



## Memorandum For Record

**Timothy W. Monville**  
**Sr. Air Safety Investigator**  
**Eastern Region**

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**Date: 7/17/2023**  
**NTSB Accident Number: ERA21LA289**

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Following the accident, the left engine, model IO-360-C1C, serial number L-33770-51 was shipped to the manufacturer's facility for an engine run with oversight from the Federal Aviation Administration (FAA).

Inspection of the engine prior to the engine run revealed the left magneto was timed 0° Before Top Dead Center (BTDC), while the right magneto was timed 20° BTDC<sup>1</sup>. Inspection of the engine before removal from the crate revealed a shipping strap was tightly secured around the housing of the left magneto (Figure 1). Personnel of FAA and Lycoming consulted with NTSB who advised to set the left magneto timing to the field found setting of 21° for the attempted engine run. In preparation for the engine run impact damaged components were removed and replaced and Engine test (EG18 Special Club) was installed<sup>2</sup>. The engine was placed in a test stand and:

8:45am - The engine was started on 1st attempt. The engine accelerated and decelerated through the entire sweep range with no correlation to NTSB Preliminary Report claim of "slowly" or response felt "like bungee cords". The engine was shut down and the propeller blade angle was adjusted to set full throttle to the engines rated RPM of 2700.

915am – The engine was restarted, and Engine test (EG18 Special Club) was initiated. At no time did the engine fail to reach RPM states up to 2200. When the Left Mag check was conducted the drop was 193.1 RPM. The test was stopped, and the engine was shut down to troubleshoot the excessive rpm drop from the left magneto. The left magneto wiring harness was inspected. There was no chaffing or areas found that might cause a short or arc. The left magneto timing was checked again in the test cell and found to be at 21°. The customers idle setting was set to 720 RPM. Lycoming typically sets the idle setting at 650 to 700. The test cell mechanic

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<sup>1</sup> During the initial engine examination, the left magneto was found timed 21° BTDC and the right magneto was timed 20° BTDC.

<sup>2</sup> The fixed propeller was designed to make rated horsepower when rated rpm and manifold pressure were achieved.

adjusted the idle set screw on the injector to achieve 700 RPM setting. The engine was operated again, and Engine Test (EG18 Special Club) was initiated. The engine went all rpm test states as a "Pass" (Attachment 1). The left magneto was flagged "Fail" due to magneto drop more than 150 rpm and Drop-off difference 35rpm. (Actual – 171.7 RPM which is within limitations in the operator's manual Max of 175 RPM. Magneto drop difference between left and right magnetos exceeded the operator's manual of 50RPM ((Actual 74.8 RPM)). Idle speed was 700.8 RPM. High limit is 700.

The engine was shut down and NTSB was contacted. A discussion was made between NTSB, Lycoming and Piper personnel regarding the left magneto timing that was found in the field vs. the timing that was found during Lycoming in- house investigation. NTSB requested that the Left magneto be adjusted to the 0° timing and the engine operated for observation of engine condition. The magneto was set to 0°. The engine was hard to start but eventually operated. At a low RPM setting, the engine would stumble significantly. The engine was operated up to 1700 RPM and a magneto drop was conducted. The engine dropped more than 600 RPM on the left magneto before the operator reinitiated the right magneto back online. The operator stated, "the engine would have stalled out on just the left mag only".

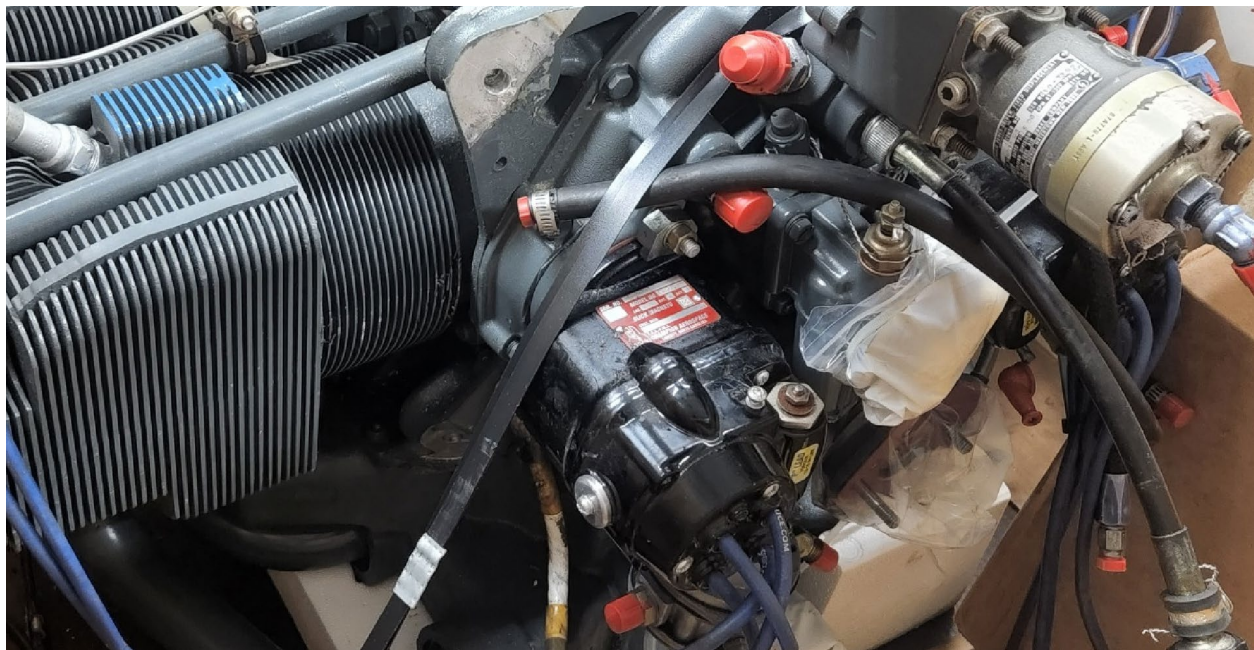


Figure 1: Lycoming Digital Photograph. View Showing the Tightly Secure Shipping Strap Over the Left Magneto.

Cell No. 1-3

**LYCOMING**

Production Automated Engine Test Log

Form# T-001

Power, Filter &amp; Leak Data Sheet

|                         |                                              |                          |                          |
|-------------------------|----------------------------------------------|--------------------------|--------------------------|
| Engine #: L-33770-51    | Model #: IO-360-C1C                          | Order #: MT299247        | Preservation: LPS 486    |
| Operator 1: T. HOY      | Accept/Date: _____                           | Test Mode: Final         | Part 3.2 Test            |
| Operator 2:             | Accept/Date: _____                           | BOM: ENPL-RT10473        | Sign: _____              |
| Fuel Serial #: 70C50007 | Ignition Left: 19090143                      | Ignition Right: 20100042 |                          |
| Fuel Slave: NO          | Ignit_L Slave: NO                            | Ignit_R Slave: NO        | SW Rev: LSW20001-B LCY   |
| Fuel Curve: N/A         | Float Bowl Connected to Fuel Pump Inlet: YES |                          | Barometer: 29.2          |
| Pre-Oil Temp: 165       | Pre-Oil Pres: 85                             | Setting #: 2524450-9     | Read Time: 5/18/22 09:13 |
| ETS #: 634eg180         | ETS Rev: EC0-26217                           | Date/Time: 5/18/22 08:56 | Test Status: Fail        |

Comments

Variations

|             |                                                                                                                                                                                                                                      |            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
|             | The following minor variations to the applicable engine test specification were observed during this test and determined to be acceptable 'as is'. The acceptance of these variations will not affect air worthiness or performance. |            |
|             | 1) _____                                                                                                                                                                                                                             |            |
|             | 2) _____                                                                                                                                                                                                                             |            |
|             | 3) _____                                                                                                                                                                                                                             |            |
|             | 4) _____                                                                                                                                                                                                                             |            |
| Engr. _____ | Q.C. _____                                                                                                                                                                                                                           | Date _____ |

| When / Test                       | Low Limit | Value | High Limit | Status |
|-----------------------------------|-----------|-------|------------|--------|
| <b>2 Runin @ 1500 for 5 min</b>   |           |       |            |        |
| Allowable Speed Variation (RPM)   | -75       | 0.2   | 75         | Pass   |
| Cylinder Head Temperature (DegF)  |           | 253.5 | 475        | Pass   |
| Inlet Air Temp (DegF)             | 0         | 65.2  | 110        | Pass   |
| <b>5 Runin @ 1800 for 5 min</b>   |           |       |            |        |
| Allowable Speed Variation (RPM)   | -75       | 2.2   | 75         | Pass   |
| Cylinder Head Temperature (DegF)  |           | 256.2 | 475        | Pass   |
| Inlet Air Temp (DegF)             | 0         | 63.3  | 110        | Pass   |
| <b>8 Runin @ 2200 for 5 min</b>   |           |       |            |        |
| Allowable Speed Variation (RPM)   | -75       | 2.6   | 75         | Pass   |
| Cylinder Head Temperature (DegF)  |           | 290.8 | 475        | Pass   |
| Inlet Air Temp (DegF)             | 0         | 64.6  | 110        | Pass   |
| <b>11 MagChk @ 2200 for 1 min</b> |           |       |            |        |
| Magneto Dropoff - Each Mag (RPM)  |           | 193.1 | 150        | Fail   |

# 2<sup>ND</sup> TEST @ LYCOMING IDLE SETTING

Cell No. 1-3

**LYCOMING**

Production Automated Engine Test Log  
Power, Filter & Leak Data Sheet

Form# T-001

|                                 |                                                      |                                  |                                  |
|---------------------------------|------------------------------------------------------|----------------------------------|----------------------------------|
| <b>Engine # :</b> L-33770-51    | <b>Model # :</b> IO-360-C1C                          | <b>Order # :</b> MT299247        | <b>Preservation :</b> LPS 486    |
| <b>Operator 1:</b> T. HOY       | <b>Accept/Date :</b> _____                           | <b>Test Mode :</b> Green         | <b>Part 3.2 Test</b>             |
| <b>Operator 2:</b>              | <b>Accept/Date :</b> _____                           | <b>BOM :</b> ENPL-RT10473        | <b>Sign :</b> _____              |
| <b>Fuel Serial # :</b> 70C50007 | <b>Ignition Left :</b> 19090143                      | <b>Ignition Right :</b> 20100042 |                                  |
| <b>Fuel Slave :</b> NO          | <b>Ignit_L Slave :</b> NO                            | <b>Ignit_R Slave :</b> NO        | <b>SW Rev :</b> LSW20001-8 LCY   |
| <b>Fuel Curve :</b> N/A         | <b>Float Bowl Connected to Fuel Pump Inlet :</b> YES |                                  | <b>Barometer :</b> 29.2          |
| <b>Pre-Oil Temp :</b> 165       | <b>Pre-Oil Pres :</b> 85                             | <b>Setting # :</b> 2524450-9     | <b>Read Time :</b> 5/18/22 10:57 |
| <b>ETS # :</b> 634eg180         | <b>ETS Rev :</b> ECO-26217                           | <b>Date/Time :</b> 5/18/22 10:24 | <b>Test Status :</b> Fail        |

**Comments**

**Variations**

|  |                                                                                                                                                                                                                                                                                                                                                      |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>The following minor variations to the applicable engine test specification were observed during this test and determined to be acceptable 'as is'. The acceptance of these variations will not affect air worthiness or performance.</p> <p>1) _____</p> <p>2) _____</p> <p>3) _____</p> <p>4) _____</p> <p>Engr. _____ Q.C. _____ Date _____</p> |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| When / Test                            | Low Limit | Value  | High Limit | Status |
|----------------------------------------|-----------|--------|------------|--------|
| <b>13 Runin @ 1500 for 5 min</b>       |           |        |            |        |
| Allowable Speed Variation (RPM)        | -75       | 4.5    | 75         | Pass   |
| Cylinder Head Temperature (DegF)       |           | 251.8  | 475        | Pass   |
| Inlet Air Temp (DegF)                  | 0         | 66.1   | 110        | Pass   |
| <b>16 Runin @ 1800 for 5 min</b>       |           |        |            |        |
| Allowable Speed Variation (RPM)        | -75       | 1.2    | 75         | Pass   |
| Cylinder Head Temperature (DegF)       |           | 257.3  | 475        | Pass   |
| Inlet Air Temp (DegF)                  | 0         | 65.8   | 110        | Pass   |
| <b>19 Runin @ 2200 for 5 min</b>       |           |        |            |        |
| Allowable Speed Variation (RPM)        | -75       | 2.2    | 75         | Pass   |
| Cylinder Head Temperature (DegF)       |           | 288    | 475        | Pass   |
| Inlet Air Temp (DegF)                  | 0         | 65.3   | 110        | Pass   |
| <b>22 MagChk @ 2200 for 1 min</b>      |           |        |            |        |
| Magneto Dropoff - Each Mag (RPM)       |           | 171.7  | 150        | Fail   |
| Magneto Dropoff - Difference (RPM)     |           | 74.8   | 35         | Fail   |
| Cylinder Head Temperature (DegF)       |           | 287.9  | 475        | Pass   |
| Inlet Air Temp (DegF)                  | 0         | 66.3   | 110        | Pass   |
| <b>24 Rated @ Rated for 10 min</b>     |           |        |            |        |
| Rated Speed (RPM)                      | 2650      | 2686.6 | 2750       | Pass   |
| Manifold Pressure @ Rated ("HG)        | 26.5      | 28.25  | 28.5       | Pass   |
| Fuel Pressure @ Rated (PSI)            | 18        | 22.1   | 28         | Pass   |
| Oil Pressure @ Rated (PSI)             | 75        | 79.6   | 85         | Pass   |
| Air Flow Limits (PPH)                  | 1014      | 1094   |            | Pass   |
| Cylinder Head Temperature (DegF)       |           | 343.7  | 475        | Pass   |
| Oil Gallery Temp @ Rated (DegF)        | 165       | 182.2  | 215        | Pass   |
| Inlet Air Temp (DegF)                  | 0         | 76.2   | 110        | Pass   |
| <b>27 Final_Idle @ 0 for 5 min</b>     |           |        |            |        |
| Idle Speed (RPM)                       | 600       | 700.8  | 700        | Review |
| Cylinder Head Temperature (DegF)       |           | 259    | 475        | Pass   |
| Oil Gallery Temp @ Final_Idle (DegF)   | 140       | 176.7  | 215        | Pass   |
| Oil Pressure @ Idle (PSI)              | 25        | 51.9   |            | Pass   |
| Manifold Pressure @ Final Idle (In Hg) | 8         | 12.7   | 17         | Pass   |
| Inlet Air Temp (DegF)                  | 0         | 65.7   | 110        | Pass   |
| <b>29 Manual @ N/A for 0 min</b>       |           |        |            |        |
| Acceleration Check (sec)               | 2         | 3      | 5          | Pass   |
| Idle Cut-off Time (sec)                | 0         | 4      | 5          | Pass   |
| Engine # : L-33770-51                  |           |        |            |        |
| Date/Time : 5/18/22 10:24              |           |        |            |        |