Linear actuator

DFPI-...-ND2P

FESTO

Repair instructions (en)

Editorial information

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Foreword

These repair instructions are valid for the linear actuator listed on the title page to the exclusion of any liability claims.

Deviations compared to the descriptions in these repair instructions may arise depending on the design and/or modification status of the specific linear actuator. The user must check this prior to carrying out the repair and take the deviations into consideration if necessary.

These repair instructions have been prepared with care.

Festo AG & Co. KG does not, however, accept liability for any errors in these repair instructions or their consequences. Likewise, no liability is accepted for direct or consequential damage resulting from incorrect use of the products.

More detailed information on this can be found in section 9 „Liability“.

The relevant regulations on occupational safety, safety engineering and interference suppression as well as the stipulations contained in these repair instructions must be observed when working on the products.

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Table of contents

1 Important information

1.1 About these repair instructions

This document contains important information about the professional repair of the linear actuator type DFPI-...-ND2P.

Before carrying out a repair, the relevant section in these instructions must be read in full and followed consistently.

For reasons of clarity, these repair instructions do not contain complete detailed information. The following documents should therefore also be available while performing repair work on the linear actuator:

- **Operating instructions**

  Contain information about the function, structure, application, installation, commissioning, maintenance and care, etc. Can be found on the Festo website (www.festo.com).

- **Spare parts documentation**

  Contains an overview of the spare and wearing parts as well as information on their installation. This can be found in the online spare parts catalogue on the Festo website (http://spareparts.festo.com).

- **Assembly aids**

  Contains an overview of available assembly aids such as lubricating greases, thread locking agents, maintenance tools, etc. (information brochure "Accessories, equipment and tools" (7Accessories_a_en)). This can be found in the online spare parts catalogue on the Festo website (http://spareparts.festo.com/xdki/data/SPC/0/PDF_SAFE/Fitting%20aids.pdf).

1.2 Pictograms used in these repair instructions

Warning

... means that non-observance may result in serious personal injury or damage to property.

Caution

... means that non-observance may result in personal injury or damage to property.

Note

... means that non-observance may result in damage to property.

Marking special information

The following pictograms mark passages in the text which contain special information.

Information:

Recommendations, tips and references to other sources of information.

Environment:

Information on the environmentally-friendly use of Festo products.

1.3 Text markings used in these repair instructions

- •Indicates activities that can be carried out in any order.

1. Indicates activities that should be carried out in the order specified.

– Indicates general lists.

Underlined, blue text indicates a cross-reference or hyperlink that you can click on in the PDF. The section marked in the text will then be displayed in the document.

1.4 Safety instructions

1.4.1 General safety information

Warning

Risk of injury from electric shock.

- The linear actuator DFPI must be de-energised and depressurised and reliably secured against unauthorised restart before starting any maintenance and repair work.

Caution

The linear actuator DFPI must only be repaired by authorised and trained persons in accordance with the specifications in the technical documentation and using original spare parts.

Installation and repair by unauthorised and untrained persons, repairs using non-original spare parts or without the technical documentation required for installation and/or repair are dangerous and therefore not permitted.

Repairs must only be carried out in conjunction with these repair instructions as well as the respective operating instructions for the device.

Instead of carrying out the repair yourself, your local Festo sales office offers the option of having the repair carried out by Festo.

Components and equipment replaced as part of a repair must be disposed of in accordance with the locally valid environmental protection regulations.

1.4.2 Intended use

The DFPI is intended to actuate linear process valves in systems, such as gate valves and shut-off valves.

1.4.3 Technical requirements

Note

The following instructions for correct and safe use must be observed:

- Observe the connection and ambient conditions specified in the technical data of the products and all the connected components. The product can only be operated in compliance with the relevant safety regulations if you comply with the limit values and load limits (see enclosed documentation).
- The linear actuator must be in faultless technical condition.
- The linear actuator must be operated in its original status, without unauthorised modifications.
- The linear actuator is designed for industrial use.
- Observe all further warnings and instructions in this documentation.

1.4.4 Qualification of specialised personnel

Caution

The linear actuator must only be repaired by authorised or trained persons in accordance with the specifications in the technical documentation and using original spare parts. Installation and repair work carried out by unauthorised and untrained persons is dangerous, and therefore not permissible.

Furthermore, repair and installation staff must be knowledgeable about the following areas:

- Installation and operation of electrical control systems
- The applicable regulations for operating safety-engineered systems
- The applicable regulations for accident prevention and occupational safety

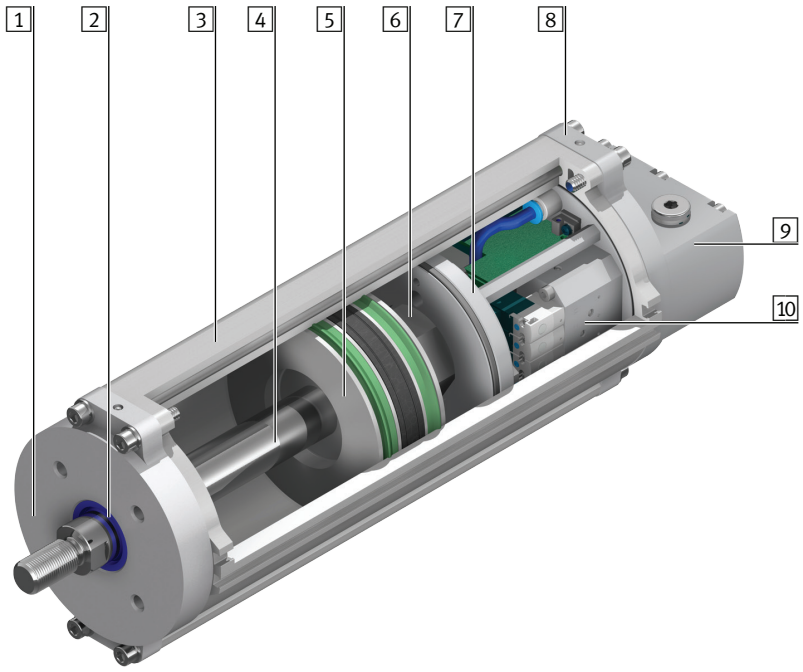
1.4.5 Standards and test values

Standards and test values that the products must comply with and fulfil can be found in the “Technical data” sections of the accompanying documentation.

2 General product description

2.1 Functional description

The DFPI-...-ND2P is a linear actuator with the functional principle of a double-acting piston for power transmission and a built-in displacement encoder. The piston moves in the cylinder barrel when a cylinder chamber is pressurised. The piston rod transmits the movements to the outside. The advanced piston rod is retracted again when the other cylinder chamber is pressurised. The linear actuator is only available in versions with a built-in displacement encoder (DFPI-...-E-P) and with an additional, built-in controller and valve block
(DFPI-...-C1V-...). On the -P connection type, the electrical and pneumatic connections are well protected from external mechanical influences by a sturdy housing.



1 Bearing cap
2 Piston rod seal
3 Cylinder barrel
4 Piston rod
5 Piston
6 Magnet holder
7 Intermediate cap
8 End cap
9 Housing (-P variants only)
10 Valve block

2.2 Types and part numbers

Type	Part number
DFPI-100-...-ND2P-E-P-G2	1808236
DFPI-100-...-ND2P-C1V-A / DFPI-100-...-ND2P-C1V-P-A	1548004 / 1548005
DFPI-125-...-ND2P-E-P-G2	1808239
DFPI-125-...-ND2P-C1V-A / DFPI-125-...-ND2P-C1V-P-A	1548020 / 1548021
DFPI-160-...-ND2P-E-P-G2	1808242
DFPI-160-...-ND2P-C1V-A / DFPI-160-...-ND2P-C1V-P-A	1548026 / 1548028
DFPI-200-...-ND2P-E-P-G2	1804245
DFPI-200-...-ND2P-C1V-A / DFPI-200-...-ND2P-C1V-P-A	1548030 / 1548032
DFPI-250-...-ND2P-E-P-G2	1808253
DFPI-250-...-ND2P-C1V-A / DFPI-250-...-ND2P-C1V-P-A	1548037 / 1548039
DFPI-320-...-ND2P-E-P-G2	1808263
DFPI-320-...-ND2P-C1V-A / DFPI-320-...-ND2P-C1V-P-A	1548041 / 1548044

A complete overview of features, accessories, type codes, technical data and dimensions for the linear actuator DFPI-...-ND2P can be found in the product catalogue or on the Festo website (www.festo.com).

2.3 Orientation designation

This diagram provides an overview of the orientation designations for the linear actuator.

Orientation:

Festo = Reference point (rating plate)

O = Top

U = Underneath

R = Right

L = Left

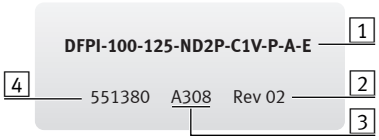
V = Front

H = Rear

2.4 Type code

The precise features of a linear actuator can be determined with the help of the rating plate. The type code is located directly beneath the Festo logo and provides the linear actuator's features, separated by hyphens (-).

Example 1:



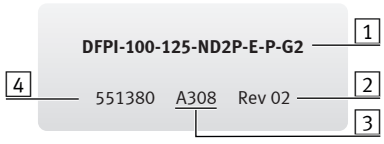
1 Type code

2 Test number

3 Serial number

4 Part number

Example 2:



1 Type code
2 Test number
3 Serial number
4 Part number

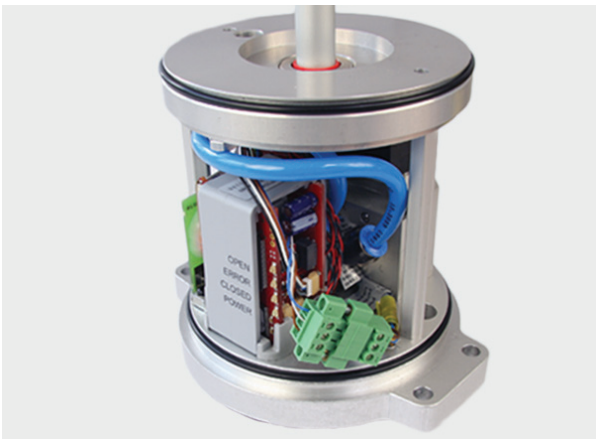
The type code on these rating plates provides the following information:

DFPI	Linear actuator of the type DFPI
100	Diameter of the installed piston
125	Stroke 125 mm
N	No cushioning
D2	Analogue displacement encoder
P-	Displacement measurement via potentiometer
C1	Control via controller 1
V	Integrated directional control valve
-P-	Protected connection type
A	Analogue feedback signal
-E-	External controller attachment position (no specification indicates internal attachment position)
G2	Second generation
-E	Retracted piston safety position (no specification indicates advanced safety position)

A list and description of all the equipment features available for the linear actuator can be found in the data sheet, which is available on the Festo website (www.festo.com).

2.5 Production series

The linear actuator type DFPI-...-ND2P is built with 2 different controllers. The repair steps differ depending on the controller, and are described separately for each controller in these repair instructions.

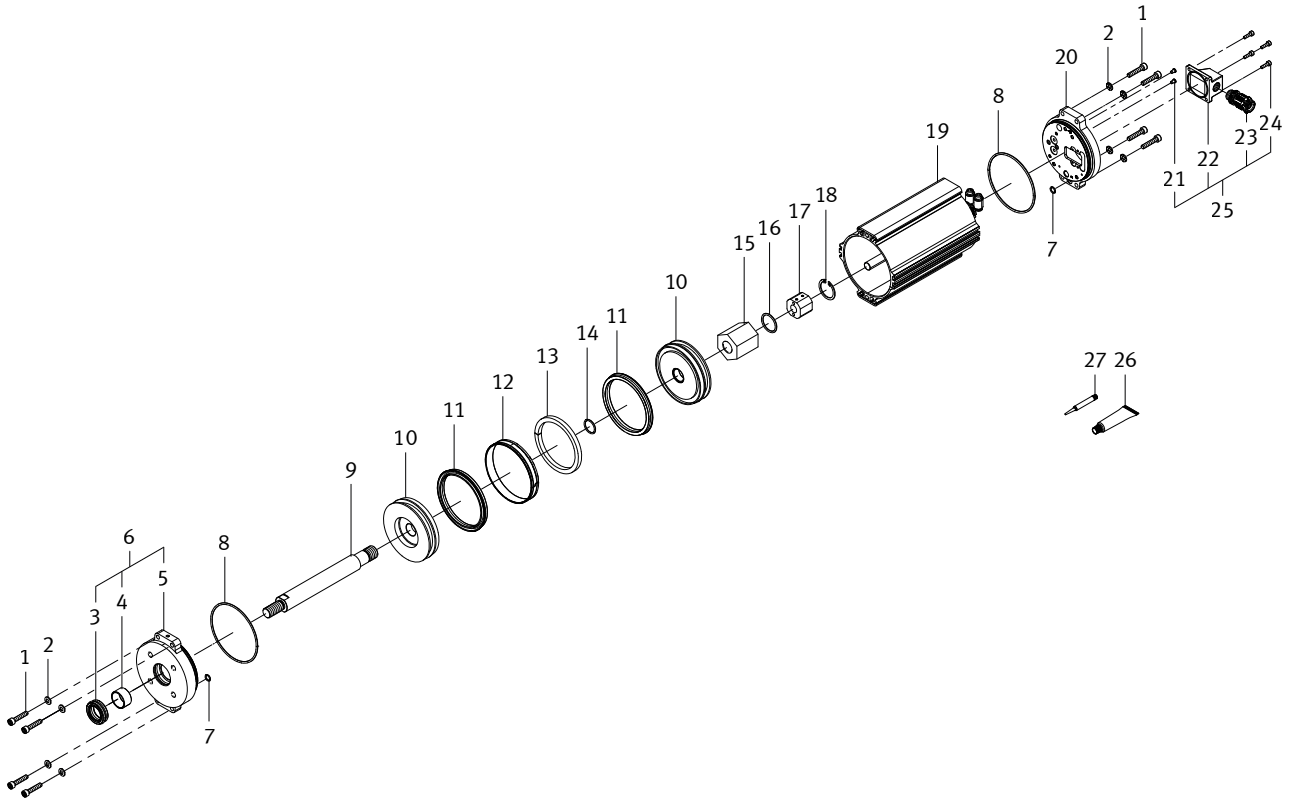


See section 4.5 „Repair steps for the end cap module“.

See section 4.7 „Repair steps for the end cap module“.

3 Components list

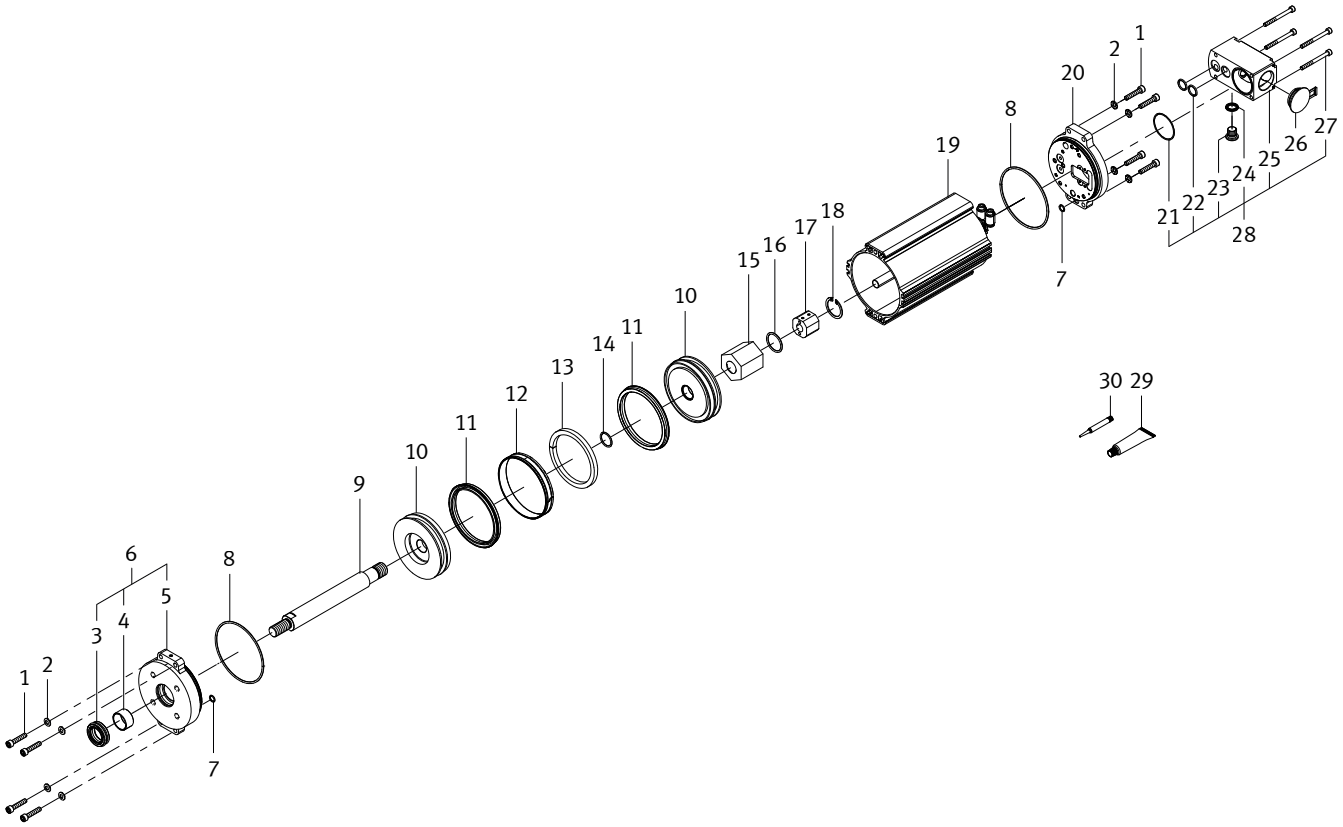
3.1 DFPI-100/125/160-...-ND2P-C1V-A



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (http://spareparts.festo.com).

Linear actuator		DFPI-100	DFPI-125	DFPI-160
Item	Designation	Type	Type	Type
1	Self-tapping screw	DIN 7500-E-M6×30-A4-70	DIN 7500-M8×30-St-IP	DIN 7500-M8×30-St-IP
2	Washer	6.1×12.2×1.2		
3	Rod seal	AS01-25-PU	32×42×11.5 PERBUNAN	32×42×11.5 PERBUNAN
4	Bearing bushing	25×28×15-2515-DP4	32×36×20-3220-DP4	32×36×20-3220-DP4
5	Bearing cap			
6	Bearing cap module			
7	O-ring	I 3601 8×1.5-N-NBR70	I 3601 B-9×1.5-N-NBR75	I 3601 B-9×1.5-N-NBR75
8	O-ring	I 3601 B-95×2.5-N-NBR75	I 3601 B-117×4-N-NBR75	I 3601 B-152×4-N-NBR75
9	Piston rod	ARA-25-×0057.5-B	ARA-32-×0075.0-B	ARA-32-×0073.5-B
10	Piston			
11	Lip seal	100×88×8.5 75FKM181327	125×110×10	160×145×10:E4
12	Sliding ring			
13	Magnetic strip			
14	O-ring	I 3601 B-20×2-N-NBR70	I 3601 B-20×2-N-NBR70	I 3601 B-25×2.5-N-NBR70
15	Magnet holder			
16	O-ring	I 3601 B-27×2.5-N-NBR75	I 3601 B-27×2.5-N-NBR75	I 3601 B-27×2.5-N-NBR75
17	Magnet			
18	Retaining ring	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2
19	Cylinder barrel			
20	End cap module			
21	Plug			
22	Flange receptacle			
23	Cable connector			
24	Socket head screw	DIN 912-M4×14-A2-70	DIN 912-M4×14-A2-70	DIN 912-M4×14-A2-70
25	Flange receptacle module			
26	Lubricating grease	LUB-KC1, silicone-free	LUB-KC1, silicone-free	LUB-KC1, silicone-free
27	Thread locking agent	LOCTITE 243	LOCTITE 243	LOCTITE 243

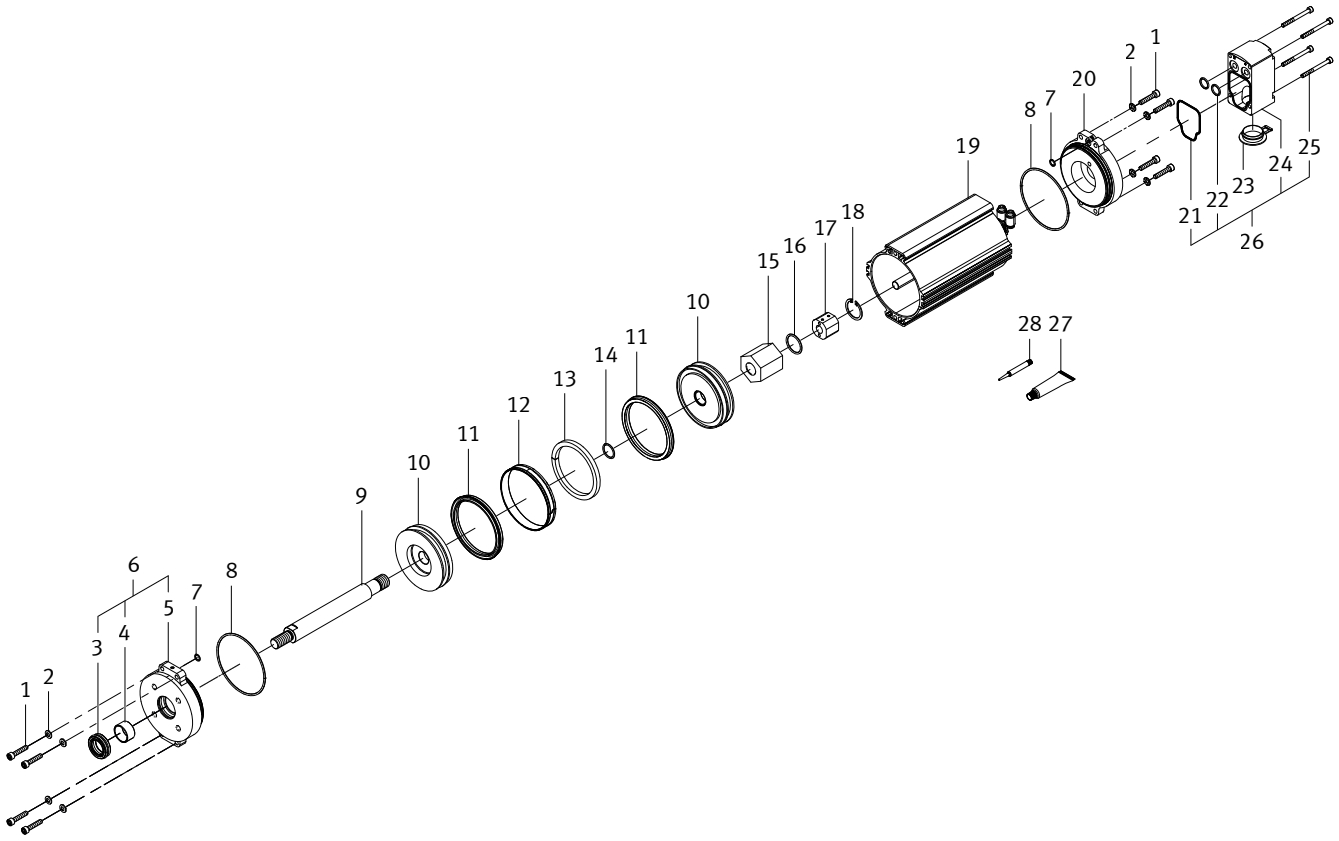
3.2 DFPI-100/125/160-...-ND2P-C1V-A-P



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (http://spareparts.festo.com).

Linear actuator		DFPI-100	DFPI-125	DFPI-160
Item	Designation	Type	Type	Type
1	Self-tapping screw	DIN 7500-E-M6×30-A4-70	DIN 7500-M8×30-St-IP	DIN 7500-M8×30-St-IP
2	Washer			
3	Rod seal	AS01-25-PU	32×42×11.5 PERBUNAN	32×42×11.5 PERBUNAN
4	Bearing bushing	25×28×15-2515-DP4	32×36×20-3220-DP4	32×36×20-3220-DP4
5	Bearing cap			
6	Bearing cap module			
7	O-ring	I 3601 8×1.5-N-NBR70	I 3601 B-9×1.5-N-NBR75	I 3601 B-9×1.5-N-NBR75
8	O-ring	I 3601 B-95×2.5-N-NBR75	I 3601 B-117×4-N-NBR75	ISO 3601 B-152×4-N-NBR75
9	Piston rod	ARA-25-×0057.5-B	ARA-32-×0075.0-B	ARA-32-×0073.5-B
10	Piston			
11	Lip seal	100×88×8.5 75FKM181327	125×110×10	160×145×10 : E 4
14	O-ring	I 3601 B-20×2-N-NBR70	I 3601 B-20×2-N-NBR70	I 3601 B-25×2.5-N-NBR70
15	Magnet holder			
16	O-ring	I 3601 B-27×2.5-N-NBR75	I 3601 B-27×2.5-N-NBR75	I 3601 B-27×2.5-N-NBR75
18	Retaining ring			
19	Cylinder barrel			
20	End cap module			
21	O-ring	I 3601 B-40×1.5-N-NBR70	I 3601 B-40×1.5-N-NBR70	I 3601 B-40×1.5-N-NBR70
22	O-ring	I 3601 B-14×2-N-NBR70	I 3601 B-14×2-N-NBR70	I 3601 B-14×2-N-NBR70
23	Blanking screw	DIN 908-G1/ 4A-A2-70	DIN 908-G1/ 4A-A2-70	DIN 908-G1/ 4A-A2-70
24	Sealing ring			
25	Housing			
26	Blanking plug			
27	Socket head screw	DIN 912-M5×55-A2-70	DIN 912-M5×55-A2-70	DIN 912-M5×55-A2-70
28	Flange receptacle module			
29	Lubricating grease	LUB-KC1, silicone-free	LUB-KC1, silicone-free	LUB-KC1, silicone-free
30	Thread locking agent	LOCTITE 243	LOCTITE 243	LOCTITE 243

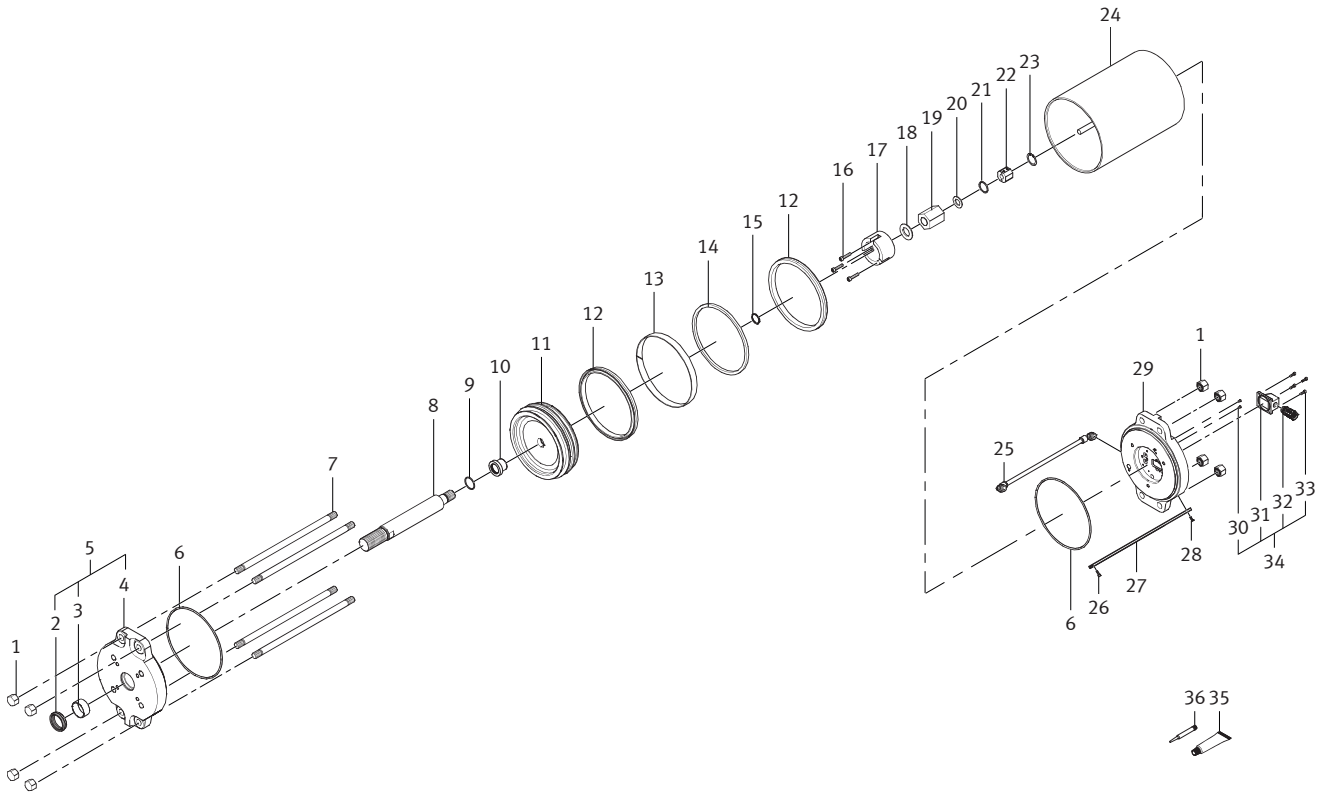
3.3 DFPI-100/125/160-...-ND2P-G2



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (http://spareparts.festo.com).

Linear actuator		DFPI-100	DFPI-125	DFPI-160
Item	Designation	Type	Type	Type
1	Self-tapping screw	DIN 7500-E-M6×30-A4-70	DIN 7500-M8×30-St-IP	DIN 7500-M8×30-St-IP
2	Washer			
3	Rod seal	AS01-25-PU	32×42×11.5 PERBUNAN	32×42×11.5 PERBUNAN
4	Bearing bushing	25×28×15-2515-DP4	32×36×20-3220-DP4	32×36×20-3220-DP4
5	Bearing cap			
6	Bearing cap module			
7	O-ring	8×1.5-N-NBR70	I 3601 B-9×1.5-N-NBR75	I 3601 B-9×1.5-N-NBR75
8	O-ring	I3601 B-95×2.5-N-NBR75	I 3601 B-117×4-N-NBR75	I 3601 B-152×4-N-NBR75
9	Piston rod	ARA-25-×0057.5-B	ARA-32-×0075.0-B	ARA-32-×0073.5-B
10	Piston			
11	Lip seal	100×88×8.5 75FKM181327	125×110×10	160×145×10:E4
12	Sliding ring			
13	Magnetic strip			
14	O-ring	I 3601 B-20×2-N-NBR70	I 3601 B-20×2-N-NBR70	I 3601 B-25×2.5-N-NBR70
15	Magnet holder			
16	O-ring			
17	Magnet			
18	Retaining ring			
19	Cylinder barrel			
20	End cap module			
21	O-ring	I 3601 B-55×1.5-N-NBR70	I 3601 B-55×1.5-N-NBR70	I 3601 B-65×1.5-N-NBR70
22	O-ring			
23	Blanking plug			
24	Flange receptacle			
25	Socket head screws			
26	Flange receptacle module			
27	Lubricating grease	LUB-KC1, silicone-free	LUB-KC1, silicone-free	LUB-KC1, silicone-free
28	Thread locking agent	LOCTITE 243	LOCTITE 243	LOCTITE 243

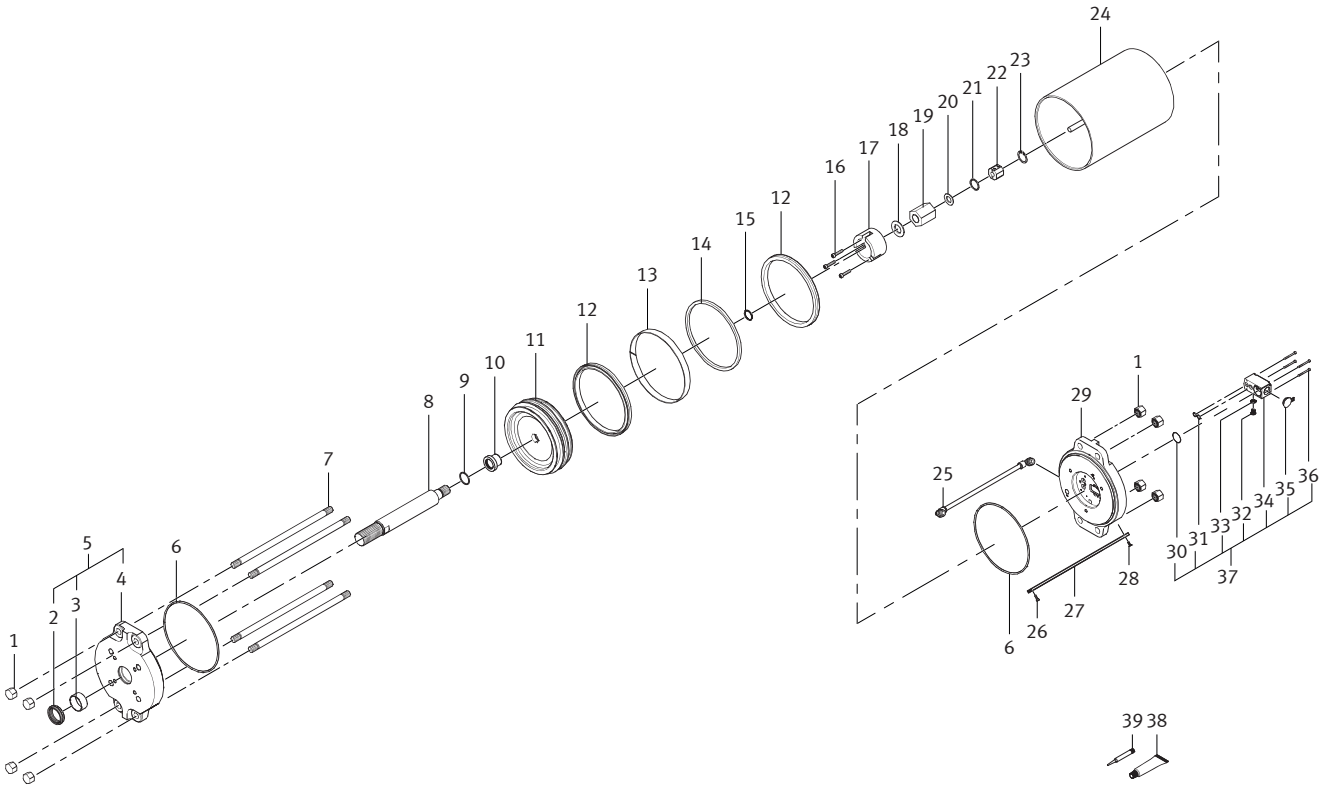
3.4 DFPI-200/250/320-...-ND2P-C1V-A



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (http://spareparts.festo.com).

Linear actuator		DFPI-200	DFPI-250	DFPI-320
Item	Designation	Type	Type	Type
1	Cap nut	F-M16-A2-70	F-M20-A2-70	F-M20-A2-70
2	Rod seal			
3	Bearing bushing			
4	Bearing cap			
5	Bearing cap module			
6	O-ring	I 3601 B-192×4-N-NBR70	I 3601 B-238×4-N-NBR70	I 3601 B-305×4.5-N-NBR75
7	Tie rod			
8	Piston rod	ARA-40-×0094.5-B	ARA-40-×0093.5-B	ARA-40-×0083.5-B
9	O-ring			
10	Socket			
11	Piston			
12	Lip seal	200×180×14 PERBUNAN	250×225×18 PERBUNAN	320×295×18 PERBUNAN
13	Guiding band			
14	Magnetic strip			
15	O-ring	I 3601 B-25×2.5-N-NBR70	I 3601 B-32×2.5-N-NBR70	I 3601 B-37×2.5-N-NBR70
16	Self-tapping screw			
17	Spacer disc			
18	Washer			
19	Magnet holder			
20	Shim	DIN 988-22×32×0.2	DIN 988-22×32×0.2	DIN 988-22×32×0.2
21	O-ring	I 3601 B-25×2.5-N-NBR75	I 3601 B-25×2.5-N-NBR75	I 3601 B-25×2.5-N-NBR75
22	Magnet			
23	Retaining ring	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2
24	Cylinder barrel			
25	Push-in L-fitting			
26	Socket head screw	DIN 912-M4×12-A2-70	DIN 912-M4×12-A2-70	DIN 912-M4×12-A2-70
27	Mounting rail			
28	Countersunk screw	DIN 7991-M4×12-A2-70	DIN 7991-M4×12-A2-70	DIN 7991-M4×12-A2-70
29	End cap			
30	Plug			
31	Flange receptacle			
32	Cable connector			
33	Socket head screw	DIN 912-M4×14-A2-70	DIN 912-M4×14-A2-70	DIN 912-M4×14-A2-70
34	Flange receptacle module			
35	Lubricating grease	LUB-KC1, silicone-free	LUB-KC1, silicone-free	LUB-KC1, silicone-free
36	Thread locking agent	LOCTITE 243	LOCTITE 243	LOCTITE 243

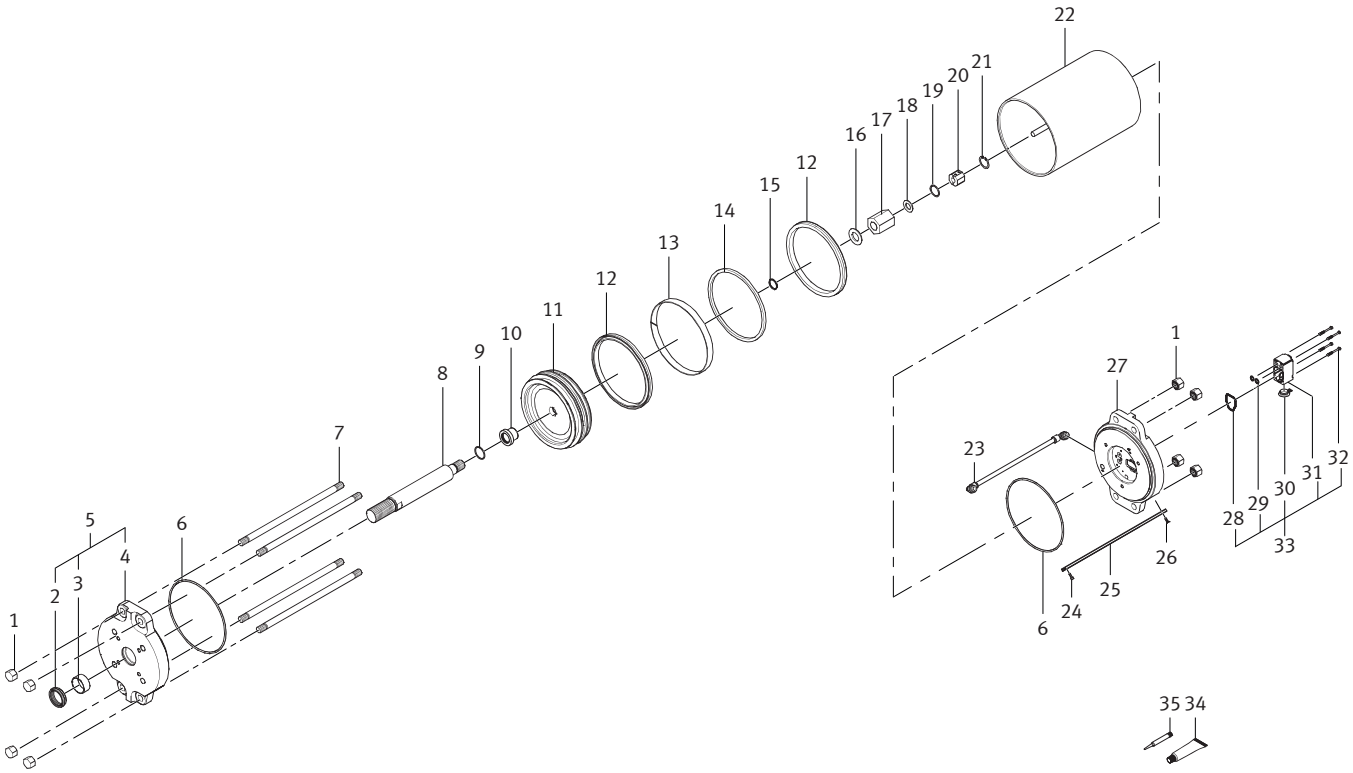
3.5 DFPI-200/250/320-...-ND2P-C1V-P-A



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (http://spareparts.festo.com).

Linear actuator		DFPI-200	DFPI-250	DFPI-320
Item	Designation	Type	Type	Type
1	Cap nut	F-M16-A2-70	F-M20-A2-70	F-M20-A2-70
2	Rod seal	40×50×11.5 PERBUNAN	40×50×11.5 PERBUNAN	40×50×11.5 PERBUNAN
3	Bearing bushing	40×44×20-4020-DP4	40×44×20-4020-DP4	40×44×20-4020-DP4
4	Bearing cap			
5	Bearing cap module			
6	O-ring	I 3601 B-192×4-N-NBR70	I 3601 B-238×4-N-NBR70	I 3601 B-305×4.5-N-NBR75
7	Tie rod			
8	Piston rod	ARA-40-×0094.5-B	ARA-40-×0093.5-B	ARA-40-×0083.5-B
9	O-ring	I 3601 B-32×2.5-N-NBR70	I 3601 B-32×2.5-N-NBR70	I 3601 B-32×2.5-N-NBR70
10	Socket			
11	Piston			
12	Lip seal	200×180×14 PERBUNAN	250×225×18 PERBUNAN	320×295×18 PERBUNAN
13	Guiding band			
14	Magnetic strip			
15	O-ring	I 3601 B-25×2.5-N-NBR70	I 3601 B-32×2.5-N-NBR70	I 3601 B-37×2.5-N-NBR70
16	Self-tapping screw	DIN 7500-E-M6×30-A4-70	DIN 7500-E-M6×30-A4-70	DIN 7500-E-M6×30-A4-70
17	Spacer disc			
18	Washer			
19	Magnet holder			
20	Shim	DIN 988-22×32×0.2	DIN 988-22×32×0.2	DIN 988-22×32×0.2
21	O-ring	I 3601 B-25×2.5-N-NBR75	I 3601 B-25×2.5-N-NBR75	I 3601 B-25×2.5-N-NBR75
22	Magnet			
23	Retaining ring	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2
24	Cylinder barrel			
25	Push-in L-fitting			
26	Socket head screw	DIN 912-M4×12-A2-70	DIN 912-M4×12-A2-70	DIN 912-M4×12-A2-70
27	Mounting rail			
28	Countersunk screw	DIN 7991-M4×12-A2-70	DIN 7991-M4×12-A2-70	DIN 7991-M4×12-A2-70
29	End cap			
30	O-ring	I 3601 B-40×1.5-N-NBR70	I 3601 B-40×1.5-N-NBR70	I 3601 B-40×1.5-N-NBR70
31	O-ring	I 3601 B-14×2-N-NBR70	I 3601 B-14×2-N-NBR70	I 3601 B-14×2-N-NBR70
32	Blanking screw	DIN 908-G1/ 4A-A2-70	DIN 908-G1/ 4A-A2-70	DIN 908-G1/ 4A-A2-70
33	Sealing ring			
34	Housing			
35	Blanking plug			
36	Socket head screw	DIN 912-M5×55-A2-70	DIN 912-M5×55-A2-70	DIN 912-M5×55-A2-70
37	Flange receptacle module			
38	Lubricating grease	LUB-KC1, silicone-free	LUB-KC1, silicone-free	LUB-KC1, silicone-free
39	Thread locking agent	LOCTITE 243	LOCTITE 243	LOCTITE 243

3.6 DFPI-200/250/320-...-ND2P-G2



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (http://spareparts.festo.com).

Linear actuator		DFPI-200	DFPI-250	DFPI-320
Item	Designation	Type	Type	Type
1	Cap nut	F-M16-A2-70	F-M20-A2-70	F-M20-A2-70
2	Rod seal	40×50×11.5 PERBUNAN	40×50×11.5 PERBUNAN	40×50×11.5 PERBUNAN
3	Bearing bushing	40×44×20-4020-DP4	40×44×20-4020-DP4	40×44×20-4020-DP4
4	Bearing cap			
5	Bearing cap module			
6	O-ring	I 3601 B-192×4-N-NBR70	I 3601 B-238×4-N-NBR70	I 3601 B-305×4.5-N-NBR75
7	Tie rod			
8	Piston rod	ARA-40-×0094.5-B	ARA-40-×0093.5-B	ARA-40-×0083.5-B
9	O-ring	I 3601 B-32×2.5-N-NBR70	I 3601 B-32×2.5-N-NBR70	I 3601 B-32×2.5-N-NBR70
10	Socket			
11	Piston			
12	Lip seal	200×180×14 PERBUNAN	250×225×18 PERBUNAN	320×295×18 PERBUNAN
13	Guiding band			
14	Magnetic strip			
15	O-ring	I 3601 B-25×2.5-N-NBR70	I 3601 B-32×2.5-N-NBR70	I 3601 B-37×2.5-N-NBR70
16	Washer			
17	Magnet holder			
18	Shim	DIN 988-22×32×0.2	DIN 988-22×32×0.2	DIN 988-22×32×0.2
19	O-ring	I 3601 B-25×2.5-N-NBR75	I 3601 B-25×2.5-N-NBR75	I 3601 B-25×2.5-N-NBR75
20	Magnet			
21	Retaining ring	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2	DIN 472-32×1.2-A2
22	Cylinder barrel			
23	Push-in L-fitting			
24	Socket head screw	DIN 912-M4×12-A2-70	DIN 912-M4×12-A2-70	DIN 912-M4×12-A2-70
25	Mounting rail			
26	Countersunk screw	DIN 7991-M4×12-A2-70	DIN 7991-M4×12-A2-70	DIN 7991-M4×12-A2-70
27	End cap			
28	O-ring	I 3601 B-69×1.5-N-NBR70	I 3601 B-69×1.5-N-NBR70	I 3601 B-69×1.5-N-NBR70
29	O-ring	I 3601 B-14×2-N-NBR70	I 3601 B-14×2-N-NBR70	I 3601 B-14×2-N-NBR70
30	Blanking plug			
31	Flange receptacle			
32	Socket head screw	DIN 912-M6×60-A2-70	DIN 912-M6×60-A2-70	DIN 912-M6×60-A2-70
33	Valve block module			
34	Lubricating grease	LUB-KC1, silicone-free	LUB-KC1, silicone-free	LUB-KC1, silicone-free
35	Thread locking agent	LOCTITE 243	LOCTITE 243	LOCTITE 243

4 Repair steps

This section describes how to dismantle, repair and assemble the linear actuator DFPI-...-ND2P. Note that the linear actuator does not need to be fully dismantled for all repair work.

Depending on the cause of the defect to be eliminated, it may be necessary to replace several components. The cause of a defect must therefore always be determined before starting a repair.

The repair should preferably be carried out on a stable and flat work surface with storage for small parts.

4.1 Preparation for dismantling

Warning

Crushing hazard due to uncontrolled advancing of piston rod!

The linear actuator must be fully de-energised and depressurised before each repair. The correct order must be observed when switching off the energy supply: **operating voltage supply** first, then **compressed air supply**.

If the compressed air supply is switched off before the operating voltage supply, there may be continuous excess pressure in a cylinder chamber in case of an error (e.g. defective valve block). The linear actuator may then advance unexpectedly during dismantling, thus crushing body parts.

- Switch off the power supply in the following order to allow the integrated valve block to vent the linear actuator:
  1. Switch off the **operating voltage** for the linear actuator.
  2. Switch off the **compressed air** for the linear actuator.

Warning

All electrical and pneumatic supply lines must be disconnected before each repair.

– Disconnect all electrical cables and compressed air tubing to the linear actuator. In addition, remove the non-return valves and fittings on the linear actuator so that any pressure present when the bearing or end cap is opened is not suddenly released, causing the cap to fly off.

Note

To prevent damage to sealing rims or guide surfaces, do not use pointed or sharp-edged assembly aids. In addition, keep your working environment tidy.

Note

Remove any attachments (e.g. end-position lock adapter on the piston rod, etc.) in accordance with the accompanying operating instructions before starting any repair work.

Only use the spare parts and assembly aids (grease, thread locking agent, etc.) provided in the set of wearing parts.

4.1.1 Disconnecting supply lines from the linear actuator

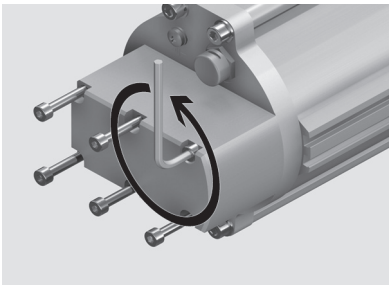
Unprotected variant

1. De-energise and depressurise the linear actuator and secure it against being restarted.
2. Unscrew the mounting screws from the flange receptacle and plug halves.
3. Separate the plug halves.

Protected variant

The housing must be dismantled and all supply lines disconnected on the protected variants (-P).

1. De-energise and depressurise the linear actuator and secure it against being restarted.
2. Unscrew the mounting screws from the housing.



The 5-pin plug for the displacement encoder must be unplugged when removing the housing from the end cap.

3. Unscrew the retaining screws from the two plug halves.
4. Separate the two plug halves.

4.2 Visual inspection

Check the linear actuator for visible damage that might impair its function, such as warping on the piston rod, deposits and scoring. The entire linear actuator must be replaced if there are signs of significant damage.

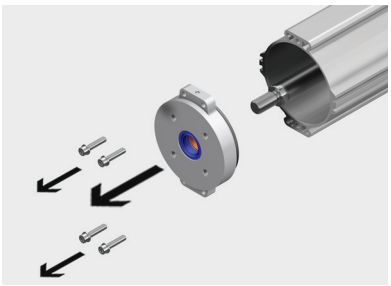
4.3 Repair steps for the bearing cap

Note

A certain amount of force is required when removing the bearing cap. Do not, under any circumstances, lever the bearing cap off the cylinder barrel using a sharp-edged object, as this could damage the O-ring or cylinder barrel.

Sizes DFPI 100/125/160:

1. Unscrew the self-tapping screws in the bearing cap.
2. Pull the bearing cap forwards, away from the cylinder barrel.



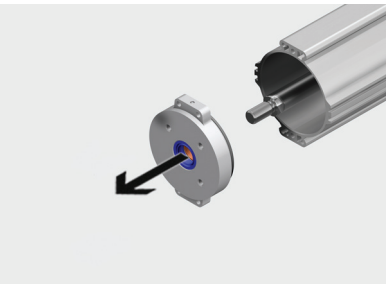
Sizes DFPI 200/250/320:

1. Pull the pneumatic tubing out of the two push-in L-fittings. To do this, push the blue ring on the push-in fitting back and pull out the pneumatic tubing.
2. Unscrew the countersunk screw and socket head screw from the mounting rail and remove the mounting rail.

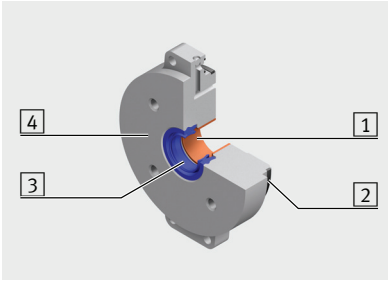
The next repair step can be skipped if the push-in L-fittings in the bearing and end caps are free from defects.

3. Unscrew the two push-in L-fittings from the bearing and end caps.

4. Remove the front cap nuts from the tie rods.
5. Remove the tie rods from the bearing and end caps from the back.
6. Pull the bearing cap forwards and off the cylinder barrel.



Design of the bearing cap:

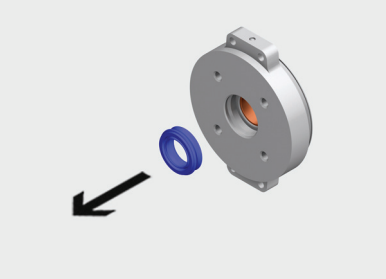


1 Plain bearing
2 O-ring
3 Piston rod seal
4 Bearing cap

4.3.1 Replacing bearing cap components

1. Remove the small O-ring from the seat in the mounting flange in the bearing cap.
2. Carefully remove the O-ring from the groove in the bearing cap.

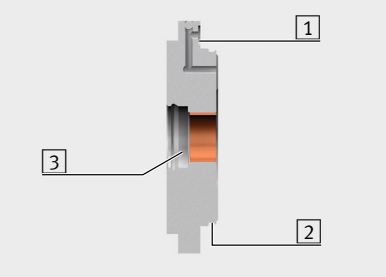
3. Carefully remove the rod seal from the bearing cap.



Note

Inspect the plain bearing in the bearing cap for visible damage that might impair the function of the bearing, such as deposits and scoring. The entire bearing cap must be replaced if there are signs of significant damage.

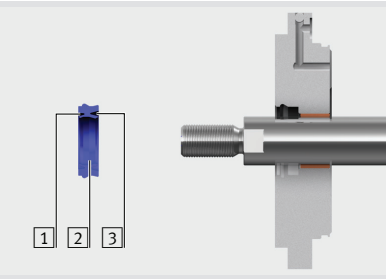
4. Clean the seats of the two O-rings [1] and [2]; see section 6.1 „Cleaning“.
5. Clean the seat of the rod seal [3]; see section 6.1 „Cleaning“.



6. Grease the rod seal as follows:

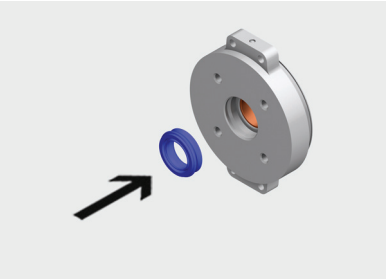
Area	Greasing
[1] Grease reservoir[1)] for piston rod	Fill 2/3 with grease
[2] External surface for bearing cap	Apply a thin film
[3] Grease reservoir[1)] for bearing	Fill 2/3 with grease

[1)] See section 6 „Cleaning and greasing“.

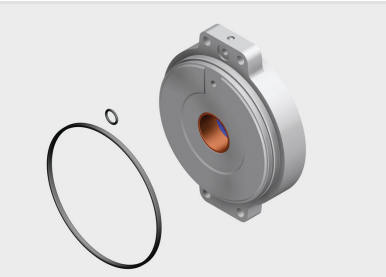


Note the mounting direction of the rod seal in the bearing cap. The groove in the front side of the rod seal faces outwards, i.e. away from the bearing bushing.

7. Insert the rod seal into the bearing cap.

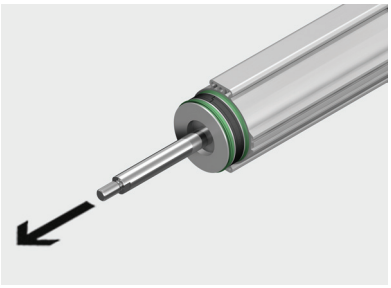


8. Apply a light coating of grease to the O-rings.
9. Insert the O-rings into their respective seats.



4.4 Repair steps for the piston

1. Carefully pull the piston rod out of the cylinder barrel.
2. Inspect the cylinder barrel and piston rod for damage.



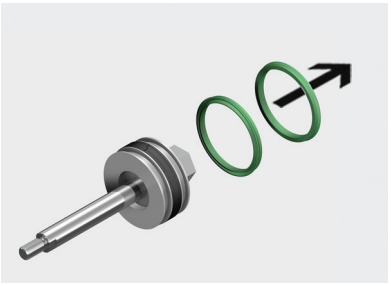
Note

If the cylinder barrel is showing signs of significant damage (especially scoring on the bearing surface), the seals of the piston can no longer provide a clean seal and the entire linear actuator must be replaced.

4.4.1 Replacing the piston components

Note

The lip rings must not, under any circumstances, be levered out of the groove using a sharp-edged object as this can damage them. Use a flat, blunt object.

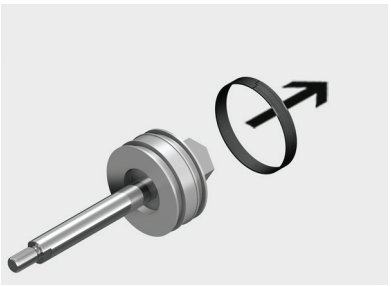


1. Carefully remove the lip rings from the seats in the piston.
2. Inspect the lip rings for damage.

Scores in the lip seals cause leaks between the lip ring and the cylinder barrel bearing surface. Damage to the sliding seal has a negative effect on the sliding characteristics of the piston.

Note

Do not, under any circumstances, bend the sliding ring open too far, as this can damage it.



3. **Slightly** open the sliding ring at the transverse groove and remove from the piston in the direction of the axis.

4.4.2 Replacing the magnet holder

If the magnetic driver (magnet) of the displacement encoder is damaged, together with the corresponding holder or the displacement encoder (linear potentiometer) that is still in the cylinder barrel, these can only be replaced using a spare parts kit. Further information can be found on the Festo website (http://spareparts.festo.com).

In this case, the magnet holder must be removed from the piston rod.

The spare parts kit contains:

- The magnet
- The magnet holder with O-ring and retaining ring
- The magnet rod with cable connector, all electrical cables and the plug

Caution

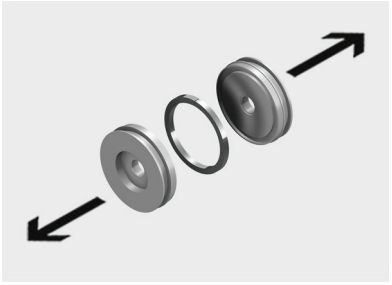
The two piston halves may come loose from the piston rod and fall off when unscrewing the magnet holder. This poses a risk of injury.

1. Counterhold the piston rod at the two flat surfaces on the opposite side of the magnet holder using an open-ended spanner.
2. Loosen the magnet holder using an open-ended spanner, and unscrew it from the piston rod.

Note

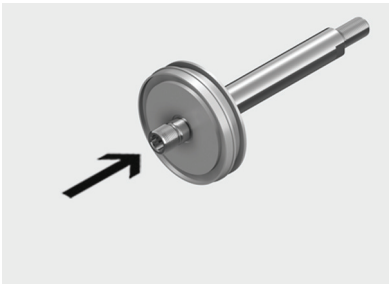
A magnetic strip is inserted between the two piston halves. This could fall off and become damaged when removing the two piston halves.

3. Remove both piston halves from the piston rod together with the magnetic strip.

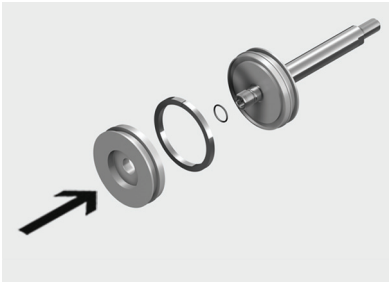


Assembling the piston

1. Place one piston half on the piston rod.

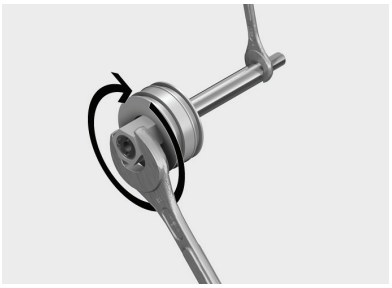


The marking on the magnetic strip must face away from the magnet holder, i.e. towards the bearing cap.



2. Apply a light coating of grease to the O-ring.
3. Insert the O-ring and magnetic strip into the respective seats in the piston half that is on the piston rod.
4. Place the second piston half on the piston rod so that the seats of the O-ring and magnetic strip are facing the other piston half.

5. Place the magnet holder on the piston rod and tighten to the appropriate torque.

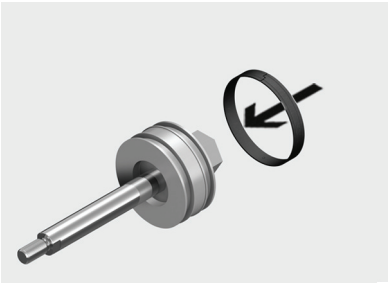


Type	Tightening torque
DFPI-100-...-ND2P-	108 Nm ±10%
DFPI-125-...-ND2P-	108 Nm ±10%
DFPI-160-...-ND2P-	108 Nm ±10%
DFPI-200-...-ND2P-	310 Nm ±10%
DFPI-250-...-ND2P-	310 Nm ±10%
DFPI-320-...-ND2P-	345 Nm ±10%

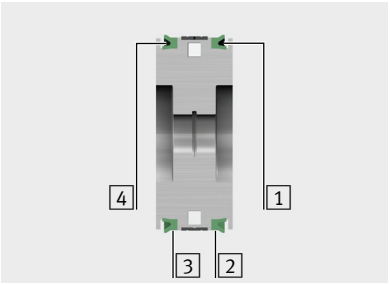
Note

The sliding ring must not be opened too far during assembly, as this can damage it.

6. Insert the sliding ring into the centre groove on the piston in axial direction. The sliding ring can be opened **slightly** at the transverse groove during this process.



The lip rings must be mounted in the correct position. If the sealing lips are mounted in the wrong direction, they will not be able to provide a clean seal for the cylinder chamber, and the function of the linear actuator will be significantly affected.

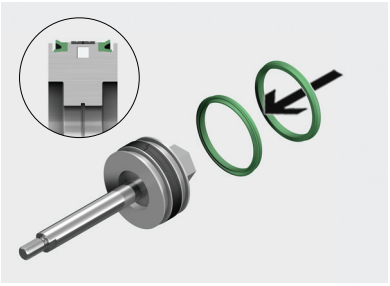


7. The lip rings must be greased as follows before mounting:

Area	Greasing
1 and 4 Grease reservoir[1)] facing away from sliding ring	Fill 2/3 with grease
2 and 3 External surface for the bearing surface of the cylinder barrel	Apply a thin film

[1)] See section 6 „Cleaning and greasing“.

8. Insert the two lip rings into the seats in the piston.

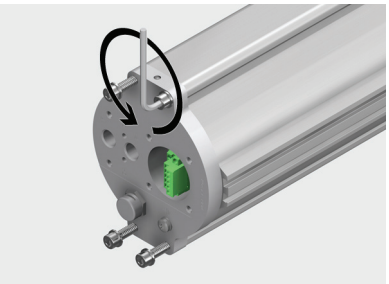


If no further repair steps are necessary, the linear actuator can be reassembled as described in section 4.9 „Assembling the linear actuator“.

4.5 Repair steps for the end cap module

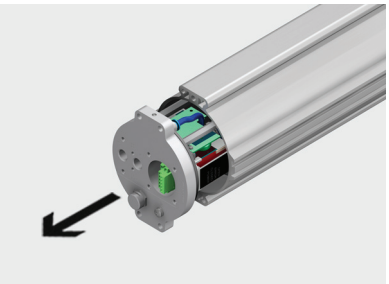
The linear actuator type DFPI-...-ND2P is built with 2 different controllers. The repair steps differ depending on the controller, and are described separately for each controller in these repair instructions; see section 2.5 „Production series“.

1. Unscrew the self-tapping screws from the end cap.



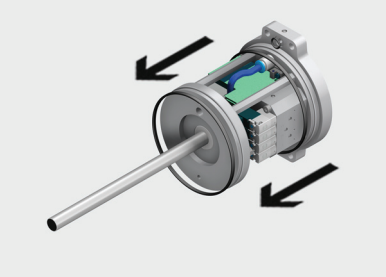
Note

A certain amount of force is required when removing the end cap module. Do not, under any circumstances, lever the end cap off the cylinder barrel using a sharp-edged object, as this could damage the O-ring or cylinder barrel.

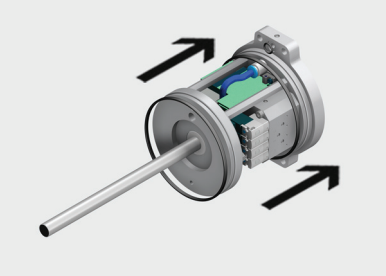


2. Carefully pull the end cap module out of the cylinder barrel.
3. Clean the cylinder barrel with a soft cloth; see section 6.1 „Cleaning“.

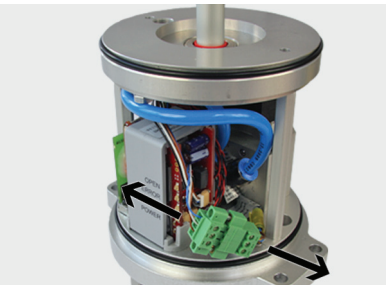
4. Remove the two O-rings from the seats of the end cap module.
5. Clean the two O-rings and seats; see section 6.1 „Cleaning“.



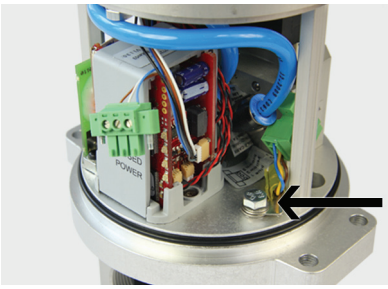
6. Apply a light coating of grease to the two O-rings of the end cap module.
7. Place the two O-rings in the seats of the end cap module.



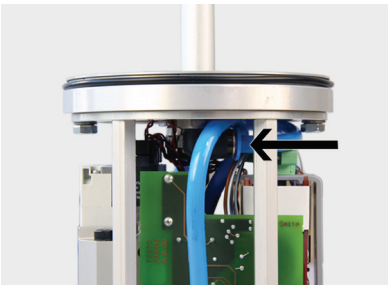
8. Unscrew the retaining screws on the sensor plug and separate the plug halves.



9. Unscrew the hexagon head screw from the earth terminal.

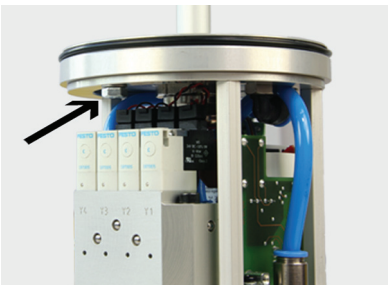


10. Pull the pneumatic tubing out of the elbow connector in the intermediate cap. To do this, push the blue ring back and pull out the pneumatic tubing.



Note

Make sure that none of the tubing or cables is damaged when removing the intermediate cap.



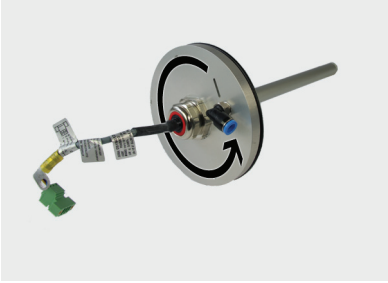
11. Unscrew the mounting screws on the intermediate cap and remove the intermediate cap from the end cap module.

4.5.1 Replacing the displacement encoder

This section can be skipped if the displacement encoder (linear potentiometer) is not faulty and does not need to be replaced.

Note

Be careful not to damage the intermediate cap with the torque spanner.



1. Detach the magnet from the displacement encoder (linear potentiometer).
2. Loosen the retaining nut on the cable connector and unscrew from the intermediate plate.
3. Remove the displacement encoder from the intermediate plate.

The front union nut must also be loosened in order to remove the cable connector from the displacement encoder (linear potentiometer).

4. Remove the front union nut on the cable connector from the displacement encoder (linear potentiometer).

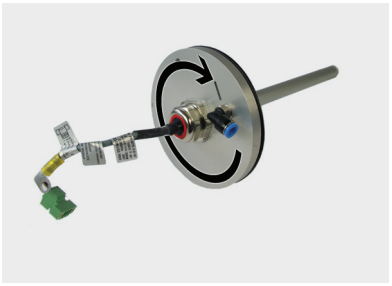
Place the cable connector on the displacement encoder (linear potentiometer) so that it is flush with the black plastic.

5. Push the new cable connector onto the displacement encoder (linear potentiometer) so that the front union nut is facing in the direction of the black plastic of the cable end.
6. Tighten the front union nut to a torque of 12 Nm ±10%.

7. Insert the new displacement encoder in the intermediate plate.

Note

Be careful not to damage the intermediate cap or the push-in fitting with the torque spanner.



8. Screw the cable connector into the intermediate plate and tighten to a torque of 15 Nm ±10%.

4.5.2 Replacing the controller with electronic function module

Note

The controller and electronic function module contain electrostatically sensitive components. Electrostatic discharges caused by improper handling or lack of earthing can damage the internal electronics. The following points should therefore be taken into consideration:

- Observe the specifications for handling electrostatically sensitive devices.
- Discharge yourself of static electricity before installing or removing modules in order to protect them.

This section can be skipped if the controller is not faulty and does not need to be replaced.

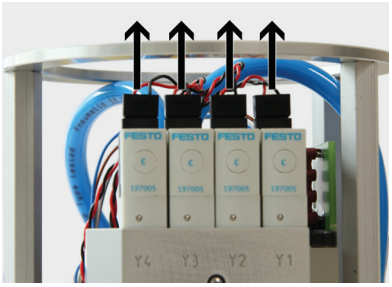
Removing the controller

The valve cable assembly and the connections on the valve block are numbered.

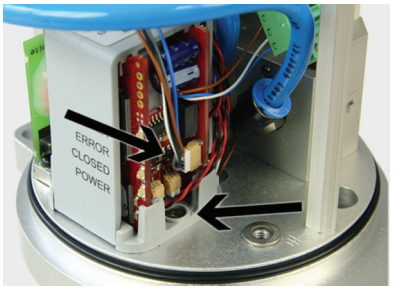
If the numbers are no longer legible, mark the pilot lines before detaching them from the valve block.

When connecting, make sure that the numbers on the pilot lines match the numbers of the connections on the valve block.

1. Detach the valve cable assembly from the valve block.



2. Disconnect the plug connector from the controller.
3. Unscrew the mounting screws of the controller and remove the controller.



4.5.3 Replacing the electronic function module

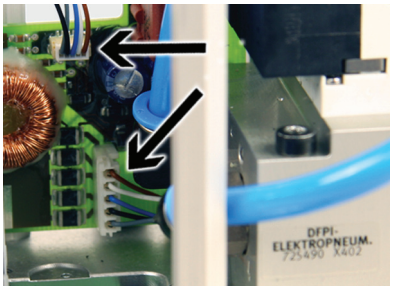
The following repair steps can be skipped if the electronic function module does not need to be replaced.

Removing the electronic function module

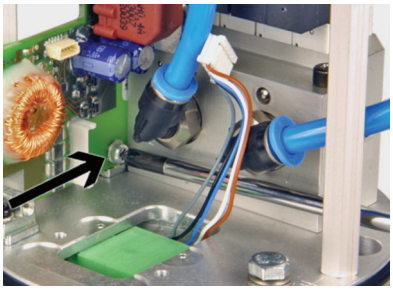
Note

When removing the two plugs from the printed circuit board, make sure that the lines do not kink and the pins on the printed circuit board are not bent or torn off.

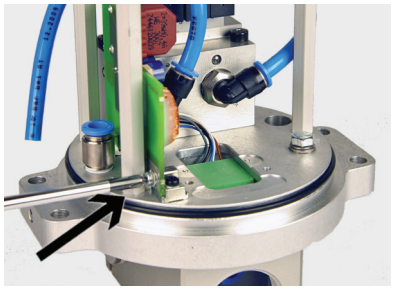
1. Disconnect the top and bottom plugs.



2. Unscrew the internal mounting screw.



3. Unscrew the external mounting screw.
4. Remove the electronic function module.

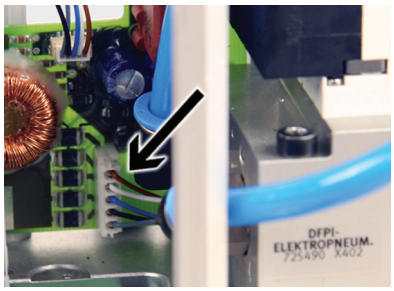


Installing the electronic function module

1. Position the electronic function module in the correct position relative to the two retainers.
2. Fit the retaining washer on the two mounting screws so that the washer teeth are facing away from the screw head.
3. Screw in both mounting screws to a tightening torque of 0.5 Nm ±10%.
4. Plug in the bottom plug connector.

The colours of the individual wires in the cable harness are as follows from top to bottom (end cap facing downwards):

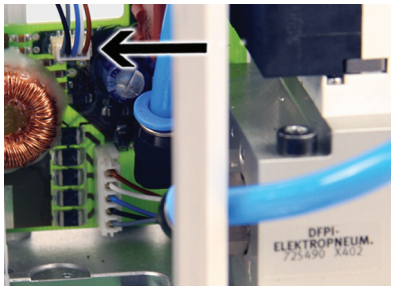
Brown
White
Blue
Black
Grey



5. Plug in the top plug connector.

The colours of the individual wires in the cable harness are as follows from left to right (end cap facing downwards):

Grey	**Black**	**Blue**	**White**	**Brown**

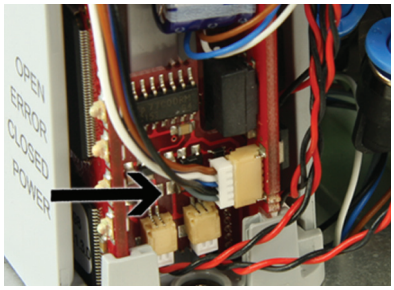


Installing the controller

Note

When installing the controller, make sure that there are no kinks or tension in the tubing or cables. Kinked lines are susceptible to premature faults and will result in failure of the linear actuator.

1. Plug the plug connector into the controller.

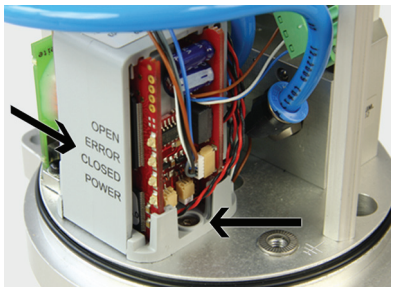


The colours of the individual wires in the cable harness are as follows from top to bottom (end cap facing downwards):

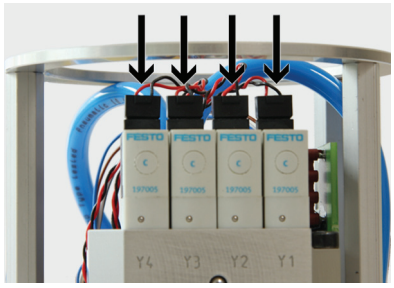
Brown
White
Blue
Black
Grey

The wiring harness plug is protected against incorrect polarity and can only be inserted in one direction. When inserted correctly, the pin contacts of the plug will be facing inwards, and will not be visible from the outside.

2. Insert the controller into the end cap module so that the labels "OPEN", "ERROR", "CLOSED" and "POWER" can be read from the outside.
3. Screw in the mounting screws to a tightening torque of 0.8 Nm.



4. Plug the valve cable assembly into the valve block in accordance with the labels "Y1", "Y2", "Y3" and "Y4".



4.5.4 Replacing the valve block

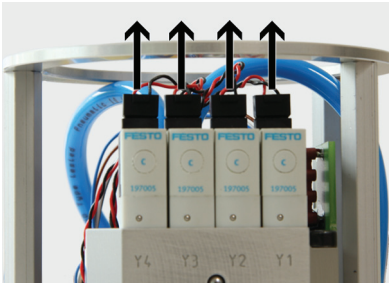
The valve block, controller and electronic function module make up the control unit of the linear actuator. The four individual valves form a single unit together with the valve base, and move the linear actuator to the required travel position. This enables additional travel to intermediate positions within the travel range.

The valve cable assembly and the connections on the valve block are numbered.

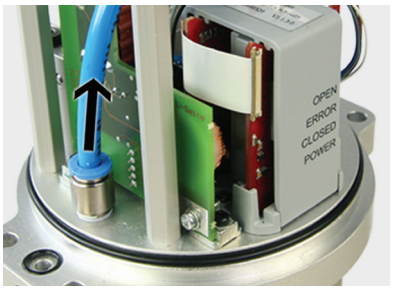
If the numbers are no longer legible, mark the pilot lines before detaching them from the valve block.

When connecting, make sure that the numbers on the pilot lines match the numbers of the connections on the valve block.

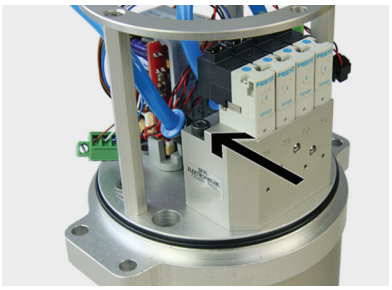
1. Detach the valve cable assembly from the valve block.



2. Pull the pneumatic tubing out of the push-in connector in the end cap.
   To do this, push the blue ring on the push-in fitting down and pull out the pneumatic tubing.



3. Unscrew the two mounting screws from the valve block and carefully remove the valve block.



There are O-rings between the valve block and end cap for sealing off the compressed air. Make sure that these are not lost when removing the valve block.

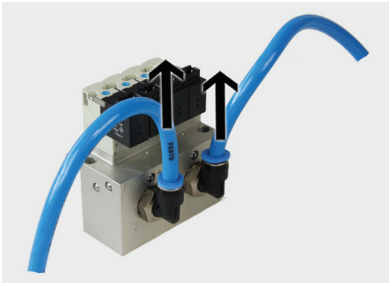
If the pneumatic tubing is damaged, they will also need to be replaced. The lengths and diameters can be found in the table.

Length and diameter of pneumatic tubing:

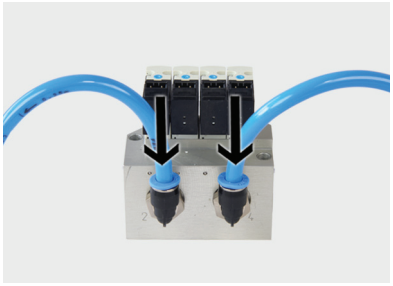
Type	Tubing diameter in mm	Length in mm for pilot line 2	Length in mm for pilot line 4
DFPI-100-...-ND2P-...-	6 mm	165 mm ±3 mm	165 mm ±3 mm
DFPI-125-...-ND2P-...-	6 mm	300 mm ±3 mm	300 mm ±3 mm
DFPI-160-...-ND2P-...-	6 mm	200 mm ±3 mm	200 mm ±3 mm
DFPI-200-...-ND2P-...-	6 mm	250 mm ±3 mm	250 mm ±3 mm
DFPI-250-...-ND2P-...-	6 mm	250 mm ±3 mm	250 mm ±3 mm
DFPI-320-...-ND2P-...-	6 mm	300 mm ±3 mm	300 mm ±3 mm

Pneumatic tubing can be cut using sturdy scissors or a sharp knife.

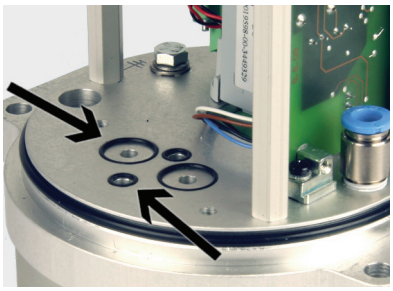
4. Pull the pneumatic tubing out of the push-in connectors in the valve block by pushing the blue ring on the push-in fitting down, then pulling out the pneumatic tubing.



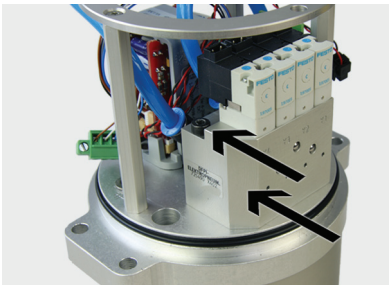
5. Insert the new pneumatic tubing into the push-in connectors in the valve block.



6. Apply a light coating of grease to all four O-rings for sealing the compressed air between the valve block and end cap, and insert into the end cap.



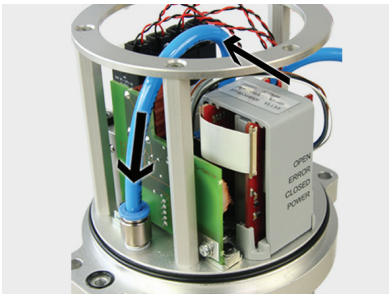
7. Insert the new valve block so that the chamfers are facing outwards.
8. Screw in the mounting screws to a tightening torque of 1.4 Nm.



9. Plug the valve cable assembly into the valve block so that the pilot line numbers correspond with the solenoid valve numbers.
10. Plug the pneumatic tubing from pilot port **2** on the valve block into the push-in connector on the end cap. When doing so, thread the pneumatic tubing through the electronic function module in an arc.

With DFPI-...-ND2P-...-E (piston rod retracting):

- Plug the pneumatic tubing from pilot port **4** on the valve block into the push-in connector on the end cap. When doing so, thread the pneumatic tubing through the electronic function module in an arc.

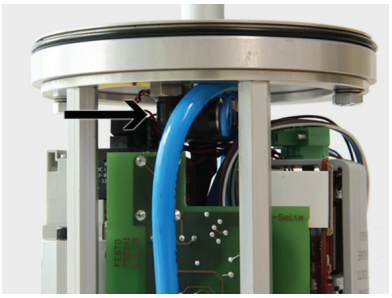


4.6 Fitting the end cap module

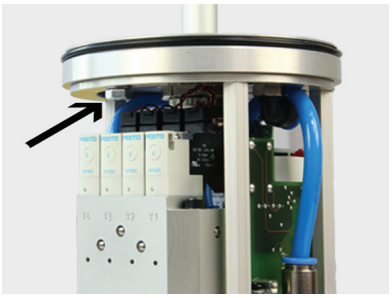
Note

When installing the end cap module, make sure that there are no kinks or tension in the tubing or cables. Kinked tubing or cables are susceptible to premature faults and will result in failure of the linear actuator.

1. Place the intermediate cap together with the installed displacement encoder on the thrust ring so that the push-in connector in the intermediate cap is over the electronic function module.
2. Pass the connecting cable of the displacement encoder downwards between pilot lines 2 and 4 in the valve block.

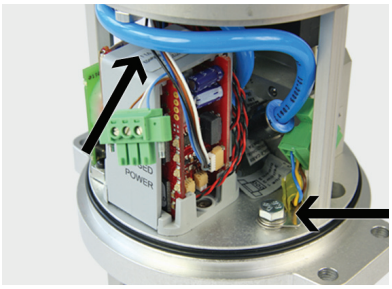


3. Apply a light coating of LOCTITE 243 thread locking agent to the two mounting screws in the intermediate cap and tighten to the appropriate torque.



Type	Tightening torque
DFPI-100-...-ND2P-...-	1.2 Nm ±10%
DFPI-125-...-ND2P-...-	1.2 Nm ±10%
DFPI-160-...-ND2P-...-	1.2 Nm ±10%
DFPI-200-...-ND2P-...-	3.0 Nm ±10%
DFPI-250-...-ND2P-...-	3.0 Nm ±10%
DFPI-320-...-ND2P-...-	3.0 Nm ±10%

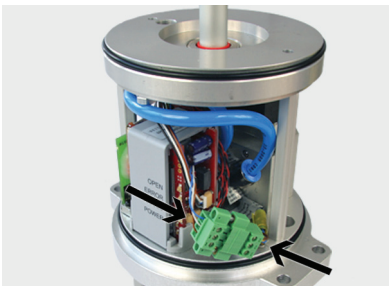
4. Plug the pneumatic tubing from pilot port 4 on the valve block into the push-in connector on the intermediate cap. Thread the pneumatic tubing through the controller in an arc.



With DFPI-...-ND2P-...-E (piston rod retracting):

1. Plug the pneumatic tubing from pilot port **2** on the valve block into the push-in connector on the intermediate cap. Thread the pneumatic tubing through the controller in an arc.
2. Screw the hexagon head screw on the earth terminal into the end cap and tighten to a torque of 2.7 Nm ±10%.

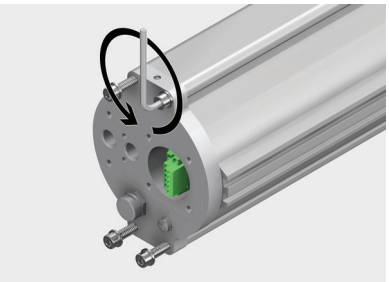
5. Push the two halves of the sensor plug together.
6. Tighten the retaining screws to a torque of 0.5 Nm ±10%.



4.7 Repair steps for the end cap module

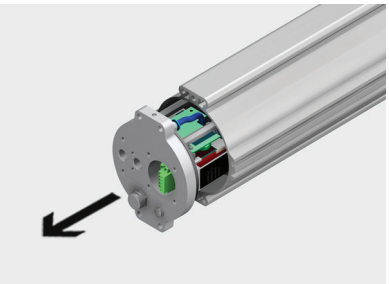
The linear actuator type DFPI-...-ND2P is built with 2 different controllers. The repair steps differ depending on the controller, and are described separately for each controller in these repair instructions; see section 2.5 „Production series“.

1. Unscrew the self-tapping screws from the end cap.



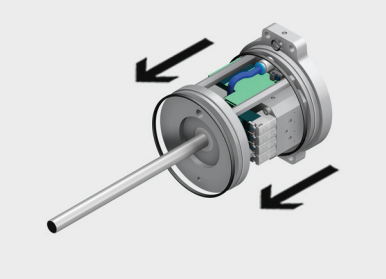
Note

A certain amount of force is required when removing the end cap. Do not, under any circumstances, lever the end cap off the cylinder barrel using a sharp-edged object, as this could damage the O-ring or cylinder barrel.



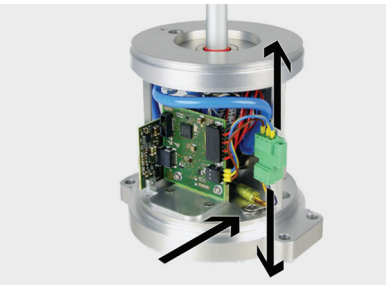
2. Carefully pull the end cap out of the cylinder barrel.
3. Clean the cylinder barrel with a soft cloth; see section 6.1 „Cleaning“.

4. Remove the two O-rings from the seats of the end cap module.
5. Clean the two O-rings and seats; see section 6.1 „Cleaning“.

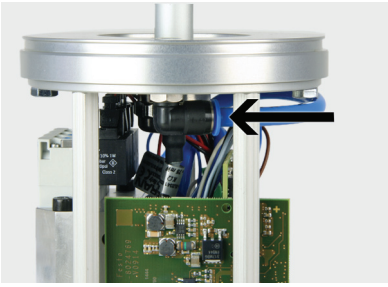


6. Disconnect the sensor plug from the hexagonal column.

7. Unscrew the hexagon head screw from the earth terminal.
8. Unscrew the retaining screws on the sensor plug.
9. Separate the plug halves.



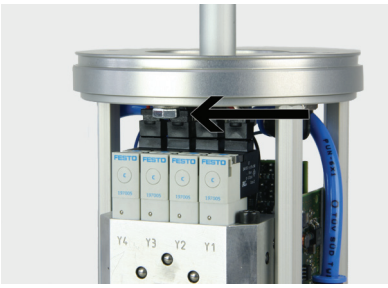
10. Pull the pneumatic tubing out of the elbow connector in the intermediate cap. To do this, push the blue ring back and pull out the pneumatic tubing.



Note

Make sure that none of the tubing or cables is damaged when removing the intermediate cap.

11. Unscrew the mounting screws on the intermediate cap and remove the intermediate cap from the end cap module.



4.7.1 Replacing the displacement encoder

The procedure for removing the displacement encoder (linear potentiometer) is described in section 4.5.1 „Replacing the displacement encoder“.

4.7.2 Replacing the driver board with the input board

This section can be skipped if the driver and input boards are not faulty and do not need to be replaced.

Removing the driver board with the input board

Note

The driver and input boards contain electrostatically sensitive components. Electrostatic discharges caused by incorrect handling or lack of earthing can damage the internal electronics. The following points should therefore be taken into consideration:

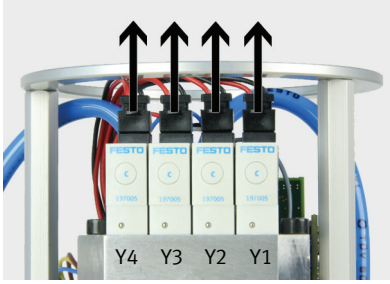
- Observe the specifications for handling electrostatically sensitive devices.
- Discharge yourself of static electricity before installing or removing modules in order to protect them.

The valve cable assembly and the connections on the valve block are numbered.

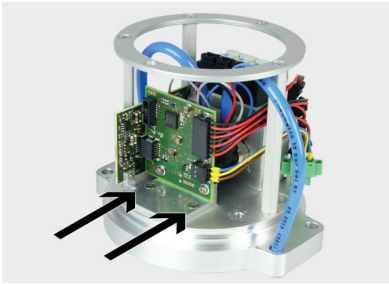
If the numbers are no longer legible, mark the pilot lines before detaching them from the valve block.

When connecting, make sure that the numbers on the pilot lines match the numbers of the connections on the valve block.

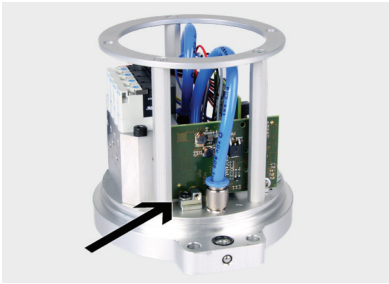
1. Detach the valve cable assembly from the valve block.



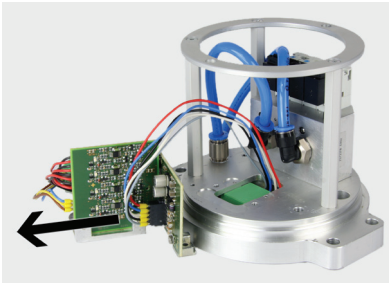
2. Unscrew the mounting screws on the retainer.



3. Unscrew the mounting screw on the mounting bracket.

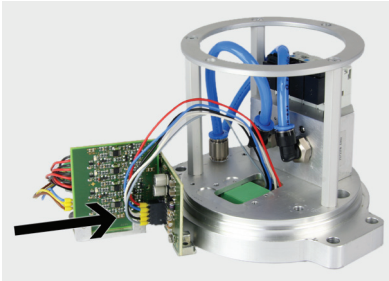


4. Remove the controller.
5. Pull the customer plug assembly out of the input board. To do this, push a screwdriver into the recesses behind the lines and use it to lever out the lines.



Installing the driver board with the input board

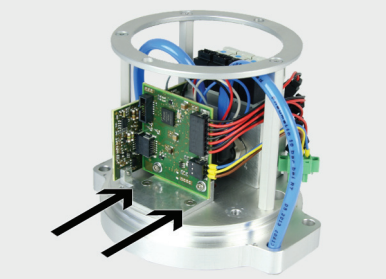
1. Plug the customer plug assembly into the input board.



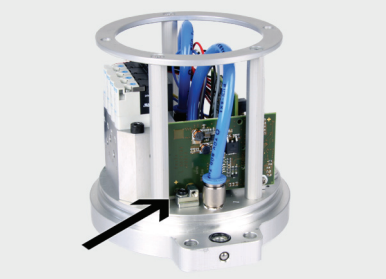
The colours of the individual wires in the customer plug assembly are as follows from top to bottom (end cap facing downwards):

Red
Blue
White
Black
Grey

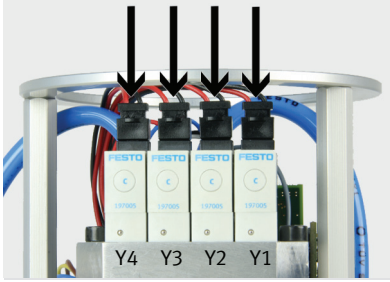
2. Insert a new controller.
3. Screw in the retainer mounting screws to a tightening torque of 0.8 Nm ±10%.



4. Place the scratch plate on the self-tapping screw and insert into the mounting bracket.
5. Screw the self-tapping screw into the end cap and tighten to a torque of 0.7 Nm ±10%.



6. Plug the valve cable assembly into the valve block in accordance with the labels Y1, Y2, Y3 and Y4.



4.7.3 Replacing the valve block

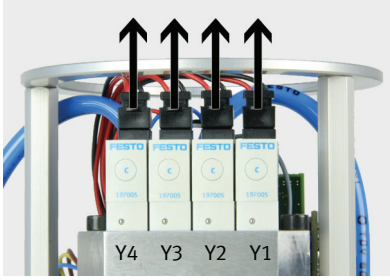
The valve block and controller make up the control unit of the linear actuator. The four individual valves together with the valve base form a single unit, and move the linear actuator to the required travel position. This enables additional travel to intermediate positions within the travel range.

The valve cable assembly and the connections on the valve block are numbered.

If the numbers are no longer legible, mark the pilot lines before detaching them from the valve block.

When connecting, make sure that the numbers on the pilot lines match the numbers of the connections on the valve block.

1. Detach the valve cable assembly from the valve block.



2. Pull the pneumatic tubing out of the push-in connector in the end cap. To do this, push the blue ring on the push-in fitting back and pull out the pneumatic tubing.

3. Unscrew the two mounting screws from the valve block and carefully remove the valve block.

There are O-rings between the valve block and end cap for sealing off the compressed air. Make sure that these are not lost when removing the valve block.

If the pneumatic tubing is damaged, it will also need to be replaced. The lengths and diameters can be found in the table.

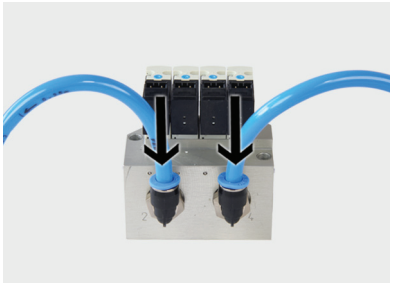
Length and diameter of pneumatic tubing:

Type	Tubing diameter in mm	Length in mm for pilot line 2	Length in mm for pilot line 4
DFPI-100-...-ND2P-...-	6 mm	165 mm ±3 mm	165 mm ±3 mm
DFPI-125-...-ND2P-...-	6 mm	300 mm ±3 mm	300 mm ±3 mm
DFPI-160-...-ND2P-...-	6 mm	200 mm ±3 mm	200 mm ±3 mm
DFPI-200-...-ND2P-...-	6 mm	250 mm ±3 mm	250 mm ±3 mm
DFPI-250-...-ND2P-...-	6 mm	250 mm ±3 mm	250 mm ±3 mm
DFPI-320-...-ND2P-...-	6 mm	300 mm ±3 mm	300 mm ±3 mm

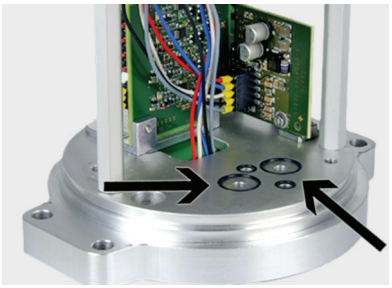
Pneumatic tubing can be cut using sturdy scissors or a sharp knife.

4. Pull the pneumatic tubing out of the push-in connectors in the valve block by pushing the blue ring on the push-in fitting down, then pulling out the pneumatic tubing.

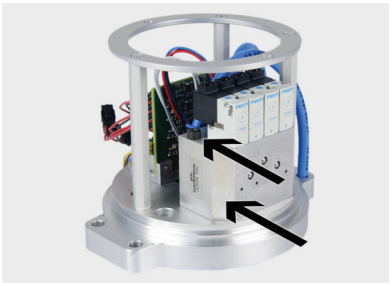
5. Insert the new pneumatic tubing into the push-in connectors in the valve block.



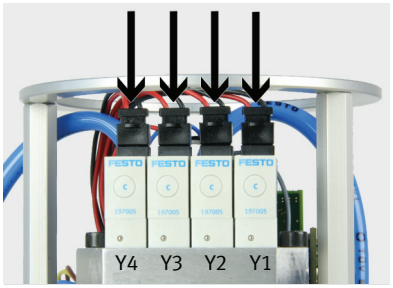
6. Apply a light coating of grease to all four O-rings for sealing the compressed air between the valve block and end cap, and insert into the end cap.



7. Insert the new valve block so that the chamfers are facing outwards.
8. Screw in the mounting screws to a tightening torque of 1.4 Nm.



9. Plug the valve cable assembly into the valve block in accordance with the labels Y1, Y2, Y3 and Y4.



10. Plug the pneumatic tubing from pilot port **2** on the valve block into the push-in connector on the end cap. When doing so, thread the pneumatic tubing through the input board in an arc.

With DFPI-...-ND2P-...-E (piston rod retracting):

- Plug the pneumatic tubing from pilot port **4** on the valve block into the push-in connector on the end cap. When doing so, thread the pneumatic tubing through the input board in an arc.

4.8 Fitting the end cap module

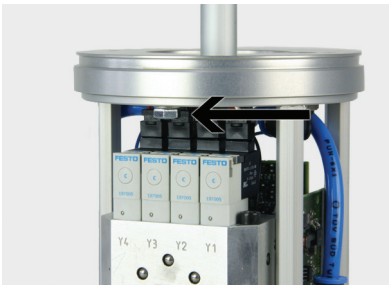
Note

When installing the end cap module, make sure that there are no kinks or tension in the tubing and cables. Kinked tubing and cables are susceptible to premature faults and will result in failure of the linear actuator.

1. Place the intermediate cap together with the installed displacement encoder on the thrust ring so that the push-in connector in the intermediate cap is over the input printed circuit board.
2. Pass the connecting cable of the displacement encoder downwards between pilot lines 2 and 4 in the valve block.

3. Apply a light coating of LOCTITE 243 to the two mounting screws in the intermediate cap and tighten to the appropriate torque.

Type	Tightening torque
DFPI-100-...-ND2P-...-	1.2 Nm ±10%
DFPI-125-...-ND2P-...-	1.2 Nm ±10%
DFPI-160-...-ND2P-...-	1.2 Nm ±10%
DFPI-200-...-ND2P-...-	3.0 Nm ±10%
DFPI-250-...-ND2P-...-	3.0 Nm ±10%
DFPI-320-...-ND2P-...-	3.0 Nm ±10%

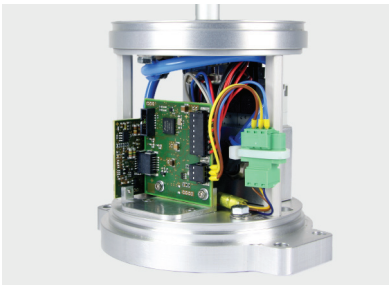


4. Plug the pneumatic tubing from pilot port 4 on the valve block into the push-in connector on the intermediate cap. Thread the pneumatic tubing through the controller in an arc.

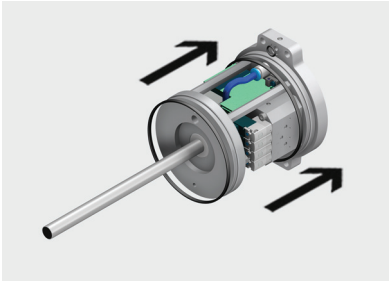
With DFPI-...-ND2P-...-E (piston rod retracting):

- Plug the pneumatic tube from pilot port **2** on the valve block into the push-in connector on the intermediate cap. Thread it through the controller in an arc.

5. Screw in the hexagon head screws on the earth terminal to a tightening torque of 2.7 Nm ±10%.
6. Push the two halves of the sensor plug together.
7. Tighten the retaining screws on the sensor plug to a torque of 2.7 Nm ±10%.

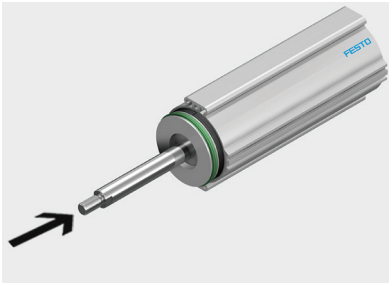


8. Apply a light coating of grease to the two O-rings of the end cap module; see section 6.2 „Greasing“.
9. Place the two O-rings in the seats of the end cap module.



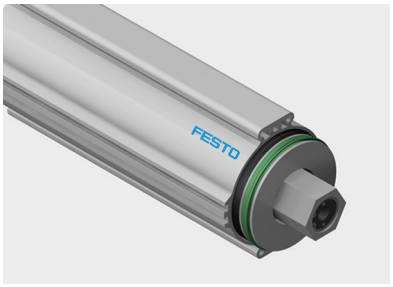
4.9 Assembling the linear actuator

1. Apply a light coating of grease to the outside of the two lip rings, the sliding ring and the piston rod.
2. Insert the piston into the cylinder barrel so that the thread of the piston rod is opposite the Festo logo and facing away from it.

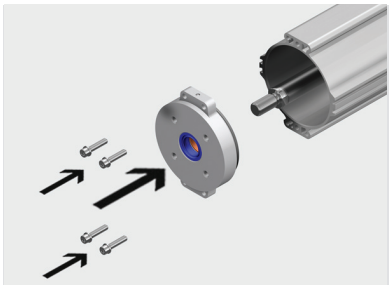


A flat, blunt object can be used as an assembly aid so that the first lip seal does not fold back when inserting the piston.

3. Push the piston far enough into the cylinder barrel that the first lip seal protrudes slightly at the other end of the barrel.
4. Pull the piston rod back again until the piston is sitting fully in the cylinder barrel.



5. Apply a light coating of grease to the O-ring of the bearing cap.



Caution

There is a danger of crushing when pressing in the bearing cap. Make sure that you do not put your hand between the cylinder barrel and bearing cap.

Note

When placing the bearing cap on the cylinder barrel, make sure that it is not tilted, as this can damage the O-ring.

6. Place the bearing cap on the cylinder barrel so that the piston rod seal is facing outwards and the plain bearing is facing inwards.

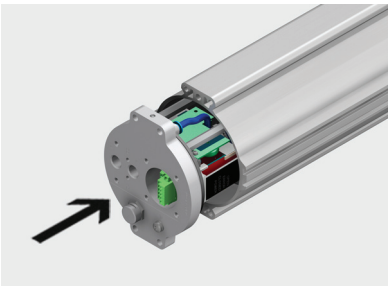
Sizes DFPI 100/125/160:

1. Apply LOCTITE 243 to the self-tapping screws on the bearing cap.
2. Tighten the self-tapping screws on the bearing cap to the appropriate torque.

Type	Tightening torque
DFPI-100-...-ND2P-...-	12 Nm ±10%
DFPI-125-...-ND2P-...-	25 Nm ±10%
DFPI-160-...-ND2P-...-	25 Nm ±10%

Caution

There is a danger of crushing when pressing in the end cap module. Make sure that you do not put your hand between the cylinder barrel and end cap.



Note

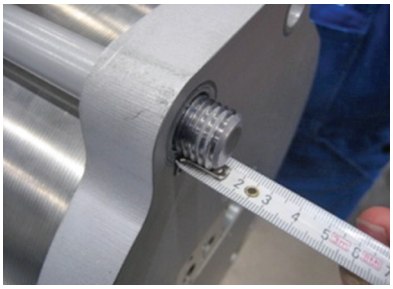
When assembling the end cap module on the cylinder barrel, take care to ensure that the linear potentiometer of the displacement encoder is not damaged. It must not be kinked or compressed under any circumstances.

All sizes

7. Apply a light coating of grease to the outside of the linear potentiometer of the displacement encoder.
8. Insert the linear potentiometer of the displacement encoder into the longitudinal hole of the piston and place the end cap on the cylinder barrel so that it is in full contact with the cylinder barrel.

Sizes DFPI 200/250/320:

1. Push the tie rod through the holes in the end cap and bearing cap.



When screwing the cap nuts onto the tie rods, take care to ensure that the tie rods protrude by roughly the same amount on both sides.

2. Apply a light coating of LOCTITE 243 to the tie rods and screw the cap nuts onto both sides of the respective tie rods.
3. Tighten the cap nuts to a torque of 80 Nm ±10%.

This work step can be skipped if the two push-in L-fittings have not been removed.

4. Screw the two push-in L-fittings into the bearing and end caps and tighten to a torque of 22.5 Nm ±10%.

5. Screw the countersunk screw on the mounting rail into the end cap and tighten to a torque of 2.7 Nm ±10%. Position the mounting rail so that the groove is facing outwards.
6. Screw the socket head screw on the mounting rail into the bearing cap and tighten to a torque of 2.7 Nm ±10%.

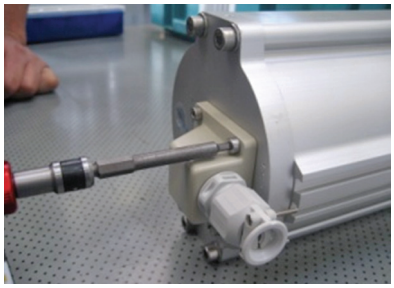
7. Plug the pneumatic tubing into both push-in L-connectors.

4.9.1 Connecting supply lines to the linear actuator

Unprotected variant

1. Push the two plug halves of the displacement encoder together.
2. Tighten the retaining screws on the two plug halves to a torque of 0.5 Nm ±10%.

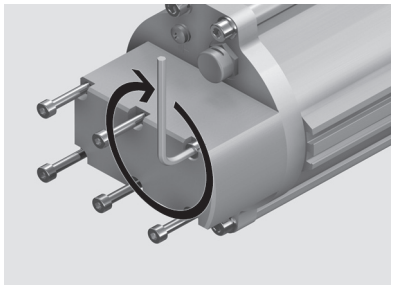
3. Tighten the mounting screws on the flange receptacle to a torque of 0.3 Nm ±10%.



Protected variant

1. Push the two plug halves of the displacement encoder together.
2. Tighten the retaining screws on the two plug halves to a torque of 0.5 Nm ±10%.

3. Apply a thin film of LOCTITE 243 to the mounting screws in the housing.
4. Tighten the mounting screws to a torque of 2.7 ±10% Nm.



5 Troubleshooting

This chapter provides concise information about various fault symptoms, their possible causes and how to fix them.

5.1 DFPI-ND2P-C1V-...-A

Fault symptom	Operating mode	Possible cause	Remedial measure(s)
Piston rod does not retract or advance	Initialisation	No compressed air supply or problem with the compressed air supply	Check compressed air supply and pneumatic ports.
		Flow control valves D2 and D4 fully closed	Open flow control valves D2 and D4.
		Load too high	Reduce load on piston rod.
	Normal operation	Dirt in valve block/valve faulty	Replace valve block; see section 4.5.4 „Replacing the valve block“. Replace valve block; see section 4.7.3 „Replacing the valve block“.
		Piston rod jamming due to high transverse forces	Reduce transverse forces.
Piston rod not moving following successful initialisation	Initialisation	Problem with electrical connection on valve block	Check electrical connections, connect correctly if connected wrongly.
Piston rod moves too fast	Initialisation	Compressed air supply too high	Reduce compressed air supply.
		Flow control valves D2 and D4 fully open	Adjust speed of actuator using flow control valves D2 and D4.
Piston rod moves too slowly	Initialisation	Compressed air supply too low	Increase compressed air supply.
		Flow control valves D2 and D4 closed	Adjust speed of actuator using flow control valves D2 and D4.
Piston rod does not reach end position Initialisation stops	Initialisation/ normal operation	Seal not seated correctly/faulty seal on piston	Check that seal is seated correctly/replace faulty seal.

Fault symptom	Operating mode	Possible cause	Remedial measure(s)
Piston moves to end position "advancing"	Initialisation	Operating voltage outside permissible range	Check operating voltage
			Check contacts of electrical cables for mains voltage. Check voltage between pin 1 and pin 3.
		Displacement encoder faulty	Switch off compressed air supply. Check analogue feedback (pin 4 on 5-pin plug) while moving piston rod by hand. Dismantle 5-pin plug; see section 4.1 „Preparation for dismantling“. If feedback shows no change while piston rod is being moved by hand -› repair or replace. Replace displacement encoder; see section 4.5.1 „Replacing the displacement encoder“. Replace displacement encoder; see section 4.7.1 „Replacing the displacement encoder“.
		Dirt in valve block/valve faulty	Replace valve block; see section 4.5.4 „Replacing the valve block“. Replace valve block; see section 4.7.3 „Replacing the valve block“.
		3-pin/5-pin plug connected incorrectly	Check electrical connection of 3-pin/5-pin plug, correct if necessary. Dismantle 3-pin plug; see section 4.5 „Repair steps for the end cap module“/4.7 „Repair steps for the end cap module“. Dismantle 5-pin plug; see section 4.1 „Preparation for dismantling“.
	Normal operation	Operating voltage outside permissible range	Check operating voltage.
			Check contacts of electrical cables for mains voltage. Check voltage between pin 1 and pin 3.
			Excessive voltage will damage the positioner. Inspect it and replace if necessary.
		Displacement encoder faulty	Switch off compressed air supply. Check analogue feedback (pin 4 on 5-pin plug) while moving piston rod by hand. Dismantle 5-pin plug; see section 4.1 „Preparation for dismantling“. If feedback shows no change while piston rod is being moved by hand -› repair or replace. Replace displacement encoder; see section 4.5.1 „Replacing the displacement encoder“. Replace displacement encoder; see section 4.7.1 „Replacing the displacement encoder“.
		Dirt in valve block/valve faulty	Replace valve block; see section 4.5.4 „Replacing the valve block“. Replace valve block; see section 4.7.3 „Replacing the valve block“.
		Analogue setpoint outside permissible range	Check range of setpoint signal and check for wire breaks.
Piston rod suddenly advances/retracts more slowly	Initialisation/ normal operation	Pneumatic components of intermediate cap/bearing cap leaking	Check pneumatic tubing and seals.
		Flow control valves D2 and D4 set differently	Adjust speed of actuator using flow control valves D2 and D4.
		Dirt in valve block/ valve faulty	Replace valve block; see section 4.5.2 „Replacing the controller with electronic function module“. Replace valve block; see section 4.7.3 „Replacing the valve block“.

Fault symptom	Operating mode	Possible cause	Remedial measure(s)
Advancing end position is end position of DFPI	Initialisation	Problem with pneumatic connection	Check pneumatic tubing in end cap module.
Piston rod does not reach end position	Initialisation	Initialisation not completed	Initialisation can take up to 30 min depending on the size of the pneumatic actuator.
		Displacement encoder outside measuring range/displacement encoder faulty	Switch off compressed air supply. Check analogue feedback while moving piston rod by hand. If feedback shows no change while piston rod is being moved by hand -› repair or replace. Replace displacement encoder; see section 4.5.1 „Replacing the displacement encoder“. Replace displacement encoder; see section 4.7.1 „Replacing the displacement encoder“.
		Compressed air supply too low	Increase compressed air supply.
		Flow control valves D2 and D4 closed	Open flow control valves D2 and D4 by two to three turns.
		Load too high	Reduce load.
		Dirt in valve block	Replace valve block; see section 4.5.4 „Replacing the valve block“. Replace valve block; see section 4.7.3 „Replacing the valve block“.
		Transverse forces on piston rod bearings too high	Ensure that there are no transverse forces acting on the piston rod.
	Normal operation	Dirt in valve block	Replace valve block; see section 4.5.4 „Replacing the valve block“. Replace valve block; see section 4.7.3 „Replacing the valve block“.
		Friction due to vibrations, impacts or shocks too high	Eliminate cause of vibrations, impacts and shocks.
		Displacement encoder shifted by vibrations, impacts or shocks	Eliminate cause of vibrations, impacts and shocks. Analogue feedback must be 4 mA for retracting end position and 20 mA for advancing end position.
Piston rod oscillates around intermediate position. Valves on valve block continuously switching, setpoint unchanged.	Normal operation	Change in compressed air supply following initialisation	Adjust compressed air supply.
		Stiction due to excessive load, vibrations, impacts, shocks and dirt too high	Eliminate cause of impacts, vibrations and shocks, clean piston rod, reduce load.
DFPI corrects setpoint position after a while, one valve on valve block switching continuously at unchanged setpoint.	Normal operation	Pneumatic components leaking	Replace faulty supply lines and seals.
		Pneumatic tubing exceed maximum permissible length.	Check whether length of pneumatic tubing exceeds maximum permissible length of 30 m and shorten if necessary.
		Valve faulty	Replace valve block; see section 4.5.4 „Replacing the valve block“. Replace valve block; see section 4.7.3 „Replacing the valve block“.

Fault symptom	Operating mode	Possible cause	Remedial measure(s)
Piston rod does not move to correct target position following successful initialisation	Normal operation	Displacement encoder outside measuring range	Switch off compressed air supply. Check analogue feedback while moving piston rod by hand. If feedback shows no change while piston rod is being moved by hand -› repair or replace. Replace displacement encoder; see section 4.5.1 „Replacing the displacement encoder“. Replace displacement encoder; see section 4.7.1 „Replacing the displacement encoder“.
		3-pin plug connected incorrectly	Switch blue and brown wires. Dismantle 3-pin plug; see section 4.5 „Repair steps for the end cap module“/4.7 „Repair steps for the end cap module“.

5.2 DFPI-ND2P-G2

Fault symptom	Possible cause	Remedial measure(s)
Piston rod does not retract or advance	Problem with compressed air supply	Check compressed air supply and pneumatic connections, and correct if necessary.
	Pneumatic tubing kinked	
	Load too high	Reduce load.
	Piston rod jamming due to high transverse forces	Reduce transverse forces.
Piston rod not moving to setpoint position	Displacement encoder faulty	Measure resistance between pin 1 and pin 2 on 3-pin plug while moving piston rod by hand. Dismantle 3-pin plug; see section 4.5 „Repair steps for the end cap module“/4.7 „Repair steps for the end cap module“.
	Problem with 3-pin plug connection to displacement encoder	Check electrical connection of 3-pin plug. Dismantle 3-pin plug; see section 4.5 „Repair steps for the end cap module“/4.7 „Repair steps for the end cap module“.
Piston rod not reaching end position	Displacement encoder faulty Displacement encoder outside measuring range	Measure resistance between pin 1 and pin 2 on 3-pin plug while moving piston rod by hand. Dismantle 3-pin plug; see section 4.5 „Repair steps for the end cap module“/4.7 „Repair steps for the end cap module“.
	Compressed air supply too low	Increase compressed air supply.
	Load too high	Reduce load.
	Transverse forces on piston rod too high	Reduce transverse forces on piston rod.
	Friction changed by vibration, impacts or shocks	Eliminate cause of vibrations, impacts and shocks.
	Displacement encoder shifted by vibrations, impacts or shocks	Eliminate cause of vibrations, impacts and shocks.
	Seal not seated correctly/faulty seal on piston	Check that seal is seated correctly/replace faulty seal.
No holding force in intermediate positions	Seal not seated correctly/faulty seal on piston	Check that seal is seated correctly/replace faulty seal.
Piston rod moving too slow/fast	Compressed air supply too high/low	Increase/reduce compressed air supply.
Piston rod suddenly advances/retracts more slowly	Pneumatic components of intermediate cap/bearing cap leaking	Fix leaks in pneumatic components of bearing cap/end cap.

6 Cleaning and greasing

6.1 Cleaning

The seals are designed so that the lubricant film applied to them will be effective for the entire service life. The linear actuator must be thoroughly cleaned of all foreign particles, machining residues and old lubricants before it is greased to ensure that this "life-time lubrication" is retained.

Note

Festo recommends LOCTITE 7063 and LOCTITE 7070 for cleaning.

When using other cleaning agents, make sure that they do not corrode the seals of the linear actuator. If in doubt, check the resistance of the seals using the data on the Festo website (www.festo.com).

6.2 Greasing

6.2.1 Definition of terms

The various components and seals of the linear actuator require different levels of greasing depending on a number of factors.

Note

To guarantee the life-time lubrication, the piston rod with assembled piston and piston seals must be moved across the entire stroke of the cylinder barrel several times after greasing in order to produce an even lubricant film.

Grease reservoir

There is a certain amount of oil enclosed between two sealing rims or in enclosed ring volumes.

Thin grease film

A film of grease covers the bearing surface so that the grease colour darkens the surface slightly.

Recommendation:

Apply the grease with a soft brush or similar.

Extremely thin grease film

A barely continuous film of grease covers the bearing surface. The grease can give a sheen to the surface; however, the colour of the grease must not darken it.

Recommendation:

Apply the grease using a cloth or similar object that has been dipped in the grease.

Remove the excess grease by scraping once with the relevant seal system components (e.g. by drawing the installed piston with piston rod fully through the greased cylinder barrel once) and then remove the excess from the seal components by wiping it off.

7 Maintenance and care

Clean any dirt from the piston rod using a soft cloth.

All non-abrasive cleaning agents are permissible. Due to its life-time lubrication, the linear actuator does not require any maintenance. Regular removal of the lubricant on the surface of the piston rod reduces its service life.

8 Tools

This section provides an overview of the tools and aids required to repair and maintain the linear actuator.

8.1 Standard tools

The following standard tools, among others, are required to repair the linear actuator:

- Screwdriver
- Wrench
- Flat pliers
- Torque spanner

8.2 Equipment and measuring devices

The reference for all equipment and measuring devices without an order number can be requested from Festo.

Further information on the equipment and measuring devices can be found in the information brochure **"Accessories, equipment and tools"** (7Accessories_a_en). This can be found in the online spare parts catalogue on the Festo website (http://spareparts.festo.com/xdki/data/SPC/0/PDF_SAFE/Fitting%20aids.pdf).

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III. Warranty

1. Festo products are continuously being developed with regard to hardware and software. The hardware status and, where applicable, the software status of the product can be found on the rating plate of the product. If the Electronic Documentation, in whatever form, is not supplied with the product, i.e. is not supplied on a data storage medium (diskettes, CD ROM, removable disc) as a delivery unit with the relevant product, Festo cannot guarantee that the Electronic Documentation corresponds to every aspect of the product's hardware and software. In this case, only the printed documentation from Festo accompanying the product is decisive for ensuring that the hardware and software of the product matches that in the Electronic Documentation.

2. The information included in this Electronic Documentation can be amended by Festo without prior notice and does not constitute any obligation on the part of Festo.

IV. Liability/limitations on liability

1. Festo provides this Electronic Documentation to assist the user in creating his machine and system documentation. If a product is not accompanied by Electronic Documentation in the form of data storage media (diskettes, CD ROM, removable disc), i.e. said Electronic Documentation is not automatically supplied together with that product, Festo cannot guarantee that the Electronic Documentation available/supplied separately matches the product actually used by the user.

The latter applies particularly to extracts of the documents for the user’s own documentation. The guarantee and liability for separately available/supplied portable data storage media, i.e. with the exception of Electronic Documentation provided on the Internet/intranet, are limited exclusively to proper duplication of the software, whereby Festo guarantees that, in each case, the relevant portable data storage medium or software contains the latest status of the documentation. There is no guarantee that the Electronic Documentation available on the Internet/Intranet will have the same version status as the last printed edition.

2. Furthermore, Festo cannot be held liable for any lack of economic success, damage or claims by third parties resulting from the use of the documentation by the user, with the exception of claims arising from infringement of the patent rights of third parties concerning the use of the Electronic Documentation.

3. The limitations on liability as per paragraphs 1 and 2 do not apply if, in cases of intent or gross negligence or lack of warranted quality, a compulsory liability exists. In such cases, Festo's liability is limited to the damage discernable by Festo when the concrete circumstances are made known.

V. Safety guidelines/documentation

Warranty and liability claims in conformity with the aforementioned regulations (items III. and IV) may be raised only if the user has observed the safety guidelines of the documentation in conjunction with the use of the machine and its safety guidelines. The user himself is responsible for ensuring that Electronic Documentation not supplied with the product matches the product actually used by the user.