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Motorcycle cylinder head machining: reduce scrap and increase machine productivity

Reduce scrap

Increase productivity

Increase profit

Overview

The global market for motorcycles continues to grow, with an estimated 100 million units currently in use. In this expanding market, it is imperative that manufacturers of high-volume motorcycle components reduce scrap and maximise machine productivity to meet the growing demand, as well as increase profits.

Manufacturers of motorcycle cylinder heads use CNC machining centres for high-volume, small-tool drilling and tapping operations. Such light machining operations are at risk of high tool breakage rates, resulting in potentially significant scrap volumes and related costs. High scrap also results in significant non-productive time in terms of rework and machine down-time.

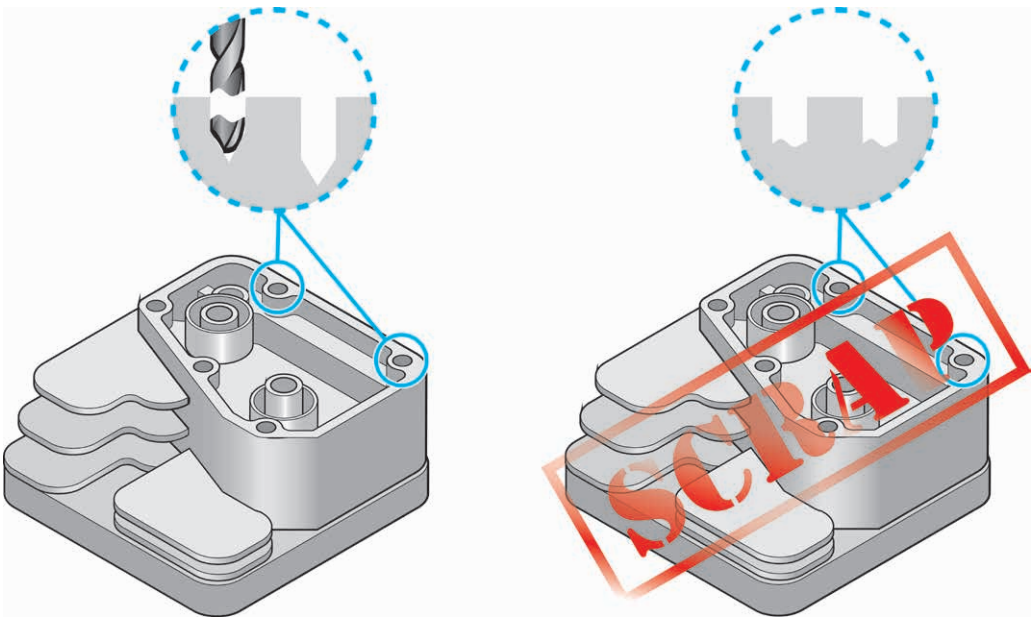
Typical process

A factory producing 4,000,000 cylinder heads per year uses 400 CNC machine tools to machine aluminium castings.	Light machining operations on all sides of a casting includes milling, boring, spot facing, drilling and tapping using 10–15 different tools (depending on engine model).	Multiple 4.5 mm and 5.5 mm drilled and tapped holes are machined for assembly purposes.

Challenge

1 **Reduce scrap and costs**

With large volumes of high-value components being produced, minimal scrap rates are essential. Due to the high frequency of drilling and tapping operations, tools are often broken. These fully automated machining cycles lead to broken tools going undetected, creating scrap and wasting machining time. For this manufacturer, a scrap rate of 1.26% requires production of an additional 50,400 parts to meet demand. For a part valued at $15, the additional cost due to rework is more than $750,000 per annum.

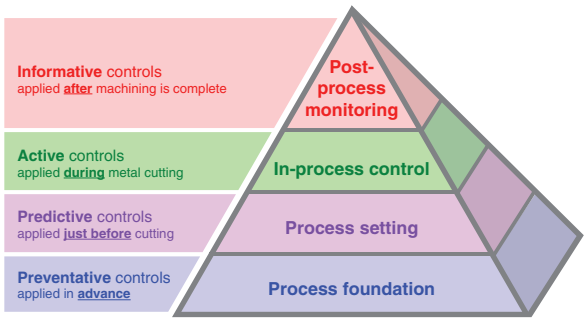


Process considerations

Renishaw engineers considered key elements within a customer's process and production stages of high-volume cylinder head manufacturing using Renishaw's ***Productive Process Pyramid™***. This framework is used to identify and control the variations that can occur at key stages of the machining process.

For more information, please visit the **When do I probe?** section of the Renishaw website:

www.renishaw.com/en/whendoiprobe



Productive Process Pyramid

Solutions

Manufacturing process focus: in-process control

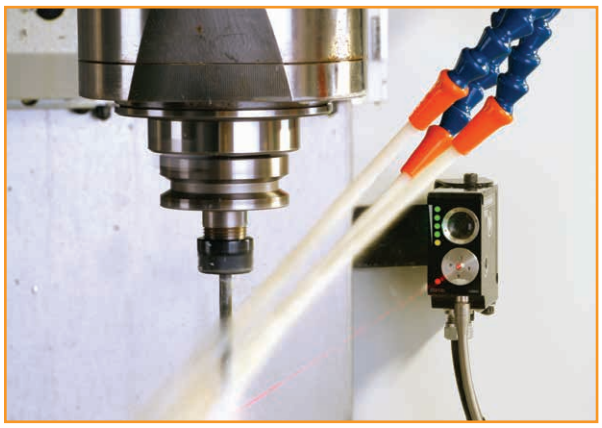
Focusing on in-process control, Renishaw engineers introduced measures to dramatically reduce non-productive time.

With the TRS2 non-contact laser system providing the machine tool with a layer of intelligence, the condition of a rotating tool during a machining cycle can be automatically and efficiently identified. When a broken tool is detected the machine will stop, preventing potential damage to subsequent components. Alternatively, the machine will automatically call up a sister tool to safely continue machining.

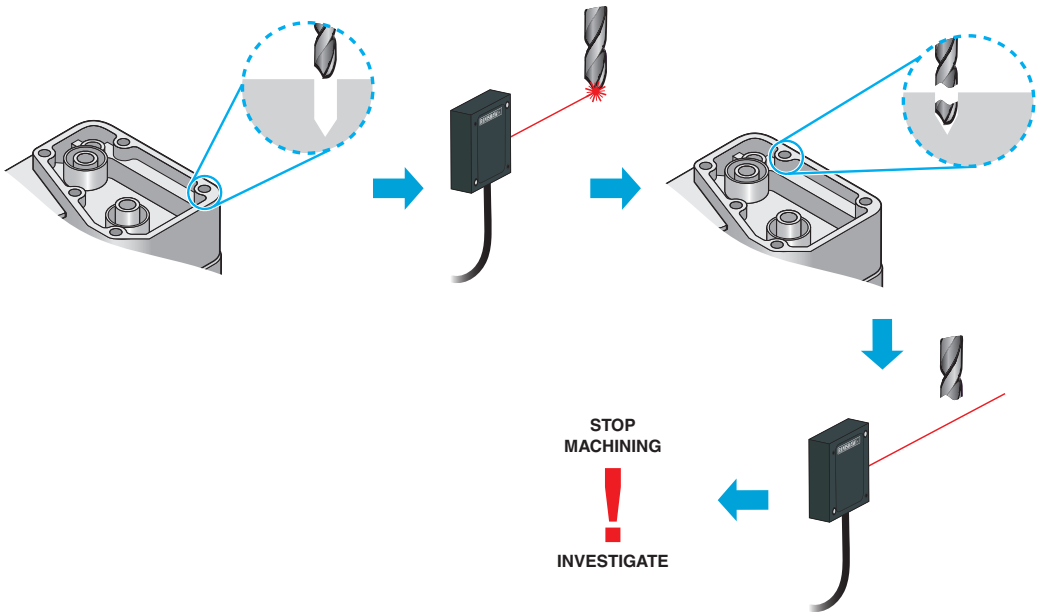
A fast and effective tool recognition system allows a company to:

- **Improve process efficiency**
- **Increase productivity**
- **Reduce overall investment**

Renishaw tools in use



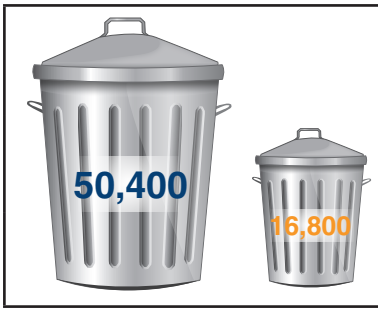
TRS2 non-contact tool recognition system in use



Typical results

The industry-specific charts below compare scrap rates before and after the introduction of a Renishaw tool recognition system. These values are based on a conservative average of just one tool breakage per week per machine, where machine utilisation is 42 weeks per year. Each unrecognised broken tool leads to three scrapped parts.

Reduced scrap



	Without TRS2	With TRS2	Reduction
Broken tools	16,800	16,800	
Scrap rate	1.26%	0.42%	66.67%
Scrap	50,400	16,800	33,600

Increased savings

	Without TRS2	With TRS2	Saving
Part cost US$	15	15	
Bad parts	50,400	16,800	33,600
Cost of scrap US$	756,000	252,000	504,000

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Summary

Process controls applied to cylinder head manufacturing using the Renishaw TRS2 tool recognition system provide a cost-effective method of significantly reducing scrap. Subsequent reductions in rework time and costs enable significant savings and increased productivity. When machines and man-hours are not monopolised by rework, valuable resource can be reassigned for new work or utilised to meet the increase in demand.

A fast and reliable method of detecting broken tools using Renishaw systems enables manufacturers of high-volume motorcycle components to:

- **Enhance machining capability, and enable new market opportunities**
- **Increase productivity and throughput of existing assets**
- **Reduce delivery times and improve customer relations**
- **Increase profits**

Contact

To find out how you could benefit from our process control solutions, contact us today – find your local office at

www.renishaw.com/contacts

Customer comment

"Renishaw probing systems encompass the best productivity solutions, which are impeccable and highly dependable. These solutions are also extremely versatile, ensuring that the company is on the right track. Renishaw has been a trustworthy partner in providing a complete solution and transforming our manufacturing process."

Best practice

Productive Process Patterns™ from Renishaw provide guidance on best practice and the implementation of a wide range of probing solutions.

For more information regarding job set-up and other applications, visit **www.renishaw.com/processcontrol**

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About Renishaw

Renishaw is an established world leader in engineering technologies, with a strong history of innovation in product development and manufacturing. Since its formation in 1973, the company has supplied leading-edge products that increase process productivity, improve product quality and deliver cost-effective automation solutions.

A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Products include:

- Additive manufacturing and vacuum casting technologies for design, prototyping, and production applications
- Dental CAD/CAM scanning systems and supply of dental structures
- Encoder systems for high-accuracy linear, angle and rotary position feedback
- Fixturing for CMMs (co-ordinate measuring machines) and gauging systems
- Gauging systems for comparative measurement of machined parts
- High-speed laser measurement and surveying systems for use in extreme environments
- Laser and ballbar systems for performance measurement and calibration of machines
- Medical devices for neurosurgical applications
- Probe systems and software for job set-up, tool setting and inspection on CNC machine tools
- Raman spectroscopy systems for non-destructive material analysis
- Sensor systems and software for measurement on CMMs
- Styli for CMM and machine tool probe applications

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