

## Equipment related to rechargeable batteries P4\* Series



Material  
restrictions



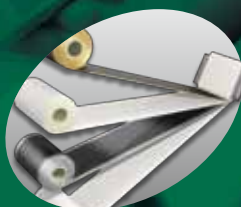
Countermeasures  
against dust generation



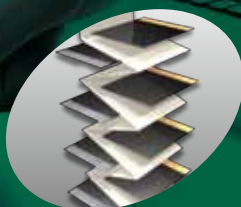
Countermeasures  
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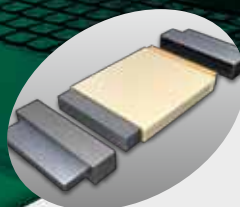
Dry  
environment



Winding



Stacking



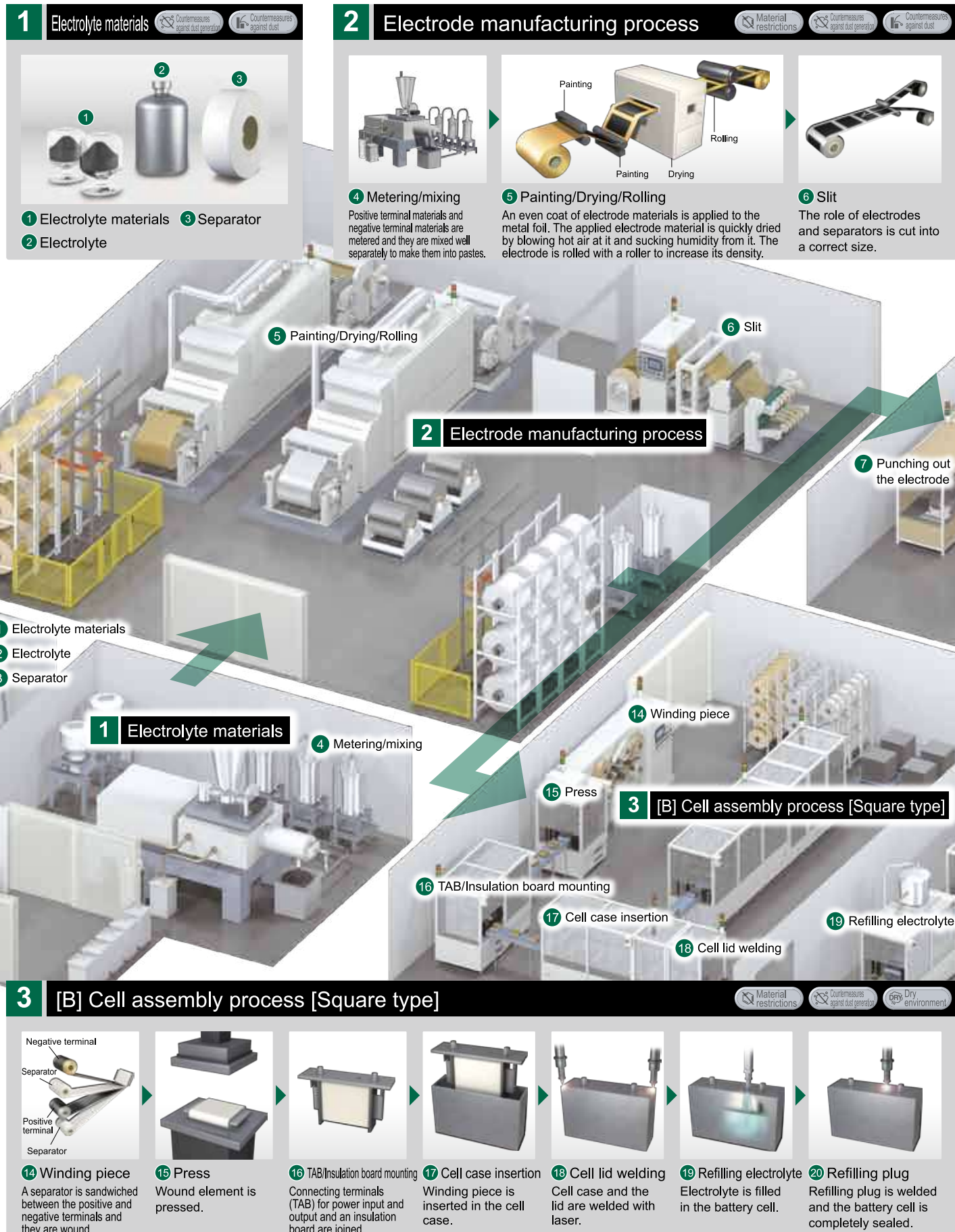
TAB Welding



Immersion

# Secondary battery manufacturing process

In the secondary battery manufacturing process, various environmental requirements should be addressed such as dust prevention, explosion proof, vacuum, ultra dryness, and materials to be used.



# Equipments corresponding to the secondary cell P4\* Series

## 3 [A] Cell assembly process [Laminate type]

Material restrictions Countermeasures against dust generation Dry environment



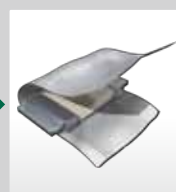
**7 Punching out the electrode**  
Positive terminal plate/negative terminal plates are punched out into specific sizes.



**8 Stacking**  
Electrolytes and separators are stacked alternately at high speed with high precision.



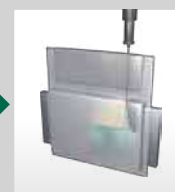
**9 TAB welding**  
Connecting terminals (TAB) for power input and output are connected.



**10 Laminate**  
Electrode sandwich is wrapped with the covering material.



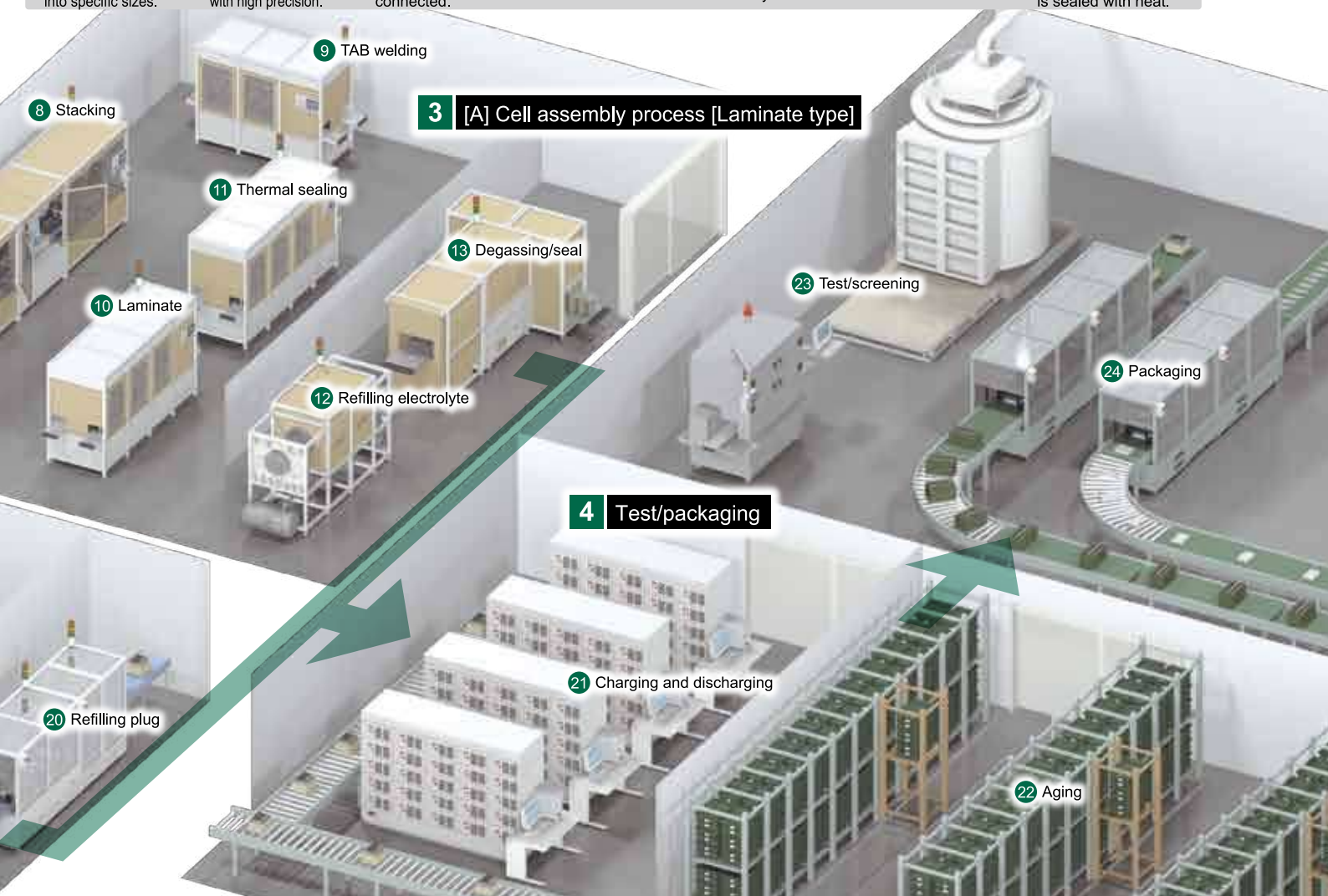
**11 Thermal sealing**  
Three sides of the cell are glued thermally.



**12 Refilling electrolyte**  
Electrolyte is filled in the battery cell.



**13 Degassing seal**  
Gas generated in the cell is taken out, and the battery cell is sealed with heat.



## 4 Test/packaging

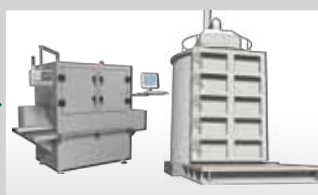
Material restrictions Countermeasures against dust generation Dry environment



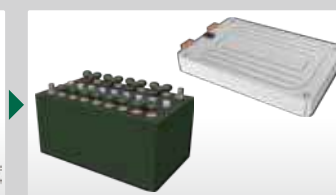
**21 Charging and discharging**  
Battery is activated by repeating charging and discharging.



**22 Aging**  
Fully charged battery cells are left for a certain period of time at a specified temperature.



**23 Test/screening**  
Performance as products is checked.



**24 Packaging**  
Battery cells are stacked and put in a case.

## Series supporting the secondary battery manufacturing process

CKD responds consistently to customer needs for the secondary battery manufacturing, from electrode production to packaging, with our product aiming the safe secondary battery production process.



### Materials for parts are restricted

Materials and surface treatment unsuitable for the secondary battery production processes are restricted. This will help reduce defects in secondary batteries.



Copper materials are restricted



Zinc materials are restricted



Nickel materials are restricted



Zinc plating is restricted



Electrolytic nickel plating is restricted



### Long service life in a dusty environment

Effective anti-dust features such as scraper and rod packing are adopted. Dust is blocked from entering the cylinder.



### Metal wear particles are minimized

Local exhaust function (vacuum sweep port) is installed. This feature prevents metal wear particles from leaking out contaminating electrodes and cells.

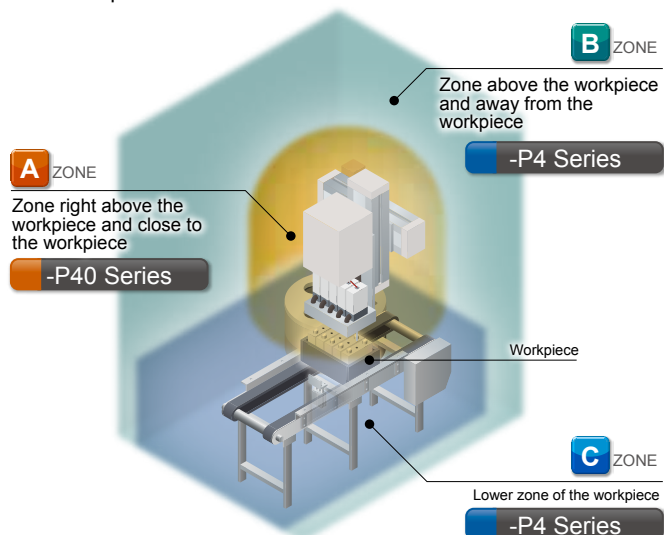


### Long service life in an ultra dry environment

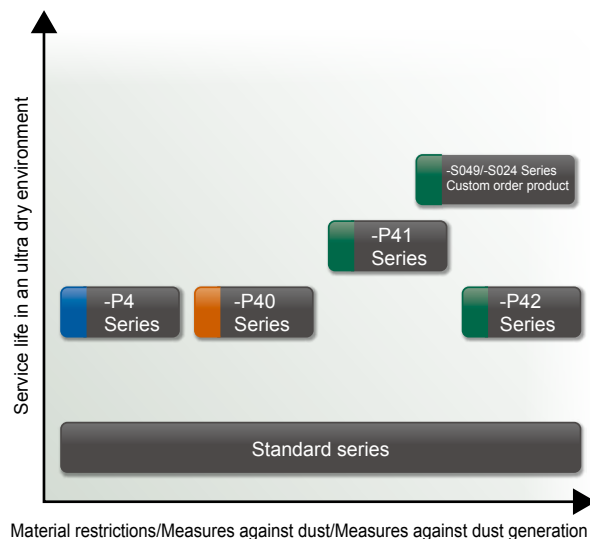
Grease compatible with ultra dry environment is used. Lubrication of the sliding areas can be maintained for an extended period of time even in a dry environment.

#### Series zoning

Two different grade applicable models are offered for different atmosphere and location inside the device.



#### Series overview



#### Series variation

|                            | -P4 Series                      | -P40 Series                            | -P41 Series                     | -P42 Series                             | -S049/-S024 Series<br>Custom order product |
|----------------------------|---------------------------------|----------------------------------------|---------------------------------|-----------------------------------------|--------------------------------------------|
|                            | Flow path material restrictions | Materials for all parts are restricted | Countermeasures against dry air | Countermeasures against dust generation | Countermeasures against dust               |
| Pneumatic actuator         | ●                               | ●                                      | ●                               | ●                                       | ●                                          |
| Pneumatic valve            | ●                               | ●                                      |                                 |                                         |                                            |
| Clean air components       | ●                               | ▲                                      |                                 |                                         |                                            |
| Vacuum components          | ●                               |                                        |                                 |                                         |                                            |
| General purpose valves     | ●                               | ●                                      |                                 |                                         |                                            |
| Pneumatic related products | ●                               | ●                                      |                                 |                                         |                                            |

\* Small amounts in alloy are excluded.

## Restricting materials in the flow path and sliding areas

### -P4 Series

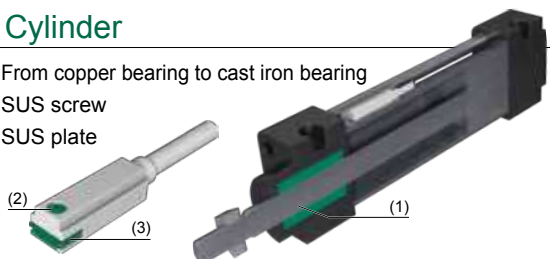
The same mounting size as the standard type



Copper/Zinc/Nickel materials and electrolytic nickel plating are restricted in the flow path and sliding areas.

#### Cylinder

- (1) From copper bearing to cast iron bearing
- (2) SUS screw
- (3) SUS plate



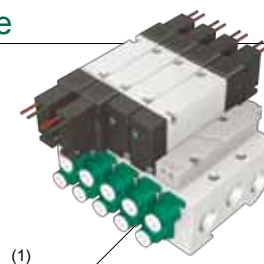
#### Regulator

- (1) Exhaust treatment



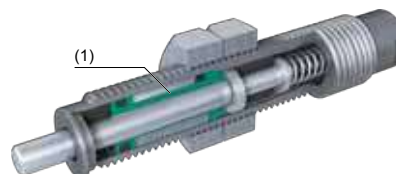
#### Pneumatic valve

- (1) SUS fitting



#### Shock absorber

- (1) Aluminum



## Materials for all parts are restricted

\* Electrical parts (coil, circuit, wiring, etc.) are excluded.

\* Small amounts in alloy are excluded.

### -P40 Series

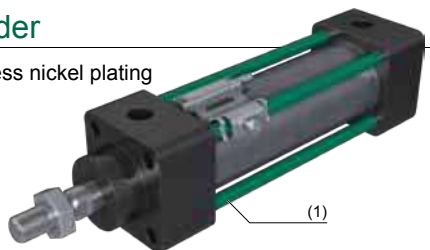
The same mounting size as the standard type



Copper/Zinc/Nickel materials and electrolytic nickel plating are restricted for all parts.

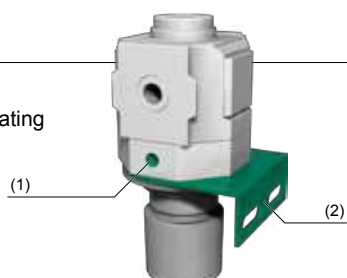
#### Cylinder

- (1) Electroless nickel plating



#### Regulator

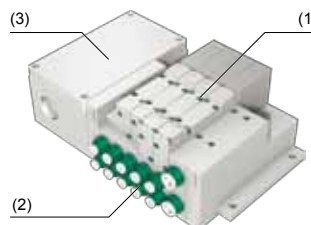
- (1) Exhaust treatment
- (2) Electroless nickel plating



#### Pneumatic valve

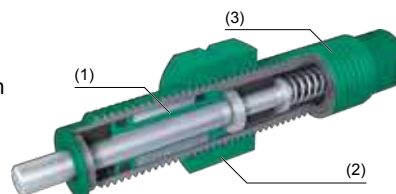
- (1) SUS screw
- (2) SUS fitting
- (3) Electrical circuit section IP65\*

\* IP40 is of D sub-connector specifications.



#### Shock absorber

- (1) Aluminum
- (2) SUS nut
- (3) Hard chromium plating



\* This varies depending on our testing conditions.

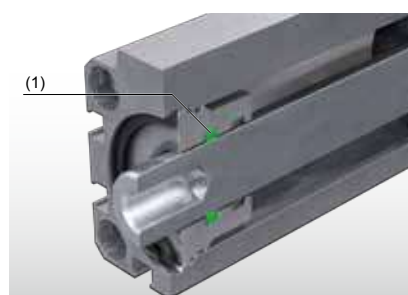
## Clearing over 20 million times of endurance test for ultra dry environment

### -P41 Series



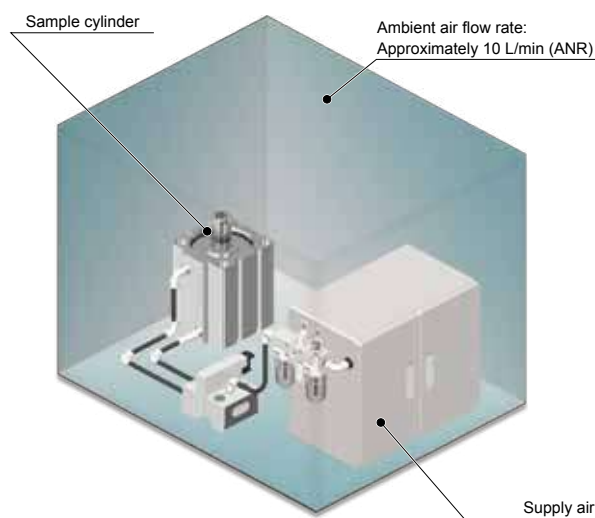
Grease impregnated fiber composite (lube keeping structure) is added to P40 specifications. This enables stable lubrication to the sliding areas for an extended period of time to achieve long service life in an ultra dry environment. SUS is used for piston rods.

#### Cylinder



(1) Dry air countermeasures (lube keeping structure)

\*Dimensions vary from the standard model.



#### Testing method

Cylinder is placed vertically facing upward. This is operated in an ultra dry environment for the endurance test.

#### Test conditions

|                                               |          |
|-----------------------------------------------|----------|
| Supply pressure                               | 0.5 MPa  |
| Cylinder speed                                | 300 mm/s |
| Supply air atmospheric dew point              | -61°C    |
| Surrounding environment atmospheric dew point | -61°C    |
| Load                                          | No load  |

## Dust generation is reduced to 1/5 or less

\* Comparison with our standard cylinder.

### -P42 Series



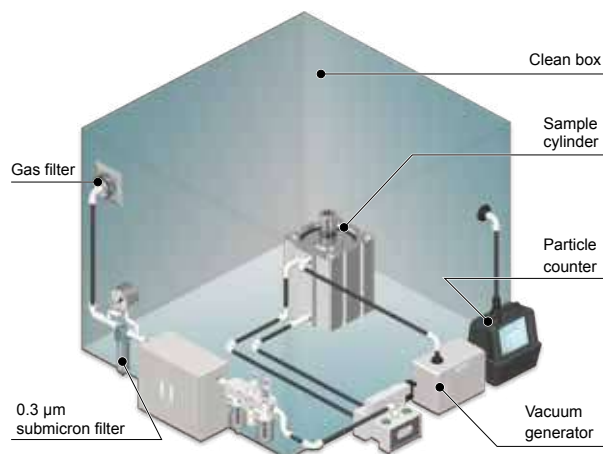
Local exhaust function (vacuum sweep port) is added to P40 specifications. This will prevent metal particles from contaminating electrodes and cells and help reduce defects in secondary batteries. SUS is used for piston rods.

#### Cylinder



(1) Vacuum sweep port

\*Dimensions vary from the standard model.



#### Testing method

The device is run in a clean box to measure the amount of dust generated.

|                 |          |
|-----------------|----------|
| Supply pressure | 0.5 MPa  |
| Cylinder speed  | 200 mm/s |
| Frequency       | 30 cpm   |
| Load            | No load  |

\* This series are custom order products. For applicable models, contact CKD.

## Two different countermeasures you can choose against dust

### -S049/-S024 Series

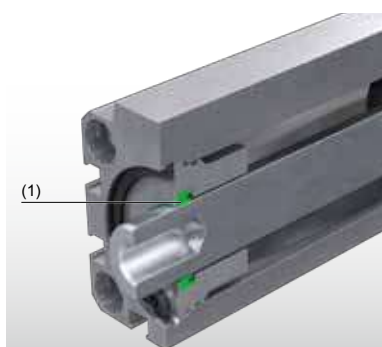


You can choose from "S049 Series" to implement dust measures without changing the design of the existing system or "S024 Series" to implement more powerful dust measures.

\* S024 Series supports dry environment.

#### -S049 Series

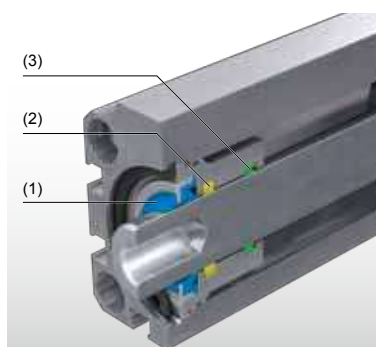
The same mounting size as the standard type



(1) Scraper and rod packing are built in.

- Materials and shapes of the standard rod packing are modified to achieve long service life.
- Dimensions are compatible with our standard products. Without changing the design, you can save the space.
- Dimensions are compatible with products by other companies.

#### -S024 Series



(1) Heavy duty scraper  
(2) Lube keeping structure  
(3) Rod packing

\*Dimensions vary from the standard model.

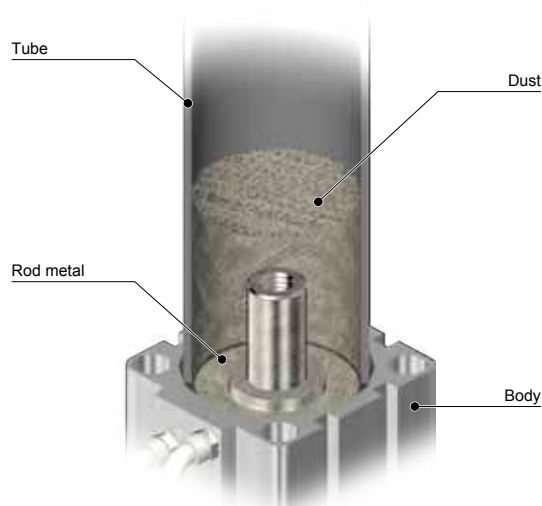
- Powerful measures against dust such as the heavy duty scraper (SCB), the lube keeping structure, and the rod packing structure are introduced to achieve long service life.
- CKD has experience in providing measures against dust in the source process.

#### Testing method

Cylinder is placed vertically facing upward. The rod metal is covered with a tube. The device is run while buried in dust.

#### Test conditions

|                 |          |
|-----------------|----------|
| Supply pressure | 0.5 MPa  |
| Cylinder speed  | 200 mm/s |
| Frequency       | 30 cpm   |
| Load            | No load  |



| Type                                                      | Sample No. | Endurance test (10 thousand times) |    |    |    |    |     |     |     |
|-----------------------------------------------------------|------------|------------------------------------|----|----|----|----|-----|-----|-----|
|                                                           |            | 0                                  | 10 | 30 | 50 | 75 | 100 | 125 | 150 |
| Standard products                                         | Standard-1 | ○                                  | ■  | ○  | ■  | ○  | ■   | ○   | ■   |
|                                                           | Standard-2 | ○                                  | ■  | ○  | ■  | ○  | ■   | ○   | ■   |
| -S049 Series<br>(Compatible with the standard dimensions) | S049-1     | ○                                  | ■  | ○  | ■  | ○  | ■   | ○   | ■   |
|                                                           | S049-2     | ○                                  | ■  | ○  | ■  | ○  | ■   | ○   | ■   |
| -S024 Series<br>(heavy duty scraper)                      | S024-1     | ○                                  | ■  | ○  | ■  | ○  | ■   | ○   | ■   |
|                                                           | S024-2     | ○                                  | ■  | ○  | ■  | ○  | ■   | ○   | ■   |

## Ary air supply

Super heatless air dryer

**SHD** Series



High polymer membrane air dryer

**SU** Series



Dryer

**SD** Series



For dry air  
2, 3 port solenoid valve

**AB/ADK-Z** Series



## Liquid supply

Chemical liquids air  
operated valve

**AMD** Part **3R** Series



Clean cylinder valve

**LAD** Series



Air operated type ball valve

**CHB/CHG** Series



## Tension control

Air bearing actuator

**LBC** Series



Precision regulator

**RP/RPE** Series



Electro pneumatic regulator

**EVD/EVR** Series



Pneumatic cylinder low  
friction type

**SCM-U/SCG-U/  
SSD2-U** Series



EVR does not meet our P4 Series standard.

# Equipments corresponding to the secondary cell P4\* Series

## Explosion proof environment

Diaphragm type cylinder valve

**NAD** Series



Air operated type 3 port valve

**NAP11** Series



Pilot operated type explosion proof  
5 port valve

**4F\*\*0E** Series



## Vacuum control

High vacuum control valve

**AVB** Series



Valve for process gas

**AGD\*R** Series



Vacuum components

**SELVACS** Series



## Transport using suction

Precise suction plate

**PVP** Series



Magnetic spring buffer

**FBU2** Series



3 port direct acting valve

**3QR** Series



Assembling/inspection process

Super compact cylinder

**SSD2** Series



Guided cylinder

**STG** Series



Super rodless cylinder

**SRL3** Series



Compact cylinder

**SMG** Series



Super twin rod cylinder

**STR2** Series



Linear slide cylinder  
Standard model

**LCR** Series



Linear slide cylinder  
Ultra high rigidity model

**LCG** Series



Table type rotary actuator

**GRC** Series



Compact wide parallel hand

**HMF** Series



Linear guide hand with  
rubber cover

**LHAG** Series



Pilot operated type  
3/5 port valve

**4G** Series



3 port direct acting valve

**3QR** Series



# Equipments corresponding to the secondary cell P4\* Series

## Energy saving

Direct drive actuator

**AX** Series



This does not meet our P4 Series standard.

Electric driven actuator  
Ball thread drive/low particle generation specifications

**ETS/ECS** Series



Electric driven actuator  
Belt drive

**ETV** Series



This does not meet our P4 Series standard.

## Electrolyte/refilling

Valve for process gas

**AGD\*R** Series



Device for pneumatic piping



High vacuum control valve

**AVB** Series



## Air blow

Direct acting type 2, 3 port solenoid valve for various fluid control

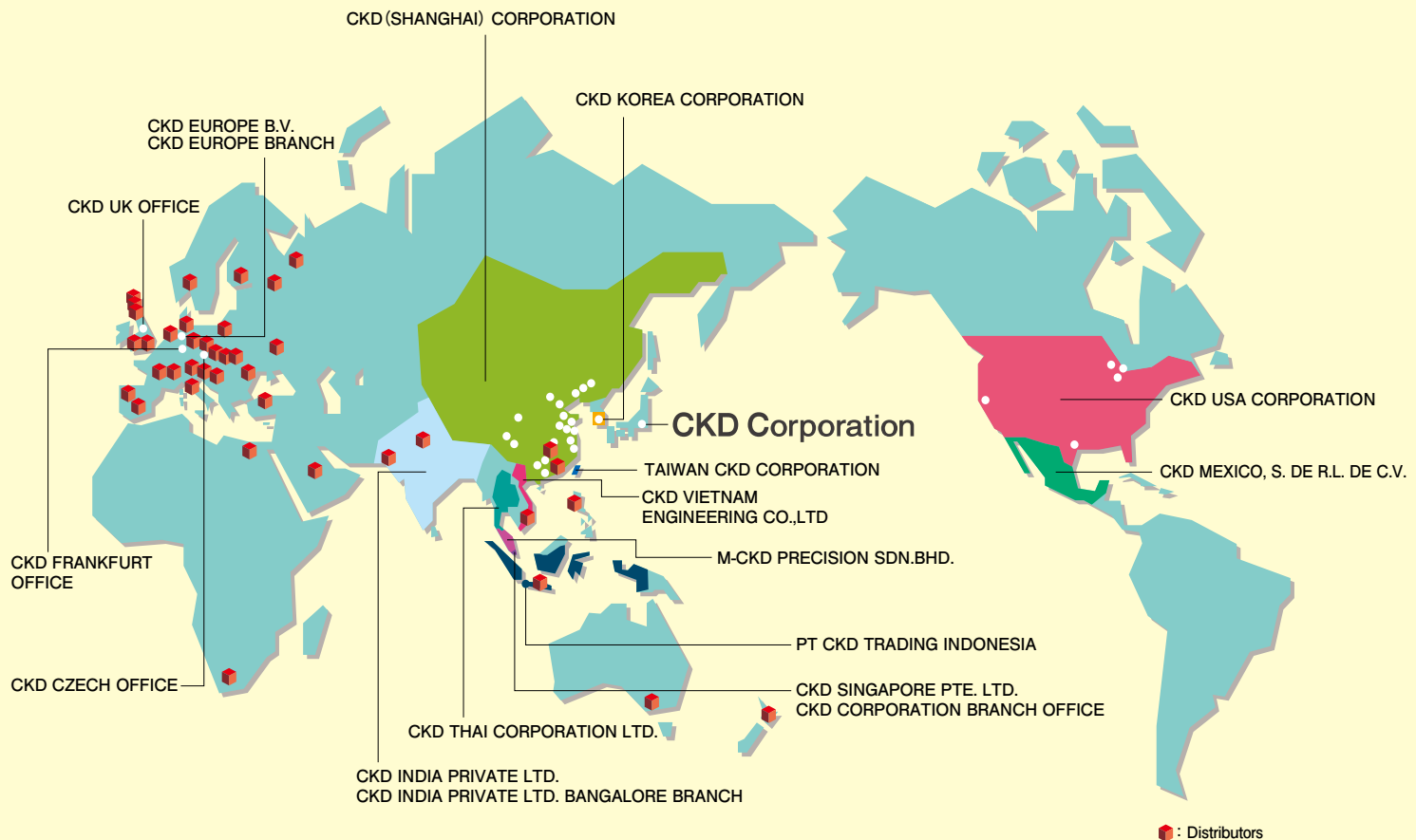
**AB-Z/AG-Z/ADK-Z** Series



Small size flow rate sensor

**FSM2** Series





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