



D.E.H.™ 444
Epoxy Curing Agent

Description D.E.H.™ 444 cycloaliphatic polyamine hardener is used as curing agent for epoxy resin. It offers low tendency to yellowing when exposed to UV irradiation, low viscosity and long pot life.

- Advantages**
- Low tendency to yellowing when exposed to UV irradiation
 - Long pot life

- Typical Applications**
- This product is suitable for use in applications such as:
- Top coats
 - Mortars
 - Coating systems

Typical Properties

Property ⁽¹⁾	Method	Value
Appearance	Visual	Clear
Color, Gardner		Max 1
Density @ 25°C (g/ml)	ASTM D4052	1.0
Viscosity @ 25°C (mPa·s)	ASTM D445	160 - 220
Amine value [mgKOH/g]	ISO 9702	320 - 350
Amine Hydrogen Equivalent Weight	Calculated	93
Shelf Life (Months)		12

(1) Typical properties, not to be construed as specifications.

Typical Handling Properties

Property	Method	Value
		D.E.R.™ 331
		D.E.H.™ 444
Dry time (hrs)	ASTM D1640-03	7
Gel Time (min/100 g mass @25°C) ²		56 - 58
Mix ratio, phr (weight)		50

⁽²⁾ Tested by Paul N. Gardner Standard Model Gel Timer

Typical Performance Properties³

Property	Method	Value
		D.E.R.™ 331
		D.E.H.™ 444
Mix ratio, phr (weight)		50
Film appearance	Visual	Semi-glossy
Glass Transition Temperature (°C) ⁽⁴⁾		74
Hardness Shore D	ASTM D2240	80
Cross Hatch Adhesion	ASTM D3359	
@ 25°C/50% relative humidity		4B
@ 25°C/95% relative humidity		2B
Blushing		
@ 25°C/50% relative humidity		No
@ 25°C/95% relative humidity		No
Flexural Strength (psi)		15258
Flexural Modulus (thousand psi)		460
Tensile Strength (psi)		9181
Tensile Modulus (thousand psi)		483
Elongation %		3.8

⁽³⁾ Unless otherwise specified, properties obtained after more than 7 days cure at ambient temperature

⁽⁴⁾ Glass transition temperature measured by DSC

Safety and Handling

The Dow Chemical Company provides its customers with a product specific Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS) to cover potential health effects, safe handling, storage, use and disposal information. Dow strongly encourages its customers to review the MSDS or SDS on its products and other materials prior to their use.

This curing agent should retain its chemical properties for a period of at least 12 months.

For further handling information, consult the Dow brochure entitled, *DOW Epoxy Curing Agents Product Stewardship Manual, Safe Handling and Storage*, Form No. 296-01331 and the Dow technical bulletin, *Product Coding, Shelf-life and Storage Stability*, Form No. 296-01657.

Product Stewardship

The Dow Chemical Company has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis of our Product Stewardship philosophy by which we assess the health and environmental information on our products and then take the appropriate steps to protect employee and public health and the environment. The Dow Chemical Company has enduring commitments to Responsible Care® in the management of chemicals worldwide. Our Product Stewardship program rests with every individual involved with Dow products from the initial concept and research to the manufacture, sale, distribution, and disposal of each product.



D.E.H.™ 445
Epoxy Curing Agent

Description D.E.H.™ 445 curing agent is a modified cycloaliphatic polyamine. It has very good chemical and mechanical resistance and is therefore suitable for highly stressed industrial floorings.

- Advantages**
- Very low tendency to yellowing in case of UV-irradiation
 - Nonylphenol free
 - Good water resistance after a short curing time.

Typical Applications This product is suitable for use in applications such as:

- Industrial Flooring

Typical Properties

Property ⁽¹⁾	Method	Value
Appearance	Visual	Clear
Color, Gardner		Max 1
Density @ 25°C (g/ml)	ASTM D4052	1.02
Viscosity @ 25°C (mPa·s)	ASTM D445	370-570
Amine value [mgKOH/g]	ISO 9702	280-310
Amine Hydrogen Equivalent Weight	Calculated	105
Shelf Life (Months)		12

(1) Typical properties, not to be construed as specifications.

Typical Handling Properties

Property	Method	Value
		D.E.R. 331™
		D.E.H. 445
Dry time (hrs)	ASTM D1640-03	5-6
Gel Time (min/100 g mass @25°C) ²		35
Mix ratio, phr (weight)		56

⁽²⁾ Tested by Paul N. Gardner Standard Model Gel Timer

Typical Performance Properties³

Property	Method	Value
		D.E.R. 331™
		D.E.H. 445
Mix ratio, phr (weight)		56
Film appearance	Visual	Semi- glossy
Glass Transition Temperature (°C) ⁽⁴⁾		42
Hardness Shore D	ASTM D2240	79
Cross Hatch Adhesion	ASTM D3359	
@ 25°C/50% relative humidity		1B
@ 25°C/95% relative humidity		1B
Blushing		
@ 25°C/50% relative humidity		No
Flexural Strength (psi)		14503
Flexural Modulus (thousand psi)		481
Tensile Strength (psi)		8167
Tensile Modulus (thousand psi)		473
Elongation %		2.5

⁽³⁾ Unless otherwise specified, properties obtained after more than 7 days cure at ambient temperature

⁽⁴⁾ Glass transition temperature measured by DSC

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D.E.H.™ 487
Epoxy Curing Agent

Description D.E.H.™ 487 is a modified cycloaliphatic polyamine curing agent with long pot life. No phenol or nonylphenol were used in the manufacture of this material. It has high reactivity, low viscosity and good acid and chemical resistance. Epoxy resin systems cured with D.E.H.™ 487 at temperatures above 10 °C show an outstanding early water resistance.

- Advantages**
- Low viscosity
 - High reactivity
 - No phenol or nonylphenol were used in the manufacture of this material.

- Typical Applications**
- This product is suitable for use in applications such as:
- High-filled self-leveling coating systems
 - Mortars
 - Highly stressed industrial floorings

Typical Properties

Property ⁽¹⁾	Method	Value
Appearance	Visual	clear
Color, Gardner		1 max.
Density @ 25°C (g/ml)	ASTM D4052	1.04
Viscosity @ 25°C (mPa·s)	ASTM D445	170 - 270
Amine value [mgKOH/g]	ISO 9702	317
Amine Hydrogen Equivalent Weight	Calculated	93
Shelf Life (Months)		12

(1) Typical properties, not to be construed as specifications.

Typical Handling Properties

Property	Method	Value
		D.E.R.™ 331
		D.E.H.™ 487
Dry time (hrs)	ASTM D1640-03	5
Gel Time (min/100 g mass @25°C) ²		40 - 42
Mix ratio, phr (weight)		50

⁽²⁾ Tested by Paul N. Gardner Standard Model Gel Timer

Typical Performance Properties³

Property ⁽³⁾	Method	Value
		D.E.R.™ 331
		D.E.H.™ 487
Mix ratio, phr (weight)		50
Film appearance	Visual	Glossy
Glass Transition Temperature (°C) ⁴		76
Hardness Shore D	ASTM D2240	73
Cross Hatch Adhesion	ASTM D3359	
@ 25°C/50% relative humidity		1B
@ 25°C/95% relative humidity		0B
Blushing		
@ 25°C/50% relative humidity		No
@ 25°C/95% relative humidity		No
Flexural Strength (psi)		14678
Flexural Modulus (thousand psi)		493
Tensile Strength (psi)		9064
Tensile Modulus (thousand psi)		587
Elongation %		2.8

⁽³⁾ Unless otherwise specified, properties obtained after more than 7 days cure at ambient temperature ⁽⁴⁾Glass transition temperature measured by DSC

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D.E.H.™ 488
Epoxy Curing Agent

Description D.E.H.™ 488 is a modified cycloaliphatic polyamine curing agent intended for ambient curing of liquid epoxy resin. It has low viscosity and good acid and chemical resistance. Epoxy resin systems cured with D.E.H.™ 488 at temperatures above 10 °C show tack-free and colorfast surfaces. D.E.H.™ 488 has an outstanding resistance to early water spotting.

- Advantages**
- Low viscosity
 - High reactivity
 - Not manufactured with nonylphenol

- Typical Applications**
- This product is suitable for use in applications such as:
- High-filled self-leveling coating systems
 - Mortars
 - Highly stressed industrial floorings

Typical Properties

Property ⁽¹⁾	Method	Value
Appearance	Visual	clear
Color, Gardner		2 max.
Density @ 25°C (g/ml)	ASTM D4052	1.05
Viscosity @ 25°C (mPa·s)	ASTM D445	280 - 380
Amine value [mgKOH/g]	ISO 9702	300 - 330
Amine Hydrogen Equivalent Weight	Calculated	93
Shelf Life (Months)		12

(1) Typical properties, not to be construed as specifications.

Typical Handling Properties

Property	Method	Value
		D.E.R.™ 331
		D.E.H.™ 488
Dry time (hrs)	ASTM D1640-03	4
Gel Time (min/100 g mass @25°C) ²		24 - 26
Mix ratio, phr (weight)		50

⁽²⁾ Tested by Paul N. Gardner Standard Model Gel Timer

Typical Performance Properties³

Property ⁽³⁾	Method	Value
		D.E.R.™ 331
		D.E.H.™ 488
Mix ratio, phr (weight)		50
Film appearance	Visual	Glossy
Glass Transition Temperature (°C) ⁴		88
Hardness Shore D	ASTM D2240	82
Cross Hatch Adhesion	ASTM D3359	
@ 25°C/50% relative humidity		3B
@ 25°C/95% relative humidity		1B
Blushing		
@ 25°C/50% relative humidity		No
@ 25°C/95% relative humidity		No
Flexural Strength (psi)		15867
Flexural Modulus (thousand psi)		467
Tensile Strength (psi)		9398
Tensile Modulus (thousand psi)		487
Elongation %		2.8

⁽³⁾ Unless otherwise specified, properties obtained after more than 7 days cure at ambient temperature ⁽⁴⁾ Glass transition temperature measured by DSC

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D.E.H.™ 4060 Epoxy Curing Agent

Description D.E.H.™ 4060 Epoxy Curing Agent is a cycloaliphatic polyamine adduct curing agent for epoxy resins.

Benefits D.E.H.™ 4060 is used for coatings where high chemical resistance is a key requirement. Epoxy systems cured with D.E.H. 4060 at temperatures above 10°C and up to 80 % relative humidity, can achieve tack-free surfaces without blooming. Resulting coating systems are light and colourfast. It is especially used for containers, pipelines and floors and can also be formulated to be suitable for food contact applications.

- Applications**
- Building & Civil Engineering
 - Building & Civil Engineering: Roller Coating Flooring
 - Industrial Coatings: Marine and Protective

Dow Epoxy	Nominal Value	Unit	Test Method
AHEW	122	g/eq	
Viscosity, absolute (25°C)	5000 to 7000	mPa·s	ISO 3219
Colour (Max. Gardner)	4		ASTM D1544
Density (25°C)	1.05	g/cm ³	ASTM D4052
Amine Value	245 to 275	mg KOH/g	ISO 9702
Pot Life (23°C, 100 g)	30	min	GELNORM Geltimer-TC ¹

Notes

These are typical properties only and are not to be construed as specifications. Users should confirm results by their own tests.

¹ Reference Resin: D.E.R.™ 331

Safety Considerations

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D.E.H.™ 4712 Epoxy Curing Agent

Description D.E.H.™ 4712 Epoxy Curing Agent is modified cycloaliphatic polyamine curing agent for epoxy resins.

Benefits D.E.H.™ 4712 is suitable for highly filled mortars. It offers systems with good UV-stability and is therefore also suitable for paints and coatings.

- Applications**
- Building & Civil Engineering
 - Building & Civil Engineering: Mortars & Grouts
 - Building & Civil Engineering: Roller Coating Flooring
 - Industrial Coatings: Marine and Protective

Dow Epoxy	Nominal Value	Unit	Test Method
AHEW	87	g/eq	
Viscosity, absolute (25°C)	1600 to 2400	mPa·s	ISO 3219
Colour (Max. Gardner)	1		ASTM D1544
Amine Value	370 to 400	mg KOH/g	ISO 9702
Pot Life (23°C, 100 g)	20	min	GELNORM Geltimer-TC ¹

Notes

These are typical properties only and are not to be construed as specifications. Users should confirm results by their own tests.

¹ Reference Resin: D.E.R.™ 3581

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D.E.H.™ 4911

Epoxy Curing Agent

Description D.E.H.™ 4911 is a modified cycloaliphatic amine epoxy curing agent.

Benefits D.E.H.™ 4911 is a fully reactive curing agent: it contains no volatile content, including benzyl alcohol or other VOC according to the European Directive 2004/42/EC. In addition, it does not contain any alkyl phenol. Clear coatings as well as formulated coatings formulated with D.E.R.™ 3531 and D.E.H. 4911 passed the AgBB evaluation scheme; they were also awarded an A+ label according to the French labeling of construction products evaluation scheme (details of the emission test results can be found in the separate certificate document). D.E.H. 4911 can hence be used to develop flooring formulations that are meant to be applied in areas where the amount of emissions coming from construction products needs to be kept to a minimum, such as in schools, hospitals, clean rooms etc.

D.E.H.™ 4911 based specimen develop a high shore D hardness after 24 hours, at 23°C and 50% relative humidity. The use of a bifunctional reactive diluent containing epoxy resin, such as D.E.R. 3571, will permit speeding-up the shore D hardness development in the first hours after application, both at 13°C and 80% relative humidity and 23°C and 50% relative humidity. Besides, the D.E.H.™ 4911 based specimen exhibit superior mechanical properties, making this fully reactive curing agent also suitable in industrial environment.

Applications

- Roller-coat flooring
- Self-leveling flooring

Typical properties

	Nominal Value	(English)	Test Method
Viscosity at 25°C	360 - 460	mPa.s	ISO 3219
Amine value	390 - 420	mg KOH/g	ISO 9702
Amine Hydrogen Equivalent Weight	82	g/eq	Calculated

Notes

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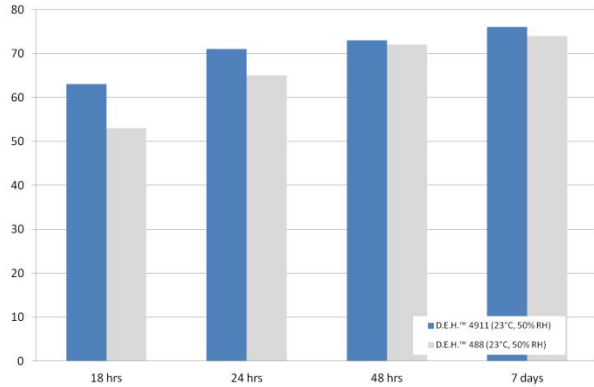
Typical Handling and Performance Properties

All data presented hereunder were developed using D.E.R. 3531 as an epoxy resin component.

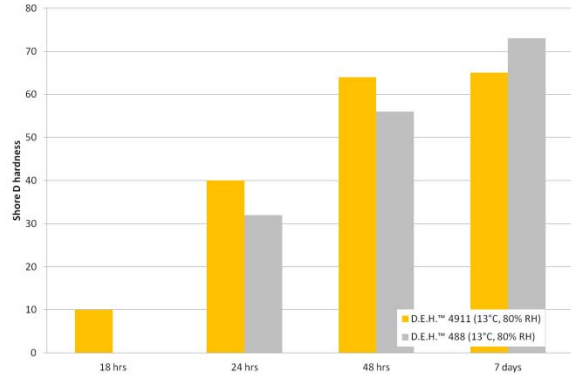
	Nominal Value	(English)
Mixing ratio	100 : 45	
Mixing viscosity at 25°C	700	mPa.s
Pot-life	50	minutes

Shore D hardness development

At 23°C and 50% Relative Humidity

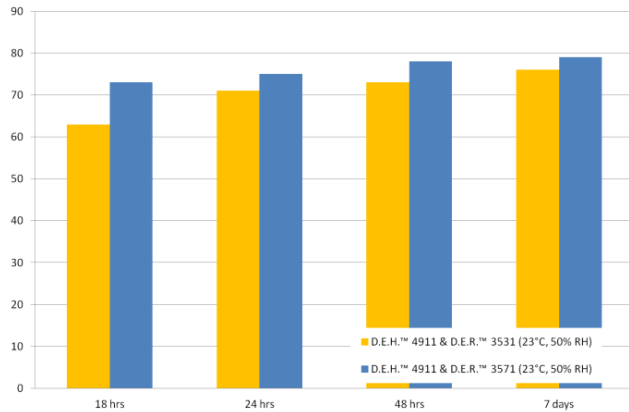


At 13°C and 80% Relative Humidity

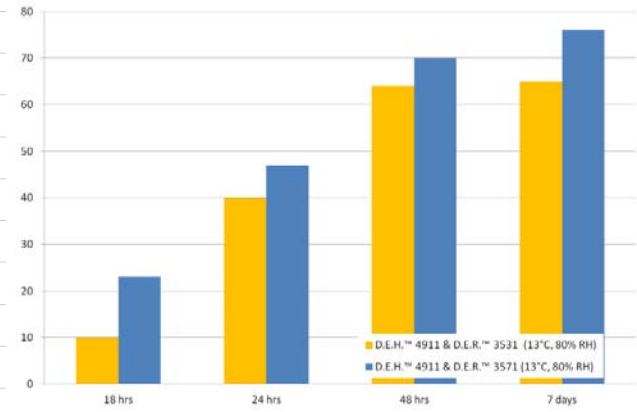


The use of a bifunctional reactive diluent containing epoxy resin, such as D.E.R.™ 3571, will permit increasing further the speed of shore D hardness development in the first hours after application.

At 23°C and 50% Relative Humidity

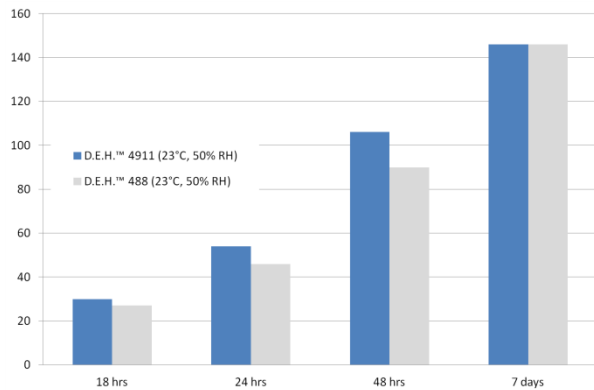


At 13°C and 80% Relative Humidity

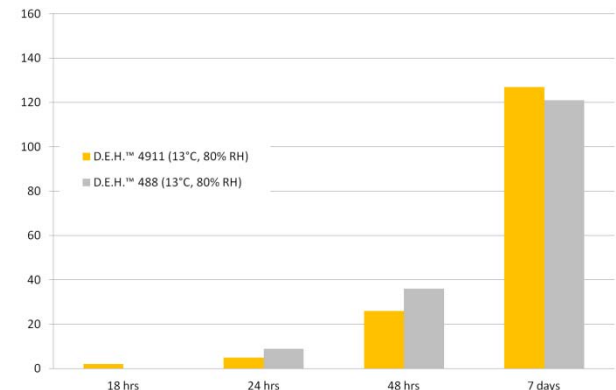


Koenig pendulum hardness development

At 23°C and 50% Relative Humidity

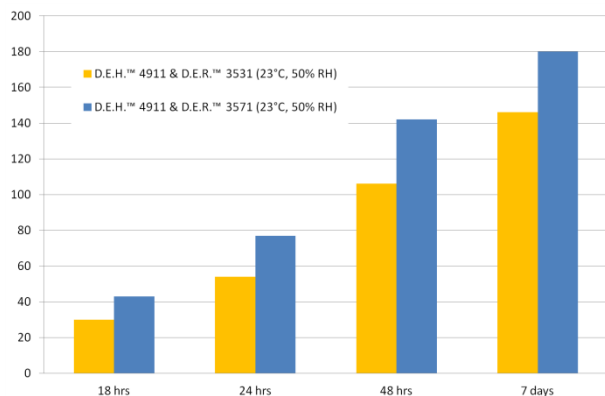


At 13°C and 80% Relative Humidity

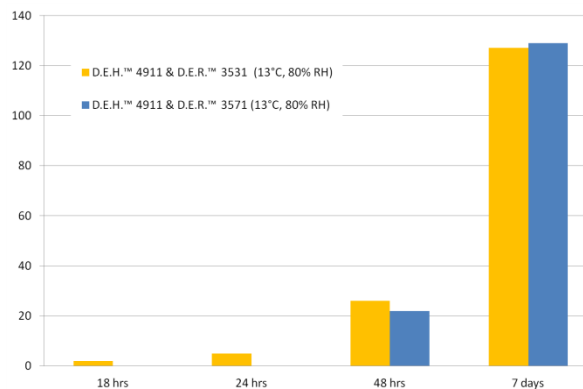


The use of a bifunctional reactive diluent containing epoxy resin, such as D.E.R.[™] 3571, will also permit increasing the speed of Pendulum hardness development at 23°C and 50% relative humidity, whilst the effect is less pronounced at 13°C and 80% relative humidity.

At 23°C and 50% Relative Humidity



At 13°C and 80% Relative Humidity



Mechanical properties

	D.E.H. [™] 4911 & D.E.R. [™] 3531	D.E.H. [™] 488 & D.E.R. [™] 3531	(English)
Tensile strength	55	32	N/mm ²
Compressive strength	107	75	N/mm ²
Flexural strength	91	60	N/mm ²

Starting formulation

Components	Mass
Part A	
D.E.R. [™] 3531	36 gr
Defoaming agent, e.g. Tego 950	0.75 gr
Pigment	2 gr
Thickening agent, e.g. Garamite 1958	0.125 gr
Silica, e.g. Silica flour SF 300	46.45 gr
D.E.R. [™] 3531	13.425 gr
Defoaming agent, e.g. Tego 950	0.75 gr
Defoaming agent, e.g. Efka 3277	0.5 gr
Part B	
D.E.H. [™] 4911	21 gr

Notes

This starting formulation allowed developing flooring specimen that passed the AgBB evaluation scheme.