International Journal of Scientific Engineering and Science
Volume 3, Issue 10, pp. 21-23, 2019. ISSN (Online): 2456-7361

Archiving Solution for Space Optimization in a Semiconductor Manufacturing Floor

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***Abstract*—** *Sample retention is a standard process ensuring that potential issues encountered in the future can be analyzed using the retained samples. Floor space, cabinets and continuous nitrogen supply are required making sample retention economically challenging. Herein, we present a simple solution to reduce the floor space and cabinet space requirement, and nitrogen supply cost resulting in a 30 kUSD cost avoidance. The solution eliminates the use of trays where the units are placed by utilizing Gel-paks, where the space requirement is reduced by around 25 %, and the unit allocation is increased by around 135 % for a given space.*

***Keywords*—** *Kaizen, retention, Gel-pak, cost avoidance.*

I. INTRODUCTION

Sample retention for production or reliability lot are required to ensure that potential issues can be supported should they arise in the future. The availability of these retained samples are instrumental in failure analysis should a customer complaint is encountered or should additional analysis is required after a period of time. The disadvantage of sample retention is primarily the space occupied by these samples during storage. These samples are stored in specialized cabinets with a continuous supply of nitrogen gas to ensure that no environmental contamination is introduced during storage that can affect the integrity of the retained samples.

Under normal circumstances, retained samples are stored in JEDEC trays and placed inside the nitrogen cabinet. These trays occupy a large footprint and can contain a pre-defined number of samples. In this particular case, the standard Velcro strap is not appropriate and a rubber band is used instead. However, the degradation of the rubber band effected by environmental conditions or mechanical forces (*e.g.* abrasions, scratching, stretching, etc.) induces the fall-out of tiny particles considered as foreign material, that can affect the functionality of the devices stored in the tray. Due to these constraints, elimination of the tray and the rubber band was implemented.

Fig. 1. Representative FM on the surface of a retained sample.

II. KAIZEN SOLUTION

Tray and rubber band removal eliminates possible quality issues such as foreign material and contamination issues (Fig. 1) in retained samples from reliability lots. One solution implemented is the use of Gel-pak (Fig. 2), where the samples can be adhered on the gel inside the package. The Gel-pak offers a space conserving solution, with a maximum capacity of 60 units. In comparison, a tray can contain 448 units. This translates to around 7.5 Gel-paks per tray conversion. In terms of space consumption, the use of Gel-paks offers a 25% space reduction at 100% tray capacity.

Fig. 2. Sample photo of Gel-pak containers.

The identified driving forces for the implementation of this solution of utilizing Gel-paks over trays (Fig. 3) include the reduction of nitrogen cabinet that will be utilized by the archive units in tray during storage, the 5S contribution arising from the minimization of the area occupied by the trays of the archive units, and the reduction of the probability of foreign materials and other contaminants induced by using rubber band for securing the trays. Conversely, the restraining forces include the purchase of the Gel-pak containers, project approval and the delivery details of the containers.

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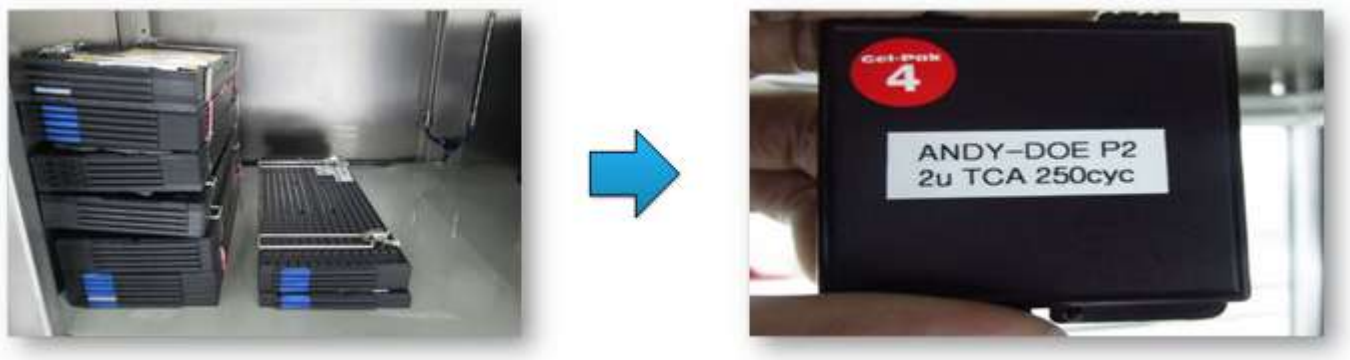

Fig. 3. Conversion of storage container from tray to Gel-paks.

TABLE 1. Validation of restraining forces.

(-) Restraining Forces	Method of Verification	Result of Verification	Conclusion (True Restraining Forces/ Not True Restraining Forces)	Controllability
PR order for the Gelpak container	Check if we have a problem for the PR of Gelpak.	PR request is created	Not a true restraining force	
Approval for the request	Check if the request is comprehended on our budget forecast	Material is approved by our Director and Manager. Comprehended on our budget forecast.	Not a true restraining force	
Delivery date of Gelpak	Check if the delivery date required can be meet by our supplier	WW30 is our plan for the delivery of material, waiting for PO approval.	True restraining force	Within control

TABLE 2. Identification and validation of alternative solutions.

Restraining Forces	Alternative Solutions	EP LEVEL	Validation		Measures for Effectiveness					Decision
			Method	Results	Risk	Ease	Cost	Rating	Rank	Go / No Go
Delivery date of Gel-pak	Loan Gel-pak from Test and FA while waiting for the purchase order of gelpak for Rel	1	Communicate with concerned individuals for the request to loan us some gelpak from them.	1	1	1	1	1	1	GO
	Used the same procedure for archiving units	1	Use tray and rubber band/metal strap for storing of units	2	2	2	2	2	2	NO-GO

TABLE 3. Potential problem analysis.

Best solution	Potential Problem	Potential Cause	Preventive Action	Containment Action	EP Level
Communicate with concerned individuals for the request to loan us some Gel-pak from them.	Check if they have enough stock for them to lend us the material that we request	They have a minimum order per area	Check there actual inventory vs their requirement		EP 3

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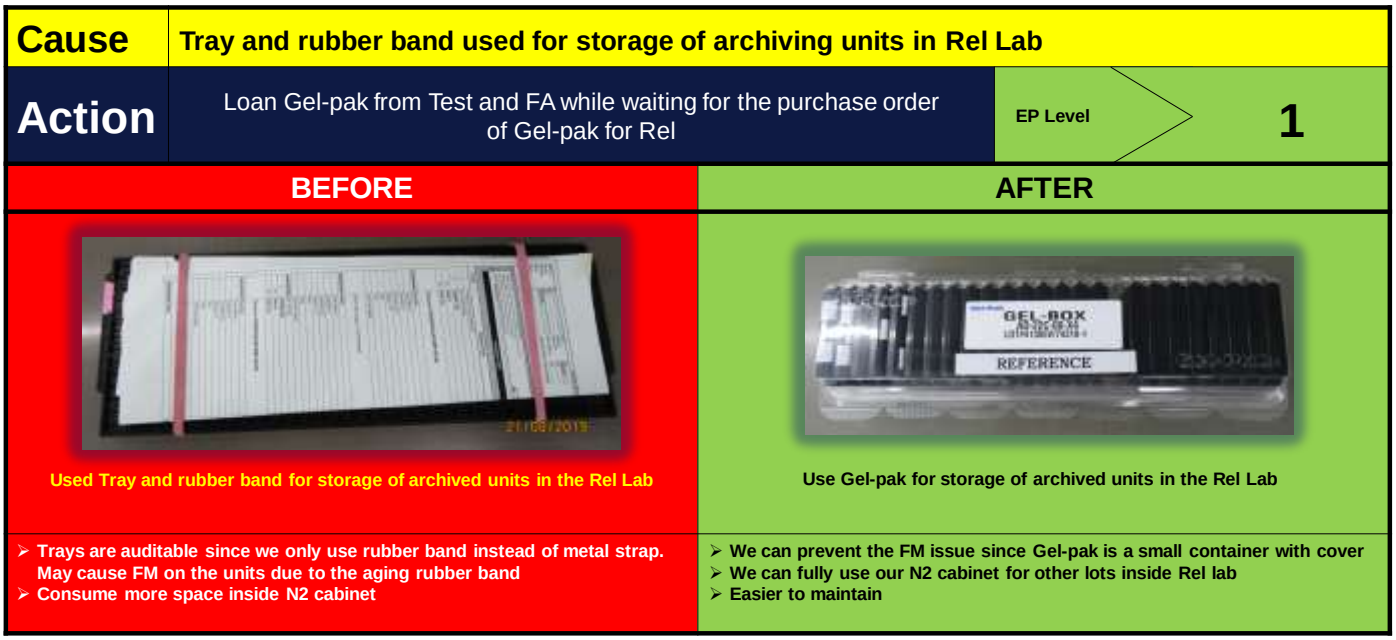

Fig. 4. Comparative image of storage container before (trays) and after (Gel-pak) solution implementation.

Validation of the restraining forces (Table 1) highlighted that the true restraining force is the availability of the Gel-paks subject to delivery details. Fortunately, this restraining force is within control. The identified solution to this detractor is the loaning of available Gel-paks from other stations until the arrival of the allocated gel-paks (Table 2). During the period prior the arrival of the purchased Gel-paks, the criticality of available inventory might become a potential problem (Table 3). Proper planning and communication with all the parties concerned can reduce the risk of this potential problem.

Implementation of the solution (Fig. 4) eliminated the use of trays which are auditable (by internal standards) since rubber bands are used instead of metal straps. In addition, foreign materials could be introduced on the units due to the aging rubber band, and space consumption is higher if trays are placed inside the N_2 cabinet. Benefits of the implemented solution include FM prevention due to provision of cover by the Gel-pak container, optimization of space in N_2 cabinets through co-allocation with other Reliability lots, and ease of maintenance. More importantly, this simple solution resulted in a huge cost avoidance of 30 kUSD.

III. Conclusion

A simple solution of substituting trays with Gel-paks as storage media of archived units in the Reliability laboratory resulted in about 25 % space reduction at 100% tray capacity, and about 135 % unit capacity per given space. This space reduction translated to a cost avoidance of around 30 kUSD.

Acknowledgment

The authors acknowledge the support of the Test and Failure Analysis teams for providing the Gel-paks prior the delivery date of the allocated inventory in the Rel Lab.