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## Bringing It All Back Home: The Reshoring Initiative

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See page 11 for details!





# Don't Bring a Heat Gun to a Flex Forming Fight

**Q:** *I have a very stiff flex circuit that I am trying to form to 90 degrees. The problem is that the circuit does not hold the bend after it is formed. Is a heat gun the best tool to use to pre-heat a circuit before forming?*

**A:** Three words—NO, NO, NO. And furthermore, NO! OK, four words. Heat can be an effective method to make a flex circuit hold its shape after forming, but a heat gun is usually not the best way to apply the heat. The problem with a standard heat gun is that it

temperatures is usually a slow process, and an impatient operator may be tempted to up the temp to make things go more quickly.

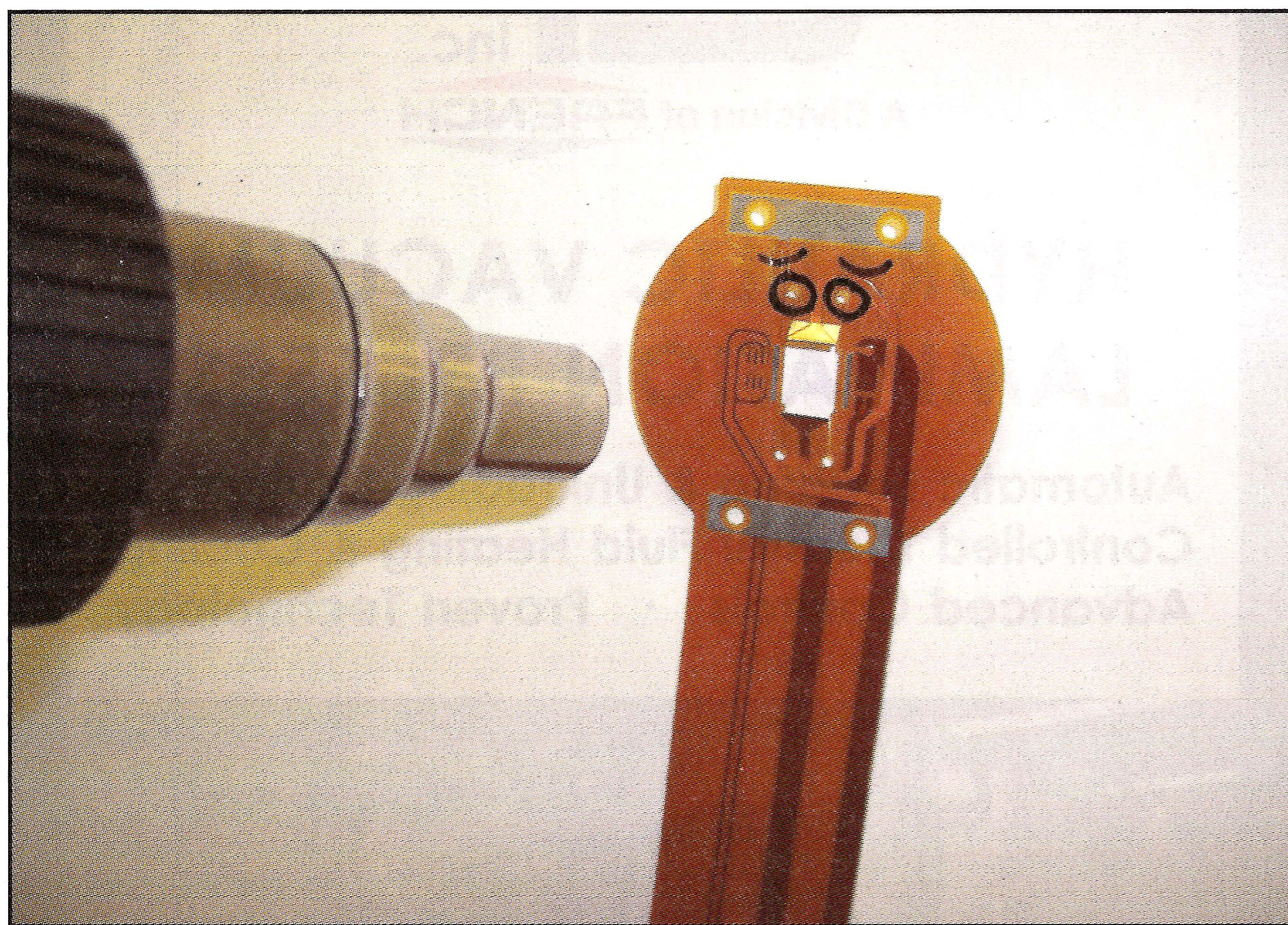
Since you stated that your flex was very stiff, I assume that it is also very thick. Also, the fact that it does not hold its shape well after forming indicates that it has a relatively low copper content. If that is the case, you would have a much lower chance of damaging your circuit if you form it cold. Once the circuit is formed, you would want to constrain the circuit in the formed condition and then apply heat. The best way to do this is with an oven with an accurate temperature

advise starting around 150 degrees F and observe what type of results you get. You should see a great improvement over your cold-only formed circuit. If the circuit still relaxes too much, kick up the oven temp by 25 degrees F and try it again. Repeat this until you get the results you desire, and then record the oven temp. You should not have to exceed 350 degrees F to get even the most stubborn circuit to hold its form. On each of your tests, ensure that the circuit and constraining tooling has thoroughly cooled before you remove the circuit. If your constraining tooling is made from a non-metallic material such as Delrin, it will take longer to cool. Thick plastic tooling may feel cool on the outside, but may still be over 150 degrees F on the inside where the circuit is held. Removing the circuit when it is still hot completely negates the benefit of heat forming.

Once your circuit is formed and is holding the desired shape, you should inspect the bend area and any other circuit surfaces that were in contact with the forming tooling. You should inspect the inside of the bend area for delamination. You will probably have some wrinkles there, but if the cover has not separated from the rest of the circuit, you are in good shape. Next inspect the outside of the bend for tears in the outer cover material or cracks in the conductors on the outer layers. If all is well, look over the other surfaces that were in contact with the tooling for any signs of damage. If the circuit looks good, you have success!

And no Flexpert column would be complete if I did not remind you that your flex circuit manufacturer is there to help you with the design of your forming tooling or any other aspect of your flex circuit design. They have most likely already done what you are attempting and would be happy to share their knowledge so that you will be successful in your venture. ■

The Flexperts are Mark Finstad and Mark Verbrugge



is almost impossible to determine how much heat you are applying to the flex circuit. The temp six inches from the nozzle may be a safe 225 degrees F, but three inches from the nozzle it could be a very dangerous 500 degrees F, and at one inch it could be a catastrophic 800 degrees F. You just don't know. And considering that there may be multiple operators doing the forming, it becomes even more difficult to control. Some of the more expensive heat guns now have digital temperature control making them a bit safer, but again the distance from the nozzle is critical. Also, flex circuit forming at safe

gauge. Once the circuit is heated to temp, it is allowed to cool back to room temp and then removed from the constraining mechanism. The circuit and constraining mechanism should be placed on a carrier such as a baking sheet to allow the circuit to be inserted and removed from the oven without actually touching the flex circuit. The flex will be very fragile when it is hot, and handling the flex with the constraining tooling prior to cooling is not advised.

The best temperature to apply to your circuit to make it hold the form is the absolute lowest temperature that works. I would