



## **Theory of Operation**

Universal Testing is a product development test or quality control test used to determine the force or energy that causes plastic film or other materials to fail under specified conditions by pulling the material until failure or compressing it until failure. Common tests run on this type of tester include: yield force, yield strength, load at break, break or tensile strength, peel strength, secant modulus, elastic modulus, and puncture resistance.

The MT Series Universal Testers by Oakland Instrument offer several unique features and benefits:

First, our universal testers are PC-driven, giving us an advantage with state-of-the-art testing modes which are “built-in” as standard features. No need to upgrade software if you want to add a test method or test mode. Just add an inexpensive fixture or grip(s) for added system flexibility.

Second, the large work platform on the MT Series tester base allows attachment of a variety of fixtures for testing properties such as 90 degree Peel, 180 degree Peel, T-Peel and Seal strength, COF, Cling, Blocking, Puncture, Compression, Bend, Film Shrinkage, and many others.

Third, the system is designed for ease-of-use and flexibility. Changing load cells to test with different force capacities is simple and intuitive; changing fixtures and grips is equally simple. Create testing routines and recipes with the MT-2500 Software that can be recalled from pull-downs to speed up testing. And, with full-digital operation, you can even perform your own load calibrations and certifications with easy-to-follow software routines. No requirement to have either Oakland or a certified Calibration company perform this work, giving you complete control.

And finally, as a captive design-build firm, Oakland has in-house expertise in product design, applications engineering, software development, manufacturing, parts machining, circuit board production, and wire-harness fabrication – which gives Oakland the unique ability to control the quality of the design & manufacturing processes and provide value-based price points across our comprehensive instrument range.

Oakland offers test fixtures and a wide range of grips to cover a broad range of ASTM, TAPPI, and ISO test methods for film, flexible packaging, laminates, tapes, paper, tissue, textiles, and other materials. We welcome the opportunity to discuss your custom applications as well.

## **ASTM, TAPPI, and International Standards**

The Oakland Instrument Series MT-1500 Universal Testers are designed to meet the testing requirements of ASTM D-882 “Tensile Properties of Thin Plastic Sheeting”. ASTM D-882 defines tests for samples of thickness less than 10 mils (250 microns). Other test methods, for example ASTM D-638, test for thicker plastic samples and other materials.

Oakland Instrument manufactures models to meet five extension ranges for various testing applications: Our Model MT-1516 with 16.0 inches of test travel, the Model MT-1522 with 22.0 inches of travel, the Model MT-1528 with 28.0 inches of travel, the Model MT-1540 with 40.0 inches of travel, and the MT-1552 with 52.0 inches of travel for very high-extension materials.

## **Preparing Film or Material Samples**

Test specimens need to be long enough to allow insertion into the upper grip and the lower grip. For most applications, a dual-blade (or “strip”) sample cutter is recommended for straight samples for your tensile or universal tester. Samples should be to accurate dimensions (width and parallelism), and they should be free of pinholes, wrinkles, folds, and imperfections, unless, however, those imperfections constitute a variable under study.

Oakland Instrument offers a variety of sample preparation cutters, presses, and templates to assist you with accurate sample preparation for your tester.

## **Loading Film or Material Samples**

First, open the upper grip or clamp, either manually or by lifting the toggle switch on your air control unit to apply or release air pressure for pneumatic sample clamps. Insert your sample into the upper grip, align it, and close the upper grip so that the grip inserts uniformly and securely hold the sample.

Repeat the same with the lower grip to secure your sample in your tester.

## **Running the Universal or Tensile Test**

Measure and record the average thickness of the test specimens in the area of elongation if following ASTM D-882. Load the specimen, and open the appropriate pre-programmed recipe on your MT-2500 Quality Control Software to the test method you would like to run.

Start the sample test by clicking on the “SPC Start Sample” button on your software. The sample will run to completion or failure, the drive motor will stop, and will reverse direction to return to the starting position for the next test (assuming you have set up your test recipe with the Auto-Stop / Auto-Return feature enabled). Examine the broken specimen to determine whether it has, or has not, failed at the edge of the grip inserts on your sample grips. ASTM recommends not accepting test runs where the sample failure occurs at one or both grip insert edges; sample failure should occur at a location on the sample in between the upper and lower grip inserts. The sequence is typically repeated until 5 samples are recorded in the MD direction, and 5 samples in the TD direction.

At the end of each cycle of testing, you may save your data with your MT-2500 Software, view & print reports, or export the data to an external database or third-party SQC Software package.

## **Changing Load Cells on your Oakland Universal Tester**

To change a load cell on your Oakland Universal tester to install one with a different capacity, first close your MT-2500 Software, and remove power from your universal tester.

Remove the upper Grip or Fixture piece from the Load Cell coupling. Next, disconnect the 9-Pin D-Sub Connector on the signal cable at the Load Cell.

Then, loosen (by hand) the load cell Connection Bolt by turning the knurled knob on the bolt head, holding the load cell with the other hand, until the load cell releases and drops from the tester crosshead.

Reverse this exact process to install your replacement load cell. Reapply power to the tester, and re-open your MT-2500 Software.

You will need to verify, and possibly recalibrate, your newly installed load cell to verify the accuracy of your readings after replacing a load cell.

## **Installing Grips or Changing Fixtures on your Oakland Universal Tester**

Remove the upper Grip or Fixture piece from the load cell coupling by removing the pin from the coupling. If the coupling is supplied with a compression jam-nut design, loosen the jam nut slightly before attempting to remove the coupling pin.

Remove the lower Grip or Fixture from the base coupling by removing the pin from the coupling. Loosen the jam nut slightly if supplied with a compression jam-nut design.

Reverse the procedure for installing new grips or fixtures on your MT-1500 Universal Tester. Don't forget to tighten the jam-nuts on the couplings after re-installation.

## **Creating Test Routines and Recipes with your MT-2500 Software**

To create a new test recipe, open your Setup Screen to the "Test Mode" page, and select the test mode you would like to run. For example: Tensile to Break, Secant, or Coefficient of Friction. The MT-2500 Software currently offers 11 different pre-programmed test modes for your selection. Set your Crosshead Speed, Grip Separation, Jog Speed, Start Threshold value, and any mode-specific settings prompted and active in the Test Mode setup screen.

After creating your new Recipe, save the Recipe by giving it a unique name in the "Save" routine.

When running individual samples under a test routine or recipe, if following ASTM D-882 or other standards, you are typically required to record: product (specimen) description, sample conditioning procedure followed, instrument configuration and setup, testing technique used, specimen thickness, sample width, and date and operator name. Note that many tests and calculations require the sample thickness and sample width be entered before running the test, for the software algorithm to calculate an accurate result; for example those tests that divide a force value by the cross-sectional area of the sample.

## **Running Reports, Saving Data Files, and Exporting to 3<sup>rd</sup> Party Software Packages**

After recording the test data, determine and report the calculated statistics for the test mode run.

Your MT-2500 Software currently has two standard test report forms: Graph and Statistics. The Graph Report displays the force vs. elongation graphic for the last sample run, plus the appropriate statistics for the last sample run, plus averages for all samples run under the current test cycle. The Statistics Report displays all calculated and statistical values for each individual test run under the current test cycle, plus a summary of averages for that same group of test results.

Oakland Instrument's MT-2500 Software also allows editing and exporting data in standard file formats, allowing direct loading into 3<sup>rd</sup> party Statistical Software packages such as Microsoft Excel™.