Large Crankshaft Deep Rolling & Roll Straightening

Machine Model 7625

For flexible manufacturing of large crankshafts

...technology in motion

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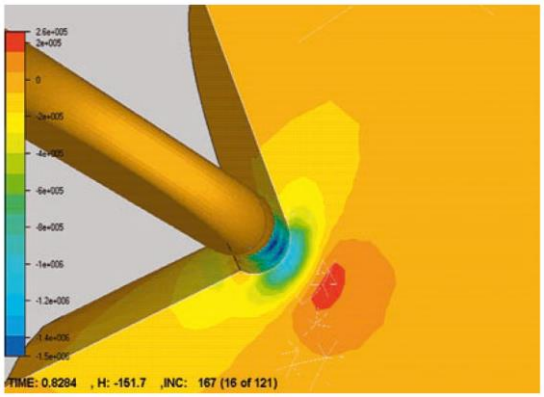
Machine Model 7625

Our latest invention, the machine model 7625, is designed for the manufacturing of large crankshafts up to 4.000 mm length. The deep rolling of main and pin bearing fillet radii & roll straightening of main bearings can follow directly after the pre-machining operations turning of main bearings and milling of pin bearings in order to increase the fatigue strength of the large crankshaft and to correct possible main bearing run outs. By roll straightening the pre-machining cost can be reduced tremendously by less stock allowance and semi-finishing machining cost for grinding can be reduced as well by less grinding tool cost due to low TIR run-outs.

Increasing of Fatigue Strength by Deep Rolling

The process deep rolling of fillet radii to improve the fatigue strength of highly stressed crankshafts is a world-wide accepted process technology within the powertrain engineering field.
The deep rolling process induces residual compressive stresses into the fillet radii, increasing the fatigue limit and significantly increasing service life of the product.
The deep rolling process offers a particularly economical and capable method of optimizing the fatigue strength of large crankshafts.
Hegenscheidt-MFD invented the crankshaft fillet deep rolling technology, which has been applied in the automotive industry since 1957, when by deep rolling the VW 'Beetle' crankshaft the engine horse power was increased by 30% without design changes.



Enhancing Material Properties

The deep rolling process results in the plastic deformation of the surface layer of the material. This induces positive three-dimensional residual compressive stresses within the bearing fillet areas, which are subject to the highest performance stresses. The surface pressure exerted during the deep rolling process induces residual compressive stresses that prevent the creation of tensile stress under load conditions. With optimized deep rolling processes, increases in fatigue strength of more than 200% can be achieved. In addition, the process work hardens the material, improves surface hardness and considerably increases the crankshaft's resistance to dynamic stresses and stress corrosion.

Improving Radial Run-Out by Roll Straightening

Roll straightening reduces the radial run-out of the crankshaft main bearings. This process innovated by Hegenscheidt-MFD is the only cold straightening method that does not impair fatigue strength. Our roll straightening process actually increases fatigue strength of the crankshaft through the application of additional residual compressive stresses in the fillet radii. Alternative straightening methods can reduce the fatigue strength by up to 40 %. During the combined deep rolling and roll straightening process, the degree of TIR affecting the crankshaft is measured following the deep rolling phase and then minimized by a calculated increase of deep rolling force during the roll straightening cycle.

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Angle Dependent Deep Rolling

Our invention of the angle dependent deep rolling process effectively counteracts axial run-out deviations caused by varying degrees of rigidity in the upper shoulders of the pin journals. This run-out deviation reduction is achieved by automatically reducing rolling force when contact is made with the bearing shoulders during the rolling sequence. The rolling force is increased again to improve fatigue strength in the fracture line portion of the crankshaft.

Machining Process

After the crankshaft has been loaded, pre-centered and fixed by using a compensating chuck, the integrated NC-operated spindle positioning system gages the radial position and stroke of the crankshaft and rotates the crankshaft into the correct deep rolling position. The deep rolling units with durable tools automatically encircle the crankshaft main and pin bearings. The fillet radii of these journals are then deep rolled with angle dependent rolling force control. Precision probes measure the TIR at the main bearings. The measured values are relayed to the roll straightening program for evaluation and precise identification of the direction and degree of radial run-out. This data is the basis for the roll straightening process to reduce the run-out. The incorporated process management system monitors the penetration depth within the radii for optimum process reliability.

High-Performance Process for all manufacturing requirements

Our innovative machine model 7625 combines the deep rolling and roll straightening technology to improve both, the fatigue strength of crankshafts and the radial run-out of the crankshaft main bearings. Combining these two features in one machine enhances product quality, process capability and improves process efficiency.
Model 7625 is designed as single machine to fulfill all crankshaft production requirements for highly flexible crankshaft families with varying quantities and geometry of bearings. The simple tool change ensures minimized set-up times.

Long Life Premium Tools

Our crankshaft deep rolling machines are equipped with new Hegenscheidt-MFD high performance deep rolling tools for highest tool life.

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Our innovative deep rolling & roll straightening machine model 7625 offers the following advantages to the manufacturers of large crankshafts:

Economic Advantages Model 7625

- Energy saving process
- Low production cost
- High production rate
- Low maintenance cost
- High machine availability
- Less stock allowance (pre-machining)
- Less grinding material (semi-machining)
- Less manufacturing cost of large crankshafts

System Advantages

- High flexibility for part families with varying stroke, journal spacing & journal quantity
- Automatic stroke adjustment
- Quick change-over from one family type crankshaft to another
- Direct loading into machining position
- Low loading height
- Automatic radial positioning
- Integrated laser measuring probe to check stroke and angular position
- Angle dependent rolling for minimized run-out and reduced shoulder deformation
- Measuring of the total indicated run-out on all main bearings
- Measuring of run-out with reference to centers or to vee-blocks
- Straightening of crankshafts without loss of fatigue strength
- Roll straightening computer with software for all common types of crankshafts
- Self teaching roll straightening program
- High degree of process capability by monitoring all parameters
- Monitoring of fillet penetration depth
- Tool monitoring system
- Tool design for long tool life

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