◾ Product series

Series name		Acting type	Bore size	Collocation of sensor switch
				DS1−H
HRQ Series		Double acting →	10	●
			20	●
			30	●
			50	●
Page	354			403

◾ Installation and application ⚠

1. Dirty substances in the pipe must be eliminated before cylinder is connected with pipeline to prevent the entrance of impurities into the cylinder.
2. The medium used by cylinder shall be filtered to 40 μ m or below.
3. Anti−freezing measure shall be adopted under low temperature environment to prevent moisture freezing.
4. If the cylinder is dismantled and stored for a long time, pay attention to conduct anti−rust treatment to the surface. Anti−dust caps shall be added in air inlet and outlet ports.
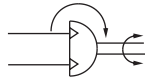
HRQ

Symbol

Product feature

1. Rack and pinion design, stable functioning.
2. Double cylinder structure, double output could be achieved.
3. The manufacturing precision of working platform is high, and is easy for installation , and is of precise orientation.
4. The center of working platform has a through hole, and pipe can be located and passed through this hole;
5. Two sides of cylinder have orientation holes, to facilitate installation.
6. Two modes of buffer could be chosen, adjustment bolt buffer and internal shock absorber, the maximum buffer energy of internal shock absorber is 3-5 times that of adjustment bolt buffer.
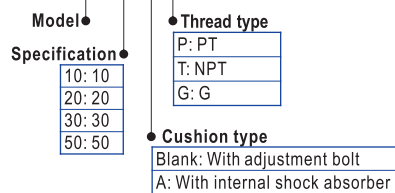
HRQ

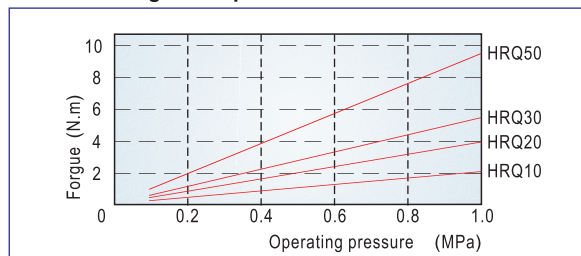## Ordering code

Model can to be changed Ordering code. Example:
Production type: HRQ
Specification: 50
Buffer type: Internal shock absorber
Thread type: NPT
Model:HRQ50-A-T
Ordering code: HRQ 50 A T

Model●
Specification●
| 10: 10 |
| 20: 20 |
| 30: 30 |
| 50: 50 |

●**Thread type**
| P: PT |
| T: NPT |
| G: G |

●**Cushion type**
| Blank: With adjustment bolt |
| A: With internal shock absorber |

Actual forgue output

Specification

Specification		10	20	30	50
Acting type		Double rack and pinion(Double acting)			
Fluid		Air(to be filtered by 40 μ m filter element)			
Operating pressure	With adjustment bolt	0.1~1.0MPa(15~145psi)(1.0~10.0bar)			
	With internal shock absorber	0.1~0.6MPa(15~87psi)(1.0~6.0bar)			
Proof pressure		1.5MPa(218psi)(15.0bar)			
Temperature ℃		0~60			
Angle adjustment range		0~190°			
Repeatable precision	With adjustment bolt	0.2°			
	With internal shock absorber	0.05°			
Theoretic moment (Nm)(0.5MPa)		1.1	2.2	2.75	5.15
Cushion type	With adjustment bolt	Rubber bumper			
	With internal shock absorber	Shock absorber			
Port size	End ports	M5×0.8		1/8" ①	
	Side ports			M5×0.8	
Weight g		535	940	1260	2060

① PT thread、NPT and G thread are available.
Add) QCK series are all attached with magnet, please refer to Page 403~426 for the specific content of sensor switch.
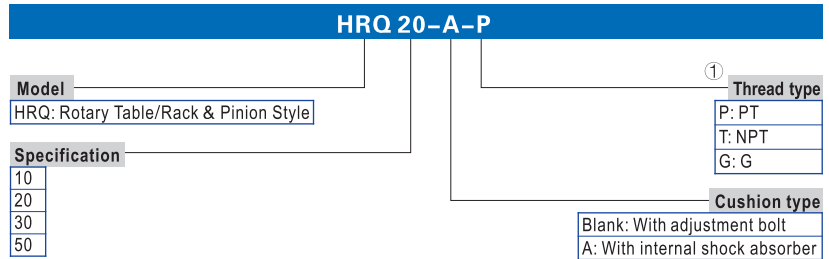
Maximum allowed movement energy and rotation times

Model	Maximal allowed energy (J)		Rotation times (s/90°)	
	With adjustment bolt	With internal shock absorber	With adjustment bolt	With internal shock absorber
HRQ10	0.01	0.04	0.2~1.0	0.2~0.7
HRQ20	0.025	0.12	0.2~1.0	0.2~0.7
HRQ30	0.05	0.12	0.2~1.0	0.2~0.7
HRQ50	0.08	0.30	0.2~1.0	0.2~0.7

Note) ①:The movement energy should not exceed the allowed maximum energy, or the inner accessories of product would be damaged;
　　②:When the rotation times of with shock absorber is larger than the allowed tolerance, the bigger effect will be lost.

Explain of model

HRQ 20–A–P

Model
HRQ: Rotary Table/Rack & Pinion Style

Specification
| 10 |
| 20 |
| 30 |
| 50 |

①
Thread type
| P: PT |
| T: NPT |
| G: G |

Cushion type
| Blank: With adjustment bolt |
| A: With internal shock absorber |

Note ①: When it is 10,20 specification, thread type is M5, it is blank here.
　　 Add) HRQ series are all attached with magnet.

Maximum allowed loading

Loading type		Model			
		HRQ10	HRQ20	HRQ30	HRQ50
	Maximal allowed radial loading (N)	80	150	200	300
	Maximal allowed axial loading (N)	80	150	200	300
	Maximal allowed bending moment (Nm)	2.5	4.0	5.5	10.0

Rotary table cylinder

HRQ Series

AirTAC

■ Inner structure and material of major parts
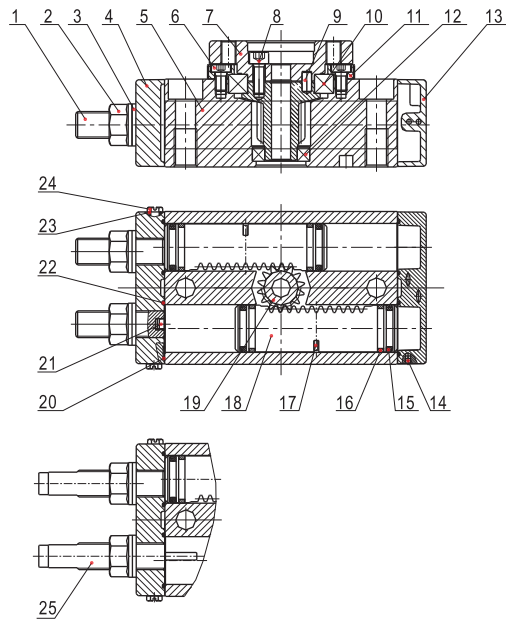
HRQ□−A(With internal shock absorber)

NO.	Item	Material
1	Adjustment bole	Carbon steel
2	Hxcagon nut	Carbon steel
3	Seal washer	Carbon steel & Rubber
4	Front cover	Aluminum alloy
5	Body	Aluminum alloy
6	Hexagon socket head set bole	Carbon steel
7	Table	Aluminum alloy
8	Hexagon socket head set bole	Stainless steel
9	Parallel pin	Carbon steel
10	Deep-groove bearing	Subassembly
11	Bearing retainer	Aluminum alloy
12	Deep-groove bearing	Subassembly
13	Bacl cover	Aluminum alloy
14	Steel ball	Stainless steel
15	Piston seal	NBR
16	Wear ring	Wear resistant material
17	Magnet	Rare earths
18	Rack	Stainless steel
19	Pinion	Chrome molybdenum steel
20	O−ring	NBR
21	Bumper	NBR
22	O−ring	NBR
23	O−ring	NBR
24	Hexagon screw	Stainless steel
25	Shock absorber	Subassembly

■ Dimensions

HRQ□−A(With internal shock absorber)

HRQ
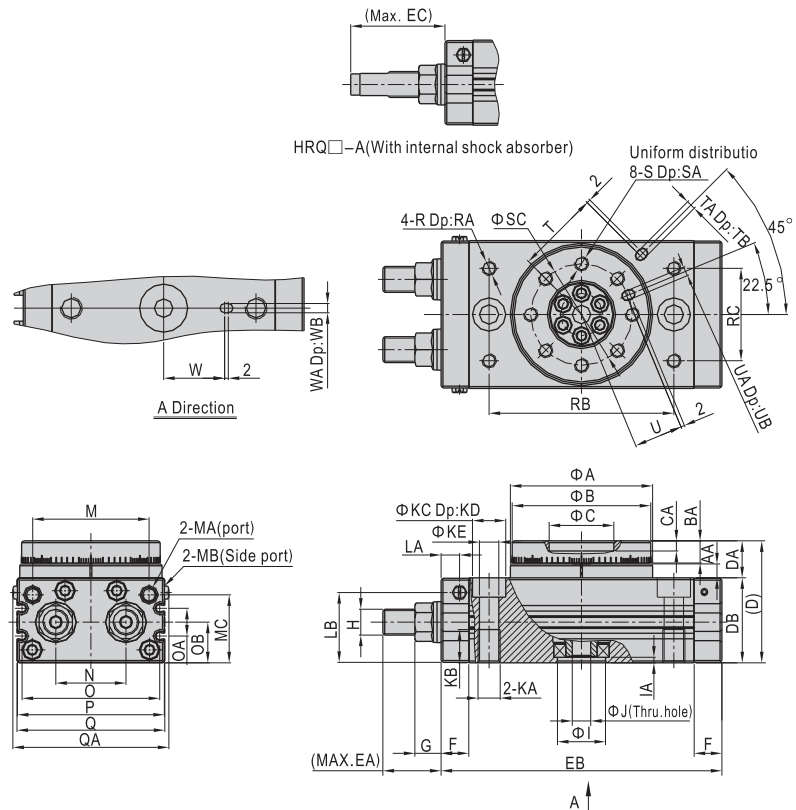
Type\Item	A	AA	B	BA	C	CA	D	DA	DB	EA	EB	EC	F
10	46(h9)	4.5	45(h9)	8	20(H9)	4.5	47	13	34	17.5	92	28.5	9.5
20	61(h9)	6.5	60(h9)	10	28(H9)	6.5	54	17	37	26	117	37	11
30	67(h9)	6.5	65(h9)	10	32(H9)	5	57	17	40	25.5	127	36.5	11.5
50	77(h9)	7.5	75(h9)	12	35(H9)	5.5	66	20	46	31.5	152	51	15

Type\Item	G	H	I	IA	J	KA	KB	KC	KD	KE	LA	LB	M
10	9.5	M10 × 1.0	15(H9)	3	5	M8 × 1.25	12	11	6.5	6.8	4.5	29	34.5
20	9.5	M10 × 1.0	17(H9)	2.5	9	M10 × 1.5	15	14	8.5	8.6	6	30	47
30	9.5	M10 × 1.0	22(H9)	3	9	M10 × 1.5	15	14	8.5	8.6	6.5	34	50
50	14	M14 × 1.5	26(H9)	3	10	M12 × 1.75	18	18	10.5	10.5	10	38	63

Type\Item	MA	MB	MC	N	O	OA	OB	P	Q	QA	R	RA	RB
10	M5 × 0.8	M5 × 0.8	27.8	20.5	45	13.5	15.5	49.5	50	54.5	M5 × 0.8	8	60
20	M5 × 0.8	M5 × 0.8	30	27.5	59	12	16	64.5	65	69.5	M6 × 1.0	8	76
30	1/8"	M5 × 0.8	32	29	64	13.5	18.5	69.5	70	74.5	M6 × 1.0	8	84
50	1/8"	M5 × 0.8	38	38	74.5	15	22	79.5	80	84.5	M8 × 1.25	8	100

Type\Item	RC	S	SA	SC	T	TA	TB	U	UA	UB	W	WA	WB
10	27	M5 × 0.8	8	32	27	3(H9)	3.5	15	3(H9)	3.5	19	3(H9)	3.5
20	34	M6 × 1.0	10	43	36	4(H9)	4.5	20.5	4(H9)	4.5	24	4(H9)	4.5
30	37	M6 × 1.0	10	48	39	4(H9)	4.5	23	4(H9)	5	28	4(H9)	4.5
50	50	M8 × 1.25	12	55	45	5(H9)	5.5	26.5	5(H9)	6	33	5(H9)	5.5
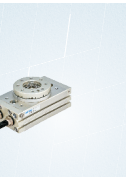
Rotary table cylinder

HRQ Series

■ How to select product

1. Determine the following working conditions according to the actual situation:

1.1) Rotation angle θ: The actual rotation angle must be within the maximum allowed range of rotation angle of cylinder.

1.2) Rotation time t: The rotation time must be within the maximum allowed range of rotation time of cylinder.

1.3) Installation position of cylinder: Allow enough installation space, so as to ensure leaving adequate space for rotation of cylinder and workpieces.

1.4) Determination of loading mass and loading shape.

2. Calculation of necessary forgue needed when loading rotation (T(N.m):

Calculate the necessary moment required for loading rotation according to the formula below, and combine with the forgue diagram of actual effect, to choose pneumatic cylinder with suitable forgue output.

$$T = K \times I \times \dot{\omega}$$
$$\dot{\omega} = \frac{2\theta}{t^2}$$

T:Necessary forgue required for loading rotation (N.m)
K:Coefficient of allowance, K is defined as 5
I:Moment of inertia（kg.m²）
$\dot{\omega}$:Angular acceleration（rad/s²）
θ :Rotation Angle（rad）
t:Rotation time（s）

2.1、Calculation method of moment of inertia in different conditions

Diagram	Description	Calculation formula of moment of inertia	Rotation radius
Disk	d:Diameter (m) m:Mass (kg)	$I = \dfrac{md^2}{8}$	$\dfrac{d^2}{8}$
		Note: no special installation direction	
Classified disk	d_1:Diameter(m) d_2:Diameter(m) m_1:d_1 Mass(kg) m_2:d_2 Mass(kg)	$I = \dfrac{m_1 d_1^2 + m_2 d_2^2}{8}$	$\dfrac{d_1^2 + d_2^2}{8}$
		Note: compare d_1 with d_2, disregard d_1 if d_1 is extremely tiny	
Disk	d:Diameter (m) m:Mass (kg)	$I = \dfrac{md^2}{16}$	$\dfrac{d^2}{16}$
		Note: no special installation direction	
Sphere	r:Radius(m) m:Mass(kg)	$I = \dfrac{2mr^2}{5}$	$\dfrac{2r^2}{5}$
		Note: no special installation direction	
Thin-stick	a_1:Length of stick(m) a_2:Length of stick(m) m_1:a_1 Mass(kg) m_2:a_2Mass(kg)	$I = \dfrac{m_1 a_1^2 + m_2 a_2^2}{3}$	$\dfrac{a_1^2 + a_2^2}{3}$
		Note: 1. horizontal installation. 2. pay attention to the change of movement time when vertical installation.	
Rectangle sheet	a_1:Sheet length (m) a_2:Sheet length (m) b: Length of side(m) m_1:a_1 Mass(kg) m_2:a_2 Mass(kg)	$I = \dfrac{m_1(4a_1^2 + b^2) + m_2(4a_2^2 + b^2)}{12}$	$\dfrac{2a_1^2 + 2a_2^2 + b^2}{6}$
		Note: 1. horizontal installation. 2. pay attention to the change of movement time when vertical installation.	
Rectangle sheet	a:Sheet length (m) b:Length of side(m) m:Mass(kg)	$I = \dfrac{m(a^2 + b^2)}{12}$	$\dfrac{a^2 + b^2}{12}$
		Note: no special installation direction	

Diagram	Description	Calculation formula of moment of inertia	Rotation radius
Rectangle sheet	a:Sheet ength (m) m:Mass (kg)	$I = \dfrac{ma^2}{12}$	$\dfrac{a^2}{12}$
		Note: no special installation direction	
Rectangle sheet	a:Sheet ength (m) m:Mass(kg)	$I = \dfrac{ma^2}{3}$	$\dfrac{a^2}{3}$
		Note: 1. horizontal installation. 2. pay attention to the change of movement time when vertical installation.	
Rectangle sheet	a:Sheet length (m) b:Distance between the rotation axis and the gravity center of loading (m) m:Mass(kg)	$I = \dfrac{ma^2}{12} + mb^2$	$\dfrac{a^2}{12} + b^2$
		Note: the cuboids are same too.	
Concentrated load	a_1:Vertical distance between the rotation axis and the concentrated loading(m) a_2:Length of arm(m) m_1:Mass of concentrated loading(kg) m_2:Mass of arm(kg)	$I = m_1 a_1^2 + \dfrac{m_2 a_2^2}{3} + m_1 K$	
		Note: 1. horizontal installation. 2. compared with m, disregard if m is extremely tiny. 3. calculate K according to the shape of concentrated loading row by row. For example, when the loading is spheroid, $K = \dfrac{2r^2}{5}$	
Gear	a:Tooth number of gear b:Tooth number of loading gear	$I_a = (\dfrac{a}{b})^2 I_b$	

3. Calculation of maximum movement energy E_{max}(J):

Calculate the maximum movement energy E_{max} according to the formula below, and make sure that the maximum movement energy is within allowed energy range of the chosen pneumatic cylinder, excessive large movement energy would lead to damage of inner parts, please choose rotation cylinder attached with shock absorber when the movement energy is fairly large.

$$E_{max} = \frac{1}{2} I \omega_{max}^2 \qquad \omega_{max} = \frac{2\theta}{t} \qquad \omega_{max}: \text{ Maximal angular velocity(rad/s)}$$

4. Calculation of loading rate

Calculate the loading rate according to the formula below, and the loading rate must not be more than 1.

$$\text{Loading rate} = \frac{W_s}{\begin{array}{c}\text{Maximal allowed}\\\text{axial loading}\end{array}} + \frac{W_r}{\begin{array}{c}\text{Maximal allowed}\\\text{radial loading}\end{array}} + \frac{M}{\begin{array}{c}\text{Maximal allowed bending}\\\text{moment of working platform}\end{array}} \leqslant 1$$

W_s: Actual axial loading W_r: Actual radial loading   M: Actual loaded bending moment of working platform

5. Determination method

It could be used only when the chosen pneumatic cylinder must meet the requirements of article 2, 3 and 4 simultaneously.
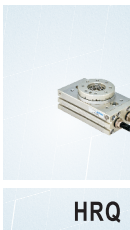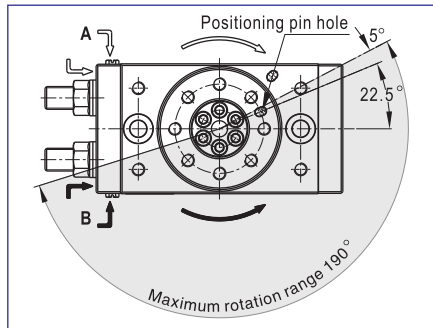
◼ Installation and application

1. Rotation Direction and Rotation Angle

1.1) Rotation Direction

A) By adjusting the adjustment bolt, the rotation end can be
set within the range shown in the up drawing:
Maximum ratation is 190° ;

B) The rotary table turns in the clockwise direction when
the A port is pressurized, and in the counter−clockwise
direction when the B port is pressurized.

1.2) Rotation Range Example(90° Rotation)

Adjustment amount by adjustment bolt B

Adjustment amount by adjustment bolt B

Adjustment amount by adjustment bolt A, B
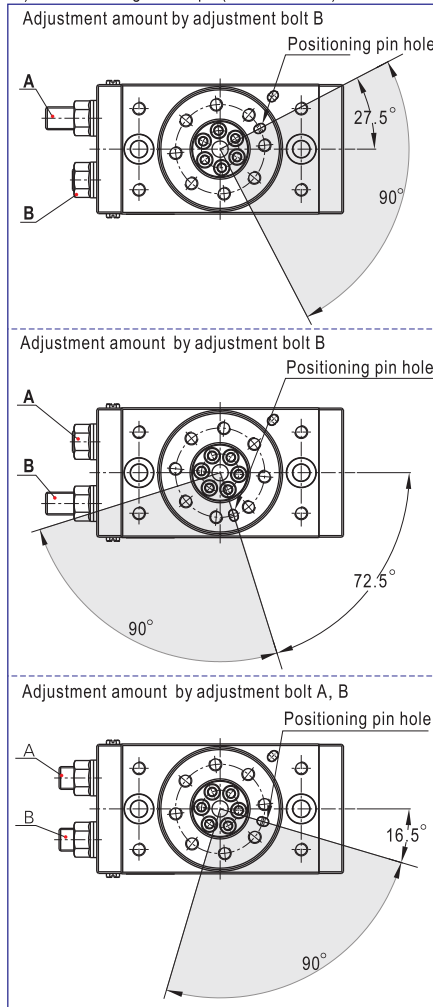
1.3) The rotation angle can also be set on a type with
internal absorber.

Model	Adjustment angle per rotation of angle (adjustment screw or shock absorber)
HRQ10	10.2°
HRQ20	6.5°
HRQ30	6.5°
HRQ50	8.2°

2. The range of rotation angle has been adjusted to the
maximum in the factory, please do not enlarge the rotation
angle any more.

3. The movement energy should not exceed the allowed
maximum energy, or the inner parts will be damaged.

4. The rotary parts need no lubrication.

5. Series HRQ is equipped with a rubber bumper or shock
absorber. Therefore, perform rotation adjustment in the
pressurized condition(minimum operation pressure: 0.1
Mpa or more for adjustment bolt and internal shock
absorber types, and 0.2 MPa or more for external shock
absorber type.)

6. Refer to the table below for tightening torques of the
shock absorber setting nut.

Shock absorber size	Max. tightening torque(Nm)
M10	3.5
M14	11.0

7. Never loosen the bottom screw of the shock absorber.
(It is not an adjustment screw.) That may cause oil
leakage.

8. Shock absorbers are consumable parts. When a decrease
in energy absorption capacity is noticed, it must be
replaced.

Rotary table cylinder	Shock absorber
HRQ10	ACA1006-A
HRQ20\HRQ30	ACA1007-A
HRQ50	ACA1412-A

HRQ

HRQ