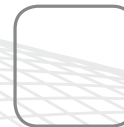
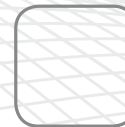




Advanced Materials

Tooling, composites and repair solutions

Selector
guide for wind
industry





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confidence



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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: Methacrylate

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/cm ³		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/cm ³		°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/cm ³		°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.

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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:

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your
challenge

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Anwendungs-, Verfahrens- und Dosiertechnik

Großer Kolonnenweg 3
Tel.: 0511 - 353982 - 0
internet: www.t-e-klebertechnik.de

30163 Hannover
Fax.: 0511 353982 - 40
mail: infotek@t-e-klebertechnik.de



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Ref. No. AdlMat Wind selector guide 03.12_EN_EU



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