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# EFFORTS TO REDUCE THE RISK OF DEFECTS OF MINICAB PRODUCTS TYPE MSM 2230 IN ASSEMBLING PROCESS WITH FAILURE MODE EFFECT AND ANALYSIS METHOD

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## ABSTRACT

PT. Indospring Tbk, is a spring producer company of two types, namely leaf springs and coil springs. Based on the results of the data obtained from the assembling process at PT. Indospring, Tbk that there are still high defects or product incompatibility, especially Minicab type MSM 2230 with 290 types of defects for 3 months (January 2021 - March 2021) with a percentage of 18.59%. The purpose of this research is to find out the types of Minicab MSM 2230 defects in the assembly line process, to find out the factors that cause defects problems, to provide benefits as knowledge and considerations to improve quality by correcting the causes of product defects. In finding the cause of product defects and their impact using the Failure Mode Effect and Analysis (FMEA) method. During the period from January to March 2021, before repairing the average defect, koba defects 17.33, scratch 20, eye forming defects 4.33, half span NG 15.33, eccentricity out spec 2, taper NG 11.66, pieces NG, 18 .66, EF gap narrowed 0.66, crack 6.66. Based on Failure Mode Effect Analysis, scratch has the highest Risk Priority Number value, which is 324 with a value of 9 on severity, 6 on occurrence and 6 on detection. The results of brainstorming factors that cause defect scratch, namely the product testing process is often dragged down due to speeding up the production flow, during the after tempering process the operator is wrong in the arrangement on the rack / pallet, and it can also be that the material from the supplier is already scratched. So that the highest defect will be the main priority for immediate repairs.

**Keywords: Defect, causes, FMEA**

## 1. INTRODUCTION

PT. Indospring, Tbk is an automotive company engaged in manufacturing Leaf spring products for automotive and industrial components. The types of products produced are various types of Leaf springs in the form of a set of leaf springs and in retail form per one Leaf with various models and specifications according to consumer demand and needs. PT. Indospring, Tbk requires that the quality of a product and timeliness in delivery are not only the responsibility of Quality Control but also of all employees in the company, all of which must be applied in a quality management system that is carried out with high commitment.To ensure product quality and reduce the number of defects produced in the production process at PT. Indospring, Tbk , the company will implement improvements to its production process, namely the shearing, heating, assembling processes, which produce many defective products every month. The following is product defect data in the Shearing, Heating and Assembling process for 3 months (January 2021 - March 2021) as follows:

**Table 1** Defect product data for Shearing, Heating and Assembling Processes for 3 months (January2021 – March 2021)

| Periode | Defect Product (*Shearing*) ( Pcs ) | Defect Product (*Heating*) ( Pcs ) | Defect Product (*Assembling*) ( Pcs ) |
|---|---|---|---|
| January | 29 | 28 | 172 |
| February | 31 | 30 | 183 |
| March | 31 | 16 | 199 |
| Total | 91 | 74 | 554 |

Source : PT. Indospring Tbk, 2021 ( Proses *Shearing, Heating & Assembling*)

From table 1.1, which contributed the most defects with 554 defects, namely in the assembly process.

Then the breakdown or discrepancy in the assembly process is returned, and the results are:

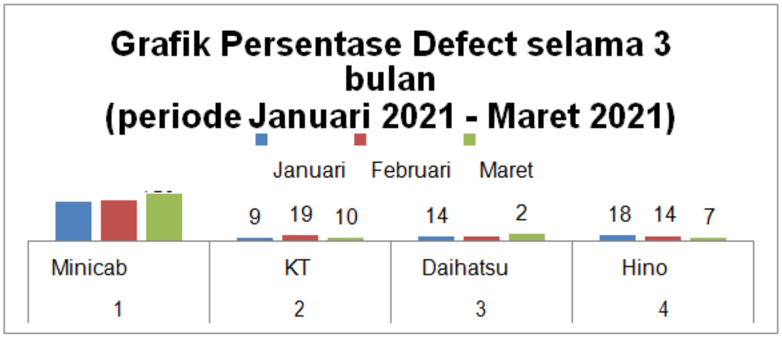
**Table 1** Data on non-conformance of Minicab type (MSM) products in the assembling process for 3 months (January 2021 – March 2021)

| Types of defects | *Type* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Minicab (MSM) ( Pcs ) | | | Krama Yudha Tiga Berlian (KTB) ( Pcs ) | | | Daihatsu (DH) ( Pcs ) | | | Hino (HN) ( Pcs ) | | |
| | Jan | Feb | Mar | Jan | Feb | Mar | Jan | Feb | Mar | Jan | Feb | Mar |
| Koba's Defect | 24 | 16 | 28 | 2 | 3 | 2 | 1 | 2 | 2 | 4 | 0 | 0 |
| Scratch | 26 | 31 | 19 | 0 | 0 | 2 | 2 | 2 | 6 | 3 | 2 | 2 |
| Eye Forming Defect | 8 | 7 | 7 | 1 | 3 | 2 | 0 | 1 | 2 | 2 | 1 | 0 |
| Half Span NG | 19 | 15 | 25 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 1 | 3 |
| Eccentricity Out Spec | 5 | 10 | 11 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 2 | 0 |
| NG tapers | 13 | 15 | 20 | 3 | 4 | 2 | 7 | 6 | 5 | 2 | 3 | 0 |
| NG cut | 23 | 32 | 32 | 0 | 2 | 1 | 1 | 2 | 3 | 0 | 0 | 1 |
| EF Gap Closes | 2 | 1 | 5 | 0 | 2 | 0 | 0 | 1 | 0 | 2 | 1 | 1 |
| Crack | 11 | 8 | 12 | 1 | 4 | 0 | 2 | 0 | 3 | 3 | 4 | 0 |
| Total | 131 | 135 | 159 | 9 | 19 | 10 | 14 | 15 | 23 | 18 | 14 | 7 |

| | | | | |
|---|---|---|---|---|
| Total per 3 bulan | 425 | 38 | 52 | 39 |

Source : PT. Indo*spring* Tbk, 2021 ( Process *Assembling*)

Table 1.2 describes the total defects that occurred in the assembly process for 425 pcs minicab (MSM) products, 38 pcs krama yudha three diamonds (KTB) products, 52 Daihatsu (DH) products, and 39 Hino (HN) products. . Based on the table, the following is a graph of the percentage of defects for 3 months in the assembly process:




Source : PT. Indo*spring* Tbk, 2021 ( Process *Assembling*)

**Figure 1** Graph of Product Non-conformance for 3 Months in the Assembling Process

From Figure 1.1, in particular, minicab products account for the most defects with 425 defects in the assembly process. Then the breakdown or mismatch of the Minicab type (MSM) is broken down in the assembly process, and the result is :

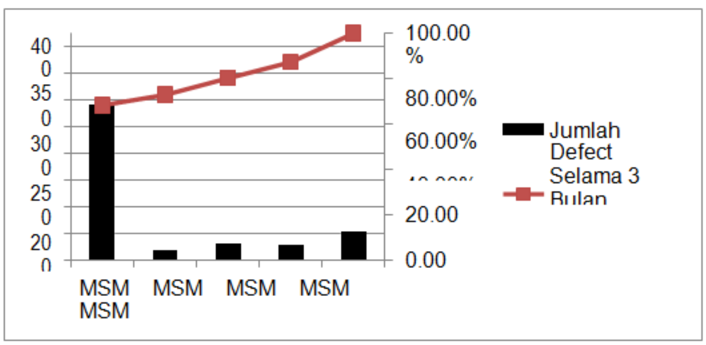



**Figure 2** Minicab Defect Graph Data January 2021 – March 2021 Based on Type in Assembling Process

From Figure 1.2, it can be seen that MSM 2230 occupies the highest defect data during January – March 2021 with 68.24% defects or product non-conformances in the assembly process. then it is broken down again based on the type of defect in table 1.3 along with the visual defect in table 1.3:

**Table 2** MSM 2230 Defect Data in the Assembling Process (January 2021 – March 2021)

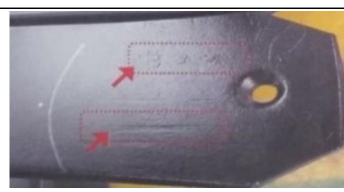
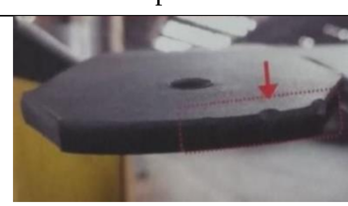
| No | Types of *defects* | January ( Pcs ) | February ( Pcs ) | March ( Pcs ) | Average |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | Koba's Defect | 19 | 11 | 22 | 17,33 |
| 2 | Scratch | 18 | 28 | 14 | 20 |
| 3 | Eye Forming Defect | 7 | 2 | 4 | 4,33 |
| 4 | Half Span NG | 14 | 14 | 18 | 15,33 |
| 5 | Eccentricity Out Spec | 2 | 0 | 4 | 2 |
| 6 | NG tapers | 8 | 10 | 17 | 11,66 |
| 7 | NG cut | 15 | 13 | 28 | 18,66 |
| 8 | EF Gap Closes | 0 | 0 | 2 | 0,66 |
| 9 | Crack | 6 | 5 | 9 | 6,66 |
| Total | | 89 | 83 | 118 | |
| Total for 3 months | | 290 | | | |

Source : PT. Indo*spring* Tbk, 2021 ( Process *Assembling*)

Based on table 1.3 defects that occur in the assembly process for minicab products (MSM) type 2230 accounted for defects of 290 pcs or 68.24% of the total minicab type defects, so improvements are focused on minicab products (MSM) type 2230, the following is evidence defects that occur in minicab (MSM) type 2230 products:

**Table 3** Figures of Types of MSM 2230 Defects in the Assembling Process (January 2021 – March 2021)

| Gambar jenis - jenis defect MSM 2230 | | |
|---|---|---|
| Cacat Koba | Scratch | Eye Forming cacat |
|  |  |  |
| Half Span NG | Eccentricity Out spec | Taper NG |
|  |  |  |
| Potongan NG | Gap EF Mepet | Crack |

Source : PT. Indo*spring* Tbk, 2021 ( Process *Assembling*)

The following is the data that has been obtained in the assembling process area, namely the data on the production of leaf springs
starting January 2021 – March 2021 are as follows:

**Table 4** Data on Total Assembling Production for 3 months (January 2021 – March 2021)

| Type | Amount ( Pcs ) | Month | | |
|---|---|---|---|---|
| MSM 2230 | 5.393 | January ( Pcs ) | February ( Pcs ) | March ( Pcs ) |
| | | 1.525 | 1.788 | 2.082 |

Source : PT. Indo*spring* Tbk, 2021 ( Process *Assembling*)

Based on table 1.5 the results of leaf spring production for minicab (MSM) 2230 products in January as many as 1525 pcs, February as many as 1788 pcs, and March as many as 2082 pcs with a total production of 5393 pcs. Meanwhile, the defects caused by process incompatibility for minicab (MSM) 2230 products are as follows:

**Table 5** Percentage of Number of Defects for 3 months (January 2021 – March 2021)

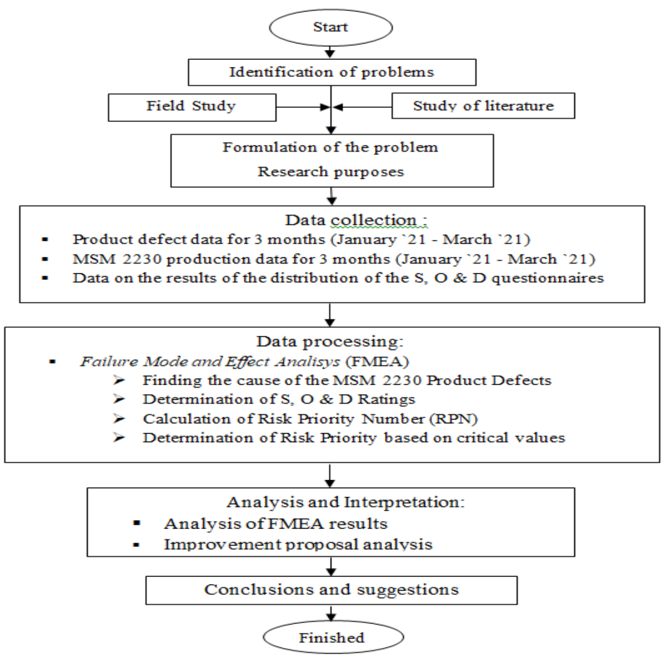
| Type | Total defect percentage | January | February | March | Target *Defect* |
|---|---|---|---|---|---|
| MSM 2230 | 18,59% | 17,13% | 21,54% | 17,64% | 10% |

Source : PT. Indo*spring* Tbk, 2021 ( Process *Assembling*)

Based on the results of the data obtained from the assembling process at PT. Indospring, Tbk that there are still high defects or non-conformance of products, especially Minicab type MSM 2230 with 290 types of defects for 3 months (January 2021 - March 2021) with a percentage of 18.59%. Therefore we need a suitable method to be used to reduce defects or process failures. If this is not done, it will have an impact on the company itself, if it produces product defects too often, it is certain that they will receive customer claims. If this happens continuously, it will have a very big impact and can harm PT. Indospring, Tbk itself.

To overcome the problem of the number of defects that occur in MSM 2230, first we must first find out what causes the defect, then look for the root of the problem and make suggestions for improvement. In finding the cause of product defects and their impact using the Failure Mode Effect and Analysis (FMEA) method. According to Stamatis (2015) citing Omdahl and ASQC, FMEA is a technique used to define, identify and reduce known and/or potential failures, problems, errors and so on of a system, design, process and/or service before reaching it. consumer. This method will be very useful for Knowing what causes are the most influential or most need to be considered for the causes of many defects in the Minicab type MSM 2230 product in the assembly process. So that the formulation of the problem is obtained how to identify defects or non-conformances of the minicab (MSM) type 2230 product in the assembling process, what are the factors causing the defect and suggestions for improvements made to reduce the number of defects. The purpose of this study is to identify the types of defects in the Minicab type MSM 2230 during the Assembling process, identify the root causes of the defects produced by MSM 2230 and provide suggestions for improvements based on the results of the analysis to reduce the number of defects produced by the Minicab type MSM 2230 in the Assembling process.

## 2. METHODS




This research methodology aims to facilitate the conduct of research so that the research conducted can be well structured. In order to obtain objective and scientific data in the preparation, certain methods or steps are needed that can be used as guidelines in investigating and discussing the problems at hand.

The object of this research is PT Indospring Tbk on the minicab (MSM) type 2230 product in the assembly process. The steps taken to obtain the proposed continuous improvement in this research begin with identifying problems, field studies, literature studies, problem formulation, determining research objectives, data collection, data processing, analysis and interpretation, as well as conclusions and suggestions.At the data collection stage, this was carried out for 3 months, namely January 2021 to

March 2021 in the assembly process, especially for minicab (MSM) type 2230 products, and weighted Severity, Occurance, and Detection by distributing questionnaires to production operators./ QC, production form / QC, production staff / QC. Meanwhile, at the data processing stage, processing is carried out based on the FMEA method to find the cause of the occurrence of Minicab (MSM) type 2230 product defects by determining the S, O, D rating and calculating the Risk Priority Number to determine the priority scale for repairs

## 3. DISCUSSION

FMEA is a structured procedure to identify as many failure modes as possible. FMEA is used to analyze the reliability of a system and the causes of its failure to achieve the reliability and security requirements of systems, designs and processes by providing basic information about system reliability predictions, designs, and processes.

Effect, Cause and Control for each failure mode and the value of severity, occurrence and detection which the final result is an RPN (Risk Priority Number) for each failure mode obtained from a brainstorming questionnaire to 4 respondents who are experienced in the process (expert judgment) by consensus system. In which the brainstorming process is carried out with the QC shift leader, QC operator, production operator, and production foreman, the scale used for filling the RPN questionnaire on Severity, Occurance, and detection is as follows:

**Table 7** Criteria for Ranking Severity (severity)

| Rank | Criteria |
|---|---|
| 1 | Negligible severity. We do not need to think that this result will have an impact on product performance. End users may not notice this flaw |
| 2<br>3 | Mild severity (mild adverse effects). The consequences are only mild. End users will not notice any performance changes.<br>Repairs can be done during regular maintenance. |
| 4<br>5<br>6 | Moderate severity (moderate adverse effect). End users will feel a decrease in performance, but still within tolerance limits.<br>Repairs are inexpensive and can be completed in no time. |
| 7<br>8 | High severity (high bad influence). Users will feel the bad consequences that will be received, are beyond the limits of tolerance.<br>Repairs are very expensive. |

| | |
|---|---|
| 9<br><br>10 | Potential safety problems. The consequences are very dangerous and affect the safety of users.<br>Against the law. |

Sourch : (Gasperz, 2002)

**Table 8** Occurance Rating Criteria (severity)

| Degree | Berdasarkan pada frekuensi kejadian | Rating |
|---|---|---|
| Remote | 0,01 per 1000 item | 1 |
| Low | 0,1 per 1000 item | 2 |
| | 0,5 per 1000 item | 3 |
| Moderate | 1 per 1000 item | 4 |
| | 2 per 1000 item | 5 |
| | 5 per 1000 item | 6 |
| High | 10 per 1000 item | 7 |
| | 20 per 1000 item | 8 |
| Very High | 50 per 1000 item | 9 |
| | 100 per 1000 item | 10 |

Sourch : (Gasperz, 2002)

**Table 9** Criteria for Rating Detection

| Rank | Criteria | Based on the frequency of occurrence |
|---|---|---|
| 1 | This method of prevention is very effective. There is no chance that the cause appears | 0,01 per 1000 item |
| 2 | | 0,1 per 1000 item |
| 3 | The probability of this happening is very low | 0,5 per 1000 item |
| 4<br>5<br>6 | Possible causes for this to occur are moderate. Prevention method sometimes allow that cause to occur | 1 per 1000 item<br>2 per 1000 item<br>5 per 1000 item |

| | | |
|---|---|---|
| 7<br><br>8 | The probability of this happening is still high. Ineffective prevention methods, causes still repeating itself. | 10 per 1000 item<br>20 per 1000 item |
| 9<br>10 | The probability of this happening is very high. Prevention methods are not effective, the cause is always repeated. | 50 per 1000 item<br>100 per 1000 item |

Sourch : (Gasperz, 2002)

To determine the priority of a form of failure, you must first define Severity, Occurrance, Detection which the final result is an RPN (Risk Priority Number). Calculation of RPN (Risk Priority Number) from FMEA results:

**RPN = S x O x D**

Description :

RPN = *Risk Priority Number*

S = *Severity*

O = *Occurance*

D = *Detection*

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The Risk Priority Number (RPN) is a measure used when assessing risk to help identify "critical failure modes" related to a design or process. RPN values range from 1 (absolute best) to 1000 (absolute worst). The FMEA RPN is commonly used in industry and is somewhat similar to the criticality number used. The following is the result of the RPN value for the MSM type 2230 minicab engine.

**Table 10** Value of Severity, Occurence and Detection

| Process Description | Failure Mode | Failure Effect | S | Cause of Failure | O | Control | D |
|---|---|---|---|---|---|---|---|
| MSM 2230 . production process | Koba Defect (Defect on the side of the material) | • Product entered quarantine / NG<br>• Grinding repair process<br>• Reprocessed from ssp to final painting | 7 | • In the Setting process there is a hammer so that the product is more aligned (hard hammer structure)<br>• During the cambering process the leaf spring hits the die | 6 | • Inspection before processing<br>• Visual inspection after processing (which can cause cobalt defects) is good or not<br>• Coordination between operators and QC is more emphasized<br>• Instruct the operator to be more careful | 6 |
| | Scratch (Striped material) | • Product entered quarantine / NG<br>• Grinding repair process<br>• Reprocessed from ssp to final painting<br>• Leaf spring has the potential to break | 9 | • In the product testing process is often dragged<br>• During the after tempering process, the leaf spring is scratched during arrangement on the rack / pallet<br>• The material from the | 6 | • Inspection before processing<br>• Visual inspection after processing (which can cause scratch) is good or not<br>• Checks on incoming and assembling must be | 6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | supplier has been scratched | | tightened | |
| | Defective Eye Forming | • Product entered quarantine / NG<br>• The building repair process<br>• Reprocessed from tempering to final painting | 7 | • Installing too much pressure bushing<br>• The base of the bushing machine has a lump of iron material / gram<br>• During the tempering process, the leaf spring hit the conveyor<br>• Production operators do not see the visual good or not | 4 | • Inspection before processing<br>• Visual inspection after processing (which can cause defective E.F) is good or not<br>• Coordination between operators and QC is more emphasized<br>• Anvil and engine cleaning so that no gram remains after processing | 3 |
| | Half Span NG (Wrong side lengths A and B) | • Cannot be installed on the unit | 8 | • The eye forming process is not perfect<br>• The operator made a mistake during the setup process<br>• The stoper in the process of making the canter hole is loose / shifted<br>• Operator does not see the standard | 5 | • Visual check of eye forming diameter<br>• Initial initials must be good and standard<br>• Operators verify/check regularly | 6 |
| | Eccentricity Out spec (The center hole is not in the middle) | • Product entered quarantine / NG<br>• Reprocessed from shearing to final painting | 7 | • The stoper in the process of making the canter hole is loose / shifted | 2 | • Initial initial checks must be good and standard<br>• Operators verify/check regularly | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | • Width of the assy exceeds the standard<br>• Leaf spring cannot be assembled/assembled | | | | • More emphasis on operator settings to be more thorough | |
| | Taper NG (The flattened end has a defect) | • Product entered quarantine<br>• Grinding repair process<br>• Reprocessed from primary painting / base paint to final painting / paint finish | 5 | • When the cambering process collides with die material,<br>• During the tempering process the material hit the conveyor<br>• During the taper manufacturing process, the stopper has iron impurities/defective stopper<br>• Production operators do not see the visual good or not | 5 | • Inspection before processing<br>• Visual inspection after processing (which can cause Taper NG) is good or not<br>• Coordination between operators and QC is more emphasized<br>• Instruct the operator to be more careful | 6 |
| | NG Cut (Material not cut perfectly) | • Product entered quarantine / NG<br>• Reprocessed from shearing to final painting | 8 | • Wrong set up stopper in cutting process<br>• Wrong view of standard / reference<br>• Operator does not re-check | 6 | • Initial initials must be good and standard<br>• Operators verify/check regularly<br>• More emphasis on operators and QC assembling to be more | 6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | thorough | |
| | EF Gap Closes | • Product entered quarantine / NG<br>• NG . span length<br>• Eye forming tight<br>• Cannot be installed on the unit<br>• Reprocessed from shearing to final painting | 8 | • Eye forming does not go through the reaming process<br>• Wrong stopper size<br>• Wrong view of standard<br>• Operator does not re-check | 1 | • Inspection before processing<br>• Visual inspection after processing is good or not<br>• Initial initials must be good and standard<br>• Operators verify/check regularly<br>• More emphasis on operators and QC assembling to be more thorough | 2 |
| | Crack (Torn material surface) | • Product entered quarantine / NG<br>• Grinding repair process<br>• Reprocessed from ssp to final painting | 7 | • In the product testing process is often dragged<br>• SSP engine amperage is too big<br>• The material from the supplier is cracked | 4 | • Inspection before processing<br>• Visual inspection after processing (which can cause cracks) is good or not<br>• Checks on incoming and assembling must be tightened | 2 |

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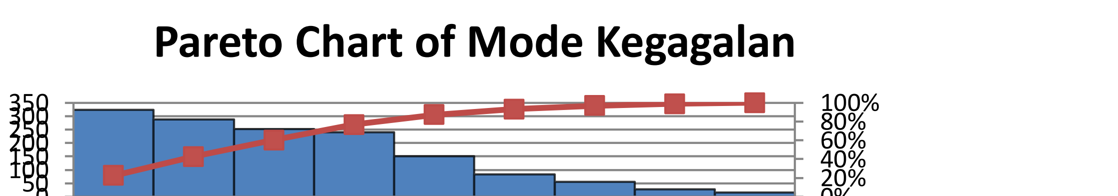
Table 10 is the FMEA weighting based on the Severity, Occurance, and Detection values performed by the shift leader QC, QC operators, production operators, and production foreman. Next is the RPN calculation, the following is the RPN value:

**Table 11** Value of Risk Priority Number (RPN)

| No. | *Failure Mode* | S | O | D | RPN | *Failure Mode from Highest to Lowest RPN* | RPN |
|---|---|---|---|---|---|---|---|
| 1 | Koba's Defect | 7 | 6 | 6 | 252 | Scratch | 324 |
| 2 | Scratch | 9 | 6 | 6 | 324 | NG cut | 288 |
| 3 | Eye Forming Defect | 7 | 4 | 3 | 84 | Koba's Defect | 252 |
| 4 | Half Span NG | 8 | 5 | 6 | 240 | Half Span NG | 240 |
| 5 | Eccentricity Out Spec | 7 | 2 | 2 | 28 | NG tapers | 150 |
| 6 | NG tapers | 5 | 5 | 6 | 150 | Eye Forming Defect | 84 |
| 7 | NG cut | 8 | 6 | 6 | 288 | Crack | 56 |
| 8 | EF Gap Closes | 8 | 1 | 2 | 16 | Eccentricity Out Spec | 28 |
| 9 | Crack | 7 | 4 | 2 | 56 | EF Gap Closes | 16 |

Based on the results of the calculation of the RPN value for the minican machine (MSM) type 2230 contained in table 11, it can be seen that the priority of repair is based on the RPN value that has the highest to the lowest value, namely Scratch, NG Cut, Koba Defect, Half Span NG, Taper NG, Eye Forming defects. , Crack, Eccentricity Out Spec, and Gap EF Mepet. Then the following is a Pareto diagram based on the results of the RPN value :




| | Scratch | Potongan NG | Cacat Koba | Half Span NG | Taper NG | Eye Forming Cacat | Crack | Eccentricity Out Spec | Gap EF Mepet |
|---|---|---|---|---|---|---|---|---|---|
| RPN | 324 | 288 | 252 | 240 | 150 | 84 | 56 | 28 | 16 |
| % KUMULATIF | 23% | 43% | 60% | 77% | 87% | 93% | 97% | 99% | 100% |

**Figure 3** Pareto Diagram of MSM 2230 Products Based on RPN.

Based on the Pareto diagram in Figure 3, it can be seen that the critical failure modes include scratch with an RPN value of 324, NG pieces with an RPN value of 288 and a koba defect failure mode with an RPN value of 252.

1. Scratch failure mode

The Scratch failure mode in the MSM 2230 production process was caused by the product testing process being dragged frequently due to speeding up the production flow, during the after tempering process the operator was wrong in the arrangement on the rack / pallet, and it could also be that the material from the supplier was already scratched.

2. NG cut failure mode

The failure mode of NG cut in the MSM 2230 production process was caused by incorrectly setting up the stopper in the matrial cutting process, errors in viewing the standard / reference length of cut, and the operator not re-checking the initials that have been set.

3. Coba-defect failure mode

The failure mode for the cobalt defects in the MSM 2230 production process was caused by the process of setting the product hammering so that the sides of the cobalt could be aligned, and when the cambering leaf spring collided with the dies.

Furthermore, from the 3 critical failure modes, an evaluation of corrective actions is carried out to prevent defects that will occur in the future, the following is an evaluation of corrective actions based on 5W 1 H:

**Table 12**. Evaluation of corrective actions

| No. | *What ( What mode the failure that most critical)* | *Why (Why should it be fixed)* | *where (Where to fix)* | *Who (Who should fix))* | *When (When to di repair )* | *How (How to Suggestion for improvement)* |
|---|---|---|---|---|---|---|
| | Shearing Department | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | Scratch (Striped material) | To maintain product quality and reduce product defects | In the incoming | Production operators, supervisors and QC | Every next month's production process | • Provide understanding to workers or operators about the importance of carrying out standard operating procedures.<br>• More emphasis is placed on incoming QC so that initial checking is more stringent so that it does not pass through the process production. |
| | Heating Department | | | | | |
| | *Scratch (Striped material)* | To maintain product quality and reduce product defects | In the setting after tempering | Production operators, supervisors and QC | Every next month's production process | Provide training on the method when setting up after tempering so that the leaf spring is lifted and not pushed. |
| | Assembling Department | | | | | |
| | *Scratch (Striped material)* | To maintain product quality and reduce product defects | In the testing section | Production operators, supervisors and QC | Every next month's production process | Provided training or briefing before starting work, especially for workers in the testing section so as not to drag the leaf spring when the conveyor is loose so as not to cause a scratch. |
| 2 | *Shearing* Department | | | | | |
| | NG cut (Material not cut perfectly) | To maintain product quality and reduce product defects | On the cutting machine | Production operators, supervisors and QC | Every next month's production process | • Provided training or briefing before starting work, especially for workers in the cutting section to be more precise at the time of initial set up.<br>• Conduct periodic check intervals on products that are generated. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | Heating Department | | | | | |
| | Koba Defect (Defect on the side of the material) | To maintain product quality and reduce product defects | In the cambering section | Production operators, supervisors and QC | Every next month's production process | • Provided training or briefing before starting work, especially for workers in the setting section so that they are more careful during the leaf spring hammering process so as not to cause defects.<br>• Especially for operators in the cambering section to be careful when inserting leaf springs into the press quencing / press roll so they don't hit dies. |
| | Departemen Assembling | | | | | |
| | Koba Defect (Defect on the side of the material) | To maintain product quality and reduce product defects | In the settings | Production operators, supervisors and QC | Every next month's production process | • Provided training or briefing before starting work, especially for workers in the setting section so that they are more careful during the leaf spring hammering process so as not to cause defects.<br>• Use a hammer whose structure is softer than the leaf spring. |

## 4. CONCLUSION

**From the results of research using the FMEA method, it can be concluded as follows:**

1. Based on FMEA analysis, the most critical failure modes are scratch with a severity value of 9, occurrence value 6, detection value 6 and RPN value 324. NG pieces with severity value 8, occurrence value, detection value 6 and RPN value 288. And Koba defects with a severity value of 7, an occurrence value of 6, a detection value of 6 and an RPN value of 252.

2. Based on the highest RPN value, the scratch failure mode is known to cause product failure, namely in the product testing process it is often dragged, during the after tempering process the leaf spring is scratched during arrangement on the rack / pallet, the material from the supplier has scratched. It is known that the failure mode of NG Cuts is the cause of the failure of the product, which is the wrong set-up stopper in the cutting process, the operator sees the standard / reference incorrectly, the operator does not re-check. The failure mode of the cobalt defect is known to be the cause of the product's failure is the hard hammer structure so that the timidity in the setting process so that the product is more aligned has the potential to cause cobalt defects, when the cambering leaf spring collides with the die.

3. Suggestions for improvement for the scratch failure mode are as follows providing understanding to workers or operators about the importance of carrying out standard operating work procedures, being given training or briefing before starting work, especially for workers in the testing section so as not to drag the leaf spring when the conveyor is loose so as not to cause scratch, when setting up after tempering so that the leaf springs are lifted and not pushed, and more emphasis is placed on incoming QC so that initial checks are tightened so that they do not pass through the production process. Suggestions for improvement to reduce the failure mode of NG pieces are as follows to provide understanding to workers or operators about the importance of carrying out standard operating procedures related to the operation or set-up of a cutting machine stopper, Provided training or briefing before starting work, especially for workers in the cutting section to be more precise at the time of initial set up and perform periodic check intervals on the resulting product. Suggestions for improvement to reduce the Koba defect failure mode are as follows to provide understanding to workers or operators about the importance of carrying out standard operating work procedures, Provide training or briefings before starting work, especially for workers in the setting section to be more careful during the leaf spring hammering process so that does not cause defects, using a hammer whose structure is softer than the leaf spring, especially for operators in the cambering section to be careful when inserting the leaf spring into the press quencing / press roll so as not to hit the dies.

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