



FLIGHT TEST CHECKS

AUTO-PILOT INSTALLATIONS

**LAA/FT-AP
Issue 5**

A/C Type:

Reg:

Date:

Auto-pilot Make/Model:

- Notes: 1. *Valid flight test authorisation issued by LAA Engineering required prior to flight.*
 2. Do not attempt to carry out this flight test without first reading and understanding the guidance material in Technical Leaflet TL 3.19.
 3. Check items 1 to 4 first on the ground then, if found satisfactory, also in flight.
 4. Circle SAT (satisfactory) or UNSAT as appropriate

GENERAL

1. Check that both of the required auto-pilot 'disengage' switches are suitably located and correctly disconnect power to the servos.

SAT	UNSAT	Comments:
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2. For auto-pilots that are so equipped, check the correct operation and effectiveness of the aural 'auto-pilot disengaged/maximum force' warning.

SAT	UNSAT	Comments:
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3. Check that radio transmissions from installed avionics from several frequencies throughout the available range do not affect servo operation.

SAT	UNSAT	Comments:
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4. Check the operation of both roll and pitch servo slip systems as appropriate.
 Note: For aircraft with an electric pitch trim system the pitch control servo must maintain a steady slip but not disengage. If the servo disengages, adjustment or replacement may be necessary.
 For auto-pilot control systems designed to command servo disengagement following pilot applied force to the controls, such disengagement must include both axes and be accompanied by unambiguous aural and visual warnings. State servo slip period before disengagement.

SAT	UNSAT	Comments: Servo slip period before servo disengagement: Aural servo disengagement warning type:
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5. The aircraft is to be flown at normal approach speed, power off with full flaps, auto-pilot off. Medium rudder sideslips, with control inputs applied and removed gently, are to be carried out to left and right. The aileron control is then to be released and the ability for the down wing to rise is to be checked.

	Left Sideslip (right rudder, left wing low)	Right Sideslip (left rudder, right wing low)	COMMENTS
Ailerons released	SAT / UNSAT	SAT / UNSAT	

6. Check that the auto-pilot (roll) and/or (pitch) systems, when engaged, do not induce airframe vibrations or flutter at airspeeds up to maximum level speed (V_H), but not exceeding V_{NE} and not exceeding maximum engine RPM.

SAT	UNSAT	$V_H =$ kts. Comments:
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ROLL SPECIFIC FUNCTIONS

7. Check that the auto-pilot (roll) system is able to maintain a wings-level and uniform rate turn condition to within $\pm 10^\circ$ in normal use through light to moderate turbulence and that the correct system loop gain is set by ensuring that the auto-pilot (roll) system operates at a suitable rate but does not jitter.

SAT	UNSAT	Comments:
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8. Where coupled to a navigational system, check that the auto-pilot (roll) system is able to intercept and maintain a track, VOR, heading, etc. State the maximum angle off-track that the system is capable of acquiring the selected track.

SAT	UNSAT	Comments: Max off-track acquisition angle achieved: (Note: Max off-track acquisition angle possible is 180°)
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9. Check that with the auto-pilot (roll) servo at maximum deflection obtainable, by use of the auto-pilot roll control (if fitted), either in normal use or in the event of a malfunction (simulated servo runaway) the roll response is not excessive and does not cause extreme deviations in the flight path assuming that corrective action begins within a reasonable time. From level flight, if corrective action is taken four seconds after initiation of the simulated runaway, roll angle should not at any time exceed 60 degrees.

To be checked at a representative range of different airspeeds / power settings and in left and right hand roll directions.

Notes: 1. Where auto-pilot manual roll control is not fitted it is permissible to roll the aircraft to 60 degrees using the aircraft aileron control (auto-pilot engaged) then release it and record the time taken for the auto-pilot to return the aircraft to a wings level attitude. The time taken should be more than four seconds.

2. With an auto-pilot control system designed to command servo disengagement following servo slip, establish the minimum stick force to cause servo slip then, with the auto-pilot disengaged, apply and maintain this stick force to roll the aircraft from wings level flight and record the time taken to roll to 60 degrees angle of bank.

SAT	UNSAT	Comments:
		Measured time to roll through 60° = Seconds

PITCH SPECIFIC FUNCTIONS Tick if not applicable but remember to sign the declaration.

10. Check that the auto-pilot (pitch) system is able to maintain altitude in normal use to within ± 30 feet through light to moderate turbulence and that the correct system loop gain is set by ensuring that the system operates at a suitable rate but does not jitter and that the servo does not slip excessively. If adjusted from the initial setting, record below the final pitch stick force at servo slip.

SAT	UNSAT	Max altitude excursion observed: feet. Comments:
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11. Where an auto-pilot (roll) system is also fitted, check that the auto-pilot (pitch) system is able to hold altitude to within ± 30 feet while entering, during and exiting rate one turns each way commanded by the auto-pilot (roll) system.

SAT	UNSAT	Max altitude excursion observed: feet. Comments:
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12. If automatic pitch trim control is fitted, check that the pitch trim system operates in the correct sense to relieve loads on the auto-pilot (pitch) servo.

SAT	UNSAT	Comments:
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13. Where no automatic pitch trim control is fitted, check that the pitch trim annunciator system is operating and in the correct sense.

SAT	UNSAT	Comments:
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14. Where no automatic pitch trim is fitted, from a trimmed airspeed of V_{S1} (stall speed, flaps up) $\times 2.0$ and following gradual reduction of engine power, check that the altitude hold system will slip to prevent the airspeed from decaying to $V_{S1} \times 1.2$.

Record the minimum airspeed reached at auto-pilot servo slip and, following auto-pilot manual disengagement, comment on the out-of-trim stick force required to prevent excessive pitch rate and the resulting stick-free pitch rate.

Note: Where a pre-programmable airspeed limit protection feature is installed, for this test it must be temporarily disabled or set to a value below V_{S1} .

SAT	UNSAT	$V_{S1} \times 2.0 =$ kts/mph	Observed Min speed = kts/mph
		$V_{S1} \times 1.2 =$ kts/mph	
		Comments: Out of trim forces: Stick free pitch rate:	

15. Where automatic climb and descent mode with vertical speed value selection is fitted, check that a representative range of rates of climb and descent achieved and maintained are within 20% of that selected.

SAT	UNSAT	Comments:
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16. Where automatic altitude capture mode is fitted, check that the altitude at which the aircraft levels and maintains is within ± 30 feet of that selected.

SAT	UNSAT	Comments:
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17. Where pre-programmable airspeed limit protection is available, when selecting the maximum vertical rate setting available for the equipment without changing the power setting, check that the steady speed in climb and descent is limited by an airspeed of no less than $V_{S1} \times 1.5$ in the climb and no more than $V_{NE} \times 0.9$ in the descent.

SAT	UNSAT	Maximum Vertical Rate Set = _____ fpm	
		$V_{S1} \times 1.5 =$ kts/mph	Steady climb speed = kts/mph
		$V_{NE} \times 0.9 =$ kts/mph	Steady descent speed = kts/mph
Comments:			

18. Where automatic climb and descent mode *without* pre-programmable airspeed limit protection is fitted, check that when the maximum vertical speed setting is selected, from normal trimmed cruise speed and with full power applied, the aircraft will not slow to less than $V_{S1} \times 1.5$ in the climb nor when at idle power the aircraft will not accelerate to more than $V_{NE} \times 0.9$ in the descent.

SAT	UNSAT	$V_{S1} \times 1.5 =$ kts/mph	Observed Min climb speed = kts/mph
		$V_{NE} \times 0.9 =$ kts/mph	Observed Max descent speed = kts/mph
Comments:			

19. By use of the auto-pilot climb or descent control, if fitted, set to the maximum rate obtainable, either in normal use or in the event of a malfunction (simulated auto-pilot servo runaway) check that the pitch response is not excessive and does not cause extreme deviations in the flight path assuming that corrective action begins within a reasonable time.

From level flight, if corrective action is taken 4 seconds after initiation of the simulated auto-pilot servo runaway, pitch change should not at any time exceed 20 degrees. To be checked at a representative range of different airspeeds / power settings and in both pitch-up and pitch-down directions.

SAT	UNSAT	Comments:
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20. Note: For this test item, guard or gently hold the control column without applying force to it in readiness for rapid pitching.

Where electric pitch trim is fitted, from trimmed level flight, simulate a pitch trim runaway by operating the pitch trim nose up continuously until 4 seconds *after* the aircraft begins to pitch and check at a representative range of airspeeds, but initially at a low speed for safety reasons, that there is no hazardous effect - e.g. extreme stick force, pitch rate, aircraft attitude, etc. Check that the auto-pilot (pitch) system servo slips but does not disengage. If the servo disengages, adjustment or replacement may be necessary.

Note: For auto-pilot control systems designed to command servo disengagement following servo slip, expect this to occur before the pitch trim running time is complete. Verify that the aural and visual warnings are triggered at automatic disengagement.

Repeat these checks with nose down trim.

Before re-trimming, return the aircraft to level flight and its original speed and, while holding the control column to prevent sudden pitching, manually disengage the auto-pilot and comment on the out-of-trim stick force required to maintain steady level flight and then, by gently releasing the controls, the resulting stick-free pitch rate, nose up and down.

SAT	UNSAT	Comments:
		Out of trim force:
		Stick free pitch rate:

Record below auto-pilot adjustable settings following satisfactory flight testing.

Parameter	Value
Roll servo slip force (measured at stick grip)	lbs or kg
Roll servo electronic parameter value (if applicable)	
Pitch servo slip force (measured at stick grip)	lbs or kg
Pitch servo electronic parameter value (if applicable)	
Airspeed minimum limit (if applicable)	knots or mph
Airspeed maximum limit (if applicable)	knots or mph
Climb rate maximum limit (if applicable)	fpm
Descent rate maximum limit (if applicable)	fpm

Record below all other relevant auto-pilot settings, e.g., servo gains, etc.

Parameter	Value

21. I certify that I have flown the above aircraft and that the above checks have been carried out to my satisfaction.

Name:	Signed:	Date of Test:	Licence No.:
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Once completed, send this form to LAA Engineering.

Remember: *While flight is authorised under a flight test authorisation issued by LAA Engineering, the aircraft may be flown for test purposes only.*