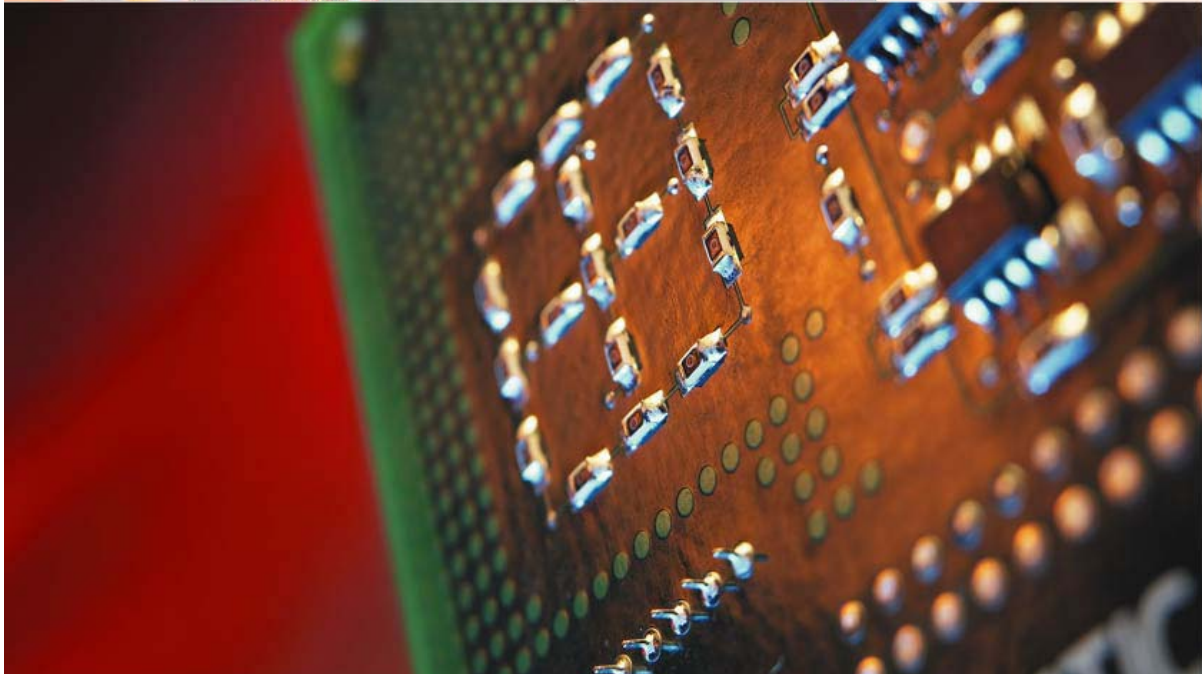


Hysol® **LOCTITE** Macromelt®

Circuit Board Protection Solutions



Advanced Potting Materials for Transformer Applications

Whether lighting up your neighborhood street or enabling your laptop, scanner or printer, transformers play a pivotal role in current control and electrical function. The transformer device transforms energy from one circuit to another, utilizing two or more coupled windings. Used to convert between high and low voltages, transformers enable consistent electrical current for many everyday products.

Protecting the windings with stable material is critical for their longevity and successful operation. Henkel's material delivers the essential properties necessary for enabling outstanding performance and long-term use. Our line of advanced potting materials provide solutions for a wide range of transformer products and requirements, including medical electronics, data communication robotics and control module.

Excellent adhesion, good thermal insulation, humidity resistance and superior electrical performance are all characteristics of advanced coil potting materials and properties embodied in Henkel's line of potting products. It is also crucial that materials are track resistance, so that superior electrical insulation is provided especially in high voltage applications. The advanced formulation of Henkel's potting materials deliver this essential property and ensure robust performance even when dealing with higher voltages.



Maximum Performance Materials for LED Lighting

The integrity and long-term reliability of the materials used in LED lighting applications mean the difference between success and failure. Without proper protection, environmental exposure can cause a total loss of function and result in the scrapping of the entire LED light assembly. But, with the right material, these costly errors can be avoided and the lighting that delivers automotive safety and consumer confidence will work as it should, when it should.

Formulating the right potting material for LED protection can involve many considerations including adhesion characteristics, cure times, material color for various reflective properties and, of course, environmental and thermal resistance.

Traditionally, LEDs are mounted on a printed circuit board (PCB) and placed into a clear plastic housing and then potted. These versatile lights can be used in a variety of applications including warning lights, turn signal lights, tail lights, decorative lights, flashlights, remote controls and digital clocks.

Henkel's decades-long experience with conformal coating, potting and encapsulating materials has resulted in a broad product range to meet any LED application requirement and to deliver the high-performance and quality expected of a materials innovator. With market-leading conformal coating, potting, encapsulating and thermal adhesive materials for LED applications, Henkel's LED product solutions provide the performance manufacturers require and reliability consumers demand.



Optimized Materials for Control Modules

From critical air bag operations and engine control to common household appliance functions, control modules play a central role in the reliable performance of many of the products consumers depend on everyday. In fact, the consistent operation of these products has become an expectation.

In order for control modules to preform as they were designed, they must be protected from the surrounding environment. Robust materials must be used for the various process of control modules to ensure reliability and longevity.

With housing made from materials such as cast aluminum, stamped aluminum, nylon, Valox or a variety of plastics, control modules come in many shapes and sizes and require different processes for different applications. Control module manufacture may include adding protection for the circuit board in the form of conformal coating, complete encapsulation of the board in the form of potting, sealing a multi-piece module over the board, or even molding completely over the board with a low pressure molding compound Macromelt.

As the premiere materials developer for the numerous materials that may be used for control module production, Henkel has a unique understanding of different applications and the price/performance benefits for various materials that can be used for control module products.

While potting is often the most traditional method to protect a circuit in a complex shape, it may not be the most cost effective. Perhaps the module is of a size and shape that is conducive to Henkel's cost effective Macromelt process. For less harsh environments, a conformal coating may provide sufficient protection. Whatever the material or the applications, Henkel will have the chemical know-how and understanding of the requirements to ensure the most efficient production, highest yield, and most robust product.



Sensor Protection for Mission Critical Electronics Operations

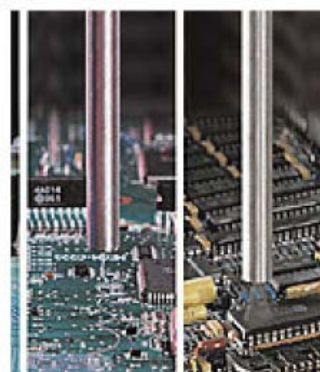
An airbag deploys upon impact. A driver's car notifies him that the tire pressure is low. The gas light comes on when the automobile fuel tank is nearly empty. All of these conveniences that make lives safer and easier are made possible through the use of electronic sensors. These small, but mission critical devices, are found in numerous types of products including automobiles, household appliances and medical electronics, just to name a few.

In essence, a sensor's function is to monitor certain conditions -- for example, the tension of the seat belt to determine the passenger's size and weight and appropriateness of air bag deployment - to ensure the proper function of other electronic devices within the system. But, a sensor is only as good as the materials that are enabling its operation and protecting it from adverse environmental conditions. At Henkel, we make sure that all materials used to assemble, coat and protect electronic sensors are compatible with one another and highly reliable in the field.

From conformal coatings for the printed circuit board (PCB) to potting materials to simple, one-step Macromelt encapsulation, Henkel develops and formulates total material solutions for your specific application requirements.

If your sensor production operation needs a highly-automated solution for high-volumes or an encapsulating material that delivers high adhesion and cost efficiencies or a potting material that can withstand constant submersion in gasoline, Henkel has the solution.

Whatever the sensor production challenge, Henkel's team of material experts can provide a approach that delivers product superiority and enhances your company's competitiveness.

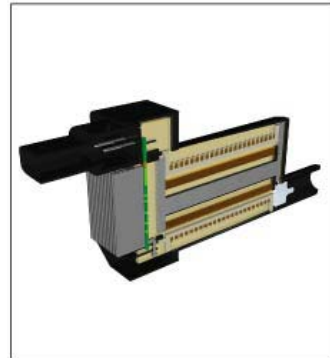


Coil Potting Materials Provide a Great Start

It's a routine most people go through several times a day: put the key in the ignition, turn it over and the engine starts. What others take for granted - a successful vehicle start - the materials experts at Henkel take very seriously and invest significant resources into developing products that ensure operator confidence and motor vehicle safety.

Any ignition coil's function is to convert a low voltage into a high voltage to jump the spark plug gap and ignite the fuel-air mixture in the combustion chamber. To protect the coil during operation, advanced potting compounds are used and must provide very high thermal resistance and excellent adhesion in order to deliver long-term, in-field dependability.

Without high-performance coil potting materials, ignition coil function and reliability are in jeopardy. Key to the success of Henkel's potting products are their coil impregnation characteristics and superior adhesion properties, which provide excellent stability even when subjected to extreme thermal cycles. Henkel's line of advanced potting materials deliver enduring material integrity and provide unmatched coil protection so that automotive manufacturers can produce safe, reliable products and motorists can depend on their car starting the first time... every time.



Circuit Board Protection

Potting/Encapsulation

Hysol® Epoxy

Product	Description/Application	Viscosity (cps)	Recommended Curing Condition Alternative Curing Condition	Mix Ratio (PBW) Mix Ratio (PBV)	Shore Hardness
ES1000	Two-component, long pot life, casting system with excellent handling properties. Ideal for encapsulation of various components and modules. (UL 94HB) Black	25,000	36-48 hrs @ 25 °C/or 3 hrs @ 60 °C	100/90 1/1	75D
ES1001	Two-component, casting system with excellent handling properties. Ideal for impregnation applications with small tolerances. Black	10,000	24 hrs @ 25 °C/or 3 hrs @ 60 °C	100/87 1/1	75D
ES1002	Two-component, casting system with excellent handling properties. Ideal for machine metering/dispersing or regular hand mixer applications. (UL 94-V0) Black	10,500	36-48 hrs @ 25 °C/or 3 hrs @ 60 °C	100/100 1/1	88D
ES1003	Filled, low viscosity, impregnation system having excellent electrical and physical properties. Recommended for impregnation of fine wires. Tan	20,000	2 hrs @ 110 °C/or 1 hrs @ 125 °C	100/21 100/30	94D
ES1004	Cast compound. Meet the needs for flame-out, Easily handled casting system. (UL 94-V0) Black	26,000	2 hrs @ 80 °C plus 2 hrs @ 150 °C	100/13 4/1	88D
ES1005	Soft, resilient epoxy system. Excellent thermal shock resistance and lower stress on sensitive components. Tan	11,500	4 hrs @ 120 °C	100/25 2/1	75D
ES1300	Two-component filled epoxy system designed for vacuum impregnation application. Recommended for bobbin wound ignition coil applications. Brown	85,000	3 hrs @ 93 °C plus 1 hrs @ 130 °C	100/100 1/1	94D
ES1301	Silica filled epoxy casting system. Recommended for coils, transformers, and general purpose casting. Black	1,600	4 hrs @ 110 °C	100/38 2/1	90-95D
ES1900	Two-component, casting system with excellent handling properties. Recommended for small potting and laminating application where clarity and excellent electrical and mechanical properties are required. Clear	6,000	12-24 hrs @ 25 °C/or 2 hrs @ 65 °C	100/46 2/1	90D
ES1901	A fast-setting, toughened, medium-viscosity, industrial grade epoxy adhesive. Ideal for flex circuits, cable boots and staking fillet bonds. Clear	2,500	24 hrs @ 25 °C	100/105 1/1	55D
ES1902	Transparent, low viscosity epoxy resin formulation recommended for potting and laminating applications where clarity and excellent electrical and mechanical properties are required. Clear	290	24 hrs @ 25 °C/or 2 hrs @ 60 °C	100/41.7 2/1	80D
ES2200	An undiluted epoxy 100% solids system and should be used where very low mixed viscosity is not critical requirement. Amber	3,000	2 hrs @ 60 °C/or 24 hrs @ 22 °C	100/11 100/13	85D
ES2201	An undiluted epoxy, low viscosity casting system. Recommended for potting where high impact strength is required and where rigid or flexible wire leads protrude directly from the encapsulation. Amber	600	3 hrs @ 60 °C/or 24 hrs @ 22 °C	100/30 100/33	75-80D
ES2202	An unfilled epoxy system with a high operating temperature and long pot life. Recommended for use where excellent chemical resistance, high heat distortion temperature and good electrical properties under high humidity conditions are required. Amber	8,000-10,000	2 hrs @ 80 °C plus 2 hrs @ 150 °C	100/25 100/28	80-85D
ES2203	An undiluted, silica filled epoxy casting compound which exhibits improved thermal properties, lower shrinkage and lower expansion characteristics. Black	10,500	2 hrs @ 60 °C/or 24 hrs @ 22 °C	100/5.5 100/9	87D
ES2204	A filled system offering improved thermal conductivity and increased resistance to heat and thermal shock. (0.46 w/m²K) Black	2,000	3 hrs @ 60 °C/or 24 hrs @ 22 °C	100/15 100/24	80-85D
ES2205	A filled system with a high operation temperature and long pot life. Recommended for use where excellent chemical resistance, high heat distortion temperature and good electrical properties under high humidity conditions are required. Black	20,000-30,000	2 hrs @ 80 °C plus 2 hrs @ 150 °C	100/12.5 100/19	80-85D
ES2206	A soft, flexible, filled black epoxy casting system with improved adhesion characteristics, good heat resistance, and a convenient mix ratio. It is best suited for low stress applications. Black	1,820	5 hrs @ 85 °C	100/49 100/72	55A
ES2207	A filled, resilient, low viscosity, room temperature cure epoxy potting compound. This material has excellent adhesion to many substrates and has good surface appearance. (UL 94-V0) Black	8,800	24 hrs @ 25 °C/or 2 hrs @ 60 °C	100/15.8 4/1	
ES2500	A resilient, low cost, fast gelling, potting compound. Recommended for potting and encapsulating high volume parts. (UL 94HB) Black	1,500	16 hrs @ 25 °C/or 2 hrs @ 60 °C	100/29.5 2/1	70D
ES2501	An unfilled, fast, room temperature cure adhesive system designed to harden in 3 to 5 minutes. Ideal for bonding to metal, wood, concrete or most plastics surface. Yellow	13,500	1 hrs @ 25 °C	100/100 1/1	72D
ES2502	Two component heat cured casting system designed for the insulation of various types of transformers. Black	57,600	3 hrs @ 80 °C	100/95 1/1	75D

Circuit Board Protection

Potting/Encapsulation

Hysol® Urethane

Product	Description/Application	Viscosity (cps)	Recommended Curing Condition Alternative Curing Condition	Mix Ratio PBW	Shore Hardness
US1150	An extended polybutadiene/MDI based, mineral filled, medium hardness, ambient cure urethane encapsulant/sealant.	3,500	24-48 hrs @ 25 °C/or 2-4 hrs @ 60-85 °C	21/100	60A
US1151	A low viscosity, reenterable potting and encapsulation compound. Ideal for electronics for under-the-hood automotive and marine.	1,000	24 hrs @ 23 °C	12.8/100	30 A
US2050	A quick set, optically clear polyurethane compound that exhibits excellent uv resistance.	500	48 hrs @ 25 °C/or 1 hrs @ 85 °C	1.78/1	90 A
US2350	A flexible, flame retardant, mineral filled, polyurethane compound.	2,400	12-24 hrs @ 23 °C	21.2/100	85 A
US2650	A low viscosity, flexible, flame retardant, castor oil/MDI based urethane potting/encapsulating compound. Ideal for potting and encapsulating electronic or electrical devices or assemblies.	3,500	16 hrs @ 25 °C/or 1-3 hrs @ 65 °C	1/4	83 A
US2651	An unfilled, low viscosity, reenterable potting and encapsulation compound. Use to encapsulate electronics for automotive applications including under the hood.	1,000	16 hrs @ 23 °C/or 1-2 hrs @ 65-85 °C	52.3/47.7	15 A

Sealing/Gasketing

Loctite® Silicone

Product	Description/Application	Type	Cure Cycle	Viscosity/ Extrusion Rate	Tensile PSI/kPa	Elongation	Shore Hardness
5089™ Nuva-Sil®	UV-curing silicone for electronics module sealing. Ideal for high-speed potting. In-line pressure testing possible immediately after cure.	Filled Amber Alkoxy	UV Moisture 60 s 40mW/cm² + 3 days RTH	1000,000 cps	145	190%	>25A
Fastgasket 5950™	Cure-In-Place. UV/Moisture cure. Black paste.	Acetoxy	UV Moisture 60 s 40mW/cm² + 7 days RTH	250-425 gpm	>148	>180%	20 - 33
5900™	High viscosity form in place silicone gasketing material for use where low pressure blow out test is required before cure. Excellent oil resistance.	Oxime	10 days RTH	20 to 50 gpm	246	400%	35A
5910™	Form-in-Place. Superior flexibility and adhesion. Excellent fluid resistance. Non-Corrosive. Black.	Oxime	10 days RTH	>300 gpm	247	>400%	30
5084™ Nuva-Sil®	Non-corrosive, non-slumping, UV silicone for gasketing and sealing devices. Provides excellent environmental protection.	Filled Amber Alkoxy	UV Moisture 60 s 40mW/cm² + 7 days RTH	140-300 gpm	493	250%	32-47A
5145™	Bonding, sealing and coating electronic devices. Ideal for reinforcing and strain-relieving delicate components. Meets Mil-A46146B. Ideal for severe weather environment.	Filled Translucent Alkoxy	Moisture 24 hr @ 25 °C + 7 days RTH	40 gpm	435	330%	45A
5421™	Non-corrosive, non-slumping, UV silicone for gasketing and sealing devices requiring EMI/RF shielding. Provides severe environmental protection.	Filled Tan Alkoxy	Moisture 24 hr @ 125 °C + 7 days RTH	N/A	102	>40%	50-65A

Circuit Board Protection

Conformal Coatings

Product	Description	Type	Viscosity (cps)	Pot Life	Cure Cycle	Alternate Cure	Dielectric Strength (V/mil/KV/cm)	Mix Ratio	Temp Range
3900™	This air-dry coating is designed for small production runs. It may be applied by spray, dip or brush procedures. Aerosol - fast cure.	Acrylic One Component	Aerosol	N/A	Air Dry - 5 min	N/A	1652/650	N/A	-40 °C to 125 °C
PC30STD™	Repairable low VOC, waterborne acrylic, one component, stable printed circuit board coating with superior toughness and abrasion resistance. IPC CC830	Acrylic One Component	380	N/A	2 hrs @ 60 °C	7 days @ 25 °C	860	N/A	continuous up to 110 °C
PC20M™	Repairable, stable, good moisture and environmental protection, superior toughness. MIL 46058 listed.	Acrylic One Component	2,000	N/A	45 min @ 75 °C	24 hrs @ 25 °C	200/787	N/A	continuous up to 110 °C
PC51™	Rapid drying, one component for dipping applications. Provides excellent vibration resistance and toughness. Can be removed for repair.	Acrylic One Component	140	N/A	45 min @ 75 °C		2000/780	N/A	continuous up to 125 °C
PC54™	Rapid drying, one component for nonatomized spray coating applications, provides excellent vibration resistance and toughness. Can be removed for repair.	Acrylic One Component	75	N/A	45 min @ 75 °C		2000/780	N/A	continuous up to 125 °C

Product	Description	Type	Viscosity (cps)	Pot Life	Cure Cycle	Alternate Cure	Dielectric Strength (V/mil/KV/cm)	Mix Ratio	Temp Range
PC18M™	Flexible solvent-based, one component, urethane coating. Provides good thermal shock resistance. MIL 46058 listed.	Urethane One Component	350	20 min	2 hrs @ 60 °C	7 days @ 25 °C	1200/472	N/A	continuous up to 110 °C
PC29M™	Thin film printed circuit board coating with good toughness and high flexibility. MIL 46058 listed.	Urethane Two Component	225	200 g 6 hrs	2 hrs @ 100 °C	4 hrs @ 60 °C	1500/591	100/60	continuous up to 125 °C
PC28STD™	Convenient aerosol packaging, oxygen-cure, printed circuit board coating system.	Urethane Component	20-50	N/A	2 hrs @ 60 °C	5-7 days @ 25 °C	1500/591	N/A	continuous up to 110 °C
AC0305™	Special blend of solvents, has moderately slow evaporation, used for adjustment of viscosity and/or film thickness on printed circuit coatings. Can be used with all the conformal coating materials above, except with acrylic and silicone systems above.	Thinner							

Product	Description	Type	Viscosity (cps)	Pot Life	Cure Cycle	Alternate Cure	Dielectric Strength (V/mil/KV/cm)	Mix Ratio	Temp Range
PC12-0007M™	General purpose, 100% solids, epoxy printed circuit board with maximum electrical and ruggedization properties. Suitable for continuous operation up to 125 °C. MIL 46058 listed.	Epoxy Two Component	7,500-20,000	190 min	2 hrs @ 75 °C	4 hrs @ 65 °C	1500/591	100/80	continuous up to 125 °C

Product	Description	Type	Viscosity (cps)	Pot Life	Cure Cycle	Alternate Cure	Dielectric Strength (V/mil/KV/cm)	Mix Ratio	Temp Range
5293™	UV Silicone for severe temperature cycling environments. High reliability automotive. No solvents. Very low VOC. UV + moisture cure	Silicone One Component	600	N/A	UV 20-40 S 75mW/cm ²	MOISTURE Tack-free: 2-6 hrs Full Cure: 72 hrs	406/160	N/A	-40 °C to 204 °C
5296™	Heat cure silicone can be applied with brush, dip, or spray. High reliability. For automotive application. Clear.	Silicone One Component	150 - 235	N/A	Heat 7min@ 125 °C	N/A	524/206	N/A	-40 °C to 204 °C

Macromelt® Low Pressure Molding

The Macromelt® line of high performance thermoplastic polyamides is specially designed to meet all your molding process requirements.



These products provide good adhesion, an excellent environmental seal, high in-service temperature resistance and good resistance to solvents. The low melt viscosity of these materials allow for low capital equipment cost and low molding pressure that will not damage delicate electronic surface mount components.

Low pressure molding is the solution for production issues associated with traditional high-pressure injection molding over sensitive electronic components or circuit boards. The polyamide hot melt adhesive material may actually be used to mold in mounting studs or eyes, eliminate injection molded housings and covers, and replace epoxy potting operations all in one simple process. The materials also provide great strain relief in molded grommets and connectors.



The low viscosity of the molten Macromelt® materials allow for in mold at pressures as low as 1.8 bar (25 PSI). The low mold pressure is critical to encapsulating fragile surface mount components, wire bonds, and solder joints. to overmold, seal and protect fragile electronic components. With a short cycle time of 15 to 45 seconds, injection-molding results in very high production rates compared to generic 24 hour cure, two component urethane or epoxy potting operations.

Advantages

- Complete water tight encapsulation
- Fast cycle times (15-45 seconds)
- Low capital equipment costs
- Safe, 1 component, UL 94-V0 Approved
- Low pressure and high speed molding for electronics encapsulation

Applications

- Automotive Sensors
- Hall Effects Sensors
- Circuit Board Protection
- Automotive Modules
- Connectors
- Strain Relief
- Switches
- Battery Sealing

Macromelt Selector

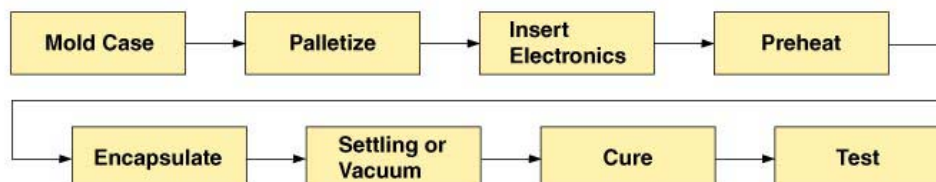
Product	Description/Application	Color	Performance Temperature	Shore A Hardness	Softening Point
OM633™ OM638™	Moldable polyamide with service temperature up to 125°C such as in an automotive firewall.	Amber Black	-40°C to 125°C	90	157 ± 5°C
OM641™ OM646™	Moldable polyamide where strength and hardness are needed such as in memory sticks and computer connectors.	Amber Black	-40°C to 125°C	92	175 ± 5°C
OM652™ OM657™	Moldable polyamide where excellent adhesion and cold temperature flexibility are important such as in an automotive exterior. Also used extensively in white goods.	Amber Black	-40°C to 100°C	77	175 ± 5°C
OM673™ OM678™	Moldable polyamide with good adhesion for higher temperature applications such as in an automotive under-hood.	Amber Black	-40°C to 140°C	88	187 ± 5°C
OM682™ OM687™	Moldable polyamide for the most demanding high humidity applications such as on the inside of an automobile tire. Formulated for very low water vapor transmission.	Amber Black	-40°C to 140°C	88	188 ± 5°C
MM6206™ MM6208S™	Moldable polyamide with excellent adhesion to tough substrates. Great flexibility offers incredible strain relief on cables and wires. Ideal for encapsulation of heat producing components in appliance and consumer electronics. UL RTI 95°C	Amber Black	-40°C to 130°C	78	155 ± 5°C
Q5375™	Moldable polyolefin for demanding moisture and solvent resistance. Excellent adhesion to the most difficult substrates.	Opaque White	-30°C to 100°C	55	139 ± 5°C

Macromelt® Low Pressure Molding

Product Properties

Material Property (units)	OM633™ OM638™	OM641™ OM646™	OM652™ OM657™	OM673™ OM678™	OM682™ OM687™	MM6206™ MM6206S™	Q5375™
Color	Amber/Black	Amber/Black	Amber/Black	Amber/Black	Amber/Black	Amber/Black	Opaque White
Cold Flexibility (°C)	-40°C	-40°C	-40°C	-40°C	-40°C	-40°C	-30°C
Flammability Rating	UL 94-V0	UL 94-V0	UL 94-V0	UL 94-V0	UL 94-V0	UL 94-V0	
Glass Transition Temperature (°C)	-36°C	-40°C	-40°C	-40°C	-40°C	-35°C	-30°C
Injection Temperature (°C)	200°C to 225°C	200°C to 225°C	180°C to 225°C	200°C to 225°C	200°C to 240°C	200°C to 225°C	
Performance Temperature (°C)	-40°C to 125°C	-40°C to 125°C	-40°C to 110°C	-40°C to 150°C	-40°C to 150°C	-40°C to 130°C	-30°C to 100°C
Softening Point (°C)	175°C ± 5°C	175°C ± 5°C	157°C ± 5°C	187°C ± 5°C	188°C ± 5°C	155°C ± 5°C	139°C ± 5°C
Thermal Expansion Coefficient (1/°C)	5E-04	5E-04	5E-04	5E-04	5E-04	5E-04	
Mechanical							
Density (g/cc)	0.98	0.98	0.98	0.98	0.98	0.98	0.94
Elongation at Rupture (%)	400	800	400	500	550	600	480
Shore-A-Hardness	90	92	77	88	88	78	55
Shore-D-Hardness	56	59	41	51	57	43	15
Tensile Strength at Rupture (N/mm²)	4.5	11	2.7	5.7	5	3.2	0.76
Electrical Properties							
Dielectric Constant (1kHz)	4.5/4.7	5.1/5.5	62./6.3	4.9/4.9	5.3/5.5	6.1/6.3	
Dielectric Strength (kV/mm)	24/19	25/22	14/15	20/20	18/16	23/23	
Viscosity @ 210°C (cps)	3,500	4,500	3,900	3,400	4,500	3600	2,000
Volume Resistivity (Ωcm)	1.00E+13	1.00E+14	1.00E+13	1.00E+13	1.00E+14	1.90E+11/1.60E+11	1.30E+17

Traditional Potting Process Flow



Low Pressure Molding Process Flow





Henkel - Your partner worldwide...

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