Instron® TechNotes

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Application Story

MacGyver-style Leg Brace May Reduce Amputations

In developing African countries, many individuals wait several months to receive proper care for compound fractures, which often results in amputations. Treatment is delayed because appropriate surgical implant systems for leg fractures are expensive and scarce.

The Dartmouth Biomedical Engineering Center took on this humanitarian challenge and is currently working with the Mulago Hospital in Uganda and the Anchorage Fracture and Orthopedic Clinic to develop an affordable solution for doctors in Africa.

"We are making external fixation (ExFix) devices, designed to help stabilize compound fractures, with the materials that are readily available in Africa. This MacGyver-type approach means that we can only use supplies such as PVC pipe, gauze and construction glue," says John Currier, Research Engineer at the Thayer School of Engineering at Dartmouth.

After Currier and his team designs and constructs the ExFix prototypes, they test them to simulate a patient walking with the device in place. Currier uses an Instron 8501 fatigue testing system, with an EXTEND upgrade, to test the materials available to build these devices.

"We learned that a single pipe allows too much motion of the bone, so it's important to place one of the pipes as close to the broken limb as possible, with the other pipe 2 or 3 inches away. This prevents excessive load on the bone fracture surface, which is not only painful, but can also inhibit healing. Once we design the best option, we will put together guidelines for the doctors to use in the construction of these ExFix devices in the field," says Currier.

Currier and his coworkers applied to the Orthopedic Research and Education Foundation for a grant to fund this humanitarian project. Currently the team is on track to produce an ExFix device that could be made in Africa for a tiny fraction of the cost of a functionally equivalent device from the United States.

Tech Tip

Unsure if your load cell is reading correctly?

Use the calibration check function available in your Instron software to check the value of your load cell. This value is usually 50% of the full load cell rating for static load cells (used in universal testing systems) and 100% for fatigue and torsion load cells. For more information, use your software's online help system.

Ask the Expert

Have a question about materials testing?

Submit your question and you may see it featured in a future issue of TechNotes.

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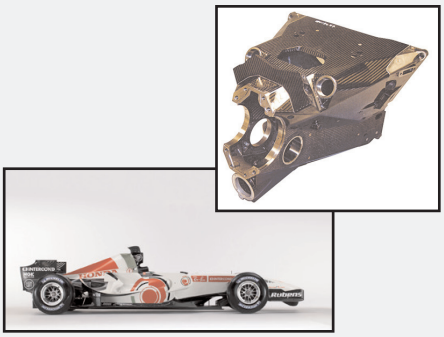
Technologies

Case Study: Formula 1 Racer Gears Up With Carbon Fiber

By: Sara Black, Technical Editor,
High-Performance Composites © Ray Publishing



Of the numerous forms of motor sports, Formula 1 auto racing is the most advanced in terms of both technology and money. One recent innovation is a composite gearbox developed by the B.A.R. Honda Formula 1 design team, now the Honda Racing F1 Team.

Source: Honda Racing

The gearbox encases the car's high-grade steel gears that are responsible for transmitting the engine's rotational power to the rear wheels. The composite solution came about because of the lackluster performance of previous aluminum versions. Because weight and low inertia are so critical at this level of racing, aluminum castings for the gearbox had to be extremely thin and, as a result, rapidly developed fatigue cracks due to imposed vibrational and torsional stresses.

Honda tested the new gearbox using Instron®'s 5582 (100kN) and 5584 (200kN) floor-standing universal test machines fitted with hydraulic grips and an Instron environmental chamber.

The results showed improved tensile and shear strength, along with increased fracture toughness. Honda was convinced the new composite material from Cytec Engineered Materials Inc. delivered the necessary strength and toughness for this demanding application and as a result, it specified the new composite formula for not only the gearbox, but other composite parts on the car as well.

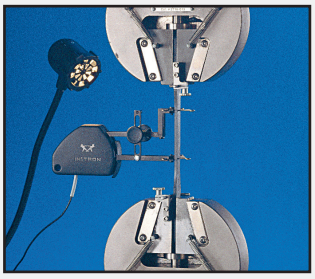
"We consider the composite gearbox to be the 'jewel in the crown' in terms of our race car design," says Honda Racing F1 Team's deputy technical director Gary Savage, who holds a PhD in mechanical engineering and is a 16-year veteran of Formula 1 car design. The gearbox's design has continued to evolve from the first 2004 version and is now even lighter and easier to manufacture, he asserts.

In the last year, the composite formula has been improved to withstand higher temperatures. When compared to the original aluminum version, the current 2006 composite gearbox is 30 percent lighter, has 14 percent more torsional rigidity and 19 percent greater lateral stiffness, which ultimately leads to better racing performance.

Click here to read the entire article online.

You Asked - We Answered

Q: How do I select an extensometer when determining a yield stress?



A: Extensometers are available from 1% to 3000%+ full scale travel, but using the longer travel is not always the best solution. When testing stiff specimens, such as steel, an extensometer with 10% or less travel is recommended to ensure adequate resolution for the determination of yield. On the other hand, materials such as plastics commonly yield at greater strain values, and therefore an instrument with 50% travel is recommended. Long travel instruments (100% or more) should be reserved for high-elongation specimens, such as rubber. An Instron Application Engineer can recommend the correct instrument for your specimen type.

What do you think? Tell us!

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