



Distributed by:

ALFA
CHEMICALS

Terrace Road South, Binfield
Berkshire, RG42 4PZ
Email: info@alfa-chemicals.co.uk
Phone: 01344 397751
Fax: 01344 451400

HUNTSMAN

Enriching lives through innovation

JEFFAMINE®
Polyetheramines

INTRODUCTION

Huntsman's **JEFFAMINE**® amine product line offers the world's most extensive selection of polyetheramines, many of which are unavailable elsewhere. These highly versatile products contain primary amine groups attached to polyether backbones, typically based on propylene oxide (PO), ethylene oxide (EO), or a mixture of both oxides.

Our core **JEFFAMINE**® amine product line consists of monoamines, diamines, and triamines based on PPG or PEG polyether backbone structures. More recently, the addition of secondary, hindered, high-conversion, and polytetramethylene glycol (PTMEG)-based polyetheramines has increased the breadth and utility of our product line.

Our PPG-based **JEFFAMINE**® polyetheramines are easy to handle, low viscosity, and low color products. Our PEG-based amines are either liquids or waxy solids at room temperature, depending on molecular weight. Polyetheramines impart increased flexibility and toughness to a polymer network. They can also increase hydrophilicity depending on how the polyether backbone is designed.

With a broad range of molecular weights, functionality, and repeating unit design, Huntsman's **JEFFAMINE**® polyetheramines offer great scope to designing new compounds or mixtures. **JEFFAMINE**® polyetheramines are particularly important in the production of polyurea coating technologies, epoxy applications, and pigment dispersions.

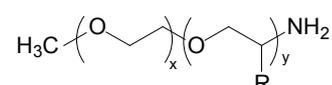


JEFFAMINE® MONOAMINES

JEFFAMINE® M Series Monoamines

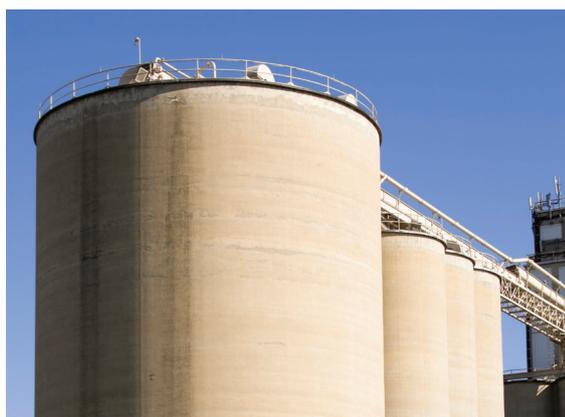
JEFFAMINE® M series polyetheramine products are monoamines based on PPG or PEG/PPG backbones. They have the following representative structure:

Structure



JEFFAMINE® M Series Monoamines*	MW	Average AHEW, g/eq	Application
Polypropylene glycol (PPG) based : Relatively hydrophobic. Preparation of comb polymers with poly(acrylic acid) or similar linear polymers.			
M-600	600	291	<ul style="list-style-type: none"> Molecular weight, flexibility control in polyamides
M-2005	2,000	1,045	<ul style="list-style-type: none"> Molecular weight, flexibility control in polyamides
Polyethylene glycol (PEG) based : Relatively hydrophilic. Formulating emulsifiers and corrosion inhibitors.			
M-1000	1,000	489	<ul style="list-style-type: none"> Ore flotation agent Agricultural emulsifier Emulsification of epoxy resins
M-2070	2,000	1,040	<ul style="list-style-type: none"> Formulating pressure sensitive adhesives Reactive dispersant
M-2095	2,000	1,120	<ul style="list-style-type: none"> Modification of epoxy resins and other thermoset resins Preparation of epoxy resin adducts. Preparation of comb polymers with poly(acrylic acid) or similar linear polymers Formulating emulsifiers, pressure sensitive adhesives, and corrosion inhibitors
M-3085	3,000	1,520	

* Above range of products are subject to availability in your region. Kindly contact your local sales representative for more information.



JEFFAMINE® DIAMINES

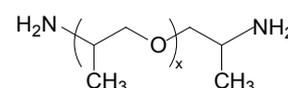
JEFFAMINE® diamines include the D, ED, and EDR series products. The D signifies a diamine with a PPG backbone, ED signifies a diamine with a predominantly PEG backbone, and EDR designates a highly reactive diamine.



JEFFAMINE® D Series Diamines

JEFFAMINE® D series diamines are polyether diamines based on a PPG backbone. The amines are low viscosity, low color, and miscible with a variety of solvents.

Structure



JEFFAMINE® D Series Diamines*	MW	Average AHEW, g/eq	Application
D-230	230	60	<ul style="list-style-type: none"> Provides tough, clear, impact resistant coatings, castings, and adhesives Reacts with carboxylic acids to form hot melt adhesives Reacts quickly with isocyanates Gives coatings free of surface blush prevalent with many amine curing agents
D-400	430	115	<ul style="list-style-type: none"> Used in polyurethanes, polyureas, and termo-plastic polyamide adhesives
D-2000	2,000	514	<ul style="list-style-type: none"> Key ingredient in the formulation of polyurea spray Co-reactant in epoxy systems which require increased flexibility and toughness Increases peel strength
D-2010	2,000	~514	<ul style="list-style-type: none"> Key ingredient in the formulation of polyurea and RIM Co-reactant in epoxy systems which require increased flexibility and toughness
D-4000	4,000	1,000	<ul style="list-style-type: none"> Co-curing agent in epoxy systems which require increased flexibility and toughness General polymer flexibilizer Increases peel strength in adhesives

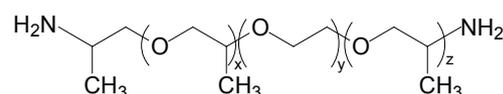
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JEFFAMINE® ED Series Diamines

JEFFAMINE® ED series diamines are polyether diamines based predominantly on a PEG backbone. PEG imparts complete water solubility to each of the products in this series. JEFFAMINE® ED diamine products are miscible with a variety of solvents, and are primarily used to impart hydrophilicity to a variety of polymers and additives.

Structure



JEFFAMINE® ED Series Diamines*	MW	Average AHEW, g/eq	Application
ED-600	600	132	<ul style="list-style-type: none"> • Preparation of epoxy resin adducts • Modification of polyamides for enhanced hydrophilicity • Hydrophilicity from polyethylene glycol • Reactivity from amine end group
ED-900	900	250	<ul style="list-style-type: none"> • Modification of polyamides for enhanced hydrophilicity • Preparation of biocompatible articles and coatings • Preparation of hydrogels with isocyanates • Hydrophilicity from polyethylene glycol • Reactivity from amine end group • Biocompatibility of polyethylene glycol
ED-2003	2,000	575	<ul style="list-style-type: none"> • Hydrophilic polymers • Antistatic agents • Epoxy modifiers • Textile treating • Water-based coatings • Water-soluble, water-dispersible, water-swallowable polyamides • Water-soluble polyurea formulations • Reactivity of the primary amine end groups

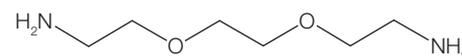
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JEFFAMINE® EDR Diamine

JEFFAMINE® EDR-148 diamine is much more reactive than other JEFFAMINE® diamines and triamines due to the unhindered nature of the amine groups. The high reactivity of JEFFAMINE® EDR-148 diamine makes it an excellent choice for fast curing adhesives, and for polyamide modification.

Structure



JEFFAMINE® EDR Series Diamines*	MW	Average AHEW, g/eq	Application
EDR-148	148	37	<ul style="list-style-type: none"> • Epoxy curing agent • Monomer for polyamides • Imparts flexibility and toughness to thermoset polymers • Can be formulated to cure at room temperature • Rapid cure at elevated temperatures • Excellent thermal shock resistance in cured epoxies

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JEFFAMINE® THF Series Amines

The JEFFAMINE® THF polyetheramines products are diamines or triamines based on either a PTMEG [poly(tetramethylene ether glycol)] / PPG (polypropylene glycol) copolymer, or a predominantly PTMEG backbone. Polyetheramines of this type are useful in a variety of polymers, including cured epoxy resins, polyurea, and polyamides. Higher molecular weight polyetheramines are effective in flexibilizing and promoting adhesive peel strength in epoxy formulations. They have also been used to improve flexibility and low temperature properties for polyamides.

As with most other JEFFAMINE® polyetheramines, the amine groups in the THF-100 amine are adjacent to methyl groups, which somewhat moderates their reactivity.

New Products*	Average AHEW, g/eq	Benefits
THF-100	260	<ul style="list-style-type: none"> • Used in polyurethanes, polyureas, and nylons
THF-170	380	

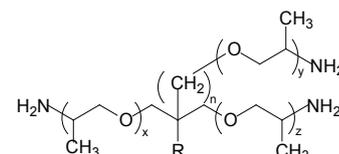
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JEFFAMINE® TRIAMINES

JEFFAMINE® T Series Triamines

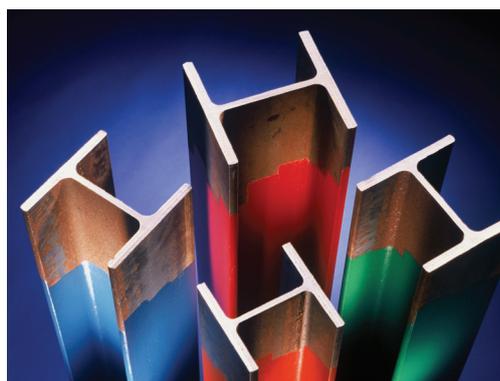
JEFFAMINE® T-series polyetheramine products are triamines based on trifunctional PPG backbones. They have the following representative structure:

Structure



JEFFAMINE® T Series Triamines*	R	MW	Average AHEW, g/eq	Application
T-403	C ₂ H ₅	440	81	<ul style="list-style-type: none"> Moderate reactivity in epoxy curing Anti-sag agent for polyurethanes Low color, viscosity, and vapor pressure. Can be blended with higher-viscosity curing agents to reduce their viscosity, or with cycloaliphatics to improve the elongation of higher-T_g cured resins Completely miscible with a wide variety of solvents, including water Improves flexibility and strength
T-3000	H	3,000	530	<ul style="list-style-type: none"> Highly reactive soft block in polyurea spray applications Thermoplastic polymer modifier and adhesion promoter in epoxy systems Modifier and curative in polyurethane elastomers and foams Flexible crosslinking Moderate reactivity
T-5000	H	5,000	952	<ul style="list-style-type: none"> Crosslinker for polyurea Co-reactant in epoxy systems where adhesion promotion and flexibility are important Surfactant and corrosion inhibitor applications Low color Increased peel strength in epoxy adhesives Increased toughness

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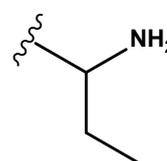
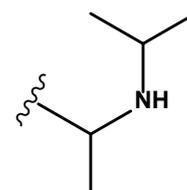
SLOWER POLYETHERAMINES

For applications where a slower curing speed is beneficial, Huntsman offers two JEFFAMINE® polyetheramine products specifically designed for longer open time, low exotherm applications.

JEFFAMINE® SD-2001 amine is a difunctional secondary amine derived from JEFFAMINE® D-2000 amine. JEFFAMINE® SD-2001 amine allows for better control of open time and curing speed in applications like polyurea spray coatings, polyurea pre-polymers, and polyurea hybrid systems.

JEFFAMINE® D-205 amine is similar in AHEW and structure to JEFFAMINE® D-230 amine. However, its primary amines are more hindered, making it slower to react with epoxy groups. JEFFAMINE® D-205 amine is a good choice for epoxy applications where longer open time and a low exotherm are highly desired.

Structure



JEFFAMINE® Amine*	Average AHEW, g/eq	Application
SD-2001	1,000	<ul style="list-style-type: none"> Slower reactions with isocyanates – more manageable polyurea application
D-205	58	<ul style="list-style-type: none"> Slower reactions with epoxy resins – more manageable large scale composites, etc

* Above range of products are subject to availability in your region. Kindly contact your local sales representative for more information.



NEW POLYETHERAMINES

JEFFAMINE® RFD-270 Amine

JEFFAMINE® RFD-270 amine is a novel amine containing both rigid (cycloaliphatic) and flexible (polyetheramine) segments in the same molecule. This product offers a unique formulating option for composites, coatings, and adhesives. When used for epoxy resin curing, this amine can provide synergistic processing and cured resin performance advantages relative to simple mixtures of polyetheramines and cycloaliphatic amines.

JEFFAMINE® RFD-270 amine can be used as an epoxy curing agent in coatings, adhesives or composites. Some of the benefits of this material are its higher glass transition temperature capability, low VOC and lower blushing.

New Products*	Average AHEW, g/eq	Benefits
RFD-270	67	<ul style="list-style-type: none"> • Faster curing and property development, allowing reduction of any accelerator usage • Low viscosity, color and vapor pressure • Lower blushing or carbamation (reaction with atmospheric carbon dioxide) compared to cycloaliphatic amines • Faster strength development than other PEA curatives and excellent mechanical properties • Potential cost savings when formulated with JEFFSOL® PC carbonate-diluted resin vs. aliphatic epoxy-diluted resin • Improved chemical resistance to typical acids and bases in coating applications

* Above product is subject to availability in your region. Kindly contact your local sales representative for more information.



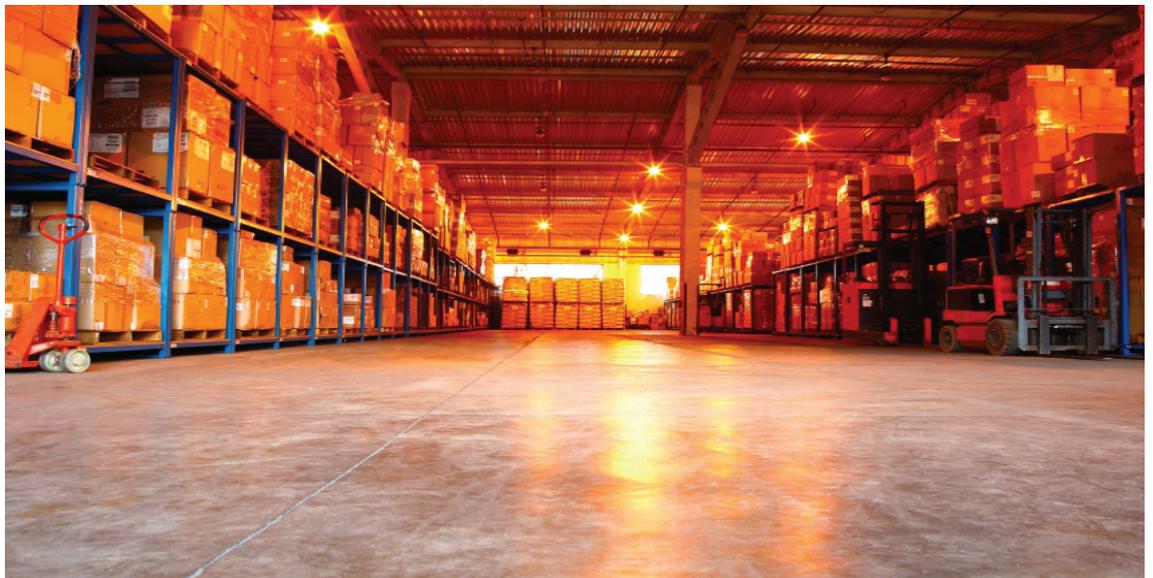
STORAGE AND HANDLING

Materials of Construction

JEFFAMINE® polyetheramines may be stored under air at ambient temperatures for extended periods, however a nitrogen blanket is suggested for all storage to reduce the effect of accidental exposure to high temperatures and to reduce the absorption of atmospheric moisture and carbon dioxide. It should be noted that pronounced discoloration is likely to occur at temperatures above 140°F (60°C), whatever the gaseous pad. Dispose of waste in strict accordance with local, state, and federal regulations.

At temperatures of 75-100°F (24-38°C)	
Tanks	Carbon steel
Lines, valves	Carbon steel
Pumps	Carbon steel
Atmosphere	Nitrogen or dry air
Heat exchange Surfaces	Stainless steel
Hoses	Stainless steel, polyethylene, polypropylene, TEFLON® (Elastomers such as neoprene, Buna N, and VITON® should be avoided)

At temperatures above 100°F (38°C)	
Tanks	Stainless steel
Lines, valves	Stainless steel
Pumps	Stainless steel or Carpenter 20 equivalent
Atmosphere	Nitrogen



Global Headquarters

Huntsman Corporation
10003 Woodloch Forest Drive
The Woodlands, Texas, 77380
USA

Tel : +1-281-719-6000

Fax : +1-281-719-6055

Asia Pacific

Huntsman Performance Products
No. 455 Wenjing Road
Minhang Economic &
Technological Development Zone
Shanghai 200245
P. R. China

Tel : +86-21-3357-6588

Fax : +86-21-3357-6547

Europe, Middle East and Africa

Huntsman Performance Products
Everslaan 45
B-3078 Everberg
Belgium

Tel : +32-2-758-9725

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