Aviation Investigation Final Report

Location:	Winters, California	**Accident Number:**	WPR19LA108
Date & Time:	April 13, 2019, 11:45 Local	**Registration:**	N120EJ
Aircraft:	Europa XS	**Aircraft Damage:**	Substantial
Defining Event:	Powerplant sys/comp malf/fail	**Injuries:**	1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

During a local flight, the pilot, who was also the builder of the airplane, heard a noise accompanied by a sudden vibration and partial loss of engine power. He noted that the No. 5 cylinder exhaust gas temperature was abnormally low. He recycled the throttle, but the vibration persisted, and the engine lost total power. The pilot performed a forced landing into a field, during which the airplane nosed over and was substantially damaged.

The pilot had removed cylinder Nos. 3 and 5 from the airplane to install new piston rings several months (4 flight hours) before the accident. Postaccident examination revealed internal catastrophic damage to the No. 5 cylinder and engine case, consistent with a No. 5 cylinder wrist pin circlip being improperly installed.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's failure to properly install a wrist pin circlip, which resulted in internal damage to the No. 5 cylinder and a subsequent total loss of engine power.

Findings

Aircraft	Recip eng cyl section - Incorrect service/maintenance

Factual Information

History of Flight

Enroute-cruise	Powerplant sys/comp malf/fail (Defining event)
Enroute-cruise	Loss of engine power (total)
Landing	Collision with terr/obj (non-CFIT)
Landing	Nose over/nose down

On April 13, 2019, about 1145 Pacific daylight time, an experimental, amateur-built Europa XS, N120EJ, was substantially damaged when it was involved in an accident near Winters, California. The airline transport pilot was seriously injured. The airplane was operated as a Title *14 Code of Federal Regulations* Part 91 personal flight.

According to the pilot, he had not flown the airplane for 6 months. Two days before his departure, the pilot sprayed oil into each cylinder through the spark plug port holes. He then turned the engine over by hand about 30 times and did not observe any binding. After cleaning and reinstalling the spark plugs, the pilot attempted to start the engine, but the battery was weak. He charged the battery and 2 days later, the engine started normally. The pilot departed uneventfully and flew north before he turned west and climbed the airplane to 3,000 ft. He then turned south and checked his airspeed as he advanced the power to 2,950 rpm, but immediately heard a loud noise accompanied by a sudden vibration and then a partial loss of power. The pilot turned the airplane toward the departure airport and reduced engine power. During this time, he observed that the exhaust gas temperature on the multifunction display (MFD) was low and determined that the No. 5 cylinder had failed. He advanced the throttle again and the engine continued to run with a vibration. As the pilot approached the airport, the engine lost total power. The pilot subsequently performed a forced landing to a plowed field during which the nose landing gear dug into the dirt; the airplane nosed over and came to rest inverted.

A review of photographs provided by law enforcement personnel revealed substantial damage to the right wing and empennage.

According to Federal Aviation Administration records, the airplane was registered to the pilot on November 15, 2011. The airplane was powered by a Jabiru 3300 120-horsepower air cooled, reciprocating engine. Maintenance records indicated that the airplane's most recent condition inspection was completed on May 11, 2018, at a total time of 185 flight hours. Subsequent maintenance work performed June 2018, but not documented in the logbook, showed that the pistons to cylinder Nos. 3 and 5 were removed and reinstalled to facilitate the installation of new piston rings. According to the pilot's statement, the airplane had accumulated about 4 total flight hours since its most recent condition inspection.

The Jabiru 3300 engine overhaul manual contains instructions for installing the snap rings (circlips) in the wrist pin (gudgeon) journals. Each clip has a "rounded" side and a "flat" side. The instructions state that the "rounded" side should face the item being retained and that the clip will not be able to carry as

much load and will fail more easily if installed improperly. In the same section, the instruction states to compress the clip only by the bare minimum amount required and to not allow the eyelets to contact each other. Overcompressing the clip will result in permanent damage and is easier to dislodge. The installer should use circlip pliers to gently compress the snap ring, complete the installation, and listen for a crisp "snapping" sound, which indicates the ring has dropped into place.

The wrist pin snap ring installation section of the manual also provides a warning:

Clips that are loose will rotate in service and wear the piston circlip [snap ring] *groove away resulting in a loose fit and, eventually, the gudgeon* [wrist] *pin being liberated & engine failure. Circlips must be fitted and inspected correctly or engine failure will result.*

The pilot did not recall how he installed the wrist pin snap rings but stated that he may have installed the circlips incorrectly.

Postaccident examination revealed that the engine rocker box covers were mostly normal in appearance and displayed resistance when force was applied, with the exception of the No. 5 exhaust valve rocker arm, which moved freely. The cylinder No. 5 piston head exhibited multiple gouges along the circumference, striations, galling and some polishing consistent with visible damage to the cylinder walls. The journal that housed the wrist pin (or gudgeon) on the backside of the piston had separated and was found inside the engine case. Both wrist pin circlips were found inside the engine; one circlip was intact and retrieved from the oil sump and the other circlip was found in two pieces within the engine case. The cylinder No. 5 valve journal bank was separated from the engine case.

The intact circlip did not display any visible imperfections and was installed in a separate piston uneventfully.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	75,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine; Helicopter; Instrument airplane; Instrument helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	November 20, 2018
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	14985 hours (Total, all aircraft), 197 hours (Total, this make and model), 12598 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Europa	**Registration:**	N120EJ
Model/Series:	XS	**Aircraft Category:**	Airplane
Year of Manufacture:	2012	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	A210
Landing Gear Type:	Tricycle	**Seats:**	2
Date/Type of Last Inspection:	May 11, 2018 Condition	**Certified Max Gross Wt.:**	1450 lbs
Time Since Last Inspection:	4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	189 Hrs at time of accident	**Engine Manufacturer:**	Jabiru
ELT:	C126 installed, not activated	**Engine Model/Series:**	3300A
Registered Owner:		**Rated Power:**	120 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	68 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	11:55 Local	**Direction from Accident Site:**	131°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	50°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.04 inches Hg	**Temperature/Dew Point:**	20°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Davis/Woodland/Winters, CA (DWA)	**Type of Flight Plan Filed:**	None
Destination:	Davis/Woodland/Winters, CA (DWA)	**Type of Clearance:**	None
Departure Time:	10:40 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	38.553333,-121.866668

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen		
Additional Participating Persons:	Craig Miller; Federal Aviation Administration; Sacramento, CA		
Original Publish Date:	March 16, 2022	**Investigation Class:**	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=99253		