



3M™ Two Component Structural Adhesive 9820

1) Part Numbers

SA9820 (B/A) Orange and SA9820 (B/A) Black

2) Description and end uses

3M™ Structural Adhesive 9820 (B/A) is a highly toughened 2-part structural adhesive for composite and aluminium bonding in crash resistant areas. These products have been formulated for the automotive industry and mix quality can be checked by appearance of the applied or cured adhesive in the standard orange version. There is also 3M™ SA9820 Black, which is designed for applications where the black adhesive is more suitable, but the performance of both products is the same. 3M™ SA9820 Orange and SA9820 Black have a wide process window and can be applied under normal body-in-white (BIW) conditions at OEM's or in Tier-1 companies for modular assemblies and later fitting in BIW. SA9820 has good compatibility with a number of dry lubes* and other lubricants* and features broad off-ratio, adhesive gap and bake tolerances. In addition, the adhesive offers excellent dwell time compatibility* on oily surfaces for closed joints before E-coat bake without any reduction in performance. It can be induction heated at low temperatures to accelerate the cure, thereby minimizing distortion. Room temperature curing also provides excellent performance*.

*subject to tests performed on substrate oil combinations.

3) Physical Properties

Product Feature's	Performance Advantages	Customer Benefits
Epoxy Chemistry	High bond strength with cohesive failure mode on aluminium substrates as well as composite materials	Robust, structural bonding performance
	Compatible with wet and dry lubes	Provides good bond strength under various process conditions
	Provides good bond strength under various process conditions	

	Excellent long-term durability (to heat, humidity, salt water)	
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Two-Part	Extended shelf life	Broad handling and dispensing windows
	Controlled reactivity; balance of longer open time and proper lock-up e.g. after induction	
	Room temperature strength build-up	
	Can be dispensed with commercially available dispensing systems; off-ratio tolerance	
	Wash out resistance in E-Coat	

Induction Activation	Low temperature activation 80°C to 115°C, depending on cycle time	Broad curing windows; faster cycle times
	Reduced potential for panel distortion and increased options for multi-material bonding	
Final Heat Cure	99+% Solids	

b) Physical Properties

	Part A	Part B	Mixed Adhesive
Colour			
SA9820	Red	Yellow	Orange
SA9820 Black	Off-White	Black	Black
% Solids	100%	100%	100%
Density (± 0,06)	1,07 g/cc	1,07 g/cc	
Viscosity ¹ at RT [Pas] (± 20)	70	260	

4) Directions for Use

a) Handling / Process Properties

Storage	Part A	Part B
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Container sizes**(standard)		
• Drums	182 L in 200 L	182 L in 200 L
• Pails	18 L in 20 L	18 L in 20 L
• Dual-pack cartridges (400ml)		
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Shelf life at 21°C ***	9 months	12 months
From date of manufacture (3 months extension possible after retest)		

Stored at average temperatures between 10°C and 30°C. Temperatures are preferably controlled to 20°C or above to ensure good application and mixing. Temporary temperatures up to 40°C and lower than 10°C are not a problem.		
Dispensing	Mixed Adhesive	
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Mix Ratio (B:A)		
• By weight	4,0 B: 1,0 A	
• By volume	4,0 B: 1,0 A	
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Off-ratio tolerance		
• By weight	3,60 – 4,40 B: 1,0 A (±10%)	
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Open time Approximately 60 minutes at room temperature
(open time depends on temperature)

Rate of Strength Build up: See data below

Nozzle life Approximately 30 minutes depending on temperature.
Typical mixer nozzle recommendation is Mixpac™ MCX 10v x24

Induction Cure Typically over 100°C, heat acceleration profiles are available from
3M Technical Service on request

Final Cure

b) Cure temperature and cure options:

Normally the adhesive is applied at room temperature and allowed to cure for a minimum of 2h before bake. The adhesive can also be applied after conditioning cartridges or mixer head hoses at temperatures up to 50°C to confer improved application and cure rates for example.

In applications where higher strength is required during a high temperature bake cycle, we would propose room temperature cure for a minimum of 24h before bake (other methods are also available to accelerate cure if required including pre-warming the adhesive as indicated above). Where combined with mechanical fasteners this additional cure time may not be necessary.

The product typically develops good pre-E-coat wash out resistance within 2h of application, depending on temperature of the adhesive.

Typical cure cycles range from room temperature (23°C) to normal E-coat paint bake oven cycles (165°C to 200°C). Final performance may depend on cure cycle and substrates used and should be tested for each new application.

For maximum performance we would propose testing post cure bake from 80°C for clean surfaces or above 115°C on oily surfaces depending on substrate and oil specification.

Dispensing Equipment	Drum can be dispensed through bulk equipment specifically designed for use with 2-part epoxy adhesives.
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Clean-up Uncured adhesive can be removed by scraping with a putty knife or similar tool.

c) Performance Properties

Tg (ASTM D4065 tan delta peak):	96.5°C
Tensile Properties ASTM D638:	
• Tensile Strength:	39.5 MPa
• Elongation at break:	3.1%
• E Modulus:	2.1 GPa

Over-Lap Shear (OLS) ² 5754PT2AL070 (2 mm) 170°C bake	Value	Failure Mode
Room temperature plus oven cure ³ Tested at 23°C	; 20 MPa	cohesive
Room temperature plus oven cure ³ Tested at 80°C hot shear	; 13 MPa	cohesive
Room temperature plus oven cure ³ Tested at -40°C hot shear	; 22 MPa	close surface cohesive
Over-Lap Shear (OLS) ² 5754PT2AL070 (2 mm) 100°C bake	Value	Failure Mode
Room temperature plus oven cure ⁴ Tested at 23°C	; 14,5 MPa	cohesive
Room temperature plus oven cure ⁴ Tested at 80°C hot shear	; 13 MPa	mixed
Room temperature plus oven cure ⁴ Tested at -40°C hot shear	; 1 5,5 MPa	close surface cohesive
Over-Lap Shear (OLS) ² 2024T3 clad etched Aluminium (1,6 mm) 115°C bake	Value	Failure Mode
Room temperature plus oven cure ⁵ Tested at 23°C	; 29 MPa	cohesive
Room temperature plus oven cure ⁵ Tested at 80°C hot shear	; 18,5 MPa	mixed
Room temperature plus oven cure ⁵ Tested at -40°C hot shear	; 27 MPa	close surface cohesive

Over-Lap Shear (OLS) ² 5754PT2AL070 (2 mm) 170°C bake	Value	Failure Mode
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Room temperature plus oven cure ³ Tested at 23°C	; 20 MPa	cohesive
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Room temperature plus oven cure ³ Tested at 80°C hot shear	; 13 MPa	cohesive
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Room temperature plus oven cure ³ Tested at -40°C hot shear	; 22 MPa	close surface cohesive
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T-peel strength⁶ 5754PT2AL070 (1 mm) 170°C bake	Value	Failure Mode
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Room temperature plus oven cure ³ Tested at 23°C	; 220 N/25 mm	cohesive
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T-peel strength⁶ AA6016-Alodine 2010 Multidraw E1 (1,1 mm) 170°C bake	Value	Failure Mode
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Room temperature plus oven cure ³ Tested at 23°C	; 220 N/25 mm	cohesive
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T-peel strength⁶ 2024T3 clad etched Aluminium (1 mm) 115°C bake	Value	Failure Mode
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Room temperature plus oven cure ⁵ ;	150 N/25 mm	cohesive
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Fatigue Testing

ASTMD3166. Samples fatigued using 1KN load while exposed at Cyclic loading of 1KN was used on overlap shear test joints mad from etched 2024T3 aluminium that were exposed to 50degC/95%RH during the whole of the test. Fatigue testing in hot/wet conditions is a key discriminator of both adhesive and mechanical performance. The test was conducted to 10 million cycles and then stopped. All the test joints survived the 10 million cycles and were then tested to destruction in an Instron.

Fatigue Cycles (test stopped)	Substrate	Adhesive	Shear Stress MPa (tested after fatigue)	Failure Mode
10,202,766. Fatigue cycles 50C/95%RH	2024T3	9820 Orange	27.21	cohesion
10,202,775. Fatigue cycles 50C/95%RH	CFRP	9820 Black	26.93	cohesion

Rate of Strength Build up in Assembled Joints:

Method

Overlap shear samples were made as follows:

Substrate: 2024T3 aluminium (1"x4")

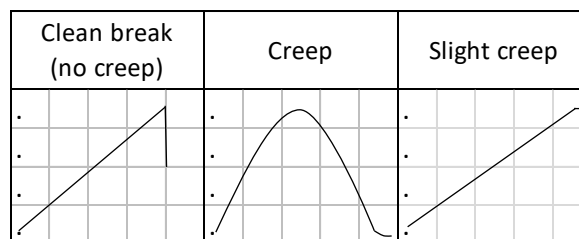
Adhesive: 3M SA9820, batch 0404K8

Overlap: 13 mm

Dwell: 2hr, 3hr, 4hr, 5hr, 6hr or 8hr

Dwell temperature: 15°C, 23°C or 35°C

After the specified dwell time samples were tested at a rate of 13 mm/min; test temperature was 23°C. Shear strength, in MPa, and whether samples showed signs of creep were recorded. If there was a clean break when the sample was tested, then there was no creep; if there was evidence of movement within adhesive before failure then there was creep. This was determined from the load extension curves:



Results

Dwell temp	Dwell time	Shear Strength, MPa	Creep? Y/N
15°C	2hr	0.05	Y
15°C	3hr	0.09	Y
15°C	4hr	0.30	Y
15°C	5hr	1.88	Y
15°C	6hr	4.32	Y (slight)
15°C	8hr	7.48	N
23°C	2hr	0.37	Y
23°C	3hr	2.06	Y
23°C	4hr	4.74	Y (slight)
23°C	5hr	9.22	N
23°C	6hr	12.58	N
23°C	8hr	13.47	N
35°C	2hr	12.48	N
35°C	3hr	18.59	N
35°C	4hr	22.47	N
35°C	5hr	23.49	N
35°C	6hr	23.17	N
35°C	8hr	23.80	N

- 1) The temperature that the adhesive is cured at has a large effect on curing rate. Workshop temperature must be monitored to ensure adhesive is cured before de-clamping.
- 2) Handling strength is usually defined as over 2MPa. Reaching this value indicates that the adhesive has cured sufficiently for de-clamping. From these results we would suggest that if significant transient loads are likely to be applied to parts after de-clamping, a de-clamping time of 6hrs at 15°C, 3-4hrs at 23°C, or 2hrs at 35°C should be tested. The shear strength achieved after these times is considerably higher than 2MPa.

- 3) While the adhesive has cured sufficiently for de-clamping after the times stated above, the adhesive may still creep when subjected to continuous stress including bolting and torque application.
Before subjecting joints to continuous stress, it is suggested that the adhesive must be allowed to cure for 8hrs at 15°C, 5hrs at 23°C or 2hrs at 35°C.

Important Note: This data is not intended to be used for specification purpose.

¹ Rheometer RS600 measuring system plate/ plate 20; shear rate = 2,000 sec⁻¹; gap 1,5mm

² DIN EN 1465 measured on 25 mm wide coupons using 13 mm over-lap bonds; adhesive bond line thickness 0,3 mm; cross head speed 13 mm/min.; substrate thickness see table

³ After 24 h stored at room temperature followed by 30 min 170°C oven bake

⁴ After 24 h stored at room temperature followed by 30 min 100°C oven bake

⁵ After 24 h stored at room temperature followed by 30 min 115°C oven bake

⁶ DIN EN 1464 measured on 25 mm wide coupons; bond line thickness 0,3mm; cross head speed 127 mm/min.; substrate thickness 1 mm

Substrates were used pre-coated with oil or dry lube from supplier.

Safety

Observe proper handling precautions as outlined in the Material Safety Data Sheet (MSDS), which is available on request. The website address for 3M Material safety data sheets is www.3m.com.msds

3M™ SA9820 (B/A) Orange and SA9820 (B/A) Black is designed FOR PROFESSIONAL INDUSTRIAL USE ONLY.

Disclaimer

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