



Diamond DA42 Aircraft Systems Overview

Aircraft Overview

- ▶ Low wing, retractable gear, twin engine, aircraft constructed of mainly carbon-fiber reinforced plastic (CFRP).
- ▶ The fuselage is a semi-monocoque shell structure constructed from CFRP with glass-fiber reinforced plastic (GFRP) bulkheads and stiffeners. A roll-over bar forms the part of the construction of the cockpit area and provides the anchor point for the forward hinging one piece from canopy and passenger door access.
- ▶ The wing is a semi-monocoque construction constructed using CFRP and GFRP. Winglets are fitted to reduce tip vortices and induced drag.
- ▶ The tail fin is an integral part of the fuselage and has a "T" tail horizontal stabilizer. The ailerons, rudder, elevator, and flaps are all constructed of CFRP and GFRP.

Aircraft Limitations

Empty Weight – 2928.90 lbs

Max Takeoff Weight – 3935 lbs

Max Landing Weight – 3935 lbs

Max operating Altitude: 18,000ft

Max Restarting Altitude: 8,000ft

Restart Airspeed: 80-120 KIAS

Max Nose Baggage: 66 lbs

Max Cabin Baggage: 100 lbs

Maximum Takeoff Power – 2300 RPM @ 100% load

Max Continuous Power – 2300 RPM @ 100% load

Voltage – 24.1 Minimum volts: 32 Maximum Volts

Amperage Max: 60 amps

Max RPM – 2300 RPM

Maximum Prop Overspeed: 2500 RPM for 20 seconds.

V-Speeds

Aircraft Speeds (per POH)		KIAS
VA	Maneuvering Speed Max weight	126 KIAS
VFE (APP)	Max Flaps Extended Approach Flaps	137 KIAS
VFE (LDG)	Max Flaps Extended Landing Flaps	111 KIAS
VLOE	Max Landing Gear Operating Speed - Extension	194 KIAS
VLOR	Max Landing Gear Operating Speed - Retraction	156 KIAS
VLE	Max Landing Gear Extended Speed	194 KIAS
VMCA	Minimum Control Speed Airborne	68 KIAS
VNO	Max Structural Cursing Speed	155 KIAS
VNE	Never Exceed Speed	194 KIAS
VYSE	Best Rate of Climb Single Engine	82 KIAS
Vr	Rotation Speed	72 KIAS
VX	Best Angle of Climb	MIN 79 KIAS
VY	Best Rate of Climb	MIN 79 KIAS
	Cruise Climb	90 KIAS
	Approach Speed	90 KIAS
	Landing Speed	84 KIAS

AIRFRAME



Diamond DA42 Aircraft Systems

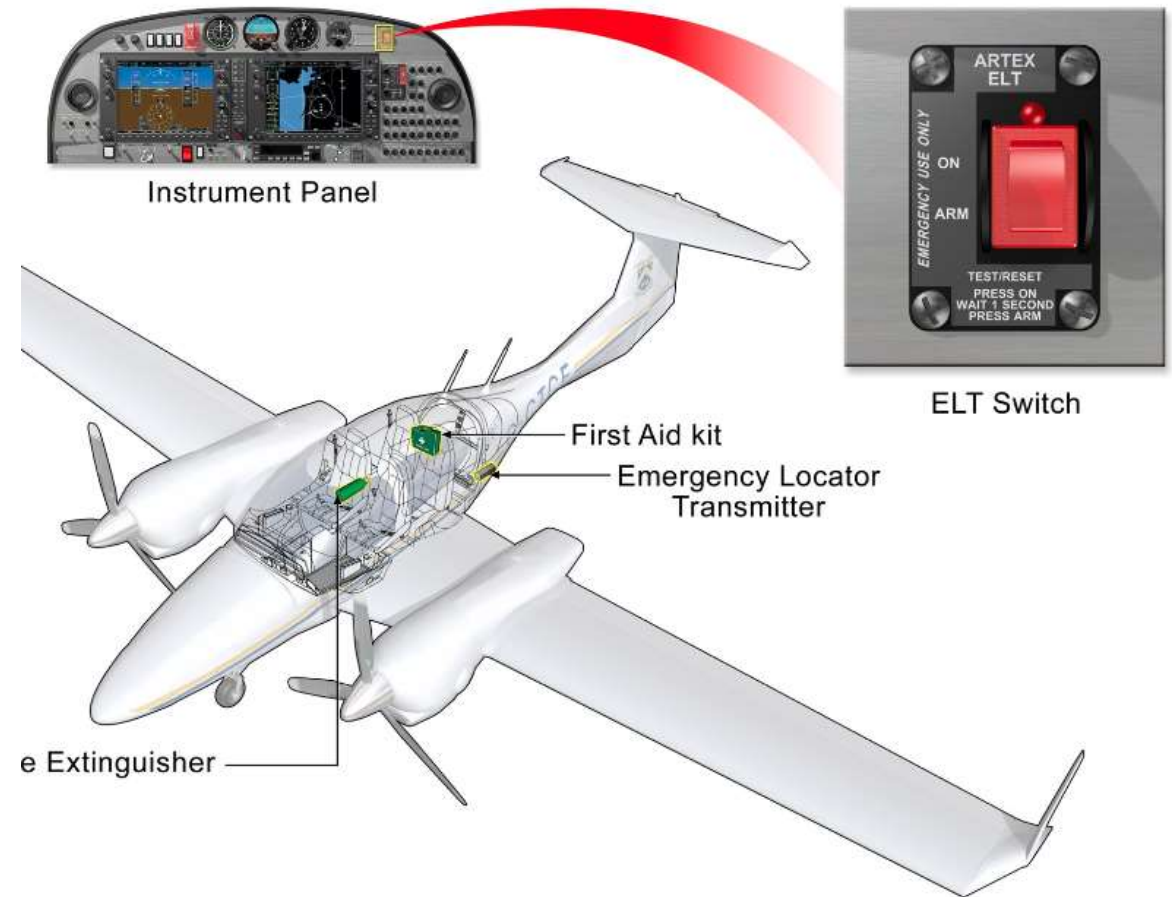
Cabin and Cabin Equipment

- ▶ Access to the Cabin via wing walkways on either side of the aircraft
- ▶ Steps at the trailing edge of each wing and fuselage mounted grab handles to ease access
- ▶ Locking handles for both latches are on the left side of the aircraft.
- ▶ Front Canopy is closed by pulling down the canopy frame
 - ▶ Two positions
 - ▶ MUST BE FULLY CLOSED FOR FLIGHT OPERATIONS



Emergency Locator Transmitter (ELT)

- ▶ Emergency Locator Transmitter is mounted in the rear fuselage below the baggage.
- ▶ ELT Aerial is fitted on the upper fuselage.
- ▶ Remote Control Panel Indicator is mounted on upper right-hand side of instrument panel.
- ▶ If activated ELT will transmit for up to 72 hours.



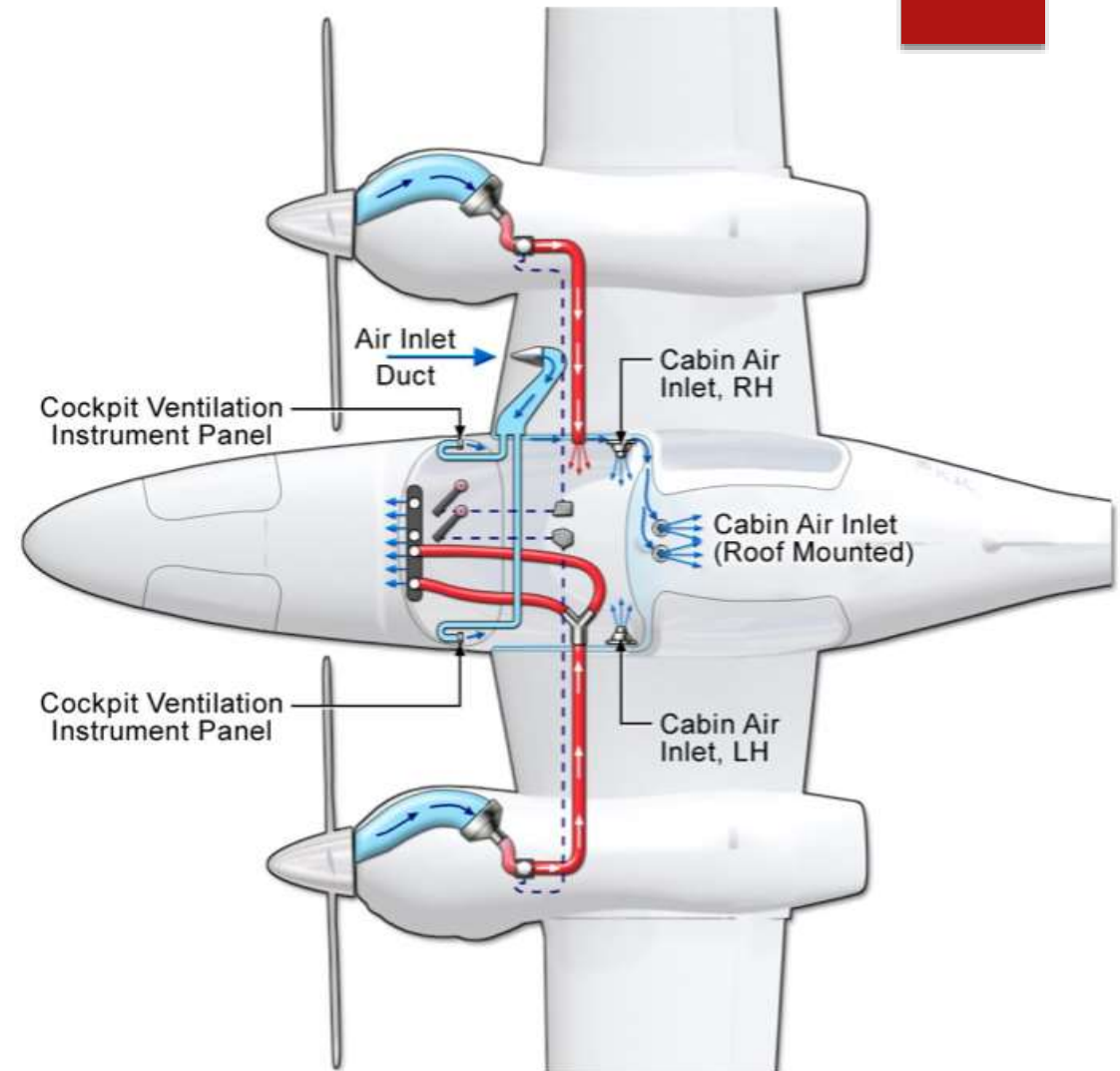
Panel, Console, & Control Layout

- ▶ Instrument Panel is driven by two Garmin G1000 display screens.
- ▶ G1000 is a fully integrated Avionics and system monitoring suite.
- ▶ The Center Console houses:
 - ▶ Heating Controls
 - ▶ Power Levers
 - ▶ Fuel Selectors
 - ▶ Elevator Trim



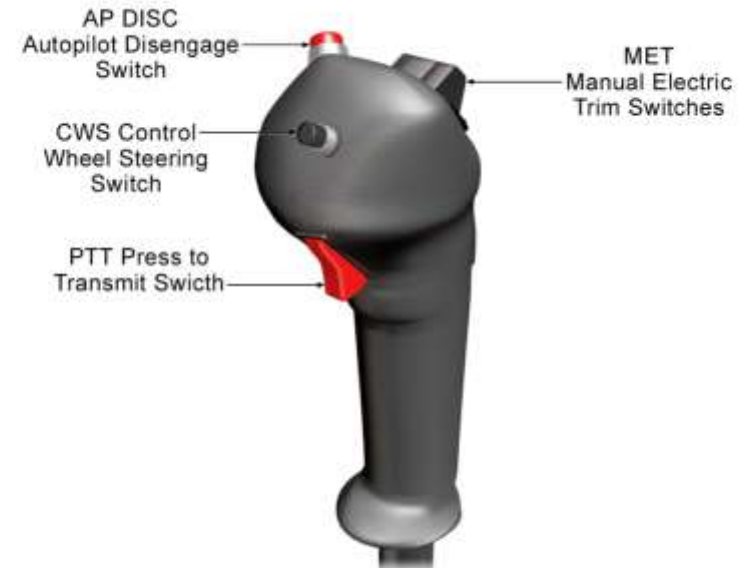
Cabin Ventilation System

- ▶ Does not have active air-cooling system. Instead ambient air flows into the cabin directly from a duct on the right wing.
- ▶ Air flow is controlled by a number of ventilation outlets mounted on the main instrument panel, cabin roof, and cockpit walls.
- ▶ IF ALT Static Source is selected the cabin ventilation controls MUST BE CLOSED.



Flight Controls

- ▶ Dual primary flying controls operate the ailerons and elevator via control rods.
- ▶ Rudder is operated by control cables.
- ▶ Flaps are electronically operated.
- ▶ Elevator is fitted to the horizontal stabilizer and is equipped with an adjustable trim tab.
- ▶ Rudder Trim is operated via control cables and located on the lower part of the rudder.

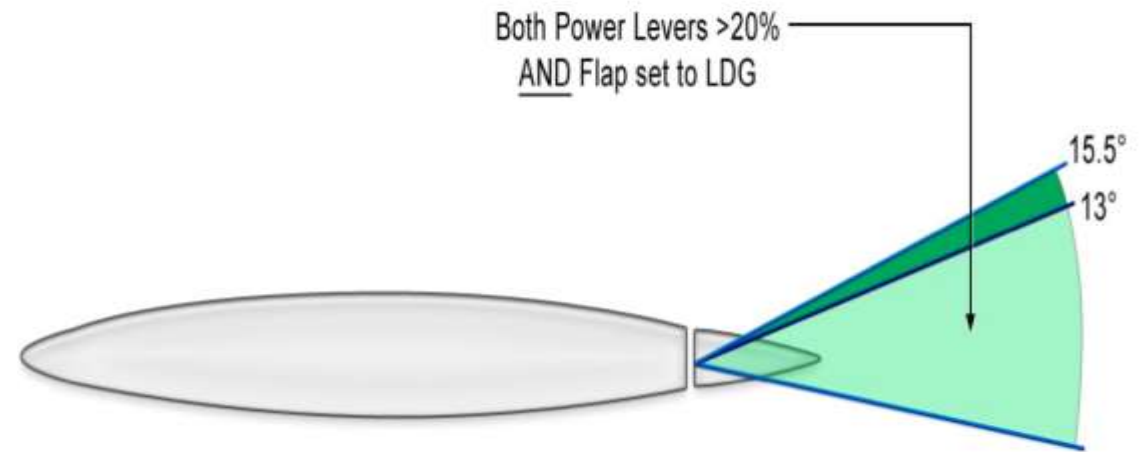


Elevator Trim Systems

- ▶ The manual trim wheel is located behind the power levers.
 - ▶ Rotating the wheel forward gives nose down trip.
 - ▶ Rotating the wheel back gives nose up trim
- ▶ Take off Trim is noted in the center of the wheel and noted with a "T"
- ▶ Electrical elevator trim is operated by two components
 - ▶ Control stick mounted switch
 - ▶ Servo motor connected to the elevator trim wheel.
- ▶ The stick switch is a dual pole switch requiring both to be actuated simultaneously.
- ▶ If either part is moved and held for more than 3 seconds the system detects a fault.

Stick Limiter

- ▶ Full elevator upwards deflection is normally 15.5° but is reduced to 13° in certain circumstances using an electronically actuated control stop.
- ▶ Tested during PRE-FLIGHT
- ▶ System senses the position of the power levers and the flap selector switch. Whenever both engines exceed 20% power, and flaps are set to LDG the stick limit is applied.



Stick Limiter Test

▶ Test Procedure:

- ▶ Pull control column fully aft and hold
- ▶ Set flap to LDG
- ▶ Set Both Engines to max
- ▶ Notice the control column move forward slightly
- ▶ Set power to idle and check to ensure full deflection

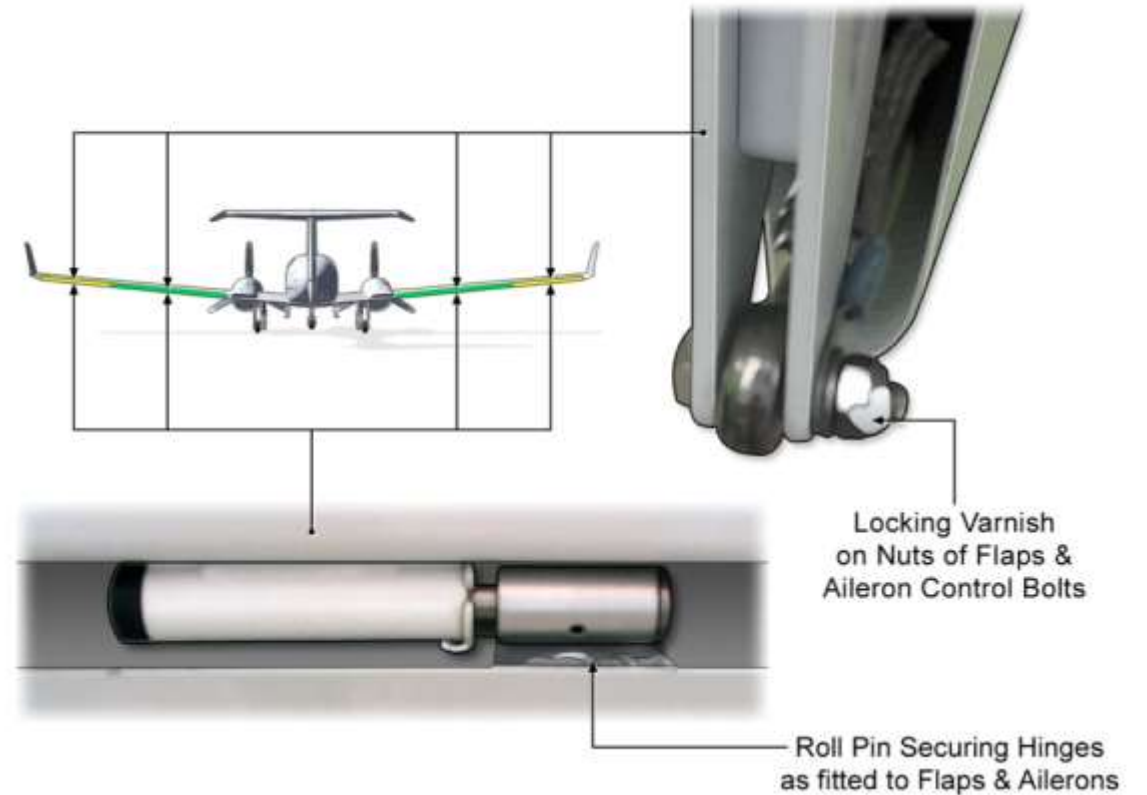
FLAPS

- ▶ Operated by control rods moved by an electric actuator.
- ▶ 3 position switch on right side of instrument panel
 - ▶ Cruise (Up) - 0°
 - ▶ Approach (APP) - 20°
 - ▶ Landing (LDG) - 42°
- ▶ Velocity Flaps Extended Speed
 - ▶ VFE APP – 137 KIAS
 - ▶ VFE LDG – 111 KIAS
- ▶ Limit Switches prevent overrun of flaps and should trip a circuit breaker should a failure occur.



Aileron and Hinge Checks

- ▶ Ailerons are mounted using a series of hinges.
- ▶ Hinges are secured with roll pins (should be checked on preflight)
- ▶ Nuts and Bolts of control rods are covered with varnish. (must be checked on pre-flight)



Stall Warning System

- ▶ An electrical flapper stall warning device is fitted to the leading edge of the outer wing section.
- ▶ Provides continuous audible warning to the cockpit at angles of attack just before the critical angle.
- ▶ Vane is heated to prevent ice build up and operated when the Pitot Heat is on.
- ▶ Check during PRE-FLIGHT

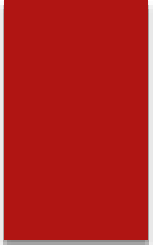


POWERPLANT OVERVIEW

A detailed photograph of a Diamond DA42 aircraft engine, showing the propeller, cylinder heads, and various mechanical components. The engine is mounted on a white aircraft fuselage. The background is a solid red color.

Diamond DA42 Aircraft Systems

Powerplant Overview



Powered by two, four-cylinder, liquid cooled, turbocharged Thielert TAE 125-02-99 four stroke diesel engines each generating 135hp at 2300RPMs.

Propeller is driven by a reduction gearbox

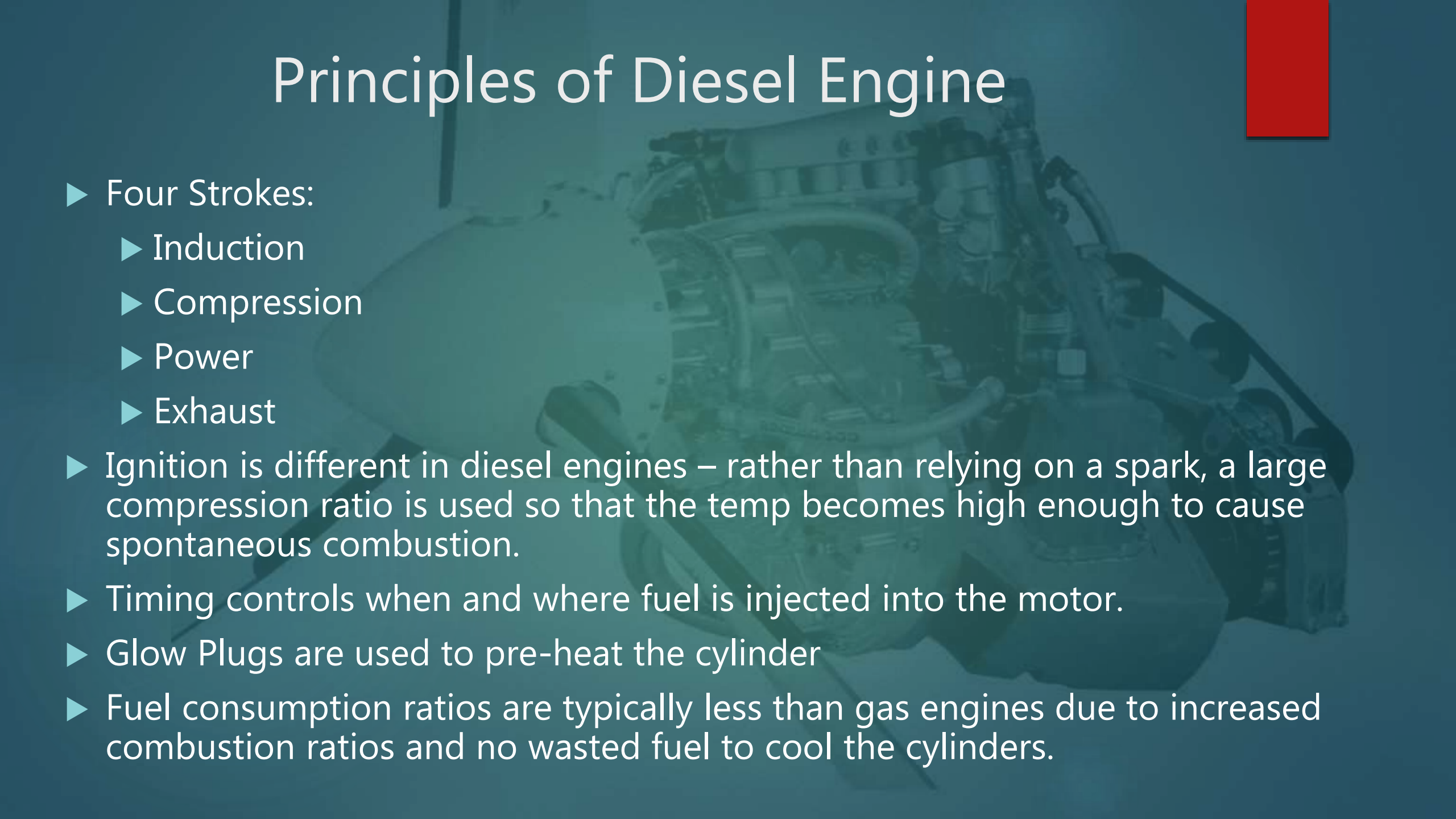
Engine performance is displayed on the G1000

All aspects of operations are controlled by Full Authority Digital Engine Control (FADEC) system operating two engine control Units (ECU) on each engine.

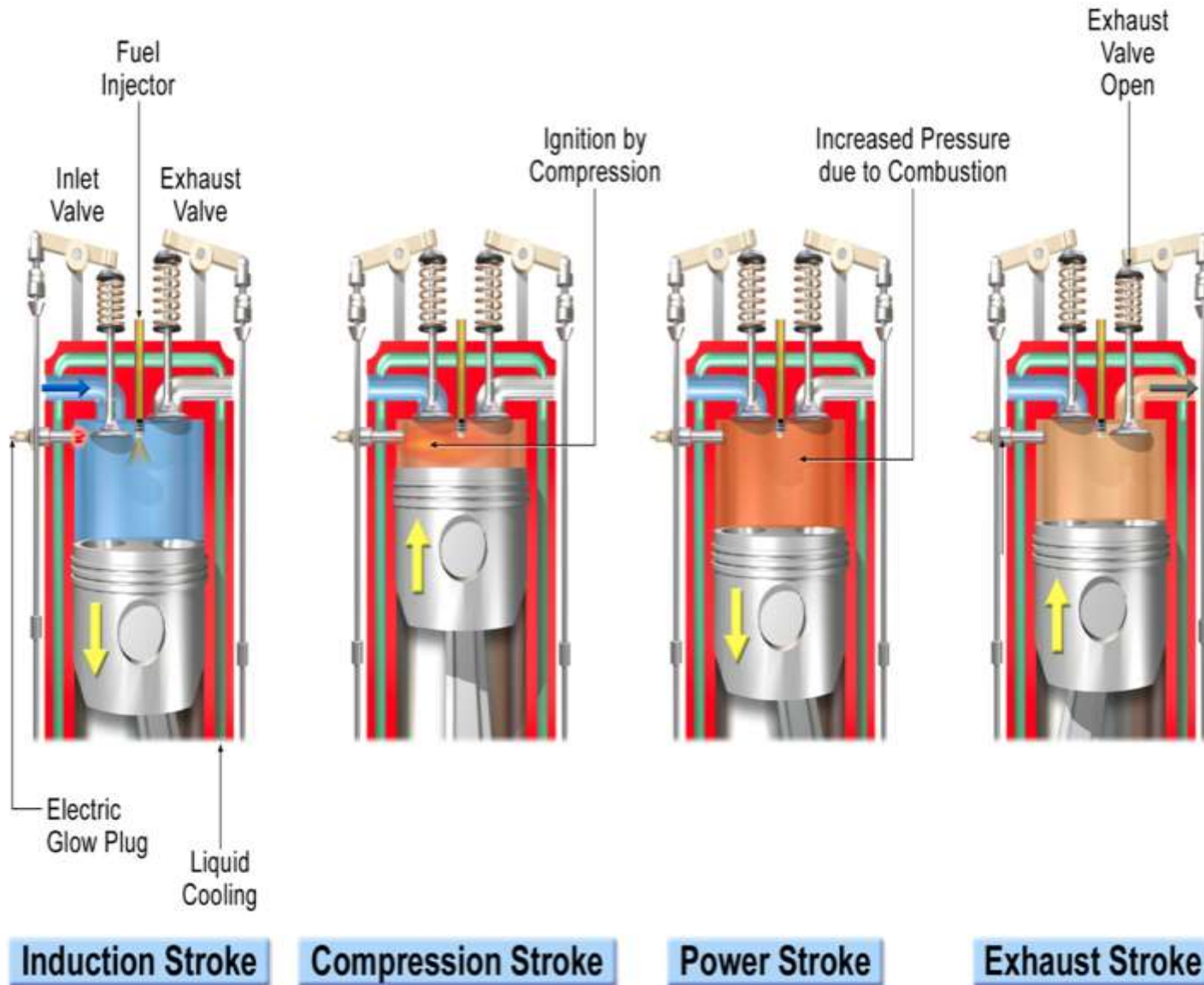
Only one ECU is active at a time and the other remains at standby.

FADEC controls the engine fuel system, propeller as well as the turbo charger system

Principles of Diesel Engine



- ▶ Four Strokes:
 - ▶ Induction
 - ▶ Compression
 - ▶ Power
 - ▶ Exhaust
- ▶ Ignition is different in diesel engines – rather than relying on a spark, a large compression ratio is used so that the temp becomes high enough to cause spontaneous combustion.
- ▶ Timing controls when and where fuel is injected into the motor.
- ▶ Glow Plugs are used to pre-heat the cylinder
- ▶ Fuel consumption ratios are typically less than gas engines due to increased combustion ratios and no wasted fuel to cool the cylinders.



Diesel Engine Combustion Cycle

Lubrication Systems

▶ Engine

- ▶ Wet Sump lubrication system with external filter and air cooler.
- ▶ Engine driven pump provides flow of oil for the engine and turbocharger lubrication
- ▶ Visual dipstick is located on the upper right side of the engine.
- ▶ Min Oil – 4.8 qts
- ▶ Max Oil – 6.3 qts

▶ Gearbox

- ▶ Gearbox oil system has its own pump which supplies the gearbox and propeller pitch control system.
- ▶ Gearbox oil is checked via a sight glass on the lower right side of the engine cowling.

Fuel Injection System

Fuel from the aircraft is delivered to the engine via a filter located at the rear of the engine nacelle

There is a sediment bowl located at the bottom of the filter with a drain. Should be checked for water during pre-flight

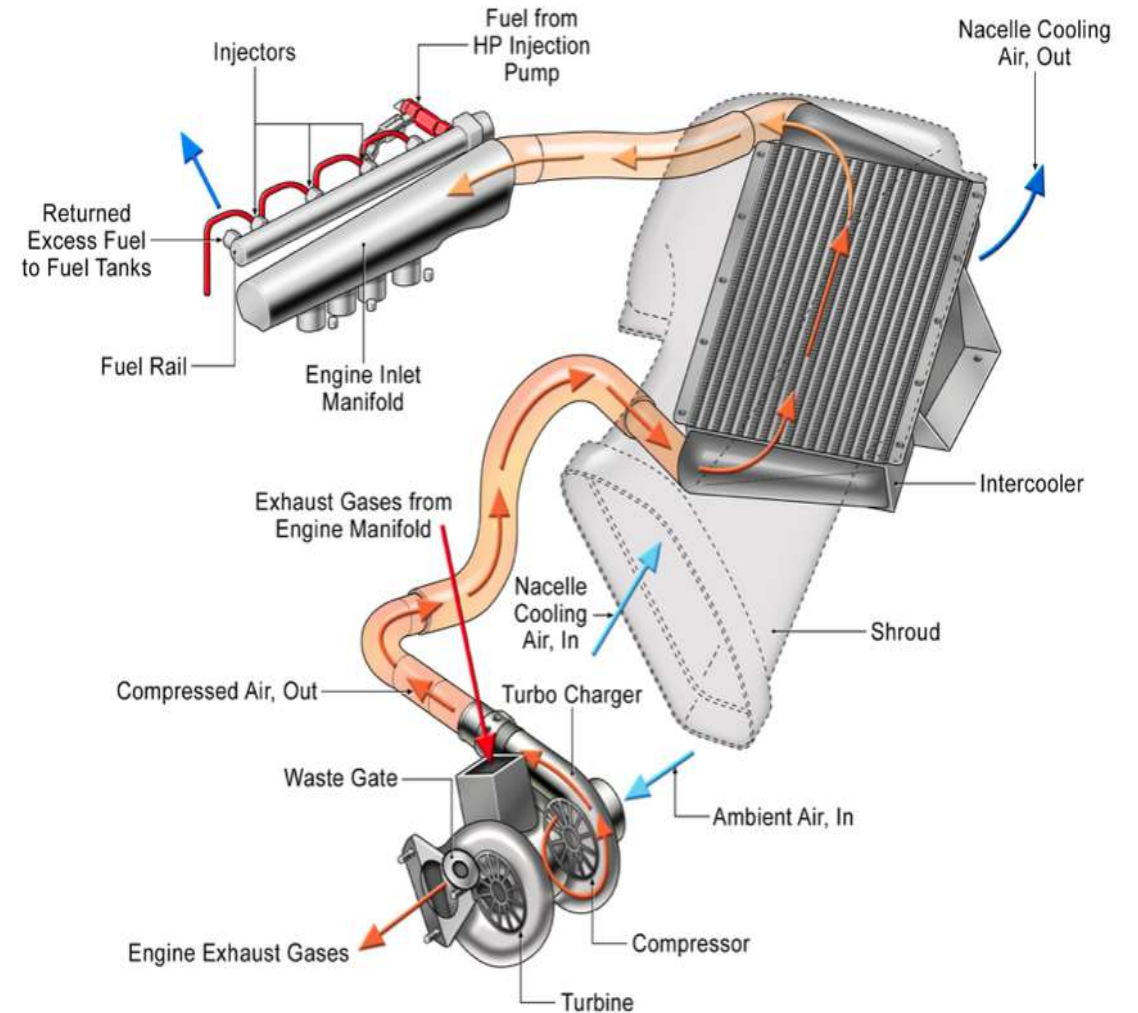
From the filter fuel is delivered to a low-pressure pump which in turn delivers fuel to the engine high pressure pump.

High pressure fuel is then delivered to a fuel injector located in each cylinder.

Excess fuel is returned to the appropriate wing tank.

Engine Turbocharger System

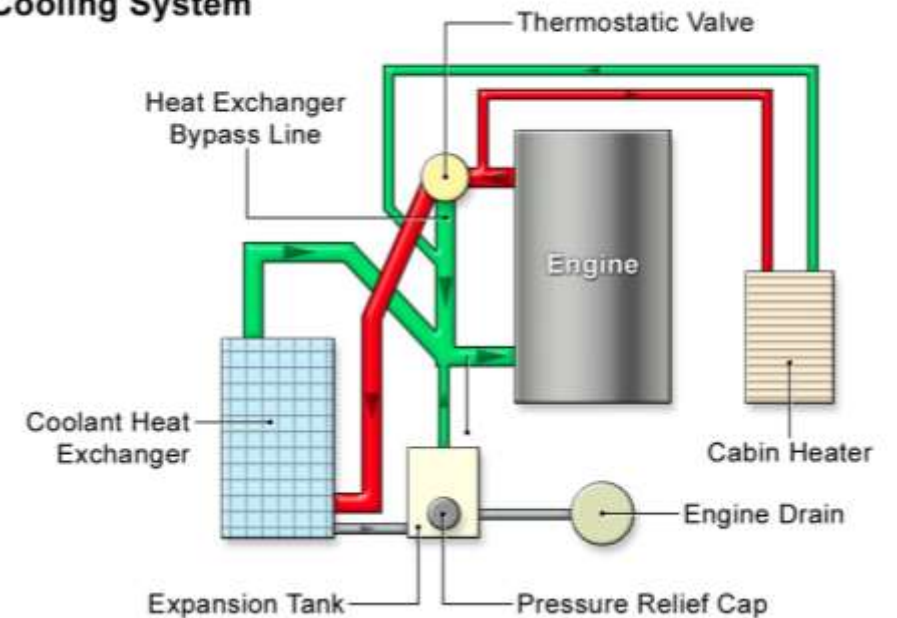
- ▶ The air intake system provides either filtered ram air, or unfiltered warm air from within the engine cowlings, to the turbo charger.
- ▶ Pressurized air from the turbocharger is delivered via an intercooler to the engine inlet manifold.
- ▶ Turbocharger is controlled by a waste gate fitted in parallel to the exhaust system. The waste gate is controlled by the FADEC.
- ▶ If air inlet filter becomes blocked the alternate air source can be selected via the lever located under the instrument panel.



Engine Cooling System

- ▶ Engines are liquid cooled.
- ▶ Coolant is a mixture of water and antifreeze and is pumped around the passages within the engine by a belt driven pump.
- ▶ Two circuits
 - ▶ Main Circuit
 - ▶ includes a heat exchanger and a thermostatic control valve. Located beneath the engine directly inline with the air intake.
 - ▶ Bypass circuit
- ▶ When coolant is hot the thermostatic valve directs fluid through the heat exchanger.
- ▶ When the coolant is cold the valve directs fluid through the bypass circuit straight back to the pump inlet.
- ▶ A sensor located in the valve provides a temperature signal to the Ecu and to the EIS to display the coolant temperature.
- ▶ There is an expansion tank with a pressure relief valve designed to prevent overpressure.
- ▶ There is an overflow valve located below the engine nacelle.

Cooling System



Propeller & Propeller Control System

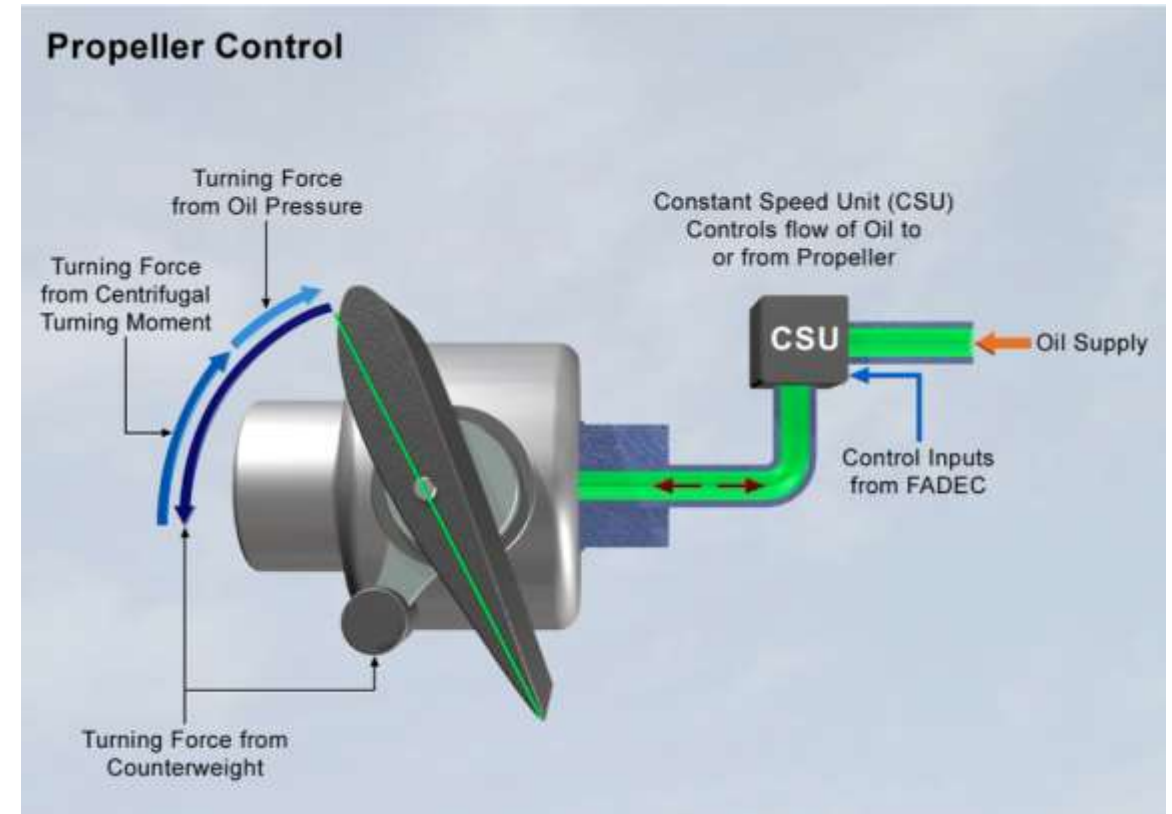
- ▶ Each engine is fitted with a three blade, constant speed, feathering propeller.
- ▶ Both propellers rotate clockwise as viewed from the cockpit. Therefore the LEFT ENGINE is the CRITICAL ENGINE.
- ▶ Each blade is a wood-composite construction with fiber-reinforced plastic coating and a stainless-steel leading edge.
- ▶ Blade pitch is controlled automatically by the ECU.
- ▶ Normal operations drive blade to a coarse pitch. Oil pressure is used to drive blades toward fine pitch.
- ▶ The pressure accumulator uses oil from gearbox, and the accumulator is connected to an electric valve operated by the Engine Master switch.

Propeller & Propeller Control System

- ▶ Engine and propeller are controlled by a single power lever.
- ▶ Power demands set on the power lever are sensed by FADEC which schedules various engine and propeller parameters to ensure optimum power delivery and pitch angle.
- ▶ Power is displayed as a % of maximum load.
- ▶ Power lever full forward = 100% power
- ▶ Power lever full aft = IDLE power
- ▶ NEVER ROTATE PROPELLERS BY HAND

Propeller & Propeller Control System

- ▶ The system is equipped with an oil accumulator that has a shut-off valve controlled by the engine master switch.
- ▶ When the master is on the switch is on and vice versa
- ▶ During normal engine operations the valve is open resulting in the accumulator being charged with oil at system pressure.
- ▶ Stored oil is used for unfeathering as well as ensuring oil supply to the CSU.



Propeller & Propeller Control System

- ▶ Start Latch – during normal engine shut down, with idle at 0% load, a centrifugal latch engages at 1300 RPM and prevents the blades from entering the feathered range.
- ▶ The start lock blade angle is approx. 15° which reduces engine load during start.
 - ▶ *If ECU malfunctions and the proper blade angle gets stuck in the start lock position the propeller will produce negative thrust and will over-speed as soon as power is applied.*
- ▶ Feathering occurs when the engine master is switched to OFF.
 - ▶ Accumulator valve closes, storing the oil charge
 - ▶ Electrically operated governor valve allows oil to flow back from the propeller.
 - ▶ **In-flight Shutdown must occur above 1300 RPM or the start lock will engage**

Full Authority Digital Engine Control

- ▶ Each engine is controlled by a dedicated FADEC system comprising two Engine Control Units: ECUs A and B
- ▶ ECUs receive information from a variety of sensors, and senses the load demanded by the power lever.
- ▶ There are no mechanical inputs or Outputs from the FADEC.
- ▶ During normal operation, the ECU swap switch should be set to AUTO.
- ▶ If an ECU system fails it will automatically switch to the second ECU.
- ▶ **Manually switching ECUs should only be completed in an emergency.**
- ▶ Each FADEC unit is supplied with electrical power from a dedicated ENG ECU busbar which is supplied directly from the engine alternator.
- ▶ **In case of alternator failure ECUs will be powered for approximately 30 minutes.**
- ▶ **ECU Fail inflight you can attempt to reset by holding the ECU test for 2 seconds.**

Engine Start

Engine Start

- ▶ Each engine is equipped with an electric starter.
- ▶ Power is provided from battery or from external powers supply
 - ▶ Power Idle
 - ▶ Electric Master ON
 - ▶ Engine Master ON
 - ▶ Glow light out
 - ▶ Turn key and hold on until 500 RPM

Engine Shut down

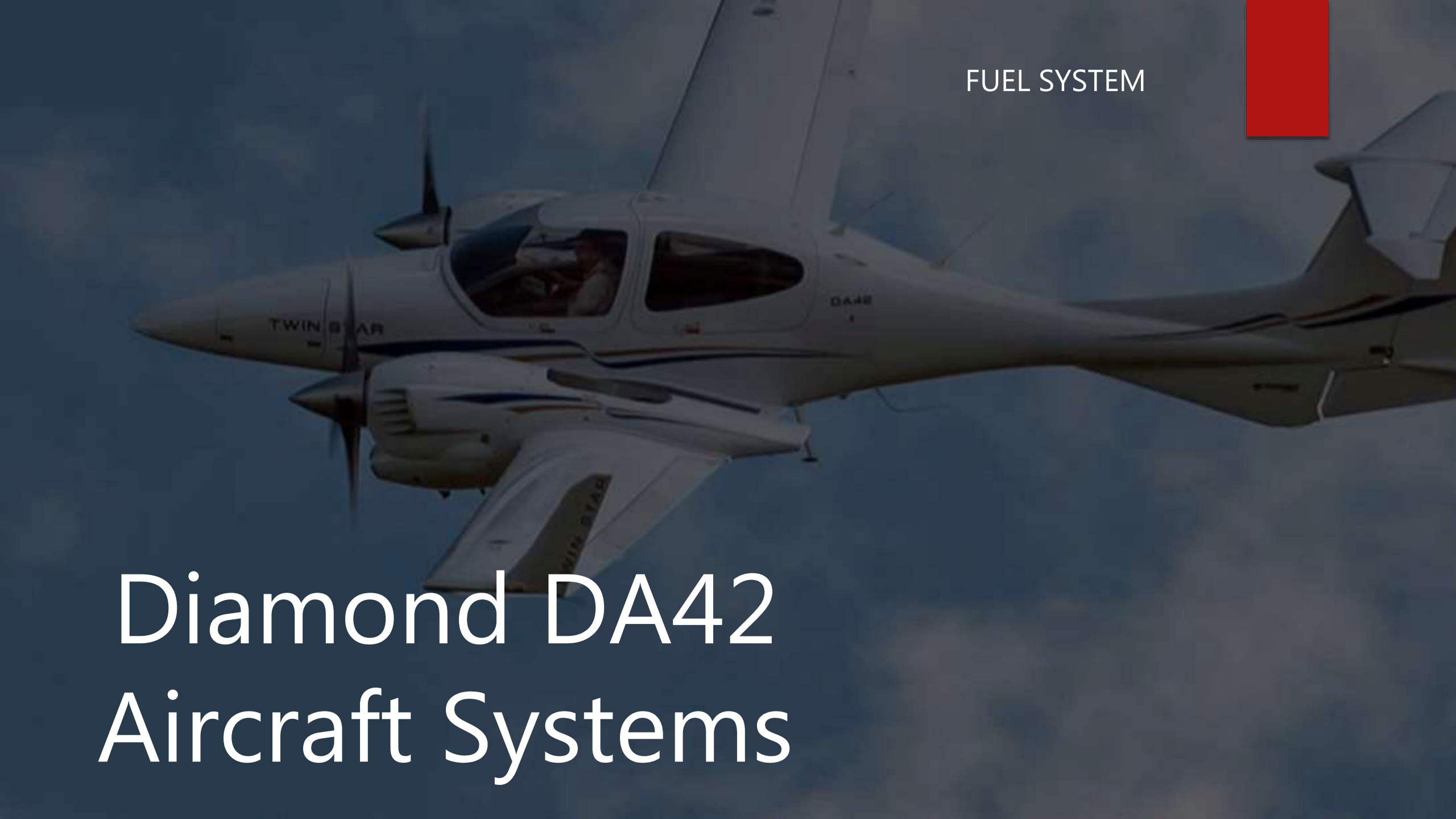
- ▶ Engine must idle for 2 minutes prior to shut down to avoid heat damage to the turbo charger.
 - ▶ Power Idle
 - ▶ Turn off Master



Fire Detection System

- ▶ An overheat detector is in each engine bay.
- ▶ Activated if compartment temp increases over 480°
- ▶ Must be checked during PRE-FLIGHT



A Diamond DA42 twin-engine turboprop aircraft is shown in flight against a blue sky with light clouds. The aircraft is white with blue and grey accents. The words "TWIN STAR" are visible on the nose and the wing. The registration "DA42" is visible on the fuselage. A red vertical bar is located in the top right corner of the image.

FUEL SYSTEM

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Fuel Tanks

Uses JET A1 fuel.

Stored in aluminum tanks located in each wing

Each Tank has three interconnected chambers.

Fuel Filler point located on the upper surface of each wing and directly feed into the outer chamber.

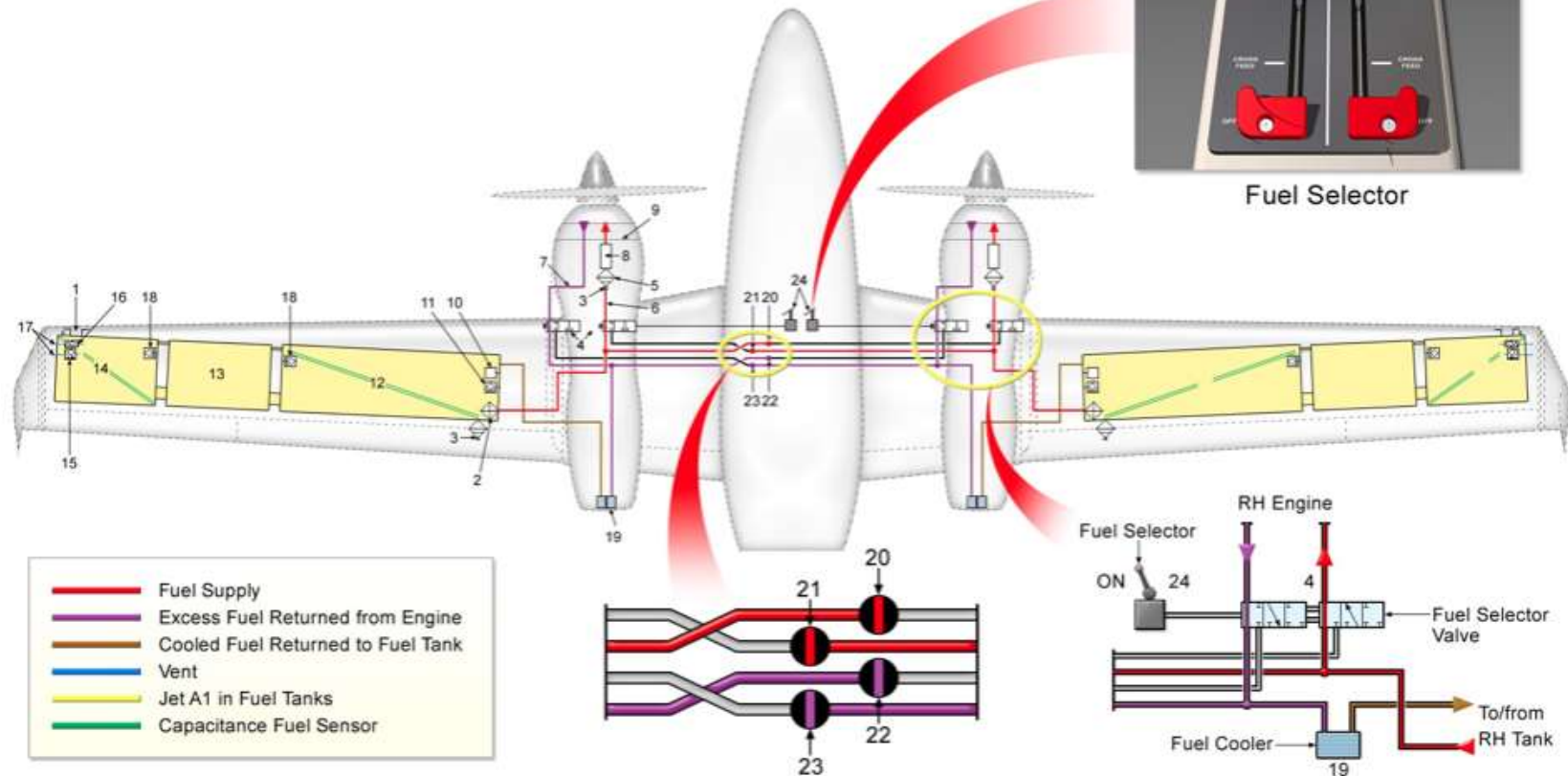
Tanks are ventilated to the atmosphere by check and pressure relief valves. Located on the underside of the wing.

Auxiliary fuel tanks are located on each engine nacelle.

Main Tank Capacity – 25 gallons of useful fuel

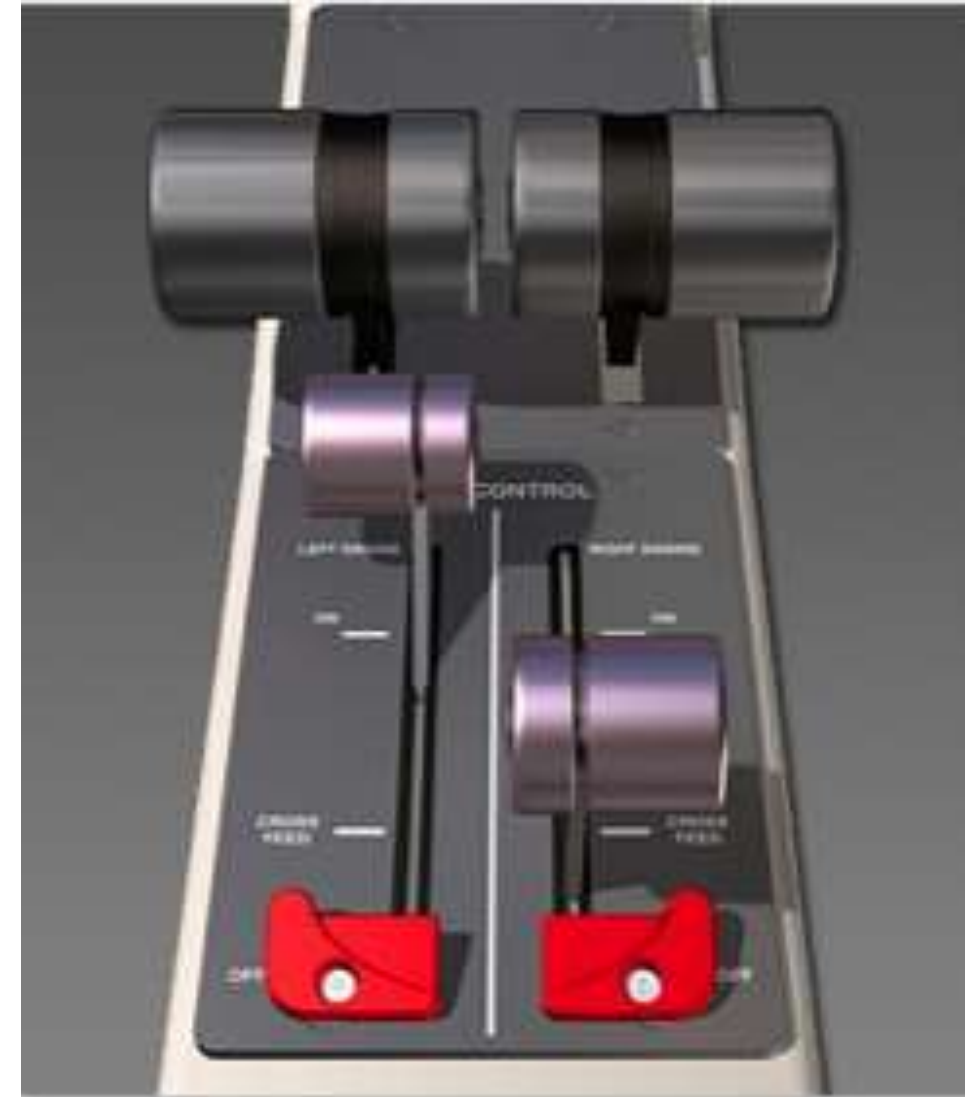
Auxiliary Tank Capacity – 13 gallons of useful fuel.

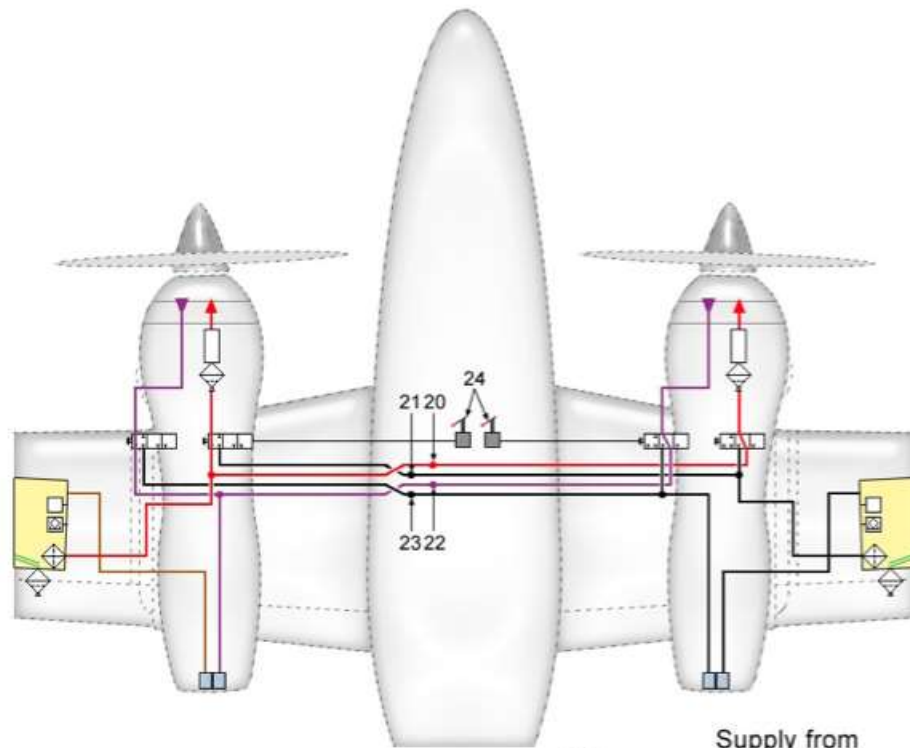
- | | |
|--|---|
| 1. Fuel Filter | 13. Middle Chamber |
| 2. Finger Filter | 14. Outboard Chamber (with Fuel Lever Sensor) |
| 3. Drain | 15. Check Valve Incl. Capillary |
| 4. Fuel Transfer/Shut Off Valve | 16. Pressure Relief Valve |
| 5. Sediment Bowl | 17. Fuel Tank Vent |
| 6. Fuel Supply | 18. Fuel Level Switch |
| 7. Return Pipe | 19. Fuel Cooler |
| 8. TAE Diesel Filter | 20. Fuel Supply from LH Tank to RH Engine |
| 9. Firewall | 21. Fuel Supply from RH Tank to LH Engine |
| 10. Temperature Sensor | 22. Fuel Return from RH Engine to LH Tank |
| 11. Low Fuel Sensor | 23. Fuel Return from LH Engine to RH Tank |
| 12. Inboard Chamber (with Fuel Lever Sensor) | 24. Fuel Selector Lever |



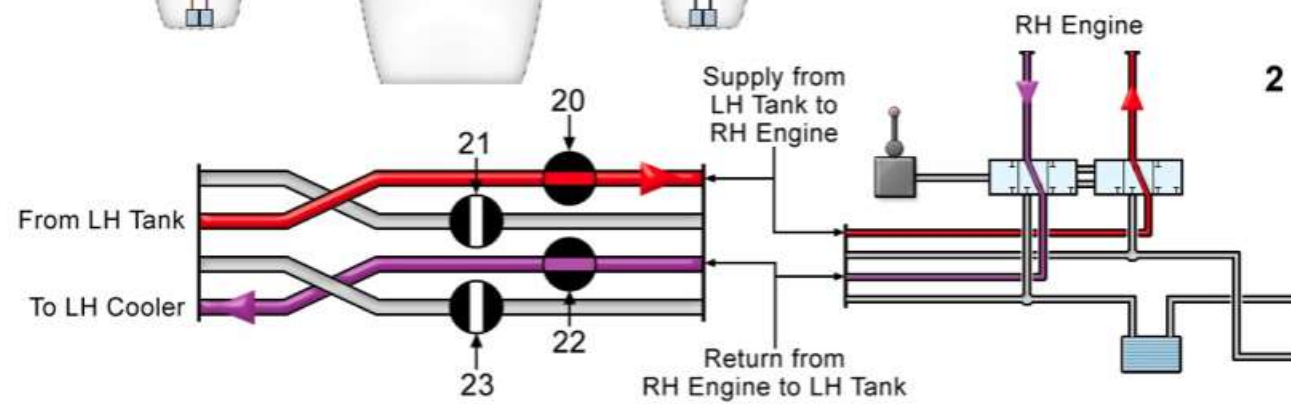
Fuel Selector and Crossfeed

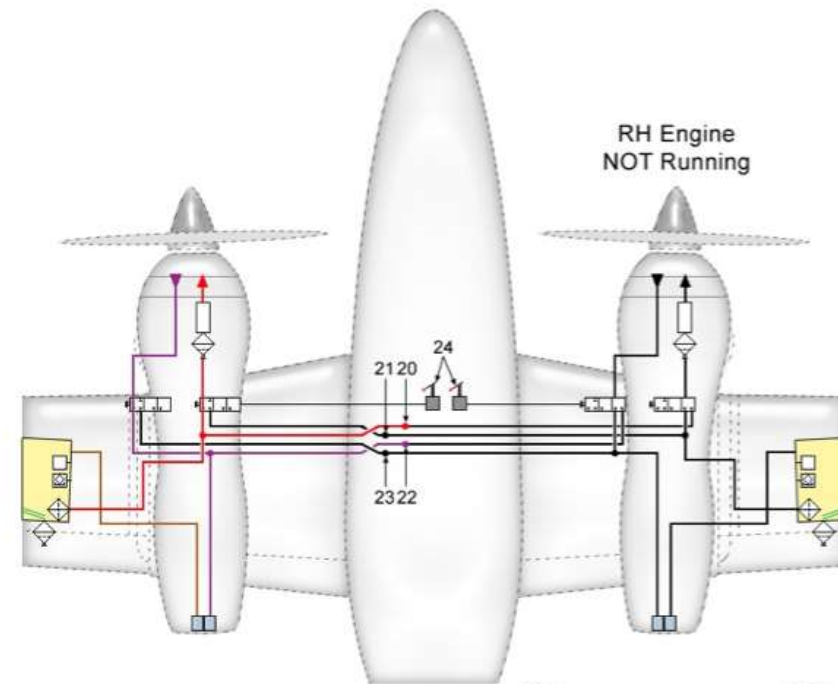
- ▶ Fuel Selector ON - Under normal conditions the right tank feeds the right engine and the left tank feeds the left engine
- ▶ Fuel Selector CROSSFEED - Allows fuel to be fed from the opposite tank to cater for emergencies and to allow the pilot to balance fuel.
- ▶ Fuel Selector OFF – is Guarded by a spring-loaded guard latch.



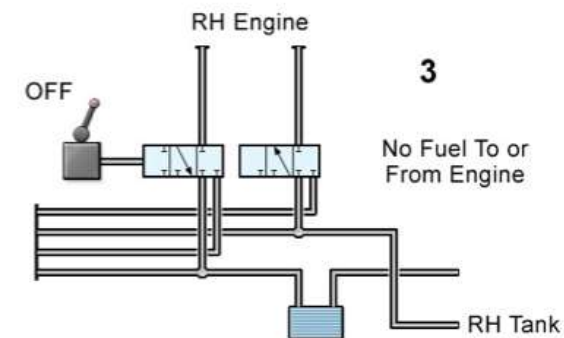
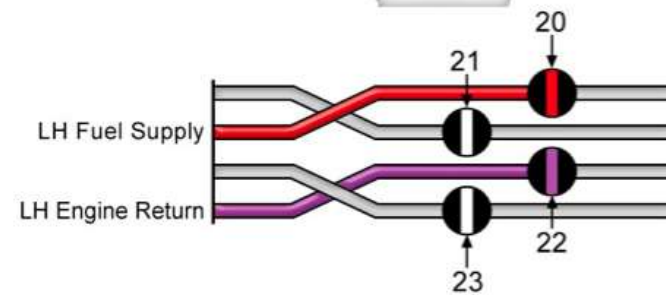


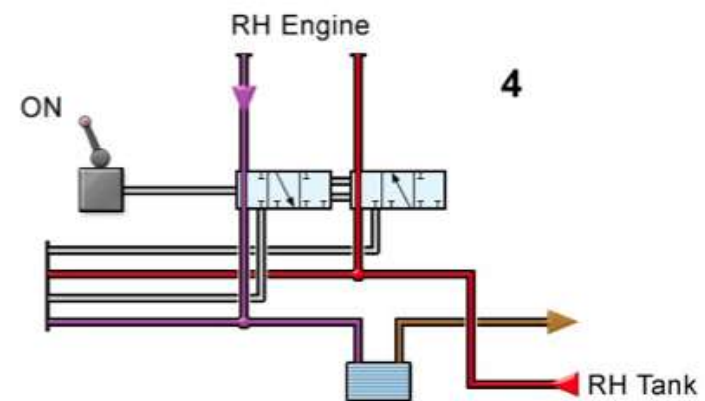
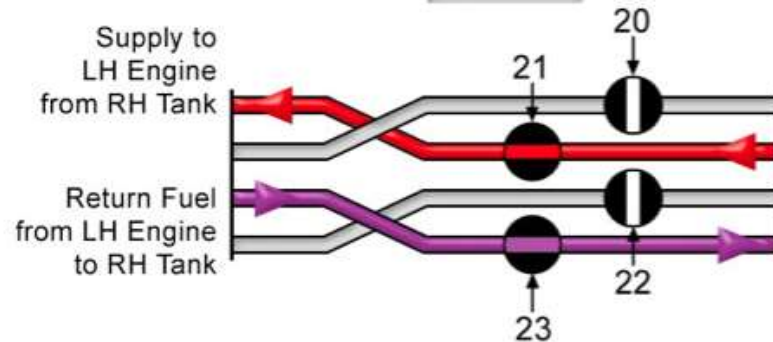
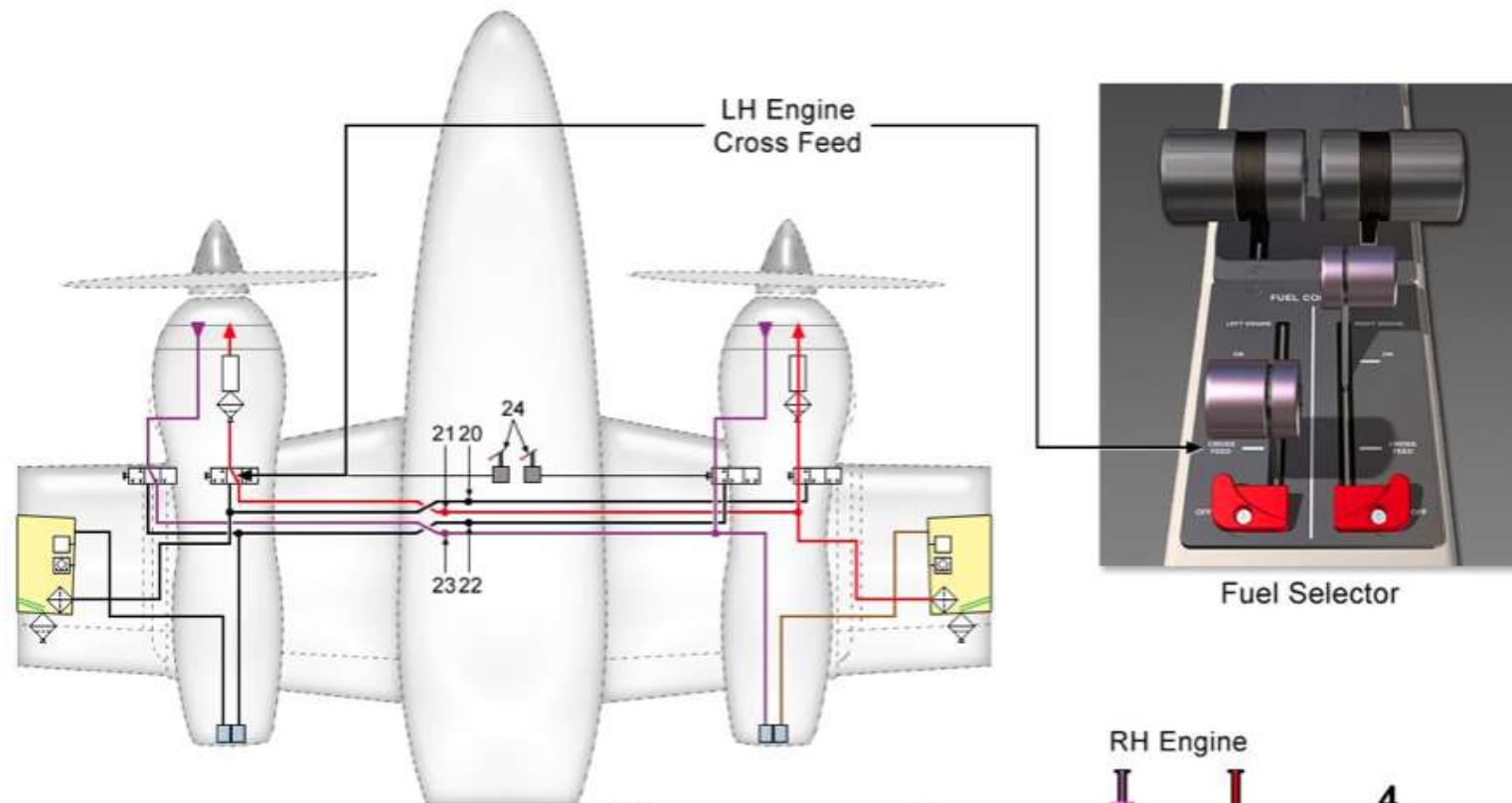
Fuel Selector

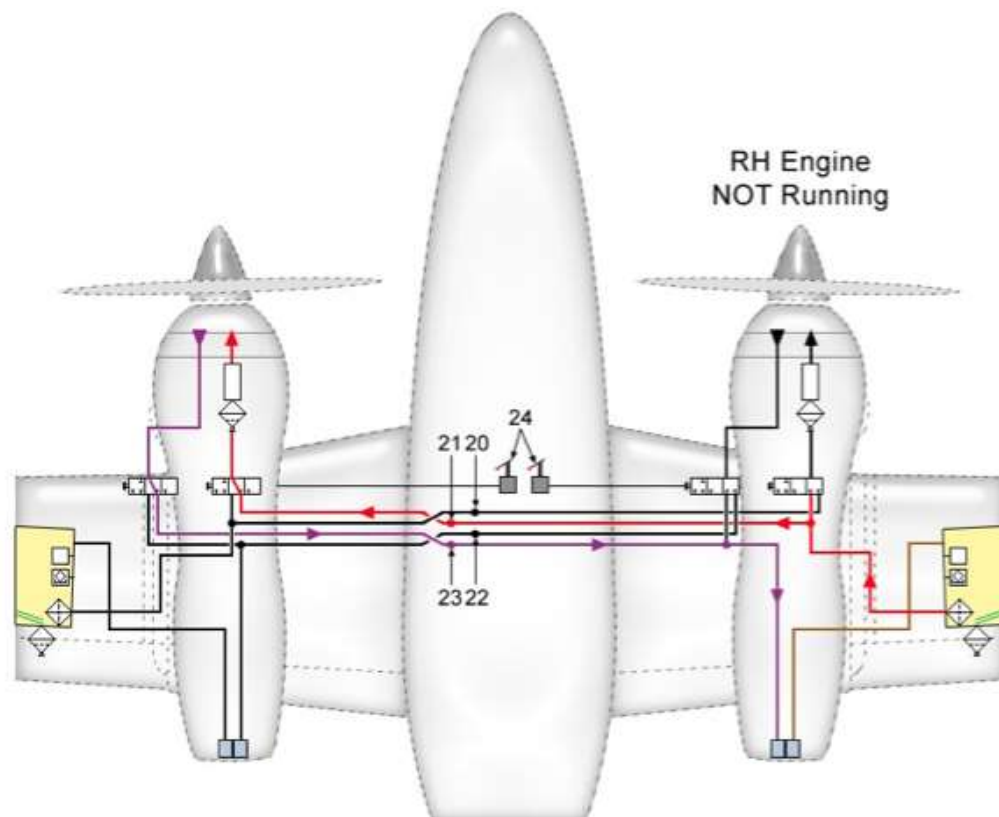




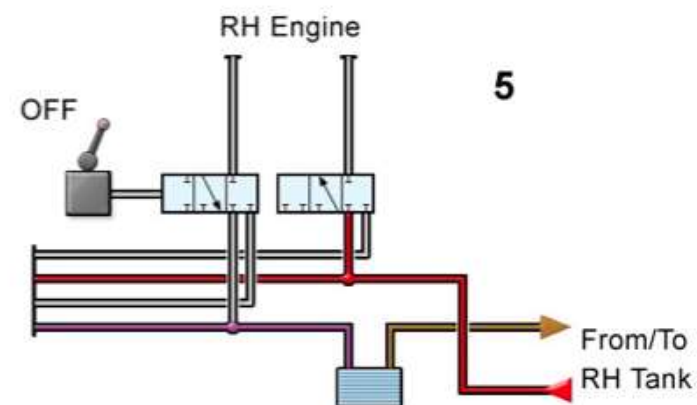
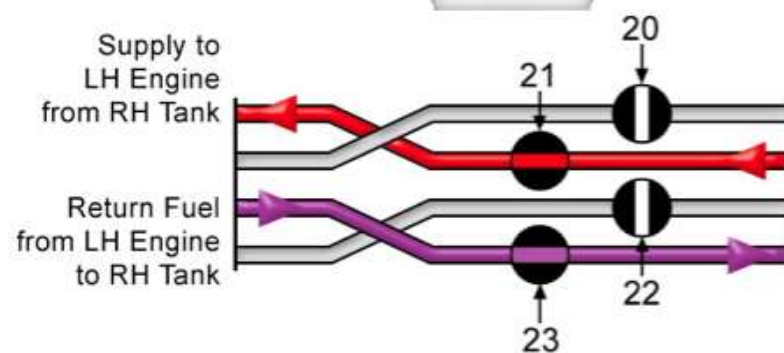
Fuel Selector







Fuel Selector



Fuel System Indications

- ▶ Fuel system indications are displayed on the G1000 usually on the left side of the MFD.
- ▶ There are two fuel sensors located in each tank and a low-level sensor located on the inner chamber.
- ▶ **The low-level switch activates when there is 3-4 gallons remaining**
- ▶ Max fuel temperature is 167°F (75°C)

Fuel System Limitations

- ▶ When one engine is inoperative the inoperative fuel selector valve must be set to OFF.
- ▶ Do NOT operate with both fuel selectors in the CROSSFEED position.
- ▶ DO NOT TAKEOFF with either fuel selector in the CROSSFEED position.
- ▶ DO NOT SHUTDOWN and engine by moving the fuel selector to OFF position – this will damage the high-pressure fuel pump. Use the ENGINE MASTER off switch.

LANDING GEAR, WHEELS, AND BRAKES

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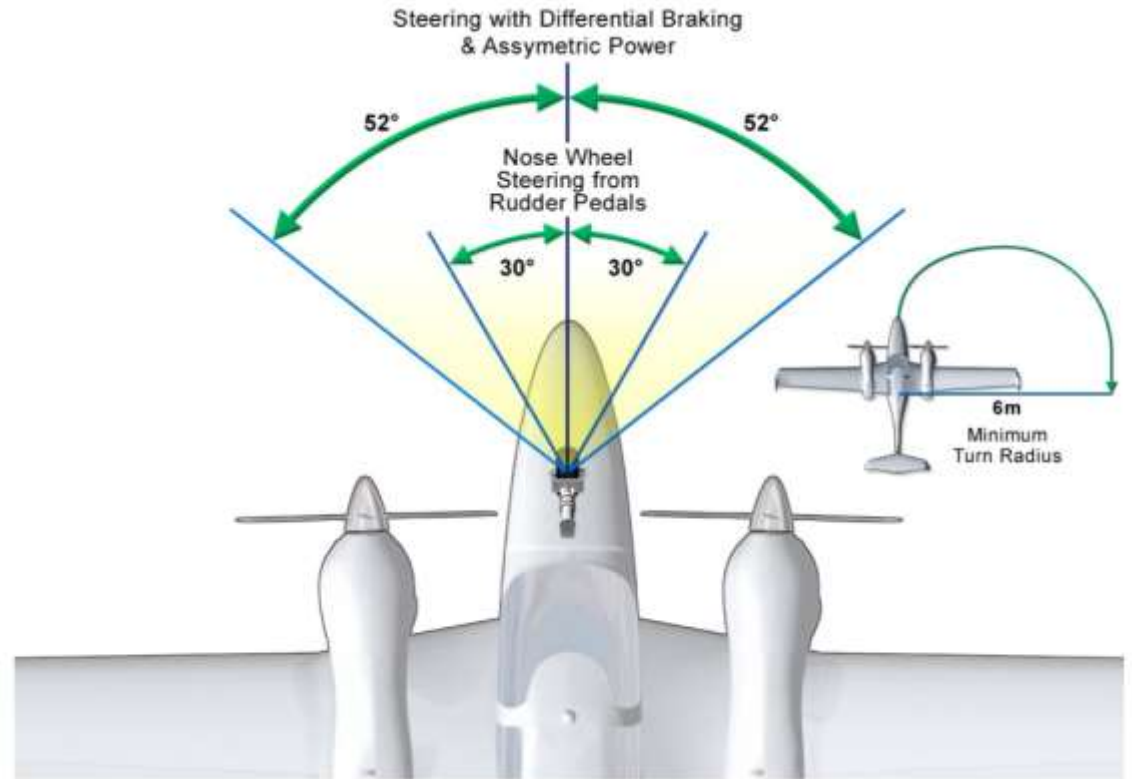


Landing Gear System

- ▶ DA42 has retractable tricycle gear with conventional oleo-pneumatic struts and a steerable nose wheel.
- ▶ The gear is retracted and extended hydraulically
- ▶ Hydraulic pressure is provided by an electric pump.
- ▶ Gear extension normally takes 6-10 seconds.
- ▶ Gear extension and locking is assisted by springs.
- ▶ Hydraulic pressure on the actuators keeps the landing gear retracted.
- ▶ In the event of a pump failure gear can be extended by the use of gravity.
- ▶ Green Lights – Indicate gear is down and locked
- ▶ Red Gear Unsafe Light – illuminates if any gear leg is neither locked or down or up.
- ▶ Main Wheels have hydraulic disk brakes operated by pedals on the top of the rudder pedals.

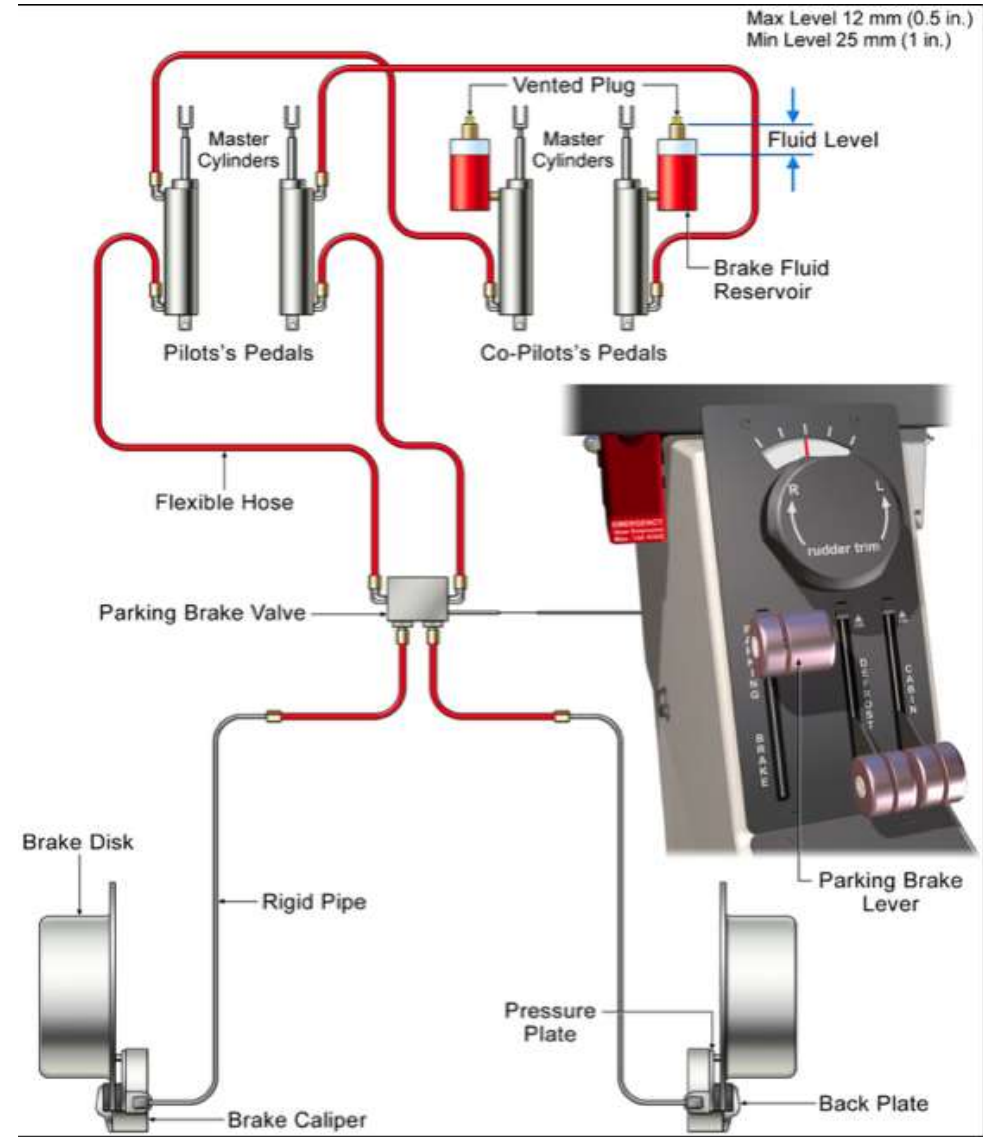
Nose Wheel Steering

- ▶ Using the rudder pedals the nose can be turned up to 30° either side of center.
- ▶ A larger deflection of up to 52° can be achieved using differential braking.
- ▶ On retraction the nose wheel is automatically centered, and the steering linkage disengaged to reduce rudder pedal loads.



Braking System

- ▶ Main wheels are fitted with hydraulic disc brakes operated by toe pedals fitted to the rudder pedals.
- ▶ Hydraulic fluid for brake operation is independent from the hydraulic retraction system and stored in two reservoirs fitted to the copilot's brake pedal actuators.
- ▶ A parking brake lever is located on the left side of the center console under the instrument panel.



Landing Gear Operation

Hydraulic pressure to operate the landing gear is provided by an electrically driven hydraulic pump controlled by a pressure switch.

The pump only operates when the system pressure falls below a pre-determined value.

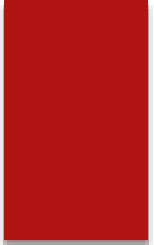
One actuator is fitted to each landing gear assembly.

A pressurized gas container acts to maintain constant system pressure while the actuators are operating. This prevents the continual starting and stopping of the hydraulic pump.

Landing gear lever is on the instrument panel to the right pilot's right knee

The emergency gear lever is below the instrument panel in the same area.

Normal Gear Extension Operation



Lever must be pulled out before it can be operated.

3 Green Lights indicated gear down and locked

Red light – gear unsafe

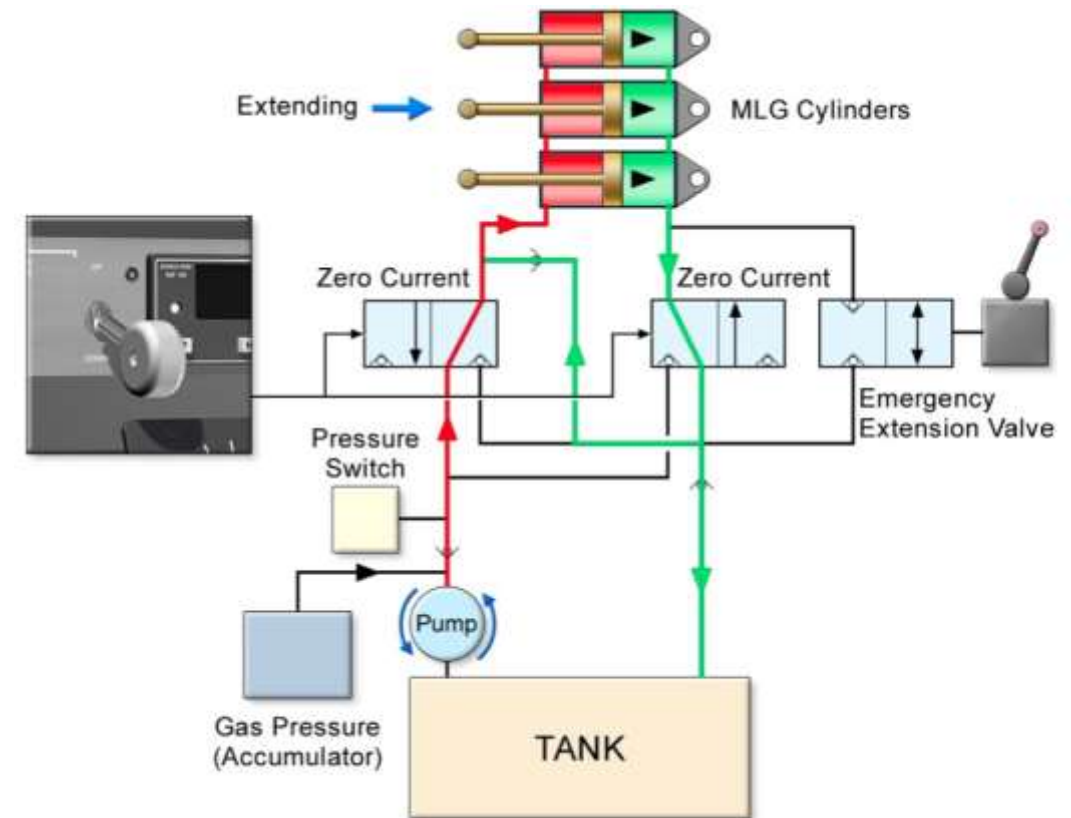
Normal Extension takes 6-10 seconds.

Landing Gear should be retracted before reaching 156 KIAS (VLOR)

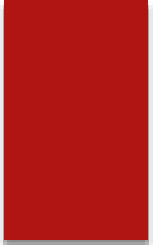
Landing Gear can be extended up to 194 KIAS (VLOE)

Gear down, hydraulic pressure is supplied to 3 actuators to extend gear. Springs assist gear extension and a manual locks.

Normal Gear Extension



Normal Gear Retraction Operation



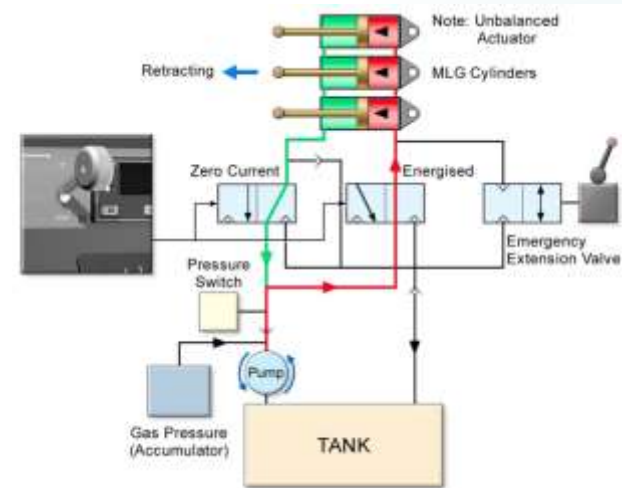
When gear selector is up hydraulic pressure is directed to both sides of the actuators.

Because of the larger surface area on the retraction side, fluid flows from the extension side and the gear retracts.

Inadvertent retraction is prevented on the ground by squat switches on the landing gear.

Gear is kept retracted by hydraulic pressure supplied by the accumulator topped by the pump as required.

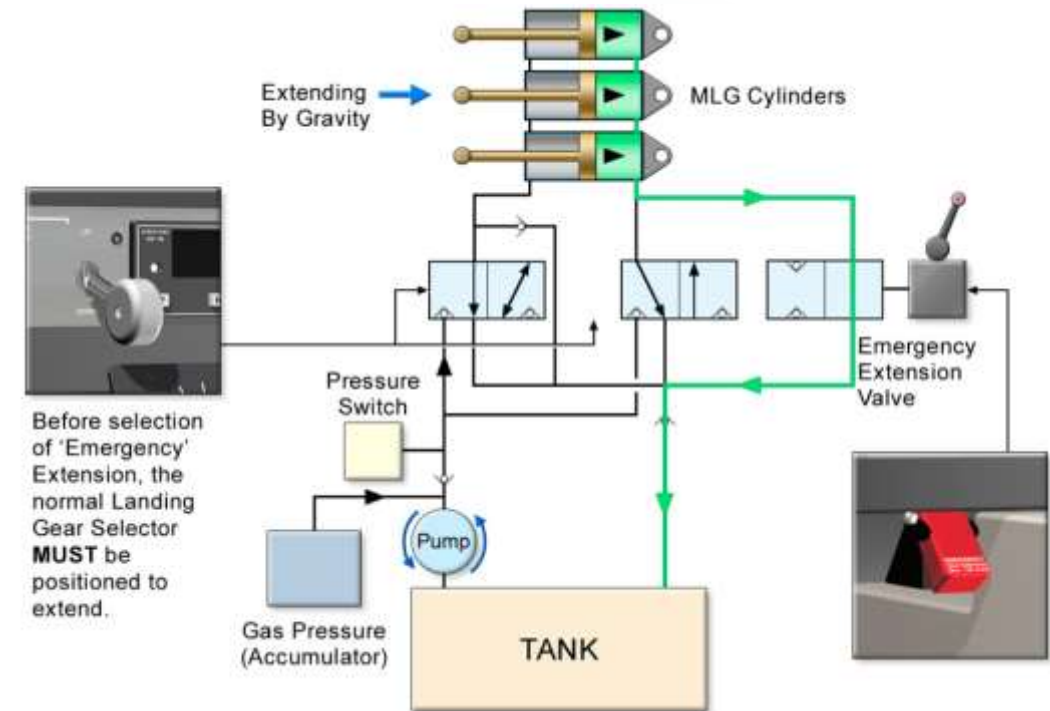
Normal Gear Retraction



Emergency Gear Extension

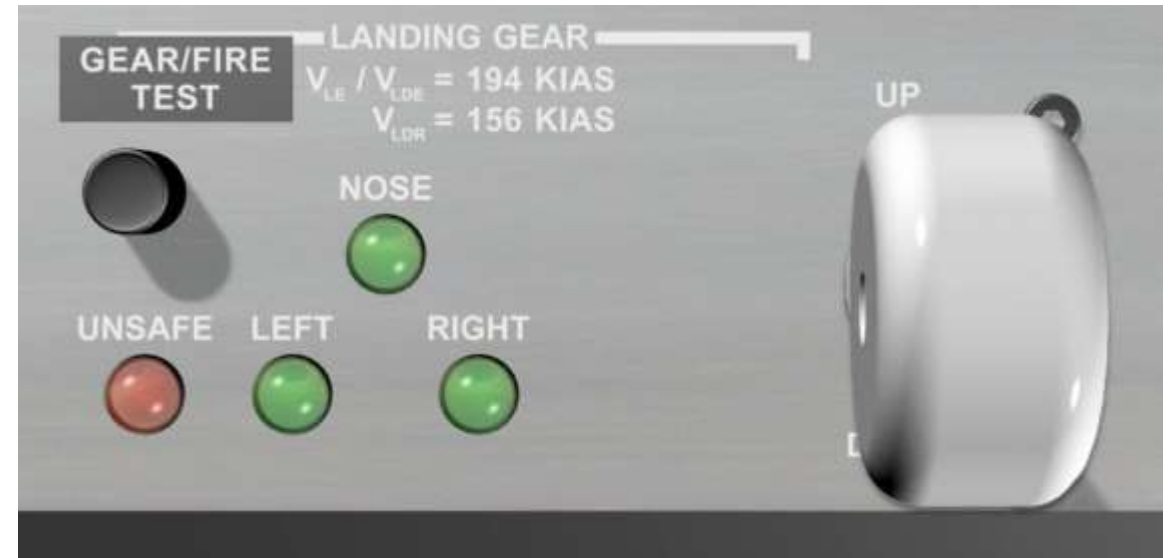
- ▶ The landing gear is held retracted by hydraulic pressure.
- ▶ When pressure is released by the manual gear extension lever this pressure reduces and gravity forces gear to extend.
- ▶ Before Pulling the manual lever make sure the gear selector is in the DOWN position.

Emergency Gear Extension



Landing Gear Warning

- ▶ Landing gear warning alarm will activate when either the power is below 20% while the gear is up and/or when the flaps are set to LDG while the gear is up.
- ▶ Test warning system during pre-flight



Diamond DA42 Aircraft Systems



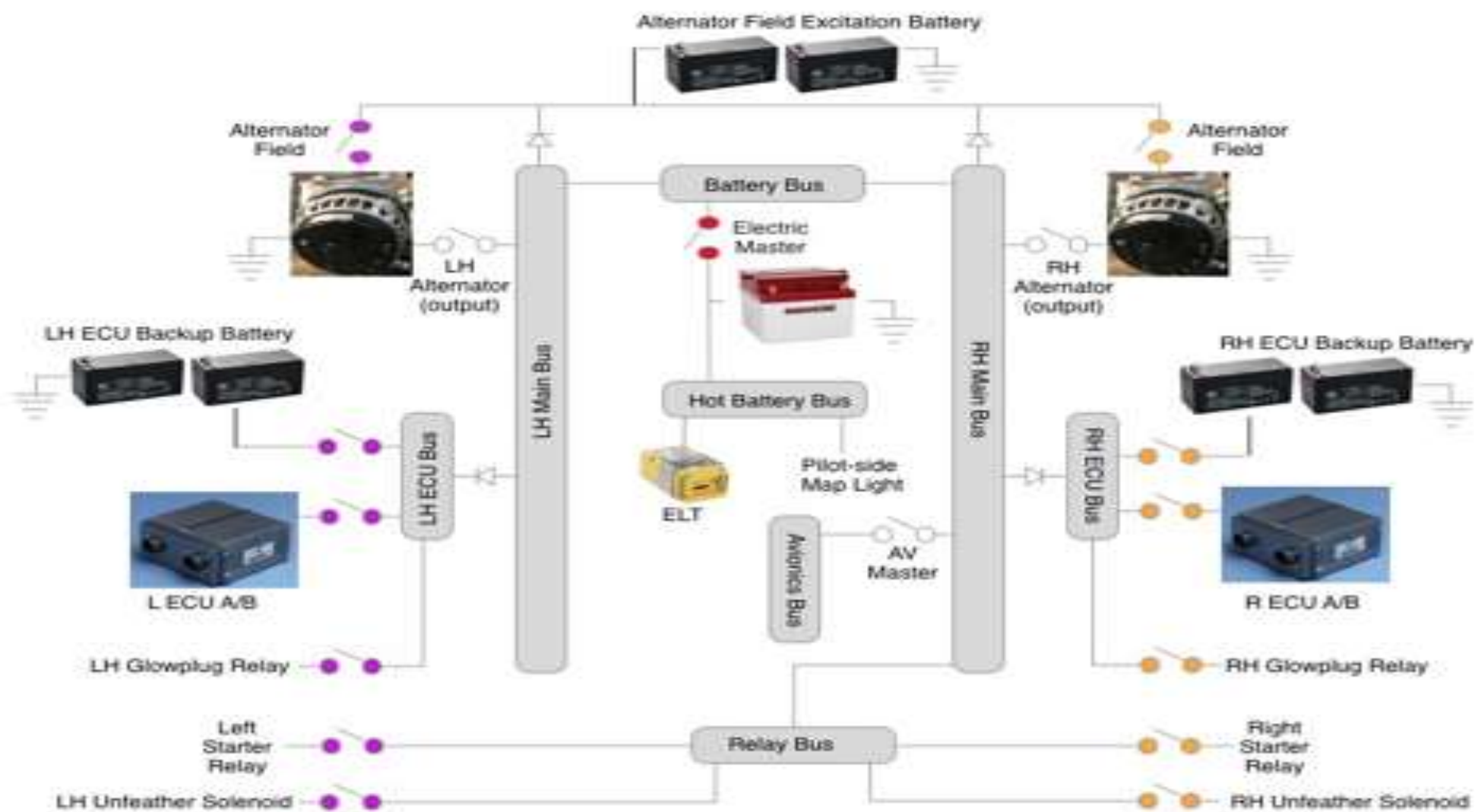
ELECTRICAL SYSTEM

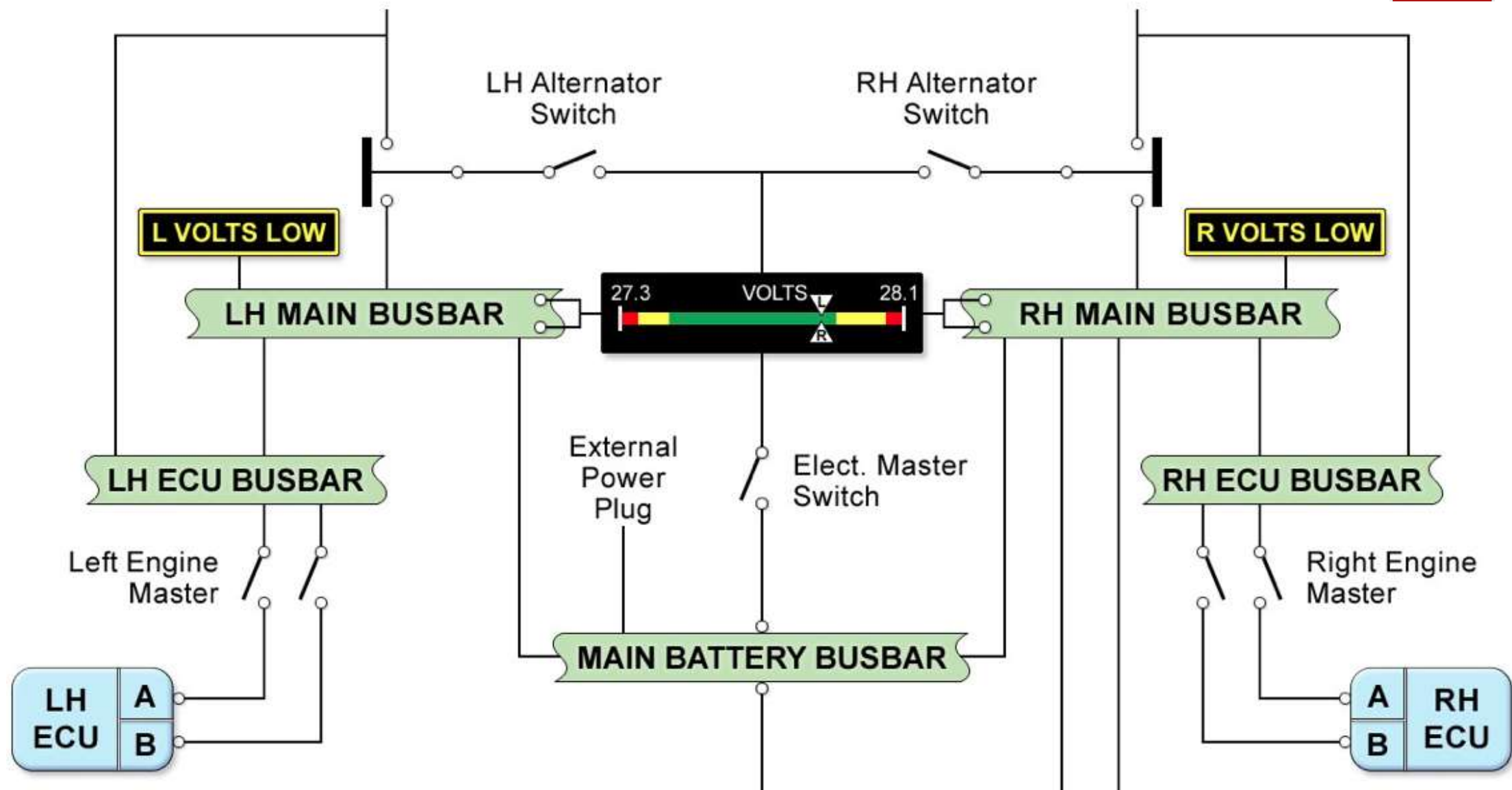
Electrical System

- ▶ The DA42 NG has a 28V DC electrical system. Power is generated by two 60 amp engine driven alternators mounted on the bottom left side of each engine.
- ▶ Main battery power is stored in a 24 V 10 Ah battery. The battery relay is controlled with the Electric Master switch on the instrument panel.
- ▶ A non-rechargeable battery provides emergency power to the standby attitude indicator and panel flood light. The battery provides 1.5 hours of power.
- ▶ Each alternator has a alternator control unit (ACU) which monitors and controls its output.
- ▶ The ACUs will warn the operator using a caution message on the G1000 PFD in case of over or undervoltage.
- ▶ Under normal conditions, alternator voltage is shown on the voltmeter.

Power Distribution

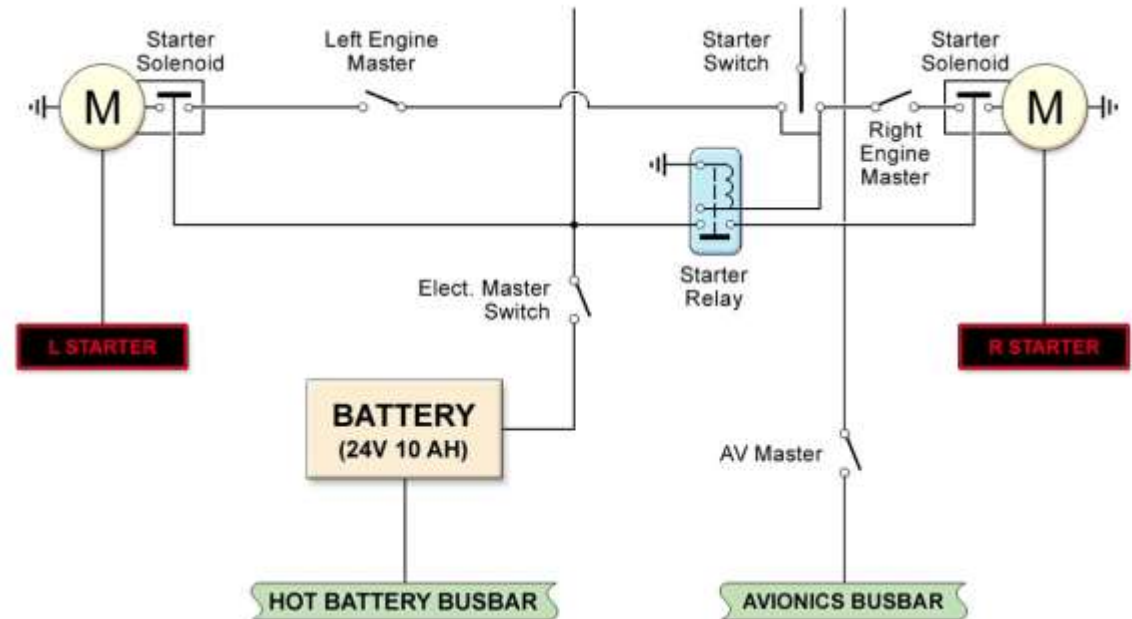
- ▶ Outputs from each alternator are connected to dedicated main busbars via their respective alternator relays and a 70 amp circuit breaker.
- ▶ The Battery Bus is connected to the main battery and controlled by the Electric Master switch. The Battery Bus provides power to the LH (RH) Main Bus and heavy duty power to both starters.
- ▶ The LH and RH Main Busses provide power directly to their respective connected consumers. The RH Main Bus also provides power to the Avionic Bus.
- ▶ The LH (RH) ECU Bus is connected to the LH (RH) Main Bus and also connected to the power output of the alternator which provides power for the ECU A and ECU B via the LH (RH) ECU A(B) relays which are controlled by the Engine Master Switches.
- ▶ The LH (RH) Engine Master switches must be On to connect the ECU A and ECU B to the ECU Bus.
- ▶ Alternator electrical power supplied to ECUs in case of Main Battery malfunction by additional batteries (ECU backup battery) and connected to LH (RH) ECU Bus.
- ▶ Two 12 V backup batteries provide 30 minutes of engine operation in case of complete electrical failure. **Both engine may stop after 30 minutes.**





Engine Starting Circuit

- ▶ The main battery provides power to the left and right starter motors via the starter relay.
- ▶ Power Supplied only if:
 - ▶ Electrical master ON
 - ▶ Engine master ON
 - ▶ Start Switch turned to appropriate engine



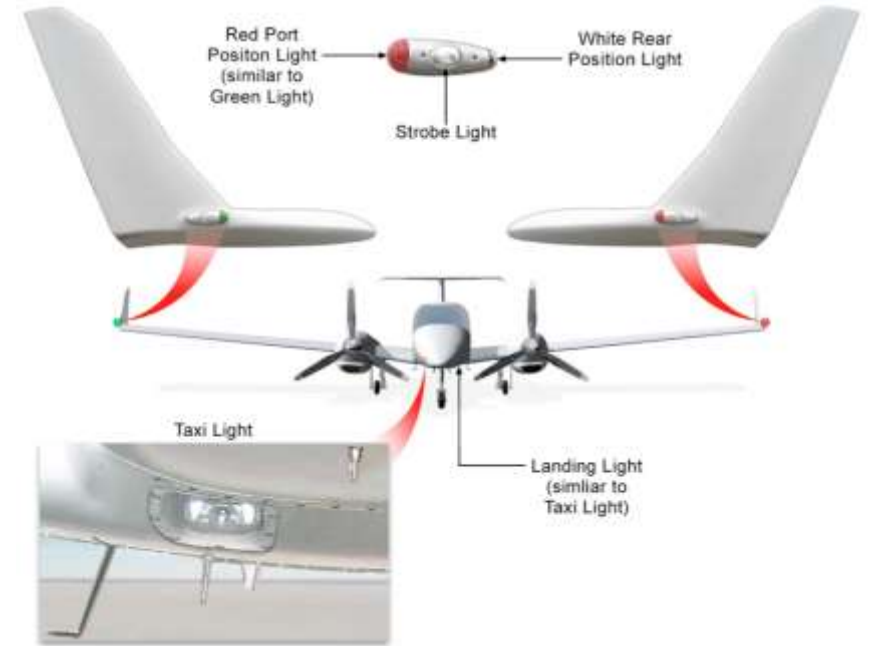
Aircraft Lighting

►Instrument/Panel Lighting

- Instrument lighting uses a strip of switches on top of the PFD to control:
 - Landing
 - Taxi
 - Position
 - Strobe
- Two rotary control knobs control the intensity levels for instrument lights and flood light.

►Reading Lights

- Three reading lights each having an on/off switch are mounted in the ceiling.
- Exterior Lighting
 - Navigation lights are located on the wing tips
 - Anti-Collision strobe lights are also located in the wing tips.
 - Landing & Taxi lights located on the front fuselage.



A detailed view of the Diamond DA42 cockpit instrument panel. The panel features a variety of analog gauges at the top, including a tachometer, altimeter, and airspeed indicator. Below these are two large digital displays showing engine parameters and a map. The panel is densely packed with numerous buttons, switches, and knobs. A red vertical bar is visible on the right side of the image.

Diamond DA42 Aircraft Systems

INSTRUMENT AND AVIONICS

Instruments and Avionics

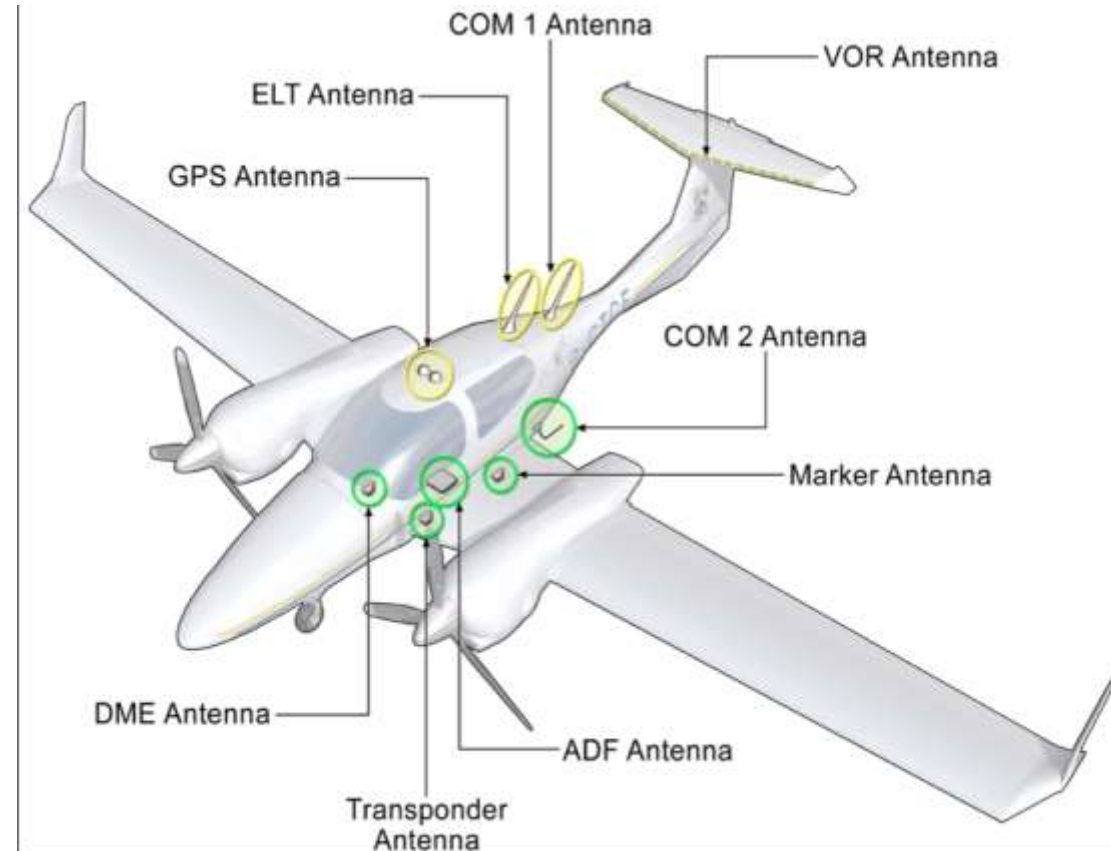
The Garmin G1000 Integrated Cockpit System (ICS) is deeply integrated into the DA42 aircraft systems. The suite comprises a series of interlinked line replaceable units listed below:

- ▶ Two Display Units – PFD & MFD
- ▶ An Attitude and Heading Reference System (AHRS)
- ▶ A magnetometer
- ▶ An Air Data Computer (ADC)
- ▶ Two Integrated Avionics Units (IAU)
- ▶ An audio system
- ▶ Mode S Transponder
- ▶ An Engine/Airframe Interface Unit

Instruments and Avionics

- ▶ The ICS provide virtually all information required to operate and navigate the aircraft shown on two highly integrated cockpit displays.
- ▶ These include a Crew Alerting System (CAS) which monitors various engine and airframe parameters and automatically displays warning and alerts to the pilot via annunciation and alert windows.
- ▶ The display screens and IAU1 are powered as soon as the ELECTRIC MASTER switch is set to on.
- ▶ The audio panel and IAU2 is powered when the AVIONICS MASTER switch is set to on.
- ▶ Conventional ASI, Attitude Indicator, and Altimeter are located above the G1000 display's incase complete failure.

Antenna Locations



PFD, MFD, & Audio Panel



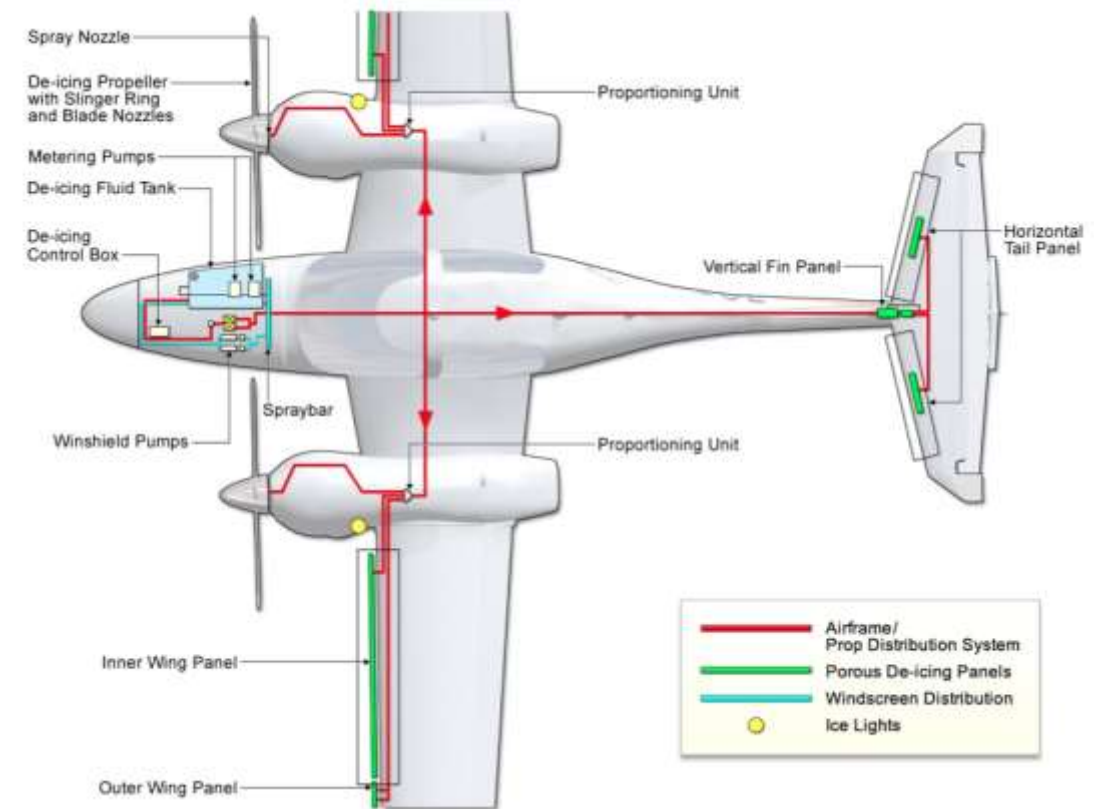
Pitot-Static System

- ▶ The pitot static system comprises a combined pitot-static sensing head mounted underneath the left wing, and OAT sensor mounted below the nose baggage compartment.
- ▶ An alternate static source senses cabin pressure.
- ▶ Information for the pitot-static sensing head is fed to the ADC and to the standby ASI and altimeter.
- ▶ OAT is fed to the ADC
- ▶ Pitot-Static sensor is heated, and the element is energized by the pitot heat switch.
- ▶ Alternate Static Source is located under the main instrument panel just above the pilot's map bin.

A Diamond DA42 twin-engine turboprop aircraft is shown in flight, banking to the right. The aircraft is white with blue and grey stripes and the word "COBHAM" on the side. The registration "C-FFMV" is visible on the tail. The background features a dark, hazy landscape with mountains and water. A solid red rectangle is located in the top right corner of the image.

Diamond DA42 Aircraft Systems

Ice Protection System



Ice Protection System

- ▶ NOTE: the ice protection system is NOT a “DE-ICING” system. It is only capable of removing small accumulations of ice. Its main purpose is to prevent ice accumulation.
- ▶ MUST BE ON BEFORE ICING CONDITIONS ARE ENCOUNTERED
- ▶ When system is operational the DA42 is approved for operation in known icing conditions

Ice Protection System

- ▶ System is electrically operated; powered from the LH main bus
- ▶ Engine and Airframe protection is provided by two electric pumps that feed fluid through filters to proportion units located in each engine nacelle and the tail of the aircraft.
- ▶ These units regulate the flow of fluid to porous panels attached to the leading edge of wings, fin, and horizontal stabilizer, and to a slinger rings at each propeller.
- ▶ The porous panels weep fluid over the airframe leading edge surfaces.
- ▶ On the prop centrifugal force spreads the fluid.
- ▶ A separate system distributes fluid to the windshield
- ▶ (5 seconds each time activated)
- ▶ De-Icing Tank – 8.3 gallons of Glycol-based Fluid (AL-5 (DTD 406B) and Aeroshell Compound 7

Ice Protection System

- ▶ When the OFF/NORM/HIGH switch selects airframe/propeller deicing pumps.
- ▶ NORM – both pumps are used to provide intermittent flow 30 seconds on 90 seconds off (2.5 hours operating time)
- ▶ HIGH – Selected when icing conditions are more demanding. Max operating time is 1 hour.
- ▶ MAX – applies highest flow possible but fluid capacity will only last for about 30 minutes. Will only stay in MAX for 2 min.
- ▶ Alternate switch connects pump 2 to the RH main bus. Operation will be similar to HIGH mode.



BENDIX KING AUTO PILOT

Diamond DA42 Aircraft Systems



Bendix King 140 Autopilot

- ▶ The KAP 140 system as installed on the DA42 is a two-axis autopilot that can be used to control pitch and roll.
- ▶ There is no automatic control of power or the yaw axis.
- ▶ Therefore THROTTLE and RUDDER control remain pilot's responsibility.
- ▶ Control panel provides an altitude alerting system. Which is independent of both autopilot operation and an additional altitude alerting system provided by the PFD.
- ▶ Autopilot has control of the electronic trim.



Bendix King 140 Autopilot

- ▶ CAT 1 ILS operations in Approach Mode
 - ▶ Down to 200ft AGL with IAS is below 130 KIAS
 - ▶ Flaps up or APP
 - ▶ Must be disconnected before FLAPS LDG
- ▶ Autopilot receives altitude, heading, and navigation information from the ADC, AHRS, and integrated avionics units.
- ▶ Rate of turn and bank angle are provided by separate turn-and-bank sensors mounted behind the instrument panel.
- ▶ Pitch axis data is derived from a combination of pressure sensors and accelerometers.
- ▶ When a mismatch is detected between commanded and actual conditions the autopilot signals corrective action to the roll, pitch, or trim servos which are connected to the aileron, elevator, and pitch trim control systems.

Autopilot Modes

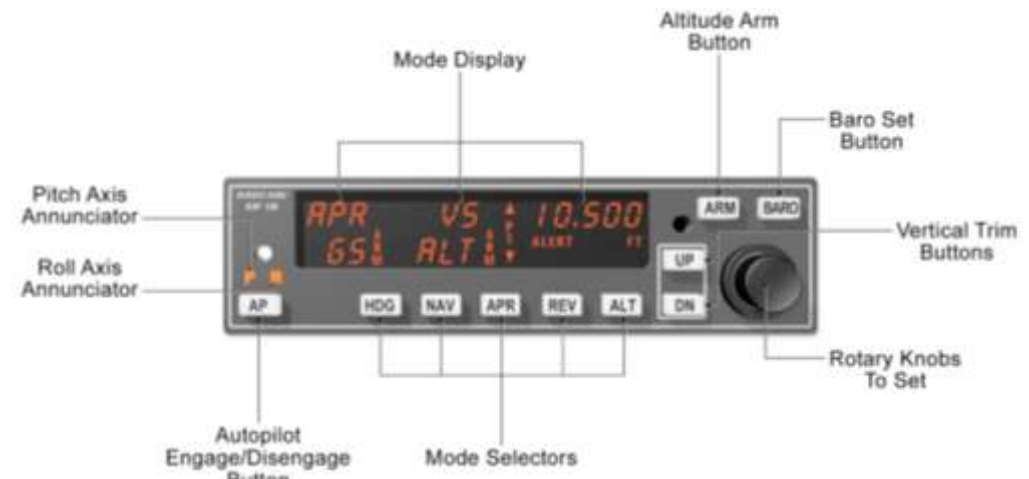
- ▶ **Roll Modes:**

- ▶ Roll: levels wings
- ▶ Heading: turns to follow PFD Heading
- ▶ Navigation: captures and tracks VOR, ILS, or GPS course
- ▶ Approach: Captures and tracks an ILS localizer inbound.
- ▶ Reverse: Captures and tracks an ILS localizer outbound.

- ▶ **Pitch Modes:**

- ▶ Vertical Speed – flies at a specified rate of climb or descent.
- ▶ Altitude Hold – Captures and maintains an altitude.
- ▶ Glideslope: captures and tracks and ILS glideslope.

Control Panel Overview



Engaging the Autopilot

Autopilot: Disengaged



0.25 Seconds + Conditions Valid

Autopilot engaged, in:

Roll Mode

Vertical Speed

(Current VS Shown)



3 Seconds

Display Reverts



Disengaging the Autopilot

Autopilot: Engaged



Autopilot: Disengages
Ap Annunciation flashes

"AUTOPILOT!"
Voice Message



5 Seconds



Autopilot Limitations

Must have a successful system pre-takeoff check

No cabin windows open

No single engine operations

Aircraft should be in trim when engaged

Do not use if electric trim malfunctions

OFF during takeoff & landing

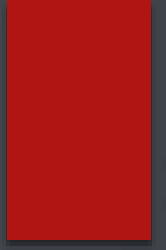
Max IAS – 185 KIAS

MIN IAS – 90 KIAS

Disengaged

- Below 200 AGL with IAS below 130 KIAS.
- Below 250 AGL with IAS above 130 KIAS.
- Below 200 AGL during departure operations
- Below 800 AGL for other phases of flight.

WEIGHT & BALANCE AND AIRCRAFT PERFORMANCE

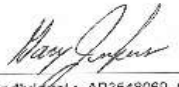
A front-facing view of a Diamond DA42 twin-engine turboprop aircraft in flight, positioned centrally in the upper half of the slide. The aircraft is flying over a runway with a dark, wooded background.

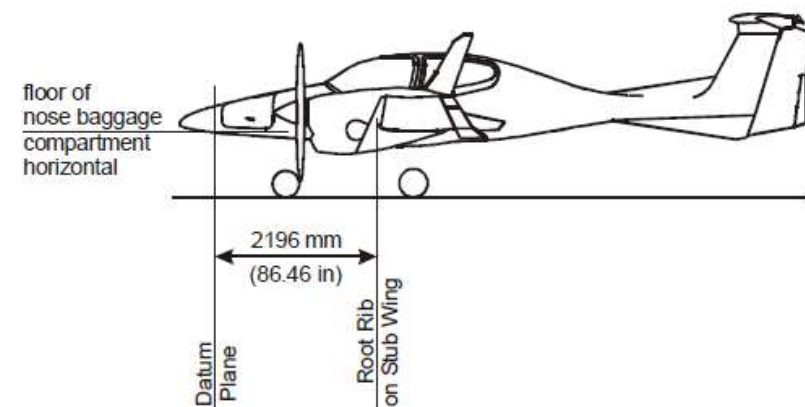
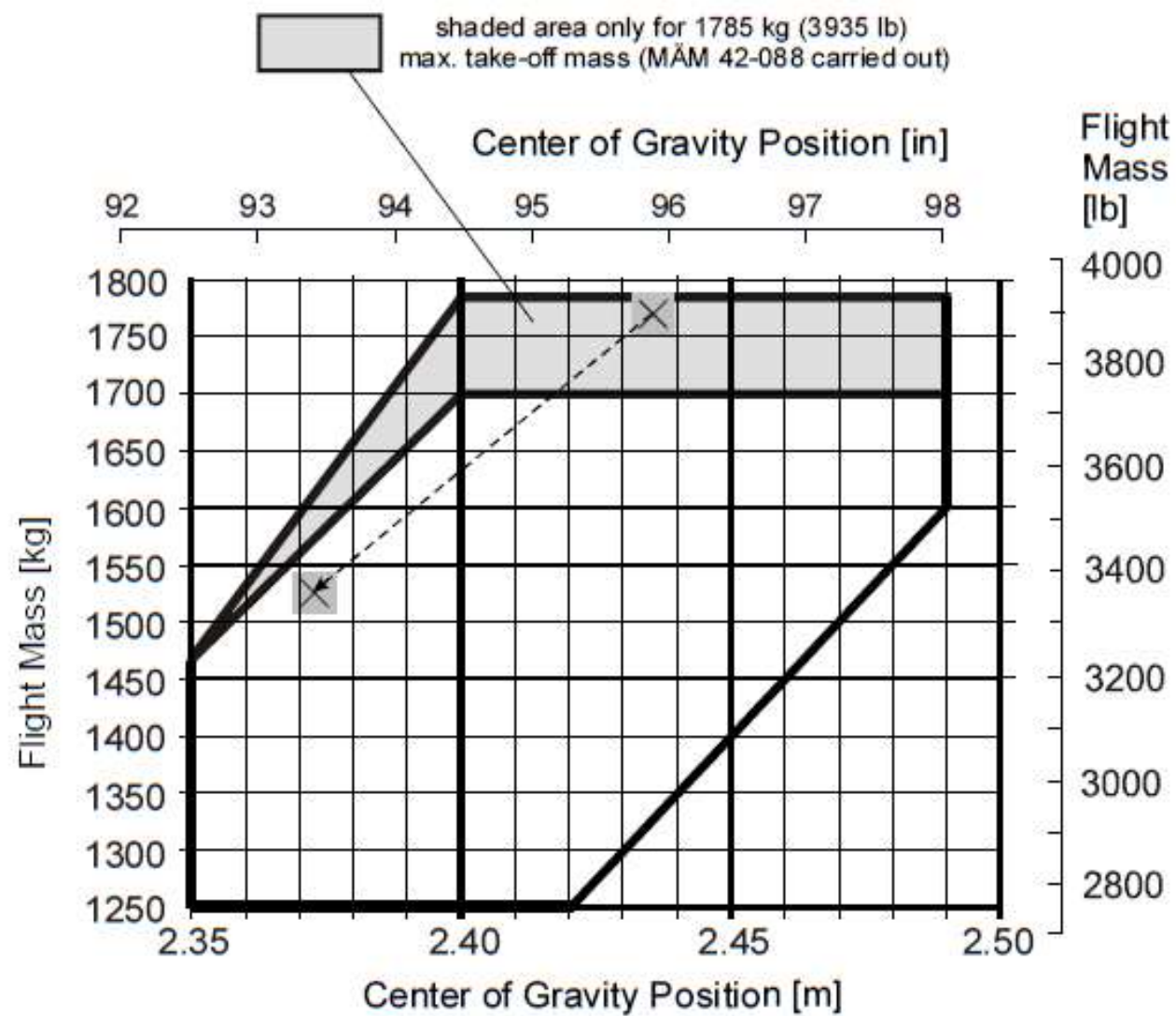
Diamond DA42 Aircraft Systems

Weight and Balance (11/2019)

N480TS

- ▶ Weight – 2928.90 lbs
- ▶ GC/ARM – 95.26
- ▶ Moment – 279,004.71
- ▶ Total Useful Load- 1006.1lbs
- ▶ Aircraft Weight Full of Fuel & TKS – 3429 lbs (Useful load – 506 lbs)
- ▶ Max Takeoff – 3935 lbs
- ▶ Max Landing – 3935 lbs
- ▶ Max Zero Fuel- 3814 lbs
- ▶ Max Nose Baggage – 66 lbs
- ▶ Max Cabin Baggage – 100 lbs

Weight / Balance & Equipment List Revision					Page # : 1
Carolina Avionics Group, LLC 3550 Airport Loop Road Salisbury, NC 28147 Tel: 704-630-0211					
A/C Tail # : N480TS		A/C Make : DIAMOND/KATANA			
Register Name : HILLSBORO AERO ACADEMY LLC		A/C Model : DA42			
Name 2 :		A/C Serial # : 42.AC080			
Address 1 : 3355 NE CORNELL RD		WO Ref # :			
Address 2 :		WB Date : Nov-16-2019			
City, State, PC : HILLSBORO, WASHINGTON 97124		WB ID # : 443			
Previous data taken from document dated Sep-27-2018					
Model # Serial #	Description Part #	(LB / FT)	Weight	CG/Arm	Moment
		Previous data ->	2928.80	95.26	278589.40
REMOVED ITEMS -----					
GTX-33 89103445	MODE S TRANSPONDER 011-05779-39		-3.20	153.10	-489.92
REMOVED SUB TOTAL		1 Item @	-3.20	153.10	-489.92
INSTALLED ITEMS -----					
GTX-345R 36H421849	ADS-B TRANSPONDER 011-63303-02		3.30	153.10	505.23
INSTALLED SUB TOTAL		1 Item @	3.30	153.10	505.23
NEW DATA >>			2928.90	95.26	279004.71
					
Authorized Individual : AP3548069 GARY JENKINS					



Item		Lever Arm	
		[m]	[in]
Occupants on front seats		2.30	90.6
Occupants on rear seats		3.25	128.0
Fuel	In main tanks	2.63	103.5
	In auxiliary tanks	3.20	126.0
De-Icing Fluid (if equipment installed, OAM 42-053 or OAM 42-054)		1.00	39.4
Baggage in Compartments	Nose	0.60	23.6
	Cabin	3.89	153.1
	Extension	4.54	178.7

Stall Speeds

5.3.4 STALLING SPEEDS

CAUTION

The calculated stalling speeds may be higher than the maximum approved / limiting flap-extended and / or maneuvering airspeeds.

Stalling Speeds at Various Flight Masses

Airspeeds in KIAS at idle power:

1400 kg (3086 lb)		Bank Angle			
Gear	Flaps	0°	30°	45°	60°
UP	UP	56	60	68	83
DOWN	APP	53	58	65	78
DOWN	LDG	49	53	61	75

1700 kg (3748 lb)		Bank Angle			
Gear	Flaps	0°	30°	45°	60°
UP	UP	62	67	76	92
DOWN	APP	59	64	72	87
DOWN	LDG	55	60	68	84

if MAM 42-088 is carried out:

1785 kg (3935 lb)		Bank Angle			
Gear	Flaps	0°	30°	45°	60°
UP	UP	64	69	78	95
DOWN	APP	61	66	74	90
DOWN	LDG	57	62	70	86

5.3.6 TAKE-OFF DISTANCE

Conditions:

- POWER lever both MAX @ 2300 RPM
- Flaps UP
- Nose wheel lift-off
 - up to 1700 kg (3748 lb) @ $v_R = 70$ KIAS
 - above 1700 kg (3748 lb) @ $v_R = 72$ KIAS
- Airspeed for initial climb
 - up to 1700 kg (3748 lb) 77 KIAS
 - above 1700 kg (3748 lb) 79 KIAS
- Runway level, hard paved surface
(concrete, asphalt, etc.)

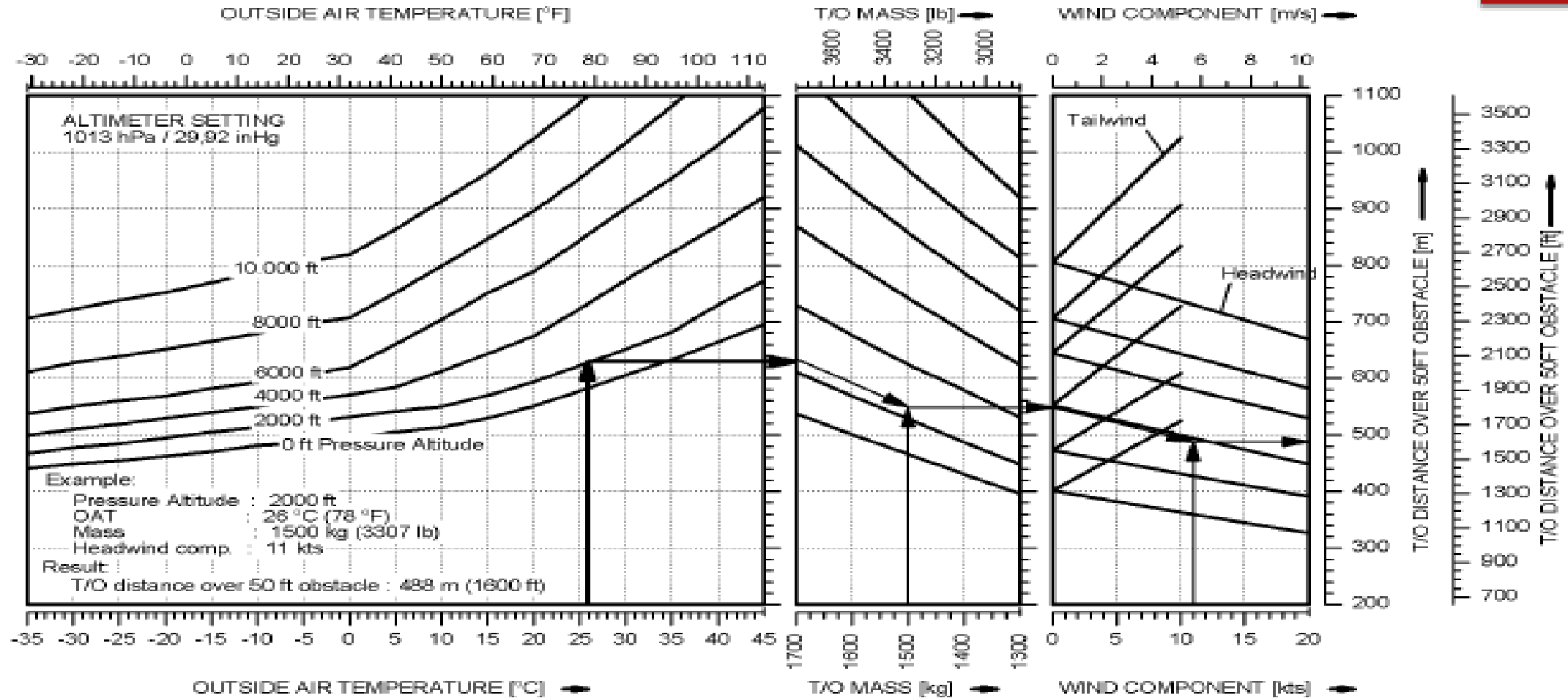
Values for ISA and MSL, at 1700 kg (3748 lb)	
Take-off distance over a 50 ft (15 m) obstacle	530 m (1739 ft)
Take-off ground roll	348 m (1142 ft)

if MÄM 42-088 is carried out:

Values for ISA and MSL, at 1785 kg (3935 lb)	
Take-off distance over a 50 ft (15 m) obstacle	691 m (2267 ft)
Take-off ground roll	427 m (1401 ft)

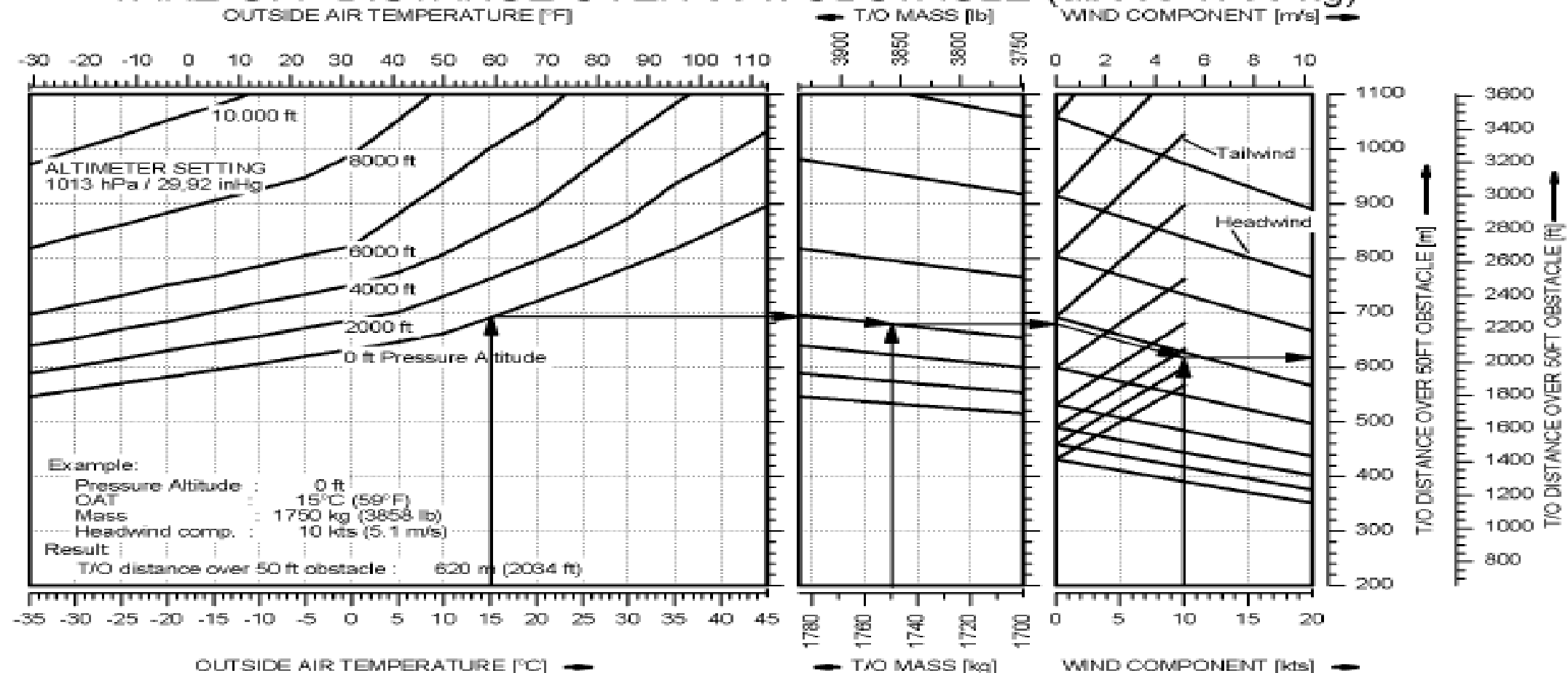
Takeoff Distance

TAKE-OFF DISTANCE OVER 50 ft OBSTACLE



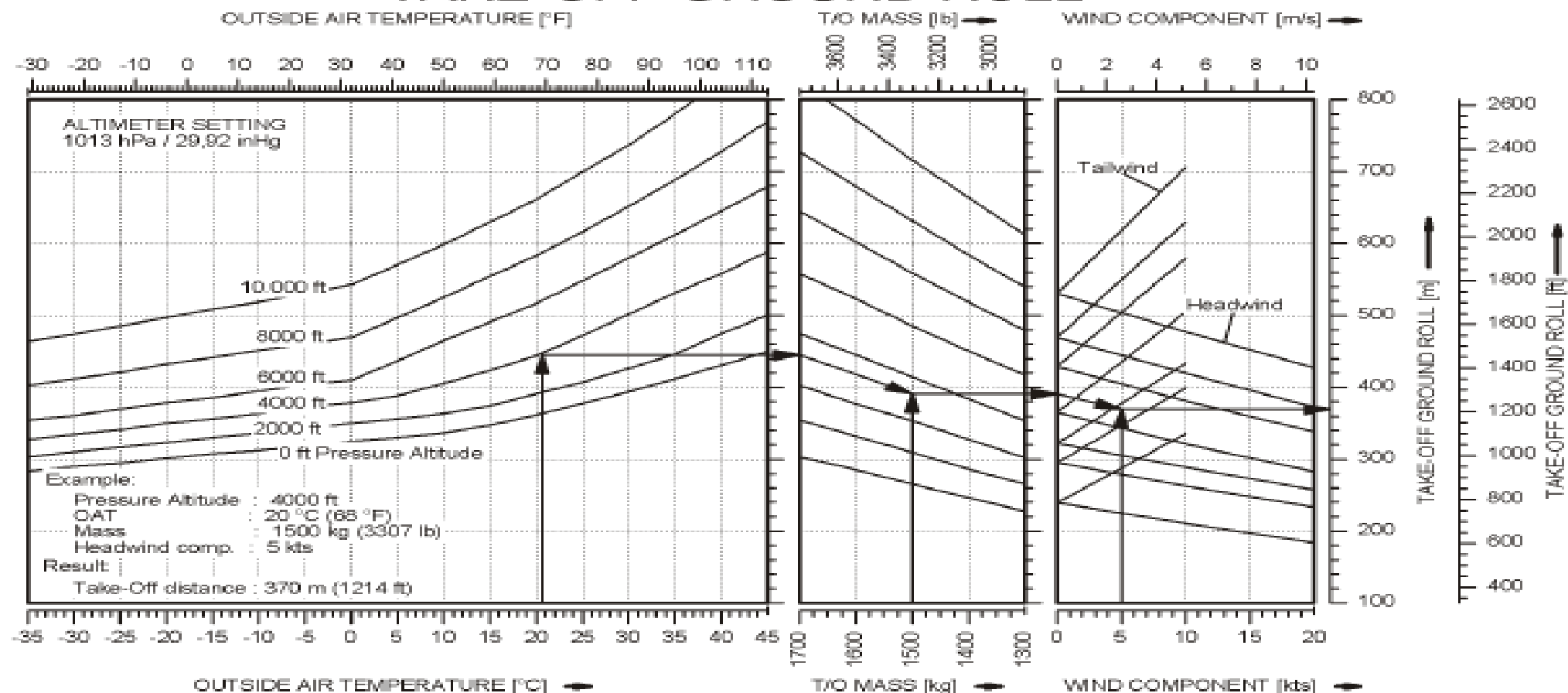
Conditions: Flaps: UP, Power: both MAX @ 2300 RPM, v_R : 70 KIAS, Airspeed: 77 KIAS, Runway: hard, paved

TAKE-OFF DISTANCE OVER 50 ft OBSTACLE (above 1700 kg)

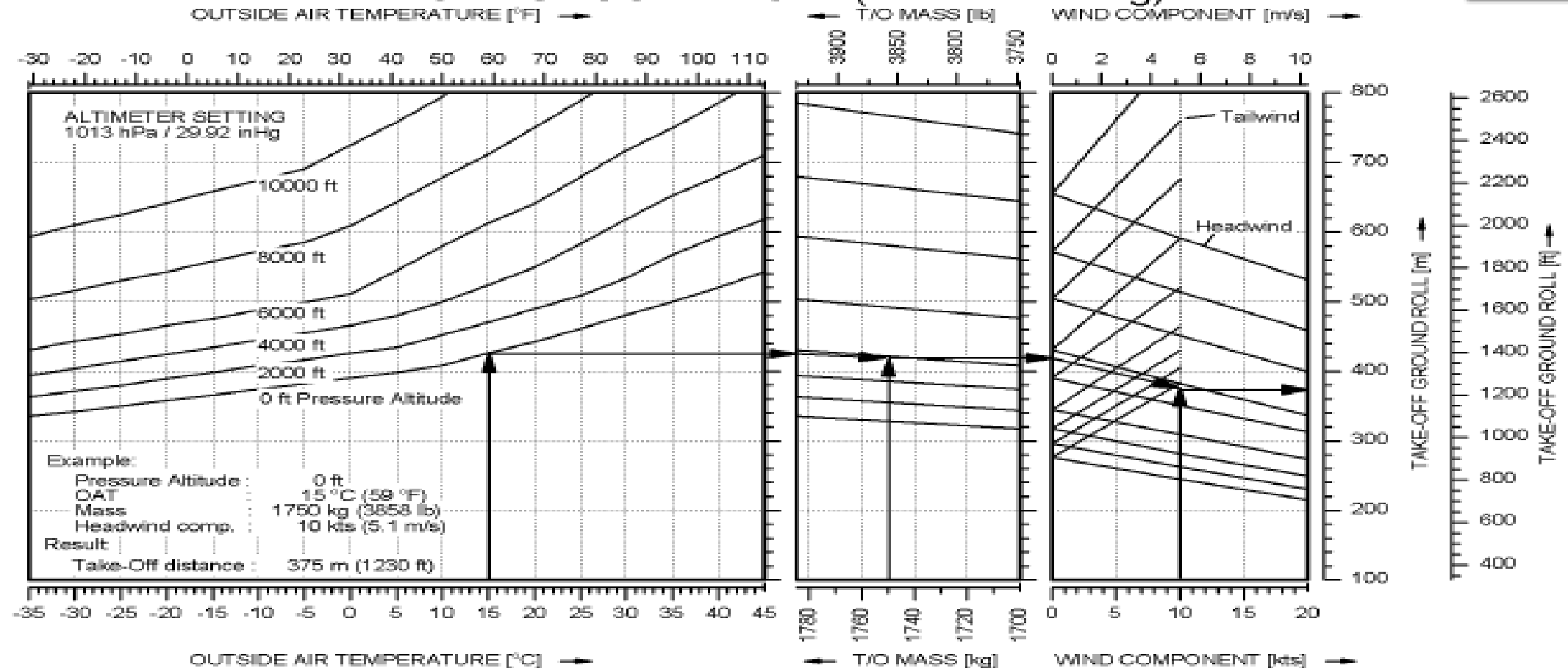


Conditions: Flaps: UP, Power: both MAX @ 2300 RPM, v_R : 72 KIAS, Airspeed: 79 KIAS, Runway: hard, paved

TAKE-OFF GROUND ROLL



TAKE-OFF GROUND ROLL (above 1700 kg)



Conditions: Flaps: UP, Power: both MAX @ 2300 RPM, v_R : 72 KIAS, Airspeed: 79 KIAS, Runway: hard, paved

Climb Performance

Takeoff Climb

5.3.7 CLIMB PERFORMANCE - TAKE-OFF CLIMB

Conditions:

- POWER lever both MAX @ 2300 RPM
- Flaps UP
- Landing gear retracted
- Airspeed
 - up to 1700 kg (3748 lb) 77 KIAS
 - above 1700 kg (3748 lb) 79 KIAS

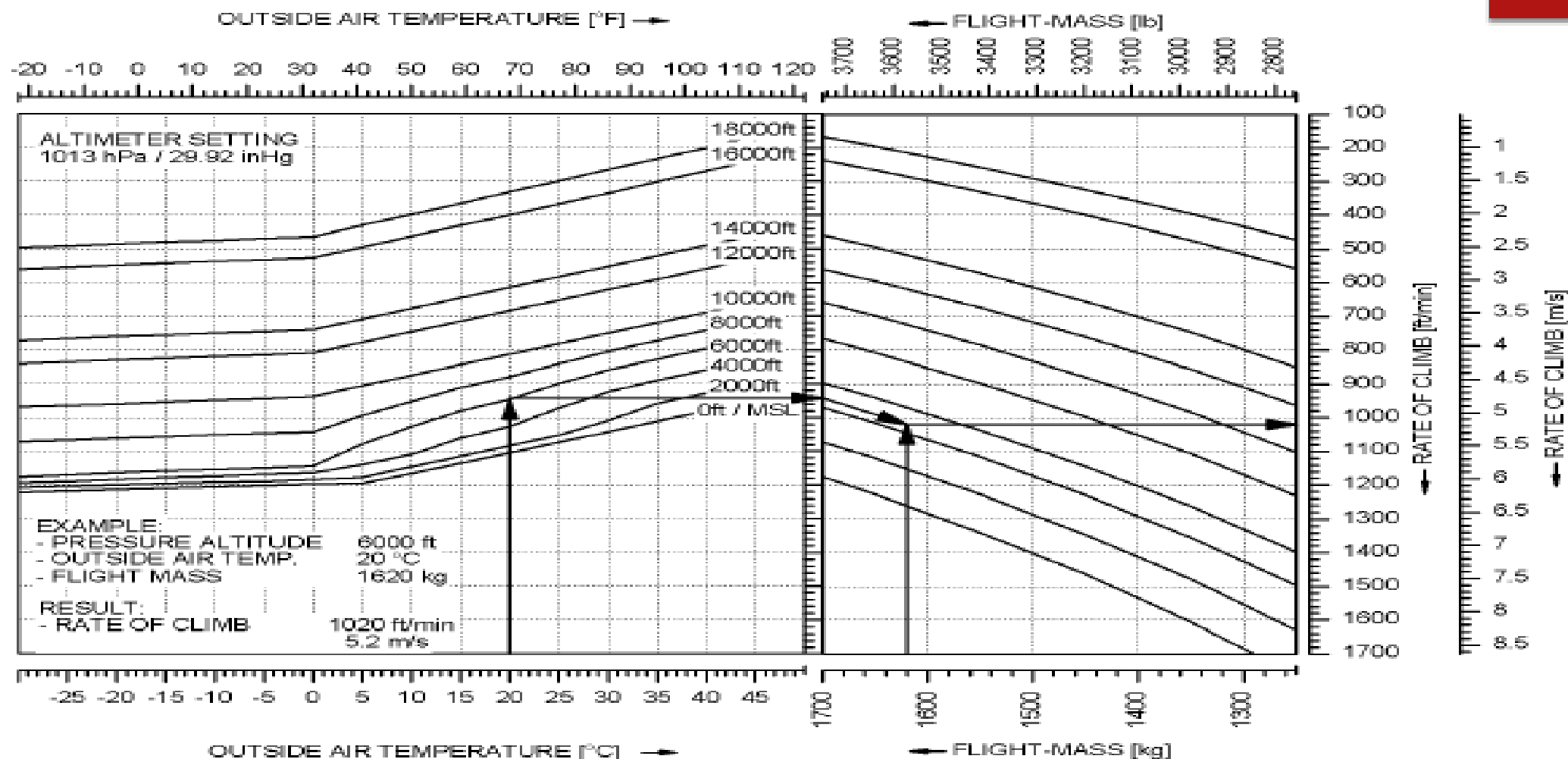
NOTE

The charts on the following pages show the *rate* of climb. The *gradient* of climb cannot easily be determined with a chart, but it can be calculated using the following formulae:

$$\text{Gradient [\%]} = \frac{\text{ROC [fpm]}}{\text{TAS [KTAS]}} \cdot 0.95$$

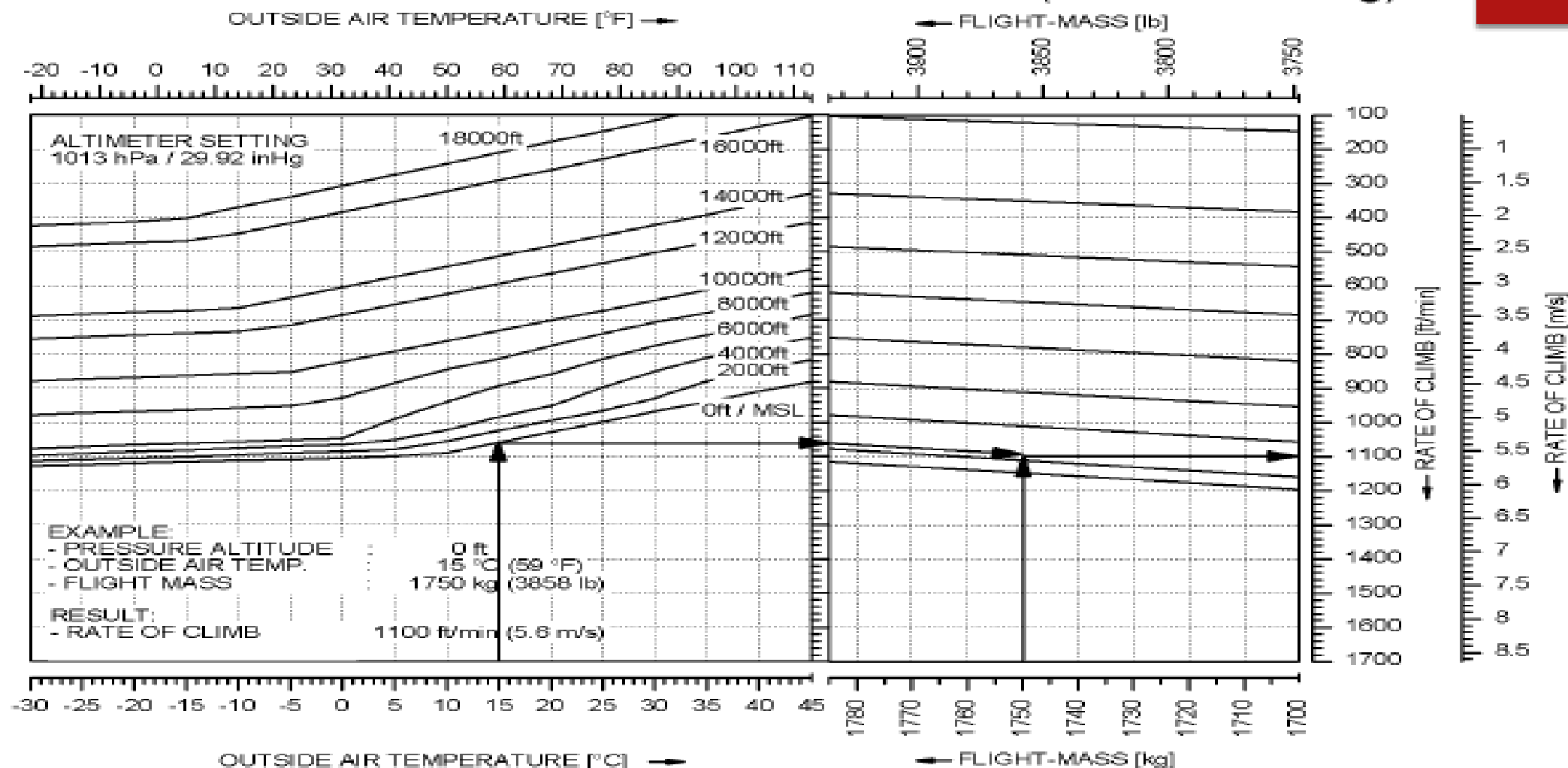
$$\text{Gradient [\%]} = \frac{\text{ROC [m/s]}}{\text{TAS [KTAS]}} \cdot 190$$

CLIMB PERFORMANCE - TAKE-OFF CLIMB



Conditions: Flaps: UP, Power: both MAX @ 2300 RPM, Landing gear: retracted, Airspeed: 77 KIAS

CLIMB PERFORMANCE - TAKE-OFF CLIMB (above 1700 kg)



5.3.8 CLIMB PERFORMANCE - CRUISE CLIMB

Conditions:

- POWER lever both MAX @ 2300 RPM
- Flaps UP
- Airspeed
 - up to 1700 kg (3748 lb) 85 KIAS
 - above 1700 kg (3748 lb) 86 KIAS

NOTE

The graphs on the following pages show the *rate* of climb.
The *gradient* of climb cannot easily be determined with a graph, but it can be calculated using the following formulae:

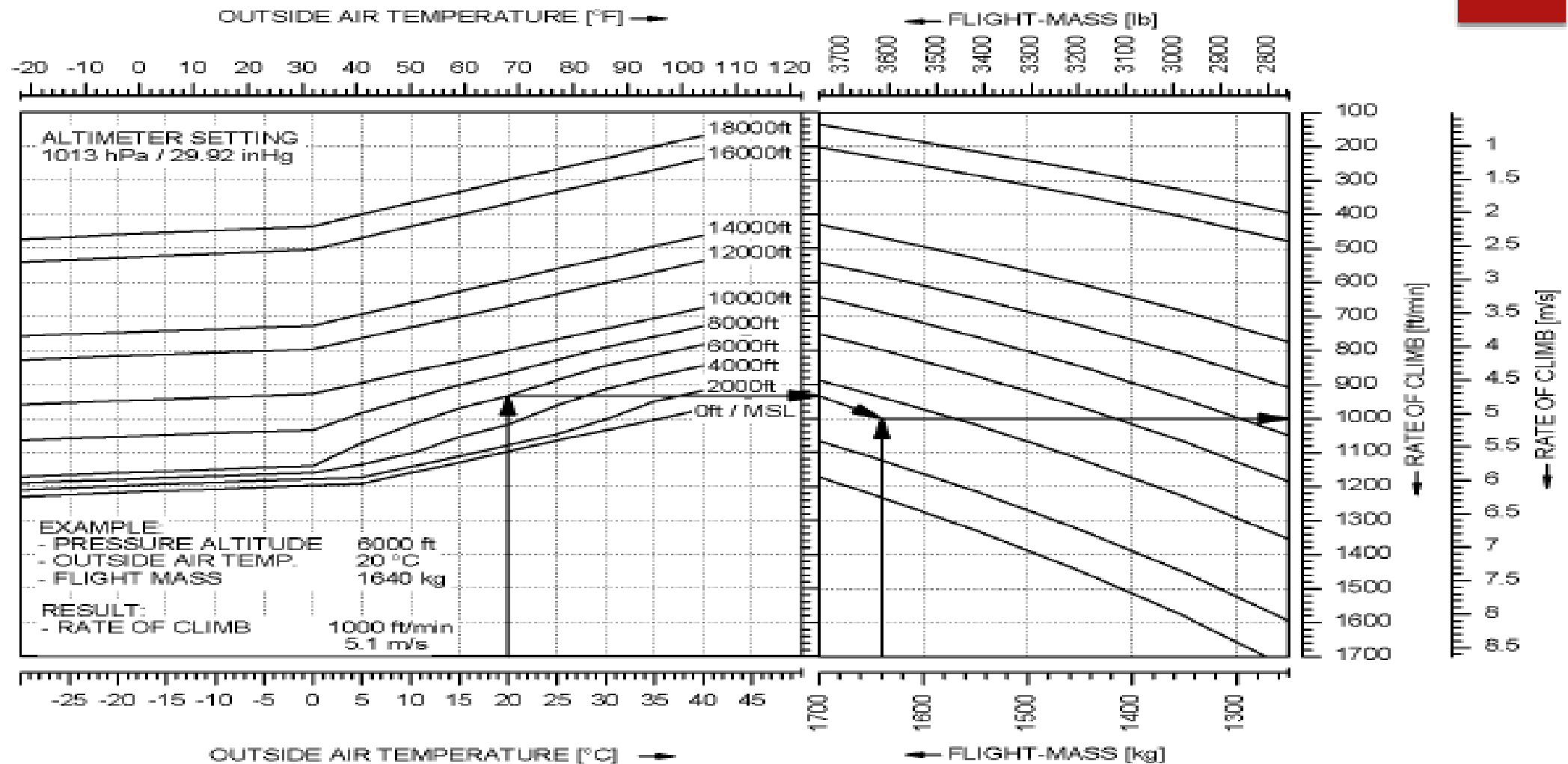
$$\text{Gradient [\%]} = \frac{\text{ROC [fpm]}}{\text{TAS [KTAS]}} \cdot 0.95$$

$$\text{Gradient [\%]} = \frac{\text{ROC [m/s]}}{\text{TAS [KTAS]}} \cdot 190$$

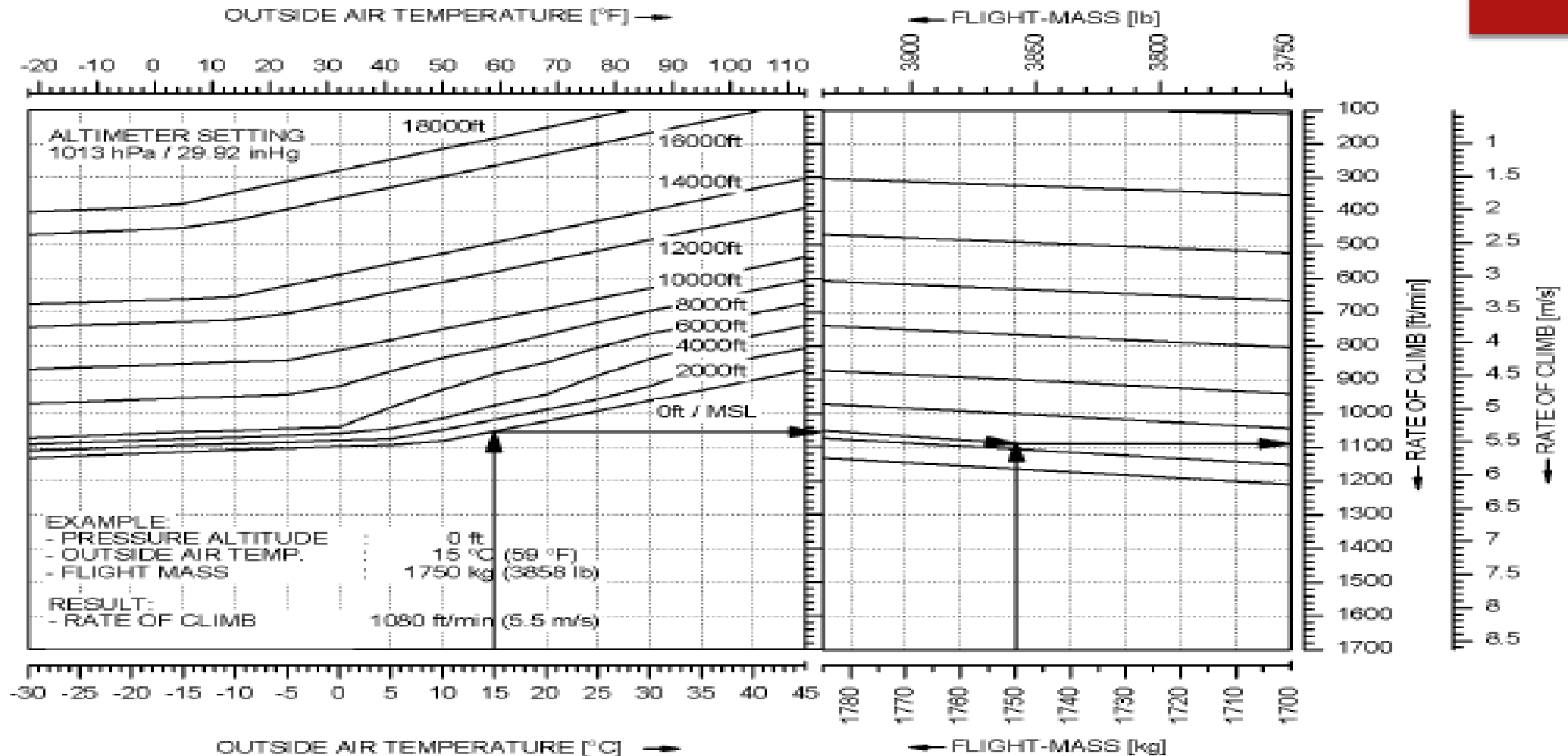
Climb Performance

Cruise Climb

CLIMB PERFORMANCE - CRUISE CLIMB



CLIMB PERFORMANCE - CRUISE CLIMB (above 1700 kg)



Conditions: Flaps: UP, Power: both MAX @ 2300 RPM, Airspeed: 86 KIAS

One Engine Inoperative

Climb Performance

5.3.9 ONE ENGINE INOPERATIVE CLIMB PERFORMANCE

Conditions:

- Remaining engine (RH) MAX @ 2300 RPM
- Dead engine feathered and secured
- Flaps UP
- Airspeed 82 KIAS
- Landing gear retracted
- Zero sideslip established

NOTE

With respect to handling and performance, the left-hand engine (pilots view) is considered the "critical" engine.

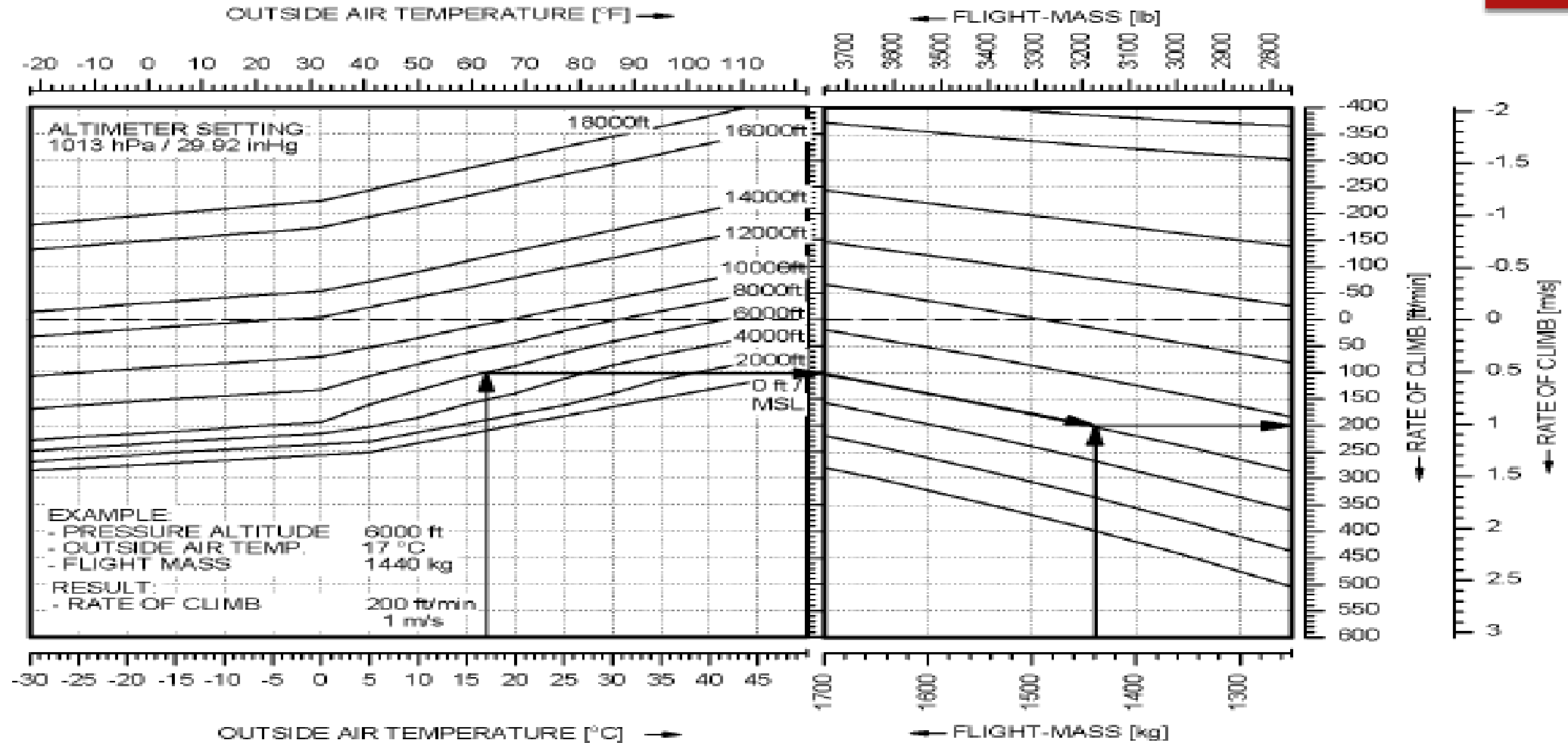
NOTE

The graphs on the following pages show the *rate* of climb. The *gradient* of climb cannot easily be determined with a graph, but it can be calculated using the following formulae:

$$\text{Gradient [\%]} = \frac{\text{ROC [fpm]}}{\text{TAS [KTAS]}} \cdot 0.95$$

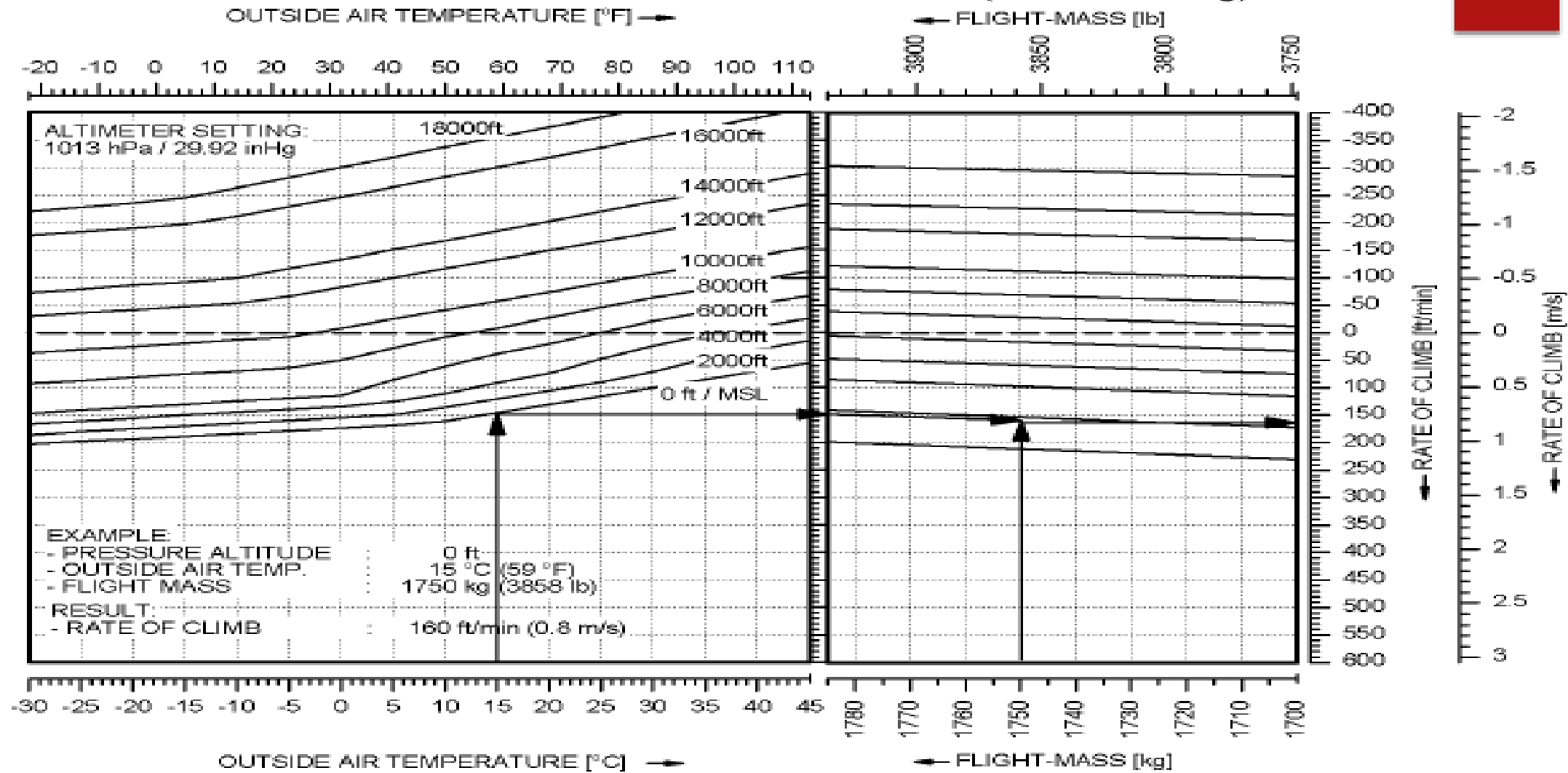
$$\text{Gradient [\%]} = \frac{\text{ROC [m/s]}}{\text{TAS [KTAS]}} \cdot 190$$

ONE ENGINE INOPERATIVE CLIMB / DESCENT



Conditions: Flaps: UP, Power: remaining engine MAX @ 2300 RPM / Dead engine: feathered+secured, Airspeed: 82 KIAS

ONE ENGINE INOPERATIVE CLIMB / DESCENT (above 1700 kg)



5.3.11 LANDING DISTANCE

- Conditions:
- POWER lever both IDLE
 - Flaps LDG
 - Runway level, asphalt surface, dry

Values for ISA and MSL, at 1700 kg (3748 lb), Approach Speed 76 KIAS	
Landing distance over a 50 ft (15 m) obstacle	572 m (1877 ft)
Ground roll	323 m (1060 ft)

NOTE

If MÄM 42-088 is carried out and OÄM 42-195 is not carried out, a landing with a mass between 1700 kg (3748 lb) and 1785 kg (3935 lb) constitutes an abnormal operating procedure.

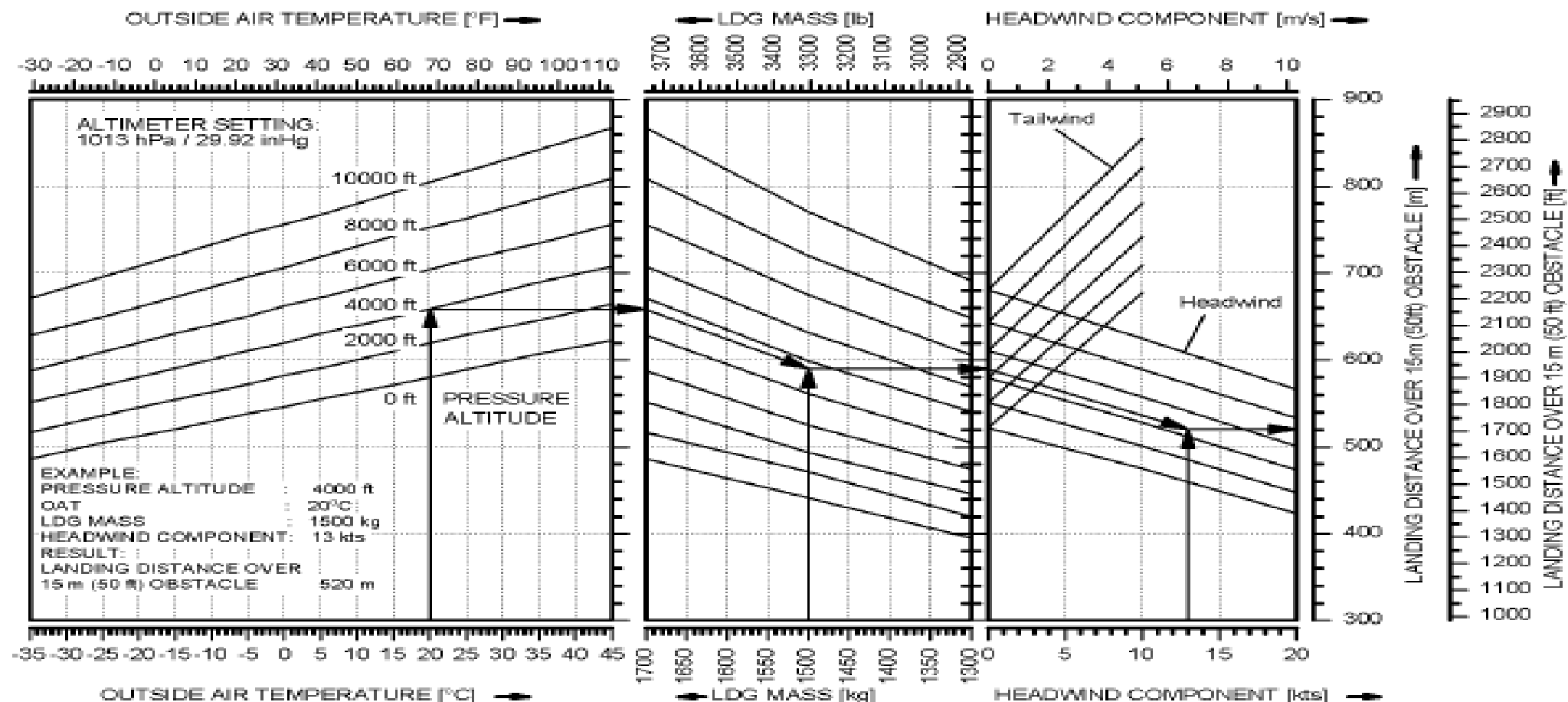
Values for ISA and MSL, at 1785 kg (3935 lb), Approach Speed 78 KIAS	
Landing distance over a 50 ft (15 m) obstacle	710 m (2329 ft)
Ground roll	397 m (1302 ft)

WARNING

For a safe landing the available runway length must be at least equal to the landing distance over a 50 ft (15 m) obstacle.

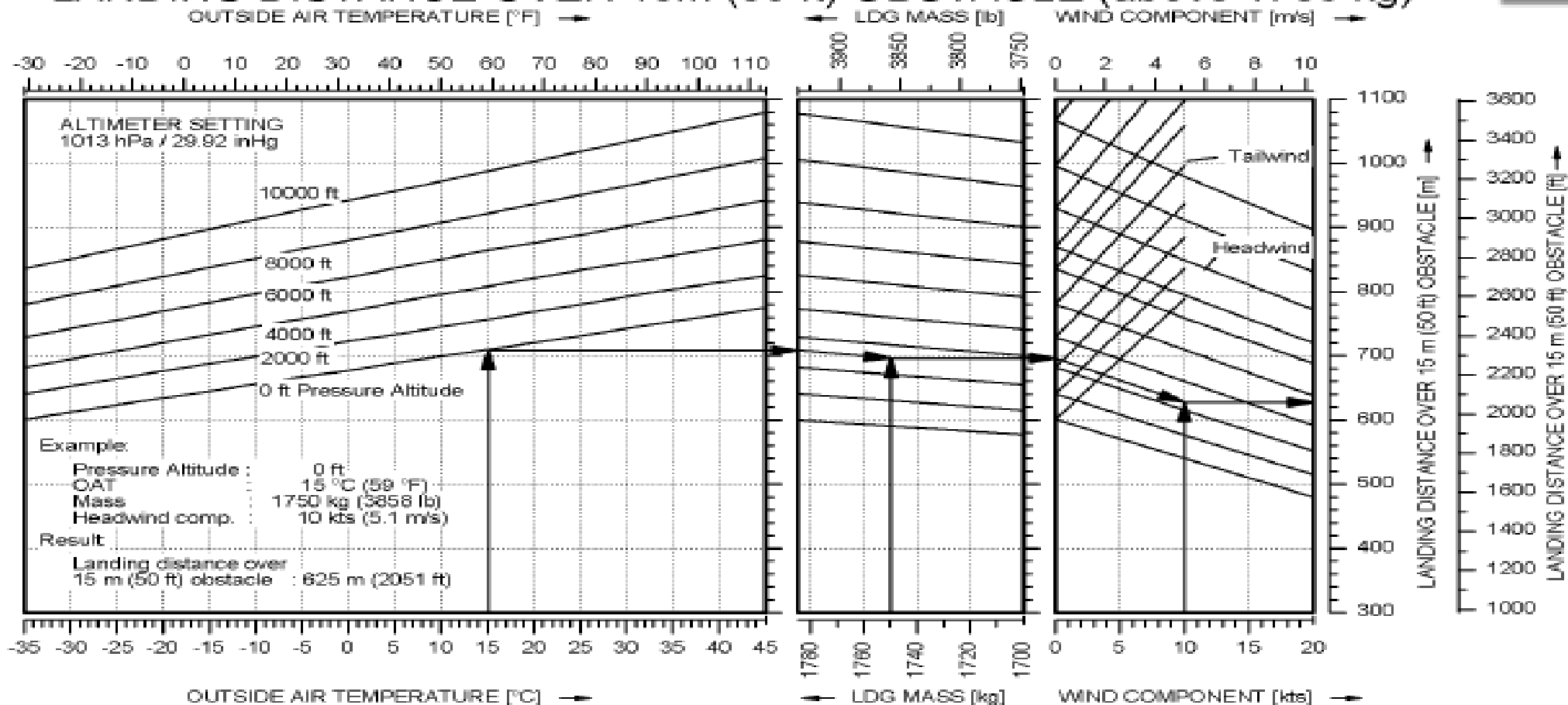
Landing Distance

LANDING DISTANCE OVER 15 m (50 ft) OBSTACLE



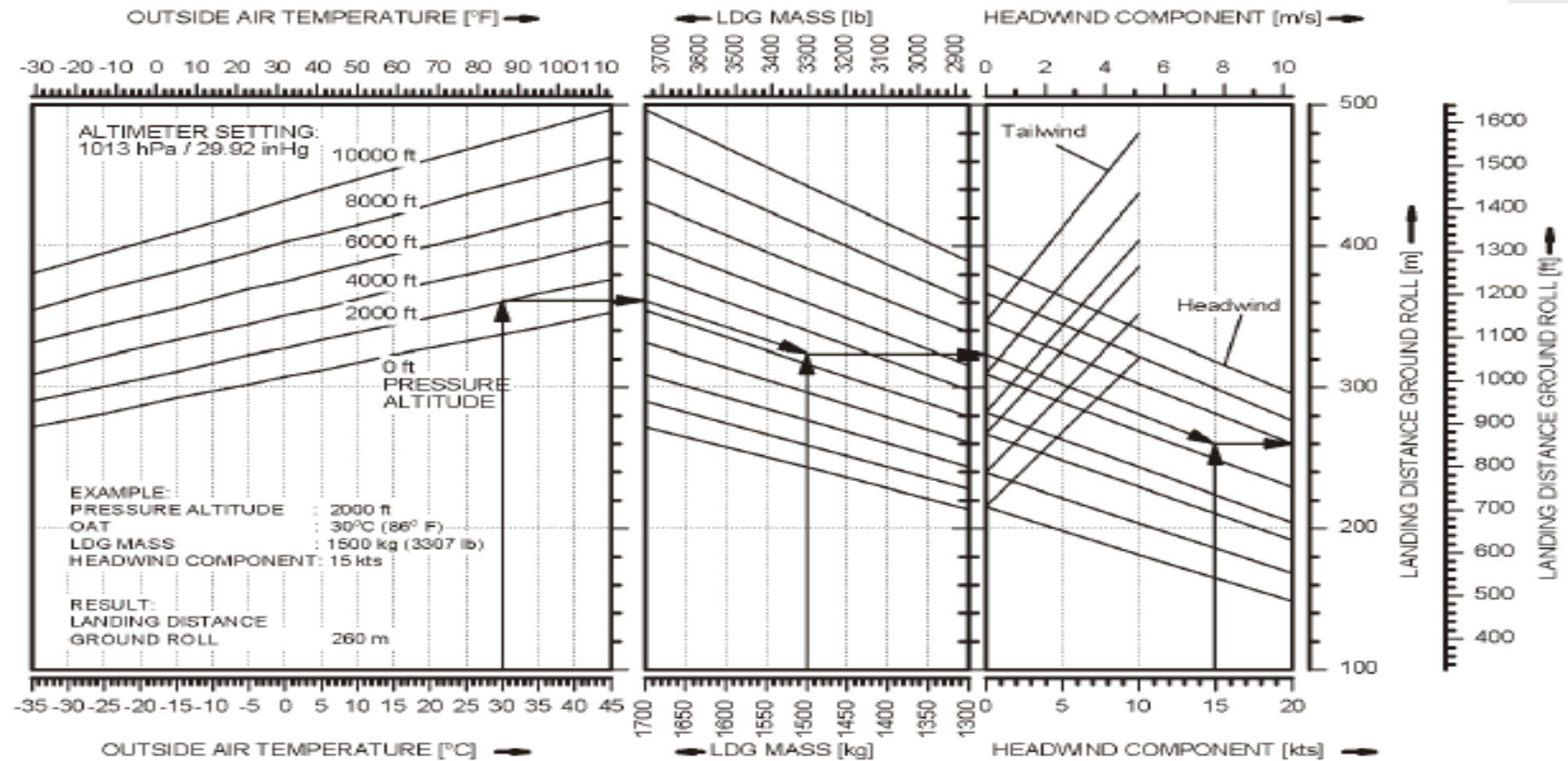
Conditions: Flaps: LDG, Power: both IDLE, Runway: level and hard, dry surface, Approach Speed: 76 KIAS

LANDING DISTANCE OVER 15m (50 ft) OBSTACLE (above 1700 kg)



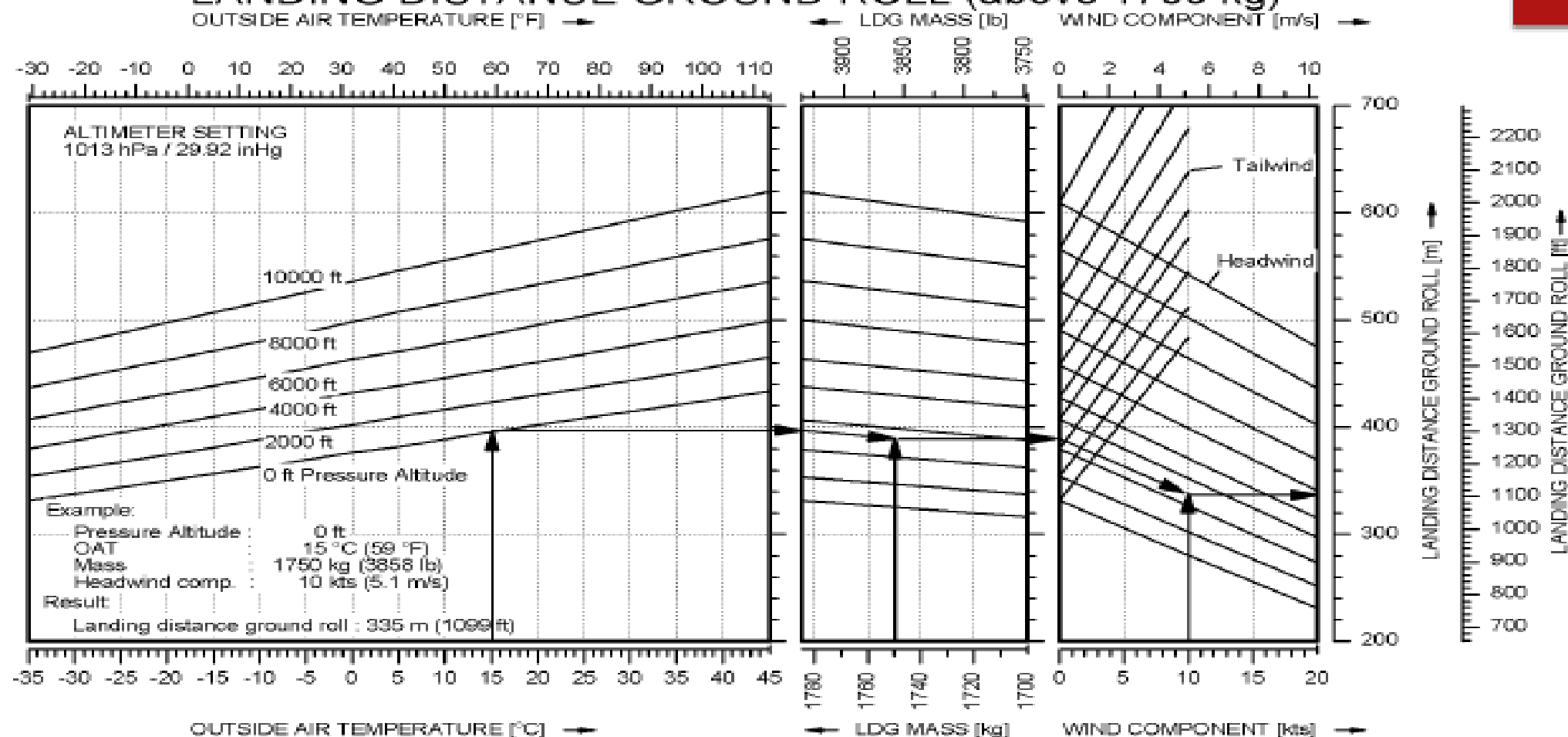
Conditions: Flaps: LDG, Power : both IDLE, Runway: level and hard, dry surface, Approach Speed: 78 KIAS

LANDING DISTANCE GROUND ROLL



Conditions: Flaps: LDG, Power: both IDLE, Runway: level and hard, dry surface, Approach Speed: 76 KIAS

LANDING DISTANCE GROUND ROLL (above 1700 kg)



Conditions: Flaps: LDG, Power: both IDLE, Runway: level and hard, dry surface, Approach Speed: 78 KIAS

Gradient of Climb on GO-AROUND

5.3.12 GRADIENT OF CLIMB ON GO-AROUND

Conditions:

- POWER lever both MAX @ 2300 RPM
- Flaps LDG
- Landing gear extended
- Airspeed:
 - up to 1700 kg (3748 lb) 76 KIAS
 - above 1700 kg (3748 lb) 78 KIAS

Value for ISA and MSL, at 1700 kg (3748 lb)	
Constant gradient of climb	5.25 % (equals 3.0° climb angle) or 400 ft/min

NOTE

If MÄM 42-088 is carried out and OÄM 42-195 is not carried out, a landing with a mass between 1700 kg (3748 lb) and 1785 kg (3935 lb) constitutes an abnormal operating procedure.

Value for ISA and MSL, at 1785 kg (3935 lb)	
Constant gradient of climb	4.30 % (equals 2.5° climb angle) or 340 ft/min