04
LINEAR ACTUATORS WITH INTEGRATED REDUCTION AND COMPACT GEARBOX

FHM Series: Steel tube
AHM Series: Aluminum tube

"WE HAVE A STRATEGIC PLAN. IT'S CALLED DOING THINGS."

HERB KELLEHER
SOUTHWEST AIRLINES
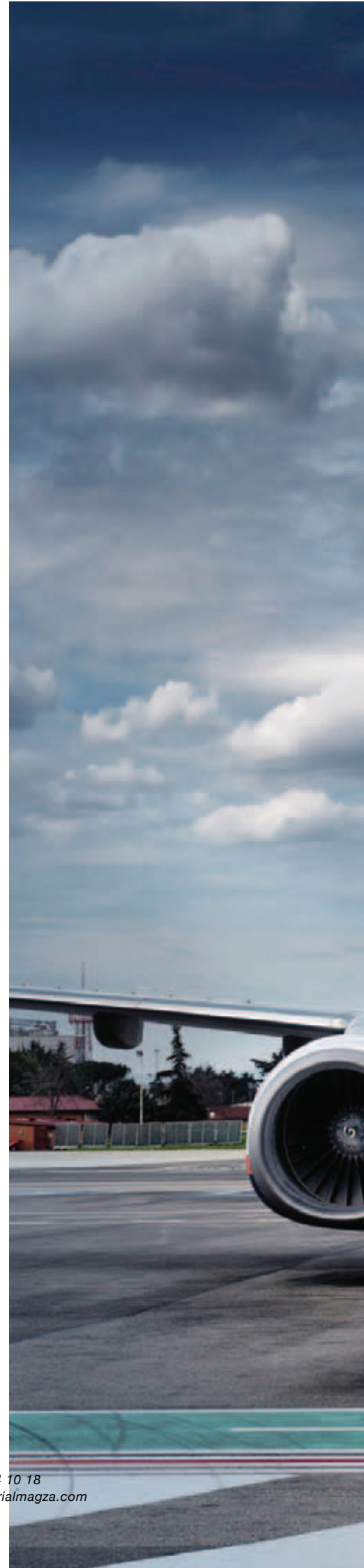
INTRODUCTION

NIASA FHM/AHM Series electro-mechanical actuators have evolved from the FM/AM Series, aimed at specific requirements in the solar energy generation sector (photovoltaic, thermo-solar, etc.). They can also be used in any other kind of application with demanding environmental conditions.

The gearbox is round and not cubic, and the input shaft offers the possibility to connect directly to any type of drive. Additionally, the D variant includes a second reduction, thus avoiding the use of reducers in solar tracking or similar applications, where very slow advance speeds are required.

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

...   Greater movement and positioning precision.

...   Greater safety, due to their 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.

...   Possibility to operate in multiple positions.

...   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 gearbox. Three possible reductions per actuator size are offered, from 4:1 up to 160:1.

...   Trapezoidal and ball screws, depending on the performance required, precision of movement and positioning, etc.

...   Fastening accessories and elements, for optimal adaptation.

...   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.

·   ...

Please do not hesitate to contact NIASA if you require FHM/AHM 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.

04

LINEAR ACTUATORS
WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE │ AHM SERIES: ALUMINUM TUBE

APPLICATIONS

STIRLING TRACKER

FHM-D Series actuator, with IPX protection, that produces the zenithal orientation movement of a parabolic mirror grid, whose purpose is to concentrate the Sun's rays on a Stirling motor joined to them. The actuator size depends on the total surface of the mirrors, the tilt of the Stirling, etc.

PHOTOVOLTAIC INSTALLATION

FHM-D Series actuator that enables zenithal movement on one or more horizontal or polar photovoltaic panel grids. The number and size of the grids to move depends on the size of the actuator, motorization, etc.
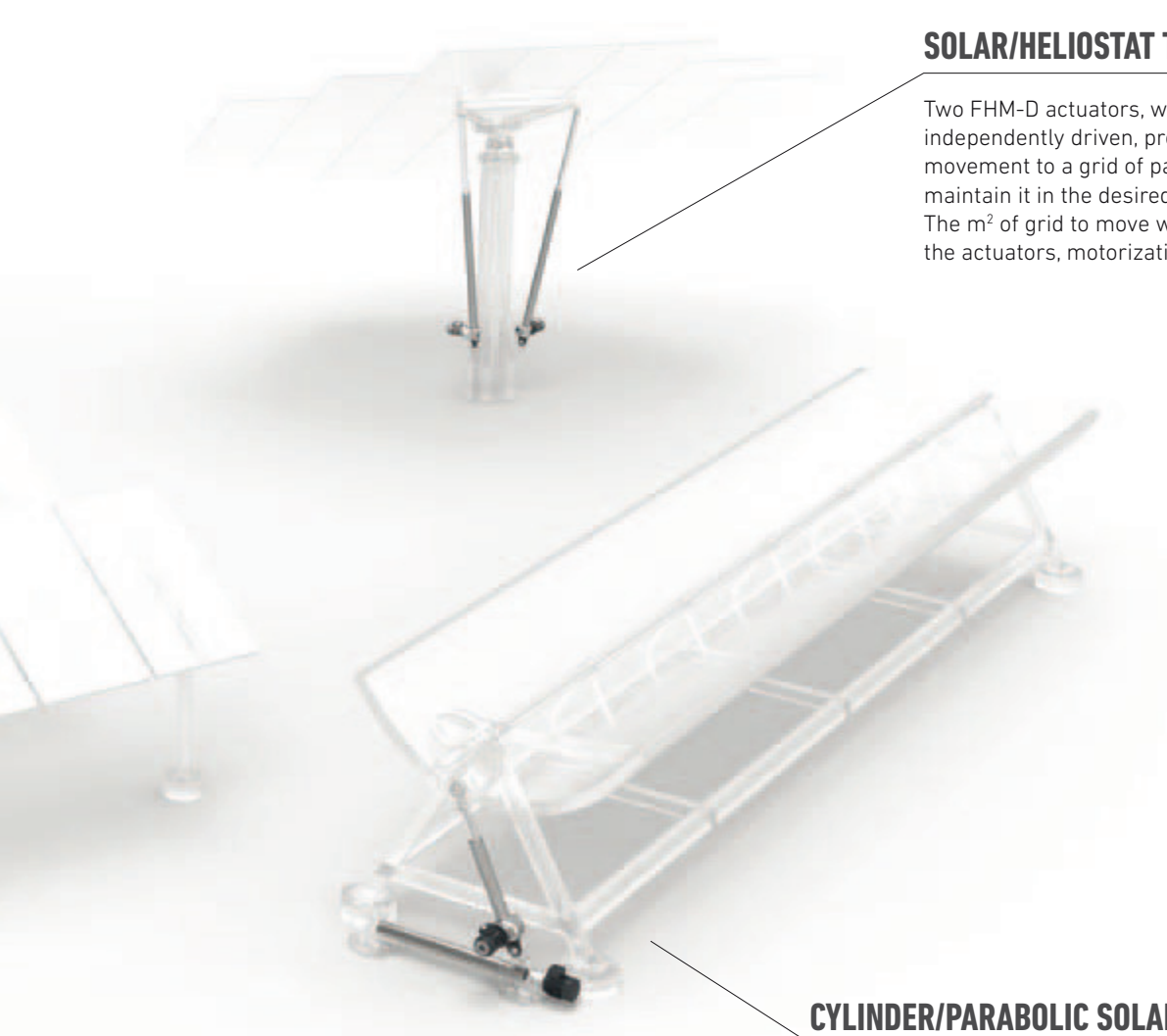
SOLAR/HELIOSTAT TRACKER 2 SHAFTS

Two FHM-D actuators, with IPX protection, independently driven, provide azimuth and zenithal movement to a grid of panels or mirrors, to maintain it in the desired orientation at all times. The m^2 of grid to move will depend on the size of the actuators, motorization, etc.

CYLINDER/PARABOLIC SOLAR CONCENTRATION

FHM-D Series actuator, with IPX protection, placed on a horizontal movement table. Both actuators combined change the angle of parabolic trough's orientation to concentrate the solar energy on the central conduit where the fluid to be heated circulates.

LINEAR ACTUATORS
## WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE │AHM SERIES: ALUMINUM TUBE

SIZES

On all the sizes there are trapezoidal and ball screw options (see chapter on screws for further information), as well as normal speed (S) and slow speed (H) gearboxes. A third reduction with super slow speed (D) is also available from size HM4.

Up to	HM1 5 kN	HM2 10 kN	HM3 25 kN
F Steel exterior tube	page 156	page 157	page 158
A Aluminum exterior tube With anti-corrosion on the stem (optional) With magnetic sensor integrated on the aluminum tube (optional)	page 156	page 157	page 158

In addition to the standard range of HM Series 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, please contact the NIASA technical department.

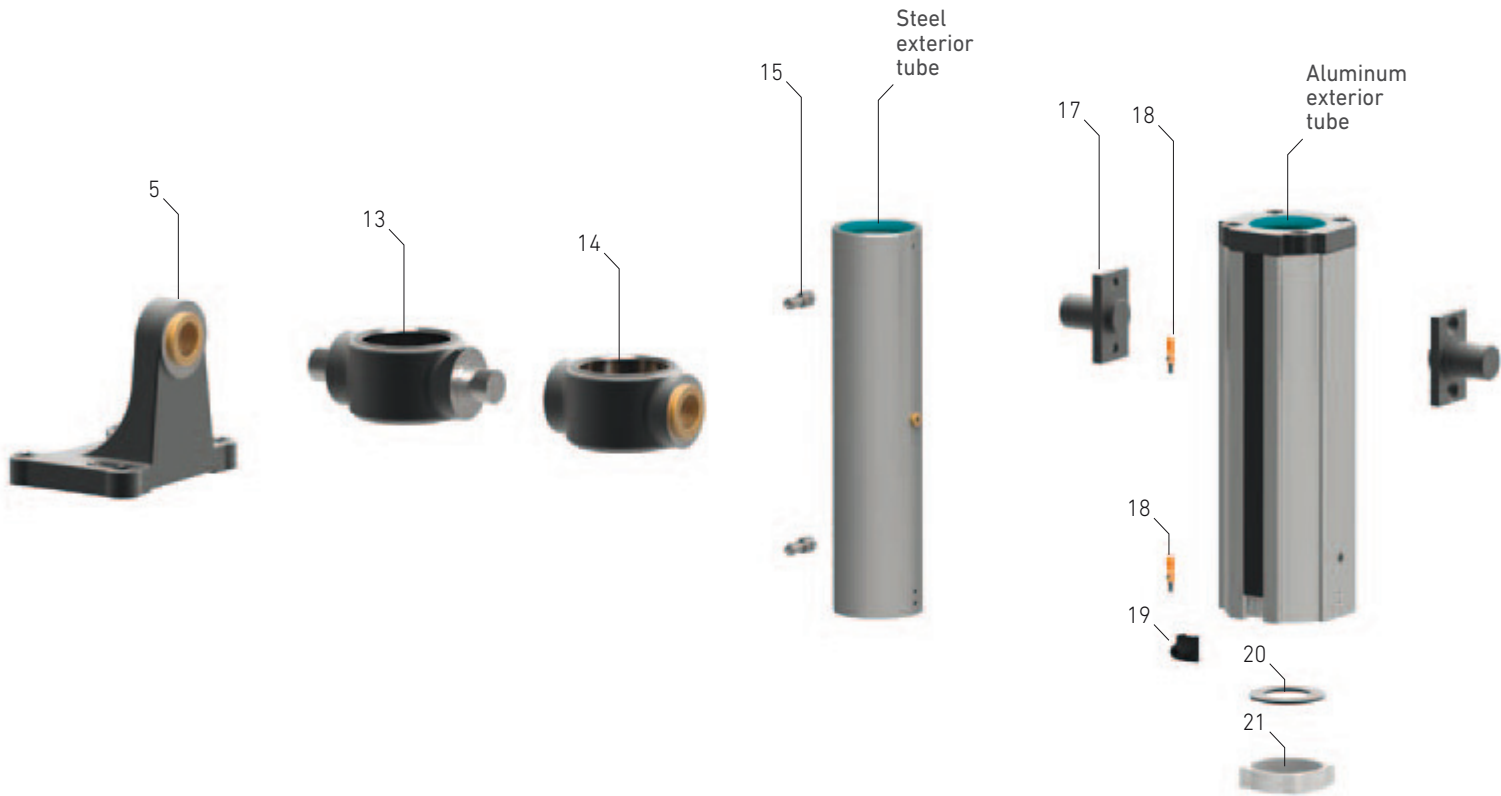| HM4	HM5	HJ1	HJ3
50 kN	**100 kN**	**150 kN**	**250 kN**
page 159	page 160	page 161	page 162

page 159

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE | AHM SERIES: ALUMINUM TUBE

GENERAL PRODUCT OVERVIEW

Name		Page
01	HM series gearbox	152
02	Screw + Trapezoidal nut + Stem	156
03	Screw + Ball nut + Stem	156
04	HFR ball joint	271
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06	GIR clevis rod	282
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10	Motor flange	312
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13	Flanges with bolts for BB Series steel tube	272
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15	FCI inductive limit switch	307

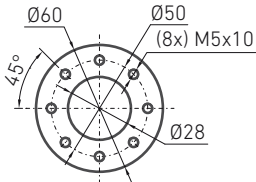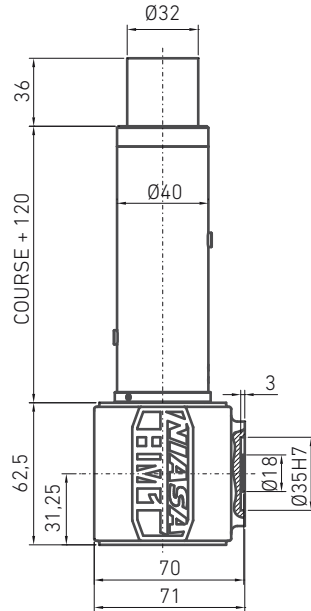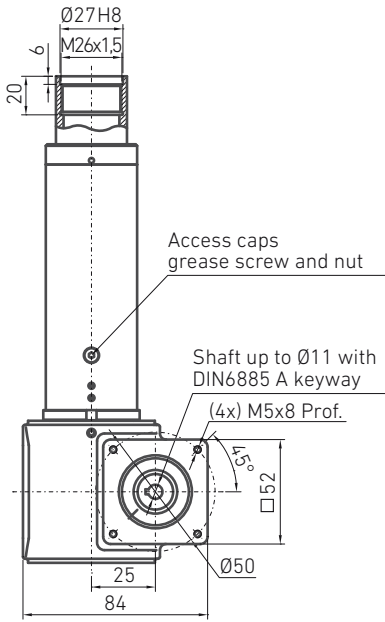|		
17	BA bolts for aluminum tube	274
18	FCG magnetic limit switch	308
19	Connection sensor input adapter	308
20	Position sensor magnet	308
21	Anti-rotation system	
22	D reduction	163

FHM1/AHM1 LINEAR ACTUATOR

UP TO 5 kN Tr TRAPEZ. KGS BALLS

FHM   AHM

Ø27H8
M26x1,5
6
20

Access caps
grease screw and nut

Shaft up to Ø11 with
DIN6885 A keyway

(4x) M5x8 Prof.

45°
□52
25
84
Ø50

Ø32
36

COURSE + 120

Ø40

62,5
31,25
3
Ø18
Ø35H7

70
71

Ø60   Ø50
         (8x) M5x10
45°

Ø28

LOWER GEARBOX FASTENING

20   20   36

SAFETY MARGIN

Screw diameter and step (mm)	Maximum axial strength (kN)	Reduction		Travel (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm)				Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100mm 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	(0.46 x F) + 0.17	(0.15 x F) + 0.08			0.80 x F	0.34 x F	1.9	0.5
KGS 1605	5	4:1	16:1	1.25	0.31	71	56	(0.28 x F) + 0.14	(0.09 x F) + 0.08			0.39 x F	0.16 x F	1.9	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 166).

... Ensure that the dynamic load of the application does not surpass the critical values indicated, in order to avoid overheating of the unit and buckling and resonance of the screw. See calculations chapter (page 166).

| 276 | 272 | 273 | 274 | 271 | 278 | 282 | 281 | 280 | 308 | 307 | 312 |

FHM2/AHM2 LINEAR ACTUATOR

UP TO 10 kN

Tr TRAPEZ. | KGS BALLS

FHM

AHM

Ø29 H8
M27x2
Access caps
grease screw and nut

Shaft up to Ø20 with
DIN6885 A keyway
(4x) M5x10 Prof.

□70
45°
32
Ø65
112

Ø35
COURSE + 161
Ø55
36
89
44,5
3
Ø30
Ø60H7
99
100

Ø85
Ø65
(8x) M6x12
45°
Ø52
Ø60H7

LOWER GEARBOX FASTENING

20 | 20 | 36

SAFETY MARGIN

04

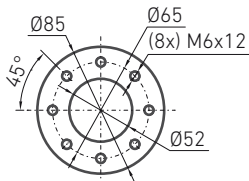| Screw diameter and step (mm)	Maximum axial strength (kN)	Reduction		Travel (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm)		Start-up torque, M_0 (Nm)		Weight stroke 0 (kg)	Approx. weight each 100mm of stroke (kg)
								F (kN), load to move in dynamic					
		S	H	S	H	S	H	S	H	S	H		
Tr 24x5	10	4:1	16:1	1.25	0.31	31	25	(0.64 x F) + 0.35	(0.20 x F) + 0.17	1.11 x F	0.43 x F	4.7	1
KGS 2005	10	4:1	16:1	1.25	0.31	72	58	(0.28 x F) + 0.32	(0.09 x F) + 0.17	0.39 x F	0.15 x F	4.7	1
KGS 2020	7.5	4:1	16:1	5.00	1.25	72	58	(1.10 x F) + 0.34	(0.35 x F) + 0.17	1.55 x F	0.60 x F	4.7	1

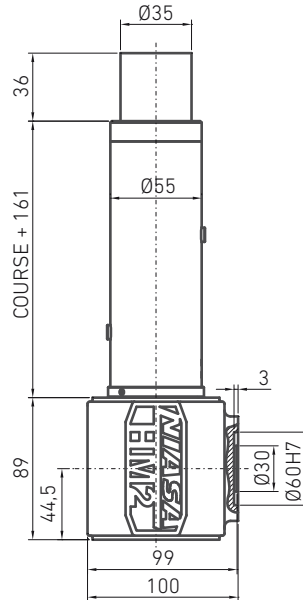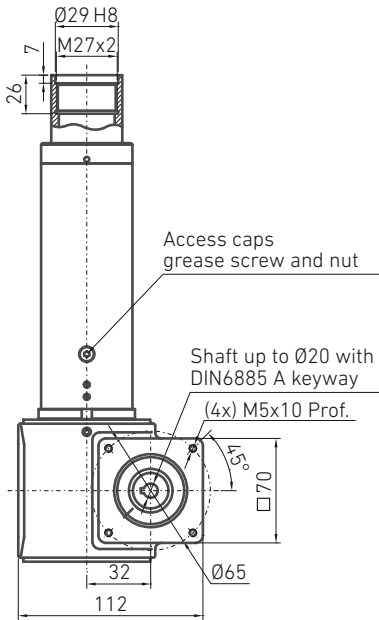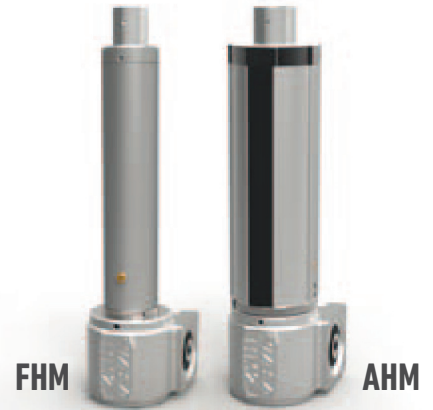... Power required: P_D (kW) = 0,157x M_D (Nm).

... All the data in the table correspond to an input speed of 1,500 rpm. For other speeds, please see the calculation chapter (page 166).

... Ensure that the dynamic load of the application does not surpass the critical values indicated, in order to avoid overheating of the unit and buckling and resonance of the screw. See calculations chapter (page 166).
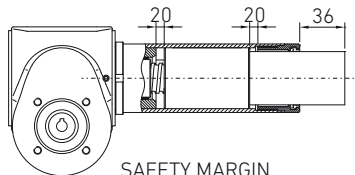

276 | 272 | 273 | 274 | 271 | 278 | 282 | 281 | 280 | 308 | 307 | 312

NIASA®

FHM3/AHM3 LINEAR ACTUATOR

UP TO **25 kN** TrE | KGS BALLS

FHM **AHM**

Ø43H8
M42x2
9
30

Access caps
grease screw and nut

Shaft up to Ø20 with
DIN6885 A keyway
(4x) M6x12 Prof.

45°

Ø70
R40

45
125

Ø50
37

COURSE + 224

Ø75

95
47,5

3 15

Ø30
Ø62H7

110
125

Ø98
Ø70
(8x) M8x16

45°

Ø47

LOWER GEARBOX FASTENING

20*   20*   37

SAFETY MARGIN
(*) If incorporating a KGM 3220 nut,
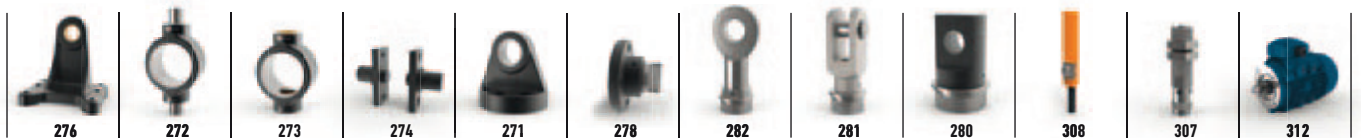the safety margin is 15 mm.

Screw diameter and step (mm)	Maximum axial strength (kN)	Reduction		Travel (mm/revol. input)		Performance (%)		Drive torque, M_D (Nm)		Start-up torque, M_O (Nm)		Weight stroke 0 (kg)	Approx. weight each 100mm 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	28	22	(0.58 x F) + 0.57	(0.18 x F) + 0.31	1.04 x F	0.40 x F	11.5	2.1
KGS 3205	20	6:1	24:1	0.83	0.21	73	58	(0.18 x F) + 0.52	(0.06 x F) + 0.29	0.26 x F	0.11 x F	11.5	2.1
KGS 3210	25	6:1	24:1	1.67	0.42	73	58	(0.36 x F) + 0.52	(0.12 x F) + 0.29	0.52 x F	0.21 x F	11.5	2.1
KGS 3220	20	6:1	24:1	3.33	0.83	73	58	(0.73 x F) + 0.52	(0.23 x F) + 0.29	1.03 x F	0.42 x F	11.5	2.1
KGS 3240	10	6:1	24:1	6.67	1.67	73	58	(1.46 x F) + 0.52	(0.46 x F) + 0.29	2.07 x F	0.84 x F	11.5	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 166).
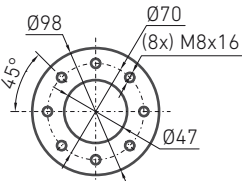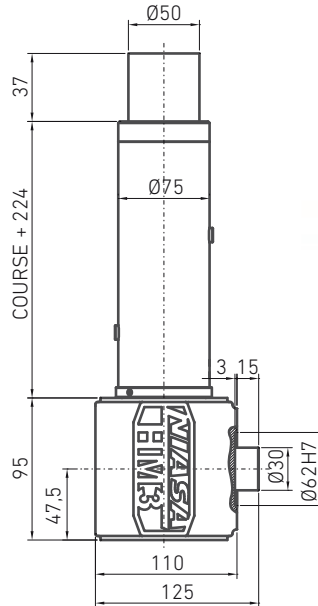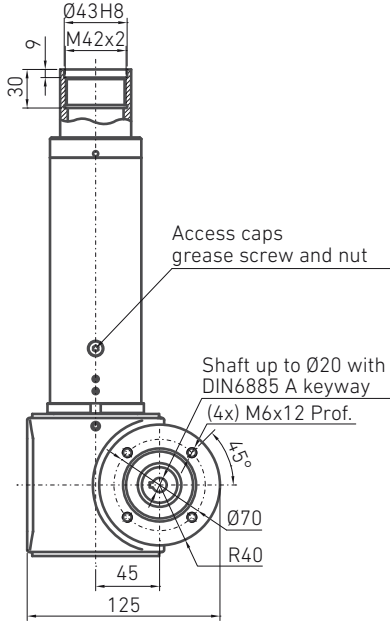... Ensure that the dynamic load of the application does not surpass the critical values indicated, in order to avoid overheating of the unit and buckling and resonance of the screw. See calculations chapter (page 166).
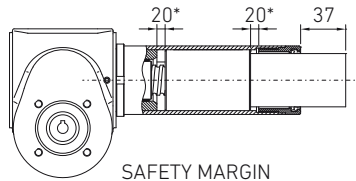
276   **272**   **273**   **274**   **271**   **278**   **282**   **281**   **280**   **308**   **307**   **312**

FHM4/AHM4 LINEAR ACTUATOR

UP TO 50 kN Tr TRAPEZ. KGS BALLS

FHM **AHM**

Ø62 H8
M60x2

Access caps
grease screw and nut

Shaft up to Ø24 with
DIN6885 A keyway
(4x) M10x16 Prof.

Ø90
R 65
63
196

Ø70
COURSE + 262
Ø90
140
70
3 22
Ø35
Ø72H7
= =
144
166
67

Ø 95
Ø 125
(8x) M10x16
45°
Ø 62
LOWER GEARBOX FASTENING

20 20 67
SAFETY MARGIN

NOTE:

See dimensions of the D configuration
at the end of this chapter.

04
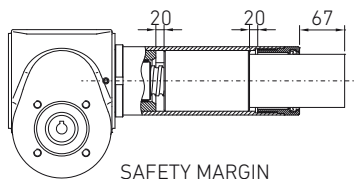
Screw diameter and pitch (mm)	Maximum axial strength (kN)	Reduction			Travel (mm/revol. input)		
		S	H	D	S	H	D
Tr 45x7	50	7:1	28:1	84:1	1.00	0.25	0.08
KGS 4010	42	7:1	28:1	84:1	1.43	0.36	0.12
KGS 4020	37	7:1	28:1	84:1	2.86	0.71	0.24
KGS 4040	35	7:1	28:1	84:1	5.71	1.43	0.48

Screw diameter and step (mm)	Performance (%)			Drive torque, M_D (Nm)			Start-up torque, M_0 (Nm)			Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)	DR accessory weight (kg)
				F (kN), load to move in dynamic								
	S	H	D	S	H	D	S	H	D			
Tr 45x7	26	21	18	(0.61 x F) + 0.97	(0.19 x F) + 0.57	(0.076 x F) + 0.19	1.18 x F	0.44 x F	0.155 x F	26	3.3	2.5
KGS 4010	73	60	49	(0.31 x F) + 0.93	(0.09 x F) + 0.56	(0.038 x F) + 0.19	0.45 x F	0.18 x F	0.063 x F	26	3.3	2.5
KGS 4020	73	60	49	(0.62 x F) + 0.94	(0.19 x F) + 0.56	(0.077 x F) + 0.19	0.90 x F	0.36 x F	0.127 x F	26	3.3	2.5
KGS 4040	73	60	49	(1.25 x F) + 0.94	(0.38 x F) + 0.56	(0.154 x F) + 0.19	1.80 x F	0.72 x F	0.253 x F	26	3.3	2.5

... 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 166).

... Ensure that the dynamic load of the application does not surpass the critical values indicated, in order to avoid overheating of the unit and buckling and resonance of the screw. See calculations chapter (page 166).
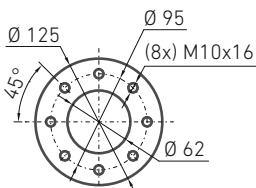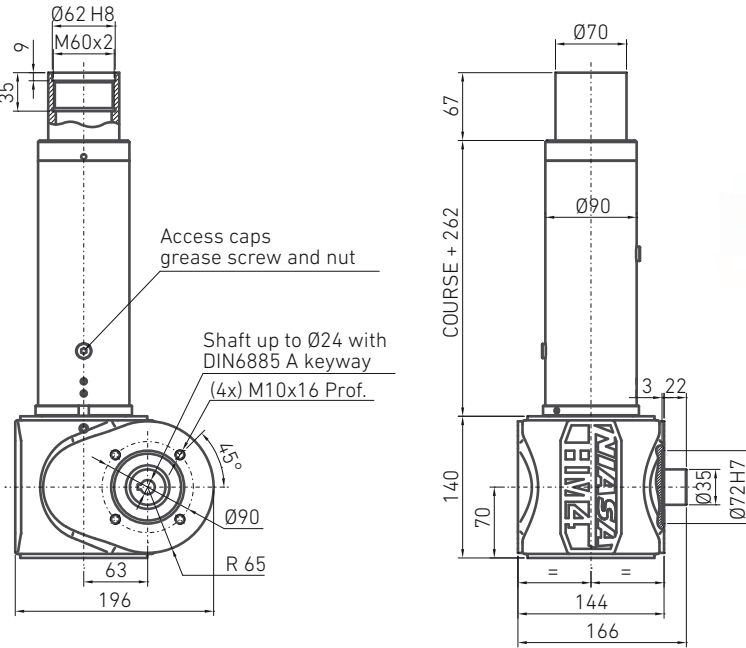
| 276 | 272 | 273 | 274 | 271 | 278 | 282 | 281 | 280 | 308 | 307 | 312 |

NIASA®
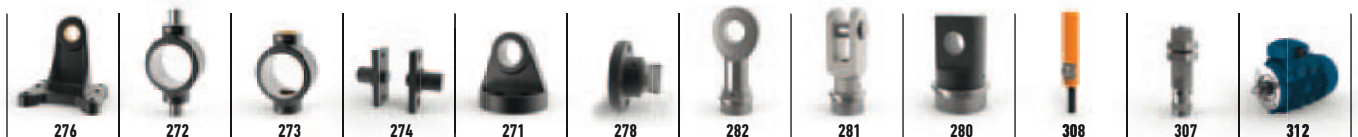
FHM5 ACTUATOR

UP TO 100 kN Tr TRAPEZ. KGS BALLS

The capacity indicated corresponds to the basic configuration.
Higher capacities are available on request.

Ø82 H8
M80x2
10
37
Access caps
grease screw and nut
Shaft up to Ø30 with
DIN6885 A keyway
(4x) M12x16 Prof.
45°
Ø100
R75
71
226

Ø90
65
Ø115
COURSE + 300
2 25
170
85
Ø40
Ø80H7
= =
160
185

NOTE:

See dimensions of the D configuration at the end of this chapter.

Ø145
Ø120
(8x) M12x18
45°
Ø80

LOWER GEARBOX FASTENING

20 20 65
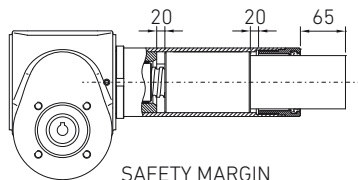
SAFETY MARGIN

Screw diameter and pitch (mm)	Maximum axial strength (kN)	Reduction			Travel (mm/revol. input)		
		S	H	D	S	H	D
Tr 50x8	100	9:1	36:1	108:1	0.89	0.22	0.07
KGS 5010	65	9:1	36:1	108:1	1.11	0.28	0.09

Screw diameter and step (mm)	Performance (%)			Drive torque, M_D (Nm)			Start-up torque, M_0 (Nm)			Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)	DR accessory weight (kg)
				F (kN), load to move in dynamic								
	S	H	D	S	H	D	S	H	D			
Tr 50x8	27	21	17	(0.53 x F) + 1.91	(0.17 x F) + 1.08	(0.067 x F) + 0.36	0.98 x F	0.39 x F	0.138 x F	40.2	4.9	3
KGS 5010	73	58	48	(0.24 x F) + 1.87	(0.08 x F) + 1.07	(0.031 x F) + 0.36	0.36 x F	0.15 x F	0.054 x F	40.2	4.9	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 166).

... Ensure that the dynamic load of the application does not surpass the critical values indicated, in order to avoid overheating of the unit and buckling and resonance of the screw. See calculations chapter (page 166).
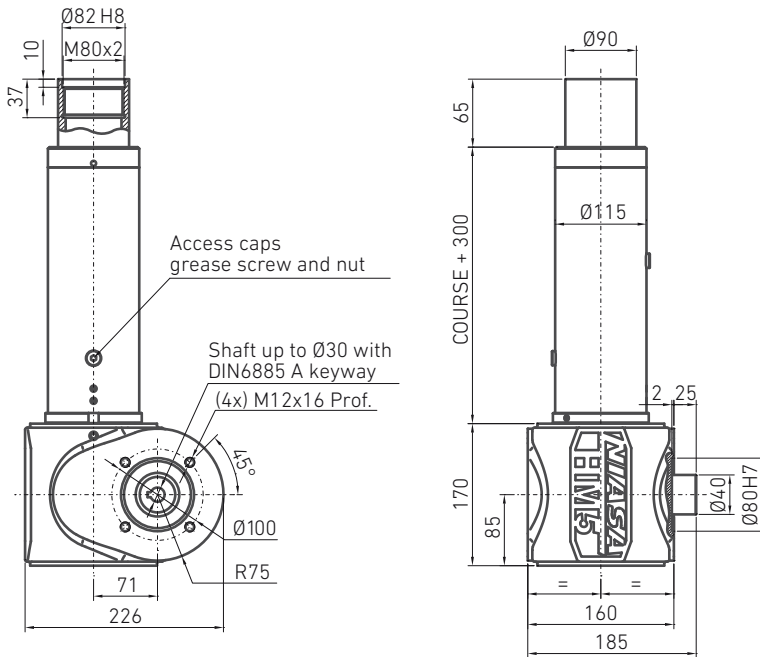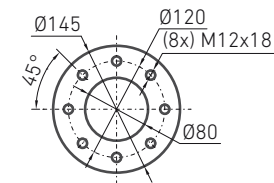

| 276 | 272 | 273 | 274 | 271 | 278 | 282 | 281 | 280 | 307 | 312 |

FHJ1 ACTUATOR
UP TO 150 kN Tr TRAPEZ. KGS BALLS

The capacity indicated corresponds to the basic configuration.
Higher capacities are available on request.

Ø100 H8
M95x2
10
45

COURSE + 325
95
Ø110
Ø150

Access caps
grease screw and nut

Shaft up to Ø34 with
DIN6885 A keyway
(4x) M10x16 Prof.

45°

Ø105
R70
71
268

180
16
3
30
Ø45
Ø85 H7
= =
190
220

NOTE:

See dimensions of the D configuration at the end of this chapter.

04

Ø180
Ø160
(8x) M12x20
45°
Ø90

LOWER GEARBOX FASTENING

20 20 95
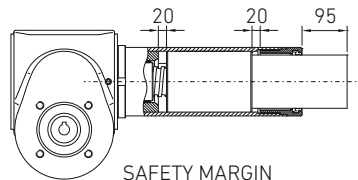
SAFETY MARGIN

Screw diameter and pitch (mm)	Maximum axial strength (kN)	Reduction			Travel (mm/revol. input)		
		S	H	D	S	H	D
Tr 70x10	150	9:1	36:1	108:1	1.11	0.28	0.09
KGS 6310	65	9:1	36:1	108:1	1.11	0.28	0.09

Screw diameter and step (mm)	Performance (%)			Drive torque, M_D (Nm)			Start-up torque, M_O (Nm)			Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)	DR accessory weight (kg)
				F (kN), load to move in dynamic								
	S	H	D	S	H	D	S	H	D			
Tr 70x10	24	18	16	(0.73 x F) + 2.03	(0.24 x F) + 1.21	(0.09 x F) + 0.4	1.31 x F	0.49 x F	0.172 x F	79.5	9	3.8
KGS 6310	73	55	49	(0.24 x F) + 1.97	(0.08 x F) + 1.19	(0.03 x F) + 0.4	0.33 x F	0.14 x F	0.048 x F	81.5	9	3.8

... 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 166).

... Ensure that the dynamic load of the application does not surpass the critical values indicated, in order to avoid overheating of the unit and buckling and resonance of the screw. See calculations chapter (page 166).
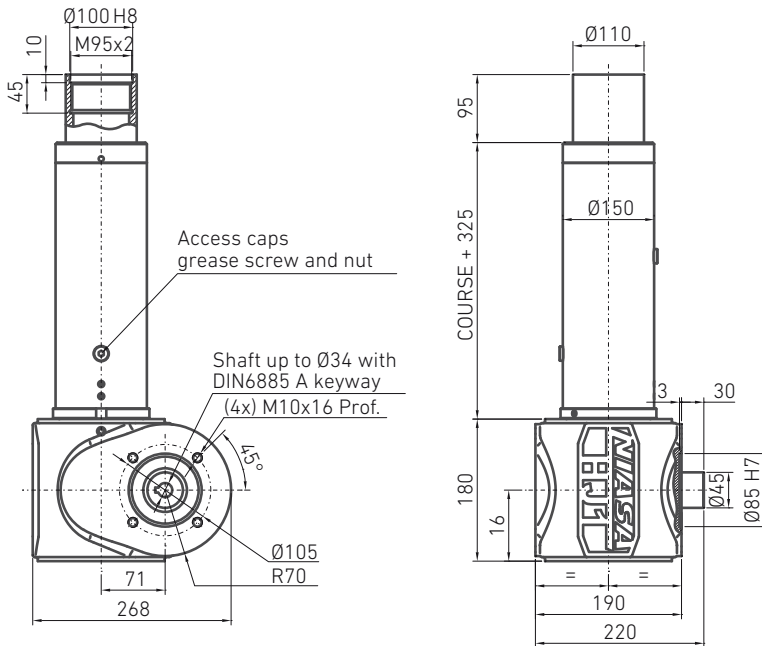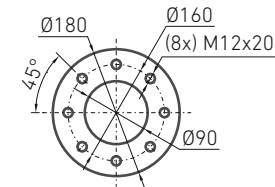
276 272 273 274 271 278 282 281 280 307 312

FHJ3 ACTUATOR
UP TO 250 kN Tr TRAPEZ.

Contact versions with ball screw. The capacity indicated corresponds to the basic configuration. Higher capacities are available on request.

Ø114 H8
M110x2
10
65

Access caps grease screw and nut

Shaft up to Ø42 with DIN6885 A keyway

(4x) M12x18 Prof.
45°
Ø125
80
R80
300

Ø130
100
Ø150
COURSE + 360
195
97,5
3   40
Ø80
Ø140 H7
=   =
220
260

Ø205
Ø165
(8x) M16x25
45°
Ø100
Ø100

LOWER GEARBOX FASTENING

20   20   110

SAFETY MARGIN

NOTE:

See dimensions of the D configuration at the end of this chapter.

Screw diameter and pitch (mm)	Maximum axial strength (kN)	Reduction			Travel (mm/revol. input)		
		S	H	D	S	H	D
Tr 80x10	250	10:1	40:1	160:1	1.00	0.25	0.06
KGS 8010	80	10:1	40:1	160:1	1.00	0.25	0.06

Screw diameter and step (mm)	Performance (%)			Drive torque, M$_D$ (Nm)			Start-up torque, M$_O$ (Nm)			Weight stroke 0 (kg)	Approx. weight each 100 mm of stroke (kg)	DR accessory weight (kg)
				F (kN), load to move in dynamic								
	S	H	D	S	H	D	S	H	D			
Tr 80x10	22	19	17	(0.73 x F) + 2.81	(0.21 x F) + 1.95	(0.058 x F) + 0.49	1.18 x F	0.40 x F	0.106 x F	109.5	14	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 166).
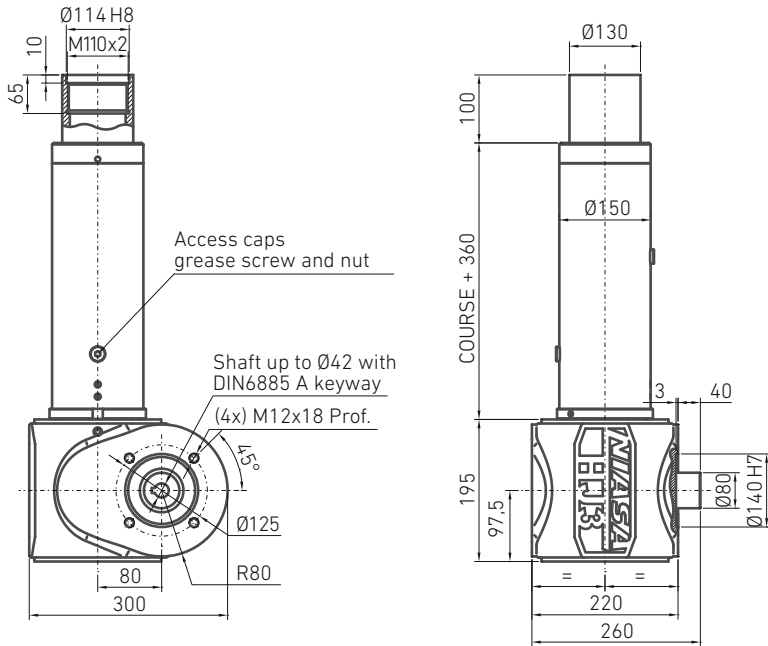
... Ensure that the dynamic load of the application does not surpass the critical values indicated, in order to avoid overheating of the unit and buckling and resonance of the screw. See calculations chapter (page 166).
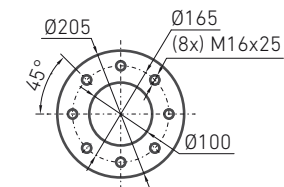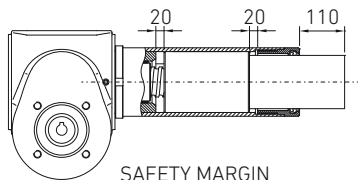
276   272   273   274   271   278   282   281   280   307   312

FHM4 / FHM5
FHJ1 / FHJ3
AHM4

04

Shaft up to Ø D

45°

HM DR

(4x) MFxG Prof.

Ø E

ØA

Ø B f7

Ø C

J   H

K

L
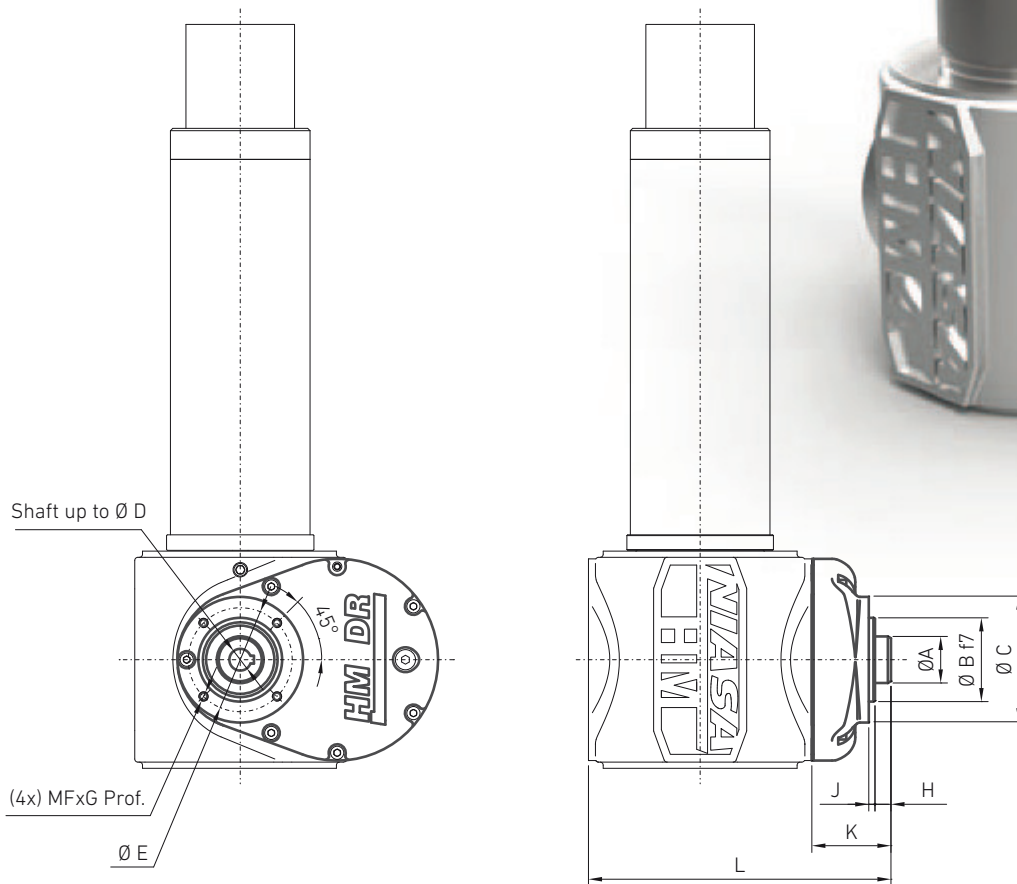
	ø A	ø B	ø C	ø D	ø E	M FxG	H	J	K	L
HM4	30	54	81	22	67	M 6x12	10	4	51	195
HM5	40	72	110	28	90	M 6x12	15	4	60	220
HJ1	50	85	130	38	105	M 8x16	15	4	104	294
HJ3	65	115	150	50	130	M 10x18	18	6	107	305

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE | AHM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

To select the correct HM 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.
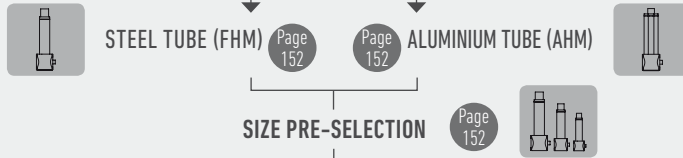
1 FHM/AHM ACTUATOR MODEL AND SIZE DEFINITION

APPLICATION

STEEL TUBE (FHM) — Page 152   Page 152 — ALUMINIUM TUBE (AHM)

SIZE PRE-SELECTION — Page 152

2 SCREW AND REDUCTION TYPE DEFINITION

SCREW TYPE — Page 156   Page 156 — REDUCTION

BALL (KGS)   NORMAL (S)
TRAPEZOIDAL (Tr)   SLOW (H)
SPECIAL   SUPER SLOW(D)
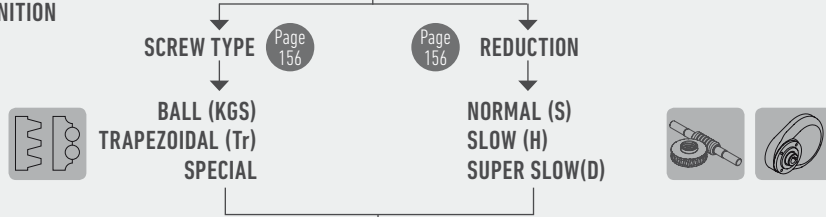
3 DRIVE TORQUE AND POWER CALCULATION

Page 166 — TORQUE AND POWER CALCULATION

STANDARD DRIVE   SPECIAL DRIVE
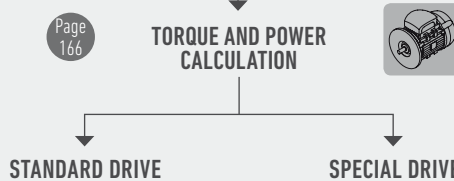
4 ADDITIONAL CONFIGURATION AND ACCESSORIES

ADDITIONAL CONFIGURATION
- Stem end
- Input shaft
- Lubrication
- Corrosion protection
- Sealing
- Ambient temperature
- ....

Page 168

ACCESSORIES — Page 260

5 PLACING AN ORDER
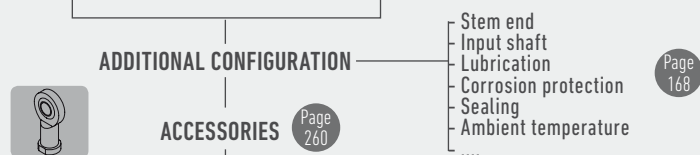
PLACING AN ORDER — Page 171

6 DESIGN VALIDATION (NIASA)
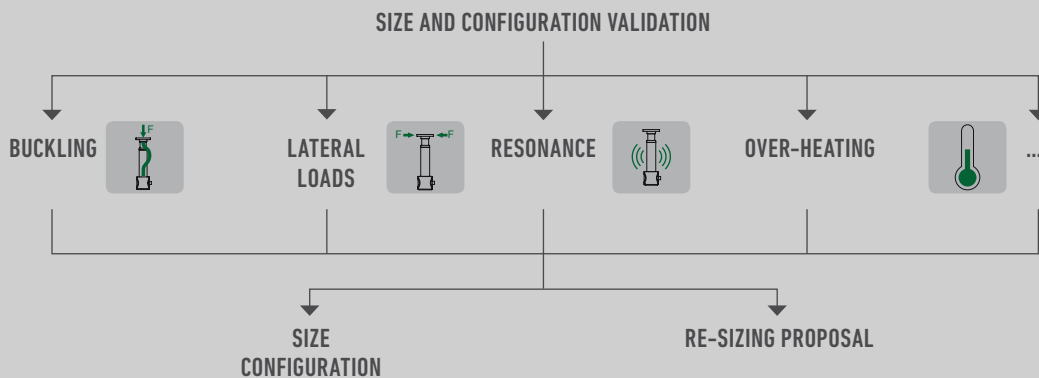
SIZE AND CONFIGURATION VALIDATION

BUCKLING   LATERAL LOADS   RESONANCE   OVER-HEATING   ...

SIZE CONFIGURATION   RE-SIZING PROPOSAL

04

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE │ AHM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

STRENGTH AND TORQUE ACTING ON AN HM SERIES LINEAR ACTUATOR

F Load to move at traction and/or compression.

F_L Lateral load on the stem.

V Stem advance speed.

M_D Torque on the input shaft.

n Speed on the input shaft.

TORQUE AND POWER OF A LINEAR ACTUATOR HM SERIES LINEAR

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

1. DRIVE TORQUE

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

F Load to move in dynamic (kN)

P Screw pitch (mm)

M_I Drive 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:

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

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

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

input rpm	FHM1/AHM1		FHM2/AHM2		FHM3/AHM3		FHM4/AHM4			FHM5			FHJ1			FHJ3		
	S	H	S	H	S	H	S	H	D	S	H	D	S	H	D	S	H	D
3,000	0.91	0.75	0.90	0.77	0.92	0.76					Non-standard							
1,500	0.88	0.69	0.89	0.71	0.90	0.71	0.90	0.74	0.61	0.90	0.72	0.59	0.90	0.68	0.61	0.90	0.77	0.68
1000	0.87	0.67	0.88	0.69	0.88	0.68	0.88	0.69	0.57	0.87	0.67	0.55	0.89	0.67	0.57	0.89	0.76	0.66
750	0.85	0.64	0.87	0.66	0.87	0.67	0.87	0.68	0.55	0.86	0.65	0.54	0.88	0.65	0.55	0.89	0.75	0.64
500	0.84	0.61	0.85	0.64	0.85	0.63	0.85	0.64	0.53	0.84	0.62	0.51	0.87	0.64	0.53	0.88	0.74	0.63
100	0.79	0.54	0.79	0.56	0.79	0.54	0.79	0.55	0.51	0.78	0.53	0.49	0.81	0.55	0.51	0.84	0.66	0.61

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 (F/A)

S gearbox version (normal speed)

	HM1	HM2	HM3	HM4	HM5	HJ1	HJ3
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)

	HM1	HM2	HM3	HM4	HM5	HJ1	HJ3
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

D gearbox version (super-slow speed)

	HM1	HM2	HM3	HM4	HM5	HJ1	HJ3
Trapezoidal				0.19	0.36	0.40	0.49
Balls				0.19	0.36	0.40	0.48

η_{SA} Actuator static efficiency (F/A)

S gearbox box version (normal speed)

	HM1	HM2	HM3	HM4	HM5	HJ1	HJ3
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)

	HM1	HM2	HM3	HM4	HM5	HJ1	HJ3
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

D gearbox version (super-slow speed)

	HM1	HM2	HM3	HM4	HM5	HJ1	HJ3
Trapezoidal				0.10	0.10	0.10	0.10
Balls				0.33	0.30	0.34	0.43

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 COMPACT GEARBOX. FHM SERIES: STEEL TUBE | AHM 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 a screw jack to torque over that indicated for its shaft and keys (see plans in the chapter "sizes", page 152).
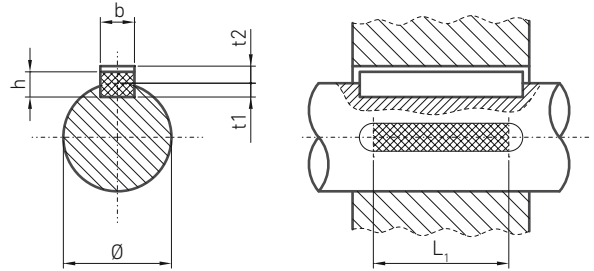
Shaft diameter Ø (mm)	Key dimensions			Maximum transferrable torque, M_D (Nm) Key effective length, L_1 (mm)						
	b x h (mm)	t1 (mm)	t2 (mm)	10	16	20	28	40	50	70
8 – 10	3 x 3	1.8	1.4	5	9	12	-	-	-	-
10 – 12	4 x 4	2.5	1.8	9	13	17	-	-	-	-
12 – 17	5 x 5	3	2.3	15	24	30	42	-	-	-
17 – 22	6 x 6	3.5	2.8	25	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 HM 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.

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

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 HM Series actuators with a brass lubrication cap with O-ring, on the gearbox and on the tube, to ensure it is sealed.

There is a possibility to supply HM Series actuators with a grease nipple angled 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 COMPACT GEARBOX. FHM SERIES: STEEL TUBE | AHM 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 60º 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 –20ºC and/or above +40ºC.

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 COMPACT GEARBOX. FHM SERIES: STEEL TUBE | AHM SERIES: ALUMINUM TUBE

PRODUCT SELECTION

OPTIONAL CONFIGURATIONS

Optionally, NIASA may adapt your HM 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.
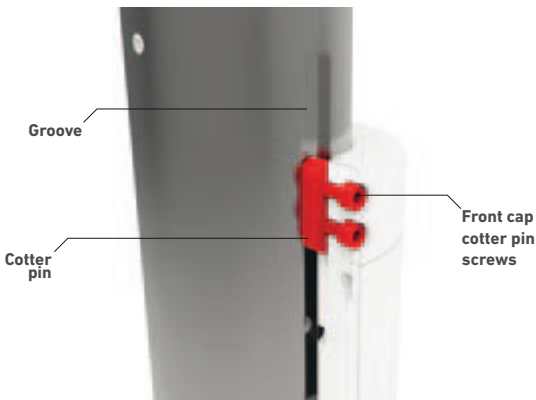

With this configuration, the scraper for the stem cannot be mounted on the front cap. To avoid the possible input of particles or liquid through the stem, it is recommended to mount a bellow to protect it.

For further information, please contact the NIASA technical department.

Special configurations

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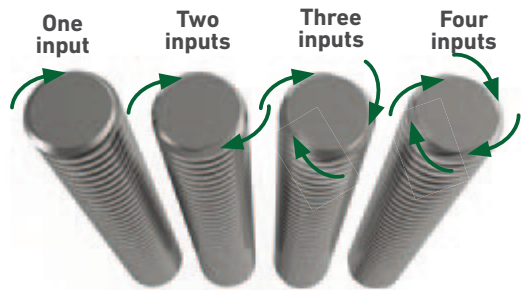
LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE | AHM SERIES: ALUMINUM TUBE

PLACING AN ORDER

01 SIZE
FHM1 / AHM1
FHM2 / AHM2
FHM3 / AHM3
FHM4 / AHM4
FHM5
FHJ1
FHJ3

02 GEARBOX
All sizes
S Normal speed
H Reduced speed

Only sizes HM4 / HM5 / HJ1 / HJ3
D Super-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 Clevis rod
FES Special end fastening
000 No accessory

08 GEARBOX FASTENING ACCESSORY
Always on the back of the gearbox
HFR Gearbox fastening rod
FMS Special gearbox fastening
000 No accessory

09 EXTERIOR TUBE FASTENING ACCESSORY
Exterior tube configurationF
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 TIP ACCESSORY
SB With tip support
00 No tip 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

12 STEM PROTECTION ACCESSORY
Exterior tube configuration F
FB Bellow type protector
00 No protector

13 DRIVE ADAPTATION
MB Adaptation flange
00 No adaptation

14 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

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

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

17 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

04

Example	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
	HM3	H	IPS	TRS3606	1000	00	BPS	HFR	00	00	FCI	FB	MB	GR080A	GRA	AGR	RGG

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE │AHM SERIES: ALUMINUM TUBE
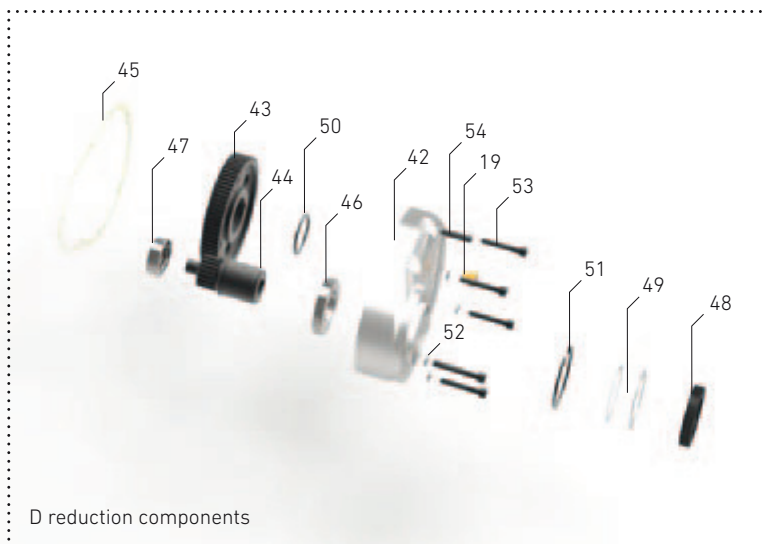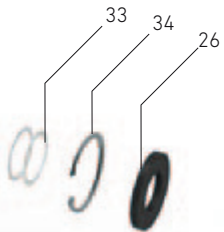
DISASSEMBLY

	Name				
01	HM series gearbox	15	Screw support ring	29	Dual-effect scraper
02	Top cap	16	Nut	30	O-Ring
03	Front cap	17	Locknut	31	O-Ring
04	Exterior tube	18	Tube position nut	32	O-Ring
05	Stem	19	Lubrication cap	33	Adjustment washer
06	Worm gear	20	Axial bearing	34	Inside circlip
07	Worm wheel	21	Radial bearing	35	Allen screw
08	Ball screw	22	Radial bearing	36	Straight key
09	Trapezoidal screw	23	Bearing	37	Straight key
10	Ball nut	24	Bearing	38	Stud with point
11	Trapezoidal nut	25	Double lip radial seal ring	39	Stud with point
12	Guide ring	26	Double lip radial seal ring	40	Stud with point
13	Supplement nut bushing	27	Obturator	41	Flat stud
14	Front support	28	Obturator		

04

D reduction components

	D reduction designation
42	Cap
43	Wheel
44	Pinion
45	Sealed joint
46	Radial bearing
47	Radial bearing
48	Double lip seal ring
49	Adjustment washer
50	Exterior circlip
51	Inside circlip
52	Grower washer
53	Allen screw
54	Extraction thread stud

LINEAR ACTUATORS

WITH INTEGRATED REDUCTION AND COMPACT GEARBOX. FHM SERIES: STEEL TUBE | AHM SERIES: ALUMINUM TUBE

SPECIAL CONFIGURATIONS

Special GK
clevis rod

Front cap with
double scraper
system

BB special non-
symmetrical
flange

Special cast gearbox
with flange adapted
for customer's
servomotor

Flange
adapted to the
customer's
servomotor

Encoder system
direct to the screw
mounted underneath
the gearbox