

Designing couplings for the fastest sports car in the US



When you're building America's fastest production sports car - General Motor's ZR1 Corvette - you need quality components that can deal with speeds of 200mph and 6,600rpm. Unidrive, who were developing the driveshaft for this powerful engine, turned to Gulf to design and manufacture the critical rubber couplings that could handle these extreme requirements.

The application

The Corvette has a 6.2L V8 supercharged engine producing 620HP, 823Nm of torque through the driveline. This generates operating temperatures of up to 120 degrees Celsius inside the torque tube, the ZR1 Corvette truly is a hot car. In fact, it's the most powerful Corvette ever built. Used for Indy 500 racing, it reaches speeds of up to 200mph.

One of the key components of such a high specification vehicle is the driveshaft, which was developed by Unidrive, an Australian-based supplier of boutique prop shafts. As part of their design, they required specialist rubber couplings to connect the engine to the gearbox and reduce vibration and wear.

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The challenge

Unidrive approached Gulf to design a rubber coupling that would meet the extremely tough specifications and requirements of the ZR1. “As an existing supplier to Unidrive

for alignment bushes we had established a good track record,” says Andrew Smart, Sales Manager at Gulf Australia. “We ticked all the boxes in terms of having the product expertise, meeting quality standards and offering a low cost solution.”

The ZR1 is a unique and extreme application for a rubber coupling with very challenging parameters. The couplings needed excellent fatigue and durability properties in order to endure high torque loads of up to 1,800Nm, temperatures of up to 120 degrees Celsius and rotational speeds of up to 6,600rpm.

Maximum precision was required as the clearance space between the coupling and the lining of the torque tube was less than 2mm, and an angular misalignment of up to 1 degree had to be factored in.



The custom designed Corvette ZR1 coupling

Case Study #021: Corvette Coupling

How Gulf made a difference

Using its technical expertise in this sector, Gulf was able to precisely calculate the rubber coupling strength required and design all components accordingly. This included the rubber, nylon yarn, a steel mushroom head bush and steel collars. To achieve the material strength required, purpose built nylon loops were assembled into a nest and rubber overmoulded. The parts were then tuned and tested to meet stiffness, durability and fatigue specifications.

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“We developed a unique design with six mushroom head bushes instead of three, which hasn’t been manufactured by our competitors,” says Andrew Smart. “Our design is special and of the highest quality, ensuring performance and durability. On top of this, we were able to deliver this very quickly and cost-effectively.”

A key success factor was the test equipment. Having test rigs that can simulate the exact situation in the vehicle allowed Gulf to confirm that their design met all requirements without the customer having to test it first.

Result

On time and within budget, Unidrive received high performing rubber couplings that were fully tested and met all their requirements. The couplings have been in production since 2008, maintaining a zero defect record even in Indy 500 racing.

Gulf has produced over 1 million couplings and is now also a long-term coupling supplier for Jaguar, Holden, Jeep, Ford and other vehicles.



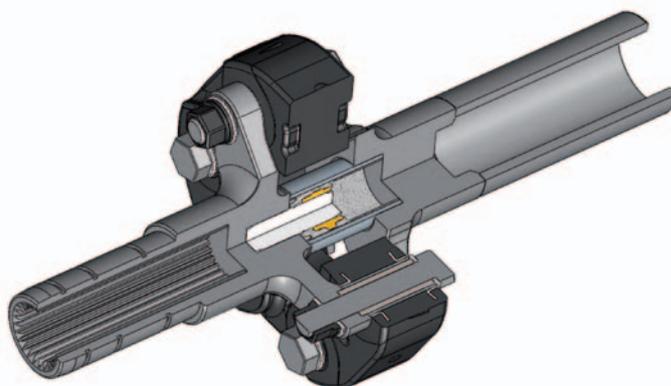
Project Overview

Customer: Unidrive

Project: Rubber couplings for General Motor’s ZR1 Corvette

Application parameters:

- High torque loads of up to 1,800Nm
- Temperatures of up to 120 degrees Celsius
- Maximum rotational speed of 6,600rpm
- Clearance of less than 2mm between coupling and inside of torque tube
- Angular misalignment of up to 1 degree
- New bush with aluminium flange, allowing M12 bolt torque to 110Nm with no bush deflection under bending loads
- Limited space inside the torque tube for the components.



- Used in rear wheel and 4 wheel drive vehicles.
- Absorbs torsional shocks for a smooth and quiet ride.
- Must allow cardanic motion.
- Requires precision moulding involving rubber, nylon yarn and steel.

