Technical Appendix

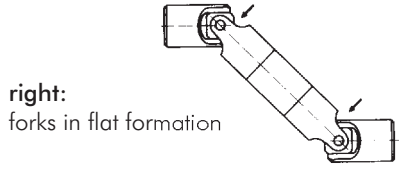
Installation Instructions

These universal joints and telescopic shafts are now, and will be in the future, indispensable and versatile components for transmitting rotary motion.

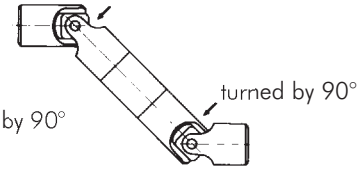
If two shafts, which are inclined towards each other at a given angle, are connected to each other via a universal joint, and if one of the shafts rotates with a constant regular speed, then the other shaft rotates with a variable angular velocity. This irregularity of motion - which is also called gimbal error - causes the rotating angle to advance and lag alternately, thus effecting the second shaft to rotate with sinusoidal fluctuations. The greater the deflection angle α, the greater the non uniformity of the rotating motion.

For this reason, single universal joints are only used when variable rotary motion is permissible. The non uniformity of motion can be compensated by using two single universal joints in sequence or by using a double universal joint. When properly installed, the second universal joint can compensate the irregular motion of the first one under the following conditions as enumerated by DIN 808.

1. **Correct fork position: when using two single universal joints make sure that the two inside forks are in flat formation, as in the case of double universal joints.**

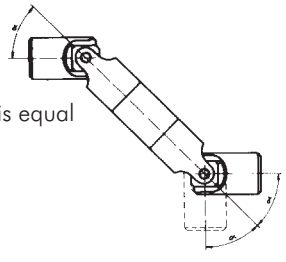


right:
forks in flat formation

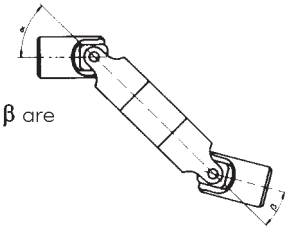


wrong:
fork plane turned by 90°

2. **The deflection angles at both ends must be equal.**

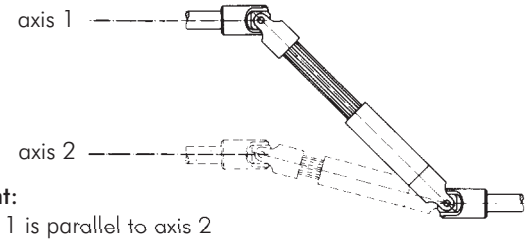


right:
the angle α is equal everywhere

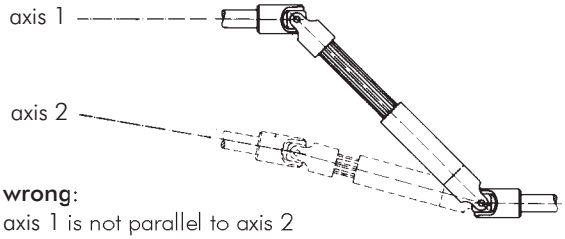


wrong:
the angles α and β are not equal

3. **The driving and driven shafts may only be shifted in directions parallel to the shafts.**

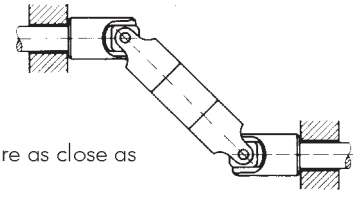


right:
axis 1 is parallel to axis 2

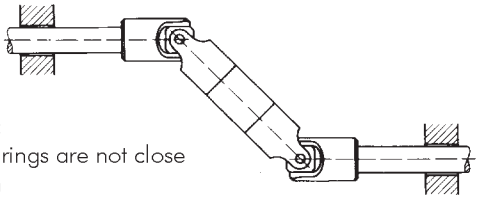


wrong:
axis 1 is not parallel to axis 2

4. **The bearings of the shaft joint - or of the double universal joint - should be positioned as close as possible to the universal joints.**



right:
the bearings are as close as possible



wrong:
the bearings are not close enough

The shaft joints are delivered without pinholes and clamping studs.
The length of the dowel pins is determined by the outer diameter of the universal joint; it must be flush when set.

We recommend dowel pins DIN 1481.

diam. of bore ø	6	8	10	12	16	20	25	32	40	50
diam.of dowel pin ø	2	3	4	5	6	8	10	12	14	16

Technical Appendix

Calculating the Dimensions of the Universal Joints - Type 808 - Series "G"

Pages 36 & 40

The selection of a universal joint is not determined exclusively by the max. torque to be transmitted. There are also other operative conditions which must be taken into account, such as impact load, angular ratios, angular velocities, etc.

The diagrams presented below give approximate preliminary values for calculating the dimensions of the universal joints and contain the corresponding standard values.

Fig. 1 shows the power and torque values transmitted by single precision universal joints during permanent operation with a deflection angle of $\alpha = 10°$.

Fig. 2 shows the adjustment value to be taken into consideration for greater deflection angles. For deflection angles less than 10°, e.g. between 0° to 5° you may increase the standard power value shown in fig. 1 by 25%.

Notes: There are no general standard values for precision universal joints with friction bearings, for which it is possible to specify the service life, the stress and strain to which the friction surfaces are exposed is determined by the regularity of the lubrication intervals.
The loads to which double universal joints are exposed may only be about 90% of the corresponding values for single universal joints. This also applies to telescopic joints.

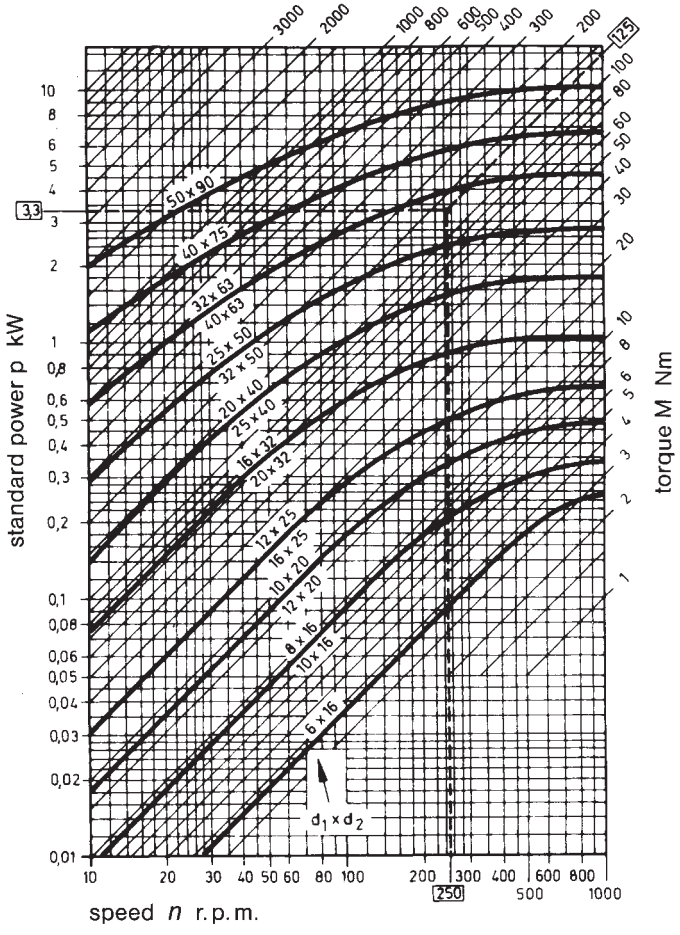


Figure 1: Power diagram for precision universal joints with friction bearings in accordance with DIN 808-G

Figure 1 yields for $n = 250$ r.p.m. and 3.3 kW:
shaft joint E 32 x 63 (or E 40 x 63) with the admissible torque value of M = 125 Nm.

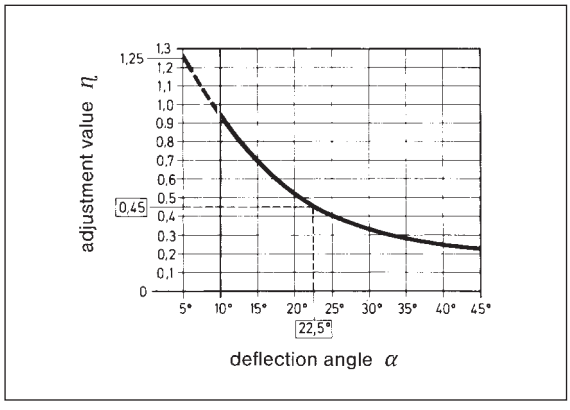


Figure 1: Adjustment value in relation to the deflection angle

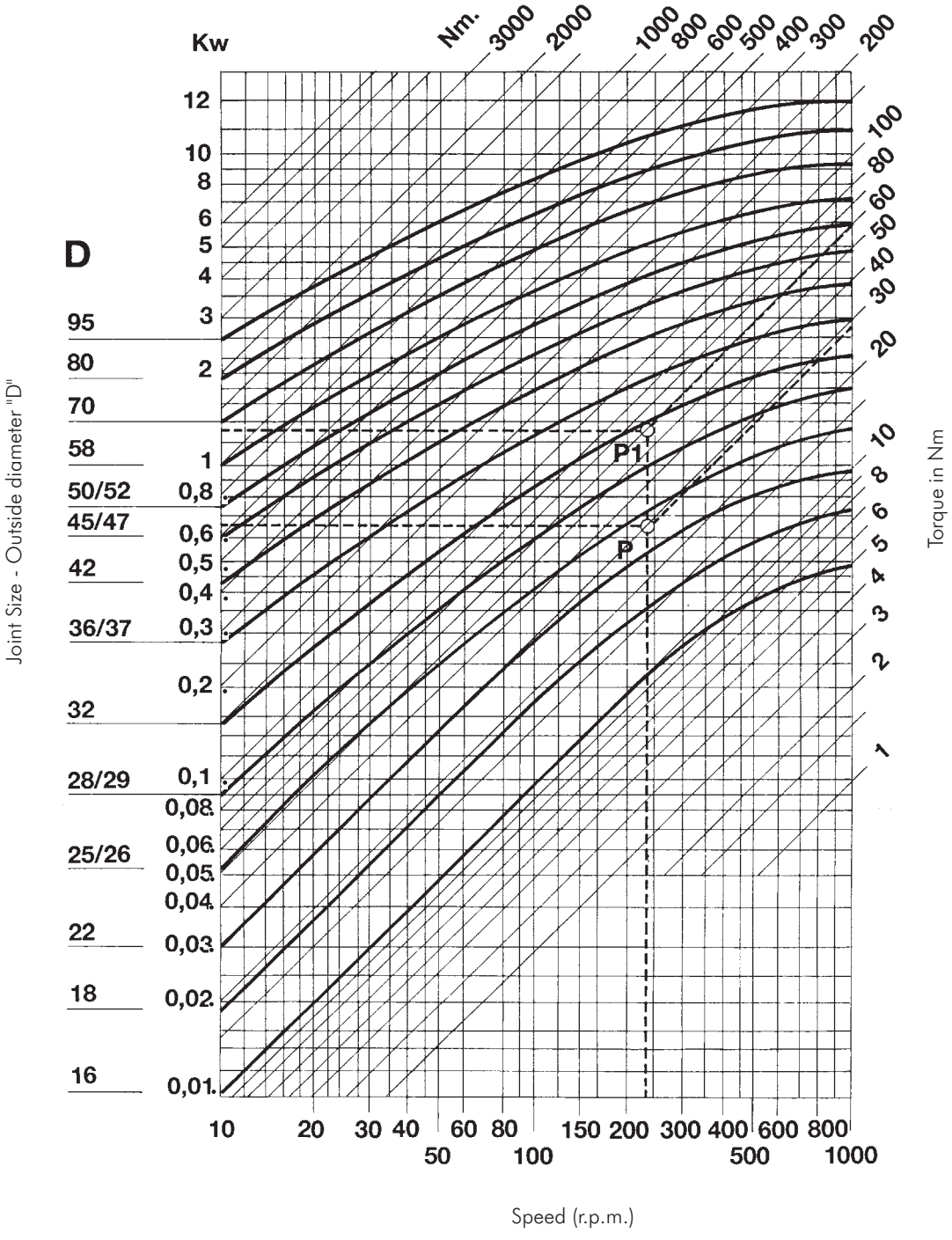
Example

Given values:
the power to be transmitted P = 1.5 kW
speed $n = 250$ r.p.m.
defection angle $\alpha = 22° 30'$

Calculation:
adjustment value from figure $2\eta = 0.45$

standard power $P' = \frac{P}{\eta} = \frac{1.5}{0.45} = 3.3$ kW

Diagram for Joints - Series "G" & "GD" on pages 37 & 38



WORKING ANGLE "α"	CORRECTION FACTOR "F"
45°	0.25
40°	0.30
35°	0.38
30°	0.45
25°	0.55
20°	0.65
15°	0.80
10°	1.00
5°	1.25

Example

- Power: 0.65 kW
- R.P.M.: 230
- With working angle α 10° Factor F=1 we get point P. Torque = 27 Nm corresponding to joint size "D" = 25/26 mm. = Type 04G
- With working angle α 30° Factor F = 0.45 (KW 0.65 : 0.45 = KW 1.44) we get point P1 Torque = 60 Nm corresponding to joint size "D" = 32 mm. = Type 1G

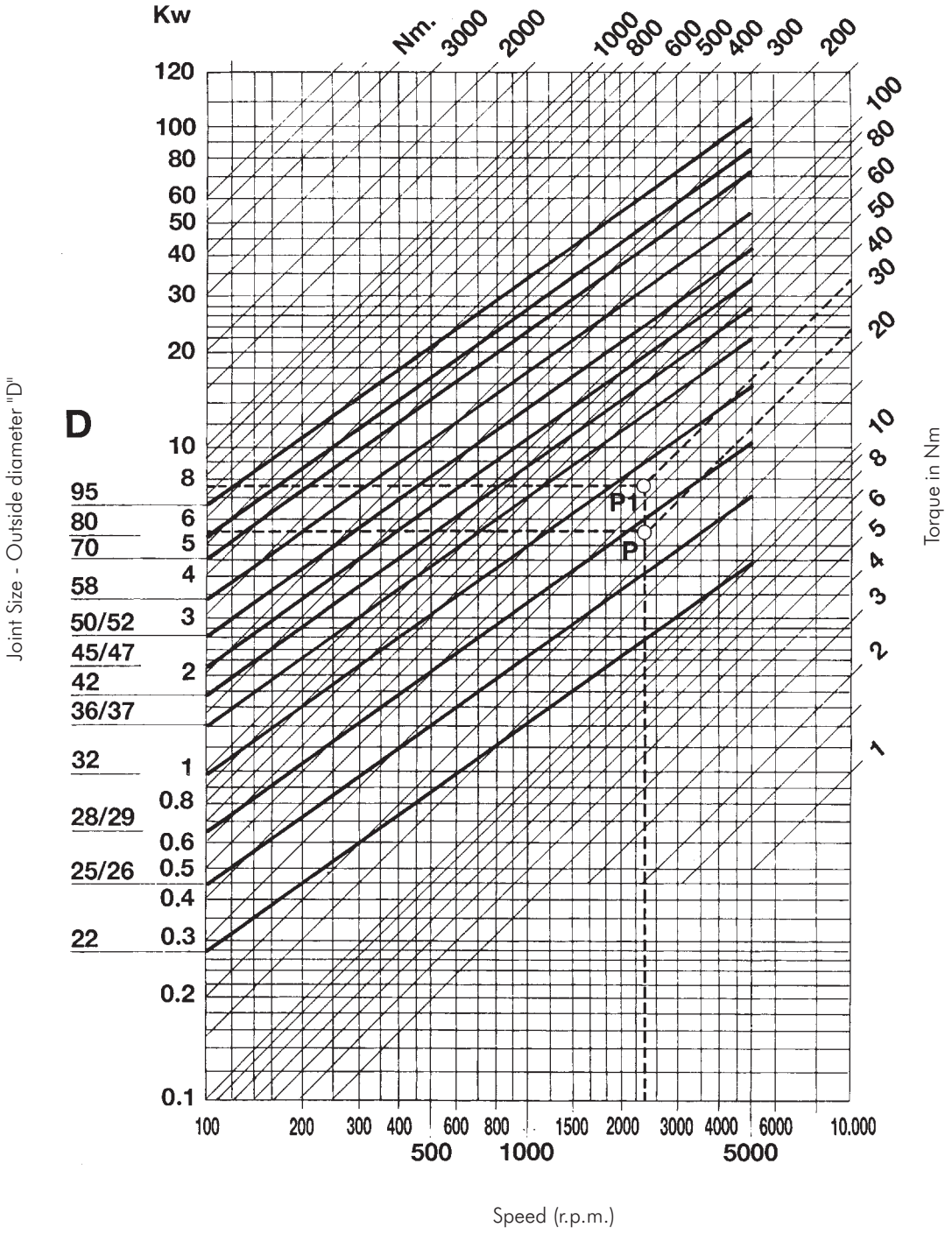
Consider that:

$$\text{Torque in Nm.} = 9550 \times \frac{\text{Power (kW)}}{\text{Speed (r/min)}}$$

$$\text{Torque in Nm.} = 7020 \times \frac{\text{Power (CV)}}{\text{Speed (r/min)}}$$

N° 1 kW = 1,35 CV - N° 1 CV = 0,736 kW
N° 1 Kgm = 9,81 Nm - N° 1 Nm = 0,102 Kgm

Diagram for Joints - Series "H" & "HD" High Speed page 39



WORKING ANGLE "α"	CORRECTION FACTOR "F"
45°	0.25
40°	0.30
35°	0.40
30°	0.50
25°	0.70
20°	0.80
15°	0.90
10°	1.00
5°	1.25

Example

- Power: 5.5 kW
- R.P.M.: 2300
- With working angle α 10° Factor F=1 we get point P. Torque = 23 Nm corresponding to joint size "D" = 28/29 mm. = Type 05H
- With working angle α 25° Factor F = 0.70 (KW 5.5 : 0.70 = 7.85 KW) we get point P1 Torque = 33 Nm corresponding to joint size "D" = 32 mm. = Type 1H

Consider that: $\text{Torque in Nm.} = 9550 \times \frac{\text{Power (kW)}}{\text{Speed (r/min)}}$

$\text{Torque in Nm.} = 7020 \times \frac{\text{Power (CV)}}{\text{Speed (r/min)}}$

N° 1 kW = 1,35 CV - N° 1 CV = 0,736 kW
N° 1 Kgm = 9,81 Nm - N° 1 Nm = 0,102 Kgm

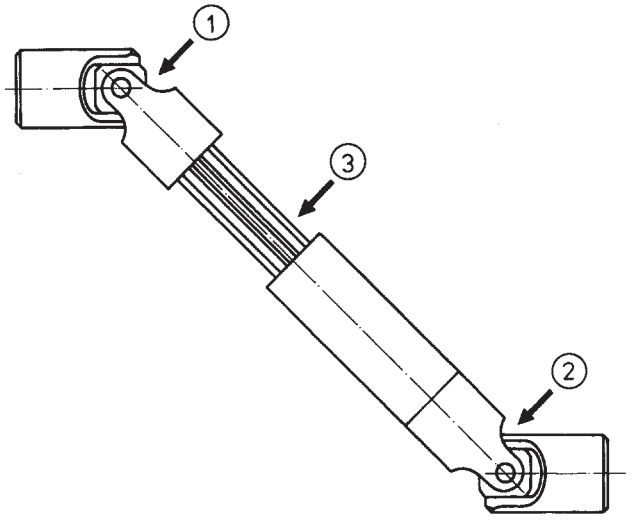
Technical Appendix

Maintenance & Lubrication for Universal Joints with Friction Bearings and Telescopic Universal Joints.

Needle roller bearing universal joints are maintenance free due to their permanent lubrication, and are ideal for use in machine components that are difficult to access.

Friction bearing universal joints, single, double and telescopic should be lubricated at regular intervals.

Telescopic universal joints are ready for immediate use. They are lubricated with a lithium saponified extreme pressure lubricant on a mineral oil base.
Temperature range: -30°C +125°C
Peak temperature: Maximum 140°C
Please use lubricants with the same specification when re-lubricating.



Lubricating Points:

Lubrication is required at least once daily for permanent operation at the lubricating points marked with arrows. For friction bearings this means all the sliding parts on the cube, the fork piece and bearing pins (1) and (2) as well as, for telescopic joints, the sliding parts of the extendable splined profile (3).

In harsh environments, the sliding parts should be protected against fibrous particles and steam by means of a folding bellow (See page 47). Permanent self-lubrication for an indefinite time is achieved by filling the folding bellow with the lubricating grease and clamping the ends tight.

Note: Maintenance work should be carried out at regular intervals, preferably while carrying out maintenance work on other machine parts. At such times, we also recommend that noise and backlash tests be conducted, or if the working noise and/or backlash of the joint and profile parts deviate from the standard values.

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