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## Chapter VI. D

# Reliability Production

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## WHAT IS RELIABILITY PRODUCTION

When the point has been reached where design specifications are available from the oil tool engineer, a choice has been made of the proper elastomer to use and all compound compromising has been accomplished, then it is time for the compound designing and testing. Do we take what is a minimum requirement or do we set higher than minimum limits for initial laboratory work?

In order for a product to perform its necessary functions it must be over designed for laboratory testing in order to have the correct property ranges after normal plant production procedures. In the past this type design work has been referred to as designing to intrinsic values. It is realized there is a loss in values and quality from highly controlled laboratory procedures to normal plant controlled production, but do all manufacturers design for this, and if so, what is the intrinsic safety factor that is used?

It is our contention that all design properties must be over designed by a factor equivalent to the value of the production inspection and quality control departments as compared to the laboratory. There are many plants that have no laboratory controls whatsoever and here the intrinsic safety factor should be as high as 200%. On the other hand, there are plants so well organized and established in the laboratory and the quality areas that a safety factor of 110% is sufficient.

A point on the oil tool engineers must list in picking the vendor for their rubber products is an evaluation of laboratory procedures and techniques vs. quality control and inspection practices in the plant. This can be the most important consideration for continued product reliability over the long haul. What is the vendor doing daily to protect their product? How do they go about this and what does it produce?

To further elaborate on the use of intrinsic values, the rubber products vendor must be very conscious of the exact loss in properties of any formulation in going from the laboratory to and thru production.

If this value is established at 25%, then the vendor's research people must over design the required properties by this value. As an example we will assume the tensile strength at room temperature of a certain formulation should be 1000 pounds per square inch in the finished product. We must then find a consistency in the laboratory of 1250#/in in design testing in order to allow the 25% drop.

In establishing the intrinsic values for the desired formulation, the vendor has only taken the first

step. They must, in order to produce a successful product, establish the environmental conditions that will be encountered by the finished product and then test at and under these conditions in the laboratory. Room temperature properties mean nothing at all when considering a product working down hole at 300° F and 3000 psi gas pressure. The room temperature testing can only establish the fact that what is produced in production will furnish the properties the particular formulation was basically designed to attain. In no way will room temperature properties establish anything other than a series of check points.

**I**t is also a veritable need to require quality control to take test samples from the products themselves to first check for authenticity of proper formulation and production procedures used and then to test samples from the same products in environmental conditions simulating where they will operate. It is necessary to know that proper materials and procedures have been used and a consistency exist in quality test results from week to week and month to month. Continuous verification of these established check points is necessary to product reliability.

**W**e no longer can operate with the assumption that one or two formulations can cover the full range of product requirements in the oil field. We also can no longer use hardness or what is commonly regarded as the "fingernail test" to determine the acceptability of oil field products. We can no longer take the attitude that it is someone else's problem to make a rubber product perform properly. It is the oil tool design engineer's duty to require reproducibility and product reliability. They are in control of their product and it is their responsibility to set the scope and limits.

**I have known a great many troubles,  
but most of them never happened.**

**Mark Twain**