

**FINAL**  
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**NATIONAL  
TRANSPORTATION  
SAFETY  
COMMITTEE**

**Aircraft Serious Incident Investigation**

**Alfa Flying School  
Cessna 172 ; PK-SDQ  
Cikampek KM 72 + 400 Highway  
Cikampek, West Java  
Republic of Indonesia  
29 October 2008**



**NATIONAL TRANSPORTATION SAFETY COMMITTEE  
MINISTRY OF TRANSPORTATION  
REPUBLIC OF INDONESIA  
2011**

This Final Report was produced by the National Transportation Safety Committee (NTSC), Ministry of Transportation Building 3<sup>rd</sup> Floor, Jalan Merdeka Timur No. 5 Jakarta 10110, Indonesia.

The report is based upon the investigation carried out by the NTSC in accordance with Annex 13 to the Convention on International Civil Aviation, the Indonesian Aviation Act (UU No. 1/2009) and Government Regulation (PP No. 3/2001).

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## GLOSSARY OF ABBREVIATIONS

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AD	Airworthiness Directive
AFM	Airplane Flight Manual
AGL	Above Ground Level
ALAR	Approach-and-landing Accident Reduction
AMSL	Above Mean Sea Level
AOC	Air Operator Certificate
ATC	Air Traffic Control
ATPL	Air Transport Pilot License
ATS	Air Traffic Service
Avsec	Aviation Security
BMKG	Badan Meterologi, Klimatologi dan Geofisika
BOM	Basic Operation Manual
°C	Degrees Celsius
CAMP	Continuous Airworthiness Maintenance Program
CASO	Civil Aviation Safety Officer
CASR	Civil Aviation Safety Regulation
CPL	Commercial Pilot License
COM	Company Operation Manual
CRM	Cockpit Recourses Management
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DFDAU	Digital Flight Data Acquisition Unit
DGCA	Directorate General of Civil Aviation
DME	Distance Measuring Equipment
EEPROM	Electrically Erasable Programmable Read Only Memory
EFIS	Electronic Flight Instrument System
EGT	Exhaust Gas Temperature
EIS	Engine Indicating System
FL	Flight Level
F/O	First officer or Co-pilot
FDR	Flight Data Recorder
FOQA	Flight Operation Quality Assurance

GPWS	Ground Proximity Warning System
hPa	Hectopascals
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IIC	Investigator in Charge
ILS	Instrument Landing System
Kg	Kilogram(s)
Km	Kilometer(s)
Kt	Knots (NM/hour)
Mm	Millimeter(s)
MTOW	Maximum Take-off Weight
NM	Nautical mile(s)
KNKT / NTSC	Komite Nasional Keselamatan Transportasi / National Transportation Safety Committee
PIC	Pilot in Command
QFE	Height above aerodrome elevation (or runway threshold elevation) based on local station pressure
QNH	Altitude above mean sea level based on local station pressure
RESA	Runway End Safety Area
RPM	Revolution Per Minute
SCT	Scattered
S/N	Serial Number
SSCVR	Solid State Cockpit Voice Recorder
SSFDR	Solid State Flight Data Recorder
TS/RA	Thunderstorm and rain
TAF	Terminal Aerodrome Forecast
TSN	Time Since New
TT/TD	Ambient Temperature/Dew Point
TTIS	Total Time in Service
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

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## **INTRODUCTION**

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### **SYNOPSIS**

On 29 October 2008, the aircraft Cessna 172 registered PK-SDQ operated by Alfa Flying School was being in cross country flight training from Halim Perdanakusuma Airport, Jakarta to Penggung Airport, Cirebon.

On board in this flight were one instructor, one observer, and one student pilot.

At 0040 UTC (0740 LT) the aircraft departed runway 24 Halim Perdanakusuma and climb to altitude 1,500 feet and proceed to BARUS point. After BARUS point the aircraft climb to 2,500 feet and contacted Jakarta approach, the pilot requested to fly to 5,500 feet.

While the aircraft flying over the PW NDB, the aircraft lost the engine power. The pilot decided to make a force landing at Jakarta-Cikampek highway.

The engine quit due to failure of the crankshaft idle gear that stopped the rotation of magneto and ignition.



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# 1 FACTUAL INFORMATION

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## 1.1 History of the flight

On 29 October 2008, the aircraft Cessna 172 registered PK-SDQ operated by Alfa Flying School was being in cross country flight training from Halim Perdanakusuma Airport<sup>1</sup>, Jakarta to Penggung Airport, Cirebon.

There were one instructor, one observer, and one student pilot. The student pilot was control the aircraft.

At 00:40 UTC<sup>2</sup> (07:40 LT) the aircraft departed runway 24 Halim and climb to altitude 1,500 feet and proceed to BARUS point. After BARUS point the aircraft climbed to 2,500 feet and contacted Jakarta approach, the pilot requested to fly to 5,500 feet.

At 01:10 while the aircraft passing 5,000 feet (over the PW NDB/Purwakarta area), the engine was quit. The student pilot attempted to restart the engine but failed. The instructor was taken over to control the aircraft then transmitted a distress message (mayday) and selected transponder code to 7700.

At 01:15 the aircraft landed at the shoulder lane of Jakarta – Cikampek highway with landing direction approximately 070 on the side of traffic toward Cikampek.

No one injured in this serious incident.

## 1.2 Injuries to persons

Injury	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	3	-	3	-
<b>TOTAL</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>-</b>

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<sup>1</sup> Halim Perdanakusuma Airport, Jakarta will named Halim for the purposes of this report.

<sup>2</sup> The 24-hour clock in Coordinated Universal Time (UTC) is used in this report to describe the local time as specific events occurred. Local time in the area of the accident, West Indonesia standard Time (Waktu Indonesia Barat (WIB)) is UTC +7 hours

### **1.3 Damage to aircraft**

There was no damage to the aircraft.

### **1.4 Other damage**

There was no other damage to other property and/or the environment.

### **1.5 Personnel Information**

#### **1.5.1 Pilot in command (Pilot Instructor)**

Gender	:	Female
Date of birth	:	10 April 1961
Marital status	:	Married
Nationality	:	Indonesia
License	:	Commercial Pilot Licence (CPL)
Valid to	:	16 March 2010
Aircraft type rating	:	Cessna 172
Instrument rating	:	Valid
Medical certificate	:	Class 1
Date of medical	:	28 Augusts 2008
Valid to	:	February 2009
Last proficiency check	:	February 2008
Total hours	:	5934,1 hours
Total on this type	:	1900 hours
Last 90 days	:	180 hours
Last 72 days	:	60 hours
Last 24 hours	:	6 hours
This flight	:	25 minutes

#### **1.5.2 Student Pilot**

Gender	:	Male
Date of birth	:	15 April 1989
Marital status	:	Single

Nationality	: Indonesia
License	: Student Pilot Permit (SPP)
Valid to	: 13 August 2010
Aircraft type rating	: Cessna 172
Medical certificate	: Second Class
Date of medical	: 13 August 2008
Valid to	: February 2009
Total hours	: 45 hours

## **1.6 Aircraft Information**

### **1.6.1 Aircraft data**

Manufacturer	Cessna Aircraft Company, USA
Model	172 N
Serial number	17270484
Registration	PK-SDQ
Year of manufacture	1979
Certificate of airworthiness Validity	30 January 2009
Issued date	31 January 2008
Certificate of registration Valid	23 January 2009
TSN	14,976.5 hours
Weight and balance issued date	4 March 2007
Swing compass issued date	11 March 2008
Radio permit	Valid until 15 April 2009

### **1.6.2 Engine data**

Manufacturer	Textron Lycoming
Model	O-320 D2J
Serial number	RL 9211-39E
TSO	717 hours 24 minutes

## **1.7 Meteorological information**

Not relevant to this serious incident

## **1.8 Aids to navigation**

Not relevant to this serious incident.

## **1.9 Communications**

All communication between ATS and the crew were recorded by ground-based automatic voice recording equipment for the duration of the flight. The quality of the ground-base automatic voice recording and the aircraft transmission was good.

## **1.10 Aerodrome information**

Not relevant to this serious incident.

## **1.11 Flight Recorders**

The aircraft was not fitted with a Flight Data Recorder or Cockpit Voice Recorder. It is not required under current Indonesia Civil Aviation Regulation.

## **1.12 Wreckage and impact information**

Not relevant to this serious incident.

## **1.13 Medical and pathological information**

There was no evidence that physiological factors or incapacitation of the pilots affected their performance.

## **1.14 Fire**

There was no pre or post-impact fire.

## **1.15 Survival aspects**

This accident was survivable.

## **1.16 Tests and research**

Not relevant to this accident.

## **1.17 Organisational and management information**

Aircraft Owner : Alfa Flying School

Aircraft Operator : Alfa Flying School  
Halim Perdanakusuma Airport Jakarta, Indonesia

Aircraft Operator Certificate number: AOC/141- 004

## **1.18 Additional information**

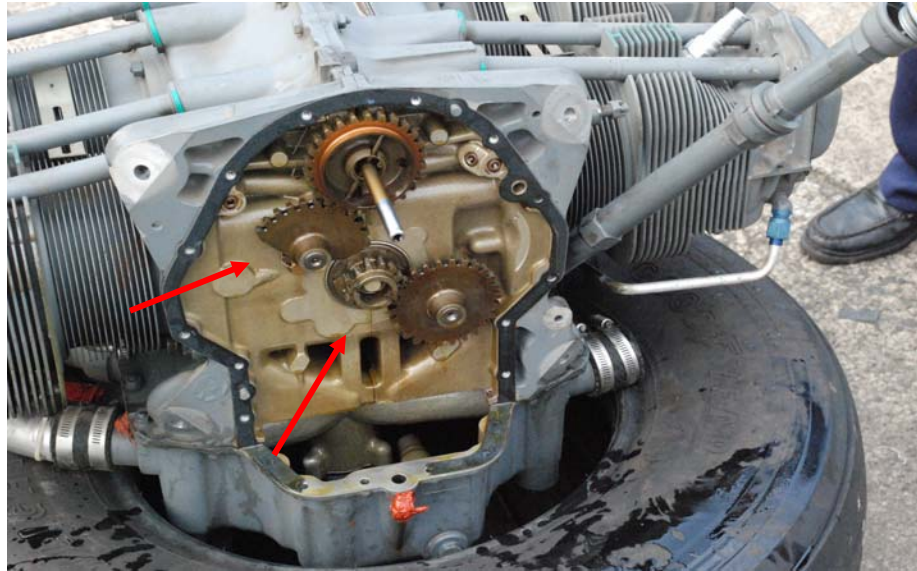
### **1.18.1 Engine examination**

To determine the cause of the engine failure, the investigation decided to tear down the engine. The engine tear down was conducted at the facilities of Halim Perdanakusuma Airport of Jakarta by the NTSC investigator.

General visual inspection to the engine showed that no evidence of damaged, the propeller blades could be rotated by hand.

The engine tear down was then performed with the following sequences:

1. The Engine Rocker Box was opened and the propeller was rotated clockwise. It was found that rocker arm did not move. This indicated that the camshaft did not rotate.
2. The accessory gear case was opened. The investigation found that the crank shaft idle gear and the crankshaft gear were broken. Broken pieces of the crankshaft gear and the idle gear were sent to the Metallurgical Laboratory of the Institute of Technology, Bandung for further analysis.



**Figure 1: Accessories Gear Case after being opened**

The Investigation found that the damaged parts installed were as follows.

1. Crankshaft Idler Gear, plain P/N 7447 DET 74996-ASSY V 6498 43/07
2. Crankshaft Gear P/N 13S19646

Refer to the IPC (Illustrated Parts Catalogue) of Lycoming O-320-B and D Series the part number data are as follows.

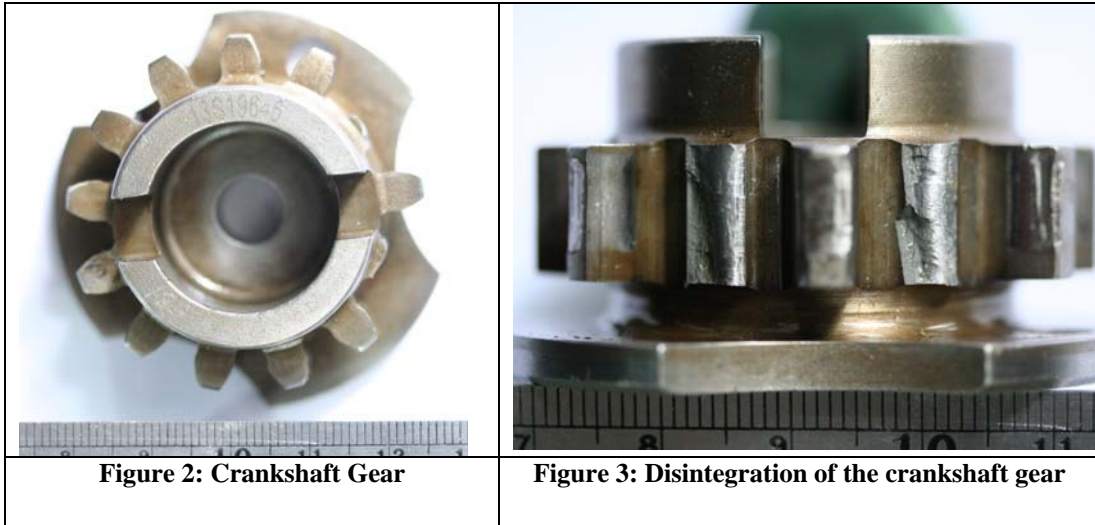
1. Crankshaft Idler Gear, plain P/N 75072
2. Crankshaft Gear P/N 61155

### **1.18.2 Metallurgical analysis**

The crankshaft gear and crankshaft idle gear that failed were analyzed in the Metallurgical Laboratory to determine the cause of the failure.

On the crankshaft gear there were two gear teeth that disintegrated/ detached (see figure 4). Other gear teeth of the crankshaft gear also indicated wear, pits or dent on the gear surface. The mode of failure on the detached gear teeth can be concluded as a fatigue failure (see figure 5). Fatigue fractures were propagated from the left side.

Gear surface finish was relatively rough.



Analysis on the failed crank-shaft gear showed that the wear, dent and pits on the contact surface indicated that the gear had a meshing / geometric problem. This indication was also supported by the fact that the surface finish was relatively rough, and machining marks were still visible on the matching gear surface. A gear grinding operation should be performed followed a hardening process. These showed that the gear failed due to improper manufacturing process.

The crank shaft idle gear failure was due to static overload. That is to say the failure of the crankshaft gear was followed by disintegration of the idle gear.



**Figure 4: Crankshaft idle gear**

The failure of the crankshaft idle gear would then stopped the rotation of the magneto as well as the ignition, and followed by the engine quit.

### **1.18.3 History of the Engine**

The engine was overhauled and tested at the Lycoming Facility under Work order number AR 323063 dated 14 April 2008. The engine was send back to Indonesia with Export Airworthiness Certificate No. E – 274 dated 15 April 2008.

There was no evidence of part replacement record on the overhaul data.

The engine was installed on PK–SDQ aircraft since 06 June 2008. At that time of the engine installation the Aircraft Total Flight hours was 14259.1

### **1.19 Useful or Effective Investigation Technique**

The investigation is being conducted in accordance with NTSC approved policies and procedures, and in accordance with the standards and recommended practices of Annex 13 to the Chicago Convention.



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## 2 ANALYSIS

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The engine was overhauled and tested at Lycoming Facility under work order number AR 323063 dated 14 April 2008. The engine was sent to Indonesia with an Export Airworthiness Certificate No. E – 274 dated 15 April 2008.

There was no evidence of part replacement record on the overhaul data.

The engine was installed on PK–SDQ aircraft since 06 June 2008. At that time of the engine installation the Aircraft Total Flight hours was 14259.1

The broken parts of the engine were as follow:

1. Crankshaft Idler Gear, plain P/N 7447 DET 74996-ASSY V 6498 43/07
2. Crankshaft Gear P/N 13S19646

Refer to the IPC (Illustrated Parts Catalogue) of Lycoming O-320-B and D Series the part number data should be as follows:

1. Crankshaft Idler Gear, plain P/N 75072
2. Crankshaft Gear P/N 61155

It showed that there were discrepancies in part number between the part catalogue and the installed parts. However the investigation could not reveal the interchange ability of different part numbers.

The failure of the crank-shaft gear was due to contact/meshing problem. There were evidence of wear, pits and dents on its gear surface. The gear surfaces were relatively rough; the machining marks were still on the gear surfaces. It indicated that the final dimension of the crank-shaft gear was improper causing extraneous load. A gear grinding operation should be performed following a hardening process. These showed that the gear failed due to an improper manufacturing process.

The failure of the crankshaft idle gear stopped the rotation of the magneto and the ignition. It caused the engine quit.

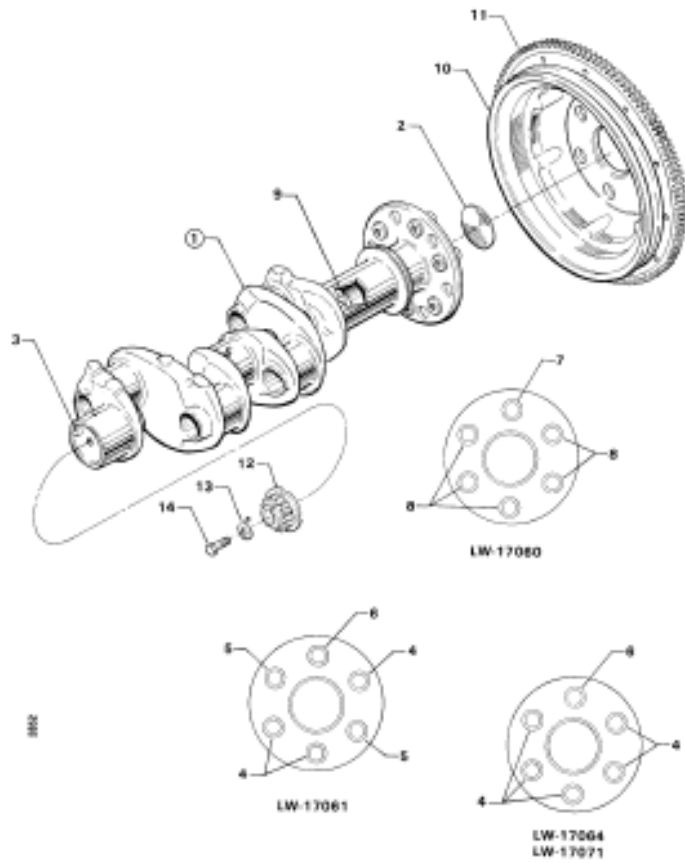


Figure 4. CRANKSHAFT AND RELATED PARTS

1-8

Figure 5: Refer to Avco lycoming part catalogue, crankshaft and related parts

**CRANKCASE, CRANKSHAFT AND CAMSHAFT GROUP**  
CRANKSHAFT AND RELATED PARTS

FIG. REF. 4	PART NUMBER	DESCRIPTION	O N A L L	QUANTITY PER ASSEMBLY												
				B 2 B	B 2 C	B 3 B	D 1 A	D 1 D	D 1 F	D 2 A	D 2 B	D 2 C	D 2 G	D 2 J	D 3 G	
1	LW-17060	CRANKSHAFT AND PLUG ASSEMBLY		1	1					1	1	1		1		
	LW-17061	CRANKSHAFT AND PLUG ASSEMBLY				1	1	1	1							
	LW-17064	CRANKSHAFT AND PLUG ASSEMBLY											1			
	LW-17071	CRANKSHAFT AND PLUG ASSEMBLY												1		
2	STD-1211	PLUG, 2.00 dia. expansion	1													
3	STD-1065	DOWEL, Stepped 5/16-1/4 dia. x 9/16 long	1													
4	72063	BUSHING, Propeller flange				3	3	3	3							
	72063	BUSHING, Propeller flange											5	5		
5	72064	BUSHING, Propeller flange				2	2	2	2							
6	72065	BUSHING, Propeller flange				1	1	1	1				1	1		
7	72066	BUSHING, Propeller flange			1	1				1	1	1			1	
8	72067	BUSHING, Propeller flange			5	5				5	5	5			5	
9	61510	PLUG, 1-3/4 O.D.				1	1	1	1							
10	74414	SUPPORT ASSY., Starter ring gear 12/14 pitch, 1.91:1														
		drive			1	1	1	1		1	1	1			1	
	76628	SUPPORT ASSY., Starter ring gear 12/14 pitch, 3.25:1														
		drive			1	1	1	1	1	1	1	1	1			
	LW-16843	SUPPORT ASSY., Starter ring gear 12/14 pitch, 3.25:1														
		drive													1	
11	72566	GEAR, Starter ring	1													
12	61155	GEAR, Crankshaft	1													
13	LW-18639	LOCKPLATE, Crankshaft gear	1													
14	STD-2213	SCREW, 5/16-24 x 1.00 long	1													

Figure 6: Refer to Avco lycoming part catalogue, Crankcase, Crankshaft and Camshaft Group

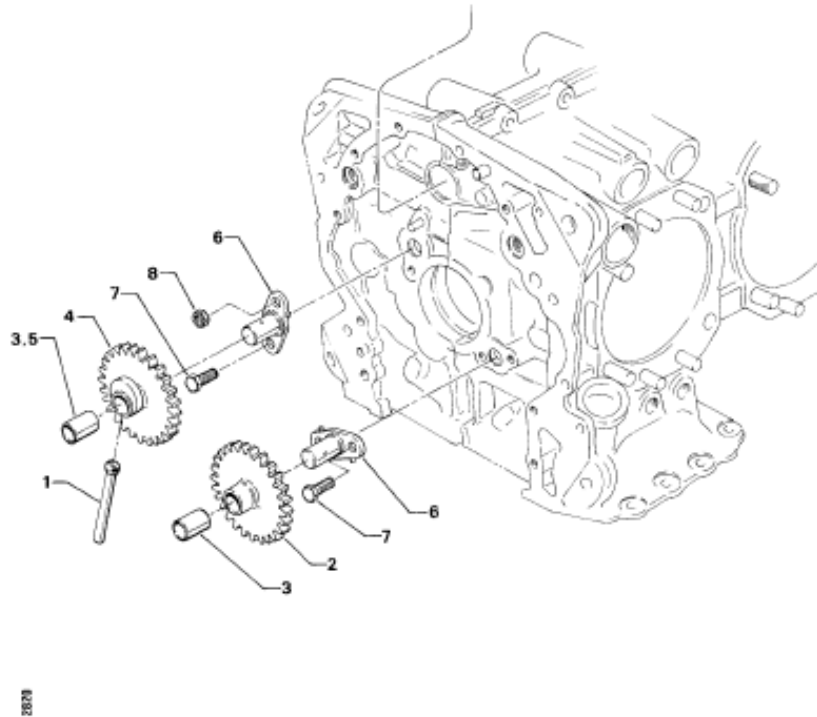


Figure 7. CRANKSHAFT IDLER GEARS

1-14

Figure 7: Refer to Avco Lycoming part catalogue, Cranksaft Idler Gear

**CRANKCASE, CRANKSHAFT AND CAMSHAFT GROUP**

**CRANKSHAFT IDLER GEARS**

FIG. REF. 7	PART NUMBER	DESCRIPTION	O N A L L	QUANTITY PER ASSEMBLY																			
				B 2 B 2 B 3 B 1 D 1 D 2 D 2 D 2 D 2 D 2 D 3	B C B A D F A B C G J G																		
1	61544	PLUNGER, Fuel pump, long		1	1	1	1	1	1	1	1	1	1	1	1								
2	74996	GEAR ASSY., Crankshaft idler, plain		1	1	1	1	1	1	1	1	1	1	1	1								
	74996	GEAR ASSY., Crankshaft idler, plain		2	2										2	2							
3	77309	BUSHING, Crankshaft idler gear		1	1	1	1	1	1	1	1	1	1	1	1								
	77309	BUSHING, Crankshaft idler gear		2	2										2	2							
4	75072	GEAR ASSY., Crankshaft idler		1	1	1	1	1	1	1	1	1	1	1	1								
5	77309	BUSHING, Crankshaft idler gear		1	1	1	1	1	1	1	1	1	1	1	1								
6	LW-13796	SHAFT, Crankshaft idler gear	2																				
7	STD-2167	SCREW, 5/16-18 x 7/8 long, hex. hd. dr.	3																				
8	STD-2168	NUT, 5/16-18 NC-3 slotted shear	1																				

**Figure 8: Refer to Avco lycoming part catalogue, Crankcase, Crankshaft and Camshaft Group**

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## **3 CONCLUSIONS**

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### **3.1 Findings**

- The instructor pilot held a valid license for the operation of the aircraft.
- The aircraft was certified as being airworthy at the time of the serious incident.
- The aircraft conducted a forced landing at shoulder lane of Jakarta-Cikampek highway with a landing direction approximately 070 on the side of traffic toward Cikampek.
- The crank-shaft idle gear and crankshaft gear were broken.
- The failure of the crank-shaft gear was due to contact/meshing problem. There were evidence of wear, pits and dents on its gear surface. The gear surfaces were relatively rough; the machining marks were still on the gear surfaces. It indicated that the final dimension of the crank-shaft gear was improper causing extraneous load. A gear grinding operation should be performed following a hardening process. These showed that the gear failed due to an improper manufacturing process.
- The crank-shaft idle gear failure was caused by static overload following the failure of the crank-shaft gear.
- The failure of the crankshaft idle gear stopped the rotation of the magneto and the ignition. It caused the engine quit.

### **3.2 Causes**

The failed crank-shaft gear showed that the wear, dent and pits on tooth/ contact surface indicated that the gear has a meshing / geometric problem. This indication was also supported by the fact that the surface finish was relatively rough, and machining marks were still visible on the matching gear surface. A gear grinding operation should be performed followed a hardening process.

The cause of the serious incident was a failure in the crank-shaft gear which was due to an improper manufacturing process.

The crank-shaft idle gear failure was caused by static overload following the failure of the crank-shaft gear.

The failed of the crank-shaft idle gear has stopped the rotation of magneto and ignition, and followed by the engine quit.

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## **4 SAFETY RECOMMENDATIONS**

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As a result of this investigation, the National Transportation Safety Committee issues the following recommendations:

### **4.1 Recommendation to Textron Inc. (Lycoming Engines Manufacturer):**

The National Transportation Safety Committee recommends that Textron Inc. to review the manufacturing process performed to the failed crank-shaft gear and the possibility of similar condition to crank-shaft gear in the same manufacturing batch number.