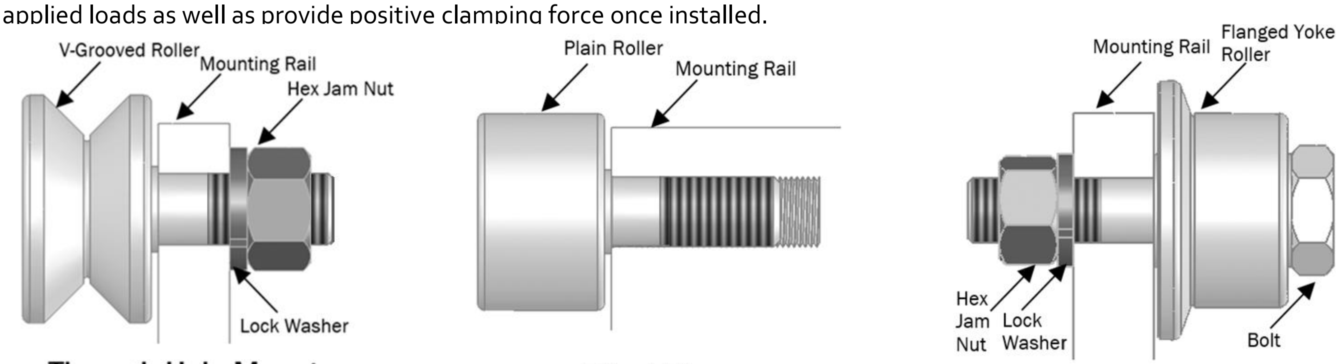
INSTALLING STUD TYPE LOAD BEARING ROLLER ASSEMBLIES

Mounting holes should be machined to the nominal stud size within +.001/-.000 (+.025mm / -.000mm) tolerance. When properly aligned, the stud of the roller should slip into the mounting rail. Do not force the stud into the mounting rail or damage may occur. When mounting rollers, do not torque the jam nuts (or the hex of the roller when blind mounting) beyond the recommended torque capacity of the unit or damage may occur. Recommended torque capacities are listed on item specification pages for units with dry threads. Decrease the listed torque by half if threads are lubricated. Be sure that the mounting rail surface is as large as the Shoulder Diameter (SD) of the roller and is of sufficient thickness to support the applied loads as well as provide positive clamping force once installed.



Through-Hole Mount Stud Type | Blind Mount Stud Type | Through-Hole Mount Yoke Type

Be sure to consult item specification pages to obtain the recommended torque value for a given unit. If a maximum torque value cannot be located on the item's specification page, consult the table below for a baseline recommended maximum torque value based on the unit's stud diameter.

STUD DIAMETER	DRY THREADS	LUBRICATED THREADS
Less than 5/8"/16mm	180 in. Lb/20Nm	96 in. Lb/10Nm
5/8"/16mm to 1"/24mm	600 in. Lb/68Nm	300 in. Lb/34Nm
Over 1"/24mm	1200 in. Lb/136Nm	600 in. Lb/68Nm

LOAD BEARING ROLLER ASSEMBLIES
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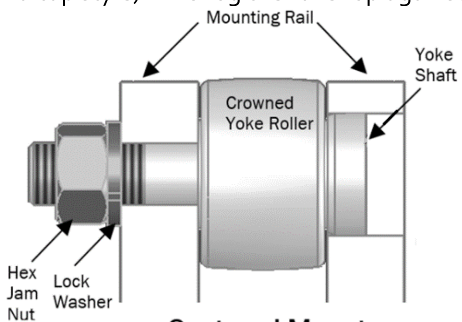
INSTALLING YOKE TYPE LOAD BEARING ROLLER ASSEMBLIES

Mounting rails should be spaced so that there is +.032″ clearance beyond the stated inner race width of the roller. Be sure that the mounting rail is at least as large in diameter as the Shoulder Diameter (SD) of the roller and is of sufficient thickness to support the applied loads as well as provide positive clamping force once installed.

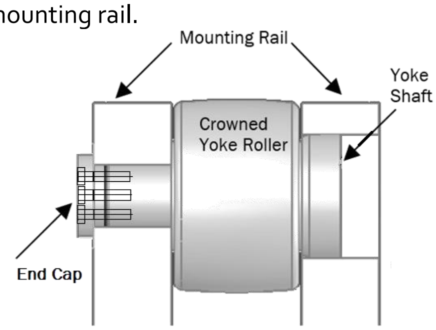
NOTE: Both shoulders of the inner race must be tightened firmly against the mounting rail such that the inner race is isolated and not allowed to rotate on the yoke shaft. Failure to immobilize the inner race of a yoke roller may result in undesirable performance and/or failure of the unit.

FOR YOKE STYLE ROLLERS WITH A PLAIN / CYLINDRICAL ROLLER BODY PROFILE

Locate either side of the roller against the mounting rail with the smaller hole. Simply tightening the lock nut (mounting bolts on an end cap style) will snug the roller up against the mounting rail.



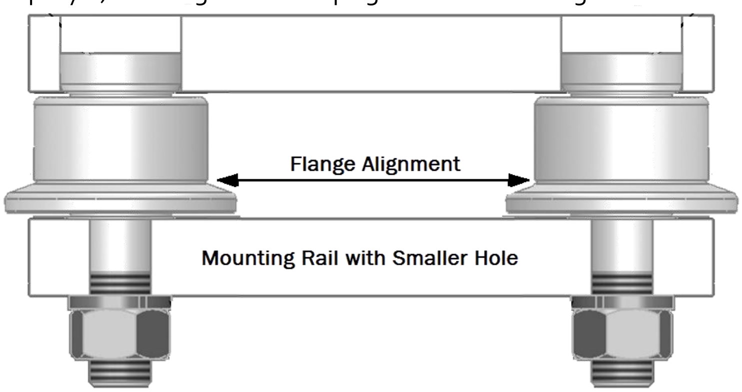
Captured Mount
Yoke Type



Captured Mount
Yoke Type

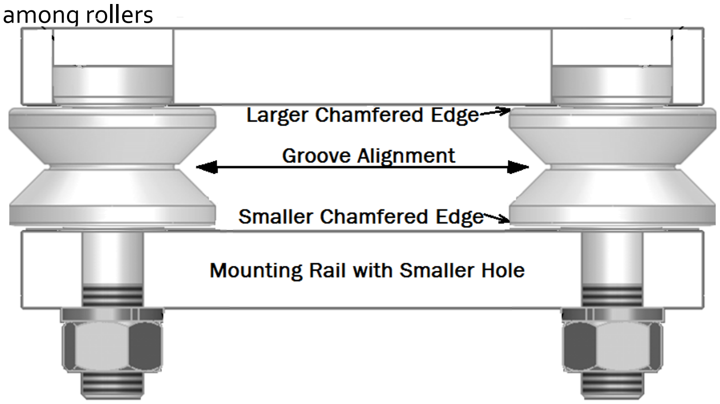
FOR YOKE STYLE ROLLERS WITH A FLANGED ROLLER BODY PROFILE

Locate the flanged side of the roller against the mounting rail with the smaller hole. Simply tightening the lock nut (mounting bolts on an end cap style) will snug the roller up against the mounting rail. This will ensure proper flange alignment among rollers.



FOR YOKE STYLE ROLLERS WITH A V-GROOVED ROLLER BODY PROFILE

Locate the side of the roller with the smaller chamfered edge against the mounting rail with the smaller hole. Simply tightening the lock nut (mounting bolts on an end cap style) will snug the roller up against the mounting rail. This will ensure proper v-groove alignment among rollers



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LOAD RATINGS

The load ratings listed in this document are to be used for reference purposes only and are best suited for allowing comparison across product families. For optimum results, loads should not exceed the listed stud capacity or no more than 50% of the dynamic capacity.

CAPACITY OF THE BEARING ELEMENT - BASIC DYNAMIC LOAD RATING (BDR)

PCI Load Bearing Roller Assemblies that have been properly mounted, lubricated, shielded from contamination and maintained will operate with minimal wear until fatigue failure of the rolling elements takes place. Individual bearing life is expressed as the number of revolutions or the number of hours at a given speed that a bearing will complete before fatigue failure occurs. The L10 or minimum life is a common expression of bearing life and is defined as the number of hours at a constant speed (or number revolutions) that 90% of a given test group of identical bearings should survive under controlled, laboratory-like conditions. The Basic Dynamic Load Ratings listed in this catalog are calculated using 33-1/3RPM and 500 hours as application variables. To relate the BDR required to the speed, load and desired life, use the following formula:

Required BDR = 0.05413 X P X (L X N) ^ A

BDR = Basic Dynamic Load Rating Required
P = Applied Load in Application
L = Desired Life (hours)
N = Speed (RPM)
A = Exponent (1/3 for ball bearings-3/10 for roller bearings)

BASIC STATIC LOAD RATING

Loads are to be considered static when the Load Bearing Roller assembly is rotating at speeds less than 10RPM, or subjected to very slow oscillating movements, or are stationary during a significant period of time. The Basic Static Load Rating is the static load which will cause a contact stress of 609,000psi for ball bearings and 580,000psi for roller bearings between the rolling elements and the raceway. Loads above the Basic Static load rating cause permanent deformation of the rolling element in excess of .0001 of the rolling element diameter.

C - BASIC RADIAL DYNAMIC LOAD RATING

The Basic Radial Dynamic Load Ratings listed as “C” values are in reference to load applied 90 degrees to the bearing bore or axis of rotation only. If load is to be applied in any other manner, this value may not be directly applicable.

C_0 - BASIC RADIAL STATIC LOAD RATING

The Basic Radial Static Load Ratings listed as “Co” values are in reference to load applied 90 degrees to the bearing bore or axis of rotation only. If load is to be applied in any other manner, this value may not be directly applicable.

THRUST DYNAMIC LOAD RATING

The Thrust Dynamic Load Ratings listed are in reference to pure axial load only which is load applied directly parallel with the bearing bore or axis of rotation. Since load is not likely to be applied in this manner with this family of products, this value is to be used for comparison purposes only.

THRUST STATIC LOAD RATING

The Thrust Static Load Ratings listed are in reference to pure axial load only which is load applied directly parallel with the bearing bore or axis of rotation. Since load is not likely to be applied in this manner with this family of products, this value is to be used for comparison purposes only.

STUD CAPACITY

In some cases, the maximum allowable load on a Load Bearing Roller Assembly is limited by the capacity of the stud or mounting agent. The stud becomes the limiting factor based on its maximum permissible bending stress. The stud capacities listed in this document are calculated as the maximum bending stress based on a load centered on the roller body tread surface and include a factor of safety of 1.33.

TRACK CAPACITY

Track capacity for flat track surfaces can be calculated through use of Hertzian contract stress formulas. These formulas utilize the properties of track material and the contact conditions between the track and the Load Bearing Roller Assembly to calculate the maximum contact stresses generated in a given situation. To maximize track life, the maximum Hertzian contact stress must not exceed the ultimate tensile strength of the track. To determine the appropriate track and/or roller for a particular application, use the following steps:

1. **Select the appropriate Hertzian formula based on the profile of the PCI Load Bearing Roller Assembly.** (Contact PCI Customer Service for assistance in calculating capacities for track profiles other than flat)
2. **Enter the variables into the appropriate formula and calculate the maximum contact stress.**
3. **Use the approximate ultimate tensile strength tables to determine the tensile strength of the track**
4. **Compare the maximum calculated contact stress to the tensile strength of the track**
5. **If the maximum contact stress is greater than the track tensile strength, a harder track or larger diameter roller should be selected and reanalyzed.**

MAXIMUM CONTACT STRESS: Plain / Cylindrical Roller Body

The maximum contact stress between the tread surface of a steel or stainless steel roller body with a plain/cylindrical profile can be approximated using a simplified Hertzian Contact Stress equation; given by "Roark, Formulas for Stress and Strain" as:

$$\sigma_{C\,max} = 3{,}237 \times \sqrt{\frac{P}{l_{eff} \times D}}$$

Where: $\sigma_{C\,max}$ = Maximum contact stress [psi]

P = Radial load [lbf]

l_{eff} = Effective length of outer ring contact

D = Outer ring diameter

MAXIMUM CONTACT STRESS: Crowned / Spherical Roller Body

The maximum contact stress between the tread surface of a steel or stainless steel roller body with crowned/spherical profile can be approximated using a simplified Hertzian Contact Stress equation; given by "Roark, Formulas for Stress and Strain" as:

$$\sigma_{C\,max} = \frac{.4775\,P}{\alpha\beta\left(\sqrt[3]{P \times K_D \times (6.106 \times 10^{-8})}\right)^2}$$

Where: $\sigma_{C\,max}$ = Maximum contact stress [psi]

P = Radial load [lbf]

$$K_D = \frac{1.5}{\left(\frac{1}{R_1}\right) + \left(\frac{1}{R'_1}\right)}$$

R_1 = Outer ring radius [in]

R'_1 = Crown radius [in])

α and β = Solve the equation below for *Cos Ø* and use Table 1

$$Cos\ \theta = \left(\frac{1}{\left(\frac{1}{R_1}\right)+\left(\frac{1}{R'_1}\right)}\right) \left|\left(\frac{1}{R_1} - \frac{1}{R'_1}\right)\right|$$

Cos Ø	α	β
0.00	1.000	1.000
0.10	1.070	0.936
0.20	1.150	0.878
0.30	1.242	0.822
0.40	1.351	0.769
0.50	1.486	0.717
0.60	1.661	0.644
0.70	1.905	0.608
0.75	2.072	0.578
0.80	2.292	0.544
0.85	2.600	0.507
0.90	3.093	0.461
0.92	3.396	0.438
0.94	3.824	0.412
0.96	3.508	0.378
0.98	5.937	0.328
0.99	7.774	0.287

Table 1: Contact Stress Variables

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TRACK CAPACITY (continued)

Determine the ultimate tensile strength of the track material using Tables 2 and 3 below. Table 2 contains approximated tensile strength values based on the hardness of standard alloy steels while Table 3 contains the same information pertaining to common stainless steel materials. Compare the approximated tensile strength from these charts to the calculated maximum contact stress value obtained in the previous steps. The maximum contact stress value should not exceed the track ultimate tensile strength value. If the contact stress exceeds the ultimate tensile strength, a harder track material or a load bearing roller assembly with a larger and/or wider roller body should be selected.

Alloy Steel Hardness Rockwell C	Approximate Tensile Strength (ksi)
20	110
25	122
30	138
35	157
40	182
45	215
50	252
55	298

Table 2: Approximate Ultimate Tensile Strength of Standard Steel Materials (Fundamentals of Machine Component Design; Second Edition, p. 85)

Stainless Steel Material (Condition)	Hardness	Approximate Tensile Strength (ksi)
316 (Annealed)	80 Rockwell B	85
440C (Annealed)	96 Rockwell B	110
440C (Hardened & Tempered)	57 Rockwell C	285

Table 3: Approximate Ultimate Tensile Strength of Stainless Steel Materials (Machinery's Handbook: 25th Edition, p. 440-441)

TEMPERATURE LIMITATIONS

Unless otherwise noted, PCI Cam Followers are limited to a continuous operating temperature of 200°F while PCI Track Rollers, DCB Rollers and XR Rollers are limited to a continuous operating temperature range of -30°F to 225°F due to limitations in the sealing provisions. Many high and low temperature options are available.
Please consult with a PCI Customer Service Representative for additional information.

APPLICATION CONSIDERATIONS

The proper selection and application of PCI Load Bearing Roller Assemblies is the responsibility of the system designer. Operation and performance requirements and potential associated issues will vary appreciably depending upon the use and application of such products and components. The scope of the technical and application information included in this publication is necessarily limited. Unusual operating environments and conditions, lubrication requirements, loading supports and other factors can affect the application and operating results of the products and components and the customer should carefully review its requirements. Any technical advice or review furnished by PCI, with respect to the use of products is given in good faith and without charge and PCI assumes no obligation or liability for the advice given, or results obtained, all such advice and review being given and accepted at customer's risk.

PCI Load Bearing Rollers Assemblies and related components are not recommended for use in any nuclear related environments or applications.

A copy of our **Terms of Sale Rider-PCI Standard Terms and Conditions of Sale** can be found on our website www.pcimfg.com or can be requested by contacting our Customer Service department at 989.358.6148.