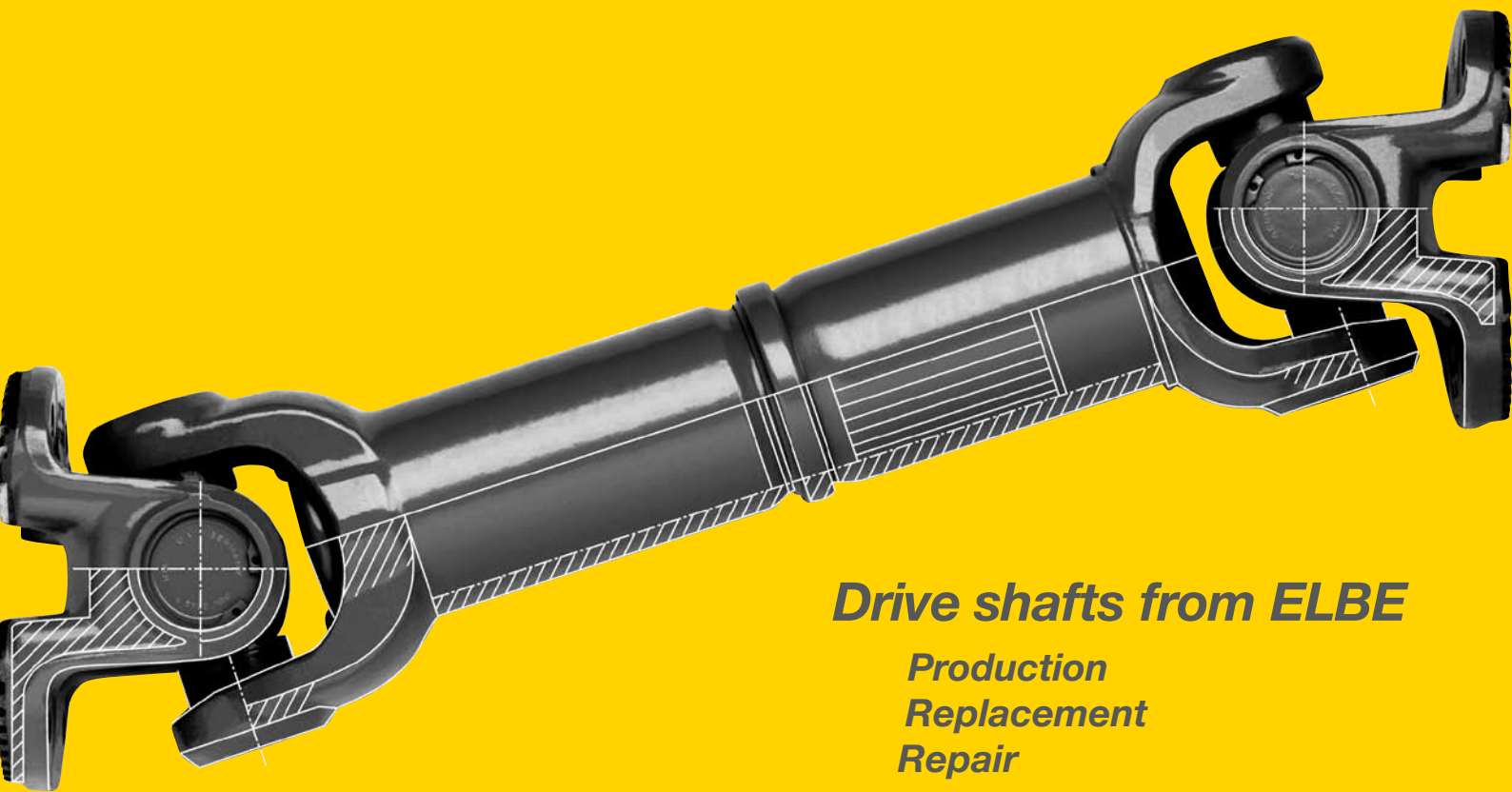




Installation instructions and maintenance guidelines



Drive shafts from ELBE

***Production
Replacement
Repair***

Installation instructions – transport and storage

Our drive shafts are supplied ready for installation. Unless specified otherwise by the orderer, they are dynamically balanced for $n = 2,000$ rpm as per grade G16 in accordance with ISO standard 1940.

Transport and storage

To preserve their excellent balance, it must be ensured that the drive shafts are not knocked or impacted during transport and storage. The best position for transport is horizontal. If transported in the vertical position, the drive shaft halves must be prevented from coming apart through the use of a suitable safeguard.

Installation instructions

Before installing the drive shafts, all flange surfaces are to be thoroughly cleaned of any rust inhibitor, dirt and grease so as to ensure the required adhesion coefficient for torque transmission. The drive shafts also need to be lubricated after installation.

The drive shafts, which have a large deflection angle due to the installation conditions and run at

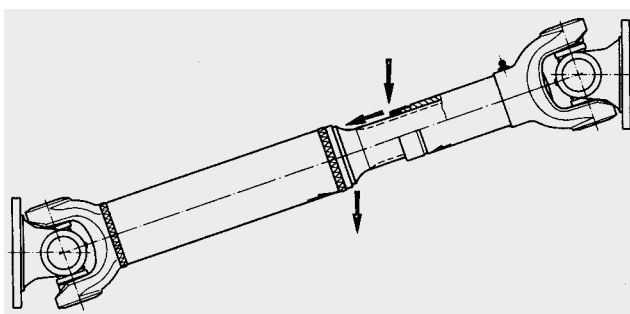
When storing the drive shafts, it is also preferable to keep them in the horizontal position, as this prevents the shafts from falling over and possibly being damaged from the start. Never store drive shafts directly on the floor. Store them on wooden shelves if possible. If they will be stored for a longer period of time, bare metal parts must be checked for corrosion and treated with corrosion protection oil if necessary.

high speeds ($\beta \cdot n > 18,000$), must be re-lubricated at the spiders after the initial break-in phase of approx. 10-15 minutes. Refer to the Maintenance guidelines sheet for acceptable greases.

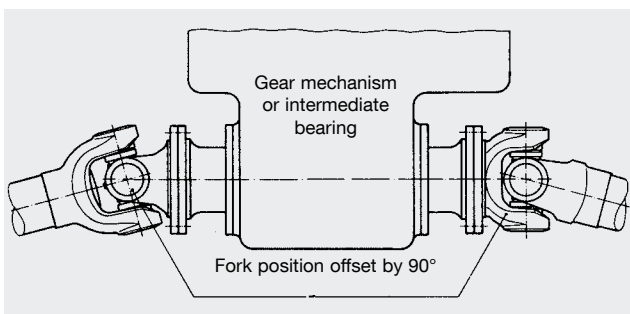
$$\beta^\circ (\text{deflection angle}) \times n (\text{torque}_{\text{max}}) < 20,000$$

The drive shafts may not be separated in the spline profile and swapped one for another, as this will severely compromise the balance. For the same reason, balancing plates may not be removed.

Before installing drive shafts, it must be ensured that they are assembled properly, i.e. the marker points located on the splined shaft and the splined hub face each other.



The drive shafts are to be positioned so that the spline profile is protected against dirt and moisture as much as possible. This generally means that they are installed as per the schematic shown here, where the profile seal faces downwards so that any splashes of water run off the spline profile.



If two or more drive shafts are located one after another, we recommend installing them offset by 90° to one another. Doing so at least partially reduces the outward mass acceleration torque that results from the asymmetric run of the centre sections of the drive shafts.

If installed vertically, the shafts are to be positioned in such a way that the sliding section side is mounted to the intermediate bearing block in each case.



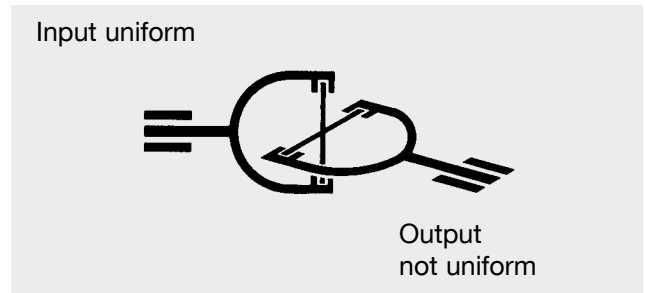
Upon request, we can also supply the bolt kits required for flange connection.
(See the "Flange bolt kits" sheet).

Important note:

When tightening the bolt, use a torque spanner if possible and tighten evenly in an alternating fashion.

Basic installation rules

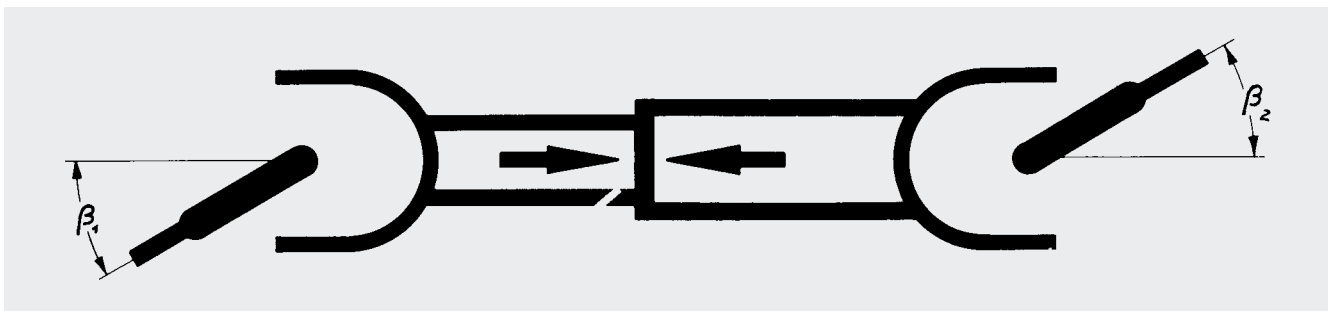
When a single cardan, cross drive or ball and socket joint is rotated uniformly in an angled state, the motion taking place on the output side is not uniform.



This lack of uniformity is eliminated when two single joints are connected to form a drive shaft. For full synchronous motion, the following conditions must be met:

- a) Equal deflection angles at both joints
($\beta_1 = \beta_2$).
- b) The two inner forks must be on a single plane.
- c) Input and output shafts must also lie on one plane.

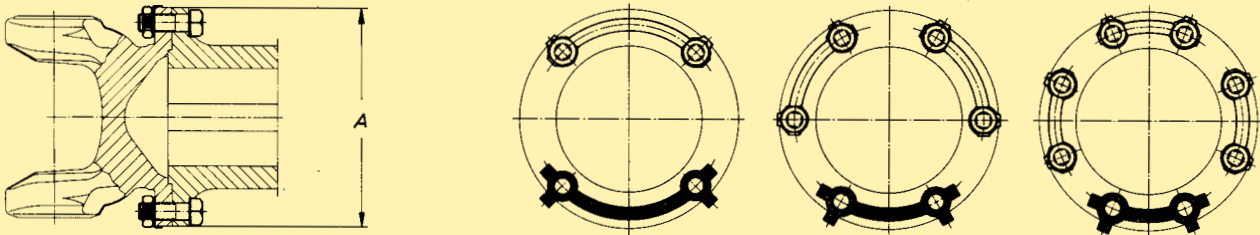
Exception: If a drive shaft is angled in three dimensions, the input and output shafts are not on one plane. To obtain uniform output motion, it is necessary in this case to offset the inner forks relative to each other so that they end up on the same plane of deflection created by their joints. In addition, the three-dimensional deflection angles must be equal. (We will gladly assist you in determining the appropriate offset angle.)



Note: Incorrectly assembled drive shafts do not compensate for non-uniform output motion. In fact, they amplify it. This can damage joint bearings and spline profiles. For this reason, the marker points on the splined shaft and splined hub must face each other when assembling the drive shaft halves.

Flange bolt kits

The specified quantities for each set are based on a drive shaft with two flanges



Double tab washers are not part of the flange bolt kit and are now only available on request.

Instead of the double tab washers previously used, generally only class-10 self-locking nuts are used.

Order No.	21237	21238	19976	13798	13799
Flange diameter A	58	65	75	90	100
To be used with	0.105	0.106	0.107	0.109	0.110
Hexagon bolts similar to DIN 960 - 10.9	M5 x 0.8 x 16	M6 x 1.0 x 20	M6 x 1.0 x 20	M8 x 1.0 x 25	M8 x 1.0 x 25
Qty. per kit	8	8	12	8	12
Hexagon nuts DIN 985 - 10.9	M5 x 0.8	M6 x 1	M6 x 1	M8 x 1	M8 x 1
Qty. per kit	8	8	12	8	12
Tightening torque in Nm	8.5	14	14	35	35

Order No.	13834	31468	30456	28524	29686
Flange diameter A	165/180	180	180/225	250	285
To be used with	0.117 0.122	0.120 0.122	0.120 0.125	0.122	0.128
Hexagon bolts similar to DIN 960 - 10.9	M16 x 1.5 x 45	M16 x 2 x 50	M16 x 2 x 50	M18 x 2.5 x 60	M20 x 2 x 80
Qty. per kit	16	20	16	16	16
Hexagon nuts DIN 985 - 10	M16 x 1.5	M16 x 2	M16 x 2	M18 x 2.5	M20 x 2
Qty. per kit	16	20	16	16	16
Tightening torque in Nm	295	295	295	450	580



The connecting bolts are usually inserted from the counterflange. Here, the recess also serves to secure the bolt head.

Only with some sizes insertion of the bolts on the joint side is possible without subsequent work.

13827	13831	21239	13832	29666	21240	13833
120	120	150	150	150	180	165/180
0.112	0.113	0.115	0.148	0.117	0.117 0.158	0.158
M8 x 1.0 x 25	M10 x 1.0 x 30	M10 x 1.0 x 35	M12 x 1.5 x 35	M12 x 1.5 x 35	M12 x 1.5 x 40	M14 x 1.5 x 40
16	16	16	16	24	16	16
M8 x 1	M10 x 1	M10 x 1	M12 x 1.5	M12 x 1.5	M12 x 1.5	M14 x 1.5
16	16	16	16	24	16	16
35	69	69	120	120	120	190
29687	29688	29689	29665	30923	27581	27580
315	350	390	435	120 KV	150 KV	180 KV
0.131	0.135	0.139	0.112 0.143	0.117 0.148	0.177 0.158 0.122	0.120
M22 x 2 x 90	M22 x 2.5 x 90	M24 x 2 x 100	M27 x 2 x 100	M10 x 1.5 x 40	M12 x 1.5 x 45	M14 x 1.5 x 50
16	20	20	20	8	8	8
M22 x 2	M22 x 2.5	M24 x 2	M27 x 2	M10 x 1.5	M12 x 1.5	M14 x 1.5
16	20	20	20	8	8	8
780	780	1000	1500	46	79	125-

Maintenance guidelines

Lubrication of cardan drive shafts

Elbe cardan drive shafts normally feature three DIN 71412 conical grease nipples. Each individual joint is lubricated by a nipple; the third nipple serves to re-lubricate the spline profile. In the case of plastic-coated length compensation, this nipple is not required.

Lubricants

When re-lubricating drive shafts, only lithium-saponified greases of consistency class 2 with a penetration of 265-295 and a dropping point of approx. 180 °C may be used. The lubricants may not contain any MOS₂ additives.

Re-lubricating intervals

The following approximate re-lubricating intervals should be complied with for greases of the type mentioned above.

These guideline values may need to be shortened in unfavourable operating conditions.

Intended use	Joints	Length compensation
Commercial vehicles used on roads	50,000 km or 1 year	Maintenance-free
Commercial vehicles used off-road	25,000 km or 6 months	Maintenance-free
Earth-moving/construction machinery	10,000 km or 1 month	Maintenance-free
Stationary equipment and mechanical engineering	500 operating hours or 3 months	3 months, if not maintenance-free

Low-maintenance drive shafts

If longer re-lubricating intervals are required, low-maintenance versions of the drive shafts are also available. Here, the needle bearings are lubricated with especially high-quality, long-lasting greases. The spline profiles are also pretreated accordingly. The drive shafts are supplied with plastic-coated spline profiles, which exhibit especially favourable sliding properties. The re-lubricating intervals can be extended two to three times with low-maintenance drive shafts.

Depending on the operating conditions, maintenance-free versions can also be purchased. Availability must be determined on a case-by-case basis, however.

High- or low-temperature drive shaft versions

Cardan drive shafts can normally be used in a temperature range of -30 °C to max. +100 °C. For higher or lower temperatures, special versions must be used:

High-temperature version

This allows temperatures up to approx. +160 °C, and briefly up to +180 °C. Lubricants: High-temperature greases of consistency 1 or 2. Some special versions up to +250 °C are also available.

Low-temperature version

Suitable for temperatures of approx. -60 °C to +110 °C. Lubricants: Low-temperature greases of consistency 1 or 2.

Note: Use only lithium-saponified greases!
Clean lubricating nipples before lubricating!
The needle bearings must be lubricated until the old grease exits at all seals.
Do not allow pressure surges to occur while lubricating so as to prevent seals being damaged.
Max. pressing power: 20 bar.



Lubricating drive shafts

The optimum service life of a cardan drive shaft can only be reached when regular maintenance is performed. The bearing points and spiders, in particular, need regular lubrication. Please note that only a manually operated press may be used for lubrication in this case. Since the lubrication path in the spider and through the intermediate spaces of the rolling elements is long and narrow, the grease needs time to expand. Even distribution of the grease is only ensured with slow lubrication at a low pressure.

Under the high pressure of a compressed-air impact pressure gun, the seals of all four bearing points could move out of position. Clean the lubricating nipples before lubricating and use only lithium-saponified greases.

If a high-pressure steam jet unit was used for cleaning near the cardan shaft, carry out re-lubrication again immediately so as to push out the water (which may even contain a grease solvent) which has penetrated.

Safety precautions, care and maintenance

The owner must take appropriate preventive safety measures which rule out danger to people and property by rotating drive shafts or their parts.

The user or owner must comply with the statutory safety-related precautions and take suitable preventive measures before starting maintenance work:

- Installation, mounting and maintenance work may only be performed on drive shafts by specialist personnel.
- When installing, removing and transporting drive shafts, do not reach into the joints to avoid crushing injuries caused by a tipping flange or joint parts. Carry out suitable measures to ensure that drive shaft halves do not slide out of one another and cause injury or damage.
- Secure drive shafts with safety devices such as safety bows and protective guards to prevent parts flying off and to prevent contact. Inform others of the potential dangers using clearly visible warning information.
- Do not weigh down shafts while at a standstill, and do not place tools or other objects on the shaft, hang them inside it or attach them to it in any other way.
- Drive shafts and cross drive joint can become hot! Exercise caution even when the equipment is at a standstill. Guard against burns!
- Use only approved universal flange bolt kits when mounting drive shafts. See the "Flange bolt kits" technical sheets.

Basic information

To avoid damage and danger, you must observe the following basic information:

- The permissible operating speed may not be exceeded.
- Do not exceed the permissible deflection angle.
- In the case of shafts with length compensation, the maximum permissible X value (length compensation) may not be exceeded. 1/3 of the total length compensation is optimum.
- The balancing quality of a drive shaft may not be changed under any circumstances.
- Do not make any changes or independent repairs to the drive shaft without written approval from the manufacturer. Otherwise, dangers to people and property could arise and any warranties would be voided.
- Drive shafts may not be cleaned with pressurised water or a steam jet so as to prevent the seals being damaged and the penetration of water and dirt.
- Plastic-coated profiles and sliding surfaces are to be protected against mechanical, thermal and chemical damage. Sliding surfaces for seals are to be covered before painting work is carried out.
- Drive shafts may only be used in liquid and solid media with written approval from the manufacturer.
- Localised heating of the drive shafts (e.g. to burn off residual paint) is to be avoided, as otherwise the true running characteristics could be changed considerably.
- Required maintenance and lubrication intervals must be complied with to prevent damage to property or injury to people which could result from drive shaft failure.



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