

IN TODAY'S institutes of higher education, students learn Ohm's Law, Kirchhoff's Law, and other engineering and technical necessities. However, a more basic and infinitely more important law is never mentioned. Everyone at one time or another encounters Murphy's Law or one of its corollaries. Often these encounters are quite shocking and leave the victim bewildered. The purpose of this article is to prepare the younger readers for future encounters and to show them that they will not be alone.

J. Edsel Murphy and his contributions have never been fully appreciated. A victim of his own Law, Murphy was destined for a place in the engineering Hall of Fame when something went wrong. The mere discovery of the Law which bears his name was not his most important contribution, but more important was its impact and universal application. The Law itself, though basically simple, has formed a foundation on which future generations will build. It has been reported that Murphy's Law, in all its simplicity, first came to him when his bride-to-be informed him of the forthcoming birth of an heir to the family estate.

Murphy's Law, as first recorded, states "If anything can go wrong, it will." Expressed in more exact mathematical form this would be: $1 + 1 \approx 2$ where \approx is the mathematical symbol for hardly ever is.

First known expansion of Murphy's Law occurred when H. Snizel stated, "If anything can go wrong, it will—during the demonstration."

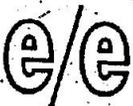
The following examples, collected through personal experience and conversations with various associates, are presented with a two-fold purpose: first, to show the wide-ranging nature of Murphy's work, and second, to provide the reader with a greater appreciation of Edsel Murphy, his Law, and its importance.

In the Area of Mathematics

1. All constants are variables.
2. Any error that can creep in, will.
3. A decimal will always be misplaced.
4. In any miscalculation, if more than one person is involved, the fault will never be placed.
5. In a complex calculation, one factor from the denominator will always move into the numerator.
6. Any error that does occur will be in the direction that will cause the greatest error.
7. In any set of calculations, the figure that is most obviously correct will be wrong.

General Engineering Principles

1. An important instruction manual or operating manual will have been lost or misplaced.
2. Original drawings will be destroyed by the copying machine.



MURPHY'S LAW

3. Dimensions will always be expressed in the least usable terms. For example, furlongs per fortnight would denote velocity.
4. All warranty and guarantee statements become void upon payment of invoice.
5. The less important a change of design appears, the more its influence will be felt.
6. The closer a system is to completion, the greater the necessity of making a major change.

Specifications and Dollars

1. Cost of equipment will exceed any given estimate by a factor of 2.8, or more.
2. Budgets and labor timetables, which have been set as the result of practical experience, will be exceeded.
3. Manufacturers' specification sheets will be incorrect by a factor of 0.6 or 2.5, depending upon which multiplier gives the most optimistic value.
4. Salesmen's claims on estimated costs will be incorrect by factors of 0.1 or 10.0.
5. Specified environmental conditions will always be exceeded.
6. In any instrument which is characterized by a number of plus-or-minus errors, the total error will be the sum of all errors adding in the same direction—cancellation of errors does not occur.



In the Shop

1. A dropped tool will land where it will do the most damage.
(This is sometimes known as the Law of Selective Gravitation.)

2. After an instrument has been fully assembled, extra components will be found on the bench.
3. If a particular resistance is needed, that value will not be available. In addition, it cannot be developed with any parallel or series combination of available resistors.
4. Identical units, which have been tested under identical conditions, will not be identical in actual use.
5. The more delicate the component, the greater the probability that it will be dropped.
6. Interchangeable parts won't.
7. That which should amplify will oscillate, and that which should oscillate will only amplify.
8. A fail-safe circuit will destroy others.
9. A pnp transistor will be npn.
10. Any transistor which is protected by a fast-acting fuse will protect the fuse by blowing first.
11. After the last of 35 mounting screws has been removed from an access cover, it will be discovered that the wrong cover has been removed.
12. After an access cover has been secured by the last of 35 holddown screws, it will be discovered that the gasket has been left out.
13. Any wire which has been cut to pre-measured length will be too short.
14. The possibility that a dimension will be omitted from a drawing is directly proportional to its importance.
15. If N components are needed for a project, there will be $N-1$ units in stock.
16. A failure will not appear until a unit passes final inspection.
17. The probability of failure of a component or assembly is inversely proportional to its ease of repair or replacement.
18. Any device randomly selected from a group having 99% reliability will be a member of the 1% group.
19. Any carton thrown away before assembly is guaranteed to contain at least two essential parts.

Additional examples were to be included with the preceding list, but in accordance with Murphy's Law, the notes and references have been misplaced. These will invariably be found after the article has gone to press. ■