ENGINE MANUAL
Operation / Maintenance / Installation
IAE50R – AA

Doc. No. **: E1.01.05 – E**

Revision **: 6**

Date of Revision **: 10 March 2011**

The technical information contained in this document has been approved under the authority of DOA No. EASA.21J.399 in conjunction with the Mandatory Design Change MDC E1 - 116.

Affected Pages:

Chapter	Page
all	all

Instruction:

- Replace the affected pages of the original manual with the pages contained in this revision.

Austro Engine GmbH
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Austria

FOREWORD

We congratulate you on the acquisition of your new Austro Engine GmbH IAE50R-AA.

Skillful operation of the engine increases both safety and the enjoyment of flying. Please take the time therefore, to familiarize yourself with your new IAE50R-AA.

This engine may only be operated in accordance with the procedures and operating limitations of the Engine

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1.1 Record of Revisions

All revisions of this manual, with the exception of -

- Temporary Revisions

must be recorded in the following table. Revisions of approved chapters require the countersignature of Austro Control GmbH.
The new or amended text is indicated by a vertical black line at the right hand side of the revised page, with the revision number and data appearing at the bottom of the page.

If pages are revised which contain information valid for your particular serial number (modification level of the engine, Equipment Inventory, etc.), then this information must be transferred to the new pages in hand–writing.

Temporary revisions, if applicable, are inserted behind the cover page of this manual. Temporary revisions are used to provide information on systems or equipment until the next 'permanent' revision of the Engine Manual. When a 'permanent' revision covers a Mandatory or Optional Design Change (MDC or ODC), then the corresponding temporary revision is superseded.

It is the responsibility of the operator to ensure that this manual is maintained to a current status.

If you move, or the ownership of the engine/aircraft changes, please complete the change of address card and send it to Austro Engine.

Rev. No.	Reason	Chapter	Page(s)	Date of Revision	Approval	Date of Approval	Date In-serted	Signature
1	Editorial changes	5.2.3	5	15-02-06	-	-		
			6					
		5.2.4	6					
	Part No Correction	11.1	26		-	-		
2	Page numbering	all	all	10-04-06				
	Editorial Changes	1.2	1-4					
		1.3	1-5					
		8.2.1 8.2.4	8-1					
		8.6.4	8-5					
		9.4 9.5.1	9-3					
		12.2	12-2					
		13.3	13-1					
		13.5.5	13-4 13-5					
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		19.1	19-2					
		19.2	19-3					
		19.4	19-4					
		20.0	20-2					
	Maintenance Interval	12.1	12-1					
3	New spark plug implemented	1.1	1-3	22-11-06				
		1.2	1-4					
		11.1	11-1					
4	No. changed	1.1	1-3	10-11-08				
		1.2	1-4					
		8.4	8-2					
		11.1	11-1					

5	Editorial change	1.1 1.2 8.4 11.1	1-3,1-4 1-5 8-1 11-1	08-07-09				
6	All Diamond Logos changed to Austro Engine Logo. Oil specification changed	all	all	10-03-11				

1.2 LIST OF EFFECTIVE PAGES

Ch.	Page	Date
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1.3 TABLE OF CONTENTS

2.0 PREFACE

Every reasonable effort has been made to ensure that the information contained in this publication is correct when going to print.

However, as Austro Engine GmbH policy is one of continuous improvement, the information given here may be superseded over a period of time by manual revisions or temporary by Service Bulletins.

THIS MANUAL IS PUBLISHED BY:

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This manual is for use with engines specified by Engine Type Certificate Data Sheet No EASA.E.085.

3.0 SAFETY INFORMATION

The instructions in this manual have been compiled to assist pilots and personnel responsible for maintenance in the correct operation of the engines produced by Austro Engine GmbH . Only correct operation and maintenance can ensure optimum availability throughout engine life.

No recommendation in this manual absolves operators from compliance with any official directive that may be issued by the controlling aviation authority of any country concerned, or with any relevant Austro Engine GmbH Service Bulletins.

Austro Engine GmbH personnel are always happy to answer queries or give advice on individual service problems. All queries to Austro Engine GmbH should be accompanied by details of the engine model and serial number, hours operated and any other relevant information.

3.1 Safety Symbols

NOTE !

A note symbol shows an additional significant information.

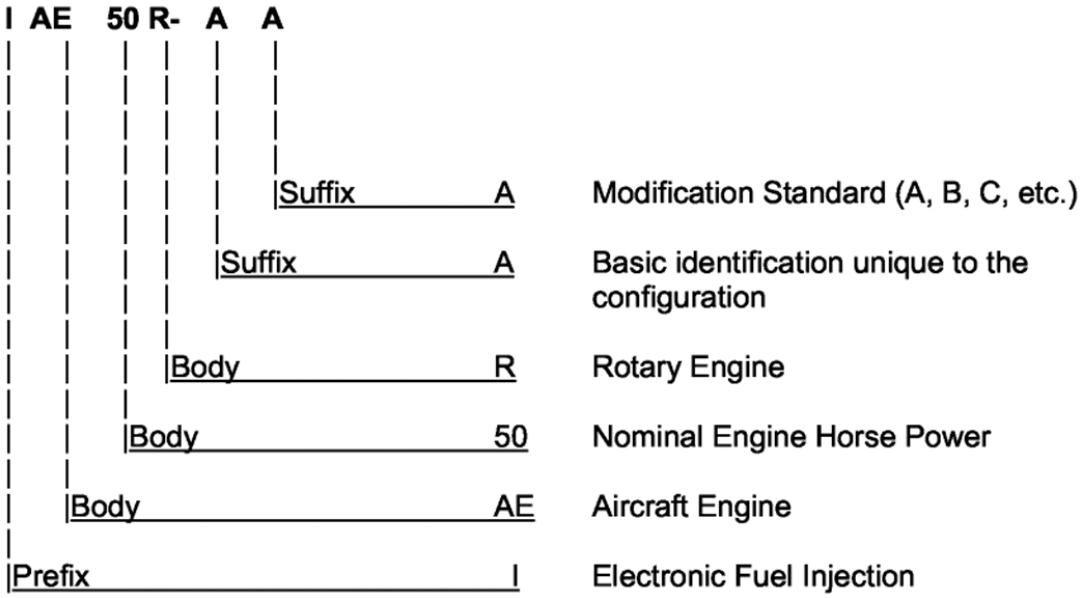
CAUTION!

A caution symbol indicates special procedures which should be followed to avoid the risk of serious damage to engine or to components.

WARNING!

A warning symbol indicates special procedures, which must be followed to avoid the risk of death or serious injury to persons.

3.2 Model Designation Breakdown



3.3

NOTE!

It is strongly recommended that only genuine, quality–assured, replacement spare parts are used when carrying out maintenance operations on this engine.

The use of parts not approved by Austro Engine GmbH may significantly affect the performance, reliability and life of the engine and may hazard the operator.

WARNING!

The use of parts not approved by Austro Engine GmbH may invalidate the Engine Certification.

4.0 Reserved

Intentionally left blank

5.0 GENERAL ENGINE DATA

5.1 Description

Wankel type rotary, single rotor, dual spark ignition, liquid cooled rotor housing, forced air cooled rotor, 'Flytronic' engine management, normal aspirated.

5.2. Technical data

5.2.1 Design Responsibility

Austro Engine GmbH

Rudolf – Diesel – Straße 11

A – 2700 Wiener Neustadt

Austria

5.2.2 Certification

Certification Basis: JAR – 22, Subpart H, at Change 5 effective 28/10/95 January 1986 together with AMJ20X section 3 JAR E at change 19.

5.2.3 Engine Particulars

Design	Single rotor Wankel–type rotary engine
Eccentricity	11.6 mm
Width of Housing	68.2 mm
Generating Radius	69.0 mm
Compression Ratio	9 : 1
Swept Volume	294 ccm
Rotor	Cast iron internally cooled by a belt driven centrifugal fan.
Main and End Housing	Aluminium alloy castings, cooled with a pump circulated pressurized water–glycol mixture and supporting an optional oil separator assembly (supplied by the installer mounted directly onto the outlet casting).

Eccentric Shaft	Hardened and ground alloy steel. The complete rotating assembly is in full dynamic balance to minimise vibration, achieved by counter weighting each end of the assembly. Both the main and rotor bearings are rolling element types.
Flywheel	Cast iron fitted with an induction–hardened steel starter ring gear.

5.2.4 Out – put Drive

Take from the eccentric shaft via a woodruff key.

Rotation Direction	The eccentric shaft rotate in a clockwise direction when viewed from the driving side of the engine.

5.2.5 Net Dry Weight

Approximately 59.5 lbs. (27 kg)

5.2.6 Cooling

Approximately 90% of surplus heat is rejected into the liquid cooling system; the balance is rejected via rotor cooling air.

Coolant	50 : 50 Distilled Water – Ethylene Glycol mix Silkolene PRO–COOL (or equivalent)

5.2.7 Fuel Specification

AVGAS 100LL
EUROSUPER, ROZ 95, in accordance with EN228
or equivalents.

5.2.8 Pressure to Fuel Injector

Nominal 3 bar, operation range 2.8 bar to 3.2 bar
Controlled by a pressure regulator.

5.2.9 Lubrication

Lubrication of all bearings and rubbing surfaces is achieved via two lines from the oil metering unit driven off the water pump. The flow rate of the metering unit is calibrated and must not be adjusted. Use only approved engines oils.

Oil Separator

An optional oil separator is recommended. The separator is to be supplied by the engine installer.

5.2.10 Oil Specification

Silkolene Comp 2 Premix (Not comp 2 Injector)
Castrol XR77 (EMPA specification 417478/01)
Castrol Power 1 Racing 2T (API TC+, JASO FD, ISO EGD)
AeroShell Oil Sport Plus2 (API TC)

6.0 OPERATING DATA / LIMITATIONS:

Static sea level ratings under the following conditions:

- International Standard Atmospheric conditions at seal level
- Generator functioning
- Liquid coolant outlet temperature 65 °C (± 5 °C)
- Standard induction pipe fitted with filter
- Power measured at eccentric shaft output
- Approved fuels
- Test bed exhaust used

6.1 Maximum Take – off Rating

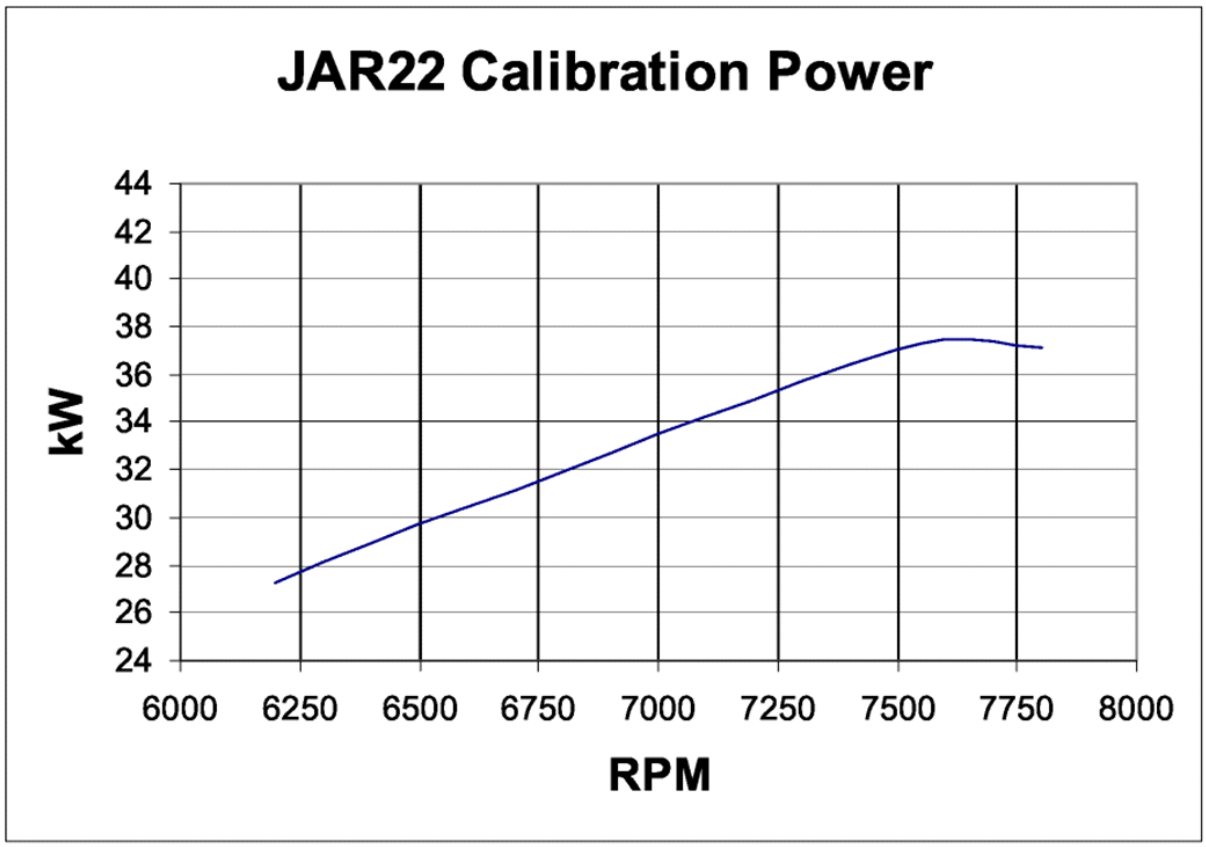
Max. T/O – Power (minimum)	37.3. kW (50 BHP) (Value quoted includes losses associated with intake exhaust conditions specified.)
Max. T/O – RPM	7 750 RPM
Fuel consumption (max)	24 liters / hr
Exhaust back pressure	0.21 bar ± 0.04 bar (3 psi ± 0.5 psi) at 7750 RPM with test bed system

6.2 Maximum Continuous Rating

Max. Cont. Power	35.8 kW (48 BHP)
Max. Cont. rpm	7 100 RPM
Fuel consumption (max)	18 liters / hr

6.2.1 Power Curve

Fig. 1, Typical Power Curve



6.3 Operating Limitations

6.3.1 Engine RPM

Maximum for take–off (for 3 mins)	7 750 RPM
Maximum Continuous	7 100 RPM
Maximum Overspeed (20 sec. limit)	8 000 RPM
Idle Minimum	2 500 RPM

6.3.2 Ambient Temperature Limits

Minimum Starting Ambient (without priming)	-10 °C
Maximum Ambient	+55 °C

6.3.3 Liquid Coolant Temperature Limits

Maximum for Take–off	90 °C
Minimum for Take–off	60 °C
Maximum continuous	100°C

6.3.4 Rotor Cooling Air Outlet Temperature Limits

Maximum for Take–off (3 minutes)	120 °C
Maximum Continuous	110 °C

6.3.5 Exhaust Gas Temperature (EGT)

Maximum Exhaust Gas Temperature	970 °C

6.3.6 Fuel Pressure

Nominal Fuel Pressure	3 bar (43.5 psi)
Fuel Pressure Tolerance	± 0,2 bar (± 2.9 psi)

6.3.7 Altitude

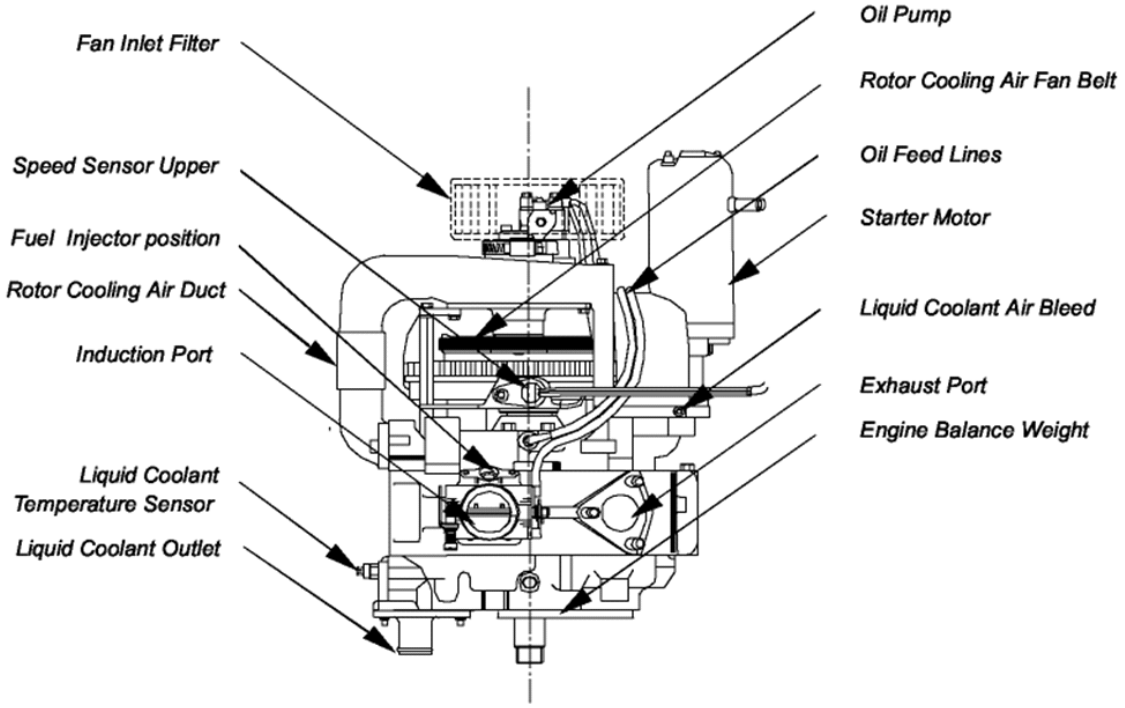
The engine has been tested for use up to 14.000 ft pressure altitude

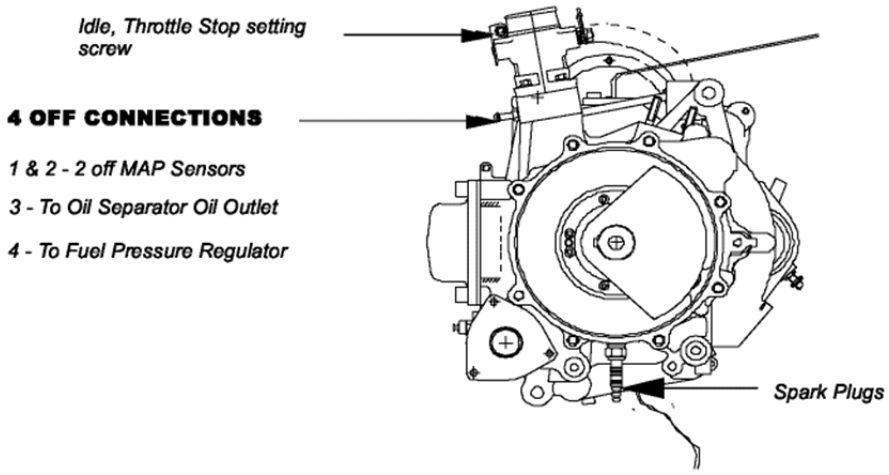
6.4 Manuals

Operation / Maintenance / Installation	Doc. No. E1.01.05–E
Overhaul Manual	MWE (D) 085

7.0 COMPONENTS

Location of Components





FIGS. 2 & 3

*MAP"
Manifold Absolute Pressure

7.1 Description of Components

7.1.1 Rear Assemblies

These assemblies comprise of a back plate, with integral mounting lugs, water pump, alternator, speed sensors, rotor cooling air fan assembly, oil pump and starter motor.

7.1.2 Front Assemblies

The front assemblies comprise of a water cooled end plate, temperature transmitter.

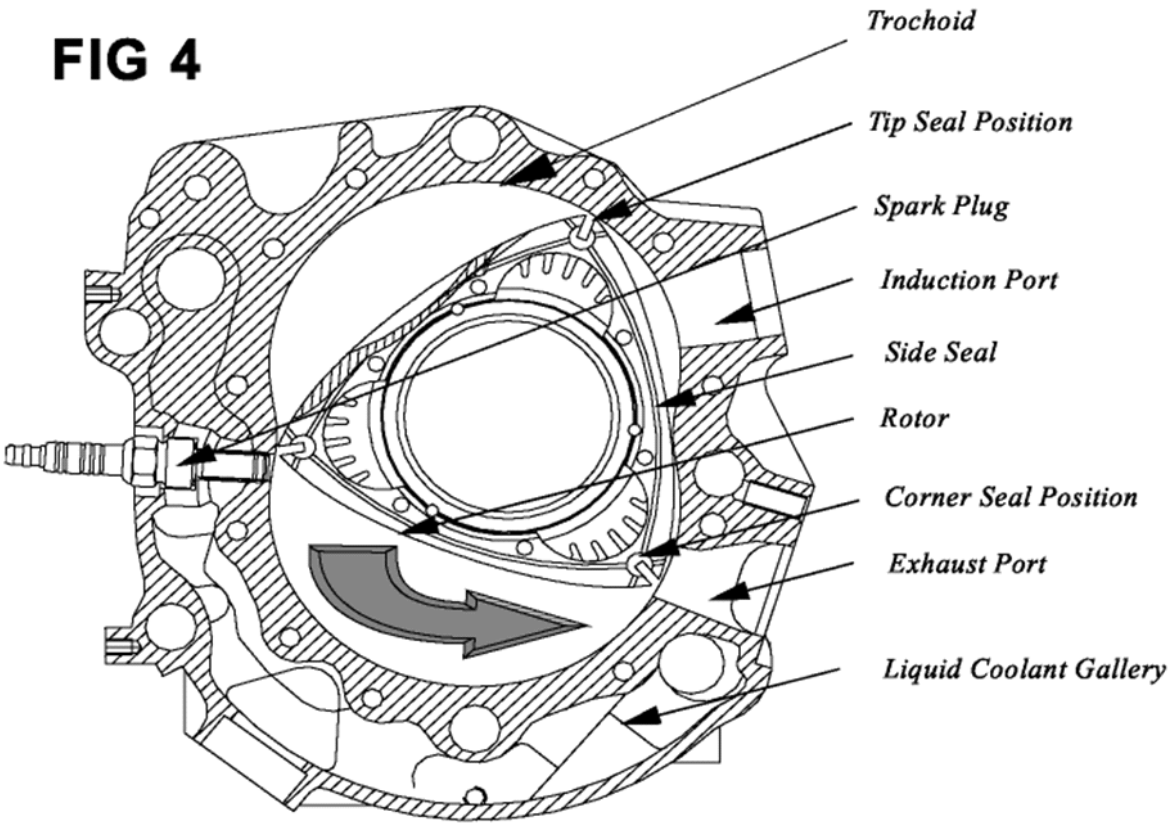
7.1.3 Centre and Rotating Assembly

The centre assembly comprises a rotor housing with passageways for liquid cooling. Externally is the throttle body with fuel injector, spark plugs, and exhaust flange and, internally, the eccentric shaft and rotor assembly.

7.1.4 Rotor Sealing

Rotor sealing is provided by the tip seals, side seals and corner seals with each seal being spring loaded outwards. The corner seals placed at the junction of the side and tip seals provide sealing at these critical locations.

FIG 4



8.0 DESCRIPTOPN OF SYSTEMS

8.1 Flytronic System

The Flytronic Engine Management System monitors throttle setting and engine speed to deliver the correct fuel setting and ignition timing for optimum performance and economy. A signal output is available from the Management Unit to display error warning information to the pilot by means of a coded flashing light.

The Flytronic management unit consumes 0.3 amps and receives its supply via duplicated feeds from the aircraft bus bar (2 x 1 amp circuit breakers.)

8.2 Ignition System

8.2.1 Triggering

Two steps in the rim of the flywheel, nominally 180° apart, trigger each timing sensor. If a sensor should become defective the Flytronic unit will automatically select the other and provide a cockpit indication via a coded error warning signal.

8.2.2 Ignition

The spark plug pair are fired simultaneously, each by its own coil, triggered by the output from the Flytronic unit. Each ignition switch interrupts the supply to its coil.

8.2.3 H.T. Leads

The inductive H.T. coils are connected to the spark plugs by copper–cored cable and resistive plug caps.

8.2.4 Spark plugs

The specified spark plug type must be used; substitution with a non–approved type may reduce engine power and reliability, and may cause mechanical damage to the engine.

8.3 Generator System

A flywheel mounted 18 amp brushless / bearing less generator, with a separate voltage control regulator / rectifier unit, provides 14 volt DC supply to the aircraft bus bar.

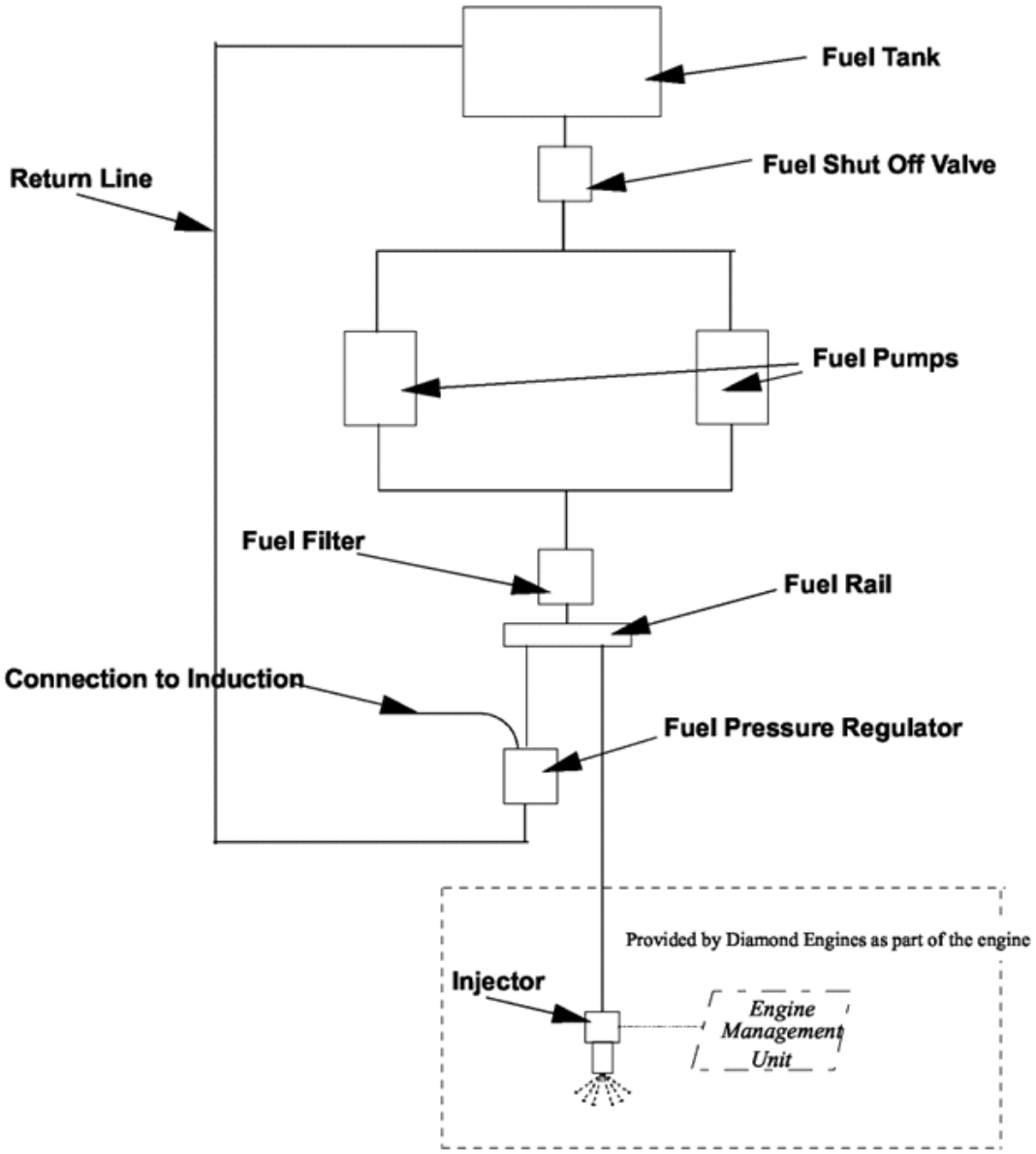
8.4 Starter

The starter is an electric starter operated with 12 V, 50 A. It is of a Bendix Type, engaging the gear when operated (refer to drawing no. R1A-90-000-000).

8.5 Fuel Injection System

8.5.1 **Typical Schematic Fuel System** (provided by engine installer)

FIG 5



8.5.2 Timing

The throttle body assembly, including the throttle valve, injector, and fuel rail, is attached to the rotor housing via a spacer block with tapping points for oil feeds and MAP sensors.

The correct fuel injection timing is provided by the same speed sensors, described in section 7.0 above, and the appropriate amount of fuel is delivered by controlling the “on–time” of the injector. The “on–time” is determined by the Flytronic unit reflect engine speed, manifold pressure and ambient conditions.

8.5.3 Fuel System

The fuel injector requires clean fuel at 3 bar ± 0.2 bar with a minimum return fuel of 80 liters per hour.

Continuous circulation of fuel trough the rail removes heat from the injector and reduces the risk of vapour locking.

8.5.4 Load Demand

Duplicated Manifold Absolute Pressure (MAP) sensors measure the load demand on the engine. These sense the air pressure inside the throttle body as determined by the combination of engine speed, throttle setting and ambient pressure. If either sensor should become defective, the Flytronic unit will automatically select the other and provide a cockpit indication via a coded error warning signal.

8.5.5 Throttle Valve Setting

As a flight safety measure, the throttle valve is set to return to wide–open throttle position by the return spring in the event of disconnection from the throttle cable.

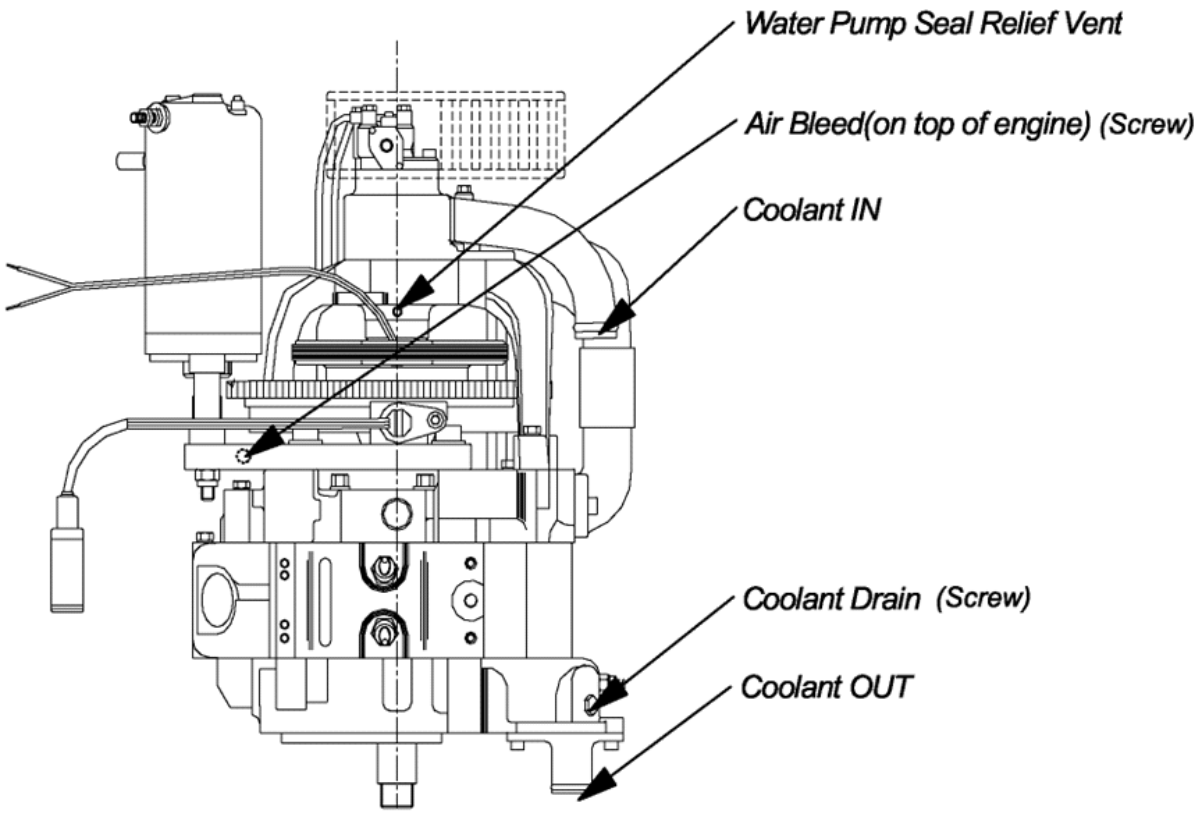
A spring–loaded adjuster screw on the throttle body controls idle speed setting.

8.6 Cooling System

8.6.1 Liquid Cooling System

Coolant Circuit Items

FIG 6



8.6.2 Water Pump

A water pump impeller, driven from the eccentric shaft via a tufnol drive coupling (a shear point) is mounted at the rear of the engine and circulates coolant through the engine casting and radiator.

8.6.3 Temperature Regulation

No thermostat is fitted. A minimum coolant temperature of 60 °C must be maintained and a normal operating temperature of 70 °C is desirable.

8.6.4 Coolant Temperature Sensor

A temperature sensor is fitted to the engine in the front plate, for connecting to a temperature gauge.

8.6.5 Coolant

Coolant is a 50 / 50 water – ethylene glycol mix. For details refer to Chapter 5.2.6

CAUTION !

The use of a pre–mix solution such as Silkolene Pro–Cool is strongly recommended so that there is no variation in the strength or the heat transfer properties of the coolant.

8.6.6 System Pressure

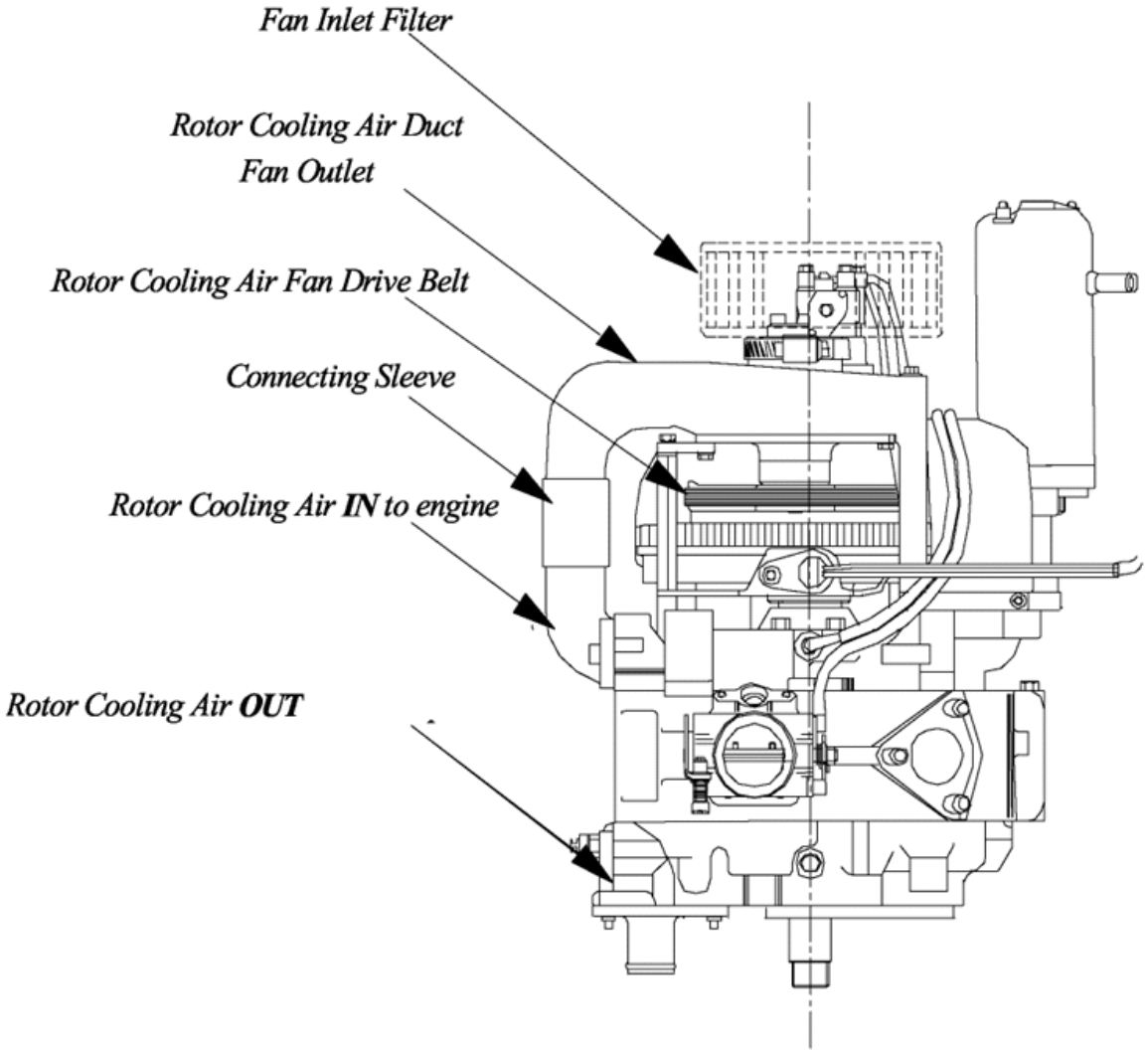
The cooling system is a closed loop system, designed for a working pressure of 0.9 bar (13 psi).

8.6.7 Air cooling system

Lubrication of the eccentric shaft rear bearings is achieved by direct injection of oil from the metering oil unit and results in an oil mist being entrained into the rotor cooling air system. The oil mist, in turn, lubricates the rotor bearing, front main bearing and cools the inside of the rotor.

8.6.8 Rotor Cooling Air Parts

FIG 7



9.0 OPERATING THE ENGINE

9.1 Starting Procedure and Warm–up

Starting

The settings, start and warm–up procedures for the first start of a newly installed engine are obviously to be treated with the greatest care. However, all engines supplied by Austro Engine GmbH will have been fully run–in and performance–tested prior to shipping.

NOTE !

If the engine fails to start after three attempts (normal maximum starter engagement per attempt of five seconds) there is something incorrect!
(Fuel, ignition, or outside air temperature).
Starting between -5 °C and -10 °C may require assistance for the aircraft battery!

1) Check coolant level, that the engine oil tank level is sufficient for flight / test and that the fuel is sufficient, on, and water free.
2) Set throttle slightly off the idle stop.
3) Switch on battery and alternator.
4) Switch on ignition – verify that all gauges / alarms are correct.
5) Switch on both fuel pumps – verify that all gauges / alarms are correct.
6) Switch on one Flytronic supply – verify error light on continuously (switch off).
7) Switch on second Flytronic supply and verify error light on continuously (switch off).
8) Switch on both Flytronic supplies and verify error light on continuously.

WARNING !

Ensure all personnel are clear of propeller and aware that the engine is to be started.

9) Crank the engine for 5 seconds (or less if the engine starts).
10) If the engine fails to start, recheck switch positions and alarms.
11) If cold start – repeat (9) at 15 second intervals.
12) (See NOTES above for starting limitations).
13) Allow engine to warm up at approximately 3 000 RPM to 50 °C.
14) Check that the rpm rise is smooth and trouble free.
15) A sudden liquid coolant temperature rise indicates air trapped in the system. In this case the bleed procedure should be carried out (see 13.3)

CAUTION !

During cold starts not more than 5 x 5 second start attempts in any 3 minute period.

9.2 Engine Start down to Approximately -10 °C

The engine will start equally well with either permitted fuels.

9.3 Flytronic Alarm Patterns

When the engine is stopped and fault–free, the light will be on continuously whilst the ECU is powered.

When the engine is running and fault–free, the error light will be out.

When an error is detected by the Flytronic unit, due either to a sensor failure, an out of range indication or an internal unit fault, the error warning light will give an indication of the failure. Error warning display is continuously light during engine operation. When the engine is stopped, and there are errors, the light will flash with a coded message to indicate which fault has occurred whilst the ECU is powered. Each error code consists of two numbers. These are counted out in flashes in two groups (E.g. the code for 2 3: The light will flash twice – then on steady for one second – and the flash three times).

If there is more than one error then each code will be flashed in sequence with 5 seconds between codes.

9.4 Error Code Table

CODE	FAILURE ITEM	DESCRIPTION	ACTION BY PILOT
1 1	Manifold Press 1 Sensor	Sensor faulty Not connected – Out of range	None–Investigate on landing
1 2	Manifold Press 2 Sensor	Sensor faulty Not connected – Out of range	None–Investigate on landing
1 3	Air Temperature Sensor	Sensor short circuit or sensor low	None–Investigate on landing
1 4	Rotor Cooling Air Sensor	Sensor open circuit or reading high	None–Investigate on landing
2 1	Supply Voltage	Supply volts	See 8.6.2, then investigate on landing
2 2	Engine Speed 1	Error or electronic noise has been detected	None–Investigate on landing
2 3	Engine Speed 2		None–Investigate on landing
2 4	Flytronic internal error	Possible electronic noise on speed lines	Notify Austro Engine GmbH after landing
3 1	Overspeed calculated		None–Investigate on landing
4 2	Internal clock error		Notify Austro Engine GmbH after landing
4 3	Flytronic internal error		Notify Austro Engine GmbH after landing
4 4	Flytronic internal error		Notify Austro Engine GmbH after landing

9.5 Ground Tests

(See 15.0)

9.5.1 Full Power Check

Set WOT and note RPM achieved in relation to the minimum acceptable value as defined in the aircraft operating manual. Check that all instrumentation is functioning and that all parameters are within limits. Check that single ignition drops are less than 300 RPM at 6 200 RPM.

9.5.2 Idle Check

Fully close the throttle and note rpm; it should be 2,500 RPM ± 100 RPM. Adjustment, if required, is by the throttle stop screw on the throttle body. For method, and precautions, see the aircraft manufacturer's manual.

9.5.3 Stopping the Engine

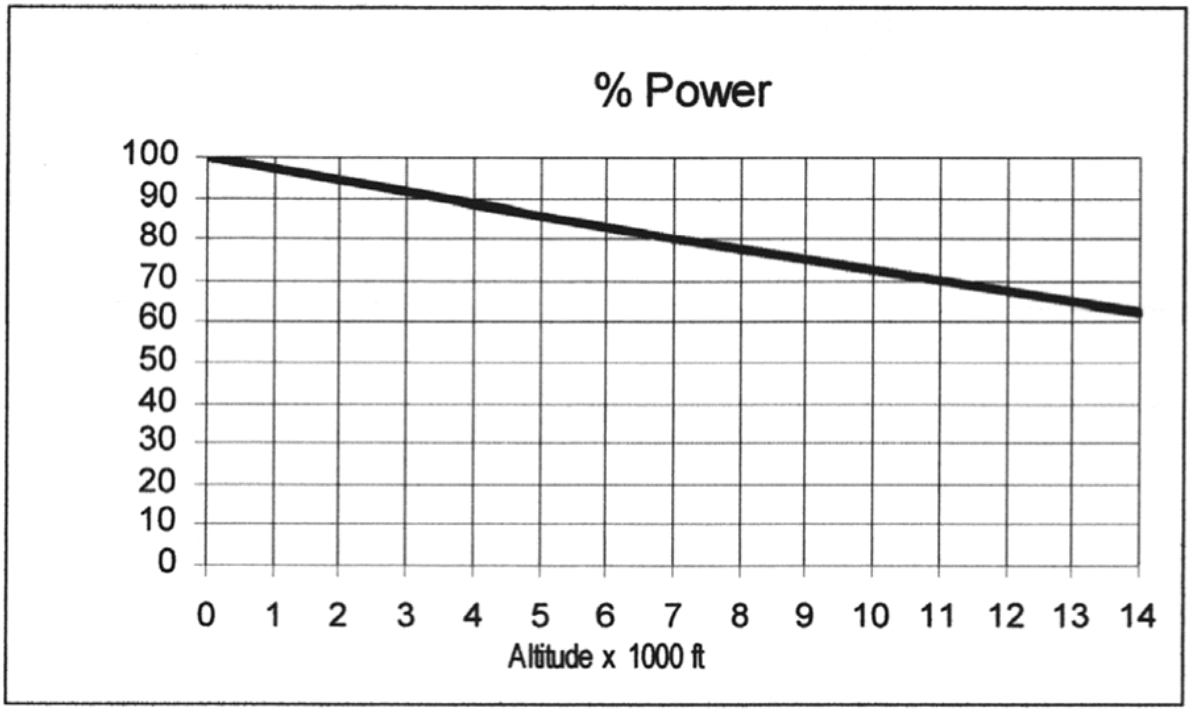
It is usual to idle the engine for 2 to 3 minutes before stopping (to dissipate internal heat prior to shut down) [see aircraft manufacturers operating manual].

Switching off either the ECU power, or ignition switches, or the fuel pumps will stop the engine. The latter gives a short run down and dissipates pressure in the fuel lines.

9.6 Power Loss at Altitude

Performance at altitude is degraded due to a reduction in air density. The approximate power available (at given RPM / throttle setting) is given in 6.2.1 for Sea Level.

FIG 8



9.7 Storage

General (installed engine).

Proper steps must be taken, on engines used infrequently, to lessen the possibility of corrosion. This is especially true if the aircraft is based near the sea coast or in areas of high humidity.

In all geographical areas the best method of preventing corrosion of internal parts of the engine is to fly the aircraft at least once a week. Alternatively the engine should be run long enough to reach normal operating temperatures.

9.7.1 Storage up to 90 Days

No special treatment is required for storage periods of up to 90 days.

The aircraft should be protected from the weather and excessively damp conditions.

9.7.2 Storage over 90 Days

NOTE !

The following procedures may require that the engine is removed from the aircraft – see aircraft manufacturer's instructions.

CAUTION !

Never rotate the engine with the oil can nozzle still in the spark plug or exhaust / inlet ports!

1) To protect the internal of the engine it is recommended that additional engine oil be introduced. This can, for example, be via the spark plug holes, the throttle body or the exhaust and is determined by the aircraft manufacturer.
2) Where appropriate, ensure all electrical circuits are off, and then manually rotate the propeller shaft and engine.
3) Inject 5cc of the prescribed engine lubrication oil through either spark plug hole in the rotor housing. (See CAUTION! above)
4) Rotate the engine through 1/3 revolution of the flywheel (by turning the propeller or propeller shaft and hence the eccentric shaft, by hand).
5) Repeat (3 & 4) five times.
6) Rotate the engine through 6 revolutions of the flywheel then refit the spark plugs.
7) Seal all inlets and exhaust openings to prevent moisture ingress.
8) To protect the bearings and associated parts, engine oil should be introduced into the area. The aircraft manufacturer describes the method by which this is achieved and the instructions must be followed carefully.

9) Blank off all open holes.

10) To protect the outside of the engine, anti corrosion oils of well–known oil companies are recommended, such as:

Anticorit 5 of Messrs FUCHS, D – 6600 Mannheim, Germany
Lubrication Oil MTL – L – 644 B of MOBIL–OIL
Shell ENSIS Fluid 2360 of SHELL
RUST BAN 395 of ESSO

It is also ESSENTIAL that the fuel system be drained.
Items (1) to (3) should be carried out every 90 days.

9.7.3 Returning to Service from Storage

1) Restore the engine to operation according to the Aircraft Manufacturers instructions.
2) If the aircraft been laid–up for more than 6 months, please carry out 9.7.2 ((1) to (6)).
3) Rotate the engine by hand several times to ensure that all excess oil is drained via the spark plug holes.
4) Clean and refit, or replace, the spark plugs.
5) Check the engine for external damage or deterioration suffered during storage, and rectify as necessary.
6) Clean engine to remove inhibitor and remove all storage blanks.
7) Refit engine in accordance with the aircraft manufacturer's instructions.

CAUTION !

Stale fuel must NOT be reused!

10.0 ENGINE EMERGENCY PROCEDURES

10.1 Fan Belt Failure

In the unlikely event of a fan belt failure, the indication will be a sudden rise in Rotor Cooling Air temperature. The engine load / rpm should be reduced as much as is practical to prevent further heat build up. If the rotor cooling outlet air temperature reaches 130 °C the engine should, if possible, be switched off. Continued running of the engine under these conditions will cause damage.

10.1.2 Charge Circuit Fail Alarm

In the unlikely event of a charging circuit failure, indicated by the appropriate alarm, the electrical bus bar will be fed automatically from the battery. Any non–essential electrical items should be switched off. The battery should be capable of providing sufficient power to run the Flytronic unit etc. for a minimum of ½ hour. Reducing power will not significantly increase engine–running time.

10.1.3 Low Oil in the Tank

In the unlikely event of low oil alarm the engine RPM should be reduced as much as is practical. Flying time should be limited to a total of 10 minutes at this reduced power. Flying under such conditions may cause damage to the engine.

10.1.4 Low Fuel Pressure

If low fuel pressure is indicated, the engine may stop or operate at reduced power and may also indicated an excessively high exhaust temperature. Throttle setting should be adjusted, if practical, to minimise excess temperature.

Continued operation at excess exhaust temperature will cause damage to the engine.

10.1.5 Rotor Cooling Air Temperature

If the rotor cooling air temperature rises above the specified limit, the engine should be shut down as soon as possible. Continued operation at excess temperature is likely to cause damage to the engine.

10.1.6 Water Temperature

If the water–cooling temperature rises above the specified limit, the engine should be shut down as soon as possible. Continued operation at excess temperature is likely to cause damage to the engine.

11.0 MAINTENANCE NOTES

11.1 Austro Engine GmbH Available Consumables

R1A-06-000-803	Rotor Cooling Air Filter
R1A-06-000-805	Induction Air Filter
Engine Oil	see Chapter 5.2.10
Glysantin Aluprotect Premium	Engine Coolant (One Litre Container)
Copper ease	Copper ease
Loctite 243	Screw Locking
Loctite 595	Sealing silicone
R1A-09-000-801	Spark Plug (NGK)
K&N Filter Oil	Air Filter Oil
R1A-30-000-801	Injector

For further part replacement contact Austro Engine GmbH.

11.2 General Torque Settings

Bolts / Socket Head Cap Screw

4 mm	2.0 Newton metres (Nm)
5 mm	4.5 Nm
6 mm	8.5 Nm
8 mm	21.5 Nm
10 mm	30.0 Nm

Nuts and Stiff Nuts – as above.

11.2.1 Specific Torque Settings

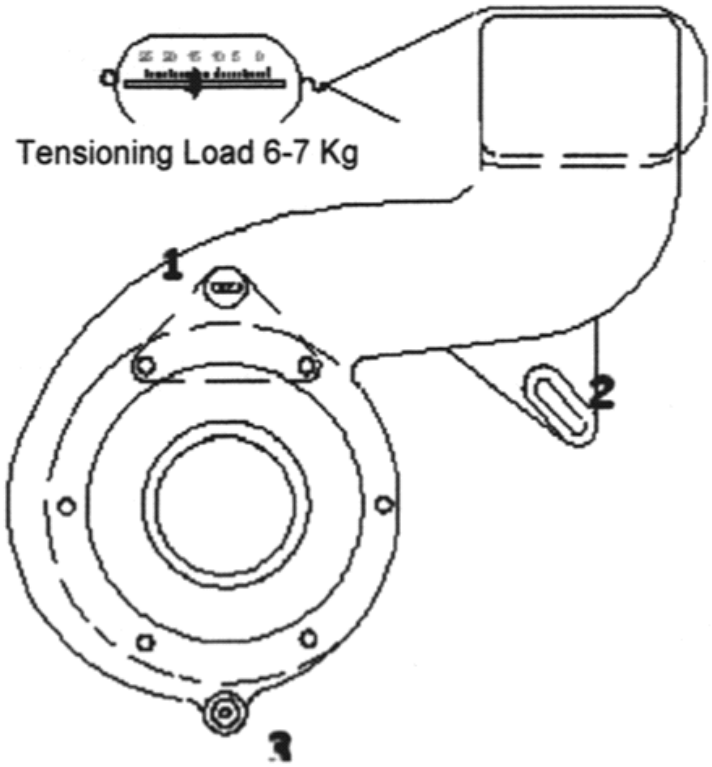
Spark Plug	10.0 Newton Meters (Nm)
Coolant Temperature Sender	4.5 Nm
Starter Motor Terminal	8.0 Nm
Oil Pump Inlet Fitting	2.5 Nm (caution)
Oil Pump Outlet Banjo	2.5 Nm (caution)
Oil Pipe Nut & Olive	3.0 Nm (caution)

11.2.2 MAP Hoses

Remove all MAP hoses and clips and clean out any oil. Make sure that they are dry before placing them back onto the engine.

11.2.3 Checking & Setting Fan Belt Tension

FIG.9



NOTE !

The silicon rubber tube and the tie wraps are left in place during the test.

1) Slacken the three attachments numbered 1, 2 and 3 above.
2) Attach a loop of suitable material around the fan outlet duct.
3) Using a suitable spring balance, apply a force to the loop of 6 – 7 Kilograms.
4) With this force still applied, tighten the 3 housing attachments.
5) Confirm the attachments are not at the end of their adjustment slots.
6) If a new belt is required, see Section 13.5.2

11.2.4 Adjusting engine idle speed

For adjusting procedure, and precautions, see the aircraft manufacturer's instructions.

12.0 SCHEDULED MAINTENANCE

12.1 Maintenance Schedule

ALL HOURS QUOTED ARE ENGINE HOURS

ITEM	1A	1B	2	3	4
a) Engine oil level / coolant level check	X	X	X	X	aircraft manual
b) Coolant leak check		X	X	X	13.4
c) Insp. / clean / replace air filters			X	X	13.5.4
d) Insp. engine, mountings and all external fasteners			X	X	aircraft manual
e) Check fan belt condition & tension			X	X	13.5.1
f) Check cooling system condition and security			X	X	13.0
g) Inspect / clean / replace spark plugs			X	X	14.1
h) Full engine ground run			X	X	15.0
i) End plates – examine seals & seal faces				X	14.0
j) Inspect fan impeller (300 hours)					13.5.5
k) Renew coolant, pressure test system (annual)					13.3
l) Replace fan belt (earlier of 300 hrs or 5 yearly)					13.5.2
m) Replace in line fuel filter				X	aircraft manual
n) Clean & inspect MAP hoses and clips				X	11.2.2
o) Replace fuel injector (150 hrs or 5 yearly)					aircraft manual
p) Continuity of ECU earth straps outer case (2)				X	aircraft manual
q) Continuity of ECU loom ground connections (2)				X	aircraft manual

1A = Check A (every flight)

1B = Check B (every flying day)

2 = every 50 hrs OR annually

3 = every 150 hrs or 3 yearly

4 = Section Reference

12.2 Typical 50 Hours Check

NOTE !

Visual Checks Only unless stated! All Checks to include Fastenings, Cracking, Leaks, Discoloration and Wire Locking!

REF	ITEM	CHECKS / COMMENTS
1	Water Outlet Cover	Leakage
2	Water Hoses	Security of all clips – Leaks
3	Oil Separator	Leakage and temperature sensor connection
4	Oil Pump – Lines and Terminations	Leakage
5	Spark Plug Coils and Plug Caps	Cables and terminations
6	Spark Plug Condition	Connection & gap area
7	Engine Mounts – Starboard Side	Nuts, bolts secure
8	Starter Motor Mounts and Cable	Bolts and cable connections
9	Starter Pinion – Condition and Laxity	Teeth, free movement, play
10	Generator (Stator / Rotor)	Note any debris in the area

WARNING !

Ensure that all switches are OFF before rotating the engine.

11	Starter Ring – rotate engine via prop	Chipped or missing teeth
12	Generator Cables	Signs of contact and chafing/cracking
13	Lower Timing Sensor and cables	Signs of contact and chafing/cracking
14	Water Pump Housing	Vent hole
15	Upper Timing Sensor and cables	Signs of contact and chafing/cracking
16	Fan Housing	Cracks
17	Fan Belt	Check tension and condition
18	Fan Filter – remove and check	View Fan Impeller – Debris – Cracks
19	Engine Mounts – port side	Nuts, bolts
20	Fuel Rail, Injector, Pressure Regulator	Leaks – Cracks – Cable Connection
21	Linkage, Throttle Stops	
22	Ram pipe	Check temperature sensor connection
23	Induction Air Filter	Cleanliness and damage
24	Rotor Housing drain screw	Security – Leaks
25	Exhaust System - complete	Overheat adjacent parts – Security
26	Flytronic unit and cables	Signs of deterioration
27	Voltage Regulator and cables	Signs of deterioration

28	Flytronic Sensors and Cables	Signs of Deterioration
29	Engine Alarms, Transducers and Cables	Signs of Deterioration
30	Oil Tank and Vent	Security – Leaks – Level - Connections
31	Radiator and Overflow Tank	Security – Damage – Leaks – Debris – Level
32	Oil Separator Hoses	Leakage
33	Rotate Propeller by Hand	Check 6 x compression on prop

NOTE !

Carry out engine ground run according to check list!

12.3 Mandatory Life Limitation

There is no life limit of the engine, engine operation is on condition.

NOTE !

Reliable operation of this engine is dependent upon injector replacement in accordance with maintenance recommendations.

CAUTION !

Lightning strikes may damage the ECU. Following any lightning strike the ECU should be returned to Austro Engine GmbH for checking.

13.0 COOLING SYSTEM

13.1 Liquid Cooling System

Coolant Level Check: Refer to Aircraft Manufacturer's instructions.

In a fault free system, the coolant level will not alter significantly. Any unusual drop in the coolant level in the tank indicates a fault in the system that must be rectified before further flights.

13.2 Coolant Hose Inspection

Check all hoses for cracks, wear, security and leaks (a white crust around a hose joint is an indication of a leak!). Refer also to engine installers handbook. If a leak is found, replace hose and hose clips, tighten hose–clips etc. as necessary and check / bleed / pressure test the system as detailed below:

13.3 Coolant System Filling and Bleeding

NOTE !

This test should be carried out if leaks are suspected after any part of the coolant system has been disturbed.

NOTE !

This is a guide, any variations in the aircraft manual should be followed!

1) Slowly fill the system with the coolant mix
2) Undo bleed plugs until fluid escapes, then tighten.
3) Top up radiator header tank with coolant mix.
4) Check for coolant leaks at all connections / interfaces.
   In doubt fit a coolant pressure tester.
5) If required fit a coolant system pressure tester (Blue Point No STV 262 or similar) to the header tank and pressure test.
6) Recheck bleed points for air after the first engine run.
7) Repeat (6) until no further air is emitted from the bleed point(s) When running the engine ensure that coolant temperature rise is slow and consistent with warm up and no sudden temperature jumps occur. If the coolant temperature suddenly rises then there will still be entrained air in existence and the cycle must be repeated.
8) Top up header tank with coolant mix. Refit the filler cap and wire lock if appropriate.
9) Fill the overflow tank with coolant mixture within the MINIMUM and MAXIMUM levels.
10) Carry out full engine ground run

CAUTION !

If coolant temperature rises rapidly shut down the engine and bleed the system again!

WARNING !

Risk of scalding – do not remove the pressure cap from the radiator until the engine and radiator have cooled.

13.4 Coolant System Pressure Test

1) Remove header tank pressure cap and fit a Coolant System Tester (Blue Point No. SVT262 or equivalent) in its place.
2) Apply pressure of 17 p.s.i (1.2 bar) to the system.
3) This pressure is to be held for 5 minutes during which time it must not drop by more than 0.5 p.s.i (0.03 bar)
4) Whilst under pressure the coolant system should be checked visually for any leaks for weeps at all connections.

13.5 Air Cooling System

13.5.1 Fan Belt

Check fan belt condition. Examine belt for fraying, cracks or broken strands. If in doubt replace it. Check belt tension as in 11.2.3. Adjust as necessary.

NOTE !

Need for significant or regular adjustment indicates need for belt replacement! When changing a fan belt, see 11.2 for torque settings!

13.5.2 Fan Belt Replacement

1) Drain off the coolant & remove connections to the water pump.
2) Disconnect alternator leads and oil pipes.
3) Remove the fan assembly and check bearings for play / roughness.
4) Remove the Water Pump Housing along with the Alternator Stator Assembly and check the water pump bearings for play.

NOTE !

Care should be taken in withdrawing the assemblies due to the loose internal tufnol drive coupling!

5) Fit the new Fan Belt (using Austro Engine GmbH “Fan Belt Kit”).
6) Reassemble using the reverse procedure for items (2) to (5) inclusive, above, and tension the belt as in 11.3 Fig. 9

NOTE !

Replace tufnol drive coupling from the fan belt kit and assemble with the reduced diameter towards the water pump!
Fit the new O–Rings in the water pump housing with those from the fan belt kit using compatible grease to hold in place!
Use Loctite 242 on all fixings!
IF IN DOUBT PLEASE CONTACT Austro Engine GmbH!

7) Connect services, as appropriate and fill with coolant.
8) Ensure that the coolant lines and oil lines are bled.
9) If necessary, pressure test the coolant system as per aircraft manual or chapter above, and check for leaks.
10) Test run the engine to verify satisfactory operation before flight.

13.5.3 Air Filters

The two air filters, induction and rotor cooling air, should be visually inspected at the specified intervals for contamination, large pieces of debris and cracks. Both filters may be cleaned and re–used, although great care must be taken to correctly follow the manufacturer’s instructions. Damaged filters should be replaced.

13.5.4 Air Filter Cleaning Procedure:

1) Tap filter gently, and then brush outside of filter with a soft bristle brush, to remove loose dirt.
2) Wash the outside of the filter with mild liquid soap and warm (maximum 40 °C) water, by agitating the filter in the solution.
3) Ensure that the contaminated solution does not come in contact with the inside surfaced of the filter.

4) Rinse off the filter, from the inside, with clean low pressure water – from a tap or a similar supply. Rinse thoroughly to ensure all soap is removed.
5) Examine filter and if necessary repeat stages 2 and 3.
6) Shake off all surplus water and allow filter to dry naturally.
7) Re–oil element: Aerosol – Spray one pass per pleat into each pleat, from the outside
   Liquid – One bead of oil every 6 mm down each pleat.
8) Check that no white patches remain after 10 minutes.
9) Re–oil where necessary. A red dye in the oil clearly shows those areas that have been correctly oiled.
10) Reinstall air filter and tighten all clips and fittings.

NOTE !

Do not use harsh detergents, caustic solutions, solvents, fuel, steam, or pressure washers!

CAUTION !

Excess heat (over 40 °C), or compressed air will damage the filter:
Do not use without re–oiling!
Only use filter oil from Austro Engine GmbH or K & N!

CAUTION !

Once the filters have been removed, the associated duct and fan impeller should be inspected for dust or debris of any type. If found, it indicates inadequate filter care or a damaged filter and could have serious consequences. Advice should be sought from Austro Engine GmbH on the significance of this material and the effect it may have on the engine. Either or both filters should be replaced if their condition is suspect.

13.5.5 Rotor Cooling Air Fan Impeller

1) At the intervals stated in 12.1 the fan impeller should be inspected. The complete fan should be removed from the engine and the bearing housing assembly removed from the fan housing.
2) Carefully examine the impeller for cracks with a X 10 magnifying glass, particularly on the fan blade – back plate, root radius. No cracks are allowed.

NOTE !

If in doubt change the impeller / bearing housing assembly!

The impeller cannot be removed from spindle!

3) Refit and check the fan belt tension (see Section 11.2.3).

14.0 ENGINE INTERNAL INSPECTION

Remove all dirt from the exterior of the engine and inspect for evidence of overheating or other unsatisfactory conditions.

Inspect rotor tip seals and internal side plate faces.

1) It will be necessary to remove the throttle body and the exhaust pip to carry out this inspection. The use of a 'Boroscope' or fibre optic probe facilitates viewing.

NOTE !

Care must be taken to ensure the probe is withdrawn before the engine is rotated!

2) Once the openings are exposed, rotate the eccentric shaft by hand to view the rotor tip seals. Each seal should not be stuck in the groove and free to spring. The side plate seal faces inside the engine should not exhibit significant distress. Minor scoring and scuffing is acceptable. It is important to obtain a good view of the side faces above the centre line of the engine, where the cooling medium is air. This can only be achieved through the inlet port.
3) If there is any doubt about the acceptability of the faces or the seals, then access should be gained to the air outlet of the front plate by removal of the oil separator. If there are any hard carbon deposits on the internal walls of the duct in the front plate then the side seals may have allowed combustion gas to blow by. Austro Engine GmbH should be consulted if this condition is found.

14.1 Spark Plug

The spark plug is of the surface discharge type with a long life platinum centre electrode.
See 11.1 for the replacement Part Number.

The spark plugs must be removed for inspection at the intervals required in the maintenance schedule.

1) Check the electrical connections for corrosion and lightly smear with silicone grease.
2) Clean the electrode area of the plugs with gasoline if required.
3) If possible check plug function under pressure.
4) Replace spark plug in engine, (torque to value as in 11.2.1)
5) Anti–seize grease must be used on the threads. See 11.1 for Part Number.

CAUTION !

Fitting other types of spark plug may cause damage to the engine!

NOTE !

Do not sand blast, or clean with steel or brass wire brush, or use abrasive materials!

If due to local conditions, the plug connections become corroded then the corrosion may be removed from the plug nipple with a wire brush and the inside of the plug cap cleaned with a dry cloth or paper wiper. When complete, re–smear the connections with fresh silicone grease. Torque to the value given in 11.2.1. If the plug are unserviceable they should be replaced with new ones.

15.0 GROUND RUN

15.1 Pre–start Checks Outside Aircraft

1) Position aircraft into wind
2) Brakes fully on and wheels chocked
3) Check fuel drains, (no water)
4) Check coolant level at overflow tank
5) Check oil tank level
6) Check fuel level

15.2 Pre–start Checks Inside Aircraft

1) Close and lock canopy if appropriate
2) Record outside air temperature (Minimum limit -10 °C for normal starts)
3) Battery master ON
4) Check / note all indicators and alarms, as indicated in the aircraft manufacturers manual
5) Record fuel gauge reading
6) Check both ignitions ON
7) Check ECU power supplies ON
8) Check fuel pump ON
9) Alternator master ON
10) Avionics off

15.3 Ground Run

Start the engine (see also 9.1). When the coolant temperature has reached 50 °C, carry out and record the following ground run checks.

15.4 Ground Run Check List (example)

ENGINE GROUND RUND RESULTS

Date:…….. A/C Reg…….. Engine No……..

Flight Hours…… Total Running Time (hrs meter)……

QFE…… Outside Air Temperature……

Instrumentation – Gauge / Alarm Function Test

Pressure	Temperature	Others
	RCAO	Battery Fail Alarm
Low Fuel Pressure Alarm	Engine Coolant	Charge System Fail Alarm
	OAT	Flytronic Error Warning
	EGT 1 (optional)	Fuel Flow
		Oil Low Alarm

Record data after 1 minute steady running at each condition after warm – up

	Engine RPM	Coolant Temp	RCAO Temp	Remarks
Warm – up	…….	…….	…….	…….
Idle	…….	…….	…….	…….
5000	…….	…….	…….	…….
6000	…….	…….	…….	…….
Max	…….	…….	…….	…….
Idle	…….	…….	…….	…….

	Ign. 1	Ign. 2
Mag Drops at 6000 RPM	…….	…….

Acceleration tests (3 off) Remarks

(Idle to Max RPM response) ……

(1 sec throttle time) ……

Comments If any adjustments are made as a result of this ground run they should be recorded and the ground run repeated

……

……

……

Record results in engine maintenance file !

16.0 MAINTENANCE AND OVERHAUL

For maintenance of particular system or for overhauling the engine please contact Austro Engine GmbH or engine installer.

17.0 TROUBLE SHOOTING

17.1 General

NOTE !

This section is included as an aid although some items may be carried out by the owner / pilot, most would be carried out by a maintenance organisation.

NOTE !

Replace alls gaskets, seals and joint material if disturbed!
Coolant, fuel & oil systems MUST be bled if disturbed!

CAUTION !

If, during troubleshooting, any foreign object fall into the engine internals, through the spark plug holes, the inlet or exhaust ports, or the rotor air cooling inlet and exit passages, they must be removed before attempting to turn or run the engine!
Failure to do so may result in considerable damage to the engine!

WARNING !

Do not stand within the area of the propeller AT ANY TIME, unless it is essential and you have confirmed that both ignition switches are 'OFF'!

17.2 Rough Idle

Ignition failure	–	Check continuity of wiring and connectors.
	–	Check spark plugs.

17.3 Engine Misfires on One Spark Plug

Dirty plug cap / terminal	-	Clean / replace
Wiring fault	-	Wiring to earth or open circuit
Faulty spark plug	-	Clean / replace
HT fault	-	Check / replace spark plug / HT lead / plug cap for arcing

17.4 Engine Cannot Develop Full Power

Incomplete throttle opening	-	Adjust throttle linkage
HT fault	-	Check/replace spark plug/HT lead/plug cap
Increase in exhaust back pressure	-	Investigate exhaust / replace
Loss of compression	-	Investigate
Blocked Induction Filter	-	Replace / clean filter
Low fuel pressure	-	Investigate fuel system / replace fuel filter

17.5 Excessive Rotor Cooling Outlet Temperatures

Excessive back pressure in outlet duct	-	Rectify before continuing running engine
Blocked rotor air inlet filter	-	Clean or replace filter
Slipping / broken fan belt	-	Adjust / replace
Fan failure / impeller failure bearing failure	-	Replace assembly
Stuck side seal(s)	-	Investigate outlet for black carbon deposits

If found please contact Austro Engine GmbH.

Investigate possible exhaust leakage within the engine bay area.

17.6 Liquid Coolant Overheats on Medium and High Power

Restricted radiator core	-	Rectify
Constricted radiator hose	-	Rectify
Water pump drive failure	-	Overhaul pump
Air in system	-	Vent / bleed
Coolant leak	-	Rectify

17.7 Flytronic Error Warning Light Flashes

See 9.3

18.0 APPENDICES

18.1 Form Sheets

Notification of Receipt

Austro Engine GmbH

Rudolf – Diesel – Straße 11

A – 2700 Wiener Neustadt

Austria

Tel: +43 – 2622 – 23 000

Fax: +43 – 2622 – 26 000 2711

Internet: www.austroengine.at

Engine Manual IAE50R – AA

NOTIFICATION OF RECEIPT Copy Number:……

Signature:…….. Date:……

Name:……

On behalf of:……

Address:……

……

Austro Engine GmbH

Rudolf – Diesel – Straße 11

A – 2700 Wiener Neustadt

Austria

Tel: +43 – 2622 – 23000

Fax: +43 – 2622 – 23000 2711

Internet: www.austroengine.at

Engine Manual IAE50R – AA

NOTIFICATION OF RECEIPT Copy Number:……

Signature:…….. Date:……

Name:……

On behalf of:……

Address:……

……

18.2 Problem Report

Austro Engine GmbH

Rudolf – Diesel – Straße 11

A – 2700 Wiener Neustadt

Austria

Tel: +43 – 2622 – 23000

Fax: +43 – 2622 – 23000 2711

Internet: www.austroengine.at

PROBLEM REPORT

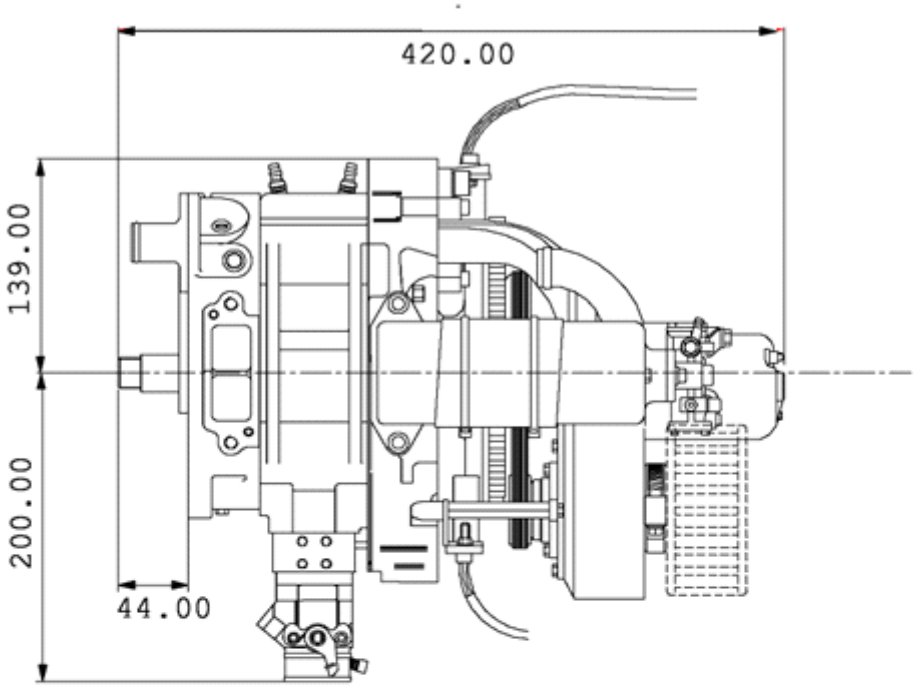
Date:	Engine No
Description :	
	Hours Run

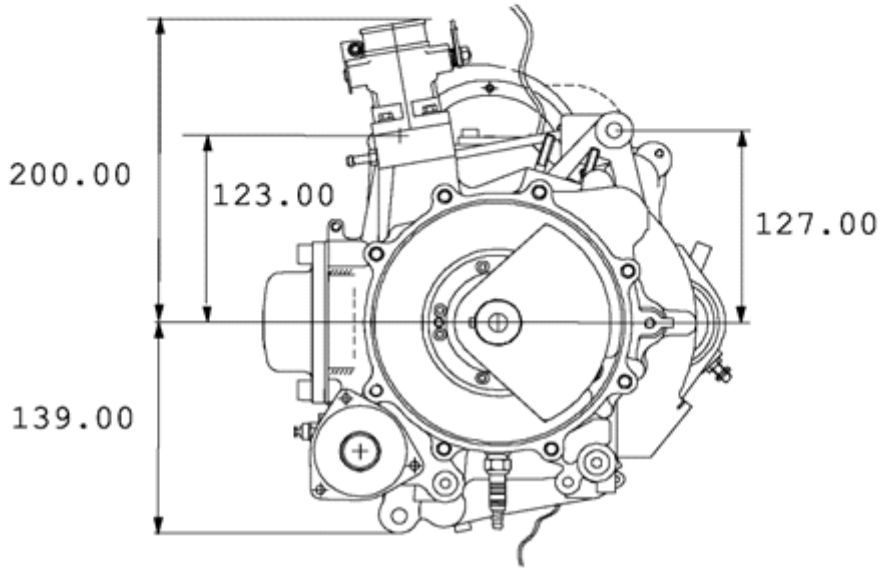
For completion by **Austro Engine** Staff Only

Problem Report No	W.O.C. No
Action Taken :	Test Proc. No

18.3 Engine Overall Dimensions

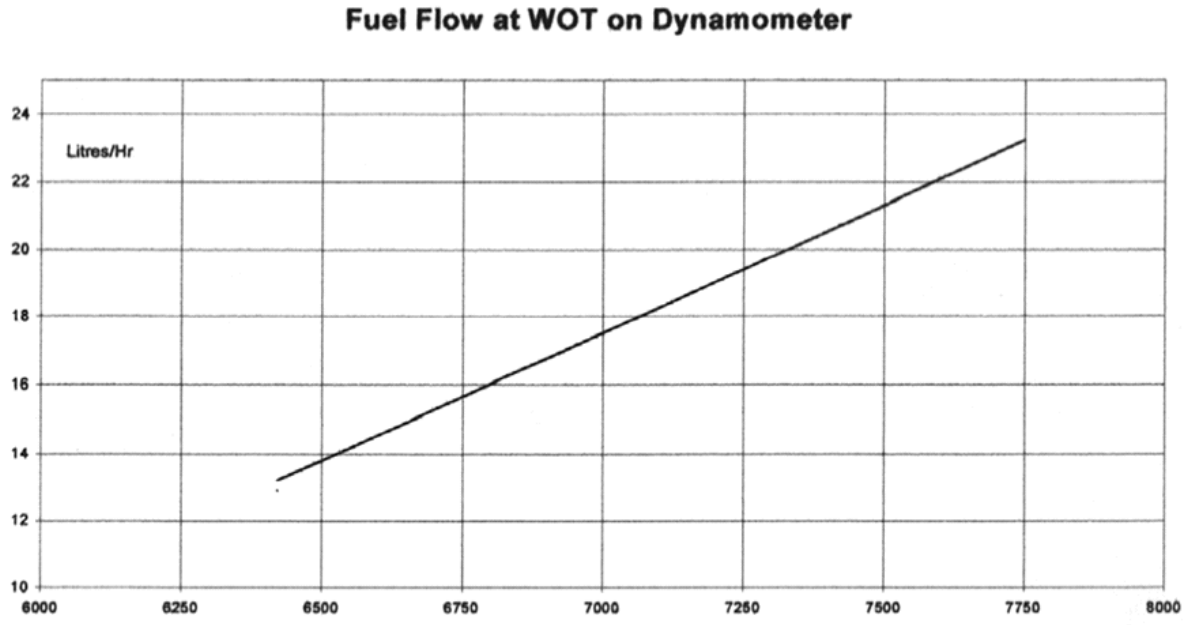
FIG 10





18.4 Fuel Consumption Curve

FIG. 11



Note that these values are taken from JAR 22 calibration test results and are not indicative of actual consumption rates.

Typical in–flight fuel flows, particularly at part–throttle conditions, may be expected to be significantly lower.

19.0 NOTES FOR INSTALLERS OF ENGINES

19.1 General Notes

NOTE !

In order to maintain the warranty, use only genuine Austro Engine GmbH parts.

Use only clean screws and nuts and always check threads for damage. If in doubt, always renew them.
Once loosened, always renew ‘stiff’’ nuts, i.e. self–locking nuts.
Always use the specified torque values.
Whenever components are disturbed, always renew gaskets, seals, jointing material, O–rings and sealant

NOTE !

Do not use additives with the oils.

Copper slip anti–seize must be used on spark plug and exhaust flange nuts.
It is **VITAL** that all coolant and oil systems are bled before attempting to operate the engine for the first time, or if they are subsequently disturbed in any way.

19.2 Notes for engine installers

COOLING SYSTEM
Arrangement must be made by the engine installer to carry the rotor cooling air out from the front plate elbow, if fitted, to the oil separator or some suitable mean of removing the oil entrained in the cooling air before allowing it to vent overboard.

Cooling air should be arranged to flow over the engine and exhaust system whenever the engine is in operation.

An ample supply of cold air must be available to the induction air and rotor cooling fan filters whenever the engine is in operation.

CAUTION !

On no account should this rotor cooling air be used directly for cabin heating it may contain products of combustion including CO & CO_2
On no account should the engine be run without either of the air intake filters in place.

The liquid cooling system is designed to run at 0.9 bar (13 psi). The aircraft manufacturer or engine installer should provide a relief valve. It should be fitted with a vacuum valve to ensure that no undue negative pressure is generated on cooling after engines switch off. Therefore the relief valve should open for reverse flow at -0.2 bar.

A VDO temperature sensor is fitted to the engine in the front end plate. Provision of a compatible gauge is the responsibility.

Coolant 50/50 water / ethylene glycol mix (A corrosion inhibiting anti–freeze must be used, refer to 5.2.6). This water/glycol mix will provide protection down to -36 °C.
Operating temperature is in the range of 60 °C to 90 °C after warm up. Maximum continuous 100 °C.
Heat rejection rate approximately 25 kW of heat is rejected to the coolant when the engine is operated at max continuous power (50 BHP).
An integral water pump is provided with the engine. This provides a water flow of approx. 40 liters per minute at 7000 rpm.

CAUTION !

Radiator. The optimum radiator design will vary with each installation. It is the responsibility of the installer to provide an adequate cooling system and thus ensure that the maximum recommended coolant temperature is never exceeded even under the most adverse operation conditions. The design should also ensure that the minimum operating temperature can be achieved under all flying weather conditions.

Flight trials will probably be necessary to confirm that the design caters for the above conditions.

19.3 Fuel System

19.3.1 Fuel Specification

Refer to chapter 5.2

19.3.2 Fuel delivery

No fuel pumps are provided by Austro Engine GmbH. Therefore electric pumps each capable of delivering 80 liters an hour at three–bar pressure.

19.3.3 Fuel filters

No fuel filters are provided by Austro Engine GmbH. Therefore a filter of 40 microns or better with a flow capacity of least 80 liters per hour at 0.1 bar pressure drop must be fitted in the fuel delivery line after the pumps.

19.3.4 Pressure Regulator

No fuel pressure regulator is supplied with this engine. It is the responsibility of the aircraft manufacturer / installer to provide the injector with the fuel regulated at three bar pressure. A manifold depression tapping points is provided at the throttle body spacer for connection to the pressure regulator.

19.3.5 Water in Fuel

The fuel system shall incorporate suitable means if isolating, removing, and checking for the presence of water in the fuel system before each flight.

19.3.6 Fuel Lines

Fuel lines must be routed away and protected from hot engine and exhaust components. Fuel line should be of sufficient quality and appropriate to the pressures transmitted. Fuel hose end connections must be of threaded taper seat type and should be permanently swaged to the hoses. Push–on type hose connections are not acceptable for high–pressure fuel systems. Return hose diameter from the fuel pressure regulator should not be smaller than the fuel feed hose to the fuel rail.

No primer system is required with fuel injection.

NOTE !

The whole fuel system must be able to allow a minimum fuel flow rate of 80 liters per hour.

19.4 Oil System

Oil tank is supplied by the aircraft manufacturer but must have a minimum usable capacity of 500 ml for each hour of engine running with a strainer of mesh size not larger than 0.5 mm. Line connections:

The oil connection line between the tank and the pump should be calculated to provide AT THE PUMP INLET a minimum flow of 8 ml per minute at -10 °C by gravity flow rate. The flow rate of the pump is pre–set and will not require adjustment.

19.5 Electrical System

The installation of the electric system and the Flytronic Engine Management System should be done in accordance with Austro Engine GmbH drawings. Please contact Austro Engine GmbH therefore.

No electrical circuit protection is provided by Austro Engine GmbH.

Voltage regulator connections are shown in wiring diagram. Fig. 12. Its temperature operation range is -30 °C to +65 °C (Outer surface). Adequate cooling should be provided.

19.5.1 Electrical components relating to the fuel injection.

ECU

Supplied by Austro Engine GmbH and should be carried on anti vibration mounting.

2 independent earth connections to the outer body should be made back to the – ve battery connection.

The bonding leads must be 16 AWG minimum and each must be connected to a separate ECU mounting bolt. The case must be de–painted under the connections and re–protected after marking the connections.

In order to maintain the dual safety aspect of the ignition and injection system two independent 12–volt supply feeds to the ECU from the aircraft bus bar(s) must be installed.

Austro Engine GmbH Engines for wiring detail information.

Air Temperature sensor

Supplied by Austro Engine GmbH and should be installed with its probe in the induction airflow.

Rotor cooling air out temperature sensor

Supplied by Austro Engine GmbH and should be mounted in the rotor cooling out airflow within 100 mm or less downstream from outlet.

Map Sensors

Supplied by Austro Engine GmbH and must be mounted with the pressure inlet at the bottom and the flexible pipes running down the throttle body spacer, thus allowing any fuel in the pipe to drain back into the engine.

19.5.2 Software Quality level

In accordance with DO 178B level C.

19.6 Engine mounting

The engine mounting points on the engine have been designed and tested to meet the required 15 g load test. Engine location and fitting remain the responsibility of the aircraft manufacturer. Contact Austro Engine GmbH for installation details.

19.7 Exhaust system

Exhaust design and fitting remains the responsibility of the aircraft manufacturer / engine installer. Limitations must be regarded.

19.8 Air Filters

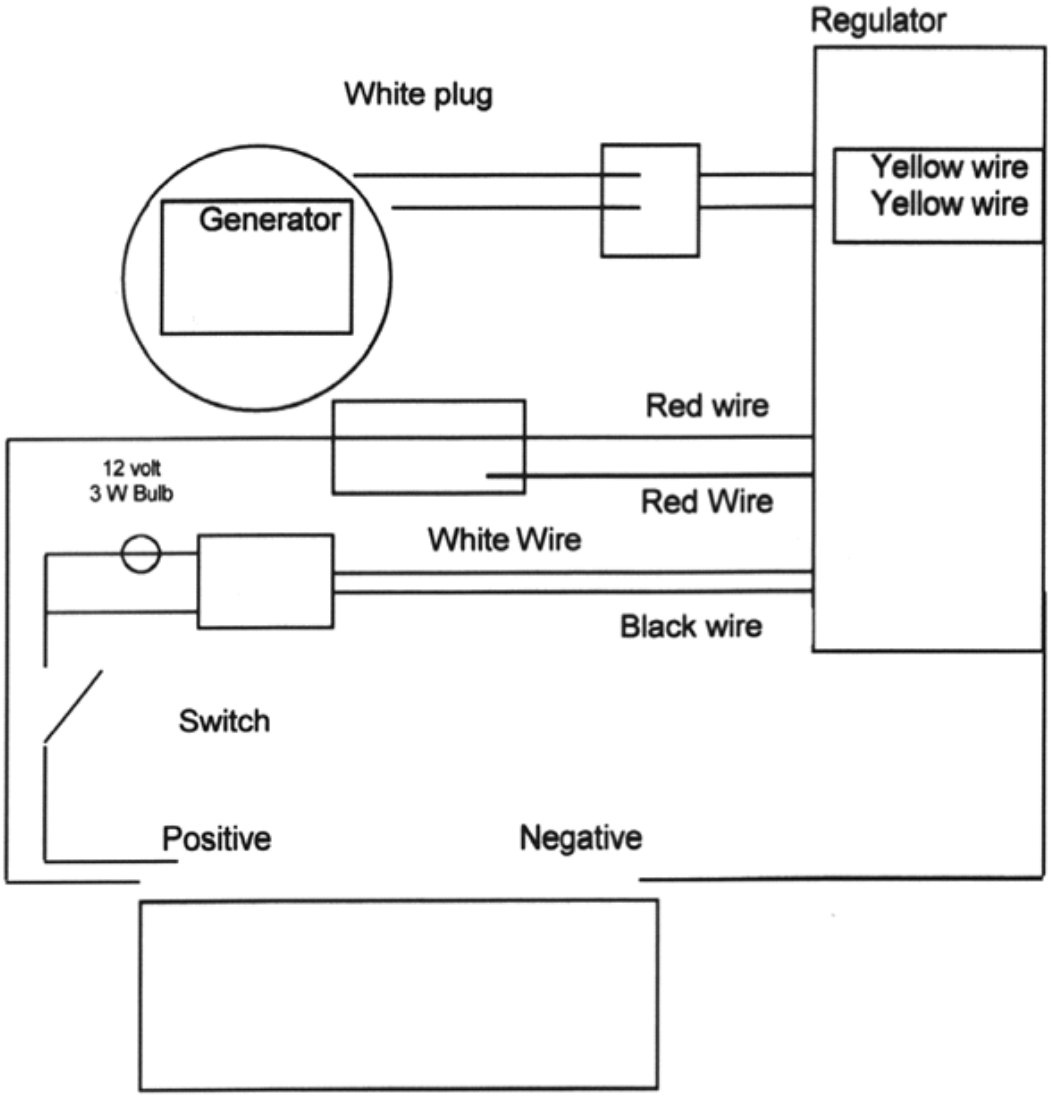
Supplied by Austro Engine GmbH as part of design. For other air filters Austro Engine GmbH must be consulted.

19.9 Drive interface

The output shaft is parallel, fitted with a woodruff key for load transmission. For more details contact Austro Engine GmbH.

19.10 Voltage regulator wiring

Fig 12



20.0 ELECTRONIC COMPONENTS CAPABILITY

The electronic components have been tested to meet environmental requirements as specified in RTCA 160 C. The following information is to assist the engine installer.

• Operation Shock & Crash Safety Tests.	DO-160C,	Section 7. Category B
• Sinusoidal Vibration Tests.	DO-160C,	Section 8.5.1 Curve M Standard vibration test fixed wing aircraft
• Humidity Tests	DO-160C;	Section 6.3.2 severe humidity environment 65°C @ 95% humidity.
• Waterproofness (Drip) Tests	DO-160D,	Section 10, Cat W, falling water test

The ECU has been designed to operate between -15 °C and +70 °C. For the purposes of this test, the ECU was operated at -45 °C and tested to -55 °C for ground survival (non – operating).

• Temperature & Altitude Tests	DO-160D,	Sections 4.5.2, 4.5.3 and 4.5.6; Cat B2
• Temperature Variation Test	DO-160C,	Section 5 Cat B.

To show that the ECU is not susceptible to failure when exposed to external electrical effects, a number of tests were performed.

• Power Input Test	DO-160C,	Section 16 Cat Z.
• Voltage Spike Test	DO-160C,	Section 17 Cat A.
• Audio Frequency Conducted Susceptibility	DO-160C,	Section 18 Cat Z.
• Induced Signal Susceptibility Test	DO-160C,	Section 19 Cat Z.
• Conducted RF Susceptibility Test	DO-160C,	Section 20.4 Cat U 10kHz to 400 MHz
• Conducted RF Susceptibility Test	DO-160D,	Section 20.4 Cat Y 10kHz to 400 MHz
• Radiated RF Susceptibility Test	DO-160C,	Section 20.5 Cat U Fig 20.7 30MHz to 1.215 GHz
• Radiated RF Susceptibility Test	DO-160C,	Section 20.5 Cat Y 100 MHz to 18 GHz.
• Emission of Radio Frequency Energy Conducted RF Interference	DO-160C,	Section 21.3
• Emission of Radio Frequency Energy Conducted RF Interference	DO-160C,	Section 21.4

- Lightening Induced Transient Susceptibility DO-160C, Section 22 Cat Z.

- The ECU and associated equipment is compatible with fluids liable to be found in the vicinity of the engine. Fluids Susceptibility DO-160D, Section 11.

- The ECU and a sample of the cable loom complete with ident sleeve and tag were subjected to the following fluids:

  AVGAS 100LL, leaded and unleaded motor fuel, Jet A1 turbine fuel, “Comp-2” and ”SRG-75” lube oil, “Procool” coolant, “Aeroshell” fluids 31, 41 and “Skydrol 500B” Hydraulic oils, Ethylene Glycol and “Kilfrost ABC-3” De-icing fluids, Isopropyl Alcohol, Denatured Alcohol, and Trichoroethane solvents.

  The ECU was not affected by the application of fluids.

- The ECU was tested to determine its magnetic effect to assist the installer in choosing the proper location of the equipment in the aircraft.

  Magnetic Effect DO-160C, Section 15, Equipment Class Z

  The compass safe distance for 1° deflection was established as 8.5 cm.

- In order to guard against SEUs caused by cosmic or background radiation effects, all semiconductor components are of a generation that is no longer “state of the art” in terms of their miniaturisation. Thus the active parts of the semi-conductors are large by contemporary standards and so are also large in comparison with radiation particles. Any leakage current arising from the “trail effect” caused by a radiation particle passing through the semi–conductor material is at least 2nd order and unlikely to cause a failure.

- The ECU is supplied with power from its own internal bus bar. Two diodes are fitted within the ECU, one between each supply line and the internal bus bar. These protect against a short to ground in the supply wires to the ECU, preventing high current drain from the ECU internal bus bar from the other supply which would cause the ungrounded breaker to “pop”.

For further information contact Austro Engine GmbH.

21.0 CONTROL SYSTEM RELIABILITY

Control system reliability objective.

Certification requirements states a reliability objective to be quoted in the engine manual.

The control system has been designed to meet AMJ20X–target reliability of 1 in 100,000 hours when operated in accordance with Austro Engine GmbH stated maintenance and installation specification.