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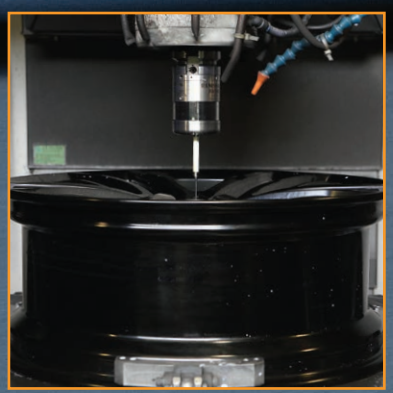
Forged alloy wheel production: delivering high-precision parts through in-process gauging

Reduce cycle time

Eliminate scrap

Improve accuracy



Overview

Company information	SuperAlloy Industrial Company Ltd. (SAI) is an international company specialising in engineering and manufacturing lightweight metal products.		
	The company is headquartered in Taiwan, with sales and support offices in United States of America, United Kingdom, Germany, China and Australia.		
	Tier-one supplier to the following automotive brands: Audi, Bentley, BMW, Chrysler, Ducati, Ferrari, Ford, Honda, Jaguar, Land Rover, McLaren, Mercedes-Benz, Porsche and Toyota.		
Products and services	Engineers and manufactures lightweight metal products for automotive and aviation industries.		
Industry accreditation	TUV TS 16949	TUV OHSAS 18001	AS 7003 NADCAP Material testing
	BV AS 9100C	TUV ISO 14001	JWTC VIA-JWLT-20191019
Company objectives	Deliver customer value by producing high-quality products that are competitively priced.		
	Provide all customers with expert management services to build and sustain relationships.		
	Maintain growth through continuous development and refinement of products.		

Process

High-quality, forged aluminium wheels are manufactured to strict industry standards. Over 200 types are produced, resulting in a highly complex – low-volume, high-diversity – production environment. Six hundred CNC machine tools (150 Victory Taichung lathes and 450 YCM mills) are engaged in a three-shift pattern, five days per week.

Challenges

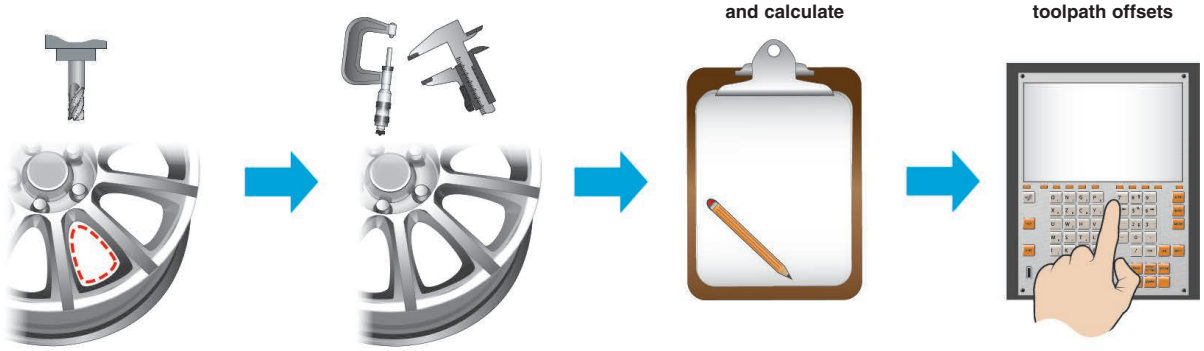
1 Increase product quality

Automotive manufacturers have extremely high expectations when it comes to the quality, dimensional stability and accuracy of their alloy wheels. SAI was able to meet the volume requirements placed on them, but the quality of their finished product needed to improve.

2 Reduce cycle times and rework

In recent years, wheel styling has moved from flatter 2D designs towards more complex 3D styles. The tighter tolerance requirements associated with these 3D designs has gradually increased cycle times. In order to achieve the necessary accuracy, SAI was stopping the machining process at various stages to manually measure key dimensions. This was a time-consuming and error-prone practice. Manually calculating and updating tool offsets, combined with remachining, meant that processing a complete wheel took up to 240 minutes, with the final 3D appearance process taking 27 minutes.

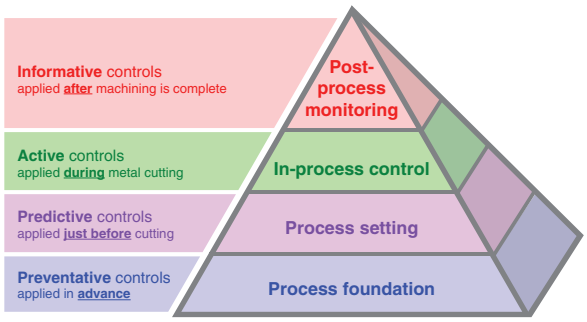
1. Machine feature **2. Manually measure feature** **3. Manually record dimensions and calculate** **4. Manually update toolpath offsets**



Process considerations

Renishaw engineers considered key elements within SAI's process and production stages of 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: process setting and in-process control

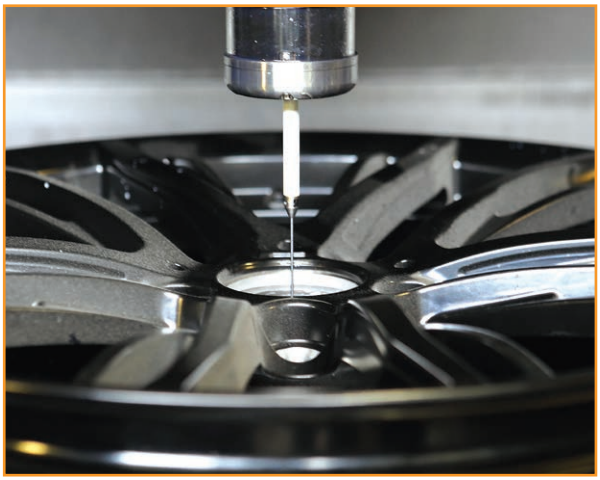
Focusing on process setting and in-process control, Renishaw engineers introduced measures which have dramatically improved product quality and reduced the overall cycle time.

The introduction of the Renishaw RMP60 probing system has significantly increased finished component accuracy, as the position of each part can now be checked before any machining takes place.

The ability to automatically measure key features during the cutting process has resulted in a 48% reduction in the 3D appearance processing time. The real-time size/position of key features can now be fed back to the CNC control automatically, allowing toolpath offsets to be updated if necessary.

As a result, the manual, time-consuming and error-prone methods previously used to control the process are no longer required.

Renishaw tools in use



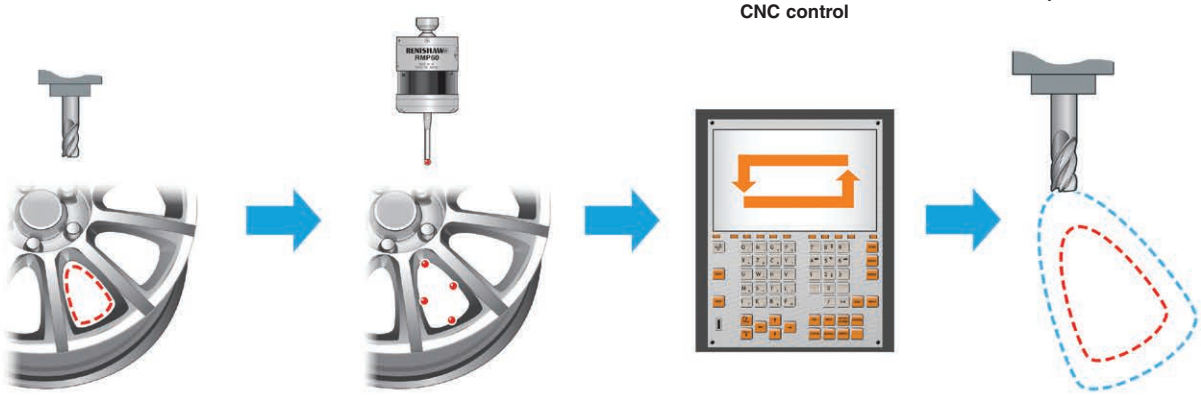
RMP60 measuring the alloy wheel mounting surface

1. Machine feature

2. Automatically measure feature

3. Automatically feed back size/position to CNC control

4. Automatically update toolpath offsets



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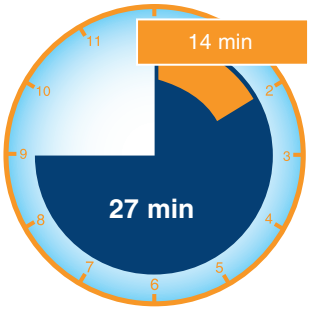
Typical results

These charts provide a typical illustration for this industry application where probing has been introduced.

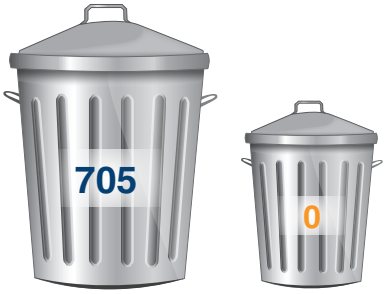
Reduced 3D appearance processing time*



	Without probing	With probing	Saving
Time/ component	27 min	14 min	13 min

* Including set-up and machining time

Eliminated scrap



	Without probing	With probing	Difference
Scrap rate	3%	0%	-
Scrap parts/ annum	705	0	-

Increased savings

	Without probing	With probing	Saving
Cost/ component NT$	275	143	132
Total cost of scrap NT$/ annum	193,875	0	193,875

Improved component tolerance

	Without probing	With probing	Improvement
Component tolerance	±0.05 mm to ±0.1 mm	±0.02 mm	0.03 mm to 0.08 mm

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Summary

The introduction of the RMP60 probing system has added new layers of control before and during the metal cutting process, significantly improving manufacturing performance.

Before the Renishaw system was introduced, operator error meant that wheels typically needed to be machined twice in order to achieve the necessary component tolerance of ±0.05 mm to ±0.10 mm. The 3D appearance machining process was time-consuming and inefficient, with scrap rates of 2–3%. With the Renishaw system now fully embedded into the manufacturing process, rework has been reduced by 80%, scrap has been eliminated, 3D appearance processing time has been reduced by 48% and the component tolerance of less than ±0.02 mm is now achievable.

Additionally, the new capability has helped the company to:

- **Increase automation and reduce human intervention**
- **Extract more throughput from their existing machinery**
- **Reduce delivery times and improve customer relations**

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

> "Through Renishaw, we discovered machine tool probe measurement solutions that could deliver in-process measurement control and real-time data feedback on our existing CNC machines, thereby providing effective precision manufacturing control. This was a massive help in terms of increasing production efficiency and precision."

SAI SUPERALLOY

SuperAlloy Industrial Company Ltd. (Taiwan)

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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H-2000-3805-01

Part no.: H-2000-3805-01-B
Issued: 07.2016