



STARTUNED®

Information for the Independent Mercedes-Benz Service Professional

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Mercedes-Benz

TO OUR READERS:

Welcome to StarTuned, the magazine for independent service technicians working on Mercedes-Benz vehicles. Your Mercedes-Benz dealer sponsors StarTuned and provides the information coming your way in each issue.

Mercedes-Benz wants to present the information you need to know to diagnose and repair Mercedes-Benz vehicles accurately, quickly and the first time; text, graphics, on-line and other technical sources combine to make this possible.

Feature articles, derived from approved company sources, focus on being useful and interesting.

Our digest of technical information can help you solve unanticipated problems quickly and expertly.

We want StarTuned to be both helpful and informative, so please let us know just what kinds of features and other diagnostic services you'd like to see in it. We'll continue to bring you selected service bulletins from Mercedes-Benz and articles covering the different systems on these vehicles.

Send your suggestions, questions or comments to us at: StarTuned

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www.MBWholesaleParts.com to view this issue and all past issues of StarTuned, along with a wealth of information on Genuine Mercedes-Benz Parts.

To locate a Mercedes-Benz dealer near you, go to **www.mbusa.com**.

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Formula Friction

We've all been performing brake jobs for as long as we've been technicians. We've heard all of the typical complaints in the aftermath:

"The brake dust!"

"It's vibrating when I brake!"

and, finally,

"That squeal!"

Let's look at the savings that accrue if we do it right the first time.

—We all perform brake jobs. Most of them go flawlessly – no complaints from the customer at all. Some do not go so well. We may have the vehicle in and on a lift once or twice more to take care of one problem or another. The time wasted in putting the vehicle on and off the lift either cuts into the profits of this job, or the next one. Take a minute to calculate the time lost on a single brake job comeback. Let's say you do one brake job a day on average. For a five-day work week, that comes out to about 20 brake jobs a month. If 25% of them come back, and you only spend 30 minutes rectifying each one, that's a loss of 2.5 hours a month, and, more than that, you may have some unhappy customers.

—How can you avoid this wasted time? You'll get all sorts of advice on how to install wheel shields, cutting the rotors, and insulating the pads, but you should realize you may only be masking a problem that can resurface in anywhere from a month to a few months. The time invested in doing the job right once represents substantial savings for both you and your customer. What causes brake dust? What creates a braking vibration? What makes the brakes squeal like that? If you can answer these questions, you can prevent these costly mistakes.

—Most often, your demanding Mercedes-Benz owners are willing to invest in better quality parts,

Above: First determine if you are dealing with the SBC system. If you are, disable it. Then, you can start disassembly. These are heavy calipers, so suspend them so that there's no stress on the brake hose, line, or lining sensor wires.

so you can still maintain the same profit margins as you would with aftermarket "equivalents." Also, a brake job is more than just cutting or replacing rotors and slapping on a set of new pads. Let's do a quick review of some overlooked items.

Fact of life

—It's very common for customers to complain about accumulations of dust on their beautiful alloy wheels. Unfortunately, there's no real remedy, but explaining the truth about friction material formulas will help keep your patrons happy with your work. That is, brake pads are made according to a proprietary "recipe" that gives the best combination of stopping performance, durability, silent operation, and avoidance of dust generation. In the case of Mercedes-Benz Genuine Parts, these characteristics are very carefully engineered and tested, even to the point of the formulas being model-specific. So, to make pads that won't produce dust would require sacrifices in other, more important areas. You also might want to recommend that they apply car wax to their wheels, which will keep the dust from sticking – just a quick rinse with a hose will wash it off.

Procedures

— If there's a problem that needs to be diagnosed, it's always best to do a road test, with the customer if possible, to feel and isolate the complaint. If it is a straightforward brake job, you should start with a visual inspection. All of the wheels should come off of the affected axle. If the pads are to be replaced, then they should be removed, and each pad's thickness should be looked at. This will tell you if there are any sticking pads or pistons that may require special attention. Before any disassembly takes place, find out if the vehicle has SBC brakes. This system applies the brakes when the door is opened. If it were to be activated while the brakes are disassembled, it could be a disaster. For procedures on how to disable the system, refer to www.startekinfo.com. Once you've determined that the brake pads must be replaced, you need to look at the brake rotors. The finish should be perfectly smooth to properly "seat" or "bed in" the new pads. If a rotor has grooves, it will have to be resurfaced, or replaced.

— There are many rotor resurfacing machines that do a good job, but what will the thickness of the rotor be afterwards? Will it be down to the specified throw-away thickness? Even if it's not quite, the thinner rotor will naturally be more prone to warpage and thickness variation. Also, the brake rotor run-out will need to be measured. If the rotor is warped, even more material will need to be removed to straighten it. This may require multiple cuts. Fast cuts will get you through the process in less time, but you will need to do at least one slow cut to create a fine surface for the new brake pads. These multiple cuts will add to the labor time.

— A more cost-effective solution may be new rotors. In fact, rotor replacement has become the preferred choice, especially among first-class shops that specialize in Mercedes-Benz. As one service manager tells ST, "We've thrown away our brake lathe."

— Of course, in order to remove the rotor you will need to unbolt and lift off the caliper. Always make



Look at the surfaces where the pads slide in the caliper. These areas need to be free of brake dust and corrosion to allow the pads to slide back and forth. If the surfaces are clean, you should not need any lubricant.



The OEM pads provided by your Mercedes-Benz dealer have chamfered friction material to help avoid brake noise. The shim on the back reduces brake pad vibration, which is what causes squeal.



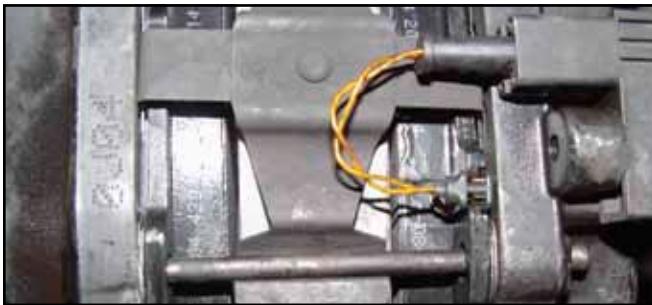
While ordering brake pads and rotors, don't forget the brake pad wear sensors. You should replace them even if the old ones are not worn out. Be careful not to route the wires so that they bear against any moving parts.

sure to suspend the caliper from a suspension component to keep the stress off the brake hose and lining sensor wires. Usually a securing bolt holds the rotor in place. Also, you may want to order new caliper mounting bolts in case the originals are damaged during removal.

Before Reassembly

—Clean components work best. You do not want brake dust and road debris interfering with pad movement. In a Mercedes-Benz brake job, you will be dealing with either a single- or dual-sided piston caliper. With the dual-sided type, you should clean the surfaces where the pads slide. This will prevent uneven wear and unusual pedal feel. Scrub with a wire brush and wash with brake cleaner. Do not use compressed air as brake dust may be inhaled and create a health hazard. On single-piston calipers, steel springs fit into the caliper mounting bracket. You will still need to clean these surfaces, and you should replace the pad springs. New ones will apply the proper amount of tension to the pads, thus reducing the chances of brake squeal. You should also clean and lubricate the caliper guide pins. Do not use anti-seize compound because it accelerates wear. Synthetic brake grease will allow the caliper to “float” and apply even braking pressure.

—Clean out as much dust as you can from the caliper dust seals without damaging them. The goal is to have all the components moving freely. You can now force the pistons back into the calipers. There has always been some debate as to whether or not the bleeder screws should be opened while doing this. The straightforward answer is that it depends. If the brake fluid is being replaced every



Clean and/or replace all brake hardware before reassembly. This will make the job go more smoothly, and will help reduce the chances of binding pads and pad vibration.

two years as Mercedes-Benz recommends, then you do not have to open the system. Try to inform your customers that brake fluid is hygroscopic, which means it absorbs moisture over time. With those customers whose brake linings last only a year or so because of heavy use, a flush should be performed every other brake job. Besides moisture, flushing the system removes most other contaminants that may cause components to stick. While you're at the dealer's parts department picking up the pads and rotors, don't forget to order OEM brake fluid and the other parts mentioned above.

Reassembly

—When installing the new pads, always put the wear sensor in the inside pad. This is usually the first pad to receive pressure. When bolting on either the caliper, or the mount to the spindle, use an approved thread locking compound and torque the bolts to specifications. After connecting the brake pad wear sensor, you can install the wheel. Tighten the lug bolts to specifications with a torque wrench. If you hammer them on with an air gun, there is a chance you will over-tighten them and warp the rotor. While the vehicle is on the ground, apply the brakes repeatedly until the pedal is firm. It is now safe to go on a road test to check your work. If the SBC systems was disabled it will need to be enabled before your road test.

In Conclusion

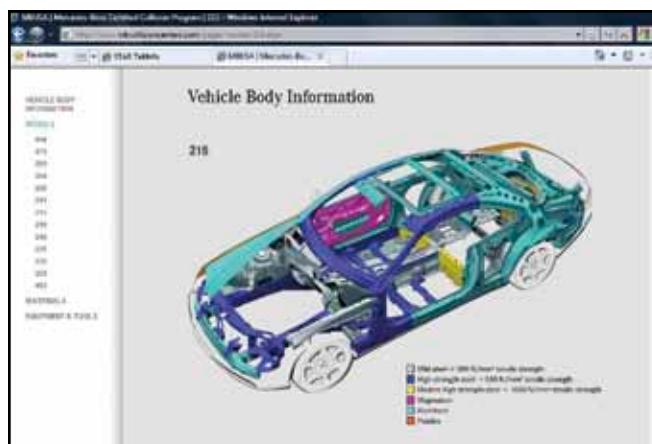
—Waiting for parts can slow down production. A one-step order from your Mercedes-Benz dealer will save you time and increase your profits. A single order of genuine original equipment brake pads, rotors, securing bolts, retaining springs, wear sensors, and brake fluid allows your independent repair shop to provide OEM-level service. Remember, a soft brake friction material will reduce squeal, but wears relatively fast and may create an objectionable amount of brake dust. A hard pad lasts longer, but is more likely to make noise and cause accelerated rotor wear. Original equipment brake pads from your local Mercedes-Benz dealership's parts department offer the best balance between the two. |

When Welding Won't Do...

New vehicle construction techniques mean new procedures in collision repair. You must maintain the integrity of the body/chassis to Mercedes-Benz standards in case of any following accidents. Here's one way you're going to get that job done.

Mercedes-Benz is committed to safety in more than just its new vehicles. These examples of automotive perfection have always been durable, reliable, and beautiful, and it's your job to keep them that way. When performing collision work, you have to look deeper than panel straightening and the perfect paint job. The chassis must be prepared for a possible second strike. It must perform the same way as it did the first time. You may attribute it to government mpg regulations requiring lighter vehicles, or just to Mercedes-Benz engineering prowess, but the bodies are getting lighter and stronger every model year. This is sometimes achieved by the use of lighter materials such as aluminum and magnesium. Also, to maintain crash strength, several different mild and high-tensile strength steels are employed. These are known as “hybrid” construction vehicles.

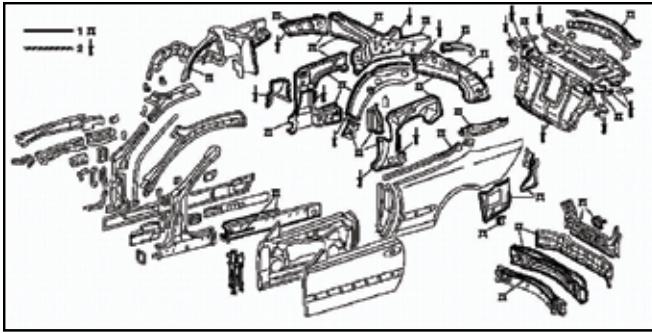
While there are advantages to this kind of construction, it does mean new work procedures for you. These different materials cannot be welded together. You must learn how to use a new and stronger method of securing panels: chemical bonding, which is an excellent alternative where welding is not possible. It also allows you to secure non-structural panels in “blind spot” areas where mechanical fasteners cannot reach. Mercedes-Benz requires a combination of riveting and chemically bonding panels to maintain chassis strength. What



Being a Mercedes-Benz Collision Center gets you access to the website. This information is vital to making the proper repair. Here you can see the different materials used in a 215 chassis.

can we do to properly repair these well-engineered machines? Training information is available through Mercedes Benz. For more information, please contact Mr. Mark Allen, mark.allen@mbusa.com.

The first step in any collision repair is a visit to the Mercedes-Benz collision repair site, www.mbcollisioncenters.com. Take a look at the “Models” area to view the construction materials of the vehicle at hand. The last thing you want to do is to start cutting the inner door panel of a 215 chassis only to find out it is magnesium. When magnesium ignites, it gives off a high-intensity light that is blinding, and can lead to many dangerous



Startekinfo's WIS program is not just for mechanical and electrical work. It also has collision repair information that you will need to do the job right. Here is a picture of where pop rivets and punch rivets should be applied on a 215 chassis.

Clean down to the metal for bonded surfaces, but do not take off the corrosion-inhibiting material (primer). It is just not necessary. Be careful about cross-contamination between aluminum and steel particles while cleaning. Keep both of these metals apart in the work area.



These are the structural rivets you need to attach modern high strength panels. They are available at your Mercedes-Benz dealer. Allow the parts department to help you pick out the right rivet when purchasing collision repair panels.

ventilation is necessary to remove the particles from the air. If you're going to working with this metal, you must avoid any cross-contamination with other metals. The reaction between aluminum dust and steel dust that occurs because they are dissimilar metals can lead to corrosion under the primer and paint. It is recommended that you have two different areas and two different sets of tools to prevent this cross-contamination. Where two different metals are attached to each other is where bonding/riveting shines. When welding, you may deform the metal. Riveting/bonding doesn't involve heat, so that won't happen. Corrosion protection is another benefit, if proper procedures are followed.

shop situations. Always know the composition of what you are cutting into. While on the website, look at the area of the crash damage and determine what metals or plastics you are going to be working with. As you browse through each material, you are instructed as to the proper methods of attaching them. For instance, mild steel can be MIG, MIG brazed, spot welded, or rivet/bonded.

Other materials such as magnesium should never be worked, and are replaced as an entire component. Aluminum cannot be resistance welded, but can be safely MIG brazed, MIG welded, and riveted/bonded. When working with aluminum, remember that its dust can be explosive. Proper

When fastening panels together with either welding or riveting, you must use the proper fasteners. When riveting aluminum, you should use aluminum rivets, and steel rivets for steel. Mercedes-Benz makes extensive use of high-strength steels in its vehicles, and therefore requires high-strength rivets. All of these materials are available through your Mercedes-Benz parts supplier, who can advise you when you are ordering replacement panels as to what rivets and bonding agents are recommended. If you are using an aftermarket supplier, you will need to ask questions such as, "Are the rivets strong enough to support modern high-strength steels?" and hope that you get a straight answer. There is no point in using

WHEN WELDING WON'T DO...

rivets that the panels will outperform in the event of another accident. Obviously, when dealing with high-strength rivets, you may have to upgrade your rivet gun to make sure it will handle the additional stress.

— Just as areas where resistance spot welds are made need to be clean, so do places where bonding is done. But if you grind the panel down to bare metal, you'll remove all of the corrosion inhibitor. So, don't take off too much, only what you need to attach the panels together. You want the bonding adhesive to attach to the metal, not a painted surface.

— Drill out rivet holes according to the work procedures outlined in WIS (Workshop Information Systems). You can access WIS through a paid subscription to www.startekinfo.com. All collision repair procedures are included, as well as mechanical and electrical repair information. When drilling out holes, try to stay away from

This kit is also available at your Mercedes-Benz parts supplier. It comes with all the necessary components except the applicator gun, which is available separately. With bonding agents, rivets, repair panels, and Startekinfo, you are good to go!



areas that were already welded since the metal is weaker there. The quantity of rivets used is just as important as the quality. Chamfer each hole to insure the rivet will compress the panels together freely. Size up the new panel's proper position with the panel it will be attached to, but do not secure it just yet. Check gaps and measurements before the final assembly.

— Now that you have done the prep work, you can start the assembly procedure. Begin by applying the bonding agent. Mercedes-Benz has kits available for this procedure. Squeeze half an inch to an inch of the two-part adhesive out of the tube. Now, use the static mixer, which forces the two separate parts together and mixes them evenly. This is known as “equalizing” the mixture. This helps the adhesive to dry evenly with uniform strength. Apply a 10 to 12 millimeter bead to the two panels being joined. Clamp the panels in their proper positions. If you need to reposition the panel, do not lift the panel and reapply it. This separates the bonding material and may allow for air bubbles. Instead, slide the panel into its proper position. Once it's in place, remove all excess material. You may find that the adhesive is getting warm as the chemical reaction

takes place. This is normal. After one hour, most bonding agents become workable, but they may take four to 24 hours to fully cure. You can now install the rivets. Be sure to fully cover them to inhibit corrosion. Next, work the area to prepare for undercoat and paint.

Finally

— With new vehicles come new techniques. You have access to all the important tools to help you do collision repairs properly, especially www.startekinfo.com, and related collision websites. Also, your Mercedes-Benz parts supplier is there to assist you in performing safe and profitable repairs. Now, that's just good business. |

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Artificial Intelligence, Transmissionwise

Computer controlled systems are everywhere, and they do add a certain level of complexity to diagnostic procedures. On the other hand, they can also make mechanical troubleshooting easier.

—One of the benchmarks of a well-engineered motor vehicle is its road manners. In the case of an automatic transmission, the goal is smooth, seamless shifting. This is accomplished by applying exactly the right hydraulic pressure at exactly the right time to the clutch assemblies. If the pressure is too high, the shifts will be too firm and very noticeable. If too low, the clutches will slip, causing long, slow shifts that accelerate wear and are also noticeable. The key is precise control of both the pressure and timing of the shifts, which results in a transmission that offers maximum fuel efficiency, performance and durability, and imperceptible shifting. Of course, aggressive drivers require firm shifts, while more easy-going drivers want smoother shifting. So, engineers have always had to strike a balance between the two during the design process. Sophisticated electronic control of line pressure and shift points makes that less of a compromise.

Mortality

—Even the most well-built transmissions can't live forever. Clutch assemblies wear, and the clutch material circulates around the hydraulic circuits. This can cause the pistons in the valve body to stick and possibly affect shift quality. As the plates get thinner, it takes more time for the clutch to grip, which accelerates wear. The way the vehicle is driven will affect longevity as well. Adaptive strategies in the electronic module help to mitigate the damage, and maintain shift quality in spite of the inevitable wear.

—How does the control unit know what to change? Input sensors provide the necessary data. There

Above: Before reading any adaptation data, the first step is to verify proper fluid level. If the level is too low, you cannot trust the readings to tell you the true condition of the transmission. Here is the special tool available from your Mercedes-Benz dealer for checking fluid level.



Above the valve body are speed sensors N2 and N3. They fit into the lower part of the case and indicate the speed of the clutch basket tone wheel. This is how the control unit determines slippage. Make sure you do not have any speed sensor problems before trusting scan data.

is a fluid temperature sensor, pressure sensors, and speed sensors. By comparing the speed of the input and output shafts, the computer can determine when the clutch assemblies engage. If the sensors indicate slippage, more pressure can be applied by different commands to the hydraulic solenoids. A pressure sensor monitors this change. The temperature sensor is used to manage shifting during cold and hot situations. All of this happens during normal driving.

Sensor data

—Artificial intelligence in the programming and the electronic transmission control unit (ETC) monitors sensor data, changes shift points, and

even compensates for wear. This information can be valuable when diagnosing a problem with transmission performance. The SDS scan tool will display this data and allow you to make a more precise diagnosis. After selecting “Drive,” select “Transmission” on your SDS, or equivalent. Or, you can select it directly after performing a “Quick Test.” From here, you can pull codes, look at live data, and evaluate transmission “Adaptation Data.” Considering the cost of transmission repair, your accuracy may mean the difference between a happy and an unhappy customer.

While monitoring adaptation data, you will notice that you can select to look at up-shifts or down-shifts. If you are trying to diagnose a specific shifting problem, you can look at the “Assignment of hydraulic shift elements.” This tells you what solenoids are active during a particular shift. For instance, let’s say you are looking for a 1-2 shift problem. You can see that in first gear hydraulic

brake solenoids B2 and B3, as well as clutch solenoid K3, are engaged. In second gear, solenoid B3 is no longer activated, but B1 is now energized. Now that you are familiar with which solenoids affect which shift, you can monitor the solenoids that have an affect on the shifting problem.

Reset

With the SDS, you can reset the adaptation data as well as view it. When viewing the data, you are given two parameters. The first one is “Fill Time of Brake (solenoid) B1 through B3,” depending on how many gears this particular transmission has. This counter is measured in cycles. To assist in reading the data, the maximum and minimum readings are displayed as well as the actual value for three different temperature ranges. Ideally, you should see the number “0” in the actual value field. This means the ETC does not have to compensate at all for any component wear.

Vehicle	211.022	Control unit	ETC
Electronic transmission control (722.9 7G-Tronic)			
Control unit version			
Fault codes			
Event memory			
Actual values			
Initial startup			
Control unit adaptations			
Transmission adaptation			
Diagnosis routines			

Once you’ve selected the EGS control unit, you can enter the transmission adaptation tables and look at the readings. You have the option to look at upshifts, downshifts, and reset the tables. This should be done if transmission fluid levels were low, or other problems were found (speed sensor codes, for example).

Vehicle	211.022	Control unit	ETC		
Adaptation data					
Adaptation values of shift 1 - 2:	Lower limit value:	Upper limit value:	Actual value 60°C	Actual value 90°C	Actual value 110°C
Fill time of brake B1 [cycles]	-20	20	-7.5	-7	-7.5
Brake filling pressure B1 [mbar]:	-2000	2000	-240	-400	-240

The adaptation tables show you the maximum and minimum limits for each reading. You also see readings for a cold, normal and hot transmission. The upper reading indicates the time it took to apply the clutch basket. The lower reading indicates the pressure required to make that happen.

—The second line of data is “Brake Filling Pressure” for each shift. This is measured in mBAR from the pressure sensors. Once again, the maximum and minimum limits are displayed along with the actual values for three temperature ranges. In either case, if you see a negative number, the control unit is reducing pressure to correct the shift. If you see a positive number, the control unit is adding pressure to improve shift quality. This is more common with high mileage transmissions that have significant wear. Resetting the adaptations allows you to bring the counters to zero as if the transmission were new. After evaluating the current data and resetting, you can then perform an “Adaptation.”

—Put the ETC in adaptation mode and go on a road test. The computer will make changes to the shifting patterns faster than it would if the owner were just driving it around. Look to see how quickly these adaptations are made. A worn or malfunctioning component will cause the actual values to change a lot. Adaptation can be read and performed for both the shift solenoids and torque converter lock-up performance.

—If either of these values is excessive, repair work is going to be needed. By looking at the value for each shift, you may determine that the transmission

is worn out and a single repair will correct the problem, but a remanufactured transmission from Mercedes-Benz may be a more cost-effective solution in the long run because all Genuine Remanufactured Parts meet the same standards for quality, reliability and value as brand new parts. The term “remanufactured” means brought back to production specifications, reassembled, and tested such that the expected performance can be defined and warranted (two years, or 24,000 miles, whichever comes first). It’s an entirely different level of quality than aftermarket transmissions that may be called “rebuilt,” which typically means replacement of only those components that may be broken or unusable, without a complete disassembly and precision inspection.

Finally

—Mercedes-Benz transmissions are completely capable of lasting 200,000 miles and beyond. Using smart computers along with regular maintenance increases their life, but ultimately an overhaul will be required. Take the time to read the adaptation data and explain to customers what is in their best interest. In most cases, you’ll find that the typical Mercedes-Benz owner will be willing to invest in the repair. |

Resetting of adaptation data

IMPORTANT NOTE :

- Adaptation data should only be reset following completion of repair work.
- Resetting the adaptation data cannot be expected to improve shift quality, though there will be a change.
- To optimize shift quality, adaptation can be performed using menu item 'Performing adaptation'.

Either as a diagnostic procedure, or after the repair is complete, reset the transmission adaptation tables. There will be a noticeable change in shifting. Drive the vehicle and feel if any shifts are not smooth. From here, you can force the adaptation to improve shift quality.

Upshifts

Warning!

Always adapt the complained shift operation only. There is no technical reason to perform an adaptation procedure for all shift operations.

Before performing adaptation, it is essential to refer to the following notes :

- Test procedure carried out as part of the road test
- A second person is always required for this step to check the data displayed.
- When carrying out adaptation, it is important to ensure that the specified torques are not exceeded as no adaptation of the transmission takes place in this case.

If a transmission shift is not up to par, you can adapt that one shift, whether upshift or downshift. Follow the instructions on your SDS screen. During the procedure, avoid any sudden throttle movements that may block the adaptation.

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- N**EW — Tested to new unit standards.

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Remanufacturing Process (Genuine Mercedes-Benz)

1. Dismantle core and clean all components.
2. Replace key components 100% with new OE part.
3. Test all other critical components.
4. Replace components that do not meet specs.
5. Assemble, test and box.

Rebuilt Process (Typical Aftermarket)

1. Identify damaged part or parts.
2. Replace damaged part with non-OE part and clean.
3. Re-assemble, test and box.



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DENSO

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If these factory brake parts were any more local, you'd be living in Germany.

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