

Tandem bearings in large gearboxes Series T.AR

Technical Product Information

Tandem bearings

Series T.AR



Figure 1 · Tandem bearing T3AR

Tandem bearings offer an optimum solution wherever the following requirements apply:

- small radial design envelope
- high axial forces
- long operating life
- low frictional energy.

Tandem bearings have proven effective principally in gearboxes for single and twin screw extruders in the rubber and plastics industry.

Other possible applications include:

- deep hole drilling equipment
- friction welding machines.

Product description

Tandem bearings consist of several axial cylindrical roller bearings arranged in line, *Figure 1*. A system of rings and washers matched to each other ensures that all stages of the tandem bearing are subjected to uniform load at all times irrespective of the ratio C/F. The rings and washers are made from hardened steel. Tandem bearings are predominantly fitted with standard axial cylindrical roller and bearing assemblies. *Figure 3*, page 3, shows the power flow in a tandem bearing.

Table 1 · Series of tandem bearings

Series	Dimensions d×D×H mm		Basic load ratings				Load F _{a max} N	
			C N		C ₀ N			
	from	to	from	to	from	to	from	to
T2AR	8×37 × 37,5	420×900 × 586	62 000	20 200 000	114 000	84 000 000	26 700	4 900 000
T3AR	5×31,5 × 58	420×900 × 886	565 000	29 000 000	106 500	126 000 000	20 000	7 150 000
T4AR	5×31,5 × 81	350×750 × 1027	73 000	27 000 000	142 000	118 000 000	40 000	9 075 000
T6AR	5×37 × 117	85×290 × 674	165 000	6 200 000	342 000	26 000 000	60 000	2 792 000
T8AR	6×45 × 183,5	200×435 × 1251	292 000	15 250 000	693 000	61 600 000	145 000	8 070 000

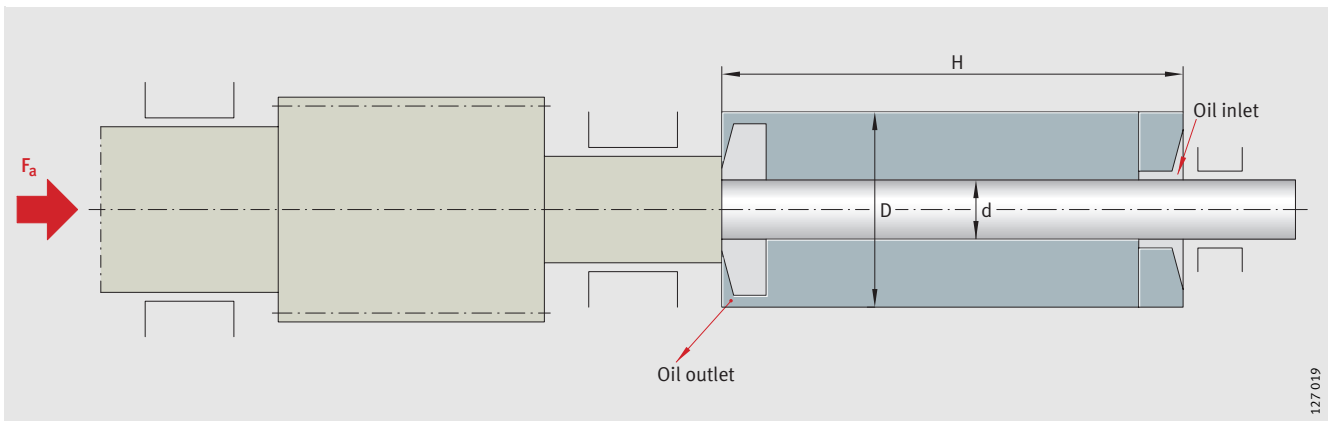


Figure 2 · Oil outlet, oil inlet, dimensions

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Design of bearing arrangements

For the installation of tandem bearings, the adjacent construction must be designed as follows:

- with preload of one percent of the basic dynamic load rating
- with radial guidance, for example by means of needle roller bearings, *Figure 5*, page 4
- without tilting. The adjacent parts must be machined such that no tilting is transmitted
- taking account of the spring constants of the tandem bearing, especially when combined with axial bearings of a different design
- with a mounting fit of f6 for the shaft and F7 for the housing bore, in order to achieve correct functioning of the bearings.

For advice in the selection of tandem bearings and for the preparation of installation proposals, a completed copy of the **questionnaire TAR** should be attached to each enquiry. The recommendation is the basis for the INA warranty.

Lubrication

Tandem bearings are always operated with recirculating oil lubrication, *Figure 2*. We calculate the oil quantity and oil viscosity in accordance with the data given in the **questionnaire TAR**.

In general, attention should be paid to the catalogue “HR1 Rolling bearings”, section “Technical principles”.

Ordering example

- Tandem bearing with 2 stages
- Shaft diameter 12 mm
- Outside diameter 42 mm
- Bearing width 41,5 mm.

Ordering designation

T2AR12X42X41,5

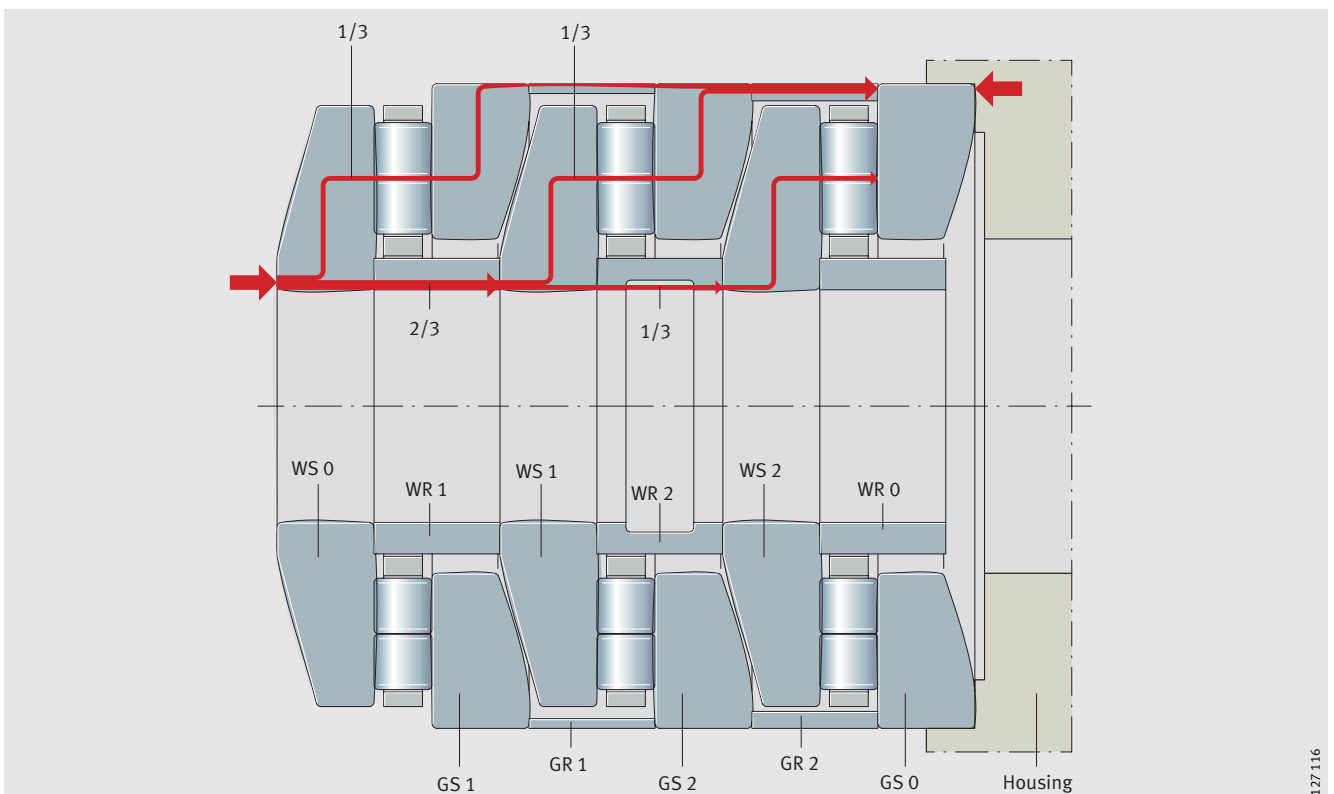


Figure 3 · Structure and power flow

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Twin screw extruder gearbox

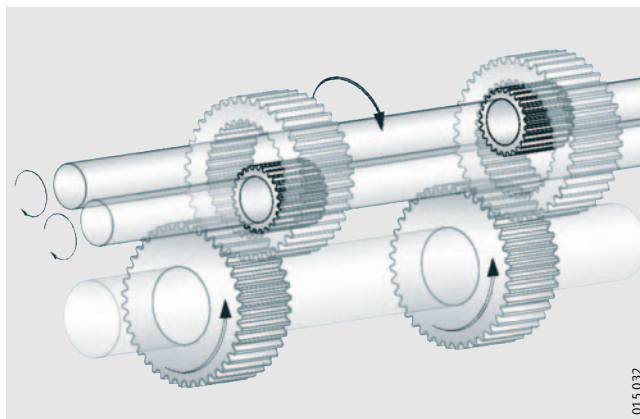


Figure 4 · Small centre distances

Extruders are used in the processing of plastics in powder or granulate form, mixed with stabilisers, parting agents and any colourings and fillers; they are conveyed, compacted, degassed, homogenised and finally pressed through a die into profiled tooling. In order to apply the necessary forces correctly, very high demands are placed on the extruder gearboxes. Small centre distances, *Figure 4*, are present in certain extrusion processes. As a result, the gearboxes have high power levels and the screws are subjected to very high axial forces.

Design solution, *Figure 5*

The axial forces are supported by a four-stage tandem bearing T4AR combined with an axial cylindrical roller bearing of series 894. This solution allows a very small centre distance to be achieved. The tandem bearing and axial cylindrical roller bearing are supported radially by needle roller bearings of series NK and NA. The tandem bearing and the axial cylindrical roller bearing 894 are axially preloaded by means of springs and axial cylindrical roller bearings of series 812..TV. As a result, both

bearings work within the linear region of their spring curves. The tooth forces are transmitted to the housing by three-ring, full complement cylindrical roller bearings N3CF. These bearings are matched to the elastic line of the shaft, giving uniform loading of all the rows of rollers. The lubricating oil flows, in the opposite direction to the power flow, through all stages of the tandem bearing and the other axial bearings and flows out unpressurised through well dimensioned drain holes.

INA products used

- ① Cylindrical roller bearing N3CF
- ② Axial cylindrical roller bearing 812..TV
- ③ Axial cylindrical roller bearing 894
- ④ Tandem bearing T4AR
- ⑤ Needle roller bearing NA49..C3
- ⑥ Needle roller bearing NK
- ⑦ Inner ring IR..C3
- ⑧ Needle roller bearing NA49..C3

Mounting tolerances

- Housing H7, shaft m6
- Housing H7, shaft h6
- Housing H7, shaft h6
- Housing F7, shaft f6
- Housing J7, shaft k6
- Housing J7
- Shaft k6
- Housing J7, shaft k6

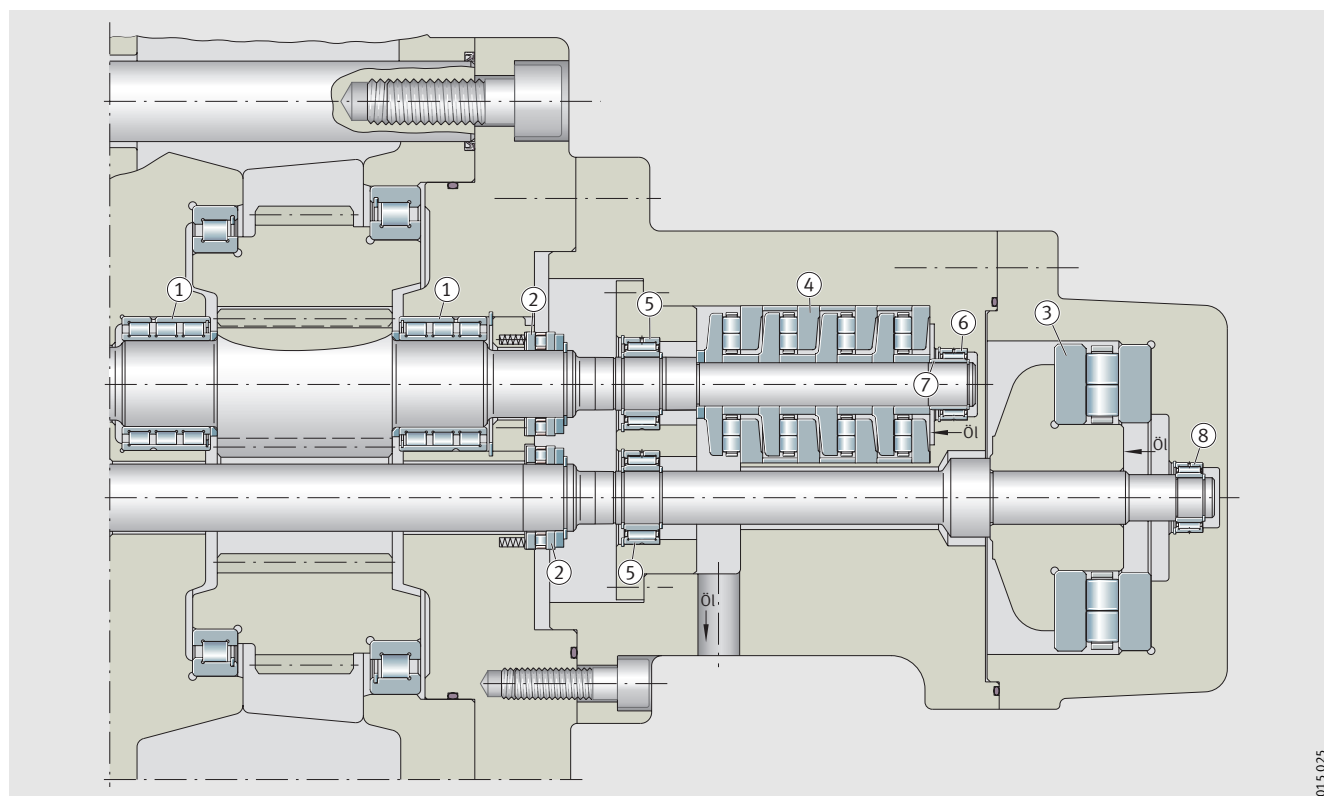


Figure 5 · Twin screw extruder gearbox

Twin screw extruder gearbox

In a twin screw extruder gearbox, high axial forces as well as high torques must be transmitted. Due to the resulting radial forces in combination with the small centre distances, special bearing arrangements are necessary. The output shafts are subjected to considerable flexing.

Design solution, Figure 6

Two large tandem bearings T8AR direct the axial forces into the housing. The tolerances are f6 for the shaft and F7 for the housing. The nine row, full complement cylindrical roller bearings are designed so that they match themselves to the elastic line of the shaft. The shaft has a tolerance m5, the housing has a tolerance J6. The two gears are supported on the shaft by cylindrical roller bearings of series SL1829 with a tolerance m6.

The centre distance a in this application is so small that the outer rings of the nine row cylindrical roller bearings must have radially flattened areas.

INA products used

- ① Nine row cylindrical roller bearing (special design)
- ② Axial cylindrical roller bearing 811
- ③ Needle roller bearing NA49
- ④ Cylindrical roller bearing SL1829
- ⑤ Tandem bearing T8AR

Mounting tolerances

- Housing J6, shaft m5
- Housing H7, shaft h6
- Housing K6, shaft k5
- Housing H7, shaft m6
- Housing F7, shaft f6

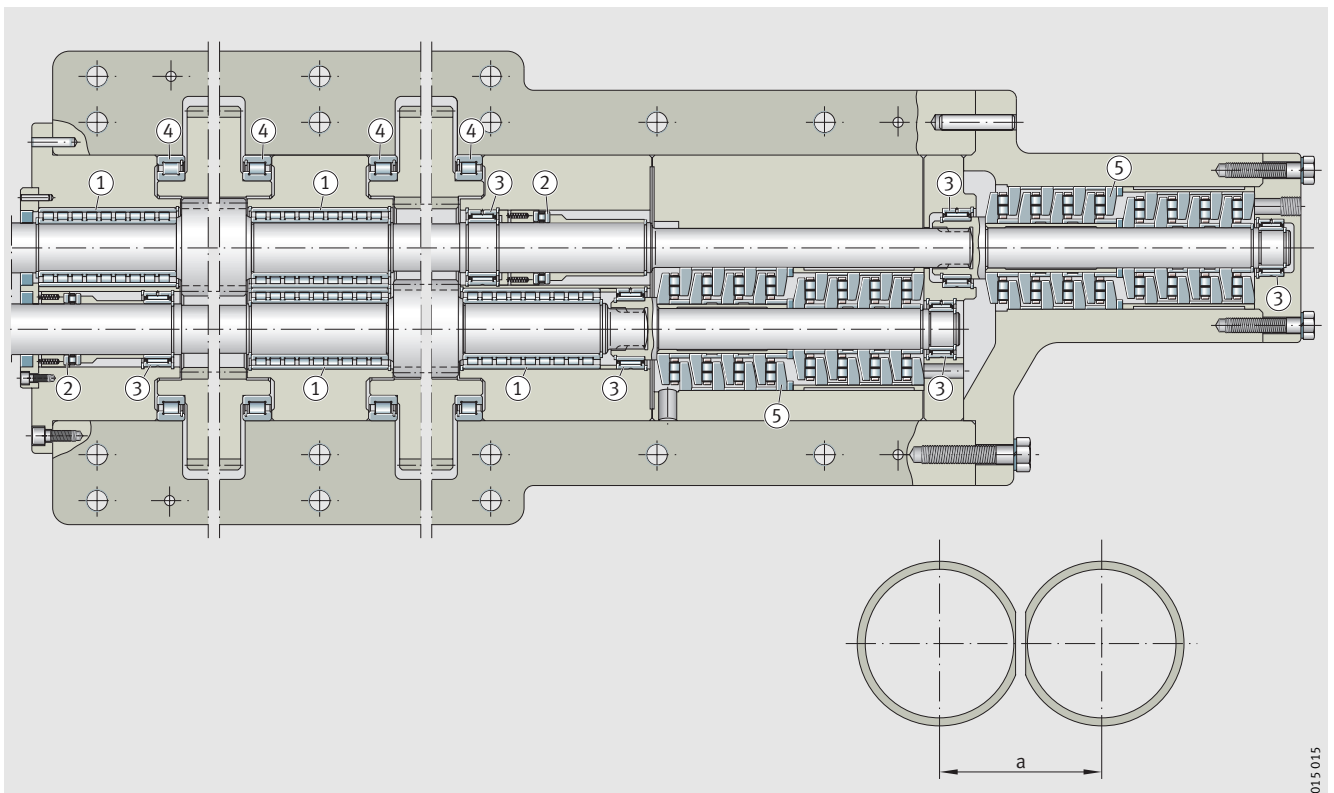


Figure 6 · Twin screw extruder gearbox

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