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Implementation of Poka Yoke in Needle Bearing Assembly Process

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Abstract: *Dismissal of made parts at different phases of assembling can't go on without serious consequences now days underway situation because of extreme rivalry around the world. This paper concentrates on a quality change extend at SNL Bearings Ltd utilizing botch sealing strategy or Poka-yoke. All assembling businesses are moving toward zero deformity generation. To actualize this the first and most critical thing which is being finished by the assembling businesses is to avoid blunder or totally dispose of the mistake with the utilization of some demonstrated strategies and this paper concentrates on a use of this methods on a needle bearing assembling organization. Utilization of Poka yoke in assembling forms predominantly to wipe out manual blunder by outlining appropriate means which diminishes the dismissals. The review is gone for giving changes thoughts to existing issues at the manual gathering station for the needle roller orientation. Examinations were directed to recognize reasons for imperfections. Utilizing consequences of unstructured meetings and important information and from manufacturing plant perception the issue was examined utilizing circumstances and end results graph where the primary driver were recognized. Subsequently of the Poka yoke on the needle roller bearing, probability of deformity is disposed of totally.*

Keywords: *Lean Manufacturing, Mistake Proofing, Needle Bearing, Poka Yoke*

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I. Introduction

In today's focused world any association needs to make brilliant, imperfection free items at ideal cost. The new culture of aggregate quality administration, add up to beneficial administration in the assembling and administration division brought forth better approaches to enhance nature of items. By utilizing different apparatuses of TQM like KAIZEN, 6 sigma, JIT, JIDCO, POKA YOKE, FMS and so forth association is planned to create quality culture. The paper is expected to center fundamental idea of poka yoke, sorts of poka yoke framework, approaches to accomplish straightforward poka yoke instrument. It likewise covers viable review work done by different analysts. Amid genuine assembling of any item there are an excessive number of basic and dull strides which are done by administrators. These tedious work operations result into mental weakness and absence of enthusiasm for work which eventually causes senseless missteps of administrators and we realize that human is inclined to mistakes despite the fact that he doesn't need it. To stay away from these straightforward oversights, poka yoke idea assumes vital part. By actualizing some basic arrangements we can keep away from oversights. The long haul accomplishment of poka yoke gives yield of sparing time and we discharge the work weight on psyche of laborer. We can utilize imagination and unique aptitudes of laborers for more innovative operations as opposed to expanding weight for dreary exercises.

The fundamental goal of the venture is to create the deformity free item, i.e. enhancing item and process nature of needle bearing item by executing preventive instrument – Poka Yoke.

What is poka yoke?

Poka - Yoke is a gadget that is utilized to either identify or keep deserts from happening. The point of Poka-Yoke is to dispose of imperfections in an item by forestalling or revising mistakes as right on time as would be prudent. The basic thought of Poka-Yoke is to plan your procedure with the goal that slip-ups are inconceivable or possibly effectively distinguished and amended. It is in this manner a powerful way to deal with applying systems to anticipate mistakes arrangement exactly right now they happen. Thought of "grounds order deserts" known as the strategy or procedure Poka-Yoke is quite recently such system. Poka-Yoke technique was presented by Shigeo Shingo in 1961, when this was one of architects Toyota Motor Corporation. This technique, as it were, is to forestall imperfections and blunders beginning in the slip-up. Poka-Yoke method can be connected both to avoid causes, which will bring about resulting events of mistakes and to complete cheap control deciding if to embrace or reject the item. A methodic approach to manage creates Poka-Yoke a

countermeasure has been proposed by the APS system which includes in a three phases examination of the risks to be directed:
1. Distinguishing proof of the need
2. Distinguishing proof of conceivable slip-ups
3. Administration of slip-ups before fulfilling the need

These means are mulled over while considering execution of Poka Yoke framework in any field since this strategy stays same at all the circumstances and conditions.

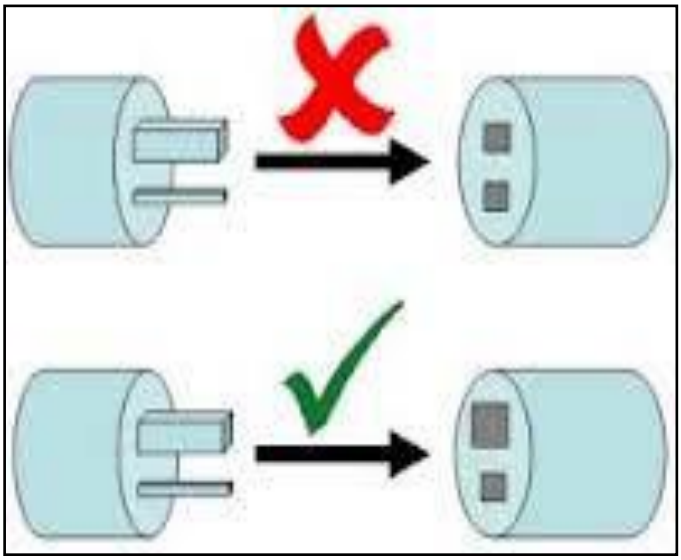

Fig: 1- Simple Example of Poka Yoke

Above figure demonstrates the idea of the Poka Yoke framework. In upper graph, size of both holes are same, hence there might be misstep of putting positive terminal into negative hole yet then again, in lower figure, the sizes of both the holes are distinctive which brings about keeping away from the scattering of the terminal into wrong hole.

II. Technical Aspect Of Poka-Yoke Method

Poka-Yoke system can be connected both to avert causes, which will bring about ensuing events of blunders and to complete modest control deciding if to embrace or reject the item. It is not generally 100% likelihood end of all mistakes, in such cases it is the undertaking of Poka-Yoke techniques is discovery at the earliest opportunity. Examine the procedure of item imperfections arrangement noticed that between an oversights coming about because of the deformity is yet one, the potential plausibility: The perception error and its right. It is along these lines the proposition - technique for diminishing inadequate is arranging conditions in which mistake may not occur, or will be instantly obvious and caught. Consider the above Shigeo Shingo built up an accomplishing "zero deformities" in modern conditions, i.e. in such a route as straightforward and modest. Was itself at the matter, that it is impractical to lessen the deformities utilizing irregular checks. It is important to the aggregate control - 100% control. Shigeo Shingo received after presumptions:
• For the situation of disarray applying the factual procedure control is inadequate,
• Monitoring and control the poka-yoke ought to be:
• Autonomous, i.e. operations did by the contractual worker without intercession all things considered,
• 100% - the aggregate
• Cheap.

When to use it?

Poka-yoke can be utilized wherever something can turn out badly or a blunder can be made. It is a strategy, an instrument that can be connected to a procedure be it in assembling or the administration business. Mistakes are of many sorts;
1. Processing blunder: Process operation missed or not performed per the standard working strategy.
2. Setup blunders: Using the wrong tooling or setting machine modification inaccurately.
3. Missing part: Not all parts incorporated into the get together, welding, or different procedures.
4. Improper section/thing: Wrong part utilized as a part of the procedure.

5. Operations blunder: Carrying out an operation inaccurately; having the off base adaptation of the determination.
6. Measurement blunder: Errors in machine alteration, test estimation or measurements of a section rolling in from a provider.

How to use it?

Well ordered process in applying poka-yoke:

1. Identify the operation or process - in light of a Pareto.
2. Analyze the 5-whys and comprehend the ways a procedure can come up short.
3. Decide the privilege poka-yoke approach, for example, utilizing a close out sort (keeping a mistake being made), or a consideration sort (highlighting that a blunder has been made) poka-yoke adopt a more exhaustive strategy rather than only considering Poka-yoke as point of confinement switches, or programmed shutoffs a poka-yoke can be electrical, mechanical, procedural, visual, human or whatever other shape that forestalls wrong execution of a procedure step
4. Determine whether a contact - utilization of shape, size or other physical characteristics for recognition, steady number – mistake activated if a specific number of activities are not made arrangement strategy - utilization of an agenda to guarantee finishing all procedure steps is suitable
5. Trial the technique and check whether it works
6. Train the administrator, audit execution and measure achievement.

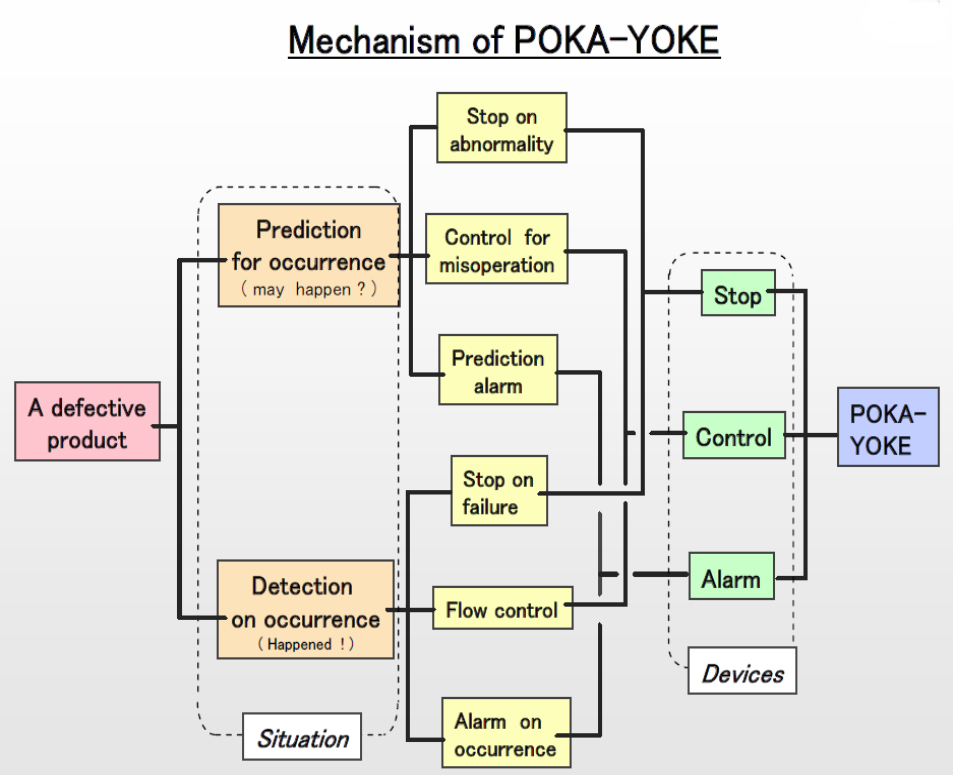

Fig: 2- Mechanism of Poka Yoke

Problem

The issue requires to be gone to with high need and it is imperative to lessen dismissal since it influences organization's notoriety and cost too. The human mistake end is required such that it wipes out the blunder. For that reason, Poka Yoke procedures is recognized and it will be actualized in assembling process, i.e. change in assembling process so the said issue can be disposed of.

Fig: 3 Cage, Needle and bearing

Table 1: Analysis of Causes of Defective Bearings:

S.No.	Nature of Defects in Bearing	Percentage Contribution	Major	Minor
1	Needle Missing	30	✓	—
2	Shell crack	9	✓	—
3	Slot variation	12	✓	—
4	Line thickness variation	5	✓	—
5	Needle rusty	11	✓	—
6	Defective cage	8	✓	—
7	OD over size	4	—	✓
8	OD under size	3	—	✓
9	Shell Pitted	3.25	—	✓
10	Mix bearing	1.5	—	✓
11	Loose fit	0.5	—	✓
12	Tight fit	1	—	✓
13	Corrosion	3.25	—	✓
14	Axial crack	0.75	—	✓
15	Normal fatigue	1.25	—	✓
16	Insufficient heat temperature	0.5	—	✓
17	Defective shell bearing	2.5	—	✓
18	Miss alignment	1.5	—	✓
19	Shell OD rusty	2	—	✓

The issue for this situation was needle missing, shell crack, slot variation, Line thickness variation, needle rusty, defective cage is major defects in needle bearing. These were results in wastage of time and material which in a roundabout way influence profitability of the plant and organization. This was the major issue.

Cause & Effect Diagram for Needle Missing

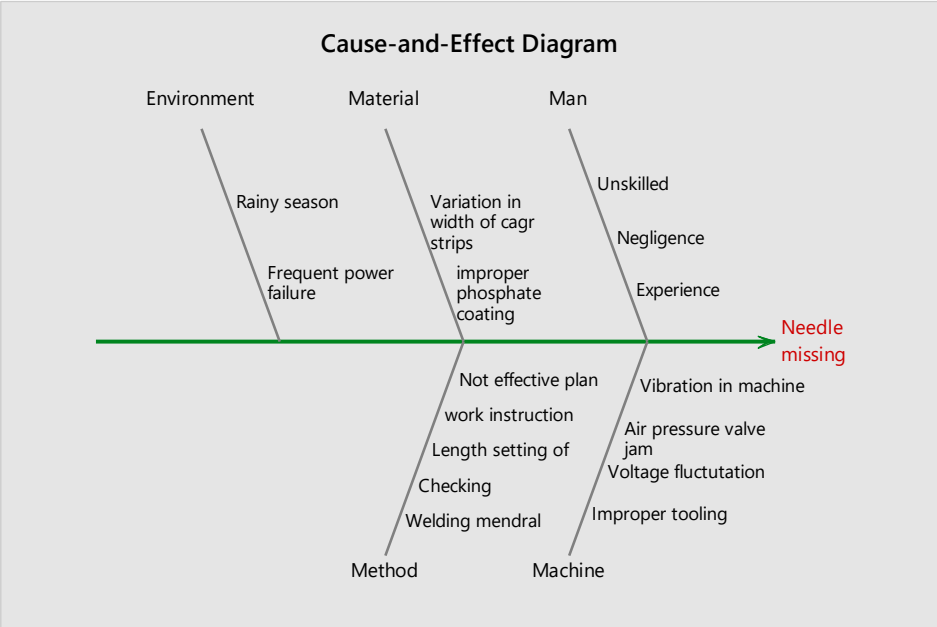

Fig: 4 Cause & Effect Diagram for Needle Missing

Table 2: IS or IS-NOT Analysis of Needle Missing:

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Unskilled	Man	—	✓	1.1
2.	Negligence	Man	✓	—	19
3.	Experience	Man	—	✓	3
4.	Improper tooling	Machine	—	✓	4.4
5.	Voltage fluctuation	Machine	✓	—	20
6.	Air pressure valve jam	Machine	—	✓	5.5
7.	Vibration in machine	Machine	✓	—	15.1
8.	Variation in width of cage	Material	—	✓	1.75
9.	Improper phosphate coating	Material	—	✓	2.25
10.	Welding mandrel setting not proper	Method	—	✓	7
11.	Checking frequency not effective	Method	—	✓	9
12.	Length setting of slide not proper	Method	—	✓	4
13.	Work instruction not followed by operator	Method	—	✓	15.5
14.	Not effective plan	Method	—	✓	4.5
15.	Rainy season	Environment	—	✓	2.5
16.	Frequent power failure	Environment	—	✓	2.5

Table 3: Major Contributor Table:

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Voltage fluctuation	Machine	✓	—	20
2.	Negligence	Man	✓	—	19
3.	Vibration in machine	Machine	✓	—	15.1

Table 4: Cause and Remedy for Major Contributor:

S.No.	Causes	Factor	Remedy
1.	Voltage fluctuation	Method	Voltage stabilizer must be operated regularly to provide sufficient voltage for proper needle feeding.
2.	Negligence	Material	Operation must have to reduce negligence during needle filling in slot by complete rotation of

			cage.
3.	Vibration in machine	Method	The base of machine must be put on damping free bed.

Cause & Effect Diagram for Needle Rusty

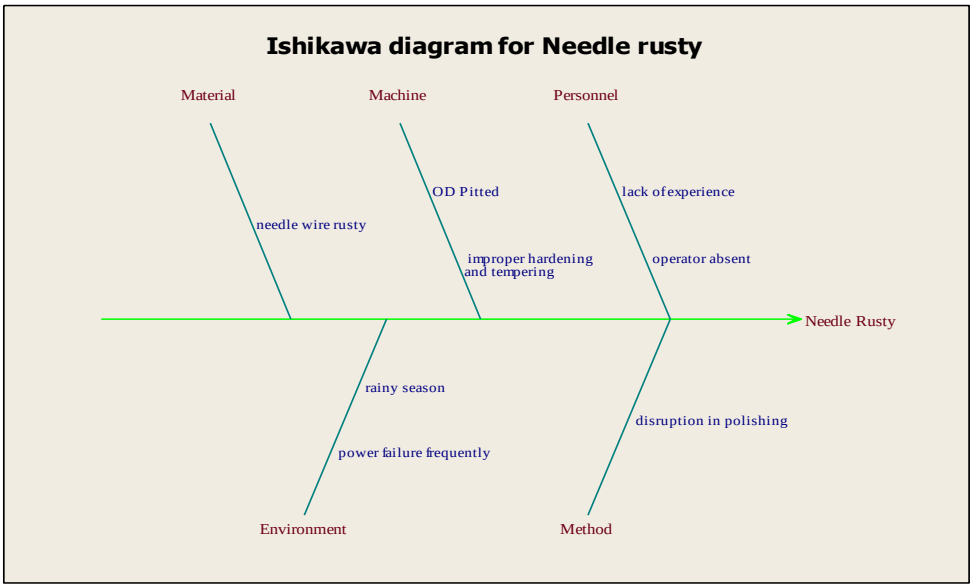

Fig: 5 Cause & Effect Diagram for Needle Rusty

Table 5: IS or IS-NOT Analysis of Needle Rusty

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Needle wire rusty	Material	—	✓	6
2.	OD Pitted	Machine	✓	—	27
3.	Improper hardening and Tempering	Machine	✓	—	16.9
4.	Lack of experience	Man	—	✓	1.7
5.	Operator absent	Man	—	✓	3.3
6.	Disruption in polishing	Method	✓	—	31
7.	Rainy season	Environment	—	✓	9
8.	Power failure frequently	Environment	—	✓	5

Table 6: Major Cause of failure

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Disruption in polishing	Method	✓	—	31
2.	OD Pitted	Machine	✓	—	27
3.	Improper hardening and Tempering	Machine	✓	—	16.9

Table 7: Cause and Remedy for Major Cause

S.No.	Causes	Factor	Remedy
1.	Disruption in polishing	Method	The polishing of needle must be continuously and finish any disruption occurs.
2.	OD Pitted	Machine	Heat treatment temperature is checked

			regularly as per lot.
3.	Improper hardening and Tempering	Machine	Cutting tool must be inspected regularly i.e. Weekly.

Cause & Effect Diagram for Shell Crack

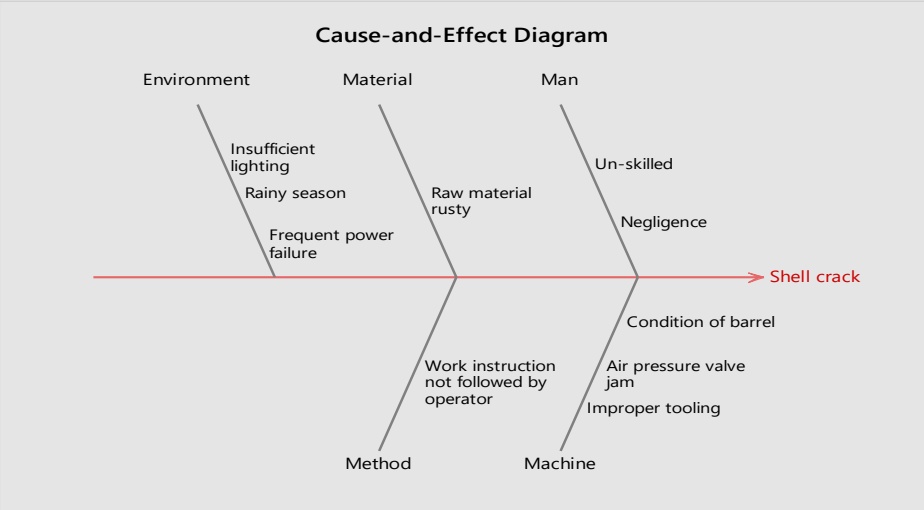

Fig: 6 Cause & Effect Diagram for Shell Crack

Table 8: IS or IS-NOT Analysis of Shell Crack

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Unskilled	Man	—	✓	2.2
2.	Negligence	Man	—	✓	3.8
3.	Improper Loading	Machine	—	✓	3.3
4.	Air pressure valve jam	Machine	—	✓	1.7
5.	Condition of barrel	Machine	✓	—	54
6.	Raw material rusty	Material	✓	—	18.0
7.	Work instruction not followed by operator	Method	—	✓	7
8.	Insufficient lighting	Environment	—	✓	7.1
9.	Rainy season	Environment	—	✓	1.8
10.	Frequent power failure	Environment	—	✓	2.1

Table 9: Major Cause of failure

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Condition of barrel	Machine	✓	—	54
2.	Raw material rusty	Material	✓	—	18

Table 10: Cause and Remedy for Major Cause

S.No.	Causes	Factor	Remedy
1.	Condition of barrel	Machine	Speed of barrel must be desirable for polishing.
2.	Raw material rusty	Machine	Raw material for shell formation must be kept in rust free environment.

Cause & Effect Diagram for Damaged cage

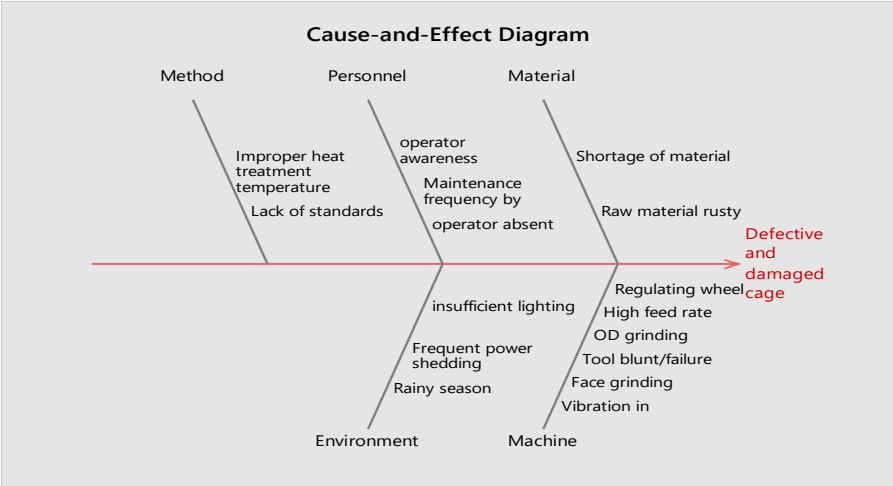

Fig: 7 Cause & Effect Diagram for Damaged cage

Table 11: IS or IS-NOT Analysis of Defective and Damaged Cage

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Shortage of material	Man	—	✓	0.3
2.	Raw material rusty	Man	—	✓	1.7
3.	High feed rate	Machine	—		0.8
4.	Regulating wheel angle are not ok	Machine	—	✓	2.3
5.	Vibrations in machines	Machine	✓	—	36.2
6.	Face grinding	Machine	—	—	1.3
7.	Tool blunt and failure	Material	✓	—	9.4
8.	OD grinding	Material	—	✓	1.0
9.	Operator awareness	Method	—	✓	2.8
10.	Maintenance frequency by operator	Method	—	✓	0.2
11.	Operator absent	Method	—	✓	0.2
12.	Improper heat treatment temperature	Method	✓	—	29.9
13.	Lack of standard	Environment	—	✓	3.1
14.	Rainy season	Environment	—	✓	2.7
15.	Frequent power shedding	Environment	—	✓	4.1
16.	Insufficient lighting	Environment	—	✓	2.2

Table 12: Major Cause of failure

S.No.	Causes	Factor	Major	Minor	Percentage Contribution
1.	Vibrations in machines	Machine	✓	—	36.2
2.	Improper heat treatment temperature	Method	✓	—	29.9
3.	Tool blunt and failure	Material	✓	—	9.4

Table 13: Cause and Remedy for Major Cause

S.No.	Causes	Factor	Remedy
1.	Vibrations in machines	Machine	The base of machine must be put on damping free bed.
2.	Improper heat treatment temperature	Method	Heat treatment temperature is checked regularly as per lot.
3.	Tool blunt and failure	Material	Cutting tool must be inspected regularly i.e. Weekly.

Table 14: Analysis of Causes of Defective Bearings after using Poka Yoke Techniques:

S.No.	**Nature of Defects in Bearing**	**Percentage Contribution before**	**Percentage Contribution After using Poka yoke**	**FINAL %**
1	Needle Missing	30	11	36.67
2	Shell crack	9	3	33.24
3	Slot variation	12	4	33.33
4	Line thickness variation	5	1	20
5	Needle rusty	11	3	27.27
6	Defective cage	8	3	37.5
7	OD over size	4	2	50
8	OD under size	3	3	100
9	Shell Pitted	3.25	3	92.3
10	Mix bearing	1.5	1.5	100
11	Loose fit	0.5	0.5	100
12	Tight fit	1	1	100
13	Corrosion	3.25	2.4	73.84
14	Axial crack	0.75	0.7	93.33
15	Normal fatigue	1.25	1.25	100
16	Insufficient heat temperature	0.5	0.5	100
17	Defective shell bearing	2.5	2	80
18	Miss alignment	1.5	1	66.66
19	Shell OD rusty	2	0	0

III. Conclusion

The various defect in assembly of needle bearing are shown above in my thesis in which improper welding variation, needle miss causes more amount of rejection in needle bearing assembly. The root cause has been identified using Poka-yoke tool. The factors are main material method material and measurement systems are the root causes which have been shown in root cause ishikawa diagram. To make error is human nature so we cannot blame human being for each and every mistake as like errors intelligence is also human nature by next nature so we can dominate preceding nature by next nature. Initially the case of needle missing in bearing where 30 %, but after implementation of lean tool Poka-Yoke the case of needle missing is totally decreased the is obtained maximum efficient bearing and this case not any complain from customer side. This increases customer satisfaction regarding company and faith in product so that company sells increase and profit as well as production also high.

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