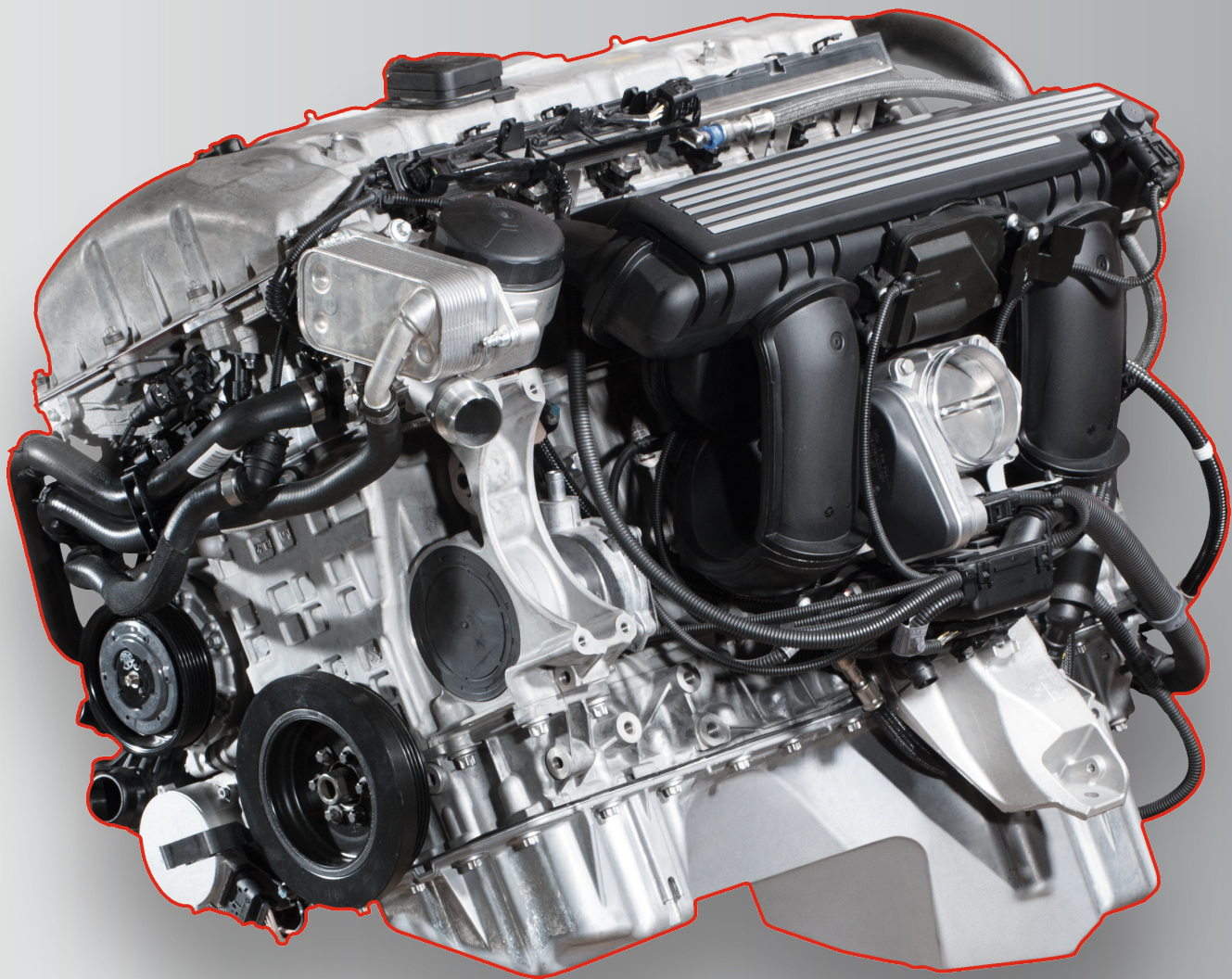


LOCTITE®
BONDERITE®

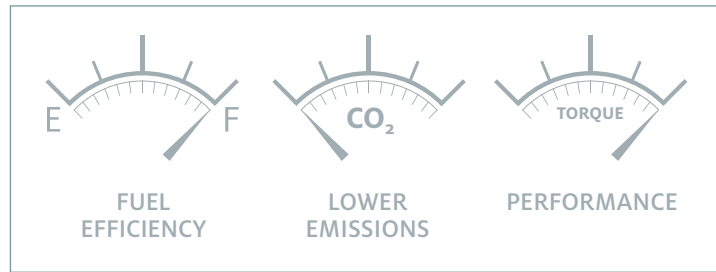
Powertrain Solutions along the entire Value Chain



Henkel

Powertrain Market Dynamics

Increasing fuel efficiency and engine performance while reducing tailpipe and evaporative emissions have been the drivers steering the activities within the automotive powertrain industry within the last several years.



Industry Needs

The industry is developing many diverse options to achieve its goals by:

- > Downsizing of engines while improving performance
- > Shifting in the propulsion mix toward alternative powertrains
- > Incorporating changes in parts and substrates to reduce mass
- > Reducing friction wherever possible

Our Solutions

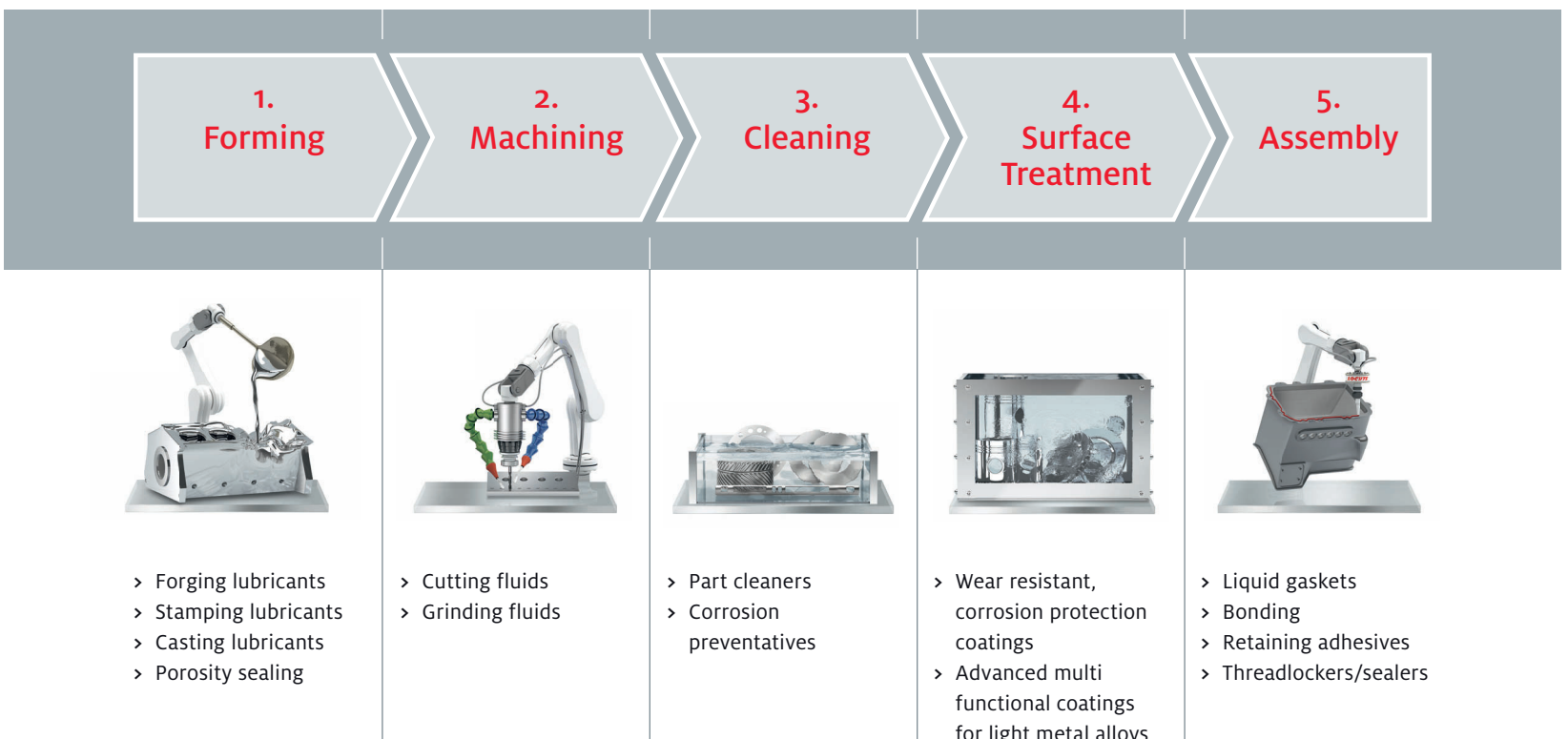
Our technologies help our customers to meet the industry needs by:

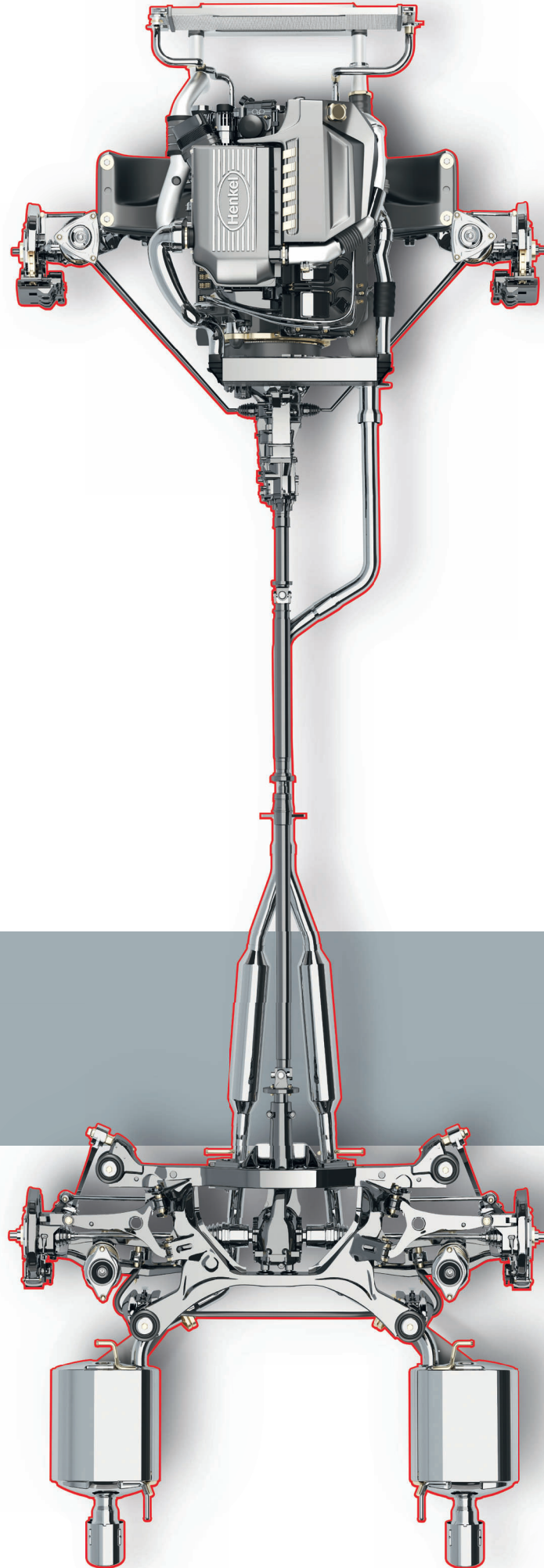
- > Enabling increase use of performance enhancing components
- > Enabling alternative propulsion technologies using advanced specialty chemistries
- > Enabling lightweight initiatives
- > Providing advanced multi functional coatings



- > Utilizing sustainable, green raw materials and processes

Powertrain technologies along the entire value chain







1. Forming

Forging lubricants

Hot/Warm Forging

Henkel's forging lubricants bring value throughout your forging operations. Through the BONDERITE L-FG forge products, Henkel offers an extensive line of lubricants for hot, warm and precision forging processes. These products are designed to perform under extreme temperatures and pressure. In addition, Henkel offers synthetic and hybrid products specifically formulated to replace fully graphitic products while providing lubrication and protection to tooling on even the toughest forgings.

Benefits:

- > Extended die life
- > Enhanced part quality
- > Increased productivity and efficiency

Cold Forging

Henkel's line of BONDERITE L-FM polymers for cold forming are developed using environmentally sustainable technology that can easily be applied with in-line or batch systems. An alternative to reactive and non-reactive soaps, these water-based, dry-in-place coatings are compatible with traditional pretreatment technology. From forging to extrusion and drawing of steels, non-ferrous metals and difficult-to-work super alloys, Henkel's forging die lubricants and release agents are outstanding performers under the most extreme conditions of temperature and abrasion.



Stamping lubricants

Henkel's full line of quality metal forming products for stamping and drawing are available in a variety of chemistries, including straight oils, emulsions, synthetics or dry films. Key product lines include:

BONDERITE L-MF series is developed with a unique composition of corrosion inhibitors, extreme pressure and lubricity additives, which provide a durable product for drawing operations.



BONDERITE L-MF is Henkel's dry film series of products for heavy drawing applications. These products can be mill applied to ferrous and non-ferrous substrates to replace mill oil, prelubes and drawing compounds.

BONDERITE L-MF series is designed for a variety of stamping operations where a straight oil is required. These products feature BONDERITE L-MF PL series, which acts as a light stamping product with multiple automaker approvals and also operate as an extended corrosion preventative.

Benefits:

- > Increased corrosion protection
- > Multiple automaker approvals
- > Increased tool life

Casting lubricants

High Pressure Die-Casting

BONDERITE L-CA CP is the release agent series for the die-casting of aluminum, magnesium and zinc components. The BONDERITE L-CA CP range of water-based release agents are specifically designed for the pressure die-casting, thixocasting and squeeze casting of aluminum, magnesium and other non-ferrous metals. All BONDERITE L-CA CP release agents provide superior release and lubrication at extremely cost-effective dilution ratios. The large range of BONDERITE L-CA CP formulations allows for specialist products for niche applications, including very thin castings, radiators or structural castings.



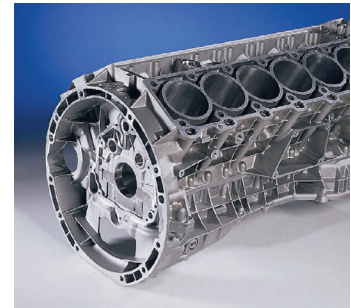
Sustainability

Water & Wastewater: High wetting temperatures reduce cooling-water needs.

Energy & Climate: Highly concentrated products = reduced transport costs.

Benefits:

- > Highly concentrated products and advanced formulation allow extremely high dilution ratios (up to 300:1).
- > Patented formulations give market-leading release properties.
- > Very clean and paintable castings with high surface finish (e. g. special formulations for electronic applications).
- > Higher wetting temperatures protect dies and allow higher production rates.
- > Wax-free formulations are available, reducing die maintenance and down-time.
- > BONDERITE L-CA CP release agent series allow for highly optimized processes and maximum productivity.



Low Pressure/Gravity Casting

Additionally Henkel's BONDERITE L-CA CG and BONDERITE L-CA CC series of die release lubricants ensure optimized part quality and easy release in the casting process.

Benefits:

- > Solvent-free
- > Improved release
- > Improved surface finish

Porosity sealing

LOCTITE Impregnation Series

The LOCTITE impregnation series are suitable for various cast parts made of aluminum, cast iron or brass-like engine blocks, oil sumps, cylinder heads/covers, gearboxes, filter housings, fittings and many more. Microporosity in parts made of cast metals and non-leakproof areas in electrical components may cause pressure leaks, inferior surface quality, corrosion and high reject rates. LOCTITE vacuum impregnation can reliably seal porosities, shrinkage pores, capillaries and cracks.

Benefits:

- > Fast and flexible impregnation service
- > Reduction of overproduction and reject rate
- > Environmentally sustainable recycling technology
- > Fully automated processes with high capacity
- > Excellent resistance to chemicals and temperature
- > Excellent sealing result
- > Cost saving
- > All our Impregnation Service Centers and processes are certified according to ISO/TS 16949, ISO 14001 + BS OHSAS 18001

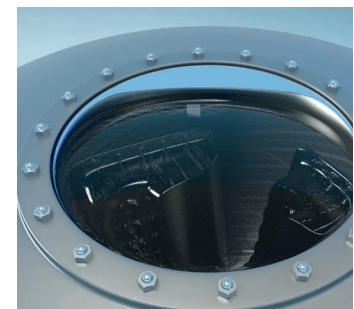


Sustainability

Energy & Climate: The impregnation process enables thin-walled diecast parts to be produced. This saves weight and contributes to environmental protection.

Water & Wastewater: LOCTITE vacuum impregnation incorporates a recycling system, with which impregnants are continuously recovered from the washing water and fed back into the impregnation process. The water is also reused.

Materials & Waste: Impregnation reduces reject rates, so that parts can still be used and material and machines can be employed more efficiently.





2. Machining

Cutting and Grinding Fluids

BONDERITE L-MR metal removal-fluids are ideal for a broad range of powertrain applications, including machining and grinding of engines, pistons, cylinder, cylinder heads, turbochargers, gearboxes, and steering and brake systems, etc. They provide excellent performance for precision components.

The high-performance coolants of the BONDERITE L-MR product range are suitable for the economical cutting, grinding and forming of light metals, cast iron, steel alloys and nonferrous metals. The cutting fluids and cleaners from Henkel are based on a modular system. Consistent use of the same patented emulsifier and corrosion protection modules ensures the best possible compatibility of the metal processing and cleaning stages.

Due to its novel bactericide free-formulations of BONDERITE L-MR, Henkel has achieved a major breakthrough with a successful generation of water-miscible cutting fluids containing a patented emulsifier-technology. Normally the tank side addition of bactericides is also unnecessary. The new BONDERITE L-MR products reduce the handling risks involved when dealing with bactericides, ideally the risk is eliminated. Also because of the high hardwater-stability of BONDERITE L-MR the emulsion-bath-life-time increase.

Benefits:

- > Great cleaning and cooling performance
- > Minimal product consumption
- > Long emulsion-bath-life-times
- > Low reject rate and good surface quality
- > Longer tool life
- > Inhibitors prevent corrosion of steel, aluminum and nonferrous metals
- > No expensive additives required
- > Good defoaming and hard-water-stability properties
- > Simple bath maintenance and long bath life time means improved economic efficiency
- > Good skin compatibility



Sustainability

Water: Reduced concentrate consumption. Water savings through 10 to 15 % reduction in concentrate in the application emulsion. Reduction in wastewater.





3. Cleaning

Part cleaners

The unique composition of alkalinity, corrosion inhibitors and surfactants provides a durable low foaming, hard water-stable product for today's light to moderate duty cleaning and protecting needs. These cleaners are ideal for removing oils and emulsions, drawing compounds, metal chips and pigment off the surface of machined or pressed parts.

BONDERITE C-NE series provides a range of neutral cleaners with corrosion protection. A key product is:

- > BONDERITE C-NE 3300, a neutral-based, in-process cleaner with corrosion inhibitors designed for mid-term corrosion protection of ferrous and aluminum alloys. Its unique composition provides a durable, hard-water-stable product for cleaning and protection.

BONDERITE S-FN series provide a full range of corrosion preventatives to meet the demands of today's in-process, storage and transportation requirements. A key product is:

- > BONDERITE S-FN 6750 is a synthetic corrosion inhibitor designed for short-term to moderate corrosion protection on ferrous alloys. Its unique composition provides a durable, low-foaming product with a non-tacky film.



Benefits:

- > Simple bath maintenance and long bath life time means improved economic efficiency
- > No expensive additives required
- > Good defoaming properties
- > Multi purpose cleaner for steel, cast iron, aluminum, aluminum alloys and non-ferrous/yellow metals



Sustainability

Water & wastewater: By using BONDERITE C-NE and S-FN, you achieve a reduction of up to 50% in wastewater and a reduction of up to 30% in water consumption.

Materials & waste: With BONDERITE C-NE and S-FN, you use up to 30% less cleaner and need no additives.



Corrosion preventatives

Henkel provides the industry with waterbased corrosion preventatives for steel and light metals since 80 years. The BONDERITE S-PR products prepare surfaces and parts for a successive process like bonding, coating, painting or storing, ensuring cleanliness and corrosion protection.

Key products:

BONDERITE S-PR 6788 is a 3-in-1 product: cutting fluid, cleaning and corrosion protection

BONDERITE S-PR TS 941 is a corrosion protection oil with dewatering properties

Benefits:

- > Process simplification: Waterbased emulsions reduce the need for further cleaning
- > Cost effectiveness: high performance even with high dilution ratios.



4. Surface Treatment

Wear resistant, corrosion protection coatings

These corrosion-resistant coatings consist mainly of iron and manganese phosphates, and reduce wear on such articles as pistons, rings, liners, camshafts, tappets, motor blocks and similar bearing surfaces. Other beneficial effects: permit rapid break-in of moving parts without scuffing or welding by preventing metal-to-metal contact between the bearing surfaces, increases lubrication of treated surfaces due to the oil-absorptive coating, and removes light metal scratches remaining from machining operations.

BONDERITE M-MN 2 is formulated to produce nonmetallic, oil-absorptive coatings on iron and steel bearing surfaces. These corrosion-resistant coatings consist chiefly of iron and manganese phosphates, and reduce wear on such articles as pistons, rings, liners, camshafts, tappets, motor blocks and similar bearing surfaces.

BONDERITE M-MN LT 10 is the same as BONDERITE M-MN 2, except that it is used at lower temperatures.

Benefits:

- > Improved corrosion resistance
- > Reduced part wear

Advanced multi functional coatings for light metal alloys

Electro Ceramic Coatings

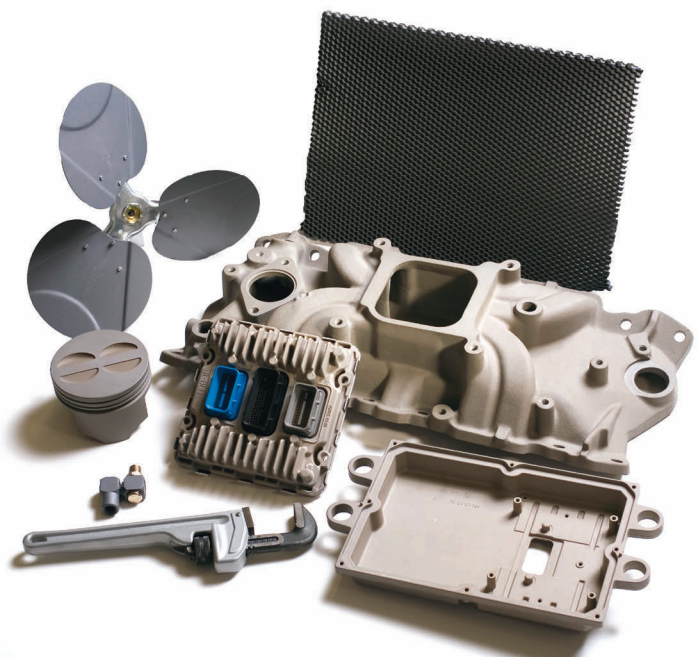
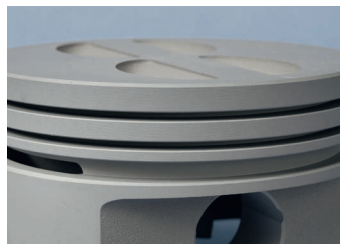
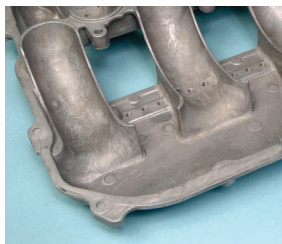
Innovative new surface treatment technology for aluminum, magnesium, titanium and their related alloys. Electro Ceramic Coatings virtually eliminate corrosion whilst providing an excellent base layer for adhesion to subsequent painting or adhesive application.

Able to withstand the most extreme conditions of temperature and chemical exposure, Electro Ceramic Coatings prolong the lifespan of your light metal components. With their extremely low surface roughness and superior wear resistance, Electro Ceramic Coatings provide a high performing solution for applications of dry or lubricated friction.

With simple immersion application, Electro Ceramic Coatings provide our customers with a sustainable, durable and economically attractive system to support their light weighting targets.

Benefits:

- > Excellent corrosion protection
- > Excellent wear resistance
- > Low coefficient of friction
- > Positively effects engine combustion characteristics
- > Chrome-free
- > Stable, efficient process
- > No regulated heavy metals





5. Assembly

Liquid gaskets

LOCTITE liquid gasketing products are the low cost sealing solution for powertrain assemblies. Henkel combines both product and process design to achieve the highest quality and most efficient solution.

Products:

Formed-in-Place Gasketing:

- > Provides a tight seal by filling the voids between parts and creating a flexible bond

Cured-in-Place Gasketing:

- > Provides a tight seal by compressing the cured rubber sealant

Applications:

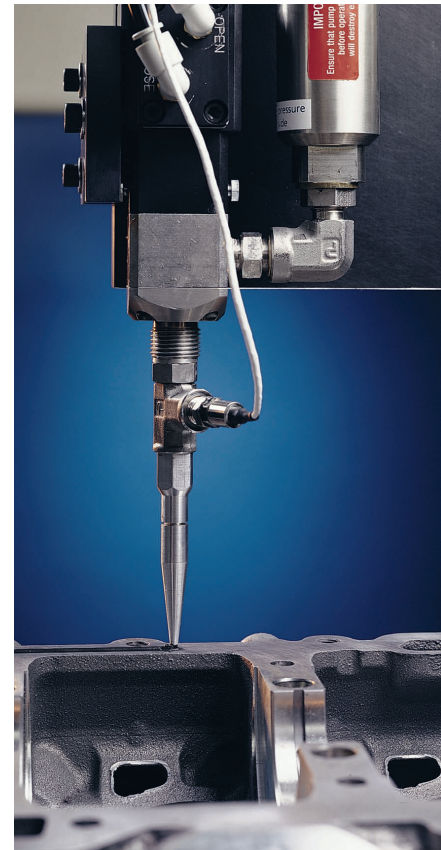
- > Engine and /or transmission oil pans
- > Engine covers
- > Axle covers
- > Timingbelt covers
- > Transmission caves halves

Chemistries:

- > Anaerobic
- > Silicone
- > Polyacrylate

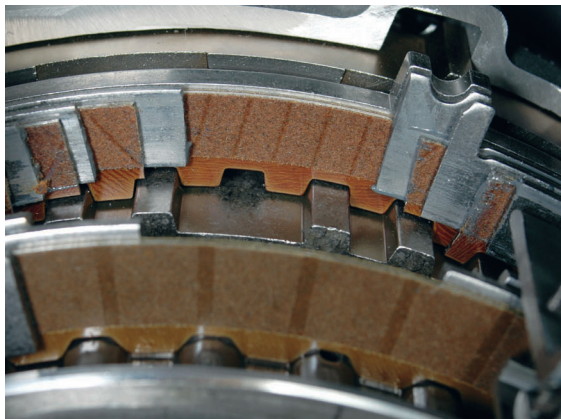
Benefits:

- > Low cost sealing solution
- > Increases assembly efficiency
- > Improves quality



Bonding

Henkel's adhesives are used to bond components such as clips or intake manifolds. Henkel is the world's largest manufacturer of adhesives, allowing its engineers to select the best adhesive technology for a given powertrain or underhood application.



Applications:

- > Intake manifolds
- > Clips

Chemistries:

- > Epoxy
- > Acrylic
- > Cyanoacrylate

Benefits:

- > Industry's broadest lineup of adhesives
- > Lower cost than other joining methods
- > Customized products
- > Low energy consumption
- > Time-tested performance in demanding applications



5. Assembly

Retaining adhesives

LOCTITE retaining compounds fill the “inner space” between press and slip-fit shear assemblies and cure to form a strong precision assembly.

Applications:

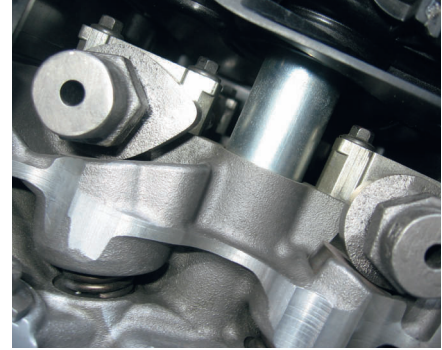
- > Spark plug tubes
- > Engine block and cylinder head cup/core plugs
- > Vent tubes and fittings
- > Axle gears and flanges

Chemistries:

- > Liquid anaerobics

Benefits:

- > High-strength chemical bonding for non-threaded cylindrical assemblies



Threadlockers/Sealers

LOCTITE threadlockers and thread sealers are designed to lock and seal everything from delicate electronic components to heavy construction equipment, and are available in varying viscosities and strengths for virtually any automotive application. For high-volume production environments, these products can arrive preapplied to the fastener to avoid additional cycle time.

Applications:

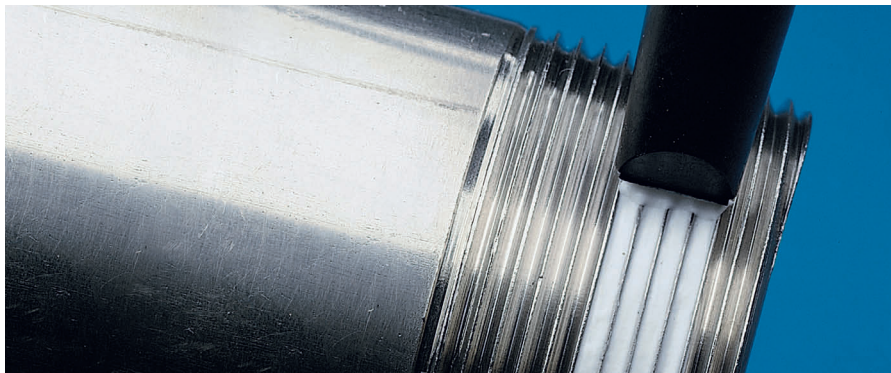
- > Engines, transmissions and axles
- > Fully compatible with all automotive fluids and temperature ranges

Chemistries:

- > Liquid anaerobic adhesives and sealants
- > Preapplied, solid anaerobic adhesives and sealants

Benefits:

- > Ensures solid, leak-proof components
- > Reduces costs by eliminating the need for some fasteners
- > Raises component reliability



Ecommitment

Sustainability – The Foundation of Henkel

Henkel is founded on a deep commitment to deliver services and chemical products that consistently exceed customer expectations while encompassing product safety and ecological compatibility. The guiding principles of Henkel inspire long-term customer relationships based on reliability, credibility and mutual trust. Henkel continuously develops innovative products and technologies which offer customers benefits in environmental and health protection, and are economically advantageous.

This trust is earned by the continued practice of putting the customer first and working to discover new, more effective solutions every day.

With more than 50,000 employees, Henkel continues to expand its diversified range of products and services. Facilities in over 80 countries help ensure Henkel remains a global market leader.



Chemical Management

Henkel's chemical management program provides customers with a source for inventory management, environmental reporting and enhanced purchasing for all chemicals and support services.

Benefits:

- > Automated environmental reporting
- > Maximum cost efficiency
- > MSDS management and streamlined logistics
- > On-site technical support
- > Procurement

Chemical Management Services:

- > Analytical services
- > Consolidated purchasing
- > Cost-per-unit programs
- > Integrated process management
- > Materials management
- > Process and waste water treatment
- > Process improvement
- > System monitoring
- > Total fluid chemical/fluid management
- > Sealant management



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TECHNOMELT®
TEROSON®
AQUENCE®

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