FH800SX-i Horizontal Spindle Machining Center

In recent years, emission regulations have become stricter for diesel engines of large-scale transportation vehicles, such as trucks. To respond to these regulations, vehicle manufacturers have shifted from V engines to inline-six cylinder engines, which enable easy arrangement of devices for reducing harmful exhaust. This has led to demands for machines with larger machining range and higher productivity than ever before. Since 2005, JTEKT has been selling the FH800SX horizontal spindle machining center, suited for machining of components for truck diesel engines and highly evaluated by customers. This report introduces JTEKT development FH800SX-i, for which we have adjusted maximum workpiece size and machine travel amount to suit even larger workpieces.

1. Specifications

This machine has a maximum workpiece swing of ϕ1 500mm and a maximum loading mass of 2 500 kg, with the highest capability in its class for responding to large size workpieces. Furthermore, the minimum access distance from the table center to the spindle nose was designed as 100mm to enable high efficiency machining with short tools. In addition, the Z-axis travel amount has been enlarged to 1 550mm, which has expanded the selection range for tooling and fixtures without causing interference range to occur in the Z-axis origin even with a combination of maximum workpiece swing and maximum tool length. With a maximum tool diameter of ϕ350mm × tool length 800mm and maximum tool weight of 35 kg, this machine supports a wide variety of machining demands.

Machine specifications

Main specifications			FH800SX-i
Feed	X-axis travel	mm	1 450
	Y-axis travel	mm	1 250
	Z-axis travel	mm	1 550
	Rapid feed rate	m/min	54
	Rapid feed acceleration	m/s^2	4.9
Table	Working surface size	mm	800 × 800
	Max. workpiece swing × height	mm	ϕ1 500 × 1 500
	Max. workpiece weight	kg	2 500
Spindle	Spindle taper size	–	BT No.50
	Spindle rotation speed	min^{-1}	6 000 (6 000 15 000)
	Spindle output	kW	30/22 (37/30 30/25)
ATC	No. of tools	Tools	60 (121)
	Tool change time (C-C)	sec	4.4
	Max. tool dia.	mm	ϕ350
	Max. tool length	mm	800
	Max. tool weight	kg	35
Control	CNC	–	FANUC 31i
Floor space	Width × Depth	mm	4 680 × 7 710

(Optional specifications shown in parenthesis)

2. Features

2. 1 High speed/High rigidity

This machine has been given the following three abilities to achieve a combination of high speed and high rigidity.

(1) The Y-axis and Z-axis, which bear large cutting load, have been equipped with dual drives consisting of two ball screws. The main components supporting these axes, including the bed, column and table, have been arranged in an optimized rib layout to achieve sufficient rigidity.

(2) The support bearings at either end of the ball screws of all axes employ a double anchor method which restricts the ball screw in both axial directions. This ensures high rigidity within the entire stroke range and prevents vibration.

(3) Weight reduction has been achieved for moving parts with the introduction of a thin structure using high strength casting. In addition, a roller type linear guide with high rigidity and excellent damping performance has been employed for the feed.

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These additions have resulted in a large size machine able to achieve a rapid feedrate of 54 m/min on all axes.

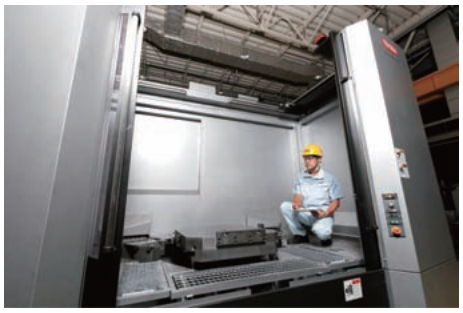
2. 2 Low thermal displacement design and compensation function

Symmetrical design and heat capacity analysis using CAE were conducted for main components such as the bed and column to achieve balanced shape in terms of heat capacity. Each ball screw of each axis is hollow, and coolant which is controlled to track bed temperature flows constantly through the center of the axis. These technologies suppress thermal displacement and achieve stable, highly accurate machining. Furthermore, thermal displacement can be suppressed to an even higher level with the addition of the optional spindle thermal displacement compensation function (a function which directly measures and corrects spindle elongation in real time).

2. 3 Workability

The operator must completely enter the machine to perform workpiece centering and confirmation of the machining face and tool cutting edge. Large steps have therefore been installed near the main operation panel to allow the operator to safely and easily conduct these operations. Steps were also installed within the machining chamber to allow safe entry inside. The main operation panel was arranged at the left hand of the operator to enable operation while viewing the workpiece, and the input keys were installed at an angle to be able to be pressed more easily. Moreover, the main operation panel can be swiveled at will, allowing the operator to confirm status on the monitor while working inside the machine. With a pallet changer door which opens to the ceiling and wide, flat steps, this machine enables operators to safely perform setup work, including operations involving cranes.

Main operation panel and easily accessible operation door



Easily accessible pallet changer

2. 4 Automation

JTEKT has a long history in the delivery of flexible manufacturing systems (FMS) both domestically and overseas, beginning with our first FMS delivery to customers in 1972. Through the utilization of a turn type pallet changer on the FH800SX-i, we have reduced cycle time and condensed the floor space of the entire system. Furthermore, this machine supports a great variety of transfer modules including the stacker crane, RGV (Rail Guided Vehicle), robot, and gantry loader types. It also supports automation modules such as the tilt loading station and coupler type automatic hydraulic fixtures.

FH800SX-i and RGV

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