

Faster cycles for crankshafts or shorter cycle times for crankshafts

Nagel reduces auxiliary process times for crankshaft superfinishing machines

The lower the bearing friction in a piston engine, the higher its effectiveness. For the bottom line, that also translates into lower fuel needs and CO₂ emissions. One of the focal points is the crankshaft, for example. Superfinishing the bearing points of these key components has already become a standard process. Nagel has optimised the interplay of the required process steps on the finishing machines of the UF series. As a result, cycle times have been significantly reduced.

Crankshafts in combustion engines are being manufactured in large volumes. All production processes, whether forming, rough or fine machining, are subject to high requirements with regard to productivity. When the dFlex finishing tools were introduced, the focus was to optimise the processing time. As a result, the superfinishing machines of the UF series by Nagel complete a common crankshaft within approx. 20 seconds. That is an excellent time value. Some of the auxiliary process times, necessitated by clamping, in feeding and traversing processes, take twice as much time in some cases. This especially applies where a machine concept makes complete processing possible, which is the case for the machines by the finishing experts from Nürtingen. In addition to the main and big end bearings, shaft seal seats and thrust bearings can be finished and oil drillings deburred. Accordingly, the larger



set screws to further improve productivity are in the range of the auxiliary process times.

"We have reviewed all the processes of our UF series machines and developed a completely new control concept," explains Marcel Bosch, head of Process Development/Service at Nagel. The start approvals for subsequent processes are now granted as soon as the finishing arms are opened from the constraining contour of the crankshaft.

Improved position windows of the NC axes result in a faster program cycle. Parallelising the clamping processes of tail stock and spindle stock also saves valuable seconds. If the travel distance remains within a preset tolerance window, the axis is immediately accelerated to its maximum value. Last but not least, the precise control of the NC drives provides extra dynamics.

"Thanks to these measures, we were able to reduce the auxiliary process times by 30 percent", says Marcel Bosch.

Or from a different perspective, where the quality requirements of the automotive manufacturers increase and necessitate longer finishing times, shorter auxiliary process times compensate for this increase so that the original cycle times can be preserved. The bottom line is a crankshaft compliant with current quality requirements which only spends 43 seconds inside the machine.

Marcel Bosch continues: "In light of normal cycle times in the automotive industry, a platform 2000, meaning 2,000 crankshafts per day, can be achieved through a single processing machine. Rz values of 0.5 µm can be achieved while



The current dFlex finishing tools guarantee minimum processing times and high process safety for the superfinishing machines by Nagel

taking common series pre-treatment into consideration. Combined with our dFlex finishing tools of the second generation, material removals with a diameter of 8 µm are possible."

It is important to point out that optimisation does not affect the aspects of quality and process safety which remain at their usual high level, as shown, for example, by the results of the big end bearings. They are the real challenge when finishing crankshafts as they rotate eccentrically around the shaft axis. The finishing arms must follow the bearings. Generally, different acceleration forces are created which contrast with the closing forces of the finishing tools. At worst, different surface qualities are created over the perimeter of the bearing.

"We designed our finishing arms and tools as such to ensure maximum process safety so that these effects will have no impact. Differences in the surface finish at the bearing perimeter (OT/UT) do not occur, the quality remains at a constant high level, also as requirements increase," explains Marcel Bosch.

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Marcel Bosch, head of Process Development/Service at Nagel Maschinen- und Werkzeugfabrik GmbH, Nürtingen: The auxiliary process times of the superfinishing machines of the UF series were reduced by 30 percent, making it possible to map a 2000 platform