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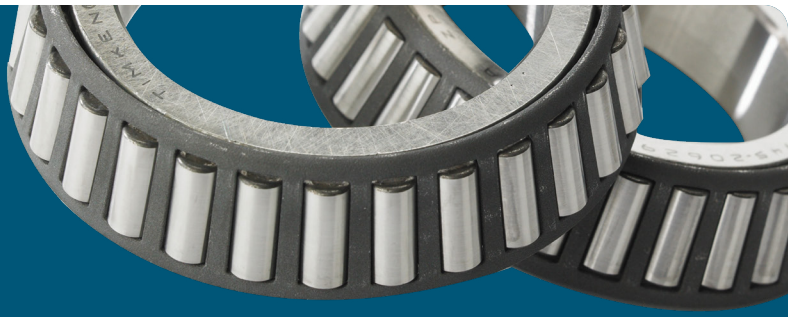
Bearing Spring Rates Help Guide



What Are Spring Rates

Bearing spring rates and bearing stiffness are related concepts that describe the resistance to deformation under load. Bearing stiffness refers to the bearing's ability to deflect or displace when a force is applied. The **spring rate** specifically measures the force required to deflect or displace the bearing. Understanding bearing spring rates helps determine whether a bearing is suitable for the loads applied in a specific application.

Types of spring rates you can calculate:

- Spring rates under **radial load (C90)** and **axial load (Ca90)**
- Spring rates under load **with preload force** applied in both radial and axial directions

Load zones:

- **No Preload:** Assumes a 180° load zone (half of the rollers share the load)
- **Yes Preload:** Assumes a 360° load zone (all rollers share the load)

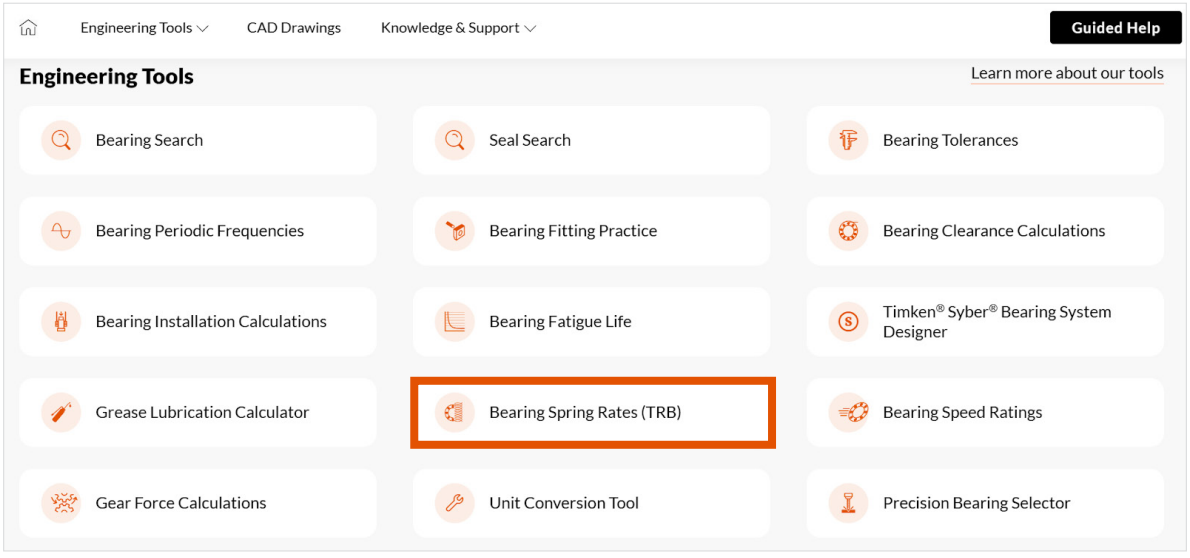
The bearing stiffness is dependent on the bearing type, size, and materials. Bearing stiffness is typically expressed as a spring rate force.

The spring rate calculation tool developed by Timken helps users determine the stiffness values that a bearing can handle under predetermined loads applied to the bearing. This allows users to evaluate whether their chosen bearing will perform well in their application.

How to Use the Spring Rate Calculation Tool

Please follow the simple steps below to get the spring rates/stiffness to help you determine the bearing that is best for your application.

1. Go to engineering.timken.com.
2. Select Bearing Spring Rates (TRB) from the Engineering Tools.



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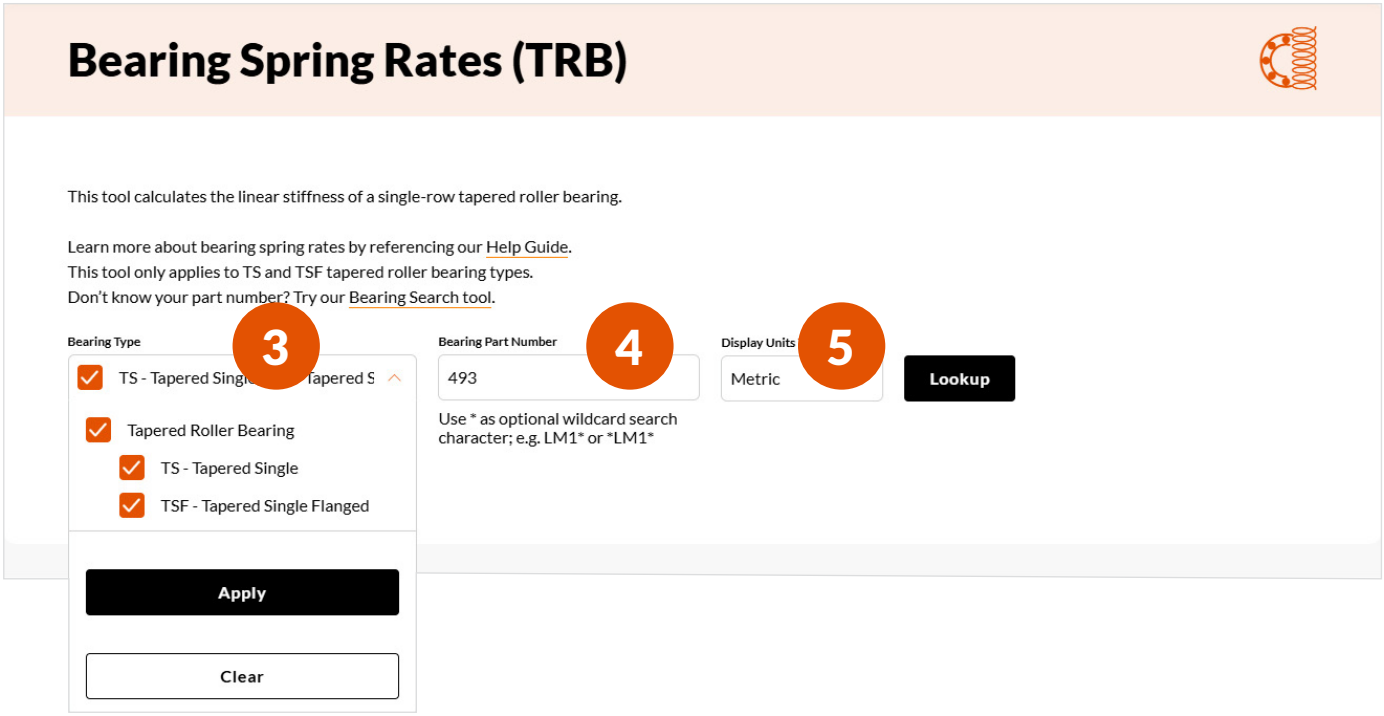
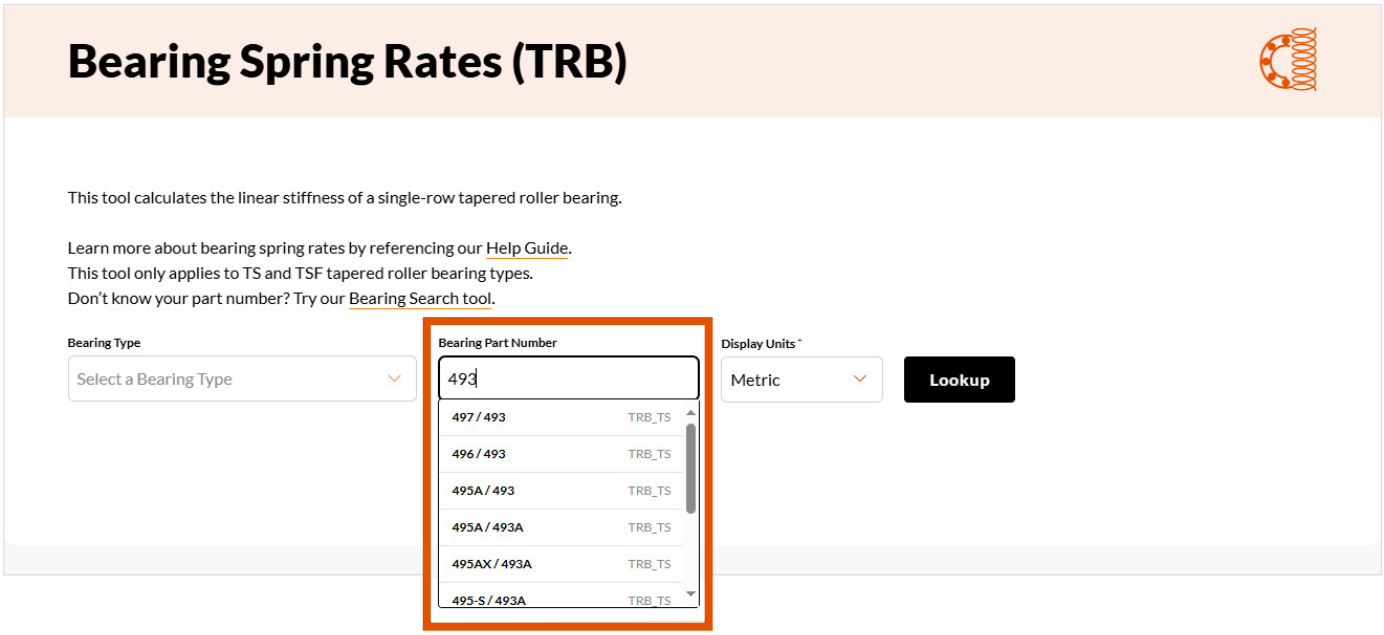
3. Choose Bearing Type.
4. Enter the Bearing Part Number to be used, or select it from the drop-down list.
5. Select your preferred Display Units.



A Part List also can be accessed.



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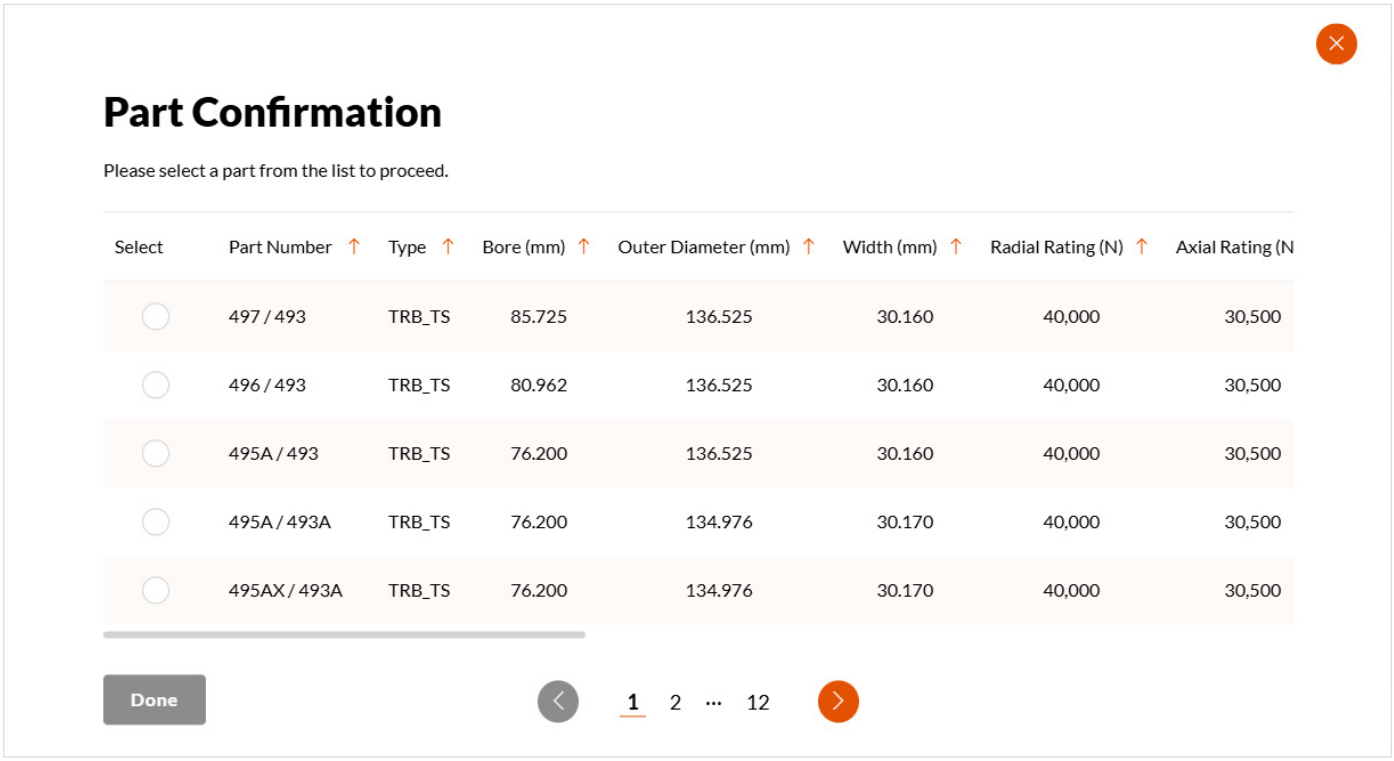
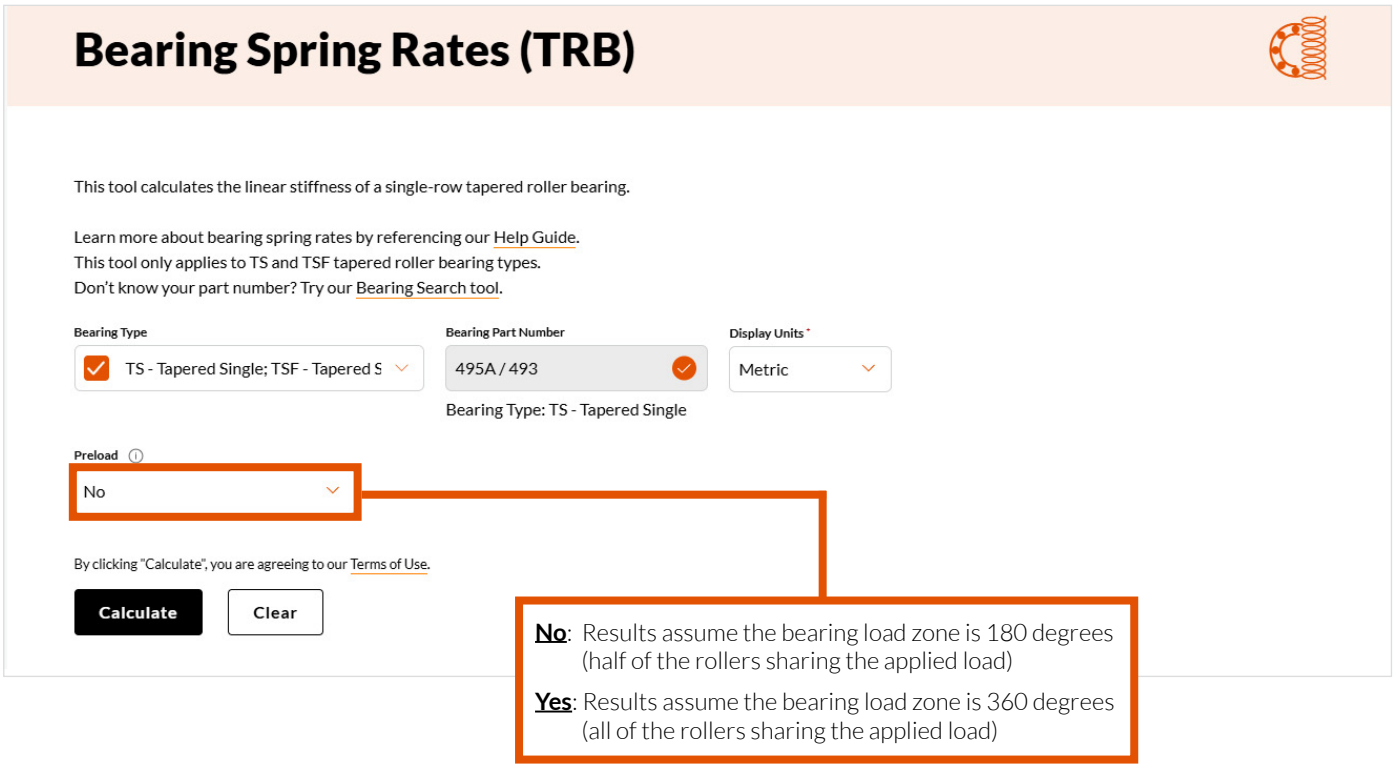


6. Choose Preload Yes/No.

- If you select Yes, the preload will be a 360° lo ad zone
- If you select No, the preload will be a 180° load zone



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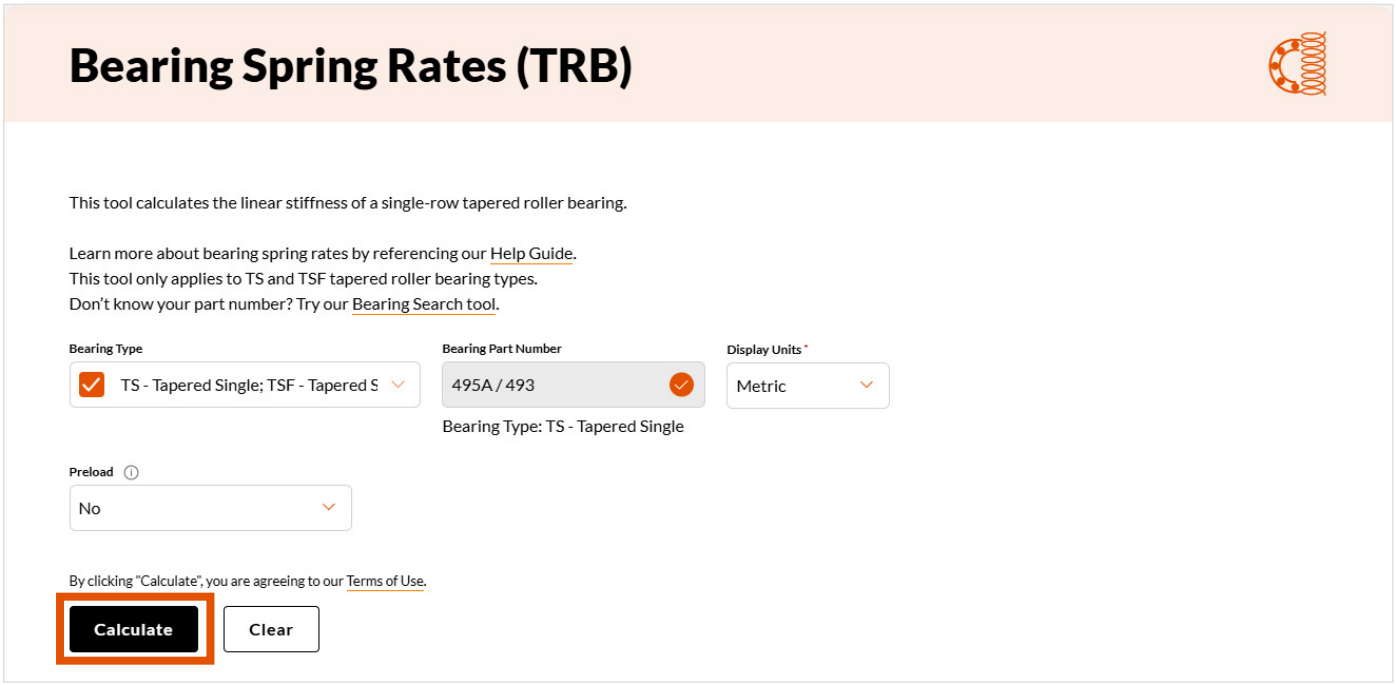
7. Click Calculate



Spring Rate Values No Preload.

Results

Disclaimer

Spring Rates for 495A / 493 (TS - Tapered Single) [76.200x136.525x30.160]

Bearing stiffness varies according to the applied load and operating load zone. See our Help Guide for more details.

Radial Results

Radial (180 LZ) (% C90)	Load (N)	Deflection (mm)	Spring Rate (N/mm)
10	4,000	0.003526	1,140,000
25	10,000	0.008111	1,230,000
50	20,000	0.015232	1,310,000
75	30,000	0.022021	1,360,000
100	40,000	0.028603	1,400,000
125	50,000	0.035036	1,430,000
150	60,100	0.041352	1,450,000
175	70,100	0.047573	1,470,000
200	80,100	0.053713	1,490,000

Axial Results

Axial (% Ca90)	Load (N)	Deflection (mm)	Spring Rate (N/mm)
10	3,050	0.007825	389,000
25	7,620	0.017998	423,000
50	15,200	0.033799	451,000
75	22,900	0.048864	468,000
100	30,500	0.063470	480,000
125	38,100	0.077744	490,000
150	45,700	0.091760	498,000
175	53,300	0.105564	505,000
200	60,900	0.119189	511,000

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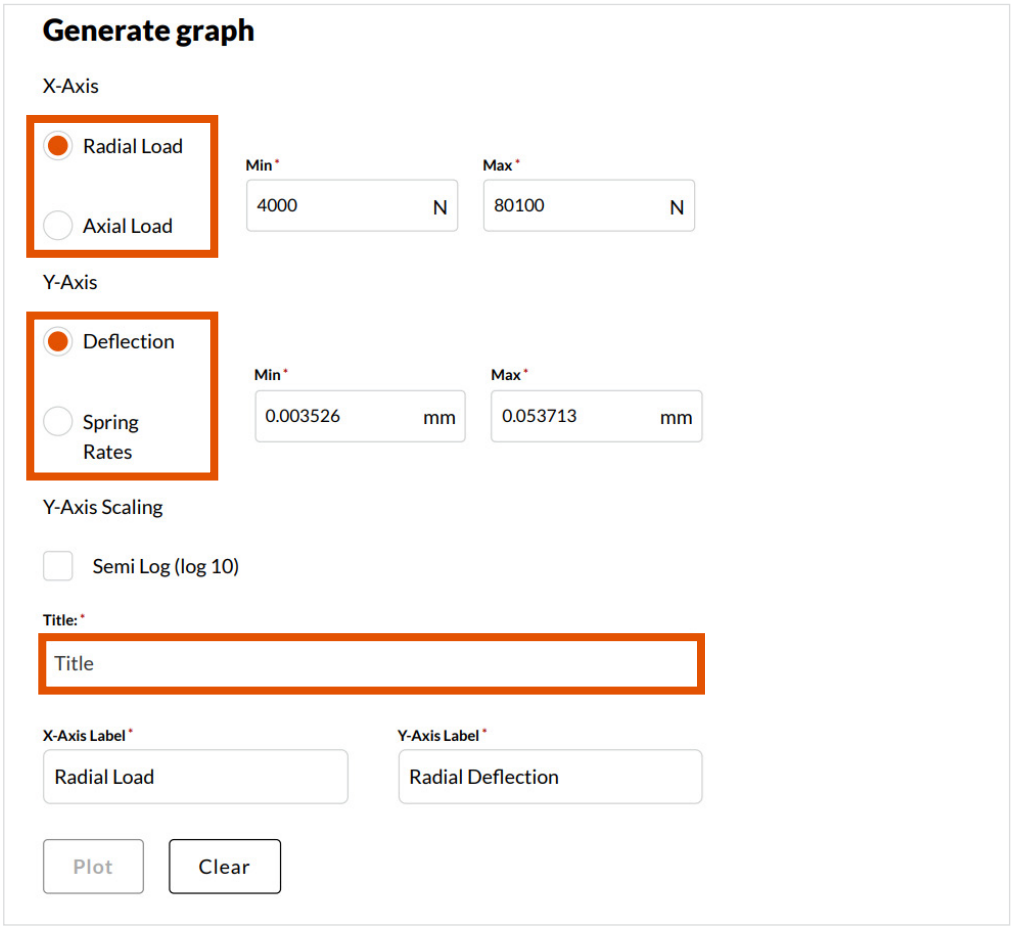
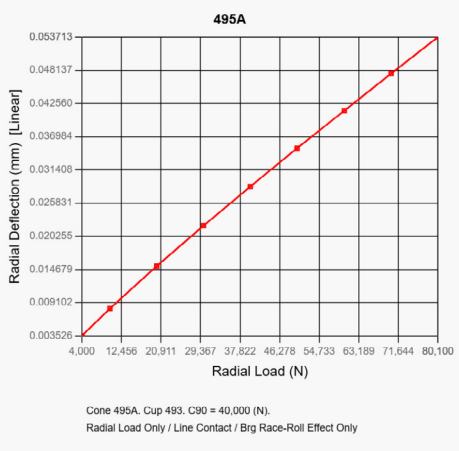
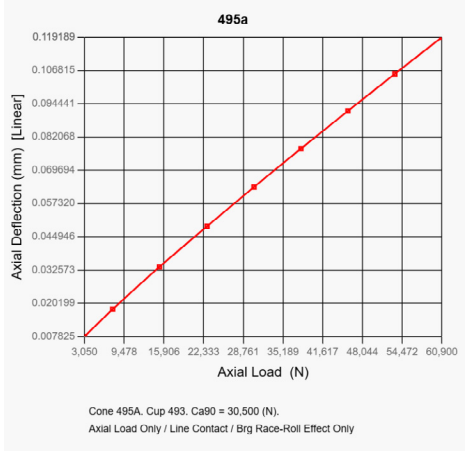
8. To generate graphs, you must choose between Axial Load or Radial Load, and Deflection or Spring Rates. You will also need to choose a title name for your graph. When using Semi Log (log 10), you must use the Plot button again to get your graph.



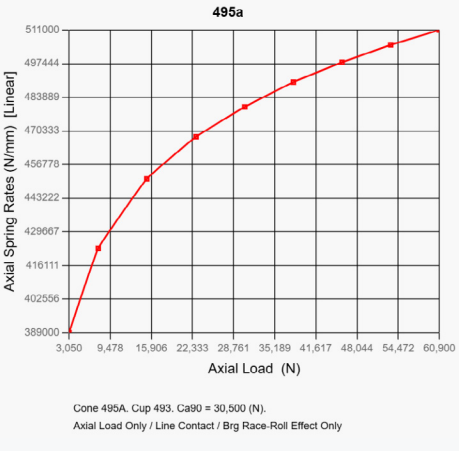
This is an example of a graph for:
Radial Load, Deflection, No Preload



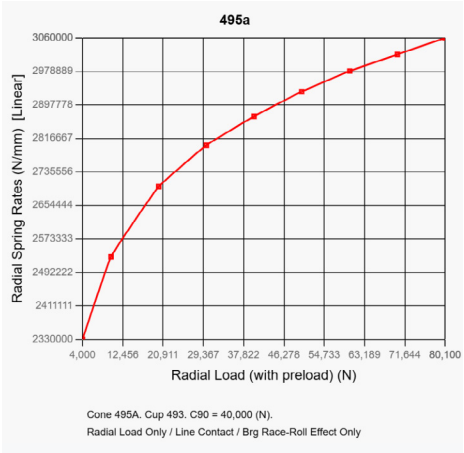
This is an example of a graph for:
Axial Load, Deflection, Yes Preload



This is an example of a graph for:
Axial Load, Spring Rates, Yes Preload



This is an example of a graph for:
Radial Load, Spring Rates, Yes Preload



How to Apply the Results

The bearing spring rate / stiffness determines, how much, or how little bearing deformation occurs under loads. A stiffer bearing will deform less, leading to better support of the load in the application. The information gathered from the spring rates are crucial for accurate simulations of rotating machinery, and other systems that use roller bearings. The spring rates help determine the deflection, stress and dynamic behavior of rotating applications.

Still Need Help?

- Contact your Timken sales office. Locate your local office by visiting locations.timken.com.
- Email us at TimkenEngineeringHelp@timken.com.

IMPORTANT NOTE: The accuracy of the technical information supplied through this engineering tool is dependent upon the accuracy and completeness of information supplied to Timken. Actual product performance is affected by many factors beyond the control of Timken, and which cannot be modeled through this engineering tool. Therefore, you must validate the suitability and feasibility of all designs and product selection. The technical information is presented solely to provide you, a customer of Timken or its affiliates, with data to assist you in your design. No warranty, expressed or implied, including any warranty of fitness for a particular purpose, is made by Timken through the provision of this information.

The Timken team applies their know-how to improve the reliability and performance of machinery in diverse markets worldwide. The company designs, makes and markets bearings, gear drives, automated lubrication systems, belts, brakes, clutches, chain, couplings, linear motion products and related industrial motion rebuild and repair services.