National Workshop on “Enabling MSME to be Competitive through Quality Tools”

WELCOME TO MSME UPGRADATION THROUGH MACE CLUSTER APPROACH AT GENBA USING QC TOOLS

METHODOLOGY ADOPTED

- Cluster Approach
- Pricol and Tier -2 Vendors Top Management Commitment And Active Involvement
- Goal Setting Based On The Future Challenges
- Monthly Visits At Genba Along With MACE Counselor
- Step by Step Activities Implementation As Per Decided 4 Phase Model
- Monthly Progress Review
- Trainings and Motivation
- Two way communication

PRICOL LIMITED OVERVIEW

PRICOL LIMITED OVERVIEW

PLAN DO CHECK ACT

Formation of Cluster-1

- Selected 7 Vendors Based On Share Of Business (Approx 60% of Total Buying), Criticality Of Components Supplied & Past Performance of At Least One Year.
- Cluster was launched in May-2009.
- Commodity of Vendors - Plastics, Sheet metal & Wiring Harness

Deming Cycle followed in each activity

Phases

Phase 1

- TPM Cluster
- Certified Quality Engineer
- Six Sigma Black Belts
- Benchmarking Visits
- Horizontal Deployment of Cluster Activity through Tier-2

Phase 2

- Complete 5-S
- Up-gradation through advance Quality Tools (VSM, 5F, 5W, 5C, 5M)
- Autonomous Maintenance; OEE
- Yield Improvement
- Implementation of 8 Pillars Check sheet
- Training on advance tools like DOE, DMAIC & OEE

Phase 3

- Capturing Customer Voice
- 1-S, 2-S and Visualization
- Customer Concern (QCD) through why-why Analysis
- Red Bin Analysis using basic QC Tools
- Daily Work Management for Target Monitoring
- Monthly Performance Review at Gemba
- Team building
- Six New Kaizen per month
- VPR (Value added per employee cost)
- Training on 5S, VUD, 7 QC tools, CAPA

Phase 4

- TEI through SSQC activities
- Single Piece Flow using Model Line; identifying Lean Manufacturing Projects (MPS) based on Customer Requirements
- Inventory Turns Ratio Management
- Energy Consumption Management
- Cost of Poor Quality
- Initial Supply Control
- Value added per employee cost (VAPCO)
- Training on SSQC, MPS, EMS, QMS, NPD
TARGET SETTING (2009~10)

<table>
<thead>
<tr>
<th>Year</th>
<th>Target Setting for PPM</th>
<th>Target Setting for Defects</th>
</tr>
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<tbody>
<tr>
<td>2008-09</td>
<td>14000</td>
<td>90</td>
</tr>
<tr>
<td>2009-10</td>
<td>10472</td>
<td>30</td>
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</table>

ACTIVITIES INITIATED

- Phase-1
  - Capturing Customer Voice (CSR Review)
  - Customer Concern Analysis (CSR Analysis Using Basic QC Tools)
  - Red Bin Analysis by using basic QC Tools
  - 5-Why and Visualization (Red Tags, Basic Housekeeping)
  - Monthly Performance Review & Collaborative Learning
  - Delivery Failure analysis
  - Daily Work Management Implementation (Managers Only)

CUSTOMER SATISFACTION REPORT AND GAP ANALYSIS

<table>
<thead>
<tr>
<th>Month</th>
<th>GAP ANALYSIS REPORT</th>
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<tr>
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<td>Action Taken</td>
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<tr>
<td>Dec-2009</td>
<td>1. Identify the defects using Pareto charts</td>
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<tr>
<td></td>
<td>2. Implement countermeasures and verify results</td>
</tr>
<tr>
<td></td>
<td>3. Review the effectiveness of the implemented countermeasures</td>
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<td></td>
<td>4. Continuous improvement</td>
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</table>

RED BIN ANALYSIS - Procedure

1. Recruitment of CFT (CFT) to meet at defined time to discuss priority defect rejection.
2. CFT should make up the daily action plan.
3. CFT is supposed to take decision regarding the top defect of the week.
4. Each CFT member should identify the root cause.
5. Effectiveness of implemented countermeasures should be verified by the CFT.
6. The CFT should produce the improvement action plan.

IS & 2S

Before Improvement (Photo or Explanation Drawing)

- Red Bin Analysis

After Improvement (Photo or Explanation Drawing)

- Red Bin Analysis

BENEFITS

- SPACE SAVING
- 1S & 2S

MONTHLY PERFORMANCE REVIEW BY TOP MANAGEMENT

Previous receiving material, dispatch material, rejections and slow moving mold kept in same place.

Separate Location identified and demarcation for receiving and dispatch area.
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RESULTS – 2009~10

<table>
<thead>
<tr>
<th></th>
<th>2008~09</th>
<th>2009~10</th>
<th>Target</th>
<th>Achieved</th>
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<tr>
<td>PPM at Pricol</td>
<td>63</td>
<td>47</td>
<td>51</td>
<td>51</td>
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<td>Defects at Pricol</td>
<td>120</td>
<td>20</td>
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TARGET SETTING 2010~11

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<th>2010~11</th>
<th>Target</th>
<th>Achieved</th>
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<td>67</td>
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<td>Defects at Pricol</td>
<td>120</td>
<td>26</td>
<td>26</td>
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</table>

ACTIVITIES INITIATED

- Deep Analysis of Defects by using 7 QC Tools.
- Monitoring of PPM & Reduction by using 7 QC Tools.
- Poka Yoke Implementation.
- Implementation of QC Circle activities (One QC Circle in each area).
- Starting of Suggestion scheme & implementation of Kaizens.
- Daily Work Management implementation in entire plant.
- Inventory Turns Ratio Calculation & Monitoring.
- Delivery Failure Analysis in Deep way.
- Direct On Line

POKA–YOKE TREND

CUMULATIVE POKA YOKE TREND 2010-11

KAIZEN TREND

CUMULATIVE KAIZEN TREND 2010-11

BEST POKA–YOKE

PROBLEM
No fool proofing is done in the Visor mold. So, Turn lens fitted in any directions.

SOLUTION
1. Poka Yoke in both side of Visor P17/ZZLX molds.
2. Leg to be provided in all cavity of Turn lens.

QUALITY CIRCLE STATUS–2010~11

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>No. of Quality Circles formed</td>
<td>14</td>
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<tr>
<td>No. of Projects Completed</td>
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RESULTS – 2010~11

<table>
<thead>
<tr>
<th></th>
<th>2009~10</th>
<th>2010~11</th>
<th>Target</th>
<th>Achieved</th>
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<td>4244</td>
<td>4156</td>
<td>4156</td>
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<tr>
<td>Defects</td>
<td>16</td>
<td>47</td>
<td>51</td>
<td>51</td>
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Delivery Rating criteria was added in Focus area from April 2010.
Cluster-2 was launched in June 2010 in which we added different commodity vendors like Bulb and Electronics.
TARGET SETTING (2011~12)

<table>
<thead>
<tr>
<th>Year</th>
<th>PPM</th>
<th>Defects</th>
<th>Delivery</th>
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</thead>
<tbody>
<tr>
<td>2010-11</td>
<td>2150</td>
<td>3903</td>
<td>2900</td>
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<tr>
<td>2011-12</td>
<td>2000</td>
<td>3500</td>
<td>1900</td>
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</table>

CLUSTER ACHIEVEMENTS SINCE START OF CLUSTER

REJECTION PPM AT PRICOL

Cluster-1:
- Overall: -72%
- 2008-09: 60
- 2009-10: 31
- 2010-11 Apr-Dec: 15

Cluster-2:
- Overall: -76%
- 2008-09: 10
- 2009-10: 6
- 2010-11 Apr-Dec: 2

NO. OF DEFECTS AT PRICOL

Cluster-1:
- Overall: -76%
- 2008-09: 2.3
- 2009-10: 4.6
- 2010-11 Apr-Dec: 5.3

Cluster-2:
- Overall: 5%
- 2008-09: 1.17
- 2009-10: 1.11
- 2010-11 Apr-Dec: 1.1

NO. OF DEFECTS AT MSIL

Cluster-1:
- No Defect due to Cluster-1

Cluster-2:
- No Defect due to Cluster-2

FOCUS AREAS FOR 2011~12

- Lean Projects Implementation
- Strengthening of QC Circle activities
- Implementation of Direct On Line Activity
- Daily Work Management implementation in entire plant at all level

INTERNAL QC CIRCLE COMPETITION (NOV-2011) FOR PROMOTING QC CIRCLE ACTIVITIES

Winner- Aar- Aar Technoplast
1st Runner up- ADPL

LEAN PROJECTS IDENTIFIED 2011~12

<table>
<thead>
<tr>
<th>S.No</th>
<th>Project Title</th>
<th>No. of vendors</th>
<th>Project Completed (till Dec-11)</th>
<th>Project Under Progress</th>
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<tbody>
<tr>
<td>1.</td>
<td>SMED</td>
<td>5</td>
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<td>2.</td>
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<td>4</td>
<td>1</td>
<td>3</td>
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<tr>
<td>3.</td>
<td>Machine Break down Reduction</td>
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<td>2</td>
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<td>4.</td>
<td>Inventory Turn Over Ratio</td>
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<td>1</td>
<td>3</td>
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<td>5.</td>
<td>Productivity Improvement</td>
<td>4</td>
<td>1</td>
<td>3</td>
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<td>6.</td>
<td>Quality Improvement</td>
<td>4</td>
<td>1</td>
<td>3</td>
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<tr>
<td>7.</td>
<td>Energy Consumption Reduction</td>
<td>4</td>
<td>1</td>
<td>3</td>
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<tr>
<td>TOTAL</td>
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<td>28</td>
<td>9</td>
<td>19</td>
</tr>
</tbody>
</table>
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**NO. OF KAIZENS IMPLEMENTED**

- **Cluster-1**
  - 2009-10: 10
  - 2010-11: 10
  - Apr-Dec'11: 10

- **Cluster-2**
  - 2009-10: 10
  - 2010-11: 10
  - Apr-Dec'11: 10

**NO. OF POKA YOKE IMPLEMENTED**

- **Cluster-1**
  - 2009-10: 2
  - 2010-11: 2
  - Apr-Dec'11: 2

- **Cluster-2**
  - 2009-10: 2
  - 2010-11: 2
  - Apr-Dec'11: 2

**NO. OF DIRECT ON LINE COMPONENTS**

- 2009-10: 4
- 2010-11: 17
- 11-12 Upto Dec: 45

**RECOGNITION BY MSIL**

- **Maruti Suzuki India Limited**
  - is pleased to award this certificate to Pricel Limited in recognition of sincere efforts and superior performance in the field of Tier-2 Upgradation in the year 2010-11.
  - 3rd & 4th May, 2011

**WINNER OF QUALITY CIRCLE COMPETITION AT MSIL – OCT-2010**

- 1st Runner Up of Quality Circle Competition at MSIL – Nov-2011

**ACHIEVEMENT & AWARDS**
National Workshop on “Enabling MSME to be Competitive through Quality Tools”

Kaizen Convention at MSIL – Sep-2011

Winner of Tops Case Study Presentation at MSIL

Winner of Case Study in Manufacturing Excellence Stream at 4th CII National Summit – 2011

AAR-AAR Case Study Presentation

Company Introduction

Customer Details

Team Introduction

Details of Quality Circle:
- Date of Formation: 25th Nov 2010
- No of Projects Completed: 05
- Current Project Started: 5th Apr 2011
- Target for Completion: 25th June 2011
- Team Working Area: Moulding

Meeting Day & Time:
- Frequency: Once in a Week
- Every Wednesday
- Time: 3:00 to 03:30 pm
- Attendance: 97.66%
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### ACTIVITIES TIME PLAN

<table>
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<th>Period</th>
<th>Apr-11</th>
<th>May-11</th>
<th>Jun-11</th>
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<tr>
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<td>Problem selection</td>
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<td>Problem Definition</td>
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<td>Data collection &amp; target setting</td>
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<td>Root cause analysis</td>
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<td>Developing solution</td>
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<td>Trial of counter measures</td>
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<td>Checking result</td>
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<tr>
<td>Implementation of counter measures</td>
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<td>Effectiveness</td>
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<td>Standardization</td>
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<td>Horizontal development</td>
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<td>Payback period analysis</td>
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</table>

### THEME SELECTION

“TO ELIMINATE REJECTION ON ACCOUNT OF WARPAGE & CRACK IN BACK COVER YG8”

### IN HOUSE REJECTION PPM (PRICOL COMPONENTS) APR 10 TO MAR 11

**COMPONENT WISE PARETO OF INHOUSE REJECTION**

**DEFECT WISE PARETO OF BACK COVER YG8(APR 10 TO MAR 11)**

**IN HOUSE PPM OF BACK COVER YG6 DUE TO CRACK & WARPAGE (APR 10 TO MAR 11)**

**PPM OF BACK COVER DUE TO WARPAGE & CRACK AT CUSTOMER END(APR 10 TO MAR 11)**

**NEW ALTO CAR**
**TARGET SETTING**

![Target Setting Diagram](image)

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**DEFECT-1 (WARPAGE)**

UNDERSTANDING OF PROBLEM

![Problems Diagram](image)

RESULT: WARPAGE OBSERVED

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**SAMPLE SIZE CALCULATION FOR ANALYSIS**

\[ np \geq 5 \]

Where \( n = \) sample size

\( p = \) proportion of rejection

Our PPM is 98072

\( p = 98072 \quad 0.098072 \)

\( n \times 0.098072 \geq 5 \)

\( n = 51 \quad 50.98 \)

\( 0.098072 \)

\( n \geq 51 \)

**CAUSE & EFFECT DIAGRAM FOR MOULDING**

![Cause and Effect Diagram](image)

**RANKING TO IDENTIFY POTENTIAL CAUSES**

<table>
<thead>
<tr>
<th>NO.</th>
<th>STAGES</th>
<th>CAUSES</th>
<th>DEEP</th>
<th>RIFFL</th>
<th>HOLE</th>
<th>RING</th>
<th>PUSHPA</th>
<th>ORPS</th>
<th>（中文）</th>
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<tbody>
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</tbody>
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RANKING MORE THAN 10 IS CONSIDERED AS POTENTIAL CAUSES

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**STAGE IDENTIFICATION FOR WARPAGE OCCURRENCE**

![Stage Identification Diagram](image)

INFER: WE FOUND THAT THERE WERE TWO STAGES OF DEFECT OCCURRENCE MOULDING & STACKING.
SUMMARY OF POTENTIAL CAUSES

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>STAGES</th>
<th>POTENTIAL CAUSES</th>
<th>RANKING</th>
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<td>MAN</td>
<td>UNSKILLED</td>
<td>4TH</td>
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<td>2</td>
<td>MACHINE</td>
<td>COOLING TIME</td>
<td>1ST</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>MOLD TEMPERATURE</td>
<td>5TH</td>
</tr>
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<td>4</td>
<td>METHOD</td>
<td>HOLDING TIME</td>
<td>3RD</td>
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<tr>
<td>5</td>
<td></td>
<td>WARPAGE DEVELOPED AFTER MOLDING</td>
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<tr>
<td>6</td>
<td></td>
<td>BARREL TEMP.</td>
<td>6TH</td>
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</table>

Why Why Analysis for Warpage Developed after Moulding

Why-1 Why? Warpage developed after Moulding
Answer: Because – No Cooling Fixture after moulding

Why-2 Why? No Cooling Fixture after moulding
Answer: Because – Not Considered during Development.

Root Cause Not Considered during Development

Validation of Potential Cause

<table>
<thead>
<tr>
<th>S. NO</th>
<th>POTENTIAL CAUSE</th>
<th>VALIDATION METHOD</th>
<th>VALIDATION DATA</th>
<th>JUDGMENT</th>
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<tr>
<td>1</td>
<td>COOLING TIME</td>
<td>THROUGH SCATTER DIAG</td>
<td>50 ± 5</td>
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</tbody>
</table>

Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}} \cdot 0.36$, Where $N = 30$

Reference: Since $R^2 = 88.5\%$ which is greater than 36%, So there is a relationship between Cooling time and Warpage but our spec is 45-55. As shown in graph within our spec there is no rejection. So, this cause is not significant

Why? Warpage developed after Moulding
Answer: Because – No Cooling Fixture after moulding

Why? No Cooling Fixture after moulding
Answer: Because – Not Considered during Development.

Root Cause Not Considered during Development

Validation of Potential Cause

<table>
<thead>
<tr>
<th>S. NO</th>
<th>POTENTIAL CAUSE</th>
<th>VALIDATION METHOD</th>
<th>VALIDATION DATA</th>
<th>JUDGMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>HOLDING TIME</td>
<td>SCATTER DIAGRAM</td>
<td>3 ± 1</td>
<td></td>
</tr>
</tbody>
</table>

Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}} \cdot 0.63$, Where $N = 10$

Reference: Since $R^2 = 88\%$ which is greater than 63%, means there is a relationship between Warpage & holding time. As shown in graph there is rejection developed within spec. It means our spec needs to be revised. So, this is a significant cause.

Why? Warpage developed after Moulding
Answer: Because – No Cooling Fixture after moulding

Why? No Cooling Fixture after moulding
Answer: Because – Not Considered during Development.

Root Cause Not Considered during Development

Validation of Potential Cause

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<tr>
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Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}} \cdot 0.36$, Where $N = 30$

Reference: Since $R^2 = 88.5\%$ which is greater than 36%, So there is a relationship between Cooling time and Warpage but our spec is 45-55. As shown in graph within our spec there is no rejection. So, this cause is not significant

Why? Warpage developed after Moulding
Answer: Because – No Cooling Fixture after moulding

Why? No Cooling Fixture after moulding
Answer: Because – Not Considered during Development.

Root Cause Not Considered during Development

Validation of Potential Cause

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<tr>
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</table>

Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}} \cdot 0.36$, Where $N = 30$

Reference: Since $R^2 = 88.5\%$ which is greater than 36%, So there is a relationship between Cooling time and Warpage but our spec is 45-55. As shown in graph within our spec there is no rejection. So, this cause is not significant

Why? Warpage developed after Moulding
Answer: Because – No Cooling Fixture after moulding

Why? No Cooling Fixture after moulding
Answer: Because – Not Considered during Development.

Root Cause Not Considered during Development

Validation of Potential Cause

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</table>

Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}} \cdot 0.36$, Where $N = 30$

Reference: Since $R^2 = 88.5\%$ which is greater than 36%, So there is a relationship between Cooling time and Warpage but our spec is 45-55. As shown in graph within our spec there is no rejection. So, this cause is not significant

Why? Warpage developed after Moulding
Answer: Because – No Cooling Fixture after moulding

Why? No Cooling Fixture after moulding
Answer: Because – Not Considered during Development.

Root Cause Not Considered during Development

Validation of Potential Cause

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<tr>
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</tr>
</thead>
</table>

Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}} \cdot 0.36$, Where $N = 30$

Reference: Since $R^2 = 88.5\%$ which is greater than 36%, So there is a relationship between Cooling time and Warpage but our spec is 45-55. As shown in graph within our spec there is no rejection. So, this cause is not significant

Why? Warpage developed after Moulding
Answer: Because – No Cooling Fixture after moulding

Why? No Cooling Fixture after moulding
Answer: Because – Not Considered during Development.

Root Cause Not Considered during Development
Validation of Potential Cause

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<tr>
<th>S. NO</th>
<th>POTENTIAL CAUSE</th>
<th>VALIDATION METHOD</th>
<th>VALIDATION DATA</th>
<th>JUDGMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>MOLD TEMPERATURE THROUGH SCATTER DIAG</td>
<td>SPEC: 42 ± 5</td>
<td>OBSRV:</td>
<td>We checked the relationship between mold Temp &amp; Warpage through scatter which has been shown below</td>
</tr>
</tbody>
</table>

Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}}$, Where $N = 30$

INFERENC E: Since $R^2 = 83\%$ which is greater than $36\%$. So there is a relationship b/w Mold temp and Warpage but our spec is 37-47, as shown in graph within our spec there is no rejection. So, this cause is not significant.

---

Validation of Potential Cause

<table>
<thead>
<tr>
<th>S. NO</th>
<th>POTENTIAL CAUSE</th>
<th>VALIDATION METHOD</th>
<th>VALIDATION DATA</th>
<th>JUDGMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>BARREL TEMP. THROUGH SCATTER DIAGRAM</td>
<td>SPEC: Z1 - 210 ± 10</td>
<td>OBSRV: Z2 - 220 ± 10 Z3 - 220 ± 10 Z4 - 210 ± 10</td>
<td>We checked the relationship between barrel temp and Warpage through scatter which has been shown in next slides</td>
</tr>
</tbody>
</table>

Decision Criteria: $R^2 \geq \frac{2}{\sqrt{N}}$, Where $N = 30$

INFERENC E: Since $R^2 = 85\%$ which is greater than $36\%$. So there is a relationship b/w Warpage & Zone 3 Temp. As shown in graph there is rejection developed within spec. It means our spec needs to be revised. So, this is a significant cause.
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**LIST OF VALID CAUSES**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>VALID CAUSE</th>
<th>PICTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOLDING TIME.</td>
<td><img src="image1" alt="Graph" /></td>
</tr>
<tr>
<td>2</td>
<td>BARREL TEMPERATURE OF ZONE II &amp; III.</td>
<td><img src="image2" alt="Graph" /></td>
</tr>
<tr>
<td>3</td>
<td>WARPAGE DEVELOPED AFTER MOLDING</td>
<td><img src="image3" alt="Image" /></td>
</tr>
</tbody>
</table>

**COUNTERMEASURE NO. 1**

<table>
<thead>
<tr>
<th>S.N.O.</th>
<th>COUNTERMEASURE</th>
<th>LOCATION</th>
<th>IMPLEMENTATION DATE</th>
<th>VERIFICATION DATE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HOLDING TIME FROZEN FROM 3 ± 1°C 5 ± 1</td>
<td>ON MACHINE</td>
<td>04 JUNE 2011</td>
<td>04 JUNE 2011</td>
<td>OK</td>
</tr>
</tbody>
</table>

As shown in graph, Equation Y = m x + c, hence

\[ Y = 0.1173x - 1.362 \]

Warpage = 0.1173 * Holding Time – 1.362
Customer spec of warpage = Max-1mm
RR Tgt = 0.80 mm

\[ 0 = 0.1173 \times \text{Holding Time} - 1.362 \]

Holding Time = 1.362 / 0.1173 = 11.61

\[ 0.8 = 0.1173 \times \text{Holding Time} \]

Holding Time = 1.362 + 0.8 / 0.1173 = 8.18

But on this spec Cycle Time Increased. So that As per scatter plot we decided to revised this spec is 5 ± 1

**COUNTERMEASURE NO. 2**

<table>
<thead>
<tr>
<th>S.N.O.</th>
<th>COUNTERMEASURE</th>
<th>LOCATION</th>
<th>IMPLEMENTATION DATE</th>
<th>VERIFICATION DATE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BARREL TEMPERATURE FOR ZONE II &amp; III EARLIER IT WAS 220 ± 10°C</td>
<td>PROCESS DATA SHEET</td>
<td>04 JUNE 2011</td>
<td>04 JUNE 2011</td>
<td>OK</td>
</tr>
</tbody>
</table>

As shown in graph, Equation Y = m x + c, hence

\[ Y = 0.0304x - 5.7414 \]

Warpage = 0.0304 * Zone Temp - 5.7414
Customer spec of warpage = Max-1mm
RR Tgt = 0.80 mm

\[ 0 = 0.0304 \times \text{Zone Temp} - 5.7414 \]

Zone Temp = 5.7414 / 0.0304 = 189°C

\[ 0.8 = 0.0304 \times \text{Zone Temp} \]

Zone Temp = 5.7414 + 0.8 / 0.0304 = 215°C

Spec as per Equation :- 189 - 215°C
We produce 500 pcs on this spec., but pcs were rejected because of short mould so we decided to revised this spec is 205 ± 5

**COUNTERMEASURE NO. 3**

<table>
<thead>
<tr>
<th>S.N.O.</th>
<th>COUNTERMEASURE</th>
<th>LOCATION</th>
<th>IMPLEMENTATION DATE</th>
<th>VERIFICATION DATE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BARREL TEMPERATURE FOR ZONE II &amp; III EARLIER IT WAS 220 ± 10°C</td>
<td>PROCESS DATA SHEET</td>
<td>04 JUNE 2011</td>
<td>04 JUNE 2011</td>
<td>OK</td>
</tr>
</tbody>
</table>

As shown in graph
Equation Y = m x + c, hence

\[ Y = 0.0568x - 11.543 \]

Warpage = 0.0568 * Zone Temp – 11.543
Customer spec of warpage = Max-1mm
RR Tgt = 0.80 mm

\[ 0 = 0.0568 \times \text{Zone Temp} - 11.543 \]

Zone Temp = 11.543 / 0.0568 = 203°C

\[ 0.8 = 0.0568 \times \text{Zone Temp} \]

Zone Temp = 11.543 + 0.8 / 0.0568 = 217°C

Spec as per Equation :- 203 - 217°C
so we decided to revised this spec is 210 ± 5

**EFFECTIVENESS**

- **PROCESS OPTIMISED**

**COUNTERMEASURE NO. 4**

<table>
<thead>
<tr>
<th>S.N. O.</th>
<th>COUNTERMEASURE</th>
<th>LOCATION</th>
<th>IMPLEMENTATION DATE</th>
<th>VERIFICATION DATE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200 GMS OF WEIGHT PROVIDED ON COMPONENT FOR PROPER COOLING AFTER MOLDING</td>
<td>ON MACHINE</td>
<td>11 JUNE 2011</td>
<td>11 JUNE 2011</td>
<td>OK</td>
</tr>
</tbody>
</table>

INFERENCE: After putting the weight no pcs were rejected because of warpage

**DIMENSIONAL TREND**

<table>
<thead>
<tr>
<th>MONTHS</th>
<th>IMMEDIATE ON MACHINE</th>
<th>After 5 MIN</th>
<th>After 1 HR.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O. MIN.</td>
<td>MAX.</td>
<td>O. MIN.</td>
</tr>
<tr>
<td>IMMEDIATE ON MACHINE</td>
<td>After 5 MIN</td>
<td>After 1 HR.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>O. MIN.</td>
<td>MAX.</td>
<td>O. MIN.</td>
</tr>
</tbody>
</table>
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**EFFECTIVENESS**

- **Process Optimised**
- **Weight Provided on Component**

**OVERALL EFFECTIVENESS (INHOUSE)**

- **Temperature & Holding Time Frozen**
- **Polishing Done**

**EFFECTIVENESS (CUSTOMER)**

**COUNTERMEASURE TAKEN**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COUNTERMEASURE</th>
<th>LOCATION</th>
<th>IMPLEMENTATION DATE</th>
<th>VERIFICATION DATE</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Polish done in mould and frequency decided i.e. 20K shots.</td>
<td>Inhouse</td>
<td>08 June 2011</td>
<td>08 June 2011</td>
<td>Ok</td>
</tr>
</tbody>
</table>

**COUNTERMEASURE EFFECTIVENESS FOR CRACK**

- **Polishing Done & Frequency Decreased**

**STANDARDIZATION**

<table>
<thead>
<tr>
<th>S.no</th>
<th>What</th>
<th>When</th>
<th>Where</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PROCESS DATA SHEET UPDATED</td>
<td>25 June 2011</td>
<td>PROCESS DATA</td>
<td>NEEL KAMAL</td>
</tr>
<tr>
<td>2</td>
<td>PM CHECK SHEET AND HISTORY CARD UPDATED FOR RIB AREA POLISHING FREQUENCY 20K SHOTS</td>
<td>28 June 2011</td>
<td>PROCESS DATA SHEET</td>
<td>NEEL KAMAL</td>
</tr>
<tr>
<td>3</td>
<td>WORK INSTRUCTIONS UPDATED</td>
<td>28 June 2011</td>
<td>WORK INSTRUCTIONS</td>
<td>NEEL KAMAL</td>
</tr>
<tr>
<td>4</td>
<td>PFMEA AND CONTROL PLAN UPDATED</td>
<td>28 June 2011</td>
<td>PFMEA</td>
<td>NEEL KAMAL</td>
</tr>
</tbody>
</table>

**HORIZONTAL DEPLOYMENT**

<table>
<thead>
<tr>
<th>S.no</th>
<th>What</th>
<th>When</th>
<th>Where</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SEPARATE POLISHING FREQUENCY DECIDED FOR RIB AREA</td>
<td>05 July 2011</td>
<td>HOUSING FRONT FOGLAMP AND ROOM LAMP SWIFT</td>
<td>MR. R.L. DOGRA</td>
</tr>
</tbody>
</table>

** NOTE: THERE WERE NO SIDE EFFECTS OF THESE COUNTERMEASURES. **

- **Root Cause identified for crack – Ejector Speed High due to Catching developed in Mould at Rib Area**
  (Same Methodology was used for analysis as used for Warpage)
Customer rejection ppm reduced from 2016 to 0 on account of Warpage & Crack.
Inhouse Rejection reduced from 96056 PPM avg to 0. Per month to 0 PPM on account of CRACK & WARPAGE.
Productivity increased by 9.6 % (Man per unit per hour)
Spray Consumption Minimized & save Rs. 2170 per Year after polishing done
Direct cost saving \( \frac{1440\times12\times8.96}{100} \) Rs. 154829 (approx) Rs per Year on Account of Saving by Eliminate Warpage & Crack from Back cover YG8

**TANGIBLE BENEFITS**

- Most intractable problem resolved
- Horizontally Deployment done benefiting other Component
- Computer skill developed for making Presentation
- Knowledge of new tools & techniques
- Knowledge gain for all
- Team morale high to take up More challenges.

**INTANGIBLE BENEFITS**

- Lesson Learnt

  1. Cooling fixture should be there after molding to eliminate defect Warpage for material PPTF.
  2. Polishing frequency should be separately decided for each affected area or removal items.
  3. Process parameter optimization should be done during development.

**QC TOOLS & TECHNIQUES USED**

- Checksheet
- Pareto Diagram
- Process Flow
- Scatter Diagram
- Cause & Effect Diagram
- Graph

**THANK YOU**