

Testing the Ground Circuit



- Ground of electrical products
- Class I vs. Class II products
- Ground Continuity Test
- Ground Bond Test
- What is tested during each test

Meet Our Team



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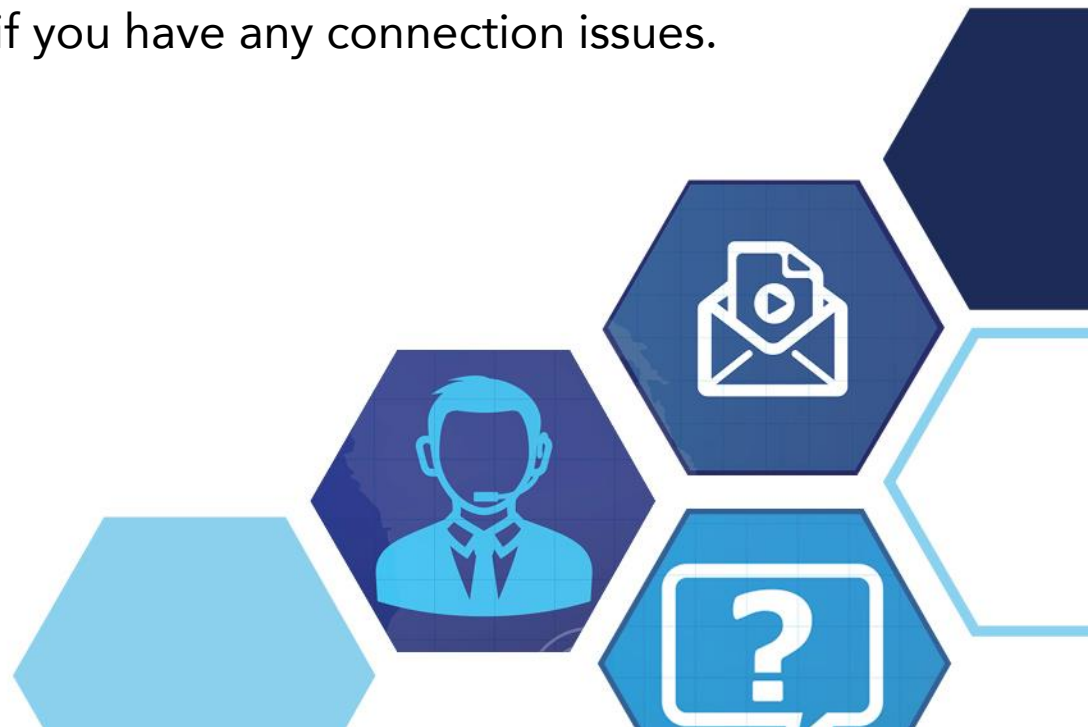


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Please contact Brittany Socha – on the chat line or email Brittany.socha@ikonixusa.com if you have any connection issues.



Ground Bond & Ground Continuity Testing Learning Objectives

Ground

- What is Ground?
- Grounding of electrical products
- Class I vs. Class II products

Ground Bond

- The Ground Bond Test – What is it?
- Ground Bond Standards Information
- Ground Bond Testing Examples

Ground Continuity

- The Ground Continuity Test – What is it?
- Ground Continuity Standards Information
- Ground Continuity Testing Examples

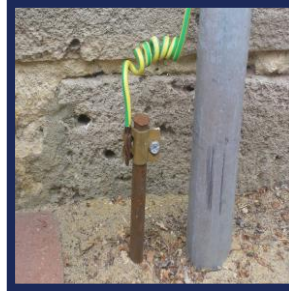
Bond vs. Continuity

- Comparing the Ground Bond and Ground Continuity tests
- Example of Ground Bond vs Ground Continuity

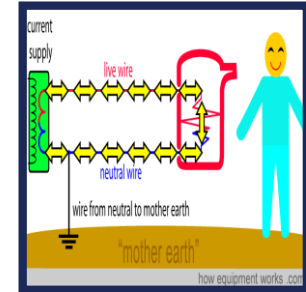
What is Ground?



Reference point
for an electrical
circuit



Second line of
defense against
electrical shock¹



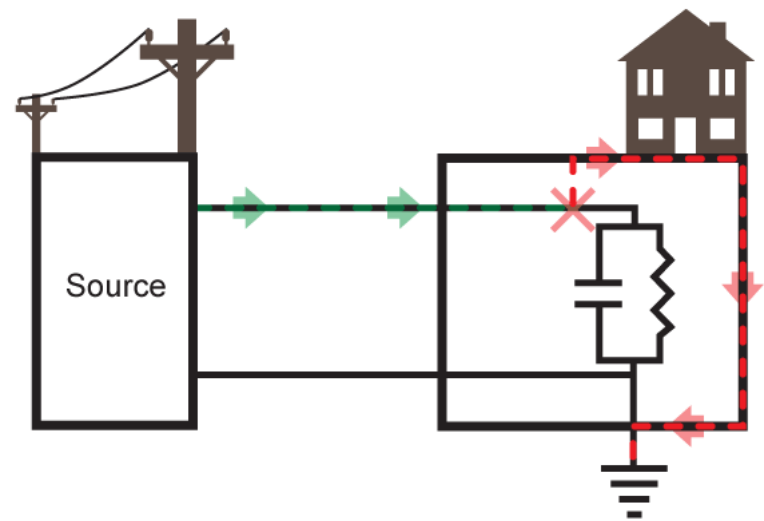
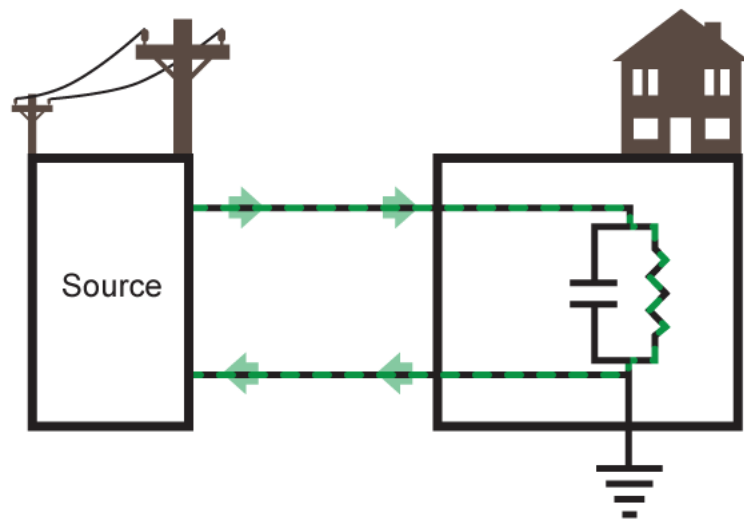
Common return
path for electrical
current²

Ground or “earth” can have numerous functions and meanings. The main purpose of a ground is to reduce the risk of electrical shock.

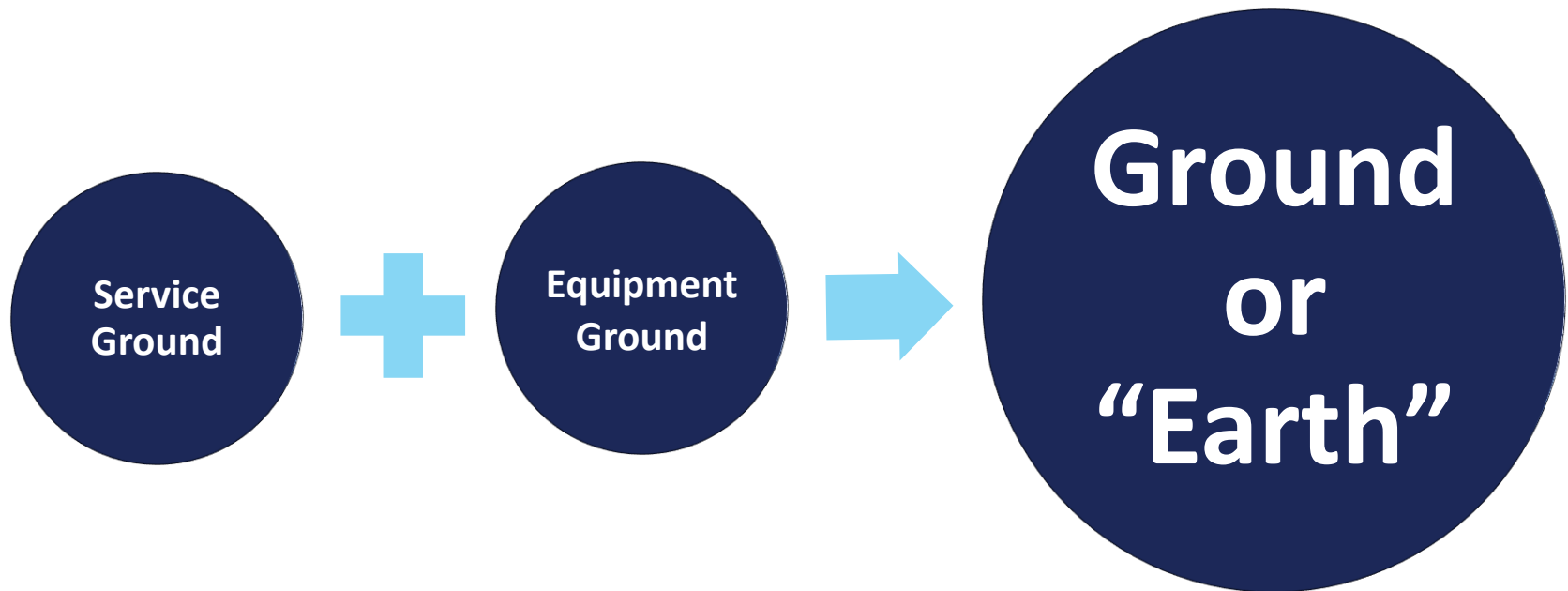
1 – http://en.wikipedia.org/wiki/Ground_%28electricity%29#mediaviewer/File:HomeEarthRodAustralia1.jpg

2 - http://www.howequipmentworks.com/physics/electricity/elec_safety/electrical_safety.html

Modern Power Distribution



Different Functions of Ground



System or Service ground – designed to protect machines, tools and insulation.

Equipment Ground – Designed to protect operator from electrical shock hazards.

Class I vs. Class II Electrical Products

Electrical products can be classified according to insulation type

Class I Products



- Terminate in 3 prong line cord (line, neutral and ground).
- Ground prong connects to product chassis.
- Safety through basic insulation and proper grounding.

Class II Products



- Double insulated products.
- Terminate in 2 prong line cord (line and neutral).
- Safety through dual layer of insulation.

Class I products provide electrical protection by employing basic insulation and a grounded chassis. Class II products employ a double layer of insulation so a grounded chassis is not necessary.

What is Good Ground?

National Electrical Code

- NFPA 70
- Protect people and property from electrical hazards

NEC 250-45

- "Any exposed non-current carrying metal parts of cord & plug connected equipment which may become energized shall be grounded."

NEC 250-51

- Permanent and Continuous
- Capacity to conduct fault current
- Low impedance to limit voltage to ground.

NFPA (National Fire Protection Agency) stipulates the NEC which is adopted in all 50 U.S. States. The NEC gives requirements for grounding products and installations. The NEC defines a "good" ground.

Ground Bond and Continuity Tests

Purpose

- Ground Bond and Ground Continuity tests are designed to “check” the ground connection on a product or system.
- How you ensure you have a proper ground.

Method

- Apply a current to the ground point of a product or system.
- Measure potential drop across the ground circuit and calculate the circuit resistance.

Testing

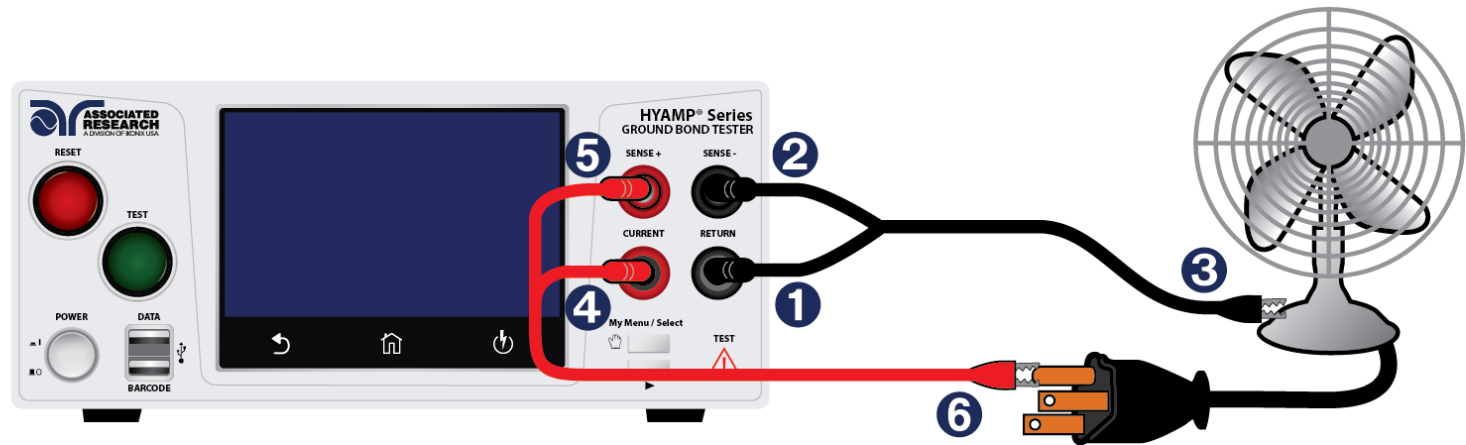
- Permanent and Continuous
- Capacity to conduct fault current
- Low impedance to limit voltage to ground.

These two types of tests are used to prove and verify that there is a low impedance path to the ground for electrical products and systems. This ensures proper grounding.

Quiz Question

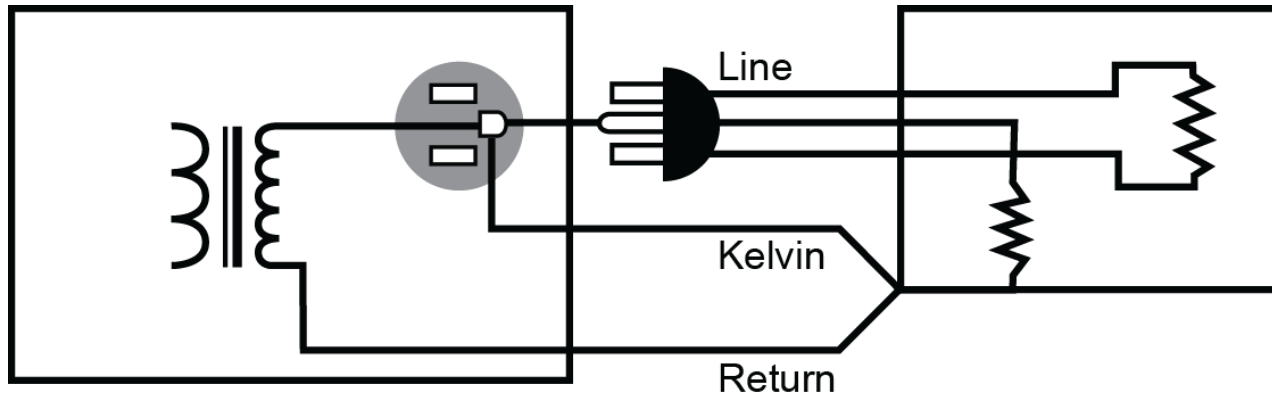
Which of the following best represents the result of a ground Bond test?

The Ground Bond Test

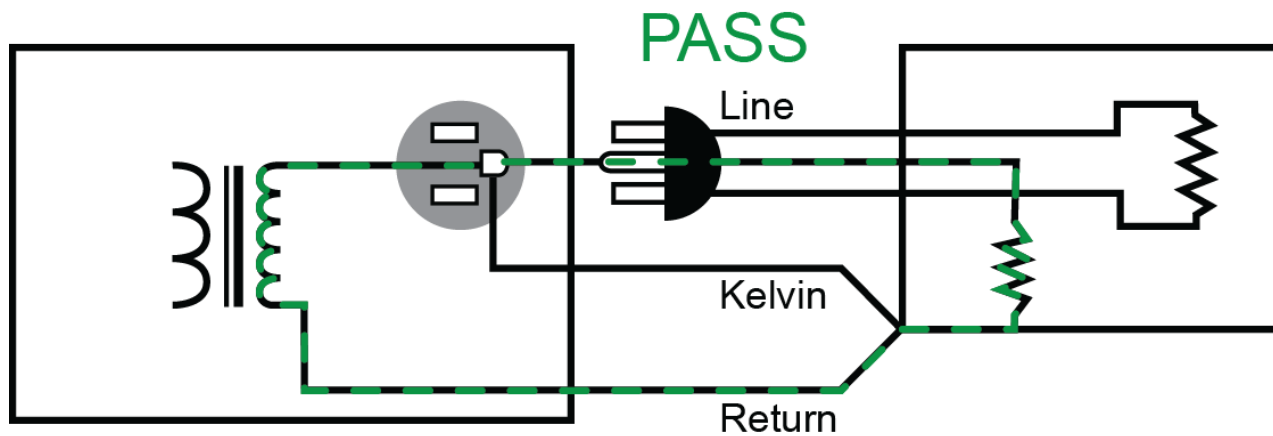


Associated Research HYAMP connected to
a DUT (Device Under Test)

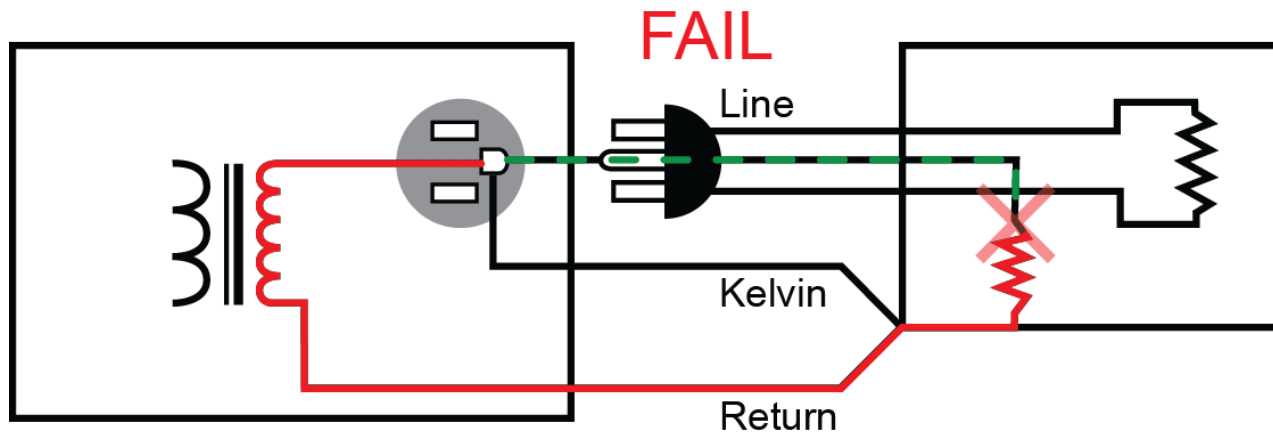
Ground Bond Testing



Ground Bond Testing



Ground Bond Testing



By the Numbers – What the Standards State

IEC/UL 60601-1 3rd Edition

8.6.4 Impedance and Current Carrying Capability (AC Ground Bond Test)

REQUIREMENT	PASS CRITERIA
Current = 25 A OR 1.5 * highest rated current (whichever is greater $\pm 10\%$) passed through protective earthing circuit. Frequency = 50 or 60 Hz, no load voltage ≤ 6 V	Impedance protective earthing circuit on the DUT ≤ 100 m Ω For DUTs with non-detachable supply cord, impedance for DUT ≤ 200 m Ω

By the Numbers – What the Standards State

UL 1598/CSA C22.2 No. 250.0-08 3rd Edition Luminaires

17.2 Bonding Circuit Impedance (Ground Bond Test)

REQUIREMENT	PASS CRITERIA
Test current = 30 A passed between earthing contact point and accessible conductive parts No load voltage ≤ 12 V AC or DC Test time = 60 - 120 sec (Refer to clause 17.2.4)	Impedance protective earthing circuit on the DUT ≤ 100 m Ω

By the Numbers – What the Standards State

IEC/UL 60335-1 5th Edition

27.5 Provision for Earthing Test (AC Ground Bond Test)

REQUIREMENT	PASS CRITERIA
Current = 25 A OR 1.5 * highest rated current (whichever is greater) passed through protective earthing circuit. No load voltage ≤ 12 V AC or DC	Impedance protective earthing circuit on the DUT $\leq 100 \text{ m}\Omega$

Ground Continuity Testing

Purpose

- A DC low current test to check circuit resistance.
- Similar concept to the Ground Bond testing.

Method

- Not all readings display on Ohmic value
- Light/buzzer meters to check whether continuity exists.

Ground Continuity testing is the same concept as Ground Bond testing. You're simply checking for a continuous path on a ground circuit. However, there are key differences between these two tests.

By the Numbers – What the Standards State

IEC/UL 61010-1 3rd Edition

Annex F - Routine Tests

THE CONTINUITY TEST

A continuity test to be run on the protective earth circuit
No current value specified. Simple continuity test to show
existence of protective earth circuit

THE HIPOT TEST

Test voltage - Refer to Table F.1
No flashover or breakdown on product insulation

By the Numbers – What the Standards State

IEC/UL 60335-1 5th Edition

Annex A (Routine Tests)

ROUTINE GROUND BOND

Test Current = 10 A
No load voltage ≤ 12 V AC or DC
Impedance of earthing conductor for cord connected equipment ≤ 200 m Ω
Impedance for all other appliances ≤ 100 m Ω

ROUTINE HIPOT

Test voltage - Refer to Table A.1
Leakage current limit ≤ 5 mA
Leakage current limit for high leakage appliances ≤ 30 mA

Ground Bond Vs. Ground Continuity

Ground Continuity Test	Ground Bond Test
<ul style="list-style-type: none">• Verifies the existence of a ground connection• Readings generally given in Ωs• The test is quick to set up and easy to perform• Usually used as an extra feature during the Hipot test.	<ul style="list-style-type: none">• Verifies the integrity of a ground connection• Readings generally given in $m\Omega$• Provides more valuable safety information about DUT• Can be combined with a Hipot test for a more complete safety testing system.

The Ground Bond test is more stringent than the Ground Continuity test.

Ground Bond Vs. Ground Continuity



Example: 64 strand wire with all but one strand connected.

Ground Bond Vs. Ground Continuity



Example: 64 strand wire with all but one strand connected. A ground continuity test would pass this wire because the instrument reads a continuous path.

Ground Bond Vs. Ground Continuity



Example: A Ground Bond test load the wire with high current. This would “burn up” the connection and cause a FAIL.

Poll Question

When are you performing the Ground
Bond test on your product?

Video Demonstration

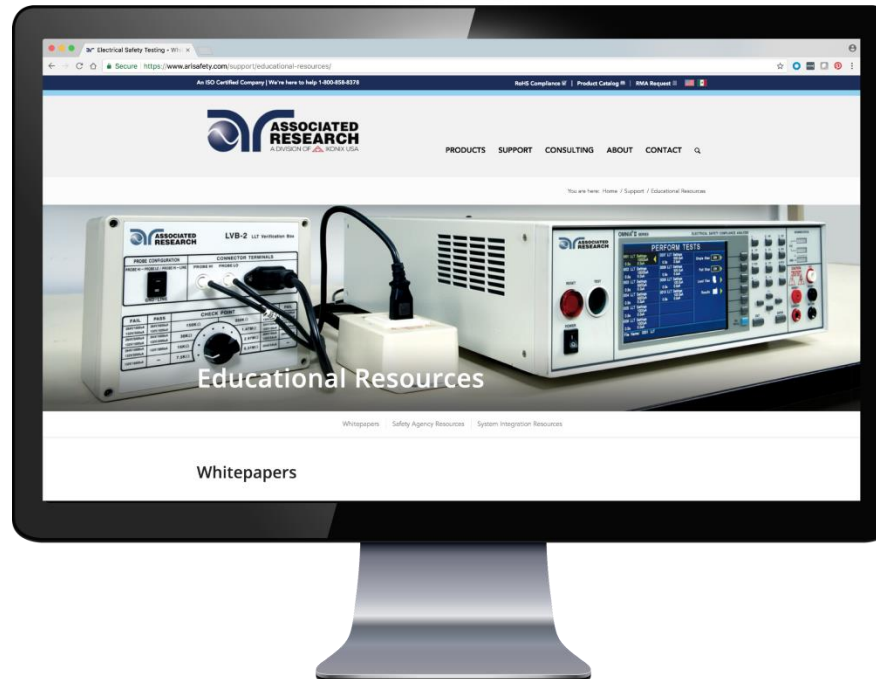


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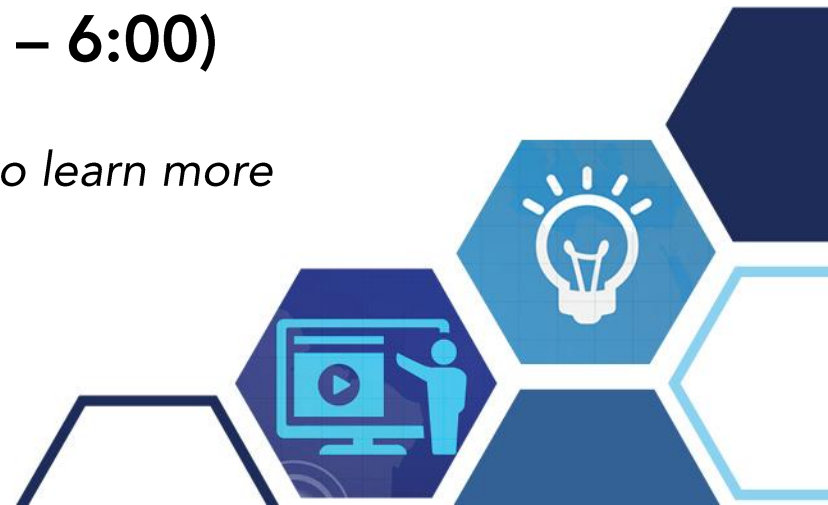
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