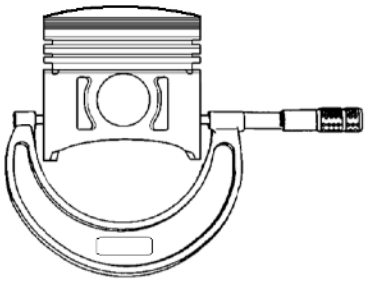
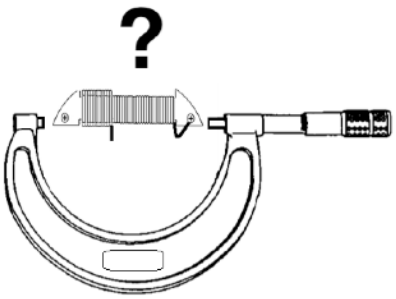
Section 2. CDI Fault Finding: Assessment of Windings



Measurements will show how worn a mechanical part is.

The problems created when the windings that provide power for the spark and timing information age justify their own separate guide. Shop manuals go in to detail when discussing how to assess mechanical parts for condition but when it comes to electrical items, particularly CDi ignition windings they are vague or misleading. Section 2 is focused on sharing information we have gathered over many years experience analysing and repairing aging CDi ignition systems.



Measurements with multimeters only tests the resistance of the copper wire, not insulation strength so do not always show the full story.

All the components in the system must be within their useful life expectancy as CDi units require precise inputs to function correctly. Poorly repaired, old or off specification windings cause CDi units to 'lock out' or give running issues. The 'source' and trigger windings must precisely match the OEM specification to within 5% or closer to get the best from the system.

It is also important to understand test meters use a tiny current when measuring resistance to avoid damaging the part under test. This checks the copper wire resistance but not the insulation strength, so a multimeter by no means tells you the full story. Weak insulation is one of the reasons why in some cases parts checked by a multimeter pass, yet in use the part proves not to work properly.

A typical CDi source winding is made up of very fine magnet wire of a similar diameter as the full stop at the end of this sentence. That wire has a very thin coat of insulation so it doesn't short to surrounding wires. A layer of base insulation stops power leaking to the laminate core. This fine wire carries 200-300 volts when powering the ignition, yet as the insulation ages it is no longer able to insulate as well as it did when new, allowing power to randomly leak away. It is the random way power bleeds away through old insulation that causes so many differing symptoms and problems.

Because a multimeter is not testing insulation strength nor is it placing the winding under any load an old winding may appear to give an exact or 'in tolerance' reading - this leads you to think it must be OK. This something most people get wrong as they are misled by wide tolerances in the shop manual. So how can you assess a winding accurately? The method that proves most accurate uses a combination of information; age of the part, symptoms, comparison of test data, and temperature compensation.

Rule 1: **Time since manufacture** is the key factor and the most accurate method to assess how 'worn' a CDi source coil is. Electrical insulation degrades as it ages even if not used. Therefore the system may not run properly if there are end of life parts left in it, nor can you blame brand new parts for problems when they are mixed with end of life parts. When a fault exists this factor is so vital that it must be arbitrarily applied, even to N.O.S parts. The time since manufacture rule proves so important it cannot be dismissed.

New CDi units and windings can only be guaranteed to function as intended when the other parts of the system are to OEM specification and in good condition, this can be said when they all pass exactly to specification and are less than ten years old, IE in the green zone.

Time since manufacture limitation for windings that power and trigger CDi units

0-10 Years	10-20 Years	20 Years and over

If you have a system that is in the orange or red it may very well go on working correctly, this is a testament to how well it was manufactured. However should that system develop a fault, age since manufacture of the windings (and electronics) is the key factor that must be applied arbitrarily when fault finding that system.

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Rule 2: **Symptoms The Machine is Showing.** If you have eliminated fuel and other faults the following symptoms are common winding or CDi unit issues:

-Starts normally when cold but is hard to start hot or won't start hot.
-Engine runs then a misfire develops or engine cuts out. Fault clears when cool.
-Will start and rev in neutral, when loaded engine won't rev.
-No, weak, intermittent, yellow or thin white spark
-Mis-fires at higher RPMs - all other factors have been eliminated
-Not running on all cylinders - all other factors have been eliminated
-Runs with an old CDi unit but not a new one.
-Won't kick start, but will bump start.

Heat is a very important factor where insulation is concerned. Problems that come on when the engine is hot and go away when its cool are a really strong indication of a winding fault. Insulation loses ability to insulate when hot, more so due to age degradation.

IMPORTANT: Experiences has shown time and time again that ultra-sonic cleaning of carburettors is far from 100% successful and does not guarantee that carburettor is fault free.

Rule 3: **Resistance Checking Windings**
This test is commonly shown in the shop manual and is a very valid check. If get an obvious fault such as no reading, one that is not steady or one out of tolerance you have found the problem. However very often you get readings that sort of seem OK and the wide tolerance given in shop manuals compounds the mis-information. Our method is to apply winding industry standard tolerance and temperature compensation to highlight resistance shifts in old windings.

Important: The resistance of windings is always given at a specified temperature, normally 20 degrees C. Windings are manufactured to exact specification so if they are now any different either
1) they are not at 20 degrees
2) The insulation has failed completely and now the windings inside are compromised.
A jump in resistance indicates windings are shorting together. That area may not be good electrical connection so readings may be unsteady, higher or more commonly a lower resistance is shown as the turns become shorted to each other decreasing the winding's over-all resistance.

The shop manual likely gives a wide resistance tolerance because copper changes its resistance with temperature. Windings are precision made to 2% tolerance or less. Correcting your readings for temperature eliminates temperature as a factor. If you then apply the more realistic 5% tolerance it becomes very easy to spot windings in trouble, as when temperature isn't the reason, the winding must be faulty. There are many 'on line' resistance/temperature correction calculators for copper wire or, if you send your readings to the technical team, with the temperature then we can correct them for you.

A multimeter cannot check the strength of the insulation. If this is failing when under load but has not yet failed completely a multimeter test will not register this, you may get an exact specification reading if the copper wire is still OK. However apply the #1 rule, time since manufacture and (where a fault exists) this will lead you to repair or replace windings in the red zone.

When taking readings: Calculate +/- 5% (half 10% to make this easy) of the winding resistance in the shop manual. Write this down and repeat for all the CDi trigger & source windings. Note down the temperature. If it is within +/- 2 degrees of 20C (70F) there is no need to apply temperature correction. If there is a result outside or closer to the 5% limit than the others, that winding is suspect. Using a list is good as if all the readings are little high or low you can consider that down to temperature or your meter, yet one that sits differently in the range will always be the problem winding. Note the engine must not have run for many hours and be completely cold.

-Some manuals give only a resistance range, however write down your results with the range in the manual as one that has shifted will show up better when in a list. Don't be fooled in to thinking because they are all in the range they must be good. Again, apply the time since manufacture rule.

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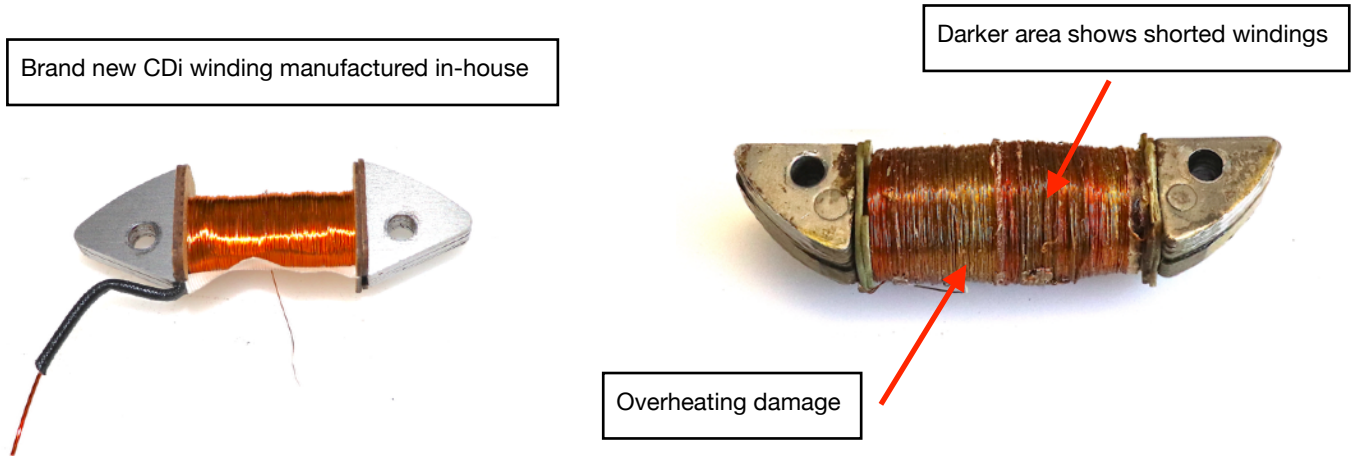

Example. The left source winding is brand new. The one on the right tested within the tolerances shown in the shop manual, leading the mechanic believe it was OK. Many parts were then replaced with worsening symptoms from the engine. Finally our technical team were contacted and parts sent for checking. The winding's top cover was removed to show damage to the windings that the resistance tolerance in the manual said was acceptable.

Symptoms: The bike ran until hot, then stopped and would not re-start until cool, a new HT coil was fitted with no changes. However a new CDi unit was fitted and the bike would not run at all.

Diagnosis: The generator windings were in the red 'time since manufacture' zone. The winding just passed according to the 10% tolerance in the shop manual but the 5% tolerance rule clearly put the winding at fault by highlighting it's resistance had altered. Temperature correction was not needed as it was 18 degrees C. At over 30 years old the 'time since manufactured' rule really backed up the 5% tolerance on test meter resistance readings in this case.

Fix: The mechanic told us that had he been aware of our assessment methods the winding would have been the first item he replaced which would have saved his customer a lot of time and money. We had a newly manufactured winding in stock. The customer reported that the engine seemed a lot more responsive, the new CDi now ran perfectly and it had completely transformed power delivery once the parts were returned and fitted.

Effects of Mixing Age Degraded Electrical Parts with New. The CDi unit and the windings that power it are very finely matched and all have to be in good order for the system to function. New CDi units often can't be driven by old, end of life windings. The capacitors in the new CDi will charge up fully whereas age degraded capacitors in an old CDi may only be capable of charging to a far lower percentage, therefore don't load the source windings as much as the new one will.

You can liken this effect to an engine that is so worn its about to fail, it makes some power, but not the power it did when it was new. When pushed hard that motor stops completely. A new CDi is like someone with no mechanical sympathy, wringing that old motor for every last drop of power. On the other hand an old, tired CDi unit that isn't able to give the same level of performance any more and can be likened to someone nursing that engine to keep it going a little longer, but you know this is only delaying a much needed, and full overhaul.

Put very simply, where you mix brand new parts with end of life parts, you can not expect the system to run properly, nor can you blame the new parts.

Our mission is to continue improving and building on our knowledge of these systems and then to share this knowledge with our customers. We are here to help and assist with experience, knowledge and spare parts that have been carefully developed and are tried and tested worldwide.

Our technicians are on hand to help you troubleshoot and understand CDi ignition better.

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