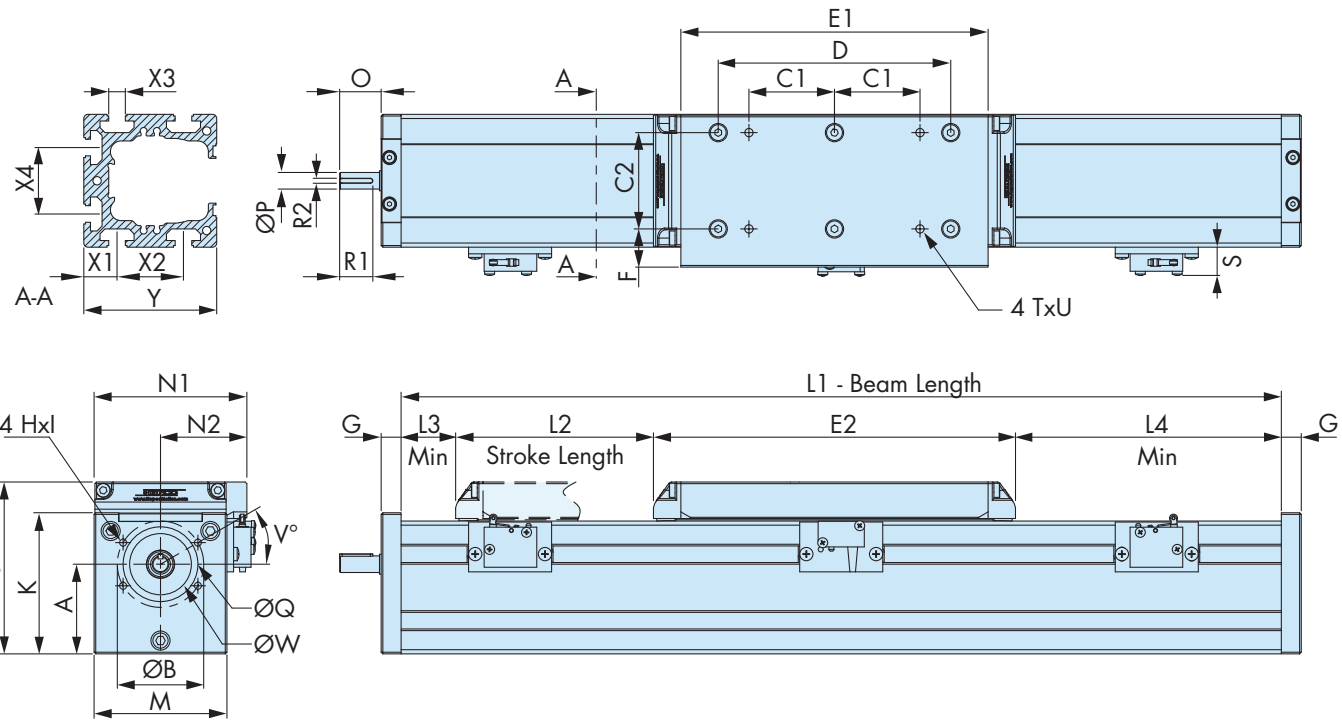
HepcoMotion®

SDM - Screw Driven Module

The HepcoMotion® SDM range has been based on the popular SBD range of belt driven linear actuators but incorporates a ballscrew into the design. This allows for improved stiffness and precision.
Units are supplied in increments of 60mm (SDM20-80) and 80mm (SDM30-100) up to 2800mm in one piece. Longer units are available on request. The nominal stroke length is calculated with the carriage up against the internal buffers. In practice a clearance should be provided to allow for overrun.

The main dimensions of the standard length SDM unit are shown below.



SDM Unit	Pitch	A	B	C1	C2	D	E1	E2	F	G	HxI	J	K	L1 (min)	L2 Nominal stroke
SDM 20-80	Ø16x5/10/16	54	52	51.5	58	140	185	218	23	12	M5x12	103.5	85	530	L1-294
SDM 30-100	Ø20x5	69	60	65	76	180	235	268	24.5	12	M5x12	123.5	105	530	L1-322
	Ø20x20													540	L1-332

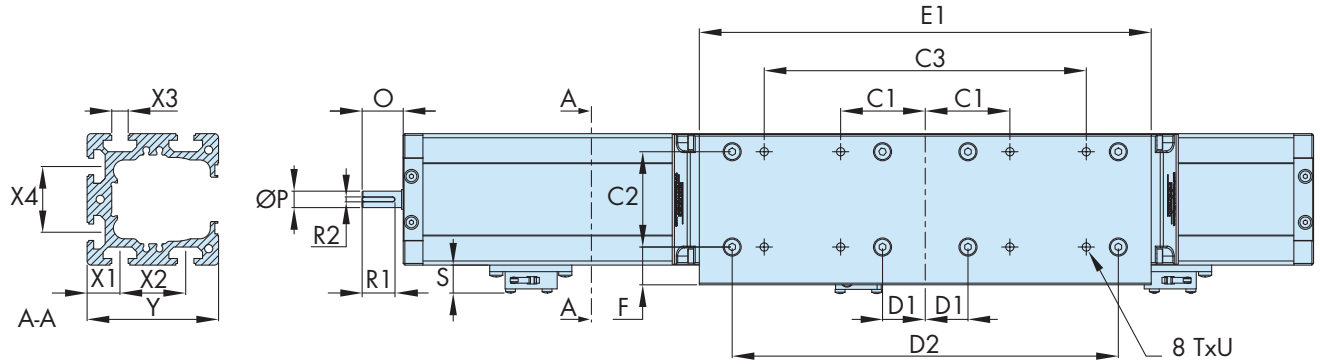
SDM Unit	Pitch	L3 (min)	L4 (min)	M	N1	N2	O	P	Q*1 H7	R1	R2	S	TxU	V	W*1	X1	X2	X3	X4	Y
SDM 20-80	Ø16x5/10/16	31	45	80	91.5	52	25	10	44.5	20	3	17	M6x9.5	30	-	20	40	10	40	80
SDM 30-100	Ø20x5	28	26.5	100	112	62.5	30	15	50	25	5	17	M8x9.5	45	43	30	40	10	50	100
	Ø20x20		36.5																	

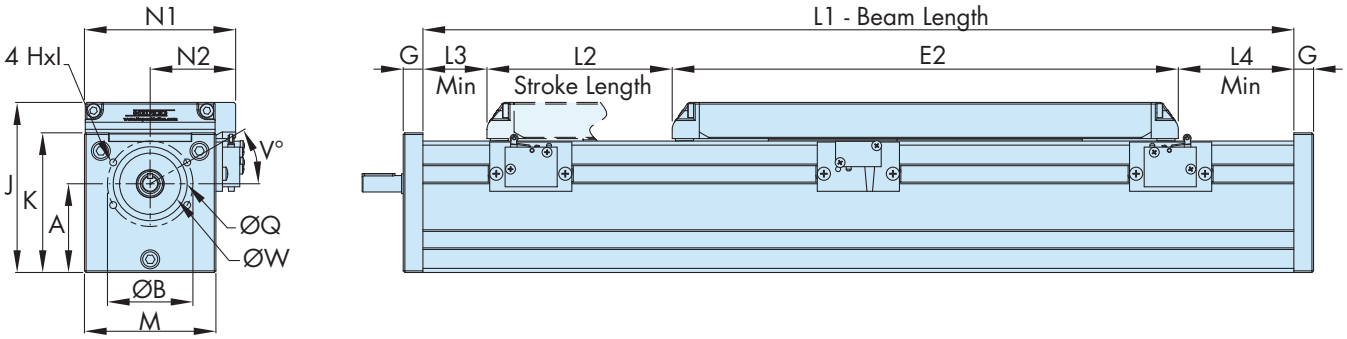
(All dimensions in mm)

Note
1. Diameters Q and W relate to a recess 2mm deep

SDM - Screw Driven Module - Long Carriage

SDM units are available with a long carriage option. This version has two LBG bearing blocks in the carriage and has much improved load capacity. The main dimensions of the standard long carriage SDM units are shown below. For further information please contact Hepco's technical department.





SDM Unit	Pitch	A	B	C1	C2	C3	D1	D2	E1	E2	F	G	HxI	J	K	L1 (min)	L2 Nominal Stroke
SDM 20-80	Ø16x5/10/16	54	52	51.5	58	196	26	235	275	308	23	12	M5x12	103.5	85	540	L1-362
SDM 30-100	Ø20x5	69	60	65	76	260	46	295	340	373	24.5	12	M5x12	123.5	105	530	L1-404
	Ø20x20															540	L1-424

SDM Unit	Pitch	L3 (min)	L4 (min)	M	N1	N2	O	P	Q*1 H7	R1	R2	S	TxU	V	W*1	X1	X2	X3	X4	Y
SDM 20-80	Ø16x5/10/16	10	45	80	91.5	52	25	10	44.5	20	3	17	M6x9.5	30	-	20	40	10	40	80
SDM 30-100	Ø20x5	20	31	100	112	62.5	30	15	50	25	5	17	M8x9.5	45	43	30	40	10	50	100
	Ø20x20																			

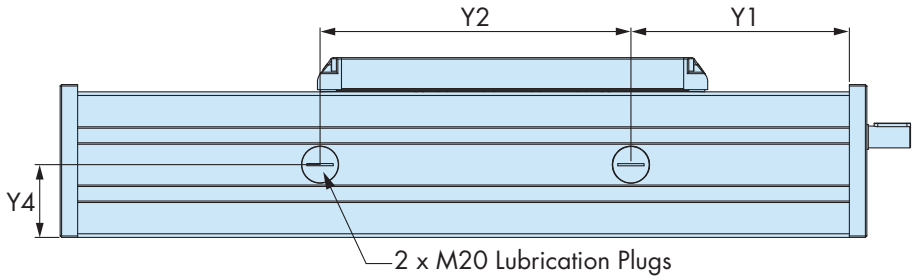
(All dimensions in mm)

Note:
1. Diameters Q and W relate to a recess 2mm deep.

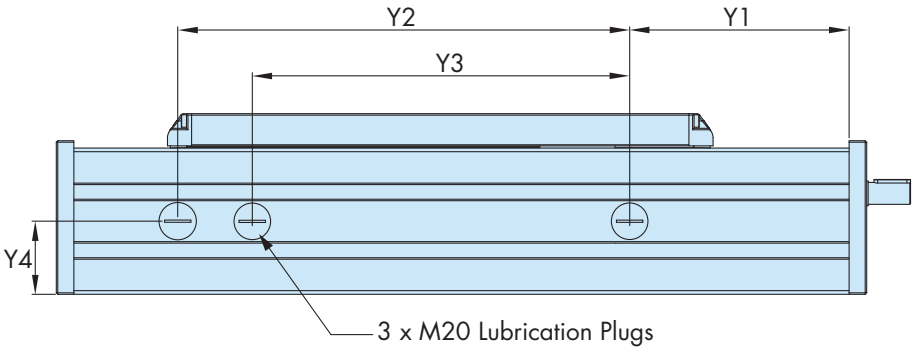
SDM Lubrication Information

Re- lubrication of the ball guide carriage blocks and the ballscrew is via the access points in the side of the beam, and closed off with a threaded plug. The lubrication interval depends on length of stroke, speed and duty, but should be no longer than 500km linear travel.

The positions of the lubrication holes for both standard and long carriage arrangements are detailed below.



Standard



Long carriage

SDM Unit		Ballscrew Pitch	Y1	Y2	Y3	Y4
SDM20-80	Standard	Ø16x05	150	172	-	36
		Ø16x10		179.5		
		Ø16x16		175		
	Long Carriage	Ø16x5/10	150	264.5	186.5	36
		Ø16x16		266.5		
SDM30-100	Standard	Ø20x5	156	207.5	-	50
		Ø20x20		215		
	Long Carriage	Ø20x5	156	314	246	50
		Ø20x20		310.5		

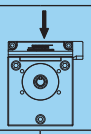
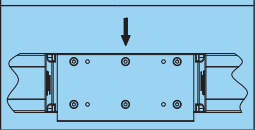
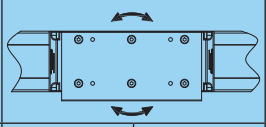
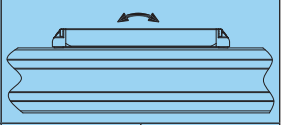
Lubricant must be applied to all lubrication points on the SDM unit. Use lithium soap based grease NLGI consistency No 2 or similar. For further details please contact Hepco's technical department.

System Life Calculation

The system life of a SDM unit will be dependant on many factors. These include the life of the LBG linear ball guide, which supports the moving load applied to the carriage, and the ballscrew which provides the driving force. In many applications the limiting factor will be the linear ball guide, and this life can be calculated in the section below. In some applications where the SDM is providing a high driving force, then the life of the ballscrew should also be considered.

LBG Linear Ball Guide life

The table shows the maximum carriage loading, and the calculation below determines the system life.

SDM Unit		L1		L2		Ms		Mv		M	
											
		Nominal	@ 10000km	Nominal	@ 10000km	Nominal	@ 10000km	Nominal	@ 10000km	Nominal	@ 10000km
SDM 20-80	Standard Carriage	21200N	1813N	21200N	1813N	189Nm	16.2Nm	175Nm	14.9Nm	175Nm	14.9Nm
	Long Carriage	33920N	2900N	33920N	2900N	302Nm	25.8Nm	1150Nm	138Nm	1150Nm	138Nm
SDM 30-100	Standard Carriage	52100N	4455N	52100N	4455N	639Nm	54Nm	755Nm	64Nm	755Nm	64Nm
	Long Carriage	68800N	5882N	68800N	5882N	848Nm	72.5Nm	2990Nm	360Nm	2990Nm	360Nm

The tabulated load figures above for 10000km assume a value for variable load factor fv = 2, which is suitable for most applications. The long carriage figures are based on LBG ball guide dynamic load capacities combined with a mounting factor of 0.8 (see LBG Catalogue 17).

To determine system life, first calculate the load factor L_F using the equation below.

$$L_F = \frac{L_1}{L_{1(max)}} + \frac{L_2}{L_{2(max)}} + \frac{M_s}{M_{s(max)}} + \frac{M}{M_{(max)}} + \frac{M_v}{M_{v(max)}} \leq 0.2$$

The life of the system is then calculated using the equation below:

$$\text{System Life (km)} = 50 \times \left(\frac{1}{L_F \times f_v} \right)^3$$

Note: f_v is the variable load factor which takes account of speed and vibration/impact conditions. A value of 2 is appropriate for typical SDM applications, but consult Hepco's technical department for specific advice.

Ballscrew Life

The table below shows details of the ballscrew static and dynamic capacities, and the maximum driving force that can be applied by the SDM unit for a linear travel of 10000km.

SDM Unit	Ballscrew Diameter x pitch	Ballscrew Nut Capacity		Maximum driving force @ 10000 km
		Static Coa	Dynamic Ca	
SDM20-80	16 x 5	17900N	7800N	620N
	16 x 10	12490N	7210N	720N
	16 x 16	12800N	6500N	760N
SDM30-100	20 x 5	23800N	11300N	900N
	20 x 20	21400N	9800N	1230N

For more further details on ballscrew life please refer to the BSP catalogue, available at **www.HepcoMotion.com** or contact Hepco's technical department.

Calculations & Performance

Drive Data & Calculations

The linear force which can be generated by a SDM unit is determined by the torque applied (τ in Nm), the force coefficient (C_f) and composite drag (D_c) of the SDM unit.

SDM Force Coefficient C_f					
	SDM20-80			SDM30-100	
Screw pitch /mm	5	10	16	5	20
Force Coefficient C_f	1131	565	353	1131	283

SDM Composite Drag D_c		
	Standard Carriage	Long Carriage
SDM 20-80	40 + 0.01xL_A	50+ 0.01xL_A
SDM 30-100	55 + 0.01xL_A	70 + 0.01xL_A

Where L_A is load applied to the carriage

$$\text{Linear Force (N)} = C_f \times \tau - D_c$$

The above equation gives the linear force developed by a typical system in typical conditions, but there will be some variation. It is recommended to select motors which have significantly more than the minimum torque, to ensure performance and reliability.

Beam Deflection Calculations & Data

The deflection of a SDM unit under load follows conventional beam calculations.
For example, the deflection of a SDM unit L (mm) long, simply supported at the ends and subject to a central load F (N) is:

$$\text{Deflection (mm)} = \frac{F \times L^3}{48 \times E \times I}$$

Where E is the young's modulus of aluminium alloy (= 7×10^4 N/mm^2) and I is the second moment of area of the SDM beam section (see table).

Second moment of area (mm^4)	Ix-x	Iy-y
SDM 20-80	14.2×10^5	17.0×10^5
SDM 30-100	36.2×10^5	44.0×10^5

Example: In the case of a simply supported SDM 20-80 beam 2000mm between supports, and subject to a central Ix-x loading of 150N, the deflection at the centre of the span will be 0.25mm.

SDM Unit Weights

The weight of a SDM unit is calculated using the formula in the table below, where L is the beam length in m. This data will allow the calculation of the mass of the moving parts.

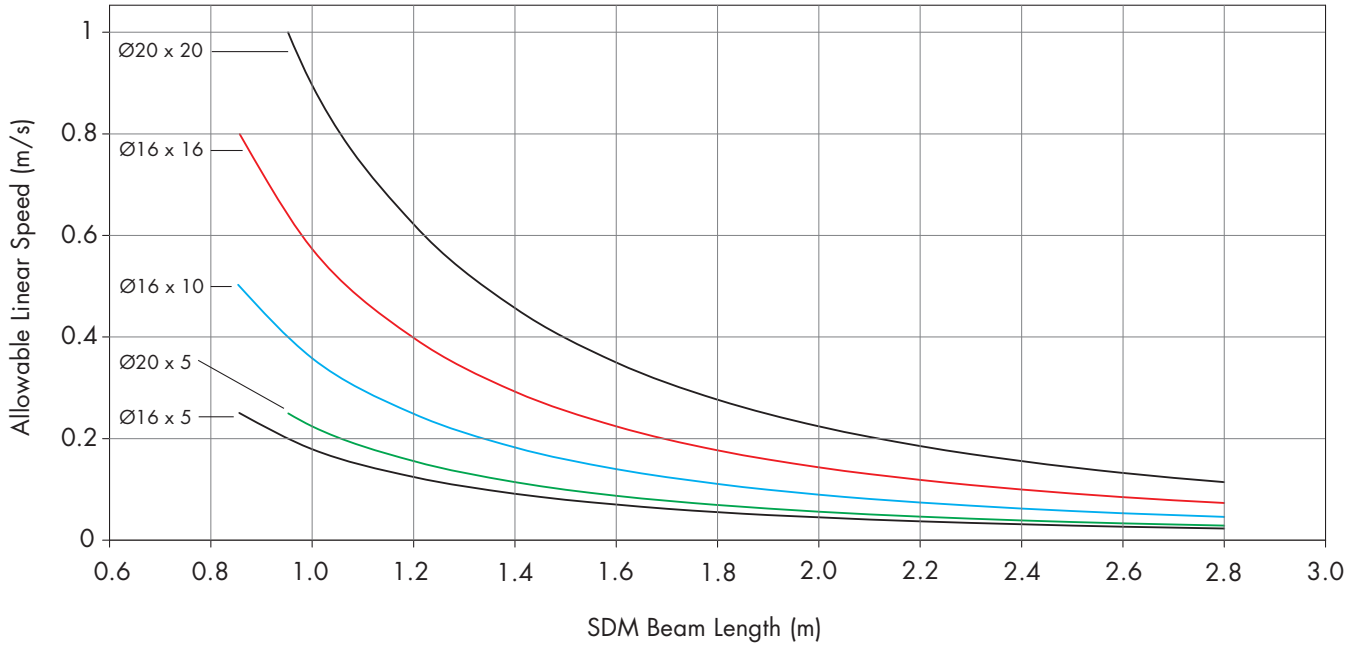
SDM Unit	SDM Unit Mass (kg)		Carriage Mass (kg)
SDM 20-80	Standard Carriage	9.75 x L + 2.86	2.00
	Long Carriage	9.75 x L + 3.72	2.85
SDM 30-100	Standard Carriage	16.1 x L + 5.41	3.99
	Long Carriage	16.1 x L + 7.13	5.71

Calculations & Performance

Screw Critical Speed

For any SDM unit, there is a critical speed of rotation beyond which the screw is susceptible to large amplitude vibration and deflection due to 'whip'. The speed at which this becomes possible depends upon the maximum length of the screw between the support bearing and the nut, and the length of the screw. It is important that operating speeds are below this critical speed. In all cases the ballscrew should not operate at speeds in excess of 3000rpm.

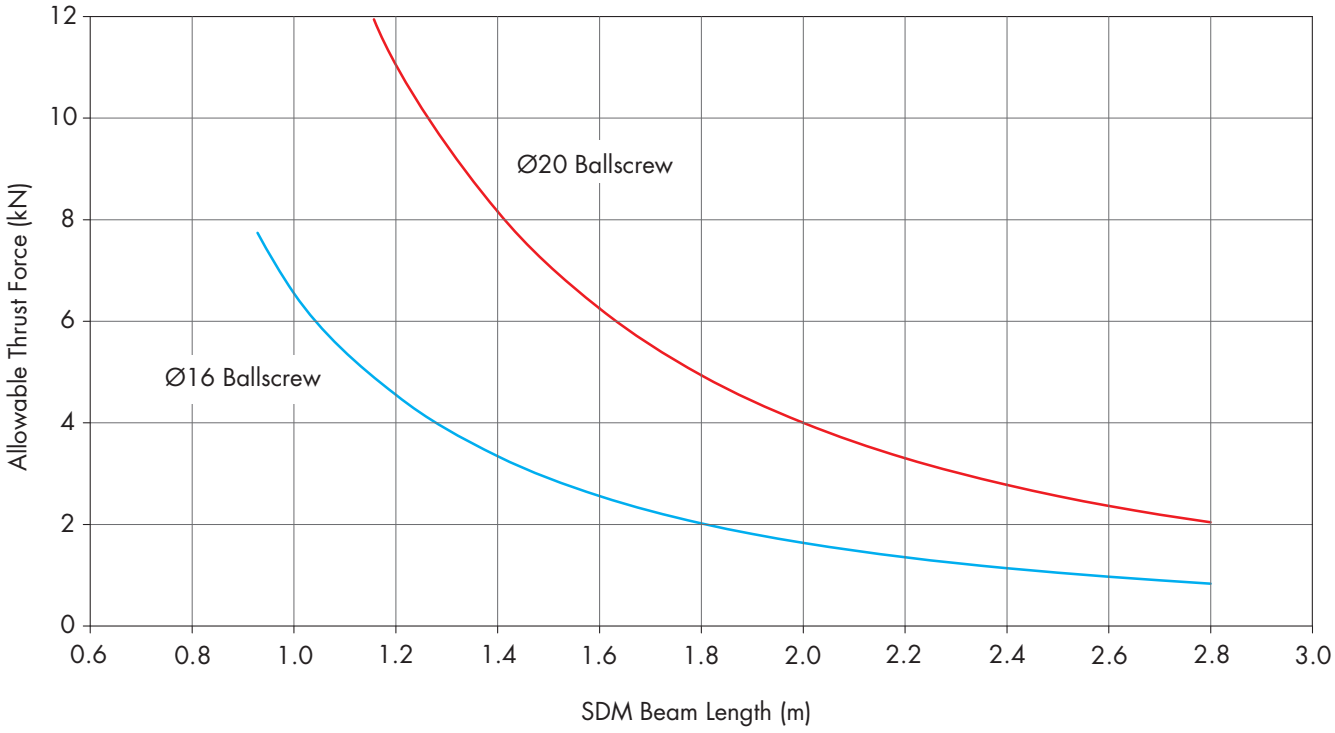
The curves shown include a safety factor of 20% on speed.



Screw Buckling Load

The maximum axial load on the screw can be limited by buckling of the screw, where systems are long or thrust loads are high. The curves shown include a safety factor of 100%.

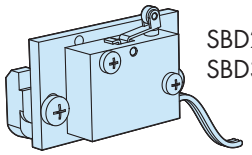
For long systems, where the loading on the screw (which is fixed at the drive end and floats axially at the other end) is high, then it may be possible to arrange the principle load to put the screw in tension.



Ancillary Components

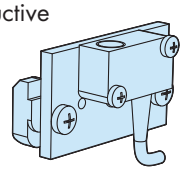
Limit Switch Assembly
(Includes switch, brackets and fixings)

Mechanical



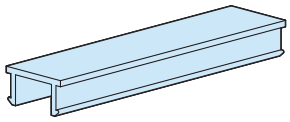
SBD20-80-V3SWA-M
SBD30-100-V3SWA-M

Inductive



SBD20-80-V3SWA-I
SBD30-100-V3SWA-I

T-Slot Cover (Supplied fitted in each of the T-slots)



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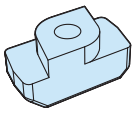
T-Nuts

M4



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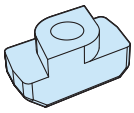
M5



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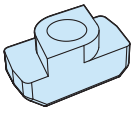
M6



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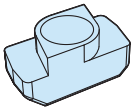
M8



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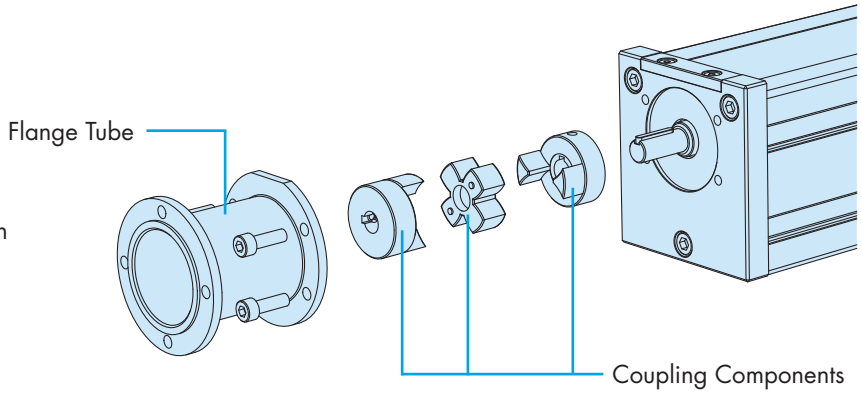
Motor Connection Kits
(These include the flange tube, coupling components and all fasteners required.)

Hepco will make flanges to fit any motor type on request, standard kits are available to fit a wide range of motors and gearboxes. Please contact Hepco's technical department for further advice and information.



Ordering Details

SDM **20-80** **L1200** **1605** **B2**

SDM - Product Range

Size of unit: Choose **20-80** or **30-100**

Beam Length. Beam lengths are available in increments of 60mm for SDM 20-80 and increments of 80mm for SDM 30-100.

Ballscrew size and pitch: Choose from **16x5**, **16x10** or **16x16** for SDM20-80 and **20x5** or **20x20** for SDM30-100.

Long Carriage option with twin LBG bearing blocks: **B2**

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