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Peter Spreij: For a biography see *IEEE Transactions on Reliability,* 1983 October, page 345.

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★★★

Book Review . . . . . Ralph A. Evans, *Product Assurance Consultant*

IEEE Recommended Practice for Design of Reliable Industrial and Commercial Power Systems

(The Gold Book)
Power System Technologies Committee of the
IEEE Industry Applications Society
1980, 224 pages, *ca.* $20
Wiley-Interscience
LCCC 80-83819; ISBN 0-417-09261-4

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This is a very useful book for those who need: 1) this kind of data, and/or 2) the introduction to reliability concepts this book provides. The book itself is a pioneering effort and reports the results of some pioneering efforts.

Two of the excellent aspects of the book are:

1. The emphasis on planning, design, and corrective action.

2. The many examples and their illustrative numerics.

Both aspects will help engineers to learn that the reliability discipline is not a numbers game but is an important aid to traditional engineering tasks.

The treatment of probability and statistics is above average for an engineering book (but is deficient as explained below). Considering that the book is a pioneering work, the treatment is very good. Some areas for future improvement are:

1. The assumption of constant failure rate should be explicit.

2. The differences between statistical jargon and ordinary language should be explained better. For example, *expected* and *confidence* are used as statistical jargon, but *significance* is not. Three different words (expected value, mean, average) are all used to mean the same thing. In a technical treatise, synonyms can and should be given in a glossary, but in the text there should be a one-to-one correspondence between concepts and the names for those concepts.

3. FMEA (failure modes and effects analysis) should either be explained more conventionally or its differences from the conventional version should be explained.

4. The category of maintenance-induced failures should be introduced under preventive maintenance. Preventive maintenance should be used only where it is clear that more good than harm will come from actions done in its name.

5. The explanations and examples for *series* and *parallel* systems need more work. *Series* and *parallel* in this context refer to logic diagrams, not to schematics. Where there is more than one failure mode for a component then the concepts of *series* and *parallel* become more complicated.

For example, assume: a) a capacitor can fail only *short* or *open,* and b) a 2-capacitor bank can likewise fail only *short* or *open*. Two capacitors that are physically in parallel are in *series* for *shorts* (the 2-capacitor bank fails if either one *shorts*) and in *parallel* for *opens* (the 2-capacitor bank does not fail *open* unless both fail *open*).

6. The failure data for each class of component are not a random sample from a population that has a single, constant failure rate. There are several sub-populations, each with its own failure rate. Thus, the statistical treatment of confidence intervals is not appropriate. The explanations treat *accuracy* and *confidence* as synonomous; that is especially not true in the current treatment.

7. The MTBF (mean time between failures) is the reciprocal of the failure rate only when the anticipated lives are much greater than the reciprocal failure rate.

8. The problem of common-causes of failures is not treated adequately. For example, one violent electrical storm can damage several components; those failures are definitely not a random sample from a sub-population with a constant failure rate.

★★★