



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

ENGINE EXAM / RUN

WPR19LA017

Accident Date: October 30, 2018
Exam Date: February 19, 2020

This document contains 23 embedded images

A. ACCIDENT

Location: Cottonwood, California
Date: October 30, 2018
Aircraft: Cessna 180, N6414X, Serial # 18050914
NTSB IIC: Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
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NTSB
Western Pacific Region

Henry Soderlund
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CAT

C. ACCIDENT SUMMARY

On October 30, 2018, about 0924 Pacific Daylight time, a Cessna 180D airplane, N6414X, impacted terrain short of the runway during an approach for landing at Lake California Air Park (68CA), Cottonwood, California. The private pilot/owner sustained serious injuries, and the airplane was substantially damaged. The flight had originated from Palo Alto Airport (PAO), Palo Alto, California, earlier that morning. The pilot reported that when the airplane was on the final approach leg to 68CA, at an altitude of about 200 ft above ground level, the engine suddenly "quit," which resulted in the short landing.

D. PREVIOUS EXAMINATION ACTIVITY

The airframe and engine were examined at the recovery facility on December 6, 2018. The relevant details are described in a separate document. The engine appeared to be runnable, and was removed and shipped to CAT Mobile AL. The removal and crating was accomplished by the recovery company personnel, without NTSB oversight.

E. INITIAL INFORMATION

- Engine O-470K17H, SN 900430
- Muffler/exhaust had been removed for shipping
 - Muffler shroud was removed at CAT and muffler examined
 - No punctures, significant corrosion, or loose internal baffling were observed
- Carburetor had been removed for shipping – reinstalled for test cell run
- A non-aviation solenoid was attached to the starter motor by an improvised means using a worm-clamp and safety wire
- Oil sump – slightly crushed from accident impact – no debris noted – replaced (to prevent blocking of oil pickup screen)
- Oil Pickup Screen – partially flattened by oil sump contact, but reused
- Balance/crossover tube – Partly crushed, plus one puncture (all impact-related)
 - Blue deposition/staining (fuel) around puncture, including on puncture fracture surfaces
 - Staining appeared to be from vapor ('soft' edges to staining) as opposed to liquid
 - No evidence of any blue staining on engine or components in vicinity of puncture
 - Replaced with new
- Cylinders borescoped (via top spark plug holes)
 - Spark plugs unremarkable/normal
 - Some minor debris (consistent with flaked-off combustion deposits) were observed in a few cylinders
 - All cylinder walls, valves, and valve seats were unremarkable
- Removed exhaust pipes, replaced with straight stacks (to fit on test cell engine stand)
- Removed alternator, vacuum pump, and governor (used test cell governor)
 - Governor oil screen was free of debris
- Magneto timing
 - Spec: 22° Left: 24° Right: 23.5°
- Cold Compressions (80 psi input, master orifice 44 psi)
 - Cyl 1- 5 psi, Cyl 2- 20 psi, Cyl 3 – 21 psi, Cyl 4 – 15 psi, Cyl 5- 5 psi, Cyl 6 – 35 psi

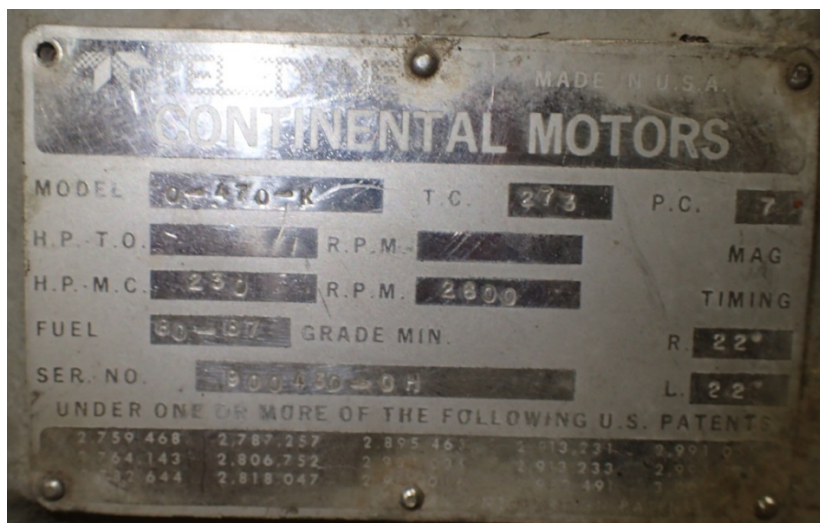


Figure 1 - Engine Data Plate

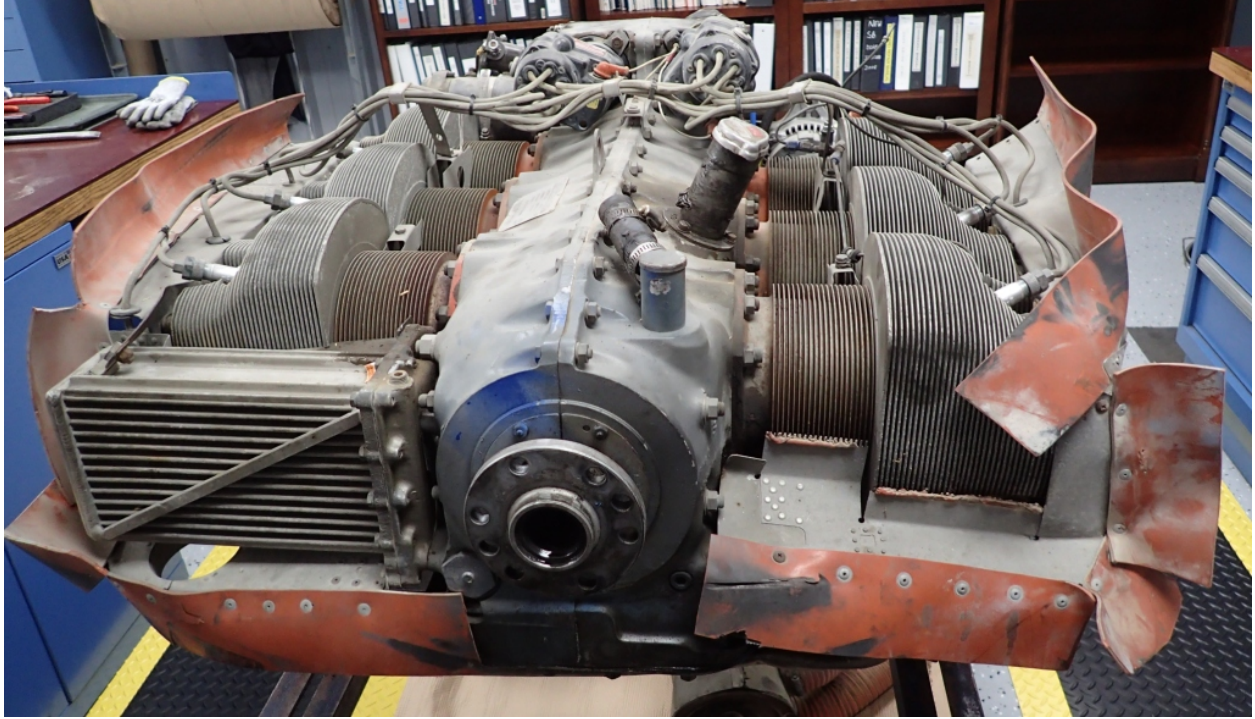


Figure 2 - Front of Engine

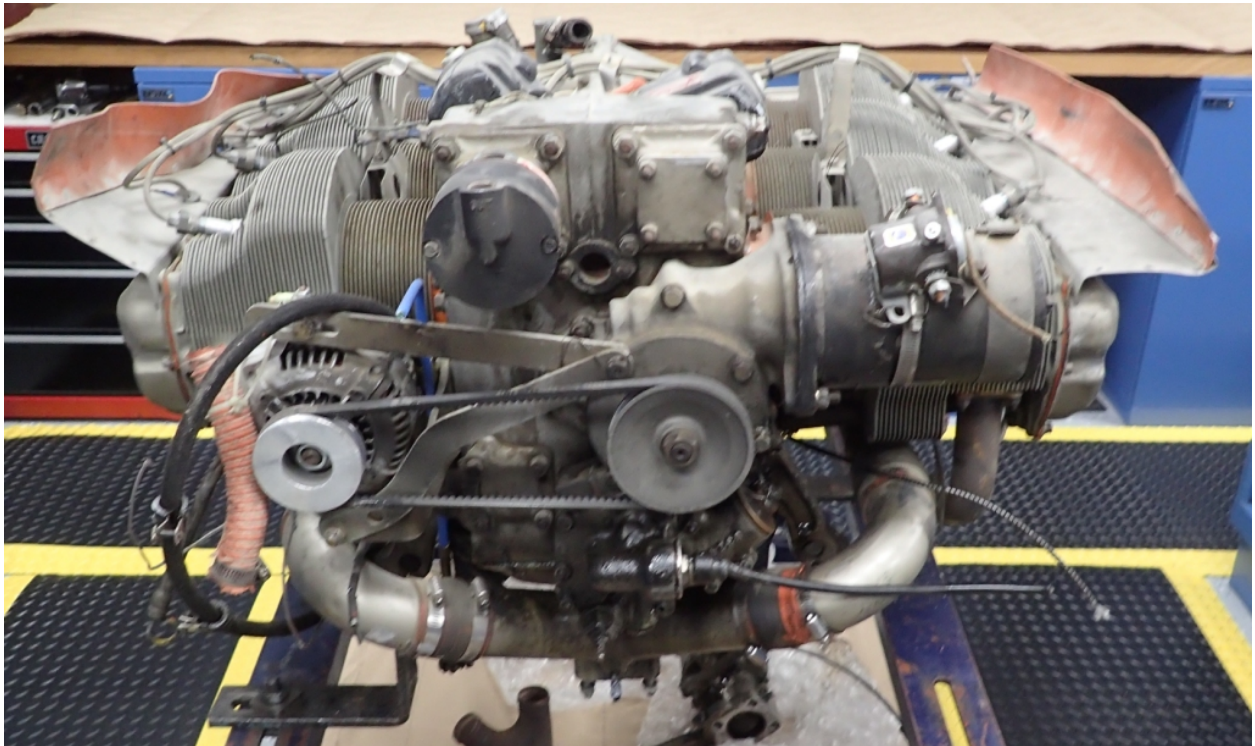


Figure 3 - Aft End of Engine

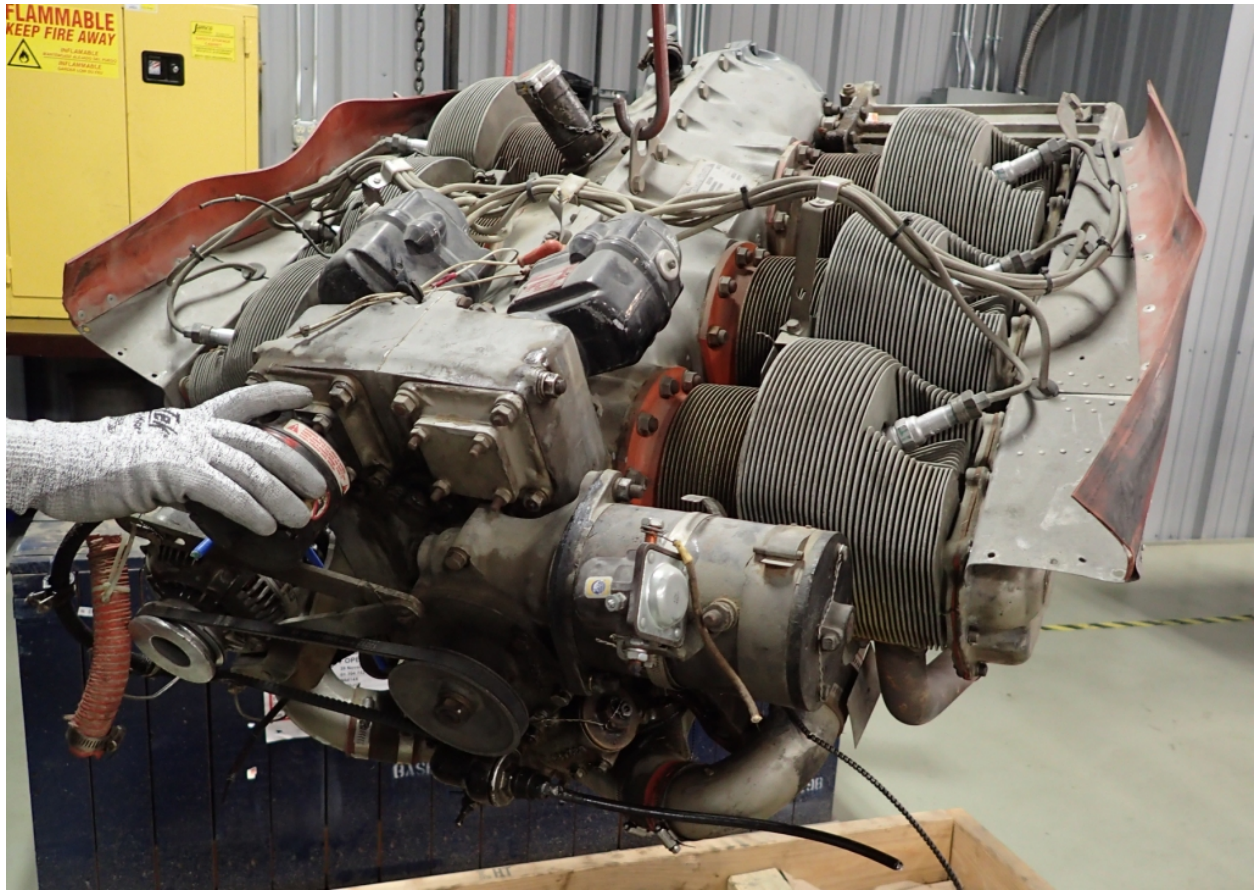


Figure 4 - Aft and Top of Engine



Figure 5 - Muffler with Shroud Removed



Figure 6 - Carburetor as Received

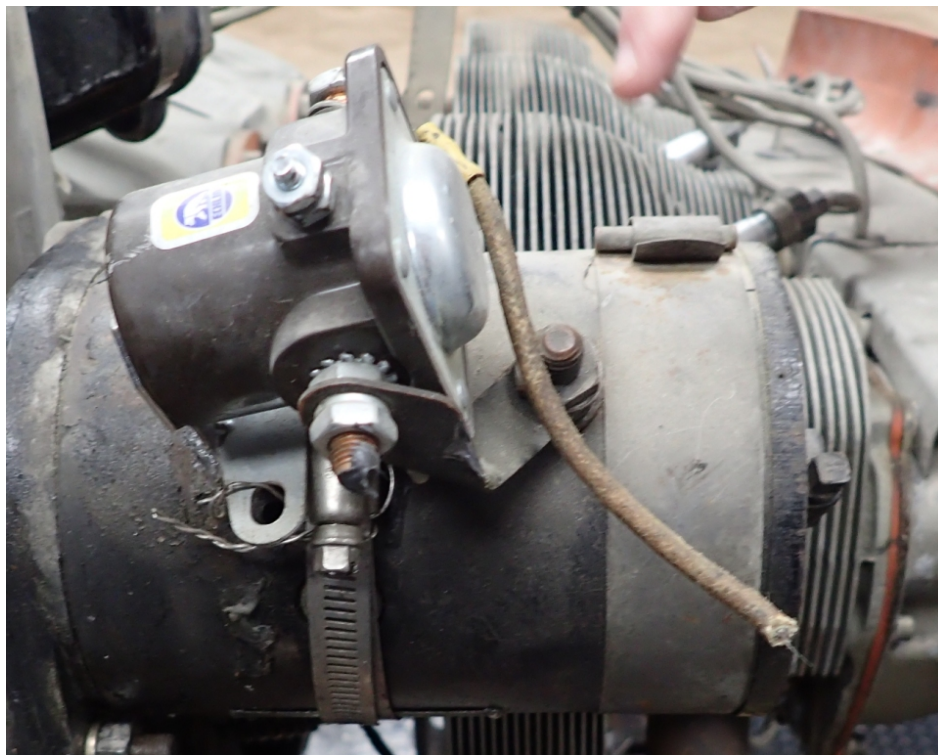


Figure 7 - Starter with Non-Aviation Solenoid



Figure 8 - Close-up of Solenoid



Figure 9 - Solenoid Attach Hardware



Figure 10 - Damaged Oil Sump

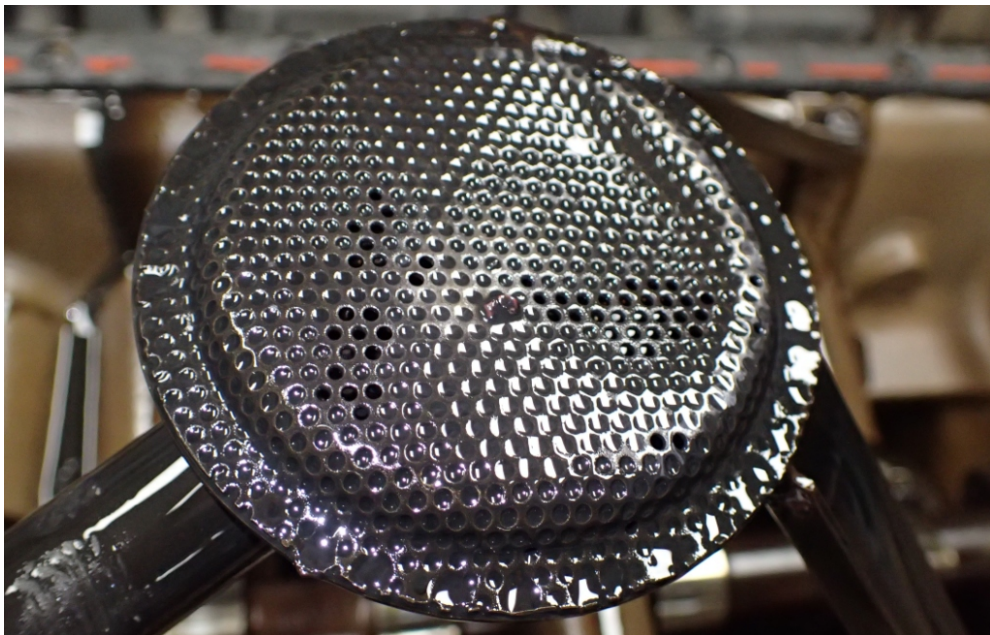


Figure 11 - Oil Pickup Screen



Figure 12 - Balance Tube



Figure 13 - Puncture in Balance Tube



Figure 14 - Top Spark Plugs

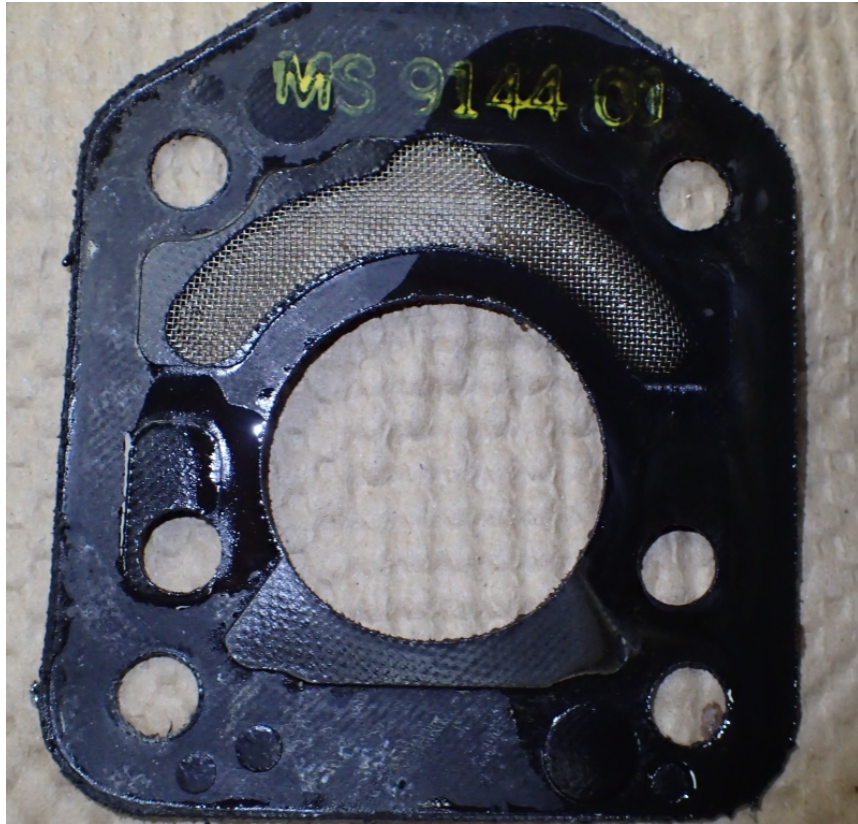


Figure 15 - Governor Oil Screen

F. TEST RUN INFORMATION

1.0 Setup

- Engine installed in test cell
 - Oil quantity verified
 - Instrumentation and controls connected
 - Test propeller installed (ground-adjustable pitch)

2.0 First Test Run

- Engine started successfully
 - The engine was allowed to warm up, and then run briefly at all the test rpm values except the maximum (redline) value of 2,600 rpm
 - Maximum (full throttle) rpm approximately 2,400
- Engine shut down and blades re-pitched (flatter) about 1°

3.0 Second Test Run

- Engine re-started and run to determine maximum achievable (full throttle) rpm (2,485)

- Conducted test per procedure, and engine operated normally at all rpm values except inability to achieve full throttle redline value of 2,600 rpm
 - EGT, CHT, and oil pressure values were all normal
 - Except CHT probe #1 inop
 - Fuel flow values were all normal except at full throttle
- Observed full throttle fuel flow value of 129 pph/21.5 gph at 2,485 rpm was higher than expected/normal
- See Figure 17 for tabular results
- Engine shut down normally after test



Figure 16 - Engine in Test Cell

Date	Engine Model	Engine Serial Number	Aircraft Registration	Page
02/20/2020	O470K17H	900430	N6414X	1 of 1

Engine Operational Test Log

ENGINE RUN PARAMETERS

Record	RPM	MP/TDP ° Hg	Oil		Fuel				Cell ° F	Cylinder Heat Temp (CHT) / Exhaust Gas Temp (EGT) ° F					
			PSI	° F	Lbs/Hr	Nozz PSI	Pump PSI	Fuel ° F		# 1	# 2	# 3	# 4	# 5	# 6
1	1200	14.6	63	108	356	—	—	63	60	1948	207	1934	200	1886	163
2	1600	19.2	62	143	529	—	—	63	61	11078	247	1891	322	1108	182
3	2100	26.2	56	147	923	—	—	69	63	11144	282	1117	386	11174	220
4	2450	27.0	52	165	121	—	—	75	69	11235	367	11181	130	11240	235
5	F/T 2485	27.4	50	168	129	—	—	76	69	11240	366	1187	133	1238	221
6	Idle 810	16.4	42	142	131	—	—	67	58	1399	217	406	63	393	147
7		/								/	/	/	/	/	/
Ambient Air Temperature °F			Ambient Air Pressure		Transfer Collar Δ P		Maximum Rated Power Engine Operational Parameters								
63.4			30.06		IN	OUT	RPM	° Hg MP	Fuel Flow Lbs/Hr	Metered PSI	Unmetered PSI				
					64.3	62.0	2600			N/A	N/A				

Notes: Operator – Randy Bryant.

Transfer collar pressure delta measured at full throttle power setting.

All recorded data was taken at 5-minute intervals unless otherwise noted.

Engine Performance Test				
Test RPM	Left Magneto	Left Magneto	Right Magneto	Right Magneto
	RPM	RPM Drop	RPM	RPM Drop
2100	2010	90	2012	88

Figure 17 - Engine Run Data

4.0 Post Test Run Activities

- Engine re-run following day to warm up in order to conduct compression checks
- Operating temperature engine compression checks (80 psi input)
 - o Cyl 1 - 68 psi
 - o Cyl 2 - 56 psi, rings/exhaust
 - o Cyl 3 - 73 psi
 - o Cyl 4 - 60 psi, exhaust
 - o Cyl 5 - 55 psi, rings
 - o Cyl 6 - 55 psi, rings
- Carburetor was removed from engine, examined, and disassembled
 - o No external irregularities noted
 - o Carburetor bowl was clean and free of debris or corrosion
 - o Metal floats intact/undamaged
 - o No indications of floats abrading against bowl walls
 - o Accelerator pump plunger intact and pliable
 - o Fuel inlet screen had several hair-like fibrous strands of undetermined origin or composition –insufficient to result in fuel flow decrease



Figure 18 – Carburetor



Figure 198 - Carburetor Data Plate

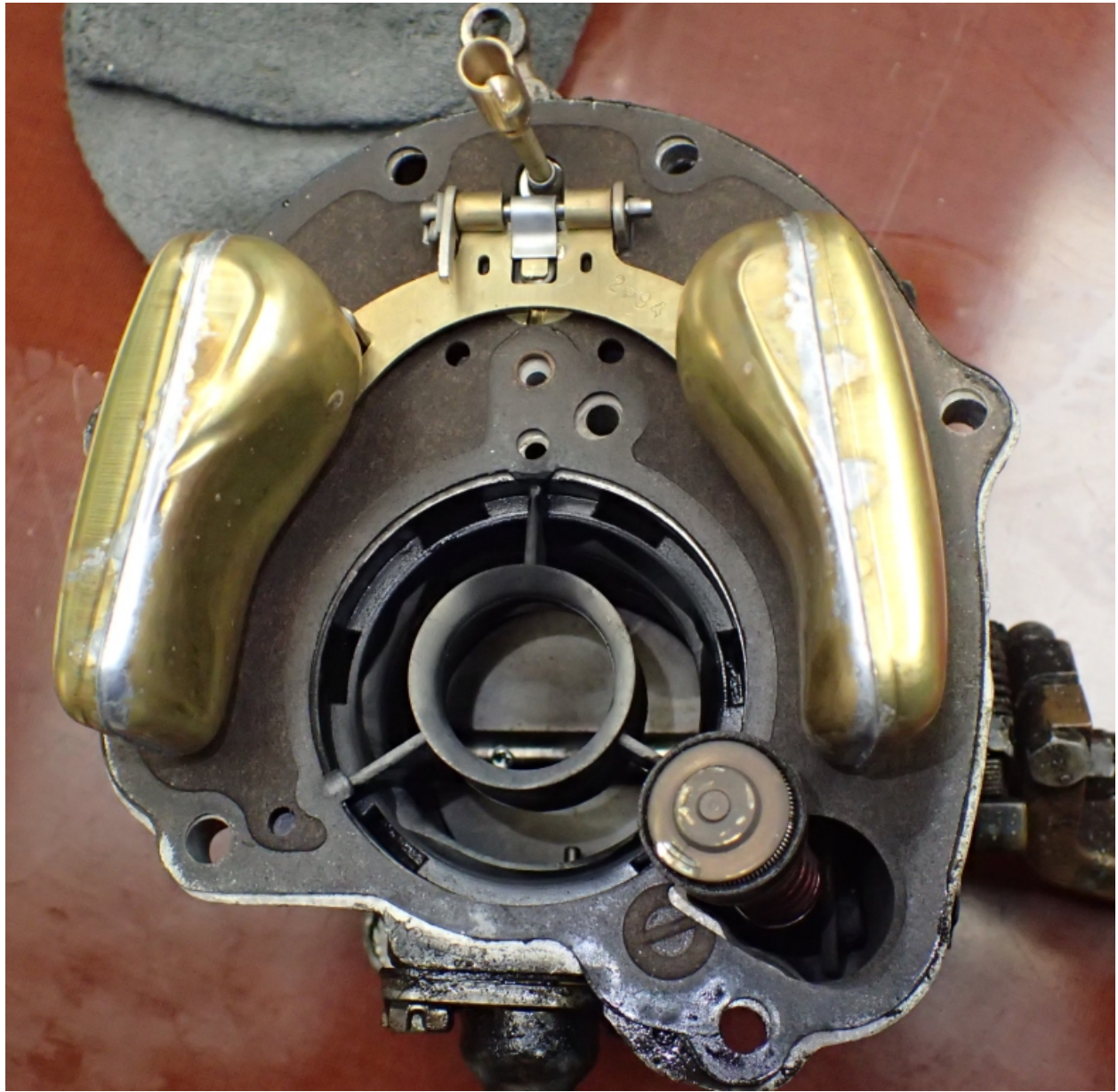


Figure 20 - Carburetor Floats



Figure 21 - Accelerator Pump and Floats

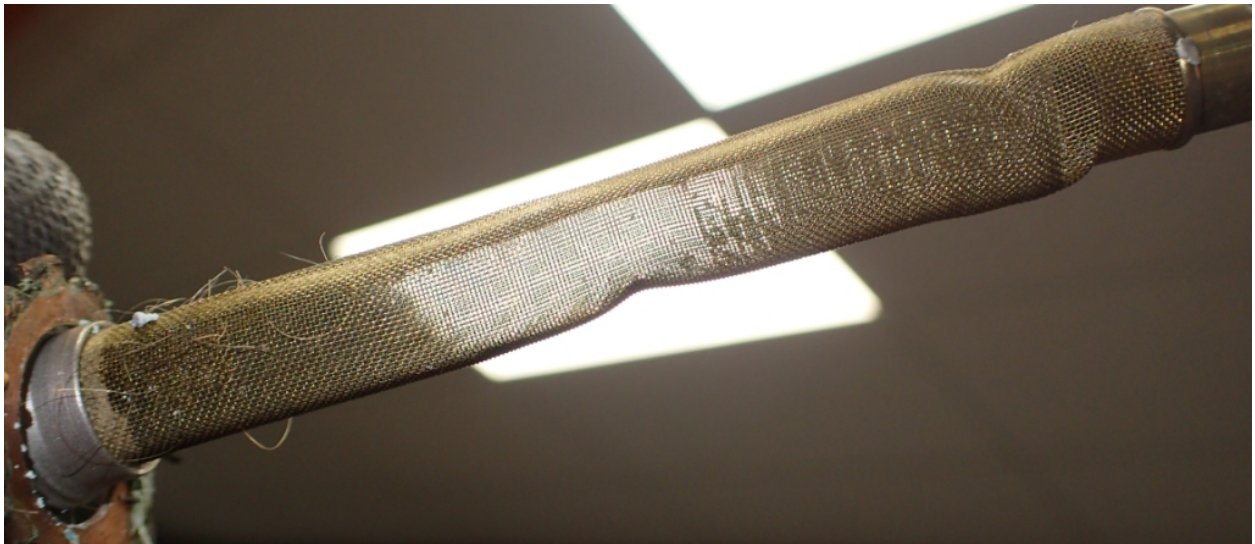


Figure 22 - Carburetor Fuel Screen

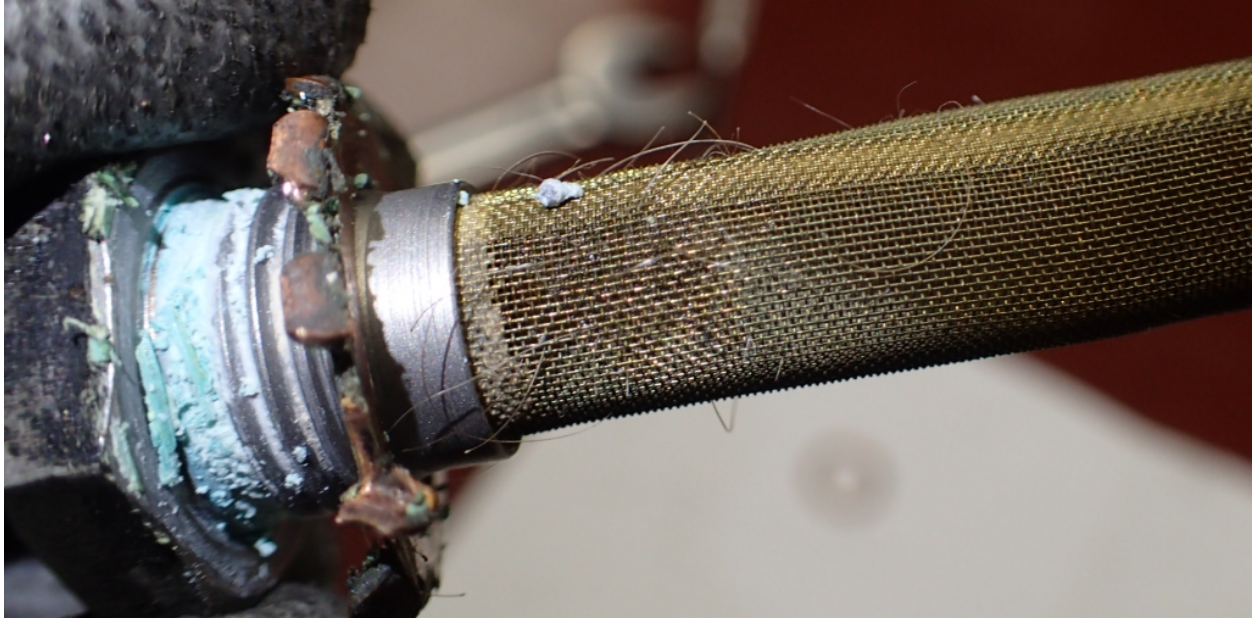


Figure 23 - Carburetor Fuel Screen and Fibrous Debris

5.0 Results/Conclusions

- The reason(s) that the engine was unable to reach redline full throttle rpm were not conclusively determined
 - A CAT Analytical representative stated that based on the high fuel flow values observed at full throttle, it was likely that the engine was running too rich to achieve the target 2,600 rpm value
 - The issue was deemed to be moot because the pilot-reported engine power loss occurred at a low power setting
- The examination and testing did not reveal any reasons for the power loss reported by the pilot