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Chatter marks in external and groove turning

Surface examples of vibration problems

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Vibration problems in external and groove turning

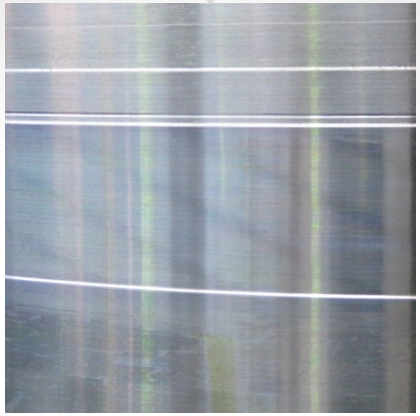
Influence on the surface quality :

Tool geometry
Type, orientation of the cutting edges, influence of the cutting fluid

Process parameters
Speed, feed, infeed

Static stiffness
Tool deflection due to the static part of the cutting force

Dynamic flexibility / resonance
Chatter vibrations due to structural weakpoints (natural vibrations)



External vibration sources
Motors / aggregates / traffic

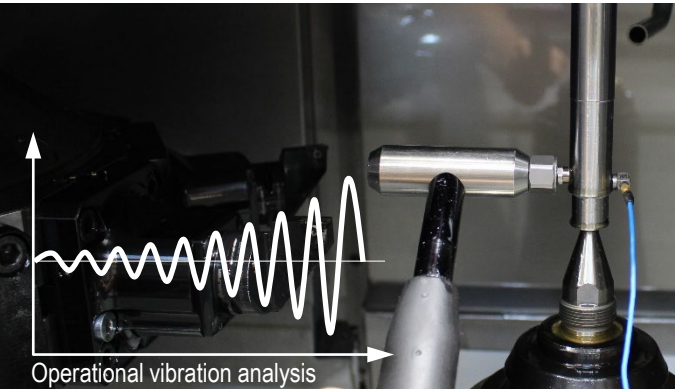
Other errors
Control / special cases

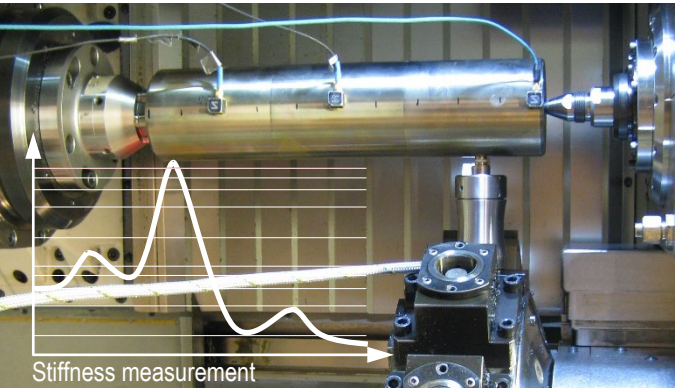
Characteristics of the turning process:

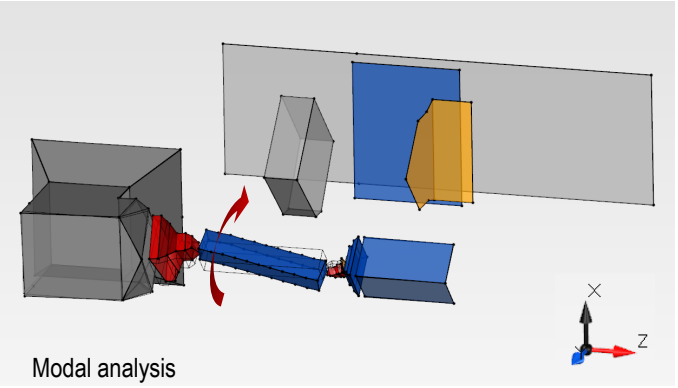
- Chatter vibrations can occur very suddenly (small workpieces) or develop slowly over a large number of revolutions (e.g. hard turning of large diameter bearing rings)
- Regenerative effect possible by overturning the waviness of the last cut/revolution
- Chip width and tool geometry have a significant impact on dynamic stability
- Widely overhanging, flexible workpieces pose a risk of chatter vibrations during turning
- Processes with high cutting rigidity (e.g. hard turning) are sensitive to dynamic structural weakpoints
- Various causes on the tool, workpiece, machine or process side

Chatter marks in external and groove turning - surface examples of vibration problems

Analysis and recommendation of improvement measures


Operational vibration analysis


Stiffness measurement



Modal analysis

Examples of chatter surfaces:

- Images of different chatter problems help to classify your surface problem
- The following examples show surface patterns of complex vibration problems. The interpretation and solution of these problems belongs to our specialties.
- Examples of other processes (milling / drilling / turning / grinding) can be found at: *https://www.planlauf.com/en/measurement/diagnosis-of-chatter-marks*

Our solution:

- **Competence** - More than 15 years of experience in machining error analysis
- **Fast problem analysis** - short-term problem investigations worldwide on your machine
- **Independent measurements** – metrological vibration, stiffness and modal analyzes to help manufacturing companies to avoid vibration problems
- **Well-founded recommendations -** Computationally verified suggestions for optimizing the stiffness and damping of critical process-machine combinations

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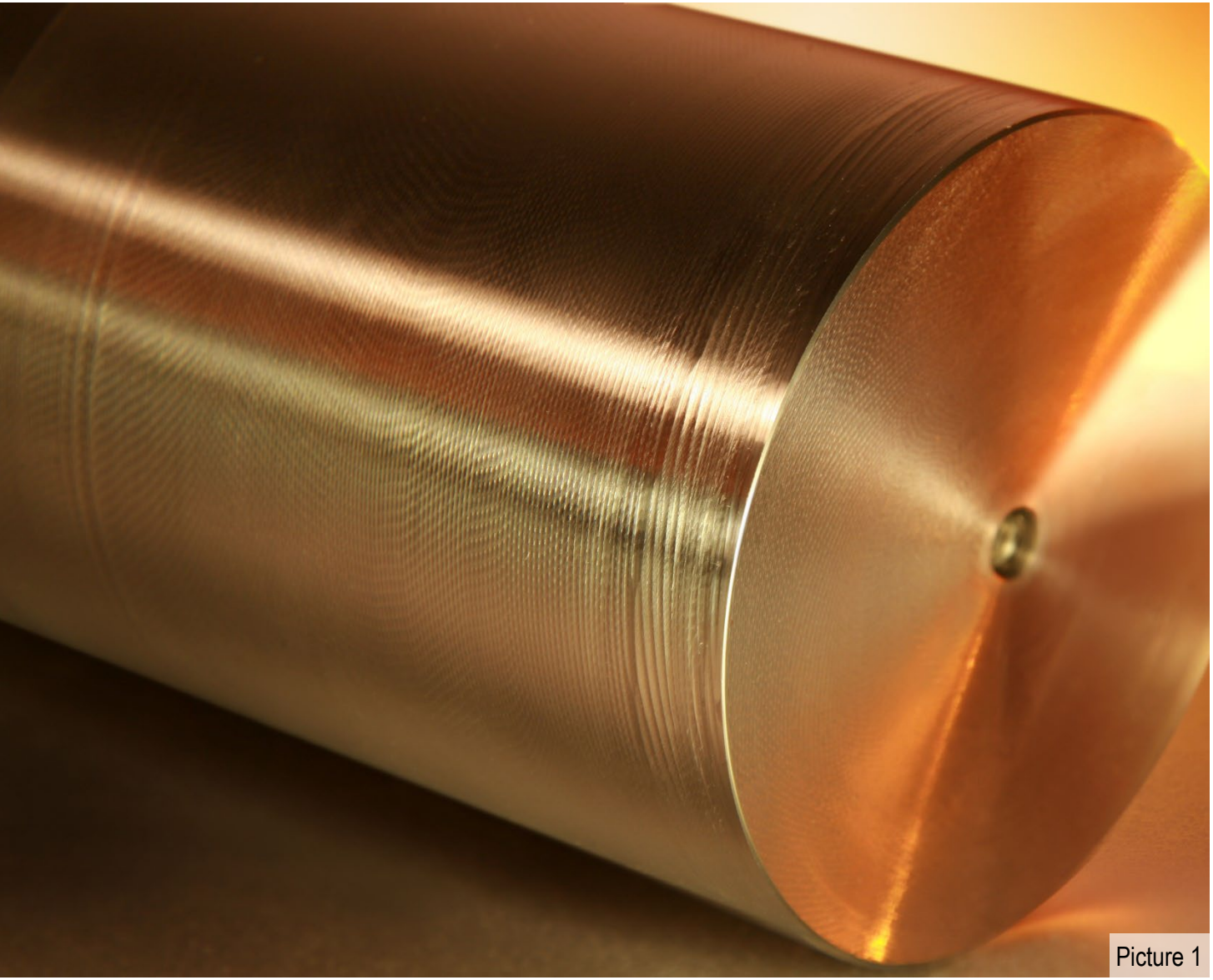
Surface examples

Chatter marks during external turning

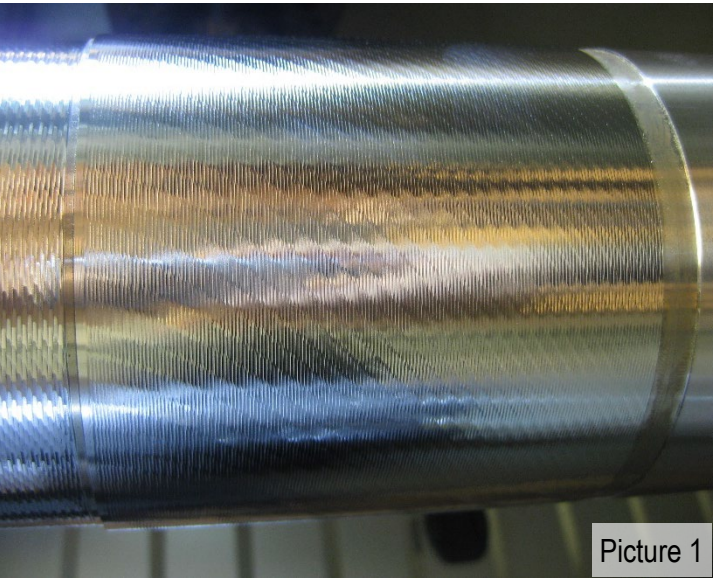


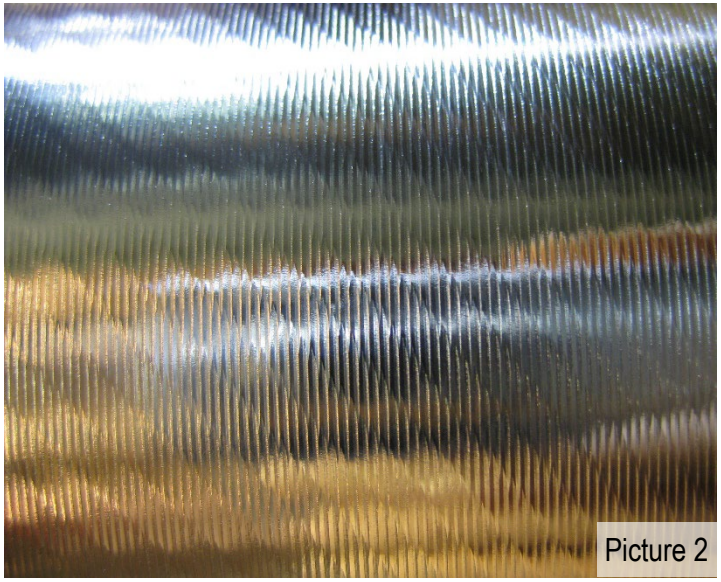
Picture 1

Picture 1

- Typical chatter marks in external turning

Vibration pattern in external turning


Picture 1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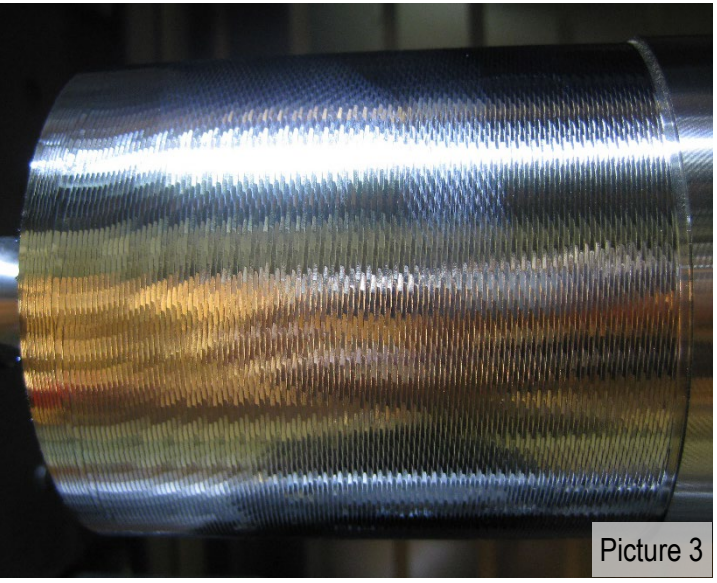
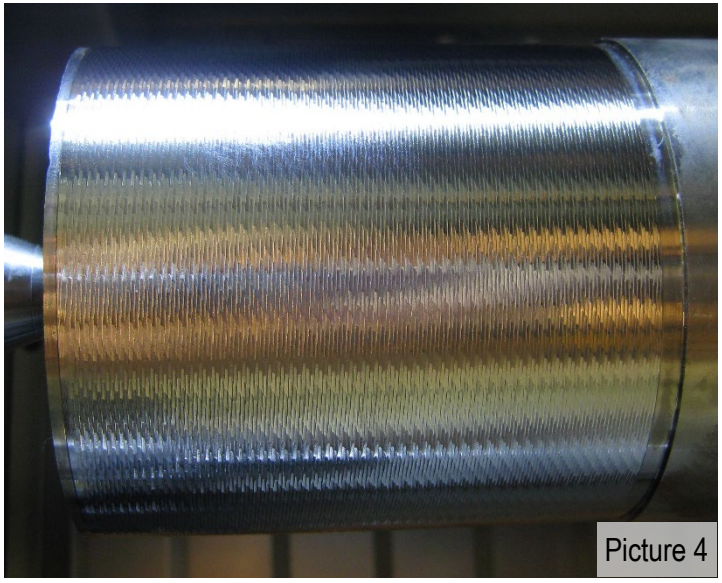

Picture 3


Picture 4

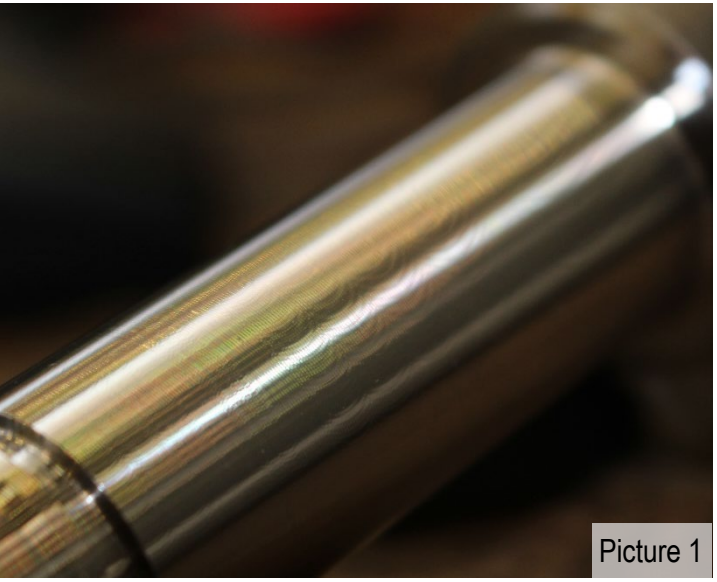
Picture 1 - 2

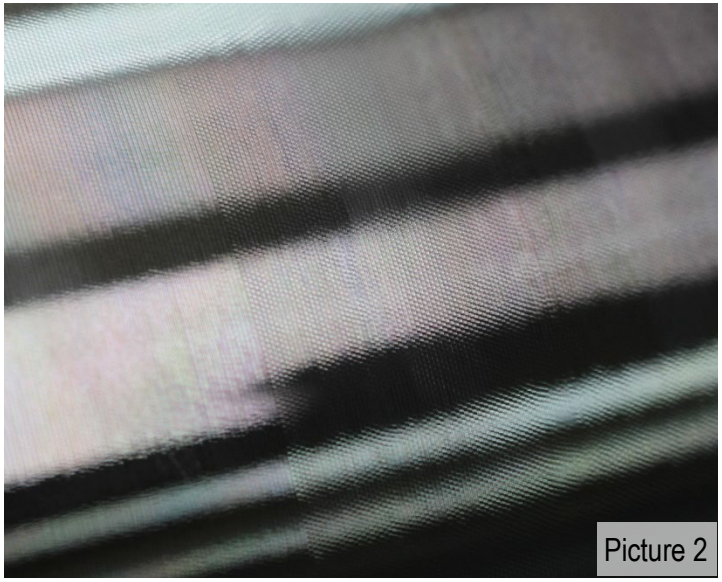
- Chatter vibration during external turning causes a pattern with varying pitch

Picture 3 - 4

- Despite the same cause, the chatter mark image can change significantly depending on the parameters

Chatter marks during external turning


Picture 1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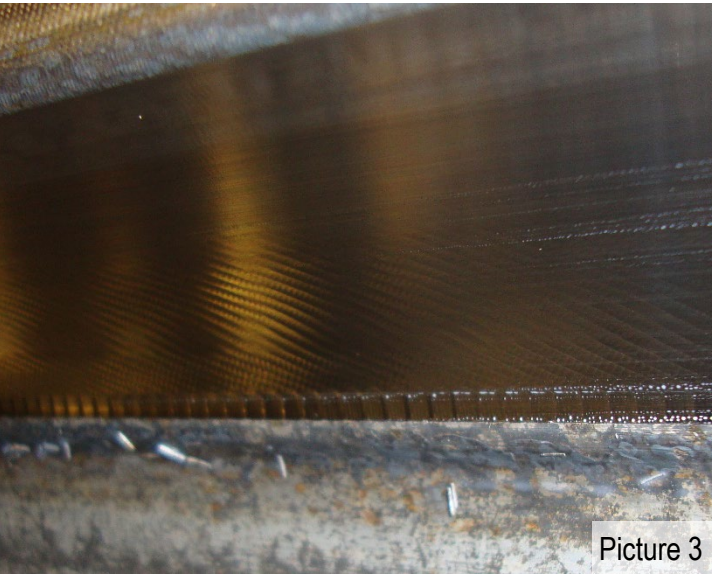
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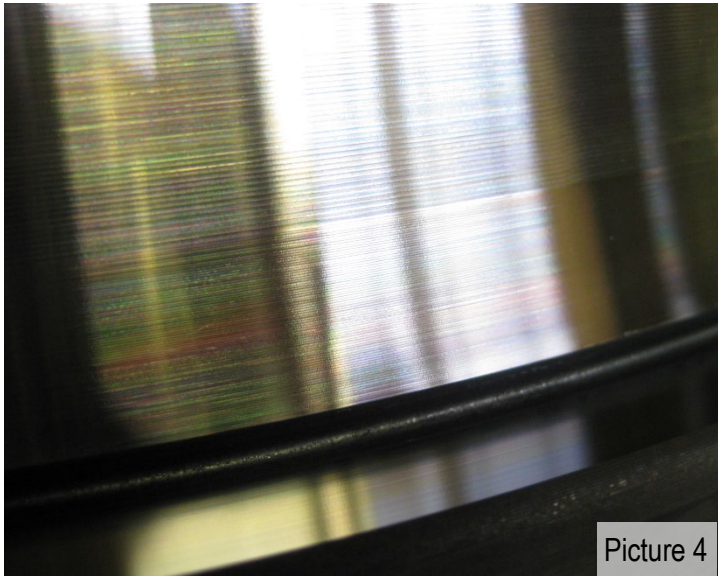

Picture 4

Picture 1

- Wavy surface patterns in hard turning

Picture 2

- Extreme short waviness in external turning

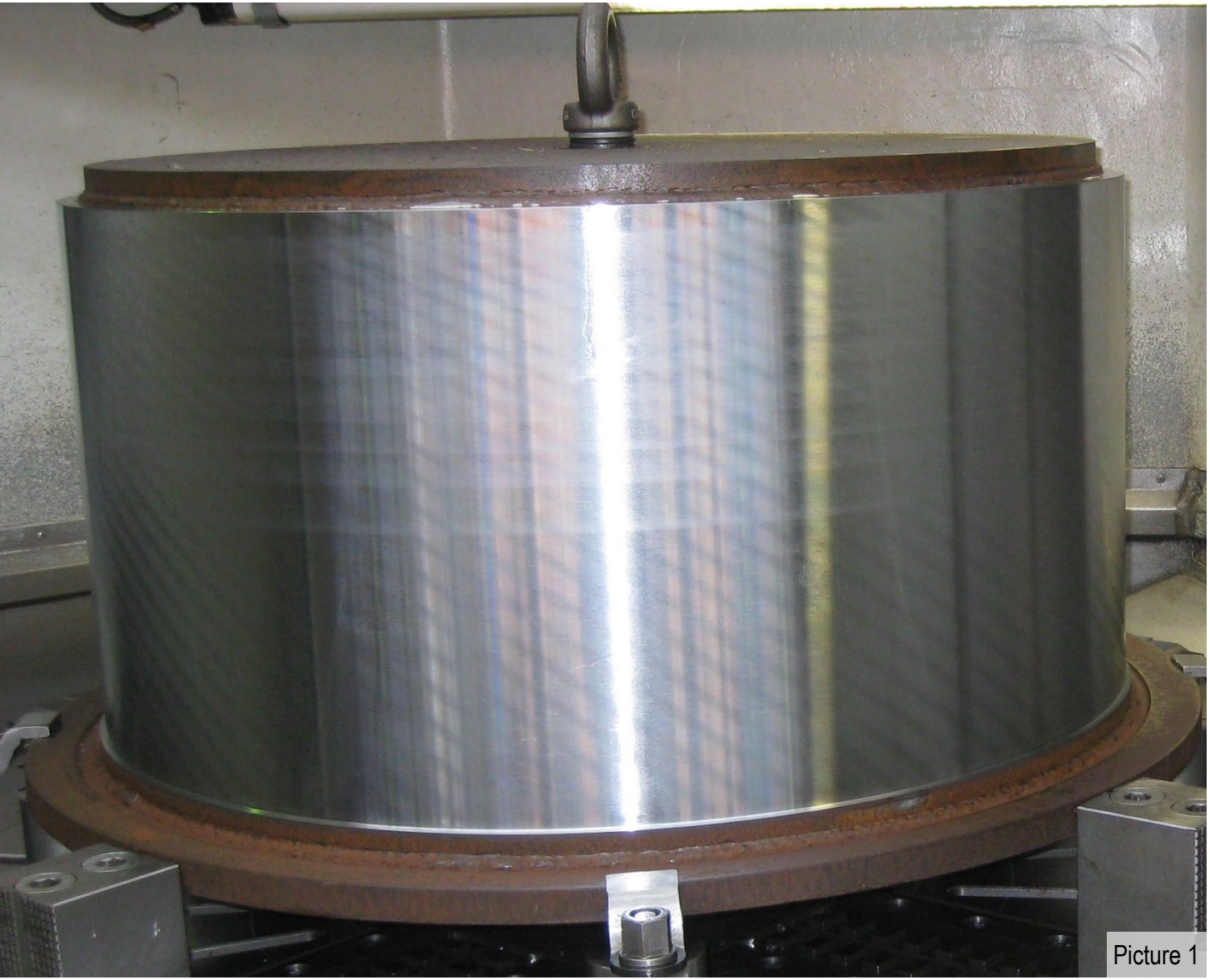
Picture 3

- Chatter marks as an oblique beat pattern when rotating large diameter bearing rings

Picture 4

- Vibrations when hard turning the raceways of large diameter bearing rings: Chatter marks are similar to feed grooves with a very large distance

Uniform vibration pattern after external turning

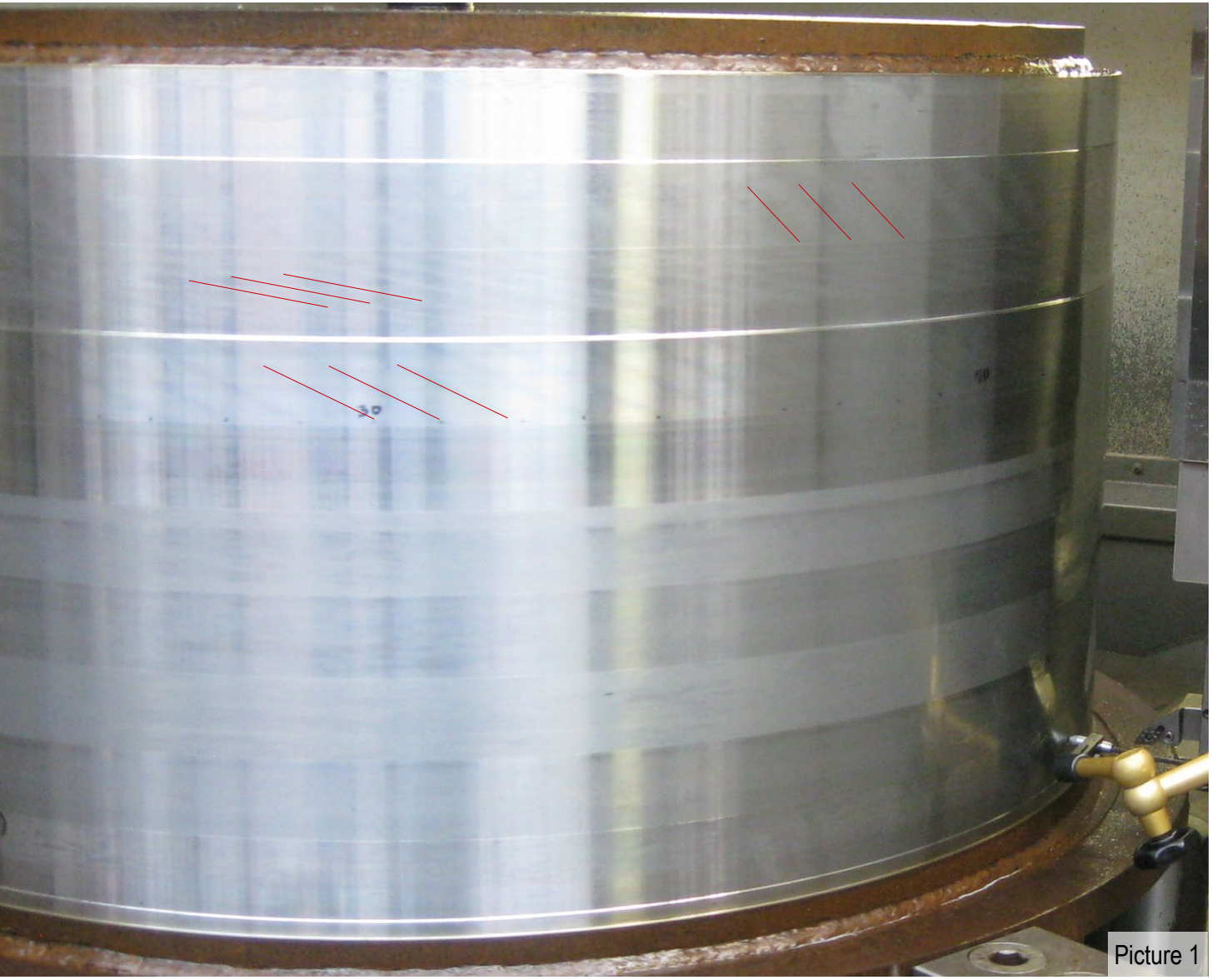


Picture 1

Picture 1

- Result of vibration after external turning with low feed and constant speed.
- The waviness is very low and can hardly be measured in the roughness area, but is clearly visible (oblique streaks)

Wave formation with different pitches during external turning

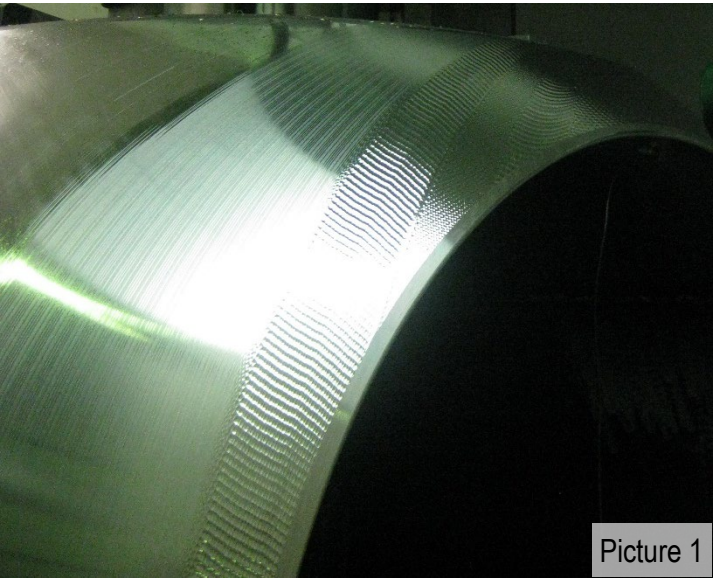


Picture 1

Picture 1

- Influence of different speeds on the vibration pattern

Special case: Chatter marks during spherical turning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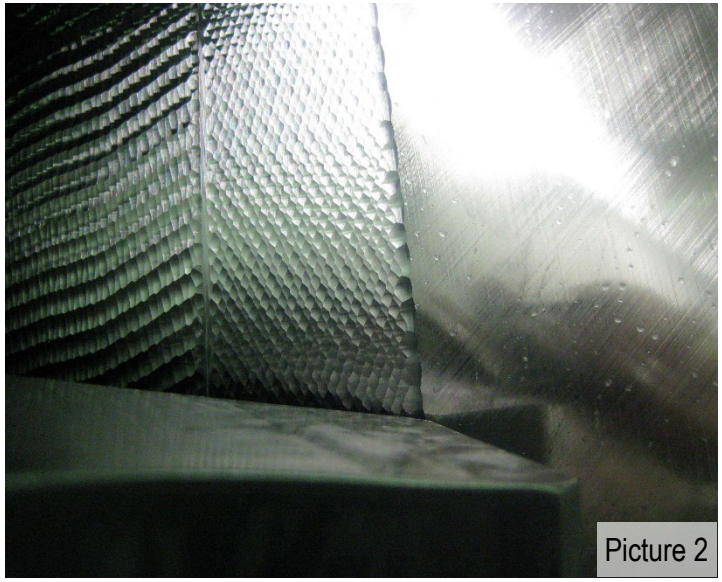
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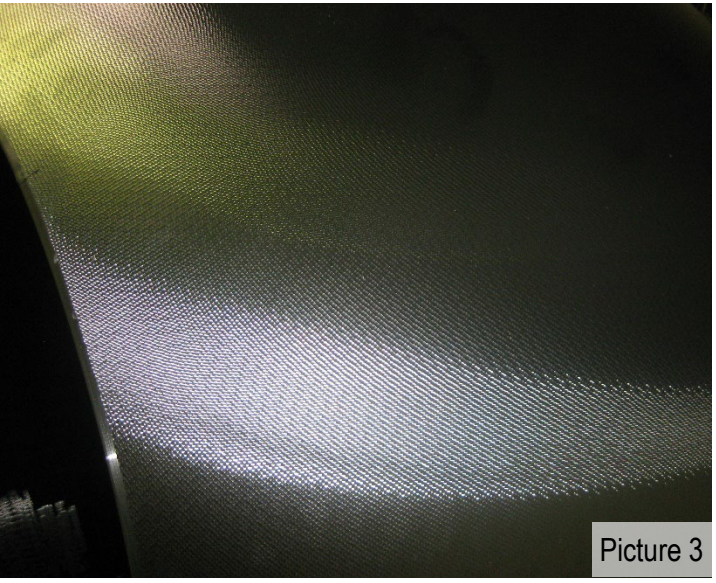
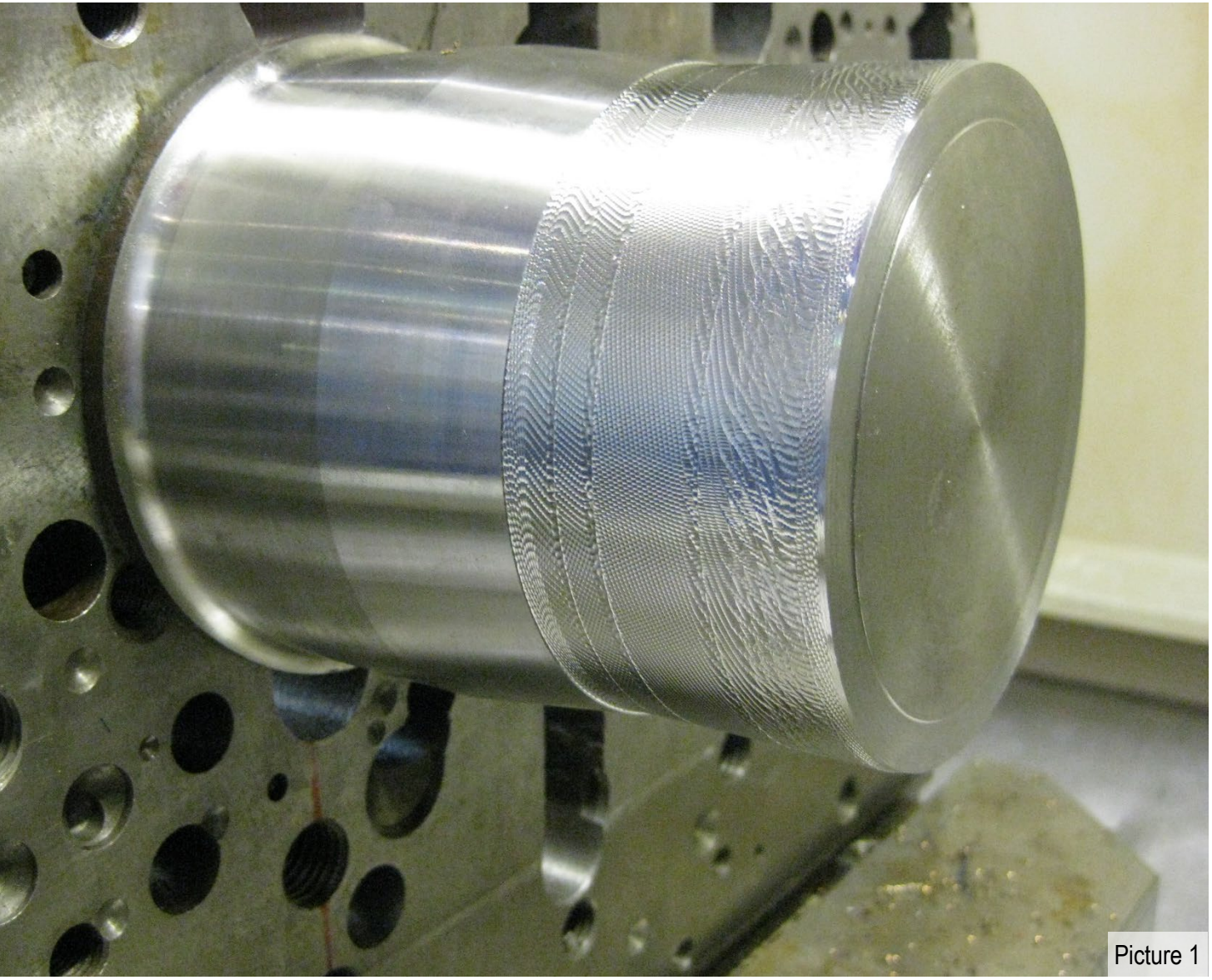

Picture 3

Picture 1 - 3

- Turning-milling process on a spherical workpiece (pipeline ball valve)

Special case: Machining with rotating tool

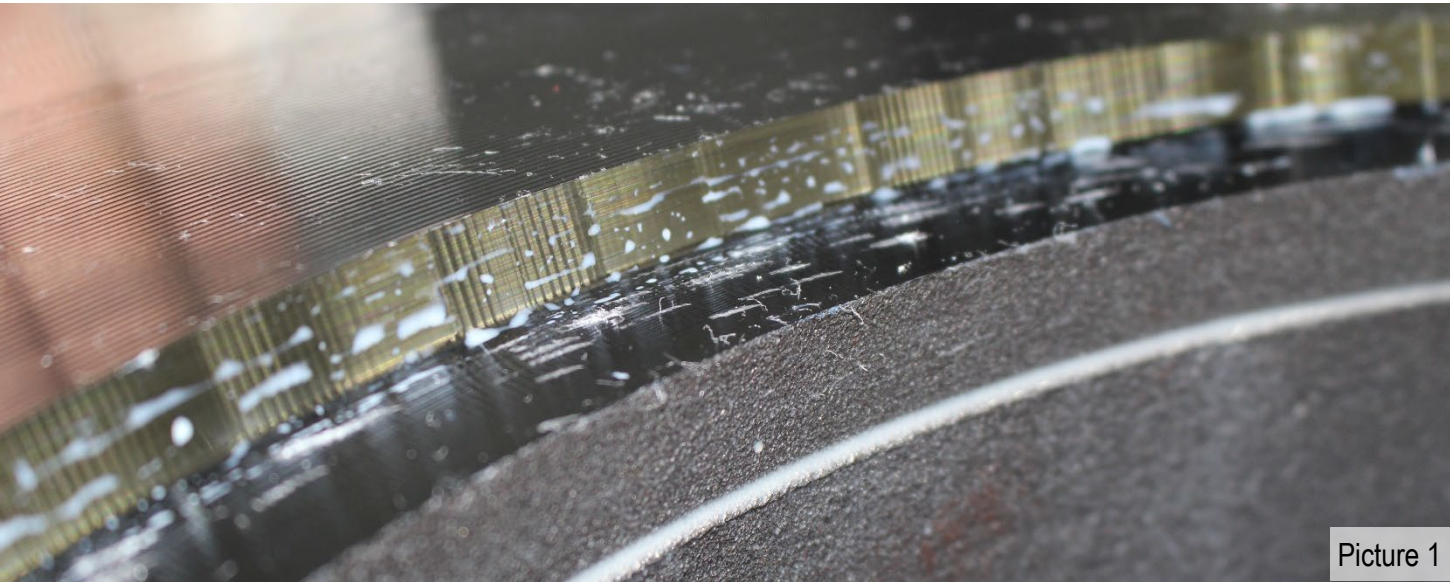


Picture 1

Picture 1

- Chatter marks when using a rotating special tool

Facets after groove turning



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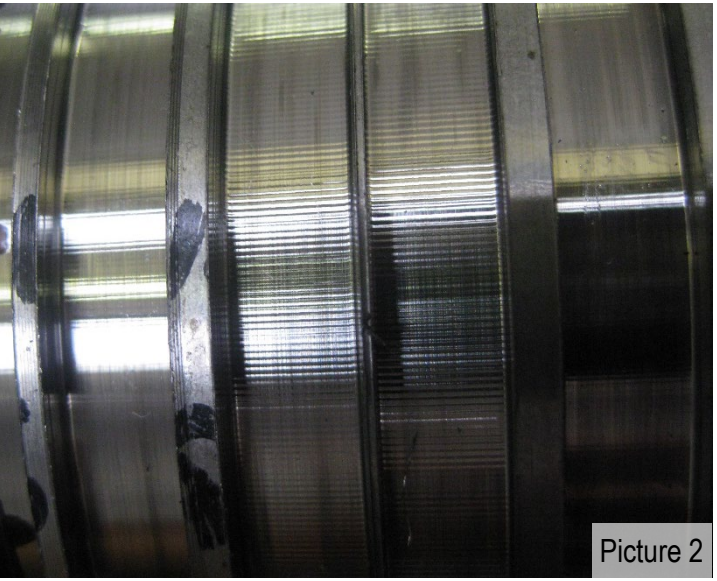

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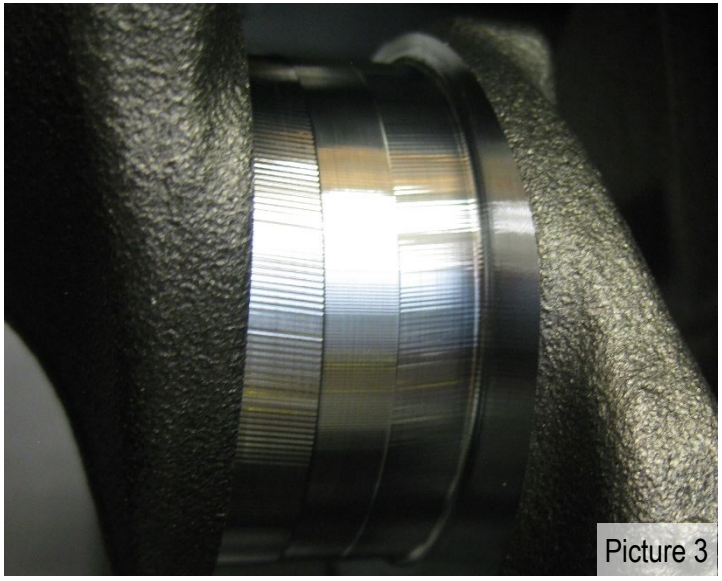

Picture 3

Picture 1

- Stochastic occurrence of chatter marks after grooving

Picture 2

- Waviness on the workpiece surface after grooving

Picture 3

- Chatter marks on a crankshaft