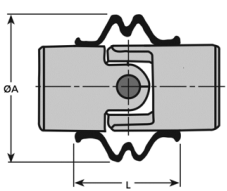
Couplings

Universal Joints Retaining Covers

Material
PVC & Neoprene

DISCOUNTS	
1 - 9	List Price
10-24	-2%
25-49	-4%
50 +	-6%



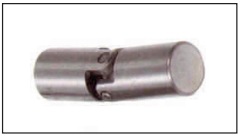
PART NUMBER PVC	Joint Size Dia.	To Fit	A	L	PRICE EACH 1-5
HPCA9050	16	HPCME16/ HPCSME16	47.36	31.75	£18.18
HPCA9054	20	HPCME20/ HPCSME20	57.15	39.69	£22.71
HPCA9052	25	HPCME25/ HPCSME25	66.68	46.83	£24.80
HPCA9053	32	HPCME32/ HPCSME32	79.38	60.33	£32.01
HPCA9056	45	HPCME45/ HPCSME45	125.41	76.20	£35.11
HPCA9057	50	HPCME50/ HPCSME50	141.29	84.93	£39.24
HPCA9058	63	HPCME63/ HPCSME63	155.58	103.98	£42.34

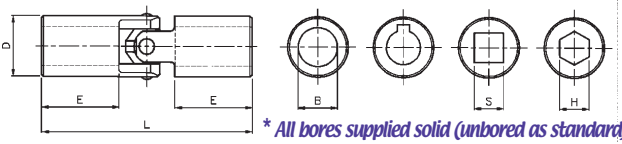
PART NUMBER Neoprene	Joint Size Dia.	To Fit	A	L	PRICE EACH 1-5
HPCA15028	13	HPCME13/ HPCSME13	23.81	26.99	£20.30
HPCA9028	16	HPCME16/ HPCSME16	23.81	26.99	£21.68
HPCA9029	20	HPCME20/ HPCSME20	31.75	31.75	£28.39
HPCA9030	25	HPCME25/ HPCSME25	38.10	46.83	£37.58
HPCA9031	32	HPCME32/ HPCSME32	44.45	56.36	£40.02
HPCA9032	40	HPCME40/ HPCSME40	60.33	74.61	£42.59
HPCA9033	45	HPCME45/ HPCSME45	76.20	79.38	£43.89
HPCA9034	50	HPCME50/ HPCSME50	82.55	87.31	£49.05

Couplings
Single Universal Joints

Material
Steel & Stainless Steel

DISCOUNTS	
1 - 9	List Price
10-24	-2%
25-49	-4%
50 +	-6%





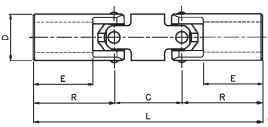
** All bores supplied solid (unbored as standard).*

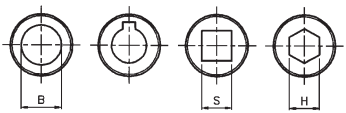
PART NUMBER						'B' Max					PRICE EACH 1-5	
Steel	Stainless	D	L	E Min	* B	MB	WK	S	H	SBT	Steel	Stainless
HPCME16	HPCSME16	16	58	19	8	10	8	-	-	45	£56.58	£128.43
HPCME20	HPCSME20	20	64	19	10	13	11	10	10	88	£57.40	£140.63
HPCME25	HPCSME25	25	86	26	12	16	14	12	12	180	£62.17	£149.82
HPCME32	HPCSME32	32	95	28	16	22	18	16	16	405	£76.49	£180.46
HPCME40	HPCSME40	40	108	30	20	25	22	19	19	860	£91.81	£235.50
HPCME45	HPCSME45	45	127	36	20	30	25	22	22	1250	£116.99	£302.74
HPCME50	HPCSME50	50	140	41	25	35	30	25	25	1730	£194.13	£394.55
HPCME63	HPCSME63	63	178	52	32	45	35	32	32	3400	£259.19	£556.49

B : Standard round bore available to order,
if required please add an additional £15.00 per end
MB : Max round bore available
WK: Max round bore available with keyway, please contact sales for a quote
S : Max square bore available, please contact sales for a quote
H : Max hexagon bore available, please contact sales for a quote
SBT: Static Breaking Torque (Nm)

Material
Steel & Stainless Steel

DISCOUNTS	
1 - 9	List Price
10-24	-2%
25-49	-4%
50 +	-6%





* All bores supplied solid (unbored as standard).

PART NUMBER								'B' Max					PRICE EACH 1-5	
Steel	Stainless	D	L	E Min	R	C	* B	MB	WK	S	H	SBT	Steel	Stainless
HPCMF16	HPCSMF16	16	83	16	28	25	8	10	8			45	£124.39	£247.25
HPCMF20	HPCSMF20	20	92	18	31	30	10	13	11	10	10	88	£127.92	£302.74
HPCMF25	HPCSMF25	25	122	25	43	36	12	16	14	12	12	180	£145.60	£339.38
HPCMF32	HPCSMF32	32	143	27.5	47.5	47	16	22	18	16	16	405	£196.65	£403.58
HPCMF40	HPCSMF40	40	164	30	54	56	20	25	22	19	19	860	£219.21	£531.98
HPCMF45	HPCSMF45	45	190	33.5	63.5	63	20	30	25	22	22	1250	£265.93	£660.37
HPCMF50	HPCSMF50	50	210	41	70	70	25	35	30	25	25	1730	£328.81	£871.40
HPCMF63	HPCSMF63	63	262	52	89	84	32	45	35	32	32	3400	£439.41	£1146.75

B : Standard round bore available to order,
if required please add an additional £15.00 per end
MB : Max round bore available
WK: Max round bore available with keyway, please contact sales for a quote
S : Max square bore available, please contact sales for a quote
H : Max hexagon bore available, please contact sales for a quote
SBT: Static Breaking Torque (Nm)

Materials & Finishes

Bodies:	Acetal
Cross-pieces:	Brass BS 2874 CZ121, CZ122, (HPC101, HPC103, HPC109, HPC111)
Bore Inserts:	Brass BS 2874 CZ121 (HPC103, HPC111) Al. Alloy 2014A T6 (HPC105)
Fasteners:	Alloy steel, black oiled

General description
Light duty plastic universal joints.
Low mass, corrosion resistant, ideal where conventional steel joints would be under-utilised.

Where to use
Intermittent applications in business machines, instrumentation, lab equipment, analytical apparatus, etc., where steel joints would be under-utilised.

Speeds
Up to 1000 rpm

Peak torque largest size
10.7 Nm

Standard bores
3 to 20 mm

Temperature range
-20˚C to +60˚C

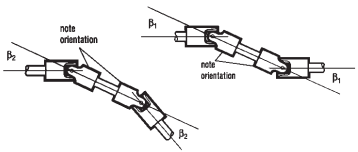
Electrically isolating
Yes

Connection
Set Screw, Bonding or Cross-Pinning

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.

Adjustable Torque

Peak torque values apply when the working angle is zero. Adjusted torque takes account of dynamic loading at the 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= 0.1Nm
working angle = 20°
Accordingly:
a) 400 rpm x 20° = 8000
b) 10000 – 8000 = 2000
c) 10000 / 2000 = 5
d) 5 x 0.1Nm = 0.5Nm
Select a joint where Peak Torque exceeds 0.5Nm, 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.

Single Joints - Performance (At 20° C)

Coupling Size	Brass Cross-piece HPC101, HPC103, HPC105				Max angular compensation @ 1000 rev/min
	Peak Torque (Nm)	Static Break Torque Nm	Torsional rate deg/Nm	Torsional Stiffness Nm/rad	
06	0.11	0.45	19.7	2.9	45
09	0.36	1.9	6.8	8.4	45
13	0.85	4.5	3.2	18	45
16	1.6	6.8	1.7	34	45
20	2.8	17	0.94	61	40
25	5.6	34	0.51	112	40
32	10.7	72	0.25	229	40

Standard Bores

Coupling Size \ Bore Size	Bore tolerances HPC101 = +0.04/-0.0mm HPC103 = +0.03/-0.0mm									
	3	3.175	4	4.763	5	6	6.350	8	9.525	10
06	●	●	●	●						
09	●	●	●	●	●	●	●			
13			●	●	●	●	●	●		
16						●	●	●	●	●
20								●	●	●
25										●
32										
Bore ref.	14	16	18	19	20	22	24	28	31	32

● Moulded bores only ● Sleeved bores only ● Moulded or sleeved bores only

Coupling Size \ Bore Size	Bore tolerances HPC101 = +0.04/-0.0mm HPC103 = +0.03/-0.0mm								
	12	12.7	14	15.875	16	18	19	19.05	20
06									
09									
13									
16									
20		●							
25	●	●							
32			●	●	●	●	●	●	●
Bore ref.	35	36	38	41	42	45	46	47	48

Single Joints - Dimensions and Order Codes

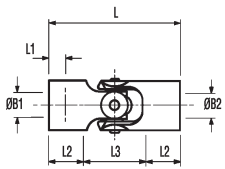
❶

PART NUMBER	Dimensions							Moment of inertia Kgm^2 x 10^{-8}
❶ Brass Cross-piece	Coupling Type & Size	OD	L	L1	L2	L3	B1, B2 Max	
HPC101.06.----	06	7.1	19.1	3.3	5.3	8.6	4.76	0.3
HPC103.06.----			27.2	-	9.3		3.18	1.1
HPC101.09.----	09	11.1	28.5	4.3	8.6	11.4	6.35	4.0
HPC103.09.----			37.6	-	13.1		5.0	13.5
HPC101.13.----	13	14.3	35.6	5.6	10.4	14.8	8.0	14.3
HPC103.13.----			46.2	-	15.7		6.35	44.6
HPC101.16.----	16	17.5	53.3	8.9	15.2	23.0	11.0	32.3
HPC103.16.----			67.6	-	22.3		10.0	136
HPC105.20.----	20	23.0	62.0	8.0	17.0	28.0	12.7	147
HPC105.25.----	25	28.5	74.0	10.0	20.0	34.0	14	463
HPC105.32.----	32	36.5	86.0	10.0	21.0	44.0	20	1339

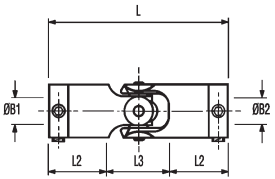
Order codes: Please combine the universal joint part number in the above table with the bore reference in the standard bores table (see pages 3.90 & 3.91). Please identify both bores to complete the part number eg. HPC101.06. 14 19

Part Number ØB1 ØB2

DISCOUNTS	1 - 5	6-15	16-40	41-99	100 +
	List Price	-5%	-10%	-15%	-20%



Type HPC101, HPC105



Type HPC103

Fasteners			Mass kg	PART NUMBER	PRICE EACH
Size	Torque (Nm)	A/F (mm)	x 10^{-3}	Size	1-5
-	-	-	0.7	HPC101.06.----	£6.03
M3	0.94	1.5	3.1	HPC103.06.----	£17.05
-	-	-	2.7	HPC101.09.----	£5.75
M3	0.94	1.5	9.3	HPC103.09.----	£17.05
-	-	-	5.7	HPC101.13.----	£6.21
M3	0.94	1.5	17.7	HPC103.13.----	£19.68
-	-	-	12.2	HPC101.16.----	£6.79
M4	2.27	2.0	35.0	HPC103.16.----	£22.46
-	-	-	25.7	HPC105.20.----	£19.78
-	-	-	56	HPC105.25.----	£25.38
-	-	-	103	HPC105.32.----	£24.73

Materials & Finishes

Bodies:	Acetal
Cross-pieces:	Brass BS 2874 CZ121, CZ122, (HPC101, HPC103, HPC109, HPC111)
Bore Inserts:	Brass BS 2874 CZ121 (HPC103, HPC111) Al. Alloy 2014A T6 (HPC105)
Fasteners:	Alloy steel, black oiled

General description
Light duty plastic universal joints.
Low mass, corrosion resistant, ideal where conventional steel joints would be under-utilised.

Where to use
Intermittent applications in business machines, instrumentation, lab equipment, analytical apparatus, etc., where steel joints would be under-utilised.

Speeds
Up to 1000 rpm

Peak torque largest size
10.7 Nm

Standard bores
3 to 20 mm

Temperature range
-20˚C to +60˚C

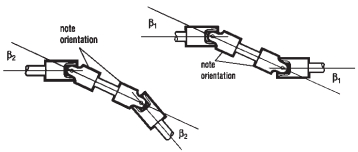
Electrically isolating
Yes

Connection
Set Screw, Bonding or Cross-Pinning

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.

Adjustable Torque

Peak torque values apply when the working angle is zero. Adjusted torque takes account of dynamic loading at the 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= 0.1Nm
working angle = 20°
Accordingly:
a) 400 rpm x 20° = 8000
b) 10000 – 8000 = 2000
c) 10000 / 2000 = 5
d) 5 x 0.1Nm = 0.5Nm
Select a joint where Peak Torque exceeds 0.5Nm, 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

Coupling Size \ Bore Size	Bore tolerances HPC101 = +0.04/-0.0mm HPC103 = +0.03/-0.0mm									
	3	3.175	4	4.763	5	6	6.350	8	9.525	10
06	●	●	●	●						
09	●	●	●	●	●	●	●			
13			●	●	●	●	●	●		
16						●	●	●	●	●
20								●	●	●
25										●
32										
Bore ref.	14	16	18	19	20	22	24	28	31	32

● Moulded bores only ● Sleeved bores only ● Moulded or sleeved bores only

Bore Size / Coupling Size	Bore tolerances HPC101 = +0.04/-0.0mm HPC103 = +0.03/-0.0mm								
	12	12.7	14	15.875	16	18	19	19.05	20
06									
09									
13									
16									
20		●							
25	●	●							
32			●	●	●	●	●	●	●
Bore ref.	35	36	38	41	42	45	46	47	48

Double Joints - Dimensions and Order Codes

❶

PART NUMBER	Dimensions								
❶ Brass Cross-piece	Coupling Type & Size	OD	L	L1	L2	L3	L4	B1, B2 Max	Mi
HPC109.06.----	06	7.1	27.2	3.3	5.3	16.7	8.1	4.76	0.6
HPC111.06.----			35.3	-	9.3			3.18	1.3
HPC109.09.----	09	11.1	41.7	4.3	8.6	24.6	13.2	6.35	5.9
HPC111.09.----			50.8	-	13.1			5.0	15.3
HPC109.13.----	13	14.3	51.4	5.6	10.4	30.7	15.9	8.0	23.7
HPC111.13.----			62.1	-	15.7			6.35	50.4
HPC109.16.----	16	17.5	75.5	8.9	15.2	45.2	22.2	11.0	63.5
HPC111.16.----			89.8	-	22.3			10.0	178.0

Order codes: Please combine the universal joint part number in the above table with the bore reference in the standard bores table (see pages 3.96 & 3.97). Please identify both bores to complete the part number eg. HPC109.06. 14 19

Part Number ØB1 ØB2

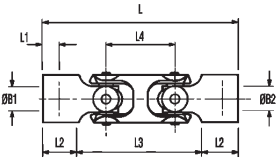
Mi: Moment of inertia kgm^2 x 10^{-8}

Material

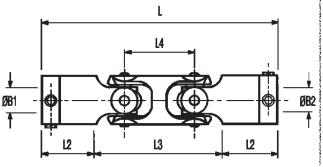
Acetal Body

Double Universal Joints

DISCOUNTS	1 - 5	6-15	16-40	41-99	100 +
	List Price	-5%	-10%	-15%	-20%

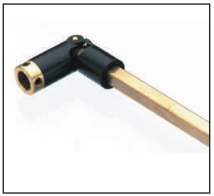


Type HPC109



Type HPC111

Fasteners			Mass kg	PART NUMBER	PRICE EACH
Size	Torque (Nm)	A/F (mm)	x 10^{-3}	Size	1-19
-	-	-	1.1	HPC109.06.----	£11.62
M3	0.94	1.5	3.5	HPC111.06.----	£19.56
-	-	-	4.5	HPC109.09.----	£10.48
M3	0.94	1.5	11.1	HPC111.09.----	£19.56
-	-	-	9.6	HPC109.13.----	£11.62
M3	0.94	1.5	21.6	HPC111.13.----	£24.03
-	-	-	19.7	HPC109.16.----	£12.55
M4	2.27	2.0	42.4	HPC111.16.----	£27.22



Materials & Finishes

Bodies:	Acetal
Cross-pieces:	Brass BS 2874 CZ121 CZ122, (HPC101, HPC103, HPC109, HPC111)
Bore Inserts:	Brass BS 2874 CZ121 (HPC103, HPC111) Al. Alloy 2014A T6 (HPC105)
Fasteners:	Alloy steel, black oiled

General description
Light duty plastic universal joints.
Low mass, corrosion resistant, ideal where conventional steel joints would be under-utilised.

Where to use
Intermittent applications in business machines, instrumentation, lab equipment, analytical apparatus, etc., where steel joints would be under-utilised.

Speeds
Up to 1000 rpm

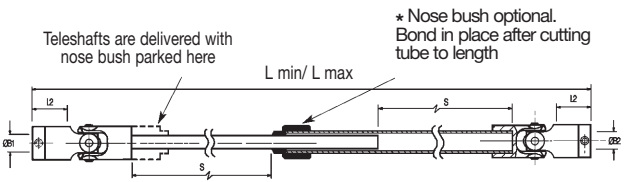
Peak torque largest size
10.7 Nm

Standard bores
3 to 20 mm

Temperature range
-20˚C to +60˚C

Electrically isolating
Yes

Connection
Set Screw, Bonding or Cross-Pinning

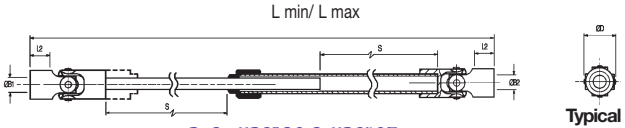


Refs. HPC128 & HPC495

Joints sleeved with headed brass inserts fitted 2 screws per end

End A (inner tube)

End B (outer tube)



Refs. HPC130 & HPC497

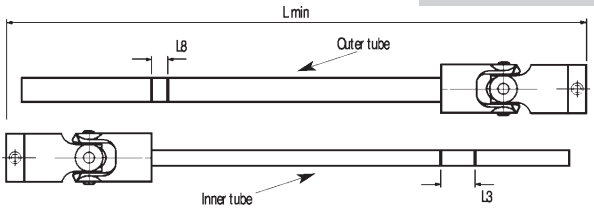
Joints sleeved with metal inserts. Attached to shafts by cross-pinning or bonding

Extensible drive shafts (teleshafts), are useful when the distance between actuator and load varies during operation, or needs to accommodate component variances, or when a quick disconnect facility is needed in the drive line.

HPC teleshafts are in keeping with the light duty capabilities of plastics universal joints and employ precision drawn square brass tubes as the telescoping medium. These can easily be cut by the user to provide an extensible drive shaft with customised dimensions.

There are 2 ways to arrive at a customised teleshaft: empirically (shown below), or with tables that provide all necessary data on stroke and tube lengths for teleshafts with and without nose bushes up to 520mm retracted length.

Size	L3	L8
09	8.6	3.2
13	10.4	4.3
16	15.2	6.1
20	17.0	8.2
25	20.0	10.3
32	21.0	18.0



Standard Bores

Bore Size / Coupling Size	ØB1, ØB2 + 0.03 / - 0 mm						
	3.175	4	4.763	5	6	6.350	8
09	●	●	●	●			
13		●	●	●	●	●	
16					●	●	●
20							
25							
32							
Bore ref.	16	18	19	20	22	24	28
Corresponding bore adaptor				251		253	255

Diameters for which a bore adaptor is shown can be adapted to smaller shaft sizes. See page 3.84 for details.

Empirical method (based on the retracted length)

• Disengage the teleshaft, remove the nose bush parked on the inner tube and keep it in case you need to use it later. Then lay the 2 halves of the teleshaft side by side.

• Slide one half alongside the other so that overall length L min matches the intended length of the teleshaft when fully retracted. With a felt tip pen, draw a line across the outer tube at the point where this is level with the inboard end of the universal joint.

• If you are sure that the teleshaft will satisfactorily extend the required amount, cut the tube at the line.

• Mark the inner tube in the same way, then add an amount equivalent to dimension L3 for your teleshaft size and draw a second line. Cut the tube at this second line.

• Now re-engage the tubes, taking care to orientate them correctly so that the inboard forks of the joints are in the same plane, and retract the teleshaft. The overall length should be as intended, and both tubes should bottom out simultaneously.

• If required, the nose bush can now be fitted by bonding it to the outer tube with an instant adhesive, (factory fitted bushes are retained by a barbing technique). The bush will add an amount equivalent to dimension L8 to the retracted length. Cutting this amount from the outer tube will reinstate the intended retracted length.

• The purpose of the nose bush is to eliminate any torsional free play that may be apparent in the tubes due to working clearances.

Bore Size / Coupling Size	ØB1, ØB2 + 0.03 / - 0 mm							
	9.525	10	12	12.7	15.875	16	19.05	20
09								
13								
16	●	●						
20	●	●						
25			●	●				
32					●	●	●	●
Bore ref.	31	32	35	36	41	42	47	48
Corresponding bore adaptor		257		259		260		261

Dimensions and Order Codes

PART NUMBER		Teleshaft Size	ØD	L	L	Stroke	L2
❶ Standard tubes self-colour brass	Wear-resistant tubes Niflor coated			±1.0 min	max	S	❷
HPC128.09.240.----	HPC495.09.240.----	09	11.1	240	389	149	13.1
HPC128.13.300.----	HPC495.13.300.----	13	14.3	300	484	184	15.7
HPC128.16.450.----	HPC495.16.450.----	16	17.5	450	730	280	22.3
HPC130.20.464.----	HPC497.20.464.----	20	23.0	464	745	281	17.0
HPC130.25.500.----	HPC497.25.500.----	25	28.5	500	784	284	20.0
HPC130.32.564.----	HPC497.32.564.----	32	36.5	564	868	304	21.0

❶ Niflor is a proprietory PTFE impregnated electroless nickel plating process.

❷ Max shaft penetration.

❸ Values apply with max bores.

• A range of standard telescopes is available which can be shortened to achieve an infinite number of length/stroke requirements. The lengths L min shown in the table above are the longest of the standard range in each size. Specific lengths are produced by cutting an equal amount from both ends of the nearest standard size. See next page for recommended procedure.

• Custom Teleshaft assemblies can be factory made subject to minimum order quantities.

• *The nose bush eliminates any torsional free play that may be apparent in the tubes due to working clearances.

• Full details of the standard range and product order codes are available on request. Please ask for a HPC Teleshaft data sheet.

Order codes: Please combine the universal joint part number in the above table with the bore reference in the standard bores table (see pages 3.102 & 3.103). Please identify both bores to complete the part number eg. HPC128.09.240. 18 20

Part Number ØB1 ØB2

Teleshaft Size	ØB1, ØB2 max	Mass kg x 10^{-3} ❸	PART NUMBER ❶ Standard tubes self-colour brass	PRICE EACH 1-5	PART NUMBER Wear-resistant tubes Niflor coated	PRICE EACH 1-5
09	240	149	HPC128.09.240.----	£36.51	HPC495.09.240.----	£40.20
13	300	184	HPC128.13.300.----	£41.94	HPC495.13.300.----	£52.57
16	450	280	HPC128.16.450.----	£45.86	HPC495.16.450.----	£62.75
20	464	281	HPC130.20.464.----	£52.36	HPC497.20.464.----	£75.95
25	500	284	HPC130.25.500.----	£72.89	HPC497.25.500.----	£109.13
32	564	304	HPC130.32.564.----	£80.29	HPC497.32.564.----	£140.08

How to order customised teleshafts

Please specify your teleshaft by completing the questionnaire.

Teleshaft size ☐ 09 ☐ 13 ☐ 16 ☐ 20 ☐ 25 ☐ 32

Teleshaft ref. ☐ 128 ☐ 130 ☐ 495 ☐ 497

Bore diameter End A .....

Bore diameter End B .....

Fitted nose bush (end B only) ☐

Speed of rotation ☐ rpm

Please specify:
L min ..... and/or
L max ..... and/or
Stroke S .....
If more than one parameter is specified, which one is critical? .....
Please quote ..... pcs
Projected annual qtys ..... pcs