TELEDYNE CONTINENTAL ® AIRCRAFT ENGINE

MANDATORY SERVICE BULLETIN

The Subject Matter of this Service Bulletin is Incorporated In Whole or in Part in an FAA Airworthiness Directive

CATEGORY 1

MSB94-8A

FAA APPROVED
SUPERSEDES M88-8R1 and SB94-8

SUBJECT: **MAGNETO TO ENGINE TIMING**

PURPOSE: A. To provide magneto to engine timing procedure for all TCM engines.

The importance of establishing and maintaining correct magneto to engine timing cannot be over-emphasized. Incorrect timing, in addition to producing a rough running engine, can lead to detonation, pre-ignition and internal engine damage or failure.

B. To provide O-200-A and B engine models that are eligible for magneto timing advance. See timing table Note 5 and Figures 1 and 2.

COMPLIANCE: At every 100 hour inspection, annual inspection, progressive inspection, whenever magneto maintenance is performed or whenever magnetos are removed or replaced. Magneto maintenance and internal magneto timing must be conducted in accordance with magneto manufacturer's instructions.

MODELS AFFECTED: All.

WARNING

Magneto-to-engine timing maintenance does not assure magneto, harness and spark plug performance. Failure to properly maintain the magneto, harness and spark plugs will lead to internal engine damage and failure. Magneto, ignition harness and spark plugs must be maintained in accordance with the manufacturer's instructions.

NOTE: A single severe "kick back" while cranking the engine can cause failure of components of the cranking system. Kick back can be caused by intermittent operation of the impulse couplings or shower of sparks system. Perform the following operational tests at the specified intervals to insure that these systems are functioning properly. It is important to note that these operational tests (paragraph I & II) do not supersede inspection, maintenance and overhaul instructions set forth in current manufacturer's service bulletins and overhaul manuals.

I. As part of the routine 100 hour, annual or progressive inspection, whichever occurs most often, for all TCM engines incorporating impulse coupled magnetos, perform the following "magneto impulse coupling operational test."

WARNING:

Failure to properly ground magnetos will result in engine ignition and possible injury to personnel.

1. Assure that both magnetos are properly grounded. With all spark plugs installed in all cylinders, remove all spark plug harness lead ends from the spark plugs and ground to the engine to prevent ignition.
2. a. Magneto switch, if separate from starter switch - off.
   b. Mixture - idle cut off.
   c. Throttle - closed.
   d. Fuel selector - off.
   e. Master switch - on.
3. Crank engine several revolutions.

WARNING

Use extreme caution in the area of the propeller while performing this test.

a. Impulse coupling operation is audible and can also be felt through the magneto housings. They should "click" together and consistently while cranking the engine.

b. If "no clicking" or "intermittent clicking" is discovered, remove magneto and service per manufacturer's instructions.

NOTE: Some engine installations incorporate only one impulse coupling on the left magneto, with the right magneto grounded through the ignition switch during starting. Verify the number of impulse couplings that are used for the particular magneto/engine installation. For those that use only one impulse coupling, verify that the non-impulse coupling magneto is grounded during starting. See paragraph II, 1.

II. As part of the routine 100 hour, annual or progressive inspection, whichever occurs most often, for all TCM engines incorporating a shower-of-sparks ignition system, perform the following operational tests:

WARNING

Use extreme caution in the area of the propeller while performing these tests.

1. Confirm that the right magneto is grounded during start:
   a. Remove the P-lead from the right magneto and connect an ohmmeter between the P-lead end and ground.
   b. With the starter motor disconnected from the aircraft power, actuate the aircraft start switch to the "start" position and confirm that the P-lead has continuity with ground as long as the switch is in the start position.
   c. If the P-lead does not show continuity during "start", repair or replace the P-lead assembly or ignition switch.
2. Confirm retard timing and vibrator circuit operation:
   a. Verify that the magnetos are timed to the engine at the proper degrees before top dead center on number one cylinder. See timing table.
   b. Disconnect the starter motor from the aircraft power. Move the propeller/crankshaft to top dead center compression stroke on number one cylinder.

c. Remove the number one cylinder bottom spark plug lead and position the lead end tip 3/16" from engine ground. Turn aircraft master switch "on" and turn the start switch to the "start" position for a maximum of 20 seconds.

CAUTION: Do not operate the starting vibrator for longer than 20 seconds in a two minute period as overheating will occur.

d. Verify a constant, strong blue spark and confirm that the spark begins a few degrees (8 degrees maximum) before top dead center on compression stroke.

e. If no spark is observed during this test, test magneto starting circuit and components so that the problem can be isolated and repairs can be accomplished. If a spark is observed before the maximum advanced position, inspect the left magneto for the correct main and retard contact point timing. All tests and repairs must be accomplished in accordance with the applicable ignition system maintenance manual.

In conducting magneto timing checks, the use of a positive dead center locator, protractor and pointer such as the Eastern Electronics Model E25 Timing Indicator or equivalent are the most accurate tools to use. Tools which call for a specific arm on the piston dome are more susceptible to error due to bending or excessive carbon build-up. Use the following basic timing procedure to assure that timing is accomplished in accordance with the required specifications.

NOTE: If the engine is equipped with a right angle drive starter adapter and does not freely turn in the opposite direction of normal rotation, the starter motor may be removed from the starter adapter. Some right angle starter drive adapters incorporate spring clutch design that resists engine rotation in the opposite direction of normal rotation. See TCM Service Bulletin M92-10 or current revision as applicable.

MAGNETO TO ENGINE TIMING PROCEDURE

A. Direct Drive Engines.

1. Remove all top spark plugs. Rotate piston to the start of the compression stroke on No. 1 cylinder. Install the top dead center locator into No. 1 cylinder top spark plug hole.
2. Install timing disc of indicator being used on the crankshaft flange, propeller spinner, hub or blade.
3. Turn propeller slowly in direction of normal rotation until piston lightly touches TDC locator.
4. Rotate disc of timing indicator until the 0 degree mark aligns with the pointer.
5. Slowly turn propeller in opposite direction of normal rotation until the piston lightly touches TDC locator. Observe reading on the disc under the pointer and move the disc, to exactly one-half of the number of degrees observed, toward the top center mark. This will be approximately one-half the number of degrees remaining of 360 degrees of crankshaft rotation. You have now located top dead center.
6. Remove TDC locator from the cylinder and find the compression stroke on No. 1 cylinder by placing a finger over the spark plug hole, or any other adequate method. As you come up on compression, stop the pointer at the TDC location as determined in step 5. For engines equipped with impulse couplings, continue turning the propeller in the normal direction of rotation until each impulse coupling trips. Couplings may trip a few degrees on either side of TDC. If one or both impulse couplings trip after TDC, turn the propeller back to a few degrees before TDC and approach the TDC position from the normal direction of rotation.

7. To check either the magneto timing or to time the magneto to the engine, move the propeller in the opposite direction of normal rotation past the specified magneto timing setting and then back in the direction of normal rotation until the desired setting before top dead center is under the pointer. (This removes the factor of gear backlash).
8. The breaker points should just be starting to open at this setting. Breaker point opening must be checked with a timing light.

NOTE: Whenever setting or checking timing, always turn the crankshaft steadily in the direction of rotation to eliminate any backlash error.

B. Geared Engines.

1. Complete steps A-1 through 3.
2. Rotate disc of timing indicator until 0 degrees aligns with the pointer.
3. Slowly turn the propeller in opposite direction of normal rotation until the piston lightly touches the TDC locator. Observe the reading, (total degrees of travel) and record. This is the "X" value.
4. Rotate the disc to align 0 degrees with the pointer. Use the following applicable formula to determine TDC.

GO-300, GIO-470, GTSIO-520-C.	X DEGREES DIVIDED BY 2 + 135 = Y DEGREES
GTSIO-520-D,H,F, K,L,M & N.	X DEGREES DIVIDED BY 2 + 120 DEGREES = Y DEGREES
Tiara 6-285, 6-320.	X DEGREES DIVIDED BY 2 + 90 DEGREES = Y DEGREES

Y = DEGREES OF PROP ROTATION FROM 0 DEGREES (PARAGRAPH 4) TO TDC.

5. Remove the TDC locator from the cylinder.
6. With the Y degrees determined, move the propeller that number of degrees (Y degrees), in the direction of normal rotation. This will place the piston at TDC.
7. Once TDC has been established and set, reset the timing disc to 0 degrees at TDC.
8. Now the correct timing can be set by using the appropriate propeller shaft angle for the corresponding engine model. Move the propeller in the opposite direction of normal rotation past the specified "propeller shaft angle" magneto timing setting and then back in the direction of normal rotation until the specified "propeller shaft angle" before top dead center is under the pointer. (This removes the factor of gear backlash). Reference the following example and chart for "propeller shaft angle".

EXAMPLES:

For a geared engine with a .75 propeller to crankshaft RPM ratio and timing specification of 24 degrees BTC, the propeller shaft angle would be .75 X 24 degrees or 18 degrees BTC. If the propeller shaft to crankshaft ratio was .667, the propeller shaft timing angle would be .667 X 24 degrees or 16 BTC.

The magneto timing specifications for the current geared engine models is as follows:

ENGINE MODEL	CRANKSHAFT ANGLE	PROPELLER GEAR RATIO	PROPELLER SHAFT ANGLE
GO-300	28 DEGREES BTC	.75	21 DEGREES BTC
GIO-470	24 DEGREES BTC	.75	18 DEGREES BTC
GTSIO-520-C	22 DEGREES BTC	.75	16.5 DEGREES BTC
GTSIO-520-D,H,F,K	20 DEGREES BTC	.667	13.3 DEGREES BTC
GTSIO-520-L,M,N	24 DEGREES BTC	.667	16 DEGREES BTC
TIARA 6-285	30 DEGREES BTC	.50	15 DEGREES BTC
TIARA 6-320	32 DEGREES BTC	.50	16 DEGREES BTC

MODEL	RIGHT MAG [3]	LEFT MAG [3]	NOTES
A65	30 DEGREES BTC	30 DEGREES BTC	
A75, A80	29 DEGREES BTC	32 DEGREES BTC	
C75, C85	28 DEGREES BTC	30 DEGREES BTC	
C90	26 DEGREES BTC	28 DEGREES BTC	
O-200-A, B	24 DEGREES BTC	24 DEGREES BTC	[5]
IO-240-A	22 DEGREES BTC	22 DEGREES BTC	
IO-240-B	26 DEGREES BTC	26 DEGREES BTC	
C-125	28 DEGREES BTC	30 DEGREES BTC	
C-145, O-300	26 DEGREES BTC	28 DEGREES BTC	
GO-300	28 DEGREES BTC	28 DEGREES BTC	
E165, E185, E225	26 DEGREES BTC	26 DEGREES BTC	
O-470-A, E	26 DEGREES BTC	26 DEGREES BTC	
O-470-B, G, M, P & U	24 DEGREES BTC	24 DEGREES BTC	
O-470-J	20 DEGREES BTC	20 DEGREES BTC	
O-470-K, L, R & S	22 DEGREES BTC	22 DEGREES BTC	
IO-346	24 DEGREES BTC	24 DEGREES BTC	
IO-360	20 DEGREES BTC	20 DEGREES BTC	[1]
IO-360-ES	24 DEGREES BTC	24 DEGREES BTC	
IO-470-C, G, R, & P	26 DEGREES BTC	26 DEGREES BTC	
IO-470-D, E, F, H, L, M, N, S, U, V & VO	20 DEGREES BTC	20 DEGREES BTC	
IO-470-J, K	22 DEGREES BTC	22 DEGREES BTC	
GIO-470	24 DEGREES BTC	24 DEGREES BTC	
IO-520	22 DEGREES BTC	22 DEGREES BTC	[1]
IO-550	22 DEGREES BTC	22 DEGREES BTC	
LTSIO & TSIO-360	20 DEGREES BTC	20 DEGREES BTC	[1]
TSIO-470	22 DEGREES BTC	22 DEGREES BTC	
LTSIO-520-AE	20 DEGREES BTC	20 DEGREES BTC	
TSIO-520-B, C, D, E, H, J, K, L, N, VB, WB, AE & CE	20 DEGREES BTC	20 DEGREES BTC	[1]

MODEL	RIGHT MAG [3]	LEFT MAG [3]	NOTES
TSIO-520-M, R, T, UB, AF & P	22 DEGREES BTC	22 DEGREES BTC	[1] [4]
TSIO-520-BE	24 DEGREES BTC	24 DEGREES BTC	
TSIO-550-B,C,E	24 DEGREES BTC	24 DEGREES BTC	
TSIOL-550-A	20 DEGREES BTC	20 DEGREES BTC	
GTSIO-520-C	22 DEGREES BTC	22 DEGREES BTC	
GTSIO-520-D, H, F & K	20 DEGREES BTC	20 DEGREES BTC	
GTSIO-520-L, M & N	24 DEGREES BTC	24 DEGREES BTC	
6-285	30 DEGREES BTC	30 DEGREES BTC	
6-320	32 DEGREES BTC	32 DEGREES BTC	
W-670	32 DEGREES BTC	32 DEGREES BTC	
W-670-23	5 DEGREES BTC	14 DEGREES BTC	[2]

NOTES:

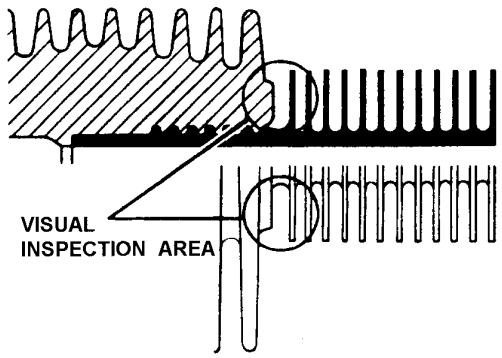
[1] "B" Models (i.e. IO-360-DB, etc.) same as standard model.

[2] This engine has one magneto on left position and battery ignition on right. Both have automatic advance and are in retarded position.

[3] Magneto setting tolerance to be plus or minus one (1) degree unless otherwise noted.

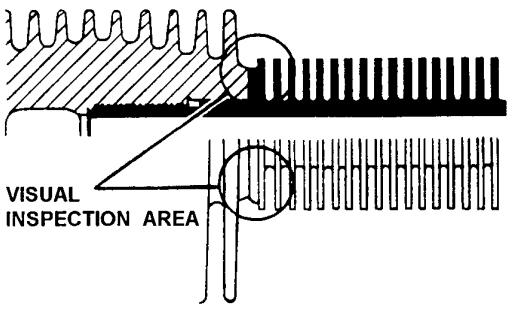
[4] Magneto setting tolerance of TSIO-520-P to be plus 0 degrees or minus 1 degree.

[5] O-200-A and B model engines that have a complete set (4 each) of 641917 or subsequent (higher) part number cylinders installed are eligible to have the timing advanced to 28 degrees BTC. This may include a combination of 641917, 649543, 653426 or subsequent (higher) part number cylinders. The cylinders (641917) were first produced beginning in 1977. The cylinder part number is stamped on the barrel flange. The absence of a cylinder part number usually indicates cylinders manufactured prior to P/N 641917. Visual acceptance can be determined by the examples listed in Figures 1 and 2. For those engines that have the applicable cylinders installed and timing advanced, restamp the engine data plate to indicate magneto timing of 28 degrees and make a log book entry noting the change and the part number of the cylinders installed. Subsequent installation of cylinders must be of the part numbers listed above to retain the advanced (28 degree BTC) timing.



P/N 641917 AND SUBSEQUENT CYLINDER CONSTRUCTION - ACCEPTABLE FOR 28° BTC TIMING ON 0-200.

FIGURE 1.



OLD STYLE CYLINDER CONSTRUCTION NOT ACCEPTABLE FOR 28° BTC TIMING ON 0-200.

FIGURE 2.