NATIONAL CONVENTION ON QUALITY AND PRODUCTIVITY 2022

Project Report

Stream 2 - QCC & CFT

Name of the Organization	GPV Lanka (Pvt) Ltd	
Plant & Address	Baseline Rd, Daluwakotuwa, Kochchikade.	
Category (tick √)	**Quality Control Circles (QCC)**	
	Cross Functional Teams (CFT)	√
Name of the Team	Powertronics	
Name of the Project	Elimination of Soldered Transformer Scrap at Visual Inspection Line	
Date emailed to SLAAQP	15/02/2023	

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Introduction

1.1 Introduction of the Company

GPV (Glostrup Plade Vaerksted) Internationals is an EDMS (Electronic Devices Manufacturing Services) supplier, provides NPI (New Product Introduction) to box building for OEMs (Original Equipment Manufacturers) all around the world. GPV group is one of the top 10 EMS companies in Europe. It's a high-mix / low-medium volume, box-build and mechatronics supplier. Providing services with high quality, GPV has production facilities in the three major time lines, with nine countries

- Austria
- China
- Denmark
- Germany
- Mexico
- Slovakia
- Sri Lanka
- Switzerland
- Thailand

GPV Lanka is passionately committed providing high service and quality products to our respected customers by applying best practices and business excellence. Sri Lanka's rated as EMS partner with a staff of over 1000. The company delivers advanced electronics solutions to customers all around the globe such as;

- Cable-Assemblies
- Design & Engineering
- Electronics Manufacturing Services
- System Integration

1.2 Company Logo

Figure 01: Company Logo

1.3 Company Address

GPV Lanka (Pvt.) Ltd is situated in the Western province of Daluwakotuwa, Negombo.

1.4 Team Demographics

Project Title: - Elimination of Soldered Transformer Scrap at Visual Inspection Line

Team Formation Date: - 01/10/2022

1.5 Project Team Members

Table 01: Team Demographics

Description	Name	Designation	Dept.	Personal Contribution
Mentor	Mr. Kasun Samarasinghe	IE Engineer	Industrial Engineering	-
Team Leader	Mr. Navod Kiriwaththuduwa	Junior NPI Engineer	NPI-DF	Overall Project Instructions & Fishbone Analysis
Member 2	Mr. Naveen Dharmasiri	Quality Engineer	Quality Management	Document Creation & Analysis
Member 3	Mr. Aruna Dilshan	Junior Test Engineer	Test	Data Collection & Analysis
Member 4	Mr. Sahan Silva	Admin-IT Support	IT	Data Analysis & Analysis
Member 5	Ms. Beenu Rathnayake	Engineering Assistant	NPI-DF	Document Creation & Analysis

1.6 Team Logo

Figure 02: Team Logo

1.7 Company PI Production Process

There are a few main departments involved in the PCB (Printed Circuit Board) assembling line,

SMT (Surface Mounted Technology) Department - Surface Mounted components are assembled to the PCB here.

THT (Through Hole Technology) Department - Components with through hole technology are assembled to the PCB here. THT department is comprised with a few sections such as Hand Soldering, Wave Soldering, and Selective Soldering sections. These soldering processes are carried out according to the requirement of the product. All transformers are assembled to the PCBs at the THT department.

Washing Department - After the SMT and THT assembly processes, there is a special requirement from the customer “Power Integrations” to all wash all PCBs under a special washing process. In here all the residues are totally removed by chemical washing process and a drying process.

VI (Visual Inspection) Department - Properties of all assembled components are inspected in this section, such as; correct component alignment, correct direction/polarity, check for missing components. After the visual inspection process, a Traceability label is placed on the PCB as the PCB Identifier.

After the VI is done all test require PBCAs get tested in Power Integrations testers, and OGQC (Outgoing Quality Control) is done to check the quality of the products.

PI Conformal Coating Department - Some products are subjected to a coating process after the Testing as the customer requirement.

AQL (Accepted Quality Level) Department - In the AQL section, final visual inspection is conducted. In the AQL inspection, check whether the final product is acceptable to ship out to the customer.

Packing Department - After all assembly and inspection processes are completed, the end product is directed to the packing department.

Following is the generic process flow of the PI production process at GPV.

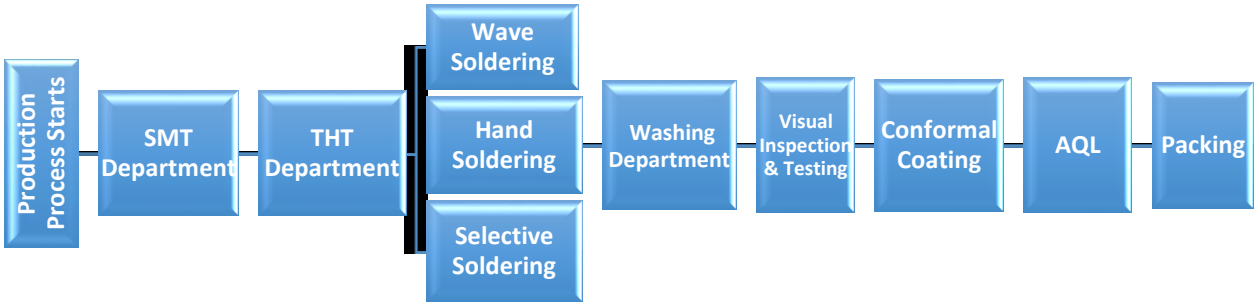
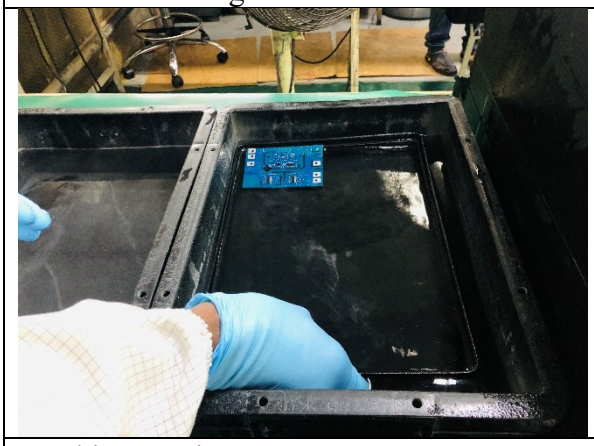
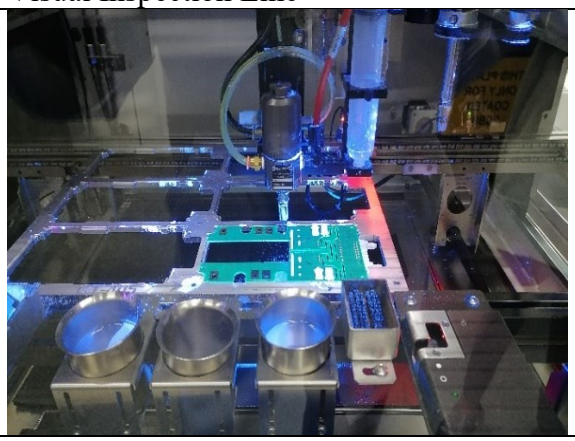


Figure 03: Production Process for PI Products at GPV

	
SMT Assembling line	THT Assembling line
	
Washing Section	Visual Inspection Line
	
PI Testing Line	Conformal Coating

	
AQL Inspection Line	Packing Section

Figure 04: Production Sections for PI Products at GPV

2 Project Selection

2.1 Brief description of the project selected, project selection methodology (tools and techniques used to prioritize project problem).

To identify production process issues, a GEMBA walk was done prior to the selection of the project. Through the GEMBA walk, a few issues were identified and the most critical issue was identified as follows. We used below shown project prioritization matrix to evaluate and prioritize different projects based on their potential impact and feasibility.

Table 02: Project Prioritization Matrix

No.	Segment	Impact on customer (+)	Impact on Business (+)	Strategic Alignment (+)	Do ability (+)	Current Performance (-)	Total
A	Elimination of Soldered Transformer scrap at Visual Inspection Line	10	10	10	9	2	**37**
B	Minimize the testing failure rate at Testing Line	9	6	9	6	6	**24**
C	Reducing wastage of Solder bars at THT line	7	7	6	5	8	**17**
D	Reducing job mixing at washing section	8	8	5	6	7	**20**

Based on the project prioritization matrix score we have selected “Elimination of Soldered Transformer scrap at Visual Inspection Line” as our project. Below we have filled the project selection check list to further verify our project selection.

Table 03: Project Selection Check List

	Project Selection Check List	Yes / No
1	Scope of the project is under the area of my influence	Yes
2	It related to repetitive problem (Chronic, not sporadic)	Yes
3	I cannot solve this by judgment by knowledge of experience available with me & my team members	Yes
4	I don't know cause & I don't know solution	Yes
5	I can collect sufficient data of the problem during project for the problem selected	Yes
6	Project scope is limited to only one product service one type of defect issue	No
7	This project will give substantial annualized saving Project is very important for the organization customer	Yes
8	This Project is linked to the business objective of the organization	Yes
9	Project will not require lot of additional resources so that timely completion is possible	Yes
10	I can complete the project within reasonable time period	Yes
11	If it is a project with some supplier then the supplier is going to stay with you for at least 2 years	N/A
12	My mentor has accepted to support for this project	Yes

3 Problem Analysis

3.1 Description of current situation (challenge/ problem/ practice/ opportunity). Six Sigma, Lean tools etc.

When PCBAs arrived at PI visual testing line, transformers are soldered. Then it was identified that a considerable amount of transformers has been scrapped due to many reasons at the PI visual & testing line. New transformers have been replaced for scrapped transformers resulting a huge cost. Reasons for this was analyzed and reasons were identified. Fishbone diagram was used to find out the most contributing factor for the scrapping of the soldered transformers.

3.2 Description of problem analysis method using appropriate tools and techniques / Six Sigma, Lean methodology etc.

The brainstorming session was conducted to identify the possible root cause. The cross-functional team was arranged the session at the PI Production line and started the first step as to identify the main problem. All identified causes for the problem was stated as shown in the image below.

Figure 05: Team leader explaining the problem to the production staff.

Figure 06: Voting

After the causes identification, the voting was conducted to understand which root cause is most relevant to the problem.

Figure 07 : N/3 Analysis

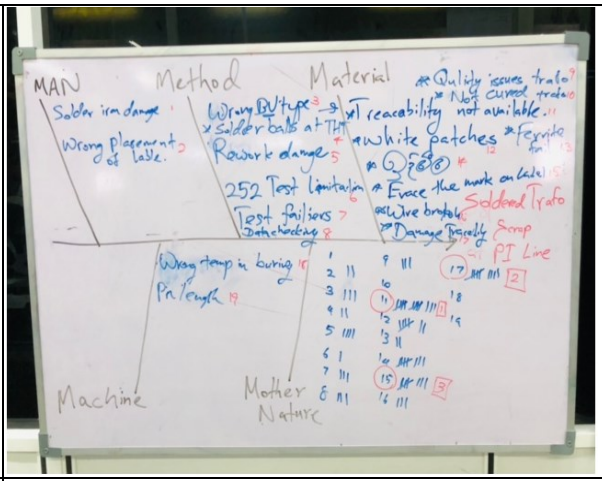


Figure 08 : Fishbone Diagram Analysis

After the factors that could be causing or contributing to the problem were categorized. Depended on team dynamics used a powerful technique called N over 3. To do N/3, simply count up the number of root causes identified and divide that number by 3. Then, each team member got that many votes as they select which causes they feel are the most important.

Table 04: Possible Causes Analysis

Possible Causes	Participants													Total
	A	B	C	D	E	F	G	H	I	J	K	L	M	
Solder Iron Damage														0
Wrong Placement of the Label	1							1						2
Wrong Pin Length														
Wrong Temperature in a burning chamber														0
Wrong BV Type		1	1				1							3
Rework Damage	1					1					1	1		4
Test Failures		1							1				1	3
Data Checking	1			1						1				3
Solder Balls at THT					1				1					2
Test Limitation								1						1
Broken Wires	1		1				1							3
Traceability Damage		1	1	1	1	1				1		1	1	8
Traceability Erase	1			1	1			1		1	1	1	1	8
Housing Expanding														0
Traceability not Available	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Ferrite Fail				1							1			2
White Patches		1		1		1		1	1		1		1	7
Not Cured Transformers														0
Quality Issues of Transformers		1					1						1	3

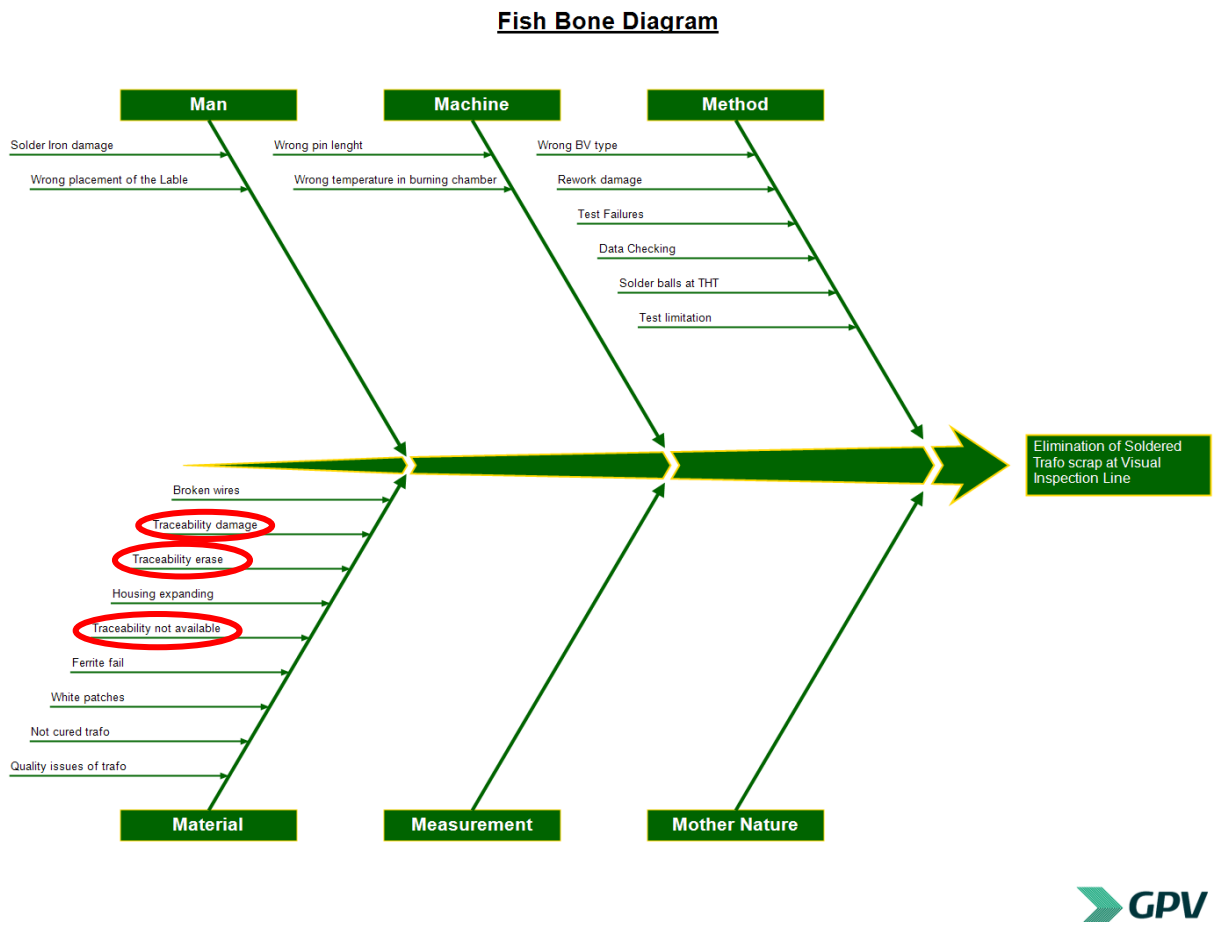


Figure 09: Fishbone Diagram

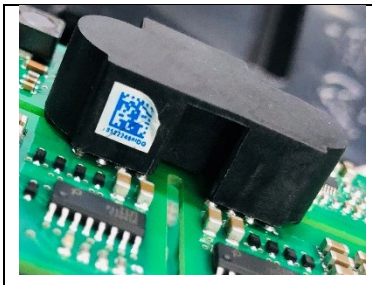
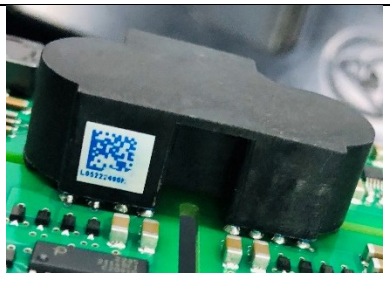
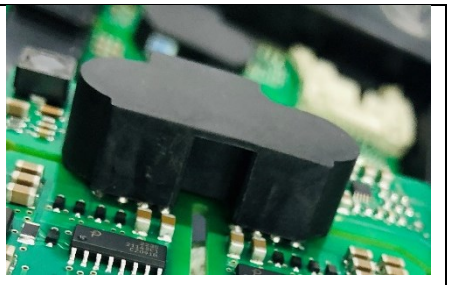
		
Damaged Traceability Label	Erased Traceability Label	Traceability Label Missing

Figure 10: Transformer Traceability issues

3.3 Statistical data analysis to identify root causes

After identification of the most contributing factors for the cause, why-why analysis was also conducted.

Table 05: Why-Why Analysis

Identified problem	Removed Transformers from PCBAs at PI Visual and Testing Line were scrapped
Why 01	Soldered Transformers were replaced by transformers which has good traceability labels
Why 02	Transformers which has damaged, erased or removed traceability labels cannot be identified or tested
Why 03	There is no pre linking between the transformer traceability label and PCB traceability label
Why 04	Traceability assignment to the PCBA is being done once after received to the PI visual line
Action Plan	Find a method to establish link between the traceability labels of transformers and the PCBA before arriving to PI visual line

The driver serial, which is the traceability marking of the PCBA is pasted in the Visual Inspection line. When comes to the PI visual line, the traceability marking of the transformer should available in order to track the PCBA. If the traceability marking of the transformer not available at the PI visual line, there is no data available to track the PCBA hence it is no use of marking the PCBA with driver serial. Then the current practice is to remove the soldered transformer from the PCBA and re-solder a new transformer with traceability serial. All the transformers without the traceability marking are scrapped at the PI visual line. With the new transformer, the driver serial can be attached.

3.4 Analyzing traceability issue incidents

From October to December 2022 tractability issue incidents were recorded and analyzed as below.

CT-203, CT-225, CT-235, CT-238, CT-247, CT-273, CT-302, CT-353 and CT-367 types of PCBs were identified as the top contributors for the problem according to the following pareto chart.

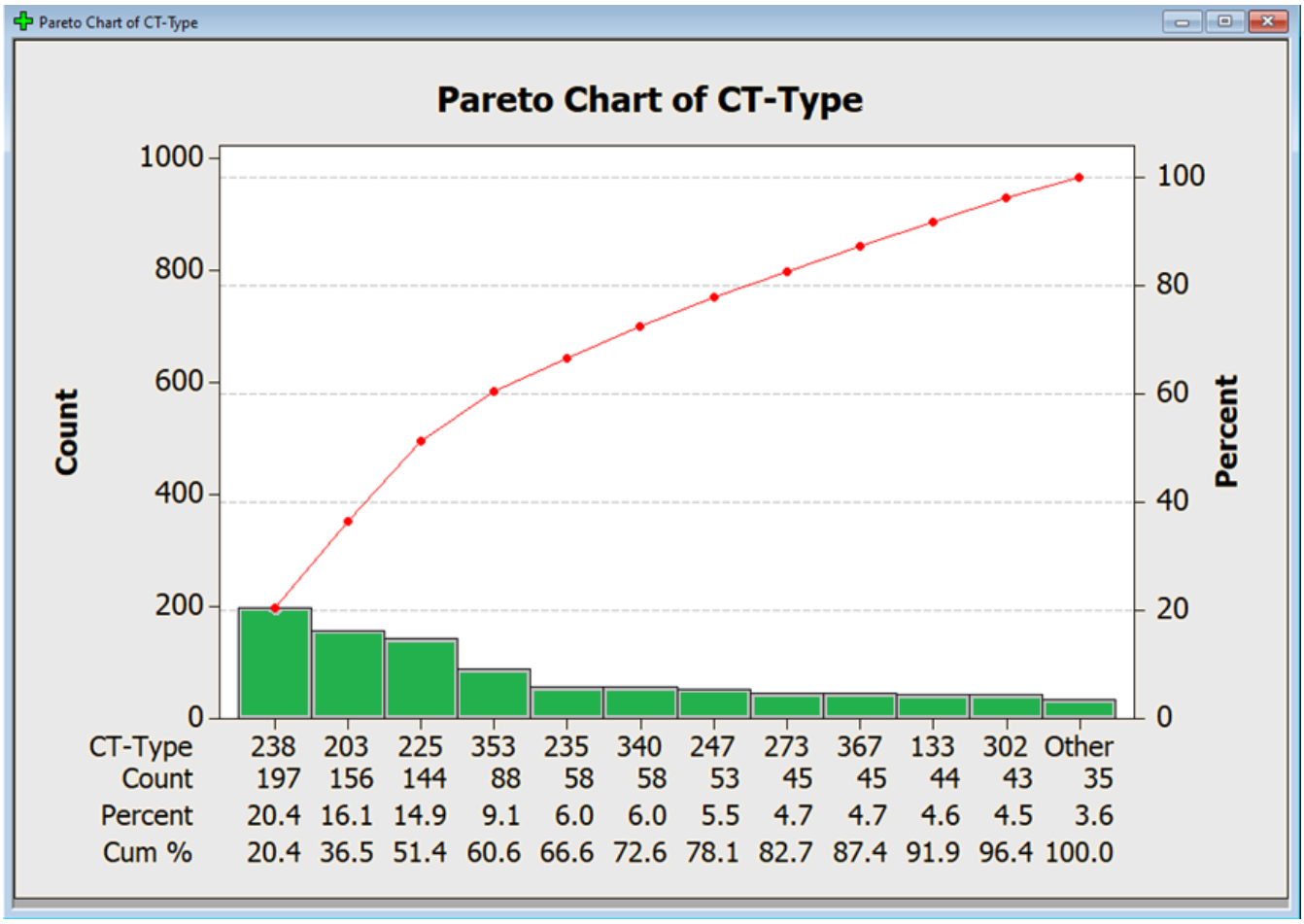


Figure 11: Pareto Chart

4 Project Solutions

4.1 Description of the problem-solving tools/methods used, innovative ideas, best practices considered, technologies leveraged/adopted/used to develop possible solutions.

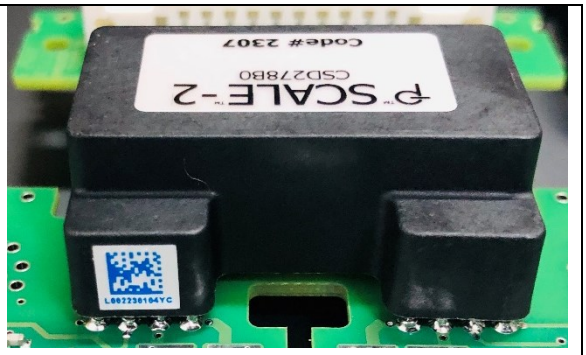
After identifying the root causes for the problem, a separate brainstorming session was conducted for the solution selection and following ideas were suggested and trails were done where necessary.

1. Non-removable material for label - The material change for the label was discussed with the customer and the approval was not granted for the material change.
2. Pasting the PCBA traceability serial at the beginning of the SMT assembly

	
Traceability label on PCB before the Reflow Oven process	Traceability label on PCB after the Reflow Oven process

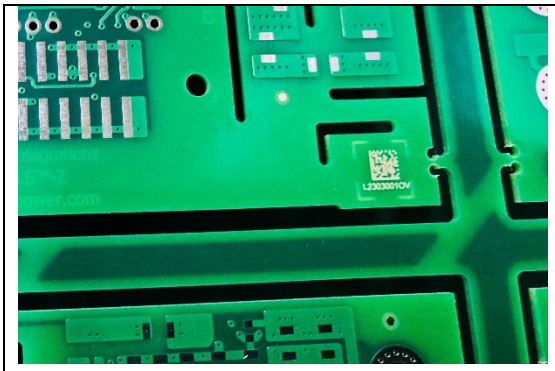
A sample of 100 PCBA were used as a trail and the traceability was completed damaged at the reflow oven.

3. Printing traceability marking on transformer

	
Feasible locations to print on transformers	Customer defined locations to paste treatability label on transformers

Even though the printing is possible, the customer defined locations were not feasible for the printing of the traceability on the transformers.

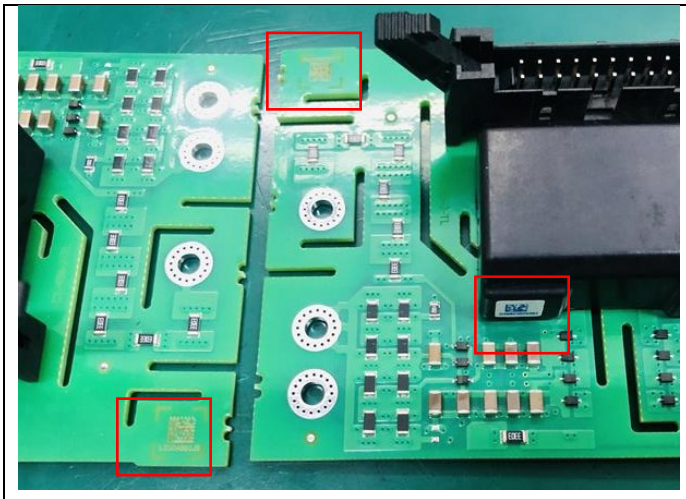
4. Laser mark on PCB before the SMD Line and tally with the Transformer traceability label after THT assembly.

	
Laser Marked locations on PCB	Customer defined locations to paste traceability label on PCB

A sample of 100 PCBA were used as a trial and the customer approval was gained for the Laser marking on the PCB. After the laser marking was done the Transformers were assembled at THT assembling department.

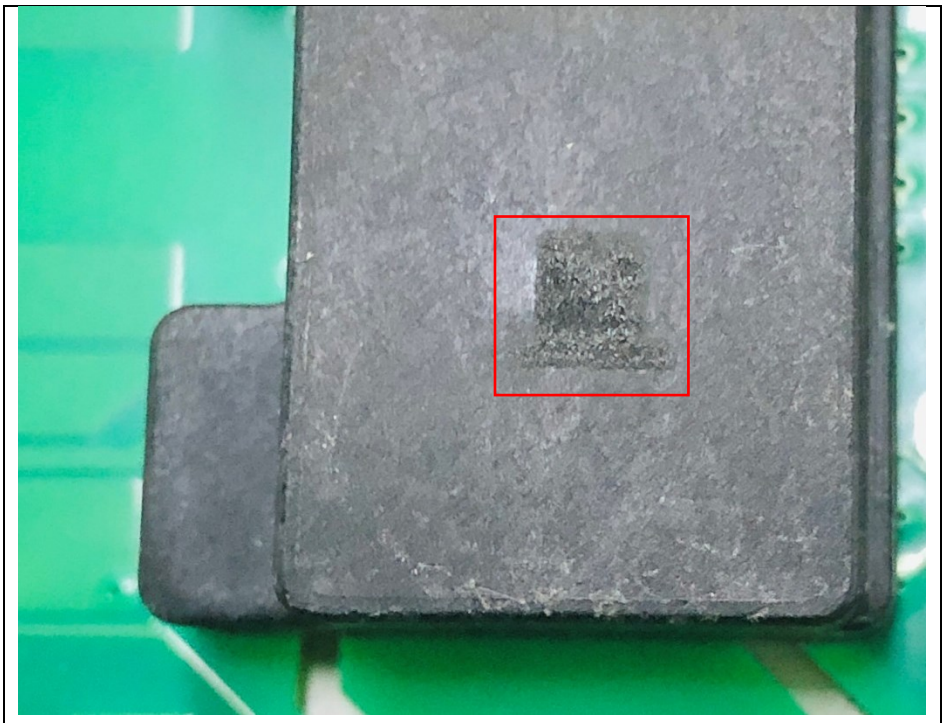
After the assembly of the Transformers both serials were scanned and recorded with the link between PCB Traceability marking and the transformer traceability label.

Customer approval was taken to reprint the label at PI Line for traceability label damaged, erased or missing transformers without removing the transformers and scrapping.



Laser marking on PCBA and Traceability Label on Transformer

5. Laser mark on transformer



Laser mark on Transformer

A sample was done using different intensities and the laser marking was not readable and the print quality was not at the acceptable level.

After the results of the trails the team gathered and voting was done for each suggested solution and results were given as follows,

Table 06: Project Solution Analysis

Seq	Segment	Navod	Naveen	Beenu	Sahan	Aruna	Total
1	Non-removable material for label	1	5	2	2	4	14
3	Pasting the PCBA traceability serial at the beginning of the SMT assembly	3	2	1	4	3	13
4	Printing on transformer	2	3	3	3	2	13
5	Laser mark on PCB and tally with the transformer	5	4	5	5	5	24
6	Laser mark on transformer	4	1	4	1	1	11

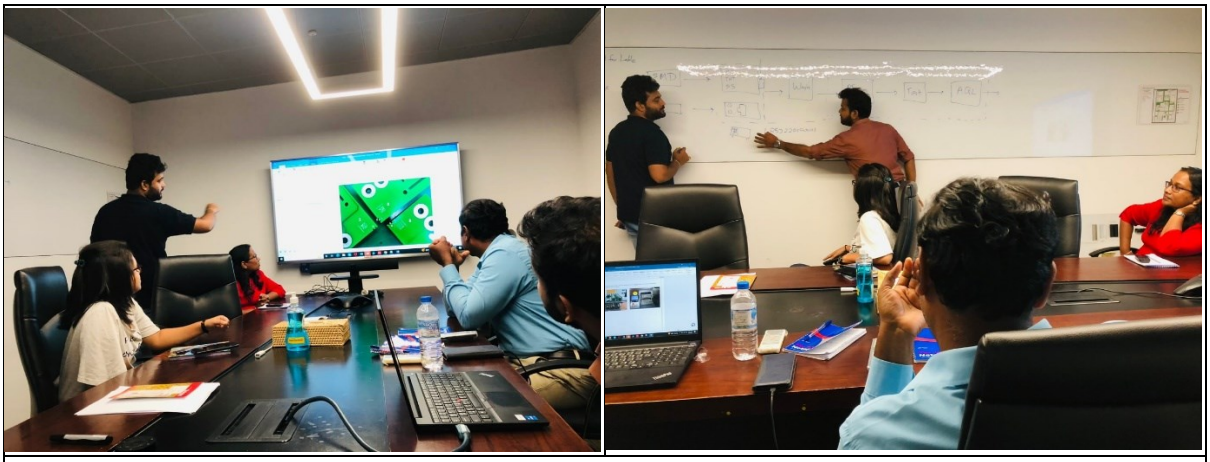


Figure 12: Conducting the Brainstorming Session

List of participants for the brainstorming session:

Table 07: Brainstorming-Participants

Brainstorming Session - Participants		
Name	**Section**	**Designation**
Mr. Damith Kularathne	NPI-DF	Senior NPI Engineer
Mrs. Linda Don Paul	QC	Executive-Junior
Mrs. Nuwanthi Wickramasinghe	Material Compliance	Junior Engineer
Mr. Sahan Silva	IT	Admin-IT Support
Mr. Navod Kiriwaththuduwa	NPI-DF	Junior NPI Engineer
Mr. Naveen Dharmasiri	QC	Quality Engineer

With the voting results, the solution was selected as to laser mark on PCB and tally with the transformer. If the transformer traceability is not available at the PI visual and testing line, the label can be reprint and paste by using the PCBA laser mark as a reference.

4.2 Description of the innovativeness/value-added or value-creation clarity resulting from the final solution.

Following value-added improvements were resulted due to the new implementation of laser marking of PCBAs

- Cost for the traceability labels for PCBAs were reduced
- Cost due to the transformer scrap was reduced

4.3 Stakeholder engagement and co-creation

The process was improved using the available resources at GPV Lanka. Therefore, no third-party involvement was required.

4.4 Implementation plan (Time Plan)

Table 08: Timeline Plan

Elimination of Soldered Transformer scrap at Visual Inspection Line										
Project Formation date:17/11/2022										
	November		December		January				February	
TASK	W 3	W 4	W 1	W 2	W 1	W 2	W 3	W 4	W 1	W 2
GEMBA walk										
Problem Identification										
Topic Finalization										
Project Objectives Analysis										
Current situation Analysis										
Statistical Data Analysis										
Problem analysis with Fishbone diagram										
5why analysis										
Final Solution Analysis										
Implementation Plan										
Final Result & Discussion										
Final Report Creation										
Final Report Submission										

5 Results

5.1 Results achieved/ productivity improved.

From CW01 of January 2023 onwards Laser marking on the PCB was done for CT-203, CT-225, CT-235, CT-238, CT-247, CT-273, CT-302, CT-353 and CT-367 types of PCB.

After the laser marking was done the Transformers were assembled at THT assembling department. After the assembly of the Transformers both serials were scanned and recorded with the link between PCB laser marking and the Transformer traceability label.

With the track record, Labels were reprinted and pasted on the transformers at PI Line for traceability label damaged, erased or missing transformers without removing the transformers and scrapping. Impact of results to organization's goals/ objectives/vision.

5.2 Tangible benefits achieved and reported (Cost- Benefit analysis, Expenses and Savings of project)

Table 09: Traceability Damaged Transformer Quantities

PCB Type	Traceability Damaged Transformer Quantity (October-December)	Traceability Damaged Transformer Quantity (January-February)
CT-133	44	20
CT-203	156	72
CT-225	144	88
CT-235	58	36
CT-238	197	57
CT-247	53	25
CT-273	45	18
CT-302	43	9
CT-353	88	47
CT-367	45	28
Other	149	50
Total	**1022**	**450**
Value of Transformers	Rs. 398,580.00	Rs. 175,500.00

Due to the implementation of the solution the Labels of CT-203, CT-225, CT-235, CT-238, CT-247, CT-273, CT-302, CT-353 and CT-367 has been reprinted and pasted on transformers.

Table 10: Soldered Transformer Scrap at Visual Inspection Line

Period	October-December	January - February
Soldered Transformer Scrap at Visual Inspection Line	Rs. 398,580.00	Rs. 19,500.00

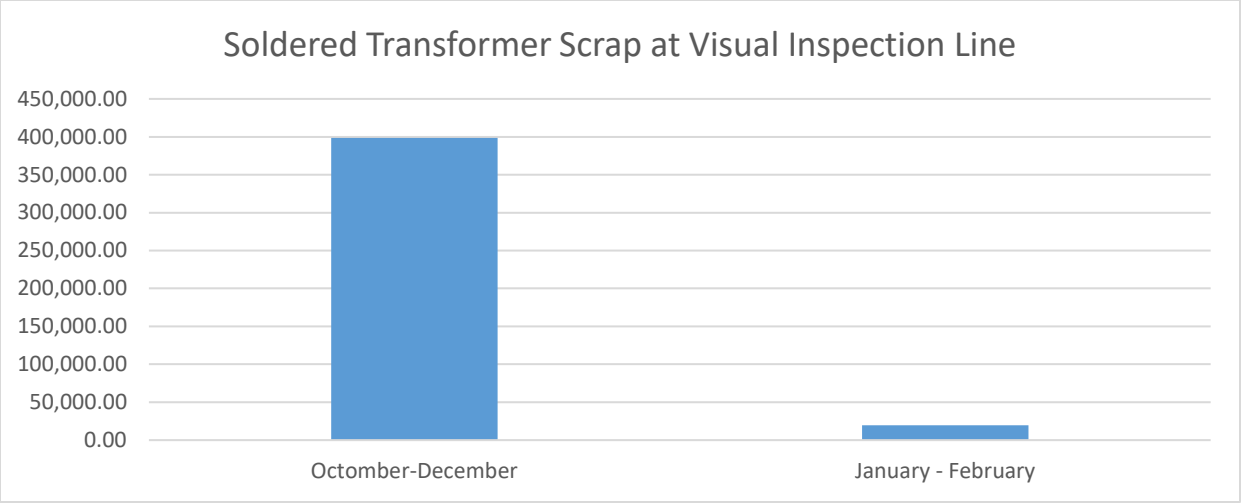


Figure 13: Soldered Transformer Scrap at Visual Inspection Line

Total Savings After Implementation = Rs. 156,000.00