Fixture Modification by Reduction in Rejection

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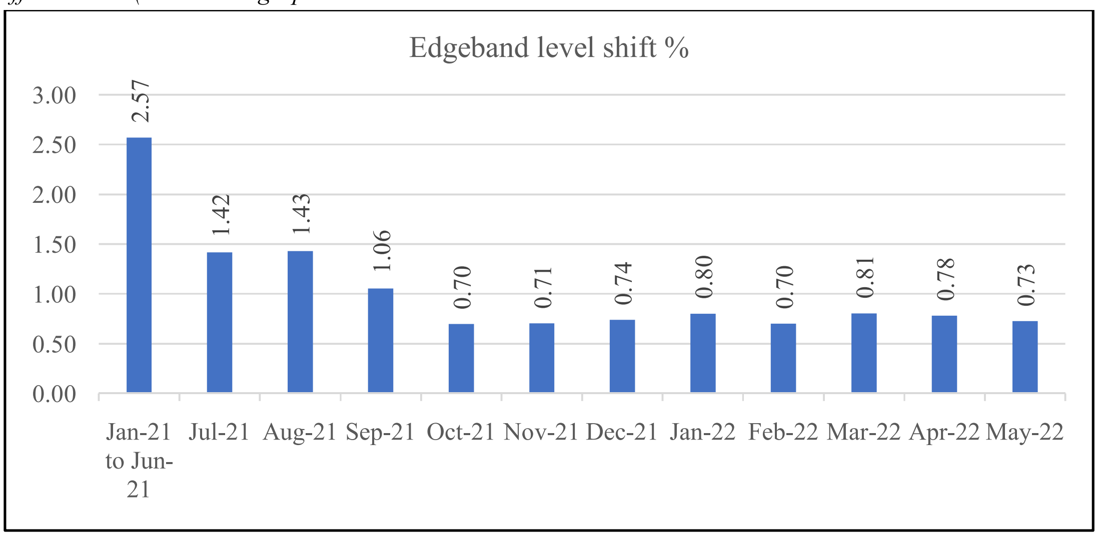
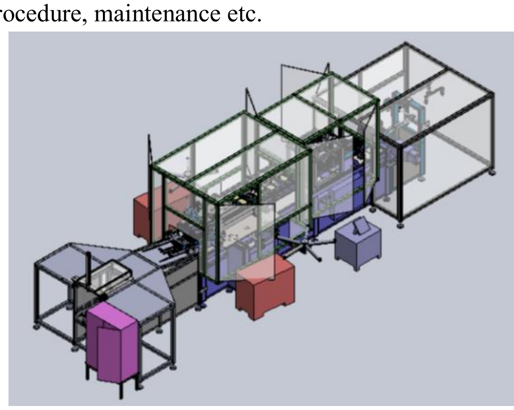
Abstract: *Looking at high rejection %, we did stratification of defects (Lean tool) with the help of PDCA we analysed defect, took actions through A3/White board analysis and monitored the progress along with effectiveness (Below KPI graph.*



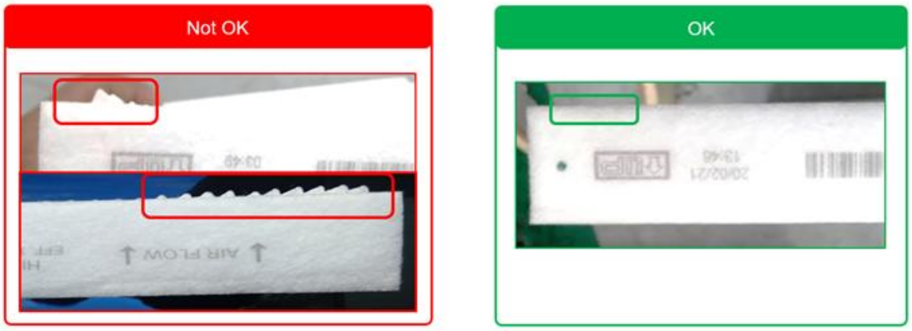
Keywords: Edge band level shift rejection reduced from 2.73 to 0.73. (~73% reduction).

I. INTRODUCTION

The system basically consists of a slat chain conveyor driven by a servo motor which carries the pleat pack on fixtures. The adhesive is applied by dispenser on the edge band. The edge band is pressed on the filters using servo motor driven belt drives. After curing under fans, the filter is cut as per the set length and width is measured using the displacement sensors. The filter is then picked by gripper cylinders and placed in bins. The empty fixtures are returned to the start point by belt conveyor and pneumatic cylinder based lifting system. Following sections provides the details about the design of the system, operation procedure, maintenance etc.



II. PROBLEM STATEMENT- EDGE BAND LEVEL SHIFT



2.1 Objective

We have taken this project as this as this is one of the major rejections for Filter leakage. We have monitored the rejection % period of Jan'21 to June'21 month and observed Rej % is 2.57 %

2.2 Scope

Reduction in rejection. It will reduce cost of poor quality.

2.3 Methodology

50% reduction in Edge band level shift issue by modifying in Fixture. DMAIC to be used to achieve this goal.

2.4 Organization of Dissertation

Total 52,565 Filters reworked in a six month & rejection % is 2.57%.
This causes organization to lose approx. 10,51,000 in a six month.

III. LITERATURE REVIEW

A fixture is a device designed to repeatedly and accurately locate a work piece in a position and orientation, relative to another work piece or the reference frame of a machine tool or measurement machine. This process is often referred to as locating. Secondly, fixtures must be able to securely hold the work piece in the desired location throughout the duration of a manufacturing process without damaging the product. Thirdly, a fixture has to provide ample support of the work piece during the manufacturing process in order to minimize the deflection due to clamping and machining forces. Furthermore, the fixture has to be designed such that the workpiece is accessible and requires a minimum level of maintenance during its lifetime. Fixtures can be used in assembly, machining, measurement and welding operations. They belong to the greater family of work-holding devices. They can be identified and differentiated from other work holding family members through their comprising elements and their functionalities. More detailed information can be found in Hargrove and Kusiak (1994) and Nee et al. (1995). Although simple in concept and role, the design of a fixture requires extensive experience and expertise but also imagination and intuition. For this reason, some engineers might state that the design of a fixture is a combination of engineering science and art. Fixtures can affect the performance of a manufacturing line in a number of ways.

Firstly, the flexibility of the line is largely dictated by the selected fixturing solution. A fixturing system that demands significant effort to be adjusted to accept a new product geometry, can annul the benefits of modern numerically-controlled (NC) machine-tools and automated manufacturing cells. On the other hand, fixtures, due to their immediate contact with the workpiece largely determine the outcome of the manufacturing process. Geometrical variations in the features of the fixture reduce the locating accuracy of the workpiece relative to the global coordinate frame of the manufacturing process. This can result in the production of out-of-tolerance parts. Furthermore, fixtures affect the static and dynamic rigidity of the workpiece. A poorly designed fixture may result in over-clamping and excessive vibration.

Sensing and Actuated Fixturing Concepts

Sensor-Based Fixture Design Sensor-based fixture design is a fixturing strategy where vision and sensor systems are utilized to ensure that the part is located correctly in the fixture (fool proofing). This is an important step towards the automatic loading into fixtures (Benhabib et al. 1991, Rong et al. 2005) and also the design of a generation of adaptive fixtures. They do not strictly constitute a separate category of fixture concepts as they take the form of any of the previously mentioned fixtures. The difference is that they bear sensing elements integrated into their structure. In the vast majority of cases, these elements are used to record clamping, reaction and external forces for the purpose of machining condition monitoring. However, position sensors have also been used to record work piece displacement from its desired location. A piezoelectric dynamometer was placed on the fixed V-block to measure clamping forces. Another dynamometer, measuring thrust forces and torque from the drilling tool, was placed below the base of the two V-blocks. The recorded data was used to identify the safe and unsafe clamping force regions in relation to spindle speed and feed rate. Hameed et al. (2004) investigated the performance of a fixture with uniaxial-force sensor-integrated elements for accurate monitoring of the cutting forces from milling operations. The goal was to alleviate the need for a multi-axis dynamometer. June 17, 2015 17:10 International Journal of Production Research IJPR˙UoN 8 O.J. Bakker et al. de Meter and Hockenberger (1997) instrumented a fixture with eddy current displacement sensors to record work piece displacement from its desired position due to the clamping process.

Denkena et al. designed and built a fixture with integrated MEMS temperature and acceleration sensors and strain gauges-based displacement transducers. The sensors and strain gauges have been optimally placed in the design by means of model-based optimization. Sah and Gao (2008) made a fixture-die-binder system that can measure the contact forces that can be used to produce a real-time estimate of the contact pressure during the stamping operation for the purpose of process monitoring.

Shirinzadeh (1995) proposed the application of sensors and vision systems to establish the location and orientation of a part and to use this information to control the tooling operations in an assembly fixture, as e.g. used in aerospace industry.

To the best of the authors' knowledge, the first NC fixtures were conceptualized and presented by Tuffentsammer (1981). In this work two NC fixturing principles were presented: the double revolver and the translational movement. The first one can achieve differentiation in the fixture element position by using independently actuated revolvers, called the primary and the secondary. The primary revolvers take the form of disks, on which a variable number of secondary revolvers is assembled. Each revolver is able to rotate independently. The secondary revolvers bear cylindrical-pin formations, which are positioned eccentrically to the revolvers axis of rotation and are able to extend and retract. By combining the movement of the primary and the secondary revolvers, different fixture set-ups are achieved for a variety of processes. Hydraulic linear actuators, which are positioned above the work piece, are used to apply the required clamping forces. The translational-movement-based system uses linear motion to achieve the necessary readjustment of the position of the elements. Just as in the double-revolver concept, this June 17, 2015 17:10 International Journal of Production Research IJPR˙UoN International Journal of Production Research 9 fixture deploys cylindrical-pin formation that can extend and retract to conform to the work piece geometry. Contrary to the previous concept, however, the clamping elements of this NC fixture are situated at the side of the work piece and are positioned on slides with vertical orientation.

Automatically Reconfigurable Fixtures

In this section fixtures with automatically self-reconfigurable capabilities are discussed. To the best of the authors' knowledge, the first NC fixtures were conceptualized and presented by Tuffentsammer (1981). In this work two NC fixturing principles were presented: the double revolver and the translational movement. The first one can achieve differentiation in the fixture element position by using independently actuated revolvers,

called the primary and the secondary. The primary revolvers take the form of disks, on which a variable number of secondary revolvers is assembled. Each revolver is able to rotate independently. The secondary revolvers bear cylindrical-pin formations, which are positioned eccentrically to the revolvers axis of rotation and are able to extend and retract. By combining the movement of the primary and the secondary revolvers, different fixture set-ups are achieved for a variety of processes. Hydraulic linear actuators, which are positioned above the workpiece, are used to apply the required clamping forces. The translational-movement-based system uses linear motion to achieve the necessary readjustment of the position of the elements. Just as in the double revolver concept, this fixture deploys cylindrical-pin formation that can extend and retract to conform to the workpiece geometry. Contrary to the previous concept, however, the clamping elements of this NC fixture are situated at the side of the workpiece and are positioned on slides with vertical orientation. The two previously mentioned principles are presented schematically in Figure 1. These principles have also been used by Du and Lin (1998) and Du et al. (1999) in their proposals of NC fixturing concepts.

1. Prof. Yasunova T.A - Influence of tool shape on friction stir welded joint of aluminum and steel with circular weld line is used to achieve the circular weld line was performed, and effect of welding tool shape was investigated for improving the weldability.

2. Prof. sharma H. - Experimental Analysis of Friction Stir Welding of Dissimilar Alloys AA6061 and Mg AZ31 Using Circular Butt Joint Geometry is used stir welding of size and shape parts has to be weld very common are CIRCULAR and straight welds. To eliminate this common problem our circular welding jig and fixture assembly which works on the simple mechanism of gear train which transmit power from manual handle to rotating motion to workpiece and reciprocating motion to our tool in this case the electrode will consume on workpiece and fine circular weld done on worlpiece pieces where there is rust on the body. Titanium is used in the process which is known to be resistant to corrosion. Various types of welding went through different stages of change to come to the state as we see them today. Primarily to join two pieces together, we had to beat them until they unite. Nowadays, we have so much efficient and effective welding processes that use fire, electric arc, electromagnetic ration and so on. No matter which method is used, the procedures are surprisingly useful. circular butt weld joint between Aluminum alloy AA6061 and Magnesium alloy AZ31.

3. Prof. raut .M -A Review on Design of Fixtures in which The efficiency and reliability of the fixture design has enhanced by the system and the result of the fixture design has made more reasonable.

4.Prof. Yong .G-design and fabrication of mig welding jigs is tends to In designing and fabricating the MIG welding jigs, 5 concepts were designed in order to find for the best concept.

5.Prof. Girish V. -Design of Welding Fixtures and Positioners are use to the process of conducting operations related to welding fixture and positions help in gaining a deeper understanding as well as effective project process.

6. Prof. shinde A. - Design of Welding Fixture for Head End Sub-Assembly of Motor Case are design practice of the welding fixture and at the bottom of clamp plate the arsenic copper provide the support so that there is no effect of clamping force on the part head end sub-assembly.

7. Prof. Simon. - Design and implementation of spot welding trainer for body shop assembly line by using a test plate that is clamped to the new teaching aid, it can help to reduce parts problem. The advantages of this welding jig are it can be located in many different angles.

8. Prof. Okechukwu E.-The Design and Need for Jigs and Fixtures in Manufacturing to adequate strength and rigidity, mild steel with 16 millimeters in diameter was chosen for the design of a sample jig and fixture for the making of jigs of fixtures.

9. Prof. Singh M. -Interpretation and Implementation of Some Aspects of Welding Process and Fixture for Increasing SPR in Manufacturing Industry developed welding fixtures that able to clamp workpiece and reduce the rejection ratio in production. Clamping design and common welding jigs material was studied in order to design and generate concept for the MIG welding jigs

10. Prof. Anbarasan I. -Design and fabrication of jig and fixture for hollow cylindrical component in drilling machine concluded that the project design and fabrication of a jig and fixture holding and indexing of the circular job is made easy.

11. Prof. SmitaBhise - Design & Development of Hydraulic Fixture for VMC Implemented that this project eliminates the need of human operator for clamping of manifolds. It reduces the cycle time. It gives an economically feasible design.

12. Prof. P. Vakharia -Design & Development of Fixture for CNC – Reviews, Practices & Future Directions concluded that Fixture design needs to be tested and evaluated in real manufacturing.

13. Prof. Martin P - Welding Fixture with Active Position Adapting Functions concluded based on the information that they have collected about each aspect of their project.
14. Prof. SukumarBhate- Research on Rotary Friction Welding concluded that the process of friction welding of dissimilar welding is much different than conventional fusion welding process. Result of variation in parameters of friction welding process on the weld strength and weld geometry is needs to be studied.
15. Prof. Rajashree S. Pawar- Modeling and Analysis of Vertical Rotary Automated Drilling Fixture concluded that the machine tool for indexing is feasible with bracket mounting fixtures with vertical drive fitted.
16. Prof. Heidar Hashemi-Fixture Designers Guidance: A Review of Recent Advanced Approaches concluded that by combining CBR with other intelligent methods, effective and more comprehensive fixture design systems can be achieved.
17. Prof. Anatoly P. Pashkevicha -Kinematic aspects of a robot-positioner system in an arc welding applications concluded that the developed technique allows to co-ordinate movements of two manipulators of knowledge by using this technique together with the work piece CAD-data, it is also possible to achieve an essential time reduction of the design.
18. Prof. AnkushBatta - Optimization of Submerged Arc Welding Process: A Review concluded that very less work has been reported on metal transfer in SAW, which influences the chemical composition and metallurgy of weld metal, arc stability, weld bead geometry as well as strength of the weld influence by current.
19. Prof. Dr. S.V. Patil - Design and Analysis of Welding Fixture for Automotive Component using FEA conclude that the complete fixture for welding of cab leg assembly has been designed analytically as well as critical components of the fixture assembly are analysed using FEA for safety.
20. Prof. GauravBhavsar -Design of special purpose machine for welding concluded that the Methodology which was used prior to the automated system included Welding which was done by means of hand held Welding guns. This method had less accuracy and precision as compared to the automated system of welding.
21. Prof. M. Ganesan -Experimental investigation of tensile strength of friction welding concluded that the experiments were conducted on Austenitic stainless steel grade using the continuous drive friction welding machine. The experiments were accomplished for various combinations of heating pressure, upset pressure and heating time
22. Prof. N. Sahoo -Study of aluminum plate welding concluded that with an increase in amplitude the failure load is decreasing or we can say that the weld strength or tensile strength is decreasing. At moderate weld pressure, failure load or tensile stress is minimum.
23. Prof. D. Lundin - Dissimilar Metal Welds concluded that the Carbon migration across the weld interface is considered a significant factor in the "life" of a transition joint, since time dependent property changes occur in the regions where carbon movement occurs. The carbon migration causes loss of strength in the ferritic material adjacent to the weld interface.
24. Prof. D.D. Balsaraf- Analysis of Sensitization and Corrosion of Ferrite Stainless Steel (FSS) by Different Welding Processes concluded that when thermally treated in the range greater than 900oC, and as such it becomes readily prone to corrosive attack. So this is done in region of ferrite temperature to avoid corrosion.
25. Prof. J. C. Trappey- A literature survey of fixture design automation. The major topics of the review are the Fixturing principles (supporting, locating and clamping), automated.
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The idea of using modular designing3 is neither new nor specific for the fixture design. Wide range of sciences facilitates using the modular approach because of numerous benefits of that. First of all, it can decrease the cost of change significantly because of the possibility to applying the changes partially just to the desired module and not to the whole system. It also reduces the shut down time of the system during the changing phase and finally it standardizes the design process by facilitating standard parts. (8) Counts some of the benefits of modular designing as follows:
Modularity creates options. Modular designs evolve as the options are pursued and exercised Modularity makes complexity manageable Modularity enables parallel work Modularity is tolerant of uncertainty The modular approach in fixture design appeared in almost the same age of Flexible Manufacturing Systems. In addition, the recent strong intention of using standard parts in the design process accelerated this approach.
To be more precise, by term of ―Modular Fixture‖ two slightly different ideas has been presented. First and older idea is using some ready, precisely pre-holed, or pre-slotted plates and parts that can be fit together according to this holes and slots. Most of the times, a modular base plate is a plate with grid of holes or Slots that can be served as the mounting point for supports, locators and clamps. In this method, there is not much attention to use standard parts for clamps, supports, and locators. The main idea is more concentrated on easy reconfiguring the fixture layout by changing the location of these primary elements on the base plate. However, because of great flexibility and cost effectiveness, this method is widely used by medium size industries.

3.1 Methodology

Step1. Drawing interpretation

- Size and shape of the work piece
- Accuracy required
- Work piece material
- Quantity required
- Locating and clamping surfaces

Step2. Manufacturing analysis

REFERENCES

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