

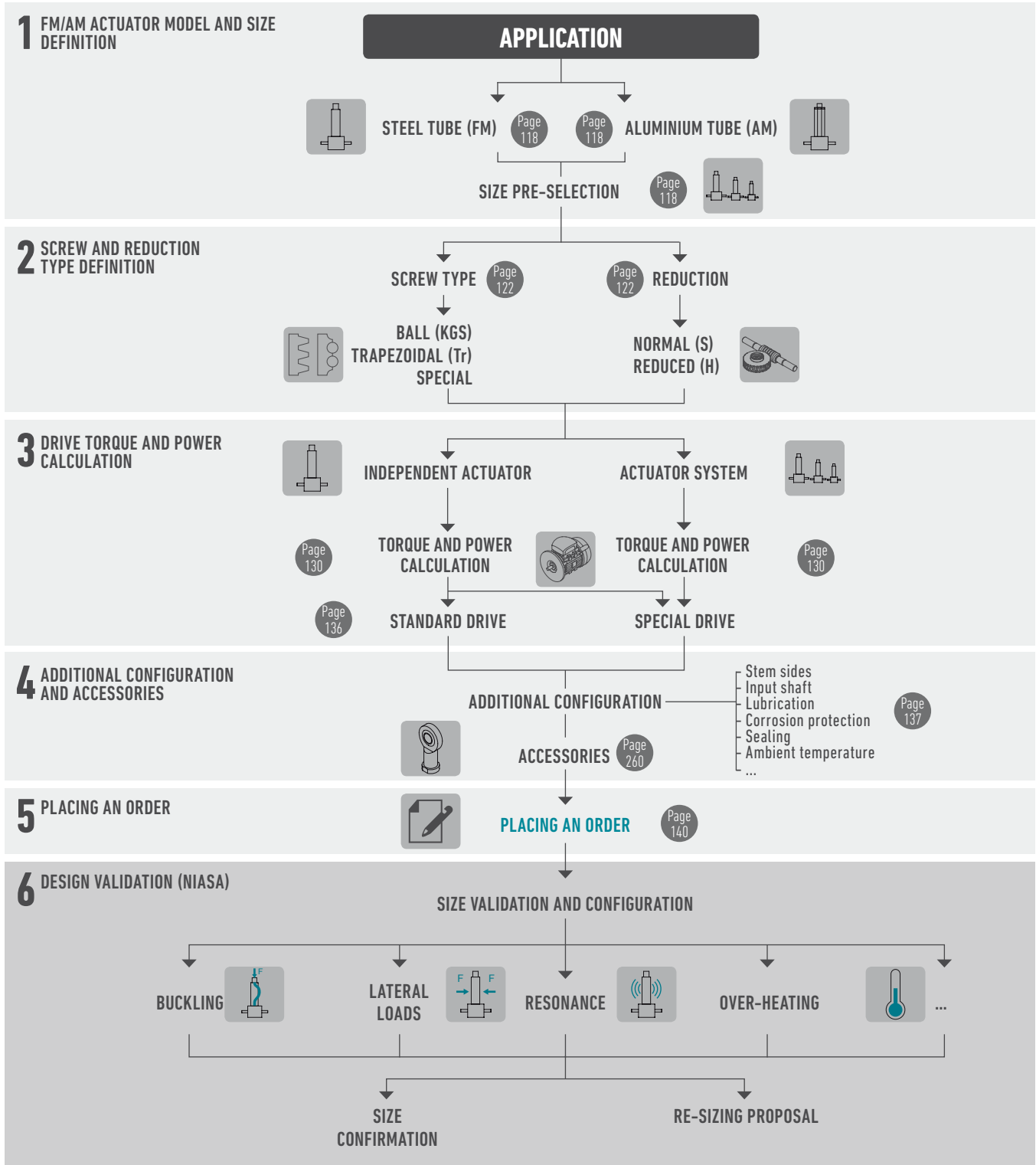
LINEAR ACTUATORS

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



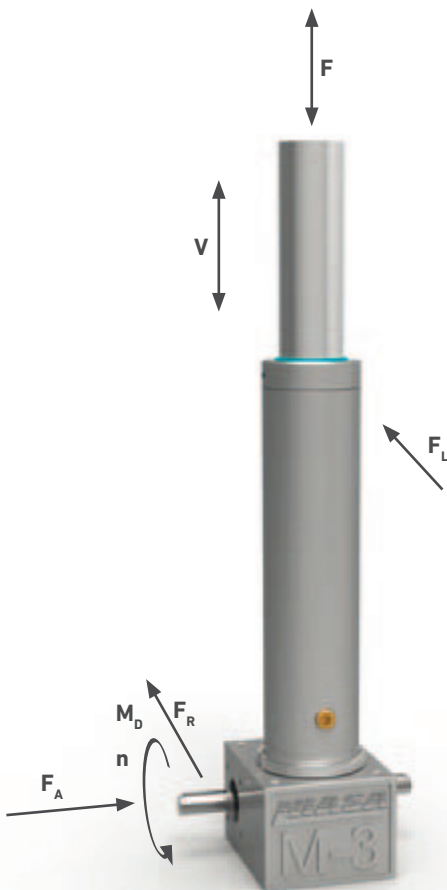
LINEAR ACTUATORS

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

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

- 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

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

- 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:

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

- 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_{DC} 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

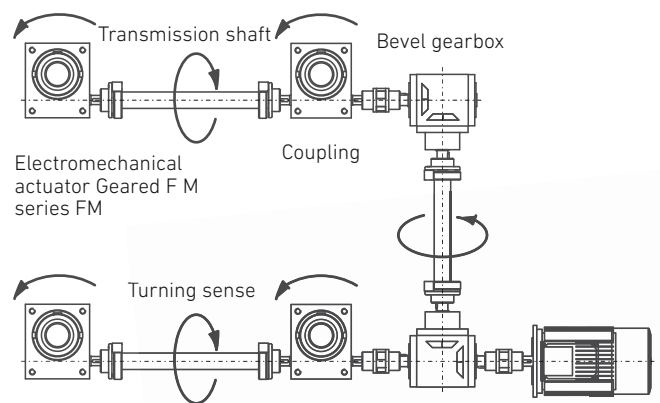
DESIGNING INSTALLATIONS WITH FM/AM SERIES LINEAR ACTUATORS

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

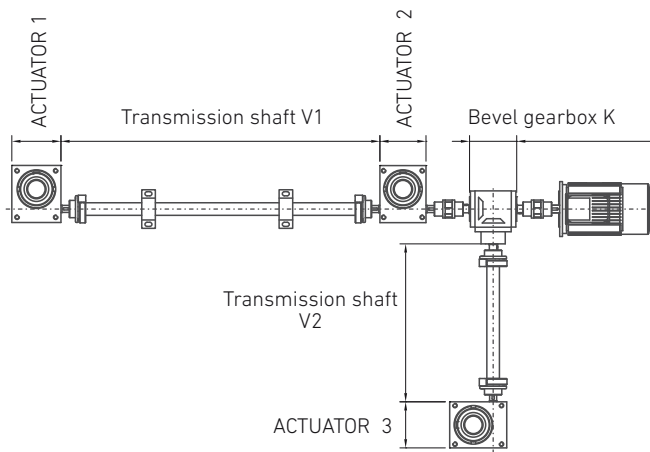
WITH INTEGRATED REDUCTION AND CUBIC GEARBOX. FM SERIES: STEEL TUBE | AM SERIES: ALUMINUM TUBE

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

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

- $M_{D1}/M_{D2}/M_{D3}$ 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.

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

- 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:

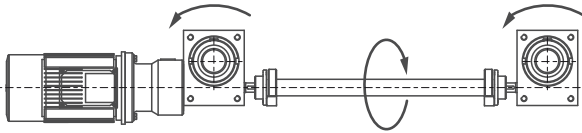
$$M_{DS} \text{ (Nm)} = \frac{M_{DS}}{\eta_{sA}}$$

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

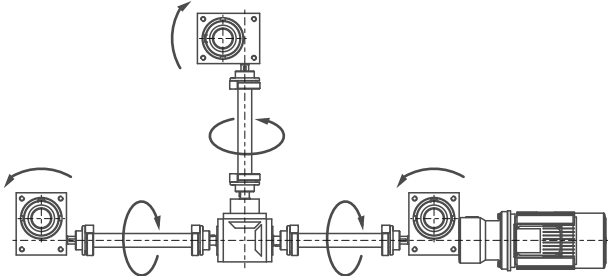
IMPORTANT

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

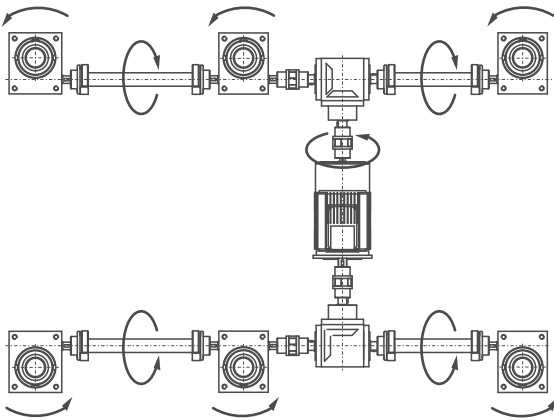
$f_s = 2.1$



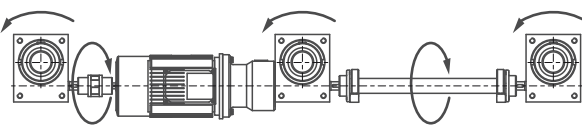
$f_s = 3.34$



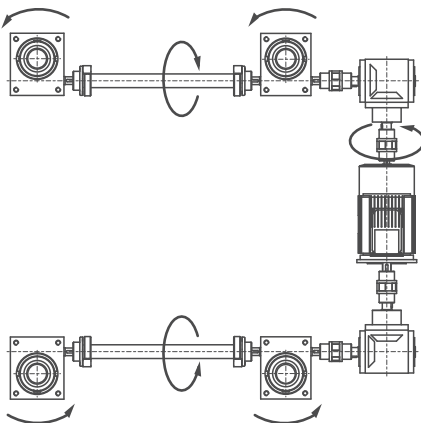
$f_s = 6.8$



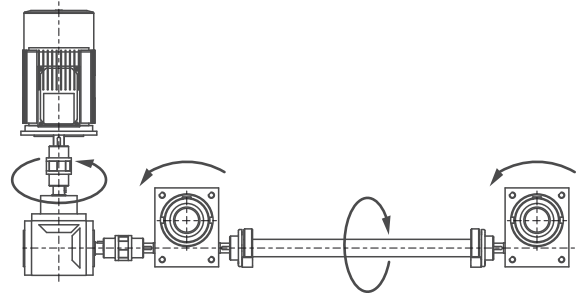
$f_s = 3.1$



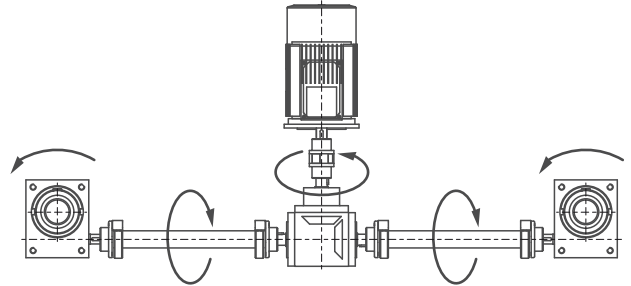
$f_s = 4.4$



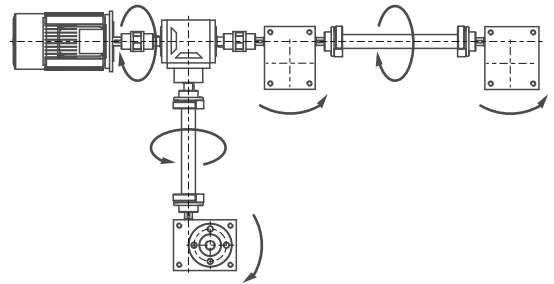
$f_s = 2.25$



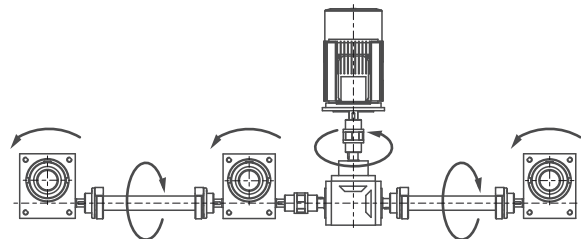
$f_s = 2.25$



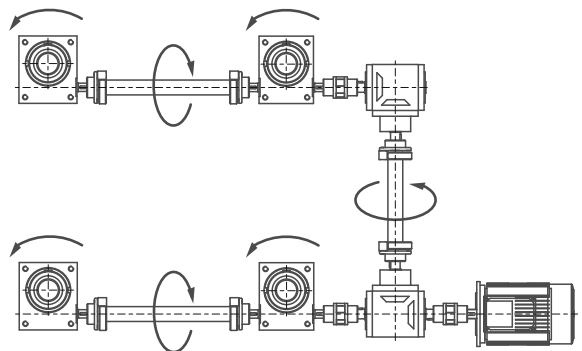
$f_s = 3.27$



$f_s = 3.35$



$f_s = 4.6$

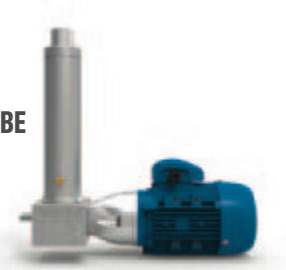


LINEAR ACTUATORS

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.

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

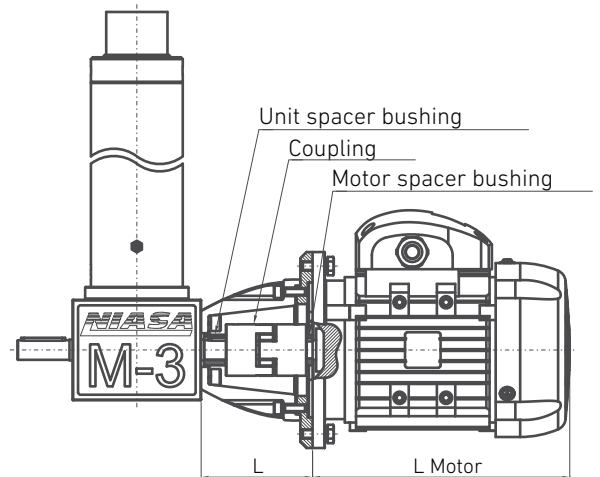
The following table shows the powers available for each actuator size and the type of flange on the motor, in addition to the length of its fastening flange to the gearbox.

	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 lose 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

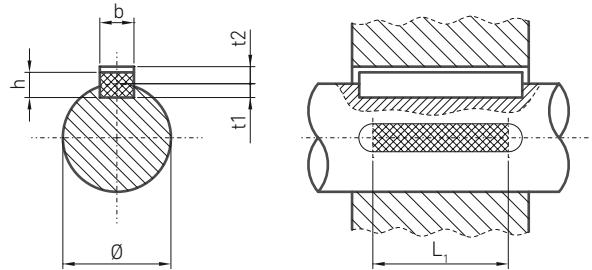
PRODUCT SELECTION

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_o (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 +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.

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 45° 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

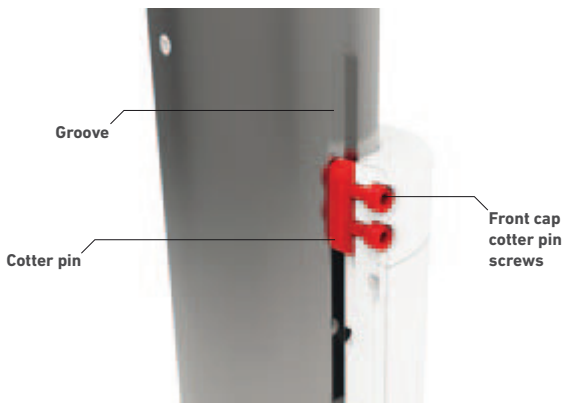
OPTIONAL CONFIGURATIONS

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.



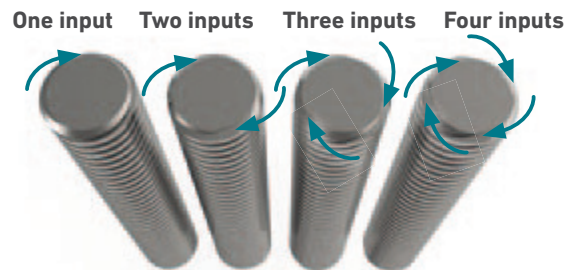
With this configuration, the scraper for the stem cannot be mounted on the front cap. To avoid the possible input of particles or liquid through the stem, it is recommended to mount a bellow to protect it.

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.

