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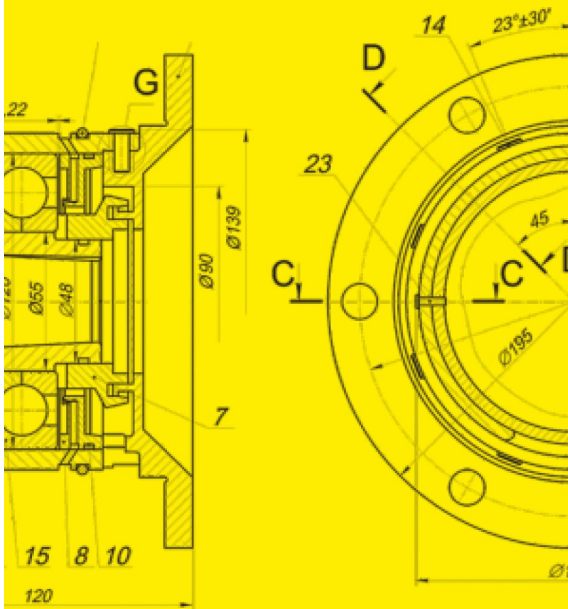


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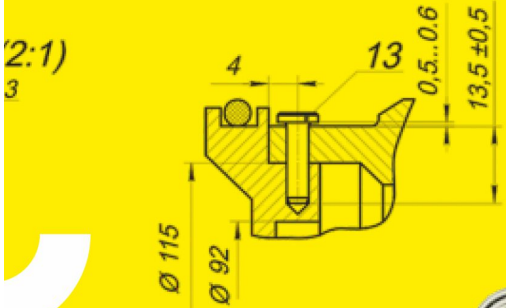
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CATALOGUE/TC-106, 01/2024



ROLLING BEARINGS

Bearing Fitment and Handling



This version supersedes all previously published versions. All the bearing mentioned in this catalogue are manufactured with normal tolerance class. We can, however, supply other class bearing against specific requirement.

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2 WHEELERS



3 WHEELERS



4 WHEELERS



TRACTORS



LCV, HCV



INDUSTRIES



RAILWAYS



AEROSPACE



Products from NBC

Founded in 1946, NBC is India's first bearings manufacturer and the last word in quality and durability. In 2020, the company acquired leading European manufacturer, Kinex Bearings to further boost its expertise.

75 years since its beginning, NBC remains India's leading bearings manufacturer and exporter. NBC is also the world's only bearings manufacturer to receive the prestigious Deming Grand Prize for Total Quality Management.



Since the challenges faced by industry are many, NBC offers a diverse range of exceptional bearings. NBC bearings are available in sizes from 04 mm bore to 2000 mm outer diameter.



* Products with special features like high temperature application, special heat treatment, coated roller/faces and cage options are also available across product range.

13 Bearing fitment and handling

13.1 Fitment

Rolling bearing is a very precise product and its mounting deserves careful attention. Mounting is an important function as it:

- Ensures safety of the equipment and the operator
- Minimizes breakdown and reduces downtime
- Bearing can perform to its maximum load carrying capacity
- Enhance the bearing life
- Prevent creeping of rings on shaft under load

The characteristics and assembly of the bearing should be thoroughly studied before mounting. The sequence of mounting must be established and verified. Mounting process is an important factor that affect the service life of bearing. Few basic rules should be obeyed while mounting such as:

- keeping the mounting area absolutely clean
- Protection of all bearing parts from contamination and corrosion
- Proper cleaning of bearing component
- Checking bearing fitment dimensions
- Using proper tools for mounting
- Follow mounting sequence
- Post mounting checks
- Exact quantity of Lubricant must be filled in the bearing
- After assembly check correctness of bearing functioning

Tips for bearing maintenance to help ensure a longer life span.

Handle with care

Bearings are delicate enough to get damaged quickly. As such, it is very important that they are stored horizontally in a clean and dry environment with their packaging intact. Do not expose them to any airborne contaminants, as even a tiny speck of dirt can cause premature failure. Never hammer or pound them, or apply a direct force on it or its outer ring, which can cause damage to the rolling elements, resulting in misalignment. The most important thing to remember is to never remove bearings from their packaging until ready for use.

Absolute cleanliness is essential when handling bearings. They should not be removed from their wrappings until required for fitting. All tools, shaft, housings and other components must be perfectly clean. If fitting operations are delayed or interrupted the assembly should be wrapped with grease proof paper to exclude dirt and dust.

Check the bearing housing and shaft

Whenever a bearing is used for mounting, it is crucial that the housing and shaft are inspected for any sort of physical condition or damage. Always use a soft cloth to wipe the surfaces clean and make sure any nicks and burrs are removed.

Mount the bearings correctly

The method used to mount the bearings depends on the type of bearing. For example, bearings with cylindrical bores are generally mounted through a press fit method. Bearings with tapered bores can be mounted directly on tapered or cylindrical shafts with the use of tapered sleeves. The fits of the rings with shaft and housing on bearing seating are very important. Therefore ensure that the shaft and housing seating are of correct size and of good shape.

All shoulders must be smooth and square with the axis of rotation. Drive one ring on its seating by blows on the other. Such blows would irretrievably damage the balls or rollers and raceways.

Where the ring of a bearing is against an abutment, make sure it is tight fit. For heavy interference fits, inner rings may be shrunk on to the seating after heating in clean mineral oil at a temperature of approximately 100°C. Be sure that the bearing is in contact with the abutment shoulder after it has cooled.

Avoid preheating or overheating

The maximum heating allowed on the bearings depends on the heat treatment of the material. If they are heated above the permitted limit, they can permanently deform or soften the bearing steel, lowering load carrying capacity and resulting in a failure. Always heat the bearings using induction heaters, and never with an open flame.

Always use the proper tools

Specialized tools like bearing pullers, bearing fitting tool kits, oil injector kits, hydraulic nuts, or induction heaters should be used in the mounting and dismounting processes. These tools ensure the smooth process of mounting or dismounting, in order to minimize the risk of damage. Apply pressure evenly around the rings. "A press is better than a hammer."

Should a hammer be used, mild steel or brass tube of suitable size, faced up square, should be interposed between it and the bearing. This will distribute the force of the blows (or rather taps), which should be given progressively around the ring.

When the parts are separable, roller bearings are brought together, the inner ring, the outer ring and the rollers must all be square with the other. If not square, then the rollers would not slide freely, and force would have to be used to bring the parts together. Such force would result in the rollers and raceways becoming scored and this, in addition to causing noisy running could cause early failure of the bearing.

Avoid corrosion

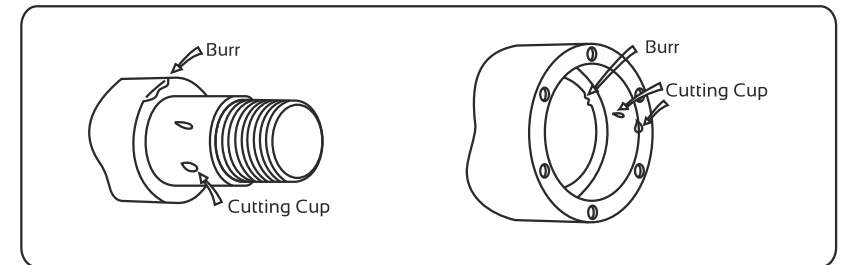
It is crucial that you should not expose bearings to the presence of water for a long time, as it will lead to rust and corrosion. It will also cause the premature failure of the bearings, which can affect the machine performance and productivity. As a result, it will increase your operating costs. Also, make sure to wear gloves when handling bearings. Perspiration can also lead to rust and corrosion.

Proper lubrication

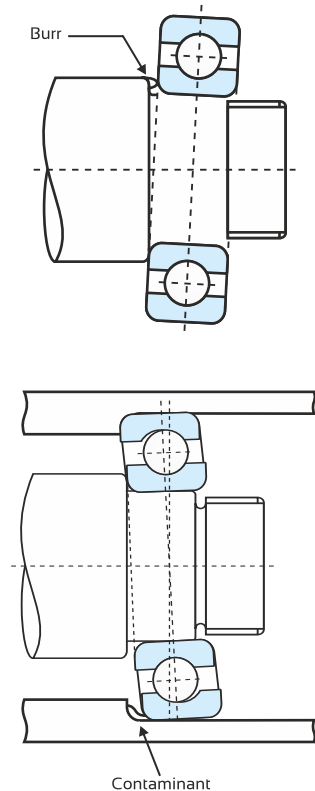
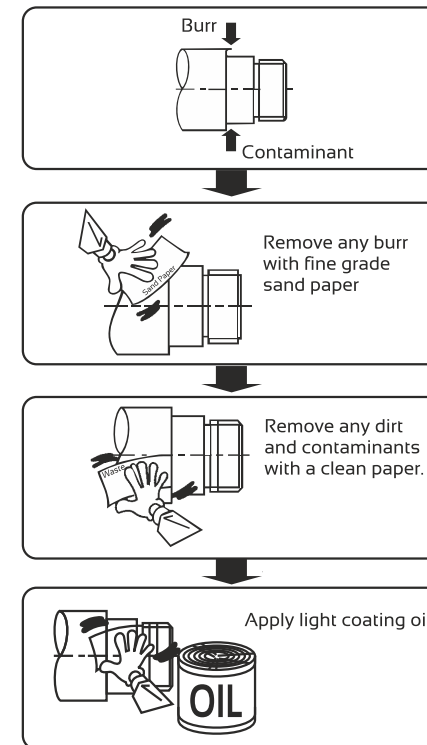
If you want to have a prolonged life of your bearings, it is crucial that they should be properly lubricated. The correct lubricant depends on the environmental conditions, temperature, speed and load. In this case, it is advisable that you should follow your manufacturer's recommendations.

13.2 Preparations Before Mounting

- Do not remove the bearings from their packaging until just before use.
- The bearings are covered with anti-corrosion oil. The oil should not be wiped out from bearing surfaces until bearing is not used. At the time of mounting wipe out oil from bearing outer surface and bore only. Sealed /shield bearings must never be washed before mounting.
- Clean shaft and housing. Any burrs, cutting chips, rust or dirt should be removed from the bearing mounting surfaces by using fine grade sand papers/ file. Installation can then be simplified if the clean surfaces are lubricated with spindle oil. Ensure that lubricating holes and threaded holes are clean.



9.1.2 Preparation Procedure



- Check dimensions, shoulder and finishing of shaft and the housing as per the drawing. The shaft diameter and housing bore diameter should be measured at the several points. Tapered shaft must be checked with ring gauge and sine bar. The diameter of straight shaft and housing is usually checked with micrometer and internal gauge. Check the size at two different positions and at four locations

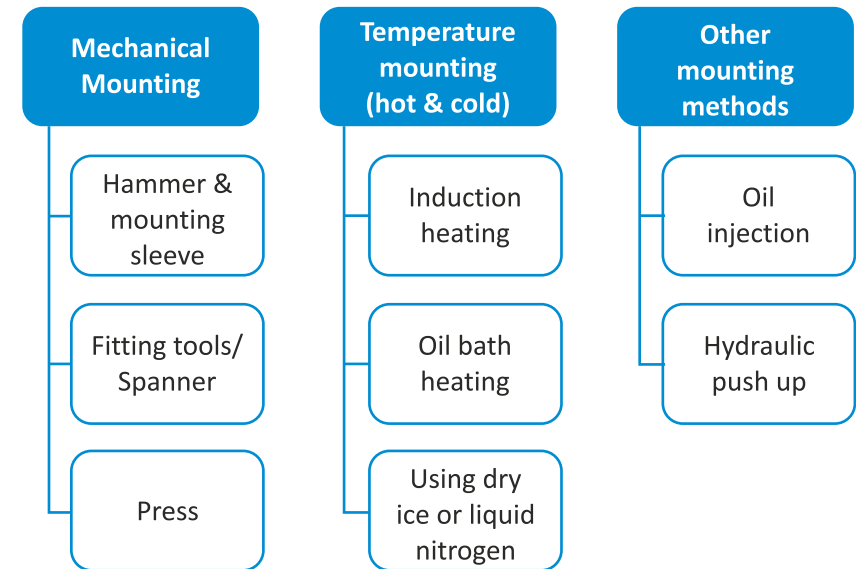


- Check dimensions, shoulder and finishing of shaft and the housing as per the drawing. The shaft diameter and housing bore



13.3 Mounting

Bearing mounting depends upon the type of bearing, application, size of bearing. Avoid direct hammer blows on the bearings while mounting. Make sure that cage and seals are not hit directly. Mounting can be done in the following ways.



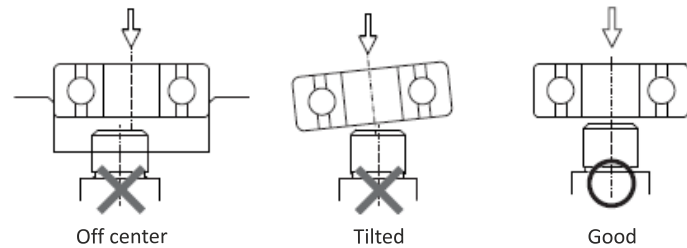
13.3.1 Mechanical method

The method used to mount the bearings depends on the type of bearing. The bearings are with cylindrical bore and tapered bore.

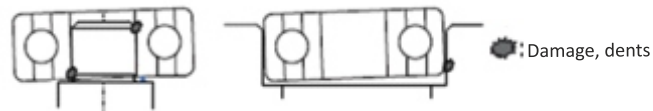
- Non-separable bearing, the component which is tight fit is mounted first in housing or shaft.
- Separable bearing, inner can be mounted independently of outer. During assembly, care must be taken to align the shaft properly with housing.

Alignment

Ensure proper alignment of shaft or housing with the inner or outer. If either of the component is misaligned, it will get stuck.

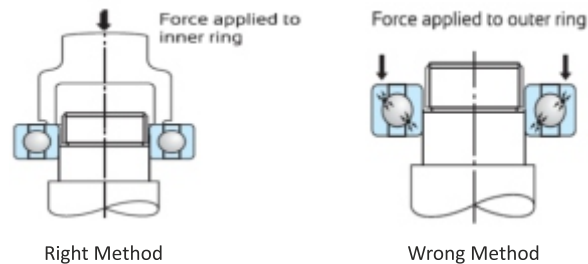
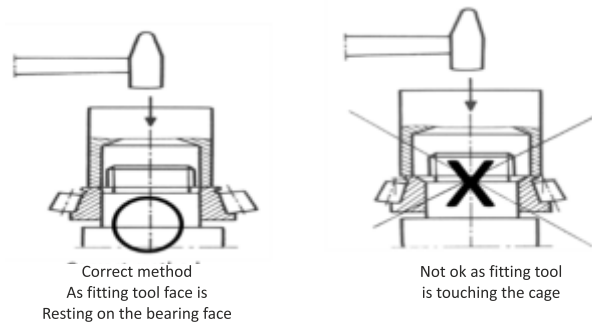


Misalignment Due to Contamination and Damage



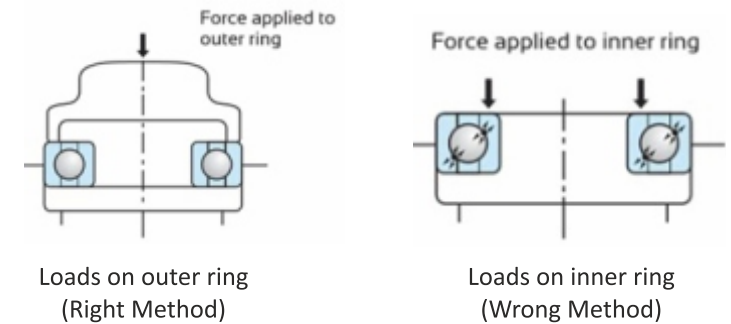
Inner mounting on shaft

While pressing on the shaft apply force on the inner ring face.



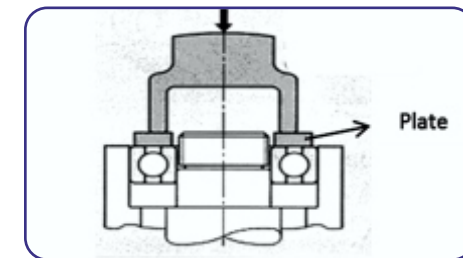
Outer ring mounting in housing

During pressing in the housing apply force on the outer ring face.

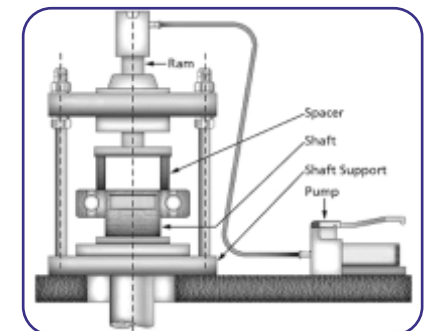


Mounting both housing and shaft together

When both inner and outer are mounted together, than force is applied by a fitting tool on the plate that is placed on the face of the bearing as shown.



Mounting by hydraulic press



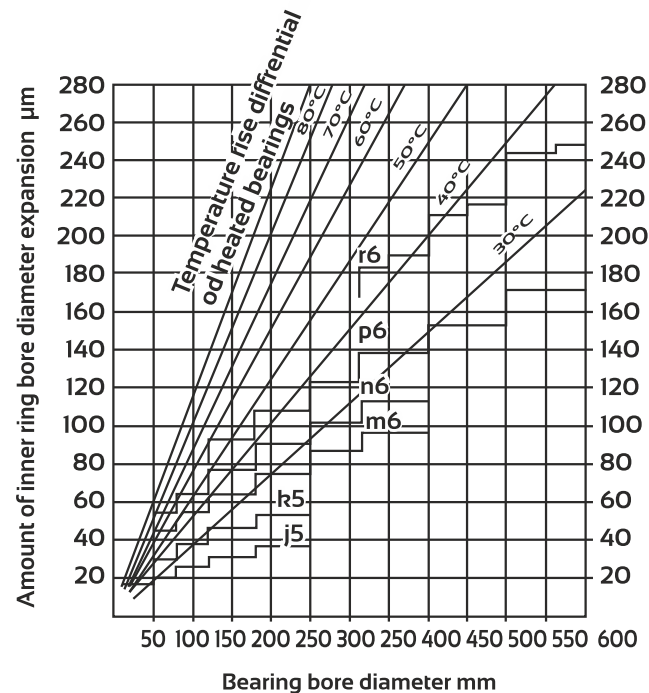
13.3.2 Temperature Mounting

(Heat expansion of inner ring to ease installation)

Oil bath method

Commonly used for large bearings and bearings with a heavy interference fit.

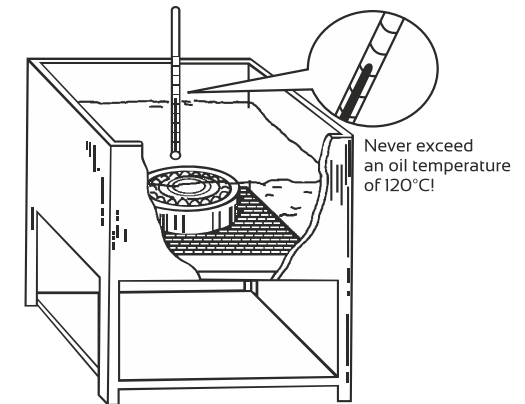
1. Immersion of the bearing in heated oil is the most common method. Use clean oil and suspend the bearing in the oil with a wire or support it underneath using a metal screen in order to avoid uneven heating of bearing elements.
2. The temperature to which the inner ring should be heated depends upon the amount of interference fit i.e. the diameter of the interference fit surfaces. Refer to the following graph to determine the proper temperature.



3. To prevent gaps from occurring between the inner ring and shaft shoulder, bearings which have been heated and mounted on the shaft should be held in place until they have cooled completely.

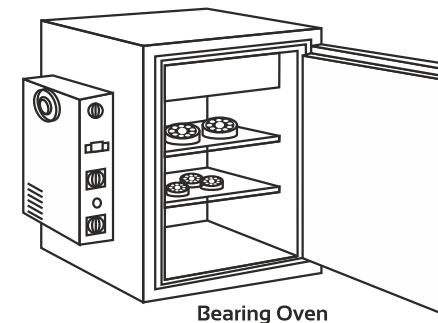
Precautions : Bearings should never be heated over 120°C.

For higher operating consult NBC. Temperature mounting cannot be used for pre-greased and sealed or shield bearings.



Bearing Oven

This method can also be used for heating pre-greased bearings. Bearings must not be heated above 80-85°C. The seals on the bearing must never touch the plate of oven. Always keep a ring between bearing and oven plate.



Induction Heating

This method can also be used for the inner rings of roller bearings. Bearings are dry and can be heated up in a short period of time. After using this method, administer a demagnetizing treatment to the bearing.



13.4 Mounting Bearings on Tapered Bore

Tapered bore bearings are always mounted with interference fit and this will depend upon how far the bearing is driven on the tapered shaft. During mounting the radial clearance decreases. Hence it is important to check the clearance as the bearing is pushed up the shaft.

Bearings with tapered bores can be mounted directly on tapered or cylindrical shafts with the use of tapered sleeves. However, pressure should be applied only with a press fit because without it the raceways can be damaged.

In case of tapered sleeve and nut bearings, the clamping nut must not be over-tightened, for this could expand the inner ring and eliminate all clearance within the bearing, or even fracture the inner ring. We recommend that after the nut has been tightened by hand pressure, use a pin hammer. Give one or two light hammer blows to the handle of the spanner. This should tighten the nut just sufficiently.

If possible, check that the sleeve is still clamped firmly to the shaft after a few days of running. As an additional precaution we recommend that whenever the bearings are fitted, check the rotation of the shaft as it tends to tighten the nut on the sleeve. To assist customers who use torque spanners we recommend that the following torque be applied to the clamping nut for light series bearings.

Shaft Diameter	Torque on Nut
1" (25mm)	7.6 Kg.m
1.5" (38 mm)	12.4 Kg.m
2" (50mm)	17.25 Kg.m
3"(75mm)	30.3 Kg.m

For medium series bearing we recommend that the above values be increased by approximately 50 percent.

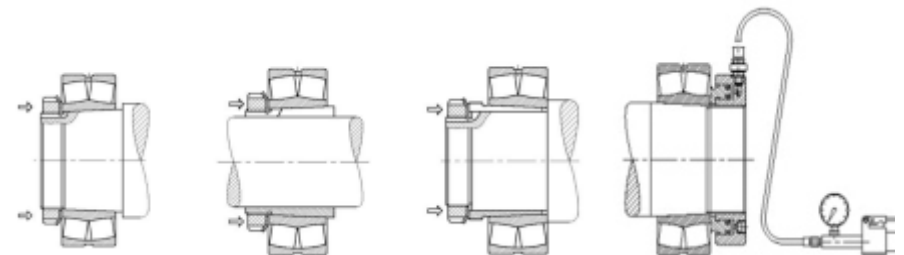
Mounting can be done in the following ways.

For shaft diameter up to 75 mm.

- By pushing the bearing directly on the shaft by a fitting tool or a lock nut.
- Using adaptor sleeve and sleeve locking nut.

For shaft diameter more than 75 mm.

- Oil injection method. Shaft and sleeve with duct. Duct is used to feed oil under pressure to bearing seating. As the bearing expand radially, the sleeve is inserted axially with adjusting bolts.
- Hydraulic nut cum dial pressure gauge arrangement



Mounting bearing Directly over shaft with lock nut
Lock nut is clamped against the face of bearing

Bearing mounted on adaptor sleeve with adaptor sleeve lock nut

Bearing mounted on withdrawal sleeve with lock nut

Hydraulic nut & dial pressure gauge arrangement

13.5 Measurement of Radial Clearance Reduction for Bearings with Tapered Bore

While mounting large bearings on tapered shaft it is important to measure radial clearance otherwise due to reduction of clearance there is possibility of bearings getting jammed during mounting. Follow the steps :

1. Measure the initial clearance before mounting.
2. Rotate the bearing 4-5 times before measuring the clearance in mounted bearing
3. Measure the clearance between the rolling element and outer ring

(Note: measurement may be affected due to weight of bearing or if the shape of the outer gets deformed after mounting. Also if the feeler gauge positioning is not ok).



Feeler gauge

Checking clearance with feeler gauge

While Mounting spherical roller bearing on the tapered shaft, radial clearance must be checked and for Permissible residual clearance refer table below.

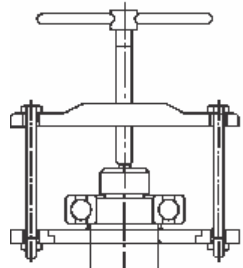
Table for permissible residual clearance

Bearing Bore Diameter d		Reduction in Radial Clearance		Push-in amount in axial direction				Minimum Permissible Residual Clearance	
				Taper 1:12		Taper 1:30			
over	incl	min.	max.	min.	max.	min.	max.	CN	C3
30	40	0.025	0.03	0.4	0.45	-	-	0.01	0.025
40	50	0.03	0.035	0.45	0.55	-	-	0.015	0.03
50	65	0.03	0.035	0.45	0.55	-	-	0.025	0.035
65	80	0.04	0.045	0.6	0.7	-	-	0.03	0.04
80	100	0.045	0.055	0.7	0.85	1.75	2.15	0.035	0.05
100	120	0.05	0.06	0.75	0.9	1.9	2.25	0.045	0.065
120	140	0.06	0.07	0.9	1.1	2.25	2.75	0.055	0.08
140	160	0.065	0.08	1	1.3	2.5	3.25	0.06	0.1
160	160	0.07	0.09	1.1	1.4	2.75	3.5	0.07	0.11
160	200	0.08	0.1	1.3	1.6	3.25	4	0.07	0.11
200	225	0.09	0.11	1.4	1.7	3.5	4.25	0.08	0.13
225	250	0.1	0.12	1.6	1.9	4	4.75	0.09	0.14
250	280	0.11	0.14	1.7	2.2	4.25	5.5	0.1	0.15
280	315	0.12	0.15	1.9	2.4	4.75	6	0.11	0.16
315	355	0.14	0.17	2.2	2.7	5.5	6.75	0.12	0.18
355	400	0.15	0.19	2.4	3	6	7.5	0.13	0.2
400	450	0.17	0.21	2.7	3.3	6.75	8.25	0.14	0.22
450	500	0.19	0.24	3	3.7	7.5	9.25	0.16	0.24
500	560	0.21	0.27	3.4	4.3	8.5	11	0.17	0.27
560	630	0.23	0.3	3.7	4.8	9.25	12	0.2	0.31
630	710	0.26	0.33	4.2	5.3	10.5	13	0.22	0.33
710	800	0.28	0.37	4.5	5.9	11.5	15	0.24	0.39
800	900	0.31	0.41	5	6.6	12.5	16.5	0.28	0.43
900	1000	0.34	0.46	5.5	7.4	14	18.5	0.31	0.74
1000	1120	0.37	0.5	5.9	8	15	20	0.36	0.53

13.6 Dismounting

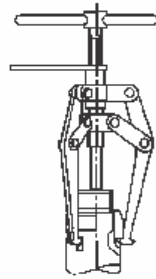
A bearing may be removed for periodic inspection. If the removed bearing is to be used again or it is removed only for inspection, it should be dismantled as carefully as when it was mounted. If the bearing has a tight fit, its removal may be difficult. The means for removal should be considered in the original design of the adjacent parts of the machine. When dismantling, the procedure and sequence of removal should first be studied using the machine drawing and considering the type of mounting fit in order to perform the operation properly. In case of non-separable bearing, the ring having loose fit must be withdrawn first. For separable bearing the rings can be dismantled independent of each other.

Small size bearings can be dismantled using press or mechanical puller. In case of large size bearings (bore > 75 mm) it is recommended to use oil injection method and puller both.

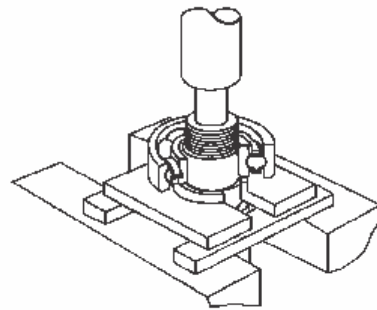


(a)

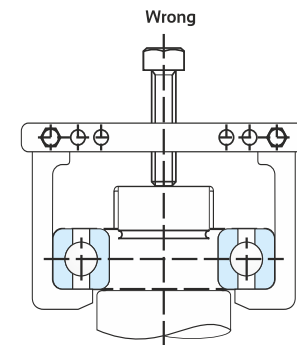
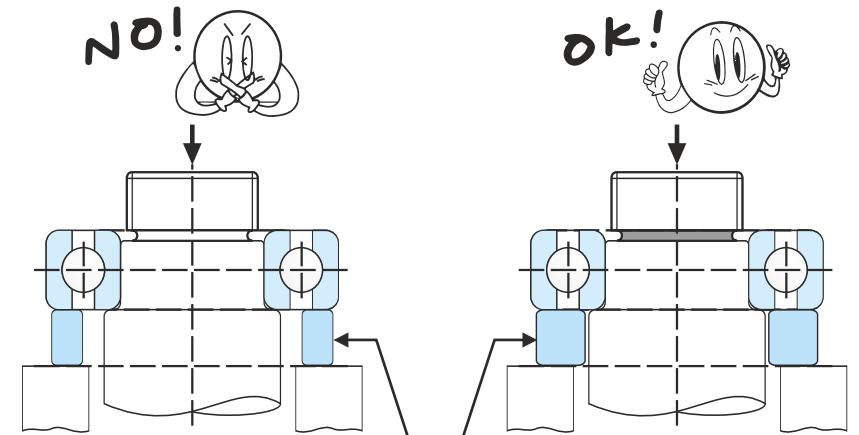
Removal Using a Bearing puller



(b)

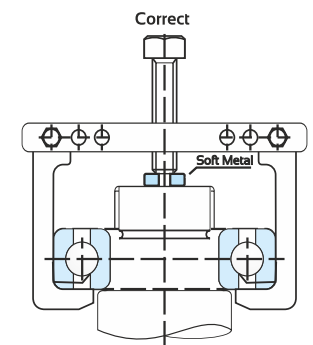


Removal Using a spacer

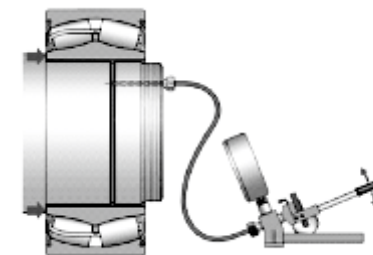


Wrong

Permissible



Correct



Removal by hydraulic pressure

13.7 Bearing Cleaning

It is seldom necessary to clean bearings with the sole object of removing the rust preventive oil, which they are coated before being packed. Rust preventives with a petroleum jelly base have certain lubrication qualities and in any case since the amount used for the protection of bearings is small, no harm is done with the grease or oil used for lubrication.

As a rule washing shall only be done when bearings have become dirty or when the mechanism in which they are used is so sensitive that even slight irregular resistance to rotation is not permissible. When bearings are inspected, the appearance of the bearings should first be recorded and the amount and condition of the lubricant should be checked. After the lubricant has been sampled for examination, the bearings should be cleaned. Cleaning media most commonly employed for used bearing are:

- (a) Benzene
- (b) White Spirit (Low flash point)
- (c) Turpentine
- (d) Paraffin Oil
- (e) Light Spindle Oil
- (f) Trichloro Ethylene
- (g) Carbon Tetra Chloride
- (h) Petroleum Ether

Method of cleaning

Rough cleaning

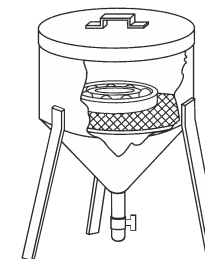
In Rough cleaning a separate container should be used and to support the bearing. A screen is provided in the container. All the cleaning media as mentioned above can be used for cleaning bearing, if bearing is very dirty, Gasoline should be used. Care should be taken to prevent igniting and to prevent rusting after cleaning.

In rough cleaning, each bearing is moved about vigorously without rotating it, since any trapped foreign matter can scratch the rolling elements & trace. If the oil is heated it cleans the bearing effectively. However, never heat the oil above 100°C. After as much as possible of the dirt has been removed this way, the bearing is transferred to the final cleaning.

Final cleaning

Now bearing is submerged in clean oil & rotated gently the inner ring or outer ring so that inside of the bearing will also be cleaned. After that, rotate the bearing faster until all trace of dirt has been removed. Now remove the bearing from bath and wipe it with a clean cloth, apply a coat of rust preventive oil to the bearing and wrap it is not going to be used immediately. It is necessary to always keep rinsing oil clean.

After any cleaning process it is necessary to protect the bearing by dipping it in hot petroleum jelly or oil, or by applying the grease to be used that it reaches every part of the surface. In the latter case rotation of bearings is necessary while grease is being applied.



Cleaning Apparatus

13.8 Inspection and Evaluation of Bearings

After being thoroughly cleaned, bearings should be examined for the condition of their raceways and external surfaces, the amount of cage wear, the increase in internal clearance, and degradation of tolerances. These should be carefully checked, in addition to examination for possible damage or other abnormalities, in order to determine the possibility for its reuse.

In the case of small non-separable ball bearings, hold the bearing horizontally in one hand, and then rotate the outer ring to confirm that it turns smoothly.

Separable bearings such as tapered roller bearings may be checked by individually examining their rolling elements and the outer ring raceway.

Large bearings cannot be rotated manually; however, the rolling elements, raceway surfaces, cages, and contact surface of the ribs should be carefully examined visually. The more important a bearing is, the more carefully it should be inspected.

The determination to reuse a bearing should be made only after considering the degree of bearing wear, the function of the machine, the importance of the bearings in the machine, operating conditions, and the time until the next inspection. However, if any of the following defects exist, reuse is impossible and replacement is necessary.

- (a) When there are cracks in the inner or outer rings, rolling elements, or cage.
- (b) When there is flaking of the raceway or rolling elements.
- (c) When there is significant smearing of the raceway surfaces, ribs, or rolling elements.
- (d) When the cage is significantly worn or rivets are loose.

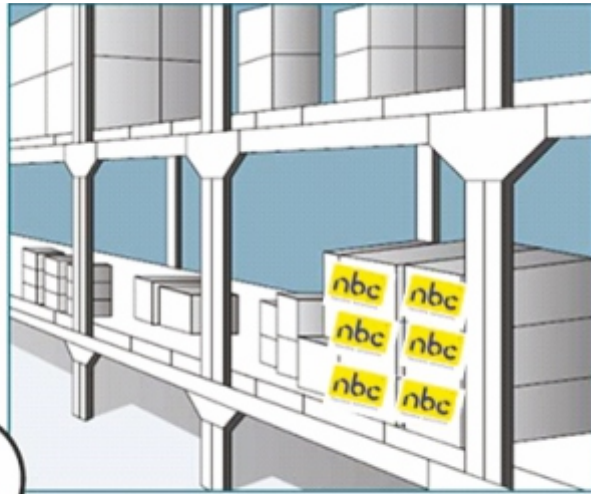
- (e) When there is rust or scoring on the raceway surfaces or rolling elements.
- (f) When there are any significant impact or brinell traces on the raceway surfaces or rolling elements.
- (g) When there is significant evidence of creep on the bore or the periphery of the outer ring.
- (h) When discoloration by heat is evident.
- (i) When significant damage to the seals or shields of grease sealed bearings has occurred

13.9 Bearing Handling & Storage

13.9.1 Storage

Importance of proper bearing storage

- Store the bearings in their original packing to avoid any contamination or corrosion
- Place large and heavier bearings on a flat surface with complete support at the bottom.
- Never store the bearings in upright position
- Store bearings in cool and dry rooms away from direct sunlight
- Avoid contact with aggressive media like chemicals, gases, acidic fumes etc. during storage
- Open bearings (without seal or shield) can be stored up to five years. Sealed and Shielded (Greased) bearings needs regular attention



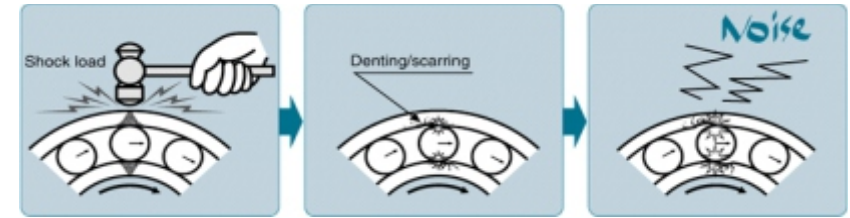
Proper storage

13.9.2 Bearing Handling

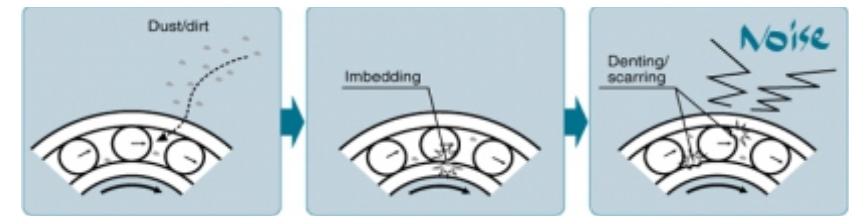
Bearings carry their loads along an extremely narrow contact surface between the rolling elements and the inner and outer raceway surfaces.

If an excessive load or impact is applied to this narrow area of contact, brinelling and/or scarring will occur. This damage leads to objectionable noise and vibration levels and rough bearing rotation. (Even dropping bearings on the floor will cause this type of damage.)

Bearings are very susceptible to impacts and shock loads!

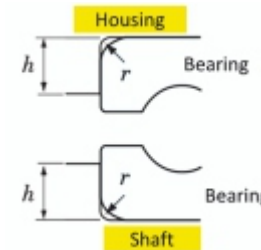


Bearings are very susceptible to foreign particle contamination! If foreign particles infiltrate the bearing during rotation, denting and/or scarring will occur and this will lead to poor bearing rotation and excess noise.



13.10 Abutments for Bearings

1. Shaft and housing abutments for a ball or roller bearing must be flat and square with the axis of rotation.
2. An abutment must be deep enough to clear the unground corner radius of a bearing and contact its ground face.
3. The radius at the root of an abutment must be smaller than the corner radius of the ring located against that abutment, alternatively the root may be undercut.
4. The edge of an abutment must be reduced or chamfered, as a burred edge can so easily dent or distort a bearing ring.



The fillet radius (r) of shaft / housing, should be smaller than the chamfer dimensions of the bearing.

Ball Bearings, Angular Contact and Duplex Bearings

When a bearing carries heavy axial load, abutments must be deeper i.e. it should not extend beyond the inner ring outside diameter or below the outer ring bore. A deep abutment can cause difficulties when a bearing is removed from its seating and, therefore, it is advantageous to provide grooves or holes on such an abutment so that a suitable extraction tool can be used.

Roller Bearings

Bearings not carrying axial loads

The maximum abutment depth is more important for these bearings than for ball bearings. The maximum inner abutment diameter and minimum outer ring abutment diameter are recommended accordingly. Broadly these coincide with the diameter of the inner and outer ring raceways respectively.

Bearings carrying axial load

Abutments for these bearings should extend beyond the raceways to avoid shear stresses in the lips. Every possible care is necessary to ensure that the abutments are flat and square with the axis of rotation.

Thrust Bearings

Abutments for Thrust bearings should extend beyond the pitch circle diameter of the balls to prevent the washers moving under load.

For standard Thrust bearings with one small bore washer and one large bore washer, the approximate pitch circle diameter

$$= \frac{\text{Small bore diameter} + \text{Large outside diameter}}{2}$$

In case of bearings with two bore washers, use the pitch circle diameter for the same basic bearing size with one large bore washer and one small bore washer.

14 Bearing Failure