Permabond®
Engineering Adhesives

Manufacturer, Custom Formulator, & Innovator of Adhesives

- Structural Bonding
- Light Curing
- Sealing
- Instant Bonding
- Threadlocking
- Retaining
- Potting
- Encapsulating
- Lightweighting

...and more!

Permabond®

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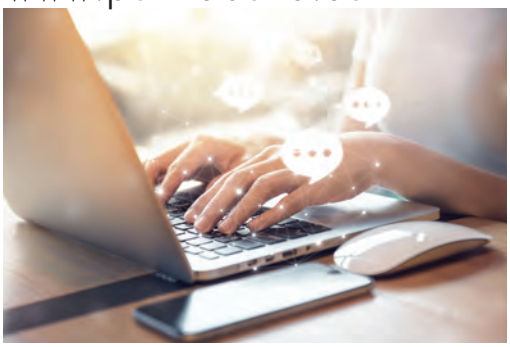
800-640-7599 ↔ 732-868-1372

CONTACT US
www.permabond.com



EMAIL
info.americas@permabond.com

CONTACT US

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.

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. A sampling of products is listed on the following pages. Please note strength results will vary depending on the level of surface preparation and gap.

ISO 9001:2015 Certified

Permabond products conform to many company and industry specifications. Some of the most common are listed here.


Automotive


Defense and Aerospace


Sports and Leisure


Machinery


Transportation


Electric Motor

Military Specifications and Standards

MIL-S-22473E[1] • ASTM D5363[2]

Permabond Grade	Grade	ASTM D5363 Assigned #	Group	Class	Grade
HH120	AVV	AN 0124	01	2	4
HL126	AA	AN 0111	01	1	1
MM115	CVV	AN 0143	01	4	3
LM012	HVV	AN 0163	01	6	3
ASC10	N & T	N/A	N/A	N/A	N & T

MIL-S-46163A[1] • ASTM D5363[2]

Permabond Grade	Type / Grade	ASTM D5363 Assigned #	Group	Class	Grade
HH120	I / L	AN 0211	02	1	1
HL126	III / R	AN 0261	02	6	1
HM118	II / O	AN 0331	03	3	1
HM128	I / K	AN 0221	02	2	1
LM113	II / M	AN 0311	03	1	1
MM115	II / N	AN 0321	03	2	1
ASC10	F	N/A	N/A	N/A	N & T

MIL-R-46082B[1] • ASTM D5363[2]

Permabond Grade	Type	ASTM D5363 Assigned #	Group	Class	Grade
HL138	I	AN 0411	04	1	1
HM160	II	AN 0412	04	1	2
HM161	III	AN 0421	04	2	1

[1]MIL-SPECS are for existing designs ONLY
[2]ASTM D5363 is for NEW designs

MIL-A-46050C[1]

Permabond Grade	Type/Class
101	Type II, Class 1
102	Type II, Class 2
105	Type II, Class 1
108	Type II, Class 3
170	Type I, Class 3
268	Type II, Class 3
790	Type II, Class 1
791	Type II, Class 1
792	Type II, Class 2
795	Type II, Class 3
798	Type II, Class 3
799	Type II, Class 4
910	Type I, Class 2
910FS	Type I, Class 1
919	Type V, Class 1
920	Type V, Class 2
922	Type V, Class 3
QFS16	All Types

CID A-A-3097

Permabond Grade	Type/Class
101	Type II, Class 1
108	Type II, Class 3
200	Type II, Class 3
268	Type II, Class 3
791	Type II, Class 1
792	Type II, Class 2
795	Type II, Class 3
910	Type I, Class 2
910FS	Type I, Class 1
2011	Type II, Class 5
QFS16	All Types

Permabond has adhesives and sealants that bond virtually any substrate including composites, glass, metal, plastics, rubber, wood, and leather.

Biocompatibility

CYTOTOXICITY ISO 10993-5

Permabond Grade
130UV
4C10
4C20
4C30
4C40
731
820
920
ET530
UV630
POP

USP CLASS VI

Permabond Grade
4C10
4C20
4C30
4C40

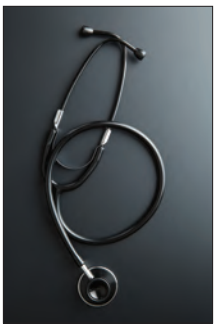
SENSITIZATION ISO 10993-10

Permabond Grade
ET530

Food

Permabond Grade	CFR 175.105
ET5145	Formulated using FDA approved raw materials.
ET5147	

Permabond Grade	NSF Non-food Compound Category Code P1
792	Reg # 156137
2011	Reg # 155298



Medical Device

Filters

Food Contact

Speaker

Fire Protection

Oxygen Gas

Permabond Grade	BAM Certification
MH052	Approved for use with gaseous oxygen up to 10 bar (145 psi) and 60°C (140°F).

Potable Water

ANSI Accredited Program PRODUCT CERTIFICATION

NSF's Certification Program is accredited by the American National Standards Institute

Permabond Grade
HH040 PURE
LH050 PURE
MM115 PURE

Underwriters Laboratory

CLASSIFIED UL

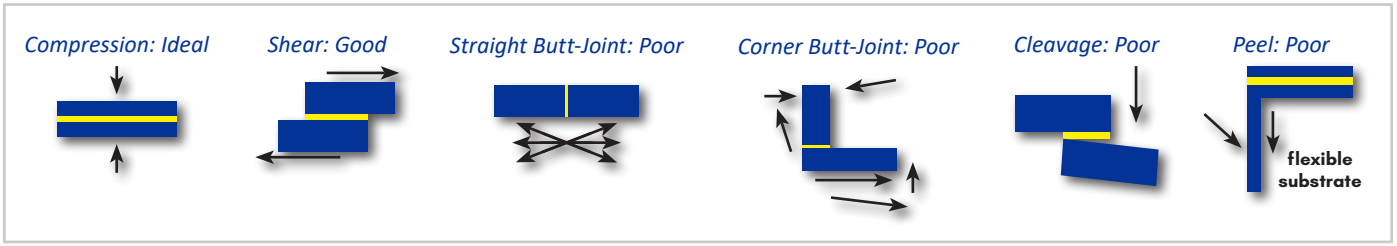
Permabond Grade
LH050
LH150

DESIGN CONSIDERATIONS

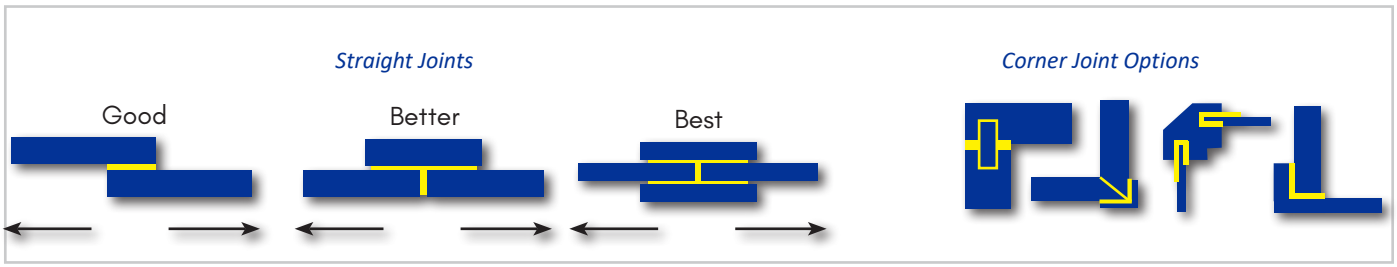
Designing components and assembly processes with adhesive use in mind improves quality and efficiency. In addition to adhesion, consider joint design, surface preparation, gap fill and viscosity, adhesive usage, and service conditions.

Joint Designs

Typical Joints



Suggested Improvements



Gap Fill and Adhesive Viscosity

Adhesive viscosity and gap fill capability are closely related - generally, for a given chemistry, the higher the adhesive viscosity, the larger the gap filling capability. It is important to note the maximum gap fill for each product. Exceeding the maximum gap fill can weaken bond strength. To help "get a feel" for viscosity measurements, the list below shows everyday substances and their approximate viscosity.

Substance	Viscosity mPa.s = cP
Water	1
Milk	3
SAE 10 Motor oil	85-140
SAE 20 Motor oil	140-420
SAE 30 Motor oil	420-650
SAE 40 Motor oil	650-900
Castor oil	1000
Maple syrup	5000
Honey	10,000
Chocolate syrup	25,000
Ketchup	50,000
Mustard	70,000
Sour cream	100,000
Peanut butter	250,000

Surface Preparation

Most materials can be bonded without surface pre-treatment unless surfaces are grossly contaminated. To achieve maximum performance and repeatable results, it is advisable to ensure the bondable surface is clean and consistent. Increasing the surface energy can optimize the bond strength. Various surface treatments can be used to increase the surface energy.

Surface Treatment

Low Surface Energy

Poor Wetting

- Solvent wiping
- Mechanical abrasion
- Chemical pretreatment
- Flame treatment

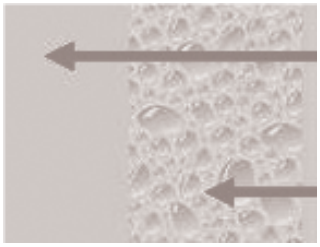
- Chromic acid
- Iodine
- Corona or Plasma treatments
- Primers

High Surface Energy

Good Wetting

Permabond 2K Primer

Permabond 2K Primer improves adhesion, prevents corrosion, and provides easy visual inspection of surface bondability. On the left, the 2K Primer wets out the surface leaving a uniform coating. The surface to the right is not yet prepared well for bonding and the 2K primer beads up.

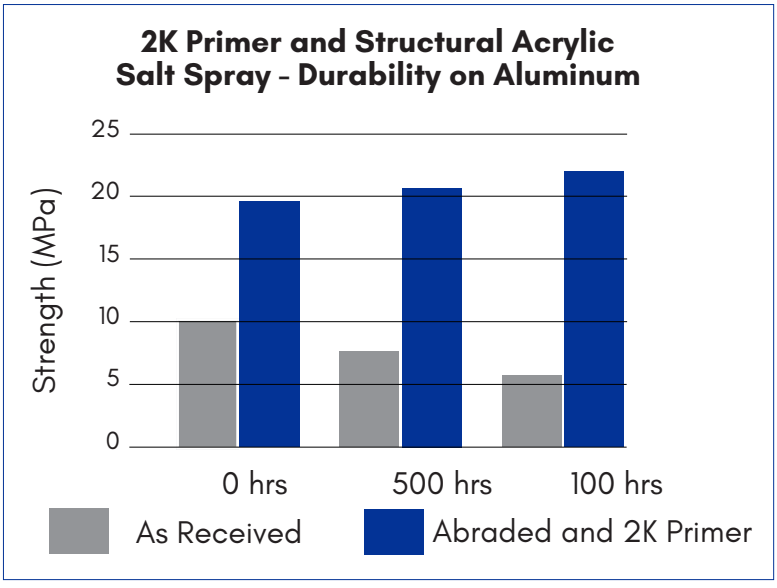


Ready for Bonding

Surface Preparation Needed

Salt Spray - Durability on Aluminum

The graph below shows the strength retention with and without Permabond 2K Primer on abraded aluminum surfaces bonded with structural acrylic adhesive. The results of the salt spray aging test show improved durability.



ADHESIVE SELECTION

Selecting the most appropriate adhesive for an engineering application requires consideration of a number of factors. The following tables and charts will aid to narrow down the options. Permabond welcomes the opportunity to assist in your selection. Please call 800-640-7599.

Adhesion					Cured State	
Chemistry	**Metal**	**Glass**	**Plastic**	**Composite**	**Flexibility**	**Hardness**
Anaerobic	Excellent	Not Applicable	Not Applicable	Not Applicable	Low	Rigid
Cyanoacrylate	Very Good	Poor	Excellent	Good	Low to High	Rigid to Very Soft
Epoxy - 1 Part	Excellent	Excellent	Substrate Specific	Excellent	Low	Rigid
Epoxy - 2 Part	Excellent	Excellent	Fair	Excellent	Medium	Semi Rigid
Epoxy - Modified	Excellent	Excellent	Excellent	Excellent	High	Very Soft
MS Polymer	Very Good	Good	Excellent	Very Good	High	Very Soft
Polyurethane	Very Good	Good	Excellent	Excellent	Medium	Semi Rigid
Structural Acrylic - No Mix	Excellent	Good	Product Specific	Very Good	Low	Semi Rigid
Structural Acrylic - 2 Part	Excellent	Good	Product Specific	Very Good	Low	Semi Rigid
Structural Acrylic - 2 Part MMA	Excellent	Product Specific	Excellent	Excellent	Low	Semi Rigid
UV Curable	Very Good	Excellent	Excellent	Very Good	Product Specific	Product Specific

Solvent Resistance			Temperature Resistance	
Examples of polar solvents: Water, Ethylene Glycol, IPA, Acetone Examples of non-polar solvents: Motor Oil, Toluene, Gasoline			**Products can withstand higher temperatures for brief periods providing the joint is not unduly stressed.**	
Chemistry	**Polar**	**Non Polar**	**Standard Grade**	**High Temp Grade**
Anaerobic	Very Good	Very Good	300°F (150°C)	450°F (230°C)
Cyanoacrylate	Poor	Good	185°F (85°C)	480°F (250°C)
Epoxy - 1 Part	Very Good	Excellent	350°F (180°C)	570°F (300°C)*
Epoxy - 2 Part	Very Good	Very Good	175°F (80°C)	570°F (300°C)*
Epoxy - Modified	Good	Very Good	175°F (80°C)	-
MS Polymer	Good	Fair	175°F (80°C)	-
Polyurethane	Good	Good	250°F (120°C)	-
Structural Acrylic - No Mix	Good	Very Good	300°F (150°C)	390°F (200°C)
Structural Acrylic - 2 Part	Good	Very Good	250°F (120°C)	-
Structural Acrylic - 2 Part MMA	Good	Very Good	250°F (120°C)	-
UV Curable	Good	Very Good	250°F (120°C)	300°F (150°C)

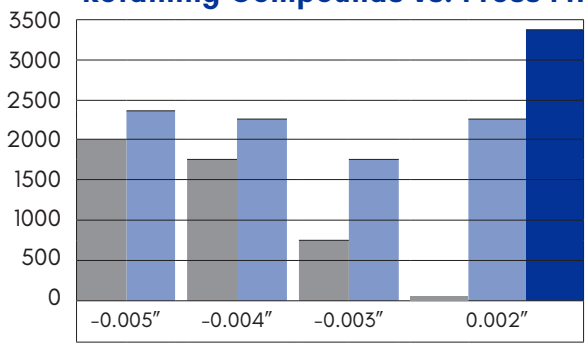
*Contact Permabond for more information.

ANAEROBIC RETAINING COMPOUNDS

Permabond retaining compounds are for the permanent bonding of co-axial joints. They provide 100% surface-to-surface contact while mechanical joining techniques provide only 20% of surface-to-surface contact. The resulting surface area increase allows for a greater load carrying capacity, more than 5 times that of mechanical joining techniques.

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

Retaining Compounds vs. Press Fits



- **Press Fit (6 micro-inch finish)** 25% to 30% metal to metal contact
- **Adhesive (6 micro-inch finish)**
- **Adhesive (machine finish)** 100% contact area is used to transfer load

The highest strength is achieved with the least expensive tolerance and finish.

Anaerobic Retaining Compounds

Grade	HH040	HH040 PURE	HL138	HM160	HM161	HM162	HM165	HH167
Features	General purpose, maximum gap fill	General purpose, NSF/ANSI 61 Certified	General purpose, press fit	General purpose, slip fit	Gap fill, slip fit	Fast curing, high temperature resistant	Maximum gap fill, high temperature resistant	Maximum gap fill, metal repair
Color	Green	Colorless	Green	Green	Green	Green	Green	Silver
Viscosity	5000 cP		225 cP	600 cP	2000 cP	1000 cP	2 rpm 25,000 cP 20 rpm 10,000 cP	2 rpm 500,000 cP 20 rpm 90,000 cP
Fluorescing	Yes	No	No	Yes	Yes	Yes	Yes	No
Max Gap Fill	0.010 in		0.005 in	0.008 in	0.010 in	0.008 in	0.012 in	0.02 in
	0.254 mm		0.127 mm	0.203 mm	0.254 mm	0.203 mm	0.305 mm	0.500 mm
Shear Strength Steel	2000 psi		2300 psi	2000 psi	3500 psi	4300 psi	2900 psi	4700 psi
	14 MPa		16 MPa	14 MPa	24 MPa	30 MPa	20 MPa	32 MPa
Torque Breakaway M10 Steel Nuts and Bolts	220 in•lb		180 in•lb	270 in•lb	275 in•lb	280 in•lb	310 in•lb	400 in•lb
	25 N•m		20 N•m	30 N•m	31 N•m	32 N•m	35 N•m	45 N•m
Torque Prevail M10 Steel Nuts and Bolts	330 in•lb		315 in•lb	450 in•lb	400 in•lb	510 in•lb	450 in•lb	280 in•lb
	37 N•m		36 N•m	50 N•m	45 N•m	57 N•m	50 N•m	32 N•m
Fixture	15 min		10 min	10 min	10 min	5 min	15 min	15 min
Full Cure	24 hr		24 hr	24 hr	24 hr	24 hr	24 hr	24 hr
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	-65 to 300°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	-55 to 150°C

ANAEROBIC THREADLOCKERS

Anaerobic Threadlockers

	REMOVABLE			PERMANENT (Disassemble with Heat)					
Grade	**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 Temperature
Color	**Purple**	**Blue**	**Colorless**	**Red**	**Green**	**Red**	**Red**	**Red**	**Red**
Viscosity cP	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
Max 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
Max 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 and 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 and 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	8 min	10 min	15 min	10 min	15 min
Full Cure	24 hr	24 hr		24 hr	24 hr	24 hr	24 hr	24 hr	24 hr
Temp. 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

Approvals

MIL-46163A for EXISTING designs only.	Type II Grade M	Type II Grade N		Type II Grade O	Type III Grade R	Type I Grade L	Type I Grade K		
ASTM D5363 for NEW designs.	AN0311	AN0321		AN0331	AN0261	AN0211	AN0221		
MIL-S-22473E for EXISTING designs only.		Grade CVV			Grade AVV	Grade AVV			
ASTM D5363 for NEW designs.		AN0143			AN0111	AN0124			
NSF / ANSI 61			NSF/ ANSI 61						

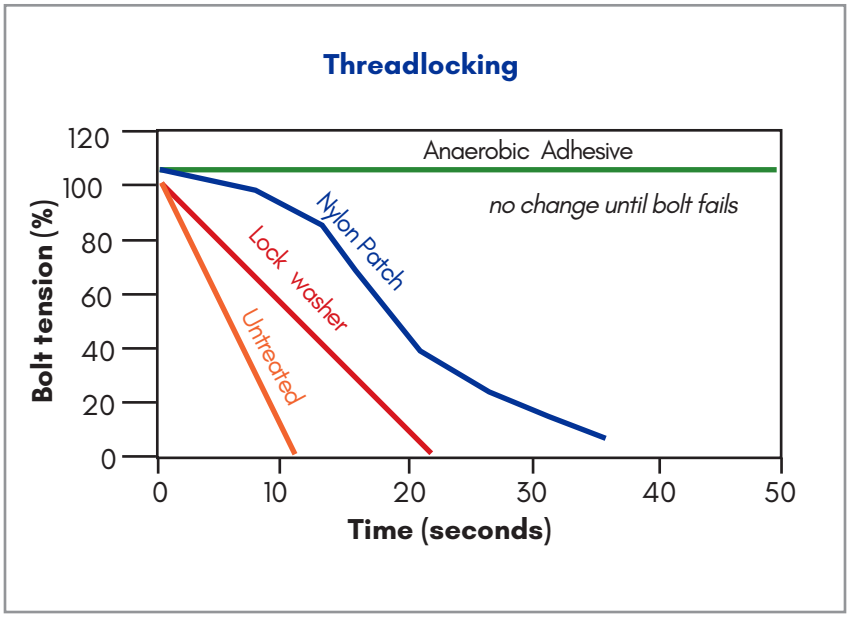
ASC 10 Anaerobic Surface Conditioner

Permabond ASC10 is a surface activator for anaerobic adhesives, suitable for use on non-metallic surfaces or on less active metals (see chart on page 10) to accelerate cure speed and allow products to cure through larger gaps.

Permabond threadlocking anaerobic adhesives and sealants enable you to lock screws, nuts, bolts, and studs against loosening.

- Lubricate for easier assembly and prevent rust
- Seal against leaks
- Prevent loosening due to thermal expansion
- Stop nuts and bolts from working loose due to vibration
- Varying strengths to meet removable and permanent requirements
- More cost-effective than mechanical locking devices

Metal Reactivity as Related to Anaerobic Cure Speed				
Reactivity	Super Active	Active	Less Active	Passive
Anaerobic Cure Speed	Very Fast Cure	Fast Cure	Slow Cure	Activator Needed
Metal	Brass Copper	Steel Nickel Iron Aluminum Zinc	Anodized aluminum Cadmium finishes Chrome finishes Passivated metals Stainless steel Titanium	Ceramics Glass Plastics Painted finishes Lacquered finishes



ANAEROBIC THREAD SEALANTS

Permabond anaerobic thread sealants are designed to replace traditional materials such as hemp, PTFE tape, and pipe dope.

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

Anaerobic Thread Sealants						
Grade	**LM012**	**LH050**	**LH050 PURE**	**LH051**	**MH052**	**LH150**
Features	No Fillers, Hydraulics Sealing Grade	General Purpose, UL Classified	NSF/ANSI 61 Certified, Potable Water Grade	Automatic Dispensing	Medium Strength, BAM Approved for Oxygen	Stainless Steel Grade, UL Classified
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
Fluorescent	Yes	No		No	Yes	No
Max 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
Torque Breakaway M10 Nuts and 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 and 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 hr	24 hr		24 hr	24 hr	24 hr
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
Approvals						
		UL® Classified	NSF/ANSI 61 Certified		BAM Approved*	UL® Classified

*BAM Approved for use with gaseous oxygen up to 10 bar (145 psi) and 60°C (140°F).

ASC 10 Anaerobic Surface Conditioner

Permabond ASC10 is a surface activator for anaerobic adhesives, suitable for use on non-metallic surfaces or on less active metals to accelerate cure speed and allow products to cure through larger gaps.

Chemical Compatibility of Anaerobic Adhesives & Sealants

Few industrial chemicals have a damaging effect on Permabond's anaerobic adhesives. However, strong concentrations or elevated temperatures may make the adhesive more susceptible to chemical degradation.

Liquids										Gases	
Acetic acid	B	Chromic acid	C	Glycerine	A	Oil (hydraulic)	A	Shellac	A	Air	A
Acetone	A	Citric acid	C	Gypsum	A	Oil (linseed)	A	Sodium Hydroxide	C	Carbon dioxide	A
Alcohols	A	Copper sulphate	A	Hexane	A	Oil (lubricating)	A	Starch	A	Carbon monoxide	A
Ammonia sol.	C	Creosote	A	Hydrochloric acid	C	Oil (mineral)	A	Sugar	A	Chlorine	X
Animal fat	A	Cyanide sol.	B	Ink	A	Ozone (wet)	X	Sulfuric acid	C	Freon	C
Battery acid	B	Detergents	A	Insecticide*	A	Paraffin	A	Sulphurus acid	C	Helium	A
Bleach	A	Dielectric fluid*	A	Isocyanate resin	A	Perfume	A	Toluene	A	Methane	A
Bromine	X	Dye stuffs	A	Jet fuel	A	Petrol	A	Trichloroethane	A	Natural gas	A
Carbolic acid	B	Ethyl acetate	A	Kerosene	A	Petroleum jelly	A	Turpentine	A	Pure oxygen	**
Carbonic acid	B	Ferric chloride	B	Lactic acid	A	Photo Developer	A	Water (fresh/sea)	A	Ozone	X
Cement	A	Fertilizer*	A	Nitric acid	X	Phosphoric acid	C	Water (heavy)	A	Propane	A
China Clay	A	Formaldehyde	C	Oil (fuel)	A	Sewage	A	Xylene	A	Steam	X

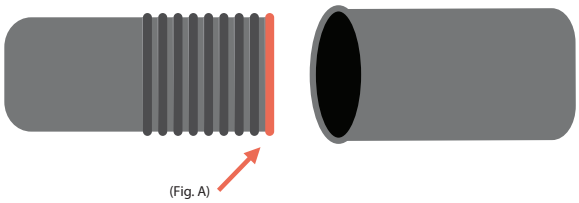
A: Most Permabond products are suitable
B: For concentrations up to 10% most adhesives can be used
C: Only use high-strength Permabond products
X: Not suitable for Permabond anaerobic adhesives

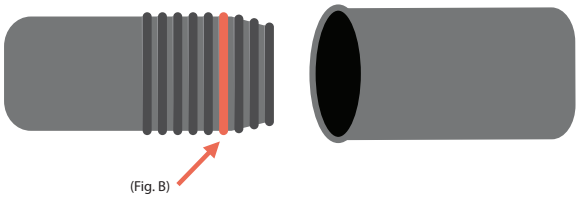
***Test first as some brands/types are more aggressive than others**
**** MH052 - Approved for use with gaseous oxygen up to 10 bar (145 psi) and 60°C (140°F).**

Thread Sealing Assembly and Removal Technique

- Parallel to parallel pipe joints (Fig A.) Apply sealant to the leading edge of the male component.
- Tapered to parallel pipe joints (Fig B.) Apply sealant several threads back from the leading edge of the male component to ensure maximum contact.

IN EACH CASE EXCESS SEALANT SHOULD BE VISIBLE AFTER TIGHTENING The purpose of the excess is to visualize complete 360° coverage to ensure no leaks. The exposed sealant will not cure as it is in contact with air. This excess can be wiped away.





Pipe joints sealed with low-strength thread sealants can be dismantled using normal tools. Heating parts with a hot air gun or blow torch will make parts easier to disassemble. Before reapplying sealant, clean pipe joints with a wire brush.

ANAEROBIC F.I.P. GASKETING

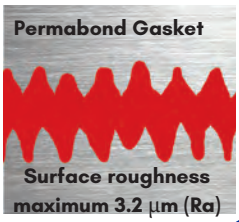
Permabond gasketing anaerobic adhesives replace traditional cork, wood, rubber, paper, and silicone gaskets.

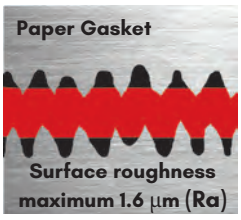
- No relaxation or shrinkage - eliminate the need to re-tighten over time
- One adhesive will replace many pre-cut gasket shapes
- No need to handle fragile gaskets
- No disintegration means no leaks or blockages
- Vibration proof
- No long-term embrittlement
- Easy to dismantle with normal tools
- 100% surface contact for uniform stress distribution
- Seal rough surfaces; reduces machining needs
- Non-shimming

Anaerobic Form-in-Place Gasketing				
Grade	**HH190**	**MH196**	**LH197**	**MH199**
Features	General purpose flange sealant	Fast curing, high temperature resistant	Flexible, easy to remove even from soft metals	Highly thixotropic, high temperature resistant
Color	**Purple**	**Red**	**Green**	**Red**
Viscosity	300,000 cP	2 rpm 500,000 cP 20 rpm 100,000 cP	2 rpm 50,000 cP 20 rpm 20,500 cP	2 rpm 225,000 cP 20 rpm 75,000 cP
Fluorescing	No	Yes	No	Yes
Max Gap Fill	0.012 in	0.020 in	0.012 in	0.020 in
	0.3 mm	0.5 mm	0.3 mm	0.5 mm
Shear Strength Steel	900 psi	1450 psi	750 psi	1100 psi
	6 MPa	10 MPa	5 MPa	8 MPa
Fixture Steel	15 min	15 min	20 min	20 min
Full Cure	24 hr	24 hr	24 hr	24 hr
Temperature Range	-65 to 250°F	-65 to 390°F	-65 to 300°F	-65 to 390°F
	-55 to 120°C	-55 to 200°C	-55 to 150°C	-55 to 200°C
Oil Resistance	Excellent	Excellent	Excellent	Excellent
Water Resistance	Excellent	Excellent	Excellent	Excellent

Form-in-Place Gaskets

Liquid gasketing adhesives give 100% contact between metal parts and also allow the engineer to cut down the amount of surface-finish machining, therefore reducing costs and increasing production rates.





CYANOACRYLATES

Permabond Cyanoacrylate (instant) Adhesives are single component adhesives that cure by reacting to small traces of moisture on the surface of the substrates being bonded. They develop strength very quickly at room temperature, eliminating the need for costly ovens or curing equipment. Full strength is achieved in 24 hours.

For best results, use only enough adhesive to cover the bond area. Excess adhesive will not increase bond strength and can reduce cure speed.

Mil Specs and other approvals are listed on pages 3 and 4.

The original cyanoacrylate, 910, set the highest standard against which all our formulations are measured. 910 is still the only pure methyl and creates the strongest bonds. Permabond continues the tradition of excellence by formulating products that meet many diverse application needs for very strong bonds, high temperature resistance, and purity. "The Original 910" formula remains unchanged. The reason is simple – it is the best metal bonding formulation there is.

Instant Bonds! Apply the adhesive, assemble the components, and count... one, two, three, four, five, six, seven, eight, 9, 10! That's It! Parts are bonded.

Primers and Accelerators	
Grade	**Description**
POP	POP (Polyolefin Primer) improves the adhesion of cyanoacrylate adhesives to PP, PE, PTFE, other low surface energy plastics, and silicones.
QFS10 QFS16 CSA-NF	QFS10, QFS16, and CSA NF increase the speed of cure of cyanoacrylates and cure any exposed cyanoacrylate adhesive very quickly, reducing blooming and allowing products to cure through larger gaps.

Typical Applications

- Electronics wire tacking
- Bonding headsets
- Hose clips onto hoses
- Bonding automotive interior trim
- Tacking parts during assembly process
- Fabricating silicone and standard o-rings
- Disposable medical device bonding
- Bonding musical instruments
- Mobile phone casings, antennae
- Keypads for phones and tablets
- Sealing batteries
- Glazing applications
- Sealing transformer laminates

CYANOACRYLATES

UV CURABLE CYANOACRYLATE

Permabond 130UV is a UV/moisture dual cure ethyl cyanoacrylate adhesive. It is ideal for applications in which the UV light can't reach all of the adhesive. The adhesive cures with UV light at 365-420 nm. UV cure time is ≤1 at 150mW/cm². The moisture cure, cures the adhesive in shadow areas. Moisture cure set time is 3 - 90 seconds depending on substrate.

Grade	Description	Viscosity	Gap Fill		Temperature Range	
		23 °C	Max.		Lower	Upper
		cP	in.	mm	°F (°C)	°F (°C)
130UV	UV curable	200	.006	0.15	-65 (-55)	250 (120)

- Tack-free in seconds using low powered UV light
- Reduced blooming
- Transparent in a thin layer
- Passes 85°C-85% RH - ideal for automotive
- Passes ISO10993-5 cytotoxicity for medical devices
- Low hazard rating
- Suitable for electronics - RoHS compliant
- Easy to automate

WATER RESISTANT CYANOACRYLATE

Permabond 712 is a low viscosity, solvent-free, water resistant cyanoacrylate adhesive. 712 has outstanding resistance underwater and great performance in hot and humid conditions. It maintains 75% of its strength even after 1,000 hours of exposure to 60°C water, and maintains 90% of strength during 85/85 testing (85°C and 85% humidity). The temperature range is -65°F (-55°C) to 250°F (120°C).

Grade	Description	Viscosity	Gap Fill		Shear Strength		Set Time		
		23 °C	Max.		Steel		Rubber	Plastic	Metal
		cP	in	mm	psi	N/mm²	sec	sec	sec
712	Water & moisture resistant	100	.006	0.15	2755 - 3480	19 - 25	10	20	25

Note - do not use primers or accelerators with Permabond 712.

- Excellent environmental durability
- Excellent resistance to water immersion
- Resistant to 120°C continuous exposure, 150°C peak
- Passes 85°C-85% RH - ideal for automotive
- Single component (no mixing required)
- Ideal for metals, rubbers, and a wide range of plastics
- Rapid cure in seconds
- High strength bonding
- Transparent
- Easy to apply

CYANOACRYLATES

GENERAL PURPOSE

Permabond general purpose ethyl cyanoacrylate adhesives quickly form bonds to a wide variety of substrates. These adhesives are known for their ability to very effectively bond plastics and other substrates. The service temperature range of this group is -65°F (-55°C) to 180°F (82°C.) They form strong bonds to rubbers, plastics, and metals and set in less than 20 seconds.

Grade	Description	Viscosity	Gap Fill	
		23 °C	Max.	
		cP	in	mm
101	Wicking type, plastic bonding	2	0.002	0.05
102	Plastic bonding	80	0.006	0.15
105	Elastomer bonding	40	0.004	0.10
108	Intermediate gap fill, plastic bonding	500	0.008	0.20
240	Maximum gap fill, flow control	1850	0.017	0.43
268	Fast curing, maximum gap fill	1800	0.017	0.43
2010	Thixotropic, maximum gap fill	15,000	0.020	0.50

METAL BONDING

Permabond 910 is the original instant adhesive; 910 is a pure methyl cyanoacrylate that creates very strong bonds between metal substrates. 170 is higher viscosity and 910FS is a faster setting, wicking grade. The service temperature range of this group is -65°F (-55°C) to 195°F (90°C.) 910 and 170 set in under 20 seconds whereas 910FS sets in less than 10 seconds.

Grade	Description	Viscosity	Gap Fill		Shear Strength	
		23 °C	Max.		Steel	
		cP	in	mm	psi	N/mm²
170	Maximum gap fill	1500	0.015	0.38	3300 - 3600	23 - 25
910	**The Original!**	80	0.006	0.15	3300 - 4200	23 - 29
910FS	Wicking type, fast	3	0.002	0.05	3300 - 4200	23 - 29

TOUGHENED

Toughened cyanoacrylates are preferred when the assembly is subject to vibration, impact, peel, or flexing stresses. Set time is under 20 seconds. The service temperature range of 2050 is -65°F (-55°C) to 180°F (82°C). Permabond 731, 735, and 737 withstand -65°F (-55°C) to 250°F (120°C).

Grade	Description	Viscosity	Gap Fill		Shear Strength	
		23 °C	Max.		Steel	
		cP	in	mm	psi	N/mm²
731	Excellent peel, impact, and shear strength	150	0.006	0.15	3500 - 4400	24 - 30
735	Similar to 731, black	150	0.006	0.15	3500 - 4400	24 - 30
737	Impact resistant, gap filling, black	3000	0.020	0.50	2800 - 3300	19 - 23
2050	Toughened	1500	0.008	0.20	2300 - 2900	16 - 20

CYANOACRYLATES

SURFACE INSENSITIVE

Surface insensitive cyanoacrylates overcome the challenges posed when bonding acidic surfaces such as wood, leather, paper, or cork. These ethyl cyanoacrylates also perform well on very dry or porous materials, extending the range of application possibilities.

Grade	Description	Viscosity	Gap Fill		Set Time	Temperature Range	
		23 °C	Max.			Lower	Upper
		cP	in	mm	sec	°F (°C)	°F (°C)
790	Very fast set, wicking type	2	0.002	0.05	2 - 3	-65 (-55)	180 (82)
791	Very fast set, close fitting parts	40	0.004	0.10	2 - 3	-65 (-55)	180 (82)
792	Very fast curing, higher temperature resistance	90	0.006	0.15	2 - 3	-65 (-55)	250 (120)
795	Fast curing, general purpose	500	0.007	0.18	3 - 6	-65 (-55)	180 (82)
799	Fast curing, maximum gap fill	5000	0.020	0.50	6 - 10	-65 (-55)	180 (82)
2011	Non-sag, maximum gap fill, high temperature resistance	Gel	0.020	0.50	5 - 10	-65 (-55)	250 (120)

HIGH TEMPERATURE RESISTANT

Form strong high temperature resistant bonds fast with Permabond's high temperature resistant cyanoacrylates. Permabond 800 series offers the highest temperature resistance available in ambient cure conditions. Permabond 919, 920, and 922 are formulated to offer increased temperature resistance with the use of the secondary heat cure process.

Grade	Description	Viscosity	Gap Fill		Set Time	Temperature Range	
		23 °C	Max.			Lower	Upper
		cP	in	mm	sec	°F (°C)	°F (°C)
801	Resists to 130°C, wicking type	13	0.002	0.05	10 - 15	-65 (-55)	270 (130)
802	Resists to 160°C	100	0.006	0.15	10 - 15	-65 (-55)	320 (160)
825	Resists to 200°C, Patented Technology	125	0.006	0.15	5 - 15	-65 (-55)	390 (200)
919	Resists to 250°C after post cure, wicking type	4	0.002	0.05	<20	-65 (-55)	*482 (250)
920	Resists to 250°C after post cure	80	0.006	0.15	10 - 15	-65 (-55)	*482 (250)
922	Resists to 250°C after post cure, maximum gap fill	1600	0.017	0.43	<45	-65 (-55)	*482 (250)

* 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)

CYANOACRYLATES

LOW ODOR / NON-BLOOMING

Low odor formulations contain low vapor pressure monomers which result in a less volatile product. There is little to no odor during application and virtually no residue when cured. The service temperature range of this group is -65 °F (-55°C) to 180 °F (82°C.)

Grade	Description	Viscosity	Gap Fill		Set Time
		23 °C	Max.		Plastic
		cP	in	mm	sec
940	Low odor and non-blooming, wicking type	7	0.002	0.05	10 - 15
941	Low odor and non-blooming	15	0.003	0.08	10 - 15
943	Low odor and non-blooming, general purpose	100	0.006	0.15	5 - 10
947	Low odor and non-blooming, gap fill	1200	0.010	0.25	20 - 30

MEDICAL DEVICE GRADES

Following is a short list of products that have been tested for biocompatibility. If the grade you prefer is not included below, please contact us.

Grade	Description	ISO 10993-5 /	USP Class VI	Viscosity	Gap Fill		Set Time	Temperature Range	
		Cytotoxicity		23 °C	Max.		Plas-tic	Lower	Upper
				cP	in	mm	sec	°F (°C)	°F (°C)
4C10	Wicking grade	Pass	Pass	40	0.004	0.10	5 - 10	-65 (-55)	180 (82)
4C20	Low viscosity	Pass	Pass	500	0.008	0.20	10	-65 (-55)	180 (82)
4C30	Medium viscosity	Pass	Pass	1500	0.015	0.38	15	-65 (-55)	180 (82)
4C40	High viscosity	Pass	Pass	2000	0.017	0.43	5 - 10	-65 (-55)	180 (82)
731	Toughened	Pass	Not tested	150	0.006	0.15	30	-65 (-55)	250 (120)
820	High temp. resist	Pass	Not tested	100	0.015	0.38	15	-65 (-55)	390 (200)
920	High temp. resist	Pass	Not tested	80	0.006	0.15	15	-65 (-55)	482 (250)*

** See post cure instructions on the previous page.*

Grade	ISO 10993-5 /	Viscosity	UV Tack Free Time		Temperature Range	
	Cytotoxicity	23 °C			Lower	Upper
		cP	150 mW/cm², 405nm	25mW/cm², 405nm	°F (°C)	°F (°C)
130UV	Pass	200	≤1 second	≤5 seconds	-65 (-55)	250 (120)

EPOXY TWO COMPONENT

Key benefits of Permabond Two Part Epoxies include

- High peel strength for design versatility
- Easily dispensed with static mix nozzles
- Excellent chemical and environmental durability
- No curing equipment required

Epoxies - Two Component								
Grade	**Mix**	**Description**	**Color**	**Viscosity**	**Viscosity A** mPa.s (cP)	**Viscosity B** mPa.s (cP)	**Specific Gravity**	**Max. Gap**
ET500	1:1	Fast, non-yellowing	Clear	Low	15,000	22,500	A) 1.2 B) 1.1	0.08 in 2.00 mm
ET503	1:1	Fast, tough	Whitish	Thixotropic	17,000	13,000	A) 1.2 B) 1.2	0.04 in 1.00 mm
ET505	1:1	Tough, multi purpose	Amber	Medium Low	20,000	17,500	A) 1.1 B) 1.0	0.08 in 2.00 mm
ET510	1:1	Flexible, resists peel & impact	Amber	Medium	21,000	40,000	A) 1.1 B) 1.1	0.08 in 2.00 mm
ET514	1:1	Toughened	Grey	Thixotropic Paste	20 rpm: 65,000 2 rpm: 225,000	20 rpm: 65,000 2 rpm: 150,000	A) 1.1 B) 1.2	0.08 in 2.00 mm
ET515	1:1	Clear, flexible	Clear	Medium	20 rpm: 15,000	20 rpm: 19,000	A) 1.1 B) 1.1	0.08 in 2.00 mm
ET536	1:1	Toughened	Grey	Thixotropic Paste	20 rpm: 75,000 2 rpm: 225,000	20 rpm: 150,000 2 rpm: 300,000	A) 1.1 B) 1.2	0.20 in 5.00 mm
ET538	1:1	Bonds many plastics	Grey	Thixotropic Paste	20 rpm: 75,000 2.5 rpm: 225,000	20 rpm: 30,000 2 rpm: 60,000	A) 1.1 B) 1.4	0.20 in 5.00 mm
ET5145	1:1	Food grade	Off-white	Thixotropic Paste	20 rpm: 65,000 2 rpm: 250,000	20 rpm: 150,000 2 rpm: 325,000	A) 1.3 B) 1.3	0.08 in 2.00 mm
ET5147	2:1	Food grade	Off-white	Thixotropic Paste	20 rpm: 32,500 2 rpm: 120,000	20 rpm: 120,000 2 rpm: 225,000	A) 1.3 B) 1.2	0.08 in 2.00 mm
ET5401	2:1	High Temp. resistance	Grey	Thixotropic Paste	20 rpm: 90,000 2.5 rpm: 350,000	20 rpm: 75,000 2.5 rpm: 200,000	A) 1.2 B) 1.1	0.20 in 5.00 mm
-	-	-	-	-	-	-	-	-
ET5422	2:1	Toughened	Blue	Thixotropic Paste	20 rpm: 105,000	20 rpm: 100,000	A) 1.14 B) 1.00	0.20 in 5.00 mm
ET5428	2:1	Composite bonder	Black or Cream	Thixotropic Paste	20 rpm: 115,000 2 rpm: 300,000	20 rpm: 200,000 2 rpm: 1,100,000	A) 1.1 B) 1.1	0.20 in 5.00 mm
ET5429	2:1	Composite bonder	Charcoal Black	Thixotropic Paste	20 rpm: 200,000 2 rpm: 300,000	20 rpm: 60,000 2 rpm: 150,000	A) 1.0 B) 1.0	0.20 in 5.00 mm

Available Accessories

- Mixing nozzles
- Dispensing guns

Epoxies - Two Component *(continued)*									
Grade	**Shore Hardness**	**Elongation**	**Dielectric Strength kV/mm**	**Thermal Conductivity W/(m.K)**	**Tg Glass Transition**	**Shear Strength Steel**	**Handling Strength**	**Peel Strength**	**Temp Resist**
ET500	D 75	<5%	15 - 25	0.22	40 - 50°C (104 -122°F)	1700 - 2600 psi 12 - 18 N/mm²	5 - 8 min	1 - 4 PIW 5 - 20 N/25mm	80°C 175°F
ET503	D 50	50%	15 - 25	0.3	NA	2900 - 3770 psi 20 - 26 N/mm²	6 min	32 - 41 PIW 130 - 180 N/25mm	100°C 212°F
ET505	D 70	5 - 10%	15 - 25	0.35	40 - 50°C (104 - 122°F)	2600 - 3000 psi 18 - 21 N/mm²	3 - 5 hr	13 - 18 PIW 60 - 80 N/25mm	80°C 175°F
ET510	D 55	15 - 25%	15 - 25	0.35	40 - 50°C (104 - 122°F)	1160 - 1740 psi 8 - 12 N/mm²	20 - 40 min	16 - 20 PIW 70 - 90 N/25mm	80°C 175°F
ET514	D 68	10 - 15%	15 - 25	0.3	40 - 50°C (104 - 122°F)	2900 - 4350 psi 20 - 30 N/mm²	1 - 2 hr	23 - 34 PIW 100 - 150 N/25mm	80°C 175°F
ET515	D 40	20 - 40%	15 - 25	0.34	20°C (68°F)	1160 - 1740 psi 8 - 12 N/mm²	20 - 30 min	23 - 34 PIW 100 - 150 N/25mm	100°C 212°F
ET536	D 70	4 - 8%	15 - 25	0.4	45 - 55°C (113 - 131°F)	3190 - 4640 psi 22 - 32 N/mm²	1.5 - 2 hr	16 - 21 PIW 70 - 90 N/25mm	80°C 175°F
ET538	D 75	4 - 8%	15 - 25	0.55	45 - 55°C (113 - 131°F)	3625 - 4350 psi 25 - 30 N/mm²	3 - 5 hr	13 - 18 PIW 60 - 80 N/25mm	100°C 212°F
ET5145	D 80	-	15 - 25	-	40 - 50°C (104 - 122°F)	2800 - 3000 psi 19 - 21 N/mm²	3 - 5 hr	7 - 11 PIW 30 - 50 N/25mm	80°C 175°F
ET5147	D 70	-	15 - 25	-	50 - 60°C (122 - 140°F)	2600 - 2900 psi 18 - 20 N/mm²	3 - 5 hr	7 - 11 PIW 30 - 50 N/25mm	120°C 250°F
ET5401 cured 7 days @ 25°C	D 80	4 - 8%	15 - 25	0.32	50°C (122°F)	1450 - 2200 psi 10 - 15 N/mm²	1 - 1.5 hr	3 - 5 PIW 20 - 25 N/25mm	80°C 175°F
ET5401 cured 1 hr @ 80°C	D 80	4 - 8%	15 - 25	0.32	110°C (230°F)	2900 - 4400 psi 20 - 30 N/mm²	-	55 - 66 PIW 250 - 300 N/25mm	140°C 285°F
ET5422	>D 80	-	-	-	see TDS	4350 - 5510 psi 30 - 38 N/mm²	16 hr	59 - 70 PIW 270 - 320 N/25mm	120°C 250°F
ET5428	D 70	<5%	15 - 25	-	50 - 60°C (122 - 140°F)	4060 - 4930 psi 28 - 34 N/mm²	30 - 45 min	33 - 55 PIW 150 - 250 N/25mm	120°C 250°F
ET5429	D 70	<5%	15 - 25	-	50 - 60°C (122 - 140°F)	3335 - 4350 psi 23 - 28 N/mm²	6 - 10 hr	33 - 51 PIW 150 - 230 N/25mm	120°C 250°F

MODIFIED EPOXY

Permabond Modified Epoxies are two component hybrid technology adhesives that cure at ambient temperature. Products are available in 10:1 and 2:1 dual cartridges for dispensing through static mix tips. These soft, flexible adhesives cure with very low shrinkage and are ideal for bonding thin materials with no read through, and for potting without disturbing sensitive electronic components. They form strong bonds to composites, metals, wood, FRP, glass, plastics, concrete, masonry, brick, and stone.

Modified Epoxies -Two Component			
Grade	**MT382**	**MT3821**	**MT3809**
Description	Self Leveling	Thixotropic Paste	Self Leveling, Ideal for plastics
Mix Ratio	2:1 by Volume 130:50 by Weight	2:1 by Volume 100:63 by Weight	10:1 by Volume 12.5: 1 by Weight
Color Part A	Black	Black	Grey
Color Part B	Amber	Charcoal Black	Black
Specific Gravity Part A	1.3	1.3	1.3
Specific Gravity Part B	1.0	1.7	1.1
Viscosity Part A cP(mPa.s)	32,500	200,000 thixotropic	20 rpm 8000 2 rpm 20,000
Viscosity Part B cP(mPa.s)	300	100,000	7500
Pot Life	20 - 50 min	10 - 20 min	10 - 12 min
Handling Time	105 - 120 min	60 - 90 min	25 - 30 min
Full Cure	≥72 hr	≥72 hr	≥72 hr
Shore Hardness	A 70, D 25	A 70, D 25	A 70, D 25
Elongation	150 - 200%	100 - 150%	150%
Temperature Range	-40 to +248°F (-40 to +120°C)	-40 to +248°F (-40 to +120°C)	-40 to +248°F (-40 to +120°C)
Shear Strength			
Steel	4 - 7 N/mm² (600 - 1000 psi)	4 - 7 N/mm² (600 - 1000 psi)	6 - 8 N/mm² (900 - 1200 psi)
Aluminum	6 - 8 N/mm² (900 - 1200 psi)	6 - 8 N/mm² (900 - 1200 psi)	6 - 8 N/mm² (900 - 1200 psi)
ABS	4 - 6 N/mm² (600 - 900 psi)	4 - 6 N/mm² (600 - 900 psi)	4 - 6 N/mm² (600 - 900 psi)
Acrylic	3 - 5 N/mm² (400 - 700 psi)	2 - 5 N/mm² (300 - 700 psi)	3 - 5 N/mm² (400 - 700 psi)
Nylon	3 - 5 N/mm² (400 - 700 psi)	2 - 4 N/mm² (300 - 600 psi)	3 - 5 N/mm² (400 - 700 psi)
Polycarbonate	5 - 7 N/mm² (700 - 1000 psi)	4 - 6 N/mm² (600 - 900 psi)	5 - 7 N/mm² (700 - 900 psi)
PVC	3 - 5 N/mm² (400 - 700 psi)	3 - 5 N/mm² (400 - 700 psi)	4 - 6 N/mm² (600 - 900 psi)
FRP Glass Epoxy	5 - 7 N/mm² (700 - 1000 psi)	5 - 7 N/mm² (700 - 1000 psi)	5 - 7 N/mm² (700 - 1000 psi)
FRP Glass Polyester	5 - 7 N/mm² (700 - 1000 psi)	5 - 7 N/mm² (700 - 1000 psi)	5 - 7 N/mm² (700 - 1000 psi)
Carbon Fiber	6 - 8 N/mm² (600 - 1200 psi)	6 - 8 N/mm² (600 - 1200 psi)	6 - 8 N/mm² (600 - 1200 psi)

EPOXY ONE COMPONENT

Key benefits of Single Part Epoxies include

- High shear, impact, and peel strength increases joint design versatility
- Excellent chemical, temperature, and environmental resistance
- A good alternative to welding or brazing - reduces costs

Contact Permabond for low temperature curing grades for bonding heat vulnerable parts.

Epoxies - One Component

Grade	Description	Color	Flow	Viscosity cP (MPa)	Specific Gravity	Gap Fill	Cure Times	Shore Hardness	Elongation
ES550	Toughened, high impact strength	Silver Grey	No Flow	1,500,000	1.5	0.20 in (5.00 mm)	130°C (266°F) 75 min 150°C (300°F) 60 min 170°C (338°F) 40 min	D 80 - 85	<3%
ES558	Toughened, high impact strength	Grey	Free Flowing	200,000	1.5	0.02 in (0.50 mm)	130°C (266°F) 75 min 150°C (300°F) 60 min 170°C (338°F) 40 min	D 80 - 85	<3%
ES562	Low viscosity	White	Free Flowing	22,500	1.2	0.01 in (0.25 mm)	130°C (266°F) 60 min 150°C (300°F) 45 min 160°C (320°F) 20 min	D 80 - 85	<3%
ES569	Non stringing, high peel strength	Black	Non Sag	375,000	1.2	0.20 in (5.00 mm)	130°C (266°F) 75 min 150°C (300°F) 60 min 170°C (338°F) 40 min	D 80 - 85	<3%
ES578	Thermally conductive, electrically insulative	Black	Flowing	700,000	1.6	0.20 in (5.00 mm)	130°C (266°F) 75 min 150°C (300°F) 60 min 170°C (338°F) 25 min	D 80 - 85	<3%

Epoxies - One Component *(continued)*

Grade	E-modulus	Coefficient of Thermal Expansion	Thermal Conductivity	Tg	Shear Strength psi (N/mm²)	Service Temp
ES550	3.5 GPa	45 x 10^{-6} mm/mm/°C (below Tg) 160 x 10^{-6} mm/mm/°C (above Tg)	0.55 W/(m.K)	120°C (250°F)	Steel 4000 - 6000 (27 - 41) Aluminum 2500 - 4500 (17 - 31) Zinc 2000 - 4000 (14 - 27)	-40 to 355°F (-40 to 180°C)
ES558	3.5 GPa	45 x 10^{-6} mm/mm/°C (below Tg) 160 x 10^{-6} mm/mm/°C (above Tg)	0.9 W/(m.K)	120°C (250°F)	Steel 4000 - 6000 (27 - 41) Aluminum 2500 - 4500 (17 - 31) Zinc 2000 - 4000 (14 - 27)	-40 to 355°F (-40 to 180°C)
ES562	2.1 GPa	50 x 10^{-6} mm/mm/°C (below Tg) 165 x 10^{-6} mm/mm/°C (above Tg)	0.25 W/(m.K)	115°C (240°F)	Steel 3000 - 5000 (20 - 35) Aluminum 2000 - 4000 (14 - 27) Zinc 2000 - 4000 (14 - 27)	-40 to 355°F (-40 to 180°C)
ES569	3.5 GPa	90 x 10^{-6} mm/mm/°C (below Tg) 180 x 10^{-6} mm/mm/°C (above Tg)	0.5 W/(m.K)	130°C (266°F)	Steel 4000 - 6000 (27 - 41) Aluminum 2500 - 4500 (17 - 31) Zinc 2000 - 4000 (14 - 27) FRP Glass/Epoxy 1300 - 1600 (9 - 11) Carbon Fiber 1450 - 1700 (10 - 12)	-40 to 355°F (-40 to 180°C)
ES578	2.5 GPa	45 x 10^{-6} mm/mm/°C (below Tg)	1.0 W/(m.K)	105°C (220°F)	Steel 4000 - 6000 (27 - 41) Aluminum 2500 - 4500 (17 - 31) Zinc 2000 - 4000 (14 - 27)	-40 to 355°F (-40 to 180°C)

MS POLYMERS

Key benefits of MS Polymers include

- Adhesion to a variety of substrates
- Fast tack-free time
- Non-corrosive
- Paintable

Permabond MS Polymers are single component, hybrid technology adhesives that moisture cure at ambient temperature. The high elongation and flexible nature of these strong bonds meet the demands of stress from impact, peel, and expansion that can occur when bonding dissimilar materials. They have excellent environmental resistance and remain very flexible.

MS Polymers - Single Component			
Grade	**MS359 Grey**	**MS359 A Grey**	**MS359 Clear**
Appearance	Grey thixotropic paste	Grey Self Leveling	Clear thixotropic paste
Viscosity cP (mPa.s)	Non-Sag Paste	17,500	Non-Sag Paste
Specific Gravity	1.5	1.5	1.1
Skin Over Time	10 - 20 min	10 - 20 min	10 - 20 min
Cure Rate	~5mm / 24 hr	~3-4mm / 24 hr	~4mm / 24 hr
Shore Hardness	A 45 - 60	A 40 - 50	A 40 - 50
Elongation	150 - 350%	100 - 170%	80 - 100%
Tensile Strength	2 - 3 MPa (290 - 440 psi)	0.5 - 1.5 MPa (70 - 200 psi)	0.7 - 1.5 MPa (100 - 200 psi)
Temperature Range	-40 to +212°F (-40 to +100°C)	-40 to +212°F (-40 to +100°C)	-40 to +212°F (-40 to +100°C)
Shear Strength			
Steel	2 - 3 N/mm² (290 - 440 psi)	1 - 2 N/mm² (145 - 290 psi)	2 - 3 N/mm² (290 - 440 psi)
Aluminum	2 - 3 N/mm² (290 - 440 psi)	1 - 2 N/mm² (145 - 290 psi)	2 - 3 N/mm² (290 - 440 psi)
Zinc	2 - 3 N/mm² (290 - 440 psi)	1 - 2 N/mm² (145 - 290 psi)	2 - 3 N/mm² (290 - 440 psi)
PVC	2 - 3 N/mm² (290 - 440 psi)	1 - 2 N/mm² (145 - 290 psi)	2 - 3 N/mm² (290 - 440 psi)
Polycarbonate	1 - 1.5 N/mm² (145 - 220 psi)	0.5 - 1 N/mm² (75 - 145 psi)	1 - 1.5 N/mm² (145 - 220 psi)
Polystyrene	1 - 1.5 N/mm² (145 - 220 psi)	0.5 - 1.5 N/mm² (75 - 220 psi)	1 - 1.5 N/mm² (145 - 220 psi)
Wood	2 - 3 N/mm² (290 - 440 psi)	1 - 2 N/mm² (145 - 290 psi)	2 - 3 N/mm² (290 - 440 psi)

POLYURETHANES

Key benefits of Permabond Polyurethanes include

- Good tensile strength
- No primer needed
- Ease of application
- Various set times to match production needs
- Adhesion to a variety of substrates

Permabond Polyurethanes are ideal for many bonding applications including bonding composites, plastics, leather, and other materials in automotive applications. Products are available with long working life to allow use on large bonding and potting areas. In addition to composites, leather, and plastics, Permabond Two Component Polyurethanes form strong bonds to metals, wood, and glass.

Polyurethanes have good resistance to both polar and non polar solvents. They form resilient bonds with higher adhesive tensile strength than MS polymers or modified epoxies.

Polyurethane - Two Component			
Grade	**PT321**	**PT326**	**PT328**
Description	Fast, Strong	Moderate Pot Life	Extended Pot Life
Color Part A	Black	Black	Black
Color Part B	Cream	Cream	Cream
Viscosity Part A cP (mPa.s)	6000	6000	6000
Viscosity Part B cP (mPa.s)	4500	4500	4500
Specific Gravity Part A	1.25	1.25	1.25
Specific Gravity Part B	1.45	1.45	1.45
Mix Ratio	1:1	1:1	1:1
Bond Gap Fill	0.2 in (5mm)	0.2 in (5mm)	0.2 in (5mm)
Pot Life	1 - 1.5 min	4 - 7 min	15 - 20 min
Handling Strength	10 - 15 min	60 - 90 min	90 - 120 min
Full Strength (cured @ 23°C)	24 hours	4 - 5 days	4 - 5 days
Full Strength (cured @ 90°C)	30 min	30 min	30 min
Hardness	D 75	D 70	D 63
Elongation	<10%	<15%	<20%
Shear Strength Grit Blasted Steel	2600 - 3600 psi (18 - 25 N/mm^2)	1700 - 2900 psi (12 - 20 N/mm^2)	1700 - 2600 psi (12 - 18 N/mm^2)
Tensile Strength	2900 - 3600 psi (20 - 25 N/mm^2)	2300 - 3600 psi (16 - 25 N/mm^2)	2200 - 2900 psi (15 - 20 N/mm^2)
Temperature Range	-40 to 248°F (-40 to +120°C)	-40 to 248°F (-40 to +120°C)	-40 to 248°F (-40 to +120°C)

Tip: Permabond two component polyurethanes are available in dual cartridges with static mix nozzles. When using a mixing nozzle for the first time, dispense a bead of adhesive a couple of inches long onto a paper towel prior to dispensing onto your assembly. This will ensure the adhesive is completely mixed.

UV LIGHT CURABLES

Permabond UV Light Curable Adhesives are single part, cure on demand, solvent-free adhesives. With temperature ranges of -65 to 250°F (-54 to 120°C), they are suitable for a wide range of applications. UV curable adhesives cure when UV light activates the photo initiators. Many products also have visible light cure capabilities. Except for dual cure formulas, the curing process will cease when the light is removed.

Permabond UV7141 has a secondary anaerobic cure mechanism. UV light can be used to cure the exposed area, and the adhesive between the two pieces of metal will continue curing anaerobically. This product also has a slightly higher temperature resistance -65°F to 300°F (-54°C to 150°C).

Key benefits of UV Curable Adhesives include

- High strength bonds
- Cure only when exposed to light - permits alignment of parts prior to bonding
- Select a cure speed - double production speed by simply adding another lamp to the line
- Solvent-free - Non-flammable, increased safety
- Single part product - No mixing required
- 100% solids - No waste
- Save energy - UV lamps require less electricity than heat cure ovens for epoxies
- Space savings - UV lamps require less space than heat cure oven tunnels
- Appearance - UV adhesives are available in clear colorless formulations

Cure speed is affected by the wavelength and intensity of light at the bond site.

Distance, attenuation, and light absorption by the substrate and the adhesive all affect the cure rate.

Contact Permabond for assistance in determining the best cure schedule for your application.

Applications include

- Glass furniture
- Glass to metal structural bonding
- Lenses
- Plastic bonding
- Acrylic display racks
- Electronics
- Glass ornaments
- Trophies

UV Light Curable Adhesives								
Grade	**Description**	**Cure Type**	**Visc. cP (mPa.s)**	**Tensile Strength**	**Shear Strength**	**Shore Hardness**	**Elongation**	**Temp. Range**
Metal and Glass Bonding					**Steel To Glass**			
UV610	High strength, glass to metal	UV	950	2500 psi 17 N/mm²	1900 - 2300 psi 13 - 16 N/mm²	D 70	95%	-65 to +250°F -55 to +120°C
UV620	General purpose, optically clear	UV	2550	2300 psi 16 N/mm²	1300 - 1500 psi 9 - 10 N/mm²	D 68	>80%	-65 to +250°F -55 to +120°C
UV625	Large gaps, vertical application	UV	2.5 rpm: 185,000 20 rpm: 42,500	2300 psi 16 N/mm²	1300 - 1500 psi 9 - 10 N/mm²	D 65	>60%	-65 to +250°F -55 to +120°C
UV670	Metal to glass, flexible	UV	2500	1700 psi 12 N/mm²	870 - 1450 psi 6 - 10 N/mm²	D 55	>80%	-65 to +250°F -55 to +120°C
UV6160	Excellent optical clarity	UV-Visible	1500	3265 psi 25 N/mm²	1600 psi 11 N/mm²	D 70	125%	-65 to +250°F -55 to +120°C
UV6231	Optical clarity, moisture resistance	UV	6500	1450 psi 10 N/mm²	1450 psi 10 N/mm²	D 48	>120%	-65 to +250°F -55 to +120°C
UV7141	Metals, dual cure	UV-Anerobic	1350	2900 psi 20 N/mm²	2000- 2500 psi 14 - 17 N/mm²	D 65	35%	-65 to +300°F -55 to +150°C
Plastic Bonding					**Polycarbonate**			
UV630	Low viscosity	UV-Visible	250	2000 psi 14 N/mm²	Substrate failure	D 60	110%	-65 to +250°F -55 to +120°C
UV632	Low viscosity, acrylic bonder	UV-Visible	300	1900 psi 13 N/mm²	Substrate failure	D 65	>70%	-65 to +250°F -55 to +120°C
UV639	Acrylic and PETG bonder	UV-Visible	1300	2900 psi 20 N/mm²	Substrate failure	D 40	>220%	-65 to +250°F -55 to +120°C
UV640	Medium viscosity	UV-Visible	2.5 rpm 18,500 20 rpm 4000	1900 psi 13 N/mm²	Substrate failure	D 65	110%	-65 to +250°F -55 to +120°C
UV643	Strong, fast, tack free	UV-Visible	2rpm 17,600 20rpm 2000	3336 psi 23 N/mm²	Substrate failure	D 65	50%	-65 to +250°F -55 to +120°C
UV645	High viscosity	UV-Visible	2.5 rpm 45,000 20 rpm 9000	1600 psi 11 N/mm²	Substrate failure	D 58	>70%	-65 to +250°F -55 to +120°C
UV648	High viscosity, acrylic bonder	UV-Visible	20rpm: 30,000 2rpm: 150,000	1600 psi 11 N/mm²	Substrate failure	D 58	>70%	-65 to +250°F -55 to +120°C
UV649	Thixotropic gel	UV-Visible	Thixotropic Gel	2200 psi 15 N/mm²	Substrate failure	D 58	>70%	-65 to +250°F -55 to +120°C
Coating								
UV681	Low viscosity, tack free coating	UV-Visible	100	1700 psi 12 N/mm²	-	D 58	>50%	-65 to +250°F -55 to +120°C
UV683	Doming viscosity, tack free coating	UV-Visible	1300	2000 psi 14 N/mm²	-	D 58	>50%	-65 to +250°F -55 to +120°C
UV Light Curable Cyanoacrylate *(see page 16)*								

STRUCTURAL ACRYLICS

Permabond's line of structural acrylics was developed for demanding applications that require high tensile, shear, and peel strength as well as maximum shock and impact resistance.

They offer fast fixture and cure at room temperature, providing a solution to the continuous demands for increased line speeds while decreasing the manufacturing costs that are associated with heat curing.

Permabond structural acrylics are suitable for bonding a wide variety of substrates, offering great material selection. Materials such as metals, glass, and composites are easily bonded with Permabond structural acrylics.

Structural Acrylic adhesive types:

- Two component
- No-mix surface activated
- Specialty products for difficult to bond plastics

Structural Acrylic - Two Component					
Grade	**TA4207**	**TA4810**	**TA4820**	**TA440 A&B**	**TA4522**
Description	2-part 1:1 toughened methacrylate	2-part 1:1 toughened methacrylate	2-part 1:1 toughened methacrylate	2-part 1:1 non-flammable structural acrylic	2-part 1:1 non-flammable structural acrylic
Dispensing	Dual cartridge with static mix nozzles or bead on bead	Dual cartridge with static mix nozzles	Dual cartridge with static mix nozzles	Bead on Bead	Dual cartridge with static mix nozzles
Key Features	1 hour cure, acid free, excellent adhesion to difficult metals	Thixotropic, non-sag, fast set	Thixotropic, non-sag, delayed set	Lower odor	Non-flammable, low odor, for rigid plastic and metal
Appearance	Light Yellow	Off-White/Amber	Off-White/Amber	Amber/Green	Green
Viscosity cP	2500 cP	175,000 cP	200,000 cP	10,000 cP	4500 cP
Fixture Time	8 - 10 min	10 - 15 min	30 - 35 min	<30 sec	4 - 7 min
Full Strength	1 hr	24 hr	24 hr	24 hr	24 hr
Shear Strength Steel	>3800 psi (>26 N/mm^2)	3000 - 4000 psi (21 - 28 N/mm^2)	3000 - 4000 psi (21 - 28 N/mm^2)	2200 - 3600 psi (15 - 25 $N/mm^{2)}$	3045 - 3335 psi (21 - 23 N/mm^2)
Shear Strength Aluminum	>3600 psi (>25 N/mm^2)	2000 - 3200 psi (14 - 22 N/mm^2)	2500 - 3500 psi (17 - 24 N/mm^2)	1500 - 2500 psi (10 - 17 N/mm^2)	2030 - 2320 psi (14 - 16 N/mm^2)
Shear Strength Fiber Glass	-	1700 psi (>12 N/mm^2)	1700 psi (>12 N/mm^2)	-	1300 psi (>9 N/mm^2)
Gap Fill	0.02 in (0.5 mm)	0.08 in (2.0 mm)	0.08 in (2.0 mm)	0.02 in (0.5 mm)	0.02 in (0.5 mm)
Temperature Range	-40 to +250°F (-40 to +120°C)	-40 to +250°F (-40 to +120°C)	-40 to +250°F (-40 to +120°C)	-65 to +250°F (-55 to +120°C)	-65 to +270°F (-55 to +130°C)

Permabond no-mix, surface activated structural acrylics are solvent free and greatly increase design possibilities. They form strong bonds to a wide variety of substrates including metals, glass, magnets, and composites. They are ideal for applications involving close fitting parts.

Structural Acrylic - No-Mix Surface Activated							
Grade	**TA430 and Initiator 41 or Initiator 41M**	**TA435 and Initiator 41 or Initiator 41M**	**TA436 and Initiator 43**	**TA437 and Initiator 41 or Initiator 41M**	**TA439 and Initiator 41 or Initiator 41M***	**TA4590 and Initiator 44**	**TA4246 and Initiator 46**
Color	Amber	Amber	Amber	Orange	Amber	Blue	Amber
Feature	General Purpose	High Peel Strength	High Temp	Anaerobic Cure	Acid Free	Acid Free	MMA - very high strength
Visc. cP 2.5 rpm	50,000	70,000	60,000	130,000	-	90,000	-
Visc. cP 20 rpm	20,000	30,000	25,000	40,000	1000	20,000	28,000
Specific Gravity	1.1	1.0	1.1	1.1	1.0	1.1	1.0
Gap Fill inch (mm)	0.02 (0.51)	0.02 (0.51)	0.02 (0.51)	0.02 (0.51)	0.006 (0.15)	0.02 (0.51)	0.02 (0.51)
Handling Time	3 - 5 min	3 - 5 min	1 - 3 min	1 - 3 min 15 - 20 min**	40 - 75 sec	30 - 60 sec	2 - 4 min
Working Strength	40 - 60 min	30 - 60 min	30 - 60 min	30 - 60 min 60 - 120 min**	3 - 5 min	2 - 3 min	15 - 30 min
Full Cure	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr
Impact Strength	10 - 15 kJ/m^2	10 - 15 kJ/m^2	10 - 15 kJ/m^2	10 - 15 kJ/m^2	10 - 20 kJ/m^2	15 - 20 kJ/m^2	50 - 60 kJ/m^2
Shear Strength Steel	2200-3600 psi 15 - 25 N/mm^2	2200-3600 psi 15 - 25 N/mm^2	2200-3600 psi 15 - 25 N/mm^2	2000-3000 psi 14 - 20 N/mm^2	2900-3600 psi 20 - 25 N/mm^2	2900-3600 psi 20 - 25 N/mm^2	4800-5100 psi 33 - 35 N/mm^2
Peel Strength Aluminum	10 - 14 PIW 45-65 N/25mm	18 - 22 PIW 85-100 N/25mm	10 - 14 PIW 45-65 N/25mm	18 - 22 PIW 85-100 N/25mm	18 - 22 PIW 85-100 N/25mm	18 - 22 PIW 85-100 N/25mm	33 - 40 PIW 150-180 N/25mm
CTE	80 x 10^{-6} 1/K	80 x 10^{-6} 1/K	80 x 10^{-6} 1/K	80 x 10^{-6} 1/K	80 x 10^{-6} 1/K	80 x 10^{-6} 1/K	80 x 10^{-6} 1/K
Thermal Conductivity	0.1 W/(m.K)	0.1 W/(m.K)	0.1 W/(m.K)	0.1 W/(m.K)	0.1 W/(m.K)	0.1 W/(m.K)	0.1 W/(m.K)
Dielectric Constant	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Dielectric Strength	30 - 50 kVmm	30 - 50 kVmm	30 - 50 kVmm	30 - 50 kVmm	30 - 50 kVmm	30 - 50 kVmm	30 - 50 kVmm
Volume Resistivity	2 x 10^{13} Ohm.cm	2 x 10^{13} Ohm.cm	2 x 10^{13} Ohm.cm	2 x 10^{13} Ohm.cm	2 x 10^{13} Ohm.cm	2 x 10^{13} Ohm.cm	2 x 10^{13} Ohm.cm
Temperature Range	-65 to +250°F -55 to +120°C	-65 to +250°F -55 to +120°C	-65 to +300°F -55 to +150°C	-65 to +390°F -55 to +200°C	-65 to +330°F -55 to +165°C	-65 to +330°F -55 to +165°C	-40 to +250°F -40 to +120°C

* Initiator 43 can be used when bonding plastic.

** TA437 time on metal with no initiator. TA437 has an anaerobic cure mechanism and can be used with no initiator.

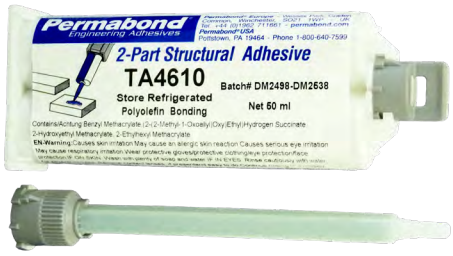
STRUCTURAL ACRYLICS FOR POLYOLEFINS

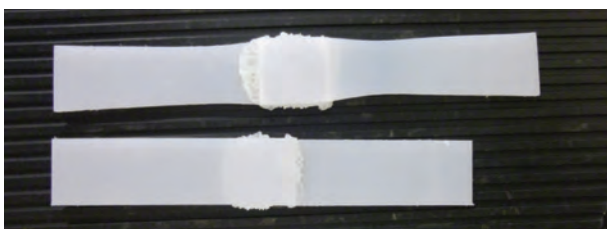
Permabond Structural Acrylics bond polyolefins and other low surface energy plastics which were commonly called "difficult-to-bond" plastics. Difficult to bond no more!!

Structural Acrylic Polyolefin Bonders

Grade	TA4605	TA4610	TA4611	TA4631
Appearance	A: Off-white B: Almost colorless Mixed: Off-white	A: Off-white B: Almost colorless Mixed: Off-white	A: White B: Transparent Mixed: Off-white	A: White B: White Mixed: White
Features	Fast cure	Fast cure for large components	Smaller gap fill (no micro beads)	Low odor, smaller gap fill (no micro beads)
Viscosity @ 25°C	Mixed: 125,000 cPs	Mixed: 210,000 cPs	Mixed: 21,500 cPs	Mixed: 21,500 cPs
Mix Ratio	1:1	1:1	1:1	1:1
Fixture Time	5 - 10 minutes	12 - 15 minutes	10 - 16 minutes	12 - 18 minutes
Handling Time	20 - 25 minutes	40 - 50 minutes	40 - 50 minutes	40 - 50 minutes
Working Strength	2 - 4 hours	6 - 8 hours	6 - 8 hours	6 - 8 hours
Shear Strength Polypropylene	>8 N/mm² (>1200 psi) Substrate Failed	>8 N/mm² (>1200 psi) Substrate Failed	>8 N/mm² (>1200 psi) Substrate Failed	>8 N/mm² (>1200 psi) Substrate Failed
Shear Strength Polyethylene	>7 N/mm² (>1015 psi) Substrate Failed	>7 N/mm² (>1015 psi) Substrate Failed	>7 N/mm² (>1015 psi) Substrate Failed	>7 N/mm² (>1015 psi) Substrate Failed
Service Temp	-55 to +100°C	-55 to +100°C	-55 to +100°C	-55 to +100°C
Packaging Cartridges*	10 x 50ml	10 x 50ml	15 x 25ml & 10 x 50ml	15 x 25ml & 10 x 50ml
	6 x 400ml	6 x 400ml	6 x 400ml	6 x 400ml
Storage	5 to 25°C (41 to 77°F)	5 to 25°C (41 to 77°F)	5 to 25°C (41 to 77°F)	5 to 25°C (41 to 77°F)

*Bulk available upon request





Untreated polypropylene lap shears bonded with TA4610.
The adhesive bond is so strong the plastic stretches, deforms, and fails before the bonded joint.

STRUCTURAL ACRYLICS FOR NYLON

Permabond TA4550 forms high-strength bonds to nylon, other plastics, composites, and metals. It is a two-part, 2:1, low-odor, high-viscosity, thixotropic, structural acrylic adhesive. TA4550 requires no surface primers or additional surface treatment before bonding, facilitating high-speed production and efficiency. The high viscosity provides excellent flow control properties for more controlled, accurate dispensing, even in vertical applications.

Extremely high shear and peel strength on nylon and a high level of toughening provide outstanding resistance to impact and vibration.

TA4550 Nylon Bonder

Grade	TA4550
Appearance	A: Clear, colorless B: Green
Features	Fast cure
Viscosity @ 25°C	Mixed: 100,000 cPs
Mix Ratio	2:1
Fixture Time	5 - 6 minutes
Working Strength	2 hours
Hardness	60-65 Shore D
Tensile Strength	11 MPa (1595 psi)
Elongation	140%
Packaging Cartridges*	10 x 50ml
	6 x 400ml
Storage	5 to 25°C (41 to 77°F)
Nylon PA6	≥6 N/mm² (≥870 psi)
Mild Steel to Nylon	≥6 N/mm² (≥870 psi)
Aluminum to Nylon	≥6 N/mm² (≥870 psi)
PVC	≥6 N/mm² (≥870 psi)
PC	5 N/mm² (725 psi)
ABS	6 N/mm² (870 psi)
PMMA	≥4 N/mm² (≥580 psi)
CFRP	25 N/mm² (3626 psi)
PETG	≥5 N/mm² (≥725 psi)

*Bulk available upon request

≥ Indicates Substrate Failure

Permabond®

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