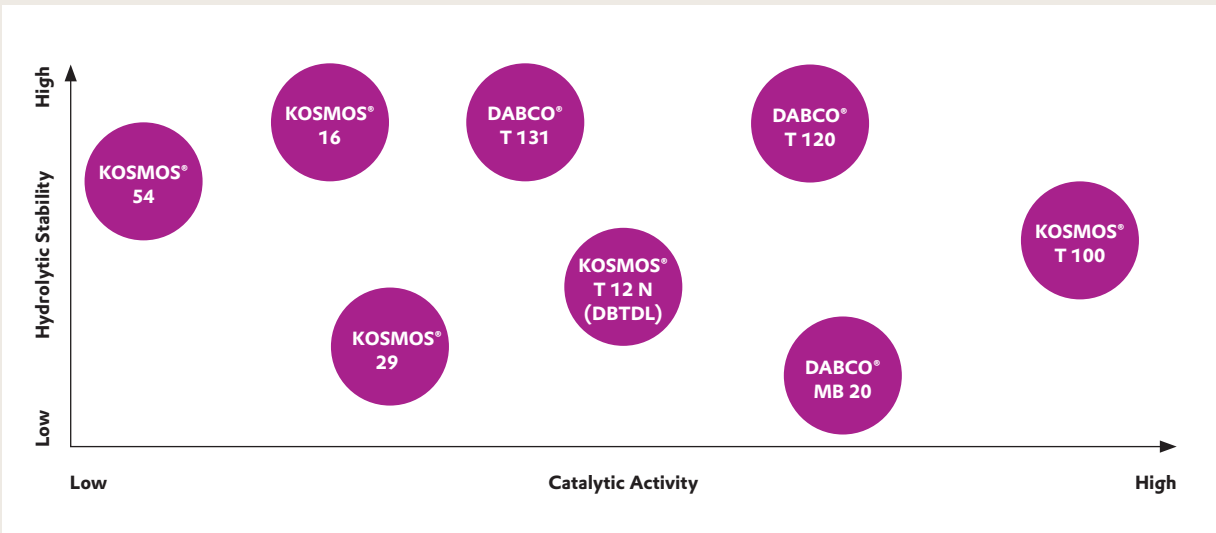
Catalyst ratios may need to be optimized to achieve desired curing profile and pot life for a specific formulation.



	GEL / BLOW / TRIMER	LONGER POT LIFE	RETURN TO SERVICE	LOW VOC	HYDROLYTIC STABILITY	VISCOSITY (cP @ 25°C)	SPECIFIC GRAVITY (@ 25 °C)	CALCULATED OH NUMBER (MG KOH/G)	MINIMUM CURE TEMPERATURE °C	PRODUCT DESCRIPTION
HIGH PERFORMANCE CATALYSTS	High performance curing catalysts that support hard segment formation. They can be used alone, or at low levels with existing amine catalysts to improve back-end cure.									
DABCO® DC 1	G	++	++		++	400	1.19	689	RT	Catalyst that gives a back-end cure similar to a tin catalyst and a similar working time as an amine catalyst.
DABCO® DC 2	G	+	+++		++	391	1.25	603	RT	Catalyst that gives a back-end cure similar to a tin catalyst and a similar working time as an amine catalyst. DABCO® DC 2 is more reactive than DABCO® DC 1.
DABCO® DC 5 LE	G	++	++	++	++	4300	1.08	138	RT	Low emission catalyst that gives a back-end cure similar to a tin catalyst and a similar working time as an amine catalyst.
POLYCAT® SA 20	G	+	+	++	+	5000–11000	1.09	45	RT	DBT-free low emission catalyst that gives a back-end cure similar to a tin catalyst and a similar working time as an amine catalyst.
POLYCAT® SA 5	G	+	++	+	+	60	1.05	119	RT	Metal-free catalyst that provides excellent back-end cure.
THERMOLATENT CATALYSTS	Temperature-activated catalysts that strongly promote the urethane reaction and enable the extension of back-end cure.									
POLYCAT® SA 1/10	G	+	++		+++	600	1.06	0	35	Acid-free heat activated catalyst that provides excellent back-end cure. Can provide an extended pot life. It stays liquid at low temperature.
POLYCAT® SA 2 LE	G	+	++	+	+	2600	1.03	0	35	Low emission heat activated catalyst that exhibits a front end delay with rapid back end-cure.
POLYCAT® SA 4	G	++	++		+++	4000	1.01	84	50	Heat activated catalyst with higher de-blocking temperature and longer pot life time than POLYCAT® SA 1/10.
POLYCAT® SA 8	G	+++	++	+	+	9500	1.18	258	>70	Heat activated co-catalyst with an excellent front-end delay.
DELAYED ACTION CATALYST	Catalysts that can enhance pot life time while maintaining curing property or demold time as compared to traditional TEDA technology.									
DABCO® 1027	G	++	+	–	+++	75	1.1	1195	RT	Non-acid-blocked delayed action catalyst that is useful in microcellular applications requiring stronger back-end cure. It is a controlled activity catalyst for MEG extended polyester and polyether systems.
DABCO® 1028	G	++	+	–	+++	125	1.03	900	RT	Non-acid-blocked delayed action catalyst that is useful in microcellular applications requiring stronger back-end cure. It is a controlled-activity catalyst for 1,4-butanediol extended polyester and polyether systems.
DABCO® 8154	G	++	+	–	+++	160	1.04	0	RT	Acid-blocked delayed action catalyst that is useful in extending pot life.
NON-EMISSIVE AMINE CATALYSTS	Reactive amine catalysts for use in highly emission-critical applications.									
DABCO® NE 1070	G			+++	+++	1200	1.06	780	RT	Low emission gel catalyst suitable for replacement of traditional TEDA catalysts like DABCO® 33 LV or DABCO® EG.
DABCO® NE 1091	G			+++	+	425	0.99	117	RT	Highly efficient low emissive gel catalyst suitable to replace traditional TEDA catalysts. Can be used to improve humid aging.
DABCO® NE 1550	G			+++	+++	579	0.93	311	RT	Latest non-emissive, highly efficient, and polycarbonate-friendly gel catalyst suitable for replacement of traditional TEDA catalysts like DABCO® 33 LV or DABCO® EG.
DABCO® NE 300	B			+++	+++		0.91	276	RT	Highly efficient low emissive blow catalyst suitable for replacement of BDMAEE catalysts.
BISMUTH AND ZINC CATALYSTS	Alternatives to tin catalyst that can be used as co-catalysts with amines or as standalone alternatives to other metals									
DABCO® MB 20	G				–	~5000	1.22	177	RT	Bismuth-based gel catalyst developed for a wide range of urethane formulations. It does not contain 2-EHA, DBT or TBT.
KOSMOS® 54	G				+++	1000–2000	1.01	300	RT	Zinc-based gel catalyst with good hydrolytic properties which can be combined with amine or metal catalysts.
TRIMERIZATION CATALYSTS	Catalysts that promote the trimer reaction. They contribute to increased Tg, high temperature performance, improved hardness and back-end cure.									
DABCO® TMR 7	T			+	+++				RT	Unique highly efficient trimerization catalyst with improved back-end cure.
DABCO® TMR 31	T	+			+++				RT	Catalyst with improved back-end cure without sacrificing front-end activity.
AMINE CATALYSTS	Broad range of industry standard and specialized amine catalysts. Available in a variety of carriers for different applications.									
POLYCAT® DBU	G			–	–	14	1.04	0	RT	Strong gel catalyst that provides snap cure at ambient temperature.
DABCO® CRYSTALLINE	G			–	–	NA	1.14	0	RT	100% solid triethylene diamine (TEDA). Used in the synthesis of prepolymers and curing of polyurethanes. Able to be dissolved in a wide range of carriers.
DABCO® 33 LV	G			–	+++	125	1.03	560	RT	33% TEDA dissolved in dipropylene glycol. Used in the synthesis of prepolymers and curing of polyurethanes.
DABCO® EG	G			–	+++	60	1.09	1207	RT	33% TEDA dissolved in ethylene glycol. Used in the synthesis of prepolymers and curing of polyurethanes.
DABCO® 33 S	G			–	+++	135	1.02	830	RT	33% TEDA dissolved in 1,4-butanediol. Used in the synthesis of prepolymers and curing of polyurethanes. Also available as 25% TEDA in 1,4 BDO.
DABCO® B 16 E	G			–	+++	<50	0.79	0	RT	Pure amine catalyst which can be used in combination with other amine and metal catalysts to improve edge curing properties.
POLYCAT® 77	G/B				+++	3	0.8	0	RT	Strong low-odor amine catalyst which is especially suitable for 2K sealing and adhesive systems.
DABCO® 2040	G				+++	8	1.5	543	RT	DABCO® 2040 is a low-odor amine gel catalyst providing exceptionally long shelf-life times in 2K PU systems and can be used to replace BDMA.
DABCO® DMDEE	B			–	+++	18	1.05	0	RT	Amine catalyst that is isocyanate stable. It is used in one component moisture cured applications in CASE.
TIN CATALYSTS	Tin-based catalysts that offer excellent back-end cure in CASE applications									
KOSMOS® 29	G		+++		–	250	1.29	0	RT	Stannous octoate. Strong gel catalyst. Very low hydrolytic stability.
KOSMOS® T 12 N	G		+++		–	60	1.05	0	RT	Dibutyltin dilaurate. Strong gel catalyst. Moderate hydrolytic stability.
DABCO® T 2064	G		+++		–	312	1.00	53	RT	Dibutyltin-based catalyst suitable to improve ease of dosing at very low use levels.
KOSMOS® T 100	G		+++		–	2500	1.05	0	RT	Strongest gel catalyst particularly suitable for fast curing applications such as spray coatings and RIM. Suitable in particular for use with aliphatic isocyanates.
DABCO® T 120	G		+++		+	20	1.02	0	RT	Strong gel catalyst with good hydrolytic stability.
DABCO® T 131	G	+	+++		+	33	1.11	0	RT	Strong gel catalyst with good hydrolytic stability which provides a more delayed action than DBTDL.
KOSMOS® 16	G	+	++		+	35	1.04	0	RT	Delayed-action gel catalyst with good hydrolytic stability and improved EHS profile compared to standard DBTL.

+ = Good ++ = Very Good +++ = Excellent - = Not Recommend; RT= Room Temperature

METAL CATALYSTS



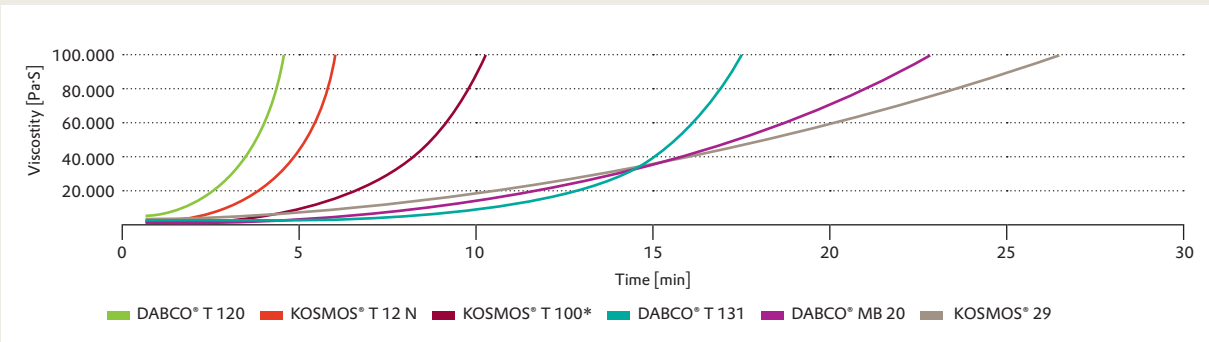
Evonik provides a portfolio of metal catalysts consisting of various tin compounds, bismuth, and zinc catalysts. DABCO® MB 20 is a tin-free alternative with exceptionally low acid content. In addition to the industry standard KOSMOS® T 12 N, our tin portfolio includes DABCO® T 120 which provides improved shelf life stability in formulated systems. KOSMOS® T 100 offers the

highest activity within this portfolio and has a fast viscosity build-up in fast curing spray and RIM applications. DABCO® T 131 provides longer pot life times. If tin (IV) compounds with organic ligands are not an option due to EH&S concerns, our KOSMOS® 29 can help to fulfil more stringent EH&S requirements. KOSMOS® 16 is a delayed-action, hydrolytically stable tin compound

with a more beneficial EHS profile compared to standard DBTDL. KOSMOS® 54 is a unique zinc-based catalyst providing improved tack-free times.

The illustration above shows the hydrolytic stability and catalytic activity of these products.

Isothermal (25°C) Viscosity Profiles in a standard aromatic elastomer formulation



Use level: 0.02 pphp *0.01pphp

PERFORMANCE ADDITIVES AND RELEASE AGENTS

Performance additives and surfactants from our ORTEGOL®, DABCO®, and TEGOSTAB® product lines help formulators tailor material as well as processing properties to their specific needs. Our additives enhance miscibility, promote electrical conductivity and abrasion resistance, support adhesion, or can also serve as degassing agents. Release agents from the GORAPUR®

range of products help to ensure a safe molding process of any PU based elastomer and any isocyanate bound material combination. Whilst being designed for optimal processing and efficiency they are adapted to meet any specific need with respect to surface appearance and haptics. The products below provide a selection, but please contact us for a specific recommendation or for tailored products.



	COATINGS	ADHESIVES	SEALANTS	ELASTOMERS	PRODUCT DESCRIPTION
ORTEGOL® AST 8	●	●	●	●	Highly potent antistatic agent with no impact on physical properties.
ORTEGOL® AB				●	Silicone-based abrasion reducer; easy to blend into the system.
ORTEGOL® NOP	●	●	●	●	Emulsifier enhancing miscibility of polyester or polyether polyols with natural oil based polyols.
ORTEGOL® 215	●	●	●	●	Emulsifier for enhanced miscibility of 1,4-BDO in polyols.
DABCO® LK 221 E		●	●	●	Organic surfactant that serves as a good emulsifier, especially for 1,4-BDO in polyol blends, and improves adhesion.
TEGOSTAB® B 8950			●	●	General purpose silicone surfactant that serves as a good emulsifier, especially for 1,4-BDO in polyol blends.
TEGOSTAB® B 8900	●		●	●	Silicone-based surfactant with strong cell-opening and degassing properties.
ORTEGOL® IR 2				●	Silicone-based additive reducing stickiness of soft elastomers and gels to facilitate processing of final parts.
ORTEGOL® BW 1		●			Isocyanate-stable wetting agent for binder applications.
DABCO® BA 306		●	●		Additive to improve hydrolytic stability of PU sealants and adhesives, especially when reactive catalysts are used.
GORAPUR® IMR 412 T				●	Internal mold release agent to improve process stability and reduce the necessary amount of external mold release.
GORAPUR® LI 0245-29 B				●	High solid, solvent-based mold release agent for elastomers with a silky matt surface finish. Ready to use or dilutable up to 1:2.
GORAPUR® LS 1459-19				●	100% pure silicone based release agent concentrate for dilution with organic solvents; for demolding parts of isocyanate bound rubber chips such as anti-slip and protective mats, sports and leisure applications.
GORAPUR® LS 1035-2 W				●	Water-based, general purpose release agent for PU elastomers. Dilutable up to 1:20.
GORAPUR® LS 1646-119 B				●	Highly efficient solvent-based release agent for glossy elastomers.

VERSALINK® CURATIVES

Our VERSALINK® products are specialty diamines for use as curatives and chain extenders in high-performance polyurea and polyurea-hybrid applications.

VERSALINK® P series oligomeric diamines are low-reactivity non-hazardous aromatic amines which

can be liquid-processed with monomeric and polymeric MDI or TDI prepolymers as well as other diisocyanates and diisocyanate prepolymers. VERSALINK® 740 M is a non-hazardous monomeric aromatic diamine for use in mixed isomer liquid polyurethane prepolymers or as chain extender in polyol pre-blends.

By using our VERSALINK® curatives formulators can combine the material performance of polyurea with the ease of use that comes with long pot-life and safe processing.



Benefits

- High temperature resistance
- Excellent heat aging
- Excellent abrasion resistance
- Excellent tear resistance
- Low linear shrinkage
- Excellent adhesion
- Hardness from 40A–80D
- VERSALINK® 740 M is FDA approved
- Long pot life
- Less sensitive to moisture than butanediol/polyol systems
- Non-hazardous aromatic diamines

	VISCOSITY (cPs @ 25 °C)	PHYSICAL STATE (25 °C)	AMINE EQUIVALENT
VERSALINK® 740 M	solid	solid (mp 130 °C)	157
VERSALINK® P 250	solid	solid (mp 60 °C)	220–250
VERSALINK® P 650	2,500	liquid	335–475
VERSALINK® P 1000	3,000	liquid	575–625
VERSALINK® P 2000	solid	solid (mp 35 °C)	940–1245

Processing and Final Elastomer Properties of Liquid MDI Cured with VERSALINK® P-series:

	VERSALINK® P 250	VERSALINK® P 650	VERSALINK® P 1000	VERSALINK® P 2000
Isocyanate	Liquid 4,4'- MDI (29wt% NCO)	Liquid 4,4'- MDI (29wt% NCO)	Liquid 4,4'- MDI (29wt% NCO)	Liquid 4,4'- MDI (29wt% NCO)
Mix Ratio* by weight (VERSALINK® to Isocyanate)	0.5	1.9	3.3	5.7
Approximate pot life (min)	2	12	20	40
FINAL ELASTOMER PHYSICAL PROPERTIES**				
Hardness (Shore D)	84	55	50	35
Ultimate Tensile Strength (MPa)	66	55	31	28
Ultimate Elongation (%)	10	350	460	550
Die C Tear Strength (N/mm)	1051	806	736	578

*Calculated based upon a 95% stoichiometry
**Cured @ 25 °C for 7 days

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To discuss your Polyurethane CASE requirements please visit:
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