

Oxygen free packaging solution for
industrial products

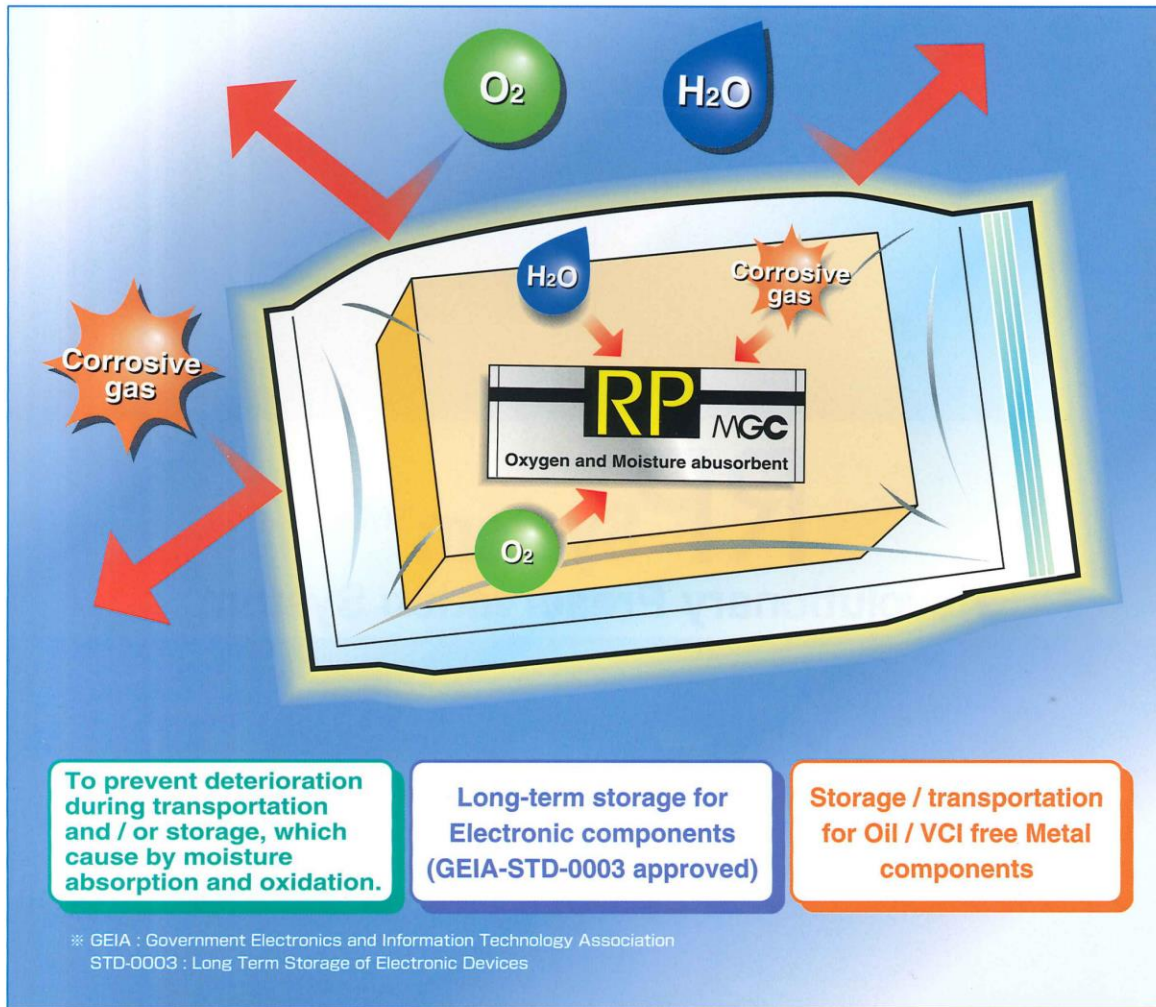
RPSystem™
Revolutionary Preservation System

MGC

MITSUBISHI GAS CHEMICAL COMPANY, INC.

1 What is the RP System™

RP System is to prevent deterioration of industrial products under dry Nitrogen condition. Put an RP agent and the target item into a high gas barrier bag then seal up, RP agent absorbs Oxygen, Moisture and various corrosive gases automatically. Eventually, dry Nitrogen condition is created. Quality of the item which packed by RP system is maintained until customer wants to use.

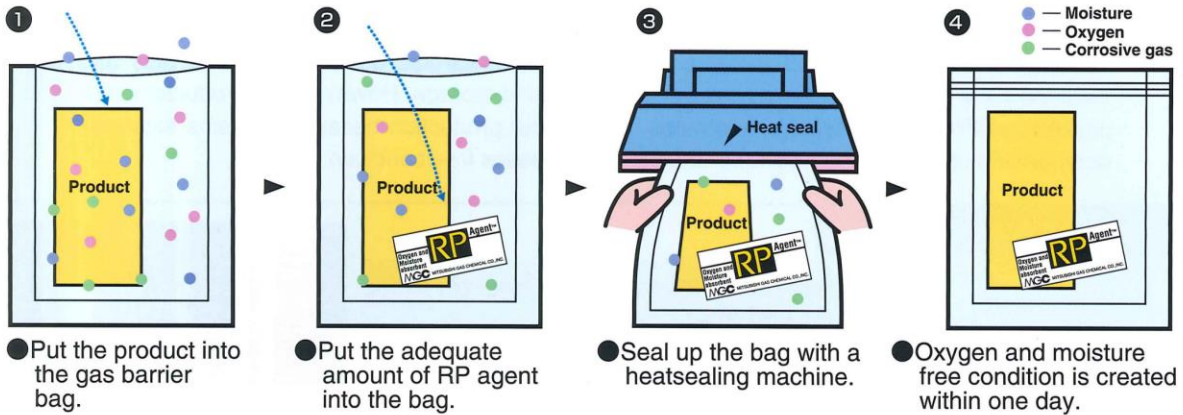


The RP System consists of oxygen and moisture absorber "RP agent" and gasbarrier bag "Aluminum bag or PTS bag"

Environmental Concern Substances

Analysis Result of RoHS substances, Hg, Pb, Cd, Cr and Organic Bromides (flame retardant) is available. Please ask your distributor.

2 Outline of RPSystem™



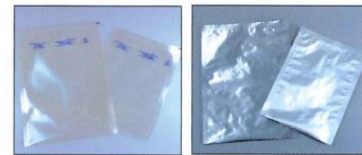
RPAgent™

..... Absorbs oxygen, moisture, and corrosive gas by means of chemical reaction.



Gas-barrier Bag

..... A high gas barrier container is required to maintain oxygen and moisture free condition.

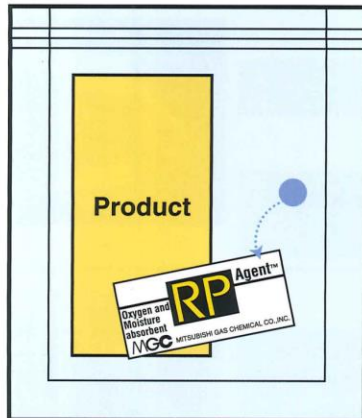


PTS bag

Aluminum bag

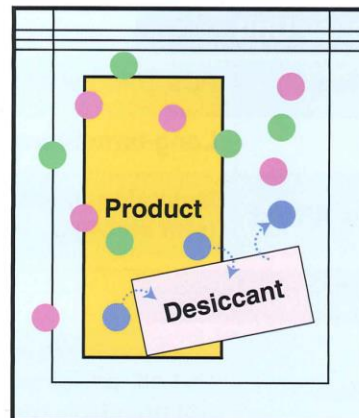
3 What is different

● Moisture ● Oxygen ● Corrosive Gas



RPSystem™

Oxygen, moisture and corrosive gases free condition. RP Agent does not release previously absorbed oxygen and moisture.



Desiccant packaging

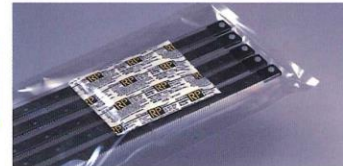
Silica gel releases moisture again depend on environment.

4 Applications of RPSystem™

In other words, RP system is quality control system after out going inspection until be used at the customer. Many kinds of industrial products like electronic devices, raw materials and machine parts are deteriorated during transportation and storage. However, the products, which packed by RP system, maintain freshness as just after production because no items expected deterioration under oxygen, moisture and corrosive gasses free condition.

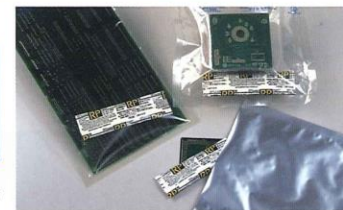
Electronic devices

| | |
|------------------------|--|
| Application | Any items (ICs, Connectors, Passive devices and etc.) |
| Purpose | Transportation / Export, Long-term storage |
| Expected Effect | Prevent any deterioration (Maintains Solderability, Avoid moisture absorption) |



Printed Wiring Board

| | |
|------------------------|---|
| Application | Any items (BGA/CSP Substrates, Mother Boards, FPC/Rigid Flexible, TAB, COF and etc.) |
| Purpose | Transportation / Export, Long-term storage, In-house storage |
| Expected Effect | Prevent any deterioration (Maintain Solderability and bondability, Avoid moisture absorption, Prevent discoloration and delamination) |



Maintenance Unit

| | |
|------------------------|---|
| Application | PCB Unit for a Maintenance |
| Purpose | Long-term Storage |
| Expected Effect | Maintain reliability of the unit after long-term storage. |



Machine parts

| | |
|------------------------|--|
| Application | Machine Parts which Corrosion Inhibitor, VCI oil, paper or film, are not applicable or not effective. (Engine Parts, Miniture Bearing, Camera Parts and etc) |
| Purpose | Export, especially by boat |
| Expected Effect | Rust / stain free during export by boat. Eliminate cleaning / washing process before set up. |



Raw materials

Application

Any oxygen and/or moisture sensitive materials (Fine powder, wire or ingot of Solder, Lead Free Solder, Copper, Brass, Silver and various transition metals.

Purpose

Export, Long-term and in-house storage

Expected Effect

Prevent deterioration due to oxidation and/or moisture absorption.



others

Application

Any oxygen and/or moisture sensitive items (Glass Lens, Ceramic, Rubber, Adhesive)

Purpose

Export, Long-term Storage

Expected Effect

To prevent haze on the glass. Maintain quality of the items

Note : Packaging design for long-term Preservation

- Avoid enclosing **closed cell cushion**, like a formed PS, within an RP pack. It will be a supplier of moisture and oxygen for a time being.
- **Paper** items including a **corrugated cardboard** and a **cardboard** will be expected a collapse because losing moisture under RP packaging. MGC recommends preserving devices as bulk form for long term and then mount onto a tape just before use. It is the best method for long-term preservation of paper reeled devices.
- **Nylon resin** loses elasticity due to dry up. It will almost recover after moisture absorbing again, just place items at ambient condition for a couple of days. If use Nylon item such as a connector, do not use just after open the RP pack.

5 RP Agent™

RP Agent is an oxygen-absorbing desiccant. It absorbs moisture, oxygen and various corrosive gasses by means of chemical reaction. Those gases are fixed and not release again under ambient condition.



RP-1A
(For 100ml of air)



RP-3A(300ml)



RP-5A(500ml)



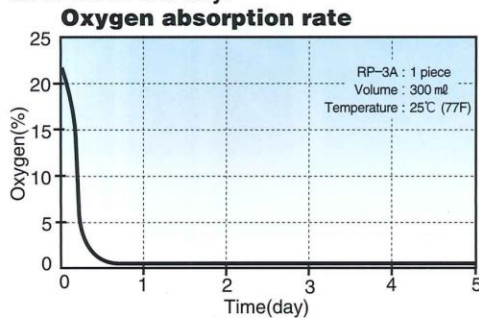
RP-5T(Desiccant)



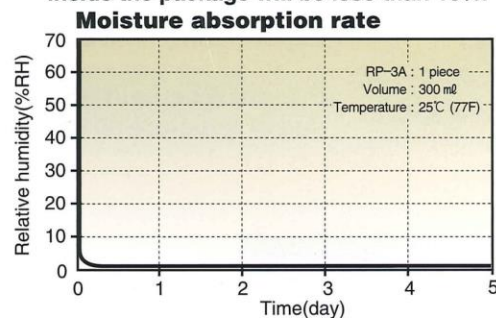
RP-20A(2,000ml)

Performance the RP agent

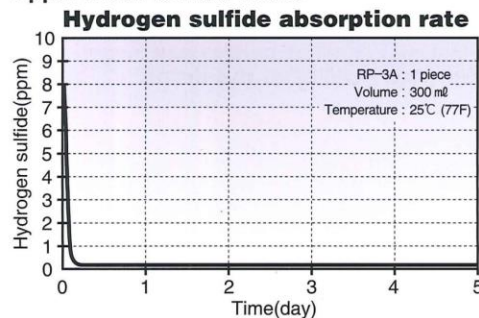
- ① The oxygen content will be less than 0.1% within one day.



- ② In several hours after sealing, the relative humidity inside the package will be less than 10%.



- ③ Various kind of corrosive gases will be less than 1 ppm within several hours.



● Other gas be absorbed : SO_x, NO_x, Hydrogen Chloride and Ammonia gases.

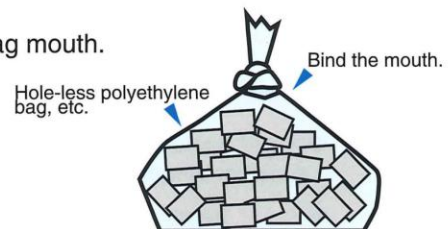
● Absorption rate will be change in accordance with condition

*These graphs are our test result. Not guaranteed.

Disposal Method for RP Agent -in case of more than 10 pcs

- Avoid contact with other inflammables
- Put into a bag, like a PE bag, up to 50pcs, then bind the bag mouth.
- Burn up in an incinerator.

Ash and the RP agent itself may dispose as ordinary industrial waste, because it does not contain heavy metals and halogens. RP Agent is not considered as hazardous waste under current RCRA regulations.



Notes

Refer to the MSDS before use. If accidentally contact the ingredients of RP agents to eye or mouth, wash immediately with a large amount of running water at least 20 minutes, and then ask a doctor for treatment.

- Do not break the RP Agent sachet.
- RP agent is not reusable.
- Do not pile a large amount of RP agent. It may generate heat due to chemical reaction.

6 Gas-barrier Bag

A high gas barrier bag and completely / hermetic seal are essential for RP system to show best performance.



PTS bag(Ceramic deposited)



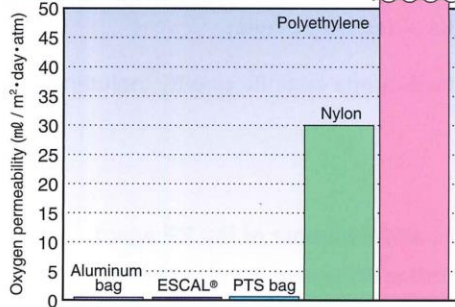
Al bag(Aluminum foil laminated)

Performance comparison of gas-barrier bags

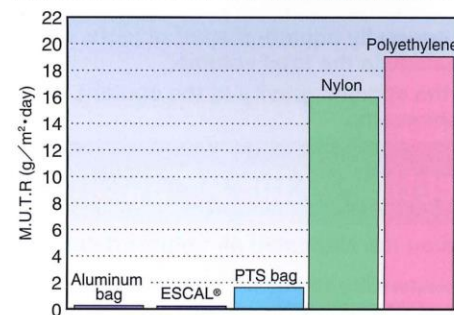
| Suitability | Type | Oxygen permeability (25°C, 60%RH) ml/m ² ·day·atm | M.V.T.R.(40°C, 90%RH) g/m ² ·day | Remarks |
|-------------|----------------|---|--|---|
| ◎ | Aluminum bag | <0.01 | <0.01 | Opaque, for long term preservation |
| ◎ | ESCAL® | 0.05 | 0.1~0.4 | Transparent, for long term up to 1year preservation |
| ◎ | PTS bag | 0.5 | 1.5 | Transparent, |
| × | Nylon (ONY/PE) | 30~120 | 16 | Improper |
| × | Polyethylene | 2000~5000 | 19 | Improper |

※The above are measured values, not guaranteed

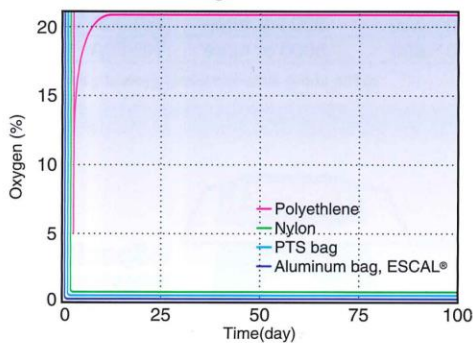
Oxygen permeability of various packaging materials



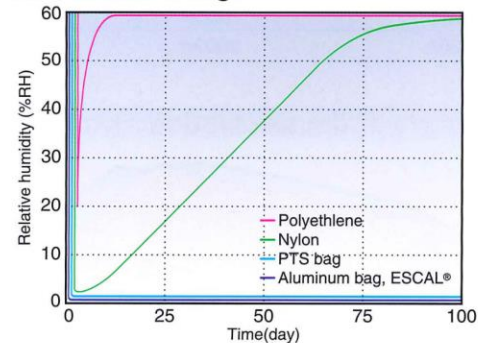
M.V.T.R of various packaging materials



Oxygen concentration change with various kind of bags



Relative humidity change with various kind of bags



Notes

- A low barrier film is not applicable for an RP packaging.
- Mind a projection or a sharp edge. These should be covered or protected. In spite of a tiny pinhole, RP system does not work well.



ESCAL®(Ceramic deposited.)

7 How to use of RPsystem™

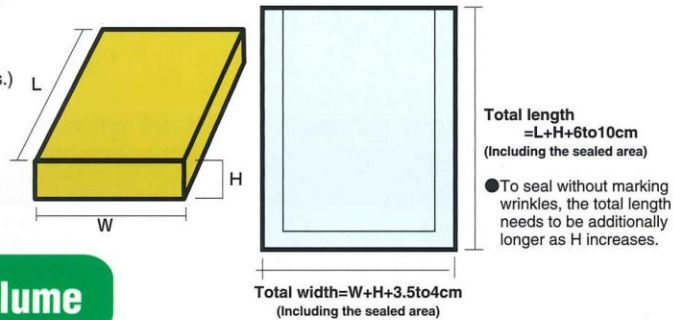
<Procedure for the validation test>

1 Choose a bag

Determine the quantity of samples to be enclosed and select a suitable gas-barrier bag. (See other seat for bag sizes.)

- PTS bag : For out going visible inspection required items, For export
- AI bag: For long-term storage, For quite moisture sensitive items

◎Guidance for the bag size based on the product size



2 Estimation of the air volume

Estimate the air volume inside the package using the following Calculation:

$$\text{Air volume (m}\ell\text{)} = \text{Total volume (m}\ell\text{)} - \frac{\text{Weight (g)}}{\text{Specific gravity of the content}}$$

- For generally square-shaped objects, measure the sides with a ruler, to calculate the total volume.
- For the specific gravity of the content, estimate an average specific gravity including the tray, cushion, etc.

3 Selection of the RP agent

Based on the estimated air volume, determine a size and a number of the RP agent.

◎Corresponding air volume of the RP agent

| RP agent | Corresponding air volume |
|----------|--------------------------|
| RP-1A | 100mℓ |
| RP-3A | 300mℓ |
| RP-5A | 500mℓ |
| RP-20A | 2000mℓ |

◎Guideline of the quantity of the RP agent

| Bag size(mm) | Expected air volume(mℓ) | RP Agent Size | Quantity |
|--------------|-------------------------|---------------|-----------|
| 180×250 | 300 | RP-3A | 1 |
| 220×300 | 500 | RP-5A | 1 |
| 350×500 | 1000 or more | RP-5A | 2 or more |
| 400×620 | 2000 or more | RP-20A | 1 or more |
| 800×850 | 6000 or more | RP-20A | 3 or more |

※The above table represents general guidelines for reference.

Example of the calculation

◎Specific gravity

| Items | Specific gravity |
|----------------|------------------|
| Metals Typical | 8 |
| Resins | 2 |
| PWB | 4 |

$$\text{Total volume (m}\ell\text{)} = \text{W (cm)} \times \text{L (cm)} \times \text{H (cm)}$$

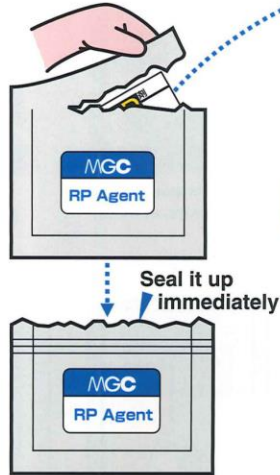
Specific gravity:4

$$\text{Total volume} = 20 \times 30 \times 3 = 1800\text{m}\ell$$

$$\text{Total volume} = 1800 - \frac{1200}{4} = 1500\text{m}\ell \rightarrow \text{Use 3 pcs of RP-5A}$$

4 Enclosing / Heat Seal

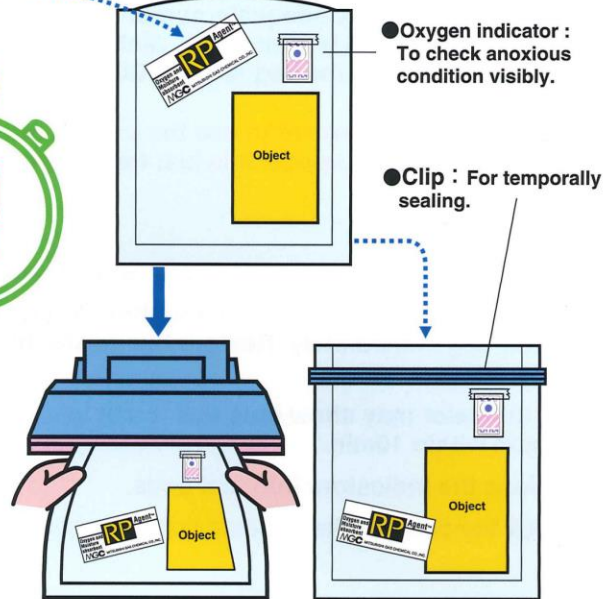
- Take out the necessary amount of RP agent, and then reseal immediately.



- RP agent is degraded when contact with air.



- Enclose the object and the RP agent into the high gas-barrier bag and seal it up with the sealing machine.



5 Preservation / Transportation

An RP packed item and the control should keep ambient condition at least one day.

Notes for packaging design

- Decrease 20% of volume after oxygen absorption.
- Do not vacuum too much when use a vacuum sealer.
- Avoid direct contact the RP agent and target items to prevent cross contamination.

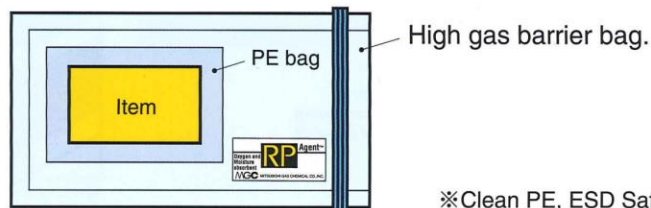
For powder, clean pack and static electricity sensitive items
Double packaging is recommended as figure.



● Formed mat.



● Air cap.



※ Clean PE, ESD Safe PE.

8 Oxygen Indicator (For packaging design)

This oxygen indicator is to check oxygen free or not visibly. It informs only adequate number and size of RP agents are used, seal is completed, pinhole free and a proper bag is used if the bag is not MGC's.

MGC does not recommend to use the oxygen indicator for any quality control purpose. It is just for test purpose.

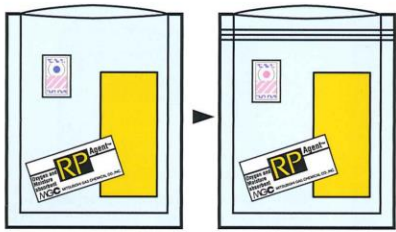
How to use

- Confirm the oxygen indicator tablet is pink before use.
- Take out the oxygen indicator and then seal up the master bag immediately. Restore the master bag into a refrigerator.
- The indicator may show blue due to contact with oxygen within 10min.
- Enclose the indicators into test bags.
- Check the color of the indicator tablet as pictures.



Oxygen present
(0.5% or more)

Oxygen free
(0.1% or less)



Put into the gas-barrier bag.

Seal

Notes

- The oxygen indicator is oxygen, light, dry and thermal sensitive. It should be stored under oxygen free condition in a refrigerator. Shelf life is 6 months.
- The color after long-term storage is unsure.
- The oxygen indicator is not reusable.

9 Seal

Use a reliable sealing machine.

These items are not our products. Please ask your distributor.



Impulse Sealer
For a mass production.



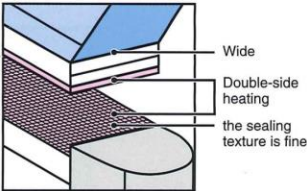
Clip sealer
● Hot bar type
● For a big packaging
● For a small quantity



● Tensile the bag to prevent wrinkle or tunnel at sealed area.



● Do not insert foreign matters in the sealed area.



● At least a 5mm width seal bar is required. 10mm is ideal. The most desirable sealing width is 10 mm.



● Check the seal result condition. (Do this by pulling out the sealed area to left and right. If it peels, heating is not sufficient.)

10

Cost comparison

RP system reduces total cost in spite of increasing the packaging material cost

The current method is cause of customer's claim.

Current method

- Direct cost for claim solution
- Personnel cost
- Loose chance
- Bland / Company name value Competitiveness

RP Agent Packaging

The packaging material cost is higher than current method.

Please compare not only a packaging material cost but also hidden cost.

RP packaging makes:

- decreasing total cost
- increasing customer satisfaction, bland / company value and eventually an order volume

Cost comparison of long-term storage

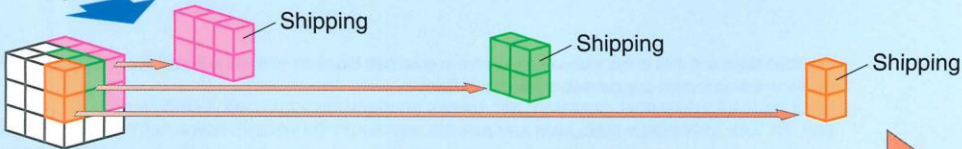
RP Agent is GEIA-STD-0003, long-term storage of electronic devices, authorized.

- You can sell products for long-term only production once, which divided small QTY packaging by RP system.

Production times ①



RP

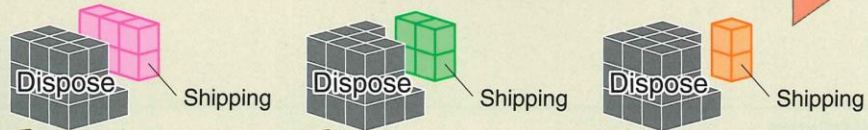


1st year

2nd year

3rd year

Current method



Production times ①



Production times ②



Production times ③



- Current method makes a lot of waste due to frequent production in spite of maintenance parts. Also it is environmental unfriendly.



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