

Thrust Angular-Contact Needle Bearing Assemblies

Series ZAXFM



For Rolled Thread Screws

ZAXFM's are bearing assemblies for:

- **Rolled** thread ball and acme screws

They supplement the extensive range of INA thrust needle/cylindrical roller bearings and INA thrust angular-contact ball bearings.

The philosophy behind the development of these locating bearings was:

- *As accurate as needed, and as durable as possible*

Therefore, Series ZAXFM thrust angular-contact needle bearing assemblies are used in applications where speed, repeatability, and stroke allow the use of acme screws but the stiffness requirements of the support bearings are quite high.

Design of the Bearing Assemblies

Each assembly consists of:

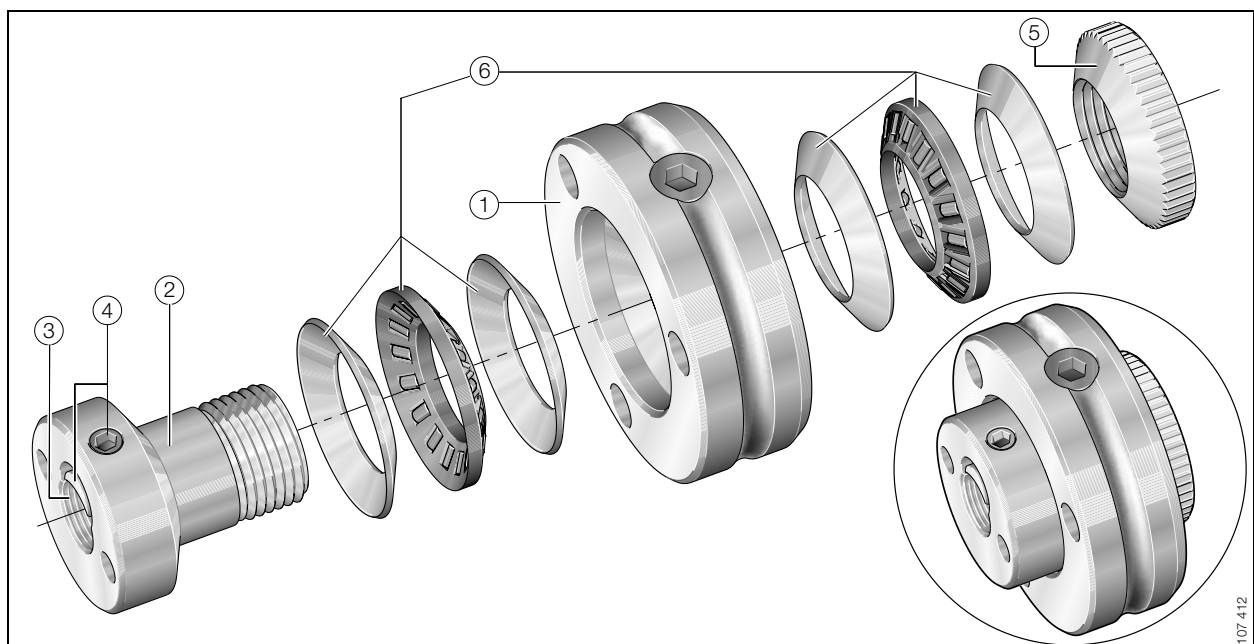
- Outer ring ① with radial lubrication groove and lubrication hole or axial threaded bore for a lubricant fitting
 - lubrication holes or threaded bores are sealed with a set screw
- Inner ring ② with one-sided mounting thread in the bore ③ and integrated locknut fixing system ④
- Adjusting nut ⑤
- Two thrust angular-contact needle bearings ⑥ in an "O" arrangement with a 60° contact angle

Bearing rings and adjusting nuts are precision-machined parts of high-strength aluminum; thrust roller and cage assemblies and thrust washers are produced by forming.

Features

The bearing assemblies:

- Have double-direction thrust angular-contact needle bearings
- Support high axial loads and have high rigidity due to the needle roller and cage assemblies and the contact angle of 60°
- Have a maximum axial runout on the inner ring of 0,05 mm
 - similar to rolled screw threads lead errors
- Can be set clearance-free with the adjusting nut
 - no adjustment needed at assembly
- Are mounted directly by fixing the outer ring onto the face of the supporting structure
- Require no additional axial location of the screw
 - bearing assembly mounted on the screw through the thread in the bore of the inner ring
 - locknut securing system locks the inner ring and facilitates a close fit
- Have a lightweight design with a significantly lower moment of inertia of the rotating inner ring compared to bearings made of steel
- Are protected from corrosion by the aluminum design
- Are greased and can be relubricated through outer ring
 - lubricating grease KP2N-25 DIN 51825
 - suitable lubricating nipples conform to DIN 71412-A M6



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Thrust Angular-Contact Needle Bearing Assemblies

Preferred Application Ranges

Series ZAXFM thrust angular-contact needle bearing assemblies are used very successfully in the following areas of application:

- Handling and automation
- Lifting and conveying
- Robotics
- Medical and laboratory technology
 - X-ray devices
 - radiation equipment
 - hospital beds
 - analytical instruments
- Fittings and valves
 - valve screws
- Signaling technology
 - adjustment devices
- Locks and armatures
 - doors and gates
- General mechanical engineering
 - welding machines and devices
 - packaging equipment
 - wood processing machines
 - textile machinery
 - paper machines
 - clamping technology
- Precision mechanics
 - testing machines
 - sport devices
 - office equipment
- Semiconductors
 - silkscreen printing machines
 - LP magazine stackers

Bearing Size

The selection of the suitable bearing size depends on the following:

- Basic rating life L or L_h
- Static load safety factor S_0

Basic rating life

$$L = \left(\frac{C_a}{P}\right)^p$$

$$L_h = \frac{16\,666}{n} \cdot \left(\frac{C_a}{P}\right)^p$$

L 10^6 revolutions
Basic rating life in millions of revolutions

L_h h
Basic rating life in operating hours

C_a N
Basic dynamic load rating (axial)

P N
Equivalent dynamic bearing load

p –
Life exponent:
 $p = 10/3$ for needle bearings

n min^{-1}
Operating speed

Static load safety factor

The static load safety factor S_0 indicates the safety level against permissible permanent deformations in the bearing and is determined by the following equation:

$$S_0 = \frac{C_{0a}}{P_0}$$

S_0 –
Static load safety factor

C_{0a} N
Static load rating (axial)

P_0 N
Maximum load P of the bearing




To prevent settling in the mounting threads and excessive bearing clearances, the maximum load on the bearing should not exceed $0,5 \times C_{0a}$.

Installation

INA Series ZAXFM thrust angular-contact needle bearing assemblies are particularly easy to install. They are mounted with the outer ring directly onto the supporting structure – no additional radial location is required.

The inner ring is installed through the mounting thread onto the threaded screw journal and secured with the integrated locknut.

A set preload in the bearing eliminates the need for adjustment at assembly.

 The adjusting nut of the bearing is secured and must not be unscrewed.

Mounting the inner ring of the bearing on the screw (Figure 1)

- Thread the inner ring of the bearing assembly ① onto the screw ② with a socket wrench
 - the inner ring must be fitted tightly against the screw shoulder ③
- Secure the inner ring against rotation with the locknut ④
 - the tightening torque M_m (*Dimension table*) must not be exceeded
 - the locknut consists of a crescent-shaped locking element that is deformed by the set screw and becomes tightly clamped to the thread on the screw journal during counter-rotation

Mounting the outer ring of the bearing to the supporting structure (Figure 2)

- Hand-tighten the mounting bolts ② to fix the outer ring of the bearing assembly ① onto the supporting structure
- Move the screw nut ③ to the end position (see arrow); the bearing adjusts automatically into the optimum radial position
- Tighten the mounting bolts ② using the tightening torques specified by the manufacturer

If central lubrication is used, remove the set screw from the bearing outer ring before connection.

Ordering Example and Order Code

Thrust Angular-Contact Needle Bearing Assembly ZAXFM:

- For acme screw TR 16×4 to DIN 103
- With screw journal diameter of 10 mm

Order code: ZAXFM 1055 (Figure 3)

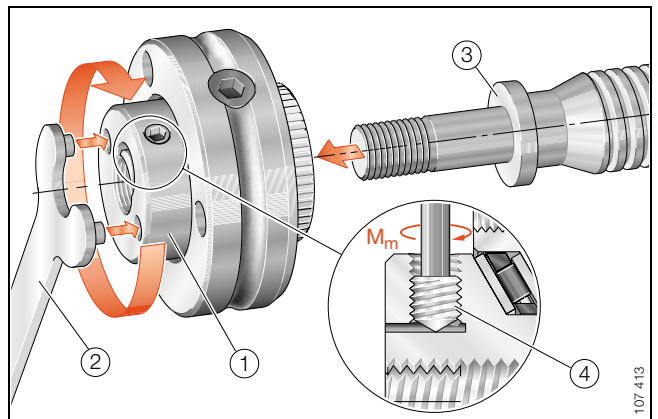


Figure 1 · Installation of a bearing assembly on the screw

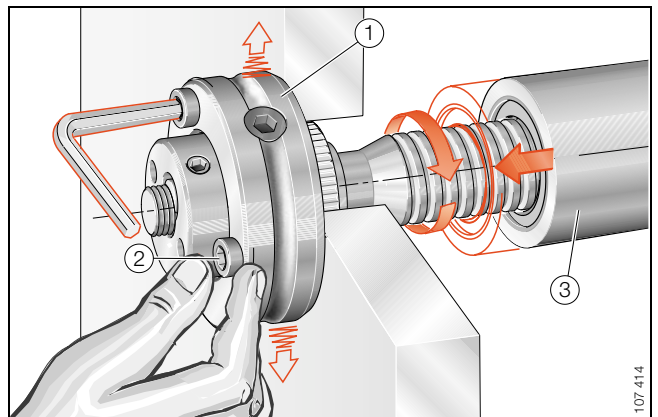


Figure 2 · Installation of a bearing assembly on the mounting structure

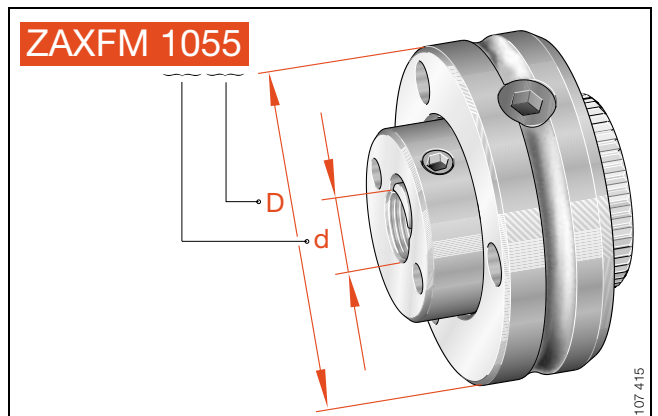
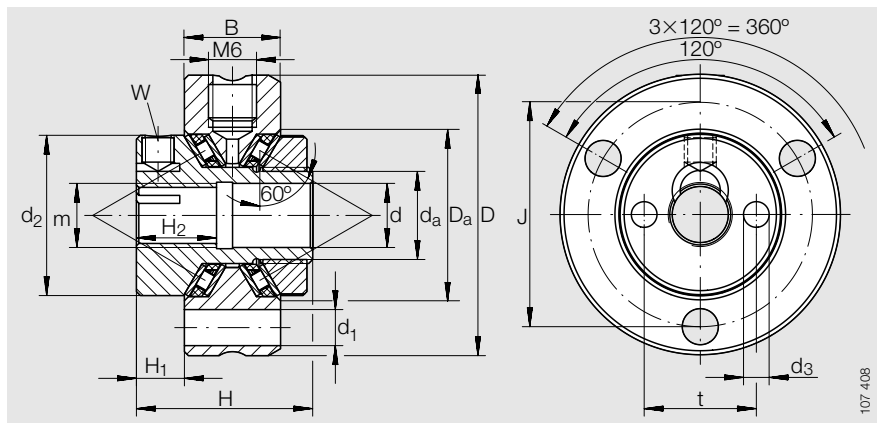


Figure 3 · Ordering example and order code

Thrust Angular-Contact Needle Bearing Assemblies

Series ZAXFM

Double-direction,
aluminum rings,
suitable for flange mounting⁴⁾,
preloaded



Thrust angular-contact needle bearing assemblies \leq ZAXFM 0835


Dimension Table · Dimensions in mm

Shaft diameter	Designation	Mass \approx g	Dimensions														Mounting dimensions		Mounting bolts DIN 912 ¹⁾
			d	D ⁴⁾	B	B ₁	H	H ₁	H ₂	m	J	d ₁	d ₂	t	d ₃	d _a max.	D _a min.		
5	ZAXFM 0535	39	5	35	12	-	22	6	8	M 5	28	4,3	20	14	3,2	11	21	M4	
6	ZAXFM 0635	38	6	35	12	-	22	6	8	M 6	28	4,3	20	14	3,2	11	21	M4	
8	ZAXFM 0835	36	8	35	12	-	22	6	8	M 8	28	4,3	20	14	3,2	11	21	M4	
10	ZAXFM 1055	170	10	55	20	5	35	10	15	M10×1	45	5,3	34	24	4,3	19	35	M5	
12	ZAXFM 1255	160	12	55	20	5	35	10	15	M12×1	45	5,3	34	24	4,3	19	35	M5	
15	ZAXFM 1555	150	15	55	20	5	35	10	15	M15×1	45	5,3	34	24	4,3	19	35	M5	
20	ZAXFM 2075	350	20	75	25	5	42	10	15	M20×1	63	6,5	49	36	5,3	33	50	M6	
25	ZAXFM 2575	330	25	75	25	5	42	10	15	M25×1,5	63	6,5	49	36	5,3	33	50	M6	

The needle cages are made of plastic;
permissible operating temperature: +120 °C (continuous operation)

1) Tightening torque of the mounting bolts to manufacturer recommendations;
bolts conforming to DIN 912 must be ordered separately

2) $P_{0perm} = 0,5 \times C_{0a}$

3)  The starting torque of 2 to 3×M_{RL} must be taken into account when selecting the bearing size,
the values given in the tables are guidelines based on a measuring speed of $\approx 5 \text{ min}^{-1}$

4) The bearing outer ring is anodized blue

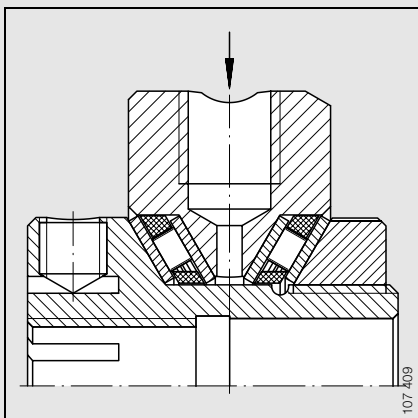
5) Moment of inertia for rotating inner ring and integrated adjusting nut

Tolerances of the mounting structure:

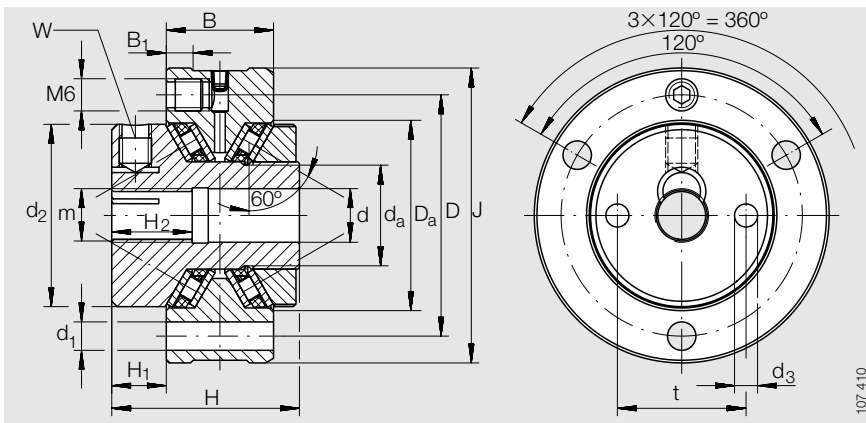
Shaft tolerance: h7

Thread tolerance: 6g (mounting thread on the screw for the bearing inner ring)

Housing tolerance: H8

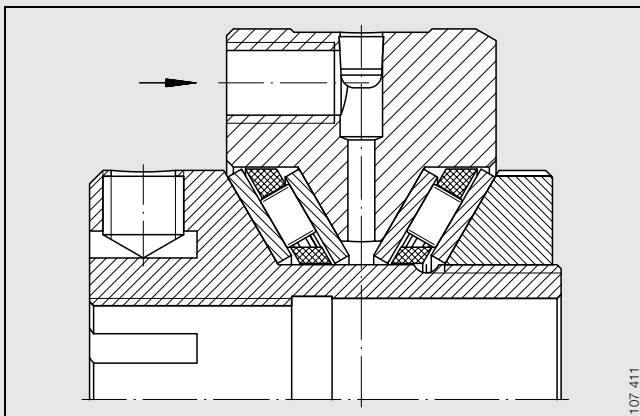


Lubricant flow (arrow) for \leq ZAXFM 0835



Thrust angular-contact needle bearing assemblies \cong ZAXFM 1055

Basic axial load ratings		Limiting speed n_G grease min^{-1}	Total frictional torque ³⁾ M_{RL} Ncm	Axial runout accuracy ³⁾ mm	Axial rigidity c_{aL} $\text{N}/\mu\text{m}$	Moment of inertia ⁵⁾ M_M $\text{kg} \cdot \text{cm}^2$	Set screw DIN 913		Recommended screw drive		Shaft diameter
dyn. C_a kN	stat. $C_{0a}^{2)}$ kN						W mm	M_m Nm	Ball screw DIN 69051	Acme screw DIN 103	
3,4	7,8	2 000	2	0,03	350	0,0067	2	2	KGT 6×1	TR 8×1,5	5
3,4	7,8	2 000	2	0,03	350	0,0066	2	2	KGT 8×2,5	TR 10×2	6
3,4	7,8	2 000	2	0,03	350	0,0065	2	2	KGT 12×5	TR 12×3	8
9,6	24,5	1 200	6	0,05	550	0,1227	3	5	KGT 12×2	TR 16×4	10
9,6	24,5	1 200	6	0,05	550	0,1221	3	5	KGT 16×5	TR 18×4	12
9,6	24,5	1 200	6	0,05	550	0,1195	3	5	KGT 20×5	TR 20×4	15
18,2	52	800	10	0,05	1050	0,4571	3	5	KGT 25×5	TR 28×5	20
18,2	52	800	10	0,05	1050	0,4276	3	5	KGT 32×5	TR 36×6	25



Lubricant flow (arrow) for \cong ZAXFM 1055

Screw Jacks

Bearing arrangements for acme screws

Screw jacks are used in applications requiring accurate lifting, lowering, tilting, and swiveling and, under normal operating conditions, are maintenance-free. They are used most frequently in control devices for rollers, tables, and conveyors; in clamping systems, presses, and hoists; and in assembly systems.

The screw in the screw jack is powered by an electric motor. A bronze nut that moves axially on the screw converts the rotation of the motor into linear motion, which is used for traversing, positioning, lifting, lowering, etc.

The bearing arrangement of the screw on the drive side must be compact and must simplify an existing complicated solution. The bearing must have a high axial rigidity and must be preloaded, particularly easy to install, and suitable for rolled acme screws. A low rotating mass is also desirable.

INA Design Solution

The figure below shows a conventional bearing arrangement for a transport screw with radial and thrust deep groove ball bearings, and the INA solution using a ZAXFM thrust angular-contact needle bearing assembly.

This bearing assembly with integrated adjusting nut is preloaded, clearance-free, at the factory. It has an axial runout accuracy on the inner ring of 0,05 mm and is ideally suited for rolled acme screws.

Because of the 60° contact angle and the needle roller and cage assemblies, the bearing can support high axial loads. The aluminum design results in a moment of inertia for the rotating inner ring that is considerably lower than that of the traditional solution.

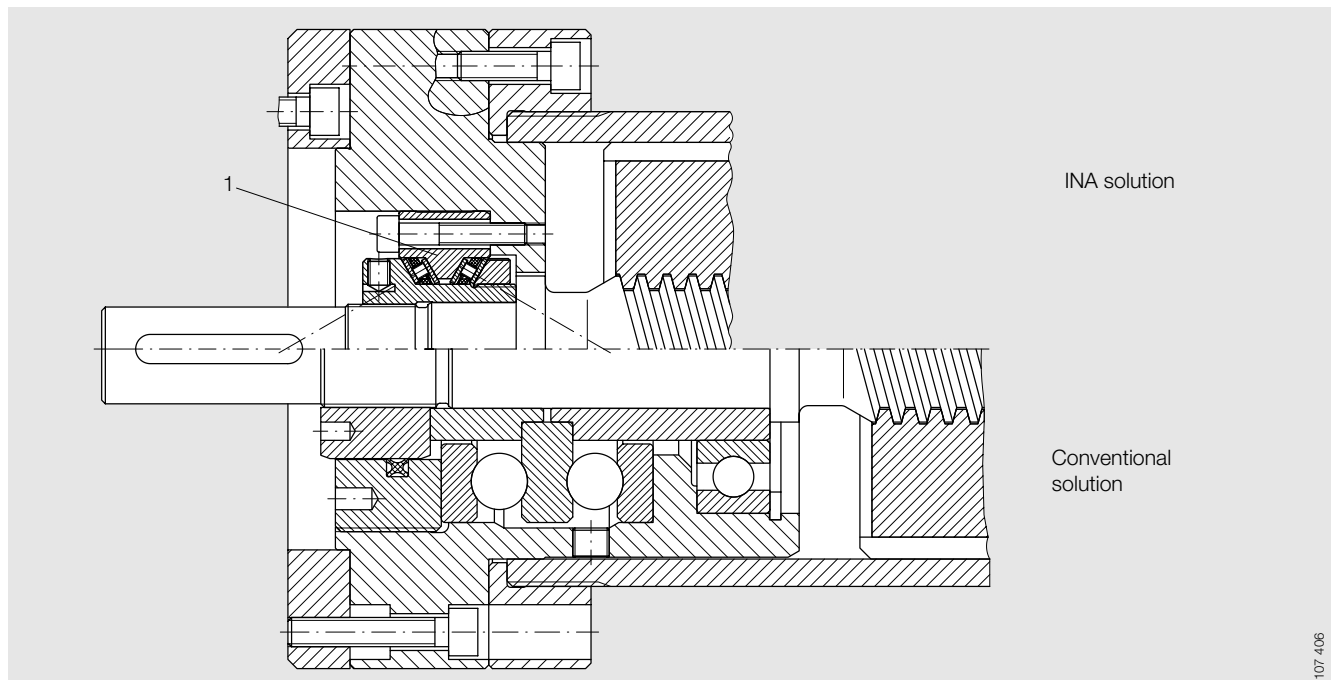
The outer ring is bolted to the mounting structure, and the inner ring is installed with the mounting thread directly onto the screw and secured by the locknut. This eliminates the need for adjustment during installation.

The bearing is greased and can be lubricated through the outer ring.

A Series ZAXFM thrust angular-contact needle roller bearing assembly combined with an acme screw results in a much simpler and more economical bearing/drive assembly with significantly fewer components.

INA Products Used for this Application

- 1 Thrust angular-contact needle roller bearing assembly ZAXFM



Linear Actuator

Bearing arrangement for ball screws

Electromechanical linear actuators are used for a variety of applications in automation technology. To meet the requirements of the manufacturer, these units must be economical and must allow for reliable series production and problem-free final assembly.

The locating bearing of the rolled ball screw should simplify the geometry of the supporting structure and shorten assembly time. Reductions in mass and design space, as well as design improvements, are also desirable.

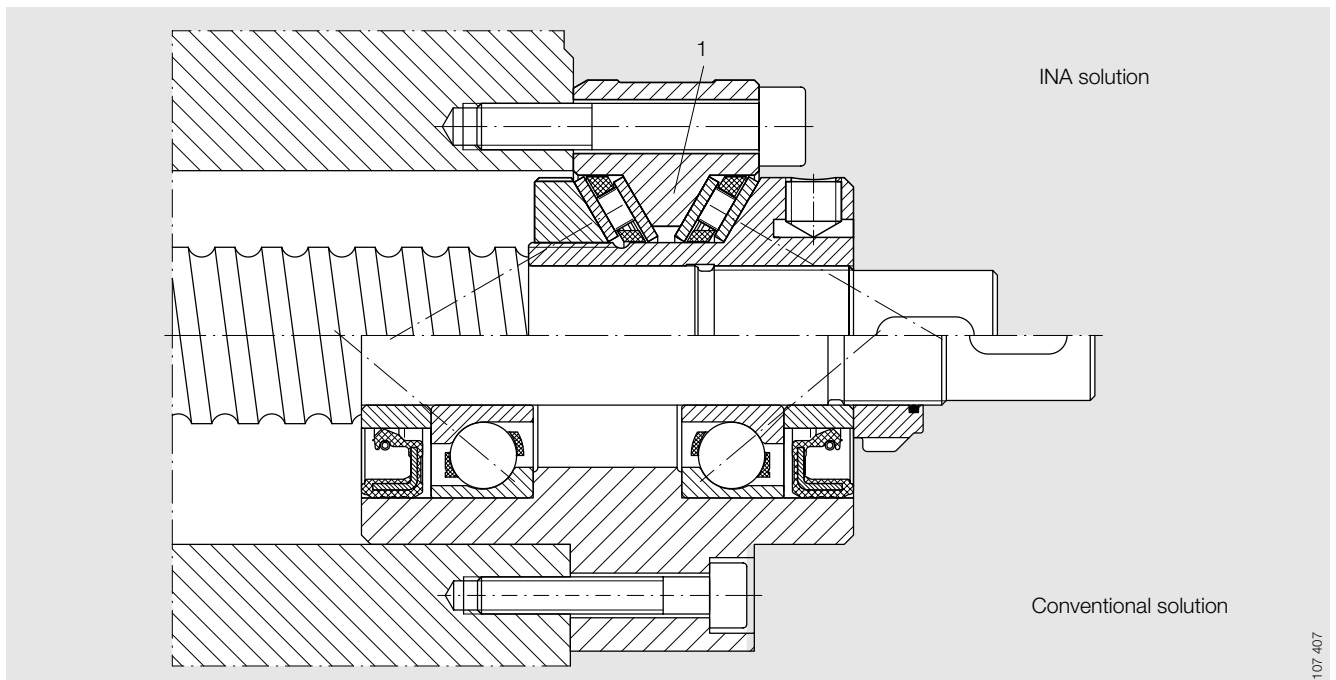
INA Design Solution

The expertise needed to correctly install and lubricate a conventional bearing solution is eliminated. INA delivers Series ZAXFM thrust angular-contact needle bearing assemblies lubricated and preloaded. Therefore, the adjusting nut is also already integrated in the bearing assembly.

The shorter design of the rolling bearing in the INA solution results in a longer stroke and also requires only a machined locating face. Compared to a version with identical dimensions made of rolling bearing steel, the aluminum ring reduces the bearing weight by 60%. This bearing assembly with blue anodized outer ring and easy face-mounted installation enhances the overall design and appearance of the linear actuator.

INA Products Used for this Application

- 1 Thrust angular-contact needle roller bearing assembly ZAXFM



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