Deep Rolling and Roll Straightening Machine

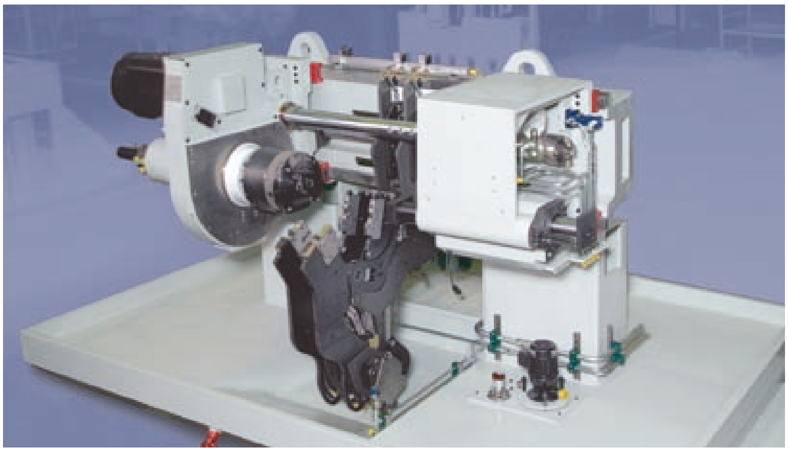
Typ 7895

For high volume production of crankshafts

...technology in motion

Hegenscheidt MFD

Increasing Fatigue Strength by Deep Rolling



7895 machine bed

The Deep Rolling Process

Hegenscheidt-MFD has decisively shaped the development of deep rolling technology. Crankshaft fillet deep rolling technology has been applied in the automotive industry since 1957.
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 high performance crankshafts in a high volume production environment.

Enhancing Material Properties

The deep rolling process results in the plastic deformation of the surface layer of 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 optimised 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.

Machining Process

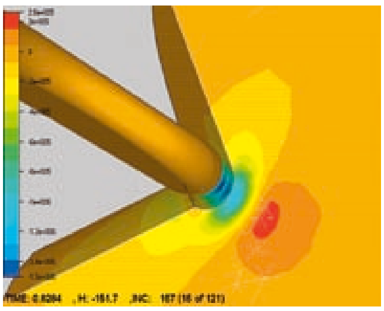
After the crankshaft has been loaded, pre-centered and chucked, the integrated PLC-operated spindle positioning system rotates the crankshaft into the correct deep rolling position. The tools automatically encircle the crankshaft main and pin bearings. The undercut fillet radii of these journals are then deep rolled with angle dependent rolling force control, after which the total indicated run-out TIR is minimised during roll straightening. The incorporated process management system monitors the penetration depth within the radii undercut for optimum process reliability.

Angle Dependent Deep Rolling

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, rolling force is increased again to improve fatigue strength in the fracture line portion of the crankshaft.

Roll Straightening (option)

Roll straightening reduces radial run-out. The process developed by Hegenscheidt-MFD is the only cold straightening method that does not impair fatigue strength. The 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 minimised by a calculated increase of deep rolling force during the roll straightening cycle.



Deep rolling of bearing fillets

Machine Design

Economic Advantages

Hegenscheidt-MFD's innovative 7895 deep rolling and roll straightening machines offer the following economic advantages to the manufacture of crankshafts:

- Energy saving process
- Low production costs
- High production rate
- Low maintenance costs
- High machine availability

Deep rolling machine Type 7895

Extensive Machine Features

Hegenscheidt-MFD's latest generation of crankshaft deep rolling machines are equipped with new Hegenscheidt-MFD high performance deep rolling tools for high tool life.

Precision probes measure the TIR at max. 3 main bearings. This data is the basis for the roll straightening process.

Deep rolling tooling

System Advantages

All 7895 machines provide the following features:

- for crank families with varying stroke, journal spacing and quantity of journals
- Automatic stroke adjustment (option)
- Direct loading into machining position
- Low loading height of 1100 mm
- Automatic radial positioning (option)
- Angle dependent rolling for minimised run-out and reduced deformation of shoulders
- Measuring of the total indicated run-out on max. 3 main bearings
- Straightening of crankshafts without loss of fatigue strength (option)
- Self teaching straightening program (option)
- High degree of process capability by monitoring all parameters
- Monitoring of fillet penetration depth (option)
- Tool monitoring system
- Tool design for long tool life

Technical Specifications

	Type 7895
Machine Details	Headstock manually adjustable. Ideally for the machining of one type of crankshaft. Accommodates variable stroke
Crankshaft	
Max. pitch of enter main bearings:	450 mm
Max. radius of counterweight: (depending on stroke and bearing width)	195 – 270 mm
Max. radius of counterweight for shifting:	-
Max. quantity of bearings:	5 main bearings 4 pin bearings
Min./max. main bearing diameter:	30 / 88 mm
Min./max. pin bearing diameter:	30 / 84 mm
Min. bearing width:	18.5 mm
Max. stroke:	120 mm
Min. pitch between main and pin bearing:	29,5 mm
Deep rolling units	
Max. deep rolling force:	20.000 N
Headstock	
Main drive power:	20 kW
Deep rolling speed:	120 min^{-1}
Roll straightening speed:	60 min^{-1}
Measuring speed:	30 min^{-1}
Machine	
Weight including auxiliary equipment:	approx 10.000 kg
Dimensions including integrated control panel and hydraulic unit (L/W/H):	4,0 x 2,5 x 2,2 m
Machine center height:	1.100 mm

Technical data subject to alterations.

GP059EN HM-PC 11.06

THE TECHNOLOGY PROVIDER

THE NSH GROUP
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