Dimensions and the costs of a spring.

Tolerances on a print effect the cost of production of a spring. Tolerances too tight will increase the manufacturing cost and will reflect a higher cost to purchase. Tolerances too liberal may cause a spring not to assemble or function properly. This can have drastic effects on both the Customer and Supplier.

A simple concept of a spring is a mechanical device designed to store a given amount of energy in a given envelope. Many dimensions of a spring can be reference dimensions if the assembly and operating parameters envelope are specified. It also allows performance standards to drive all of the design parameters.

Corporate Engineering Standards

Engineering Standards can be used to transfer Design FMEA information without releasing the original Design FMEA.

Due to the proprietary nature of many Design Failure Mode Effect and Analysis calculations, many companies have policies against releasing them. It's understandable in a business sense. However, much of the information still needs to be released to the supply chain. Corporate Engineering Standards can be a tool to this end.

By defining information that will be included on a drawing as a standard, critical areas may be identified without releasing the design FMEA information. This will focus on spring applications, as we are a spring maker. But, with a little thought, they can be adapted to many other areas.

The envelope a spring must function within is standard for spring manufacturers. And it is a standard part of a Design FMEA and should be part of a Process FMEA, if the information is available. By adding "Fits in", "Fits over", and "Maximum solid height" to an Engineering Standard, critical dimensions can be transferred to the supply chain.

As an example, if we specify a spring with a .950 outside diameter must fit in a .985 hole, we are transferring the data without identifying this as a critical dimension on the DFMEA.

We can specify a spring must fit over a .580 dimension, without saying "Our Design FMEA requires the spring to fit over a .577 valve spool or we have an assembly failure."

We can specify .735 as a maximum solid height when the design of the spring wire diameter, number of coils, and end condition allow it, while we know it will never close to less than a .780 dimension in use.

This will assure there is no chance of the spring being pressed solid on a regular basis to cause premature failure. If we do experience premature failures, we will know the required solid height of the spring, and our Design FMEA accounted for the height. It allows us to minimize the causes we have to review to find the reason for the failure.

By using an engineering standard that requires this information on all spring drawings, it causes the designer to check the calculations. As a spring manufacturer, we review this data to create our Process FMEA. We drive our Control Plans from the required data on the drawings. By specifying "Fits in", "Fits over", and "Maximum solid height", it requires the manufacturer to verify these attributes in addition to checking the dimensions of the part. Any fit and function issues should be identified as the manufacturer verifies the part fits within that envelope.

This list is not all inclusive, as there is always the opportunity for special requirements. As a minimum, we would recommend the following information be included on all spring drawing to facilitate the manufacture of a spring. For compression springs, the following dimensions would generally be requested.

Wire Diameter

Outside Diameter

Inside Diameter

Active Coils

Total Coils

Free Length

Maximum Solid Height

Spring Rate

Load @ installed height

Fits in (Hole Size)

Fits over (Rod Size)

Type of Ends (Open or Closed, ground or not ground)

Corporate standards should identify general tolerances for these dimensions. The dimensions can be included on the drawing, or as a separate Corporate Standards document. Please do NOT use standard machined dimensions, such as:

1 decimal place = + /-.040

2 decimal places = +/- .020

3 decimal places = +/- .005

Angles = +/- 0.5 Degrees

Realistic general dimensions for springs might be:

Outside Diameter Tolerance = (OD +/- 2%, +/-.015 in minimum)

Free Length Tolerance = (Free Length +/- 5%, +/-.030 minimum)

Total and Active Coils = (Coils +/- 5%, +/- ¼ coil minimum)

Load @ Test Length = (Load +/- 10%. No tolerance on test length)

There is a publication "Tolerancing and Testing" published by SMI, the Spring Manufacturers Institute (www.smihq.org). We have a link on our links page to the Spring Manufacturers Institute website.

Whatever general tolerances you choose, remember you can always tighten them on the drawing by specifying a tolerance.

If you choose to go with the Corporate Standards document, remember you will be releasing this to the Supply Chain. I have dealt with several companies that have published Corporate Standards. Their drawings are marked "Indicates mandatory specifications that must be held within limits shown, or per Corporate Standard XXXX. Then the Engineering department has decided not to release the standard to suppliers, because they felt it needed to be updated. Situations such as this will require multiple drawings to be modified.

For this reason, separate Corporate Standards should be considered very carefully.