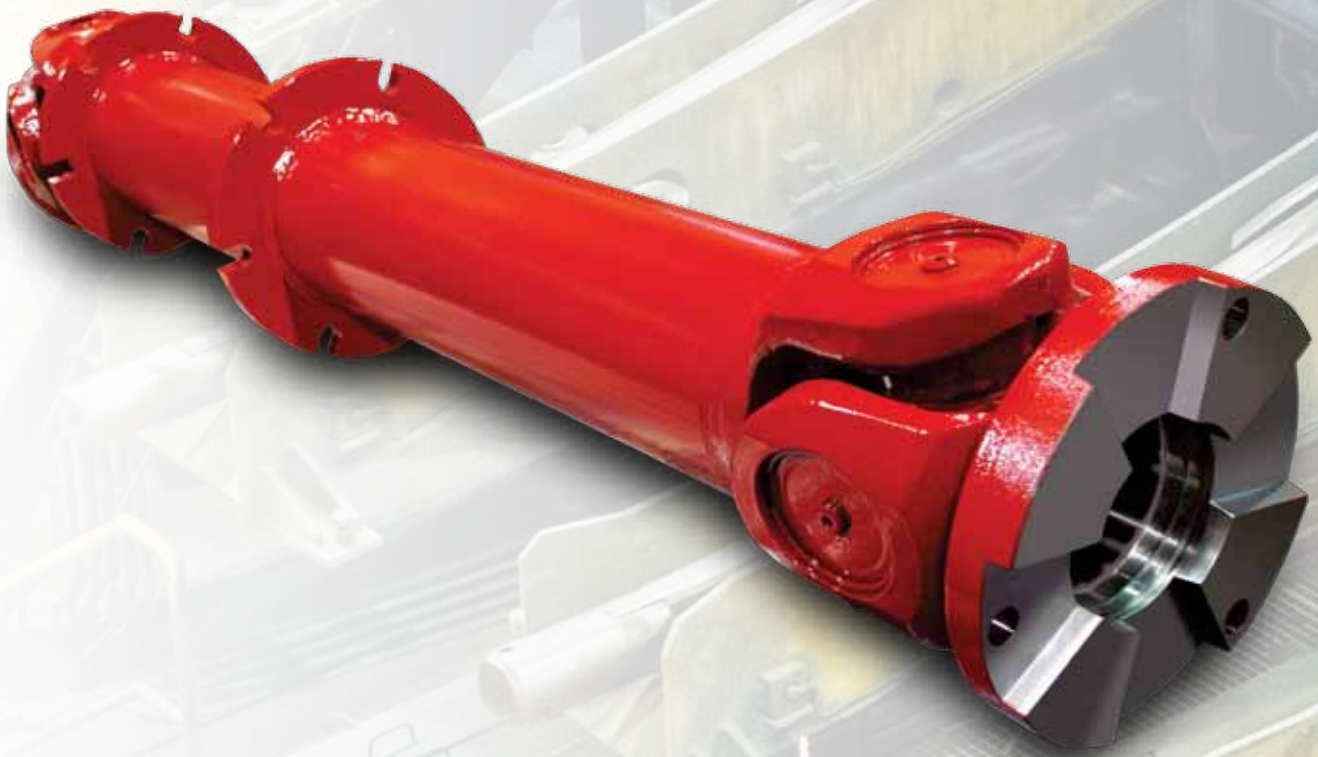
UNIVERSAL SHAFTS

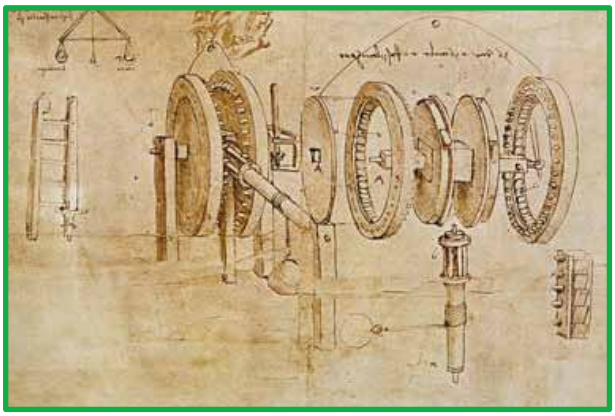


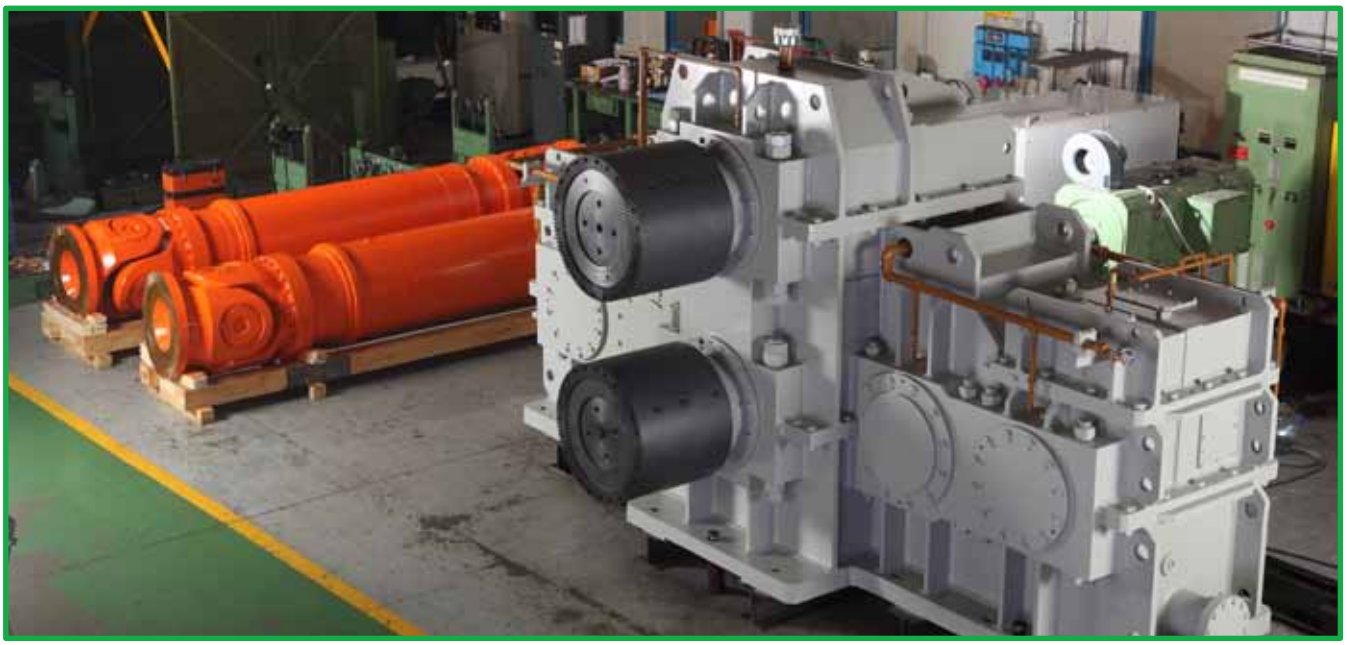
UNIVERSAL SHAFTS

Our company has developed the production of Universal shafts, with high quality and accuracy. The production range covers the ligth-medium-heavy duty sector, up to a torque of 9 000 000 Nm. Our technology also allows us to manufacture special universal shafts, for those application not included in the normal commercial products. Starting from the design and until the painting, each production step is controlled and verified in order to guarantee an excellent, top quality product. All the universal shafts produced must meet a series of strict controls, starting from the quality of the raw material up to the dynamic balancing (also for the big shafts), where the application requires it. Our company offers its customers the know-how and the experience in the field of the industrial design, to optimise and integrate its products, so as to increase the efficiency of the plants. We offer our technical support during the design, the installation, the maintenance and the evaluation of the performance.
The main characteristics of a universal joint are:
-its capacity of compensating high angles, thus allowing the transmission of the torque between two shafts not in line
-In its version with double extensible joint, a universal joint will allow both radial and axial displacements.
-It can transmit very high torques
-it requires a very reduced maintenance
-it is easy to install

History of cardan joint

The origins of the cardan (universal) joint (or Hooke joint) go back to the 16th century and the name of its actual inventor is unknown. The name of cardan joint comes from the Italian mathematician Gerolamo Cardano (1500 - 1576) who was the first to theorise the operation principle of a mechanism capable of an angular displacement and at the same time able to transmit a rotary movement between two axes not in line.
Rober Hooke (1653 - 1702) an English scientist, applied these same principles in an independent way, by manufacturing a transmission for the movement of a number of mirrors for the safe observation of the sun. Hooke also studied the use of two couplings in series in order to create a uniform motion between two misaligned rotating shafts. In the anglo-saxon world, this coupling is known as Hooke coupling, or universal shaft. However, although the invention is attributed to these scientists, a similar joint was in use in China a few centuries before, for purposes not too different from the current ones.
The documents speak of a lamp used on board of vessels which has the characteristics of always staying upright.
The same mechanism was then used on the compass, there are documents speaking of universal joint dating back to 300 years b.C., in Greece.
The use of this type of joint was marginal for a long period, until the recent boom due to the growth of the car market.





Types of universal shafts

Our universal shafts have been divided into different series for light-medium-heavy and for heavy industrial applications. we offer different model suitable for each specific application.
The material and construction quality level is the same. In both cases special model are available upon request.

MODEL HL
For industrial light-medium duty application. The universal shaft model HL propose flange DIN from 58 mm to 225 mm diameter with torque from 190 Nm up to 25.000 Nm. Deflection angle up to 35°. Each size can be manufactured with bigger flange.

MODEL HS
For the industrial heavy duty application, the universal shafts model HS propose flanges from 225 up to 620 mm, with torque up to 1200 kNm.
This type of universal shaft is both solid and efficient, and it is optimised for those application where the force is the main factor.

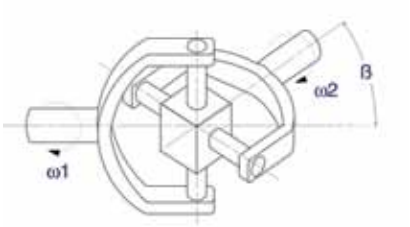
MODEL HH
This model of universal shafts was developed for industrial application with extra heavy loading (from 1250 to 9000 kNm and is the top of its category, both as regards the capacity and the price. It is supplied with a Hirth model flange, to ensure the maximum safety. Upon request different flanges can be supplied, after verifying their torque transmission capacity. Higher torques can be reached, upon request.

MODEL HST
This model of universal shafts was developed for vertical rolling stands application. The thootshafts is passing througt the holed cross so to have a special short design with an high elongation.

MODEL HB
The HB model has a special design of the flange wich is not monolitic but bolted for an easy replacement of the cross on site. This shaft can be asked on request, if easy maintenance on site is needed.

KINEMATICS

The characteristic of the simple universal coupling is to transmit a uniform input motion in a non uniform way on the output.
With the half joint on the motor side at constant speed, the other half coupling will have a periodic motion, although the average speed will be the same.



By rotating the fork on the motor side of a fraction of turn, the fork on the drive side too will move of a fraction of turn, but the rotation angle of the drive side j2 differs from the rotation angle j1 of the motor side half joint, according to the formula:

$$\tan \varphi_2 = \frac{\tan \varphi_1}{\cos \beta}$$

Wher e:

φ_1 = motor side rotation angle

φ_2 = drive side rotation angle

β = coupling slope angle.

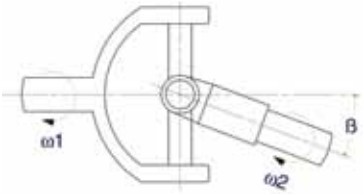
The angular speed of the two half joints is directly influenced by the fact that the driven half joint rotates with a certain advance in the first quarter of turn, and with a certain delay in the second quarter.

$$\frac{\omega_2}{\omega_1} = \frac{\cos \beta}{1 - \cos^2 \varphi_1 \sin^2 \beta}$$

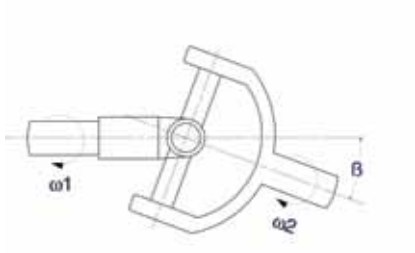
ω_1 = angular speed – motor side
ω_2 = angular speed – driven shaft
β = coupling slope angle

The period ir regularity grade (cardan error) is directly proportional to the coupling slope angle, with two maximum and two minimum values per turn.

ω_2/ω_1 max= 1/cosβ (at φ_1=90°e 270°)

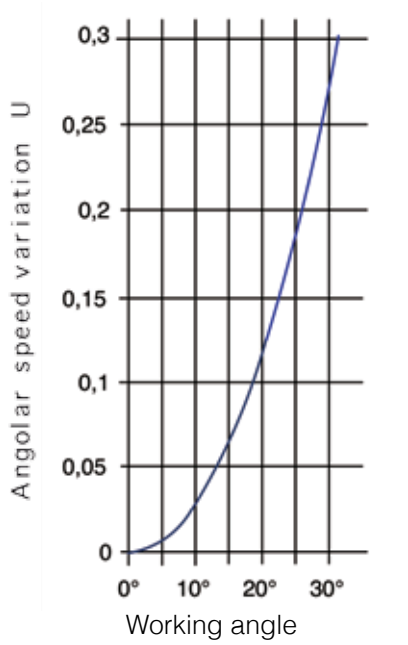


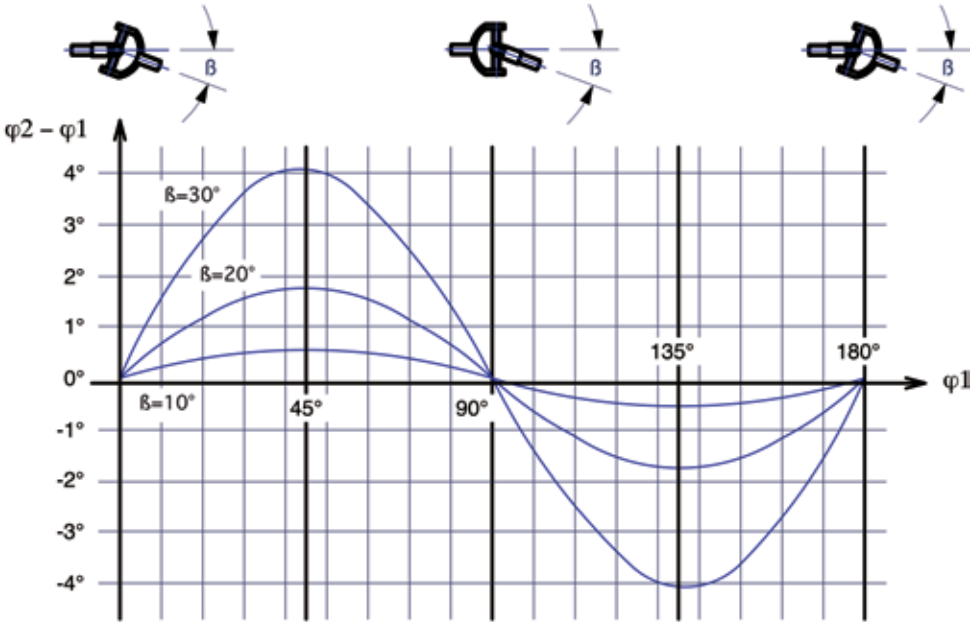
ω_2/ω_1 min = cosβ (at φ_1=0° e 180°)



The maximum fluctuation grade between the input and output angular speed is calculated as follows:.

$$U = \frac{\omega_2 \max - \omega_2 \min}{\omega_1} = \tan ß \ \sin ß$$





CARDAN and TRANSMISSION s.r.l.

SPEED - LIMITS

Slope angle/speed

The central part of a universal shaft that rotates with a slope angle > 0 is subject to accelerations and deceler ations twice at each turn.
The acceleration moment thus obtained is the result of the working speed, working angle and of the moment of inertia of the central part of the shaft itself.
In order to ensure a regular rotation, especially with high speeds, it is necessary that the product of rpm by working angle (n x ß) does not exceed, for each size, the values indicated in the table 1.

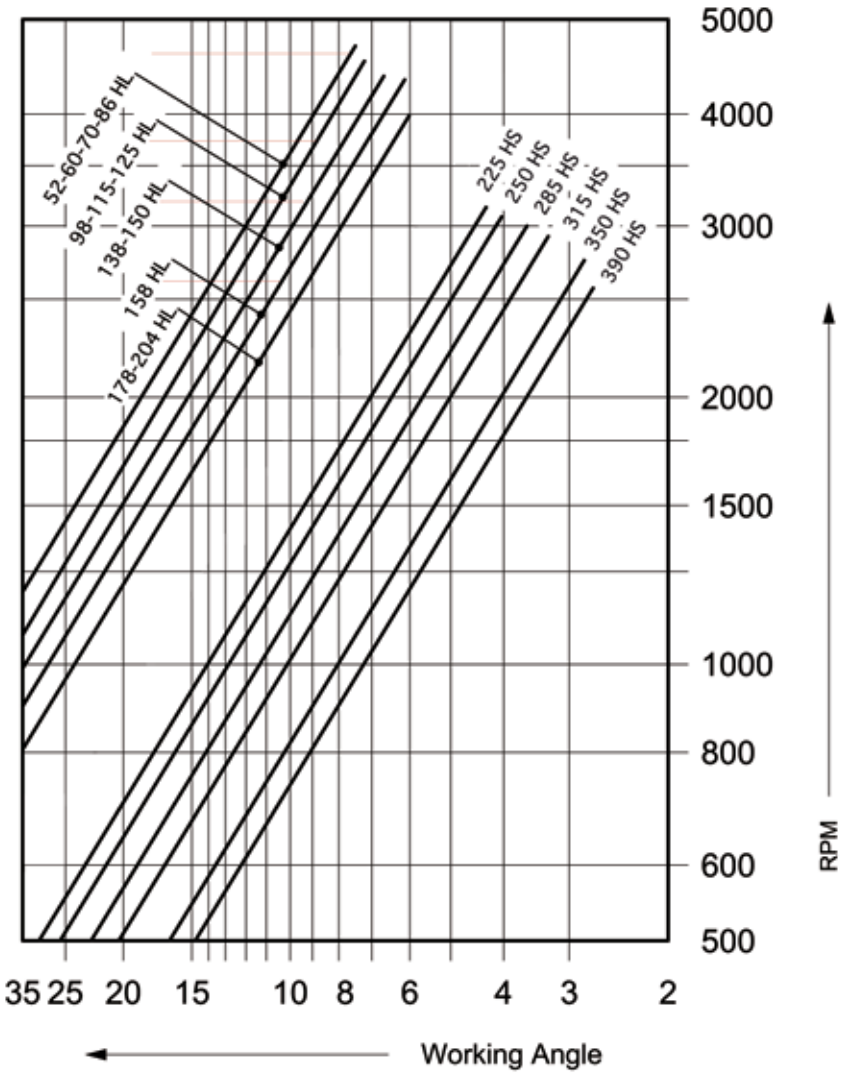
Length/critical speed

The maximum length of a universal transmission is limited by the critical flexional speed of its intermediate part, which is subject to variable flexional moments that can cause vibrations.
Given the external diameter, the thickness of the connection pipe and the distance between the center line of the for ks inside the transmission, the critical speed of a univer sal shaft is calculated with the following formula:

$$Ncr = 1{,}21 \cdot 10^{8} \cdot \sqrt{\frac{D^2 + d^2}{L}}$$

D = external diameter of the pipe
d = internal diameter of the pipe
L = length of the intermediate part

Table 1 : Working angle/ Rpm



The maximum speed must at any rate be less than the critical one:
Max . speed = 0, 65 x ncr
In applications where the speed is half the critical one, there can be vibrations. For these applications the speed must be 8% higher or 50% lower than the critical one.

Balancing:
All the transmissions with working speed less than 300 rpm are supplied without dynamic balancing.
From 300 up to 800 rpm the transmissions are balanced upon request. Beyond 850 rpm all the transmissions are normally supplied with dynamic balancing.

ARRANGEMENT

Arrangement of universal shafts

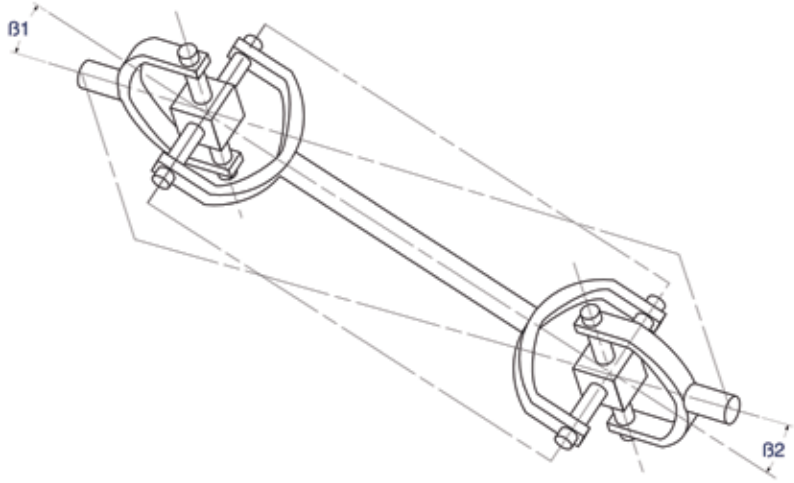
As shown above, the use of a simple coupling is limited to application with low speed and a working angle of a few degrees. The motion periodic variation existing on a simple universal coupling can however by cancelled by installing two couplings in tandem.
By installing the two couplings accor ding to Z arrangement, or according to W arrangement and with the two slope angles ß1 and ß 2 having the same value, the angular variations of the fir st coupling ar e compensated by the angular speed of the second coupling.

Arrangement Z

Arrangement W

By meeting the three following conditions, it is possible to obtain a uniform motion between the motor shaft and the output shaft. When these conditions ar e not met, the driven shaft will be subject to a fluctuating angular speed, which can result in a damage to the transmission.

Al the parts of the shaft must be on the same plane



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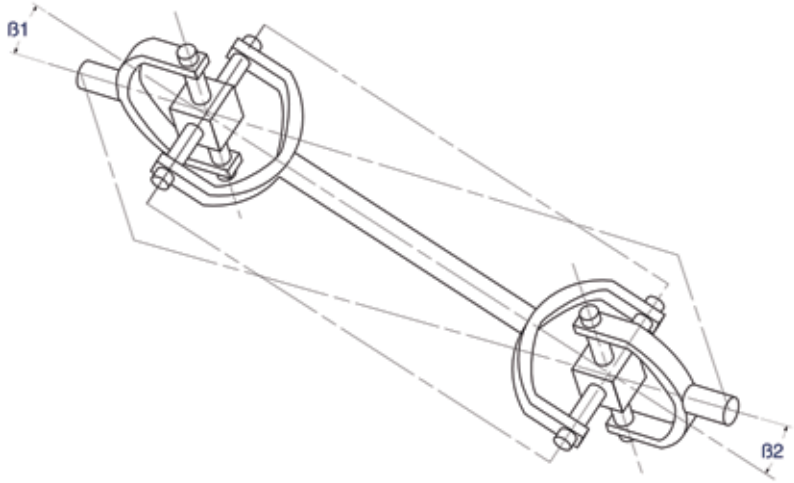
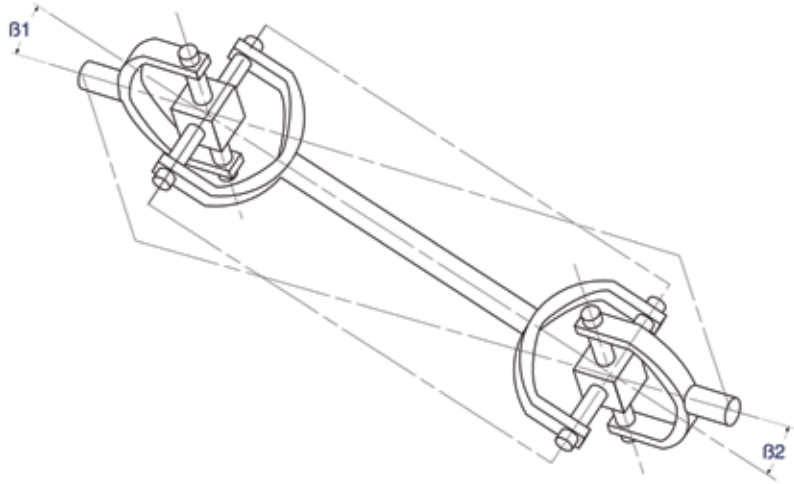


Al the parts of the shaft must be on the same plane



INSTALLATION AND USE

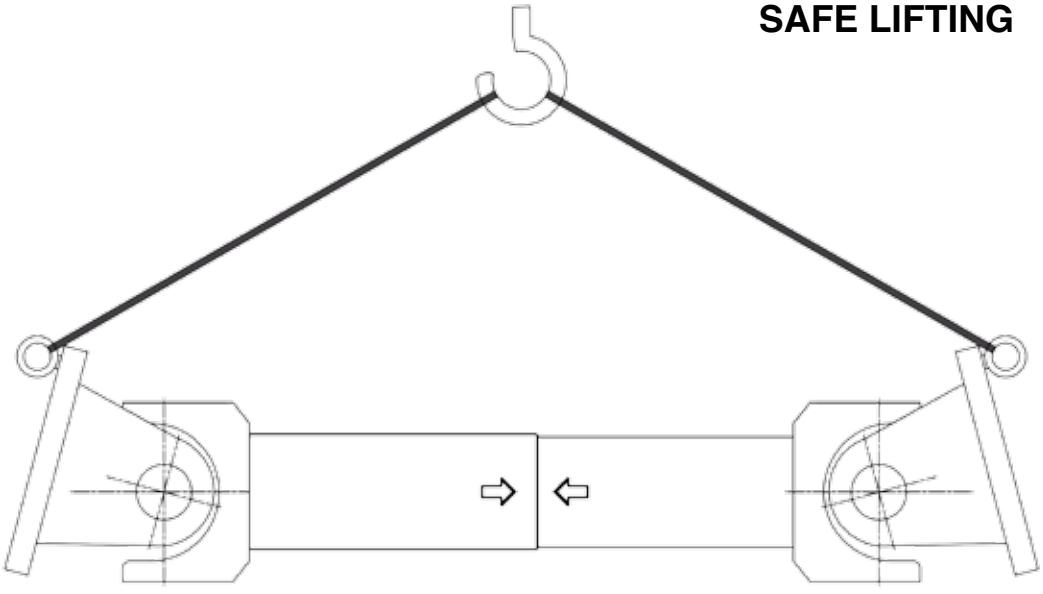
For universal shafts movimentation, refer to attached drawing (safe lifting). If possible use lifting rings for movimentation. Before installation it is not needed to clean the inside of the universal shaft, since shaft is given already lubricated and ready to start.
Remove rust protection covering, paint and grease from flange surface, on both universal shaft flange and connection on the motor/gearbox/driven machine.
Check carefully that the flange dimensions are fully compatible with the connection on the machine. Installation has to be like one of the two configurations shown on the drawing, W or Z. Check carefully for disalignment.
Check that the two angles β_1 and β_2 are the same.
Check that the spline and sleeve are mounted with the facing arrows aligned. The flange bolts must be locked simmetrically, with the shoun torque, using a dynanometric key. After 24 working hours of the new universal shaft, lock the bolts again as before. This operation should be made twice to avoid that the bolts release by themselves.

TRANSPORT AND STORAGE
Universal shaft should be carried and moved in the horizontal position (i.e with the shaft parallel to the ground).
We suggest the use of non-metallic ropes for lifting. Keep attention to not damage bearings while lowering the shaft to the ground. Use the attached drawing (Sollevamento sicuro / Safe lifting). for reference.
Universal shafts should be stored in a dry space,and not exposed to sun and rain. Avoid to store the universal shafts near acid, alkaline or organic reagents.

MAINTENANCE AND REPAIR
New universal shafts do not require grease filling. It is needed a grease filling dor universal shafts that have been stored for more than 6 months. Bearings and shafts should be lubricated periodically while working. In standard conditions grease should be refilled every 500 working hours.
For universal shafts working at high temperature, grese should be refilled every week (140 hours).
Verify the grase kind, standard or high temperature.

PERIODICAL CONTROLS
Check if noise is abnormally high
Check if radial swinging is abnormal
Check if bolts are loose
Check if lubrication is enough
Any anomaly should be taken care immediately

SAFE LIFTING



SERVICE FACTOR

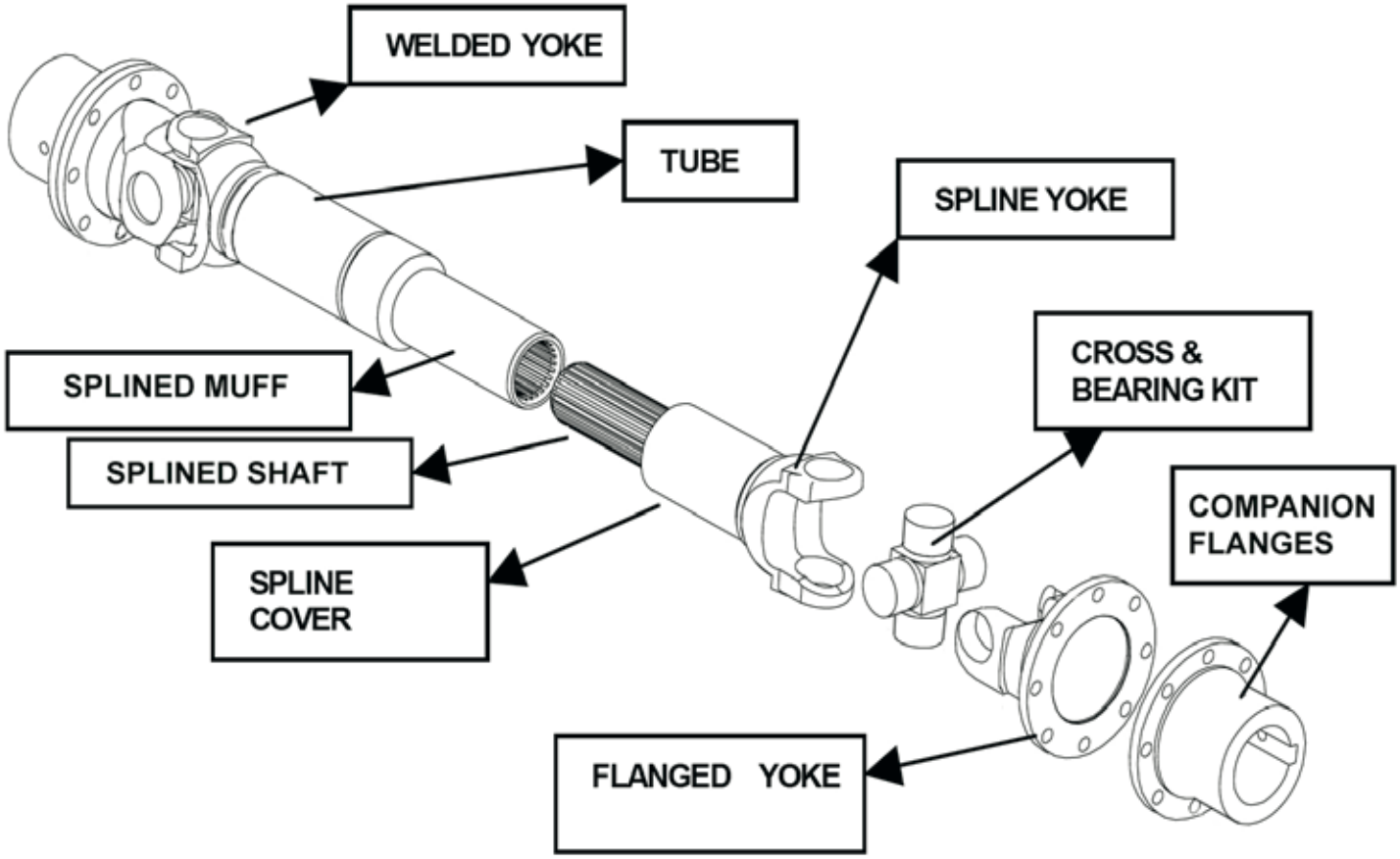
The table below shows some tipical values for service factors. These values are only an example. The selection of the real value must be based on the typical estimation of admissible overloads resulting from the process analisys and the know how of the applications and considering the existing motor. As you can see, the same machine may fall in different categories as a consequence of different factors can be considered. For this reason our Technical Department is at your disposal to provide you with the correct selection based on our experience of many applications already realized.

Application	Ks
Constant load Continuous generators, little fans, centrifugal pumps, machine tools, printing machines, belt conveyors.	1,1 - 1,5
Light load Variable load generators, centrifugal pumps, conveyor belts with discontinuous load, wood machines, bar mills, fans.	1,5 - 2,0
Medium load Big fans, marine transmissions, vibrating tables, calanders, pinch rolls, tube mills, winch drives, mixers, continuous mills, exavators, presses, drilling machines, monocilynder compressors, monocilynder pumps,paper mills.	2,0 - 3,0
Heavy load Continuous oscillating tables, midium size mills, big tube mills, vibrating conveyors, machines for continuous milling, straightners, cold mills, mills.	3,0 - 5,0
High heavy load Winders, plate shears, mills.	5,0 - 10,0

Notes

Tn (kNm)	Rating designed torque. It corrispond to the maximum allowable static torque. Only unfrequent and minor load peaks are admitted
Tlim (kNm)	limit torque. It corrispond to the maximum static torque provided by the permissible elastic limit. Such a torque can be applied only few time and for very short period
Tp (kNm)	Pulsating torque. It corrispond to the fatigue maximum limit torque for shafts subject to a pulsating load
Ta (kNm)	Alternating torque. It corrispond to the fatigue maximum limit torque for shafts subject to alternating load
ß(°)	maximum angle of deflection per joint if wider angle is need special design is available.
Lz (mm)	minimum compressed lenght. If shorter shaft is needed special extrashort design is available
s (mm)	skip(elongation)

In order to facilitate the rating, we will indicate a few basic configurations. The Lz (length of the broached shaft, when completed retracted) indicated is the minimum that can be reached for that configuration. The stroke indicated on the catalogue is the maximum admissible for the minimum construction length. If Lz is increased the stroke too can be increased. You should consult our technical office if you need strokes different from those indicated on the catalogue, as well as for construction length >3 m, or flanges different from the standard ones indicated on the catalogue. The distance between the driving and driven machines, together with any length changes during operation, determines the operating length:
Optimum operating length: l
B,opt ≈ lz + s/3
Maximum permissible operating length: l
B,max = lz + s



COMPONENTS OF UNIVERSAL SHAFT CROSS AND BEARING KIT
It is the central element of the universal shaft, and its rating is the most critical. Fundamental are both the material of the cross and that of the rollers, that are therefore submitted to the most rigorous tests to ensure a good quality. The bearings are built to ensure a long life and to operation in the heaviest conditions.

FLANGES AND FORKS
The rating of the flanges and forks required accurate studies of the transmissible moment and of the deformations under load. The forks and the flanges are manufactured starting from a forging, with high quality standards, both as concerns the material and the working.

SPLINED SHAFT AND SPLINED MUFF
The splined shaft and sleeve allow the relative sliding of the joints and the actual variation of the universal shaft length, for those application where the distance between the driver and the driven element is variable, or to facilitate the assembly and dismantling operations. The broached part is induction hardened and is built in such a way as to minimize the radial backlashes.

SELECTION OF A UNIVERSAL SHAFT

The selection of a universal shaft requires several steps, in order to make a safe and efficient choice. The under rating of one or more characteristics will cause the failure of malfunctioning and should be avoided with he maximum attention. The procedure is:
1. Determine the geometrical characteristics; the spaces where the universal shaft will be installed; verify the minimum and maximum length, the stroke, if any, the working angle and the maximum dimension of the flange.
2. Determine the torque acting on the universal shaft; the type of work (continuous, pulsating, alternating); verify the admissible stress.
3. Determine the theoretical working life span, using the catalogue data.
4. Select the flange and verify that the torque can be transmitted through the flange.
5. Verify the critical speeds of the universal shaft.

DETERMINATION OF THE GEOMETRICAL CHARACTERISTICS
Consider very carefully the equipment where the universal shaft will be installed.
- Determine the required distance between the external flanges and choose on the catalogue the suitable type.
- Choose between fixed or extensible universal shaft
- Determine the dimension of the flanges
- Determine whether sleeves are required and in this case subtract the space required by the sleeve from the total available space.

TO DETERMINE THE TORQUE ACTING ON THE UNIVERSAL SHAFT
For the calculation of the maximum admissible torque you will need to know the power (kW/h) supplied by the motor and at which speed. The torque will be:

*T = P*9550/n[Nm]*

Where: P[kW] is the power supplied by the motor and *n[rpm]* is the rotation speed of the universal shaft in rpm. In order to verify the maximum admissible load a safety factor Ks must be considered too. It accounts for the type of application and it is practically a multiplier of the torque according to the type of service of the universal shaft. The value for the verification depends on the load application frequency. A torque applied unidirectionally at a nearly constant value, is defined as T_n, i.e. as a value applicable for a short period (10^3 cycles), with no permanent deformations of the joint. A torque applied unidirectionally with a fluctuation of the value applied is defined as T_p, i.e. as a pulsating load that can be applied for a short period of time (10^3 cycles), with no permanent deformations of the joint.
A torque with a direction of application varying in time with a definite interval and width, is defined T_p, i.e. as an alternating load applicable for a short period (10^3 cycles), with no permanent deformations of the joint.
The calculeted torque T must be: $T< T_n$ or $T<T_p$ or $T<T_a$ accondingly to load type.

DETERMINATION OF THE LIFE SPAN
The theoretical life of an universal shaft depends on three factors:
- Average working angle β
- Rotation speed in rpm n
- Transmitted torque T

These values, as a function of a value (Tc) which can be given by our technical dept. will give the theoretical life in hours L_{h10} with the formula

$$\left(\frac{T_c}{T}\right)^{10/3} * \frac{1{,}5 * 10^6}{n * \beta}$$

EXAMPLE
A gearbox with a reduction ratio 1:10 is fed by a 150 kW motor at 1200 rpm. Output speed: 1200/10 = 120 rpm. 20 000 hours of service are required: *T = 300*9550 / 120 = 23875 Nm* We consider to use it with a mixer (K_s =1.75) *Tnmin = T*Ks = 41781.2 Nm* It will therefore be necessary to use at least a universal shaft HS 225, which has T_n*= 55 kNm* We will consider a working angle of 2° HS225 has a value of Tc=22

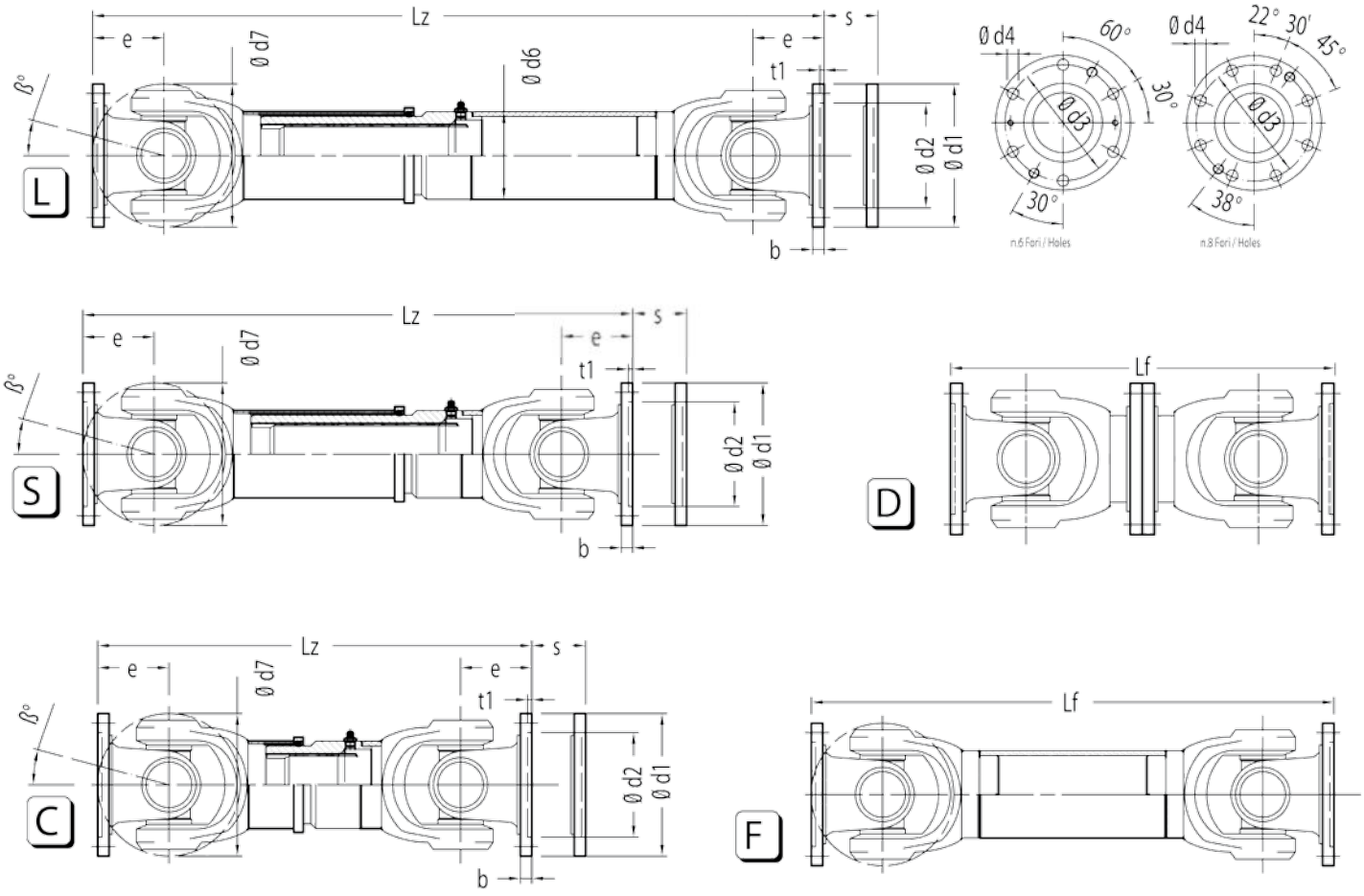
$$L_{h10}\left(\frac{22}{23{,}9}\right)^{10/3} * \frac{1{,}5 * 10^6}{120 * 2} = 4762 \text{ h}$$

Since the life span is rather low, we will repeat the rating with an HS 250. $T_n = 80$ *kNm*

$$L_{h10}\left(\frac{34{,}6}{23{,}9}\right)^{10/3} * \frac{1{,}5 * 10^6}{120 * 2} = 21452 \text{ h}$$

Hence, a universal shaft HS 250 will perfectly meet the requirements.

HL 52-125



PRODUCT CODE KEY - EXAMPLE					
HL	86	S	100	520	40
Model					
Size					
type					
Flange Ød1					
Lz					
s**					

** Longer stroke may be available on request

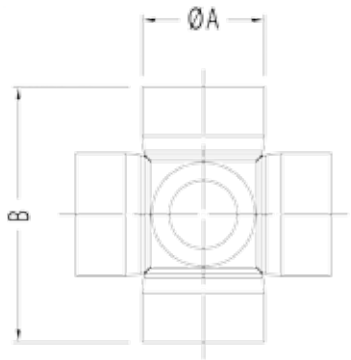
LEGENDA	
HL size	Size of the shaft equal to cross rotation
Code	Company internal production code
Tn (Nm)	Nominal torque
Tlim (Nm)	Max limit torque
Ø d1 (mm)	standard flange/ bigger flange
ß (*)	maximum angle of deflection per joint
Lz	compressed lenght
s	skip(elongation)
DIN 5480	spline shafts DIN standard

HL 52-125

SIZE Ød7	52	60	70	86	98	115	125
CODE	105	106	107	109	110	112	113
Tn (Nm)	190	400	920	1700	2300	3350	4100
Tlim (Nm)	250	520	1200	2200	3000	4350	5350
Ød1(mm)	58/65	65/75	75/90	90/100	100/120	120/150	120/150
ß (*)	30	30	30	35	35	35	35

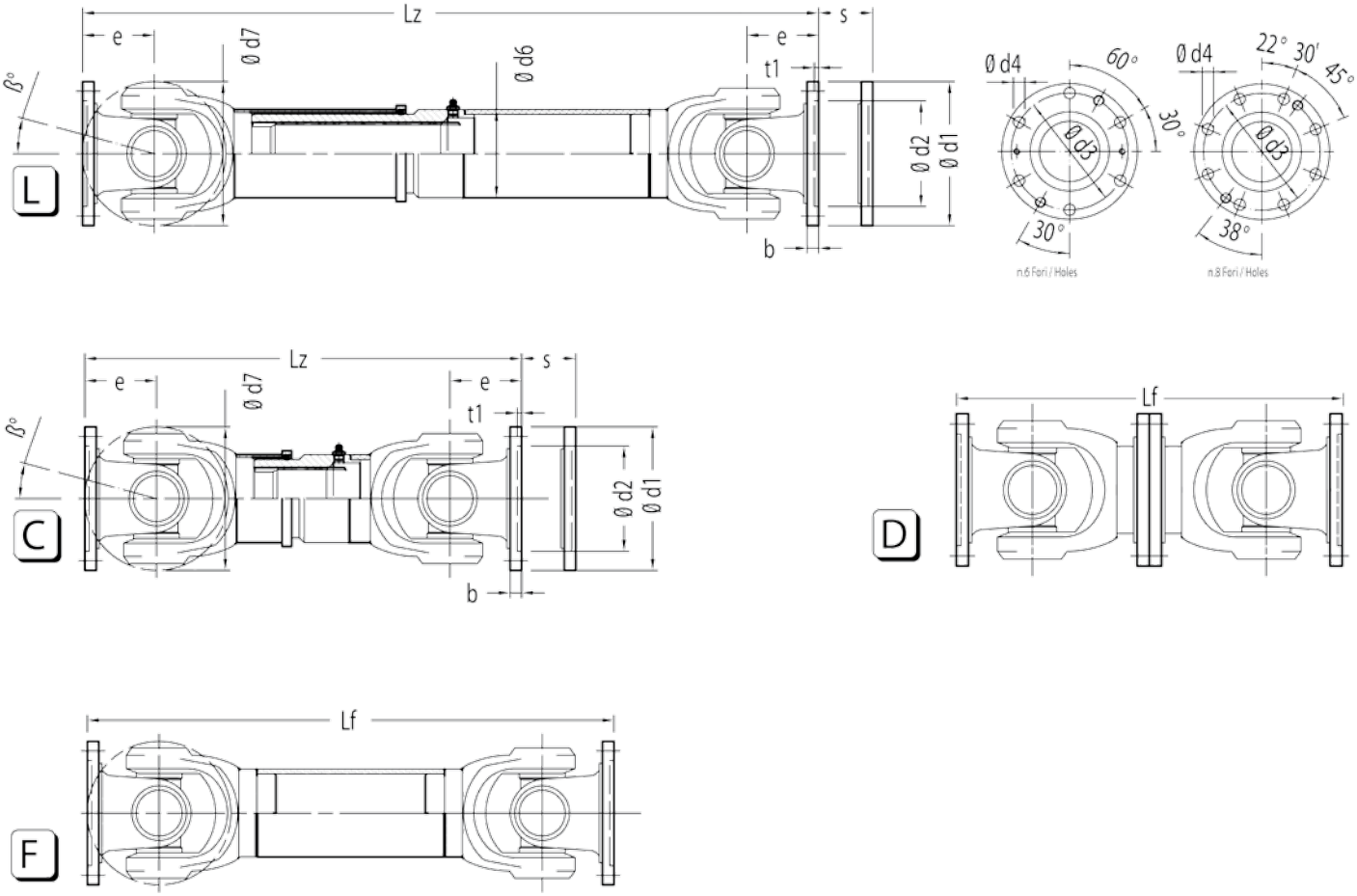
L	Lz (mm)	257	290	360	393	464	523	556
	s (mm)	40	60	70	80	95	120	130
	Mass (Kg)	1,26/1,33	1,87/2,04	3,04/3,35	5,41/5,61	7,48/7,93	11,55/12,91	15,46/16,82
S	Lz (mm)	240	260	300	348	374	473	491
	s (mm)	25	30	35	40	40	60	60
	Mass (Kg)	1,18/1,25	1,77/1,95	2,60/2,90	4,91/5,12	6,32/6,70	10,66/12,02	13,66/15,02
C	Lz (mm)	165	180	200	225	255	325	345
	s (mm)	20	20	25	25	30	35	35
	Mass (Kg)	0,93/1	1,39/1,56	1,98/2,29	3,80/4,00	5,12/5,57	8,75/10,11	11,31/12,67
F	Lf (mm)	160	165	200	216	250	301	307
	Mass (Kg)	0,88/0,95	1,16/1,34	1,89/2,20	3,73/3,94	4,90/5,35	7,88/9,24	9,36/10,72
D	Lf (mm)	110	120	140	152	160	200	200
	Mass (Kg)	0,69/0,76	0,99/1,16	1,51/1,82	3,02/3,23	3,98/4,43	6,44/7,80	7,97/9,33

Ød7	52	60	70	86	98	115	125
Ød2 (H7)	30/35	35/42	42/47	47/57	57/75	75/90	75/90
Ød3	47/52	52/62	62/74,5	74,5/84	84/101,5	101,5/130	101,5/130
Ød4	5/6	6	6/8	8	8	8/10	10
t1	1,5/1,7	1,7/2,2	2,2/2,5	2,5	2,5	2,5/3	2,5/3
Ød6	28*1,5	32*1,5	40*2	50*2	50*3	60*4	70*4
e	30	32	36	42	46	60	60
b	3,5/4	4/5,5	5,5/6	6/7	7/8	8/9	9
z	4	4/6	4/6	4/6	6/8	8	8
DIN 5480	20X1,5X12	25X1,5X15	28X1,5X17	32X2X14	35X2X16	42X2X20	50X2X24



SIZE	ØA(mm)	B (mm)	Weight(kg)
52	17	41	0,1
60	19	48	0,1
70	22	58	0,2
86	28,5	70,9	0,5
98	30	83	0,7
115	35	97	1,0
125	38	106	1,3

HL 138-204



PRODUCT CODE KEY - EXAMPLE					
HL	178	C	180	820	45
Model					
Size					
type					
Flange Ød1					
Lz					
s**					

** Longer stroke may be available on request

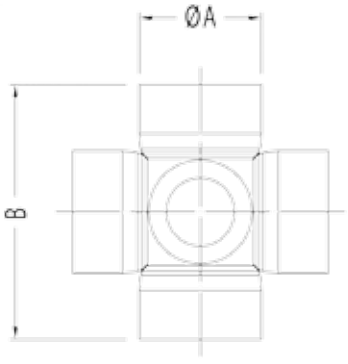
LEGENDA	
HL size	Size of the shaft equal to cross rotation
Code	Company internal production code
Tn (Nm)	Nominal torque
Tlim (Nm)	Max limit torque
Ø d1 (mm)	standard flange/ bigger flange
ß (°)	maximum angle of deflection per joint
Lz (mm)	compressed lenght
s (mm)	skip(elongation)
DIN 5480	spline shafts DIN standard

HL 138-204

SIZE Ød7	138	150	158	178	204
CODE	148	158	117	120	122
Tn (Nm)	5500	8200	10000	16850	26750
Tlim (Nm)	7050	10650	13000	21900	35000
Ød1 (mm)	150/180	150/180	150/165/180	180/225	180/225/250
ß (°)	35	35	30	30	30

L	Lz (mm)	550	710	660	740	830
	s (mm)	110	110	110	110	140
	Mass (Kg)	20,87/22,17	31,10/31,80	35,03/35,51/36,56	48,75/52,89/	72,05/76,93/80,82
C	Lz (mm)	360	400	495	560	650
	s (mm)	40	50	45	45	80
	Mass (Kg)	15,63/16,93	19,62/21,18	28,21/28,69/29,74	40,27/44,41	60,67/65,55/68,79
F	Lf (mm)	345	425	430	465	520
	Mass (Kg)	14,53/15,83	20,26/21,82	25,31/25,79/26,84	33,90/38,05	45,70/50,58/54,24
D	Lf (mm)	230	300	296	384	440
	Mass (Kg)	11,92/13,22	16,68/19,80	21,02/21,50/22,57	28,20/37,76	41,54/51,28/53,20

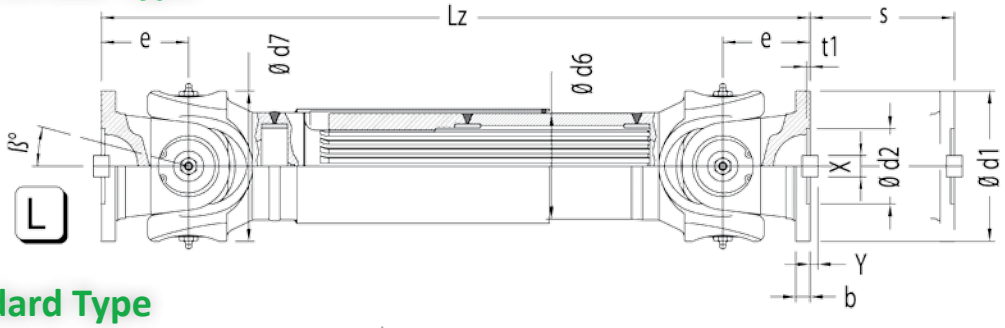
Ød7	138	150	158	178	204
Ød2 (H7)	90/110	90/110	90/95/110	110/140	110/140
Ød3	130/155,5	130/155,5	130/140/155,5	155,5/196	155,5/196
Ød4	12	12/14	12/16/16	16	16
t1	3/3,6	3/3,6	3/3/3,6	3,6/5	3,6/5/6
Ød6	80*4	90*4	100*5	110*6	120*6
e	65	150	158	178	204
b	10	12	12	14/15	15
z	8	8	12/8/8	10/8	10/8/12
DIN 5480	55X2,5X20	60X2,5X22	65X2,5X24	75X2,5X28	90X2,5X34



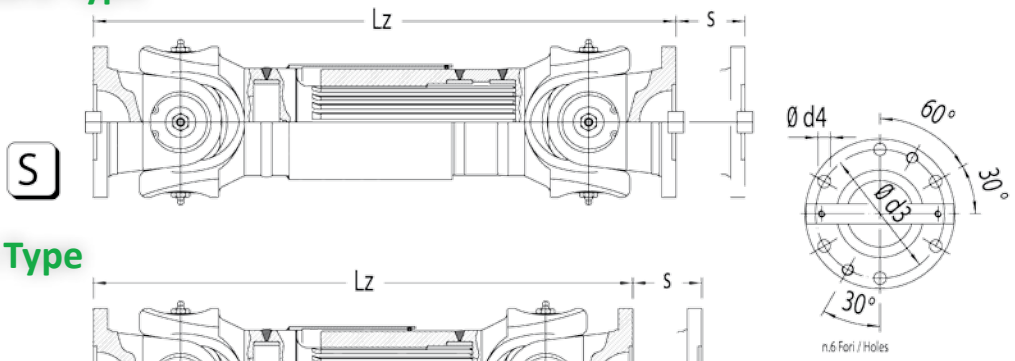
SIZE	ØA(mm)	B (mm)	Weight (kg)
138	42	117,5	1,7
150	48	126	2,3
158	53	135	3,3
178	57	152	4,2
204	65	172	6,2

HS 225-350

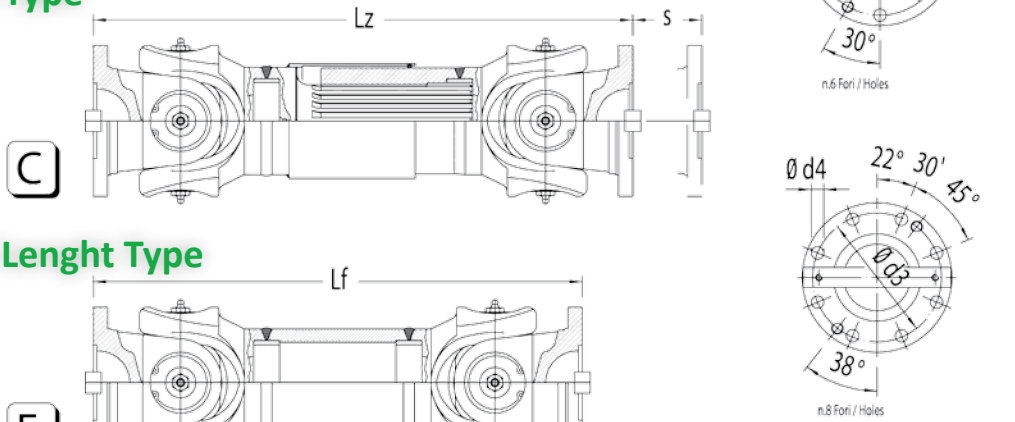
Long Stroke Type



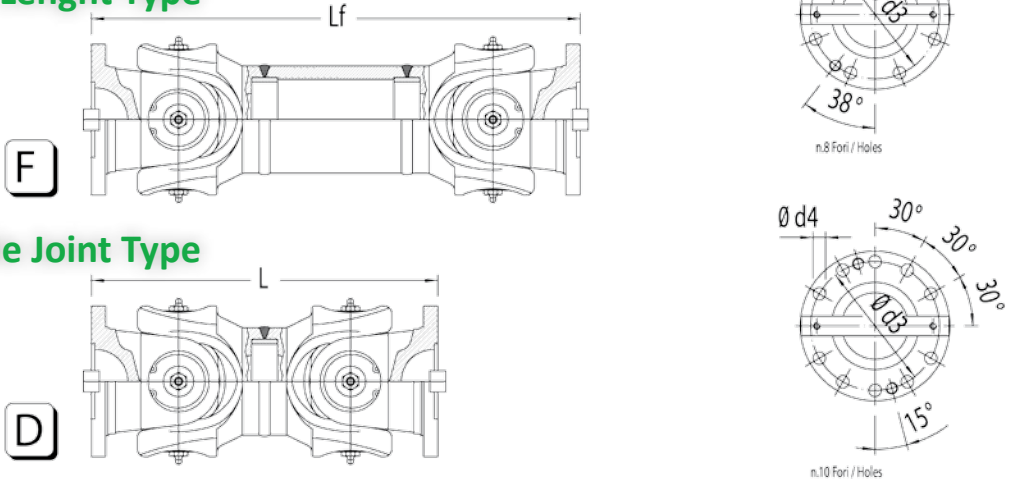
Standard Type



Short Type



Fixed Lenght Type



Double Joint Type

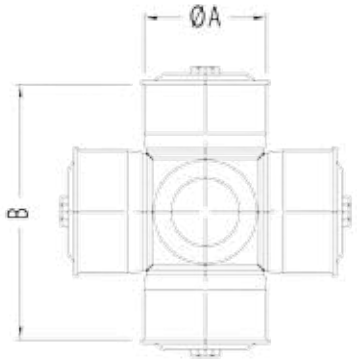
PRODUCT CODE KEY - EXAMPLE					
HS	250	/ 315	C	920	50
Model					
Size					
Ød1 (mm)*					
Type					
Lz (mm)					
s (mm)					

*indicate only if it is different from Size

LEGENDA	
Tn (kNm)	Rating designed torque.
Tlim (kNm)	limit torque.
Tp (kNm)	Pulsating torque.
Ta (kNm)	Alternating torque.
ß(°)	maximum angle of deflection per joint.
Lz (mm)	compressed lenght
s (mm)	skip(elongation)

HS 225-350

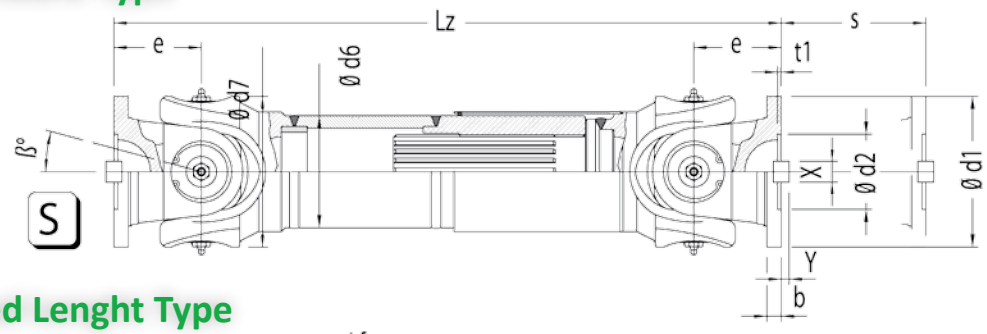
SIZE		225	250	285	315	350
Tn (kNm)		55	80	115	170	225
T lim (kNm)		72	104	150	221	293
Tp (kNm)		37	49	70	100	140
Ta (kNm)		26	35	50	71	100
ß (°)		15	15	15	15	15
L	Lz (mm)	1370	1520	1635	1870	2150
	s (mm)	600	650	700	750	800
	Mass (Kg)	228	307	464	644	1121
S	Lz (mm)	915	1020	1090	1280	1515
	s (mm)	145	150	155	160	165
	Mass (Kg)	130	182	279	396	700
C	Lz (mm)	820	920	995	1180	1415
	s (mm)	50	50	60	60	65
	Mass (Kg)	110	157	247	354	634
F	Lf (mm)	565	655	720	815	100
	Mass (Kg)	92	152	215	306	440
D	L (mm)	505	595	655	735	780
	Mass (Kg)	90	130	189	270	355
Ød1 – Ød7		225	250	285	315	350
Ød2 (H7)		105	105	125	130	210
Ød3		196	218	245	280	310
Ød4		17	19	21	23	23
t1		5	6	7	8	8
Ød6		157*21	181*21	200*23	225*26	245*19
e		130	145	165	185	195
b		20	25	27	32	35
X (h9)		32	40	40	40	50
Y		12,5	15	15	15	16
z		8	8	8	10	10
flange bolt		M16	M18	M20	M22	M22
DIN 5480		110X3X35	130X4X31	140X4X34	160X5X30	190X5X36



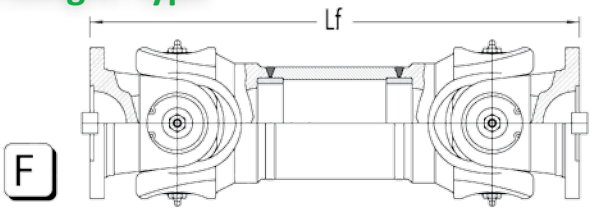
SIZE	ØA (mm)	B (mm)	Weight (Kg)
225	90	192	14,2
250	100	214	19,5
285	115	243	29,3
315	130	269	41,4
350	145	299	57,2

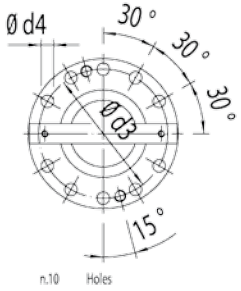
HS 390-620

Standard Type

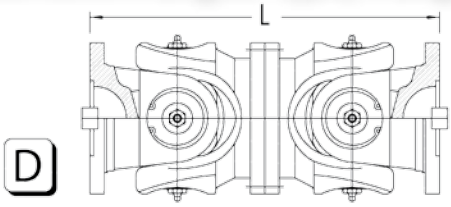


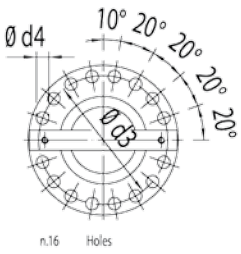
Fixed Lenght Type



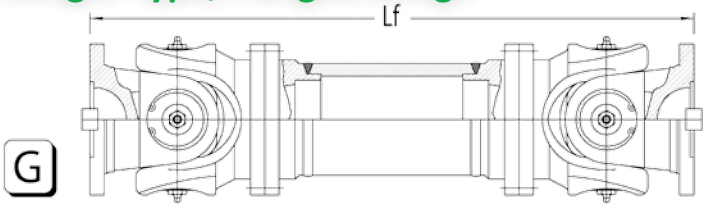


Double Joint Flanged Type, Flanged design

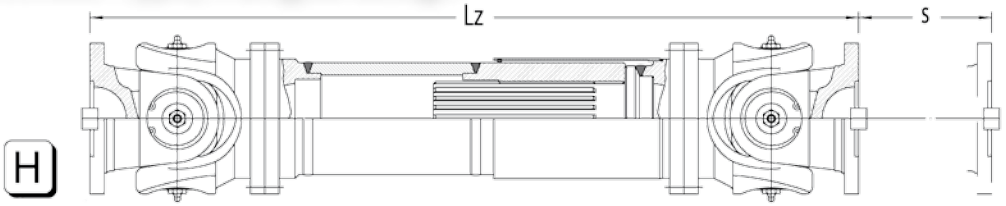




Fixed Lenght Type, Flanged design



Long Stroke Type, Flanged design



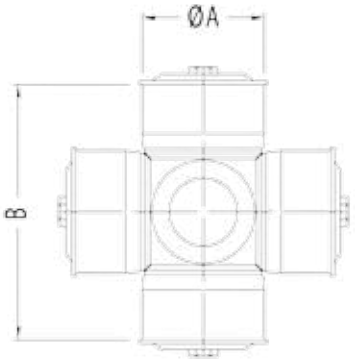
PRODUCT CODE KEY - EXAMPLE					
HS	390	/ 440	H	2600	900
Model					
Size					
Ød1 (mm)*					
Type					
Lz (mm)					
s (mm)					

*indicate only if it is different from Size

LEGENDA	
Tn (kNm)	Rating designed torque.
Tlim (kNm)	limit torque.
Tp (kNm)	Pulsating torque.
Ta (kNm)	Alternating torque.
β (°)	maximum angle of deflection per joint.
Lz (mm)	compressed lenght
s (mm)	Skip (elongation)

HS 390-620

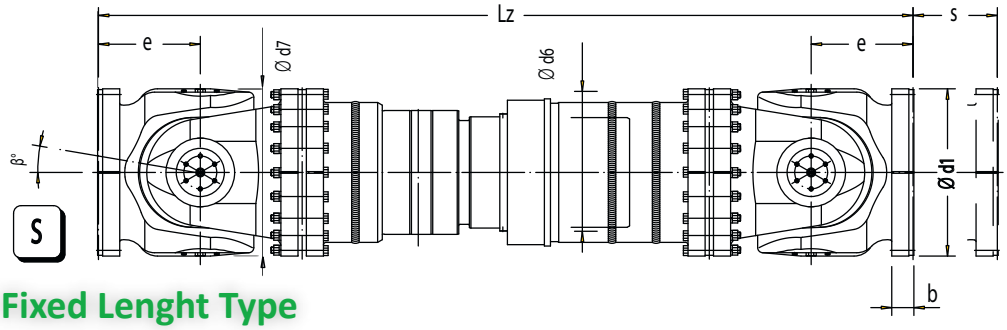
SIZE		390	440	490	550	620
Tn (kNm)		325	500	730	1000	1250
Tlim (kNm)		423	650	949	1300	1625
Tp (kNm)		224	350	483	700	910
Ta (kNm)		160	250	345	500	650
ß (°)		15	15	15	15	15
S	Lz (mm)	1740	1880	2060	2280	2520
	s (mm)	180	190	200	210	220
	Mass (Kg)	770	1200	1560	2260	2950
F	Lf (mm)	1010	1190	1280	1420	1660
	Mass (Kg)	571	855	1092	1703	2267
D	L(mm)	860	1040	1080	1220	1360
	Mass (Kg)	602	891	1157	1789	2405
G	Lf (mm)	505	595	655	735	780
	Mass (Kg)	647	945	1226	1875	2541
H	Lz (mm)	2410	2590	2860	3170	3500
	s (mm)	850	900	1000	1100	1200
	Mass (Kg)	1313	1962	2151	3751	4847
Ød1 – Ød7		390	440	490	550	620
Ød2 (H7)		235	255	275	320	380
Ød3		345	390	435	492	555
Ød4		25	28	31	31	38
t1		8	10	12	12	15
Ød6		273*21	325*25	351*30	402*32	426*40
e		215	260	270	305	340
b		40	42	47	50	55
X (h9)		70	80	90	100	100
Y		18	20	22,5	22,5	25
z		10	16	16	16	18
flange bolt		M24	M27	M30	M30	M36



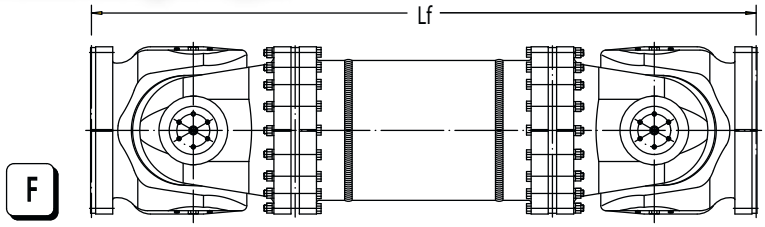
SIZE	ØA (mm)	B (mm)	Weight (kg)
390	165	333	102,9
440	185	377	146,6
490	210	419	209,6
550	240	472	307,9
620	265	526	418,7

HH 680-1200

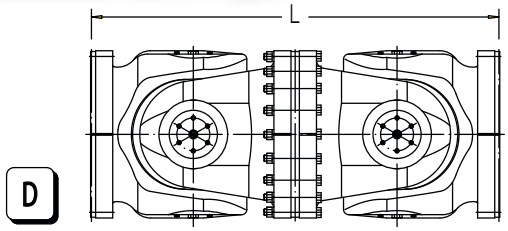
Standard type

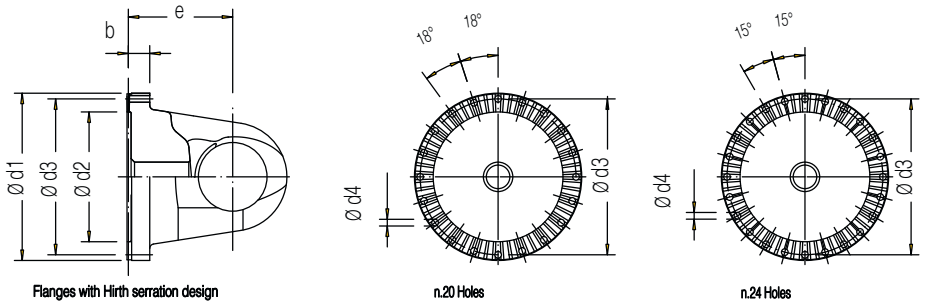


Fixed Lenght Type



Double Joint Type





PRODUCT CODE KEY - EXAMPLE				
HH	750	S	4070	600
Model				
Size				
Type				
Lz (mm)				
s (mm)				

LEGENDA	
Tn (kNm)	Rating designed torque.
Tlim (kNm)	limit torque.
Tp (kNm)	Pulsating torque.
Ta (kNm)	Alternating torque.
ß (°)	maximum angle of deflection per joint.
Lz (mm)	compressed lenght
s (mm)	Skip (elongation)

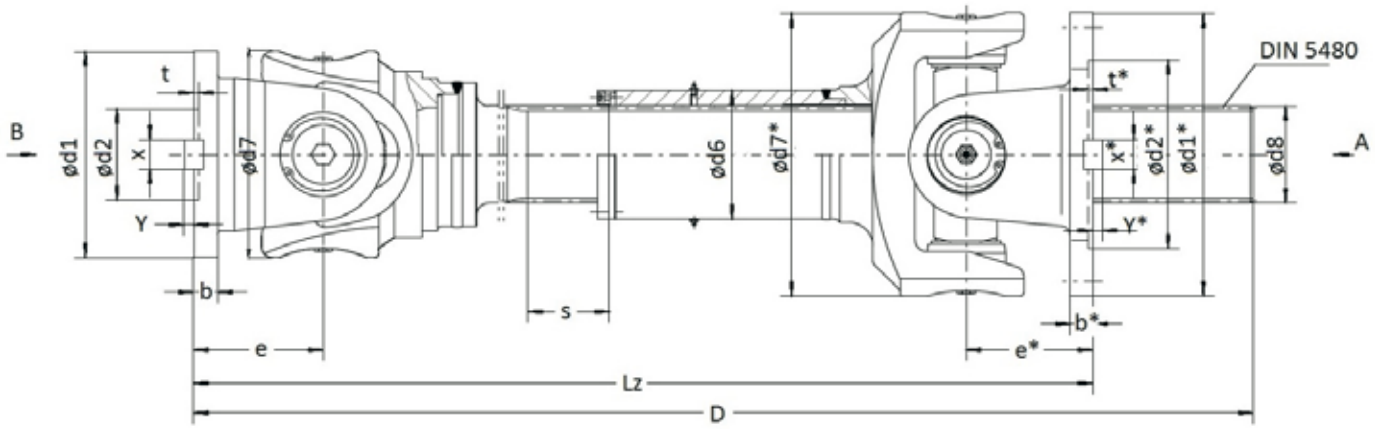
HH 680-840

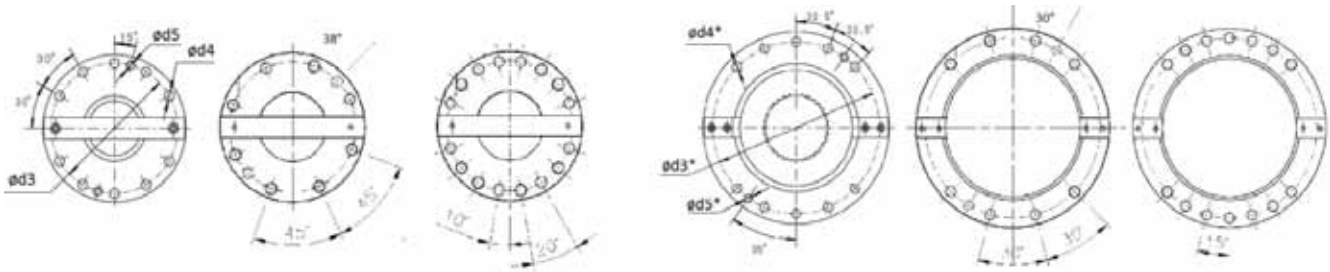
SIZE		680	700	750	800	840
Tn (kNm)		1640	1750	2250	2670	3100
Tp (kNm)		1372	1470	1890	2240	2604
Ta (kNm)		980	1050	1350	1600	1860
ß(°)		10÷15	10÷15	10÷15	10÷15	10÷15
S	Lz (mm)	3230	3460	3620	4000	4250
	s (mm)	250	250	250	250	250
	Mass (Kg)	4880	5400	8000	9070	11800
F	Lz (mm)	1940	2100	2400	2500	2680
	Mass (Kg)	3220	3530	4500	5800	7470
D	Lz (mm)	1540	1600	1840	1920	2120
	Mass (Kg)	3150	3450	4300	5050	6400
Ød1-Ød7		680	700	750	800	840
Ød2 (H9)		550	570	610	660	710
Ød3		635	655	695	745	775
Ød4		26	26	31	36	38
Ød6		560	560	620	660	660
e		385	400	460	480	530
b		70	70	95	95	110
z		24	24	24	24	24
flange bolt		M24	M24	M30	M34	M36

HH 900-1200

SIZE		900	920	1000	1060	1200
Tn (kNm)		3800	4050	5200	6500	9000
Tp (kNm)		3192	3405	4368	5460	7560
Ta (kNm)		2280	2430	3120	3900	5400
ß(°)		10÷15	10÷15	10÷15	10÷15	10÷15
S	Lz (mm)	4580	4650	4770	4950	5660
	s (mm)	300	300	300	300	300
	Mass (Kg)	15900	16500	19900	22000	34800
F	Lz (mm)	2950	2950	3130	3200	3570
	Mass (Kg)	9980	10500	12300	14500	19500
D	Lz (mm)	2280	2280	2380	2480	2720
	Mass (Kg)	8420	8950	10600	12100	16900
Ød1-Ød7		900	920	1000	1060	1200
Ød2 (H9)		740	760	840	840	1000
Ød3		835	855	915	980	1100
Ød4		38	38	50	50	58
Ød6		750	750	790	800	900
e		570	570	595	620	680
b		120	120	130	130	130
z		24	24	24	24	24
flange bolt		M36	M36	M48	M48	M56

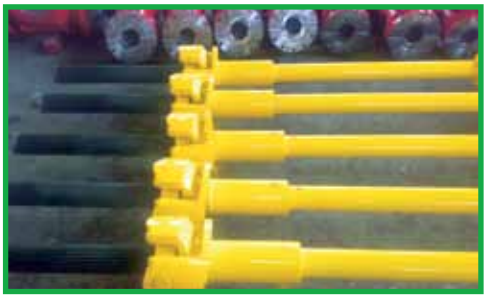
HST





PRODUCT CODE KEY - EXAMPLE					
HST	440	/ 600	2575	1745	1200
Model					
Size					
Ød1*					
D					
Lz					
s					

LEGENDA	
Tn (kNm)	Rating designed torque.
Tlim (kNm)	limit torque.
Tp (kNm)	Pulsating torque.
Ta (kNm)	Alternating torque.
ß (°)	maximum angle of deflection per joint small flange side
Lz (mm)	compressed lenght
s (mm)	Skip (elongation)
ß (°)	maximum deflection angle for big flange side
D (mm)	total lenght



HST

SIZE	225	250	285	315	350	390	440	490	550
Tn (kNm)	55	80	115	170	225	325	500	730	1000
Tlim (kNm)	72	104	150	221	293	423	650	949	1300
Tp (kNm)	37	49	70	100	140	224	350	483	700
Ta (kNm)	26	35	50	71	100	160	250	345	500
ß(°)	15	15	15	15	15	15	15	15	15
ß*(°)	10	10	10	10	10	10	10	10	10

Lz (mm)	945	1025	1145	1260	1469	1575	1760	1860	2055
s (mm)	650	650	750	750	800	800	800	900	1000
D (mm)	1415	1475	1670	1765	2000	2070	2215	2375	2625
Mass (Kg)	198	272	409	553	772	973	1378	1732	2495

Ød1-Ød7	225	250	285	315	350	390	440	490	550
Ød2 (H7)	105	105	125	130	210	235	255	275	320
Ød3	196	218	245	280	310	345	390	435	492
Ød4-Ød4*	17	19	21	23	23	25	28	31	31
t	5	6	7	8	8	8	10	12	12
Ød6	157*21	181*21	200*23	225*26	245*19	273*21	325*25	351*30	402*32
e	130	145	165	185	195	215	260	270	305
b	20	25	27	32	35	40	42	47	50
X-X*(h9)	32	40	40	40	50	70	80	90	100
Y	12,5	15	15	15	16	18	20	22,5	22,5
z	8	8	8	10	10	10	16	16	16
flange bolt	M16	M18	M20	M22	M22	M24	M27	M30	M30
Ød1*-Ød7*	315	330	390	435	480	520	600	650	710
Ød2* (H7)	130	210	260	275	320	360	420	450	520
Ød3*	285	300	355	390	430	480	550	595	650
t*	5	6	7	8	8	12	12	12	15
e*	140	155	175	190	210	235	265	290	325
b*	30	30	35	35	40	50	55	55	60
Y*	9	12,5	15	15	16	18	20	22,5	22,5
z*	8	8	8	10	10	10	10	14	14
Ød8	100X2,5	115X2,5	130X3	150X3	170X5	185X5	210X5	220X5	245X5

COMPANION FLANGES

TYPES OF COMPANION FLANGES

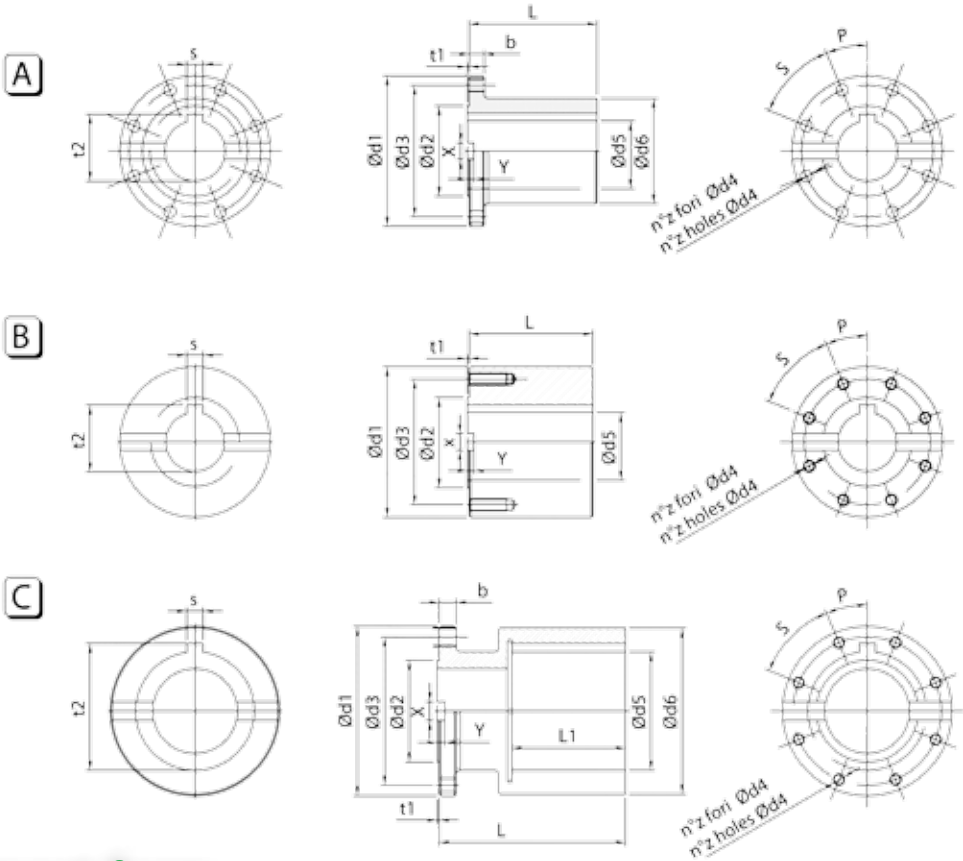
The companion flanges are an integrant part of the universal shafts that provides the interface between the universal shaft and the driving or operating machine. Our company supplies various types of companion flanges as a standard accessory. Upon request, we can also manufacture these components upon customers' drawings. Solution A is the basic type for shaft dimension less than the centering diameter. Solution B is used for the shaft with diameter equal to greater than the centering diameter. Solution C, for big shafts, where the diameter of the shaft is nears as big as the diameter of the flange (special applications). Other solutions (with wearing plates, built-in with the flanges, with adaptation plates) can be made upon request. At any rate, the companion flanges are made with the same quality and precision of the universal shaft and with the same high quality materials. Consult our technical office for the balancing of the companion langes. The companion flanges are required according to the diameter of the flange, length and diameter of the external shaft (with relevant shrinking-on tolerances) and dimension of the keys.

STANDARD FLANGE

The flat flanges are shwon with a diameter and a number of holes standard for that diameter. Upon request we can supply both normal bolts (8G) and high resistance bolts (10K). All the standard flanges are fitted with a key.

SPECIAL FLANGES

There are several types of flanges that can be made upon customers' request, with special holes or machining, without keys, with different centering etc. Two special flanges for high loading are the "dog toothed" and those with Hirth toothing. The dog toothed flanged universal shaft is often used in the rolling mills thanks to its special characteristics. The Hirth toothed flanges are used as a standard on the HH type universal shafts and are the ideal solution for high torques.



Requirement form

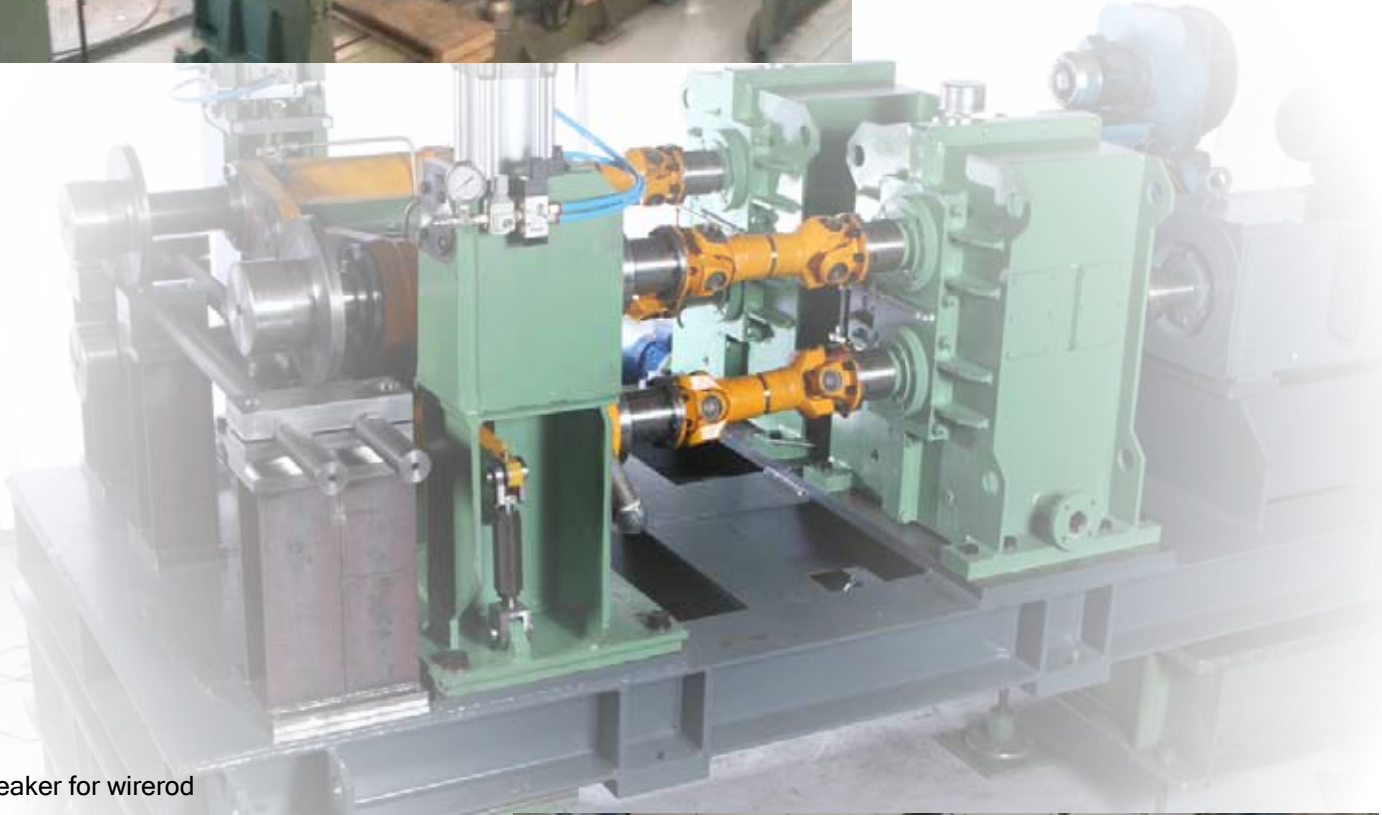
All measures marked * shall report required tolerance.

Ød1 (mm)		b (mm)		z	
Ød2 (mm)*		t1 (mm)		S (deg)	
Ød3 (mm)		t2 (mm)		P (deg)	
Ød4 (mm)		s (mm)*		L (mm)	
Ød5 (mm)*		X (mm)*		L1 (mm)	
Ød6 (mm)		Y (mm)*			

CONSTRUCTION

NOTES

Dinamic balancing

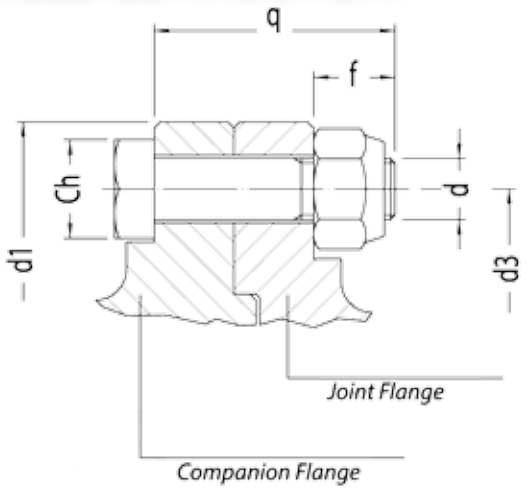


tailbreaker for wirerod

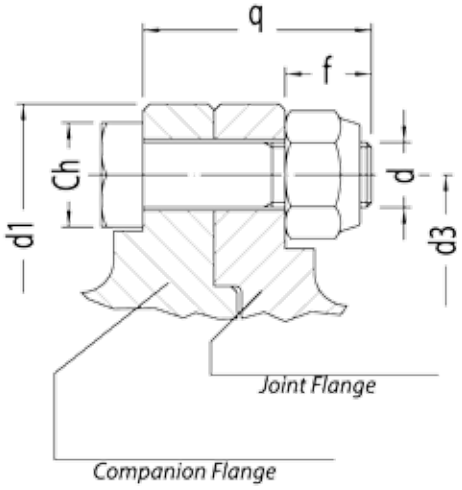
HH900 for reversible HSM stand

FLANGES CONNECTION

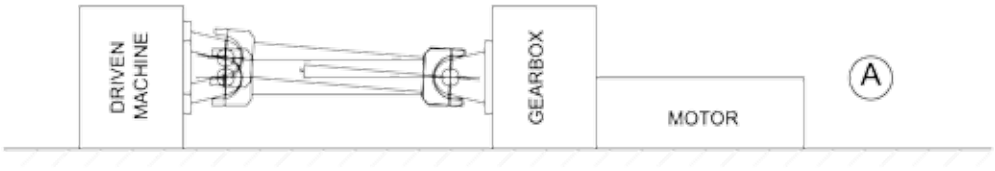
A

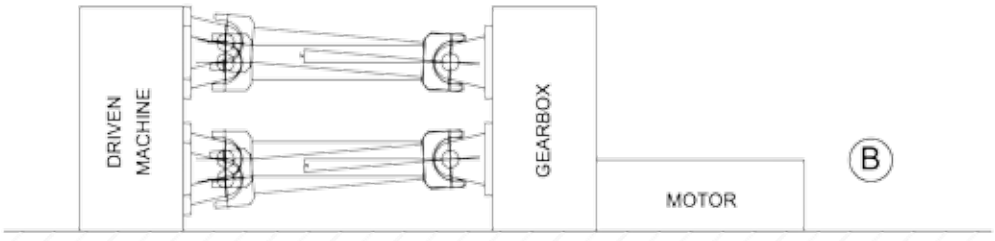


B



Hexagonal or cylindrical headed bolts in accordance to DIN 931 - 10.9 or 12.9, self-locking nuts according to DIN 980 - 10 or 8. The bolts are inserted from companion flange side. With larger flanges it is possible to insert the bolts from the joint side. With cylindrical companion flanges it is possible to use stud bolt. The bolts are to be tightened with a dynamometrical wrench,in accordance to the indicated torque. Maximum tightening torque must not exceed 90% of the elastic limit of the bolt material and must be applied to oiled bolts (friction factor 0.12). Hexagonal or cylindrical headed bolts in accordance to DIN 931 - 10.9 or 12.9, self-locking nuts according to DIN 980 - 10 or 8. The bolts are inserted from companion flange side. With larger flanges it is possible to insert the bolts from the joint side. With cylindrical companion flanges it is possible to use stud bolt. The bolts are to be tightened with a dynamometrical wrench,in accordance to the indicated torque. Maximum tightening torque must not exceed 90% of the elastic limit of the bolt material and must be applied to oiled bolts (friction factor 0.12).





SELECTION FORM

NECESSARY DIMENSIONING (A e B) INFO
Motor Power (kW)*
Motor speed (rpm)*
Average Working Angle (w°)*
Gearbox Ratio (i)*
B DIMENSIONING
Torque sharing (%)*
GEOMETRICAL LIMITS
Closed lenght
Stroke
Flange Diameter
Centering Diameter
Hole Dimensions
Face Key

APPLICATION DESCRIPTION

NOTES

* required informations

HL 52-125

SIZE	52	60	70	86	98	115	138	158	178	204
d1 (mm)	58	65	75	90	100	120	150	180	200	225
d3 (mm)	47	52	62	74,5	84	101,5	130	155,5	170	196
d (mm)	M5	M6	M6	M8	M8	M10	M12	M14	M16	M16
q (mm)	13	17	19	21	25	28	34	40	42	48
f (mm)	6	8	8	9	9	12	14	16	18	18
Ch (mm)	8	10	10	13	13	16	18	22	24	24
n nr.	4	4	6	4	6	8	8	8	8	8
Torque (Nm)	6	10	10	25	25	50	85	190	287	287

HS 180-620

SIZE	225	250	285	315	350	390	440	490	550	620
d1 (mm)	225	250	285	315	350	390	440	490	550	620
d3 (mm)	196	218	245	280	310	345	390	435	492	555
d (mm)	M16	M18	M20	M22	M22	M24	M27	M30	M30	M36
q (mm)	60	70	80	90	95	110	120	130	140	150
f (mm)	20	20	26	26	25	30	36	36	40	40
Ch (mm)	24	27	30	32	32	36	41	46	46	55
n nr.	8	8	8	10	8	8	10	12	12	12
Torque (Nm)	287	396	560	745	745	975	1415	1920	1920	3300

HH 680-1200

SIZE	680	700	750	780	800	840	900	920	1000	1060	1200
d1 (mm)	680	700	750	780	800	840	900	920	1000	1060	1200
d3 (mm)	635	635	695	725	745	775	835	855	915	980	1100
d (mm)	M24	M24	M30	M30	M30	M36	M36	M36	M48	M48	M56
q (mm)	210	210	230	230	240	250	270	270	290	290	290
f (mm)	30	30	40	40	40	45	50	50	60	60	60
Ch (mm)	36	36	46	46	46	55	55	55	75	75	90
n nr.	24	24	24	24	24	24	24	24	20	20	20
Torque (Nm)	975	975	1920	1920	1920	3300	3300	3300	6200	6200	9000