Machining

Deep-Hole Drilling

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ADO-30xD carbide drill with through-coolant holes eliminates frequent tool breakage in engine block production.

Hole drilling is a common manufacturing operation. Deep-hole drilling, however, presents a different level of difficulty. In general, a ratio of 5-to-1 or greater in depth versus hole diameter is considered as deep-hole drilling. Deep-hole drilling operations are challenging because of the confined environment that constraints chip evacuation and coolant delivery. Unstable chip generation and heat control may lead to tool breakage and poor surface finish, which can be very costly.

In the manufacturing of engine blocks, a variety of holes are required to be drilled. The largest holes are the cylinders, the small round orifices are mounting holes, and the small oval orifices are coolant or oil duct. The engine block is one of the most important components of the internal combustion engine. Commonly referred to as a cylinder block, the key function of the engine block is to contain and support parts of the engine, such as the piston, connecting rod, crankshaft, cooling circuit, etc. When a vehicle is running, high mechanical and thermal stress are applied on the engine block, which must withstand high forces, pressures, vibrations and temperatures. With safety in jeopardy, the quality of the holes drilled must meet the required tolerance. In one of the engine blocks that MWM Motores Diesel produces, two deep-holes at a depth of 405 mm and 8 mm in diameter are required to be drilled.

Founded in 1953, MWM is a leader in technology and development of Diesel engines in Latin America. In 2005, MWM became a part of the North American Navistar Engine Group. MWM has plants in Sao Paulo, Brazil and Jesus Maria in Cordoba, Argentina. MWM's products serve the vehicular, agricultural, industrial, power generation and maritime segments. In addition to the traditional Diesel engines, MWM also offers a complete portfolio of spare parts well over 16,000 items. Today, the company exports to over 45 countries in South America, North America, Central America, Europe, Asia, Africa and Oceania.

MWM has been producing the Acteon engine block since 2011 and manufactures approximately 3,800 blocks annually.

MWM's plant in Sao Paulo, Brazil has approximately 83,000-square-meter of production floor space and employs 1,250 staff. MWM Process Engineer Tarcisio Bottaccini, who is in charge of MWM's Acteon engine block production, was troubled by frequent tool breakage during machining, which resulted in repeated rework of the part. The Acteon engine block is made of gray cast iron GG25. MWM has been producing this part since 2011 and manufactures approximately 3,800 blocks annually. Each part requires the drilling of two 8 mm diameter through-holes at a depth of 405 mm. The accuracy tolerance must lie within ± 0.1 mm and requires a surface roughness of Rz 63.

MWM uses a Heller MCH 350 five axis horizontal machining center for the application with an HSK-100 toolholder and soluble oil for the coolant. MWM was originally using a competitor 8 mm diameter carbide drill with through-coolant with unstable performance. As an existing OSG client with proven successes in other applications, Bottaccini decided to consult with OSG Sales Technician Valdir Lima to seek processing improvement.

Upon a detailed evaluation of the application, Lima recommended OSG's ADO 30xD 8 mm diameter next generation high-performance carbide drill. The ADO series is OSG's premium line of carbide drills with through-coolant. Standard stock is available from 3xD up to 50xD. The ADO's unique flute specification with smooth chip evacuation and high tool rigidity qualities are engineered for optimum performance in ultra deep-hole applications. Especially critical in MWM's application, the ADO's capability to break chips into small and manageable pieces stably provides a great advantage versus the competitor tool.

MWM Process Engineer Tarcisio Bottaccini inspects the 8 mm diameter ADO 30xD next generation high-performance carbide drill.

MWM ran the competitor carbide drill at Vc 80 m, a feed rate of 0.08 mm per revolution, and obtained an average tool life of 40 minutes. The ADO drill, on the other hand, is able to excel at Vc 100 m, increase feed rate to 0.12 mm per revolution, and extend tool life to 60 minutes. In addition to being able to eliminate the headache of frequent tool breakage, MWM is able to generate a 33 percent savings by implementing the ADO drill. With reliable tooling, MWM is able to turbocharge its engine block production with excellent quality consistently and economically.

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