

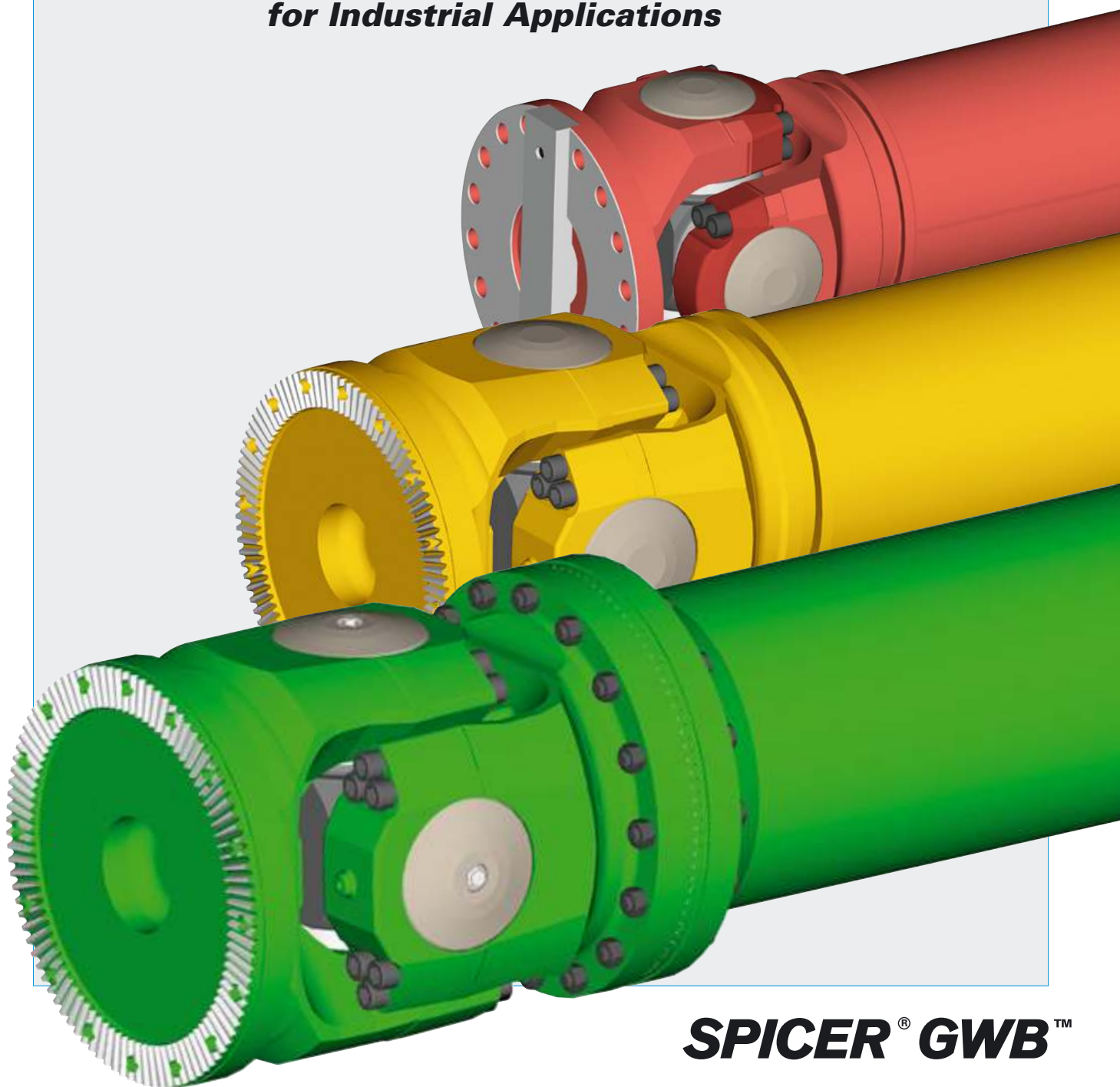


SPICER GELENKWELLENBAU

工业万向轴

Cardan Shafts

for Industrial Applications



SPICER® GWB™

Printed in Germany 2006

我们是传动技术的专家	第 2 页
万向轴产品系列一览	第 4 页
万向轴的特殊设计及附件	第 8 页
数据表阅读指南	第 10 页
应用实例	第 11 页
数据表	
● 687/688 系列	第 14 页
● 587 系列	第 18 页
● 390 系列	第 20 页
● 392/393 系列	第 22 页
● 492 系列	第 24 页
● 498 系列	第 26 页
● 587/190 超短型设计	第 28 页
● 330 系列快装接头	第 30 页
● 230 系列快装接头	第 31 页
● 十字轴总成	第 32 页
● 端面齿法兰联接	第 33 页
● 687/688/587/390 的特殊法兰连接	第 34 页
● 法兰轴套	第 35 页
应用实例	第 36 页
设计特点	第 40 页
理论概述	第 42 页
使用技术指南	第 44 页
万向轴的选型	第 54 页
安装与维护	第 57 页
询价与定货须知	第 68 页
售后服务	第 69 页

We are the experts in transmission engineering	Page 2
Survey of cardan shaft series	Page 4
Special designs of cardan shafts and additional equipment	Page 8
Directions for handling of data sheets	Page 10
Application examples	Page 11
Data sheets	
● Series 687/688	Page 14
● Series 587	Page 18
● Series 390	Page 20
● Series 392/393	Page 22
● Series 492	Page 24
● Series 498	Page 26
● Series 587/190 super short designs	Page 28
● Quick release couplings Series 330	Page 30
● Quick release couplings Series 230	Page 31
● Journal cross assemblies	Page 32
● Flange connection with serration	Page 33
● Face key connection Series 687/688/587/390	Page 34
● Standard companion flanges	Page 35
Application examples	Page 36
Design features	Page 40
General theoretical directions	Page 42
Technical directions for application	Page 44
Selection of cardan shafts	Page 54
Installation and maintenance	Page 57
Directions for inquiries and orders	Page 68
After-sales service	Page 69



60 余年来我们在万向轴方面积累了丰富的经验，使 SPICER GWB 公司在汽车及工业万向轴的制造和应用方面处于领先地位。

我们卓越的能力是基于遍布全球的经营合作网络及以 DANA 国际集团公司为后盾的强大实力。

我们公司的宗旨是通过技术创新，产品的质量，可靠性和灵活性，长期保持这一领先地位，在不断更新的市场环境中为用户提供经济高效，性能超群的产品。

我们的万向轴产品品种齐全，能满足各行业应用的需要。其转矩范围为

Our experience with a multitude of cardan shaft applications, gathered over more than 60 years, has made Spicer Gelenkwellenbau a leading manufacturer of cardan shafts for automotive and industrial uses.

A worldwide network of activities and partnerships and belonging to DANA's international group of companies form the basis of our competence.

It is our corporate policy to secure this position in the long-term through technical innovation, quality, reliability and flexibility, thereby maintaining our capability to supply economically efficient, high-performance products in a changing market environment.

Our cardan shafts contain a wide range of products for various applications, covering a torque range from

2.400 – 15.000.000 Nm

万向轴大致分为两种类型，已逐渐形成世界范围的技术标准。它们的主要区别就在于叉头轴承孔的设计。

整体式轴承孔设计：这种设计主要用于大批量商业化车辆领域及一般性机械制造领域(687/688和587系列)。

剖分式轴承孔设计：这种设计（390/392/393 系列和 492/498 系列）是为重载和超重载应用而开发的，其结构尺寸紧凑，许用转矩大，使用寿命大大增加，同时也便于维护和拆装。

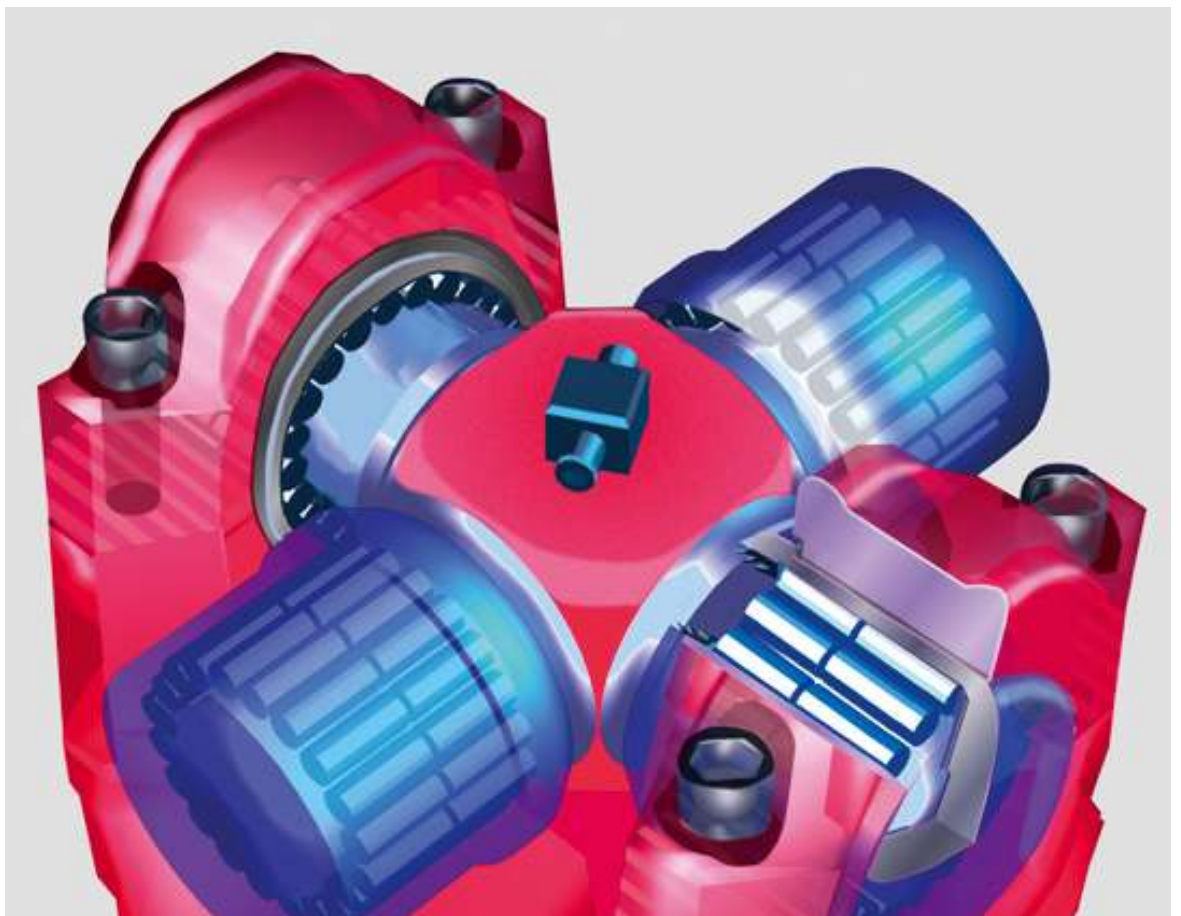
There are basically two types of cardan shafts which have evolved into a worldwide technology standard. Their main difference lies in the design of the bearing eye.

Closed bearing eye: *This is a design used mainly in the commercial vehicles sector and for general mechanical engineering applications (Series 687/688 and 587).*

Split bearing eye: *Developed for heavy and super-heavy duty applications, this design (Series 390/ 392/393 and 492/498), provides compact dimensions in conjunction with a maximum torque transmission capability and greatly improved service life, apart from facilitating maintenance and assembly operations.*



整体式轴承孔
设计
Closed bearing eye

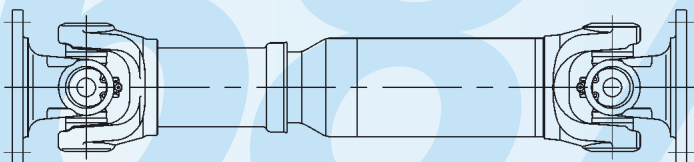


剖分式轴承孔
设计
Split bearing eye

万向轴产品系列一览

系列 / Series

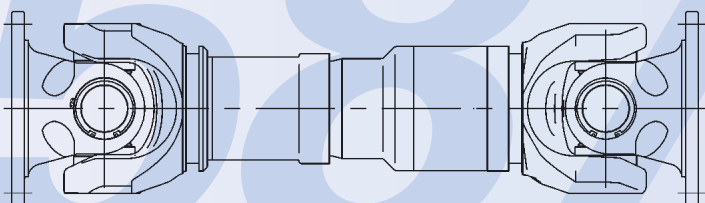
687/688 系列



转矩范围 T_{CS} 为
2.4 - 35 kNm
法兰直径 100 - 225 mm

*Torque range T_{CS}
from 2,4 to 35 kNm
Flange diameter
from 100 to 225 mm*

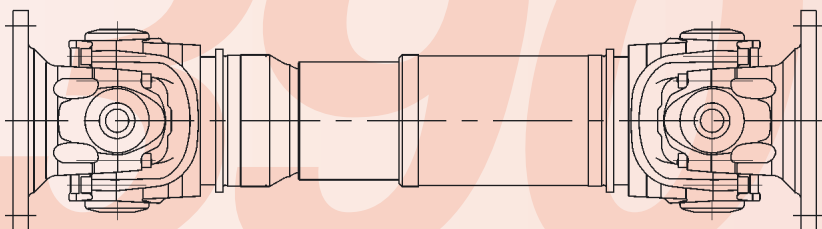
587 系列



转矩范围 T_{CS} 为
43 - 57 kNm
法兰直径 225 - 285 mm

*Torque range T_{CS}
from 43 to 57 kNm
Flange diameter
from 225 to 285 mm*

390 系列 (最大轴承寿命设计) (max. bearing life)



转矩范围 T_{CS} 为
60 - 255 kNm
法兰直径 285 - 435 mm

*Torque range T_{CS}
from 60 to 255 kNm
Flange diameter
from 285 to 435 mm*

设计特点 / Design features

应用领域 / Preferred application

- 整体式轴承孔设计
- 紧凑型设计
- 维护量低
- 花键轴带有塑料涂层
- 许用工作角度可达 25°
部分可达 44°

- *Closed bearing eyes*
- *Compact design*
- *Low maintenance*
- *Plastic-coated splines*
- *Operating angle up to 25°,
partly up to 44°*

- 铁路车辆
- 轧钢厂
- 船舶传动装置
- 一般机械制造厂

技术参数见参数页

- *Railway vehicles*
- *Rolling mill plants*
- *Marine drives*
- *General machinery construction plants*

Technical data (see Data sheets)

- 整体式轴承孔设计
- 紧凑型设计
- 维护量低
- 花键轴涂有润滑涂层
(587.50 型为塑料涂层)
- 许用工作角度可达 24°

- *Closed bearing eyes*
- *Compact design*
- *Low maintenance*
- *Splines coated with lubricating
varnish (587.50 – Plastic-coated)*
- *Operating angle up to 24°*

- 铁路车辆
- 轧钢厂
- 船舶传动装置
- 一般机械制造厂

技术参数见参数页

- *Railway vehicles*
- *Rolling mill plants*
- *Marine drives*
- *General machinery construction plants*

Technical data (see Data sheets)

- 有限空间内最大轴承寿命设计
- 剖分式轴承孔设计，
剖分面带齿
- 紧凑型设计
- 优化滚子轴承
- 伸缩部位涂有润滑涂层
- 许用工作角度可达 15°

- *Maximum bearing life in
confined spaces*
- *Split bearing eyes with
toothed bearing cap*
- *Compact design*
- *Optimized roller bearing*
- *Length compensation coated
with lubricating varnish*
- *Operating angle up to 15°*

- 铁路车辆
- 船舶传动装置
- 起重设备
- 造纸机械
- 一般机械制造厂

技术参数见参数页

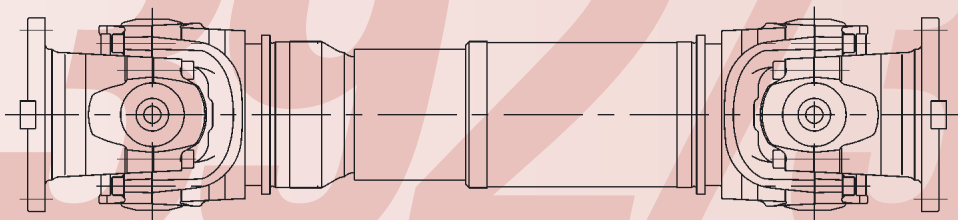
- *Railway vehicles*
- *Marine drives*
- *Crane systems*
- *Paper machines*
- *General machinery construction plants*

Technical data (see Data sheets)

万向轴产品系列一览

系列 / Series

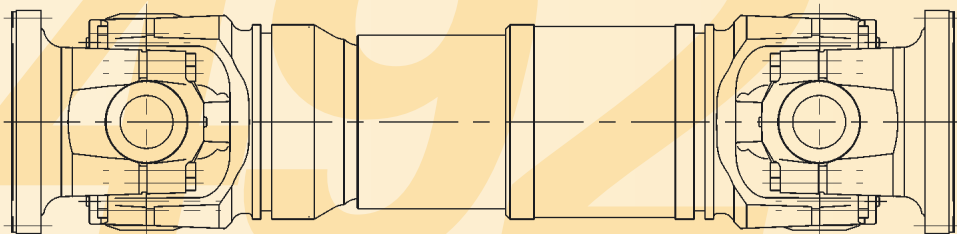
392/393 系列 (大转矩/长寿命轴承) (*high torque capacity/optimized bearing life*)



转矩范围 T_{CS} 为
70 - 1150kNm
法兰直径 225 - 550mm

*Torque range T_{CS}
from 70 to 1150 kNm
Flange diameter
from 225 to 550 mm*

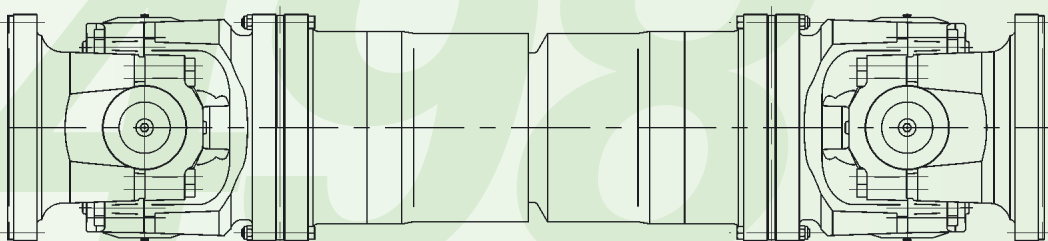
492 系列 (最大转矩承载能力) (*max. torque capacity*)



转矩范围 T_{CS} 为
210 - 1300kNm
法兰直径 285 - 550mm

*Torque range T_{CS}
from 210 to 1300 kNm
Flange diameter
from 285 to 550 mm*

498 系列



转矩范围 T_{CS} 为
1880-15000kNm
法兰直径 600-1200mm

如需要, 可提供更大尺寸

*Torque range T_{CS}
from 1880 to 15000 kNm
Flange diameter
from 600 to 1200 mm
Larger sizes available on request*

设计特点 / Design features

- 连接尺寸小，但许用转矩大
- 剖分式轴承孔设计，剖分面带齿
- 紧凑型设计
- 十字轴轴颈内侧带有浅凹槽
- 伸缩部位涂有润滑涂层
- 许用工作角度为 $10^\circ - 15^\circ$
- 393 型其轴承具有长寿命
- *High torque capacity despite small connecting dimensions*
- *Split bearing eyes with toothed bearing cap*
- *Compact design*
- *Journal cross with low notch factor*
- *Length compensation coated with lubricating varnish*
- *Operating angle 10° up to 15°*
- *393 with optimized bearing life*

应用领域 / Preferred application

- 轧钢厂
- 压延机传动装置
- 一般重型机械

技术参数见参数页

- *Rolling mill plants*
- *Calender drives*
- *Heavy-loaded plants of general machinery construction*

Technical data (see Data sheets)

- 许用转矩比 393 系列更大
- 剖分式轴承孔设计，剖分面带齿
- 标准端面齿法兰
- 十字轴轴颈内侧带有浅凹槽
- 伸缩部位涂有润滑涂层
- 许用工作角度为 $7^\circ - 15^\circ$
- *Increased torque capacity in comparison to 393*
- *Split bearing eyes with toothed bearing cap*
- *Standard Hirth-serrated flange*
- *Journal cross with low notch factor*
- *Length compensation coated with lubricant varnish*
- *Operating angle 7° up to 15°*

- 轧钢厂
- 压延机传动装置
- 特重型机械

技术参数见参数页

- *Rolling mill plants*
- *Calender drives*
- *Extremely high loaded plants of general machinery construction*

Technical data (see Data sheets)

- 根据对最大许用转矩或最大轴承寿命的要求，有三种许用工作角度的类型可供选择
- 剖分式轴承孔设计，剖分面带齿
- 标准端面齿法兰
- 许用工作角度可达 15°
- *3 operating angle versions for maximum torque or maximum bearing life capacity*
- *Split bearing eyes with toothed bearing cap*
- *Standard Hirth-serrated flange*
- *Operating angle up to 15°*

- 轧制生产线的主传动系统
- 一般重型机械

技术参数见参数页

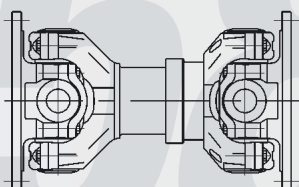
- *Main rolling mill drive units*
- *Heavy-machinery construction plants*

Technical data (see Data sheets)

万向轴的特殊设计及附件

系列 / *Series*

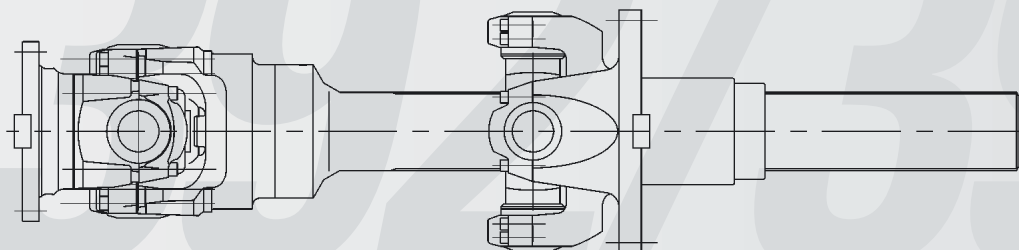
587/190 系列 (超短型设计) / *Super short designs*



转矩范围 T_{CS} 为
23 - 94kNm
法兰直径 275 - 405mm

*Torque range T_{CS}
from 23 to 94 kNm
Flange diameter
from 275 to 405 mm*

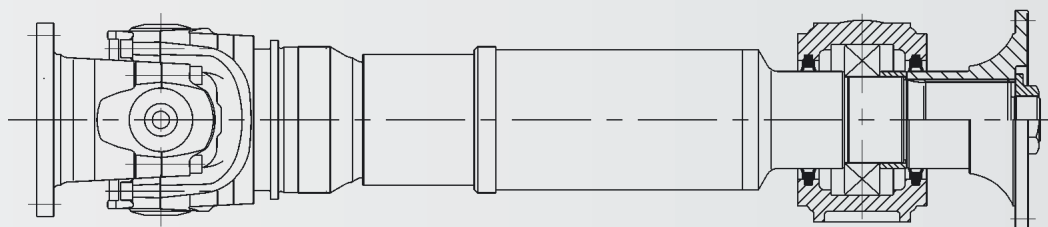
392/393 系列 (空心关节式万向轴) / *Tunnel joint shafts*



转矩范围 T_{CS} 为
57- 1053kNm
法兰直径
225/315 - 550/710mm

*Torque range T_{CS}
from 57 to 1053 kNm
Flange diameter from
225/315 to 550/710 mm*

单关节万向轴 / *Intermediate shafts*



Special designs of cardan shafts and additional equipment

设计特点 / *Design features*

- 整体式轴承孔设计 (587)
- 剖分式轴承孔设计 (190)
- 关节及伸缩部位可再次润滑
- 许用工作角度可达 5°
- *Closed bearing eyes (587)*
- *Split bearing eyes (190)*
- *Joints and length compensation regreasable*
- *Operating angle up to 5°*

应用领域 / *Preferred application*

- 铁路车辆
- 轧钢厂
- 船舶传动装置
- 压延机传动装置
- 造纸机械
- 一般机械制造厂

- *Railway vehicles*
- *Rolling mill plants*
- *Marine drives*
- *Calender drives*
- *Paper machines*
- *General machinery construction plants*

技术参数见参数页

Technical data (see Data sheets)

- 具有大伸缩量的短型设计
- 通过关节的空心洞孔加大伸缩
- 连接尺寸小而许用转矩大
- 剖分式轴承孔，其剖分面带齿
- 轴承密封为迷宫式
- 许用工作角度可达 10°/7.5°
- *Shorter designs with large length compensation*
- *Length compensation through the joint*
- *High torque capacity with small connection dimensions*
- *Split bearing eyes with toothed bearing cap*
- *Bearings with labyrinth seals*
- *Operating angle up to 10°/7,5°*

- 轧钢厂

- *Rolling mill plants*

- 可伸缩或无伸缩
- 支撑轴承一体化

- *With or without length compensation*
- *Integrated bearing location*

- 泵站传动装置

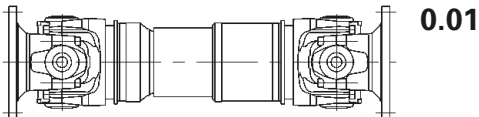
- *Pump drives*

下列一览表的内容包括
现行的标准产品及
若干特殊设计。

The following sheets give
a summary of the current
standard range of products
and some special designs.

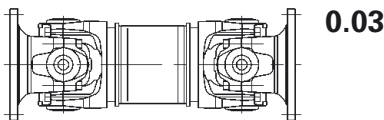
标准设计

Standard designs



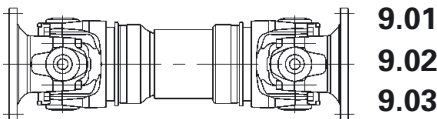
可伸缩万向轴

Cardan shaft with length
compensation, tubular
design



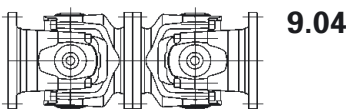
无伸缩万向轴

Cardan shaft without
length compensation,
tubular design



短伸缩万向轴

Cardan shaft with length
compensation, short
design

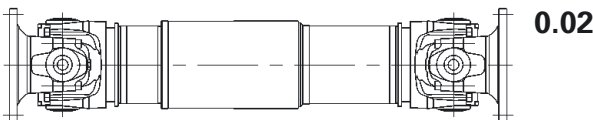


无伸缩双法兰短型万向轴

Cardan shaft without
length compensation,
double flange shaft design

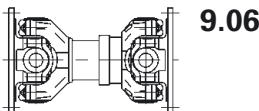
特殊设计

Special designs



大伸缩万向轴

Cardan shaft with large
length compensation,
tubular design



可伸缩超短型万向轴

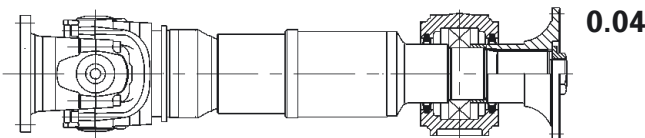
Cardan shaft with length
compensation, super short
design

单关节万向轴 *

Intermediate shafts*

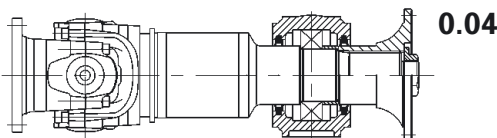
(可根据要求提供
中间支承轴承)

(available with intermedia-
te bearing on request)



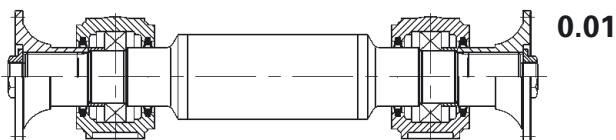
可伸缩单关节万向轴

Intermediate shaft with
length compensation



无伸缩单关节万向轴

Intermediate shaft without
length compensation

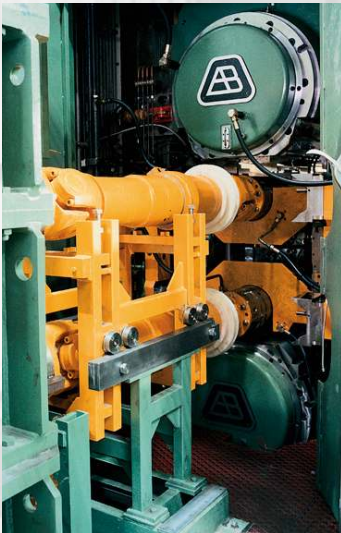


中间接轴

Midship shaft

* 技术数据及图纸函索即寄。

* Data sheet and/or drawing on
request



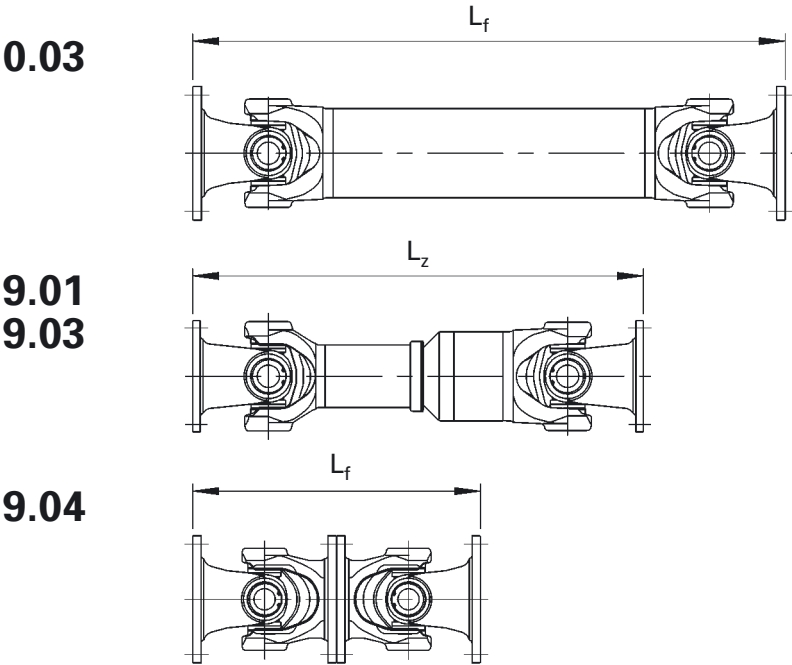
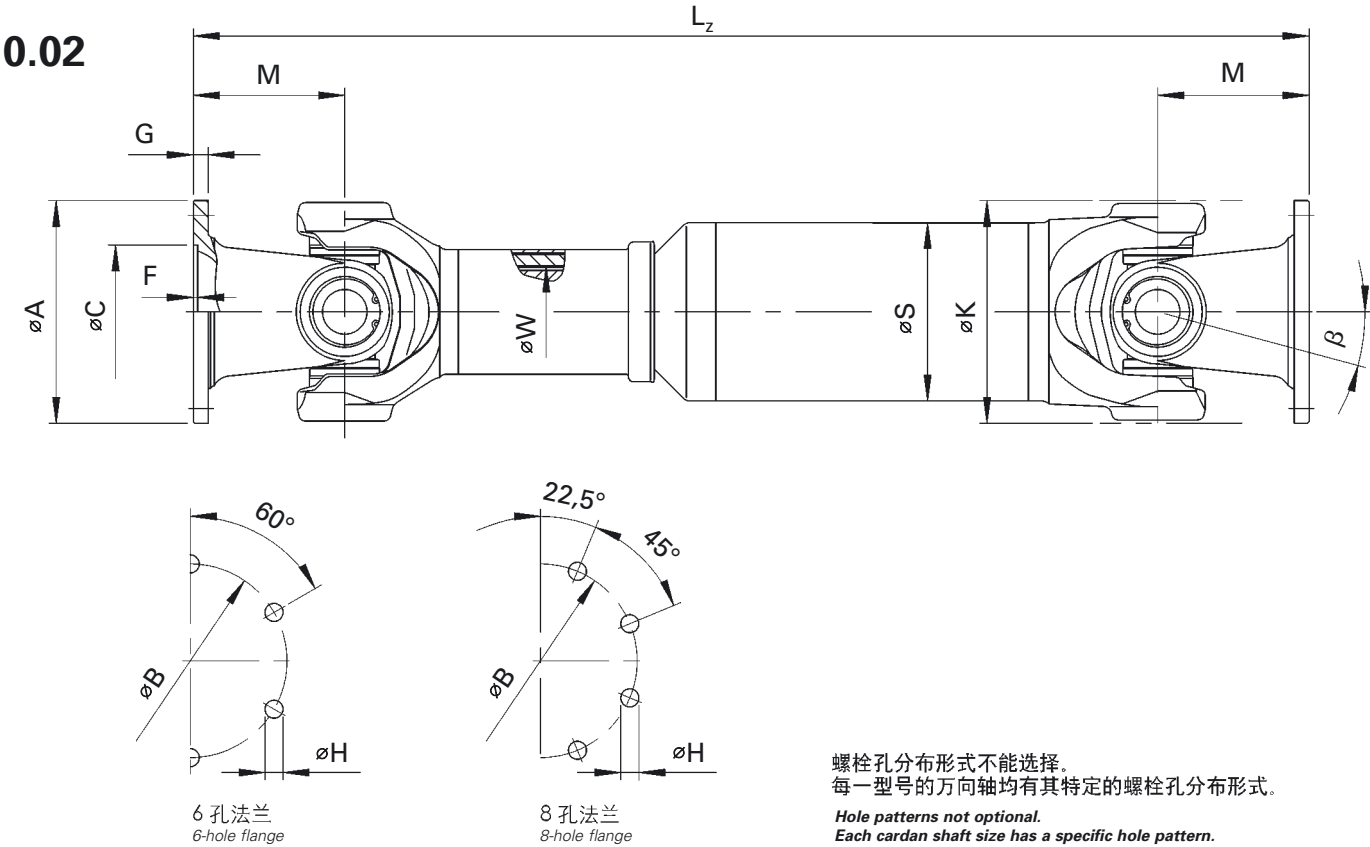
现场照片由以下公司提供:
Pictures provided by kind permission of:

ACHENBACH BUSCHHÜTTEN
Böhler Bleche GmbH
BOMBARDIER
BWG
Kranbau Köthen GmbH
MAN TAKRAF
Rolls-Royce Oy Ab
SCHOTTEL
SMS Demag
SMS Meer
VAI
Vossloh Schienenfahrzeugtechnik GmbH





设计 Design	0.02	接管伸缩型	0.02 with length compensation, tubular design
	0.03	接管无伸缩型	0.03 without length compensation, tubular design
	9.01	伸缩短型	9.01 with length compensation, short design
	9.03	伸缩短型	9.03 with length compensation, short design
	9.04	无伸缩双法兰型	9.04 without length compensation, double flange shaft design



Shaft size		687/688.15	687/688.20	687/688.25	687/688.30		687/688.35		687/688.40			
T _{CS}	kNm	2,4	3,5	5	6,5		10		14			
T _{DW}	kNm	0,7	1,0	1,6	1,9		2,9		4,4			
L _c	–	1,79 x 10 ⁻⁴	5,39 x 10 ⁻⁴	1,79 x 10 ⁻³	2,59 x 10 ⁻³		0,0128		0,0422			
β	°	25	25	25	25		25		25	44	25	44
A	mm	100	120	120	120	150	150	180	150	150	180	180
K	mm	90	98	113	127	127	144	144	160	160	160	160
B ± 0,1 mm	mm	84	101,5	101,5	101,5	130	130	155,5	130	130	155,5	155,5
C H7	mm	57	75	75	75	90	90	110	90	90	110	110
F ¹⁾	mm	2,5	2,5	2,5	2,5	3	3	3	3	3	3	3
G	mm	7	8	8	8	10	10	12	10	10	12	12
H + 0,2 mm	mm	8,25	10,25	10,25	10,25	12,25	12,1	14,1	12,1	12,1	14,1	14,1
I ²⁾	–	6	8	8	8	8	8	8	8	8	8	8
M	mm	48	54	70	72	78	95	90	102	102	102	102
S	mm	63,5 x 2,4	76,2 x 2,4	89 x 2,4	90 x 3	90 x 3	100 x 3	100 x 3	120 x 3	100 x 4,5	120 x 3	100 x 4,5
W DIN 5480	mm	36 x 1,5	40 x 1,5	45 x 1,5	48 x 1,5	48 x 1,5	54 x 1,5	54 x 1,5	62 x 1,75			

T_{CS} = 功能性极限转矩

如要完全达到功能性极限扭矩 T_{CS}，
须加强法兰连接。

T_{DW} = 交变疲劳转矩*

L_c = 承载力系数*

* (见万向轴说明书)

β = 每个关节的最大倾角

管型接轴如焊有补偿平衡块，
其疲劳转矩值 T_{DW} 会降低。

1) 有效止口深度

2) 法兰螺栓孔数

T_{CS} = Functional limit torque*

If the permissible functional limit torque T_{CS} is to be
fully utilized, the flange connection must be reinforced.

T_{DW} = Reversing fatigue torque*

L_c = Bearing capacity factor*

* (see specifications of cardan shafts)

β = max. deflection angle per joint

Tubular shafts with welded-on balancing plates have

lower fatigue torques T_{DW}

1) Effective spigot depth

2) Number of flange holes

长度，重量，惯性矩，抗扭刚度

Length dimensions · weights · moments of inertia · torsional stiffness

Design	Shaft size		687/688.15	687/688.20	687/688.25	687/688.30		687/688.35		687/688.40			
0.02	L _{z min}	mm	346	379	458	492	504	582	572	586	693	586	693
	L _a	mm	60	70	100	110	110	110	110	110	180	110	180
	G	kg	5,7	8,4	12,0	13	14,2	24,0	25,6	28,7	30,3	29,4	30,9
	G _R	kg	3,62	4,37	5,13	6,44	6,44	7,18	7,18	8,66	10,6	8,66	10,6
	J _m	kgm ²	0,0043	0,0089	0,0144	0,0245	0,0245	0,043		0,0676	0,0706	0,0776	0,0806
	J _{mR}	kgm ²	0,0034	0,0059	0,0096	0,0122	0,0122	0,0169	0,0169	0,0296	0,0242	0,0296	0,0242
	C	Nm/rad.	0,26 x 10 ⁵	0,42 x 10 ⁵	0,71 x 10 ⁵	0,78 x 10 ⁵	0,78 x 10 ⁵	1,18 x 10 ⁵		2,17 x 10 ⁵	1,61 x 10 ⁵	2,17 x 10 ⁵	1,61 x 10 ⁵
0.03	C _R	Nm/rad.	0,34 x 10 ⁵	0,60 x 10 ⁵	0,98 x 10 ⁵	1,25 x 10 ⁵	1,25 x 10 ⁵	1,72 x 10 ⁵	1,72 x 10 ⁵	3,02 x 10 ⁵	2,47 x 10 ⁵	3,02 x 10 ⁵	2,47 x 10 ⁵
	L _{f min}	mm	221	239	282	310	322	379	369	423	449	423	449
	G	kg	4,1	5,8	8,6	8,6	9,8	18,0	19,6	22,8	21,0	23,4	21,6
	J _m	kgm ²	0,0038	0,0085	0,0129	0,0238	0,0238	0,04		0,066	0,0628	0,076	0,0728
9.01	C	Nm/rad.	0,44 x 10 ⁵	0,86 x 10 ⁵	1,44 x 10 ⁵	1,74 x 10 ⁵	1,74 x 10 ⁵	1,81 x 10 ⁵		3,35 x 10 ⁵	2,78 x 10 ⁵	3,35 x 10 ⁵	2,78 x 10 ⁵
	L _{z min}	mm	296	322	361	379	391	510	500	505	525	505	525
	L _{a min}	mm	38	41	36	36	36	70	70	70	60	70	60
	L _{z max}	mm	348	381	425	453	465	550	540	545	645	545	645
9.03	L _{a max}	mm	90	100	100	110	110	110	110	110	180	110	180
	L _{z min}	mm	245	274	313	331	343	419	409	441	–	441	–
	L _{a min}	mm	25	27	28	29	29	45	45	45	–	45	–
	L _{z max}	mm	280	317	355	397	409	484	474	506	–	506	–
9.04	L _{a max}	mm	60	70	70	95	95	110	110	110	–	110	–
	L _{f min}	mm	192	216	240	288	312	380	360	408	408	408	408

L_{z min} = 最小伸缩长度

L_G = 伸缩量

L_{f min} = 最小固定长度

L_z + L_G = 最大工作长度

G = 万向轴重量

G_R = 每 1000mm 管段重量

J_m = 惯性矩

J_{mR} = 每 1000mm 管段惯性矩

C = 无管万向轴抗扭刚度

C_R = 每 1000mm 管段抗扭刚度

L_{z min} = shortest possible compressed length

L_a = Length compensation

L_{f min} = shortest fixed length

L_z + L_a = max. operating length

G = Weight of shaft

G_R = Weight per 1000 mm tube

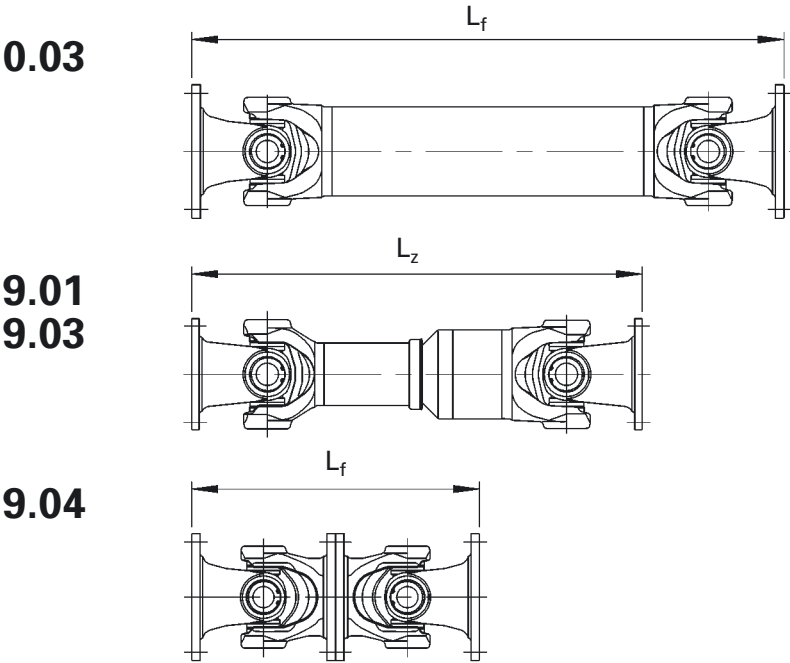
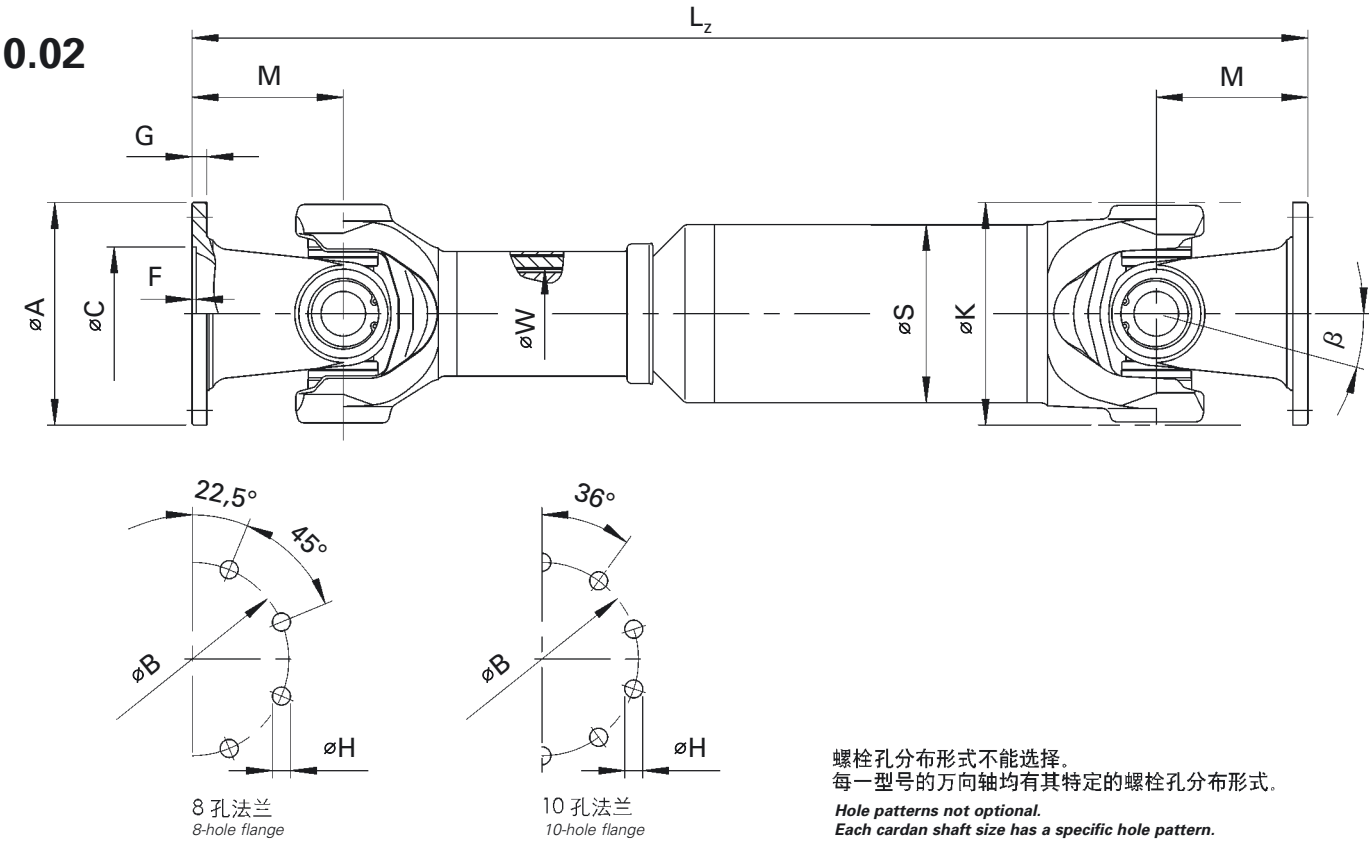
J_m = Moment of inertia

J_{mR} = Moment of inertia per 1000 mm tube

C = Torsional stiffness of shaft without tube

C_R = Torsional stiffness per 1000 mm tube

设计 Design	0.02	接管伸缩型	0.02 with length compensation, tubular design
	0.03	接管无伸缩型	0.03 without length compensation, tubular design
	9.01	伸缩短型	9.01 with length compensation, short design
	9.03	伸缩短型	9.03 with length compensation, short design
	9.04	无伸缩双法兰型	9.04 without length compensation, double flange shaft design



Shaft size		687/688.45			687/688.55			687/688.65	
T _{CS}	kNm	17			25			35	
T _{DW}	kNm	5,1			7,3			11	
L _c	–	0,104			0,236			0,837	
β	°	25	35	25	25	35	25	25	25
A	mm	180	180	225	180	180	225	180	225
K	mm	174	174	174	178	178	178	204	204
B ± 0,1 mm	mm	155,5	155,5	196	155,5	155,5	196	155,5	196
C H7	mm	110	110	140	110	110	140	110	140
F ¹⁾	mm	3	3	5	3	3	5	3	5
G	mm	12	12	15	14	14	15	15	15
H + 0,2 mm	mm	14,1	14,1	16,1	16,1	16,1	16,1	16,1	16,1
I ²⁾	–	8	8	8	10	10	8	10	8
M	mm	95	95	90	115	115	95	110	110
S	mm	120 x 4	110 x 5	120 x 4	120 x 6	120 x 6	120 x 6	142 x 6	142 x 6
W DIN 5480	mm	68 x 1,75			78 x 2			88 x 2,5	

T_{CS} = 功能性极限转矩

如要完全达到功能性极限转矩 T_{CS}，
须加强法兰连接。

T_{DW} = 交变疲劳转矩*

L_c = 承载能力系数*

* (见万向轴说明书)

β = 每个关节的最大倾角

管型接轴如焊有补偿平衡块，

其疲劳转矩值 T_{DW} 会降低。

1) 有效止口深度

2) 法兰螺栓孔数

T_{CS} = Functional limit torque*

If the permissible functional limit torque T_{CS} is to be
fully utilized, the flange connection must be reinforced.

T_{DW} = Reversing fatigue torque*

L_c = Bearing capacity factor*

* (see specifications of cardan shafts)

β = max. deflection angle per joint

Tubular shafts with welded-on balancing plates have

lower fatigue torques T_{DW}

1) Effective spigot depth

2) Number of flange holes

长度，重量，惯性矩，抗扭刚度

Length dimensions · weights · moments of inertia · torsional stiffness

Design	Shaft size		687/688.45			687/688.55			687/688.65	
0.02	L _{z min}	mm	595	703	585	662	681	622	686	686
	L _a	mm	110	180	110	110	110	110	110	110
	G	kg	35,7	38,4	37,7	44,0	49,2	47,0	60,6	64,6
	G _R	kg	11,44	12,95	11,44	16,86	16,86	16,86	20,12	20,12
	J _m	kgm ²	0,1002	0,1242	0,1342	0,131	–	0,151	0,2224	0,2614
	J _{mR}	kgm ²	0,0385	0,0357	0,0385	0,055	–	0,055	0,0932	0,0932
	C	Nm/rad.	3,10 x 10 ⁵	2,18 x 10 ⁵	3,10 x 10 ⁵	4,05 x 10 ⁵	–	4,05 x 10 ⁵	5,63 x 10 ⁵	5,63 x 10 ⁵
	C _R	Nm/rad.	3,93 x 10 ⁵	3,65 x 10 ⁵	3,93 x 10 ⁵	5,60 x 10 ⁵	5,60 x 10 ⁵	5,60 x 10 ⁵	9,50 x 10 ⁵	9,50 x 10 ⁵
0.03	L _{f min}	mm	425	425	415	475	495	435	491	491
	G	kg	28,0	27,8	30	33,1	–	36,1	47,3	51,3
	J _m	kgm ²	0,0954	0,0976	0,1294	0,1176	–	0,1376	0,2032	0,2422
	C	Nm/rad.	4,82 x 10 ⁵	3,71 x 10 ⁵	4,82 x 10 ⁵	5,39 x 10 ⁵	–	5,39 x 10 ⁵	7,17 x 10 ⁵	7,17 x 10 ⁵
9.01	L _{z min}	mm	517	538	507	587	606	547	601	601
	L _{a min}	mm	70	60	70	70	70	70	70	70
	L _{z max}	mm	557	658	547	617	636	577	641	641
	L _{a max}	mm	110	180	110	100	100	100	110	110
9.03	L _{z min}	mm	447	–	437	513	–	473	524	524
	L _{a min}	mm	50	–	50	50	–	50	50	50
	L _{z max}	mm	507	–	497	563	–	523	584	584
	L _{a max}	mm	110	–	110	110	–	110	110	110
9.04	L _{f min}	mm	380	380	360	460	460	380	440	440

L_{z min} = 最小伸缩长度

L_a = 伸缩量

L_{f min} = 最小固定长度

L_z + L_a = 最大工作长度

G = 万向轴重量

G_R = 每 1000mm 管段重量

J_m = 惯性矩

J_{mR} = 每 1000mm 管段惯性矩

C = 无管万向轴抗扭刚度

C_R = 每 1000mm 管段抗扭刚度

L_{z min} = shortest possible compressed length

L_a = Length compensation

L_{f min} = shortest fixed length

L_z + L_a = max. operating length

G = Weight of shaft

G_R = Weight per 1000 mm tube

J_m = Moment of inertia

J_{mR} = Moment of inertia per 1000 mm tube

C = Torsional stiffness of shaft without tube

C_R = Torsional stiffness per 1000 mm tube

设计
Design

- 0.01 接管伸缩型

0.02 接管大伸型

0.03 接管无伸缩型

9.01 伸缩短型

9.02 伸缩短型

9.03 伸缩短型

9.04 无伸缩双法兰型
- 0.01 with length compensation, tubular design

0.02 with large length compensation, tubular design

0.03 without length compensation, tubular design

9.01 with length compensation, short design

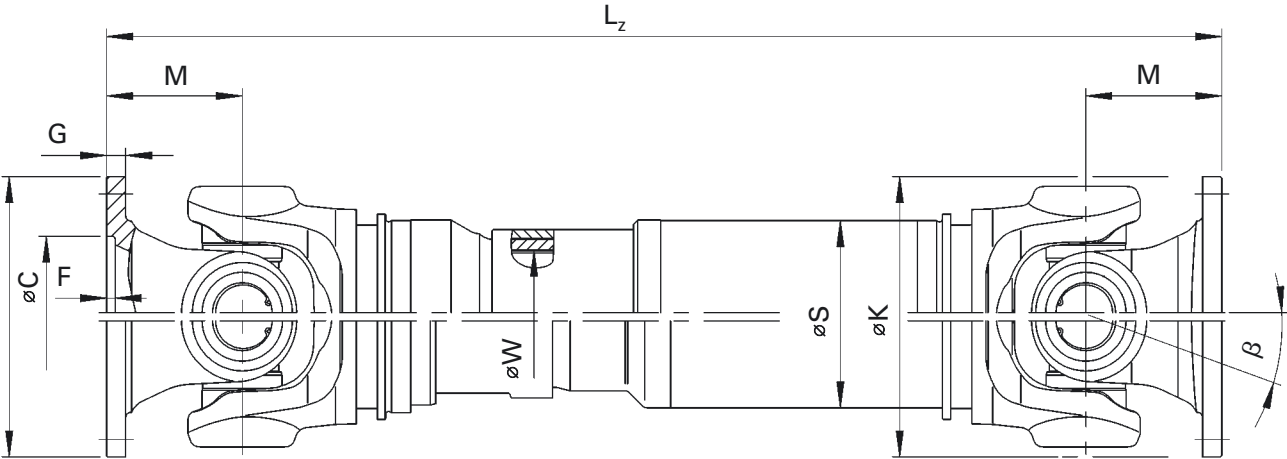
9.02 with length compensation, short design

9.03 with length compensation, short design

9.04 without length compensation, double flange shaft design

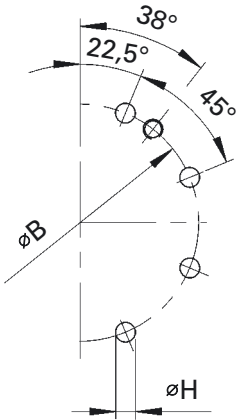
0.01
587.55
587.60

0.02
587.50

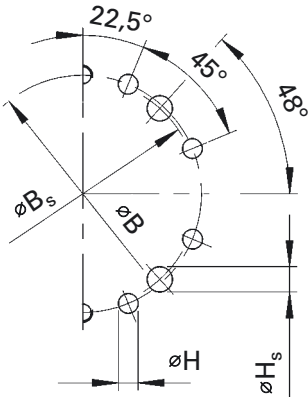


标准法兰连接
Standard flange connection

销钉连接按 DIN 15451 标准
Dowel pin connection according to DIN 15451

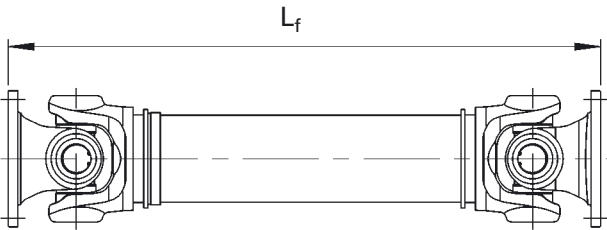


8 孔法兰
8-hole flange

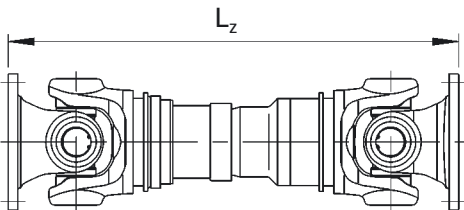


8 孔法兰
8-hole flange

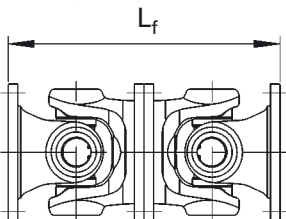
0.03



9.01
9.02
9.03



9.04



Shaft size		587.50		587.55		587.60	
T _{CS}	kNm	43		52		57	
T _{DW}	kNm	13		18		23	
L _c	–	1,84		7,6		24,8	
β	°	24	24	20	20	20	20
A	mm	225	250	250	285	285	285
K	mm	215	215	250	250	265	265
B ± 0,1 mm	mm	196	218	218	245	245	245
Bs ± 0,1 mm	mm	–	214	214	–	240	–
C H7	mm	140	140	140	175	175	175
F ¹⁾	mm	4,4	5,4	5,5	6,0	6,0	6,0
G	mm	15	18	18	20	20	20
H + 0,2 mm	mm	16,1	18,1	18,1	20,1	20,1	20,1
Hs H12	mm	–	25	25	–	28	–
I ²⁾	–	8	8	8	8	8	8
Is ³⁾	–	–	4	4	–	4	–
M	mm	108	108	125	125	135	135
S	mm	144 x 7	144 x 7	168, 8 x 7,3	168, 8 x 7,3	167,7 x 9,8	167,7 x 9,8
W DIN 5480	mm	90 x 2,5	90 x 2,5	115 x 2,5	115 x 2,5	115 x 2,5	115 x 2,5

T_{CS} = 功能性极限转矩 *

要完全到达允许的功能性极限转矩 T_{CS},
必须加强法兰连接, 比如使用销钉。

屈服转矩高于 T_{CS} 30%

T_{DW} = 交变疲劳转矩 *

L_c = 承载能力系数 *

* (见万向轴的使用说明书)

β = 每个关节的最大倾角

1) 有效接口深度

2) 法兰螺栓孔数目 (标准法兰连接)

3) 法兰螺栓孔数目 (销钉连接)

T_{CS} = Functional limit torque*

If the permissible functional limit torque T_{CS}
is to be fully utilized, the flange connection for example
with dowel pins must be reinforced.

Yield torque 30% over T_{CS}

T_{DW} = Reversing fatigue torque*

L_c = Bearing capacity factor*

* (see specifications of cardan shafts)

β = max. deflection angle per joint

1) Effective spigot depth

2) Number of flange holes (Standard flange connection)

3) Number of flange holes (Dowel pin connection)

长度, 重量, 惯性矩, 抗扭刚度

Length dimensions · weights · moments of inertia · torsional stiffness

Design	Shaft size		587.50				587.55				587.60			
0.01	L _{2 min}	mm	–				840				870			
	L _a	mm	–				100				100			
	G	kg	–				118				123			
	G _R	kg	–				29,1				38,2			
	Jm	kgm ²	–				0,657				0,737			
	Jm _R	kgm ²	–				0,190				0,239			
	C	Nm/rad.	–				8,7 x 10 ⁵				9,6 x 10 ⁵			
	C _R	Nm/rad.	–				19,4 x 10 ⁵				24,3 x 10 ⁵			
0.02*	L _{2 min}	mm	800				960				990			
	L _{a min}	mm	110				200				200			
	G	kg	86				155				160			
	G _R	kg	23,7				29,1				38,2			
	Jm	kgm ²	0,325				0,361				0,411			
	Jm _R	kgm ²	0,111				0,190				0,239			
	C	Nm/rad.	5,29 x 10 ⁵				5,29 x 10 ⁵				5,29 x 10 ⁵			
	C _R	Nm/rad.	11,33 x 10 ⁵				11,33 x 10 ⁵				11,33 x 10 ⁵			
0.03	L _i	mm	540				610				640			
	G	kg	72				88				93			
	G _R	kg	23,7				29,1				38,2			
	Jm	kgm ²	0,270				0,306				0,342			
	Jm _R	kgm ²	0,111				0,190				0,239			
	C	Nm/rad.	7,2 x 10 ⁵				9,8 x 10 ⁵				11,5 x 10 ⁵			
	C _R	Nm/rad.	11,33 x 10 ⁵				19,4 x 10 ⁵				24,3 x 10 ⁵			
9.01	L _{2 min}	mm	–				815				843			
	L _a	mm	–				100				100			
	G	kg	–				110				115			
	Jm	kgm ²	–				0,64				0,72			
	C	Nm/rad.	–				8,8 x 10 ⁵				9,7 x 10 ⁵			
9.02	L ₂	mm	–				780				810			
	L _a	mm	–				65				70			
	G	kg	–				108				113			
9.03	L ₂	mm	550	600	650	696	550	600	650	696	720	720	750	750
	L _a	mm	60	75	90	110	60	75	90	110	65	65	65	65
	G	kg	61	66	68	70	66	71	73	75	113	118	126	126
9.04	L _i	mm	432				432				500			
	G	kg	58				68				81			

L_{2 min} = 最小伸缩长度

L_a = 伸缩量

L_{i min} = 最小固定长度

L_i + L_a = 最大工作长度

G = 万向轴质量

G_R = 每 1000mm 管长的质量

Jm = 惯性矩

Jm_R = 每 1000mm 管长的惯性矩

C = 无管万向轴抗扭刚度

C_R = 每 1000mm 管长的抗扭刚度

* 可按要求增大伸缩量。

L_{2 min} = shortest possible compressed length

L_a = Length compensation

L_{i min} = shortest fixed length

L_i + L_a = max. operating length

G = Weight of shaft

G_R = Weight per 1000 mm tube

Jm = Moment of inertia

Jm_R = Moment of inertia per 1000 mm tube

C = Torsional stiffness of shaft without tube

C_R = Torsional stiffness per 1000 mm tube

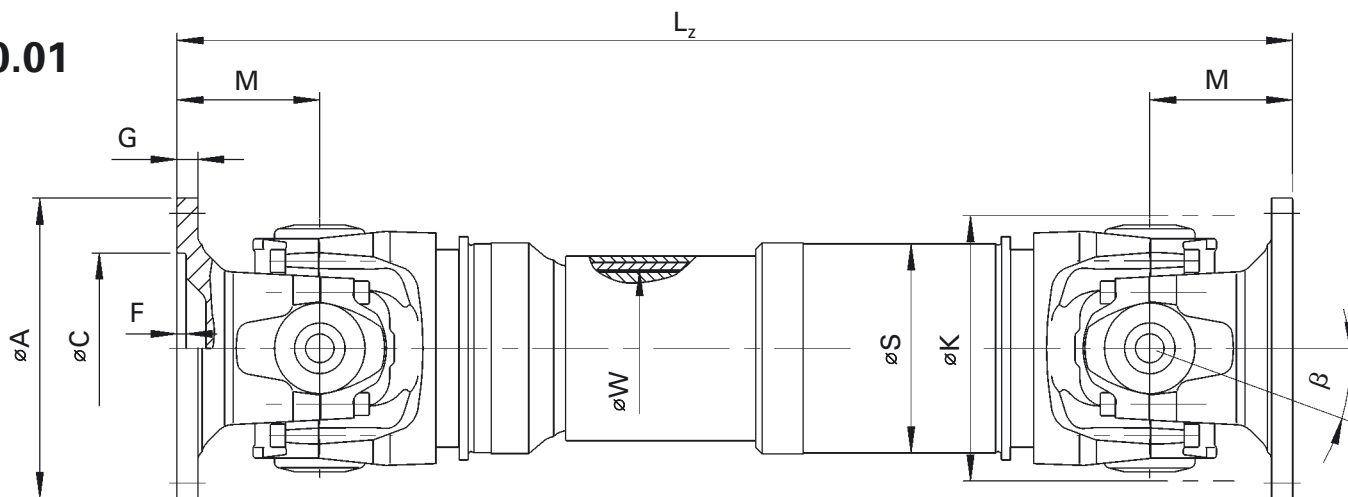
* Larger length compensation on request

设计
Design

- 0.01 接管伸缩型
- 0.02 接管大伸型
- 0.03 接管无伸缩型
- 9.01 伸缩短型
- 9.02 伸缩短型
- 9.03 伸缩短型
- 9.04 无伸缩双法兰型

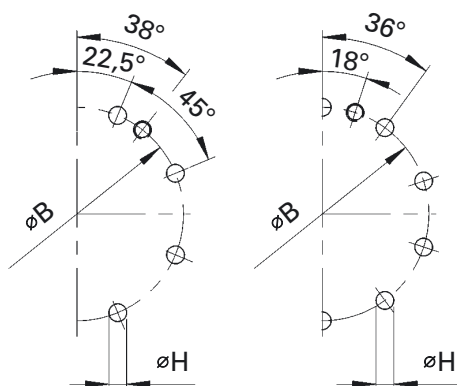
- 0.01 with length compensation, tubular design
- 0.02 with large length compensation, tubular design
- 0.03 without length compensation, tubular design
- 9.01 with length compensation, short design
- 9.02 with length compensation, short design
- 9.03 with length compensation, short design
- 9.04 without length compensation, double flange shaft design

0.01



标准法兰连接

Standard flange connection

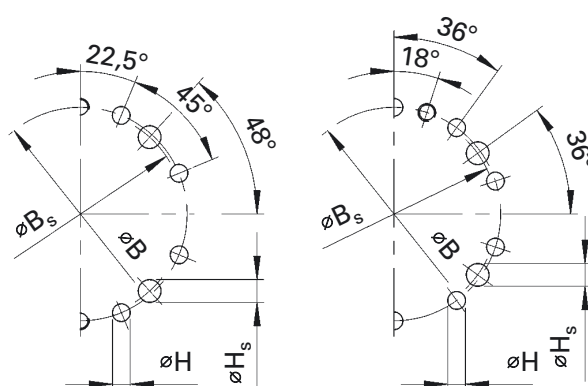


8 孔法兰
8-hole flange

10 孔法兰
10-hole flange

销钉连接按 DIN 15451 标准

Dowel pin connection according to DIN 15451



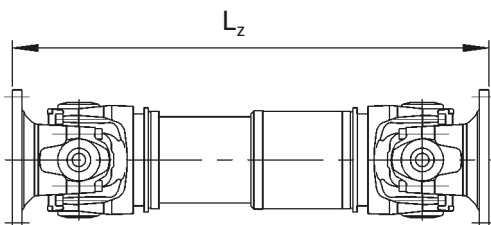
8 孔法兰
8-hole flange

10 孔法兰
10-hole flange

每一型号的万向轴均有其特定的螺栓孔分布形式（见表格）。也可以根据要求采用其他的螺栓孔分布。

Each cardan shaft size has a specific hole pattern (see table). Other hole patterns on request.

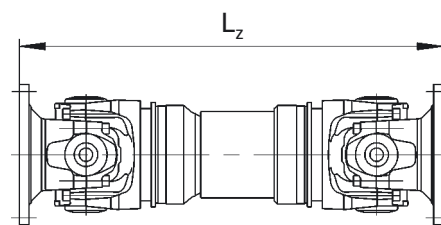
0.02



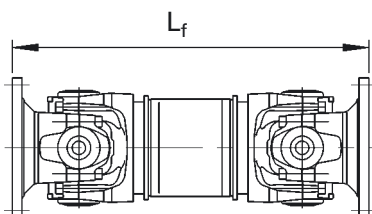
9.01

9.02

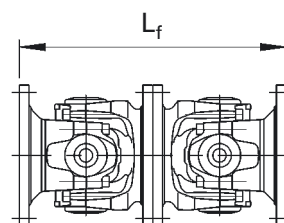
9.03



0.03



9.04



Shaft size		390.60	390.65	390.70	390.75	390.80
T_{CS}	kNm	60	90	130	190	255
T_{DW}	kNm	23	36	53	75	102
L_c	—	24,8	70,2	238	618	1563
β	°	15	15	15	15	15
A	mm	285	315	350	390	435
K	mm	240	265	300	330	370
B $\pm 0,1$ mm	mm	245	280	310	345	385
Bs $\pm 0,1$ mm	mm	240	270	300	340	378
C H7	mm	175	175	220	250	280
F ¹⁾	mm	6	6	7	7	9
G	mm	20	22	25	28	32
H $+ 0,2$ mm	mm	20,1	22,1	22,1	24,1	27,1
Hs H12	mm	28	30	32	32	35
I ²⁾	—	8	8	10	10	10
Is ³⁾	—	4	4	4	4	4
M	mm	135	150	170	190	210
S	mm	167,7 x 9,8	218,2 x 8,7	219 x 13,3	273 x 11,6	273 x 19
W DIN 5480	mm	115 x 2,5	150 x 3	150 x 3	185 x 5	185 x 5

T_{CS} = 功能性极限转矩*
 要完全到达允许的功能性极限转矩 T_{CS} ,
 必须加强法兰连接, 比如使用销钉。

屈服转矩高于 T_{CS} 30%

T_{DW} = 交变疲劳转矩*

L_c = 承载能力系数*

* (见万向轴的使用说明书)

β = 每个关节的最大倾角

- 1) 有效接口深度
- 2) 法兰螺栓孔数目 (标准法兰连接)
- 3) 法兰螺栓孔数目 (销钉连接)

T_{CS} = Functional limit torque*

If the permissible functional limit torque T_{CS}
 is to be fully utilized, the flange connection for example
 with dowel pins must be reinforced.

Yield torque 30% over T_{CS}

T_{DW} = Reversing fatigue torque*

L_c = Bearing capacity factor*

* (see specifications of cardan shafts)

β = max. deflection angle per joint

- 1) Effective spigot depth
- 2) Number of flange holes (Standard flange connection)
- 3) Number of flange holes (Dowel pin connection)

长度, 重量, 惯性矩, 抗扭刚度

Length dimensions · weights · moments of inertia · torsional stiffness

Design	Shaft size		390.60	390.65	390.70	390.75	390.80
0.01	$L_{z \min}$	mm	870	980	1070	1210	1280
	L_a	mm	100	135	135	170	170
	G	kg	138	216	276	405	490
	G_R	kg	38,2	45,0	67,5	74,8	119
	Jm	kgm ²	1,04	1,61	2,51	4,20	8,20
	Jm_R	kgm ²	0,239	0,494	0,716	1,28	1,93
	C	Nm/rad.	$1,0 \times 10^6$	$1,65 \times 10^6$	$2,43 \times 10^6$	$3,3 \times 10^6$	$4,7 \times 10^6$
0.02*	C_R	Nm/rad.	$2,43 \times 10^6$	$5,04 \times 10^6$	$7,3 \times 10^6$	$1,3 \times 10^7$	$1,96 \times 10^7$
	$L_{z \min}$	mm	990	1080	1170	1295	1365
	L_a	mm	200	220	220	250	250
	G	kg	178	280	337	508	586
	G_R	kg	38,2	45,0	67,5	74,8	119
0.03	$L_{f \min}$	mm	640	710	800	890	960
	G	kg	109	159	218	302	385
	G_R	kg	38,2	45,0	67,5	74,8	119
9.01	L_z	mm	843	953	1043	1175	1245
	L_a	mm	100	135	135	170	170
	G	kg	136	213	273	402	482
9.02	L_z	mm	810	890	980	1100	1170
	L_a	mm	70	75	75	95	95
	G	kg	135	198	261	375	456
9.03	L_z	mm	750	835	925	1030	1100
	L_a	mm	65	75	75	85	85
	G	kg	135	202	264	371	453
9.04	L_f	mm	540	600	680	760	840
	G	kg	108	146	210	284	380

$L_{z \min}$ = 最小伸缩长度

L_a = 伸缩量

$L_{f \min}$ = 最小固定长度

$L_z + L_a$ = 最大工作长度

G = 万向轴质量

G_R = 每 1000mm 管长的质量

Jm = 惯性矩

Jm_R = 每 1000mm 管长的惯性矩

C = 无管万向轴抗扭刚度

C_R = 每 1000mm 管长的抗扭刚度

* 可按要求增大伸缩量。

$L_{z \min}$ = shortest possible compressed length

L_a = Length compensation

$L_{f \min}$ = shortest fixed length

$L_z + L_a$ = max. operating length

G = Weight of shaft

G_R = Weight per 1000 mm tube

Jm = Moment of inertia

Jm_R = Moment of inertia per 1000 mm tube

C = Torsional stiffness of shaft without tube

C_R = Torsional stiffness per 1000 mm tube

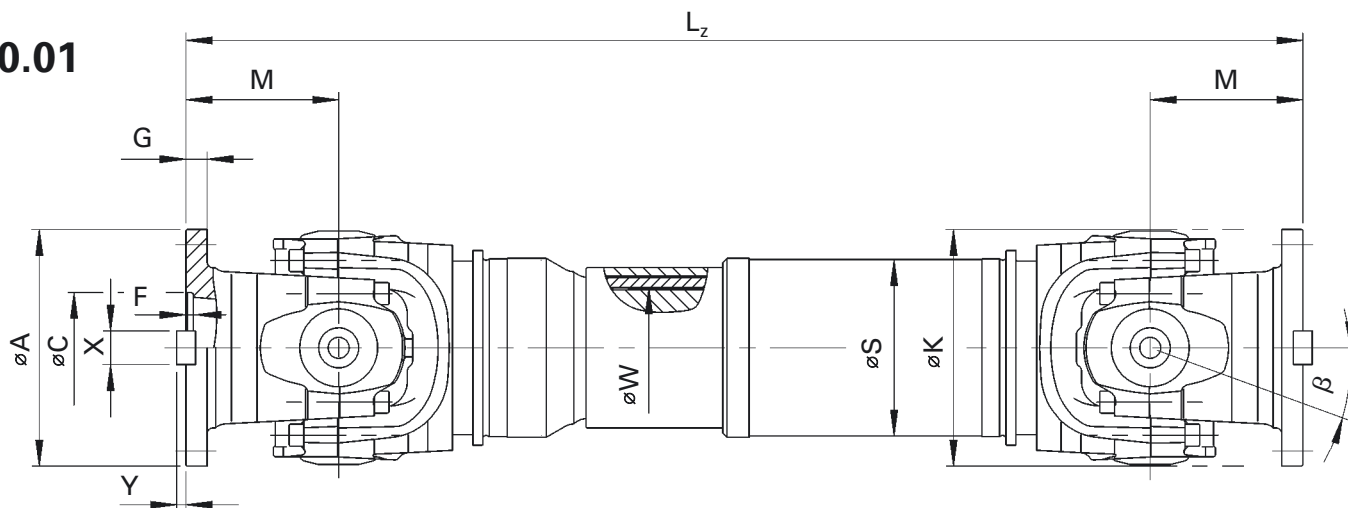
* Larger length compensation on request

设计 Design

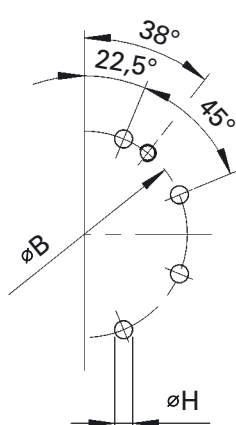
- 0.01 接管伸缩型
- 0.02 接管大伸型
- 0.03 接管无伸缩型
- 9.01 伸缩短型
- 9.02 伸缩短型
- 9.03 伸缩短型
- 9.04 无伸缩双法兰型

- 0.01 with length compensation, tubular design
- 0.02 with large length compensation, tubular design
- 0.03 without length compensation, tubular design
- 9.01 with length compensation, short design
- 9.02 with length compensation, short design
- 9.03 with length compensation, short design
- 9.04 without length compensation, double flange shaft design

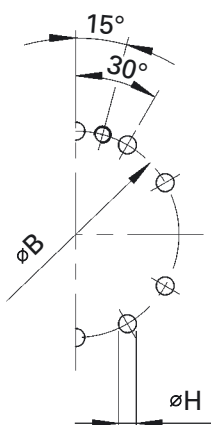
0.01



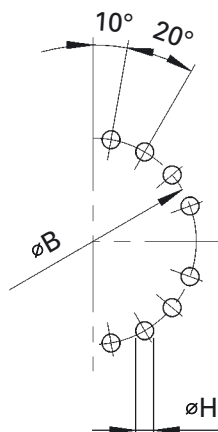
端面键法兰连接
Flange connection with face key



8 孔法兰
8-hole flange



10 孔法兰
10-hole flange

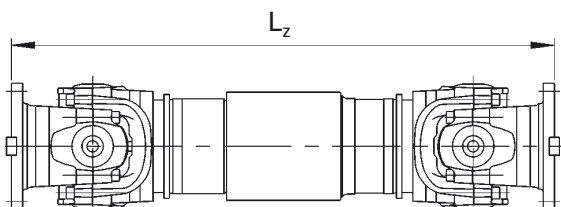


16 孔法兰
16-hole flange

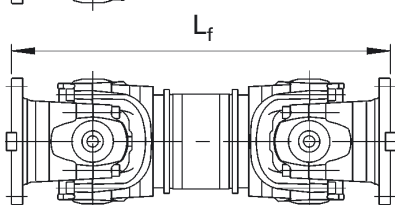
每一型号的万向轴均有其特定的螺栓孔分布形式 (见表格)。也可以根据要求采用其他的螺栓孔分布。

Each cardan shaft size has a specific hole pattern (see table). Other hole patterns on request.

0.02



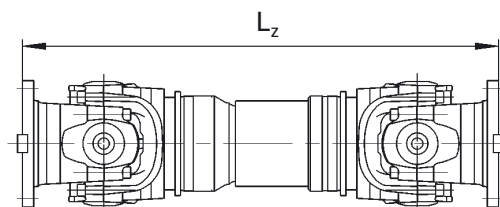
0.03



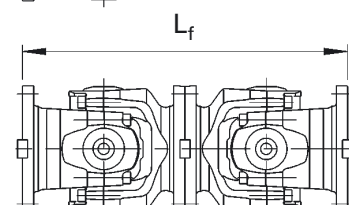
9.01

9.02

9.03



9.04



Shaft size		392.50	392.55	392.60	392.65	392.70	393.75	393.80	393.85	393.90
T _{CS}	kNm	70	105	150	215	295	390	580	750	1150
T _{DW}	kNm	23	36	53	75	102	140	220	285	435
L _c	–	7,6	25,2	82,6	261	684	1700	7070	15600	62600
β	°	15	15	15	15	15	10	10	10	10
A	mm	225	250	285	315	350	390	435	480	550
K	mm	225	250	285	315	350	390	435	480	550
B	mm	196	218	245	280	310	345	385	425	492
C _{H7}	mm	105	105	125	130	155	170	190	205	250
F ¹⁾	mm	4,5	5	6	7	7	8	10	12	12
G	mm	20	25	27	32	35	40	42	47	50
H	mm	17	19	21	23	23	25	28	31	31
I ²⁾	–	8	8	8	10	10	10	16	16	16
M	mm	145	165	180	205	225	205	235	265	290
S	mm	167,7 x 9,8	218,2 x 8,7	219 x 13,3	273 x 11,6	273 x 19	273 x 36	323,9 x 36	355,6 x 40	406,4 x 45
X _{e9}	mm	32	40	40	40	50	70	80	90	100
Y	mm	9	12,5	15	15	16	18	20	22,5	22,5
W _{DIN 5480}	mm	115 x 2,5	150 x 3	150 x 3	185 x 5	185 x 5	185 x 5	210 x 5	210 x 5	240 x 5

T_{CS} = 功能性极限转矩 *屈服转矩高于 T_{CS} 30%T_{DW} = 交变疲劳转矩 *L_c = 承载能力系数 *
(见万向轴的使用说明书)

β = 每个关节的最大倾角

1) 有效接口深度

2) 法兰螺栓孔数目

T_{CS} = Functional limit torque*Yield torque 30% over T_{CS}T_{DW} = Reversing fatigue torque*L_c = Bearing capacity factor*
(see specifications of cardan shafts)

* = max. deflection angle per joint

1) Effective spigot depth

2) Number of flange holes

长度, 重量, 惯性矩, 抗扭刚度

Length dimensions · weights ·
moments of inertia · torsional stiffness

Design	Shaft size		392.50	392.55	392.60	392.65	392.70	393.75	393.80	393.85	393.90
0.01	L _{z min}	mm	890	1010	1090	1240	1310	1430	1620	1820	2035
	L _a	mm	100	135	135	170	170	170	170	190	210
	G	kg	129	214	272	406	493	732	1055	1468	2209
	G _R	kg	38,2	45	67,5	74,8	119	210,4	255,6	311,3	401,1
	J _m	kgm ²	1,02	1,43	2,23	3,80	6,5	11,72	17,84	25,21	40,76
	J _{mR}	kgm ²	0,239	0,494	0,716	1,28	1,93	3,02	5,38	7,87	13,3
	C	Nm/rad.	9,5 x 10 ⁵	1,42 x 10 ⁶	2,36 x 10 ⁶	3,1 x 10 ⁶	4,4 x 10 ⁶	5,19 x 10 ⁶	7,86 x 10 ⁶	9,44 x 10 ⁶	1,43 x 10 ⁷
0.02*	C _R	Nm/rad.	2,43 x 10 ⁶	5,06 x 10 ⁶	7,3 x 10 ⁶	1,3 x 10 ⁷	1,96 x 10 ⁷	3,08 x 10 ⁷	5,48 x 10 ⁷	8,03 x 10 ⁷	1,36 x 10 ⁸
	L _{z min}	mm	1010	1110	1190	1325	1395	1570	1780	1975	2190
	L _{a min}	mm	200	220	220	250	250	310	330	345	365
	G	kg	171	275	331	515	603	796	1158	1589	2367
0.03	G _R	kg	38,2	45	67,5	74,8	119	210,4	255,6	311,3	401,1
	L _{f min}	mm	660	740	820	920	990	977	1110	1240	1380
	G	kg	101	156	215	301	389	538	748	1052	1600
9.01	G _R	kg	38,2	45	67,5	74,8	119	210,4	255,6	311,3	401,1
	L _z	mm	863	983	1063	1205	1275	1363	1550	1750	1955
	L _a	mm	100	135	135	170	170	170	170	190	210
9.02	G	kg	130	210	269	402	487	718	1037	1446	2177
	L _z	mm	830	920	1000	1130	1200	1300	1400	1630	1770
	L _a	mm	70	75	75	95	95	90	90	100	100
9.03	G	kg	124	204	263	375	466	641	876	1171	1717
	L _z	mm	770	865	945	1060	1130	1200	1300	1520	1680
	L _a	mm	65	75	75	85	85	70	70	80	80
9.04	G	kg	123	197	260	371	457	602	832	1116	1657
	L _f	mm	580	660	720	820	900	820	940	1060	1160
	G	kg	94	145	207	288	391	485	653	922	1443

L_{z min} = 最小伸缩长度L_c = 伸缩量L_{f min} = 最小固定长度L_f + L_c = 最大工作长度

G = 万向轴质量

G_R = 每 1000mm 管长的质量J_m = 惯性矩J_{mR} = 每 1000mm 管长的惯性矩

C = 无管万向轴抗扭刚度

C_R = 每 1000mm 管长的抗扭刚度

* 可按要求增大伸缩量。

L_{z min} = shortest possible compressed lengthL_a = Length compensationL_{f min} = shortest fixed lengthL_f + L_a = max. operating length

G = Weight of shaft

G_R = Weight per 1000 mm tubeJ_m = Moment of inertiaJ_{mR} = Moment of inertia per 1000 mm tube

C = Torsional stiffness of shaft without tube

C_R = Torsional stiffness per 1000 mm tube

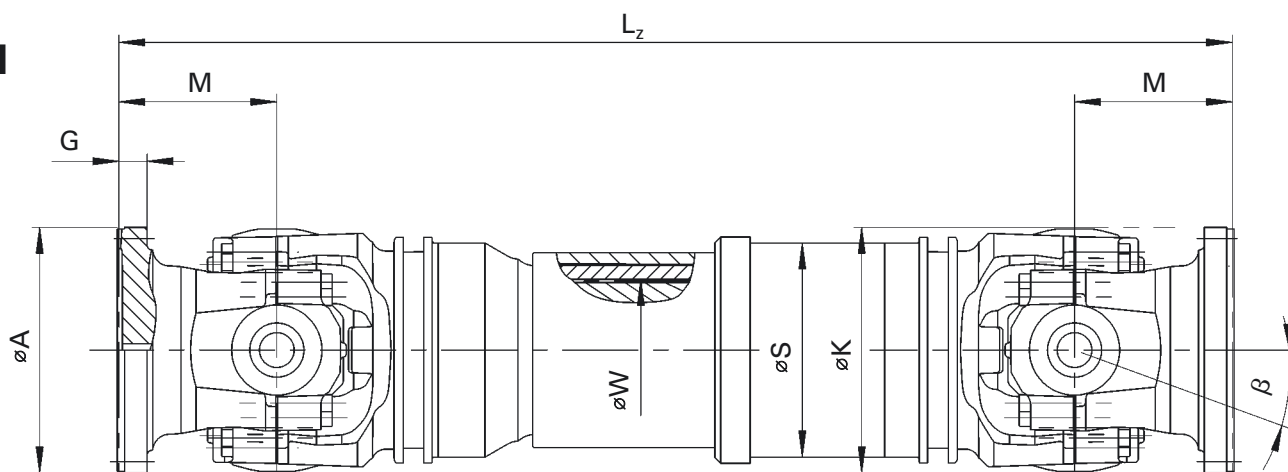
* Larger length compensation on request

设计
Design

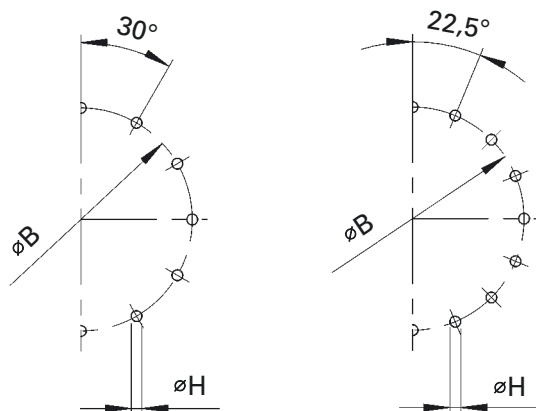
0.01 接管伸缩型
0.03 接管无伸缩型
9.01 伸缩短型
9.02 伸缩短型
9.03 伸缩短型
9.04 无伸缩双法兰型

0.01 with length compensation, tubular design
0.03 without length compensation, tubular design
9.01 with length compensation, short design
9.02 with length compensation, short design
9.03 with length compensation, short design
9.04 without length compensation, double flange shaft design

0.01



希斯(Hirth)端面齿法兰连接
Flange connection with Hirth-serration



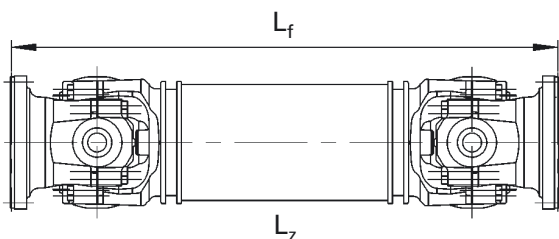
12 孔法兰
12-hole flange

16 孔法兰
16-hole flange

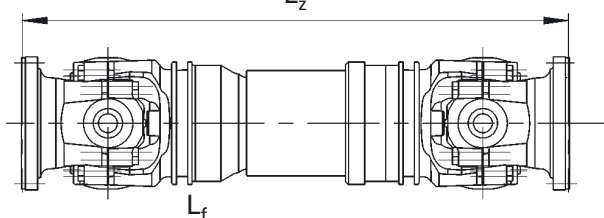
每一型号的万向轴均有其特定的螺栓孔分布形式(见表格)。也可以根据要求采用其他的螺栓孔分布。

Each cardan shaft size has a specific hole pattern (see table). Other hole patterns on request.

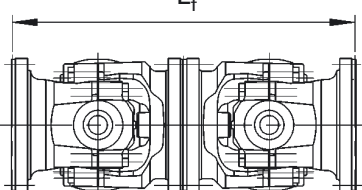
0.03



9.01
9.02
9.03



9.04



Shaft size		492.60	492.65	492.70	492.75		492.80		492.85		492.90	
T_{CS}	kNm	210	245	340	440	410	650	580	850	770	1300	1170
T_{DW}	kNm	100	115	160	210	190	280	250	400	360	600	540
L_c	–	93	332	860	2060		7390		17400		61200	
β	°	7	7	7	10	15	10	15	10	15	10	15
A	mm	285	315	350	390		435		480		550	
K	mm	285	315	350	390		435		480		550	
B	mm	255	280	315	350		395		445		510	
G	mm	35	35	40	45		50		55		65	
H	mm	15	17	17	19		19		21		23	
$l^{1)}$	–	10	10	12	12		16		16		16	
M	mm	200	220	240	260		280		300		330	
S	mm	244,5 x 22,2	244,5 x 28	273 x 30	323,9 x 36		355,6 x 40		406,4 x 40		457 x 50	
W DIN 5480	mm	185 x 5	185 x 5	210 x 5	210 x 5		210 x 5		240 x 5		290 x 8	

T_{CS} = 功能性极限转矩 *

屈服转矩高于 T_{CS} 30%

T_{DW} = 交变疲劳转矩 *

L_c = 承载能力系数 *
(见万向轴使用说明书)

β = 每个关节的最大倾角

1) 法兰螺栓孔数目

T_{CS} = Functional limit torque*

Yield torque 30% over T_{CS}

T_{DW} = Reversing fatigue torque*

L_c = Bearing capacity factor*

* (see specifications of cardan shafts)

β = max. deflection angle per joint

1) Number of flange holes

长度，重量，惯性矩，抗扭刚度

Length dimensions · weights · moments of inertia · torsional stiffness

Design	Shaft size		92.60	492.65	492.70	492.75	492.80	492.85	492.90
0.01	$L_{z \min}$	mm	1440	1520	1680	1750	1900	2130	2415
	L_a	mm	135	135	150	170	170	190	210
	G	kg	472	568	788	1025	1355	1873	2750
	G_R	kg	121	149	180	255,6	311,3	361,4	501,94
	Jm	kgm ²	4,16	5,16	7,73	15	30,7	50,4	92,7
	Jm_R	kgm ²	1,52	1,78	2,69	5,38	7,88	12,28	21,1
	C	Nm/rad.	$3,32 \times 10^6$	$4,31 \times 10^6$	$5,97 \times 10^6$	$6,76 \times 10^6$	$9,7 \times 10^6$	$13,64 \times 10^6$	$19,44 \times 10^6$
	C_R	Nm/rad.	$1,55 \times 10^7$	$1,82 \times 10^7$	$2,75 \times 10^7$	$5,48 \times 10^7$	$8,03 \times 10^7$	$12,51 \times 10^7$	$21,5 \times 10^7$
0.03	$L_{f \min}$	mm	940	1020	1130	1220	1320	1450	1620
	G	kg	311	407	557	819	1040	1330	1880
	G_R	kg	121	149	180	198,9	311,3	361,4	501,9
9.01	L_z	mm	1380	1460	1620	1700	1840	2050	2340
	L_a	mm	135	135	150	170	170	190	210
	G	kg	465	559	777	1010	1340	1850	2710
9.04	L_f	mm	800	880	980	1040	1120	1200	1320
	G	kg	286	374	514	780	1000	1300	1830

$L_{z \min}$ = 最小伸缩长度

L_a = 伸缩量

$L_{f \min}$ = 最小固定长度

$L_z + L_a$ = 最大工作长度

G = 万向轴重量

G_R = 每 1000mm 管段重量

Jm = 惯性矩

Jm_R = 每 1000mm 管段惯性矩

C = 无管万向轴抗扭刚度

C_R = 每 1000mm 管段抗扭刚度

$L_{z \min}$ = shortest possible compressed length

L_a = Length compensation

$L_{f \min}$ = shortest fixed length

$L_z + L_a$ = max. operating length

G = Weight of shaft

G_R = Weight per 1000 mm tube

Jm = Moment of inertia

Jm_R = Moment of inertia per 1000 mm tube

C = Torsional stiffness of shaft without tube

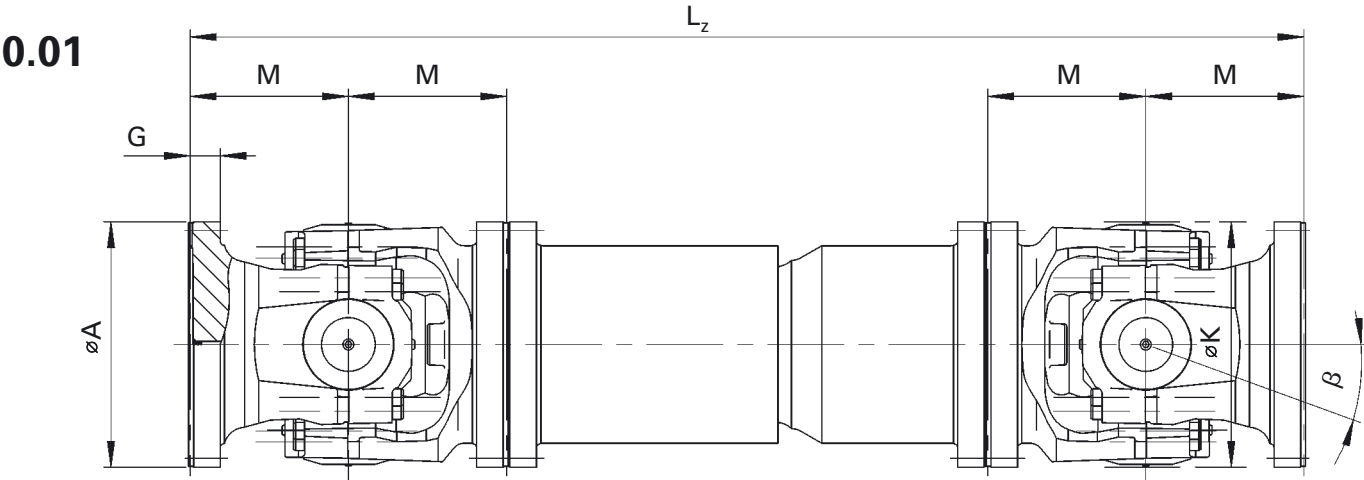
C_R = Torsional stiffness per 1000 mm tube

0.02, 9.02, 9.03 的设计长度 (L_z/L_a)

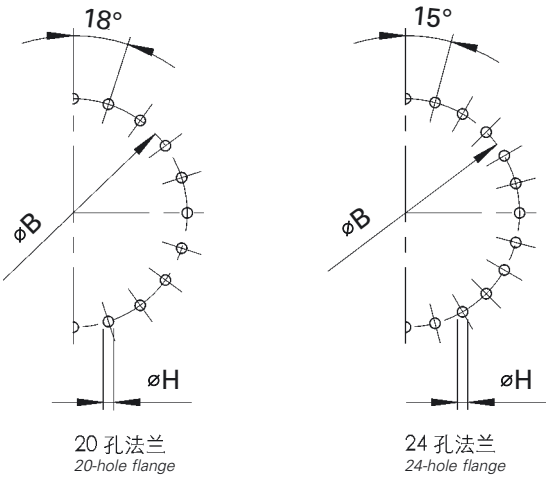
可按用户要求进行调整。

Length dimensions (L_z/L_a) of the designs
0.02 · 9.02 · 9.03 on request

设计 Design	0.01	接管伸缩型	0.01 with length compensation, tubular design
	0.03	接管无伸缩型	0.03 without length compensation, tubular design
	9.04	无伸缩双法兰型	9.04 without length compensation, double flange shaft design

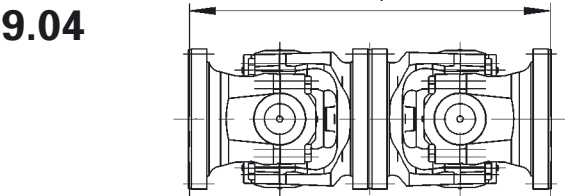
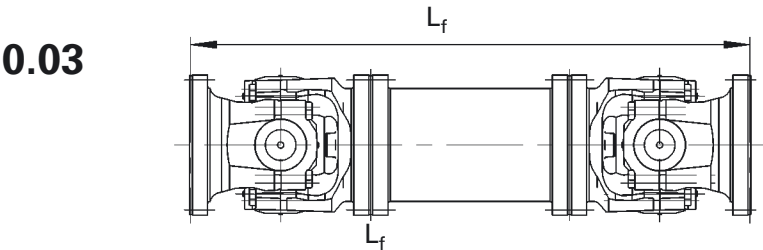


希斯(Hirth)端面齿法兰连接
Flange connection with Hirth-serration



每一型号的万向轴均有其特定的螺栓孔分布形式（见表格）。也可以根据要求采用其他的螺栓孔分布。

Each cardan shaft size has a specific holepattern (see table). Other hole patterns on request.



Shaft size		498.00			498.05			498.10			498.15		
T _{CS}	kNm	1880	1620	1430	2340	2080	1750	3000	2600	2200	3640	3100	2700
T _{DW}	kNm	900	780	680	1120	1000	840	1430	1250	1050	1750	1500	1300
L _c	–	0,115 x 10 ⁶	0,144 x 10 ⁶	0,154 x 10 ⁶	0,224 x 10 ⁶	0,322 x 10 ⁶	0,343 x 10 ⁶	0,530 x 10 ⁶	0,684 x 10 ⁶	0,720 x 10 ⁶	1,09 x 10 ⁶	1,35 x 10 ⁶	1,43 x 10 ⁶
β	↘ °	5	10	15	5	10	15	5	10	15	5	10	15
A	mm	600			650			700			750		
K	mm	600			650			700			750		
B	mm	555			605			655			695		
G	mm	75			80			90			95		
H	mm	26			26			26			32		
I ¹⁾	–	20			20			24			24		
M	mm	370	370	390	390	390	410	420	420	440	460	460	480

Shaft size		498.20			498.25			498.30			498.35		
T _{CS}	kNm	4420	3800	3300	5300	4500	4050	6300	5400	4700	7400	6500	5600
T _{DW}	kNm	2120	1850	1600	2550	2200	1950	3050	2650	2250	3500	3100	2700
L _c	–	1,69 x 10 ⁶	2,14 x 10 ⁶	2,55 x 10 ⁶	3,26 x 10 ⁶	4,01 x 10 ⁶	4,681 x 10 ⁶	7,05 x 10 ⁶	7,86 x 10 ⁶	8,29 x 10 ⁶	9,71 x 10 ⁶	10,7 x 10 ⁶	14,24 x 10 ⁶
β	↘ °	5	10	15	5	10	15	5	10	15	5	10	15
A	mm	800			850			900			950		
K	mm	800			850			900			950		
B	mm	745			785			835			885		
G	mm	100			105			110			120		
H	mm	32			38			38			38		
I ¹⁾	–	24			24			24			24		
M	mm	480	480	500	530	530	555	555	555	580	580	580	610

Shaft size		498.40			498.45			498.50			498.55			498.60		
T _{CS}	kNm	8700	7500	6500	10000	8700	7500	11500	10000	8600	13200	11400	9900	15000	13000	11200
T _{DW}	kNm	4200	3600	3100	4800	4200	3600	5500	4800	4100	6300	5500	4700	7200	6200	5400
L _c	–	16,1 x 10 ⁶	17,4 x 10 ⁶	23,78 x 10 ⁶	24,4 x 10 ⁶	28,71 x 10 ⁶	38,73 x 10 ⁶	36,4 x 10 ⁶	42,63 x 10 ⁶	61,67 x 10 ⁶	56,3 x 10 ⁶	70,8 x 10 ⁶	96,19 x 10 ⁶	89,9 x 10 ⁶	102 x 10 ⁶	147,2 x 10 ⁶
β	↘ °	5	10	15	5	10	15	5	10	15	5	10	15	5	10	15
A	mm	1000			1050			1100			1150			1200		
K	mm	1000			1050			1100			1150			1200		
B	mm	925			975			1025			1065			1115		
G	mm	125			130			135			140			150		
H	mm	44			44			44			50			50		
I ¹⁾	–	20			20			20			20			20		
M	mm	625	625	655	645	645	675	670	670	700	715	715	745	740	740	775

T_{CS} = 功能性极限转矩 *
屈服转矩高于 T_{CS}30%
T_{DW} = 交变疲劳转矩 *
L_c = 承载能力系数 *
* (见万向轴使用说明书)
β = 每个关节的最大倾角
1) 法兰螺栓孔数目

T_{CS} = Functional limit torque*
Yield torque 30% over T_{CS}
T_{DW} = Reversing fatigue torque*
L_c = Bearing capacity factor*
* (see specifications of cardan shafts)
β = max. deflection angle per joint
1) Number of flange holes

0.01, 0.03, 9.04 的设计长度 (L_z/L_f/L_a)
可按用户要求进行调整。

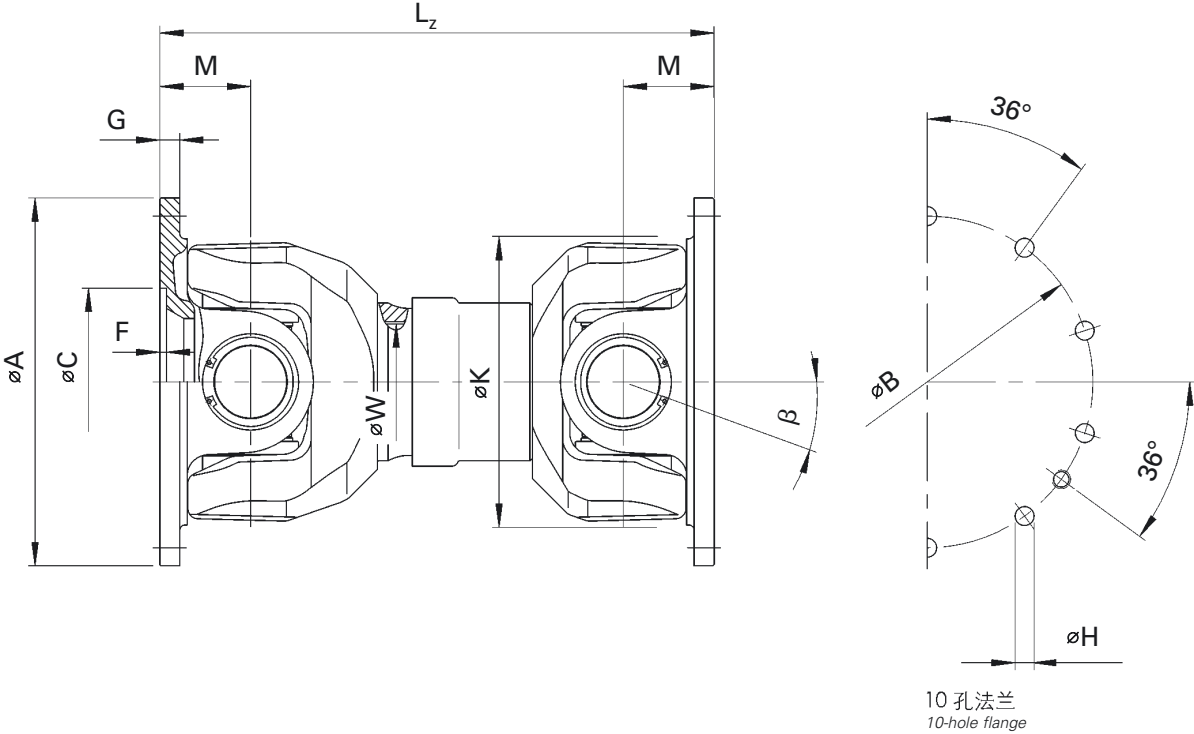
Length dimensions (L_z/L_f/L_a) of the designs
0.01 · 0.03 · 9.04 on request

设计
Design

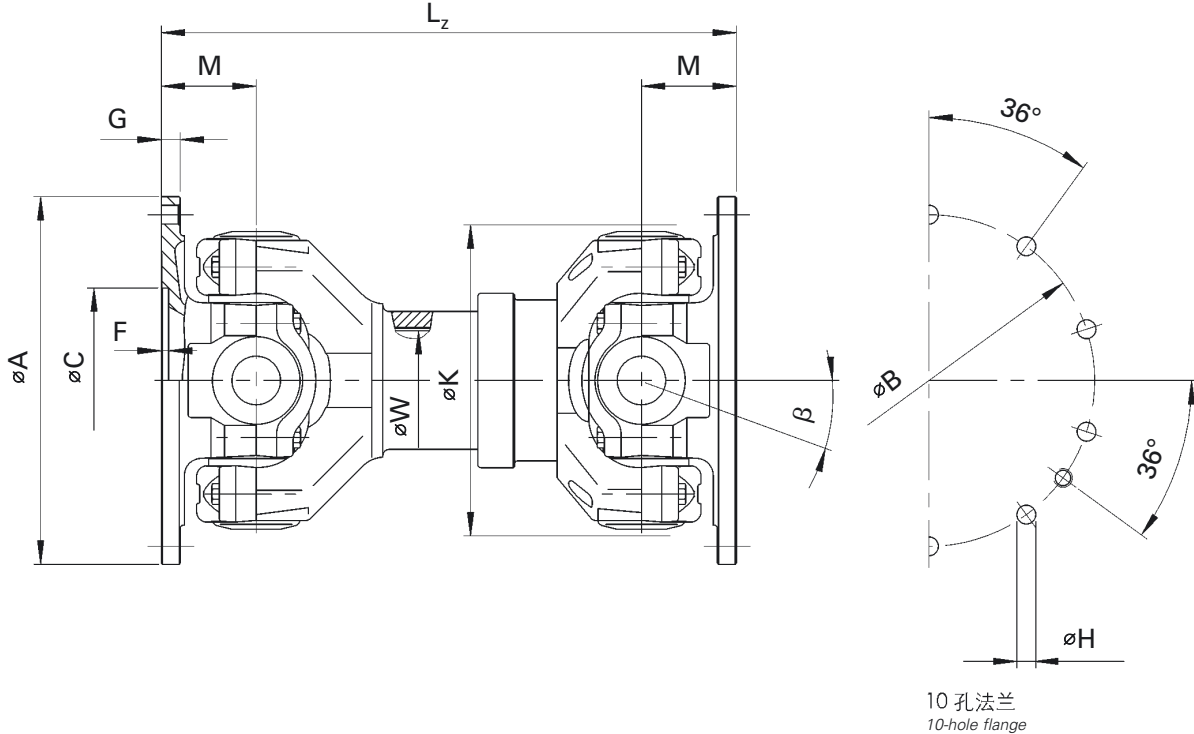
9.06 可伸缩超短型万向轴

9.06 Cardan shaft with length compensation,
super short design

9.06 系列 / Series 587



9.06 系列 / Series 190



Shaft size		587.50	190.55	190.60	190.65	190.70
T _{CS}	kNm	23	33	48	68	94
T _{DW}	kNm	8,5	11	21	25	36
L _c	–	1,84	7,0	58,5	166	510
β	°	5	5	5	5	5
A	mm	275	305	348	360	405
K	mm	215	250	285	315	350
B ± 0,1 mm	mm	248	275	314	328	370
C H7	mm	140	140	175	175	220
F ¹⁾	mm	4,5	5,5	6,5	6	6,5
G	mm	15	15	18	18	22
H + 0,2 mm	mm	14,1	16,1	18,1	18,1	20,1
I ²⁾	–	10	10	10	10	10
M	mm	68	80	90	100	108
W DIN 5482/5480	mm	90 x 2,5	100 x 94	100 x 94	130 x 3	150 x 3

T_{CS} = 功能性极限转矩 *
屈服转矩高于 T_{CS}30%
T_{DW} = 交变疲劳转矩 *
L_c = 承载能力系数 *
* (见万向轴的使用说明书)
β = 每个关节的最大倾角
1) 有效接口深度
2) 法兰螺栓孔数目

T_{CS} = Functional limit torque*
Yield torque 30% over T_{CS}
T_{DW} = Reversing fatigue torque*
L_c = Bearing capacity factor*
* (see specifications of cardan shafts)
β = max. deflection angle per joint
1) Effective spigot depth
2) Number of flange holes

长度，质量，惯性矩

Length dimensions · weights ·
moments of inertia

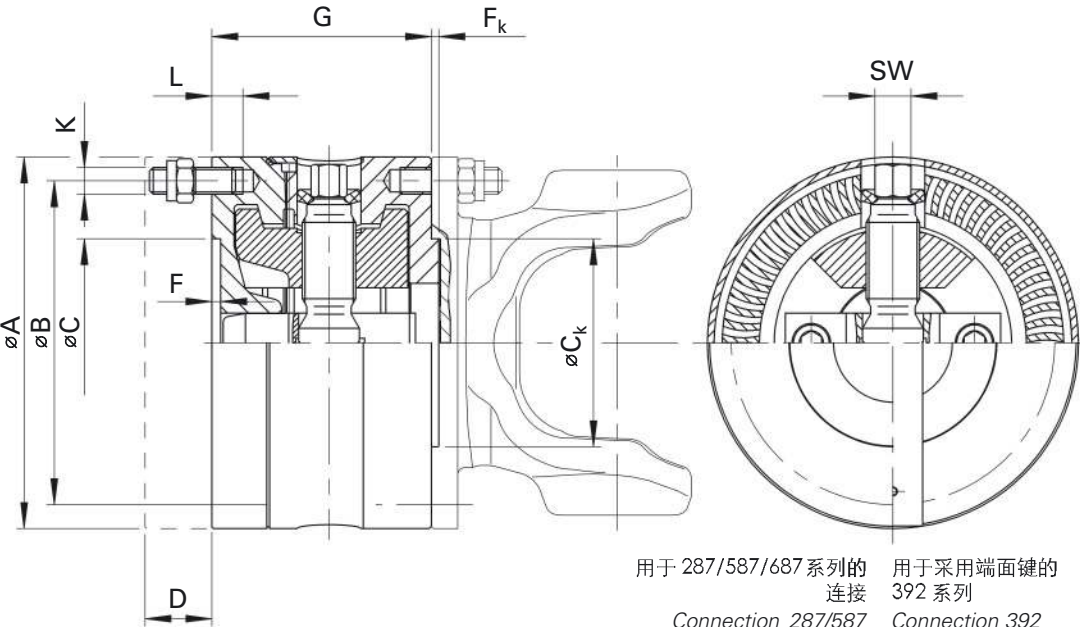
Design	Shaft size		587.50	190.55	190.60	190.65	190.70
9.06	L _z	mm	415	495	545	600	688
	L _a	mm	40	40	40	40	55
	G	kg	60	98	120	169	256
	Jm	kgm ²	0,33	0,624	1,179	2,286	3,785

L_z = 最小伸缩长度
L_a = 伸缩量
L_z + L_a = 最大工作长度
G = 万向轴质量
Jm = 惯性矩

L_z = shortest compressed length
L_a = Length compensation
L_z + L_a = max. operating length
G = Weight of shaft
Jm = Moment of inertia

设计
Design

本螺旋齿面设计适用于高速传动
with spiral serration for higher speeds



螺栓孔分布参见相应
万向轴的数据表。
For hole distribution see
data sheets of the
corresponding cardan shaft

用于 287/587/687 系列的
连接
Connection 287/587
687/688
用于采用端面键的
392 系列
Connection 392
with face key

Coupling size			330.10	330.20	330.30		330.40	330.50			330.55		
Shaft connection			687/688.15 287.10	687/688.20	687/688.25 687/688.35	687/688.30 687/688.40	687/688.40 687/688.45	687/688.45	687/688.55 687/688.65	587.50	392.50	587.55	392.55
Model		Nr.	000	003	003		003	000			001	000	001
	A	mm	100	130	150		180	225			225	250	250
	B	mm	84	101,5	130		155,5	196			196	218	218
	C ¹⁾	mm	57	75	90		110	140			105	140	105
	C _k ¹¹⁾	mm	57	75	90		110	140			105	140	105
	D ²⁾	mm	20	38	40		40	45			45	45	45
	F	mm	2,5	2,5	3,5		4	5			5	6	6
	F _k	mm	2,3–0,2	2,3–0,15	2,3–0,2		2,3–0,15	4–0,2			4–0,2	5–0,2	5–0,2
	G	mm	76	100	100		112	144			144	148	162
	I ³⁾	–	6	8	8		8	8			8	8	8
	K ⁴⁾	–	M 8 x 18	M 10 x 22	M 12 x 25		M 14 x 28	M 16 x 35			M 16 x 40	M 18 x 40	M 18 x 45
	L ¹⁰⁾	mm	10	11	14		20	18			18	21	21
	G _k ¹²⁾	kg	4,7	7,5	10,6		16,4	34			36	40	49
Ta Nut		Nm	35	69	120		190	295			295	405	405
Extension ⁵⁾		Nr.	2365/13 M	2365/17 M	2365/19 M		22 M	24 R			24 R	27 R	27 R
Ta Spindle		Nm	30	45	80		100	190			190	220	220
Socket wrench ⁶⁾		Nr.	1/2" D 19 SW 13		1/2" D 19 SW 17		1/2" D 19 SW 22						

操作指南

联轴器的连接与拆卸

联结与拆卸是通过操纵螺杆来进行的。螺杆位于快换接头内部，可以从显露于圆周面的两端用套筒扳手松开与紧固。（见表）

注意：

- 待安装的快换接头，其接合齿应完全吻合。
- 安装方向用箭头标出。螺杆可以按顺时针或逆时针方向紧固。
- 关节部件拆卸时会掉下来，
要防止砸伤！

对于后来才安装快换接头的情况，万向轴必须要相应减短一些。联轴器的螺杆应采用其供应厂家提供的 MoS₂ 经常润滑。

Operating instructions

Engaging and disengaging the coupling

The engaging and disengaging is done by operating the threaded spindle located in the inner part of the coupling. The spindle can be reached from two sides and be operated. The spindle is tightened by means of a socket wrench (see table).

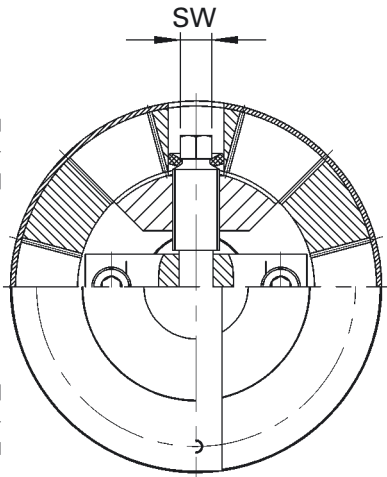
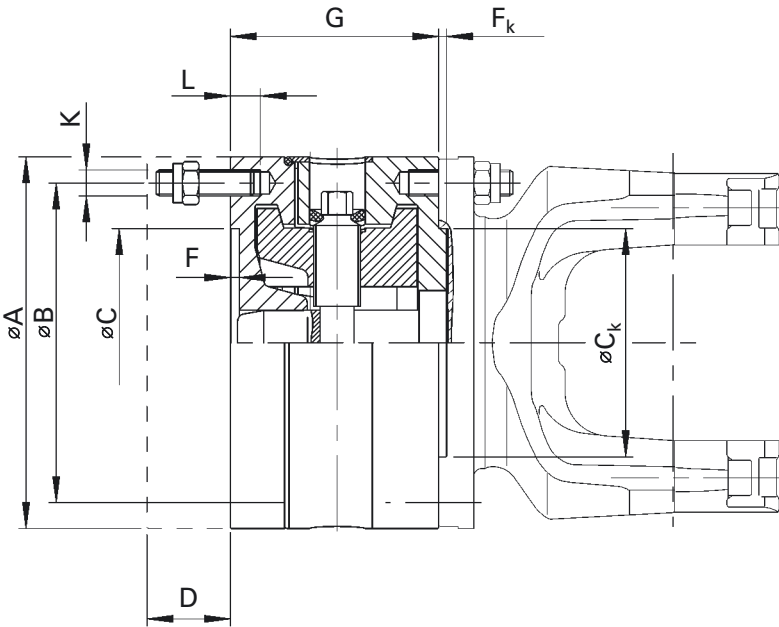
Attention:

- Before engaging the coupling make sure that the coupling teeth are properly fitted.
- The engagement direction is marked by arrows. The spindle may be tightened either clockwise or anti-clockwise.
- The joint with the coupling component falls back when disengaged.
Danger of injury!

In case of a subsequent installation of the quick release coupling the cardan shaft must be correspondingly shorter. The threaded spindles of the coupling are lubricated by the supplier with MoS₂. We recommend relubricating from time to time.

设计
Design

本梯形齿面设计使用转速可达 1000r/min.
with trapezoidal serration for speeds up to 1000 rpm



螺栓孔分布参见相应
万向轴的数据表。
*For hole distribution see
data sheets of the
corresponding cardan shaft*

用于 390 系列的
连接
Connection 390
用于采用端面键连接的
392/393 系列
Connection 392/393
with face key

Coupling size			230.60		230.65		230.70		230.75		230.80	
Shaft connection			390.60	392.60	390.65	392.65	390.70	392.70	390.75	393.75	390.80	393.80
Model		Nr.	000	001	000	001	000	001	000	001	000	001
	A	mm	285	285	315	315	350	350	390	390	435	435
	B	mm	245	245	280	280	310	310	345	345	385	385
	C ¹⁾	mm	175	125	175	130	220	155	250	170	280	190
	C _k ¹¹⁾	mm	175	125	175	130	220	155	250	170	280	190
	D ²⁾	mm	64	64	66	66	72	72	82	82	92	92
	F	mm	7	7	7	8	8	8	8	8	10	10
	F _k	mm	6-0,2	6-0,5	6-0,2	7-0,5	7-0,3	7-0,5	7-0,2	7-0,5	9-0,5	9-0,5
	G	mm	160	174	172	192	184	204	196	220	226	246
	I ³⁾	–	8	8	8	10	10	10	10	10	10	16
	K ⁴⁾	–	M 20 x 55	M 20 x 55	M 22 x 50	M 22 x 60	M 22 x 50	M 22 x 60	M 24 x 55	M 24 x 70	M 27 x 65	M 27 x 75
	L ¹⁰⁾	mm	23	23	25	25	25	25	27	27	30	30
	G _k ¹²⁾	kg	66	71	83	95	110	120	143	150	210	230
Ta Nut			Nm	580	580	780	780	780	1000	1000	1500	1500
Extension ⁵⁾			Nr.	30 R	30 R	32 R	32 R	32 R	36 R	36 R	41 R	41 R
Ta Spindle			Nm	290	290	400	400	550	550	680	680	950 ⁹⁾
Socket wrench ⁶⁾			Nr.	3/4" D 32 SW 22	3/4" D 32 SW 27	3/4" D 32 SW 27	3/4" D 32 SW 27	3/4" D 32 SW 32	3/4" D 32 SW 36	3/4" D 32 SW 36	3/4" D 32 SW 36	3/4" D 32 SW 36
X = 4 spanners ⁸⁾			Nr.									TD 750

- 止口 C 配合为 H7
- 用于拆卸联轴器时实现分离移动
- i 为每个法兰的螺栓数目
- 螺栓连接要求 (K)
螺栓为 DIN 938
自锁六角螺母为 DIN 980
- 按 GWB N4.2.5.标准属于爪或
环的延伸部分
- 用来转动螺杆的 Gedore 式
套筒扳手
- 转矩表为 Rahsol
- 增力扳手 X = 4 (TD 750)
- 可调扭矩扳手 756C = 238 Nm
- L 为螺纹深度
- C_k 配合 h6 至 390 系列
392/393 系列配合为 f8
- G_k 为联轴器重量
- Ta 为法兰螺栓连接以及紧固联轴
器螺杆的拧紧力矩

- Spigot fit H7
- Disengaging movement for
separation of the coupling
- Number of stud bolts per flange
- Dimensions of the bolt connections
Stud bolt DIN 938
Self locking hexagon nut DIN 980
- Jaw or ring extension in accordance
with GWB standard N 4.2.5
- Gedore socket spanner set
for tightening the spindle
- Rahsol torque meter
- Force multiplier spanner
x = 4 (TD 750)
- Adjusting moment of the torque
wrench 756 C = 238 Nm
- Thread depth
- Fit h6 up to series 390
Fit f8 for series 392/393
- G_k = Weight of coupling
- Ta = Tightening torques of flange
boltings and of the threaded
couplings-spindles

Torque wrench ⁷⁾		Torque range	
Type		from	to
756 B		20 Nm	100 Nm
756 C		80 Nm	300 Nm
756 D		280 Nm	760 Nm

当使用转速超过 1000r/min 时,
请与我们的工程师联系。

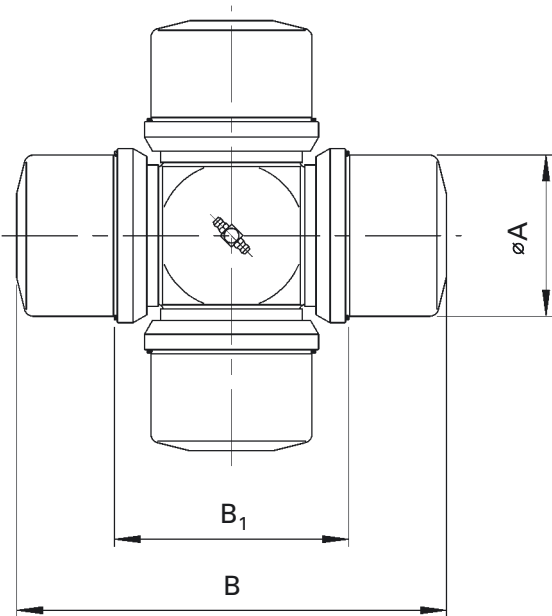
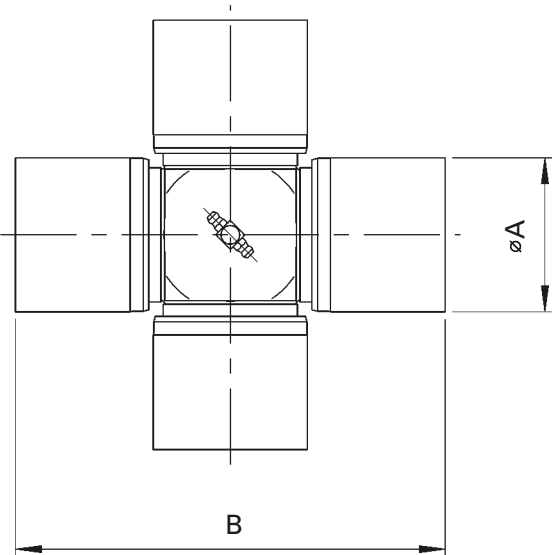
应用户要求, 可提供其它类型
的设计。

For applications with speeds
higher than 1000 rpm please
contact our engineers.
Other designs on request.

十字轴总成（组合部件）
Journal cross assemblies (Unit packs)

数据表

设计 7.06 十字轴总成
Design 7.06 Journal cross, complete



十字轴总成是按整个部件供应的，如果可能的话，订货时请说明轴的尺寸或整根万向轴的图号。十字轴总成的润滑见安装与维护一章。

Journal cross assemblies are only supplied as complete units. For orders please state shaft size or, if known, the drawing no. of the complete cardan shaft. Lubrication of journal cross assemblies: (see Installation and maintenance)

* 392/393 十字轴总成的尺寸与 292 相同。

** The dimensions of the journal cross assemblies 392/393 are equal to 292.*

Shaft size	$\varnothing A$ [mm]	B [mm]
473.10	15	41
473.20	19	49,2
473.30	22	59
287.00	26	69,8
287.10	30	81,8
287.20	35	96,8
587.10	35	96,8
587.15	42	104,5
587.20	48	116,5
587.30	52	133
587.35/36	57	144
587.42	57	152,06
587.48	65	172
587.50	72	185
587.55	74	217
587.60	83	231,4
687/688.15	27,0	74,5
687/688.20	30,2	81,8
687/688.25	34,9	92,0
687/688.30	34,9	106,4
687/688.35	42,0	119,4
687/688.40	47,6	135,17
687/688.45	52,0	147,2
687/688.55	57,0	152,0
687/688.65	65,0	172,0

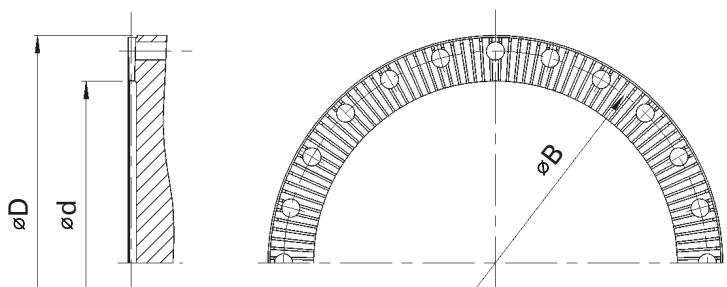
Shaft size	$\varnothing A$ [mm]	B [mm]	B ₁ [mm]
190.50	65	220	143
190.55	74	244	154
190.60	83	280	175
190.65	95	308	190
190.70	110	340	210
190.75	120	379	235
190.80	130	425	262
390.60	83	235,8	129
390.65	95	258,8	139
390.70	110	293,4	160
390.75	120	325,2	176
390.80	130	363,2	196
392.50*	74	222	129
392.55*	83	246	139
392.60*	95	279,6	160
392.65*	110	309,6	176
392.70*	120	343,4	196
393.75*	130	383,4	216
393.80*	154	430	250
393.85*	170	464	276
393.90*	195	530	315

超重型组合部件 398(已停产), 492 和 498 系列均可供货。

Ultra heavy duty unit pack sets Series 398 (discontinued), 492 and 498 available on request

希斯(Hirth)端面齿
Hirth-serration

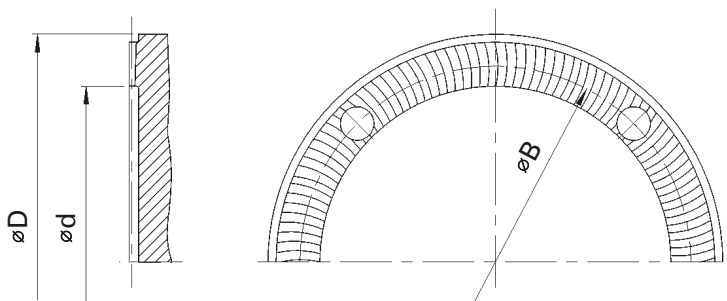
- 齿形角为 40°
- 承载能力大
- 齿型锁定
- 自动定心
- flank angle 40°
- high transmission capacity
- form locking
- self-centring



D [mm]	d [mm]	z	B [mm]	i*
225	180	48	200	8 x M 12
250	200	48	225	8 x M 14
285	225	60	255	10 x M 14
315	250	60	280	10 x M 16
350	280	72	315	12 x M 16
390	315	72	350	12 x M 18
435	345	96	395	16 x M 18
480	370	96	445	16 x M 20
550	440	96	510	16 x M 22
600	480	120	555	20 x M 24
650	520	120	605	20 x M 24
700	570	120	655	24 x M 24
750	610	144	695	24 x M 30
800	650	144	745	24 x M 30
850	680	144	785	24 x M 36
900	710	144	835	24 x M 36
950	760	144	885	24 x M 36
1000	800	180	925	20 x M 42 x 3
1050	840	180	975	20 x M 42 x 3
1100	880	180	1025	20 x M 42 x 3
1150	925	180	1065	20 x M 48 x 3
1200	960	180	1115	20 x M 48 x 3

克林格贝格(Klingelberg)端面齿
Klingelberg-serration

- 齿形角为 25°
- 承载能力大
- 齿型锁定
- 自动定心
- flank angle 25°
- high transmission capacity
- form locking
- self-centring



D [mm]	d [mm]	z	B [mm]	i
95	65	16	84	4 x M 8
115	80	24	101,5	4 x M 10
145	110	24	130	4 x M 12
175	140	32	155,5	4 x M 16
215	175	48	196	4 x M 16
240	195	48	218	4 x M 18
275	220	48	245	4 x M 20
305	245	48	280	4 x M 20
340	280	72	310	4 x M 22
380	315	72	345	6 x M 24
425	355	96	385	6 x M 27
465	390	96	425	8 x M 30
535	455	96	492	8 x M 30

D = 外径
d = 内径
Z = 齿数
B = 节圆直径
i = 螺栓的数目和规格,
螺栓强度级别: 10.9 级

* 只有通过特殊安排方可减少螺栓数目
(如, 用于快速更换系统)

如需要可提供其他直径的
端面齿连接法兰

D = Outside diameter
d = Inside diameter
z = Number of teeth
B = Pitch diameter
i = Number and size of bolts
Bolt material: 10.9

* Reduced number of bolts
by special arrangement only
(e.g., for use as quick-
change system)

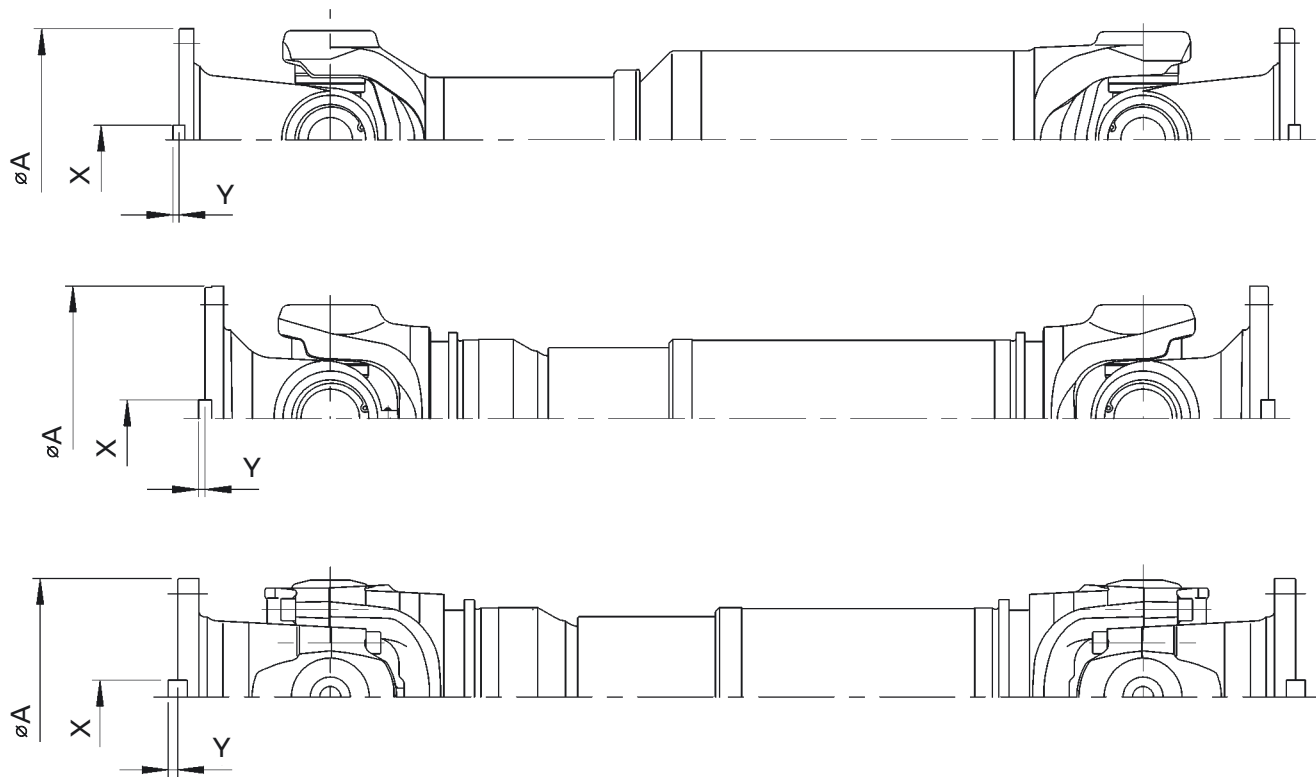
Other diameters on request

687/688/587/390 的特殊法兰连接

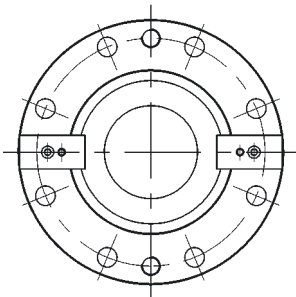
Face key connection 687/688/587/390

我们也可以按用户要求，生产端面键连接的687/688/587/390 系列的万向轴。

We manufacture the cardan shaft series 687/688/587/390 also with face key connection on request.



Cardan shaft connection				
Shaft size	Ø A mm	l ²) x H ¹⁾	X e9 mm	Y mm
687/688.35 687/688.40	150	8 x 13	20	4,0
687/688.45 687/688.55 687/688.65	180	8 x 15	25 25 32	4,5 4,5 5,5
587.50	225	8 x 17	32	5,5
587.55	250	8 x 19	40	7,0
587.60	285	8 x 21	45	8,0
390.60	285	8 x 21	45	8,0
390.65	315	8 x 23	45	8,0
390.70	350	10 x 23	50	9,0
390.75	390	10 x 25	50	9,0
390.80	435	10 x 28	63	12,0

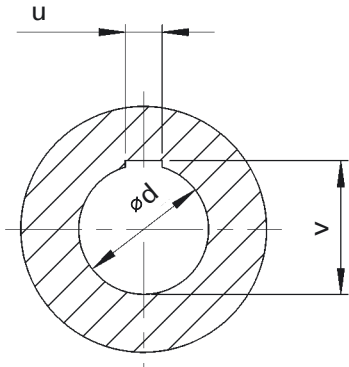
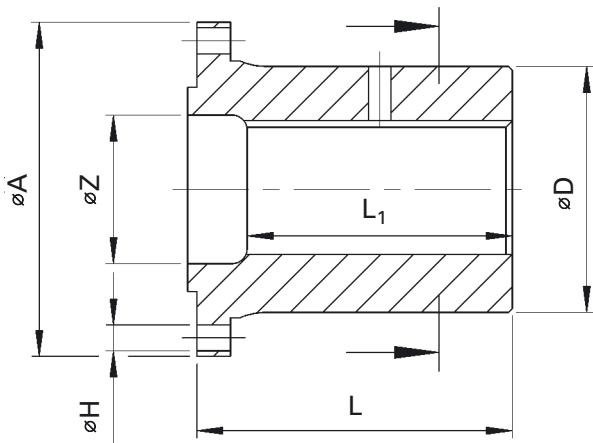


1. 公差+0.2mm (对于 390.75 和 390.80 公差为 +0.5mm)
2. 法兰螺栓孔数目

1. Tolerance + 0,2 mm (for 390.75 and 390.80 Tolerance + 0,5 mm)
2. Number of flange holes

我们可按客户要求，制造标准的圆柱形孔端面键连接法兰轴套（材料 C45；调质处理 750 - 900 N/mm²）。如采用油压连接，圆锥形孔、扁轴颈及选用其它材料等，请向我们查询并提供有关的图纸。

We manufacture standard companion flanges with cylindrical bore holes and face keyway (material C45; hardened and tempered 750 – 900 N/mm²) on request. For designs deviating from the standard, e.g. oil pressure connection, conical bore, flat journal and material we would ask you to send us an inquiry and the relevant drawings.



Cardan shaft connection			Dimension
Shaft size	$\varnothing A$ mm	$l^2) \times H^1)$	$\varnothing D_{max}$ mm
687/688.15 687/688.20	100	6 x 8,1	69,5
687/688.15 687/688.20 687/688.25 687/688.30	120	8 x 10,1	84
687/688.25 687/688.30 687/688.35 687/688.40	150	8 x 12,1	110,3
687/688.35 687/688.40 687/688.45	180	8 x 14,1	132,5
687/688.55 687/688.65		10 x 16,1	
687/688.45 687/688.55 687/688.65 587.50	225	8 x 16,1	171
587.50 587.55	250	8 x 18,1	189
587.60 390.60	285	8 x 20,1	213
390.65	315	8 x 22,1	247
390.70	350	10 x 22,1	277
390.75	390	10 x 24,1	308
390.80	435	10 x 27,1	342

1. 公差+0.2mm (对于 390.75 和 390.80 公差为 +0.5mm)

2. 法兰螺栓孔数目

1. Tolerance + 0,2 mm (for 390.75 and 390.80 Tolerance + 0,5 mm)

2. Number of flange holes

定货时请说明:
Please state with your order:

轴的规格
Shaft size = _____

法兰直径
Flange dia. = _____ mm

$l \times H$

= _____

螺栓孔数目
number of holes

x $\varnothing$ _____ mm

L

= _____ mm

L_1

= _____ mm

Z

= _____ mm

D

= _____ mm

d

= _____ mm

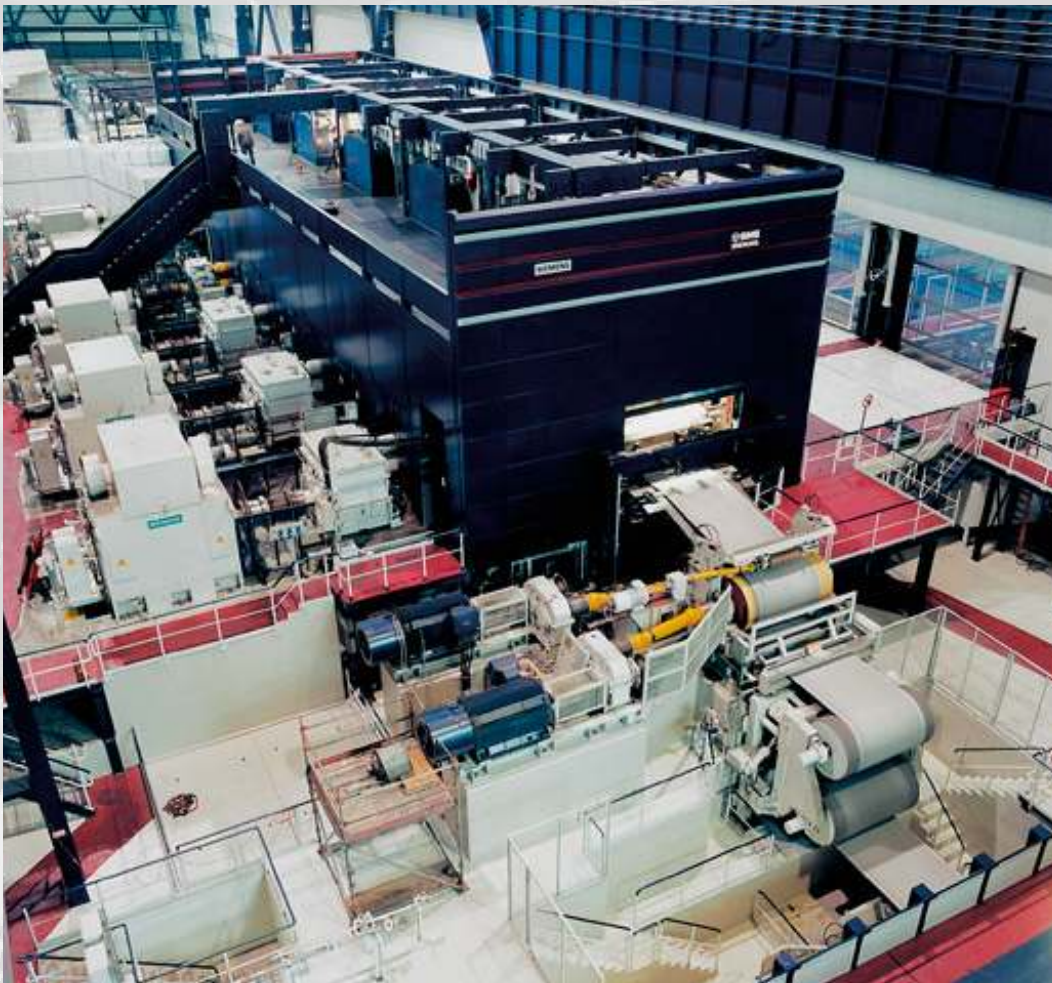
u

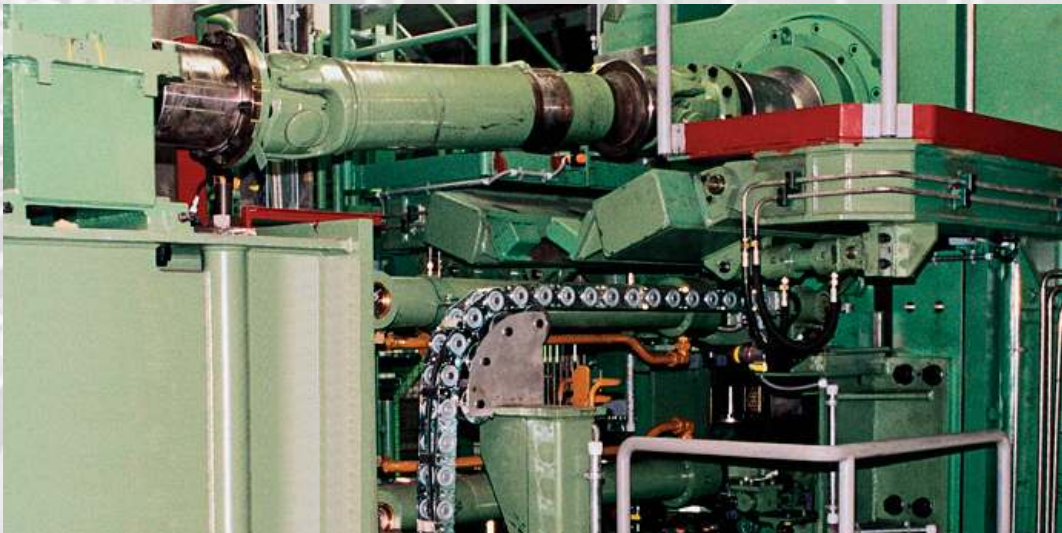
= _____ mm

v

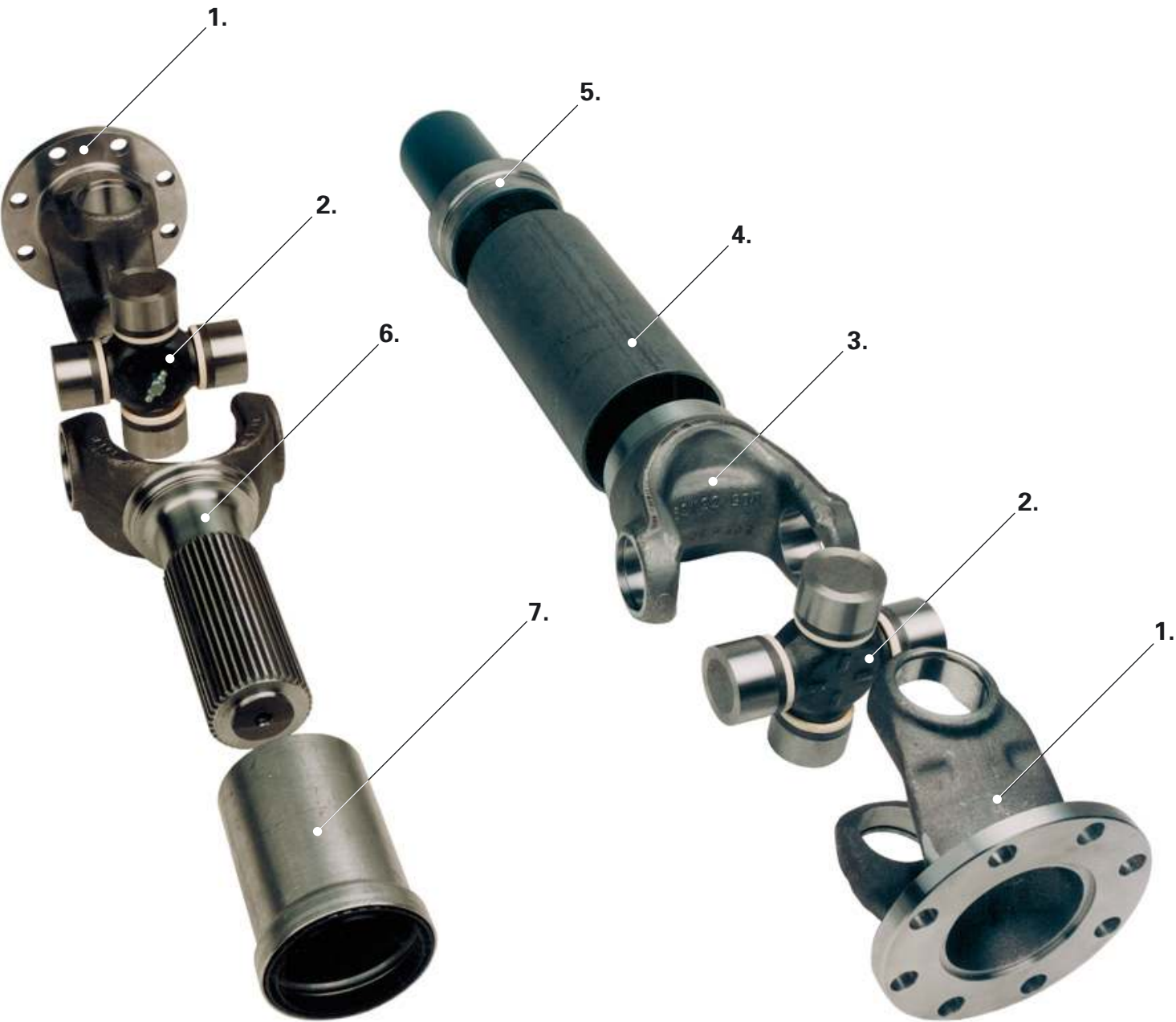
= _____ mm









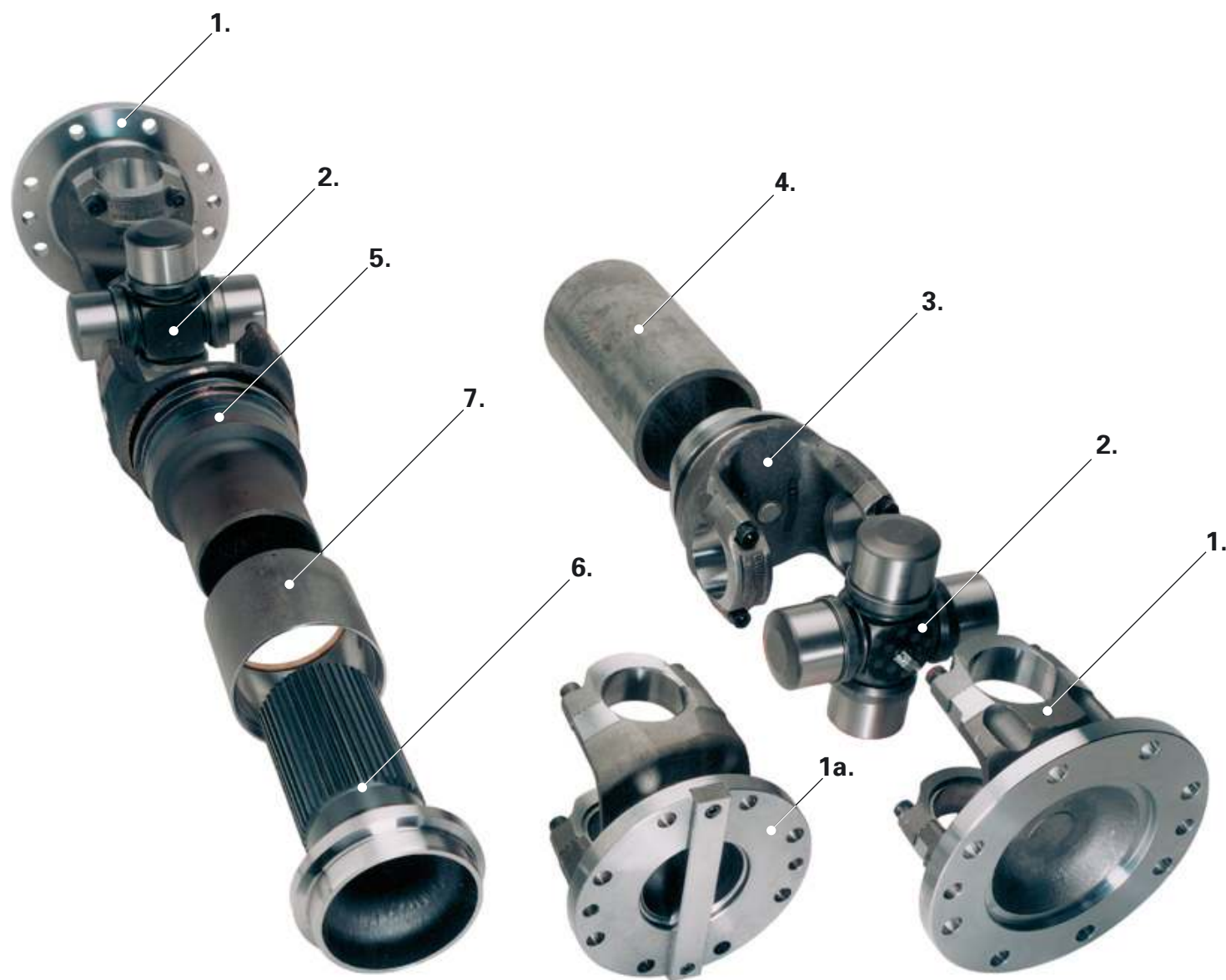


万向轴的主要零部件

- 1. 法兰叉头
- 2. 十字轴总成
- 3. 待焊叉头
- 4. 接管
- 5. 花键套
- 6. 联轴叉头
- 7. 罩管

Main components of the cardan shafts

- 1. Flange yoke
- 2. Journal cross assembly
- 3. Tube yoke
- 4. Tube
- 5. Sliding muff
- 6. Yoke shaft
- 7. Cover tube assembly



万向轴的主要零部件

- 1. 390 系列的法兰叉头（摩擦连接）
- 1a. 392/393 系列的法兰叉头（端面键连接）
- 2. 十字轴总成
- 3. 待焊叉头
- 4. 接管
- 5. 联套叉头
- 6. 花键轴
- 7. 罩管

Main components of the cardan shafts

- 1. Flange yoke for series 390 (friction connection)
- 1a. Flange yoke for series 392/393 (face key connection)
- 2. Journal cross assembly
- 3. Tube yoke
- 4. Tube
- 5. Tube yoke with sliding muff
- 6. Slip stub shaft
- 7. Cover tube assembly

万向关节的运动学原理

1. 关节

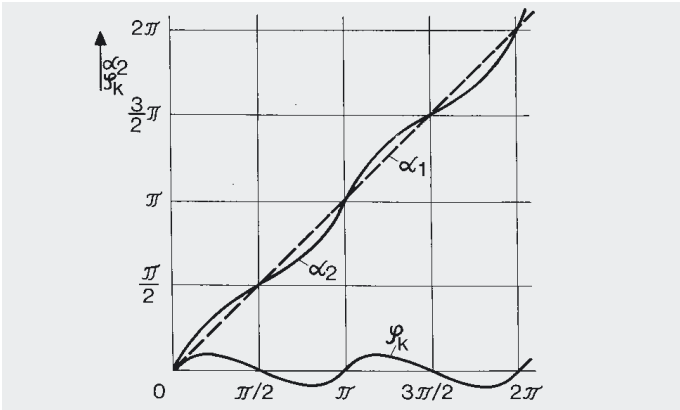
在机械学理论中，万向节指的是一种转数比恒等于 1 而瞬时角速度比不同的空间或球型的变角传动机构。这种关节的传动状况由以下公式描述。

$$\alpha_2 = \arctan\left(\frac{1}{\cos\beta} \cdot \tan\alpha_1\right)$$

β = 关节倾角 (°)

β = Deflection angle of joint [°]

公式中， α_2 指从动轴 2 的瞬间旋转角度。
下图显示了主动与从动两端的运动情况。
图中的不同步线 α_2 和同步线 α_1 (虚线)
表示轴的不同步及其运动的情况。



对其运动的不等性可通过计算旋转角度 α_2 和旋转角度 α_1 之差，或者角速度 ω_2 和 ω_1 的传动比来度量。用公式表示，即：

a) 旋转角度差

$$\varphi_K = \alpha_2 - \alpha_1$$

(也称为框架误差)

$$\varphi_K = \arctan\left(\frac{1}{\cos\beta} \cdot \tan\alpha_1\right) - \alpha_1$$

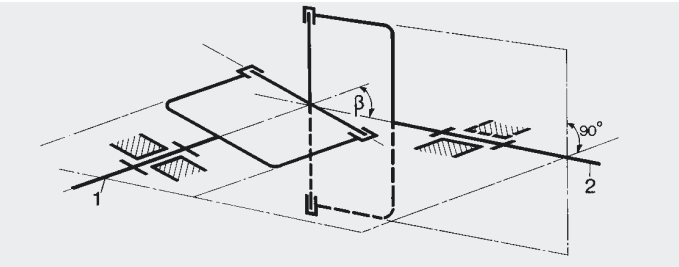
b) 速比

$$i = \frac{\omega_2}{\omega_1} = \frac{\cos\beta}{1 - \sin^2\beta \cdot \cos^2\alpha_1}$$

Kinematics of Hooke's joints

1. The joints

In the theory of mechanics the cardan joint or Hooke's joint is defined as a spatial or spherical drive unit with a non-uniform gear ratio or transmission. The transmission behaviour of this joint is described by the equation.



In this equation α_2 is the momentary rotation angle of the driven shaft 2. The motion behaviour of the driving and the driven ends is shown in the following diagram. The asynchronous and/or non-homokinematic running of the shaft 2 is shown in the periodical oscillation of the asynchronous line α_2 round the synchronous line α_1 (dotted line).

A measure for the non-uniformity is the difference of the rotation angles α_2 and α_1 or the transmission ratio of the angular speeds ω_2 and ω_1 .

Expressed by an equation, that means:

a) Rotation angle difference:

$$\varphi_K = \alpha_2 - \alpha_1$$

(also called gimbal error)

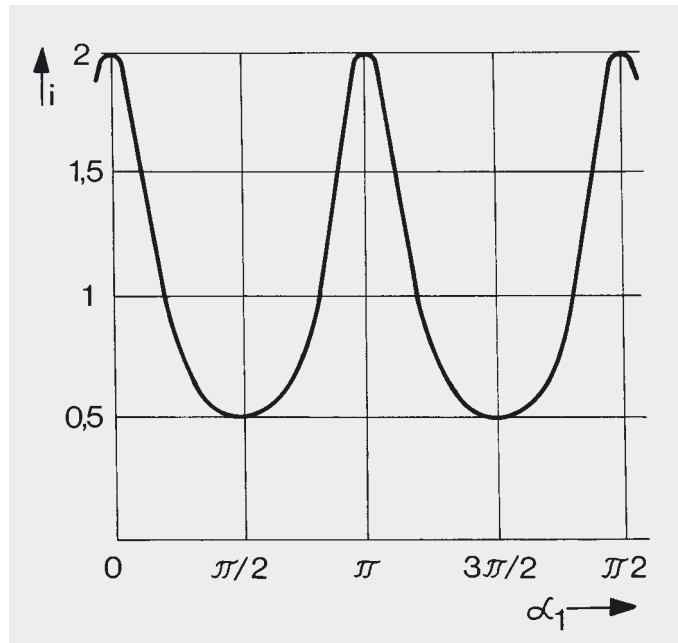
$$\varphi_{K\max} = \arctan\left(\frac{\cos\beta - 1}{2\sqrt{\cos\beta}}\right)$$

b) Ratio:

$$i = \frac{\omega_2}{\omega_1} = \frac{\cos\beta}{1 - \sin^2\beta \cdot \cos^2\alpha_1}$$

下图所示为 $\beta = 60^\circ$ 万向节旋转一周其瞬时角速度比 $i = \omega_2/\omega_1$ 的变化情况。

The following diagram shows the ratio $i = \omega_2/\omega_1$ for a full revolution of the universal joint for $\beta = 60^\circ$.



不等性程度 U 用下式表达：

The degree of non-uniformity U is defined by:

$$U = i_{\max} - i_{\min} = \tan\beta \cdot \sin\beta$$

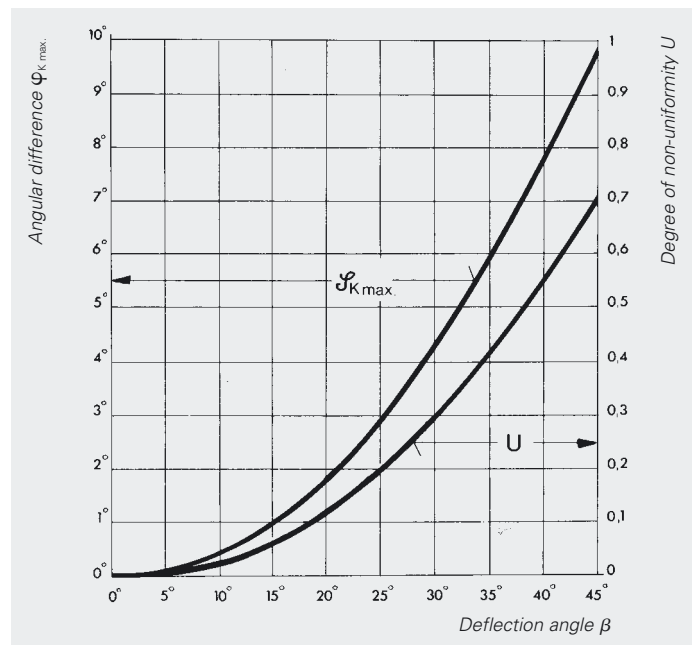
式中：

where:

$$U = i_{\max} - i_{\min} = \tan\beta \cdot \sin\beta$$

$$i_{\max} = \frac{1}{\cos\beta}$$

$$i_{\min} = \cos\beta$$



曲线图显示了关节倾角从 0° 到 45° ，其运动不等性程度 U 及最大旋转角度差 $\phi_{K \max}$ 的变化情况。

The diagram shows the course of the degree of non-uniformity U and of the angular difference $\phi_{K \max}$ as a function of the deflection angle of the joint from 0 to 45° .

从其运动等式可见，在 45° 以下沿虚线进行的同步运动只有在倾角 $\beta = 0^\circ$ 的情况下才能实现（如图所示）。

From the motion equation it is evident that a homokinematic motion behaviour corresponding to the dotted line under 45° – as shown in the diagram – can only be obtained for the deflection angle $\beta = 0^\circ$.

完全同步或同步的运行状况可以通过两个或多个关节的适当组合或连接来达到。

A synchronous or homokinematic running can be achieved by a suitable combination or connection of two or more joints.

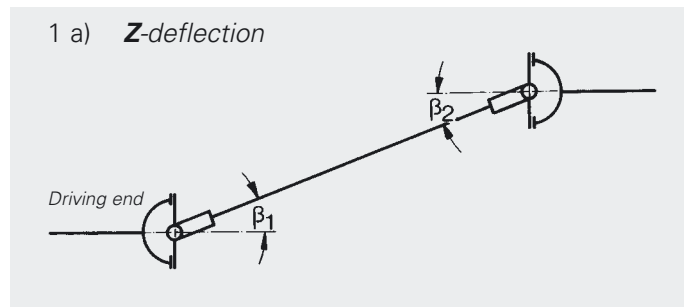
2. 万向轴

倾斜万向轴旋转角度差 φ_K 或框架误差能够在特定的安装条件下, 由第二个万向关节来抵消。建设性的解决办法如下:

- 1) 两个关节的倾角必须相等, 即

$$\beta_1 = \beta_2$$

有两种可行的布置:

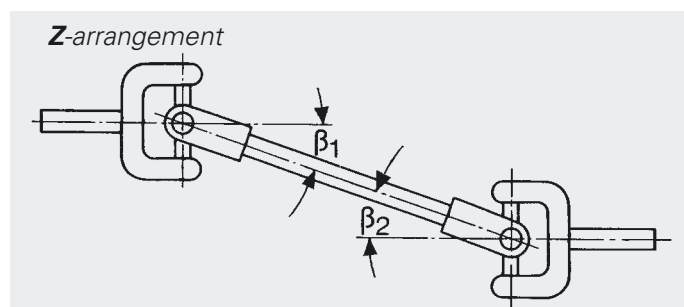


- 2) 两个关节必须有 $90^\circ (\pi/2)$ 的运动学的角度关系, 即接轴两端的叉头处在同一平面。

对万向轴运动学更深入的研究, 请参阅 VDI-recommendation 2722 及有关的技术资料。

工 作 角 度

最常见的布置是 Z 形或 W 形倾斜。首先, 以所有接轴均在同一平面连接为前提来考虑这一系统的布置。



最大允许角度差

若要达到等速输出, 必不可少的条件之一是 $\beta_1 = \beta_2$, 而这一条件并非总是可以满足。因此, 设计人员和工程师通常允许两个关节之间有一定的误差。

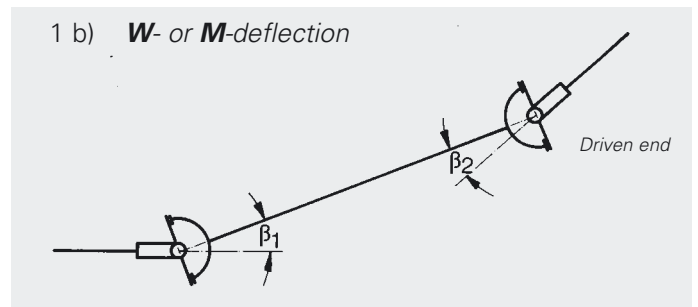
大转矩和高速机械传动装置的倾角应尽可能相等。在不等的情况下, 其误差不应大于 $1^\circ - 1.5^\circ$ 。

2. The universal shaft

The rotation angle difference φ_K or the gimbal error of a deflected universal joint can be offset under certain installation conditions with a second universal joint. The constructive solutions are the following:

- 1) The deflection angles of both joints must be equal, i. e. $\beta_1 = \beta_2$

Two arrangements are possible:

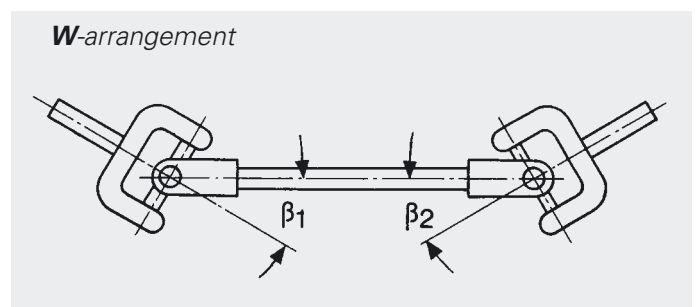


- 2) The two joints must have a kinematic angular relationship of $90^\circ (\pi/2)$, i.e. the yokes of the connecting shaft are in one plane.

For a more intensive study of universal shaft kinematics we refer you to the VDI-recommendation 2722 and to the relevant technical literature.

Operating angles

The most common arrangements are the Z- and W-deflections. To begin with, we will consider the system in which the shafts to be connected are in the same plane.



Maximum permissible angle difference

The condition $\beta_1 = \beta_2$ is one of the essential requirements for a uniform output speed condition and cannot always be fulfilled. Therefore designers and engineers will often ask for the permissible difference between the deflection angles of both joints.

The deflection angles for high-torque and high-speed machine drives should be equal. If not, the difference should be limited to $1^\circ - 1.5^\circ$.

在低速应用的情况下，有 3°-5° 的误差不会有什么损害对于不等倾角工作条件下使用的情况，应尽可能在整个倾斜范围内使倾角保持一致。

两个平面上的倾斜意味着既有平行又有垂直的倾斜。两种相同类型的倾斜的配合（Z/Z 或 W/W）及相同的倾角的配合可保证等速。Z 形或 W 形倾斜相配合使用的话，内侧叉头必须偏移予以补偿。倾角补偿量的合理数值可向 GWB 的应用工程师咨询。

最大允许工作倾角 β 的确定

依据不同的万向轴产品系列，每个关节的最大允许倾角 β 为 5°-44°。基于上述万向轴的运动特点，必须根据其转速对倾角进行限制。

对多种应用情况的计算和观察表明，其中间部分质量的总加速转矩不应超过保证传动系统平稳运行所允许的范围。该加速转矩取决于

$$\text{转速和倾角的乘积} \\ = n \cdot \beta$$

以及接轴中间部分的惯性矩。

在已知速度和万向轴平均长度的条件下，最大允许倾角可通过如下公式确定：

$$D = n \cdot \beta$$

式中， n - 工作转速 (r/min)
 β - 关节倾角 (°)

确切的确定请与我们联系。

Greater differences about 3° to 5° are acceptable without disadvantages in low speed applications. For applications with varying deflection conditions it is important to obtain uniformity, if possible over the complete deflection range.

Deflection in two planes means that the deflection is both horizontal and vertical. The combination of two identical types of deflection (Z/Z or W/W) and identical deflection angles ensure uniformity. For combination of Z- and W-deflection the inner yokes must be offset. Please consult GWB's application engineers to determine the proper amount of angular offset.

Determination of the maximum permissible operating deflection angle β

Depending on the cardan shaft series the maximum deflection angle per joint is $\beta = 5^\circ - 44^\circ$. Due to the kinematic conditions of the cardan joint, as described before, the deflection angle must be limited in relation to the speed.

Calculations and observations of many applications have shown that certain mass acceleration torques of the centre part must not be exceeded in order to guarantee smooth running of the drive systems. This acceleration torque depends on the

$$\text{Product of speed and deflection angle} \\ = n \cdot \beta$$

and the moment of inertia of the middle part of the shaft.

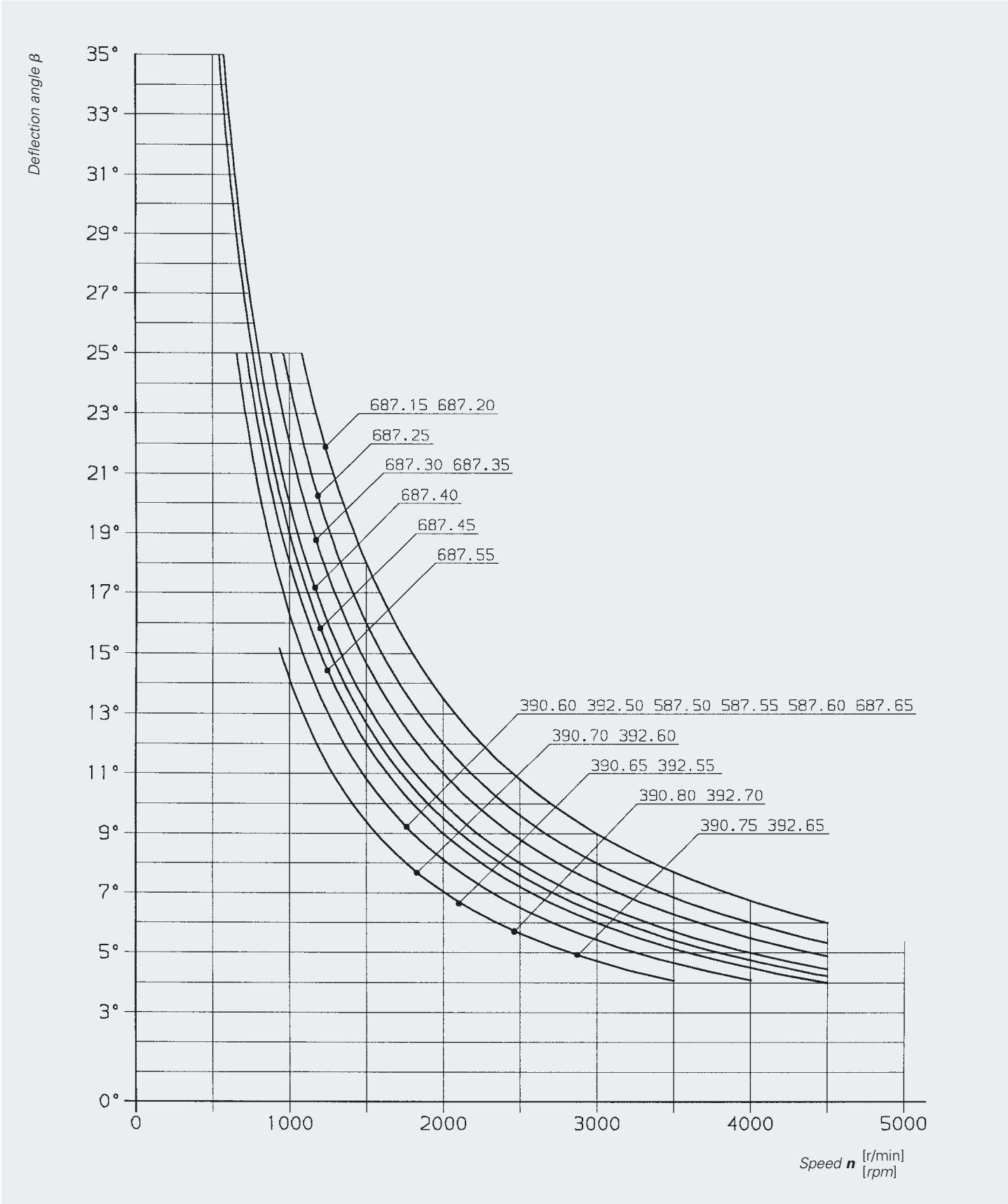
The maximum permissible deflection angle at a given speed and an average cardan shaft length can be determined from:

n = Operating speed [rpm]
 β = Deflection angle of joint [°]

For exact determination please contact us.

万向轴产品工作转速与倾角极限

Limits for the product of operating speed and deflection angle



转速

临界扭转速度的校核

为避免扭转震动，设备或者机车生产商须避免万向轴在驱动设备的临界扭转速度范围内使用，因此需要确定驱动设备系统的临界扭转速度范围。所选用万向轴的惯性矩和抗扭刚度的数值可以从数据表中获得，也可以向我们索取。

临界弯曲速度的校核

除短型和固定连接型之外，万向轴是具有临界弯曲速度和弹性震动特性的弹性部件，必须进行校核。一阶,甚至二阶临界弯曲速度都很重要。

为安全起见，最大允许工作速度 $n_{perm. max}$ 和临界弯曲 $n_{crit.}$ 转速之间必须留有足够余地。

$$n_{perm. max.} \approx 0,8 \cdot n_{crit.} \quad \left[\frac{r/min}{rpm} \right]$$

某一特定尺寸万向轴的临界弯曲速度仅取决于其长度和中部管段的直径（见图）。若长度尺寸加大，轴管直径也要增加。轴管直径又受到万向轴大小的限制。因此，单根万向轴只能使用到某个长度。超过这一界限安装的万向轴必须配置分割的传动系统。

请参照下面的图表来确定临界弯曲速度。

这些图表只适用于在法兰附近配有固定轴承支承的情况。

对于其它安装型式，例如带有弹性支承的情况，其临界弯曲速度必须低一些。

在某些类型的工厂，可能会由于二阶振荡产生弹性振动。如果倾角超过 3° 而轴身较长，请与我们的工程师联系。

Speed

Checking the critical torsional speed

The plant or vehicle manufacturer has to prevent the use of cardan shafts within the critical torsional speed ranges of the drive. Therefore the determination of the critical torsional speed ranges of the drive system is required. The values for the moment of inertia and torsional stiffness of the selected cardan shaft can be taken out of the data sheets or can be supplied upon request.

Checking the critical bending speed

Except for short and rigid designs, cardan shafts are flexible units with critical bending speeds and flexural vibrations that have to be checked. For this, the first and possibly second order critical bending speed is important.

For safety reasons, the maximum permissible operating speed must be at a sufficient distance from the critical bending speed.

The critical bending speed for a particular shaft size is determined by the length and the tube diameter only (see diagram). For greater length dimensions the tube diameter has to be increased. The diameter is limited because of the ratio to the shaft size. Therefore single cardan shafts can only be provided up to a certain length. All installations exceeding this limit have to be equipped with subdivided drive lines.

For determination of the critical bending speed see the following selection diagrams.

These diagrams only apply to cardan shafts that are installed with solid bearing supports located close to the flange.

Different installations, e. g. units with elastic mounting bearing, must have lower critical bending speeds.

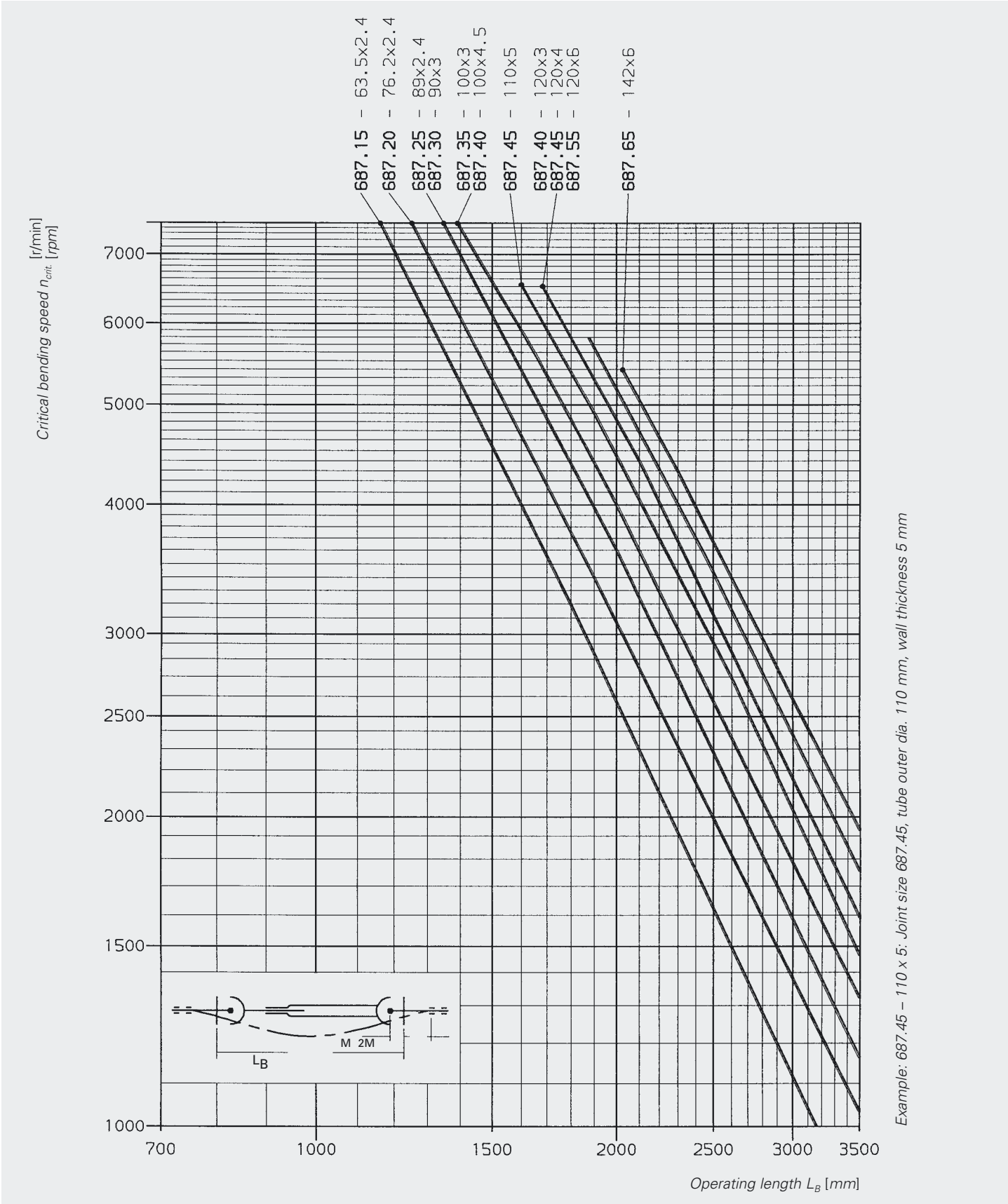
Depending on the type of the plant, excitations of 2nd order can cause flexible vibrations. Please contact our engineers if the deflection angle exceeds 3° and at greater length dimensions.

687/688 系列

按相应的工作长度确定临界弯曲速度

Series 687/688

Determination of the critical bending speed depending on the respective operating length

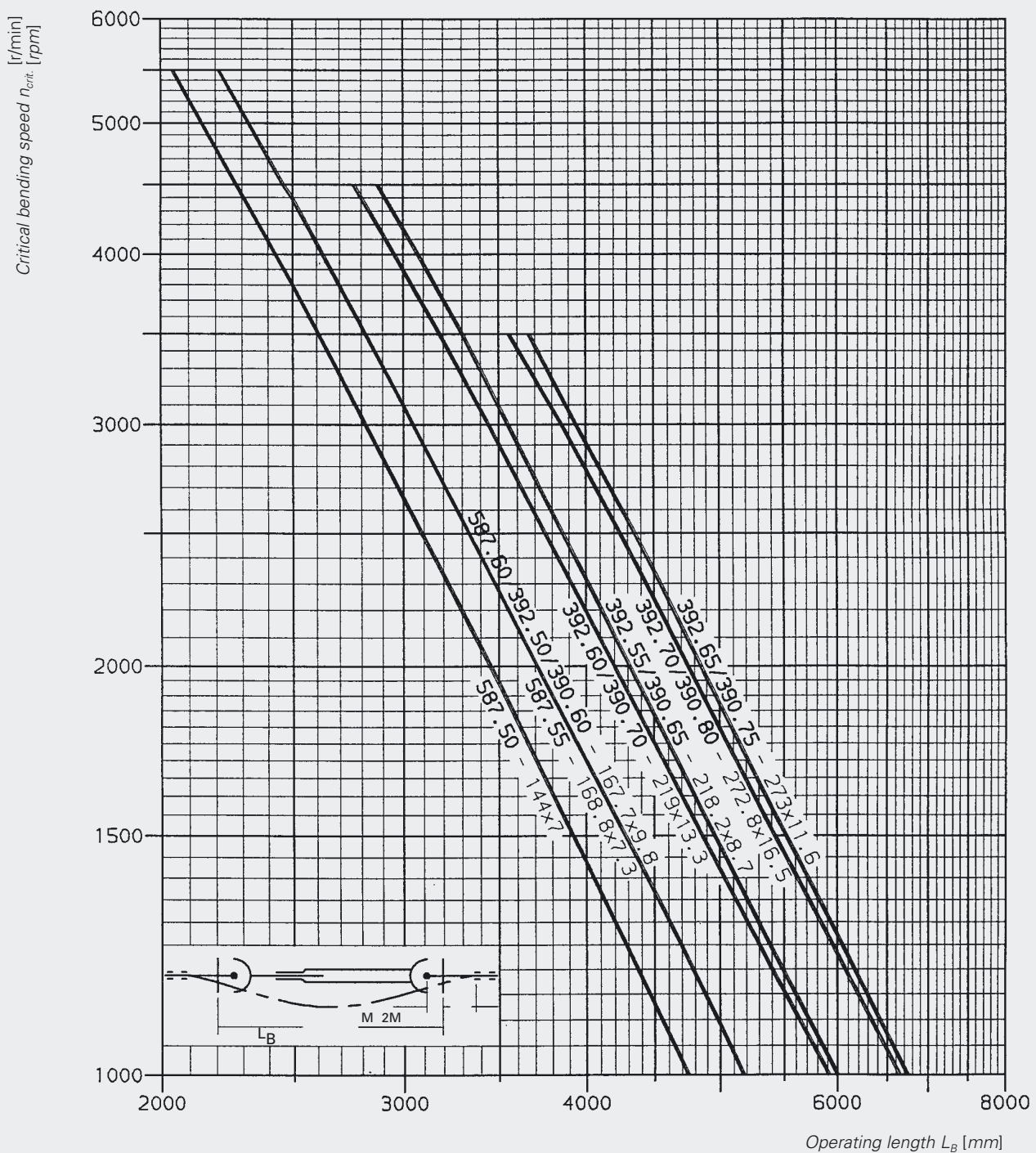


587/390/392 系列

按相应的工作长度确定临界弯曲速度

Series 587/390/392

Determination of the critical bending speed depending on the respective operating length



Example: 390.60 – 167,7 x 9,8: Joint size 390.60, tube outer dia. 167,7 mm, wall thickness 9,8 mm

长度尺寸

万向轴工作长度由以下因素确定：

- 驱动和被驱动装置之间的距离
- 运行中的伸缩量

使用简称如下：

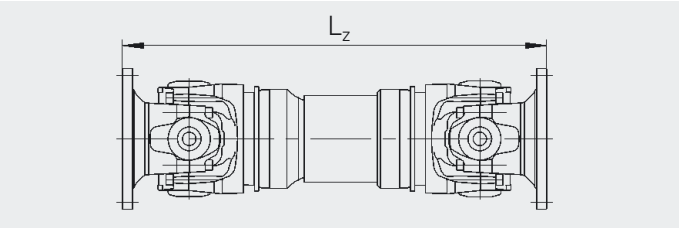
L_z = 压缩长度

这是万向轴的最短长度，无法进一步压缩。

L_a = 伸缩量

这是万向轴可以伸出的最大长度，超过这一尺寸无法再伸长。

L_z + L_a = 最大许用工作长度 L_{Bmax}.



万向轴在运行中可以伸长到这一长度，但其最佳工作长度 L_B 是伸出长度为伸缩量的三分之一时万向轴所具有的长度。

Length dimensions

The operating length of a universal shaft is determined by:

- the distance between the driving and the driven units
- the length compensation during operation

The following abbreviations are used:

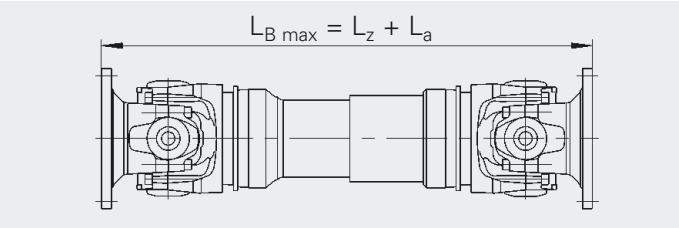
L_z = Compressed length

This is the shortest length of the shaft. A further compression is not possible.

L_a = Length compensation

The universal shaft can be expanded by this amount. An expansion beyond that dimension is not permissible.

L_z + L_a = Max. perm. operating length L_{Bmax}.



During operation the universal shaft can be expanded up to this length. The optimum working length L_B of an universal shaft is achieved if the length compensation is extracted by one-third of its length.

$$L_B = L_z + \frac{1}{3}L_a$$

[mm]

这一大致的规则适用于大多数配置。对于使用时其长度需要进行较大变动的情况，选择工作长度要保证其伸缩移动量不超过允许伸缩量的范围。

This rough rule applies to most of the arrangements. For applications where larger length alterations are expected the operating length should be chosen in such a way that the movement will be within the limit of the permissible length compensation.

万向轴的配置

- 安装距离较大时可将万向轴串联配置。

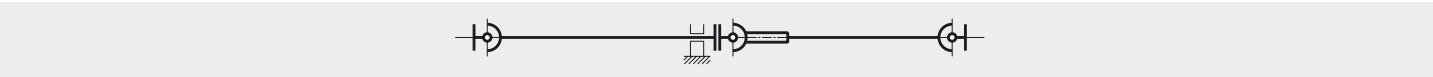
Arrangements of cardan shafts

A tandem arrangement of universal shafts could become necessary:

- to cope with greater installation lengths

万向轴组合的基本型式：

万向轴与单关节接轴组合



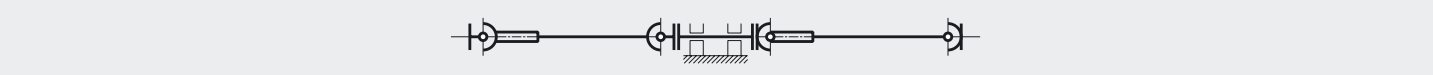
万向轴与两根单关节接轴组合

Universal shaft with two intermediate shafts



中部带双支撑接轴的两根万向轴组合

2 universal shafts with double intermediate bearing



在这些配置中，要注意对各个叉头的位置和倾角进行调整，从而使不等性程度（见理论概述）和对连接装置的轴承反力（见使用说明书）降低到最小程度。

连接装置轴承上的载荷

轴 向 力

万向轴的设计必须考虑到可能发生的轴向力，它应由连接装置的轴向推力轴承所吸收。

轴向力会在万向轴长度发生变化时产生。还有一些轴向力是由于转矩加大和润滑花键轴压力增加所造成的，此类轴向力会自动降低，也可能由于安装减压阀而加剧。

轴向力 A_k 由两部分组成：

1. 摩擦力 F_{RL}

摩擦力源于万向轴的伸缩运动，其值由以下公式确定：

$$F_{RL} = T \cdot \frac{\mu}{r_m} \cdot \cos \beta$$

式中， F_{RL} = 由于伸缩运动产生的摩擦力（N）

它取决于：

- T = 万向轴承受的转矩（Nm）
- r_m = 万向轴滑动部分的节圆半径（m）
- μ = 摩擦系数（取决于对花键轴的处理）
 - 有塑料涂层的花键轴为 0.08
 - 金属与金属摩擦（润滑）为 0.11
- β = 工作倾角

2. 力 F_p

该力产生于伸缩部分，是由于万向轴润滑槽内压力增大造成的。

其值取决于润滑压力（最大不变压力为 15 bar）。

In such arrangements the individual yoke positions and deflection angles should be adjusted with regard to one another in such a way that the degree of non-uniformity (see general theoretical directions) and the reaction forces acting on the connection bearings (see technical directions for applications) are minimized.

Load on bearings of the connected units

Axial forces

For the design of a cardan shaft it must be taken into account that axial forces can occur. These must be absorbed by axial thrust bearings of the connected units.

Axial forces will occur during length variations in the cardan shaft. Additional axial forces are caused increasing torque and by increasing pressure during lubrication of the splines. This force will decrease automatically and can be accelerated by the installation of a relief valve.

The axial force A_k is a combination of two components:

1. Frictional force F_{RL}

This is the force that occurs in the length compensation. It can be determined from:

F_{RL} = Frictional force from the length compensation [N]

It depends on:

- T = Torque of the cardan shaft [Nm]
- r_m = Pitch circle radius in the sliding parts of the cardan shaft [m]
- μ = Friction coefficient (depends on spline-treatment):
 - 0,08 for plastic-coated splines
 - 0,11 for steel/steel (greased)
- β = Operating deflection angle

2. Force F_p

This force occurs in the length compensation due to the increasing pressure in the lubrication grooves of the cardan shaft.

The force depends on the lubrication pressure (max. perm. pressure 15 bar).

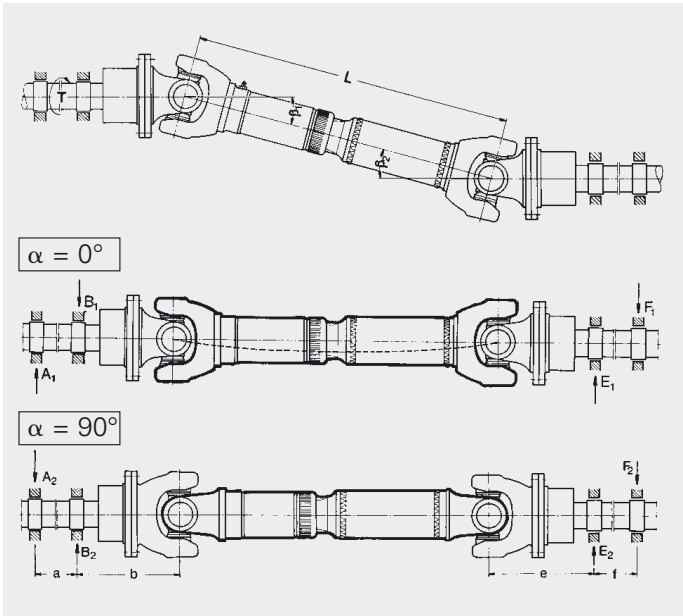
连接装置轴承径向力的计算

万向轴 Z 形安装

位置角度为 0° 时，法兰叉头轴承孔中心线与图形平面成直角。
位置角度为 90° 时，法兰叉头轴承孔中心线平行于图形平面。

Universal shaft in Z-arrangement

Position 0° , flange yoke right-angled to drawing plane
Position $\pi/2$, flange yoke in drawing plane



$$\begin{aligned}\alpha = 0^\circ \quad A_1 &= T \cdot \frac{\cos\beta_1 \cdot b}{L \cdot a} \cdot (\tan\beta_1 - \tan\beta_2) \\ B_1 &= T \cdot \frac{\cos\beta_1 (a+b)}{L \cdot a} \cdot (\tan\beta_1 - \tan\beta_2) \\ F_1 &= T \cdot \frac{\cos\beta_1 \cdot e}{L \cdot f} \cdot (\tan\beta_1 - \tan\beta_2) \\ E_1 &= T \cdot \frac{\cos\beta_1 (e+f)}{L \cdot f} \cdot (\tan\beta_1 - \tan\beta_2)\end{aligned}$$

$$\begin{aligned}\alpha = \pi/2 = 90^\circ \quad A_2 &= B_2 = T \cdot \frac{\tan\beta_1}{a} \\ F_2 &= E_2 = T \cdot \frac{\sin\beta_2}{f \cdot \cos\beta_1}\end{aligned}$$

万向轴在倾角相等和
支撑距离相等情况下的配置

$$\begin{aligned}\beta_1 &= \beta_2 \\ a &= f, b = e\end{aligned}$$

Universal shaft arrangement with
equal deflection angles and equal bearing distances

$$\begin{aligned}\alpha = 0^\circ \quad A_1 &= F_1 = B_1 = E_1 = 0 \\ \alpha = \pi/2 = 90^\circ \quad A_2 &= B_2 = T \cdot \frac{\tan\beta_1}{a} \\ F_2 &= E_2 = T \cdot \frac{\tan\beta_1}{a}\end{aligned}$$

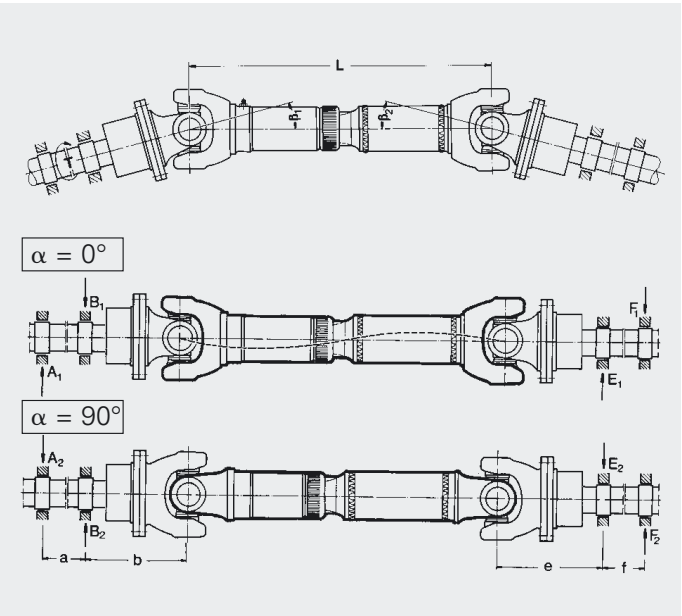
Calculation scheme of radial forces on connecting bearings

万向轴 W 形安装

位置角度为 0° 时，法兰叉头轴承孔中心线与图形平面成直角。
位置角度为 90° 时，法兰叉头轴承孔中心线平行于图形平面。

Universal shaft in W-arrangement

Position 0° , flange yoke right-angled to drawing plane
Position $\pi/2$, flange yoke in drawing plane



$$\begin{aligned}\alpha = 0^\circ \quad A_1 &= T \cdot \frac{\cos\beta_1 \cdot b}{L \cdot a} \cdot (\tan\beta_1 - \tan\beta_2) \\ B_1 &= T \cdot \frac{\cos\beta_1 (a+b)}{L \cdot a} \cdot (\tan\beta_1 - \tan\beta_2) \\ F_1 &= T \cdot \frac{\cos\beta_1 \cdot e}{L \cdot f} \cdot (\tan\beta_1 - \tan\beta_2) \\ E_1 &= T \cdot \frac{\cos\beta_1 (e+f)}{L \cdot f} \cdot (\tan\beta_1 - \tan\beta_2)\end{aligned}$$

$$\begin{aligned}\alpha = \pi/2 = 90^\circ \quad A_2 &= B_2 = T \cdot \frac{\tan\beta_1}{a} \\ F_2 &= E_2 = T \cdot \frac{\sin\beta_2}{f \cdot \cos\beta_1}\end{aligned}$$

万向轴在倾角相等和
支撑距离相等情况下的配置

$$\begin{aligned}\beta_1 &= \beta_2 \\ a &= f, b = e\end{aligned}$$

Universal shaft arrangement with
equal deflection angles and equal bearing distances

$$\begin{aligned}\alpha = 0^\circ \quad A_1 &= F_1 = 2T \cdot \frac{\sin\beta_1 \cdot b}{L \cdot a} \\ B_1 &= E_1 = 2T \cdot \frac{\sin\beta_1 (a+b)}{L \cdot a} \\ \alpha = \pi/2 = 90^\circ &\text{ 见 Z 形安装 } \alpha = \pi/2 \\ &\text{ see Z-arrangement}\end{aligned}$$

万向轴的动平衡

对万向轴做动平衡是为了对偏心转动的不平衡质量进行补偿，从而可以防止振动，减少作用于所连接设备上的附加载荷。

动平衡是根据 ISO 1940 “旋转刚体的平衡品质” 标准来进行的。根据这一标准，允许剩余不平衡量取决于工作转速和被平衡部件的质量。

根据我们的经验，转速低于 500r/min 一般不需要做动平衡。就个别情况来说，根据整个传动链具体情况，这一范围可以扩大或缩小。

万向轴的动平衡是在两个平面上进行的，一般平衡精度为 G16 到 G40 之间。

● 动平衡转速

动平衡转速：一般为传动系统或车辆等设备的最大速度。

● 质量等级

确定质量等级需要考虑用户在自己的试验装置上进行验证试验时再现的水平。质量等级取决于下列因素：

- 动平衡试验机的类型（硬性、刚性、柔性支架）
- 测量系统的精度
- 装配公差
- 关节轴承的径向和轴向间隙
- 纵向移位方向的角偏移

实地分析表明，这些因素加在一起可以导致 100% 的误差，由此产生了动平衡等级的如下定义：

- 生产厂家动平衡： G16
- 用户验证试验： G32

Balancing of cardan shafts

The balancing of cardan shafts is performed to equalize eccentrically running masses, thereby preventing vibrations and reducing the load on any connected equipment.

Balancing is carried out in accordance with ISO Standard 1940, "Balance quality of rotating rigid bodies". According to this standard, the permissible residual unbalance is dependent on the operating speed and mass of the balanced components.

Our experience has shown that balancing is not normally required for rotational speeds below 500 rpm. In individual cases this range may be extended or reduced, depending on the overall drivetrain characteristics.

Cardan shafts are balanced in two planes, normally to a balancing accuracy between G16 and G40.

● Balancing speed

The balancing speed is normally the maximum speed of the system or vehicle.

● Quality grade

In defining a quality grade, it is necessary to consider the reproducibility levels achievable in the customer's own test rig during verification testing. Quality grades are dependent on the following variables:

- type of balancing machine (hard, rigid or soft suspension)
- accuracy of the measuring system
- mounting tolerances
- joint bearing radial and axial play
- angular backlash in longitudinal displacement direction

Field analyses have shown that the sum of these factors may result in inaccuracies of up to 100 %. This observation has given rise to the definition of the following balancing quality grades:

- producer balancing: G16
- customer verification tests: G32

G 40	汽车车轮、轮圈、整套车轮、 驱动轴 、弹性装安六缸和多缸高速四冲程发动机（汽油机和柴油机）的曲轴驱动件，汽车、卡车和机车发动机的曲轴驱动件。	Car wheels, wheel rims, wheel sets, drive shafts Crankshaft/drives of elastically mounted fast four-cycle engines (gasoline or diesel) with six or more cylinders Crankshaft/drives of engines of cars, trucks and locomotives
G 16	特殊要求的驱动轴（螺旋桨轴、 万向轴 ），破碎机械的转动件，农业机械的转动件、汽车、卡车和机车发动机（汽油机和柴油机）的个别转动件，特殊要求的六缸和多缸发动机的曲轴驱动件。	Drive shafts (propeller shafts, cardan shafts) with special requirements Parts of crushing machines and agricultural machinery Individual components of engines (gasoline or diesel) for cars, trucks and locomotives Crankshaft/drives of engines with six or more cylinders under special requirements
G 6,3	机床部件，船用主汽轮机齿轮（海运用），风机、飞轮、离心分离机的转子，造纸机械滚筒、印刷滚筒、组装式航空发动机转子泵用叶轮。	Parts of process plant machines Marine main turbine gears (merchant service) Fans, flywheels, centrifuge drums Paper machinery rolls, print rolls Assembled aircraft gas turbine rotors Pump impellers
G 2,5	汽轮机和燃气机的转子，发电机的刚性转子，离心式压缩机的转子，机床驱动件，特殊要求的中型和大型的电机转子，小型电机转子，汽轮机驱动的水泵转子。	Gas and steam turbines, including marine main turbines (merchant service) Rigid turbo-generator rotors Turbo-compressors, turbine-driven pumps Machine-tool drives Computer memory drums and discs

引自 DIN ISO 1940/第一部分
Extract from DIN ISO 1940/Part 1

万向轴的选型

根据长期的计算与试验结果，设计万向轴必须考虑排除任何可能对人员和设备本身造成伤害的因素或采取其它适当的步骤。（见安装与维护/安全指南）。

本章所述的选型步骤只是一般性的建议，最终设计请与我们的工程师商定。

万向轴根据以下条件选型：

1. 万向轴规格
2. 根据轴承寿命选型
3. 工作可靠性
4. 工作角度
5. 速度
6. 长度尺寸
7. 相联设备的轴承载荷

1. 万向轴的规格

T_{CS} = 功能性极限转矩 (Nm)

在达到这一最大允许转矩的状态下，万向轴可以在一定的极限频率内受载，而不会因万向轴任何功能部位永久变形而影响其工作能力。在 T_{CS} 状态下，可承受 1000 次的载荷变化（短期疲劳强度有限寿命），而不会对轴承寿命造成多大的影响。

屈服转矩

该转矩可对万向轴造成永久性的塑性变形，甚至可能导致整个传动系统被迫停车。

T_{DW} = 交变疲劳转矩 (Nm)

在此交替变化的转矩作用下，万向轴可以保持永久稳固，焊有平衡块的 687 系列万向轴各项数值低一些。

对于承受疲劳转矩的万向轴，必须检查法兰连接的承载能力。

T_{DSch} = 振动疲劳转矩 (Nm)

在此转矩状态下，万向轴在振动负荷中可保持永久稳固地运行，

$$T_{DSch} = 1,4 \cdot T_{DW}$$

L_C = 轴承寿命系数

轴承寿命系数考虑了轴承的动态寿命 C_{dyn} （见 DIN/ISO 281）以及关节的几何系数 R 。各种规格万向轴的 L_C 值已在表中列出（见参数表）。

选择万向轴时，其轴承寿命和工作强度应分开考虑，同时还必须根据载荷状况将交变疲劳转矩 T_{DW} 或振动疲劳转矩 T_{DSch} 考虑在内。

The designing of cardan shafts must exclude all possible danger to persons and material by secured calculation and test results as well as other suitable steps (see installation and maintenance/safety instructions).

The selection procedure described in this chapter is only a general recommendation. Please consult our engineers for the final design.

The selection of a cardan shaft should be based on the following conditions:

1. Specifications of cardan shafts
2. Selection by bearing life
3. Operational dependability
4. Operating angles
5. Speed
6. Length dimensions
7. Load on bearings of the connected units

1. Specifications of cardan shafts

T_{CS} = Functional limit torque [Nm]

Up to this maximum permissible torque a load may be applied to a cardan shaft for a limited frequency without the working capability being affected by permanent deformation of any cardan shaft functional area. Up to 1000 load changes (short time fatigue strength for finite life) are capable of being sustained with T_{CS} . This does not result in any unpermissible effect on bearing life.

Yield torque

This torque level leads to irreversible plastic deformation of the cardan shaft which could result in a failure of the complete drive system.

T_{DW} = Reversing fatigue torque [Nm]

At this torque the cardan shaft is permanently solid at alternating loads. The values for cardan shafts of series 687 with welded balancing plates are lower. With a fatigue torque of this order the transmission capacity of the flange connection must be checked.

T_{DSch} = Pulsating fatigue torque [Nm]

At this torque the cardan shaft is permanently solid at pulsating loads.

L_C = Bearing capacity factor

The bearing capacity factor takes into consideration the dynamic service life C_{dyn} (see DIN/ISO 281) of the bearings and the joint geometry R . The L_C -values for the different shaft sizes are shown in the tables (see data sheets).

For selecting a cardan shaft the bearing life and the operating strength must be considered separately. According to the load state the reversing fatigue torque T_{DW} or the pulsating fatigue torque T_{DSch} must also be taken into consideration.

2. 根据轴承寿命选型

根据轴承寿命系数 L_C 选型

万向轴的轴承寿命 L_h 取决于轴承寿命系数，其值按下列公式计算：

$$L_h = \frac{L_C \cdot 10^{10}}{n \cdot \beta \cdot T^{10/3} \cdot K_1}$$

如果已知所需的轴承寿命，关节的大小就可以根据轴承寿命系数 L_C 计算出来：

$$L_C = \frac{L_h \cdot n \cdot \beta \cdot T^{10/3} \cdot K_1}{10^{10}}$$

L_C 值可以查表获得（见参数表）。

L_C = 轴承寿命系数
 n = 工作转速 (r/min)
 β = 工作倾角 ($^\circ$)
 T = 工作转矩 (kNm)
 K_1 = 冲击系数

如果工作参数基于工作循环，可以计算出更为精确的使用期限。

当原动机为内燃机时，可能会出现尖峰载荷，必须通过系数 K_1 给予考虑。各种原动机的系数 K_1 值如下：

电机/透平机		$K_1 = 1,00$
汽油发动机	(4 缸以上)	$K_1 = 1,15$
柴油机	(4 缸以上)	$K_1 = 1,20$

上列数值为一般数值。如果使用弹性联轴器，其冲击系数会降低。原则上，应按电机及联轴器生产厂家提供的数据取值。

3. 工作可靠性

如果已知负载周期，就可以确定工作可靠性。万向轴在常规工作条件下的计算寿命必须达到或超过所要求的使用寿命。

负载周期通常无法确定。在这种情况下，请与我们的工程师联系，利用我们 50 余年生产万向轴的经验，可以提供最佳选择。

我们计算的依据是尖峰转矩 T 和可能出现的最大尖峰转矩 T_{SP} 。

尖峰转矩是根据工作类型和转矩的特点来确定的，它应该低于相应的转矩 T_{DSch} 和 T_{DW} 。

2. Selection by bearing life

by bearing capacity factor L_C

The bearing life L_h of a cardan shaft depends on the bearing capacity factor and is based on the following formula:

If the desired bearing life L_h is given, the joint size can be calculated by the bearing capacity factor L_C .

The L_C -values can be taken from the tables (see data sheets).

L_C = Bearing capacity factor
 n = Operating speed [rpm]
 β = Operating deflection angle [$^\circ$]
 T = Operating torque [kNm]
 K_1 = Shock factor

If operating data are based on a duty cycle, a more precise durability can be calculated.

Drives with internal combustion engines may cause torque peaks that must be considered by factor K_1 .

Electric motor/turbine		$K_1 = 1,00$
Gasoline engine	4 cyl. and more	$K_1 = 1,15$
Diesel engine	4 cyl. and more	$K_1 = 1,20$

The values shown in the tables are general values. If a flexible coupling is used, the shock factor is lower. Principally the data of the motor and/or coupling manufacturer must be observed.

3. Operating dependability

The operating dependability can be determined if a certain duty cycle is given. The calculated service life of a cardan shaft under normal working conditions has to achieve or exceed the required service life.

Duty cycles are often not available. In this case, please contact our engineers and make use of our more than 50 years of experience as a manufacturer of cardan shafts. We will provide an optimal selection.

Our calculations are based on the peak torque T and the maximum peak torque T_{SP} that may occur.

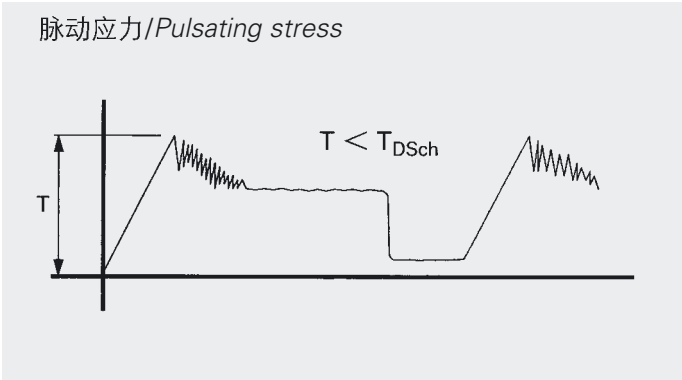
The peak torque is determined according to the kind of operation and the torque characteristic. It should be lower than the corresponding torques T_{DSch} and T_{DW} .

$$T_N \cdot K = T < T_{DSch} \text{ or } T_{DW}$$

万向轴的选型

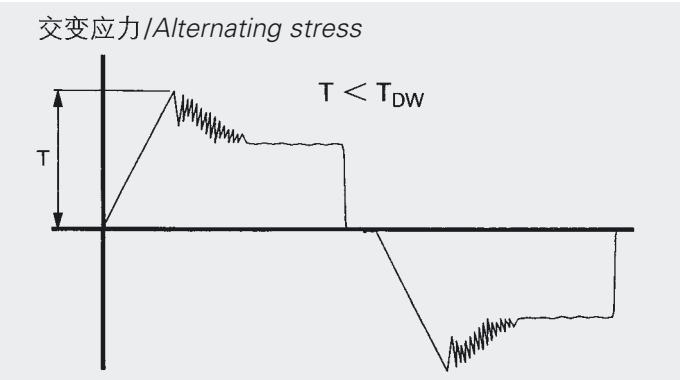
Selection of cardan shafts

典型的转矩类型：



最大尖峰转矩 T_{SP} 在系统中很少出现，只有在事故等特殊情况下才会发生。最大尖峰转矩 T_{SP} 不应超过万向轴的功能极限转矩 T_{CS} 。

Typical types of torques:



The maximum peak torque T_{SP} is the extremely rare occuring torque of the system (crash, emergency case).
This maximum torque (T_{SP}) should not exceed the functional limited torque T_{CS} of the cardan shaft.

$$T_{SP} < T_{CS}$$

式中， T_{SP} = 最大尖峰转矩 [Nm] T_{SP} = Maximum peak torque [Nm]
 T_N = 公称转矩 [Nm] T_N = Nominal torque [Nm]
 T_{CS} = 功能极限转矩 [Nm] T_{CS} = Functional limit torque of the cardan shaft [Nm]
(见参数表) (see data sheets)

使用系数 K

使用系数的概略值见下表

轻型冲击负荷 /light shock load: K = 1,1 - 1,5	
选配万向轴的设备	driven machine
离心泵	Centrifugal pumps
发电机(连续负荷)	Generators (continuous load)
输送机(连续负荷)	Conveyors (continuous load)
小型风机	small ventilators
机床	Machine tools
印刷机	Printing machines
中等冲击负荷 /medium shock load: K = 1,5 - 2	
选配万向轴的设备	driven machine
离心泵	Centrifugal pumps
发电机(非连续负荷)	Generators (non-continuous load)
输送机(非连续负荷)	Conveyors (non-continuous load)
中型风机	medium ventilators
木工机床	Wood handling machines
小型造纸及纺织机	small paper and textile machines
多缸式活塞泵	Pumps (multi-cyl.)
多缸式压缩机	Compressors (multi-cyl.)
线材与棒材轧机	Road and bar mills
机车主传动	Locomotive primary drives
重型冲击负荷 /heavy shock load: K = 2 - 3	
选配万向轴的设备	driven machine
大型风机	Large ventilators
船舶传动	Marine transmissions
压延机传动	Calender drives
运输辊道	Transport roller tables
小型夹送辊	small pinch rolls
小型轧管机	small tube mills
大型造纸及纺织机	heavy paper and textile machines
单缸压缩机	Compressors (single-cyl.)
单缸活塞泵	Pumps (single-cyl.)

重型冲击负荷 /heavy shock load: K = 2 - 3	
选配万向轴的设备	driven machine
搅拌机	Mixers
斗轮输送机	Bucket wheel reclaimers
弯曲机	Bending machines
压力机	Presses
旋转式钻井机	Rotary drilling rigs
机车辅传动	Locomotive secondary drives
连轧机	Continuous casters
起重机主传动	Crane drives
特重冲击负荷 /extra heavy shock load: K = 3 - 5	
选配万向轴的设备	driven machine
连续工作辊道	continuous working roller tables
中型钢轧机	Medium section mills
连续板轧机及初轧机	continuous slabbing and blooming mills
连续重型管轧机	continuous heavy tube mills
可逆工作辊道	reversing working roller tables
振动输送机	Vibration conveyors
破鳞机	Scale breakers
矫直机	Straightening machines
冷轧机	Cold rolling mills
卷取机	Reeling drives
初轧机	Blooming stands
极重冲击负荷 /extreme shock load: K = 5 - 10	
选配万向轴的设备	driven machine
轧机送料辊道	Feed roller drives
打包机传动	Wrapper roll drives
厚板剪切机	Plate-shears
可逆板轧机及初板轧机	reversing slabbing and blooming mills

安全指南

我们的产品开发与试验采用了当今最先进的技术与工艺，我们的各种技术资料中所列举的产品特性均经过严格而精心的验证。

产品尚可具有其他特性，但须经我们书面确认。

对我们的产品在某一应用范围的各项要求应由购买方确定。我们根据买方提供的数据绘制的图纸及其相关技术文件买方有责任进行核实确认，并检查产品对其应用是否适宜。我们提供的选型和产品规格应全部作为建议看待。

为了防止对人身和财产的危害，在使用和装卸万向轴时，必须严格遵守以下安全规则。

- 万向轴运转时对人身和设备有危险的地方，用户或操作人员必须按照欧共体对机械运行的规定安装安全装置。
- 安装、组装和维护工作必须由有资格的人员进行。
- 万向轴的各项参数，如最大转矩、转速、倾角、长度等，使用时均不得超过原定的范围。
- 凡未经我们同意自行对万向轴进行了任何形式的改动，我们将不再对产品保证期内产品发生的问题承担责任。

GWB 交付的万向轴是即可安装的完整部件，已经进行了润滑，并按技术资料要求完成了动平衡和喷漆。



万向轴的动平衡状态切勿改变。

超过范围的不平衡状态可能导致不均匀运转，还可能造成关节及与万向轴相联设备上轴承的过早磨损，甚至还可能发生万向轴断裂，使其中间轴部分从车辆或机器上甩出去的事故，当然这种情况极为罕见。

**注意人身安全！
安装安全保护装置！**

更详细的安全规则已编入有关小节。

Safety instructions

Our products have been developed and tested according to the latest state-of-the-art engineering. The characteristic features of the products which are described in our information material or which we specified in writing were subjected to proper and careful inspection.

Other features are possible but they are subject to our written confirmation.

The knowledge of the various demands on our product for a particular application lies with the purchaser, and it is incumbent on him to verify the drawings and documents prepared by ourselves on the basis of the data made available by the purchaser and to examine the suitability of the product for the proposed use. The selection of shaft types and the specification of their sizes on our part shall in all cases be considered as a recommendation only.

When using and handling cardan shafts, the following safety instructions must be strictly observed to prevent damage to persons and property.

- *Where danger to people or material can be caused by rotating cardan shafts, a safety device has to be installed by the user and/or operator.*
Observe the EC Regulations for Machinery!
- *Installation, assembly and maintenance work may only be carried out by **qualified personnel**.*
- *The operating data of the cardan shafts, such as max. torque, speed, deflection angles, lengths etc. must never be exceeded.*
- *If cardan shafts are in any way altered **without our written consent, they are no longer covered by our warranty.***

GWB cardan shafts are delivered as complete units ready for installation. The shafts are greased for operation. They are balanced and painted in accordance with the technical information sheets.



The balance state of a cardan shaft must on no account be altered.

An inadmissible out-of-balance of a shaft may result in uneven running and premature wear of the joints and the bearings of the units to which the cardan shaft is connected. In extreme cases the cardan shaft could break and shaft components could be thrown at speed from the vehicle or machine.

**Danger of injury!
Provide a safety guard device!**

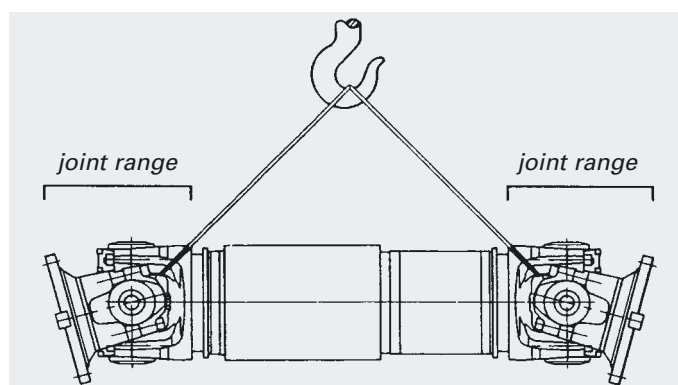
Further safety instructions are incorporated in the relevant items.

运输和储存

⚠ 为了防止人身受伤或万向轴损坏，一定要保证万向轴的安全运输和储存。

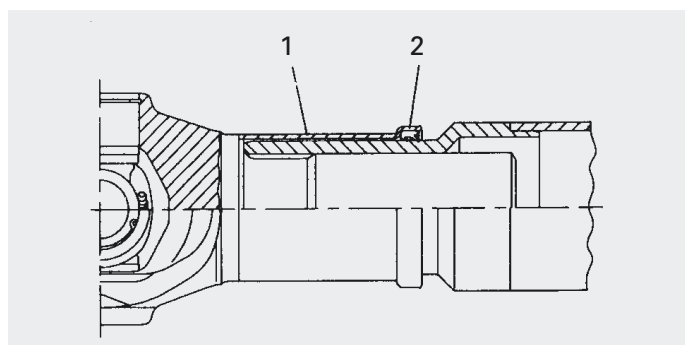
请考虑以下防范措施：

- 使用结实的尼龙绳或吊运带。若用钢丝绳，与其接触的边棱处要进行防护，以免钢绳受伤。
- 万向轴应平置搬运（见图）。非平置搬运时，必须采取额外的防范措施，防止花键部件分离。
注意人身安全！



- 在提升和放置万向轴时，很可能活动部件（法兰叉头、十字轴）倾斜伤人。
切不可用手触摸关节！小心挤伤手！

- 运输和储存时要避免碰撞和震动。
- 在存放和搬运万向轴时，要防止花键保护罩（1）和密封圈（2）受力被挤压坏。



系列 / Series 587, 687, 688

- 使用适应的框架和底盘来存放，这样可避免法兰叉头受载。
- 使用木块和楔子，防止万向轴滚动。
- 垂直放置时，要将万向轴垂直固定好，以防倾倒。
- 将万向轴存放在干燥的场所。

Transport and storage

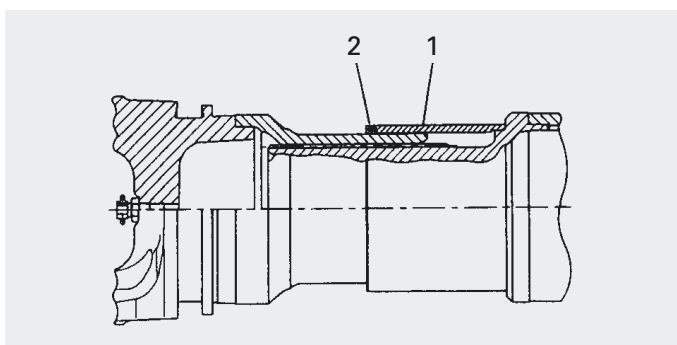
⚠ *To prevent injuries of persons and damage to the cardan shafts always make sure that the shafts are safely transported and stored.*

Please consider the following precautions:

- *Use strong nylon ropes or lifting belts. When using steel cords, protect the edges.*
- *Cardan shafts should be transported in a horizontal position (see illustration). For non-horizontal transportation additional precautions must be taken to prevent the splined parts from separating.*
Danger of injury!

- *When lifting or putting down the shaft, the moving parts (flange yoke and journal cross) may tilt and lead to injuries.*
Keep hands away from the joint!
Danger of crushed hands!

- *Avoid bumps and knocks during transport and storage.*
- *Do not store or handle the shaft with any stress or load on the spline protection (1) or the seal (2).*



系列 / Series 390, 392, 393

- *Use appropriate frames or racks for storage, so that the flange yokes are not loaded.*
- *Use chocks or blocks to prevent cardan shaft from rolling.*
- *Secure shaft against falling over if it is stored in a vertical position.*
- *Keep cardan shafts in a dry place.*

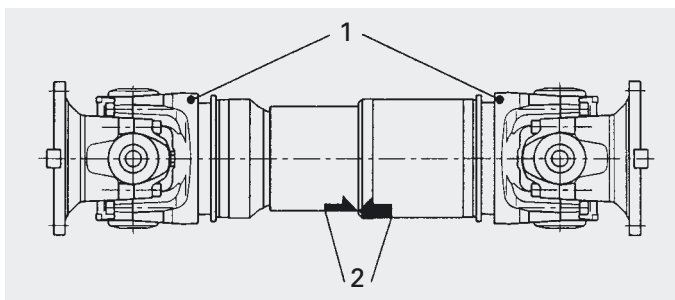
安 装 / 拆 卸

安 装

 为保证万向轴性能达到样本资料中规定的要求，必须保持其交货状态而不得进行任何改动。

凡运转中的万向轴有可能对人身和设备造成伤害的地方，使用人员必须采取相应的安全措施。

- 必须提供适当的安全装置（如：设置坚固的护板等），防止其部件甩出。**注意人身安全！**
- 万向轴属弹性体和挠性体。为控制工作转速必须计算出它们的挠性振动和临界挠曲速度。最大允许工作速度必须足够地低于一阶临界挠曲速度。
- 为了保障万向轴平稳安全运行，其 $n \times \beta$ （转速 $\times$ 倾角）之值不得超过该规格万向轴所对应的某一范围。有关问题请与我们联系。
- 为了保证安全连接，万向轴及连法兰的端面和定位止口处不得有灰尘，油污或油漆等污物。
- 搬运万向轴要特别小心。活动的法兰叉头很容易造成**人身伤害！**
- 检查万向轴的叉头（1）的位置，注意轴身上的两个箭头标记（2），它们必须对准成一条线。花键副是定配的，不可调换并应防止变形。



- 安装前如有运输固定装置，应将其除去。如有疑问请与供应商联系。
- 检查轴向和径向跳动及安装法兰止口和相连设备的配合情况（见连接法兰部分）。
- 不得转动带有装配杆的万向轴关节，这样可能会损坏润滑油嘴或油压安全阀。
- 要使用规定质量（强度）等级的螺母和螺栓（见法兰螺栓连接）。

Installation/dismantling

Installation

 In order to guarantee the properties of the cardan shaft as described in the information brochure they must not be altered from its as-delivered state.

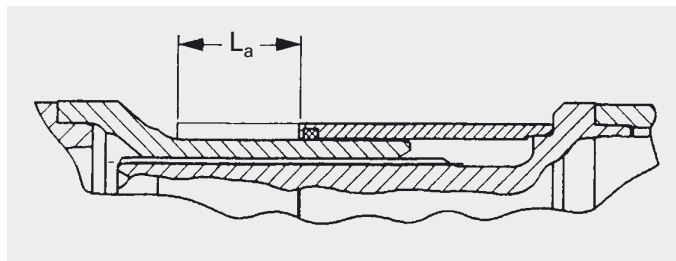
Whenever people or material might be endangered by rotating cardan shafts, the user must take for the relevant safety precautions.

- Suitable safety devices (e.g. catch bows, solid safety guards) must be provided to prevent the parts of the shaft from being thrown around.
- **Danger to life!**
- Cardan shafts are elastic and flexural bodies. Their flexural vibration and their critical bending speed must be calculated. The maximum permissible operating speed must be sufficiently below the critical bending speed of the first order.
- For the smooth running and safety of the shaft the $n \times \beta$ value (speed $\times$ deflection angle) of the relevant shaft size must not be exceeded. Please contact us.
- The faces and the centering diameter of the shaft flanges and companion flanges must be free of dust, grease or paint to guarantee a safe connection.
- Be careful when handling the cardan shaft. Freely moving flange yokes may cause **INJURIES!**
- Check position of yokes (1) of the shaft. Observe the arrow markings (2). They must be in alignment. The splines are fitted to one another and must not be exchanged or distorted.

- Before installation remove the transport retainer device, if present. In case of doubt please contact the supplier.
- Check the axial and radial run-out as well as the spigot fit of the mounted flanges and the connected units (see companion flanges).
- Do not turn the joints of the cardan shafts with assembly levers because this may damage the grease nipples or relief valves.
- Use nuts and bolts of the prescribed quality (strength) (see flange boltings).

安装与维护

- 只能使用供应商所要求性能的螺母和螺栓。
- 应使用力矩扳手将螺栓按顺时针方向均匀地拧紧（见法兰螺栓连接）。
- 在使用**无伸缩**万向轴时，为适应法兰定位安装，其中一个连接单元必须是**游动的**。必须考虑到由温度变化而造成的长度变化。其值可用一个适当的连接轴承来补偿。
- 使用**伸缩**万向轴时，连接法兰必须**接在**相联设备的接轴上。
- 存放了 6 个月以上的万向轴，必须在使用前重新润滑（见维护与保养）。
- 往万向轴身上喷漆时，要将密封滑动区域（伸缩量 L_a ）覆盖起来。



- 万向轴的喷漆建议执行我们的油漆标准（请向我们询问）。
- 保护涂有聚酰胺纤维涂层的花键副（花键套和连套叉头），以防
 - 受热
 - 接触溶剂
 - 机械损伤
- 在清洗万向轴时，不要使用具有腐蚀性的化学清洗剂或高压水流或蒸汽喷射。
- 万向轴能够在 -25°C (-13°F) 至 $+80^{\circ}\text{C}$ ($+176^{\circ}\text{F}$) 的温度范围内使用。但在有限时间内和不经常的情况下，使用温度可高达 $+120^{\circ}\text{C}$ ($+248^{\circ}\text{F}$)。若使用温度超出此范围，请与我们联系。

拆卸

- 拆卸前要采取措施，防止万向轴花键副分离
- 在拆卸连接法兰之前，要将万向轴固定以防掉下。法兰叉头容易倾斜，**注意人身安全！**
- 遵守万向轴运输、储存和安装指南的要求。

- Only use nuts and bolts in accordance with the supplier's specification.
- The bolts should be evenly tightened crosswise with a torque wrench (see flange boltings).
- When using cardan shafts **without length compensation**, one of the connecting units must be **flexible** in order to be fitted over the flange pilot. Variations in length which may be caused by temperature changes must be allowed for by a suitable connecting bearing.
- If cardan shafts **with length compensation** are used, the companion flanges must be firmly **fitted** on the shafts of the connected units.
- Cardan shafts that have been stored for more than 6 months must be re-lubricated before use (see Maintenance).
- For spray-painting the cardan shaft, make sure that the sliding range of the seal (length compensation L_a) is covered.

- For spray-painting the shaft we recommend our paint standards (Please ask for them).
- Protect rilsan-coated splines (sleeve muff or sleeve yoke) against
 - heat
 - solvents
 - mechanical damage.
- When cleaning cardan shafts, do not use aggressive chemical detergents or pressurized water or steam jets because the seals may be damaged and dirt or water may penetrate.
- Cardan shafts can be used in a temperature range between -25°C (-13°F) and $+80^{\circ}\text{C}$ ($+176^{\circ}\text{F}$), up to $+120^{\circ}\text{C}$ ($+248^{\circ}\text{F}$) but only for limited periods and not on a frequent basis. Please contact us if the operating temperature deviates from these values.

Disassembly

- Before disassembly protect the cardan shaft from spline separation.
- Secure the cardan shaft against falling down before pulling it off the companion flange. The flange yoke may tilt. **Danger of injury!**
- Observe the directions for transport, storage and installation of cardan shafts.

法兰螺栓

GWB 可应用户要求提供法兰螺栓组件。

表列螺栓长度只有在 $2 \times G$ 尺寸不超过相应法兰厚度 G 的两倍时才适用（见数据表）。如要使用较长的螺栓，则需检查螺栓能否从万向关节一侧插入。

我们推荐使用的螺栓组件包括：

DIN931/10.9 带有短螺纹的六角头螺栓（其光杆部分长度大于法兰厚度）；

DIN980/934-10 的自锁螺母。

这类螺栓安装在

- 关节一侧，其局部凹陷直径 C 不影响螺栓转动；
- 连接法兰一侧，我们建议将凹陷直径 C_1 设计为可以卡住螺栓头。

螺栓的插入参见表格

所有螺栓必须按规定的扭矩拧紧。表格中所提供的紧固扭矩 T_a 是基于 90% 的弹性极限利用率（端面齿则为 80%），以及适用于螺栓稍微涂油的情况。

不可往螺栓螺母上涂敷二硫化钼或其它润滑脂。若使用经防锈处理的螺栓螺母（如 Dacromet 500），请与我们联系。

最大允许公差为 DIN 25202 B 级。

Flange bolting

The flange bolting set can be supplied by GWB on request.

The bolt lengths given in the tables are only suitable if the dimension $2 \times G$ corresponding to the double the flange thickness G is not exceeded (see data sheets). If longer bolts are used, check whether the bolts can still be inserted from the joint side.

We recommended a bolting set consisting of:

Hexagon bolt with short thread similar to DIN 931/10.9 (shaft length greater than flange thickness)

Self-locking nut, similar to DIN 980/934-10.

The bolts allow fitting

- partially from the joint side, i.e. the recessed diameter c does not prevent the bolt from turning;
- from the companion flange side. We recommend designing the recessed diameter c_1 so as locate the bolt head.

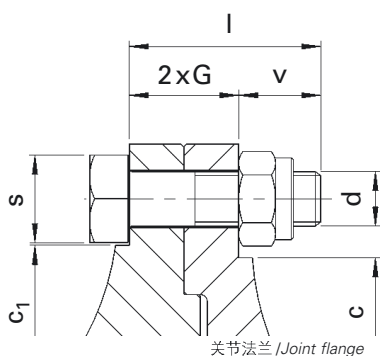
See tables for insertion of bolts.

All bolts must be tightened with the specified torque. The tightening torques T_a given in the table are based on a 90% (80% Hirth-serration) utilization of the elastic limit and apply to slightly oiled bolts.

Do not use molybdate paste or any other grease on the bolts and nuts. In case of corrosion protected bolts and nuts (e.g. Dacromet 500), please contact us.

Max. permissible tolerance of DIN 25202 class B.

系列 / Series 587/687/688



六角螺栓：
相当于 DIN 931/10.9
的短形螺栓
六角螺母：
相当于 DIN 980/10
的自锁螺母

Hexagon bolt:
short model similar to
DIN 931/10.9
Hexagon nut:
similar to DIN 980/10
Self-locking

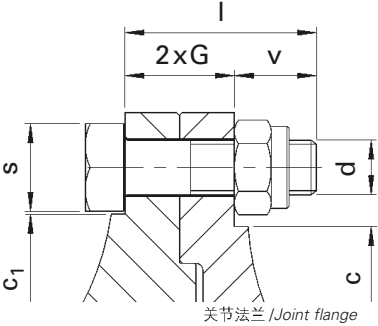
Shaft size		587.50		587.55		587.60
Flange dia. A	mm	225	250	250	285	285
Ta	Nm	295	405	405	580	580
c	mm	158	176	168	202	202
c ₁	mm	171	189	189	214	214
d	–	M 16	M 18	M 18	M 20	M 20
l	mm	50	60	60	64	64
v	mm	20	24	24	24	24
s	mm	24	27	27	30	30
i ¹⁾	–	8	8	8	8	8
Bolts inserted from joint side		yes	yes	yes	yes	yes

1) = 螺栓孔数目
Ta = 螺栓连接的拧紧力矩
可应用户要求提供专用力矩扳手

1) = Number of bolt holes
Ta = Tightening torque of bolting
Special torque wrenches supplied
on request

Shaft size		687/688.15	687/688.20	687/688.25	687/688.30	687/688.35	687/688.40	687/688.45	687/688.55	687/688.65
Flange dia. A	mm	100	120	120	120	150	150	180	180	225
Ta	Nm	35	69	69	69	120	120	190	120	190
c	mm	64	76	76	76	100	100	119	119	158
c ₁	mm	69,5	84	84	84	110,3	110,3	132,5	132,5	171
d	–	M 8	M 10	M 10	M 10	M 12	M 12	M 14	M 14	M 16
l	mm	23	27	27	27	33	33	40	40	50
v	mm	9	11	11	11	13	13	16	16	20
s	mm	13	17	17	17	19	19	22	22	24
i ¹⁾	–	6	8	8	8	8	8	8	8	10
Bolts inserted from joint side		Normal design	yes	yes	yes	yes	yes	yes	yes	yes
Bolts inserted from joint side		Wide angle design	–	–	–	–	–	yes	yes	–

系列 / *Series 390*
标准螺栓连接 / *Standard bolting*



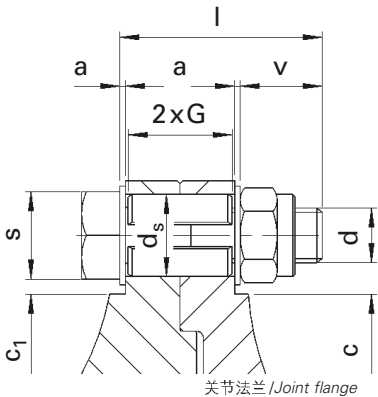
六角螺栓:
相当于 DIN 931/10.9
的矩形螺栓
六角螺母:
相当于 DIN 980/10
的自锁螺母
Hexagon bolt:
short model similar to
DIN 931/10.9
Hexagon nut:
similar to DIN 980/10
Self-locking

Shaft size		390.60	390.65	390.70	390.75	390.80
Flange dia. A	mm	285	315	350	390	435
Ta	Nm	580	780	780	1000	1500
c	mm	202	230	256	295	332
c ₁	mm	214	247	277	308	343
d	–	M 20	M 22	M 22	M 24	M 27
l	mm	64	70	75	85	95
v	mm	24	26	25	29	31
s	mm	30	32	32	36	41
i ¹⁾	–	8	8	10	10	10
Bolts inserted from joint side		yes	yes	yes	yes	yes

1) = 螺栓孔数目
T_a = 螺栓连接的拧紧力矩
可应用户要求提供专用力矩扳手

1) = Number of bolt holes
T_a = Tightening torque of bolting
Special torque wrenches supplied
on request

系列 / *Series 587/390*
销钉连接
Dowel pin connection



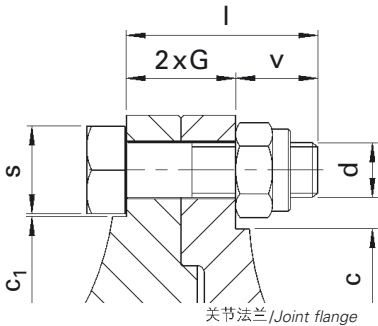
六角螺栓:
相当于 DIN 931/8.8
的矩形螺栓
六角螺母:
相当于 DIN 980/10
的自锁螺母
销钉: DIN 1481
垫圈: DIN 7349
Hexagon bolt:
short model similar to
DIN 931/8.8
Hexagon nut:
similar to DIN 980/10
Self-locking
Dowel pin: DIN 1481
Washer: DIN 7349

Shaft size		587.50	587.55	390.60	390.65	390.70	390.75	390.80
Flange dia. A	mm	250	250	285	315	350	390	435
Ta	Nm	130	130	200	200	280	280	400
c	mm	176	168	202	230	256	295	332
c ₁ ²⁾	mm	176	176	198	228	254	294	332
d	–	M 14	M 14	M 16	M 16	M 18	M 18	M 20
l	mm	65	65	75	75	90	95	110
d _s	mm	25	25	28	30	32	32	35
l _s	mm	32	32	36	40	45	50	60
v	mm	17	17	23	19	24	23	30
a	mm	6	6	6	6	8	8	8
s	mm	22	22	24	24	27	27	30
i ¹⁾	–	4	4	4	4	4	4	4
Bolts inserted from joint side		yes	yes	yes	yes	yes	yes	yes

1) = 螺栓孔数目
2) = 无定位销连接
T_a = 螺栓连接拧紧力矩
可应用户要求提供专用力矩扳手

1) = Number of bolt holes
2) = Dowel pin connection without
locking
T_a = Tightening torque of bolting
Special torque wrenches supplied
on request

系列 / *Series 587/190*
超短型设计 / *Super short designs*



六角螺栓:
相当于 DIN 931/10.9
的矩形螺栓
六角螺母:
相当于 DIN 980/10
的自锁螺母
Hexagon bolt:
short model similar to
DIN 931/10.9
Hexagon nut:
similar to DIN 980/10
Self-locking

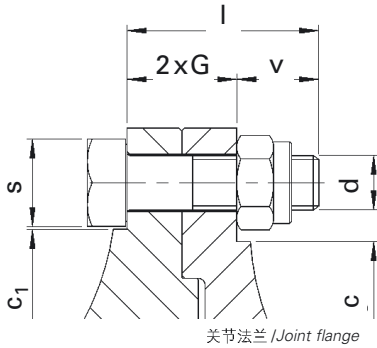
Shaft size		587.50	190.55	190.60	190.65	190.70
Flange dia. A	mm	275	305	348	360	405
Ta	Nm	190	295	405	405	580
c	mm	213,5	237,5	274	288	324,5
c ₁	mm	225	250	285	299	338
d	–	M 14	M 16	M 18	M 18	M 20
l	mm	50	50	60	60	65
v	mm	15	20	24	24	21
s	mm	22	24	27	27	30
i ¹⁾	–	10	10	10	10	10
Bolts inserted from joint side		yes	yes	yes	yes	yes

1) = 螺栓孔数目
T_a = 螺栓连接的拧紧力矩
可应用户要求提供专用力矩扳手

1) = Number of bolt holes
T_a = Tightening torque of bolting
Special torque wrenches supplied
on request

系列 / Series 392/393

端面键法兰连接 / Flange connection with face key



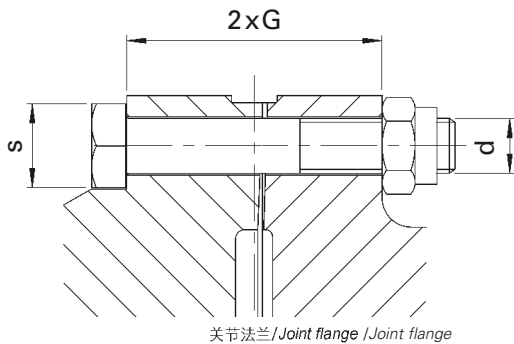
六角螺栓:
相当于 DIN 931/10.9
的短形螺栓
六角螺母:
相当于 DIN 980/10
的自锁螺母

Hexagon bolt:
short model similar to
DIN 931/10.9

Hexagon nut:
similar to DIN 980/10
Self-locking

Shaft size		392.50	392.55	392.60	392.65	392.70	393.75	393.80	393.85	393.90
Flange dia. A	mm	225	250	285	315	350	390	435	480	550
Ta	Nm	295	405	580	780	780	1000	1500	2000	2000
c	mm	152	170	193	224	254	286	315	334	420
c ₁	mm	171	190	214	247	277	307	342	377	444
d	–	M 16	M 18	M 20	M 22	M 22	M 24	M 27	M 30	M 30
l	mm	60	75	80	90	100	110	120	130	140
v	mm	20	25	26	26	30	30	36	36	40
s	mm	24	27	30	32	32	36	41	46	46
i ¹⁾	–	8	8	8	10	10	10	16	16	16
Bolts inserted from joint side		no	no	no	no	no	no	no	no	no

Baureihe / Series 492/498



六角螺栓:
相当于 DIN 931/10.9
的短形螺栓
六角螺母:
相当于 DIN 980/934-10
的自锁螺母

Hexagon bolt:
short model similar to
DIN 931/10.9

Hexagon nut:
similar to DIN 980/934-10
Self-locking

系列 / Series 492

Shaft size		492.60	492.65	492.70	492.75	492.80	492.85	492.90
Flange dia. A	mm	285	315	350	390	435	480	550
Ta	Nm	180	270	270	375	375	525	720
d	–	M 14	M 16	M 16	M 18	M 18	M 20	M 22
s	mm	21	24	24	27	27	30	32
i ¹⁾	–	10	10	12	12	16	16	16
Bolts inserted from joint side		no	no	no	no	no	no	no

系列 / Series 498

Shaft size		498.00	498.05	498.10	498.15	498.20	498.25	498.30	498.35	498.40	498.45	498.50	498.55	498.60
Flange dia. A	mm	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
Ta	Nm	900	900	900	1800	1800	3150	3150	3150	5400	5400	5400	8200	8200
d	–	M 24	M 24	M 24	M 30	M 30	M 36	M 36	M 36	M 42 x 3	M 42 x 3	M 42 x 3	M 48 x 3	M 48 x 3
s	mm	36	36	36	46	46	55	55	55	65	65	65	75	75
i ¹⁾	–	20	20	24	24	24	24	24	24	20	20	20	20	20
Bolts inserted from joint side		no	no	no	no	no	no	no	no	no	no	no	no	no

1) = 螺栓孔数目
Ta = 螺栓连接的拧紧力矩
可应用户要求提供专用力矩扳手

1) = Number of bolt holes
Ta = Tightening torque of bolting
Special torque wrenches supplied
on request

连接法兰

一般情况下，万向轴通过连接法兰与被驱动装置相连。连接法兰材料的抗拉强度必须达到 750 N/mm²。

万向轴的精确运转要求控制连接法兰端面和止口的轴向和径向跳动公差（见表格）。

除了定位止口深度 FA 和配合尺寸 CA 以及键槽深度 tA 和宽度 bA 以外，连接法兰的尺寸与相应万向轴法兰尺寸也要一致，其数据可以从下表中查出。

为了更好的拧紧螺栓，我们建议在连接法兰背面螺孔部位设计螺栓头安装平面，并且从连接法兰背面一侧插入螺栓。为此法兰背面空间的距离至少应达到 Z_{min}。如果无法从连接法兰背面一侧将螺栓插入，我们建议使用螺栓柱。

系列 / Series 587

Shaft size		587.50		587.55		587.60
A	mm	225	250	250	285	285
F _A	mm	4-0,2	5-0,2	5-0,2	6-0,5	6-0,5
G	mm	15	18	18	20	20
X and Y	mm	0,05	0,06	0,06	0,06	0,06
C _A h6	mm	140	140	140	175	175

系列 / Series 687/688

Shaft size		687/688.15	687/688.20	687/688.25	687/688.30		687/688.35		687/688.40		687/688.45		687/688.55		687/688.65	
A	mm	100	120	120	120	150	150	180	150	180	180	225	180	225	180	225
F _A	mm	2,3-0,2	2,3-0,2	2,3-0,2	2,3-0,2	2,3-0,2	2,3-0,2	2,3-0,2	2,3-0,2	2,3-0,2	2,3-0,2	4-0,2	2,3-0,2	4-0,2	2,3-0,2	4-0,2
G	mm	7	8	8	8	10	10	12	10	12	12	15	14	15	15	15
X und/and Y	mm	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05
C _A h6	mm	57	75	75	75	90	90	110	90	110	110	140	110	140	110	140

系列 / Series 390

Shaft size		390.60	390.65	390.70	390.75	390.80
A	mm	285	315	350	390	435
F _A	mm	6-0,5	6-0,5	7-0,5	7-0,5	9-0,5
G	mm	20	22	25	28	32
X and Y	mm	0,06	0,06	0,06	0,06	0,06
C _A h6	mm	175	175	220	250	280

系列 / Series 392/393

Shaft size		392.50	392.55	392.60	392.65	392.70	393.75	393.80	393.85	393.90
A	mm	225	250	285	315	350	390	435	480	550
F _A	mm	4,5-0,5	5-0,5	6-0,5	7-0,5	7-0,5	7-0,5	9-0,5	11-0,5	11-0,5
G	mm	20	25	27	32	35	40	42	47	50
X and Y	mm	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06	0,06
C _A f8	mm	105	105	125	130	155	170	190	205	250
b _A K8	mm	32	40	40	40	50	70	80	90	100
t _A +0,2 mm	mm	9	12,5	15	15	16	18	20	22,5	22,5

Companion flanges

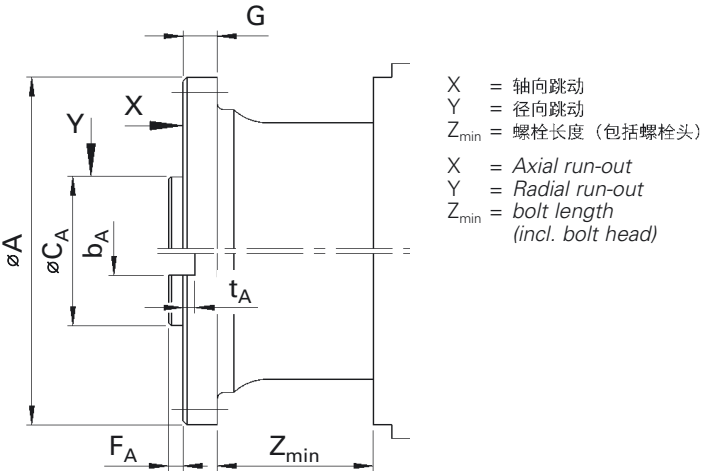
In general, cardan shafts are connected to the driven units by companion flanges. The companion flange material must have a tensile strength of 750 N/mm².

The accurate running of a cardan shaft requires certain tolerances for the axial and radial run-out (see tables).

The dimensions of the companion flanges correspond with those of the same size of cardan shafts, except for the centring depth F_A and the fit C_A, the depth of the keyway t_A and the width b_A. They can be taken from the following tables.

For better bolt locking we recommend designing the relief of the companion flange as a bolt head surface and inserting the bolt from the companion flange side. In this case the distance Z_{min} must be met between the flange and the adjacent housing.

If it is not possible to insert the bolts from the companion flange side, we recommend the use of stud bolts.



系列 / Series 587/ 190

超短型设计 / Super short designs

Shaft size		587.50	190.55	190.60	190.65	190.70
A	mm	275	305	348	360	405
F _A	mm	4-0,2	5-0,3	6-0,5	6-0,5	7-0,5
G	mm	15	15	18	18	22
X and Y	mm	0,06	0,06	0,06	0,06	0,06
C _A h6	mm	140	140	175	175	220

维护

维护间隔

万向轴可应用于多种不同类型的工厂，其工作条件各异。

我们建议要定期检查，在可能的条件下，与设备其它部件的维护工作协调进行，无论如何维护工作应当每年至少进行一次。

检查

- 检查法兰螺栓是否松动，并按规定扭矩重新拧紧（见法兰螺栓的固定）。
- 间隙检查。抬起关节和伸缩部分，查看是否有可见的间隙。

检查万向轴是否有异常响声、振动和其它不正常情况，如有异常要检修。

润滑

GWB 万向轴已用润滑脂进行过润滑，即可安装。

- 对万向轴再次润滑时，请使用符合 STD 4006-000 的标准润滑脂，比如，根据 DIN 51818 标准选用符合 KP2N-20/ DIN 51502 规格的锂基合成润滑脂。
不可使用含有二硫化钼添加剂的润滑脂！
原有的 GWB 标准润滑脂只能与矿物油类锂基合成润滑脂混合。
- 再次润滑之前应将润滑油嘴清理干净。
- 向油嘴注入油脂时压力不宜过大或注油过猛，最大允许润滑压力为 15 bar (15×10^5 Pa)。
- 如万向轴存放了6个月以上，使用前必须重新润滑。
- 清洗万向轴时，不得使用具有腐蚀性的化学清洗剂、高压水或蒸汽，以免破坏密封，使脏物或水侵入。万向轴清洗过后，必须重新润滑，直至润滑脂从密封处溢出为止。

十字轴总成

十字轴总成可以通过十字轴中部或轴承套底部的锥形油嘴 (DIN 71412) 注入润滑脂进行润滑。

十字轴总成在总工作时间达到其轴承计算寿命之前必须进行更换。

Maintenance

Maintenance intervals

Cardan shafts are used in a great variety of industrial plants with very different operating conditions.

We recommend inspections at regular intervals and, if possible, to coordinate them with maintenance work on other parts of the equipment. However maintenance work should be carried out once a year at least.

Inspection

- Check the flange bolts for tightness and retighten them with the prescribed torque (see flange boltings).
- Backlash inspection. By lifting the joints and the length compensation check the visible or tangible backlash.

Check the cardan shaft for any unusual noise, vibration or abnormal behaviour and repair the damage, if any.

Lubrication

GWB cardan shafts are lubricated with grease and ready for installation.

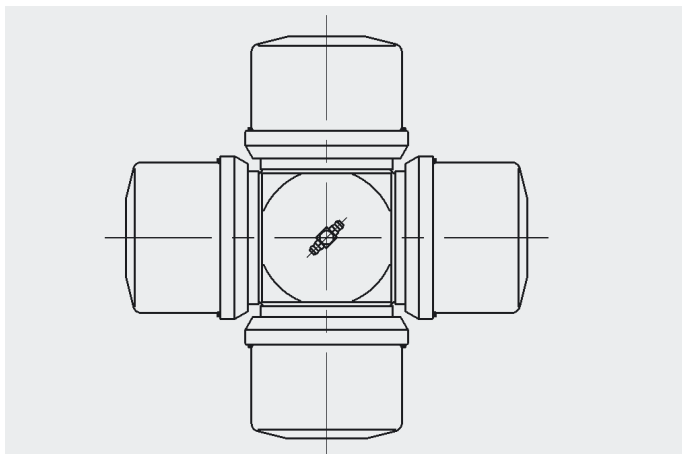
- For the re-lubrication of cardan shafts use a standard grease acc. to STD 4006-000 as for example a lithium-complex grease of the following specification only: KP2N-20 / DIN 51502 acc. to DIN 51818.
Do not use grease with molybdate additives!
Original standard GWB grease can be mixed only with lithium complex grease on mineral oil base.
- Clean the grease nipples before re-lubricating.
- Do not grease with too high a pressure or with hard jerks. Max. permissible lubricating pressure 15 bar (15×10^5 Pa).
- Cardan shafts that have been stored for more than 6 months must be re-greased before use.
- When cleaning cardan shafts, do not use aggressive chemical detergents or pressurized water or steam jets because the seals may be damaged and dirt or water may penetrate. After a cleaning the cardan shaft must be re-greased until the grease escapes out from the seals.

Journal cross assemblies

The journal cross assemblies may be re-lubricated via a conical grease nipple (DIN 71412) located in the middle of the cross or at the bottom of the bush.

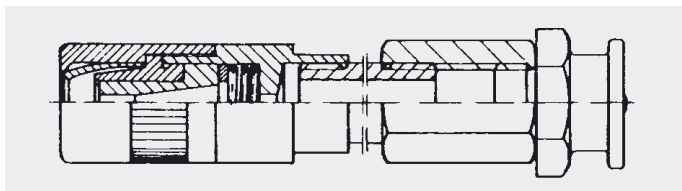
The journal cross assembly has to be replaced before the calculated bearing lifetime is reached.

中心润滑 Central lubrication



为保证十字轴轴承及密封的润滑,注油时必须达到润滑脂从轴承密封处溢出为止。

498 系列万向轴 (在特殊情况下也包括 390、392、393、492 系列) 必须根据 DIN 3404 标准,通过油泵进行润滑。图中所示即为万向轴上的嘴 (按照 DIN 71412) 与润滑油泵上油嘴之间的连接管 (见图)。



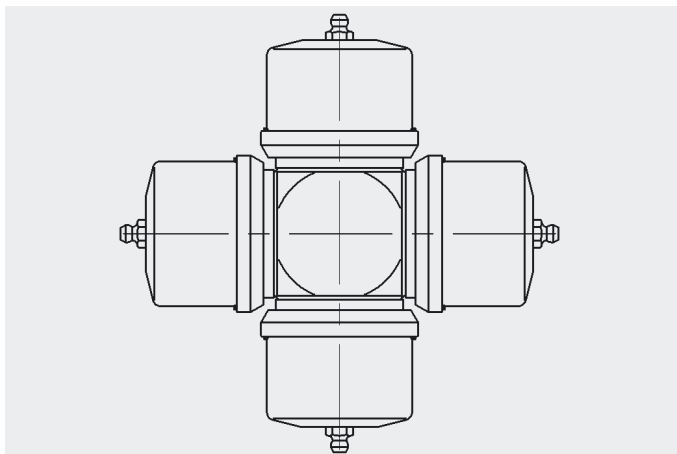
万向轴的伸缩

687/688 系列标准型的伸缩部位无需维护。390、392、393、492 和 587 系列以及 687/688 系列中的某些特殊设计,是根据 DIN 71412 标准通过带有锥形润滑油嘴的组合油气减压阀而进行的 (无自锁油嘴)。

498 系列的伸缩部位按 DIN 3404 标准通过扁平油嘴进行润滑。

- 不得拆除油气减压阀或用标准润滑油嘴代替。
- 操作前应拆除保护罩。
- 再次润滑应在万向轴最短压缩长度 L_z 状态下进行。

四点润滑 4 point lubrication



The seals of the journal cross bearings must be lubricated until the grease passes through from the seals of the bearings.

Cardan shafts of the series 498 (in special cases also the series 390, 392, 393, 492) must be lubricated via a flat grease nipple according to DIN 3404. The illustrated adapter pipe can be used as adapter between a conical grease nipple at the cardan shaft (acc. to DIN 71412) and a flat grease nipple connection at the grease pump (see illustration).

订货代号: 8605006 (90mm 长度)
8605025 (300mm 长度)
Order No.: 8605006 (90mm length)
8605025 (300mm length)

Length compensation

The length compensation of the standard version of the series 687/688 is maintenance-free. The length compensation of the series 390, 392, 393, 492, 190 and 587 as well as special designs of the series 687/688 is lubricated via a combined grease and air-relief valve with a conical grease nipple according to DIN 71412 (no self-locking grease nipple).

The length compensation of the series 498 is lubricated via a flat grease nipple according to DIN 3404.

- Grease and air-relief valves must not be removed or replaced by standard grease nipples.
- Protection caps should be removed from the grease nipples before operation.
- Re-lubricating should be done at the shortest compressed length L_z of the shaft.

再次润滑的周期

我们建议检修和再次润滑按如下周期进行：

系 列 <i>Series</i>	再次润滑间隔 / <i>Re-greasing intervals</i>	
	关节 / <i>Joints</i>	伸缩轴 / <i>Length compensation</i>
587	6个月 / <i>months</i>	6个月 / <i>months</i> ¹⁾
687/688	6个月 / <i>months</i>	无需维护 / <i>maintenance-free</i> 12个月 / <i>months</i> ¹⁾
190	6个月 / <i>months</i>	6个月 / <i>months</i>
390	6个月 / <i>months</i>	6个月 / <i>months</i>
392/393	6个月 / <i>months</i>	6个月 / <i>months</i>
492/498	3个月 / <i>months</i>	3个月 / <i>months</i>

1) 适用于伸缩型万向轴

1) for greasable length compensation

- 由于气温、脏物和水等不良影响可能需要缩短润滑周期，因此原则上我们建议润滑周期应根据特定的工作条件来调整。
- 如万向轴的花键轴（应用户要求）涂有塑料涂层，再次润滑的周期可根据使用情况延长至 12 个月。

Recommended re-greasing intervals

We recommend the following inspection and re-greasing intervals.

- Unfavourable effects like temperature, dirt and water may necessitate shorter lubricating intervals. Principally we recommend adapting the lubricating intervals to the individual operating conditions.
- For cardan shafts with plastic-coated splines (on request) the re-lubricating intervals may be extended, dependent on the application, to 12 months.

维 修

出于安全的原因，万向轴应该由 GWB 或 GWB 认可的厂家来维修。

万向轴是由我们的万向轴维护专家专业维修的。万向轴大修时使用崭新的部件。用户对万向轴的维修只有在紧急情况下方可进行，而且只限于万向轴转速不超过 500r/min 的情况。当转速超过 500r/min 时，万向轴要再次进行动平衡试验。

 如需更换十字总成，我们还建议同时更换此系列剖分式叉头万向轴的轴承盖螺栓。请按我们的安装与维修指南操作，并与我们联系。

Repair

For safety reasons, cardan shafts should only be repaired by GWB or by GWB-approved repair shops.

The repair of cardan shafts is carried in a professional manner by our cardan shaft service experts. The shafts are overhauled using original spare parts. The repair of cardan shafts by the user should only be made in emergency cases and only for such equipment where the operating speed of the shaft does not exceed 500 rpm. If the speed exceeds 500 rpm, the cardan shaft must be rebalanced.

 If journal cross assemblies are to be replaced, we also recommend replacing the bearing cap screws of shafts of the series with split yokes. Observe our installation and repair instructions. Please contact us.

环境保护

我们环境保护管理的特征之一就是致力于对产品的责任性，而且格外注重万向轴产品对环境的影响。我们的万向轴产品润滑剂无铅的成分，油漆涂层的溶剂含量很低，不含任何重金属，使用方法简单，用后可以回收重复利用。

Environmental Protection

A particular feature of our environmental protection management is dedication to product responsibility. As a result the effect of driveshafts on the environment is given particular attention. Thus our driveshafts are lubricated with lead-free grease, their paint finishes are low in solvents and free of heavy metals, they are easy to maintain and after use can be re-introduced into the re-cycling process.

询价与定货须知

Directions for inquiries and orders

特殊应用的选择程序

用于机车传动的万向轴

用于有轨车辆二阶系统的万向轴，应根据可能传输到轨道上的最大转矩（车轮打滑或粘附转矩）来进行选择。

用于吊车行走机构的万向轴

DIN 15400 标准考虑到了吊车行走机构的特殊工作条件，因此，可根据这一标准选择此类应用的万向轴。

用于船舶传动的万向轴

此类万向轴须经验收，必须与相应的分类协会的标准一致。用于其它类型客运车辆的万向轴

用于其它类型客运车辆的万向轴

用于游乐场设备、滑雪缆车或类似的缆车系统、电梯和有轨车辆的万向轴，必须遵守特许和监督部门的标准与规定。

在易爆环境下使用万向轴（Atex - 纲要）

在有爆炸危险的区域使用万向轴，我们可以提供符合 EC 94/9/EG 纲要标准的证书。属于“万向轴”产品的类别有：

- a) 一般应用:   II 3 GDc T6
- b) 改进性能的万向轴:   II 2 GDc T6

万向轴不应在如下操作条件下应用：

- 在驱动设备的临界弯曲速度范围内
- 在驱动设备的临界扭转速度范围内
- 工作角度超过规定的最大值（参见图纸）
- 动态和静态的工作扭矩超过规定极限（参见图纸）
- 速度 x 倾角 (n x β) 超过极限值（参见 GWB 样本）
- 使用时间超过关节轴承的计算寿命

万向轴的选择

万向轴的选择不仅取决于其最大允许转矩和连接型式，还有赖于各种其它因素。为了准确地确定和选用万向轴（参见万向轴选择一节）。

我们的工程师愿意借助电脑程序为您合理选择万向轴和关节提出建议。

为此，我们需要您提供以下数据。

- 万向轴的安装长度
- 万向节最大的角度要求
- 所需的伸缩量
- 万向轴的最大转速
- 轴端连接的详细尺寸
- 需要传输的最大转矩
- 需要传输的公称转矩
- 载荷的分布
- 对设备的说明及工作条件

Selection procedures for specific applications

Cardan shafts in railways transmissions

The selection of cardan shafts in the secondary system of rail vehicles must be based on the maximum torque that can be transmitted to the track (wheel slip or adhesion torque).

Cardan shafts in crane travel drives

The particular operating conditions for travel drives of cranes have been taken into consideration in the DIN-standard 15 450. Therefore, cardan shafts of those applications can be selected by using this standard.

Cardan shafts in marine transmissions

Those cardan shafts are subject to acceptance and must correspond to the standards on the respective classification society.

Cardan shafts for other forms of passenger conveyance

Cardan shafts used in amusement park equipments, ski lifts or similar lift systems, elevators and rail vehicles must be in accordance with the standards and specifications of the licence and supervisory authority.

Cardan shafts in explosive environments (Atex-outline)

For the use of cardan shafts in areas with danger of explosion an EC- conformity- certificate acc. to EC-outline 94/9/EG can be supplied. The possible categories for the product „cardan shaft“ are:

- a) in general:   II 3 GDc T6
- b) for cardan shafts with adapted features:   II 2 GDc T6

The cardan shaft should not be used under the following operating conditions:

- within the critical bending speed range of the drive
- within the critical torsional speed range of the drive
- operating angles which exceed the specified maximum (ref.: drawing)
- dynamic and static operating torques which exceed the specified limit (ref.: drawing)
- speed x deflection angle (n x β) condition which exceed the limit (ref.: GWB catalogue)
- usage time which exceeds the calculated bearing lifetime of the joint bearings

Selection of cardan shafts

The selection of a cardan shaft is not only determined by the maximum permissible torque of the shaft and the connections. It also depends on a variety of other factors. For the exact determination and selection of cardan shafts (see selection of cardan shafts).

Our engineers will be pleased to advise you on the selection of the right size of the shaft and joint by applying computer programmes.

For this purpose we require the following data from you:

- Installation length of the cardan shaft
- max. joint angle requirement
- the required length compensation
- the maximum rotation speed of the shaft
- the shaft end connection details
- the maximum torque to be transmitted
- the nominal torque to be transmitted
- the load occurrences
- description of the equipment and the working conditions

Spicer Gelenkwellenbau GmbH & Co. KG, E-Mail: industrial@gwb-essen.de, Internet: <http://www.gwb-essen.de>
P. O. Box 101362 – D-45013 Essen, Westendhof 5-9 – D-45143 Essen, Telephone: 0049 (0)201 / 8124-0

Home Country

GKN Service International GmbH
D-22525 Hamburg
Ottensener Str. 150
Tel. 0 40-54 00 90-0
Fax 0 40-54 00 90-43
E-Mail: gkn-ind.hamburg@gkndriveline.com
Internet: <http://www.gknservice.de>

Foreign Country

Argentina
Chilicote S.A.
Avda. Julio A. Roca 546
C1067ABN - Buenos Aires
Tel. 0054-11-4331-6610
Fax 0054-11-4331-4278
E-Mail: chilicote@chilicote.com.ar

Also responsible for Uruguay and Chile

Australia
Hardy Spicer Company P/L
1/9 Monterey Road
Dandenong South, Victoria 3175
Tel. 0061-3-97941900
Fax 0061-3-97069928
E-Mail: russel.plowman@hardyspicer.com.au

Austria
GKN Service Austria GmbH
Slamastraße 32
Postfach 36
A-1232 Wien
Tel.: 0043-1-6163880
Fax: 0043-1-6163828
E-Mail: info.gknwien@gkndriveline.com
Internet: <http://www.gkn.co.at>

Also responsible for Eastern Europe

Belgium
GKN Driveline Benelux B.V.
Rue Emile Pathéstraat 410
B-1190 Brussel (Vorst-Forest)
Tel.: 0032-2-3349880
Fax: 0032-2-3349892
E-Mail: industrie@gkndriveline.com

Brazil
Dana Industrial Ltda.
Av. Fukuichi Nakata,
451/539 - Piraporinha - Diadema
Sao Paulo – 09950-400
Tel.: 0055-11-40755700
Fax 0055-11-40755875
E-Mail: fabricao.santos@dana.com

China/P.R.C.
Dana China Shanghai Office
Cloud Nine Plaza, Room 1103, 11th floor
1118 Yan An Road West
Changning District
Shanghai, P.R. China, 200052
Tel.: 0086-2152585577
Fax: 0086-2152580660

Denmark
GKN Driveline Service Scandinavia AB
Baldershøj 11 A+B
DK-2635 Ishøj
Tel.: 0045-44866844
Fax: 0045-44688822
E-Mail: ids.copenhagen@gkndriveline.com
Internet: <http://www.gknservice.dk>

Finland
Oy Unilink AB
Lapinrinne 1
FIN-00180 Helsinki-Helsingfors
Tel.: 00358-9-6866170
Fax: 00358-9-6940449
E-Mail: unilink@unilink.fi

France
GKN Glenco SA
170 Rue Léonard de Vinci
F-78955 Carrières sous Poissy
Tel.: 0033-1-30068431
Fax: 0033-1-30068439
E-Mail: jeanmarie.schutz@gkndriveline.com

Greece
Sokrates Mechanics GmbH
205, Piraeus Str.
GR-11853 Athens
Tel. 0030-210-3471910
Fax 0030-210-3414554
E-Mail: sokrates@otenet.gr

Hellas Cardan GmbH
Strofi Oreokastrou
GR-56430 Thessaloniki
Tel. 0030-2310-682702
Fax 0030-2310-692972
E-Mail: hecardan@otenet.gr

Great Britain
GKN Driveline Ltd.
Higher Wood Croft, Leek
GB-Staffordshire ST13 5QF
Tel.: 0044-1538-384278
Fax: 0044-1538-371265
E-Mail: steve.witton@gkndriveline.com

India
XLO India Ltd.
80, Dr. Annie Besant Road
Worli, Mumbai 400018
Tel. 0091-22-24937451
Fax 0091-22-24934925
E-Mail: exloin@vsnl.com

Italy
Uni-Cardan Italia S.p.A.
Via Galileo Ferraris 125
I-20021 Ospiate di Bollate (MI)
Tel.: 0039-02-383381
Fax: 0039-02-38338236
E-Mail: ids.milano@gkndriveline.com
Internet: <http://www.unicardanitalia.it>

Japan
Nakamura Jico Co. Ltd.
10-10, Tsukiji, 3-chome
Chuo-Ku, Tokyo
Tel. 0081-3-3543-9772
Fax 0081-3-3543-9779

Netherlands
GKN Driveline Benelux B.V.
Haarlemmer Straatweg 155-159
NL-1165 MK Halfweg
Tel.: 0031-20-4070207
Fax: 0031-20-4070217
E-Mail: industrie@gkndriveline.com

Norway
GKN Driveline Service Scandinavia AB
Karihaugveien 102
N-1086 Oslo
Tel.: 0047-23286810
Fax: 0047-23286819
E-Mail: ids.oslo@gkndriveline.com
Internet: <http://www.gknservice.no>

Russia-Ukraine
KANDT KG (GmbH & Co.) APA GmbH
Robert-Koch-Straße 36
D-20249 Hamburg
Tel.: 0049-40-480 614 38
Fax: 0049-40-480 614 938
E-Mail: info@apa-hamburg.de
Internet: <http://www.kandt-hamburg.de>
Internet: <http://www.apa-hamburg.de>

Sweden
GKN Driveline Service Scandinavia AB
Stensåtravägen 9
P.O. Box 3100
S-12703 Skärholmen
Tel.: 0046-86039700
Fax: 0046-86039702
E-Mail: ids.stockholm@gkndriveline.com
Internet: <http://www.gknservice.se>

Switzerland
GKN Service International GmbH, Rösrath (D)
Zweigniederlassung Regensburg
Althardstraße 141
CH-8105 Regensburg
Tel.: 0041-1-871-60 70
Fax: 0041-1-871-60 80
E-Mail: gkn.switzerland@gkndriveline.com

Spain
Gelenk Industrial S.A.
Balmes, 152
E-08008 Barcelona
Tel. 00349-3-2374245
Fax 00349-3-2372580
E-Mail: javier.montoya@gelenkindustrial.com

South Africa
Mining Power Transfer (Pty) Ltd. (T/A)
Driveline Technologies
CNR. Derrick & Newton Roads
Spartan, Kempton Park
P. O. Box 2649
Kempton Park 1620
Tel. 0027-11-929-5600
Fax 0027-11-394-7846
E-Mail: richard@driveline.co.za

USA, Canada
Spicer GWB North America
Merovan Business Center
1200 Woodruff Road
Suite A-5
Greenville S.C. 29607
Tel. 001-864-987-0281
Fax 001-864-987-0295
E-Mail: dudley.potter@dana.com



SPICER GELENKWELLENBAU

SPICER® GWB™

Spicer Gelenkwellenbau GmbH
Westendhof 5-9
45143 Essen/Germany

Tel.: 00 49 (0) 2 01 – 81 24-0
Fax: 00 49 (0) 2 01 – 81 24-6 52
Web: www.gwb-essen.de

工业万向轴

Cardan Shafts

for Industrial Applications

