

Reliability, Availability, Maintainability & Supportability Analysis of a Boiler

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Abstract - Sudden failures of any power plant boiler component lead to, loss of production and high maintenance cost due to unplanned and irregular maintenance. This unnecessarily increases the production cost of electricity. This study is focused at examining & analysing the failure times of boiler at thermal power plant identify its critical failure expectancy & system reliability. Method to choose best analysis mode has been discussed here. Reliability and maintainability analysis was carried out using Weibull probability plot & statistical analysis and the results being presented in charts. Achieved results & conclusions drawn shows the need & way to improvement.

Keywords :- Reliability, Maintainability, Availability, Hazard plot, Probability Distribution Function, Industrial processes, Production instability, industrial organization, defect, failure, maintenance costs, Weibull Distribution, failure data sorting.

I. INTRODUCTION

India as one of the largest electricity consumption country produces 65% of its power from thermal power plant with 85% being coal based. The boiler used in power plant extracts energy from fuel (such as coal etc.) to produce highly pressurized steam. This highly pressurized steam produced every hour is used to generate power with turbine, compressor and other mechanical devices.

The constant working of boiler for long hours can cause failure in the boiler unit like super-heater tube leakage, economizer tube leakage, water wall tube leakage etc. The main/sub-reason of these failures are thermal fatigue, creep, thermal stress, corrosion, cavitation, over-heating, high pressure, low pressure etc. That's why periodically maintenance of boiler is necessary as it may result in loss of hundreds of megawatt and also decline its revenue. Sometimes it may cause big explosion or disaster which can cost many lives.

The RAM analysis helps in analysing the reliability (which tells about the probability of working efficiently under stated condition), availability (which gives a measure of boiler to be available at any given time to work in the stated condition) and maintainability (which tells about the

probability of maintenance time of a boiler to work again in its stated condition). This analysis helps in deeply analysing how much work should be taken or can take from the boiler before shutting down for maintenance. This helps in reducing the number of failures and hence estimating the maintenance time / outage time required for the unit.

The RAM analysis can be done with different methods and different probability distribution but the most used and accurate method is 3-parameter Weibull distribution. The curves helps in understanding the nature of reliability and maintainability and find its value at any given time t in period T . The 3-parameter in Weibull distribution indicates scale parameter, shape meter and location parameter of the given failure data.

II. LITERATURE REVIEW :

There are various method to analyze the performance of system using RAMS.

RAMS is a logistic tool that estimate the performance of equipment at different levels. It directs safety and operation problems and find the area in the system where refinement work should be done. Certain key performance parameters such as Mean Time To Failure (MTTF), Mean Time Between Failure (MTBF), Mean Down Time (MDT), Mean Time To Repair (MTTR) and Availability (A) values can be determined to perform the analysis. The result gained from the statistics analysis of these values help in the assessment of the RAMS need of systems.

A. Discrete Analysis

$MTBF = \text{Total System Operating Hours} / \text{Number of Failures}$

$MTTR = \text{Forced outage hour} / \text{Total number of failure}$

$\text{Availability} = \text{System Uptime} / \text{System Uptime} + \text{System Downtime}$

B. Continuous Analysis

A.1 Goodness of fit

An applied mathematics model's goodness of work (GOF) refers to how well it fits a group of information. The distinction between actual values and foretold values beneath applied mathematics model is summarized by the

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