Pressure / Force Table

Piston force [N]								
Ø	Operating pressure [bar]							
	1	2	3	4	5	6	7	8
2.5	0.4	0.9	1.3	1.8	2.2	2.7	3.1	3.5
3.5	0.9	1.7	3.8	3.5	4.3	5.2	6.1	6.9
5.35	2	4	6.1	8.1	10.1	12.1	14.2	16.2
6	2.5	5.1	7.6	10.2	12.7	15.3	17.8	20.4
8	4.5	9	13.6	18.1	22.6	27.1	31.7	36.2
10	7.1	14.1	21.2	28.3	35.3	42.4	49.5	56.5
12	10.2	20.4	30.5	40.7	50.9	61.0	71.3	81.4
16	18.1	36.5	54.3	72.4	90.5	109	127	145
20	28.3	56.5	84.8	113	141	170	198	226
25	44.2	88.4	133	177	221	265	309	353
32	72.4	145	217	290	362	434	507	579
40	113	226	339	452	565	679	792	905
50	177	353	530	707	884	1,060	1,240	1,410
63	281	561	842	1,120	1,400	1,680	1,960	2,240
80	452	905	1,360	1,810	2,260	2,710	3,170	3,620
100	707	1,410	2,120	2,830	3,530	4,240	4,950	5,650
125	1,100	2,210	3,310	4,420	5,520	6,630	7,730	8,840
160	1,810	3,620	5,430	7,240	9,050	10,900	12,700	14,500
200	2,830	5,650	8,480	11,300	14,100	17,000	19,800	22,600
250	4,420	8,840	13,300	17,700	22,100	26,500	30,900	35,300
320	7 240	14,500	21,700	29,000	36,200	43,400	50,700	57,900

Piston force [N]							
Ø	Operating pressure [bar]						
	9	10	11	12	13	14	15
2.5	4	4.4	4.9	5.3	5.7	6.2	6.6
3.5	7.8	8.7	9.5	10.4	11.3	12.1	13
5.35	18.2	20.2	22.2	24.3	26.3	28.3	30.3
6	22.9	25.4	28	30.5	33.1	35.6	38.2
8	40.7	45.2	49.8	54.3	58.8	63.3	67.9
10	63.6	70.7	77.8	84.8	91.9	99	106
12	91.6	101	112	122	132	143	153
16	163	181	199	217	235	253	271
20	254	283	311	339	368	396	424
25	398	442	486	530	574	619	663
32	651	724	796	869	941	1,010	1,090
40	1,020	1,130	1,240	1,360	1,470	1,580	1,700
50	1,590	1,770	1,940	2,120	2,300	2,470	2,650
63	2,520	2,810	3,090	3,370	3,650	3,930	4,210
80	4,070	4,520	4,980	5,430	5,880	6,330	6,790
100	6,360	7,070	7,780	8,480	9,190	9,900	10,600
125	9,940	11,000	12,100	13,300	14,400	15,500	16,600
160	16,300	18,100	19,900	21,700	23,500	25,300	27,100
200	25,400	28,300	31,100	33,900	36,800	39,600	42,400
250	39,800	44,200	48,600	53,000	57,400	61,900	66,300
320	65,100	72,400	79,600	86,900	94,100	101,000	109,000

The piston force F can be calculated from the piston area A, the operating pressure p and the friction R using the following formula:

Piston Force (Final Pressure)

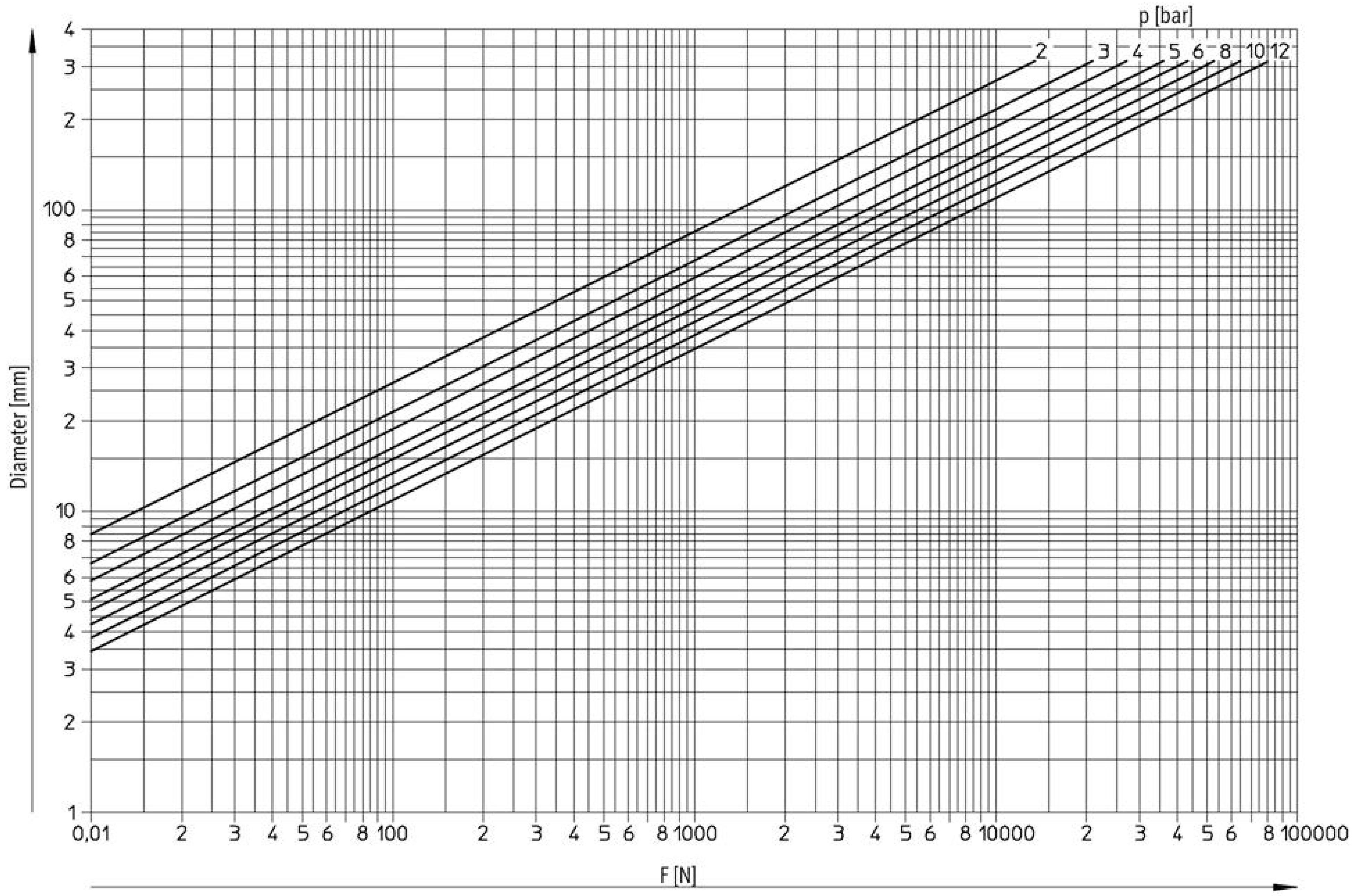
$$F = p \cdot A - R$$

$$F = p \cdot 10 \cdot \frac{d^2 \cdot \pi}{4} - R$$

p	= Operating pressure	[bar]
d	= Piston diameter	[cm]
R	= Friction ~10%	[N]
A	= Piston area	[cm^2]
F	= Effective piston force	[N]

Pressure / Force Graph

Operating pressure p as a function of piston diameter and force F
An allowance of 10% has been included for frictional force



Given:
Load 800 N
Available system pressure 6 bar.

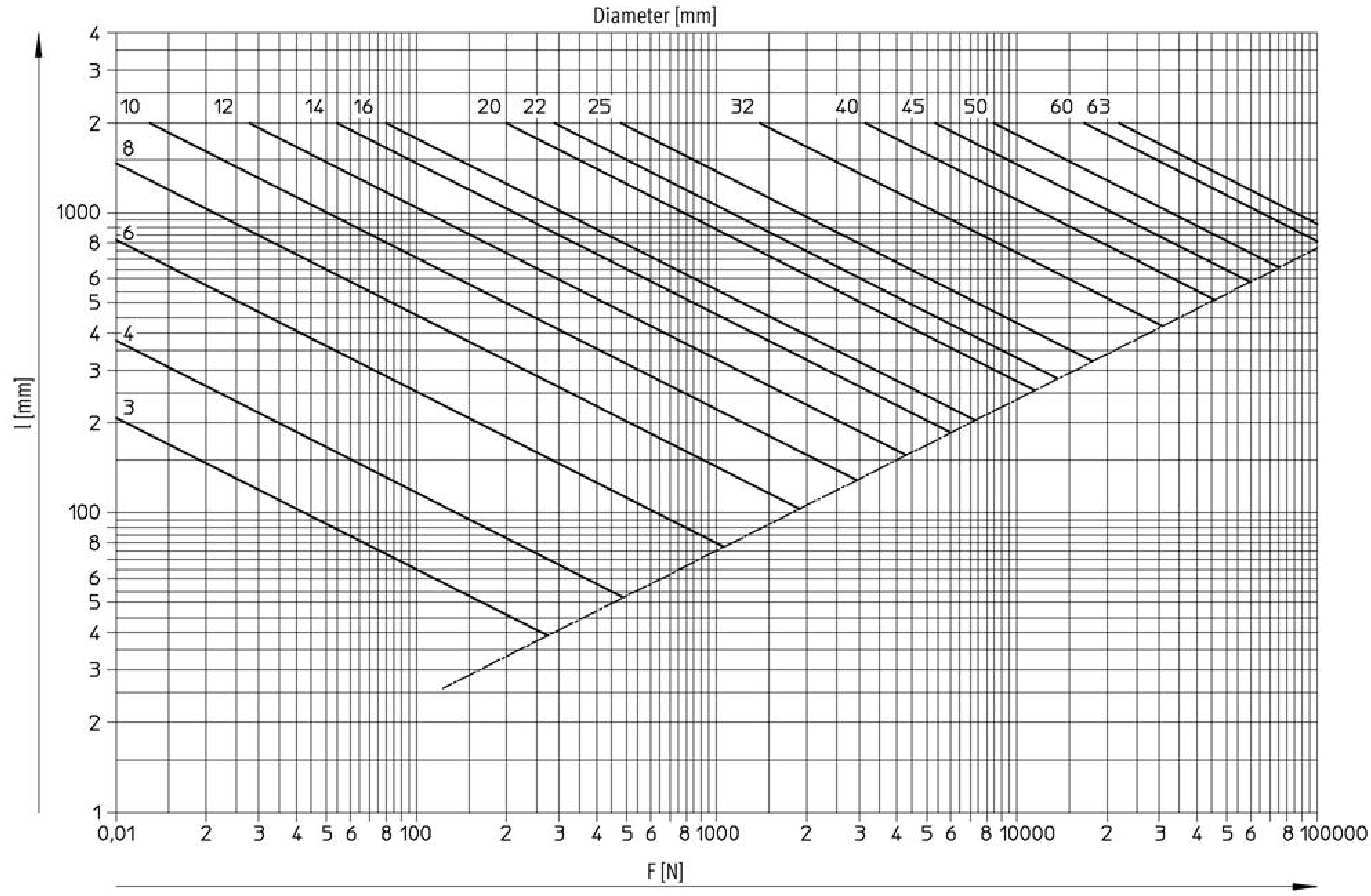
To be calculated:
Required piston diameter
Operating pressure to be set.

Procedure:
From F = 800 N go vertically upwards to the point of intersection with the 6 bar line. The next largest piston diameter, 50 mm, lies between the lines for 4 and 5 bar, which means that the operating pressure should be set to approx. 4.5 bar.

The selection of pneumatic drives is governed primarily by the forces to be overcome and the distances to be travelled.
A small percentage of the piston force is used to overcome friction, the remainder is used to drive the load.
Only approximate values can be given, since frictional force depends on numerous factors (lubrication, operating pressure, back pressure, seal design, etc.).
Back pressure generates a force which acts in the opposite direction andpartially cancels out the effective force.
Back pressure occurs in particular when exhaust air flow controls are used or the exhaust port is constricted

Buckling Load Graph

Piston rod diameter as a function of stroke length l and force F



Given:
Load 800 N
Stroke length 500 mm
Piston Ø 50 mm

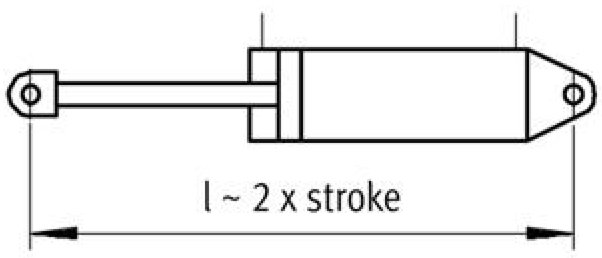
To be calculated:
Piston rod diameter
Cylinder type: Standard cylinder

Procedure:
From F = 800 N go vertically upwards to the point of intersection with the horizontal line through l = 500 mm.
The next largest piston rod diameter in the graph is 16 mm.
The standard cylinder DNC-50-500 with a piston rod diameter of 20 mm is suitable for this stroke length.
Due to buckling stress, the maximum permissible load for a piston rod with a long stroke length is lower than the value suggested by the maximum permissible operating pressure and piston area.
This load must not exceed certain maximum values. These depend upon stroke length and piston rod diameter.

The graph shows this relationship based on the following formula:

$$F_K = \frac{\pi^2 \cdot E \cdot J}{l^2 \cdot S}$$

F_K = Permissible buckling force [N]
E = Modulus of elasticity [N/mm²]
J = Moment of inertia [cm⁴]
l = Buckling length
2x stroke length [cm]
S = Safety factor (selected value: 5)



Note
The least satisfactory type of mounting for this kind of stress is a swivel mounting.
The permissible load is higher for other types of mounting.

SC Series Standard Cylinder

Max. Pressure: 1.0MPa

Ordering Code

SC-W - 50 x 50 - 25 - S - LB - MT - XC8A

Model
SC: Pull Rod Type
SU: Hidden Pull Rod Type

Blank: Standard double Action
W: Double-shaft Double Action

Cylinder Bore
32 40
50 63
80 100
125 160
200 250
320

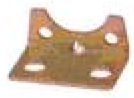
Stroke

SCJ adjustable stroke type
SUJ adjustable stroke type

Magnet Code
S: attach magnet
Blank: not attach magnet

Fixed Type

Blank: Basic Type
LB: Front And Back Fixed Type



FA: Front Cover Fixed Type (Front flange type)
FB: Back Cover Fixed Type
(Rear flange type)

CA: Back Cover Fixed Type
(Single Earring)

CB: Back Cover Fixed Type
(double Earring)

TC: Swinging Type
TC-M: Swinging Type
Attaching Foot Seat

Sensor

DP-21

PAC

PM

SC

Blank: Without adjustable shaft
XC8A: Ajustable stroke
0 ~ 25 mm
XC8B: Adjustable stroke
0 ~ 50 mm

MAL SeriesAluminium Alloy Mini Cylinder

Max. Pressure: 1.0MPa

Ordering Code

MAL - CA 20 x 50 - 25 - S - LB - W5

Model
MAL: Double Action
MSAL: Single Action
MALD: Double-shaft Double Actiion
MALJ: Double-shaft and adjust able stroke type

Back Cover Type
Blank: Fishtail type
CM: Rounded type
U: Horizontal type

Cylinder Bore
16
20
25
32
40

Stroke

MALJ adjustable stroke type

Magnet Code
S: Attach magnet
Blank: Not attach magnet

Fixed Type

Blank: Basic Type
LB: Front And Back Fixed Type

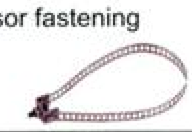
FA: Front Cover Fixed Type

SDB: Back Cover Swinging Type

Sensor

W5 Type

Sensor fastening



Air Cylinder

DPC®

DNG Series ISO6431 Standard Cylinder

Max. Pressure: 1.0MPa

Ordering Code

DNG - W - 50 x 50 - S LB - MT - XC8A

Model
DNG: ISO6431 Standard Double Action Type

Blank: Standard double Action
W: Double-shaft Double Action

Cylinder Bore

32	40
50	63
80	100
125	160
200	

Stroke

Magnet Code
Blank: Not attach magnet
S: Attach magnet

Fixed Type
Blank: basic type
LB: Front and back fixed type

FA: Front Cover Fixed Type (Front flange type)
FB: Back Cover Fixed Type (Rear flange type)

CA: Back Cover Fixed Type (Single Earring)

CB: Back Cover Fixed Type (double Earring)

YB: Back Cover Rear Hinge Fixed Type

Blank: Without adjustable shaft
XC8A: Ajustable stroke 0 ~ 25 mm
XC8B: Adjustable stroke 0 ~ 50 mm

Sensor
DP-21 Type

PI Clamp

DNC Series ISO6431 Standard Squareness Cylinder

Max. Pressure: 1.0MPa

Ordering Code

DNC - W - 63 × 50 □ - □ - □ LB MT

Series Code

Blank: Standard double Action
W: Double-shaft Double Action

Cylinder Bore
32
40
50
63
80
100
125

Stroke

Buffer
Blank: Non Buffer
PPV: Attach Buffer

Magnet Code
Blank: Standard Type
A: Inside magnet

S2: Through Piston Rod
K2: Extended External Thread of Piston Rod
K3: Internal Thread on Piston Rod
K5: Special Thread on Piston Rod
K8: Extended Piston Rod

Sensor
DP-30 Type

Fixed Type
Blank: basic type
LB: Front and back fixed type

FA: Front Cover Fixed Type (Front flange type)
FB: Back Cover Fixed Type (Rear flange type)

CA: Back Cover Fixed Type (Single Earring)

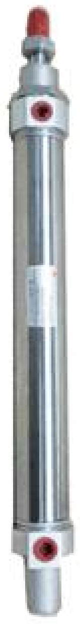
CB: Back Cover Fixed Type (double Earring)

YB: Back Cover Rear Hinge Fixed Type

DSNU Series ISO6432 Stainless Steel Mini Cylinder

Built in magnet

Max. Pressure: 1.0MPa



Ordering Code

DSNU - W - 20 x 50 - LB W5

Series Code
DSNU: Standard Double Action
ESNU: Single Action with Spring

Blank: Standard double Action
W: Double-shaft Double Action

Cylinder Bore
16
20
25
32
40

Stroke

Fixed Type

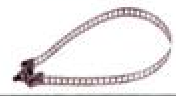
Blank: Basic Type
LB: Front And Back Fixed Type

FA: Front Cover Fixed Type

SDB: Back Cover Swinging Type

Sensor
W5 Type

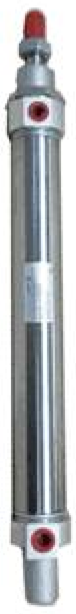
Sensor fastening



ESNU Series Single Action ISO6432 Stainless Steel Mini Cylinder

Built in magnet

Max. Pressure: 1.0MPa



Ordering Code

ESNU - W - 20 x 50 - S - LB W5

Series Code
DSNU: Standard Double Action
ESNU: Single Action with Spring

Blank: Standard double Action
W: Double-shaft Double Action

Cylinder Bore
16
20
25
32
40

Stroke

S: Single Action Spring Return
T: Single Acting Spring Extended

Fixed Type

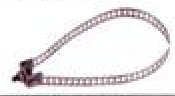
Blank: Basic Type
LB: Front And Back Fixed Type

FA: Front Cover Fixed Type

SDB: Back Cover Swinging Type

Sensor
W5 Type

Sensor fastening



SDA Series Thin Type Cylinder

Working Pressure: 0.1 ~ 0.9MPa

Ordering Code

SDA - W - 20 x 30 - S - B - MT

Type
SDA: Double Action

Blank: Standard double Action
W: Double-shaft Double Action

Cylinder Bore

12	16
20	25
32	40
50	63
80	100

Stroke

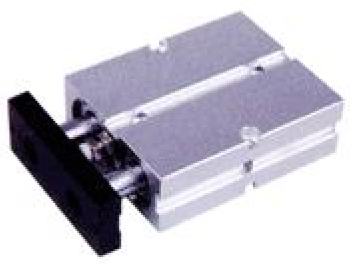
Magnet Code
S: Attach magnet
Blank: Not attach magnet

Cog Type
Blank: Internal Thread
B: External Thread
N: No Thread

Sensor
DP-11 Type

TN Series Double-shaft Cylinder

Working Pressure: 0.1 ~ 0.9MPa



Ordering Code

TN - 20 x 50 - S

Series Code
TN: Double-shaft Double Action

Cylinder Bore

10	16
20	25
32	

Stroke

Magnet Code
S: attach magnet
Blank: not attach magnet