

CATERPILLAR AKASHI CAMPUS GUIDE

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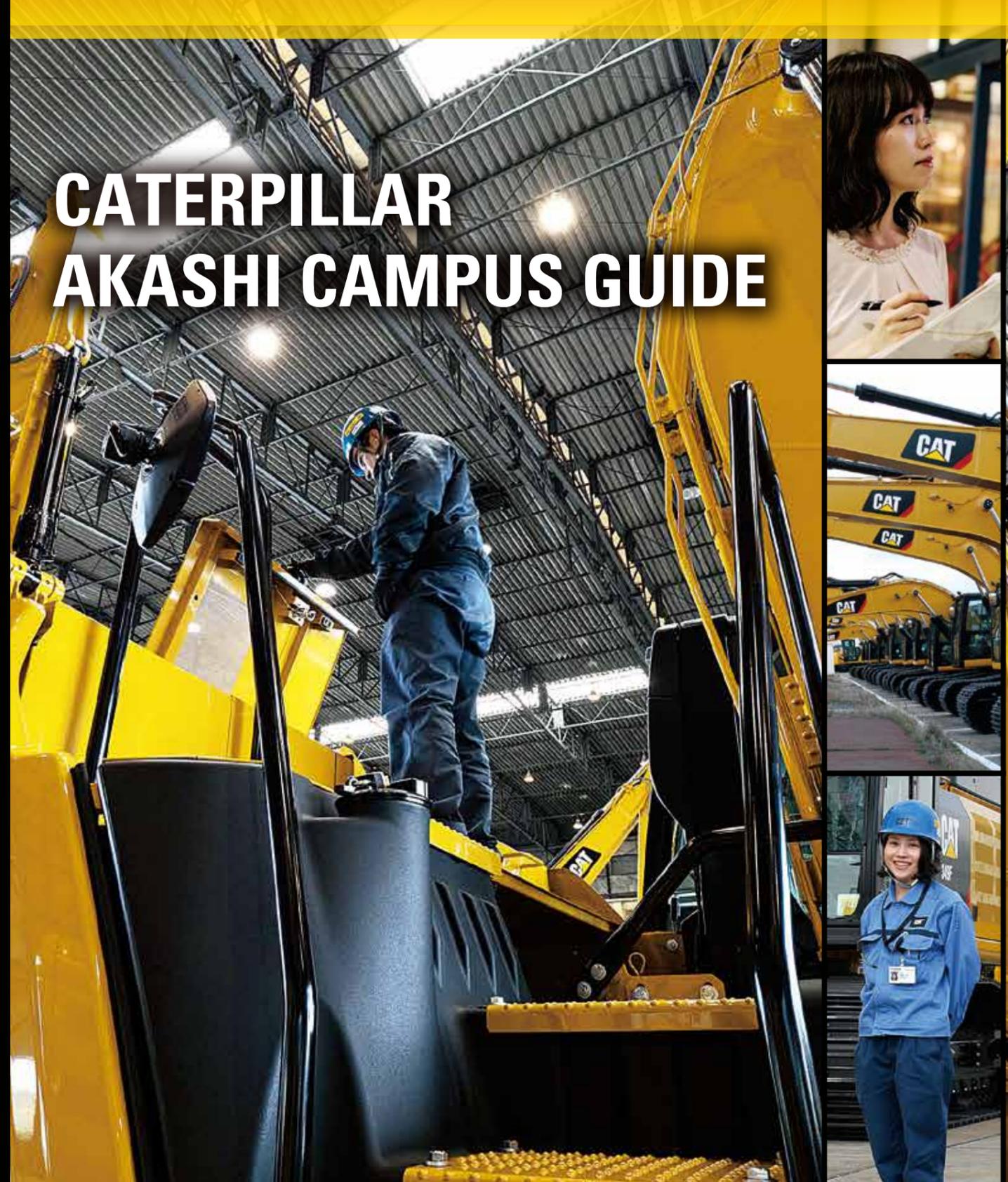
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CAT®





Transforming the world. Creating the future!

For about half a century since developing the Y-35, Japan's first domestically manufactured hydraulic excavator, the Akashi Plant has built performance that's remained one step ahead of its era into its hydraulic excavators, shipping a series of well-loved products that have inspired numerous customers to treat them as instant classics. The driving force behind that successful track record has been a dedication to facilitate the evolution of hydraulic excavators, the result of

a craftsman-like urge on the part of the plant's entire team to create new hydraulic excavators themselves. Home to the Hydraulic Excavator Development Center, the only facility in Caterpillar's global business to be granted the authority to design and develop products ranging from the Y-35 to the Next Generation Hydraulic Excavator, the Akashi plant will continue to play a leading role in the global hydraulic excavator industry going forward.

History of Akashi Campus

- 1960** ● The Akashi Plant is established as a facility specializing in the manufacture of construction machinery at Shin Mitsubishi Heavy Industries. **1**
- 1961** ● Production of the Y-35, Japan's first domestically manufactured hydraulic excavator, begins.
- 1971** ● Production capacity is increased in response to growing demand, and the facility is spun off as Mitsubishi Heavy Industries "Akashi Plant."
- 1972** ● Production of the MS series begins.
- 1986** ● Hydraulic Excavator Development Center (HEDC) is established in Akashi.
- 1987** ● Caterpillar Mitsubishi and the Akashi Plant merge to form Shin Caterpillar Mitsubishi. Production of the CAT E200B, the first hydraulic excavator launched under the CAT brand, begins. **2**
- 1989** ● Cumulative production reaches 100,000 units.
- 1992** ● Production of the 300 family REGA CAT hydraulic excavator with standardized global specifications begins. **3**
Construction of the NTC building, a new hydraulic excavator development facility, is completed.

*The Hydraulic Excavator Development Center is reorganized.



Behind us lies a pioneering history. In front of us, a promising future.

The story of the Akashi Plant coincides with the history of the evolution of hydraulic excavators.

Just one year after the Akashi Plant was established as a facility specializing in the manufacture of construction machinery at Shin Mitsubishi Heavy Industries came a noteworthy milestone as production of the Y-35—Japan's first domestically manufactured hydraulic excavator—began. The product's advanced functionality earned it praise throughout Japan, and the word its first letter stood for—Yumbo—became synonymous with the hydraulic excavator. The plant went on to launch numerous famous products, including the MS series, which built on the body of expertise gained from the Y series with state-of-the-art technology, in 1972 and then the 300 family of REGA CAT hydraulic excavators with globally standardized specifications in 1992.

In 2017, we opened a new chapter in the history of Akashi Campus by introducing the Next Generation Hydraulic Excavator (called NGH) which transcends previous models in every way, including in terms of technology, work efficiency, fuel economy, maintenance costs and safety – thanks to the first full redesign in 25 years !

The willingness of our operation to embrace challenges will be inexhaustible as we strive to deliver absolute safety, reliability, and potential for our hydraulic excavators.

- 1996** ● Production of the REGA B series begins. The company earns certification under the ISO 9001 international quality management standard for hydraulic excavators.
- 1998** ● Cumulative worldwide sales of the 300 family reach 100,000 units.
- 1999** ● The company earns certification under the ISO 14001 international environmental management standard.
- 2000** ● Cumulative production reaches 200,000 units. Production of the C series begins.
- 2005** ● Production of the D series begins. **4**
- 2008** ● Cumulative production reaches 300,000 units. The company changes its name to Caterpillar Japan.
- 2011** ● Production of the E series begins.
- 2014** ● Production of the F series begins.
- 2015** ● Cumulative production reaches 400,000 units. **5**
- 2016** ● The Y-35 is registered under the Essential Historical Materials for Science and Technology program.
- 2017** ● Production of Next Generation Hydraulic Excavators begins.
- 2018** ● The company receives a Good Design Award. **6**



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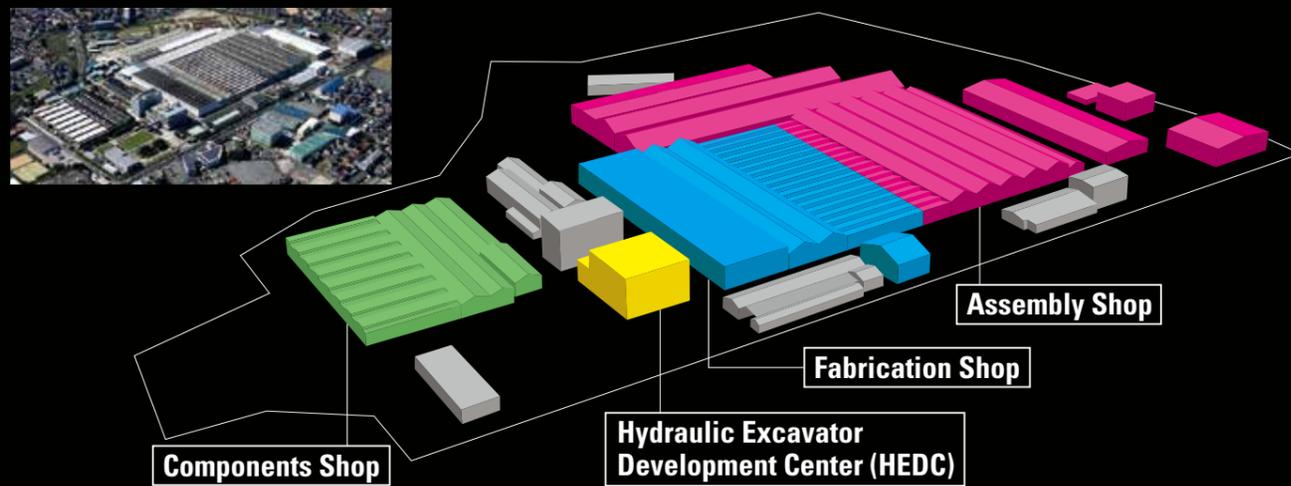
油圧ショベル開発本部
Hydraulic Excavator
Development Center



Plant

State-of-the-art hydraulic excavators are born in a leading-edge environment.

The Akashi Plant consists of three facilities located on a site of about 240,000 square meters, about six times the size of Hanshin Koshien Stadium. The entire production process for hydraulic excavators is carried out in-house, from fabrication of major components such as the control valves that serve as the heart of hydraulic control and the sheet metal structures that make up each machine's skeleton to final assembly. To fulfill its mission of rapidly supplying state-of-the-art products backed up by sure reliability to customers worldwide as a leading hydraulic excavator plant representing the Caterpillar Group, Akashi Plant strives to realize high production efficiency, flexibility, and quality through an ongoing program of plant innovation. Specifically, the facility has built a production control system that makes possible make-to-order operations, implemented optimal distribution through just-in-time (JIT) supply, established a system for sharing quality information with suppliers and sales companies, and introduced leading-edge production and quality control systems, including computer-controlled torque tightening systems and instruments, welding robots (FMS), and automatic transport systems. It has also integrated the entire site into a single system so that it can accommodate the full range of customer needs for hydraulic excavators and deliver increasingly high-value-added products.



Assembly Shop

- Hydraulic excavator assembly line
- Front outfitting line
- Sheet metal structure painting line
- Performance testing (operational performance adjustment)
- Shipping inspections

The Assembly Shop assembles components and major structures fabricated in the Components Shop and the Fabrication Shop to produce completed hydraulic excavators. In order to offer fine-grained flexibility for make-to-order production of individual products in response to customer needs and deliver them with the shortest possible lead times, the shop has established a flexible manufacturing system that combines highly experienced workers with state-of-the-art equipment.

Painting

Our thoroughgoing commitment to quality extends to painting. Swing frames are painted with environmentally friendly powder paint that yields a uniform finish. In addition, by painting individual components before assembly, we strive to endow the product with beauty that extends to every nook and cranny.



The transport interval on our 200-meter-long main assembly line can be freely adjusted based on the model being produced.



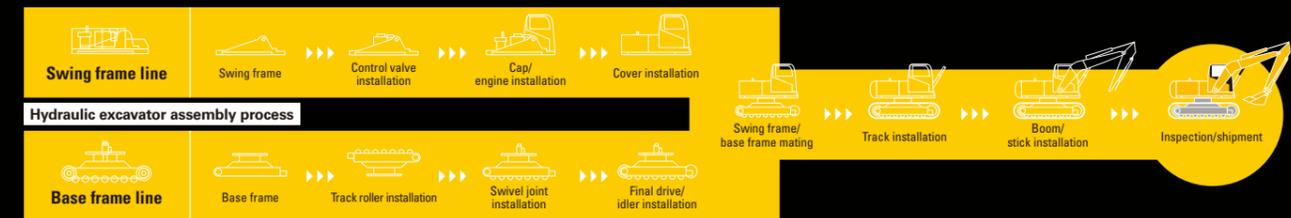
A monorail transports small parts to stations on the assembly line.



Here tracks are being installed on a base machine.



In the performance testing area, completed products are checked one at a time on a computer-controlled test stand.



During track roller installation, torque control tools increase tightening quality.



This autoloader transports completed swing frames to the process in which they are mated with a base frame.



The boom/stick is quickly mounted in line with order specifications.



Specialized inspectors carefully conduct a final check of performance and quality in the shipping inspection area.

Components Shop

- Machining FMS
- Component assembly line
- Component testing and inspection system

The Components Shop produces control valves, which are the heart of hydraulic control, as well as swing bearings and other components. The high-quality components produced here are supplied to Caterpillar Group hydraulic excavator production facilities worldwide, where they underpin the unshakable reliability of the CAT brand.



Our control valve machining FMS uses machining centers.



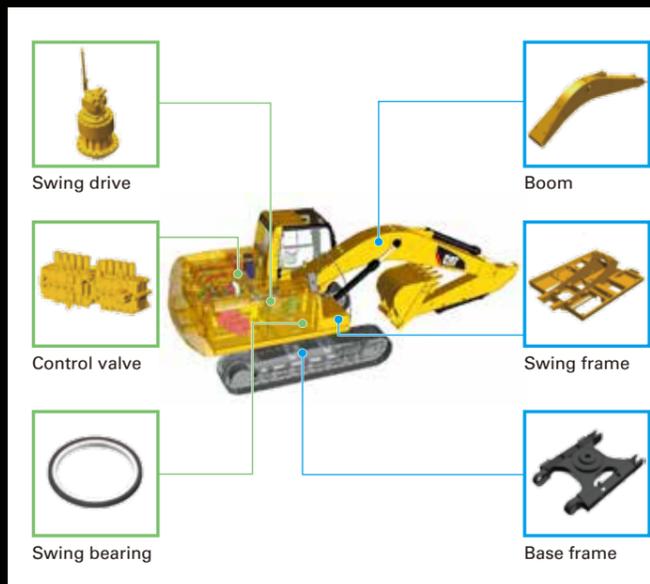
Our honing line boasts micron-order machining precision.



This test stand is used to perform quality inspections of assembled control valves.



The control valve assembly room is subject to contamination controls.



Fabrication Shop

- Large sheet metal structure processing machine
- Swing frame fabricating FMS
- Base frame fabricating FMS
- Large coordinate measuring machine

The Fabrication Shop produces the major structures (frames, swing frames, and base frames) that form the skeleton of each hydraulic excavator. In addition to state-of-the-art welding and machining systems used to create robust structures, the facility operates large-scale annealing equipment to further enhance durability.



The plant's swing frame FMS consists of four state-of-the-art welding robots.



Twin welding robots make possible high-speed production of robust base frames.



A large coordinate measuring machine—one of Japan's largest—checks structures with micron-order precision.



Robust frames are produced using high-speed tandem arc robot welding.

■ **What's an FMS?** An FMS, or flexible manufacturing system, is an automated production system that utilizes robots and other tools.

Hydraulic Excavator Development Center (HEDC)

The future of hydraulic excavators comes alive at the Hydraulic Excavator Development Center.

The Caterpillar Group supplies hydraulic excavators worldwide, and those excavators are developed at the Hydraulic Excavator Development Center (HEDC). Top specialists thoroughly analyze global market information and operating data collected via the Group's global network to formulate development concepts. Design specifications are refined by simulation analysis using design tools that encompass an enormous body of accumulated expertise and undergo repeated verification through component testing.

The finished design drawings that are the final product of this process are sent to Caterpillar overseas as the embodiment of standardized global specifications and used to manufacture products worldwide.



The NTC Building is home to the Hydraulic Excavator Development Center.



Development personnel from around the world gathered at this worldwide meeting.



Concepts are given shape with 3D CAD so that high-quality products can be designed quickly.



Products are visualized using a virtual reality system, allowing detailed study from the initial development stage prior to equipment fabrication in a virtual environment that closely reproduces the feel of actual use.

Verification

More demanding than anywhere else in the world

CAT signifies reliability. Only products with the ultimate level of quality and performance bear the CAT brand.

Before being shipped worldwide, the NGH next-generation CAT hydraulic excavator that recently made its global debut underwent a demanding regimen of durability and performance testing.

We deliver hydraulic excavators with reliability and durability that satisfy customers worldwide only after carrying out a variety of component-level testing; performance valuation of operability, productivity, fuel economy, and other characteristics with actual production units; and durability testing including continuous excavation over extended periods of time and operation on rough, uneven surfaces.



Components undergo vibration durability testing.



Continuous excavation testing ensures realizable quality.



Operational testing is carried out at a harsh site consisting of crushed stone.



We strive to deliver high precision for earthwork with semi-automatic control.

Akashi Campus Initiatives

① We are involved in a variety of activities in order to fulfill our corporate social responsibility (CSR).

We are carrying out a variety of activities in order to realize sustained growth together with the local community. In particular, we are focused on providing opportunities for students to experience what it means to work as an engineer by participating in the Cabinet Office's STEM ACTIVITY and Try-Yaru-Week programs as STEM education for future generations. Additionally, we have contributed to local emergency medical care by installing a heliport for air ambulances, and we host a Cool Summer Festival that attracts about 5,000 participants in August each year as a way for employees to share an enjoyable experience with local residents.



① Try-Yaru-Week

We welcome local middle-school students for five days of work experience and learning.

② STEM ACTIVITY

We actively participate in the STEM ACTIVITY program as a way to help increase the number of future engineers.

③ On-campus heliport

We contribute to emergency medical care in the local community.

④ Cool Summer Festival

We host a summer festival on our campus and invite celebrities as part of this exciting event.

② We strive to empower employees through a variety of activities.

To empower employees, we have enhanced our human resources development system, and we are committed to an ongoing program of improvements to programs and the work environment. New hires undergo one year of training that helps them master the full range of manufacturing skills before they are assigned to a workplace. This educational approach serves as the foundation for our manufacturing. Additionally, we help employees get engaged in a variety of ways, including by offering in-house daycare and support for volunteer activities.



① Enhancing in-house education

Employees study a proprietary educational curriculum at the Training Center "KEISEIJYUKU" before being assigned to a workplace one year later.

② Active hiring and career development programs for female employees

We are working to broaden the environment in which female employees work.

③ Work environment

We are helping ensure employees can work with peace of mind by offering in-house daycare.

④ Support for WIN activities

We were recognized by the Hyogo Council on Female Participation in the Workplace for our WIN activities.

■ What's WIN?

The Women's Initiative Network (WIN) is an employee resource group (ERG) established at Caterpillar. It seeks to foster and broaden a corporate culture that embraces and utilizes the diversity of each and every employee through programs such as women's activities, multicultural understanding, and service programs.

Global Network

Excavation Division

4 continents **18** countries **50** cities



The Excavation Division is one of the largest business units at Caterpillar. With more than 6,000 employees, it consists of a network spanning 50 cities in 18 countries on four continents. Akashi is home to both the Hydraulic Excavator Development Center, which is the only Caterpillar development facility of its kind in the world, as well as the Akashi Plant, which serves as the flagship plant for its product line. We are working to develop products and improve performance and quality as Caterpillar's flagship campus.

Global partnerships of Akashi Campus contribute to our exceptional products.

