03
LINEAR ACTUATORS WITH INTEGRATED REDUCTION AND CUBIC GEARBOX

FM Series: Steel tube
AM Series: Aluminum tube

"SUSTAINABILITY IS INDUSTRIALISED ECOLOGY."

DAVID GARCÍA
HOME-THERME

NIASA ACTUATORS IN THE TONOPAH THERMO-SOLAR PLANT, NEVADA, USA.

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LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

INTRODUCTION

NIASA FM/AM Series electro-mechanical actuators combine the sleeve and stem system of the F/A Series linear actuators with the gearbox of the screw jacks, thus obtaining the most interesting features of both types of product.

This way, the FM/AM Series electro-mechanical actuators become the optimal technical solution for applications that require the movement specifications of a screw jack, with the additional advantage of being able to work under the most demanding environmental conditions.

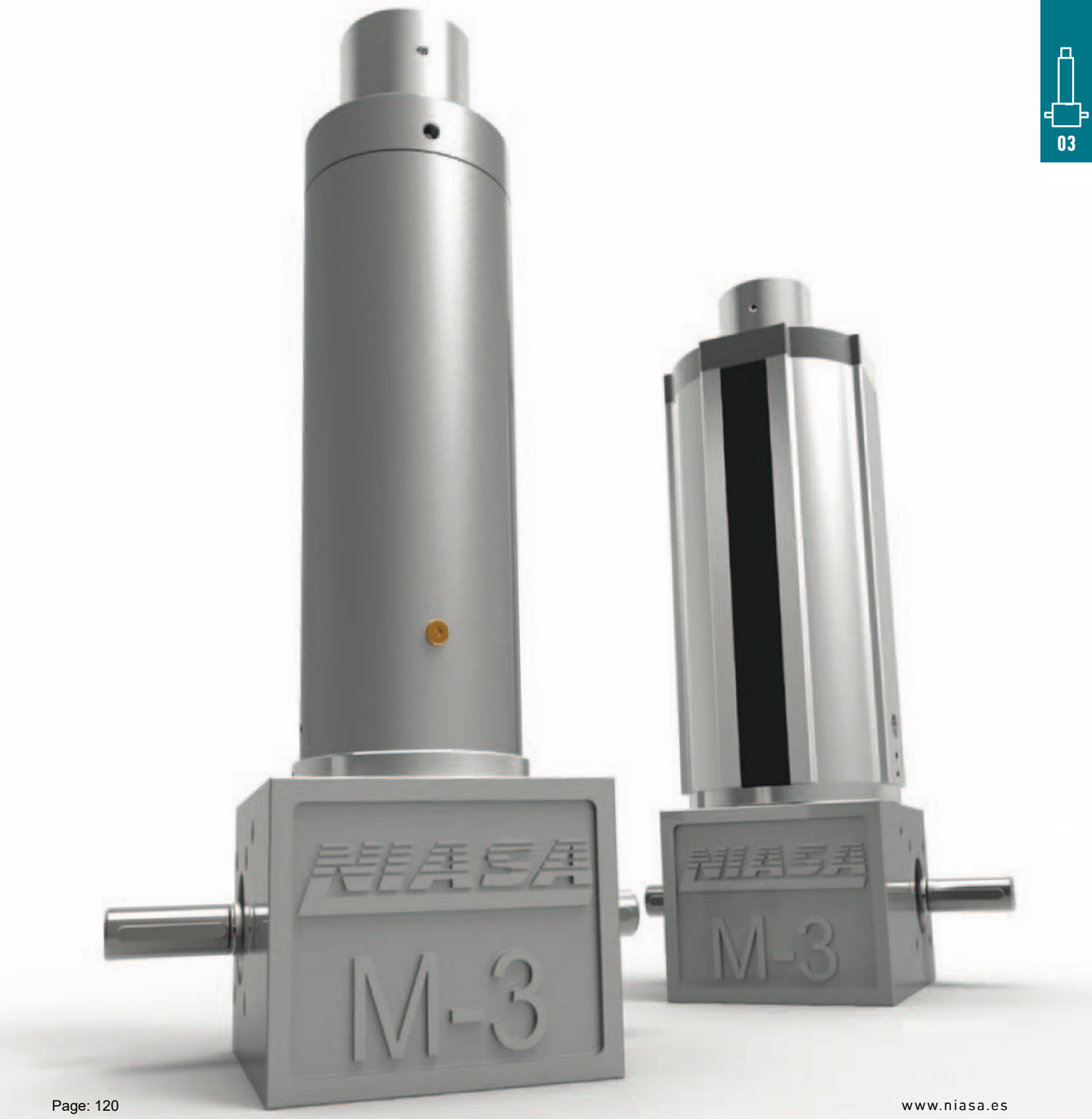
Their main advantages against other systems, such as pneumatic or hydraulic cylinders, are the following:

- Greater movement and positioning precision.
- Greater safety, due to its irreversibility in many configurations (ask NIASA) and/or the incorporation of different braking devices.
- Superior energy efficiency, as their parts offer high/very high performance, especially with the ball screws, low transmission ratios and high speeds.
- Easier and faster assembly, since hydraulic or pneumatic groups are not required, just an electric motor on the unit itself.
- Greater reliability and duration, and less maintenance, due to the mechanical robustness and construction simplicity.
- Modular design and the possibility to operate in multiple positions.
- Easier to obtain synchronized advance movements of several actuators, including under different loads.
- Lower size for the same load capacity.
- ...

The screw supports also characterized for offering an extensive range of:

- Axial load capacities, from 5 kN up to 250 kN.
- Advance speeds; depending on the screw pitch and the gearbox, two possible reductions are offered depending on the size of the actuator, from 4:1 to 40:1.
- Trapezoidal and ball screws, depending on the performance required, precision of movement and positioning, etc.
- Fastening accessories and elements, for optimal adaptation to the most varied systems that may be designed.
- Control and safety systems (mechanical/inductive limit switches, absolute/incremental encoders, etc.).
- Materials and surface coverings, depending on the environmental conditions in which the unit will be installed.
- Two types of external sleeve for the stem:
  - Steel round tube.
  - Aluminum extrusion profile (magnetic sensors, anti-rotation system).
- ...

Please do not hesitate to contact NIASA if you require FM/AM actuators (and their drive mechanisms) with specifications other than those covered in this chapter. The NIASA technical department will specifically develop the special units that best meet your requirements.



LINEAR ACTUATORS

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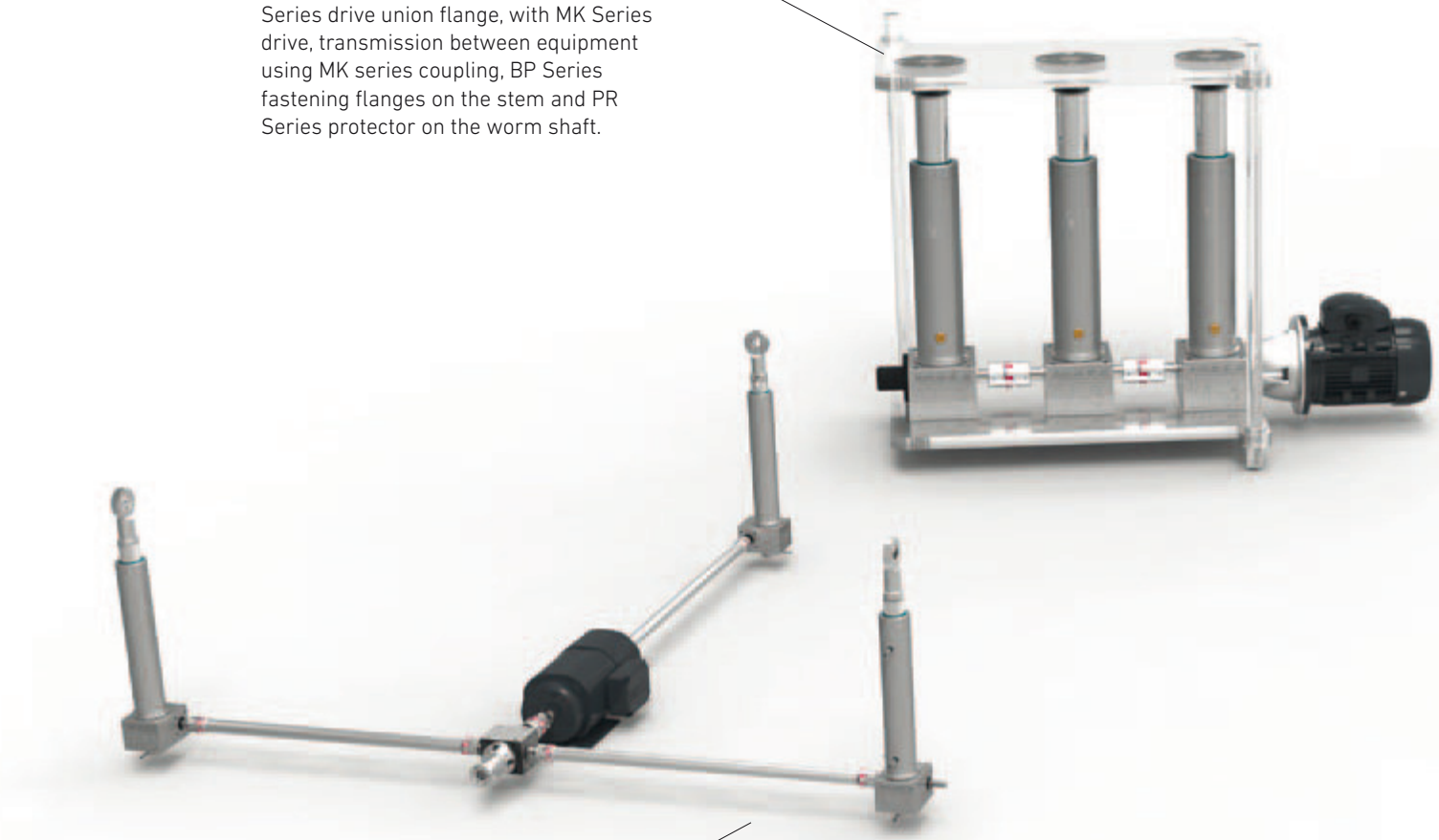
APPLICATIONS

PRESS TYPE SYSTEM

Three FM3 Series actuators made up of a three-phase motor drive system, MK Series drive union flange, with MK Series drive, transmission between equipment using MK series coupling, BP Series fastening flanges on the stem and PR Series protector on the worm shaft.



THREE SHAFT SCREW JACK SYSTEM

Three FM3 series actuators made up of a double-shaft, three-phase drive system, transmission between units with EZ series joint shafts, FCI series inductive sensor with a position encoding system underneath the gearbox, bevel gearbox with encoder adapted and GIR series ball with joint fastening on the stem.

CONVEYOR BELT ELEVATION SYSTEM

Two FJ1 Series actuators made up of a three-phase drive system with brake, MK Series drive union flange, transmission between units with EZ Series joint shafts, support structure with protection for the transmission shaft, GIR series ball joint on the stem and HFM Series gearbox fastening.

ELEVATION SYSTEM WITH INTEGRATED MAGNETIC SENSOR.

Two AM2 Series actuators made up of a three-phase motor drive system, drive union flange, transmission between units with EZ Series joint shafts, exterior aluminum tube with anti-turning system and an FCG Series integrated magnetic sensor, tilt fastening on the BA Series tube, GKB Series ball joint fastening on the stem.

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

SIZES

There are trapezoidal and ball screw options on all the sizes (see chapter on screws for further information), as well as normal speed (S) and slow speed (H) gearboxes.

	M1	M2	M3
Up to	5 kN	10 kN	25 kN
F Steel exterior tube	 page 122	 page 123	 page 124
A Aluminum exterior tube With anti-rotation on the stem (optional) With magnetic sensor integrated on the aluminum tube (optional)	 page 122	 page 123	 page 124

In addition to the standard range of linear actuators, NIASA can specifically develop the unit that best meets your application requirements. Contact NIASA.

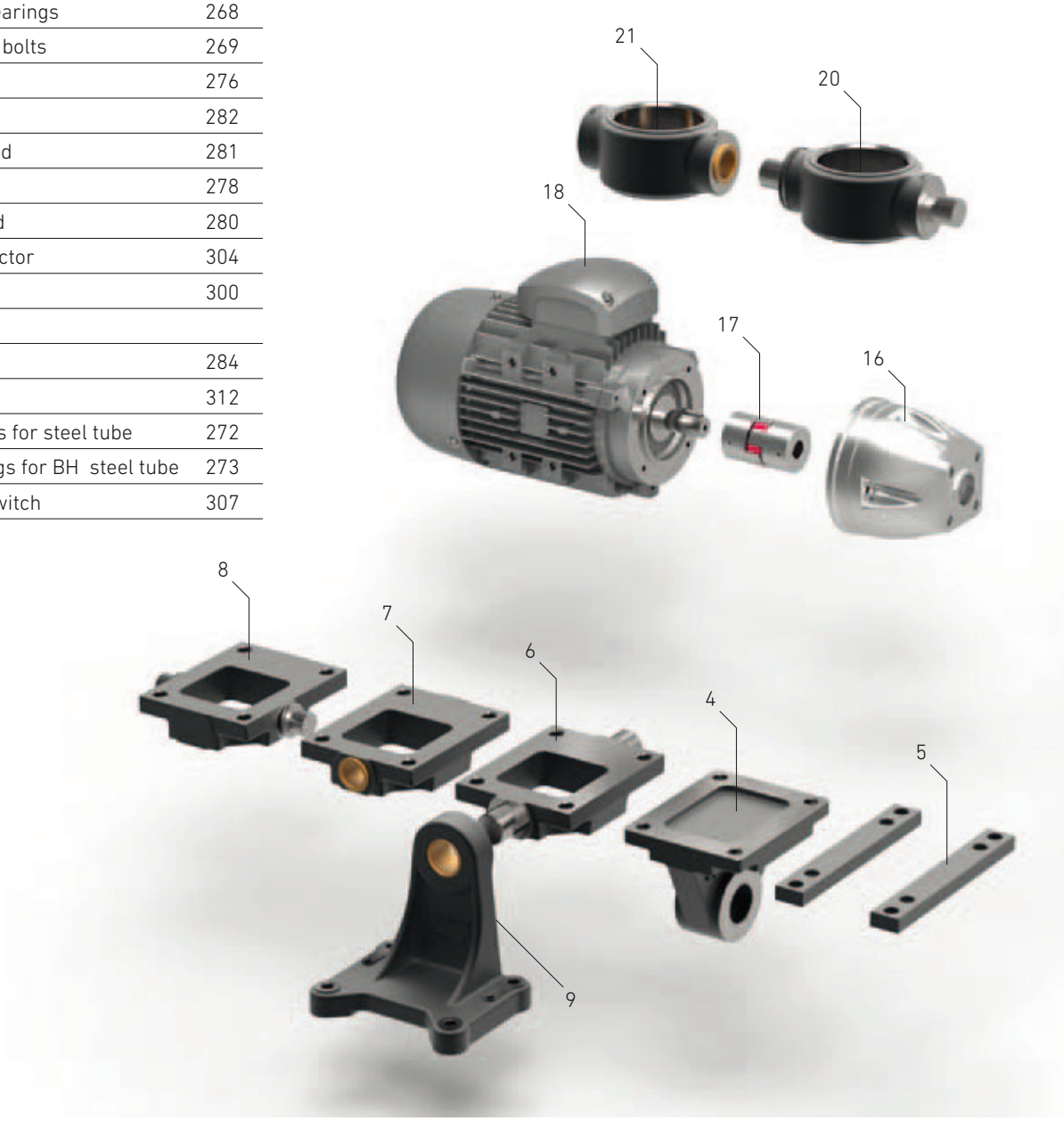
IMPORTANT All the technical data included in this chapter correspond to the configuration with steel tube and to the aluminum tube configuration.
For further information about the latter, please contact the NIASA technical department.

M4	M5	J1	J3
50 kN	100 kN	150 kN	250 kN
			
page 125	page 126	page 127	page 128
			
page 125			

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

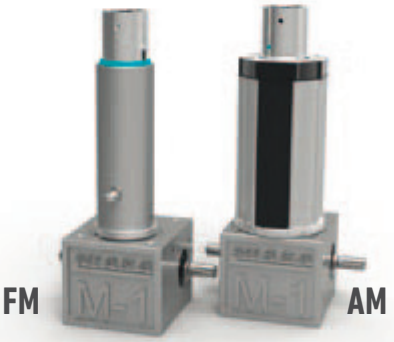
GENERAL PRODUCT OVERVIEW

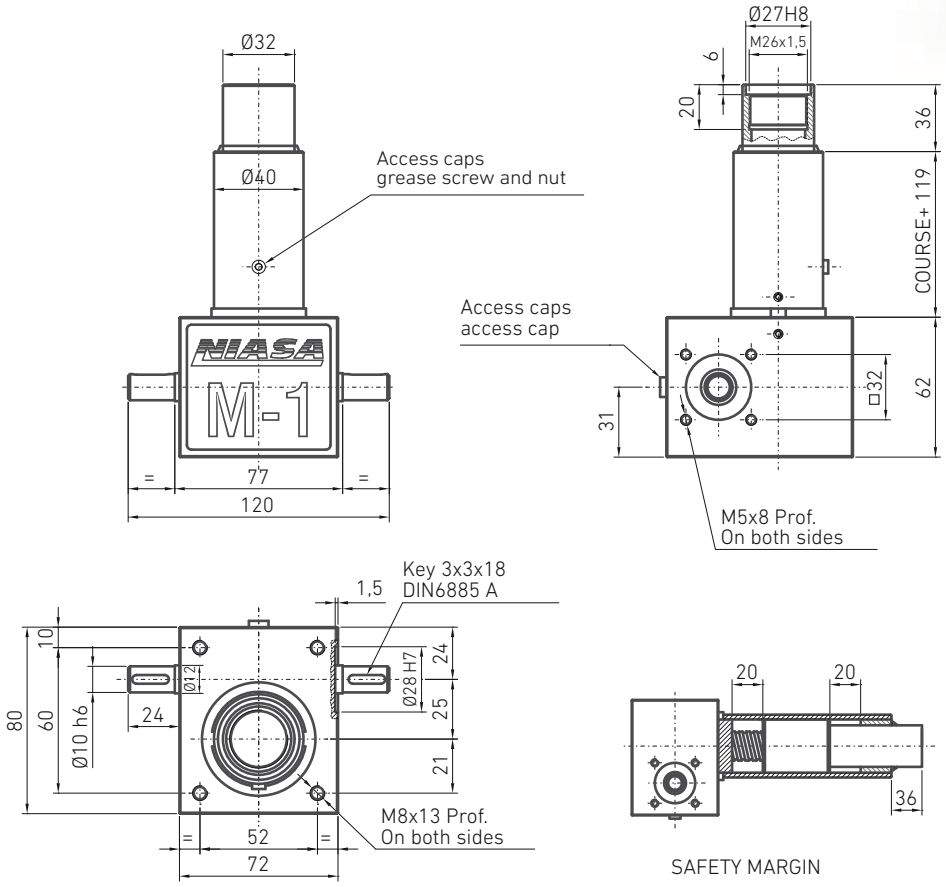



13
12
11
10
3
2
Steel exterior tube
22
Aluminium exterior tube
24
24
25
22
25
1
15
14
26
27
28

FM1/AM1 LINEAR ACTUATOR

UP TO 5 kN





Diameter and step screw (mm)	Maximum axial strength (kN)	Reduction		Advance (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm)		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)
								F (kN), load to move in dynamic					
		S	H	S	H	S	H	S	H	S	H		
Tr 16x4	5	4:1	16:1	1.00	0.25	35	27	(0,46xF)+0.17	(0,15xF)+0.08	0.80xF	0.34xF	1.8	0.5
KGS 1605	5	4:1	16:1	1.25	0.31	71	56	(0.28xF)+0.14	(0.09xF)+0.08	0.39xF	0.16xF	1.8	0.5

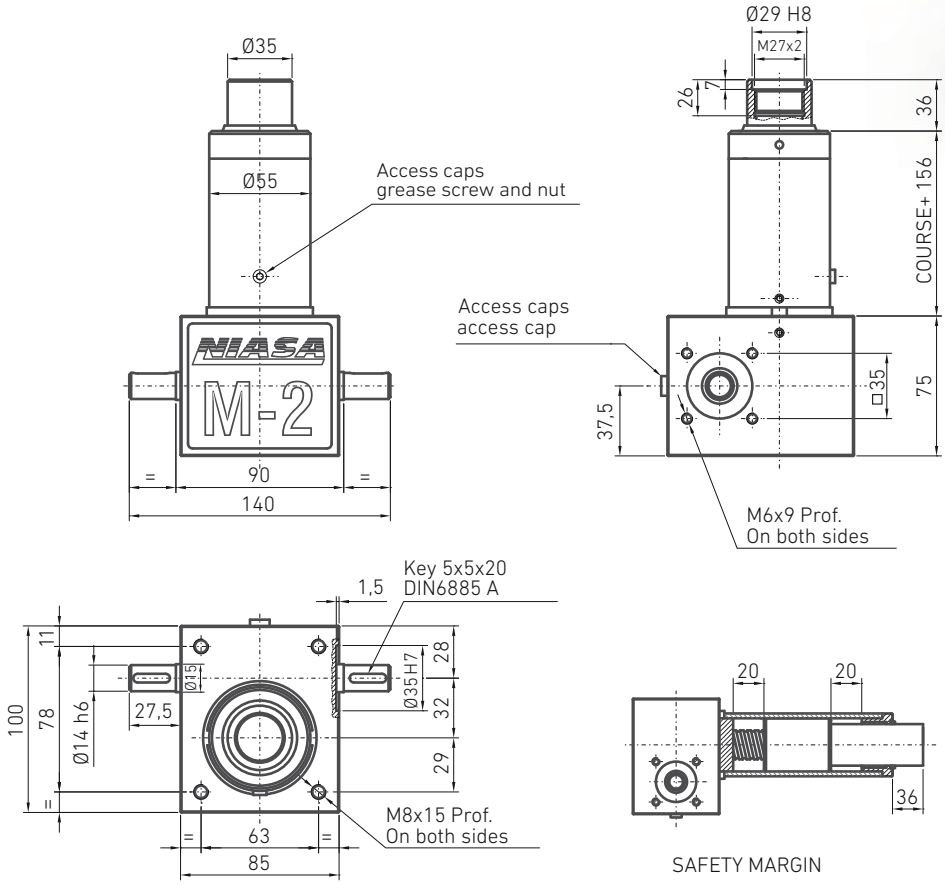
... Power required: P_D (kW) = 0,157x M_D (Nm).

... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 130).

Ensure that the application's dynamic load does not exceed the critical values indicated, in order to avoid overheating of the unit and buckling and resonance. See calculations chapter (page 130).

FM2/AM2 LINEAR ACTUATOR

UP TO 10 kN

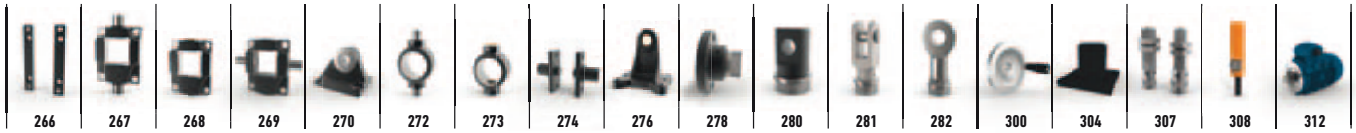


Diameter and step screw (mm)	Maximum axial strength (kN)	Reduction		Advance (mm/revol. input)		Performance (%)		Drive torque M_D (Nm)		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)
								F (kN), load to move in dynamic					
		S	H	S	H	S	H	S	H	S	H		
Tr 24x5	10	4:1	16:1	1.25	0.31	0.31	0.25	(0.64xF)+0.35	(0.20xF)+0.17	1.11xF	0.43xF	4.6	1
KGS 2005	10	4:1	16:1	1.25	0.31	0.72	0.58	(0.28xF)+0.33	(0.09xF)+0.17	0.39xF	0.15xF	4.6	1
KGS 2020	7.5	4:1	16:1	5.00	1.25	0.72	0.58	(1.10xF)+0.33	(0.35xF)+0.17	1.55xF	0.6xF	4.6	1

... Power required: P_D (kW) = 0,157x M_D (Nm).

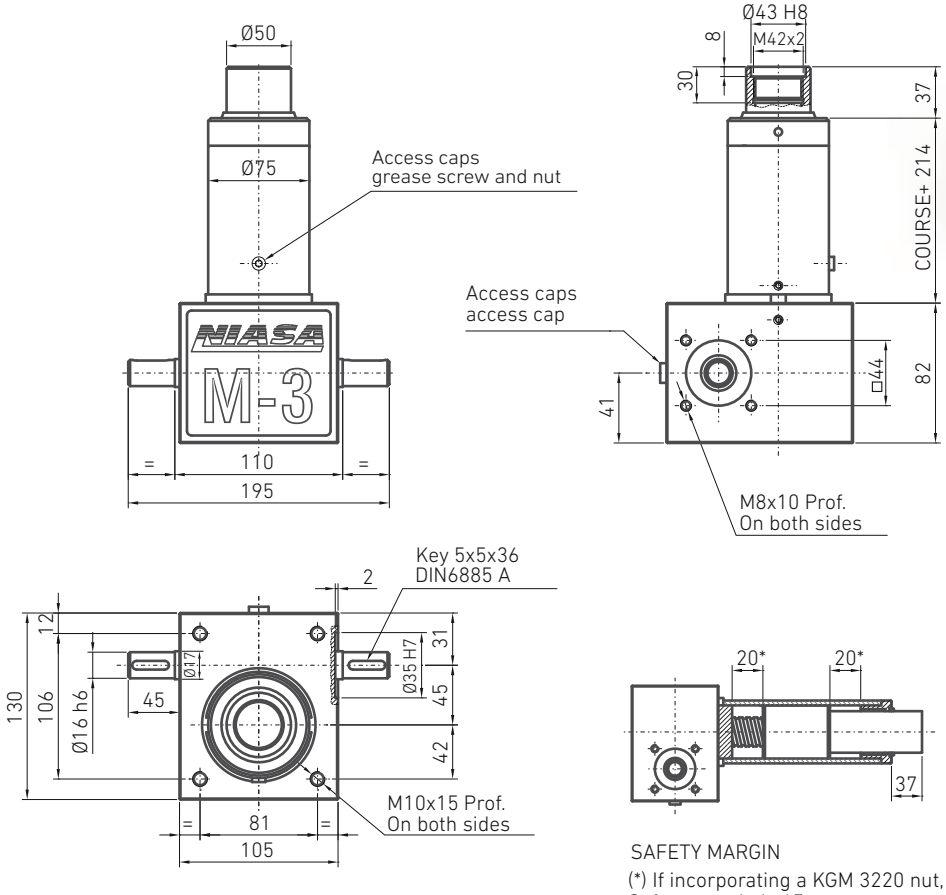
... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 130).

... Ensure that the application's dynamic load does not exceed the critical values indicated, in order to avoid overheating of the unit and buckling and resonance. See calculations chapter (page 130).



FM3/AM3 LINEAR ACTUATOR

UP TO 25 kN



SAFETY MARGIN

(*) If incorporating a KGM 3220 nut, Safety margin is 15 mm.

Diameter and step screw (mm)	Maximum axial strength (kN)	Reduction		Advance (mm/revol. input)		Performance (%)		Drive torque M_D (Nm)		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)
								F (kN), load to move in dynamic					
		S	H	S	H	S	H	S	H	S	H		
Tr 36x6	25	6:1	24:1	1.00	0.25	0.28	0.22	(0.58xF)+0.57	(0.18xF)+0.31	1.04xF	0.4xF	12	2.1
KGS 3205	20	6:1	24:1	0.83	0.21	0.73	0.58	(0.18xF)+0.52	(0.06xF)+0.29	0.26xF	0.11xF	12	2.1
KGS 3210	25	6:1	24:1	1.67	0.42	0.73	0.58	(0.36xF)+0.52	(0.12xF)+0.29	0.52xF	0.21xF	12	2.1
KGS 3220	20	6:1	24:1	3.33	0.83	0.73	0.58	(0.73xF)+0.52	(0.23xF)+0.29	1.03xF	0.42xF	12	2.1
KGS 3240	10	6:1	24:1	6.67	1.67	0.73	0.58	(1.46xF)+0.52	(0.46xF)+0.29	2.07xF	0.84xF	12	2.1

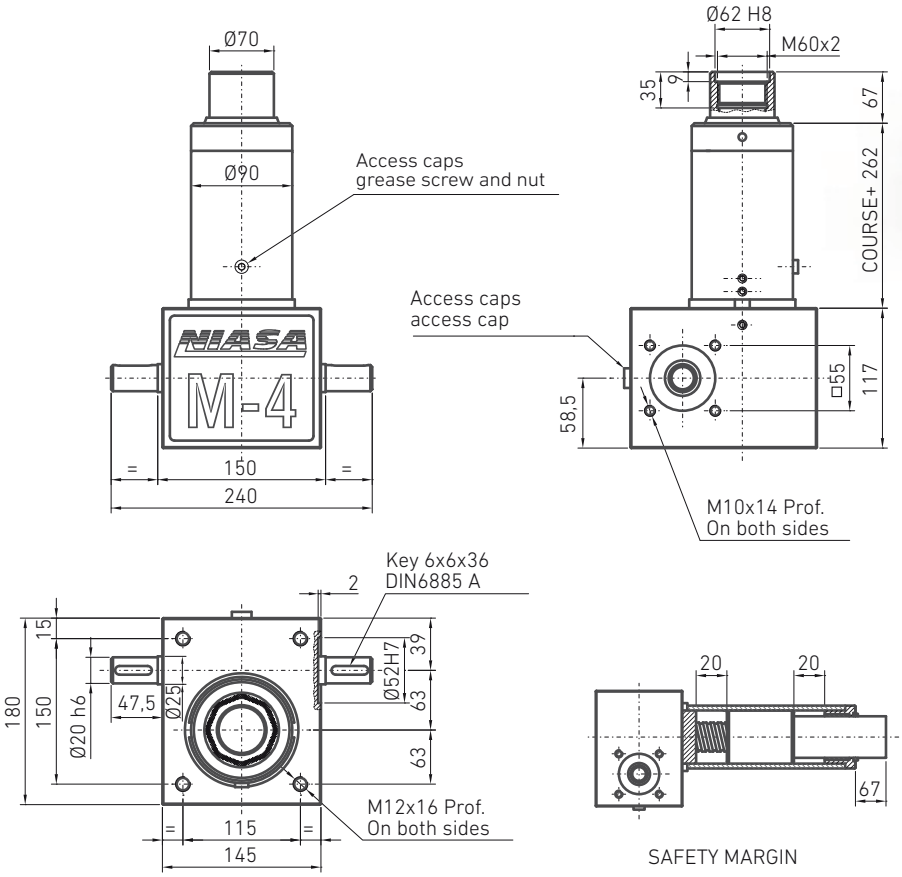
... Power required: P_D (kW) = 0,157x M_D (Nm).

... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 130).

... Ensure that the application's dynamic load does not exceed the critical values indicated, in order to avoid overheating of the unit and buckling and resonance. See calculations chapter (page 130).

FM4/AM4 LINEAR ACTUATOR

UP TO 50 kN



Diameter and step screw (mm)	Maximum axial strength (kN)	Reduction		Advance (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm)		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)
								F (kN), load to move in dynamic					
		S	H	S	H	S	H	S	H	S	H		
Tr 45x7	50	7:1	28:1	1.00	0.25	0.26	0.21	(0.61xF)+0.97	(0.19xF)+0.57	1.18xF	0.44xF	27.3	3.3
KGS 4010	42	7:1	28:1	1.43	0.36	0.73	0.60	(0.31xF)+0.93	(0.09xF)+0.56	0.45xF	0.18xF	27.3	3.3
KGS 4020	37	7:1	28:1	2.86	0.71	0.73	0.60	(0.62xF)+0.93	(0.19xF)+0.56	0.9xF	0.36xF	27.3	3.3
KGS 4040	35	7:1	28:1	5.71	1.43	0.73	0.60	(1.25xF)+0.93	(0.38xF)+0.56	1.8xF	0.72xF	27.3	3.3

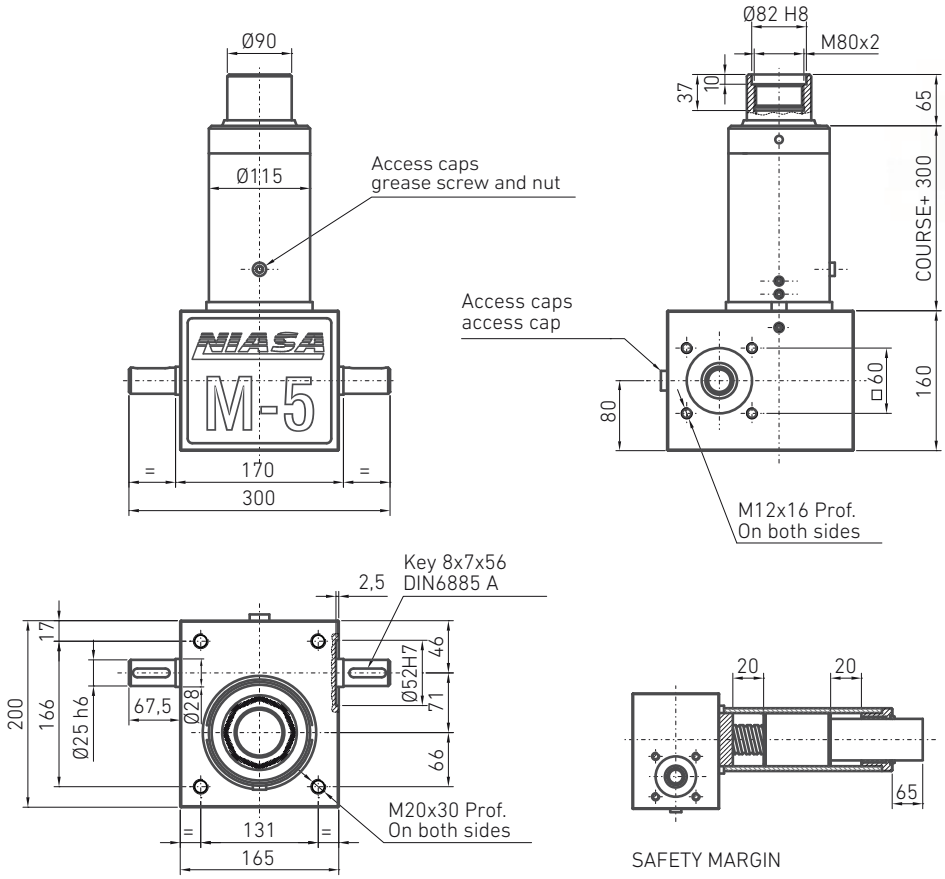
... Power required: P_D (kW) = 0,157x M_D (Nm).
... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 130).
... Ensure that the application's dynamic load does not exceed the critical values indicated, in order to avoid overheating of the unit and buckling and resonance. See calculations chapter (page 130).

FM5 LINEAR ACTUATOR

UP TO 100 kN

TRAPEZ. KGS BALLS

The capacity indicated corresponds to the basic configuration. There is a possibility for higher capacities on request.



Diameter and step screw (mm)	Maximum axial strength (kN)	Reduction		Advance (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm) F (kN), load to move in dynamic		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)
		S	H	S	H	S	H	S	H	S	H		
Tr 50x8	100	9:1	36:1	0.89	0.22	0.27	0.21	(0.53xF)+1.91	(0.17xF)+1.08	0.98xF	0.39xF	45.2	4.9
KGS 5010	65	9:1	36:1	1.11	0.28	0.73	0.58	(0.24xF)+1.87	(0.08xF)+1.07	0.36xF	0.15xF	45.2	4.9

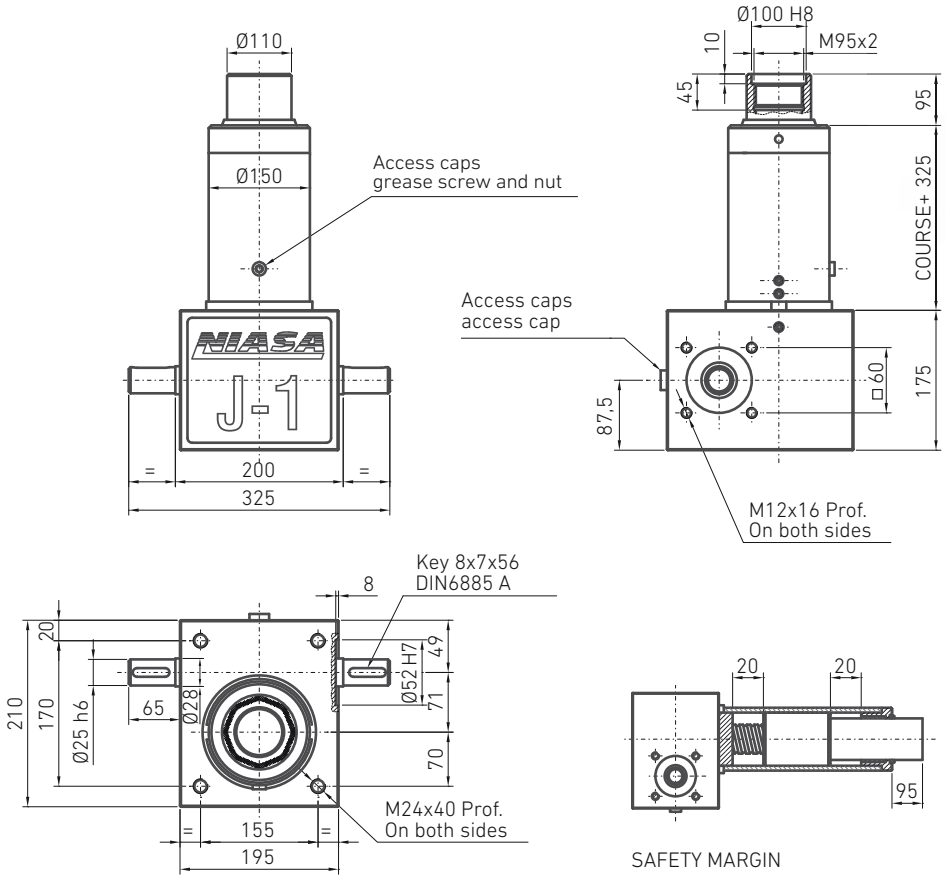
... Power required: P_D (kW) = 0,157x M_D (Nm).
... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 130).
... Ensure that the application's dynamic load does not exceed the critical values indicated, in order to avoid overheating of the unit and buckling and resonance. See calculations chapter (page 130).

FJ1 LINEAR ACTUATOR

UP TO 150 kN

TRAPEZ. KGS BALLS

The capacity indicated corresponds to the basic configuration. There is a possibility for higher capacities on request.

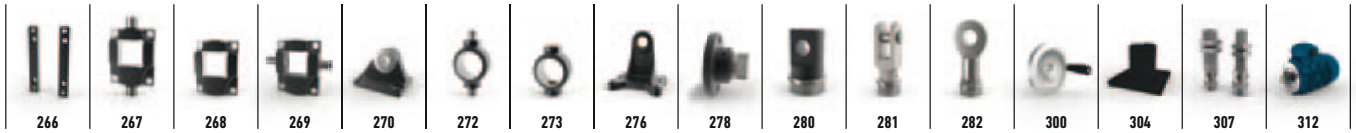


Diameter and step screw (mm)	Maximum axial strength (kN)	Reduction		Advance (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm)		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)
								F (kN), load to move in dynamic					
		S	H	S	H	S	H	S	H	S	H		
Tr 70x10	150	9:1	36:1	1.11	0.28	0.24	0.18	(0.73xF)+2.3	(0.24xF)+1.21	1.31xF	0.49xF	84.8	9
KGS 6310	65	9:1	36:1	1.11	0.28	0.73	0.55	(0.24xF)+1.97	(0.08xF)+1.19	0.33xF	0.14xF	86.8	9

... Power required: P_D (kW) = 0,157x M_D (Nm).

... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 130).

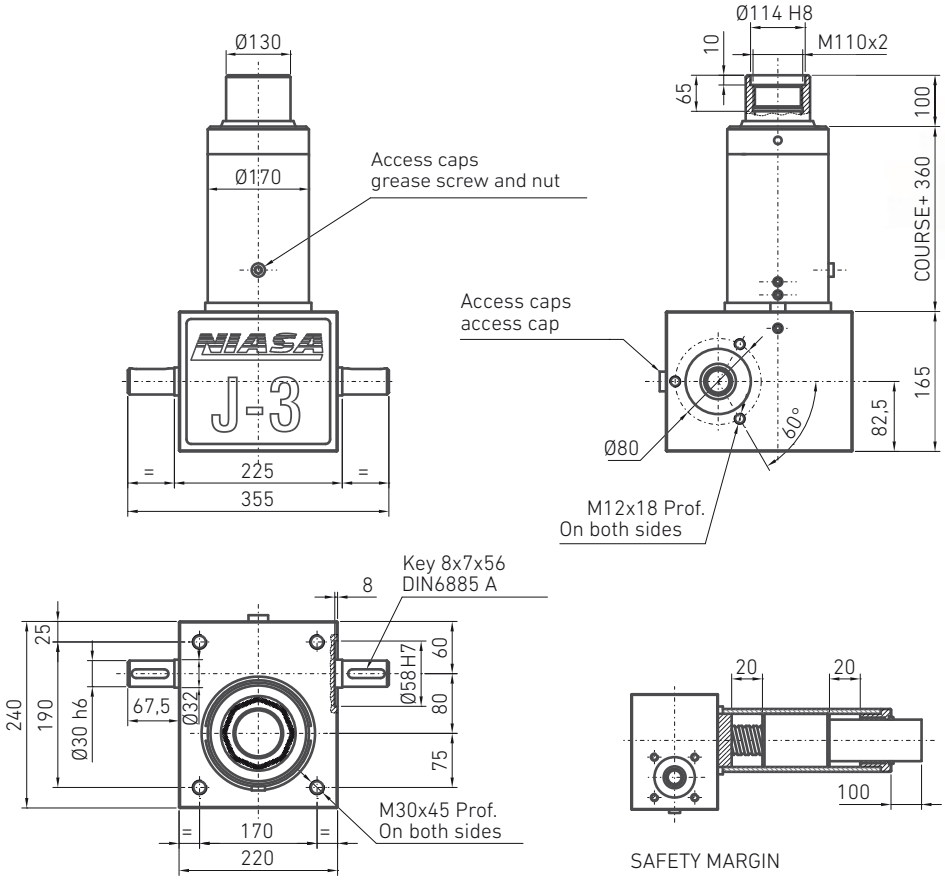
... Ensure that the application's dynamic load does not exceed the critical values indicated, in order to avoid overheating of the unit and buckling and resonance. See calculations chapter (page 130).



FJ3 LINEAR ACTUATOR

UP TO 250 kN

Contact versions with ball screw.

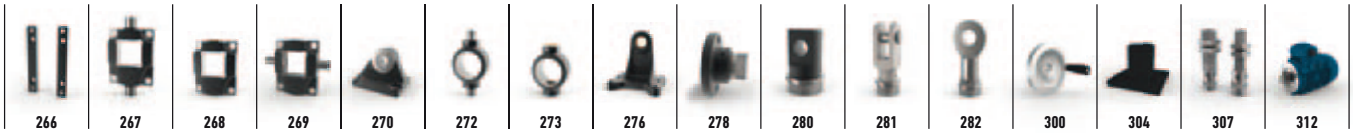


Diameter and step screw (mm)	Maximum axial strength (kN)	Reduction		Advance (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm)		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)
								F (kN), load to move in dynamic					
		S	H	S	H	S	H	S	H	S	H		
Tr 80x10	250	10:1	40:1	1.00	0.25	0.22	0.19	(0.73xF)+2.81	(0.21xF)+1.95	1.18xF	0.4xF	100	14

... Power required: P_D (kW) = 0,157x M_D (Nm).

... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 130).

... Ensure that the application's dynamic load does not exceed the critical values indicated, in order to avoid overheating of the unit and buckling and resonance. See calculations chapter (page 130).



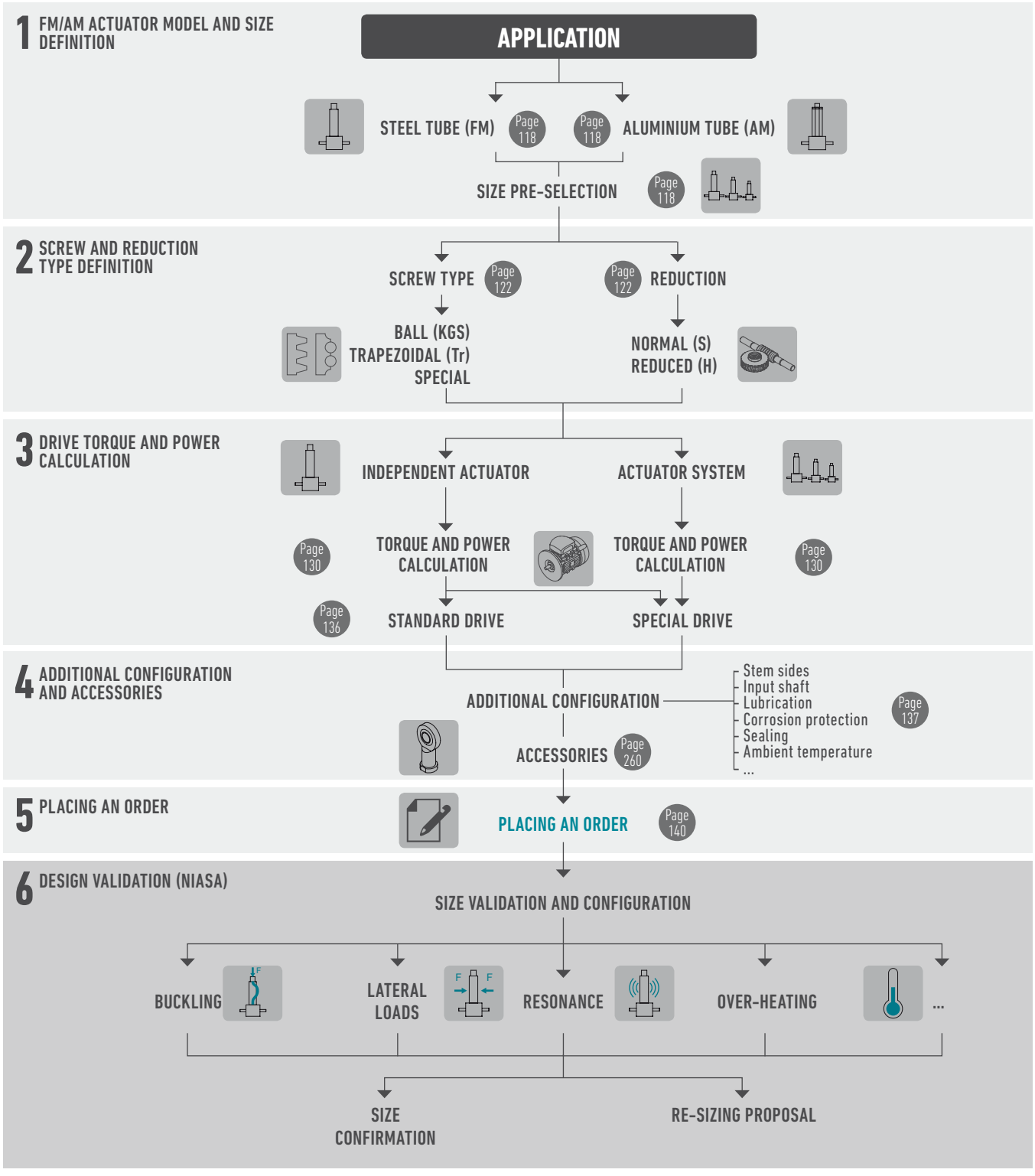
LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

To select the correct FM/AM Series linear actuator, 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.



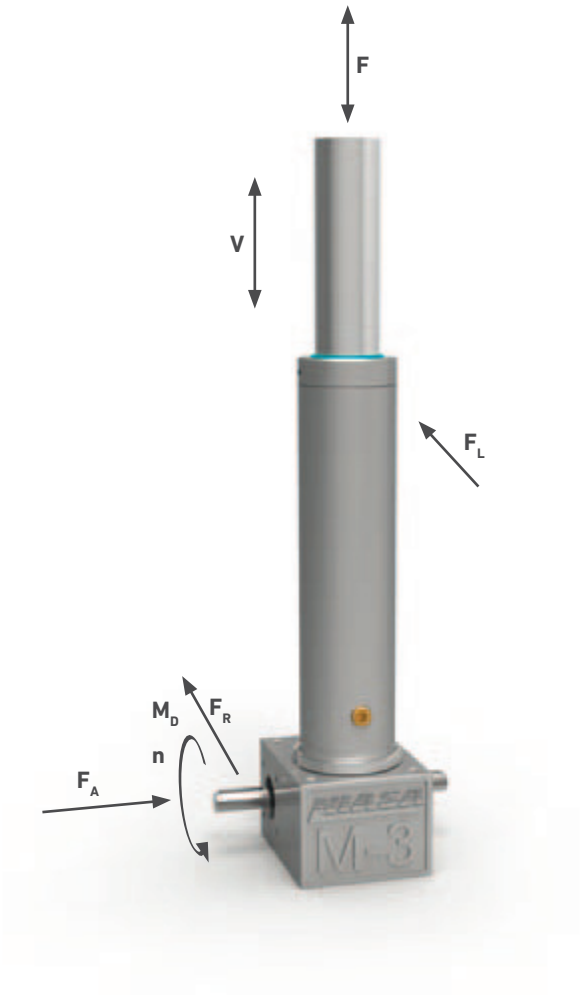
LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

FORCE AND TORQUE ACTING ON AN FM /AM SERIES ACTUATOR

F Load to move at traction and/or compression.
F_L Lateral load on the stem.
V Stem travel speed.
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.



TORQUE AND POWER OF A LINEAR ACTUATOR INDEPENDENT FM/AM SERIES

After pre-selecting the suitable FM/AM Series linear actuator for the application, select the drive motor following the steps below:

1. DRIVE TORQUE

$$M_D\ (Nm) = \frac{F \times P}{2 \times \pi \times 0.9 \times \eta_{DG} \times \eta_{DS} \times i} + M_i$$

M_D Drive torque (kN)
F Load to move in dynamic (kN)
P Screw pitch (mm)
M_i Idle torque (Nm)
i Actuator reduction
0.9 Cylinder dynamic efficiency
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 2; the smaller the installation the higher the coefficient

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

3. START-UP TORQUE

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

$$M_0\ (Nm) = \frac{F \times P}{2 \times \pi \times 0.9 \times \eta_{SA} \times i}$$

η_{SA} Actuator static efficiency (gearbox + screw)

IMPORTANT

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

η_{DG} Gearbox dynamic efficiency

S gearbox version (normal speed)

input rpm	FM1/ AM1	FM2/ AM2	FM3/ AM3	FM4/ AM4	FM5	FJ1	FJ3
3,000	0.91	0.90	0.92		Non-standard		
1,500	0.88	0.89	0.90	0.90	0.90	0.90	0.90
1000	0.87	0.88	0.88	0.88	0.87	0.89	0.89
750	0.85	0.87	0.87	0.87	0.86	0.88	0.89
500	0.84	0.85	0.85	0.85	0.84	0.87	0.88
100	0.79	0.79	0.79	0.79	0.78	0.81	0.84

H gearbox version (slow speed)

input rpm	FM1/ AM1	FM2/ AM2	FM3/ AM3	FM4/ AM4	FM5	FJ1	FJ3
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
1000	0.67	0.69	0.68	0.69	0.67	0.67	0.76
750	0.64	0.66	0.67	0.68	0.65	0.65	0.75
500	0.61	0.64	0.63	0.64	0.62	0.64	0.74
100	0.54	0.56	0.54	0.55	0.53	0.55	0.66

η_{DS} Screw dynamic efficiency

Trapezoidal screw (Tr)						
16x4	24x5	36x6	45x7	50x8	70x10	80x10
0.44	0.39	0.34	0.32	0.33	0.30	0.27

Ball screw (KGS)
0.9 (for all sizes)

M_i Idle Torque

S gearbox version (normal speed)

	FM1/ AM1	FM2/ AM2	FM3/ AM3	FM4/ AM4	FM5	FJ1	FJ3
Trapezoidal	0.17	0.35	0.57	0.97	1.91	2.03	2.81
Balls	0.14	0.33	0.52	0.93	1.87	1.97	2.75

H gearbox version (slow speed)

	FM1/ AM1	FM2/ AM2	FM3/ AM3	FM4/ AM4	FM5	FJ1	FJ3
Trapezoidal	0.08	0.17	0.31	0.57	1.08	1.21	1.95
Balls	0.08	0.17	0.29	0.56	1.07	1.19	1.94

η_{SA} Actuator static efficiency

S gearbox version (normal speed)

	FM1/ AM1	FM2/ AM2	FM3/ AM3	FM4/ AM4	FM5	FJ1	FJ3
Trapezoidal	0.22	0.20	0.17	0.15	0.16	0.15	0.15
Balls	0.57	0.57	0.57	0.56	0.55	0.59	0.64

H gearbox version (slow speed)

	FM1/ AM1	FM2/ AM2	FM3/ AM3	FM4/ AM4	FM5	FJ1	FJ3
Trapezoidal	0.13	0.13	0.11	0.10	0.10	0.10	0.11
Balls	0.35	0.37	0.35	0.35	0.32	0.36	0.45

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.

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

DESIGNING INSTALLATIONS WITH FM/AM SERIES LINEAR ACTUATORS

For the application of FM/AM Series linear actuators in installations with several units, the following criteria must be taken into account:

1. Define the number, position and orientation of the equipment.

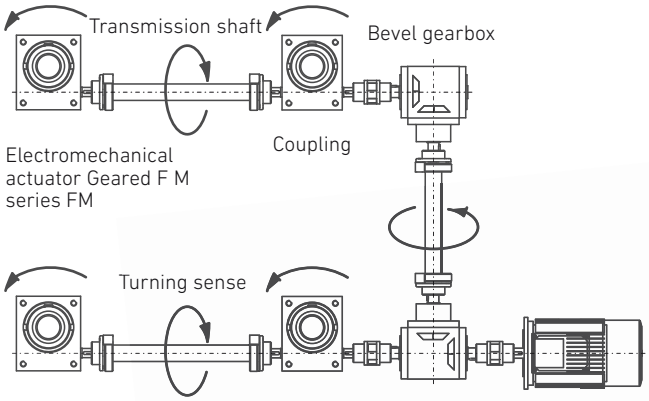
2. Select the drag components (couplings, transmission shafts, supports, bevel gearboxes, motors, etc.) taking the following recommendations into account:

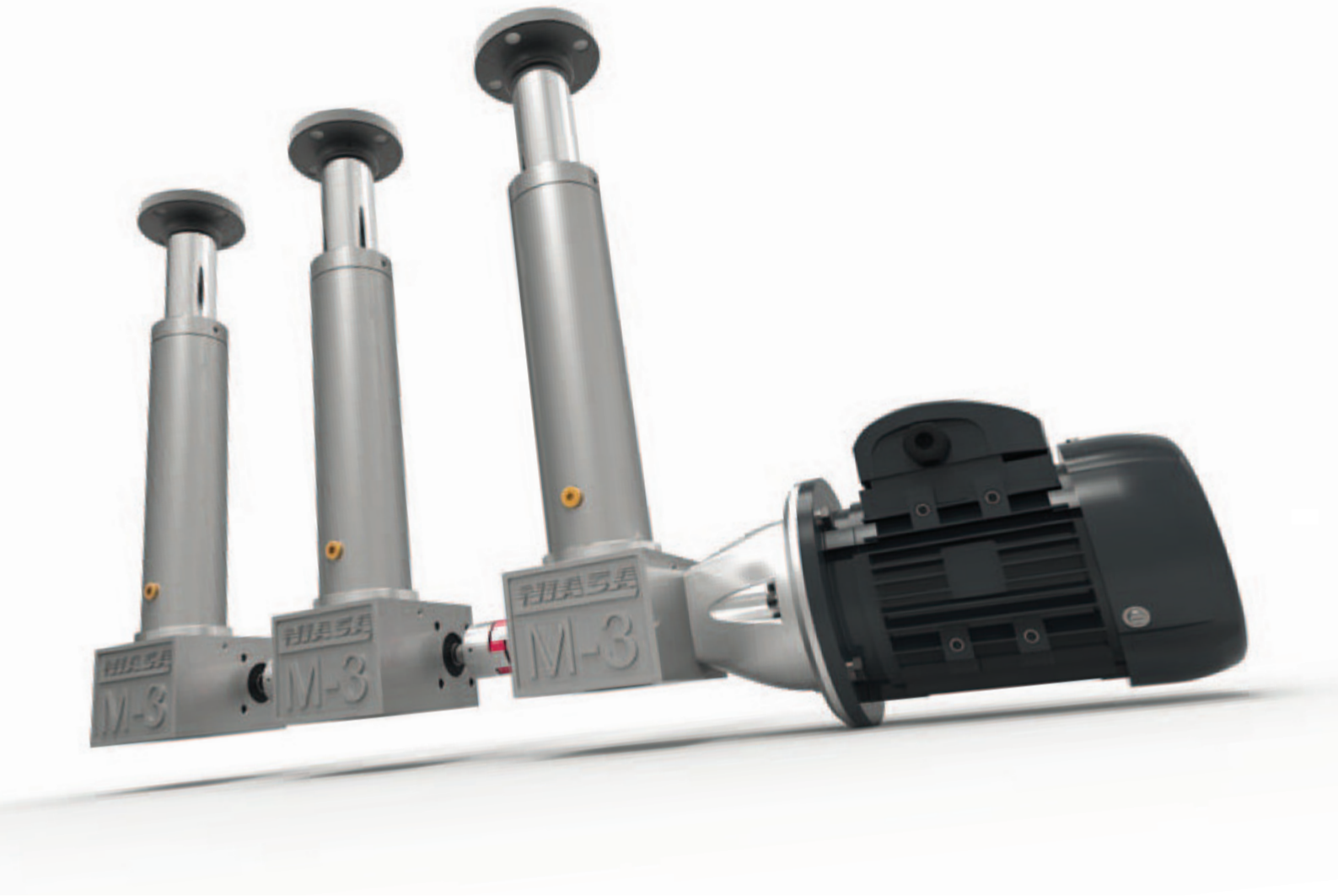
- ... Ensure that the total load is distributed uniformly between all the installation's actuators.
- ... The lowest possible number of transmission parts is recommended.
- ... The transmission shafts should be as short as possible.
- ... Try to protect the overall installation with a safety torque limiter.

3. If a problem arises during the design of the installation in defining the turning sense of the different elements, it is advisable to apply the following method:

- ... Indicate the orientation of the actuator elements.
- ... Mark the screw turning sense on each actuator to "lift".
- ... Show the position of the bevel gearboxes and the transmission shafts in a diagram.

Example:
Elevation system with four FM linear actuators and two bevel gearboxes.





LINEAR ACTUATORS

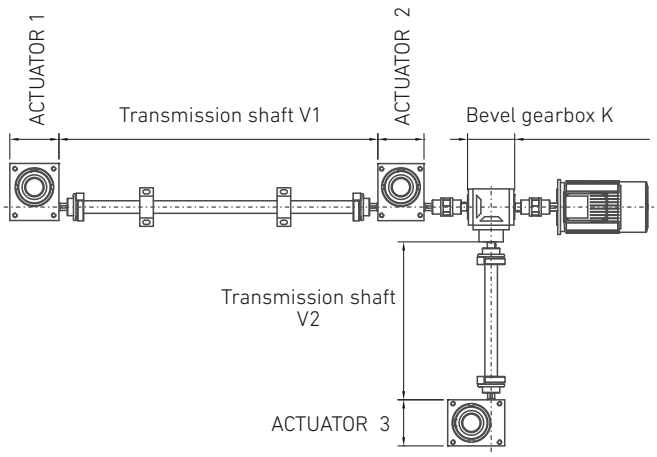
WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

DRIVE TORQUE OF AN FM/AM SERIES LINEAR ACTUATOR SYSTEM

The drive torque of a system made up of several FM/AM Series linear actuators 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

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

$M_{D1}/M_{D2}/M_{D3}$	Actuator drive torque 1 / 2 / 3 (Nm)
η_{V1}/η_{V2}	Gearbox efficiency V1/V2 (0.90-0.95 approx.)
η_K	Bevel 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 following formula.

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

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

M_D	Independent elevator drive torque
f_S	Factor, according to 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:

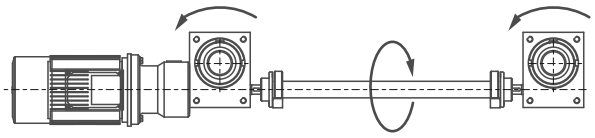
$$M_{DS}\ (Nm) = \frac{M_{DS}}{\eta_{SA}}$$

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

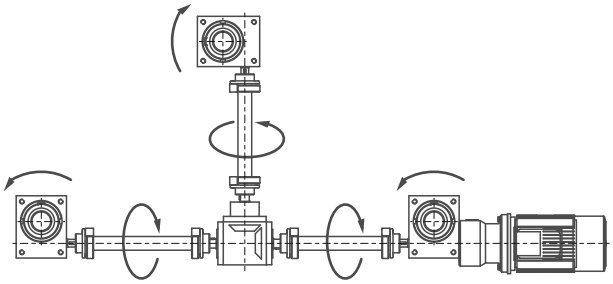
IMPORTANT

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

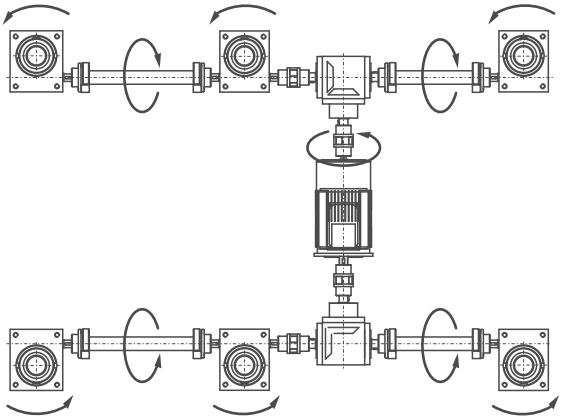
f_S = 2.1



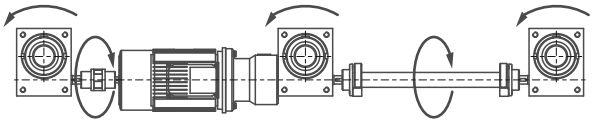
f_S = 3.34



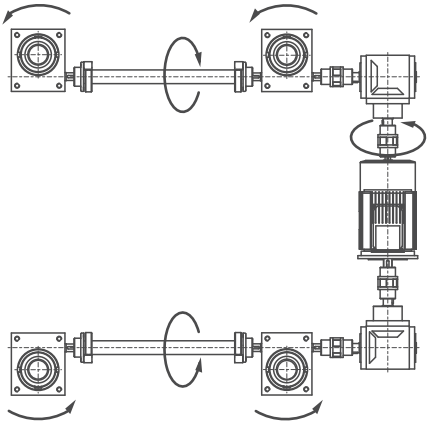
f_S = 6.8



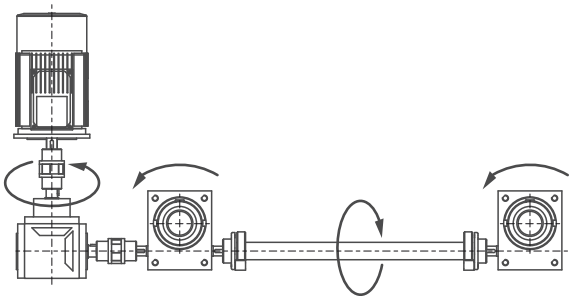
f_S = 3.1



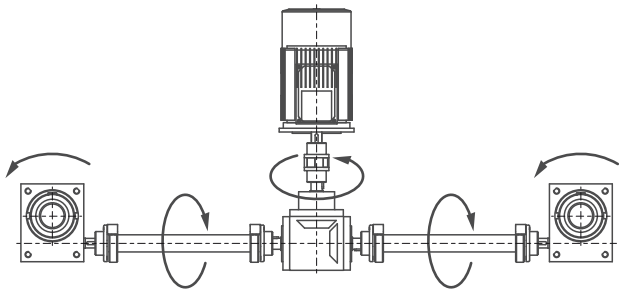
f_S = 4.4



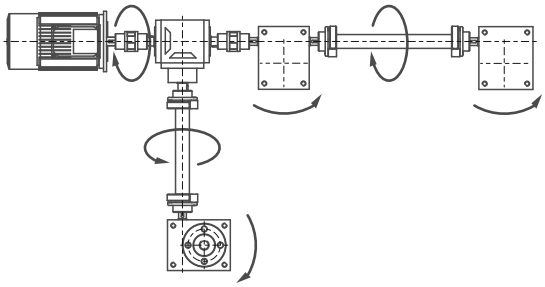
f_S = 2.25



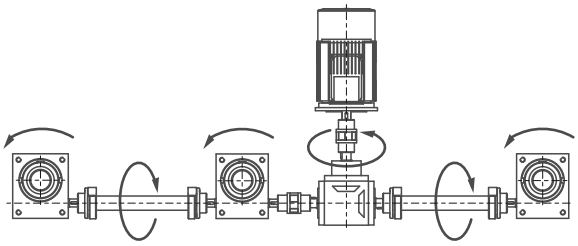
f_S = 2.25



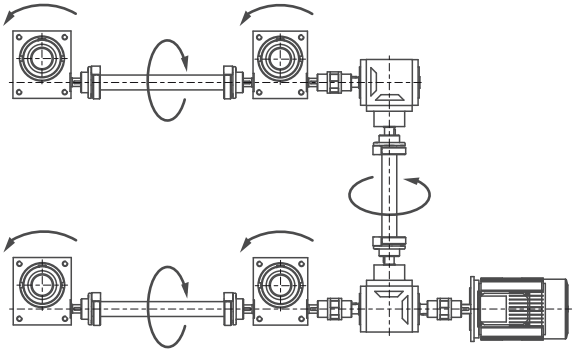
f_S = 3.27



f_S = 3.35

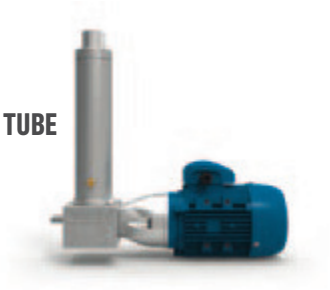


f_S = 4.6



LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE



PRODUCT SELECTION

STANDARD DRIVE

The standard drive of the FM/AM Series linear actuators is made using Ac motors.

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

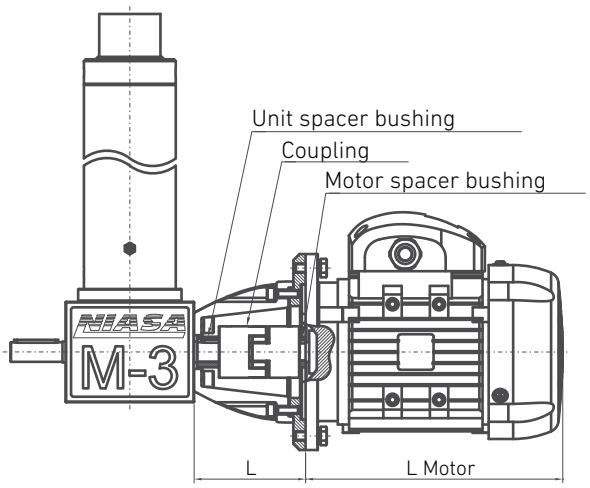
For another size or different type of drive, please contact NIASA. NIASA can supply alternating or stepper motors with sensors of any type, etc.

	Motor flange	MOTOR GROUP																			
		56		63		71		80		90		100		112	132		160		180	
		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
FM1 / AM1	L	57		60		67														
	Motor flange	B14		B14		B14														
FM2 / AM2	L			63		70		83												
	Motor flange			B14		B14		B14												
FM3 / AM3	L					91		101		113		123								
	Motor flange					B5		B14		B14		B14								
FM4 / AM4	L					91		101		113		123								
	Motor flange					B5		B5		B14		B14								
FM5	L							125		135		145			167		201			
	Motor flange							B5		B5		B14			B14		B14			
FJ1	L											145			165		199			
	Motor flange											B14			B14		B14			
FJ3	L									135		145			167		201		203	
	Motor flange									B5		B5			B5		B5		B5	

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

If using ball screws (or trapezoidal screws with more than one input), together with the normal speed gearboxes (S) the FM/AM linear actuator 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.



LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

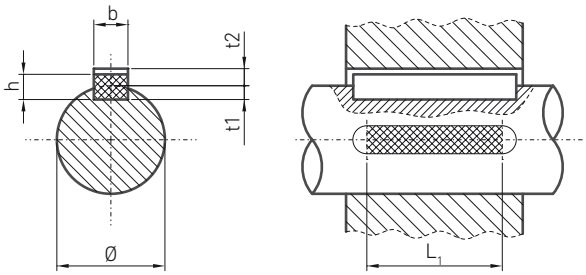
PRODUCT SELECTION

MAXIMUM TRANSFERABLE TORQUE ACCORDING TO SHAFT/ PARALLEL COTTER PIN (DIN 6885)

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

IMPORTANT

... Never subject the input of an FM Series actuator to torque over that indicated for its shaft and keys (see plans in the sub-chapter "sizes", page 118).



Shaft diameter Ø (mm)	Key dimensions			Maximum transferrable torque, M_D (Nm) / Effective key 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

Material: C45 (1.1191) according to EN 10083-1
Load type: Drive - Uniform /
Load - Slight 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 FM/AM Series linear actuators are supplied lubricated with DIVINOL LITHOGREASE G421 type grease.
This is a semi-synthetic grease with a lithium compound with the following specifications,.

Specifications

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

For further information, please contact the NIASA technical department.

NIASA supplies its FM/AM Series actuators with a brass lubrication cap with O-ring, on the gearbox and on the tube, to ensure it is sealed.

A change of grease type may affect the correct operation of the actuator.

There is a possibility of supplying FM/AM Series actuators with an angled grease nipple at 45º DIN 71412 type B for the gearbox, and a straight grease nipple
DIN 71412 type A for the tube.

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.

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

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 actuators offer, as standard, an IP65 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 and/or above +40°C.

NIASA's technical department will prescribe the most suitable materials and sealing components for the specific conditions of the application.

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

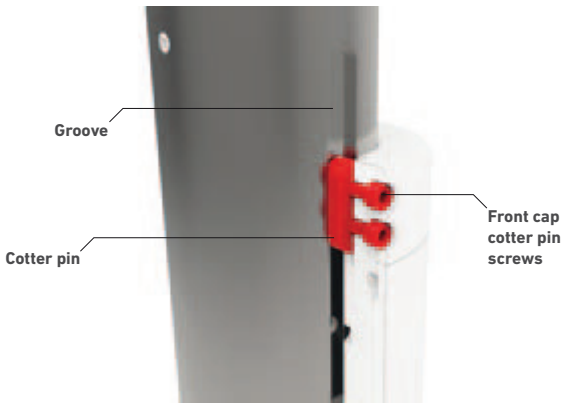
OPTIONAL CONFIGURATIONS

Optionally, NIASA may adapt your FM/AM linear actuator, modifying the different parts of it to your preferences.

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

Immobilizations

The FM Series electro-mechanical actuators, on request, can be supplied with the immobilized stem in rotation. This is achieved by mounting a key on the upper cap and machining a groove along the stem.

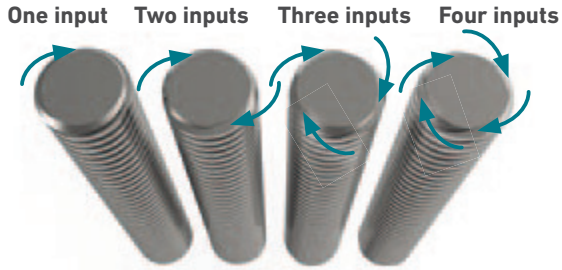


With this configuration, the scraper for the stem cannot be mounted on the front cap. To avoid the possible input of particles or liquid through the stem, it is recommended to mount a bellow to protect it.

For further information, please contact the NIASA technical department.

Special configurations

At the customer's request, the FM/AM Series linear actuators can be supplied with a screw of several inputs so that higher speeds can be obtained.



Worm gear

At the customer's request, the FM/AM linear actuators can be supplied with one of the sides of the worm shaft cut.

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

PLACING AN ORDER

01 SIZE
FM1/AM1
FM2/AM2
FM3/AM3
FM4/AM4
FM5
FJ1
FJ3

02 GEARBOX
S Normal speed
H Slow speed

03 EQUIPMENT GENERAL PROTECTION
IPS Standard IP protection level
IPX Special IP protection level

04 SCREW TYPE (DIAMETER x PITCH)
TRS Steel trapezoidal screw
KGS Ball screw

05 STROKE
0000 Equipment usable stroke in mm

06 IMMOBILISATION IN ROTATION
00 No immobilization
01 Immobilized

07 STEM FASTENING ACCESSORY
BPS Screw flange
GKS Single rod
GKB Double rod
GIR Ball joint
FES Special end fastening
000 No accessory

08 BOX FASTENING ACCESSORY
Always on the back of the box
HFM Gearbox fastening rod
LCM Gearbox mounting feet
ZKM ZK gearbox fastening with bolts
ZKH ZK gearbox fastening with bearings
ZKV ZK gearbox fastening with 90° bolts
FMS Special gearbox fastening
000 No accessory

09 EXTERIOR TUBE FASTENING ACCESSORY
Exterior tube configuration F
BB Trunnion mount with studs
BH Trunnion mount with ball bearings

Exterior tube configuration A
BA Trunnion mount with studs

All models
FS Special fastening
00 No accessory

10 tilt ACCESSORY
SB With tilt support
00 No tilt support

11 LIMIT SWITCH ACCESSORY
Exterior tube configuration F
FCI Inductive limit switches
FCR Inductive limit switches with regulation

Exterior tube configuration A
FCG Magnetic limit switches

All models
000 No limit switches

Example	01	02	03	04	05	06	07	08	09	10	11
	FM3	H	IPS	TRS3606	1000	00	BPS	HFM	00	00	FCI

12 STEM PROTECTION ACCESSORY

Exterior tube configuration F

FB Bellow type protector
00 No protector

13 DRIVE ADAPTATION

MK Standard flange
MS Special drive union
VE Wheel
00 No adaptation

14 DRIVE POSITION ON GEARBOX

A Worm shaft side A
B Worm shaft side B

15 STANDARD MOTOR

MK drive adaptation

080 Group size
A Power-1 / **B** Power-2

MS drive adaptation

1111 Non-standard drive

Both adaptations

0000 Without drive

16 WORM SHAFT END

A Side A end suppressed
B Side B end suppressed
0 Both sides maintained

17 WORM SHAFT PROTECTION ACCESSORY

PR With protector
00 No protector

18 LUBRICANT

GRA Standard lubricant
GRX Lubricant for low extreme temperatures
GRS Other lubricant

19 LUBRICATION ACCESSORIES

ETP Sealed lubrication cap (standard)
EMT Angled lubricator on gearbox or straight on tube
AGR Automatic lubricating accessory
000 No lubricating accessory

20 EQUIPMENT GENERAL COLOUR

With type A configuration, only the gearbox is painted

RGG Graphite grey RAL7024 (standard)
RAZ Blue RAL5017
RGP Silver grey RAL9006
RSP Special colour indicated by the customer
CIP Only grey 411 priming
000 Not painted

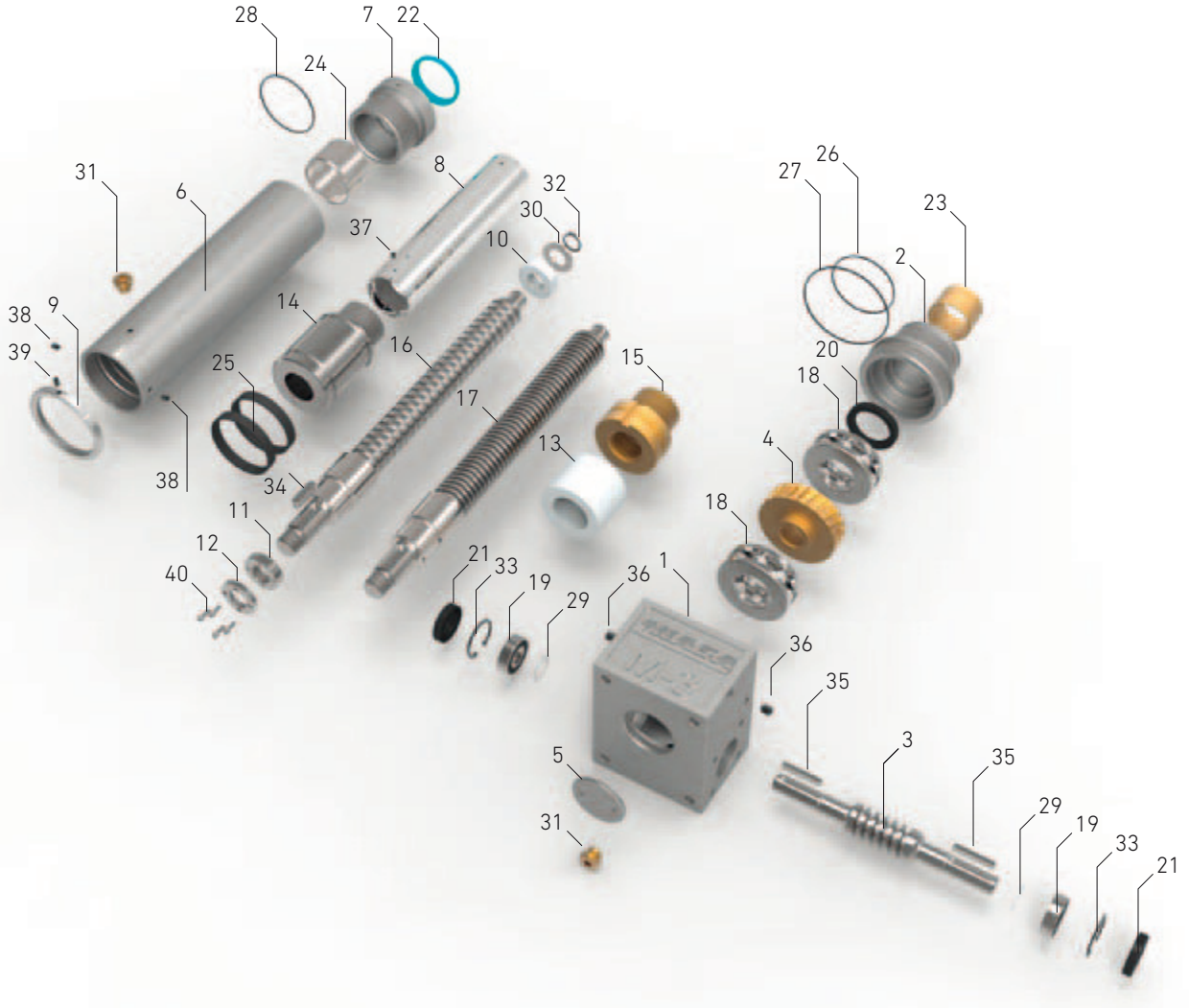
12	13	14	15	16	17	18	19	20
FB	MK	A	GR080A	B	00	GRA	AGR	RGG

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

DISASSEMBLY

	Name
01	M series box
02	Top cap
03	Worm gear
04	Worm wheel
05	Lower cap
06	Exterior tube
07	Front cap
08	Stem
09	Tube position nut
10	Front support
11	Lock nut
12	Lock nut
13	Supplement bushing
14	Ball nut
15	Trapezoidal nut
16	Ball screw
17	Trapezoidal screw
18	Axial bearing
19	Radial bearing
20	Seal
21	Seal
22	Scraper
23	Bearing
24	Bearing
25	Guide ring
26	O-Ring
27	O-Ring
28	O-Ring
29	Adjustment washer
30	Flat washer
31	Brass lubrication cap
32	Exterior Circlip
33	Inside circlip
34	Straight key
35	Straight key
36	Stud with point
37	Flat stud
38	Stud with point
39	Flat stud
40	Allen screw



LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

SPECIAL CONFIGURATIONS