AMERICAN MOTORS SPARK CONTROL SYSTEMS

DESCRIPTION

American Motors uses 7 spark control devices to assist the ignition system in controlling exhaust emissions. They are the Spark Coolant Temperature Override (CTO) Switch, the Non-Linear Vacuum Regulator (NLVR) Valve, Forward and Reverse delay valves, a Vacuum Solenoid Valve (VSV) and a Thermal Vacuum Spark Control Valve used in conjunction with a Vacuum Spark Control Delay Valve (on 4 cylinder models).

SPARK COOLANT TEMPERATURE OVERRIDE SYSTEM

This system operates during cold engine warm-up to improve driveability. It operates the distributor vacuum spark advance by manifold vacuum during cold engine. The CTO switch, threaded into bottom of the thermostat housing on 4 cylinder models, into left rear of block on Eagle models, into heater hose fitting on 6 cylinder models without air conditioning and in the heater valve on 6 cylinder models with air conditioning, responds to coolant temperature to allow either manifold vacuum or carburetor ported vacuum to the distributor. This switch may, on some models, be used in conjunction with other vacuum advance signal controlling devices.

With coolant temperature below 160°F (Federal 6-cylinder), 165°F (California 6-cylinder) or 120°F (4-cylinder), check ball is held against inner seat by spring pressure. Manifold vacuum enters port "1" and is applied through port "D". This allows full manifold vacuum to distributor. Above calibrated temperature, port "1" is blocked and carburetor ported vacuum enters through port "2" and connects to port "D". Ported vacuum now controls spark advance.

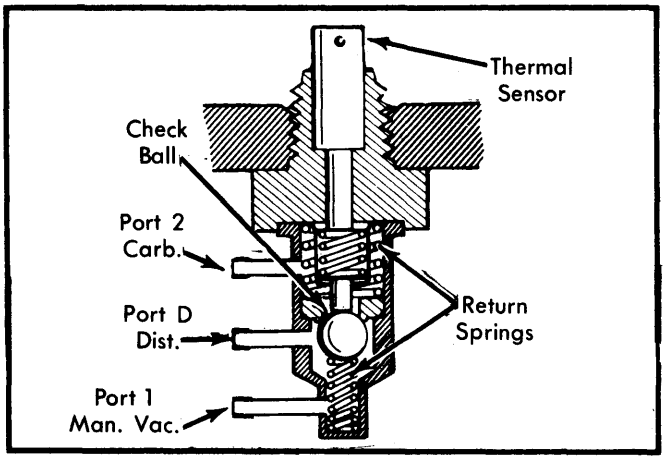

Fig. 1 Spark Coolant Temperature Override Switch

NON-LINEAR VACUUM REGULATOR VALVE

Used on some AMC vehicles, this valve combines regulated manifold vacuum at idle speed and carburetor ported vacuum to the ignition spark advance mechanism. It is mounted in line between the vacuum source port and distributor vacuum can.

There are 2 input ports on the NLVR: Intake manifold vacuum and carburetor ported vacuum. One outlet port connects to distributor advance unit. At idle, regulated vacuum is supplied to advance unit (when manifold vacuum is high and ported vacuum is very low). The NLVR regulates vacuum signal so it is between these 2 vacuum source levels at idle. As engine load increases, vacuum signal above 7.5 in. Hg @ 70-80°F, regulator valve switches to ported vacuum output.

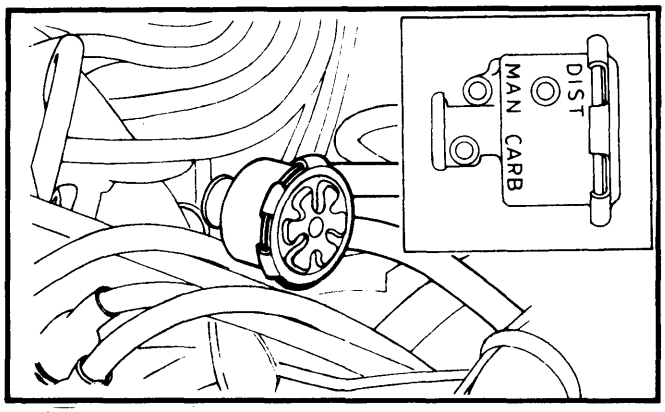

Fig. 2 Non-Linear Vacuum Regulator Valve

FORWARD & REVERSE DELAY VALVES

The forward and reverse delay valves are one-way check valves used in the vacuum advance signal circuit to control speed and direction of vacuum advance signals sent to distributor. These aid in driveability and in lowering hydrocarbon emissions.

The forward delay valve allows a gradual advance signal to distributor. The reverse delay valve does not allow advance signal to bleed out of distributor advance unit (cold engine) during acceleration. This holds distributor in full advance mode until CTO switches to ported vacuum after engine warms up.

VACUUM SOLENOID VALVE (VSV)

This valve is an electrically actuated solenoid and is used on Federal 4 cylinder models equipped with air conditioning and automatic transmission to switch advance vacuum signal from manifold vacuum (A/C off) to ported vacuum (A/C on).

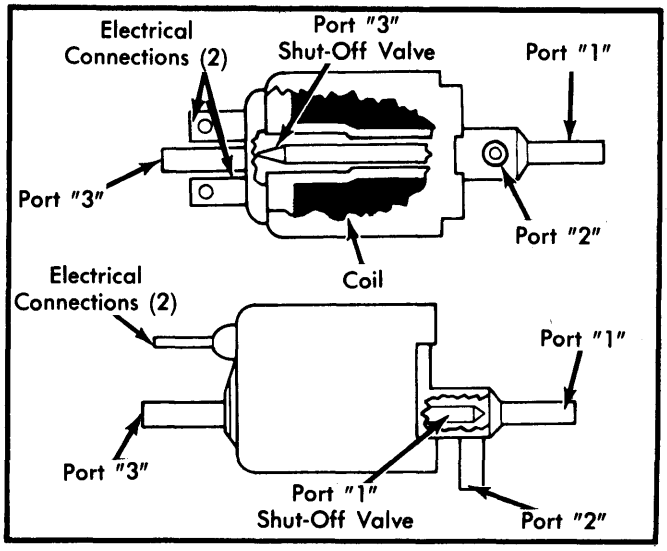

Fig. 3 Vacuum Solenoid Valve

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When the A/C is on, the solenoid is energized connecting ports "1" and "2" allowing ported vacuum to supply advance signal to distributor. With A/C off, solenoid de-energizes and ports "2" and "3" are connected to supply manifold vacuum advance signal to distributor.

THERMAL VACUUM SPARK CONTROL VALVE (TVS) & VACUUM SPARK CONTROL DELAY VALVE

The TVS, mounted in air cleaner, allows flow of controlled vacuum to spark CTO when intake air temperature is below 55°F on 6 cylinders or 63°F on 4 cylinders. At or above these temperatures, manifold vacuum is prevented from reaching spark CTO until coolant temperature reaches spark CTO switching point.

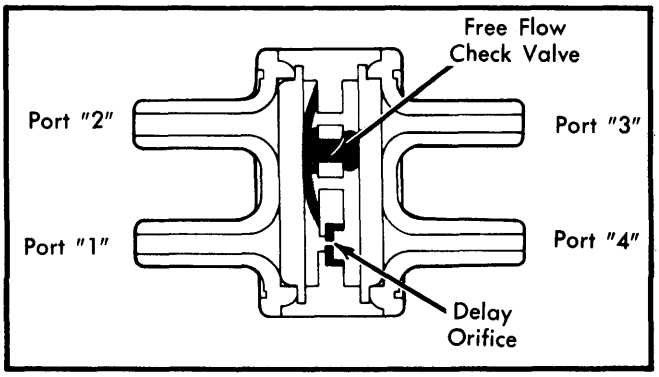

Fig. 4 Cutaway View of Vacuum Spark Control Delay Valve

The Vacuum Spark Control Delay Valve has been added to improve driveability when engine is cold. Ports "1" and "2", "3" and "4" are connected internally. During acceleration, vacuum is greater at port "4" than at port "1" and air must flow from "1" to "4" through the orifice to equalize pressure. This creats a delay to prevent a sudden decrease in spark advance. When vacuum is greater at port "1", air flows freely through unseated check valve equalizing pressure instantly.

MAINTENANCE

Periodic maintenance is not normally required; should any switch or valve fail to function properly it should be replaced.

TESTING

SPARK COOLANT TEMPERATURE OVERRIDE SWITCH

Connect a vacuum gauge to center port ("D") of spark CTO. Below calibrated temperature, manifold vacuum should register. Above calibrated temperature, carburetor ported vacuum should register. If either is incorrect, replace spark CTO.

NOTE – *Ported vacuum is not available with throttle closed. Ported vacuum is available at part throttle (equivalent of 1000 RPM).*

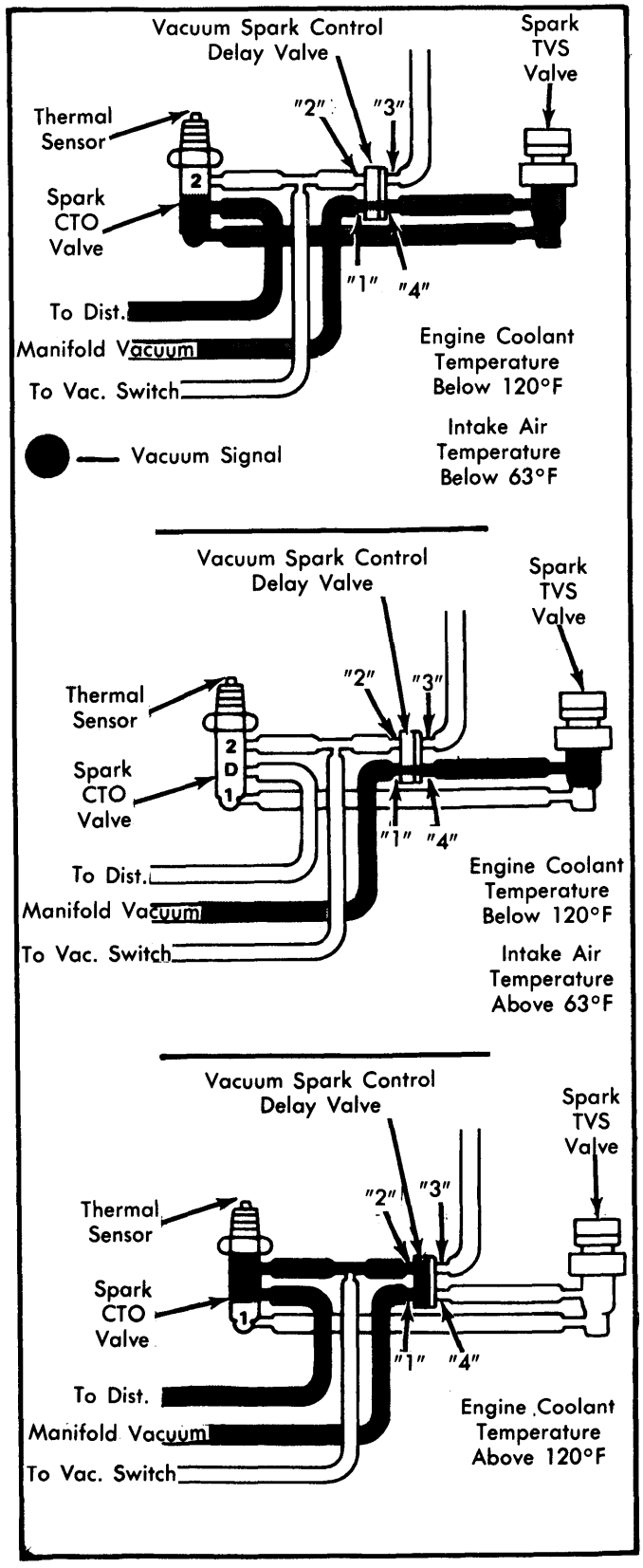

Fig. 5 Advance Signal Control System Operation (With TVS and Vacuum Spark Control Delay Valve)

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NON-LINEAR VACUUM REGULATOR VALVE

Connect vacuum gauge to distributor port ("DIST") on NLVR. With engine at idle speed, a vacuum reading of 7 in. Hg should be shown. As throttle is opened and engine speed increases, ported vacuum level should be indicated. If not, replace NLVR.

VACUUM SOLENOID VALVE

With engine running, A/C off, check vacuum at port "2". Manifold vacuum should be indicated. Turn A/C on and accelerate engine. Carburetor ported vacuum should be indicated on gauge. If either test fails, replace vacuum solenoid valve.

VACUUM SPARK CONTROL DELAY VALVE

Connect tee fittings to ports "1" and "4". Connect a vacuum gauge to each fitting. Start engine and check gauges. Vacuum should be equal for both gauges. Accelerate engine while watching gauges. Vacuum at port "1" should instantly decrease while vacuum at port "4" should be maintained momentarily. If valve fails test, replace it.

THERMAL VACUUM SPARK CONTROL VALVE (TVS)

Disconnect vacuum hose to port "1" of spark CTO and connect vacuum gauge to hose. Start engine. With intake air below calibrated TVS temperature, manifold vacuum should be indicated on gauge. When intake air above calibrated TVS temperature, no vacuum should be indicated on gauge. If either is incorrect, replace spark TVS.

FORWARD DELAY VALVE

Apply constant vacuum of 10 in. Hg to black side of delay valve. Attach a vacuum gauge (using a 24 INCH section of vacuum hose) to colored side of valve. Count time in seconds for vacuum gauge to read 8 in. Hg with a constant vacuum of 10 in. Hg applied to black side of valve. Compare times with those shown in table. If incorrect, replace valve.

Forward Delay Valve Flow Test

Color	Time in Seconds Minimum	Maximum
Blk/Gray	0.6	1.6
Blk/Brown	1.0	3.0
Blk/White	2.7	9.3
Blk/Yellow	4.5	13.2
Blk/Purple	0.3	1.0

REVERSE DELAY VALVE

Apply a constant vacuum of 10 in. Hg to colored end on delay valve. Attach a vacuum gauge (using a 24 INCH section of vacuum hose) to white end of valve. Count time in seconds for vacuum gauge to read 8 in. Hg with a constant vacuum of 10 in. Hg applied to colored end of valve. Compare times with those in table. If incorrect, replace valve.

Reverse Delay Valve Flow Test

Color	Time in Seconds Minimum	Maximum
White/Gray	0.6	1.6
White/Brown	1.0	3.0
White/Gold	0.6	2.3
White/Red	13.0	15.0
White/Purple	0.3	1.0

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