HUNTSMAN

Enriching lives through innovation

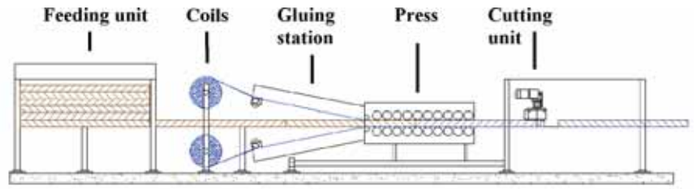
ADHESIVES

Panel laminating

Two-component adhesives systems

SUPRASEC® MDI

Process Diagram



Polyurethane adhesive feed:

Side 1	Isocyanate
Side 2	Formulated polyol blend
Index	Between 103 and 120

Huntsman Polyurethanes pioneered the development of MDI technology over 40 years ago. Today the company maintains a deep understanding of this chemistry through continuous innovation and by working with customers to support their formulating, processing and handling requirements. Huntsman Polyurethanes employs over 500 scientists and engineers in more than 20 countries around the world.

Introduction

Sandwich panels are an attractive option in new buildings such as machine halls, cold storage rooms, mobile homes and warehouses. Modern bonding technology must meet the increasing performance demands on products and goods for the construction industry.
With Huntsman Polyurethanes' adhesive systems for continuous panel laminating (CPL), based on its SUPRASEC® diphenylmethane diisocyanate (MDI) and DALTOFOAM® formulated polyol blend, higher efficiency targets can be reached and production outputs increased.
Adhesive systems developed by Huntsman enhance the performance of sandwich boards with features such as faster green-strength build-up, greater flexibility and higher bonding strength.

Process

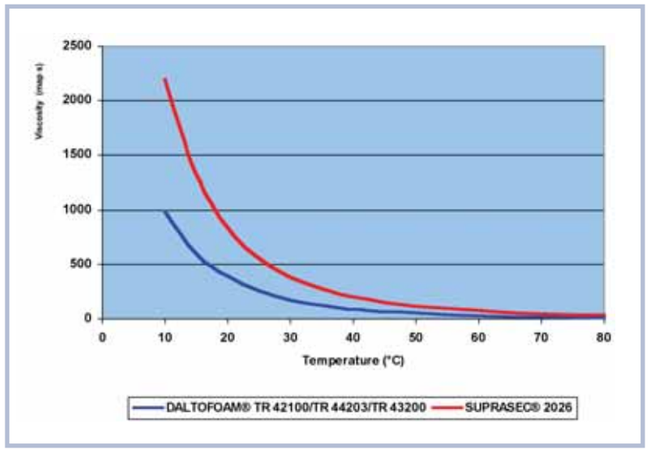
Continuous lamination is generally used for the large-scale manufacture of long production runs with a standard design. Construction panels, made in a continuous process, can be manufactured by bonding steel, aluminum or foil-stressed skin materials to polyurethane or polystyrene foam, mineral wool or other insulating cores.
The equipment to produce the panels is a relatively high investment cost but the production and labor cost is low. New continuous panel laminators or double-belt laminators have been designed to increase production speed. To accommodate the requirements of this new machinery, Huntsman Polyurethanes has introduced a new generation of panel laminating polyurethane adhesives.

The excellent sealing process provided by Huntsman Polyurethanes' adhesives based on SUPRASEC® MDI and DALTOFOAM® polyol blend allows the laminated panel to absorb the stresses of the structural weight while providing excellent thermal adaptability.

Raw Materials combinations and standard characteristics

System	Product type	Product name	Viscosity at 25°C, mPa.s	Density at 25°C, g/cm³
High performance -low speed-	Isocyanate	SUPRASEC® 2026	500	1.22
	Formulated polyol blend	DALTOFOAM® TR 42100	270	1.05
High performance -conveyer belts of standard length and speed -	Isocyanate	SUPRASEC® 2026	500	1.22
	Formulated polyol blend	DALTOFOAM® TR 44203	270	1.05
High performance -conveyer belts of limited length and higher speed *-	Isocyanate	SUPRASEC® 2026	500	1.22
	Formulated polyol blend	DALTOFOAM® TR 43200	260	1.05

Influence of temperature on viscosity profile



measured with Brookfield (spindle 21)

Huntsman Polyurethanes offers three adhesives systems for panel laminating.

High performance elastomeric systems

- SUPRASEC® 2026/DALTOFOAM® TR 42100 system with slow reactivity
- SUPRASEC® 2026/DALTOFOAM® TR 44203 system with medium reactivity
- SUPRASEC® 2026/DALTOFOAM® TR 43200 system with fast reactivity

SUPRASEC® 2026 is a modified MDI containing some higher functionality isocyanates. It is developed primarily for usage in two-component panel laminating adhesives (PLA).
The selection of the resin formulation is based on processing speed and machine type (distance glue station towards conveyer belt) (see reactivity control).

These high performance systems offer good flexibility and allow higher production efficiency due to the faster 'green-strength'

Processing Speed	Distance glue station from press	
	1 m	3 m
2 m/min	DALTOFOAM® TR 44203	DALTOFOAM® TR 42100
3 m/min	DALTOFOAM® TR 44203	DALTOFOAM® TR 42100
4 m/min	DALTOFOAM® TR 44203	DALTOFOAM® TR 44203
5 m/min	DALTOFOAM® TR 44203 / TR 43200	DALTOFOAM® TR 44203
.....	DALTOFOAM® TR 43200	DALTOFOAM® TR 43200

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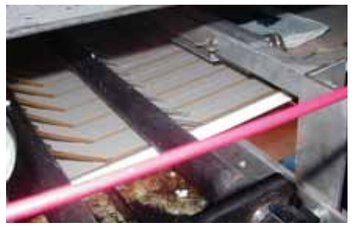
Application methods for high performance elastomeric systems



1. Fingertips + wiper
Both materials are side by side on the surface and are mixed by wiper on the inner facing surface.
Results in some distribution fluctuations.

2. Dispensing technique
Both materials are mixed under low pressure conditions prior to use.
Adhesive system is put on the substrates.
Results in an even distribution

3. Spray application
Both materials are mixed under low or high pressure conditions prior use.
Adhesive system sprayed on the facings.
Results in an even distribution.

Processing recommendations

Temperature 20 ± 2 °C					
It is recommended that the chemicals are mixed as follows:					
DALTOFOAM® TR 42100	100 pbw*	DALTOFOAM® TR 44203	100 pbw	DALTOFOAM® TR 43200	100 pbw
SUPRASEC® 2026	170 pbw	SUPRASEC® 2026	70 pbw	SUPRASEC® 2026	170 pbw
OR					
DALTOFOAM® TR 42100	40 pbv**	DALTOFOAM® TR 44203	40 pbv	DALTOFOAM® TR 43200	40 pbv
SUPRASEC® 2026	60 pbv	SUPRASEC® 2026	60 pbv	SUPRASEC® 2026	60 pbv

Machine type:
Continuous panel laminator.

* part by weight
** part by volume

Properties comparison of the three Huntsman adhesives systems

Reactivity control.

The system based on SUPRASEC® 2026 and DALTOFOAM® TR 43200 is reacting faster than the one based on SUPRASEC® 2026 and DALTOFOAM® TR 42100 whereas the system based on DALTOFOAM® TR 44203 is the slowest.

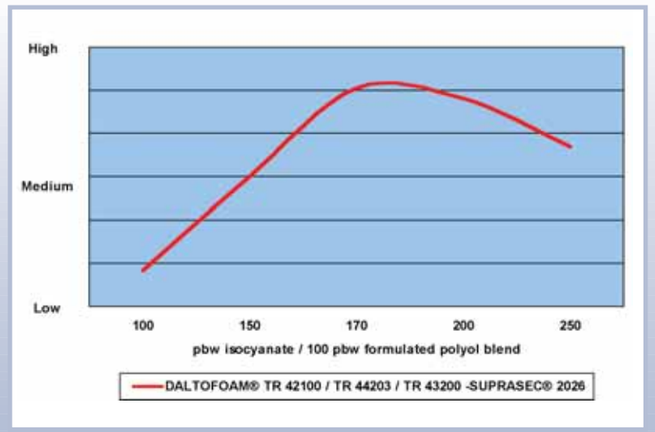
Typical values (at 20°C) in seconds

	SUPRASEC® 2026 DALTOFOAM® TR 42100	SUPRASEC® 2026 DALTOFOAM® TR 44203	SUPRASEC® 2026 DALTOFOAM® TR 43200
Cream time	18	11	11
Full cup	47	25	21
String time	78	27	24
End of Rise	119	51	36

Cream time (CT) = time at which gas bubbles begin to form within the reacting liquid.
String time (ST) = a fast increase in the viscosity of the material.

Influence of mixing ratio on bond strength

SUPRASEC® 2026 DALTOFOAM® TR 42100/TR 44203 / TR 43200					
DALTOFOAM®, in pbw			100		
SUPRASEC®, in pbw	100	150	170	200	250
Isocyanate Index	68	101	114	134	168
Application time (seconds)			15		



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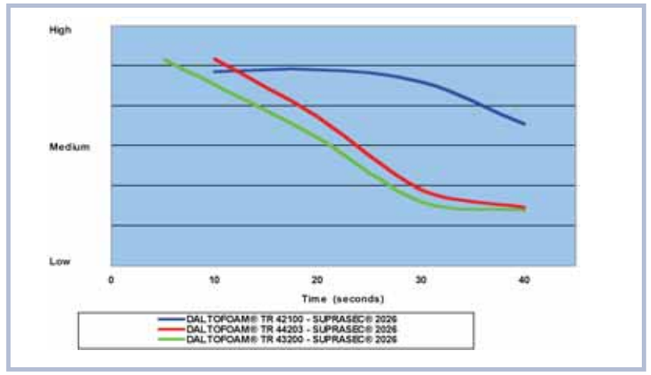
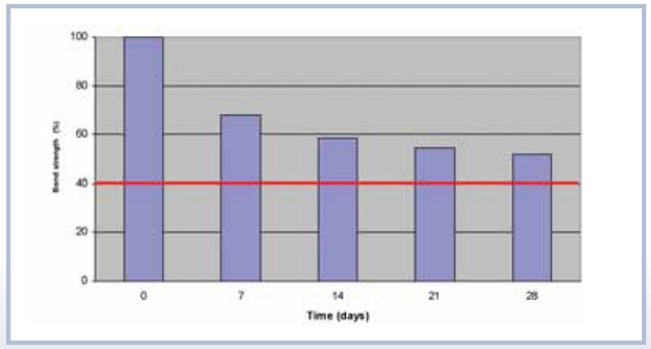
Influence of the application time on bond strength

SUPRASEC® 2026 DALTOFOAM® TR 42100/TR44203/TR 43200				
DALTOFOAM®, in pbw	100			
SUPRASEC®, in pbw	170			
Isocyanate Index	114			
Application time (seconds)	10	20	30	40



Durability test : mineral wool failure



A drop is observed which is caused by the reduced bond strength of the mineral wool binder.

High temperature exposure

As PU systems tend to fail at higher temperature, full sandwich panels are exposed to 150°C for one month. This to simulate the impact of direct sun-light onto panels which can cause surface temperatures up to 80°C.

Start	100 %
End	60 %
Drop	40 %

Here also the drop is completely caused by the mineral wool binder failure.

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Huntsman Polyurethanes is committed to your business and can offer fast and flexible response to your needs

Believing in confidential dialogue, we offer direct links into the laboratories with full technical backup. Commercial support and dedicated customer service is available throughout Europe, Asia and the US.

Contact us
ACE@Huntsman.com
Phone: 32 (0)2 758 9420
Fax: 32 (0)2 758 7420
www.huntsman.com/pu/ACE

The Huntsman story
Global resources for local needs

Huntsman Polyurethanes is a business division of Huntsman Corporation. Huntsman is a global manufacturer and marketer of differentiated chemicals. Its operating companies manufacture products for a variety of global industries including chemicals, plastics, automotive, aviation, textiles, footwear, paints and coatings, construction, technology, agriculture, health care, detergent, personal care, furniture, appliances and packaging. Originally known for pioneering innovations in packaging, and later rapid and integrated growth in petrochemicals, Huntsman today has 13,000 employees and 78 operations in 24 countries. The company had 2007 revenues of over $ 10 billion.

Products may be toxic and require special precautions in handling. The user should obtain Safety Data Sheets from Huntsman Polyurethanes and Huntsman Performance Products containing detailed information on toxicity, together with proper shipping, handling and storage procedures, and should comply with all applicable safety and environmental standards.

Hazards, toxicity and behaviour of the products may differ when used with other materials and are dependent on the manufacturing circumstances or other processes. Such hazards, toxicity and behaviour should be determined by the user and made known to handlers, processors and end users.