

ISO 14801 Dynamic Fatigue Test for Endosseous Dental Implants

TEST METHOD SUMMARY

Fatigue testing of single post endosseous per ISO 14801 is most useful for comparing different dental implant designs and sizes. The standard simulates the functional loading of the dental implant body (prosthesis) and its mating components under ‘worst case’ conditions. However, it should not be used to predict in-vivo performance of the implant or prosthesis.

Both straight and angled implant design is addressed in ISO 14801 and provides testing parameters in either ambient air or physiologically relevant conditions (usually a 37C/buffered saline bath). Typically, the sample is angled at 30 degrees and a test frequency of 15Hz. Loading is in the range of several hundred Newtons. The implant is often tested in its finished device state. For multi-part dental implants, testing is performed on the device as assembled according to its intended use and mounted/used per manufacturers recommended procedures.

A special fixture designed to hold and support the implant body is required. This fixture base provides for angular adjustment while a slide mechanism to allow positioning of the implant and placed axially concentric with the loading component of the test system. The upper loading component must freely allow for the lateral motion the implant would experience during testing. The implant can be tested in the most practical or convenient manner as defined by the standard. Screw-in implant bodies can be either “potted” or screwed-in directly to the holder. Per ISO 14801 loading schematic, the loading force shall be applied so that no lateral constraint occurs, and the loading center is well-defined so that the moment arm (γ) is easily measured/calculated.

Solutions for ISO 14801 typically include these components;

THE DENTAL FIXTURE*

Dental Fixture	Specimen Holder	Cyclic Performance Plot
<p>Dental fixture with linear positioning to provide 30 degrees (as required) of angular adjustment.</p>	<p>Interchangeable specimen holder for either a potting material (modulus of elasticity > 3 GPa) or screw-in mounting of implant body.</p>	<p>This plot shows typical cyclic performance; 15 Hz, 25-250 N (R=.1). Fatigue testing would continue till specimen failure or significant axial displacement is observed. General principles for fatigue testing as described in ISO 1099 and ASTM 466 shall apply.</p>



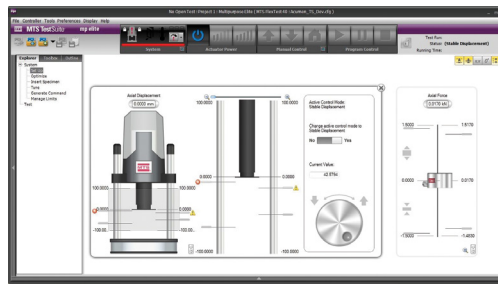
MTS Acumen®
Electrodynamic Test Systems

LOAD FRAME OPTIONS*

MTS Acumen® Electrodynamic Test Systems are an ideal solution for testing per ISO 14801. It's capable of applying the prescribed load with an error not exceeding +5% of maximum load. When configured with the dental fatigue test fixture, testing is a plug-n-play exercise. The MTS Acumen systems are ideal for ultra clean laboratories. Designed with proven, highly efficient electric linear motors, these systems provide clean, quiet and cost-effective operation. Electrodynamic actuation consumes less energy than other technologies and can be put into service quickly without additional infrastructure such as hydraulic power units, high pressure hoses or water cooling/chiller systems.

The MTS Acumen systems can be set up in any location with a 110/220v electrical outlet. Additionally, with higher forces (to 3000N) and higher frequencies (to 100Hz) Stress/Strain (S/N curves) are easily and quickly generated as part of the fatigue protocol required to meet device submission guidelines to regulatory governing entities.

SOFTWARE OPTIONS*



TestSuite™ for MTS Acumen

MTS TestSuite Multipurpose Software delivers the test definition, execution, analysis and reporting capabilities required for electrodynamic testing. The intuitive user interface is optimized for MTS Acumen systems, enabling a level of integration that dramatically improves the ease and efficiency of test setup, execution and reporting. Modules and templates for fatigue, fracture, tension and other test types are available to address specific test standards.

Task-centric workflow is a defining characteristic of the TestSuite user interface for MTS Acumen systems. During test setup, the software guides users through each task in the correct order. For experienced operators, this scheme improves convenience and productivity. For those unfamiliar with the testing process, it minimizes the learning curve. Most important, it increases usability for all operators without compromising the system's test capabilities. To accommodate a variety of skill sets and levels of operator experience, the MTS Acumen software interface offers several load frame tuning options, from fully automatic to fully manual and everything in between. For many operators, automatic tuning is fastest and easiest because the software works independently to detect and enter specimen parameters. For advanced operators, manual tuning provides access to raw control loop parameters.

*NOTE: This technical note is intended to show some of the popular and more common solutions used for this particular application. Most of the time, additional options are available and necessary to accomplish your more comprehensive test objectives.

OTHER APPLICABLE STANDARDS

The following standards serve as additional reference for this application	
ISO 1099	Metallic Materials - Fatigue Testing - Axial Force Controlled Method
ASTM 466-96	Standard for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials
ASTM 468-90	Standard Practice for Presentation of Constant Amplitude Test Results for Metallic Materials
ISO 6892	Tensile Testing of Metallic Materials at Ambient Temperature



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