

AUTOMOTIVE ENGINEERING

The Ultimate Technical Guide to the 2007 Mercedes-Benz R-Class (W251): Engineering, Maintenance, and Owner's Resources

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The 2007 Mercedes-Benz R-Class, internally designated as the W251, represents one of the most intriguing chapters in modern automotive engineering. Marketed as a "Grand Sports Tourer," the R-Class was designed to bridge the gap between a luxury sedan, a premium SUV, and a high-capacity MPV. For owners, enthusiasts, and technical professionals, understanding the intricate systems of the 2007 model year—which saw the introduction of the legendary R63 AMG and the refinement of the 4MATIC system—requires a deep dive into its 570-page owner's manual and workshop documentation. This article provides a comprehensive technical analysis of the vehicle's architecture, maintenance protocols, and the critical importance of localized technical data for preserving these complex machines.

The Architectural Framework of the W251 Chassis

The 2007 R-Class shares its DNA with the M-Class (W164) and GL-Class (X164), utilizing a unibody construction rather than a traditional body-on-frame design. This choice was pivotal for achieving the ride quality expected of a Mercedes-Benz flagship while maintaining the structural rigidity necessary for a vehicle with a long wheelbase (3,215 mm for the long version). The engineering focus was on **NVH (Noise, Vibration, and Harshness)** reduction, utilizing high-strength steel alloys in over 60% of the body structure.

Technically, the R-Class features a double-wishbone front suspension and a four-link independent rear suspension. The 2007 models often came equipped with the **AIRMATIC** semi-active air suspension system, which integrates the **Adaptive Damping System (ADS II)**. This system uses complex pneumatic bellows instead of traditional coil springs, allowing for variable ride height and electronic control of damping forces based on road conditions and driving style.

Key Powertrain Configurations for 2007

The 2007 model year offered a diverse range of powerplants, each requiring specific maintenance schedules and technical oversight. From the fuel-efficient R320 CDI to the high-performance R63 AMG, the engineering variations are significant:

- R350: Powered by the M272 3.5L V6 engine, featuring 24 valves and double overhead cams (DOHC).

- R320 CDI: Utilizes the OM642 3.0L V6 Turbo Diesel, a masterpiece of common-rail direct injection (CRDI) technology.
- R500: Features the M113 5.0L V8, known for its reliability and 3-valve-per-cylinder architecture.
- R63 AMG: The pinnacle of the range, housing the hand-built M156 6.2L naturally aspirated V8.

Detailed Technical Specifications Matrix

To understand the performance envelope of the 2007 R-Class, we must evaluate the core metrics that define each variant. The following table provides a side-by-side comparison of the primary technical data found in the 2007 workshop manuals.

Feature	R350 4MATIC	R320 CDI	R500 4MATIC	R63 AMG
Engine Code	M272.967	OM642.950	M113.971	M156.980
Displacement	3,498 cc	2,987 cc	4,966 cc	6,208 cc
Horsepower	268 hp @ 6000 RPM	221 hp @ 3800 RPM	302 hp @ 5600 RPM	503 hp @ 6800 RPM
Torque	258 lb-ft @ 2400 RPM	376 lb-ft @ 1600 RPM	339 lb-ft @ 2700 RPM	465 lb-ft @ 5200 RPM
Transmission	7G-TRONIC (722.9)	7G-TRONIC (722.9)	7G-TRONIC (722.9)	7G-TRONIC Speedshift
0-100 km/h	8.3 Seconds	8.8 Seconds	7.0 Seconds	5.0 Seconds

Deep Dive: The 7G-TRONIC Transmission and 4MATIC System

One of the core mechanical innovations present in the 2007 R-Class is the **7G-TRONIC (722.9)** automatic transmission. This was the first seven-speed automatic transmission in a production passenger car. Its design incorporates two reverse gears with different ratios and the ability to skip multiple gears during downshifting (e.g., from 7th straight to 5th) to maximize torque delivery.

The **4MATIC** permanent all-wheel-drive system in the W251 is equally sophisticated. It operates via a center differential that splits power 40:60 between the front and rear axles. Unlike traditional locking differentials, the R-Class utilizes the **4-ETS (Electronic Traction System)**. This system uses the ABS/ESP sensors to monitor wheel slip and applies braking force to individual wheels that have lost traction, effectively simulating a locking differential and redirecting torque to the wheels with grip.

The Role of the Owner's Manual in Technical Management

The 2007 Mercedes-Benz R-Class owner's manual is not merely a guide for basic operation; it is a 570-page technical repository. For the at-home mechanic or the dedicated owner, the manual serves as the first line of defense against operational errors. Key sections include:

1. **Fuses and Relays:** Detailed diagrams of the engine compartment, passenger footwell, and rear cargo area fuse boxes. This is critical as the R-Class is heavily reliant on SAM (Signal Acquisition and Actuation Modules) units.
2. **Fluid Specifications:** Precise requirements for MB 229.5 or 229.51 engine oils, essential for preventing premature wear in the M272/M273 balance shafts or OM642 particulate filters.
3. **Tire Pressure Monitoring System (TPMS):** Instructions on recalibrating sensors after tire rotation or replacement, a common point of electronic failure if not handled correctly.
4. **Emergency Procedures:** Manual override instructions for the electronic gear selector (Direct Select) and the power tailgate.

Maintenance and Common Technical Challenges

As the 2007 R-Class fleet ages, specific technical challenges have emerged that require rigorous adherence to the workshop manual's service intervals. Maintaining a luxury MPV of this complexity involves proactive management of its various subsystems.

1. The AIRMATIC Suspension System

The air springs (bellows) are prone to developing micro-cracks over time. If the air compressor runs too frequently to compensate for a leak, it may burn out. Technical diagnostics involve using the **STAR Diagnosis System (SDS)** to check for pressure deviations in the central reservoir and

individual strut valves.

2. M272 Engine Balance Shaft Issues

Early 2007 R350 models were occasionally affected by the M272 balance shaft gear wear issue. The gear teeth can wear down, causing the engine timing to drift. This triggers a Check Engine Light with codes P0016 or P0017. Correction requires an extensive engine-out repair, highlighting the importance of checking engine serial numbers against known technical service bulletins (TSBs).

3. Oil Cooler Seals in the OM642 (R320 CDI)

The V6 diesel engine is a powerhouse, but it is notorious for oil cooler seal leaks. The cooler is located in the "V" of the engine. While the seals themselves are inexpensive, the labor involves removing the turbocharger and intake manifolds. Following the workshop manual's torque sequence is vital to prevent future leaks.

Step-by-Step Procedure: Manual Reset of the Service Indicator (ASSYST PLUS)

For owners who perform their own oil changes or basic maintenance, resetting the **ASSYST PLUS** service computer is a necessary step. While typically done via a diagnostic tool, it can be performed through the steering wheel controls:

- Step 1: Turn the ignition key to position 1.
- Step 2: Press the system selection button on the steering wheel until the basic display (odometer) appears.
- Step 3: Press the 'reset' button (usually on the side of the instrument cluster) three times rapidly. You should hear a beep and see the voltage display.
- Step 4: Use the down arrow button to navigate to the "Service Menu."
- Step 5: Navigate to "Full Service" and confirm.
- Step 6: Select the oil grade used (e.g., "Standard Oil" or "MB 229.5") and confirm the service completion.

Comparative Analysis: R-Class vs. Contemporary Competitors

In 2007, the R-Class competed in a unique niche. It was often compared to the Audi Q7 and the Mercedes-Benz GL-Class. However, the R-Class offered a lower center of gravity and more car-like handling characteristics.

Metric	2007 R-Class (W251)	2007 Audi Q7 (4L)	2007 GL-Class (X164)
Platform	Unibody / MPV-Crossover	Unibody / SUV	Unibody / Full-size SUV
Max Cargo Volume	85.0 cu ft	72.5 cu ft	83.3 cu ft
Turning Circle	39.2 ft	39.4 ft	39.7 ft
Drive Config	Rear or AWD	Quattro AWD	4MATIC AWD

The R63 AMG: A Technical Anomaly

The 2007 R63 AMG deserves special mention as it remains one of the rarest production Mercedes-Benz models ever built. With fewer than 200 units estimated for the North American market, it is a collector's item. Technically, it required significant modifications to the W251 chassis to accommodate the **M156 V8**. The braking system was upgraded to 390mm perforated discs at the front, and the transmission was tuned for much faster shift times. For owners of this specific model, the "Owner's Manual Supplement for AMG Models" is an essential document, as it outlines unique oil requirements and thermal management procedures.

Troubleshooting Electrical Subsystems

The R-Class is equipped with a complex **CAN-BUS** (Controller Area Network) system that facilitates communication between the ECU, TCM, and various SAM modules. Common electrical issues often stem from water ingress in the rear SAM (located under the cargo floor), which can cause erratic behavior in tail lights, fuel level sensors, and the central locking system.

When troubleshooting, a professional-grade multimeter and an OBDII scanner capable of reading Mercedes-specific hex codes are required. **Resistance Testing:** Always ensure the battery is disconnected before testing the resistance of CAN wires to avoid damaging the sensitive CMOS circuits within the modules.

Practical Implementation: Winter Maintenance for the 4MATIC

Given that many R-Class vehicles are used in northern climates, maintaining the 4MATIC and winter-related systems is crucial. The workshop manual recommends:

- **Transfer Case Fluid:** Inspecting the transfer case for leaks. The fluid should be changed every 60,000 miles to prevent internal chain wear.
- **Heated Washer System:** The R-Class features a heated washer fluid reservoir and heated nozzles. Ensuring the correct concentration of winter-grade washer fluid is vital to prevent the heating element from cracking the reservoir due to freezing expansion.
- **Battery Health:** Because the R-Class has high parasitic draw from its numerous ECUs, a battery with at least 900 Cold Cranking Amps (CCA) is recommended for 2007 models.

Conclusion and Future Outlook

The 2007 Mercedes-Benz R-Class remains a testament to a time when automotive manufacturers were willing to experiment with daring new segments. Its blend of mechanical complexity and luxury utility makes it a rewarding vehicle to own, provided that the owner respects the technical requirements outlined in its manuals. Whether you are performing a routine oil change on an R350

or maintaining the rare powertrain of an R63 AMG, access to accurate technical data-such as torque specifications, fluid capacities, and electrical diagrams-is the difference between a reliable luxury cruiser and a stationary project car.

As these vehicles transition into the realm of modern classics, the availability of digital owner's manuals and workshop PDF archives becomes even more critical. They allow the next generation of enthusiasts to preserve the engineering integrity of the W251, ensuring that the "Grand Sports Tourer" continues to provide its unique blend of comfort and performance for years to come. Understanding the mathematical precision of its 4MATIC system and the chemical requirements of its various lubricants is not just about maintenance; it is about honoring the sophisticated German engineering that defined the mid-2000s Mercedes-Benz era.