



Falex Litigation Technical Investigations Small Arms Full-Scale Weapons Testing

Full-scale testing of small arms is extremely time-consuming because the weapon must be unjammed every time there is a failure, it must be periodically cleaned, and thousands of rounds must be fired. Full-scale testing is also challenging because firing the weapon has to be done in a realistic environment, there are numerous variables for which there is no well-founded way to select a value, the weapon contains many components that move, and all of the moving surfaces are involved in the full-scale test, which requires that every failure be examined to determine the cause. Falex Litigation Technical Investigations has developed resourceful ways, often unique, to overcome all of these challenges to provide an effective validation, under realistic conditions, of a weapon's performance, and to validate bench-scale testing that determined the key issues involved in failures, or adherence to patent claims.



For testing abrasion resistance, Falex Litigation Technical Investigations uses an aggressive test in a dust chamber that was specifically designed to provide repeatable and consistent dust conditions. The dust chamber is configured as a once-through open system. Ambient air is injected via a $\frac{3}{4}$ hp blower motor and exhausted through a dust capture bag. This permits the air to be circulated around

the weapon at such a velocity that the dust particles remain in suspension, but allows for the escape of air to prevent pressurization of the chamber. The dust capture bag also ensures that dust particles remain in the chamber as the air is exhausted. In this manner, every test contains the same amount and distribution of dust particles.

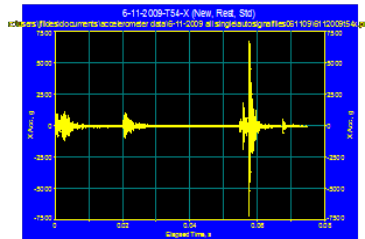


The dust chamber is capable of handling a wide variety of sand/dust types. We have utilized Silica Flour #140 and Silica Sand #35-50, which are materials that meet the specifications of MIL-STD-810F for sand, and rounded quartz grain sand, as typified by AFS 50/70 Test Sand that meets ASTM 65-04 Standard Test Method for Measuring Abrasion Using the Dry Sand/Rubber Wheel Apparatus.

Inside the dust chamber, weapons are mounted to a weapon specific (M4 or M9) firing rack that has nitrogen-filled gas shock tubes and a pneumatic trigger pull mechanism. This mounting system ensures repeatable recoil reaction and controlled firing sequences.

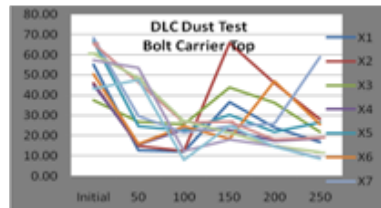


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During full-scale testing, the weapon is monitored with a sensor suite that includes a PCB 3 axis accelerometer (model 350B50) that provides a range of +/- 10,000 g's with a frequency response of 10,000 Hz for +/- 1 db and 20,000 Hz for -3 db and a micro-electromechanical (MEMs) acoustic sensor. Data collection is via a National Instruments USB

data acquisition system (NI USB9234) with four channels, each sampling at up to 51,200 samples per second with 24 bits. The accelerometer provides 0.524 mv/g and the 24-bit data converter of the NI card is able to read down to 176 nv, providing a detection range of slightly less than +/- 0.5 g's to +/- 10,000 g's. The MEMs acoustic sensor provides 40 Hz to 20 KHz frequency response. Advanced wavelet joint time-frequency analysis and neural network signature recognition are used with statistical methods and short-time Fourier transform analysis.



The effectiveness of materials and coatings in full-scale testing is measured by several methods. The failures to fire are examined and categorized according to criteria used by the Army, and this data is plotted to provide graphical records of the weapon's

performance. The wear of the weapon's components are also measured quantitatively using profilometric methods and microscopic examination. Bench-scale test data provides further insight for the full-scale performance of the weapon.

Falex Litigation Technical Investigations

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Falex Litigation Technical Investigations was formed to provide litigators, insurers, and corporate counsel with expert witness consulting and scientific investigations that are informed by core competencies in the physical sciences, materials performance, and tribology - the science of friction, wear, and lubrication - to provide better outcomes at lower cost with intellectual property disputes, product failures, process incidents, accident investigations, and Consumer Product Safety Commission recalls and issues.