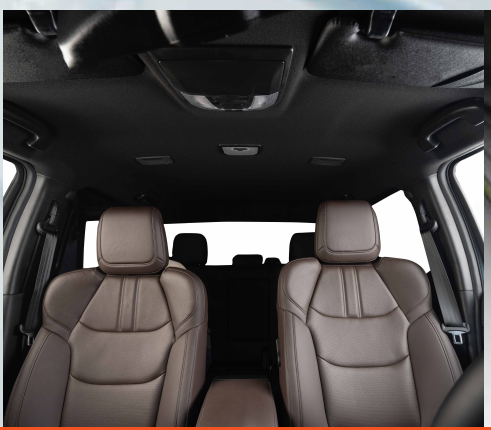
Concentrol
PU Additives

SILICONE SURFACTANTS

FOR POLYURETHANE FOAM



HR FLEXIBLE POLYURETHANE FOAM

HR MOULDED FOAM

CONCENTROL	HR MDI	HR TDI/MDI	HR TDI	Stabilizing Efficiency	Additional Information
STB PU-1220	+++	++ (co-surf)	+ (co-surf)	Low	Low potency MDI surfactant, very wide processing latitude for open foams.
STB PU-1230*	+++	++ (co-surf)	+ (co-surf)	Low	Cell regulation surfactant, open foams with very good crushability and wide processing latitude.
STB PU-1231	+++	++ (co-surf)	+ (co-surf)	Low	Standard silicone surfactant for MDI foam, low VOC and broad processing latitude for open foams.
STB PU-1234	+++	++ (co-surf)	++ (co-surf)	Low-medium	Standard silicone surfactant for MDI foam with very low VOC contribution, wide processing latitude for open foams.
STB PU-1240	++ (co-surf)	+++	++	Low-medium	Low medium potency TDI, also used as co-surfactant regulation at lower usage levels.
STB PU-1251	++ (co-surf)	+++	+++	Medium	Medium potency TDI surfactant, also used as co-surfactant at low dosage for MDI/TDI systems.
STB PU-1250*	++ (co-surf)	++	+++	Medium	Medium potency surfactant with wide processing latitude for TDI foams.
STB PU-1254	+	++	+++	High	Low VOC TDI surfactant with broad processing latitude. Foam stabilizer with good surface regulation.
STB PU-1256	-	-	+++	High	Strong TDI stabilizer. Can be used as a sole surfactant (high polymer solids systems), or for more open foams, in combination with a cell regulator (STB PU-1257)
STB PU-1257	-	++	+++ (co-surf)	High	Strongest cell regulator (sub-surface void reduction), with only moderate stabilizing effect.
STB PU-1258	+	++	+++	High	Wide process latitude. Low VOC emissions. High stabilising capacity with very good cell regulation.
STB PU-1259	++	+	+++	High	Very broad processing latitude. Lowest VOC TDI silicone surfactant. High stabilizing effect with good cellular regulation.
STB PU-1261*	++	+++	+++	Medium-High	Very low emissions (VOC). Also for formulations with polymer polyols (PIPA, PHD or SAN). Open cell, easy to crush foam also in unstable formulations (high water and high solid content)
STB PU-1262	+	++	+++	High	Stabilizing TDI systems, low emission (VOC), prevents defects such as irregular cell structure and defects below the foam surface.
STB PU-1270	+++	+++ (co-surf)	++ (co-surf)	Medium	Cell regulation with medium stabilizing effect, very wide processing latitude for less stable MDI systems and TDI/MDI foams.

Cell regulating surfactant

Stabilizing surfactant

+++ strongly recommended
++ recommended with adjustment
+ may be recommended
* Slabstock Foam

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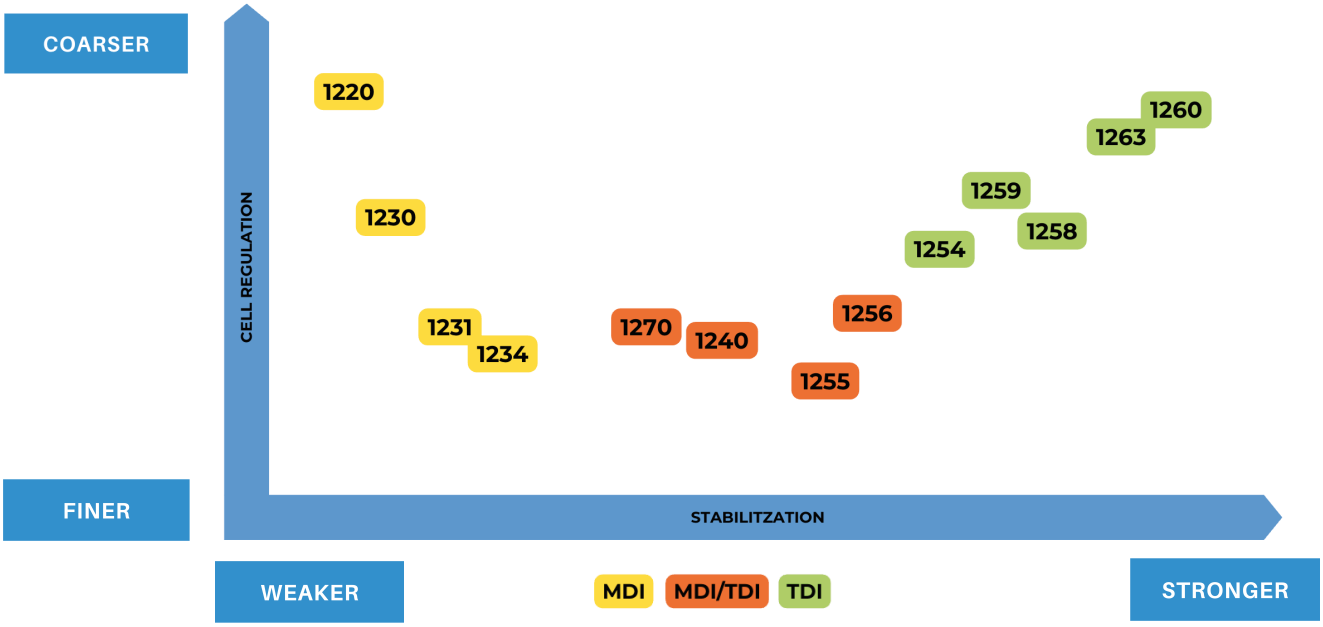


CONCENTROL surfactants meet the main requirements of HR polyurethane producers:

1. **WIDE SELECTION OF ADDITIVES** in order to offer different stabilizing potency for MDI, TDI/MDI and TDI systems, also providing different ratios in cellular regulation.
2. **CELL REGULATION** and **INTERNAL STABILIZATION** may be adjusted in order to obtain good quality foams with improved processability.
3. **LOW EMISSION FOAMS**, regarding VOC and fogging, from the point of view of the surfactant.

SPECIAL APPLICATIONS

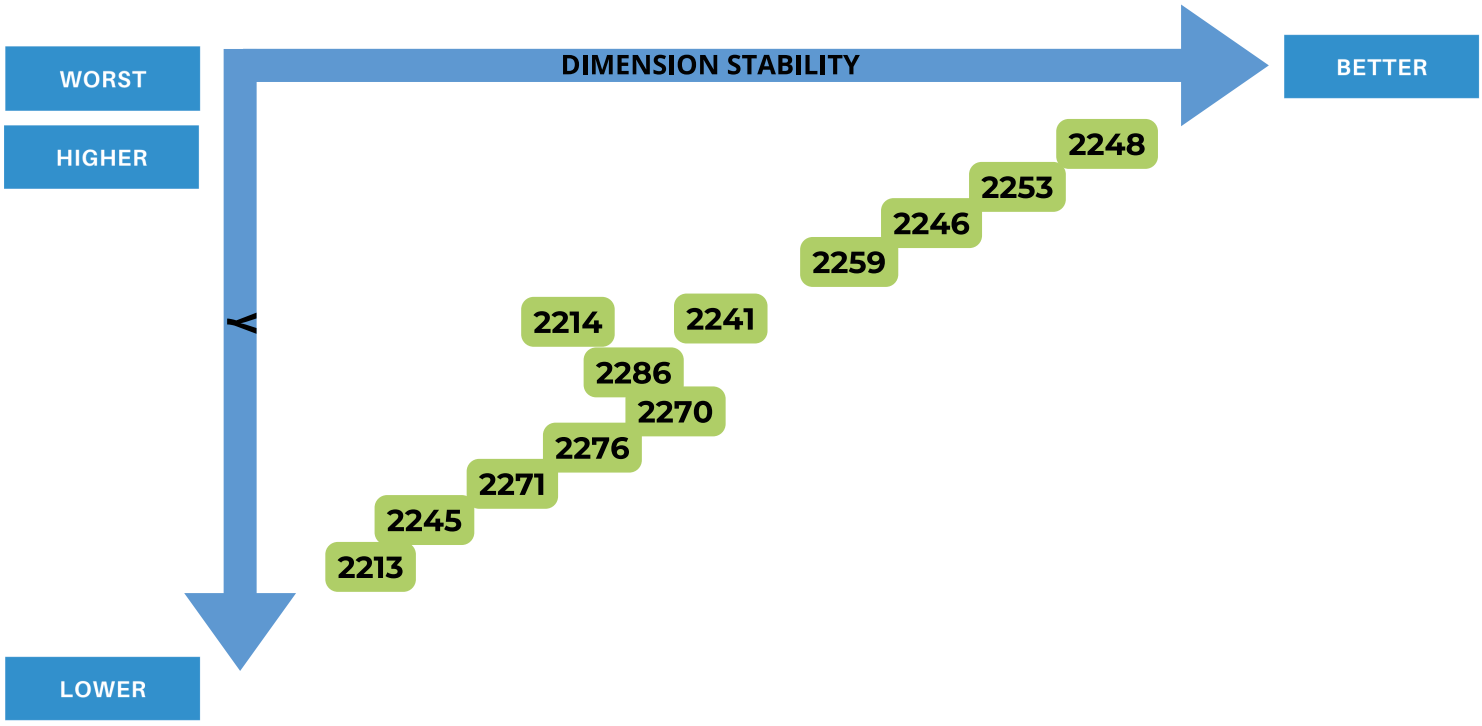
Foam type	CONCENTROL STB PU-	Additional information
Wood Imitation	2239 2218 2244	Higher density foams (>100kg/m ^{3})
Packaging	2291 2237	Low density, water blown foam (<15kg/m ^{3}) Packaging foams, open celled foam offering excellent dimensional stability
OCF – straw foam	2208 D 2209	Non-reactive surfactants
	2211	Non-reactive surfactant for winter formulations. Usable with high amount of blowing agent, polyester polyols and chlorinated paraffins.
OCF – gun foam	2226	Fine, regular open celled foam
	2211	Non-reactive surfactant for winter formulations. Usable with high amount of blowing agent, polyester polyols and chlorinated paraffins.

Concentrol
PU Additives

RIGID POLYURETHANE FOAM

			Cont. flex-faced panel		Cont. metal-faced panel		Block		Spray	
Blowing agent	**Appliance**	**Disc. Panel**	**PUR**	**PIR**	**PUR**	**PIR**	**PUR**	**PIR**	**Conventional**	**Low density**
Pentane	2242 2265 2270/2274	2274 2276 [3] 2286 [4]	2203 2208 2252	2213 2239 2271	2208 2244	2203 2244	2259 2265 2270 2279	2203 2276		
water	2254 2265 [1] 2272	2254 2265 [1] 2272			2264 2272		2259 2279		2238 2242 2248 [2]	2237 2267
HFC-365mfc/ HFC-227ea		2265 2270 2286 [4]		2203	2265 2270 2271		2259 2265 2270 2279	2203	2264 2272	
HFC-245 fa	2265 [1] 2270	2286 [4]					2259/2265 2270/2279	2203 2265 [1] 2270	2240 2248 [2]	
HCFC-141b	2242 2265 [1] 2270	2265 2270	2265 [1] 2270		2244 2265 2270/2271		2259/2265 [1] 2270/2279		2264 2272	
HFO	2226 2265 [1] 2270	2265 [1] 2270/2274 2286 [4]	2208 2213 2270	2213 2270	2208	2213 2270	2213/2259 2270/2279	2213	2240 2248 [2]	2267

1) Suitable for blowing agents with low-boiling point (e.g. HFC-134a)
2) For FR-rated systems
3) Pipe insulation systems
4) Also for formic acid co-blown systems (resists acid)



POLYURETHANE INTEGRAL SKIN FOAM AND SHOE SOLES

Silicone surfactants are surface active additives that modify the surface tension and act as cellular regulators in PU integral systems and shoe sole systems. Taking advantage of its emulsification properties, its use achieves an improvement of the miscibility of the various components of the formulation, that allows better pigment distribution, less flow lines and a general improvement in various physical properties. Additives that act as cell openers are used in medium or low density PU formulations, in order to improve dimensional stability.

Reference	Polyether	Polyester	Shoe soles	Integral foam	Stabilizing power	Cell opener	Surface appearance	Emissions	Density	Additional information
STB PU-2248	✓	✓	✓	✓	+++	+	+	Very low	M-H	It allows to obtain a fine and uniform cell structure.Good emulsifying characteristics, high polarity surfactants.
STB PU-2256	✓		✓	✓	+++	+	+	Very low	M-H	Power cell regulator, uniform and fine cell structure. Tensile strength and elongation are improved.
STB PU-2103 STB PU-2104	✓	✓	✓	✓	++	++	+	Low	L-M	Co-surfactants that improve the skin of the foam by obtaining a certain degree of cellular openness.
STB PU-1231 STB PU-1234	✓			✓	+	++	+	Low / Very low	L	Weak cell regulator. Its use reduces the appearance of pinholes and improves the appearance of the foam surface. Very good cell structure in the skin.
STB PU-2160		✓	✓		++	+	+++	Low	L-M	Co-surfactant, excellent skin formation, minimizes the peeling effect and other defects such as flow marks or craters.
STB PU-2291	✓		✓	✓	+++	++	++	Very low	L-M	Silicone surfactant of medium regulatory strength with the ability to improve the appearance of the surface and reduce the pinholes.
STB PU-4001		✓	✓		+	+++	+++	Low	L-M	Cell regulator and cell opener. It is formulated with organic polymers free of silicones. Improves the skin formation. More homogeneous foams are obtained while distribution of the added pigments is improved, reducing the flow lines.
STB PU-4002	✓		✓		+	++	+++	Low	L-M	Cell regulator and cell opener, very low polarity fluid, it allows flexibility, lubricity and water repellency in polyurethane coating. Used for high density formulations (filters).
STB PU-4057		✓	✓		+	++	+++	Low	L-M	Provides good skin formation and minimum peeling. Reduces the appearance of pores and improves the mechanical properties.

STANDARD: Silicone surfactants without FR properties, although they are used in a wide variety of formulations, either for continuous and discontinuous processes.

CONCENTROL STB PU-	CO_2	Stabilizing Power	FR Properties	Density	Additional information
3270	-	**	+	L-H	Medium-high efficiency, wide processing latitude for low-medium densities. For most standard formulations with water or methylene chloride.
3223 **3280 C**		***	+	L-M	High potency surfactants, excellent cell stabilization with wide processing latitude and high breathability for low and ultra-low densities (5 up to 18 kg/ m^3). Especially suitable for CO_2 or methylene chloride.

UNIVERSAL: Silicone surfactants that offer some FR properties, for example, they can be used in foams that must require Cal 117 and FMVSS 302.

CONCENTROL STB PU-	CO_2	Stabilizing Power	FR Properties	Density	Additional information
3111	-	***	++	L-M	Standard high-potency surfactant for foaming with physical blowing agent.
3224	-	***	++	L-M	It is a combination of high potency and a medium latitude process. It offers a low to medium density range.
3227	-	***	++	L-M	It is a combination of high potency and a medium latitude process with large cell opening. Offers a low to medium density range
3233	-	**	++	L-M	Good balance between stabilizing power and cell opening. Specially designed for formulations with high percentage of EO (hydrophilic polyols).
3250	✓	***	++	L-M	High activity surfactant. Provides a fine and regular cell with low VOC designed for CO2 formulations.
3262	-	**	+++	L-H	High-efficiency surfactant for flexible PU foam with excellent stability, breathability, and low top collapse—suitable for conventional and FR systems.
3274	✓	***	++	L-M	High activity surfactant. Provides a fine and regular cell. Improves compression set values.

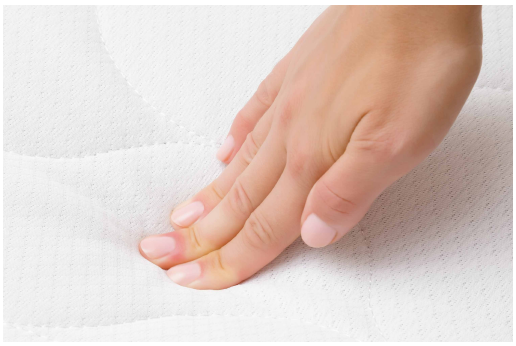
FLAME RETARDANT (FR): Silicone surfactants that have a minimal contribution to the foam flammability. They are used to pass "Crib V".

CONCENTROL STB PU-	CO_2	Stabilizing Power	FR Properties	Density	Additional information
3231	-	*	++	M-H	Low-medium strength surfactant with high process latitude for medium and high densities.
3238	✓	***	+++	L-M	Gives very good flame retardant properties. Contains ultra low VOC. Provides a fine and regular cell structure throughout the foam.
3244K	✓	***	+++	L-M	Surfactant with high stabilizing power, but with good cell opening. Specially designed for formulations with high percentage of EO (hydrophilic polyols).

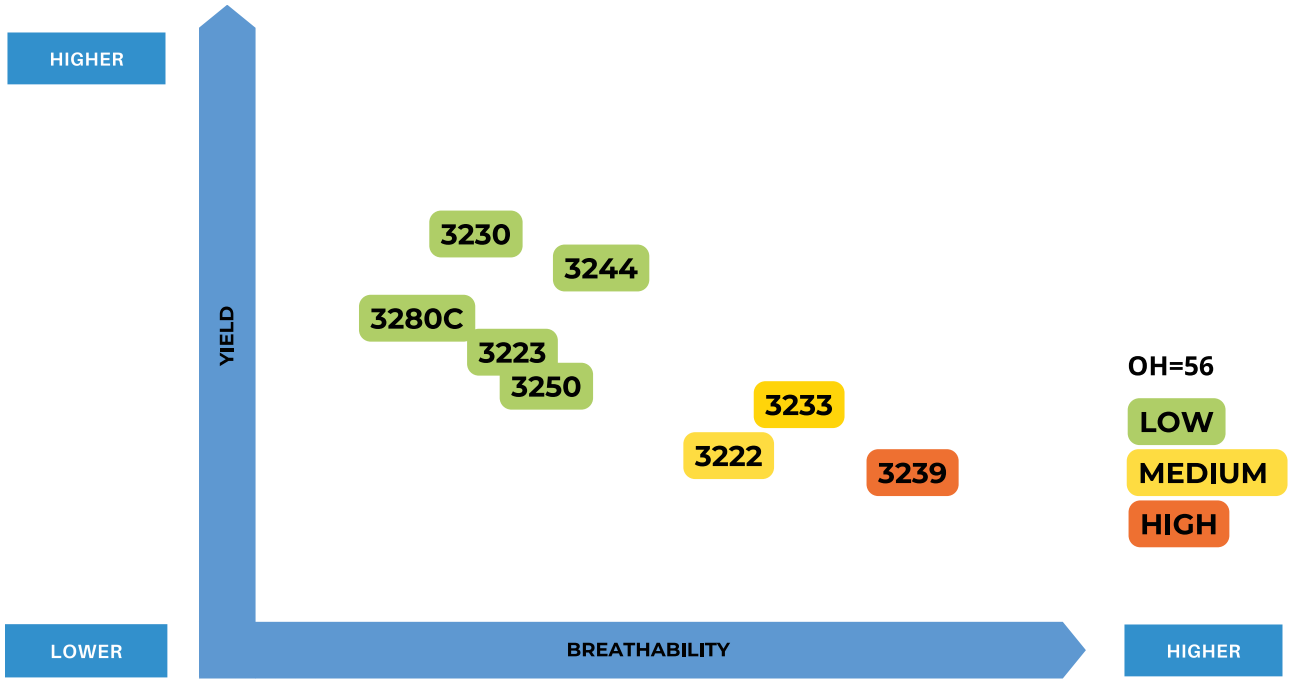
NOTE: All these silicone surfactants are resistant for hydrolysis.

SILICONE SURFACTANTS FOR MEMORY PU FOAM

Flexible viscoelastic PU foam, known as memory foam, is capable of uniformly dissipating pressure exerted by a body on it. This property is due to the pneumatic effect that occurs when the cell membrane network of the foam is deformed. The recovery time of this foam is slower than that of conventional flexible foams and varies depending on the structure of the membrane network and the strength of the surfactant used. Viscoelastic foams can be of two types: physical viscoelastic (pVE), independent of temperature, and chemical viscoelastic (cVE), which depends on temperature. Concentrol offers a varied range of solutions for both applications. All surfactants in this range have a very low cyclic siloxane content.



CONCENTROL	Open Cell	Fine cell Structure	MDI	TDI	Additional information
STB PU-3260	++	+	✓	✓	Surfactant containing low emissions with high effectiveness and slightly opens the cell.
STB PU-3262	+	++	✓	✓	Highly effective surfactant with low emissions.
STB PU-3229	+	++	✓	✓	Highly effective surfactant with low emissions. Cell-opener co-surfactant
STB PU-2254	+	++	✓	-	Highly effective stabilizer with excellent cell stabilization.
STB PU-2255	+	++	✓	-	Highly effective stabilizer with excellent cell stabilization.
STB PU-2259	-	+++	✓	-	Used to increase the number of closed cells. For closed cell cases, the use of PU2234 is recommended.
STB PU-2234	+++	-	✓	-	Silicone co-surfactant, used to balance the number of closed cells. Used as a "cell opener" in some systems.
STB PU-2264	+++	++	✓	-	Silicone surfactant with large cell opening. High recovery power.
STB PU-2279	++	++	✓	-	Silicone surfactant with medium-large cell opening.



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MAY,2025