

Extending the life

The story of a maintenance department that revived a horizontal borer

Larsen & Toubro Ltd. Heavy Engineering Division in Mumbai is an engineering giant in India, with manufacturing facilities at various locations throughout the country. In 1979, Larsen & Toubro representatives attended an international machine tool exhibition in Mumbai, where the company purchased a horizontal borer from M/S DEFUM, a Polish company.

It was an excellent deal at least we thought so in those days of getting a floor-mounted horizontal borer with a spindle diameter of 160 mm at throw away price of \$375,000. The machine had excellent hardened and ground guide ways and very good spindle concentricity.

The design had some limitations, using a single AC motor with combination of electromagnetic clutches for feed in the X, Y, Z and W axes. The position readouts were of the optical type and spindle speeds were limited to 32 steps through 800 rpm. One could argue that features such as stepless control of spindle and feed are not only desirable but essential for a good machine tool, but we bought the machine for specific machining applications which required fixed machining variables.

The machine's limitations were exposed soon after we installed it. The optical readout failed when its special fused lamps failed and replacements had to be imported. The electromagnetic clutch on the feed gearbox failed, causing some feeds to stop functioning. A few of the spindle drive ranges ceased functioning when some hydraulic shifters failed.

After two years of use, the machine was dismantled to repair these faults using improved clutches and other controls. The optical readout was converted to a digital readout. But this wasn't enough. Three years later, the machine needed similar repairs.

The machine was now considered to be a non-productive because it suffered from almost 40 % downtime during this period. In 1990, management attempted to sell this machine and to purchase a new horizontal borer replacement. A new machine of similar size would cost between \$470,000 and \$550,000. The maintenance department realized that the proposed replacement machine will be an expensive proposition that would lead to an increased machine-hour rate.

We studied the alternatives and decided to take on the challenge of redesigning the defective machine controls. The effort received good support from upper management.

We took following steps to improve machine performance:

- We redesigned the axis feed control system and reduced the number of feed clutches from six to two. We installed a variable speed DC drive and motor to achieve stepless feed control.
- We converted the spindle control system from a hydraulic gear shifting type to stepless DC motor speed control.

- We changed the axis position display to a digital readout with linear metallic scales for Y and Z axes and a precision track encoder with rack and pinion drive for the X axis. This improved the machine's positioning accuracy.
- We replaced the X axis telescopic guideway covers to improve and maintain the condition of the guideway.
- We installed a centralized lubrication system under timer control on the guideways.
- We replaced contactor logic with a PLC controller to improve control system reliability.

Economics of machine upgrade

Performing the engineering inhouse reduced the cash outflow for the upgrade. We procured components and subassemblies at a cost of \$50,000. And we used our own internal manpower for retrofitting.

During the first year after the modification was completed, downtime dropped from 40% to 5% and the unit exhibited much higher machining accuracy. As a result, the payback on the investment was less than one year. The biggest advantage was that capital investment on new machine was deferred, which avoided having to change the machine-hour rate.

Larsen & Toubro's maintenance crew has highly skilled and knowledgeable technicians and engineers who perform machine upgrades and retrofits every year. Our heavy machine shop has some vertical and horizontal borers that are more than 40 years old, which we've reconditioned and retrofitted with the latest CNC controls to keep our machining cost competitive.