

Quality Control

What are we worried about?

Dimensions

Color

Strength

Surface Finish

Why?

Assembly

Look and feel

Won't break

Sliding

Measurement

How much?

Measure every part

Measure some part

International
Standards
Organization

Quality control systems

ISO 9000 Series Certifications

Statistics

Randomness

temperature

debris contamination

human error

material properties

tool wear

Cutting fluid changes

machine errors

machine wear

Example

Measure 100 parts

all within tolerance

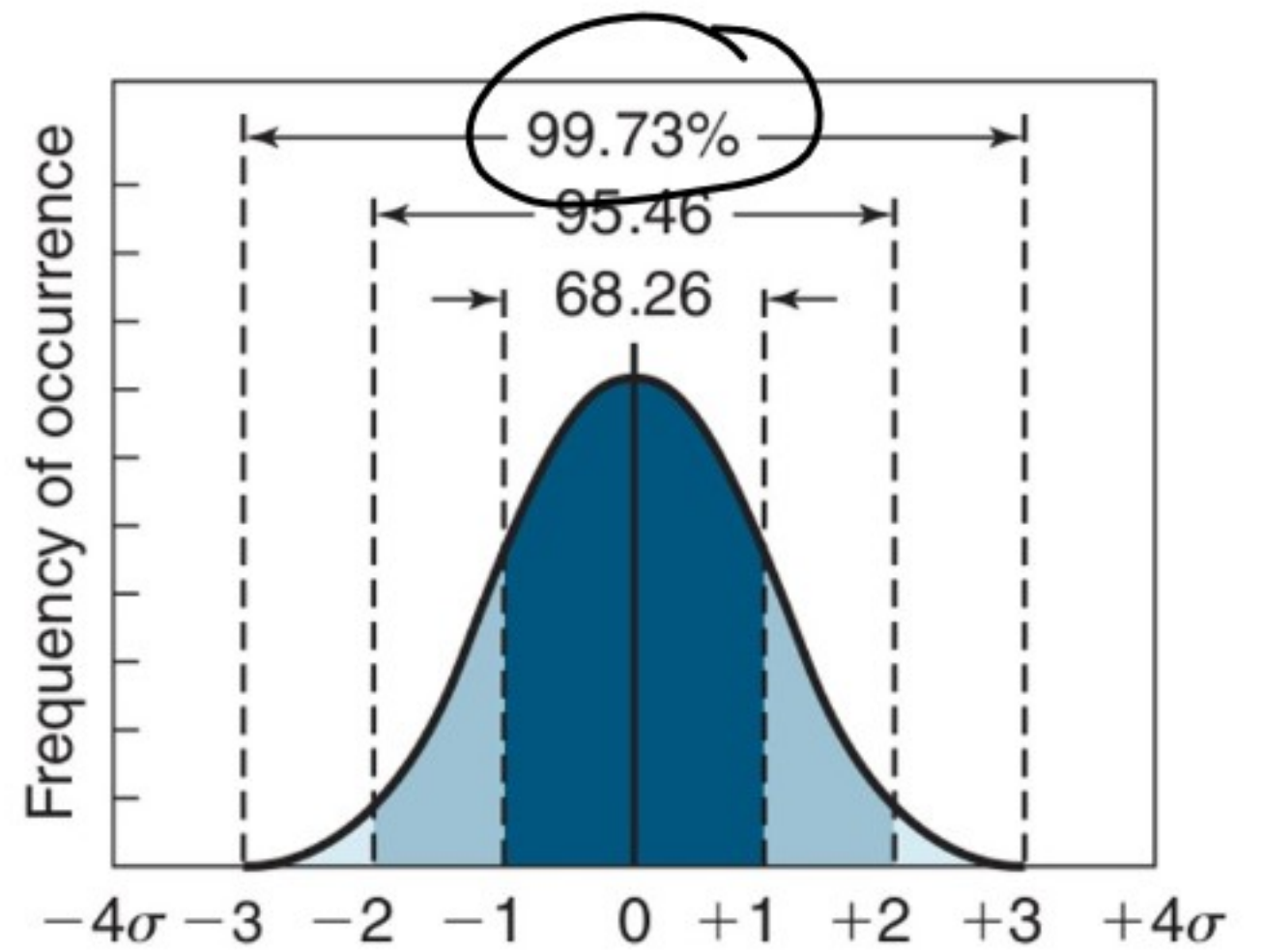
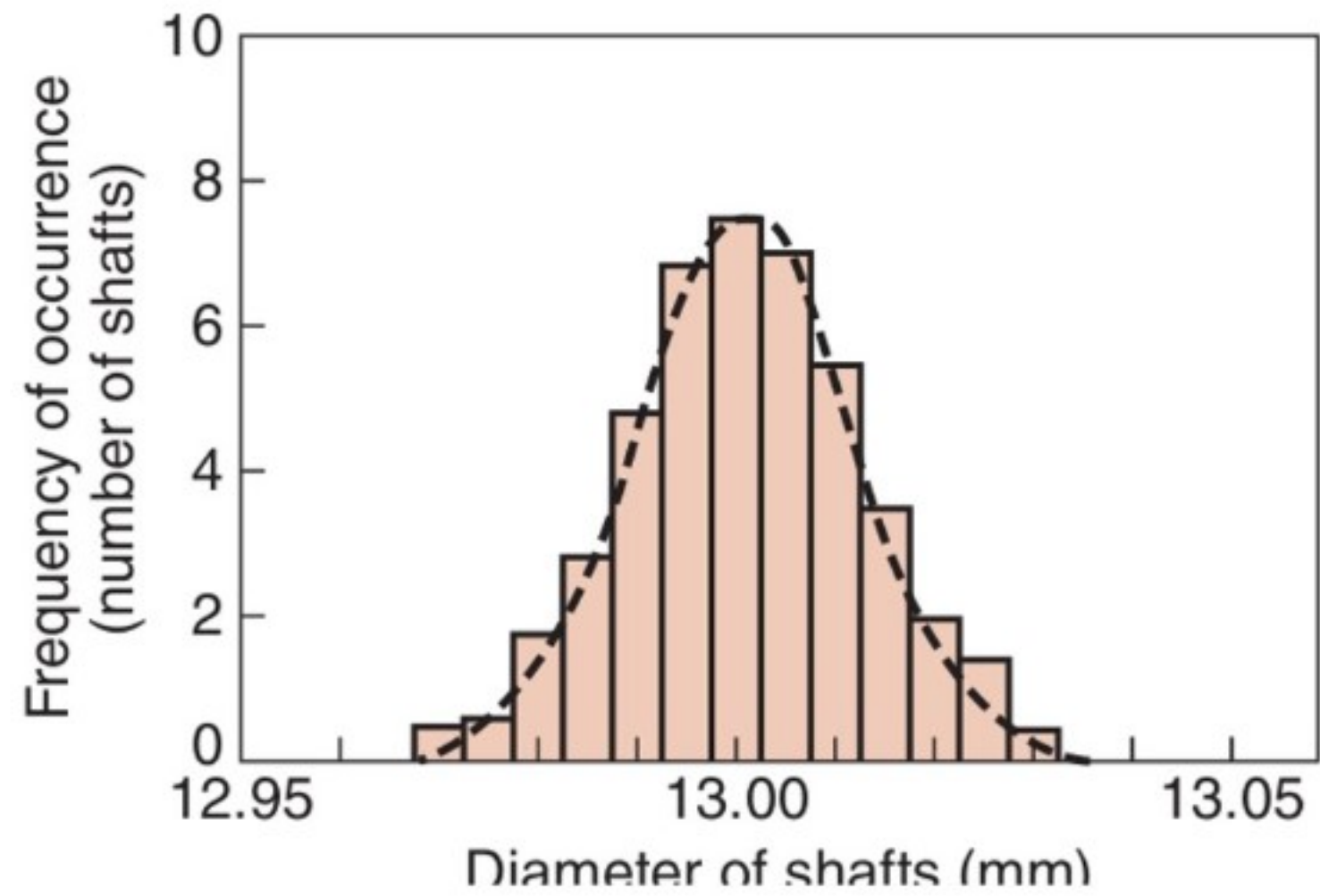
find standard deviation

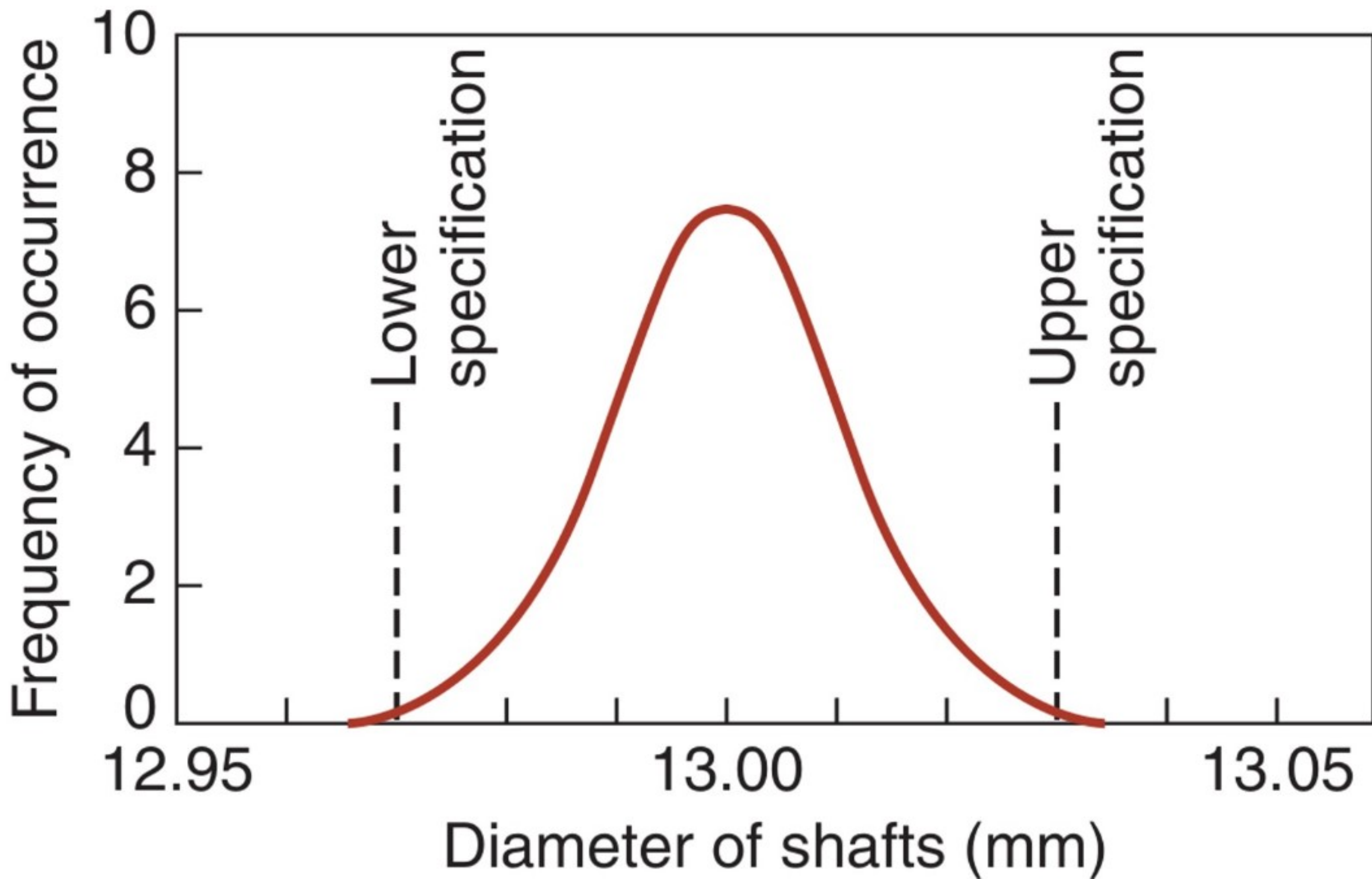
tolerance band $\pm 3\sigma$

99.73% in tolerance

0.27% out of tolerance

1 in 370 parts bad





$\pm 4\sigma$

1 in 16000

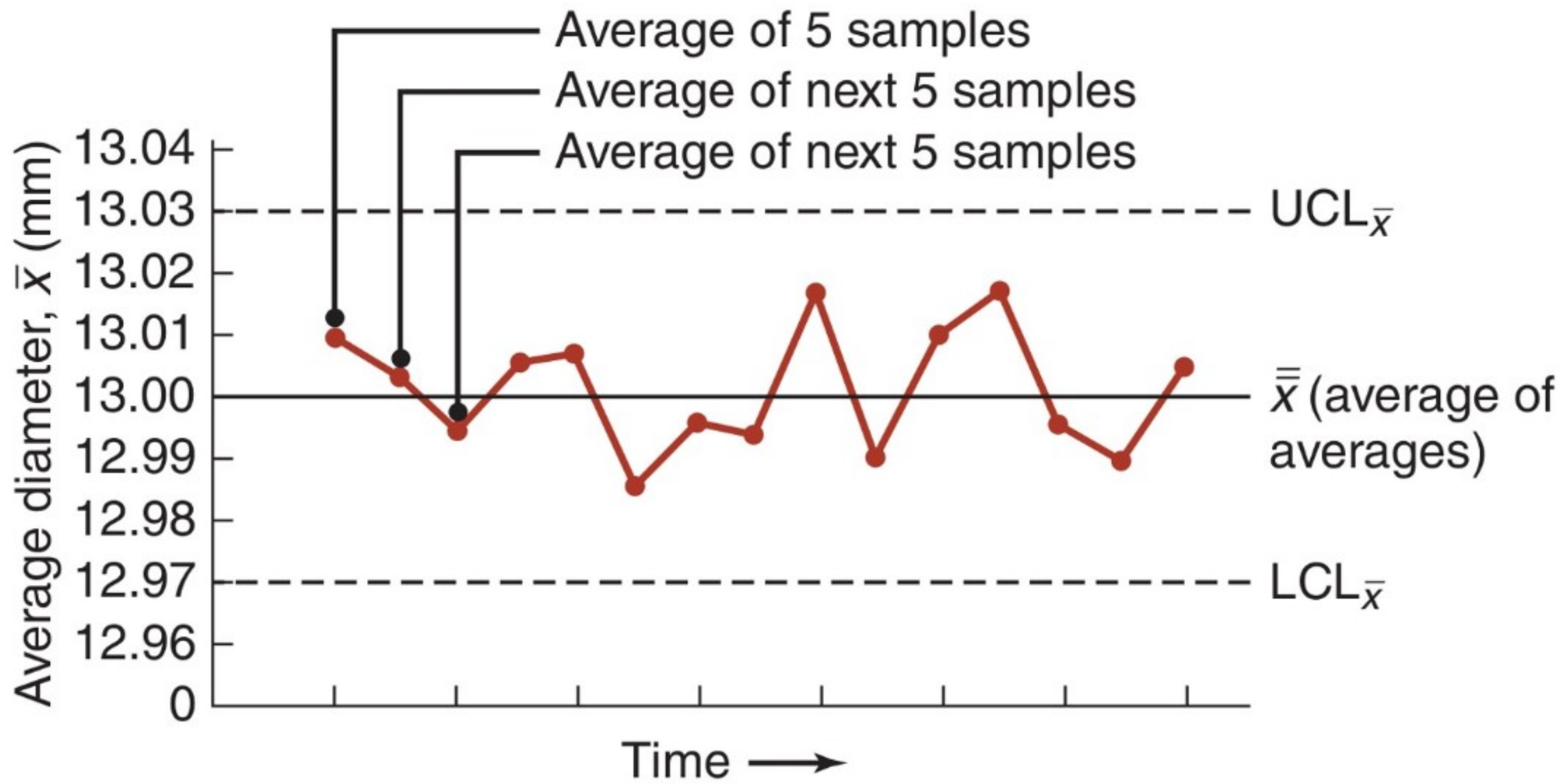
$\pm 5\sigma$

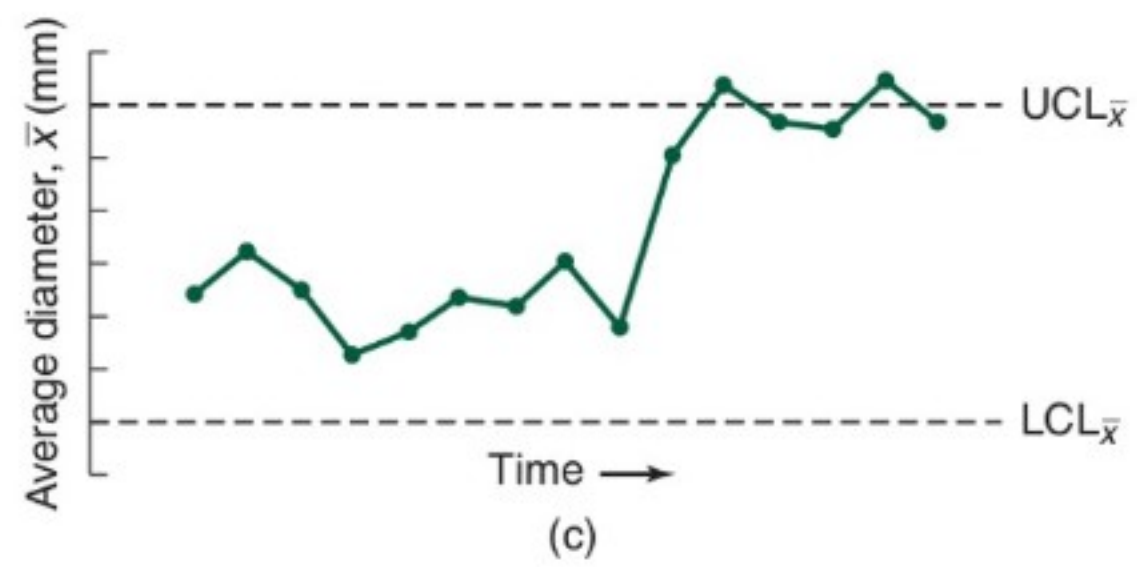
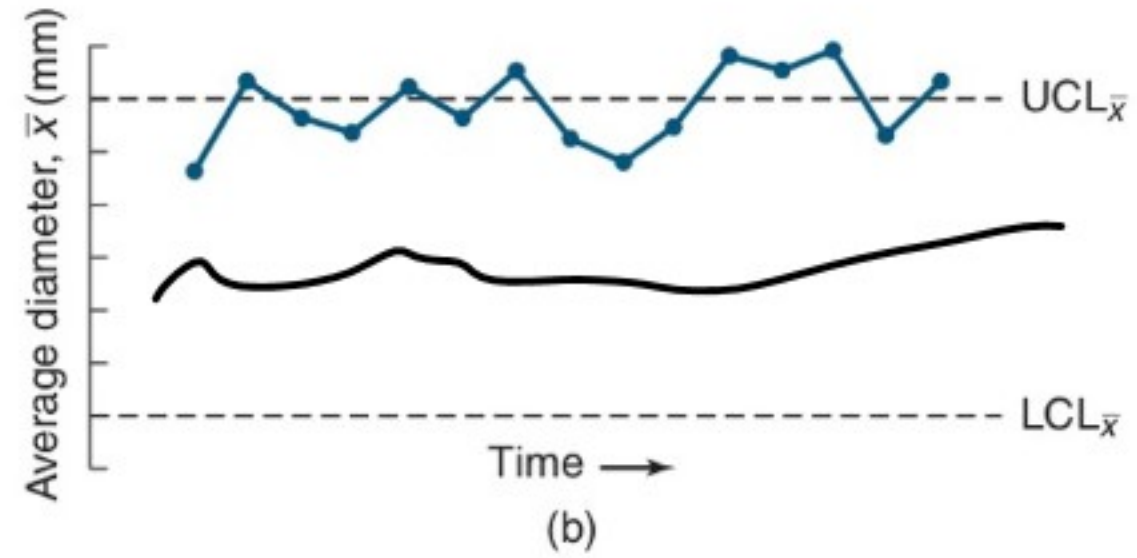
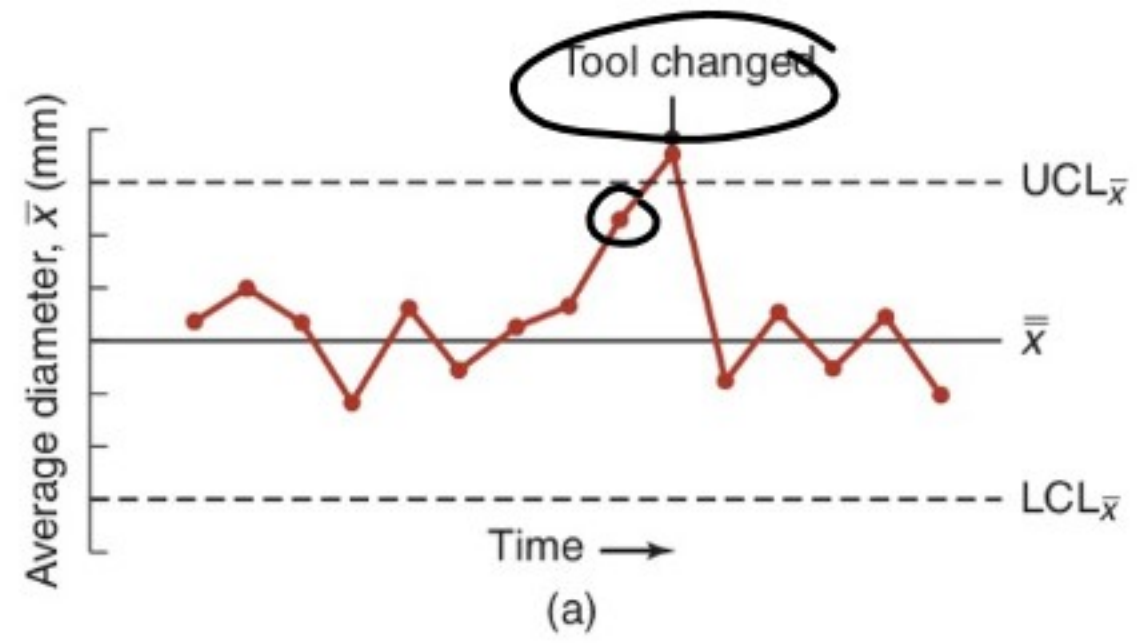
1 in 1.7 million

$\pm 6\sigma$

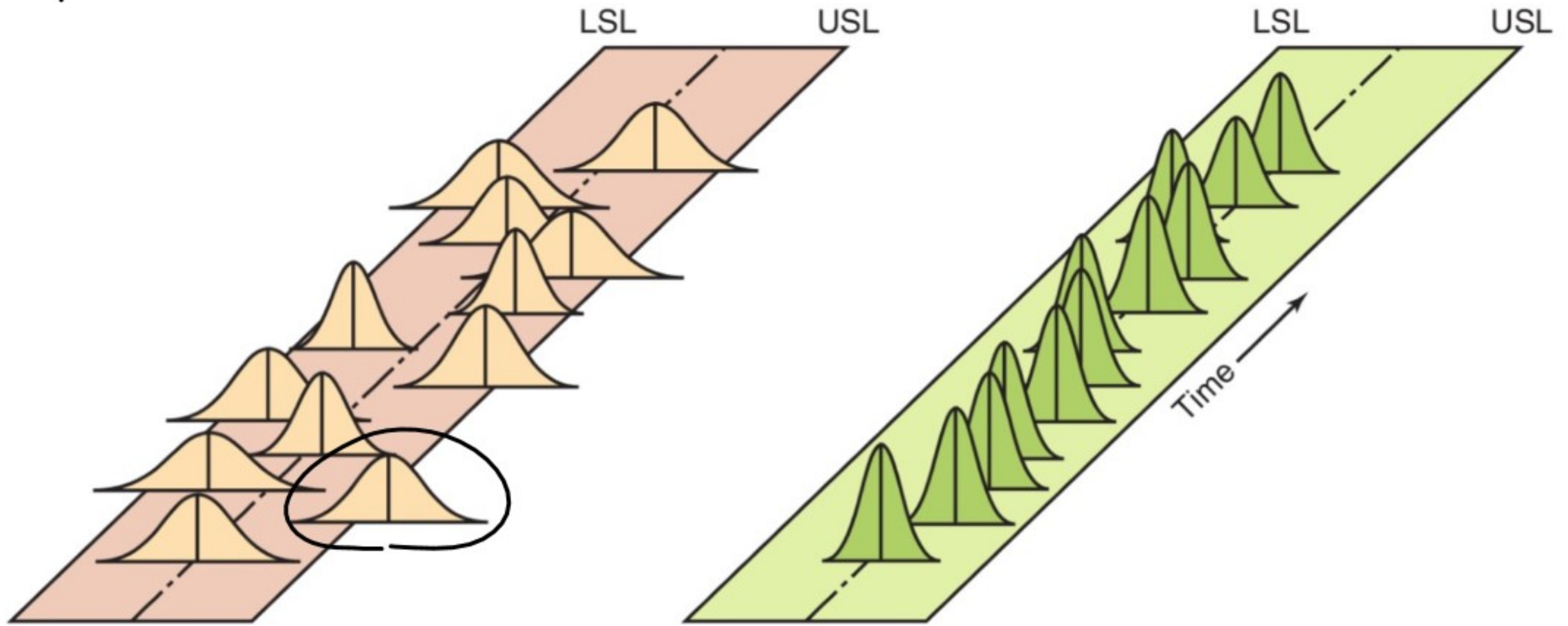
1 in 26 million

Control Charts





Unstable and stable processes



(a) Unstable

(b) Stable

Transmission

Warranty

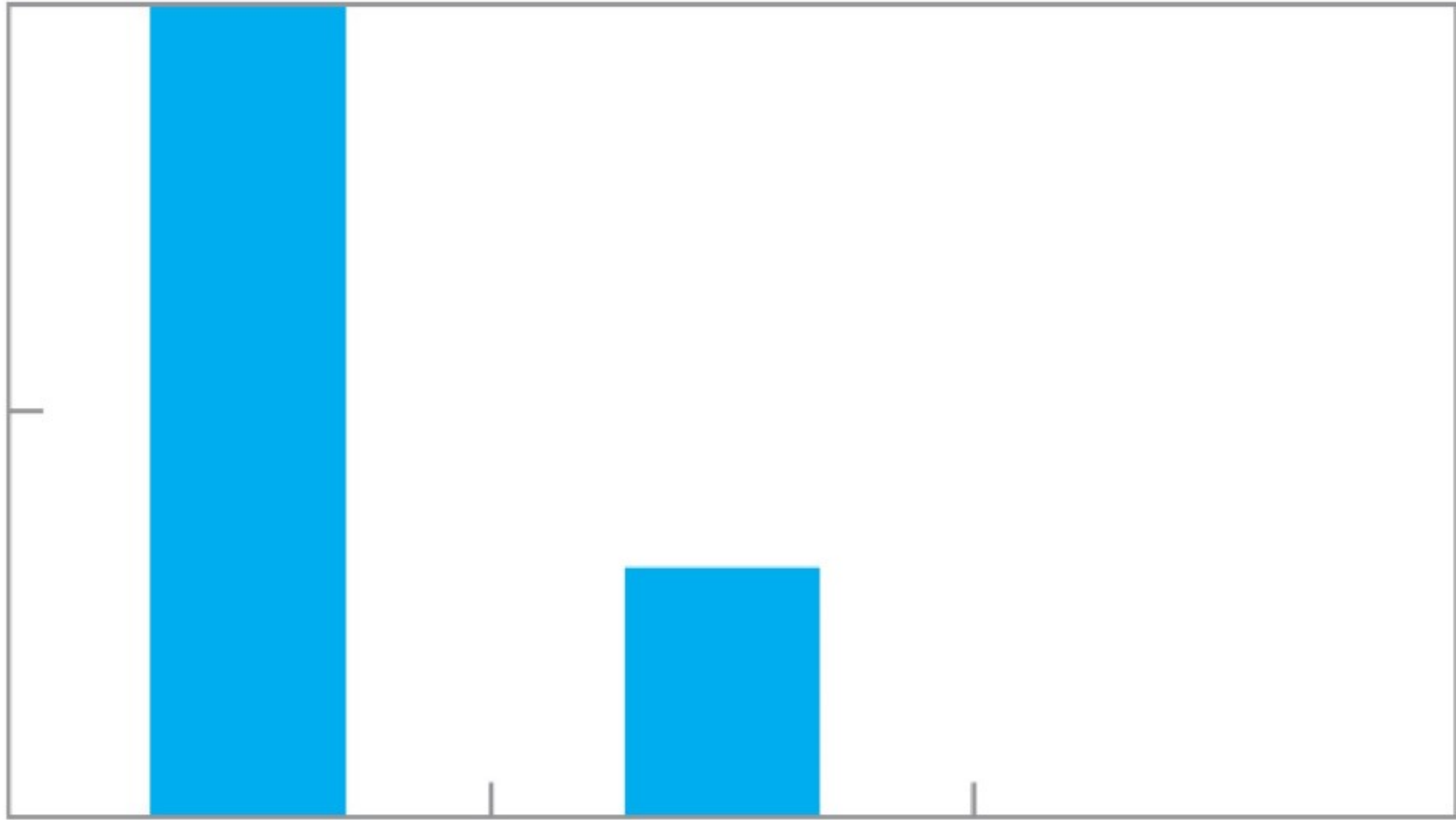
Costs

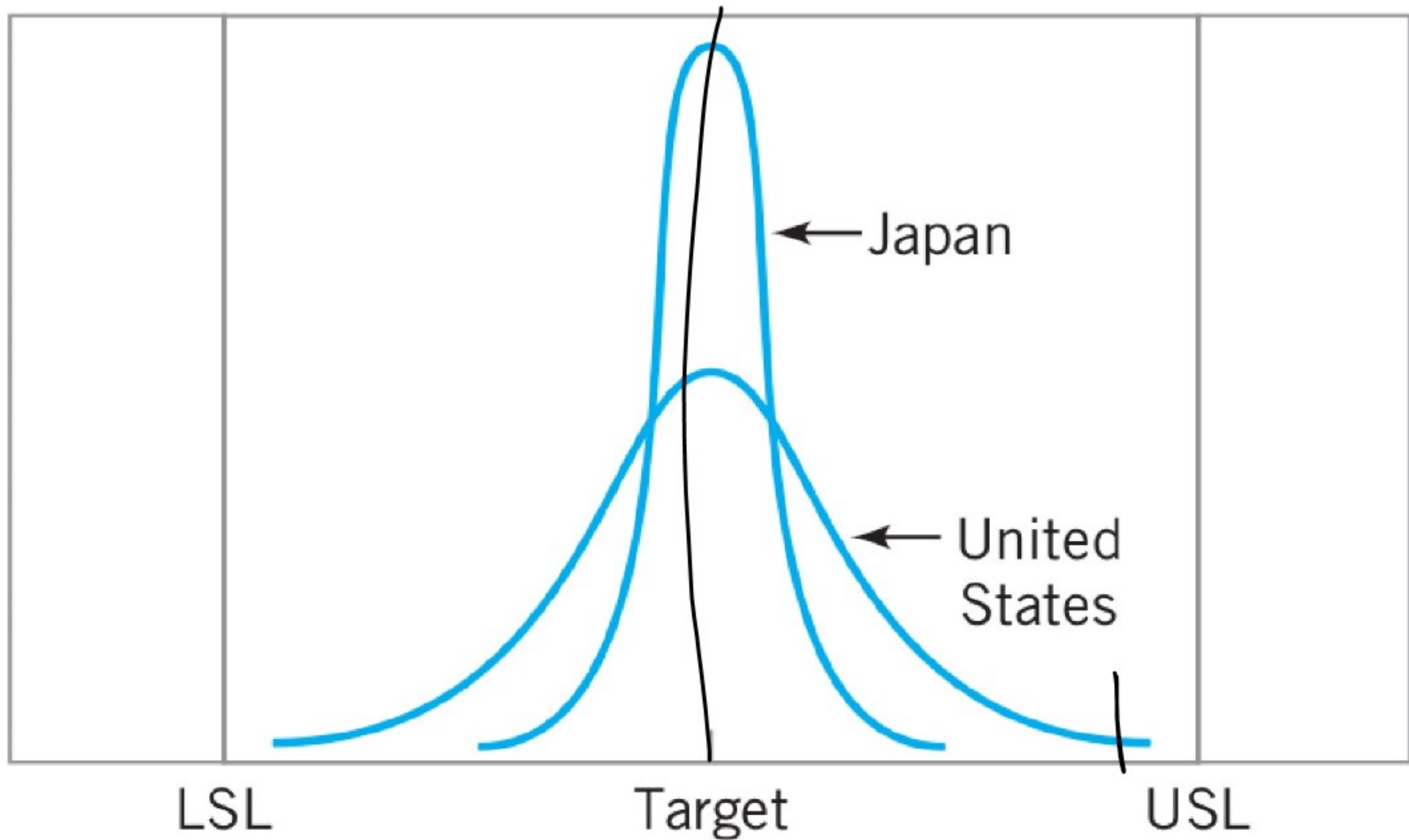
\$

0

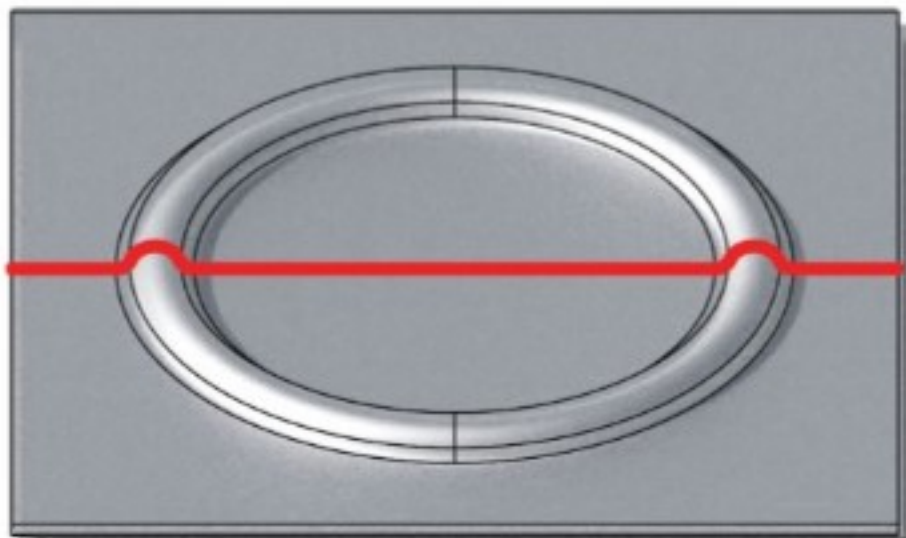
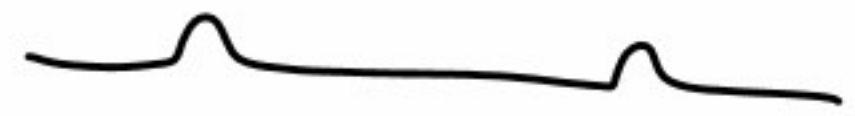
United States

Japan

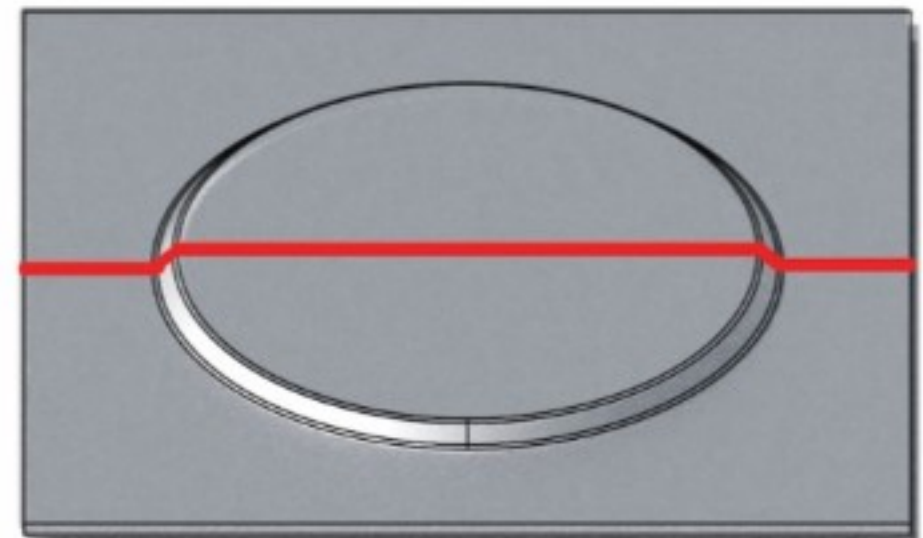




- ▶ Gear Cutting
(<https://www.tiktok.com/@romisamilkate86/video/7163927429109550382>)
- ▶ Gear Hardening
(<https://www.tiktok.com/@extremetals/video/7160766023254314286>)
- ▶ Rotary Forging
(<https://www.tiktok.com/@pangbang666/video/7159197613500173574>)
- ▶ Forging (<https://www.tiktok.com/@blancheteng/video/7163261669534092590>)
- ▶ Beadrolling (<https://www.tiktok.com/@gmssfab/video/7163106182784175402>)



Bead Rolling



Offset Wheel



Flare Rolling