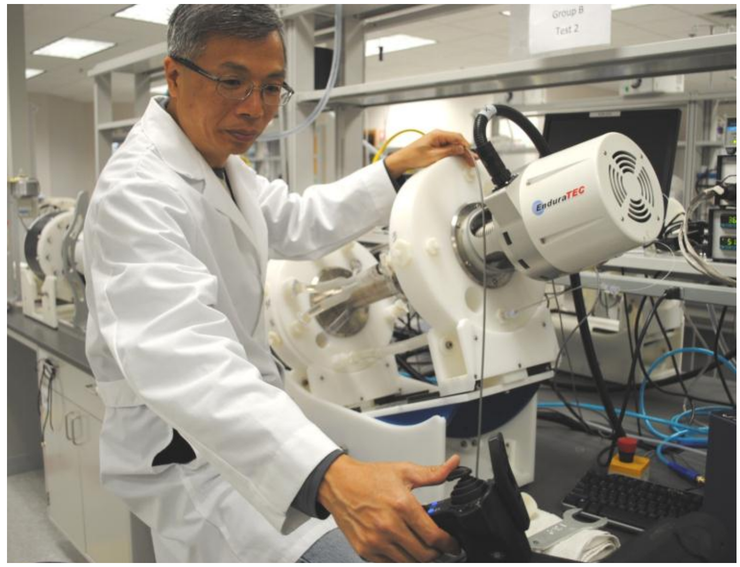
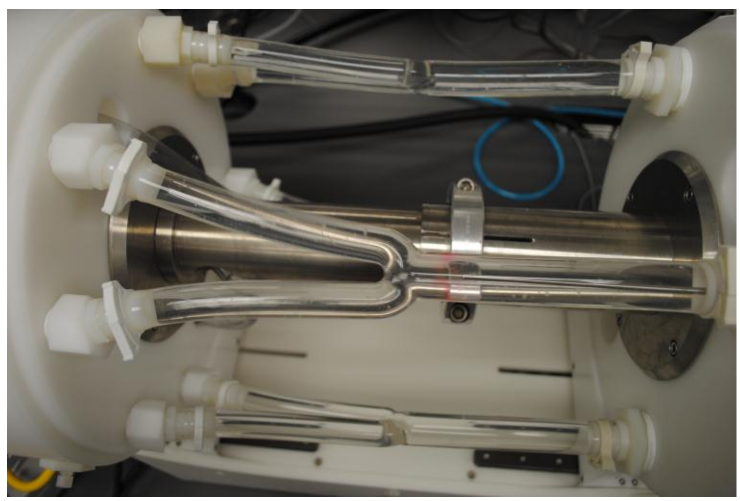
High Speed Stent and Graft Testers: Interview with CEO and Inventor, Kent Vilendrer

The need for 380M cycle testing of stents and stent devices has ushered in a whole new generation of fatigue testers. Over the years MDT has led this development with the introduction of the first linear motor driven stent tester (US patent number 5,670,708). After decades of experience testing hundreds of medical devices, MDT engineers have learned to adapt the stent graft testers in their inventory to virtually any test application.



Series 9100 Stent/Graft Tester

The ElectroForce 9100 Series of Stent/Graft Testers outperform all other competitive offerings available. By using a multi-faceted approach employing advanced system design principles to accelerate performance, their design makes them the fastest stent testers available anywhere. Below is an interview with Kent Vilendrer, Founder and CEO of MDT, on the history and performance of the Series 9100 Stent Graft Testers.

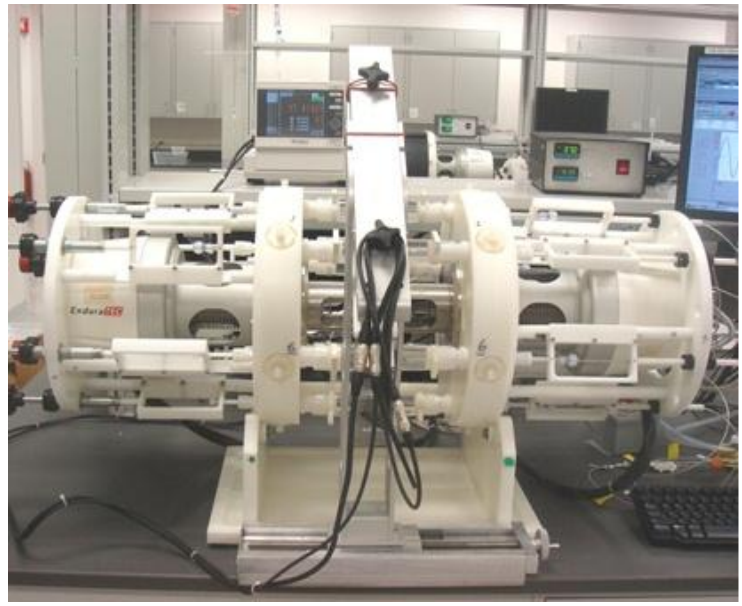


Thick Walled Silicone Mock Arteries for Bifurcated AAA Device

Kent: "Stent graft testers can be mathematically modeled using a series of springs, masses and dampers. The mock arteries are volumetric springs that respond to pressure changes by taking fluid volume into or pushing it out of their arterial ends. The mock arteries are the softest elements within the test system which means they pretty much dominate the natural frequency response of the tester. To raise the system frequency, one has to reduce the fluid mass entering and exiting the ends of the mock arteries.

Within each mock artery, the fluid is aligned in a column. The longer the fluid column the larger the fluid mass that needs to be moved. The testers we utilize feature two separate fluid pumps, one on each end of the mock artery. The twin pumps effectively cut the fluid column length in half because they reduce the fluid velocity in the middle of the mock artery to zero. Since the natural frequency of the mock artery is proportional to the square root of the radial spring constant divided by the fluid mass, cutting the fluid mass in half effectively raises the natural frequency of the mock artery (and system) by about 41%.

Another way to raise the frequency response of the mock artery is to make them radially stiffer (or less compliant depending on your perspective). This is done by stiffening the walls (increasing wall thickness) of the mock artery. Complementing this approach is the direct strain measurement technique which uses a strain measurement transducer such as a laser micrometer to measure the radial strain. When MDT first started using thick-walled mock arteries almost 20 years ago, it was a new concept. Other stent tester manufacturers at the time were using physiologically compliant (PC) mock arteries in their testers. They were doing so because they were using the applied pressure reading to determine the applied radial strain. For example, physiologically compliant means that if you apply an 80-160mmHg pressure to a PC coronary mock artery at 72 bpm (1.2Hz), you should see a radial strain of around 3-5%. The setup works well at 72bpm but as you begin to accelerate the test at some point you will see flattening of the mock artery as the pump attempts to withdraw fluid from the mock artery faster than it can eject it. Stiffening the arterial walls of the mock artery enables it to eject the fluid faster. Thick-walled arteries require higher applied pressures to achieve the same radial strains as physiological mock arteries so you can’t use the applied pressure differential to determine the applied radial strain. However, since you are measuring the strain directly using a laser micrometer, you are able to control the applied strain more accurately. This method of using thick-walled arteries allows us to test at the highest frequencies in the industry.


Stent Graft Tester Adapted for Percutaneous Heart Valve Testing

Once you have raised the natural frequency of the system by using twin pumps and thick-walled arteries, you still need a lot of motor power to push the system performance beyond the system resonant frequency. Our first systems used voice coil-driven pumps to generate the applied strains. They did not have as much power as we would have liked, and their output was limited because it was difficult to dissipate the heat generated by the moving coil. Once we started using the moving magnet motors developed by the Bose Corporation (whom we eventually sold EnduraTEC to), we were able to take the performance to a whole new level because of the higher force capability afforded by that motor design. The Bose linear motors are several times more powerful than voice coils.

By combining the twin pump concept (which effectively halves the length of the mock artery) with thick arterial walls and powerful motors, we are able to provide the fastest tester in the industry. Competitive systems use a single pump approach that is voice coil-driven. Our approach is simply faster because we have the highest mock artery response and most powerful motors in the industry.”

MDT has spent the last 20 years providing high speed test solutions for hundreds of testing applications. We offer free consultations on testing protocols and expedited service to help you get your product through the FDA approval process. Contact us today with your high speed testing requirements.

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