

Automation Technology Inc. manufactures a complete line of testing and process control products including:

- Armature Test Systems
- Rotor Test Systems
- Stator Test Systems
- Field Coil Test Systems
- No-load Motor Test Systems
- Patented Digitorque® Full-load Motor Test Systems
- Benchtop Surge Testers
- Scratched Wire Detectors
- Turns Counters
- Life Test Systems
- Final Product Testers
- Wire Bonding Process Equipment

ARMATURE TEST SYSTEMS
A T S 3 8 0 0

summary of tests performed

HI POT/DIELECTRIC

ATI utilizes the latest concepts in Hipot/Dielectric testing. Important Standard features incorporated in this test include:

- Capacitance Compensation separates the real resistive current from the sometimes very large capacitive current which flows as a result of winding to core capacitance. This feature permits maximum leakage current limits to be set lower and provides better analysis of the Stator insulation.
- Ramped Turn-on of Hipot Voltage eliminates the high current inrush associated with the instantaneous application of high voltage to the part under test. If a ground is detected during the voltage ramp-up, Hipot power is removed before damage can occur.
- True RMS Measurement of both leakage current and applied voltage is more accurate due to the requirement to measure parameters that contain out-of-phase components.
- Arc Detection is a feature that detects arcing that is sometimes observed at the peaks of the test voltage. This arcing, because of the short duration, may not be of sufficient magnitude to cause the RMS leakage current to exceed the maximum leakage current limit.



Independent Modular Test Shelves allow for simple calibration and quick diagnostics

ATI also offers bench-top Hipot testers from manufactures such as Quadtech that may be incorporated as an option to our standard Hipot test.

RESISTANCE

To provide the greatest possible accuracy, ATI's Armature Test System utilizes a number of technical features when performing a resistance test that are not common in competitor's equipment. Following are some of these features:

- Test current is kept to a minimum and applied for the shortest amount of time possible to avoid heating of the copper or aluminum magnet wire. Because magnet wire has a resistance temperature coefficient of approximately 0.4 %/°C, it is important to avoid heating the wire in order to produce stable, repeatable measurement values.
- Connection to the Armature commutator bars is made via a 4-wire Kelvin connection.
- Both test current and the resultant voltage drop are integrated over one line cycle and measured simultaneously. This integration over a power line cycle causes the voltage and current values to be extensively filtered at harmonics of the line frequency. Most electrical noise found in motor manufacturing facilities is at harmonics of the power line frequency. This is a feature not found in competitor's products.
- A sixteen-bit converter is used for the A to D measurement. Typical competitive Systems are twelve-bit.
- Ambient temperature compensation is standard. Optional, non-contact, infrared, part temperature measurement is available. This temperature compensation feature normalizes the resistance measurements back to programmable standard laboratory conditions typically 25°C.

The combination of the above features and test methods provide the best Gage R&R of any Armature Test System available (particularly at the very low resistance ranges below 0.100 Ohms).

SURGE (IMPULSE)

The surge test is conducted by discharging a charged high voltage capacitor into the coil under test. The result is a decaying ringing pulse at a frequency defined as $f=1/(2\pi\sqrt{LC})$. Measurement of the surge data is as follows:

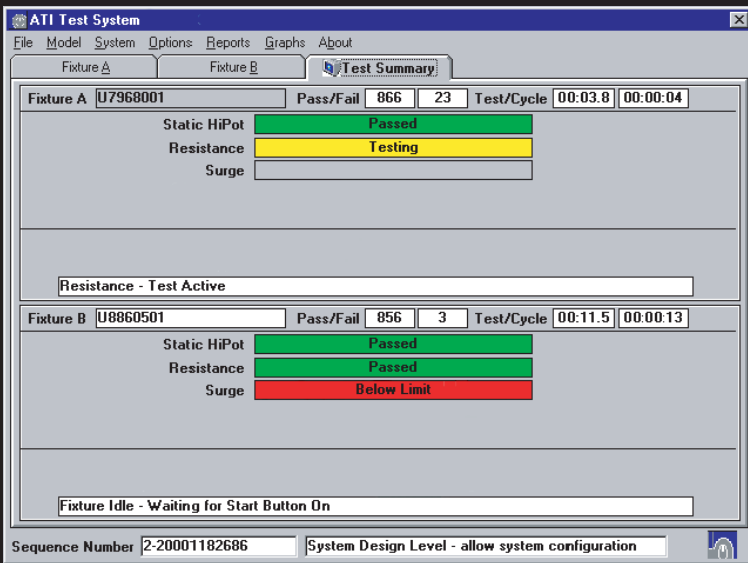
- ATI's high-resolution timer circuitry measures the period of this frequency to a resolution of 20 nanoseconds. (0.0000002 seconds). Typical period readings would be in the range of 50.00 μ S to 250.00 μ S. Extremely small changes in inductance such as shorted turns, incorrect turns count and incorrect turns placement can be easily detected with this method. This type of test unlike most others is not affected by small variations in test voltage.
- To avoid nuisance rejects caused by inductance or capacitance variations resulting from acceptable process

variables, ATI has developed a method whereby the ratios of the period measurements within an armature are compared to programmable ratio limits. This permits the setting of very tight ratio limits which detects very minor winding defects without having nuisance rejects resulting from variations in the steel, stack length, etc. Techniques used in competitive equipment do not permit this capability.

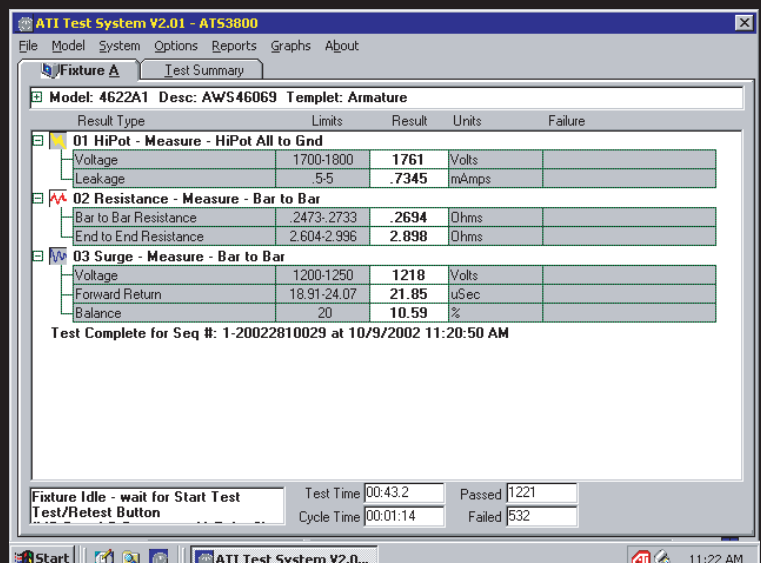
WELD RESISTANCE

For armatures having Tang (hook) type commutator connections, ATI's Weld Resistance Test tests the connections of the armature commutator connections and the resistance values of the individual windings using a pair of independent constant current sources connected across opposite pairs of armature windings through their respective commutator bars. The constant current sources are identical in output current and are connected in opposite polarity to minimize circulating

current from flowing in other windings of the armature. The voltages developed across windings adjacent the two current sources are combined and are a function of the resistances of the connections between the windings and the commutator bars. The voltages across each constant current source represent the resistance of the winding to which it is connected.



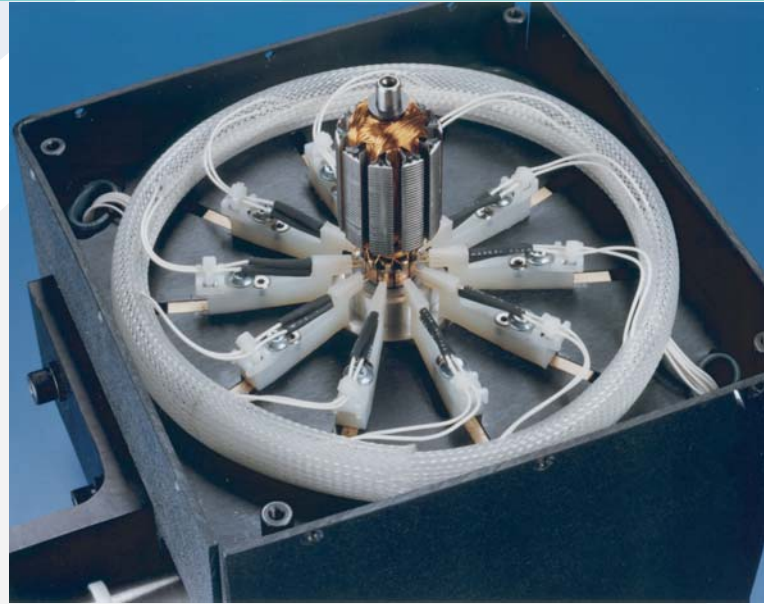
Test Summary/Operator Screen: This screen displays the model being tested in each fixture, the sequence number and the result of each test performed.



Fixture Detail Screen: There are one of these screens per fixture that can be selected. These screens display actual numerical measured data for each test being conducted at the selected fixture.

manual or automated fixturing

- ATI offers a complete range of system configurations from manual to fully automatic lines. Systems can be integrated into new or existing manufacturing lines. Test heads utilize gold plated, pogo pins to make a reliable Kelvin connection to the commutator bars. For manual systems, safety interlocked light curtains are used whenever possible to speed load/unload time providing maximum throughput.
- For high production systems, ATI testers utilize a test head like that shown. These heads have two independent connections (Kelvin) at each commutator bar. The connections are made using easily replaceable, gold-plated, pogo pins. The test head's cam design allows all connections to be engaged/disengaged using a single air cylinder. The cam design means that **ALL** connections are either engaged or disengaged.
- The Patented Lift and Slide system for automatic lines eliminates the load/unload time from the total cycle time allowing true 100% utilization of the test system.



- To align the Armature for Test in an Automatic Line Test System, ATI incorporates our Patented method using non-magnetic, wear resistant ceramic rollers. Because these rollers are non-magnetic, they do not influence the Surge Test Data by changing the capacitance of the armature under test.
- ATI's Rotary Armature Test Fixture is ideal for lower volume runs of varying configurations. This system allows testing of armatures having varying numbers of bars, commutator diameters, stack diameters, shaft diameters and lengths, etc.

standard & optional features

STANDARD FEATURES:

- Industry Leading Two-year Limited Warranty
- Requires Only 120V AC Single Phase Power Input
- Automatic Setting of HiPot and Surge Test Voltage
- Easy to Use Windows® Operating System
- Ambient Temperature Compensation
- Results Management (Statistical Analysis)
- Comprehensive Diagnostics Utilities
- Inkjet Data Printer
- Dual Hard Drives with Automatic File Backup Software

- Modem and Software to Provide Remote Diagnostics
- Power Regulation and Power Transient Protection
- Learn Mode with Percentage or Standard Deviation Tolerances and Adjustable Thresholds for Resistance and Surge
- Capable of Network Interface
- Simultaneous Testing on Dual Fixtures for Maximum Throughput

OPTIONAL FEATURES:

- Reject label Printer
- Bar Code Reader
- Touch Screen
- Infrared Temperature Compensation
- Automatic Passed Part Marker
- Neutral Zone/Bar Advance Test

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