

## The Power of Incremental Change ... Tighter Tolerances

**30 years ago it was rare for a car to have over 100,000 miles.** Typically 100,000 miles on the clock indicated a *Maintenance Queen* requiring many trips to the repair shop. It is not unusual today for automobiles made in the past 10 years to surpass 100,000 miles without any major maintenance costs at all. Why?

The secret to the longevity of machines lies in manufacturing tolerances. When components are made to very high tolerances they fit together with less slop. Less slop means lower the wear between the parts. Lower wear means lower need for repair. Tighter tolerance means less play in how parts work together, and increases the quality of the product. Tighter tolerances affect business processes too. A company with tight process tolerances can fine tune their business with small incremental changes. These incremental changes can be a slight adjustment of a formula, of a process or of someone's attitude. Slight adjustments can make huge changes.

### The Impact of Engineering Change

In the late 1980s the Ford Motor Company introduced the Taurus SHO. It was Ford's attempt to counter the tide of the performance sedans from BMW, Lexus, and Honda. Ford could not make a production level high-powered engine at the time and turned to Japanese Yamaha Motor Company for the design and production of the SHO engine. The Yamaha V-6 SHO motor was a magnificent engine and was sought after by true enthusiasts.

In 1996 Ford made a major change to the Taurus body style and the Yamaha V-6 would not fit. The V-6 SHO did not sell well compared to the foreign performance sedans so Ford's created a V-8 SHO motor. Ford use to Yamaha for the design but decided to make the new V-8 SHO in-house. In the 10 years Ford's engineering and engine manufacturing ability and quality improved greatly so the Ford *Motor* Company felt that it could make the new SHO engine. This decision proved to be fatal to the reputation of the Taurus SHO.

The Yamaha design used zero tolerance between the top of the piston and the top of the cylinder where neither the exhaust nor intake valves can be open or else the piston slams into the valve and destroys the engine. A pair of rotating camshafts controls the opening and closing of the engine valves. In the Yamaha design the gear on the camshafts was forged out of the same metal as the camshafts themselves; a very expensive process that guarantees that the timing remains accurate. To reduce cost Ford engineers made a value engineering decision to create the camshafts out of two parts; a gear swaged on to the camshaft. Swaging is a mechanical process of press fitting two parts together depending on the friction of the two parts to prevent movement. This change did not account for heat and in operation the camshafts and the driving gears did move. Over time the did gears move on the shaft and could not maintain index tolerance. Once the gear moved far enough the exhaust valve would be slightly open as the piston approached the top of the cylinder, eventually moving enough where the exhaust valve would be open far enough for the piston to strike the valve at a high rate of speed, bending the valve and punching a hole in the top of the piston, and the engine would destroy itself.

### The Connection to Business Practice

How have small changes created catastrophic failures in your business? Why did the small change happen? What was the cause of the change?

As business conditions become difficult companies search for ways to reduce costs. Often cost reductions are taken with a myopic viewpoint that never looks beyond the immediate impact of that specific activity. It is not unusual in business practices to the maximize cost control within a specific business silo that press higher costs elsewhere and destroy the financial effectiveness of the company in the whole.

A classic example is the fight between shipment size and order frequency. LTL freight is expensive when measured as a cost per case and compared to the relative cost per case for truckload. But buying that truckload ties up more company capital, reducing its available liquid cash. The chase for reduced freight cost is an income statement exercise. The fight to reduce inventory is a balance sheet exercise. The enlightened manager understands that you must look at the cash flow to determine what the optimum solution is.

So, are cost reduction efforts on the income statement driving up your asset allocation on your balance sheet?

*Tight Tolerance  
needs thoughtful  
design to be  
dependable.*

How balanced are the operations in your business? How well are the different departments working together? How would it feel to have logistics process engineers design a thigh process? Call us and find out.

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