Ask The Flexperts: Pre-Forming Flex Circuits

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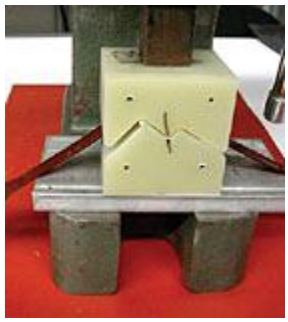
I've heard that flexible circuits can be pre-formed by the manufacturer. Is this a good idea and does it add a lot to the cost?

Properly Designed Forming Tooling Can Form Multiple, Precise Bends in a Single Operation



There are many instances where having the manufacturer pre-form a flex circuit makes sense and other instances where it is just a waste of money. When trying to determine whether or not to pre-form, you will first need to evaluate the circuit construction. Most single-layer flex circuits are far too thin and flexible to pre-form effectively. Unless you have very heavy copper conductors, the insulation materials will make up over 75 percent of the overall circuit thickness. The insulation materials have virtually no memory, so after the part is formed, it will just relax back to its flat state. Also, because a single layer circuit is so flexible, pre-forming really does not offer any assembly advantages. However, as the circuit layer count increases, the copper content as a percentage of the overall circuit thickness will also generally increase. This can make pre-forming a viable option because the higher copper content will help the circuit hold the form. Also, as the layer count increases, the circuit will get thicker and stiffer, which makes a pre-formed circuit even more attractive. The downsides to having the manufacturer pre-form your circuit are forming costs and shipping headaches. Unless your circuit has a very high copper content, a cold form in the circuit will try to relax back to its flat state. For this reason, custom shipping containers may be required to constrain the circuit in the formed condition while in transit and prior to installation. While not extremely expensive, these containers will add a moderate cost to the delivered product. A bigger problem can be the added volume that a formed circuit will occupy during shipping and storage. For example, imagine if your circuit in its flat state is approximately the size of your hand and 0.020 in thick. In that flat state, you would be able to get several hundred of them into a container the size of a shoebox. If that same circuit is pre-formed so that it occupies the volume of a baseball, you may only be able to get six to eight circuits in the same shoebox-sized container. This will drive shipping costs up, and if you have a large number of circuits delivered, they will take up a lot more room at your facility prior to installation.

The actual cost of forming a flex circuit varies according to the type of form required and the positional tolerances required of the form(s). A form that is fairly simple (i.e., moderate bend radius and positional tolerance) on a two- or three-layer circuit can be cold formed quickly with inexpensive tooling. On the other hand, a thick multilayer circuit with multiple tight radii bends will most likely require expensive precision tooling and may require that the circuit be heated prior to the forming process. Forming tools can range from a simple wedge tool that is used with an arbor press to custom hand-forming tools to complex machined tools that can form

multiple critical bends simultaneously. Obviously, as the complexity of the tooling increases, the cost of that tooling will increase as well.

The bottom line is that all of these factors have to be weighed prior to determining whether a circuit should be pre-formed by a manufacturer. Most flex circuit manufacturers will be more than happy to help you evaluate the different forming options so you can make an informed decision. If it turns out that it is more efficient or cost effective to form the circuit at your facility, a flex circuit manufacturer can help you determine the most reliable forming method for your application. The manufacturer can also assist in the design of a forming tool that can be used by assembly operators prior to installation of the flex circuit. Because many failures occur due to improper forming tooling or techniques, it is important to tap into the manufacturer's experience to ensure that all tooling is properly constructed and that all techniques are correct and repeatable. This way, any forming operations that are undertaken at your facility will not cause reliability problems at a later time.

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