INSTALLATION MANUAL
FOR
JABIRU 2200 AIRCRAFT ENGINE

This Manual has been prepared as a guide to correctly install the Jabiru 2200 engine into an airframe.

Should you have any questions or doubts about the contents of this manual, please contact Jabiru Aircraft Pty Ltd.

Applicable to Jabiru 2200cc Enginers, S/No. 2068 Onwards (Hydraulic Lifter Type)

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1.2 List of Effective Pages

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2	0	29/6/05	22	0	29/6/05
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4	0	29/6/05	24	0	29/6/05
5	0	29/6/05	25	0	29/6/05
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Issue Notes:

2 Description

2.1 Model

All Jabiru 2200 Engine Models from S/No 2068 on.

2.2 Details

- 4 Stroke
- 4 Cylinder Horizontally Opposed
- 1 Central Camshaft
- Push Rods
- Over Head Valves (OHV)
- Hydraulic Valve Lifters with Automatic Adjustment
- Ram Air Cooled
- Wet Sump Lubrication
- Direct Propeller Drive
- Dual Transistorised Magneto Ignition
- Integrated AC Generator
- Electric Starter
- Mechanical Fuel Pump
- Naturally Aspirated – 1 Pressure Compensating Carburettor
- 6 Bearing Crankshaft

2.3 Manufacturer

Jabiru Aircraft Pty Ltd,
P.O. Box 5186,
Bundaberg West,
Queensland 4670

2.4 Manuals

Instruction and Maintenance Manual
Installation Manual
Parts Catalogue

3 Specifications

3.1 General

- Displacement : 2200 cc
- Bore : 97.5 mm
- Stroke : 74 mm
- Compression Ratio : 8 :1
- Direction of Rotation of Prop Shaft : Clockwise – Pilot's view – Tractor Applications
- Ramp Weight : 61 kg (134 lbs) Complete including Exhaust, Carburettor, Starter Motor, Alternator & Ignition System.
- Ignition Timing : 25^{o} BTDC
- Firing Order : 1 – 3 – 2 – 4
- DC Output : 10 Amps
- Fuel Consumption @ 75% Power : 13 l/hr (3.5 US gal/hr)
- Fuel : AVGAS 100/130. MOGAS with RON Octane Rating 95 or above may be used if AVGAS is not available.
- Oil : Aero Oil W Multigrade 15W-50, or equivalent Lubricant complying with MIL-L-22851C, or Lycoming Spec. 301F, or Teledyne – Continental Spec MHF-24B
- Oil Capacity : 2.3 L (2.2 quarts)
- Spark Plugs : NGK D9EA – Automotive

3.2 Performance

Static sea level ratings under the following conditions:-

- International Standard Atmospheric conditions at sea level.
- Aircraft service equipment drives unloaded. (Vacuum Pump not fitted)
- Full rich fuel/air mixture.
- Maximum cylinder head temperature.
- Standard Jabiru air filter and cold air.
- Standard exhaust muffler.

3.2.1 Engine Ratings

- Takeoff/Max Continuous 85 hp / 3300 RPM
- Fuel Consumption 21 L/hr @ Takeoff/Max Continuous Rating
- Oil Consumption 0.1 L/hr (max)

4 Operating Limitations

4.1 RPM

Continuous : 3300 RPM / Full Throttle
Recommended Cruise: 2750 RPM – 3100 RPM

4.2 Engine Cooling

Maximum Cylinder Head Temperatures measured under exhaust spark plug.

Maximum Peak Temperature	200ºC (392°F)
Continuous Operation	180ºC (356°F)

4.3 Fuel

4.3.1 Specifications

- Avgas 100LL & Avgas 100/130
- Leaded and Unleaded Automotive Gasoline above 95 Octane RON

4.4 Pressure to Carburettor (above ambient)

- Maximum 20 kPa (3 psi)
- Minimum 5 kPa (0.75 psi)

WARNING – When using auto fuels, ensure all components of the fuel delivery system are cooled to prevent fuel vaporization.

4.5 Oil

4.5.1 Specifications

Aero Oil W Multigrade 15W-50,
or equivalent Lubricant complying with
MIL-L-22851C, or
Lycoming Spec. 301F, or
Teledyne - Continental Spec MHF-24B

4.5.2 Oil Temperature

- Minimum for Take-off Power 50°C (122°F)
- Maximum 118°C (244°F)
- Continuous 80°C – 100°C (176°F - 212°F)

4.5.3 Pressure

- Normal Operations: Min 220 kPa (32 psi)
  Max 525 kPa (76 psi)
- Idle: Min 80 kPa (12 psi)
- Starting & Warm Up: Max 525 kPa (76 psi)

5 Dimensions

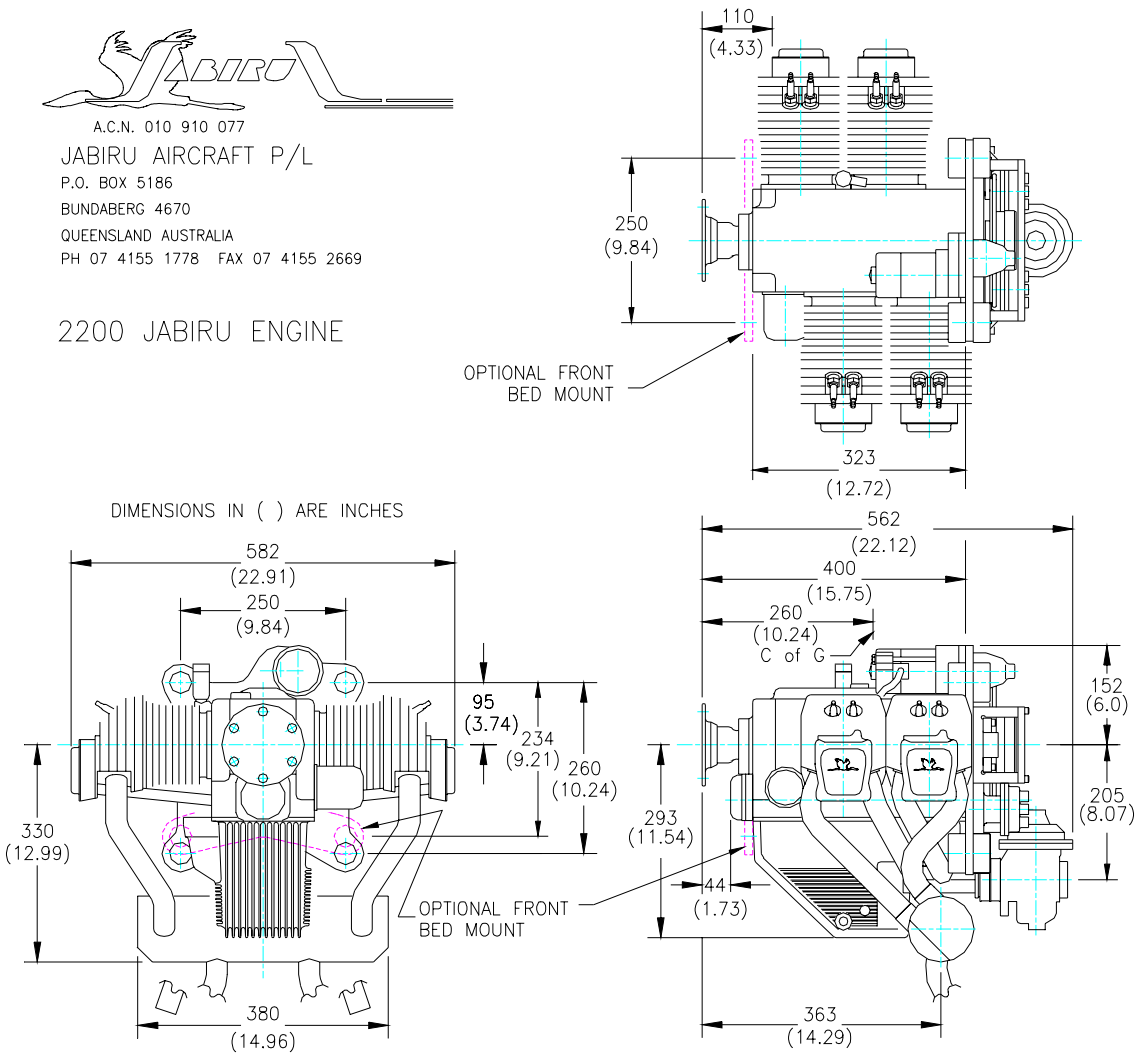


Figure 1. Drawing 9404041/1 Engine Dimensions

6 Denomination Of Cylinders

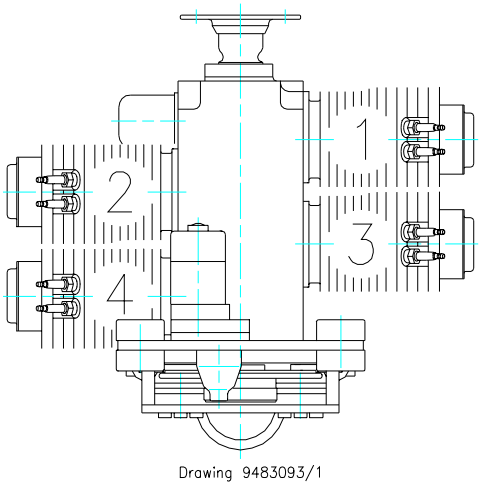


Figure 2. Cylinder Firing Order

Cylinder Firing Order: 1 – 3 – 2 – 4

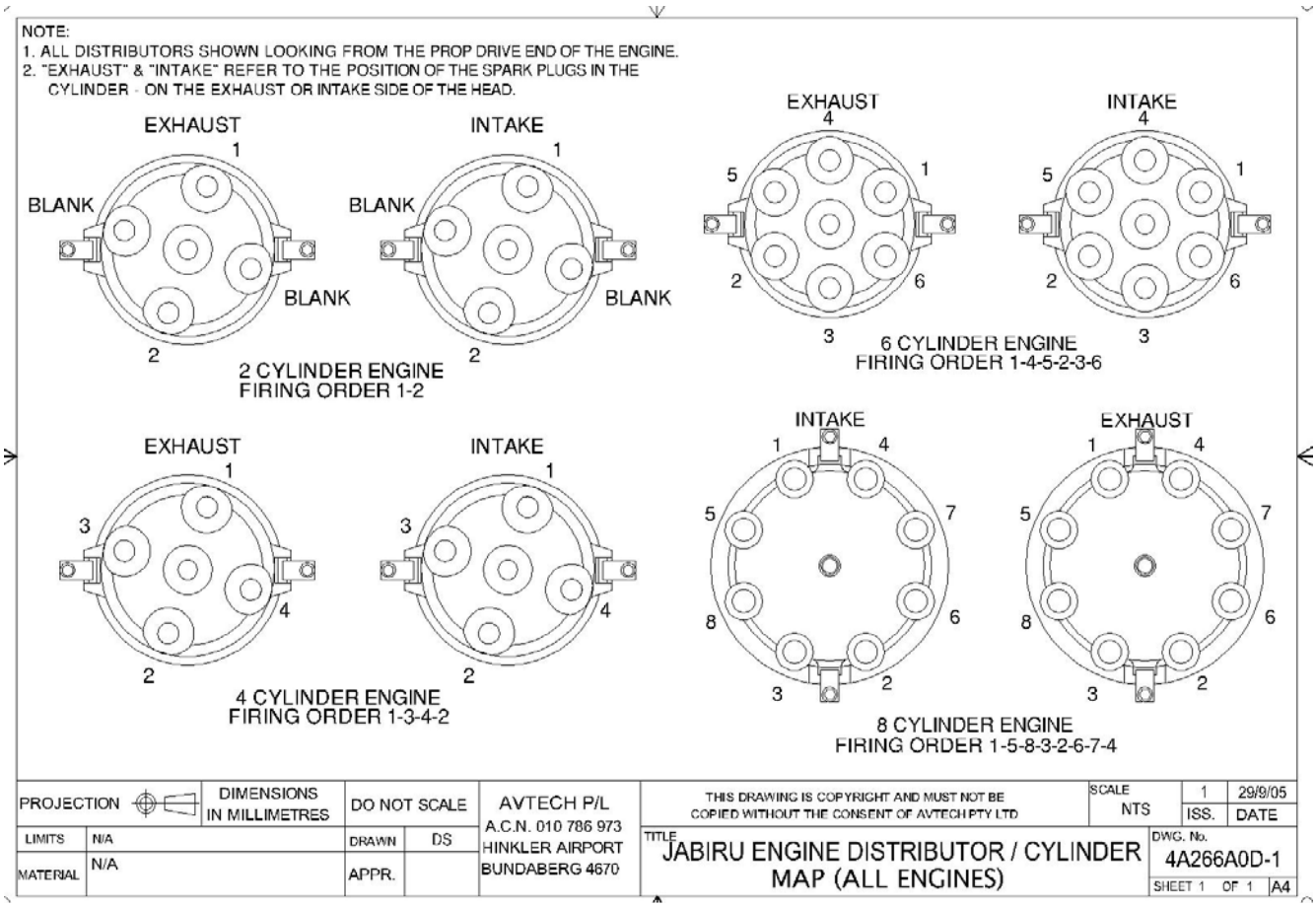


Figure 3. Distributor Cylinder Map

7 Engine Mount

The design of the engine mount must not only take into account the structural loadings but must make allowances for accessibility of components and the removal of equipment located at the rear of the engine.

The engine has four engine mounting points located at the rear of the engine (refer to figure 1.0) from which the engine is to be mounted. An optional bed mount may be fitted.

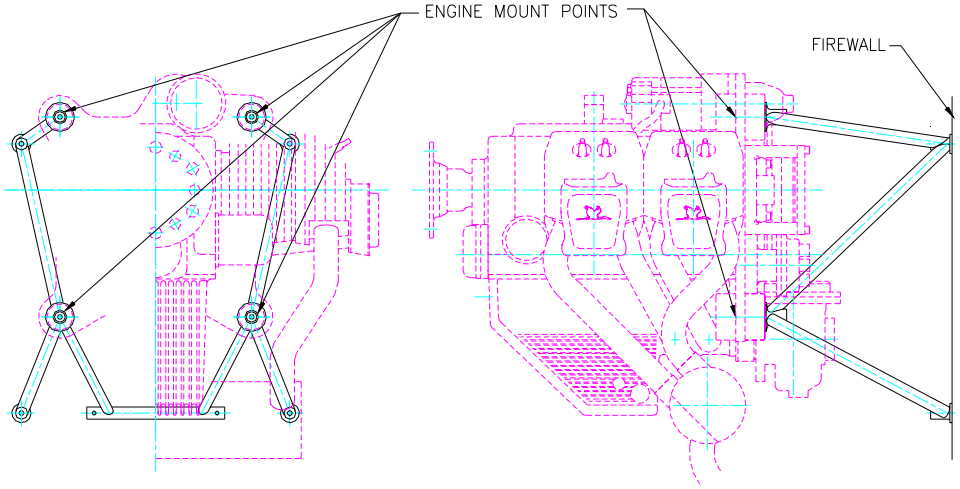


Figure 4. Engine Mount Point Locations

The correct installation is shown below in Figure 4.0

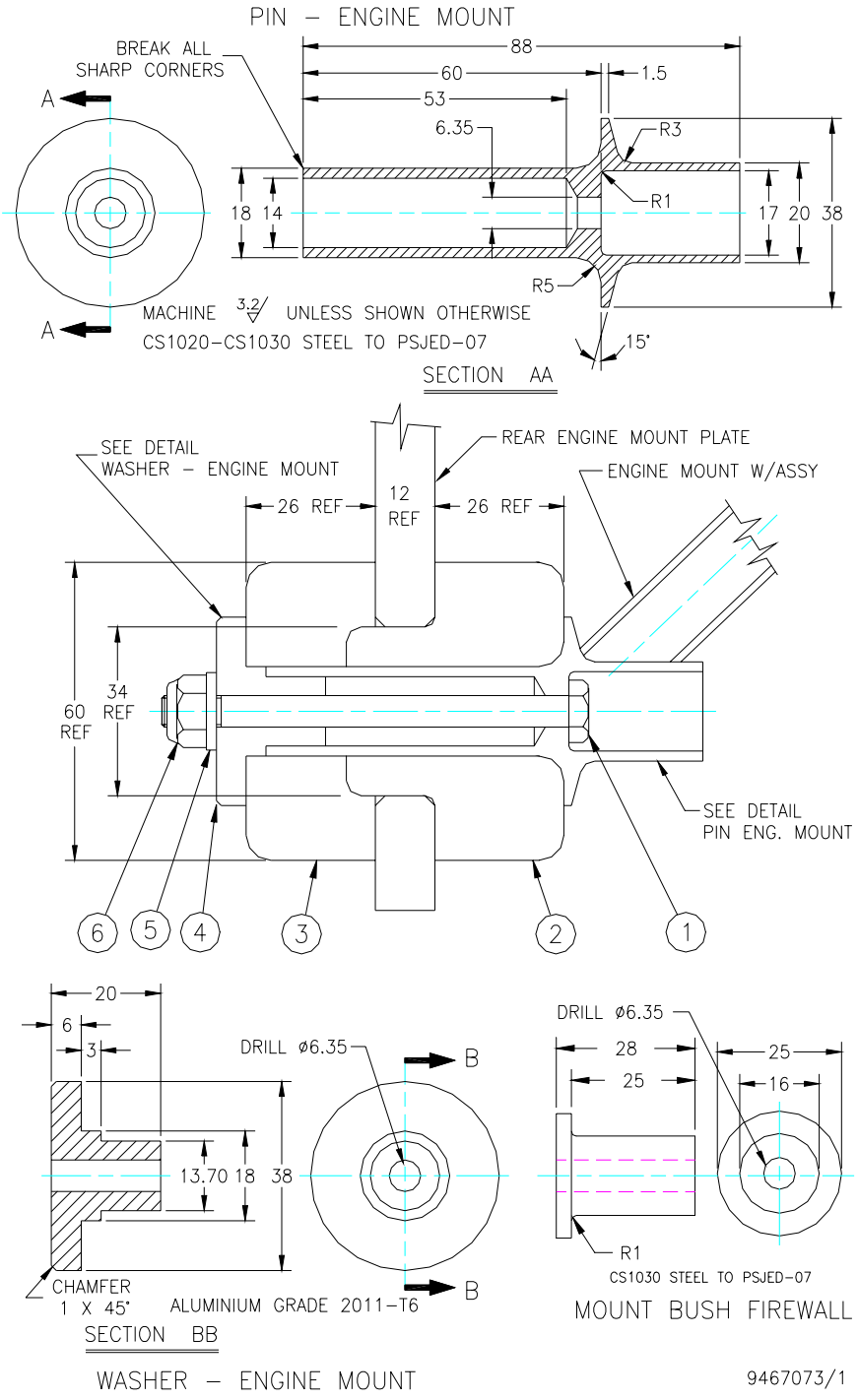


Figure 5 Engine Mount Assembly

Corrections of the engine alignment may be made using spacers under the rubber cushions. The maximum spacer thickness on any one mount is 3mm.

8 Controls

This section comprises of the mechanical controls and electrical switches.

8.1 Throttle and Choke

Provisions for the connection of the throttle and choke are made on the carburettor.
Note: Since a pressure compensating carburettor is used there is no mixture control.

8.2 Master Switch, Ignition Switches and Starter Button

The switches are connected as shown by the circuit diagram, on Page 10.

9 Instruments

9.1 Electronic Tachometer

The tachometer picks up on 2 metal tabs attached to the inside of the flywheel. Pickup is of induction sender type.

9.1.1 Tachometer Wiring

3 Tachometer Negative (3) to Earth
4 Tachometer Positive (4) to Instrument
8 Tachometer to Red Wire tachometer pick-up
7 Tachometer to Black Wire tachometer pick-up

9.1.2 Oil Temperature Gauge

The Oil Temperature Gauge uses an electric probe mounted in the base of the sump. Jabiru Part No. PI10752N is recommended.

9.1.2.1 Oil Temperature Wiring

Black Oil Temperature Gauge Negative to Earth
Red Oil Temperature Gauge Positive to Instrument
White Oil Temperature Gauge Sensor (S) to Oil Temperature Sensor (Lower Left Eng Sump)

9.1.3 Oil Pressure Gauge

An electric oil pressure sender is fitted to the engine for an Oil Pressure Gauge. Jabiru Part No. PI10762N is the recommended gauge.

9.1.3.1 Oil Pressure Wiring

Black Oil Pressure Gauge Negative to Earth
Red Oil Pressure Gauge Positive to Instrument
White Oil Pressure Gauge Sensor (S) to Oil Pressure Sensor (Fwd Top Eng)

9.1.4 Cylinder Head Temperature Gauge

The Cylinder Head Temperature Gauge uses a thermocouple. An audit must be done to establish the hottest cylinder and the thermocouple probe should be fitted under the exhaust

spark plug on that cylinder. (Note that number 4 head runs hottest in normal tractor installations.) Jabiru Part No. PI10732N is the recommended gauge.

9.1.4.1 Cylinder Head Temperature Wiring

Loom and sensor is supplied with the instrument. These must be installed as per directions. If cable is too long it must be looped as many times as necessary and strapped behind the instrument panel.

DO NOT CUT TO LENGTH

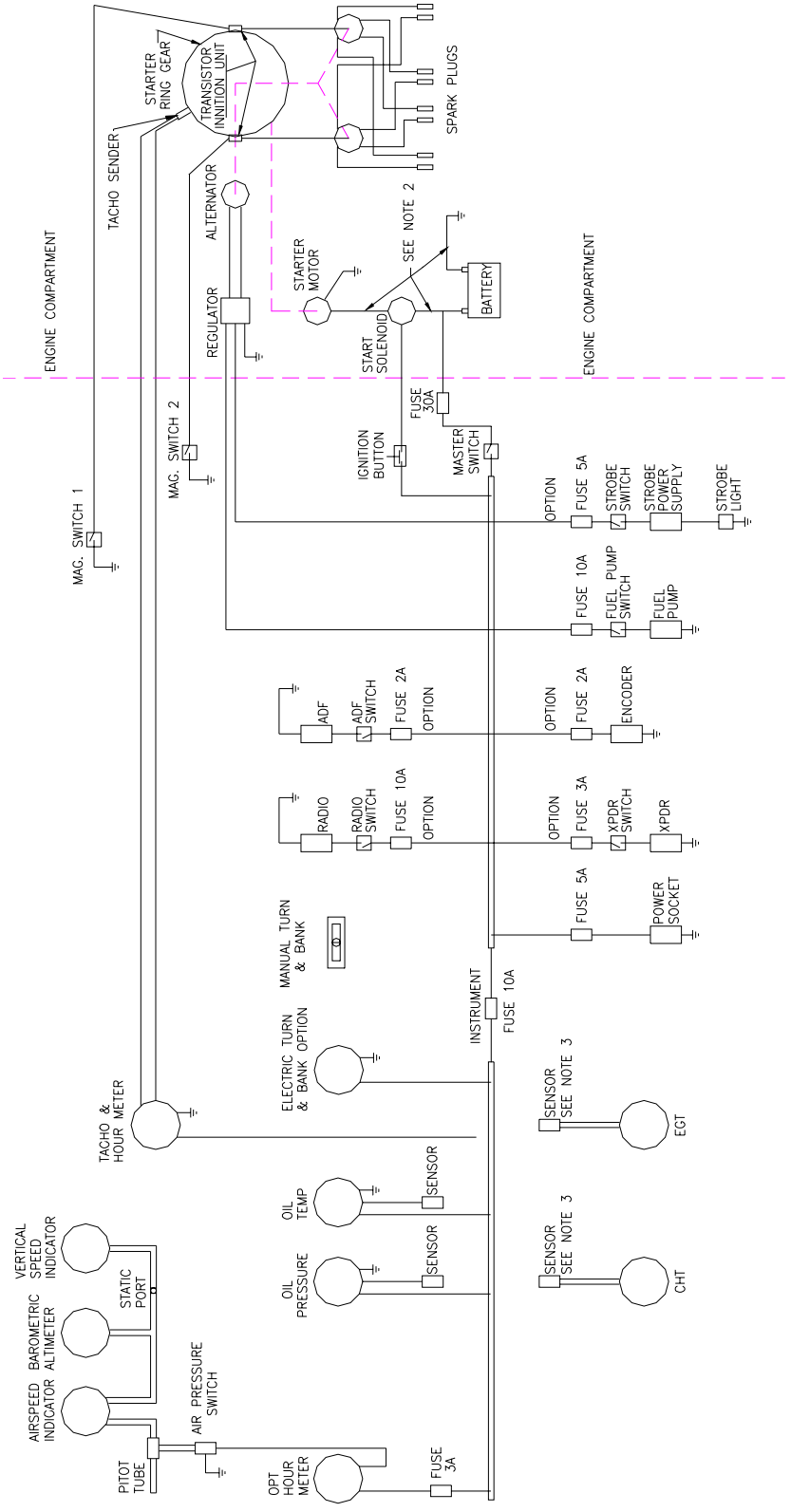
Ensure that wire is not chaffing on the fibreglass air duct or cooing fins.
No power connection is required.

9.1.4.2 CHT Sender

Temperature of the cold junction for best results should be around 50ºC. Ensure cold junction is furthest from the thermo couple probe as possible.

9.1.5 Exhaust Gas Temperature Gauge

An optional Exhaust Gas Temperature Gauge can be fitted. The probe should be positioned 100mm from the port flange on the exhaust pipe of a convenient cylinder. Jabiru Part No. PI0325N is the recommended gauge.



Drawing 4119234/3 ELECTRICAL WIRING

Figure 6. Wiring Diagram

10 Electrical Equipment

10.1 Alternator

The alternator fitted to the Jabiru 2200 engine is a single phase, permanently excited with a regulator. The rotor is mounted on the flywheel with the stator mounted on the alternator mount plate at the back of the engine. The alternator mount plate is also the mount for the ignition coils and the vacuum pump.

Specifications

Power (Max): 120W Continuous

Note: The electrical system is Negative Earth.

10.2 Regulator

The regulator has been selected to match the voltage and current of the integral alternator. Only Jabiru Part No. PI10652N should be used. (The regulator output voltage is 14 volts ± 0.8 volt.).

Recommended wiring of regulator is positive and negative of the regulator directly to the battery. A 20A fuse or circuit breaker may be used between the regulator & battery

10.3 Ignition

The ignition unit has dual breakerless transistorised ignition with the magnets mounted on the flywheel and the coils mounted on the alternator mount plate.
The current from the coils flows to the distributor from where it is distributed to the spark plugs. (See also Regulator Wiring at Page 12.)

- The ignition is turned off by grounding the coils via the ignition switches.
- The ignition is timed to 25° BTDC
- The temperature limit for the ignition coils is 70°C. This should be checked by the installer. It is recommended that pipes of 12mm dia be fitted to the top rear of each air duct directing air onto the coils for cooling purposes.
- Coil gaps are set at 0.25mm to 0.30mm (0.010” to 0.012”).

10.3.1 Transistorised Ignition 1 Wiring

No. 1 Switch – Upper to Left Transistorised Ignition
No. 1 Switch – Lower to Earth
Switch Open for Ignition ON, closed for Ignition OFF.

10.3.2 Transistorised Ignition 2 Wiring

No. 2 Switch – Upper to Right Transistorised Ignition
No. 2 Switch – Lower to Earth
Switch Open for Ignition ON, closed for Ignition OFF.

10.4 Starter Motor

The starter is mounted on the top of the engine and drives the ring gear on the flywheel. The motor is activated by engaging the starter button (the master switch has to be ON) which trips the solenoid, hence current flows from the battery to the motor. The cable from Battery to starter should be minimum 16mm^2 copper.

10.4.1 Starter Wiring

Starter Button Switch (lower) to Main Bus
Starter Button Switch (upper) to Start Solenoid (through Grommet)

10.5 Battery

The battery should be of a light weight, 12V, 20 Ah type able to accept a charging voltage up to 14 V (± 0.8V) and a 10 AMP Input.

10.5.1 Battery Cables

Black Starter Motor Mount (Engine Rear) to Battery Negative
Red Battery Positive to Starter Solenoid
Red Starter Solenoid (Switched) to Starter Motor (Part of)

10.6 Additional Wiring Information

10.6.1 Engine Hourmeter Wiring

Red Hourmeter Positive to Positive
Black Oil Pressure Switch to Engine Sump Bolt
Black Hourmeter to Oil Pressure Switch (Fwd Eng Left)

10.6.2 Earth Wiring

Black Battery Earth Negative to Firewall Earth (Engine Bay)
Black Battery Earth Negative to Earth Bus

10.6.3 Master Wiring

Red Starter Solenoid to Main Fuse

Red	Main Fuse to Master Switch (Lower)
Red	Master Switch (Upper) to Main Bus
Red	Main Bus to Red on Regulator

10.6.4 Fuel Pump Wiring

Red	Main Bus to Fuel Pump Fuse
Red	Fuel Pump Fuse to Fuel Pump Switch (Lower)
Red	Fuel Pump Switch (Upper) to fuel Pump (Red Wire)
Black	Fuel Pump (Black Wire) to Earth Bus

10.6.5 Regulator

Pale Blue (No Coding)	Pale Blue Wire Regulator plug to one Alternator Wire
Pale Blue (No Coding)	Pale Blue Wire Regulator plug to the other Alt. Wire
Black	Black Wire Regulator Plug to Earth
Red 10 g	Positive to Red Wire Reg. Plug
Yellow 16g	Positive to Yellow Wire Reg Plug
Green	Not connected – can power a charging light.

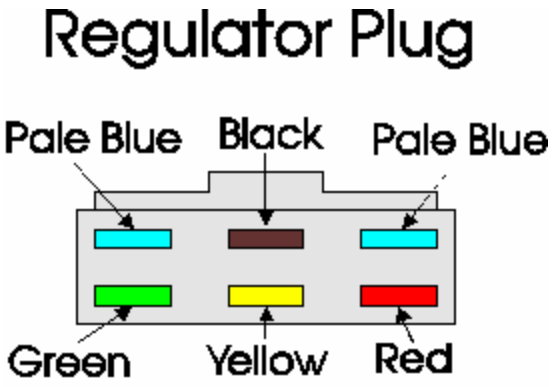


Figure 7. Regulator Plug

11 Fuel Supply System

11.1 Fuel Tank

The fuel tank must be fitted with an outlet strainer of between 8 and 16 mesh per inch, with a minimum total mesh area of 5 cm^2.

11.2 Fuel Filtration

A Fuel filter capable of preventing the passage of particles larger than 0.1mm (100um) must be installed between the fuel tank outlet and the fuel pump.

The filter must be present in the system for the fuel flow test. The size of the filter should give consideration to allow adequate flow with a used filter.

A Ryco Z15 or similar filter has been used successfully.

11.3 Mechanical Fuel Pump

The mechanical fuel pump is mounted on the engine crankcase and is camshaft driven. It is designed to supply fuel at the pressure described in the following paragraph. If fitted, the electrical boost pump must also fulfill the fuel input criteria for the carburettor, given below.

11.4 Carburettor

A Bing constant depression type 94/40 is used. This carburettor has a minimum delivery pressure of 5 kPa (0.75 Psi) and a maximum pressure of 20 kPa (3 psi). To confirm that the fuel system is capable of delivering this pressure a fuel flow test must be performed.

To check pressure, insert a 'T' piece between the mechanical pump and the carby. Test boost pump with engine off, then mechanical fuel pump with engine on, then combine with electrical boost pump as well, before first flight.

A method for performing a fuel flow test is available from Jabiru if required. A drip deflector to deflect overflowing fuel from the exhaust system is supplied as standard equipment on the engine.

Because idle adjustments cannot accurately be made on the dynamometer (where every engine is run before delivery), some adjustment of the 7mm idle set screw may be required. A hot idle of around 900RPM is desirable. Fitting an earth strap from carby to crankcase is recommended to eliminate possible radio interference.

11.4.1 Carburettor Tuning

Late in 2004 Jabiru Aircraft introduced a new system of needles and jets to the 2200 engine. The new configuration lowers fuel consumption and is now standard. Details of the configuration are given below:

Idle Jet	Bing Jet, size 45.
Idle Air Bleed	Size increased to 1.6mm diameter.
Idle Mixture Screw	Typically, Out 1 Turn.
Needle Jet	Bing Jet, size 276.
Main Jet	Bing Jet, size 220.
Needle	Jabiru Needle P/No. 4A138A0D

Note that the needle used is a proprietary item developed by Jabiru specifically for use on the 2200 engine. From S/N 2161 main jet 225 needle jet 280.

Engine tuning may be significantly affected by extreme ranges of climate or propellers which incur RPM values outside suggested figures (Appendix C).

Carburettor tuning must not be altered other than with advice from Jabiru Aircraft. If in doubt, contact Jabiru Aircraft or our local representative

11.5 Fuel Lines

Fuel lines are nominally 6mm bore. All hoses forward of the firewall require fire resistant sheathing and those between moving sections such as between engine and firewall should be flexible. Hoses must be changed every two years, though if there are visible signs of degradation (such as cracking or hardening) the hose should be changed immediately.

12 Air Intake System

12.1 SCAT HOSE

Remove at each 50 hourly inspection one end of each scat hose. Inspect for holes, leaks and condition of helical wound in a wire former. Replace if any signs of corrosion is evident.

12.2 Air Filter

- The induction system must not cause positive RAM induction pressure as this will have an unpredictable affect the fuel/air mixture supplied to the engine.
- The filter must be capable of supplying 250 kg/hr (550 pph) of air
- The filter may have to be changed at regular intervals if the engine is to be used in a dusty environment.
- Air flow should be as direct as possible, no tight bends and air taken from outside the cowl. Current air filter is RAF 17 (Repco)

13 Exhaust System

- An exhaust system is provided with the engine. Both Pusher and Tractor systems are available.
- Muffler Volume – Capacity 3 litres
- Back pressure at Takeoff Performance – Max 0.2 bar (2.9 psi). Readings taken 70mm from muffler flange connections. Only complete mufflers supplied with Jabiru Aircraft are welded – all others require tail pipes to be TIG welded to the muffler body. NOTE: Drilled ends of pipes go inside muffler cavity. The tail pipes go completely through the muffler body and are welded on both top and bottom.
- When fitting the muffler one or more of the exhaust pipes can be loosened at the connection to the cylinder head to allow easy fit of the muffler. They then must be tightened.
- Exhaust Gas Temperature (EGT) - Nominal 650^{o} – 750^{o} (1202^{o}F – 1382^{o}F) measured 100mm from the exhaust manifold flange.

14 Cooling Systems

14.1 Air Ducts

- The engine should be installed using RAM AIR ducts provided with the engine.
- Each duct must have a 25mm hole at the inside top front to bleed air over the crankcase.
- Cylinder and cylinder head cooling is achieved by ducting air over the cylinders and heads. The Static Air Pressure inside the cooling ducts must not be lower than 4.3cm (1.7") water gauge at 1.3 times the stall speed.
- The cooling ducts provided are only a starting point in establishing effective engine cooling. The ducts may require to be increased in size and additional baffles provided to achieve the specified maximum cylinder head temperature of 180^{o}C (see page 19).

14.2 Oil Cooling

- The dipstick cap must be screwed fully in before removal for reading oil level.
- An oil cooler adapter is supplied with the engine and is fitted under the oil filter.
- Oil coolers are available from Jabiru Aircraft.
- Unless operating in environments of low temperatures, oil coolers are mandatory.
- The cooler can be plumbed either way to the adaptor – flow direction through the cooler is not important.
- In continuous operation oil temperatures between 80°C and 90°C (176°F – 194°F) are desirable. 70°C (158°F) is the minimum allowable temperature for continuous running and 100°C (212°F) is the maximum allowable temperature for continuous running.
- Over filling with oil is not desirable. Over filling may result in elevated temperatures and excessive oil loss through the crankcase vent.
- When installed in a tail-dragger aircraft, recalibration of the dipstick will be required by the owner.
- Hoses should be nominally 10mm (3/8") bore.
- Hoses must be changed every two years or when visible degradation (cracking, hardening) is visible during inspections.

The limits in the Specification Sheet, contained in Appendix B, must be strictly adhered to. Warranty will not be paid on engine damage attributed to overheating of cylinders or oil.

15 Propeller Selection

- The hub of the propeller must be drilled with holes to match the flange.
- The propeller must be carefully selected to match the airframe and the engine: Propellers up to 1727mm (68") in diameter and between 762mm (30") and 1219mm (48") in pitch may be used. The propeller flange is drilled with 6 holes at both 4" PCD and 100mm PCD (total of 12 holes).
- All Propellers must be able to obtain 2800rpm static and 3150rpm to 3300rpm wide open throttle straight and level.
- Do not cruise or climb in the range 2100rpm – 2400rpm.
- Maximum moment of inertia 0.25 kgm2

Applications outside this range should be referred to Jabiru.

Engine MUST NEVER BE RUN WITHOUT THE PROPELLER. Damage will occur in this state.

16 Auxiliary Units

16.1 Vacuum Pump

For the installation of an artificial horizon and/or a direction gyro a vacuum pump is necessary. A Tempest 212CW (or equivalent) vacuum pump can be fitted to the alternator mounting plate and directly coupled to the crankshaft. The drive pad is dry.

The pad and spline are SAE Standard.

17 Appendix A – Wiring Diagrams

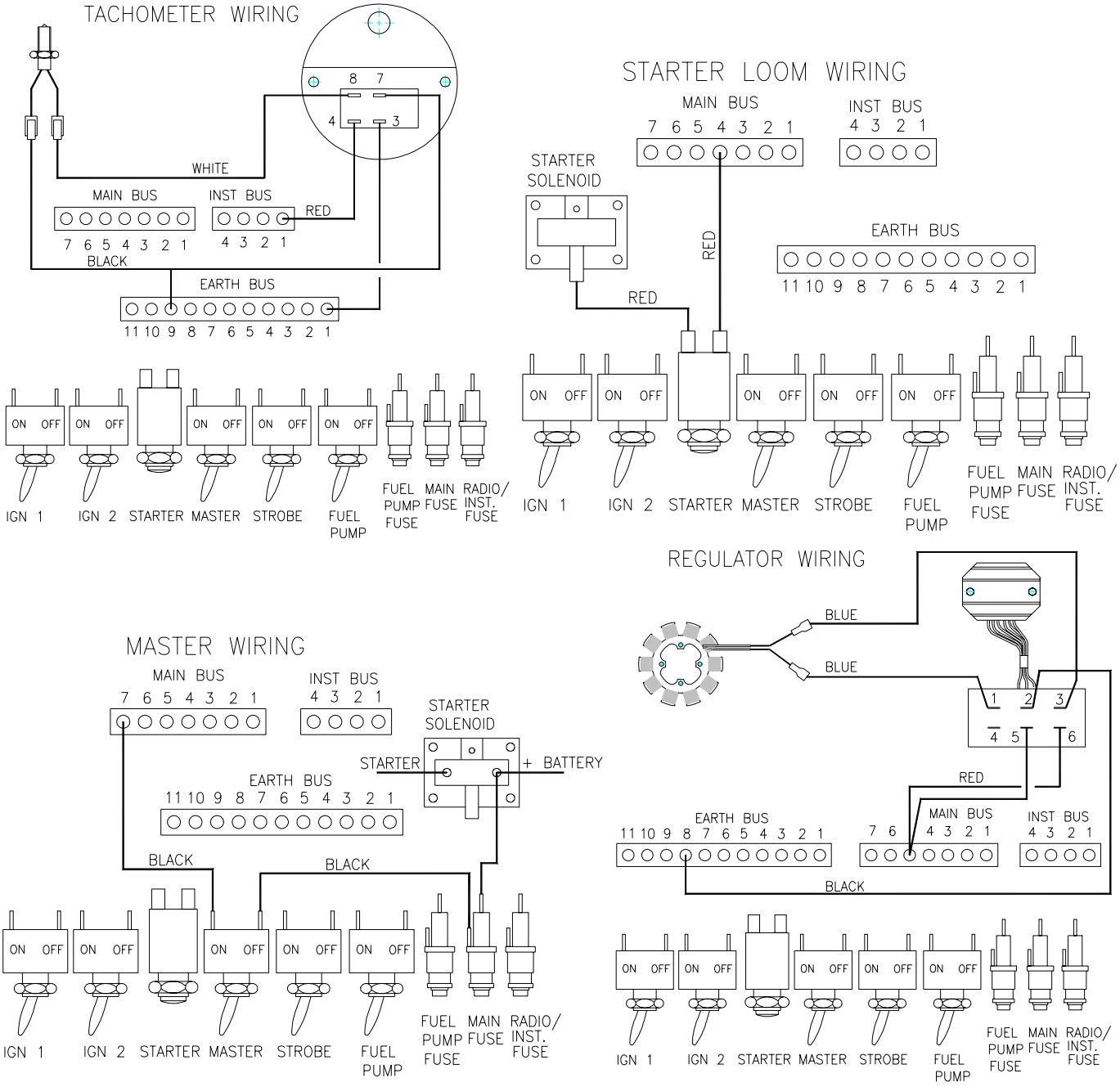


Figure 8 – Wiring Details

18 Appendix B – Supplemantay Information

18.1 Recommended Propeller Type

- Fixed pitch wooden propellers.
- Maximum propeller diameter 1727mm (68").

18.2 Equipment

The following equipment is included in the engine approval:-

- Carburettor: 1 x Bing constant Pressure carburettor type 94/40 Main jet is Bing 220. Needle jet 276. Idle jet 45.
- Fuel Pump: Mechanical, Jabiru P/N PG10332N
- Ignition System: Jabiru dual magneto, high voltage transistorised, contactless P/N PI10522N
- Spark Plugs: NGK D9EA
- Alternator: Integrated Jabiru, permanent magnet single phase alternator, P/N 4532064/4535064 with regulator rectifier P/No. PI10652N.
- Starter: Jabiru 12V/1.5 kW, engagement via reduction gear and flywheel. Nippon Denso type, P/No. 4933023.

The following optional equipment may be driven by or fitted to the engine subject to the type number being included in the approved Jabiru Aircraft Pty Ltd engine specification:-

Vacuum Pump: Tempest 212CW (or equivalent) vacuum pump fitted to the alternator mounting plate and directly coupled to the crankshaft. The drive pad is dry & The pad and spline are SAE Standard

19 Appendix C – Jabiru Engine Installation Tips

19.1 Prop

- For optimal performance, Jabiru engines require 2800 – 2900 RPM at take off and 3200 in the air straight and level. This may vary with aircraft and prop type, but variation beyond these limits will affect tuning and in extreme cases may result in damage to the engine.
- Carby tuning must not be altered other than with advice from Jabiru Aircraft. If in doubt, contact Jabiru Aircraft or our local representative.

19.2 Tacho

- Ensure gauge is reading correctly. While large errors will be obvious, smaller errors are harder to pick and it is recommended to check the gauge reading with another instrument (such as a hand-held optical prop-tach)

19.3 Cooling

- Cowls should have adequate entry and exit areas. As a general guide, cowl outlets should have approximately 3 times as much area as the inlets.
- Care must be taken not to flood the cowl area with oil cooler air (excessive oil cooler duct size). Too much air coming in through the oil cooler will reduce the amount of air flowing through the ram air ducts & increase CHTs.
- Air ducts as supplied are starting points and for best performance must be optimized by the builder. Poor connections and air gaps around ducts/cooler etc give second rate cooling

Damage caused by overheating due to poor installation techniques would not be covered under warranty

19.4 Air Induction

- Air must enter from outside the cowl.
- All scat hoses should have only slight bends, with all sharp edges removed from the induction path (including hot air sources).
- Ensure the filter used has adequate size.

19.5 Carburettor

- The bowl vent line must be connected to the filtered side of air box.
- Ensure that the two sense holes on the rear of venturi (intake side of carburettor) have not been obscured.
- Set engine idle when warm.
- Ensure throttle and choke movement is correct.

19.6 Fuel Pump

- Ensure boost pump is not capable of more than 3 lb (20 kPa) pressure.

19.7 Oil

- Expel inhibiting oil from cylinders and pressure up (wind engine on starter until a the oil pressure gauge shows a reading) before first start.
- Ensure correct run-in type oil is used for the first 25 – 30 hours to ensure proper ring bedding-in.
- Once past the initial 25-30 hours, ensure the oil used meets the specifications given above.
- Oil coolers are mandatory unless operating in very cold ambient temperatures. Refer to Oil Cooling section above for allowable oil operating temperature ranges.
- Do not overfill the engine – this may result in high oil temperatures.

19.8 Fuel

- Avgas 100LL
- MOGAS above 95 Octane RON.
- Ensure a suitable fuel filter is used.
- Ensure the fuel tank is properly vented.

19.9 Oil Overflow

- Use a small collector bottle to catch engine oil venting.

19.10 Heads/Valves

- See section on early operation
- Check Head bolt tensions at regular intervals.

19.11 Additives

- No Oil or fuel additives should be used.
-

Use of oil or fuel additives will void warranty.

19.12 Temperature

- Refer to correct temperature operation of the engine

19.13 Connections

- “G” terminal on oil pressure sender is connected to gauge.
- “W” terminal on oil pressure sender can be connected to a warning light
- Regulator should be connected as per instructions above.
- Oil temp terminal connects to gauge per instructions included with gauge.

- CHT sensor ring under spark plug connects to gauge.
- EGT (optional) connects to gauge.
- Fuel hoses/oil hoses as required. Hoses must be protected by fire sleeve.
- Throttle/choke connected & movement adjusted.
- Carburettor heat arrangement working
- Correct scat hoses and directions
- Run hose from sump vent pipe to collection bottle.

19.14 Contact

- Check for contact of engine, cooler or ducts on cowl. Any contact will cause excessive vibration & if the oil cooler is rubbing it will eventually fail & leak.

19.15 Warranty

Damage caused by overheating due to poor installation techniques would not be covered under warranty.

Operation of the engine on non approved oils and fuel will likewise not be covered

19.16 Performance

- Overall performance of engine and airframe depends on correct installation and prop match

19.17 Coils

- When installing new ignition coils the output leads go in the directon of prop rotation. RHS coil output lead is up LHS coil output lead goes down – See page 24.

19.18 Induction

- It is strongly recommended that when connecting SCAT hose to the carburettor (intake system) that some form of fiberglass tube or specially manufactured “Cobra Head” made by Jabiru Aircraft be used. This will prevent air turbulence in front of the 2 sense holes on the intake of the carby. Turbulence next to these sense holes can cause the engine to run “out of tune” or “roughly” at certain revs

20 Appendix D – Normal Engine Figures

The following information is intended to allow an assessment of the engine's performance when installed in a known airframe with a known propeller.

20.1 Known Airframe / Engine Details

- Jabiru SP (2 Seater)
- Propeller 60" x 42" (1525mm x 1067mm) or
- 60" x 44" (1525mm x 1118mm)

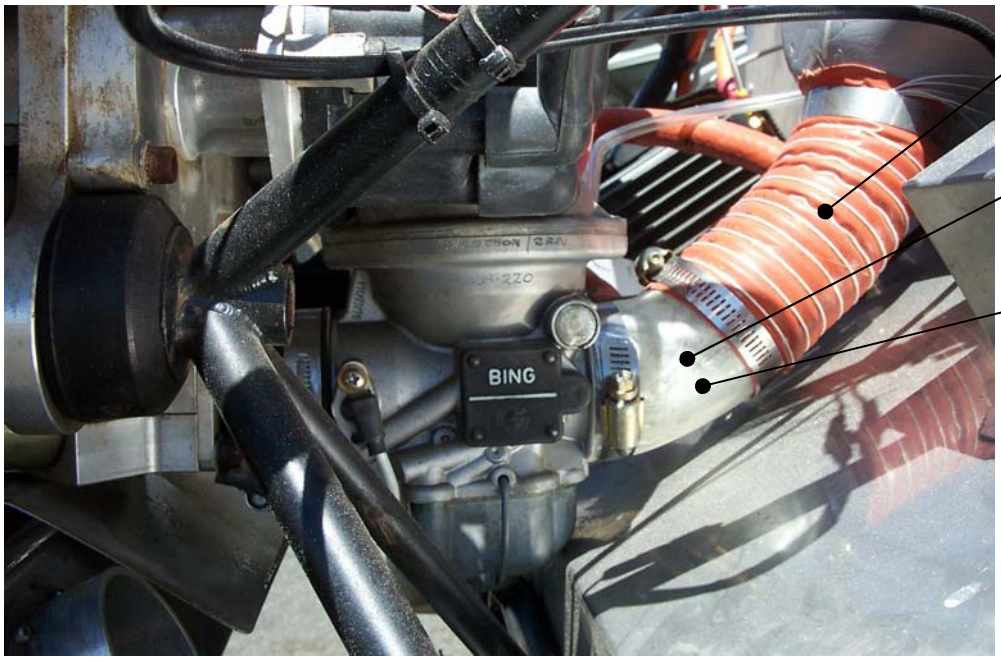
20.2 Reference Information:

- Figures given are approximate guide only.
- Engines installed in other aircraft with different prop loads, elevation and fuel types will differ from the Jabiru airframe.
- Poor installations will result in poor performance.
- All air inlet junctions from outside the cowl to the carburettor inlet must be free of edges, ledges and tight bends.
- Carburettor inlet must have protection to the scat hose attachment (short glass tube or Jabiru produced adaptor).
- Air vent for the carburettor bowl must be routed to the filtered side of the air box.
- Engines must be fitted with an oil cooler.
- Engines work best at RPM quoted. Extended operation of the engine at other speeds may result in reduced performance or engine damage. Engines fitted with coarser or finer pitched props will cause variation from figures quoted and could cause excessive fuel consumption and higher than normal CHT's
- Engines are jetted to a standard and must not be changed without discussion with Jabiru Aircraft or local representative.
- All figures given at sea level and at summer temp of around 25 ˚C O.A.T

20.3 Normal Operation Data

Idle Hot:	900 – 950 RPM
Take Off Power:	2800 RPM (60" x 44" Propeller) 2900 RPM (60" x 42" Propeller)
Full Power S&L:	3200 RPM (60" x 44" Propeller) 3300 RPM (60" x 42" Propeller)
Cruise At 75% Power:	2750 - 2850 RPM
Oil Pressure:	226 - 525 kPa (32 psi – 76 psi)
Oil Temperature:	70˚C - 100°C (158°F - 212°F) normal operation, 118°C Max (244˚F)
Max Cruise CHT:	180°C (356°F)
Max Climb CHT:	200°C (392°F)
EGT:	650°C – 750°C (1202°F – 1382°F)
Mechanical Fuel Pump Pressure	3 lbs (20 kPa)

21 Appendix E - Typical Installation

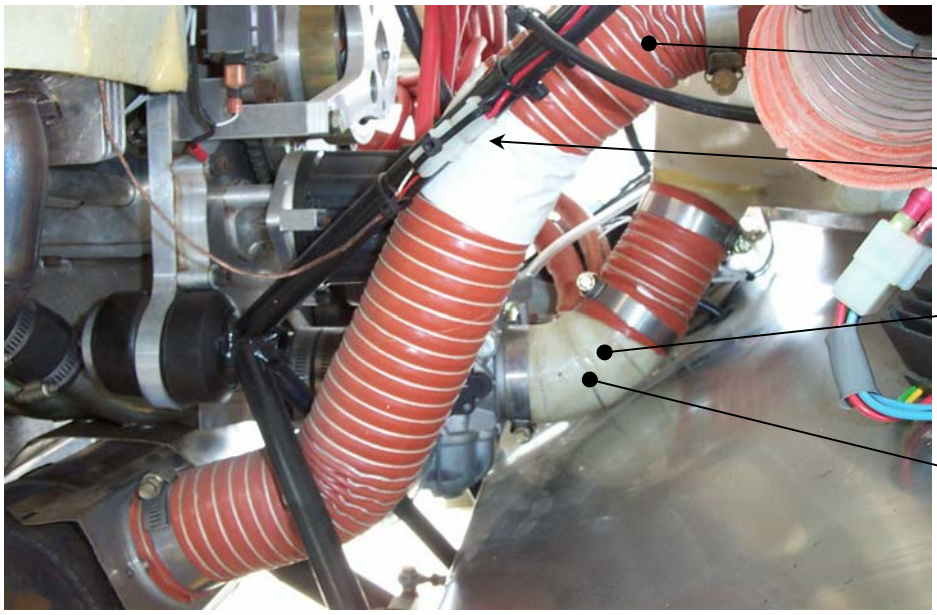


Gradual bends only in SCAT hose

Glass duct removes a sharp corner in SCAT tube

Glass duct prevents bunched SCAT hose from blocking sensor holes on carburettor inlet

Figure 9. Intake Detail #1



Gradual bends only in SCAT hose

CHT cold junction positioned well clear of engine

Glass duct removes a sharp corner in SCAT tube

Glass duct prevents bunched SCAT hose from blocking sensor holes on carburettor inlet

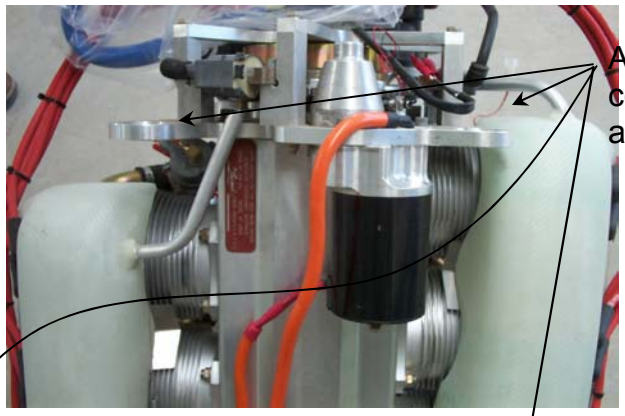
Figure 10. Intake Detail #2

Ram air ducts fixed to engine with rocker cover cap screws front & rear.

Oil cooler "soft" mounted on rubber grommets

Torque on propeller bolts 6 ft.lb

Figure 11. Engine Installation #1



Air pipes direct cooling air from ram air ducts over coils.

Figure 12. Coil Cooling Detail #1

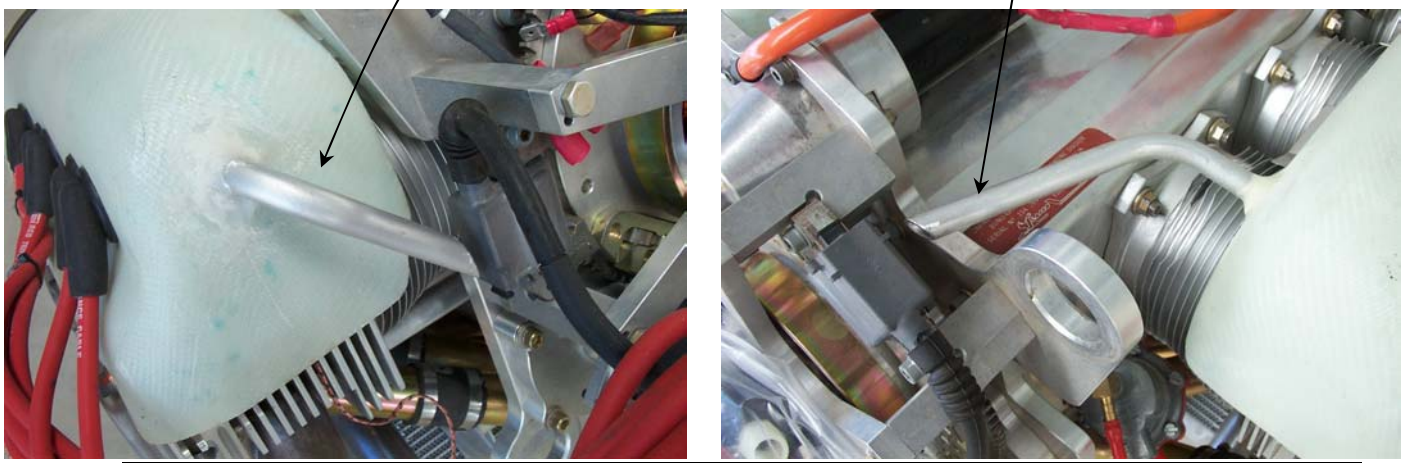


Figure 13. Coil Cooling Detail #2

21.1 Engine Installation Procedure

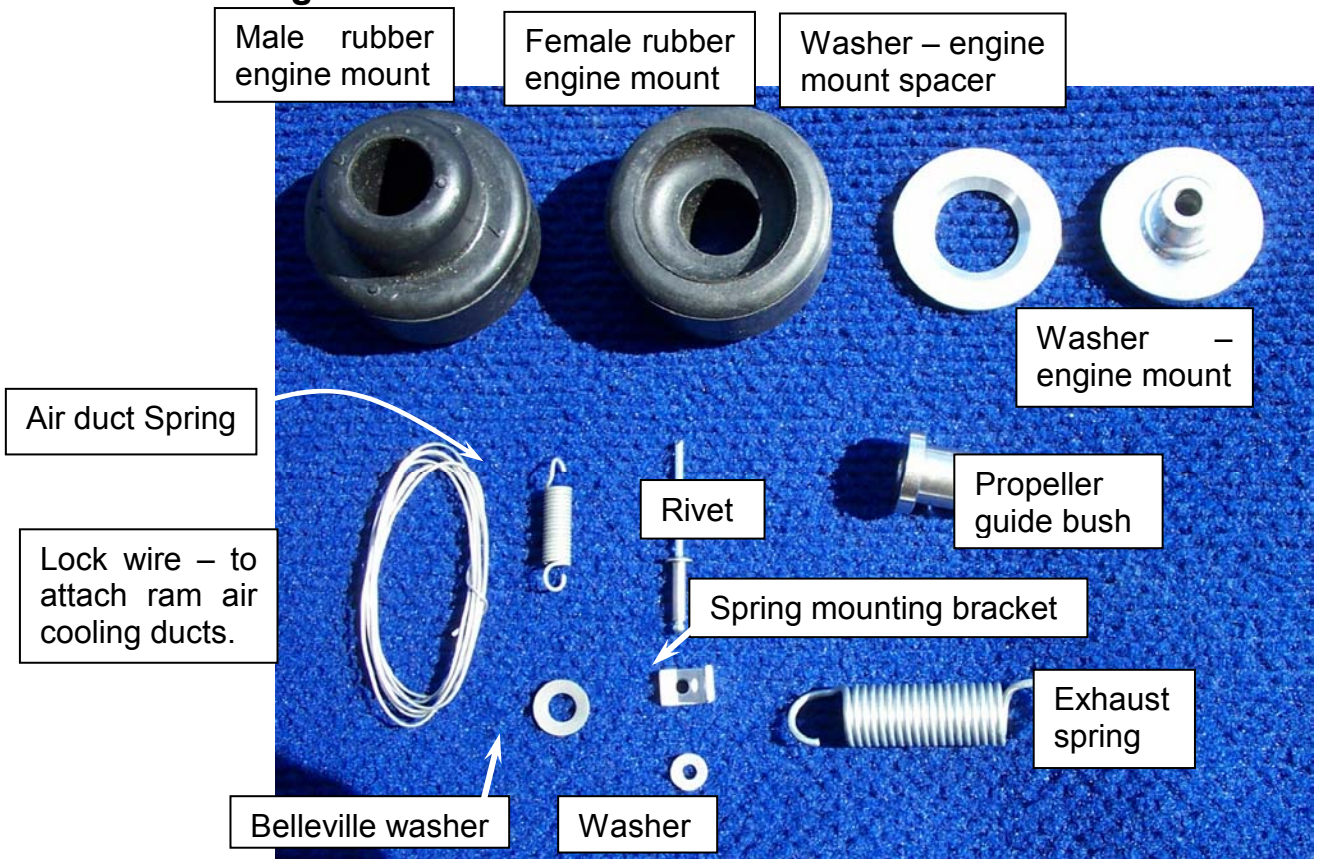


Figure 14. Engine Accessory Pack Contents

21.1.1 Procedure:

a) Attach male engine mount rubbers to all engine mount pins on the engine mount. Place an AN4-31A bolt through each mount (see details below). Note that an engine mount spacer washer is fitted between the male rubber & the lower engine mount pins (Refer to Figure below).

b) With the Back of the Aircraft Supported & the wheels chocked, lift the engine onto the engine mount.

c) Insert the upper engine mount rubbers into the engine backing plate first by tilting the front of the engine up. Once both upper rubbers are through the engine backing plate, fit the female rubber, engine mount spacer washer, engine mount washer, ¼" washer & Heat Proof nut.

d) To place the nuts on the mount bolts the rubbers must be compressed. Do this by using a deep reach socket inside the engine mount pins & clamping the rubber mount assembly using a G-clamp with the swivel taken off the ball. See Photo. Start nuts on both upper mount bolts.

e) Once bolts of the upper rubbers are started, continue lowering the front of the engine & align the lower engine mount pins with the engine backing plate.

f) Use the weight of the engine to compress the lower rubbers & fit the nuts to the bolts.

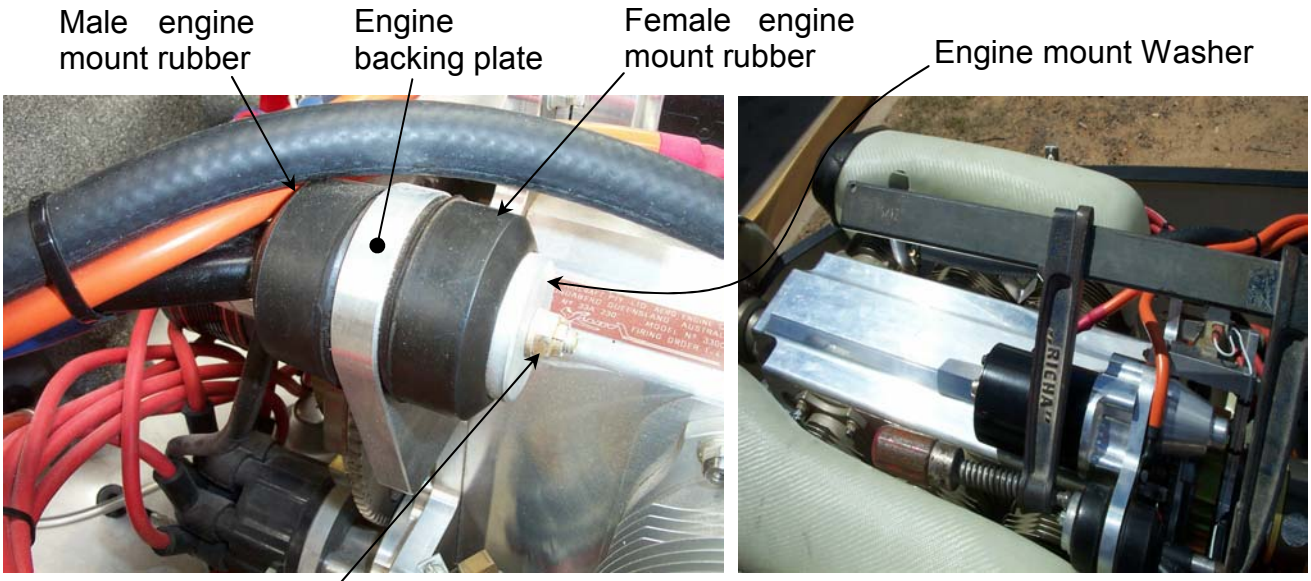


Figure 15. Upper Engine Mount Detail

g) The lower engine mount rubbers are assembled in the same way, except the male engine mount rubber is fitted to the engine mount pins first. Refer to drawing below.

h) Tighten nuts until firm. (Engine mount washer will touch the engine mount pin as the rubbers compress)

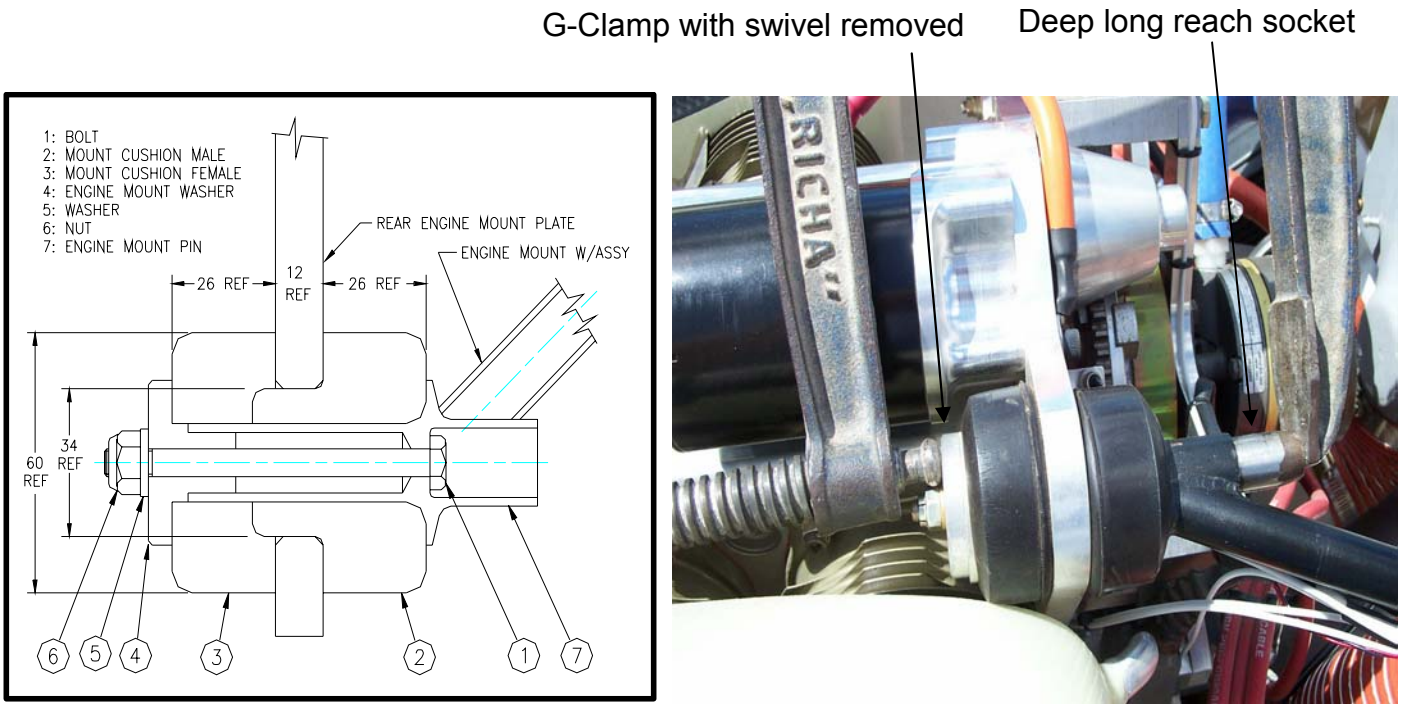


Figure 16 Lower Engine Mount Detail

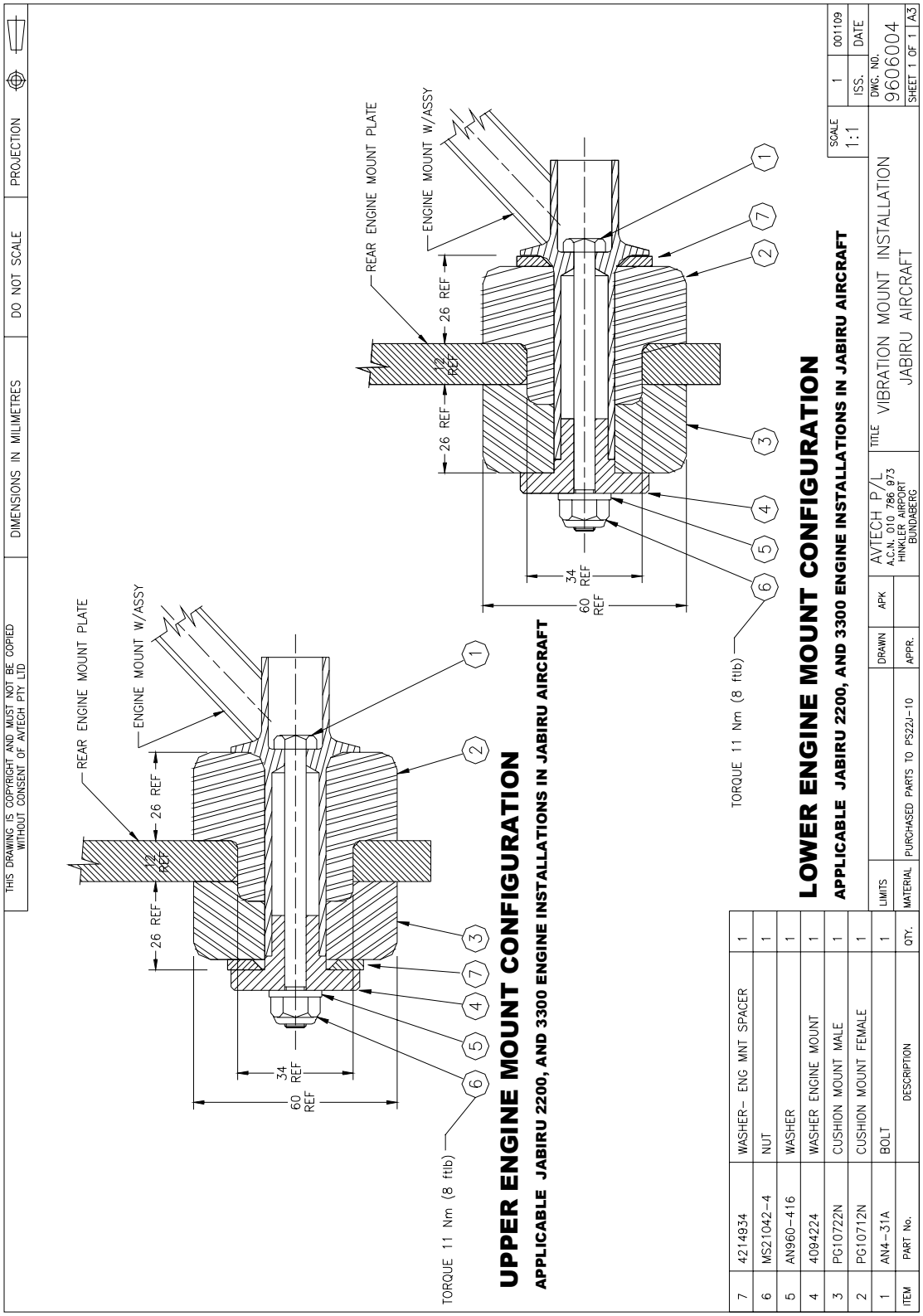

THIS DRAWING IS COPYRIGHT AND MUST NOT BE COPIED WITHOUT CONSENT OF AVTECH PTY LTD
DIMENSIONS IN MILIMETRES
DO NOT SCALE
PROJECTION
REAR ENGINE MOUNT PLATE
ENGINE MOUNT W/ASSY
26 REF
12 REF
34 REF
60 REF
TORQUE 11 Nm (8 ftlb)
UPPER ENGINE MOUNT CONFIGURATION
APPLICABLE JABIRU 2200, AND 3300 ENGINE INSTALLATIONS IN JABIRU AIRCRAFT
LOWER ENGINE MOUNT CONFIGURATION
APPLICABLE JABIRU 2200, AND 3300 ENGINE INSTALLATIONS IN JABIRU AIRCRAFT
ITEM | PART No. | DESCRIPTION | QTY.
1 | AN4-31A | BOLT | 1
2 | PG10712N | CUSHION MOUNT FEMALE | 1
3 | PG10722N | CUSHION MOUNT MALE | 1
4 | 4094224 | WASHER ENGINE MOUNT | 1
5 | AN960-416 | WASHER | 1
6 | MS21042-4 | NUT | 1
7 | 4214934 | WASHER- ENG MNT SPACER | 1
MATERIAL | PURCHASED PARTS TO PS22J-10
LIMITS
DRAWN | APK
APPR.
AVTECH P/L
A.C.N. 010 786 973
HINKLER AIRPORT
BUNDABERG
TITLE VIBRATION MOUNT INSTALLATION
JABIRU AIRCRAFT
SCALE 1:1
ISS. 1 001109
DWG. NO. 9606004
SHEET 1 OF 1 | A3

Figure 17. Engine Mount Detail

Figure 18. Fuel Connections General

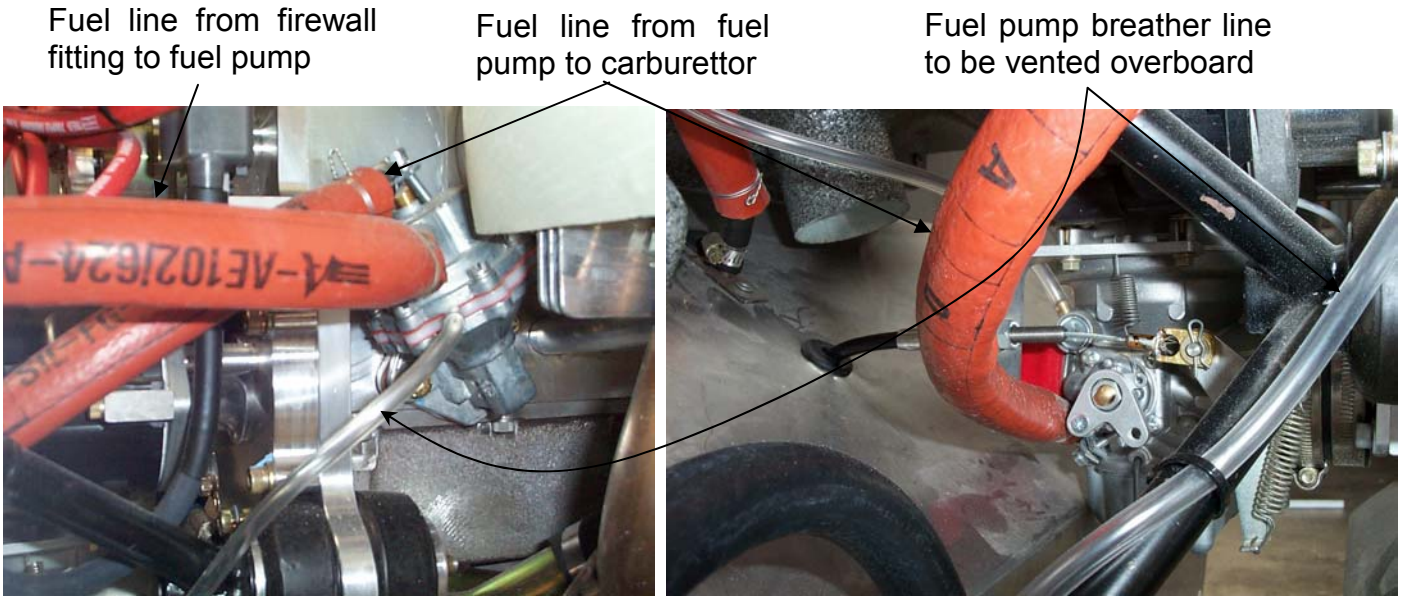


Figure 19. Fuel Connection Detail

i) Connect the fuel line to fuel pump (Refer to photo). Ensure the fireproof sleeve is in place.

j) Ensure the fuel line from fuel pump to the carburettor is connected & protected by fireproof sleeve.

k) Ensure that the fuel overflow line is in place, and secured to vent overboard.

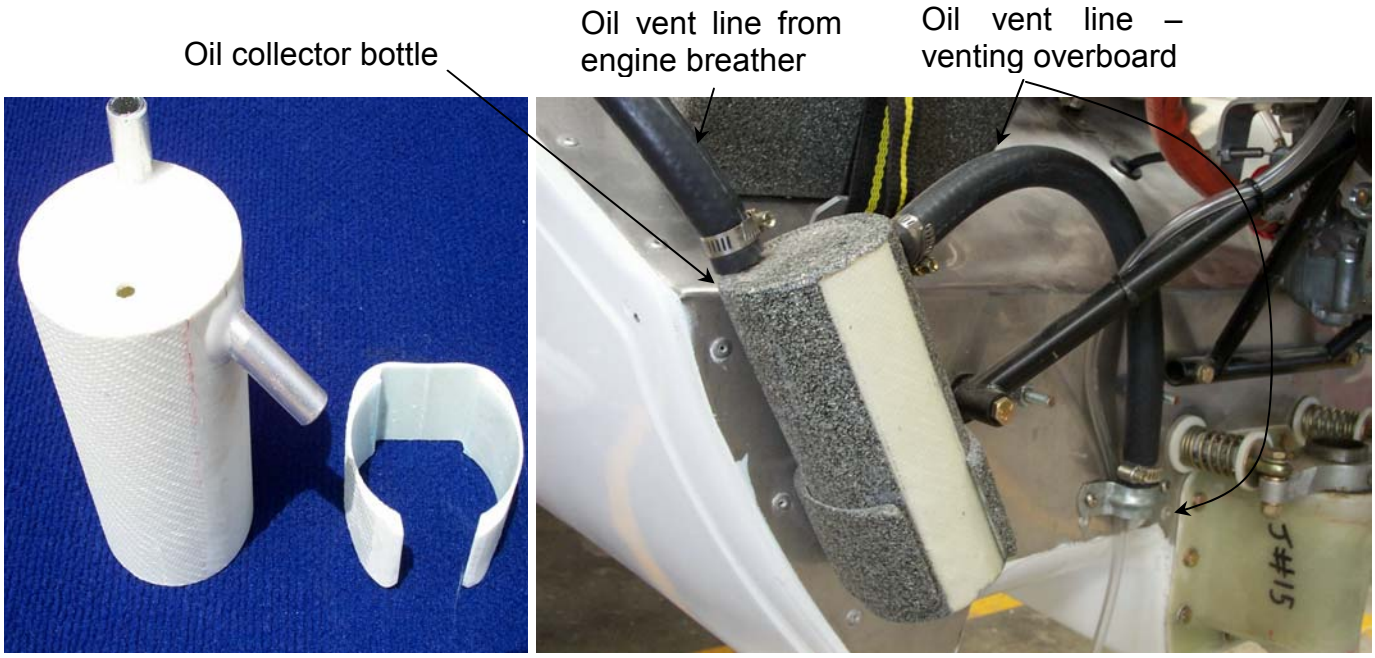


Figure 20. Oil Collector Bottle

l) Fit the oil over flow bottle to the firewall by drilling and Riveting oil bottle holder in place using 73AS 6-6 rivets. Refer to photo.

m) Connect the oil breather line from the engine breather.

n) Ensure that the oil overflow line is in place and vents overboard.

o) Fit Scat hoses from NACA duct to Air Inlet Housing Assembly, from hot air muff to carburettor heat inlet on the hot air mixer box and from the hot air mixer box to carburetor.

Note It is most important to remove any sharp edges or lips off the inside of the mixer box cover. See Photos below

Incorrect plumbing – Note sharp lips

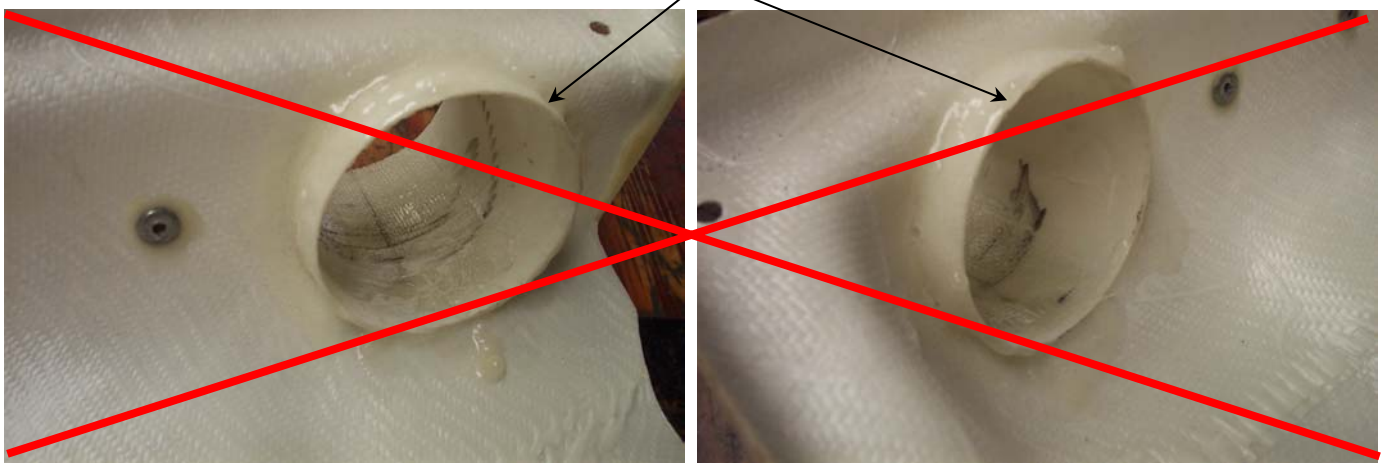


Figure 21. Hot Air Plumbing – Incorrect

Correct plumbing – sharp lips & abrupt corners rounded & smoothed off.

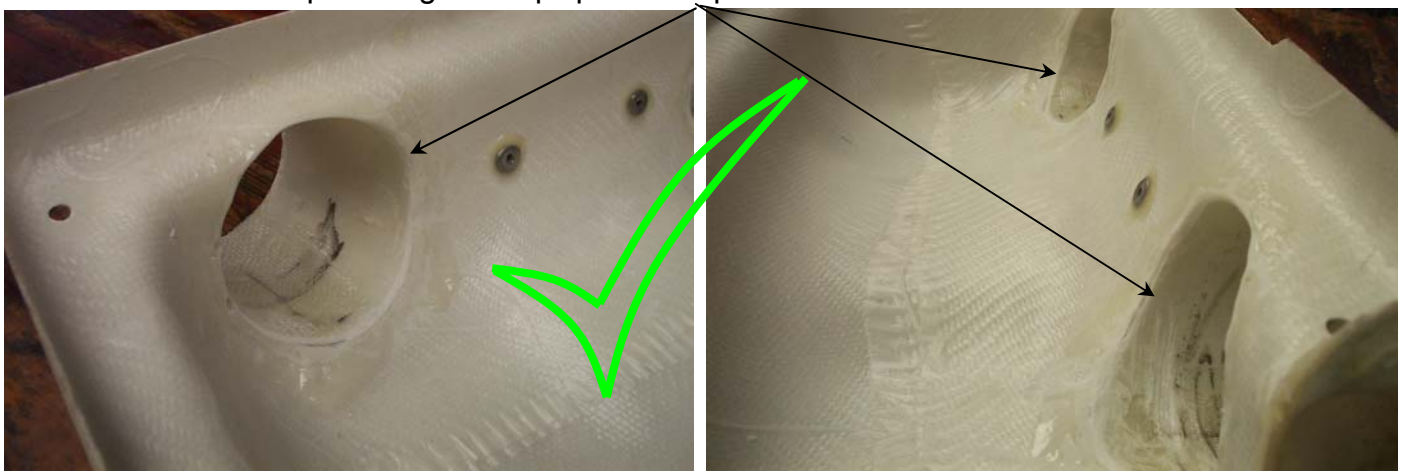


Figure 22 Hot Air Plumbing – Correct

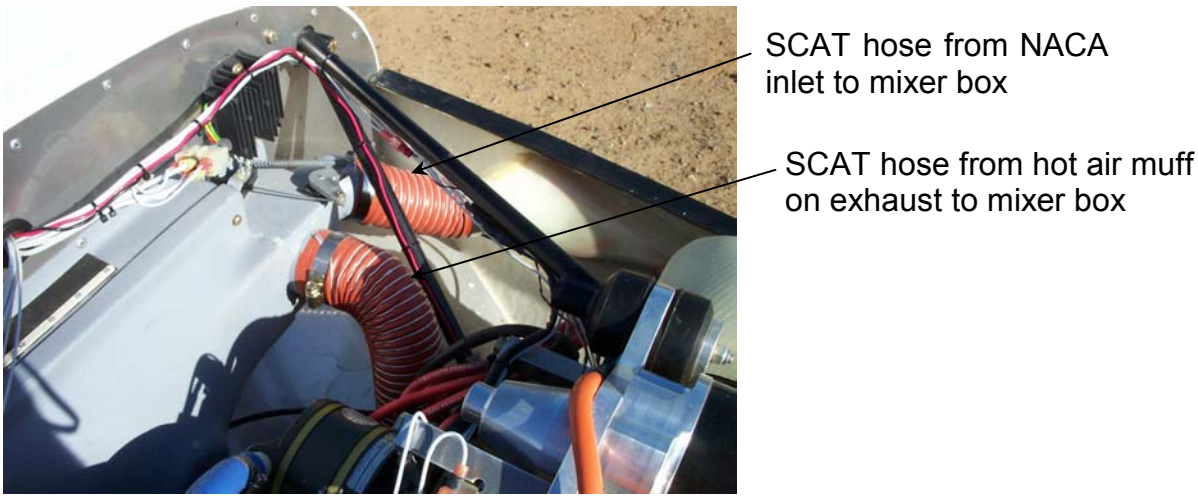


Figure 23. SCAT Hose Detail #1

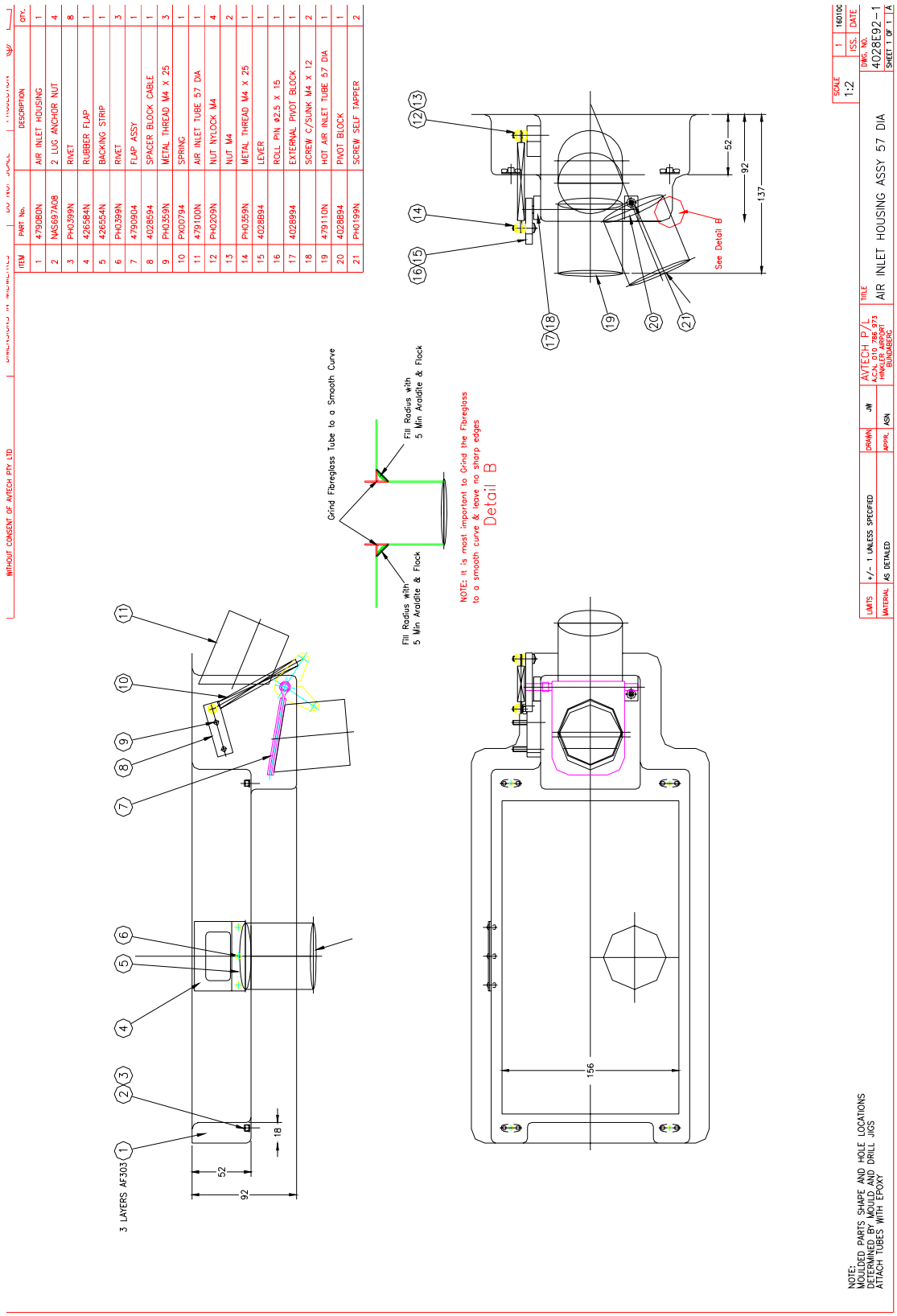

ITEM | PART No. | DESCRIPTION | QTY.
1 | 479080N | AIR INLET HOUSING | 1
2 | NAS6976A08 | 2 LUG ANCHOR NUT | 4
3 | PH0399N | RIVET | 8
4 | 426584N | RUBBER FLAP | 1
5 | 426554N | BACKING STRIP | 1
6 | PH0399N | RIVET | 3
7 | 4790904 | FLAP ASSY | 1
8 | 4026594 | SPACER BLOCK CABLE | 1
9 | PH0359N | METAL THREAD M4 X 25 | 3
10 | PX00794 | SPRING | 1
11 | 479100N | AIR INLET TUBE 57 DIA | 1
12 | PH0209N | NUT NYLOCK M4 | 4
13 | | NUT M4 | 2
14 | PH0359N | METAL THREAD M4 X 25 | 1
15 | 4026894 | LEVER | 1
16 | | ROLL PIN ø2.5 X 15 | 1
17 | 4026894 | EXTERNAL PIVOT BLOCK | 1
18 | | SCREW c/SUNK M4 X 12 | 2
19 | 479110N | HOT AIR INLET TUBE 57 DIA | 1
20 | 4026894 | PIVOT BLOCK | 1
21 | PH0199N | SCREW SELF TAPPER | 2
See Detail B
52
92
137
Grind Fibreglass Tube to a Smooth Curve
Fill Radius with 5 Min Araldite & Flock
Fill Radius with 5 Min Araldite & Flock
NOTE: It is most important to Grind the Fibreglass to a smooth curve & leave no sharp edges
Detail B
3 LAYERS AF303
18
52
92
156
NOTE:
MOULDED PARTS SHAPE AND HOLE LOCATIONS DETERMINED BY MOULD AND DRILL JIGS
ATTACH TUBES WITH EPOXY
SCALE 1:2
ISS. 1
DATE 160106
DWG. NO. 4028E92_1
SHEET 1 OF 1 A
TITLE AIR INLET HOUSING ASSY 57 DIA
AVTECH P/L
ACN 010 786 673
HANGER AIRPORT
BUNDABERG
DRAWN JW
APPR. ASN
LIMITS +/- 1 UNLESS SPECIFIED
MATERIAL AS DETAILED
WITHOUT CONSENT OF AVTECH PTY LTD

Figure 24. Typical Hot Air Mixer Box

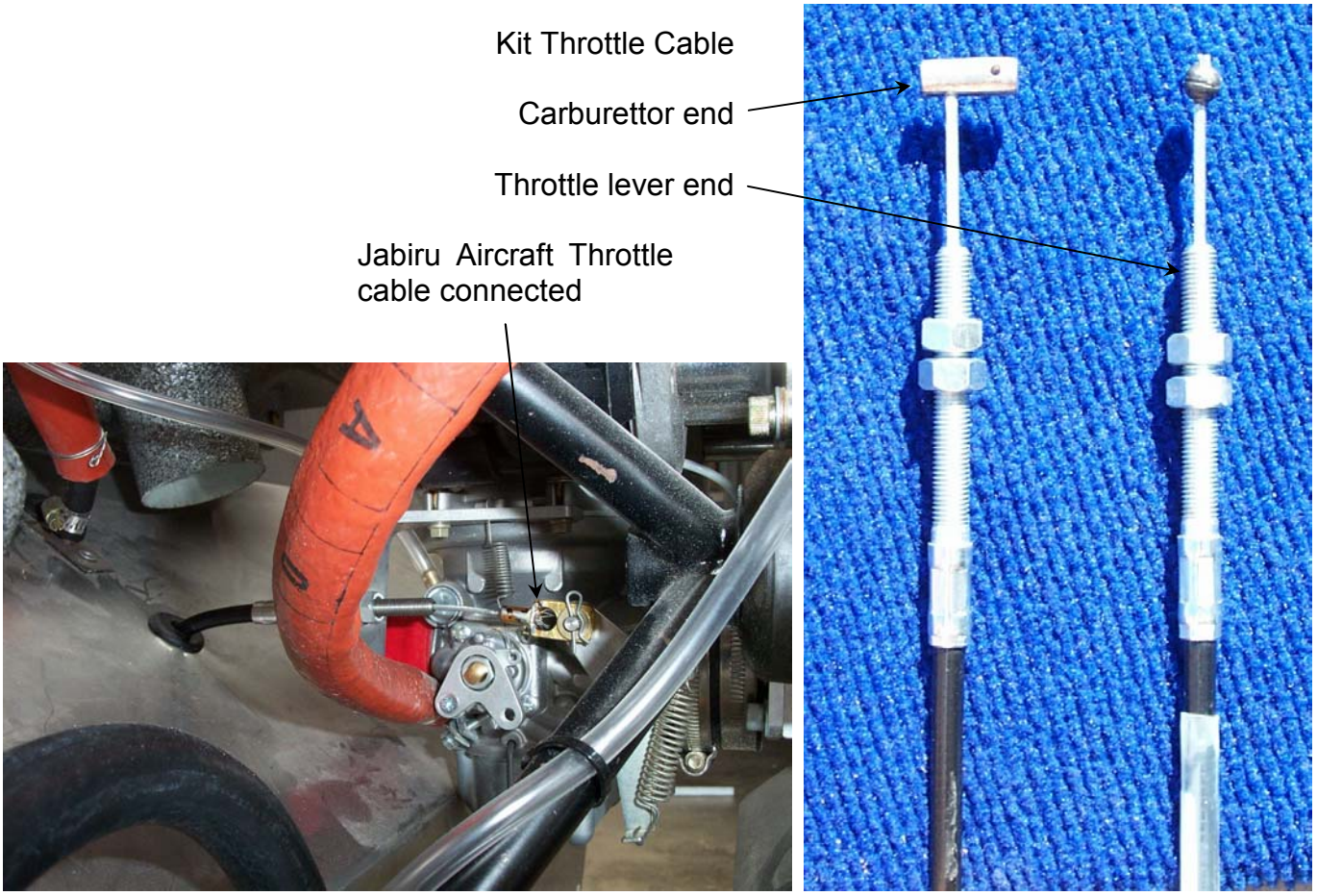


Figure 25. Control Connections to Carburettor

p) Fit throttle cable to carburetor. Note that Jabiru Aircraft kits come with a throttle cable cut to length and with the correct end fitting attached. Engines used in firewall-forward kits will be supplied with a length of throttle cable with no end – the builder must cut the cable to length and fit the carburettor end fitting. 5/16" washers are used on the cable end fitting (one washer either side of cable end fitting) to align cable. Use R-clip to assemble.

q) Fit choke cable to carburettor. Use an R-clip to assemble. Note that the fuel line from the fuel pump to the carburettor passes between the choke and throttle cables. Choke cable not shown on Figure above.

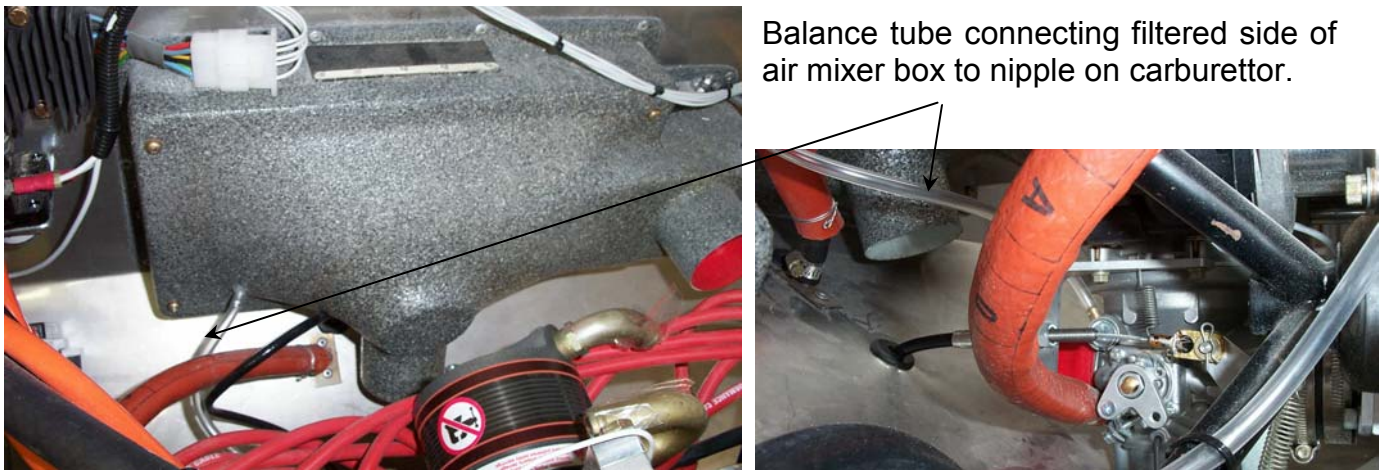


Figure 26. Balance Tube Detail #1

r) Connect the fuel balance tube from the nipple on the carburettor to a fitting on the filtered air side of the air mixer box.

Note: The balance tube must be connected to ensure proper mixture control.

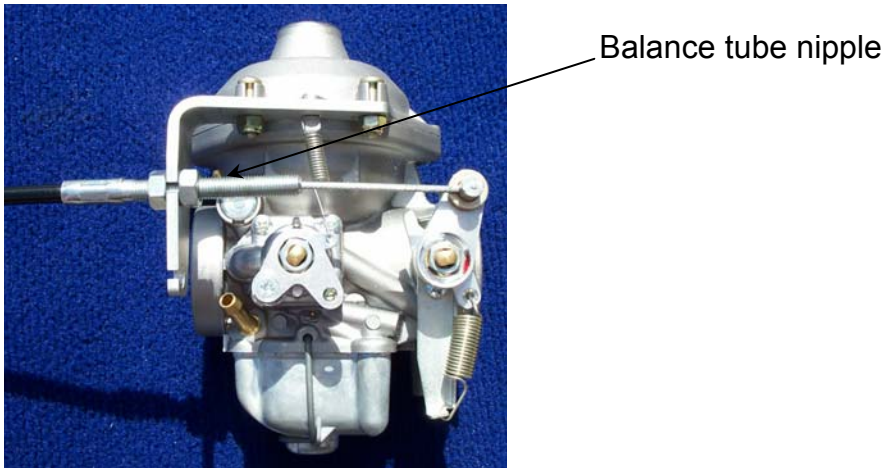


Figure 27. Carburettor Balance Tube Nipple

s) Fit cylinder head temperature (CHT) sensor. The CHT sensor used in Jabiru aircraft is a J-type thermocouple located under the rear spark plug of No: 4 cylinder. The VDO 310 980 Cylinder Head Temperature Gauge Kit is compatible with this sensor and is installed as standard equipment in Jabiru Aircraft. Note that to ensure an accurate temperature reading it is important to have the cold junction for the CHT (the plug between the stiff thermocouple wires and the normal, plastic-insulated gauge wires) located away from the heat of the engine. Refer to Figure at the beginning of the engine installation section above.

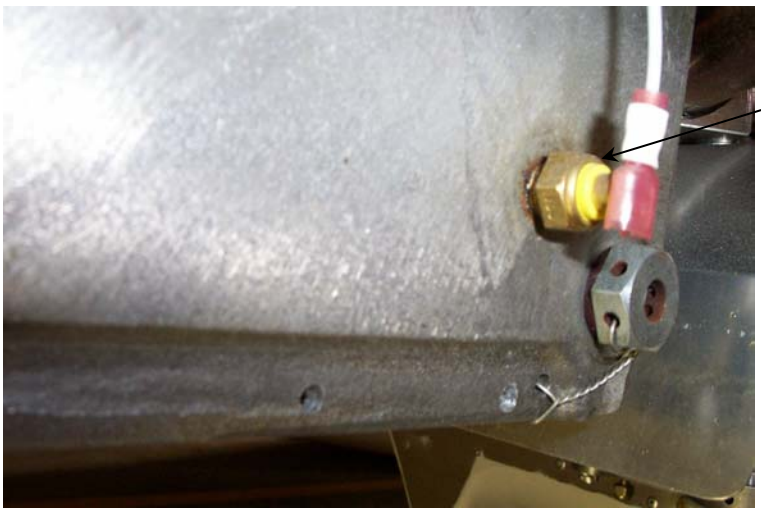


Figure 28. Oil Temperature Sensor

t) The Oil Temperature Sensor used is a VDO 320 028 which is located in the bottom of the sump as shown in photo.

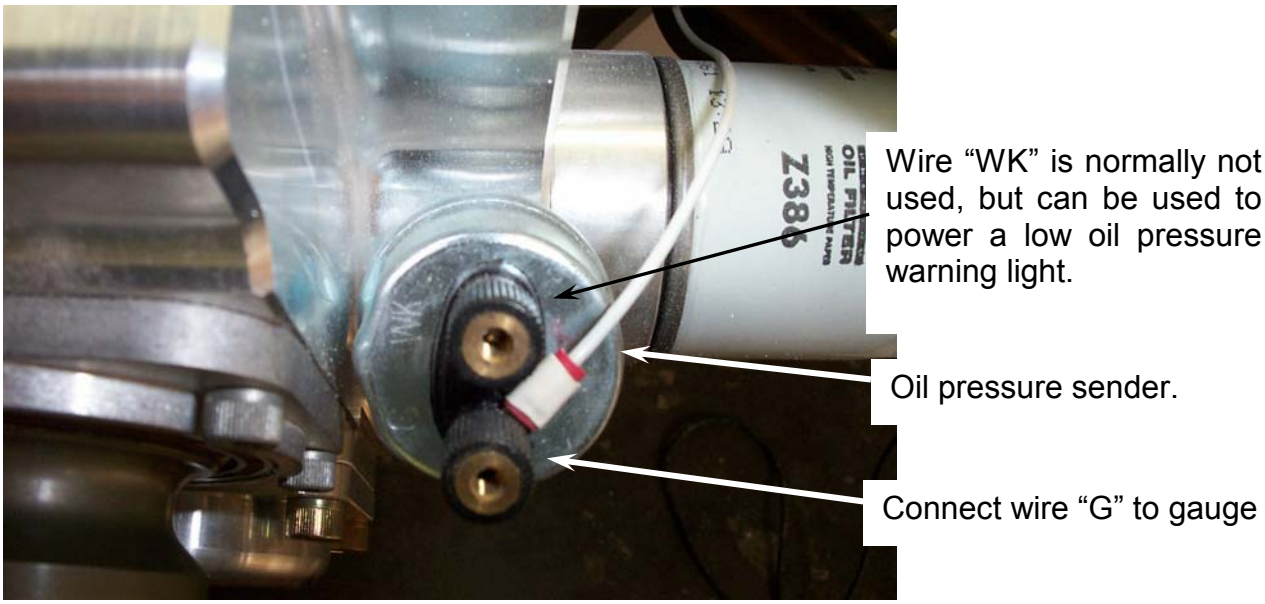


Figure 29. Oil Pressure Sensor

u) The oil pressure sensor is located at the base of the oil filter and this can be seen in photo. The sensor used is VDO 360 001

v) The exhaust gas probe used on Jabiru engines is a VDO 310 306 Pyrometer which is supplied as a complete kit. The probe is mounted in a fitting which is welded to an

exhaust pipe. **Note that this fitting is not standard**. The installation of the fitting is best done at the time of order, though if required the exhaust pipe may be returned to Jabiru and the fitting added. Note that in this case it will normally take around 2 weeks before the pipe is returned to you. The fitting is welded to the pipe 100mm down from the exhaust manifold mounting plate.

w) The Tachometer sensor used is a 6.35 x 22 mm analogue magnetic pick-up and is fitted to a bracket on the alternator housing. Refer to photo below. The sensor picks up on 2 tags fitted behind the flywheel.

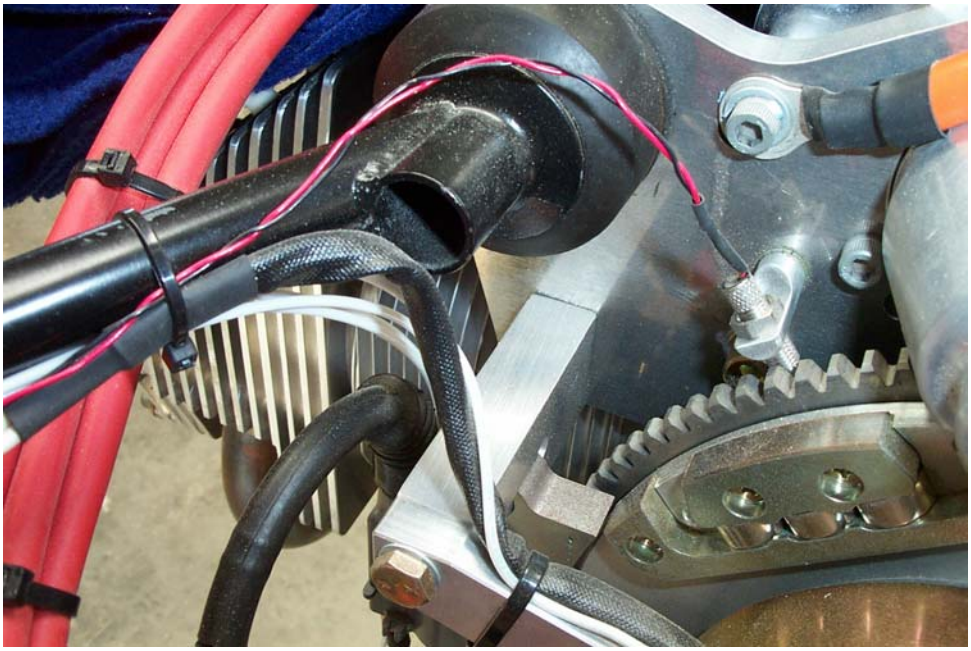


Figure 30. Tachometer Sensor Installation.