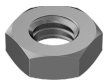
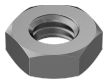
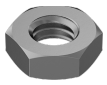
Model T
Motor Control Coil Testing

DRAFT 12/31/19

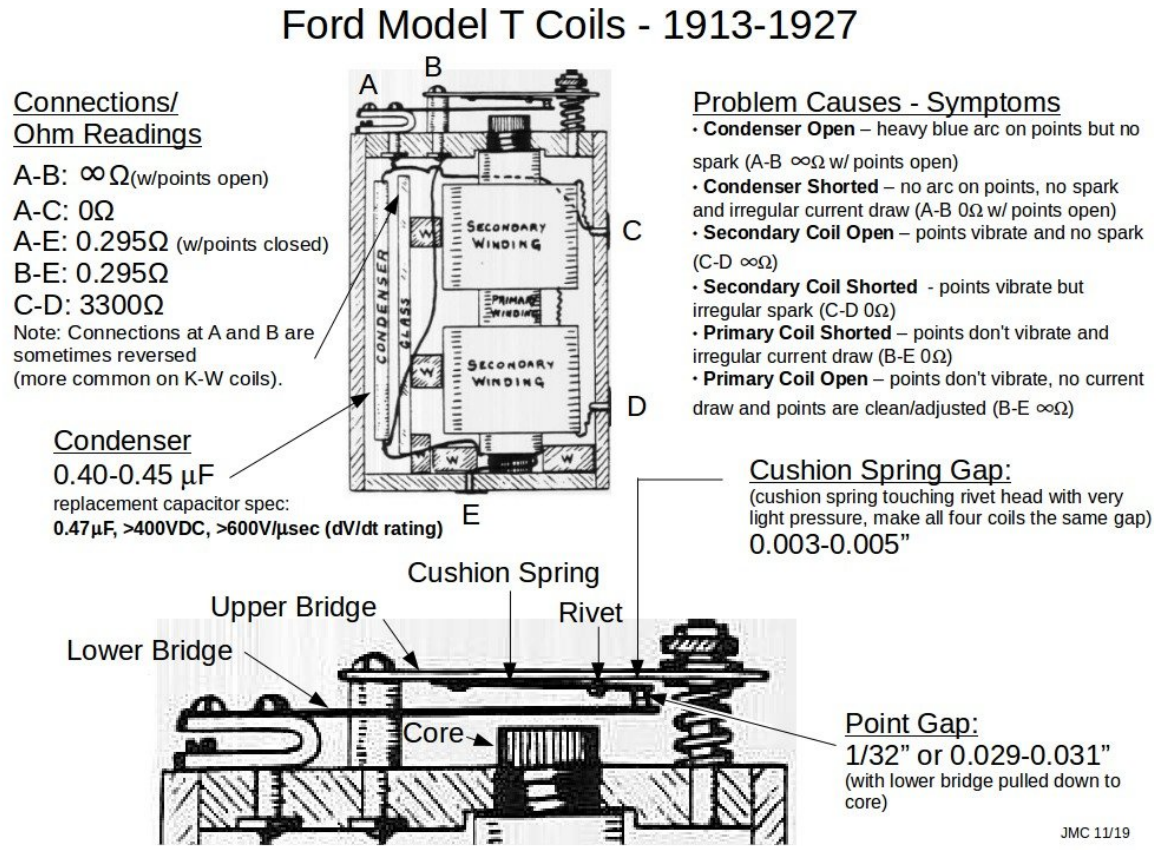
Ordering Coil Hardware

(Also see reference 3.) (Prices from summer 2019, use as a reference.)

Image	Description	Price/Quantity	Purpose
	Brass Pan Head Slotted Screws, 4-40 Thread Size, 3/16" Long https://www.mcmaster.com/92443A076	$5.89/100	Cushen spring rivet replacement
	Brass Hex Nut, 4-40 Thread Size https://www.mcmaster.com/92671A005	$4.65/100	Lock nut for screw above
	Extra-Long Life Machine Tool Tap, 4-40 Thread Size https://www.mcmaster.com/2568A33	$13.10/each	Tap for above
	Brass Hex Nut, 10-32 Thread Size, ⅜” nut https://www.mcmaster.com/92671A195	$8.72/100	Adjustment nut
	Brass Hex Nut, 10-32 Thread Size, 5/16” nut https://www.mcmaster.com/95130A160	$9.78/100	Lock nut for above
	Machine Tool Plug Chamfer Tap for Through-Hole Threading, 12-32 Thread Size https://www.mcmaster.com/25705A57	$29.80/each	Use with nut above for 4 nuts on mounting studs
	5 mm flat washer .043 thousands thick		
	Cadmium-Plated Steel Mil. Spec. Washer for Number 10 Screw Size, 0.365" OD, MS-27183-47 https://www.mcmaster.com/98032A466	$2.40/100	Shim spacers on compressed wood
	Aluminum Unthreaded Spacer, 3/8" OD, 7/16" Long, for Number 12 Screw Size https://www.mcmaster.com/92510A278	$1.15/each	Spacer for contacts
	Fiber washer for spring		
	#12-32 Jam Nut 0.312" (7.92mm) 5/16" Stainless Steel, Gold Plating 1-328690-2-ND	$2,940.00/2000	For 4 nuts on mounting studs
	5007N Nut Set For Coils, Brass https://www.chaffinsgarage.com/catalog.pdf	$1.50/one set	

Basic Electrical Tests

Perform the following texts to diagnose and fix issues detected. Capacitance can be verified by using a multimeter on high resistance setting and watching reading move slowly then reversing leads to see the same or a capacitance tester. It may be desirable to do Basic Mechanical Adjustments (i.e. remove/replace points) before completing these tests.



Results

To record multiple coils use table in appendix. (Figure above drawn by John Carter.)

Test	Desired	Results	Comment
A-B (w/Points open)	∞Ω		
A-C	0Ω		
A-E (w/Points closed)	0.295Ω		
B-E	0.295Ω		
C-D	3300Ω (Ford) 2100Ω (some KW)		
Point Gap	1/32"		
Spring Cushion	0.005		
Condenser	.47 µF		
Current Draw	1.3 Amp		

Comments:

Basic Mechanical Adjustments

The following are the basic mechanical adjustments needed for a coil. It is a good idea to electrically test coil to verify that you have a rebuildable coil before proceeding.

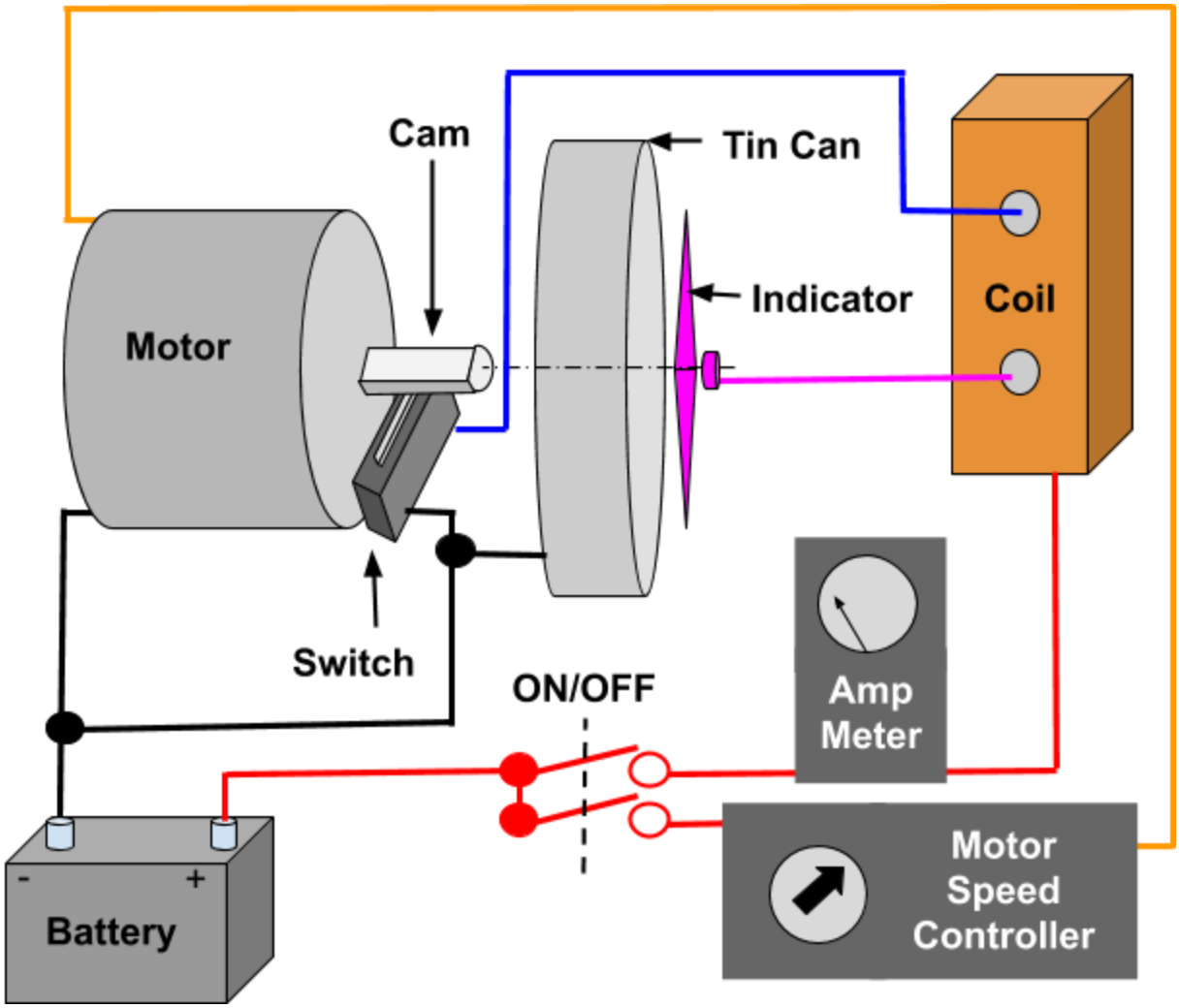
1. **Disassembly**
    - Clean all bolts with wire brush/wheel to remove rust and dirt.
    - Add favorite oil to threads and allow to set overnight.
    - Gently loosen nuts. Use care to not turn studs as they are electrically connected internally.
    - Clean all studs, nuts and determine usable hardware.
    - Before moving forward this would be a good time to test/replace electrical components including the capacitor. See Basic Electrical Adjustment section.
2. **Cushion Spring Gap**
    - Set Cushion Spring Gap
        - Originally Ford requested .005” (This is generally recommended.)
        - Some set it up to .012”. See arguments for (Ref 2) and against (Ref 1).
    - Replace rivet with screw (see Ref 2 for image of this)
        - Many new points have .020” travel.
        - It is recommended to remove rivet and replace with 4-40 screw.
        - Screw is put in place using tap and lock nut.
3. **Polish Points**
    - Use a wet stone or wet/dry sandpaper to clean/poslish points.
    - If deep peaks and valleys use course then go down to 1000 grit.
4. **Instal Points**
    - Add shims under points if hardware has sunk into wood.
    - Points should come together flat. If not, shims can help.
5. **Set Point Gap**
    - Ford recommended that points be set to 1/32” (.031”) gap when coil spring is pulled down.
    - This can be done with a feeler gauge or use a small paper clip.
6. **Set Spring Tension**
    - It is recommended that the current be set to 1.3 A @ 6 Volts by adjusting tension.
    - Tension can be set by gently prying and hammering on lower bridge.

Dynamic Coil Adjustments

To fully test a coil it must be dynamically tested. Traditionally the Hand Crank Coil Tester (HCCT) was used. Recently, two alternatives were made available (i.e. Strobo-Spark and the ECCT). Ultimately the goal is to create four *matched* coils that produce sparks with similar dwell and spark intensity over a wide range of engine speeds. All three of these products have been used successfully.

Motor Crank Coil Tester Design

Here is the simple design used for the Motor Crank Coil Tester (MCCT):



Simply put the MCCT is a Ford coil triggered by a switch. This switch is controlled by a cam on a motor. The motor speed controller adjusts motor speed that controls the switching time to the coil very much like a commutator does on the Model T. The indicator turns and can display the spark on a scale similar to a Hand Crank Coil Tester (HCCT). Additionally an amp meter is used to display the amount of current flowing to coil.

Testing

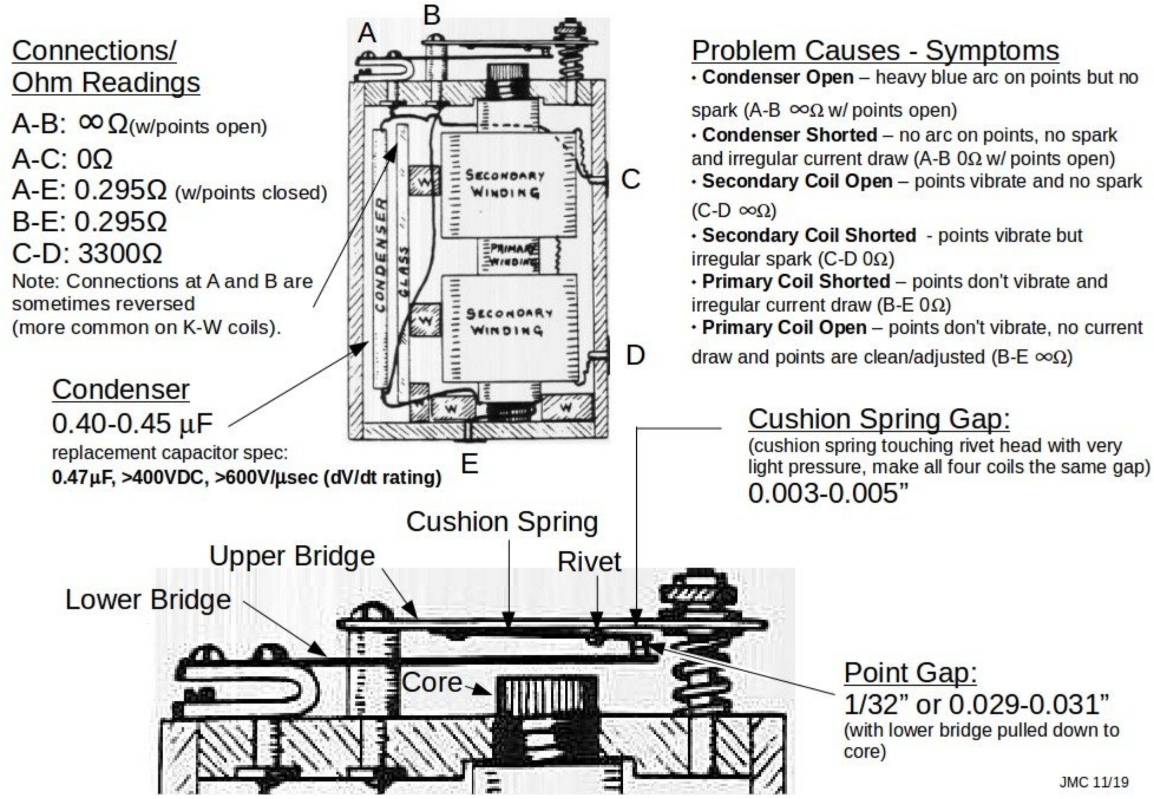
The following is a simple dynamic test using a Motor Crank Coil Tester (MCCT).

1. Verify current by placing the coil in tester and turning it on w/o motor power. This will give the current of the coil when it is vibrating at zero RPM (~1.3 A @ 6 V).
2. Turn on motor to observe spark looking for dwell and second spark timing. The period of the spark should be the same.
3. Adjust cushion spring bridge to get appropriate 2 ms dwell. The following chart gives the desired dwell relative to RPM.

Engine (RPM)	Camshaft (RPM)	Crankshaft (° per ms)	Desired ° Dwell (degree=2ms)
500	250	3	6
1000	500	6	12
1500	750	9	18
2000	1000	12	24
2500	1250	15	30

4. To get desired results: fine tune spring tension by adjusting lower and upper bridge.
5. The goal is to make adjustments above to get coils to have matching dwell over a large range of speeds and an acceptable second spark.

Basic Electrical Tests for Multiple Coils

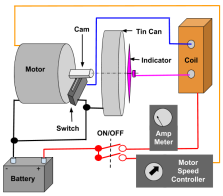


(Figure above drawn by John Carter.)

Test results:

Coil #	A-B (w/Points open)	A-C	A-E (w/Points closed)	B-E	C-D	Point Gap	Cushion Gap	Condenser	Current Draw
Nominal	∞Ω	0Ω	0.3Ω	0.3Ω	3300Ω (Ford) 2100Ω (some KW)	1/32”	0.005”	.47 µF If can't measure replace with new.	1.3 A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A
	Ω	Ω	Ω	Ω	Ω	”	”	µF	A

Comparing Model T Coil Testers

Overall Ranking	Tester	Function	Price
1	 **ECCT** (Electrically Controlled)	Sets time to fire of each coil. Additionally test capacitor and peak current. Can be purchased/used as a stand alone device or with advanced software on PC.	$$$+
2	 **Strobo-Spark**	Modern tester better than hand cranked spark testers. Tests current going into coil and gives visule of sparks. Tests capacitor.	$$$+ *(Unavailable? Word is that vendors don't have these in stock.)*
3	 **Home Made**	Lot's of DIY options that amount to any combination of other testers. Functions very based on designer and who makes it. For this comparison I will use the MCCT. The tester was built with about $20 spare parts and lots of time.	<$
4	**HCCT** (Hand Crank) 	This is the original coil tester used by Ford. The theory is to set current going to coil. Also can visualize both double sparks and missing sparks. If one has parts a homebuilt HCCT can be made very easily.	$$$$$$$$$ *(Price varies because these are collectors items. You might get a deal, or make your own to save money.)*
5	 **Buzz Box**	Basic Model T Coil Buzz box is a portable solution to do simple tests to set the current on the coil. But the $150 dollars spent on these would be better spent on anything else.	$+

Additional Articles/References

1. Figure drawn by John Carter from:
   http://www.mtfca.com/discus/messages/599638/646227.html?1464833674

2. Discussion on Cushion Spring Gap and how to adjust (.005" prefered, but can go up to .012" and most importantly all should be the same):
   http://www.mtfca.com/discus/messages/80257/98687.html?1247931406#POST174792

3. Ordering coil hardware:
   http://www.mtfca.com/discus/messages/80257/94772.html?1250731519

4. Another Model T Coil Cushion Spring Adjustment Tool:
   http://www.pbase.com/jimthode/coil_current

5. ECCT Instruction Manual (Lots of good info about coil adjustments) by Mictel LLC
   http://www.modeltecct.com/uploads/ECCT_Instructions.pdf

6. Videos on Coil rebuilding (Part 1, click on next to see all three videos.)
   https://www.youtube.com/watch?v=uhaxW3jaG0Q&list=PLYG_IIhIwKyL1_nmd6sCkGZBwglKpRWA3

7. *More on Model T Ford Spark Timing*, by Ron Patterson
   http://www.funprojects.com/pdf/More%20on%20Spark%20Timing.pdf

8. *The Double Spark Doctrine Paradox,* By Mike Kossor
   http://www.modeltecct.com/uploads/The_Double_Spark_Doctrine_Paradox_V5.pdf

9. *The Model T Ignition Coil Part I: The Ford/K-W Ignition Company Story,* By Trent Boggess and Ronald Patterson
   http://docs.wixstatic.com/ugd/3a96dc_cf55a51ac76a42ab9087dd905c5d4e55.pdf

10. *HCCT Manual,* By Ford Motor Company
    http://www.funprojects.com/pdf/HCCTManual.pdf

11. *Ford Model T Buzz Coil* - primary (212 turns), secondary (16,600 turns), Buzz 200 times/second
    https://www.princeton.edu/ssp/joseph-henry-project/spark/ford-model-t-buzz-coil/