

What is Your Roller's True Shape and Why Does It Matter?

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Common Roller Tolerances

Geometry Based Measurements

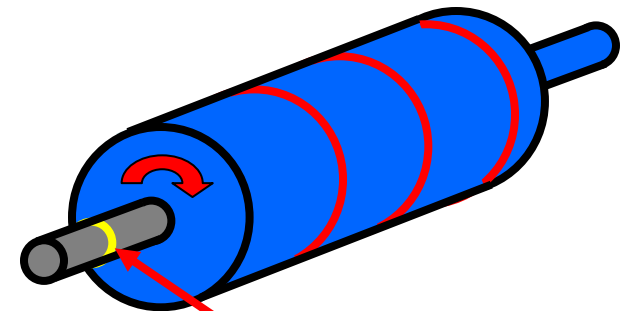
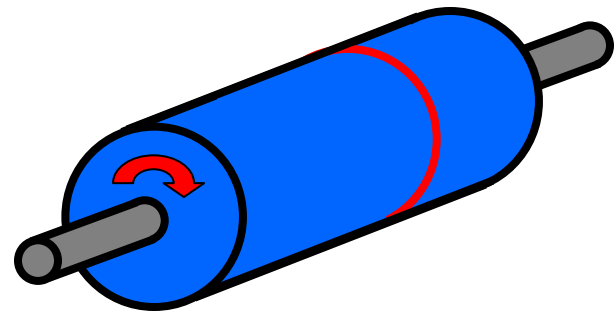
- TIR
- Runout
- Concentricity
- Taper
- Profile
- Cylindricity



Is TIR and Concentricity the Same Thing?

No !

- **TIR** (Total Indicated or Indicator Runout) is simply the measurement of how much an indicator moves while a part is rotated underneath it. It only references one slice of the entire object.
- **Concentricity** uses one reference diameter and compares its midpoint location to the midpoint locations of several more diameters (3 – 8) measured on the work piece.

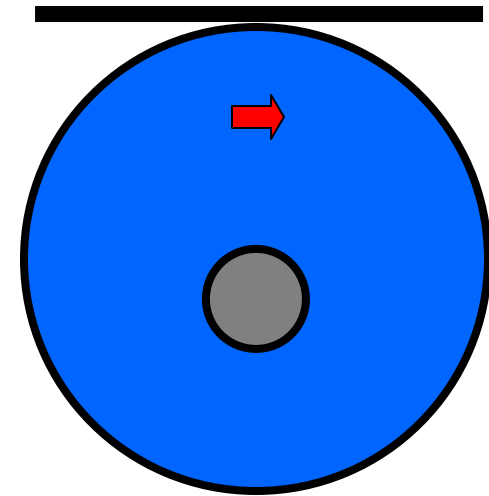
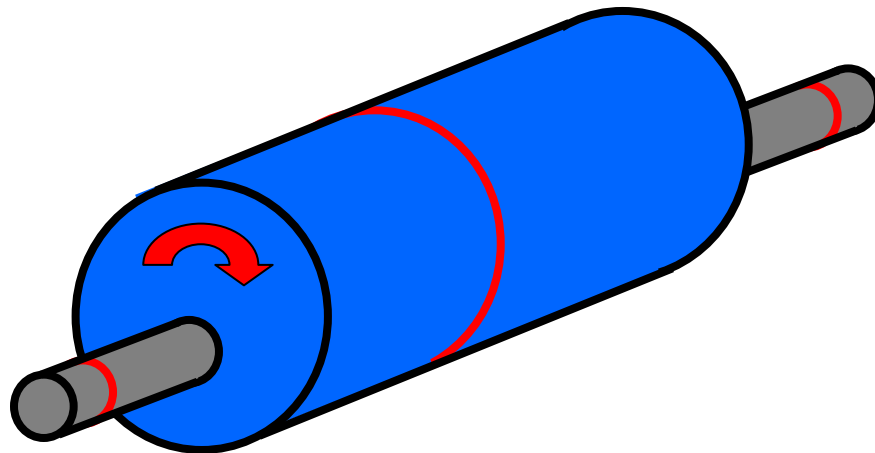


Reference Diameter



Is It Possible to Have Both a Round Roller and Large TIR at the Same Time?

Yes !

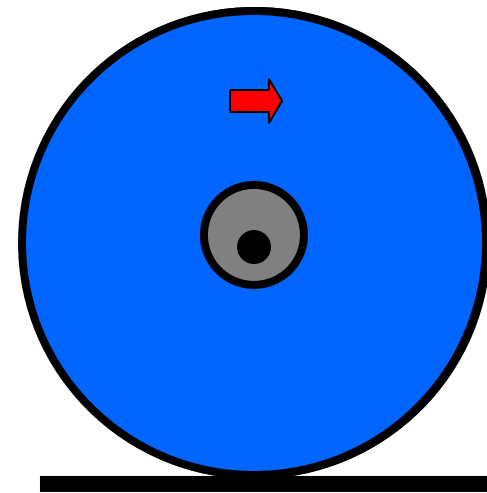


- This Example Illustrates the Relationship Between TIR & Concentricity.
- TIR is 2-Dimensional and Concentricity is 3-Dimensional



Why is My Roller Running Out Even Though My Vendor Says It is Round?

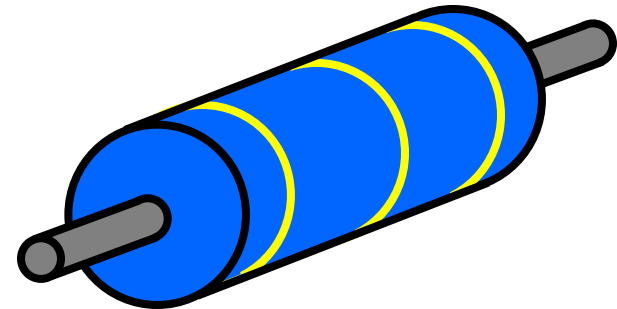
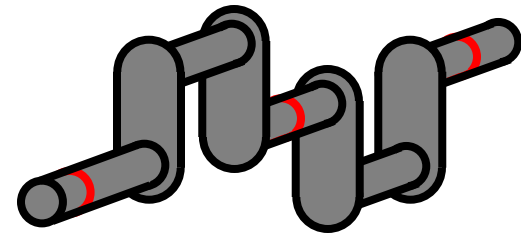
- Most Rollers are Ground on Centers.
- Ground Surfaces (Roller Body) will be Concentric to the Holding Method (Center Holes)
- If the Center Holes Are Not Concentric to the Bearing Journals, the Roller Will Run Out.



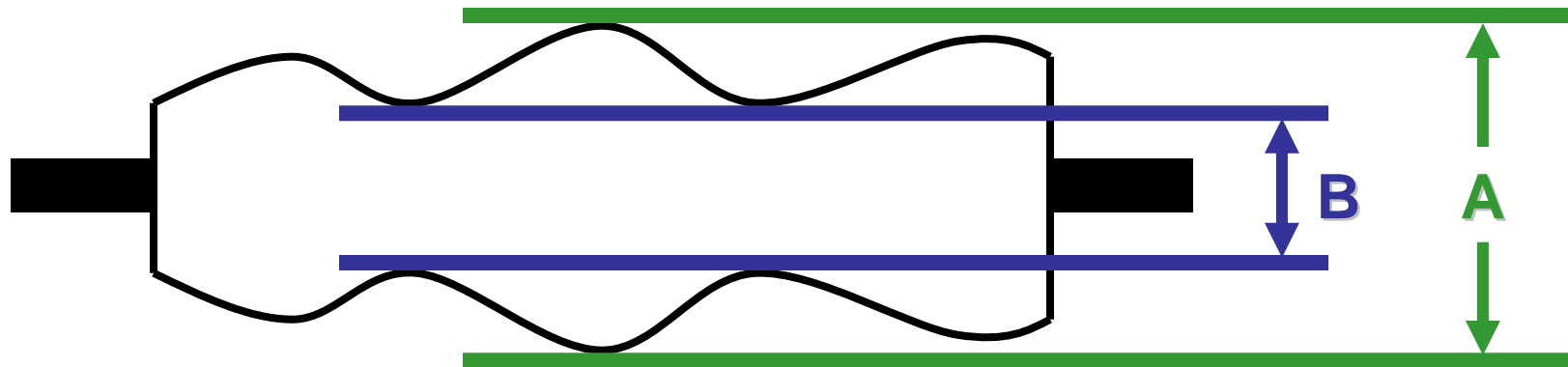
Is Concentricity the Only Tolerance to Worry About?

No !!

- A Crankshaft is Perfectly Concentric On All of Its Bearing Locations. However, It Wouldn't Do Your Web Any Good.
- One of the Most Critical Tolerances that Is Overlooked is known as **Cylindricity** or Cylindrical Diameter Variation. This is Sometimes Referred to as Roller Profile.



What Does Cylindricity Look Like?

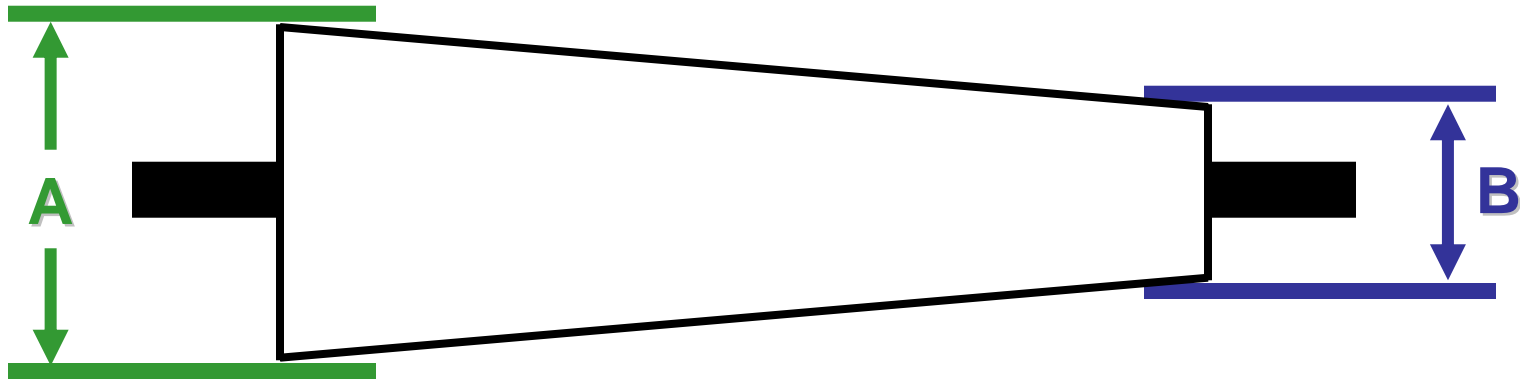


- Cylindricity = Maximum Diameter– Minimum Diameter

$$A - B = \text{Cylindricity}$$



Isn't Taper the Same?



- Taper = Maximum End Diameter – Minimum End Diameter

$$A - B = C$$

- Taper Usually Implies a Straight Change in Diameter



Roller Specifications

- **Industrial Standards for Precision Rollers**
 - Roller Cylindricity **0.001** inch (25 μm)
 - Roller Concentricity **0.001** inch (25 μm)
- **Tolerances for High-Precision Rollers**
 - Roller Cylindricity **< 0.0005** inch (12.7 μm)
 - Roller Concentricity **< 0.0003** inch (7.6 μm)



Measuring Roller Tolerances

- **A Roller's True Shape Can Only Be Discovered by Using the Correct Tools**
- **Measuring Tool Capabilities**
 - **Measuring Tapes** ± 0.03 Inch (762 μm)
 - **Pi Tapes** ± 0.005 Inch (127 μm)
 - **Micrometers** ± 0.001 Inch (25 μm)
 - **Dial Indicators** ± 0.0005 Inch (12.7 μm)
 - **LVDT Sensors** ± 0.0001 Inch (2.5 μm)



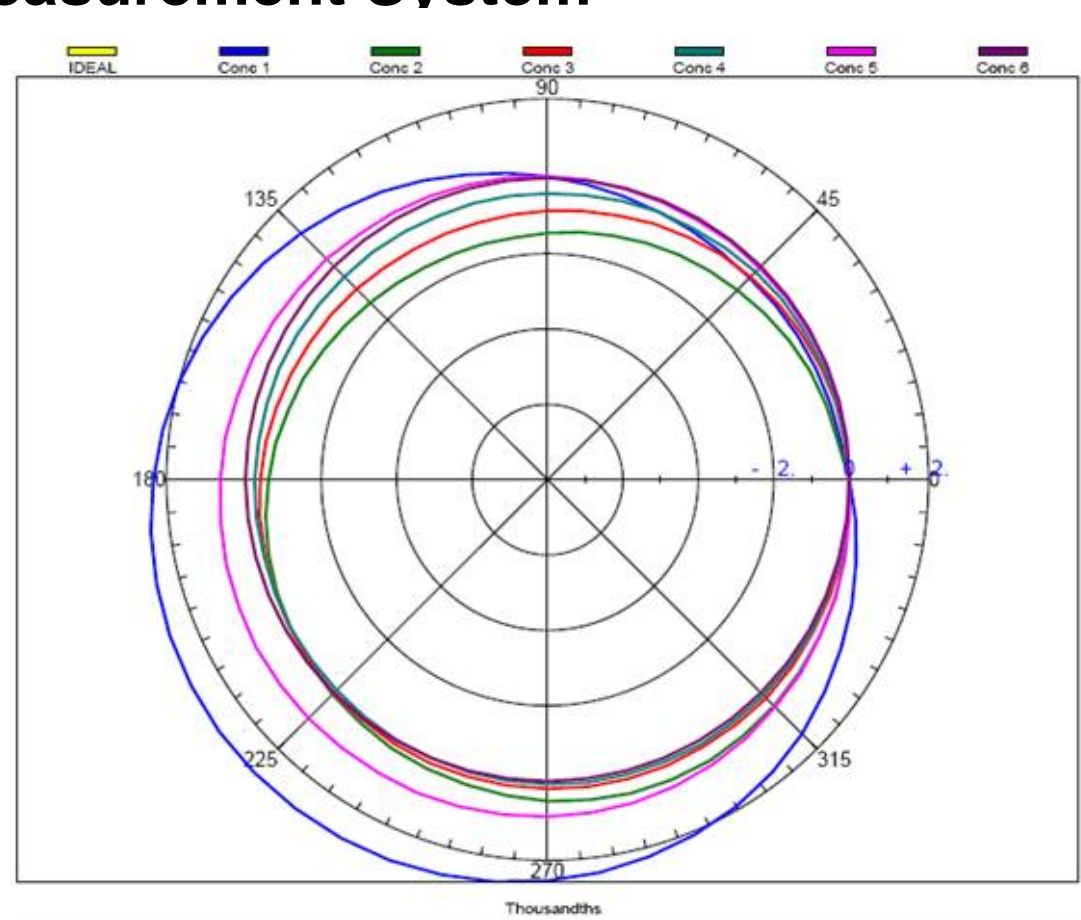
Discovering Your Roller's True Shape

- **Large Numbers of Accurate Data Points Are Needed to Find a Roller's True Shape**
 - **Most Measuring Tools Aren't Accurate Enough**
 - **Accurate Measurements Can Be Time Consuming**
 - **Not Enough Data Points Can Be Misleading**
 - **Data Must Be Processed to be Meaningful**
 - **Data Must Be Easy to Interpret**



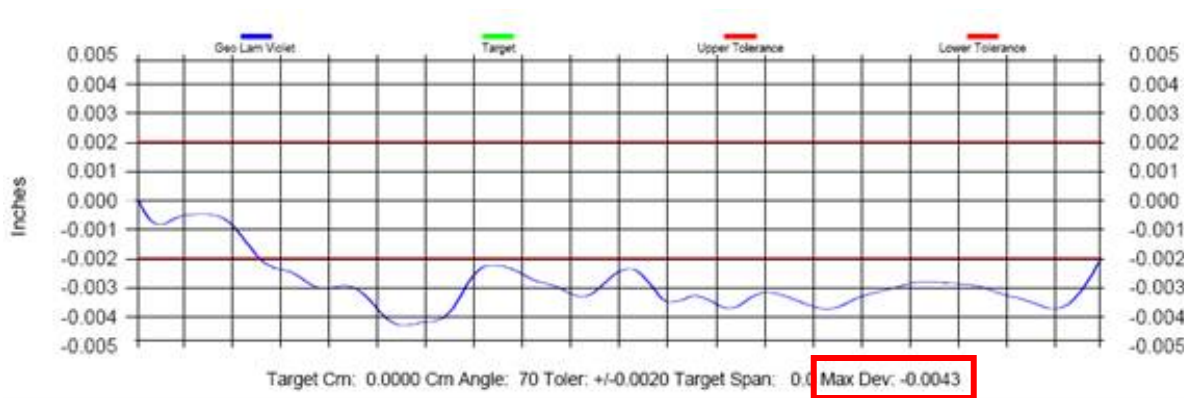
A New Way to View Concentricity

- Concentricity As Measured by IRP's TruShape™ Measurement System



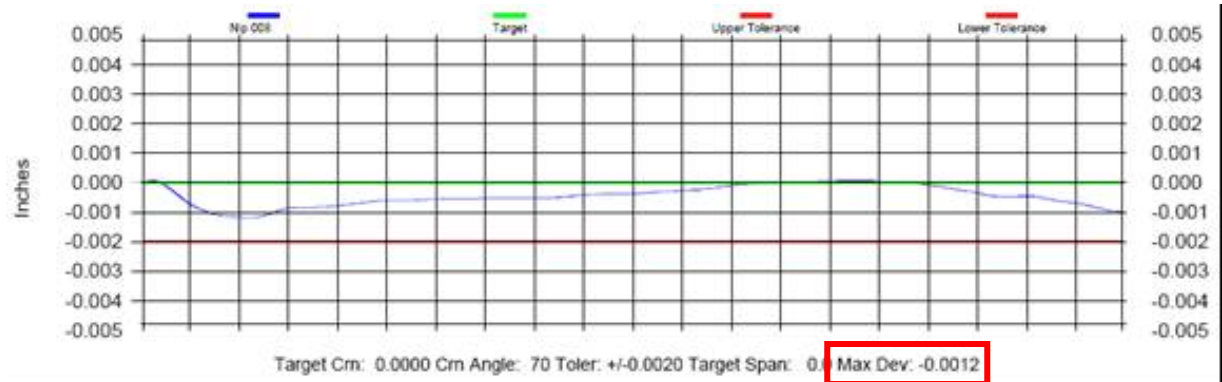
A New Way to View Cylindricity

- Cylindricity As Measured by IRP's TruShape™ Measurement System



- Roll With a Cylindricity of 0.0043 Inch

- Roll With a Cylindricity of 0.0012 Inch



How Do These Tolerances Affect My Web & Equipment?

TIR, Runout, and Concentricity

- Tension Variations for Sensitive Webs
- Repeating Patterns on the Web (Coating, Laminating, Printing, etc.)
- Out of Balance (< 500 fpm)
- Excessive Bearing Wear, Vibrations, Heat
- Bearing Fretting



How Do These Tolerances Affect My Web & Equipment? (Cont.)

Taper, Profile, and Cylindricity

- Normal Entry Law
- Wrinkling, Buckling, Creasing
- Web Guiding
- Stretching



Conclusion

- 1. For Successful Web Handling, It Is Important to Properly Specify the Geometry of a Roller.**
- 2. Specifications are Useless without Accurate Measurements.**
- 3. It is Difficult to Gather Meaningful Data with Conventional Measuring Tools Like Dial Indicators and Pi Tapes.**
- 4. Tools Like the TruShape™ Make Visualizing a Roller's Actual Geometry a Reality.**



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