

Reliable In-Process Burr Removal

Ford Geelong/Victoria: Deburring of Camshafts with Okuma and OrbiTool

Ford Australia needed a reliable and rapid method of deburring the intersections of cross-holes in camshafts. Their mechanical engineering partner, Okuma, came up with a thorough and cost-effective solution, which involved incorporating the OrbiTool deburring tool in the machine immediately after drilling. The challenging time and quality requirements set by the automobile manufacturer were comfortably met.

When Ford Geelong in Victoria, Australia, encountered an increasing number of engine problems, it quickly became clear that they were being caused by burrs in drilled holes, which can break off and jam the variable cam timing system. This significantly impairs performance and, in the worst-case scenario, may lead to engine damage. Okuma Australia Pty Ltd has long been a key supplier of production equipment to the Ford engine works in Geelong, Victoria, so Ford set out its requirements for eliminating the

cause of the damage and commissioned Okuma's experts to investigate possible solutions and present proposals. "The first solution we proposed was to maintain the existing drilling unit and to add a thermal deburring station", explains Leigh Milvain, the Technical and Engineering Manager of Okuma Australia Pty Ltd. "But we soon discarded the thermal option in favor of the solution using OrbiTool." The OrbiTool is a tool that allows intersecting holes to be drilled and then deburred on the same

Camshaft: the drill holes are clearly visible at the front end. Troublesome burrs form at the points where the holes intersect.



machine. The tool has a flexible shaft and a protective disc that reliably shields the hole as the tool is inserted. An orbital motion is then employed to remove the burrs and, where required, bevel the edges. In accordance with Ford's requirements, Okuma Australia Pty Ltd developed a turnkey solution involving a fully automated system with automated materials handling and a floor-to-floor time of around 60 seconds.



[Photo] An example of one of the Okuma machining centers used to drill holes and deburr them using the OrbiTool.

Profile

Okuma Australia Pty. Ltd

Okuma Australia is the exclusive dealership of the Japanese machine tool manufacturer for Australia and New Zealand. It employs around 40 staff, who develop user-specific solutions for the region's automobile industry and other companies.

The task at hand was to drill and deburr eight radial holes in the front grooves of a motor vehicle camshaft. The holes have a diameter of 4 mm and are drilled within two 5 mm-wide circular grooves having a root diameter of 28 mm. There are four holes in each groove. The rear holes break through into the axial holes on a PCD, while the front holes break through into the central bore.

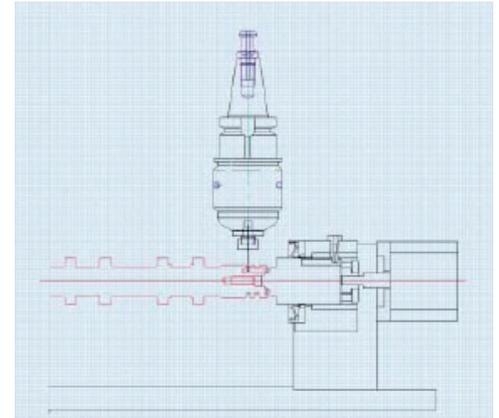
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"The first problem we had to solve was the initial positioning of the tool in the cell", explains Milvain. "After that it was relatively simple: we easily managed to feed in the component, drill and deburr the total of eight holes and unload the component within the prescribed time."

The system is based on a vertical Okuma MF-46 VA machining center. As the component is inserted, a vision system is used to take readings, and any misalignment of the axial hole pattern is taken into account and fed into the NC processing data as correction parameters. A Kirby drill is then used to make the radial holes, and the OrbiTool is used to ensure that the intersections of the cross-holes are free of burrs. If the quality of the drilled hole is uniform after drilling, then the OrbiTool can be programmed using a set routine to produce a finished part that meets the process requirements.



The next tool deployed after the drill is the OrbiTool, which enables reliable in-process removal of burrs within 2 s.



OrbiTool dual deburring tool: the flexible tool shank combined with the protective ring enables burrs to be removed without damaging the component.

Operating principle: the dual deburring tool also reliably removes all burrs at the sensitive interface of the two drill holes.



One aspect that must be monitored particularly carefully in this process is drill wear. If the drill is pushed too far in its tool life, the size of the attached swarf and the pushed burr that is generated when the drill breaks through into the central bore become too large for the OrbiTool to remove within the time restraints governing the whole process.

Optimum coordination with overall process

In designing the system, Okuma worked in close collaboration with the OrbiTool manufacturer JW Done (USA, distributed in Europe by VSH Hermann GmbH and Jakob AG Qualitäts-Werkzeuge). Different combinations of speeds, feeds, interpolations and the projection length of the deburring tool from the chuck were experimented with in order to achieve the final solution.

Extensive operational testing of the system was initially carried out at the Okuma Australia Pty Ltd Technical Center prior to installation and commissioning on the production line at the Ford facility. The time required for reliable in-process hole deburring is 2 s, and an OrbiTool has a tool life of approximately 8000 holes. Development of the overall process including drilling and deburring extended over a period of several months. Establishing the tool life of the Kirby drills was the single biggest problem. Extending the tool life of the drill inevitably caused problems with deburring quality.

"Even the most stubborn burr can be removed if you have enough time", explains Milvain. "But that was precisely the problem. Ford had specified very tight requirements with regard to total cycle time." The tool life of the drills was not therefore pushed to its ultimate extreme, since it was important to find the most

economical solution for the process as a whole.

"Due to the tight timeframe, we had to set the speeds and feed of the OrbiTool very progressively from the start", explains Milvain. "The parameters were changed several times until an acceptable result was achieved. Personally, I think that experimentation is the best way to find out what does and doesn't work."

In the end, they settled on a spindle speed of 12,000 rpm and a feed of 0.1 mm/revolution, and these parameters have not changed since. The process is now machining 240,000 components per year without any problems.

"I would recommend the OrbiTool to anyone that has a manufacturing issue with burrs at the intersection of cross-holes", sums up Milvain. "The tool provides a simple solution to a difficult problem."

User Verdict

The User:
Okuma Australia Pty Ltd,
Victoria

The Technology:
OrbiTool deburring tool

Advantages

- High process reliability
- Not dependent on machine operators "form on the day"
- Long tool life (8000 drill holes)

• Works in harmony with the Okuma Machining Center MF-46 VA

- Short cycle time
- Drilling and deburring in a single set-up
- Automated deburring
- No damage to component thanks to protective disc

Disadvantages

- None reported by user