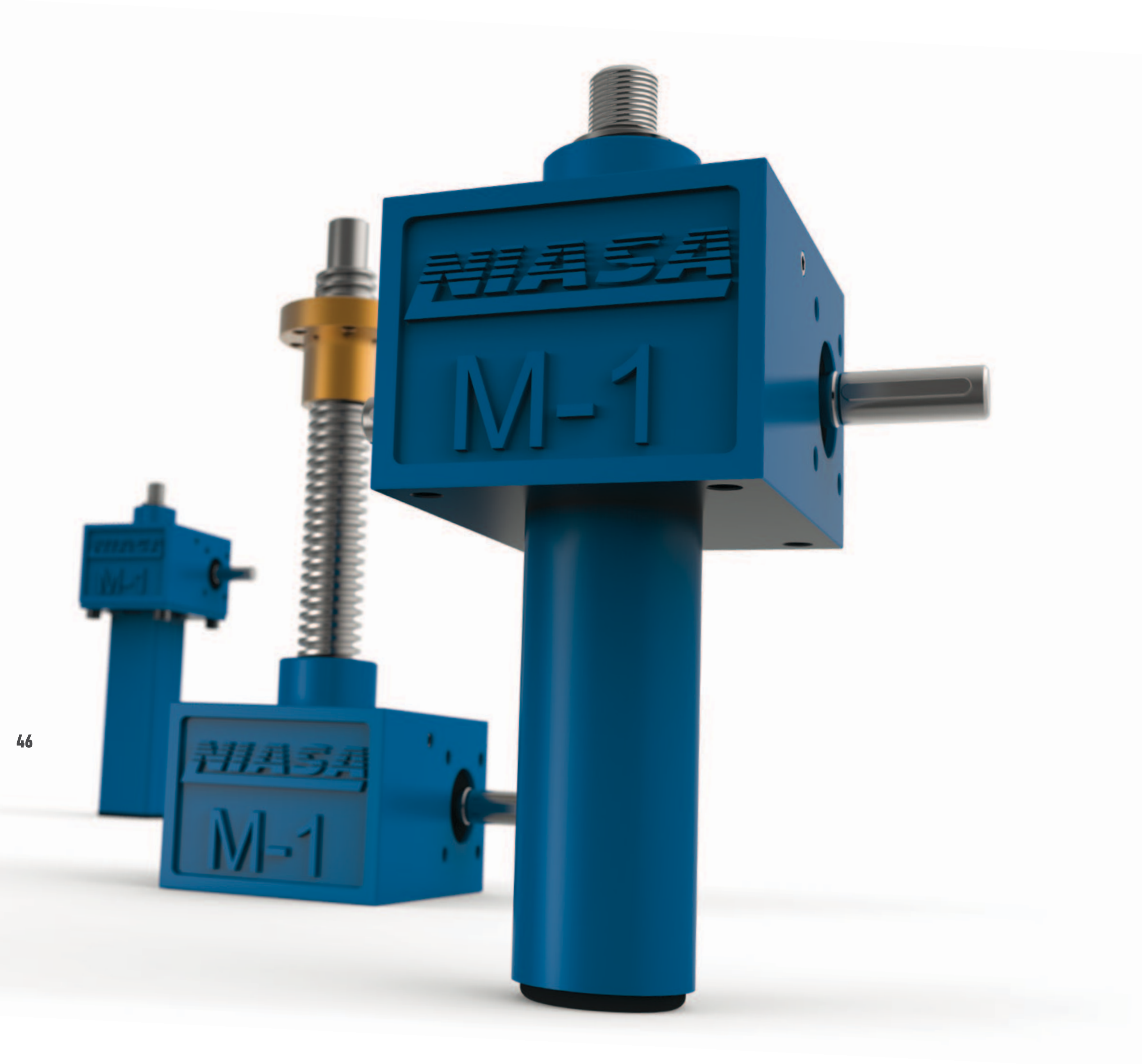
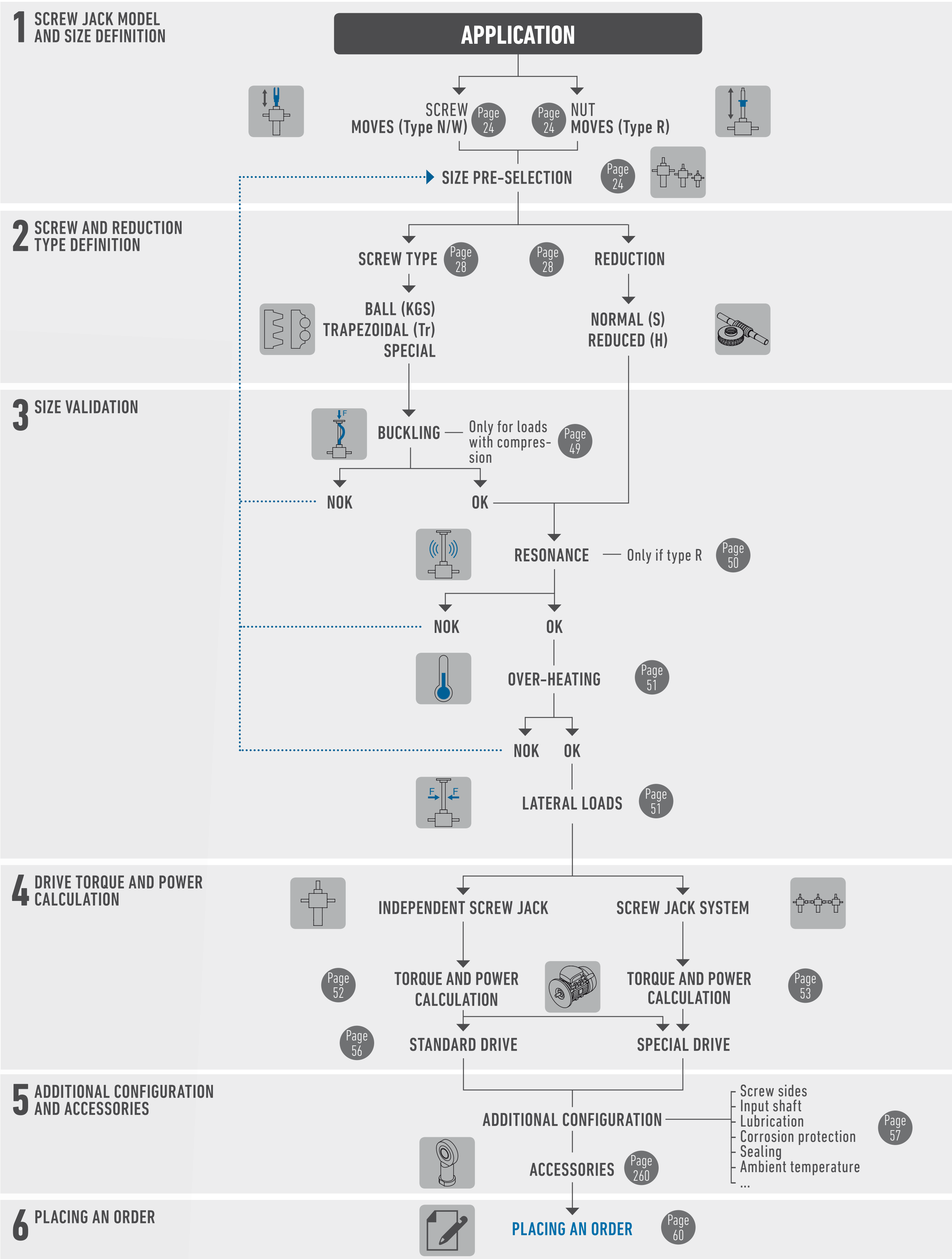
SCREW JACKS
PRODUCT SELECTION

To select the correct screw jack, please follow this flow diagram.

If you would like to know the expected service life of a unit for your application, please send the relevant data to the NIASA service department.

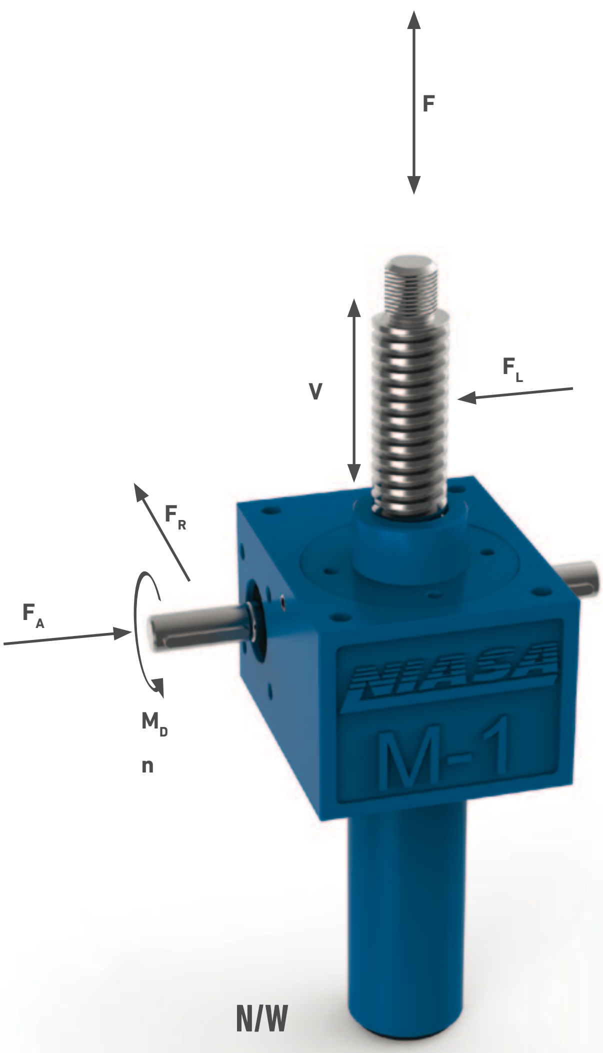


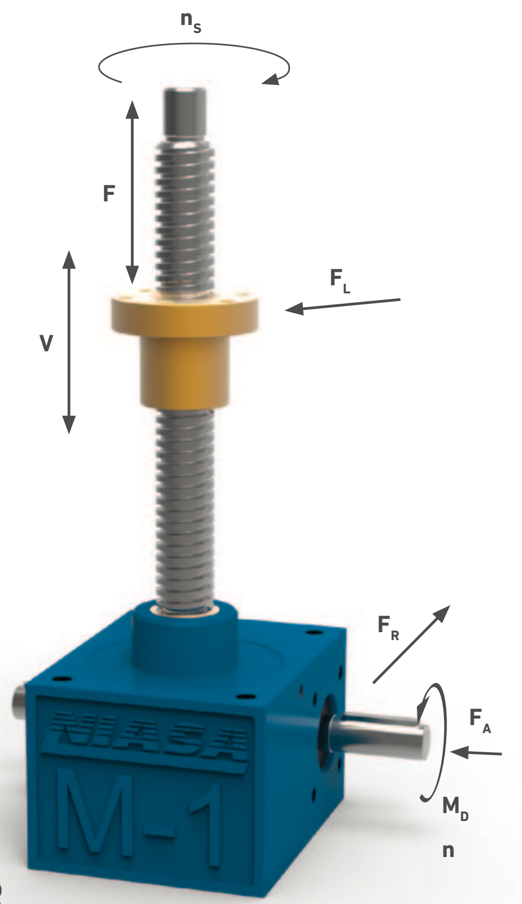

1 SCREW JACK MODEL AND SIZE DEFINITION
APPLICATION
SCREW MOVES (Type N/W)
Page 24
Page 24
NUT MOVES (Type R)
SIZE PRE-SELECTION
Page 24
2 SCREW AND REDUCTION TYPE DEFINITION
SCREW TYPE
Page 28
Page 28
REDUCTION
BALL (KGS)
TRAPEZOIDAL (Tr)
SPECIAL
NORMAL (S)
REDUCED (H)
3 SIZE VALIDATION
F
BUCKLING
Only for loads with compres-sion
Page 49
NOK
OK
RESONANCE
Only if type R
Page 50
NOK
OK
OVER-HEATING
Page 51
NOK
OK
F
F
LATERAL LOADS
Page 51
4 DRIVE TORQUE AND POWER CALCULATION
INDEPENDENT SCREW JACK
SCREW JACK SYSTEM
Page 52
TORQUE AND POWER CALCULATION
TORQUE AND POWER CALCULATION
Page 53
Page 56
STANDARD DRIVE
SPECIAL DRIVE
5 ADDITIONAL CONFIGURATION AND ACCESSORIES
ADDITIONAL CONFIGURATION
Screw sides
Input shaft
Lubrication
Corrosion protection
Sealing
Ambient temperature
...
Page 57
ACCESSORIES
Page 260
6 PLACING AN ORDER
PLACING AN ORDER
Page 60

SCREW JACKS
PRODUCT SELECTION

FORCE AND TORQUE ACTING ON A SCREW JACK

F Load to move at traction and/or compression.
F_L Lateral load on the screw.
V Travel speed of the screw or the nut.
F_A Axial load on the input shaft.
F_R Radial load on the input shaft.
M_D Torque on the input shaft.
n Speed on the input shaft.
n_S Screw turning speed.





CRITICAL COMPRESSION BUCKLING LOAD OF A SCREW JACK

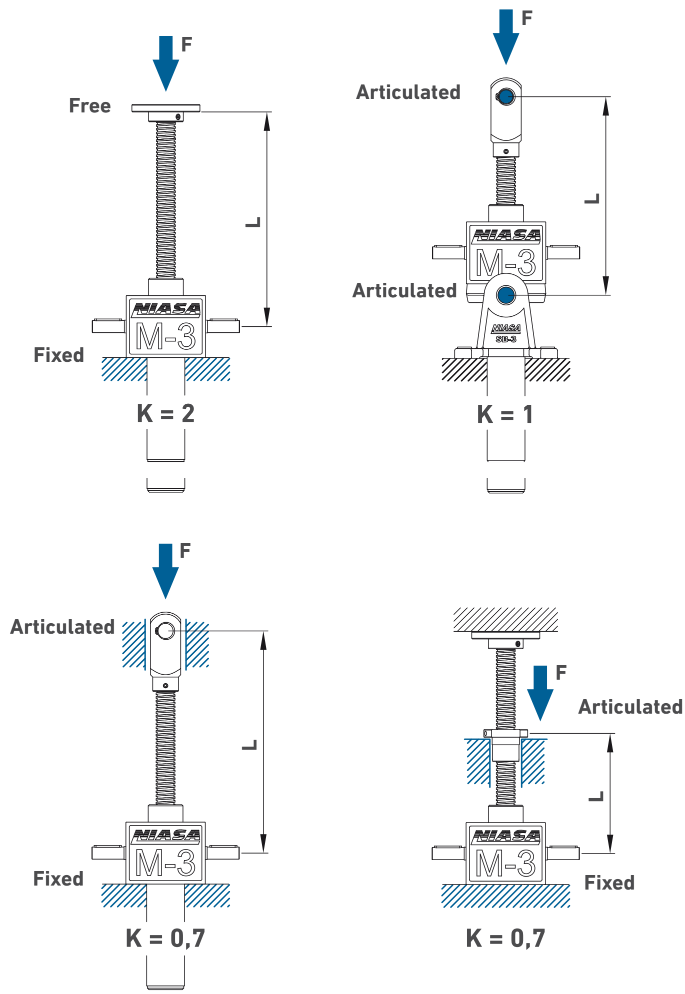
When there are compression loads on the screw, it may fail due to buckling, before reaching its static load capacity.

If the critical compression buckling load calculated is lower than the actual compression buckling load applied, a screw jack with a larger diameter screw must be selected and its suitability checked.

Check it using the following steps:

1. COMPRESSION BUCKLING LENGTH AND CORRECTOR FACTOR

Select the length L (mm) and the factor K, to be considered in the buckling critical load calculation. Do this based on the type of support on the sides of the screw jack, according to the figures shown on the right.



2. BUCKLING CRITICAL LOAD

$$F_{crit}\,(kN) = 33{,}91 \times \frac{d^4}{(K \times L)^2}$$

d Screw core diameter (mm).
L Buckling length (mm).
K Length corrector factor.

IMPORTANT

... In general, the load applied on the screw jack, including possible impacts, must not surpass the calculated value.

... The safety factor considered is 3; reconsider this if so considered opportune for the specific application. As a recommendation, when a hypothetical screw jack failure may involve injuries to people, multiply the critical load calculated by an additional factor of 0.6 (final safety factor, 5).

d - Screw core diameter (mm).

Trapezoidal screw (Tr)								
18x4	20x4	30x6	40x7	55x9	60x9	80x10	100x10	120x14
13	14.5	22.3	31.2	44	49	67.9	87.9	103.5

Ball screw (KGS)						
1605	2005	2505	4005	4010	5010	8010
12.9	16.9	21.9	36.9	34.1	44.1	74.1

SCREW JACKS
PRODUCT SELECTION

CRITICAL RESONANCE SPEED OF A SCREW JACK

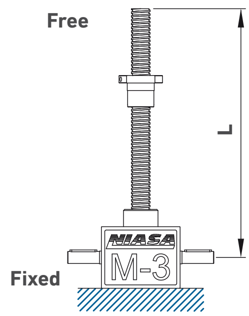
Applicable to the R version (the screw rotates and the nut moves).

With reduced diameter and long length screws, there is a risk of having considerable vibration on turning if this occurs at speeds close to the first vibration frequency (the second and highest correspond to very high speeds, at which the screws never work). In the worst cases, the screw may break and, additionally, the risk of collapse due to side buckling considerably increases.

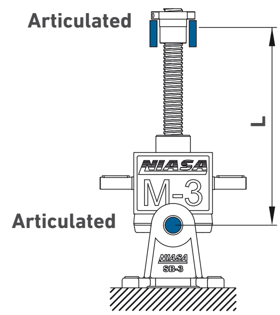
For these reasons, be sure that the screw jack screw works at considerably lower rotation speeds than resonance speeds. If not, select a screw of a larger diameter and/or reduce its turning speed and/or modify the screw jack end supports.

1. LENGTH, RESONANCE AND CORRECTOR FACTOR

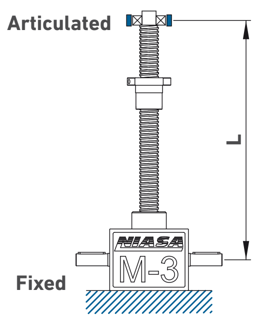
Select the length L and the correction factor M to consider. Do this based on the types of supports on the sides of the screw jack, according to the figures shown on the right.



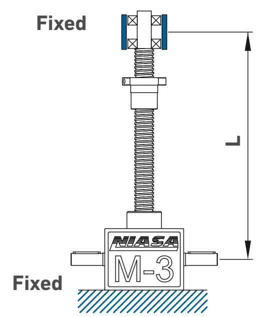
M = 0,34



M = 0,97



M = 1,51



M = 2,19

2. MAXIMUM ADMISSIBLE SPEED

$$n_{adm}\,(rpm) = M \times \frac{d}{L^2} \times 10^8$$

d Screw core diameter (mm).
L Length between supports (mm).
M Corrector factor according to supports.

IMPORTANT

... The safety factor considered is 1.25 (maximum admissible speed = 80% of the critical resonance speed).

d - Screw core diameter (mm)

Trapezoidal screw (Tr)								
18x4	20x4	30x6	40x7	55x9	60x9	80x10	100x10	120x14
13	14.5	22.3	31.2	44	49	67.9	87.9	103.5

Ball screw (KGS)						
1605	2005	2505	4005	4010	5010	8010
12.9	16.9	21.9	36.9	34.1	44.1	74.1

SCREW JACKS
PRODUCT SELECTION

OVERHEATING OF A SCREW JACK

With the aim of avoiding overheating due to internal friction of the screw jacks, the axial strength and the advance speed must be controlled. To do this, check the unit selected with the following formula.

If it does not comply, choose a larger screw jack and/or reduce the load and/or reduce the speed.

For very small strokes, please contact the NIASA technical department.

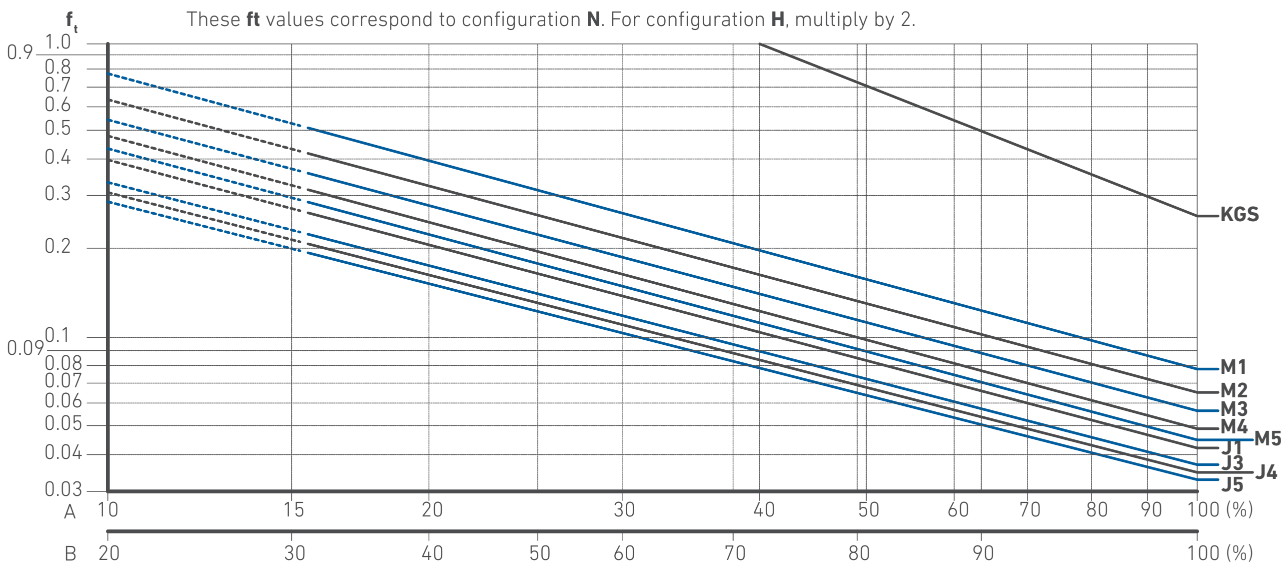
$$F \times V \leq F_{max} \times V_{max} \times f_t$$

F Axial strength on the screw (kN).
V Advance speed of the screw (mm/min).
F_{max} Axial load capacity of the screw jack (kN).
f_t Temperature factor, according to the diagram.

V_{max} $V_{max}\left(\frac{mm}{min}\right) = 1.500\left(\frac{1}{min}\right) \times \text{advance}\left(\frac{mm}{rev}\right)$

For input speeds over 1,500 rpm, please contact the NIASA technical department.

These **ft** values correspond to configuration **N**. For configuration **H**, multiply by 2.



A: Table for 60 minute intervals at 20°C.
B: Table for 10 minute intervals at 20°C.

LATERAL LOAD OF A SCREW JACK

NIASA recommends that, if they exist, the lateral loads on the screw must be supported by guide systems designed for this purpose, in addition to the guide for the gearbox, so that the screw or the nut exclusively support axial traction/compression loads.

If there are side loads, the life of the screw jack will be notably reduced, as there will be premature wear of the screw and the nut, which is often the origin of faults.

IMPORTANT

... If it is essential that the screw jack is subject to lateral loads, please contact the NIASA design department for correct design of the unit.

... This includes the horizontal mountings, on which the screw can flex when subject to the action of its own weight.

DRIVE TORQUE AND POWER OF AN INDEPENDENT SCREW JACK

After pre-selecting the suitable screw jack for the application, select the drive motor, following the steps below.

1. DRIVE TORQUE

$$M_D\ (Nm) = \frac{F \times P}{2 \times \pi \times \eta_{DG} \times \eta_{DS} \times i} + M_I$$

F Load to elevate in dynamic (kN)
P Screw pitch (mm)
M_I Idle torque (Nm)
i Screw jack gearbox
η_{DG} Gearbox dynamic efficiency
η_{DS} Screw dynamic efficiency

2. POWER REQUIRED

$$P_D\ (kW) = \frac{M_D \times n}{9550}$$

M_D Drive torque (Nm)
n Screw jack input speed (rpm)

IMPORTANT

... In general, it is advisable to multiply the power value calculated for a safety coefficient of 1.3 to 1.5; or for small installations, a factor of 2.

... When the load to move is lower than 10% of the elevator's nominal load, consider that value for the previous calculations.

3. START-UP TORQUE

For loads between 25% and 100% of the screw jack's nominal value, calculate the start-up torque with this formula:

$$M_D\ (Nm) = \frac{F \times P}{2 \times \pi \times \eta_{SA} \times i}$$

η_{SA} Screw jack static efficiency (gearbox + screw)

IMPORTANT

... For loads under 25% of the screw jack's nominal value, select the start-up torque by multiplying the drive torque by 2.

η_{DG} Gearbox dynamic efficiency

rpm input	S version (normal speed)								
	M1	M2	M3	M4	M5	J1	J3	J4	J5
3,000	0.91	0.9	0.92	Non-standard					
1,500	0.88	0.89	0.9	0.9	0.9	0.9	0.9	Non-standard	
1,000	0.87	0.88	0.88	0.88	0.87	0.89	0.89	0.9	0.91
750	0.85	0.87	0.87	0.87	0.86	0.88	0.89	0.9	0.91
500	0.84	0.85	0.85	0.85	0.84	0.87	0.88	0.89	0.9
100	0.79	0.79	0.79	0.79	0.78	0.81	0.84	0.85	0.88

rpm input	H version (reduced speed)								
	M1	M2	M3	M4	M5	J1	J3	J4	J5
3,000	0.75	0.77	0.76	Non-standard					
1,500	0.69	0.71	0.71	0.74	0.72	0.68	0.77	Non-standard	
1,000	0.67	0.69	0.68	0.69	0.67	0.67	0.76	0.77	0.75
750	0.64	0.66	0.67	0.68	0.65	0.65	0.75	0.77	0.74
500	0.61	0.64	0.63	0.64	0.62	0.64	0.74	0.76	0.72
100	0.54	0.56	0.54	0.55	0.53	0.55	0.66	0.69	0.62

η_{DS} Screw dynamic efficiency

Trapezoidal screw (Tr)								
18x4	20x4	30x6	40x7	55x9	60x9	80x10	100x10	120x14
0.41	0.38	0.38	0.35	0.33	0.31	0.27	0.23	0.26

Ball screw (KGS)
0.9 (for all sizes)

M_I Idle Torque

S version (normal speed)								
M1	M2	M3	M4	M5	J1	J3	J4	J5
0.08	0.22	0.3	0.7	1.68	1.8	2.6	3.2	4

H version (reduced speed)								
M1	M2	M3	M4	M5	J1	J3	J4	J5
0.06	0.14	0.24	0.5	1.02	1.15	1.9	2.2	2.9

η_{SA} Screw jack static efficiency

	S version (normal speed)								
	M1	M2	M3	M4	M5	J1	J3	J4	J5
Trapez.	0.24	0.22	0.22	0.19	0.18	0.18	0.17	0.13	0.16
Balls	0.63	0.63	0.63	0.62	0.61	0.65	0.71	0.68	0.7

	H version (reduced speed)								
	M1	M2	M3	M4	M5	J1	J3	J4	J5
Trapez.	0.15	0.14	0.13	0.12	0.11	0.11	0.12	0.1	0.1
Balls	0.39	0.41	0.39	0.39	0.36	0.4	0.5	0.51	0.44

IMPORTANT

... The values indicated in the tables correspond to the lubrication conditions established by NIASA, for gearbox and screw, and will be reached after a small period of operation.

... In the case of low temperatures, these can be reduced considerably.

SCREW JACKS
PRODUCT SELECTION

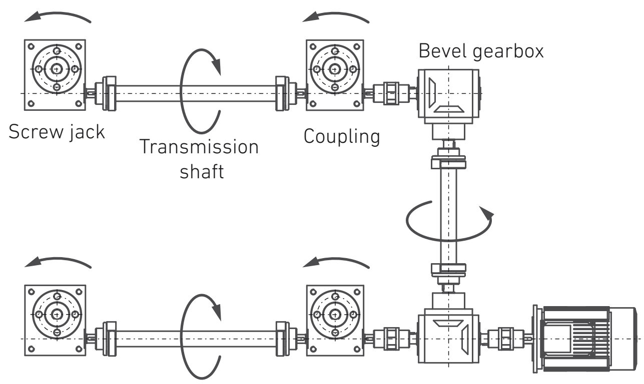
PLANNING INSTALLATIONS WITH SCREW JACKS

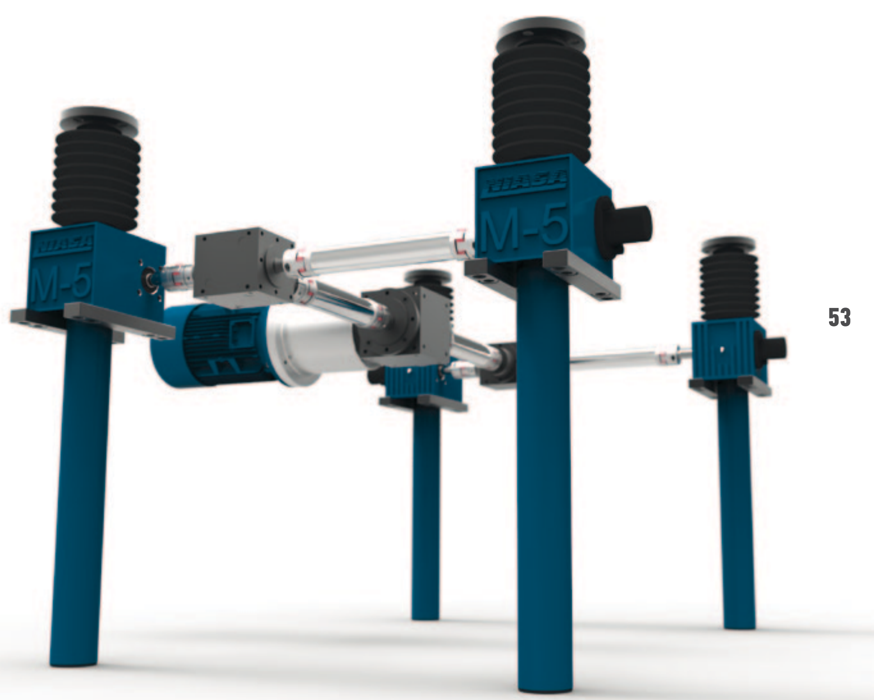
For the application of screw jacks in installations with several units, the following criteria must be taken into account:

1. Define the number, position and orientation of the screw jacks.
2. Select the drag components (couplings, transmission shafts, supports, bevel gearboxes, motors, etc.) taking the following recommendations into account:
   - ... Ensure that the total load is distributed uniformly between all the installation's screw jacks.
   - ... The lowest possible number of transmission parts is recommended.
   - ... The transmission shafts should be as short as possible.
   - ... Try to protect the overall installation with a safety torque limiter.
3. If during the design of the installation a problem arises in defining the turning sense of the different elements, it is advised to apply the following method:
   - ... Indicate the orientation of the screw jack elements.
   - ... Mark the screw turning sense on each screw jack to “lift”.
   - ... Show the position of the bevel gearboxes and the transmission shafts in a diagram.

Example:

Elevation system with four screw jacks and two bevel gearboxes.

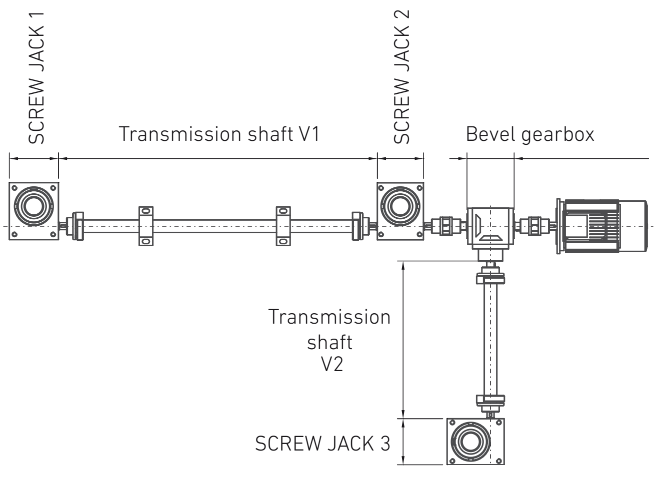




DRIVE TORQUE OF A SCREW JACK SYSTEM

The drive torque of a system made up of several screw jacks connected to each other depends on the torque required for the individual drive of each one and the efficiency of the transmission parts that connect them.

Example:



1. SYSTEM DRIVE TORQUE

$$M_{DS}\,(Nm) = \frac{M_{D1}}{\eta_{V1}} + M_{D2} + \left(\frac{M_{D3}}{\eta_{V2}} \times \frac{1}{\eta_k}\right)$$

$M_{D1}/M_{D2}/M_{D3}$	Screw jack drive torque 1 / 2 / 3 (Nm)
η_{V1}/η_{V2}	Gearbox efficiency V1 / V2 (0.90-0.95 approx.)
η_K	Distribution gearbox efficiency (0.90 approx.)

IMPORTANT

- ... In general, it is advisable to multiply the value calculated for a safety coefficient of 1.3 to 1.5; or for small installations, a factor of 2.
- ... When the load to move is lower than 10% of the elevator's nominal load, consider that value for the previous calculations.

To help the calculation, some frequent arrangements are shown for those for which the system's drive torque can be calculated approximately using the formula below.

It is assumed that the load distribution is uniform between all the units and that they are all the same size.

$$M_{DS}\,(Nm) = M_D \times f_S$$

M_D	Independent screw jack drive torque
f_S	Factor, depending on system (see figures next page)

2. SYSTEM START-UP TORQUE

For loads by screw jack between 25% and 100% of the screw jack's nominal value, calculate the start-up torque with this formula:

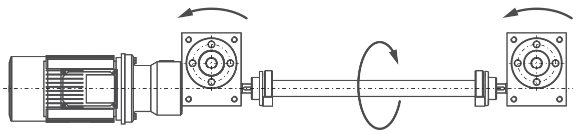
$$M_{DS}\,(Nm) = \frac{M_{DS}}{\eta_{SJ}}$$

M_{DS}	System drive torque (Nm)
η_{SJ}	Elevator static efficiency

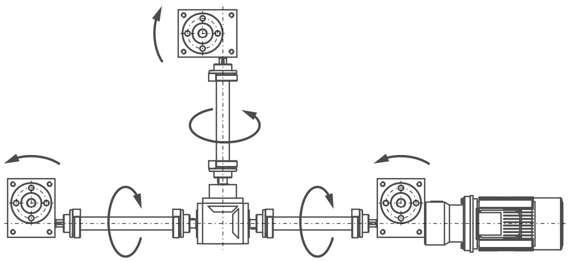
IMPORTANT

- ... For loads by elevator lower than 25% of its nominal value, multiply the system drive torque by 2.

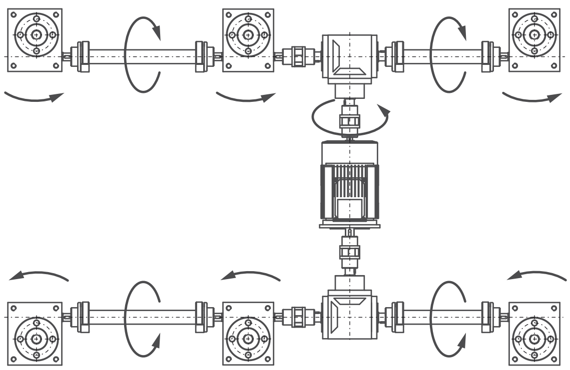
$f_s = 2.1$



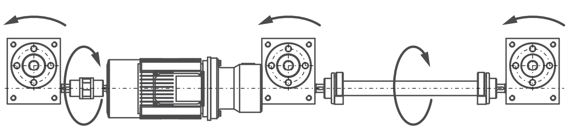
$f_s = 3.34$



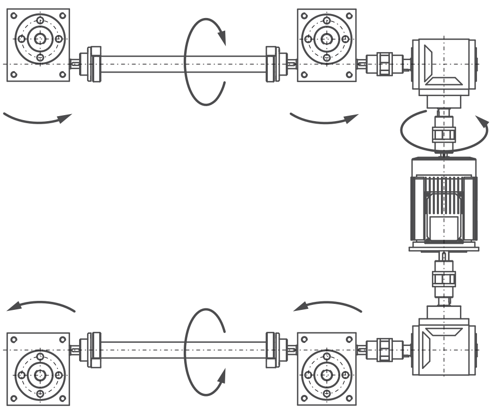
$f_s = 6.8$



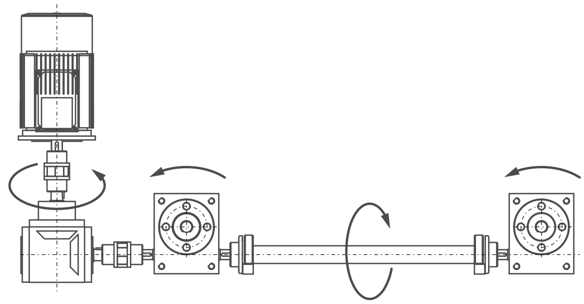
$f_s = 3.1$



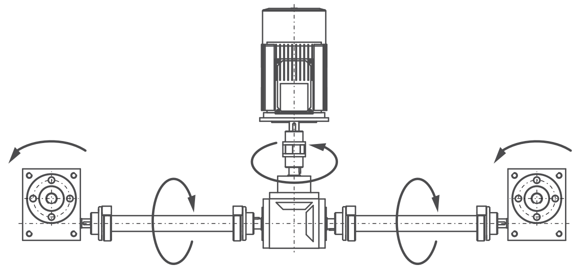
$f_s = 4.4$



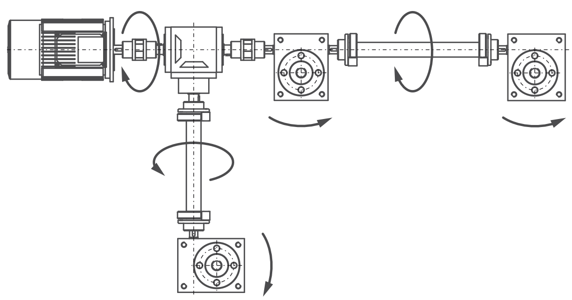
$f_s = 2.25$



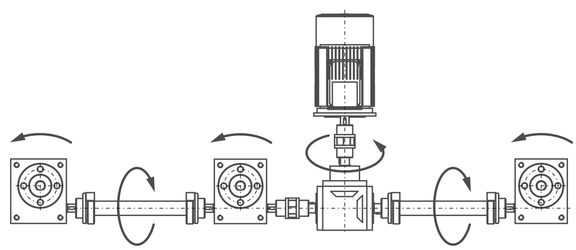
$f_s = 2.25$



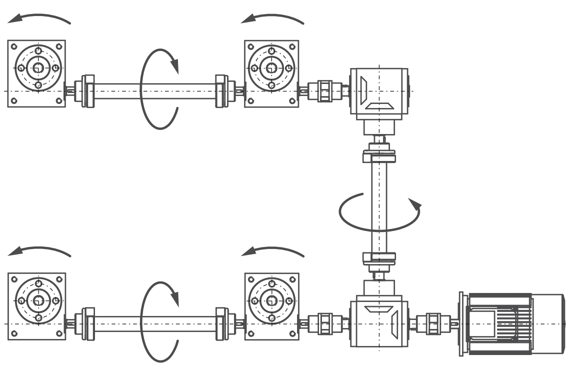
$f_s = 3.27$



$f_s = 3.35$

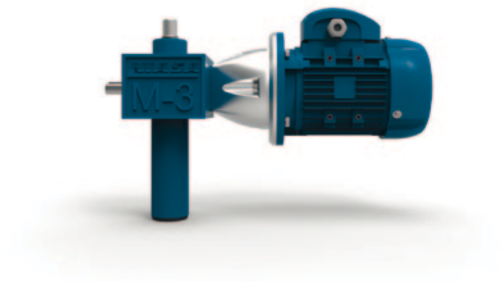


$f_s = 4.6$



NIASA

SCREW JACKS
PRODUCT SELECTION



STANDARD DRIVE

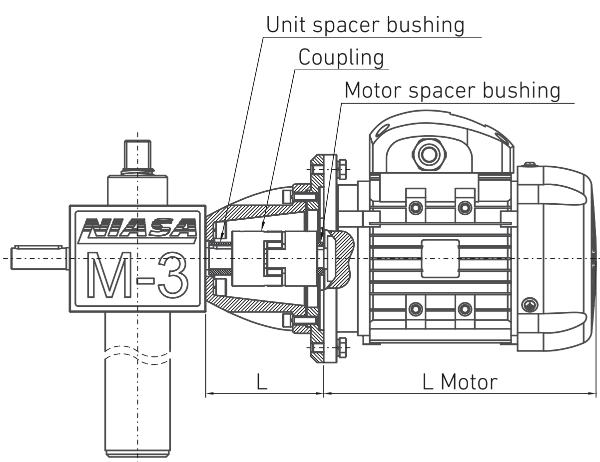
The standard drive of the screw jacks is made using AC motors.

The following table shows the powers available for each screw jack size and the type of flange on the motor, in addition to the length of its fastening flange to the gearbox.

For another size or different type of drive, please contact NIASA. NIASA can supply alternating or stepper motors with sensors of any type, etc.

		MOTOR GROUP																		
		56		63		71		80		90		100		112	132		160		180	
	Motor flange	POWER (kW)																		
		A	B	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	A	B
		0.06	0.09	0.12	0.18	0.25	0.37	0.55	0.75	1.1	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22
M1	L	57		60		67														
	Motor flange	B14		B14		B14														
M2	L			63		70		83												
	Motor flange			B14		B14		B14												
M3	L					91		101		113		123								
	Motor flange					B5		B14		B14		B14								
M4	L					91		101		113		123								
	Motor flange					B5		B5		B14		B14								
M5	L							125		135		145			167		201			
	Motor flange							B5		B5		B14			B14		B14			
J1	L											145			165		199			
	Motor flange											B14			B14		B14			
J3	L									135		145			167		201		203	
	Motor flange									B5		B5			B5		B5		B5	

For asynchronous motor specifications, see the motorization chapter (page 312).



In the case of using ball screws (or trapezoidal screws with more than one input), together with the normal speed gearboxes (S) the screw jack may be reversible. Contact the NIASA technical department for the most suitable brake selection for your application.

In general, it is always advisable that the motors incorporate a brake, standard brakes are sufficient for each motor size in most cases. This will ensure the screw does not loose position when it stops or if there are vibrations, etc.

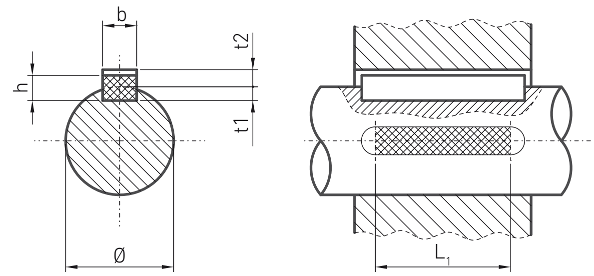
SCREW JACKS
PRODUCT SELECTION

MAXIMUM TRANSFERABLE TORQUE DEPENDING ON SHAFT/ PARALLEL COTTER PIN (DIN 6885)

The following table shows the maximum transferable torque for a shaft and its keys. It is considered that the shaft is subject exclusively to torsional forces.

IMPORTANT

... Never apply to the input shaft of a screw jack torques over those indicated for its shaft and keys (see plans in the sub-chapter "sizes").



Shaft diameter Ø (mm)	Key dimensions			Maximum transferable torque, M_D (Nm) Key effective length, L_1 (mm)						
	b x h (mm)	t1 (mm)	t2 (mm)	10	16	20	28	40	50	70
8 – 10	3 x 3	1.8	1.4	5	9	12	-	-	-	-
10 – 12	4 x 4	2.5	1.8	9	13	17	-	-	-	-
12 – 17	5 x 5	3	2.3	15	24	30	42	-	-	-
17 – 22	6 x 6	3.5	2.8	25	40	50	70	100	-	-
22 – 30	8 x 7	4	3.3	39	63	78	109	157	195	-
30 – 38	10 x 8	5	3.3	50	82	102	143	204	255	357
38 – 44	12 x 8	5	3.3	62	98	123	173	247	308	432
44 – 50	14 x 9	5.5	3.8	82	132	164	230	330	412	575

Material: C45 (1.1191) according to EN 10083-1
Load type: Drive - Uniform /
Load - Light knocks
Assembly: tight
Cycles: >1,000,000
Safety factor: 1.5 - 2.5
IMPORTANT For other conditions, please contact the NIASA technical department

LUBRICATION

NIASA screw jacks are supplied lubricated with DIVINOL LITHOGREASE G421 type grease. This is a semi-synthetic grease with a lithium compound with the following specifications.

Specifications

Lithium compound semi-synthetic grease DIVINOL LITHGREASE G421	
Working temperature	-35 to +160°C
Density at 15°C	0.9 kg/dm^3
Cinematic viscosity (s/DIN 51 562)	130 mm^2/s at 40°C 15 mm^2/s at 100°C
Dropping point (s/DIN ISO 2176)	>220°C
Water resistance (s/DIN 51 807/T1)	Level 1

For further information, please contact the NIASA technical department.

A complete cleaning and change of grease is recommended after five years.

The greasing interval depends on the type of work and its cycle. It is advisable to lubricate from 30 to 50 hours after start-up and approximately every six months.
It is important to avoid over-lubricating.

A group lubricator is recommended for automatic lubrication of the units. Depending on the type of group lubricator, the lubrication may last up to two years. See lubrication chapter in accessories.

NIASA supplies its screw jacks with the following type of hydraulic greasing mechanism:

... 45° inclined greasing mechanism MT508 DIN 71412.

... As a greasing nozzle, the 515/G – 516/G hydraulic connector is recommended. For its protection and conservation, use plastic caps.

The spring screw jacks can also be supplied with a brass greasing cap with O-ring.

SCREW JACKS
PRODUCT SELECTION

PROTECTION AGAINST CORROSION, SEALING AND AMBIENT TEMPERATURE

PROTECTION AGAINST CORROSION

Select the environment in which the equipment will work, using the atmospheric corrosion categories classification established in the DIN EN ISO 12944-2 standard (protection against the corrosion of steel structures using painted systems). Also establish the durability required before carrying out the first maintenance of the exterior surfaces (durability does not imply a "time" guarantee).

If the corrosion category is higher than "C3" for your application and/or higher than "average" durability is required, please contact NIASA so that the technical department can select the surface protection system and select the most suitable components.

CORROSION CATEGORY		ENVIRONMENT	
		Outdoors	Indoors
C1	Very low		Buildings with heating and clean atmospheres.
C2	Low	Atmospheres with low levels of pollution. Rural areas.	Buildings with no heating and possible condensation.
C3	Medium	Urban and industrial atmospheres, with moderate SO_2 pollution. Coastal areas with low salinity.	Manufacturing plants with high humidity and some pollution.
C4	High	Industrial areas and coastal areas with moderate salinity.	Chemical and swimming pool industries.
C5-I	Very high (industrial)	Industrial areas with high humidity and aggressive atmosphere.	Buildings or areas with almost permanent condensation and high contamination.
C5-M	Very high (maritime)	Coastal and maritime areas with high salinity.	Buildings or areas with permanent condensation and high contamination.

DURABILITY		
LOW	L	2 to 5 years
MEDIUM	M	5 to 15 years
HIGH	H	More than 15 years

PROTECTION AGAINST THE INPUT OF SOLIDS AND LIQUIDS

NIASA screw jacks offer, as standard, an IP54 protection index to prevent solid and liquid particles from entering the inside, which may damage them or reduce their designed service life.

Use the following table, according to the DIN EN IEC 60529 standard, if the level of protection must be higher than that indicated. NIASA supplies, on request, specially designed units to withstand the most aggressive environments.

The protection levels are defined with a code made up of the letters "IP" and two numbers "XY".

LEVEL OF PROTECTION "IP", AGAINST THE INPUT OF ...			
... solid particles: "X"		... liquids: "Y"	
	...		...
5	Protection against dust residues (the dust that may penetrate the inside does not imply incorrect operation of the equipment).	3	Protection against spray water (from angle up to 60° with vertical).
6	Total protection against the penetration of any kind of solid body (sealing).	4	Protection against water splashes (from any direction).
		5	Protection against water streams from any direction with hose.
		6	Protection against sporadic floods (example: tidal wave).
		...	...

AMBIENT TEMPERATURE

Contact NIASA if your unit will be installed in an environment that may reach temperatures below -20°C.

NIASA's technical department will prescribe the most suitable materials and sealing components for the specific conditions of the application. Also do this
if ambient temperatures over 40°C are expected.

SCREW JACKS
PRODUCT SELECTION

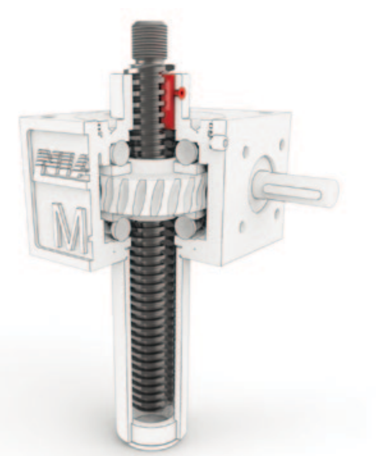
OPTIONAL CONFIGURATIONS

Optionally, NIASA may adapt your screw jack, modifying the different parts of it to your preferences.

Some examples are shown below.
See sub-chapter “Placing an order”.

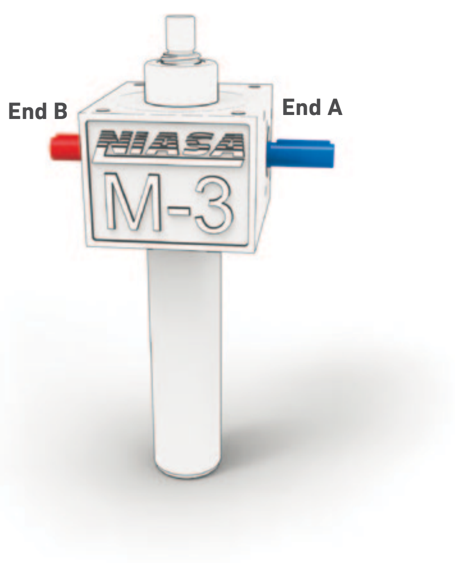
Immobilizations

Configuration N with anti-rotating screw using a pin on the upper cover and a groove on the screw. This configuration is only available for trapezoidal screws and on small strokes. For further information please contact NIASA.



Worm gear

There is a possibility, at the customer's request, to supply the screw jacks with one of the sides of the worm shaft cut.



Screw end

O. With no end.
G. With standard thread.
Z. Standard cylindrical end.
S. Special end.

Special configurations

On request, screws with various inputs can be supplied to obtain higher, but eventually reversible, travel speeds. The screw jacks can also be supplied with left-thread screws.