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I-CAR ADVANTAGE Online™

Technical Information For The Collision Industry

ADVANCEMENTS FROM THE INSIDE OUT - THE CHEVROLET CORVETTE ZR1

All Corvettes are built in Bowling Green, KY, but only one can claim the title of the fastest Corvette ever built. That title goes to the 2009 ZR1. Using advanced materials and manufacturing processes, General Motors reviewed the Corvette from top to bottom, improving all aspects of the car's performance while maintaining day-to-day driveability. (see Figure 1).

To ensure proper repairs, General Motors requires dealerships slated to receive the ZR1 have at least one technician attend a hands-on, four-day training program at the I-CAR Tech Centre in Appleton, WI on the collision repair procedures for the vehicle.

ALUMINUM SPACE FRAME

The aluminum space frame of the ZR1 is identical to the Z06 space frame. Using GMA (MIG) welding, laser welding, and self-piercing rivets, about 90 cast and stamped aluminum parts are joined to the hydroformed rails creating a strong, lightweight chassis.

Some factory assembly processes, including laser welding, cannot be duplicated in a collision repair facility. A second challenge is the repair or replacement of parts originally joined with self-piercing rivets. Alternative assembly processes including GMA (MIG) welding or monobolts are used to repair the structure.

Inner panels are constructed of carbon fiber, sheet-molded compound, or aluminum. The correct joining process should be used based on the materials being joined to the space frame.

There are multiple die-marks or zones that designate where the rails of the space frame can be sectioned. A pre-sleeved service part is only available for the front rail end. All other sectioning procedures require the purchase of a complete rail with sectioning done in the designated locations (see Figure 2).

Figure 1– Chicago Auto Show 2009 – Day Two IMG_8528JPG) The Corvette ZR1 uses multiple materials in construction including aluminum, sheet-molded compound, and carbon fiber.

Figure 2– General Motors has die marks (red) and sectioning zones (blue) for the ZR1 rail.

COOLING AND LUBRICATION

To develop 638 hp from the LS9 engine, General Motors uses a four-lobe rotor supercharger that can reduce the intake charge up to 60°C (140°F). To achieve this reduction in temperature, the supercharger has an independent liquid cooling system consisting of a coolant tank, pump, and radiator.

Similar to the Z06, the ZR1 has a dry-sump lubrication system. However, the ZR1 system operates at a higher pressure and volume and includes an additional 2.6 liter (2.75 quart) reserve oil tank. Due to the high performance output of the engine, ZR1-specific parts must be used when servicing the engine and drivetrain.

BRAKES

Upgrades to the braking system include carbon-ceramic rotors with 6-piston front and 4-piston rear calipers and a ZR1-specific ABS system. The benefits of using carbon-

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ceramic include high-heat resistance and a lighter weight. A carbon-ceramic brake rotor for a ZR1 is approximately 5 kg (11 lb) lighter than a comparable cast-iron rotor. Unlike a cast-iron rotor that measures wear by rotor thickness, a carbon-ceramic rotor is measured by weight. A rotor must be replaced when the weight is below the minimum requirement stamped on the rotor.

Carbon-ceramic brake rotors are more fragile than their cast-iron counterparts. Four foam rotor protectors are shipped with each ZR1 and must be used to protect the rotors when removing a wheel or rotor from the vehicle. No brake, wheel, or tire cleaners should come in contact with the carbon-ceramic rotors at anytime (see Figure 3).

MORE CARBON FIBER

To help offset the increase in vehicle weight from the supercharger, larger wheels and tires, additional parts, and to improve the vehicle center of gravity, more carbon fiber is used in the ZR1 compared to the Z06. The carbon fiber parts can be divided into two groups by their exterior finishing process.

Exposed weave parts include the roof, wheel flares, rocker panel trim, front splitter, and the underside of the hood. A special additive is mixed with the clearcoat at the factory for all exposed weave parts except the hood for protection against UV radiation (see Figure 4).

The wheel flares, rocker panel trim, and front splitter are installed at the dealership. Following installation, ground clearance is reduced to approximately 63 mm (2.5 in). Extra care must be taken when servicing the ZR1, including using ramps to raise the vehicle to an acceptable level of ground clearance for a hoist.

The outer hood and fenders are constructed of carbon fiber and finished with traditional processes like all other Corvettes. There are repair options for some damage to painted carbon fiber panels provided the damage does not extend to the edge of the panel.

The hood is unique to the ZR1 with a raised center section, creating additional room under the hood and includes a polycarbonate window displaying the supercharger (see Figure 5). Shallow scratches to the polycarbonate window can be repaired with polish and a reapplication of clearcoat with UV protection. More extensive damage to the polycarbonate window will require replacement of the hood.

CONCLUSION

General Motors has chosen aluminum, sheet-molded compound, and carbon fiber for both strength and lightweight characteristics for the ZR1. Carbon-ceramic brakes and the liquid-cooled supercharged V8 further enhance the performance. With proper training, Corvette technicians will be educated on the unique aspects of the ZR1 and how to handle collision repair scenarios.

For comments or suggestions on the Advantage Online, please contact I-CAR at advantage@i-car.com.

Figure 3– Carbon-ceramic brake rotors require ZR1-specific tools when servicing the wheels or brakes.

Figure 4– The exposed weave carbon fiber on the ZR1 has a special additive applied to protect against UV radiation.

Figure 5– The carbon fiber hood on the ZR1 has a polycarbonate window to display the supercharger.