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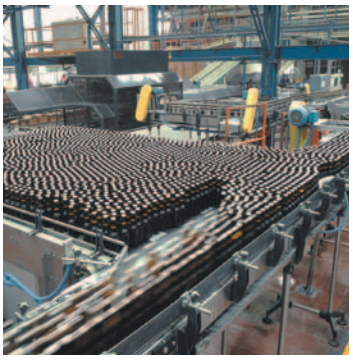
(Revised 1-2-2013)



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Pneumatic Actuator Products

P1Q Series Global Compact Cylinders

Catalog 0960-E

Parker

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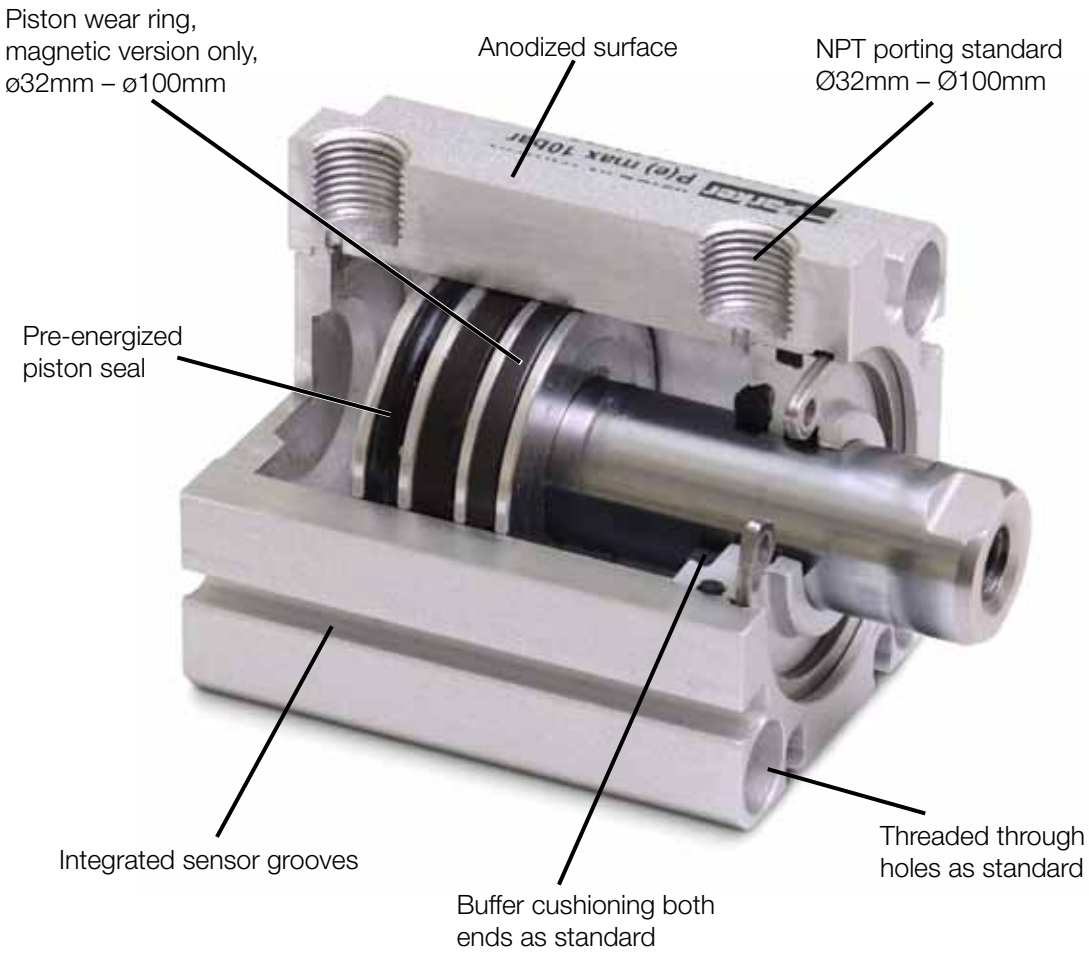
Features



P1Q Compact Cylinder

Parker's P1Q series cylinders provide an economical, compact design suited for a variety of applications. With its modular flexibility, the P1Q will provide the ideal solution machine builders need today.

The P1Q series is available in 10 bore sizes from 12 mm to 100 mm and standard strokes from 5 mm to 100 mm. The cylinder is supplied in a choice of magnetic or non-magnetic function, the non-magnetic version offers very short axial dimensions. For optimum compactness the P1Q series is supplied with female piston rod thread as standard. A rod stud is available to reconfigure to a male thread when needed.

The P1Q provides quieter operation due to its built in bumpers which are standard on all bore sizes. Included within the magnetic versions bores 32 - 100mm is a teflon piston wear ring providing superior life.

Sensors and Accessories

When position signals are needed anywhere along the stroke the integrated sensor grooves provide flexible mounting of any combination of PNP, NPN, reed sensors with flying leads and M8 cord options within the Parker P8S Global Sensor Family.

In addition to the compactness and modular design flexibility of the P1Q are a range of cylinder mountings including flange, foot and clevis brackets to ease installation

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Technical Information

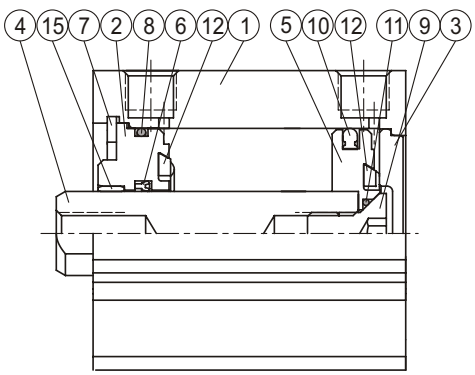
General technical data

Product type		Compact
Bore size		12 - 100 mm
Stroke length		100 mm
Versions	P1Q...B/E	Double acting, Non magnetic
	P1Q...G/N	Double acting, Magnetic
Cushioning		Elastic bumpers
Position sensing		Proximity sensor
Installation	Direct	Through holes
		Female thread on front and rear end face
	Accessories	Cylinder mountings
Mounting position		Any

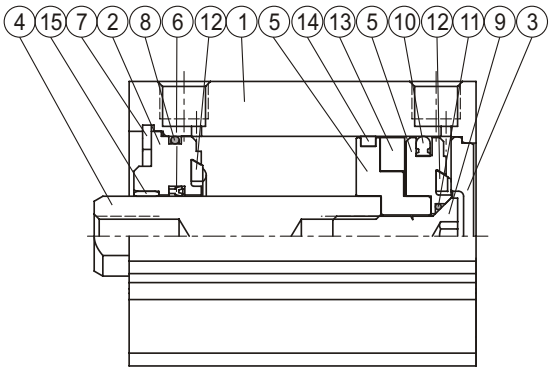
Operating and environmental data

Operating medium	For best possible service life and trouble-free operation it is recommended to use dry, filtered compressed air to ISO 8573-1:2010 quality class 3.4.3. This specifies a dew point of +3°C for indoor operation (a lower dew point should be selected for outdoor operation) and is in line with the air quality from most standard compressors with a standard filter. Refer to page 18.
Operating pressure	0.5 bar to 10 bar
Ambient temperature	-5°C to 60°C
Pre-lubricated	Further lubrication is normally not necessary. If additional lubrication is introduced it must be continued.
Corrosion resistance	High resistance to corrosion and chemicals. Materials and surface treatment have been selected for industrial applications where solvents and detergents are frequently used.

Non magnetic



Magnetic



Material specification

Part No	Part name / bore	12 - 25	32	40 - 100
1	Body	Hard anodised aluminium alloy		
2	Front cover	Hard anodised aluminium alloy		Anodised aluminium alloy
3	Rear cover	Anodised aluminium alloy		
4	Piston rod	Stainless steel		Medium carbon steel
5	Piston	Anodised aluminium alloy		
6	Piston rod seal	NBR		
7	Circlip	Stainless steel		Spring steel
8	O ring	NBR		
9	Piston bolt	Stainless steel		SCM
10	Piston seal	NBR		
11	Piston gasket	NBR		
12	Buffer	NBR		
13	Magnet	Plastic		
14	Wear ring	–	Teflon	
15	Bush	–	–	Copper

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Technical Information

Main data: P1Q

Cylinder designation	Cylinder bore mm	Cylinder bore area cm²	Piston rod area mm	Piston rod area cm²	Thread (female)	Thread (male)	Total weight at 0 mm stroke kg	Total weight addition per 5 mm stroke kg	Air consumption liters	Port size
P1Q012	12	1.1	6	0.28	M3 x 0.5	M5 x 0.8	0.06	0.01	0.0139 [1)]	M5
P1Q016	16	2.0	8	0.50	M4 x 0.7	M6 x 1.0	0.07	0.02	0.0246 [1)]	M5
P1Q020	20	3.1	10	0.79	M5 x 0.8	M8 x 1.25	0.09	0.03	0.0385 [1)]	M5
P1Q025	25	4.9	12	1.1	M6 x 1.0	M10 x 1.25	0.13	0.03	0.0633 [1)]	M5
P1Q032	32	8.0	16	2.0	M8 x 1.25	M14 x 1.5	0.19	0.03	0.1050 [1)]	1/8
P1Q040	40	12.6	16	2.0	M8 x 1.25	M14 x 1.5	0.25	0.03	0.1620 [1)]	1/8
P1Q050	50	19.6	20	3.1	M10 x 1.5	M18 x 1.5	0.45	0.04	0.2530 [1)]	1/4
P1Q063	63	31.2	20	3.1	M10 x 1.5	M18 x 1.5	0.68	0.05	0.4140 [1)]	1/4
P1Q080	80	50.3	25	4.9	M16 x 2.0	M22 x 1.5	1.25	0.07	0.6690 [1)]	3/8
P1Q100	100	78.5	30	7.0	M20 x 2.5	M26 x 1.5	1.93	0.15	1.0430 [1)]	3/8

[1)] Free air consumption per 10 mm stroke length for a double stroke at 6 bar.

Cylinder forces, double acting variants

Cyl. bore / piston rod mm		Stroke piston area cm²	Max theoretical force in N (bar) 1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
12/6	+	1.1	11	23	34	45	57	**68**	79	90	102	113
	-	0.8	8	17	25	34	42	**51**	59	68	76	85
16/8	+	2.0	20	40	60	80	101	**121**	141	161	181	201
	-	1.5	15	30	45	60	75	**90**	106	121	136	151
20/10	+	3.1	31	63	94	126	157	**188**	220	251	283	314
	-	2.4	24	47	71	94	118	**141**	165	188	212	236
25/12	+	4.9	49	98	147	196	245	**295**	344	393	442	491
	-	3.8	38	76	113	151	189	**227**	264	302	340	378
32/16	+	8.0	80	161	241	322	402	**483**	563	643	724	804
	-	6.0	60	121	181	241	302	**362**	422	483	543	603
40/16	+	12.6	126	251	377	503	628	**754**	880	1005	1131	1257
	-	10.6	106	211	317	422	528	**633**	739	844	950	1056
50/20	+	19.6	196	393	589	785	982	**1178**	1374	1571	1767	1963
	-	16.5	165	330	495	660	825	**990**	1155	1319	1484	1649
63/20	+	31.2	312	623	935	1247	1559	**1870**	2182	2494	2806	3117
	-	28.0	280	561	841	1121	1402	**1682**	1962	2242	2523	2803
80/25	+	50.3	503	1005	1508	2011	2513	**3016**	3519	4021	4524	5027
	-	45.4	454	907	1361	1814	2268	**2721**	3175	3629	4082	4536
100/30	+	78.5	785	1571	2356	3142	3927	**4712**	5498	6283	7069	7854
	-	71.5	715	1430	2145	2860	3575	**4290**	5005	5720	6435	7150

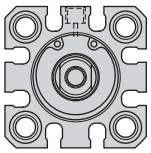
\+ = Outward stroke
\- = Return stroke

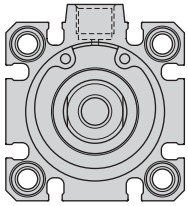
Note:
Select a theoretical force 50-100% larger than the force required

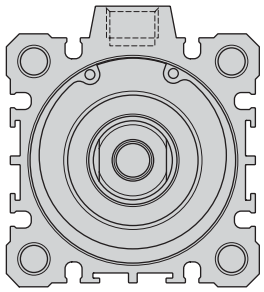
Front profiles by bore size


Ø12


Ø16


Ø20 - Ø25


Ø32 - Ø40


Ø50 - Ø100

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Selecting Pneumatic System Components

Cylinder to Valve: The below chart contains recommendations for selecting air valve products based on 5.5 bar (80 psi) with a 0.35 bar (5 psi) pressure drop. The values within the chart show the corresponding Cv values.

Moduflex Valve System

- Stand-alone valves, short-build valve manifold, or large valve manifold configurations available
- Cv range from 0.18 – 0.80
- Peripheral modules available— flow control, pressure regulation, P.O. check valves and vacuum generators

Cylinder speed (mm/s) \ Cylinder bore size	12	16	20	25	32	40	50	63	80	100
50	0.004	0.01	0.01	0.02	0.03	0.04	0.06	0.10	0.16	0.26
100	0.01	0.01	0.02	0.03	0.05	0.08	0.13	0.20	0.33	0.51
150	0.01	0.02	0.03	0.05	0.08	0.12	0.19	0.30	0.49	0.77
200	0.01	0.03	0.04	0.06	0.10	0.16	0.26	0.41	0.65	1.02
250	0.02	0.03	0.05	0.08	0.13	0.20	0.32	0.51	0.82	1.28
300	0.02	0.04	0.06	0.10	0.16	0.25	0.38	0.61	0.98	1.53
350	0.03	0.05	0.07	0.11	0.18	0.29	0.45	0.71	1.15	1.79
400	0.03	0.05	0.08	0.13	0.21	0.33	0.51	0.81	1.31	2.04
450	0.03	0.06	0.09	0.14	0.24	0.37	0.58	0.91	1.47	2.30
500	0.04	0.07	0.10	0.16	0.26	0.41	0.64	1.01	1.64	2.56
	Size 1					Size 2		See Larger valve system		

Isys Micro / ISO Valve System

- Isys Micro Cv range 0.30 – 0.35
- IsysNet system fieldbus, Turck system fieldbus, 25 pin D-sub, or low cost Moduflex fieldbus options available
- Isys ISO offers 5 sizes with Cv range 0.55 – 6.0

Cylinder speed (mm/s) \ Cylinder bore size	12	16	20	25	32	40	50	63	80	100	
50	0.004	0.01	0.01	0.02	0.03	0.04	0.06	0.10	0.16	0.26	Isys Micro
100	0.01	0.01	0.02	0.03	0.05	0.08	0.13	0.20	0.33	0.51	HB
150	0.01	0.02	0.03	0.05	0.08	0.12	0.19	0.30	0.49	0.77	HA
200	0.01	0.03	0.04	0.06	0.10	0.16	0.26	0.41	0.65	1.02	HA
250	0.02	0.03	0.05	0.08	0.13	0.20	0.32	0.51	0.82	1.28	H1
300	0.02	0.04	0.06	0.10	0.16	0.25	0.38	0.61	0.98	1.53	H2
350	0.03	0.05	0.07	0.11	0.18	0.29	0.45	0.71	1.15	1.79	H2
400	0.03	0.05	0.08	0.13	0.21	0.33	0.51	0.81	1.31	2.04	H2
450	0.03	0.06	0.09	0.14	0.24	0.37	0.58	0.91	1.47	2.30	H2
500	0.04	0.07	0.10	0.16	0.26	0.41	0.64	1.01	1.64	2.56	H2
	Isys Micro					HB	HA		H2		

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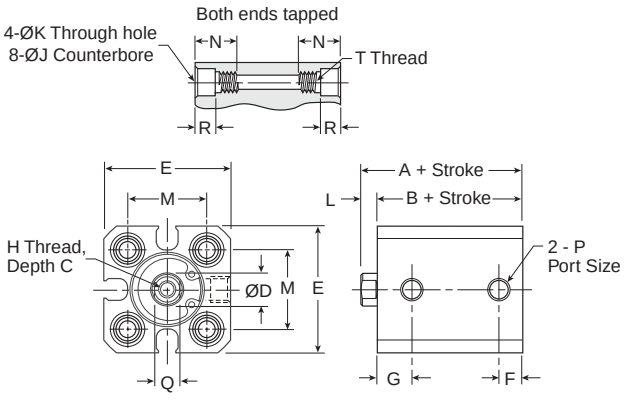
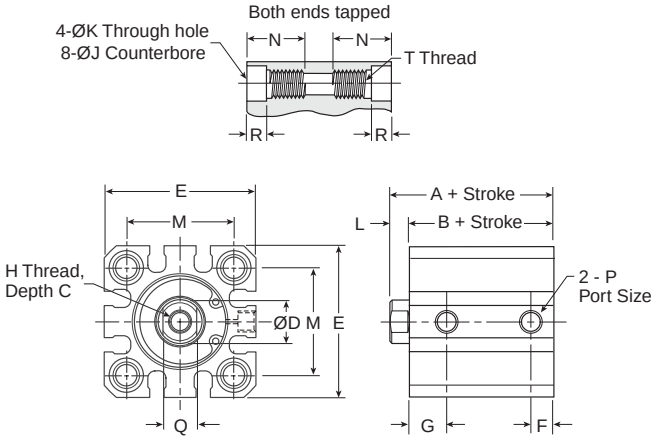
Non-magnet Dimensions

Non-magnet Dimensions

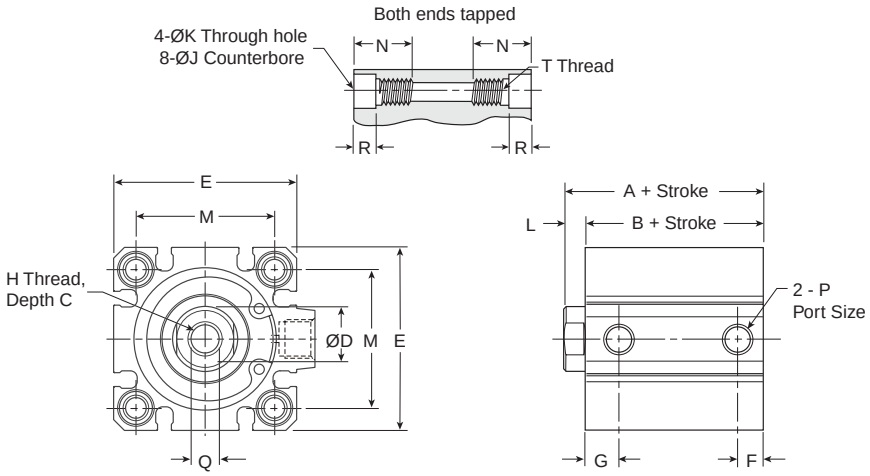
Ø12 - Ø16



Ø20 - Ø25



Ø32 - Ø100



Bore size	A 5 to 50mm	A 75 to 100mm	B 5 to 50mm	B 75 to 100mm	C mm	D mm	E mm	F mm	G mm	H	J mm	K mm	L mm	M mm	N mm	P	Q mm	R mm	T
12	20.5	–	17	–	6	6	25	5	7.5	M3x0.5	6.5	3.5	3.5	15.5	11	M5x0.8	5	4	M4x0.7
16	20.5	–	17	–	8	8	29	5	7.5	M4x0.7	6.5	3.5	3.5	20	11	M5x0.8	6	4	M4x0.7
20	24	–	19.5	–	7	10	36	5.5	9	M5x0.8	9	5.4	4.5	25.5	17	M5x0.8	8	7	M6x1.0
25	27.5	–	22.5	–	12	12	40	5.5	11	M6x1.0	9	5.4	5	28	17	M5x0.8	10	7	M6x1.0
32	30	40	23	33	13	16	45	7.5	10.5	M8x1.25	9	5.5	7	34	17	1/8"	14	7	M6x1.0
40	36.5	46.5	29.5	39.5	13	16	52	8	11	M8x1.25	9	5.5	7	40	17	1/8"	14	7	M6x1.0
50	38.5	48.5	30.5	40.5	15	20	64	10.5	10.5	M10x1.5	11	6.6	8	50	22	1/4"	17	8	M8x1.25
63	44	54	36	46	15	20	77	10.5	15	M10x1.5	14	9	8	60	28.5	1/4"	17	10.5	M10x1.5
80	53.5	63.5	43.5	53.5	21	25	98	12.5	16	M16x2.0	17.5	11	10	77	35.5	3/8"	22	13.5	M12x1.75
100	65	75	53	63	27	30	117	13	23	M20x2.5	17.5	11	12	94	35.5	3/8"	27	13.5	M12x1.75

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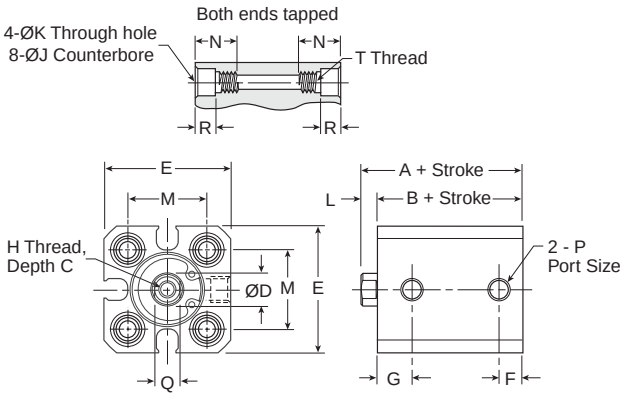
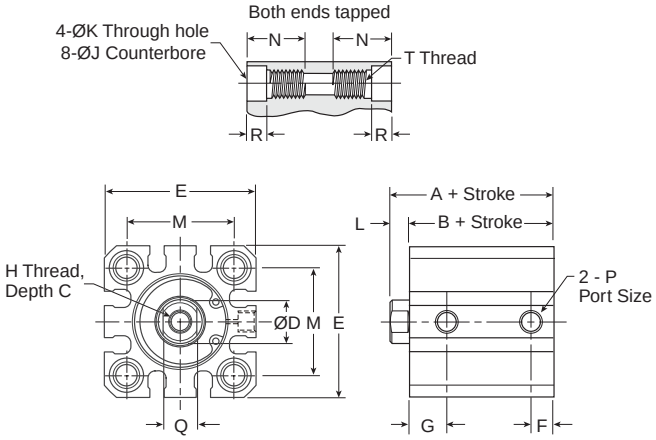
Magnet Dimensions

Magnet Dimensions

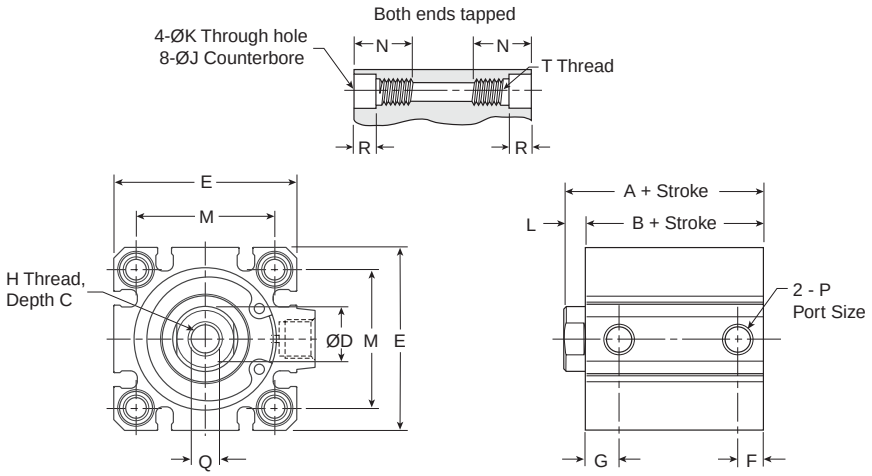
Ø12 - Ø16



Ø20 - Ø25



Ø32 - Ø100



Bore size	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H	J mm	K mm	L mm	M mm	N mm	P	Q mm	R mm	T
12	25.5	22	6	6	25	5	7.5	M3x0.5	6.5	3.5	3.5	15.5	11	M5x0.8	5	4	M4x0.7
16	25.5	22	8	8	29	5	7.5	M4x0.7	6.5	3.5	3.5	20	11	M5x0.8	6	4	M4x0.7
20	34	29.5	7	10	36	5.5	9	M5x0.8	9	5.4	4.5	25.5	17	M5x0.8	8	7	M6x1.0
25	37.5	32.5	12	12	40	5.5	11	M6x1.0	9	5.4	5	28	17	M5x0.8	10	7	M6x1.0
32	40	33	13	16	45	7.5	10.5	M8x1.25	9	5.5	7	34	17	1/8"	14	7	M6x1.0
40	46.5	39.5	13	16	52	8	11	M8x1.25	9	5.5	7	40	17	1/8"	14	7	M6x1.0
50	48.5	40.5	15	20	64	10.5	10.5	M10x1.5	11	6.6	8	50	22	1/4"	17	8	M8x1.25
63	54	46	15	20	77	10.5	15	M10x1.5	14	9	8	60	28.5	1/4"	17	10.5	M10x1.5
80	63.5	53.5	21	25	98	12.5	16	M16x2.0	17.5	11	10	77	35.5	3/8"	22	13.5	M12x1.75
100	75	63	27	30	117	13	23	M20x2.5	17.5	11	12	94	35.5	3/8"	27	13.5	M12x1.75

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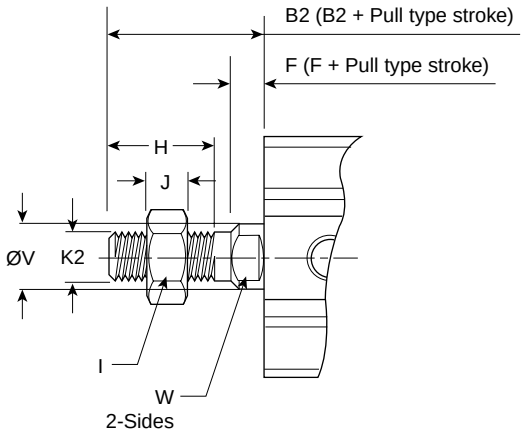
Male Rod Thread Dimensions

Male Rod Thread Dimensions



Bore size	B2 mm	F mm	H mm	I mm	J mm	K2	V mm	W mm
12	14.0	3.5	10.5	18	2.7	M5x0.8	6	5
16	15.5	3.5	12	10	3.2	M6x1.0	8	6
20	18.5	4.5	14	13	4	M8x1.25	10	8
25	22.5	5	17.5	17	5	M10x1.25	12	10
32	28.5	7	21.5	22	7	M14x1.5	16	14
40	28.5	7	21.5	22	7	M14x1.5	16	14
50	33.5	8	25.5	27	8	M18x1.5	20	17
63	33.5	8	25.2	27	8	M18x1.5	20	17
80	43.5	10	33.5	32	11	M22x1.5	25	22
100	43.5	12	31.5	41	16	M26x1.5	32	27

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Model Number Index, Technical Data

Ordering information

P1Q	S	032	D	C	7	N	0025

Cylinder versions

S	Metric version

Function

D	Double acting

Bore size

012	12mm
016	16mm
020	20mm
025	25mm
032	32mm
040	40mm
050	50mm
063	63mm
080	80mm
100	100mm

Material

C	Bore sizes 12mm - 32mm only available in stainless steel. Bore sizes 40mm - 100mm only available in chrome plated steel.

Mounting style

Female thread	
7	Both ends threaded
F	Foot brackets
J	Front flange
A	Clevis bracket
H	Rear flange
Male thread	
8	Both ends threaded
9	Foot brackets
4	Front flange
2	Clevis bracket
5	Rear flange

Cylinder ports & magnet function *

Magnet	
G	M5 threads
N	NPT threads
No magnet	
B	M5 threads
E	NPT threads

* Bore sizes 12mm - 25mm are M5 threaded ports, NPT threads only available bore sizes 32mm - 100mm.

Stroke length

See below table for standard stroke lengths in mm.

Standard strokes

Bore size	5	10	15	25	30	40	50	75	100
12 - 16	•	•	•	•	•				
20 - 25		•	•	•	•	•	•		
32		•	•	•	•	•	•	•	•
40 - 50			•	•	•	•	•	•	•
63 - 100			•	•	•	•	•	•	

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Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Common part numbers

Double Acting / Non-Magnetic - Female Threaded Piston Rod

12mm

Stroke (mm)	Part number
5	P1QS012DC7B0005
10	P1QS012DC7B0010
15	P1QS012DC7B0015
20	P1QS012DC7B0020
25	P1QS012DC7B0025
30	P1QS012DC7B0030

16mm

5	P1QS016DC7B0005
10	P1QS016DC7B0010
15	P1QS016DC7B0015
20	P1QS016DC7B0020
25	P1QS016DC7B0025
30	P1QS016DC7B0030

20mm

10	P1QS020DC7B0010
15	P1QS020DC7B0015
20	P1QS020DC7B0020
25	P1QS020DC7B0025
30	P1QS020DC7B0030
40	P1QS020DC7B0040
50	P1QS020DC7B0050

25mm

10	P1QS025DC7B0010
15	P1QS025DC7B0015
20	P1QS025DC7B0020
25	P1QS025DC7B0025
30	P1QS025DC7B0030
40	P1QS025DC7B0040
50	P1QS025DC7B0050

32mm

Stroke (mm)	Part number
10	P1QS032DC7E0010
15	P1QS032DC7E0015
20	P1QS032DC7E0020
25	P1QS032DC7E0025
30	P1QS032DC7E0030
40	P1QS032DC7E0040
50	P1QS032DC7E0050
75	P1QS032DC7E0075
100	P1QS032DC7E0100

40mm

15	P1QS040DC7E0015
20	P1QS040DC7E0020
25	P1QS040DC7E0025
30	P1QS040DC7E0030
40	P1QS040DC7E0040
50	P1QS040DC7E0050
75	P1QS040DC7E0075
100	P1QS040DC7E0100

50mm

15	P1QS050DC7E0015
20	P1QS050DC7E0020
25	P1QS050DC7E0025
30	P1QS050DC7E0030
40	P1QS050DC7E0040
50	P1QS050DC7E0050
75	P1QS050DC7E0075
100	P1QS050DC7E0100

63mm

Stroke (mm)	Part number
15	P1QS063DC7E0015
20	P1QS063DC7E0020
25	P1QS063DC7E0025
30	P1QS063DC7E0030
40	P1QS063DC7E0040
50	P1QS063DC7E0050
75	P1QS063DC7E0075

80mm

15	P1QS080DC7E0015
20	P1QS080DC7E0020
25	P1QS080DC7E0025
30	P1QS080DC7E0030
40	P1QS080DC7E0040
50	P1QS080DC7E0050
75	P1QS080DC7E0075

100mm

15	P1QS100DC7E0015
20	P1QS100DC7E0020
25	P1QS100DC7E0025
30	P1QS100DC7E0030
40	P1QS100DC7E0040
50	P1QS100DC7E0050
75	P1QS100DC7E0075

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Common part numbers

Double Acting / Magnetic - Female Threaded Piston Rod

12mm

Stroke (mm)	Part number
5	P1QS012DC7G0005
10	P1QS012DC7G0010
15	P1QS012DC7G0015
20	P1QS012DC7G0020
25	P1QS012DC7G0025
30	P1QS012DC7G0030

16mm

5	P1QS016DC7G0005
10	P1QS016DC7G0010
15	P1QS016DC7G0015
20	P1QS016DC7G0020
25	P1QS016DC7G0025
30	P1QS016DC7G0030

20mm

10	P1QS020DC7G0010
15	P1QS020DC7G0015
20	P1QS020DC7G0020
25	P1QS020DC7G0025
30	P1QS020DC7G0030
40	P1QS020DC7G0040
50	P1QS020DC7G0050

25mm

10	P1QS025DC7G0010
15	P1QS025DC7G0015
20	P1QS025DC7G0020
25	P1QS025DC7G0025
30	P1QS025DC7G0030
40	P1QS025DC7G0040
50	P1QS025DC7G0050

32mm

Stroke (mm)	Part number
10	P1QS032DC7N0010
15	P1QS032DC7N0015
20	P1QS032DC7N0020
25	P1QS032DC7N0025
30	P1QS032DC7N0030
40	P1QS032DC7N0040
50	P1QS032DC7N0050
75	P1QS032DC7N0075
100	P1QS032DC7N0100

40mm

15	P1QS040DC7N0015
20	P1QS040DC7N0020
25	P1QS040DC7N0025
30	P1QS040DC7N0030
40	P1QS040DC7N0040
50	P1QS040DC7N0050
75	P1QS040DC7N0075
100	P1QS040DC7N0100

50mm

15	P1QS050DC7N0015
20	P1QS050DC7N0020
25	P1QS050DC7N0025
30	P1QS050DC7N0030
40	P1QS050DC7N0040
50	P1QS050DC7N0050
75	P1QS050DC7N0075
100	P1QS050DC7N0100

63mm

Stroke (mm)	Part number
15	P1QS063DC7N0015
20	P1QS063DC7N0020
25	P1QS063DC7N0025
30	P1QS063DC7N0030
40	P1QS063DC7N0040
50	P1QS063DC7N0050
75	P1QS063DC7N0075

80mm

15	P1QS080DC7N0015
20	P1QS080DC7N0020
25	P1QS080DC7N0025
30	P1QS080DC7N0030
40	P1QS080DC7N0040
50	P1QS080DC7N0050
75	P1QS080DC7N0075

100mm

15	P1QS100DC7N0015
20	P1QS100DC7N0020
25	P1QS100DC7N0025
30	P1QS100DC7N0030
40	P1QS100DC7N0040
50	P1QS100DC7N0050
75	P1QS100DC7N0075

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Accessories - Mountings

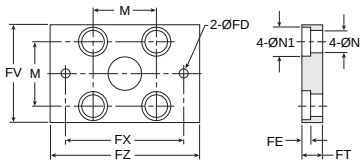
Flange mounting

Intended for fixed mounting of cylinder. Flange can be fitted to front or rear of cylinder.

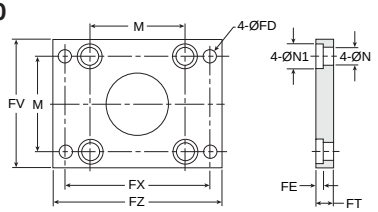
Material
Flange: surface treated steel

Supplied complete with mounting screws for attachment to cylinder.

Ø12 - Ø25



Ø32 - Ø100



Bore size	FD mm	FT mm	FV mm	FX mm	FZ mm	M mm	N mm	N1 mm	Weight kg	Part number
12	4.5	5.5	25	45	55	15.5	4.5	7.5	0.08	**P1Q-4DMB**
16	4.5	5.5	30	45	55	20	4.5	7.5	0.10	**P1Q-4FMB**
20	6.5	8	39	48	60	25.5	6.5	10.5	0.16	**P1Q-4HMB**
25	6.5	8	42	52	64	28	6.5	10.5	0.20	**P1Q-4JMB**
32	5.5	8	48	56	65	34	6.5	10.5	0.23	**P1Q-4KMB**
40	5.5	8	54	62	72	40	6.5	10.5	0.28	**P1Q-4LMB**
50	6.5	9	67	76	89	50	8.5	13.5	0.53	**P1Q-4MMB**
63	9	9	80	92	108	60	10.5	16.5	0.71	**P1Q-4NMB**
80	11	11	99	116	134	77	12.5	18.5	1.59	**P1Q-4PMB**
100	11	11	117	136	154	94	12.5	18.5	2.19	**P1Q-4QMB**

Foot mounting

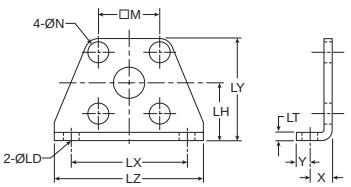
Intended for fixed mounting of cylinder. Angle bracket can be fitted to front and rear of cylinder.

Material
Angle bracket: surface treated steel

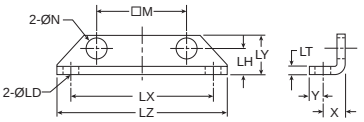
Supplied in pairs with mounting screws for attachment to cylinder.

* Weight per item

Ø12 - Ø25



Ø32 - Ø100



Bore size	LD mm	LH mm	LT mm	LX mm	LY mm	LZ mm	X mm	Y mm	M mm	N mm	Weight kg	Part number
12	4.5	17	2	34	29.5	44	8	4.5	15.5	4.5	0.02*	**P1Q-4DMF**
16	4.5	19	2	38	33.5	48	8	5	20	4.5	0.02*	**P1Q-4FMF**
20	6.5	24	3.2	48	42	62	9.2	5.8	25.5	6.5	0.04*	**P1Q-4HMF**
25	6.5	26	3.2	52	46	66	10.7	5.8	28	6.5	0.05*	**P1Q-4JMF**
32	6.5	13	3.2	57	20	71	11.2	5.8	34	6.5	0.06*	**P1Q-4KMF**
40	6.5	13	3.2	64	20	78	11.2	7	40	6.5	0.08*	**P1Q-4LMF**
50	8.5	14	3.2	79	22	95	12.2	8	50	8.5	0.16*	**P1Q-4MMF**
63	10.5	16	3.2	95	26	113	13.7	9	60	10.5	0.25*	**P1Q-4NMF**
80	13	20.5	4.5	118	32	140	16.5	11	77	13	0.50*	**P1Q-4PMF**
100	13	24	6	137	36	162	23	11.5	94	13	0.85*	**P1Q-4QMF**

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Accessories - Mountings

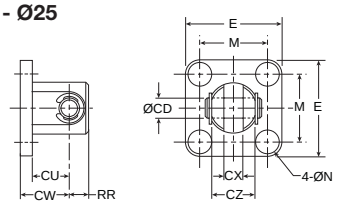
Clevis mounting

Intended for flexible mounting of cylinder. Clevis bracket can be fitted to the rear of cylinder.

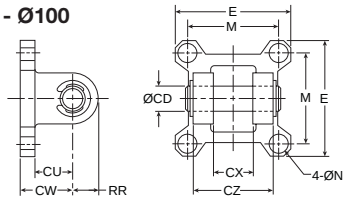
Material
Clevis bracket: surface treated steel, black

Supplied complete with mounting screws for attachment to cylinder.

Ø12 - Ø25



Ø32 - Ø100

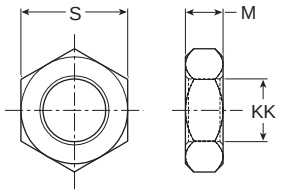


Bore size	CD mm	CU mm	CW mm	CX mm	CZ mm	N mm	RR mm	M mm	E mm	Weight kg	Part number
12	5	9.5	14	5.3	9.8	4.5	6	15.5	25	0.02	**P1Q-4DMT**
16	5	10.5	15	6.8	11.8	4.5	6	20	29	0.03	**P1Q-4FMT**
20	8	12.5	18	8.3	15.8	6.5	9	25.5	36	0.05	**P1Q-4HMT**
25	10	14.5	20	10.3	19.8	6.5	10	28	40	0.06	**P1Q-4JMT**
32	10	14.5	20	18.3	35.8	6.5	10	34	45.5	0.08	**P1Q-4KMT**
40	10	15	22	18.3	35.8	6.5	10	40	53.5	0.11	**P1Q-4LMT**
50	14	20	28	22.3	43.8	8.5	14	50	64.5	0.14	**P1Q-4MMT**
63	14	21	30	22.3	43.8	10.5	14	60	77.5	0.29	**P1Q-4NMT**
80	18	28	38	28.3	55.8	12.5	18	77	98.5	0.36	**P1Q-4PMT**
100	22	32	45	32.3	63.8	12.5	22	94	117.5	0.64	**P1Q-4QMT**

Lock nut

Intended for fixed mounting of accessories to the piston rod.

Note:
Not sold separately



Bore size	KK	M	S	Mass kg	Part number
12	M5x0.8	2.7	18	0.002	**L075540005**
16	M6x1.0	3.2	10	0.002	**L075540006**
20	M8x1.25	4	13	0.005	**L075540008**
25	M10x1.25	5	17	0.007	**L075540010**
32	M14x1.5	7	22	0.010	**L075540014**
40	M14x1.5	7	22	0.010	**L075540014**
50	M18x1.5	8	27	0.021	**L075540018**
63	M18x1.5	8	27	0.021	**L075540018**
80	M22x1.5	11	32	0.040	**L075540022**
100	M26x1.5	16	41	0.040	**L075540026**

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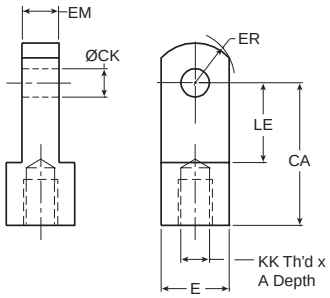
Accessories - Mountings

Rod eye

Rod eye for articulated mounting of cylinder.
Rod eye can be combined with clevis bracket.
Maintenance-free.

Material
Rod eye, nut: galvanized steel

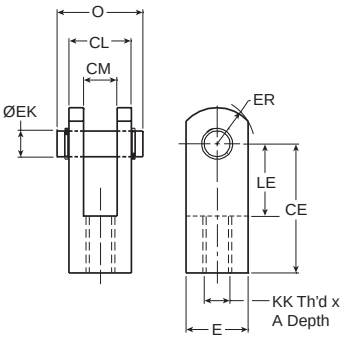


Bore size	A mm	E mm	CA mm	KK	ER mm	LE mm	CK mm	EM mm	Mass kg	Part number
12	7	9.5 Sq.	16	M5x0.8	6.5	7	5	5	0.03	**P1M-4DRE**
16	8	11 Sq.	25	M6x1.0	8	14	5	6.5	0.03	**P1M-4FRE**
20	8.5	16 Sq.	25	M8x1.25	10.5	11.5	8	8	0.05	**P1M-4HRE**
25	10.5	19 Sq.	30	M10x1.25	13	14	10	10	0.07	**P1M-4JRE**
32	14	22 Dia.	30	M14x1.5	12	14	10	18	0.08	**P1M-4LRE**
40	14	22 Dia.	30	M14x1.5	12	14	10	18	0.12	**P1M-4LRE**
50	18.5	28 Dia.	40	M18x1.5	16	20	14	22	0.25	**P1M-4MRE**
63	18.5	28 Dia.	40	M18x1.5	16	20	14	22	0.25	**P1M-4MRE**
80	22	38 Dia.	50	M22x1.5	21	27	18	28	0.25	**P1M-4PRE**

Rod clevis

Clevis for articulated mounting of cylinder.

Material
Clevis, clip, nut: galvanized steel
Pin: hardened steel



Bore size	A mm	E mm	CE mm	KK	ER mm	LE mm	EK (h9) mm	CM mm	CL mm	O mm	Mass kg	Part number
12	7	9.5	16	M5x0.8	6.5	7	5	5	9.5	14.5	0.02	**P1M-4DRC**
16	11	11	21	M6x1.0	8	10	5	6.5	11	16.5	0.02	**P1M-4FRC**
20	8.5	16	25	M8x1.25	10.5	11.5	8	8	16	21	0.05	**P1M-4HRC**
25	10.5	19	30	M10x1.25	13	14	10	10	19	25.5	0.09	**P1M-4JRC**
32	16	22 Dia.	30	M14x1.25	12	14	10	18	36	41.5	0.09	**P1M-4LRC**
40	16	22 Dia.	30	M14x1.25	12	14	10	18	36	41.5	0.15	**P1M-4LRC**
50	20	28 Dia.	40	M18x1.5	16	20	14	22	44	50.5	0.35	**P1M-4MRC**
63	20	28 Dia.	40	M18x1.5	16	20	14	22	44	50.5	0.35	**P1M-4MRC**
80	23	38 Dia.	50	M22x1.5	21	27	18	28	56	64	0.75	**P1M-4PRC**

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Global P8S Sensor Series

The P8S family of sensors provides a broad range of reed and solid state sensor types with flying lead or M8 options available. Mounting on all cylinders is within the integrated sensor grooves allowing for compact installation. For 12mm and 16mm bores the sensors can be mounted on 3 sides and on 20mm to 100mm bores on four sides for flexible mounting and ease of installation.

Electronic sensors

The electronic sensors utilise “Solid State” technology, providing operation with no moving parts. These switches are available in NPN and PNP type, both provide built in short circuit and transient protection as standard. The solid state operation allows for high switching on off frequency, ideal for applications where long service life is required.

Technical data

Design	GMR (Giant Magnetic Resistance) magneto-resistive function
Installation	Mounts within cylinder switch Groove
Outputs	PNP or NPN, normally open
Voltage range	5-30 V DC
Voltage drop	1.5 V max
Switching Current	50 mA max
Switch Rating	1.5 W max
Leakage current	0.01 mA max
Internal consumption	10 mA max (NPN) 12 mA max (PNP)
On/off switching frequency	1000 Hz max
Encapsulation	IP67 (NEMA 6)
Temperature range	–10 °C to +70 °C
Indication	LED Red (NPN) LED Green (PNP)
Cable	Polyurethane

Reed sensors

Reed type sensors are based on proven reed switch technology and provide reliable function in many applications. Simple installation and the available AC voltage range are advantages for this range of sensors.

Technical data

Design	Reed element
Installation	Mounts within cylinder switch Groove
Output	Normally open
Voltage range	5-120 V DC/AC
Voltage Drop	2.5 V max
Switching Current	100 mA max
Switch Rating	10 W max
Encapsulation	IP67 (NEMA 6)
Temperature range	–10 °C to +70 °C
Indication	LED Red
Cable	Polyurethane

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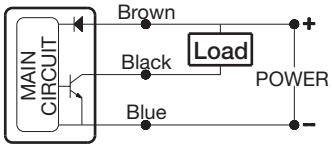
Accessories – Sensors

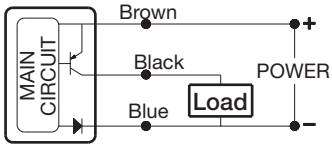
Electronic sensors

Schematic

NPN type

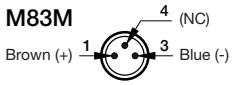


PNP type

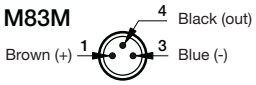


M8 Connect

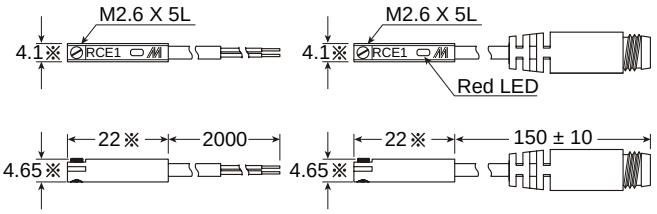
2 wire QC wiring



3 wire QC wiring



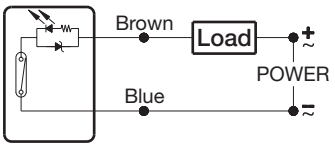
Dimensions



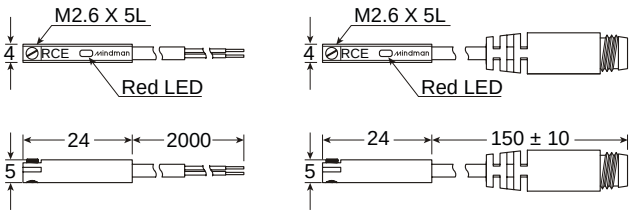
Reed sensors

Schematic

Reed type



Dimensions



Electronic and Reed Sensors

Size	Description	Part number
Flush Mount Style		
PNP type, normally open	0.165 m cable and M8 screw male connector	**P8S-EPSUS**
PNP type, normally open	2 m PVC cable without connector	**P8S-EPFXS**
NPN type, normally open	0.165 m cable and M8 screw male connector	**P8S-ENSUS**
NPN type, normally open	2 m PVC cable without connector	**P8S-ENFXS**
Reed type, normally open	0.15 m cable and M8 screw male connector	**P8S-ERSUS**
Reed type, normally open	2 m PVC cable without connector	**P8S-ERFXS**

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Specifying air quality (purity) in accordance with ISO8573-1:2010, the international standard for Compressed Air Quality

ISO8573-1 is the primary document used from the ISO8573 series as it is this document which specifies the amount of contamination allowed in each cubic meter of compressed air.

ISO8573-1 lists the main contaminants as Solid Particulate, Water and Oil. The purity levels for each contaminant are shown separately in tabular form, however for ease of use, this document combines all three contaminants into one easy to use table.

ISO8573-1:2010 CLASS	Solid Particulate				Water		Oil
	Maximum number of particles per m^3			Mass Concentration mg/m^3	Vapor Pressure Dewpoint	Liquid g/m^3	Total Oil (aerosol liquid and vapor)
	0,1 - 0,5 micron	0,5 - 1 micron	1 - 5 micron				mg/m^3
0	As specified by the equipment user or supplier and more stringent than Class 1						
1	≤ 20 000	≤ 400	≤ 10	-	≤ -70°C	-	0.01
2	≤ 400 000	≤ 6 000	≤ 100	-	≤ -40°C	-	0.1
3	-	≤ 90 000	≤ 1 000	-	≤ -20°C	-	1
4	-	-	≤ 10 000	-	≤ +3°C	-	5
5	-	-	≤ 100 000	-	≤ +7°C	-	-
6	-	-	-	≤ 5	≤ +10°C	-	-
7	-	-	-	5 - 10	-	≤ 0,5	-
8	-	-	-	-	-	0.5 - 5	-
9	-	-	-	-	-	5 - 10	-
X	-	-	-	> 10	-	> 10	> 10

Specifying air purity in accordance with ISO8573-1:2010

When specifying the purity of air required, the standard must always be referenced, followed by the purity class selected for each contaminant (a different purity class can be selected for each contamination if required).

An example of how to write an air quality specification is shown below:

ISO 8573-1:2010 Class 1.2.1

ISO 8573-1:2010 refers to the standard document and its revision, the three digits refer to the purity classifications selected for solid particulate, water and total oil. Selecting an air purity class of 1.2.1 would specify the following air quality when operating at the standard's reference conditions :

Class 1 - Particulate

In each cubic meter of compressed air, the particulate count should not exceed 20,000 particles in the 0.1 to 0.5 micron size range, 400 particles in the 0.5 to 1 micron size range and 10 particles in the 1 to 5 micron size range.

Class 2 - Water

A pressure dewpoint (PDP) of -40°C or better is required and no liquid water is allowed.

Class 1 - Oil

In each cubic meter of compressed air, not more than 0.01mg of oil is allowed. This is a total level for liquid oil, oil aerosol and oil vapor.

ISO8573-1:2010 Class zero

- **Class 0 does not mean zero contamination.**
- **Class 0 requires the user and the equipment manufacturer to agree contamination levels as part of a written specification.**
- **The agreed contamination levels for a Class 0 specification should be within the measurement capabilities of the test equipment and test methods shown in ISO8573 Pt 2 to Pt 9.**
- **The agreed Class 0 specification must be written on all documentation to be in accordance with the standard.**
- **Stating Class 0 without the agreed specification is meaningless and not in accordance with the standard.**
- **A number of compressor manufacturers claim that the delivered air from their oil-free compressors is in compliance with Class 0.**
- **If the compressor was tested in clean room conditions, the contamination detected at the outlet will be minimal. Should the same compressor now be installed in typical urban environment, the level of contamination will be dependent upon what is drawn into the compressor intake, rendering the Class 0 claim invalid.**
- **A compressor delivering air to Class 0 will still require purification equipment in both the compressor room and at the point of use for the Class 0 purity to be maintained at the application.**
- **Air for critical applications such as breathing, medical, food, etc typically only requires air quality to Class 2.2.1 or Class 2.1.1.**
- **Purification of air to meet a Class 0 specification is only cost effective if carried out at the point of use.**

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Notes

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Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

WARNING: ⚠ FAILURE OF THE CYLINDER, ITS PARTS, ITS MOUNTING, ITS CONNECTIONS TO OTHER OBJECTS, OR ITS CONTROLS CAN RESULT IN:

- **Unanticipated or uncontrolled movement of the cylinder or objects connected to it.**
- **Falling of the cylinder or objects held up by it.**
- **Fluid escaping from the cylinder, potentially at high velocity.**

THESE EVENTS COULD CAUSE DEATH OR PERSONAL INJURY BY, FOR EXAMPLE, PERSONS FALLING FROM HIGH LOCATIONS, BEING CRUSHED OR STRUCK BY HEAVY OR FAST MOVING OBJECTS, BEING PUSHED INTO DANGEROUS EQUIPMENT OR SITUATIONS, OR SLIPPING ON ESCAPED FLUID.

Before selecting or using Parker (The Company) cylinders or related accessories, it is important that you read, understand and follow the following safety information. Training is advised before selecting and using The Company's products.

1.0 General Instructions

1.1 Scope – This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) cylinder products. This safety guide is a supplement to and is to be used with the specific Company publications for the specific cylinder products that are being considered for use.

1.2 Fail Safe – Cylinder products can and do fail without warning for many reasons. All systems and equipment should be designed in a fail-safe mode so that if the failure of a cylinder product occurs people and property won't be endangered.

1.3 Distribution – Provide a free copy of this safety guide to each person responsible for selecting or using cylinder products. Do not select or use The Company's cylinders without thoroughly reading and understanding this safety guide as well as the specific Company publications for the products considered or selected.

1.4 User Responsibility – Due to very wide variety of cylinder applications and cylinder operating conditions, The Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to The Company's design guidelines and do not necessarily meet the design guideline of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

1.5 Additional Questions – Call the appropriate Company technical service department if you have any questions or require any additional information. See the Company publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2.0 Cylinder and Accessories Selection

2.1 Seals – Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult the "seal information page(s)" of the publication for the series of cylinders of interest.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

2.2 Piston Rods – Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.
- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Follow the recommendations of the "Piston Rod Selection Chart and Data" in the publication for the series of cylinders of interest. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod buckling.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston to rod joint.

2.3 Cushions – Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be review by our engineering department.

2.4 Cylinder Mountings – Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

2.5 Port Fittings – Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end.

The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure x effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

3.0 Cylinder and Accessories Installation and Mounting

3.1 Installation

3.1.1 – Cleanliness is an important consideration, and cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.

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3.1.2 – Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.

3.1.3 – Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

3.1.4 – Sometimes it may be necessary to rotate the piston rod in order to thread the piston rod into the machine member. This operation must always be done with zero pressure being applied to either side of the piston. Failure to follow this procedure may result in loosening the piston to rod-threaded connection. In some rare cases the turning of the piston rod may rotate a threaded piston rod gland and loosen it from the cylinder head. Confirm that this condition is not occurring. If it does, re-tighten the piston rod gland firmly against the cylinder head.

For double rod cylinders it is also important that when attaching or detaching the piston rod from the machine member that the torque be applied to the piston rod end of the cylinder that is directly attaching to the machine member with the opposite end unrestrained. If the design of the machine is such that only the rod end of the cylinder opposite to where the rod attaches to the machine member can be rotated, consult the factory for further instructions.

3.2 Mounting Recommendations

3.2.1 – Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

3.2.2 – Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.

3.2.3 – Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.

3.2.4 – Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.

3.2.5 – Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.

3.2.6 – Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

4.1 Storage – At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

4.1.1 – Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.

4.1.2 – Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.

4.1.3 – Port protector plugs should be left in the cylinder until the time of installation.

4.1.4 – If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

4.1.5 – When cylinders are mounted on equipment that is stored outside for extended periods, exposed unpainted surfaces, e.g. piston rod, must be coated with a rust-inhibiting compound to prevent corrosion.

4.2 Cylinder Trouble Shooting

4.2.1 – External Leakage

4.2.1.1 – Rod seal leakage can generally be traced to worn or damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to gland wear. If clearance is excessive, replace rod bushing and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

4.2.1.2 – Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque tie rods as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorque as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

4.2.2 – Internal Leakage

4.2.2.1 – Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.

4.2.2.2 – With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.

4.2.2.3 – What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

4.2.3 – Cylinder Fails to Move the Load

4.2.3.1 – Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.

4.2.3.2 – Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.

4.2.3.3 – Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.

4.3 Erratic or Chatter Operation

4.3.1 – Excessive friction at rod gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.

4.3.2 – Cylinder sized too close to load requirements – Reduce load or install larger cylinder.

4.3.3 – Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

4.4 Cylinder Modifications, Repairs, or Failed Component – Cylinders as shipped from the factory are not to be disassembled and or modified. If cylinders require modifications, these modifications must be done at company locations or by The Company's certified facilities. The Cylinder Division Engineering Department must be notified in the event of a mechanical fracture or permanent deformation of any cylinder component (excluding seals). This includes a broken piston rod, tie rod, mounting accessory or any other cylinder component. The notification should include all operation and application details. This information will be used to provide an engineered repair that will prevent recurrence of the failure.

It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

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Offer of Sale

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods or work described will be referred to as "Products".

1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated, Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Delivery Dates; Title and Risk; Shipment. All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve months from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. **IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure") Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appointments a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) the dissolves or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which the Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

02/12

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