7. AEROPLANE AND SYSTEMS DESCRIPTION

SECTION 7

7. AIRPLANE AND SYSTEM DESCRIPTION

7.1 Introduction

This section describes systems of the airplane and its operation. More detailed information on optional systems and equipment are available in section 9, Supplements.

7.2 Airframe

The airframe of HARMONY LSA airplane is a combination of semimonocoque structure consisting of metal reinforcement, frames and duralumin sheet skin, with a composite back side of fuselage and composite canopy.

7.2.1 Fuselage

The fuselage is a combination of semimonocoque structure consisting of reinforcements and duralumin skin, with a composite back side of fuselage and composite canopy. Fuselage section is rectangular in the lower part and elliptic in the upper part. The fin is an integral part of fuselage. The cockpit for two-member crew is located in the middle part of the fuselage that is accessible after uncovering the single-piece organic glass composite canopy. The engine compartment in the front part of the fuselage is separated from the cockpit by the steel firewall to which the engine bed is attached.

7.2.2 Wing

The wing is of rectangular shape at root and trapezoidal at wing tips, single-spar structure with the auxiliary spar with suspended ailerons and split wing flaps. Riveting is used for connecting individual structural elements. Fiber-glass wing tips are riveted on the wing ends. There is an integral fuel tank inside each wing half, in the section between the main and auxiliary spar at the wing root.

7.2.3 Horizontal tail unit (HTU)

The VTU of conventional type consists of the stabilizer and elevator with the trim tab. Single-spar structure of HTU consists of duralumin ribs, spar and skin. Top view of HTU is of rectangular shape at root and trapezoidal at tips.

7.2.4 Vertical tail unit (VTU)

VTU is of trapezoidal shape. Its fin is an integral part of the fuselage. The rudder is suspended on the fin by means of two hinges. The VTU structure consists of the duralumin spar and skin.

7.3 Control

Airplane control consists of ailerons, elevator and rudder.
Directional control is connected by means of pull rods with nose landing gear control. Main landing gear brakes are controlled by pedals of directional control.
Airplane is equipped with dual control enabling flight with two-member crew.

7.3.1 Longitudinal control

Longitudinal control is actuated by the control stick. Longitudinal movement of control stick is transferred to the elevator by mechanical system of pull rods and levers.

7.3.2 Lateral control

Lateral control is actuated by the control stick. From the control stick the movement is transferred through the system of levers and pull rods to ailerons.

7.3.3 Rudder control

Rudder control is controlled by pedals of foot control. The rudder is interconnected with foot control pedals by cable system.

Foot control pedals adjustable into three positions can be installed as an option.

Way of adjustment of ruder pedals:

1. Release the pin from the adjusting groove by pressing lever.
2. Set pedal to required position and release lever.
3. Check on the pin locking-on in the adjusting groove

WARNING
RIGHT AND LEFT PEDAL OF RUDDER CONTROL MUST BE ADJUSTED IN THE SAME POSITIONS AND SECURED!

7.3.4 Elevator trim tab control

The elevator trim tab is controlled by the lever located in between the pilot seats. The control lever is interconnected with the trim tab by means of bowdwen-cables.

Electric elevator trim tab control can be installed as an option. Control switches are located on the control stick, trim tab position indicator is located on the instrument panel.

7.3.5 Aileron trim tab control

Electric aileron trim tab control can be installed optionally. Control switches are located on the control stick, trim tab position indicator is located on the instrument panel.

7.4 Controls in cockpit

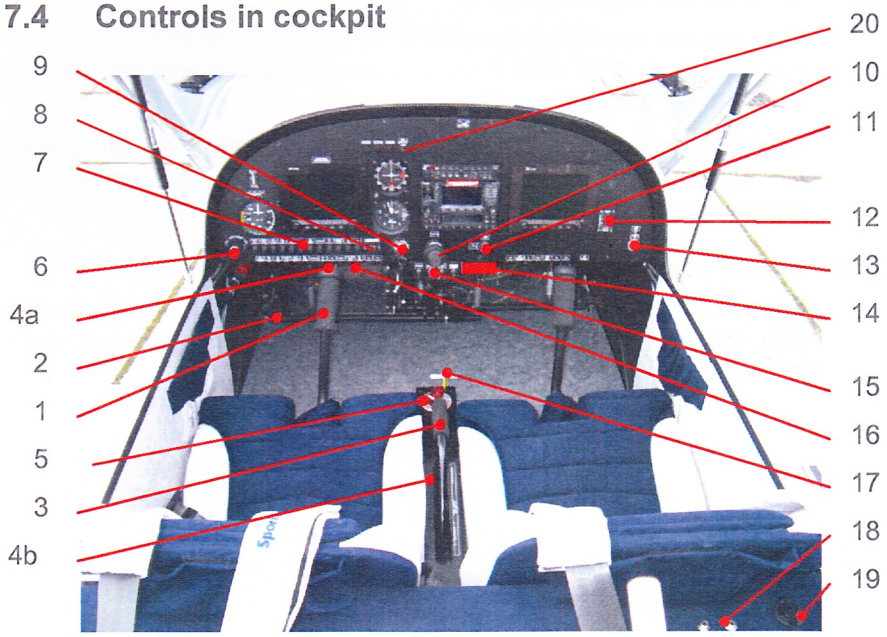


Figure 7–1 Cockpit control elements

1.	Control stick	2.	Rudder pedals
3.	Flap control lever	4.	4a Electric trim (option) 4b Elevator trim control lever
5.	Fuel tank selector	6.	Static pressure selector (option)
7.	Switches (depending on equipment)	8.	Master switch
9.	Switch box	10.	Throttle lever
11.	Choke lever	12.	ELT switch
13.	12V socket	14.	Emergency parachute system lever (option)
15.	Knobs from the left: • Cold air • Hot air • Canopy defog • Carburetor pre-heating	16.	Pop-up breakers (depending on equipment)
17.	Parking brake lever (option)	18.	Headset sockets
19.	Additional 12V socket (option)	20.	Dimmer (option)

7.5 Instrument panel

See Section 9 – Supplements,
Instrument panel is shown in Supplement No. 4 Aircraft Description.

7.6 Inside and outside marking and placards

See Aircraft Maintenance and Inspection Procedures.

7.7 Landing gear and brakes

7.7.1 Landing gear

The airplane is equipped with a sort of fixed nose landing gear. Main landing gear legs are produced from composite spring. Nose landing gear leg is welded from two pieces - the tube and the yoke- in which the nose wheel is mounted. The nose landing gear is spring-loaded by a rubber rope. The nose wheel is steerable; wheel control is coupled with rudder control by means of two pull rods. Wheels can be fitted with fiber-glass aerodynamic pants.

7.7.2 Brakes

The HARMONY LSA airplane is equipped with disk hydraulic brakes on main landing gear wheels. Brake system is composed of toe-brake pedals (these are a part of rudder control pedals), brake pumps, brake fluid reservoir, brake fluid central bottle on the firewall, hoses for leading brake liquid, brake yokes with wheel cylinders and brake pads. By depressing the brake pedals compression of brake pumps occurs, which generates pressure in brake circuit and hydraulic cylinders press the brake pads onto the brake disks. Braking pressure can be regulated only by force of brake pedals depressing.

The airplane can be equipped by mechanical manually controlled parking brake. PARKING BRAKE handle is located in front of the pilots, on the front wall of the fuel tank selector console.

7.8 Seat and safety harnesses

HARMONY LSA is a two-seat airplane with side-by-side seats. Seats are fixed, non-adjustable and fitted with light upholstery.

Each of seats is fitted with four-point safety harness which is composed of safety belts, shoulder straps and lock. The safety harness is anchored in the fuselage sides behind the seats and on the seat sides.

7.9 Baggage compartment

Baggage compartment is positioned behind seat rests. Maximum weight of baggage is 55 lbs (25 kg) and is stated on the placard in the baggage compartment. The baggage compartment is fitted with rubber net for baggage fixation.

WARNING

It is prohibited to use a space behind baggage compartment for additional stowage. This is due to airplane aft C.G. limit.

7.10 Canopy

The cockpit canopy is of a semidrop shape. The framework is composed of composite structure on which the organic glass canopy is stuck.

The canopy is attached to the fuselage in the front part by two swivel pins by means of which it can be folded up forwards. In order to make opening easier, the actual weight of canopy is balanced by two gas struts.

Lock

The canopy is provided with an automotive lock in the rear upper part of the tip-up frame and key lock on the top of rear fixed frame. There is also a canopy open/close sensor installed in the lock, with indication of canopy open position by a red light on the instrument panel or red/green light on a display if digital instruments like Dynon EFIS/EMS or TruTrak EFIS/EMS are installed.

The lock hook (latch) has two positions – fully closed (when the green light is on) and closed (when the red light is still on). In both these positions is the canopy held against opening. To open the canopy pull the T lever down and simultaneously push the canopy up by other hand.

Maintenance of automotive lock: Spray the lock with WD-40 spray annually from time to time

Check: Check the lock visually for deformations

Adjustment: Release the socket wrench screws on back of the lock, adjust lock position and tight the socket wrench screws.

7.11 Power unit

7.11.1 General

The engine ROTAX 912 ULS (100 hp) is standard used to power HARMONY LSA airplane. IFR version is fitted with certified ROTAX 912S.
ROTAX 912 is a four-cylinder, four-stroke engine with opposite cylinders, central cam shaft and OHV valve mechanism.

The on-ground adjustable, composite, 3-blade propeller WOODCOMP KLASSIC 170/3/R is standard mounted on the engine ROTAX 912 ULS.

IFR version is fitted with ground adjustable, 3-bladed, composite Warpdrive CF prop, with Nickel protection of blade leading edges.

Other propeller type can be installed on customer's request - see Section 9 for detailed information.

7.11.2 Engine control

Engine power is controlled by means of THROTTLE lever, which is located in the middle of the instrument panel and which controls engine power range from idle up to maximum take-off. Engine power controller is mechanically interconnected with the flap on carburetors.

If the lever is fully pushed in, then this position corresponds to maximum engine power. If the lever is fully pulled out, then this position corresponds to idle. Rapid changes in engine power setting can be made by pressing down the round button on the lever body and by its pulling out or pushing in. Small changes in power setting can be performed through lever turning (counterclockwise - power increase).

The lever is fitted with the locking ring, counterclockwise turning of which ensures locking of the lever in requested position.

7.11.3 Engine instruments

The following analog instruments located on the instrument panel serve for engine performance monitoring. The digital engine monitoring system can be installed in the airplane instead of analog engine instruments.

RPM indicator

The electrical RPM indicator is controlled by signal from the generator RPM transmitter. Working range of the RPM indicator is 0 - 7000 RPM. Color code is stated in 2.5.

Cylinder head thermometer

The cylinder head thermometer transmitter senses temperature of cylinder No. 3. Working range of the cylinder head thermometer is 120 ÷ 300°F. Color code is stated in 2.5.

Oil thermometer

Oil temperature on engine input is measured by the sensor located behind the oil pump. Working range of oil thermometer is 120 ÷ 300°F. Color code is stated in 2.5.

Oil pressure gauge

Oil pressure on the oil input into engine is measured by means of sensor which is located behind the oil filter. Working range is 0 ÷ 150 PSI. Color code is stated in 2.5.

7.11.4 Engine cooling system

Engine cooling is combined, cylinder heads are cooled by water, and cylinders are cooled by air.

Cooling circuit of cylinder heads is designed as a closed system containing pump, expansion reservoir (1) with pressure closure (3), cooler of cooling liquid (2) and drainage reservoir (4). Scheme of cylinder head cooling system is shown in Fig. 7–2.

When changing, the cooling liquid is filled up through the cap of expansion reservoir (1), during airplane operation it is replenished into drainage reservoir (4) between the lines of maximum and minimum level.

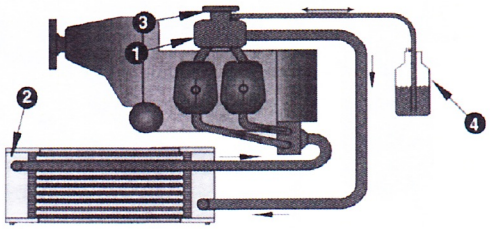


Figure 7–2 Scheme of cylinder head cooling system

7.11.5 Engine lubrication system

Engine lubrication system is performed with the dry crank case. Engine lubrication system is equipped with oil pump (1) ensuring oil feeding from reservoir (4) located on the fire wall through the oil cooler (5) and the oil cleaner (6) to the lubricated points of engine. The pressure sensor (2) is located behind the oil pump. The oil reservoir is aerated by the hose (7) which is led under the airplane. Oil pressure and temperature are indicated on instruments in right side of the instrument panel. Oil is replenished through the lid in the upper part of the oil reservoir.

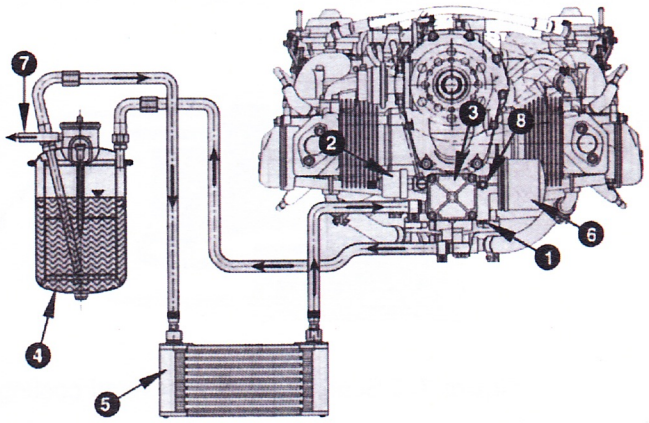


Figure 7–3 Scheme of engine lubrication system

7.11.6 Engine intake system

Engine intake system ensures delivery of sufficient air into engine. Air is taken into the engine through openings on the engine covers through the air filters.

The intake system can be equipped with carburetor heating system. Hot air from the heat exchanger (located on the exhaust collector) is taken to the mixing chamber. Amount of in-taken hot air is regulated by flaps in mixing chamber inlets. Flaps are controlled by the CARBURETTOR PREHEATER knob on the instrument panel.

7.11.7 Ignition system

The engine is equipped with the double contactless ignition system. Each ignition circuit has own source of energy, control unit, 2 ignition coils and 4 spark plugs. It is fully autonomous on the other circuit of accumulator. High voltage current is distributed to the spark plugs through high-voltage cables. Ignition sequence of individual engine cylinders:

Ignition circuits are controlled by the ignition switch on the instrument panel.
Positions of ignition switch:

OFF	engine ignition is off
R	only ignition circuit B is on
L	only ignition circuit A is on
BOTH	both circuits are on
START	both circuits are on and starter is cranking the engine

7.12 Fuel system

Fuel system serves for keeping fuel in the airplane and its feeding to the engine. Fuel system of HARMONY LSA airplane is composed of integral fuel tanks, fuel line, fuel selector, fuel filter, mechanical fuel pump - located on the engine (auxiliary electrical fuel pump can be installed), distribution pipe of fuel with, return branch of fuel, fuel gauges and fuel tanks draining valves.

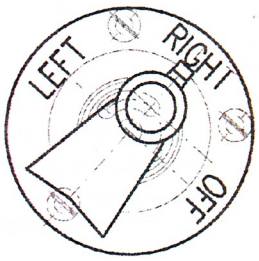
7.12.1 Fuel tanks

Fuel is contained in the wing integral tanks. Each tank is fitted with air venting (output is under the wing tip) and draining valve on the bottom side of the wing. Fuel is led from the tanks through the hoses to the fuel selector located on a central console under the instrument panel and then through a fuel filter to the engine pump and carburetors. Fuel return hose goes from the fuel pump into the left tank, which is due to considered as a “primary” tank. See figure 7-4 for Scheme of fuel system.

7.12.2 Fuel selector

The fuel selector serves for tank selection and fuel delivery interruption in case of engine fire or long parking of airplane. To move selector from OFF (closed) position it necessary pull the safety button on the fuel selector, turn the handle from the OFF position to the left and then release safety button. Now the handle

can be freely moved between LEFT and RIGHT position. Safety button prevents unintentionally switch the selector to OFF position. To move selector to OFF (closed) position it is necessary pull the safety button on the fuel selector, turn the handle to the OFF position and then release safety button. Now the handle is blocked in the OFF position. Safety button prevents unintentionally switch the selector from the OFF position during parking.



7.12.3 Fuel filter

The fuel filter separates all mechanical impurities from fuel. The fuel filter is located in the cockpit on the left airframe panel.

7.12.4 Indication of fuel quantity

Fuel quantity is measured by a float fuel gauge transmitter in each tank and indicated on fuel gauge on the instrument panel. LH fuel gauges indicates fuel quantity in the left tank, RH indicator in the right tank. True fuel quantity is indicated only on ground and in level flight and it takes approx. 2 minutes to level fuel after transition from climb/descent.

7.12.5 Fuel tank draining

Draining of the fuel tank is specified in Section 8.

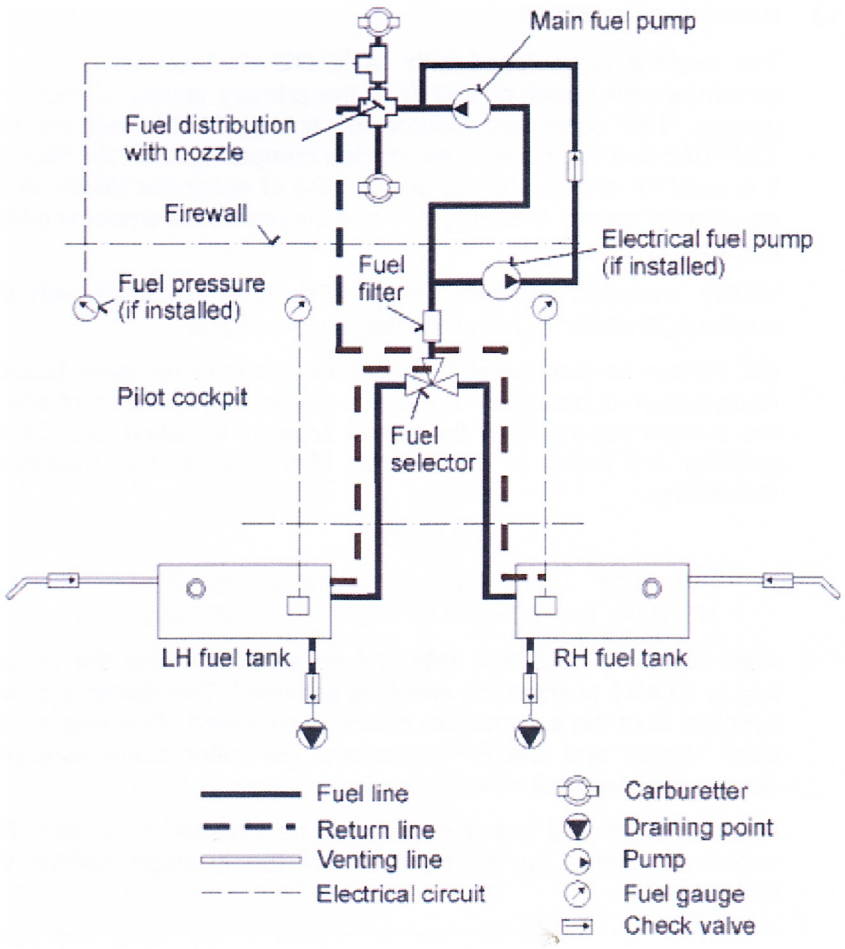


Figure 7–4 Scheme of fuel system

7.13 Electrical system

The airplane is equipped with 14 V DC electrical installation. A generator with power of 250 W is the primary source of electrical energy. The secondary source of energy is the accumulator 12V/16Ah that is located in the engine compartment on the firewall. It is used for engine starting and in case of generator failure as an emergency source of energy and also serves as the smoothing filter of power system.

Widely equipped airplanes (night VFR, IFR) are fitted with the auxiliary generator SD-20, mounted on the engine.

DC voltage is distributed to individual systems by main busbar. Each system is protected by circuit breaker. If overloading of any of the circuits occurs, then the circuit breaker is pulled out. Circuit beakers are listed in the Aircraft Maintenance and Inspection Procedures.

CAUTION

DO NOT USE CIRCUIT BREAKERS FOR NORMAL SWITCHING OFF OF THE SYSTEMS

After switching **MASTER SWITCH** on and by turning the ignition key to **START** position the starter is activated. The starter is power supplied from the accumulator before engine start. After engine has been started and idle RPM reached, generator starts supplying current into electrical network.

Piper type external power socket can be installed optionally. The socket is located on the right side of the fuselage, behind the firewall.

Optionally 12V automotive socket located on the instrument panel can be installed, as well as another 12V socket behind the co-pilot seat, next to the headphones sockets.

7.13.1 Lighting

Airplane can be equipped with an external lighting.

External lighting can be composed of position lights and anticollision beacons which are located in wing tip and landing headlight which is located in left wing leading edge or in the lower engine cowling. Position lights are switched by **POS. LIGHTS**

switch and anticollision beacon by **BEACON** switch. Landing headlight is switched by **LDG LIGHT** switch.

Night VFR and IFR versions are equipped with the landing light, position lights & anticollision beacons. There is also a cockpit light installed for these versions.

7.13.2 Electrical system scheme

See Aircraft Maintenance and Inspection Procedures - Supplements.

7.14 Pitot-static system

Pitot-static tube for sensing static and total pressure is located under the left half of the wing. Total pressure is sensed through the opening in the Pitot-static tube face. Static pressure is sensed through openings on the tube circumference. System of pressure distribution to individual instruments are made by means of flexible plastic hoses. Transparent draining reservoirs are located in the pressure branch of static and total pressure on the left fuselage side on the bottom next to wing leading edge.

Static pressure is led to altimeter, airspeed indicator, and variometer and altitude encoder (if installed). Total pressure is led only to the airspeed indicator.

IFR version is equipped with an alternate pitot-static tube located under the right half of the wing. This pitot serves only as a source of alternate static pressure. Both Primary and Alternate pitots are heated. There is a static pressure select knob located on the instrument panel to switch from Primary to Alternate static pressure.

For scheme of IFR pitot-static system refer to IFR Supplement to this AOI.

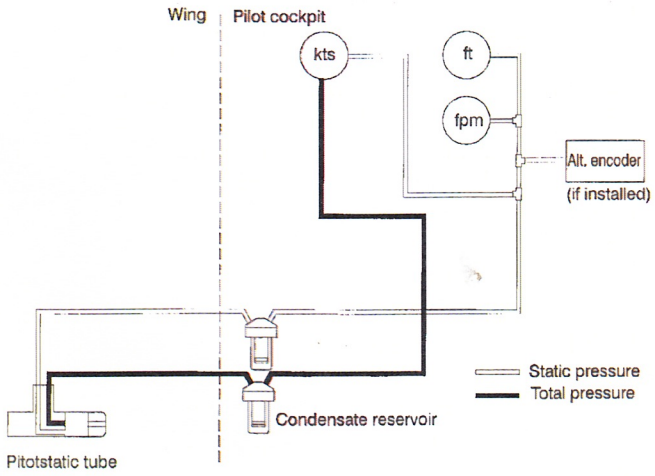


Figure 7–5 Scheme of pitot-static system

7.15 Supplementary equipment

7.15.1 Ventilation and heating system

Cockpit ventilation is ensured by 2 eye–ball vents located on the left and right of the tip-up canopy frame. Vents are connected to the NACA scoops through tip-up canopy frame front flaps.

Cockpit heating is provided by air conducted through a hose guided from a fiberglass collector behind the engine radiator into the heat exchanger and then into the mixture flap on the firewall and further through a directional flap to the cockpit floor or to the hot air outputs through the instrument panel cover as well as into the hollow spaces of the tip-up frame for defrosting. Hot air quantity is regulated by the **HOT AIR** knob, cold air quantity is regulated by the **COLD AIR** knob on the instrument panel. Proportion of the cold and hot air in the heating system can be set continuously. Other knob below the **HOT AIR** knob serves for air routing to the cockpit floor or on the canopy glass.

Defog / defrosting of windshield and sides is ensured by hot air conducted from a cold/hot air mixture flap on the firewall into the tip-up canopy frame and then through a row of holes onto the glass.

7.16 Navigation and communication equipment

Description of operation of navigation and communication equipment see Section 9 - Supplements.

Intentionally left blank