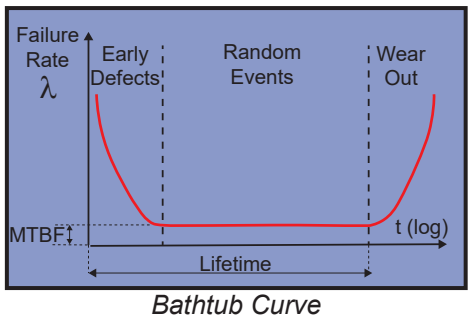
MTBF & Lifetime..... What Do The Hours Really Mean?

There is some confusion when it comes to understanding the difference between Mean Time Between Failures (MTBF) and lifetime. A product might have a MTBF of 500,000 hours but a lifetime expectancy of only 20,000 hours. So one might ask, why is there such a large discrepancy between the two? The answer is easy if you understand the difference between the two terms. The most important fact is that one does not have anything to do with the other.

MTBF

Mean Time Between Failures represents the statistical approximation of how long a number of units should operate before a failure can be expected. MTBF is expressed in hours and does not represent how long the unit will last. There are many ways of calculating MTBF. One of the more popular ones is using



Bathtub Curve

calculations based on models such as SN 29500, MIL HDBK-217 or Belcore. Another method is to use field failures, or Field MTBF. The final way to derive MTBF is to use laboratory testing, or Demonstrated MTBF. If we use the last method in an example and test 10,000 units for 1000 hours with 10 failures, the MTBF would be 1 million hours. This does not suggest that the unit will operate for 114 years. A better representation would be if 500 units are operating at the same time, a failure could be expected every 2000 hours, or 83 days.

Lifetime

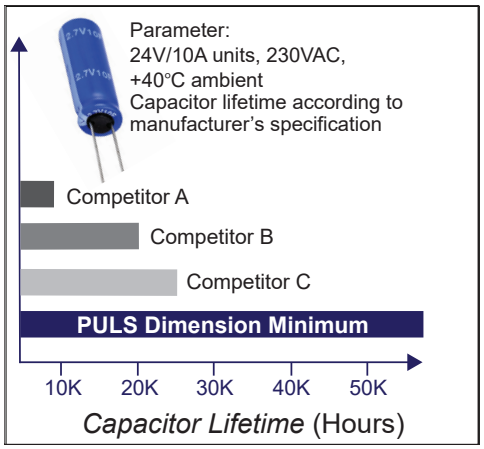
Unlike the hours from the MTBF calculations, lifetime indicates the operating hours expected under normal operating conditions. The lifetime is the period of time between starting to use the device and the beginning of the wear-out phase. This period of time is determined by the life expectancy of the components used in the assembly of the unit. As with any design, the weakest component with the shortest life expectancy determines what the life of the whole product will be. For power supplies, the electrolytic capacitors have the shortest lifetime expectancy.

MTBF Versus Lifetime

A product goes through three phases over its lifetime. In the first phase, the failure rate is high and is referred to as the “infant mortality” phase. In the second phase, the failure rate is low and pretty much constant. In the third phase, the failure rate begins to increase again and is called the “wear out” phase. The complete graph is called the “bathtub curve” because it looks like one. MTBF is an excellent way of determining how many spare parts you might need to support 500 units, but a poor guide on when those parts should be changed to prevent a break down. A unit that is operated only 8 hours a day will last three times longer than a device that is operating around the clock. However, the MTBF is the same because both units receive the same number of hours in service.

Reliability

There are many factors that determine reliability - low failure rate and a long life are just two. A good quality process control and a high degree of automation during production can also lower the defect rate and improve reliability. Finally, a rugged design utilizing high quality components can improve reliability not just at the device level but system wide. Environmental conditions such as vibration and temperature can play a major role in the defect rate and reliability of a device. For power supplies, heat is the number one enemy and can shorten the life of the electrolytic capacitors dramatically. The industry rule states that every 10°C increase in temperature reduces the life of the capacitor by half. PULS only uses large diameter (min. 10mm) high quality capacitors allowing the Dimension series to have a rated life of at least 50,000 hours. You can’t put a price on quality and reliability, and with PULS you get the best power supply with the longest life!



	AC 100V	AC 120V	AC 230V	
Lifetime expectancy	128 000h	141 000h	176 000h	At 24V, 5A and 40°C
	61 000h	75 000h	120 000h	At 24V, 10A and 40°C
	47 000h	59 000h	101 000h	At 24V, 12A and 40°C
	363 000h	399 000h	499 000h	At 24V, 5A and 25°C
	173 000h	211 000h	338 000h	At 24V, 10A and 25°C
	132 000h	166 000h	286 000h	At 24V, 12A and 25°C
	AC 100V	**AC 120V**	**AC 230V**	
MTBF SN 29500, IEC 61709	550 000h	560 000h	661 000h	At 24V, 10A and 40°C
	1 003 000h	1 017 000h	1 176 000h	At 24V, 10A and 25°C
MTBF MIL HDBK 217F	188 000h	188 000h	213 000h	At 24V, 10A and 40°C; Ground Benign GB40
	252 000h	252 000h	290 000h	At 24V, 10A and 25°C; Ground Benign GB25
	40 000h	40 000h	47 000h	At 24V, 10A and 40°C; Ground Fixed GF40
	51 000h	51 000h	61 000h	At 24V, 10A and 25°C; Ground Fixed GF25

PULS CP10.241 Power Supply MTBF & Lifetime - From Data Sheet