Reliability Prediction and Analysis of Sun Tracking Solar System

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Abstract: ***Now-a-days numerous of Electrical consumption devices are developed for the sophistication of Human Life. Hence, Non-Renewable Sources are reducing and not possible to meet future Electrical Demand alone with it. That's why making use of Renewable Resources especially Solar and Wind are potential in the universe. So, for sustainable generation of Electricity to meet the demand of future endeavours, Renewable Energy plays a significant role. In this paper, [6] it is motivated to track the Solar Energy with the help of Sun Tracking Solar System (STSS). It is a device [5] that operates to track and rotate by adjusting the angle of the solar panel to orient itself, towards the normal of solar rays all the time during the day. STSS mainly consists of Sensors, Electronic Devices like Resistors, Inductors, Capacitors, Microprocessor and Motor. If STSS fails, tracking Solar Energy is Difficult and subsequently generation of Electricity reduces since Solar Panel will not move along the Sun Rays. Hence, it is more essential to understand Reliability Prediction [1] of STSS. Generally, failures of STSS may be due to sophisticated components like Electronic Devices rather than robust equipment like Motor. In this paper, it is proposed to Perform Reliability Prediction of Sun Tracking Solar System in terms of Mean Time Between Failures (MTBF) by using the Bellcore standard [7] and its validation through High Accelerated Life Testing (HALT) results.***

Keywords: Sun Tracking Solar System (STSS), Reliability Prediction, Failure Rate, Bellcore standard, Item Toolkit Software, Mean Time Between Failure (MTBF), High Accelerated Life Test (HALT).

1. Introduction

The human world is facing drastic changes in the consumption and production of electrical energy. Electrical energy is essential in our present-day lives. By using electrical energy, it is a sustainable source all over the world. Broadly classified as heat energy, electrical energy, light energy, wind energy, chemical energy & nuclear energy etc., Solar, nuclear, and wind are all viable options for generating power. To put it simply, solar energy is the electricity that comes from absorbing the sun's rays. It's the least climate-damaging and most environmentally friendly power option. Solar energy has more abundance and can easily be replenished by converting heat energy into electrical energy using PV cells. The power from the sun intercepted by the earth is approximately $1.8*10^{11}$MW, which is many thousands of times larger than the present consumption rate on the earth from all other in-use commercial energy sources. Even in the hottest regions on the earth, the solar radiation flux available rarely exceeds 1 KW/M, which is insufficient for technological utilization. This problem can be rectified by a device solar tracker which ensures maximum intensity of sun rays hitting the surface of the panel from sunrise to sunset. The main problem with solar energy is its dilute nature. However, the unpredictable weather and fixed-tilt angle could potentially reduce the output power of the PV systems. Therefore, it is important to increase or optimize the efficiency of solar photovoltaic (PV) modules. To optimize the efficiency of solar photovoltaic modules, some techniques have been widely used: maximum power point tracking (MPPT) [1-4] and solar tracking (ST) [5-8]. One can use a combination of both techniques for better performance even though the tracking system will become expensive, bulky, and complex. The solar tracking system includes a sensor made up of four Light Dependent Resistors. It is via the integration of electronic and mechanical parts that the reliability of STSS may be predicted. The efficiency of a solar power system can be increased by as much as 50 percent using a tracking and rotating mechanism that constantly adjusts the panel's angle to face the sun. By tracking it can split into two axes: Single-axis & Dual-axis tracking system. With the configuration of Single-axis, Horizontal and Tilted tracking are used to orient the North-South module towards the East in the morning and the West in the afternoon. Then it can prefer optimal efficiency & ability of solar track the sun throughout the day. Dual-axis configurations of Tip-tilted and Azimuth-altitude are tracked to orient a mirror and redirect sunlight along a fixed axis towards the stationary receiver of both the axis vertical and horizontal can generate the maximum amount of energy to consume. So the STSS module is most necessary in the reliability study.

An electronics component has wide applications in industries to create efficiency, computerization, and reliability of electronic devices.. With the improved technology and many specialists, they should gratify consumer needs by using electronic components in different sectors. To meet [1] customer satisfaction, electronic engineers are collecting information to overcome troubles.

Transforming customer needs into engineering specifications plays a crucial role in reliability. So, estimating the reliability prediction in astonishing tools of STSS device has the software module ITEM Toolkit, BOM, Environment & stress values of components.

In literature, Actuator [6] has explained how to track the sun orientation of a solar panel and hold a solar reflector using an STSS device. Gerro Prinsloo [5] & Robert Dobson have discussed sun-tracking solar panels followed by the sun to generate electricity. Roy Billiton [8] has discussed reliability in different factors of Temperature, Environment, Quality, & Electrical factor to predict the failure rate & MTBF by using the experiential formula. By applying, factors can calculate the theoretical & practical values. Dr Gregg Hobbs [11] has explained how to accelerate the life testing method to validate tests for improving product reliability. Using the Bellcore standard in ITEM Toolkit Software can enumerate the Failure rate, MTBF and validation of HALT results through STSS device in reliability prediction.

2. Problem Statement

When we try to implement the use of solar photovoltaic (PV) systems for off-grid household consumption, one of the most significant challenges we encounter is increasing the efficiency of the output that is generated from the PV module. Because the position of the sun is always shifting in tropical places, we require a system that can assist us in increasing the output efficiency of the solar panel. Therefore, it is necessary to design a solar tracking system that can ensure the position of the panel in such a way that the sun is perpendicular to the surface of the PV module or panel. This ensures that the sunlight falls correctly onto the surface of the panel and that the output is improved regardless of enhancements in the position of the sun. This motion is accomplished by connecting a stepper motor to the solar panel in such a way that it adjusts its orientation in response to the location of the sun and the angle of the panel. The major objective is to determine whether it is possible to make a realistic prediction of sun-tracking solar systems by using the Bellcore standard.

Solar Module

Several solar cells joined together to form one panel is known as a solar module. Using sunlight as fuel, solar cells generate electricity. Homes get their power from a bank of modules. Typically, there are 6 rows and 10 columns of solar cells in a solar panel. The efficiency and wattage performance of solar cells might vary depending on the type of solar cells utilized and the consistency of their production. A solar module's DC electrical output might be anything from 100 to 365 watts. Higher wattage means more energy was produced by the solar cells. In the past, satellites and later Spacelab relied heavily on photovoltaics for their energy needs. However, these days most solar panels are used to supplement grid electricity [25]. In these solar power setups, we frequently make use of the inverter, which changes the DC current into AC.

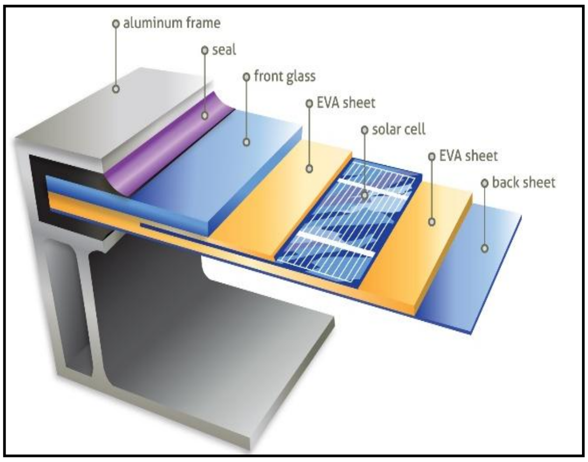


Figure (a): Solar PV Module

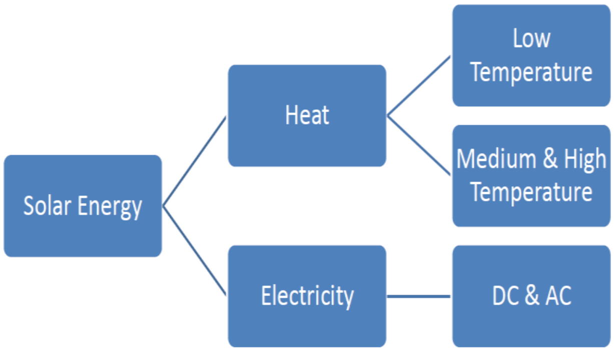


Figure (b): Conversion of Solar Energy

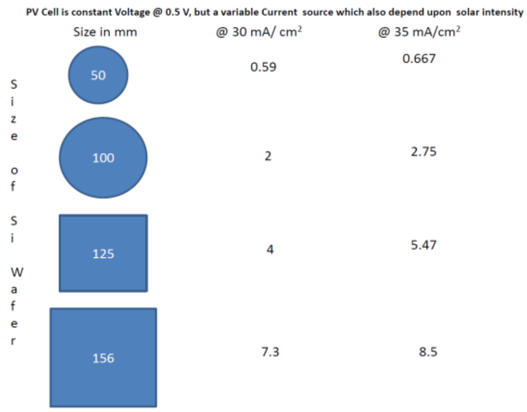


Figure (c): Size of wafer

Figure 1: Solar panel and energy conversion

Solar Tracking system

A solar tracker rotates the panel constantly in the direction of the sun. Solar trackers can be used to boost electricity generation, and research shows that they can generate up to 40% more energy in some areas than fixed PV solar systems. When the system is continuously adjusted to the proper angle as the sun rotates in the sky, the effectiveness of the solar application is increased. To harvest the most energy from the sun, solar trackers rotate the solar panels so that they constantly face the direction of the sun.

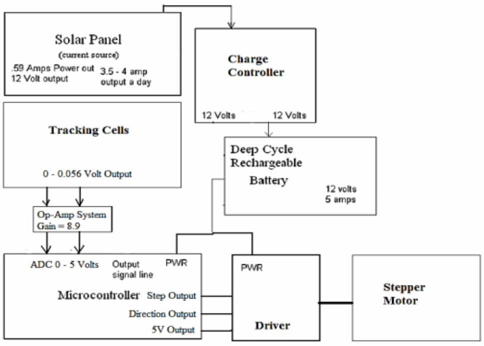


Figure 2: Block diagram of sun tracking system

The LDR of the sensor is used to accomplish auto-tracking. In this system, the LDR collects data on light intensity. The analogue data is then transformed into digital form by the ADC, whereupon the microcontroller receives the eight-bit light data., Multiple readings from the ADC are obtained by the microcontroller 8051. Its subroutines compare these readings, Microcontroller 8051 pauses a short while before making a judgement about the stepper motor if any of the values are equal.It sends a small amount to move to the stepper motor if it receives the bigger value of the difference that is defined in it. Until the low light threshold is achieved, the tracker will continue to measure at its current location if the light intensity is below that level. A constant in the microcontroller has been assigned to the threshold for this segment. This amount is consistent with what the solar panel measured during the day. The system can reset itself at the end of the day thanks to a section of the microcontroller's routine. The 12-volt battery has one of six cells in a series that produces a charge output voltage of 12.6 volts. The battery compartment has two plates, a fine plate covered with a paste of lead dioxide and a non-abrasive material made from a sponge, as well as an intermediate cover.

- **Discharged Battery:**

  $PbSo_4(positive)+PbSo_4(negative)+h_2O+0e$...(1)
- **Fully Charged Battery:**

  $Pbo_2+Pb+H_2So_4 \leftrightarrows PbSo_4+PbSo_4+H_20$ …. (2)

The net position of the tracker is always known thanks to the registers that are incremented or decremented after each motor movement. Once the tracker has rotated 180 degrees and the light intensity has been assessed, the device will revert back to its original position and go into sleep mode. A solar tracker is quite inexpensive when compared to the cost of PV solar panels. The majority of photovoltaic (PV) solar panels are installed in fixed locations, such as on the sloped roof of a home or on a ground-mounted structure. This is far from a perfect option because the sun moves across the sky throughout the day. Typically, solar panels are positioned so that they are directly exposed to the sun for most of the day, facing either South in the Northern Hemisphere or North in the Southern Hemisphere. As a result, the total amount of electricity that can be produced each day is reduced since morning and evening sunlight strikes the panels at an acute angle.

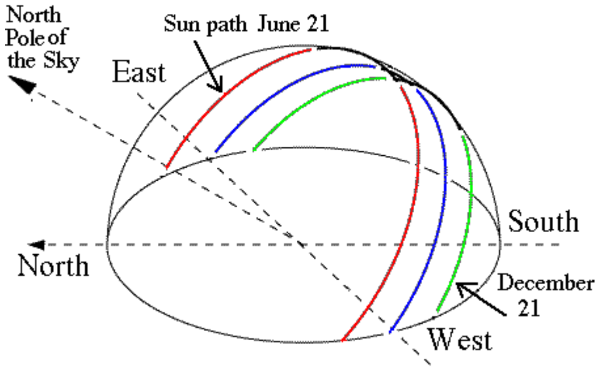


Figure 3: Sun's apparent motion

Sun angles:

Daily sun-tracking: It is an important part of the operation for maximizing water output. It is provided to follow the path of the sun throughout the day from sunrise to sunset from east to west. The support structure has provision for tracking in 3 positions.

- Morning: At sunrise, the panels should be facing east.
- Mid-day: At noon the panels should be horizontal
- Afternoon: During the afternoon the panels should be facing west

Seasonal tracking: It is provided to adjust to the seasonal variations in the path of the sun from north to south. In India, the panels should be facing south. The tilt angle towards the south depends upon the latitude. Seasonal adjustment is done twice a year, for summer (April) and for winter (October). South facing tilt angle should be adjusted as

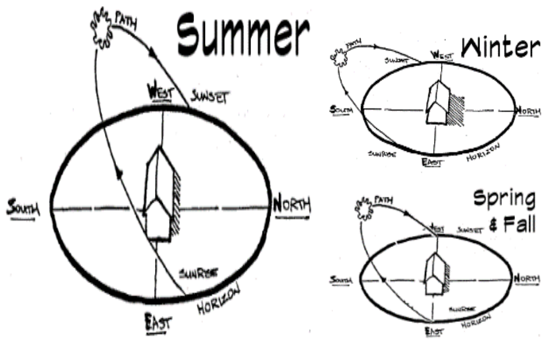


Figure 4: Advantages of Sun Tracking Solar Panel

As a non-renewable resource, solar energy can be recycled. Additionally, since no electricity costs are incurred, this saves money (excluding the initial setup cost) and helps by continuously tracking the sun to increase the absorption of solar energy.

Reliability Prediction

Electronic devices have a significant impact on a variety of industries in the modern world and are integrated into people's daily lives due to their signal processing and data collection capabilities. The impact of these electronic devices on daily life is greater. In Reliability, it can predict the Failure rate of product life cycle & mostly used in the designing of products & development sectors. Its main aim is to enumerate the failure rate of electronic & mechanical components. However, showing the Failures in electronic components is not sufficient for future endeavours. That's why [13] reliability prediction is more essential to enumerate the failure rate of electronic devices used in different fields & sectors like telecommunications, industries & warzones. For performing reliability prediction, the details of the Bill of Material (BOM), Datasheet, and Environment of the components are to be known. A reliability engineer [1] should gather information on how many tests are done on equipment in accurate time, physical & application parameters of components, information on electronic devices & specific design functioning of Electronic devices used in signal processing and the automobile industry. The performance of the reliability prediction is well established by research & development, for electronic equipment. An example of the Bellcore standard [7] is most suitable for performing electronic equipment reliability prediction. In this topic, reliability prediction is shown in two different applications of the MTBF & HALT method.

MTBF Admittance

The number of years since a system, assembly, or component has failed is measured by the mean time between failure (MTBF), regardless of whether the failure was repairable or not. In short, MTBF can assist us in choosing between conditional and preventative maintenance. The MTBF measures actual failures in a variety of repairable devices, and the duration is frequently given in hours. "Meantime" is the statistical value or "mean" over a long time and with a big number of units. Theoretical and practical values can be calculated using sophisticated components to forecast the Failure rate & MTBF values in reliability studies.

The MTBF should be aware of all the information about the components in the inputs of the BOM, stress values, environment factor, temperature factor, quality factor, and voltage stress in order to perform reliability prediction [1]. Additionally, these fundamental elements of manuals can compute the reliability prediction utilizing a variety of standards, including Bellcore/Telecordia, MIL-217, NSWC, IEC61709, and FMEA, among others. According to the study [7], Bellcore/Telecordia is the standard that is primarily used to count the electrical components when predicting reliability. There are three ways to implement the Telecordia standard. I go through the general failure rate of components under stress factors in this method, as well as how it compares to MIL-STD 217's part count and part stress requirements. Method II outlines doing lab tests using electronic components and obtaining real data values. The third technique, Method III, performs a comprehensive forecast of the statistical data for the Field failure rate and Generic steady-state failure rate.

Bellcore/Telecordia Standard

Telcordia SR-332 standards present three common reliability prediction approaches for the electronic product: the Black Box method, the Black Box integrated with laboratory data method, and the Black Box integrated with field data method. The first technique functions under the premise that neither laboratory nor field data is at hand. This document serves as the sole basis for the forecast. The second technique necessitates the availability of pertinent laboratory data on the device. The failure rate prediction is improved by the method because it takes into account both the laboratory data and the generic data. The final strategy requires adequate field data on the device. This method refines the failure rate forecast by weighing field data against generic data.

Failure Rate Prediction for Units

The failure rate prediction for a unit in Telcordia SR-332 is based on the failure rates predicted for its device components. This prediction technique is commonly known as the "Parts Count" method in which the mean unit failure rate λPC is assumed to be equal to the sum of the device failure rates. The Parts Count prediction for a unit computes the mean steady-state failure rate λPC as the sum of the mean device steady-state failure rate predictions λBBi for all n device types in the unit, weighted by the quantity of each device type(Ni) andby the unit Environment Factor πE. Specifically, the mean steady-state failure rate is:

$$\lambda_{pc} = \pi_E \sum_{i=1}^{n} N_i \, \lambda_{BBi} \ldots.. (3)$$

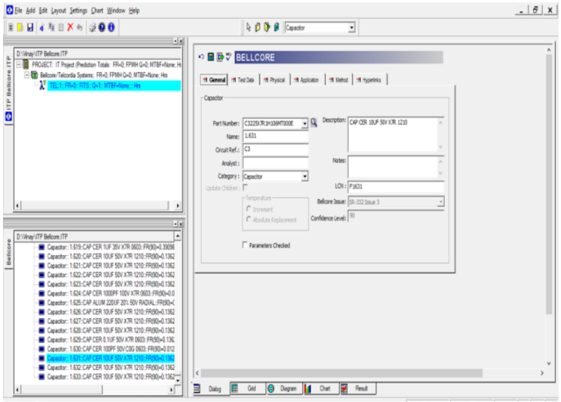


Figure 4: Capacitor in the components of ITEM Toolkit

By enumerating the failure rate, the theoretical value of components using the formula should be derived in Eqn (1).

Failure rate mean = $\lambda BB_i = \lambda_{Gi} * \pi Q_i * \pi S_i * \pi T_i$ **…** (4)

Where,

λBB_i =Mean Black Box Steady State Failure Rate.

λg_i = Mean generic steady-state failure rate

πQ_i = Quality factor

πS_i = Electrical stress factor

πT_i = Temperature factor

Failure rate standard = $\sigma BB_i = \sigma Gi * \pi Q_i * \pi S_i * \pi T_i$ **… (5)**

Where,

σBBi = Standard Deviation Black Box Steady State Failure Rate

σGi = Standard Deviation of the Generic Steady-State Failure Rate

Total Failure rate = λP% UCL = G-1 (P/100, K, θ). (6)

Where,

P% = Upper confidence level failure rate

G-1 = where G-1 is the inverse cumulative distribution function of the gamma distribution

K is the Shape parameter and

θ is the Scale parameter

As shown above, the Total Failure rate of all components can be determined by the Mean Time Between Failure (MTBF). MTBF is the reciprocal of the Failure rate as follows in Eqn (4).

MTBF = 1/λ (or) 1/ $F_{p1}+F_{p2}+F_{p3}+\ldots+F_{pn}$ …. (7)

Where,

MTBF= Mean Time Between Failure

λ = Failure rate
F_I = Failure rate of each component up to n component.

Manual sample calculations:
- In Toolkit by using the Part Number, Description, Circuit reference, and Category to evaluate the failure rate.
- By manual calculations of MTBF, can take the example of capacitors in the total components.
- Partnumber:C3225X7R1H106MT000E
- Description: CAP CER 10µF 50V X7R 1210
- Circuit reference:C3
- Category: Capacitor
- Quality: Level3
- Rated voltage: 50V.
- Applied voltage:30V.
  Voltage stress =(Applied voltage/Rated voltage)*100
  Voltage stress= (30/50) *100
  Voltage stress=60

Failure rate mean = $\lambda BB_i = \lambda G_i*\pi Q_i*\pi S_i*\pi T_i$
=>λBBi = 0.10*0.8*1.5*0.94
=>λBBi = 0.113394

B. Flow Chart

For calculation of the base failure rate and MTBF to evaluate the reliability prediction process is shown in the above figure. On the other hand, taking reference to the above module & modified with the sophisticated idea, the flowchart can be drawn step by step process as shown in Fig 5.

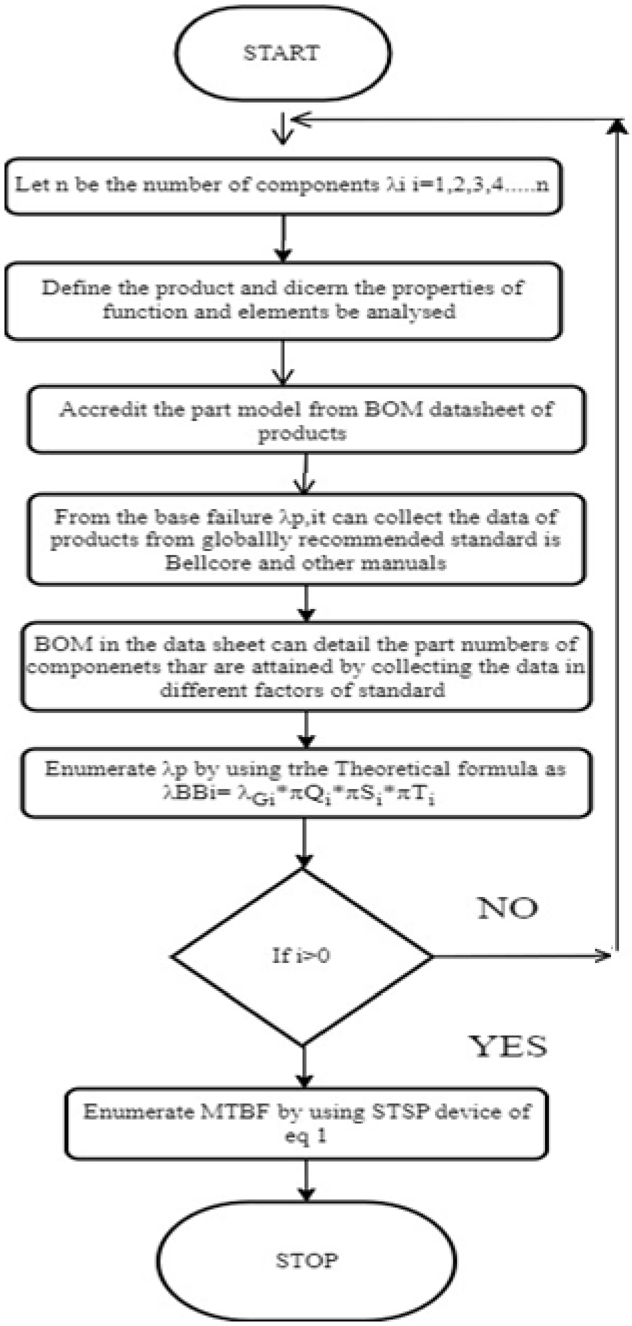


Figure 5: Flow chart of MTBF method

C. Item Toolkit Software Module

The prediction of reliability in electronic components, STSS device by using the Telecordio standard for practical values in software called ITEM Toolkit Software. This software [1] is best suited for comprehensive prediction in electronic components & analytics modules in all different parts of an integrated environment. ITEM Toolkit software contains twelve modules each having different capabilities to enumerate the reliability prediction standards. By using the Toolkit module [8] it can understand the components & systems of globally identified standards and methodologies. Optimizing it can select design components and decrease liability & abundance of safety methods. In ITEM Toolkit software, can analyse and create multiple systems & projects at the same time compared to other modules. This software, taking the component level of General, Physical & Application parameters can enumerate MTBF practical values.

Combination of Telecordio standard & ITEM Toolkit Software consist of three stages to enumerate the MTBF values. The first stage can require less information like part number & generic failure rate components to calculate MTBF values. The 2nd stage can obtain Part number, Description & Category to perform laboratory tests by using electronic components with real data values that can enumerate the MTBF values. In the third stage, the total complete information of components to calculate MTBF about Part number, Description, Category & Voltage stress can perform total prediction failure rate.

In reliability prediction of STSS device taking inputs of BOM in datasheet excel contains Part number, Description of component, Category, Quality & package of component to calculate the MTBF. From the [1] BOM in the datasheet excel picks the component part number and searches the website then it can show the complete information of the product in PDF format. Based on the Telecordia standard in the ITEM Toolkit software module can take input as part number of component in base failure rate to calculate MTBF. By using this material in the datasheet take Environment factor, Temperature, Quality factor & Voltage stress can enumerate the MTBF values. In software, the component level of General, Physical & Application parameters can calculate the MTBF values seen in the below Fig 6.

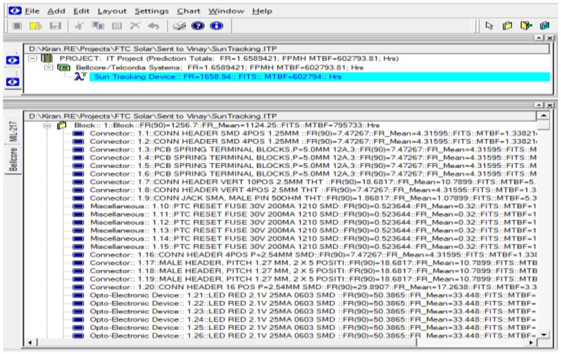


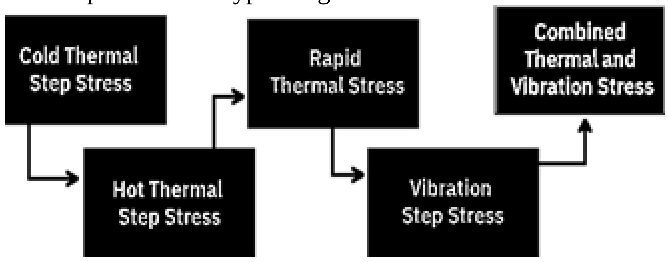
Figure 6: Screenshot of various components in ITEMTOOLKIT Software

Halt Method

High Accelerated Life Testing method [11] is a methodology for testing the stress applied on any equipment for enhancing the reliability in the products. This method detects design defects in the early stages & reduces the cost of the life cycle in the development. Its main purpose is to find weakness & fix them to improve the product reliability in all main equipments of (electronics, computers, and medicals).

A. IPC 9592A

In the Halt method test results are validated based upon different modules, mostly by considering the standard as IPC 9592A. This standard was invented in 1957 under the institute of printed circuits later it can changed the name into IPC. This IPC 9592A version was developed in 2010. Main purpose of this standard it can designing, qualification & quality purpose for reliability. It can explain the thermal & vibration parameters of HALT method of validation purposes. This standard has been used in both, defence industry & commercial appliances and developed for aerospace applications. By using this standard Halt method can be split into five types as given below.



1) Cold Temperature Step stress
2) Hot Temperature Step stress
3) Rapid Thermal Stress
4) Vibration Step stress
5) Combined Thermal & Vibration Stress

1) Cold Temperature Step stress

Set the Ambient temperature at 25ºC. From Ramp down begin with a dwell time of 1 minute at the intervals of 10ºC, of each cycle decreasing until the step reaches the end point process as LOL (Lower Operation Limit). After reaching the end point it will further decrease the cycle continuously then the running process called LDL (Lower Destruct Limit). In the below Fig.7, shown the input of working in the HALT process of Cold temperature.

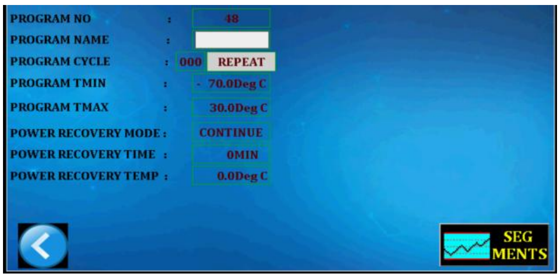


Figure 7: Input of Cold Temperature

2) Hot Temperature Step stress

Set the Ambient temperature at 25ºC. From Ramp Up begin with a dwell time of 1 minute at the intervals of 10ºC, of each cycle increasing until the step reaches the end point process as UOL (Upper Operation Limit). After reaching the end point it will further increase the cycle continuously then the running process called UDL (Upper Destruct Limit). This Step stress is similar to Cold Temperature stress. In the below Fig.8, shown the input of working in the HALT process of Hot temperature.

Figure 8: Input of Hot Temperature

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3) Rapid Thermal Stress

In rapid thermal it comprises Cold & Hot temperature stress during the operational limit of maximum & minimum temperature and the transition process. From the thermal stress set the ambient temperature of 25ºC. From Ramp Up and Down process begin with a dwell time of 1 minute at the intervals of 10ºC, of each cycle until the step reaches the end point. This stress can conduct five thermal cycles to uncover the thermal range process. Rapid thermal transition can discover the failures eminently while testing the electronic goods of time issues. In the below Fig.6, shown the input of working in the HALT method of thermal stress.

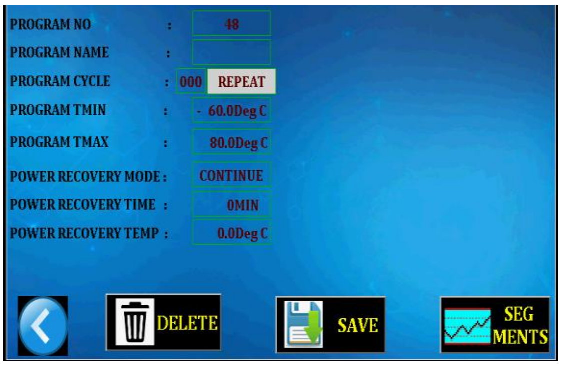

Figure 9: Input of Rapid Thermal Stress

4) Vibration Step Stress

Set the Ambient temperature of 25ºC. Begins with a level of 5 Grms along with a dwell time of 1 minute at the intervals of 10ºC, slightly increasing the level of next 5 Grms continue the process until the UOL (Under Operational Limit) and UDL (Under Destruct Limit) as determined. While conducting test we can reduce the stress level into normal condition. In the below Fig.10, shown the input of working in the HALT method of vibration stress.

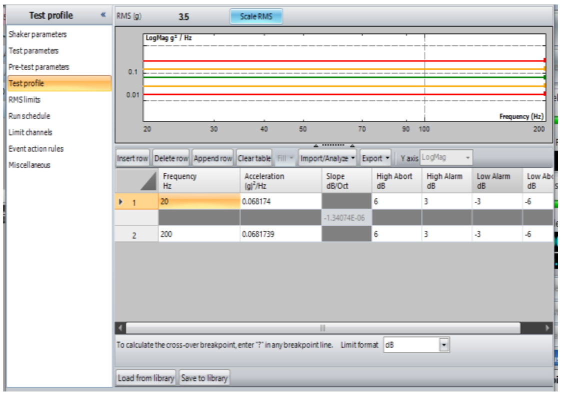

Figure 10: Input of Vibration Stress

5) Combined Thermal & Vibration Step Stress

This environment comprises Thermal & vibration step stress for testing the last stage in the HALT process. In this step consider the above profiles for conducting the tests of both thermal & vibration stress can perform rapid transition limits & stable condition of vibration levels. Both thermal & vibration stress can conduct five thermal cycles to perform their equipment levels. In the below Fig.11, combination of both thermal & vibration stress input process as shown.

Figure 11: Input of Combined Thermal & Vibration Stress

3. Results

a) MTBF Result

In reliability with the device of STSS by using the bellcore standard in ITEM Toolkit software, can predict & enumerate the MTBF report values. This Toolkit consists of input like BOM in the datasheet, Environment factor, Temperature factor, Quality factor & electrical stress can calculate the MTBF values. In MTBF ITEM Toolkit is the major source of estimation. Based upon the experiential formula Failure rate is derived as 1658.94 f/h & MTBF is 602794 hrs. In the below Fig.9, show the MTBF report values.

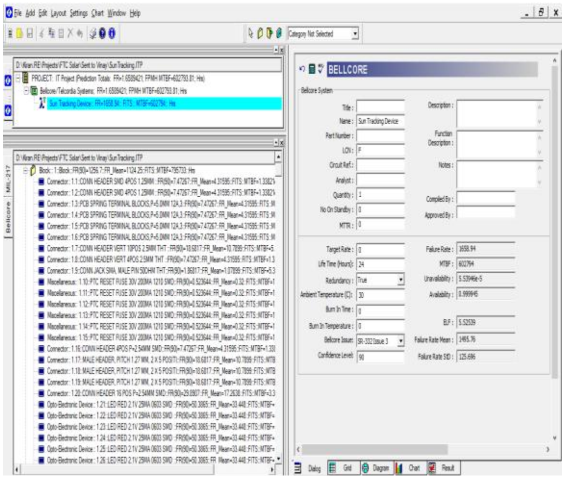

Figure 12: MTBF Output

From the above fig has shown the output of MTBF values. To derive the reliability value of STSS consider time as 100 hours & λ as 1658.94 hrs. By using the reliability formula as

Reliability (R) = $e^{-\lambda t}$ …….(8)

R = $e^{-1658.94} * 100$

R = 0.999835

b) HALT Result

By using the STSS device in reliability prediction with the assistance of IPC9592A, can validate the HALT results by showing different methods below Fig 13 to Fig 17.

1) Cold Temperature Step Stress

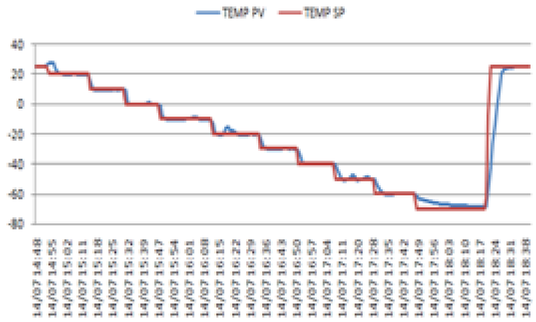

Figure 13: Output of Cold Temperature

In the above Fig.13 considered X-axis as Time, and Y-axis as Temperature. When the equipment starts at, temperature is 30ºC time should be taken as 0. When temperature goes to -70ºC equipment run time is 4 hours approx. So Unit Under Test (UUT) takes 4 hours to control the temperature span of 100ºC can be measured in STSS device.

2) Hot Temperature Step stress

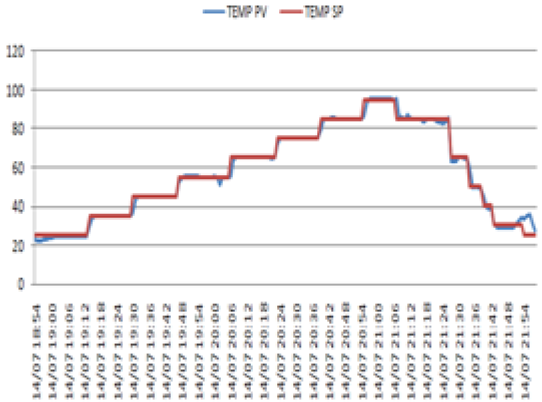

Figure 14: Output of Hot Temperature

In the above Fig.14 considered X-axis as Time, and Y-axis as Temperature. When the equipment starts at, temperature is 20ºC time should be taken as 0º. When temperature goes to 95ºC equipment run time is 3 hours approx. So Unit Under Test (UUT) takes 3 hours to control and the temperature span of 115ºC can be measured in STSS device.

3) Rapid Thermal Stress

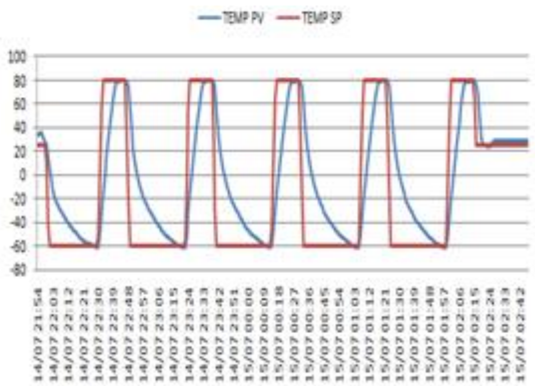

Figure 15: Output of Rapid Thermal Stress

In the above Fig.15 considered X-axis as Time, and Y-axis as Temperature. When the equipment starts at, temperature is -60ºC time should be taken as 0. When temperature goes to 80ºC equipment run time is 5 hours approx. So Unit Under Test (UUT) takes 5 hours to control the temperature span of 140ºC by combining Cold and Hot temperature can be measured in STSS device.

4) Vibration Step stress

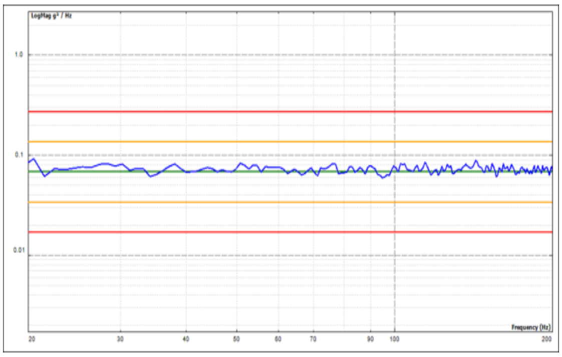

Figure 16: Output of Vibration Stress

In the above Fig.16considered X-axis as frequency, and Y-axis as acceleration. When Unit Under Test (UUT) frequency is constant, by increasing the vibration level of 5 Grms to 50 Grms till the time equipment fails.

5) Combined Thermal & Vibration Step Stress

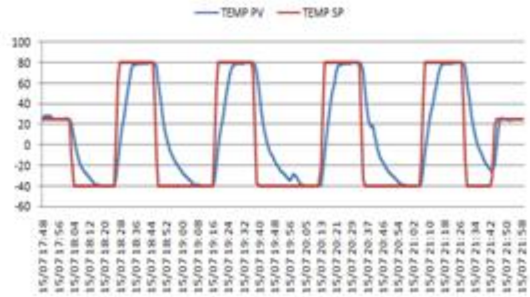

Figure 14: Output of Combined Thermal & Vibration Stress

In the above Fig.17 considered X-axis as Time, and Y-axis as Temperature. When the equipment starts at, temperature is -40ºC time should be taken as 0ºC. When temperature goes to 80ºC equipment run time is 4 hours approx. So Unit Under Test (UUT) takes 4 hours to control the temperature span of 120ºC by combination of both thermal and vibration that can be measured in STSS device.

From the above figures has shown the validation test results of HALT output. To derive the reliability value of STSS consider machine time as 100 hours & λ as 100 hrs.

Reliability (R) = $e^{-\lambda t}$.....(9)

$R = e^{-100*100}$

R = 0.99999

Comparison of Halt Method with MTBF

	Machine Time	Reliability
MTBF Method	100 hrs	0.999834
HALT Method	100 hrs	0.99999

4. Conclusion

Sun Tracking Solar System is operate to track and rotate by adjusting the angle of the solar panel to orient itself, towards the normal of solar rays all the time during the day. If STSS fails, tracking Solar Energy is Difficult and subsequently generation of Electricity reduces since Solar Panel will not move along the Sun Rays. Soit is more essential to understand Reliability Prediction of STSS. Generally, failures of STSS may be due to sophisticated components like Electronic Devices rather than robust equipment like motors.

The Reliability prediction is obtained based on the MTBF method by using the Bellcore standard of ITEM Toolkit Software. Later on this, it can be validated of test results based on the HALT method by using the IPC 95928A standard. By observing the results HALT method of reliability prediction is better than the MTBF of the Sun Tracking Solar System (STSS) approach.

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