notes

SINGLE ENGINE PISTON AEROPLANE ENDORSEMENT

ENGINEERING, DATA AND PERFORMANCE QUESTIONNAIRE

Pathfinder Aviation

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What is the make, type and model of the aeroplane?

- Make:

  The Airplane Factory
- Type:

  Aeroplane
- Model:

  Sling 2 (SLG2 *ICAO designator*)
- In which categories is the aeroplane permitted to fly?

  Light Sport Aircraft (LSA)

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2. Airspeed Limitation

List the applicable airspeeds for the aeroplane type and their meaning

- Vmax XW
  - 15kt

    - Maximum permitted cross wind speed for take-off and landing
    - *(PoH 2.4)*
- Va
    - 91KIAS
    - Maximum manouevring speed
    - *(PoH 2.2)*
- Vs0
    - 40KIAS
    - Minimum speed (above stall) to maintain level flight in landing configuration
    - *(PoH 2.2)*
- Vs1
    - 45KIAS
    - Minimum speed (above stall) to maintain level flight in clean configuration
    - *(PoH 2.2)*
- Vx
    - 65KIAS
    - Best angle of climb
    - The airspeed at which the minimum horizontal distance is achieved for any given altitude
    - *(PoH 4.5)*
- Vy
    - 72KIAS
    - Best rate of climb
    - The airspeed at which the minimum time is achieved for any given altitude
    - *(PoH 4.5)*
- Vfe
    - 85KIAS
    - Maximum speed to have flaps extended
    - *(PoH 2.2)*
- Vno
    - 120KIAS
    - Maximum structural cruise speed
    - “normal operations”
    - *(PoH 2.2)*

- Vne
  - 135KIAS
  - Maximum speed in any flight phase
  - “never exceed”
  - *(PoH 2.2)*
- Vglide
  - 70KIAS
  - Speed to achieve optimum ratio between vertical descent and lateral distance.
  - The airspeed at which induced and parasitic drag (total drag) intersect.
  - “best glide”
  - *(PoH 4.7)*

a) Maximum load factor (flaps up) is + _____ g and - _____ g; and
   - +4g
   - -2g
   - *(PoH 2.6)*

b) Maximum load factor (flaps down) is + _____ g and - _____ g; and
   - +2g
   - -1g
   - *(PoH 2.6)*

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3. Emergency Procedures

Details the emergency procedures for the following situations

a) Engine fire on the ground (engine starting)
   - Release starter immediately
   - Close fuel selector
   - Close throttle
   - Ignition OFF
   - If possible, collect fire extinguisher from luggage compartment
   - Evacuate aircraft
   - If possible, extinguish fire
   - Contact fire department if necessary
   - *(PoH 3.3.1)*

b) Electrical fire on the ground

- Close heating
- Close fuel selector
- Set throttle full open
- Ignition OFF
- If possible, collect fire extinguisher from luggage compartment
- Evacuate aircraft
- If possible, extinguish fire
- Contact fire department if necessary
- *(PoH 3.3.2)*

c) Engine fire airborne

- Close heating
- Close fuel selector
- Set throttle full open
- When engine stops due to fuel starvation, turn ignition OFF
- Perform forced landing (with no engine restart attempt)
  - 70KIAS
  - Trim
  - Select landing area
  - Check/tighten safety harness
  - Select flap as required
  - Communicate location and intentions (tx 7700)
  - Brief passenger
  - Immediately before touch-down, fuel selector OFF
  - Master switch OFF
  - Fuel pump OFF
- *(PoH 3.3.4)*
- *(PoH 3.4.1)*

d) Electrical fire in flight

- Close heating
- All non-essential (e.g. ignition) electrics OFF
- Land ASAP
- Ignition OFF
- Master switch OFF
- If possible, collect fire extinguisher from luggage compartment
- If possible, extinguish fire
- Contact fire department if necessary

e) Cabin fire in flight

- Close heating
- Open fresh air intakes
- All non-essential (e.g. ignition) electrics OFF
- Land ASAP
- Ignition OFF
- Master switch OFF
- If possible, collect fire extinguisher from luggage compartment
- If possible, extinguish fire
- Contact fire department if necessary

f) Engine failure after take-off

- 70KIAS
- Select landing area within 45 degrees either side of current heading
- Flap as required
- Throttle as required
- At touch-down, ignition OFF
- Fuel selector OFF
- Fuel pump OFF
- *(PoH 3.2.2)*

g) Engine failure in cruise

- 70KIAS
- Trim
- Select appropriate landing area, free of obstacles, into wind if possible
- Check/tighten safety harness
- If possible, attempt engine restart
  - Fuel pump ON
  - Fuel selector ON
  - Throttle 1/2 position
  - Master ON
  - Alternator ON
  - Ignition ON
  - Engage starter
- Flaps as required
- Check/tighten safety harness again
- Communicate location and intentions (tx 7700)
- Brief passenger
- Immediately before touch-down, fuel selector OFF
- Ignition OFF
- Master switch OFF
- Alternator OFF
- Fuel pump OFF

- *(PoH 3.4.1)*
- *(PoH 3.2.4)*

h) Carbon Monoxide detected in the cabin in flight

- Heating CLOSE
- Open fresh ait intake
- Land ASAP

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4. Normal Procedures

State, describe or detail:

a) the start sequence for

- cold start

  - Pre-flight CMPL
  - MR CMPL
  - Start POS CK
  - Taxi brief CMPL
  - PAX brief CMPL
  - Harness SECURE
  - Park brake ON
  - Fuel emptiest/FR
  - Switches OFF
  - Master ON
  - EFIS backup ON
  - Strobe light ON
  - Circuit Breaks CK
  - CHRG light ON
  - Fuel pump ON
  - Ignition 1&2 ON
  - Choke ON
  - Throttle SET
  - “CLEAR PROP”
  - Starter ENGAGE

  - Oil Pressure CK
  - Choke SLOW RELEASE
  - RPM SET 2000
  - Fuel pump OFF
  - Fuel pressure CK
  - Avionics/EFIS/G5 ON
  - CHRG light OFF
  - NAV light ON
  - Strobe light OFF
  - Flaps UP

- hot start

  same as cold start, except no choke

b) The RPM used for checking the ignition system

   - 4000RPM
   - *(PoH 4.2.3)*

c) The maximum RPM when checking the ignition system

   - 3700RPM
   - *(PoH 4.2.3)*

d) The climb power setting, IAS and fuel flow

   - Climb power setting: 5500RPM
   - IAS: 72KIAS
   - Fuel Flow: 20L/hr *(PoH 5.4)*

e) A typical 65% power setting, IAS and fuel flow at 5000ft pressure height

   - The engine RPM at 65% power setting is 4800RPM *(Rotax 912 Series Operators Manual 5.1)*
   - The KIAS at 4800RPM at 3000ft is 87KIAS *(PoH 5.3)*
   - The KIAS at 4800RPM at 6000ft is 80KIAS *(PoH 5.3)*
   - The KIAS at 4800RPM at interpolation of (3000, 6000)ft to 5000ft is 85KIAS
   - The fuel consumption at 4800RPM at 3000ft is 15L/hr at 87KIAS *(PoH 5.4)*
   - The fuel consumption at 4800RPM at 5000ft does not exceed 15L/hr at 85KIAS

f) Using the aeroplane flight manual or POH, calculate the endurance for the aeroplane at 5000ft AMSL (ISA) with 65% power set.

   - Assume 15L/hr at 85KIAS *(answer e))*
   - Usable fuel: 146L
   - Endurance(hours) = 146/15 = 9.733 hours = 9 hours 44 minutes = 584 minutes

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5. Weight and Balance, and Performance

Define and indicate the value of:

a) Maximum take-off weight

   - 600kg

- The maximum weight of the aircraft, including fuel, persons on board, baggage, before flight
- *(PoH 2.7)*

b) Maximum landing weight

- 600kg
- The maximum weight of the aircraft, including fuel, persons on board, baggage, before landing
- *(PoH 2.7)*

c) Maximum number of adult persons on board (POB)

2

d) Maximum baggage weight

- 35kg
- The maximum weight of the baggage, in total, in both baggage compartments
- Front section maximum: 35kg
- Back section maximum: 25kg
- *(PoH 7.6)*

e) Maximum fuel which can be carried with a full load of adult passengers (80kg/person) and maximum baggage weight

- Standard Empty Weight: 370kg
- Standard Empty Weight & PAX: 530kg
- Standard Empty Weight & PAX & Baggage: 565kg
- Maximum Fuel weight at MTOW: 35kg
- Fuel weight per volume: 0.72kg/L
- Maximum Fuel volume at MTOW: 48.6L
- *(PoH 6)*

f) Using the aeroplane flight manual, determine the take-off weight and balance solution (Maximum take-off weight and C of G position), the max amount of fuel that can be carried and the endurance; for 2x 80kg POB and 20kg cargo.

	Weight (kg)	Arm (mm)	Mom (mm/kg)
Pilot	80	1959	156720
PAX	80	1959	156720
Front bag	20	2508	50160
Rear bag	0	2896	0
Fuel		1511	
BEW	370	1653	611610

- ZFW(kg): ∑{80,80,20,370} = 550
- let Fuel = 50kg
- Fuel(L) = 50 * 0.72 = 36.0
- TOW = 600kg
- Fuel Moment (mm/kg) = 50 * 1511 = 75550
- Total Moment at ZFW (mm/kg) = ∑{156720,156720,50160,611610} = 975210
- Total Moment at TOW (mm/kg) = 975210 + 75550 = 1050760
- CG at ZFW = 975210 / 550 = 1773.11
- CG at TOW = 1050760 / 600 = 1751.27
- let Fuel burn rate = 18L/hour *(QRH 11)*
- Endurance(hour) = 36 / 18 = 2

g) Calculate the take-off distance required at maximum take-off weight, 2500ft AMSL and OAT 30C, and the minimum landing distance at maximum landing weight for the conditions at above question.

- let ISA = 15C
- ΔISA = 30 - 15 = 15
- Assume: bitumen, nil slope, nil tail wind

(QRH 5)

Condition	Factor	Actual
Increase of 1000ft PA	*1.10	2.5
Increase of 10C ambient temp	*1.10	1.5
Dry grass	*1.20	0
Wet grass	*1.30	0
2% upslope	*1.10	0
TAIL of 10% at Vr	*1.20	0
Soft ground	*1.25	0
CAO 20.7.4	*1.15	1.15

- let TKOF distance nil factor(metre) = 230 *(PoH 5.1)*
- factor = ∏{2.5,1.5,1.15} = 4.3125
- TKOF distance(metre) = 230 * 4.3125 = 991.875

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6. Fuel Systems, Fuel and Fluids

a) The correct grade of fuel

- 91 Anti-Knock Index Octane MOGAS
- *Pathfinder Aviation uses 95 or 98 Octane MOGAS*
- *(PoH 1.4)*

b) Approved alternate fuel

100LL AVGAS * *(PoH 1.4)*

c) Location of fuel tanks and drain points

- Fuel tanks are located within the wing leading edges *(PoH 1.4)*
- Fuel drain points are located at the lowest point of each fuel tank *(PoH 7.19)*
- Underneath each wing, close to the wing root

d) The total and usable fuel in each tank

- Per tank:
  - total fuel: 75L
  - total usable: 72L
- *(PoH 1.4)*

e) The position of the fuel tank vents

- The vent line starts at the top of the fuel tank and is routed around the fuel tank, down, and exits underneath the wing.
- The fuel vent exits on the bottom centre of each wing.

f) Whether the engine has a carburettor or fuel injection system

Carburetor

g) State the **minimum** fuel required for a 1 hour flight (not considering school fuel policy)

- Flight fuel _____ litres
- Fixed reverse _____ litres _____ minutes
- Total minimum fuel _____ litres
  - Assume no INTER or TEMPO *(AIP ENR 1.1 (11.8.2.4))*
  - let Fuel burn rate = 18L/hour *(QRH 11)*
  - let Fixed Fuel Reserve = 30 minutes *(CAAP 234-1(2) 4.1)*
  - Flight fuel = 18L
  - Fixed Fuel Reserve = 18L * 0.5 = 9L

- Total minimum fuel = 18L + 9L = 27L

h) State the average fuel flow _____ L/hr

18L/hour *(QRH 11)*

i) Location of the fuel boost/auxiliary pump and when it should be used

- The electric fuel pump is located after the fuel selector valve and fuel filter and before the mechanical pump. *(PoH 7.19)*
- The switch is located in the cabin, accessible to the flight crew, typically on the left side switch panel.

j) What conditions apply to tank selection for take-off, landing and cruise

Select fullest tank *(PoH 4.2.2, PoH 4.4.1)*

k) When refuelling to less than full tanks, what restrictions apply and how is the quantity checked

The first 30L of fuel is not visible or detectable by dipstick, due to dihedral wing design.

l) The correct grade of oil for the aeroplane

- RON424
- *(Rotax 912 Series Operators Manual 2.5)*
- *(Rotax Service Instruction SI-912-016)*

m) The minimum oil quantity before flight

2.05L *(Rotax 912 Series Operators Manual 3.3)*

n) The maximum quantity of oil

2.5L *(PoH 1.4)*

o) The maximum, minimum and normal engine oil pressures

- Maximum: 102psi cold engine starting
- Minimum: 12psi <3500RPM
- Normal: 29-73psi > 3500RPM
- *(PoH 2.13)*

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7. Engine and Propeller Details

a) What is the make/model of the engine?

Rotax 912ULS

b) Number of cylinders and arrangement?

4 cylinders, horizontally opposed, naturally-aspirated, on a single crankshaft

c) Describe the lubrication system

- Dry-sump system with a camshaft-driven mechanical pump and integrated pressure regulator.
- The mechanical pump draws oil from the oil tank, via the oil radiator, forcing oil through the filter to the required points of lubrication.
- Surplus oil accumulates on the bottom of the crankcase and forced back to the tank by piston blow-by.
- The oil circuit is vented on the oil tank.
- The oil temperature and pressure sensor are mounted with the mechanical oil pump.
- *(Operators Manual Rotax Engine Type 912 Series (7.3))*

d) Describe the cooling system

- The cooling system is liquid cooled cylinder heads, with ram-air cooling of cylinders.
- The liquid cooling system is a closed circuit, with expansion tank and excess pressure valve.
- Coolant flow is driven by a mechanical water pump driven by the camshaft.
- Coolant flows from the pump, through the cylinder heads, to expansion tank, then through the radiator.
- The closed circuit coolant system has a capacity of 3.0L.
- *(Operators Manual Rotax Engine Type 912 Series (7.1))*

e) What is the maximum power output?

- 98.6hp
- Maximum: 5 minutes

f) What is the take-off power setting and time limit?

- 98.6hp @ 5800RPM
- Maximum: 5 minutes
- *(PoH 2.13)*

g) What is the Maximum Continuous power and rpm?

- 92.5hp @ 5500RPM

- *(PoH 2.13)*

h) Idle speed?

- 1400RPM
- *(Operators Manual Rotax Engine Type 912 Series (2.2))*

i) The maximum, minimum and normal engine oil temperatures?

- Maximum: 140C
- Minimum: 50C
- Normal: 90-100C
- *(PoH 2.13)*

j) The maximum EGT temperature?

- 880C
- *(Operators Manual Rotax Engine Type 912 Series (2.2))*

k) The maximum engine coolant temperature?

- 120C
- *(Operators Manual Rotax Engine Type 912 Series (2.2))*

l) Propeller make and model?

- The propeller is a Warp Drive 70 inch composite ground adjustable three blade propeller.
- *(PoH 7.18)*

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8. Airframe

a) What type is the undercarriage system (fixed/retractable/tricycle/conventional

- fixed tricycle
- *(PoH 7.3)*

b) Which control surfaces can be trimmed?

- elevator
- *(PoH 7.2)*

c) What type of flap is installed in the Sling 2?

- semi-slotted fowler type
- *(PoH 7.1)*

d) Describe the flap actuating system

- Transmotec electric flap actuator DLA-12-20-A-100-POT-IP65
- Electronically controlled located on the instrument panel or control stick
- *(PoH 6.1)*
- *(PoH 7.2)*

e) Describe the flap indicating system

The flap position is indicated on the MGL EFIS.

f) What flap settings are available?

There are four flap settings, including no flap extension.

The Sling 2 PoH Rev 1.2 claims the flap limits are 0-32 degrees (+/-3), while the Sling 2 PoH Rev 2.3 claims the flap limits are 0-30 degrees (+/-3).

g) Sketch the location of exits

The exit for the aircraft is the sliding canopy.

h) Describe/sketch the location of the landing, taxi lights; fresh air intakes and fuel caps

- The landing and taxi lights are on the left wing, close to the wing tip.
- The fuel caps are located on the top centre of each wing, closer to the leading edge.
- Engine air intake is on the right side of the fuselage, immediately behind the propellor.
- Cabin air intake is on each side of the fuselage, in front of the cabin.

i) What is the wing span of the aeroplane?

- 9.165 metres
- *(PoH 1.4)*

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9. Ancillary Systems

a) What systems are hydraulically operated?

brakes

b) What procedures are followed when a hydraulic system failure is suspected?

- The only hydraulic system is the brake system.
- Land as slowly as possible.

- Shut down engine on landing.
- Avoid obstacles until aircraft comes to complete stop.

c) What are the sources of electrical power?

- Main battery
- Generator
- EFIS backup

d) What is the DC system voltage?

12V DC

e) Can an external power source be used? If so, what is the procedure?

No.

f) Where are the battery and external receptacle located?

- The battery is on the engine side of the firewall
- *(PoH 7.17)*

g) How long can the battery supply emergency power?

- The engine ignition system is supplied by a dual CDI *(Rotax 912 Series Operators Manual 7.4)*.
- The ignition system is independent of the battery and the battery cannot be used to supply backup power for the ignition system.
- The battery will provide power, dependent on the power draw from the (non-ignition) sources of electrical power demand.

h) Following an alternator/generator failure in flight, which non-essential electric services should be switched off?

All electrics, except ignition.

i) If a stall warning device is fitted, is it electrical or mechanical?

- The stall warning device is electrical.
- The pitot system is fitted with a tube that incorporates an Angle of Attack sensor. *(PoH 7.8)*
- The AoA sensor is calibrated during flight testing to achieve a static pressure differential.

j) How is the cockpit ventilated?

- Air enters the cabin through intakes on each side of the forward fuselage.
- A fresh air vent is located on each side of the cockpit, each with a shut-off valve that can be rotated through 180 degrees.

k) How is the cockpit heated?

- The cabin heat is controlled from the cockpit by a control knob located to the right of centre of the dashboard.
- The control knob causes the fresh air intakes to go through a heat exchange with the exhaust muffler.
- The heating system exhaust vent is located near the rudder pedals on the right side of the cabin.

l) Show the location of the following safety equipment:

- fire extinguisher

  mounted transverse, immediately behind and centre to the seats, in the baggage area

- ELT

  Glove box or centre console.

- Torches

  Glove box or centre console.

- Survival equipment

  Glove box or centre console.

- First aid kit

  Glove box or centre console.

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10. Flight instruments

a) Where are the pitot head(s), static vent(s) and any water drain points for the pitot/static system located?

- The pitot-static tube is located below the left wing *(PoH 7.8)*.
- There is no static vent.
- There is a water drain point on the rear of the pitot tube.

b) Is there a pitot head system fitted?

   - *head* is a typo – should be *heat*.
   - There is no pitot heat system.

c) Is there an alternate static source fitted?

   No

d) List all pressure instruments installed in the Sling 2.

   - Airspeed Indicator
   - Altimeter
   - Vertical Speed indicator

e) If the pitot tube is blocked, what instrument/s will be affected?

   Airspeed Indicator

f) If the static port is blocked, what instrument/s will be affected?

   - Airspeed Indicator
   - Altimeter
   - Vertical Speed indicator

g) Which flight instruments are operated electrically?

   Turn coordinator

h) Which flight instruments are gyroscopically operated?

   - Turn coordinator (electric)
   - Attitude indicator
   - Heading indicator

i) Which instruments are operated by vacuum?

   - Attitude indicator
   - Heading indicator

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