CESSNA 210

Training Manual

By
Oleg Roud and Danielle Bruckert

Contact the Authors:

We value your feedback, please use the below methods of contact.

D Bruckert	O Roud
redskyventures@gmail.com	roudoleg@yahoo.com
PO Box 11288 Windhoek, Namibia	PO Box 30421 Windhoek, Namibia
Red Sky Ventures	Memel CATS

Published by Red Sky Ventures and Memel CATS
Lulu paperback print version ISBN 978-0-557-01418-7, CreateSpace paperback print version ISBN-13: 978-1448696918, ISBN-10: 1448696917
First Edition © 2008, This Edition © 2011

More information about these books and online orders available at:
http://www.redskyventures.org
Other aircraft presently available in the Cessna Training Manual series are:
Cessna 152, Cessna 172, Cessna 182, Cessna 206.

COPYRIGHT & DISCLAIMER

This Training Manual is intended to supplement information you receive from your flight instructor during your type conversion training, and the information in the approved manufacturer's operating handbook from the aircraft you are flying. While every effort has been made to ensure completeness and accuracy, should any conflict arise between this training manual and other operating handbooks, the approved manufacturer's operating handbook, from on board the aircraft, must be used as a final reference. Information in this document is subject to change without notice and does not represent a commitment on the part of the authors. The authors cannot accept responsibility of any kind from the use of this material.

ACKNOWLEDGEMENTS:

Peter Hartmann, Aviation Centre, Windhoek: Supply of technical information, maintenance manuals and CD's for authors research

Brenda Whittaker, CHRISTCHURCH New Zealand: Editor, Non Technical

Note: ENGLISH SPELLING has been used in this text, which differs slightly from that used by Cessna. Differences in spelling have no bearing on interpretation.

FACTS AT A GLANCE

Common Name: Cessna 210
ICAO Designator: C210
Type: High performance four to six seat light single engine aircraft

Powerplants	
210L	One 225kW (300hp) Continental IO-520-L fuel injected flat six piston engine driving a three blade constant speed McCauley prop.
T210M	One 230kW (310hp) fuel injected and turbocharged TSIO-520-R, driving a constant speed three blade prop.
P210R	One 240kW (325hp) turbocharged and fuel injected TSIO-520-CE.
Performance	
210L	Max speed 324km/h (175kt)
	Max cruising speed 317km/h (171kt)
	Long range cruising speed 249km/h (134kt)
	Initial rate of climb 950ft/min
	Service ceiling 17,300ft
	Max range with reserves 1972km (1065nm)
T210M -	Max speed 380km/h (205kt)
	Max cruising speed 367km/h (198kt)
	Long range cruising speed 260km/h (140kt)
	Initial rate of climb 1030ft/min
	Service ceiling 28,500ft
	Range at long range cruising speed 1455km (785nm)
P210R	Max speed 417km/h (225kt) at 20,000ft
	Max cruising speed 394km/h (213kt) at 23,000ft
	Initial rate of climb 1150ft/min
	Service ceiling 25,000ft
	Range with reserves and optional fuel 2205km (1190nm)
Weights	
210L	Empty 1015kg (2238lb); Max takeoff 1725kg (3800lb)
T210M	Empty 1022kg (2250lb; Max takeoff 1725kg (3800lb
P210R	Empty 1120kg (2470lb); Max takeoff 1860kg (4100lb)

Dimensions	
210	Wing span 11.15m (36ft 9in), length 8.59m (28ft 2in). Wing area 16.3m2 (175.5sq ft)
T210M	Wing span 11.21m (36ft 9in), length 8.59m (28ft 2in), height 2.87m (9ft 5in). Wing area 16.3sqm, (175.5sq ft)
P210R	Wing span 11.84m (38ft 10in), length 8.59m (28ft 2in), height 2.95m (9ft 8in). Wing area 17.2m (185.5sq ft)
Capacity	
Typical seating for four with optional seating for extra two children in some models, or seating for six adults in later versions.	
Production	
Total 210, T210 and P210 production 9240 (including 843 P210s).	

Table of Contents

Introduction

This training manual provides technical and operational descriptions of the Cessna Centurion, Centurion II, and Turbo Centurion aircraft model range.

The information is intended as an instructional aid to assist with conversion and or ab-initio training in conjunction with an approved training organisation and use of the manufacturer's operating handbook. The text is arranged according the progression typically followed during training to allow easier use by students and assimilation with an approved training program. This layout differs from the Pilot's Operating Handbook, which is designed for easy operational use.

Figure 1a Cessna 210

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 Pilot's Operating Handbook, engineering manuals 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!). Under Wallace's leadership, the Cessna Aircraft Company eventually became the most successful general aviation company of all time.

During its production life the Cessna 210 was at the top of Cessna's single engine piston models, positioned between the 182 and the 310 twin in terms of performance. The first flight of the 210 occurred in January 1957. This new aircraft featured, for the first time on a Cessna aircraft, a retractable undercarriage and swept back vertical tail surfaces. The 210 entered production in late 1959, and from that time the type was constantly updated.

Notable early upgrades include the 210B which introduced the wrap around rear windows, the 210D with a more powerful (210kW/285hp) engine which introduced the Centurion name, and the turbocharged T210F. The 210G introduced a new strutless cantilever wing, increased fuel capacity, restyled rear windows and enlarged tail surfaces. Continual development of the 210 and T210 range continued through until production ceased in 1985.

A significant development made possible by the T210, was the pressurised P210 which first appeared in 1978. The pressurisation system meant that the cabin's internal altitude was equivalent to 8000ft when flying at altitudes up to 17,350ft, providing maximum benefit from the turbo engine.

In 1998 Cessna was considering resuming production of the 210, as they have done with the other popular models. At the time of writing no progress has been made on this decision.

Models and Differences

As detailed on the previous page, the Cessna 210 model had a number of type variants during its production history. Additionally there are a number of modifications provided for the airframe, instruments/avionics equipment and electrics.

Speeds often vary between models by a few knots, some more significant type variants have speed differences up to 40kts. Whenever maximum performance is required the speeds will also vary with weight, and density altitude. For simplification the speeds have been provided for the model C210 Centurion most commonly used, converted to knots and rounded up to the nearest 5kts. Generally multiple provision of figures can lead to confusion for memory items and this application is safer for practical uses.

During practical training reference should be made to the flight manual of the aeroplane you will be flying to ensure that the limitations applicable for that aeroplane are adhered to. Likewise when flying different models it should always be remembered that MAUW, flap limitations, engine limitations and speeds may vary from model to model. Before flying different models, particularly if maximum performance is required, the AFM should be consulted to verify differences.

Model History Table

The following table provides a brief summary of the models by year of manufacture, with descriptions of the major changes.

TYPE	***NAME***	***YEAR***	***MODEL***	***DIFFERENCES***
C210		1960	21057001-21057575	40 degrees hydraulic flap, wing with strut, 4 seat capacity, 260hp IO-470 engine, maximum gross weight 2900lbs. Battery under aft cargo compartment floor.
C210A		1961	21057576-21057840	Battery moved to under pilot seat. Third side window added to rear fueselage.
C210B		1962	21057841-21058085	Cabin size increased slightly. Maximum weight increased to 3000lbs. Battery moved to right side of engine compartment behind firewall, where it remains. Hydraulic accumulator (for pressure regulation) removed.
C210C		1963	21058086-21058220	Minor hydraulic system improvements.
C210D	Centurion	1964	21058221-21058510	Rear child seat added. Electric flap replaces hydraulic. Engine power increased from 260hp to 285hp. Minor improvements on airframe. Maximum weight increased to 3100lbs.
C210E	Centurion	1965	21058511-21058715	Alternator replaces generator, vernier throttle removed, and cowls streamlined due to extended propshaft.
C210F T210F	Centurion/ Turbo Centurion	1966	21058716-21058818 T210-0001-T210-0197	Maximum weight increased to 3300lbs. One-piece front windscreen, optional three blade prop.

TYPE	NAME	YEAR	MODEL	DIFFERENCES
C210G T210G	Centurion/ Turbo Centurion	1967	21058819-21058936 T210-0198-T210-0307	Flap reduced to 30 Degrees, full cantilever wing introduced. Fuel capacity increased from 65USG to 90USG integral tank. Maximum weight increased to 3400lbs.
C210H T210H	Centurion/ Turbo Centurion	1968	21058937 T210-0308	Improved gear saddle to address cracking problems.
C210J T210J	Centurion/ Turbo Centurion	1969	21059062	Modification to nose wheel cowling, and increase in engine TBO.
C210K T210K	Centurion II/ Turbo Centurion II	1970-71	21059200-21059502	Larger cabin, rear child seat now a full seat, MAUW increased to 3800lbs, and takeoff power increased to 300bhp (5minutes only).
C210L T210L	Centurion/II/ Turbo Centurion/II	1972-76	21059503 21061573	24 Volt electrical system introduced (1972), electric pump replaces engine driven pump for hydraulics, 3 bladed prop (1975) and aerodynamic improvements increased cruise speed by approx 8kts (1976).
C210M T210M	Centurion II/ Turbo Centurion II	1977-1980	21061574-21064135	Engine increased to 310hp in turbo model, maximum weight increased to 4000lbs on turbo model. Voltage warning light changed from high voltage to low voltage (1979).
C210N T210N	Centurion II/ Turbo Centurion II	1981-1984	21064136-21064897	Gear doors removed, resulting in higher gear extension speed (165kts)*, nose gear doors no longer close on ground, flap limit for 20 degrees increased to 130kts.
*Many earlier models in operation have now had modifications to remove the gear doors because they are prone failure and easily damaged. This modification also increases the gear extension speed.				

TYPE	NAME	YEAR	MODEL	DIFFERENCES
P210N	Pressurized Centurion/II	1978-1983	P21000001-P21000834	First pressurised model.
P210R	Pressurized Centurion/ with Value Groups A & B	1985-86	P21000835 - P21000874	Improvements in engine and instrument systems, maximum weight increased to 4100lbs (pressurised model only).
C210R T210R	Centurion II/ Turbo Centurion II	1985-86	21064898-21065009	Fuel selector has BOTH position and manual primer is installed (close to fuel selector on centre console). Optional 115USG fuel tanks, maximum weight also increased to 4100lbs on turbo model only.

Post Manufacture Modifications Table

TYPE	NAME and MANUFACTURER	DIFFERENCES and FEATURES
P210R	Silver Eagle, O & N Aircraft Modifications	Turbine Engine Installation, 450 HP Allison250-B-17F/2 turbine, includes new Garmin panel.
	Engine Conversion, Bonaire	IO550 engine installation with 300hp maximum continuous, (modification not available any more).
	Engine Conversion, Atlantic Aero	Continental IO-550 engine installation with 310hp maximum continuous, and 2000hr TBO.
T-210	Engine Conversion, Ram Aircraft Corp.	Increases engine to 310 HP, including new 402 Prop
C210	Turbo Conversion, Ram Aircraft Corp.	Replaces standard engine with TSIO-520.
P210	P210 Intercoolers, TurboPlus	Increases power available at altitude.
	Wing Tip Tanks, Flint Aero	Two auxiliary fuel tanks of 16.5USG in each installed in the wing tip, and used with an electrical transfer pump to each main tank. Higher MTOW is permitted if tanks are half full. Wing length is also increased by 26 inches.
	Additional Fuel Tank, O & N Aircraft Modifications	Additional 18, 28 or 29.7 USG fuel tank in baggage area.

TYPE	***NAME and MANUFACTURER***	***DIFFERENCES and FEATURES***
	Low Fuel Warning System, O & N Aircraft Modifications	Warns when fuel remaining is less than approximately 7USG.
	Fuel Cap Monarch Air	Umbrella style fuel caps which fix problems with leaks, predominantly occurring in older flush mounted caps, (available for most Cessna types).
	Maximum Weight Extensions, various	Take-off weight extended to 4000lbs (often included with tip-tank installation).
	Hoerner Wingtips, Met-Co-Aire	Increased lift, more speed, added stability.
	Speedbrakes (electric), Precise Flight	Increased descent rates, reduced chances of shock-cooling or structural damage by mishandling.
	Flight Control Flutter Margin Increase, O & N Aircraft Modifications	Additional structure, 100% mass balancing.
	Horton STOL	Tip and wing surface modifications to permit lower stall speed, take-off and landing speeds and distances.
	Robertson STOL	Increased lift, more speed, added stability, and lower stall speed, take-off and landing speeds and distances. *NOTE:* The very low flap speed with this STOL kit (85kts) often causes engine mishandling leading to increased instances of cracked cylinders.
C210 G to N	Bush STOL Conversions	Lower stall speed, lower take-off and landing speeds and distances.
	Gear Door Removal, Sierra Industries	Removes 19lbs from empty weight, reduces instances of gear or gear door failure, and reduces maintenance costs.

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	**Maximum Manoeuvering 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.
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 x Vso.
Vr	**Rotation Speed**	The speed which rotation should be initiated.
Vat	**Barrier Speed**	The speed nominated to reach before the 50ft barrier or on reaching 50ft above the runway.
	Maximum Demonstrated Crosswind	The maximum demonstrated crosswind during testing.
*forward centre of gravity gives a higher stall speed and so is used for certification		

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.
	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		
	Arm (moment arm)	The horizontal distance in inches from reference datum line to the centre of gravity of the item.
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 point beyond which the CG must not be located. The forward limit defines 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 maneouvering, 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.
Other		
AFM	**Aircraft Flight Manual**	These terms are inter-changeable and refer to the approved manufacturers handbook. General Aviation manufacturers from 1976 began using the term 'Pilot's Operating Handbook', early manuals were called Owners Manual and many legal texts often use the term AFM.
POH	**Pilot's Operating Handbook**	
	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 st.m to ft	1nm = 1.15stm 1nm = 6080ft	St.m to nm to ft	1 st.m = 0.87nm 1 st.m =5280ft
feet to meters	1 FT = 0.3048 m	meters to feet	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 10 kts of wind								
Kts	10	20	30	40	50	60	70	80
10	2	3	5	6	8	9	9	10

Formulas

Celsius (C) to Fahrenheit (F)	C = 5/9 x(F-32), F = Cx9/5+32
Pressure altitude (PA)	PA = Altitude AMSL + 30 x (1013-QNH) Memory aid – Subscale up/down altitude up/down
Standard Temperature (ST)	ST = 15 – 2 x PA/1000 ie. 2 degrees cooler per 1000ft altitude
Density altitude (DA)	DA = PA +(-) 120ft/deg above (below) ST i.e. 120ft higher for every degree hotter than standard
Specific Gravity	SG x volume in litres = weight in kgs
One in 60 rule	1 degree of arc ≈ 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 = TAS per hour/60/π or TAS per minute/π R ≈ TAS per hour/180 (Where π (pi) ≈3.14)
Radius of Turn Rule of Thumb	Radius of Turn lead allowance ≈ 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 ≈ GS/10+7
Percent to fpm	fpm ≈ % x GS Or fpm = % x GS x 1.013
Percent to Degrees	TANGENT (degrees in radians) x100 = Gradient in % INVERSE TANGENT (gradient in %/100) = Angle in Radians
Degrees to Radians	Degrees x 3.14 / 180 = radians (pi/180)
Gust factor (Rule of Thumb)	Vat = Vref+1/2HWC + Gust eg. Wind 20kts gusting 25 at 30 degrees to Runway: Vat = Vref +.7x10+5 = Vref+12, If the Vref is 75kts, Vat should be 75+12 = 87kts

Pilot's Operating Handbook Information

The approved manufacturer's handbook, Pilot's Operating Handbook (POH) or Aircraft Flight Manual (AFM), 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.

The format was designed for ergonomic purposes to enhance safety, and it is 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

For use in training 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 C210, the aircraft you are flying may have supplements for modifications and optional equipment which affect the operational performance.

AIRCRAFT TECHNICAL INFORMATION

General

The Cessna 210 aircraft is a single-engine, high-wing monoplane of an all metal, semi-monocoque construction. Wings are full cantilever, with sealed sections forming fuel bays.

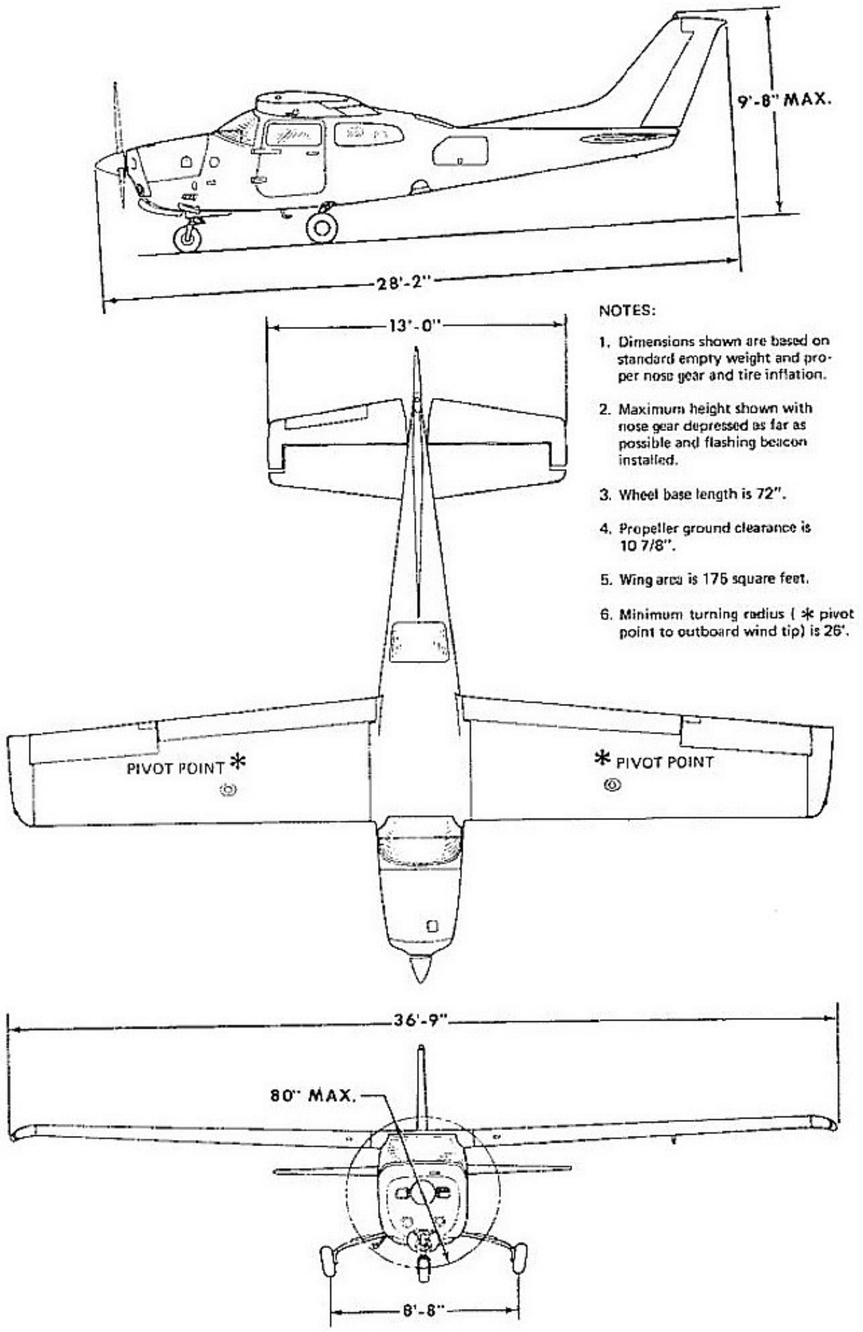


Figure 2a Airframe Front, Top, and Side Profile Diagrams

The fully-retractable tricycle landing gear consists of tubular spring-steel main gear struts and a steerable nose wheel with an air-hydraulic fluid shock strut.

The four or six place seating arrangement is a conventional forward facing type.

The standard power plant installation is a horizontally-opposed, air-cooled, six-cylinder, fuel injected engine driving an all-metal, constant-speed propeller, The engine is typically normally aspirated, however higher performance is offered in the turbocharged version of the Model 210.

Airframe

The airframe is a conventional design similar to other Cessna aircraft you may have flown (for example the C152, C172).

The construction is a 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
- four stringers for engine mounting attached to the forward door posts

Each all-metal wing panel is a full cantilever type, with a single main spar, two fuel spars, formed ribs and stringers. The front fuel spar

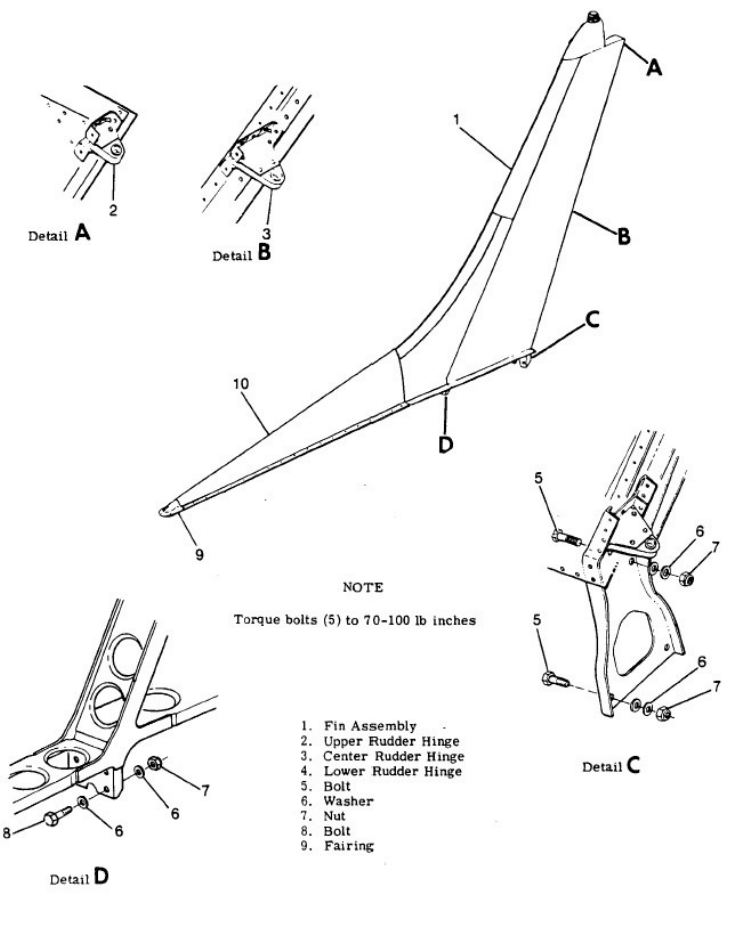


Figure 2b Example of Airframe Construction-Tail Fin Assembly

Engine & Engine Controls

The aeroplane is powered by a flat 6 cylinder horizontally opposed piston engine.

Some different types of engine configurations include:

- 210L - One 225kW (300hp) Continental IO-520-L fuel injected, normally aspirated, flat six piston engine driving a three blade constant speed prop.
- T210M - One 230kW (310hp) fuel injected and turbocharged TSIO-520-R, driving a constant speed three blade prop.
- P210R - One 240kW (325hp) turbocharged and fuel injected TSIO-520-CE.
- Bonaire Engine Conversion - One 240kW (325hp) Continental IO-550-L fuel injected, normally aspirated, flat six piston engine driving a three blade constant speed prop.

Maximum power, is limited to five minutes (except for the IO550 motor which can develop full power continuously), thereafter the maximum continuous power limit should be observed. In the IO-520 maximum power is 300bhp at 2850RPM, and maximum continuous is 285bhp at 2700RPM. The engine specifications for the IO520 and TSIO520 are included on the following pages.

The propeller is a three bladed, constant speed, aluminum alloy McCauley propeller. The propeller is approximately 2m (80 inches) in diameter. Some models of C210 may be equipped with three bladed, constant speed, aluminum alloy Hartzel propeller.

Figure 5a C210 Engine

Fuel System

The fuel system consists of two vented integral fuel tanks (one in each wing), two fuel reservoir tanks, a fuel selector valve, auxiliary fuel pump, fuel strainer, engine-driven fuel pump, fuel/air control unit, fuel manifold, and fuel injection nozzles.

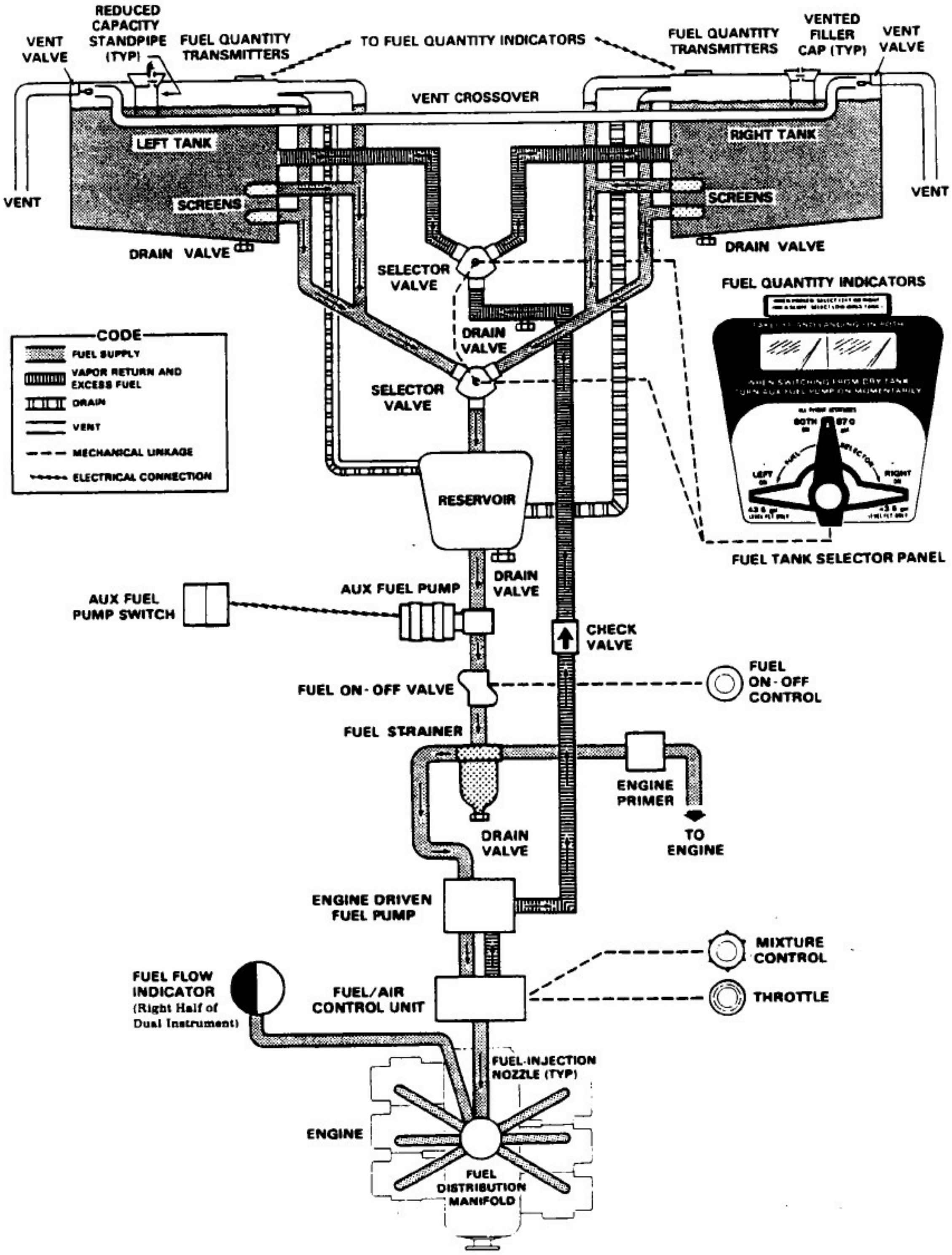


Figure 10a Fuel System Schematic

Electrical System

Electrical energy for the aircraft is supplied by a 14 or 28-volt, direct-current, single wire, negative ground, electrical system. A 12 or 24 volt battery supplies power for starting and furnishes a reserve source of power in the event of alternator failure.
An external power source receptacle may be installed to supplement the battery for starting and ground operation.

Alternator and Battery

Models produced from 1972, C210L and later had a 24 volt battery, with a 28 Volt alternator. The battery had either a standard 12.75 ampere-hour, or optional 15.6 ampere-hour capacity. Models produced before 1972 had a 12 volt battery, with a 14 Volt alternator, or for models C210D and earlier a 12 volt generator.

The amp/hour is the capacity of the battery to provide a current for a certain time. A 12.75 amp/hour battery is capable of steadily supplying a current of 1 amp for 12.75 hours and 6.3 amp for 2 hours and so on.

The battery is normally mounted on the left forward side of the firewall. Battery location in earlier models varies, from the engine compartment to aft of the cargo compartment, and even under the pilot seat in the C210A.

A standard 60 amp (or optional 95-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, so the battery charge is maintained while in normal operation.

Electrical Equipment

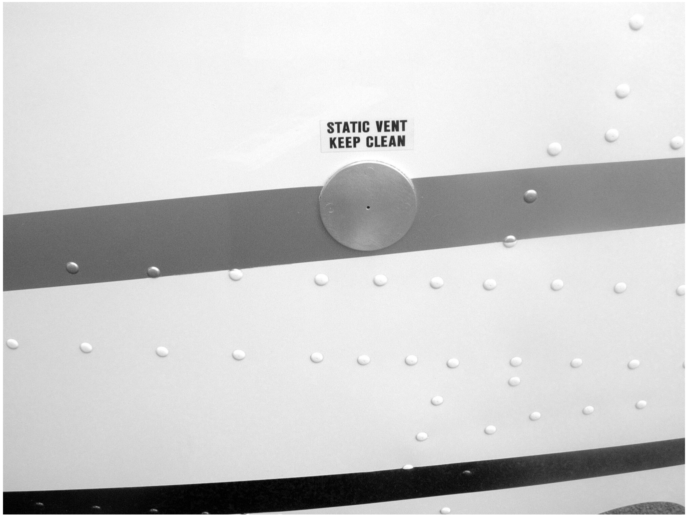
On the Cessna-210, the following standard equipment requires electrical power for operation (there may be additional optional equipment which uses electrical power):

- Fuel quantity indicators;
- All internal and external lights and beacon, including warning lights;
- Pitot heat;
- Wing flaps;
- Gear retraction/extension operation (except older engine driven manual systems);
- Starter;
- All radio and radio-navigation equipment.

Exterior Inspection

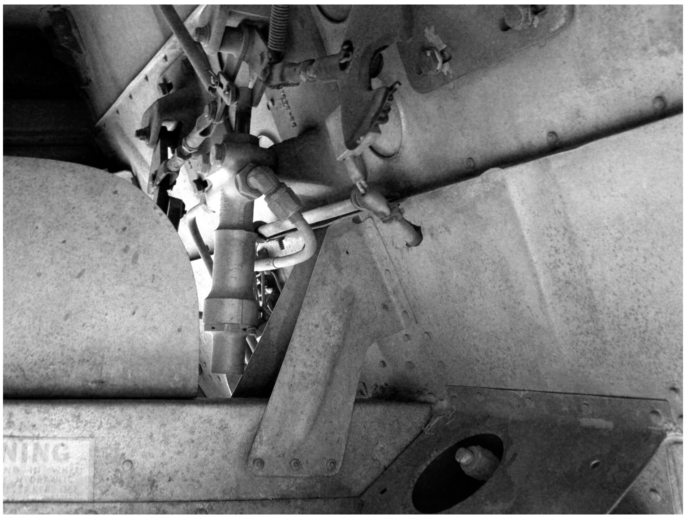
Visually check the aeroplane for general condition during the walk-around inspection, ensuring all surfaces are sound and no signs of structural damage, worked rivets, missing screws, lock wires or loose connections.

Aft Fuselage



Check left static port for blockage.


Once loading is complete, ensure the baggage and the cargo door are secure.


Check wheel well for obstructions.
Ensure gear locks and microswitches undamaged.
(If gear doors installed they may be pumped open for thorough inspection)

Tail Section

Check top, bottom, and side surfaces for any damage.
Ensure balance weights secure.
Remove rudder gust lock and tie-downs if installed.

Ensure Elevator secure and undamaged.
Check all linkages free, lock pins in place.
Check full and free movement of control.
Check trim is undamaged and in neutral position.

Rudder linkage and turnbuckles secure, free, and full and free movement, lock wires and pins in place.

Beacon, aerials and rear navigation light undamaged and secure.
Check right static vent for blockage.

Right Wing

Ensure all aerials are undamaged and secure. Check top and bottom wing surfaces for any damage or accumulations on wing. *Ice or excessive dirt must be removed before flight.*

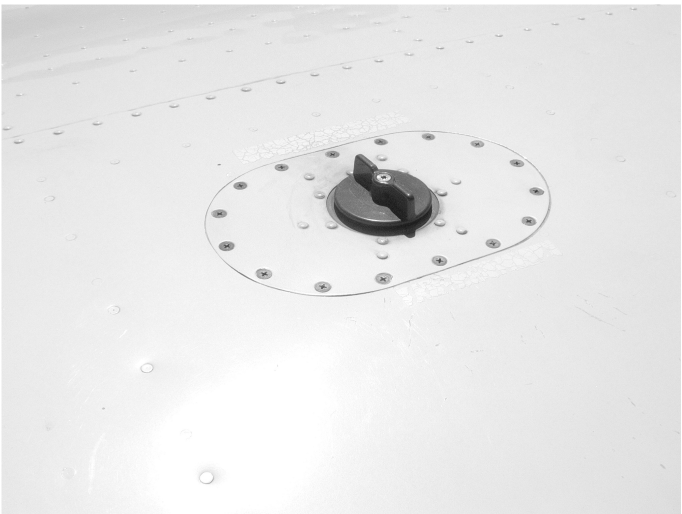
Check the flaps do not retract if pushed, and flap rollers allow small amount of play in down position.

Check for damage to surface and flap tracks, operating linkage free movement, adequate grease and security of all nuts and lock pins.

Check aileron surface for damage, security of hinge point, and ensure full and free movement. Check wing tip vent unobstructed.

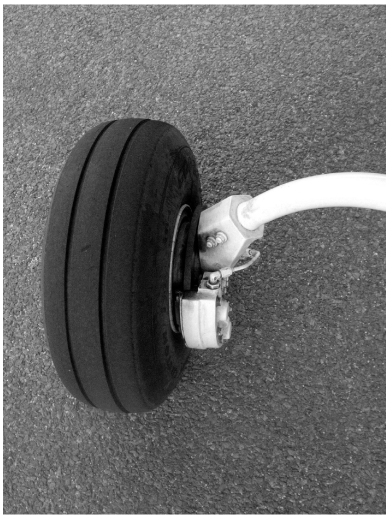
Check condition, security and colour of navigation light.

Check visually for desired fuel level using a suitable calibrated dipstick.



Check that fuel cap is secure, and vent is unobstructed.

Remove wing tie down and vent covers if installed.



Check for security, condition of strut and tyre. Check tyre for wear, cuts or abrasions, and slippage. Recommended tyre pressure should be maintained. Remember, that any drop in temperature of air inside a tyre causes a corresponding drop in air pressure.
Check operation and security of retractable step and retraction well, if installed.

Check for security, condition of hydraulic lines. From the right side door check the level of oil in the hydraulic reservoir.
Note: the hydraulic oil should be checked every 25hours, however it is considered good airmanship to check if you have not personally flown the aircraft recently.

Use sampler cup and drain a small quantity of fuel from tank sump quick-drain valves, on the wing and underneath the cabin, to check for water, sediment and proper fuel grade
(first flight of the day and after refueling).

Performance Specifications and Limitations

Performance figures given at MAUW and speeds in KIAS unless specified otherwise. Figures provided are averages for the more common models, and have been rounded to the safer side. Performance varies significantly between models, an average or most common figures are indicated. REMEMBER these figures may not correspond to those for your particular model, ALWAYS Confirm performance and operating requirements in the Pilot's Operating Handbook before flying.

Structural Limitations

Gross weight (take-off and landing)	3400lbs - 4100lbs
Maximum landing weight	3400lbs - 3900lbs
Standard empty weight	2150lbs - 2500lbs
Max Baggage in aft compartment	120-200lbs
Baggage on Folded down 5/6th seat	120lbs
Rear Compartment with Seat Removed	50lbs
Flight load factor (flaps up)	+3.8g – -1.52g
Flight load factor (flaps down)	+2.0g – 0g

Engine Specifications

	Max – 5 minutes only	Max Continuous
Engine (Lycoming IO-520 series) power	300BHP at 2850RPM	285BHP at 2700RPM
Engine (Lycoming TSIO-520 series) power	310BHP at 2700RPM	285BHP at 2600rpm
Engine (Lycoming TSIO-520 series) power	325BHP at 2700 rpm, (flat rated) maximum continuous	
Oil capacity	10Qts normally aspirated engines, 11Qts Turbo and External Filter engines Do not operate on less than 7Qts	

Fuel

Usable fuel	Standard tanks	87USG/ 329litres/534lbs
	Optional Long range	115USG
	Optional Tip tanks	Additional in each Tip Tank 16 USG/60 litres
	Filler cap quantity	64USG/ 384lbs

Ground Planning and Performance

For in-depth ground planning, the figures in the flight manual must be used. For approximate calculations, block figures may be used.
Block figures must provide built in error margins, for example speeds must be lower and fuel consumptions higher that those normally experienced, or those in the POH. These figures should normally allow a margin for error of approximately 10% over the POH figures, and are a simple method for estimating performance, but should NEVER be used where the performance is critical.

Sample block figures are provided above for a normally aspirated C210, but remember, this will *not* apply to all C210's, especially early models which were much slower.

When calculating cruise performance and fuel consumption from the flight manual, it should be remembered that the figures indicated are for a new aeroplane, and typically a minimum of 10% contingency (a factor of 1.1) should be applied. It is a good idea to apply a 10% contingency to all fuel calculations, and in some countries, it is required by law.

It is also important to remember to use the flight manual from the aircraft you are flying when calculating performance. As illustrated clearly in this manual, models and modifications can vary performance significantly between different aircraft.

Most POH's will have graphs similar to the ones included below, later models provide slightly improved versions, however performance graphs can vary significantly, especially if a modification such as an engine or STOL kit has been completed. In this case the graphs will be provided by the approved Supplemental Type Certificate (STC) from company offering the modification.

When calculating performance, ensure all instructions and foot notes are read, as these can have an effect on the graph or table's interpretation and use. Thereafter tables must be read using the appropriate ambient data and weights. For example, do not use airfield elevation when pressure or density altitude is required. In the graphs below, only one temperature is provided for each altitude, therefore it must be deduced that the required figure is density altitude. This could potentially lead to an error of 1000ft per 8 degrees above standard if interpreted wrongly. Later graphs specify pressure altitude and have several different temperature options.
The units (pounds versus kilo's or moment versus moment/1000) should never be confused or mixed up. As a reminder, lest we think we are infallible, this error has already resulted in a forced landing in a Boing 767 with two experienced airline pilots. If there is ever any doubt always use the figure which will provide the largest margin, or seek assistance.