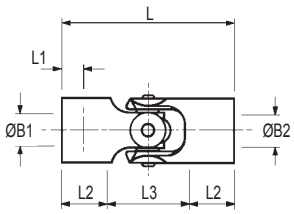
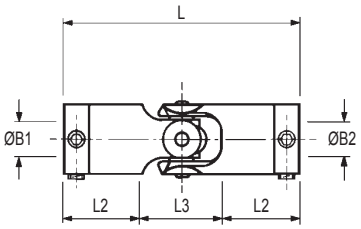
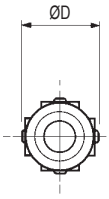
Single joints



Ref. 101
Plain molded bores.
Attach shafts by cross-pinning

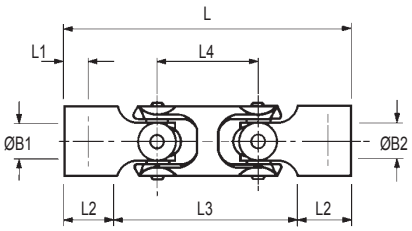


Ref. 103
Headed brass inserts fitted 2 screws
per end (size 6, one screw)

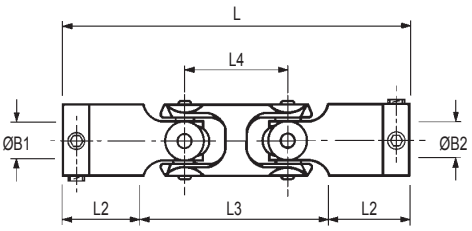


Typical

Double joints



Ref. 109
Plain molded bores.
Attach shafts by cross-pinning



Ref. 111
Headed brass inserts fitted 2 screws
per end (size 6, one screw)

Constant velocity

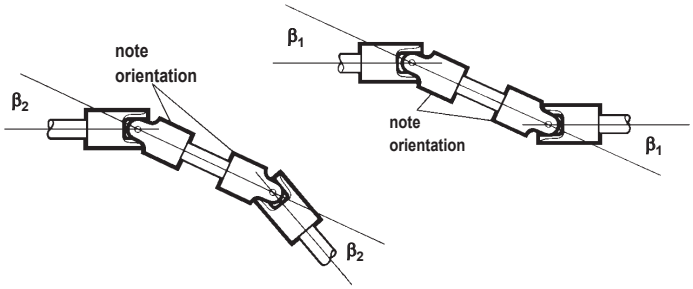
The velocity ratio of single universal joints is not constant when the working angle is greater than zero. Their geometry gives rise to sinusoidal fluctuations at the output that increase with the working angle and which vary between:

$\omega \cos \beta$ and $\omega \sec \beta$

where ω = angular velocity
and β = operating angle

For example, when the operating angle is 5°, the maximum error is ±0.4%; at 7° it is ±0.8%, and at 10° it is ±1.5%. A motor shaft turning at a constant 1000 rpm, driving through a single universal joint set at an operating angle of 5°, produces an output that fluctuates between 996 rpm and 1004 rpm twice each revolution.

The fluctuations are cancelled out when using a double joint or two single joints connected back to back.



To maintain constant velocity ratio, ensure that:

a) The orientation of two single joints is correct; the inboard forks should align as in double joints.

b) The working angle of both joints, or both halves of a double joint, is the same.

HOW TO ORDER

Combine the JOINT REF in Main Table with BORE REFS in Standard Bores Table. Please identify both bores e.g.

103.06.1418 U

- Joint ref.
- Ø B1 ref.
- Ø B2 ref.
- Metric screw with American socket (omit if metric screws are preferred)

MAIN TABLE – DIMENSIONS & ORDER CODES

Size	Joint Single	Joint Double	ØD	L	[1] L1	[2] L2	L3	L4	ØB1, ØB2 max bores	Fasteners Screw	[3] Torque	Wrench	[4] Moment of inertia	[4] Mass
	JOINT REF		in.	in.	in.	in.	in.	in.			lb.in		lb.in² x 10⁻⁵	lb.
06	101.06	–	0.28	0.75	0.13	0.21	0.33	–	0.1875	–	–	–	1.0	0.002
	103.06 ‡ U	–		1.07	–	0.37			0.1250	M3	8.3	1/16	3.8	0.007
	–	109.06		1.07	0.13	0.21	0.65	0.32	0.1875	–	–	–	2.1	0.003
	–	111.06 ‡ U		1.39	–	0.37			0.1250	M3	8.3	1/16	4.4	0.008
09	101.09	–	0.44	1.12	0.17	0.34	0.44	–	0.2500	–	–	–	13.7	0.006
	103.09 ‡ U	–		1.48	–	0.52			0.1969 (5mm)	M3	8.3	1/16	46.1	0.020
	–	109.09		1.64	0.17	0.34	0.96	0.52	0.2500	–	–	–	20.2	0.010
	–	111.09 ‡ U		2.00	–	0.52			0.1969 (5mm)	M3	8.3	1/16	52.3	0.020
13	101.13	–	0.56	1.40	0.22	0.41	0.58	–	0.3150 (8mm)	–	–	–	48.9	0.013
	103.13 ‡ U	–		1.82	–	0.62			0.2500	M3	8.3	1/16	152.0	0.039
	–	109.13		2.02	0.22	0.41	1.20	0.63	0.3150 (8mm)	–	–	–	81.0	0.021
	–	111.13 ‡ U		2.44	–	0.62			0.2500	M3	8.3	1/16	172.0	0.048
16	101.16	–	0.69	2.10	0.35	0.60	0.90	–	0.4375	–	–	–	110.0	0.027
	103.16	–		2.66	–	0.88			0.3937 (10mm)	M4	20.0	5/64	465.0	0.077
	–	109.16		2.97	0.35	0.60	1.78	0.87	0.4375	–	–	–	217.0	0.043
	–	111.16		3.54	–	0.88			0.3937 (10mm)	M4	20.0	5/64	608.0	0.093

Materials & Finishes

Forked body members:
Acetal (black)

Cross pieces & headed inserts:
Brass CZ121 (C38500 to ASTM B455 or equivalent)
Chromate & passivate finish

Fasteners:
Alloy steel, black oiled or Zinc plated, blue dye finish

Temperature Range

–4°F to +140°F
(–20°C to +60°C)

PERFORMANCE AT 68°F (20°C)

Joint Size	Single / Double	[5] Peak torque	Max compensation Angular	Max compensation Radial	[6] Torsional Rate	Torsional Stiffness	[7] Max end loading	Static break torque
		lb.in	± deg	± in.	deg / lb.in	lb.in / rad	lb.	lb.in
06	Single	1.0	45	–	2.23	25.6	4	4
	Double	0.7	90	0.22	9.24	6.2	0	3
09	Single	3.2	45	–	0.77	74.3	8.5	17
	Double	1.4	90	0.36	1.53	38.0	0	17
13	Single	7.5	45	–	2.74	159.0	15	40
	Double	5.2	90	0.43	0.92	62.8	0	30
16	Single	14.0	45	–	0.197	300.0	22	60
	Double	11.5	90	0.61	0.53	111.0	0	60

1. Recommended datum for cross-pinning/screws, etc.
2. Max shaft penetration
3. Maximum recommended tightening torque.
4. Values apply with max bores.
5. ***Peak torque***. Select a size where Peak Torque exceeds the adjusted torque.
6. Torsional stiffness values apply at 50% peak torque with no misalignment, measured shaft-to-shaft with largest standard bores.
7. With joints cross-pinned to shafts.

ADJUSTED TORQUE

Peak torque values apply when the working angle is zero. Adjusted torque takes account of dynamic loading at the joint bearings. To find adjusted torque, determine application speed, torque and operating angle,

Then:

a) multiply speed x working angle
b) subtract the result from 10000
c) divide the answer into 10000
d) apply the result to the application torque.

eg. speed = 400 rpm
application torque = 0.9 lb.in
working angle = 20°

Accordingly:

a) 400 rpm x 20° = 8000
b) 10000 – 8000 = 2000
c) 10000 / 2000 = 5
d) 5 x 0.9 lb.in = 4.5 lb.in

Select a joint where Peak Torque exceeds 4.5 lb.in, ie., size 13 or larger.

Note: To remain within the capacity of the joint, the result of speed x working angle must be less than 10000.

STANDARD BORES[8]

Joint Size	Ref.	ØB1, ØB2 Tolerances[9] 0.125	0.1875	0.250	0.375	3	4	5	6	8	10
06	101 & 109	○	○			○	○				
	103 & 111	●				●					
09	101 & 109		○	○			○	○	○		
	103 & 111	●	●			●	●	●			
13	101 & 109			○					○	○	
	103 & 111		●	●			●	●	●		
16	101 & 109				○					○	○
	103 & 111			●	●				●	●	●
Bore ref.		16	19	24	31	14	18	20	22	28	32
Corresponding bore adaptor				**253**				**251**		**255**	**257**

Diameters for which a bore adaptor is shown can be adapted to smaller shaft sizes. See *page 40* for details.

8. Couplers can be specified with 'D' bores. See *page 4* for details.
9. Refs. 101 & 109 +0.0016"/–0.0004" (+0.04/–0.01mm)
Refs. 103 & 111 +0.0012"/–0" (+0.03/–0mm)

‡ Insert both bore refs. in place of ‡.

○ molded bores
● sleeved bores

See next page for larger joints