

## ***Maxspark Ignition Kit: Mazda Miata 1990 – 2005***



For Mazda Miata model years 1990 – 2005.

Thank you for buying our Maxspark Ignition kit! We have designed this kit to fit across multiple Miata models. If you have any questions, please contact us at [support@ampefi.com](mailto:support@ampefi.com).



# Contents

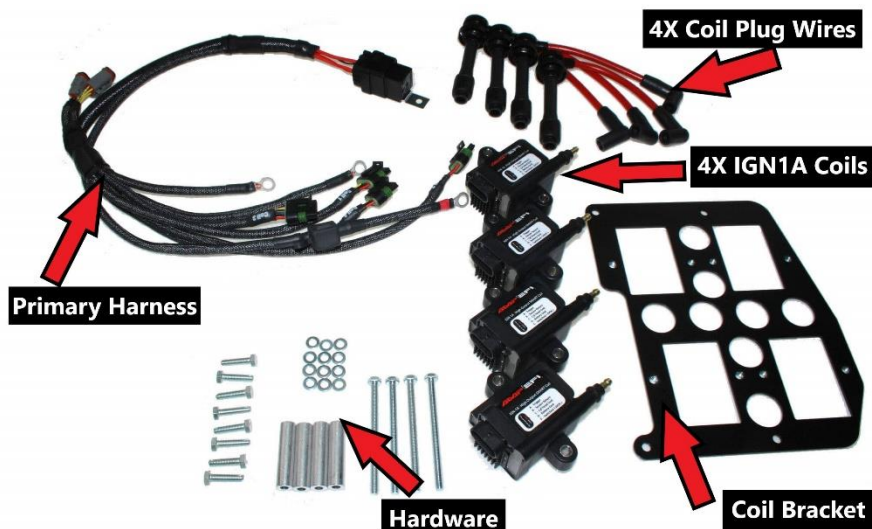
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## Kit Contents

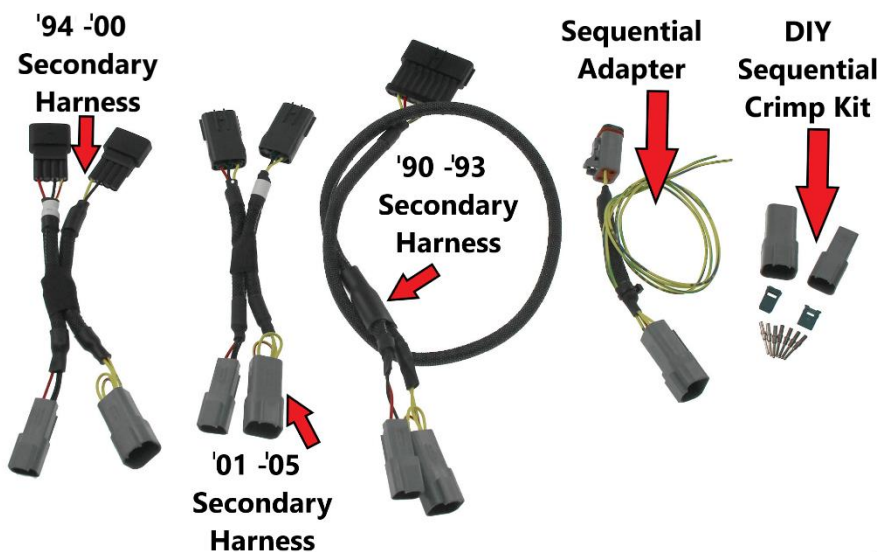
The list below shows the kit breakdown and what is included with every option. The "Main Components" listed below are included with every kit. The two additional item lists depend on which version of the kit you purchased.

Main Components (Included in every kit (See figure 1):

- 1X Maxspark primary harness
- 4X AMP EFI IGN1A Ignition Coils
- 1X Coil mounting bracket
- 1X 50 amp fuse
- 4X Bracket spacers
- 4X Long bracket bolts
- 8X Short Coil bolts
- 12X Washers
- 4X Spark plug wires



(Figure 1) Main Components ID



(Figure 2) Sub harness ID

For 1990-1993', 1994'-2000', or 2001'-2005' kits (see figure 2):

- 1X Maxspark secondary harness
- 1X Sequential adapter

For "DIY Sequential Crimp Kit Purchase" kit (see figure 3):

- 1X 4-pin Amphenol connector
- 1X 4-pin Amphenol connector lock
- 1X 2-pin Amphenol connector
- 1X 2-pin Amphenol connector lock
- 7X Connector Terminals

## Application

This harness is designed to work across multiple Mazda Miata models. There are similarities across various model years which allow this kit to be easily adapted to each model. The kits work in these groupings: 1990-1993, 1994-2000, 2001-2005 or the DIY Sequential Crimp Kit for any 1990'-2005' model (used for Mazda Miata's with custom wiring jobs or removed OEM ignition plugs). Attempting to install this kit onto another vehicle other than the ones mentioned above may cause vehicle damage or possible harm to the user.

## Pre-Installation Considerations

The Primary Harness (as shown in figure 1) is laid out with 4X labeled coil connectors (coils 1-4), a main relay, main power ring terminal (labeled with red heat shrink), 2X engine block grounds (ring terminals), a 2-pin connector for sensor ground/power, and a 4-pin connector for the ignition signal connection.

All secondary harnesses contain either 3 or 4 connectors total. The 1994' – 2000' and 2001' – 2005' secondary harnesses contain a 2-pin connector for power and ground, a 4-pin connector for the ignition signals, and 2X identical connectors to plug into the OE spark A output and OE spark B output. The only difference with the 1990'-1993' secondary harness model is that you have a single OE ignition connector instead of 2X identical ones (See figure 3 for reference on the secondary connectors).

A special note: The tachometer will not function on models from 1990 through early 1995 with this kit. Many aftermarket ECUs can generate a tach output signal, but stock ECUs do not have this feature. For ECU without a tach signal output, you can use an aftermarket tachometer. If you are running an aftermarket ECU, you can configure the tach output to work in place of this but for factory computers you will not be able to do this. For aftermarket tachometers, make sure it can trigger off a single 5-volt signal and if so, splice it to the spark output A (Solid Yellow) wire as a possible solution. For the case of aftermarket ECUs, the following bullet points show which wire to connect the ECU tach output to the harness:

- The yellow wire with a blue stripe / pin D on the ignition module for 1990-1993 models.
- The black wire with a white stripe on either ignition coil connector for 1994- early 1995 models. (1995.5 models with 3 wires on the coil connectors have an ECU controlled tach and need no wiring changes.)
- Alternatively, splice the wire to the Tach terminal in the diagnostic connector box under the hood for the whole range (1990 through early 1995).

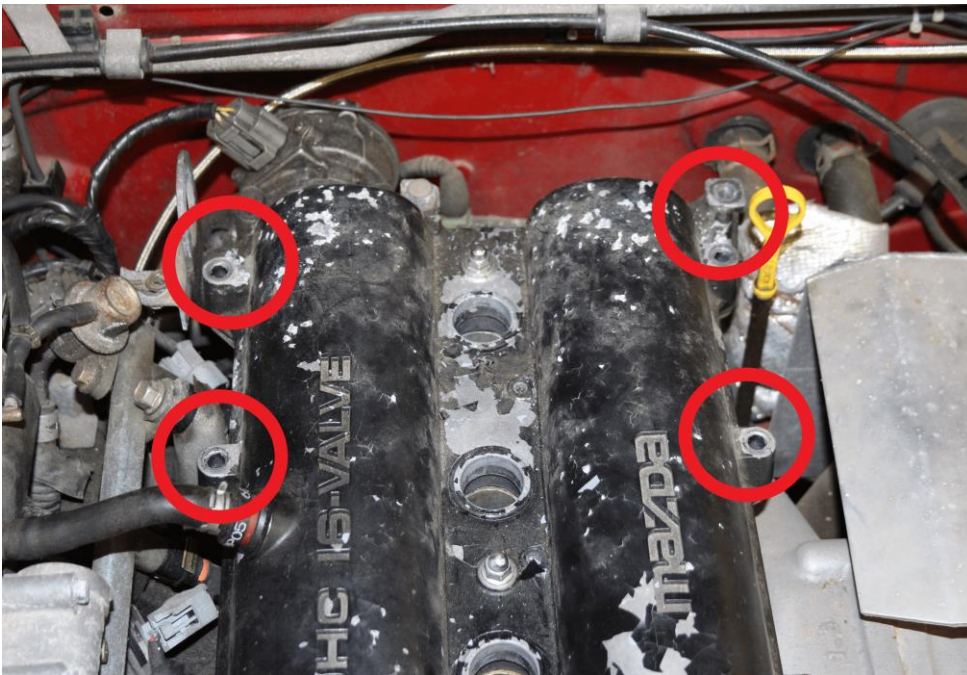
## Step-by-Step Installation Instructions

1. **Disconnect the battery.** Not doing so *can be* very dangerous and can cause vehicle damage or harm to the user.
2. Unpack your contents and make sure everything you need is accounted for. Refer to the package content listed on page 3 in the “Kit Contents” section.
3. Remove your current ignition system. Remove the OEM coils, spark plug wires, and mounting bracket. Whether you are running an OEM or an aftermarket ignition system, all components (except for spark plugs) will need to be removed. You do not need to modify or cut anything; you should only be unplugging/unbolting the OEM ignition setup for the PNP version of the Maxspark kit. If you purchased the “DIY Crimp Kit” you may already have cut OEM ignition plugs or custom wiring. If this is the case, make sure it is all present and routed near the top/middle section of the engine.



(Figure 3) Engine Bay OEM Coil Setup Removed





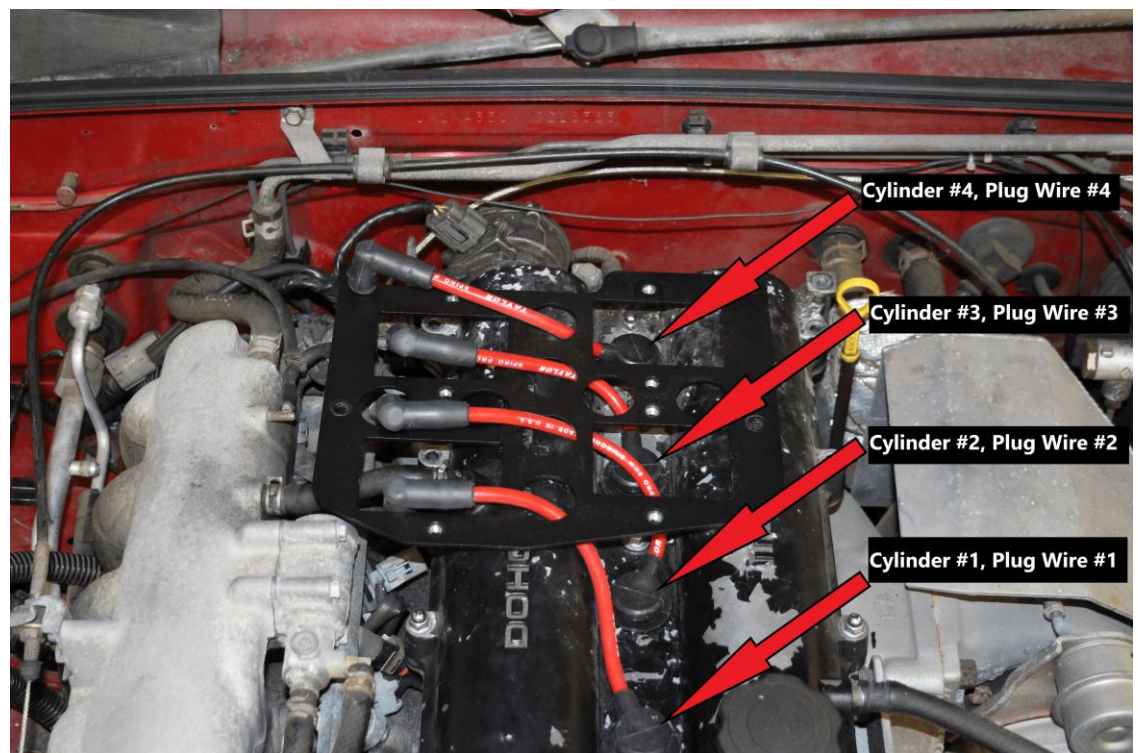
(Figure 4) Spark Plug Wires Installed with the Coil Bracket Mocked Up

4. Remove the 4X specified valve cover bolts from the valve cover (See figure 4). You will not need these as we include new bolts in the kit.

5. Begin by laying the 2X longer spark plug wires onto cylinders #1 & #2. The 2X shorter wires are for cylinders #3 and #4 (refer to figure 4).

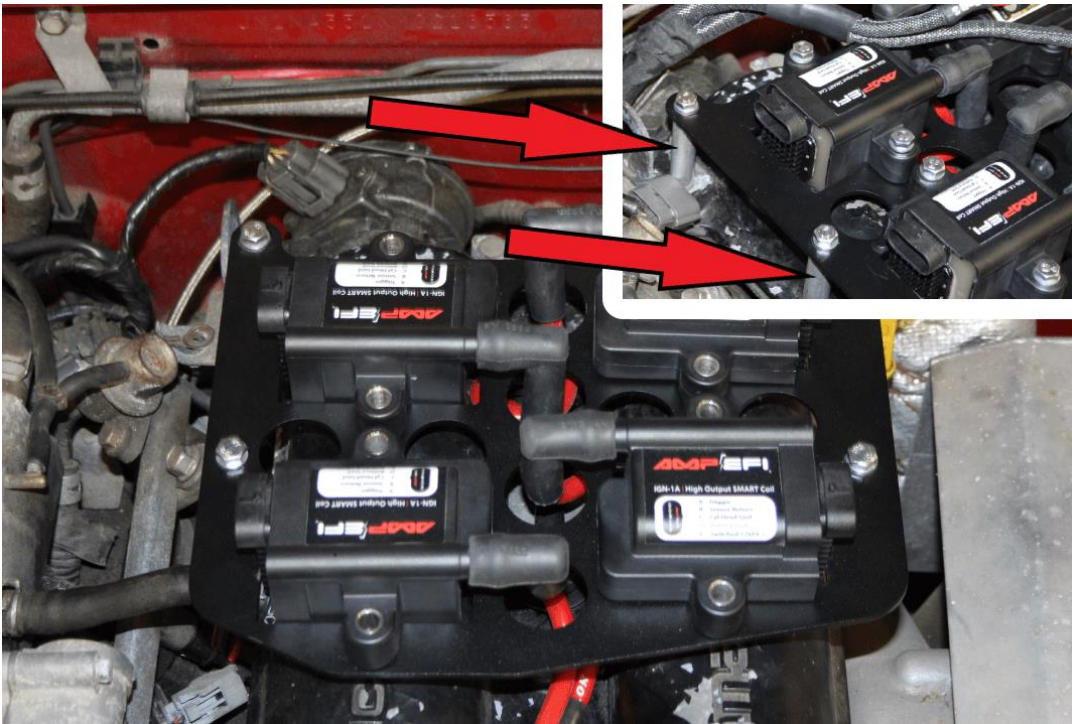
6. Lay the bracket over the valve covers making sure the cutout in the mounting bracket is placed towards the rear of the engine near the firewall (refer to figure 8 for the orientation example).

7. Feed all the wires into their respective hole: hole 1 gets coil wire 1, hole 2 gets coil 2 and so on (see figure 5).
8. Place the 4X long spacers, bolts, and washers into the 4X valve cover holes that had the bolts removed in step #4 (See figure 9).
9. OEM recommendations are to loosen all the valve cover bolts and torque them in a star sequence to 43-78 In/lbs; follow up with your manufacturers repair manual for further details. This is a recommended step but so long as the valve cover is snug in the same fashion as the OEM setup.



(Figure 5) Coil Plug Wire Layout



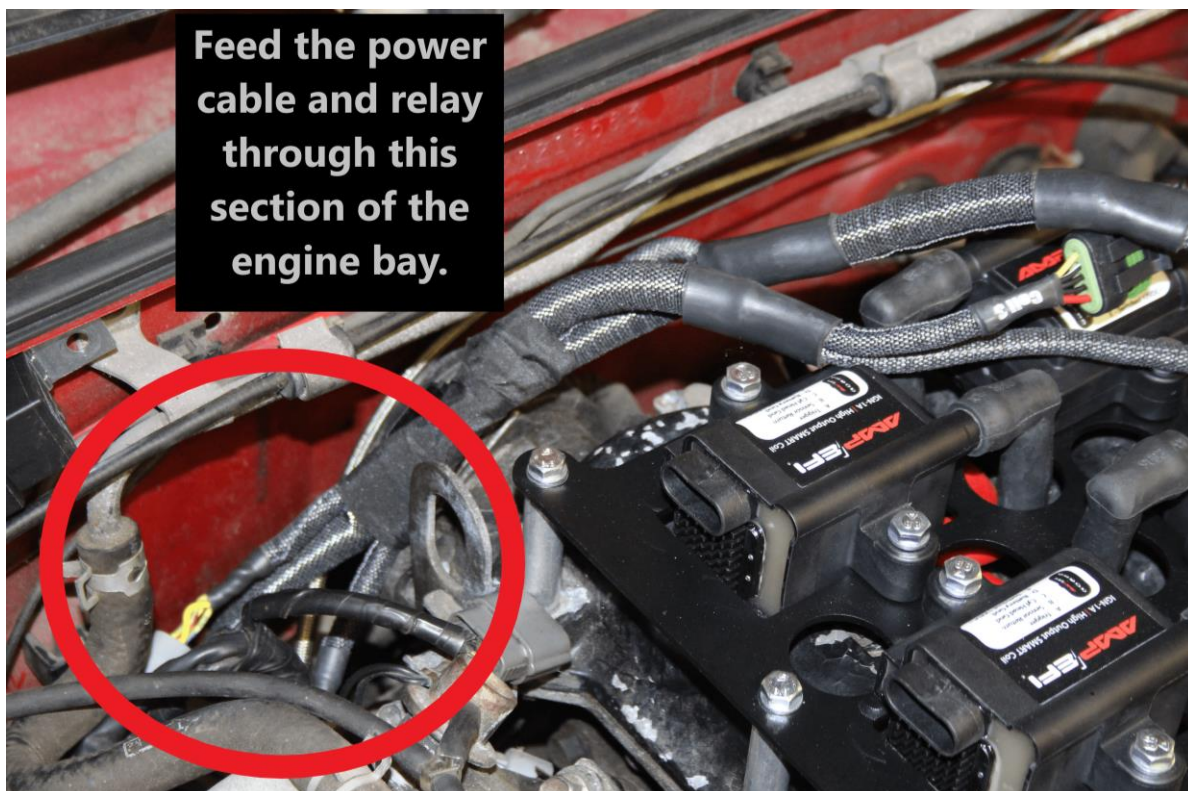


(Figure 6) IGN1A Coils and Bracket Mounted

10. Place all the IGN1A Smart coils into the coil locations and *connect* the spark plug wires *to the coils* first. This **MUST** be done first because they cannot be plugged in when the coils are bolted down; there is not enough room.

11. Using the 8X shorter bolts and lock washers provided, bolt down the IGN1A coils to the bracket (see figure 6).

12. To install the primary harness, begin by feeding the relay and power wire key ring (with fuse) through the circled section below. Entering through the top corner of the passenger side of the engine bay (near the firewall) makes for the easiest installation (see figure 7).



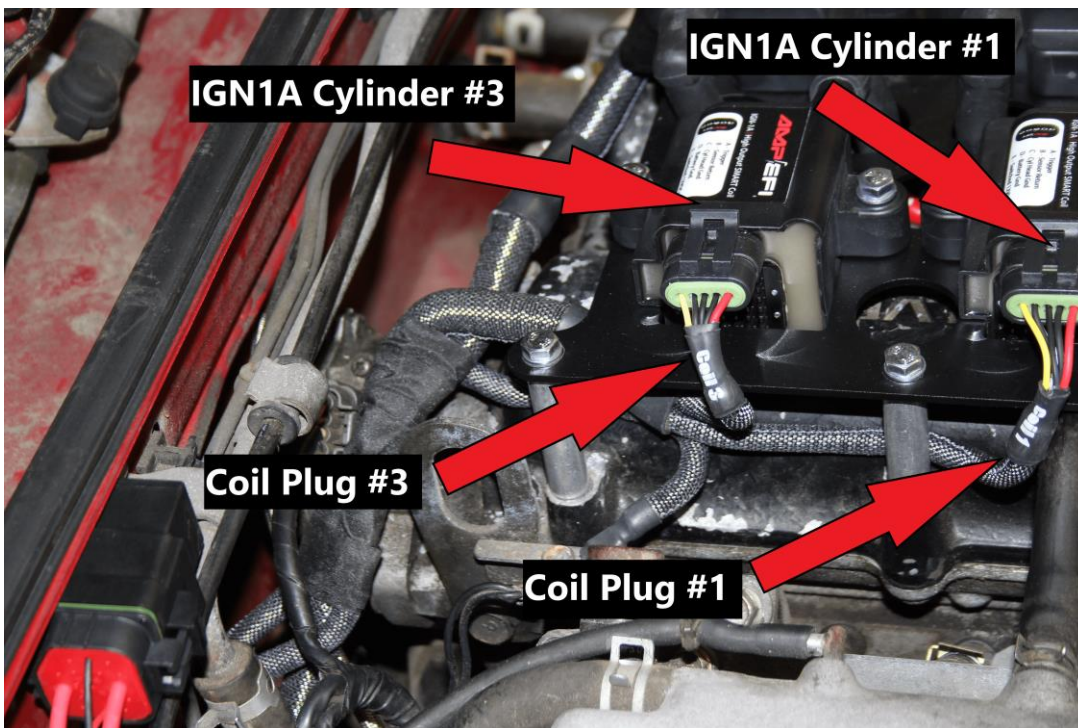
(Figure 7) Primary Harness Routing Location



13. Remove the screw holding the hard line on the passenger side of the fire wall shown below. This is where you will mount your relay for convenient and safe storage (see figure 8).



(Figure 8) Relay Mounting Location



(Figure 9) Coil plug routing example

14. Route the coil plugs to the specified IGN1A location (Ex. Connector labeled "Coil 1" to IGNA1A #1, connector labeled "Coil 2" with IGNA1A #2 and so on. For best wire management, the harness was designed to be fed underneath the bracket as seen in figure 9).

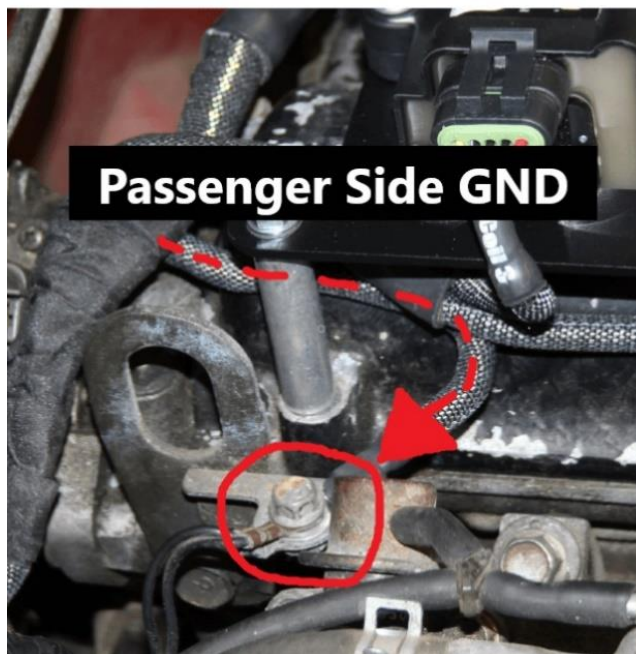






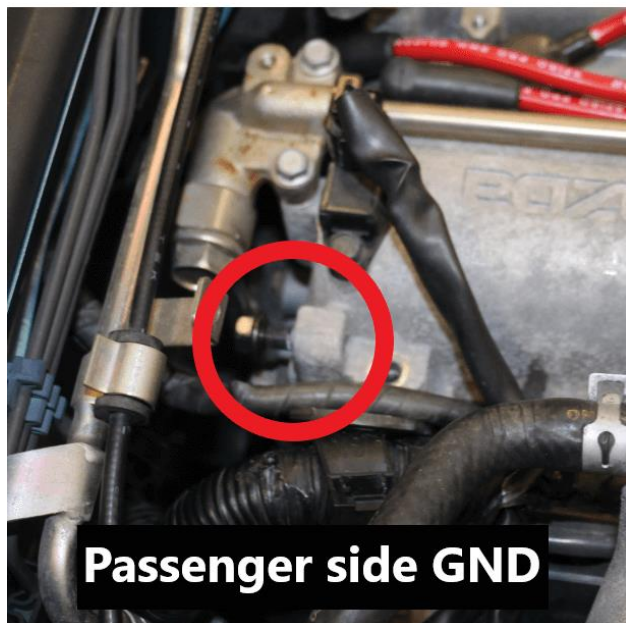
16. The primary harness has two grounding locations. These are designed to bolt on to the back corners of the head. Depending on the model year, you may find a valve cover bolt or a grounding bolt to tap into. See figure 12 and 13 for the recommended grounding points on each model year.

### '90 -'93 Engine Grounds



(Figure 12) 1990 – 1993 Engine Ground Locations

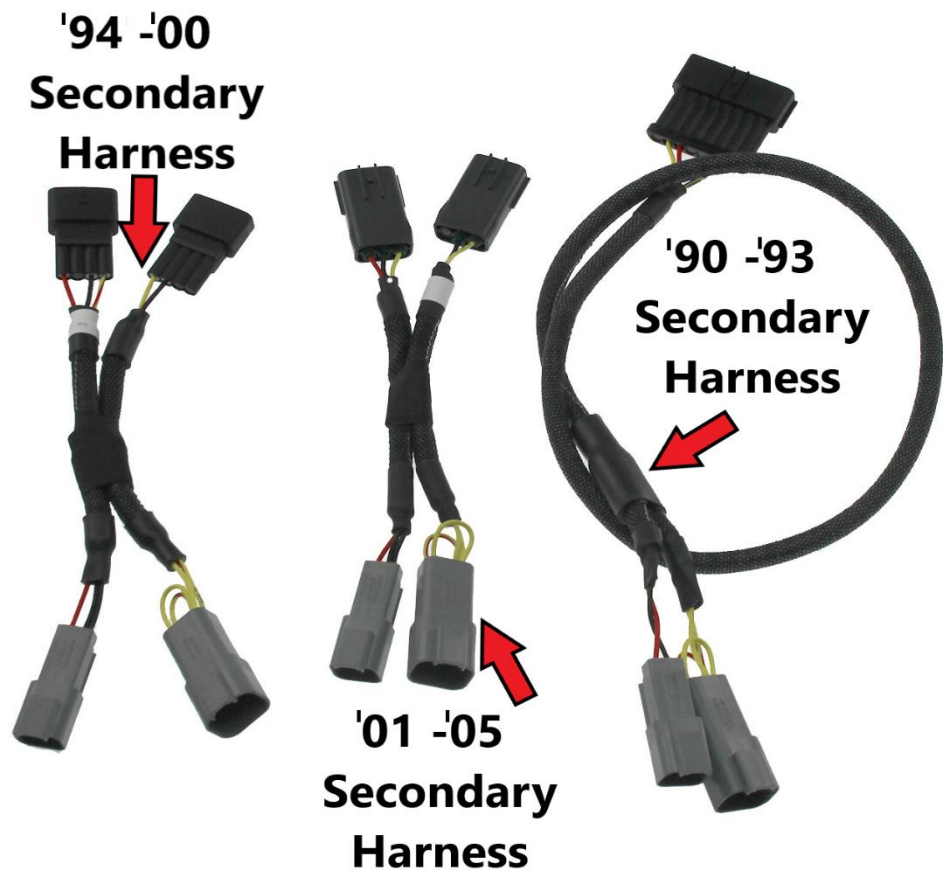
### '94 -'00 & '01 -'05



(Figure 13) 1994 – 2005 Engine Ground Locations

17. After the grounding in step 16 is complete, the primary harness install is complete. The next step is to install the secondary harness which supplies the ignition signals. Each secondary harness contains 2 light grey connectors, a 2-pin and a 4-pin. First identify which model you are using and locate these two light grey connectors (see figure 17 for a visual on the differing secondary harnesses).

18. Once you located these two light grey connectors on your secondary harness (a 2-pin and a 4-pin connector) locate the opposing 2-pin and 4-pin connectors on the primary harness that you finished installing on step 16. Once these pairs are found connect them together. These two connectors are located near the firewall on the passenger side of the engine for reference. (See figure 14 for a reference)



(Figure 17) Secondary Harness Identifier Image

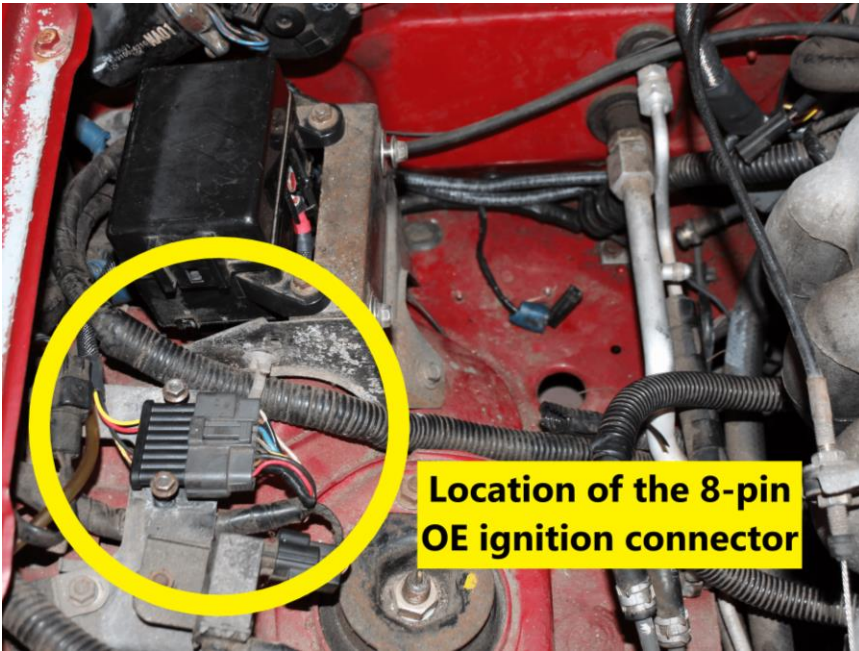
19. You will now connect the secondary harness to the OE ignition module plug on the cars body harness. The OE ignition module plug type and location depends on the model year. To know which section refers to your application, see the section call out below.

- For 1990 – 1993 models, see section 19.A
- For 1994 – 2000 models see section 19.B
- For 2001 – 2005 see section 19.C



(Figure 14) Primary to Secondary Harness Connection





(Figure 15) 1990 – 1993 Ignition Connector Identifier Image

#### A) 1990 – 1993 Secondary Harness Installation Steps

- I. If the OE Ignition Module is still present, it can be removed at this point. The secondary harness has an 8-pin connector on the end of it. This needs to be routed to the OE ignition module plug which is located near the fuse box towards the front of the car (see figure 15).

#### B) 1994 – 2000 Secondary Harness Installation Steps

- I. **If the OE Ignition Module is still present, it can be removed at this point.** Begin by locating the 2X 4-Pin identical connectors from the OEM harness that are the mating connectors for the 2X 4-Pin connectors on your secondary harness. For a cleaner tuck, tape up the slack until the connectors have an equal length. This step will also make plugging in the secondary harness more convenient.

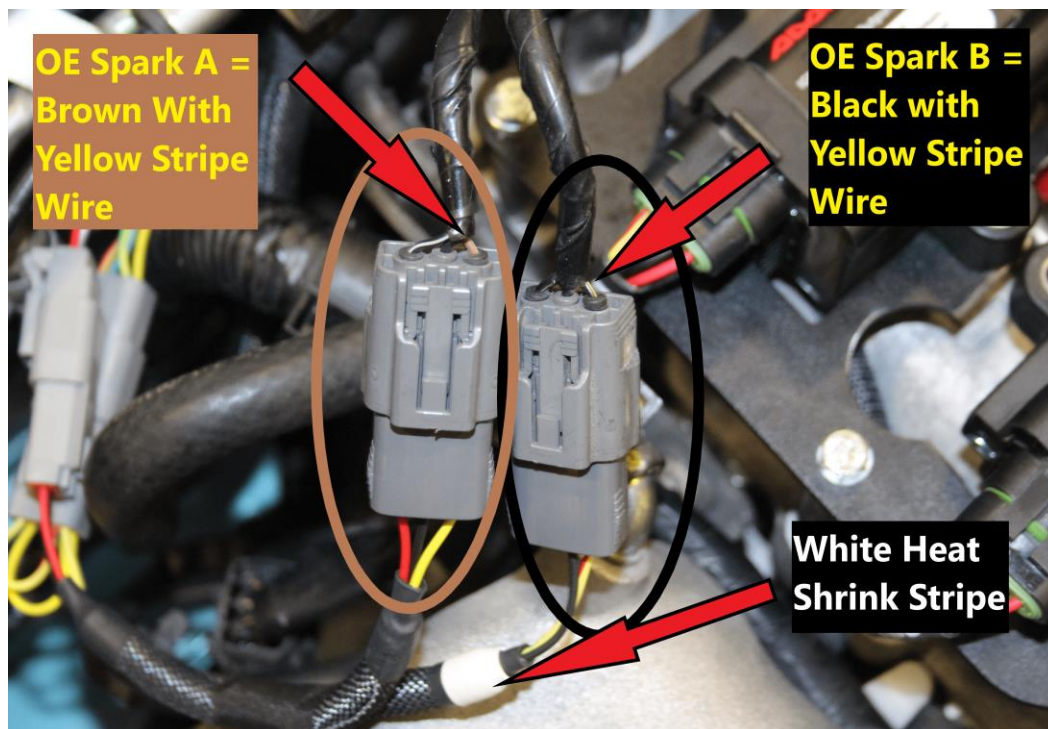


(Figure 16) 1994 – 2000 OE Connector Identifying Image

- II. The secondary harness comes with a white heat shrink strip on one of the connectors; **this white strip signifies SPARK SIGNAL-B.** Spark Signal-B connects with the OE connector that contains a SOLID BROWN WIRE for the signal output (see figure 16).
- III. This is the part of the installation process where you can choose to secure your harness in place, whether zip ties or tape, for a clean and tucked look! This completes the OE wasted spark installation process!

### C) 2001 – 2005 Secondary Harness Installation Steps

- i. If the OE Ignition Module is still present, it can be removed at this point. Begin by locating the 2X 3-Pin identical connectors from the OEM harness that are the mating connectors for the 2X 3-Pin connectors on your secondary harness. One connector will have longer wires than the other (placing it near the front of the engine closer to the front bumper). For a cleaner tuck, tape up the slack until the connectors have an equal length. This step will also make plugging in the secondary harness more convenient.



(Figure 17) 2001 – 2005 OE Connector Identifying Image

- ii. The secondary harness comes with a white heat shrink strip on one of the connectors; **this white strip signifies SPARK SIGNAL-B**. Spark Signal-B connects with the OE connector containing the BLACK WITH YELLOW STRIPE, known as the spark B output wire. **Spark output A is the BROWN WITH YELLOW STRIPE wire on the OE connectors** (see figure 17).
- iii. This is the part of the installation process where you can choose to secure your harness in place, whether zip ties or tape, for a clean and tucked look! This completed the OE wasted spark installation process!

This marks the completion of the factory ignition (wasted spark) installation. If you are looking to run sequential ignition, please see the next step “Sequential Ignition Setup”.

## Sequential Ignition Setup

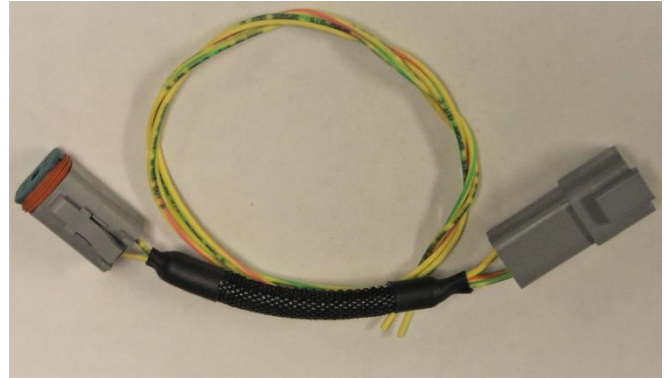
The sequential ignition setup is the same for all models with the only difference being what pins your aftermarket ECU uses to output the spark signals. Refer to your ECU manufactures data sheet to see which spark outputs you can use and route them to the back/top of the engine where they will be crimped into our Maxspark kit.

- If you are utilizing the 2 existing ignition outputs (OE spark A and OE spark B) from the OEM connectors along with 2 non-OE spark outputs, you will want to use the Sequential Adapter (included in every kit except the “DIY Crimp Kit”) see **Section A**.
- If you are utilizing 4X non-OE spark outputs, meaning you purchased a DIY crimp kit, see **Section B**.

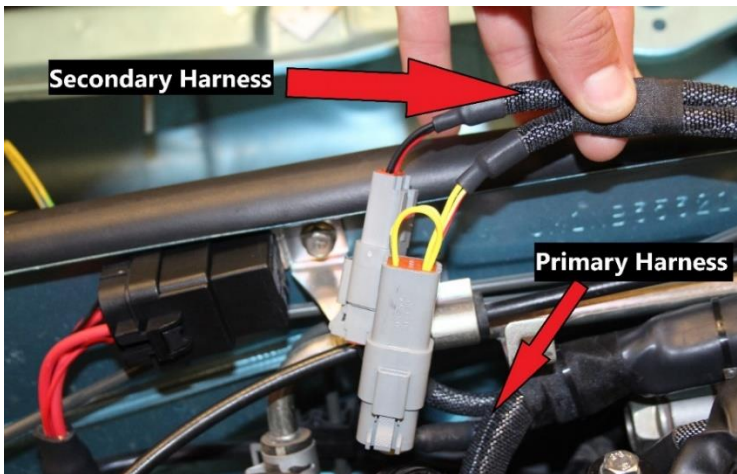


### Section A) 2 OE spark outputs + 2 added spark outputs

1. The sequential adapter (See figure 18) allows you to plug it in-line with the existing harness kit maintaining the OE spark A and B outputs while also giving you two flying leads to hook up your own spark C and D signal.



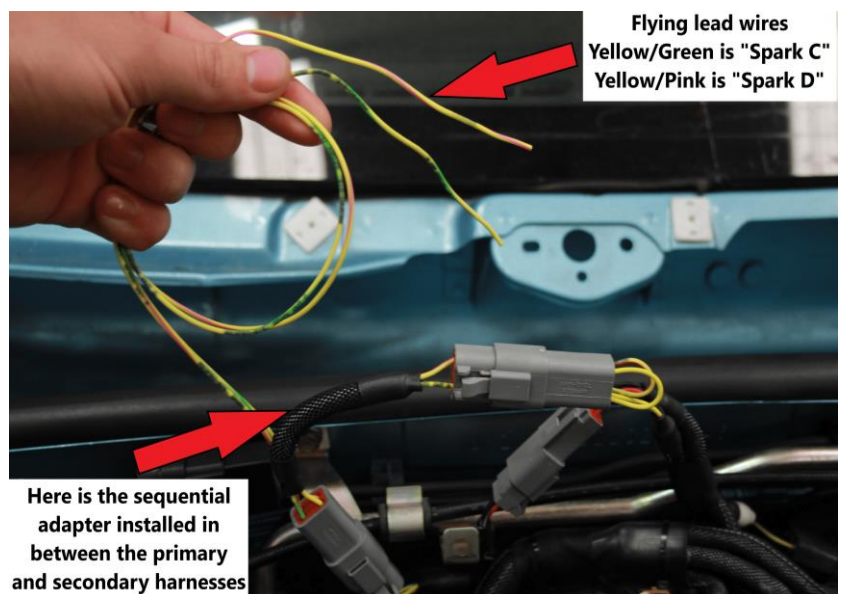
(Figure 18) Sequential Adapter Image



(Figure 19) Original Spark Connection (wasted spark configuration)

The sequential adapter when installed fits in between the secondary harness and the primary harness. See figure 19 for the approximate location that the sequential adapter will be inserted. This allows you to maintain the 2 OE spark outputs while the thrown lead wires give you the two additional spark outputs.

2. Once the sequential adapter is installed, you now have spark A and B wired up from the OE ignition connectors and can now tie in your additional spark C and D signals to the flying leads labeled Yellow/Green stripe "Spark C" and Yellow/Pink stripe "Spark D".
3. The firing order should be cylinders 1-3-4-2. This equated to spark signals: (1) Spark A -> (3) Spark B -> (4) Spark C -> (2) Spark D.

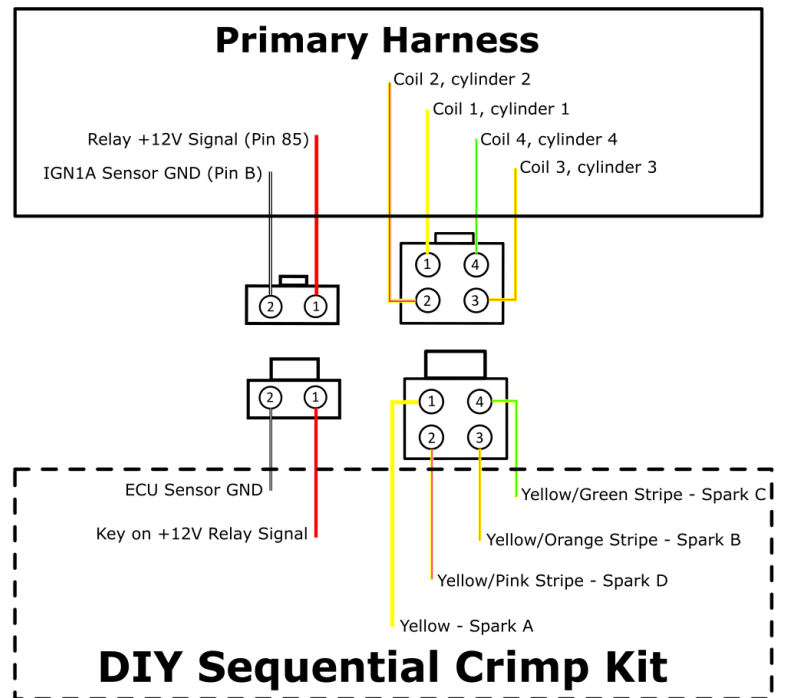


(Figure 24) Sequential Adapter Install visual

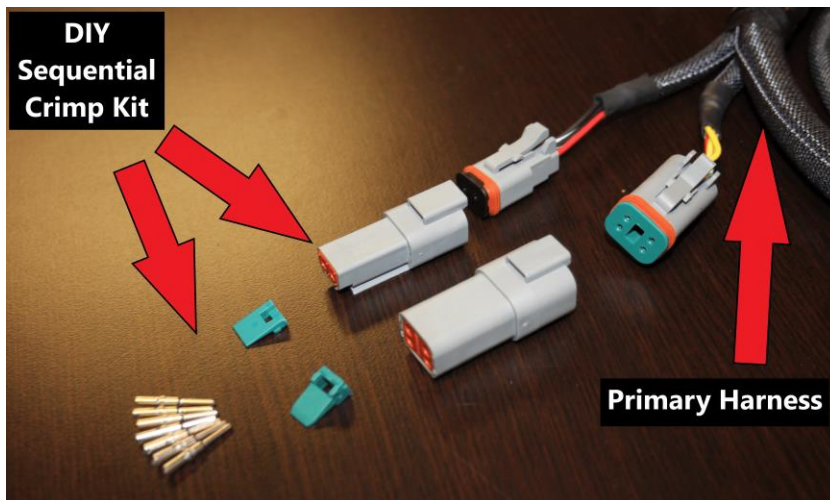
## Section B) DIY Sequential Crimp Kit

The DIY crimp kit includes a 4-pin connector, 4-pin connector lock, 2-pin connector, 2-pin connector lock, and 7 terminals for a DIY wiring job for the spark and power inputs. This is a good option if you are NOT utilizing any factory wiring/plugs or you custom wired your ignition setup already and cannot use the OEM plugs.

Figure 18 is a schematic with the associated pinout to show you how to wire your crimp kit to the primary harness.



(Figure 18) DIY Sequential Crimp Kit Schematic and Pinout



(Figure 19) DIY Sequential Crimp Kit layout

1. Start with unplugging the 2X Amphenol connectors (See figure 19) on your primary harness. The 4-pin connector is for spark and the 2-pin connector is for relay Switched +12V and coil sensor ground as shown previously in figure 18.

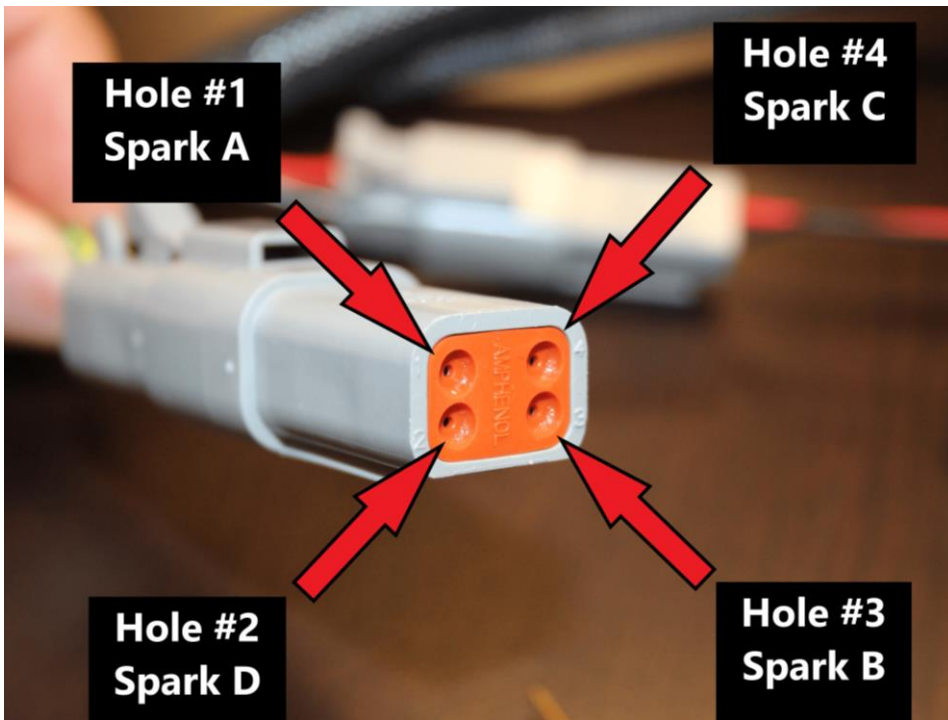
2. Route the wires to the location of these two Amphenol connectors on your primary harness. Crimp and insert the terminals (included in the DIY sequential crimp kit) according to the specs listed below. For Miatas, this picture assumes a standard firing order of cylinders 1-3-4-2.

The recommended Crimp Tool is *part number 18890* (see figure 20). It is a barrel style crimp and depending on what wire size you are using; the tool may vary. The tool pictured is specifically for 20 to 22 awg wire.



(Figure 20) Recommended Barrel Crimping Tool





(Figure 21) Spark Reference Pinout

3. Once your custom routed spark wires are cut, crimped, and inserted, you can now test the system to ensure proper installation. It is recommended to test the firing with the spark plugs pulled out of the engine one by one. This feature is available with the Mega Squirt product line; other ECUs may not offer this. Lastly you may clean up and tuck all necessary components.

This concludes the install of the DIY Sequential Crimp Kit for your Mazda Miata Maxspark Ignition Kit.

## IGN1A Coil ECU Setup

The Maxspark PNP kit uses the well known and extremely powerful IGN1A coils. These coils can be run mainly on factory ignition settings; however, we have laid out the suggested settings that we recommend users use. Starting with the coils themselves, we have the following basic information.

Coil Connector pinout:

- A – Ignition signal from ECU
- B – Logic ground, connect to ECU ground
- C – Spark wire ground, connect to cylinder head
- D – Power ground, connect to battery negative
- E – 12-volt power

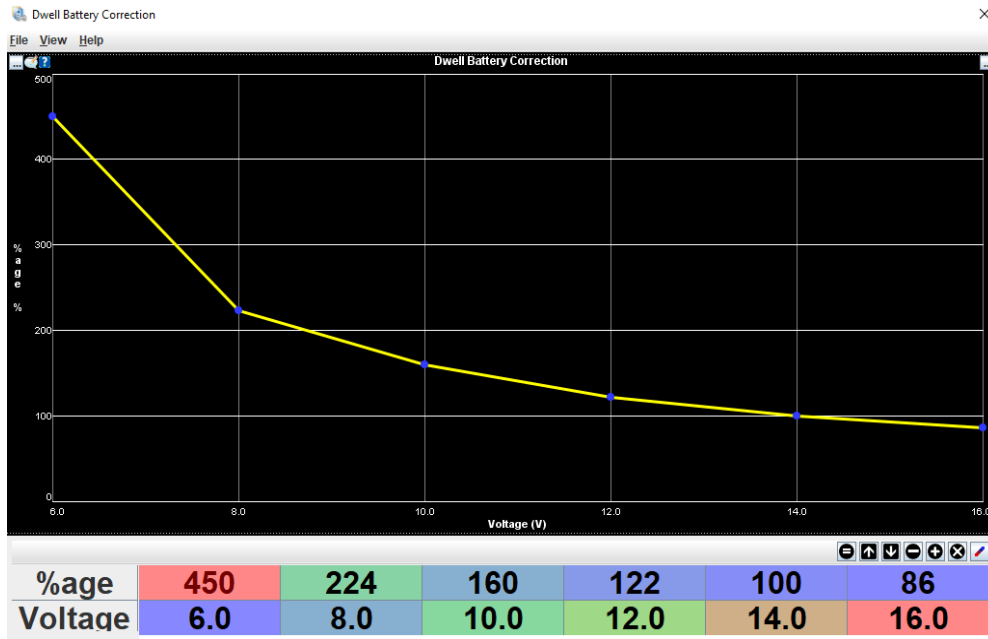
Coil Specifications:

- Minimum Output Voltage (no load, at recommended dwell): 40,000 volts
- Maximum Output Voltage: up to 81,000 volts (+/- 10%)
- Output energy: 103 mJ
- Spark duration: 2.9 ms
- Primary resistance: 0.5 ohms (not directly measurable)
- Primary inductance: 4.8 mH (not directly measurable)
- Secondary resistance: 8,500 ohms
- Secondary inductance: 22.5 H
- Turns ratio: 71.1
- Maximum current: 19 amps
- Maximum battery voltage: 17 volts
- Nominal dwell: 3.0ms
- Max dwell: 9.5ms

The information in figure 22 represents the dwell battery correction percentage at various voltage levels. This is information should be set in your ECUs settings. In TunerStudio this graph is called the “Dwell Battery Correction”. Figure 22 shows it in table form while figure 23 shows the graphical representation directly from TunerStudio.

Voltage	Dwell correction
6	449 %
8	225 %
10	160 %
12	123 %
14	100 %
16	86 %

(Figure 22) Coil Dwell %



(Figure 23) Dwell Battery Correction Table in TunerStudio

To prevent users from over dwelling their coils and causing damage, we created a table to show the current values at a given Voltage and Dwell. The current rating for the IGN1A is 19 amps and should not be exceeded. In Figure 24 we put together our test results showing the current peak at specific dwell and voltage levels. In cells that say “max” we recommend not going any higher in dwell. In the cells that say “overload”, we recommend never attempting this level as you will overload the coil and damage it.

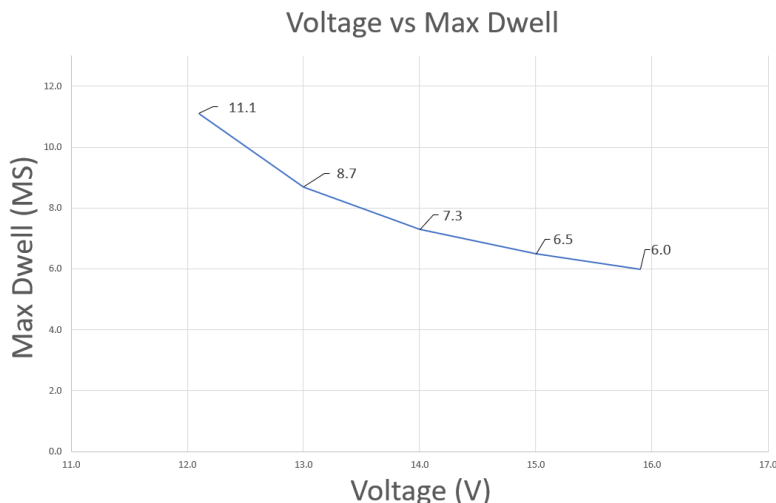
**Current Peak Graph: Dwell-X vs Voltage-Y vs Current-Z**  
Current is measured in amps (A)

Voltage (volts)	Dwell (ms)											
	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0
15.9	2.2	3.8	5.5	7.5	11.7	19 (max)	Overload					
15.0	2.1	3.6	5.2	6.8	9.8	15.2	Overload					
14.0	2.0	3.5	4.8	6.3	8.2	11.9	17.1	Overload				
13.0	1.8	3.3	4.4	5.7	7.1	9.5	13.0	17.0	Overload			
12.1	1.6	2.8	4.0	5.3	6.4	7.8	10.3	13.4	16.3	18.2	18.93 (max)	Overload

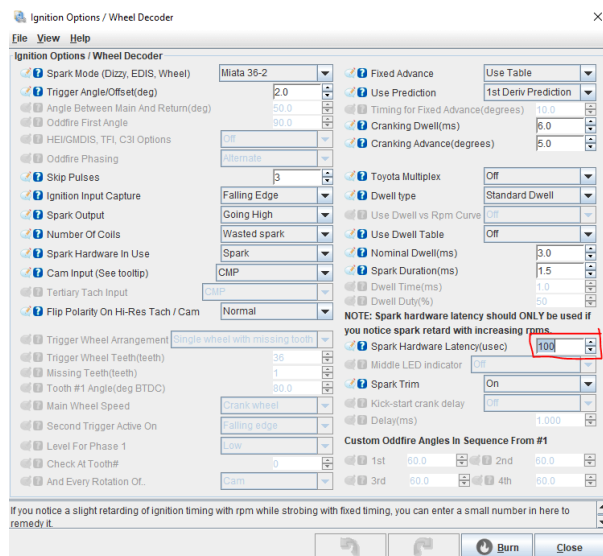
(Figure 24) Current readings at a given Voltage and Dwell for IGN1A coils



After taking the data from figure 24, we put together an approximation of what the peak dwell times should be. This curve better shows the calculated limit as opposed to figure 31 where this goes into detail on all the current readings at various points. To be safe, we recommend running below these levels for longevity of the coils as these limits are our calculated estimate possible error needs to be accounted for.



(Figure 25) Voltage vs Max Dwell graph



(Figure 26) Spark Hardware Latency

An additional setting to be adjusted is the Spark Hardware Latency. This was calculated in house by fixing the timing of each model and ramping the RPM up slightly. If a deviation in the timing was observed, Spark Hardware Latency was adjusted to compensate. For a better understanding, if the timing advances as RPM increases, latency was added; if it was retarding, latency was removed. Our results were for years 1990 – 1997, the recommended Spark Hardware Latency setting is 60ms. For years 1999 – 2005 the recommended spark hardware latency is 100ms. Refer to figure 26 for the TunerStudio menu showing where this correction value is located.

For longevity of your coils, avoid having the key on engine off for long periods.

## Conclusion

This concludes the install of the Mazda Miata Maxspark Ignition Kit. We hope you love the product and win many races.

## Warranty

*Race parts are inherently dangerous in general and may cause injury or damage if improperly modified or altered before use. Hoffmann Innovations will not be held liable for and will not pay you for any injuries or damage caused by misuse, modification, redesign, or alternation of any of our products. Hoffmann Innovations will not be held in any way responsible for any incidental or consequential damages including direct or indirect labor, towing, lodging, garage, repair, medical, or legal expense in any way attributable to the use of any item in our catalog or to the delay or inconvenience caused by the necessity of replacing or repairing any such item.*

*The coils have no warranty as they are race coils and can easily be damaged if setup incorrectly.*

*Our Maxspark Manufactured In house products (Wiring Harness and bracket) are covered by a 1-year limited manufacturer's warranty covering parts and labor for repairs of any manufacturer defect for the original purchaser.*

*Contact our product support team at [support@AMPEFI.com](mailto:support@AMPEFI.com) if you need to discuss any warranty repair/RMA.*