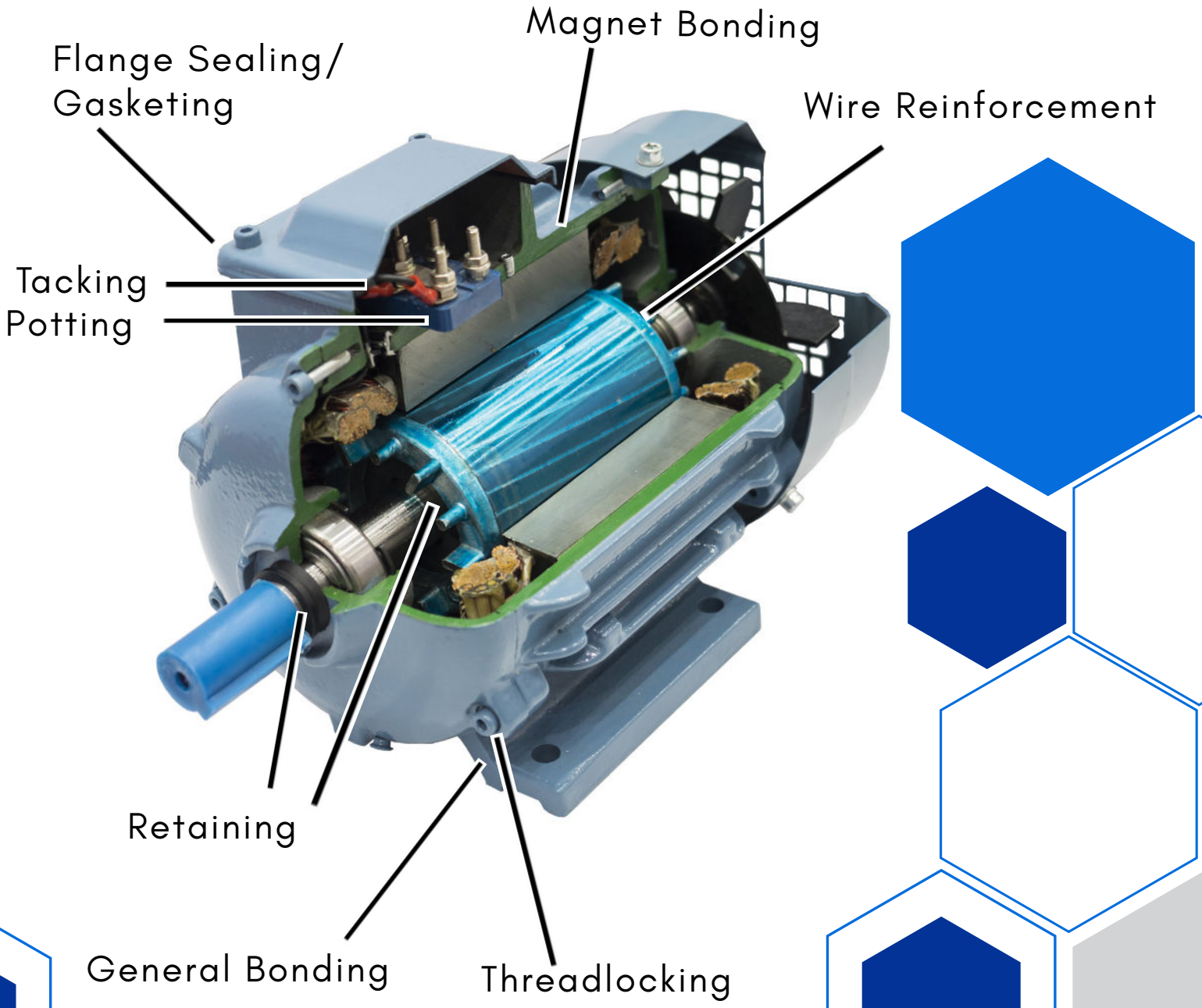
Permabond®
Engineering Adhesives

ADHESIVES FOR ELECTRIC MOTORS

Permabond adhesives and sealants are used to bond magnets, seal endplates, retain bearings, pot and reinforce wires, and for various other applications. Permabond is trusted on motors throughout diverse industries, from very large wind turbine motors to super small electronics motors. Typical applications are identified below.



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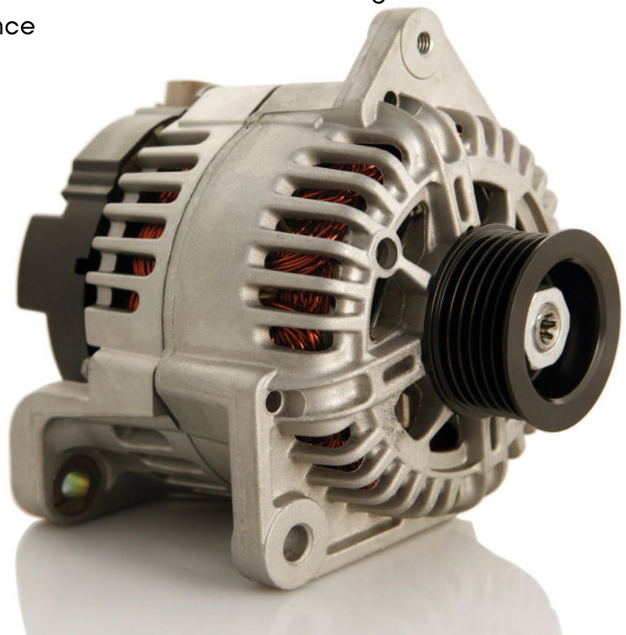
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Adhesive Advantages

Adhesives are preferred over soldering, riveting, mechanical fasteners, tapes, and all types of welding (metal, ultrasonic, and solvent) to:

- Increase motor life, they will not fracture magnets
- Increase material selection, they bond dissimilar substrates
- Reduce hazards associated with solvents and metal welding
- Improve aesthetics/appearance
- Increase process speed
- Prevent vibration noise
- Prevent corrosion
- Reduce cost



Adhesive Types

Permabond manufactures engineering adhesives and sealants for industrial use. We have a large number of specialty products and work with design engineers to custom formulate to engineering specifications. Permabond offers a wide range of adhesive technologies to suit application requirements, including:

- Anaerobic
- Cyanoacrylate
- Epoxy
- MS Polymer
- Polyurethane
- Structural Acrylic
- UV Curable



Adhesive Selection

We look forward to assisting you in selecting the best stock or custom engineering grade adhesive for your application. Our team is dedicated to providing high quality products that meet today's challenges for improvements in performance, efficiency, and cost effectiveness. Adhesive selection is based on various requirements, including:

- Strength
- Cure Speed
- Temperature Resistance
- Substrates
- Dispensing Preference
- Cure Preference
- Chemical Resistance
- Environmental Resistance

Electric Motor Retaining Applications

Anaerobic retaining compounds structurally join, unitize, and permanently bond cylindrical parts. Retaining the rotor components onto the motor shaft with anaerobic adhesives and sealants is preferred to joining via frictional or mechanical methods for the following reasons:

- Augment slip fits
- Mount bearings
- Restore correct fit
- Prevent corrosion
- Reduce machining time due to relaxed tolerances
- Rapid, quick, and easy assembly of parts
- 100% surface-to-surface contact
- Allow for greater load carrying capacity



Grade	HH040	HH040 PURE™	HL138	HM160	HM161	HM162	HM165
Features	General Use, Max. Gap Fill	General Use, NSF/ANSI 61 Certified	General Use, Press Fit	General Use, Slip Fit	Gap Fill, Slip Fit	Fast Cure, High Temperature Resistant	Max. Gap Fill, High Temperature Resistant
Color	Green	Colorless	Green	Green	Green	Green	Green
Viscosity, cP (mPa.s)	5,000		225	600	2,000	1000	2 rpm 25,000 20 rpm 10,000
Fluorescence	Yes	No	No	Yes	Yes	Yes	Yes
Maximum Gap Fill	0.010 in		0.005 in	0.008 in	0.010 in	0.008 in	0.012 in
	0.254 mm		0.127 mm	0.203 mm	0.254 mm	0.203 mm	0.305 mm
Shear Strength Steel	2000 psi		2300 psi	2000 psi	3500 psi	4300 psi	2900 psi
	14 MPa		16 MPa	14 MPa	24 MPa	30 MPa	20 MPa
Breaking Torque M10 Nuts & Bolts	220 in•lb		180 in•lb	270 in•lb	275 in•lb	280 in•lb	310 in•lb
	25 N•m		20 N•m	30 N•m	31 N•m	32 N•m	35 N•m
Torque Prevail M10 Nuts & Bolts	330 in•lb		315 in•lb	450 in•lb	400 in•lb	510 in•lb	450 in•lb
	37 N•m		36 N•m	50 N•m	45 N•m	57 N•m	50 N•m
Fixture	15 min		10 min	10 min	10 min	5 min	15 min
Full Cure	24 hours		24 hours	24 hours	24 hours	24 hours	24 hours
Temperature Range	-65 to 300°F		-65 to 250°F	-65 to 350°F	-65 to 300°F	-65 to 390°F	-65 to 445°F
	-55 to 150°C		-55 to 120°C	-55 to 177°C	-55 to 150°C	-55 to 200°C	-55 to 230°C

Electric Motor Wire Reinforcement

Protect against wire breakage with a structural epoxy. Epoxies provide a higher degree of protection against critical wire failure compared to solvent-based varnishes. It is especially important to reinforce the wires connecting to the commutator in DC motors that are expected to perform in high vibration environments or where flexing fatigue is expected.

- High strength protection against wire breakage
- Heat cure and room temperature cure products available
- Eliminate solvents





Grade	ES578	ET514	ET538	ET5441
Description	One component, Heat cure epoxy Thermally conductive, Electrically insulative Designed to meet UL94 V-0	Two component, 1:1 mix ratio Room temp cure epoxy, Resilient	Two component, 1:1 mix ratio Room temp cure epoxy, Extended pot life	Two component, 2:1 mix ratio Thermally conductive, Room temp cure epoxy
Color	Black	Gray	Gray	Gray
Viscosity, cP (mPa.s)	700,000	Thixotropic Paste	Thixotropic Paste	A: 250,000 mPa.s (cP) B: 200,000 mPa.s (cP)
Specific weight	1.6	A: 1.1 B: 1.2	A: 1.1 B: 1.4	A: 2.1 B: 2.1
Mixing Life	-	30-50 min	120-150 min	150 min
Gap Fill	0.20 in. (5 mm)	0.08 in. (2 mm)	0.20 in. (5 mm)	0.08 in (2 mm)
Shore Hardness	D 80 - 85	D 60 - 75	D 70 - 80	D 85-95
Elongation	<3%	10 - 15%	4 - 8%	2.9%
Dielectric Strength	40-45 kV/mm	15-25 kV/mm	15-25 kV/mm	15-25 kV/mm
Thermal conductivity	1.0 W/(m.K)	0.3 W/(m.K)	0.55 W/(m.K)	1.1 W/(m.K)
Glass Transition Temperature (Tg)	220°F (105°C)	104-122°F (40-50°C)	113-131°F (45-55°C)	Cured at 23C: 65C Cured 24h at 23C + 30 min at 80C: 113C
Shear Strength Steel	4000 - 6000 psi 27 - 41 N/mm^2	2900 - 4350 psi 20 - 30 N/mm^2	3625 - 4350 psi 25-30 N/mm^2	2900 psi 20 N/mm^2
Handling Strength	-	1 - 2 hours	3 - 5 hours	8 hours
Full Cure	266°F (130°C) 75 min 300°F (150°C) 60 min 338°F (170°C) 25 min	Room Temperature 24 hours	Room Temperature 24 hours	Room Temperature 7 days
Temperature Range	-40 to 356°F	-40 to 176°F	-40 to 212°F	-40 to 356°F
	-40 to 180°C	-40 to 80°C	-40 to 100°C	-40 to 200°C

Permabond® Engineering Adhesives

Electric Motor Magnet Bonding & General Bonding Applications

Most electric motor magnets are bonded because adhesives significantly reduce cost and increase motor life when compared to motor magnets that are clipped. Adhesives are also used to mount brackets, bond brush holders to brackets, and bond the bracket to the housing.

	One Component Heat Cured Epoxy		Two Component Epoxy	Surface Activated Acrylics			External Mix Acrylic	Cyanoacrylates	
	Highest Shear and Impact Strength Best Environmental Resistance Shortest Full Cure Time			*Excellent Shear and Impact Strength Very Good Environmental Resistance Fast Strength Development*				*Fast fixture, simple process, small assemblies*	
Product	**ES550**	**ES568**	**ET5424**	**TA437**	**TA439**	**TA4590**	**TA4592**	**825**	**2011**
Color	Silver-Gray	Ivory	A: Grey B: Black	Orange	Amber	Blue	Blue/Yellow	Clear	Clear
Initiator	N/A	N/A	N/A	41M	41M (43 for plastics)	44	NA	NA	NA
Feature	Non-sag	Free Flowing	High Temperature Resistant	One Component	Low Viscosity	High Viscosity	Two Component External Mix	Patented High Temp	Thixotropic
Viscosity, cP (mPa.s)	1,500,000	55,000	A: 245,000 B: 1700	20 rpm 40,000 2.5 rpm 130,000	20 rpm 1000	20 rpm 20,000 2.5 rpm 90,000	20 rpm 9,000 2.5 rpm 32,000	125	Gel
Gap Fill	0.02 in (0.5 mm)	0.02 in (0.5 mm)	3.0 in (0.12 mm)	0.02 in (0.5 mm)	0.006 in (0.15 mm)	0.02 in (0.5 mm)	0.04 in (1 mm)	0.006 in (0.15 mm)	0.02 in (0.5 mm)
Fixture Time	NA	NA	N/A	5-10 min (No initiator) 20-30 sec (Initiator 41)	20 - 40 sec	15 - 30 sec	10 - 30 sec	10 - 20 sec	5 - 10 sec
Cure Time	266°F (130°C): 75 min 300°F (150°C): 60 min 338°F (170°C): 40 min	275°F (135°C): 35 min 300°F (150°C): 20 min 338°F (170°C): 10 min	150.8°F (66°C): 1 hour 73.4°F (23°C): 3-5 days	24 hours	24 hours	24 hours	24 hours	24 hours	24 hours
Temperature Resistance	-40°F to 355°F (-40°C to 180°C)	-40°F to 355°F (-40°C to 180°C)	-40°F to 446°F (-40°C to 230°C)	-65°F to 392°F (-55°C to 200°C)	-65°F to 330°F (-55°C to 165°C)	-65°F to 330°F (-55°C to 165°C)	-65°F to 310°F (-55°C to 155°C)	-65°F to 390°F (-55°C to 200°C)	-65°F to 250°F (-55°C to 120°C)
Shear Strength Steel after 24 hours	27-41 MPa (4000-6000) psi	20-25 MPa (2900-3600) psi	22-27 MPa (2900- 3626) psi	14-20 MPa (2000-3000 psi)	20-25 MPa (2900-3600 psi)	20-25 MPa (2900-3600 psi)	20-25 MPa (2900-3600 psi)	15 - 20 MPa (2175-2900 psi)	29 - 35 MPa (2900-3500 psi)
Shear Strength Ferrite/Steel after 3 mins	NA	NA	N/A	4 MPa (600 psi)	4 MPa (600 psi)	4 MPa (600 psi)	4 MPa (600 psi)	3 MPa (400 psi)	3 MPa (400 psi)
Shear Strength Ferrite/Steel after 24 hours	>14 MPa (2,000 psi) substrate failure	>14 MPa (2,000 psi) substrate failure	N/A	>14 MPa (2000 psi) Substrate failure	>14 MPa (2000 psi) Substrate failure	>14 MPa (2000 psi) Substrate failure	>14 MPa (2000 psi) Substrate failure	>10 MPa (2000 psi)	>10 MPa (2000 psi)
Acid Free, Non-corrosive	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Impact Strength	25 - 35 KJ/m^2	25 - 35 KJ/m^2	N/A	10 - 15 KJ/m^2	15 - 20 KJ/m^2	15 - 20 KJ/m^2	10 - 20 KJ/m^2	3 - 5 KJ/m^2	3 - 5 KJ/m^2

Strength results will vary depending on the level of surface preparation and gap.

Permabond Epoxies Permabond epoxy adhesives form strong, durable bonds. Single part adhesives offer heat resistance up to 355°F (180°C). ES550 is a non-sag epoxy that stays in place during cure, while ES568 is free flowing and fills gaps as it flows into joints when heated. Two part adhesives offer heat resistance up to 446°F (230°C), with ET5424 extending performance where higher temperature resistance is required.

Permabond Surface Activated Structural Acrylics Permabond structural acrylics develop strength rapidly so parts can be unclamped in a short time. They continue to develop strength for 24 hours. Examples of Permabond's surface activated acrylic line include TA437, TA439, and TA4590. The adhesive is applied to one surface and the initiator is brushed or sprayed on to the other surface. Upon assembly, strength development occurs rapidly. Permabond TA437 can be used without the initiator provided at least one surface is metal, however strength development is faster with initiator.

Permabond External Mix Structural Acrylic High speed production lines benefit from the single dispense step and very fast strength development of Permabond TA4592. External mix dispensing equipment is used to dispense both components of TA4592 into a single stream. The components mix in the air before dispensing on the bond area.

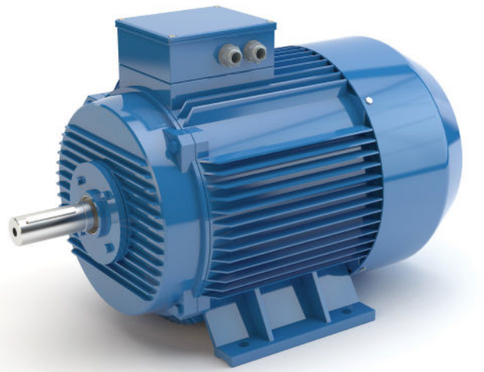
Permabond Cyanoacrylates The expanding variety of small motors includes motors with unconventional substrates. For many of these motors cyanoacrylates are ideal as they bond a variety of substrates quickly.

Permabond® Engineering Adhesives

Electric Motor Threadlocking

Prevent vibration loosening of through bolts, cover screws, and all motor assembly fasteners with anaerobic threadlockers. Anaerobic threadlockers outperform other methods of locking fasteners.

- Prevent vibration loosening
- Prevent corrosion
- Reduce cost
- Reduce weight
- Controlled strength (permanent and removable grades)



Product	LM113	MM115	MM115 PURE™	HM118	HL126	HH120	HM128	HM129	HH131
Feature	Low Strength	General Purpose	NSF/ANSI 61 Certified	High Strength	Wicking and Weld Sealing	Gap Filling	General Purpose	High Strength	High Temp.
Color	Purple	Blue	Colorless	Red	Green	Red	Red	Red	Red
Viscosity, cP (mPa.s)	2 rpm 5000 20 rpm 1200	2 rpm 5000 20 rpm 1300		2 rpm 5000 20 rpm 1800	12	7000	500	500	2 rpm 23,000 20 rpm 7500
Fluorescent	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No
Maximum Gap Fill	0.006 in	0.006 in		0.008 in	0.001 in	0.01 in	0.006 in	0.006 in	0.012 in
	0.15 mm	0.15 mm		0.20 mm	0.05 mm	0.25 mm	0.15 mm	0.15 mm	0.30 mm
Maximum Bolt Size	3/4"	3/4"		3/4"	1/2"	1 1/2"	3/4"	3/4"	2"
	M20	M20		M20	M10	M30	M20	M20	M56
Shear Strength Steel	750 psi	1450 psi		2500 psi	2200 psi	2500 psi	2500 psi	2500 psi	2500 psi
	5 MPa	10 MPa		17 MPa	15 MPa	17 MPa	17 MPa	17 MPa	17 MPa
Torque Breakaway M10 Nuts & Bolts	80 in•lb	140 in•lb		200 in•lb	125 in•lb	275 in•lb	275 in•lb	290 in•lb	240 in•lb
	9 N•m	16 N•m		23 N•m	14 N•m	31 N•m	31 N•m	33 N•m	27 N•m
Torque Prevail M10 Nuts & Bolts	40 in•lb	60 in•lb		280 in•lb	300 in•lb	300 in•lb	350 in•lb	520 in•lb	480 in•lb
	5 N•m	7 N•m		32 N•m	34 N•m	34 N•m	40 N•m	58 N•m	54 N•m
Fixture	15 min	10 min		10 min	15 min	10 min	15 min	10 min	15 min
Full Cure	24 hours	24 hours		24 hours	24 hours	24 hours	24 hours	24 hours	24 hours
Temperature Range	-65 to 300°F	-65 to 300°F		-65 to 300°F	-65 to 300°F	-65 to 300°F	-65 to 300°F	-65 to 300°F	-65 to 445°F
	-55 to 150°C	-55 to 150°C		-55 to 150°C	-55 to 150°C	-55 to 150°C	-55 to 150°C	-55 to 150°C	-55 to 230°C

Electric Motor Thread Sealing

Seal and lock metal pipe fittings and junctions with anaerobic thread sealants. These sealants provide the following advantages over pipe dope, specialty fittings, and PTFE tape.

- Fully cured sealants typically seal to the burst pressure of the pipe
- Will not shred, creep, or relax over time
- Reliable seal
- No solvents
- Reduce cost
- No loose particles to clog valves
- Resistant to a wide variety of chemicals
- Lubricates for easier assembly, allows accurate positioning of pipes
- Grades available for water, gas, air, and hydraulic systems

Product	LM012	LH050	LH050 PURE™	LH051	MH052	LH150
Features	No Fillers, Hydraulics Sealing Grade	General Use UL Classified	NSF/ANSI 61 Potable Water Certification	Automatic Dispensing	Medium Strength BAM Approved for use with gaseous oxygen up to 10 bar (145 psi) and 60°C (140°F)	Stainless Steel Grade
Color	Brown	White		White	Yellow	White
Viscosity	2000 cP	250,000 cP		2 rpm 450,000 cP 20 rpm 70,000 cP	2 rpm 65,000 cP 20 rpm 25,000 cP	260,000 cP
Fluorescence	Yes	No		No	Yes	No
Maximum Gap Fill	0.008 in	0.020 in		0.020 in	0.020 in	0.020 in
	0.20 mm	0.50 mm		0.50 mm	0.50 mm	0.50 mm
Shear Strength Steel	750 psi	1000 psi		1000 psi	1450 psi	1000 psi
	5 MPa	7 MPa		7 MPa	10 MPa	7 MPa
Breaking Torque M10 Nuts & Bolts	25 in•lb	35 in•lb		35 in•lb	180 in•lb	50 in•lb
	3 N•m	4 N•m		4 N•m	20 N•m	6 N•m
Torque Prevail M10 Nuts & Bolts	15 in•lb	25 in•lb		25 in•lb	100 in•lb	25 in•lb
	2 N•m	3 N•m		3 N•m	11 N•m	3 N•m
Fixture	30 min	120 min		120 min	15 min	120 min
Full Cure	24 hours	24 hours		24 hours	24 hours	24 hours
Temperature Range	-65 to 350°F	-65 to 350°F		-65 to 350°F	-65 to 300°F	-65 to 350°F
	-55 to 177°C	-55 to 177°C		-55 to 177°C	-55 to 150°C	-55 to 177°C

For more information on ASTM or Mil Specs, please refer to the technical data sheets or contact Permabond.

Electric Motor Tacking and Bonding

Cyanoacrylates are preferred to tack wires, paper sleeves, insulation, etc., into place to securely hold them in the proper position during assembly. They are also used to reinforce wires and other fragile components. Industry favorites are listed below.

- Fast set - No equipment required
- Excellent adhesion to a variety of substrates
- Primer available to increase adhesion to polyolefins
- Excess adhesive can be cured rapidly with an accelerator

			Viscosity	Gap Fill		Shear Strength*		Set Time		Temperature Range	
			23 °C	Max.		Steel		Plastic	Metal	Lower	Upper
	Grade	Description	cP (mPa.s)	in.	mm	psi	MPa	sec	sec	°F (°C)	°F (°C)
	130UV	NEW! UV Curable	200	-	-	1740-246	12-17	-	-	-65 (-55)	250 (120)
General Purpose	101	Wicking type	2-3	0.002	0.05	2800-3300	19-23	5-10	3-5	-65 (-55)	180 (82)
	102	Plastic bonding	70-90	0.006	0.15	2800-3300	19-23	10-15	10-15	-65 (-55)	180 (82)
	105	Elastomer bonding	30-50	0.004	0.10	2600-3200	18-22	5-10	10-15	-65 (-55)	180 (82)
	108	Intermediate gap fill	400-600	0.008	0.20	2900-3200	20-22	10	10	-65 (-55)	180 (82)
	268	Fast curing max. gap fill	1200-2400	0.017	0.43	2900-3200	20-22	5-10	5-10	-65 (-55)	180 (82)
	2010	Thixotropic, max. gap fill	15,000	0.020	0.50	2800-3300	19-23	10-15	10-15	-65 (-55)	180 (82)
Metals	170	Maximum gap fill	1000-2000	0.015	0.38	3300-3600	23-25	10-20	10-20	-65 (-55)	195 (90)
	910	*The Original!*	70-90	0.006	0.15	3300-4200	23-29	10-15	10-15	-65 (-55)	195 (90)
	910FS	Wicking type	2-4	0.002	0.05	3300-4200	23-29	<10	<10	-65 (-55)	195 (90)
	712	NEW! Water Resistant	100	0.006	0.15	2755-3480	19-24	<15	<25	-65 (-55)	250 (120)
Toughened	731	Excellent strength	100-200	0.006	0.15	3500-4400	24-30	15-20	<30	-65 (-55)	250 (120)
	735	731 - black	100-200	0.006	0.15	3500-4400	24-30	5-10	30-50	-65 (-55)	250 (120)
	737	Impact resist., gap fill, black	2000-4000	0.020	0.50	2800-3300	19-23	5-10	15-20	-65 (-55)	250 (120)
Surface Insensitive	790	Very fast set	1-3	0.002	0.05	2600-3200	18-22	2-3	2-3	-65 (-55)	180 (82)
	791	Very fast set	30-50	0.004	0.10	2600-3200	18-22	2-3	2-3	-65 (-55)	180 (82)
	792	Very fast set	60-125	0.006	0.15	2600-3200	18-22	2-3	2-3	-65 (-55)	250 (120)
	795	Fast curing	400-600	0.007	0.18	2600-3200	18-22	3-6	3-6	-65 (-55)	180 (82)
	799	Fast curing	4000-6000	0.020	0.50	2900-3200	20-22	6-10	6-10	-65 (-55)	180 (82)
	2011	Non-sag	Gel	0.020	0.50	2900-3500	20-24	5-10	5-10	-65 (-55)	250 (120)
High Temp. Resistant	801	Resists to 130°C	10-15	0.002	0.05	2800-3300	19-23	10-15	10-15	-65 (-55)	270 (130)
	802	Resists to 160°C	90-110	0.006	0.15	2800-3300	19-23	10-15	10-15	-65 (-55)	320 (160)
	825	Resists to 200°C Patented	100-150	0.006	0.15	2175-2900	15-20	10-20	10-20	-65 (-55)	390 (200)
	919	Resists to 250°C*	2-6	0.002	0.05	2900-3200	20-22	<20	<20	-65 (-55)	*482 (250)
	920	Resists to 250°C*	70-90	0.006	0.15	2800-3300	19-23	10-15	15-20	-65 (-55)	*482 (250)
	922	Resists to 250°C*	1200-2000	0.017	0.43	2800-3300	19-23	<45	<20	-65 (-55)	*482 (250)
Low Odor	940	Low odor & non-blooming	3-10	0.002	0.05	2300-2900	16-20	10-15	10-15	-65 (-55)	180 (82)
	941	Low odor & non-blooming	10-20	0.003	0.08	2300-2900	16-20	10-15	10-15	-65 (-55)	180 (82)
	943	Low odor & non-blooming	90-110	0.006	0.15	2300-2900	16-20	5-10	10-15	-65 (-55)	180 (82)
	947	Low odor & non-blooming	900-1500	0.010	0.25	2300-2900	16-20	20-30	10-15	-65 (-55)	180 (82)

Electric Motor Lamination Bonding

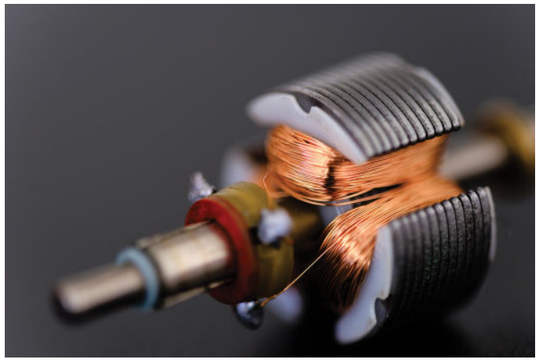
Bonding reduces corrosion, eliminates hum, and reduces interlaminar loss. Products are available with excellent thermal conductivity. Because needs vary so greatly, Permabond produces a variety of adhesive types that are trusted in laminations. Please contact Permabond to discuss which option will suit your requirements.

- Eliminate hum
- Reduce interlaminar loss
- Prevent corrosion

Type	Properties
Single Component Epoxy	Grades with excellent thermal conductivity. Withstands machining, grinding, and other finish processes.
Surface Activated Acrylic	Fast-setting room temperature cure. Withstands machining, grinding, and other finish processes.
Cyanoacrylates	Wicking grades ideal for post assembly available. High temperature resistant grades available.
UV/Anaerobic Cure	Fast fixture using UV light. Wicking grades ideal for post assembly available.
Eliminate costs associated with delamination and broken stacks! Contact Permabond for a product recommendation to suit your application.	

Electric Motor Potting

Permabond has several chemistries that are ideal for various potting applications to encapsulate areas from the environment. Potting can also protect components from impact, vibration fatigue, thermal shocks, and corrosion.



Type	Properties
Modified Epoxy	High elongation, Low shrinkage, Two component
MS Polymer	High environmental resistance, High elongation, Low shrinkage, Fast tack free time, Non-corrosive
Polyurethanes	High tensile strength, Semi-rigid

- Prevent dust and moisture ingress
- Eliminate corrosion
- Protect from impact stresses
- Reduce thermal shock
- Eliminate vibration fatigue

* Note the 800 series does not require a secondary heat cure. Following is the secondary heat cure process for 919, 920, and 922: 1) Parts are bonded and clamped at room temperature for four hours. 2) The clamped parts are then heated at 150°C (302°F) for two hours. 3) After two hours, the bond will be thermally resistant up to 250°C (482°F). **Without the secondary heat cure activation of the high temperature resistance properties, these products will only resist temperatures up to 180°F (82°C)**

Permabond®
Engineering Adhesives

ADHESIVES FOR ELECTRIC MOTORS

Permabond adhesives and sealants are available worldwide through authorized distributors.

Contact us for technical support or a distributor in your area!



PERMABOND.COM

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