CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

This chapter will conclude the experiment comparing to the objective and scope of study. In addition, some recommendations are proposed for suggestion of the method in controlling the parameters in solder-resist printing process.

6.1 Conclusions

This thesis research studied Automobile Flexible Printed Circuits to perform quality improvement and also determine the optimum condition for controlling the image printing defects in image printing process. This starts from using cause and effect diagram to explore all the potential influence factors affecting the image printing defects in image printing process. As the team could not do testing for all factors, they have decided on some potential factors to perform experiment. There are squeegee hardness, squeegee angle, squeegee cut angle, emulsion thickness, printing pressure, printing speed, and table clearance.

Next the influence factors were analysed with orthogonal array method L_{18} (2^1x 3^6) amount 18 runs with 2 replicates and 3 factor levels. Refer to the analysed results, the optimum levels were determined to be squeegee hardness of 80 B, squeegee angle of 10 degree, squeegee cut angle of 0 degree, and table clearance of 10 mm. However, the other setting levels, which were determined to be printing speed of 4 m/s, printing pressure of 28 Kgf/cm^2, and emulsion thickness of 8 microns, are needed to have additional analyse for the appropriate condition which cover its specification range and other constraints. Consequently, these factors were conducted the experiments for finding the appropriate condition.

After that the appropriate condition for controlling the image printing defects in image printing process will be determined using one-factor-at-a-time (OFAT) experiment. This experiment will vary only one factor at a time while keeping others fixed. According to the analysed results of 21 different runs, the appropriate condition for controlling the image printing defects in image printing process as a function of three factors can be set as printing speed 4 m/s, printing pressure 28 Kgf/cm^2, and emulsion thickness 2 microns. Finally, confirmation experiment is performed to confirm the result of the experiment between original condition and after improvement condition. As a result, the average ink thickness after improvement is thinner than the average ink thickness before improvement 3 microns. As a result, the printing speed was increased from 2.5 m/s to 4.0 m/s. This translates into a 60% increase process capability without effect to the whole quality of product and an annual saving of 72,244 baht.

Therefore, the appropriate condition from the experiment can implement for controlling the image printing defects in image printing process.

6.2 Recommendations

According to the experiment, it can be noted that the team did many experiments. In fact, some factors could be cut before performing statistical analysis to save cost and time for testing.

After implementation of quality improvement in image printing process, the appropriate condition for controlling the image printing defects was able to be determined. This appropriate condition can be the basis and reference for the further improvement. The team can conduct further experiments by keeping the near appropriate level values as the starting value for the new experiment. Moreover the

value settings for each factor should be seriously considered to cover the whole scope of specification.

In the experiment, there are many constraints to perform the experiment such as machine settings not being able to be adjusted easily because it will certainly effect several changes in production output, and other limitations in cost, time, product to test, and scope of improvement.

For further Study, the methodology in controlling the parameters in image printing process can be implement in controlling the parameters in solder-resist printing process. However, the appropriate condition should be tested with that process once to avoid problem of machine capability.