

Cable Lore

AN ENGINEERING PUBLICATION

ISSUE NO. 1

QUALITY

The word **quality** denotes a peculiar and essential character. It signifies a degree of excellence. When quality is ascribed to a cable it is inferred that it has properties or features that qualify it to be graded higher than another cable. The word quality is often used too frequently and, as a result, it has lost its impact. It is a catchword without substance. Overuse and misuse of the word in describing commercial products has jaded its meaning to the point where a new definition is required.

A New Definition of Cable Quality

A cable design lives up to its customers' expectations of quality when it provides reliability and safety over an expected or reasonable lifetime. This could vary, for example, from a few months in the hostile environment of a shuttle car cable application in a coal mine, to several decades for cable in a less demanding environment.

A cable with the highest quality offers the greatest probability of survival in a given application or environment. During service, a cable may be exposed to any combination of the following environments:

- Electrical
- Thermal
- Mechanical
- Chemical

These environments react simultaneously to deteriorate cable components. A cable with a high probability of survival in service, i.e. a quality cable, must have attributes that will offer maximum resistance to the deteriorating effects of its total environment.

Choosing A Quality Cable

Choosing a cable design with a high probability of survival requires two basic sets of information: An accurate assessment of the total environment to which a cable will be exposed during its service life and an intimate knowledge of properties, attributes and features of a particular cable to insure that a credible matchup is made with the in-service environment.

Laboratory evaluation of cable prototypes provides this intimate knowledge by measuring the effect of various simulated environments on a specific cable design. This information, along with field experience and engineering judgement, allow prediction of a cable's probability of survival in a given environment.

The following items suggest a method for choosing a quality cable.

Weigh the consequences of a cable failure.

Cable failures that shut down processing facilities, manufacturing plants, communications or critical equipment may cost many thousands of dollars per hour in downtime. Losses may exceed the original cable investment many times over.

Recognize that each property of a cable contributes to its survival in actual operation.

Two or three outstanding properties may not compensate for an inherent weakness in less spectacular properties; the "weak link" concept may apply. Overall cable

performance will only be as good as the total environmental resistance of all its parts.

Delineate the balance of cable properties required to insure a high probability of survival and safety.

As previously mentioned, cables will be exposed to some or all of the following types of environments: Electrical, Thermal, Mechanical and Chemical. In any given application, one particular environment might override the others to some degree. A trailing power cable supplying a dragline used in the mining industry, for example, will require primary emphasis on the mechanical environment. A power cable of the same voltage in a direct burial application will require emphasis on the electrical-chemical environment. Both cables, however, require a balanced set of properties to insure survival when exposed to all the environmental factors in a particular application.

Relate how each property makes a contribution and substantiate with performance data.

The following table lists some important properties to be considered:

ELECTRICAL

- Dielectric Constant
- Dissipation Factor
- Insulation Resistance
- Dielectric Strength
- Shielding Effectiveness
- Crosstalk
- Attenuation
- Corona Level
- Treeing Resistance
- Fault Current Capability

THERMAL

- Heat Aging
- Hot Modulus
- Deformation
- Shrink Back
- Expansion
- Cold Bend
- Rated Temperature

CHEMICAL

- Moisture Resistance
- Oil Resistance
- Resistance to Organic Chemicals
- Resistance to Inorganic Bases and Acids
- Fumes and Industrial Atmospheres
- Ozone Resistance
- Radiation

MECHANICAL

- Conductor Fatigue
- Flexibility
- Cut Resistance
- Abrasion Resistance
- Tear Resistance
- Bending Diameter
- Sidewall Pressure
- Tensile Strength

The final decision on the best cable for the application should be based on a consideration of the above factors. This will result in an installed cable with the maximum probability of survival, safety and economy and one that lives up to the total definition of quality. ≡