

CESSNA 152

Training Manual

By

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Red Sky Ventures and Memel CATS
© 2004

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Introduction

This training manual provides a technical and operational descriptions of the the Cessna 152 aeroplane.

The information is intended as an instructional aid to assist with type ratings or ab-initio training and is laid out according to training syllabus for ease of use.

This material does not supersede, nor is it meant to substitute any of the manufacturer's operation manuals. The material presented has been prepared from the basic design data obtained in the pilots operating handbook and from operational experience.

History

The Cessna aircraft company has a long and rich history. Founder Clyde Cessna built his first aeroplane in 1911, and taught himself to fly it!

He went on to build a number of innovative aeroplanes, including several race and award winning designs.

In 1934, Clyde's nephew, Dwane Wallace, fresh out of college, took over as head of the company. During the depression years Dwane acted as everything from floor sweeper to CEO, even personally flying company planes in air races (several of which he won!).



Illustration 1a Cessna 152

Under Wallace's leadership, the Cessna Aircraft Company eventually became the most successful general aviation company of all time.

Cessna first began production of two-seat light planes in 1946 with the model 120 which had an all aluminium fuselage and fabric covered wings.

This was followed by a nearly identical model the 140, with aluminium clad wings. More than 7,000 model 120-140's were sold over four years when Cessna stopped production in order to focus on four-seat aircraft.

Cessna 150

In 1957 the company decided there was a market for a two seat trainer and designed a tricycle geared version of the Model 140.

Following their standard tailwheel/tricycle model scheme, Cessna named the new aeroplane the 142, but for reasons now unknown changed their minds six days later and renamed it the 150.

Only 683 of the first model were built between 1957 and 1959. All were sold as 1959 models. By 1966 the plane had become enormously popular, over 3000 1966 C150F alone were built, Cessna began assembly in France under contract to Reims Aviation, and in 1967 the first C150 float option was offered.

By the end of production in 1978 there were 23,839 C150's built, including 1764 produced by Reims in France, 47 produced in Argentina under contract to Reims, and a total of 1079 Aerobats.

The Cessna 150 was equipped with a four cylinder 100 horsepower Continental O-200 engine. During its 18 year production history there were many changes to the C150 design. These changes included increased cabin space, inclusion of the omnivision rear window, improved control surface and cowling design, manual to electric flap, 12 Volt to 24 Volt electrical system, mixture vernier, key starter, and split master switches to name a few. Most of the changes and improvements throughout the C150 development can be considered as contributory to the initial appearance and success of the Cessna 152.

Cessna 152

In 1978 Cessna introduced the new revamped version of the C150, type certified as the C152, with a 110 horsepower Lycoming O-235 engine and modified airframe.

The Lycoming engine was chosen to make the 152 more tolerant of the new 100 octane fuel, as well as provide a long overdue increase in horsepower.

The cabin was widened slightly to make room for the increased girth of late 20th century pilots, and the maximum flap setting was reduced from 40 degrees to 30 degrees for a safer power to drag relationship.

Unlike the C150 model, there were few changes in 152's from one year to the next, and aside from minor technical and trim improvements, the C152 remained outwardly the same throughout the series' production history.

The last Model 152 rolled off the production line in 1985. In its relatively short 8 year production history, from 1978-1985, there were approximately 7,541 C152's produced worldwide, including 596 assembled by Reims in France, with a total of 396 aerobats.

Because of product liability exposure, Cessna, like most other light plane companies in the US, stopped building light aircraft altogether in the mid 1980's.

Today Cessna is once again in the light aircraft business, building 172's, 182's and 206's. Unfortunately, the high cost of production and insurance premiums make it unlikely that Cessna will reintroduce the Cessna 152. However in 2006, to compete in the light-sports-aircraft (LSA) category, they have unveiled the C162 Skycatcher as the new two seat trainer.

Although we are beginning to see many advances in light aircraft manufacturing, the Cessna 150/152 remains a favourite amongst pilots and flight schools for due to availability, affordability, and the time proven design and handling.

Both the C150 and C152, in all variations, are certified on the same FAA type certificate, No. 3A19.

Model History

The table below summarises the model history versus serial number and significant differences. The information is compiled from the type data certification summaries (TDC) and the technical information in the Cessna maintenance, parts manuals, and operating handbooks.

Models within the Series

All models of C152, those manufactured in Wichita by Cessna, and those manufactured or assembled under contract by Reims, both the aerobat and non aerobat versions are designated by ICAO as a 'C152'. The model designators listed below are the names the manufacturer has given to distinguish the different variants within the type series.

The C152 has only four model variants:

- C152, the Cessna 152 - standard model;
- A152, the Cessna 152 Aerobat, (sometimes called a C152A);
- F152, the Reims Cessna 152;
- FA152, the Reims Cessna 152 Aerobat, (sometimes called a F152A).

There was no deviation in the model designator throughout the years of manufacturer.

Aerobat models all have the following additional features:

- Strengthened main and tail spars and attachments;
- Viewing ports (windows) overhead the pilot/co-pilot seats;
- Quick release cabin doors;
- Full aerobatic harnesses;
- G-meter, and airframe 'g' limits increased to +4, -2;
- Removable seat cushions to facilitate a seat pack or backpack type parachute.

Asides from these additional features, the construction of the Aerobat is the same as the basic model for the respective year.

The C152 II and the C152T are not different models or type variants, but purchase options which were provided with the basic C152.

The C152II had additional avionics for instrument navigation, and additional interior finishes, resulting in a higher basic weight.

The C152T was an options package tailored specifically for sales to flight schools.

Model Versus Serial Number Modifications History

<i>Model</i>	<i>Serial Numbers</i>	Summary of Main Changes
1978		
<i>C152</i>	15279406-15282031	<p>Lycoming O-235-L2C engine rated at 110 HP, 28 volt electrical system, 30 degrees flap, a fuel capacity of 37.5 or 24.5 US gallons usable, McCauley propeller, gross weight 1670 lbs.</p> <p>Aileron droop rigged approximately 1 degree down, commencing serial numbers 15279474, A1520737, F15201429, and FA1520337.</p> <p>Aileron direct and carry through cable turnbuckles shifted from right wing to above headliner, from serial numbers 15281427, A1520786, F1521539, and FA1520353.</p> <p>Beginning with 15279630, F15201529, A1520742, FA1520348, the left hand cap is no longer vented, only the right cap is vented.</p>
<i>F152</i>	F15201449-F15201528	
<i>A152</i>	A1500433, A1520735-A1520808	
<i>FA152</i>	FA1520337-FA1520347	
1979		
<i>C152</i>	15282032-15283591	<p>Minor modifications to instrument panel layout. Exhaust gas temperature (EGT) indicator fitted.</p> <p>Right magneto changed to the Slick 4052 type magneto to match the left, providing impulse couplings on both magnetos to improve starting.</p> <p>Modified engine primer lines for more effective priming. Alternator Voltage Regulator replaced by Alternator Control Unit (ACU), and HIGH VOLTAGE light replaced by a LOW VOLTAGE light.</p> <p>Ignition harness changed from the right magento firing all bottom plugs and left all top plugs, to the right magneto firing bottom right and top left plugs, and the left bottom left and top right plugs, for improved performance and redundancy.</p> <p>Throttle, mixture, and propeller control cable ends changed from ball bearing-type to a pre-drilled bolt, washers castellated nut, and a cotter pin.</p> <p>Light switch added to dome light console and light switch for map light added at door pillar post. Rear view mirror in glareshield removed.</p> <p>Beginning with Aircraft 15283092 on. and A1520853 & on, a Prestolite Slower Turning starter is installed to improve starting characteristics.</p> <p>Clock changed to digital.</p> <p>Brake cylinder redesigned, improving overhaul times. Wheel fairings were not split from 1979, requiring main wheel disassembly for removal, replacements are split.</p>
<i>F152</i>	F15201529-F15201673	
<i>A152</i>	681, A1520809-A1520878	
<i>FA152</i>	FA1520348-FA1520357	

Model	Serial Numbers	Significant Changes and Features
1980		
<i>C152</i>	15283592- 15284541	Accelerator pump incorporated in carburettor. Modified windshield defrosters.
<i>F152</i>	F15201674- F15201808	Modified battery installation, eliminating battery box. Carb. heat source changed from the muffler to a shroud at #4 cylinder, beginning with 15284899, F15201894, A1520971 and FA1520378. Simulated wood instrument panels introduced.
<i>A152</i>	A1520879- A1520948	
<i>FA152</i>	FA1520358- FA1520372	
1981		
<i>C152</i>	15284542- 15285161	Spin-on oil filter now standard. Larger capacity battery contactor to reduce 'welding' occurrences. Integral intercom standard in trainer purchase options (C152T), optional on other versions. Avionics cooling fan introduced. Modified vertical fin and horizontal stabilizer attachment. Modified vacuum system. Modified bus bar. Cabin door latch system altered at serial numbers 15284730 and A1520961 to include a ball and spring plate. Interior vents changed at serial numbers 15284924, F15201894, A1520972, and FA1520378, to provide better access and more air supply.
<i>F152</i>	F15201809- F15201893	
<i>A152</i>	A1520949- A1520983	
<i>FA152</i>	FA1520373- FA1520377	
1982		
<i>C152</i>	15285162- 15285594	Additional fuel quick drain in belly below fuel selector. White toggle switches for avionics equipment introduced. On models with optional navigational equipment, the "Bow-tie" glideslope antenna was eliminated, and an antenna coupler is utilized to allow the nav receiver to receive glideslope signals. Wing root air vents are made smaller to allow for better sealing.
<i>F152</i>	F15201894- F15201928	
<i>A152</i>	A1520984- A1521014	
<i>FA152</i>	FA1520378- FA1520382	
1983		
<i>C152</i>	15285595- 15285833	Engine changed to Lycoming O-235-N2C, 108 HP to address lead fouling problems.

Model	Serial Numbers	Significant Changes and Features
<i>F152</i>	F15201929- F15201943	Avionics cooling fan improved. Vacuum system includes low-vacuum warning light. Gyro instrument installation redesigned to allow removal of gyro instruments from the front of the panel.
<i>A152</i>	A1521015- A1521025	
<i>FA152</i>	FA1520383- FA1520387	
1984		
<i>C152</i>	15285834- 15285939	Landing and taxi light wing mounted.
<i>F152</i>	F15201944- F15201952	
<i>A152</i>	A1521026- A1521027	
1985		
<i>C152</i>	15285940- 15286033	Aileron hinge changed at serial number 1525916 and A1521028.
<i>F152</i>	F15201953- F15201965	
<i>A152</i>	A1521028- A1521049	
<i>FA152</i>	FA1520388- FA1520415	
<i>FA152</i>	FA1520416- FA1520425	These serial numbers are listed by the manufacturer as produced in 1986, however all type certification information refer to production ceasing in 1985. It can be assumed no changes were made and the models were registered as 1985 builds.

Common Modifications

There are a large number of Supplemental Type Certificates issued by the FAA for modifications to the C152. The following lists some of the more commonly found.

Engine/Propeller Modifications

The 'Sparrowhawk' 125hp engine with Sensenich propeller is available from AirMods Inc. The installation includes a top overhaul, that is, larger pistons, and a modified propeller and spinner. The modifications can be done together or separately, as the engine and propeller upgrades are much more economic if completed with the routine overhaul schedules on each. The Sensenich propeller comes in three pitch options, which are an important consideration, as a climb pitch will disappoint

someone upgrading for speed, and likewise a cruise pitch, even with the higher horsepower may perform worse than a standard installation in the climb.

Lycoming O320 and O360 engine installations are available, providing increases in power to 150hp or 180hp, O&N Aircraft Technologies has one of the most popular options for this upgrade.

Note, on non-aerobat models, engine upgrades may impose restrictions on spinning because of the modified lift-weight couple. This may be of importance if looking at purchasing an aircraft or installing the upgrade for use in a flight school.

Tail Wheel

It is possible to convert the tricycle landing gear to a tail wheel version, providing shorter landing and takeoff distances and the more streamlined profile improves cruise speed. Many existing examples of this conversion can be found.

A tailwheel conversion involves strengthening of the fuselage and tail area for the new gear positions, removal of the nose wheel, alteration of the main gear, and addition of the tail wheel.

One of the most popular tail wheel conversions fitted to the C152 is the Texas Taildragger kit, from Aircraft Conversion Technologies, although they are no longer in operation which may cause problems with maintenance on existing installations. Tail wheel conversions are also available from Bush Conversions.

STOL and Speed Kits

Various STOL and speed kits are available, including the wing tip modifications, leading edge modifications, flap gaps seals, vortex generator (VG) kits, fairing and cowl modifications, and wing fences. One of the more common STOL kits is the Horton STOL, including wing tip fences, leading edge modifications and drooping wing tips, all acting to reduce stall speed, and reducing takeoff and landing speeds and thus distances.

Door Latch Modifications

Many door catch modifications are available to replace the pull to close type which often fail with wear resulting in poor closing and latching.

Note, door latch modifications that lock may not be applicable to Aerobats since they can operate in conflict with the quick release door hinges.

Fuel Modifications

Various fuel system modifications are available, including conversions to auto-fuel, auxiliary fuel tanks, additional sump (belly) drains and modified gascolators for removing water from the fuel system.

One of the most common auxiliary fuel tank modification is available from O&N Aircraft Modifications, providing 14 US gallons additional fuel, and featuring a baggage compartment tank with a transfer pump connected to the right wing. The Texas Ranger Fuel Tanks from Aircraft Conversion Technologies provide an additional 7USG per tank.

Terminology

Airspeed		
KIAS	Knots Indicated Airspeed	Speed in knots as indicated on the airspeed indicator.
KCAS	Knots Calibrated Airspeed	KIAS corrected for instrument error. Note this error is often negligible and CAS may be omitted from calculations.
KTAS	Knots True Airspeed	KCAS corrected for density (altitude and temperature) error.
Va	Max Manoeuvring Speed	The maximum speed for full or abrupt control inputs.
Vfe	Maximum Flap Extended Speed	The highest speed permitted with flap extended. Indicated by the top of the white arc.
Vno	Maximum Structural Cruising Speed	Sometimes referred to as "normal operating range". Should not be exceeded except in smooth conditions and only with caution. Indicated by the green arc.
Vne	Never Exceed speed	Maximum speed permitted, exceeding will cause structural damage. Indicated by the upper red line.
Vs	Stall Speed	The minimum speed before loss of control in the normal cruise configuration. Indicated by the bottom of the green arc. Sometimes referred to as minimum 'steady flight' speed.
Vso	Stall Speed Landing Configuration	The minimum speed before loss of control in the landing configuration, at the most forward C of G*. Indicated by the bottom of the white arc.
*forward centre of gravity gives a higher stall speed and so is used for certification		
Vx	Best Angle of Climb Speed	The speed which results in the maximum gain in altitude for a given horizontal distance.
Vy	Best Rate of Climb Speed	The speed which results in the maximum gain in altitude for a given time, indicated by the maximum rate of climb for the conditions on the VSI.
Vref	Reference Speed	The minimum safe approach speed, calculated as $1.3 \times V_{so}$.
Vbug	Nominated Speed	The speed nominated as indicated by the speed bug, for approach this is Vref plus a safety margin for conditions.

Vr	Rotation Speed	The speed which rotation should be initiated.
Vat	Barrier Speed	The speed to maintain at the 50ft barrier or on reaching 50ft above the runway.
	Maximum Demonstrated Crosswind	The maximum demonstrated crosswind during testing.
Meteorological Terms		
OAT	Outside Air Temperature	Free outside air temperature, or indicated outside air temperature corrected for gauge, position and ram air errors.
IOAT	Indicated Outside Air Temperature	Temperature indicated on the temperature gauge.
ISA	International Standard Atmosphere	The ICAO international atmosphere, as defined in document 7488. Approximate conditions are a sea level temperature of 15 degrees with a lapse rate of 1.98 degrees per 1000ft, and a sea level pressure of 1013mb with a lapse rate of 1mb per 30ft.
	Standard Temperature	The temperature in the International Standard atmosphere for the associated level, and is 15 degrees Celsius at sea level decreased by two degrees every 1000ft.
	Pressure Altitude	The altitude in the International Standard Atmosphere with a sea level pressure of 1013 and a standard reduction of 1mb per 30ft. Pressure Altitude would be observed with the altimeter subscale set to 1013.
	Density Altitude	The altitude that the prevailing density would occur in the International Standard Atmosphere, and can be found by correcting Pressure Altitude for temperature deviations.
Engine Terms		
BHP	Brake Horse Power	The power developed by the engine (actual power available will have some transmission losses).
RPM	Revolutions per Minute	Engine drive and propeller speed.
	Static RPM	The maximum RPM obtained during stationery full throttle operation

Weight and Balance Terms		
	Moment Arm	The horizontal distance in inches from reference datum line to the centre of gravity of the item concerned, or from the datum to the item 'station'.
C of G	Centre of Gravity	The point about which an aeroplane would balance if it were possible to suspend it at that point. It is the mass centre of the aeroplane, or the theoretical point at which entire weight of the aeroplane is assumed to be concentrated. It may be expressed in percent of MAC (mean aerodynamic chord) or in inches from the reference datum.
	Centre of Gravity Limit	The specified forward and aft points beyond which the CG must not be located. Typically, the forward limit primarily effects the controllability of aircraft and aft limits stability of the aircraft.
	Datum (reference datum)	An imaginary vertical plane or line from which all measurements of arm are taken. The datum is established by the manufacturer.
	Moment	The product of the weight of an item multiplied by its arm and expressed in inch-pounds. The total moment is the weight of the aeroplane multiplied by distance between the datum and the CG.
MZFW	Maximum Zero Fuel Weight	The maximum permissible weight to prevent exceeding the wing bending limits. This limit is not always applicable for aircraft with small fuel loads.
BEW	Basic Empty Weight	The weight of an empty aeroplane, including permanently installed equipment, fixed ballast, full oil and unusable fuel, and is that specified on the aircraft mass and balance documentation for each individual aircraft.
SEW	Standard Empty Weight	The basic empty weight of a standard aeroplane, specified in the POH, and is an average weight given for performance considerations and calculations.
OEW	Operating Empty Weight	The weight of the aircraft with crew, unusable fuel, and operational items (galley etc.).
	Payload	The weight the aircraft can carry with the pilot and fuel on board.
MRW	Maximum Ramp Weight	The maximum weight for ramp manoeuvring, the maximum takeoff weight plus additional fuel for start taxi and runup.

MTOW	Maximum Takeoff Weight	The maximum permissible takeoff weight and sometimes called the maximum all up weight, landing weight is normally lower as allows for burn off and carries shock loads on touchdown.
MLW	Maximum Landing Weight	Maximum permissible weight for landing. Sometimes this is the same as the takeoff weight for smaller aircraft.
<i>Note: The correct technical is 'mass' instead of 'weight' in all of these terms, however in everyday language and in many aircraft operating manuals the term weight remains in common use. In this context there is no difference in meaning and the terms may be interchanged.</i>		
Other		
AFM	Aircraft Flight Manual	These terms are inter-changeable and refer to the approved manufacturer's handbook. General Aviation manufacturers from 1976 began using the term 'Pilot's Operating Handbook', early manuals were called Owner's Manual and most legal texts use the term AFM.
POH	Pilot's Operating Handbook	
PIM	Pilot Information Manual	A Pilot Information Manual is a new term, coined to refer to a POH or AFM which is not issued to a specific aircraft

Useful Factors and Formulas

Conversion Factors			
Lbs to kg	1kg = 2.204lbs	kgs to lbs	1lb = .454kgs
USG to Lt	1USG = 3.785Lt	lt to USG	1lt = 0.264USG
Lt to Imp Gal	1lt = 0.22 Imp G	Imp.Gal to lt	1Imp G = 4.55lt
NM to KM	1nm = 1.852km	km to nm	1km = 0.54nm
NM to StM to ft	1nm = 1.15stm 1nm = 6080ft	Stm to nm to ft	1 stm = 0.87nm 5280ft
FT to Meters	1 FT = 0.3048 m	meters to ft	1 m = 3.281 FT
Inches to Cm	1 inch = 2.54cm	cm to inches	1cm = 0.394"
Hpa(mb) to "Hg	1mb = .029536"	" Hg to Hpa (mb)	1" = 33.8mb

AVGAS FUEL Volume / Weight SG = 0.72

Litres	Lt/kg	kgs	Litres	lbs/lts	Lbs
1.39	1	0.72	0.631	1	1.58

Crosswind Component per 10kts of Wind

Deg	10	20	30	40	50	60	70	80
Kts	2	3	5	6	8	9	9	10

Formulas

Celsius (C) to Fahrenheit (F)	$C = 5/9 \times (F-32),$ $F = C \times 9/5 + 32$
Pressure altitude (PA)	$PA = \text{Altitude AMSL} + 30 \times (1013 - QNH)$ Memory aid – Subscale up/down altitude up/down
Standard Temperature (ST)	$ST = 15 - 2 \times PA/1000$ ie. 2 degrees cooler per 1000ft altitude
Density altitude (DA)	$DA = PA + (-) 120\text{ft/deg above (below) ST}$ i.e. 120ft higher for every degree hotter than standard
Specific Gravity	$SG \times \text{volume in litres} = \text{weight in kgs}$
One in 60 rule	1 degree of arc \approx 1nm at a radius of 60nm i.e degrees of arc approximately equal length of arc at a radius of 60nm
Rate 1 Turn Radius	$R = \text{TAS per hour}/60/\pi$ or $\text{TAS per minute}/\pi$ $R \approx \text{TAS per hour}/180$ (Where π (pi) \approx 3.14)
Radius of Turn Rule of Thumb	Radius of Turn lead allowance \approx 1% of ground speed (This rule can be used for turning on to an arc – eg at 100kts GS, start turn 1nm before the arc limit)
Rate 1 Turn Bank Angle Rule of Thumb	degrees of bank in a rate one turn \approx $GS/10+7$

Pilot's Operating Handbook Information

The approved manufacturer's handbook, normally termed Pilot's Operating Handbook (POH) or Aircraft Flight Manual (AFM), or owners manual, is issued for the specific model and serial number, and includes all applicable supplements and modifications. It is legally required to be on board the aircraft during flight, and is the master document for all flight information.

In 1975, the US General Aviation Manufacturer's Association introduced the 'GAMA Specification No. 1' format for the 'Pilot's Operating Handbook' (POH). This format was later adopted by ICAO in their Guidance Document 9516 in 1991, and is now required for all newly certified aircraft by ICAO member states. Most light aircraft listed as built in 1976 or later, have provided Pilot's Operating Handbooks (POHs) in this format.

This format was designed to enhance safety by not only standardising layouts but also considering ergonomic use in flight. It is therefore recommended that pilots become familiar with the order and contents of each section, as summarised in the table below.

Section 1	General	Definitions and abbreviations
Section 2	Limitations	Specific operating limits, placards and specifications
Section 3	Emergencies	Complete descriptions of action in the event of any emergency or non-normal situation
Section 4	Normal Operations	Complete descriptions of required actions for all normal situations
Section 5	Performance	Performance graphs, typically for stall speeds, airspeed calibration, cross wind calculation, takeoff, climb, cruise, and landing
Section 6	Weight and Balance	Loading specifications, limitations and loading graphs or tables
Section 7	Systems Descriptions	Technical descriptions of aircraft systems, airframe, controls, fuel, engine, instruments, avionics and lights etc.
Section 8	Servicing and maintenance	Maintenance requirements, inspections, stowing, oil requirements etc.
Section 9	Supplements	Supplement sections follow the format above for additional equipment or modification.
Section 10	Safety Information	General safety information and helpful operational recommendations which the manufacturer feels are pertinent to the operation of the aircraft

For use in ground training, or reference prior to flight, this text should be read in conjunction with the POH from on board the aircraft you are going to be flying. Even if you have a copy of a POH for the same model C182, the aircraft you are flying may have supplements for modifications and optional equipment which affect the operational performance.

AIRCRAFT TECHNICAL INFORMATION

The Cessna 152 aeroplane is a single engine, two-seat, high-wing monoplane aircraft, equipped with tricycle landing gear and designed for general utility purposes.

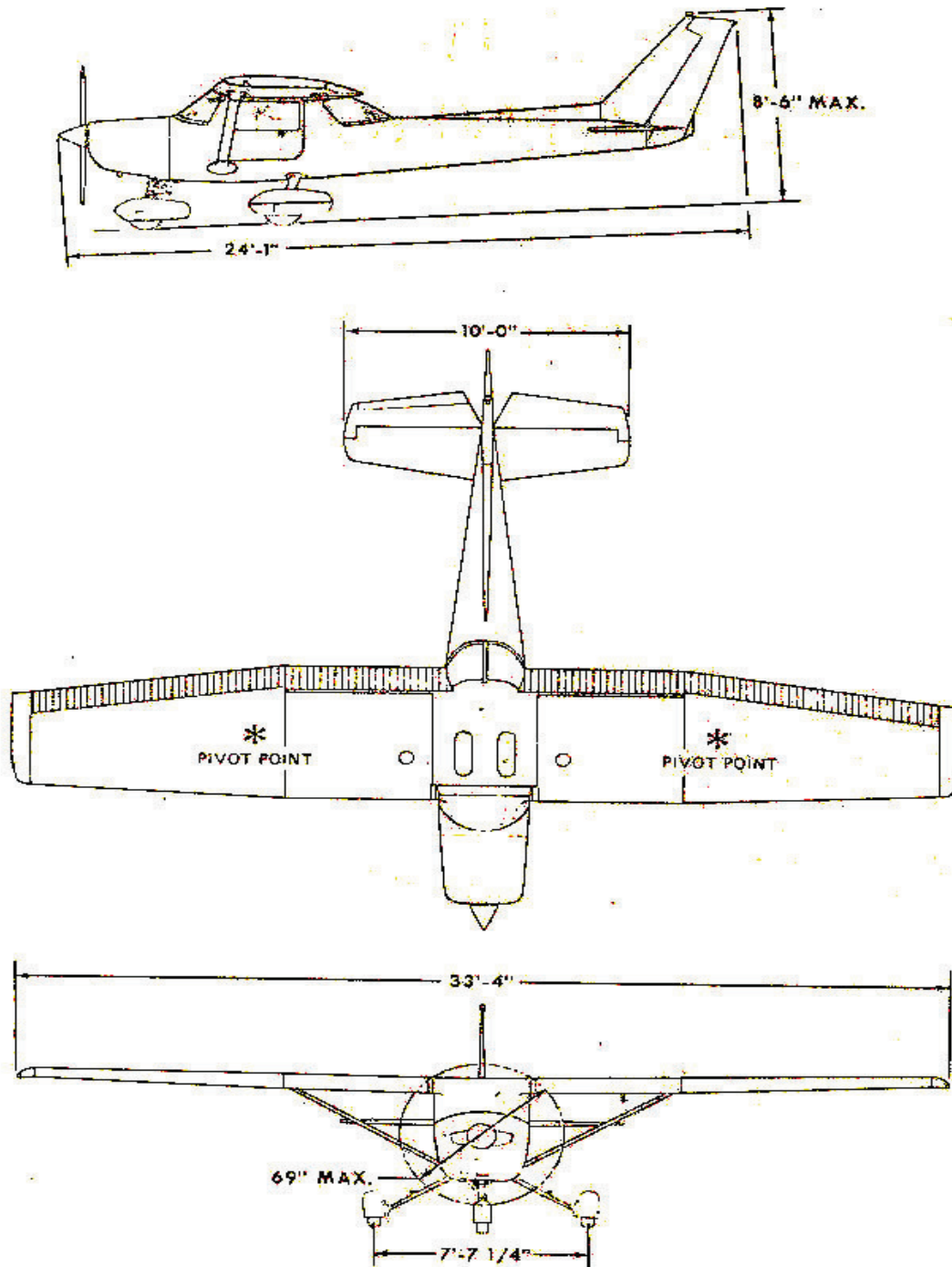


Illustration 2a Cessna 152 Profiles

Airframe

The airframe is a conventional semi-monocoque type consisting of formed sheet metal bulkheads, stringers and stressed skin.

Semi-monocoque construction is a light framework covered by skin that carries much of the stress. It is a combination of the best features of a strut-type structure, in which the internal framework carries almost all of the stress, and the pure monocoque where all stress is carried by the skin.

The fuselage forms the main body of the aircraft to which the wings, tail section and undercarriage are attached. The main structural features are:

- front and rear carry through spars for wing attachment;
- a bulkhead and forgings for landing gear attachment;
- a bulkhead and attaching plates for strut mounting;
- four stringers for engine mounting attached to the forward door posts.

The wings are all metal, semi-cantilever type with a struts spanning the inner section of the wing. They contain the integral ie. non bladder type fuel tanks.

The empennage or tail assembly consists of the vertical stabilizer and rudder, horizontal stabilizer and elevator.

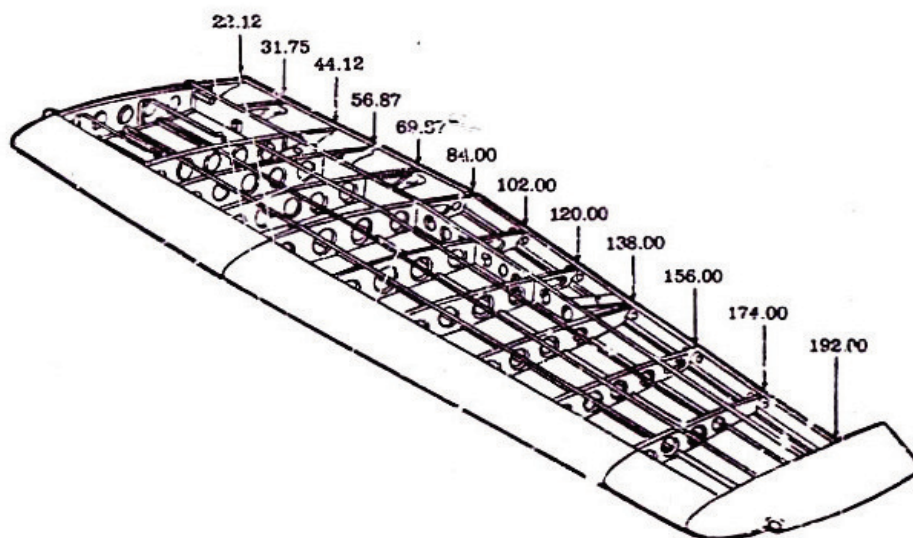


Illustration 2b Wing Construction

The construction of the wing and empennage sections consists of:

- a front (vertical stabilizer) or front and rear spar (wings/horizontal stabilizer);
- formed sheet metal ribs;
- doublers and stringers;
- wrap around and formed sheet metal/aluminium skin panels;
- control surfaces, flap and trim assembly and associated linkages.

Seats and Seat Adjustment

The seating arrangement consists of two separate adjustable seats for the pilot and co-pilot or front passenger, and an optional auxiliary child's seat (if installed) aft of the front seats.

The pilot and copilot seats are adjustable in forward and aft position, and for seat height and back inclination. Seat back and height should be adjusted to ensure adequate visibility and control *before* start-up.

When adjusting the seats forward and aft care should be taken to ensure the position is locked. Seat locks are available and installed on many aircraft following accidents involving slipping of seat position during critical phases of flight.

To ensure the seat is secure, the vertical pin attached to the seat must be firmly positioned down in the seat rail holes (displayed in the picture above). Ensure the seat is secure by applying pressure forwards and backwards to ensure it will not come loose from the rail during movement.

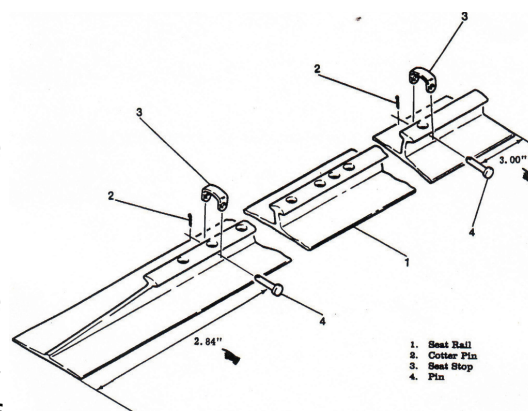


Illustration 2C Seat Rail

During pre-flight, the seat rail, mountings and mounting pin should be checked for integrity. The rails are prone to cracking around the weak points created by the locking and fastening holes, the locking pin may be loose or the spring worn, and the rails can sometimes come loose, without the pilot being aware, when the seat is moved too far forward or aft.

Doors

There are two entrance doors provided, one on the left and one on the right, and a baggage door at the rear left side of the aircraft.

The door latch is a pull to close, quick release type latch, and can only be locked from the outside.

Some aircraft may have a modified interior door latch installed to enable locking the door from the inside, various modifications are available.

Baggage Compartment

The baggage compartment consists of the area from the back of the rear passenger seats to the aft cabin bulkhead. A baggage shelf, above the wheel well, extends aft from the aft cabin bulkhead. Access to the baggage compartment and the shelf is gained through a lockable baggage door on the left side of the airplane, or from within the airplane cabin.

When loading the airplane, children should not be placed or permitted in the baggage compartment, unless an approved auxiliary child seat is installed.

Any material that may be hazardous to the airplane or occupants should never be placed anywhere in the aircraft. This includes items such as petrol ferry tanks, lead acid batteries, common household solvents such as paint thinners and many more. Items such as these can cause life threatening consequences from incapacitation due to exposure to leaking fumes, cabin fire caused by spillage combined with a static spark, explosion under pressure changes, or result in serious corrosion damage to the airframe. If any doubt exists, consult the IATA guidelines for permitted quantities of dangerous goods.

When using an approved auxiliary child seat, it is important to ensure that loading is completed within the aircraft limits, for the maximum mass and the position of the centre of gravity. More details on loading are provided in the Performance Section.

Flight Controls

The aeroplane's flight control system consists of conventional aileron, rudder and elevator control surfaces. The control surfaces are manually operated through mechanical linkages to the control wheel for the ailerons and elevator, and rudder/brake pedals for the rudder. A manually-operated elevator trim tab is provided and installed on the right elevator.

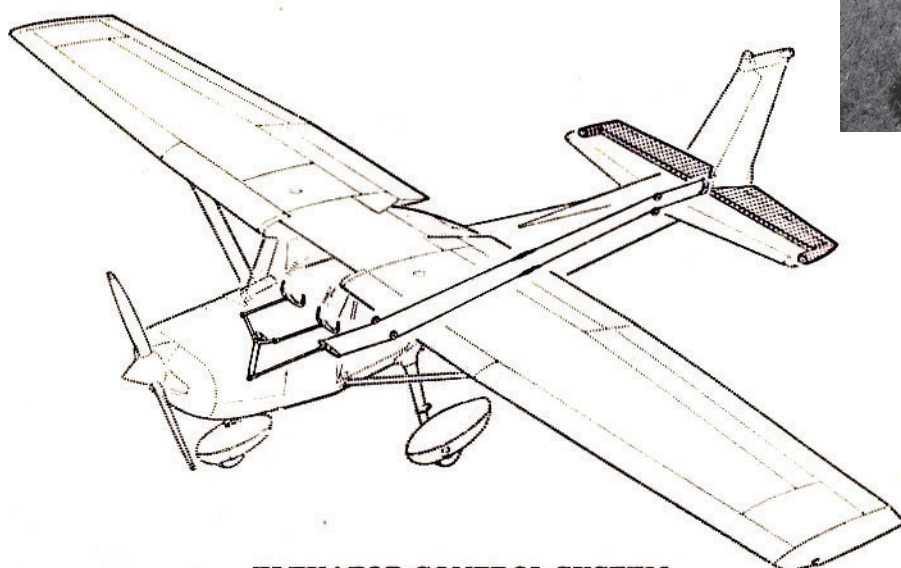
The control surfaces are formed in a similar way to the wing and tail section with the inclusion of the balance weights, actuation system (control cables etc) and trim tabs. Control actuation is provided by a series of push-pull rods, bellcranks, pulleys and cables with the required individual connections.

Elevator

The elevator is hinged to the rear part of the horizontal stabilizer on both sides. The main features are:

- an inset hinge with balance weights;
- an adjustable trim tab on the right side.

The leading edge of both left and right elevator tips incorporate extensions which contain the balance weights which aerodynamically and mechanically assists with control input reducing the force required to move the control.



ELEVATOR CONTROL SYSTEM

Illustration 3a Elevator and Elevator Control Connections



Engine & Engine Controls

The engine installation on the Cessna 152 is a four cylinder horizontally opposed, air-cooled, carburettor engine.

The engine installation is:

- Prior to 1983 a Lycoming O-235-L2C, developing 110 horsepower at 2550 rpm at sea level;
- 1983 and later a Lycoming O-235-N2C, developing 108 horsepower at 2550 rpm at sea level.

The total time before overhaul (TBO) recommended by Avco Lycoming for the 235 series is either 2000 or 2400 hours depending on the engine and engine components fitted.

The Cessna 152 is equipped with a two-bladed, fixed pitch, aluminum alloy propeller. The propeller is approximately 1.75 metres (69 inches) in diameter, with a static rpm of 2280 to 2380rpm.

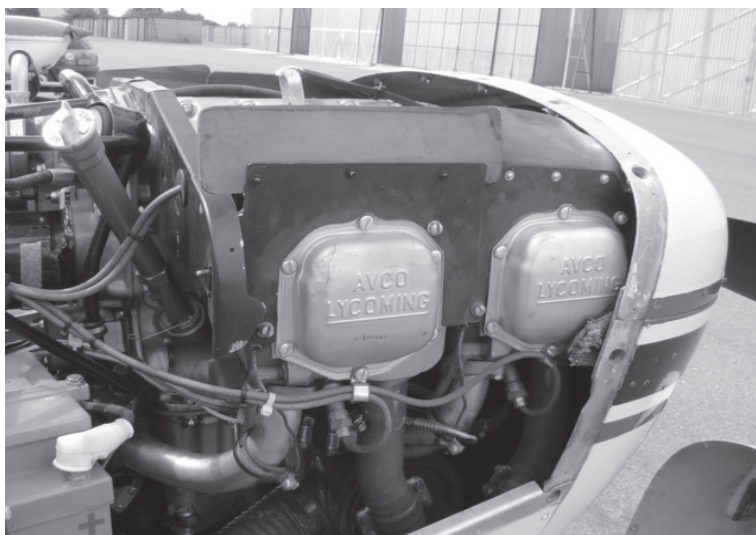


Illustration 5a Engine Installation

Engine Controls

The engine control and monitoring consists of:

- Throttle Control;
- Mixture Control;
- Carb. Heat selector;
- Engine monitoring gauges;
 - Tachometer;
 - Oil temperature and pressure;
 - Exhaust Gas Temperature (1979 models on);
 - Cylinder Head Temperature (optional).

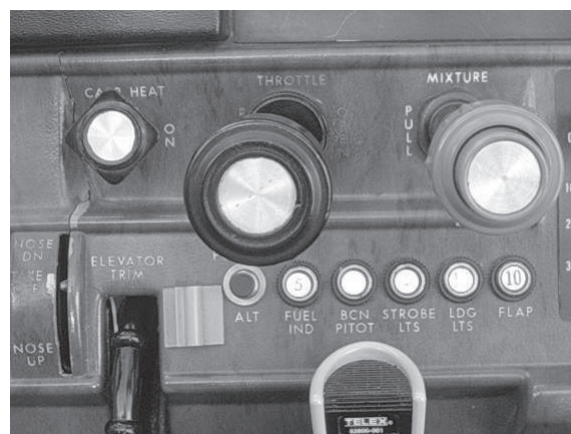


Illustration 5b Engine Controls

Throttle

Engine power is controlled by a throttle, located on the lower center portion of the instrument panel.

The throttle controls a throttle valve (or butterfly) – an oval metal disc pivoted on a central spindle that is perpendicular to the axis of the carburettor's manifold. The closed position of the valve is when the disc is rotated to an angle of about 70° to the axis of the manifold, preventing all but enough fuel/air for idling to pass through the manifold. When the valve is rotated to a position parallel to the axis of the manifold it offers very little restriction to airflow. This is the fully open position of the valve providing maximum fuel/air mixture to the manifold.

The throttle control operates in a conventional manner:

- **full forward** position, the throttle is **open** and the engine produces **maximum** power;
- **full aft** position, it is **closed** and the engine is **idling** or windmilling.

The picture below shows open and closed positions of the throttle butterfly.

Throttle in Open Position



Throttle in Closed Position



Illustration 5c Throttle Butterfly

Throttle Friction Nut

A friction lock, which is a round knurled disk, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it. This allows for reducing friction for smooth operations when frequent or large power changes are required or increasing friction when a fixed power setting or minimum changes are required.

Mixture

The mixture control is a red vernier type control for adjusting fuel/air ratio.

The mixture is used in the conventional way as follows:

- **full forward** position is the **fully rich** position (maximum fuel to air ratio);
- **full aft** position is the **idle cut-off** position (no fuel).

Electrical System

Electrical energy for the aircraft is supplied by a 28-volt, direct-current, single wire, negative ground, electrical system.

Battery

A 24-volt battery supplies power for starting and furnishes a reserve source of power in the event of alternator failure.

The battery capacity will be either

- 14 amp-hour standard (early 1978);
- 17 amp-hour optional (early 1978);
- 12.75 amp-hour standard;
- 15.5 amp-hour optional.

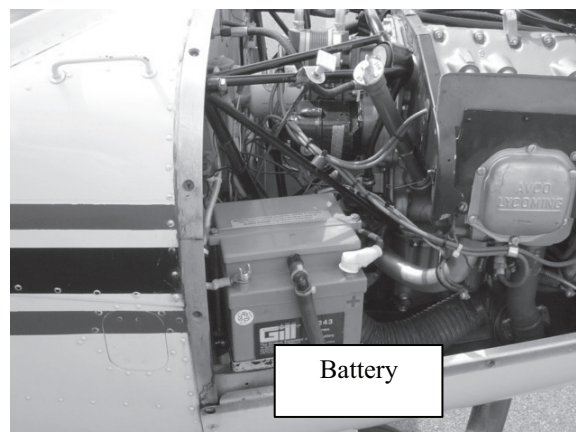


Figure 7a Battery Installation Post 1980

The amp-hour is the capacity of the battery to provide a current for a certain time. A 14 amp-hour battery is capable of steadily supplying a current of 1 amp for 14 hours and 7 amp for 2 hours and so on.

The battery is mounted on the right forward side of the firewall, as indicated in the picture above. Pre 1980 models additionally have a battery box for mounting.

Batteries should not be serviced unless under supervision of an approved maintenance organisation. Although most batteries are refilled with distilled water, some require refilling with electrolyte comprising a mix of water and acid, the composition of which is important to proper battery operation. Servicing requirements specific to the battery part number are contained within the maintenance manuals and service bulletins kept by the maintenance provider.

Alternator

A 60 amp engine-driven alternator is the normal source of power during flight and maintains a battery charge, controlled by a voltage regulator/alternator control unit.

A 28-volt electrical system with 24-volt battery means that because the alternator provides 28-volt power, which is more than battery power, the battery charge is maintained while in normal operations.

An alternator needs a small pre-charge, approximately 3 Volts to operate. In the case of a battery which is completely discharged (flat), if the engine is started by hand swinging the propeller, the alternator will not be capable of generating a charge. It is far preferable to find a ground power source, even for example a truck battery, and follow the external power starting procedure (see further below).

Ground (External) Power Receptacle

An optional ground power receptacle may be installed for easy connection of an external electrical supply. The ground power receptacle is mounted on the left side of the firewall with access via a small door in the engine cowling.

Ground power, or external supply of electrical power, can be very useful for extended use of electrical equipment on the ground, for operation of pre-heat in extreme cold weather operations, and for starting when the battery is flat.

Before connecting an external power source, it is important that the master switch be turned "ON". This will close the battery contactor and enable the battery to absorb transient voltages which otherwise might damage the electronic equipment. It will also provide excitation of the alternator field in the event that the battery is completely dead. Because the procedure is not very familiar, there may be a tendency to forget this important step, readers are reminded, for this reason unfamiliar procedures should always be conducted with reference to the Pilot's Operating Handbook.

Electrical Equipment

The following standard equipment on the Cessna 152 requires electrical power for operation (there may be additional optional equipment which uses electrical power):

- Fuel quantity indicators;
- Engine temperature gauges;
- Turn Coordinator;
- All internal and external lights, including warning lights;
- Pitot heat;
- Wing flaps;
- Starter;
- All avionics equipment.

System Protection and Distribution

Electrical power for electrical equipment and electronic installations is supplied through the split bus bar. The bus bar is interconnected by a wire and attached to the circuit breakers on the lower, centre of the instrument panel.

The circuit breakers are provided to protect electrical equipment from current overload. If there is an electrical overload or short-circuit, a circuit breaker (CB) will pop out and break the circuit so that no current can flow through it. It is normal procedure (provided there is no smell or other sign of burning or overheating) to reset a CB once only, after a cooling period, by pushing

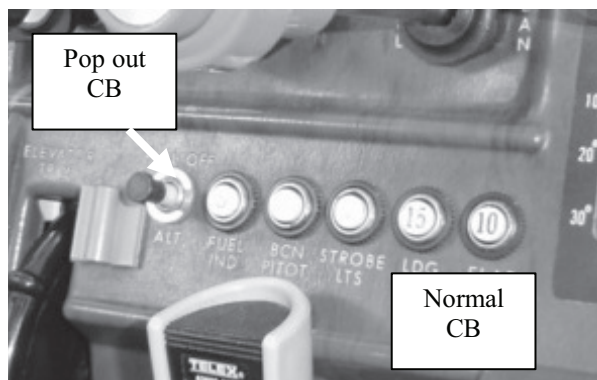


Figure 7b Circuit Breakers



Check for security, condition of hydraulic lines, disc brake and all nuts.



Use sampler cup and drain a small quantity of fuel from tank sump quick-drain valve to check for water, sediment and proper fuel grade.

Nose



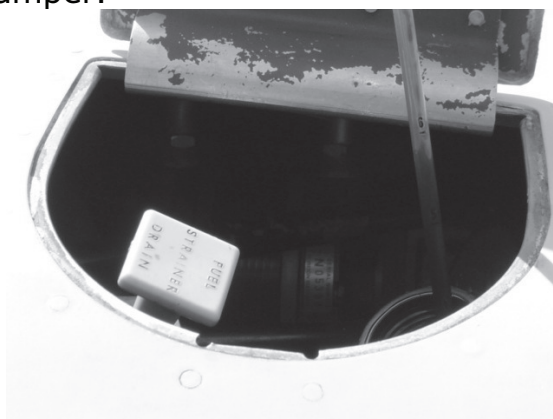
Confirm security of nuts and split pins, inspect state of tyre.



Check freedom of operating linkage, and security and state of shimmy damper.



Check condition and cleanliness of landing light. Air filter should be clear of any dust or other foreign matter. Visually check exhaust for signs of wear, if engine is cool check exhaust is secure.

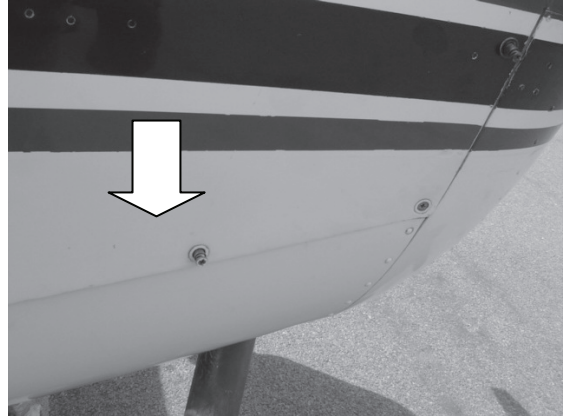


Open inspection cover, check oil level. Minimum oil 4 quarts. Before first flight of the day and after each refuelling, pull out fuel strainer to check the fuel sample. Check strainer drain closed.



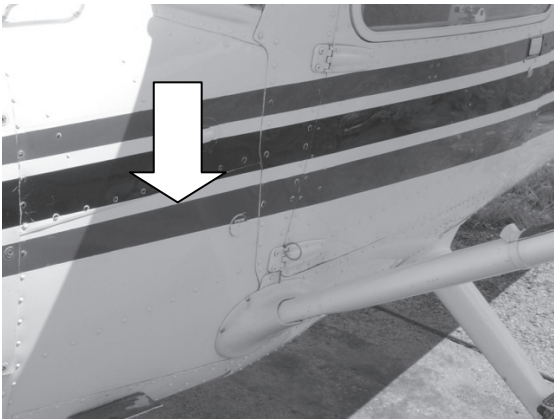
Check propeller and spinner for nicks and security. Ensure propeller blades and spinner cover is secure. The propeller may be turned through to assist with pre-start lubrication.

Always treat the propeller as live.

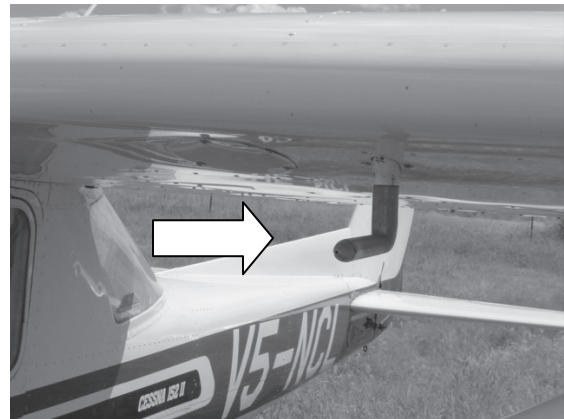


Check security and condition of engine cowling. On the picture nut indicated by arrow is unsecured.

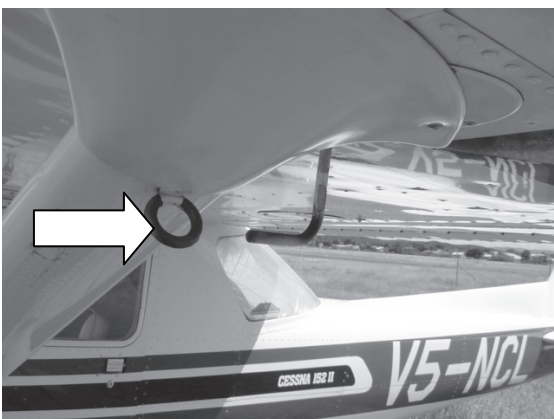
Differences on the Left Side



Check the static vent for any sign of blockage.



Remove the pitot tube cover, and check the pitot tube for any sign of blockage.



Check the fuel tank vent for security and a clear opening passage.

Final Inspection

Check all chocks and covers are removed and the aircraft is in a position to safely taxi without excessive manoeuvring or power application.

Passenger Brief

After completion of the preflight inspection and preferably before boarding the aircraft, take some time to explain to the passenger the safety equipment, safety harnesses and seat belts, operation of the doors/windows and conduct during flight.

The following items should be included:

- Location and use of the Fire Extinguisher;
- Location and use of the Axe;
- Location of the First Aid Kit;
- Location of emergency and normal water;
- Location of any other emergency or survival equipment;
- Latching, unlatching and fastening of safety harnesses;
- When harnesses should be worn, and when they must be worn;
- Opening, closing and locking of doors and windows;
- Actions in the event of a forced landing or ditching;
- Cockpit safety procedures and passenger conduct during critical phases of flight.

In-Flight Operations

Before Start

Before engine start or priming, all controls should be set in the appropriate positions, the instrument panel set up and pre-start check completed. The panel set up should be a flow through in a logical order (termed a 'flow' pattern) to ensure all equipment is set up correctly, serviceable and accessible, followed by a pre-start check, where applicable.

To provide sufficient fuel for starting the mixture should be full rich at all altitudes. It must be remembered, above approximately 3000ft field elevations the mixture should be leaned after successful starting, to prevent spark plug fouling during low power operations.

Before start checklists may be broken down into 'master off' and 'master on' checks, or more correctly named 'before start', and 'ready to start' checks. The latter items are done only once the aircraft has a start clearance, and is in a position to immediately start the engine. The reason for splitting up the checklist is that certain items such as selecting the master on and priming the engine ideally should not be done too far in advance of the start, as the delay will run down the battery and reduce the effectiveness of the priming.

- Typical after landing checks are as follows:
- **Cowl Flaps** – FIXED;
 - **Mixture** – SET for taxi;
 - **Flaps** – UP;
 - **Strobes and Landing Light** – OFF;
 - **Transponder** – STANDBY.

Taxi and Shutdown

Taxi should be planned to suit engine cooling requirements when needed. If you are operating on rough gravel remember to avoid needing to operate the aircraft stationary at idle for prolonged periods.

In a normally aspirated engine, providing the approach was accomplished without using excessive amounts of power, in most cases the taxi should provide sufficient time for cooling down the engine.

Before completing the shutdown, it may be desired to complete a dead-cut check to ensure all magneto positions, in particular the OFF position is working, so the propeller is not left 'live'.

Shutdown again can then be accomplished in a flow pattern, followed up with a checklist where available.

- Typical shutdown checks are as follows:
- **Avionics** – OFF;
 - **Mixture** – CUTOFF;
 - **Magnetos** – OFF;
 - **Master** – OFF;
 - **Control Lock** – IN;
 - **Flight Time/Hour Metre** – RECORDED;
 - **Tie Downs/Screens/Covers** – FITTED.

Circuit Pattern

The standard circuit pattern, unless published otherwise, is the left circuit pattern at 1000ft above ground for piston engine aeroplanes.

The circuit pattern may differ from airport to airport. Ask your instructor, the briefing office or consult the relevant aeronautical information publication for the pattern on your airfield.

The circuit pattern contains all the critical manoeuvres required for a normal flight, condensed into a short space of time. It is a great way to learn the critical flight checks, practice manoeuvres and improve overall flying skills.

Note: The following provides guidelines for all the checks required during flight. Some checks have been repeated here to provide a complete study aid to assist students in learning the procedures. Full details of each phase are contained in the relevant parts of the preceding pages in this section.

PERFORMANCE

Performance Specifications and Limitations

Performance figures given at 1670lbs (MAUW) and speeds in KIAS unless specified otherwise.

Structural Limitations

Gross weight (take-off and landing)		1670 lbs
Maximum ramp weight		1675 lbs (5 lbs allowed for taxi fuel)
Basic empty weights	C152	1100-1115
(approximate)	C152 II	1130-1150
Baggage allowance		120 lbs (54kgs)
Flight load factor	Flaps up	+4.4g – -1.76g
Flight load factor	Flaps down	+3.5g – 0
Aerobat flight load factors	Flaps up	+6g – -3g
Aerobat flight load factors	Flaps down	+3.5g – 0

Engine

Engine (Lycoming O-235 series) power	108 or 110 hHP at 2550 rpm
Oil capacity	6 Qt maximum (4 min)
Usable fuel	24.5 USG (93 litres)
Main wheel tyre pressure	29 psi
Nose wheel tyre pressure	21 psi

Speeds

Never Exceed Speed (Vne)	149 kts (red line)
Maximum structural speed (Vno)	111 kts (top of green arc)
Maximum flap extended speed (Vfe)	85 kts (top of white arc)
Stall speed clean/cruise configuration (Vs)	40 kts (bottom of green arc)
Stall speed in landing configuration (Vso)	35 kts
Maximum demonstrated crosswind component	12 kts
Maximum maneuvering speed (Va)	104 kts at 1670lbs 98kts at 1500lbs 93kts at 1350lbs

Speeds for Normal Operation

Normal take-off climb out speed	65-70kts
Short field take off, Flaps 10°	lift off 50ft, 50ft 54kts
Best rate of climb speed	67-61kts, sea level to 10,000ft
Normal approach flaps 30°	55-65 kts
Normal approach flaps up	60-70 kts
Short field landing flaps 30°qq	54kts

Speeds for Emergency Operation

Engine failure after take-off	60 kts
Forced landing	65 kts flap up, 60 flap down
Precautionary landing	60 kts flap 20°, 55 kts full flap

Cruise Performance*

Cruise at 2000ft pressure altitude 2300 rpm 97KTAS, 5.4gph/ lts
 Cruise at 10,000ft pressure altitude 2300 rpm 93KTAS, 4.5gph/ lts

**Cruise figures provided from the pilots operating handbook should be used with a contingency factor, a block cruises speed and fuel flow that allows for contingency and climb and descent are normally applied.*

Ground Planning

Provided below is an example for completion of pre-flight performance planning. Weight and balance graphs and performance tables are found in the C152 POH, and pre-flight planning forms similar to the ones provided here, should be available at your local flying school.

Blank copies of performance worksheets used in these examples are available at <http://www.redskyventures.org>.

In this example, the aircraft needs to carry two pilots, 20 pounds of baggage, and sufficient fuel to fly 1.5 hours en route at 8000ft on a private flight under visual flight rules.

Navigation Planning

The first step in any flight planning is to determine the route, this is normally carried out on a navigation worksheet, then transferred to the flight log for use in flight.

An example of a navigation worksheet is shown below.

FM	TO	Alt	Temp	W/V	IAS	TAS	Trk T	Var.	Trk M	G/S	Dist	EET
TOTALS												

The navigation log may be completed very accurately with reported conditions, approximately with forecast conditions, or used with block figures and still wind during advance planning, where small adjustments can be applied later. In all cases contingency needs to be applied for unexpected conditions, since weather is never static.