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A Cler Way to Bond

by Christian Stromberg

You can turn down the heat and save a bundle.

We're not suggesting that you do anything to the thermostat in your converter rebuilding shop. Rather, we want you to take advantage of our new bonding technology, which promises to deliver a consistent product more quickly and at a lower temperature than ever before.

First, a brief science lesson. Friction material is a mix of fibrous materials in a phenolic resin. The adhesive used to bond this material to steel is also phenolic-based. Phenolic is a thermoset type of plastic, and this plastic has some unique abilities.

Many plastics are really just very long strands of molecules. When they are heated, the strands untangle, and the plastic becomes soft or even melts. However phenolics form solid links in all directions when heated until there are no more links to be made. These remain linked when the plastic is heated or cooled, and they can't be melted again. This makes phenolics particularly suitable for applications where high temperatures and strength are required.

Recent advances in phenolic plastic technologies have had some impact on the processing of these materials. Sonnax engineers have been working with an adhesive laboratory to develop a modern adhesive that better adapts to the conditions of fast-heating commercial bonders. With Sonnax's new Process-E adhesive, torque converter remanufacturers can take advantage of these improvements and turn them into major savings in time and money.

Sonnax Process-E series friction rings take advantage of this new adhesive technology to dramatically reduce bonding time while achieving a stronger bond, and are more tolerant of real-world conditions. Process-E rings are made from the same friction materials as our standard rings, with the new bonding adhesive applied.

Friction rings are bonded to pistons by using pressure and heat that cause the adhesive to cure. The final curing temperature of Process-E adhesive is 350°F – that's the temperature the bond needs to reach in order to cure. The adhesive on the older friction rings cure at 400°F.

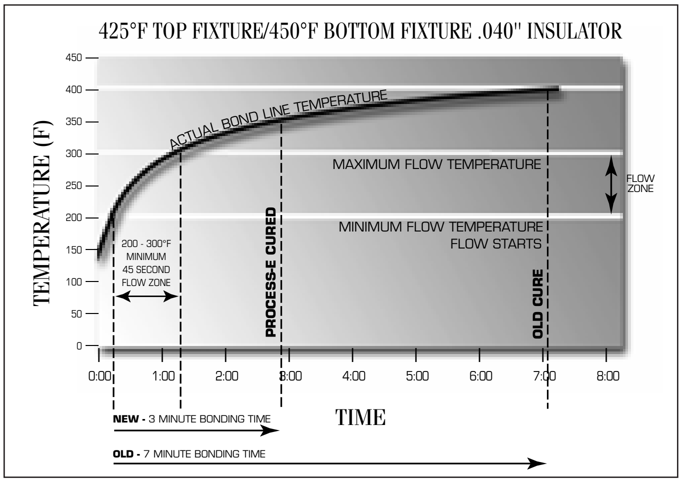
A bonding machine temperature controller setting is not the same as bond line temperature. A bonding machine may have the temperature set to 425/450°F, but the ring will not be properly bonded until the bond line temperature reaches a cure temperature of 350°F for a Process-E ring, or 400°F for the old style. Heat has to move from the heat plates through the fixture, piston and rings to reach the actual adhesive. This takes time. Regardless of what claims are made about the speed at which a particular bonder can make a good bond, the actual time is defined by how long it takes the heat to transfer through the steel piston and friction material and reach the adhesive cure temperature.

Why not just turn up the heaters? For starters, dry paper begins to scorch at 440°F, which can lead to glazing problems. Secondly, If you heat the adhesive too quickly, it hardens (crosslinks) before it can flow and wet the steel plate, which means it does not stick to the plate and the rings fall off.

Take a look at the graph on page 2. This shows a good cycle for a common GM 298mm piston and a GM-F/FE-1 ring. The new adhesive is fully cured when the temperature reaches 350°F at three minutes. It takes another four minutes to reach 400°F, the temperature needed for the older friction ring adhe-

Continued on page 2

INSIDE



sive. That's a time savings of 57%, which is significant when time is money!

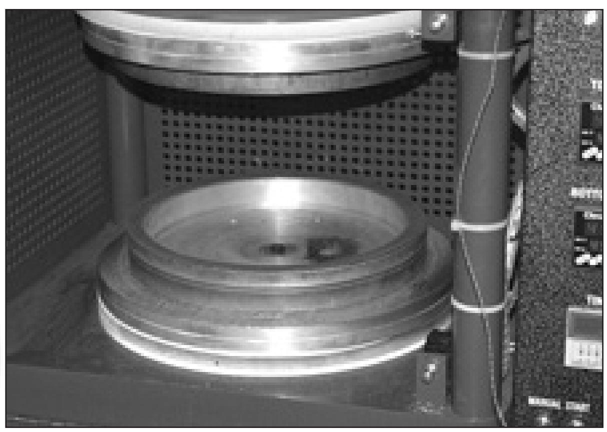
By adjusting plate temperatures and using a .040" insulator (a green ring bonded to the lower heat fixture) we created a cycle that brings the temperature up more slowly, giving the adhesive time to flow and move into the machined piston surface. The dashed lines show when the bond line reaches the 200°, 300°, 350° and 400° marks. You want the heat to rise at a rate that will allow the temperature to be between 200°F to 300°F for at least 45 seconds. Without the insulator the heat would get to the adhesive too quickly and the temperature would rise from 200°F to 300°F in under 45 seconds. In this case the adhesive would set before it had a chance to flow into the grooved steel, and the bond would be weak. After the 45-second flow time, the adhesive will cure fully at 350°F for Process-E Rings.

Other techniques you've learned for proper bonding with standard adhesives apply to Process-E rings as well. You need a minimum of 100 psi of surface pressure (150-250 psi recommended); a clean bonding surface; a piston surface finish of 90-125; and parallel bonding surfaces (no uneven pressure). If you follow these simple rules, you'll have great success!

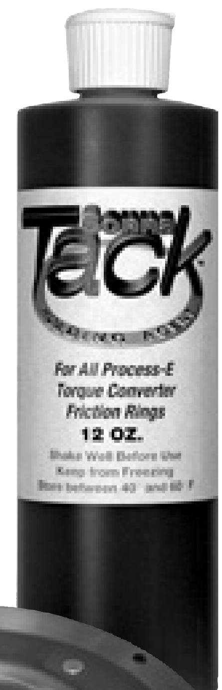
In summation, if you want to decrease your bond time and costs, our new rings with Process-E adhesive will help. By checking your bond line temperatures you can determine what the optimal bonding cycle is for your bonder, piston and friction material. By following good bonding practices, you will be able to shorten your cycle and still generate stronger bonds than before.

Here is the procedure we used to determine our optimum bond cycle:

1. Clean the surface of the piston using a solvent or other cleaner that leaves no residue.



2. Bond an insulator ring to the lower die. This is a .040" green ring bonded to the plate. Your bonder may need an .070'' insulator if it is heating too rapidly.

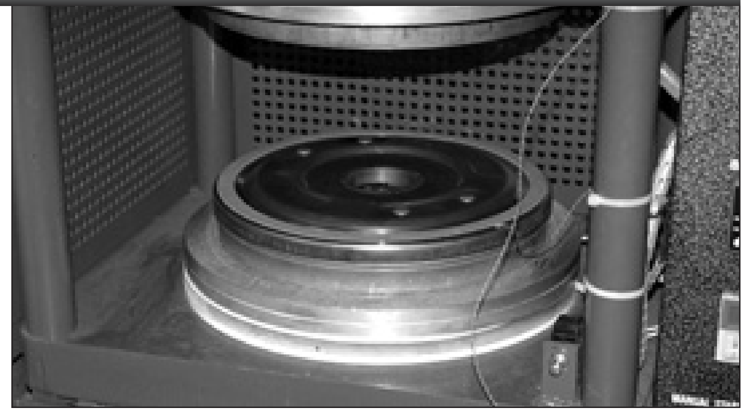


3. You can bond the Process-E rings dry, but if you need to secure the rings in place, use four small dots of SonnaTack™ (Part No. **HA12**) around the ring. Do not try to activate the Process-E rings with any liquid. Due to its durable and inert nature, it cannot be activated by any chemical.

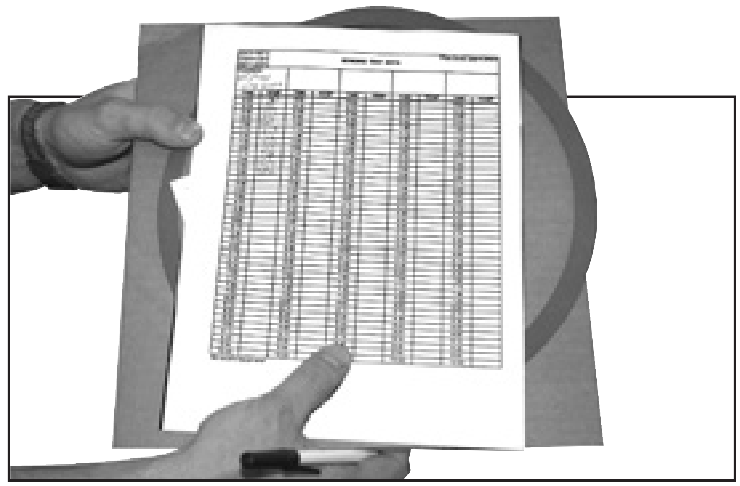
4. Set the ring in place.

5. If your operation allows sufficient time for the SonnaTack to dry (if you're racking multiple pistons before bonding) it will hold the ring very securely. If the SonnaTack is still wet, more care must be taken while handling the piston.

6. Notice the Sonnax digital thermometer **SBT-01KF** (Fahrenheit) or **SBT-01KC** (Celsius) on the outside of our bonder to show the bond line temperature. (No piston is being bonded in this photo.)



7. The thermometer lead is right under the ring. This ring doesn't have adhesive on it so we can try different settings without bonding the ring to the piston.



8. After starting your cycle, a basic paper chart showing time at 15-second intervals and the corresponding temperature off the thermometer is effective in determining your bond cycle. Just because our bonder has this heat cycle doesn't mean your bonder will have the same results. You need to check your actual temperatures! Record the result and verify that you have at least 45 seconds elapse between the 200°F to 300°F points. Note how long it takes to get to the bond line temperature, and use that for your cycle time during your next production run.

9. Everyone seems to have a different way of checking if their rings are thoroughly bonded. To really know if you have a good bond, you must destroy the ring. This scraping method is subjective, but you should not be able to easily scrape off the ring down to bare steel. While applying considerable force, this adhesive will not let go. Another thorough method is to cut the section out of the piston for a bend test. The friction material should always tear before the bond lets loose.