

Mitsubishi Turbocharger Core Component Production - From Southeast Asia to the World -



Mitsubishi Turbocharger Asia, Co. Ltd.

Mitsubishi Turbocharger Asia Co., Ltd. (MTA) is a wholly-owned subsidiary established in Thailand by Mitsubishi Heavy Industries Engine & Turbocharger Co., Ltd. (MHIET). It is the MHIET Group's largest production base of "Cartridges", which are key components of Mitsubishi turbochargers.

1. Introduction

Automotive turbochargers are used in a wide variety of vehicles, from compact cars to high-end luxury cars, as a solution to reduce CO₂ emissions – for which regulations are becoming increasingly stricter globally – and to improve both fuel efficiency and engine performance.

The turbocharger recovers the exhaust energy of the engine with a turbine wheel, uses the recovered energy to rotate the compressor wheel mounted on the same axis as the turbine wheel and feeds compressed air to the engine to enhance the combustion efficiency, contributing to exhaust gas purification and the improvement of fuel efficiency performance.

MTA plays a role as a production base of the "Cartridge (rotating assembly)," which is the most important part of the turbocharger, and supplies cartridges from Southeast Asia (Thailand) to MHIET group production sites all over the world. The cartridges produced by MTA are incorporated into complete turbocharger assembly at each site, and the finished turbochargers are delivered to major automobile manufacturers in the world.

2. History of MTA

MTA is located in the Amata City Chonburi Industrial Estate (**Figure 1**) in Chonburi Province, Thailand.

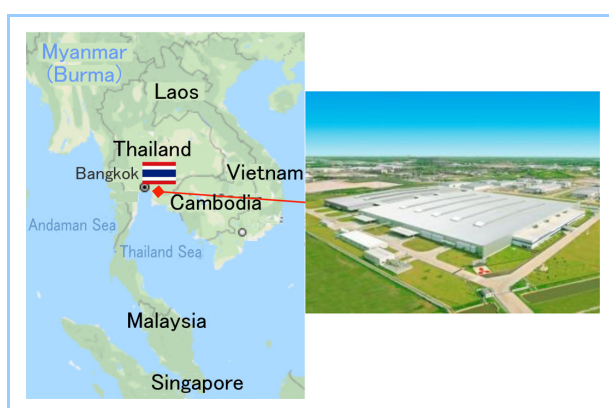


Figure 1 Location of MTA

The main history of MTA is as follows.

January 2008, Mitsubishi Turbocharger Asia, Co., Ltd. established

November 2009, Started production of cartridges for PSA

April 2016, Achieved cumulative production of 10 million units

February 2018, Achieved cumulative production of 20 million units

3. Mission of MTA

In addition to the major role of producing and supplying cartridges to MHIET group production sites all over the world, MTA produces turbochargers for the engine factories of automobile manufacturers, etc., in Thailand and supplies the complete products directly.

Thailand's automobile industry developed with the successive entry of Japanese automobile manufacturers in the 1960s, and has served as a hub for exports and parts procurement within the region since 2000. It has established its position as an automobile industry cluster in Southeast Asia.

MTA is located in Chonburi Province, which has developed remarkably as the center of the "Eastern Economic Corridor"*1, an economic development initiative currently led by the Thai government. Taking advantage of its geographical superiority and utilizing cost-competitive, locally-purchased parts and a relatively inexpensive labor force, MTA has the important mission to supply high-quality, highly-competitive products to customers all over the world.

*1: Eastern Economic Corridor: Intensive regional development carried out in the three provinces of Chonburi, Chachoengsao and Rayong located to the east of Bangkok. It is a core project of the 20-year National Strategy.

4. Product introduction

4.1 Turbochargers

MHIET Group handles various types of turbochargers for automobiles, industrial machinery, etc. MTA mainly supplies turbochargers to automobile manufacturers in Thailand, producing conventional turbochargers for gasoline engines and variable geometry (VG) turbochargers for diesel engines. **Figure 2** shows a typical turbocharger.

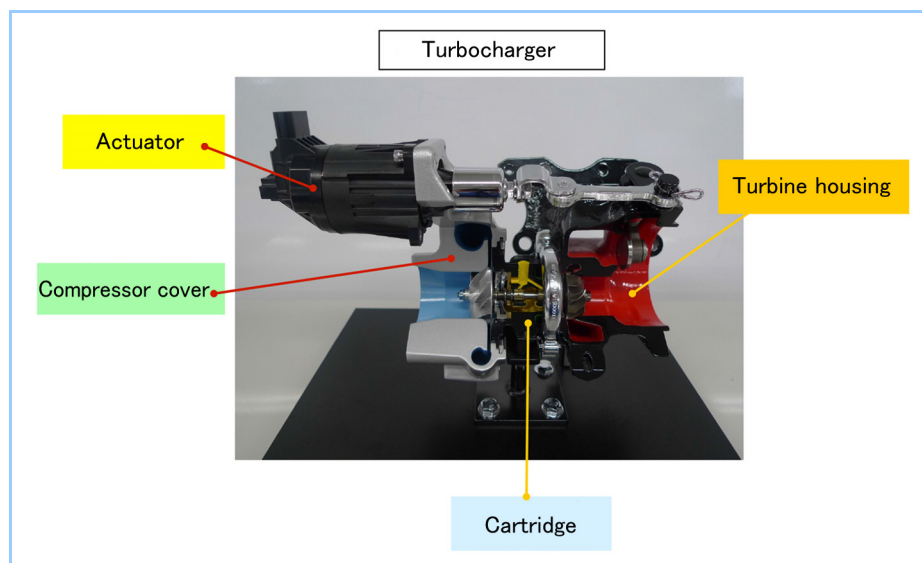


Figure 2 Typical turbocharger

4.2 Function and role of cartridges

A cartridge is a rotating parts (bearing system) assembly, which is one of the pivotal parts for the function of Mitsubishi turbochargers. In the final assembly of a turbocharger, the preliminarily assembled cartridge is installed in the center to secure the necessary functions for the rotating parts. Cartridges produced by MTA adopt full-floating type bearings. In addition, the development of a ball bearing type for the improvement of the response of turbochargers is being carried out mainly by MHIET. **Figure 3** depicts a typical cartridge configuration.

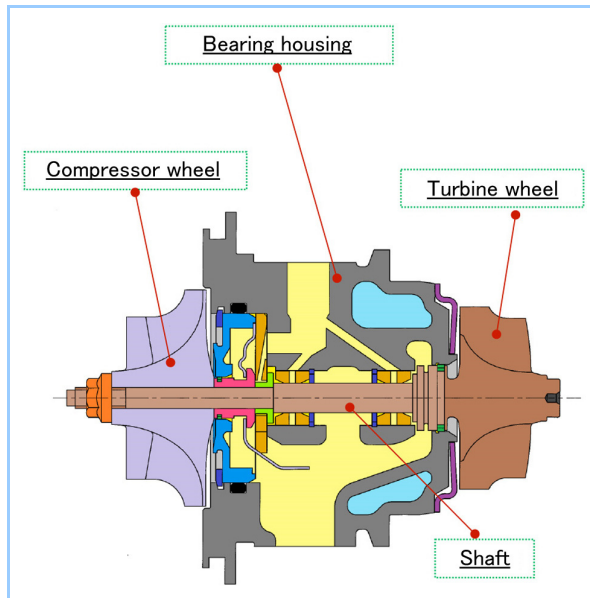


Figure 3 Typical cartridge configuration

In recent years, the rotational speed of turbochargers has been increased to meet customer performance requirements, and may reach as high as 1.5 times the speed of sound when converted to circumferential speed. Furthermore, in terms of the temperature condition, the temperature on the turbine side can exceed as much as 1000°C, while the temperature on the compressor side is 200°C, resulting in a temperature difference of nearly 800°C. Cartridges are required to support the shaft connecting the turbine wheel and the compressor wheel under such ultra-high speeds and temperature differences. The components of a cartridge need to be assembled with a clearance of several tens of microns, and highly-accurate balance correction technology is required. In addition, to suppress the noise generated from the turbocharger, the production of cartridges with little vibration is required. Thus, the cartridge is a product that requires very advanced technology. MTA produces high-quality turbochargers and cartridges using superior production technology and accurate parts control.

5. MTA's production concept

MTA's production line basically follows the equipment specifications of the production line of MHIET (Sagamihara), which is the mother factory, to unify the production quality of various production sites. In contrast to MHIET's concept of realizing a fully automated unmanned line, MTA adopts manual work in some processes to minimize capital investment costs by utilizing the competitive labor cost that is unique to sites in Southeast Asia.

Generally, in the case of manual work, the quality depends on the ability of the worker, and human error is also a concern. However, MTA has a production line concept of enabling all workers to produce products with the same quality without relying on worker skills, by incorporating various error proofing processes, Pokayoke (**Figure 4**), for preventing human errors.

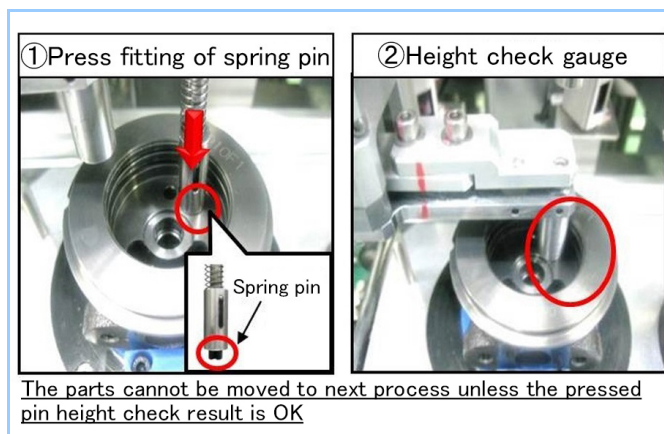


Figure 4 Example of Pokayoke

Furthermore, each production line is equipped with a monitor to check the production status, and all workers can understand the production progress on that day. This monitoring system is linked with the monitor of the manufacturing office, and a system with which the manager can not only understand the progress of production appropriately, but also quickly confirm abnormalities such as equipment failure and respond in a timely manner, is established.

MTA's production concept is a one-piece flow production method based on 12 units per lot, which does not make surplus stock by just-in-time parts supply. The concept of small-lot production is strictly followed for not only in-house manufactured key parts, but also for sub-components delivered from suppliers, and is realized through the cooperation of suppliers and kit assembly work in the stock area. The system supplying parts to each line incorporates a device to realize reliable part supply instructions and first-in-first-out using barcodes in addition to the conventional Kanban system, accurately realizing a short parts supply cycle. In terms of the supply chain, the local procurement rate has exceeded 80%, all suppliers are located nearby within roughly two hours from MTA, and a milk run logistics realize just-in-time delivery and short material lead time.

In recent years, customer requirements for establishing a traceability system capable of tracking manufacturing history in more detail have gradually increased, and MTA is also promoting the introduction of such a system. Main parts such as turbine rotors, compressor wheels and bearing housings are individually assigned manufacturing serial numbers for property control, while traceability on a shop-order basis is achieved through the small-lot production and parts supply system described earlier for other sub-components. This system makes it possible to quickly understand the manufacturing history by linking the 2D code imprinted on a turbocharger or cartridge with the property information of each component.

Manufacturing information of cartridge components is very important not only in terms of the traceability, but also in terms of the improvement of productivity with more reliable assembly and adjustment. Conventionally, many properties have been managed individually for each part, but there was a problem in connecting them with the property management of an assembly, i.e., a cartridge. By utilizing the aforementioned traceability system and linking the manufacturing information of a cartridge with various kinds of manufacturing information, the analysis of factors that affect cartridge noise becomes possible. Through the realization of this system, we will effectively utilize the big data stored for each line and facility to further improve productivity including the enhancement of the pass rate on production lines, the manufacture of lower-noise turbochargers, etc.

One of the advantages of cartridge production at MTA is the realization of stable quality and high productivity by uniformly adding the latest highly-complex technologies without omission through the balanced application of many elements such as manual work with competitive labor cost, the elimination of unsteady work by MTA's unique small-lot concept, and the latest production information management techniques, while adopting processes refined by the mother plant for each part assembly section. MTA consolidates the production of cartridges used around the world and imparts high performance and reliability to all Mitsubishi turbochargers.

6. Future development

Cartridges produced by MTA are incorporated into turbochargers at each production site, and are then supplied to automobile manufacturers around the world. By supplying high-performance, high-quality cartridges from Southeast Asia, we would like to improve customer satisfaction and create value for people. As a company that produces environmentally-friendly products, we have been working on efforts such as the introduction of solar power generation equipment in our factory, and the minimization of CO₂ emissions by reducing the number of parts delivery trucks with milkrun logistics operation, etc. Furthermore, we would like to contribute to the realization of a greener world through all our business activities.