CHILTON'S
REPAIR & TUNE-UP GUIDE

CORVAIR 1960 to 1969

TUNE-UP AND FUEL ECONOMY TIPS
COLOR SECTION

Monza • Monza Spyder • Corsa • Lakewood Wagon
Greenbrier and 95 Trucks

Timing (Degrees BTDC)/Idle Speed (RPM)

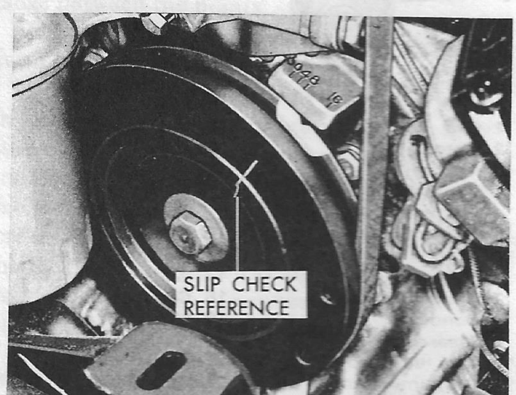
Year	Trans.	80-85-95 HP	110 HP	140 HP (4-Carb)	180 HP (Turbo* Charged)
1960	Manual	4/500			
	Auto.	4/500			
1961	Manual	4/500	13/500		
	Auto.	4/500†			
1962	Manual	4/500	13/600		24/850
	Auto.	13/500†	13/500		
1963	Manual	4/500	13/500		24/850
	Auto.	13/500†	13/500		
1964	Manual	2/500	12/600		24/850
	Auto.	10/500	12/500†		
1965	Manual	4-8/500	12-16/650	16-20/650	24/850
	Auto.	12-16/*	12-16/650		
1966	Manual Std.	6/500	14/650	18/650	24/850
	Auto. Std.	14/500	14/500‡	18/650	
	Manual A.I.R.	9ATDC/500	1 ATDC/700	3/700	
	Auto A.I.R.	4ATDC/500	4/600	8/600	
1967	Manual Std.	6/500	14/650		
	Auto Std.	14/500	14/500‡		
	Manual A.I.R.	0/700	4/700		
	Auto A.I.R.	0/500	4/600		
1968	Manual	6/700	4/700	4/700	
	Auto	14/600	12/600	4/600	
1969	Manual	6/700	4/700	4/650	
	Auto	14/600	12/600	4/550	

†With transmission in Drive.
*Highest idle which will not cause vehicle to creep in drive.
‡With air-conditioning, 24° BTDC/500 RPM.

Ignition Timing Procedure

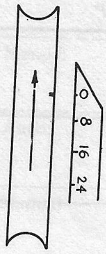
The distributor cam is in a fixed relationship to the engine, but the distributor body (containing the contact points) is movable around the axis of the cam, so that ignition timing can be changed by unclamping and rotating the distributor with or against the rotation of the cam (which rotates clockwise). Rotating the distributor clockwise will retard the timing, and rotating it counterclockwise will advance the timing.

Timing must be done with a strobe timing light, at the idle speed given in the chart. The timing mark will be found on the crankshaft pulley or harmonic balancer. On the harmonic

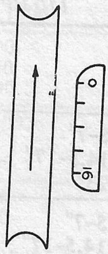


Harmonic balancer slip check reference mark

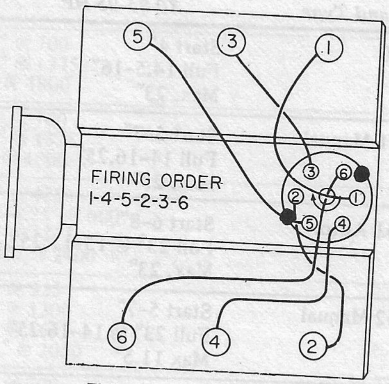
Firing Order



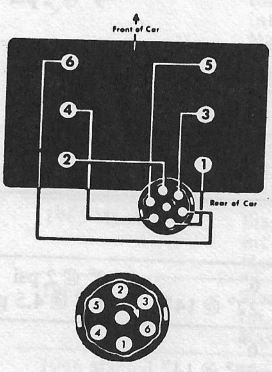
Timing marks—1966 140 and 180 H.P.; 1966-67 110 H.P., A.T., AC



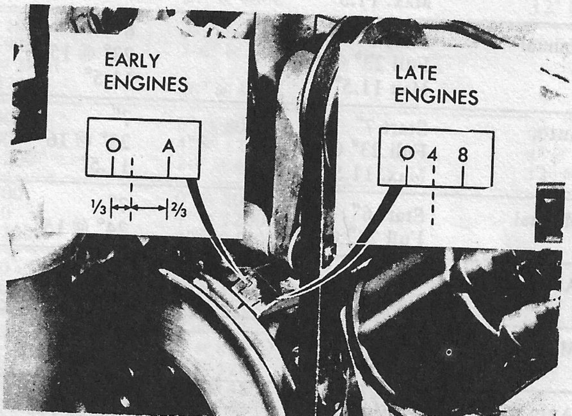
Timing marks—1965 95, 110, 140 H.P.; 1966 95, 110 H.P., and 1967-69 all



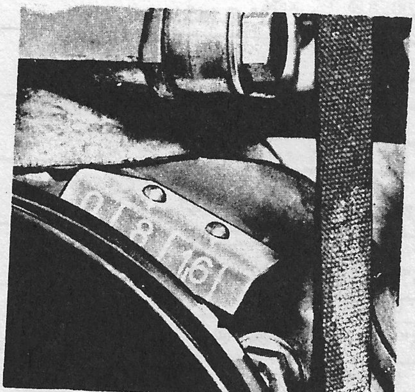
Firing order—1961-69



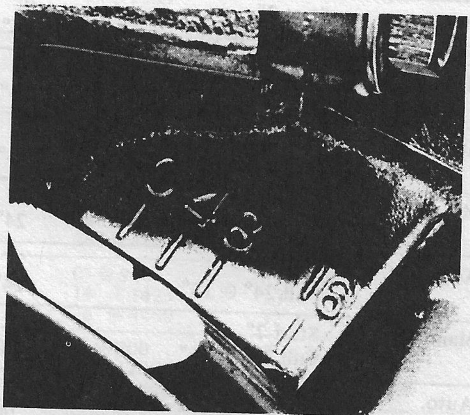
Firing order—1960



Timing marks—1960



Timing marks—1962-65 turbo charged engines



Timing marks—1961-64

Distributor Vacuum Advance

DISTRIBUTOR DEGREES ADVANCE @ INCHES HG VACUUM

Year and Type	*80-85-95 HP*	*110 HP*	*140 HP*	*180 HP*
1960	Start 4″ Full 14.5–16″ Max. 23°			
1961 Manual	Start 5–7″ Full 14–16.25″ Max. 23°	5–7″ 14.5–17″ 23°		
1961 Auto.	Start 6–8″ Full 23° @ 15–17.25″ Max. 23°	5–7″ 14.5–17″ 23°		
1962 Manual	Start 5–7″ Full 23° @ 14–16.25″ Max 11.5°	5–7″ 23° @ 14–16.25″ 11.5°		
1962 Auto.	Start 6–8″ Full 23° @ 15–17.25″ Max. 11.5°	6–8″ 23° @ 15–17.25″ 11.5°		
1963 Manual	Start 6″ Full 23° @ 15″ Max 11.5°	6″ 23° @ 15″ 11.5°		0° @ 1 psi −9° @ 2 psi
1963 Auto.	Start 7″ Full 23° @ 15″ Max. 11.5°	7″ 23° @ 16″ 11.5°		
1964 Manual	Start 6″ Full 24° @ 14″	7″ 24° @ 15″		0° @ 1 psi −6.5° @ 3.5 psi
1964 Auto.	Start 7″ Full 24° @ 15″	7″ 24° @ 15″		
1965 Manual	Start 6″ Full 24° @ 14″	7″ 24° @ 15″	6″ 22° @ 14″	0° @ 2 psi 12° @ 4.5 psi
1965 Auto.	Start 7″ Full 24° @ 15″	7″ 24° @ 15″	6″ 22° @ 14″	
1966 Manual	Start 6″ Full 24° @ 14″	7″ 24° @ 15″	6″ 22° @ 14″	0° @ 2.25 psi −8° @ 3.62 psi
1966 Auto.	Start 7″ Full 24° @ 15″	7″ 24° @ 15″	6″ 22° @ 14″	
1967 Manual	Start 7″ Full 24° @ 15″	7″ 24° @ 15″		
1967 Auto.	Start 7″ Full 24° @ 15″	7″ 24° @ 15″		
1968 Manual	Start 7″ Full 24° @ 15″	7″ 24° @ 15″	6″ 22° @ 14″	
1968 Auto.	Start 7″ Full 24° @ 15″	7″ 24° @ 15″	6″ 22° @ 14°	
1969 Manual	Start 7″ Full 24° @ 16″	7″ 24° @ 16″	7″ 24° @ 16″	
1969 Auto.	Start 7″ Full 24° @ 16″	7″ 24° @ 16″	7″ 24° @ 16″	

Distributor Centrifugal Advance

DISTRIBUTOR DEGREES @ DISTRIBUTOR RPM

Year and Type	80-85-95 HP	110 HP	140 HP	180 HP
1960	Start 0–2° @ 200 Int. 7–9° @ 1050 Max. 15–17° @ 1800			
1961 Manual	Start 0–2° @ 600 Int. 7–9° @ 1050 Max. 32° @ 3600	0–2° @ 700 6–8° @ 1375 24° @ 4800		
1961 Auto.	Start 0–2° @ 1400 Int. Max. 24° @ 3700	0–2° @ 700 6–8° @ 1375 24° @ 4800		
1962 Manual	Start 0–2° @ 600 Int. 7–9° @ 1050 Int. Max. 15–17° @ 1800	0–2° @ 425 2.25–4.25° @ 600 6–8° @ 1375 11–13° @ 2400		
1962 Auto.	Start 0–2° @ 800 Int. 5–7° @ 1270 Int. Max. 11–13° @ 1850	0–2° @ 925 3–5° @ 1300 6–8° @ 1675 9–11° @ 2050		
1963 Manual	Start 0–2° @ 600 Int. 6–10° @ 1350 Int. 15–19° @ 2200 Max. 32° @ 3600	0–2° @ 700 8–12° @ 1950 16–20° @ 3550 24° @ 4800		0–2° @ 3900 12° @ 4500
1963 Auto.	Start 0–2° @ 1400 Int. 4–8° @ 1975 Int. 13–17° @ 2850 Max. 24° @ 3700	0–2° @ 1600 2–6° @ 2100 20° @ 4100		
1964 Manual	Start 0° @ 700 Int. 4° @ 1200 Max. 28° @ 4200	0° @ 800 4° @ 1200 20° @ 4800		0° @ 3900 4° @ 1200 12° @ 4500
1964 Auto.	Start 0° @ 1700 Int. 4° @ 1200 Max. 24° @ 4200	0° @ 800 4° @ 1200 20° @ 4800		
1965 Manual	Start 0° @ 700 Int. 4° @ 1200 Max. 28° @ 4200	0° @ 800 4° @ 1200 20° @ 4800	0° @ 800 4° @ 1200 18° @ 4900	0° @ 4000 4° @ 1200 18° @ 4900
1965 Auto.	Start 0° @ 1700 Int. 4° @ 1200 Max. 24° @ 4200	0° @ 800 4° @ 1200 20° @ 4800	0° @ 800 4° @ 1200 18° @ 4900	
1966 Manual	Start 0° @ 700 Int. 4° @ 1200 Max. 28° @ 4200	0° @ 800 4° @ 1200 20° @ 4800	0° @ 800 18° @ 2800	0° @ 4000 18° @ 4900
1966 Auto.	Start 0° @ 1700 Int. Max. 20° @ 4200	0° @ 800 4° @ 1200 20° @ 4800	0° @ 800 18° @ 3200	
1967 Manual	Start 0° @ 700 Int. Max. 28° @ 4200	0° @ 800 4° @ 1200 20° @ 4800		
1967 Auto.	Start 0° @ 1700 Int. Max. 20° @ 4200	0° @ 800 4° @ 1200 20° @ 4800		
1967 A.I.R.* (all)	Start 0° @ 900 Int. 14.4° @ 1460 Max. 40° @ 4400	0° @ 900 14° @ 1425 26° @ 4400		
1968 Manual	Start 0° @ 900 Int. 14° @ 1425 Max. 28° @ 4200	0° @ 900 14° @ 1425 26° @ 4400	0° @ 900 20° @ 1420 32° @ 3000	
1968 Auto.	Start 0° @ 1700 Int. Max. 20° @ 4200	0° @ 800 4° @ 1200 20° @ 4800	0° @ 900 20° @ 1420 32° @ 3000	
1969 Manual	Start 0° @ 900 Int. 6° @ 1600 Max. 28° @ 4200	0° @ 900 14° @ 1425 26° @ 4400	0° @ 900 14° @ 1420 26° @ 3000	
1969 Auto.	Start 0° @ 1700 Int. 3° @ 2100 Max. 20° @ 4200	0° @ 800 4° @ 1200 20° @ 4800	0° @ 900 14° @ 1420 26° @ 3000	

*A.I.R. Air Injection Reactor.

balancer fitted to higher-powered Corvairs and all those equipped with automatic transmissions, a slip check mark is an indication of any slippage between the parts of the balancer, which should be remedied by replacement of the unit.

Brighten the timing mark on the pulley and on the reference tab with chalk. Connect the timing light and a tachometer and start the engine. On all vehicles (except those with turbochargers), disconnect and plug the vacuum advance line. Check the mark with the timing light while the engine is running. If not to specification, loosen the clamp bolt at the base of the distributor and turn the distributor until the mark moves to its proper position.

NOTE: On early-production 1960 cars, position the timing mark one-third of the way between the "O" and the "A" marks on the crankcase tab.

Distributor Specifications

Ignition timing operations normally are reliable, but if possible, a complete check of the distributor advance systems should be made periodically. Certain variables of distributor operation, such as vacuum advance operation, are hard to check on an installed distributor. A well-equipped service station or ignition service facility will have a distributor tester. If poor engine performance traceable to the distributor exists, a full check of the distributor should be made. Distributor specifications are given in the charts.

NOTE: Turbocharged vehicles operate under conditions of both negative and positive pressure in the intake manifold, so that a pressure-retard (rather than a vacuum advance) unit is fitted to the distributor.

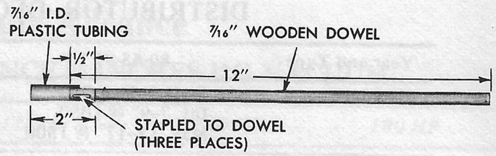
Spark Plugs

At every tune-up remove the spark plugs and inspect them, then clean and regap them. Replace worn out plugs.

Removal of Spark Plugs

Pull off the spark plug wire caps at the cylinder shrouds and check them for cracks, burns, or excessive distortion. Remove the plugs with a suitable deep socket wrench on a ratchet handle.

NOTE: A special spark plug socket is available having a rubber insert and deep throat to protect the plug when removing and installing it. This tool is well worth the small investment and will prevent broken plug ceramics. A tool like that illustrated can be fabricated to ease removal of plugs from the engine; be careful not to drop the plugs or gaskets into the engine shrouds.



Spark plug holding tool

Inspection of Spark Plugs

Much can be learned about engine condition from the spark plugs. The color of the ceramic around the center electrode is an excellent indicator of carburetor adjustment and ignition reliability.

Gap bridging (A)

May be traced to flying deposits in the combustion chamber. In some cases, fluffy deposits may accumulate on the plugs during intown driving and when the engine is suddenly put under high load; this material can melt and bridge the gap.

Scavenger deposits (B)

Fuel scavenger deposits shown may be white or yellow in color. They may appear to be harmful, but this is normal with certain brands of fuel. Note that accumulation on the ground electrode and shell areas may be unusually heavy, but the material is easily chipped off. Such plugs can be considered normal and can be cleaned using standard procedures.

Chipped insulator (C)

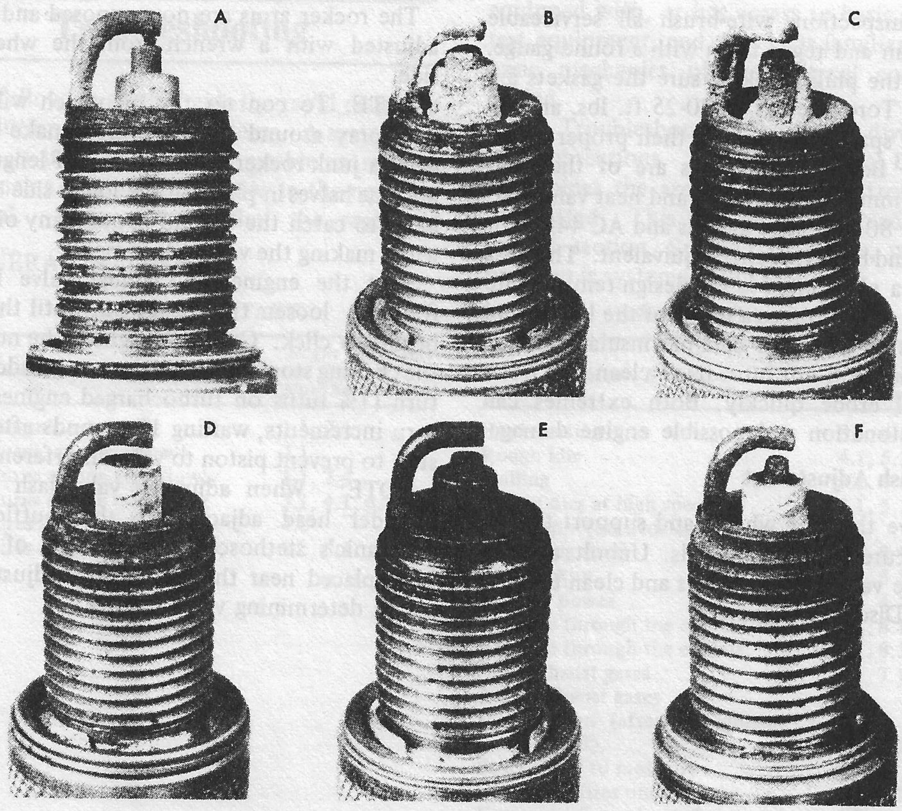
Usually results from bending the center electrode during gapping. Under certain conditions, severe detonation can also split insulator firing ends.

Preignition damage (D)

Caused by excessive temperatures, produces melting of the center electrode and, somewhat later, the ground electrode. Insulators will appear relatively clean of deposits. Check for correct plug heat range and overadvanced ignition timing.

Cold fouling (or carbon fouling) (E)

Dry, black appearance of one or two plugs in a set. Check for sticking valves or bad spark plug wires. Fouling of the entire set may be caused by a clogged air cleaner, a sticking exhaust manifold heat valve, or a faulty choke.

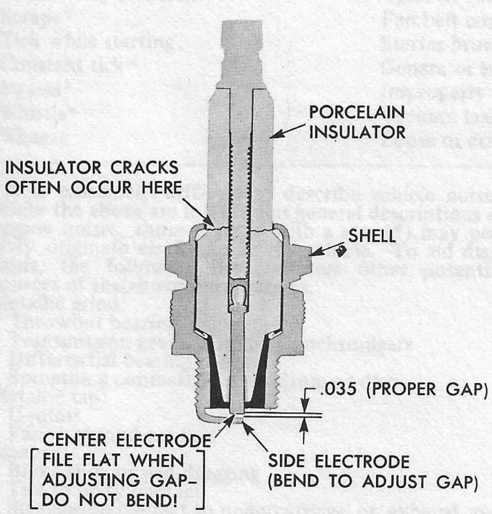


Spark plug damage

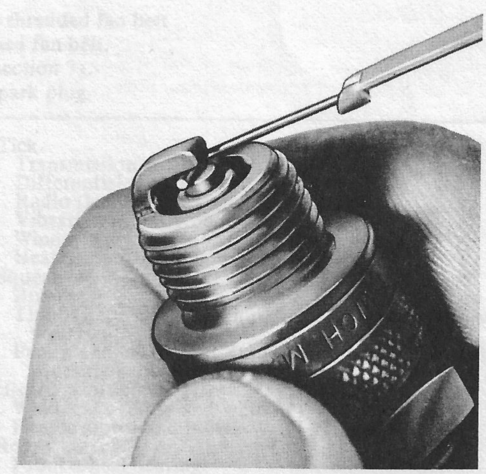
Overheating (F)

Dead white or gray insulator which appears "blistered." Electrode gap wear rate will be considerably in excess of .001"/1,000 miles. This may suggest that a cooler heat range should be used; however, overadvanced ignition timing, detonation and cooling system malfunctions can also overheat spark plugs.

Inspect the plugs for common defects, such as cracks in the ceramic, fouling, and incorrect gap. If the upper ceramic is very dirty, check for spark tracks which could point to a short-circuited plug.



Spark plug detail



Setting spark plug gap

After inspection, wire-brush all serviceable plugs clean and regap them with a round gauge.

Install the plugs, making sure the gaskets are in place. Torque plugs to 20-25 ft. lbs. and replace the spark plug wires in their proper order.

NOTE: Be sure the plugs are of the right type (14 mm., ½-inch reach) and heat value, AC 46FF for 80 to 95 hp. models and AC 44FF for 110 hp. and higher, or their equivalent. The heat value of a plug refers to the design temperature at which it will run as a result of the length and thickness of its inner ceramic insulation. Too cold a plug will not burn itself clean; too hot a plug will erode quickly. Both extremes can cause detonation and possible engine damage.

Valve Lash Adjustment

Remove the rear wheels and support the vehicle securely on jackstands. Unbolt and remove the valve rocker covers and clean them in solvent. Discard the gaskets.

The rocker arms are now exposed and can be adjusted with a wrench from the wheel-well side.

NOTE: To contain the oil which will flow and spray around the valve area, make shields from a junk rocker cover cut in half lengthwise; bolt the halves in place on the lower side of each bank to catch the oil and contain any oil spray while making the valve adjustment.

Start the engine, and adjust valve lash as follows: loosen the rocker nut until the valve begins to click. Gradually tighten the nut until the clicking stops. Tighten the nut an additional turn (1¼ turns on turbocharged engines) in ¼ turn increments, waiting 10 seconds after each step to prevent piston to valve interference.

NOTE: When adjusting valve lash on the cylinder head adjacent to the muffler(s), a mechanic's stethoscope or a length of rubber hose placed near the valve being adjusted will aid in determining valve sounds.

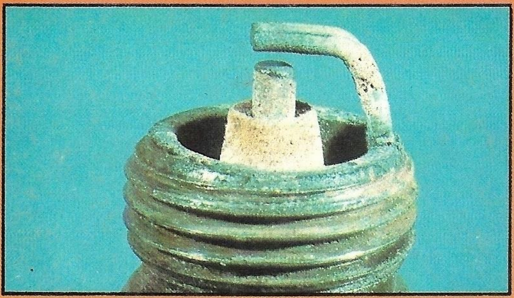
SPARK PLUG DIAGNOSIS

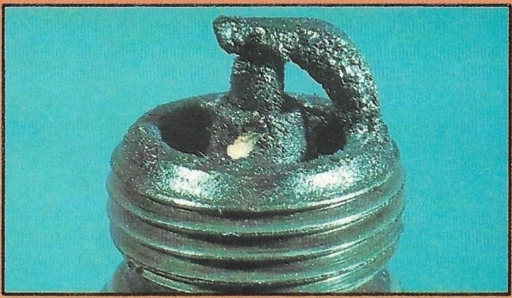
Normal

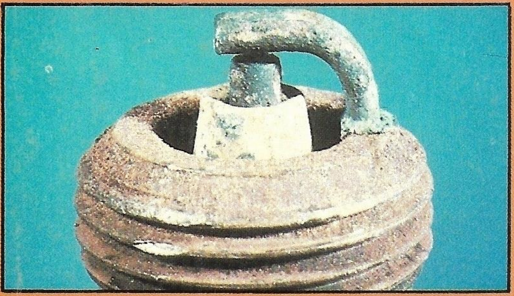
APPEARANCE: This plug is typical of one operating normally. The insulator nose varies from a light tan to grayish color with slight electrode wear. The presence of slight deposits is normal on used plugs and will have no adverse effect on engine performance. The spark plug heat range is correct for the engine and the engine is running normally.
CAUSE: Properly running engine.
RECOMMENDATION: Before reinstalling this plug, the electrodes should be cleaned and filed square. Set the gap to specifications. If the plug has been in service for more than 10-12,000 miles, the entire set should probably be replaced with a fresh set of the same heat range.

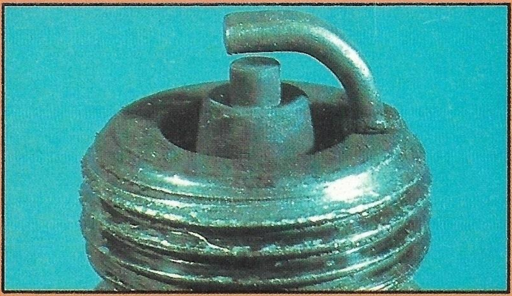
Oil Deposits

APPEARANCE: The firing end of the plug is covered with a wet, oily coating.
CAUSE: The problem is poor oil control. On high mileage engines, oil is leaking past the rings or valve guides into the combustion chamber. A common cause is also a plugged PCV valve, and a ruptured fuel pump diaphragm can also cause this condition. Oil fouled plugs such as these are often found in new or recently overhauled engines, before normal oil control is achieved, and can be cleaned and reinstalled.
RECOMMENDATION: A hotter spark plug may temporarily relieve the problem, but the engine is probably in need of work.









Incorrect Heat Range

APPEARANCE: The effects of high temperature on a spark plug are indicated by clean white, often blistered insulator. This can also be accompanied by excessive wear of the electrode, and the absence of deposits.
CAUSE: Check for the correct spark plug heat range. A plug which is too hot for the engine can result in overheating. A car operated mostly at high speeds can require a colder plug. Also check ignition timing, cooling system level, fuel mixture and leaking intake manifold.
RECOMMENDATION: If all ignition and engine adjustments are known to be correct, and no other malfunction exists, install spark plugs one heat range colder.

Carbon Deposits

APPEARANCE: Carbon fouling is easily identified by the presence of dry, soft, black, sooty deposits.
CAUSE: Changing the heat range can often lead to carbon fouling, as can prolonged slow, stop-and-start driving. If the heat range is correct, carbon fouling can be attributed to a rich fuel mixture, sticking choke, clogged air cleaner, worn breaker points, retarded timing or low compression. If only one or two plugs are carbon fouled, check for corroded or cracked wires on the affected plugs. Also look for cracks in the distributor cap between the towers of affected cylinders.
RECOMMENDATION: After the problem is corrected, these plugs can be cleaned and reinstalled if not worn severely.

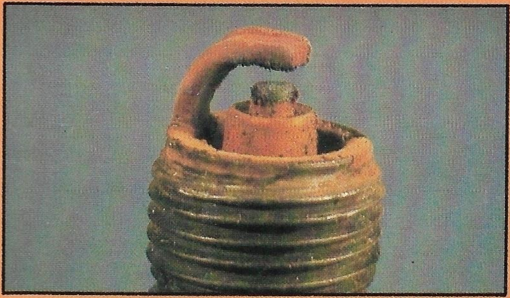
Photos Courtesy Fram Corporation

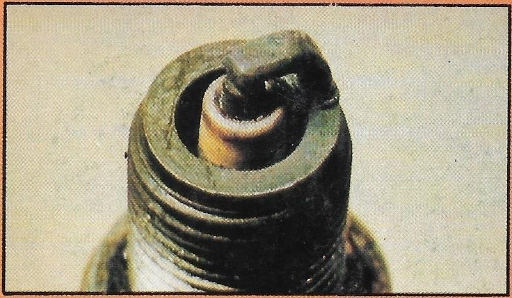
MMT Fouled

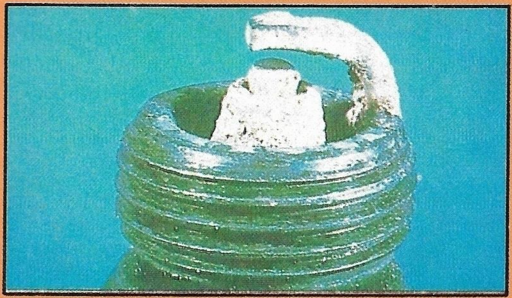
APPEARANCE: Spark plugs fouled by MMT (Methycyclopentadienyl Maganese Tricarbonyl) have reddish, rusty appearance on the insulator and side electrode.
CAUSE: MMT is an anti-knock additive in gasoline used to replace lead. During the combustion process, the MMT leaves a reddish deposit on the insulator and side electrode.
RECOMMENDATION: No engine malfunction is indicated and the deposits will not affect plug performance any more than lead deposits (see Ash Deposits). MMT fouled plugs can be cleaned, regapped and reinstalled.

High Speed Glazing

APPEARANCE: Glazing appears as shiny coating on the plug, either yellow or tan in color.
CAUSE: During hard, fast acceleration, plug temperatures rise suddenly. Deposits from normal combustion have no chance to fluff-off; instead, they melt on the insulator forming an electrically conductive coating which causes misfiring.
RECOMMENDATION: Glazed plugs are not easily cleaned. They should be replaced with a fresh set of plugs of the correct heat range. If the condition recurs, using plugs with a heat range one step colder may cure the problem.







Ash (Lead) Deposits

APPEARANCE: Ash deposits are characterized by light brown or white colored deposits crusted on the side or center electrodes. In some cases it may give the plug a rusty appearance.
CAUSE: Ash deposits are normally derived from oil or fuel additives burned during normal combustion. Normally they are harmless, though excessive amounts can cause misfiring. If deposits are excessive in short mileage, the valve guides may be worn.
RECOMMENDATION: Ash-fouled plugs can be cleaned, gapped and reinstalled.

Detonation

APPEARANCE: Detonation is usually characterized by a broken plug insulator.
CAUSE: A portion of the fuel charge will begin to burn spontaneously, from the increased heat following ignition. The explosion that results applies extreme pressure to engine components, frequently damaging spark plugs and pistons.

Detonation can result by over-advanced ignition timing, inferior gasoline (low octane) lean air/fuel mixture, poor carburetion, engine lugging or an increase in compression ratio due to combustion chamber deposits or engine modification.
RECOMMENDATION: Replace the plugs after correcting the problem.

Photos Courtesy Champion Spark Plug Co.

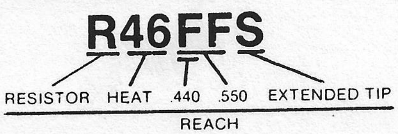
SPARKPLUGS

by Dan Brizendine
Circle City Corvairs

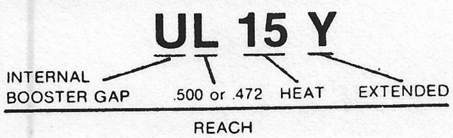
There seems to be some confusion, misunderstanding and unnecessary concern about spark plugs and what kind we're going to use in our Corvairs in the future.

There are two important things to remember when choosing spark plugs for your Corvair: heat range and thread length. Numbers on the plugs indicate these characteristics, as indicated below.

AC PLUG DESIGNATIONS

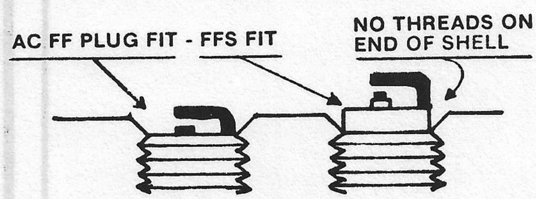


CHAMPION DESIGNATIONS



There are many plugs available in a good selection of heat ranges that will work just fine in the Corvair engine. But they won't show up in a "cross-over" chart due to unimportant differences. Each manufacturer uses their own identification system which causes most of the confusion. The higher the number for one manufacturer the hotter the plug; it is just the opposite for another manufacturer. Heat range refers to the range of temperatures the center electrode and porcelain insulator operate within when the engine has reached operating temperature. That's the only time heat range matters. Many people think a "hot" plug makes a hotter spark. The temperature is controlled mainly by the length of the insulator inside the plug shell.

There are three common thread lengths that can be safely used: 0.440, 0.472 and 1/2 inch. These lengths vary by about one thread longer or shorter than the threads in the Corvair head. The AC FFS plugs, for example, are suitable for use in Corvairs without modification. The actual thread length is the same but they are actually longer overall (see attached sketch). However, there is plenty of clearance in the combustion chamber to accommodate the extra length.



Below is a list of commonly available plugs that can be used in Corvairs. I feel these are the most suitable heat ranges, but there are others.

AC:	44, 45 or 46 F, FF or FFS or any of these with "R" prefix.
CHAMPION:	L or UL 15 or 12 "Y"
	L or UL 10, 8 or 7 with or without "Y"
	L or UL 86, 87, 85, 90, 92 or 95 with or without "Y"
NGK:	BP6 HS or H, B7HZ
AUTOLITE:	AE 22, 32, 42, 43 or 44
BOSCH:	W 175, 145, 225 T1, T7, or T35

Selecting a plug that burns clean in your engine, and for your application, will take some experimentation. A plug that's too cold will foul up, and one that's too hot may misfire under load, burn very clean, and have a yellowish or glazed porcelain.

I recommend using anti-seize compound or other lubricant on Corvair plugs. Theoretically, there is a slight loss of heat transfer capability doing this, but that slight loss is far less of a danger than damaged threads. ⊕

FOREIGN SPARK PLUGS

by Tom Wright
Lone Star Corvair Club

The proper AC plugs for Corvairs seem to be harder to find every time I need plugs. Consequently, I have been using two foreign brands, NGK and Bosch. The interchanges according to the respective manufacturers is shown in the table.

AC #	Standard Bosch	Super Bosch	NGK	NGK Fine Wire
43 FFS	W8B	W8BC	BP6HS	
44 FF	W8A	W8AC	B6HS*	B6HV
44 FFS	W8B	W8BC	BP5HS	
45 FF	W8A	W8AC	B5HS*	
45 FFS	W8B	W8BC	BP5HS	
46 FF	W10A	—	B5HS*	
46 FFS	W10A	—	BP5HS	

* These plugs are not conversions from the NGK catalogue; they are my additions. I have successfully used these plugs.

In the Bosch plug designation scheme, "A" stands for the standard tip plug and "B" for the projected tip. The "W" series has a reach of 0.460", slightly less than 1/2 inch. The AC plugs are all 1/2" reach. The Super Bosch plugs have a copper core. Smaller Bosch numbers are colder.

The "P" in the NGK plug designation indicates a projected tip plug. The standard tip plug numbers omit the "P". The "B" series plugs have a reach of 12.7mm, exactly 1/2 inch. Standard NGK plugs are all copper core. The "V" series has a fine wire electrode of precious metal. The B6HV was the only cataloged fine wire plug with an appropriate heat range and reach. Smaller NGK numbers are hotter plugs.

Bosch's catalog also lists plugs W7A, W7B, W7AC, and W7BC. These plugs are colder and might be suitable for higher performance engines. As indicated by the "W", they are all 0.460" reach.

NGK lists plugs B8HN to B10HN as "racing" plugs. These plugs are colder than any in the conversion chart.

For what it's worth, mechanics I have talked to like the NGK plugs better than Bosch. They think the NGK plugs are less likely to strip out threads in aluminum heads.

Two other tidbits of information. Champion supposedly markets shims in 0.020" increments to adjust plug reach. The shims are not for installing the incorrect reach plugs in an engine, but to compensate for plug overhang into the combustion chamber due to variations in casting thickness.

According to Harry Pellow in his books on Porsches, in the late '50s Porsche did some testing to determine the

Troubleshooting

The following section aids the rapid diagnosis and solution of engine problems. A systematic format is used to diagnose problems ranging from engine starting difficulties to the need for overhaul. It is assumed that the reader is equipped with, or has access to basic tools and test equipment, and that he is familiar with the basic mechanics of the internal combustion engine.

The Troubleshooting Section is divided into two subsections. The first, General Diagnosis, determines the area in which the trouble may be located. This then refers the reader to the second section, Specific Diagnosis, where the problem is systematically evaluated.

I. GENERAL DIAGNOSIS

ENGINE WON'T START

Problem: Symptom	*Begin Diagnosis at Section II, Number (below)*
Starter doesn't turn	1.1, 2.1
Starter turns, engine doesn't	2.1
Starter turns engine very slowly	1.1, 2.4
Starter turns engine quickly	3.1, 4.1, 6.1
Engine fires intermittently	4.1
Engine fires consistently	5.1, 6.1

ENGINE RUNS POORLY

Problem: Symptom	*Begin Diagnosis at Section II, Number (below)*
Hard starting	3.1, 4.1, 5.1, 8.1
Rough idle	4.1, 5.1, 8.1
Stalling	3.1, 4.1, 5.1, 8.1
Engine dies at high speeds	4.1, 5.1
Hesitation (on acceleration from a standing stop)	5.1, 8.1
Poor pickup	4.1, 5.1, 8.1
Lack of power	3.1, 4.1, 5.1, 8.1
Backfire through the carburetor	4.1, 8.1, 9.1
Backfire through the exhaust	4.1, 8.1, 9.1
Blue exhaust gases	6.1, 7.1
Black exhaust gases	5.1
Running on (after the ignition is turned off)	3.1, 8.1
Susceptible to moisture	4.1
Engine misfires under load	4.1, 7.1, 9.1
Engine misfires at speed	4.1
Engine misfires at idle	3.1, 4.1, 5.1, 7.1

ENGINE NOISES[1]

Problem: Symptom	*Probable Cause*
Metallic grind while starting	Starter drive not engaging (see 2.1).
Constant grind or rumble*	Starter drive not releasing, worn main bearings.
Constant knock	Worn connecting rod bearings.
Knock under load	Fuel octane too low, worn connecting rod bearings.
Metallic tap (intermittent)*	Collapsed or sticky valve lifter (see 9.1).
Metallic tap (constant)*	Valve or valve lifter (see section 9), excessive end play in a rotating shaft.
Scrape*	Fan belt contacting a stationary surface.
Tick while starting	Starter brushes
Constant tick*	Generator brushes, shredded fan belt
Squeal*	Improperly tensioned fan belt.
Whistle*	Vacuum leak (see section 7).
Wheeze	Loose or cracked spark plug.

[1] It is extremely difficult to describe vehicle noises. While the above are intended as general descriptions of engine noises, those marked with a star (*) may possibly originate elsewhere in the vehicle. To aid diagnosis, the following list considers other potential sources of the above starred items.

Metallic grind:
- Throwout bearing
- Transmission gears, bearings, synchronizers
- Differential bearings, gears
- Something contacting brake drum or disc

Metallic tap:
- U-joints
- Fan to shroud contact

Scrape:
- Brake shoe or pad dragging
- Tire to body contact
- Suspension contact to undercarriage or exhaust system

Tick:
- Transmission gears
- Differential gears
- Radio (lack of supression)
- Vibration of body panels
- Windshield wiper motor and transmission
- Heater motor and blower

Squeal:
- Brakes
- Tires (improper inflation, excessive wear, uneven wear)
- Front end alignment (most commonly due to improperly set toe-in)

Hiss or whistle:
- Wind leaks (body and window)
- Heater motor and blower

Roar:
- Front wheel bearings
- Wind leaks (body and window)

II. SPECIFIC DIAGNOSIS

This section is arranged so that following each test, instructions are given to proceed to another test until the problem is solved.

INDEX

Section	Topic
1*	Battery
2*	Cranking System
3*	Primary Electrical System
4*	Secondary Electrical System
5*	Fuel System
6*	Engine Compression
7**	Engine Vacuum
8**	Secondary Electrical System
9**	Valve Train
10**	Exhaust System
11**	Cooling System
12**	Engine Lubrication

* - The engine need not be running.
** - The engine must be running.

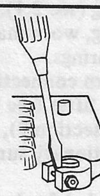
SAMPLE

The following Sample Section indicates by arrows how the Specific Diagnosis Section should be used. After checking for spark in the "Test and Procedure" column, results are analyzed in the "Results and Indications" column, and the reader proceeds to the numbered section in the "Proceed To" column. Example: If the spark is "good in some cases" you would proceed to Section 4.3 (Check the Distributor Cap and Rotor).

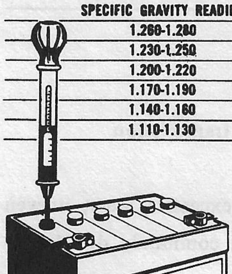
SAMPLE SECTION

	Test and Procedure	*Results and Indications*	*Proceed to*
X.X	Check for spark: Hold each spark plug wire approximately ¼″ from ground with gloves or a heavy, dry rag; observe the spark while cranking the engine:	If no spark is evident:	4.2
		If spark is good in some cases:	4.3
		If spark is good in all cases:	4.6

	Test and Procedure	*Results and Indications*	*Proceed to*
1.1	Check battery visually for case condition (cracks, corrosion) and water level:	If the case is cracked, replace battery.	1.4
		If the case is intact, remove corrosion with a baking soda and water solution and fill with water. (*Caution*: do not get solution into the battery)	1.2
1.2	Check battery cable connections: Insert a screwdriver blade between the battery terminal and cable connector; Turn the bright headlights on, and observe them as the screwdriver is gently twisted to ensure good metal to metal contact:	If the lights brighten, remove and clean the connector and post; coat the post with petroleum jelly, reattach and tighten the connector.	1.4
		If no improvement is noted:	1.3
1.3	Check the state of charge of the battery using an individual cell tester or hydrometer:	If indicated charge the battery. If no obvious reason exists for the lack of charge (i.e. battery age, prolonged storage) check the charging system.	1.4



SPECIFIC GRAVITY READING	CHARGED CONDITION
1.260-1.280	Fully Charged
1.230-1.250	Three Quarter Charged
1.200-1.220	One Half Charged
1.170-1.190	One Quarter Charged
1.140-1.160	Just About Flat
1.110-1.130	All The Way Down

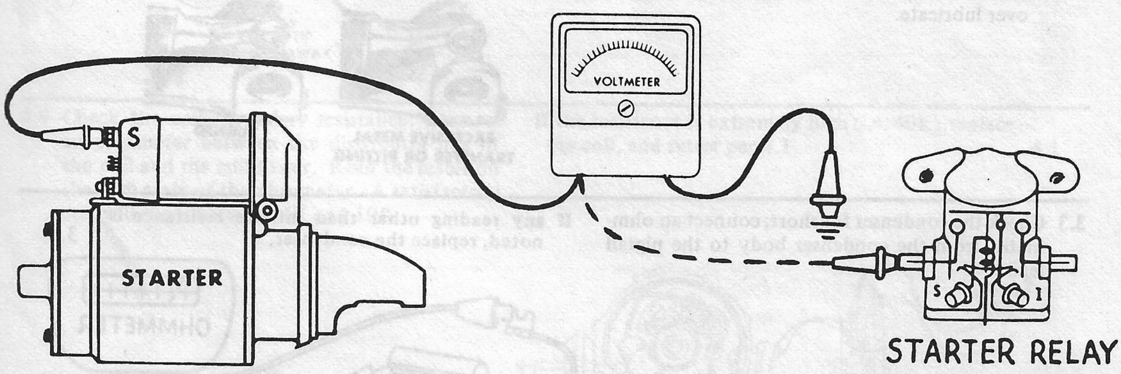


II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
1.4 Check the battery cables visually for cracking, bad connection to ground, or bad connection to the starter solenoid:	If necessary, tighten connections or replace cables.	2.1

The Following Tests, Section 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

Test and Procedure	*Results and Indications*	*Proceed to*
2.1 Check the starter motor and solenoid: Connect a jumper from the battery post of the solenoid (or relay) to the ignition post of the solenoid (or relay):	If the starter turns the engine well:	2.2
	If the starter buzzes, or turns the engine very slowly:	2.4
	If no response, replace the solenoid.	3.1
	If the starter turns, but the engine doesn't, check to ensure that the flywheel ring gear is intact; if the gear is good, replace the starter drive.	3.1
2.2 Check the neutral safety switch (where applicable); bypass the switch with a jumper: Note: This applies to all ignition and starter override switches.	If the starter turns, adjust or replace the switch.	3.1
	If the starter doesn't turn:	2.3
2.3 Check the ignition switch "start" position: Connect a voltmeter or a 12V test lamp between the starter post of the solenoid (or relay) and ground: turn the ignition switch to the "start" position, and jiggle the key:	If the lamp doesn't light when the key is turned, check the ignition switch for loose connections, cracked insulation, or broken wires. Repair if necessary.	3.1
	If the lamp flickers when the key is jiggled, replace the ignition switch.	3.2

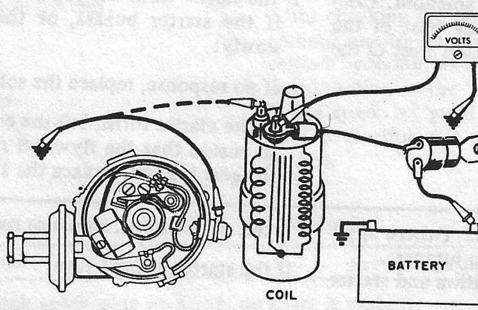


Test and Procedure	*Results and Indications*	*Proceed to*
2.4 Remove and bench test the starter according to specifications; see Chapter Five:	If the starter is not working properly, repair or replace as needed.	
	If the starter is operating properly:	2.5
2.5 Determine whether the engine can turn freely: Remove the spark plugs. Attempt to turn the engine by hand (18" flex drive and socket on crankshaft pulley nut or bolt):	If the engine will turn freely only with the spark plugs out, check valve timing	9.2
	If the engine will not turn freely, and it is known that the clutch and transmission are free, the engine must be removed and disassembled for further evaluation.	Chap. Three

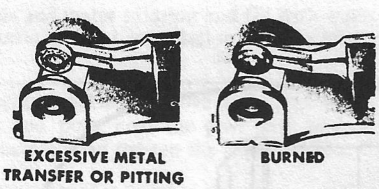
The Following Tests, Sections 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

II - SPECIFIC DIAGNOSIS—*continued*

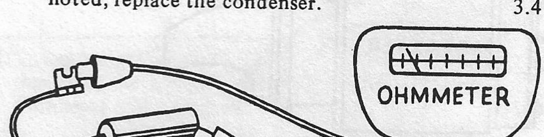
Test and Procedure	*Results and Indications*	*Proceed to*
3.1 Check the ignition switch "on" position: Connect a jumper wire from the distributor side of the coil to ground, and a voltmeter from the switch side of the coil to ground; turn the ignition switch on and jiggle the key:	If the meter reading is steady:	3.2
	If the meter reading fluctuates when the key is jiggled, replace the ignition switch.	3.2
	If no meter reading, check for loose connections. If none are found, remove the ignition switch and check for continuity. If faulty, replace; if good check the ballast resistor or resistance wire and replace if shorted or open.	3.2



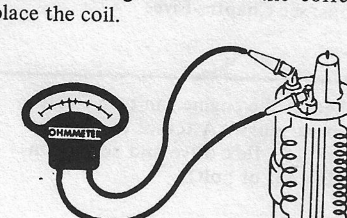
3.2 Check the breaker points; visually inspect the breaker points for pitting or excessive wear. (Note: Gray coloring of the point contact surfaces is normal.) Set point gap to specifications. *Caution*: Distributor cam lubrication is important to the proper operation of the breaker points. Follow manufacturer's recommendations for lubrication and never over lubricate.	If pitted or worn, replace the breaker points and condenser, and adjust the gap and dwell to specifications.	3.4
	If intact, adjust the gap and dwell to specifications.	3.4
	If the dwell meter shows little or no reading:	3.3



3.3 Check the condenser for short; connect an ohmmeter from the condenser body to the pigtail lead:	If any reading other than infinite resistance is noted, replace the condenser.	3.4



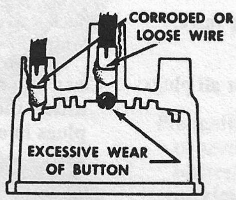
3.4 Check the coil primary circuit resistance; connect an ohmmeter across the coil primary terminals, and read the resistance on the low scale. Coils requiring external ballast resistors should read approximately 1.0 ohm; coils not requiring external ballast resistors should read approximately 4.0 ohms.	If the coil reading is not near the correct figure, replace the coil.	4.1

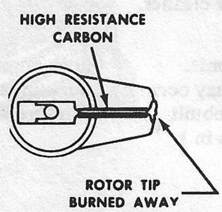


The Following Tests, Sections 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

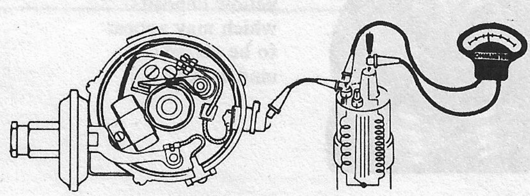
II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
4.1 Check for spark: Hold each spark plug wire approximately ¼″ from ground with gloves or a heavy, dry rag; observe the spark while cranking the engine:	If no spark is evident: If spark is good in some cases: If spark is good in all cases:	4.2 4.3 4.6
4.2 Check for spark at the coil high tension lead: Remove the coil high tension lead from the distributor cap and hold it ¼″ from ground with gloves or a heavy dry rag; crank the engine and observe the spark:	If the spark is good: If the spark is weak or non-existent, replace the coil high tension lead with an identical one, clean and tighten all connections and retest. If no improvement is noted, the coil must be tested per 3.4 and 4.4.	4.6 4.4
4.3 Check the distributor cap and rotor; visually inspect the cap and rotor for burned contacts, cracks, carbon tracks, or moisture:	If moisture is present, dry and retest per 4.1. If burned contacts, cracks or carbon tracks are noted, replace the defective part(s) and retest per 4.1. If the rotor and cap appear to be intact, thoroughly clean the distributor cap tower sockets and spark plug wire ends. Retest each lead per 4.1: If the spark is good in all cases: If the spark is not good in all cases:	 4.6 4.5





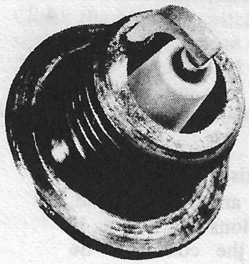
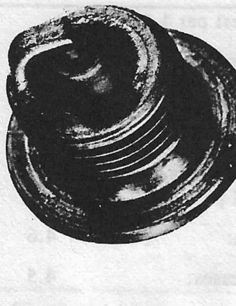
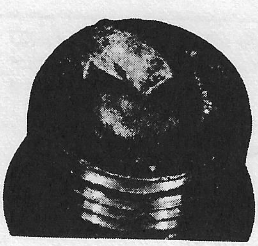
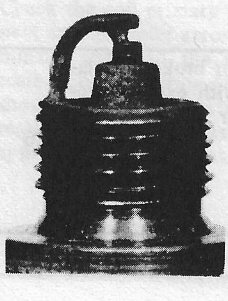
Test and Procedure	*Results and Indications*	*Proceed to*
4.4 Check the coil secondary resistance: Connect an ohmmeter between the distributor side of the coil and the coil tower. Read the result on the high scale of the ohmmeter. A satisfactory coil will show between 4K and 10K.	If the resistance is extremely high (i.e. 40K), replace the coil, and retest per 4.1.	4.1



Test and Procedure	*Results and Indications*	*Proceed to*
4.5 Check the spark plug wires: Remove the spark plug wires one by one, and test the resistance across the wire with an ohmmeter. The resistance of steel or copper core wire is very low, while the resistance of carbon or silicon suppression wire is approximately 4,000 ohms per foot.	Replace any wires with cracked or broken insulation. Also replace any wires with excessive resistance (over 8,000 ohms per foot for suppression wire).	4.6
4.6 Check the spark plugs; see Fig. 38 to 45.		

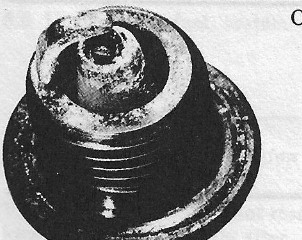
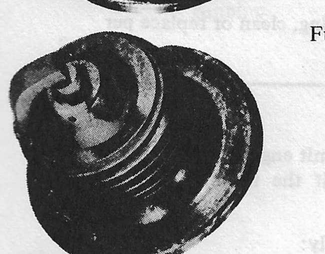
The Following Tests, Sections 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

II - SPECIFIC DIAGNOSIS—*continued*

Trouble	*Cause*	*Remedy*	*Proceed to*
 Erosion of the electrodes, light brown deposits on the insulator.	Normal wear. Normal wear is indicated by approx. .001" wear per 1,000 miles driving.	Replace the spark plugs.	4.6
 Carbon fouling (black, dry, fluffy deposits).	If present in one or two plugs only:		
	Faulty high tension leads.	Check high tension leads.	4.5
	Burnt or sticking valve.	Check valve train.	9.1
	If present on most or all plugs:	Clean and recondition the spark plugs in either case.	
	Overly rich fuel mixture, improper choke or heat riser, restricted air cleaner.	Check the fuel system.	5.1
 Oil fouling (wet, black deposits).	Worn engine components. (*Note*: Oil fouling may occur in new or recently rebuilt engines until broken in.)	Check engine vacuum and compression.	6.1
 Lead fouling (Dark gray, black, tan or yellow deposits which may appear to be glazed or cinder-like.)	Fuel combustion by-products.	Recondition the spark plugs. If the problem recurs a heat range change is in order.	
 Gap bridging (Deposits lodged between electrodes.)	Incomplete combustion or transfer of deposits from the combustion chamber.	Recondition or replace spark plugs.	

The Following Tests, Sections 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

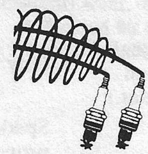
II - SPECIFIC DIAGNOSIS—*continued*

	Trouble	*Cause*	*Remedy*	*Proceed to*
	Overheating (Extremely white insulator with small black spots, and burnt electrodes.)	Ignition timing advanced too far.	Adjust timing to specifications.	4.6, 8.2
		Overly lean fuel mixture.	Check fuel system.	5.1
		Spark plugs not seated properly.	Clean spark plug seats.	
	Fused spot deposits on the insulator.	Blow-by from the combustion chamber.	Recondition or replace spark plugs.	
	Pre-ignition (Melted or severely burned, blistered insulators, or metallic deposits on the insulator.)	Incorrect spark plug heat range.	Replace with plug of proper heat range.	
		Ignition timing advanced too far.	Adjust timing to specifications.	4.6, 8.2
		Spark plugs not being cooled efficiently.	Check cooling system.	11.1
		Mixture too lean.	Check fuel system.	5.1
		Burned valve causing poor compression.	Check compression.	6.1
		Spark plugs not seated properly.	Clean spark plug seats.	
		Fuel grade too low.	Use higher octane rating fuel.	

Test and procedure	*Results and Indications*	*Proceed to*
4.7 Check static engine timing: Locate top dead center of the number 1 cylinder compression stroke (the timing mark may be used as a guide, but ensure that the cylinder is on its compression stroke): Adjust the distributor so that the rotor points toward the number 1 tower in the cap, and that the points are just opening.		4.8
4.8 Check coil polarity: Connect a voltmeter negative lead to the coil secondary lead, and the positive lead to ground (this procedure is for negative ground cars; reverse for positive ground). Crank the engine momentarily: 	If the voltmeter reads up-scale, the polarity is correct.	4.9
	If the voltmeter reads down-scale, the polarity is incorrect, and the coil leads must be reversed.	4.9

The Following Tests, Sections 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
4.9 Check to ensure that the spark plug wires are not causing crossfiring by induction: See that no two spark plug leads are very close to one another and parallel. Try to avoid crossing wires over one another.		5.1
5.1 Check to determine that the air cleaner is functioning properly; use an air filter tester, or hold it up to the light and try to see light through the filter material:	If the filter is functioning:	5.2
	If the filter is not functioning, clean or replace per specifications.	5.2
5.2 Determine whether a flooding condition exists; flooding may most easily be identified by a strong gasoline odor, and presence of excessive liquid in the bore(s) of the carburetor(s):	If flooding is not present:	5.3
	If flooding is present, permit engine to dry (a few minutes), and restart. If the flooding doesn't recur:	5.3
	If flooding recurs persistently:	5.5
5.3 Determine that fuel is reaching the carburetor: Detatch the fuel line at the carburetor inlet; hold this line over a cup while cranking the engine:	If fuel flows smoothly:	5.6
	If fuel doesn't flow (be sure that there is fuel in the tank) or flows erratically:	5.4
5.4 Check the fuel pump and fuel lines: Remove the fuel line from the input side of the fuel pump; hold finger over the input hole, crank the engine (with electric pump, turn the ignition on), and feel for vacuum: *Note*: A no start condition could also be the result of a ruptured vacuum booster pump diaphragm (where applicable). This is caused by the vacuum from the pump drawing oil through the ruptured diaphragm, and pumping it to the intake manifold; thus, oil fouling of the spark plugs may result.	If vacuum is present, blow out the fuel line to the gas tank with low pressure compressed air, until bubbling is heard from the filler neck. Also blow out the line from the pump to the carburetor (both ends disconnected).	5.5
	If no vacuum is present, repair or replace the fuel pump.	5.5
5.5 Check the needle and seat; tap the carburetor in the area of the needle and seat:	If the flooding stops, a suitable gasoline additive will often alleviate the problem.	5.6
	If flooding continues, the fuel pump should be checked for excessive pressure at the carburetor (according to specifications). If the pressure is normal, the needle and seat must be removed and checked, and/or the float level adjusted.	5.6
5.6 Determine whether the accelerator pump is working; observe the operation of the accelerator pump by looking into the carburetor while operating the throttle:	If accelerator pump operates normally:	5.7
	If the accelerator pump is not operating the carburetor must be removed and reconditioned. Prior to removal:	5.7
5.7 Determine whether carburetor main fuel system is operating: Spray any good commercial starting bomb into carburetor while attempting to start engine; engine should start and run for a few seconds:	If the engine starts and dies quickly:	5.8
	If the engine doesn't start:	6.1

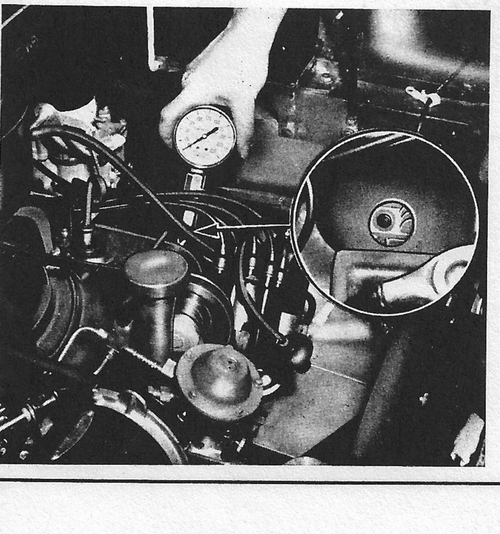
The Following Tests, Sections 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
5.8 Uncommon fuel system malfunctions: See below.	If the problem is solved:	6.1
	If the problem remains, remove and recondition the carburetor.	

Condition	*Indication*	*Test*	*Usual Weather Conditions*	*Remedy*
Vapor lock	Car will not restart shortly after running	Pour cool water over the components of the fuel system one by one, until the engine restarts.	Hot to very hot.	Once the location of the problem is established, correct as follows: Carburetor: Install spacer plate between carburetor and manifold. Check exhaust manifold heat control valve (10.1). Fuel lines: Move from the source of heat or replace with neoprene. Fuel pump: Install a vapor lock preventing device in the fuel line.
Carburetor icing	Car will not idle, stalls at low speeds.	Visually inspect the throttle plate area for frost.	High humidity, around 32° F.	Ensure that the exhaust manifold heat control valve is functioning (10.1), and that the intake manifold heat riser is not blocked.
Water in the fuel	Car sputters while running, may not start.	Pump a small amount of fuel into a glass container. Inspect the fuel for water droplets, a settled layer of water.	High humidity, extreme temp. change.	For droplets, use one or two cans of commercial gas dryer. For a layer of water, the tank must be drained, and the fuel lines blown out with compressed air.

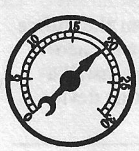
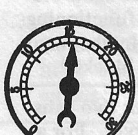
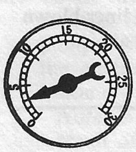
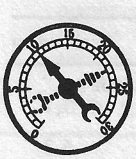
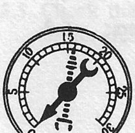
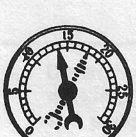
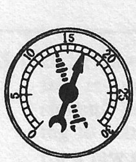
Test and Procedure	*Results and Indications*	*Proceed to*
6.1 Check engine compression: Remove all spark plugs; insert the compression gauge into a spark plug hole, and crank the engine approximately four revolutions:	The readings are within specifications on all cylinders:	7.1
	The gauge reading is low on all cylinders:	6.2
	The gauge reading is low on one or two cylinders:	6.2



The Following Tests, Sections 2 Through 6 Inclusive, Are Performed With the Coil High Tension Lead Removed, to Prevent Starting.

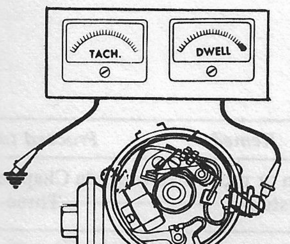
II - SPECIFIC DIAGNOSIS–*continued*

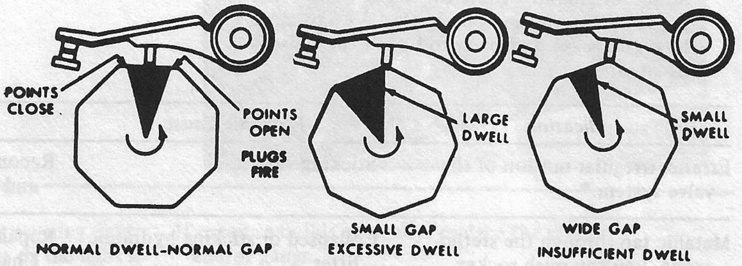
Test and Procedure	*Results and Indications*	*Proceed to*
6.2 Check engine compression (wet): Squirt approx. 30 cc. of 30 weight engine oil into the offending cylinders; test per 6.1.	If the readings improve, worn or cracked rings or broken pistons are indicated:	Chapter Three
	If the readings do not improve, burned or carboned valves or worn timing gear are indicated. *Note*: A worn timing gear is often indicated by difficult cranking.	9.1
7.1 Perform a vacuum check of the engine: Attach a vacuum gauge to the intake manifold below the carburetor, and observe the action of the needle.	See below	See below

Type of Reading	*Probable Cause*	*Proceed to*
 Steady, from 17-21 in. Hg. (normal)		8.1
 Low and steady.	Ignition or valve timing, low compression.	6.1
 Very low.	Vacuum leak.	7.2
 Needle fluctuates as engine speed increases.	Ignition miss, cylinder head gasket, leaking valve spring.	6.1
 Gradual drop in reading at idle.	Excessive back pressure in the exhaust system.	10.1
 Intermittent fluctuation.	Ignition miss, sticking valve.	8.3, 9.1
 Drifting needle.	Improper idle mixture adjustment, or minor intake leak. Adjust the carburetor and retest. If the condition persists:	7.2

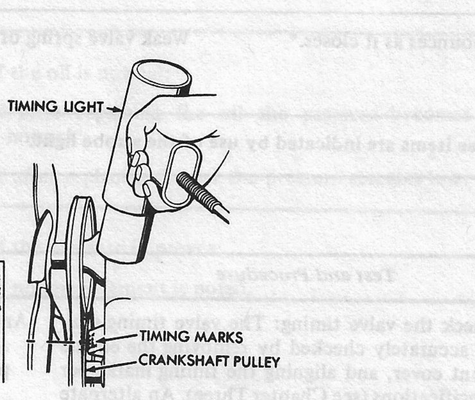
II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
7.2 Check for intake manifold vacuum leaks: Attach a vacuum gauge per 7.1, and squirt a small amount of oil around the intake manifold gaskets, carburetor gaskets, and vacuum ports; observe the action of the vacuum gauge:	If the reading increases, replace the offending gasket or seal. If the reading remains low:	8.1 7.3
7.3 Test all vacuum hoses and vacuum accessories (windshield wipers, power assist brakes, etc.) per 7.2. Also check the carburetor body (throttle shafts, dashpots, automatic choke mechanism) for vacuum leaks:	If the reading improves, replace the offending part(s). If the reading remains low:	8.1 6.1
8.1 Check the breaker point dwell: Connect a dwell meter to the distributor side of the coil and ground; observe the meter reading:	If necessary adjust the point gap. *Note*: The larger the gap, the smaller the dwell, the smaller the gap the larger the dwell.	8.2





8.2 Check dynamic engine timing: Connect a timing light (per manufacturer's recommendation) and disconnect and plug the vacuum advance if specified; start the engine and observe the timing marks at the specified engine rpm:	If the timing is not correct, adjust to specifications by turning the distributor.	8.3



8.3 Check the distributor advance mechanism: Determine the type of advance mechanism utilized. If a compound system (mechanical-vacuum) is used, disconnect all but the mechanical (or vacuum, if vacuum only) and observe the timing mark as engine speed is increased from idle. If the mark moves smoothly, it may be assumed that the basic advance system is functioning properly. To test the secondary advance system (vacuum), alternately crimp and release the distributor vacuum line, and observe the timing mark for movement; If movement is noted, the system is operating:	If the systems are functioning: If the systems are not operating properly, remove the distributor and test on a distributor tester.	8.4 8.4

II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
8.4 Locate an ignition miss (where applicable): With the engine running, remove each plug wire, one by one, until one is found that doesn't cause the engine to roughen and slow down:	When the missing cylinder is identified:	4.1
9.1 Evaluate the valve train: Remove the valve cover and ensure that the valves are adjusted to specifications. Attach a timing light in the standard manner (to the specified cylinder) and observe the valves of that cylinder. Continue to attach the timing light to each cylinder and observe the valves until the problem or problems are located. A mechanic's stethoscope is also helpful in diagnosing engine noises originating from the valve train. The probe of the stethoscope is placed on or close to each rocker and push rod until the noise is isolated:	See below	See below

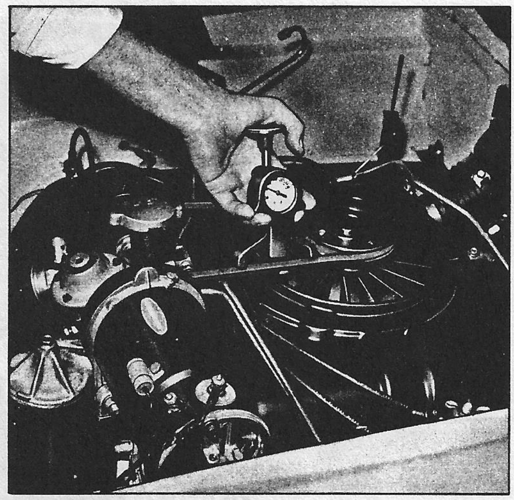
Indication	*Probable Cause*	*Remedy*	*Proceed to*
Erratic, irregular motion of the valve system.*	Sticking valve.	Recondition or replace valve guide and valve stem.	Chapter Three
Metallic tap through the stethoscope, you can push rocker arm (pushrod side) down by hand.	Collapsed or sticking hydraulic lifter.	Repair or replace the lifter. (See Chapter Three for method)	10.1
Eccentric motion of the push rod at the rocker arm.*	Bent push rod.	Replace the push rod.	10.1
Valve bounces as it closes.*	Weak valve spring or damper.	Remove and compare valve spring to specifications. Replace where necessary.	10.1

* - These items are indicated by use of the strobe light.

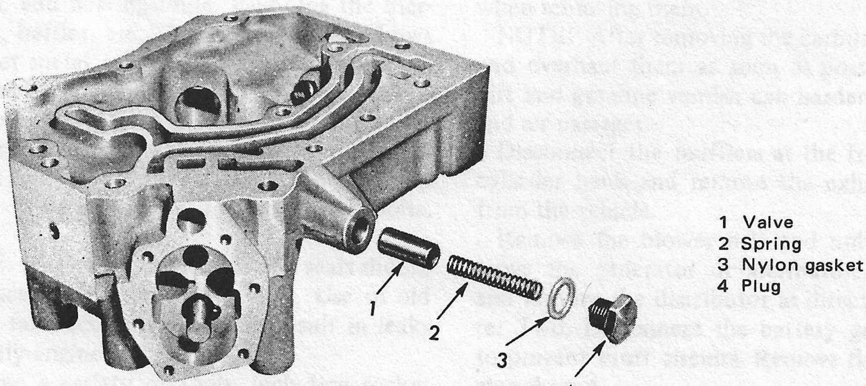
Test and Procedure	*Results and Indications*	*Proceed to*
9.2 Check the valve timing: The valve timing may be accurately checked by removing the engine front cover, and aligning the timing marks per specifications (see Chapter Three). An alternate method is the use of a degree wheel mounted on the crankshaft, compared to the intake valve opening (per specifications):	Any inaccuracies in valve timing should be corrected, and their causes (worn timing gear, excessive end play) eliminated.	10.1
10.1 Determine that there are no exhaust restrictions: Visually inspect the exhaust system for kinks or bends; any severely affected portion of the system should be replaced. Also note that gases are flowing freely from the tailpipe (place a hand immediately behind the tailpipe end and feel the flow of gases) indicating no restriction in the muffler or resonator:	Replace any portion of the system that will cause excessive back pressure in the exhaust system.	

II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
11.1 Inspect the blower belt for tightness and wear: Visually inspect the blower belt for cracks and fraying. Tighten so that the longest span of the blower belt has approximately ½″ play at its midpoint:	Replace and/or tighten the blower belt where necessary.	

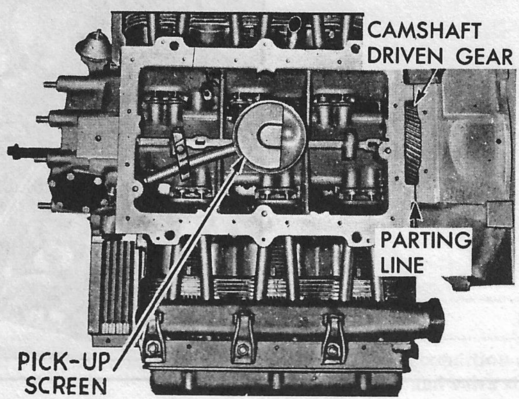


Test and Procedure	*Results and Indications*	*Proceed to*
12.1 Check the oil pressure gauge or warning light: If the gauge shows low pressure or the light is on, stop the engine and remove the oil pressure sender; install an accurate oil pressure gauge and run the engine momentarily: Note: If excessive oil consumption, knock and/or rumble or other signs of severe engine wear exist, proceed to Chapter Three.	If pressure builds normally, replace the sender and/or gauge.	
	If the pressure remains constantly low:	12.2
	If the pressure surges low to high:	12.3
12.2 Check the oil viscosity: Visually inspect the engine oil to determine that the viscosity is adequate (note that the oil is not watery or overly thin); if any indication of low viscosity is present, replace the oil and oil filter.	If the oil is normal:	12.3
	If after replacing the oil the pressure becomes normal.	
	If after replacing the oil the pressure remains low:	12.3
12.3 Check the oil pressure relief valve and spring: Inspect the valve to insure that it is not stuck; in all cases, remove and thoroughly clean the valve and spring:	If the pressure improves:	
	If no improvement is noted:	12.4



II - SPECIFIC DIAGNOSIS—*continued*

Test and Procedure	*Results and Indications*	*Proceed to*
12.4 Check to ensure that the oil pump is not cavitating (pumping air): Check that the crankcase is neither over nor underfull, and that the pickup screen in the sump is clear and free of sludge; fill or drain the crankcase to the proper capacity, and clean the pickup screen in a suitable solvent if necessary:	If no improvement is noted:	Chapter Three



12.5 Completely drain the crankcase and remove the oil filter; following this, refill the crankcase with the proper weight oil and install a new oil filter.		

FINDING THE RIGHT DISTRIBUTOR

by Gary Jarvis, Tucson Corvair Association
Larry Claypool, Chicagoland Corvair Enthusiasts

A distributor is pretty reliable; in fact, most of them will outlast several engines. Because of this, many units have parted company with one engine to find a new home with another. The most popular swap of this type is the 65-66 140hp distributor used for high-performance applications. The problem is that this distributor will not always be the best choice, and if installed without following certain guidelines, it will actually hurt performance.

The problem of swapping distributors is compounded by the fact that 15 or more different models were used on Corvairs. While they look about identical from the outside, the advance characteristics are entirely different, and some disastrous combinations can result.

Two basic types of distributors were used on Corvair engines. In 1960 and 1961 a General Motors model was used, and it had the mechanical advance located under the distributor cap itself. While the advance mechanism is easier to service on this model, this distributor is the second choice for reliability and performance. It can be quickly identified visually by the longer looking distributor cap and the apparent lack of distributor body. Chevy no longer produces this model and advises replacement with the 62-69, which is a Delco-Remy design.

The Delco-Remy model has the advance mechanism located under the point breaker plate, and is easily identified visually by the short distributor cap and large distributor body. Identifying the many variants of this model is simplified by the Chevy part number stamped on the housing. A list of distributor specifications is attached, and is extremely helpful in identifying the various 62-69 models. By working with these numbers and by knowing the engine you plan to use, it is possible to pick the distributor best suited to your needs.

Let's look closer at how to use the distributor specifications to aid in the selection of a certain model. The two important numbers are the initial timing and the full centrifugal advance in degrees. The initial timing is set by using a timing light and rotating the distributor itself to the starting point for the distributor's added centrifugal advance. The theory in use here is that as the engine speeds up, the spark plug must provide the spark sooner for maximum mechanical power to result. The springs and weights that make up the distributor's mechanical advance unit automatically advance the timing as the engine speeds up. From these two pieces of information, total

Corvair Distributor Specifications

Year	*Model*	*Part #*	*Suggested Initial Timing*	*Centrifugal Advance Starts*	*Maximum Degrees of Centrifical Advance*
1962	80 hp std	110269	4°	0-2°/1200rpm	34°/3600rpm
	80 hp auto	110271	13°	0-4°/1600	26°/3700
	84 hp all	110272	13°	0-4°/850	26°/4800
	102 hp auto	110278	13°	0-4°/1850	22°/4100
	150 hp turbo	110290	24°	0-2°/3900	12°/4500
1963	80 hp std	110294	4°	0-2°/600rpm	32°/3600rpm
	80 hp auto	110295	13°	0-2°/1400	24°/3700
	84 hp auto	110296	13°	0-2°/700	24°/4800
	102 hp all	110297	13°	0-2°/1600	20°/4100
	150 hp turbo	110298	24°	0-2°/3900	12°/4500
1964-67	150 hp std	110314	24°	2°/4000	12°/4500
	95 hp std	110310	6°	2°/900rpm	28°/4200rpm
	95 hp auto	110311	14°	2°/1950	20°/4200
	110 hp all	110319	14°	2°/1000	20°/4800
	140 hp std	110330	18°	2°/1000rpm	18°/2800rpm
	180 hp turbo	110329	24°	2°/4100	18°/4500
1967	95 hp AIR*	110369	0°	0°/900rpm	40°/4400rpm
	110 hp AIR*	110389	4°	0°/900	26°/4400
1968	95 hp std	110434	6°	0°/900rpm	28°/4200rpm
	95 hp auto	110311	14°	0°/1700	20°/4200
	110 hp std	110389	4°	0°/900	26°/4400
	110 hp auto	110319	12°	0°/800	20°/4800
	140 hp all	110371	4°	0°/900	32°/3000
1969	95 hp std	110452	6°	0°/900rpm	28°/4200rpm
	95 hp auto	110453	14°	0°/1700	20°/4200
	110 hp std	110454	4°	0°/900	26°/4400
	110 hp auto	110455	12°	0°/800	20°/4800
	140 hp all	110454	4°	0°/900	26°/4400

* "AIR" means smog pump-equipped, NOT air-conditioned

advance can be established: initial timing + full centrifugal advance = total advance. A general rule of thumb for Corvair engines is to keep total advance around 34-36 degrees. Some engines will ping at this point, while others will tolerate up to 40 degrees. But 34-36 degrees is a good starting point for experimentation with your engine.

Here are some sample combinations, some that are possible and some that are disastrous. The best solution is to modify a distributor that you have on hand to the specs your engine calls for; it's simple to do, inexpensive, and uses stock Chevy parts that are still available.

POSSIBLE DISTRIBUTOR-ENGINE COMBINATIONS, AND THEIR RESULTS - -

1. 1965 110hp engine, switched from Powerglide to 4-speed:

   No change in timing.

2. 1969 140hp engine, with a 1965 140 distributor:

   Initial timing spec for the engine is 4 degrees; the distributor provides 18 degrees advance, for a total of 22 degrees. This is too little, and will result in poor power and poor economy.

3. 1963 150hp turbo, with a 1963 80hp distributor:

   Initial timing spec for the engine is 24 degrees; the distributor provides 32 degrees advance, for a total of 56 degrees. This is, obviously, far too much total advance for a turbo engine, and would result in a destroyed engine.

4. 1965 110hp engine, with a 1965 turbo distributor:

   In this case, the distributor's advance occurs at 4100 rpm, which is about 3000 rpm too high to be useful in a 110hp engine.

5. 1969 110hp Powerglide, with a 1969 110 standard distributor:

   The engine's initial timing spec is 12 degrees: The distributor provides 26 degrees of advance, for a total of 38 degrees. This may cause pinging in an A.I.R. engine such as the '69.

6. 1965 140hp engine, with 1965 110 distributor:

   This combination will work, but it may cause pinging, with a total advance of 38 degrees. A decrease in the initial timing of 3 degrees or so may be necessary. Also, the 140hp distributor achieves full advance by 2800 rpm, while the 110hp model takes until 4800 rpm to reach full advance. This can hurt overall performance.

As you can see, merely setting the timing based upon the specs for the engine could cause problems where a different distributor has been installed. Always check the distributor number to see if it is correct for your application. Timing must always be set based upon distributor specs, not engine specs, due to actual amount of advance your distributor provides. All you need is some chalk, a tachometer, and a timing light.

Turn the crankshaft pulley until the original timing mark is at 16 degrees. Make a chalk mark on the pulley at 0 degrees, 4 degrees, 8 degrees, and 12 degrees. Then move the pulley so the mark you made at 0 degrees is at 16. Make another set of marks again at 0, 4, 8, and 12. Move the pulley once more until the mark you added at 0 is at 16. Make two more chalk marks at 8 degrees and 12 degrees. You now have a scale that reads to 40 degrees, in 4 degree increments.

Disconnect the vacuum advance hose, start the engine, and set the initial timing at zero. Then speed up the engine, and observe the amount of advance available and at what rpm it occurs. Compare this with the specification for your particular distributor.

You can lower the rpm at which full advance occurs by using lighter weight springs; or raise it, by using heavier ones.

The total amount of centrifugal advance can be reduced by installing a bushing on the pin that comes out of the bottom of the point cam. This in effect makes it bigger, thus it has less travel within its opening. You can increase the amount of total centrifugal advance by lengthening the hole the point cam lower pin moves within. Thus, the point cam moves further before it bottoms out.

When selecting or modifying a distributor, keep these general thoughts in mind:

Perform all initial tests with the vacuum advance hose off. Since this device also advances timing, you will not be able to differentiate between pinging caused by the vacuum advance or centrifugal advance. Once satisfactory centrifugal and initial advance has been established, then connect the vacuum advance. If pinging occurs only when it is operating, limit the travel of the vacuum advance arm or breaker plate until ping is eliminated.

Keep initial advance as high as possible without pinging, but do not exceed 38 total degrees, nor less than 34 total degrees.

Most unmodified hi-compression engines will ping on regular grade 89 octane gasoline when initial timing is set above 10 degrees. 140hp and 145 cid engines are slightly more tolerant.

Remember, no two cars or driving conditions are alike--experimentation will be necessary to find the best combination for your particular needs.

BASIC IGNITION EXPLAINED

by Bill Reider
Corvairs of New Mexico

There are two circuits in the ignition, the primary and the secondary. The primary is the battery voltage that goes from the ignition key to the positive side of the coil. The secondary is the high voltage that comes out of the center of the coil and goes to the center post of the distributor cap and from there to the spark plugs. Now I'll bet you're wondering how the coil gets charged up and sends the high voltage to the plugs. Well, it's not that hard to understand what happens in your ignition system.

While the points are closed, battery current flows into the coil and charges it up with a magnetic field. When the points open, the current stops, the magnetic field collapses, and a high voltage current is discharged through the center of the coil to the rotor in the distributor, that in turn sends it to whatever spark plug that the rotor is pointing to.

So much for how the spark gets to the plugs, let's go back just a little so we understand what the points and coil are doing, or how they are working together. In the primary circuit the electric current starts out at the battery at 12 volts and goes through the ignition switch to a 1.8 ohm resistor wire that drops it to 4-1/2 to 6-1/2 volts going into the coil. It then goes through the coil, to the points, and then to ground. Now, how does the coil build all that voltage? The coil is nothing but a transformer that takes in energy at a low voltage and boosts it to a high voltage.

The nice thing about a coil is that if a plug needs 15,000 volts to fire, that is what it will put out. Normally at idle a plug will only take 4,000 or 5,000 volts to fire if your ignition system is in good shape. A good coil will put out 25,000 to 30,000 volts and a high performance coil will put out about 40,000 volts. Today's high energy coils put out over 60,000 volts, that is why they have gone to the larger 8 mm wire. Otherwise the voltage would go right through the insulation. If you have dirty plugs, bad wire insulation, a bad rotor or a bad distributor cap, it could take up to 25,000 volts or more to fire your plugs at idle and when you accelerate your car will miss like crazy because more voltage is needed to jump the gap. The more pressure that the firing point of the plug is under, the higher the voltage that is needed to fire it.

Now if everything is in good order, you would probably only need 15,000 volts to fire the plugs on acceleration. This is the reason that all of your electrical system should be in good shape. I have seen many Corvairs come in the shop with original wires still in the car. When you measure the resistance of these old wires you usually get a very high reading, that means it will take an abnormally high voltage to fire the plugs. If you have an ohmmeter, you can measure the resistance of your own ignition wires. No wire should read over 20,000 ohms. If any are higher than this you could have trouble firing your plugs. When replacing your wires, I suggest "mag" wires.

When you replace those old wires, you have a choice of at least four types that I know of. They are "mag" wire, solid (or stranded) copper wire, carbon core wire, and a solid metal wire with a resistor at one end of the wire. The "mag" wire is a small-diameter wire wrapped around a fiberglass core. It has a resistance of about 1000 ohms per foot. It is a good ignition wire for minimizing radio noise. The solid or stranded copper wire has very low resistance, so it transmits electric current well, but it also gives you problems with noise in your (or your neighbor's) radio. The original equipment carbon core wire usually has a higher resistance than the "mag" core wire, around 2000 or so ohms per foot. Electric current is actually conducted by carbon particles impregnated in a fabric core, and the resistance will go up over time or with the amount of handling or flexing it gets. The fourth type, a solid wire with a resistor, is good, but you have a lot of trouble trying to get the Corvair spark plug boot over the resistor because it is so thick. Otherwise this is the best of both worlds. These solid wires with resistors are made by Whitaker and have a "life time" guarantee.

I still prefer "mag" wires for the Corvair because you can put the Corvair plug boot on with no trouble, and you have a wire that stands up well under use. ⏀

VEGA DISTRIBUTOR PARTS

by Stuart Pam
Corvanatics

Great as the Vega's troubles were, the distributor, which is similar to the Corvair's, offers several design features we may find desirable. Use 1971 thru 1974 Chevy Vega distributor internal components. The advantages are: Point plate has brass brushing in pivot pin hole, pivot pin is 3/32" longer, the spring has one additional coil, and the stationary plate and point plate have a flat stabilizer spring near the protruding tang of the vacuum advance connector pin.

GM #1846456 is the part number costing $11.94, slightly higher than Corvair #1961428. My recommendation is to locate a used complete distributor. The old ones I pick up in my travels have all been very, very serviceable. Additional advantages are: Fly weights and springs permit slower advancing, weight cover provides additional support, vacuum advance (#428) fits and permits slower advancing, and shaft seal and thrust washer reduce end play and oil seepage around distributor housing top bushing.

Specifications for a partial list of distributors are:

Model No.	Centrifugal Advance (Crank Degrees @ Engine RPM)	Vacuum Advance (In Crank Degrees)
1110492	0° @ 1185 2° @ 4000 24° @ 4000	0° @ 7" Hg. 24° @ 15" Hg.
1110435	0° @ 945 2° @ 1455 22° @ 4000	Same as above

The Vega weights and springs, which advance slower, would be beneficial to Corvair owners who are experiencing engine ping. The improved breaker plate helps keep dwell constant. ⏀

engine.

5. 1969 110 HP Powerglide, with a .1969 110 standard distributor:

   The engine's initial timing spec is 12 degrees: The distributor provides 26 degrees of advance, for a total of 38 degrees. This may cause pinging in an A.I.R. engine such as the '69.

6. 1965 140 HP engine, with 1965 110 distributor:

   This combination will work, but it may cause pinging, with a total advance of 38 degrees. A decrease in the initial timing of 3 degrees or so may be necessary. Also, the 140 HP distributor achieves full advance by 2,800 RPM, while the 110 HP model takes until 4,800 RPM to reach full advance. This can hurt overall performance.

As you can see, merely setting the timing based upon the specs for the engine could cause problems where a different distributor has been installed. Always check the distributor number to see if it is correct for your application. Timing must always be set based upon distributor specs, not engine specs, due to actual amount of advance your distributor provides. All you need is some chalk, a tachometer, and a timing light.

Turn the crankshaft pulley until the original timing mark is at 16 degrees. Make a chalk mark on the pulley at 0 degrees, 4 degrees, 8 degrees, and 12 degrees. Then move the pulley so the mark you made at 0 degrees is at 16. Make another set of marks again at 0, 4, 8, and 12. Move the pulley once more until the mark you added at 0 is at 16. Make two more chalk marks at 8 degrees and 12 degrees. You now have a scale that reads to 40 degrees, in 4 degree increments.

Disconnect the vacuum advance hose, start the engine, and set the initial timing at zero. Then speed up the engine, and observe the amount of advance available and at what RPM it occurs. Compare this with the specification for your particular distributor.

You can lower the RPM at which full advance occurs by using lighter weight springs; or raise it, by using heavier ones.

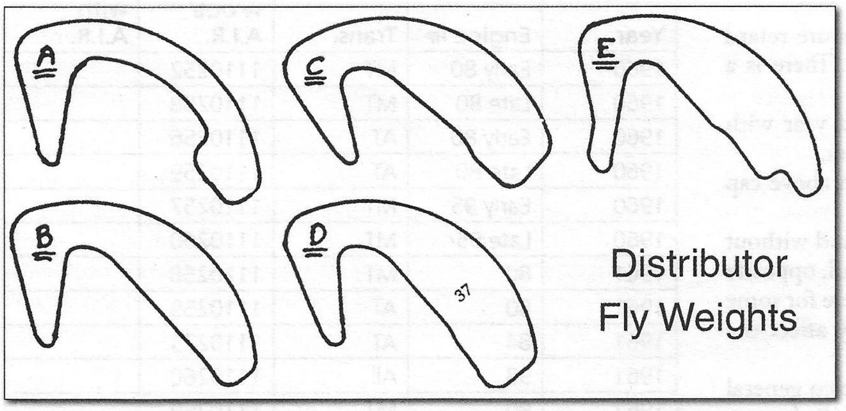
1962 84hp Automatic DIST: # 1110278

1961 84HP DIST. # 1110275 AUTOMATIC

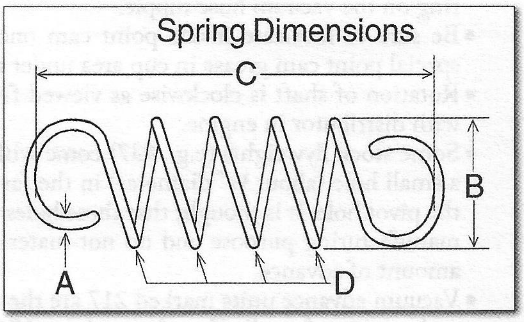
Corvair Distributor Specifications

Year	Model	Part #	Suggested Initial Timing	Centrifugal Advance Starts	Maximum Degrees of Centrifugal Advance
1962	80 HP std	1110269	4°	0-2°/1200RPM	34°/3600RPM
	80 HP auto	1110271	13°	0-4°/1600	26°/3700
	84 HP all & 102hp	1110272	13°	0-4°/850	26°/4800
	102 HP auto	1110278	13°	0-4°/1850	22°/4100
	150 HP turbo	1110290	24°	0-2°/3900	12°/4500
1963	80 HP std	1110294	4°	0-2°/600	32°/3600
	80 HP auto	1110295	13°	0-2°/1400	24°/3700
	84 HP auto	1110296	13°	0-2°/700	24°/4800
	102 HP all	1110297	13°	0-2°/1600	20°/4100
	150 HP turbo	1110298	24°	0-2°/3900	12°/4500
1964-67	150 HP std	1110314	24°	2°/4000	12°/4500
	95 HP std	1110310	6°	2°/900	28°/4200
	95 HP auto	1110311	14°	2°/1950	20°/4200
	110 HP all	1110319	14°	2°/1000	20°/4800
	140 HP std	1110330	18°	2°/1000	18°/2800
	180 HP turbo	1110329	24°	2°/4100	18°/4500
1967	95 HP AIR*	1110369	0°	0°/900	40°/4400
	110 HP AIR*	1110389	4°	0°/900	26°/4400
1968	95 HP std	1110434	6°	0°/900	28°/4200
	95 HP auto	1110311	14°	0°/1700	20°/4200
	110 HP std	1110389	4°	0°/900	26°/4400
	110 HP auto	1110319	12°	0°/800	20°/4800
	140 HP all	1110371	4°	0°/900	32°/3000
1969	95 HP std	1110452	6°	0°/900	28°/4200
	95 HP auto	1110453	14°	0°/1700	20°/4200
	110 HP std	1110454	4°	0°/900	26°/4400
	110 HP auto	1110455	12°	0°/800	20°/4800
	140 HP all	1110454	4°	0°/900	26°/4400

*AIR means smog pump equipped, not air conditioned



Distributor Fly Weights



Distributor Parts List: Actual Markings

						Spring Dimensions			
Dist.	Paint	Point Cam	Shaft #	Weight	Vac. Adv.	A	B	C	D
1110252	cadmium	730A CCW	21	C	152M	.031″	.236″	.646″	5.5
1110256	black	118A	87	B	177M	.039″	.248″	.663″	6.5
1110257	copper	122A	27	C	152M	.032″	.235″	.650″	5.5
1110258	zinc	730A CCW	21 or 87	C	152M	.031″	.236″	.645″	5.5
1110259	black	122A	87	B	177A	.041″	.255″	.670″	6.5
1110260	copper	122A CCW	27	D	152M	.035″	.238″	.686″	5.5
1110269	yellow	21	732	C	152M	.031″	.235″	.630″	5.5
1110271	none?	87	124	B	200/951	.041″	.255″	.670″	6.5
1110272	pink	27	124	D	199	.036″	.237″	.677″	5.5
1110275	zinc	118A	03	C	177M	.035″	.230″	.600″	5.5
1110278	none?	03	120	C	200/951	.035″	.230″	.600″	5.5
1110294	copper	21	732	C	199	.031″	.242″	.640″	5.5
1110295	mustard	87	124/732	B	200/951	.041″	.254″	.674″	6.5
1110296	brown	27	124	D	199	.036″	.237″	.689″	5.5
1110297	black	03	120	C	200/951	.035″	.231″	.614″	5.5
1110290	purple	201	12	A	224	.031″	.230″	.580″	5.5
1110298	purple	"."	12	A	224	.031″	.230″	.580″	5.5
1110310	mustard	21	532/728	C	229	.041″	.250″	.675″	6.5
1110311	green	03	532	C	230/311	.035″	.230″	.600″	5.5
1110314	purple	201	12/732	A	231/218/239	.031″	.230″	.580″	5.5
1110319	brown	219	720	B	230	.047″	.250″	.670″	5.5
1110329	purple	201	738	A	250	.033″	.260″	.570″	4.5
1110330	black	21	522	C	248	.031″	.245″	.608″	5/5.5
1110339	orange	84	522	C	230	.039″	.240″	.675″	4.5
1110368	?			E					
1110369	red*	156	540	E	230	.031″	.245″	.649″	4.5
1110370	pink/red*	154	536	E	230	.031″	.241″	.635″	4.5
1110371	black/red*	157	532	E	248	.031″	.254″	.658″	5.5
1110372	black/red*	158	540	E	230	.035″	.252″	.655″	5.5
1110389	copper	132	526	E	230	.034″	.250″	.653″	4
1110434	orange	21	532	C	230.	.031″	.249″	.582″	4.5
1110452	none?	21	532(A)	C	230	.031″	.249″	.582″	4.5
1110453	green	03	532	C	230	.034″	.245″	.612″	3.5
1110454	**	132	526	E	230	.032″	.247″	.625″	4
1110455	pink	219	720	B	230	.047″	.279″	.699″	4.5

1961-61 paint codes located on oiler cap. 1962-69 spray painted on housing under vacuum advance arm ¾″ x 1½″. Purple and red codes are painted with a 1½″ circular spot.

*painted on housing side near seating base

**baby blue with green dot and black rectangle on side panel

- Any distributor will physically fit in any engine but advance curves vary widely.
- Turbocharged distributors should have a pressure retard unit in place of the normal vacuum advance. There is a ring on the vacuum hose nipple.
- Be sure to lubricate inside point cam once a year with special point cam grease in cup area under rotor.
- Rotation of shaft is clockwise as viewed from above cap with distributor in engine.
- Some stock flyweights (e.g., #37) come with and without a small hole (about ⅛″ diameter) in the far end, opposite the pivot hole. It is thought that these holes were for some manufacturing purpose and do not materially affect the amount of advance.
- Vacuum advance units marked 217 are the Delco general replacement for all Corvair engines 1962-69 (except turbos). Unfortunately, they are now discontinued. Vacuum advance units marked 410 are the non-Delco general replacements, and are still available through vendors. Original vacuum advance units with failed internal rubber diaphragms can be rebuilt by Dale Manufacturing at nominal cost.

This article is a May 1998 update to the previous 11/82 spreadsheet, published in the *Tech Guide* and *Communique* at that time. On the flyweights portion of the old article, note that weights F, G, and H have been dropped, since it has been determined that only weights A through E are stock. Tables 3 and 4 in the Tech Guide (page 5 in the Ignition section) should have a note added to say that values given are in degrees of distributor advance. These should be multiplied by two to obtain engine advance numbers.

A major change to the Spring Table is the elimination of the "overall spring length" column, and its replacement by the "inside length" column. The inside length of a spring is more meaningful than the previous measurement. This will allow spring-to-spring comparisons since it eliminates the thickness of the wire from the dimension. (The previous "overall length" included the wire thickness in the measurement) The inside length is defined as the distance between the insides of the outer loops. See the sketch. Looked at another way, the inside length is the distance between the two extremities of the pins with a spring installed on the pins, and not under tension. (8/98)

Centrifugal Advance Hole Sizes

Dist. Shaft Number	Hole Diameter inches	Max. Advance degrees
12	0.250	12
124	0.310	25
522	0.305	24
532	0.353	34
720	0.294	22
732	0.361	35
738	0.485	60

Distributor Applications

Year	Engine HP	Trans.	w'out/ A.I.R.	with A.I.R.
1960	Early 80	MT	1110252	
1960	Late 80	MT	1110258	
1960	Early 80	AT	1110256	
1960	Late 80	AT	1110259	
1960	Early 95	MT	1110257	
1960	Late 95	MT	1110260	
1961	80	MT	1110258	
1961	80	AT	1110259	
1961	84	AT	1110275	
1961	98	All	1110260	
1962	80	MT	1110269	
1962	80	AT	1110271	
1962	84	AT	1110278	
1962	102	All	1110272	
1962	150	MT	1110290 or 1110298	
1963	80	MT	1110294	
1963	80	AT	1110295	
1963	84	AT	1110297	
1963	102	All	1110296	
1963	150	MT	1110298	
1964	95	MT	1110310	
1964	95	AT	1110311	
1964	110	All	1110319	
1964	150	MT	1110314	
1965	95	MT	1110310	
1965	95	AT	1110311	
1965	110	All	1110319	
1965	140	All	1110330	
1965	180	MT	1110329	
1966	95	MT	1110310	1110368
1966	95	AT	1110311	1110369
1966	110	MT	1110319	1110372
1966	110	AT	1110319	1110389
1966	140	MT	1110330	1110371
1966	140	AT	1110339	1110371
1966	180	MT	1110329	
1967	95	MT	1110310	1110368
1967	95	AT	1110311	1110369
1967	110	MT	1110319	1110372
1967	110	AT	1110319	1110389
1967	140	all	1110330	1110370
1968	95	MT		1110434
1968	95	AT		1110311
1968	110	MT		1110389
1968	110	AT		1110319
1968	140	All		1110371
1969	95	MT		1110452
1969	95	AT		1110453
1969	110	MT		1110454
1969	110	AT		1110455
1969	140	All		1110454

Part Substitutions

These Corvair distributor assembly numbers are listed in the GM Parts History (1973) as being substituted or discontinued. The first number is the original part. The second number is the replacement part. The date tells when the change was effective.

Distributor

Original	Replacement	Effective
1110297	1110311	7/66
1110298	disc.	10/73
1110311	1110453	7/69
1110314	1110298	5/65
1110319	1110455	2/69
1110368	1110369	10/69
1110370	1110389	10/67
1110371	1110389	11/68
1110372	1110454	9/72
1110389	1110454	5/69
1110434	1110452	2/72

Vacuum Advance

Original	Replacement	Effective
1116152	1116177	5/65
1116199	1116217	11/65
1116200	1116217	7/65
1116229	1116217	3/65
1116231	1116224	7/66

Ignition Coil Variations

Bob Helt

A quick look at Corvair documentation will show that Chevrolet used many different ignition coils on Corvairs. Strangely enough, replacement coils all had different part numbers than the factory installed coils. Why there are so many different coils is an enigma. It turns out (with Dave Newell's and Kent Sullivan's help) that the factory-mounted coils all included the mounting bracket, while the replacement coils did not have the bracket included. Otherwise it can be assumed that any coil specified in the Parts Manual will be equal to, or better than, that used in production for a given year and application (for instance, that the 202 coil is as good as the 200 coil, or better).

Coils Used on Corvairs			
Year	Assembly Manuals	AMA Specs	Parts Manuals
1960	135	135	087
1961	135	135	087
1962	135/172*	135/172*	087/091*
1963	135/172*	135/172*	087/091*
1964	135/172*	135/172*	087/091*
1965	200	200	202
1966	200	200	202
1967	200	200	202
1968	208/412	208	202
1969	412	412	202
* turbo engine			

The table above shows the variety of coils Chevrolet says they used on Corvairs. When a number is shown, it is intended to cover all engine varieties for that model year unless a special coil for the turbo is used. It is generally understood that a coil with a more intense spark was needed to fire the plugs of the turbo engine due to the higher cylinder pressures. Besides these Chevrolet designated coils, there are also aftermarket coils available which have claims of improved ignition over stock coils.

So what can we make out of all these different coils? Which ones are best? And even more important, maybe, which ones should be avoided due to poor spark intensity?

How does one actually test a coil? Using an accurate ohmmeter to measure the resistance of both the primary and secondary windings of the different coils might be a method of identifying the best coils. But no! All coils had different resistances, and no pattern could be developed. So other means were sought.

One method might be to install it in a car and put the car through some stress test. Another way might be to procure a voltmeter capable of measuring the high voltages put out by most coils. Thus coils could be segregated by voltage produced. Alternately, we might measure the energy in the spark of each coil.

While these methods might be ideal, no such apparatus was available for use. So the next best method was chosen. This consisted of a special test setup developed by Bob Ballew, who generously loaned it and most of these coils for this test. The test setup consisted of a battery driven motor turning a stock cam that activated a set of stock points at approximately 1,000 RPM. The coil under test was then fed 12 volts via the operating points through a 2.0 ohm ballast resistor (as close to the stock 1.8 ohms as we could achieve). Coil output was fed to an adjustable spark gap, which was closely observed. The adjustable spark gap was opened up to the largest distance where continuous sparking occurred. A larger gap made the sparking intermittent or non-existent. A smaller gap did not improve the spark quality or quantity. At this point, the battery was disconnected and the gap was measured using a digital caliper. Of course there are some inherent measuring errors in this method, but it is expected to produce some rough data and general approximations.

The above test was run on as many coils as could be gathered prior to the test. Some of the other Corvair coils were not available for testing. Each coil (with a few noted exceptions) was identified by the Delco-Remy three-digit code. Many of the coils tested are not specified for Corvair application, but were included in the testing for reference.

An electronics reference text published the breakdown voltage of dry air as approximately 32,000 volts per inch. So any spark that jumps a gap this large will be in the same voltage range. Using this number, approximate available voltages were calculated for the table below.

What can we conclude from these tests? Most of the Corvair coils tested are capable of producing voltages in the 23,000 to 25,000 volt range. These voltages agree very well with previously published data by Chevrolet and other authorities.

The turbocharger Spyder coil #172 is the best of all coils tested at almost 28,000 volts.

The Pertronix Ignitor 40,000 volt FlameThrower I coil is "good" at 24,000 volts, but no better than several of the Corvair coils. So much for marketing hype!

Test Results		
Coil Number	Measured Spark Gap	Calculated Voltage-KV
087	0.712″	22.8
202	0.836″	26.8
200	0.774″	24.8
200	0.815″	26.1
172	0.878″	28.1
208	0.575″	18.4
293	0.717″	22.9
247	0.710″	22.7
217	0.754″	24.1
067	0.564″	18.0
061	0.343″	11.0
FlameThrower I	0.753″	24.1
Clark's non-GM	0.465″	14.9

Clark's non-GM good value coil produces a weaker spark than most of the coils tested. This is probably due to the fact that its primary resistance is 3.0 ohms instead of the stock 1.3 ohms. If this coil is used, it should be without the ballast resistor.

The 208 coil appears to be inferior to the 202 coil for 1968. This tends to support the conclusion that the Parts Manual will specify a coil that is equal to, or better than, that used in production.

Finally, remember that these voltages represent "available" voltage (i.e., maximum voltage) to the ignition system. When in operation, the spark plugs will fire at a much lower voltage (around 8,000 to 12,000 volts). The voltage required to fire a plug depends on several factors such as turbulence, engine load, plug fouling, and plug gap. After the plug fires, the voltage drops to around 2,000 volts while the spark is maintained for a short duration. Thus, the voltage never rises to the "available" level. However, if you were to pull a plug wire loose, the voltage would rise to the available voltage while seeking a path to ground. The difference between available voltage and the voltage that the plug fires at is a safety margin to allow the plugs to fire under all conditions and prevent misfiring. (8/06)

High Voltage Coil?

Bob Helt

There are many parts and accessories for your Corvair that are over-hyped or misrepresented. Their advertising often claims to provide more function, or value, than actually exists. Nearly everyone is familiar with the 200 miles per gallon carburetors widely discussed years ago. And then there are the magnets that supercharge your gasoline. Oil with Teflon to plate your engine. And the list goes on.

But this one may surprise you. It's that aftermarket 40,000 volt ignition coil for your Corvair.

Well, what's wrong about wanting more spark for the plugs? Isn't that one way to ensure better combustion and improved gas mileage? No, sorry. It doesn't work that way.

Here are the reasons. When the ignition points open and the coil gives up the stored magnetic field, the falling field induces a large voltage in the secondary winding. This voltage is routed to the spark plug and produces a spark there. The stock Corvair coil produces a maximum of about 25,000 volts. But as this voltage (which starts at zero) builds up, it appears across the two conductors forming the spark plug gap. The rising voltage then ionizes the air surrounding the gap. Ionized air has a lower resistance to electrical flow, so at some point the rising voltage is high enough to jump the gap and flow from the coil through the plug wire and center electrode to the ground electrode. This causes the spark. But now consider the details. In dry air, the resistance is such that 25,000 volts will jump a gap of two opposite points separated by about one inch. That's right, 25,000 volts will cause a spark of about one full inch.

But the spark plug has a gap of only 0.035 inches. It sure doesn't take 25,000 volts to jump this gap and cause a spark. In fact, as the rising voltage reaches about 5,000 to 8,000 volts, the plug will fire and the voltage will drop to something in the range of 2,000 volts across the gap as the spark is maintained. So you see, although the stock coil can put out a maximum of about 25,000 volts, in normal operation it never does. The plugs fire at about 5,000 volts, and after that the voltage on that plug for the duration of the spark drops to a lower value. So where does the 25,000 volts come in? Well if you were to pull a plug wire and place it near ground, the coil will put out as much voltage as is necessary to jump the gap you have made, up to its maximum potential. This means that the stock coil already has a built-in reserve of voltage to fire the plugs under less than ideal circumstances, such as high combustion chamber pressures caused by use of a turbocharger, or bad plug wires, or fouled plugs and plugs with excessive gaps.

Well, if the stock coil has that much reserve voltage built in, how much more reserve do you need? A 40,000 volt coil is still going to put out only the voltage required to fire the plugs, which we have stated is in the range of 5,000-8000 volts. In other words, the aftermarket high voltage coils still put out only about 5,000 volts under normal situations, not the high voltage claimed. And normal situations encompass nearly all street driving. Only racing applications exceed most street driving conditions.

How about increasing the spark plug gap to take advantage of an aftermarket high voltage coil? Well, what are you trying to accomplish then? What will a larger than stock plug gap do for you? Not much in a Corvair. Little, if anything, is to be gained. If larger gaps worked wonders, the factory would have used them. So would everyone else by now. Of course some people claim better idle quality with larger gaps. Maybe true, but remember that the ground electrode is designed to be perpendicular to the tip of the center electrode. Large gaps on Corvair plugs disturb this relationship and upset the electrode wear and firing pattern. Others claim additional benefits from larger gaps. But where is the proof? Often, personal claims are simply the improvement that results from fixing a problem. Consider too, that a larger gap will increase the voltage at which the plug fires. That means more chance for this voltage to jump to unwanted places, such as to an adjacent distributor cap terminal.

So before you consider installing one of those aftermarket high voltage coils, consider just what benefits you will actually get. (8/03)