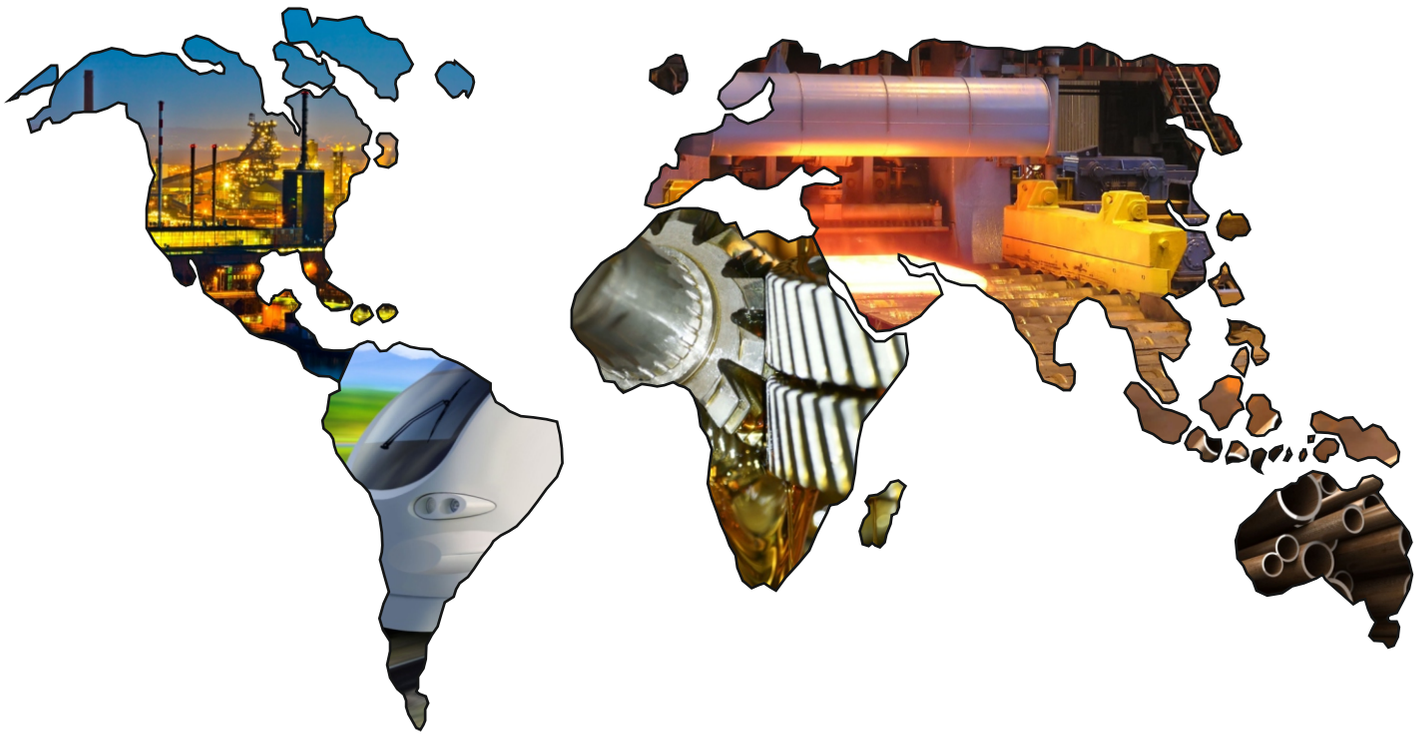
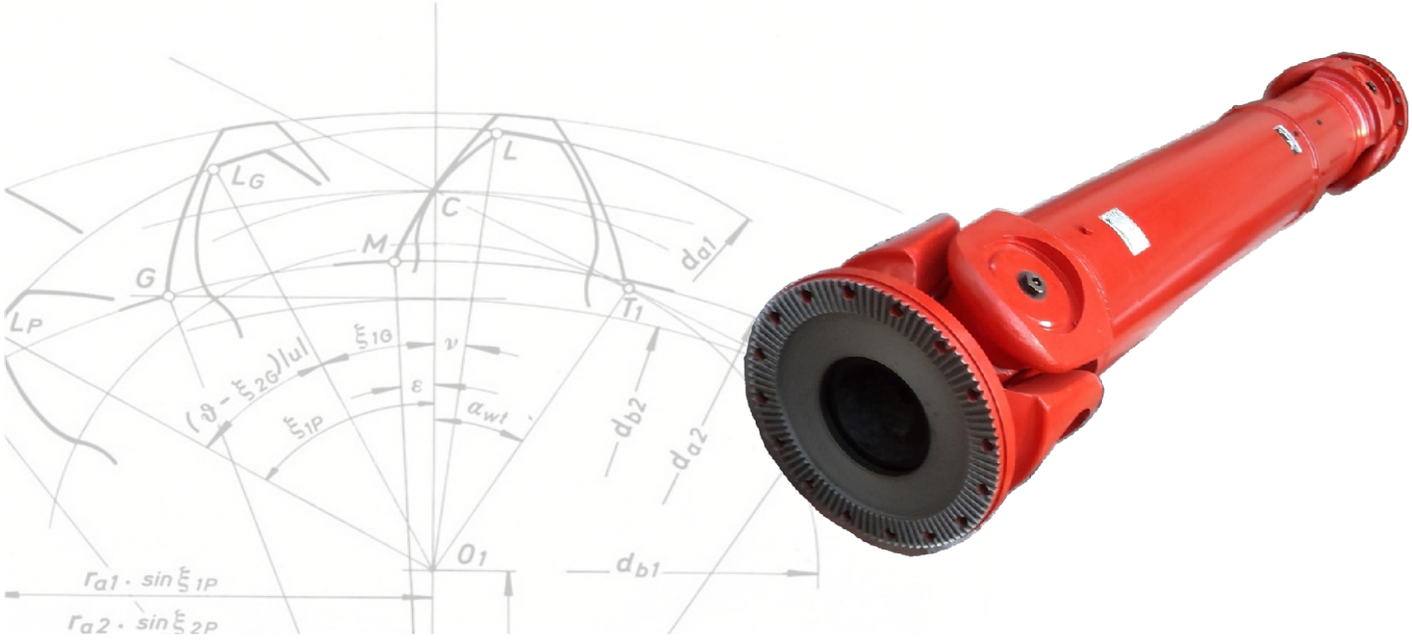
Green Gear Trasmissioni S.r.l.



CATALOGUE - UJS 2013 EDITION



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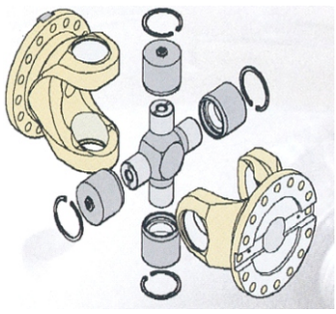
THE COMPANY

The Company Green Gear Trasmissioni Srl was founded with the goal and purpose to work side by side with customers to study and develop with them the most adequate solution. Thanks to our skills and experience, gained in more than twenty years, the Company guarantees high quality production at very competitive prices. Specializing in the production of power transmission equipment, the Company is able to offer the market the best technical and manufacturing solution on specific customer requirement. Although our products find particular application in rolling mills, our experience and flexibility enables us to meet the needs of any industrial field, both in terms of application, and in terms of final product quality level. The production area and offices are located in Asti (Piedmont), geographically well located: very close to suppliers, available within a radius of 200 km, and to seaports and airports for international transport.

PRODUCTION RANGE

1. **UNIVERSAL SHAFTS**
2. GEAR SPINDLES
3. GEAR COUPLINGS

The universal shaft enables motion transmission between driving and driven shafts, with wide working angles. The major characteristic of a universal shaft is having a transmission ratio instantly varying, when misalignment is different from zero. The transmission ratio average value however keeps uniform; to annul such variability, the connection is made by two universal joints, equalizing the angular velocity. Motion transmission is realized by a component connecting input and output shaft ends. This component is called journal cross. Generally speaking, the universal shaft operation can be distinguished into 5 single peculiarities:



1. Torque and speed
2. Possibility of changing the distance between input and output
3. Possibility of changing the angle between input and output
4. Stress for vibration
5. Torsional strength

Great part of the energy produced under these extreme operation conditions is partially absorbed by the universal shaft, and partially by the connected components.
Our universal shafts, along with a range of products covering any application of the market, offer excellent quality level, operational safety, long working life and low maintenance costs.
Especially in iron and steel field, with hard and heavy duty applications, our universal shafts are the correct choice for the following manufacturing features:

- Monolithic yoke
- Higher misalignment and minimum torsion under high loads
- Better capacity of bearing high torque loads
- Perfect design and construction of every single component
- Selected and heat treated materials
- First-rate weldings

Our universal shafts are custom-made, following the customer's requirements. They are welded by skilled personnel, who then check weldings by ultrasonic instruments, and proceed with dynamic balancing following G16 grade and DIN ISO 1940 standards. On demand, higher grade balancing can be realized. Then, the universal shafts are lubrified according to the customer's specifications and the application they are designed for, and they are finally painted.
We are able to meet every requirement by guaranteeing the best service, thanks to our flexible manufacturing process, to our full stock availability, and to our skilled collaborators.

WORKSHOP

Green Gear Trasmissioni Srl is specialized in the production of universal shafts, thanks to its executives' twenty-year wealth of experience, and ranks as a field specialist leader. Our universal shafts find their best application in the fields of steel rolling, rubber and plastic, paper, marine industry, lifting, shredding mills and drilling. Our customers are all over the world, mainly in Europe, Asia and America. We have solved application problems to many customers through manufacturing modifications and special innovative devices, currently being patented. Our target is maintaining our quality standards along with the highest technologic development, thanks to continuous research and daily studies with the best collaborators of the field, and customers' full satisfaction as the result of our serious involvement in finding the best solution.

The efforts focused on design improvement and technological innovations enable us to offer high-quality and first-rate performance universal shafts.

Our strengths are:
- Bearing longer lifetime;
- High precision in machining operations;
- High quality of balancing;

Our one of a kind sealing system assures an excellent lubrication and consequent bearing longer lifetime. The precision of splined shafts and sliding tubes is achieved by one-step broaching machines;
tooth surfaces are nitrided, so to guarantee their lifetime.
Our universal shafts are welded, checked by ultrasonic inspections and balanced within efficient manufacturing process.

Quality Program

The outstanding points of our quality program are:
- ❑ Operating under ISO 9001:2000 certification standards
- ❑ High-level managing system, with Pert and Gant diagram processing
- ❑ State of the art design and engineering instruments
- ❑ High-qualified personnel, devoted to the mutual goal of customers' complete satisfaction
- ❑ Most up-to-date instruments for manufacturing process check, along with production equipment accurately selected

SELECTION & DIMENSIONING

To select US.A and US.B universal shaft series, please follow the following procedure.
For remaining series, kindly contact us.

1. The universal shafts are selected according to their load features, calculated torques, bearing lifetime, rotation speed and working angle.

2. The calculated torque is given by the following formulas **(1), (2)** or **(1), (3):**

$$Tc = KT \quad \cdots\cdots\cdots\cdots \quad (1)$$

$$T = 9550 \frac{Pw}{n} \quad \cdots\cdots\cdots \quad (2)$$

$$T = 7020 \frac{P_H}{n} \quad \cdots\cdots\cdots \quad (3)$$

(1), (2) and (3) where:
Tc = Calculated torque [Nm]
T = Nominal torque [Nm]
Pw = Motor power [kW]
PH = Motor power [kW]
N = Rotation speed [rpm]
K = Service factor

3. Generally, the universal shafts are selected following the torque to be transmitted and the expected bearing lifetime.

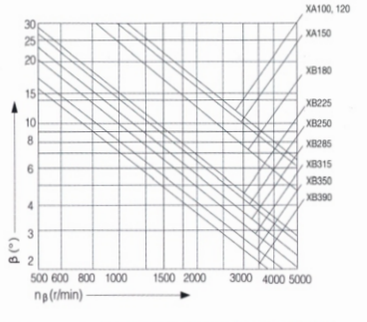
4. Check the torque following the formula **(4)**:
   Tc ≤ Tn or Tc ≤ Tf or Tc ≤ Tp.....**(4)**

5. Check the bearing lifetime following the formula **(5):** $L_N = \frac{K_L}{K_1 n \beta T^{10/3}} \times 10^{10} \geqslant L_{min}$

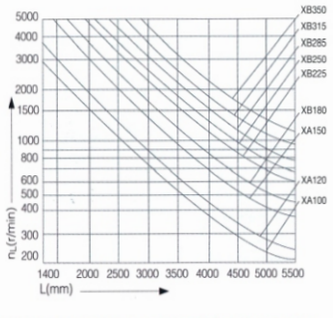
(4) where:
Tc = Calculated torque [Nm]
Tn = Nominal torque [Nm] (theoretically calculated, according to the following conditions, for example: shaft speed n = 10 rpm, angle ß = 3° and bearing lifetime LN = 5000 hours under load).
Tf = Fatigue torque suitable for alternate loads [Nm]
Tp = Pulsating torque suitable for pulsating loads [Nm]
Tp = 1.45 **Tf**

6. In case the universal shaft has both horizontal and vertical misalignment, its composite misalignment is calculated by the formula **(6):** $tg\,\beta = \sqrt{tg^2\beta_1 + tg^2\beta_2}$
   where ß is the composite angle, ß1 is the horizontal angular misalignment and ß2 the vertical one.

7. If the flange diameter is 390 mm or smaller, the formulas **(7)** and **(8)** shall be used to check the rotation maximum speed:
   nmax ≤ nß.....**(7)** maximum permissible speed on working angle – Figure 7.1
   nmax ≤ nL.....**(8)** maximum permissible speed on operating length – Figure 7.2



Maximum permissibile speed in relation to operating deflection angle **(figure 7-1)**



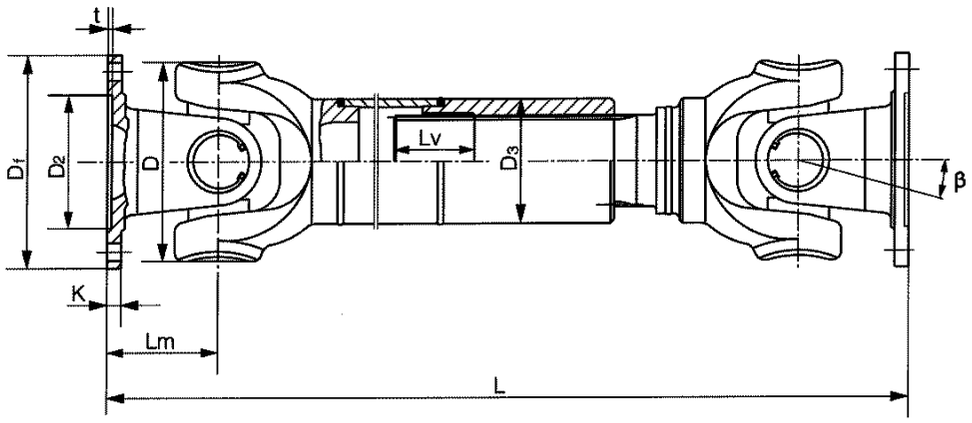
Maximum permissibile speed in relation to operating length **(figure 7-2)**

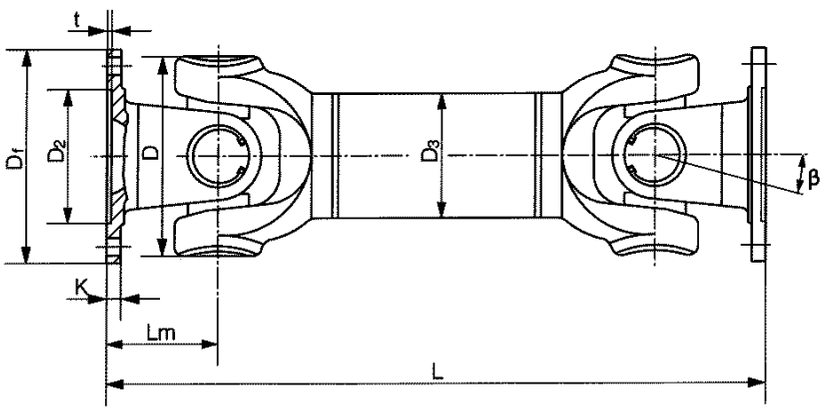
SERVICE FACTORS	DRIVEN EQUIPMENT	K
LIGHT SHOCK LOAD	Generators Centrifugal pumps Ventilators Wood handling machines Belt conveyers	1.1 ~ 1.3
MEDIUM SHOCK LOAD	Compressor (multi cyl.) Pumps (multi cyl.) Small section mills Continous wire mills Conveyer primary drives	1.3 ~ 1.8
HEAVY SHOCK LOAD	Paper machines Marine transmissions Transport roller tables Continous tube mills Continous working roller tables Medium section mills Compressors (single cyl.) Pumps (single cyl.) Mixers Presses Straightening machines Crane driver Ball mills	2 ~ 3
EXTRA HEAVY SHOCK LOAD	Crane accessory driver Crushers Reversing working roller tables Reeling drives Scale breakers Blooming stands	3 ~ 5
EXTREME SHOCK LOAD	Feed roller drives Plate shears	6 ~ 15

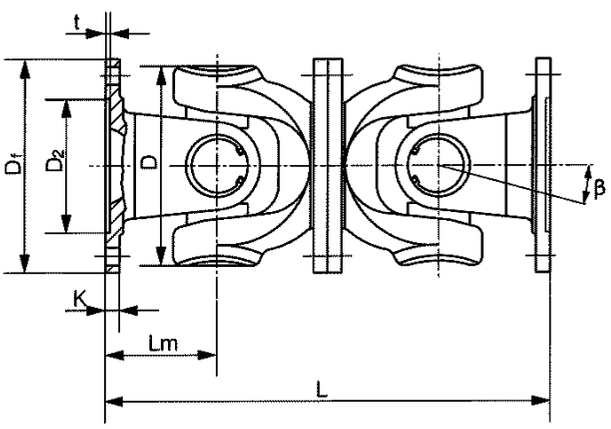
8. If the universal shaft speed line is higher than 7 m/s, a test of dynamic balancing is required, normally with precision class between G6.3 e G16. Complex variables may influence the grade of balancing.

LIGHT DUTY UNIVERSAL SHAFT – US - A SERIES

DESIGNS







LIGHT DUTY UNIVERSAL SHAFT - US.A SERIES

ENGINEERING DATA

SIZE DATA	US.A 58		US.A 65		US.A 75		US.A 90				US.A 100						US.A 120							
L min.	225	165	285	165	335	200	285	182	226	366	445	226	296	261	366	242	500	211	294	237	261	242	286	376
Lv	35	15	40	15	40	30	45	30	25	100	55	25	50	5	100	15	80	25	50	5	5	15	15	70
Tn [Nm]	**180**	**260**	**240**	**260**	**500**	**560**	**800**	**560**	**860**	**1800**	**1200**	**860**	**1100**	**1800**		**2700**	**2300**	**860**	**1100**	**1800**		**2700**	**3300**	**5200**
Tf [Nm]	**90**	**180**	**120**	**180**	**250**	**280**	**400**	**280**	**430**	**900**	**600**	**430**	**550**	**900**		**1350**	**1150**	**430**	**550**	**900**		**1350**	**1650**	**2600**
ß (°)	35	29	35	29	35	25	35	20	28	28	35	28	25	28		30	35	28	25	18	28	30	28	25
D	52	59	63	59	72	77	92	77	90	90	100	90	100	122	90	98	112	90	100	122		98	136	138
Df	DIN58		DIN65		DIN75		DIN90				DIN100						DIN120							
D1	47		52		62		74.5				84						101.5							
D2	30H7		35H7		42H7		47H7				57H7						75H7							
D3xd min.	38X1.5	35X3	45X1.5	51X2.5	51X2.5		63.5X2.5	51X2.5		60X2.5	76X2.5	51X2.5	51X2.5	76.2X2.4		60X2.5	89X2.5	60X2.5	60X2.5	90X4		75X3	90X4	
Lm	32	37	39	37	45	42	52	33		50.5	55	50.5	53	68	50.5	54	63	43	53	56	68	54	72	73
K	3.5	4	4.5	4	5.5		6	6.5		7	8	7		8	7		8				8.5	8		
t	1.5	2	1.7	2.8	2		2.5			2.8	2.5					2.6	2.5	2.7	2.5		3	2.6	3.1	2.8
n	4		4		6	4 6	4				6						8							
d	5		6.5	6	6	8 6	8.5	8			8.5	8					10.5	10						

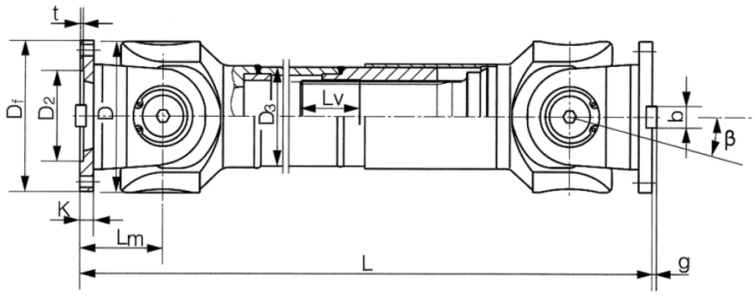
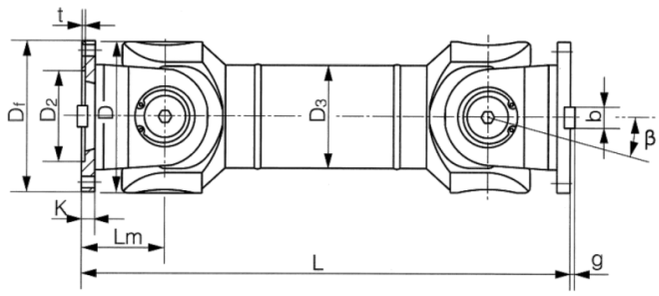
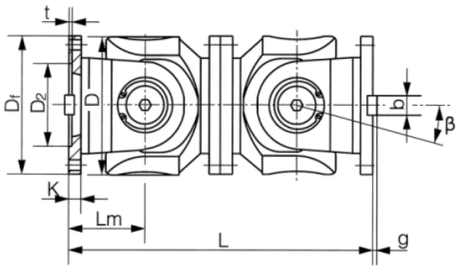
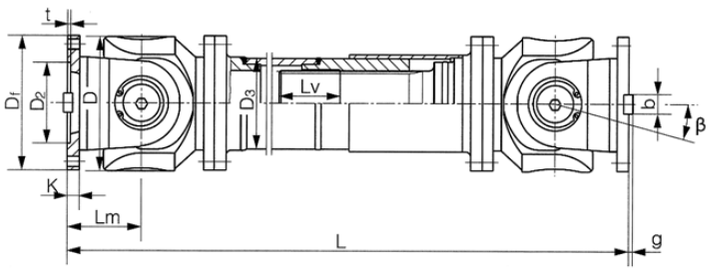
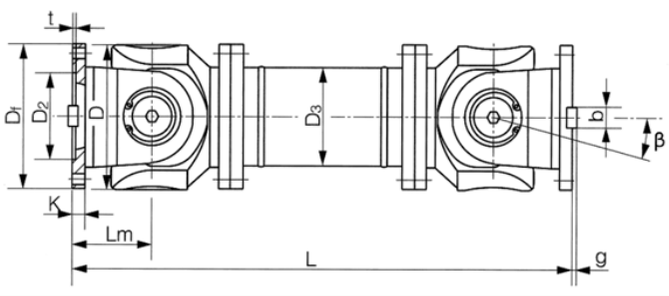
SIZE DATA	US.A 150							US.A 180										US.A 200	US.A 225				US.A 250
L min.	590	286	484	376	567	599	544	640	612	600	640	580	753	761	618	605	690	775	860	753	597	690	690
Lv	80	15	110	70	120	100	110	80	100		120	110	140		110			100	120	140	110	110	110
Tn [Nm]	**4500**	**3300**	**5000**	**5200**	**6200**	**10000**	**10500**	**8400**	**10000**		**12000**	**13000**	**16000**		**19000**		**27000**	**16000**	**22000**	**16000**	**19000**	**27000**	**27000**
Tf [Nm]	**2250**	**1650**	**2500**	**2600**	**3100**	**5000**	**5250**	**4200**	**5000**		**6000**	**6500**	**8000**		**9500**		**13500**	**8000**	**11000**	**8000**	**9500**	**13500**	**13500**
ß (°)	35	28	30	25		35	25	25	35		30	25	25	30	25	30	25	25	18	28	30	28	25
D	142	136	125	138	141	158	160	154	158		170	172	178				204	187	122		98	136	204
Df	DIN150							DIN180										DIN200	DIN225				DIN250
D1	130							155.5										170	196				218
D2	90H7							110H7										125H7	140H7				140H7
D3xd min.	102X3	90X4	76.2X2.4	90X4	85X5	100X6	120X4	120X3	100X6			120X4	112X7		120X6		140X5	112X10	140X6.5	112X7	120X6	140X5	140X5
Lm	85	72	78	73	86	89.5	90	87	96	90	100	95	96	100	96	100	110	110	120	96	96	110	110
K	10							12					14					14	15	15	15	15	18
t	3	3.3	3.1	3		3.3		4	3.3		3		3.4				2.9	4	5	5	5	5	6
n	8							8	8	10	8	8	10	8	10			8	8	8 12	8 12	8	8
d	13	12						15	14	16	14	16						17	17	16	16	16	18

NOTES:

1) Millimeters are used as measurement units except where indicated.
2) L = standard length, shorter or longer lengths are available on demand.
   Lv = standard length compensation where present.
   m = weight, referred to the dimensions of the catalogue.
   mL = weight each 100 mm of tube.
   Tn = nominal torque
   Tf = fatigue torque, i.e. the permissible torque calculated on the fatigue strength under reversible loads.
3) Please contact us for special dimensions.

MEDIUM DUTY UNIVERSAL SHAFT - US.B SERIES

DESIGNS

A	
B	
C	
D	
E	

MEDIUM DUTY UNIVERSAL SHAFT - US.B SERIES

DESIGNS & ENGINEERING DATA

TYPE	SIZE DATA	US.B 160	US.B 180	US.B 200	US.B 225	US.B 250	US.B 265	US.B 285	US.B 315	US.B 350	US.B 390	US.B 440	US.B 490	US.B 550	US.B 620
A	L	740	800	900	1000	1060	1120	1270	1390	1520	1530	1690	1850	2060	2280
	Lv	100		120	140					150	170	190		240	250
	m (kg.)	65	83	115	152	219	260	311	432	610	804	1122	1468	2154	2830
B	L	480	530	590	640	730	790	840	930	1000	1010	1130	1240	$1400	1520
	m (kg.)	44	60	85	110	160	180	226	320	440	590	820	1090	1560	2100
C	L	380	420	440	500	560	600	640	720	780	860	1040	1080	1220	1360
	m (kg.)	35	48	66	90	130	160	189	270	355	510	780	970	1330	1865
D	L	520	580	620	690	760	810	860	970	1030	1120	1230	1360	1550	1720
	m (kg.)	48	65	90	120	173	220	250	355	485	665	920	1240	1765	2390
E	L	800	850	940	1050	1120	1180	1320	1440	1550	1710	1880	2050	2310	2540
	Lv	100		120	140					150	170	190		240	250
	m (kg.)	70	92	126	168	238	280	340	472	660	886	1230	1625	2368	3135
	ß (°)	15													
	D	160	180	200	225	250	265	285	315	350	390	440	490	550	620
	Df	160	180 225	200 225	225 250	250 285	265	285 315	315 350	350 390	390 440	440 490	490	550	620
	D1	137	155 196	170 196	196 218	218 245	233	245 280	280 310	310 345	345 385	385 425	425	492	555
	D2 (H7)	90	90 105	90 105	105 105	105 125	125	125 130	130 155	155 170	170 190	190 205	205	250	280
	D3xd	114x10	127x10.5	146x11.5	159x10.5	180x12.5	194x13.5	203x14.5	219x16.5	245x19	273x21	325x25	351x30	402x32	426x40
	Lm	95	105	110	125	140	150	160	180	195	215	260	290	305	340
	K	16	17 20	18 20	20 25	25 27	25	27 32	32 35	35 40	40 42	42 47	47	50	55
	t	4	5 5	5 5	5 6	6 7	5	7 8	8 8	8 8	8 8	10 12	12	12	12
	n	8	8 8	8 8	8 8	8 8	8	8 10	10 10	10 10	16 16	16 16	16	16	16
	d	15	17 17	17 17	17 17	19 21	19	21 23	23 23	23 25	25 28	28 31	31	31	38
	b	20	24 32	28 32	32 40	40 40	40	40 40	40 50	50 70	70 80	80 90	90	100	100
	g	6.0	7.0 9.0	8.0 9.0	9.0 12.5	12.5 15.0	12.5	15.0 15.0	15.0 16.0	16.0 18.0	18.0 20.0	20.0 22.5	22.5	22.5	25
TORQUES	Tn (kNm)	21	28	40	56	80	100	120	160	225	320	500	700	1000	1250
	Tf (kNm)	10.5	14	20	28	40	50	58	80	110	160	250	350	500	625
	Tp (kNm)	15.2	20.3	29	40.6	58	72.5	87	116	159.6	232	362.5	507.5	725	906.2
	Tcs (kNm)	28	36	52	73	104	130	156	208	292.5	416	650	910	1300	1625

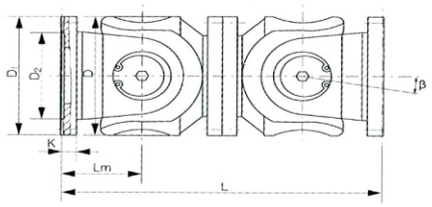
NOTES:
L = standard length, shorter or longer lengths are available on demand.
Lv = standard length compensation, where present.
m = weight, referred to the dimensions of the catalogue.
Tn = nominal torque
Tf = fatigue torque, i.e. the permissible torque calculated on the fatigue strength under reversible loads
Tp = Pulsating torque
Tcs = Limit torque

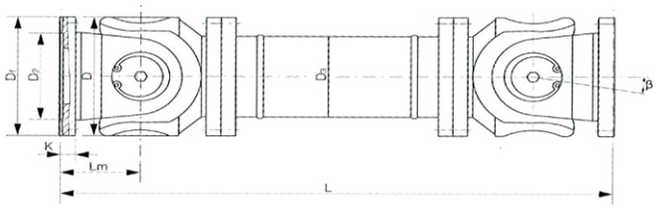
Please contact us for special dimensions.

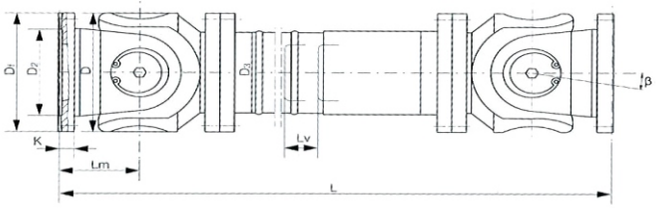
HEAVY DUTY UNIVERSAL SHAFT - US.C SERIES

DESIGNS

D E S I G N S







TIPO - TYPE:

C

GIUNTO CARDANICO, SENZA ALLUNGAMENTO

SHORT FLANGED DESIGN, WITHOUT LENGTH COMPENSATION

D

TIPO FLANGIATO, SENZA ALLUNGAMENTO

LONG FLANGED DESIGN, WITHOUT LENGTH COMPENSATION

E

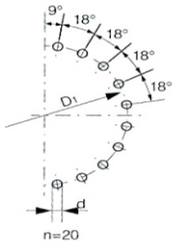
TIPO FLANGIATO, CON ALLUNGAMENTO

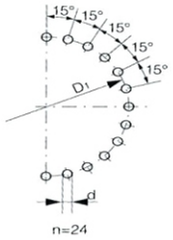
LONG FLANGED DESIGN, WITH LENGTH COMPENSATION

CARATTERISTICHE FLANGE
FLANGE BOLTHOLE AND DESIGN PATTERNS

Oltre alle flange riportate nel presente catalogo possiamo realizzare flange a disegno.

Besides the flanges brought back in this catalogue we can realize flanges to design.





Flangia con connessione a blocchi

IPC

Integral face **P**ad **C**onnection

Flangia con connessione a denti

HSC

Hirth **S**erration **C**onnection

HEAVY DUTY UNIVERSAL SHAFT - US.C SERIES

ENGINEERING DATA

TYPE	SIZE DATA	US.C 680	US.C 700	US.C 750	US.C 780	US.C 800	US.C 840	US.C 900	US.C 920	US.C 1000	US.C 1060	US.C 1100	US.C 1200
C	L	1540	1600	1840	1920		2120	2280		2380	2480	2500	2720
	m (kg.)	3150	3450	4300	4680	5050	6400	8420	8950	10600	12100	13500	16900
D	L	1940	2100	2400	2500		2680	2950		3130	3200	3300	3570
	m (kg.)	3220	3530	4500	2400	5800	7470	9980	10500	12300	14500	15800	19500
E	L	3230	3460	3620	4000		4250	4580		4770	4950	5100	5660
	Lv	250						300					
	m (kg.)	4880	5400	8000	8450	9070	11800	15900	16500	19900	22000	27500	34800
	ß (°)	15											
	D	680	700	750	780	800	840	900	920	1000	1060	1100	1200
	Df	680	700	750	780	800	840	900	920	1000	1060	1100	1200
	D^1	635		695	725	745	775	835	855	915	980	1015	1100
	$D^{2\ (H9)}$	550	570	610	640	660	710	740	760	840		920	1000
	D^3	560		620	660			750		790	800	850	900
	Lm	385	400	460	480		530	570		595	620	625	680
	K	70		95			110	120		130			
	n	24								20			
	d	26		31		36	38			50	45	50	58
TORQUES													
	Tn (kNm)	**1640**	**1750**	**2250**	**2500**	**2670**	**3100**	**3800**	**4050**	**5200**	**6500**	**6900**	**9000**
	Tf (kNm)	**980**	**1050**	**1350**	**1500**	**1600**	**1860**	**2280**	**2430**	**3120**	**3900**	**4140**	**5400**

NOTES:

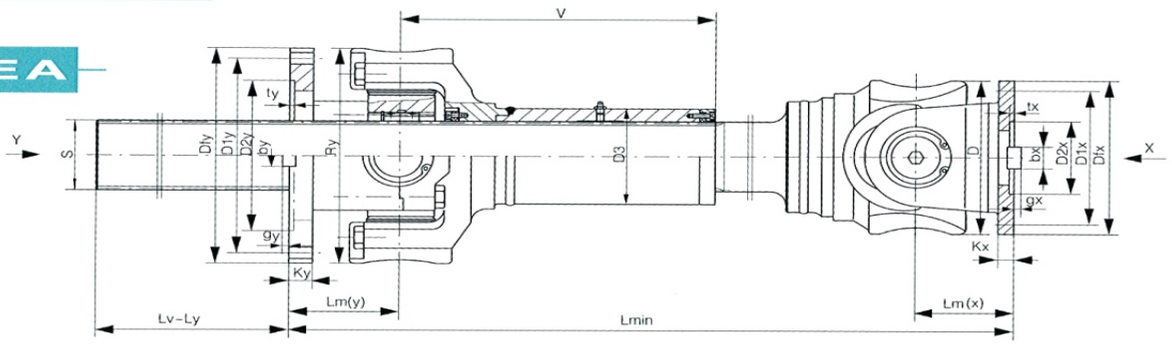
1) Millimeters are used as measurement units except where indicated.
2) L = standard length, shorter or longer lengths are available on demand.
   Lv = standard length compensation where present.
   m = weight, referred to the dimensions of the catalogue.
   mL = weight each 100 mm of tube.
   Tn = nominal torque
   Tf = fatigue torque, i.e. the permissible torque calculated on the fatigue strength under reversible loads.
3) Please contact us for special dimensions.

TUNNEL UNIVERSAL SHAFT - US.F SERIES

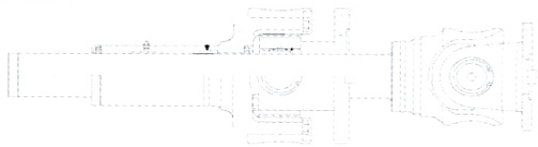
DESIGNS

TIPO - TYPE:

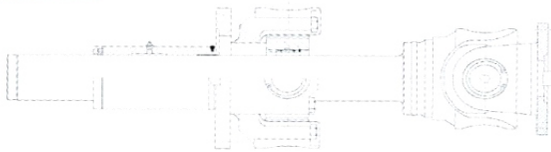
EA



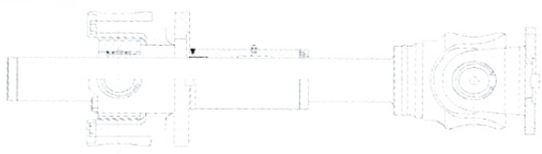
EB



EC

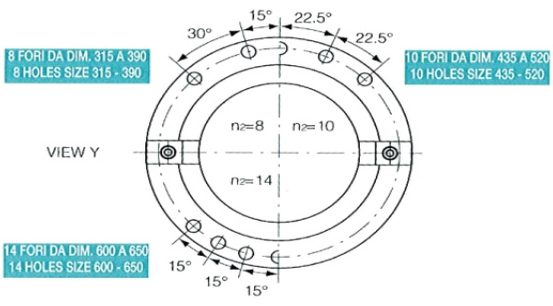


ED

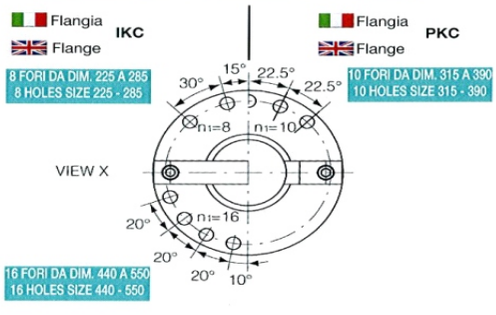


CARATTERISTICHE FLANGE
FLANGE BOLTHOLE AND DESIGN PATTERNS

FLANGIA Y - FLANGE Y



FLANGIA X - FLANGE X



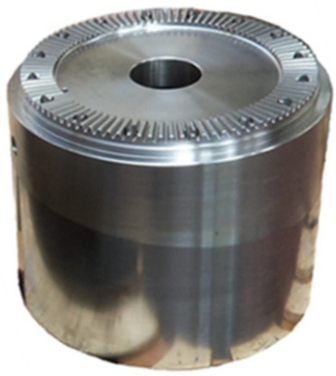
TUNNEL UNIVERSAL SHAFT - US.F SERIES

ENGINEERING DATA

TYPE	SIZE / DATA	US.F 225/315	US.F 250/330	US.F 285/390	US.F 315/435	US.F 350/490	US.F 390/550	US.F 435/600	US.F 480/640
EA	Lmin	920	1020	1140	1300	1445	1605	1760	1955
	Lv	650	700	750		800		900	
EB	Lmin	260	285	325	360	400	445	500	570
	Lv	650	700	750		800		900	
EC	Lmin	610	655	750	827	885	985	1124	1225
	Lv	650	700	750		800		900	
ED	Lmin	740	820	925	1050	1140	1250	1385	1535
	Lv	650	700	750		800		900	
	ß (°)	**15 / 5**							
	Dfx	225	250	285	315	350	390	435	480
	D1x	196	218	245	280	310	345	385	425
	D2x	105	115	135	150	165	185	200	225
	bx	32	40			50	70	80	90
	tx	5		7		8		10	12
	gx	9	12.5	15		16	18	20	22.5
	Kx	20	25	27	32	35	40	42	47
	Lm(x)	125	140	160	180	195	215	260	290
	Dfy	315	330	390	435	480	520	600	650
	Ly	190	200	230	250	290	320	390	410
	D1y	285	315	355	390	435	480	550	595
	D2y	220	240	270	300	335	385	420	450
	by	32	40			50	70	80	90
	ty	5	7	8		10		12	15
	gy	9	12.5	15		16	18	20	22.5
	Ky	28	30	40	42	47	50	60	
	Lm(y)	140	150	170	190	210	230	280	290
	n1 - d1	8 - ?17	8 - ?19	8 - ?21	10 - ?23		10 - ?25	16 - ?28	16 - ?31
	n2 - d2	8 - ?17	8 - ?19	8 - ?21	10 - ?23		10 - ?25	16 - ?28	16 - ?31
	S	102.18	117.72	127.7	137.5	165.2	177.24	201.25	225.25
	D3	146	159	180	203	219	245	273	325
	V	395	435	480	565	630	695	735	810
	Ry	315	330	390	435	480	520	600	650
	kg. Lmin	215	283	400	533	721	1013	1410	2040
	kg. 100mm	6.4	8.5	10	11.6	16.8	19.4	25	31.3
TORQUES									
	Tn (kNm)	**56**	**80**	**120**	**160**	**225**	**320**	**500**	**700**
	Tf (kNm)	**28**	**40**	**58**	**80**	**110**	**160**	**250**	**350**

COMPANION FLANGES

We can manufacture any type of companion flange, following your requirements. Generally speaking, these sleeves are grouped into 2 families, following their geometric shape:



a. CYLINDRICAL COMPANION FLANGES
b. FLANGED COMPANION FLANGES

Or, following the type of connection between its flange and the universal shaft one, they are divided into 5 categories:

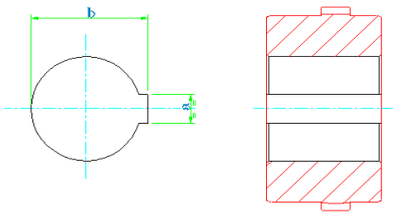
1. FLANGE WITH NO KEYWAY
2. FLANGE WITH KEYWAY
3. FLANGE WITH HIRTH SERRATION (as the picture on the right)
4. FLANGE WITH DOG TEETH
5. FLANGE WITH NO KEYWAY WITH PINS ACCORDING TO DIN 15452 STANDARDS

MAX ALLOWED FINISHED BORE DIAMETER PER SIZE

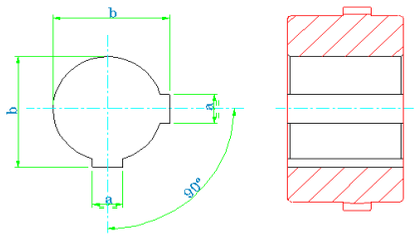
SIZE	US.B 160	US.B 180	US.B 200	US.B 225	US.B 250	US.B 265	US.B 285	US.B 315	US.B 350	US.B 390	US.B 440	US.B 490	US.B 550	US.B 620
DIAMETER [mm]	80	90	100	115	125	130	140	165	185	205	225	255	295	330

COMPANION FLANGES

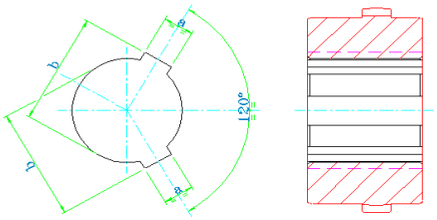
1. CYLINDRICAL FINISHED BORE & 1 KEYWAY



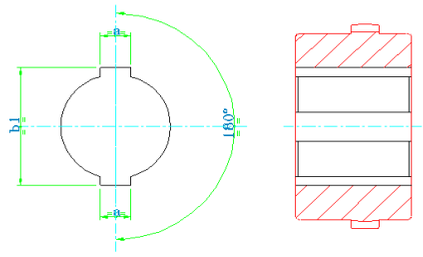
2. CYLINDRICAL FINISHED BORE & 2 KEYWAYS @ 90°



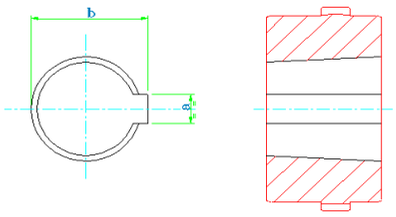
3. CYLINDRICAL FINISHED BORE & 2 KEYWAYS @ 120°



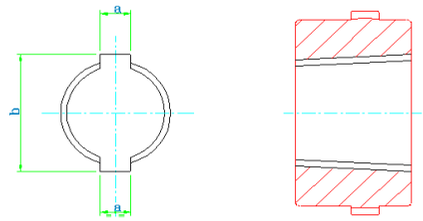
4. CYLINDRICAL FINISHED BORE & 2 KEYWAYS @ 180°



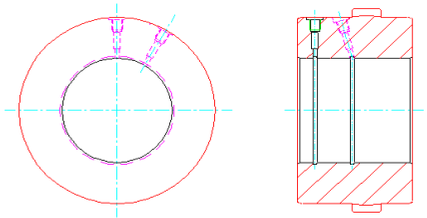
5. TAPER FINISHED BORE & 1 KEYWAY



6. TAPER FINISHED BORE & 2 KEYWAYS @ 180°



7. CYLINDRICAL FINISHED BORE WITH SHRINK FITTING & OIL PRESSURE REMOVAL



8. FINISHED BORE WITH FLAT WEAR KEYS

INSTALLATION, MAINTENANCE & LUBRICATION

BEARINGS

The composition of the journal cross bearings is shown in Figure 1.1. Three lines of rolls (7) are axially placed inside the bearing ring (6), closed by a ring (2), a seal (3), a flat spring, and held by a seal ring (4). A composite thrustbearing disc is placed at the bearing bottom with a grease nipple outside the bearing centre (10). The bearing is held inside the yoke by a seal ring (9).

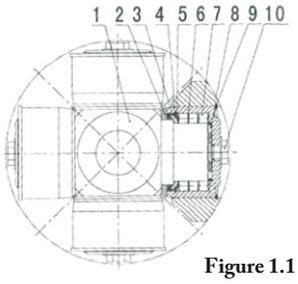


Figure 1.1

PRELIMINARY INSTRUCTIONS

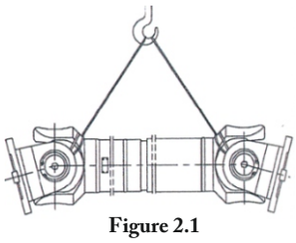


Figure 2.1

If the universal shaft needs to be kept in stock for long before installation, do not remove the protection applied on the most exposed critical surfaces. If stocked outdoor, the universal shaft must be placed on supports keeping it separated from the ground, and must be protected from rain and other atmospheric events. When moving it, insert wooden chocks in the open surfaces of the yokes, to avoid any angle misalignment and to handle safely. When transporting or lifting universal shafts, do not rope belts or chains on the tube surrounding the spline, or on the protection tube in case of telescopic universal shafts. In fact, the universal shaft may fully open, get damaged, and endanger things and people.
Always handle and transport in horizontal position, except for universal shafts designed for specific vertical applications. See Figure 2.1 for the suitable way of lifting and handling.

INSTALLATION

The universal shaft installation shall follow its drawing specification. Drawing specifications are elaborated following the working conditions required by the customers.
If properly installed, the universal shaft shall rotate with the motor shaft simultaneously, and the full rotating system will not swing.
To this purpose, the manufacturer has adopted the following technological and engineering precautions:

- Flange yoke and bearing hole axis are on the same plane;
- The intermediate section yoke bearing holes and the intermediate shaft axis are on the same plane (See Figure 3.1);
- The journal cross axis are placed vertically and symmetrically on the same plane;

During installation, make sure the two yokes and the intermediate shaft are placed in «W» and «Z» position and that their angles ß1 and ß2 are equal (see Figure 3.3 and 3.2).
This way, any fitting side speed variation is annulled by the joint side speed variation, with consequent simultaneous rotation of the whole transmission. The following procedure is recommended for the universal shaft installation, after the alignment on the machines to be connected is done.

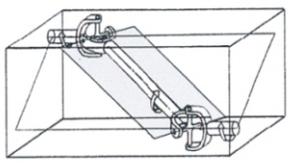


Figure 3.1

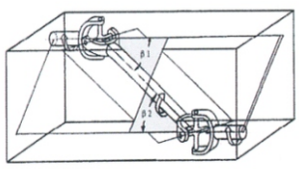
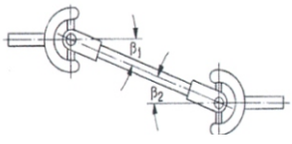
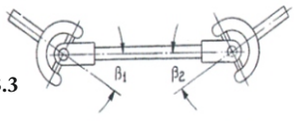


Figure 3.2 - ß1 = ß2



«Z» installation

Figure 3.3



«W» installation

INSTALLATION, MAINTENANCE & LUBRICATION

COMPANION FLANGE INSTALLATION

The different types of companion flanges require different assembly procedures. Please find below the installation procedures of two different types of companion flanges:

1. With taper bore (interference fitting):
   - I. Please follow the drawing, and check: the companion flange bore diameter, the keyway and the key seat dimensions, the flange surface, the bore diameter and their distribution, and their connection interfaces, to check if they are corresponding (keyway, hirth serration, dog teeth) for proper fitting and assembly operations.
   - II. Remove any dirt from sleeve, centering and connecting shaft, and clean every fitting surface.
   - III. Fit the keyway into its seat and align wih the connecting shaft.
   - IV. Uniformly heat at a temperature of 200°C, in a furnace or in oil bath to expand the hole. When heating the oil, be careful it doesn't catch fire. You may also employ a heating torch, to heat the companion flange. While heating, continuously rotate the companion flange or turn the heating torch around it. The surface temperature shall be constantly checked and must not exceed 260° C, so to avoid overheating.
   - V. Align the heated companion flange with the universal shaft keyway and fit it onto the shaft to be connected. If the universal shaft has no shoulder, prepare a lock to prevent the companion flange from sliding beyond the fitting limit. Let the companion flange cool down, before proceeding with any further operation and/or installation.

2. Fitting with no interference:
   - I. Please refer to the drawing, and check: the companion flange bore diameter, the keyway and the key seat dimensions, the flange surface, the bore diameters and their distribution, and their connection interfaces, to check if they are corresponding (keyway, hirth serration, dog teeth) for proper fitting and assembly operations.
   - II. Remove any dirt from sleeve, centering and connecting shaft, and clean every fitting surface.
   - III. Position and fit the companion flange.
   - IV. Check the roll fitting support devices are the proper ones. If any sleeve blocking or release device is present, please check their correct operation.

UNIVERSAL SHAFT INSTALLATION

Check that the yoke bearing holes in the intermediate section and the intermediate shaft axis are on the same plane (see Figure 3.1). This is an essential check.
Check that the flange dimensions, and the whole universal shaft in general, are according to the drawing. Check that the different components are in good condition, and that the retainer rings are in their seats. Clean any dirt, if present.
If the companion flange needs to be fitted onto a driving shaft, it has to be fitted onto the universal shaft first (see Figure 4.1).
If the companion flange is already fitted onto the shaft, lift the universal shaft by a steel cable or by a chain for heavy loads, hanging it by its yokes, as shown in Figures 2.1 and 4.1. This allows the flanges to move, making the operations of alignment easier. Lift the universal shaft in the assembly position. Fit the companion flange onto the driving shaft first, when the companion flange has an interference hole. Align the keyways with their seats, insert the screws in the matching flange aligned holes and partially screw with their nuts, when the companion flange has a hole with no interference. Make the same operation for the driven side. After screwing all the bolts, tighten them by a dynamometrical wrench in a uniform and crosswise way. Check the tighthening torque of all the fitting devices. Remove any cable or chain employed.

LUBRICATION

The universal shafts, the telescopic ones in particular, need to be fully greased. Pump lithium # 2 based grease into the grease nipples placed on the journal crosses and on the intermediate section of the universal shaft (for telescopic universal shafts), until grease leaks out of the seals. Do not over-pressurize bearings while greasing.

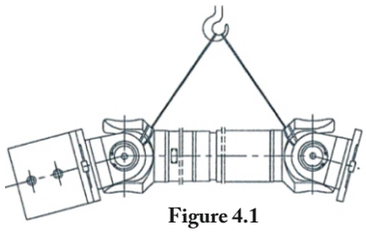


Figure 4.1

A pressure of 5 bar is strongly recommended. The telescopic universal shafts have to be greased in their fully compressed position, to avoid overfilling the splined shaft seat, which would compromise the length compensation operation.
Warning: lithium based grease is not compatible with other types of grease. Always check its compatibility with the grease producer.

LUBRICATION INTERVALS

Grease all the bearings and the splined shaft, if present, before starting to work and after 500 working hours. Next greasings shall be made every 30 days.

MAINTENANCE

Our universal shafts require very low maintenance. However, if you follow a regular maintenance program, you will ensure the best performances and the longest lifetime. Daily check tightening on the fitting devices and on the flange meshings.
If necessary, re-tighten them at the correct tightening torque. Regularly grease, as previously instructed.

Rolling Mill Application Data for Selection and Design

Fill in the boxes on the diagrams below for the following information:

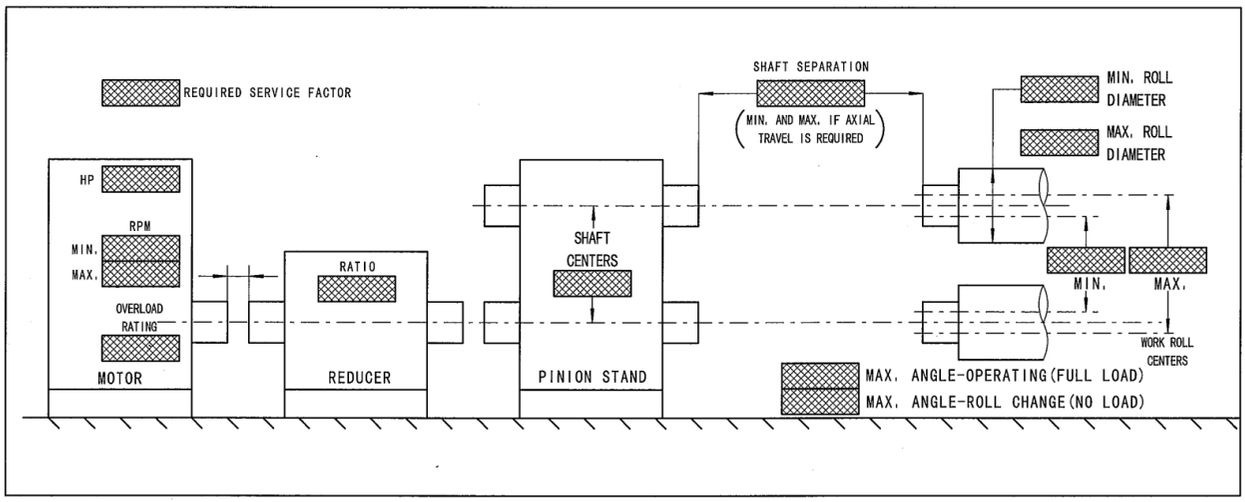
01. Motor horse power
02. Motor rpm
03. Required service factor
04. Operating rpm
05. Reducer ratio
06. Max. operating torque
07. Shaft separation
08. Pinion Centers
09. Min. Work Roll Diameter
10. Max. Work Roll Diameter
11. Min. Work Roll Centers – Operating
12. Max. Work Roll Centers – Operating
13. Max. Operating Angle (Full Load)
14. Max. Roll Change Angle (No Load)
15. Drive end bore and keyway
16. Bore Requirements
17. Driven end bore and keyway
18. Diameter limitations
19. Desired bearing lifetime
20. Ambient temperature

Comments or special conditions: _____

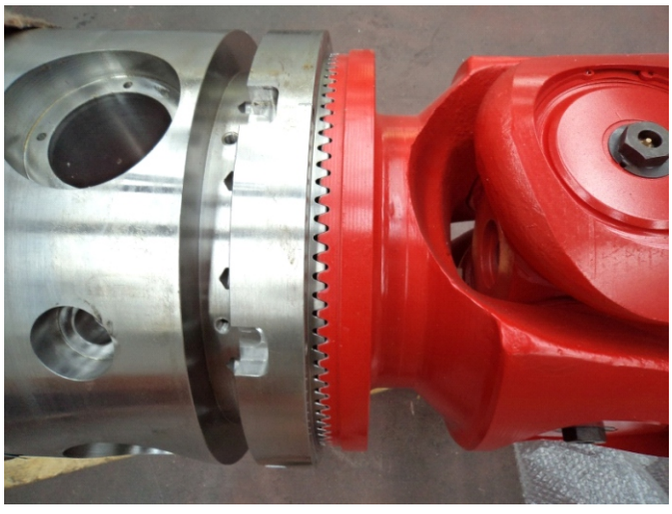
_____

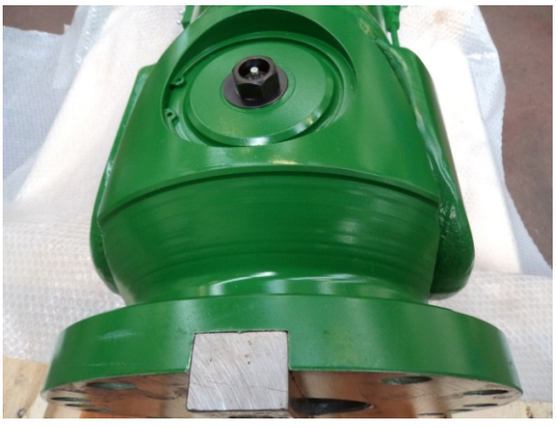
Note: if bolting to existing drive and driven flanges, please specify:

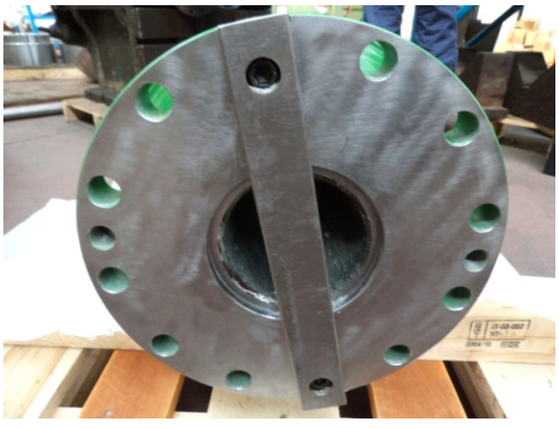
flange diameter: _____
pilot diameter: _____
bolt circle: _____
number of bolts: _____
keyway dimension: _____



UNIVERSAL JOINT SHAFT PICTURES







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