

COST-EFFICIENCY AND PERFORMANCE FOR THE GLOBAL WIND INDUSTRY

ARALDITE® adhesive solutions

Our adhesive solutions can shorten product development times by up to six months, and streamline maintenance tasks by curing up to 20% faster than alternatives.





TRUSTED ADHESIVE SOLUTIONS FOR WIND TURBINE DEVELOPMENT AND REPAIR

At Huntsman Advanced Materials, we are committed to solving complex engineering challenges for the global wind industry.

Whether you are an OEM looking to develop next generation turbines in shorter timeframes or an MRO service provider focused on optimizing resources and costs, our adhesives are the perfect bonding solution in harsh environments, including high humidity and cold temperatures.

We offer a full range of adhesive products for all development, assembly, and maintenance requirements. No other structural adhesives on the market cure as quickly in such extreme conditions.

EFFICIENCY AND PRODUCTIVITY

Huntsman Advanced Materials is trusted worldwide for delivering solutions that minimize costs and maximize performance, with strong technical and customer support. We share your goals in creating better ways to streamline processes, simplify resources, and deliver dependable results every time.

↓ **50%** Reduce downtime by up to 50%

↓ **90%** Reduce total repair time by up to 90%

↓ **-20°C** Create reliable bonds even down to -20°C

Our broad expertise and deep understanding of the challenges you face has inspired us to develop both standardized products and custom-made solutions. With excellent aging and weather resistance, fast curing times, and outstanding adhesion properties, we ensure product development teams have greater design freedom to innovate and bring products to market faster, while maintenance teams can save time and costs for off-site structural maintenance tasks.

Ideas made possible

- Open new possibilities in your design process
- Reduce development time by up to six months
- Rest assured with our OEM-qualified, TSCA- and REACH-registered product portfolio

Performance made possible

- Reduce risks through a more secure supply chain
- Extend the lifetime of your blades in all conditions
- Minimize downtime, repair time, and costs

Tomorrow made possible

- Lead the market with next generation turbine designs
- Create larger, lighter, and tougher blades that last longer
- Be ready for the future, whatever the conditions



VERSATILE APPLICATIONS FOR NEXT GENERATION TURBINES

1 Void filling and trailing edge openings:

ARALDITE® 2010-1 / ARALDITE® 2023 / ARALDITE® 2031-1

Reduce void filling time by 50% with high gap filling properties and exceptional UV resistance. ARALDITE® 2031-1 adhesive also offers excellent shear thinning properties and low shrinkage.

2 Sensor bonding and lightning conductor:

ARALDITE® 2051 & ARALDITE® 2015-1

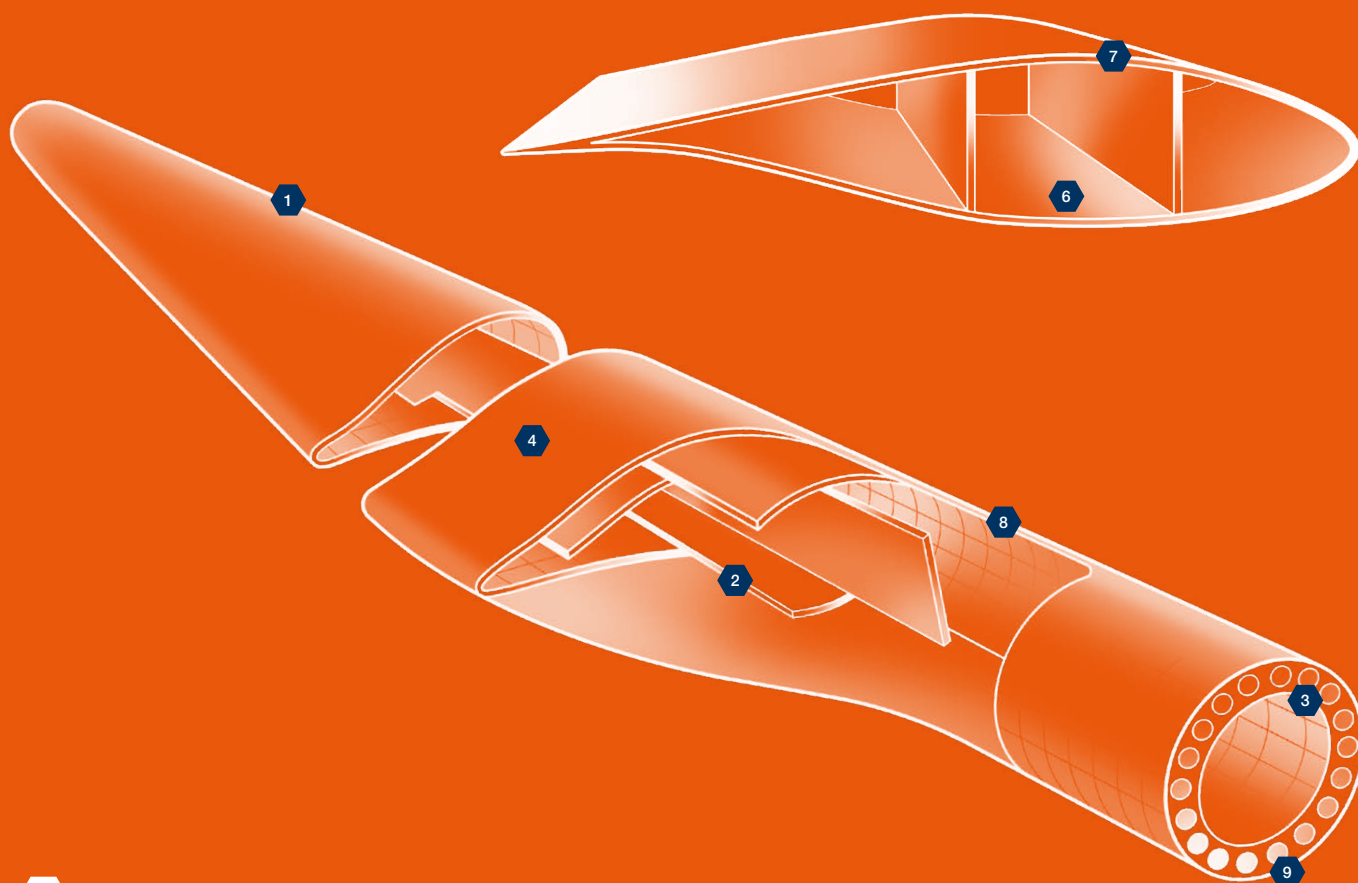
Achieve high bond strength and weathering resistance with ARALDITE® 2015-1 adhesive. ARALDITE® 2051 adhesive is approved by OEMs for its long-term bonding capability, reducing maintenance costs by up to 70%.

3 Bolt, stud and insert fixing:

ARALDITE® 2021-1 / ARALDITE® 2051 & ARALDITE® 2050

ARALDITE® 2021 and ARALDITE® 2051 adhesives enable you to position bolts, studs, and inserts with reliable handling strength within minutes.

**ARALDITE® adhesives
wind bonding
applications**



4 Vortexes and add-ons bonding:
ARALDITE® 2051 & ARALDITE® 2050 /
ARALDITE® 2021-1 & ARALDITE® 2022-1

Install add-ons and vortexes in harsh conditions with fast-curing ARALDITE® 2050 and ARALDITE® 2051 adhesives. Streamline assembly of other small parts with OEM-approved ARALDITE® 2021-1 adhesive.

5 Nacelle bonding:
ARALDITE® 2022-1

Improve assembly time with faster curing and bond multiple substrates with medium open time.

6 Tooling bonding high temperature:
ARALDITE® 2019

Increase the lifespan of tooling tools with ARALDITE® 2019 adhesive, delivering high temperature and chemical resistance and exceptional mechanical strength.

7 Shell bonding repair:
ARALDITE® 2023 / ARALDITE® 2031-1

Complete shell bonding and repairs for multiple part sizes, such as blade tips and mastics, in a single step.

8 Wind blade repair:
ARALDITE® 2023 / ARALDITE® 2050 & ARALDITE® 2051

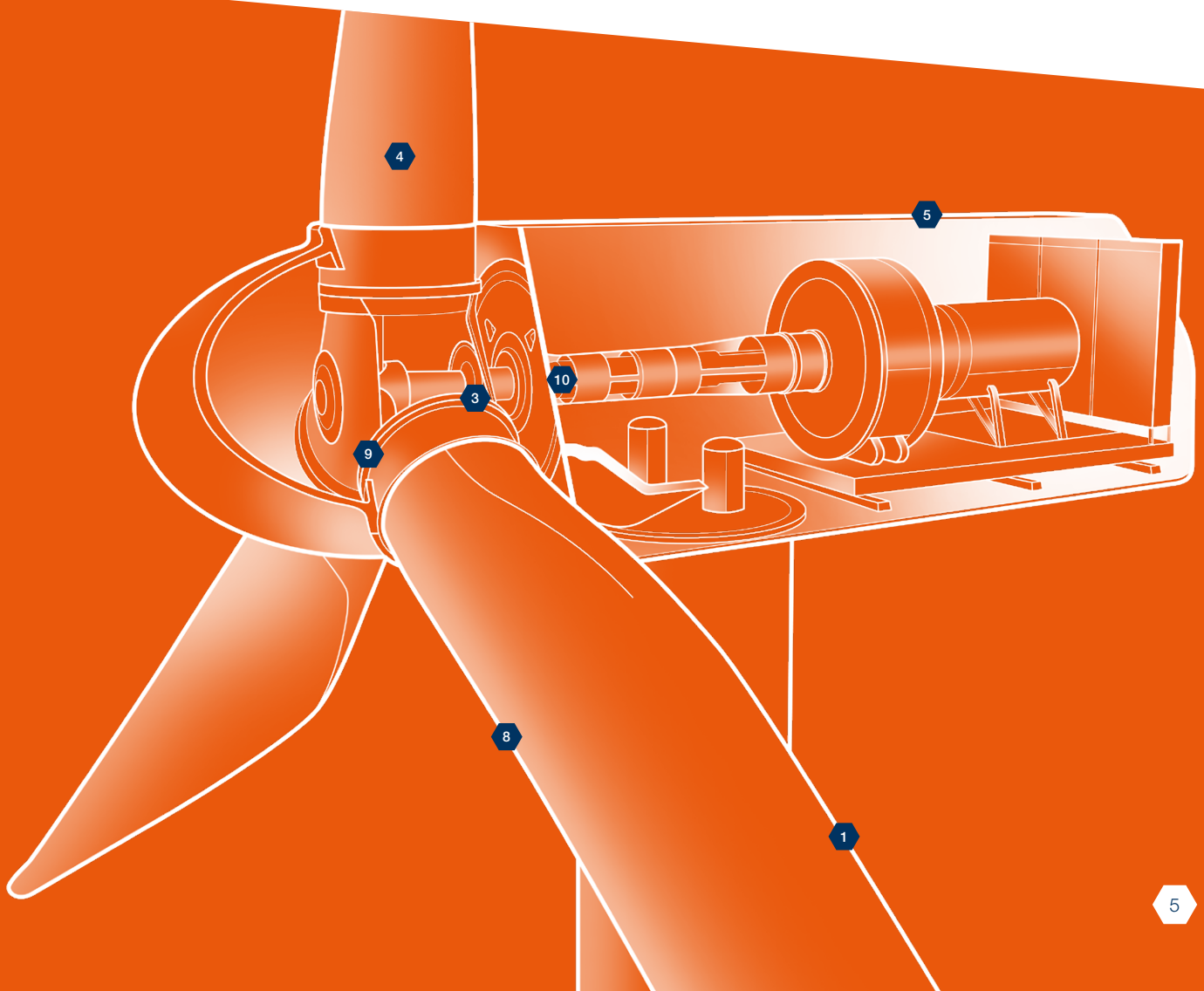
Extend the season of repair with reliable bonds in extreme temperatures and humidity using ARALDITE® 2050 and ARALDITE® 2051 adhesives.

9 Root joint adhesives:
ARALDITE® 2031-1

Achieve high fracture toughness, dynamic loading, and weathering resistance in root joints.

10 Control shaft and components:
ARALDITE® 2014-2

Achieve precise and reliable positioning of components and control shaft parts with long-lasting bonds, proven for 30+ years.



CASE 1:

GAP-FILLING OF WIND BLADES WITH ARALDITE® 2031-1 ADHESIVE



One of our OEM customers needed a reliable solution for injecting an adhesive into the gaps of wind blades after their infusion and assembly.

By using ARALDITE® 2031-1 adhesive with its shear thinning and low shrinkage properties, the OEM was able to successfully fill-in gaps left after infusion and shell bonding of the blades.

The adhesive delivered outstanding resistance to weathering and high lap shear strength, which proved to be perfect for the application's demanding outdoor conditions. The adhesive also cures at room temperature, ensuring effective blade continuity.

60mins ARALDITE® 2031-1 adhesive has a 60-minute pot life at room temperature

ARALDITE® adhesives	Chemistry	Typical properties				
		Mix ratio	Pot life	Gap fill	Recommended cure temperature	Glass transition (Tg) midpoint
Units		V/V	Mins @ 25°C / 100g	Mm	°C	°C
ARALDITE® 2010-1	Epoxy	1:1	10	1	23	40
ARALDITE® 2014-2	Epoxy	2:1	110	5	23	85***
ARALDITE® 2015-1	Epoxy	1:1	45	10	23	78
ARALDITE® 2019	Epoxy	2:1	100	5	>60	122
ARALDITE® 2031-1	Epoxy	1:1	60	10	23	75
ARALDITE® 2021-1	Acrylic	1:1	3	4	23	117
ARALDITE® 2022-1	Acrylic	1:1	10	4	23	114
ARALDITE® 2023/10/30/60	Acrylic	10:1	10* / 35* / 75*	30	23	77
ARALDITE® 2050	Acrylic	1:1	1*	4	-20 / 23	127
ARALDITE® 2051	Acrylic	1:1	4*	4	0 / 40	127
ARALDITE® 2053-15	Acrylic	10:1	15*	5	23	113
ARALDITE® 2053-05	Acrylic	10:1	5*	5	23	115

* On 20 grams ** Substrate failure ***Obtained with a post-cure

CASE 2:

BONDING INSIDE BLADE ADD-ONS WITH ARALDITE® 2051 ADHESIVE

A maintenance and repair customer needed a reliable, weather-resistant solution for bonding add-ons, such as sensors, onto the internal composite structure of wind blades.

ARALDITE® 2051 adhesive proved to be the ideal solution. The adhesive is non-sagging and can be used in freezing temperatures with no need of heating, thereby extending repairs into wintertime and reducing down time by up to three days. The adhesive has since been used by the customer for a broad variety of other tasks, simplifying its inventory and reducing maintenance costs by up to 70%.



↓ **70%** Reduce maintenance costs by up to 70% with ARALDITE® 2051 adhesive

				Key features
Handling time (time to 1 Mpa)	LSS @ 23°C VA4 steel	CFRP	EP - GRP	
Mins @ 23°C	MPa	MPa	MPa	
30	23	13	5	Fast curing epoxy, with low shrinkage
300	23	17	9**	High temperature resistance and resistant to chemicals and water
240	24	22	15	Gap filling and bonding for dis-similar substrates
270	27	35	36**	Toughened and temperature resistant to 140°C
180	25	20**	20	High weather resistant metal and composite bonder
9	24	20	12**	Toughened and rapid curing adhesive with performance to 100°C
12	25	23	18**	Multipurpose acrylic with good balance of work to cure time
40 / 70 / 100	21	21	17	For dynamic environments where large gap filling is required to produce tough flexible bonds
9	30	25	16	Ultra fast curing from -20° to 25°C under water and in high humidity conditions
15	29	18	12	Fast curing from 0° to 40 °C in high humidity conditions
40	24	22	21	Excellent ageing and weathering with high elongation
20	23	27	22	Fast cure with excellent temperature and ageing resistance

Huntsman Advanced Materials

At Huntsman Advanced Materials, we make things possible. Serving many of the world's leading businesses across virtually every industry, we enable greater innovation, performance and sustainability to address global engineering challenges and contribute towards a better quality of life.

Our capabilities in high-performance adhesives and composites, delivered by more than 1600 associates, support over 2000 global customers with innovative, tailor-made solutions and more than 1500 pioneering epoxy, acrylic, phenolic and polyurethane-based polymer products.

We operate synthesis, formulating and production facilities around the world



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