



Launch of Takako Vietnam MMP Production Line

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1 Introduction

The mini motion package (hereinafter referred to as MMP) made at KYB Gifu East Plant is a compact electric hydraulic linear actuator in which an electric motor, hydraulic pump, oil tank, and cylinder are integrated (Photo 1).

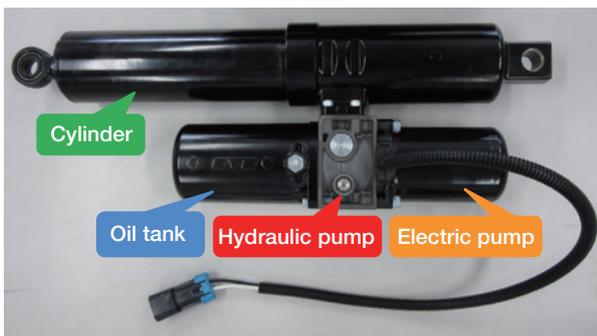


Photo 1 Mini Motion Package (MMP)

MMP is mostly used as an actuator mounted on agriculture vehicles such as combines and pesticide spraying machines, and its major markets are Japan and North America.

To reduce MMP production costs and promote overseas expansion, KYB planned to launch a new line at an overseas production site.

According to the plan, an MMP production line was launched at Takako Vietnam Co. Ltd. (hereinafter referred to as TVC), a 100% subsidiary of Takako Industries, INC, (hereinafter referred to as Takako), which is a group company of KYB.

In this report, we introduce the MMP production line at TVC's second plant (Photo 2) launched in September 2014 as the second MMP production base site following the one in KYB Gifu area.

2 Overview of plant

TVC is a local subsidiary in Vietnam established in 2003 and more than 800 employees work there.

The plant is located in an industrial park near the large



Photo 2 Exterior view of Second Plant of TVC

city of Ho Chi Minh in southern Vietnam, about 24 km from Tansonnhat International Airport (Fig. 1).



Fig. 1 Location of TVC (Google Map)

The industrial park was constructed by the governments of Vietnam and Singapore and has a complete infrastructure such as electricity, water supply, and sewage. TVC has two factories in the park, each of which has two buildings: A and B.

The newest building was the second plant's building B constructed in 2013, and it was planned to install the production line of MMP as the first line in building B.

3 Schedule of launching the line

Mass production was planned to start in August 2014 and the following schedule was made.

- ① Trial operation and training in Japan: Middle of April, 2014
- ② Delivery and installation of facilities: End of May 2014
- ③ Launch of TVC local line: Middle of July, 2014
- ④ Start of mass production: August 2014 or later

4 Concept of MMP production line

Based on the following concept for the production line, the production process and layout were discussed with local staff of TVC in TV meetings and through emails.

- ① Process that prevents defective products from being discharged even when unskilled operators are working (More mechanisms to prevent failure and avoidance of operations that rely on operator's intuition or short-cuts)
- ② Facility specifications with safety mechanisms to prevent disasters
- ③ Installation of the assembly line inside partitioned area with air conditioner to prevent contamination
- ④ Line layout that allows increase/decrease of operators depending on a change of production quantity
- ⑤ Making parts supply system for reduction of in-process inventory with physical distribution flow taken into account (Fig. 2)

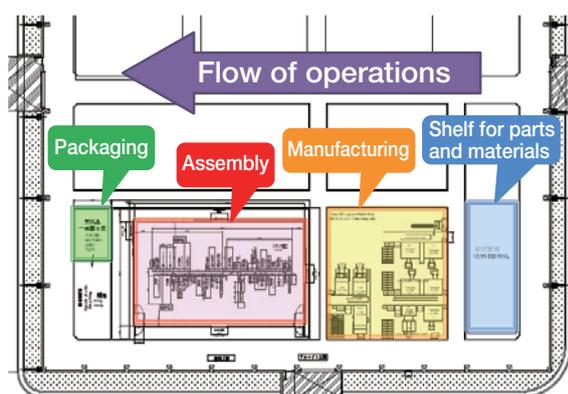


Fig. 2 Factory layout

In particular, as for ①, hammering work for mounting by skilled workers was discontinued in Japan and a new mounting machine was developed and introduced.

5 Problems of launching the line

There were problems, shown below, in launching the MMP production line of TVC.

- ① Launching of the production line in a short period of

time

- ② Operation training for local workers
- ③ Education of local engineers about products and facilities
- ④ Construction of logistics system

Mass production began one month behind schedule due to a delay in the tentative launching in Japan. However, since thorough checks and improvements could be made in advance, the launch at TVC went relatively well.

6 Launching of the line

6.1 Preparatory work in Japan

We only had about two months for the production line launching work from delivery of the facilities to start of mass production, and the deadline would be missed if a check of the processing ability of the facilities, preparation of necessary jigs, preparation of documents, and other work were conducted after the delivery of the facilities to Vietnam.

So, we launched the line and made an in-company audit of the production process in Japan before the shipment (Photo 3).



Photo 3 Launching of assembly line in Japan

For the process audit in Japan, the same requirements used for actual line launching were used. Evaluations of the following items was made.

- ① Does the production process secure the quality of products?
- ② Is there any problem in the quality of assembled prototypes?
- ③ Are the specifications required by TVC satisfied?
- ④ Are the facilities and production process safe?
- ⑤ Are a condition table and instruction manual available?
- ⑥ Are a parts-feed lane and tote box prepared?
- ⑦ Can the facilities be operated as designated in the instruction manual?

In the evaluation, performed together with staff from related divisions, prototype products were actually assembled in the developed line to find any problems in



Photo 4 Check of line work

each of the assembled products (Photo 4).

As a result, problems were identified from various viewpoints and the production process could be improved before the shipment of the facilities.

6.2 Specifications of facilities for overseas sites

The following points were taken into account in the specifications as the facilities were the first MMP facilities for overseas.

- ① Conformance with local electricity conditions
- ② Countermeasures against high temperature and humidity
- ③ Display descriptions written in both Japanese and English or switchable between Japanese and English.
- ④ Work place height suitable for average height of local workers

The power supply frequency is 60 Hz in the KYB Gifu area and 50 Hz in Vietnam. The machine was designed to use either frequency or to have inverter control. Also, a protection circuit against power failure was introduced.

Southern Vietnam where the factory is located is a tropical area. In particular, it is very humid in the rainy season. So, the facilities could have rust and the control equipment could break down. Regarding this point, we collected information from local staff and people from the company in Japan to determine the specifications of the rust processing and control panel.

Another unavoidable problem in overseas business expansion is language. It would be better if descriptions in the production line could be written in Vietnamese, but the KYB staff could not write Vietnamese. Therefore, English was used to write the descriptions. Since there were many product-specific terms and there were no translation standards for the terms, they needed to be translated one by one.

We tried to use easy English because the local workers could not understand difficult English words.

6.3 Installation of facilities at TVC

The local staff of TVC installed the facilities and partitions for air conditioning and connected the power supply and pneumatic source.

Directions given from Japan were only for the specifications, installation position, and installation height of the facilities and the local engineers were allowed to



Photo 5 Installation of assembly line

determine the details. The installation was completed successfully and the engineers seemed to get used to the installation of the facilities (Photo 5).

6.4 Trial operation adjustment and production trial

After installation of the facilities, bolts, wires, and pipes were further tightened and the facilities were inspected to make sure there was no machine damage that could be caused in the delivery.

In the trial operation, air pressure, oil pressure, oil amount, and sensor positions were adjusted and automatic cycle operation was performed to check each process quality.

As mentioned above, the power frequency is different between the Gifu area, Japan and in Vietnam. This causes a change in the motor rotation speed and reduces the flow volume of the hydraulic pump. However, the designated flow could be achieved by anticipated valve operations.

6.5 Operation training for local workers

The MMP assembling line requires a lot of manual operations and hence the performance of the line directly depends on the skill level of operators.

Therefore, skilled Japanese workers conducted training and guidance (Photo 6).



Photo 6 Training of workers

In the training, handling of quality issues and infrequent operations were explained to improve the on-site capabilities of the workers.

6.6 Education for local engineers

For the launching of the production line, it is necessary for local engineers to maintain the facilities and deal with problems.

So, we issued a manual for facilities inspection and calibration steps and educated the TVC engineers (Photo 7).



Photo 7 Training for facility inspection procedure

Also understanding the structure of MMP is necessary to grasp its production process. For example, when a non-standard MMP product is found in the performance test, one can identify the cause if he/she knows the product structure.

So, we taught the engineers about the mechanism of MMP using drawings and hydraulic circuit diagrams and explained to them about how the products were used by end users, to let them realize the importance of the management items (Photo 8).



Photo 8 Explanation on MMP structure

TVC engineers were studious and had a strong sense of responsibility. They asked a variety of questions.

I had a hard time to logically answer them and strongly realized my lack of knowledge, although I was motivated by their enthusiasm.

6.7 In-company examination and customers' approval

After the line construction, training, and production trials, an in-company examination was conducted by the quality assurance groups from Takako, TVC, and KYB (Photo 9).



Photo 9 TVC's in-company check of the line

The process audit had already been made in advance in Japan but the production line improvement was performed based on some comments from TVC and Takako. These comments were made because of incomplete prior agreement on the line specifications. This problem should be fixed in future.

There were also some comments on the processing ability of the parts and the worker education level. Because of the comments, the facilities failed to pass the examination. After countermeasures were taken, they finally passed the examination a week later.

After passing the in-company examination, we had a customers' examination at the end of August 2014, received approval for acceptance of products, and began mass production.

6.8 Start of mass production and first shipment

The MMPs produced at TVC are all exported to foreign countries. They are packed in a dedicated cardboard box and shipped from the board pallet (Photo 10).



Photo 10 Packaging and shipping of MMP

Everyone was pleased when the first MMP produced at TVC was packaged for shipment.

7 Example of problems in on-site launching

7.1 Dew condensation and rust

Although expected in advance, the problem of dew condensation and rust arose immediately after the launching of the production line.

The air conditioner kept the temperature constant inside the partitions. However, workpieces and facilities in a place where cool air directly came from the air conditioner had dew condensation and parts with little rust resistance quickly became rusty (Photo 11).



Photo 11 Dew condensation and rust of workpiece

In particular, the temperature-controlled hydraulic oil pipes had significant dew condensation and even had water dripping from them (Photo 12).



Photo 12 Dew condensation of hydraulic pipe

We therefore adjusted the temperature and wind direction of the air conditioner to prevent the workpieces from being cooled excessively. We also used heat insulating materials to cover the pipes.

These countermeasures prevented dew condensation and rust.

7.2 Parts precision problem

Machining and procurement of parts on-site are a major problem in overseas production.

For the MMP production line, a cutting process of major parts was constructed at TVC and local procurement of small parts was promoted. The precision of the parts was high enough but problems related to assembling failure occurred frequently. This was because the precision of the products processed in Japan was much higher than the standards given in the drawings or because burnishing or small deburring, not specified in the drawings, occurs on actual products, which results in differences from the drawings. These problems could affect the failure incident ratio of the assembly process.

For future promotion of part procurement on the spot, the exact designation of drawings needs to be made in collaboration with associated departments

If products are machined and assembled in the same factory and the assembled products have no particular performance problem, the machining precision of the parts would not be a big issue. However, if the parts are exported from KYB to overseas, they could be judged as defective in the acceptance inspection. This is due to a difference between the parts machining performance and the design specifications. The difference is not allowed for overseas expansion of business.

8 Change of paint in cylinder painting process

8.1 Elimination of hexavalent chromium

After being assembled, the MMP cylinders are painted in the existing painting line at TVC.

In general, the adhesive strength of paint is weak on aluminum materials and etching primer is used for primer coating to ensure the adhesive strength of black paint.

However, the etching primer contains hexavalent chromium, an environmentally hazardous substance, so we decided to change the paint material to one not containing hexavalent chromium to meet customers' requests.

We therefore discontinued the use of the etching primer and changed the coating to a single coat with highly adhesive black paint for the improvement of the pretreatment cleaning.

8.2 Introduction of pretreatment cleaner

Previous pretreatment cleaning processes were manually conducted by using white gasoline.

To maintain the paint quality after the discontinuance of the etching primer, a new cleaner was introduced for automatic pretreatment cleaning using an iron phosphate chemical conversion coating agent (hereinafter referred to as pretreatment agent). In order to maintain the painting quality even after the elimination of etching primer, a new cleaner was introduced to realize automatic pretreatment cleaning.

A pretreatment agent was chosen for future application to iron products such as HST^{Note 1)}.

Note 1) Abbreviation of Hydro-Static Transmission, which is a hydraulic change gear mounted on agriculture machines.

The cleaner was manufactured in Japan and installed at TVC after a paint test was made to check the quality (Photo 13).



Photo 13 Preprocessing cleaner (Right: Preprocessing, Left: Cleaning)

8.3 Appearance change due to change of paint

The surface texture of the cylinder changed due to a change of paint. We therefore needed to make the appearance acceptance criteria again and take the following measures.

- ① Replacement of photos used for appearance acceptance criteria
- ② Re-training of examiners to judge appearance
- ③ Re-production of a sample of a defective product

These measures are necessary for appearance quality control at overseas sites. The measures were taken mostly by the TVC Quality Assurance Department and mass production could be started by using the new painting.

9 Future development

MMP production began at TVC, but the production line can realize higher productivity.

The production quantity needs to be increased by

switching MMP production in Japan to production at TVC. Also, quality improvement and cost reduction need to be aimed at to expand the demand for MMP.

At present, the rate of procurement of MMP parts on the spot is low and the cost could be reduced by increasing the rate.

Procurement of parts on the spot is also essential for reduction of part inventory and will be promoted collaboratively with associated departments.

10 In Closing

I had a valuable experience in various aspects including technology in the launching of the first overseas site line.

Some problems, which were only potential problems in Japan, actually occurred. I think I developed a new viewpoint through this experience to handle domestic business.

I was also anxious about life and work in Vietnam during my stay. However, the people in TVC helped me a lot with private and business matters, so I could have a fruitful life in Vietnam (Photo 14).



Photo 14 Dinner with TVC staff

I hope for further friendships between and the future development of KYB Japan and TVC Vietnam, and would like to thank the staff there.

Authors



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Joined the company in 2011. Second Production Engineering Sect., Gifu South Plant, Hydraulic Components Operations. Mostly engaged in construction and improvement of machining and assembling lines of industrial hydraulic machines.



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