Let’s consider the probability of product failure. At the stage of product release into the market, failures due to non-conformity of usage environment, coming from defects of production and conception, frequently happen (early failures). Comparatively, the ratio of failures occurring during the product service life is quite low. Then, after the product has been used for a long time, and its life cycle comes to an end, failure ratio increases again (wear-out failures). This life cycle is called the “Bathtub Curve”.

The production department is responsible for inspecting the amount of early failures, and for the failures occurred after release on the market. R&D departments evaluate, test and design products, using various materials and parts, in order to increase the product service life, or reduce the amount of wear-out products.

(To reduce the amount of wear-out products, after-service division also intervene by replacing broken parts of a product).
Concept of Reliability Testing

In reality, it takes a long time before failures occur. For this reason, reliability testings imply the notion of stress in order to reduce the test time. The test that induces stress is presented in the chapter 1. Environmental Testing – Basic Knowledge, and is called Environmental Test, but in the field of reliability testing, depending on the test purpose, or the method to apply stress, tests are divided in 3 categories.

Matching these categories with the bathtub curve makes it easier to understand.

1. **Screening Test**
   This test is realized within the production department, and the purpose is to eliminate defective goods and problems. It is common to evaluate the quantity of defective products as a percentage [% (ppm, ppb)]. Among others, the most popular tests are “Aging Test”, which check the product behavior during a determined period, and the “Burn-In Test”, which check mainly the product’s functional operation.

2. **Durability (Lifetime) Test**
   This test is realized within the R&D department, to determine the impact of continuous stress combined with repetition, on materials’ characteristics and product parts (According
Concept of Reliability Testing

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3 Accelerated Test

This test is realized within the R&D department, and provides levels of stress that exceed the standard conditions determined by the regulations' values. To generate an excessive reaction within the stress period, and reduce the acceleration period, the evaluation is performed using mainly the [Failure rate (FIT=%/time)] (how many samples failed during a determined period of time) and the acceleration factor (Level of acceleration of the performed test).

Note: Limit of test:

The limits correspond to the tests involving destruction, breakdown non-conform to the bathtub curve. [HALT] (Highly Accelerated Life Test) or [HASS] (Highly Accelerated Stress Screening) are the most renown. The first one is used for design applications, the second for production applications. In these tests, the test time is reduced, but some of the generated failures are different from those generally found in the market, therefore it is necessary to determine if they are suitable for the test purpose.