Spitronics ECU - Ignition Coil Testing - Workshop Guide

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Purpose

This guide provides a practical workshop method for:

- Identifying an unknown ignition coil.
- Distinguishing between Basic and Smart coils.
- Checking basic coil windings.
- Testing Smart Coil electronics.
- Performing a safer powered spark test.
- Diagnosing common coil faults.

A multimeter test can identify many faults, but a coil may still fail when operating under load. Where practical, combine static testing with a controlled powered test.

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Basic and Smart Coils

Ignition coils can broadly be divided into:

Basic Coil

A Basic Coil contains the ignition windings but no internal high-current electronic driver.

The ECU or an external ignition driver must switch the coil primary current.

Typical characteristics:

- Often two primary terminals.
- Very low primary resistance.
- Requires a Coil Negative Driver.

Smart Coil

A Smart Coil contains an internal ignition driver or igniter.

The ECU supplies a low-current trigger signal rather than directly switching the primary coil current.

Typical characteristics:

- Usually three or more connections.
- Internal semiconductor circuitry.
- Requires Power, Ground and Trigger.

Wire count is a useful clue, but it is not an absolute identification method.

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Basic Coil Resistance Test

Disconnect the coil before resistance testing.

Set the multimeter to the lowest resistance range.

Measure between the primary terminals.

A typical conventional Basic Coil may measure approximately:

0.3-1.5 Ω (typically around 0.8 Ω)

Important

Low-resistance measurements are easily affected by:

- Test-lead resistance.
- Poor probe contact.
- Cheap multimeters.

Short the meter probes together first and note the lead resistance before judging the coil.

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Basic Coil Secondary Test

Where the secondary winding can be measured conventionally, measure between the HT output and the applicable primary terminal.

A practical range for many conventional coils is approximately 5 kΩ-15 kΩ.

5 kΩ-15 kΩ

as a typical range for many conventional coils.

This is only a practical guide.

Coil designs differ, and some modern coils contain internal diodes or other components that make a normal secondary resistance test unreliable.

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Basic Coil Test Results

Possible results include:

Result	Indication
Very low normal primary resistance	Typical Basic Coil
Open primary winding	Faulty coil or poor connection
Shorted primary winding	Faulty coil
Open secondary winding where measurable	Possible faulty coil
Resistance tests normal	Coil may still require live testing

A resistance test confirms continuity. It does not prove that the coil can generate adequate spark energy under operating conditions.

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Smart Coil Diode Test

A Smart Coil contains electronic components such as:

- Transistors.
- Protection diodes.
- Driver circuitry.

For this reason, a Diode Test is often more useful than a simple resistance test.

Set the multimeter to:

Diode Test

Test between the coil pins in both directions.

Typical Smart Coil behaviour may include:

- Different readings when the probes are reversed.
- Semiconductor voltage drops.
- Open Circuit in some combinations.

Some Smart Coils show diode-type readings of approximately 0.5-1.2 V.

The important clue is the **directional semiconductor behaviour**, not one exact voltage.

What the Diode Test Shows

When testing a Smart Coil, the meter may be measuring through:

- Internal transistor junctions.
- Protection circuitry.
- Internal driver components.

This is why readings may differ when the meter probes are reversed.

This provides a useful indication that the coil contains electronics.

It does not prove that the coil is operational.

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Identifying an Unknown Smart Coil

When no wiring diagram is available, diode readings can sometimes help identify likely:

- Power.
- Ground.
- Trigger pins.

Test every pin combination in both directions and record the readings.

With experience, patterns may become visible:

- Ground may have several semiconductor paths.
- Supply may have several paths from other pins.
- Trigger pins may show more limited electronic paths.

Important

This is an identification technique, not a guaranteed pinout method. Compare the readings with a known coil where possible.

Do not apply full battery power to an unknown coil until the likely Supply and Ground connections are reasonably established.

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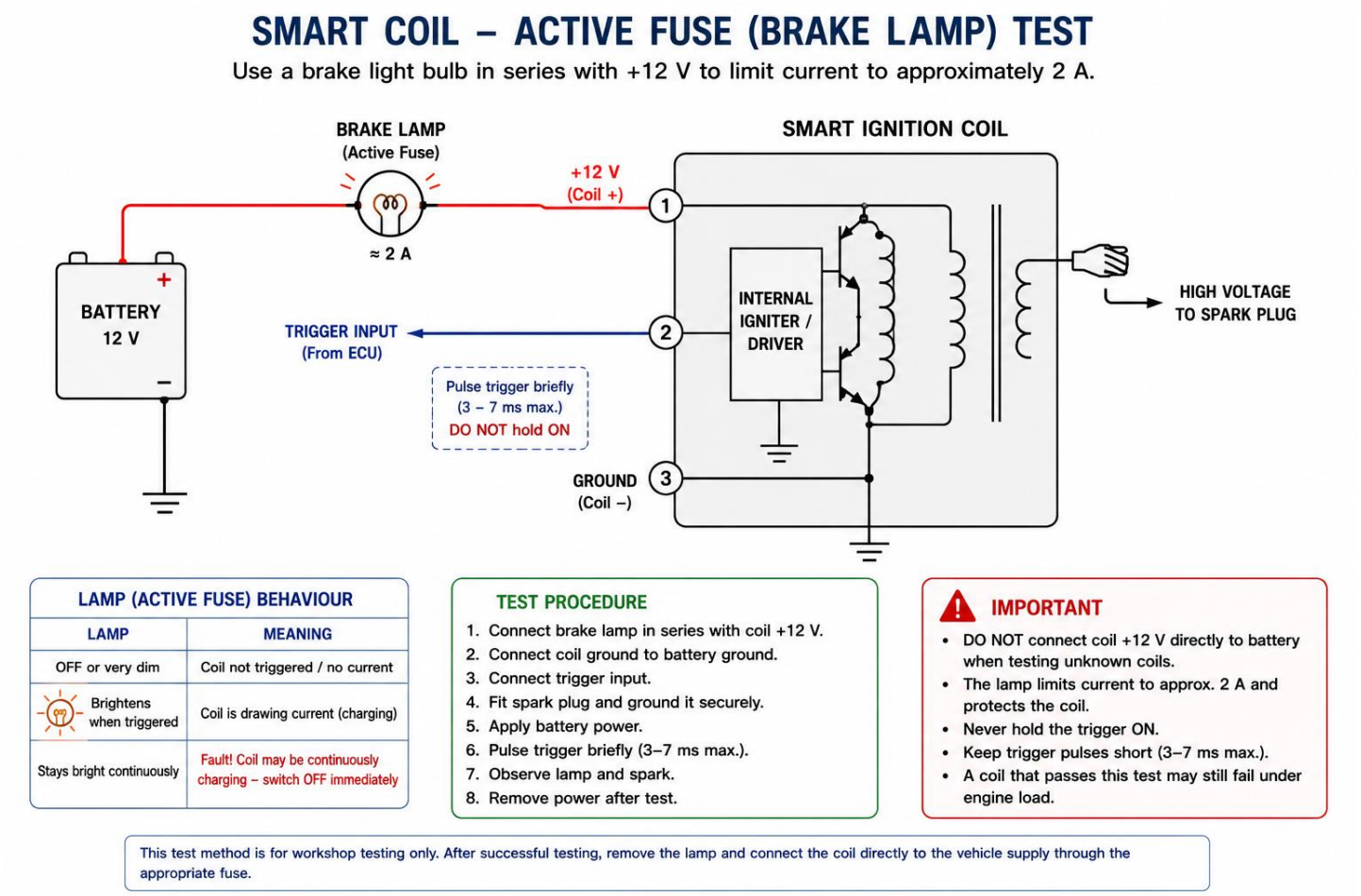
Active Fuse Test

A useful workshop method for powered Smart Coil testing is to place a conventional brake-light bulb in series with the coil's +12 V supply.

Typical connection:

Battery + → Brake Lamp → Coil +

Coil Ground → Battery Ground



The lamp performs two useful functions:

- Limits available current.
- Gives a visible indication of current flow.

A typical brake-light filament limits current to a few amps; approximately 2 A is a useful practical working value for this test.
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Why Use the Lamp

Connecting an unknown Smart Coil directly to the battery can produce very high current if:

- The pinout is wrong.
- The internal igniter is shorted.
- The trigger is held active.
- The coil is faulty.

The lamp provides a simple current limiter during initial testing.

This is safer than connecting an unidentified coil directly to an unrestricted battery supply.

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Lamp Behaviour

Typical observations:

Coil Not Triggered

Lamp may be:

- Off.
- Very dim.

Coil Triggered

The lamp should brighten as the coil draws current.

This indicates that the internal igniter is switching current through the coil.

Lamp behaviour alone does not prove that the high-voltage section is healthy.

A spark test is still required.

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Trigger Test

Once the coil Supply, Ground and Trigger are known, the Trigger can be pulsed briefly.

Critical

Do not hold the Trigger active.

Keep the test pulse very short.

For a brief manual bench test, keep the Trigger pulse within approximately 3-7 ms maximum.

for a brief manual test pulse.

The current-limiting lamp helps limit current, but it does not protect the coil against an excessively long dwell period.

Trigger Polarity

Do not assume every Smart Coil is triggered the same way.

Depending on the coil, it may require:

- Positive Trigger.
- Negative Trigger.
- Different voltage level.

Use known coil data where available.

Applying the wrong trigger polarity can:

- Prevent spark.
- Hold the coil charged continuously.
- Overheat the coil.
- Damage the internal igniter.

If uncertain, verify the Trigger waveform with an oscilloscope or known application information.

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Spark Test

Fit a known-good spark plug to the coil.

Ground the metal body of the spark plug securely.

Then:

1. Apply coil power through the brake lamp.
2. Connect Coil Ground.
3. Pulse the Trigger briefly.
4. Observe:
    - Lamp response.
    - Spark.

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Spark Plug Ground

The spark plug must have a secure Ground connection during testing.

Do not allow the coil to repeatedly fire with no suitable high-voltage discharge path.

Use:

- Properly grounded test plug.
- Approved spark tester.

Keep the high-voltage area away from:

- ECU wiring.

- Sensor wiring.
- Laptop cables.
- Flammable vapours.

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Result Interpretation

Test Result	Likely Meaning
Low primary resistance	Basic Coil
Directional diode readings	Internal electronics - likely Smart Coil
Lamp reacts when Triggered	Internal driver is drawing current
Lamp reacts and spark occurs	Coil operates in basic bench test
Lamp reacts but no spark	Possible secondary/HV fault
No lamp reaction	Wrong pinout, wrong Trigger or faulty igniter
Lamp remains bright continuously	Coil may be continuously charging - switch off immediately
Coil becomes hot rapidly	Excessive dwell, wrong polarity or internal fault

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Coil Passes the Multimeter but Misfires

A coil can pass:

- Primary resistance.
- Secondary resistance.
- Diode checks.

and still fail during engine operation.

Possible causes include:

- Breakdown under high voltage.
- Internal insulation failure.
- Heat-related fault.
- Weak spark under cylinder pressure.
- Internal igniter failure when hot.

For this reason, a multimeter result should not automatically be treated as proof that the coil is good.

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Testing a Coil on the Engine

When the coil operates on the vehicle but misfires:

Check:

[ ] Correct Supply Voltage.

[ ] Coil Ground.

[ ] Trigger polarity.

[ ] Trigger voltage.

[ ] Coil Charge Time.

[ ] Spark plug.

[ ] Coil temperature.

[ ] Trigger waveform.

[ ] Misfire under load.

A coil that sparks in free air may still fail under cylinder pressure.

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Coil Ground

Smart Coil Ground is critical because the internal igniter switches relatively high primary current.

A poor Ground connection can cause:

- Weak spark.
- Misfire.
- Coil overheating.
- Electrical interference.
- Internal driver failure.

Always verify Ground wiring before increasing dwell.

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Coil Charge Time

Do not use this bench test to determine the final Coil Charge Time.

The bench test only proves basic operation.

Final dwell should be set using:

Spitronics ECU - Ignition Coil Charge Time - Reference Guide

Use conservative values until the actual requirements of the coil are known.

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Optional Trigger Protection

A 1 kΩ series resistor in the manual Trigger test lead can provide additional protection for the test source against accidental shorts.

This is an optional workshop precaution and is not part of the normal vehicle wiring.

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Quick Identification

As a fast workshop starting point:

Very low primary resistance → likely Basic Coil

Directional diode readings → likely Smart Coil

Then confirm using the full test procedure.

Do not use wire count alone as proof of coil type.

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Safety

Ignition coils can generate dangerous high voltage.

During testing:

- Never hold the spark plug or HT terminal.
- Secure the spark plug Ground.
- Keep flammable vapours away.
- Use current limiting during unknown-coil testing.
- Do not hold the Trigger active.
- Keep Trigger pulses short.
- Stop immediately if the coil heats rapidly.
- Do not assume the Trigger polarity.
- Do not connect an unknown coil directly to unrestricted battery power without first identifying the connections.

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Workshop Test Procedure

For an unknown coil:

1. Inspect the coil and connector.
2. Perform a low-ohm resistance test.
3. If internal electronics are suspected, perform a Diode Test.
4. Identify likely Supply, Ground and Trigger pins.
5. Connect a brake-light lamp in series with +12 V.
6. Connect the coil Ground.
7. Fit and Ground a spark plug or spark tester.
8. Apply power.
9. Pulse the Trigger briefly.
10. Observe lamp reaction.
11. Observe spark.
12. Stop immediately if the lamp remains bright or the coil becomes hot.
13. Confirm the actual coil pinout and Trigger requirements before vehicle installation.

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Setup Check

Before installing an unknown coil, verify:

[ ] Basic or Smart Coil type identified.

[ ] Supply pin identified.

[ ] Ground pin identified.

[ ] Trigger pin identified where applicable.

[ ] Trigger polarity known.

[ ] Brake-lamp current limiter used during unknown powered testing.

[ ] Trigger pulse kept short.

[ ] Spark produced during controlled test.

[ ] Coil does not heat abnormally.

[ ] Vehicle wiring matches the correct coil type.

[ ] Correct Ignition Coil Type selected in Cosmos.

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