

MAHLE Engine Components Japan Corporation

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MAHLE Engine Components Japan Corporation makes pistons and cylinder liners for car and truck engines. It is a Japanese part of MAHLE GmbH, a German company, but it began as a Japanese company in 1923. I visited the office and factory in Tsuruoka, Yamagata prefecture on November 9, 2018.

Foreign companies do not often take over Japanese ones, which makes this an unusual, and of course interesting, case.

The Japanese predecessor was founded by Takashi Izumi in 1923. Previously, he was involved with Yanase, a retailer of imported vehicles that is still in operation. In 1938 he organized the Izumi Automotive Industry Company Ltd, producing pistons for diesel engines. The company had a 90 percent share of the Japanese truck diesel engine market, and was highly evaluated for technical capabilities and product development. Izumi and MAHLE began a cooperative relationship, and in 1976 a technology agreement provided Izumi with MAHLE's advanced piston technology.

In 1988, Izumi changed the company name to Izumi Industries and listed on JASDAQ, a trading venue for smaller company's stock.

Japan's rapid growth slowed substantially from 1990 as did vehicle sales, which peaked in 1996. The revenues of Izumi Industries declined and losses accumulated. By September 2001 Izumi had a balance sheet deficit of 2,278 million yen. In November 2001 a major client went bankrupt. In February

2002 Izumi Industries and its affiliated companies filed for bankruptcy, with total debts of 30.6 billion yen and paid-in capital of 4.1 billion yen. Its shareholders lost everything.

MAHLE had become increasingly involved in the management and technology of Izumi Industries from 1998, and bought it out of bankruptcy in 2002. In 2003 the company here was changed to MAHLE Izumi Corporation. In 2005 the company's name was changed to the current MAHLE Engine Components Japan Corporation.

MAHLE GmbH, headquartered in Stuttgart, is a major auto parts supplier. According to its web site "MAHLE products are fitted in at least every second vehicle worldwide." It has achieved this in part through acquisitions of companies around the globe, both broadening and deepening its product offerings. Revenues in 2017 were 12.8 billion euros, about half in Europe. The group has some 170 factories and 16 research centers in 35 countries and 78,000 employees. By comparison, in 2012, the group had sales of about 6.2 billion euros and approximately 48,000 employees working at over 100 production plants and 7 research and development centers.

MAHLE produces items for automobiles and trucks in four major segments. First, Engine Systems and Components, based on the development of pistons, is the original business, dating from when the company was founded in 1920, and has always been a core competency; it is exemplified in the Tsuruoka factory that I visited. Second, since 1926, Filtration and Engine Peripherals produce oil and air filters. Third, Thermal Management (cooling and air conditioning), is now the largest component. Fourth, Aftermarket products for engines for a wide range of vehicles, as well as agricultural and construction machinery. Thermal Management was created in 2013 when MAHLE increased ownership in Behr Group to 51 percent. This added 17,000 employees at 38 production facilities and three research centers.

In 1964 the parent company founders and (since 1933) sole shareholders, Herman and Ernst Mahle, established the charitable MAHLE Foundation and in due course transferred 99.9 percent of the

company's shares to it. The remaining 0.1 percent are held by MABEG (Verein zur Forderung und Beratung der Mahle Gruppe e.V.), which has sole voting rights. In 1971 the brothers left the Management Board.

MAHLE GmbH geographically divides the world into four areas; Asia-Pacific operations are managed from Japan. MAHLE Engine Components is the basic entity of MAHLE's operations in Japan. It has 1,138 employees in Japan. Its head office and technical center is in Saitama. Of its Japan operations, 106 employees are in the headquarters office doing a range of back-office tasks; 65 are engaged in research and development of the basic mold (die) for each specific type of piston, and 68 are in production engineering. Its major plant is in Tsuruoka, with 712 employees, of whom 552 work in the plant itself.

The Tsuruoka plant is the major plant for MAHLE's Asia-Pacific operations. Its Yamagata Plant, in Nishimuraya in Yamagata Prefecture, has 257 employees, and the Hirata Plant in Fukushima Prefecture has 72 employees. It has two other research centers and 18 sales centers in Honshu and one in Kyushu. The plants are managed by Japanese. When German MAHLE staff come to visit, English is the language used.

The Tsuruoka plant operates two 11-hour shifts, 7 days a week. Workers alternate day and night shifts. This is common in the automobile industry, though Toyota no longer uses it. Workers are divided into three groups, with basically the same pattern of assignments of day and night shifts. For example, over a different 12-day period, each group works the day shift 4 days (Monday through Thursday), then has two days off, then four days in a night shift, and another two days off, and then repeats the cycle. Ordinary workers work about 20 days, and some specialists 18, in a 30-day month.

The Tomioka factory produces pistons for essentially all of Japan's car, truck, and other diesel and gasoline engine manufacturers. Sales in 2017 were ¥21.5 billion, up from ¥21.2 billion in 2015. When Toyota becomes a customer in 2019, MAHLE will have an 80 percent share of Japan's total piston

market. Each client company has its own engine designs, and pistons are slightly different for each engine model. Ongoing development means engines and pistons are steadily being improved. Thus, pistons are generally made in relatively small lots, so only one of the 25 production lines are automated for large-lot runs.

After donning a helmet, safety glasses, a protective cover garment, and thick, heavy shoes, I was given a great tour of the piston factory. Since I am not an engineer, my understanding of the process is impressionistic rather than precise.

The production process consists of casting the basic piston unit, cutting it, then milling it to very precise tolerances. The shaping process is in several stages of increasing precision. Throughout the process the piston is being tested to ensure it is not defective, including roundness. In the final stages there is an x-ray test, and then a worker does a direct visual inspection. Very few have to be rejected. Piston making is a capital-intensive process. Workers make the basic master mold for each specific piston, change molds and reset the milling machines for each different type of piston, and inspect the pistons throughout the process.

Mass production means there are many machines of the same kind doing the same thing. On entering the factory, my first impression was of dancing robots: a machine which reaches out to use a ladle to scoop up molten aluminum from an immense container, then moves to its right and down to pour the metal into a mold, and then repeats the process. The piston hardens in the mold in just two minutes, and is automatically removed. In the next stage, robots pick up the piston piece and place it in a specific position in a container, which is then wheeled to the cutting stage. The aluminum part of the piston is then bonded to the steel part. Then there are a series of cutting and shaping steps to further refine the piston to its final, very precise shape.

Although a piston is, simplistically, just a cylindrical piece of metal that goes up and down inside a hole, as befits something that is the heart of an engine, pistons and their production process are among the marvels of engineering and mass craftsmanship. Precision is a must in a highly detailed, complex process. The factory visit was a reminder that even seemingly prosaic items can have an elegance.

### Acknowledgments

On the morning of November 9, 2018, I visited MAHLE Engine Components Japan Corporation's Tsuruoka plant in Yamagata Prefecture with an interpreter, Aki Takano. I met with Jinichi Kikuchi, Department Manager, Administrative Department, who provided me an excellent description of the company's development and activities, including information about Izumi Corporation, the predecessor company. He then led me in a tour of the plant. I deeply appreciated the information and explanations I received.

Larry Meissner, my long-term research associate and editor, provided substantial additional information incorporated here, from a range of online sources.