DONART ELECTRONICS
IRT INTERLAMINAR RESISTANCE TESTER MANUAL

User's Guide

Contents

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OTHER CONDITIONS:

This warranty allocates risks of product failure between you and DONART. DONART'S software

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STATE LAW RIGHTS:
This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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In accepting this system and software, it is agreed that the purchaser will maintain the design of both hardware and software confidential except as necessary to train operators and operate the system.

COMMERCIAL SOFTWARE SUPPLIED WITH THIS SYSTEM
All commercially supplied software, if accepted, shall bind the user to the terms of the licensing agreement supplied by this software. Donart has purchased and supplied such software as was considered necessary or convenient for proper system operation. Such software has been supplied complete with instructions and license.

SAFETY PRECAUTIONS
The test console is a complex measuring system composed of a number of independent instruments and devices operated directly from or through appropriate transformers connected to a main AC power line source. Internal wiring as well as components and wiring internal to the various instruments represent potential electrical shock hazard to personnel. The instrument should not be installed or operated until all personnel concerned with installation, operation and maintenance are made aware of these potential hazards. In addition to the suggestions contained herein, all local electrical and mill codes should be carefully adhered to by properly trained personnel concerning the installation, operation and maintenance.

HAZADORUS VOLTAGES
The exact reaction to an electrical shock can range from mild annoyance or discomfort to death. Effects of an electrical shock depend on the source of the shock, the physical condition of the individual encountering the shock, the length of time encountered, how good the electrical contact is and the individual's natural reaction to the shock among other variables. In addition to the hazard of the shock to the person receiving it, there is also the possibility of personal injury due to the physical reaction in attempting to quickly escape from the contact. As an example, voluntary or involuntary reaction to the shock can cause an individual to strike his head or other parts of his body against a cabinet or physical obstruction causing physical injury or death in addition to the specific damage caused by the shock.

In general, persons wearing pacemakers or other electrical or electronic life aid devices should not perform maintenance or operate equipment using line voltage as a primary power source. Since even mild electrical shocks can disrupt the bodies normal nerve messages, persons with nervous disorders or heart conditions should not maintain or operate this equipment.

ABOVE NORMAL BODY TEMPERATURES
Under normal operating conditions, only a few of the components in the instrument are hot enough to be uncomfortable to touch or possibly cause burns. Jerking away or otherwise reacting to contact with these parts could cause injury to parts of the body coming in contact with the cabinet or other physical obstructions. Allow the instrument to cool before performing maintenance.

In general, both transformers and motors operate normally at higher than body temperatures and contact with these without proper thermal protection should be avoided. In the event of equipment malfunctions or failure of parts, higher than normal temperatures could result in not only the above-named components, but additionally in wires, resistors and other normally cool parts. In the case of equipment malfunctions, exercise extra care to avoid the possibility of contact with above body temperature parts.

AMBIENT TEMPARTURE
The test console contains electronic circuitry; some portions of which are by nature temperature sensitive. The system will not maintain its full accuracy over a large temperature range. The ideal location for the unit is in an air-conditioned room. It is recommended that an attempt be made to maintain the ambient temperature at 72ºF (22.2º C), plus or minus 2ºF (1.0ºC). The instrument should be turned on for at least 1 hour for stabilization prior to any measurement.

1 Getting Started

Introduction

The model IRT1 Interlaminar Resistivity Tester is an advanced instrument for measuring the interlaminar resistance of electrically insulating coatings of adjacent electrical steels. This tester follows and conforms to all requirements in ASTM standard A937.

To measure an average interlaminar resistance a known area has to be defined. This is achieved by stacking the two laminations and applying pressure using two 10cm^2 pads. An overview of this can be seen below.
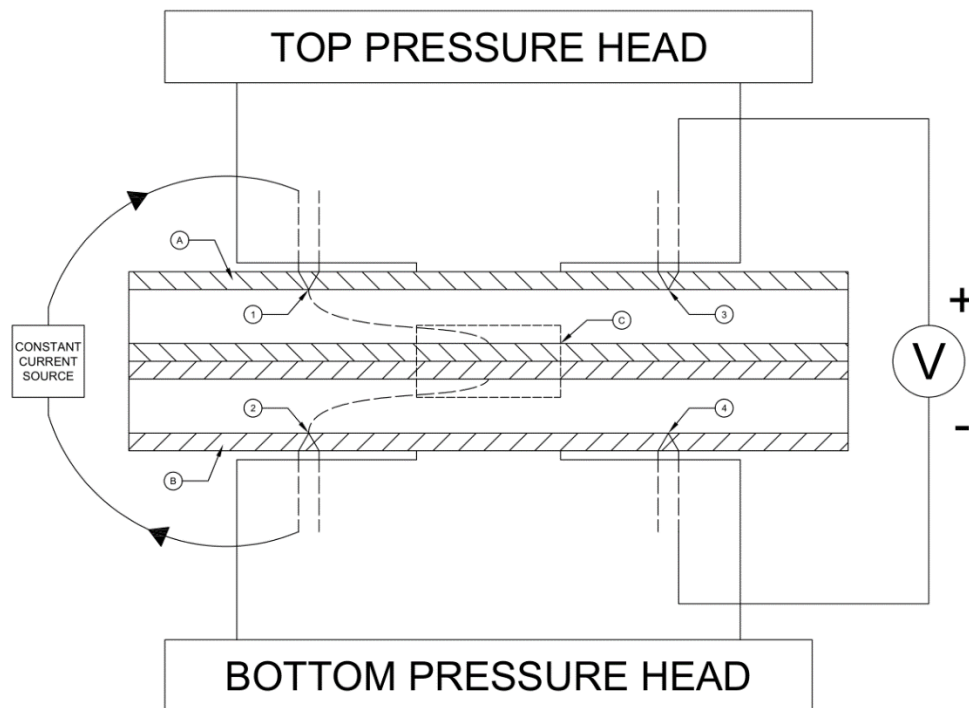

Once pressure is applied to the laminations, the tester then uses two sets of drill bits for setting current and concurrently measuring voltage. Drill bit 1 pierces the top insulation surface A, with drill bit 2 piercing the bottom insulation surface B. This allows a constant current to flow through the defined interlaminar insulation area C. Drill bits 3 and 4 then also pierce the top and bottom insulations respectively but they are used to measure the voltage drop across the interlaminar insulation.

Since the constant current is known, the voltage measurement can be used to calculate interlaminar resistance using Ohm's law which is, $Resistance = Voltage/Current.$
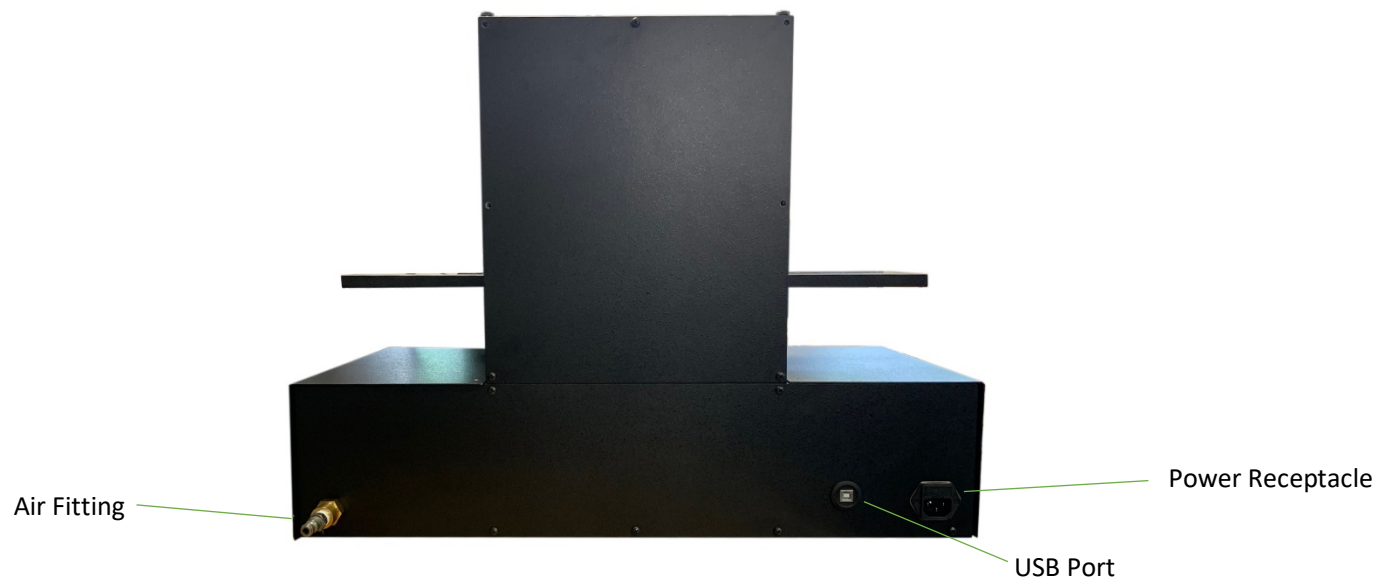
2 Installation

The IRT Tester comes assembled so the only installation is to install the computer system, connect air and power to tester and read the following overview to identify system components.

Interlaminar Tester Front View

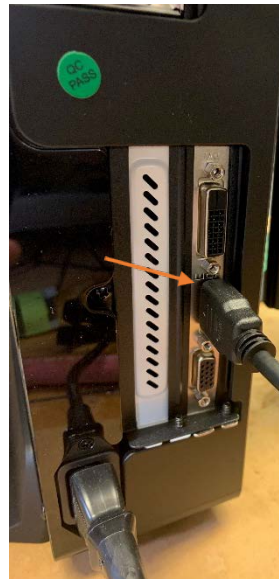
Power Switch
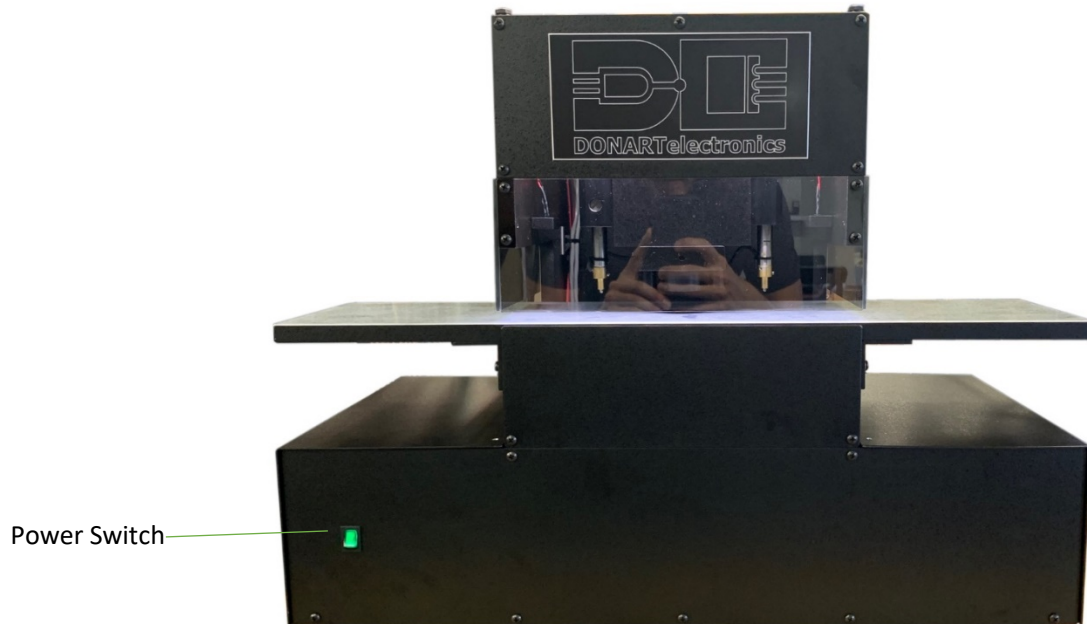
Interlaminar Tester Rear View

Air Fitting

Power Receptacle

USB Port

Interlaminar Tester Overview

Monitor

IRT Tester

Mouse   Computer

Keyboard

Interlaminar Tester Setup

1. Set up the computer by connecting power and the HDMI cable to the monitor and then plugging the other end of the HDMI to the video card on the computer.

2. Plug the wireless mouse/keyboard receiver into the front of the computer and then plug one end of the USB B cable into the rear of the computer in an open USB slot.

3. Plug the other end of the USB-B cable into the IRT Tester, along with the power cable and air. Power must be 120/220 VAC and air must a minimum of 60 PSI, Clean and water trapped.

3 Operation

System Turn on

1. Flip the power switch to the on position on the front of the IRT Tester. Its light will glow green

2. Select the Donart Interlaminar Tester program from the desktop to load the program.
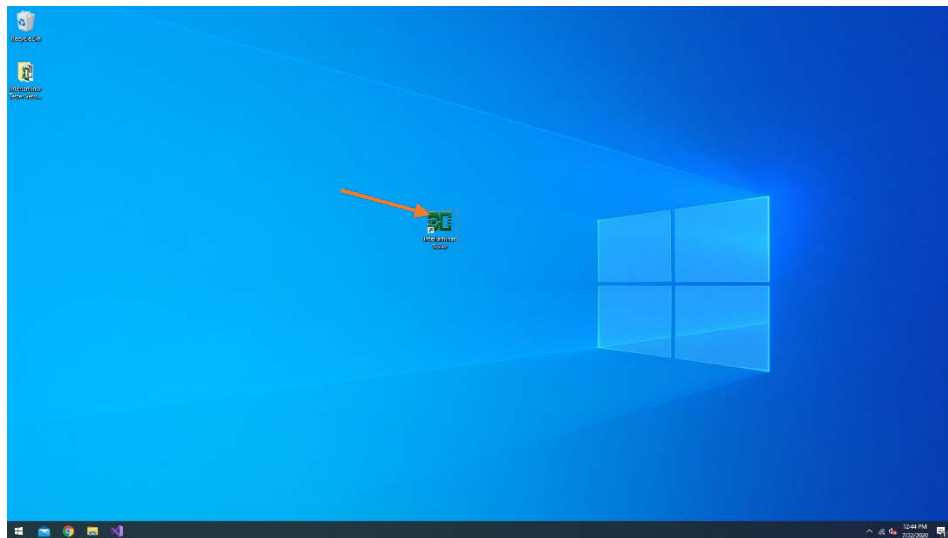
Donart Interlaminar Resistance Software

Donart Interlaminar Resistance software allows the user to control the tester and make resistance measurements from a personal computer. The software automatically calculates resistance and other statistics as well as allows saving of data locally and over a network.

Main Screen

① Test Data

Allows the user to enter test data for each sample being tested

② Measurements

Section for obtaining a number of resistance measurements for a sample

③ Meters

Allows user to watch current, voltage and resistance measurements during test

④ Statistics

Automatic calculation of test measurement statistics

⑤ Buttons

Used for controlling tester, saving and clearing of data

⑥ File Menu

For exiting and saving

⑦ Options Menu

For calibration, manual controls and settings

Test Data Section

The test data section allows the user to enter informational data for the sample being tested. This test data is saved along with measurements from the current sample. All fields have a max of 10 characters except for comments which has a max of 200.

Test Data

Tester ID		Ingot ID		Coating Type	
Order Number		Lot Number		Cycle Number	
Order Item Number		Coil Number		Adhesive	
Heat Number		Test Date	08-19-2020	Application Method	
Comments					

- Tester ID
  Unique identification for user currently operating test.
- Order Number
  Order number for sample
- Order Item Number
  Order Item number for sample
- Heat Number
  Heat number for sample
- Ingot ID
  Ingot identification
- Lot Number
  Lot number sample was obtained from
- Coil Number
  Coil sample was obtained from
- Test Date
  Date sample was tested which is filled automatically
- Coating Type
  Selectable between Inlac, Oxide, Other
- Cycle Number
  Cycle sample obtained from
- Adhesive
  Adhesive used on sample
- Application Method
  Application method used on sample
- Comments
  Section for entering comments for sample

Meters section
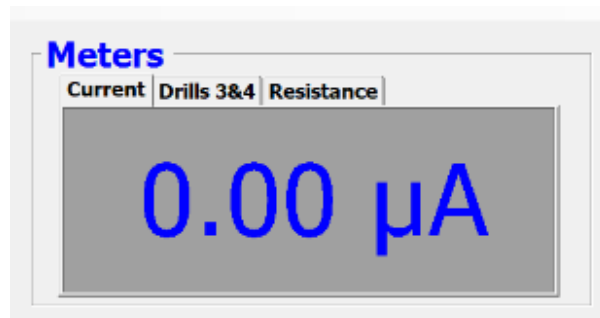
The meters section allows the user to monitor measurements during testing. It allows for monitoring of current, voltage (across drill bits 3&4) and resistance calculated from current and voltage measurements. The measurements are constantly updated in real time.
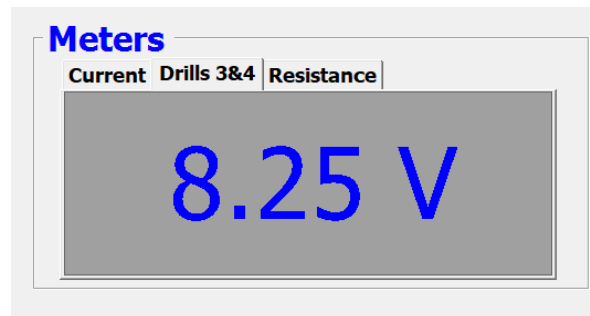
By clicking the appropriate tab on the meter, the user can switch between all three measurements. By clicking Drills 3&4, the meter will display volts which can be seen above.

Measurements Section

The measurements section allows the user to perform a number of resistance measurements for a sample. Data is automatically populated during the test in each cell. As seen above, the measurements section allows for ten measurements across a sample.

To populate a cell with a measurement, click the cell to highlight it and then click the start button. The tester will apply force to the sample and begin testing. Once the test is finished, the highlighted cell will be populated and then the next cell to the left will be highlighted.

A measurement can be changed in the same manner. To retest a measurement, simply click the measurement you want to change and click start button. Once test is finished, the measurement will be updated and the next blank cell or last measurement will be highlighted.

The statistics section contains stats that are calculated from the all the resistance measurements. They are automatically calculated during testing and saved along with test data and measurements.

- Max
  Highest resistance measured out of all measurements
- Min
  Lowest resistance measured out of all measurements
- Average
  Average resistance calculated from all measurements
- Surface Resistance
  Two surface insulation resistance calculated from the average in units of $k\Omega \cdot \text{cm}^2$
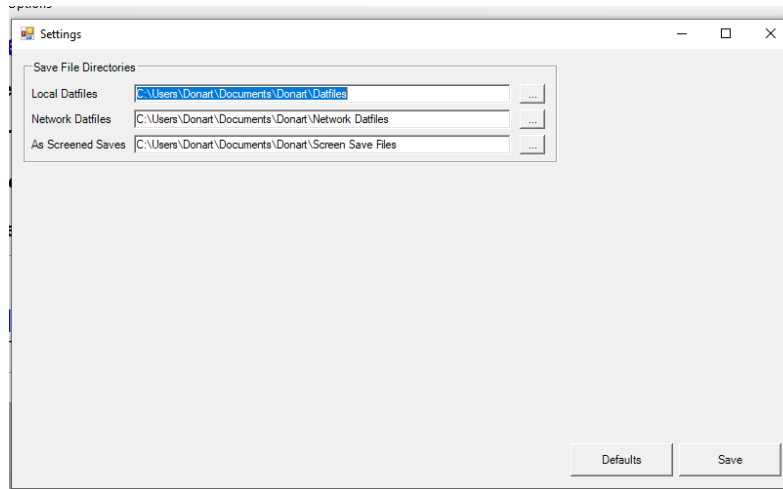
- Start/Abort
  Starts test and applies pressure/current to sample. Once clicked it will turn to an abort button to cancel test.
- Save
  Saves Test data and measurements locally and over network
- Clear
  Clears all entered test data, measurements and statistics

Settings Menu

The settings screen can be accessed by clicking options from the menu bar and then clicking settings. The settings screen allows the user to change the following save file locations.

- Local Datfile Save File Location

    Changes the save file location for local datfile strings
- Network Datfile Save File Location

    Changes the save file location for network datfile strings
- As Screened Save File Location

    Changes the save file location for as screen save files

To revert settings back to default. Click the defaults button then click save

Calibration/Manual Menu

The calibration and manual control screens can be accessed by clicking options from the menu bar and then clicking calibration/manual controls. These two screens are password protected and meant only for Donart Technicians or authorized users.

The calibration menu contains all necessary instructions and procedures for calibration of IRT Tester.

The manual controls menu allows the user to manually control all features of the system.

Save Files

The IRT software saves two different types of files. Files are saved with the data being formatted for easy reading which are referred to as "as screened save files". The other types are known as "dat files". Dat files are saved as comma delimited string files that can be saved locally and over the network, so they can be parsed and entered into a database, excel, etc.

As screened Save Files

As screened save files as seen above are easily readable containing all measurements and test data. These files can be opened in any text editor program. The save file location can be edited in the IRT software settings

Local and Network Datfiles

Datfiles are saved in two locations which can be edited in the IRT software settings. They are comma delimited and can be parsed as follows.

1	2	3	4	5	6	7	8	9	10	11	12	13
Tester ID	Order Number	Order Item Number	Heat Number	Ingot ID	Lot number	Coil Number	Test Date	Coating Type	Cycle Number	Adhesive	Application Method	Comments

14	15	16	17	18	19	…	…	17+x
Test Max	Test Min	Test Average	Test Surface Resistance	Measurement 1	Measurement 2	…	…	Measurement x

4 Maintenance

Fuses

The IRT Tester has two fuses that may need to be replaced. They are 250 V 2A 5x20mm Fast Acting fuses available online (https://www.mouser.com/ProductDetail/576-0217002.MXP) or at any automotive store.
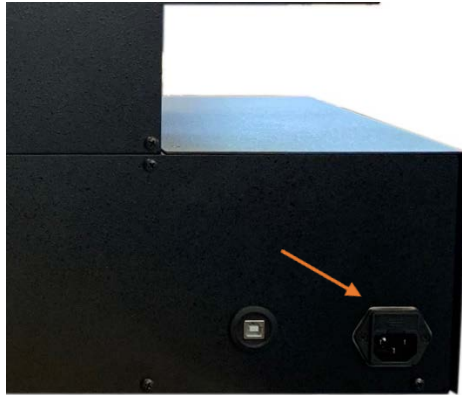
The fuses are located in the back of the tester on top of the power plug. Simply insert a screw driver to open the door and replace them when needed.

Drill Bits

The Drill bits will need to be replaced periodically once they no longer are cutting through the insulation. The user will be notified once they need replaced, through software since every test performs a drill bit check.

The drill bits can be ordered directly from Donart and when they need replaced the following procedure can be followed.
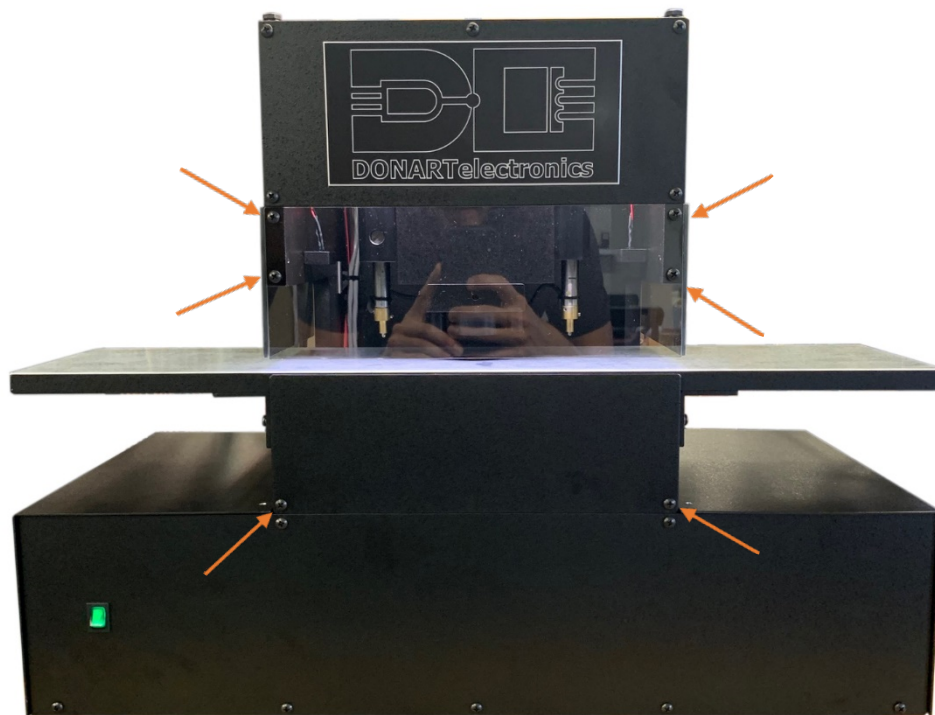
Tools needed:

- Phillips screwdriver
- 1/16" Hex key
- 5/64" Hex Key
- Cut resistant gloves (Drill bits are very sharp!!)
- Wire cutters
- Zip ties x 4

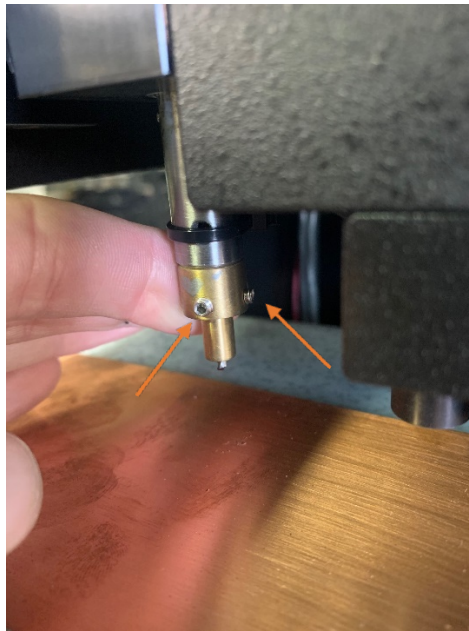1. Unplug power, USB and air supply from tester.

2. Remove the four securing the front guard along with the two screws securing the bottom
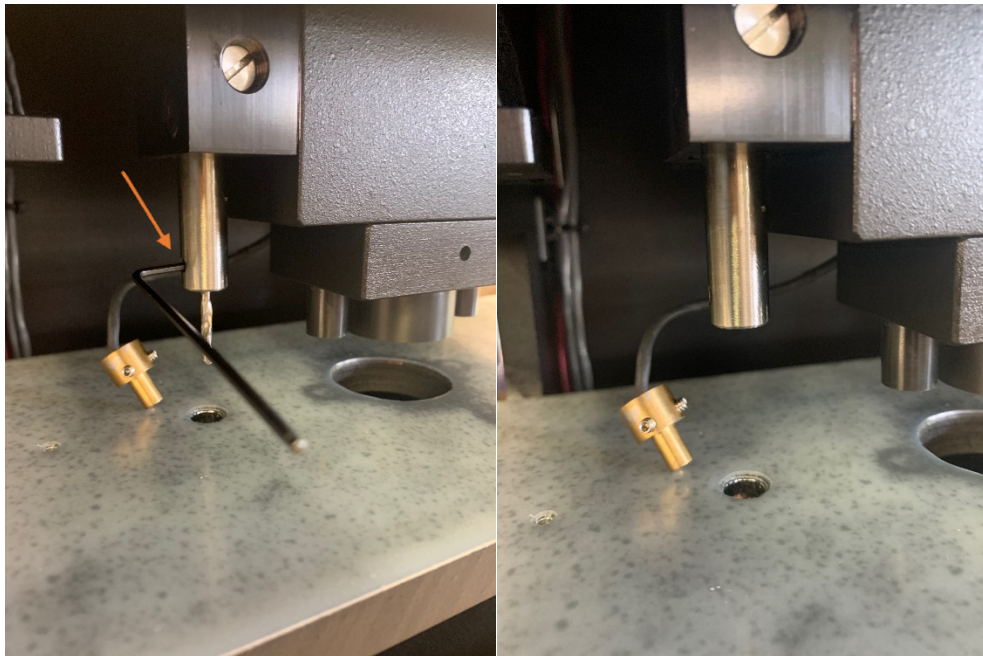   cover panel using a philips screwdriver

3. Cut the wire tie supporting the cable on the actuator

4. Loosen the two set screws on a sense collar to remove it and move it out of the way using a 1/16" hex key.
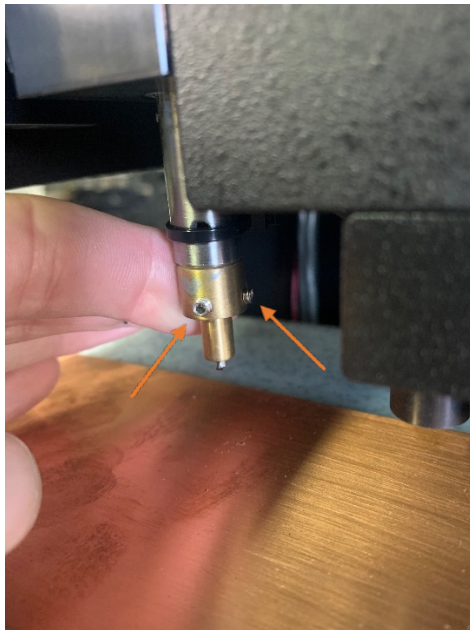

5. Loosen the set screw on the actuator and the drill bit can then be removed using the 5/64" hex key

6. Insert new drill bit into the actuator and tighten set screw to secure it
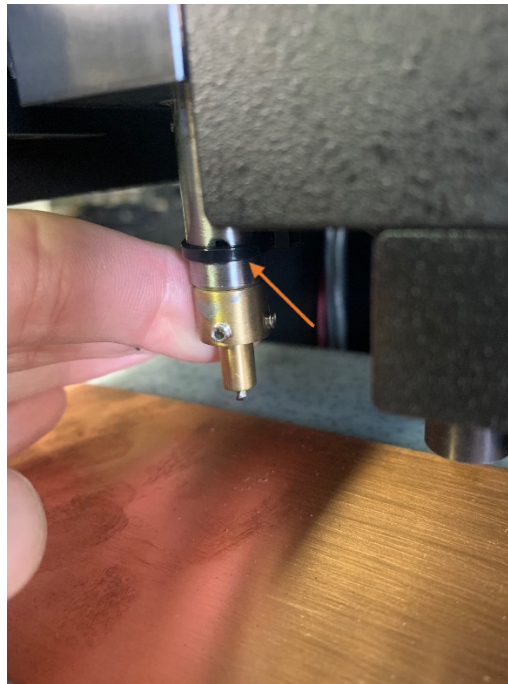

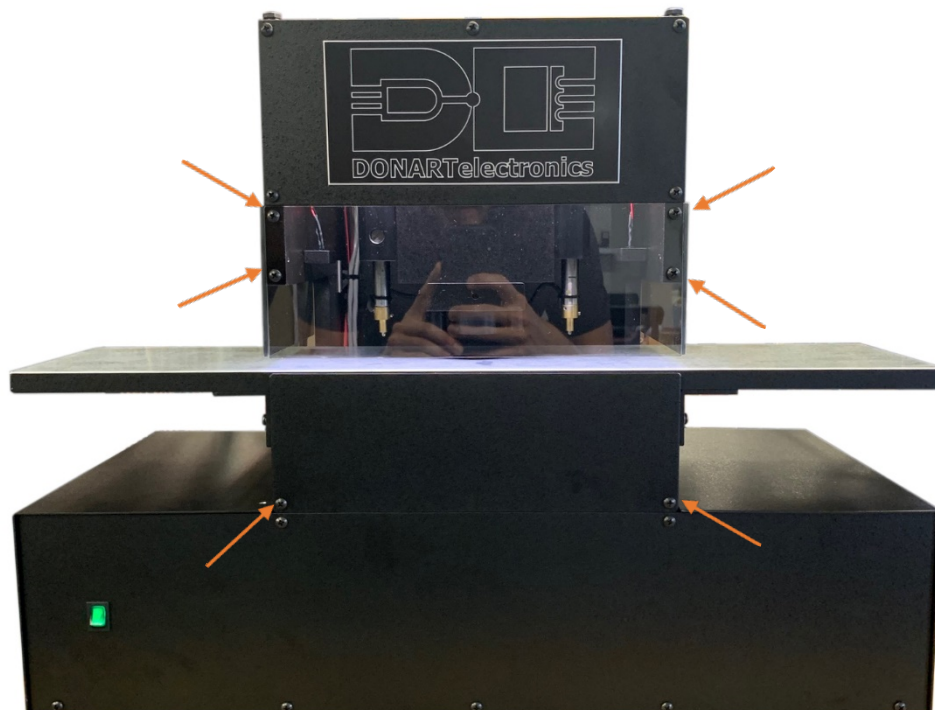7. Slide sense collar back on to new drill bit and tighten its two set screws

8. Wire tie wire back on to actuator

9. Repeat steps 3-8 for each new drill bit
10. Reinstall front guard and panels using six screws

Sample Shelf Insulation

The sample shelf has a protective insulation film on it to prevent laminations from shorting to the shelf. If a lamination shorts to the shelf, the tester will not measure resistance correctly so it is important to inspect the insulation periodically for cuts or nicks and replace as needed.

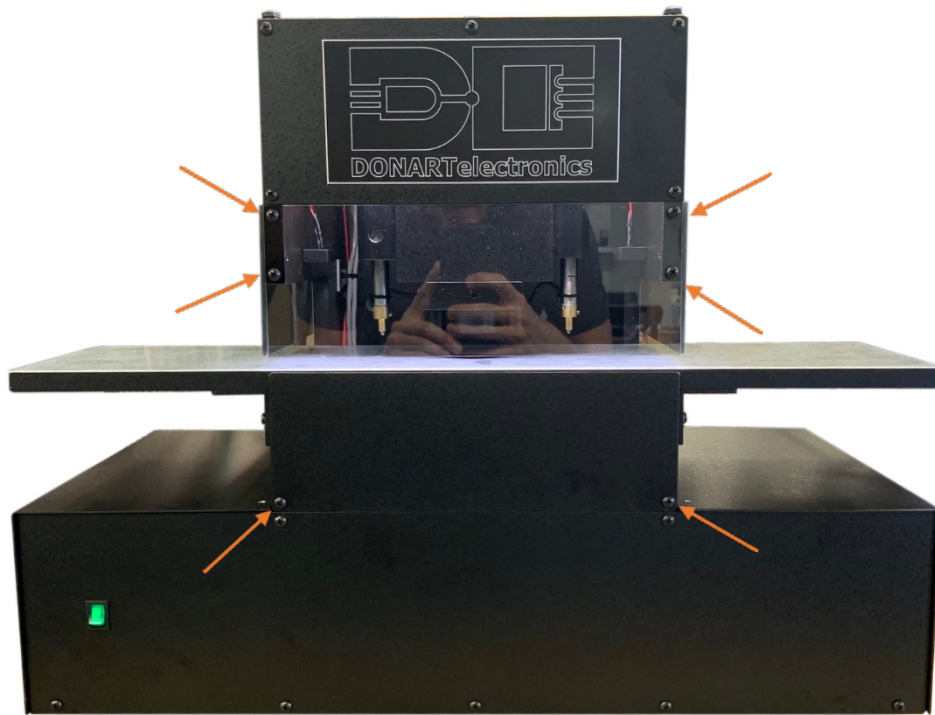The shelf can be removed by following the following procedure.

Tools required

- Phillips screwdriver
- Wire cutters
- Zip ties x 2

1. Unplug power, USB and air supply from tester.

2. Remove the four securing the front guard along with the two screws securing the bottom cover panel using a philips screwdriver

3. Remove the four screws securing the shelf to the angles using a Philips screwdriver.

4. The IR receivers are attached to the shelf so cut the wire tie below and unplug them so they can be removed with the shelf.
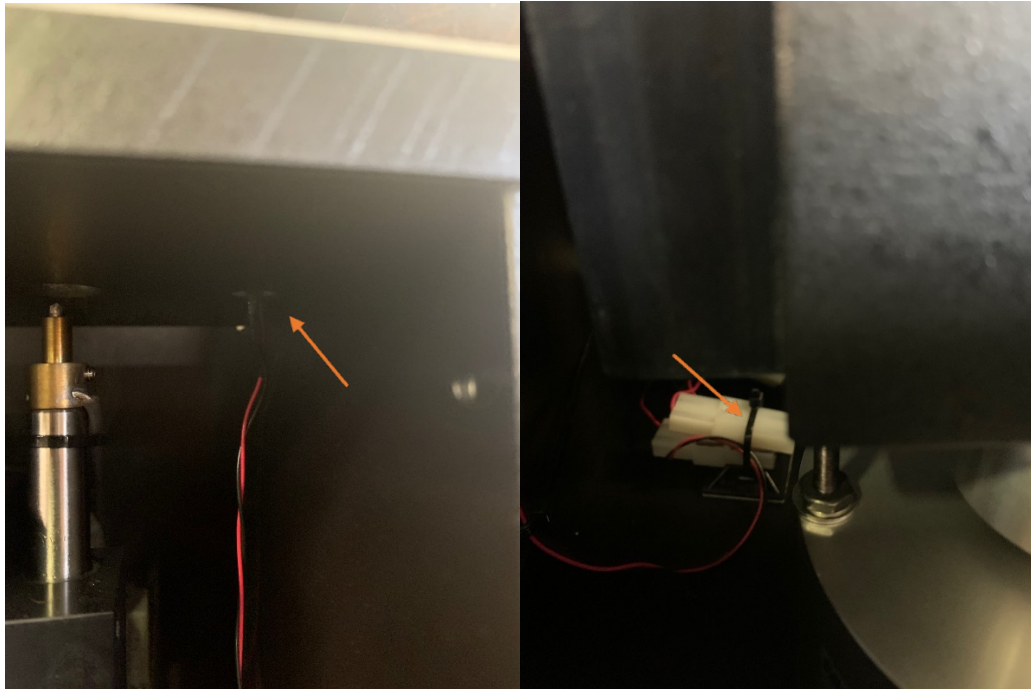
5. The shelf can now be removed by sliding it out the front of the tester. The old insulation film can be scraped off and the new one applied.

5 Specifications

Measurable Materials	Minimum 12" Long laminations having electrically insulation coating on each side Coatings of insulation resistivity in excess of $0.3\ k\Omega \cdot cm^2$ (Franklin Values of 0.02A or Greater)
Test Data Reported	Resistance, interlaminar two surface resistance, min/max/average from total measurements
Measurement accuracy	Meets or exceeds ASTM Specifications A937
Test Pressure	300 PSI
Measuring Currents	10µA, 1µA, 0.8µA
Fuses	Cartridge Fuses 250 V 2A 5x20mm Fast Acting
Operating Voltage	120/220 VAC
Operating temperature	70°F±10°F
Air supply	Minimum 60 PSI, Clean, water trapped air supply required