MURPHY'S LAW

OR

WHAT YOUR ENGINEERING PROF'S NEVER TOLD YOU

As is well known to those versed in state-of-the-art engineering, Murphy's Law tells us that, "If anything can go wrong, it will." Or, to put it in its exact mathematical form,

$$1 + 1 = * 2$$

Where * is the mathematical symbol for "hardly ever".

It is felt by this author that those new to engineering do not appreciate the far reaching effects of this most fundamental law. This paper is an attempt to show the all pervasive nature of Murphy's work and its' numerous corollaries. Below is a small sampling of some time tested principles.

I. MATHEMATICS

1. In any given miscalculation, the fault will be placed on the one person who was not involved.

2. In any given computation, the figure that is most obviously correct will be the source of a serious error.

3. All constants are variable.

4. Any error that can creep in, will. It will be in the direction that will do the most damage to the calculation.

5. In any complex calculation, arguments in the numerator and denominator will exchange places at will.

6. The memory capacity of any calculator will equal N - 1, where N is the number of bytes required in a critical computation.

II. PROTOTYPING AND PRODUCTION

1. Any wire pre-cut to any length will be one inch too short. This can be reduced to one-half inch by increasing the number of wire-ties put in place.

2. Tolerances will accumulate unidirectionally toward maximum difficulty of assembly. However disassembly will occur spontaneously.

3. Identical units tested under identical conditions will not be identical in the field.

4. The availability of a component is inversely proportional to the need for that component.

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5. If a project requires N components, there will be N - 1 units in stock.

6. A dropped tool will land where it can do the most damage, or where it is the most difficult to retrieve. (Also known as the law of selective gravitation.)

7. A device selected at random for customer inspection from a group having 99.999% reliability will be from the 0.001% group.

8. The probability of a dimension being omitted from a plan or drawing is directly proportional to the number of times it has been checked.

9. Interchangeable parts will only fit together on sales desks.

10. The probability of failure of a component, assembly, subsystem, or system is inversely proportional to the ease of repair or replacement.

11. If a prototype functions perfectly, subsequent production units will malfunction perfectly. A sub-corollary to this is:

    The number of problems in a prototype's performance at start-up will vary inversely with its distance away from the nearest customer or company president.

12. Components designed for idiot-proof assembly will find their way to a sub-idiot.

13. An expensive electronic device protected by a fast-acting fuse will protect the fuse by blowing first.

14. Failures will not appear until after a unit has passed final inspection. Units returned due to failure will function perfectly.

15. Any purchased component will meet its spec's long enough, and only long enough to pass receiving inspection.

16. Only after at least 16 mounting bolts have been removed from an access cover, will it be discovered that the wrong access cover is being removed. A sub-corollary to this is:

    Only after an access cover has been secured with at least 16 mounting bolts will it be discovered that the gasket has been omitted.

17. Graphic recorders will deposit more ink on humans than paper, and will require an order of magnitude more understanding than the new process they are recording.

III. SPECIFYING

1. Manufacturers' spec sheets will be incorrect by either a factor of 0.5 or 2.0, depending on which is more dangerous. For salesman's claims these factors will jump to 0.1 and 10.0.

2. Any given cost estimate's total will include at least one part who's price the manufacturer mistakenly gave in Rupees or Pesos, depending on which is most likely to cause employee or project termination.

3. Manufacturers' spec's will be expressed in the least useful units. Torque, for example, will be expressed in Dyne-Furlongs.

4. Only after a bolt head has been twisted off will it be discovered that the supplier's only previous experience was in used car sales.

IV. GENERAL ENGINEERING

1. The more innocuous a design change appears, the more far-reaching its influence will be.

2. A complex patent application will be preceded by one week by a similar application turned in by a retired migrant farm worker.

3. The necessity of making a major design change increases exponentially as the fabrication of the system approaches completion.

4. Suggestions made by the Value Analysis Team will increase costs and reduce functionality.

5. All textbook example calculations will be error free, unless copied for a critical engineering computation.

6. Exciting design flaws in a pet project will never present themselves at an engineering open house unless women and children are present.

7. Any number of design calculation iterations over the number one, will converge on the only unique point of total design rejection.

8. The number of blatant errors in a paper being presented to colleagues will equal N, where N is the number of industry experts in the audience.

9. Murphy's Law supersedes Ohm's.