

This article reprint (edited) is courtesy of Triumph Trax, newsletter of the Portland Triumph Owners Association. Good stuff on timing in general.

TALES OF TIMING

It is 1970. You own a brand-new TR6. Everything works perfectly, nothing has been modified. The distributor is a Lucas 22D6, part #41306, equipped with both vacuum advance and retard. The ignition timing was set by the factory 12 degrees BTDC static, 4 degrees ATDC dynamic. All Lucas type 22D distributors have mechanical (also called "centrifugal") advance. Yours was set by Joe Lucas himself to provide 0 deg advance at idle, and 22 deg at 5000 RPM. The vacuum advance capsule is stamped 4/7/8; it can provide a maximum 16 degrees of vacuum advance. The retard capsule is stamped 3/10/8; it can provide a maximum 16 degrees vacuum retard. In the examples that follow bear in mind that: TOTAL ADVANCE=STATIC ADVANCE+MECHANICAL ADVANCE+VACUUM ADVANCE-VACUUM RETARD.

EXAMPLE 1 You just started your fully warmed up engine, which is idling smoothly at 850 RPM. Static Advance = 12 deg BTDC. The Triumph mechanic set this by rotating the distributor and clamping it. It won't change in operation, except for gradual variation due to wear of the distributor's parts. Mechanical Advance = Zero. Mechanical advance is a function of engine speed only, and your distributor is "curved" for zero advance at this engine speed. Vacuum Advance = Zero. Although the manifold vacuum is very high, the vacuum advance unit doesn't sense it. The vacuum pickup, on top of the front carb, is masked by the throttle butterfly. Vacuum Retard = 16 degrees. Manifold vacuum is high, and the vacuum "signal" runs from the bottom of the rear carb, where no "masking" is occurring, to the vacuum retard capsule, which is providing its max retard value of 16. TOTAL ADVANCE = 12 deg BTDC + 0 + 0 - 16 deg = 4 degrees ATDC. This is why you set static timing to 12 deg BTDC with the engine off, but when you idle the engine with a timing light hooked up, you see 4 degrees ATDC.

EXAMPLE 2 You are driving downhill in top gear at 65 MPH, stuck behind some pogue in a MG Midget wearing open-knuckle driving gloves and a tweed cap. Engine RPM is 3000. The throttle is partially open, obviously. Static Advance = 12 deg BTDC. The Triumph mechanic set this by rotating the distributor and clamping it. It won't change in operation. Mechanical Advance = 14 deg. Mechanical advance is a function of engine speed only, and your distributor is "curved" for 14 degrees advance at this engine speed. Vacuum Advance = 6 deg (est.). The manifold vacuum is moderate, and the vacuum "signal" runs from the top of the front carb to the vacuum advance capsule, which is providing "some" advance. This improves both fuel economy and tailpipe emissions. Vacuum Retard = near Zero. Although the manifold vacuum is moderate, the vacuum advance unit doesn't sense much of it. The vacuum pickup, on the bottom of the rear carb, is masked by the throttle butterfly. TOTAL ADVANCE = 12 deg BTDC + 14 deg + 4 deg - 0 = 30 deg BTDC. If someone could hook a timing light to your engine right now, they would see 30 degrees BTDC. That's a lot of advance for such a low RPM, but the engine can tolerate it without pinging because it is only at part-throttle. Notice that the Vacuum Advance is not really providing any "extra power."

EXAMPLE 3 You've just pulled out into the passing lane and mashed the accelerator pedal. The engine is still at 3000 RPM, it has not yet responded. Static Advance: 12 deg BTDC. The Triumph mechanic set this by rotating the distributor and clamping it. It won't change in operation. Mechanical Advance = 14 degrees. Mechanical advance is a function of engine speed only, and your distributor is "curved" for 14 degrees advance at this engine speed. Vacuum Advance = Zero (Surprise!) The manifold vacuum is low, hence no vacuum advance. Vacuum Retard = Zero. The manifold vacuum is low, hence no vacuum retard. TOTAL ADVANCE = 12 deg BTDC + 14 deg + 0 - 0 = 26 deg BTDC. Notice that you now have less advance than when you were "just cruising" at the same engine speed. That's because the engine is now under load and can tolerate less advance without going to higher octane fuel. To avoid pinging, that "nice-to-have" vacuum advance economy feature is automatically cut out.

EXAMPLE 4 Victory at last! 110 mph through the hills, God bless you. Engine RPM 5000 plus, pedal to the floor. Static Advance = 12 deg BTDC. The Triumph mechanic set this by rotating the distributor and clamping it. It won't change in operation. Mechanical Advance = 22 deg. Mechanical advance is a function of engine speed only, and your distributor is "curved" for its maximum 22 deg advance at this engine speed. Vacuum Advance = Zero. The manifold vacuum is low, hence no vacuum advance. Vacuum Retard = Zero. The manifold vacuum is low, hence no vacuum retard. TOTAL ADVANCE = 12 deg BTDC + 22 deg + 0 - 0 = 34 deg BTDC. Your engine is spinning fast now, and can tolerate more advance even though it is under load.

POINTS TO REMEMBER High manifold PRESSURE = low manifold VACUUM. If the car is at sea level on an average 60 degree day, the outside ambient pressure is about 30 inches of mercury (30" Hg). At idle, the manifold pressure is low, say 12" Hg. That means the manifold vacuum is 30" Hg - 12" Hg = 18" Hg. This is a HIGH manifold vacuum at idle! At full throttle, the manifold pressure is high, say 27" Hg. That means the manifold vacuum is 30" Hg - 27" Hg = 3" Hg. This is a LOW manifold vacuum at full throttle! Vacuum retard is an idle emissions feature. It does little, if anything, at off-idle RPM unless the throttle is closed (such as during an overrun condition). Vacuum advance provides part-throttle economy, not high-load or high-RPM power. It was deleted on later cars due to tailpipe emissions, and power did not suffer a whit because of it. TOTAL ADVANCE is what you see when you point a strobe gun at the crank pulley with the engine running. This is roughly equivalent to the "Dynamic Advance" referred to in the Bentley manual. If your vacuum retard is no longer operational and you set your TOTAL ADVANCE to 4 deg ATDC with a strobe gun, your car will run poorly, since you just set your static timing to 4 deg ATDC instead of 12 deg BTDC.