Cautionary Tale XXXIII Lean Manufacturing

‘Let me have men about me that are fat……Yond Cassius has a lean and hungry look’ is what William Shakespeare wrote when Julius Caesar was voicing his fears for his future due to the ambition of one of his team members. You can take these clever words many ways, but with a bit of a stretch it is possible to apply them to lean manufacturing. Toyota successfully applies lean manufacturing and demands that their suppliers do likewise. Read a text on this subject and you’ll soon be convinced that this is the way forward for manufacturing industry. Toyota and others want their suppliers to be lean and hungry since there is no chance that their position might be threatened unless competitor’s set up leaner supply chains. However, the question is ‘can lean manufacturing work all the way down the supply chain to the spring manufacturer?’

In IST’s experience, lean manufacturing cannot be completely adopted by spring manufacturers because the quality of your raw material is not good enough. The quality aspect that is of concern here is the elastic / plastic response of the wire at the point of coiling.

National, international and commercial specifications for spring wire do not provide information about how the wire will respond during coiling, and until they do, you will not be able to rely on the next coil responding exactly like the last coil. Some adjustments will need to be made at the coiler to get the springs to the middle of the tolerance band of your customer.

Lean manufacturing is partly about minimising costs in the supply chain - a laudable goal, but let us consider the customer who calls off x thousand springs a week on a JIT basis. Which will be cheaper for the springmaker?

a) Buying wire each week (from stockists) making the required quantity of springs, and having zero stock of wire or springs.
or
b) Buying a larger lot of wire (from a mill), making the required quantity of springs each week and being confident that the wire will behave when you make these springs next week.
or
c) Buying a larger lot of wire, coiling it all in one go, and supplying springs from your stock.

Option a) is lean, option b) a little tubby, but option c) is fat, but I leave readers to decide which is cheapest.

The technological requirement is that the material suppliers provide information about the elastic / plastic and surface friction properties of their product so that springback is accurately known and consistent. Only wire suppliers who have IST’s Fracmat machine are able to do this, and since it is not likely that all wire suppliers will adopt this excellent method of characterising their wire, it is worth looking at what could be done to be more certain the coil of wire you purchase will respond the same as the last when you thread it up on the coiler and set the CNC controls to the same values you used last week.

The first instinct of many springmakers when wire doesn’t respond exactly as they expected is to check the tensile strength. Disappointingly for them, they nearly always find that to be as shown on the material supply certificate. It is a curiosity that the only test value supplied is tensile strength, yet the one thing a springmaker is never going to do, hopefully, is break the wire.

The procedure IST would commend to springmakers when first-off samples aren't accurately on the mean values required is to use a computer program that will tell you what to adjust to bring you back to the mean. An example of such a program is IST's Compass module.

A typical printout from this program is shown below for an unground compression spring.

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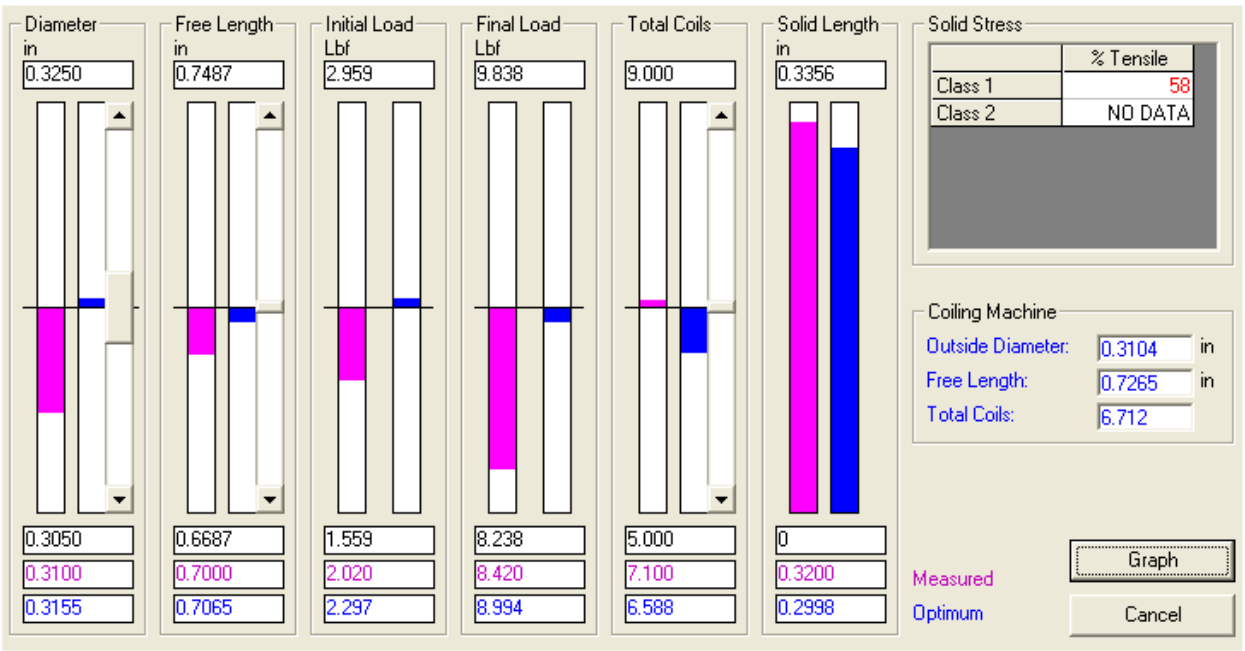
Identifier: Example

Compass Data

Specified Characteristics						
ASTM A313 302 Austenitic						
End Type:	Closed and Unground					
Dead Coils:	2.000					
Tip Thickness:	100.000	%				
Dimensional						
Solid Length:	0.3400	in				
Outside Diameter:	0.3150	±	0.01000	in	3.175	%
Free Length:	0.7087	±	0.04000	in	5.644	%
Load Deflection						
Initial Length:	0.6299	in				
Initial Load:	2.259	±	0.7000	Lbf	30.987	%
Final Length:	0.3937	in				
Final Load:	9.038	±	0.8000	Lbf	8.852	%

Measured Characterisitics		
Off The Coiler		
Outside Diameter:	0.3050	in
Free Length:	0.7200	in
After Processing		
Outside Diameter:	0.3100	in
Free Length:	0.7000	in
Total Coils:	7.100	
Initial Load:	2.020	Lbf
Final Load:	8.420	Lbf
Solid Length:	0.3200	in



This shows the dimensions off the coiler and after stress relief and prestressing under "Measured Characteristics". The load test shows the two loads are in spec, but are well below the mean value. Without this program springmakers would adjust one of the free length, outside diameter or the number of active coils using their experience to determine

the adjustment. This program says change all these parameters – increase the outside diameter, increase the free length, and take almost 0.4 coils out - and the loads will be very close to the mean second time around. This program calculates the required dimensions off the coiler knowing that dimensional changes that will occur due to stress relief and prestressing. It helps to minimise set-up time on the coiler, and hence the springmaker's chance to become a little leaner.

This cautionary tale is advising that full implementation of lean manufacturing is not realistic for springmakers, but there are technologies that will help you approach 'leaness' i.e. Fracmat and Compass, and this may be as near as you can get to being able to rely on the response of your next coil of wire. However, referring back to my original quotation you could take it another way - beware the lean, hungry and ambitious industries of China and India - they will take your market if you don't invest as far as you can in lean manufacturing.

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