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Improving the Quality of Bleeder Parts With QC Seven Tools and Kaizen at PT Hitachi Astemo Bekasi Brake Systems

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A B S T R A C T

PT Hitachi Astemo Bekasi Brake Systems Indonesia, an automotive manufacturing company which is the main vendor of PT Astra Honda Motor, has experienced an increase in the number of rejected part bleeders in its production process. Data shows a significant increase in the number of rejects over the last 3 months, reaching 13% of total production, with a time loss impact of around 2.6 days in 3 months. The research results show that after making improvements using the QC Seven Tools method and the Kaizen approach, the company succeeded in reducing the reject rate on part bleeders significantly. The rejection rate, which previously averaged 4.4%, equivalent to 1,308 pcs per month, was successfully reduced to only 0.01%, equivalent to 4 pcs per month. This shows the effectiveness of applying these methods in improving product quality and production process efficiency. This research makes an important contribution to companies in identifying and overcoming product quality problems effectively, as well as strengthening competition in the automotive market.

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INTRODUCTION

Globalization drives rapid industrial growth and tightens competition between companies. To remain relevant and competitive, companies must produce high-quality products. This challenge is complicated by the influx of imported goods that compete on price due to free trade, so companies need to take serious steps to respond to this competition [1]. Controlling product quality is one way to maintain a company's competitiveness. Good quality not only meets customer expectations, but also reduces defective or rejected products, and even reaches zero defect standards, which is very important in business competition [2]. Applying Kaizen at all stages of production helps produce high-quality products and reduces production costs by reducing the number of damaged or unsaleable goods (NG - Not Good) [3]. PT Hitachi Astemo Bekasi Brake Systems, as an automotive manufacturer and the main vendor of PT Astra Honda Motor, has faced an increase in rejects on bleeder parts in the last three months, with total rejects reaching 3,923 pcs and a damage percentage of 13.1%, which causes significant losses. This research aims to apply the QC Seven Tools and Kaizen methods to reduce rejects on part bleeders and improve product quality. It is hoped that the results of this research can reduce losses and increase the company's competitiveness in the automotive market. The following is Figure 1. related to the breeder part.

Figure 1. Part Bleeder

Previous research relevant to this research is regarding defect analysis in PLG part production. This research uses the Seven Tools and Kaizen methods. The author of evaluated problems such as Deep dropping, Double Trid Threads, and Broken Drills. The proposed solution includes adjusting SOPs, evaluating work systems, and procuring additional tools.

Research on defects in the 4L45W 21.5 MY product by the author discusses using the Seven Tools and Kaizen methods. Identified defects include hadare, and nickel. Author I proposes improvements through regular provision and training for employees, adjustments to SOPs related to work and machine maintenance, and redesigning work areas to create a safe and comfortable work environment.

Crude Palm Oil (CPO) research by the author highlights the factors that cause low quality, such as free fatty acid levels, water content, and impurity levels. The author used the Seven Tools and Kaizen methods to improve the quality of CPO on an oil palm plantation in West Sumatra. The proposed solutions include increasing operator accuracy in regulating machine temperature, maintaining a clean work environment, and increasing accuracy in the fruit harvesting and separation processes.

Defects in Azhari Baked Bread products, research by the author discusses using the Seven Tools and Kaizen methods. The main factors for defects include workers kneading the dough less evenly, negligence in lifting cooked bread, and environmental influences such as cold weather which inhibits the fermentation process. Proposed improvements include creating SOPs and changing the factory layout. The author's suggestions include monitoring the production process regularly to minimize product defects.

Other research regarding defects in Eq Spacing products by the author discusses using the Seven Tools and Kaizen methods. Research identified two main types of defects: rat tail defects and misflow defects. Causative factors include human problems (fatigue, lack of direction, lack of understanding), methods (lack of supervision, processes not following SOPs), and materials (bad raw materials from recycling rejected materials). Proposed improvements include increasing supervision of workers, directing SOPs, especially on material processes, and employee training. The improvements made focus on increasing supervision of the material mixing process (raw materials).

After conducting a literature review from previous research, this research notes the significant efforts of PT Hitachi Astemo Bekasi Brake Systems in handling the increasing number of rejects on part bleeders by applying the QC Seven Tools method and the Kaizen approach.

LITERATURE REVIEW

Defects in Azhari Baked Bread products, research by the author discusses using the Seven Tools and Kaizen methods. The main factors for defects include workers kneading the dough less evenly, negligence in lifting cooked bread, and environmental influences such as cold weather which inhibits the fermentation process. Proposed improvements include creating SOPs and changing the factory layout. The author's suggestions include monitoring the production process regularly to minimize product defects.

METHODOLOGY

This research was carried out using various systematic work steps to obtain optimal results. Research work steps are a series of procedures and steps in conducting research that are structured in a systematic and directed manner so that the objectives of the research can be achieved well. The steps used in this research are seen in Figure 2. Research flow chart:

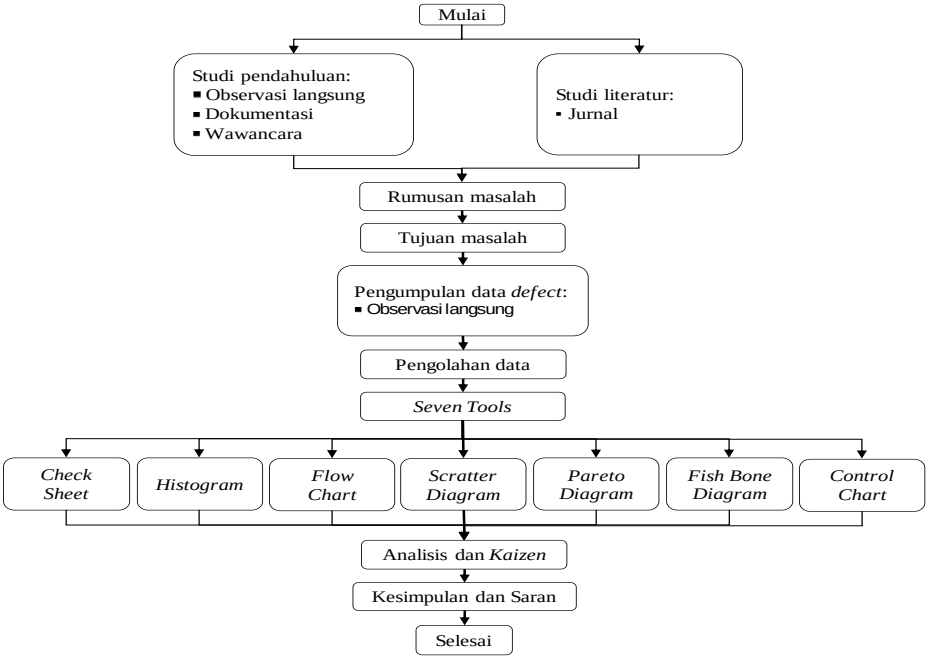

Figure 2. Flow Chart Research

The explanation of the research flow chart in Figure 2 is as follows:

Literature Study

The research began by collecting information from research journals about quality improvement using QC7 Tools and Kaizen. The focus is on quality improvement methodology in the automotive sector to build a solid theoretical foundation and identify best practices relevant to PT Hitachi Astemo Bekasi Brake Systems.

Field Study

Field research was carried out through interviews, observation, and documentation at PT Hitachi Astemo Bekasi Brake Systems. The goal is to understand the application of theory in practice, identify specific problems in the part bleeder assembly process, and obtain data directly from the production line.

Problem Formulation

After literature and field studies, the main problems in the part bleeder assembly process were formulated. Identifying the causes of rejected and scrapped parts will guide research focus, ensuring research objectives are achieved.

Goal Determination

This research aims to identify types of rejects in part bleeders and propose improvement steps using QC7 Tools and Kaizen. Another goal is to increase the efficiency and quality of the assembly process and reduce scrap and reject levels.

Data Collection

Relevant data, such as scrap quantities, job descriptions, production procedures, and types of defects in bleeder parts, were collected from production records and quality inspection reports. Interviews with operators and production managers were also conducted to obtain additional information.

Data Processing

The data collected is processed using QC7 tools, such as Pareto diagrams and fishbone diagrams, to identify the types and main causes of product defects. This processing helps in making decisions regarding improvements that need to be made.

Analysis and Kaizen

The results of data processing are analyzed and Kaizen principles are applied for continuous improvement. Improvement solutions are developed and implemented through collaboration between research teams and production management, with regular evaluations to monitor their effectiveness.

Conclusion and Suggestions

The conclusion of the study summarizes the main findings, including the type of defect and the effectiveness of the repair solution. Suggestions are given for the development of the part bleeder assembly process at PT Hitachi Astemo Bekasi Brake Systems, including additional training, modification of work procedures, and investment in technology to improve quality and production efficiency.

RESULTS

Histogram (After Repair)

After making improvements to the part bleeder assembly process, we have recorded data related to rejects on the part bleeder. The histogram in Figure 3 shows that there is a significant increase in product quality. With the revision of work instructions and training provided to operators, it has succeeded in reducing the number of rejects on part bleeders. This reflects the effectiveness of the steps taken in improving the process.

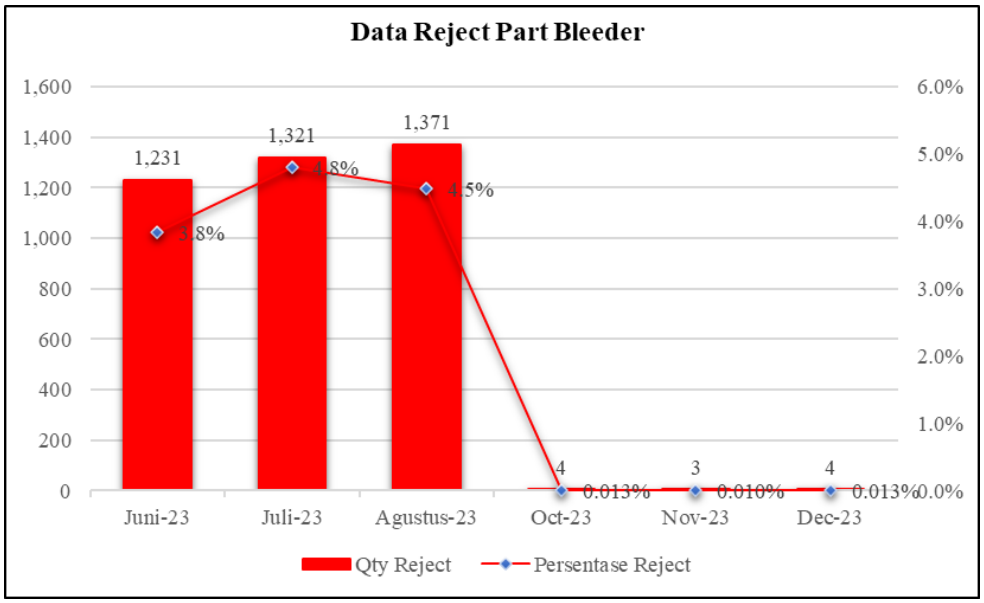

Figure 3. Bleeder Part Data After Repair

The latest data shows that the reject rate on part bleeders has decreased significantly since the implementation of improvements from an average of 4.4%, equivalent to 1,308 pcs per month, successfully reduced to only 0.01%, equivalent to 4 pcs per month. This reduction not only reduces losses resulting from the production of non-compliant bleeder parts, but also has the potential to lead to cost savings and overall productivity improvements.

DISCUSSION

In this research, the data collected starts from data on the number of rejected products and the percentage of rejected products. The data is then processed using the Seven Tools and Kaizen 5W+1H methods. The following are the results of data processing:

Data Collection Sheet (Check Sheet)

The data collection sheet (Check Sheet), is for grouping existing data in data processing, so that it can be useful to facilitate the data collection and analysis process. The following is Table 4.1 Data on the number of production and rejected bleeder parts for the period June – August 2023 at PT Hitachi Astemo Bekasi Brake Systems:

Table 1. Data on the Number of Production and Rejected Bleeder Parts for the Period June - August 2023

Tanggal	Jumlah Produksi	Jumlah *reject*	Penyebab *reject*		
			Prosess Asembly	Jatuh	*Part* NG
1 Juni 23	1,500	78	68	10	0
2 Juni 23	1,500	83	72	9	2
5 Juni 23	1,500	79	64	11	4
6 Juni 23	1,500	64	53	6	5
7 Juni 23	1,500	69	60	7	2
8 Juni 23	1,500	99	88	8	3
9 Juni 23	1,500	76	63	9	4
12 Juni 23	1,500	60	53	2	5
13 Juni 23	1,500	77	64	6	7
14 Juni 23	1,500	51	41	8	2
15 Juni 23	1,500	65	52	9	4
16 Juni 23	1,500	43	33	5	5
19 Juni 23	1,500	50	46	2	2
20 Juni 23	1,500	59	52	5	2
21 Juni 23	1,500	63	46	11	6
22 Juni 23	1,500	54	36	15	3
23 Juni 23	1,500	70	63	5	2
26 Juni 23	1,500	63	44	13	6
27 Juni 23	1,500	93	78	11	4
28 Juni 23	1,500	94	78	14	2
29 Juni 23	1,500	37	34	1	2
30 Juni 23	500	55	43	11	1
Total	32,000	1,482	1,231	178	73

Tanggal	Jumlah Produksi	Jumlah *reject*	Penyebab *reject*		
			Prosess Asembly	Jatuh	Part NG
3 Juli 23	1,500	77	72	5	0
4 Juli 23	1,500	90	82	6	2
5 Juli 23	1,500	81	77	2	2
6 Juli 23	1,500	70	63	6	1
7 Juli 23	1,500	85	83	2	0
10 Juli 23	1,500	79	75	3	1
11 Juli 23	1,500	71	66	5	0
12 Juli 23	1,500	90	83	6	1
13 Juli 23	1,500	101	93	4	4
14 Juli 23	1,500	94	86	3	5
18 Juli 23	1,500	86	79	7	0
19 Juli 23	1,500	102	93	3	6
20 Juli 23	1,500	56	46	7	3
21 Juli 23	1,500	55	52	3	0
24 Juli 23	1,500	56	46	8	2
25 Juli 23	1,500	44	40	3	1
26 Juli 23	1,500	66	63	2	1
27 Juli 23	1,500	48	44	3	1
28 Juli 23	500	82	78	4	0
Total	27,500	1,433	1,321	82	30

Tanggal	Jumlah Produksi	Jumlah *reject*	Penyebab *reject*		
			Prosess Asembly	Jatuh	Part NG
1 Agustus 23	1,500	79	77	2	0
2 Agustus 23	1,500	70	67	3	0
3 Agustus 23	1,500	70	68	0	2
6 Agustus 23	1,500	77	73	4	0
7 Agustus 23	1,500	66	61	5	0
8 Agustus 23	1,500	91	82	6	3
9 Agustus 23	1,500	70	63	7	0
10 Agustus 23	1,500	55	53	0	2
13 Agustus 23	1,500	65	62	3	0
14 Agustus 23	1,500	75	66	5	4
15 Agustus 23	1,500	84	77	7	0
16 Agustus 23	1,500	67	67	0	0
21 Agustus 23	1,500	69	66	3	0
22 Agustus 23	1,500	65	62	3	0
23 Agustus 23	1,500	47	42	0	5
24 Agustus 23	1,500	74	63	5	6
25 Agustus 23	1,500	64	55	6	3
28 Agustus 23	1,500	86	78	8	0
29 Agustus 23	1,500	85	78	4	3
30 Agustus 23	1,500	72	67	0	5
31 Agustus 23	500	47	44	3	0
Total	30,500	1,478	1,371	74	33

Tanggal	Jumblah Produksi	Jumlah *reject*	Penyebab *reject*		
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24 Agustus 23	1,500	74	63	5	6
25 Agustus 23	1,500	64	55	6	3
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30 Agustus 23	1,500	72	67	0	5
31 Agustus 23	500	47	44	3	0
Total	30,500	1,478	1,371	74	33

Based on Table 1. Data on the number of bleeder part production and rejects for the period June - August 2023, the cause of bleeder part rejects caused by the assembly process was 3,923 pcs, the cause of rejects was due to falling parts as many as 334 pcs and the cause of rejects was due to NG parts as many as 136 pcs.

Reject Product Histogram Results

A histogram is a tool like a bar graph that aims to show frequency distribution. The following is Figure 3. Reject percentage data:

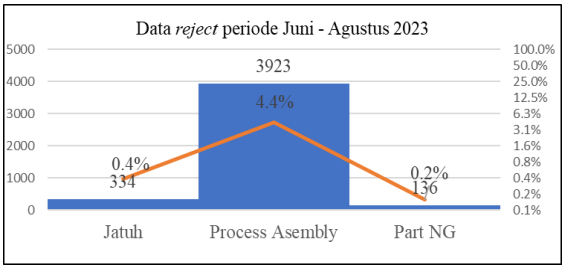


Figure 4. Reject Percentage Data

Based on Figure 4. Data on the percentage of rejects, the largest number of rejections is Process Assembly, amounting to 3,923 pcs, equivalent to 4.4% of total production.

Pareto Diagram

The Pareto Diagram aims to determine the most dominant defects in the bleeder part at PT Hitachi Astemo Bekasi Brake Systems. The following is Table 2. Data on the Percentage of Number of Defects in Bleeder parts and Figure 4. Pareto reject part bleeder diagram:

Table 2. Percentage Data on Number of Defects in Bleeder Parts

No.	Jenis NG	Qty	Persentase Kumulatif
1	Process Asembly	2063	33%
2	Jatuh	1479	80%
3	Part NG	71	100%

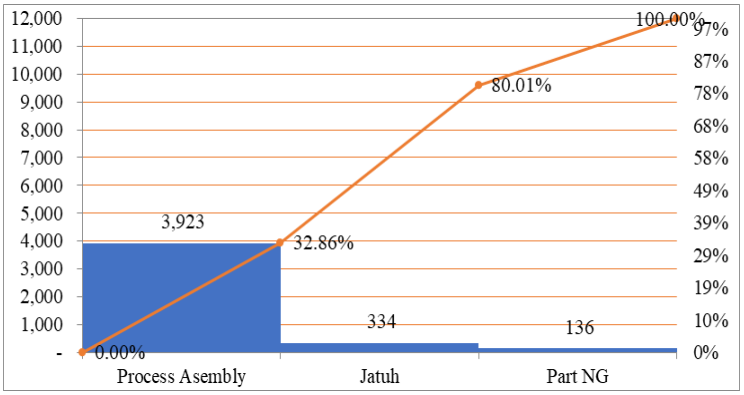


Figure 5. Pareto Reject Part Bleeder Diagram

Based on the data contained in Table 3 and Figure 4, it can be concluded that the type of reject that occurs most frequently is reject caused by the assembly process, with a total of 3,923 pcs. Followed by 334 rejects due to falling parts, and 136 rejects due to NG parts. The type of reject caused by the assembly process has the largest percentage, reaching 32.86% of the total number of rejections.

Scatter Diagrams

Scratter Diagrams are used to see the extent of the correlation between total production and the number of rejects. The following is Figure 5. Scratter diagram of the number of rejects and the number of production:

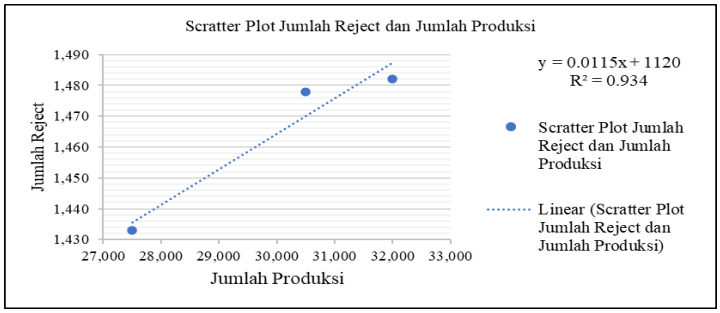


Figure 6. Scratter Diagram of Number of Rejects and Number of Production

Based on Figure 6. Scratter diagram of the number of rejects and the amount of production, it can be concluded that the Scatter diagram shows a positive relationship, or positive correlation, between the number of factors causing rejects and the level of rejects that occur. This means that the higher the number of factors causing rejection, the higher the possibility of the rejection rate.

Control Chart

By knowing the conditions of the production process from the amount of product deviation data, the non-conformity of the bleeder part product can be calculated. Control Chart is used to determine whether the resulting bleeder reject part is still within the required limits. The following is Figure 6. Control Chart for part bleeder:

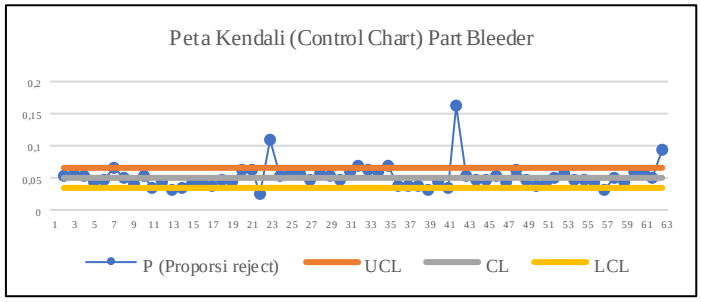


Figure 7. Control Chart for Part Bleeder

Based on Figure 7. Part bleeder Control Chart, significant anomalies were found in six sample points that exceeded the upper control limit (UCL) and five sample points that were below the lower control limit (LCL). This phenomenon indicates the potential for significant changes or deviations in the process or system being observed.

Flowchart

A flowchart is a visual tool used to represent the sequence of steps in a process. Flowcharts are used for planning and monitoring processes to ensure that steps are implemented correctly and according to plan. The following is Figure 7. Bleeder assembly flowchart:

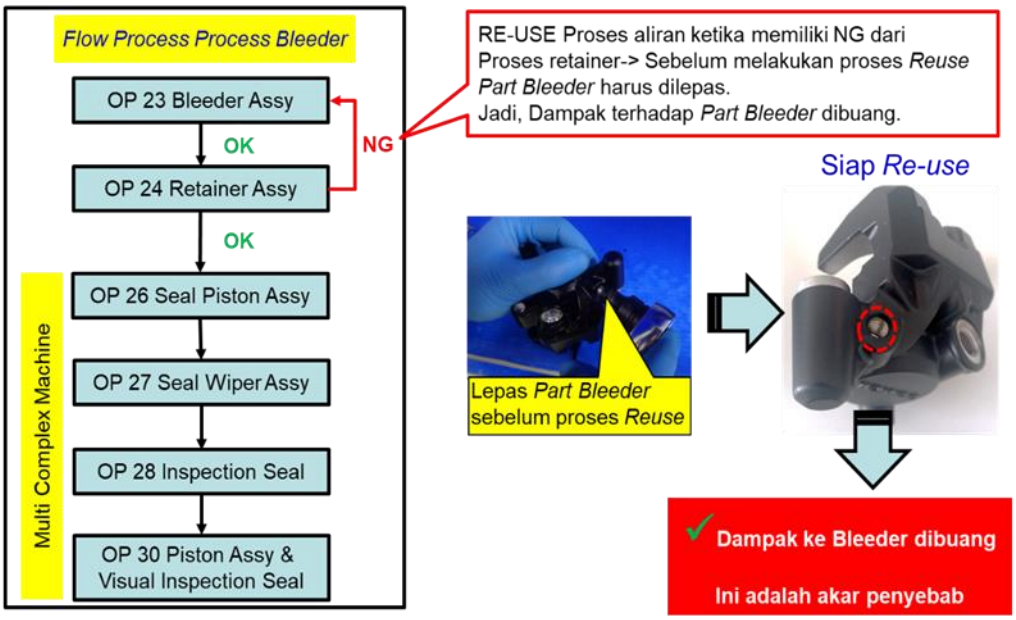


Figure 8. Flowchart Bleeder Assembly

Based on the condition of Figure 8. Flowchart of the bleeder assembly currently in the part bleeder assembly process, there is a conclusion that when a non-conforming part (NG) occurs in the OP 24 Retainer Assembly process, the step that must be taken before carrying out the repair process is to remove the bleeder part and direct it to be rejected.

Fishbone Diagram

The cause and effect diagram (fishbone diagram) is used to analyze defect factors in bleeder parts. From the results of interviews and field observations, it was found that several factors contributed to the rejection of part bleeders. By investigating the production process in the part bleeder assembly process, it was found that the factors that caused the part bleeder to be rejected during the production process. The following is Figure 9. fishbone diagram of part bleeder in the assembly process:

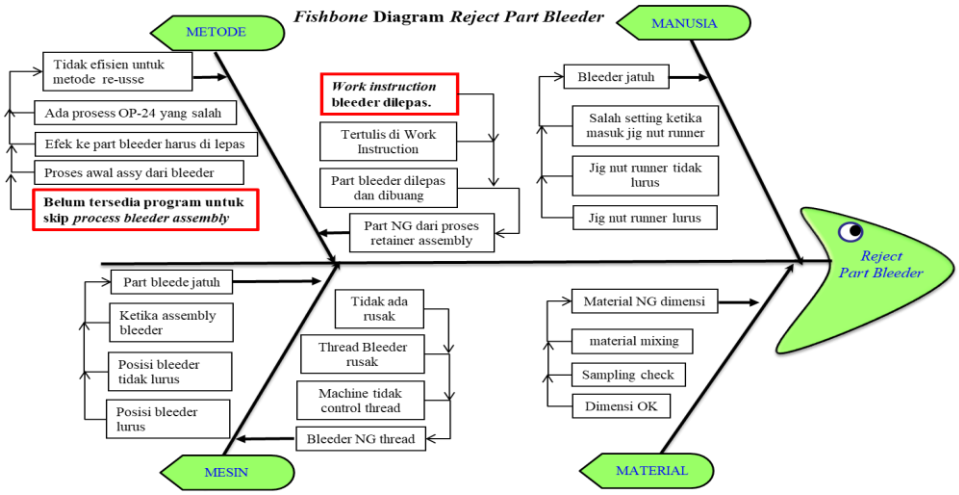


Figure 9. Fishbone Diagram Part Bleeder

Based on Figure 9. Fishbone diagram of part bleeder for the reject part bleeder case, there are several conclusions that can be drawn. One of them is related to production method factors. From this diagram, it can be seen that the method factor has a significant influence on the number of bleeder parts that are rejected. These steps will be the first step in overcoming the problem of high losses in bleeder parts. The following is Table 3. Discussion to find the root of the problem and fix:

Table 3 Discussion to Find the Root of the Problem and Fix It

Faktor yang Diperkirakan	Verifikasi	Akar penyebab atau Tidak?
Penanganan yang buruk selama perakitan *bleeder* ke jig *nut runner* oleh tenaga manusia.	Operator terlatih dan berpengalaman.	**X**
Pengaturan buruk saat memasukkan jig *nut runner*.	Jig *nut runner* masih berpusat atau tidak goyang.	**X**
Instruksi kerja membutuhkan *bleeder* untuk melakukan *reject*.	Karena alur proses perakitan *Bleeder* ketika perakitan *Retainer* NG, *Bleeder* perlu dilepas dan dibuang sebelumnya proses *Reuse*.	✓
Tidak ada urutan proses untuk perakitan *Retainer Assy*.	Kondisi saat ini urutan ketika perakitan *Retainer Assy* NG, *Bleeder* perlu dilepas, jika *Bleeder* tidak dilepas tidak dapat digunakan kembali di proses *reuse*.	✓
Tidak ada pelatihan untuk tenaga kerja.	Operator terlatih dan berpengalaman.	**X**
Tidak ada bahan yang terpisah.	Sejalan tidak ada wadah dan label untuk memisahkan dan mengidentifikasi bahan.	**X**
Tidak ada visual *Point Check*.	Visual pemeriksaan masih terkontroldi lembar cek.	**X**
Berdasarkan kontrol dokumen bukan dimensi pemeriksaan.	Dimensi pemeriksaan titik menggeliat pada lembar periksa dan termasuk dimensi kakotora.	**X**

The following is Table 4. Problem solving with 5W and 1H regarding proposed problem improvements to reduce the reject rate on part bleeders in the assembly process:

Table 4. Troubleshooting with 5W and 1H

Item	Mengapa	Siapa	Kapan	Dimana	Apa	Bagaimana
Merevisi instruksi kerja terkait proses assembly part bleeder untuk mengklarifikasi langkah-langkah yang harus diambil ketika terjadi NG pada proses OP 24 *Retainer Assembly*	Mengurangi kerugian akibat *reject part bleeder*, yang mengarah pada penghematan biaya dan peningkatan produktivitas	QA (Jaka)	Sep-23	Caliper Assembly Line	WI-BR-QA-PQC-024 – WI *Reuse Caliper Assy.*	Revisi instruksi kerja dengan melibatkan tim produksi dan pengawas produksi untuk memastikan kejelasan dan konsistensi, serta memberikan pelatihan kepada operator terkait perubahan.
Mengembangkan program baru yang memungkinkan untuk melewatkan proses *bleeder assembly*	Melewati proses OP24 perakitan *retainer assembly*	PE (Iqbal)	Sep-23	Caliper Assembly Line	Urutan modifikasi menggunakan kembali *part bleeder.*	Mengembangkan program baru dengan melibatkan operator dan menyediakan pelatihan tambahan kepada operator tentang penggunaan program baru

Based on the results of the approach using 5W1H, it can be concluded that the revision of the Work Instructions in OP 24 Retainer Assembly aims to reduce rejects on bleeder parts. And the production team provides oversight to ensure consistency of repairs, and operators are trained on changes. Then a new program was developed to skip the bleeder assembly process with the aim of improving efficiency and quality in the bleeder assembly process.

Doing Kaizen (Improvement)

`After analyzing the causes of the problem has been carried out, the next step is to apply Kaizen (improvement) to resolve the reject problem in the part bleeder. Based on these recommendations, the two proposed improvement steps are a revision of standardization of work instructions in the bleeder part reuse process and modification of the Skip Process Program in the OP 24 Retainer Assembly Process. The following is Figure 9. Improvement 1, Work

Instructions for the bleeder part reuse process and Figure 10. Improvement 2, Modification of the Skip Process Retainer Assembly Program:

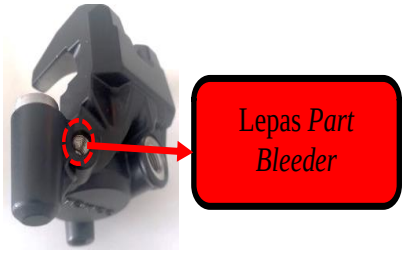
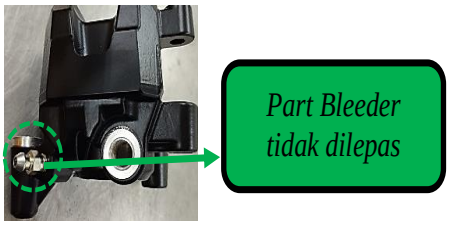
Before	*After*
Detail proses kerja (Dijelaskan *Sub-process*): Bagian Penanganan NG di (OP 24-*Retainer Assy*), *Part Bleeder dilepas.* 	*Detail* proses kerja (Dijelaskan *Sub-process*): Bagian Penanganan NG di (OP 24-*Retainer Assy*) *Part Bleeder* tidak di lepas. 

Figure 10. Improvement 1, Work Instructions for the Breeder Part Reuse Process

Before	*After*
Belum tersedia Program *Skip Process Retainer Assembly*	Modifikasi Program *Skip Process* *Reuse mode.* *Common Setting* *Reuse Mode Retainer Assy* *Next*

Figure 11. Improvement 2, Modification of the Skip Process Retainer Assembly Program

CONCLUSIONS AND RECOMMENDATIONS

The conclusions from the results of the literature study conducted at PT Hitachi Astemo Bekasi Brake Systems are as follows:

1. By making improvements to the Work Instructions in the bleeder part reuse process and modifying the Skip Process Retainer Assembly Program, we can resolve the causes of rejects in bleeder parts that are wasted in the assembly process at PT Hitachi Astemo Bekasi Brake Systems.

2. By applying the QC Seven Tools and Kaizen methods, you can significantly overcome the causes of rejects in bleeder parts. From an average of 4.4% equivalent to 1,308 pcs per month, it was successfully reduced to only 0.01% equivalent to 4 pcs per month. This shows the effectiveness of the corrective steps taken in overcoming production quality problems.

The suggestion from the research results above is the need for continuous improvement and strengthening compliance with written work instructions to ensure all production processes comply with established guidelines.

FURTHER STUDY

This research still has limitations so further research needs to be done on the topic Improving the Quality of Bleeder Parts With QC Seven Tools and Kaizen."

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