Descriptions

A **Worm Gear Machine Screw Jack** is a type of mechanical actuator that converts rotary motion into linear motion. It typically consists of a gearbox assembly combined with a screw and nut mechanism. Load capacities include **10kN, 25kN, 50kN, 100kN, 150kN, 200kN, 300kN and 500kN.**

How it works:

A motor or hand crank rotates a worm (input shaft).
The worm (input shaft) drives an internal worm gear.
This rotation causes the lifting screw to extend or retract linearly.

Key features and characteristics:

- **Linear actuation:** Machine screw jacks produce a controlled linear movement, suitable for pushing, pulling, lifting, and positioning applications.
- **Load-holding:** Many machine screw jacks are self-locking due to their inherent gear ratios and friction, meaning they can hold heavy loads in position indefinitely without creep, even in the absence of power. However, vibration loads must be avoided.
- **Versatility:** They can be used in single, tandem, or multiple arrangements to lift and position loads at the same speed, even with uneven weight distribution.
- **Precision:** They can offer precise positioning capabilities.
- **Applications:** They are commonly used in various industries for material handling, automated assembly, heavy machinery adjustments, and precise positioning tasks.

Common designs:

- **Translating screw jacks:** The most common type, where the screw extends and retracts linearly.
- **Keyed screw jacks:** Designed for applications where the lifting screw needs to translate without rotating.
- **Rotating screw jacks:** Where the screw rotates, and a traveling nut attached to the load moves linearly.

Advantages:

- **High load capacity:** Can handle substantial loads, from a few pounds up to 100 tons.
- **Stability and precision:** Offer controlled and accurate positioning.
- **Reliability:** Have fewer moving parts compared to some other systems.
- **Safety:** Self-locking capability enhances safety in the event of power loss.
- **Environmental friendliness:** Avoid hydraulic oil leaks.
- **Adaptability:** Available in various configurations and with options for different environments.

Materials

We use the best materials to guarantee the performance and lifetime of the screw jacks you purchased.

Housing

- High-strength Casting Housing, Ductile Iron.

Lifting Screw

- C45 Steel as Standard. Custom Stainless Steel 304 or 316.

Input Shaft (Worm)

- C45 Steel in high frequency heat treatment process. Custom Stainless Steel 304 or 316.

Worm Gear / Travelling Nut / Safety Nut

- High Strength Bronze ZQAl9-4 (Casting aluminum bronze) as Standard, Custom High Strength Bronze ZCuSn10Pb1(Casting tin bronze)

Bearing

- Anti-friction Ball Thrust Bearings for Worm Gear.Anti-friction Ball Bearings for Input Shaft(worm). Custom Stainless Steel 304.

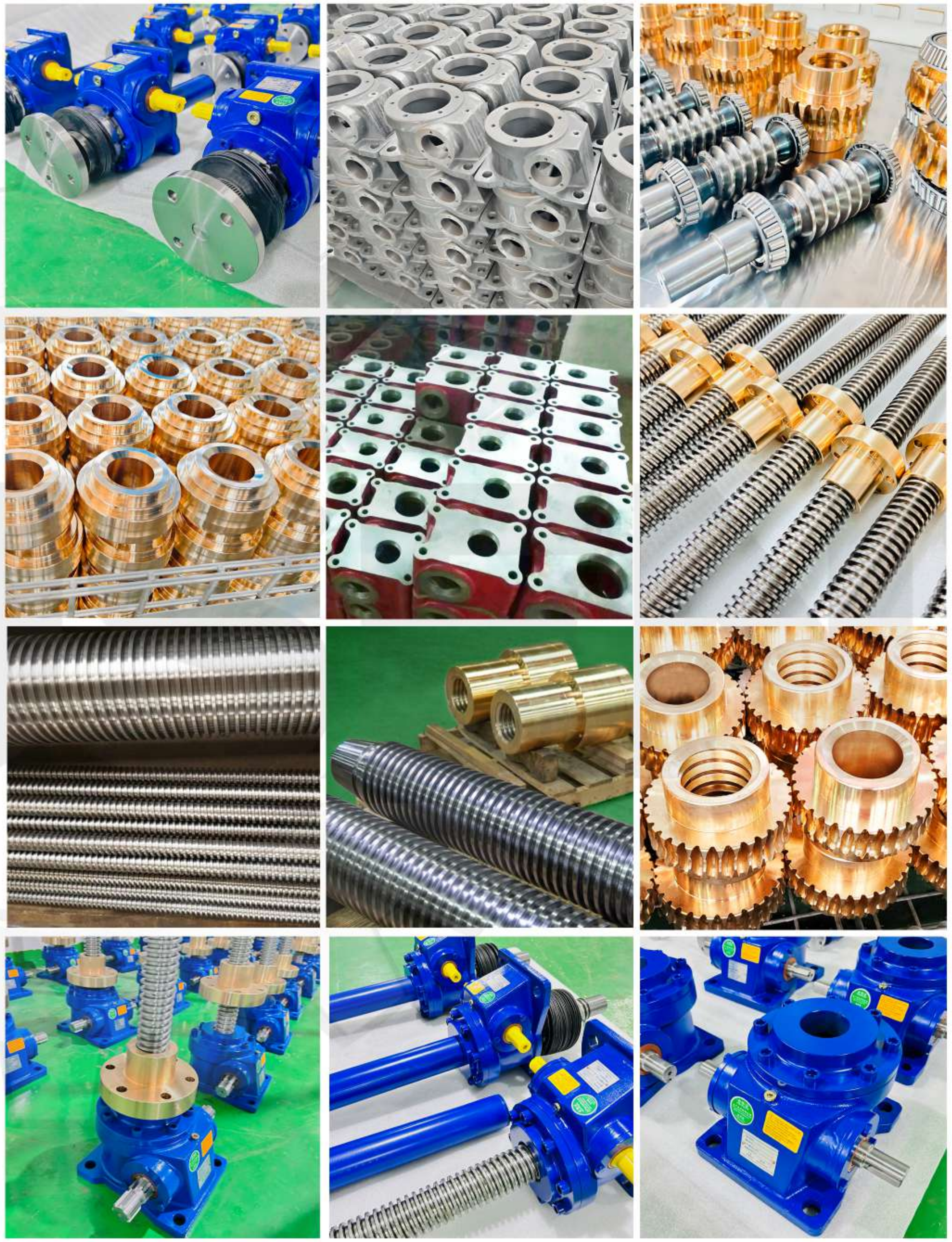
Motor Flange Adapter

- High-strength Casting Motor Adapter, Ductile Iron. Custom Stainless Steel 304 or 316.

Lubricants

- Synthetic Grease, Extreme Pressure EP2 Lithium Grease.

Materials



Selection Guide

Selection Notes

(01) Screw Jacks and Lifting Systems are for industrial use only, not recommended for transporting personnel.

(02) Carefully consider jack ratings before making a selection. Be sure that the dynamic or static load carried or sustained by jack does not exceed its maximum capacity.

(03) Carefully consider the combination of screw shaft speed (rpm) and rated load. Also, take extra care in verifying rated buckling load and screw shaft speed (rpm). Exceeding the data provided in this catalog can cause major damage to the system.

(04) Make sure that the surface temperature of the housing does not exceed temperature of -15ºC to +80ºC during operation. If using a traveling nut jack, measure the traveling nut surface temperature. Make sure all the rotating parts are completely stopped before proceeding to measure.

(05) The maximum input speed is 1500 rpm as long as the input power dose not exceed the jack's maximum allowable input power.

(06) Screw jack can not be operated continuously. Duty cycle based on 30 minutes.

- **Note:** Below duty cycles are based on ambient temperatures 20ºC. For ambient temperatures higher than 20ºC, the duty cycle (ED) must be reduced.
  * Screw Jack with Trapezoidal Screw (Machine Screw Jack) duty cycle ≤ 20%ED.
  * Screw Jack with Ball Screw (Ball Screw Jack) duty cycle ≤ 30%ED.
- **Note:** For operation longer than that mentioned above or for any continuous operation, the jacks temperature must be monitored and should not exceed 80ºC maximum in order to determine its duty cycle.

Duty Cycle (%ED) = [1 Duty Cycle / (1 Duty Cycle + 1 Rest Cycle)] x 100%

(07) Be sure not to exceed the maximum input torque for multiple screw jack systems by verifying the rated input torque for each jack.

(08) Be sure that starting torque is 200% or more of required running torque.

(09) Be sure that ample driving power is available to drive the jack when using in temperatures below 0ºC. Low temperatures decrease the jack's efficiency due to the increased grease viscosity inside the jack's gearbox.

Selection Guide

(10) Although Screw Jack with **Single-start** Trapezoidal Screw (Machine Screw Jack) has self-locking feature, vibration and shock may affect its efficiency, in which case a brake motor or extra braking device is required. Screw Jack with **Double-start** Trapezoidal Screw (Machine Screw Jack) is considered not self-locking will require a brake or other holding device. Screw Jack with Ball Screw (Ball Screw Jack) can backdrive because of their extremely high efficiencies and require some means of holding the load, such as a brake motor.

(11) When jacks are working, can not force to stop, may result in the jacks damage or injury personnel.

(12) When Ball Screw Jacks are under loads, can not change the motor drive to manual operation. Because the loads will cause the input shaft to rotate very dangerously.

(13) Mechanical stops (Stop Nuts) are not provided on the lifting screw unless requested. Therefore, it is possible to drive the screw out of the jack's housing.

(14) Never approach or touch the rotary parts (input shaft, etc.) or the lifting screw during operation.

(15) Bellows Boots and Protective Tubes should be used to protect and keep the lifting screw clean in dusty or abrasive environments.

Unit Converter

- **1 ft** = 304.8 mm
- **1 in** = 25.4 mm
- **1 m** = 10 dm = 100 cm = 1000 mm
- **1 in-lb** = 0.113 Nm
- **1 Nm** = 0.737 ft-lb
- **1 ft-lb** = 1.356 Nm
- **1 lb** = 0.454 kg
- **1 kg** = 2.205 lb = 1000 g
- **1 N** = 0.1 kg
- **1 t** = 1000 kg = 10 kN = 2000 lb
- **1 m/min** = 1000 mm/min = 16.7 mm/sec
- **1 in/sec** = 25.4 mm/sec
- **1 ft/sec** = 304.8 mm/sec
- **1 hp** = 0.75 kW
- **°C** = (°F-32) / 1.8
- **°F** = °C x 1.8 + 32

Calculation Formulas

(01) Calculate Total Load Ws (N)

$$Ws = W \times sf$$

Ws = Total Load (N)   W = Maximum Load (N)   sf = Safety Factor (**Table 1.**)

Table 1. Safety Factor sf

Load Conditions	Example Purposes	Safety Factor (sf)
Smooth movement with no shock, Light load	Opening and closing a valve, Adjusting a conveyor	1.0 ~ 1.3
Light shock, Medium load	Use with various kinds of transporting equipment and lifters	1.3 ~ 1.5
Severe shock and/or vibration, Heavy load	Use with large transporting carriages, Holding the position of a press roller	1.5 ~ 3.0

- **Note:** The above table is for general reference only. Consider particular operating conditions under which you operate before selecting a safety factor.

(02) Calculate Load Per Jack Wn (N)

$$W_n = Ws / (N_o \times fd \times \eta_g)$$

- **Note:** For a synchronous drive, use a synchronous drive coefficient (Table 2).
- **Note:** Don't ignore spiral bevel gearbox efficiency 94%.

W_n = Load Per Jack (N)   Ws = Total Load (N)

N_o = Number of jacks   fd = Multiple jacks system coefficient (**Table 2.**)

η_g = **Bevel Gearbox** efficiency = 94%

Table 2. Multiple Jacks System Coefficient fd

No. of jacks	1	2	3	4	5 ~ 8
Coefficient	1	0.95	0.9	**0.85**	0.8

(03) Jack Selection

Follow these steps to make a preliminary jack selection.

Points of preliminary jack selection

- Select (temporary) worm speed ratio by adjusting the screw shaft rpm. If difficult to select, inspect by H speed.
- Consider traveling space when selecting stroke.
- Select options based on your needs.

(04) Verifying Allowable Buckling Load P_{CR} (N)

For a compressive load, verify that it does not exceed the allowable buckling load. If it does, increase jack size and recalculate.

$$P_{CR} = fm \times (d^2 / L)^2, \text{ Make Sure } P_{CR} > W_n \times sf \text{ (sf = 4 as usual)}$$

P_{CR} = Allowable buckling load (N)   fm = Support coefficient (**Table 4.**)

L = Distance between load-supporting plane(point) and mounting plane(point) (mm)

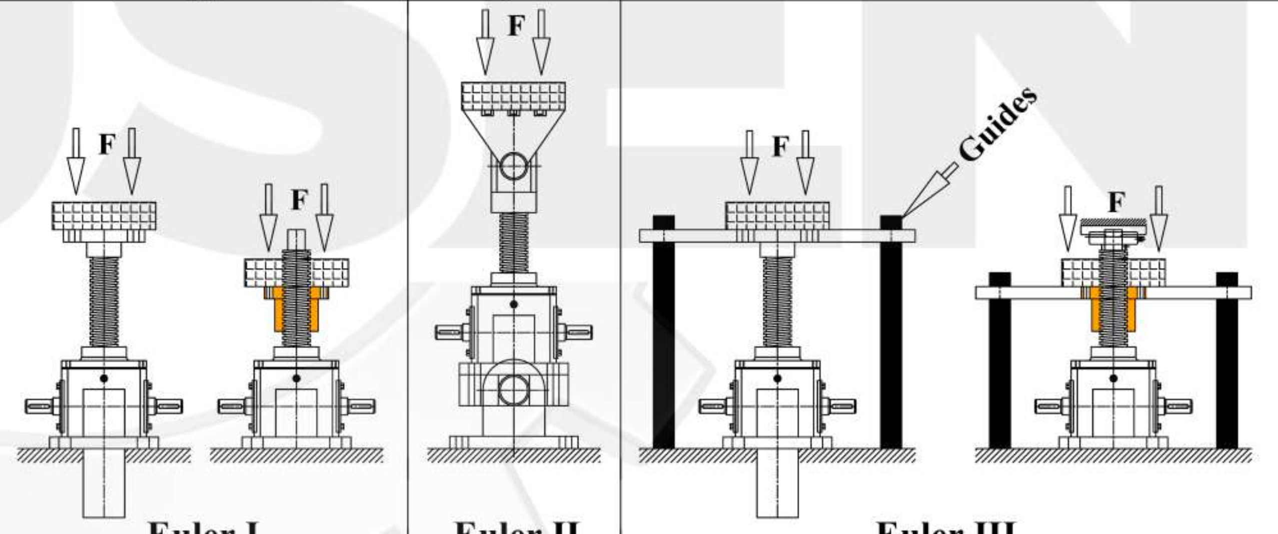
d = Screw shaft root diameter (mm) = D - TP - 2 x ac   TP = Screw pitch (mm)

W_n = Load Per Jack (N)   D = Screw diameter (mm)   ac = Assembly clearance (**Table 3.**)

Table 3. Assembly Clearance ac

Screw Pitch (mm)	ac
1.5 - 5	0.25
6 - 12	0.5
14 - 44	1

Table 4. Support Coefficient fm



Euler I (Unguided)   **Euler II (Trunnion)**   **Euler III (Guided)**

- **Euler I (fm = 2.5 x 10^4):** Screw jack housing fixed to the base (foot-mounted). Lifting screw end (or travelling nut) lifting **the free load (unguided).**
- **Euler II (fm = 1 x 10^5):** Screw jack housing and lifting screw end (or travelling nut) are trunnion mounted by pin or joint for **pivot drive.**
- **Euler III (fm = 2 x 10^5):** Screw jack housing fixed to the base (foot-mounted). Lifting screw end (or travelling nut) lifting **the fixed load (guided).**

Selection Guide

Calculation Formulas

(05) Verifying Allowable Screw Speed N_C (rpm)

- **Note:** Only for Screw Jack with Traveling Nut (Rotating Screw Jack), verify that it does not exceed the allowable screw shaft rpm. If it does, increase jack size and recalculate.

$$N_C = (96 \times fn \times d \times 10^6) / L^2, \text{ Make Sure } N_C > n2,\ n2 = n1 / i$$

N_C = Allowable screw shaft speed (rpm) fn = Shaft end support coefficient **(Table 5.)**

L = Distance between load-supporting plane and mounting plane (mm) (Table 5.)

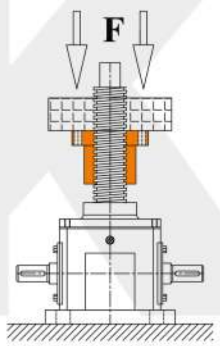
d = Screw shaft root diameter (mm) = D-TP-2xac TP = Screw pitch (mm)

D = Screw diameter (mm) ac = Assembly clearance **(Table 3.)**

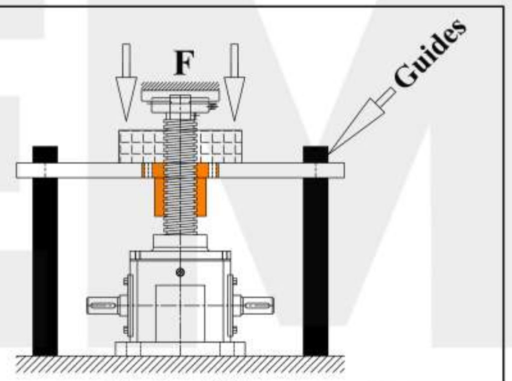
n2 = Output speed of screw shaft (rpm) n1 = Input speed of worm shaft (rpm)

i = Gear ratio

Table 5. Shaft End Support Coefficient fn



Euler I (Unguided)



Euler III (Guided)

- **Euler I (fn = 0.36):** Screw jack housing fixed to the base (foot-mounted). Travelling nut lifting **the free load (unguided).**
- **Euler III (fn = 1.56):** Screw jack housing fixed to the base (foot-mounted). Travelling nut lifting **the fixed load (guided).**

(06) Confirming Required Input Speed n1 (rpm)

Determine the required input rpm, using the required screw shaft speed.

- **Note:** Input speed should not exceed 1500 rpm.

$$n1 = v \times i / TP$$

v = Lifting speed (mm/min) n1 = Input speed of worm shaft (rpm)

TP = Screw pitch (mm) i = Gear ratio

Selection Guide

(07) Verifying Required Input Torque per T (Nm)

$$T = (F_{dyn} \times TP) / (2 \times \pi \times \eta \times i) + T_o$$

F_{dyn} = Dynamic axial force (= lifting force) (kN) F_{stat} = Static axial force (= retention force) (kN)

TP = Screw pitch (mm) $\pi = 3.1416$

η = Screw jack efficiency (see the Specifications of Jack Series)

* For Machine Screw Jacks, normal $\eta = 0.15$ (H ratio), $\eta = 0.12$ (L ratio)
* For Ball Screw Jacks, normal $\eta = 0.3\sim0.35$ (H ratio), $\eta = 0.22$ (L ratio)

i = Gear ratio

T_o = Idling torque (Nm) (see the Specifications of Jack Series)

(08) Verifying Required Input Power P (kW)

$$P = W1 \times v1 / (6000 \times \eta)$$

P = Input power (kW) W1 = Lifting force (kgf) v1 = Lifting speed (m/min)

η = Screw jack efficiency (see the Specifications of Jack Series)

* For Machine Screw Jacks, normal $\eta = 0.15$ (H ratio), $\eta = 0.12$ (L ratio)
* For Ball Screw Jacks, normal $\eta = 0.3\sim0.35$ (H ratio), $\eta = 0.22$ (L ratio)

(09) Other Calculation Formulas

09.01) Lifting Speed: $v = n1 \times TP / i$

09.02) Stroke / Revolution: $SR = TP / i$

09.03) Input Torque: $T = 9550 \times P / n1 + T_o$

09.04) Input Power: $P = P = T \times n1 / 9550$

09.05) Starting Torque per Jack: $T_{st} \approx T \times 1.3$

09.06) Hand Wheel Turning Force: $W_{hw} = T / R_{hw}$

09.07) Input Power of Multiple Jacks System: $P_s = P \times N_o / (fd \times \eta_g)$

09.08) Input Torque of Multiple Jacks System: $T_s = T \times N_o / (fd \times \eta_g)$

09.09) Screw Shaft Pitch Diameter: $d_2 = D - 0.5 \times TP$

09.10) Screw Shaft Torque: $T_{hub} = F_{dyn} \times (d_2 / 2) \times \tan(\alpha \pm \varphi),\ \varphi \approx 6°$

09.11) Lead Angle: $\alpha = \arctan[TP / (d_2 \times \pi)]$

- **Note:** A prerequisite is a vibration-free operation
  * Self-locking at standstill (Static): $2.4^0 < \alpha < 4.5^0$, may require brake motor
  * Self-locking from movement (Dynamic): $\alpha < 2.4^0$, don't require brake motor
  * No self-locking: $\alpha > 4.5^0$, require brake motor

Selection Guide

Calculation Formulas

09.12) Duty cycle based on 1 hour: ED = [S x As x 5 / (3 x v)] x 100%

09.13) Ball Screw Service Life in Hours: $L_h = (C_{dyn} / F_{dyn})^3 \times 10^6 / (n2 \times 60)$, n2 = n1 / i

- **Note:** Trapezoidal Screw Service Life cannot be determined by the formula used to calculate a Ball Screw wear life. Use the information below as a reference.
  50kN(5 ton) and below models average expected life 5000 meters.
  100kN(10 ton) and above average expected life 1000 meters.

v = Lifting speed (mm/min)
n1 = Input speed of worm shaft (rpm)
n2 = Output speed of screw shaft (rpm)
TP = Screw pitch (mm)
i = Gear ratio
SR = Stroke / Revolution (mm)
N_o = Number of jacks
fd = Multiple jacks system coefficient **(Table 2.)**
η_g = Bevel Gearbox efficiency, $\eta_g \approx 94\%$
P = Input power per jack (kW)
P_s = Input power of multiple jacks system (kW)
T_o = Idling torque (Nm)
T = Input torque per jack (Nm)
T_s = Input torque of multiple jacks system (Nm)
T_{st} = Starting torque per jack (Nm)
T_{hub} = Screw Shaft Torque (Nm)
L_h = Ball screw service life in hours (h)
C_{dyn} = Dynamic load capacity of ball screw (kN)
F_{dyn} = Dynamic axial force (= lifting force) (kN)
α = Lead Angle (°)
φ = Dynamic friction angle (°)
d_2 = Pitch diameter (mm)
D = Screw shaft diameter (mm)
W_{hw} = Hand wheel turning force (N)
R_{hw} = Hand wheel radius (m)
π = 3.1416
ED = Duty Cycle (%/hr)
S = Length of Stroke (mm)
As = Number of load cycles (up and down movement).
* **Example:** 5 times in and out movement of the screw shaft equals 10 double strokes.

Selection Guide

Sample Part Number (Example):

KMM50HAS500TPSLRZB

(1) Models and Gear Ratios

KMM10(Tr20x4) **H**=1:5 **L**=1:20	KMM25(Tr26x5) **H**=1:6 **L**=1:24	KMM50(Tr40x8) **H**=1:6 **L**=1:24	KMM100(Tr50x10) **H**=1:8 **L**=1:24	KMM150(Tr55x10) **H**=1:8 **L**=1:24
KMM200(Tr65x12) **H**=1:8 **L**=1:24	KMM300(Tr85x16) **H**=1:10-2/3 **L**=1:32	KMM500(Tr120x16) **H**=1:10-2/3 **L**=1:32	**H:** High ratio **L:** Slow ratio	

1.1) Model Note 1: the model indicates the maximum static load of this screw jack, but not the Maximum dynamic load. The dynamic load depends on the lifting speed, travel length and others working conditions.

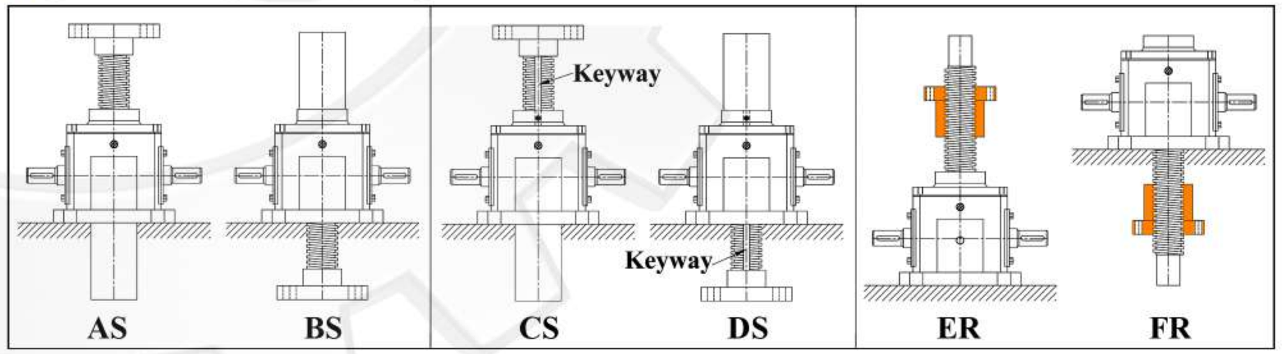
1.2) Model Note 2: The slower the lifting speed, the greater the dynamic load.

1.3) Model Note 3: In the case of compressed loads and long strokes, please calculate maximum critical buckling force.

1.4) Gear Ratio Note 1: Screw jacks with gear ratios between 20:1, 24:1 and 32:1,are self-locking and, in the absence of vibration, will hold loads without backdriving. All other ratios may require a brake to prevent backdriving.

1.5) Gear Ratio Note 2: Every screw jack model with 2 gear ratios as a standard. Custom others gear ratios.

(2) Basic Designs and Configurations



2.1) "AS" and "BS" are Translating Screw Jacks, they are the most commonly specified jack. All that is required for proper function is to restrain the rotation of the lifting screw and apply torque to the input shaft. This is often achieved through the use of guides (guided load) or by attaching a common load across multiple jacks. Most applications use this jack design.

Selection Guide

Sample Part Number

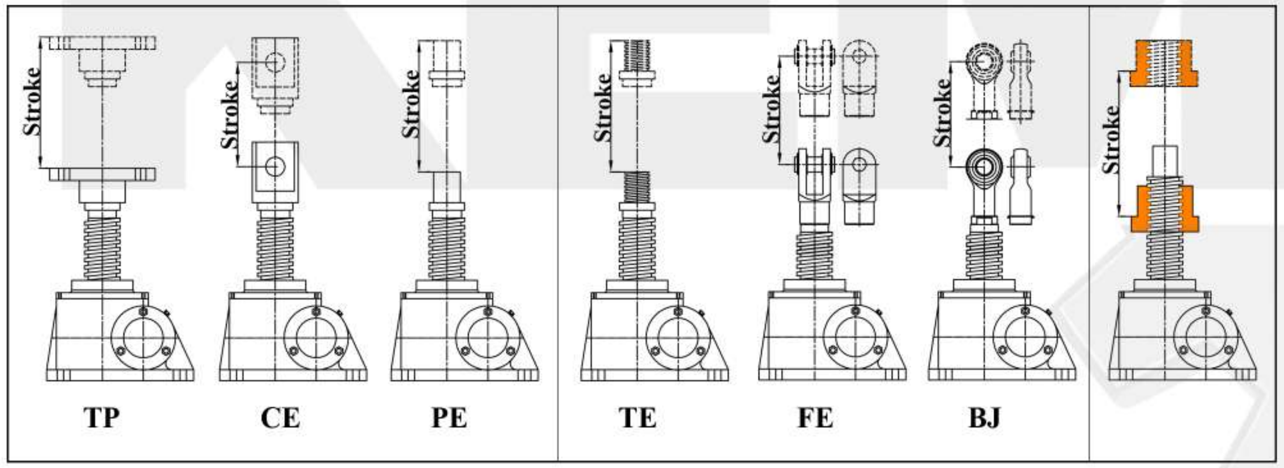
2.2) "CS "and "DS"are **Keyed Screw Jacks**, they are keyed for non-rotation. It is ideal for use in applications where a single jack must extend to meet and move a load to which it is not attached (unguided). Keyed jacks are commonly used in single jack applications where it would not otherwise be possible to restrain the rotation of the jack screw.

- **Note:** Input torque required will increase by approximately 8%.
- **Note:** Custom square protective tube for Anti-rotation Screw Jacks, a square nut is attached to the end of the lifting screw which is then fitted inside the tube, to prevent rotation.

2.3) "ER "and "FR"are **Rotating Screw Jacks**, they are also called travelling nut screw jack. It is important to restrain the rotation of the traveling nut by applying a significant load, or more commonly by guiding the load or attaching the load across multiple jacks. The Rotating Jacks mount flush and they are ideal for applications where the physical space does not allow the lifting screw to extend below or above the housing.

2.4) Custom double clevis screw jacks, trunnion mount screw jacks and anti-backlash nut screw jacks.

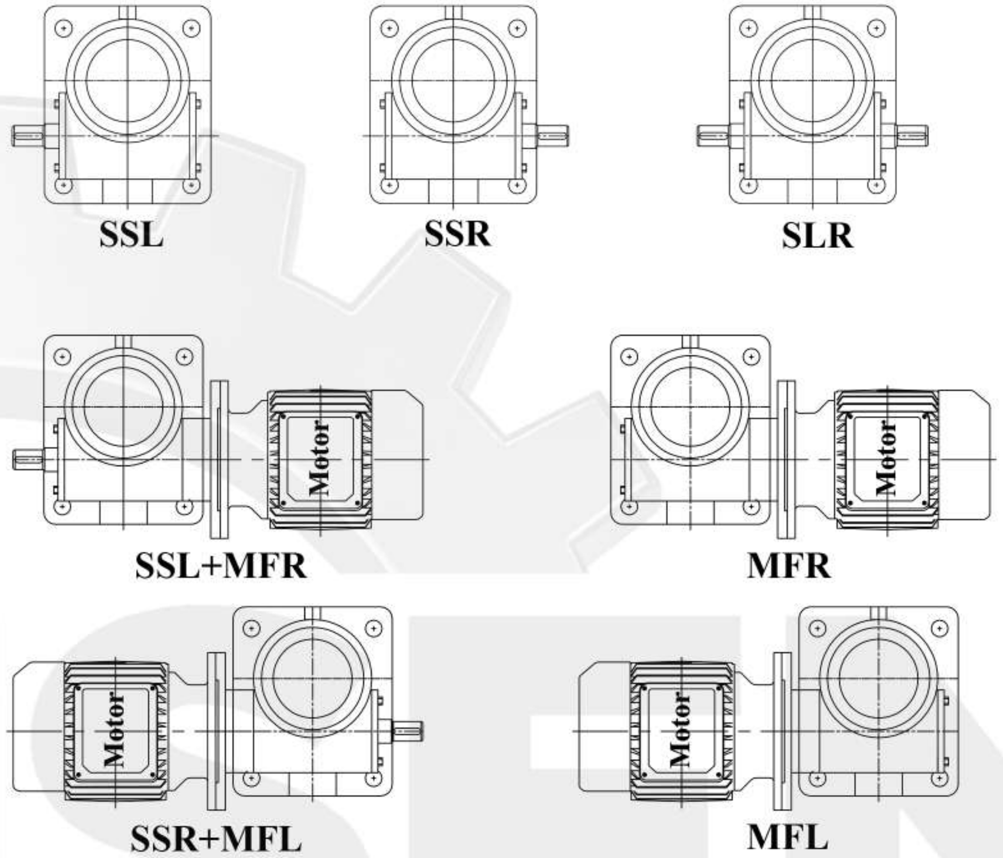
(3) Stroke and Screw End Fittings



- Stroke is travel expressed in millimeter(mm) or inches and not the actual screw length.
- Standard Lifting Screw End Fittings: (TP)Top Plate , (CE)Clevis End , (PE)Plain End , (TE)Threaded End , (FE)Forked End and (BJ)Rod End . Custom End Fittings are acceptable.

Selection Guide

(4) Input Shafts Codes and Motor Flange Adapters Codes (Top View)



4.1) SSL: Single Input, Left Side Shaft.

4.2) SSR: Single Input, Right Side Shaft.

4.3) SLR: Double Input Shafts

4.4) SSL+MFR: Left Side Shaft, Right Side Motor Flange Adapter (Motor Mounts).

4.5) MFR: Right Side Motor Flange Adapter (Motor Mounts).

4.6) SSR+MFL: Right Side Shaft, Left Side Motor Flange Adapter (Motor Mounts).

4.7) MFL: Left Side Motor Flange Adapter (Motor Mounts).

- **Note:** Screw Jacks with IEC Motor Flange Adapter as a standard. Custom NEMA Motor Flange Adapter(Stepper Motor), Servo Motor Flange Adapter and Other Non-standard Motor Flange Adapters.

Selection Guide

Sample Part Number

(5) Accessories


C Flex Coupling


U Universal Joint


T Telescopic Universal Joint


L Connecting Shaft


BJ Rod End


FE Fork End


PB Pillow Blocks


FB Flange Blocks


Z Protective Tube


B Bellows Boots


SN Stop Nut


MF Motor Flange


SP Trunnion Mount Plate


SF Safety Nut


DZ Double Clevis Protective Tube


FZ Square Protective Tube


M Electric Motor


R Geared Motor


K Bevel Geared Motor


RV Worm Gearbox


DC DC Motor


SM1 Stepper Motor


SM2 Servo Motor


CH Hand Wheel

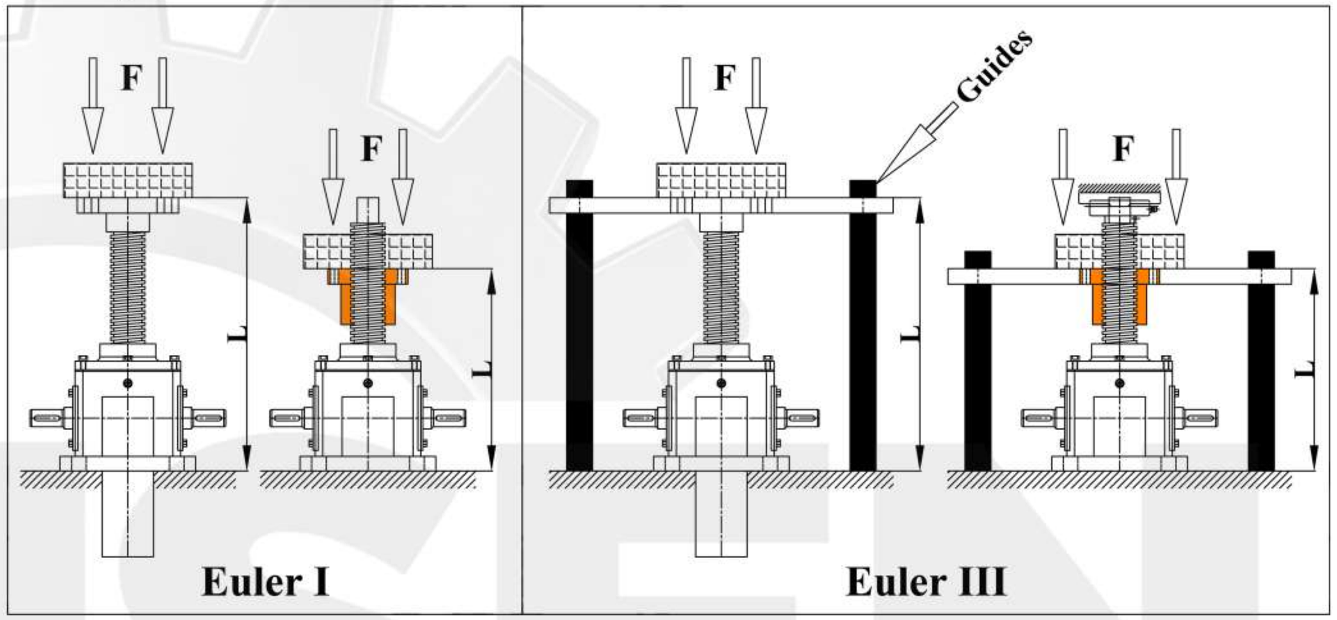

EN Rotary Encoder

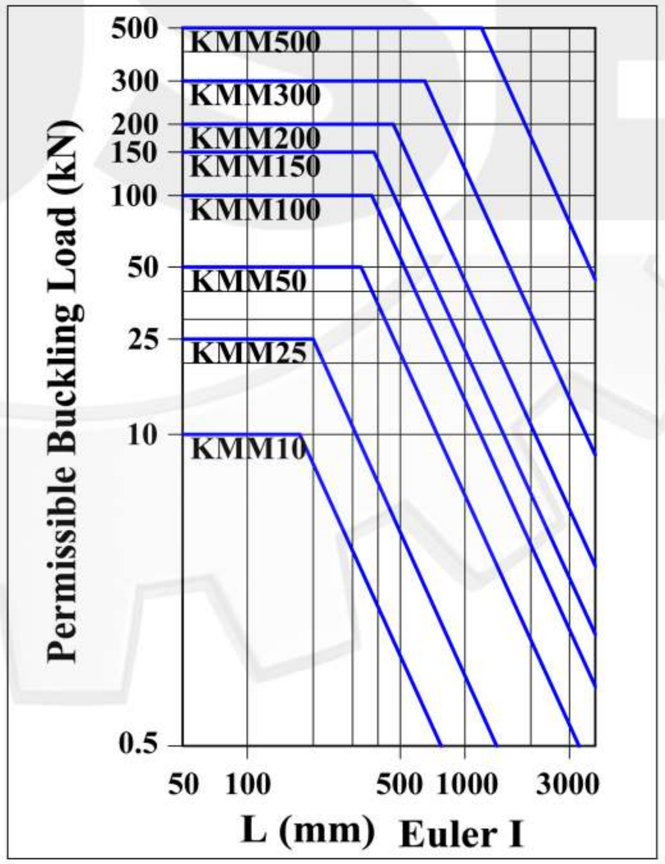

P Proximity Switch

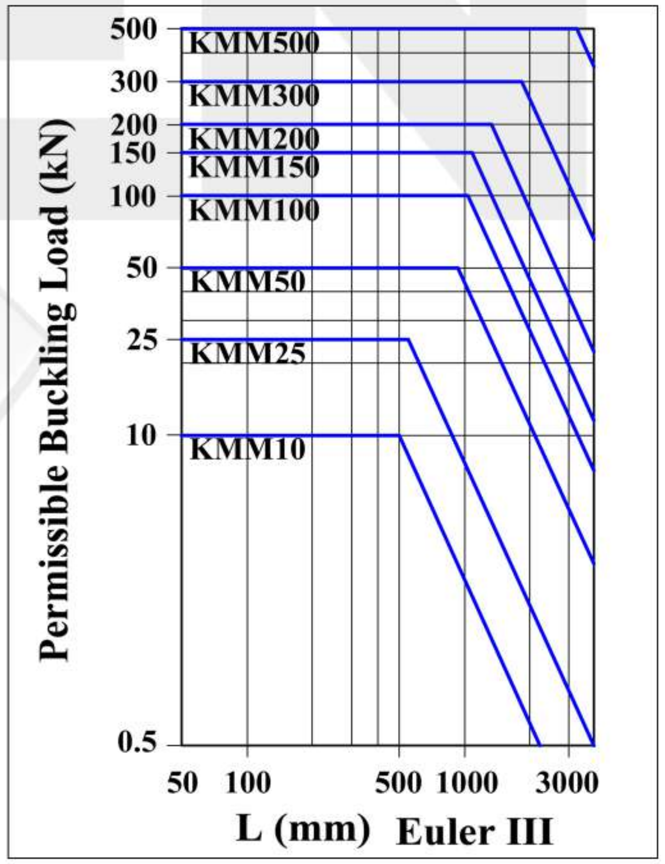
Permissible Buckling Load

If the lifting screw is loaded in tension,the buckling can be avoided,and hence be highly economical. In case of compression load, even occasional, it is necessary to check the buckling structure. Because the thin lifting screws may buckle sideways when subjected to compressive loads.

The permissible buckling load for trapezoidal-screw and ball-screw can be verified using the following bend diagrams. Verify that it does not exceed the permissible buckling load. If it does, increase jack size and recalculate.





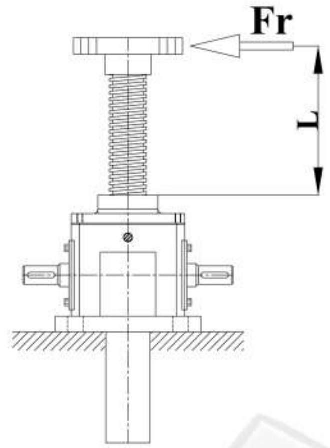


Allowable Side Load On the Lifting Screw

Lateral forces are to be prevented by constructive measures. The Lateral forces on lifting screws or travelling nuts exercise a reinforced edge compression on the movement thread, leading to increased wear and a shortened service life.

Guides are typically used for Machine Screw Types. However, if the shaft projection distance (L) beyond the housing surface is relatively short, a certain amount of side load is acceptable.

- **Note:** L represents the distance of screw shaft projection that affects side load. It does not refer to stroke distance.



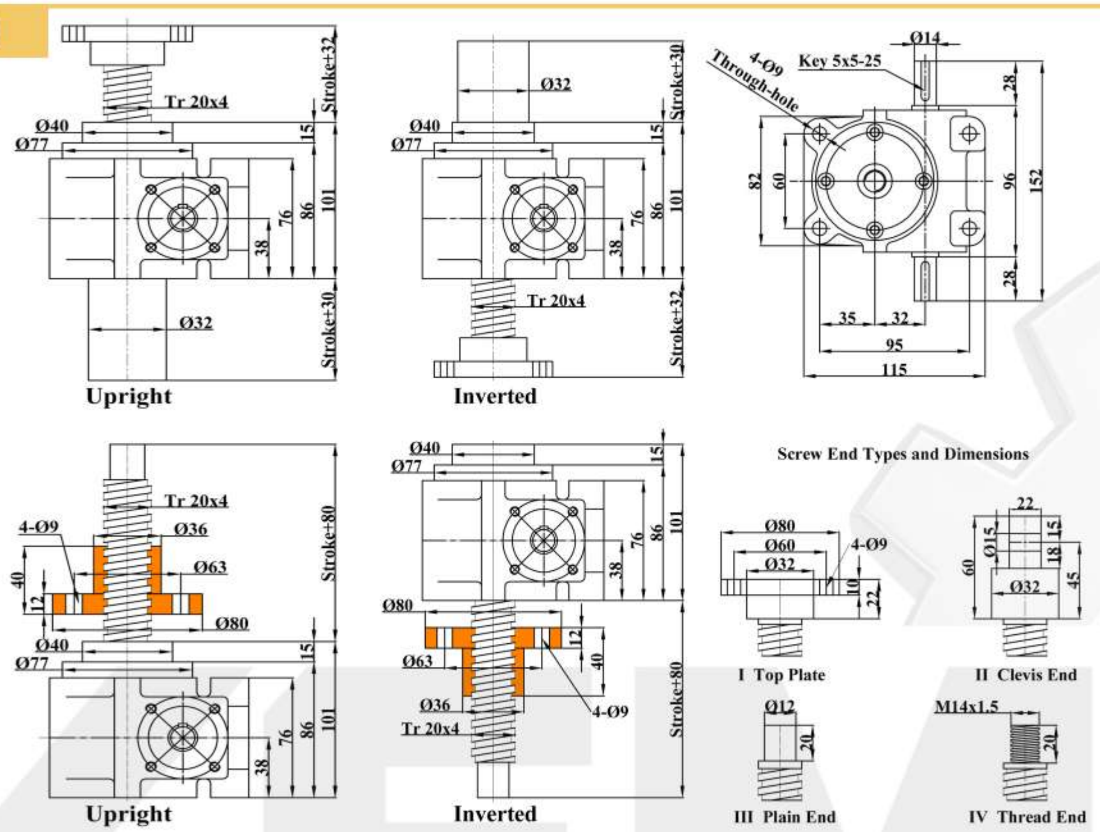
Allowable Side Load Fr (N)								
Distance L (mm)	Model							
	KMM10	KMM25	KMM50	KMM100	KMM150	KMM200	KMM300	KMM500
100	318	570	2500	4010	4610	8210	38200	85300
200	159	290	1250	2010	2300	4110	23000	50400
300	106	190	830	1340	1540	2740	15300	33600
400	79	140	620	1000	1150	2050	11400	25200
500	64	110	500	800	920	1640	9100	20200
600	53	100	420	670	770	1370	7600	16800
700	51	90	360	570	660	1170	6500	14400
800	48	90	310	500	580	1030	5700	12600
900	45	90	280	450	510	910	5000	11200
1000	42	90	250	400	460	820	4500	10100

Specifications

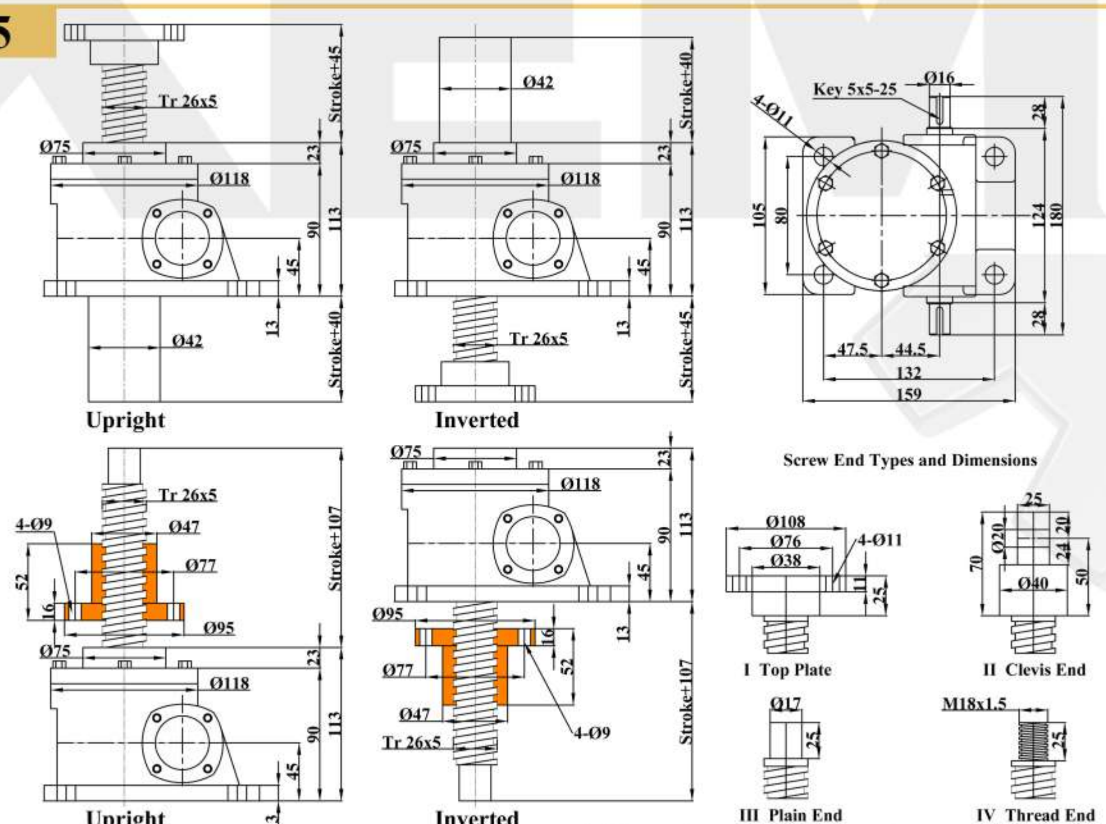
Model		KMM10	KMM25	KMM50	KMM100	KMM150	KMM200	KMM300	KMM500
Max. Load Capacity (kN)		10	25	50	100	150	200	300	500
Lift screw sizes (mm)		Tr20 x 4	Tr26 x 5	Tr40 x 8	Tr50 x 10	Tr55 x 10	Tr65 x 12	Tr85 x 16	Tr120 x 16
Root Dia. of screw (mm)		14.8	19.7	30.5	38.4	43.4	49.3	67	102
Gear ratio (high)	H	5:1	6:1	6:1	8:1	8:1	8:1	10.67:1	10.67:1
Lift screw travel (mm), per turn of input shaft	H	0.8	0.83	1.33	1.25	1.25	1.5	1.5	1.5
Efficiency %	H	21	21	22	22	20	20	19	15
Gear ratio (slow)	L	20:1	24:1	24:1	24:1	24:1	24:1	32:1	32:1
Lift screw travel (mm), per turn of input shaft	L	0.2	0.21	0.33	0.42	0.42	0.5	0.5	0.5
Efficiency %	L	12	12	14	15	14	13	11	10
Max. allowable power (kw)	H	0.49	1	2	2.8	3.1	5	8.4	13.4
	L	0.36	0.4	0.63	1.4	2.2	3.2	4.6	5.7
No-load torque (Nm)		0.29	0.62	1.4	2	2.6	3.9	9.8	19.6
Permissible torque of input shaft (Nm)		19.6	49	153.9	292	292	292	735.5	1372
Required torque of input shaft at max. load (Nm)	H	6.2	16.1	48.7	90.7	149	238.1	400	856
	L	2.9	7.4	20	45.3	72.3	124	244	453.3
Permissible max. speed (RPM) of input shaft at max. load	H	750	600	400	300	200	200	200	150
	L	1200	600	300	300	290	250	180	120
Lift screw rotational torque (Nm) at max. load		20.1	65.1	201.5	503.6	813.2	1287.7	2531.9	5551.3
Amount of Grease (g)		80	170	370	470	700	830	2600	5500
Gear housing material		Ductile Iron Stainless Steel						Ductile Iron	

Overall Dimensions

KMM10



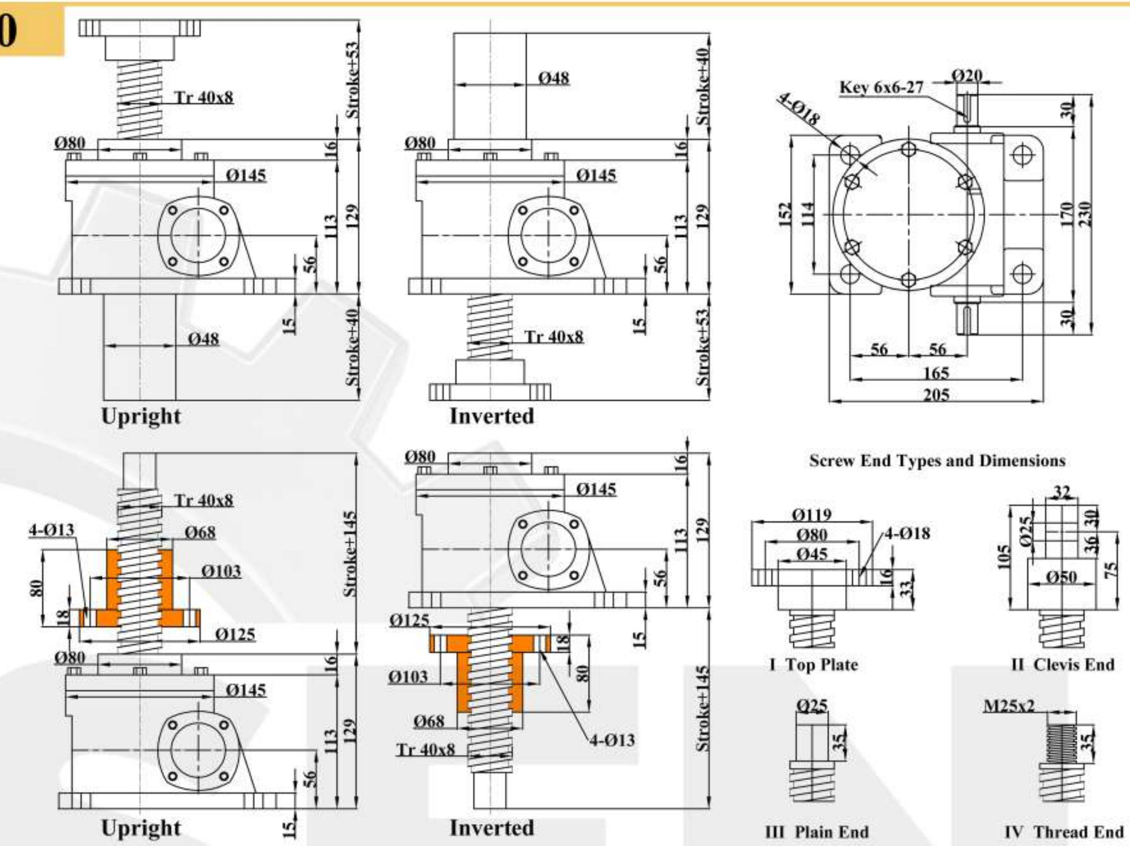
KMM25



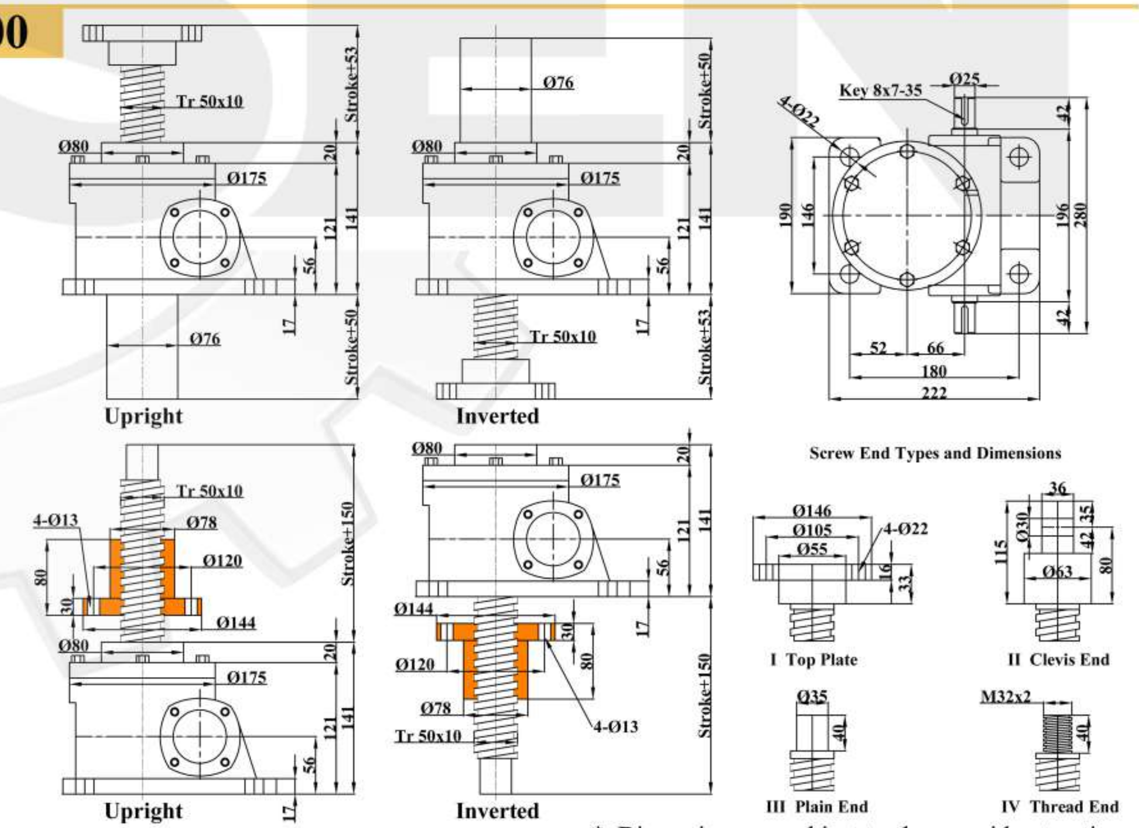
*. Dimensions are subject to change without notice

Overall Dimensions

KMM50



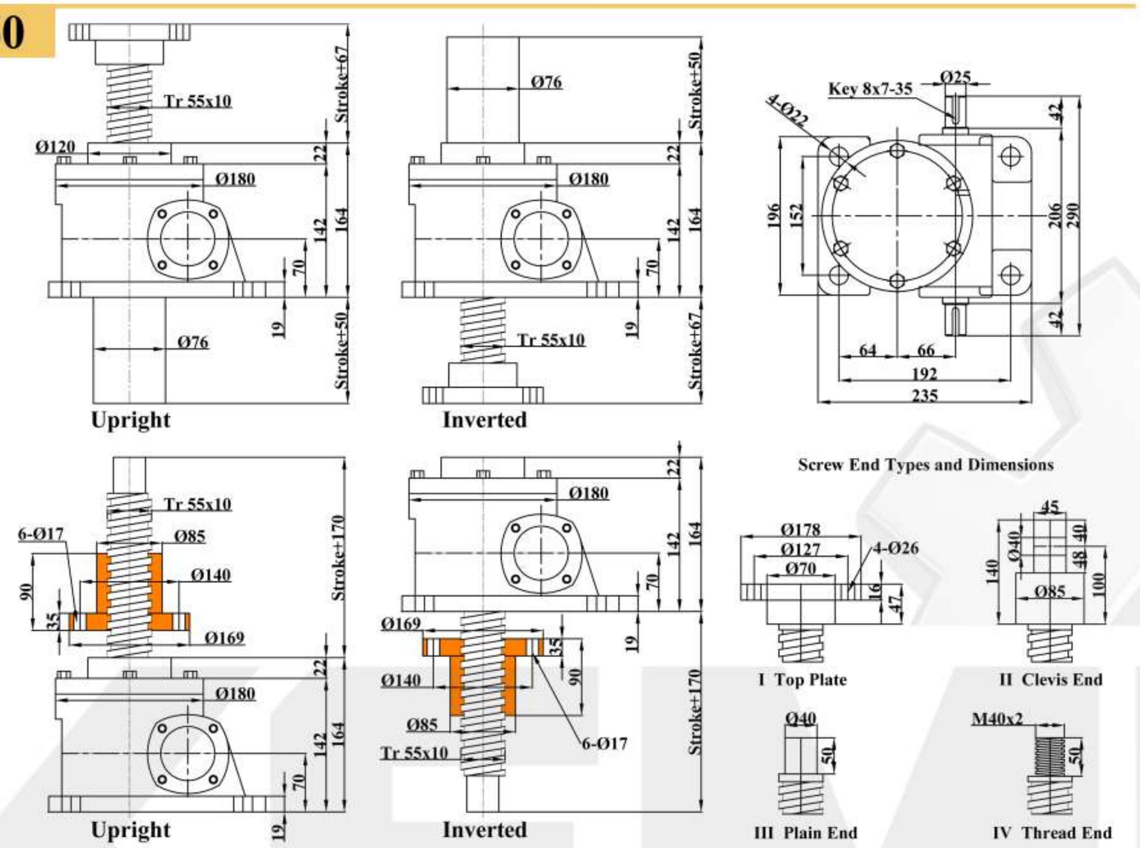
KMM100



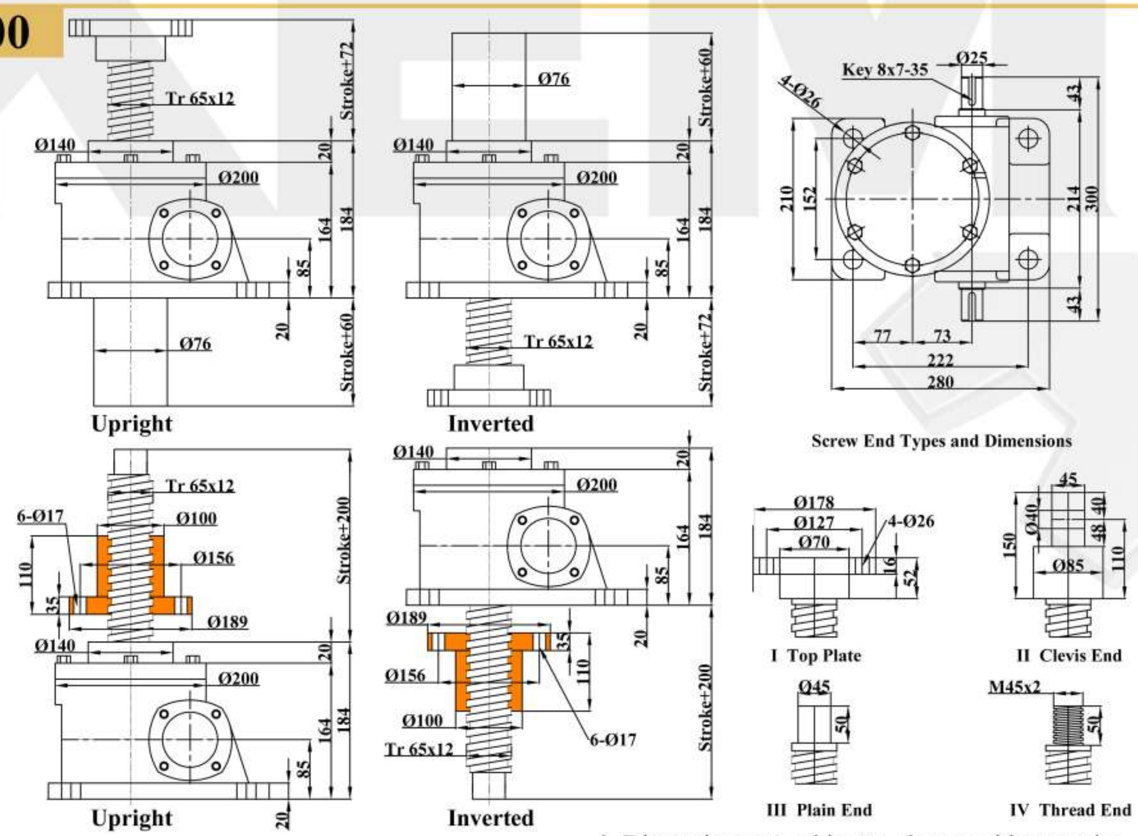
*. Dimensions are subject to change without notice

Overall Dimensions

KMM150



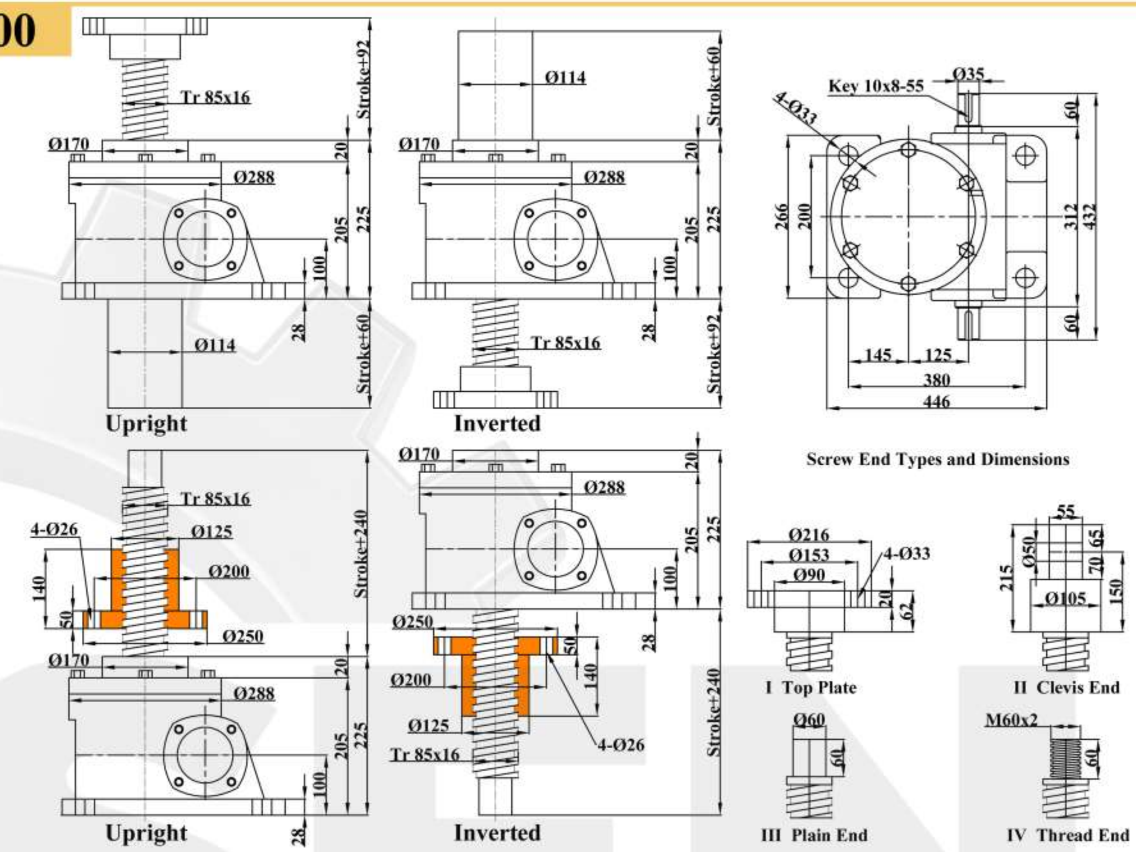
KMM200



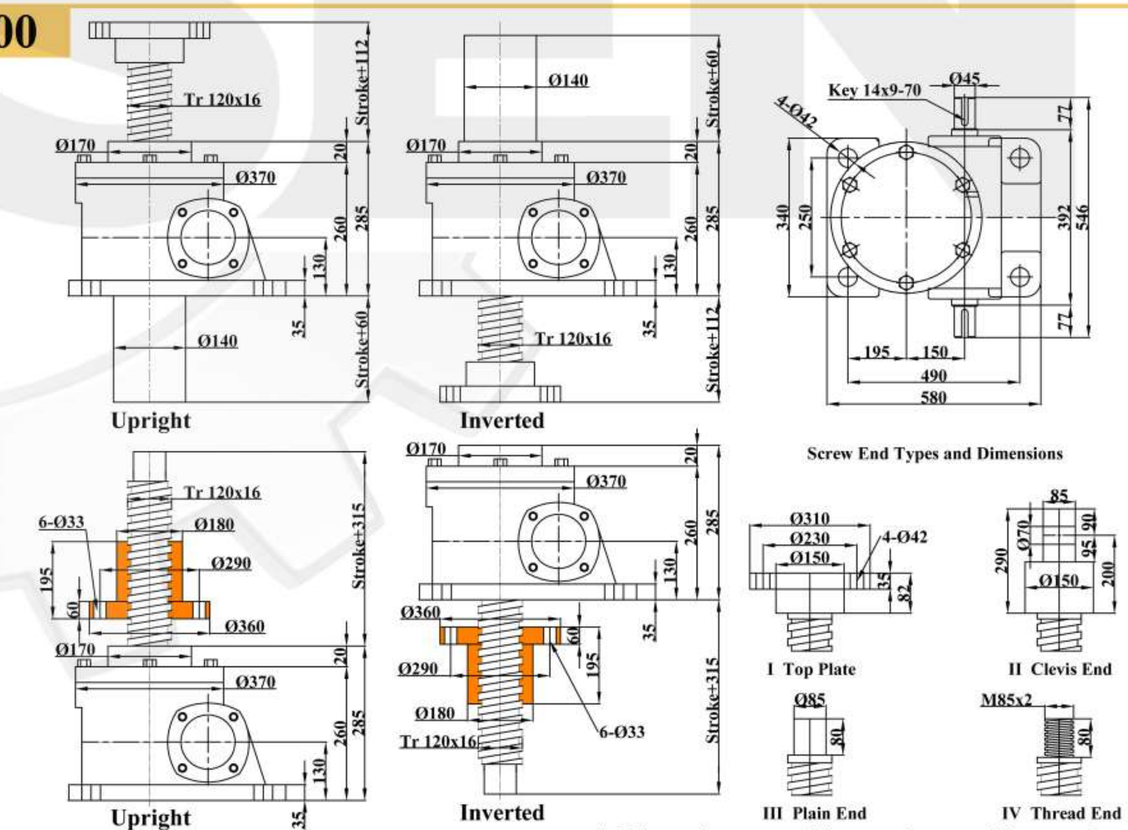
*. Dimensions are subject to change without notice

Overall Dimensions

KMM300



KMM500



*. Dimensions are subject to change without notice