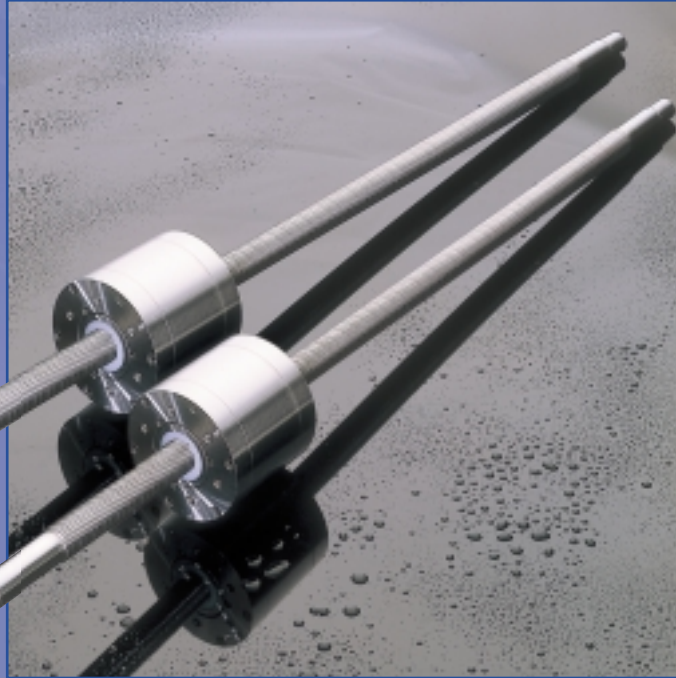


SPIRACON

PRODUCT
CATALOGUE

ROLLER SCREWS



SPIRACON



POWER JACKS

manufacturers of precision screw jacks, actuators and gearboxes

Group

www.powerjacks.com

TOTAL CAPABILITY IN ACTUATION

Power Jacks is a world leader and pace-setter in the field of mechanical linear actuation and power transmission, offering the most comprehensive range of such products from any *one* single source.

At our extensive site in Fraserburgh, Aberdeenshire we have a wide range of modern engineering facilities, techniques and fully computerised systems in design and manufacturing, which maximise efficiency and minimise delivery times. The company employs a highly trained and skilled workforce of over 80 people.

Quality is at the forefront of *Power Jacks* philosophy and the company is registered to BS EN ISO 9002 : 1994, proving an ongoing commitment to total quality, from initial conceptual design right through to manufacturing and after sales support of all its products.

The *Power Jacks* range of products comprises :

Spiracon Roller Screws

Screw Jacks (mechanical actuators)

Rolaram Actuators

Electro Mechanical Actuators

Trapezoidal/Ball Screws and Nuts

Spiral Bevel Gearboxes (Neeter Drive)

Reduction Gearboxes

Mechanical & Hydraulic Jacks

While the standard product range is extensive, *Power Jacks* is well equipped to design "*specials*" to meet customers' particular requirements. The company also offers expertise in engineering complete systems packages and has built up its reputation as a "*problem solver*".

With over 2,000,000 products operating successfully in worldwide applications, in a very wide range of manufacturing and processing sectors, the company has built up a solid track record in the marketplace. In specifying *Power Jacks* products, the design engineer is being provided with *reliability, speed of operation, efficiency and control*.

In the UK, a highly trained team of internal sales engineers and field applications engineers, with decades of engineering expertise between them, is available to assist customers in the use and selection of the company's range of linear actuation and power transmission products.

The company also exports extensively through a network of overseas distributors, covering most European countries, USA, Japan, Korea and Australasia.



CONTENTS

Page

The Company and List of Contents 2

*Working Applications for
Spiracon Roller Screws* 3

What is a Spiracon Roller Screw ? 4-5

The Spiracon Range 6

*How to Select a
Spiracon Roller Screw* 7-8

*Outline Drawing and
Technical / Dimensional Chart* 9

How to Order 10

Working Applications for SPIRACON Roller Screws

Application

Anti-sway mechanism on ship-to-shore container cranes in Hong Kong.

Linear Actuation Requirements

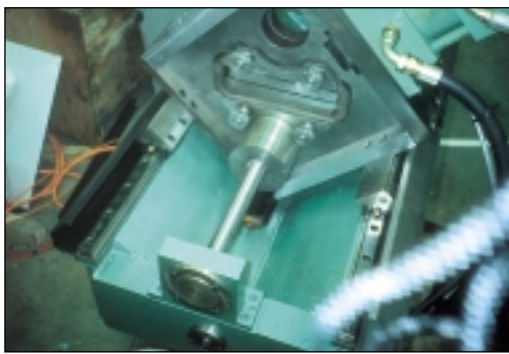
All 4 screws and nuts required to be synchronised. High loads and an aggressive marine environment were also factors.

Solution

Four model 65mm Spiracon roller screws (2 left hand and 2 right hand) with associated bevel gearboxes, couplings and shafting, per crane.



Anti Sway Mechanism, Ship to Shore Crane, Hong Kong.



Flying Shear.

Application

Flying shear for cutting to length pre-formed steel sheets.

Linear Actuation Requirements

The shear required to be operated continuously and accurate repeatability of positioning was important. Long life and low maintenance were necessary.

Solution

Model 55mm Spiracon roller screw operating on a continuous reversal basis.

Application

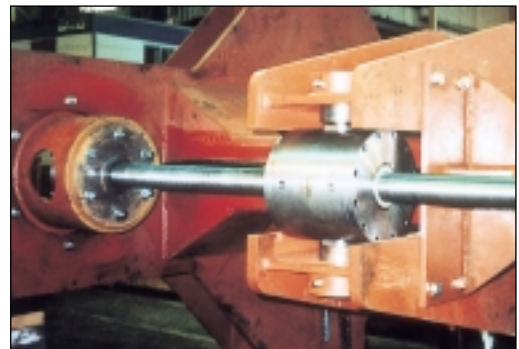
Clamping machine for reclamation of steel rolls.

Linear Actuation Requirements

High dynamic load requirement, reliability of operation and a demanding operating environment.

Solution

Model 75mm Spiracon roller screw operating a vertical clamp, to hold steel rolls in position.



Steel Roll Clamping Machine, Australia.



Inspection and Maintenance Platform, Tay Road Bridge.

Application

Road bridge inspection and maintenance platforms.

Linear Actuation Requirements

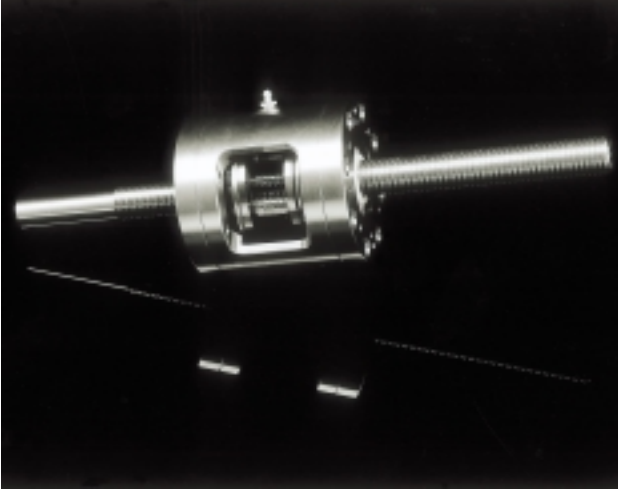
Safety was the overriding requirement, as human cargo was involved. The units would be subjected to high load requirements and hostile weather conditions.

Solution

Two 15 tonne platforms, raised and lowered by model 75mm Spiracon roller screws, fitted with disk brakes and mechanical stops as safety features.

What is a SPIRACON Roller Screw?

Spiracon™ is a planetary roller screw, which converts rotary motion to linear movement. It is a unique concept, invented and patented by Illinois Tool Works, USA, and developed by and licensed solely to Power Jacks Ltd.

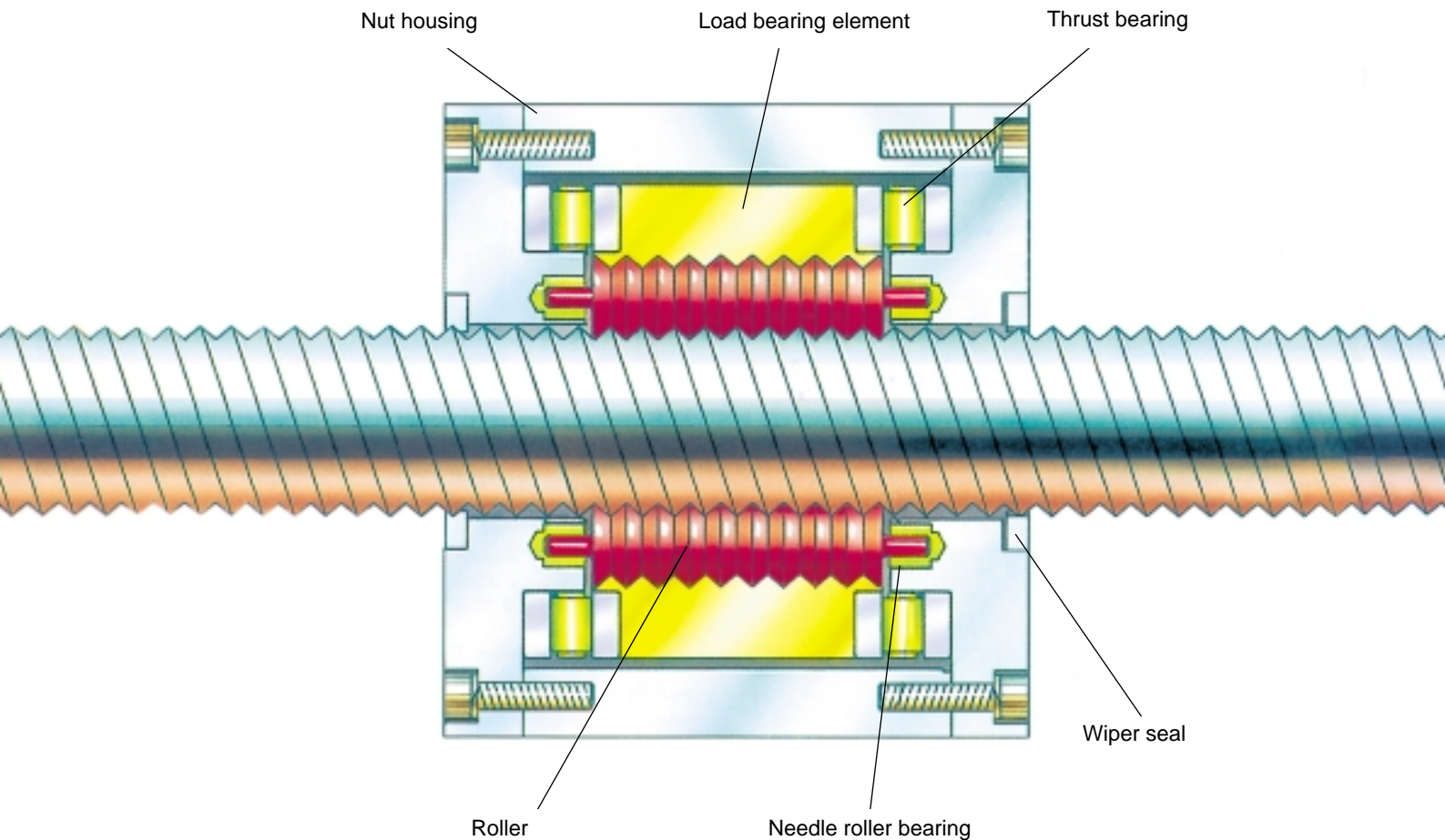


Principle of Operation

The Spiracon system consists of a multi-start screw with an involute thread form and a number of planetary rollers with annular grooves, which engage with the screw. These rollers also engage with a grooved load bearing element, which transmits the load through roller thrust bearings, to the nut housing. The rolling action results in a high efficiency mechanism, while the line contact and hardened and ground construction achieves a high dynamic load carrying capacity, together with almost no axial backlash or wear.

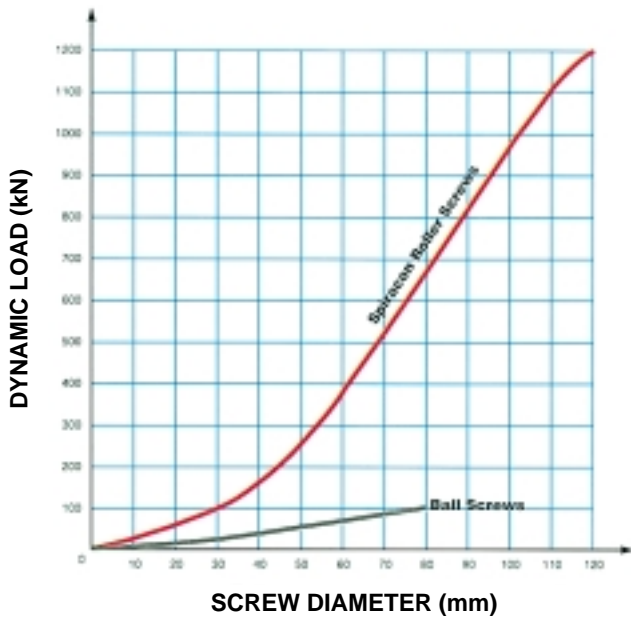
Main Features of SPIRACON Roller Screws

- High dynamic load capacity.
- High efficiency.
- Positional accuracy.
- Long life and low maintenance.
- Same nut fits both right and left handed screws.
- Hardened and ground rolling elements.
- Clean operation.
- Low noise.



Advantages over Ball Screws

- Higher dynamic load capacity.
- Larger diameters and higher leads.
- Higher positional accuracy.
- Longer life.
- Higher stiffness.
- Higher speed and acceleration.
- Low temperature operation.
- Lower noise.
- Nut easily removed with rollers retained.
- Higher safety.



Applications for Spiracon Roller Screws

Spiracon roller screws are well proven throughout the world in a wide variety of industries including :

Nuclear

Aerospace

Metal Processing

Medical

Automotive

Food Processing

Paper

Offshore & Marine

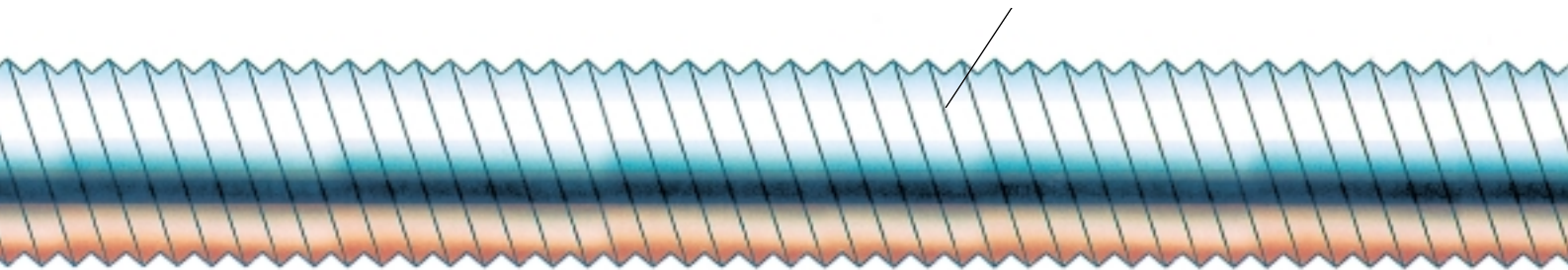
Communications

Defence

Typical applications include :

Robotics, laser tracking, indexing/adjusting, simulators, seismic testing, shield door adjustment, machine tools, antenna dish adjustment, clamping mechanisms, medical scanners, continuous casting...

Spiracon roller screw



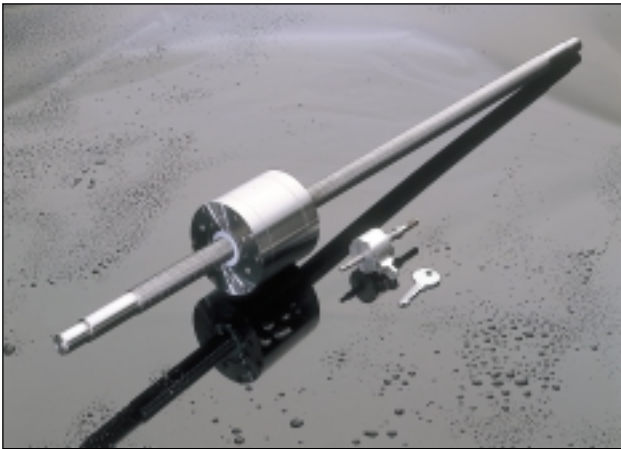
The SPIRACON Range

There are 10 standard Spiracon roller screw models, with diameters from 15 mm to 120 mm, each with a choice of 3 leads. Dynamic load capacities of over 1,000 kN (100 tonnes) and linear speeds of over 30 m/min are possible.

Where the standard range does not meet the application specification, special roller screws can be designed to meet customers' specific requirements (see Specials section below).

Efficiency

The Spiracon roller screw has an efficiency of typically 85%. Power consumption is therefore minimised, and a compact screw system is possible. Such a high efficiency means that the screw is not self-sustaining, and a braking system is needed to prevent back driving.



Tolerancing

The highly accurate machining and assembly of each roller screw means total axial play of less than 0.01mm can be achieved. The cumulative pitch error in the screw is typically less than 0.005 mm per 300 mm. Combined with a high stiffness, this means that accurate and repeatable positioning is possible. The screw straightness is within 0.1 : 1,000.

Operating Life

Operating life is dependent upon the dynamic load. The maximum dynamic loads shown in the Technical Chart on page 9 are equivalent to 1,000,000 revolutions of the screw. To determine actual operating life, please refer to How to select a SPIRACON Roller Screw on pages 7 and 8. Where severe operating conditions exist, please consult our Technical Sales Department.

Guiding the Load

Loads should be guided, to remove any possible sideload from the Spiracon nut. The guide system will also resist the torque developed by the roller screw mechanism.

Mounting

The Spiracon nut can be mounted using the standard mounting holes and location diameter. Screw end machining to suit thrust bearings is provided, or this can be specified to suit customer requirements. Mounting for operation in any orientation is possible.

Screw Length

The screw length is determined by the load and speed conditions (please refer to Step 2 of How to Select a SPIRACON Roller Screw on page 10). For total screw lengths greater than shown in the table below, please consult our Technical Sales Department.

Model	Maximum Length
Up to 20 mm	2 metres
30 mm to 90 mm	6 metres
120 mm	3 metres

Operating Environment

All units are constructed and finished to suit industrial operating conditions. Normal operating temperatures are from -10C to +50C. However, Power Jacks products have been proven in very low operating temperatures (-30C - Arctic) and in higher temperatures (+70C - steelworks). Wiper seals prevent the entry of large particles into the nut mechanism, and bellows can be provided to protect the screw. Please contact our Technical Sales Department to discuss hostile or hazardous operating environments.

Lubrication and Maintenance

Spiracon roller screws require only a minimum of maintenance during the normal operating life. Depending upon the duty, periodic lubrication should be carried out using Rocol MTS 1000 grease, through the nipple provided.

Specials

Spiracon can be offered to suit "special" applications, requiring for example

- Special screw diameters or leads.
- Left hand screw threads.
- Very high dynamic load (over 1,000kN).
- Special materials e.g stainless steel.
- Temperature extremes or hazardous environments.
- Special screw end machining or nut mounting e.g. trunnions.

How to select a SPIRACON Roller Screw

Example

Select a standard right hand Spiracon screw and nut for the following :

Dynamic load	= 220 kN (in compression)
Linear speed	= 900 mm/minute
Required life	= 2000 hours
Required stroke	= 1200 mm
Overall screw length	= 1850 mm
Screw mounting	= Vertical
Bearing support condition	= 2

Step 1

From the chart on page 9, make initial selection of :

Model 65 x 36 lead

Select a lead of 36mm to give a rotational speed of :

$$\frac{900}{36} = 25 \text{ rpm (OK > 1700 rpm)}$$

Calculate the number of revolutions of the screw to give the required life :

$$\text{Required no. of screw revs.} = 2000 \times 25 \times 60 = 3 \times 10^6$$

Check the operating life for selected Spiracon model :

$$\begin{aligned} \text{Actual no. of screw revs.} &= \frac{310^{3.33}}{220} \times 10^6 \\ &= 3.14 \times 10^6 \text{ (OK > } 3 \times 10^6) \end{aligned}$$

$$\therefore \text{Actual life in hours} = \frac{3.14 \times 10^6}{25 \times 60} = 2093 \text{ hours (OK > 2000 hours)}$$

Step 2

Stroke = 1200 mm

Length (L) = 1600 mm (see page 8)

Check the critical speed limit :

$$\begin{aligned} \text{Speed limit (rpm)} &= \frac{10^7 \times 10 \times 63.7}{1600^2} \\ &= 2488 \text{ rpm (OK > 25 rpm)} \end{aligned}$$

Check for buckling of the screw :

$$\begin{aligned} \text{Load limit (N)} &= \frac{10^4 \times 6.5 \times 63.7^4}{1600^2} \\ &= 418 \text{ kN (OK > 220 kN)} \end{aligned}$$

Step 3

The torque and power are :

$$\text{Torque (Nm)} = \frac{220000 \times 36}{2000 \times \pi \times 0.85} = 1483 \text{ Nm}$$

$$\text{Power (kW)} = \frac{1483 \times 25}{9550} = 3.88 \text{ kW}$$

\therefore The complete product code is
SPT-065-36-6-RH-1850-1500-1-0
(see page 10 for full breakdown of this code)

There are 3 simple steps as follows :

Step 1 Load, Speed and Life

From the Technical Chart on page 9, make an initial selection of a Spiracon model to suit the required maximum dynamic and static loads. Choose a screw lead and calculate the rotational speed to suit the required linear speed :

$$\text{Rotational speed} = \frac{\text{Linear speed (mm/minute)}}{\text{Screw lead (mm)}}$$

Check that the rotational speed is below the maximum speed shown in the Technical Chart for the model selected.

ODEL	LEAD	PITCH	DYNAMIC C (kN)	STATIC Co (kN)	NUT			
					A Ø	B	C Ø	D
15	6	1	45	68	92	90	34	4
	12	2	35	52	92	90	34	4
20	6	1	58	87	103	110	45	4
	12	2	58	87	103	110	45	4
	18	3	50	74	103	110	45	4

Calculate the total number of revolutions of the screw for the operating life required :

$$\begin{aligned} \text{Required no. of screw revs.} &= \\ \text{Life (hours)} \times \text{Rotational speed (rpm)} \times 60 \end{aligned}$$

Check the operating life for the selected Spiracon model :

C = Dynamic capacity (kN) from Technical Chart
F = Application dynamic load (kN)
(or Fm, mean load as below)

$$\text{Actual no. of screw revs.} = \left(\frac{C}{F}\right)^{3.33} \times 10^6$$

$$\therefore \text{Actual life in hours} = \frac{\text{No. of screw revs.}}{\text{Rotational speed} \times 60}$$

If required, reiterate the calculation to achieve the required life.

Where the dynamic load varies, the mean load (Fm) can be approximated as follows :

$$F_m = \sqrt[3]{\frac{(F_1^3 \times U_1) + (F_2^3 \times U_2) + \dots}{U}}$$

F1, F2 = constant loads during
U1, U2 revolutions

U = total number of revolutions

Where the dynamic load varies between a minimum (Fmin) and maximum (Fmax) the mean load is :

$$F_m = \frac{F_{\min} + 2 \times F_{\max}}{3}$$

Step 2 Critical Speed, Buckling and Deflection

Establish length (L) based on the required stroke and bearing support conditions.

For length (L), check that the rotational speed is below the critical speed limit, given by the formula :

$$\text{Critical speed limit (rpm)} = \frac{10^7 \times f1 \times J}{L^2}$$

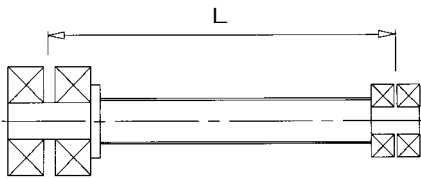
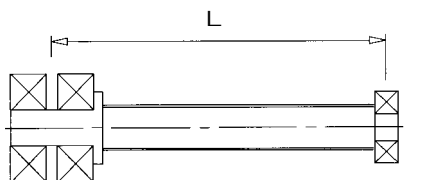
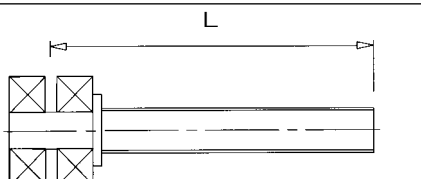
Where f1, f2 and f3 are defined by the bearing support conditions shown in the diagram below, and J is the root diameter of the Spiracon thread given in the Technical Chart on page 9.

Where the screw is under a compression load, check that the chosen screw diameter and length (L) are within the load limit for buckling, given by the formula :

$$\text{Load limit (N)} = \frac{10^4 \times f2 \times J^4}{L^2}$$

For long horizontal screws, check the deflection of the screw under its own weight :

$$\text{Deflection (mm)} = \frac{6 \times 10^{-9} \times L^4}{f3 \times J^2}$$

Bearing Support Conditions	f1	f2	f3
<p>1.</p> 	15	12.5	384
<p>2.</p> 	10	6.5	185
<p>3.</p> 	2.3	0.8	8

Step 3 Torque and Power

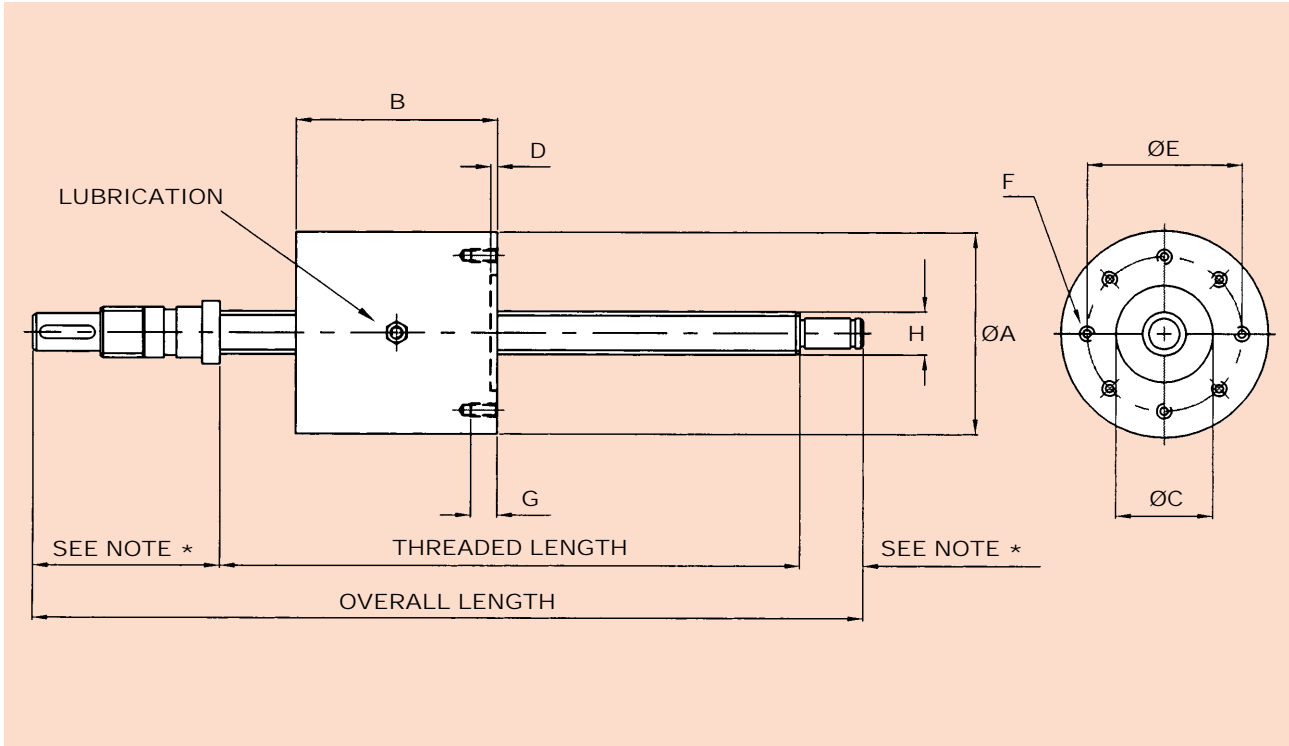
Calculate the torque required to drive the screw :

$$\text{Torque (Nm)} = \frac{\text{Dynamic load (N)} \times \text{Lead (mm)}}{2,000 \times \pi \times \text{Efficiency (0.85)}}$$

$$\text{Power (kW)} = \frac{\text{Torque (Nm)} \times \text{Rotational speed (rpm)}}{9,550}$$

Note: Where there is a high acceleration or inertia, please consult out Technical Sales Department.

OUTLINE DRAWING



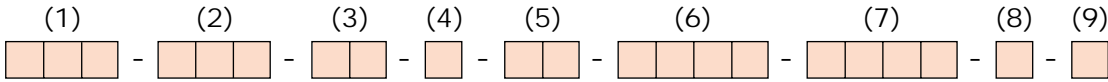
Note: * = Customer to define at time of ordering.

TECHNICAL/DIMENSIONAL CHART (all dimensions are in millimetres)

MODEL	LEAD	PITCH	DYNAMIC C (kN)	STATIC Co (kN)	NUT							SCREW			WEIGHTS	
					A Ø	B	C Ø H6	D	E PCD	F DIA x No	G	H Ø	J Ø min	MAX SPEED (rpm)	NUT (kg)	SCREW per 100 mm (kg)
15	6	1	45	68	92	90	34	4	55	M8 x 6	12	17	15.3	5500	3.5	0.18
	12	2	35	52	92	90	34	4	55	M8 x 6	12	17	15.3	5500	3.5	0.18
20	6	1	58	87	103	110	45	4	58	M8 x 8	12	21	18.4	4900	5.5	0.27
	12	2	58	87	103	110	45	4	58	M8 x 8	12	21	18.4	4900	5.5	0.27
	18	3	50	74	103	110	45	4	58	M8 x 8	12	21	18.4	4900	5.5	0.27
30	6	1	100	150	125	130	50	4	70	M10 x 8	15	30.8	28.2	4300	9.3	0.55
	18	3	90	120	125	130	50	4	70	M10 x 8	15	30.8	28.2	4300	9.3	0.55
	24	3	105	150	125	130	50	4	70	M10 x 8	15	30.8	28.2	4300	9.3	0.55
40	12	2	120	180	135	135	65	4	83	M12 x 8	18	39	35.5	3300	11.0	0.92
	24	3	128	192	135	135	65	4	83	M12 x 8	18	39	35.5	3300	11.0	0.92
	32	4	115	172	135	135	65	4	83	M12 x 8	18	39	35.5	3300	11.0	0.92
45	12	2	190	285	170	180	75	5	105	M16 x 8	24	46.6	41.3	2600	23.2	1.3
	24	4	170	255	170	180	75	5	105	M16 x 8	24	46.6	41.3	2600	23.2	1.3
	48	6	120	180	170	180	75	5	105	M16 x 8	24	46.6	41.3	2600	23.2	1.3
55	12	2	290	435	205	229	85	5	128	M20 x 8	30	56.1	50.9	2100	44.0	1.92
	24	4	270	405	205	229	85	5	128	M20 x 8	30	56.1	50.9	2100	44.0	1.92
	48	6	275	410	205	229	85	5	128	M20 x 8	30	56.1	50.9	2100	44.0	1.92
65	24	4	340	500	240	250	95	5	150	M20 x 8	30	68.8	63.7	1700	66.5	2.83
	36	6	310	465	240	250	95	5	150	M20 x 8	30	68.8	63.7	1700	66.5	2.83
	54	6	310	455	240	250	95	5	150	M20 x 8	30	68.8	63.7	1700	66.5	2.83
75	24	4	380	570	275	260	105	6	165	M20 x 8	30	75.2	70.1	1600	87.4	3.45
	36	6	340	510	275	260	105	6	165	M20 x 8	30	75.2	70.1	1600	87.4	3.45
	54	6	340	510	275	260	105	6	165	M20 x 8	30	75.2	70.1	1600	87.4	3.45
90	24	4	530	795	315	310	120	8	200	M24 x 10	35	90	85	1200	137	4.96
	36	6	520	780	315	310	120	8	200	M24 x 10	35	90	85	1200	137	4.96
	54	6	615	920	315	310	120	8	200	M24 x 10	35	90	85	1200	137	4.96
120	24	4	950	1425	420	400	150	8	250	M24 x 12	50	120	115	1000	310	8.82
	40	5	1200	1800	420	400	150	8	250	M24 x 12	50	120	115	1000	310	8.82
	54	6	1200	1800	420	400	150	8	250	M24 x 12	50	120	115	1000	310	8.82

HOW TO ORDER

The product code is of the following form :



(1) **Product**

- SPT - Spiracon Screw and Nut
- SPS - Spiracon Screw only
- SPM - Spiracon Nut only

(2) **Model**

A 3 figure code taken from the Technical Chart.

(3) **Lead**

A 2 figure code taken from the Technical Chart.

(4) **Pitch**

A 1 figure code taken from the Technical Chart.

(5) **Direction of Thread**

- RH - Right hand
- LH - Left hand

(6) **Overall Screw Length**

A 4 figure code to represent the overall screw length in mm.

(7) **Screw Threaded Length**

A 4 figure code to represent the threaded length of the screw in mm i.e. stroke (travel) + B (nut length) + overtravel at each end.

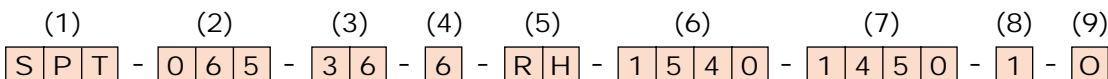
(8) **Number of Spiracon Nuts**

A 1 figure code to represent the number of nuts required.

(9) **Nut Mounting Holes**

- O - Standard Mounting Holes
- S - To Customer Drawing

EXAMPLE PART NUMBER



(1) Spiracon Screw and Nut.

(2) Model 65.

(3) 36 mm Lead.

(4) 6 mm Pitch.

(5) Right Hand Thread.

(6) 1540 mm Overall Screw Length.

(7) 1450 mm Screw Threaded Length.

(8) 1 Spiracon Nut.

(9) Standard Nut Mounting Holes.

Notes:

1. In all cases, the customer should supply a detailed drawing, indicating the screw end matching details.
2. The above part number defines a standard catalogue unit. Where a standard unit does not meet the customer's requirements, we will be pleased to design a special unit.
3. All goods are sold subject to our Standard Conditions of Sale, a copy of which is available upon request.



POWER JACKS

manufacturers of precision screw jacks, actuators and gearboxes

Group

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