

Advanced Materials

Tooling, composites and repair solutions

Selector
guide for wind
industry



A photograph of an offshore wind farm with several white wind turbines in a row on a blue sea under a clear sky. The perspective is from a low angle, looking down the line of turbines.

Rely on
us with
confidence



Araldite®
Ren®

The original brands
serving worldwide wind industry
for more than a decade.

A global partner

As a global partner and innovator working in close collaboration with all major wind energy equipment manufacturers for more than 20 years, we provide our customers with reliable, durable and cost effective solutions for wind blade production. To capture the maximum amount of energy from the wind, blades have to be large, stiff and sufficiently robust to withstand every kind of weather condition. Huntsman Advanced Materials has the right technologies and high-performance products that the industry requires. Our products are used in applications ranging from plugs and patterns, to complete composite blade production as well as assembly and repair.

We deliver more than just products

Our know-how and expertise help us to develop standard products as well as custom-made solutions formulated to answer specific project requirements. Huntsman Advanced Materials has a worldwide team of experts to develop composites and tooling materials as well as adhesives:

- > to quickly bring your product to market through rapid model build-up and repair
- > to reduce manufacturing and production costs through process time reduction
- > to improve product quality, stability and durability through physical properties like impact resistance and corrosion.



Composite resin systems

Infusion process

Product designation	Pot life	Mix viscosity	Tg*	Flexural strength*	Ultimate flexural elongation*	Key features
Conditions	23°C, 100 ml	25°C	DSC, 10K/min	25°C	25°C	
Norm			IEC 1006	ISO 178	ISO 178	
Unit	min	mPa.s	°C	MPa	%	
Araldite® LY 1564 / Aradur® 3486	560 - 620	200 - 300	80 - 84	118 - 130	10.5 - 12.5	Aradur® 3416, Aradur® 3486 and Aradur® 3487 can be mixed to adjust reactivity at constant resin/hardener mix ratio
Araldite® LY 1564 / Aradur® 3416	290 - 340	200 - 320	80 - 85	118 - 130	10.0 - 12.0	
Araldite® LY 1564 / Aradur® 3487	130 - 160	220 - 320	81 - 86	118 - 130	10.0 - 12.0	
Araldite® LY 1568 / Aradur® 3489	850 - 950	200 - 300	77 - 80	120 - 130	9.0 - 10.0	Aradur® 3489, Aradur® 3491 and Aradur® 3492 can be mixed to adjust reactivity at constant resin/hardener mix ratio - Aradur® 3489 based system provides low exothermic behavior
Araldite® LY 1568 / Aradur® 3491	750 - 850	200 - 300	74 - 80	120 - 130	9.0 - 10.0	
Araldite® LY 1568 / Aradur® 3492	300 - 350	250 - 350	80 - 85	125 - 135	7.0 - 7.5	

* Cure schedule 8h at 80°C

Wet lay-up process

Product designation	Pot life	Mix viscosity	Tg*	Flexural strength*	Ultimate flexural elongation*	Key features
Conditions	23°C, 100 ml	25°C	DSC, 10K/min	25°C	25°C	
Norm			IEC 1006	ISO 178	ISO 178	
Unit	min	mPa.s	°C	MPa	%	
Araldite® LY 3505 / XB 3403	600 - 720	300 - 400	78 - 83	110 - 130	10.5 - 13.0	Hardener XB 3403 and Aradur® 3405 can be mixed to adjust reactivity at constant resin/hardener mix ratio
Araldite® LY 3505 / Aradur® 3405	26 - 36	1 000 - 1 200	87 - 92	135 - 155	7.0 - 9.0	
Araldite® LY 1556 / Aradur® 3405	40 - 50	1 500 - 1 800	92 - 98	130 - 145	9.0 - 11.0	higher viscosity for vertical application

* Cure schedule 4h at 60°C + 6 h at 80°C

Note: Further systems are available upon request

Filament winding process

Product designation	Pot life	Mix viscosity	Tg*	Flexural strength*	Ultimate flexural elongation*	Key features
Conditions	23°C, 100 ml	25°C	DSC, 10K/min	25°C	25°C	
Norm			IEC 1006	ISO 178	ISO 178	
Unit	h	mPa.s	°C	MPa	%	
Araldite® LY 1135-1 A / Aradur® 917 / Accelerator DY 070	95 - 115	600 - 900	140 - 150	130 - 150	7.0 - 8.5	very latent and medium Tg system for winded part

* Cure schedule 4h at 80°C + 8 h at 140°C




All composite resin systems presented in this brochure are Germanischer Lloyd (GL) certified

Prepreg process

Product designation	B-Staging	Shelf life (of the prepreg after B-Staging)	Tg*	Flexural strength*	Ultimate flexural elongation*	Key features
Conditions		23°C	DSC, 10K/min	25°C	25°C	
Norm			IEC 1006	ISO 178	ISO 178	
Unit			°C	MPa	%	
Araldite® LY 1556 / Aradur® 1571 / Accelerator 1573 / XB 3403	24 - 48h at 23°C	> 6 weeks	120 - 126	105 - 115	7.0 - 10.0	easy B-staging tack adjustable
XU 3508 / Aradur® 1571 / Accelerator 1573 / XB 3403	24 - 48h at 23°C	> 6 weeks	116 - 125	110 - 120	5.5 - 8.0	toughened prepreg with easy B-staging tack adjustable

* Cure schedule 2h , respectively 4h, at 120°C

Structural adhesives (epoxy)

Product designation	Mixing ratio	Pot life	Recommended cure schedule	LSS*	Tg**	Gap filling	Key features
Conditions	parts by volume	23°C, 100g					
Unit		min		MPa	°C	mm	
Araldite® AV 4076-1 / Hardener HV 5309-1	1:1	50 - 65	4h at 60°C	20 - 24	70 - 80	2 - 5	root joint steel insert bonding
Araldite® 2015 	1:1	45 - 60	4h at 60°C	15 - 18	70 - 80	2 - 7	bonding of lightning conductor, monitor sensors, ideal for dissimilar substrates. Germanischer Lloyd (GL) certified
Araldite® 2031	1:1	50 - 65	4h at 60°C	20 - 24	70 - 80	2 - 5	for insert or composite (CFRP, GRP) bonding
Araldite® 2014-1	2:1	50 - 65	4h at 60°C	15 - 18	75 - 85	5	bonding tip, control shaft components, high temperature and chemical resistance, ideal for metals
Araldite® AW 5047-1 / Hardener HW 5067	100:45	65 - 80	1h at 80°C	20 - 22	70 - 80	< 0.5	liquid system, ideal for metal bonding, temperature resistant up to 180°C (LSS > 5 MPa)
Araldite® AW 4510 / Hardener HW 4511	2:1	85 - 100	2h at 110°C	14 - 16	110 - 125	10	non sagging paste, for gap filling or vertical application, high temperature resistance

* On epoxy composite - LSS = Lap Shear Strength

** Cured in standard blade cycle after initial fixing of shear webs at 25°C, IEC 1006, DSC, 10K/min

Fast assembly and repair

Adhesives

Product designation	Chemistry	Repair			Mixing ratio	Pot life	
		Plugs	Composite moulds	Blades			
Conditions					parts by volume	23°C, 100g	
Unit						min	
Araldite® 2021	MMA system	●	●	●	1:1	5 - 15	
Araldite® 2022	MMA system	●	●	●	1:1	10 - 20	
Araldite® 2047-1	MMA system	●	●	●	10:1	15 - 25	
Araldite® 2048	MMA system	●	●		10:1	10 - 20	
Araldite® 2029	PU system	●	●	●	1:1	35 - 45	
Araldite® 2012	EP system	●	●	●	1:1	5 - 8	
Araldite® AW 2101 / Hardener HW 2951	EP system	●	●	●	1:1	4 - 8	

* On aluminium - LSS = Lap Shear Strength
** Cured in standard blade cycle after initial fixing of shear webs at 25°C, IEC 1006, DSC, 10K/min
Note: All adhesives are available in different pack sizes including cartridges for easy use in the field

Laminating systems

Product designation	Chemistry	Repair			Mixing ratio	Pot life	
		Plugs	Composite moulds	Blades			
Conditions					parts by volume	23°C, 100g	
Unit						min	
Araldite® LY 3297 / Aradur® 3298	EP system			●	100:40	120 - 135	
Araldite® LY 3297 / Aradur® 3299	EP system			●	100:40	40 - 50	

* On aluminium - LSS = Lap Shear Strength
** Cured in standard blade cycle after initial fixing of shear webs at 25°C, IEC 1006, DSC, 10K/min
Note: All adhesives are available in different pack sizes including cartridges for easy use in the field
EP: Epoxy
PU: Polyurethane
MMA: Methacrylathe

	Recommended cure schedule	LSS*	Tg**	Gap filling	Key features
	23±2°C				
	h	MPa	°C	mm	
	1	20 - 22	65 - 80	3 - 5	very fast setting, tough adhesive for rapid fixing and filling of small voids
	2	20 - 22	65 - 80	3 - 5	medium open time and fast curing tough adhesive for field/ workshop operations
	2	10 - 14	70 - 80	3 - 5	rapid attachment of parts, multipurpose adhesive, ideal for dissimilar substrates
	1	20 - 22	65 - 75	5 - 8	rapid attachment of parts, high flexibility and gap filling adhesive
	12	20 - 24	25 - 35	3 - 5	medium open time adhesive, filling holes, high flexibility and strength
	8	16 - 18	40 - 50	self levelling	fast setting, general purpose, self levelling epoxy adhesive
	8	18 - 20	40 - 50	4 - 5	fast setting and multipurpose gap filling epoxy adhesive

	Mix viscosity	Recommended cure schedule	Tg**	Flexural modulus	Key features
	25°C, Hopper			8h at 80°C	
	mPa·s		°C	MPa	
	320 - 380	7 days at 23°C 1 day at 23°C + 4h at 90°C	55 - 60 90 - 100	2 800 - 3 000	} wet lay-up systems with low viscosity and high flexibility
	350 - 400	7 days at 23°C 1 day at 23°C + 4h at 90°C	55 - 60 100 - 105	2 800 - 3 000	

Tooling systems

Master model / Plug

Seamless modeling pastes

Product designation	Color	Minimum cure schedule	Density	Shore hardness D	Coefficient of thermal expansion	Heat deflection temperature	Compressive strength	Flexural strength
Norm				ISO 868	ISO 11359	ISO 75	ISO 604	ISO 178
Unit			g/cm³		10 ⁻⁶ K ⁻¹	°C	MPa	MPa
RenPaste® SV 4503-1 / Ren® HV 4503-1	brown	machinable after 1 day (RT* curing)	0.75 - 0.8	55 - 60	95 - 105 (3 days at RT*)	40 - 45 (3 days at RT*) 50 - 55 (8h at 80°C)	10 - 12 (3 days at RT*)	11 - 12 (3 days at RT*)
RenPaste® 4666 Resin / Ren® 4666 Hardener	light grey	machinable after 1 day (RT* curing)	0.95 - 1.0	60 - 65	75 - 80 (7 days at RT*)	50 - 55 (7 days at RT*) 70 - 75 (RT* cure + 8h at 60°C) 80 - 85 (RT* cure + 8h at 80°C)	18 - 20 (7 days at RT*)	18 - 20 (7 days at RT*)

* Room temperature 23°C

Note: Machine applied

Mould production with infusion and wet lay-up processes (heat resistance 120-150°C)

Back construction

Product designation	Process	Viscosity	Pot life	Demoulding time	Cure cycle	Ultimate Tg	Flexural strength	Ultimate flexural elongation
Conditions		25°C	100 ml			DSC, 10K/min	25°C	25°C
Norm						IEC 1006	ISO 178	ISO 178
Unit		mPa.s	min		°C	°C	MPa	%
RenLam® LY 113 / Ren® HY 98	wet lay-up / infusion	300 - 350	90 - 100	24h at 40°C	up to 120*	120 - 125	125 - 130	7.0 - 8.0
RenLam® LY 120 / Ren® HY 99	infusion	300 - 350	210 - 230	24h at 40°C	up to 150*	150 - 155	120 - 125	6.8 - 7.2

* 0.3°C / min from 40°C up to 120 respectively 150°C, allowing 2 hours dwell every 20°C. Maintain 8 hours at maximum temperature; then cool down gradually to room temperature.

Surface coat

Product designation	Color	Pot life	Gel time thin layer	Density	Shore hardness D	Heat deflection temperature	Key features
Conditions		25°C, 250 ml	23°C				
Norm					ISO 868	ISO 75	
Unit		min	min	g/cm³		°C	
XD 4615 / Ren® HY 5159	black	25 - 30	60 - 70	1.3	80 - 90	120 - 125	highly polishable, high chemical resistance

Coupling layer

Product designation	Color	Pot life	Gel time thin layer	Density	Shore hardness D	Heat deflection temperature	Key features
Conditions		25°C, 250 ml	23°C				
Norm					ISO 868	ISO 75	
Unit		min	min	g/cm³		°C	
RenGel® P99 / Ren® HY 5159	grey	25 - 30	120 - 130	1.5	80 - 90	120 - 125	provides superior interlayer adhesion between gelcoat and laminate / ideal for wet lay-up technology

Mould production with infusion and wet lay-up process (heat resistance 180-200°C)

Back construction

Product designation	Process	Viscosity	Pot life	Demoulding time	Cure cycle	Ultimate Tg	Flexural strength	Ultimate flexural elongation
Conditions		25°C	25°C, 500 ml			DSC, 10K/min	25°C	25°C
Norm						IEC 1006	ISO 178	ISO 178
Unit		mPa·s	h		°C	°C	MPa	%
RenLam® LY 5210 / Ren® HY 5212	wet lay-up	1 900 - 2 100	10 - 12	24h at 40°C	up to 200*	230 - 240	85 - 90	
RenLam® LY 5210 / Ren® HY 5213	wet lay-up	1 700 - 1 900	2 - 2.5	14h at 40°C	up to 180*	170 - 180	125 - 130	
Araldite® LY 8615 / Aradur® 8615	infusion	480 - 580	14 - 16 (100 ml)	24h at 40°C	up to 180*	210 - 220	80 - 85	2.5 - 3.5
Araldite® LY 8615 / XB 5173	infusion	270 - 370	5 - 7 (100 ml)	24h at 40°C	up to 180*	200 - 210	115 - 120	4.0 - 5.0

* 0.3°C/min from 40°C to maximum dwell temperature, allowing 2 hours dwell every 20°C. Maintain 8 hours at maximum temperature; then cool down gradually to room temperature.

Surface coat

Product designation	Color	Pot life	Density	Shore hardness D	Demoulding time	Cure cycle	Ultimate Tg	Key features
Conditions		25°C					DSC, 10K/min	
Norm				ISO 868			IEC 1006	
Unit		h	g/cm³			°C	°C	
RenGel® SW 5200 / Ren® HY 5212	black	9 - 10 (500 ml)	1.5	85 - 90	24h at 40°C	up to 200*	200 - 210	very high temperature resistance, excellent inter layer adhesion
RenGel® SW 5200 / Ren® HY 5213	black	4 - 4.5 (250 ml)	1.6	85 - 90	14h at 40°C	up to 180*	170 - 180	faster version of RenGel® SW 5200 / Ren® HY 5212

* 0.3°C/min from 40°C to maximum dwell temperature, allowing 2 hours dwell every 20°C. Maintain 8 hours at maximum temperature; then cool down gradually to room temperature.



With innovation

Every day, all over the world, our Technical Competence centers engage in intensive research and development focusing on one goal : to deliver innovative solutions by working hand-in-hand with our business partners. Together through a continual exchange of ideas, supported by an experienced team of sales and technical specialists, we strive to deliver innovative solutions.

We track both new market expectations and changing regulations. Protection of the environment, as well as health and safety are paramount concerns, playing an integral part in our development projects.

By providing certified technologies, combined with high quality and reliability, our chemists and experts bring enhanced value to our customers, ensuring their success.

With customer intimacy

We market a unique product portfolio and a broad range of forward-looking solutions for our customers. Customers and partners benefit from an advanced level of service in:

- > product development and quality
- > product trials in-house and with customers
- > customer seminars and training
- > trouble-shooting and problem-solving

Partnership with our customers is more than simply «putting them first». It requires long-term commitment to forging close relationships that create synergies of knowledge, security and adaptability to create a successful, shared future.

With care

Sustainability is a fundamental part of our corporate and business strategy. We see a better world in which our innovations help reduce consumption of natural resources and improve the quality of life for people everywhere. We are identifying the long-term trends that affect our markets and looking to see how products and applications can play a part in supporting and providing solutions to the challenges those markets face.



A photograph of four business professionals (three men and one woman) sitting around a conference table in a modern office with large windows. They are engaged in a discussion. The man in the center, wearing a dark suit and red tie, is gesturing with his hands while speaking. The woman on the left is listening attentively. The man on the right is also listening. The woman on the far right is partially visible. The table has several glasses of water and some papers. The background shows a cityscape through the windows.

We value
your
challenge

Huntsman Advanced Materials

Our Advanced Materials division is a leading global chemical solutions provider with a long heritage of pioneering technologically advanced epoxy, acrylic and polyurethane-based polymer products.

Our capabilities in high-performance adhesives and composites, delivered by more than 2 300 associates, serve over 3 000 global customers with innovative, tailor-made solutions and more than 1 500 products which address global engineering challenges.

Global presence – 13 manufacturing sites



DANLUBE A/S

"Så ved du det holder"

Tune Parkvej 5
4030 Tune
Tlf.: +45 70 25 12 80
info@danlube.dk
www.danlube.dk

HUNTSMAN

Enriching lives through innovation

For more information

www.huntsman.com/advanced_materials
advanced_materials@huntsman.com

Europe

Huntsman Advanced Materials (Switzerland) GmbH
Klybeckstrasse 200
P.O. Box
4002 Basel
Switzerland
Tel. +41 61 299 20 41
Fax +41 61 299 20 40

India, Middle East, Africa & Turkey

Huntsman Advanced Materials (India) Pvt. Ltd.
5th Floor, Bldg. No. 10
Solitaire Corporate Park, 167
Guru Hargovindji Marg, Chakal, Andheri (East)
Mumbai – 400 093
India
Tel. + 91 22 4095 1556
Fax + 91 22 4095 1300 / 1500

Asia / Pacific

Huntsman Advanced Materials (Guangdong) Co., Ltd.
Shanghai Suites 4604 – 4606, 46F Maxdo Center
8 Xing Yi Road
Shanghai, 200336
P.R. China
Tel. + 86 21 2208 7588
Fax + 86 21 2208 7511

Americas

Huntsman Advanced Materials Americas Inc.
10003 Woodloch Forest Drive
The Woodlands
Texas 77380
USA
Tel. +1 888 564 9318
Fax +1 281 719 4047

Legal information

All trademarks mentioned are either property of or licensed to Huntsman Corporation or an affiliate thereof in one or more, but not all, countries.

Sales of the product described herein ("Product") are subject to the general terms and conditions of sale of either Huntsman Advanced Materials LLC, or its appropriate affiliate including without limitation Huntsman Advanced Materials (Europe) BVBA, Huntsman Advanced Materials Americas Inc., or Huntsman Advanced Materials (Hong Kong) Ltd. or Huntsman Advanced Materials (Guangdong) Ltd. ("Huntsman"). The following supercedes Buyer's documents. While the information and recommendations included in this publication are, to the best of Huntsman's knowledge, accurate as of the date of publication, NOTHING CONTAINED HEREIN IS TO BE CONSTRUED AS A REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHTS, OR WARRANTIES AS TO QUALITY OR CORRESPONDENCE WITH PRIOR DESCRIPTION OR SAMPLE, AND THE BUYER ASSUMES ALL RISK AND LIABILITY WHATSOEVER RESULTING FROM THE USE OF SUCH PRODUCT, WHETHER USED SINGLY OR IN COMBINATION WITH OTHER SUBSTANCES. No statements or recommendations made herein are to be construed as a representation about the suitability of any Product for the particular application of Buyer or user or as an inducement to infringe any patent or other intellectual property right. Data and results are based on controlled conditions and/or lab work. Buyer is responsible to determine the applicability of such information and recommendations and the suitability of any Product for its own particular purpose, and to ensure that its intended use of the Product does not infringe any intellectual property rights.

The Product may be or become hazardous. Buyer should (i) obtain Material Safety Data Sheets and Technical Data Sheets from Huntsman containing detailed information on Product hazards and toxicity, together with proper shipping, handling and storage procedures for the Product, (ii) take all steps necessary to adequately inform, warn and familiarize its employees, agents, direct and in direct customers and contractors who may handle or be exposed to the Product of all hazards pertaining to and proper procedures for safe handling, use, storage, transportation and disposal of and exposure to the Product and (iii) comply with and ensure that its employees, agents, direct and indirect customers and contractors who may handle or be exposed to the Product comply with all safety information contained in the applicable Material Safety Data Sheets, Technical Data Sheets or other instructions provided by Huntsman and all applicable laws, regulations and standards relating to the handling, use, storage, distribution and disposal of and exposure to the Product. Please note that products may differ from country to country. If you have any queries, kindly contact your local Huntsman representative.

© 2012 Huntsman Corporation. All rights reserved.

Ref. No. AdMat Wind selector guide 03.12_EN_EU



Registered for
REACH