



Hardening large rings and gears

A guide to the benefits of induction heating



Seamless hardening. Why induction is the smarter choice

Seamless induction hardening is the proven cost-saving alternative to thermo-chemical processes. What's more, induction's speed and localized heating minimize distortion—reducing subsequent processing costs.

Induction is a powerful business tool for companies keen to reduce costs when seamlessly hardening large rings and gears. The main benefits are:

- Increased throughput—induction hardening typically takes only minutes. Conventional case-hardening on the other hand can take days.
- Improved cash flow—induction hardening minimizes parts in process. Capital is not tied up in stock.
- Minimal waste—electronically controlled heat patterns and hardening depths prevent overheating.
- Reduced logistics costs—induction hardening takes place on-site, and is usually integrated into production flows. Workpieces do not need to be shipped off-site for hardening.
- Less post-hardening processing—localized and accurate heating minimizes the risk of distortion.
- Lower energy costs—induction heating is precise and tailored to individual workpieces, no energy is wasted heating ambient air.
- Streamlined production—induction hardening is ideal for integrating into production lines.

STEP-BY-STEP TO SEAMLESS HARDENING

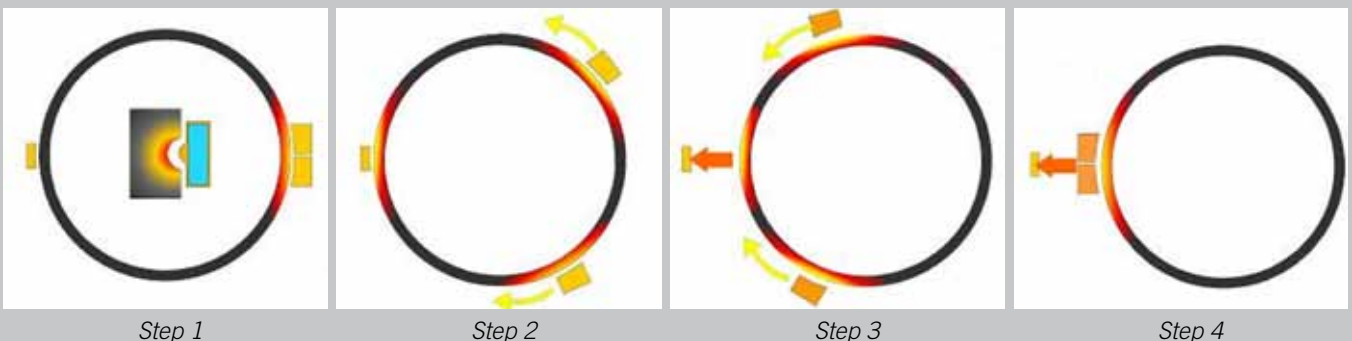
Large bearings designed for rotary applications such as the main and rotor spindles in wind power units must be hardened in such a way that does not produce a 'soft zone' or 'seam'. A patented EFD Induction process achieves such seamless hardening by the innovative use of multiple coils. The diagram shows how the process works.

Step 1 Two coils (on the right of the ring in the diagram) heat the start-zone. Once the desired temperature is reached, quenching of the start-zone begins. The coils then move around the ring, heating it.

Step 2 A stationary coil begins pre-heating the end-zone (on the left in the diagram). The two scanning coils advance towards the end-zone, heating the ring on the way.

Step 3 The stationary coil moves away as the two coils approach the end-zone.

Step 4 Once the desired temperature has been reached in the end-zone, the two coils move away and quenching begins.



Step 1

Step 2

Step 3

Step 4

Fast, accurate, controllable

Gear tooth hardening

EFD Induction gear hardening systems are divided into three categories: gap-by-gap systems, tooth-by-tooth systems and single-shot (spinning) systems. Which system you should use depends on the specific nature and requirements of the gear. Gap-by-gap hardening, for example, is typically used when hardening large gears for demanding applications such as wind power. This method hardens the areas that bear most of the load, such as the flanks of the teeth, the fillet and the root. EFD Induction's special floating inductor head contributes to low costs and optimum results by minimizing cycle times and ensuring accurate heating patterns.



Advanced coil design and process control software ensure short cycle times and precise repeatability.

Raceway and balltrack hardening

Our inclined hardening systems can handle many different types of internal and external raceways and balltracks. To allow even faster scanning, the systems can use two power supplies for pre-heating and final heating. Process repeatability is ensured by touch probes and continuously monitored rotation speeds. The control system—which is based on one of the world's most advanced and trusted platforms—incorporates our own customized software and hardware, including a handheld control panel. Although our systems have extremely small footprints, they include advanced safety and ergonomics features for maximum operator productivity.



EFD Induction offers hardening solutions for virtually any dimension of raceways, balltracks and gears.

Get more from your equipment

When you choose a solution from EFD Induction you choose security and peace-of-mind. As one of the world's largest induction heating companies we offer a full range of maintenance, logistics, training and spares services. Make the most of your heating system—with a little help from the people who built it.



EFD Induction has to date installed thousands of heating solutions for a vast range of industrial applications— bringing the benefits of induction technology to many of the world's leading manufacturing and service companies. EFD Induction has manufacturing plants, workshops and service centers in the Americas, Europe and Asia.

Learn more about EFD Induction and our solutions that are boosting productivity for companies around the world. Visit: www.efd-induction.com