Technical Description

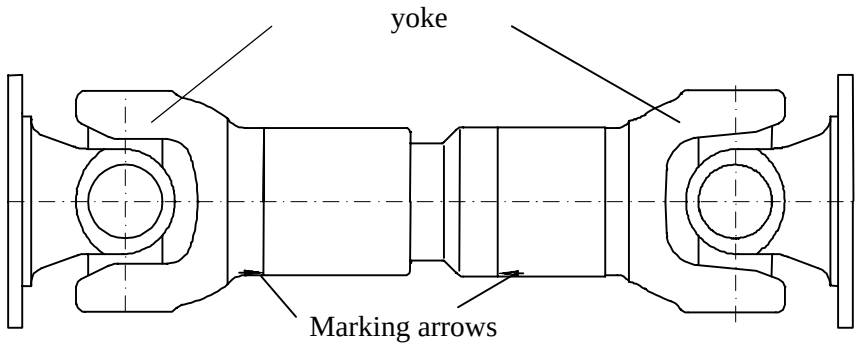
Edition 2007

Mounting, maintenance and repair of propshafts with flanged universal joints

1. Recommendations

Assembly, disassembly, maintenance and repair of propshafts should be performed only by qualified personnel. In addition, for repair work we recommend the use of original spare parts.
Our propshafts are supplied ready for installation and operation. All are lubricated, base painted and the matching surfaces of the flanges are protected by an anticorrosion-oil-film, which must be removed before assembling the propshaft into the powertrain.
The propshafts have been dynamically balanced to ensure perfect smooth running. The balance plates attached to the drive shaft tubes or the joint drivers must not be removed as they are essential for the vibration-free running of the propshaft. For the same reason, the joints must not be exchanged with one another. When a propshaft is being installed care must be taken to ensure that the engraved indicating arrows coincide so that the two joints are located within one plane, as required for perfect motion.

Fig. 1



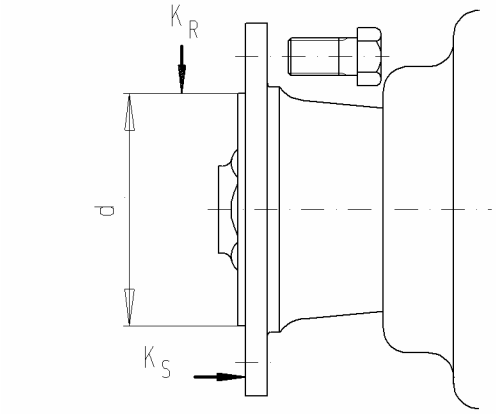
If the rotating propshaft might be dangerous for its environment, safety-means should be provided. This applies especially to propshafts rotating at high speed.
The propshaft should be set-up according to the installation instructions issued by the final manufacturer. For safety reasons, propshafts used in hazardous environments should be suitably guarded. High-speed propshafts should be guarded by safety bands to avoid damage in the event of shaft release or fracture. The relevant national regulations concerning industrial safety and protective efficiency are to be observed.
Dust and dirt adhering to the propshaft may deteriorate the balancing quality. Additionally, oily dirt may ignite on hot surfaces of the propshaft and this dirt should be removed on a regular basis. Under normal conditions the surface-temperature of propshafts should not exceed 70 centigrade (158°F). However, under unfavourable conditions the temperature may raise above 70 centigrade (158°F). In such cases please contact our application-engineers for discussing means to lower the temperature.
During transport and storage, the propshafts should be handled carefully and be protected against impacts and shocks in order to guarantee the balance quality. Propshafts should preferably be transported and stored horizontally. Any neglect of these instructions may lead to impairment of operation or a reduction in functional reliability.
CAUTION – Propshafts with length compensation may become separated at the slip section causing damage to propshaft components and possible injury. Also universal joints may tilt in handling possibly causing injury.
Propshafts should be stored in a dry atmosphere preferably in horizontal position and secured from falling over or rolling.

2. Assembly

Before the propshaft is installed, the faces of the two flanges (shaft flange and connecting flange) are to be cleaned, i.e. the faces and centring surface must be free of burrs, dirt, paint and grease. The axial and radial run out tolerances admissible for the companion flange are to be maintained, otherwise the correct running of the propshaft may be affected (Fig. 2 and Table 1).

Fig. 2

Recommended radial run out K_R



Recommended axial run out K_S

Table 1

Speed rpm	tolerance for *d*	Radial Run out K_R	axial Run out K_S
Up to 500	h8	0,15	0,18/100
500 to 3000	h7	0,08	0,10/100
More than 3000	h6	0,05	0,07/100

(K_S is in relation to Ø100 mm)

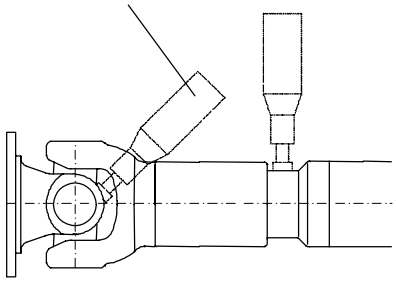
Both flanges are connected by means of hexagon bolts according or similar to ISO 4014 of property class 10.9 and hexagon nuts according to ISO 7042-V of property class 10.
Not all types of our propshafts allow inserting the hexagon bolts from the joint end.
Particular attention should be given to tighten the flange connecting bolts in order to achieve the necessary frictional torque transfer. Suitable wrenches are to be used. The specified tightening torques are provided in our latest catalogue.

3. Maintenance

Propshafts without grease nipples are greased for life and therefore require no further lubrication. If high pressure equipment is used for cleaning, it is important not to direct the jet directly onto the seal.
For propshafts fitted with a tape red grease nipple (acc. to DIN 71412) or flat grease nipple (acc. to DIN 3404) it is possible to lubricate the joints with a grease gun (see Fig. 3).

Fig. 3

Joint relubrication spline relubrication



The grease nipples must be cleaned before a grease gun is applied. The 4 bearings of each joint are lubricated by one central grease nipple.

Complete lubrication is achieved when grease can be observed coming from the bearing seals. For shafts with regreaseable shaft length compensation, 10 - 40 g of grease should be sufficient depending on shaft size.
Grease guns must be operated smoothly, at pressures not exceeding 2 MPa to prevent any damage to the seals.
Regreasing is necessary after cleaning with high pressure equipment. It is important not to direct the jet directly onto the seal.
Suitable lubricants recommended:

Lithium complex greases of specification KP 1-2 N-30 or KP 2 N-20 DIN 51502 with EP additives.

No greases containing MoS_2 or other solid lubricant additives to be used for the joint bearings as well as sliding part.

When the application temperature limits exceed the normal range of +80°C to -25°C (+176°F to -13°F), special-purpose greases of the above- mentioned specification should be used.

For general applications, the following directions are recommended:

Propshafts employed in:	**Maintenance interval**
Road motor vehicles	50,000 km (31,000 miles) or 1 year
Off-road motor vehicles	30,000 km (18,500 miles) or 1 year
Off-road motor vehicles in building sites	10,000 km (6,200 miles) or 250 hours
Rail vehicles	3,000 hours or ½ year
Stationary plant	500 hours
Marine drive lines	1,500 hours or ½ year.

Shorter maintenance intervals will be required where the propshafts are operated in extremely adverse conditions. The maintenance intervals of the propshafts in special applications are to be agreed with the final customer (OEM).
Propshafts taken out of pro-longed storage (6 months and more) should be lubricated before being installed.

4. Repair

Only qualified and experienced technicians should repair or assemble propshafts as poor workmanship and improper procedures may cause malfunction due to excessive wear, heat, or vibration.

The propshafts can be reconditioned with the aid of simple auxiliary tools, as the joints can be completely disassembled and the length-compensating attachment can be exchanged.

The principal points of wear are:

- Joint bearing:
  - Visual inspection: Perceptible play in the bearings, damaged sealings
  - After disassembling: Wear marks and indications of pitting on the bearing surfaces; damaged rollers; worn sealing,
- Sliding part:
  - Visual inspection: Perceptible play permitting twisting and/or tilting; damaged sealing; damaged sealing area of the hub (if coated then coated with RILSAN®)
  - After disassembling: Indications of pitting at profile flanks and at the head periphery; damaged sealings, damaged coating of the hub/ splined shaft, corrosion.

4.1. Replacing the journal crosses

Pay attention to clean surroundings to avoid any dirt or dust intruding in the bearings to be assembled, and to a smooth surface of the bore for the bearing.

4.1.1. Closed bearing eye

Because the bearing bushes cannot be removed completely out of the bearing eye (because of interference with the cross and claw), in a first step the two opposite bearing bushes of the fork of the weld yoke will be removed half way. Thereafter by applying the ring as shown in fig. 4 or by inserting of discs the complete removal of the bearing bushes can be done. At this disassembly some damage at the bushing or the plastic disc at the bottom of the bushing may occur. In this case these parts have to be replaced anyway.
If you still cannot take off the bearing bush by hand after pressing it out half way, you may tap the yoke ear lightly for loosening the bearing bushing.
The disassembly of the two bearing bushes of the flange yoke follows the same procedure as described above. (Fig. 5)

Fig. 4

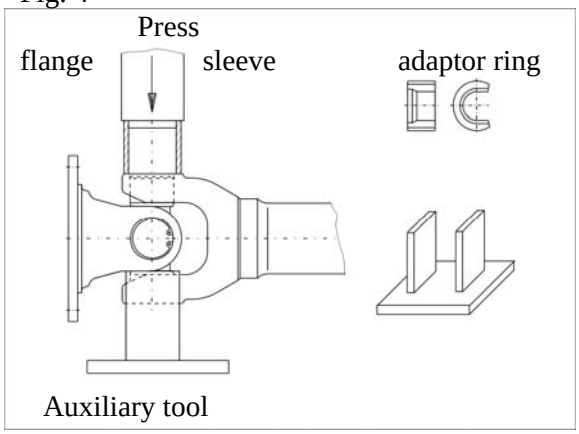
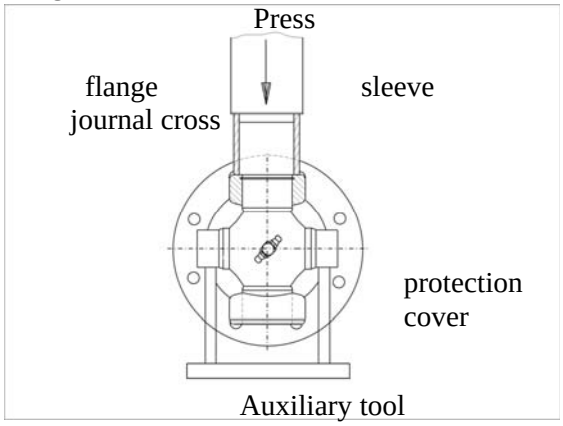


Fig. 5



The bearing bush must not be canted while it is being pressed in, it should be seated firmly in the bore of the flange yoke. The locking rings must fit snugly into the ring grooves provided. To avoid any deformation, the flange yoke should be supported during the push-in operation, if possible. Any adjustment necessary to take-up any play in the joints or lack of concentricity should be carried out at the same time (permissible tolerance +/- 0.05 mm). Play and press fit, are compensated for by using locking rings of different thickness. The joint must be smooth moveable to avoid too much friction and heat during operation, by which the joint may fail prematurely.

4.1.2. Split bearing eye (bolted yoke)

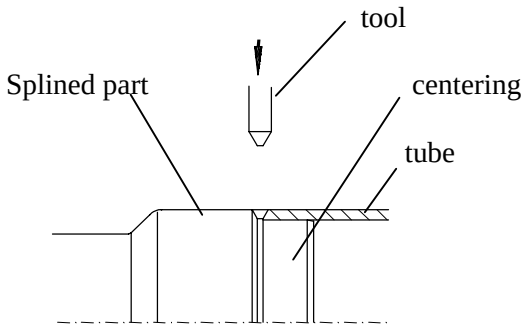
On joints with split bearing eye bores the bearing caps should be slackened to allow removal of the cap. After the 2 bearing caps have been removed, the spider, including the bearing sleeves, can be separated from the yokes.
Note! Bearing caps and yokes are in pairs and therefore must not be interchanged or mounted in a different position during reassembly (you may mark them differently before disassembly for this purpose!).
The complete cross will be assembled by inserting it in the yokes and putting the caps on the yokes. The caps have to be tightened to the yokes with new proper screws applying the prescribed torque.

To achieve the right backlash you may either use discs of different thickness at the bottom of the bearing bush ring segments of different thickness, which keep the cross concentric to the 2 claws. The joint must be smooth moveable to avoid too much friction and heat during operation, by which the joint may fail prematurely.

4.2. Slip assembly

Disassembling and remounting entails experience and craftsmanship besides appropriate equipment, especially in welding and balancing.
In a first step the tube and the profiled part have to be separated by removing the weld seam on a lathe (Fig. 6). The profiled hub and shaft always have to be replaced together, because these parts are matched individually as a unit.
Before welding the tube and profiled part make sure a perfect alignment of both parts, e.g. by providing an interference fit.

Fig. 6



The radial tolerance of the alignment should be within 0.5 mm.
After the welding operation this components (tube and profiled part) are put together with the other profiled part. At this step it has to be observed, that the inner yokes have to be in the same plane at a radial tolerance of max. 3°.
Thereafter the complete propshaft has to be straightened at a max. radial run out of 0.5 mm.

4.3. Balancing

Balancing too entails craftsmanship, experience and suitable equipment.
If not available, you may use our workshop or ask us for an authorized workshop near your site.
After a repair (replacement of crosses or slip assembly) generally propshaft running at more than 500 rpm should be balanced. Unbalanced propshafts may cause vibrations, which jeopardize operators and can damage or destroy the propshaft itself and adjacent components of the whole powertrain.
The balancing quality has been regulated by DIN ISO 1940 standard:

Balancing quality G 40 for propshafts for general applications
Balancing quality G 16 for propshafts for special applications

Gelenkwellenwerk Stadtilm GmbH
Weimarische Str. 62
D-99326 Stadtilm
Germany / Deutschland
Telefon: +49 3629 640 0
Telefax: +49 3629 80 00 02
Internet: www.gewes.de
E-Mail: gewes@gewes.de