

Appendix

Pneumatic symbols

Air treatment

Air treatment mechanisms

Pneumatic accumulator
(capacity)



Automatic drain air



Automatic drain air



Lubricator



Air filter



Filter - with manual drain

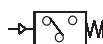


Filter - with automatic drain



Pressure control valves

Pressure switch



Free discharge pressure relief valve



Free discharge pilot-operated
pressure relief valve



Sequence valve



Pressure regulator



Pressure regulator
without exhaust valve



Pilot-operated pressure regulator
without exhaust valve



Pressure regulator without
exhaust valve (free)

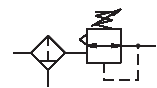


Differential pressure regulator

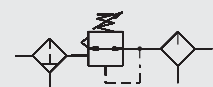


Assembled units

Filter pressure regulator



Filter pres. reg. + lubricator
Filter + pres. reg. + lubricator



Other mechanisms

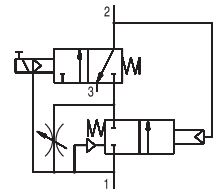
Pressure gauge



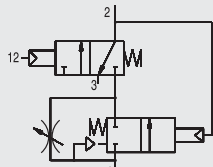
Shut-off valve



Progressive start-up valve
With Electric control



Progressive start-up valve
With Pneumatic control





Valves and solenoid valves

Terms and descriptions

The connections to the inlet and outlets of the valves can be of two types:

Main connections - supply connection identified with number 1

- consumption connection identified with number 2 and 4

- exhaust connection identified with number 3 and 5

Pilot connections - repositioning connection on 2/2 & 3/2 ways valves identified with number 10

- switching connection on 2/2 & 3/2 ways valves and repositioning connection on 5/2 & 5/3 ways valves identified with number 12

- switching connection on 5/2 & 5/3 ways valve identified with number 14

Switching: is the process that changes the state of a valve from rest position to actuated position and is achieved by means of a mechanical, pneumatic or electric signal.

Repositioning: is the process that changes the valve state from actuated back to rest position and is achieved by means of an external mechanical (spring), pneumatic (differential) or electric signal.

Ways: indicated the number of connections on the valve body and on the pneumatic diagram.

Positions: indicates the number of positions achieved by the valve and corresponds to the number of squares on the pneumatic simple.

Function: indicates the valve working diagram at rest condition and corresponds to the right square in the pneumatic scheme.

Valves symbols

Way	Pos.	Function	Symbol
2	2	Normally closed	
2	2	Normally open	
3	2	Normally closed	
3	2	Normally open	
5	2	Separated exhaust connections	
5	3	Closed centres	
5	3	Open centres	
5	3	Pressured centres	

Complementary valves

Throttle valve	
Bidirectional flow regulator	
Unidirectional flow regulator	
Quick exhaust valve	
Shuttle valve	
Silencer	
Non-return valve without spring	
Non-return valve with spring	
Non-return valve controlled during closing	
Non-return valve controlled during opening	

Switching and Repositioning

Mechanical

Plunger	
Sensitive plunger	
Roller	
Unidirectional roller	
Sensitive roller	
Pedal	
Pedal - spring return	
Push Button	
Sensitive push button	
Push button - two positions-	
Lever	
Lever - spring to center	
Sensitive lever	
Two position mechanical stop	
Three position mechanical stop	
Spring	

Pneumatics

Pneumatic	
Pneumatic -return to center	
Pneumatic - depressurised	
Differential (pneumatic spring)	
Differential external pilot	
Sensitive differential	

Electrical

Solenoid	
Bistable solenoid	
Solenoid (internal pilot)	
Solenoid (external pilot)	
Solenoid - spring to center	
Solenoid with suppl. pilot	

Valves and solenoid valves (following)

Piping and connections

Pressure line		One-way rotating intake	
Control line		Three-way rotating intake	
Exhaust line		Closed air intake	
Flexible line		Air intake with connection	
Electric line		Quick coupling connection without non-return valve	
Piping connections		Quick coupling connection with non-return valve	
Piping intersection		Air exhaust unthreaded connection	
Main air connection		Air exhaust threaded connection	

Cylinders

Single acting cylinders

With external return	
With spring return	
With spring return	

Double acting cylinders

Standard rod	
Double rod (through rod version)	
With non adjustable cushioning	
With adjustable cushioning	
With magnetic piston	
With magnetic piston with adjustable cushioning	

Tandem cylinders

In tandem, common rod	
In tandem, independant rods	
In tandem, opposite rods	
Opposed, common rod	

Non rotating cylinders

Standard rod / double acting	
Twin rod / double acting	
Twin rod / double acting through rod	
Twin through rod, double acting	
Guided compact cylinders	

Cylinders for piston rod lock

With magnetic piston with adjustable cushioning	
With non magnetic piston with adjustable cushioning	

Rodless cylinders

With magnetic piston With adjustable cushioning	
Cable cylinders with magnetic piston	
Cable cylinders with non magnetic piston	

Telescopic cylinders

Single acting	
Double acting	

Various cylinders

Rotating cylinders	
Rotating cylinder	
Bellows cylinder	

Pressure boosters

Air-Air intensifier	
Air-oil intensifier	
Hydropneumatic accumulator	

Dimensioning

Flow characteristics

Each cylinder requires, in order to generate specific forces and operate at the needed speed, specific air flow through the control valve. It is therefore necessary to know and understand the laws that regulate the flow through a valve; and therefore the relation between pressure, pressure drop and flow rate. Only by doing so is it possible to determine whether a valve is capable of supplying the required flow rate to a cylinder at a given inlet pressure and with a reasonable pressure drop.

In order to carry out these analyses it is necessary to work with precise functional data; it is not sufficient to know the valve port size. This data is presented in different ways depending on the different applicable standards and various experimental measurements methods.

The figures are mainly coefficients which must be used in specific equations, with which we can estimate the valve flow rate. In order to understand the meaning of these equations it is necessary to examine the flow inside a pneumatic valve. For example, let us consider the following conditions: a valve supplied with an absolute pressure P1 and with a flow regulator connected downstream.

Starting condition - flow regulator closed

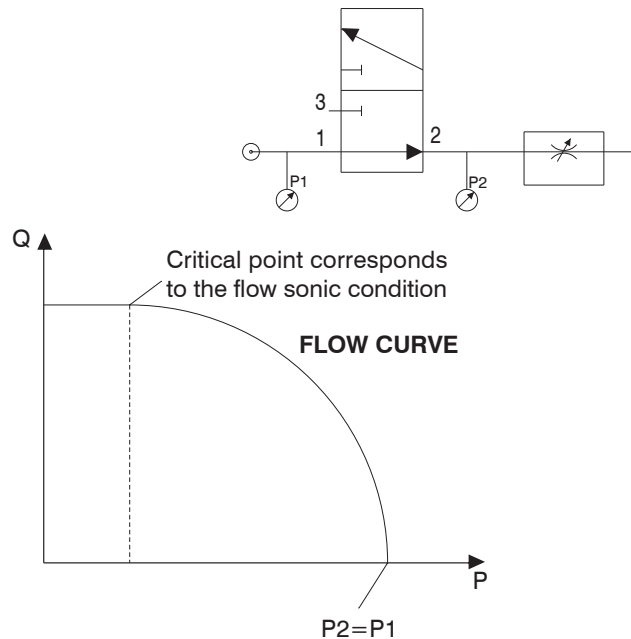
- no flow rate (Q=0)
- Upstream and downstream pressure are identical (P2=P1)

Intermediate conditions - opening flow regulator

By progressively opening the flow regulator the pressure P2 will decrease and the flow rate increase up to a critical point at which the flow rate becomes constant even if the flow regulator is opened further. This critical point corresponds to the sonic condition of the flow.

Final condition - flow regulator completely open

- maximum flow rate (constant from critical point)
- downstream pressure P2=0



On a varying P1 the curves maintain the same form and only shift into a higher or lower flow rate area depending on whether P1 has increased or decreased. The area of interest in pneumatic valve applications is the subsonic zone, just before the critical flow point is reached. This zone is expressed in a number of different ways which average the effective flow pattern enabling simple description of the flow using experimental coefficients.

Valve coefficients "C" e "B"

CETOP RP50P recommendation (derived from ISO 6358 standard) expresses flow rate in function of two experimental coefficients:

- conductance C
- critical pressure ratio b.

Conductance C = Q*/P1 is the ratio between maximum flow rate Q* and absolute inlet pressure P1 under sonic flow condition at a temperature of 20°C.

Critical ratio b = P*2/P1 is the ratio between the output absolute pressure P2 and the inlet absolute pressure P1 at which the flow becomes sonic.

The expression that represents an elliptic approximation of the relationship between pressure and flow follows:

$$Q_N = C \cdot P_1 \cdot K_t \cdot 1 - \left(\frac{r - b}{1 - b} \right)^2 \quad [1]$$

where:

QN (dm³/s) is the flow rate in dm /s at normal condition : 1,013 bar and 20°C;

C ($\frac{dm^3}{s \cdot bar}$) is the valve conductance;

P1 (bar) is the inlet absolute pressure;

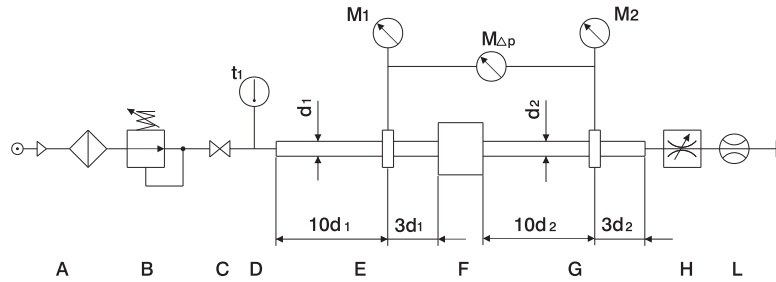
r is the ratio between downstream and upstream pressure (P2/P1);

b is the pressures critical ratio;

kt = $\sqrt{293/T_1}$ is a corrective factor that consider the absolute inlet temperature T1;

T1 = 273 + t1 (°K) is the absolute temperature (t1 is the temperature in °C).

The experimental determination of the valve coefficient C & b is carried out with compressed air following standardised procedures and according to the scheme below.



CETOP test circuit

- A Compressed air generator.
- B Pressure regulator to set upstream pressure P1.
- C Shut off valve.
- D Temperature sensor to check upstream temperature t 1, positioned in a low velocity area.
- E Pipe where the upstream pressure is measured.
- F Test valve.
- G Pipe where the downstream pressure is measured.
- H Flow regulator to adjust the downstream pressure P2.
- L Flow meter.
- M1,M2 Pressure measuring equipment for upstream and downstream.
- MΔP Pressure drop measuring equipment assuming P1-P2 < 1 bar.

Pipes E & G, used to measure the valve upstream and downstream pressure, must be sized according to the standard's specifications and change in size depending on the valve port sizes; the position of the connection at which the measurements are taken depends on the pipe's inner diameter.

Conductance C is determined with the following equation, measuring the critical flow rate Q* through the valve, where upstream pressure P1 is constant and greater than 3 bar.

$$C = \frac{Q^*}{P_1 \cdot K_t} \quad [2]$$

Pressure critical ration **b** can be calculated using the following equation:

$$b = 1 - \frac{\Delta P}{P_1 \left[1 - \sqrt{1 - \left(\frac{Q'}{Q^*} \right)^2} \right]} \quad [3]$$

Considering a given constant pressure P1 it is necessary to proceed measuring the flow rate Q' corresponding to a pressure drop DP = P1-P2 = 1 bar. Equation 3 is used to calculate the critical ratio as it is difficult to experimentally identify the exact pressure P*2 at which the flow becomes sonic. The values of both the conductance C and the critical ratio b are experimentally calculated and are the average of the results obtained.

Equation [1] is used to calculate the flow in subsonic conditions P2 > b · P1 when values C ; b and the valve working conditions (P1, P2, T1) are known. Under sonic conditions , P2 ≤ b · P1 the equation can be simplified and the maximum flow rate can be calculated as follows:

$$Q^* = C \cdot P_1 \cdot k_t \quad [4]$$

HYDRAULIC COEFFICIENT KV

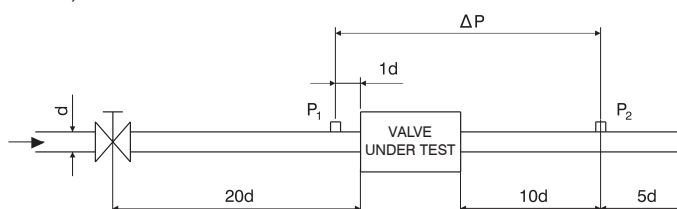
The hydraulic coefficient allows, using the equation. The calculation of the flow rate of a fluid through a valve.

$$Q = K_v \sqrt{\frac{\Delta p}{\rho}} \quad (l/min) \quad [5]$$

where:

- Q is the fluid flow rate in l/min
- Δp is the pressure drop inside the valve calculated in bar (P1 - P1)
- ρ is the fluid density calculated in Kg/dm³
- Kv is the hydraulic coefficient calculated in $\frac{l}{min} \left(\frac{kg}{dm^3 \cdot bar} \right)^{1/2}$

Using these measurement units the flow rate coefficient Kv represents the flow rate (in liters) of water across the valve with a pressure drop of 1 bar. The measurement are carried out using the standardised circuit below on which the connection ports are positioned according to the pipe inner bore size (norm VDE/VDI 2173).





Hydraulic circuit

In some cases flow rate is measured in m³/h which correspond a Kv measured

To obtain Kv expressed in $\frac{l}{min} \left(\frac{kg}{dm^3 \cdot bar} \right)^{1/2}$ it is sufficient to multiply the Kv value expressed in $\frac{m^3}{h} \left(\frac{kg}{dm^3 \cdot bar} \right)^{1/2}$ by the coefficient 16,66.

The coefficient kv is perfectly suitable to express the flow rate of fluids but only gives approximate values in case of compressed air. Experiences gained in hydraulic environments can be inferred in the pneumatic field, bearing in mind the difference in density, and assuming that the air flow will generate the same pressure drops and flow reductions as water. It is therefore possible to calculate reliable values for compressed air using flow coefficients Kv obtained from experiments with water.

To define the flow rate Qn through a valve at a given constant absolute inlet pressure P1, regardless of fluctuations of the downstream absolute pressure P2, refer to the equation below:

$$Q_N = 28,6 \cdot K_v \sqrt{P_2 \cdot \Delta P} \cdot \sqrt{\frac{T_n}{T_1}} \tag{6}$$

where:

- Q_N is the flow rate in volume l/min;
- K_v is the hydraulic coefficient $\frac{l}{min} \left(\frac{kg}{dm^3 \cdot bar} \right)^{1/2}$
- T_n is the absolute reference temperature;
- T₁ is the inlet absolute temperature in °K;
- P₂ is the downstream absolute pressure in bar;
- ΔP is the pressure drop P₁ - P₂ in bar.

Equation [6] is real up to $\Delta P = \frac{P_1}{2}$ therefore $P_2 = \frac{P_1}{2}$

For lower P2 values the flow rate is considered to be constant, corresponding to the sonic flow rate Q*N given by the following equation:

$$Q^*_N = 14,3 \cdot K_v \cdot P_1 \sqrt{\frac{T_n}{T_1}} \tag{7}$$

The nominal flow rate QNn

The nominal flow rate is the flow volume (at normal conditions) that passes through a valve with an upstream pressure P1=6bar (7 bar absolute pressure) and a pressure drop of 1 bar, corresponding to a downstream relative pressure P2 of 5bar (6 bar absolute pressure).

Normally the nominal flow rate is expressed in l/min and can be easily deduced from an experimental flow curve drawn for a upstream pressure of 6 bar (relative). Nominal flow rate can be useful for a preliminary assesment of the performances of different valves but in reality can be used only if the working conditions are the same as those mentioned before. In order to be able to compare valve characteristics which are expressed in different coefficients it is possible to use conversion equations.

Given the C and b coefficient, it is possible to determine the nominal flow rate using the following equation:

$$Q_{Nn} = 420 \cdot C \cdot \sqrt{1 - \left(\frac{0,857 - b}{1 - b} \right)^2} \tag{8}$$

where:

$$Q_{Nn} = \dot{v} \text{ in l/min e } C \text{ in } \frac{dm^3}{s \cdot bar}$$

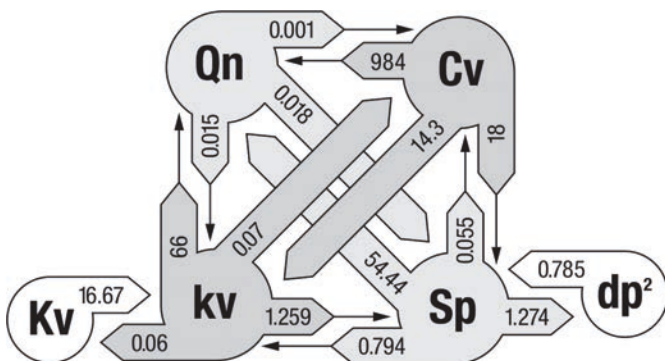
The correlation between the hydraulic coefficient KV and the corresponding nominal flow rate is as follows:

where:

$$Q_{Nn} = 66 K_v$$

$$Q_{Nn} \text{ è in l/min e } K_v \text{ in } \frac{l}{min} \left(\frac{kg}{dm^3 \cdot bar} \right)^{1/2}$$

Conversion table

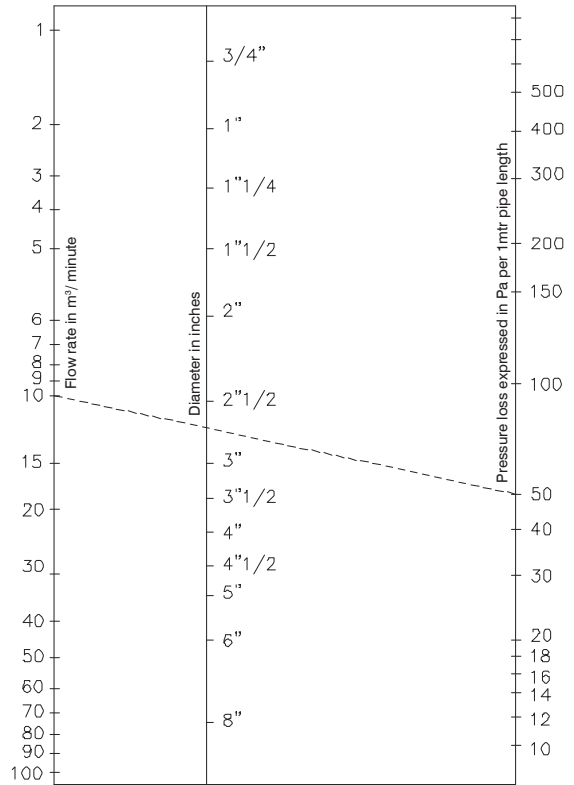


Qn	Nominal flow rate	NI/min
kv		l/min
Kv	Hydraulic coefficient	m ³ /hours
Cv		USA gallons/min
Sp	Nominal inner section area	mm ²
dp²	Nominal diameter*	mm ²

*to calculate the diameter dp (mm²) square root of dp²

Pipes flow resistance

The C factor (l/sec) indicates the pipe flow capacity and is the ratio between the maximum flow rate and absolute pressure (ISO 6358). The flow capacity progressively decreases with increasing pipe length, due to the air friction on the pipe inner surface increasing the pressure drop. Therefore the longer the pipe the smaller the flow rate. The chart below shows the flow rate characteristics of different pipe sizes (i/d and o/d) in function of the length.

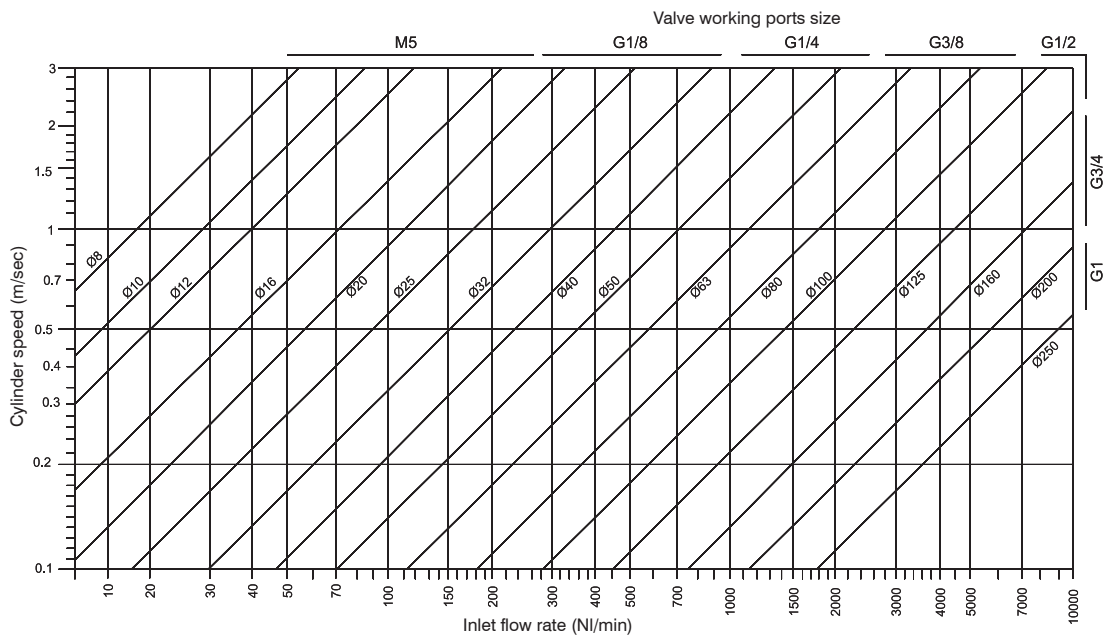


Valve sizing

The choice of the correct size valve is essential in order to ensure that the cylinder to be controlled will perform as expected. It is therefore necessary to know the cycle time to be achieved and to calculate the coefficient T which will be used as multiplier for the air consumption value previously calculated. The result of this equation, expressed in NI/min and multiplied by a safety factor of 1.2, corresponds to the minimum flow rate needed (at standard conditions 6 bar supply and 5 bar on the consumption connection) to operate the cylinder at the required rate.

$$T = \frac{60 Q_n}{\text{cycle time}} = T \times \text{Consumption}$$

It is also important to ensure that the pipes used to connect the valve to the air supply and to the cylinder do not affect the flow rate in any way. The pipe inner bore must therefore be at least 1.5 times the diameter of the valve nominal orifice size. The choice of the fittings is also very important, the inner bore must be equal or greater than the pipe I/D. The diagram below shows the flow rate required to operate different size cylinders at varying speeds and also the valve connection sizes.



A

APPENDIX



Cylinder air consumption

The air consumption corresponds to the volume of air that the cylinder uses in a complete cycle (stroke out and back in) at a specific pressure.

$$\text{Consumption} = Pa \times C \times (A+b)$$

Pa= Absolute pressure (bar)

C= Cylinder stroke (dm)

A= see tab. 1 (dm²)

b= see tab. 2 (dm²)

Air consumption is measured in Normal-liters (NI) which correspond to the volume that a specific quantity (mass) of gas would fill at atmospheric pressure.

Calculation example:

ISO 15552 cylinder - 1319 series:

Supply pressure 6 bar (Pa=7 bar)

stroke 50mm (C=0,5 dm)

Ø63 (A=0,31157 dm²)

Rod Ø=20 mm (b=0,28017 dm²)

$$\text{Consumption} = 7 \text{ (bar)} \times 0,5 \text{ (dm)} \times (0,31157 + 0,28017) = \mathbf{2,072 \text{ NI}}$$

(In order to calculate the air consumption for a specific number of cycles it is sufficient to multiply the above value for the number of cycles)

Piston surface area	
Ø cylinder	A
Ø 8	0,00502 dm ²
Ø 10	0,00785 dm ²
Ø 12	0,01130 dm ²
Ø 16	0,02010 dm ²
Ø 20	0,03140 dm ²
Ø 25	0,04906 dm ²
Ø 32	0,08038 dm ²
Ø 40	0,12560 dm ²
Ø 50	0,19625 dm ²
Ø 63	0,31157 dm ²
Ø 80	0,50240 dm ²
Ø 100	0,78500 dm ²
Ø 125	1,22656 dm ²
Ø 160	2,00960 dm ²
Ø 200	3,14000 dm ²

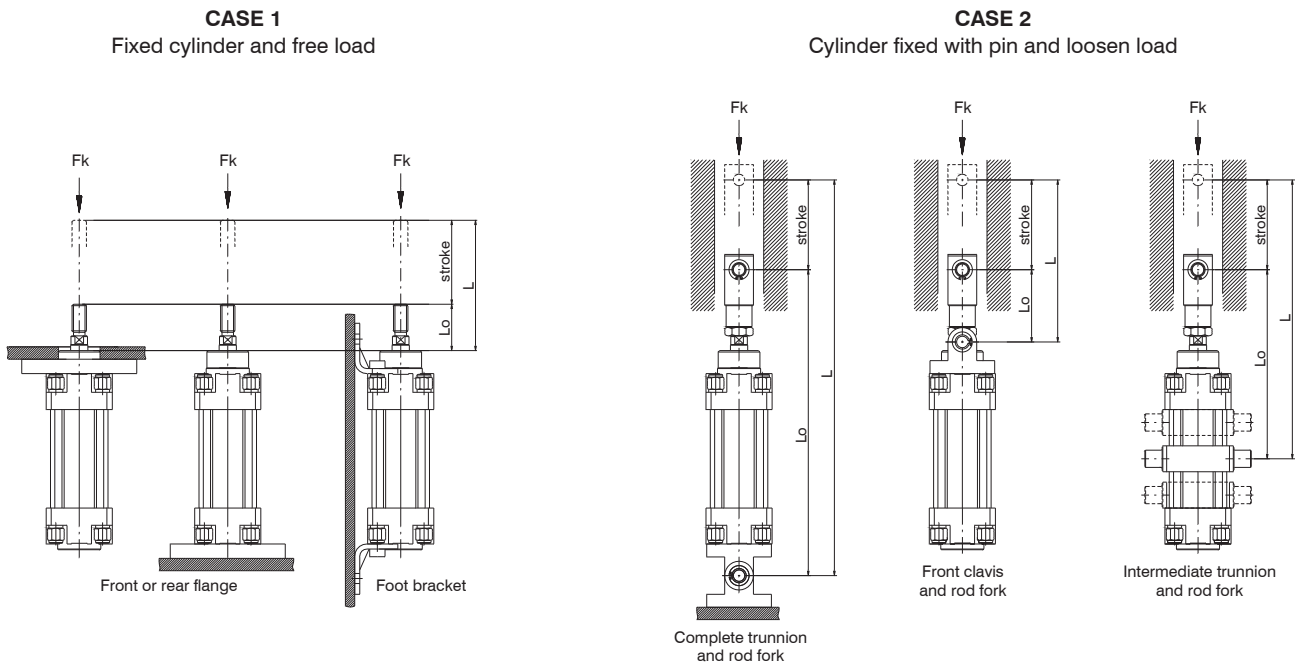
tab.1

Surface difference cylinder piston / rod Ø	
Ø cylinder - Ø rod	A
Ø 8 - Ø 4	0,00377 dm ²
Ø 10 - Ø 4	0,00659 dm ²
Ø 12 - Ø 6	0,00848 dm ²
Ø 16 - Ø 6	0,01727 dm ²
Ø 20 - Ø 8	0,02638 dm ²
Ø 25 - Ø 10	0,04121 dm ²
Ø 32 - Ø 12	0,06908 dm ²
Ø 40 - Ø 14	0,11021 dm ²
Ø 40 - Ø 16	0,10550 dm ²
Ø 40 - Ø 18	0,10017 dm ²
Ø 50 - Ø 14	0,18086 dm ²
Ø 50 - Ø 18	0,17082 dm ²
Ø 50 - Ø 20	0,16485 dm ²
Ø 63 - Ø 20	0,28017 dm ²
Ø 63 - Ø 22	0,27357 dm ²
Ø 80 - Ø 22	0,46441 dm ²
Ø 80 - Ø 25	0,45334 dm ²
Ø 100 - Ø 25	0,73594 dm ²
Ø 100 - Ø 30	0,71435 dm ²
Ø 125 - Ø 30	1,15591 dm ²
Ø 125 - Ø 32	1,14618 dm ²
Ø 160 - Ø 40	1,88400 dm ²
Ø 200 - Ø 40	3,01440 dm ²

tab.2

Allowed axial load (combined bending and compressing load)

This is the maximum load that can be applied axially on the rod tip. Above this value the rod might bend under compression. This value depends on a number of factors such as load size, rod diameter, the distance at which the load is applied (bending and compressing length L) and the conditions under which the load is applied (cylinder mountings). Among the possible conditions, the following three are the most common.



The maximum axial load can be calculated in two ways:

In an empirical way (see equations) or by checking the following diagram which shows the worst possible conditions (case 1 & 2) For all other possible mountings alternatives the axial load will surely be higher.

$$F_k = \frac{p^3 \times E \times d^4}{64 \times L^2 \times C} \quad (N)$$

$$d = \sqrt[4]{\frac{F_k \times 64 \times L^2 \times C}{p^3 \times E}} \quad (cm)$$

$$L = \sqrt{\frac{p^3 \times E \times d^4}{F_k \times 64 \times C}} \quad (cm)$$

Example: Axial load verification

Cylinder ø80 mm
Rod diameter ø20 mm
Stroke 600 mm
Mounting CASE 2 intermediate trunnion: L0=290 mm
Carico 2000 N
L (distance)= 29+60=89 cm
 $3\ 7\ 4\ 2\ F_k = (p \times 2,1 \times 10 \times 2) : (64 \times 89 \times 5) = 4104\ N$
(Above the 2000 N applied)

The same result can be obtained using the below diagram : following the bending and compression distance line relative to 900mm up to the intersection with the 20mm Ø line we obtain 4000N.

Example: Rod diameter sizing

E = rod material coefficient of elasticity (N/cm²)
(steel=2,1x10⁷ N/cm²)
d = rod diameter (cm)
L = bending and compression distance (cm)
C = safety factor (da 2,5 a 5)

Considering the same conditions as in the above case we need to determinate the rod diameter suitable to withstand a 4000N load

$$d = \sqrt[4]{(4000 \times 64 \times 89^2 \times 5) / (p^3 \times 2,1 \times 10^7)} = 2\ cm$$

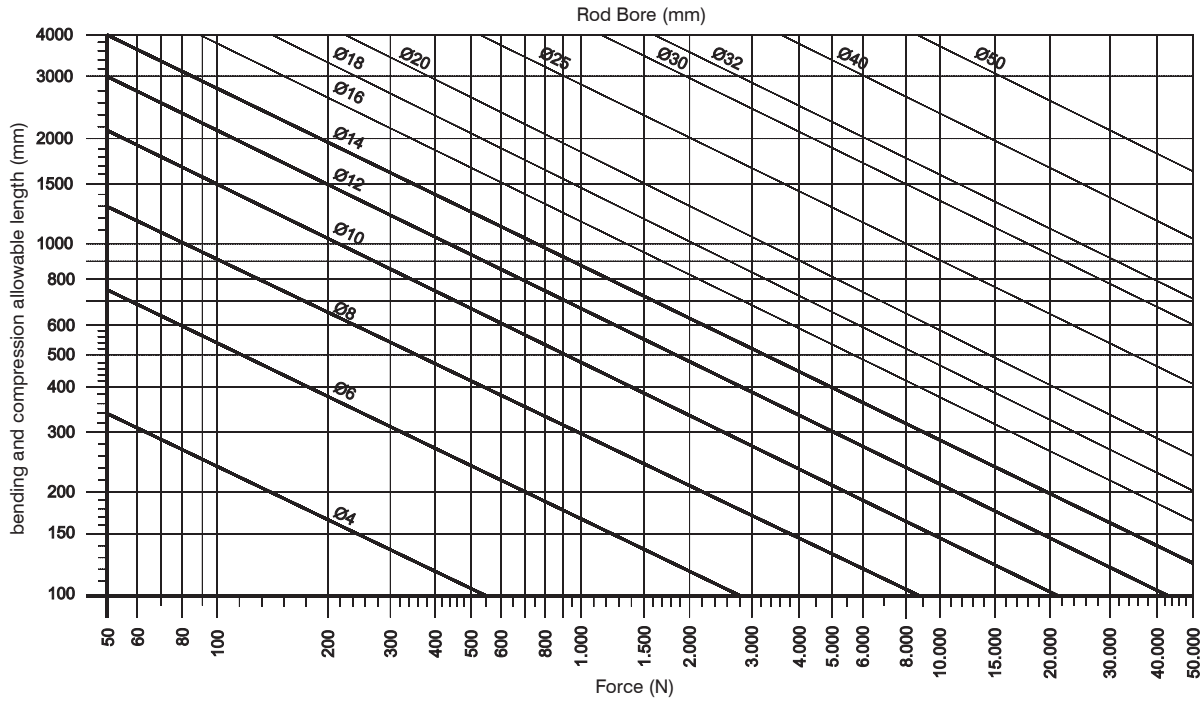
The diameter to choose is the next one up : Ø25 mm

Also this second example can be resolved using the below diagram: following the bending and compression distance line relative to 900mm up to the intersection with the 4000N maximum load we obtain Ø20 mm.

With the third equation or using the diagram it is possible to calculate the bending and compression distance.

A

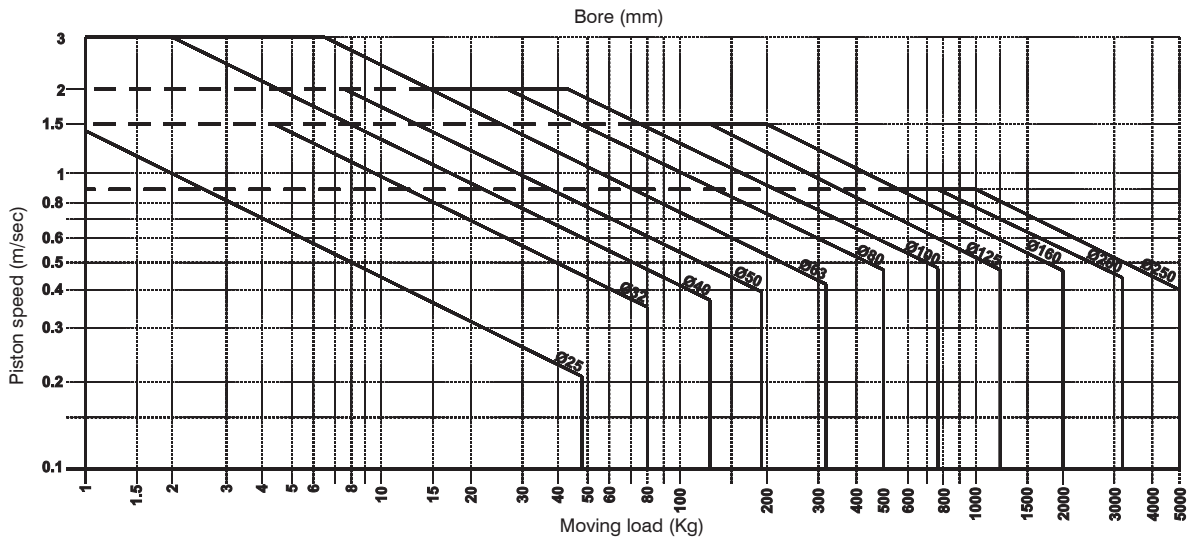
APPENDIX



End of stroke cushioning capability

The function of the end of stroke cushioning is to reduce the kinetic energy generated by movement of the load and to prevent high speed impact between the piston and end caps that could compromise the unit functionality. The use of non-cushioned cylinders is not recommended on high speed applications unless external means of deceleration (such as dampers) are used.

The maximum load that can be cushioned depends on the speed of the unit and the cylinder cushioning capacity. The chart below shows the values relative to the ISO 15552 series cylinders considering the out stroke movement and a supply pressure of 6 bar. The acceptable values for any diameter are those found below each size line.



Cylinder sizing

In order to properly size a cylinder it is necessary to consider the following parameters:

Force generated: calculated in function of the piston area and of the pressure that acts upon it.

$$F = \text{area} \times \text{pressure} \quad (\text{daN}) = (\text{cm}^2) \times (\text{bar})$$

The value is theoretical and needs to be reduced by approximately 10-15% in order to compensate for the effects of friction. We must also consider that the force generated during the return stroke (traction) is lower, as the area on which the pressure acts is reduced by the presence of the rod.

Weight of the load: the force generated by the cylinder must be sufficient to move the load in the desired direction within the specified time (cycle time). The load ratio (RdC) must not exceed 70%.

$$\frac{\text{Needed force (load weight)}}{\text{Available force (generated)}} \times 100 = \text{RdC}$$

Load position

Vertical lift (pull upwards): the real force generated by the cylinder must be sufficient to counterbalance the load and to accelerate it.

Example:

Weight to be lifted 120Kg

Working pressure 6 bar

Load ratio 70%

Using the load ratio equation it is possible to calculate the force needed to lift the load:

$$\text{Available force} = \frac{\text{Load}}{\text{Rdc}} \times 100 \quad \text{the result is } 171,4 \text{ daN}$$

A 63 bore cylinder which generates a theoretical force of 187 daN is suitable for the application.

A similar load ratio allows, using unidirectional flow regulators, good speed control.

When the speed is below 20mm/sec. It is difficult to properly control the movement.

The load ratio must be reduced to 50% on slow speed applications. In these conditions, or where constant movement is required, the use of a hydraulic speed control unit is recommended. On applications where the load is moving downwards, thereby increasing the force generated by the actuator, it is usually necessary to use flow regulators.

Horizontal or inclined movement: If the load is supported and the working position is horizontal, it is necessary to multiply the needed force by the coefficient of friction.

The coefficient of friction *m* varies according to the material.

For example considering *m* = 0.4

Weight to be moved 120Kg

Pressure 6 bar

Load ratio 70%

Solving the load ratio equation it is possible to calculate the available force:

$$\text{Available force} = \frac{\text{Load}}{\text{Rdc}} \times 100 \quad \text{which, in the above conditions is } 68,57 \text{ daN}$$

A Ø40 bore cylinder that generates a theoretical force of 75.4 daN is suitable for the application.

In cases of inclined application the required force increases according to the angle.

Also in these conditions it is necessary to multiply the needed force by a coefficient of friction.

THEORETICAL FORCE -PUSH- (N) - rod moving out

Bore (mm)	Push area (mm ²)	Feeding pressure (bar)									
		1	2	3	4	5	6	7	8	9	10
Ø 6	28	2,5	5,5	8	11	13,5	16,5	19	22	24,5	27,5
Ø 8	50	4,5	9,5	14,5	19,5	24,5	29,5	34	39	44	49
Ø 10	79	7,5	15	23	30,5	38	46	53,5	61,5	69	76,5
Ø 12	113	11	22	33	44	55	66	77	88	99	110
Ø 16	201	19	39	59	78	98	118	137	157	177	197
Ø 20	314	30	61	92	123	153	184	215	246	277	307
Ø 25	491	48	96	144	192	240	288	336	384	433	481
Ø 32	804	78	157	236	315	394	472	551	630	709	788
Ø 40	1.256	123	246	369	492	615	739	862	985	1.108	1.231
Ø 50	1.963	192	384	577	769	962	1.154	1.347	1.539	1.732	1.924
Ø 63	3.116	305	611	916	1.222	1.527	1.833	2.138	2.444	2.749	3.055
Ø 80	5.024	492	985	1.478	1.970	2.463	2.956	3.448	3.941	4.434	4.926
Ø 100	7.850	769	1.539	2.309	3.079	3.849	4.618	5.388	6.158	6.928	7.698
Ø 125	12.266	1.202	2.405	3.608	4.811	6.014	7.217	8.419	9.622	10.825	12.028
Ø 160	20.096	1.970	3.941	5.912	7.882	9.853	11.824	13.795	15.765	17.736	19.707
Ø 200	31.400	3.079	6.158	9.237	12.317	15.396	18.475	21.555	24.634	27.713	30.792
Ø 250	49.063	4.811	9.622	14.434	19.245	24.056	28.868	33.679	38.491	43.302	48.113

Surface difference - Cylinder piston / rod Ø

Ø cylinder - Ø rod	b
Ø 8 - Ø 4	0,377 cm ²
Ø 10 - Ø 4	0,659 cm ²
Ø 12 - Ø 6	0,848 cm ²
Ø 16 - Ø 6	1,727 cm ²
Ø 20 - Ø 8	2,638 cm ²
Ø 25 - Ø 10	4,121 cm ²
Ø 32 - Ø 12	6,908 cm ²
Ø 40 - Ø 14	11,021 cm ²
Ø 40 - Ø 16	10,550 cm ²
Ø 40 - Ø 18	10,017 cm ²
Ø 50 - Ø 14	18,086 cm ²
Ø 50 - Ø 18	17,082 cm ²
Ø 50 - Ø 20	16,485 cm ²
Ø 63 - Ø 20	28,017 cm ²
Ø 63 - Ø 22	27,357 cm ²
Ø 80 - Ø 22	46,441 cm ²
Ø 80 - Ø 25	45,334 cm ²
Ø 100 - Ø 25	73,594 cm ²
Ø 100 - Ø 30	71,435 cm ²
Ø 125 - Ø 30	115,591 cm ²
Ø 125 - Ø 32	114,618 cm ²
Ø 160 - Ø 40	188,400 cm ²
Ø 200 - Ø 40	301,440 cm ²

tab.2

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APPENDIX



Single acting cylinder spring initial and final load characteristics

Microbore cylinders ISO 6431 - 1260 series			Bore						
	Front spring	Rear spring	Ø 12	Ø 16	Ø 20	Ø 25	Ø 32	Ø 40	Ø 50
Initial load (N) external spring			9,9	10,8	10,8	7,9	19,7	39,3	39,3
Final load (N) compressed load			26,5	22,6	22,6	49,1	53,0	106,0	106,0

(stroke 0-40 mm)

Microbore cylinders ISO 6431 - 1280 series "MIR"			Bore						
	Front spring	Rear spring	Ø 8	Ø 10	Ø 12	Ø 16	Ø 20	Ø 25	Ø 32
Initial load (N) external spring			2,2	2,2	4,0	7,5	11,0	16,5	23,0
Final load (N) compressed load			4,2	4,2	8,7	21,0	22,0	30,7	30,7

(stroke 0-50 mm)

Cylinders ISO 15552 - 1319-20-21 series			Bore					
	Front spring	Rear spring	Ø 32	Ø 40	Ø 50	Ø 63	Ø 80	Ø 100
Initial load (N) external spring			17,2	24,6	51,0	51,0	98,1	98,1
Final load (N) compressed load			41,7	83,4	114,8	114,8	194,2	194,2

(stroke 0-50 mm)

Short stroke compact cylinders			Bore							
	Front spring	Rear spring	Ø 20	Ø 25	Ø 32	Ø 40	Ø 50	Ø 63	Ø 80	Ø 100
Initial load (N) external spring			7,9	9,9	34,4	34,4	50,1	54,0	117,7	108,9
Final load (N) compressed load			27,5	26,5	59,9	63,8	79,5	85,4	157,0	134,4

(stroke 0-10 mm)

"Europe" Compact cylinders			Bore									
	Front spring	Rear spring	Ø 12	Ø 16	Ø 20	Ø 25	Ø 32	Ø 40	Ø 50	Ø 63	Ø 80	Ø 100
Initial load (N) external spring			3,9	4,4	4,9	9,8	12,3	16,7	27,5	37,3	59,4	101,3
Final load (N) compressed load			9,3	17,7	18,1	25,5	34,3	44,1	51,0	63,8	99,4	141,9

(Ø12 stroke 0-10 mm - Ø16,100 stroke 0-25 mm)

Cylinder nuts recommended tightening torque	
Bore size	Torque (Nm)
Ø 32	8
Ø 40	8
Ø 50	16
Ø 63	16
Ø 80	22
Ø 100	22
Ø 125	30
Ø 160	85
Ø 200	85

Measure and conversion units

International system of units - table

Size	Name	Symbol
Lenght	Meter	m
Area	square meter	m ²
Volume	cubic meter	m ³
Force	Newton	N
Mass	kilogram	Kg
Pressure	Pascal	Pa (N/m ²)
Work and Energy	Joule	J (Nm)
Power	Watt	W (J/s)
Time	Second	s
Speed	meter / second	m/s
Acceleration	meter / second ²	m/s ²
Flow rate	meter / second ³	m ³ /s
Temperature	Kelvin	°K
Frequency	Hertz	Hz (1/s)
Electric current	Ampere	A
Voltage	Volt	V (W/A)
Electrical resistance	Ohm	Ω (V/A)
Electric power	Volt Ampere	VA (VA)

Measure and conversion units

Lenght	Centimetre (cm)	Meter (m)	Inch (In)	Foot (ft)	Yard (yd)
1 Meter (m)	100	1	39,37	3,281	1,094
1 Inch (In)	2,54	2,54x10 ⁻²	1	8,33x10 ⁻²	0,028
1 Foot (ft)	30,48	0,3048	12	1	0,333
1 Yard (yd)	91,44	0,9144	36	3	1

Area	Square centimetre (cm ²)	Square meter (m ²)	Square inch (sq in)	Square foot (sq ft)	Square yard (sq yd)
1 Square centimetre (cm ²)	1	1x10 ⁻⁴	0,155	1,08x10 ⁻³	1,2x10 ⁻⁴
1 Square meter (m ²)	1x10 ⁴	1	1.550	10,764	1,2
1 Square inch (sq in)	6,452	6,45x10 ⁻⁴	1	6,95x10 ⁻³	7,72x10 ⁻⁴
1 Square foot (sq ft)	929	9,29x10 ⁻²	144	1	0,111
1 Square yard (sq yd)	8.361	0,8361	1.296	9	1

Volume	Litre (l=dm ³)	Cubic metre (m ³)	Cubic inch (cu in)	Cubic foot (cu ft)	Gallon (gal-USA)	Gallon (gal-GB)
1 Liter (l) = 1dm ³	1	1x10 ⁻³	61,02	3,53x10 ⁻²	0,2642	0,22
1 Cubic meter (m ³)	1.000	1	6,102x10 ⁴	35,31	264,2	220
1 Cubic inch (cu in)	1,64x10 ⁻²	1,64x10 ⁻⁵	1	5,8x10 ⁻⁴	4,33x10 ⁻³	3,6x10 ⁻³
1 Cubic foot (cu ft)	28,317	2,83x10 ⁻²	1.728	1	7,48	6,23
1 Gallon (gal -USA)	3,785	3,79x10 ⁻³	231	0,1337	1	0,8327
1 Gallon (gal -GB)	4,546	4,55x10 ⁻³	277,4	0,1605	1,2	1



Mass (Weight)	Kilogram (Kg)	Pound (lb)	Hundred-weight USA	Hundred-weight GB
1 Kilogram (Kg)	1	2,205	1,102x10 ⁻³	9,842x10 ⁻⁴
1 Pound (lb)	0,4536	1	5x10 ⁻⁴	4,464x10 ⁻⁴
1 Hundred-weight USA	907,2	2.000	1	0,8929
1 Hundred-weight GB	1.016	2.240	1,12	1

Force	Newton (N)	Kilopound (kgp)	Poundal (pdl)
1 Newton (N)	1	0,102	7,23
1 Kilopound (kgp)	9,807	1	70,93
1 Poundal (pdl)	0,1383	0,0141	1

Pressure	Pascal (Pa)	Bar (bar)	Poundal/pollice ² (psi)	Technical atmosphere (at=kg/cm ²)	Atmosphere (atm)	Column of Mercury (mmHg = Torr)	Column of water (mH ₂ O)
1 Pascal (Pa)	1	1x10 ⁻⁵	1,45x10 ⁻⁴	1,02x10 ⁻⁵	9,87x10 ⁻⁶	7,5x10 ⁻³	1,02x10 ⁻⁴
1 Bar (bar)	1x10 ⁵	1	14,50	1,02	0,9869	750	10,2
1 Poundal/pollice ² (psi)	6.895	0,069	1	7,03x10 ⁻²	0,06805	51,72	0,703
1 Technical atmosphere (at=kg/cm ²)	9,807x10 ⁴	0,9807	14,22	1	0,9678	735,6	10
1 Atmosphere (atm)	1,013x10 ⁵	1,013	14,70	1,033	1	760	10,33
1 millimetre of mercury (mmHg = Torr)	133,32	1,34x10 ⁻³	1,934x10 ⁻²	1,36x10 ⁻³	1,316x10 ⁻³	1	1,36x10 ⁻²
1 Metre of water (mH ₂ O)	9.810	9,81x10 ⁻²	1,423	0,1	9,682x10 ⁻²	73,6	1

Work and Energy	Kilocalorie (kcal)	Kilogrammetre (kgm)	Kilowatt (kWh)	Horse power/hr (Hph) non Metric	Joule (J)
1 Kilocalorie (kcal)	1	427	1,163x10 ⁻³	1,561x10 ⁻³	4.190
1 Kilogrammeter (kgm)	2,34x10 ⁻³	1	2,724x10 ⁻⁶	3,653x10 ⁻⁶	9,806
1 Kilowatt-hour (kWh)	860	367.122	1	1,341	3,6x10 ⁵
1 Horsepower/hour-non metric (hph)	641	273.761	0,7457	1	2,685x10 ⁶
1 Joule (J)	2,39x10 ⁻⁴	0,102	2,78x10 ⁻⁷	3,725x10 ⁻⁷	1

Temperature	Kelvin (K)	Celsius (°C)	Fahrenheit (°F)
Kelvin (K)	/	K-273 = °C	(K-273)x1,8 = °F
Celsius (°C)	°C+273 = K	/	(°Cx1,8)+32 = °F
Fahrenheit (°F)	273+[(°F-32):1,8] = K	(°F-32):1,8 = °C	/

ISO metric thread UNI 4535-64

Coarse ISO metric thread			
Thread	Pitch (mm)	Ø Drilling (mm)	Ø Drill (mm)
M 1,6	0,35	1,321	1,20
M 1,8	0,35	1,521	1,45
M 2	0,40	1,679	1,60
M 2,2	0,45	1,838	1,75
M 2,5	0,45	2,138	2,05
M 3	0,50	2,599	2,5
M 3,5	0,60	3,010	2,9
M 4	0,70	3,422	3,3
M 4,5	0,75	3,878	3,7
M 5	0,80	4,334	4,2
M 6	1	5,153	5
M 7	1	6,153	6
M 8	1,25	6,912	6,8
M 9	1,25	7,912	7,8
M 10	1,5	8,676	8,5
M 11	1,5	9,676	9,5
M 12	1,75	10,441	10,2
M 14	2	12,210	12
M 16	2	14,210	14
M 18	2,5	15,744	15,5
M 20	2,5	17,744	17,5
M 22	2,5	19,744	19,5
M 24	3	21,252	21
M 27	3	24,252	24
M 30	3,5	26,771	26,5
M 33	3,5	29,771	29,5
M 36	4	32,270	32
M 39	4	35,270	35
M 42	4,5	37,799	37,5
M 45	4,5	40,799	40,5
M 48	5	43,297	43
M 52	5	47,297	47
M 56	5,5	50,796	50,5
M 60	5,5	54,796	54,5
M 64	6	58,305	58
M 68	6	62,305	62

Fine ISO metric thread			
Thread	Pitch (mm)	Ø Drilling (mm)	Ø Drill (mm)
M 3	0,35	2,721	2,65
M 4	0,50	3,599	3,5
M 5	0,50	4,599	4,5
M 6	0,75	5,378	5,2
M 7	0,75	6,378	6,2
M 8	0,75	7,378	7,2
M 8	1	7,153	7
M 9	1	8,153	8
M 10	0,75	9,378	9,2
M 10	1	9,153	9
M 10	1,25	8,912	8,8
M 11	1	10,153	10
M 12	1	11,153	11
M 12	1,25	10,912	10,8
M 12	1,5	10,676	10,5
M 14	1	13,153	13
M 14	1,25	12,912	12,8
M 14	1,5	12,676	12,5
M 15	1	14,153	14
M 15	1,5	13,676	13,5
M 16	1	15,153	15
M 16	1,5	14,676	14,5
M 18	1	17,153	17
M 18	1,5	16,676	16,5
M 18	2	16,210	16
M 20	1	19,153	19
M 20	1,5	18,676	18,5
M 20	2	18,210	18
M 22	1	21,153	21
M 22	1,5	20,676	20,5
M 21	2	20,210	20
M 24	1	23,153	23
M 24	1,5	22,676	22,5
M 24	2	22,210	22
M 24	1	24,153	24
M 25	1,5	23,676	23,5
M 26	1,5	24,676	24,5
M 27	1,5	25,676	25,5
M 27	2	25,210	25
M 28	1,5	26,676	26,5
M 30	1,5	28,676	28,5
M 30	2	28,210	28
M 32	1,5	30,676	30,5
M 33	2	31,210	31
M 35	1,5	33,676	33,5
M 36	1,5	34,676	34,5
M 36	2	34,210	34
M 36	3	33,252	33
M 38	1,5	36,676	36,5
M 39	3	36,252	36
M 40	1,5	38,676	38,5
M 42	1,5	40,676	40,5
M 45	1,5	43,676	43,5
M 50	1,5	48,676	48,5



GAS thread

«G» UNI 338-66			
Thread	Ø External (mm)	Ø Drilling (mm)	Ø Drill point (mm)
G 1/8" - 28	9,73	8,68	8,70
G 1/4" - 19	13,16	11,62	11,75
G 3/8" - 19	16,66	15,12	15,25
G 1/2" - 14	20,95	18,86	19,00
G 5/8" - 14	22,91	20,82	21,00
G 3/4" - 14	26,44	24,35	24,50
G 7/8" - 14	30,20	28,11	28,25
G 1" - 11	33,25	30,59	30,50
G 1 1/8" - 11	37,90	35,24	35,50
G 1 1/4" - 11	41,91	39,25	39,50
G 1 3/8" - 11	44,32	41,66	41,50
G 1 1/2" - 11	47,80	45,14	45,00
G 1 5/8" - 11	51,32	48,67	48,50
G 1 3/4" - 11	53,75	51,08	51,00
G 2" - 11	59,61	56,95	57,00
G 2 1/4" - 11	65,71	63,05	63,00
G 2 1/2" - 11	75,18	72,52	72,50
G 2 3/4" - 11	81,53	78,87	79,00
G 3" - 11	87,88	85,22	85,50
G 3 1/4" - 11	93,98	91,32	91,50
G 3 1/2" - 11	100,33	97,67	97,50
G 3 3/4" - 11	106,68	104,02	104,00
G 4" - 11	113,03	110,37	110,50

«Gc» UNI 339-66			
Thread	Ø External (mm)	Ø Drilling (mm)	Ø Drill point (mm)
Gc 1/8" - 28	8,5	4,9	3,1
Gc 1/4" - 19	11,5	7,3	4,7
Gc 3/8" - 19	15,0	7,7	5,1
Gc 1/2" - 14	18,5	10,0	6,4
Gc 3/4" - 14	23,5	11,3	7,7
Gc 1" - 11	30,0	12,7	8,1
Gc 1 1/4" - 11	38,0	15,0	10,4
Gc 1 3/8" - 11	41,0	15,0	10,4
Gc 1 1/2" - 11	44,5	15,0	10,4
Gc 2" - 11	56,0	18,2	13,6
Gc 2 1/2" - 11	72,0	21,0	14,0
Gc 3" - 11	85,0	24,1	17,1
		max	min

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APPENDIX



Alphanumeric index

Air distribution

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1002.52...	1000	ISO 5599-1 valves & solenoid valves	306
1002.53...	1000	ISO 5599-1 valves & solenoid valves	306
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1011.52...	1000	ISO 5599-1 valves & solenoid valves	310
1011.53...	1000	ISO 5599-1 valves & solenoid valves	309
1011.53...	1000	ISO 5599-1 valves & solenoid valves	310
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228...7...	200	Spool valves & solenoid valves	28
228...8...	200	Spool valves & solenoid valves	28
228...9...	200	Spool valves & solenoid valves	29
228.53...10...	200	Spool valves & solenoid valves	33
228.53...11...	200	Spool valves & solenoid valves	35
228.53...9...	200	Spool valves & solenoid valves	31
228.53...99...	200	Spool valves & solenoid valves	32-33
2300...	2300	Solenoid valves manifold	407
2300.16	2300	Solenoid valves manifold	407
2300.16	3000	Solenoid valves manifold	537
2300.25...	2100	Spool valves & solenoid valves	137
2300.25...	2400	Spool valves & solenoid valves	160
2300.25...	2700	ISO15407-2 valves & solenoid valves	377
2300.25...	2200	Solenoid valves manifold	426
2300.25...	2500-F	Solenoid valves manifold	464
2300.25...	2500-T	Solenoid valves manifold	496
2300.25...	2300	Solenoid valves manifold	408
2300.25...	3000	Solenoid valves manifold	538

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2300.44...	3000	Solenoid valves manifold	538
2300.50	2300	Solenoid valves manifold	407
2308...	2300	Solenoid valves manifold	407
230C.42...	2300	Solenoid valves manifold	404-405
230C.53.31...	2300	Solenoid valves manifold	402
230C.62...	2300	Solenoid valves manifold	403-404
2311.03...	2300	Solenoid valves manifold	406
2311.05...	2300	Solenoid valves manifold	406
2312.00	2300	Solenoid valves manifold	406
2317...	2300	Solenoid valves manifold	408
23EC.52.00...	2300	Solenoid valves manifold	401-402
2400...L...	2100	Spool valves & solenoid valves	137-160
2400...L...	2400	Spool valves & solenoid valves	160
2400.00	2400	Spool valves & solenoid valves	159
2400.04.25	2400	Spool valves & solenoid valves	160
2400.09...00	2200-Sc	Solenoid valves manifold	452
2400.15...00	2200-Sc	Solenoid valves manifold	452
2400.15.00	2400	Spool valves & solenoid valves	159
2400.15.02	2400	Spool valves & solenoid valves	160
2400.25...25	2700	ISO15407-2 valves & solenoid valves	377
2400.25...25	2200	Solenoid valves manifold	426
2400.25...25	2500-F	Solenoid valves manifold	464
2400.25...25	2500-T	Solenoid valves manifold	496
2400.37...	2100	Spool valves & solenoid valves	137
2400.37...	2400	Spool valves & solenoid valves	160
2400.37...	2700	ISO15407-2 valves & solenoid valves	377
2400.37...	2200	Solenoid valves manifold	426
2400.37...	2500-F	Solenoid valves manifold	464
2400.37...	2500-T	Solenoid valves manifold	496
2400.37...	3000	Solenoid valves manifold	538
2400.P...	2400	Spool valves & solenoid valves	159
241A.52.00...	2400	Spool valves & solenoid valves	140-141-143
241A.53...	2400	Spool valves & solenoid valves	143
241A.62...	2400	Spool valves & solenoid valves	144
2430...	2400	Spool valves & solenoid valves	150-151
2430.50	2400	Spool valves & solenoid valves	159
243A.52.00...	2400	Spool valves & solenoid valves	145-146-147
243A.53...	2400	Spool valves & solenoid valves	148
243A.62...	2400	Spool valves & solenoid valves	148-149
2440...	2400	Spool valves & solenoid valves	157
2440.50	2400	Spool valves & solenoid valves	159
2445.52.00...	2400	Spool valves & solenoid valves	152-153
2445.62...	2400	Spool valves & solenoid valves	156
244C.52.00...	2400	Spool valves & solenoid valves	154
244C.53...	2400	Spool valves & solenoid valves	155
2530.00	2500-F	Solenoid valves manifold	459
2530.00	2500-T	Solenoid valves manifold	489
2530.01B	2500-F	Solenoid valves manifold	459
2530.01M	2500-F	Solenoid valves manifold	459
2530.02...	2500-F	Solenoid valves manifold	458
2530.03...	2500-F	Solenoid valves manifold	458
2530.08F	2500-F	Solenoid valves manifold	467
2530.10	2500-F	Solenoid valves manifold	459
2530.10.2A	2500-F	Solenoid valves manifold	460
2530.10.4A	2500-F	Solenoid valves manifold	462
2530.12...	2500-F	Solenoid valves manifold	458
2530.17	2500-F	Solenoid valves manifold	464
2530.17	2500-T	Solenoid valves manifold	496



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2531.52.00...	2500-F	Solenoid valves manifold	456
2531.53.31...	2500-F	Solenoid valves manifold	457
2531.62...	2500-F	Solenoid valves manifold	457
2540.02...	2500-T	Solenoid valves manifold	489
2540.03...	2500-T	Solenoid valves manifold	489
2540.08T	2700	ISO15407-2 valves & solenoid valves	380
2540.08T	2500-T	Solenoid valves manifold	499
2540.10	2500-T	Solenoid valves manifold	490
2540.10.2A	2500-T	Solenoid valves manifold	492
2540.10.4A	2500-T	Solenoid valves manifold	494
2540.12...	2500-T	Solenoid valves manifold	489
2540.KD.00	2500-T	Solenoid valves manifold	490
2540.KP01	2500-T	Solenoid valves manifold	490
2540.KT.P	2500-T	Solenoid valves manifold	496
2541.01...	2500-T	Solenoid valves manifold	490
2541.52.00...	2500-T	Solenoid valves manifold	487
2541.53.31...	2500-T	Solenoid valves manifold	488
2541.62...	2500-T	Solenoid valves manifold	488
2544.01...	2500-T	Solenoid valves manifold	490
2546.01...	2500-T	Solenoid valves manifold	490
2548.01...	2500-T	Solenoid valves manifold	490
261 ^A .52.00...	2600	Spool valves & solenoid valves	163-164-165
261 ^A .53...	2600	Spool valves & solenoid valves	166
2630...	2600	Spool valves & solenoid valves	171
263 ^A .52.00...	2600	Spool valves & solenoid valves	167-168-169
263 ^A .52.00...	2600	Spool valves & solenoid valves	169
263 ^A .53...	2600	Spool valves & solenoid valves	170
2640...	2600	Spool valves & solenoid valves	176-177
2645.52.00...	2600	Spool valves & solenoid valves	172-173
264 ^C .52.00...	2600	Spool valves & solenoid valves	174
264 ^C .53...	2600	Spool valves & solenoid valves	175
2740.00	2700	ISO15407-2 valves & solenoid valves	377
2740.01...	2700	ISO15407-2 valves & solenoid valves	376
2740.02...	2700	ISO15407-2 valves & solenoid valves	376
2740.03...	2700	ISO15407-2 valves & solenoid valves	376
2740.17	2700	ISO15407-2 valves & solenoid valves	377
2741.52.00...	2700	ISO15407-2 valves & solenoid valves	374
2741.53.31...	2700	ISO15407-2 valves & solenoid valves	375
2741.62...35...	2700	ISO15407-2 valves & solenoid valves	375
300...	300	Direct operated solenoid valves	204-205
305...	300	Direct operated solenoid valves	194-195
305.11...	300	Direct operated solenoid valves	198
305.M...	300	Direct operated solenoid valves	198
305.M1	300	Direct operated solenoid valves	197
305.M1/1	300	Direct operated solenoid valves	197
305.M1/9	300	Direct operated solenoid valves	197
305.M5/B	300	Direct operated solenoid valves	200
3115...	3000	Solenoid valves manifold	528
3115.52.00...	3000	Solenoid valves manifold	524-526
3115.53.00...	3000	Solenoid valves manifold	525-527
3115.62.00...	3000	Solenoid valves manifold	525-527
3130.17	3000	Solenoid valves manifold	538
3140...	3000	Solenoid valves manifold	536
3140.10	3000	Solenoid valves manifold	537
3141.52.00...	3000	Solenoid valves manifold	534
3141.53.00...	3000	Solenoid valves manifold	535
3141.62.00...	3000	Solenoid valves manifold	535
3145...	3000	Solenoid valves manifold	539

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315...	300	Direct operated solenoid valves	186
345.M1	300	Direct operated solenoid valves	197
345.M1/1	300	Direct operated solenoid valves	197
345.M1/9	300	Direct operated solenoid valves	197
345.M5/B	300	Direct operated solenoid valves	200
354...	300	Direct operated solenoid valves	186
355...	300	Direct operated solenoid valves	186
355.M1	300	Direct operated solenoid valves	197
355.M1/1	300	Direct operated solenoid valves	197
355.M1/9	300	Direct operated solenoid valves	197
355.M5/B	300	Direct operated solenoid valves	200
35M...	300	Direct operated solenoid valves	188
35S...	300	Direct operated solenoid valves	189
371...	300	Direct operated solenoid valves	18
395...	300	Direct operated solenoid valves	183
395.00	300	Direct operated solenoid valves	180-181
411...0.0...	400	Spool valves & solenoid valves	108
411...0.1...	400	Spool valves & solenoid valves	107
411...0.12...	400	Spool valves & solenoid valves	107
411.53...0...	400	Spool valves & solenoid valves	108
412/2...0.0...	400	Spool valves & solenoid valves	106
412/2...0.1...	400	Spool valves & solenoid valves	105
412/2...0.12...	400	Spool valves & solenoid valves	105
412/2.53...0.0...	400	Spool valves & solenoid valves	106
452...0.0...	400	Spool valves & solenoid valves	102
452...0.1...	400	Spool valves & solenoid valves	101
452...0.12...	400	Spool valves & solenoid valves	101
452.53...0...	400	Spool valves & solenoid valves	102
452/1...0.0...	400	Spool valves & solenoid valves	104
452/1...0.1...	400	Spool valves & solenoid valves	103
452/1...0.12...	400	Spool valves & solenoid valves	103
452/1.53...0...	400	Spool valves & solenoid valves	104
464...0.0...	400	Spool valves & solenoid valves	97
464...0.1...	400	Spool valves & solenoid valves	97
464...0.12...	400	Spool valves & solenoid valves	97
464.53...0...	400	Spool valves & solenoid valves	98
464/1...0.0...	400	Spool valves & solenoid valves	99
464/1...0.1...	400	Spool valves & solenoid valves	99
464/1...0.12...	400	Spool valves & solenoid valves	99
464/1.53...0...	400	Spool valves & solenoid valves	100
468...0.0...	400	Spool valves & solenoid valves	91
468...0.1...	400	Spool valves & solenoid valves	91
468...0.12...	400	Spool valves & solenoid valves	91
468.53...0...	400	Spool valves & solenoid valves	92
468/1...0.0...	400	Spool valves & solenoid valves	93
468/1...0.1...	400	Spool valves & solenoid valves	92
468/1...0.12...	400	Spool valves & solenoid valves	92
468/1.53...0...	400	Spool valves & solenoid valves	93
488...	400	Spool valves & solenoid valves	96
488...0.0...	400	Spool valves & solenoid valves	94
488...0.1...	400	Spool valves & solenoid valves	94
488...0.12...	400	Spool valves & solenoid valves	94
488.53...0...	400	Spool valves & solenoid valves	95
50...	50-T50	Accessories - Blocking valves	350-351
5030.M12	3000	Solenoid valves manifold	552
5130..	3000	Solenoid valves manifold	547-548-550-551
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5200.08	2300	Solenoid valves manifold	418
5222.08S	2200	Solenoid valves manifold	445
5225.08F	2500-F	Solenoid valves manifold	481
5225.08T	2700	ISO15407-2 valves & solenoid valves	393
5225.08T	2500-T	Solenoid valves manifold	513
5225.12T	2700	ISO15407-2 valves & solenoid valves	394
5225.12T	2500-T	Solenoid valves manifold	514
5225.2 _ . _ _ T	2700	ISO15407-2 valves & solenoid valves	395
5225.25F	2500-F	Solenoid valves manifold	482
5225.2C.00F	2500-F	Solenoid valves manifold	483
5225.2C.00T	2500-T	Solenoid valves manifold	515
5225.2C.01F	2500-F	Solenoid valves manifold	483
5225.2C.01T	2500-T	Solenoid valves manifold	515
5225.2P . 0 _ T	2700	ISO15407-2 valves & solenoid valves	396
5225.2P . 1 _ T	2700	ISO15407-2 valves & solenoid valves	397
5225.2P00T	2500-T	Solenoid valves manifold	516
5225.2P10T	2500-T	Solenoid valves manifold	517
5225.2P01T	2500-T	Solenoid valves manifold	516
5225.2P11T	2500-T	Solenoid valves manifold	517
5225.2T.00F	2500-F	Solenoid valves manifold	483
5225.2T.00T	2500-T	Solenoid valves manifold	515
5225.2T.01F	2500-F	Solenoid valves manifold	483
5225.2T.01T	2500-T	Solenoid valves manifold	515
5230..	3000	Solenoid valves manifold	546-548-549
5300.T08	2700	ISO15407-2 valves & solenoid valves	398
5300.T08	2200	Solenoid valves manifold	446
5300.T08	2500-F	Solenoid valves manifold	484
5300.T08	2500-T	Solenoid valves manifold	518
5300.T12	2700	ISO15407-2 valves & solenoid valves	398
5300.T12	2200	Solenoid valves manifold	446
5300.T12	2500-F	Solenoid valves manifold	484
5300.T12	2500-T	Solenoid valves manifold	518
5308A.M03.00	2700	ISO15407-2 valves & solenoid valves	398
5308A.M03.00	2200	Solenoid valves manifold	446
5308A.M03.00	2500-F	Solenoid valves manifold	484
5308A.M03.00	2500-T	Solenoid valves manifold	518
5312A.F04.00	2700	ISO15407-2 valves & solenoid valves	398
5312A.F04.00	2200	Solenoid valves manifold	446
5312A.F04.00	2500-F	Solenoid valves manifold	484
5312A.F04.00	2500-T	Solenoid valves manifold	518
5312A.F05.00	2700	ISO15407-2 valves & solenoid valves	398
5312A.F05.00	2200	Solenoid valves manifold	446
5312A.F05.00	2500-F	Solenoid valves manifold	484
5312A.F05.00	2500-T	Solenoid valves manifold	518
5312A.M05.00	2700	ISO15407-2 valves & solenoid valves	398
5312A.M05.00	2700	ISO15407-2 valves & solenoid valves	398
5312A.M05.00	2200	Solenoid valves manifold	446
5312A.M05.00	2500-F	Solenoid valves manifold	484
5312A.M05.00	2500-F	Solenoid valves manifold	484
5312A.M05.00	2500-T	Solenoid valves manifold	518
5312A.M05.00	2500-T	Solenoid valves manifold	518
5312B.F05.00	2700	ISO15407-2 valves & solenoid valves	398
5312B.F05.00	2200	Solenoid valves manifold	446
5312B.F05.00	2500-F	Solenoid valves manifold	484
5312B.F05.00	2500-T	Solenoid valves manifold	518
5312B.M05.00	2700	ISO15407-2 valves & solenoid valves	398
5312B.M05.00	2200	Solenoid valves manifold	446
5312B.M05.00	2500-F	Solenoid valves manifold	484

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5312B.M05.00	2500-T	Solenoid valves manifold	518
5312D.M04.00	2700	ISO15407-2 valves & solenoid valves	398
5312D.M04.00	2200	Solenoid valves manifold	446
5312D.M04.00	2500-F	Solenoid valves manifold	484
5312D.M04.00	2500-T	Solenoid valves manifold	518
5322.32S	2200	Solenoid valves manifold	438
5323.22	2300	Solenoid valves manifold	417
5325.32F	2500-F	Solenoid valves manifold	475
5325.32T	2700	ISO15407-2 valves & solenoid valves	387
5325.32T	2500-T	Solenoid valves manifold	507
5330.64...	3000	Solenoid valves manifold	543
5422.32S	2200	Solenoid valves manifold	437
5423.22	2300	Solenoid valves manifold	416
5425.32F	2500-F	Solenoid valves manifold	474
5425.32T	2700	ISO15407-2 valves & solenoid valves	386
5425.32T	2500-T	Solenoid valves manifold	506
551.11...	55	Accessories - Function fittings	355
551.12...	55	Accessories - Function fittings	356
551.13...	55	Accessories - Function fittings	567
551.141...	55	Accessories - Function fittings	359
551.151...	55	Accessories - Function fittings	359
551.161...	55	Accessories - Function fittings	360
551.178...	55	Accessories - Function fittings	360
551.181...	55	Accessories - Function fittings	361
551.1F...	55	Accessories - Function fittings	362
551.1G...	55	Accessories - Function fittings	364
551.1H...	55	Accessories - Function fittings	366
551.22...	55	Accessories - Function fittings	356
551.23...	55	Accessories - Function fittings	358
551.281...	55	Accessories - Function fittings	361
551.2F...	55	Accessories - Function fittings	363
551.2G...	55	Accessories - Function fittings	365
551.2H...	55	Accessories - Function fittings	366
55116	55	Accessories - Function fittings	367
55150	55	Accessories - Function fittings	367
55160	55	Accessories - Function fittings	367
551K...	55	Accessories - Function fittings	368
551KD...	55	Accessories - Function fittings	367
551KG...	55	Accessories - Function fittings	368
551KL1	55	Accessories - Function fittings	368
551KUU	55	Accessories - Function fittings	368
5522.32S	2200	Solenoid valves manifold	436
5523.22	2300	Solenoid valves manifold	415
5525.32F	2500-F	Solenoid valves manifold	473
5525.32T	2700	ISO15407-2 valves & solenoid valves	385
5525.32T	2500-T	Solenoid valves manifold	505
5530.64...	3000	Solenoid valves manifold	542
5722.32S.EC	2200	Solenoid valves manifold	439
5722.32S.EI	2200	Solenoid valves manifold	441
5722.32S.MT	2200	Solenoid valves manifold	443
5722.32S.PL	2200	Solenoid valves manifold	442
5722.32S.PN	2200	Solenoid valves manifold	440
5725.32F.EC	2500-F	Solenoid valves manifold	476
5725.32F.EI	2500-F	Solenoid valves manifold	478
5725.32F.MT	2500-F	Solenoid valves manifold	480
5725.32F.PL	2500-F	Solenoid valves manifold	479
5725.32F.PN	2500-F	Solenoid valves manifold	477
5725.32T.EC	2700	ISO15407-2 valves & solenoid valves	388



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5725.32T.EC	2500-T	Solenoid valves manifold	508
5725.32T.EI	2700	ISO15407-2 valves & solenoid valves	390
5725.32T.EI	2500-T	Solenoid valves manifold	510
5725.32T.MT	2700	ISO15407-2 valves & solenoid valves	392
5725.32T.MT	2500-T	Solenoid valves manifold	512
5725.32T.PL	2700	ISO15407-2 valves & solenoid valves	391
5725.32T.PL	2500-T	Solenoid valves manifold	511
5725.32T.PN	2700	ISO15407-2 valves & solenoid valves	389
5725.32T.PN	2500-T	Solenoid valves manifold	509
5730.128...	3000	Solenoid valves manifold	544
5822.32S	2200	Solenoid valves manifold	444
5830.64...	3000	Solenoid valves manifold	545
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6.01.05.180	600	Accessories-Pneumatic circuit devices	330
6.01.05.180/2	600	Accessories-Pneumatic circuit devices	330
6.01.05.90	600	Accessories-Pneumatic circuit devices	329
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6.01.305...	600	Accessories-Pneumatic circuit devices	328
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6.01.34	600	Accessories-Pneumatic circuit devices	331
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6.07...	600	Accessories-Pneumatic circuit devices	335
6.07.18...	600	Accessories-Pneumatic circuit devices	335
6.08.../4	600	Accessories-Pneumatic circuit devices	335
6.08.../8	600	Accessories-Pneumatic circuit devices	336
6.09.12...	600	Accessories-Pneumatic circuit devices	336
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6.10.18...	600	Accessories-Pneumatic circuit devices	338
6.11...	600	Accessories-Pneumatic circuit devices	337
6.13.00	600	Accessories-Pneumatic circuit devices	340
771...	700	Poppet valves and solenoid valves	215
771/V...	700	Poppet valves and solenoid valves	216
772...	700	Poppet valves and solenoid valves	211
772/V...	700	Poppet valves and solenoid valves	212
773...	700	Poppet valves and solenoid valves	213
773/V...	700	Poppet valves and solenoid valves	214
776...	700	Poppet valves and solenoid valves	217-218
776/V...	700	Poppet valves and solenoid valves	219-220
779...	700	Poppet valves and solenoid valves	209
779/V...	700	Poppet valves and solenoid valves	210
805...	800	Spool valves & solenoid valves	71

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805...0...	800	Spool valves & solenoid valves	70
805...11...	800	Spool valves & solenoid valves	69
808...	800	Spool valves & solenoid valves	76
808...0...	800	Spool valves & solenoid valves	74
808...11...	800	Spool valves & solenoid valves	72
808.53...0...	800	Spool valves & solenoid valves	75
808.53...11...	800	Spool valves & solenoid valves	73
888...	888	Spool valves & solenoid valves	83
8880.32...	888	Spool valves & solenoid valves	78
8880.52.00.35...	888	Spool valves & solenoid valves	78-79
8880.52.00.39...	888	Spool valves & solenoid valves	78
8880.53...	888	Spool valves & solenoid valves	79
8880E.32...	888	Spool valves & solenoid valves	79
8880E.32.00.35...	888	Spool valves & solenoid valves	80
8880E.52.00.35...	888	Spool valves & solenoid valves	80
8880E.52.00.39...	888	Spool valves & solenoid valves	80
8880E.53...	888	Spool valves & solenoid valves	81
8883...	888	Spool valves & solenoid valves	84
8884.32.00.39...	888	Spool valves & solenoid valves	82
8884.52.00.35...	888	Spool valves & solenoid valves	82
8884.52.00.39...	888	Spool valves & solenoid valves	81
8884.53...35...	888	Spool valves & solenoid valves	82
888M...	888	Spool valves & solenoid valves	85
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900.18.11	900	Accessories -Complementary valves	344
900.18.9	900	Accessories -Complementary valves	344
900.19.01	900	Accessories -Complementary valves	348
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900.52...	900	Accessories -Complementary valves	345-346
900.52.1.1	900	Accessories -Complementary valves	343
CMP1E...	2200-Sc	Solenoid valves manifold	451
CMP9E...	2200-Sc	Solenoid valves manifold	451
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17008B.E...	1700	Air service units	96-99
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GP171AP...	Airplus	Air service units	82-86
GP171BP...	Airplus	Air service units	82-86
GP171CP...	Airplus	Air service units	82-86
GP172AP...	Airplus	Air service units	82-86
GP172BP...	Airplus	Air service units	82-86
GP172CP...	Airplus	Air service units	82-86
GP173AP...	Airplus	Air service units	82-86
GP173BP...	Airplus	Air service units	82-86
GP173CP...	Airplus	Air service units	82-86
GP174BP...	Airplus	Air service units	82-86
GT171A...	Airplus	Air service units	48-50
GT171AP...	Airplus	Air service units	82-86
GT171B...	Airplus	Air service units	48-50
GT171BP...	Airplus	Air service units	82-86
GT171C...	Airplus	Air service units	48-50
GT171CP...	Airplus	Air service units	82-86
GT172AP...	Airplus	Air service units	82-86
GT172BP...	Airplus	Air service units	82-86
GT172CP...	Airplus	Air service units	82-86
GT173AP...	Airplus	Air service units	82-86
GT173BP...	Airplus	Air service units	82-86
GT173CP...	Airplus	Air service units	82-86
GT174BP...	Airplus	Air service units	82-86
L171ADA...	Airplus	Air service units	10-14
L171AE...	Airplus	Air service units	25-30
L171AF...	Airplus	Air service units	5-9
L171AR...	Airplus	Air service units	31-37
L171AV...	Airplus	Air service units	58-61
L171BDA...	Airplus	Air service units	10-14
L171BE...	Airplus	Air service units	25-30
L171BF...	Airplus	Air service units	5-9
L171BR...	Airplus	Air service units	33-37
L171BV...	Airplus	Air service units	58-61
L171CDA...	Airplus	Air service units	10-14
L171CE...	Airplus	Air service units	25-30
L171CF...	Airplus	Air service units	5-9
L171CR...	Airplus	Air service units	33-37
L171CV...	Airplus	Air service units	58-61
L172ADA...	Airplus	Air service units	10-14
L172AE...	Airplus	Air service units	25-30
L172AF...	Airplus	Air service units	5-9
L172AR...	Airplus	Air service units	33-37
L172AV...	Airplus	Air service units	58-61
L172BDA...	Airplus	Air service units	10-14
L172BE...	Airplus	Air service units	25-30
L172BF...	Airplus	Air service units	5-9
L172BR...	Airplus	Air service units	33-37
L172BV...	Airplus	Air service units	58-61
L172CDA...	Airplus	Air service units	10-14
L172CE...	Airplus	Air service units	25-30
L172CF...	Airplus	Air service units	5-9
L172CR...	Airplus	Air service units	33-37
L172CV...	Airplus	Air service units	58-61
L173ADA...	Airplus	Air service units	10-14
L173ADD...	Airplus	Air service units	20-24
L173AE...	Airplus	Air service units	25-30
L173AF...	Airplus	Air service units	5-9
L173AR...	Airplus	Air service units	33-37



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L173AV...	Airplus	Air service units	58-61
L173BDA...	Airplus	Air service units	10-14
L173BDD...	Airplus	Air service units	20-24
L173BE...	Airplus	Air service units	25-30
L173BF...	Airplus	Air service units	5-9
L173BR...	Airplus	Air service units	33-37
L173BV...	Airplus	Air service units	58-61
L173CDA...	Airplus	Air service units	10-14
L173CDD...	Airplus	Air service units	20-24
L173CE...	Airplus	Air service units	25-30
L173CF...	Airplus	Air service units	5-9
L173CR...	Airplus	Air service units	33-37
L173CV...	Airplus	Air service units	58-61
L174BDA...	Airplus	Air service units	10-14
L174BDD...	Airplus	Air service units	20-24
L174BE...	Airplus	Air service units	25-30
L174BF...	Airplus	Air service units	5-9
L174BR...	Airplus	Air service units	33-37
L174BV...	Airplus	Air service units	58-61
L174CE...	Airplus	Air service units	25-30
L174CF...	Airplus	Air service units	5-9
L174CR...	Airplus	Air service units	33-37
MDPT40.2R...	P+	Pressure booster	218
N171AAP...	Airplus	Air service units	62-64
N171AB...	Airplus	Air service units	44-47
N171ADA...	Airplus	Air service units	10-14
N171AE...	Airplus	Air service units	25-30
N171AF...	Airplus	Air service units	5-9
N171AL...	Airplus	Air service units	53-57
N171AM...	Airplus	Air service units	44-47
N171AP...	Airplus	Air service units	70-74
N171APA...	Airplus	Air service units	65-66
N171APP...	Airplus	Air service units	67-69
N171AR...	Airplus	Air service units	33-37
N171AV...	Airplus	Air service units	58-61
N171BAP...	Airplus	Air service units	62-64
N171BB...	Airplus	Air service units	44-47
N171BDA...	Airplus	Air service units	10-14
N171BE...	Airplus	Air service units	25-30
N171BF...	Airplus	Air service units	5-9
N171BL...	Airplus	Air service units	53-57
N171BM...	Airplus	Air service units	44-47
N171BP...	Airplus	Air service units	70-74
N171BPA...	Airplus	Air service units	65-66
N171BPP...	Airplus	Air service units	67-69
N171BR...	Airplus	Air service units	33-37
N171BV...	Airplus	Air service units	58-61
N171CAP...	Airplus	Air service units	62-64
N171CB...	Airplus	Air service units	44-47
N171CDA...	Airplus	Air service units	10-14
N171CE...	Airplus	Air service units	25-30
N171CF...	Airplus	Air service units	5-9
N171CL...	Airplus	Air service units	53-57
N171CM...	Airplus	Air service units	44-47
N171CP...	Airplus	Air service units	70-74
N171CPA...	Airplus	Air service units	65-66
N171CPP...	Airplus	Air service units	67-69
N171CR...	Airplus	Air service units	33-37
N171CV...	Airplus	Air service units	58-61

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N171Y	Airplus	Air service units	87
N171YP	Airplus	Air service units	51
N172AAP...	Airplus	Air service units	62-64
N172ADA...	Airplus	Air service units	10-14
N172AE...	Airplus	Air service units	25-30
N172AF...	Airplus	Air service units	5-9
N172AL...	Airplus	Air service units	53-57
N172AP...	Airplus	Air service units	70-74
N172APA...	Airplus	Air service units	65-66
N172APP...	Airplus	Air service units	67-69
N172AR...	Airplus	Air service units	33-37
N172AV...	Airplus	Air service units	58-61
N172BAP...	Airplus	Air service units	62-64
N172BDA...	Airplus	Air service units	10-14
N172BE...	Airplus	Air service units	25-30
N172BF...	Airplus	Air service units	5-9
N172BL...	Airplus	Air service units	53-57
N172BP...	Airplus	Air service units	70-74
N172BPA...	Airplus	Air service units	65-66
N172BPP...	Airplus	Air service units	67-69
N172BR...	Airplus	Air service units	33-37
N172BV...	Airplus	Air service units	58-61
N172CAP...	Airplus	Air service units	62-64
N172CDA...	Airplus	Air service units	10-14
N172CE...	Airplus	Air service units	25-30
N172CF...	Airplus	Air service units	5-9
N172CL...	Airplus	Air service units	53-57
N172CP...	Airplus	Air service units	70-74
N172CPA...	Airplus	Air service units	65-66
N172CPP...	Airplus	Air service units	67-68
N172CR...	Airplus	Air service units	33-3
N172CV...	Airplus	Air service units	58-60
N172X	Airplus	Air service units	87
N172Y	Airplus	Air service units	87
N173AAP...	Airplus	Air service units	62-64
N173ADA...	Airplus	Air service units	10-14
N173ADB...	Airplus	Air service units	15-19
N173ADD...	Airplus	Air service units	20-24
N173AE...	Airplus	Air service units	25-30
N173AF...	Airplus	Air service units	5-9
N173AL...	Airplus	Air service units	53-57
N173AP...	Airplus	Air service units	70-74
N173APA...	Airplus	Air service units	65-66
N173APP...	Airplus	Air service units	67-69
N173AR...	Airplus	Air service units	33-37
N173AV...	Airplus	Air service units	58-61
N173BAP...	Airplus	Air service units	62-64
N173BDA...	Airplus	Air service units	10-14
N173BDB...	Airplus	Air service units	15-19
N173BDC...	Airplus	Air service units	15-19
N173BDD...	Airplus	Air service units	20-24
N173BE...	Airplus	Air service units	25-30
N173BF...	Airplus	Air service units	5-9
N173BL...	Airplus	Air service units	53-57
N173BP...	Airplus	Air service units	70-74
N173BPA...	Airplus	Air service units	65-66
N173BPP...	Airplus	Air service units	67-69
N173BR...	Airplus	Air service units	33-37



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N173BV2S...	Airplus	Air service units	75-81
N173BVS...	Airplus	Air service units	75-81
N173CAP...	Airplus	Air service units	62-64
N173CDA...	Airplus	Air service units	10-14
N173CDBV...	Airplus	Air service units	15-19
N173CDD...	Airplus	Air service units	20-24
N173CE...	Airplus	Air service units	25-30
N173CF...	Airplus	Air service units	5-9
N173CL...	Airplus	Air service units	53-57
N173CP...	Airplus	Air service units	60-74
N173CPA...	Airplus	Air service units	65-66
N173CPP...	Airplus	Air service units	67-69
N173CR...	Airplus	Air service units	33-37
N173CV...	Airplus	Air service units	58-61
N173X	Airplus	Air service units	87
N173Y	Airplus	Air service units	87
N174BAP...	Airplus	Air service units	62-64
N174BDA...	Airplus	Air service units	10-14
N174BDAV...	Airplus	Air service units	15-19
N174BDD...	Airplus	Air service units	20-24
N174BE...	Airplus	Air service units	25-30
N174BF...	Airplus	Air service units	5-9
N174BL...	Airplus	Air service units	53-57
N174BP...	Airplus	Air service units	70-74
N174BPA...	Airplus	Air service units	65-66
N174BPP...	Airplus	Air service units	67-69
N174BR...	Airplus	Air service units	33-37
N174BV...	Airplus	Air service units	58-61
N174CE...	Airplus	Air service units	25-30
N174CF...	Airplus	Air service units	5-9
N174CR...	Airplus	Air service units	33-37
N174X	Airplus	Air service units	87
N174Y	Airplus	Air service units	87
P171AAP...	Airplus	Air service units	62-64
P171ADA...	Airplus	Air service units	10-14
P171AE...	Airplus	Air service units	25-30
P171AF...	Airplus	Air service units	5-9
P171AL...	Airplus	Air service units	53-57
P171AP...	Airplus	Air service units	70-74
P171APA...	Airplus	Air service units	65-66
P171APP...	Airplus	Air service units	67-69
P171AR...	Airplus	Air service units	33-37
P171AV...	Airplus	Air service units	58-61
P171BAP...	Airplus	Air service units	62-64
P171BDA...	Airplus	Air service units	10-14
P171BE...	Airplus	Air service units	25-30
P171BF...	Airplus	Air service units	5-9
P171BL...	Airplus	Air service units	53-57
P171BP...	Airplus	Air service units	70-74
P171BPA...	Airplus	Air service units	65-66
P171BPP...	Airplus	Air service units	67-69
P171BR...	Airplus	Air service units	33-37
P171BV...	Airplus	Air service units	58-61
P171CAP...	Airplus	Air service units	62-64
P171CDA...	Airplus	Air service units	10-14
P171CE...	Airplus	Air service units	25-30
P171CF...	Airplus	Air service units	5-9
P171CL...	Airplus	Air service units	53-57

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P171CP...	Airplus	Air service units	70-74
P171CPA...	Airplus	Air service units	65-66
P171CPP...	Airplus	Air service units	67-69
P171CR...	Airplus	Air service units	33-37
P171CV...	Airplus	Air service units	58-61
P172AAP...	Airplus	Air service units	62-64
P172ADA...	Airplus	Air service units	10-14
P172AE...	Airplus	Air service units	25-30
P172AF...	Airplus	Air service units	5-9
P172AL...	Airplus	Air service units	53-57
P172AP...	Airplus	Air service units	70-74
P172APA...	Airplus	Air service units	65-66
P172APP...	Airplus	Air service units	67-69
P172AR...	Airplus	Air service units	33-37
P172AV...	Airplus	Air service units	58-61
P172BAP...	Airplus	Air service units	62-64
P172BDA...	Airplus	Air service units	10-14
P172BE...	Airplus	Air service units	25-30
P172BF...	Airplus	Air service units	5-9
P172BL...	Airplus	Air service units	53-57
P172BP...	Airplus	Air service units	70-74
P172BPA...	Airplus	Air service units	65-66
P172BPP...	Airplus	Air service units	67-69
P172BR...	Airplus	Air service units	33-37
P172BV...	Airplus	Air service units	58-61
P172CAP...	Airplus	Air service units	62-64
P172CDA...	Airplus	Air service units	10-14
P172CE...	Airplus	Air service units	25-30
P172CF...	Airplus	Air service units	5-9
P172CL...	Airplus	Air service units	53-57
P172CP...	Airplus	Air service units	70-74
P172CPA...	Airplus	Air service units	65-66
P172CPP...	Airplus	Air service units	67-69
P172CR...	Airplus	Air service units	33-37
P172CV...	Airplus	Air service units	58-61
P173AAP...	Airplus	Air service units	62-64
P173ADA...	Airplus	Air service units	10-14
P173ADB...	Airplus	Air service units	15-19
P173ADD...	Airplus	Air service units	20-24
P173AE...	Airplus	Air service units	25-30
P173AF...	Airplus	Air service units	5-9
P173AL...	Airplus	Air service units	53-57
P173AP...	Airplus	Air service units	70-74
P173APA...	Airplus	Air service units	65-66
P173APP...	Airplus	Air service units	67-69
P173AR...	Airplus	Air service units	33-37
P173AV...	Airplus	Air service units	58-61
P173BAP...	Airplus	Air service units	62-64
P173BDA...	Airplus	Air service units	10-14
P173BDB...	Airplus	Air service units	15-19
P173BDC...	Airplus	Air service units	15-19
P173BDD...	Airplus	Air service units	20-24
P173BE...	Airplus	Air service units	25-30
P173BF...	Airplus	Air service units	5-9
P173BL...	Airplus	Air service units	53-57
P173BP...	Airplus	Air service units	70-74
P173BPA...	Airplus	Air service units	65-66
P173BPP...	Airplus	Air service units	67-69
P173BR...	Airplus	Air service units	33-37



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P173BV...	Airplus	Air service units	58-61
P173CAP...	Airplus	Air service units	62-64
P173CDA...	Airplus	Air service units	10-14
P173CDBV...	Airplus	Air service units	15-19
P173CDD...	Airplus	Air service units	20-24
P173CE...	Airplus	Air service units	25-30
P173CF...	Airplus	Air service units	5-9
P173CL...	Airplus	Air service units	53-57
P173CP...	Airplus	Air service units	70-74
P173CPA...	Airplus	Air service units	65-66
P173CPP...	Airplus	Air service units	67-69
P173CR...	Airplus	Air service units	33-37
P173CV...	Airplus	Air service units	58-61
P174BAP...	Airplus	Air service units	62-64
P174BDA...	Airplus	Air service units	10-14
P174BDAV...	Airplus	Air service units	15-19
P174BDD...	Airplus	Air service units	20-24
P174BE...	Airplus	Air service units	25-30
P174BF...	Airplus	Air service units	5-9
P174BL...	Airplus	Air service units	53-57
P174BP...	Airplus	Air service units	70-74
P174BPA...	Airplus	Air service units	65-66
P174BPP...	Airplus	Air service units	67-69
P174BR...	Airplus	Air service units	33-37
P174BR...P	Airplus	Air service units	39-42
P174BV...	Airplus	Air service units	58-61
P174CE...	Airplus	Air service units	25-30
P174CF...	Airplus	Air service units	5-9
P174CR...	Airplus	Air service units	33-37
P174CR...P	Airplus	Air service units	39-42
SF172AE...	1700 Steel line	Air service units	164
SF172AF...	1700 Steel line	Air service units	162
SF172AR...	1700 Steel line	Air service units	163
SF172BE...	1700 Steel line	Air service units	164
SF172BF...	1700 Steel line	Air service units	162
SF172BR...	1700 Steel line	Air service units	163
SF172CE...	1700 Steel line	Air service units	164
SF172CF...	1700 Steel line	Air service units	162
SF172CR...	1700 Steel line	Air service units	163
SF173AE...	1700 Steel line	Air service units	168
SF173AF...	1700 Steel line	Air service units	166
SF173AR...	1700 Steel line	Air service units	167
SF173BE...	1700 Steel line	Air service units	168
SF173BF...	1700 Steel line	Air service units	166
SF173BR...	1700 Steel line	Air service units	167
SF173DE...	1700 Steel line	Air service units	168
SF173DF...	1700 Steel line	Air service units	166
SF173DR...	1700 Steel line	Air service units	167
SF174AE...	1700 Steel line	Air service units	172
SF174AF...	1700 Steel line	Air service units	170
SF174AR...	1700 Steel line	Air service units	171
SF174BE...	1700 Steel line	Air service units	172
SF174BF...	1700 Steel line	Air service units	170
SF174BR...	1700 Steel line	Air service units	171
SF174DE...	1700 Steel line	Air service units	172
SF174DF...	1700 Steel line	Air service units	170
SF174DR...	1700 Steel line	Air service units	171
SM172AE...	1700 Steel line	Air service units	164
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SM174AE...	1700 Steel line	Air service units	172
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SS17070AA	1700 Steel line	Air service units	165
SS17070AA	1700 Steel line	Air service units	169
SS17070AA	1700 Steel line	Air service units	173
SS17070AB	1700 Steel line	Air service units	165
SS17070AB	1700 Steel line	Air service units	169
SS17070AB	1700 Steel line	Air service units	173
SS17250	1700 Steel line	Air service units	165
SS172AE...	1700 Steel line	Air service units	164
SS172AF...	1700 Steel line	Air service units	162
SS172AR...	1700 Steel line	Air service units	163
SS172BE...	1700 Steel line	Air service units	164
SS172BF...	1700 Steel line	Air service units	162
SS172BR...	1700 Steel line	Air service units	163
SS172CE...	1700 Steel line	Air service units	164
SS172CF...	1700 Steel line	Air service units	162
SS172CR...	1700 Steel line	Air service units	163
SS17350	1700 Steel line	Air service units	169
SS173AE...	1700 Steel line	Air service units	168
SS173AF...	1700 Steel line	Air service units	166
SS173AR...	1700 Steel line	Air service units	167
SS173BE...	1700 Steel line	Air service units	168
SS173BF...	1700 Steel line	Air service units	166
SS173BR...	1700 Steel line	Air service units	167
SS173DE...	1700 Steel line	Air service units	168
SS173DF...	1700 Steel line	Air service units	166
SS173DR...	1700 Steel line	Air service units	167
SS17450	1700 Steel line	Air service units	173
SS174AE...	1700 Steel line	Air service units	172
SS174AF...	1700 Steel line	Air service units	170
SS174AR...	1700 Steel line	Air service units	171
SS174BE...	1700 Steel line	Air service units	172
SS174BF...	1700 Steel line	Air service units	170
SS174BR...	1700 Steel line	Air service units	171
SS174DE...	1700 Steel line	Air service units	172
SS174DF...	1700 Steel line	Air service units	170
SS174DR...	1700 Steel line	Air service units	171
T171AAP...	Airplus	Air service units	62-64
T171AB...	Airplus	Air service units	44-47
T171ADA...	Airplus	Air service units	10-14
T171AE...	Airplus	Air service units	25-30
T171AF...	Airplus	Air service units	5-9
T171AL...	Airplus	Air service units	53-57
T171AM...	Airplus	Air service units	44-47
T171AP...	Airplus	Air service units	70-74
T171APA...	Airplus	Air service units	65-66
T171APP...	Airplus	Air service units	67-69
T171AR...	Airplus	Air service units	33-37
T171AV...	Airplus	Air service units	58-61
T171BAP...	Airplus	Air service units	62-64
T171BB...	Airplus	Air service units	44-47
T171BDA...	Airplus	Air service units	10-14
T171BE...	Airplus	Air service units	25-30



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T171BF...	Airplus	Air service units	5-9
T171BL...	Airplus	Air service units	53-57
T171BM...	Airplus	Air service units	44-47
T171BP...	Airplus	Air service units	70-74
T171BPA...	Airplus	Air service units	65-66
T171BPP...	Airplus	Air service units	67-69
T171BR...	Airplus	Air service units	33-37
T171BV...	Airplus	Air service units	58-61
T171CAP...	Airplus	Air service units	62-64
T171CB...	Airplus	Air service units	44-47
T171CDA...	Airplus	Air service units	10-14
T171CE...	Airplus	Air service units	25-30
T171CF...	Airplus	Air service units	5-9
T171CL...	Airplus	Air service units	53-57
T171CM...	Airplus	Air service units	44-47
T171CP...	Airplus	Air service units	70-74
T171CPA...	Airplus	Air service units	65-66
T171CPP...	Airplus	Air service units	67-69
T171CR...	Airplus	Air service units	33-37
T171CV...	Airplus	Air service units	58-61
T171X	Airplus	Air service units	51
T171X	Airplus	Air service units	87
T171Y	Airplus	Air service units	51
T171Y	Airplus	Air service units	87
T17250	1700	Air service units	158
T17250	Airplus	Air service units	32; 38; 52
T172AAP...	Airplus	Air service units	62-64
T172ADA...	Airplus	Air service units	10-14
T172AE...	Airplus	Air service units	25-30
T172AF...	Airplus	Air service units	5-9
T172AL...	Airplus	Air service units	53-57
T172AP...	Airplus	Air service units	70-74
T172APA...	Airplus	Air service units	65-66
T172APP...	Airplus	Air service units	67-69
T172AR...	Airplus	Air service units	33-37
T172AV...	Airplus	Air service units	58-61
T172BAP...	Airplus	Air service units	62-64
T172BDA...	Airplus	Air service units	10-14
T172BE...	Airplus	Air service units	25-30
T172BF...	Airplus	Air service units	5-9
T172BL...	Airplus	Air service units	53-57
T172BP...	Airplus	Air service units	70-74
T172BPA...	Airplus	Air service units	65-66
T172BPP...	Airplus	Air service units	67-69
T172BR...	Airplus	Air service units	33-37
T172BV...	Airplus	Air service units	58-61
T172CAP...	Airplus	Air service units	62-64
T172CDA...	Airplus	Air service units	10-14
T172CE...	Airplus	Air service units	25-30
T172CF...	Airplus	Air service units	5-9
T172CL...	Airplus	Air service units	53-57
T172CP...	Airplus	Air service units	70-74
T172CPA...	Airplus	Air service units	65-66
T172CPP...	Airplus	Air service units	67-69
T172CR...	Airplus	Air service units	33-37
T172CV...	Airplus	Air service units	58-61
T172X	Airplus	Air service units	87
T172Y	Airplus	Air service units	87
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T173BP...	Airplus	Air service units	70-74
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T173CF...	Airplus	Air service units	5-9
T173CL...	Airplus	Air service units	53-57
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Pneumatic actuation

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1200...X	1200 Steel line Accessories	ISO 6432 Microbore cylinders	28-29
1213...	1200 Special performance	Threaded body microbore	103-104
1230...	1200 "TECNO-MIR"	ISO 6432 Microbore cylinders	10-11
1231...	1200 "TECNO-MIR"	ISO 6432 Microbore cylinders	10-11
1232...	1200 "TECNO-MIR"	ISO 6432 Microbore cylinders	10-11
1260...	1200 Threaded end caps	ISO 6432 Microbore cylinders	1-3
1260...	1260	Piston rod lock	271-272
1260...	1260	Linear control units	273-274
1260...F	1200 Steel line Accessories	ISO 6432 Microbore cylinders	25
1261...	1200 Threaded end caps	ISO 6432 Microbore cylinders	1-3
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1272...	1200 Threaded end caps	ISO 6432 Microbore cylinders	1-3
1273...	1200 Threaded end caps	ISO 6432 Microbore cylinders	1-3
1274...	1200 Threaded end caps	ISO 6432 Microbore cylinders	1-3
1280...	1200 Rolled end caps "MIR"	ISO 6432 Microbore cylinders	4-6
1280...X	1200 Rolled end caps "MIR-INOX"	ISO 6432 Microbore cylinders	8-9
1281...	1200 Rolled end caps "MIR"	ISO 6432 Microbore cylinders	4-6
1282...	1200 Rolled end caps "MIR"	ISO 6432 Microbore cylinders	4-6
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1291...	1200 Rolled end caps "MIR"	ISO 6432 Microbore cylinders	4-6
1292...	1200 Rolled end caps "MIR"	ISO 6432 Microbore cylinders	4-6
1293...	1200 Rolled end caps "MIR"	ISO 6432 Microbore cylinders	4-6
1294...	1200 Rolled end caps "MIR"	ISO 6432 Microbore cylinders	4-6
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1320.19	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.20	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.21	13... - Accessories	CNOMO-CETOP-ISO cylinders	33
1320.21	1330-1331-1332-1333-Accessories	Rotary actuators	216
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1320.B...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.C...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.D...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.E...	1330-1331-1332-1333-Accessories	Rotary actuators	216
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1320...	1320	Piston rod lock	269-270
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1320.18	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.19	1330-1331-1332-1333-Accessories	Rotary actuators	216
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1320.21	13... - Accessories	CNOMO-CETOP-ISO cylinders	33
1320.21	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.22	13... - Accessories	CNOMO-CETOP-ISO cylinders	33
1320.22	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.23	13... - Accessories	ISO 15552 cylinders	49
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1320.A...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.B...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.C...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.D...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.E...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320.F...	1330-1331-1332-1333-Accessories	Rotary actuators	216
1320...	1320	ISO 15552 cylinders	40-42
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1320...	1320	Piston rod lock	269-270
1320...	1320	Linear control units	269-271
1320...F	1300 - Accessories	ISO 15552 cylinders	57-67
1320...F	1500 ECOMPACT - Accessories	ISO 21287 Compact cylinders	93-102
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1325...	1325 - Twin rod cylinders	Non rotating cylinders	105-106
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1332...	1332	Rotary actuators	213-215
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1370...	1370 - ECOFLAT	Flat cylinders	108-110
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1371...	1370 - ECOFLAT	Flat cylinders	108-110
1372...	1372 - ECOFLAT	Flat cylinders	108-110
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1393.B	AISI 316 - Accessories	ISO 15552 cylinders	74
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1504...	1500 - Short stroke	Compact cylinders	131
1511...	1500 - Short stroke	Compact cylinders	128
1511...AR.	1500 - Short stroke - Accessories	Compact cylinders	133
1512...	1500 - Short stroke	Compact cylinders	129
1513...	1500 - Short stroke	Compact cylinders	130
1514...	1500 - Short stroke	Compact cylinders	131
1515...	1500 - Short stroke	Compact cylinders	132
1516...	1500 - Short stroke	Compact cylinders	132
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1583.HAP	ST	Miniaturised series	267
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1600.16...F	1605 - Accessories	Rodless cylinders	210-211
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1600.AC	SA	Standard series	255
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1600.DC	SA	Standard series	255
1600.H...	SA	Standard series	259
1600.U	SA	Standard series	255
1600.U/1	SA	Standard series	255
1600...F	1605 - Accessories	Rodless cylinders	204-206
1601...	1601	Cable cylinders	212
1605.16...	1605 - Ø16	Rodless cylinders	207-209
1605...	1605	Rodless cylinders	196-202
6100...	6100	Guided compact cylinders	153-160
6101...	6101	Guided compact cylinders	161-164
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6301...	6301 - Angular grippers	Pneumatic grippers	235-238
6302...	6302 - Angular grippers	Pneumatic grippers	239-241
6302...	6302 - Angular grippers	Pneumatic grippers	242-244
6310...	6310 - Parallel style grippers	Pneumatic grippers	245-247
6311...	6311 - Parallel style grippers	Pneumatic grippers	248-250
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HS...	SA	Standard series	260-261
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LHS...	LHS Sensors	Rodless cylinders	209
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LRS...	LRS Sensors	Rodless cylinders	209
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MC3	SR	Miniaturised series	263; 265; 268
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MHS...	MHS Sensors	ISO 15552 cylinders	54; 74
MHS...	SR	Miniaturised series	263
MRS...	MRS Sensors	ISO 15552 cylinders	54; 74
MRS...	SR	Miniaturised series	263
RS...	RS Sensors	ISO 15552 cylinders	54
RS...	SA	Standard series	256-257
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THR.P	ST	Miniaturised series	267
THS.P	ST Sensors	Rotary actuators	231
TRS.U	ST Sensors	Rotary actuators	231
TRS.U	ST	Miniaturised series	266



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