System Diagram of Grippers and Rotors
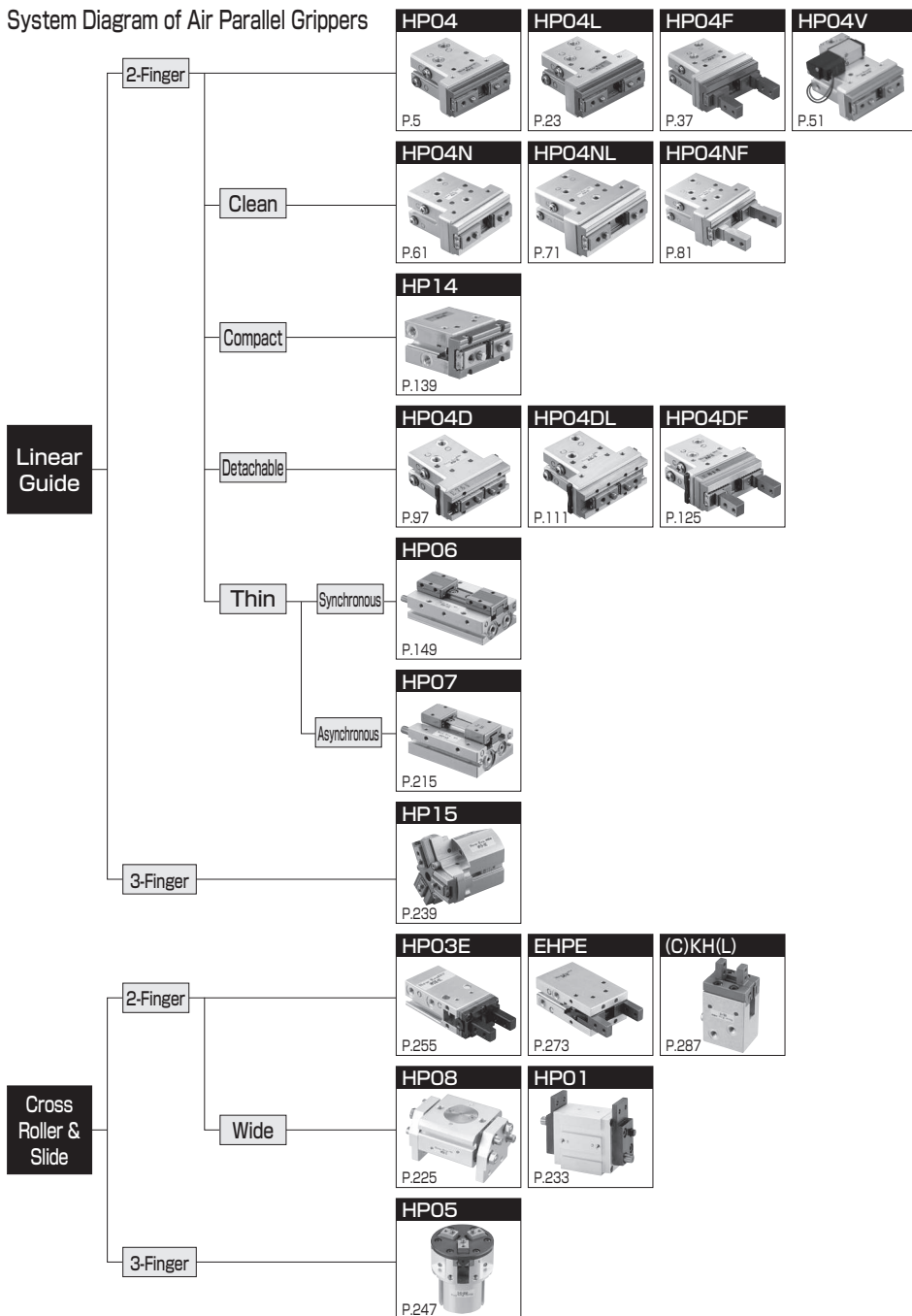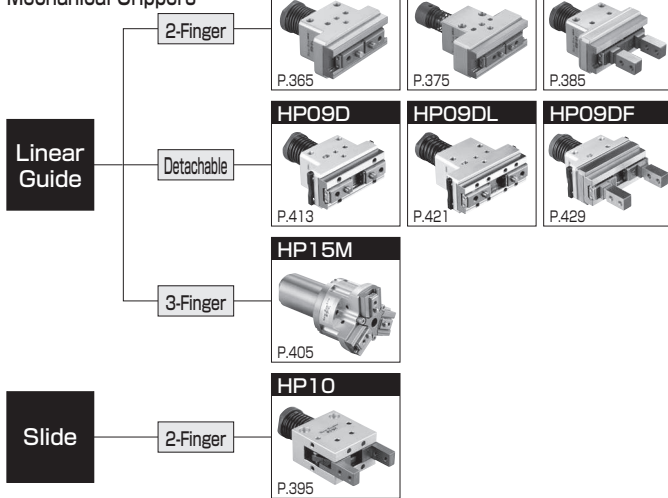
System Diagram of Air Parallel Grippers
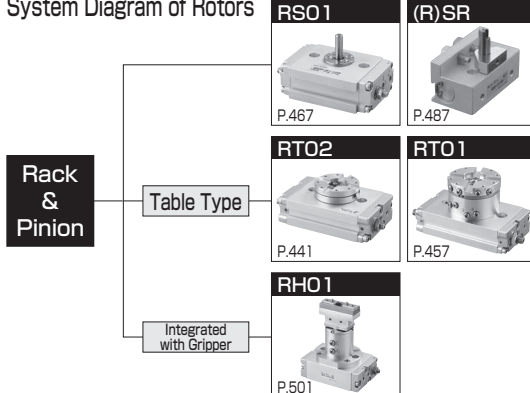
Linear Guide

- **2-Finger**

HP04	HP04L	HP04F	HP04V
P.5	P.23	P.37	P.51

  - **Clean**

HP04N	HP04NL	HP04NF
P.61	P.71	P.81

  - **Compact**

HP14
P.139

  - **Detachable**

HP04D	HP04DL	HP04DF
P.97	P.111	P.125

  - **Thin**
    - **Synchronous**

HP06
P.149

    - **Asynchronous**

HP07
P.215

- **3-Finger**

HP15
P.239

Cross Roller & Slide

- **2-Finger**

HP03E	EHPE	(C)KH(L)
P.255	P.273	P.287

  - **Wide**

HP08	HP01
P.225	P.233

- **3-Finger**

HP05
P.247

2

System Diagram of Air Rotary Grippers

Guide & Slide	2-Finger	180° opening/closing

HV02G
P.301

HV02E
P.311

EHVE
P.321

EHVJ
P.333

SH
P.341

VH
P.347

MH
P.359
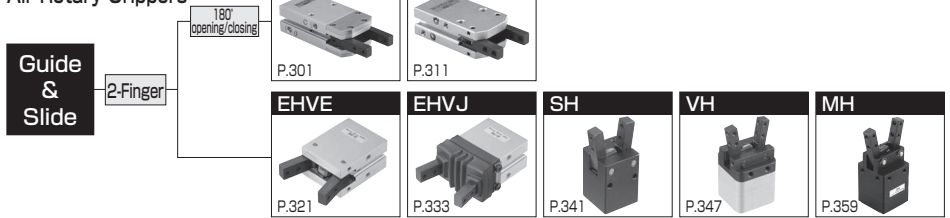
System Diagram of Mechanical Grippers

Linear Guide	2-Finger	
	Detachable	
	3-Finger	

HP09
P.365

HP09L
P.375

HP09F
P.385

HP09D
P.413

HP09DL
P.421

HP09DF
P.429

HP15M
P.405

Slide	2-Finger

HP10
P.395

System Diagram of Rotors

Rack & Pinion		
	Table Type	
	Integrated with Gripper	

RS01
P.467

(R)SR
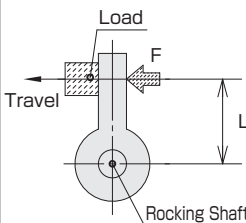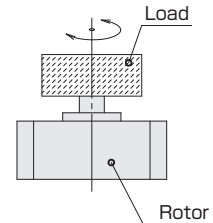P.487

RT02
P.441

RT01
P.457

RH01
P.501
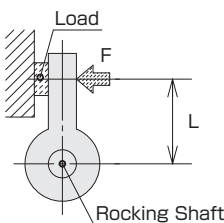
Technical Data — Rotor Selection —

Rotor Selection

Check if the torque, rocking time, kinetic energy, load and moment are within the allowable range.

1. Load Type

Load types are classified into the following three types according to the actuator mounting posture, cargo shape and use method. The inertia moment calculation formula differs depending on the cargo shape. See "Inertia Moment Calculation" in Page 549. The inertial load is inversely proportional to the square of the rocking time. Require special care to the rocking time setting in calculation.

Load Type	Static Load: Ts	Resistance load: Tr	Inertia load: Ta
Description	Load generated by static pressing such as clamping.	A load generated by an external force with object movement, such as a friction force during workpiece travelling and the gravity during rocking on the vertical surface.	A load generated by the inertia force with object rocking
Calculation Formula	$Ts = F \cdot L (N \cdot m)$	$Tr = F \cdot L (N \cdot m)$ (Example. $F = \mu \cdot m \cdot g$)	$Ta = I \dfrac{2\theta}{t^2}$ $(N \cdot m)$
Use Example	 F: Required pressing force(N) L: Length from the rocking shaft core to the working point(m)	 F : Required pressing force (N) L : Length from the rocking shaft core to the working point (m) μ : Friction coefficient m : Mass (kg) g : Gravity acceleration (m/s²)	 I : Inertia moment (kg·m²) θ : Rocking angle (rad) t : Rocking time (s)

2. Torque

Select an actuator so that the torque calculated for the load type is equal or lower than the effective torque of each model.

The effective torque is an indication value obtained from theoretical output torque in consideration of the friction resistance.

When an object is statically pressed, inertial load is generated by rocking of the cargo such as a clamp arm. Additionally, resistance load is generated depending on the mounting posture. Therefore, separate examination is required.

For static load, select a torque that has a large margin. Decrease the regulator pressure as needed.

Excess of any use condition over its allowable value will result in actuator failure and breakage such as accuracy deterioration, operation failure and life shortening.

When an object is statically pressed	$Te \geqq Ts$	Te: Effective torque (N·m)
When an object is traveled	$Te \geqq 5 \cdot Tr + 10 \cdot Ta$	Ts: Required torque for static load (N·m)
When an object is rocked	$Te \geqq 10 \cdot Ta$	Tr: Required torque for resistance load (N·m)
		Ta: Required torque for inertial load (N·m)

Technical Data

Rotor Selection

3. Allowable Rocking Time

Check if the rocking time is within the allowable rocking time range of each model.
Use of the product in the low speed zone exceeding the allowable rocking time may result in stick-slip phenomenon or stop.

Allowable Rocking Time	0.3~3s	※ For 180°

4. Allowable Kinetic Energy

Check if the kinetic energy calculated in the following formula is smaller than the allowable kinetic energy of each model.
The inertia moment calculation formula differs depending on the cargo shape. See "Inertia Moment Calculation" in Page 549.
The angular speed asked here is the end angular speed in the uniformly-accelerated motion.
When the cargo lowers, the angular speed increases by gravity acceleration, thus generating kinetic energy larger than expected.
When it is expected that the value will exceed the allowable value, equip an external shock absorber to absorb shock.
Excess of any use condition over its allowable value will result in actuator failure or body/machine/equipment damage.

$$E= \frac{1}{2} I\omega^2 \qquad \omega= \frac{2\theta}{t}$$

E : Kinetic energy　(J)
ω : Angular speed (rad/s)
θ : Rocking angle　(rad)
t : Rocking time　(s)

5. Allowable Load, Allowable Moment

· Table type
　Do not apply any load or moment to the table if they exceed the allowable values.
· Shaft type
　Use an item such as a thrust bearing or a radial bearing to avoid direct load to the shaft.
　When direct load cannot be avoided, make sure that it is within the allowable load range of each model.
　Excess of any use condition over its allowable value will result in actuator failure and breakage such as
　accuracy deterioration, operation failure and life shortening.

Allowable Thrust Load Fs

Allowable Radial Load Fr

Offset Load Fo

Moment: M=Fr×(Lr+A)

Moment: :M=Fo×Lo
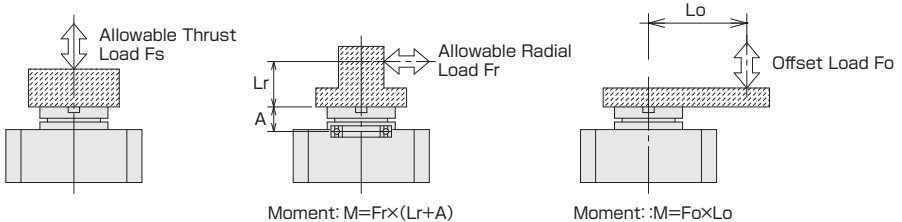
Type	RT01		RT02				
	18	22	10	14	16	18	22
Distance A from table to bearing(mm)	18.5	20.5	9.2	11.5	13.5	15	17

6. Others

In addition to the items selected so far, you need to check the working temperature, rocking angle, etc.
Use them within the allowable range with reference to the "Specifications" page of each model.
Consult us if you have any question.

Technical Data

Rotor Selection