Centric Parts
21046 South Figueroa Street
Carson, CA 90745
Phone: 310.218.1091
tech@centricparts.com

TECHNICAL WHITEPAPER:

Pad and Rotor Bed-In Theory, Definitions and Procedures

StopTech's Recommended Procedure for Bedding-in Stock-Sized Brake Systems

When a system has both new rotors and pads, there are two different objectives for bedding-in a performance brake system: heating up the brake rotors and pads in a prescribed manner, so as to transfer pad material evenly onto the rotors; and maturing the pad material, so that resins which are used to bind and form it are 'cooked' out of the pad.

The first objective is achieved by performing a series of stops, so that the brake rotor and pad material are heated steadily to a temperature that promotes the transfer of pad material onto the brake rotor friction surface. There is one pitfall in this process, however, which must be avoided. The rotor and, therefore, the vehicle should not be brought to a complete stop, with the brakes still applied, as this risks the non-uniform transfer of pad material onto the friction surface.

The second objective of the bedding-in process is achieved by performing another set of stops, in order to mature the pad itself. This ensures that resins which are used to bind and form the pad material are 'cooked' out of the pad, at the point where the pad meets the rotor's friction surface.

The bed-in process is not complete until both sets of stops have been performed.

Bedding-in Street Performance Pads

For a typical performance brake system using street-performance pads, a series of ten partial braking events, from 60mph down to 10mph, will typically raise the temperature of the brake components sufficiently to be considered one bed-in set. Each of the ten partial braking events should achieve moderate-to-high deceleration (about 80 to 90% of the deceleration required to lock up the brakes and/or to engage the ABS), and they should be made one after the other, without allowing the brakes to cool in between.

Depending on the make-up of the pad material, the brake friction will seem to gain slightly in performance, and will then lose or fade somewhat by around the fifth stop (also about the time that a friction smell will be detectable in the passenger compartment).

This does not indicate that the brakes are bedded-in. This phenomenon is known as a green fade, as it is characteristic of immature or ‘green' pads, in which the resins still need to be driven out of the pad material, at the point where the pads meet the rotors. In this circumstance, the upper temperature limit of the friction material will not yet have been reached.

As when bedding-in any set of brakes, care should be taken regarding the longer stopping distance necessary with incompletely bedded pads. This first set of stops in the bed-in process is only complete when all ten stops have been performed - not before. The system should then be allowed to cool, by driving the vehicle at the highest safe speed for the circumstances, without bringing it to a complete stop with the brakes still applied. After cooling the vehicle, a second set of ten partial braking events should be performed, followed by another cooling exercise. In some situations, a third set is beneficial, but two are normally sufficient.

Bedding-in Club Race or Full Race Pads

For a typical performance brake system using race pads, the bed-in procedure must be somewhat more aggressive, as higher temperatures need to be reached, in order to bring certain brands of pad material up to their full race potential.

We typically recommend a set of ten partial braking events, from 60mph down to 10mph, followed immediately by three or four partial braking events, from 80mph down to 10mph. Alternately, a set of eleven stops, from 80mph to 40mph, or a set of seven stops, from 100mph to 50mph, would be approximately the same. As with street pads, each of the partial braking events should achieve moderate-to-high deceleration (about 80% of the deceleration required to lock up the brakes and/or to engage the ABS), and they should be made one after the other, without allowing the brakes to cool in between.

Again, depending on the make-up of the pad material, the brake friction will seem to gain slightly in performance, and will then lose or fade somewhat about halfway through the first set of stops. This does not indicate that the brakes are bedded-in, except where race-ready pads are being used. This phenomenon is the same as that which occurs with high-performance or street pads (except that, when race-ready pads are used, they do not exhibit green fade, and they will be bedded-in after just one complete set of stops).

As when bedding-in any set of brakes, care should be taken regarding the longer stopping distance necessary with incompletely bedded pads. This first set of stops in the bed-in process is only complete when the recommended number of stops has been performed - not before. As a general rule, it would be better to perform additional stops, than not enough. The system

should then be allowed to cool, by driving the vehicle at the highest safe speed for the circumstances, without bringing it to a complete stop with the brakes still applied.

After cooling the vehicle, a second set of the recommended number of stops should be performed, followed by another cooling exercise. In some situations, a third set is beneficial, but two are normally sufficient.

Racers will note that, when a pad is bedded-in properly, there will be approximately 2mm (0.1 inch) of the pad edge near the rotor, on which the paint will have turned to ash, or the color of the pad will have changed to look as though it has been overheated.

In summary, the key to successfully bedding-in performance brakes is to bring the pads up to their operating temperature range, in a controlled manner, and to keep them there long enough to start the pad material transfer process. Different brake system designs, pad types, and driving conditions require different procedures to achieve a successful bed-in. The procedures recommended above should provide a useful starting point for developing bed-in procedures appropriate to individual applications.

by Matt Weiss and James Walker, Jr. of scR motorsports, exclusively for StopTech

James Walker, Jr. is currently the supervisor of vehicle performance development for brake control systems at Delphi Energy & Chassis. His prior professional experience includes brake control system development, design, release, and application engineering at Kelsey-Hayes, Saturn Corporation, General Motors, Bosch, and the Ford Motor Company. Mr. Walker created scR motorsports consulting in 1997, and subsequently competed in seven years of SCCA Club Racing in the Showroom Stock and Improved Touring categories.

Through scR motorsports, he has been actively serving as an industry advisor to Kettering University in the fields of brake system design and brake control systems. He also serves as a brake control system consultant for StopTech, a manufacturer of high-performance racing brake systems. In addition, Mr. Walker contributes regularly to several automotive publications focusing on brake system analysis, design, and modification for racing and other high-performance applications. He is a recipient of the SAE Forest R. McFarland Award for distinction in professional development/education. Mr. Walker has a B.S. in mechanical engineering from GMI Engineering & Management Institute.

To find out more about Mr. Walker and scR Motorsports, visit their website at www.teamscR.com

STOPTECH

Stoptech is the performance engineering and manufacturing division of Centric Parts. It is the leader in Balanced Brake Upgrades for production cars and has three patents in basic brake technology and one other pending. With a worldwide network of resellers, StopTech's product line includes Balanced Brake Upgrades for approximately 450 applications featuring StopTech's own six-, four- and two-piston calipers, two-piece AeroRotor Direct Replacement Kits, braided stainless steel brake lines and slotted and drilled original-dimension rotors. StopTech also stocks a wide range of performance brake pads. The company's website, www.stoptech.com, is a clearinghouse of performance brake information, and provides details on StopTech products.

# # # #