

# MAHLE

## GENUINE HEAVY DUTY REPLACEMENT ENGINE PARTS



[WWW.MAHLE-AFTERMARKET.COM](http://WWW.MAHLE-AFTERMARKET.COM)

**CLEVITE**<sup>®</sup>

**MAHLE**<sup>®</sup>

# WHO WE ARE

**Genuine Heavy Duty Parts are offered by MAHLE Aftermarket Inc., a company with vast resources in the heavy duty engine parts market. A full line of Clevite® engine parts, pistons, piston rings, sleeves, camshafts, engine bearings, and bushings is available. The offering also extends to MAHLE® gaskets, filters, thermostats, turbochargers and rotating electric.**

## GENUINE HEAVY DUTY PROGRAM

In addition to the brands mentioned above, the Clevite product line includes rebore kits, ring sets, rod bushings and valve train parts. Complete sleeve assemblies are also available featuring a cylinder sleeve (wet or dry), piston, piston pin, lock rings, piston ring sets and sleeve sealing rings (where required).

Through an array of heavy duty products, MAHLE Aftermarket services a variety of markets, including the truck/fleet, bus, agricultural, industrial, energy and construction industries.

MAHLE Aftermarket products represent the latest in manufacturing technology, for pistons, piston rings, cylinder sleeves, engine bearings, turbochargers, thermostats and rotating electric. As a result, MAHLE Aftermarket is a major supplier to the world's leading diesel engine builders.

The Genuine Heavy Duty Program encompasses the entire line of MAHLE Aftermarket products, ensuring that they are functionally equivalent to original equipment when it comes to quality, performance, availability, warranty and service. The program is also supported by an aggressive advertising campaign, signage and packaging. Plus, the MAHLE Aftermarket sales team is trained specifically in Clevite and MAHLE heavy duty products.

On the following pages, you'll find detailed information about each of the product lines, as well as coverage, policy overview and industry leading technology & service.

## WHO IS MAHLE?

The success story of MAHLE begins with innovation and continues with cutting-edge technology which lead to being first to the market. In 1921, the light-alloy piston developed by the brothers Hermann and Ernst Mahle was produced in volume. Air and oil filters followed in order to protect the piston from damaging dirt and dust.

In the meantime, MAHLE has become one of the world's leading system partners of the automotive and engine industry with approximately 75,000 employees at 170 production sites worldwide. Over 5,000 professional engineers work in seven research and development facilities, designing new components for the internal combustion engines of tomorrow. MAHLE innovations have become the standard for vehicles today.



*MAHLE is one of the world's leading system partners of the automotive and engine industry.*

Research and development all around the combustion engine has been a high priority since MAHLE was founded in 1920. In the former engine test workshop, MAHLE engineers developed numerous product innovations over decades, which made today's combustion engines possible. This comprises the first wear-resistant light-alloy pistons for gasoline and later also for diesel engines, cylinder liners using the centrifugal casting process, assembled camshafts and ecological filter systems.

#### **DEVELOPMENT WORLDWIDE**

MAHLE is a leader in technological innovation for combustion engines. Today, more than 5,000 engineers and technicians are working on future technologies in the Group's research and development centers in: Stuttgart, Northampton, Detroit, São Paulo, Pune, Tokyo, and Shanghai. These development units are working together on new, global tasks. The goal is to continue to provide new approaches for complex problems, such as reduced consumption and emission values and improved service life.

#### **MODERN ANALYSIS AND TESTING METHODS**

From fundamental and material research to validation of new calculation and simulation programs, to validation in engine and vehicle tests: MAHLE has all modern analysis tools. This approach and the ideas of MAHLE development engineers continue to secure clear technology leadership for the future. Over 100 combustion engine test cells serve as basic equipment for optimization and testing of MAHLE products. No other supplier in heavy duty replacement parts has more comprehensive or detailed knowledge of the entire engine.



# ENGINE KITS

## → DID YOU KNOW

*MAHLE Aftermarket offers pre-packed kits condensed into special shipping cartons for improved presentation to the customer. These pre-packed engine kits will be shipped the same day as ordered (when ordered by 2 pm CST) and are complete with all the parts needed in one box; they are stocked in both Olive Branch and Bell Service Centers to ensure even faster delivery.*

When many suppliers say they offer engine kits, all they're doing is packing parts in a box. MAHLE Aftermarket makes a commitment to offer a full line of engine kits and commits to support the kits the way every part is supported that has ever been sold. When you buy an engine kit from MAHLE Aftermarket, you're not just buying parts in a box, you're buying a philosophy of service that extends to every division of MAHLE.

MAHLE Aftermarket offers both Inframe and Overhaul engine kits to meet the needs of the market.

Below is a list of parts generally included in these engine kits. Kit contents may vary slightly based on application and market requirements.

### IN-FRAME KITS INCLUDE:

- Piston kit with rings or sleeve assemblies
- Head gasket set, oil pan gasket set or in-frame gasket set
- Rod bearings
- Main bearing set

### OVERHAUL KITS INCLUDE:

- Piston kit with rings or sleeve assemblies
- Head gasket set
- Lower gasket set
- Rod bearings
- Main bearing set

Before MAHLE Aftermarket even considers putting a part in any kits, it must meet stringent guidelines. It must live up to the MAHLE name. That's why you'll find the brands you trust in every kit – Clevite® engine parts and MAHLE® gaskets. You don't have to settle for engine kits that are not backed by the kind of service, or packed with the quality parts you can only get from MAHLE Aftermarket – but with a full line of quality engine kits at competitive prices, you'll never have to "settle" again.



# SLEEVE ASSEMBLIES

Clevite® sleeve assemblies are ready for installation and have a finish-machined or rough-turned cylinder bore depending on the type of engine. They include the following components: cylinder sleeve (wet and dry), piston, piston pin, lock rings, piston ring set and sleeve sealing rings.

Heavy duty aluminum, iron and steel components provide the structural strength and dimensional integrity to give OE equivalent performance and life. Depending on the application, contemporary design features listed below are included.

## PISTONS

- Ni-resist top grooves to control groove wear
- Balanced for smooth engine operation

## PISTON PINS

- High-strength steels meet structural requirements to prevent pin breakage or deflection
- Case hardened to provide long lasting wear surfaces
- A high degree of dimensional and surface finish control are the final requirements for strength and long life

## PISTON RINGS

- Latest, high strength materials to protect against fatigue breakage
- Chrome and moly plated O.D. finishes provide long lasting wear surfaces
- Chrome-plated and nitrided steel oil rings give good oil control

## SLEEVES

- Sleeve material is carefully manufactured to give the longest possible service life with the least amount of wear
- Heat treated as required
- Firewalls and head gasket beads are included to enhance gasket performance and life
- Cross-hatched, plateau-honed finish on I.D.s provides proper sealing and surfaces for piston rings

## SLEEVE SEALING RINGS

- Select up-to-date compounds give good resistance to compression and thermal set, tearing and leaking
- Round, rectangular and square configurations are designed to meet the specific needs of different engines



# SLEEVES



Mechanical requirements for cylinder liners are extremely important, as they must withstand rising cylinder pressures and speeds. MAHLE Aftermarket offers a product range using state-of-the-art technology. The development competence for individual solutions, for Clevite® sleeves, has grown over the years. The design of Clevite® cylinder liners is strictly optimized through FE calculations, taking into consideration the engine block, the cylinder head, the cylinder head gasket, and the pistons.

## CLEVITE CYLINDER LINERS PROGRAM

The Clevite® heavy duty cylinder liners product range is characterized by its versatility. There is the perfect product for every engine – whether a finished product or a semi-finished product, whether made of cast-iron or steel, whether with or without coating. A large variety of materials are used, depending on the required strength and wear resistance. Clevite cylinder liners can withstand tensile strengths of up to 400 MPa.

## BETTER ADJUSTMENT – BETTER INTERACTION

MAHLE designs ensure the best possible interaction of liner material and piston ring coating – reducing oil consumption and wear. Modern honing processes leading to finer surfaces contribute to lower oil consumption in engines. At the same time, cylinder liners become more wear resistant.

## INNOVATIVE MATERIALS

When it comes to materials for the next generation of engines, MAHLE is forging new paths and testing innovative cast-iron materials and steels, among other materials. Compared to the types of cast-iron in use today, these materials provide significantly higher strengths. Despite increasing load applications on engines, these new materials even afford weight savings.

# PISTON RINGS

MAHLE is currently the world's largest producer of equipment and aftermarket piston rings providing a full line of Clevite® piston rings for heavy duty applications. Today's high output, ultra-low emissions, multi-fuel engines demand power cylinder components found only in laboratory environments just a few short years ago.

MAHLE leads the industry in the development of Thermal Spray ring face coatings that not only meet but exceed the very demanding needs of today's global engine builders. In most cases, each specific engine has its own unique design requirements in order to meet the emissions regulations and durability targets of its intended operating environment.

#### THE CLEVITE BASE MATERIALS INCLUDE:

- Five grades of regular, medium and high strength gray cast-iron
- Three grades of high strength ductile iron
- Five types of alloyed carbon and stainless steel

#### CLEVITE PISTON RING FACE COATINGS INCLUDE:

- Four distinctly different plasmas including high-strength plasma, carbide fortified plasma, high-density plasma, and HVOF (high velocity oxygen fueled) plasma [HVOF is especially well suited for high output, turbocharged diesel and multi-fueled applications]
- Side plasma is available for highly loaded applications that are particularly tough on ring and groove side wear
- Conventional and thick film PVD coatings are available for those applications that require the unique operating characteristics of ion plating
- High conformability chrome cast-iron and nitrided stainless steel oil rings lead the industry in oil control and million mile durability



# PISTONS – ALUMINUM



The demands placed on aluminum pistons for commercial vehicles have been continuously tightened over the years. Higher performance requirements trigger increased thermal loads. Furthermore, brake mean effective pressures (BMEP) and peak pressures are rising. MAHLE Aftermarket offers years of experience and innovative solutions, continuously adjusting the existing product range to tomorrow's requirements.

## THE CLEVITE ALUMINUM PISTON PROGRAM

The piston range for heavy duty engines includes optimized aluminum pistons for highest demands. The pistons are made of cast, high temperature-resistant aluminum-silicon alloys. These alloys and the fine-tuned casting technology make it possible for Clevite® pistons to ideally combine low weight and high structural rigidity. The products withstand peak cylinder pressures of more than 2,900-psi. If properly combined with other components, they ensure a service life of more than 600,000 miles for commercial vehicles.

## ALUMINUM PISTONS UNDER LOAD – OPTIMIZED FOR EVERY REQUIREMENT

Depending on the thermal and mechanical requirements, aluminum pistons for heavy duty applications excel based on the following characteristics:

- **Optimized alloy**
- **Optimized casting process**
- **Spray jet cooling**
- **Ring carrier**
- **Salt core cooling channel**
- **Elevated salt core cooling channel**
- **Cooled ring carrier**
- **Bowl rim reinforcement**
- **Pin bore bushing**

Clevite® pistons for commercial vehicle diesel engines are cast from high temperature-resistant aluminum alloys. Standard features are:

- **Ring carriers made of high-strength, austenitic cast-iron (Ni-resist) for improved wear resistance of the first ring groove**
- **Salt core cooling channels or cooled ring carriers and GRAFAL® coatings for optimization of skirt running behavior**

For high-performance engines, bushings in the piston pin bores are used.

## LOCAL REINFORCEMENTS FOR MAXIMUM STRENGTH

In addition to measures such as the casting in of ring carriers and the insertion of pin bore bushings, aluminum oxide fibers are infiltrated as well, to reinforce the thermally stressed combustion chamber bowl.

## COOLED RING CARRIERS FOR CRITICAL AREAS

The cooled ring carrier allows for significant improvement of piston cooling in the critical areas – bowl rim and first ring groove. The cooled ring carrier consists of a Ni-resist ring carrier, to which a thin austenitic steel sheet with intake and outlet openings is welded. This combined insert – cast into the piston – brings the heat transfer to the cooling oil even closer to the combustion chamber and the first ring groove. Critical areas are thus cooled much more effectively than using salt core cooling channels.

# PISTONS – STEEL

Commercial vehicle engines of the highest power classes, however, make even greater demands on pistons. For this reason, Clevite® pistons are comprised of forged steel, which has proven highly effective as piston material.

The triumphant success of forged steel pistons, in commercial vehicles in the upper power class, began back in the mid-1980s. To date, there are two different Clevite® steel piston designs for these applications.

## THE TWO-PIECE FERROTHERM PISTON – THE STARTING POINT OF THE STEEL PISTON ERA

The two-piece FERROTHERM® piston was developed specifically for highly stressed commercial vehicle engines. These “articulated pistons” consist of two piston parts – an aluminum skirt and steel crown, which are only connected by the piston pin; i.e., the guide function and the sealing function occur separately.

## TOP LAND CLEARANCE

An additional important advantage of steel is its significantly lower thermal expansion coefficient. This allows smaller clearances between piston and cylinder at the top land, offering improved sealing and reduced blow-by. The small top land clearance also has a positive effect on exhaust emission values – smaller clearance means less clearance volume and therefore optimal and clean combustion.

## THE SINGLE-PIECE MONOTHERM PISTON

In the upper power class, the forged steel MONOTHERM® piston represents the evolution of the FERROTHERM® piston. The MONOTHERM piston has been in series with almost all heavy duty manufacturers since 2000. Instead of pin bore bushings, it naturally features fully phosphate-coated form bore. The cooling channel is closed by means of a two-piece cover plate on the underside. Thanks to its optimized shape with connected skirt and in combination with the short piston pin, the MONOTHERM piston is weight-equivalent to the aluminum diesel piston. At the onset of this new development, no one would have thought this possible.

## THE TRICK WITH THE SHAKER

Steel also has a disadvantage: Thermal conductivity is worse than aluminum. To counter this, MAHLE engineering developed solutions: channels through which engine oil is injected for cooling. Due to the large diameter and the up and down movement of the piston, a so-called shaker effect is generated, which cools the piston head sufficiently.



# PISTON PINS



The piston pin is a key component to engine performance. In order to master the ever increasing peak cylinder pressures, it is essential to continually optimize the load capacity of this part.

## CLEVITE PISTON PIN PROGRAM

Clevite® piston pins feature the highest quality, precision and application versatility. They are machined with state-of-the-art multiple station part formers. Innovative and complex forms can thus be achieved for increased stress resistance. Coatings such as PVD (physical vapor deposition) or DLC (diamond-like carbon) reduce wear and improve friction properties.

For piston pins in heavy duty engines, a special triple coating was developed with best cost-wear ratios. Under a DLC layer, two additional chrome-based coatings stabilize the surface and cracks are prevented.

## NEW MATERIALS AND FORMS FOR EVEN GREATER RELIABILITY

As a part of ongoing development, Clevite® piston pins are also continuously analyzed toward innovative forms and materials. New pin and pin bore geometries such as profiled piston pins and form bores, pockets and diagonally oval pin bores promise a significant increase in stress resistance.

## TESTS THAT LEAVE NOTHING TO CHANCE

Material and quality control are vital for enhanced component safety, especially for highly stressed components such as piston pins. Therefore, MAHLE Aftermarket is heavily invested into inspection procedures— and will continue to do so.



# ENGINE BEARINGS

The commitment to excellence began with the Clevite® cast copper-lead engine bearing patented decades ago. Though engine technology continues to change, this is the bearing that still provides superior load carrying capability for heavy duty engines.

Clevite® TriMetal™ cast copper-lead engine bearings have been tested and given a 12,000-psi rating – the highest in the industry. They are more resistant to corrosion and out-perform traditional bearings by 20% or more. That makes the Clevite® CL-112 TriMetal™ the strongest material currently available in the industry. With the broadest offering of TriMetal™ engine bearings available, Clevite® bearings exceed even the highest standards set by heavy duty OEMs for strength and durability.

Exclusive to Clevite, is a bearing design that features a steel backing for support, a cast copper-lead alloy center layer for strength and durability, nickel dam for chemical stability and an electroplated white metal Babbitt overlay for slipperiness, conformability and embeddability. The intermediate cast copper-lead layer creates an interlocked columnar structure capable of withstanding much heavier pulsating loads than non-cast bearing designs.

Clevite® cam bearings are precision bored on the inside diameter. Complete sets of heavy duty rod bushings which are manufactured with exclusive CL-10™ material are also available.

With heavy duty engines, Clevite TriMetal™ remains the industry standard in bearings. Typically, they can withstand up to 60% higher loads and have 40% better seizure resistance than comparable competitive engine bearings. They also exceed heavy vehicle durability requirements of 600,000 miles.

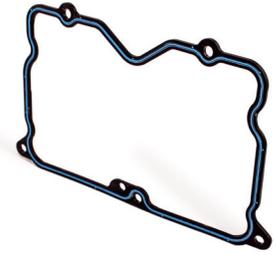
The quality and durability of Clevite® TriMetal™ engine bearings provide a margin of forgiveness for vehicles that don't get maintenance service as often as they should. Think of it as "engine insurance" for a vehicle that handles tough duty and/or long miles every day.

There are many attempts by competitors to match traditional Clevite® engine bearing strength and performance. From odd alloys and underperforming sintered metal layers to skimpy nickel barrier plating, it goes on.

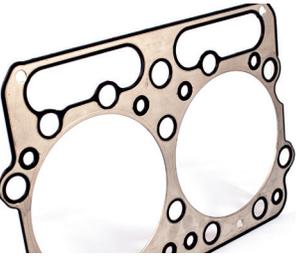
Engine builders around the world still prefer Clevite TriMetal™ engine bearings – the patented original.



# GASKETS



MAHLE Aftermarket offers heavy duty gasket sets for in-frame, consolidated full sets, and more. When the application requires gaskets that address the needs of the heavy duty, industrial and commercial applications, look no further than MAHLE® gaskets.



MAHLE Aftermarket offers a variety of specialized heavy duty gaskets, including MLS (multi-layered steel), solid core composite and graphite head gaskets. All MAHLE no-retorque head gaskets use the best materials, including heat-resistant graphite, reinforced synthetic fiber, and other special coatings. In addition, complete lower gasket sets are offered for the most popular engines.



MAHLE also has the latest sealing technologies for valve cover gaskets. molded rubber gaskets have no joints, increasing durability and sealants are not required. Over-tightening is prevented due to compression limiters and there is virtually no torque loss or shrinkage.

With unsurpassed standards of innovation and quality, MAHLE gaskets meet the most demanding conditions including drastic temperature extremes, high internal pressures and coolants and lubricants of every description.

For sealing challenges in today's engines, MAHLE employs "application engineering" to design engine gaskets as a system. This involves research and testing to apply the optimum mix of materials and technology to each engine application. Working with global gasket manufacturers helps MAHLE Aftermarket continue to lead the way in gaskets for commercial vehicles.

Global facilities are staffed by engineering, technical and manufacturing teams dedicated to making and keeping MAHLE® gaskets world class.

The environmental, fuel efficiency and performance demands that affect today's engine designs often involve sealing. Engine gaskets are asked to do more than ever. MAHLE Aftermarket analyzes mating hardware, sealing stresses, joint rigidity and other parameters. The toughest sealing challenges are addressed by researching and testing advanced materials and processes.

Designing and offering more gaskets than any other company puts MAHLE in the forefront for replacement gaskets. From unmatched engineering resources and experience to being first in technical innovation and service information, MAHLE Aftermarket is the winning team.

# TURBOCHARGERS

Exhaust-gas turbochargers are a key technology to enhance performance, reduce fuel consumption and lower exhaust emissions. When fitted to direct-injection diesel engines, turbochargers reduce fuel consumption by up to 25% compared to a naturally aspirated gasoline engine of comparable displacement.

Experts estimate that in 10 years' time, there will be roughly 16 million trucks running on this key technology – and the number will continue to rise. As a result, the turbocharger segment represents one of the largest growth markets in the automotive industry worldwide.

## MAHLE OE TECHNOLOGIES FOR THE AFTERMARKET

MAHLE is one of the technology leaders and system developers in the field of internal combustion engines and engine peripherals. It is also a long-standing business partner to international automotive and engine manufacturers in the development and production of high-loaded turbocharger components.

In particular, efficiency increases from downsizing engines. Efficiency is all the higher, the better the technologies involved are matched, such as exhaust-gas turbocharger, fuel injection technology, variable valve timing, exhaust-gas recirculation and charge-air cooling.

As part of the systematic enhancement of the product portfolio for the aftermarket, turbocharger systems are incorporated into the MAHLE Original product offering for high fuel-economy diesel engines. Not only that, but the innovative MAHLE® turbocharger technologies are also being placed in the hands of technicians.

MAHLE Original turbochargers have a range of applications including popular manufacturers like Detroit Diesel, Caterpillar, Navistar, Cummins, Volkswagen, Mercedes-Benz, MAN, Volvo and Scania. The product range continues to expand. The wide range of different sizes and types with power outputs from 100hp to 1,300hp guarantee optimized compatibility with the most diverse requirements of truck, construction, and agricultural engines.



# FILTERS & AIR DRYING CARTRIDGES



## AIR FILTERS

In commercial vehicles, robust and at the same time low-weight, MAHLE® air filter systems, made from recyclable plastic, are used which can also reduce air intake noises. In order to achieve a highly stable large filter surface, the filters are mostly cylindrical. To improve efficiency, radial sealing and axial supports are used. Additional safety inserts in the form of special non-woven cylinders protect the clean side of the filter element during maintenance and replacement.



## OIL FILTERS

MAHLE® oil filters, for heavy duty applications, reliably prevent contaminants from entering the lubrication system and maintain oil quality, performance and efficiency of the engine. Thanks to stable pleat geometry, cold start stability is ensured. Load peaks up to 290-psi are compensated due to the high pressure resistance of the housing. A pressure relief valve guarantees the oil supply under all conditions – for viscous oil encountered during cold starts or at low temperatures, for extremely contaminated filter elements or when the replacement intervals have been exceeded. A non-return flow valve prevents the draining of the filter when the engine is switched off and ensures adequate oil supply when the engine is started. High-grade sealing materials and custom-fit connecting pieces assure reliable separation of contaminated and filtered oil.



## FUEL FILTERS

Modern fuel injection systems, in today's heavy duty and commercial engines, require an extremely clean, homogeneous and free-flowing fuel supply. Contaminants can enter into the fuel stream and need to be filtered out. MAHLE® fuel filters reliably

remove contaminants. Thanks to high-quality filter media, the fuel system is protected from the smallest contaminants and therefore from corrosion damage. This protects the engine and assures efficient operation of the vehicle. The required constant fuel supply is achieved with pressure regulation and recirculation of the surplus fuel from the injection pump to the tank. Pulsation damping compensates for the pressure fluctuations caused by the fuel pump.

## AIR-DRYING CARTRIDGES

Many control and closed-loop processes in commercial vehicles, such as pneumatic brake systems, work with compressed air. However, air contains moisture, which can damage piping and tanks, contaminate lubricants and freeze at low temperatures.

Air driers are used to ensure failure-free operation of safety systems. They remove moisture from the air, prevent corrosion in pipes and tanks and guard against premature wear and malfunctions. To guarantee the operational safety of air brake systems, it is imperative that air driers are replaced according to the manufacturer's guidelines.

MAHLE® air-drying cartridges operate independently of temperature. They contain a drying agent that is regenerated under system control. At the same time, contaminants from the pre-filter and condensed water are removed. MAHLE® air-drying cartridges are resistant to corrosion from the inside and outside, completely sealed, and of course are designed and manufactured to withstand the operating pressure in a brake system over its lifetime.

# THERMOSTATS

Although thermostats are not standard wearing parts, there is considerable demand for spares. Whether due to an accident or as part of repair or maintenance work that requires access to the cooling system: these important temperature regulators should be replaced at that time to ensure continued functionality, because any loss of functionality or even complete failure can have severe consequences. If the thermostat is always open, the engine will be cooled too much. If the thermostat is always closed, then the engine will not be cooled at all and will overheat.

## EXPANSION ELEMENTS

The core of the thermostat: when heated, the expansion element (wax) expands and thus moves the piston. If the temperature drops again, it reduces in size, and a spring pushes the piston back into its starting position. Expansion elements are maintenance-free and durable. Their range of use is very versatile: actuation forces from 30 N to 2,500 N, short or long strokes, and a diversity of control ranges within the temperature span of  $-5^{\circ}\text{F}$  to  $+265^{\circ}\text{F}$ .

## THERMOSTAT INSERTS

Precision at work: thermostat inserts enable the precise regulation of coolant circuits to approximately 20 m<sup>3</sup>/h in commercial vehicles, stationary engines, agricultural and construction machinery.

## SLEEVE VALVE THERMOSTATS

They regulate the cooling circuits in large engines with flow volumes starting from approximately 20 m<sup>3</sup>/h, e.g. in commercial vehicles, ships, and locomotives. The sleeve valve principle allows the axial relief of the thermal expansion element and thus enables precise regulation even under heavy hydraulic loads—with a consistently high level of functional safety.

## THE MAP-CONTROLLED THERMOSTAT: A SAFE CHOICE FOR GREATER EFFICIENCY

In order to safely raise the operating temperature of engines to a constant higher level, and thus optimize combustion and all accompanying factors, a new thermostat technology was developed: the map-controlled thermostat. It supplements the conventional regulation of the coolant circuit with a wax element as expansion material by means of an electrically controlled, integrated heating element that is activated on demand. Consequently, the thermostat can influence the temperature considerably more quickly, allowing the engine to operate in various load and operating conditions within the corresponding optimum range.

## THIS LEADS TO SEVERAL POSITIVE EFFECTS:

- Optimum combustion due to increased wall and component temperatures
- Reduced fuel consumption due to reduced viscosity of the engine oil and consequently reduced frictional loss
- Lower pollution emissions due to improved combustion
- Improved power output at full load due to reduced coolant temperature
- More comfort due to higher coolant temperatures and, as a result, an improved interior heating performance



# ROTATING ELECTRIC

## ALTERNATORS

Our alternators are designed to meet a wide range of engineering specifications and applications. They are used in gasoline and diesel engines in the automotive industry, on trucks, buses, agricultural and construction machinery, and other applications. Different versions of our alternators are designed taking into account the requirements of each application and are built for long life and maintenance-free operation under extreme conditions.

External fan alternators are specifically designed for operation in harsh environmental conditions (dust, mud, silt spray, high vibrations level as well as high electrical and thermal loads), such as for agricultural and construction machinery. This design offers better protection of the alternator components, giving the bearings and brushes a longer life, and allowing the fitting of additional hoses for clean cooling air and dirt screens. Compact alternators are designed for a wide range of applications, where lower noise, compact design, and operation at higher rotational speeds are specifically required; for example in commercial vehicle applications.

## STARTER MOTORS

Our high-performance starter motors are ideally suited for a variety of complex applications. We develop them in close cooperation with our customers and test them both on our in-house test benches and in real, practical operating conditions, providing consistently high quality in series production through processes complying with ISO standards. This is achieved with environmentally friendly production technologies and materials. All business processes are carefully planned and monitored – from development to production, to delivery to customers. We also supply products in original equipment quality to the aftermarket, of course.

All starter motors are designed for long-life operation – even under harsh operating conditions such as salt spray, high humidity, water, dust, mud, vibrations, heat and cold, or aggressive fluids. Their design fulfills international guidelines and standards.



# EXTENSIVE PRODUCT OFFERING

## CYLINDER COMPONENTS

- Cylinder kits
- Cylinder liners
- Cylinder rebore kits
- Liner shims
- Locks
- O-rings
- Pistons
- Piston kits
- Piston pins
- Piston rings
- Repair bushings
- Universal repair sleeve

## BEARINGS

- Cam bearings and bushings
- Individual main bearings
- Main bearing sets
- Rod bearings
- Rod bushings
- Thrust washers

## GASKETS

- Head gasket sets
- Individual head gaskets
- In-frame sets
- Lower sets
- Oil seals
- Overhaul sets
- Pan sets
- Valve cover sets
- Valve seals

## ANCILLARY

- Camshafts
- Crankshafts
- Head bolts
- Injector o-rings
- Lifters
- Lubrication pumps
- Push rods
- Rollers and rockers
- Springs
- Valves
- Valve locks
- Water pumps

## ENGINE KITS

- In-frame engine kits
- Overhaul engine kits

## FILTERS

- Air-drying cartridges
- Air filters
- Fuel filters
- Oil filters

## TURBOCHARGERS

- Cartridges
- Mounting gasket kits
- New
- Remanufactured
- Service Kits

## THERMOSTATS

- Expansion elements
- Map-controlled

## ROTATING ELECTRIC

- Starters
- Alternators
- Electric drive system motors

# ABUNDANT ENGINE COVERAGE

MAHLE Aftermarket heavy duty engine coverage includes, but is not limited to, the following engine manufacturers:

- Allis-Chalmers
- AGCO (White, Oliver)
- Case/IH
- Caterpillar
- Chrysler Industrial
- Continental
- Cummins
- Detroit Diesel
- Deutz
- Ford (Industrial, Truck and Tractor)
- John Deere
- Komatsu
- Mercedes-Benz
- Mack
- Navistar
- Perkins
- Volvo

# INDUSTRY LEADING ECAPABILITIES

## WWW.MAHLE-AFTERMARKET.COM

- Product information
- Publications
- Interchanges
- Press releases
- eLearning™ courses
- Ask MAHLE Aftermarket
- Where to buy
- Calendar of events
- Contests and promotions

## CUSTOMER TRADE AREA

- New Number Announcements
- Policy information
- Price lists
- Customizable notifications
  - Product Information
  - Publications
- Access to marketing materials

## WWW.MAHLEORDER.COM

- Place orders
- Check stock
- Interchanges
- Order tracking
- View invoices

## ONLINE CATALOG

- Real-time coverage additions
- Streamlined research and order process
- Customize engine kits
- Product images

# POLICY OVERVIEW

## FREIGHT

MAHLE Aftermarket Inc. will pay freight transportation charges on orders of \$1,950.00 or more of combined products sold and marketed by MAHLE Aftermarket throughout the United States, excluding Alaska and Hawaii. We will ship the order the most economical way within the continental United States. We reserve the right to select the method and route of transportation used. If the customer requests special shipping instructions, the customer will be billed for all charges involved. Transportation charges will also be paid by MAHLE Aftermarket Inc. for the following (in the Continental U.S., excluding Alaska, Hawaii and Puerto Rico):

- **All light vehicle Master Engine Kits (with no more than two components deleted)**
- **All heavy duty Overhaul & In-Frame Kits**
- **All orders for two (2) or more heavy duty crankshafts**

For more details, refer to the Sales & Service Policy (SD-87).

## WARRANTY

All new Clevite brand water pumps, oil pumps and MAHLE Original turbochargers are warranted to be free from defects in original materials and workmanship under normal use and service for a period of one (1) year from the date of purchase, 100,000 miles or 3,600 hours whichever occurs first. All other new MAHLE Group products sold and marketed by MAHLE Aftermarket Inc. and their affiliates are warranted to be free from defects in materials and workmanship under normal use and service for two (2) years from the date of purchase, 200,000 miles, or 7,200 hours, whichever occurs first\*. Clevite 'Premium Plus' parts are warranted for three years from the date of purchase, 300,000 miles, or 10,800 hours, whichever occurs first.

*\*Clevite crankshafts: Installation of a new crankshaft damper is required for Clevite warranty. Proof of damper purchase must be submitted with claim.*

For complete warranty details see the MAHLE Aftermarket Heavy Duty Warranty (SD-76HV).

## TERMS

Our standard terms of payment on the net balance shall be 2%, 15th proximo with the net balance payable in full by the 25th of the month. Invoices not paid by the 25th will be considered past due and orders will not be shipped until the account balance is paid in full. Discounts cannot be taken on freight charges shown on the invoices.

If the Buyer becomes delinquent in payments to the Seller, then Seller has the right, in addition to any other remedy to which it may be entitled in law or equity, to cancel the sales order, refuse to make further deliveries and declare due and payable immediately all unpaid amounts for goods previously delivered to the Buyer and/or in process. In addition, Buyer will be liable for all collection costs, including court costs and attorneys' fees.

For complete terms details see the MAHLE Aftermarket Sales & Service Policy (SD-87) and the MAHLE Aftermarket Terms & Conditions of Sale (SD-89).

Current policies subject to change.



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