NEEDLE THRUST BEARINGS-
ROLLER THRUST BEARINGS

AX + CP

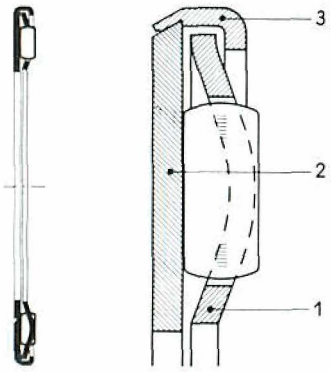
AR + CPR

AXZ

ARZ

The rolling elements of a thrust bearing are retained and guided in radial pockets within the cage (1). The latter is itself retained in relation to the plate (2) by means of a steel ring (3). This assembly of parts is easy to handle and install and provides a high axial load capacity whilst occupying minimal space.

The design of NADELLA thrust bearings serves to reduce to a minimum the friction between the rolling elements and the cage that guides them. Given correct installation and adequate oil lubrication, the coefficient of friction will be between 0.003 and 0.004 for needle thrust bearings and between 0.004 and 0.005 for roller thrust bearings.

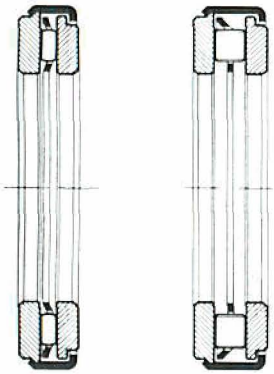


This result is due principally to the design of the one-piece steel cage (1) which has a special curvature that guides the rolling elements by their ends along their centre-lines. Thus, the loads imposed on the cage by the rollers cannot create components parallel to the axis of rotation and therefore no increase in internal friction is generated, and correct operation without wear or overheating is ensured. In addition, this special curvature gives the steel cage great rigidity and being relatively thin provides maximum space for the lubricant.

THRUST PLATES

The plate incorporated in the thrust bearing is made from hardened bearing steel and forms one of the raceways for the rolling elements. The opposing raceway is generally provided by a separate thrust plate of similar design supplied by NADELLA. When the thrust bearing is centred by the revolving part, the thrust plate must be centred by the stationary part and *vice versa*. If the revolving part and the stationary part are noticeably eccentric to each other, the thrust bearing with integral plate must without exception be centred by the revolving part (see typical examples of applications, page 116).

The second raceway for the rolling elements may also be formed by the face of a shoulder or an inserted ring, provided these have the correct geometrical dimensions and hardness.



AXZ ARZ

THRUST BEARINGS WITH TWO THRUST PLATES

Thrust bearings type AXZ and ARZ have two thrust plates retained by a steel ring giving protection against the entry of dirt and metal particles whilst at the same time assisting retention of the lubricant.

INTERMEDIATE PLATES

To ensure correct axial positioning in both directions, needle thrust bearings or roller thrust bearings may be mounted as a pair in a bearing arrangement on either side of a common intermediate plate, each face of which forms the second raceway for one of the thrust bearings. NADELLA manufactures two series of intermediate plates in hardened bearing-steel. One series to match needle thrust bearings type AX (both thick or thin) and the other to match roller thrust bearings type AR (light series).

The intermediate plates in the PM series may be used under normal loads without risk of excessive deflection. They can be centred on the shaft, the thrust bearings being centred in the housing, or *vice versa.*

Where heavy loads are involved, particularly when using roller thrust bearings type AR (light series), it is advisable to employ intermediate plates of the PMH series. The thickness and deep supporting surface of this plate gives better axial rigidity. PMH series plates are intended to be centred in the housing. They have radial holes (linked by an exterior groove) allowing oil to reach the bore of the thrust bearings, thereby ensuring effective circulation of lubricant by centrifugal force.

OPERATION

When the ring of rolling elements begins to rotate, it is automatically centred in relation to the shaft axis. Thus the thrust bearing does not need to be precisely centred by the incorporated plate. Hence it is possible to align the bearing (on the shaft or in the housing) allowing wide tolerances to be used and without surface hardening. This enables costs to be reduced. The same feature applies to centring of the thrust plate.

TYPES OF THRUST BEARING

<table>
<tr><th>Thrust bearings with incorporated plate</th><th>Separate thrust plates</th><th>Intermediate plates</th><th>Thrust bearings with two thrust plates</th></tr>
<tr><td>Needle thrust bearings
AX – Thin Series
AX – Thick Series</td><td rowspan="2">CP – Thin Series
CP – Thick Series</td><td rowspan="2">PM without oil hole

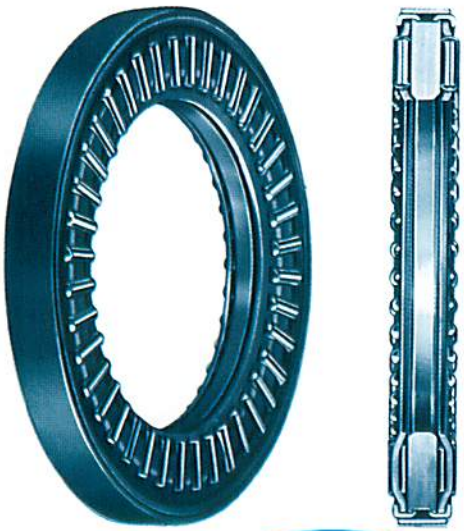
PMH with oil hole</td><td>Needle thrust bearings
AXZ Thick Series</td></tr>
<tr><td>Roller thrust bearings
AR – Light Series</td><td rowspan="2">Roller thrust bearings
ARZ Light Series
ARZ Heavy Series</td></tr>
<tr><td>AR 812 Series
AR – Heavy Series</td><td>CPR 812 Series
CPR – Heavy Series</td><td></td></tr>
</table>

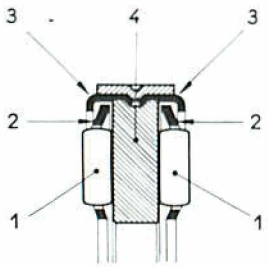
Needle thrust bearings with a thin plate are of minimal thickness and are particularly economic to use. They should be considered whenever the degree of support and rotational accuracy permits.

Standard needle thrust bearings with a thick plate and standard roller thrust bearings provide rotational accuracy and axial run-out equal to or better than class 6 according to ISO Standard 199 for ball thrust bearings. They can be supplied in High Precision "HP" quality providing a precision grade superior to that of class 5.

SPECIAL NEEDLE THRUST BEARINGS TYPE AXJ

Needle thrust bearings type AXJ have been evolved by NADELLA from an original design to run at very high rotational speed. They comprise two rows of needles (1) retained and guided in hardened steel cages (2). These assemblies are retained on either side of a common plate (4) by inserted steel rings (3) which serve to centre them with adequate clearance in relation to the plate.





The special feature of these thrust bearings is the self-centring action to which each rotating ring of needles is submitted. This self-centring is transmitted to the plate which is retained "floating" in relation to the shaft. For this reason, the relative speed of each ring of needles relative to its raceway and the speed of the plate relative to the rotating shaft are reduced by about half.

With a well-designed oil circulation, type AXJ thrust bearings permit speeds approximately twice those achieved with normal thrust bearings.

To ensure the axial position of a shaft in both directions, two AXJ thrust bearings should be mounted on either side of an intermediate plate with oil hole, type PMH, centred in the housing.

Please consult NADELLA Technical Department for any application involving the use of these special thrust bearings.

THICKNESS AND AXIAL RUN-OUT TOLERANCES

	Bore Di mm	Thickness tolerance µm	Axial run-out µm		
Needle thrust bearings (thin)	Di ≤ 60 60 < Di ≤ 90 90 < Di ≤ 120	+ 30 /- 40 [1] + 50 /- 60 [2] + 50 /- 60 [2]	20 [1] 25 [2] 30 [2]		
Needle thrust bearings (thick) Roller thrust bearings	Di ≤ 60 60 < Di ≤ 90 90 < Di ≤ 120	+ 30 /- 30 [1] + 50 /- 50 [2] + 50 /- 50 [2]	20 [1] 25 [2] 30 [2]	Quality	
				HP	HSP
Thrust plates (thin)	Di ≤ 120 120 < Di ≤ 180 180 < Di ≤ 250	+ 50 /- 60 + 50 /- 110 + 50 /- 160	5* 7* 10*	2 3 4	1 1,5 2
Thrust plates (thick) Intermediate plates	Di ≤ 120 120 < Di ≤ 180 180 < Di ≤ 250	+ 50 /- 50 + 50 /- 100 + 50 /- 150	5* 7* 10*	2 3 4	1 1,5 2

* HP quality

1) Under min. load of 150 N

2) Under min. load of 250 N

SUPPORTING FACES

For smooth running operation of needle or roller thrust bearings, it is necessary that their supporting faces should be parallel.

For a thrust bearing with intermediate thrust plate, the permissible degree of deviation from true parallelism between the two supporting faces should be no more than 1 min. (or approx. 0.3 per 1 000).

For a thrust bearing without intermediate thrust plate, the deviation must be no more than 1 min 30. sec. (or approx. 0.45 per 1 000).

Thin needle thrust bearings and thin thrust plates must be supported on a flat, rigid and continuous face throughout the area of circulation of the needles bounded by dimensions d_1 and d_2.

Thick needle thrust bearings and thick thrust plates can be supported on a more restricted or discontinuous shoulder, provided that the deflection of the plate under load does not endanger the smooth operation of the thrust bearing or the axial run-out required.

Since roller thrust bearings generally run under considerable loads, their incorporated plate and thrust plate should be supported on a shoulder covering the whole area of circulation of the rollers bounded by dimensions d_1 and d_2.

Where an application does not involve the use of a thrust plate, the surface forming the second raceway must:

– extend at least across the whole area of circulation of the rolling elements between dimensions d_1 and d_2; and,

– possess a suitable surface finish (≦ 0.5 µm C.L.A.) and sufficient hardness in relation to the load to be supported. A hardness of 58–64 HRC enables thrust bearings to carry their full load capacity. Lower hardness values reduce the capacities shown in the tables of dimensions (see Technical Section).

TOLERANCES FOR CENTRING SUPPORTS

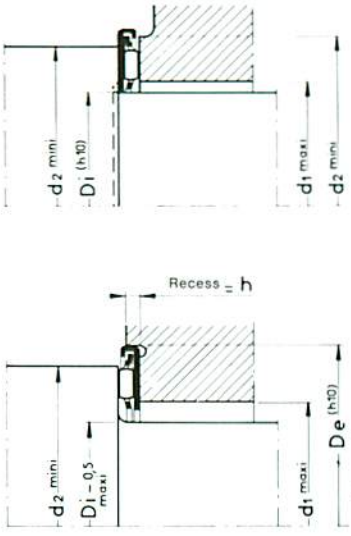
► *Centring on the shaft:* h10 on dimensions Di for thrust bearings or thrust plates or dimension d for intermediate plates.

► *Centring in the housing:* H10 on dimension De for thrust bearings or dimension B for thrust plates and dimension D for intermediate plates.

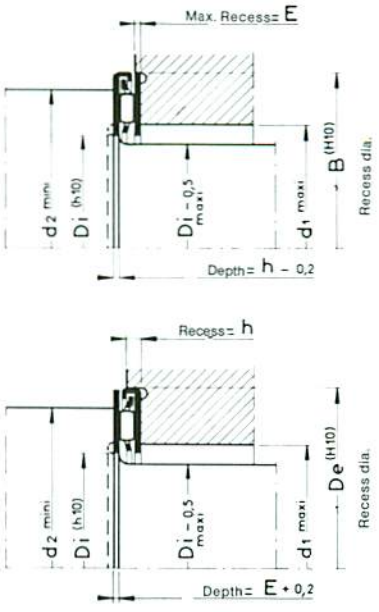
MOUNTING ARRANGEMENTS

Needle thrust bearings with incorporated thin plate

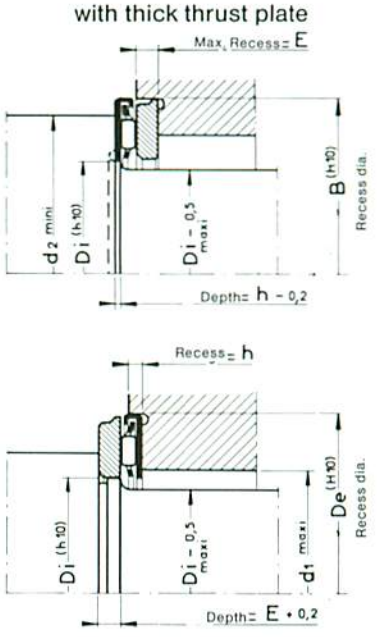
without thrust plate



with thin thrust plate

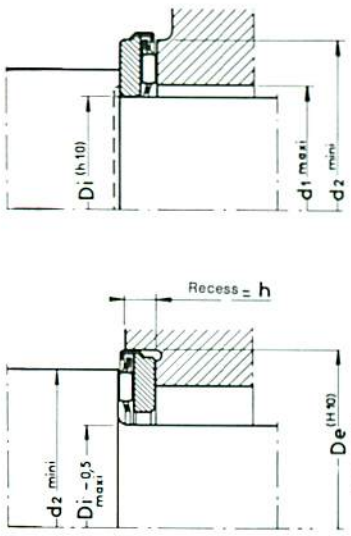


with thick thrust plate

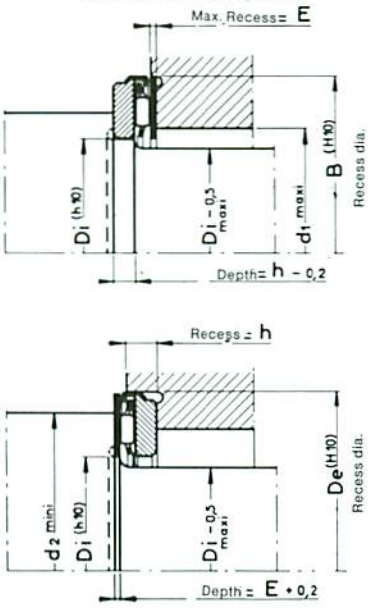


Needle thrust bearings with thin plate or light series roller thrust bearings

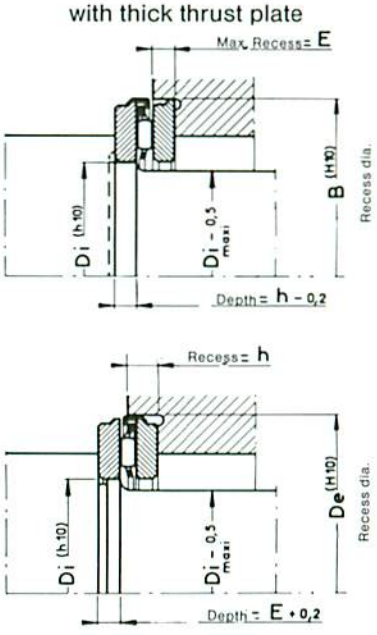
without thrust plate



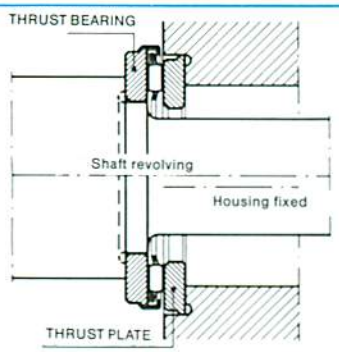
with thin thrust plate

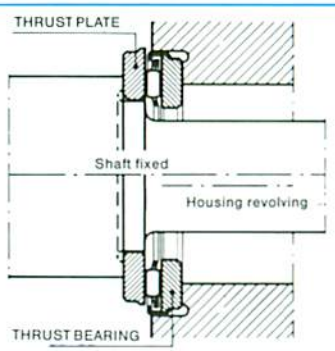


with thick thrust plate



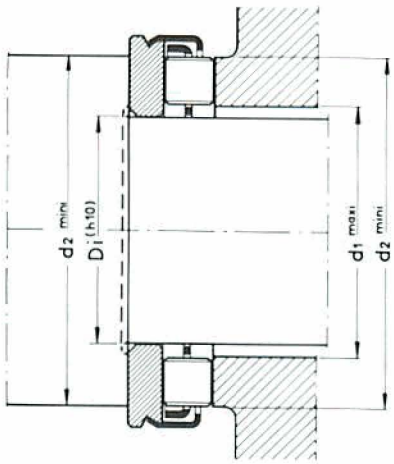
Mounting for eccentric operation



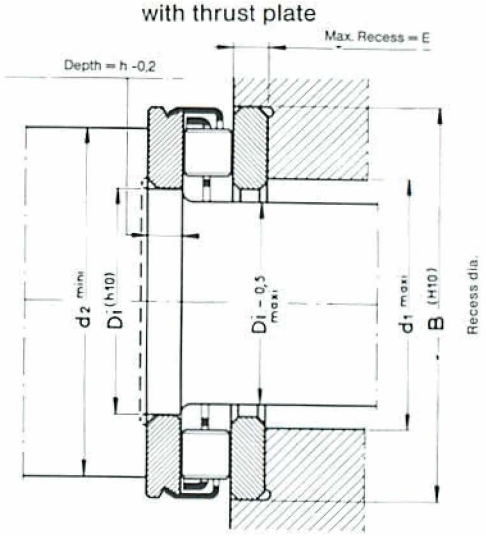


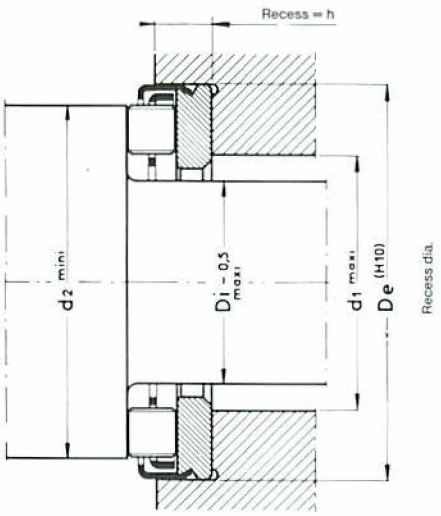
Roller thrust bearings AR 812 and heavy series

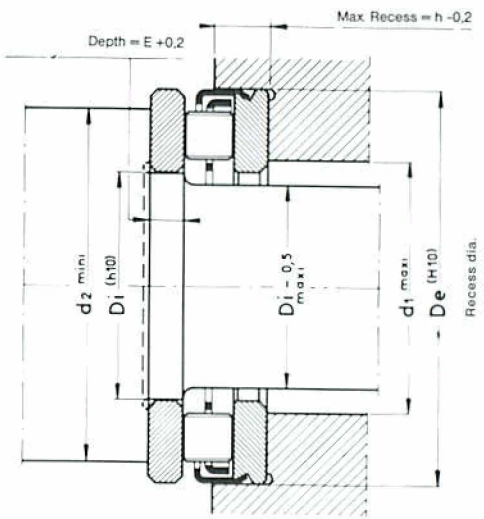
without thrust plate



with thrust plate

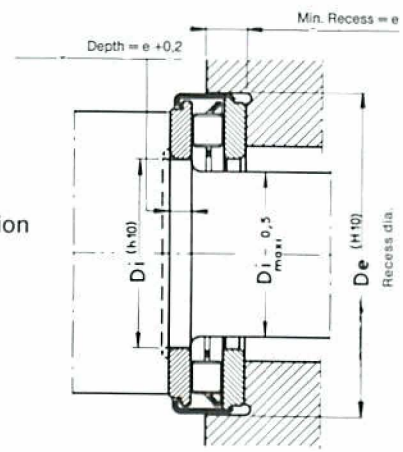


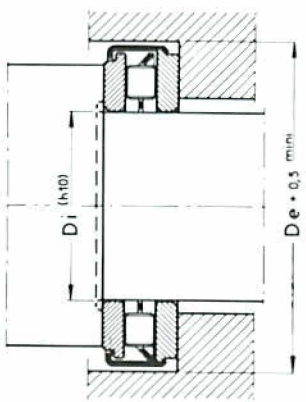




Needle thrust bearings AXZ or roller thrust bearings ARZ

Mounting for high speed rotation





Mounting for slow speed rotation or oscillating motion