Case Study

Transmission Valve Body
Where a Micron matters
Case Study

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Conclusions

• Utilizing the Coherix ShaPix surface measurement system an OEM Manufacturing Engineering and Heller Machine developed the surface milling operation of a valve body in 4 days and only needed to cut 6 parts.
• Part #1 was cut and had an overall flatness of 89.2 microns.
• Process and tooling improvements were made with subsequent parts.
• By part #6 the overall flatness had been reduced to 17.8 microns.
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Background

- Machining process development and tool development for the Valve Body was being conducted at Heller Machine Tool in Troy, Mi.
- This development was conducted between 3/31/2008 and 4/3/2008 a 4 day time period.
- There was a Coherix ShaPix measurement system available for surface analysis.
- No cubed parts were available from the casting supplier so the cubing operation was performed first.
- Measurements were made with the parts still attached to the adapters.
- Overall flatness specification for the valve body is 100 microns.
Cubed Valve Body

Overall Flatness = 51 microns

Cubing performed with circular cutter
20 Teeth 125mm diameter 3 pass operation
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Process Development

- Part # 1 was cut with the following parameters
  - *Fly cutter*
  - *Inserts 5/10*
  - *50 bar clamping pressure*
  - *26 Nm torque*
  - *50% feed rate*
  - *50% speed*
Valve Body Part #1

Overall Flatness = 89.2 microns

Feed Direction
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Process Development

• By observing the part shape and cutter path and marks with the Coherix ShaPix output the engineers determined that there was a need to reduce the pressure of the clamping.

• Examination of the cutter marks in the ShaPix 3D image indicated that a change in insert geometry was called for and 2/3 inserts replaced the 5/10 inserts on the fly cutter.

• Part #2 was cut with the following parameters
  – *Fly cutter*
  – *Inserts 2/3*
  – 20 bar clamping pressure
  – 26 Nm torque
Valve Body Part #2

Overall Flatness = 37.3 microns

Feed Direction
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Process Development

- Further reductions in overall flatness were obtained by reducing the torque from 26 Nm to 20 Nm.
- Parts #3 and #4 were cut with the following parameters
  - Fly cutter
  - Inserts 2/3
  - 20 bar clamping pressure
  - 20 Nm torque
Valve Body Part #4

Overall Flatness = 32.1 microns

Feed Direction
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Process Development

• Clamping pressure was reduced to 15 bar and torque was reduced to 15Nm.
• The feed direction was moved 90 degrees to get even further reductions in flatness levels.
• Parts #5 and #6 were cut with the following parameters
  – Fly cutter
  – Inserts 2/3
  – 15 bar clamping pressure
  – 15 Nm torque
  – New feed direction
Valve Body Part #6

Overall Flatness = 17.8 microns

Feed Direction
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Results

• 4 days elapsed time
• Reduction in overall flatness from 89.2 microns to 17.8 microns
• Only 6 parts were cut to achieve the results
• Process and tooling improvements were obtained by visualization of the part surface using the Coherix ShaPix technology