MOMENTIVE®

SOLUTIONS FOR A SUSTAINABLE WORLD™

Snapshot of Momentive's Portfolio for High-Performance Rigid Foams

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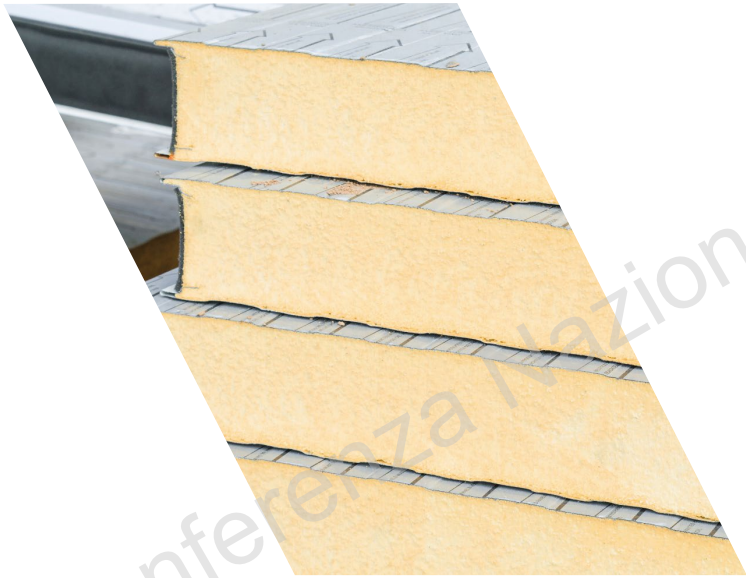

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Who We Are

A Leader in Polyurethane Additives

Momentive Performance Materials, Inc. offers one of the most trusted and diverse polyurethane additive product lines in the industry, ranging from a broad array of silicone stabilizers and a full portfolio of amine and metal-based catalysts to a selection of organic-based property modifiers.

Developed in 1962, Niax™ brand additives have long been essential ingredients in polyurethane formulations used to meet the specialized processing and performance needs of customers across the globe. Niax grades include a comprehensive line of **silicones, catalysts, and process modifiers** for polyurethane foam production.

Momentive is a pioneer in the polyurethanes additives industry and continues to serve customers with leading innovations, creative solutions, and excellent application expertise.

Where We Are

40+ LOCATIONS

20+ COUNTRIES

Major Manufacturing Sites in **U.S., Germany, Japan, Korea and China.**

Technical Support and Development Located Near Customers to Improve Speed and Communication.

AMERICAS | 11 SITES

- Niskayuna, NY (HQ)
- Waterford, NY, USA
- Pearl River, NY, USA
- Texas City, TX, USA
- Garrett, IN, USA
- Sistersville, WV, USA
- Charlotte, NC, USA
- Buenos Aires, Argentina
- Itatiba, Brazil
- Tlalnepantla, Mexico
- Mexico City, Mexico

EUROPE/MIDDLE EAST | 9 SITES

- Abingdon, United Kingdom
- Lostock, United Kingdom
- Bergen Op Zoom, Netherlands
- La Rochette, France
- Leverkusen, Germany
- Milan, Italy
- Termoli, Italy
- Istanbul, Turkey
- Dubai, UAE

ASIA | 23 SITES

- Mumbai, India
- Chennai, India
- Bangalore, India
- Rayong, Thailand
- Bangkok, Thailand
- Kuala Lumpur, Malaysia
- Singapore
- Ho Chi Minh, Vietnam
- Jakarta, Indonesia
- Guangzhou, Greater China
- Hangzhou, Greater China
- Nantong, Greater China
- Shanghai, Greater China
- Taipei, Greater China
- Daejuk, Korea
- Hwaseong, Korea
- Jeonju, Korea
- Yongin, Korea
- Ohta, Japan
- Tokyo, Japan
- Kawasaki, Japan
- Nagoya, Japan
- Osaka, Japan

Note: Locations displayed depict Momentive physical sites and do not include remote employee locations.

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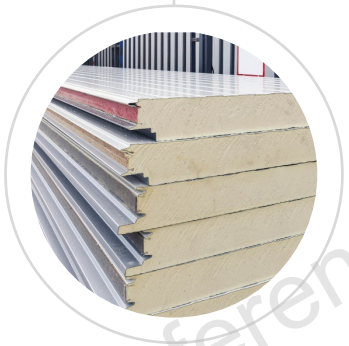
Key Performances Requirements in Final Applications

Insulation Boards

- Thermal Insulation
- Foam cure / post-expansion
- Trimerization efficiency



Metal Panels

- Surface quality / void reduction
- Foam cure / post-expansion
- Trimerization efficiency
- Fire properties in PUR systems

Spray Foam & Discontinuous

- HFO blend stability
  - Catalysts & Silicones
- Fire properties
- Surface quality (panels)

How Can Momentive's Portfolio Support the PU Market Under ECHA-Driven EHS Labelling Changes?

- **Alternative Trimerization Catalysts** – *2-EHA-free solutions*
- **Silicone Additives** – *SVHC-free label solutions*

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Silicone Range

L-5164

Fine cells, wide latitude, broad compatibility with all polyester polyols and pentanes, fast and slow reactivity. High purity surfactant. (*)

L-5210

Excellent candidate for maximizing the nucleation step, helping to reduce the cells size in the final foam. High purity surfactant. (*)

L-5158

Very good liquid and foam flow, reduced subsurface voids formation. Improved compatibility of MDI with aromatic polyester polyols and pentanes.

L-5112

Strong nucleation and emulsification, improved compatibility with polyols, fine and uniform foam also with high pentane level or in presence of reduced mixing energy.

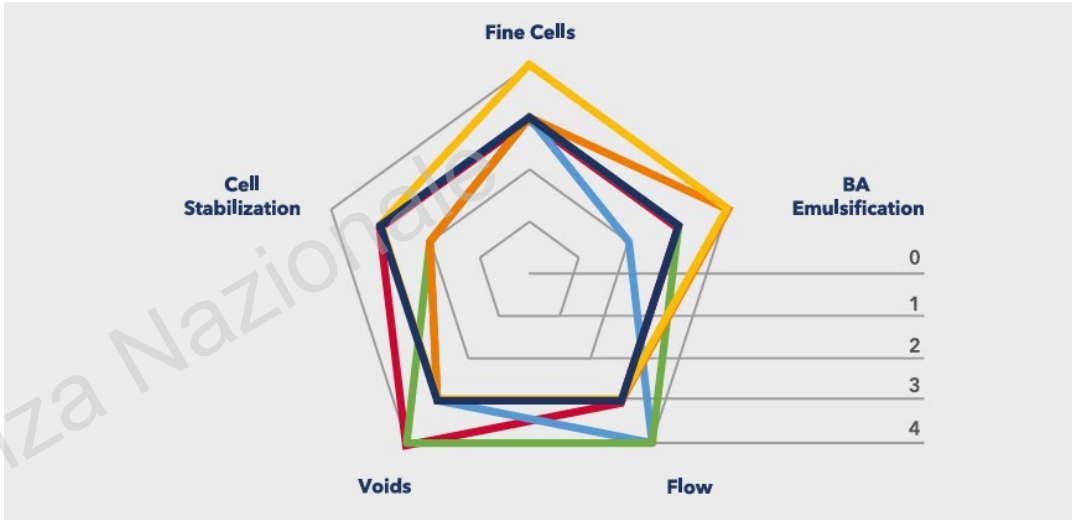
L-5466

Good balance of strong nucleation and flow, low thermal conductivity, and reduced surface voids.

L-6642

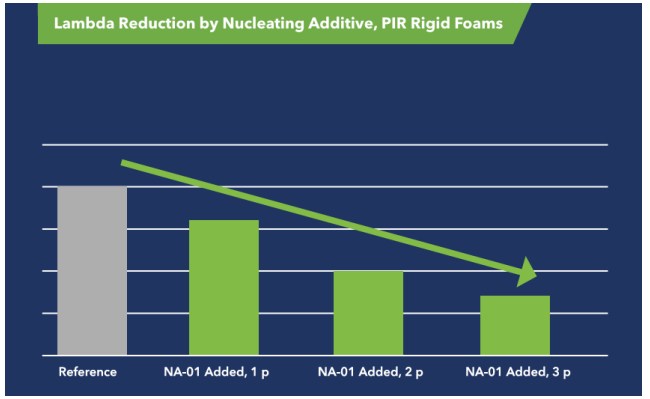
Balanced stabilizer with good voids control and flow for both continuous and discontinuous processes. Suitable for all blowing agents including formic acid and HFOs.

(*) High-purity silicones: impurities listed as SVHC below 0.1% by weight.



Niax™ NA-01 & Niax™ Y-16631

Nucleating Additives for Lambda Value Improvement



Silicone based additives that promote early gas nucleation, leading to smaller cells.
In combination with a conventional silicone, these additives further **reduce cell size and may lower thermal conductivity.** Niax Y-16631 is a high-purity silicone.

Test data. Actual results may vary.

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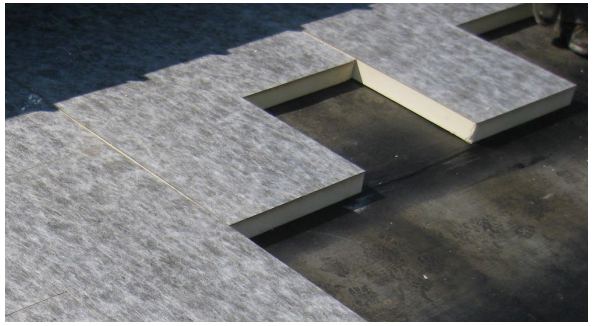
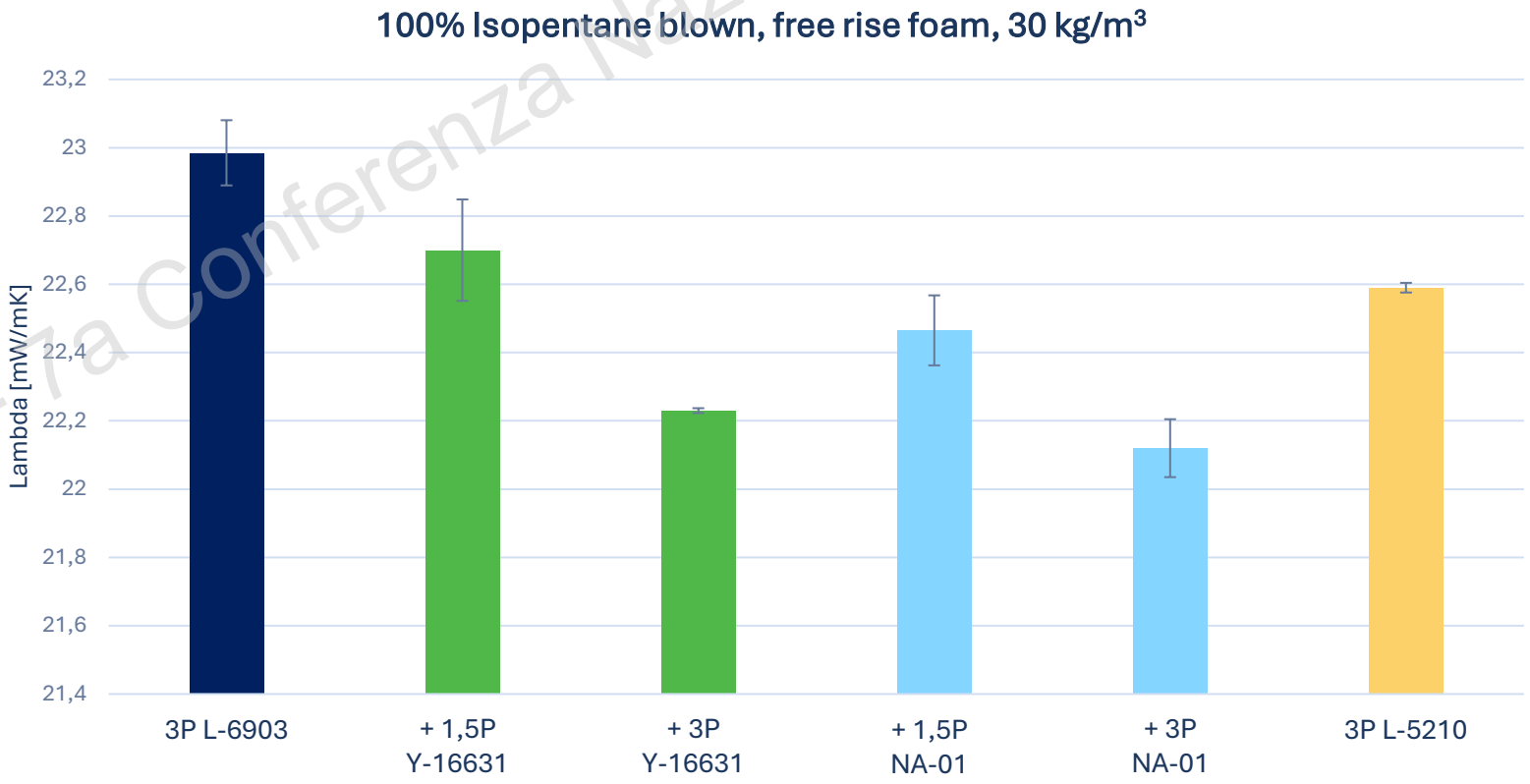
Effect of Nucleating Additives on a Typical PIR Formulation



Polyester	100
TCPP	15
Water	0.8
Niax™ C-5	0.6
Niax™ K-ZERO 3000	3
Silicone	3
Nucleating Additive	1.5 – 3
Isopentane	21
MDI	215

Test data. Actual results may vary.



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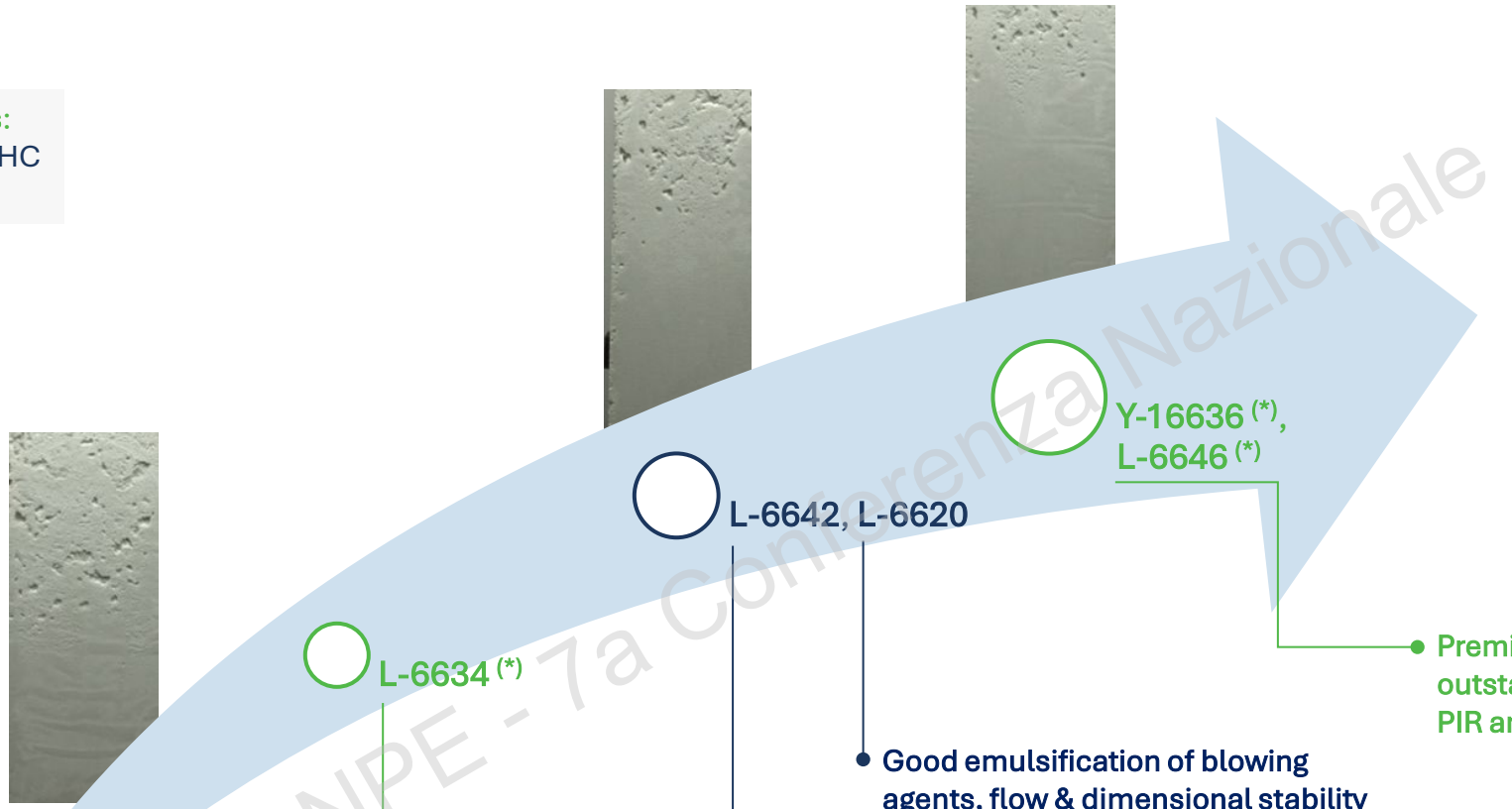
Silicones Range

(*) High-purity silicones: impurities listed as SVHC below 0.1% by weight.



L-6903 (*)
Multipurpose grade, good emulsification of blowing agents, fine cells

L-6634 (*)
Good balance cells stabilization / flow

L-6642, L-6620
Continuous & discontinuous panels (good voids control & flow)

Good emulsification of blowing agents, flow & dimensional stability

Y-16636 (*), L-6646 (*)
Premium grades for outstanding surface quality in PIR and PUR systems

Proprietary testing methodology.
Test data. Actual results may vary.

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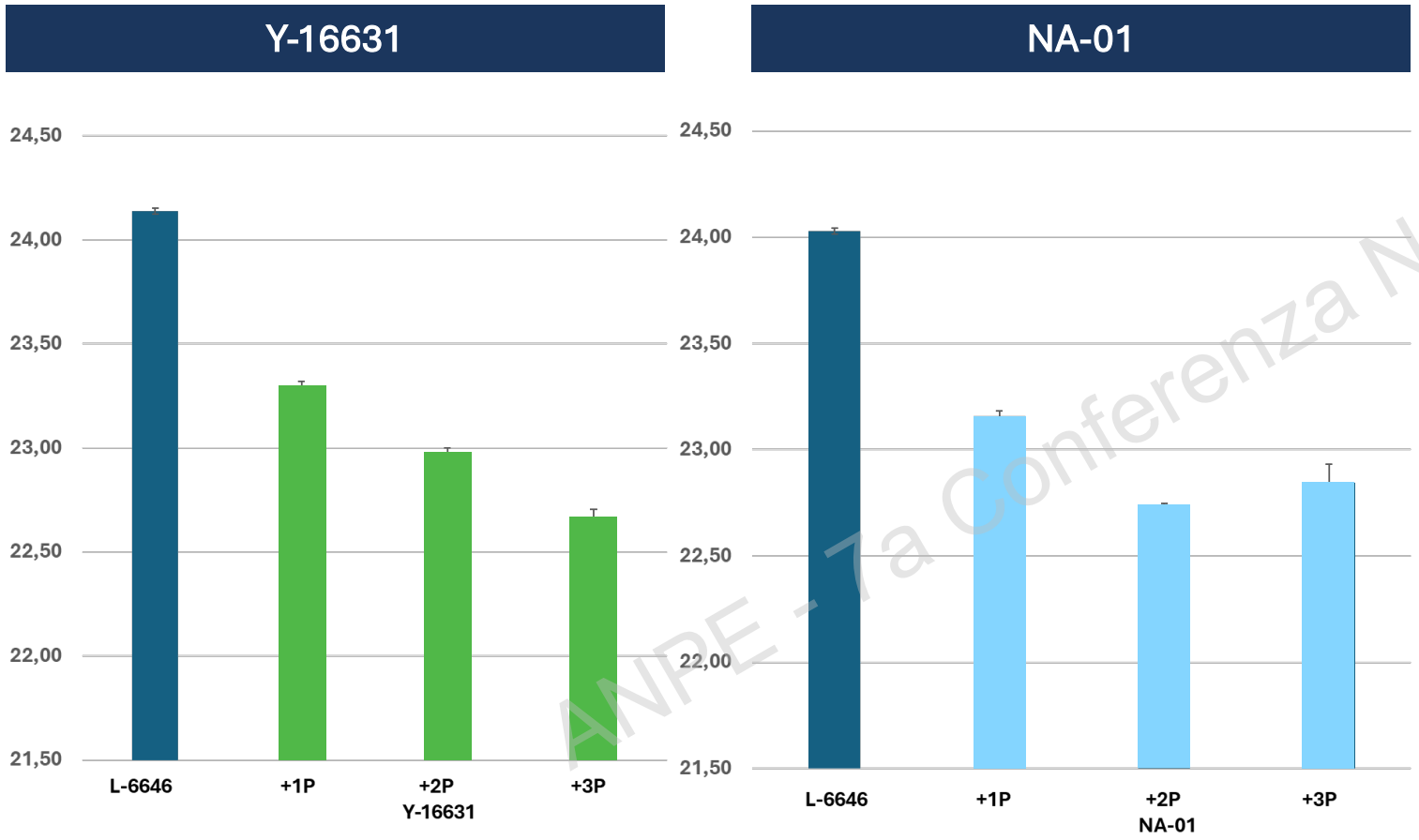
Effect of Nucleating Additives on a Typical PIR Formulation



Test data. Actual results may vary.

- 1–3 phr: significant lambda improvement in n-pentane foam
- Up to 1.5 mW/m·K improvement at 3 phr

100% n-pentane blown free rise foam

Also in Systems for Metal Panels, the use of Nucleating Additives may be Beneficial to reduce Thermal Conductivity

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Silicones Range

Closed Cells Spray Foam Systems

Silicones	Fine Cells	Blowing Agents Emulsification	Cell Stabilization	Foam Flow	Void Reduction	Product Description
L-6642	+++	++	++	++++	+++	Balanced stabilizer giving excellent nucleation, fast foam thickening with good voids control and flow, also used in continuous and discontinuous panels production, can be used for all blowing agents
L-6266 (*)	++	+++	+++	++	++	High-purity silicone for roofing applications, efficient compatibilizer delivering good levelling, smooth surface, and improved dimensional stability, can be used with hydrocarbons, mainly panels, or HFO
L-6112 (*)	++	++	+++	+++	++++	High-purity silicone, can be used with hydrocarbons or HFO, produces foams with good dimensional stability, low voids, and good fire properties

Open Cells Spray Foam Systems

Silicones	Fine Cells	Cell Opening	Cell Stabilization	Product Description
L-6186	++	++++	++	Open-cells systems, polyester or polyether-based, for densities up to 30 kg/m^3
L-6188	++	++	+	Open-cells systems, polyesters or polyether-based, foam density > 30 kg/m^3
L-6189	++++	+++	+++	Excellent for low-density foams, 10-15 kg/m^3, water-blown, polyethers or polyesters-based, fine and homogeneous cell structure, good polyol solubility
Y-16646 (*)	+++	+	++++	High-purity silicone, excellent for low-density foams such as packaging and OCF. Wide compatibility with polyethers and polyesters, strong foam stabilization

Typical properties are average data and are not to be used as or to develop specifications.

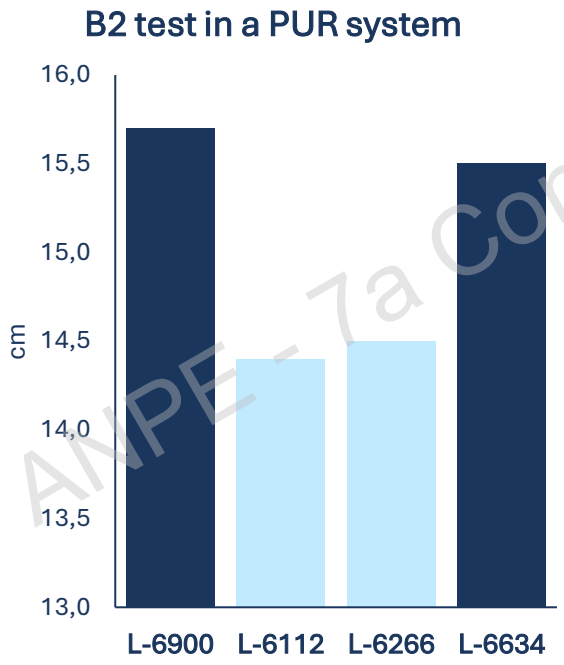
HFO = Hydroflouoro Olefin. Features: Strong = ++++, Moderate = +

(*) High-purity silicones: impurities listed as SVHC below 0.1% by weight.

Special Surfactants with Enhanced FR Performance

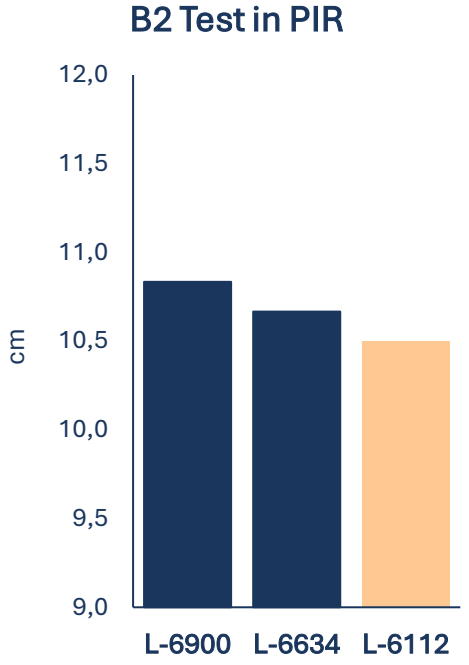
Discontinuous applications (panels or spray foam) present greater challenges in meeting FR requirements compared to lamination. In this context, silicone surfactants can contribute to achieving a B2 classification.

PUR Internal Formulation	
Polyol mix	100
Flame retardant	15
Catalyst package	4
Surfactant	4
Water	2.2
Formic acid & HFO	
MDI Index	120



In **continuous applications**, the required FR properties are mainly achieved through PIR, L-6112 can contribute marginally to flame height reduction.

PIR Internal Formulation	
Polyester Polyol	100
Catalysts package	3
Flame retardant	10
Surfactant	3
N-pentane	
MDI Index	300



Test data. Actual results may vary.

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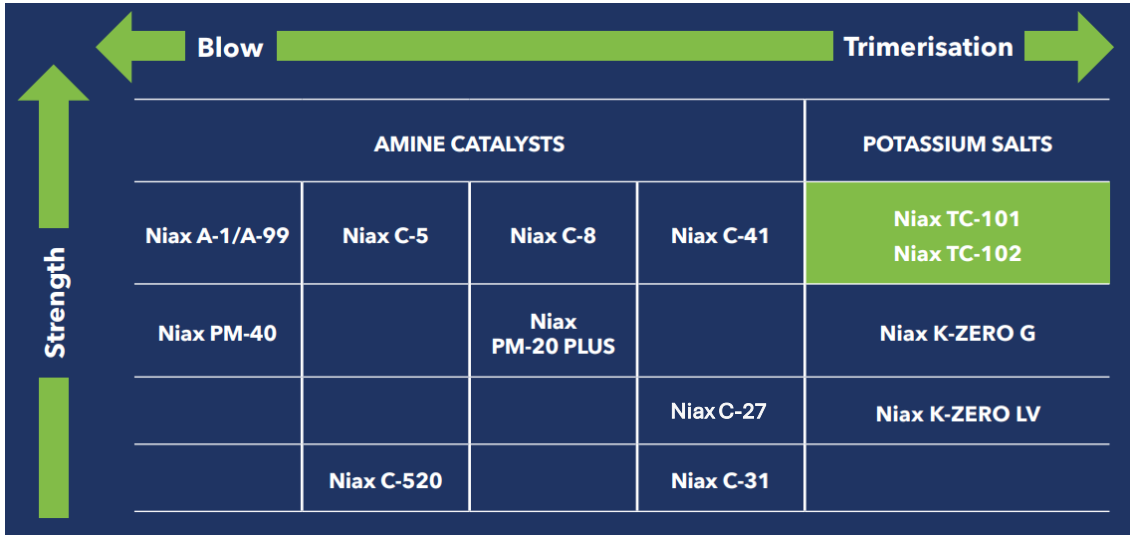
Catalysts

Standard Catalysts	Description
Niax Catalyst A-1	High selectivity toward water/MDI reaction
Niax Catalyst C-5	General purpose blowing catalyst
Niax Catalyst C-520	Easy metering blowing catalyst
Niax Catalyst Potassium Octoate	15% potassium content K-Octoate
Niax Catalyst Potassium Octoate LV	15% potassium content K-Octoate, low viscosity
Niax Catalyst Potassium Acetate	15% potassium content K-Acetate

Curing Additives	Description
Niax Additive RA-1	Delayed action catalyst, highly selective towards PIR reactions. Improved surface cure in PIR boards and metal panels
Niax Catalyst C-27	Low odor catalyst offering improved shelf life for water co-blown systems
Niax Catalyst C-31	Delayed action catalyst, highly selective towards PIR reactions. Improved surface cure and reduced post-expansion, excellent candidate for high thickness boards

Special Catalysts	Description
Niax Catalyst PM-40	Easy metering blowing catalyst, no "toxic" label
Niax Catalyst PM-20 PLUS	Combined blow-gel-trimerization catalyst, improved foam surface cure
Niax Catalyst K-ZERO G	Glycol free potassium salt, 15% potassium, reduced MDI consumption
Niax Catalyst K-ZERO LV	Glycol free potassium salt, 13% potassium, reduced MDI consumption, very low viscosity, 600 mPas
Niax Catalyst TC-101	Trimerisation catalyst based on a non-reprotoxic salt. Increased efficiency and enhanced trimer conversion versus standard octoates. Low viscosity to facilitate on-line metering
Niax Catalyst TC-102	Trimerisation catalyst based on a non-reprotoxic salt. Increased efficiency versus standard octoates, smoother rise profile. Low viscosity to facilitate on-line metering



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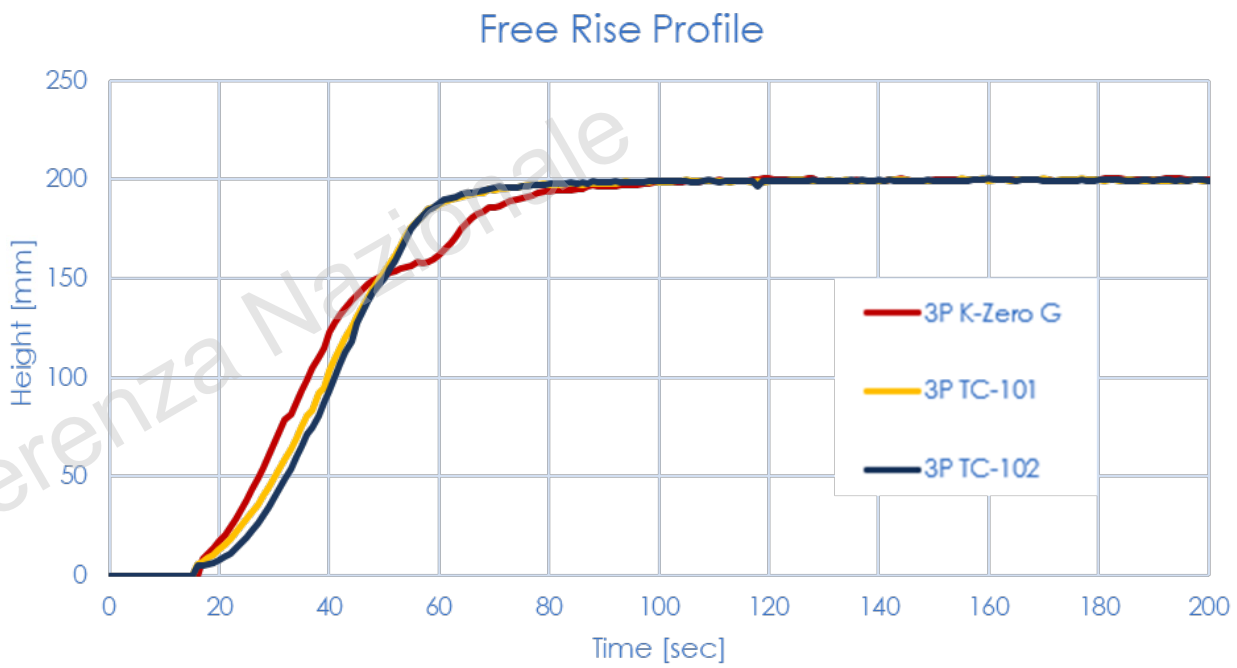
New Trimerization Catalysts

Rise Profile & Foam Cure

Same Use Level

- Niax™ catalyst **TC-101** and **TC-102** are highly efficient trimerization catalysts based on non-reprotoxic salts.
- Both Niax catalyst TC-101 and TC-102 have a smooth rise profile vs. K-Octoate. This can be beneficial for processing on a laminator line.
- By their higher trimer efficiency, Niax catalyst TC-101 and TC-102 result in faster tack free times when used at the same level.
- Niax catalyst TC-101 is based on a diluent phase with lower OH value in comparison with Niax catalyst TC-102.



	3P K-ZERO G	3P TC-101	3P TC-102
Gel Time [sec]	48	50	50
Tack Free Time [sec]	118	95	93
Density [kg/m^3]	34.6	33.2	34.1

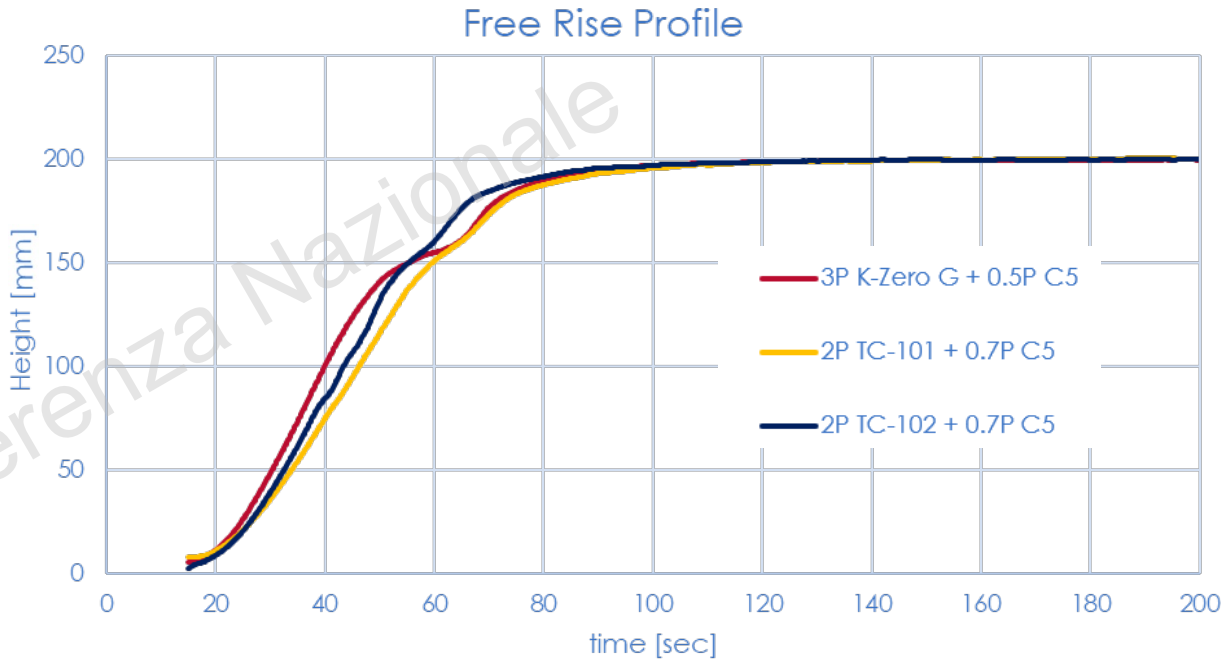
Test data. Actual results may vary.

New Trimerization Catalysts

Rise Profile & Foam Cure

Adapted Use Level - Cure Control

- A controlled end cure may be required for optimum processing. Reducing the trimer catalyst level while increasing the amine catalyst can be an approach to achieve it.
- Such adjustment maintains a smooth rise profile and delivers cure at a timing to best suit particular production line characteristics.
- It may result in a gel time closer to end of rise and a delayed cure/tack free time, which can be beneficial to foam processing.
- Overall, a **significant reduction** of Niax **trimerization catalyst TC-101** and **TC-102** can be practiced. Actual level will require optimization for specific formulations and industrial conditions.



	3P K-ZERO G 0.5P C-5	2P TC-101 0.7P C-5	2P TC-102 0.7P C-5
Gel Time [sec]	48	60	56
Tack Free Time [sec]	118	135	128
Density [kg/m^3]	34.6	35.2	34.4

Test data. Actual results may vary.

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New Trimerization Catalysts

	TC-101	TC-102
Potassium Content	13%	15%
Water Content	6%	3.25%
OH Value Without Water (mg KOH/g)	427	847
OH Value With Water (mg KOH/g)	800	1050
Viscosity (cSt)	180	170

Typical properties are average data and are not to be used as or to develop specifications.

NIAX™ CATALYST TC-101

More recent grade, production batches completed

- Market introduction in further progress, large scale quantities available
- Non reprotoxic, low in viscosity, with smooth rise profile and controlled cure
- Lower OH-Value

NIAX™ CATALYST TC-102

Commercial non reprotoxic grade

- Low in viscosity, presents a smooth rise profile and controlled cure
- Use level typically lower vs potassium octoate

Conclusions

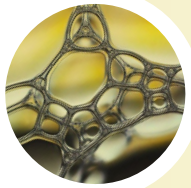
Momentive Portfolio for Rigid Foam Applications

Momentive provides a comprehensive portfolio that supports all rigid foam applications, including solutions designed to address the challenges posed by ECHA increasingly stringent chemical-labeling requirements.

SILICONES SURFACTANTS

Conventional and **high purity** grades, for:

- lambda improvement
- enhanced surface quality
- fire properties improvement



NUCLEATING ADDITIVES

Conventional and **high purity** solutions for:

- co-surfactants enabling lambda optimization

CATALYSTS

Broad portfolio of amines and trimerization catalysts, including:

- HFO-resistant catalysts
- **new trimerization catalysts**, not based on K-octoate

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Acknowledgements

RIGID & MOLDED FOAMS, SPECIALTY APPLICATIONS

METAL PANELS CONTINUOUS LAMINATION

INSULATION BOARDS & BLOCKS CONTINUOUS LAMINATION

CONTACT US

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NIAX ADDITIVES BY MOMENTIVE

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