FALL 2021 CATALOG

BACKGROUND & PRODUCT DESCRIPTIONS

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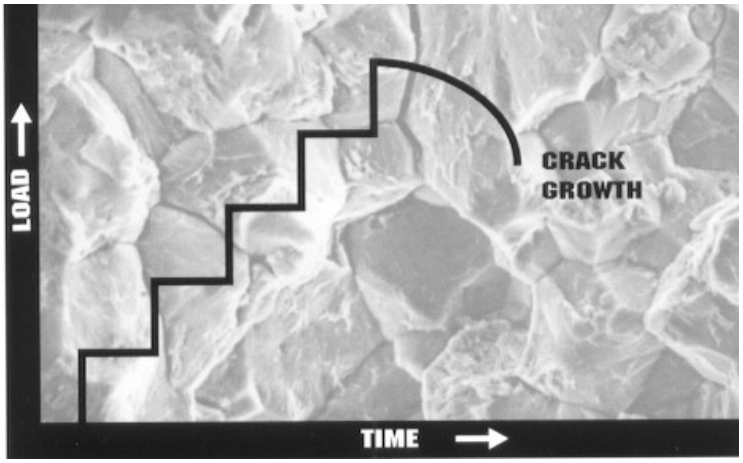
FRACTURE DIAGNOSTICS INTERNATIONAL

Fracture Diagnostics provides state-of-the-art computer controlled test equipment, utilizing the ***Rising Step Load™*** *testing technique. The* ***RSL™*** *method has been recognized as the only reliable and quantitative method for detecting the existence of, or susceptibility to, hydrogen embrittlement in high-performance materials.*

Rising Step Load Test Method



The RSL™ testing method was developed by Dr. Louis Raymond, a noted scientist, lecturer and investigator in the area of failures due to hydrogen embrittlement. Fracture Diagnostics has developed a total system to allow research facilities, production operations, failure investigators, universities and any other interested party to be able to detect the presence of hydrogen embrittlement in a material in a reliable, reproducible fashion. The simplicity of the equipment combined with a most advanced software system requires a minimal of training for proper operation.

This testing procedure has been incorporated into ASTM F519-10 “Standard Test Method for Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments,” ASTM F1940-07a “System for Process Control Verification to Prevent Hydrogen Embrittlement in Plated or Coated Fasteners” and is described in detail in ASTM F1624-09 “Standard Test Method for Measurement of Hydrogen Embrittlement in Steel by the Incremental Step Loading Technique".

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ABOUT RSL™ TESTING EQUIPMENT

- Utilizing the most advanced concepts of hydrogen embrittlement detection in a reliable and proven combination of testing equipment and software
- Maintaining precise control of displacement, whether in a sustained load or over a broad variety of loading rates
- Measuring the applied load accurately with precision load cells
- Specially designed software that provides a graphical interface that allows both simplicity of operation and a broad variety of testing parameters
- Testing units that are essentially desktop. They require very little space and can be configured so as to be portable for demonstration purposes
- Requiring only standard electric wall outlets for operation and no water cooling or waste disposal
- Can be adapted to advanced research and product performance evaluations through the addition of the Scientific Investigation Package which includes special software, the Scientific Control Unit and the solution reservoir, a potentiostat, a platinum electrode and a Saturated Calomel Electrode
- Can be used as everyday quality control units or used for the most sophisticated research investigations
- Providing data and solutions to hydrogen embrittlement problems that cannot be accomplished with any other equipment

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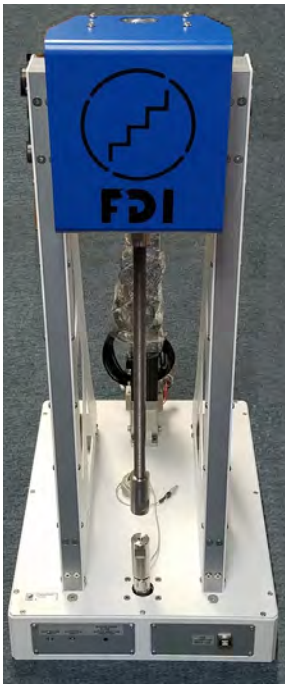
COMPONENT OVERVIEW

The RSL™ line of Digital Displacement testing equipment is modular in concept and is made up of the following individual units:



Tensile Frame: This unit is designed for testing test specimens or threaded parts in tension using either the RSL method or standard tensile loading parameters. It is capable of exerting tensile forces up to 10,000 pounds. This tensile frame is a single unit device meaning that the load control and scientific controller are all contained internally in the system.

Bending Frame: This unit uses 4 point bending to put stress on either a standard single notch square bar specimen or an actual thread specimen. It can be used in air as a quality monitoring tool or can be used in conjunction with the Scientific Controller to provide tests with an imposed potential in a reservoir containing an aqueous solution.

Scientific Controller: This unit contains an extraordinarily stable potentiostat as well as a micro voltage processor that can take input from any standard electronic extensometer or clip gauge and integrate the real time results through the Scientific Software to provide an extensive amount of experimental parameters and measurements. Load/extension is monitored through an additional electronic input.

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4-POINT BENDING FRAME

Model FDI 1200(B) – Rising Step Load™ Test System
for Quality Control Using a Bending Moment:

This FDI bend frame uses four point bending to put stress on a test specimen or actual part. It utilizes a constant displacement bending arm that is precisely controlled through software developed especially for this equipment and the broad variety of testing that it can perform. The standard test specimen is a modified single edged notched square bar. However, fixtures are readily available to allow the testing of threaded fasteners and other product forms. This unit is designed to enable hands free testing and monitoring of tests in both air and aqueous solutions. It is often used in concert with the Certified Test Specimens or specimens pulled from actual parts to provide a quantitative measure of the hydrogen generating potential of any specific plating process. It can provide up to 600lb of bending stress.

The software uses a graphical interface with the testing unit providing a unique control of testing parameters and simplicity of operation. Data generated can be filed into and analyzed by many standard data base programs.

This unit comes with an environmental chamber, a motor controller, a calibrated load cell, the operating software, a computer and a 2-day installation operating instruction course.

Testing Capability:
Rising Step Load – ASTM F1624/F1940
Sustained Load – ASTM F519
Constant Displacement
All other standard bend tests

Construction:
Stainless Steel and Aluminum Housing
Length – 14.4" X Height – 22" X Width – 9.8" – Weight 75lbs
Power Requirements 110/125 Volt AC 50/60Hz Single Phase

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RSL™ TENSILE FRAME

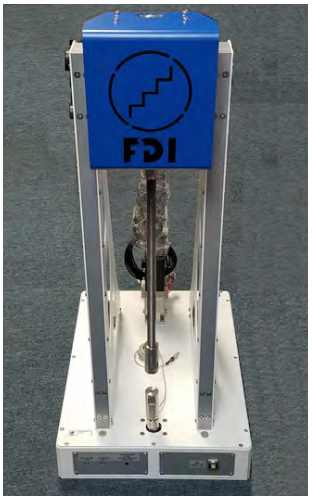
Model FDI 20000-T – Rising Step Load™ Test System
for Quality Control Using a Tensile Force:

This unit is designed for testing standard test specimens or threaded parts in tension using either the RSL™ method or standard tensile loading parameters. The unit offers displacement-controlled test capabilities and is monitored and operated by custom designed software. This provides abilities for a broad variety of testing parameters including sustained load, constant extension rate, Rising Step Load and traditional constant stress rate such as ASTM E8. It provides a tensile force capability of 10kips, which allows testing of many standard test specimens as well as actual parts in service conditions.

The software interfaces custom graphics and equations with the tensile unit providing a unique control of testing parameters and simplicity of operation. Data generated can be filed and analyzed into many standard data base programs. Stress/strain curves can be generated highlighting desired testing parameters when used in conjunction with the Scientific Controller. Test data can also be exported to .csv for more advanced analysis.

The tensile frame can be equipped with custom adapters to accommodate a broad variety of test specimen configurations. It can also be equipped with an integrated potentiostat that is controlled by the software for environmental tests.

The unit houses all of its control systems internally which allows for efficient setup and a small footprint in the lab. Additionally, it has built in universal joints to ensure proper axial loading with minimal effort.



Test Capability:
Sustained Load per ASTM F519
Constant Extension Rate per ASTM G129
Rising Step Load per ASTM F1624/F1940
Constant Stress Rate as per ASTM E8

Construction:
Robust Steel Housing with Integrated Controller
Height – 45” X Width 18” X Depth – 24”

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SCIENTIFIC CONTROLLER

Model FDI-SC Rising Step Load™ System Scientific Controller
for use with both Bending and Tensile Frames:

The Scientific Controller is an electronic signal generator and detector for utilizing the advanced functions of the Scientific Investigation Software. It provides capabilities as an extremely stable potentiostat for the imposition of a potential through a platinum electrode in relation to a Saturated Calomel Electrode from 0 to -2.0 Volts. In this mode, it is used with the solution reservoir and the two electrodes that are provided in the Scientific Investigation (SI) models of the loading frames. This feature is used to generate information relative to the performance of a test specimen or part in actual field applications and can be used with either the Tensile or Bending Frames.

The same device can be used as the detector for a variety of electronic extensometers or clip gauges that are available in the marketplace. With this unit, the Tensile Frame can provide data output recording the elongation of materials during tensile testing and crack opening displacement during fracture toughness testing, therefore, providing a broad capability tensile testing unit with the most sophisticated software available.

Construction:
Encased in a Corrosion Resistant Aluminum Housing
Height – 3” X Width – 9” X Depth – 12.5” – Weight 10 lbs
Power Requirements – 110/120 volt AC 50/60Hz Single Phase

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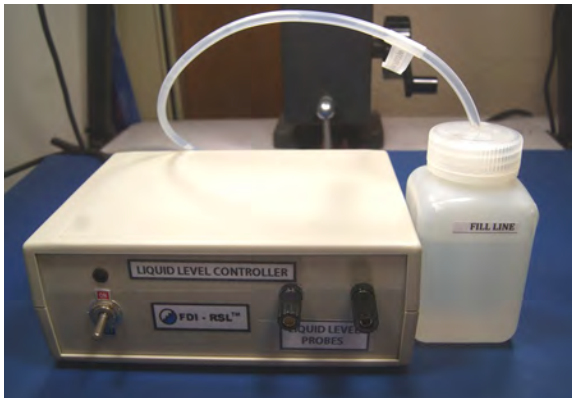
LIQUID LEVEL CONTROLLER

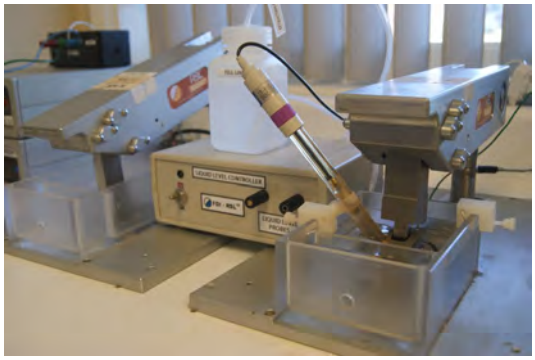
Model FDI Liquid Level Control System for use with Environmental Test Setups with RSL™ Bend and Tensile Frames

The Liquid Level Control System from FDI actively monitors the level of aqueous solution during long-term environmental tests. The system eases the burden from test operators by sensing the level of solution and automatically refilling the environmental chamber once the solution falls below a certain level. This ensures that a test can run continuously over extended amounts of time under without supervision.

The liquid Level Control System comes as a standalone unit operating under its own power completely separate from the test system. This unit combined with a computer controlled test system provide an operator with a truly "hands free" test experience by automatically monitoring and maintaining every aspect of a test setup.

Construction:
Height – 7.5" X Width – 5" X Depth – 3" – Weight 2 lbs
Power Requirements – 110/120 volt AC 50/60Hz Single Phase





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ABOUT RSL™ SOFTWARE

RSL Software was designed to complement the advanced features of the RSL test equipment. It is a graphical interface, user friendly system with capabilities to effectively and simply perform tests of substantial technical complexity. The figure below shows the test screen for a traditional RSL test which includes tracking of any two of seven parameters offered, including % Fracture Stress, Load, Net Stress, Potential, Displacement Gauge, Motor Extension, percent load drop, and Stress Intensity against Time. Ordinate values are easily changed to accommodate appropriate ranges. A "Flag" will display at a pre-described % change in pre-scribed parameter.

Some additional features of this powerful software:

- Test window displays all testing parameters, sample identification and real time test performance
- Test window as well as test data and data analysis, are available as convenient printed reports
- Able to accommodate a variety of sample geometries and configurations, including all F519 and F1940 specimen types
- Data is retained for re-plotting of test performance with alternate ordinates
- Built in standard test profiles plus ability to create any desired test profile and keep as available file
- Ease of installing and checking calibration data, with date of calibration recorded
- Special windows to establish and measure imposed potential from Scientific Controller potentiostat
- A variety of test methods available including bend or tension test controlled by RSL profile, Constant Extension Rate, Constant Load Rate, Constant Stress Rate and Constant Stress Intensity Rate
- Data are stored under test identity and can be transferred to standard spreadsheet programs
- Flags signaling critical points in data curve can be defined for any measured parameter
- Test curve can be zoomed for critical response analysis
- Test reports calculate stress, stress intensity and Hydrogen Embrittlement Ratio automatically
- Procedures can be learned by competent lab technician in very short time

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