

SMT Stencil Questionnaire Report

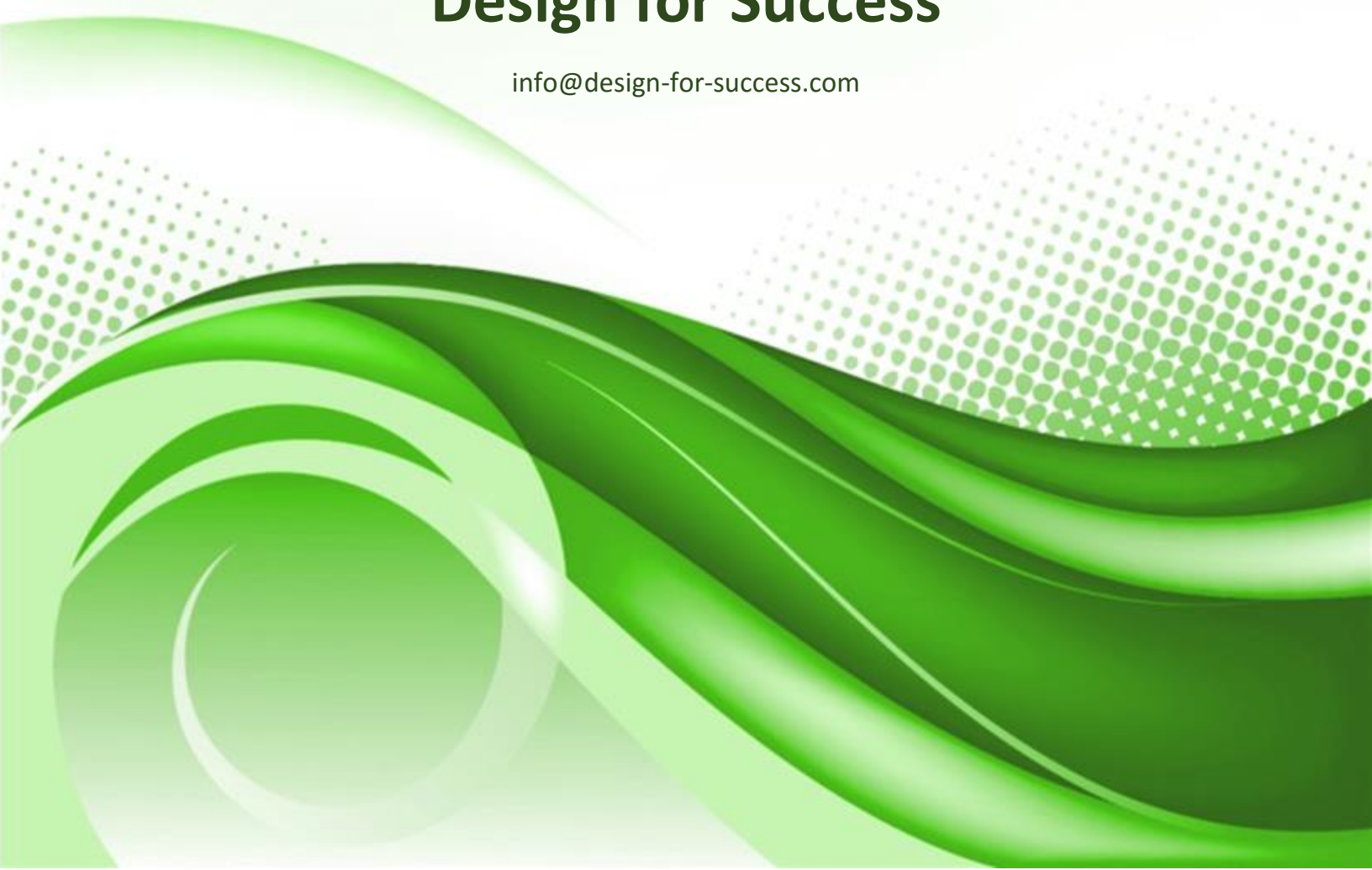
Study for professionals involved in PCB Assembly using SMT Stencils; Stencil Design, Reviews, Reports, Defect Solutions and their expectations for SMT stencil manufactures.

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Background

Being in the first stage of any PCB assembly line, SMT stencils play a major factor in the success or failure of the assembly process. When designed right, manufactured with the right material and precise machines, stencils can eliminate most of the defects process engineers face on production lines, which are increasing due to continuous miniaturization of today's electronics! The key for successful printing and hence successful assembly lies in the design of the SMT stencil, but how is that stencil being designed? Do process engineers tell stencil manufacturer what to do or they just rely on their experience to design it right? What service level does stencil manufacturer provide in terms of communicating design notes or suggestions? Do professionals involved in PCB assembly know and value the real rule Stencil plays to resolve SMT defects? This questionnaire was conducted for such questions to hopefully understand the trends and provide insights to professionals involved in designing, manufacturing and using SMT Stencil for improvements and better practices in SMT assembly industry.

Questionnaire

Built through Google forms, and published in LinkedIn groups and through an email campaign, the questionnaire aimed to form better understanding for five main areas in the industry of SMT Stencils for PCB Assembly, in order to evaluate the critical needs that process engineers may have, and suggest improvements that can add value to the industry in the light of the results of the questionnaire. These 5 areas are **Stencil Design, Design Review, Design Reports, Defect Solution** and **Customer Experience**.

Participants by Job Title

The questionnaire attracted different type of professionals involved (or were involved) in designing and ordering SMT stencils, most of them were process engineers for PCB Assembly. Figure 1 below shows the type of participants responded to this questionnaire by job title.

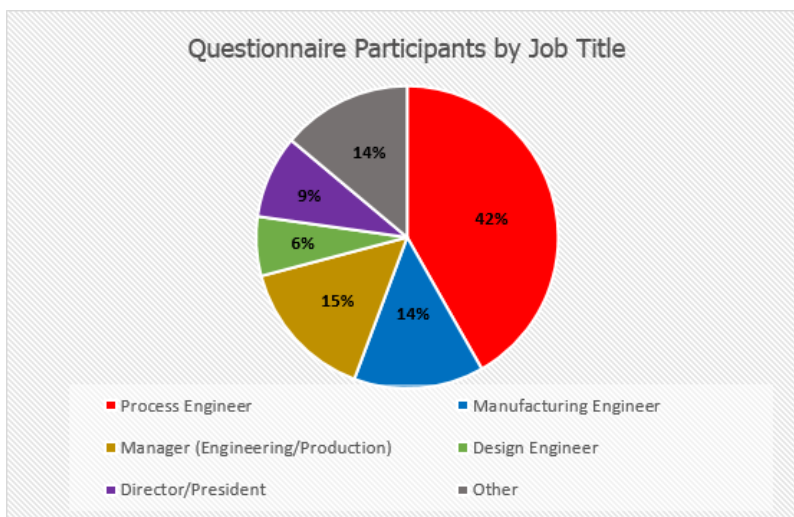


Figure 1: Participants by Job Title

I. Stencil Design

As per the responses to the first two questions shown below, it appears that participants either do their stencil designs themselves or send instructions to the stencil company's team telling them how to design it, and that's based on their well-defined design guidelines, which 64% of the participants mentioned that they have.

The percentage of participants who rely on stencil house to do the design is low although stencil house are the ones who should have more experience in the field to do the design right, and it was also interesting to have only 16% of the participants follow IPC-7525B (Stencil Design Guidelines) standards!

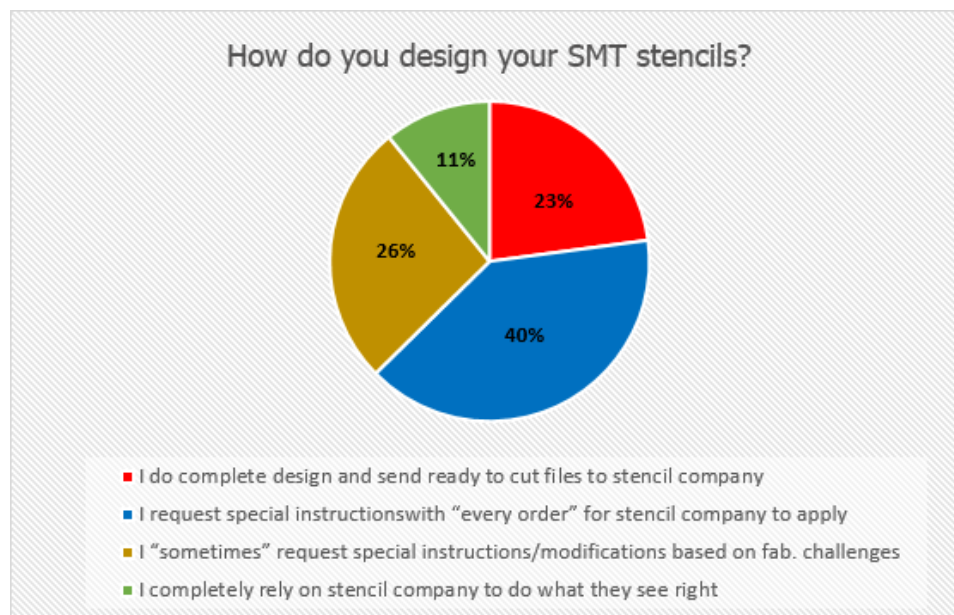


Figure 2: Q1- How do you design your SMT stencils?

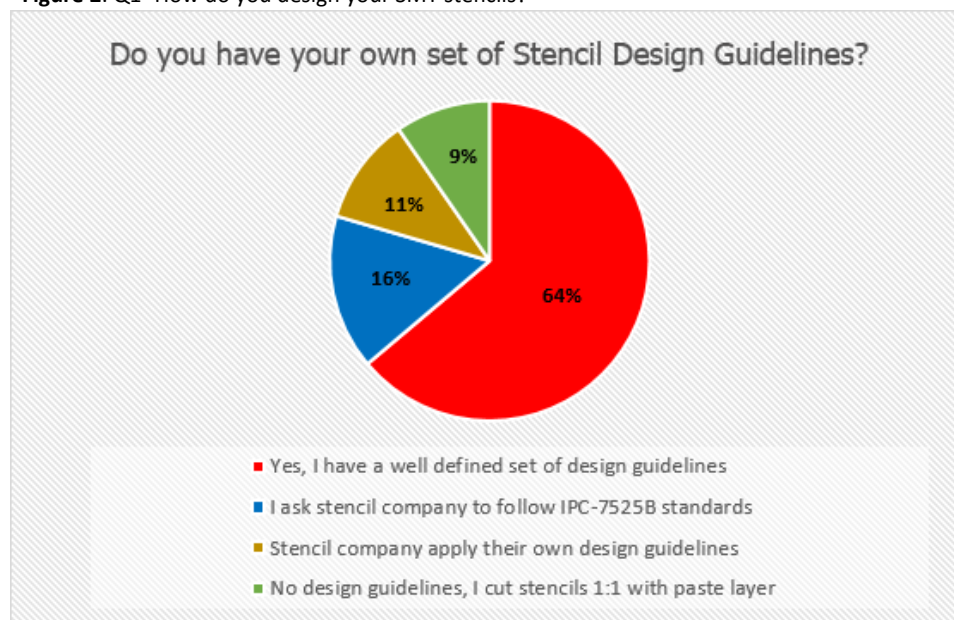


Figure 3: Q2- Do you have your own set of Stencil Design Guidelines?

II. Design Review

38% of participants reported that they usually ask for further modifications after reviewing design check plot, this percent actually gets higher to about 44% when excluding the 14% who don't review design, which is a high percent that indicated extra time in the process for both the one who order the stencil and the stencil house's team. The reason for that might be due to full instructions not sent at the time of placing the order, or stencil designer didn't get the instruction right so they did it wrong or missed some areas! Working on this might save considerable time for both parties. The 4th question was about design notes; 53% of participants mentioned that they get notes about their design, which is good, as one of the designer's tasks is to flag any areas with concerns they identify during the design process, even if the design was made based on customer's instructions.

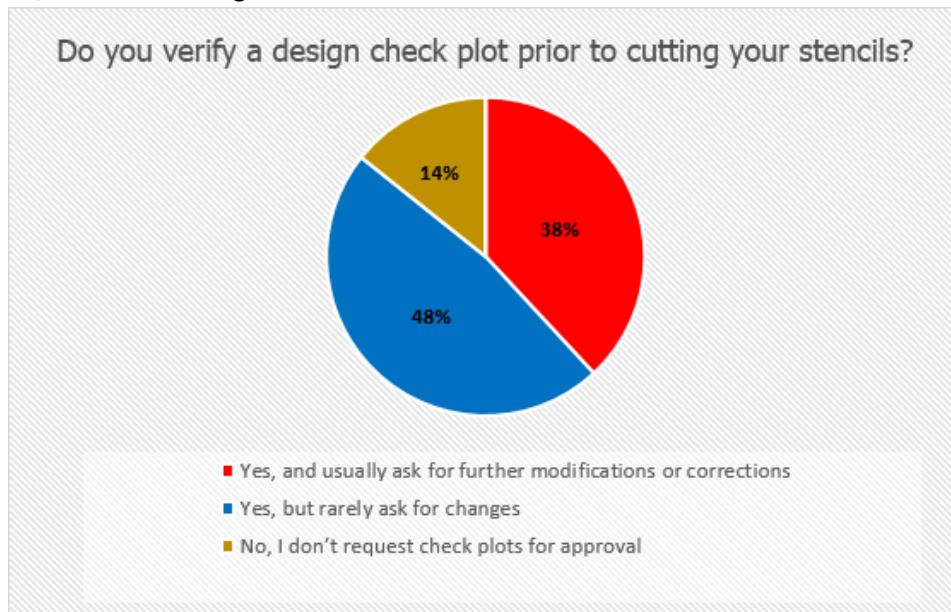


Figure 4: Q3- Do you verify a design check plot prior to cutting your stencils?

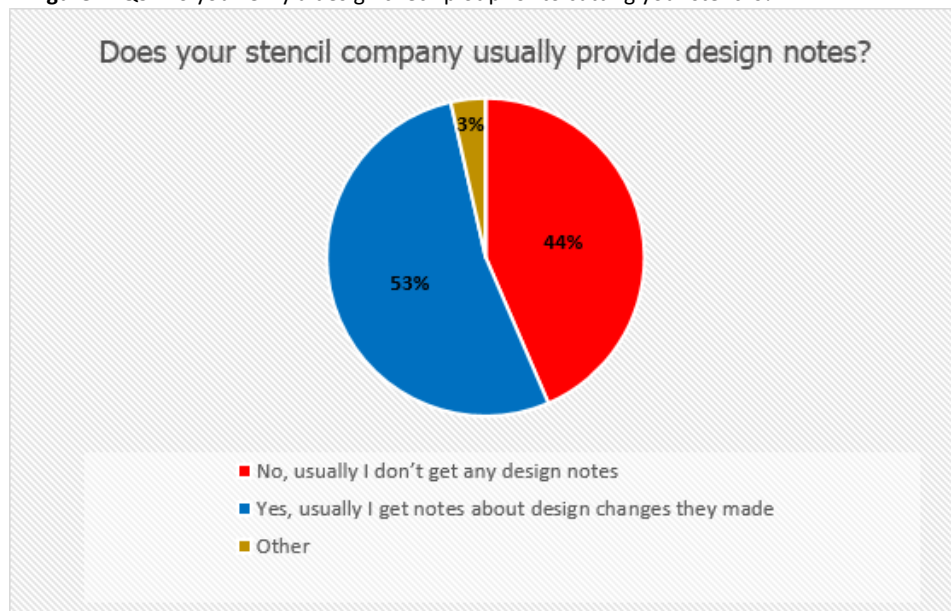


Figure 5: Q4- Does your stencil company usually provide design notes?

III. Design Reports

A significant percentage of those who responded expressed a need for design reports, like area ratio or analysis reports, and there are only 20% getting either of such reports! That does represent a call for stencil houses to consider providing such reports for their orders, which can help process engineers and other decision makers for stencil design to make a change when needed for the design, or maybe their main design guidelines!

Area ratio reports are becoming easy to generate these days with various stencil design software providing this feature with a few clicks. Such report helps identifying the areas with low area ratio and make different decisions based on that like changing stencil thickness, apply coating technology or altering aperture design. Stencil house designers are expected to suggesting solutions based on the values in such report when needed to help process engineers make a decision.

Analysis report would usually cover the critical features in stencil design, like small chip parts (< 0805) that sometimes cause solder balls or get tombstone, and it may cover fine pitch components with big apertures that might get bridging or thermal pad defects like voids or solder shortage.

Analysis report can be essential when process engineers, or the one ordering the stencil, state that they have an assembly defect, stencil house designers are expected to review the defect against fab files and suggest what can be done from stencil design stand point to eliminate or reduce the defect. It's needless to say that designer suggestion for a solution would not be guaranteed to eliminate the defect due to various parameters involved in the assembly process, but it would be considerable added service to help deciding what to do!



Figure 6: Q5- Does your stencil company provide any reports; e.g. Area Ratio or Analysis Report?

IV. Defect Solution

A high present of 94% of participants think that stencil can help with assembly defects, but only 25% are getting support from stencil house offering solutions through special aperture design, which may suggest lack of knowledge to offer solutions. And when asked how they find solutions, most of the participants indicated that they either search for solutions through IPC, SMTA and Google, or based on personal and team experience.

The results of this section might represent a missing opportunity for stencil houses, their stencils can help with defects and most of who are using them know that, but they are not getting design solutions when needed. Stencil houses might need to spend more time and energy for training their teams and equip them with the right tools to provide such support.

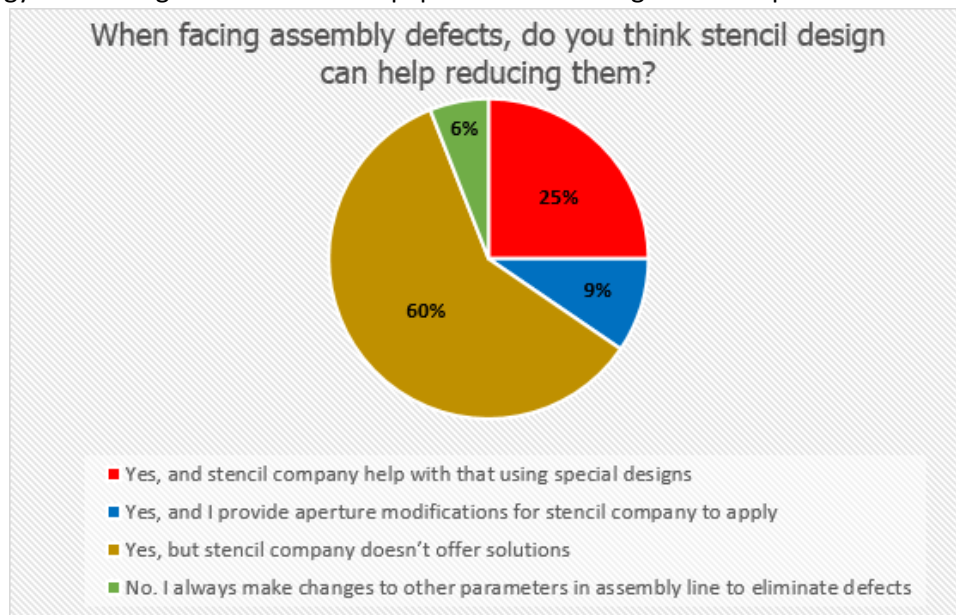


Figure 7: Q6- When facing assembly defects, do you think stencil design can help reducing them?

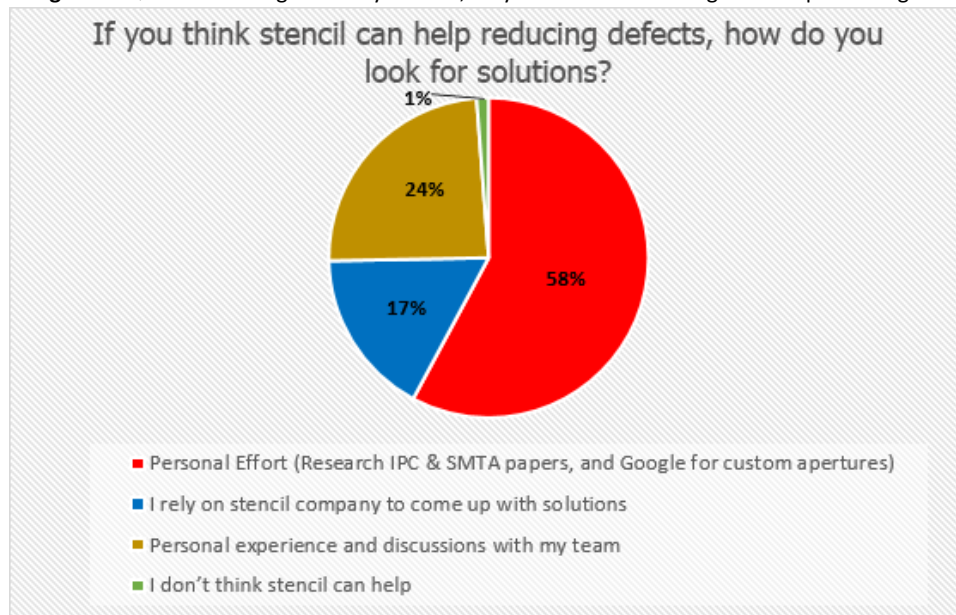


Figure 8: Q7- If you think stencil can help reducing defects, how do you find solutions?

V. Customer Experience

A generic question about customer experience for overall service was included in this questionnaire and the results were as shown in Figure 9.



Figure 9: Q8- How would you evaluate your current experience with your Stencil supplier(s)?

VI. Suggested Improvements

We got a good suggestions for improvements from some participants, here is the list:

1. Better material and better cutting machines.
2. Design guidelines.
3. Analysis of new technologies (new foils materials, new frames space-savers, new coating technologies, nano coating, cobra, etc...)
4. Having a stencil analysis report for me to review prior to cutting the stencil would be a good additive process as a gut check.
5. I think most stencil companies should always have a staff that can recommended design solutions for manufacturing so they can help their customers better.
6. Improve stencil technology, more innovation to accommodate with current technology i.e. Miniaturization opening couple with big part same station.
7. Industry as a whole could improve in sharing mutually beneficial data and research.
8. Keep design for certain CM's limited to one-three designers. When design groups are too large, consistency for certain customers is lost. My favorite stencil house only has two designers, which provides a lot more person ability and consistency between orders.
9. Most certainly AAR and volume calculations, identification of problem apertures based on Gerber files and possible mismatched ground/power plane layers (showing recommendations for correction based on those layers).
10. Analysis capabilities.
11. Most of times, stencil suppliers aperture recommendations are reactive -- they are great when we need to eliminate the defects. I would appreciate more of these ideas can be applied or recommended at the time of order.

12. Offer suggestions if seeing any issues with a modification.
13. Only some provide technical experience and assistance. Only few stand behind their apertures. On time Delivery.
14. Provide better check prints that are truly 1 to 1 with actual stencil. Suggest thickness of stencil material based around the pitch of the parts used on the particular component. Recommend tricks to help with tomb-stoning on the tiny parts. Suggest the best solder that works with their stencil. As the parts continue to get so small it has become an art to get the PCB pasted properly, for example on a hot muggy day the solder gets to runny but on a cold day it doesn't go through the stencil so some days we put our paste in the refrigerator and other days we leave it out at room temperature. It's a constant process of Stencil, paste and current environmental (temp, humidity...) conditions. Stencil supplier could help in this sense by providing guideline on the super fine pitch part stencils.
15. Provide certain reports for orders, like Area Ratio Report or Analysis Report.
16. Recommendations for tools to verify stencil consistency in house, to help accurately identify stencil problems quicker.
17. Stencil opening suggestion and recommendation.
18. Stencil suppliers are to ensure OQC are in good condition with periodical assessment done by the stencil supplier itself or customer.
19. The area ratio reporting would be nice to have, and recommendations to nano-coatings or modified foils to reach spec'd area ratio.
20. Better edge labeling of stencils so they could be easily identified when stored on stencil rack.
21. Online ordering system with downloadable check plot files for prior orders.
22. Time response on image confirmation.



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