



Redux[®] Adhesives

Selector Guide

Providing practical and economical solutions for joining materials since the 1930s.





Redux® Adhesives

Selector Guide

- Redux® Adhesives have been used in the composites industry for over 70 years
- Redux® Adhesives have achieved worldwide acclaim for aerospace and industrial bonding
- An efficient method of joining component pieces quickly and easily

Redux® Film Adhesives, Foaming Films, Primers and Liquid Shims

Hexcel formulates and manufactures a comprehensive range of structural film adhesives, foaming adhesive films, primers and liquid shims for aerospace and industrial markets.

These Redux® branded products have provided our customers with practical and economical solutions for joining materials since the 1930's. The Redux® range is manufactured in Duxford, UK and Salt Lake City, UT, USA and is supported by a global sales and technical support network.

About Hexcel

Hexcel is the largest US producer of carbon fibre; the world's largest weaver of structural fabrics; the number one producer of composite materials such as prepregs, film adhesives and honeycomb; and a leading manufacturer of composite parts and structures.

As the most vertically integrated supplier in the industry Hexcel manufactures the full spectrum of advanced material solutions. This means that we can offer enhanced design flexibility and support to our customers worldwide.

Hexcel's research and technology function supports our businesses worldwide with a highly developed expertise in materials science, textiles, process engineering and polymer chemistry.

Redux® Film Adhesives

Epoxy and bismaleimide (BMI) adhesives are supplied in film form on a roll and require heat and pressure to cure. These high performance structural adhesives are ideal for metal to metal and composite bonding and for the manufacture of honeycomb sandwich structures.

Redux® Foaming Adhesive Films

When cured at elevated temperature these films expand, making them ideal for gap filling, honeycomb core edge bonding and core splicing. Redux® foaming adhesive films are supplied in sheet form and are designed to be used in conjunction with Redux® Film Adhesives.

Redux® Primers

Each Redux® primer has been formulated to ensure the maximum possible performance is achieved from the corresponding Redux® Film Adhesive. Redux® primers protect pretreated metal surfaces prior to bonding and ensure maximum bond durability. All Redux® primers are free of chromium compounds.

Redux® Shimming Adhesives

These are two-part epoxy adhesives which can be cured either at room temperature or elevated temperature to achieve higher levels of mechanical performance.

Adhesive Selection

The comprehensive range of Redux® adhesives are suitable for many different applications. The first stage of design for bonding is the selection of the most suitable adhesive. This selector guide gives a summary of the main properties of the standard Redux® adhesive range.

Generic Type

Redux® film adhesives are supplied in two generic types:

1. Epoxy - giving higher strengths, toughness and temperature resistance up to 200°C (390°F).
2. Bismaleimide - giving good performance at even higher temperature resistance up to 230°C (450°F).

Maximum Service Temperature

The temperature at which adequate strength is maintained varies according to adhesive type and can range from 70°C (120°F) to 230°C (450°F). Most film adhesives will retain their integrity down to -55°C (-67°F).

Cure Temperature

Film adhesives generally fall into ca. 120°C (250°F) curing or ca. 180°C (350°F) curing categories. Choice depends on equipment availability, energy economy, or service temperature requirements (usually the higher the desired operating temperature the higher the cure temperature required).

Bondline Thickness Control

During heating under pressure the adhesive will tend to squeeze out from a joint. Some film adhesives contain either a lightweight fabric 'carrier' or microspheres which ensure an optimum minimum bondline thickness automatically. This is useful for bonding small areas to prevent excessive squeeze-out. However strength values can be slightly reduced by the presence of carriers and they can prevent the use of the reticulation technique on to honeycomb core.

Weight

For good overall properties and bonding to honeycomb core, areal weights of film adhesives in the range 150-400 g/m² (0.03-0.08 psf) should be used. Where weight is critical a lightweight film (60-150 g/m²) (0.01-0.03 psf) can be suitable if close tolerance joints are achievable.

Qualifications

Many applications require adhesives to meet specification values to ensure selected strength properties. Redux® films are qualified to a wide range of international and specific aerospace specifications. Further details are available on request.

Compatibility

For co-curing with prepregs (fibre reinforced matrix composites) to form a bonded sandwich structure, or as a 'surface finishing' film for prepreg, both chemical and cure cycle compatibility are essential. Compatibility with surface pretreatment protection primers and honeycomb core jointing foams is also necessary.

Shimming Adhesives

Where the intention is to bond dissimilar surfaces such as metal to composite a shimming adhesive can be used to ensure the security of the bond.

Redux® Film Adhesives

Product	Applications				Product Performance		
	Composite		Metal to Metal	Honeycomb	Maximum Service Temperature °C (°F)	Typical Cure Temperature °C (°F)	Cure Time (minutes)
Surfacing	Bonding						
Epoxy Film Adhesive							
Redux® 609	-	-	✓	✓	85 (185)	120 (250)	60
Redux® 312	-	✓	✓	✓	100 (212)	120 (250)	30-60
Redux® 677	-	✓	✓	-	75 (167)	150 (300)	04
Redux® 308	-	-	✓	✓	125 (260)	170 (350)	60
Redux® 319	-	✓	✓	✓	150 (300)	175 (350)	60
Redux® 641	✓	✓	✓	✓	150(300)	175 (350)	60
Redux® 322	-	✓	✓	✓	175 (350)	175 (350)	60
Redux® 340SP	-	✓	✓	-	175 (350)	175 (350)	60
BMI Film Adhesive							
Redux® HP655	-	✓	✓	-	230 (445)	190 (376) +post cure	240
Core Stabilising Film							
Cordux® 654	-	-	-	✓	120 (250)	-	-

Redux® Foaming Adhesive Films

Product	Associated Film Adhesive	Colour	Product Performance			
			Maximum Service Temperature °C (°F)	Typical Cure Temperature °C (°F)	Cure Time (minutes)	Expansion Ratio
Redux® 212-NA	312, 609	Black	100 (212)	120	60	1:2.0
Redux® 208/5-NA	308, 322	Black	120 (250)	175	60	1:2.2
Redux® 219/2-NA	319, 322,340SP, 641	Grey	150 (300)	175	60	1:2.0

Redux® Shimming Adhesive

Product	Applications					Maximum service temperature (°C/°F)	
	Metal to Metal bonding	Composite bonding	Potting	Structural repair	Liquid shim	Cured at 25°C (77°F)	Cured at elevated temperature
Redux® 870 A/B	✓	✓	✓	-	✓	60 (140)	NA

Product Performance				Key Features
Lap shear at 25°C (77°F) MPa (psi)	Honeycomb Climbing drum peel at 25°C (77°F) (N/76mm)	Flatwise Tensile at 25°C (77°F) MPa (psi)	Tg Dry by DMTA °C (°F)	
33 (4800)	200 (23)	7 (1000)	105 (220)	Ideal for industrial bonding applications such as: building panels, rail carriage doors, flooring partitions. Flexible cure cycle from 100 - 150°C to (212 - 300°F).
40 (5800)	650 (73)	9 (1300)	105 (220)	Short cure cycle: 30 minutes at 120°C (250°F) for faster applications and good composite to composite bonding.
20 (3000)	374 (43)	7 (1000)	103 (218)	Used with HexPly® M77 as a fast curing epoxy prepreg/adhesive system. Can be used for bonding aluminium or steel to CFRP composites.
47 (6500)	460 (52)	8 (1200)	100 (212)	Superior ageing performance for continuous operation up to 120°C (250°F).
36 (5200)	600 (68)	9 (1300)	120 (250) 200 (390)	High peel performance for automotive and aerospace (engine nacelles, flaps, aileron bonding) applications.
40 (6000)	620 (70)	12.5 (1800)	120 (250) 195 (385)	High performance adhesive with high peel and high shear strength. Exceptional honeycomb bonding.
20 (3000)	240 (27)	8 (1200)	200 (390)	Very high temperature performance. For military, engine nacelles, missile bonding, aerospace, motorsport and high temperature industrial applications.
32 (4640)	550 (62)	N/A	145 (290) 200 (390)	Low weight film adhesives with high Tg. Used for space applications.
26 (3800)	200 (23)	5 (700)	220 (430)	Very high temperature performance. Good co-cure with BMI prepreps.
-	-	-	-	Disposable backing material for cell stabilisation.

	Key Features
Aluminium double lap shear MPa/psi (1.6 mm/0.06 in gap) at 22°C (70°F)	
8.5 (1200)	Suitable for vacuum and non vacuum cure. Designed for lower temperature cure.
10 (1450)	Higher foaming ratio. Best for lap shear strength.
9 (1300)	Highest service temperature foam. Fast reacting and best suited for thin sections

Product Performance							Product Form	Key Features
Typical elevated cure temperature (°C/°F)	Lap shear at 25°C (77°F) (MPa, psi)	Compressive strength at 25°C (77°F) MPa, (psi)	Bell peel at 25°C (77°F) (N/25mm, lbf/inch)	Tg Dry 25°C (77°F) cure	Tg Dry - elevated temperature cure (°C/°F)	Pot life (100g)	Colour when mixed	
NA	43 (6200)	98 (14210)	NA	55 (130)	NA	2 hours	Grey	Two component thixotropic, gap filling high performance liquid shim adhesive, mix ratio 2:1 resin:hardener by volume.

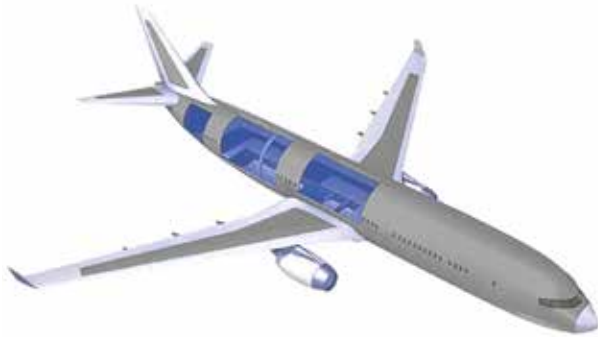
Redux[®] Primers

Product	Associated Film Adhesive	Colour	Drying Time	
			Drying Time at 25°C (77°F) (minutes)	Drying Time at 70°C (158°F) (minutes)
Redux[®] 112	Redux [®] 312, 609	Yellow	60	20
Redux[®] 119	Redux [®] 319, 641	Blue	60	30
Redux[®] 122	Redux [®] 308, 322, 340SP	Pink	60	30

Typical Aerospace Applications

Hexcel is the preferred supplier of composite materials to the civil aerospace industry with materials present in virtually every commercial aircraft currently built in the western world.

Primary Structures



- Nose landing gear doors
- Trailing edge upper and lower panels
- Main and centre landing gear doors
- Pylon fairings and nacelles
- Belly fairing panels
- Spoilers/flaps/ailerons
- Horizontal (HTP) and vertical (VTP) stabilizer
- Radome

Interiors



- Galley
- Floor panels
- Overhead stowage bins
- Wall partitions
- Lavatory
- Wardrobes
- Ceiling panels
- Sidewalls

Typical Industrial Applications

Suitable for a wide range of industries including:

- Automotive
- Buildings
- Marine
- Rail
- Sports goods
- Tooling
- Wind energy



These drawings illustrate typical applications for Redux® Adhesives. They are generic and not intended to represent a specific commercial usage. For information on the full range of Hexcel products for aerospace (carbon fibres, prepregs, honeycombs, etc) go to our website www.hexcel.com.

Hexcel Product Family



For more information

Hexcel is a leading worldwide supplier of composite materials to aerospace and industrial markets. Our comprehensive range includes:

- HexTow[®] carbon fibers
- HexForce[®] reinforcements
- HiMax[™] multiaxial reinforcements
- HexPly[®] prepregs
- HexMC[®] molding compounds
- HexFlow[®] RTM resins
- Redux[®] adhesives
- HexTool[®] tooling materials
- HexWeb[®] honeycombs
- Acousti-Cap[®] sound attenuating honeycomb
- Engineered core
- Engineered products

For US quotes, orders and product information call toll-free 1-800-688-7734. For other worldwide sales office telephone numbers and a full address list, please go to:

<http://www.hexcel.com/contact/salesoffice>

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