GENERAL DESCRIPTION OF THE AIRPLANE

1. General

Diamond Aircraft Industries GmbH, N. A. Otto-Straße 5, A-2700 Wiener Neustadt, Austria, make the DA 40 airplane.

2. Description

The DA 40 is a single-engine, four seat, low-wing monoplane. It has a cantilever wing and a óΓô tail...The airplane structure is fiber-reinforced plastic composite. This gives a very strong but light structure. .The semi-monocoque fuselage is a glass-fiber reinforced-plastic (GFRP) shell with GFRP bulkheads and stiffeners. Uni-directional carbon fiber bands give extra strength and stiffness in many areas. Leftand right half-shells bond together with a center section to make the fuselage. The center section makes the bottom of the cockpit. It has the main bulkheads which connect to the spars in each wing. .The vertical stabilizer has two GFRP half-shells that are part of the fuselage shells.

The cantilever wing is a semi-monocoque structure. Each wing has two I-shaped spars with webs made form GFRP/rigid foam sandwich and caps made from CFRP bands. Each wing has top and bottom shells made of CFRP/GFRP/rigid foam sandwich which bond to the spars. GFRP ribs and webs bond to the spars and shells to complete the structure.

The wings attach to the fuselage center section. Each wing has two stump-spars. Four large bolts attach each wing to the fuselage main bulkheads. Standard ailerons and electrically operated flaps attach to the trailing edge of the wing.

The horizontal stabilizer is a semi-monocoque structure. It has top and bottom shells made of GFRP. .The shells bond to GFRP spars and ribs. The trailing edge has a conventional elevator and a trim tab.The one-piece canopy has a large quantity of wrap-around glazing. This gives a good all-round view from the cockpit. A glazed rear passenger door gives access to the rear seats from the left side of the airplane.

A polyurethane paint finish protects the outside skin from ultraviolet rays and humidity. The fixed tricycle landing gear has fairings attached to each leg. The main legs attach to the fuselage center-section. The nose leg attaches to the forward fuselage. Each main wheel has a disc brake on the inside. Hydraulic pressure operates each disc brake.

The flight control system uses conventional ailerons, elevator and rudder. The DA 40 has 2 control sticks and 2 rudder pedal assemblies to operate the primary flight-controls. Push-pull rods operate the ailerons and elevator. Cables operate the rudder. An electric motor operates the wing flaps. A handwheel cable operate the elevator trim.

The DA 40 is powered by one of the following engines:

Lycoming IO360 - a four cylinder, direct drive, horizontally-opposed engine. The engine has a fuel Iinjection system and a conventional wet-sump oil system.

The DA 40 has a hydraulic constant-speed propeller with 3 blades.

The airplane has an aluminum fuel tank in each wing. Each tank consists of several chambers. The fuel tanks are inboard between the spars. The tank assemblies have fuel fillers at or near the outboard end. Flexible hoses connect the tanks to a fuel selector and shut-off valve under the cockpit floor. An electrical boost pump (Lycoming version only) and an engine driven pump supply fuel to the engine. The tanks have fuel quantity probes which operate the cockpit indicating systems.

The airplane has two sources of electrical power. A 28 Volt (Lycoming version) battery supplies power when the engine is not running. An alternator provides power when
the engine is running. Switches and circuit breakers control all electrical devices. A starter key controls the engine starter motor. It also controls the magnetos (Lycoming version)).

The DA 40 has a full range of flight instruments. These include Pitot/static instruments to show airspeed and altitude, as well as electrically driven instruments and vacuum driven instruments version only) to show attitude. The airplane has all the usual engine instruments, except that the The airplane also has radio and navigation aids installed.
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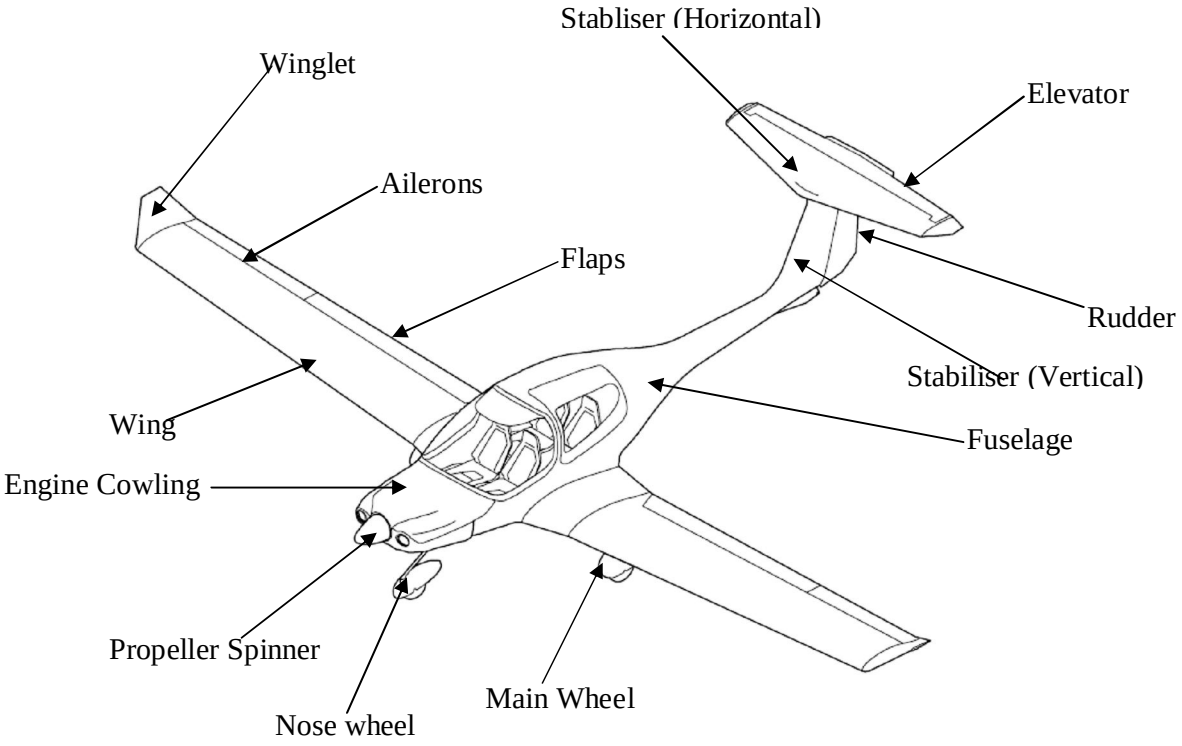

Stabliser (Horizontal)
Winglet
Elevator
Ailerons
Flaps
Rudder
Stabiliser (Vertical)
Wing
Fuselage
Engine Cowling
Propeller Spinner
Main Wheel
Nose wheel

LIGHTS

1. General

This Chapter tells you about the cockpit and the exterior lighting of the DA 40.

2. Description

The following figure shows you the location of the lights. The DA 40 has these flight compartment lights:

Reading lights.

Instrument lights

Instrument panel flood light

Some avionics equipment has internal lighting. Refer to the related Section and the equipment manufacturers handbooks for the equipment in your airplane. Combined ON/OFF and dimmer switches for the instrument panel flood lights and the internal instrument lights are located in the instrument panel, top left.

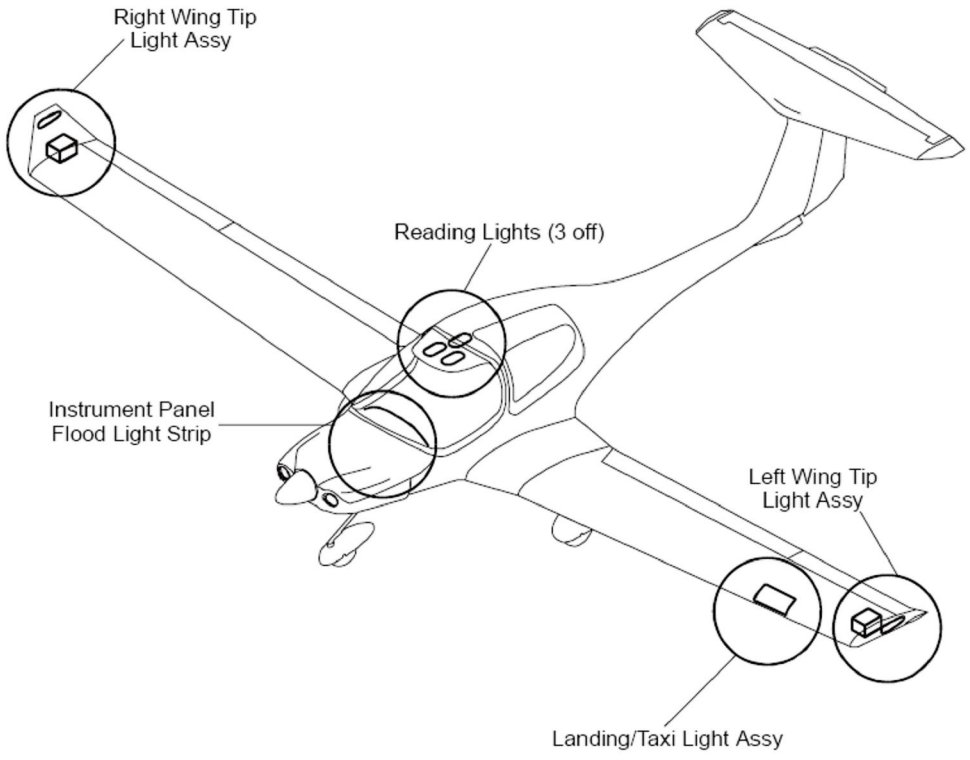
The DA 40 has these exterior lights in one light unit at each wing-tip:

Left and right position lights. The front part of the light unit has a red (left) or green (right) lens.

The light can be seen from the front and the side.

Rear position lights. The aft part of each wing-tip light unit has a clear lens. The lights can be seen from the rear only.

Strobe Light. The middle part of each wing-tip light unit has a clear lens. The filament gives a high-intensity flash. The strobe light can be seen from all directions. A separate power unit for each strobe light is mounted in the wing-tip.



Flight Compartment and Exterior Lights

Air Conditioning - Lycoming Engine

1. General

This Section gives you the system description and operation of the air conditioning system for airplanes with the Lycoming engine installed.

2. Description and Operation

The DA 40 with the Lycoming engine installed has 2 separate systems for heating and cooling/ventilating the cockpit. The following figure shows the heating system.sand the latter one shows the cooling and ventilation system.

A. Cabin Heating

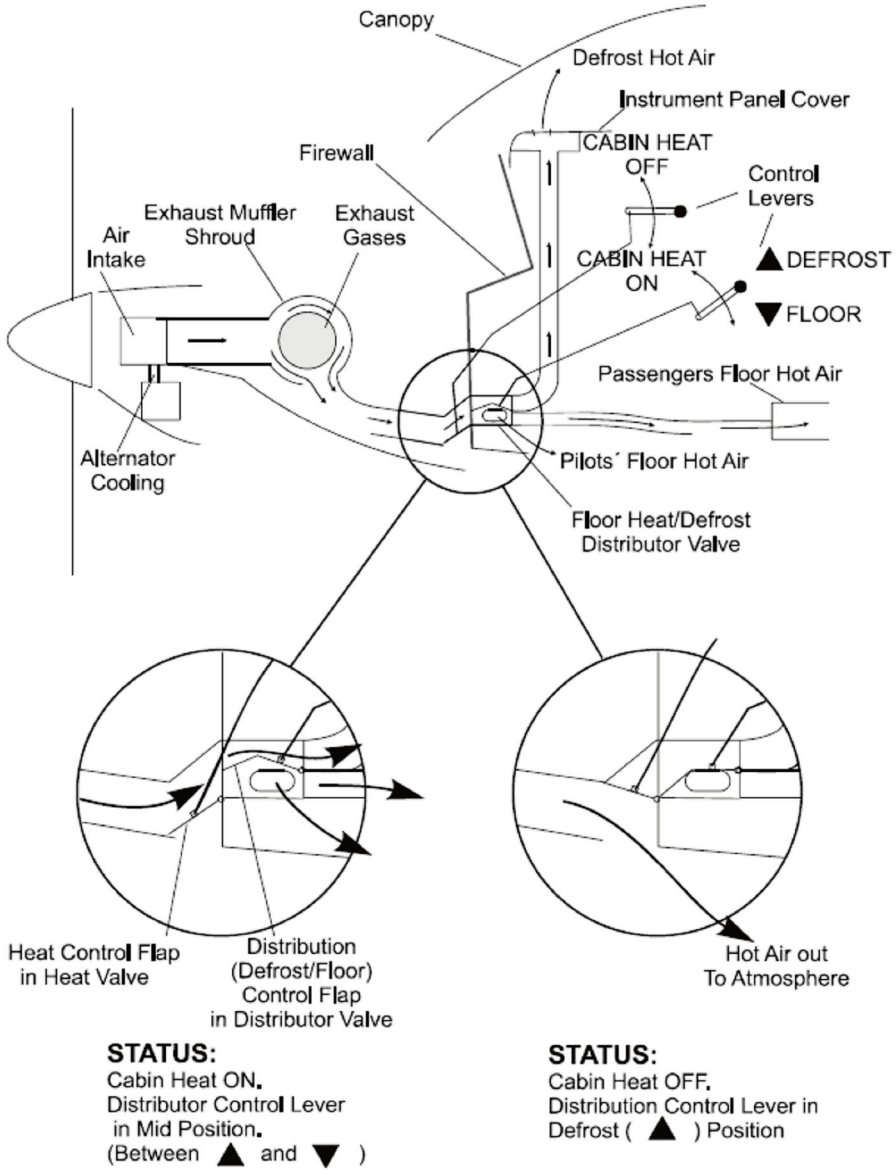
Air enters the system through an intake at the front right of the engine cowling. A metal adaptor and flexible hose connects the intake to a heat-exchanger on the engine exhaust muffler. A small hose from the side of the adaptor connects to the back of the electric alternator at the front of the engine. A shroud round the exhaust muffler and the outside wall of the muffler make the heat exchanger. You can remove the shroud to inspect the muffler for cracks. The shroud has connections for the inlet hose and an outlet hose.

The outlet hose connects to a heat valve on the firewall. A flap inside the heat valve can connect the heat valve outlet to atmosphere or to a distributor valve on the rear face of the firewall. A lever in the cockpit controls the flap. The lever is marked ócABIN HEAT, ON OFFô.

The distributor valve also has a flap. The flap can connect the valve inlet to the pilot and passenger floor areas or the front of the canopy. A lever in the cockpit controls the flap. The lever is marked ócABIN HEATôÅ. Cold ambient air enters the air intake on the engine cowling. The air flows to the heat-exchanger on the exhaust muffler. The air goes between the shroud and the muffler. Heat from the outer face of muffler makes the air hot. The air flows to the heat valve.

If the heat valve is set to OFF, the flap sends the air overboard at the bottom of the engine cowling.. If it is set to ON, the hot air goes through the firewall to the distributor valve. The valve can be set to any position between OFF and ON. If the valve is set to a middle position, only part of the airflow goes to the distributor valve.

If the distributor valve is set to ï air flows to the pilots' and passengers' footwells. If it is set to the air flows to the front of the canopy. This prevents mist or frost from forming on the canopy. The valve can be set to any position between ï and Å. If the valve is set to a middle position, part of the airflow goes to the footwells and part to the canopy.



B. Cooling and Ventilation

(1) Standard Cooling and Ventilation System

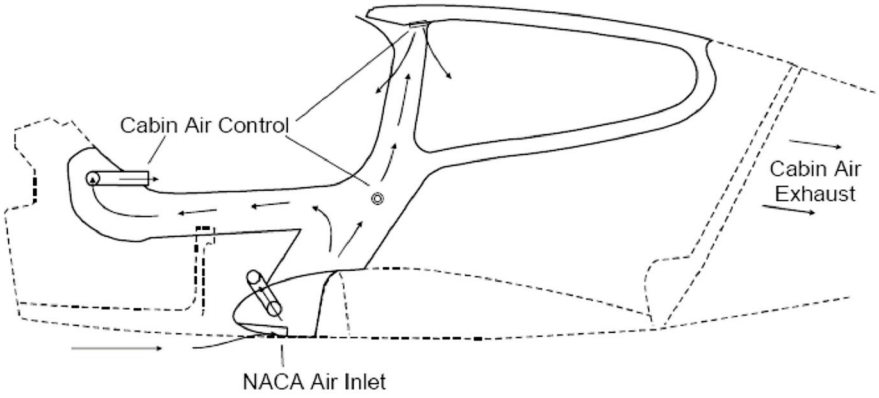
The following figure shows the cooling and ventilation system. Air enters the system at a NACA air inlet below the leading edge of the left stub-wing. The front main bulkhead and the inner and outer closing ribs make a collector box. Air can only leave the area through an opening in the front closing rib. The front of the rib connects to a pipe across the fuselage. The pipe also connects to the front closing rib of the right stub-wing.

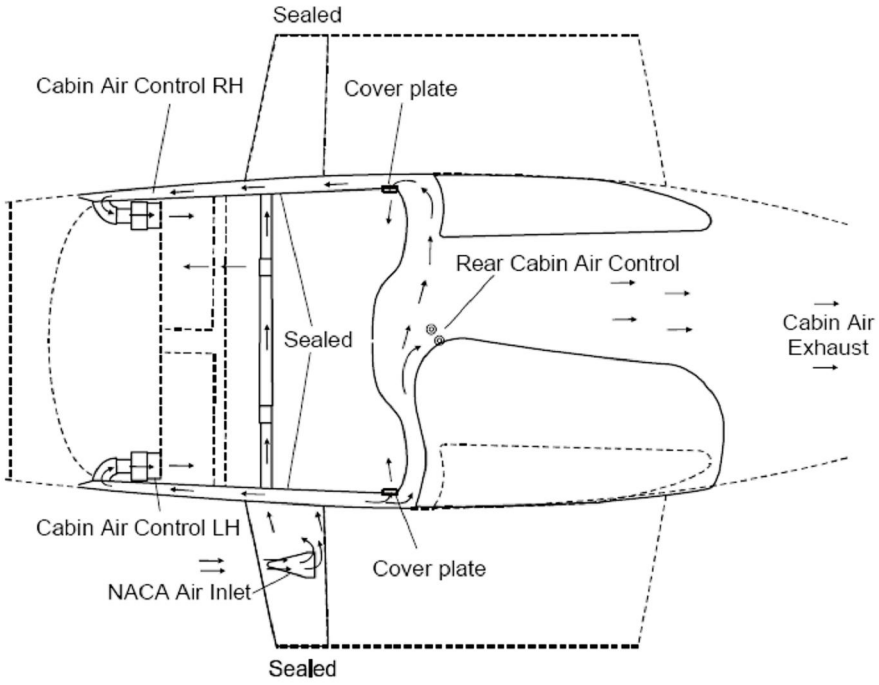
The top part of the front closing rib on each side connects to the fuselage side ducts. The side ducts connect to the roll bar. The side ducts and roll bar have adjustable outlets.

Air enters the system through the NACA air inlet. It flows through the left front closing rib and across the fuselage. The pilots can control the floor panel outlets to give cool air as necessary. Some air also flows across to the right front closing panel. Air from both front closing panels can flow up through the fuselage side ducts. Adjustable outlets in the cockpit allow the pilots or passengers to control cool air flow into the cockpit. Four adjustable outlets in the roll bar give cool air to the passengers.. Both hot and cold air leave the cockpit through holes in the baggage compartment frame. The air flows through the rear fuselage and leaves the airplane through the gap between the fuselage and the rudder.

(2) Additional Ventilation System (optional, OÄM 40-099)

Air enters the system at two NACA air inlets in the front fuselage on the left and right side.. Hoses connect the air inlets to two adjustable outlets in the bottom instrument panel.





Power Plant - Lycoming Engine

1. General

This Chapter tells you about the power plant installed in the DA 40. It tells you about the components that make the power plant..

2. Description and Operation

The DA 40 has a Lycoming 4-cylinder, horizontally opposed, direct drive engine. The engine type is IO- 360-M1A. The engine has a wet sump oil system. The IO-360-M1A is air cooled and has a fuel injector system.

It has an electric starter and Slick magnetos. It also has either a SlickSTART magneto booster system or a Limited Authority Spark Advance ignition system (LASAR). The IO-360-M1A engine has a hollow crankshaft which lets oil flow to the propeller from the propeller governor.. The propeller turns in a clockwise direction when viewed form the cockpit. The power plant has these components installed:

Cowling

The power plant has a top and bottom engine cowling. The two halves attach to each other and to the airframe with camloc quick release fasteners. The top cowling has one small access panel for the engine oil filler and dipstick. The bottom cowling has two large cooling air intakes and one air intake for the engine air filter.

Engine Mount

The engine mount attaches to the firewall at five locations. Tubular steel makes the mounting frame. The engine attaches to the engine mount with shock-mounts. Rubber and metal bushings make the engine shock-mounts.

Electrical Harness

Electrical cables go through the firewall to connect to the engine. They give electrical supply to the engine starter motor, ignition system and engine sensors. Electrical cables from the generator supply electrical power to the airplane electrical system.

Air Intakes

The bottom cowling has these air intakes:

The intake on the front left face of the bottom cowling supplies cooling air for the engine.)

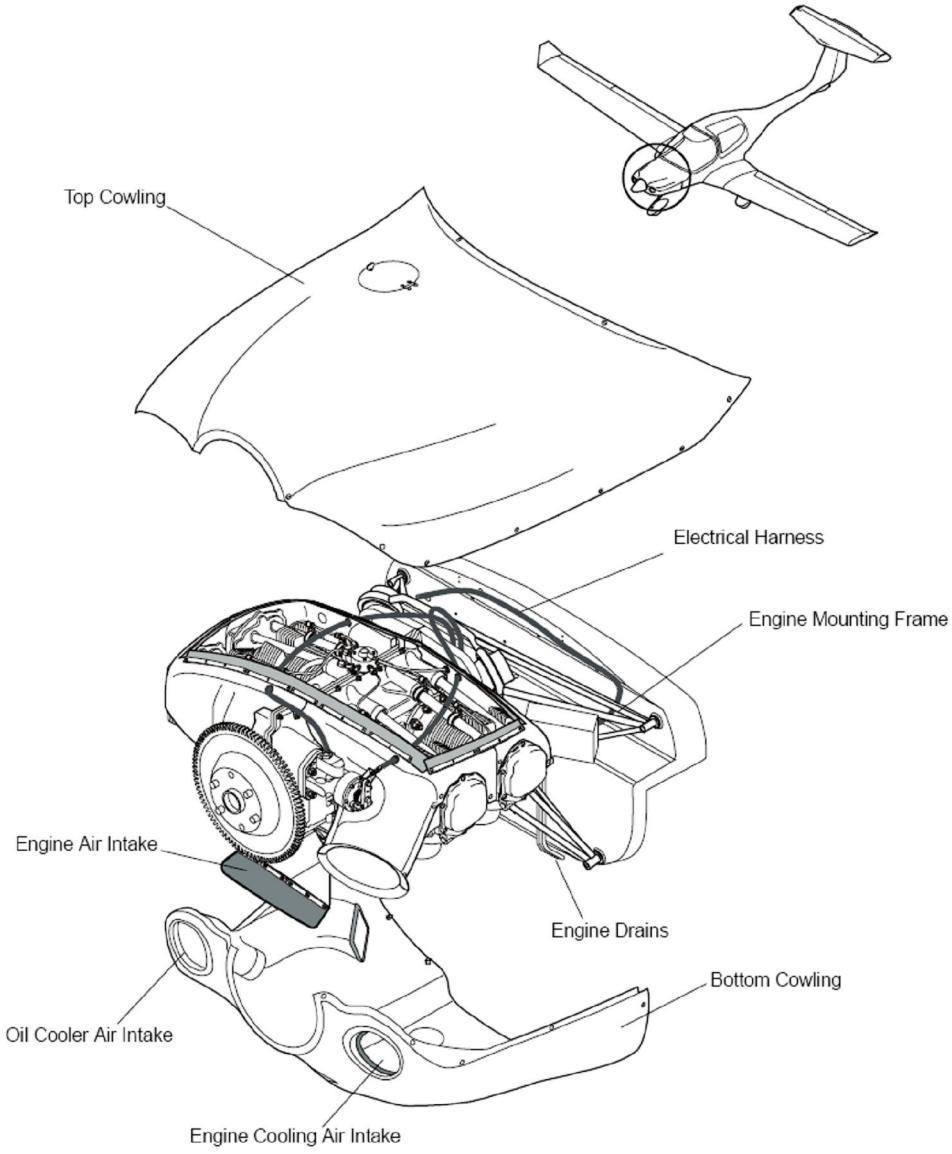
The intake on the front right face of the bottom cowling has three outlets

A small outlet which supplies additional cool air to the engine.

An outlet which supplies cooling air through integral ducting to the oil cooler.

An outlet which connects to a flexible hose which supplies cooling air to the cabin heat system, to the battery and to the alternator.

Engine air intake. This intake is located in the lower center of the cowling and supplies air to the engine air filter.



Engine Cowling and Intakes

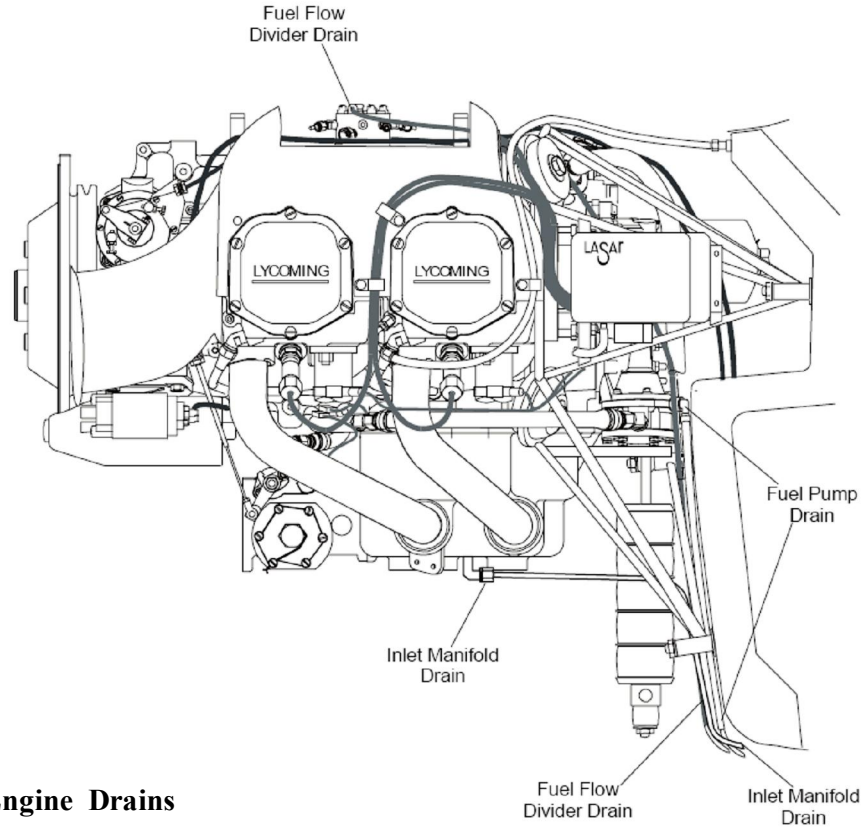
Engine Drain Pipes

The engine has these drain pipes:

Engine driven fuel pump drain.

Fuel flow divider drain.

Induction manifold drain.



Engine Drains

Engine Specification

Engine manufacturer.	Lycoming
Engine model.	IO-360-M1A
Engine operating limits:	
Rated output power.	180 HP (134.2 kW)
Rated output rotation speed during take-off and climb.	2700 RPM
Max. continuous rotation speed.	2400 RPM

Ground run-up limits:

Ground idle speed.	740 ± 20 RPM

Oil pressure:

Minimum	25 psi
Normal	55 - 95 psi
Maximum	98 psi

Fuel pressure:

Minimum	14 psi
Normal	14 - 35 psi
Maximum	35 psi

Oil temperature:

Minimum (not for continuous operation).	149 °F
Normal	149 - 245 °F
Maximum	245 °F

Cylinder head temperature:

Minimum	150 °F
Normal	150 - 475 °F
Maximum	500 °F
Fuel grade:	AVGAS 100 or 100LL

Engine Cowlings - Lycoming Engine

1. General

The DA 40 has two glass fiber reinforced plastic (GFRP) panels which make the engine cowlings. A top cowling and a bottom cowling. GFRP is very strong and is easy to maintain. The cowlings give a good aerodynamic shape to the nose of the airplane. They are very easy to remove and give good access to the engine.

2. Description

Quick-release fasteners attach the cowlings to each other and to the fuselage. Both the cowlings are very light and one person can hold them easily.
The top cowling has a small access panel for the engine oil filler and dipstick. The access panel attaches to the top cowling with a hinge.

The bottom cowling has the air intakes. The left intake gives cooling air for the engine. The right intake supplies air for the engine, the oil cooler, cabin heating, battery cooling, and alternator cooling. A special ñYò connector attaches to the inside of the cowling at the oil cooler air intake..

The ñYò connector supplies cooling air for the alternator and it supplies air for the exhaust-heat-exchanger. A quick-release fastener attaches the ñYò connector to the bottom cowling. The cowling has an air intake at the bottom-center for the fuel injector.

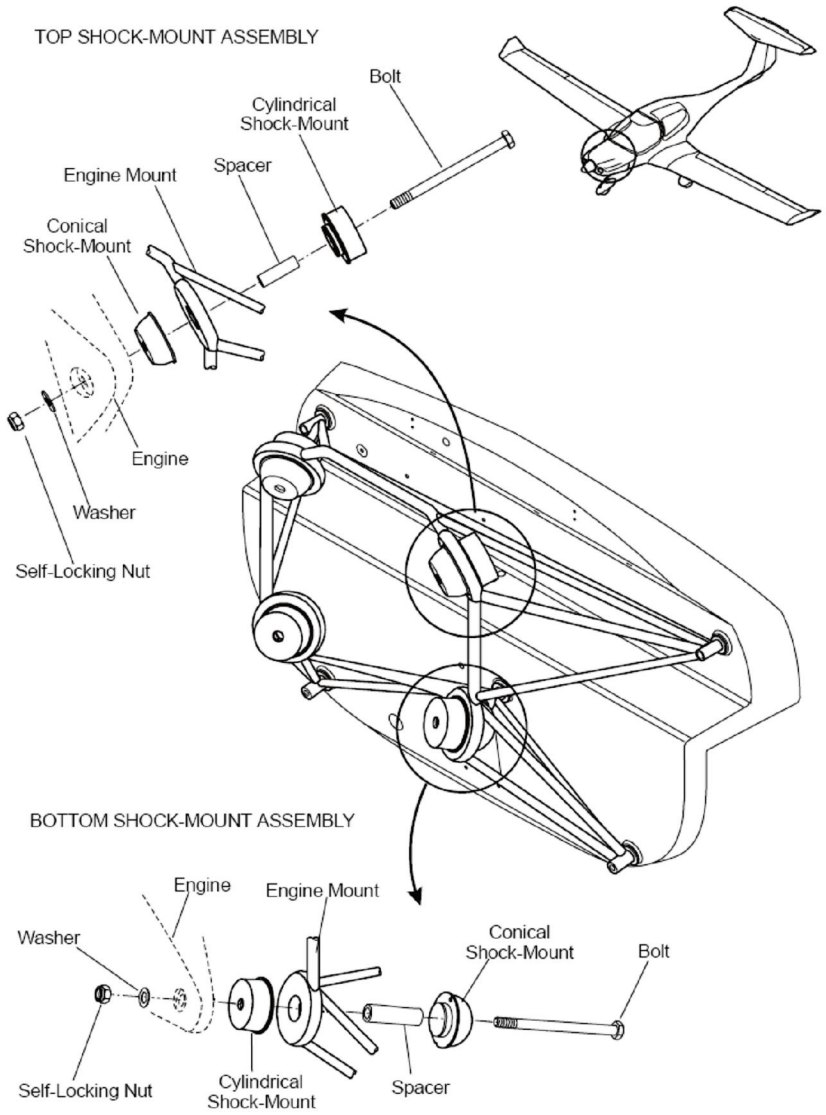
Engine Mounting - Lycoming Engine

1. General

Tubular steel makes the engine mount. The engine mount has welded joints. Paint protects the frame from corrosion. Rubber lined P-clamps and cable ties hold electrical cables and other items of equipment to the engine mount..

The engine mounting -frame has five small mounting pads at the rear of the frame. Bolts through the ads attach the engine mount to the fuselage. The center mounting also supports the elastomer pack r the nose gear leg.

The engine attaches to the engine mount at four mounting pads. Shock mounts go between the engine and the engine mount pads. These shock mounts isolate the airframe from engine vibrations.



Engine Mounting

Air Intakes - Lycoming Engine

1. General

An alternate air valve assembly, air filter housing and air filter make the engine air intake system for the DA 40 Airplane. The engine bottom cowling has a molded air intake duct and a flexible seal attached to the air filter housing makes the joint between the engine cowling and the engine intake. Figure 1 shows the engine air filter and alternate air intake.

2. Description

The air intake has 3 main parts:

Alternate air valve assembly.)

Air filter housing.

Air filter.

A. Alternate Air Valve Assembly

The alternate air valve assembly has a valve body which has 6 air inlet holes around its circumference. A Bowden cable attaches to the valve body and rotates the valve body inside they valve flange. O-ring seals locates at each end of the valve body to make a seal between the valve body and the valve flange.

The valve flange has 6 air inlet holes drilled around its circumference. A suction sleeve locates inside the valve flange and passes through the center of the alternate air valve assembly.

B. Air Filter Housing

The air filter housing has a flexible seal which makes a seal between the air intake assembly and the engine bottom cowling. The flexible seal attaches to the air filter housing with bolts. Bolts with spacers attach both the air filter housing and the alternate air valve to the fuel injector. One of the spacers has a support bracket for the Bowden cable.

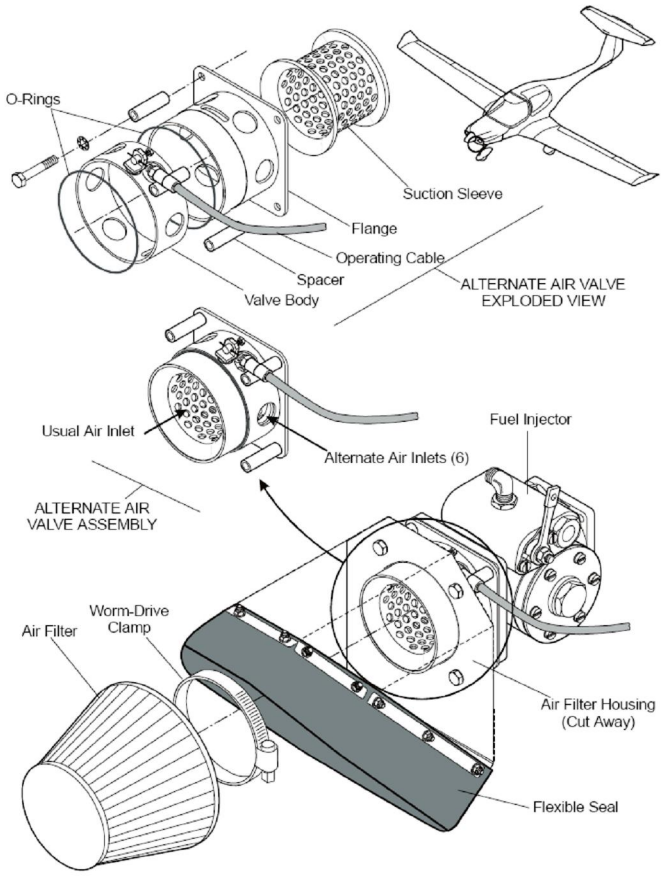
C. Air Filter

The air filter has a paper type element. The air filter locates on the air filter housing and is held by a worm-drive clamp.

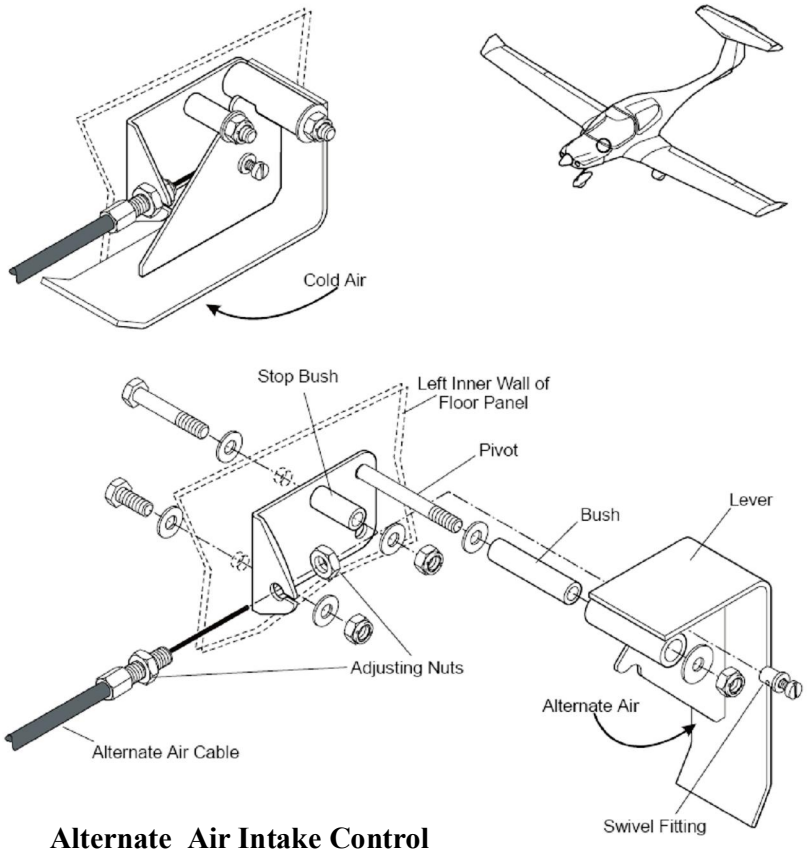
3. Operation

The following figure shows the alternate air control lever in the cockpit. It is located on the left side of the center console under the instrument panel. A Bowden control cable connects the control lever in the cockpit to the alternate air valve assembly in the engine bay.
In normal operation the alternate air control lever is set to the OFF position. The holes in the alternate air valve body and the flanged housing do not align and ambient air flows through the air filter into the fuel injector.

When the alternate air control lever in the cockpit is moved to the alternate air position, the Bowden cable rotates the valve body to align the holes in the valve body with the holes in the flanged housing. Warm air from the engine bay will now flow through the alternate air valve into the fuel injector. The alternate air valve can be selected to the alternate air position to supply warm air for anti-icing or to maintain the air supply should the air filter become blocked. The alternate air supply is not filtered.



Engine Air Filter and Alternate Air Intake



Alternate Air Intake Control

Figure 2: Alternate Air Control

Engine Drains - Lycoming Engine

1. General

The IO-360-M1A engine installed in the DA 40 has these engine drains:
Fuel/Oil drain for the engine-driven fuel-pump.)

Fuel drain for the fuel-flow-divider.)

Fuel drain for the induction manifold.)

2. Description

A. Engine Driven Fuel Pump Drain

A clear tube makes the fuel drain for the engine driven fuel pump. The fuel pump is mounted on the rear accessory housing. The tube attaches to a pipe connector at the rear of the pump. Cable ties attach the tube to the engine breather pipe. The drain connects to the main drain tube assembly at the rear of the engine compartment.

B. Fuel Distributor Drain

A clear tube makes the fuel drain for the fuel distributor. The fuel distributor is mounted centrally on top of the engine. A hose clip attaches the drain tube to the drain outlet which is on the left side of the fuel distributor. The tube goes back through a rubber grommet in the engine cooling baffle and down the main drain tube assembly at the rear of the engine compartment.

C. Induction Manifold Drain

An aluminum alloy pipe makes the induction manifold drain. The induction manifold drain connection is at the bottom of the engine below the engine sump. The drain goes left from the drain connection and then aft over the exhaust muffler to the main drain tube assembly at the rear of the engine compartment. A vent valve in the pipe at the induction manifold end closes automatically when the engine runs.

3. Operation

A. Engine Driven Fuel Pump Drain

The fuel pump drain is connected the fuel pump above the diaphragm. If the diaphragm ruptures, fuel will flow from the fuel pump drain outlet.

B. Fuel Distributor Drain

The fuel injector supplies pressurized fuel to one side of a diaphragm in the fuel distributor. Atmospheric air pressure acts on the other side of the diaphragm, assisted by a spring under a compression load. The fuel distributor drain connects to the air side of the diaphragm. If the diaphragm fails, then fuel will flow from the fuel distributor drain outlet.

C. Induction Manifold Drain

All four induction manifolds connect to a check-valve at the bottom of the manifold. The manifold drain attaches to the check-valve. When the engine is stationary, the check valve is open and any residual fuel can drain from the induction manifolds. When the engine operates, the check valve closes to seal the induction manifold.

Lycoming Engine

1. General

This Section tells you about the Lycoming IO-360-M1A engine installed in the DA 40. It tells you about the engine for background only.

2. Description

A. Crankcase

The IO-360-M1A is a four cylinder, horizontally opposed, direct drive engine. The engine has an aluminum alloy crankcase. The crankcase is in two halves, a left half and a right half. Bolts, studs nuts and washers attach the left half to the right half.

The oil sump bolts to the bottom of the crankcase. The fuel injector is attaches to a pad at the front of the sump with fours studs, washers and nuts. The first part of the induction manifold is integral with the sump.

The crankcase has the bearings for the crankshaft and the camshaft. The top of the crankcase has the mounting pads for the cylinders. The rear of the crankcase has the mounting for the accessories and the accessory housing.

B. Crankshaft

The I0-360-M1A engine has a hollow crankshaft with four main bearings. The crankshaft has four big-end bearings for the connecting rods. The front of the crankshaft has a drive flange for the propeller and flywheel.

The drive flange has six bolt holes. The bolt holes have special bushes. The bushes have a screw thread on the inside for the propeller bolts. Four of the bushes are long and two of the bushes are shorter. One of the shorter bushes is marked with an ñoò, this is the index bush.

C. Camshaft

The one-piece camshaft is mounted in the crankcase. The camshaft is driven by a gear on the rear of the crankshaft. Another gear at the front of the camshaft drives the propeller governor gear-train. The camshaft has eccentric lobes which operate the push-rods for the valve-operating-gear.

D. Connecting Rods

The engine has the usual connecting rods. The ñbig-endò of the connecting rod attaches to the
crankshaft journal and the ñsmall-endò attaches to the piston. Each rod has a split big-end bearing and it has a bearing cap. Two special bolts attach the bearing- cap to the connecting rod. The small-end has a plain bearing which is a sliding fit with the piston gudgeon-pin.

E. Flywheel

The flywheel attaches to the front of the crankshaft. The drive bushes hold the flywheel in place and a central spigot on the drive flange aligns the flywheel..The flywheel has two Vee grooves machined in it. One Vee groove on the rear of flywheel moves a flexible belt for the generator. The outside of the flywheel has the starter-ring -gear attached. A pinion gear on the electric starter turns the flywheel with the starter-ring-gear when the starter is operated.

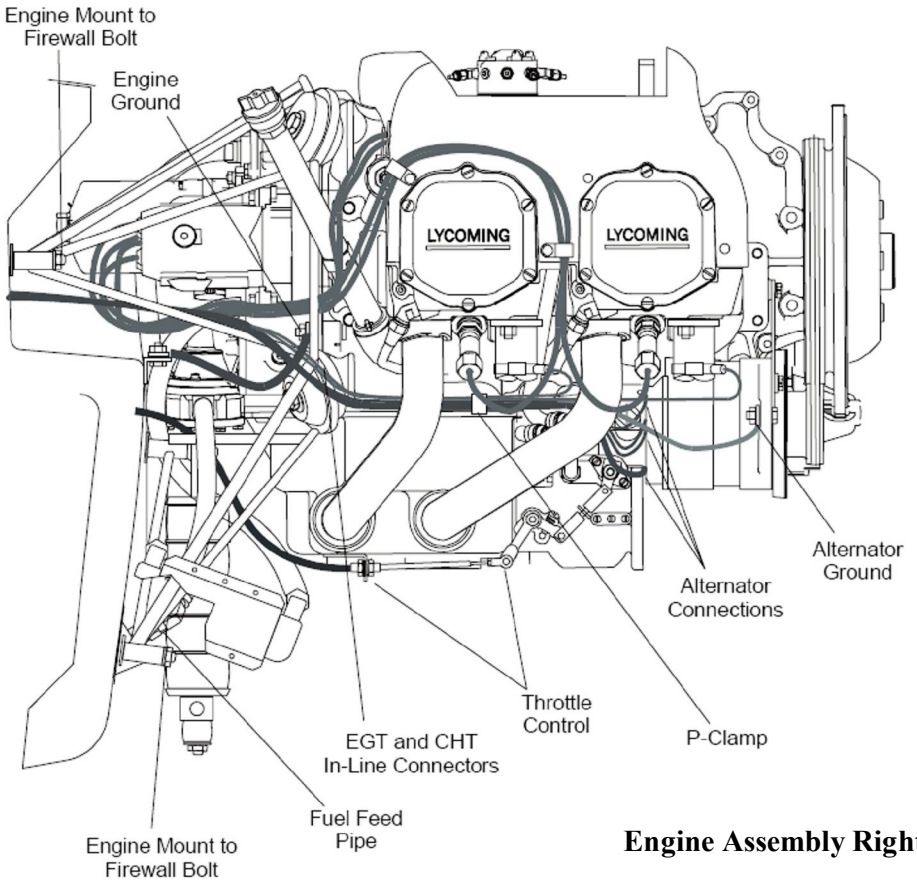
F. Cylinder Assembly

The engine has four individual cylinders. The head of the cylinder is aluminum alloy and the barrel of the cylinder is steel. The cylinder heads is screwed onto the cylinder during production and cannot be removed. The base of the cylinder has a flange which is used to attach the cylinder to the crankcase. A spigot below the flange aligns the cylinder in the crankcase. Studs, nuts and washers attach the cylinder to the crankcase. An O-ring seal makes an oil-tight seal between the base of the cylinder and the crankcase.

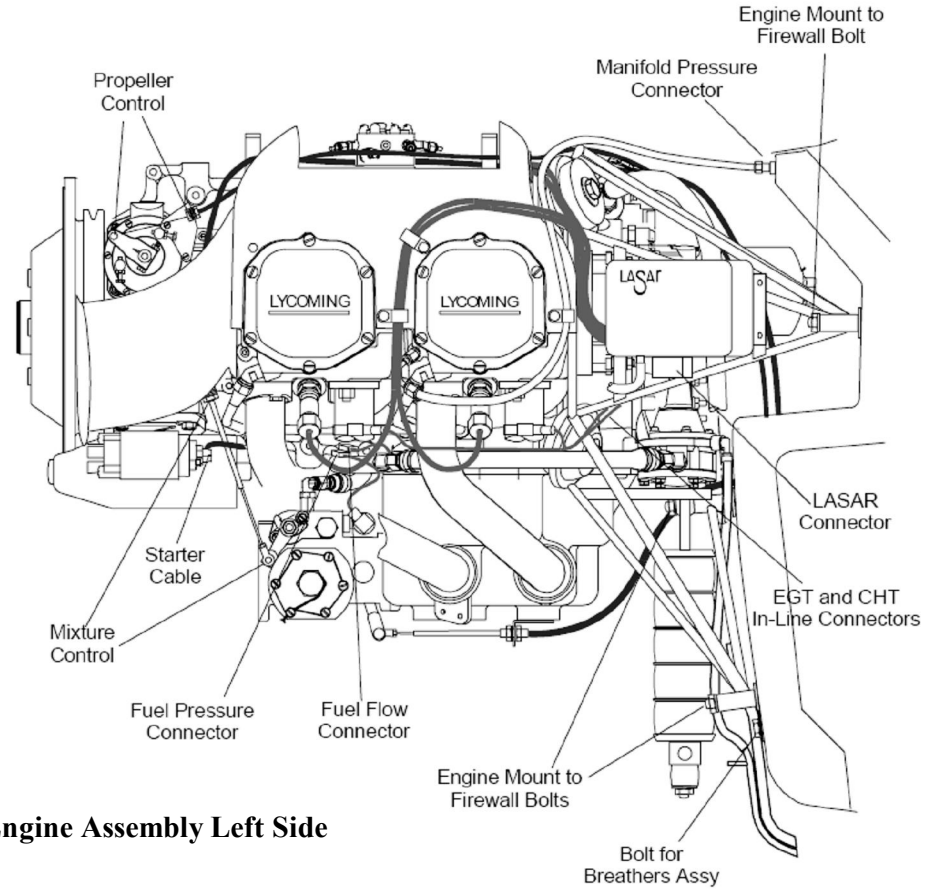
The intake and exhaust flanges are machined into the lower side of the cylinder head. The cylinder head has an upper and a lower hole for the spark plugs. The outboard end of the cylinder head has the intake and exhaust valves. It also has a housing for the valve operating gear. The valve housing (rocker box) is closed with a cover plate. The cover plate attaches to the cylinder head with six screws and a cork gasket makes an oil-tight seal.

G. Accessory Housing

The rear accessory housing attaches to the rear of the crankcase. The rear part of the crankcase holds the gears which turn the accessories. The crankshaft has a gear on the rear end. The crankshaft gear turns two idler gears. The left idler gear turns the camshaft gear and it turns a gear which attaches to the left magneto. The right idler gear turns the right magneto. The accessory housing closes the rear of the crankcase. Bolts attach the accessory housing to the crankcase. The accessory housing has mounting pads for the magnetos. The accessory housing holds the engine lubricating oil pump. The oil pump, is on the inside of the housing and an internal oil gallery connects the inlet of the oil pump to the sump. A shaft from the rear of the crankshaft turns the oil pump.

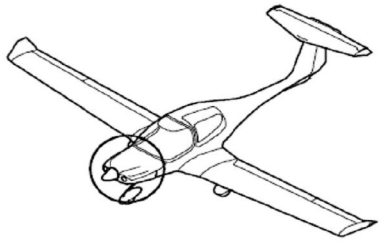


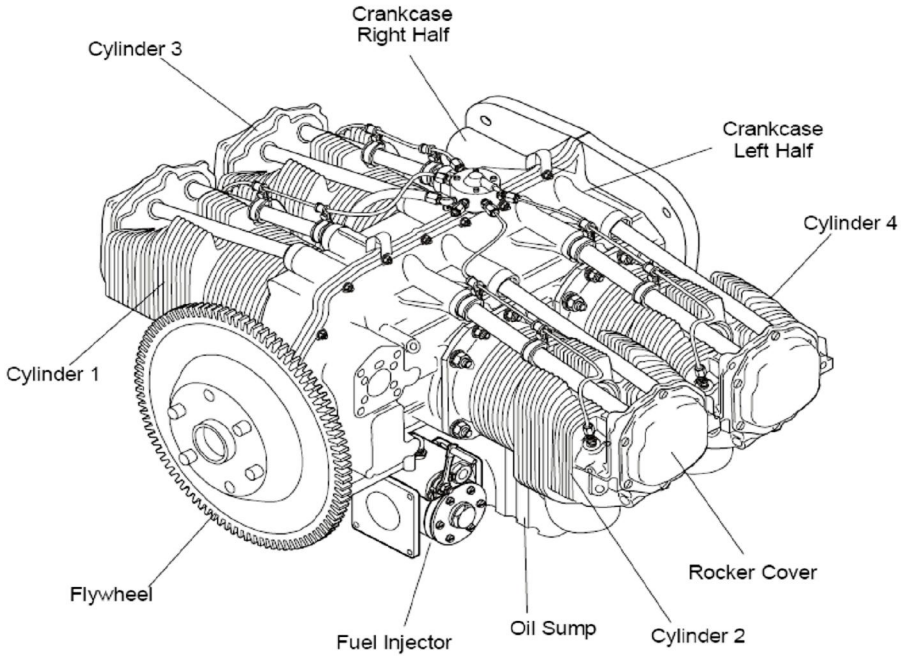
Engine Assembly Right Side



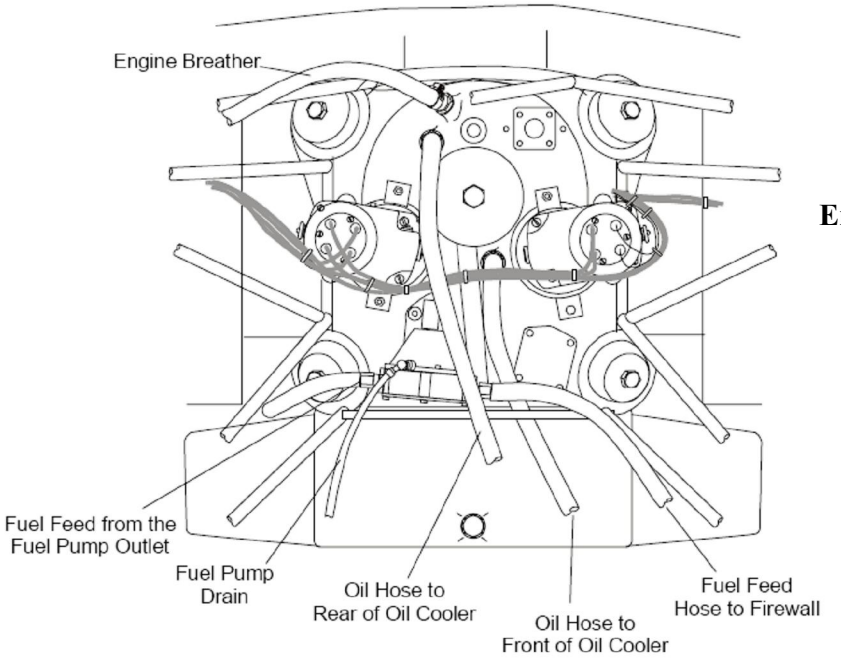
Engine Assembly Left Side

Figure 3: Left Side of the Engine





Engine Assembly



Engine Rear Side

IGNITION

1. General

This Chapter tells you about the ignition system for the engine. It gives you the general data about the ignition system.

2. Description

The DA 40 has dual ignition. The SlickSTART magneto booster system is standard equipment, the limited-authority-spark-advance-regulator (LASAR) system is optional. Two Slick magnetos supply the high voltage electrical impulses to the spark plugs. An ignition switch in the cockpit controls the magnetos and screened cables connect the magnetos to the spark-plugs. Two spark-plugs in each cylinder give ignition. The engine ignition firing order is 1-3-2-4.

A. SlickSTART Booster System

The SlickSTART booster receives power only when the starter is engaged. Therefore this system only affects the engine start-up process.

3. Ignition System Components

The following figure shows the schematic diagram of the ignition system. The ignition system has these components:

A. Ignition Switch

The ignition switch is at the lower face of the instrument panel, on the left half. You operate the ignition switch with a key. The ignition switch has these positions: OFF Both magnetos grounded, LASAR system (if installed) in back-up mode.)

R Right magneto live, left magneto grounded, LASAR system (if installed) in back-up) mode.

L Left magneto live, right magneto grounded, LASAR system (if installed) in back-up) mode.

BOTH Both magnetos live, LASAR system (if installed) in automatic mode if the engine is running. LASAR system in back-up mode if the engine is not running.

START Both magnetos live, LASAR system (if installed) in automatic mode and starter relay ON.

You cannot repair the ignition switch.

B. Ignition Switch Cables

Cables connect the ignition switch to the SlickSTART booster control unit or LASAR control unit. The control unit has special electrical cables which connect to the left magneto and connect to the right magneto.

C. SlickSTART Booster System

The SlickSTART booster system is the standard system in the DA 40. It is active only during the engine start-up process.
The ignition-switch-cables connect to the SlickSTART booster. Nuts and bolts attach the boosterto a bracket on the left side of the engine mount. Electrical cables from the booster connect to the left magneto and connect to the right magneto. The starter supplies electrical power to the booster.A 5 amp in-line fuse protects the booster.

D Magnetos

(1) SlickSTART Magneto Booster System Installed

The 2 Slick magnetos attach to the rear accessory housing and are driven directly by the engine. The contact breakers control the ignition timing. The ignition timing is fixed to 25° BTDC.During the engine start-up process, the SlickSTART booster delivers energy to the retard breaker magneto.

G. High-Tension Cables (Ignition Harness)

Each magneto supplies high-tension pulses to one spark-plug in each cylinder. High tension cables connect the magneto to the spark-plugs. Each cable has a core which transmits the high tension electricity. The core has thick layer of insulation and the insulation is covered with a braided metal screen. The braided metal screen connects to the cable end-fittings and prevents radio

interference.

Each high tension cable has special end-fittings. The end-fittings stop water going into the cable connections and electrically bonds the braided-screen. You can test the high tension ignition cables with a high tension tester.

H. Spark Plugs

Each cylinder has two spark plugs. The left magneto connects to the top spark plugs on the left cylinders and it connects to the bottom spark plugs on the right cylinders. The right magneto connects to the top spark plugs on the right cylinders and the bottom spark plugs
on the left cylinders.

4. Operation

A. Ignition switch Set to OFF

The ignition switch gives a ground to both magnetos.)

The magnetos cannot make high tension pulses of electricity.)

the spark plugs cannot make sparks.)

The engine cannot run.)

B. Ignition Switch Set to R

Use this setting to test the right magneto:

The ignition switch gives a ground to the left magneto.)

The right magneto is live.)

If the engine turns the right magneto will make high tension pulses and the spark plugs will)
make sparks.

The engine can run.

C. Ignition Switch Set to L

Use this setting to test the left magneto:
The ignition switch gives a ground to the right magneto.)

The left magneto is live.)

If the engine turns the left magneto will make high tension pulses and the spark plugs will make)
sparks.

The engine can run.)

D. Ignition Switch Set to BOTH

This is the usual setting when the engine runs.

Both magnetos are live

When the engine turns both magnetos make high tension pulses and the spark plugs make sparks.

If the engine is running and power is supplied to the LASAR system, the LASAR system will operate in automatic mode (if installed).

E. Ignition Switch Set to START

Use this setting to start the engine.

(1) SlickSTART Magneto Booster System Installed

Both magnetos are live.

The ignition switch connects a 28 V positive supply from Main Bus 1 to the starter relay.)

The SlickSTART booster receives energy and supplies the retard breaker magneto with)
energy for an additional ignition spark.

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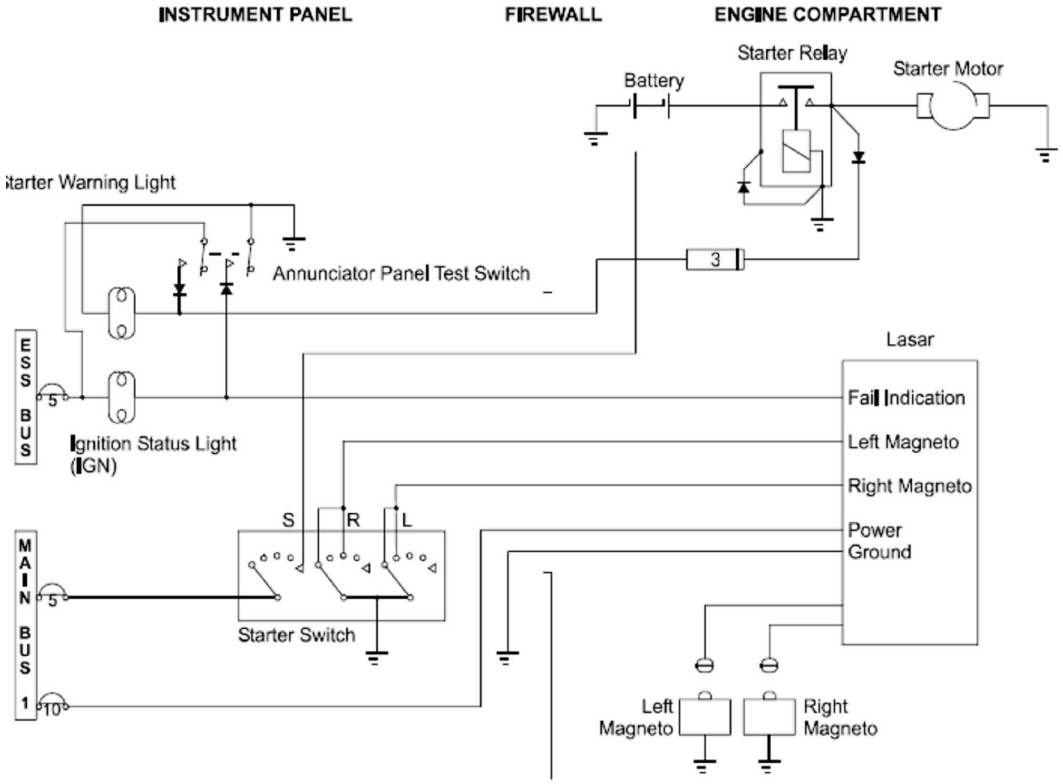


Engine Ignition Schematic Diagram

Air Cooling - Lycoming Engine
1. General

This Section gives you the data for the air cooling system for airplanes with the Lycoming engine installed.

2. Description/Operation

The baffle controls the cooling air flow. Ram air enters the cooling baffle through the intake in the engine cowling. The front duct of the baffle sends the cooling air into the space over the top of the cylinders. Rivets attach a special rubber sealing strip to the top of the baffle. The rubber sealing strip makes a seal between the baffle and the inside of the top cowling. The air goes down between the cylinders and around the outside of the cylinders. The used air goes out from the bottom rear of the engine bay. .These items pass through rubber grommets in the cooling baffle:

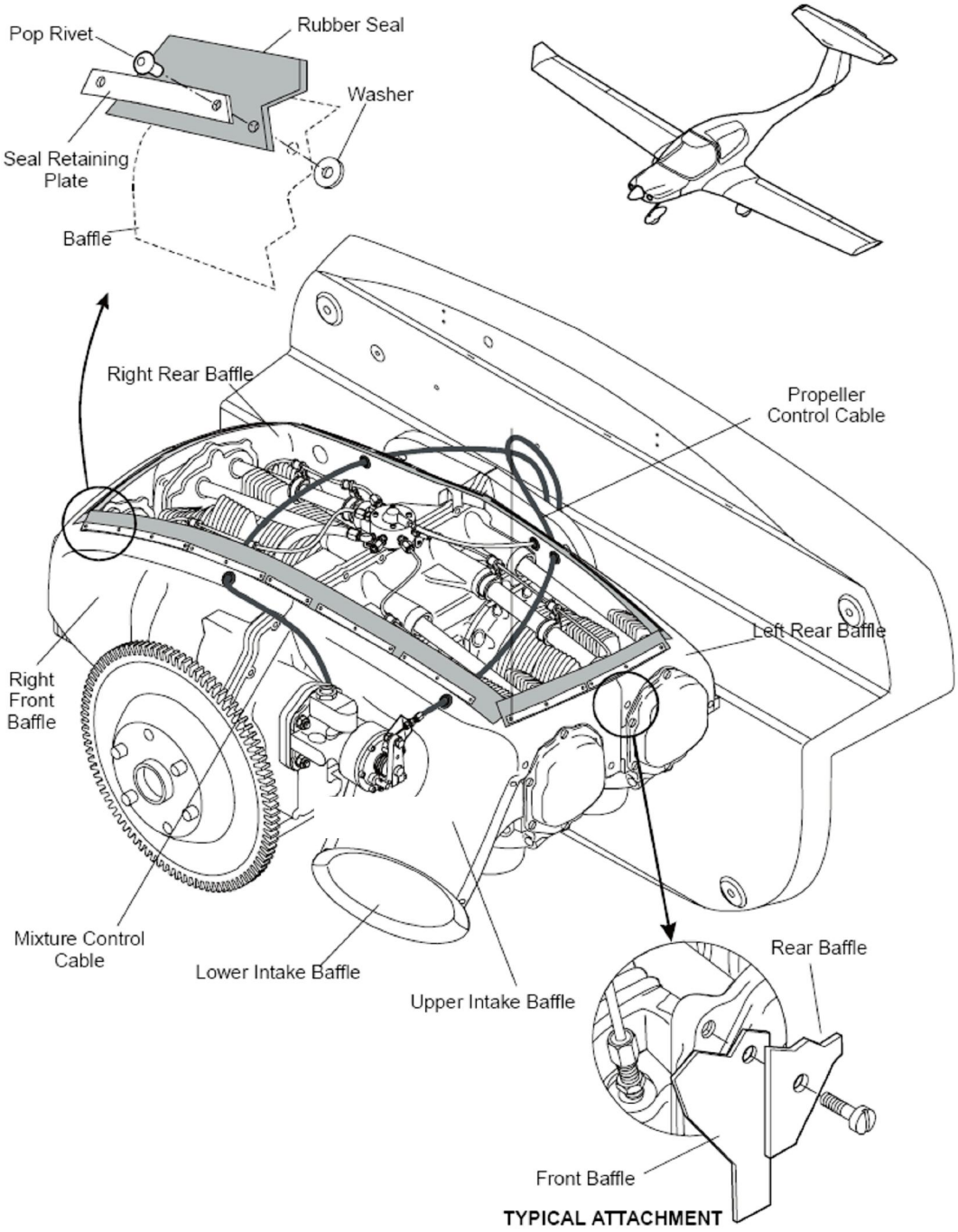
The propeller control cable

The mixture control cable.

The fuel flow divider drain.

The cables for the top spark plugs of Noôs 1 & 3 cylinders, go through a cable feed-thru in the rear of the baffle, on the right side. The cables for the top spark plugs of Noôs 2 & 4 cylinder pass through holes in the left side of the baffle, at the top.

Screws attach the baffle to the cylinder head and tie-bars hold the baffle in position around the bottom of the cylinders.



Cooling Air Baffle

FUEL SYSTEM

Fuel System - Lycoming Engine

1. General

This Section tells you about the DA 40 airplane fuel system with the Lycoming engine installed. It does not tell you about the engine fuel system. The DA 40 has a fuel tank in each wing. Each wing tank is made of the following two or three chambers:

the inboard fuel chamber,

the outboard fuel chamber, and)

All individual chambers are interconnected. The total usable fuel capacity of the fuel system is 152 liters (40 US gal) with the Standard Tank and 182 liters (48 US gal) installed. Two pumps supply fuel to the engine and a filter gives protection to sensitive components. The pilot controls the fuel system with a selector valve and a switch for the electric fuel pump. A fuel quantity indicator shows the quantity of fuel in the left tanks and in the right tanks.

2. Description

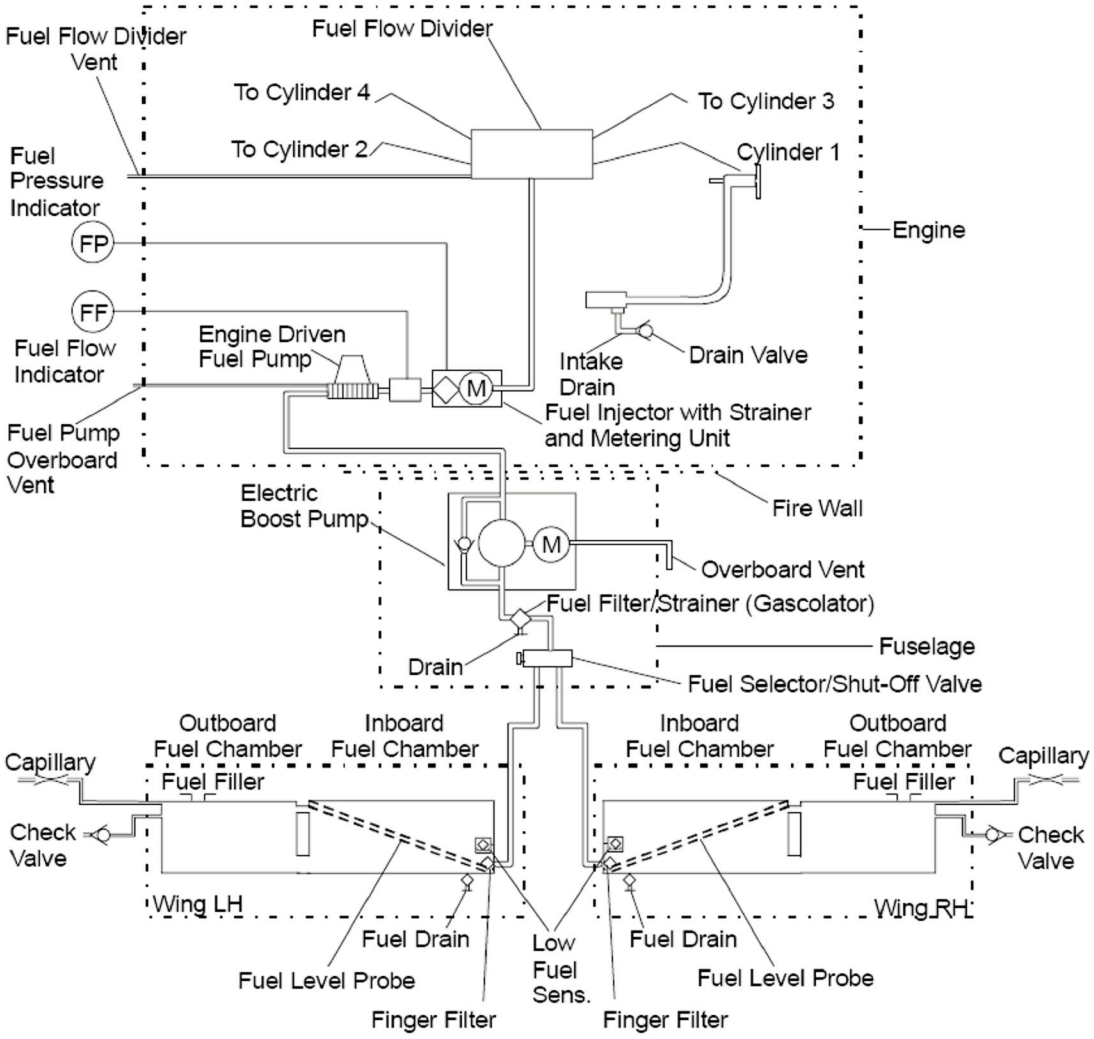
A. Standard Tanks

The following figure shows the fuel system schematic diagram for the DA 40 with the Lycoming engine and the Standard Tanks installed.

An inboard chamber and an outboard chamber in each wing hold the fuel. A flexible coupling connects the inboard chamber to the outboard chamber. Each outboard chamber has a fuel filler assembly and a vent connection. Each inboard chamber has a fuel drain and a finger-filter at the connection to the main fuel feed pipe. Fuel level sensors and probes are installed in both the inboard fuel chambers.

Flexible hoses connect the fuel tanks in the wings to the fuel selector valve in the center fuselage.A gascolator attaches to the selector valve. The gascolator has a filter and a fuel drain valve. A flexible hose connects the gascolator to the electric fuel pump (booster pump). The electric fuel pump has an internal fuel by-pass should the fuel pump become defective in flight..A flexible hose connects the booster pump to a bulkhead fitting in the firewall and another flexible hose connects the bulkhead fitting to the engine driven fuel pump. Vent pipes connect between the inboard chambers and the outboard chambers. The outboard chambers are vented to atmosphere. Check valves in the vent system prevent fuel from flowing out of the outboard chamber through the vent system.

The outboard chambers also have a small capillary tube which connects to atmosphere. These capillary tubes allow the air pressure within the tanks to equalize with the ambient pressure. The outlets for both the main vent system and the capillary vent system are on the fuel tank outer access panel in the lower surface of each wing.



Fuel System Schematic Diagram, Standard Tanks Installed

Fuel Distribution System - Lycoming Engine

1. General

This Section tells you about the fuel distribution system for airplanes with the Lycoming engine installed.

The fuel distribution system supplies fuel from the fuel tanks to the engine. This Section tells you about the components and equipment which make the fuel distribution system. These are the components of the fuel distribution system:

Flexible fuel hoses

Fuel selector/shut-off valve

Fuel gascolator and filter

Electric fuel pump (booster pump

2. Description

The following figure shows the main components of the fuel distribution system for the DA 40. Two flexible fuel hoses connect the left and right wing fuel tanks to the selector/shut-off valve. The selector/shut-off valve is located in the fuselage, under the cockpit floor. The fuel selector/cut-off valve connects to the gascolator .A flexible hose connects the outlet from the gascolator to the inlet of the electric fuel pump. Another flexible hose connects the outlet of the electric fuel pump to a bulkhead connector at the engine firewall.A flexible hose with an integral fire-sleeve connects the bulkhead connector to the engine driven fuel pump.

3. Fuel System Components

A. Flexible Hoses

The fuel system uses synthetic flexible hoses. The flexible hose in the engine bay have integral fire-protection sleeves. You must only use approved hoses in the fuel system which have been pressure tested.

B. Fuel Selector/Shut-Off Valve

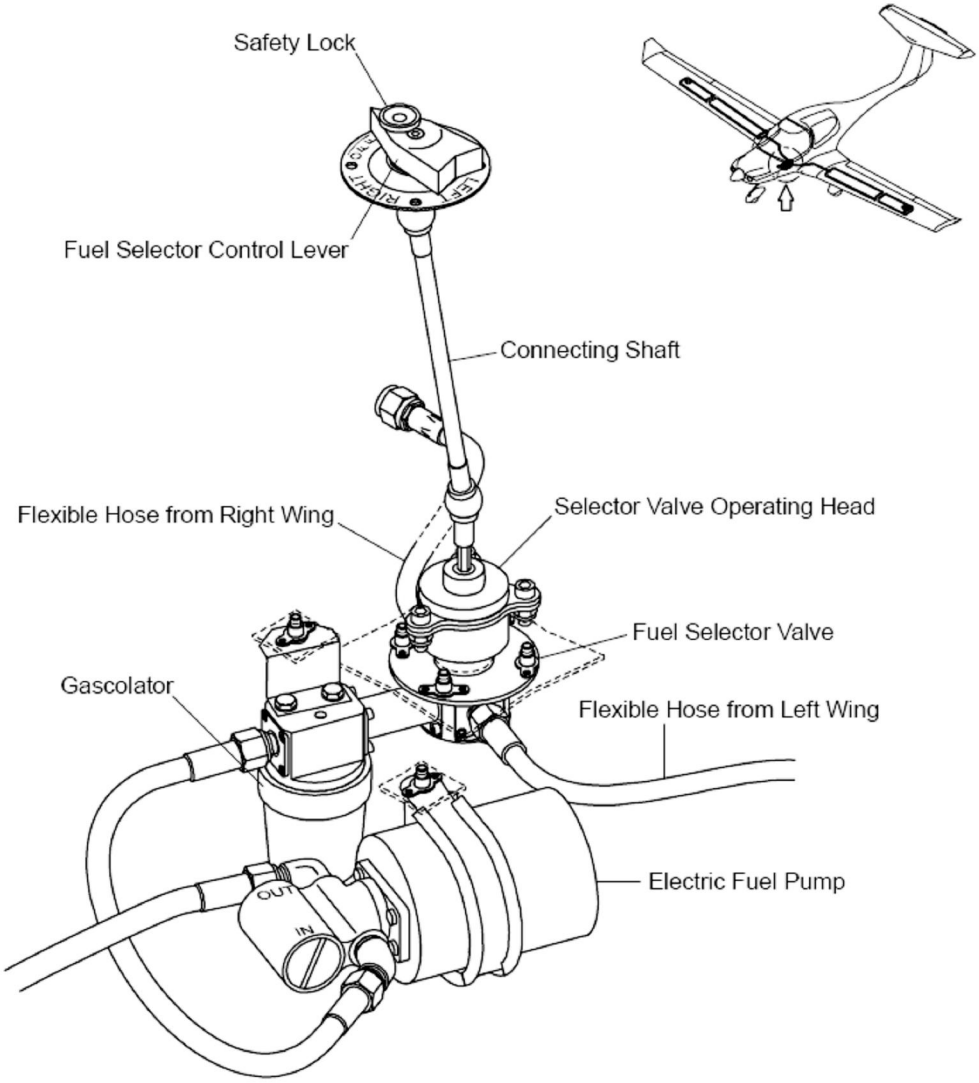
The fuel selector/shut-off valve is located below the cockpit floor. The selector valve is a three-way valve. A long shaft connects the valve to a selector control lever which is located in the cockpit. The selector control lever is mounted in the center console, aft of the engine control assembly. .If you set the control lever to LEFT then only the left wing tanks will supply fuel. If you set the control ever to RIGHT then only the right wing tanks will supply fuel. If you set the control lever to OFF then fuel will not be supplied from the tanks. To set the control lever to OFF you must lift a safety lock while you turn the control lever to the OFF position.

C. Fuel Gascolator and Filter

The gascolator connects to the selector valve. It has a filter and it has a fuel drain. You can remove the filter for cleaning/replacement. Use the fuel drain to drain the fuel distribution system and to drain fuel when you will do a test for fuel contamination.

D. Electric Fuel Pump (Booster Pump)

The electric fuel pump is located in the fuselage, below the cockpit floor. Electrical power is supplied from the main electrical bus. A switch in the lower left side of the instrument panel controls the fuel pump. A five Amp circuit-breaker protects the fuel pump electrical system. The pump is a high-pressure rotary pump. It will supply fuel to the engine if the engine driven fuel pump fails.



Fuel Distribution System Main Components

ELECTRICAL POWER

Electrical Power - Lycoming Engine
1. General

This Section tells you about the electrical system on the airplane with the Lycoming engine installed.

The DA 40 has a 28 volt direct current (DC) electrical system. The system has two integral sources of electrical power and a socket for connecting to an external power source. It has a 28 volt alternator and it has a 24 volt battery. In the usual operation the alternator supplies the power for the electrical power system. Refer to Section 24-40 for data on the external power system.

The alternator attaches to the front of the engine. A flexible belt turns the alternator. The alternator supplies power to the airplane. The power supplied by the alternator is controlled by the voltage regulator.

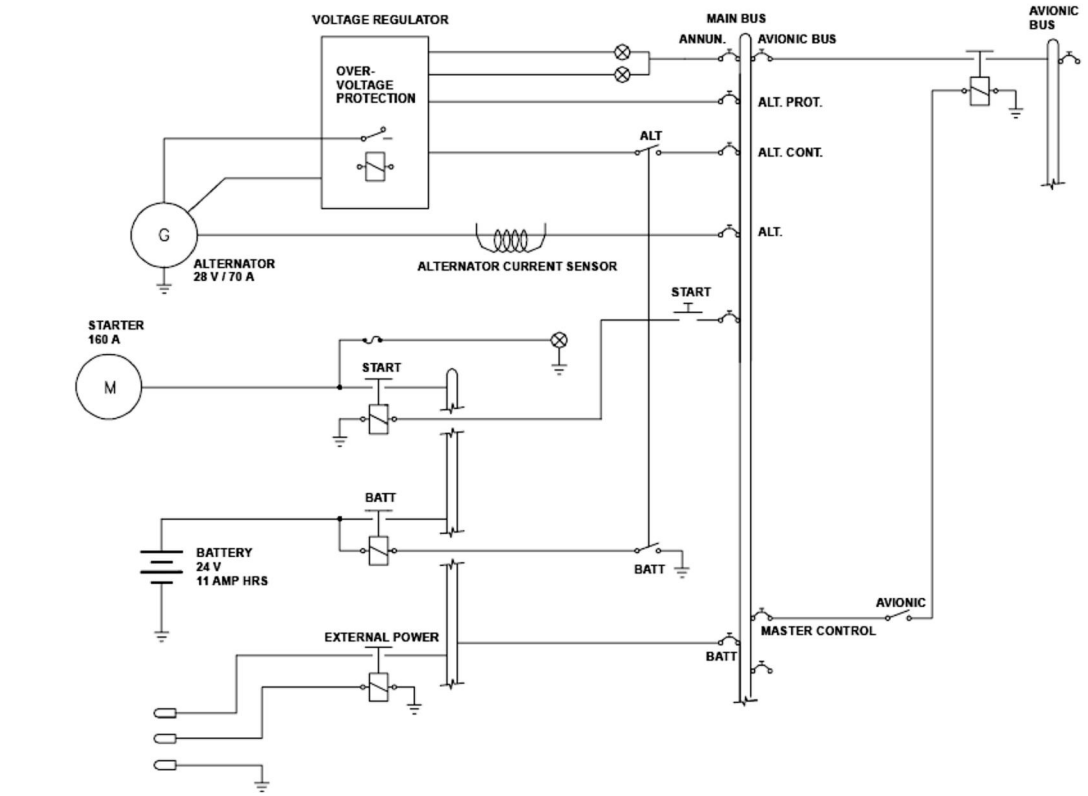
The battery is located on the front side of the firewall, on the right side.

The electrical system has a 24 Volt, 11 amp-hour battery. The battery supplies DC to the electrical system when the alternator is not operating. It also supplies power for engine starting..

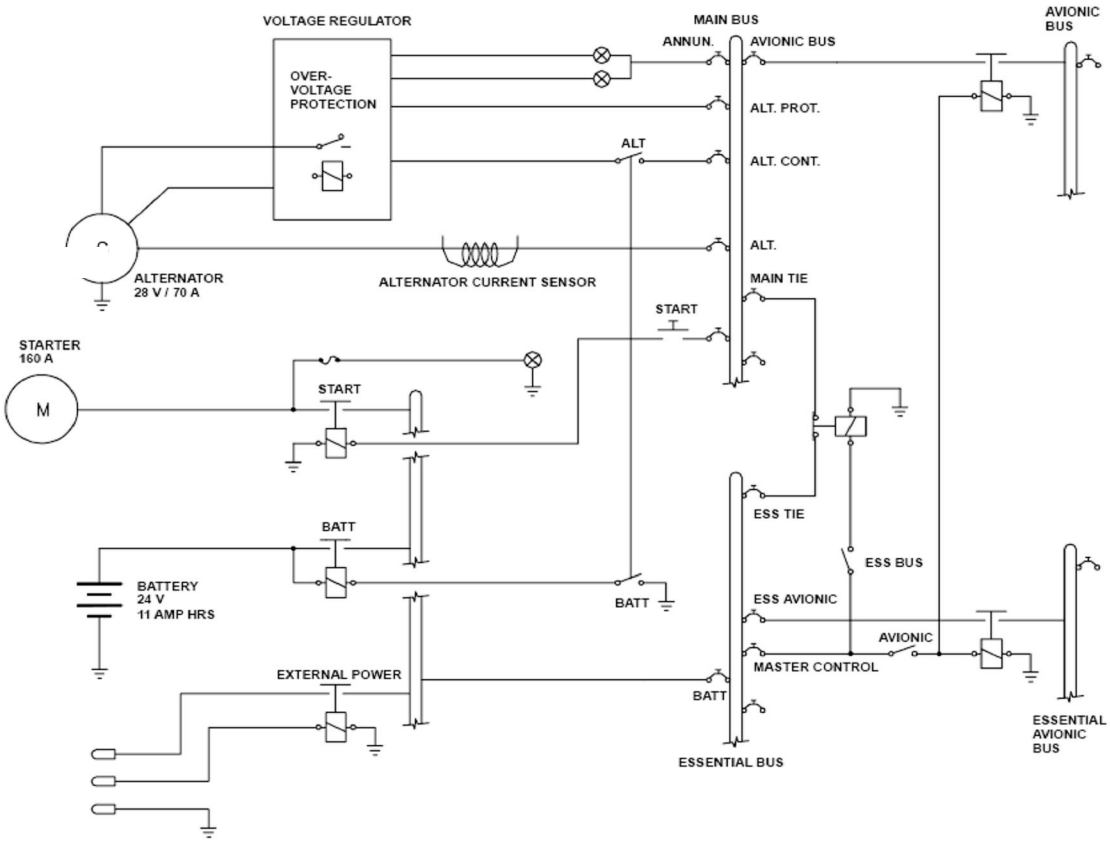
The battery canal also supplies power when the load is more than the alternator can supply.

The battery supplies heavy current for starting through the battery relay and the starter relay. The circuit has no protection. Circuit-breakers or fuses protect all other circuits. The ALT/BAT switch controls all electrical power sources in the system. Electrical bus bars distribute the power to the consumer systems.

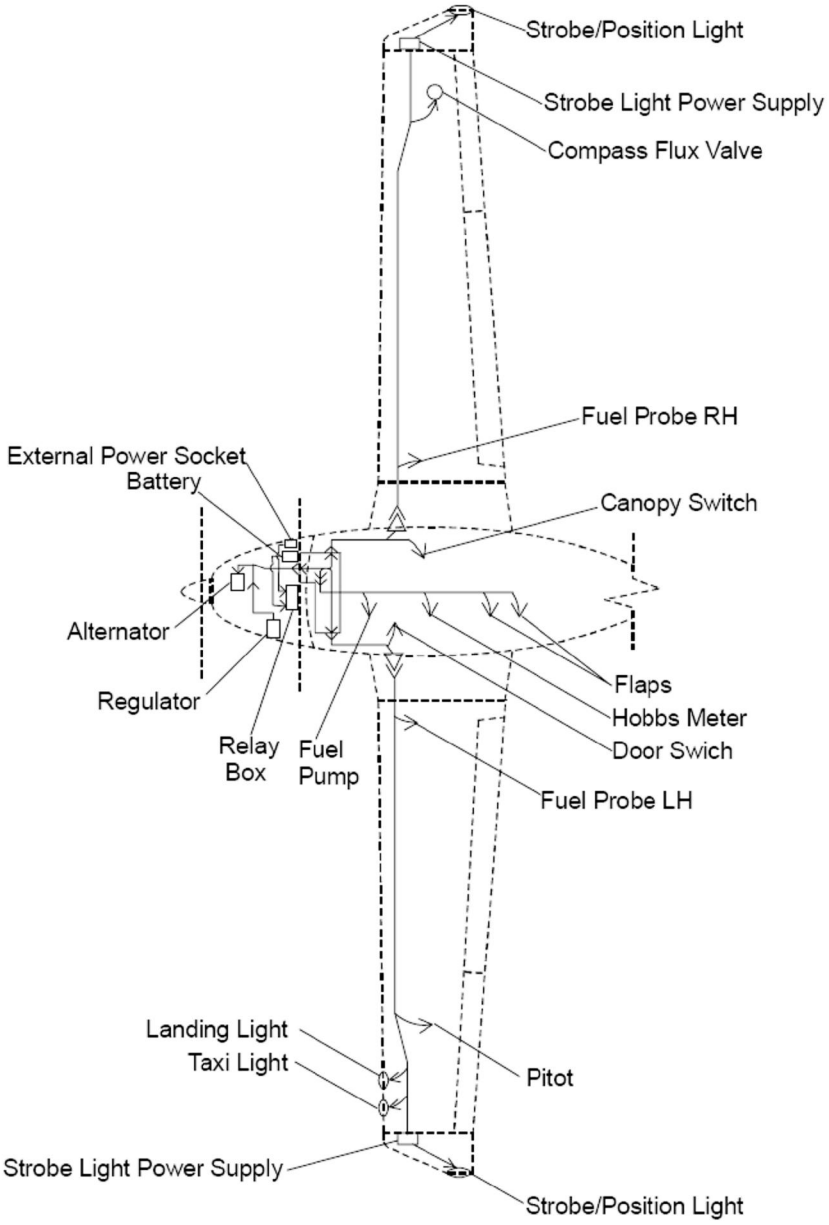
When the optional essential bus system is installed, then an ESS BUS switch is installed in the instrument panel. In the event of an electrical failure it can be set to ON. When it is set to ON, only those items of electrical equipment which are needed for the safe continuation of flight are supplied with power.



: Simplified Schematic Diagram, Electrical System without Essential Bus



!: Simplified Schematic Diagram, Electrical System with Essential Bus



Component Location Diagram

DC Generation - Lycoming Engine

1. General

The DC generation system for the DA 40 with the Lycoming engine has these components:

Alternator.

ALT/BAT switch.

Alternator control circuit-breaker

Alternator circuit-breaker

Voltage regulator

Alternator protection circuit-breaker

2. Description and Operation

Figures 1 and 2 show simplified DC electrical generation schematic diagrams.

A. Alternator

A 70 Ampère alternator attaches to the front of the engine. A flexible belt turns the alternator. Apulley on the engine crankshaft operates the flexible belt. The alternator is the usual source ofpower for the electrical system.

The output voltage from the alternator is controlled by the voltage regulator. The voltage regulator controls the output voltage at 28 V ± 2.5 %. The output from the alternator supplies the main electrical bus.The alternator can supply 70 Ampères continuously at engine speeds above 2100 RPM. The alternator will come on line when::

The engine is operating

The battery, alternator control, alternator protection, alternator and voltage sense circuit-)
breakers are closed.

The ALT/BAT switch is set to ON.

B. Voltage Regulator

The voltage regulator is located in the engine bay. An in-line connector connects the voltage regulator to the main cable harness.

The voltage regulator has these functions:

Provides electrical protection for the alternator in the event of equipment failure.)

Operates a low voltage warning if the alternator voltage falls below 24 Volts.)

Operates a warning if the alternator fails or goes off line

Controls the output voltage of the alternator to the main electrical bus.)

C. Alternator Control

These components make the alternator control system:

ALT/BAT switch.)

Alternator control circuit-breaker.)

Voltage regulator.)

Refer to Chapter 92 for the wiring diagrams.

When the ALT/BAT switch is set to ON, a ground is supplied to the battery relay circuit which % closes the battery relay and supplies battery voltage to the main bus or, if installed, to the essential bus. The ALT/BAT switch also connects the main bus to pin 1 of the voltage regulator. The alternator comes on line.

The voltage regulator controls and protects the alternator. It also gives signals for the low voltage warning system, alternator out warning system and voltage sensing.

D. Alternator Indication

These components make the alternator indicating system:

Alternator load indicator (Integral with the integrated engine instrument).)

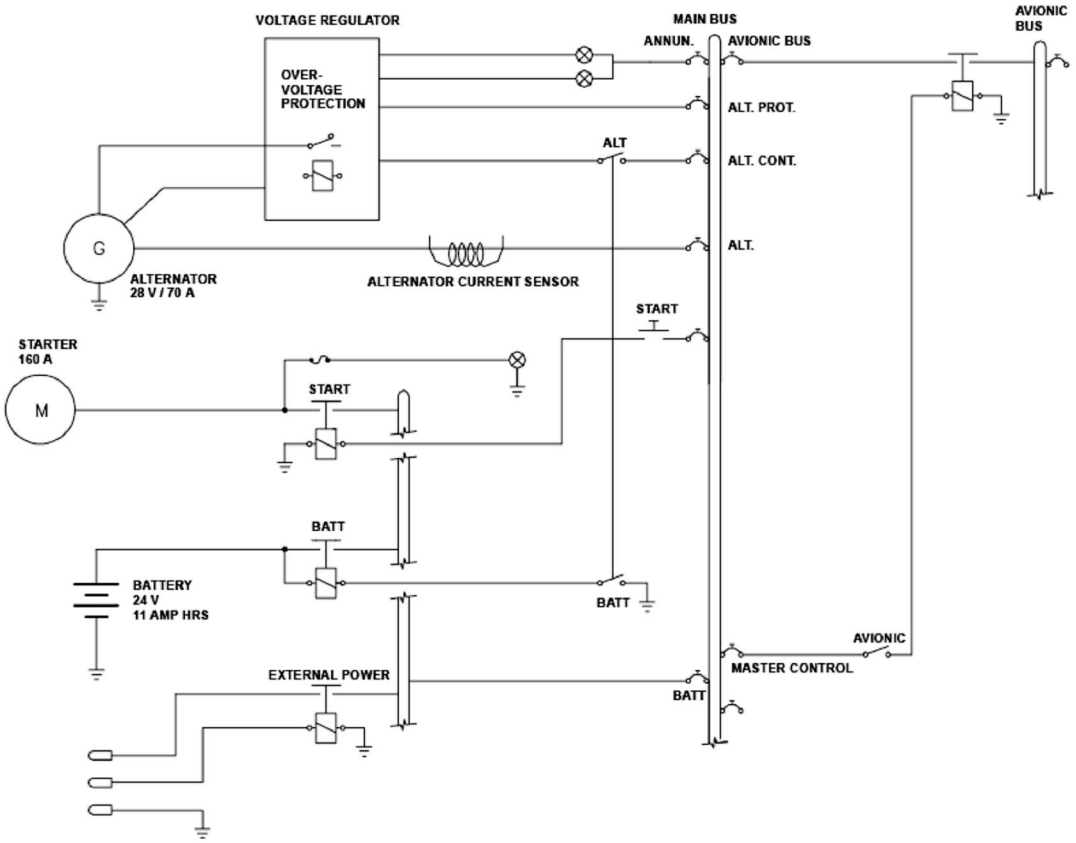
Alternator voltage indicator (Integral with the integrated engine instrument).)

Alternator out warning.

Low voltage warning.

The alternator load indicator is integral with the integrated engine instrument. It shows the current flow from the alternator to the main bus both graphically and digitally. The graphic display has color range marks for quick visual reference of load levels. If the current flow is less than 2 amps, the graphic display will flash and the red alternator warning light (ALT or ALTERNATOR) will come on in the annunciator panel.

When the alternator is operating, the voltmeter shows the alternator voltage. When the alternator is off-line, the voltmeter shows the battery voltage. The voltage is displayed both graphically and digitally. The graphic display has colored range marks for quick visual reference of voltage levels. If the voltage level is outside of the normal operating range the graphic display will flash. If the voltage falls below 24 volts, the amber low voltage caution light (VOLT or LOW VOLTS) will come on in the annunciator panel. The caution light will go out when the voltage exceeds 25 volts.



DC Generation (simplified), Electrical System without Essential Bus

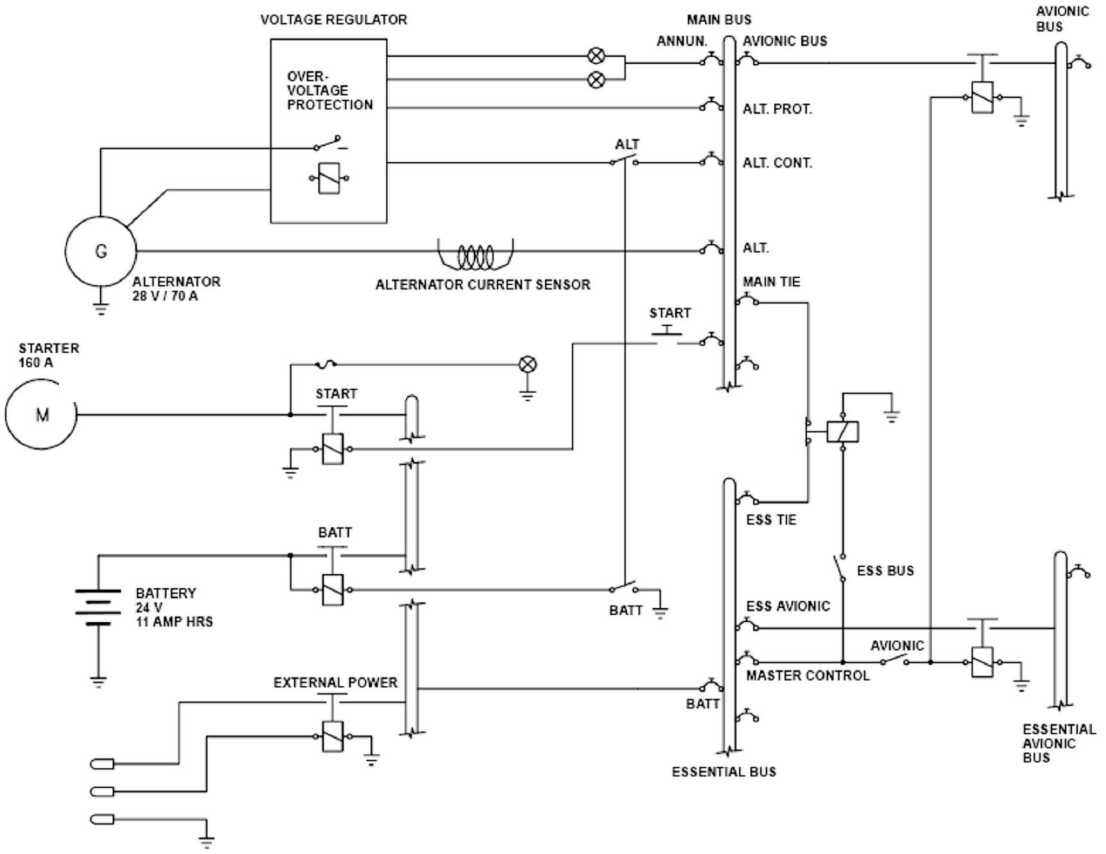


Figure 2: DC Generation (simplified), Electrical System with Essential Bus

External Power - Lycoming Engine

1. General

The DA 40 has an external power socket located on the right side of the fuselage, near the battery. It is a standard 28 Volt DC power socket. When you connect external power to the external power socket, the external power control relay is energized and the external power comes on-line.

2. Description and Operation

The following figure shows a simple schematic diagram of the external power system. The external power system has these components:

A. 28 Volt Socket

The 28 VDC power socket is located on the right side of the fuselage, near the airplane battery.
The socket has 3 pins:

A large negative pin

A large positive pin.

A small positive pin.

A diode connected between the small positive pin and the external power relay solenoid protects the system from reverse polarity.

B. External Power Relay

The external power relay is located in the relay box mounted on the firewall. Heavy duty cable connects the large positive pin to the input terminal of the relay. Another heavy duty cable connects the large negative pin to a ground point.

The small positive pin connects to the solenoid of the external power relay via the diode.

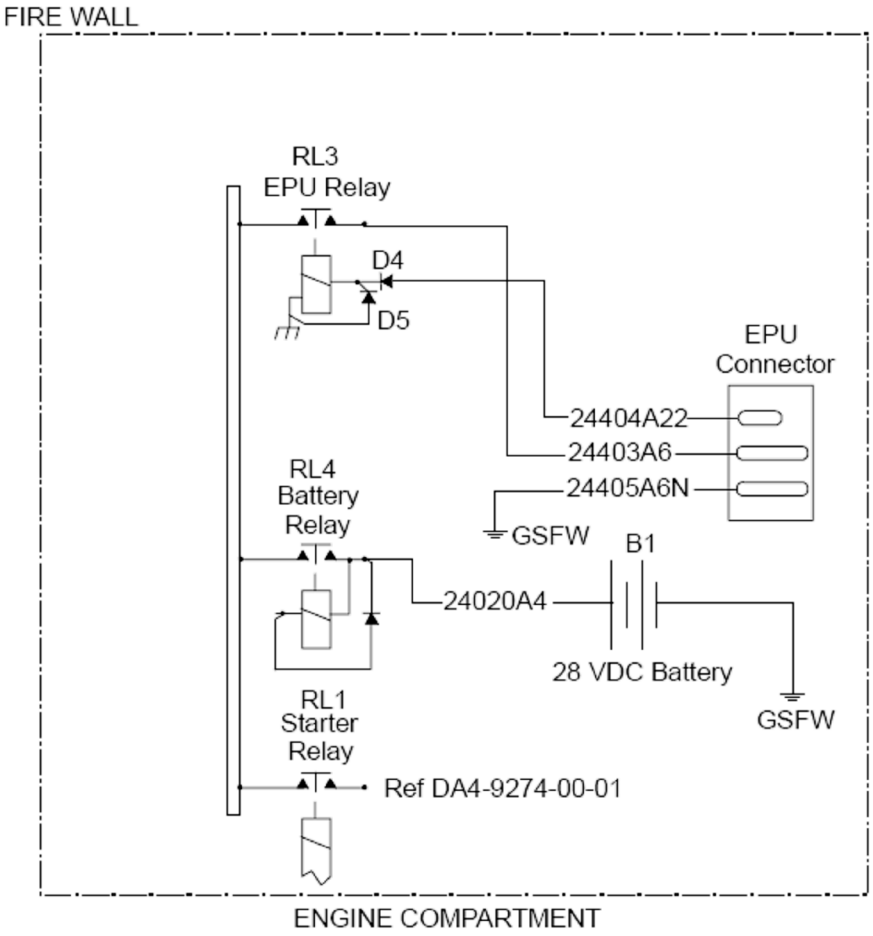
3. Operation

When you connect a 28 V DC power supply to the external power socket these things happen: Current can flow from the small positive pin to the solenoid, the solenoid operates and closes the relay.

Current can flow from the large positive pin through the external power relay to the main bus or, if installed, to the essential bus.

The large negative pin is connected to ground.)

If the polarity of the power supply is incorrect, then the diode will prevent current from flowing through the solenoid. The solenoid will not operate and current cannot flow through the external power relay to the main bus or the essential bus.



: **External Power System Schematic Diagram**

Battery System - Lycoming Engine

1. General

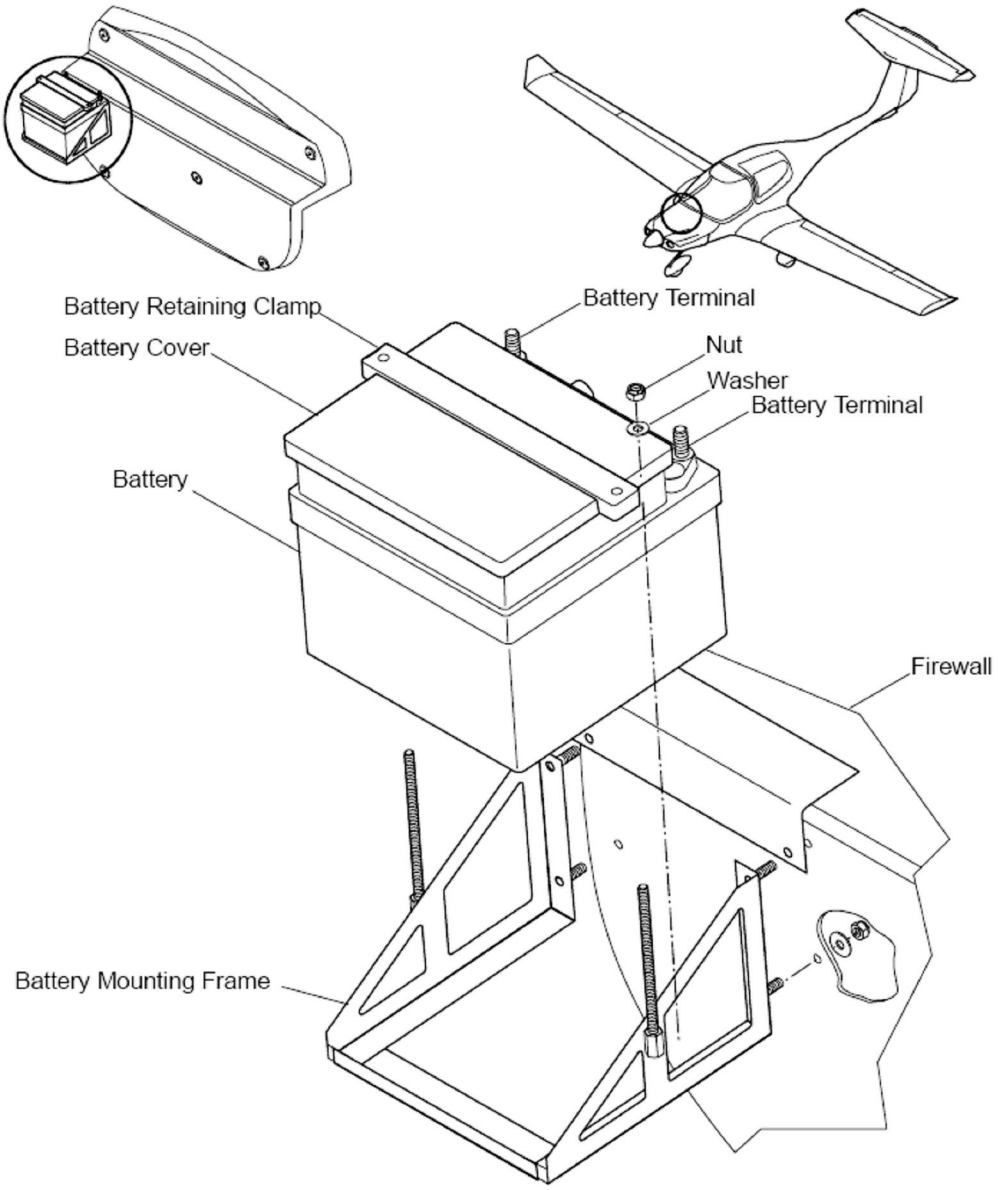
This Section tells you about the battery system for airplanes with the Lycoming engine installed.

The battery is located in the engine bay on the front of the fire-wall, on the right. When the alternator voltage is greater than the battery voltage, the alternator charges the battery.

When the alternator is operating, the voltmeter shows the alternator voltage. When the alternator is off-line, the voltmeter shows the battery voltage.

The battery supplies current to the main bus or, if installed, to the essential bus through the battery relay. The battery relay is in the relay box which is located on the firewall, inboard of the battery. A 70 amps circuit-breaker protects the battery system.

Regular maintenance of the battery system is necessary..



Emergency Battery System - Lycoming Engine

1. General

This Section tells you about the emergency battery system for airplanes with the Lycoming engine installed. The emergency battery system is only installed in the IFR model. Regular maintenance of the emergency battery system is necessary. Refer to Chapter 92 for the wiring diagrams.

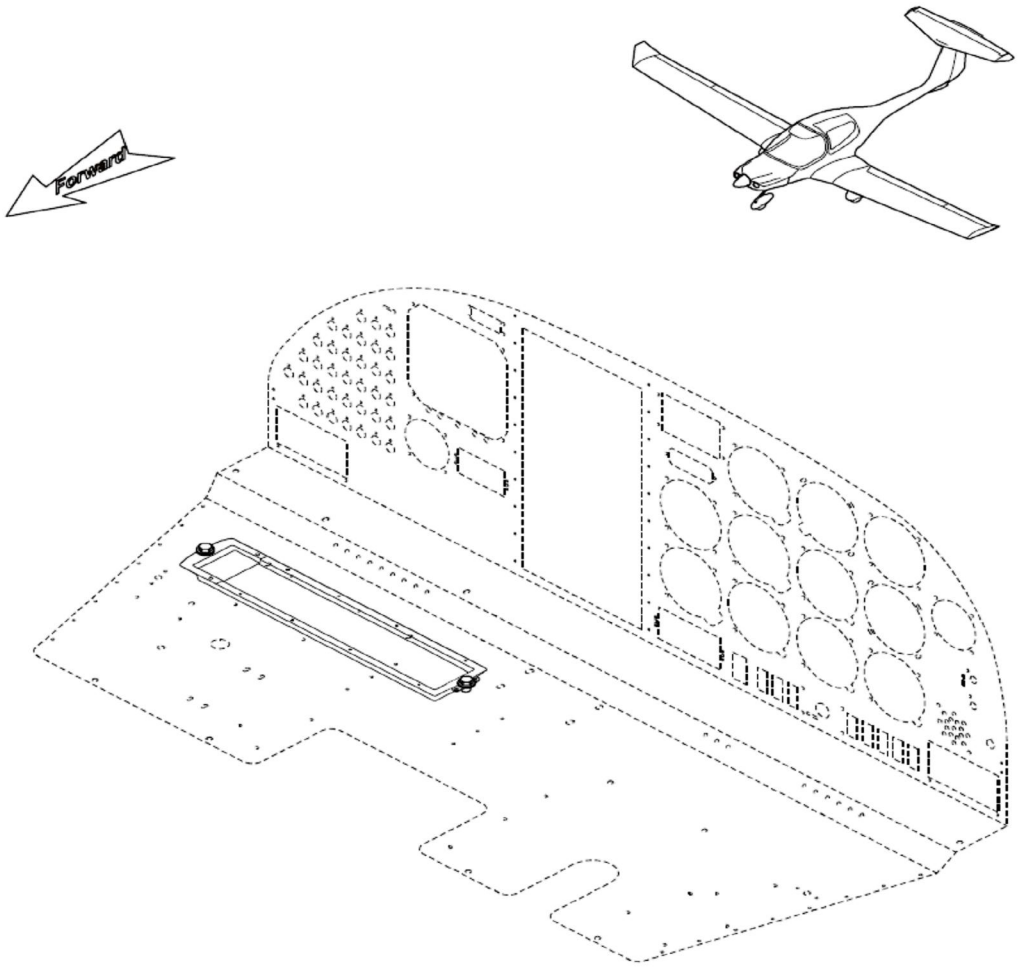
2. Description

The emergency battery system consists of: :
An emergency battery pack.

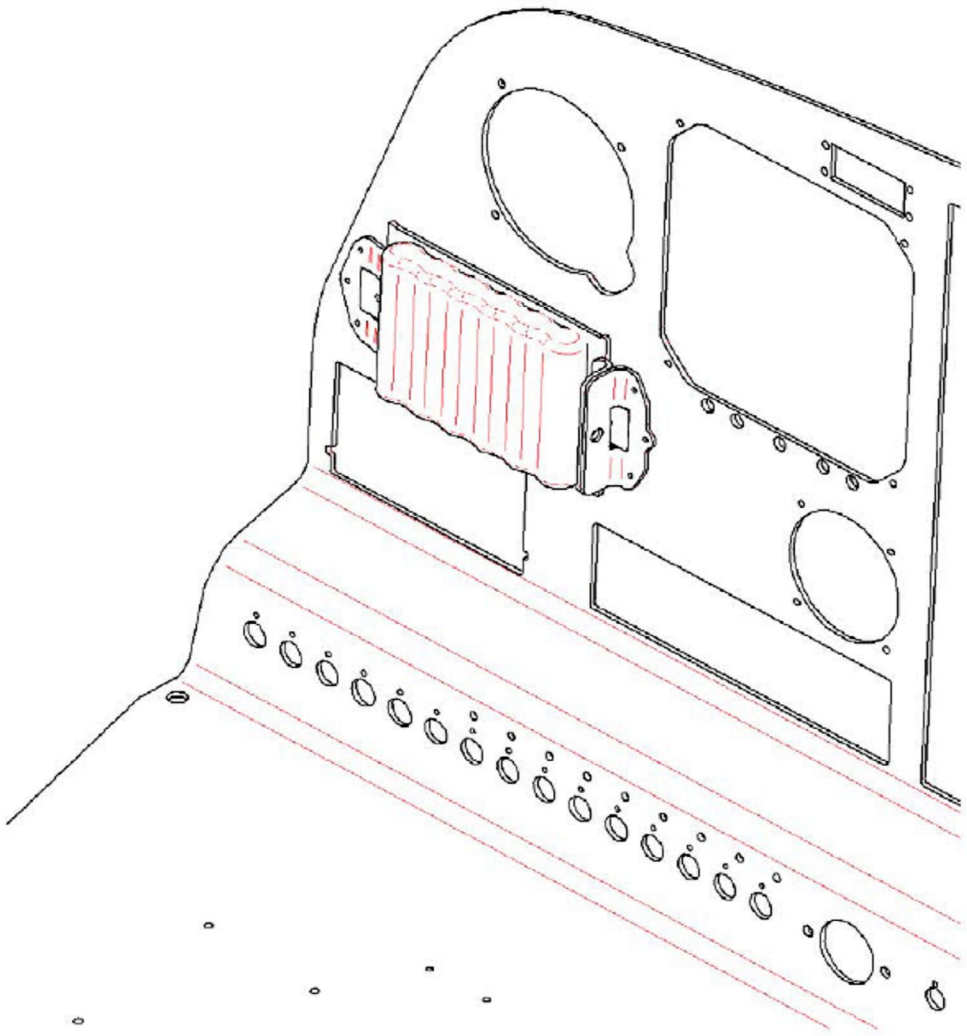
A sealed EMERGENCY switch.)

The emergency battery pack consists of 28 alkaline dry batteries, 1.5 volt, size 'AA' (also known as 'Mignon') or of 12 lithium manganese batteries, 3 volt, 1300 mAh. Refer to the Equipment List in % Section 6.5 of the Airplane Flight Manual for the approved battery type.

The GFRP tray which holds the 28 alkaline batteries is mounted under the instrument panel, on the co-pilot's side. If the lithium manganese batteries are used, the package is mounted behind the % instrument panel, on the co-pilotôs side. % When all other sources of electrical power fail during flight, the EMERGENCY switch on the left side % of the instrument panel is set to ON to use the emergency battery. It supplies the attitude gyro (horizon) and the flood light with power for at least 1 hour and 30 minutes.



1: Emergency Battery Tray (Alkaline batteries installed)



Emergency Power Package Installation (Lithium Manganese Batteries installed)