# SIGMA TESTING SYSTEM

## WinCCS Automated Creep/Stress Rupture Testing

Applied Test Systems is proud to introduce an evolutionary system for Creep and Stress Rupture testing, the SIGMA Testing System. SIGMA is a revolutionary step for WinCCS plus first and second-generation controllers, which have been in use at major testing facilities world over for thirty plus years. The SIGMA system retains WinCCS as the control software, while introducing the new third-generation SIGMA controller, along with new SIGMA testing machines. The SIGMA system is backwards compatible with previous controllers and data to protect your company's investment in existing WinCCS systems.

**Sigma Machines**
**Series 2320 & Series 2610**

## Sigma Testing System Overview

The SIGMA Testing System is an automated system utilized to perform creep, stress rupture, constant strain and stress relaxation testing. The SIGMA test system is comprised of three parts, the WinCCS SIGMA control software, the SIGMA test controller, and various test machines based on end user requirements.

### WinCCS SIGMA

The current WinCCS is a Windows PC based application that runs on a computer located in the user's laboratory, which is interfaced directly to the laboratory's test machines via communication cables. A library of testing methods utilized for creep/stress rupture testing, calibration and verification records and specimen data collected during tests are all maintained within the control software. WinCCS prepares reports and graphing which allows the software to present the test data in various user-friendly formats. WinCCS allows full testing that conforms to ASTM, ISO and turbine engine manufacturers specifications.

WinCCS SIGMA is an improved WinCCS, utilizing a redesigned interface which enhances the operator experience. WinCCS SIGMA incorporates a new report feature that allow the user to generate WinCCS SIGMA reports as an HTML document. Additionally, an optional Laboratory Information Management System interface enables WinCCS SIGMA to communicate specimen test parameters and data with existing LIMS. As always, WinCCS SIGMA is designed to work with all previous versions. Note: There are many other new features of WinCCS SIGMA, please request the WinCCS SIGMA document for more details.

### SIGMA Controller

The SIGMA Controller is a microprocessor-based controller that controls SIGMA Test Machines' specimen temperature, stress/strain, along with the measurement and collection of data. Once the test has been started by the WinCCS SIGMA control software the SIGMA Controllers are completely self-sufficient and can run the test to completion without further intervention by the host PC.

SIGMA Controller, our third generation, captures the latest advancements in hardware to achieve highly precise controls. The SIGMA Controller is a tremendous leap in technology over previous generations with faster processing, reading rates and control loop response. SIGMA Controller offer a redesigned load control system that utilizes stepper motor control of the axial specimen load, providing a new level of load control precision.

To compliment the SIGMA Controller, an improved SIGMA user terminal has been introduced that has many new

features, which include OLED high visibility display and machine jog up/down buttons for easy setup. The SIGMA terminal supports all previous test machine controllers.

**SIGMA Machines**

SIGMA Machines apply an axial load to a specimen at an elevated temperature. SIGMA measures and logs the machine and specimen parameters for the duration of the test. SIGMA Machines utilize a specimen furnace and a method to generate the axial specimen load by manually loaded fixed weights or automated load control.

The SIGMA Machine is controlled via a microcomputer-based test controller that receives all the test parameters from WinCCS SIGMA and then performs the test on the specimen.

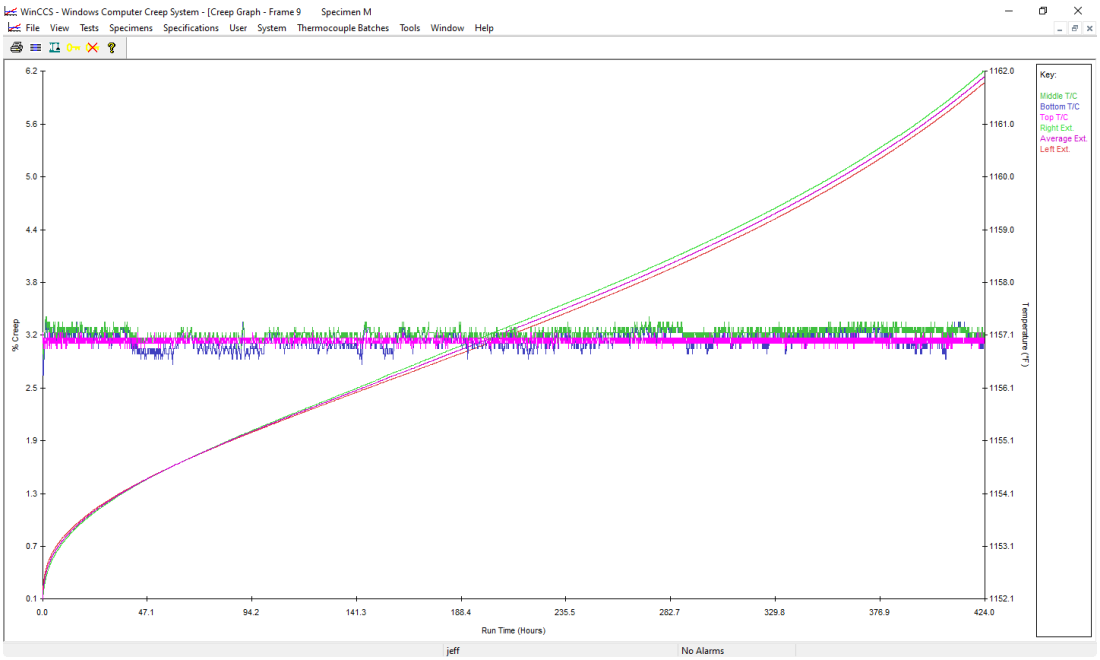
A direct loading model 2610 Test Machine, with a capacity of 10,000 lbs in a laboratory space saving package, is new for SIGMA. The 2610 Test Machine is fully automated and requires no weights.

## Status Display Screen

| Frame | State | Specimen Name | Customer | Traveler # | Heat # | Setpoint | Average | Top | Middle | Bottom | User | Stress | Time | Creep (%) | Alarms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame 1 | Run | IN718-1292-90KSI-1 | 116 | AA-1 | 9998 | 1292.0 | 1291.8 | 1291.9 | 1291.8 | 1291.7 | 72.1 | 90.10 | 2.30 | 0.10 | |
| Frame 2 | Soak | IN718-1292-90KSI-2 | 116 | AA-2 | 9998 | 1292.0 | 1291.5 | 1291.8 | 1291.5 | 1291.2 | 72.1 | 90.10 | -0.45 | 0.00 | |
| Frame 3 | Ramp | IN718-1292-90KSI-3 | 116 | AA-3 | 9998 | 1292.0 | 1053.1 | 1055.6 | 1053.4 | 1050.2 | 72.2 | 8.90 | 0.00 | 0.00 | |
| Frame 4 | Run | HASX-1800-35KSI-1 | 117 | AA-4 | 8889 | 1800.0 | 1799.5 | 1799.8 | 1799.6 | 1799.2 | 72.2 | 35.10 | 697.00 | 1.12 | |
| Frame 5 | Run | HASX-1800-35KSI-2 | 117 | AA-5 | 8889 | 1800.0 | 1801.3 | 1801.5 | 1801.3 | 1801.2 | 72.1 | 35.20 | 945.00 | 1.53 | |
| Frame 6 | Unload | IN625-1650-45KSI-1 | 118 | AA-6 | 7778 | | 448.1 | 455.5 | 448.6 | 440.1 | 72.1 | 1.00 | 1250.00 | 2.92 | Unload |
| Frame 7 | Run | IN625-1650-45KSI-2 | 118 | AA-7 | 7778 | 1650.0 | | | | | 72.1 | | | | |
| Frame 8 | Post Test | IN625-1650-45KSI-3 | 118 | AA-8 | 7778 | | 72.3 | 72.3 | OPEN | 72.3 | 72.1 | 1.00 | 135.00 | 0.88 | |
| Frame 9 | Run | IN601-1025-135KSI-1 | 119 | AA-9 | 6777 | 1025.0 | 1025.1 | 1025.2 | OPEN | 1024.9 | 72.1 | 135.02 | 129.00 | 0.99 | |
| Frame 10 | Idle | | | | | N/A | N/A | OPEN | OPEN | OPEN | 72.1 | | | | |
| Frame 11 | Post Test | M246-650-145KSI-1 | 120 | AA-11 | 5566 | 650.0 | 78.0 | 78.2 | 78.0 | 77.8 | 72.1 | 1.00 | 165.00 | 5.00 | |
| Frame 12 | Run | M246-650-145KSI-2 | 120 | AA-12 | 5566 | 650.0 | 650.2 | 650.8 | 650.2 | 649.7 | 72.1 | 145.04 | 135.00 | 3.13 | |
| Frame 13 | Run | M246-650-145KSI-3 | 120 | AA-13 | 5566 | 650.0 | 650.0 | 650.5 | 649.9 | 649.6 | 72.1 | 144.98 | 132.00 | 3.09 | |
| Frame 14 | Ramp | M246-650-145KSI-4 | 120 | AA-14 | 5566 | 650.0 | 356.9 | 359.8 | 356.7 | 354.2 | 72.1 | 14.50 | 0.00 | 0.00 | |
| Frame 15 | Soak | M246-650-145KSI-5 | 120 | AA-15 | 5566 | 650.0 | 649.3 | 649.8 | 649.2 | 648.9 | 72.1 | 14.40 | -1.00 | 0.00 | |
| Frame 16 | Run | WASP-800-25KSI-1 | 121 | AA-16 | 4443 | 800.0 | 800.7 | 801.1 | 800.7 | 800.2 | 72.1 | 25.08 | 10221.00 | 4.25 | |
| Frame 17 | Run | WASP-800-25KSI-2 | 121 | AA-17 | 4443 | 800.0 | 800.2 | 800.2 | 800.2 | 800.1 | 72.1 | 25.06 | 10202.00 | 4.11 | |
| Frame 18 | Run | WASP-800-25KSI-3 | 121 | AA-18 | 4443 | 800.0 | 799.7 | 799.8 | 799.7 | 799.6 | 72.1 | 25.07 | 9992.00 | 3.92 | |
| Frame 19 | Ramp | WASP-800-25KSI-4 | 121 | AA-19 | 4443 | 800.0 | 551.7 | 555.6 | 551.3 | 548.2 | 72.1 | 2.40 | 0.00 | 0.00 | |
| Frame 20 | Soak | WASP-800-25KSI-5 | 121 | AA-20 | 4443 | 800.0 | 799.5 | 799.9 | 799.6 | 799.1 | 72.1 | 2.48 | -0.65 | 0.00 | |

## Creep Graph with Specimen Temperature

**actual test data*



**Testers available with the Sigma Testing System**

| | 2140-W3 | 2320-W3 | 2330-W3 | 2410-W3 | 2510-W3 | 2610-W3 |
|---|---|---|---|---|---|---|
| Max Force (Pounds) | 600 lb. | 10,000 lb. | 12,000 lb. | 20,000 lb. | 50,000 lb. | 10,000 lb. |
| Max Force (KN) | 2.67 KN | 44.5 KN | 53.4 KN | 89 KN | 222.4 KN | 44.5 KN |

## Optional Enhancements

Digital Displacement Option

This option provides the capability to connect one or two Heidenhain displacement gauges to the system for creep and/or stress relaxation testing. It consists of cabling, connectors, and software to integrate the displacement gauges into your Test Machine.

Note: Displacement Gauges are available as an additional option package*

**Analog Displacement Option**

This option provides the capability to connect one or two LVDT's or other analog displacement measuring devices (such as laser extensometers) to the system for creep testing. It consists of cabling, connectors, and software to integrate the displacement gauges into your Test Machine.

Note: Displacement Gauges and transducer signal conditioning are available as an additional option package*

**Automatic Hot Step Load Option**

This option utilizes specialized software and hardware to allow the SIGMA Test System to perform automatic hot step loading a creep test without operator intervention. It consists of a Load Cell with electronic signal conditioning and adapters, special weight pan, and an additional lever arm counterweight to offset the weight of the load cell.

Note: The operator remains responsible to load the final test weights onto the machine prior to the test start. The maximum load capacity for this option is the lesser of (i) the rated frame/lever arm capacity or (ii) the capacity of the load cell multiplied by the lever arm ratio.

**Load Control Option (Standard on SIGMA 2610 Test Machines)**

This option provides for weight free specimen load control of the SIGMA Test Machine without operator intervention. It is recommended for labs that do a lot of load increases during tests or short duration creep tests with automatic step loading. It consists of a Load Cell, Load Cell Adapters, a special weight pan and frame attachment hardware, an additional lever arm counterweight to offset the weight of the load cell.

The maximum load capacity for this option is the lesser of (i) the rated frame/lever arm capacity or (ii) the capacity of the load cell multiplied by the lever arm ratio.

**Stress Relaxation Package**

This option provides the capability of performing Stress Relaxation Testing per ASTM E-328, Constant Strain Testing and Constant Stress Testing.

Note: Requires the Load Control Option with the Digital Displacement Option.

**Cyclic Option**

This option provides the ability for the Test Machine cycle between preset specimen stresses, with operator specified dwell times. The system has higher speed data collection during the increase and decrease load phases.

Note: Requires the Load Control option.

## WinCCS SIGMA Portable Display Module Option

This option provides display of specimen test parameters and provides jog control of draw head or elevator. This option is backward compatible with all previous versions of WinCCS and can be used on multiple SIGMA Test Machines or previous generations of WinCCS.


**WinCCS Portable Display Module**


**WinCCS Portable Display Module Main Screen**

### Option Recommendations per Test Type

| Test Type | Basic Tester with no options | Load Control Option[1] | Automatic Hot Step Load Option[2] | Digital Displacement Option[3] | Analog Displacement Option[3] | Stress Relaxation Option | Cyclic Load Option | WinCCS Portable Display Module Option |
|---|---|---|---|---|---|---|---|---|
| Hydrogen Embrittlement F519 | S | O | | | | | | O |
| Stress Rupture | S | O | | | | | | O |
| Stress Rupture with Uploads | S | O | | | | | | O |
| Stress Rupture Combo | S | O | | | | | | O |
| Creep | | O | | R | R | | | R |
| Creep with Hot Step Loading | | O | O | R | R | | | R |
| Stress Relaxation | | R | | R | | R | | R |
| E328 Stress Relaxation | | R | | R | | R | | R |
| Constant Stress | | R | | R | | R | | R |
| Cyclic Loading | | R | | O | O | | R | O |

*S: Standard*
*O: Optional*
*R: Required*

1. *Load Control is standard on Series 2610. System does not utilize weights*
2. *Requires Calibrated Weights*
3. *Select Digital or Analog*