PERMABOND® HL138™

Anaerobic Retaining Compound

Ref. #022908PBHL138

FEATURES & BENEFITS

Fast cure
Low viscosity
Simple one-part system
Excellent shear strength
Good environmental resistance

GENERAL DESCRIPTION

PERMABOND HL138 is a single component liquid that cures only when in contact with metal parts and oxygen is excluded. The liquid adhesive fills the "air space" between parts and upon cure unitizes and retains male and female parts. Thus it prevents their movement relative to each other, eliminating wear, erosion, and pitting. **PERMABOND HL138** cures to a tough cross-linked plastic that will prevent the corrosion of mated parts, and provides excellent environmental and temperature resistance.

Since **PERMABOND HL138** can fill the up the inner space, shaft-hub assemblies can be made with a clearance fit and eliminate an expensive press fit, while actually increasing the push out force. **PERMABOND HL138** cures extremely fast. It develops full strength in a few hours on a large variety of substrates and is used on high speed production lines.

PHYSICAL PROPERTIES OF THE UNCURED ADHESIVE

Properties	
Base Resin	Methylacrylates
Solids, %	100
Color	Green
Mean Viscosity, cP* at 25°C (77°F)	150*
Specific Gravity	1.09
Flash Point, °C (°F)	>110 (230)
Shelf Life stored @ or below 27°C (80°F),months**	12
Maximum Gap Filling, in (mm)	0.005 (0.127)

*Thixotropic viscosity, i.e., easy to dispense, but no migration when adhesive/sealant is on parts.

**Package sizes greater than one liter, six months.

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SPEED OF CURE

Typical Fixturing Time, min	10
Full Strength, hr	3

*measured on M10 steel nuts & bolts.

BEHAVIOR ON DIFFERENT SUBSTRATES

PERMABOND HL138 performs best on clean steel and will also perform well on most metals, including aluminum, stainless steel, brass, and plated materials. It will also give good results on oily parts, but for optimum performance parts should be cleaned before applying the retaining compound. When used on materials that have been treated with anti-rust compounds, the anaerobic adhesive/sealant may not cure. Passive materials will induce a "slow cure" and ultimate strength may also be reduced. Generally metals, which induce a “fast cure”, will achieve fixturing strength in approximately 15 minutes.

Activity of Materials and Finishes

Super Active	Active	Inactive	Passive
Brass	Iron	Anodized aluminum	Ceramics
Copper	Steel	Cadmium finishes	Glass
Magnesium	Nickel	Chrome finishes	Plastics
	Aluminum	Passivated metals	Painted finishes
		Stainless steel	
		Titanium	
		Zinc	

Super Active	Very fast cure
Active	Fast cure
Inactive	Slow cure
Passive	No cure without PERMABOND ASC10 Surface Conditioner

EFFECT OF TEMPERATURE ON CURE SPEED

PERMABOND Anaerobic Retaining Compound is designed to cure at room temperature but the cure can be accelerated by heat if a faster cure is needed. Heating the liquid compound above 120^{o}C (248^{o}F) is not recommended [the compound once cured, has an upper operating limit of 150^{o}C (300^{o}F)] For every 10^{o}C rise in temperature, the rate of cure doubles. Conversely for every 10^{o}C drop in temperature, the rate of cure is reduced by a factor of two.

PERFORMANCE PROPERTIES OF THE CURED ADHESIVE

Cured at 25°C for 24 hours	
Torque, ISO 10964	
Breakaway, lb·in (N·m)	
M10 steel nuts and bolts	180 (20)
Prevail, lb·in (N·m)	
M10 steel nuts and bolts	320 (36)
Compressive shear strength,ISO 10123 (Steel pin and collars)	2300 psi (16) N/mm^2

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ELECTRICAL AND THERMAL PROPERTIES OF THE CURED ADHESIVE

Dielectric Strength, MV/m	11
Electrical Resistance, ohm-m	$> 10^{17}$
Thermal Conductivity, W/m^{o}K	0.2
Thermal Expansion Coefficient, in/in^{o}C	$90x10^{-6}$
Operating Temperature, ^{o}C (^{o}F)	150^{o}C (300^{o}F)

HEAT RESISTANCE

Since **PERMABOND** Anaerobic products cure to a cross-linked, thermoset plastic, they exhibit excellent environmental and heat resistance. However, they are organic materials so the extreme upper limit is approximately 150^{o}C (300^{o}F). Low temperatures do not markedly affect strength.

CHEMICAL RESISTANCE

The fully cured and cross-linked anaerobic retaining compound resists most chemicals well, even at elevated temperatures. Chemical washes of any kind will have no effect on the adhesive because of the generally short duration of exposure. Anaerobic products are not recommended for use in the severe environment of pure oxygen and strong acids or alkalis.

JOINT DESIGN

Manufacturers can realize significant savings by changing from precision-machined fits and similar retaining methods to anaerobic bonding methods. Typically, manufacturing times per joint were reduced by 40 to 70%, and material cost per joint by up to 80%, when compared to such retaining methods as interference fits, taper pins, spring pins, splines, and keys.

A press or interference fit requires extensive machining of the parts and still only yields contact between the parts of no more than 30% due to microscopic surface irregularities. As a result, press fits can still fail in service due to fretting (micro-movements that are produced between parts), tearing, or wearing off surface high spots due to corrosion, and chemical breakdown of the surface. Together they form the process of fretting corrosion, that is the most common failure of cylindrical fitted parts.

With an anaerobic retaining compound this process is not possible, because it fills up all irregularities and forms a tough plastic that contacts both parts completely, thereby preventing micro-movements. It seals the inner joint from external and internal chemical attack, thus the durability of the assembly is improved.

PERMABOND HL 138 for retaining has a certain gap filling capability, i.e., the degree to which they will fill the tolerance between parts and cure to a tough plastic that contacts both parts and unitizes them. This means a slip fit can be used with **PERMABOND HL138** to replace an interference fitting. The following table shows the increase in push-out force in a pin and collar assembly due to this changeover.

EFFECT OF ANAEROBIC RETAINING COMPOUND ON PUSH-OUT FORCE*

	Clearance (inches)	Finish (micro-inches)	Push-Out Force (psi)
Interference fit	-0.0005	6	2100
Slip fit HL138	+0.002	6	2350
Slip fit HL138	+0.002	63	3400

*1/2 inch steel pin & collar.

JOINT STRENGTH

The amount of bonded area, the bondline thickness, and the surface finish of the cylindrical parts determine the strength of a joint.

The bond area and bondline thickness (clearance) depend on the design of the joint. As the gap (clearance) between parts increases, some loss of strength is experienced. Maximum strength is obtained when the diametrical clearance does not exceed 0.005 inches.

RELATIONSHIP BETWEEN STRENGTH AND CLEARANCE

Clearance (inches)	Percent Shear Strength Retained
0.0025	95%
0.0050	75%

RELATIONSHIP BETWEEN STRENGTH AND SURFACE FINISH

Surface Finish (micro-inches)*	Percent Shear Strength Retained
8	45%
16	50%
32	57%
64	70%
70	100%

* Micro-inches = 1 x 10^{-6} in.

A machine finish will usually yield a surface roughness of 60 to 80 micro-inches that will typically give optimum strength when using **PERMABOND HL138.**

APPLICATION & DISPENSING

1. **PERMABOND HL138** For best results, clean all surfaces with a cleaning solvent and allow to dry.
2. If the substrates being used are inactive metals or the cure speed is too slow, then spray the parts with **PERMABOND ASC10** and allow to dry.
3. On slip fitted assemblies, apply adhesive on the leading edge of the pin and on the inside of the collar. Assemble with twisting action.
4. On press fitting assemblies, apply the adhesive on the pin and collar. Assemble using a press.
5. On shrink fitted assemblies, apply the adhesive to the pin, heat the collar to create enough clearance and assemble.
6. Allow the parts to fixture before disturbing them.

STORAGE & HANDLING

Material should be stored in the original container in a cool place away from sparks, flame, excessive heat and sunlight. Handling should be done using plastic gloves and proper eye protection. Skin contact should be avoided. If skin contact occurs, the affected area should be washed thoroughly with soap and water. Eye contact should be treated by thorough washing with water followed by medical attention. Adequate ventilation is necessary to prevent inhalation of vapors. Proper Personal Protective Equipment is always recommended when using chemicals. **For more information, consult the Material Safety Data Sheet.**

Permabond HL138 has a shelf life of one year when stored at or below 27°C (80°F). Do not freeze. Product removed from original container might be contaminated during use. Do not return this material to the original container.

UNCURED (LIQUID) ANAEROBIC COMPOUND

Uncured anaerobic products contain reactive chemicals. These chemicals can cause skin irritation on individuals with sensitive skin. Good housekeeping to keep work areas and tools clean, is usually sufficient to prevent skin irritation. Barrier creams and plastic gloves should be used to ensure worker protection against accidental or chronic exposure.

Atomizing the liquid compound into the air can allow it to be inhaled and thereby expose the lungs and skin to contact irritation. Spray applications are not recommended.

CURED (SOLID) ANAEROBIC COMPOUND

The cured product is a hard inert plastic, which is safe to handle. The curing reaction reacts all of the liquid adhesive (100%) into the solid plastic. No solvents or other substances are released upon cure as is the case with many other adhesives.

FOR INDUSTRIAL USE ONLY. KEEP OUT OF REACH OF CHILDREN.