

Industrial Products & Equipment



1 Medium-capacity injection pump

1 Hitachi Adds Medium-capacity Injection Pump to Series

Targeting the oil and gas market particular in the Middle East region, Hitachi has developed a large-capacity injection pump for oil-well drilling compatible with the American Petroleum Institute (API) 610, which applies the latest technologies. Actual load demonstration tests conducted in the field verified its high level of reliability. Now Hitachi has applied these latest technologies to a medium-capacity injection pump as a new addition to the series. The new injection pump is a high-pressure multi-stage pump with a drive output of around 4,300 kW that injects sea water at high pressure (approximately 20 MPa) into the crude oil layer underground during oil-well drilling.

The main features are as follows.

- (1) As the pump handles sea water, it uses duplex stainless steel with excellent strength and corrosion resistance to ensure high reliability.
- (2) High efficiency is achieved with a pump impeller design that uses high-precision computational fluid dynamics (CFD) and lifecycle costs are also reduced.

- (3) Achieves low-vibration operation by rotor dynamics evaluation and verification.

- (4) Reduces the size and extends the life of auxiliary equipment by employing the latest components for shaft seals and bearings.

Hitachi will continue to contribute to the stable supply of energy in the future by promoting the supply of high-reliability injection pumps to the oil and gas market.

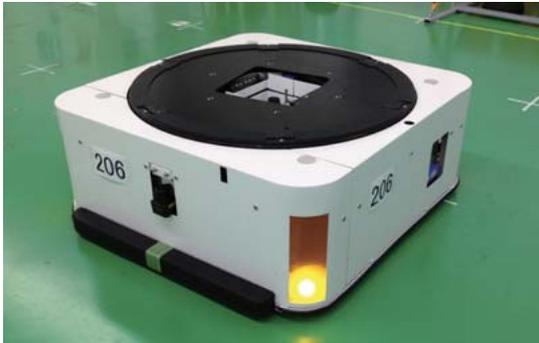
2 Compact Automatic Guided Vehicles for MonotaRO Co., Ltd.

Hitachi received an order from MonotaRO Co., Ltd. for a material handling system for the Kasama Distribution Center (Ibaraki Prefecture), its distribution base for the Kanto region and the work is proceeding towards a March 2017 delivery date. The center has a site area of around 90,000 m² and a total floor area of about 56,000 m². In its initial year of operation, the distribution center will have an inventory capacity of 300,000 items and a daily dispatch capacity of 20,000 items.

In addition to a conveyor system and automated

storage/retrieval system, 154 compact automatic guided vehicles, which Hitachi began selling from September 2014, will be used to develop a large-scale picking system.

The main features are as follows.



Exterior dimensions	L 960 mm × W 900 mm × H 380 mm
Loading capacity	Max. 500 kg
Running speed	Max. speed of 60 m/min with 500 kg load Max. speed of 80 m/min with no load
Power source	Lithium-ion battery (with automatic charging mechanism)
Usage environment and conditions	General indoor environment (location where condensation is not produced)

2 Compact automatic guided vehicle (top) and specifications of standard vehicle body (bottom)

(1) Unlike a conventional list-based picking system, since people do not need to move around the inside of a vast warehouse, the system offers higher productivity and labor savings.

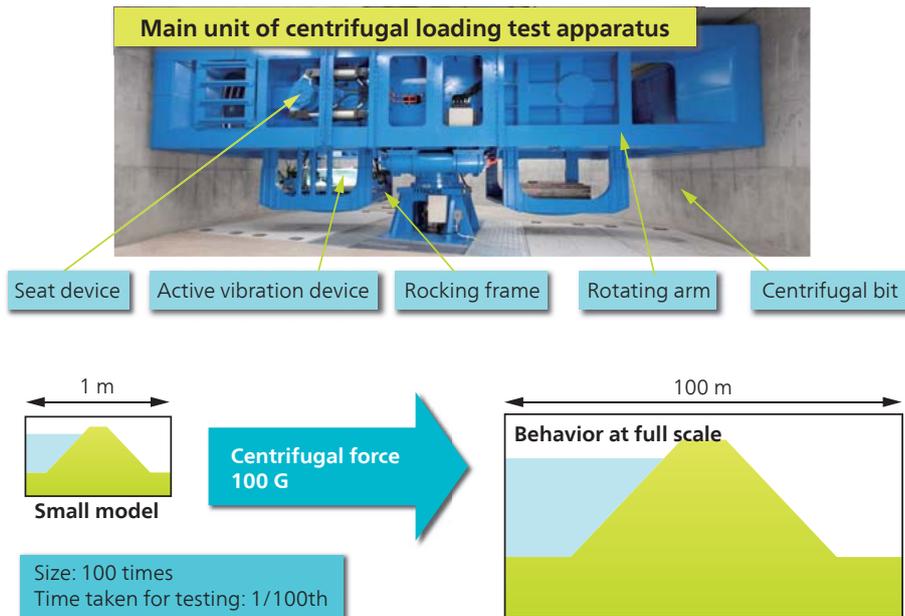
(2) Capacity can be increased by adding more compact automatic guided vehicles, enabling the phased introduction of equipment.

(3) The tasks to be carried out are simple and measures to familiarize workers such as operational training are not necessary.

3 Centrifugal Load Test Apparatus for National Agriculture and Food Research Organization

In March 2015, Hitachi delivered a centrifugal load test apparatus to the National Agriculture and Food Research Organization. The equipment carries out vibration tests and precipitation tests with small-scale models acted upon by large centrifugal forces, in order to recreate damage or deformation to agricultural facilities such as dams, reservoirs and tunnels by the Great East Japan Earthquake, an expected earthquake in the Nankai Trough or a torrential rain.

The equipment spins a rotating arm installed in a circular pit with a 12-meter diameter and 8-meter depth at a speed of 137 rotations per minute, and can produce centrifugal acceleration of up to 980 m/s^2 (100 G) on the swinging frame. This centrifugal acceleration N is imparted on a model reduced to $1/N$ in scale, thereby



3 Centrifugal load test apparatus (top), testing schematic diagram (bottom) (photograph and images courtesy of National Agriculture and Food Research Organization)

recreating the same underground stress field in the small scale model as the full-scale object. The swinging frame is equipped with a vibration device, allowing vibration tests with a maximum acceleration of 539 m/s² (55 G), maximum speed of 100 cm/s, and maximum displacement of ±4.2 mm to be performed. The equipment also includes a feature that recreates precipitation while being acted upon by centrifugal forces, a sand spreading mechanism, and other features.

Hitachi will help the customer to research the behavior of irrigation facilities during an earthquake or torrential rain with the equipment and contribute to toughening facilities and improving their durability.

4 The World's Smallest Class of Energy-saving, Medium Voltage Drives

With the movement to prevent global warming and control carbon dioxide (CO₂) emissions, Hitachi has manufactured and sold medium voltage variable frequency drives (VFDs) as a key component in reducing energy consumption through the variable speed operation of electric motors, the largest source of industrial energy consumption.

Generally speaking, VFD control has a short history, and the use of VFD control in medium-voltage electric motors that require high levels of reliability has been limited. In recent years, however, the introduction of VFDs for air blowers at cement plants and steel works has become the industry standard, and demand for VFDs at other plants has also grown. On the other hand, as some customers have found it difficult to introduce VFDs due to space constraints at existing plants, Hitachi took the step of developing a VFD that is one of the smallest in the world* by adopting an all-in-one



4 World's smallest class of medium-voltage VFD

configuration combining a converter, transformer and control panel in a single cabinet. This new VFD was released in October 2016.

As well as resolving issues with installation space, this new offering helps to shorten installation times and reduce the size of electrical rooms at new plants.

* As of October 2016, according to the study undertaken by Hitachi, Ltd.

5 New Motor Series for General Industry

Hitachi has developed and begun deliveries of the new series of application drive motors for general industry.

While Hitachi's industrial motors have been well known to customers across a wide range of fields for many years, recently customers have begun to demand motors that maintain the same performance while offering reduced size and weight, shorter lead times and lower costs. Given this, Hitachi selected a development model with the goal of reducing weight by 30% over previous models to develop the new series.

The main features are as follows.

- (1) The motors employ a standardized (modular) design to shorten design and manufacturing lead times.
- (2) Hitachi undertook an optimum design process



Capacity	1,000~12,000 kW
Voltage	3~13.8 kV
No. of poles	4~12 P
Model	Horizontal shaft, fully closed / open
Temperature rise	B rise (80 K), F rise (105 K)
Noise (average value from point 1 m away with no load)	80~90 dB

5 New series motor (top) and outline of specifications (bottom)

through electromagnetic field, stress and vibration analyses to achieve the reduced size and weight.

Hitachi is now proceeding with deliveries to customers in a sequential fashion.

6 SJ Series Type P1 Next-generation General Purpose Inverter

As the uses for general purpose inverters expand, demands for improved drive performance and operability have emerged. The SJ series type P1 next-generation general purpose inverter (SJ-P1) is able to cope with an induction motor and permanent-magnet motor in a single unit. The drive of the induction motor features further improved torque characteristics achieved by a new type of sensor-less vector control, while the permanent-magnet motor drive derives high-level performance through the automated adjustment of motor characteristics.

The display component uses a 2.4-inch thin film transistor (TFT) color liquid crystal display (LCD). This provides a screen where a user can monitor multiple pieces of information simultaneously, and straightforward operation has been achieved through up, down, left and right directional keys that match on-screen transitions. In terms of functional safety, the motor complies with Safety Integrity Level (SIL) 3 according to International Electrotechnical Commission (IEC) 61508 regulations. Moreover, to cater to a diverse range of needs, the motor is equipped with three slots for optional expansions, with plans to offer cassette-based options for capturing closed loop control encoder signals or expanding input and output (I/O) interfaces. Further, with support for various field bus communications and Ethernet communications, the product is also positioned to cater to the demands of the Internet of Things (IoT) era.

(Hitachi Industrial Equipment Systems Co., Ltd.)



6 New inverter SJ-P1 (left) and dedicated built-in operator (right)

7 HX Series IoT-compatible Industrial Controller

In recent years, concepts such as Industrie 4.0 and Industrial Internet have brought about major changes that have taken place in the automation industry, such as an accelerated fusion between on-site equipment and systems inside and outside plants, and cloud systems. To adapt to this trend, Hitachi developed HX series as industrial controllers for IoT applications programmable automation controller (PAC) system. The controllers can apply information and communication technology (ICT) with greater ease, and utilize a platform based on open operating systems (OS) and hardware which are not reliant on dedicated hardware as the core architecture for control and communication.

The HX series boasts twenty times*¹ the instruction processing performance of previous products, supports high-speed EtherCAT*², and features improved control performance that can even handle complex positioning applications. The main part of the central processing unit (CPU) module is equipped with three local area network (LAN) ports as standard, and the system is also equipped with the increasingly popular OLE for process control-unified architecture (OPC-UA) communications server functions.

Hitachi predicts that similar applications of ICT in the field of industrial equipment will continue to gain ground in the future. Accordingly, Hitachi will strive to fuse information with industry and expand the deployment of products that meet the needs of the IoT market.

(Hitachi Industrial Equipment Systems Co., Ltd.)

*¹ Compared with the EHV series programmable controller from Hitachi Industrial Equipment Systems Co., Ltd. according to the study undertaken by Hitachi Industrial Equipment Systems Co., Ltd.

*² See "Trademarks" on page 162.



7 Example of HX series configuration combined with I/O module



8 Oil-free screw compressor (55 kW water cooled type, two-stage compressor)

8 New Series of Oil-free Screw Compressor

Hitachi has been pursuing development of the oil-free screw compressor series by adding a new board and expanding functionality of its series, which supply clean compressed air that contains no oil.

A 22-120 kW two-stage compressor and 15-55 kW single-stage compressor have already gone on sale in December 2015 and July 2016, respectively. In addition, Hitachi released a 132-240 kW two-stage compressor, and hereby completed the 15-240 kW new oil-free screw compressor series.

The main features are as follows.

- (1) Improved operability through a built-in color touch panel
- (2) Higher energy-saving performance through terminal pressure prediction and control
- (3) Ambient temperatures of 45°C supported by all models
- (4) Auto function (automated motor start and stop) equipped as standard
- (5) Expanded IT communication functions including support for Modbus* communications
(Hitachi Industrial Equipment Systems Co., Ltd.)

* See "Trademarks" on page 162.

9 New Series of Oil-free Scroll Compressor

In industries that require clean air and low noise, such as the foodstuff industry and research facilities, there is a widening demand for oil-free scroll compressors. In recent years, there have been demands for products that

save more energy and have longer maintenance cycles in an effort to reduce running costs. To respond to these needs, Hitachi developed the 1.5-30 kW new oil-free scroll compressors.

The main features are as follows.

- (1) By revising the dimensions of a resin sliding component that seals the compressed air and improving the roughness of the sliding surface, product life was extended, and the maintenance cycle for the main compressor unit was lengthened from four years (10,000 hours) in the previous model to five years (12,500 hours)*.
- (2) Inverter control types were added to the lineup of compressors with 3.7 kW and 5.5 kW output. The inverter control type made it possible to reduce power consumption by approximately 5% compared with regular pressure switch-type control, due to the constant control of pressure.
- (3) The model with 7.5-30 kW output can now be configured with 2-4 multiple compressor main units and capable of unit control operation as a single product.
(Hitachi Industrial Equipment Systems Co., Ltd.)

* In case of 0.8 MPa model with return pressure set to 0.65 MPa according to the study undertaken by Hitachi Industrial Equipment Systems Co., Ltd.



9 New 30 kW oil-free scroll compressor (top) and cut model (bottom)



10 New CO₂ laser marker with highly-advanced marking technologies (horizontal type)

10 New LM-C300 Series of CO₂ Laser Markers

A CO₂ laser marker is an industrial marking unit that prints information such as dates and lot numbers on foodstuffs, beverages, cosmetics, pharmaceuticals, electrical components, automotive components, and so on. Industrial printing needs have become increasingly diverse, and demand for various printing devices has also expanded. Given the circumstances, Hitachi developed the LM-C300 series of CO₂ laser markers, which offers more variations and accommodates a wider range of needs.

The main features are as follows.

- (1) By adopting a lineup with laser outputs of 10 W and 30 W, a wide range of print areas can be selected, offering support for extensive variation.
- (2) Productivity has been improved with high-speed printing of 600 characters per second and superior scan control.
- (3) An IP54 protective structure is fitted as standard, enabling stable and crisp printing even under harsh usage environments.
- (4) The laser oscillator, which represents the heart of a laser marker, is completely equipped with a high-efficiency cooling system which circulates air, offering improved stability in laser output.
- (5) The controller is built in to the head component of the laser marker, producing a compact body with only a head part. In addition, by changing the lens mounting position of the laser head, the structure now allows the direction of laser irradiation to be modified.

(Hitachi Industrial Equipment Systems Co., Ltd.)

11 New Nitrogen Gas Generator

Nitrogen gas is used to preserve the quality of food, and to prevent oxidization or explosion in the electronic and chemical fields, and is typically supplied in the form of



11 NPO-3.7/5.5 nitrogen gas generator equipped with inverter-based energy-saving control

gas cylinders or as liquid nitrogen. To respond to market needs to obtain nitrogen gas easily and at low cost, Hitachi developed the series of new nitrogen gas generators equipped with long-life, oil-free scroll compressors.

The main features are as follows.

- (1) Long-life compressor

The newly-employed oil-free scroll compressor extends the maintenance cycle from the previous 8,000 hours to 10,000 hours due to the use of a dedicated bearing and revised shape of sliding parts, which lowers maintenance costs.

- (2) Reduced vibrations

Vibrations have been further reduced by revisions of a compressor balancing weight and rubber vibration insulation.

- (3) Improved energy saving performance

The unit is equipped with an automatic energy-saving mode which prevents excessive operation of the compressor depending on the amount of nitrogen gas used.

(Hitachi Industrial Equipment Systems Co., Ltd.)

12 Air Shower Equipped with Special Static Removal-type Plasma Cluster Ion Generator and Entry/Exit Controller

Since the first Hitachi air shower was released in 1974, Hitachi has continued to pursue dust collection performance improvements through an unceasing study of expertise and technologies. Since 2005, Hitachi has developed an extensive lineup catering to a wide range of applications based on the series equipped with



12 Air shower equipped with special static removal-type plasma cluster ion generator and entry/exit controller

the flutter jet nozzle, a distinct feature of Hitachi air showers.

In the latest iteration, a special static removal-type plasma cluster* ion generator that lowers the electric potential of statically charged clothing and items, as well as a Hitachi-made entry/exit controller have been added as optional extras to further flesh out the lineup.

The main features of the air shower equipped with a special static removal-type plasma cluster ion generator are as follows.

(1) The electric potential of statically charged clothing and other items is decreased with air jets that run for eight seconds.

The static removal time from 1 kV to 0.1 kV has been reduced by five seconds.

(2) Interoperation of the special static removal-type ion generator and air shower.

Users can select between continuous operation and door-actuated operation using a switch.

(3) Retrofitting of existing 87 series air showers is possible.

(4) Effective in inhibiting the action of adhesive bacteria (under 24-hour continuous operation, when subjects are stationary)

The main features of the air shower with the entry and exit control feature are as follows.

(1) Integrated circuit (IC) cards can be registered and read with the base unit.

The base unit is an integrated model with a built-in controller and card reader.

(2) Ability to confirm entry and exit records with the auxiliary utility software.

Historical data saved by the controller can be saved to a microSD* card and viewed from a personal computer.

(3) Card reader with LCD touch panel

Various settings can be adjusted by operating the LCD touch panel on the base unit.

Moving forward, Hitachi will look to expand sales to the electronics, electrical and food industries which require security.

(Hitachi Industrial Equipment Systems Co., Ltd.)

* See "Trademarks" on page 162.

13 Compact Reciprocating Compressor Series

The applications of compact reciprocating compressors have continued to expand, and they are now used in all manner of fields from general industry such as electrical equipment and machinery to cutting-edge industries like electronics and healthcare and even the amusement industry. Since its release in 2007, the super oil-free compact compressor series has matched market needs with its compact, low-noise concept, and has maintained a large share of the domestic market. In recent years, more customers have started to embed the products in their own equipment, and this has created the need for further vibration and noise reductions.

With the latest model change, Hitachi sought to make further reductions to vibrations and noise over the current models. In terms of the noise reduction measure employed, in addition to the unique crank case suction method and an oscillating lip ring system without a bearing structure on the small end, improvements to the air valve have reduced noise in the 800 to 1,200 Hz frequency range to improve the quality of the sounds produced. In terms of vibrations, balance has been optimized and a counter balance has been added for single-cylinder products to reduce vibrations by around 60% compared with current models.

Moving forward, Hitachi will strive to further expand sales as it responds to market needs and customer demands.

(Hitachi Industrial Equipment Systems Co., Ltd.)



13 Super oil-free compact compressor series (output 200 W)