

Preventing Rollovers

Ferrara Fire Apparatus uses Turck's inclinometer for tilt testing to make sure that its fire trucks are stable in the field

Firefighters put their lives on the line doing far more than running into burning buildings. Even getting to the emergency scene can be dangerous. That is why the National Fire Protection Association (NFPA) developed standards for new fire apparatus equipment used to transport firefighters. The code, 1901 Standard for Automotive Fire Apparatus, outlines the standards required for manufacturing a fire truck to ensure the firefighters' safety.

One of these requirements involves vehicle stability to ensure that the fire truck does not roll over during operation. NFPA 1901 4.13.1 outlines the ways in which

a fire truck can adhere to this standard: by tilting the truck on a tilt table to 26.5 degrees in both directions or to equip the truck with an electronic stability control (ESC) system. According to A.K. Rosenhan, a consulting engineer specializing in fire apparatus construction, testing, evaluation and failure analysis: "ESC systems are expensive, prone to problems and not available on all chassis. Plus, many drivers do not like their controls being overridden. Though using a tilt table is a quasi-static test, it is much easier and less dangerous to conduct – and certainly much easier on the fire truck than driving around in a circle of a specified radius

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**Ferrara Fire Apparatus
uses inclinometers
at its on-site
testing facility**



The tilt table is moved to 26.5 degrees in both directions



Turck inclinometers detect the angle of a tilt table

at a specified speed to see if you roll over." Ferrara Fire Apparatus, a leading manufacturer of custom emergency response vehicles located in Holden, Louisiana, has been heavily involved in crash testing and safety analysis, and offers both electronic stability control systems and on-site tilt table testing for their vehicles. "Knowing that stability testing was coming with the new 1901 standard, Ferrara Fire Apparatus made the investment in a test facility at our factory, compliant with SAE 2180," says Chris Ferrara, President of Ferrara Fire Apparatus.

Tilt Table Testing

The tilt table at the Ferrara factory is 12 feet wide by 50 feet long, actuated by jackscrews, and is capable of handling vehicles up to 150,000 pounds. It is also equipped with digital scales to ensure compliance with other NFPA requirements dealing with total weight, axle loading, and transverse loading. An important component of the tilt table is to accurately measure the amount of tilt and to record other test parameters, such as body shift, for documentation and ultimate certification. After using a simple pendulum type angle indicator to gauge the tilt of the table, Ferrara chose to use Turck's single axis inclinometer because of its reliability and ease of use. "Many driver/operators have a strong preference for tilt table testing, wanting to avoid the throttle limitations associated with ESC," notes Ferrara.

"As gravity is pretty constant, the results of a tilt-table test are consistent, not prone to error or interpretation, and have rather graphic proof that a fire apparatus is compliant with the NFPA standard," adds Rosenhan. "Turck's inclinometer does a fine job of providing such data." "It's a dramatic thing to see some 65,000 pounds of fire apparatus, worth up to \$1 million, hanging up in the air. Obviously there are chains and straps that loosely anchor the apparatus but do provide for enough movement to determine if the vehicle 'flunks' testing," concludes Rosenhan. ■



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A.K. Rosenhan,
Consulting Engineer

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Before a fire truck can be used in the field, it must conform to all the requirements set forth by NFPA 1901 Standard for Automotive Fire Apparatus. Ferrara Fire Apparatus uses Turck inclinometers to ensure the requirements for vehicle stability are met.