

Hardening Technology Focuses on Dimensional Accuracy

Introduction

Shorter model life-cycles, increasing demands on quality, and technological innovations continue to drive developments in high-tech industries such as car or aircraft manufacture. Hardening best shows the effect this has on the production environment. As many key components go through this process at one stage, it is a process that not only has to be highly accurate, but also guarantee consistently high component quality. Committed to the requirement of reproducibility, the specialist at Eldec's modular hardening machines offer exceptional precision and economic processes.

Reproducibility is an indisputable requirement in car production, since an automobile as a product is reliant on the unvarying component quality of the drive shaft. The indispensable hardening process, where the components' microstructures undergo a change to considerably improve stability, must guarantee constant reproducibility.

Where quality matters. Eldec experts are very well aware of the fact that the interaction between key components such as inductors, generators and coolant systems, and a multitude of other components including indexing tables, spindle drive and control systems, is of utmost importance. Over the last three decades German-based Eldec has further developed their hardening technology, and in February of 2013 the company became a part of the EMAG Group. Precision and the integrity of the production process are important



Figure 1 Manually loaded, semi-automatic or production line-integrated – the modular design of the MIND-system suits every production environment (All photos courtesy Eldec).

to Eldec experts, as Dr. Christian Krause, head of application technology, explains. “We are frequently contacted by companies that require their components to be of exceptional quality, and we can guarantee that with our system technology.”

At the center of it is the modular induction (MIND) hardening machine, offered in various sizes of MIND, MIND-M and MIND-S. Using modular technology, the machines are configured to suit individual workpiece dimensions, hardness profiles and production requirements. The modular system ensures that only well proven components are used, increasing machine stability and guaranteeing that the technology can be offered at an advantageous price-performance ratio.

“The engineering of the machine is, of course, greatly influenced by the workpieces to be hardened,” explains Krause. “Requirements are discussed in detail with the customer. This is followed by the gradual assembly of the Eldec MIND system, selecting the required key components, i.e.: basic machine, energy source, inductor, coolant system and automation components, where required.”

High-efficiency, precision-dosing. The

machine builder relies on their accumulated know-how and quality details for every component, resulting in a machine that considerably improves the economic viability of the process. For example:

The basic machine base is constructed of massive, high-prec-

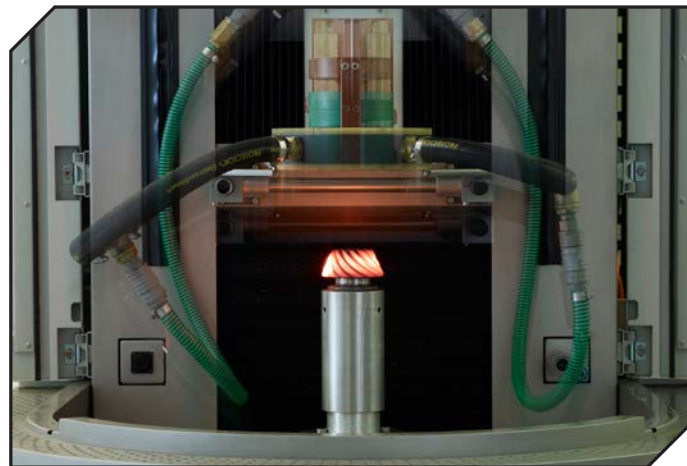


Figure 2 Processing a drive pinion – from hardening to chamfering – takes 14 seconds.

sion welded components and includes the main column for the Z-axis. The vibration-resistant construction ensures top machining accuracy. Depending on the clamping system used, Eldec machines can accommodate workpieces up to 1,200 mm diameter.

Available generators are microprocessor-controlled, single- or dual-frequency, with a capacity of 5 to 3,000 kW. They are highly efficient and allow the required energy to be adjusted with great precision. Their performance also adjusts itself automatically — and with equally great precision — to that of the inductor used.

The inductor/tools are manufactured according to customer specification, using 3D-CAD software. Made with the help of state-of-the-art machinery by an experienced staff, they are of micrometric accuracy.

Performance data of the MIND technology Eldec is capable of processing a driving pinion in as little as 14 seconds. The component is, through automation or manually, inserted into the indexing table of the machine and the hardening process takes between 100 milliseconds and a few complete seconds. After quenching, the hardened steel is gradually tempered and the machining cycle is completed with the subsequent cooling process. “Of decisive importance to us is not just the high speed of the process,



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but also the precision of the hardening operation,” states Krause. “For instance, on Eldec machines the variation in effective hardening depth is no more than ± 0.1 mm, an extremely low value within hardening technology.”

Benefitting from general trends. With these trends, Eldec is benefitting in the automotive and aviation industries. The geometries of many components are becoming more complex and, at the same time, pieces tend to get smaller. The hardening process must keep pace with this development and guarantee the



Figure 3 The Eldec shape of the tool is designed with great precision using 3D CAD software by specialist in inductor design.

required quality, despite more demanding basic conditions, and the MIND series of machines is a very good start, Eldec offering more flexibility to the workflow by providing suitable automation. The machines are available ranging from manually loaded stand-alone solutions to fully integrated, in-line hardening cells for the soft- and hard-machining of components.

Particularly in the emerging Asian markets, large automobile manufacturers rely on Eldec machines when establishing new production facilities. “In China, for instance, the production quality of components has to be on par, in every respect, with those from Europe or the United States. We offer the hardening machine technology they need. It is a technology that impresses with its economic processes,” concludes Krause.

Three advantages of MIND induction hardening machines. 1) Precision: All machine components and the inductor are specially made to suit the component to be hardened. Eldec know-how guarantees production with dimensionally accurate processes. 2) Well-built: This modular design relies entirely on well

proven, sturdy components with optimal price-performance ratio. 3) Efficiency: Machine, generator performance, and automation options ensure fast processing and low component manufacturing costs.

Manually loaded, semi-automatic or production line-integrated – the modular design of the MIND-system suits every production environment.

The machining area is fixed with an indexing table, spindle drive, and tail-stock equipped to suit the workpiece (here a drive shaft). MIND machines are designed for workpieces between 250 and 1,500 mm diameter. ⚙️

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