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# Reliability Improvement for TSR Machine of Banbury Mixer using Plant Optimization Process

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## Abstract

This paper is presented on project work carried out on critical machine Twin Screw Roller Die which is part of Banbury Mixer. To identify the failures, machine deterioration and reduce change over time, plant optimization technique is implemented to restore equipment to its proper condition as well as proper training was given to operators about the technique. The main objective of the paper is to improve key performance indicator by increasing MTBF and decreasing MTTR using Reliability Excellence pillar of plant optimization. Repeated breakdown were identified and analyzed along with critical parts. The root cause of machine part breakdown were identified and analyzed by method of why-why analysis. This turn helped to develop new preventive maintenance checklist for machine. Root cause analysis method is used to prevent failure of equipment before occurs.

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*Keywords:* Breakdown, downtime, Preventive Maintenance, Lubrication checklist and Root Cause analysis, why-why analysis

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## 1. Introduction

Reliability of machine is essential in terms of better performance, zero breakdown, and safety. To evaluate machine breakdown, failures various KPI (Key Performance Indicators) MTBF, MTTR can be used to track graph also by analyzing repeated breakdown using root cause analysis tool i.e. why-why analysis, main problem of the machine failure part helps to identified coherent and sustainable solutions [1-2]. System availability and life cycle

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cost is one of the key measure to evaluate key performance. This is achieved by using values of MTBF, MTRR and [3]. The application of the Root cause analysis i.e. 5-whys analysis in any manufacturing industry provides a fact-based and structured approach to problem identification and correction by permanent solution and using pareto chart types of failure helps to identify [4-10]. DMAIC, TPM and Plant optimization concept is based on the notion that reliability of machine can get if operators performs daily preventive maintenance checklist, lubrication checklist and also helps to improve availability of machine [11-15].

### 1.1. Plant Optimization

Plant optimization process is not only concept of engineering but it gives brief knowledge about new methods, also trained operators to identify root cause of breakdown. It consists 9 pillars in plant optimization process following are [16].

- a. Reliability Excellence: It includes maintenance schedule, processes and activities to eliminate all losses by using RE steps.
- b. Daily Equipment Care: It provides operators with the knowledge, skills to proactively identify and prevent all daily losses caused by accelerated equipment deterioration.
- c. Continuously Skill Development: Proper skills that empower all associates to standardize work and improvement in process to do right things in right way.
- d. Work Place Organization: It is a process or system used to organize and maintain a work space for efficiency and decrease wasting also optimizes quality and productivity by monitoring an organized environment.
- e. Production flow: It is a common method of production. When the production is built up through many stages, the product is passed through one stage to other stage to modify it again.
- f. Early Equipment Management: To ensure that the machine is reliable proper management of the equipment is essential.
- g. Focused Improvement: Priorities is given to make improvement in project as well as eliminate losses by identification of root cause using DMAIC method.
- h. Quality Process: This pillar has the responsibilities and process for identifying the quality records.
- i. New Product Industrialization: This pillar is for the setup of a new product concept and turning it into a production stable product.

#### 1.1.1. Problem Definition

For reliability of machine it is essential to reduce upcoming breakdown in machine and this may be done using maintenance methodology as shown in Table 1.

Table 1. Reliability Excellence Phase [16]

	Step 1	Step 2
<b>Phase 1 Reduce breakdown</b>	Analysis of current situation	Restore of equipment and correct weakness

#### 1.1.2 Details of Twin Screw Roller Die

Homogeneous mixture is formed due the TSR unit (Twin screw roller die unit). TCU comprises of the heating coil and thermocouples, which control and maintain the temp of the die. The permissible homogeneity of rubber particles batch goes on to the roller mills. These mills press this mixture to form uniform thickness rubber sheet. These sheet are wetted by liquid soap so that during staking of the rubber sheet these sheet do not adhere to each other. As the compound sheet contains high temperature continuous slurry is sprinkled on sheet as well as the fans are used to cool the rubber. A schematic representation is shown in Fig. 1.

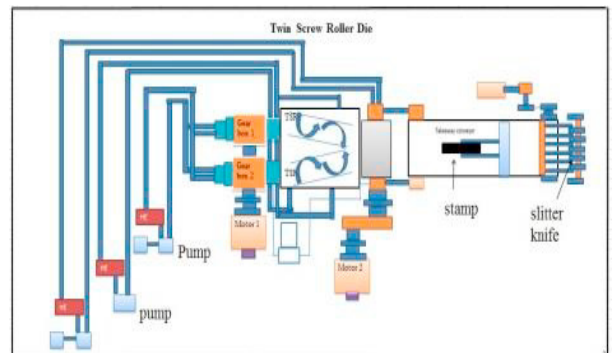


Fig. 1. Twin Screw Roller Die Machine

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