

HUNTSMAN

Enriching lives through innovation



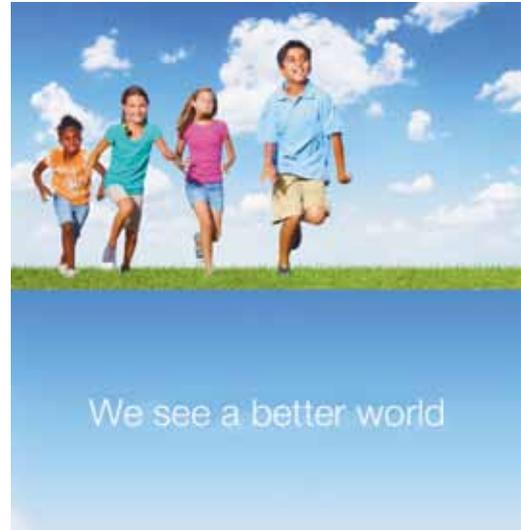
Huntsman Polyisocyanate Hardeners



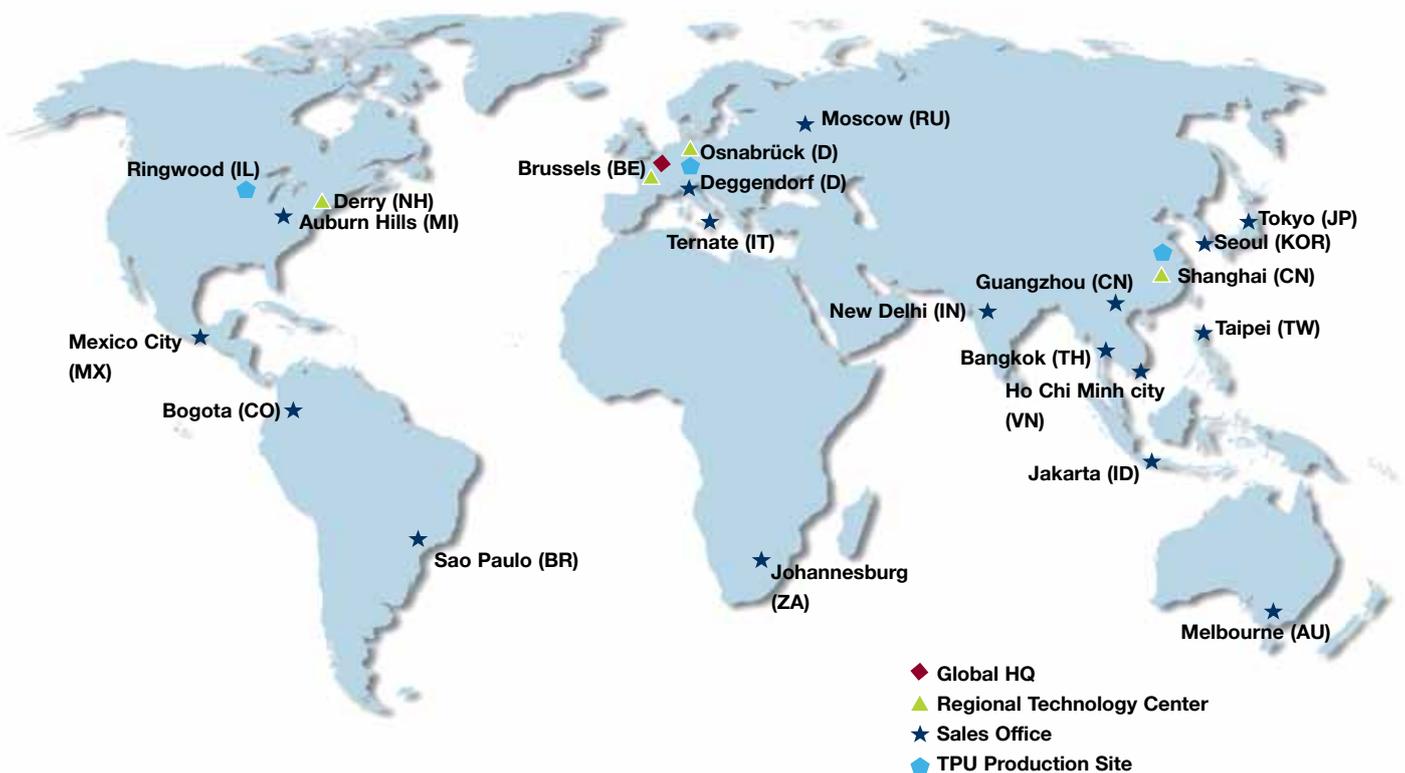
About Huntsman Corporation

Huntsman is a global manufacturer and marketer of differentiated chemicals. Our 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, for rapid and integrated growth in petrochemicals, Huntsman has approximately 2,000 employees and operates from multiple locations worldwide. The Company had 2011 revenues of over \$11 billion.

With sales and operations sites located around the globe, Huntsman is able to deliver a quality service to customers worldwide. The IRODUR® range of hardeners is manufactured by Huntsman's thermoplastic polyurethane (TPU) team in Germany.



Global TPU presence



Huntsman: A strong partner for the adhesives industry

Huntsman is a specialist supplier to the adhesives industry. We provide chemistries to help create epoxy, acrylate, polyurethane solvent-based, polyurethane water-based and TPUs for solvent-based and hot melt solutions.

Our portfolio features a wide range of hardeners, also known as crosslinkers or curing agents. These are offered under the trade name IRODUR® and are used across a variety of markets including the footwear sector.

Hardener experience that's tough to beat

- More than 30 years expertise
- Regional technical capabilities
- Solutions manufactured and packaged in Germany
- Products specified by leading manufacturers including famous sports brands.

Quality assured

- Fully automated and closed production lines
- Extremely low moisture content in solvents used
- ISO 9001 certified.

Flexible response to market demand

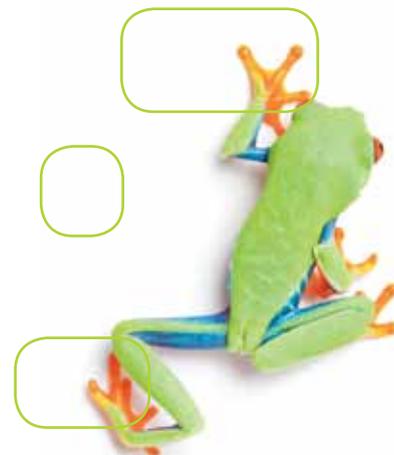
With regional technical representatives located around the world, our team is able to respond to customer demands quickly and efficiently. As well as producing innovative new materials to help ensure adhesive performance is maintained regardless of application, we also offer best practice advice on changing materials; modifying designs; production procedures; quality requirements; and environmental obligations.



Why use IRODUR® hardeners?

Under the trade name IRODUR®, Huntsman offers a range of polyisocyanates that are used as hardeners for two-component polyurethane and polychloroprene adhesives. Adding IRODUR® to adhesive formulations results in:

- Optimum cohesion and adhesion
- Rapid crosslinking and fast curing
- Outstanding heat stability
- Maximum resistance to solvents, fats and plasticizers.



Product range overview

IRODUR® E 763: For white sport shoes. Excellent UV resistance where color is important. Solvent ethyl acetate.

IRODUR® E 730 N: For white sport shoes. Superb UV and heat resistance when color is important. Solvent ethyl acetate.

IRODUR® F 108: Good oil resistance. Mainly used in primers. Can be used where flammable solvents are not allowed.

IRODUR® E 667: A special solution that must only be used in combination with polyurethane dispersions (PUD) / water-based systems.

IRODUR® E 930: Reliable heat resistance. Mainly used in primers.

IRODUR® F 318 N: Excellent heat and oil resistance.

Processing recommendations

Mixing IRODUR® hardeners and an adhesive solution should happen just prior to application. The mix ratios should be 95% adhesive solution to 5% hardener. The resulting combined adhesive / hardener may be applied to the prepared (roughened or solvent-wiped) surface:

- **Manually via brush, roller or spatula**
- **Mechanically via roller, knife, spray or air gun.**

To ensure good adhesion the mixture must be used up within the pot-life.

Note: The adhesive solution must be applied onto both surfaces. If a preparatory solvent is used it must be given time to evaporate and the surface must be dry and tack-free. Depending on the quantity applied this could take between 30 to 60 minutes. Quite often the cause of poor bonding is insufficient drying time. The adhesive layer must be activated at the required temperature and pressed for a minimum of four seconds at 60 psi (pounds per square inch).

Global offering with local support

Technical support

At Huntsman we build partnerships with our customers based on knowledge, trust and experience. This commitment means that comprehensive levels of technical support are always assured. As standard we offer:

- Access to a network of international specialists at locations around the world
- Global reach combined with local knowledge
- Innovative solutions to help solve complex challenges
- The highest levels of customer service.

Development center

To keep pace with modern formulating and manufacturing techniques, we make regular investments at our global technical center – purchasing the very latest processing equipment. This approach ensures our work remains current and relevant. Using industry standard machines to test new products and create prototypes or customer samples, we can respond rapidly to emerging trends with practical solutions that are ready to go straight into production – a major benefit for customers.

Alongside our customers we work closely with industry associations, universities and research centers around the world to keep ahead of the latest innovations and market developments.



Global technical centers

Osnabrück

Hafenringstrasse 1
49090 Osnabrück
Germany
Tel.: +49 541 91 41 0
Fax: +49 541 91 41 395

Shanghai

455 Wen Jing Road
Minhang Economic & Technical
Development Zone, Shanghai 200245
P.R. China
Tel.: +86 21 2403 7239
Fax: +86 21 2403 7000

Derry

52 Kendall Pond Rd
Derry, NH 03038
USA
Tel.: +1 603 421 3500
Fax: +1 603 421 3510

Solutions for adhesive applications

Individual IRODUR® hardener grades are available with properties geared specifically towards particular fields of adhesive application:

- Footwear
- Automotive
- Packaging
- Furniture production.



IRODUR® hardener

A firm favourite for footwear applications

IRODUR® hardeners are used where the strength and reliability of an adhesive bond really matters, for example, in shoe sole applications where different materials need to firmly stick together.

Huntsman offers a choice of IRODUR® hardeners for the footwear industry including solutions for different soling substrates such as leather, EVA, PVC and rubber - helping adhesive formulators and footwear designers improve quality and performance every step of the way.

- Sport shoes
- Casual shoes
- Safety shoes
- Fashion shoes



Advantages

- Significantly raise the softening point of adhesive films
- Improve solvent resistance and ability to withstand the migration of plasticizers, grease and oil
- Increase the resistance to chemical degradation / hydrolysis
- Significantly improve the water resistance of bonds with wood glues based on certain polyvinyl acetate dispersions
- Based on aliphatic isocyanates enhancing the resistance of the adhesive to discoloration when exposed to light.

Product selection: Pot life

IRODUR® hardener grades can be classified into three main categories according to pot life:

IRODUR® hardeners with a short pot life

Grade name	Solvent	Pot life	Color	NCO content
IRODUR® F 818	Methylene chloride	approx. 6-9h / 23°C	light brown to dark brown	5,5% ± 0,2%
IRODUR® F 108	Methylene chloride	approx. 6-9h / 23°C	light brown to dark brown	6,1% ± 0,2%
IRODUR® M 549	Ethyl-acetate	approx. 6-9h / 23°C	brown	9,2% ± 0,2%

IRODUR® hardeners with a medium pot life

Grade name	Solvent	Pot life	Color	NCO content
IRODUR® F 318 N	Ethyl-acetate	approx. 20h / 23°C	slightly brownish	7,2% ± 0,2%
IRODUR® E 462	Ethyl-acetate	approx. 20h / 23°C	brown	8,2% ± 0,2%
IRODUR® E 359	Ethyl-acetate	approx. 24h / 23°C	brown	6,1% ± 0,2%

IRODUR® hardeners with a long pot life

Grade name	Solvent	Pot life	Color	NCO content
IRODUR® E 763	Ethyl-acetate	24-36h / 23°C	water-clear	2,0% ± 0,3%
IRODUR® E 730	Ethyl-acetate	24-35h / 23°C	water-clear	2,0% ± 0,3%
IRODUR® E 803	Ethyl-acetate	24-35h / 23°C	water-clear	4,8% ± 0,3%
IRODUR® E 730N	Ethyl-acetate	>36h / 23°C	water-clear	4,8% ± 0,5%
IRODUR® E 820	Ethyl-acetate	>36h / 23°C	water-clear	7,2% ± 0,5%



Product selection: Type of adhesive

IRODUR® hardeners can be classified into two main categories, depending on the type of adhesive that they will be used with:

IRODUR® hardeners for water-based adhesives

IRODUR® hardeners are used as a crosslinking agents in adhesives based on aqueous dispersions, for example polyurethane, and for water resistant wood glues based on PVAC dispersions to comply with section D4 of DIN EN 204.

Grade name	Solvent	NCO content	Solid content	Viscosity	Color
IRODUR® E 667	Ethyl-acetate	17,5% ± 1,0%	approx. 80%	<100mPas/20°C	water-clear

IRODUR® hardeners for solvent-based adhesives

These grades of IRODUR® hardeners are used as crosslinking agents in solvent based adhesive systems. Typical examples are adhesives of natural and synthetic rubber or hydroxyl polyurethane.

Grade name	Solvent	Color	Solid content	NCO content
IRODUR® E 763	Ethyl-acetate	water-clear	>11%	2,0% ± 0,3%
IRODUR® E 320	Ethyl-acetate	brown	11% ± 2,0.	3,3% ± 0,2%
IRODUR® F 818	Methylene chloride	brown	19% ± 2,0.	5,5% ± 0,2%
IRODUR® F 108	Methylene chloride	brown	20% ± 2,0.	6,1% ± 0,2%
IRODUR® E 359	Ethyl-acetate	brown	20% ± 2,0.	6,1% ± 0,2%
IRODUR® E 730	Ethyl-acetate	water-clear	approx. 22%	3,6% ± 0,3%
IRODUR® E 462	Ethyl-acetate	brown	27% ± 2,0.	8,2% ± 0,2%
IRODUR® E 549	Ethyl-acetate	brown	27% ± 2,0.	8,2% ± 0,2%
IRODUR® E 803	Ethyl-acetate	water-clear	min. 27,5%	4,8% ± 0,3%
IRODUR® E 730 N	Ethyl-acetate	water-clear	min. 30%	4,8% ± 0,5%
IRODUR® E 930	Ethyl-acetate	yellowish	approx. 35%	6,9% ± 0,2%
IRODUR® C 720	Ethyl-acetate	water-clear	min. 35%	6,5% ± 0,2%
IRODUR® E 820	Ethyl-acetate	water-clear	min. 40%	7,2% ± 0,5%
IRODUR® F 318 N	Ethyl-acetate	slightly brownish	27% ± 0,2%	7,2% ± 0,2%

Product list of Huntsman IRODUR® hardeners

	C 720	E 320	E 359	E 462	E 667	E 730
Solvent	Ethyl-acetate	Ethyl-acetate	Ethyl-acetate	Ethyl-acetate	Ethyl-acetate	Ethyl-acetate
Pot life	24-36 h/23°C	approx. 24 h/23°C	approx. 24 h/23°C	approx. 20 h/23°C		24-36 h/23°C
Color	water-clear	brown	brown	brown	water-clear	water-clear
Solid content	min. 35%	11% ± 2,0.	20% ± 2,0.	27% ± 2,0	approx. 80%	approx 22%
NCO content	6,5% ± 0,2%	3,3% ± 0,2%	8,2% ± 0,2%	8,2% ± 0,2%	17,5% ± 1,0%	3,6% ± 0,3%
Density / 20 °C	0,96 g/cm ³	0,96 g/cm ³	0,96 g/cm ³	0,96 g/cm ³	approx. 1,10 g/cm ³	0,96 g/cm ³
Applications						
Footwear	●	●	●	●	●	●
Automotive	●	●	●	●	●	●
Packaging	●	●	●	●	●	●
Textile	●	●	●	●	●	●
Furniture	●	●	●	●	●	●
Features						
Low reactivity	●	●				
Medium reactivity	●		●	●		●
High reactivity						
Short pot life	●	●	●	●		●
Long pot life	●	●	●	●		●
Customer benefits						
Excellent heat resistance	●	●	●	●	●	●
Improves the resistance of the bond to water					●	
Improves the resistance of the bond to plasticisers					●	
Improves the resistance of the bond to solvents					●	
Good green strength	●	●	●	●		●

Packaging and storage



Bottles

- Aluminium bottles suitable for shipping solvent based products
- 1 liter (between 0,75 kg / 0,80 kg)

Depending on the type of product.

E 730 N	E 763	E 803	E 820	E 930	F 108	F 318 N	F 818	M 549
Ethyl-acetate	Ethyl-acetate	Ethyl-acetate	Ethyl-acetate	Ethyl-acetate	Methylene chloride	Ethyl-acetate	Methylene chloride	Ethyl-acetate
>36 h/23°C	24-36 h/23°C	24-36 h/23°C	36 h/23°C	approx. 24 h/23°C	approx. 6-8 h/23°C	approx. 20 h/23°C	approx. 6-8 h/23°C	approx. 6-8 h/23°C
water-clear	water-clear	water-clear	water-clear	yellowish	light brown to dark brown	slightly brown	light brown to dark brown	brown
min. 30%	> 11%	min. 27,5%	min. 40%	approx. 35%	20% ± 2,0.	27% ± 2,0.	19% ± 2,0.	27% ± 2,0.
4,8% ± 0,5%	2,0% ± 0,3%	4,8% ± 0,3%	7,2% ± 0,5%	6,9% ± 0,2%	6,1% ± 0,2%	7,2% ± 0,2%	5,5% ± 0,2%	8,2% ± 0,2%
0,96 g/cm ³	0,96 g/cm ³	0,96 g/cm ³	1,00 g/cm ³	0,96 g/cm ³	1,30 g/cm ³	0,96 g/cm ³	1,30 g/cm ³	1,30 g/cm ³
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Drums

- Drums suitable for shipping solvent based products
- Sizes 50 kg or 170 kg

For full details see individual datasheets.



Huntsman Polyurethanes is committed to working closely with its customers and can offer a fast and flexible response to your needs. We offer direct links to our laboratories with full technical backup. Commercial support and dedicated customer service is available throughout Europe, the Middle East, Asia-Pacific and the Americas.

TPU Global Headquarter Europe:

Huntsman (Germany) GmbH
Hafenringstraße 1
D - 49090 Osnabrück
Tel.: +49 541 9141-0
Fax: +49 541 9141-395
e-mail: TPU_EAME@huntsman.com
www.huntsman.com/tpu

About Huntsman:

Huntsman is a global manufacturer and marketer of differentiated chemicals. Our 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, for rapid and integrated growth in petrochemicals, Huntsman has approximately 12,000 employees and operates from multiple locations worldwide. The Company had 2011 revenues of over \$11 billion. For more information about Huntsman, please visit the Company's website at HYPERLINK "http://www.huntsman.com" www.huntsman.com.

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Sales locations:

AMERICAS

Huntsman
2190 Executive Hills Blvd.
USA - Auburn Hills, MI 48326
Tel.: +1 248-322-7300
Fax: +1 248-322-7303
e-mail: TPU_AMERICAS@huntsman.com

EUROPE

Huntsman (Germany) GmbH
Hafenringstraße 1
D - 49090 Osnabrück
Tel.: +49 541 9141-0
Fax: +49 541 9141-395
e-mail: TPU_EAME@huntsman.com

ASIA

Huntsman Polyurethanes - Thermoplastics
49F Maxdo Centre, room # 4902
8 Xing Yi Road, 200336 Shanghai
P.R. China
Tel.: +86 21 23 25 79 65
Fax: +86 21 23 25 79 68
e-mail: TPU_APAC@huntsman.com