

Importance Of Strain And Acceleration Measurements During Drop Tests For Safety Analysis And Package Design Optimization

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In drop tests for demonstrating ability of a package to withstand normal and accident conditions of transport according to the IAEA regulations for the safe transport of radioactive material the instrumentation of a specimen is an important tool to evaluate its mechanical behaviour during impact.

Generally the instrumentation incorporates the measurement of strains and accelerations at the package. Test results as deceleration- time and strain-time functions constitute a main basis for the validation of assumptions in the safety analysis, for the evaluation of calculations based on finite-element methods and extrapolation of scale model testing on full sized package within approval design tests. Also, these test results could be an advantageous basis for design alterations.

Strain gauges are useful to determine the time dependent magnitude of any deformation as well as associated stresses. Accelerometers are widely used for the measuring of motion i.e. speed or displacement of the rigid cask body, of vibration and shock. Appropriate electronic devices concerning range of analogue bandwidth, sample rate, etc. are utilised to acquire, record and store data.

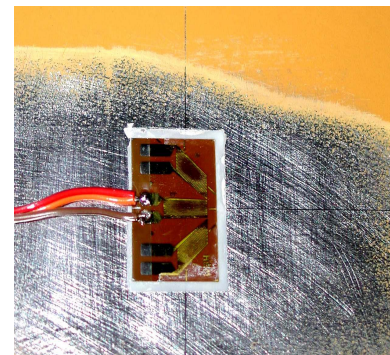


Fig.1: Instrumentation of the cask body with strain gauges and accelerometers



Fig.2: Various miniature, light weight piezoelectric/ piezoresistive accelerometers for high-level mechanical impact measurements.



Fig. 3: Multi-channel measuring devices

- wideband differential bridge amplifier for direct connection of all bridge type devices
- analogue bandwidth up to 200 kHz
- sampling rate up to 10 MSamples/s each channel
- resolution 12/ 16 bit

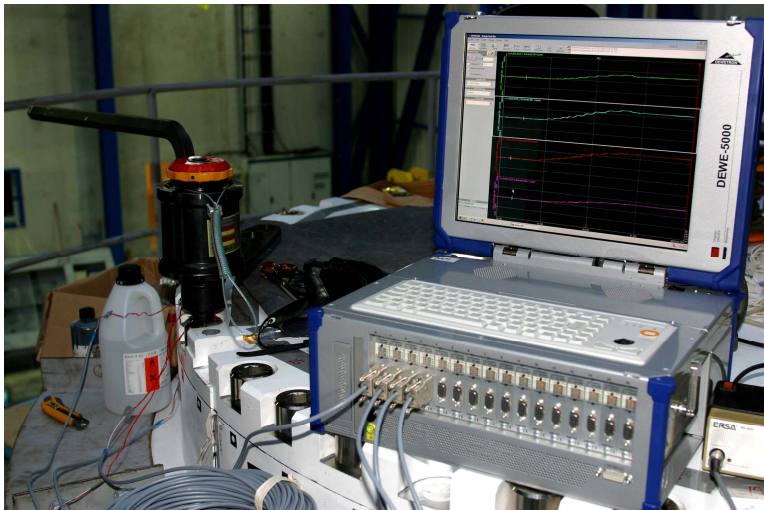


Fig.4: Cask's lid bolts instrumented with strain gauges to determine pre-strain after torquening and loading during impact.

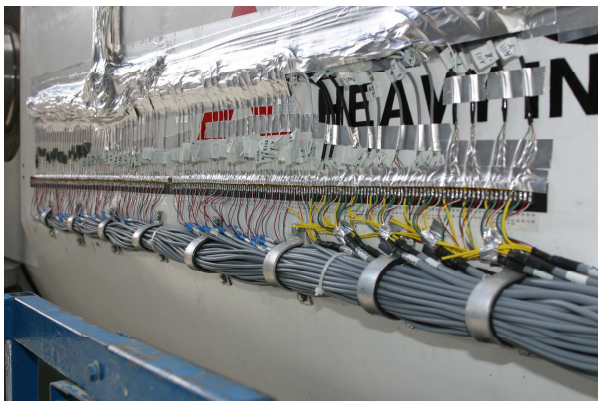


Fig.5: Central soldering terminal connecting ribbon cables coming from the sensors with the measuring cables



Fig. 6: Instrumented test specimen ready for drop test