



Orenda

ORENDA MODEL OE600A

INSTALLATION MANUAL – CONDENSED VERSION

NUMBER
OE600A.IN.M.LT

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**RECIPROCATING
ENGINES
COPY**

**ORENDA AEROSPACE
CORPORATION**

MAY 1 1998

ENGINEERING RECORDS

ORENDA RECIP INC. • 3160 DERRY ROAD EAST • MISSISSAUGA • ONTARIO L4T 1A9 • CANADA

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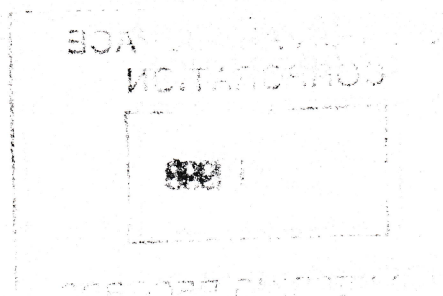

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 2 of 16	

TABLE OF CONTENTS

INSTALLATION MANUAL.....	1
1.0 RATINGS AND LIMITS.....	3
1.1 General Specifications.....	3
1.2 Engine Weight.....	4
1.3 Center of Gravity.....	4
1.4 Moments of Inertia.....	4
1.5 Performance.....	8
1.6 Allowable Operating Limits.....	9
1.7 Accessory Drives.....	13
1.8 Airframe Supplied Components.....	14
2.0 ENGINE PERFORMANCE.....	15
2.1 Engine Performance Charts.....	15



 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 3 of 16	

1.0 Ratings and Limits


The Orenda Recip, Inc. model OE600A aircraft engine has eight cylinders arranged in a conventional 90° "Vee". It is liquid cooled, fuel injected, and turbocharged. The engine utilizes a dry sump lubrication system, dual engine-driven liquid coolant pumps, and dual magneto ignition systems. The engine includes an integral reduction gearbox that reduces the engine speed to drive the output (propeller) shaft and a rear-mounted accessory gearbox with service drive pads.

WARNING

This manual should be used for general information purposes only. The data in this manual is a subset of the Transport Canada-approved Installation Manual OE600A.IN.M. The complete installation manual is available once the appropriate contractual agreements are in place.

1.1 General Specifications

Parameter	Value
Number of Cylinders	8
Bore (inches)	4.433
Stroke (inches)	4.000
Displacement (cubic inches)	495
Compression Ratio	8:1
Crankshaft Rotation (Aft looking Forward)	Counter-clockwise (CCW)
Firing Order	1-2-4-5-6-3-7-8
Ignition Timing (degrees BTDC)	38 ± 1
Cylinder Numbering (Aft looking Forward)	
Right Side Cylinders	1-3-5-7
Left Side Cylinders	2-4-6-8
Propeller Mounting Flange	SAE ARP 880A
Propeller : Engine Drive Ratio	0.4675 : 1
Propeller Shaft Rotation (Aft looking Forward)	Clockwise (CW)

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 4 of 16	

1.2 Engine Weight

Basic Engine , dry (Includes all engine supplied, Engine mounted components, see Figure 1)	659 717 Lbs
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Airframe Mounted Accessories Supplied with Engine	
Accessory	Weight (Lbs)
Fuel Servo	7.0
Turbocharger	68.0
Wastegate	5.0
Wastegate Controller	2.2
Pressure Relief Valve	1.4
Total Weight , Airframe Mounted Accessories:	83.6


1.3 Center of Gravity

Basic engine Center of Gravity (C of G) is approximately 22.4 inches aft of propeller mounting flange, 3.4 inches below propshaft centerline and along the crankshaft/propshaft centerline (viewed from front of engine). Refer to Figure 1.

1.4 Moments of Inertia

Engine Moments of Inertia in lbm-in² are with respect to a coordinate axis centered at the engine's Center of Gravity (C of G). The table below shows the moments of inertia with respect to each axis:

Axis	Moment of Inertia (Lbm-in²)
I _{M-X}	3.80 x 10 ⁴
I _{M-Y}	8.58 x 10 ⁴
I _{M-Z}	8.46 x 10 ⁴

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 5 of 16	

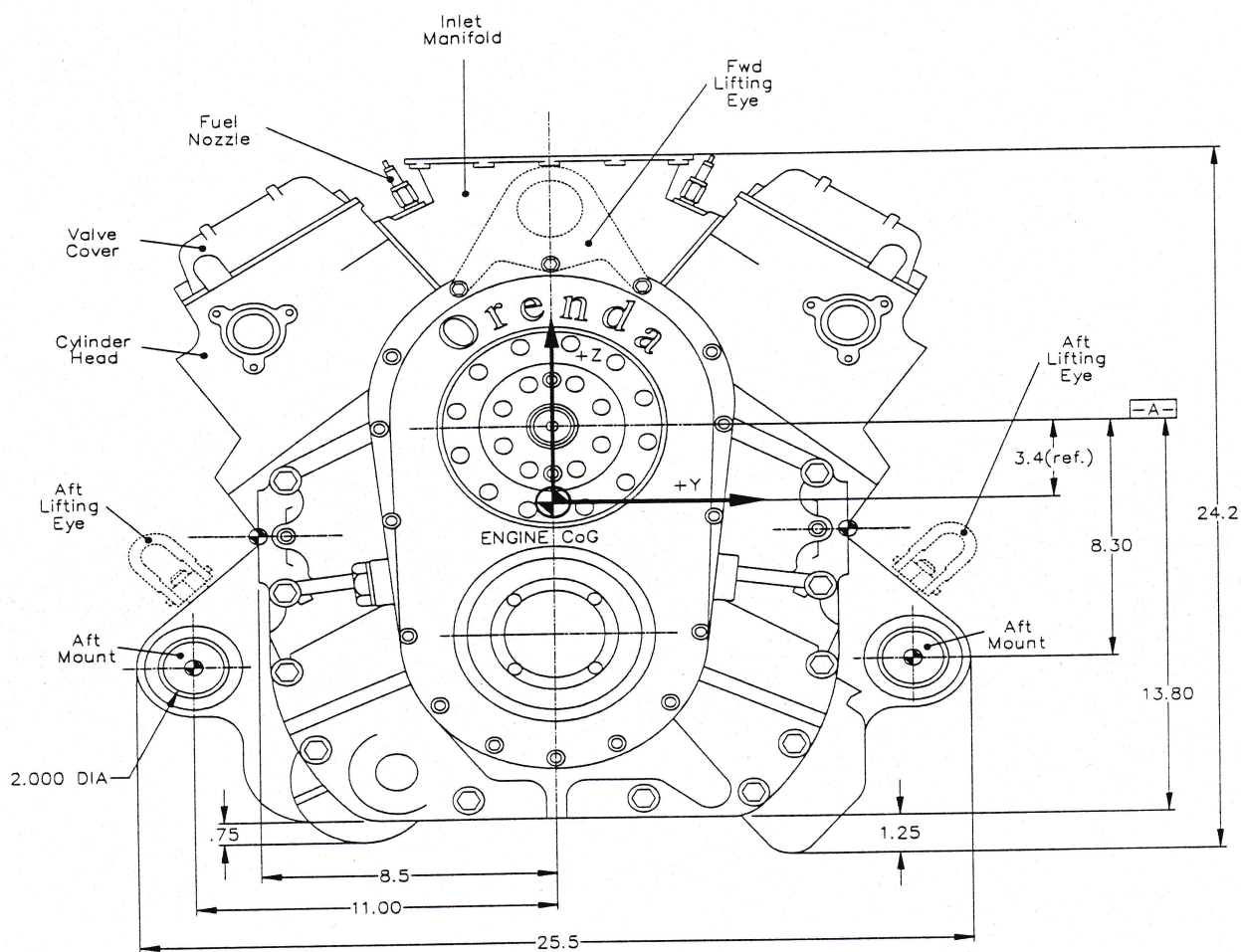

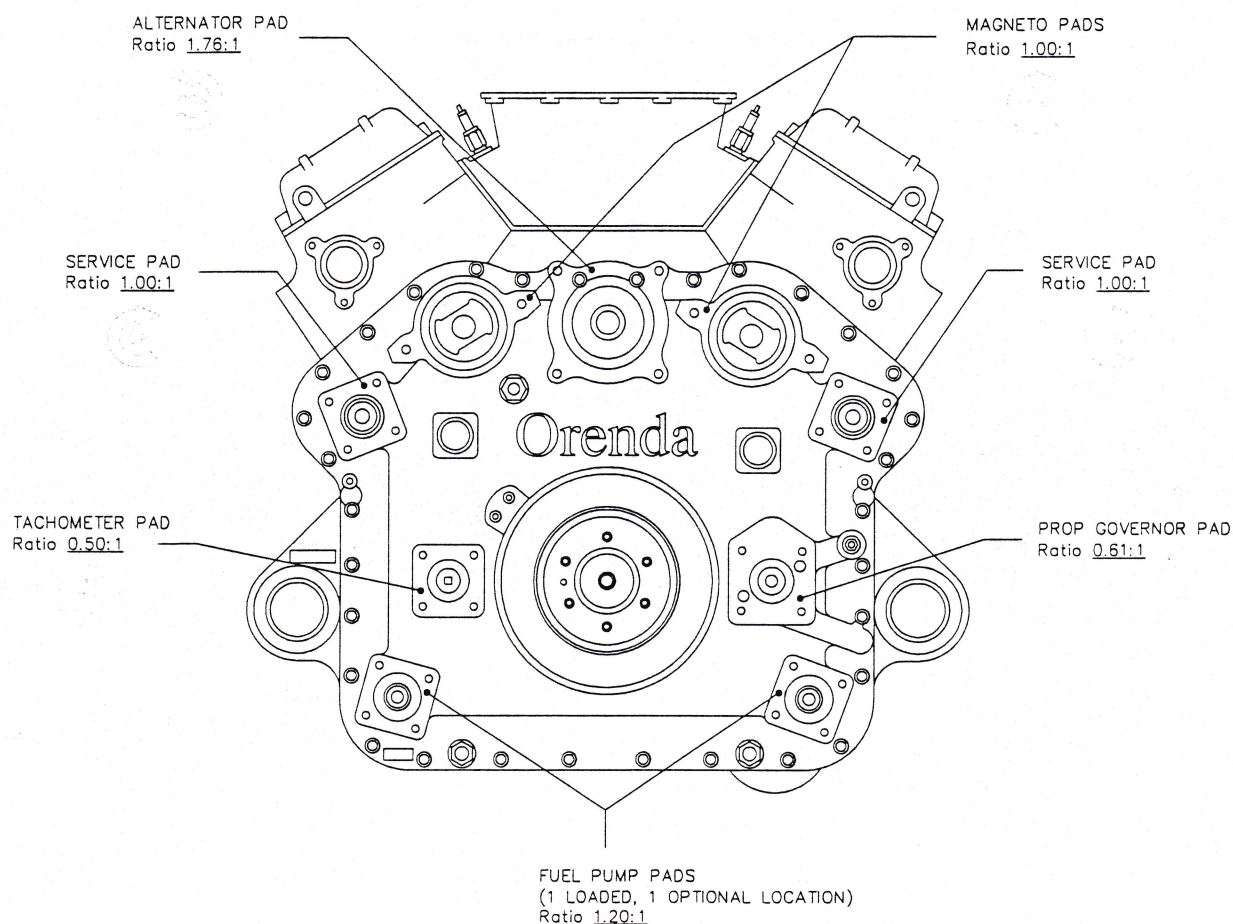


Figure 1 (Sheet 1 of 3)


BASIC ENGINE - FRONT VIEW

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 6 of 16	



Notes: Stated Drive ratio is relative to crankshaft.
Magnetos and Fuel Pump removed for clarity.

Figure 1 (Sheet 2 of 3)
BASIC ENGINE - REAR VIEW

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 7 of 16	

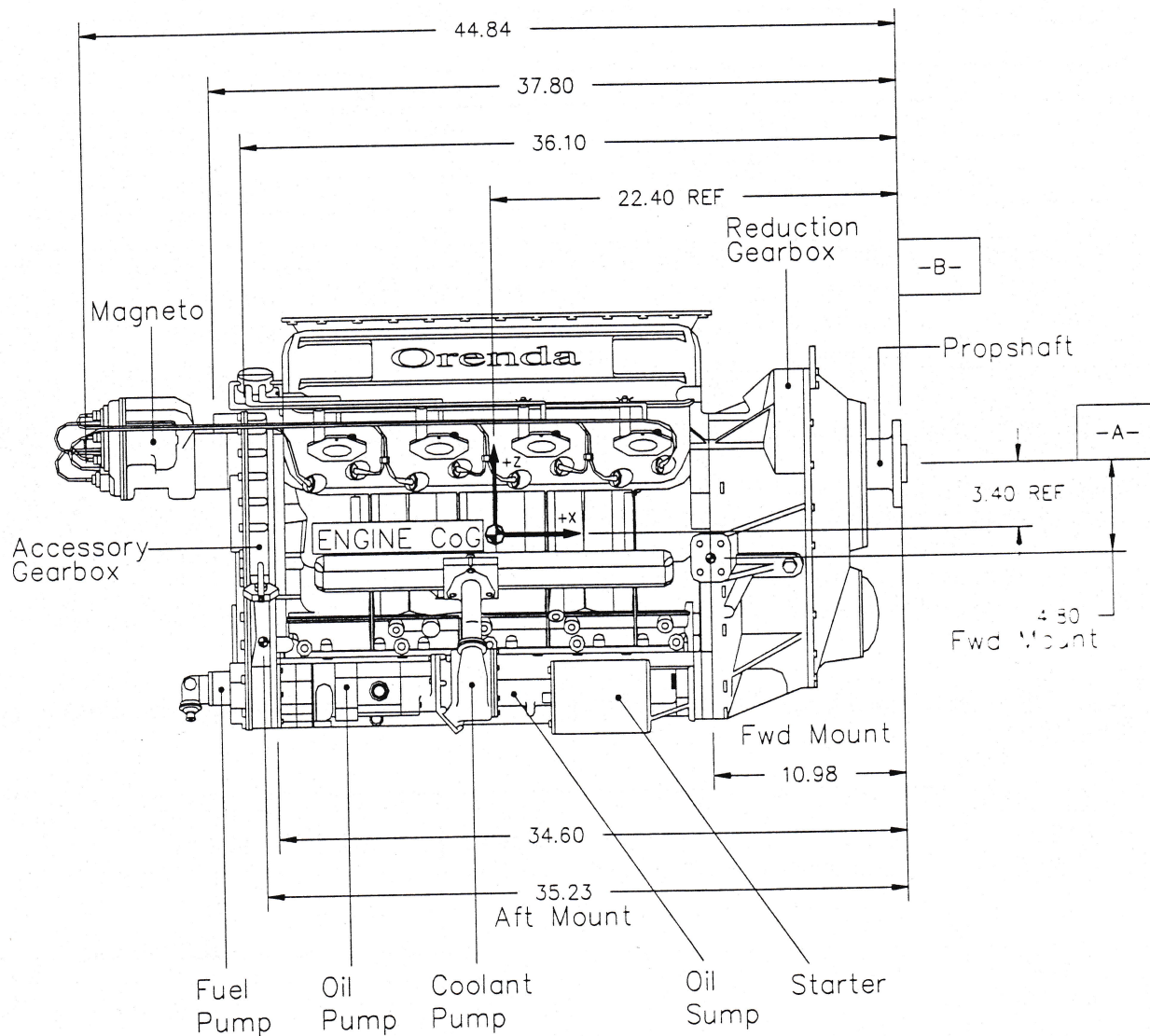



Figure 1 (Sheet 3 of 3)

BASIC ENGINE - SIDE VIEW

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 8 of 16	

1.5 Performance

1.5.1 Rated Power Settings (+5/-0 %, Standard Day Pressure Altitude, Full Rich)

Rated Engine Power Settings	
Operational Setting	Output Shaft Power (Brake Horsepower)
Takeoff Power (Note 1)	600
Maximum Continuous Power	500

Reference Altitude (feet)	POWER (Brake Horsepower) (Note 2)	Engine Speed (rpm)	Prop Speed (rpm) (Note 3)	Max. Manifold Temp. (°F)	Maximum IMAP (In Hg Abs) (Note 4)	Maximum CMAP (In Hg Abs)
0-10,000	600	4400	2057	120	52	49.3
0-20,000	500	4200	1964	145	50	46.3

Notes:


1. Five (5) minute limit at Takeoff Power rating.
2. Output Shaft Power includes extraction of airframe services up to an equivalent of 18 hp.
3. Propeller speed reduction ratio is 0.4675 to 1 (versus engine speed).
4. Maximum Indicated Manifold Pressure (IMAP) is defined at maximum manifold temperature.

1.5.2 Power Settings Above Critical Altitude (Standard Day Pressure Altitude, Best Economy Fuel Flow)

Reference Altitude (feet)	POWER (% of Maximum Continuous)	POWER (Brake Horsepower)	Engine Speed (rpm)	Prop Speed (rpm)	Maximum IMAP at Max. Manifold Temp. (145°F) (In Hg Abs)	Maximum CMAP (In Hg Abs)
23,000	85%	425	4000	1870	44	40.8
24,000	75%	375	3800	1777	43	39.8
25,000	65%	325	3600	1683	41	38.0
26,000	55%	275	3400	1590	37	34.3

Note: Refer to Figure 2 for complete Engine Operating Envelope.

The installer is to provide power setting charts that specify indicated manifold pressure as a function of ambient air temperature as this is a function of intercooler performance.

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 9 of 16	

1.6 Allowable Operating Limits

1.6.1 Engine Speeds

Operating Condition	Speed (rpm)
Idle speed	1400 – 1800
Maximum engine speed, transient Max 10 seconds	4400 - 4500
Maximum turbocharger speed	71,000 (not cockpit displayed)
Maximum engine speed, One cylinder inoperative	3800


WARNING

Engine overspeed incidents in excess of 4500 engine rpm (2104 prop rpm) and/or in excess of 4400 engine rpm (2057 prop rpm) for more than ten (10) seconds necessitate Mandatory engine inspection prior to further flight. Refer to OE600A Maintenance Manual.

1.6.2 Induction/Exhaust System

Induction/Exhaust System Operating Parameters	
Parameter	Value
Fuel Servo Inlet Air Temperature, maximum (° F)	200
Manifold Inlet Air Temperature, maximum (° F)	
@ Takeoff Power	Refer to 1.5.1 & Note 1
@ Maximum Continuous Power	Refer to 1.5.1 & Note 1
@ All Power Settings Below Maximum Continuous Power	145 (Note 1)
Indicated Manifold Absolute Pressure (IMAP), maximum (In Hg Abs)	
Takeoff Power	Refer to 1.5.1
Maximum Continuous Power	Refer to 1.5.1
Corrected Manifold Absolute Pressure (CMAP), maximum (In Hg Abs)	
One Cylinder Inoperative	30
Overboost Limit, transient (Inches Hg Abs)	
Exceedance of set point pressure, Max. 10 seconds	0-3 (Note 2)
Pressure Relief Valve Setting (In Hg Abs at Servo Inlet)	55±0.5

Maximum Exhaust Gas Temperature (EGT), steady (° F)	
@ Exhaust Port of hottest cylinder	
Takeoff Power	1500 (Note 5)
Maximum Continuous Power	1550 (Note 5)
@ Turbocharger Turbine Inlet (TIT)	1650 (Note 4)

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 10 of 16	

Induction/Exhaust System Operating Parameters	
Parameter	Value
Maximum Exhaust Gas Temperature, transient (° F)	
@ Exhaust Port of hottest cylinder, 10 seconds or less	
Takeoff Power	1500-1550 (Note 3,5)
Maximum Continuous Power	1550-1575 (Note 3,5)
@ Turbocharger Turbine Inlet (TIT), 10 seconds or less	1650-1700 (Note 3,4)

Notes:

1. The measurement and display of the above-noted temperatures is optional only if the Supplementary Type Certification has substantiated full engine operation below the appropriate specified limit. If the limit has not been substantiated, above-noted temperatures are required instrumentation.
2. Refer to OE600A Maintenance Manual if overboost exceeds the specified limit and/or duration.
3. Refer to OE600A Maintenance Manual if exhaust gas overtemperature exceeds the specified limit and/or duration.
4. The TIT can be used in place of EGT provided a correlation is established by between EGT and TIT.
5. Hot cylinder is typically cylinder #7 but must be verified in each installation

WARNING

Engine overboost incidents (Note 2) necessitate mandatory engine inspection prior to further flight. Refer to OE600A Maintenance Manual.


Engine overtemperature incidents (Note 3) necessitate mandatory engine inspection prior to further flight. Refer to OE600A Maintenance Manual.

1.6.3 Lubrication System

Engine oils conforming to SAE J1899 (formerly MIL-L-22851D - Ashless Dispersant) for multigrade 15W50 are eligible for use. Single grade oils conforming to SAE J1966 (Formerly MIL-L-6082E - Non-Dispersant) are eligible for use as follows:

Single Grade Oil - Recommended Viscosity	
Expected Ambient Temperature (° F)	Recommended SAE Viscosity
Above 60	50
10 to 60	40
Below 10	30

Note: Multi-grade oils may be used at all expected ambient temperatures.

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 11 of 16	


Lubrication system operating parameters are listed in the table below:

Lubrication System Operating Parameters	
Parameter	Value
System Capacity, minimum usable (usqts)	16
Oil Flow Rate, normal operating, typical (usgpm)	18
Oil Consumption	
Maximum (usqts/hr)	0.50
Typical (usqts/hr)	0.16
Oil Pressure (psig) @ engine inlet	
Maximum (cold oil)	120
Normal operating, typical	60 - 80
Idle, minimum	40
Oil Temperature (° F) @ engine inlet	
Maximum	210
Minimum for take-off	125
Normal operating, typical	160 - 200

1.6.4 Coolant System

Engine coolants conforming to ASTM D4985 are eligible for use. Coolant system operating parameters are listed in the table below:

Coolant System Operating Parameters	
Parameter	Value
Coolant Formulation	
Antifreeze (Percent by Volume):	
Minimum	50
Maximum	55
Distilled Water (Percent by Volume):	Remainder
System Capacity, minimum recommended (usqts)	24
Coolant Flow Rate, total, maximum (usgpm)	140
Coolant Pressure (psig) @ engine outlet	
Maximum	20
Idle, minimum	5
Coolant Temperature (° F) @ engine outlet	
Maximum	225
Normal operating, typical	180 - 195

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 12 of 16	

1.6.5 Fuel System

The OE600A engine is designed to operate with a minimum of 100 Octane, Low Lead (100LL) Aviation grade gasoline (blue) per MIL-G-5572F and ASTM- D 910-75. Under no circumstances should lower octane aviation fuel or automotive fuel (regardless of octane rating) be used.

Fuel system operating parameters are listed in the table below:

Fuel System Operating Parameters	
Parameter	Value
Fuel Temperature (° F) @ fuel pump, maximum	150
Fuel Flow Rate (pph), Take-off	
Maximum	400
Minimum - Reference	370
Fuel Pump Inlet Pressure (psia)	
Minimum	15
Maximum	60
Fuel Servo Inlet Pressure (psia)	
Minimum	59
Maximum, continuous operation	115


If operation of the airframe pump and/or engine driven pump provide a servo inlet fuel pressure in excess of that listed above, pressure regulation or other means of pressure limitation shall be provided to maintain fuel pressure within the specified range.

1.6.6 Temperatures

Operating Parameter	Value (°F)
Starting Temperature (° F)	
Preheat recommended below:	37 (Note 2)
Preheat required below:	20 (Note 2)
Minimum recommended for starting:	-30 (Note 1)
Maximum recommended start temperature:	140
Ambient Temperature, Operating (° F)	
Minimum	-65
Rated Take-off, maximum	115
Maximum Continuous, maximum	140
Cold Soak Temperature, Minimum (° F)	-40

Notes:

1. Minimum recommended start temperature based upon the freezing point of the coolant mixture at the formulation range specified in section 1.6.4.
2. Refer to the cold start and preheating guidelines found in OE600A.MM.M.

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 13 of 16	

1.6.7 Engine Operating Pressure Altitudes

Operating Parameter	Value (Feet MSL)
Minimum Pressure Altitude - Reference	-1,000
Maximum Pressure Altitude - Reference	31,000

1.6.8 Engine Operating Attitudes

Attitude	Maximum Angle
Pitch	±21°
Roll (Uncoordinated Flight)	±30°

1.6.9 Negative Accelerations

Magnitude and duration of negative accelerations is determined by oil tank design and total system capacity. Oil supply to engine cannot be interrupted. The installer shall define the negative acceleration limit.

1.6.10 Fuel Cutoff Valve

A fuel cutoff valve is required to minimize the possibility of overfueling the engine.


1.7 Accessory Drives

A total of five (5) drive pads are provided for installation of airframe supplied accessories. Accessory drive specifications are as follows (see also Figure 1 for further details):

Accessory Drive Pad (refer to Figure 1)	Drive Ratio	Max Torque (In-lb.)		Max Weight (lb.)	Max Overhang Moment (In-lb.)
		Continuous	Static		
Tachometer	0.50:1	4.0	75	1.0	1.5
Propeller Governor	0.61:1	8.8	375	3.7	9.1
Alternator (Note 2)	1.76:1	37.7	825	12.75	44.6
Customer Service (2)	1.00:1	48.0	375	3.2	8.7

Notes:

1. There are two (2) locations available for attaching the engine supplied fuel pump. Both locations cannot be loaded at the same time.
2. Alternator specifications are consistent with a 100A, 28V type unit.


 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 14 of 16	

1.8 Airframe Supplied Components

Key airframe supplied components required for engine installation are listed below, along with the applicable section of the Installation Manual. The airframe-supplied components shall comply with the applicable sections throughout this manual unless otherwise approved by Orenda Recip, Inc..

Airframe-Supplied Component
Forward Engine Mounts with Vibration Isolators
Aft Engine Mount Vibration Isolators
Oil Cooler
Oil Filter and Housing
Oil Tank / Air Separator
Coolant System Heat Exchanger
Coolant Expansion Tank with a pressure regulator
Coolant Overflow Tank
Coolant Lines
Fuel Boost Pump
Fuel Filter
Fuel Cut-off Valve
Inlet Air Heat Exchanger
Inlet Air Plenum
Inlet Air Ducting and Filter
Exhaust Manifolds and Ducting - LH, RH
Propeller
Temperature Sensors - oil and coolant
Pressure Sensors - oil and coolant

NOTE: The installer determines and supplies all other unique components required to complete the installation.

 Orenda	ORENDA MODEL OE600A	No: OE600A.IN.M.LT	Issue: ORIG
TITLE: INSTALLATION MANUAL		Date Issued: 21 APR 98	
		Page 15 of 16	

2.0 Engine Performance

2.1 Engine Performance Charts

All airframe supplied components are to be designed and sized to meet the following engine operating envelope:

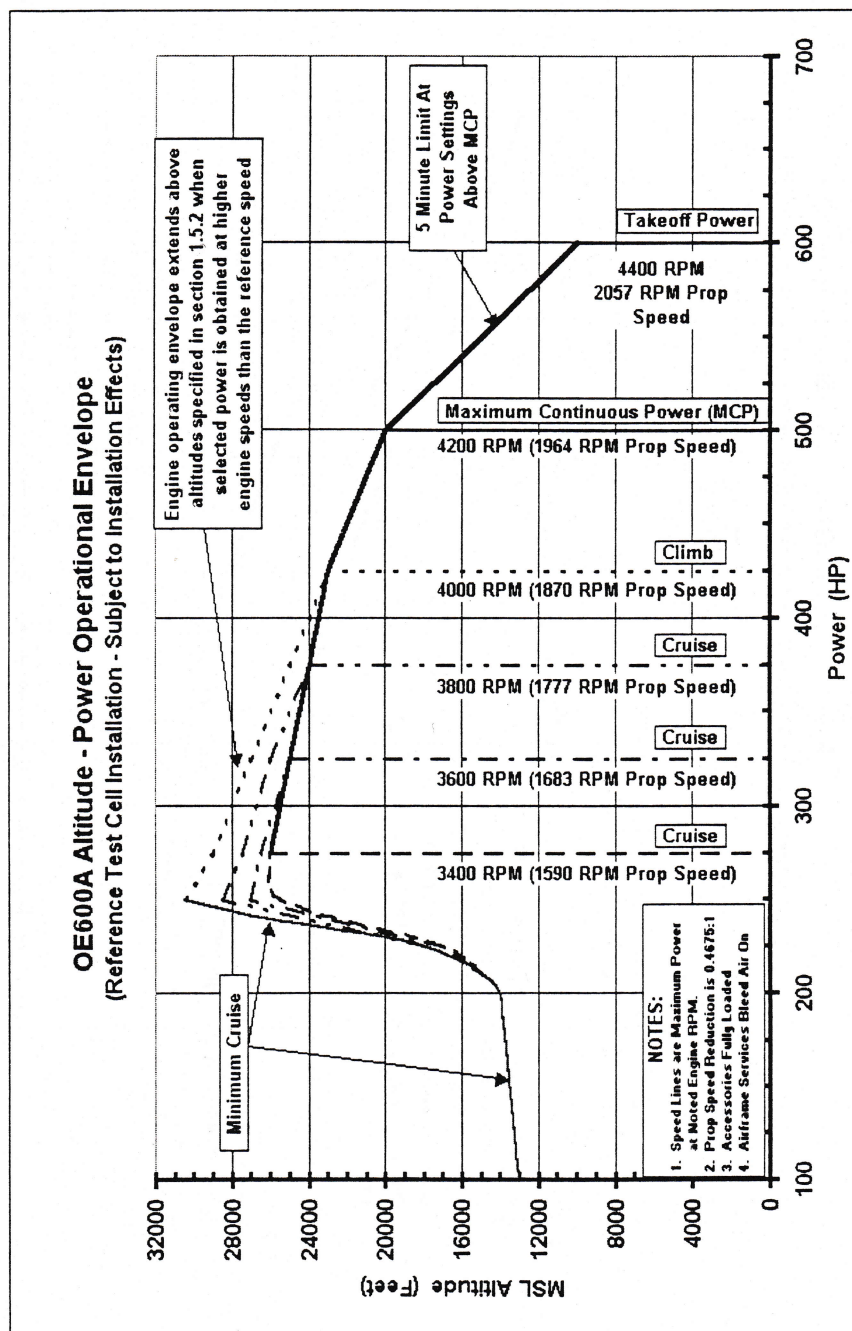


Figure 2 Engine Operating Envelope

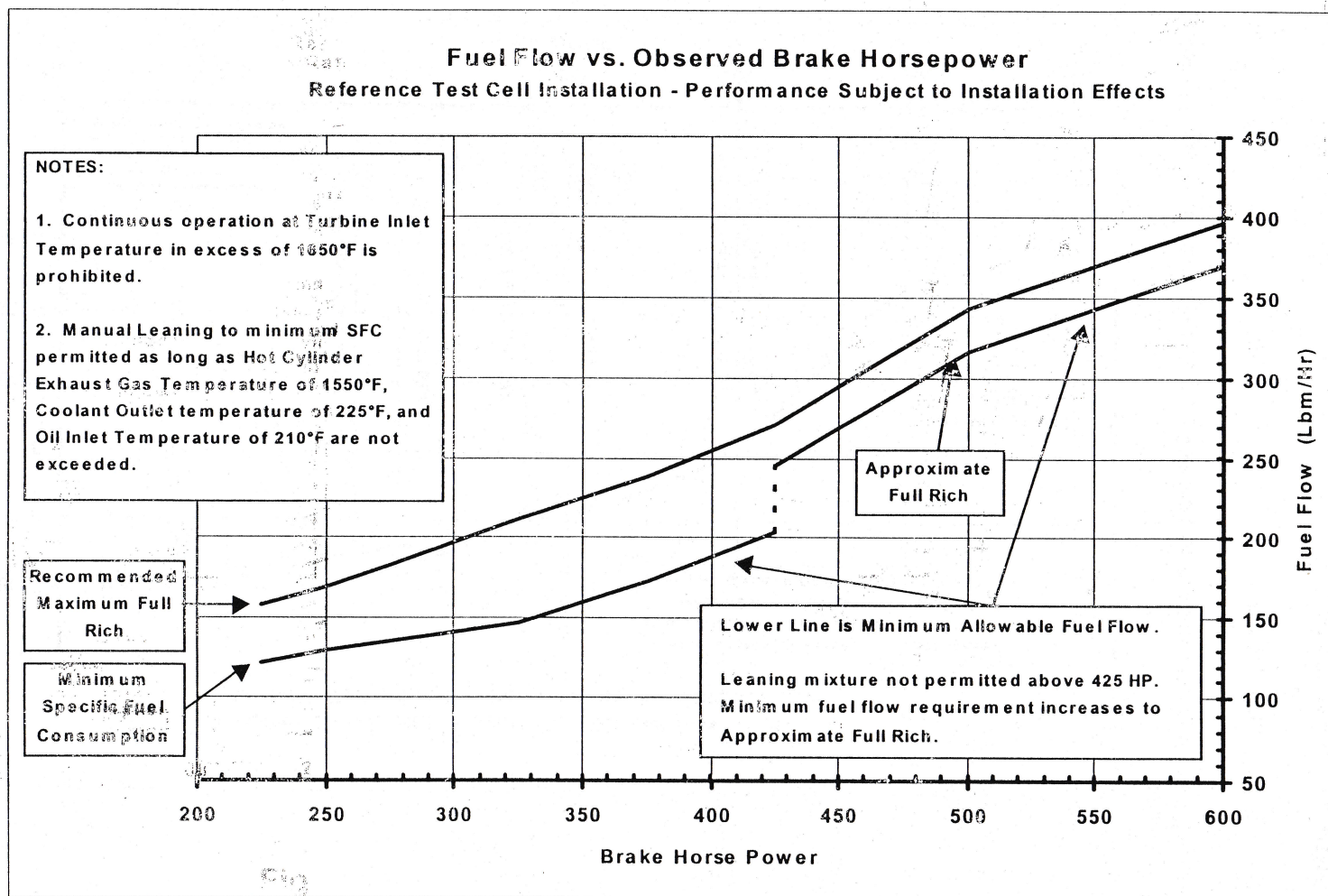


Figure 3 Fuel Flow vs. Observed Brake Horsepower