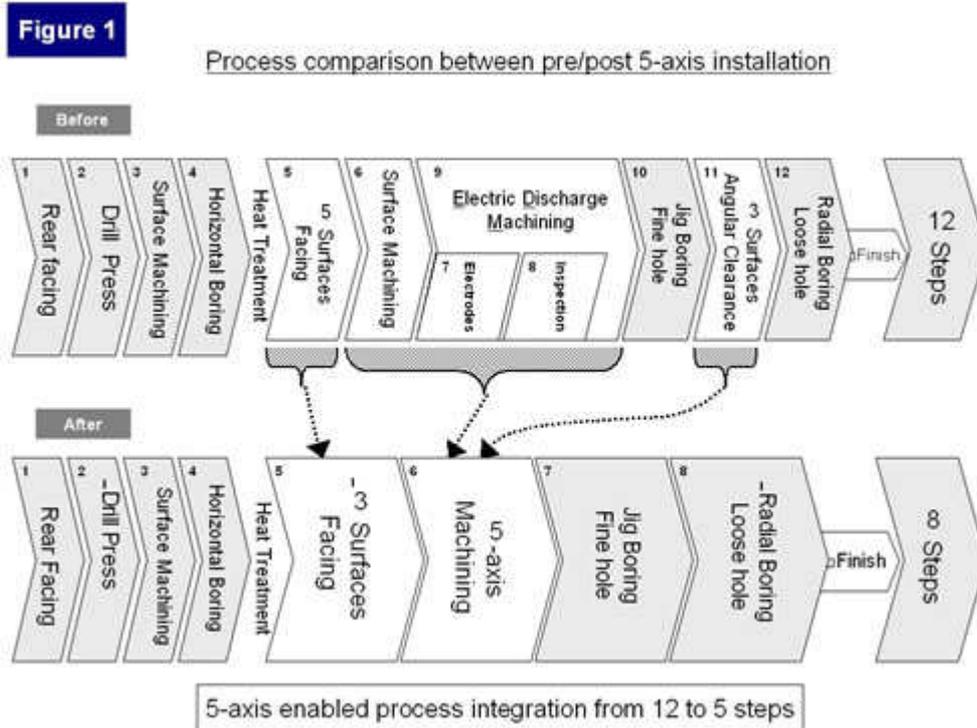


RYOBI reduces machining times by 30% with WorkNC Auto 5

RYOBI Limited, a manufacturer of die cast products, has its head office located in Hiroshima and its manufacturing plant in Shizuoka Prefecture, Japan. Formed in 1943, it supplies high quality die cast components for a wide variety of applications including electrical appliances, office automation, industrial machinery, tools for the building industry, and the automotive sector, producing parts such as gearbox casings and cylinder blocks. Additionally, the company produces finished products including power tools and printing equipment, and employs over 5,500 people across the Group.



WorkNC Auto 5 workflow

The Die Section of the Die Casting Division at the Shizuoka Plant had been using WorkNC since 2001 for 3-axis machining and positional 5-axis machining for die production. Because of the depth of the cavities, and the surface quality required, finishing operations necessitated the extensive use of electrodes. Concerns over the difficulty of creating 5-axis simultaneous toolpaths and the surface finish which they might produce, had previously prevented a move into simultaneous 5-axis machining. However, the high number of hours needed for the production of electrodes led the company to examine ways of machining more of the tool directly thereby cutting the overall production time.

Mr Ono of the Die Section explained the existing process, "The manufacturing process consisted of four machining operations, heat treatment, and then further finishing operations including EDM die sinking, cavity machining and jig boring, making a total of 12 operations." To achieve the savings it was looking for, RYOBI evaluated different production methods including ways of limiting tool length, improving surface finish, reducing machining times, and reducing the number of electrodes used by cutting more of each cavity on its machining centers. Mr Ono added, "Based on our studies we concluded that the adoption of WorkNC Auto 5 was the solution."

WorkNC Auto 5 automatically converts 3-axis toolpaths to 5-axis simultaneous toolpaths, taking into consideration the effective tool length, the geometry of the holder and the rotational limits of the machine tool. For maximum efficiency Auto 5 leaves 3-axis toolpaths unchanged where they can reach the part, optimising speed of machining, tool rigidity, and surface finish. With Auto 5 the process of generating 5-axis toolpaths is very simple as the software evaluates the 3-axis paths to be converted, performs a collision check and postprocesses the resulting toolpath with minimum operator intervention, eliminating much of the complexity associated with 5-axis programming. Mr Ono said, "Adopting Auto 5 enabled us to reduce five surface finishing processes to three, while electrode manufacture and EDM die sinking has been much reduced as we can machine the bulk of the cavity using 3/5-Axis toolpaths. The result is a reduction from 12 processes to 8."

RYOBI now uses Auto 5 starting at the re-roughing stage, using a small tool to pick out after the roughing operations. Mr Ono commented, "The parts which can be re-roughed from the top are machined with the Z-Axis only, and areas which cannot be reached are cut with simultaneous 5-Axis. This procedure has improved performance. We use the same method on the finishing operations to cut more of the mould by using 5-Axis toolpaths where necessary." He continued, "Due to the reduction in the number of operations, machine downtime is considerably lower, which shortens our lead times. In total, machining times have been reduced by around 33%. It goes without saying that labour costs are also much reduced."

Before introducing Auto 5 all the dies were machined using 3-Axis techniques. The programming used to take 55.5 hours, made up of 35.5 hours for programme preparation for operations after heat treatment plus 20 hours for programmes for electrode manufacture. With Auto 5, the preparation of 5-Axis simultaneous toolpaths only takes 8 hours, using the existing 3-Axis toolpaths as a starting point. This results in a total programming time of $35.5+8=43.5$ hours, producing a saving of approximately 20% compared with 3-Axis programming only. To test the advantages further, RYOBI programmed the same die using a combination of simultaneous, and positioning 5-axis methods. The preparation time was 46 hours, demonstrating that Auto 5 was still quicker.

Mr Ono concluded, "We have shown that simultaneous 5-Axis machining can be used successfully in the mould and die industry through our implementation of WorkNC Auto 5. New 5-Axis machines and controllers are coming onto the market, making the creation of their programmes much easier. We are committed to increasing our use of 5-Axis machining at RYOBI in collaboration with our business partners and Sescoi."