Higgs Diesel

E-1000J/G

1638 bhp @ 5300 rpm
New concept in high performance aircraft engines

Unique operating method

Low part count for high life

Extremely high power to weight

Minimum vibration

Low noise and heat signature
Higgs Diesel

Specification

E-1000J/G

• 1000 c.i (16.37 liters)

• 1638 bhp (1221 kW)* depending on specification max SL power to 50k ft

• weight 664lbs (302kg)

• L 65.51” (1,664), W 24.37” (619mm), H 28.54” (725mm)


• BSFC, 0.380 lb/hp-h (231 g/kW-h) Pratt & Whitney PT-6 Turboprop by comparison is 0.507 lb/hp-h (308 g/kW-h) (on approach and idle 0.825 lb/hp-h (502 g/kW-h) )
The crankcase, freed from any gas exchange functions, is well lubricated; the working processes being sealed above the piston. Isolation of the crankcase also permits a full pressure lubrication system to be used, as in four-cycle engines.

Inherent piston cooling characteristics of the combined cycle piston design offer a major durability advantage over conventional two-cycle engines, allowing much leaner fuel delivery than can be sustained with traditional crankcase scavenging, where usually piston overheating and consequent seizure are common.

This technology operates without complex mechanical components such as cams, valves mechanisms and the other various precision components necessary to operate them.

The absence of these mechanical components eliminates a large number of moving parts, thereby considerably reducing the costs and maintenance requirements, whilst significantly increasing reliability and retaining the simplicity of the two cycle engine.

With this novel cycle engine technology, combined with the enormous benefits together with their appealing simplicity, a new generation of light weight high performance power plants can be achieved. Which until now would have been almost impossible.
The use of combined cycle pistons, for charge transfer and combustion, allows the key advantages of two and four-cycle engines to be combined, with the elimination of disadvantages inherent in each of these engine types.

Using a combined cycle piston in we are able to completely separate the scavenging from the crankcase.

Isolation of the fresh charge from the crankcase is made possible by the provision of normal four-cycle engine compression and oil control rings on the larger diameter part of the piston.
The complete cycle
The engine is designed from the outset to run with a reduction gearbox. Generally speaking the design of such a unit for aviation is complex due to the highly stressed loading and the necessity to remove vibration from the crank, coupled with undesirable instantaneous torque fluctuations, these units tend to be massive, complex and require high maintenance.

The E1000-J/G and E300-J/G with their low torque fluctuations inherent with a two stroke, allow for a different approach to gear sizing, materials and integration. The gearbox low axial load is achieved by using a double pinion, which is supported independently by its own bearings and attached to the crank via a spline (no bending transmitted to the pinion). This method allows the torque loading to be shared between the two idler gears with a corresponding increase in service life. The gear-case is an integral part of the crank case with a gear cover containing both rolling elements for load and thrust.
extremely smooth output torque, provided by a power stroke from each cylinder for every revolution, retains an advantageous two-cycle characteristic.

A particularly smooth arrangement, which is also very compact, is provided for in this layout.

Having excellent balance, and with evenly spaced firing intervals, this gives very smooth torque characteristics, which cannot be achieved in a four-cycle engine with less than eight cylinders.

Red line is a typical 4 cylinder four stroke, the blue line is the CCT 4 cylinder and the green line is a CCT V8. The V12 peak to peak is even smaller.
It is necessary to emphasize the importance of the very high volumetric efficiency of the traditional piston controlled ports employed by the standard two cycle engine.

Until now no existing type of inlet valve could produce the essential requirements of presenting the maximum inlet area to the air in the minimum time.

The new design outlined below, significantly increases both the utility and the efficiency of the two cycle engine, which may now be more efficiently scavenged.

The port layout adopted concentrates the scavenge flow at the wall of the cylinder opposite the exhaust port. This compares with more evenly dispersed scavenge flows common in conventional engines.

Scavenge flow within the cylinder provides, in effect, a form of stratified charging and explains improvements in fuel economy obtained with such a simple layout.

This enables combined cycle engines to compete with four-cycle engines in terms of fuel economy, especially under cruise conditions.
COMBINED CYCLE PISTON OPERATIONAL ADVANTAGES

- Conventional 4 cycle wet sump lubrication
- No valve gear
- Low thermal loading of the piston
- High durability with low exhaust emissions
- Compact low mass design
- Extended oil change periods (oil does not degrade)
- Extended maintenance intervals (less parts to maintain)
- Maintenance based on RCM, no TBO
Our technology eliminates most of the maintenance operations required with conventional two and four-cycle engines. Operating conditions in the crankcase of a stepped piston engine are very similar to those in a four-cycle engine. The copious supply of oil to the working parts minimises wear. However, blow-by gases, to which the bearings and the oil are usually exposed, are isolated above the piston step. Bearing corrosion problems, well known, especially in two-cycle engines, are therefore completely avoided.

In addition to these more obvious points, analysis of oil, taken from one combined cycle automotive engine, revealed that after 400 hours the lubricant was still within the specification for new oil. Normal degradation of the additives had not occurred.

In a four-cycle engine all of the oil passes at some time into the high temperature region adjacent to the piston compression rings and is then returned to the crankcase. Therefore in a four-cycle engine all of the oil is exposed periodically to temperatures well in excess of the degrading point of the additive pack. This causes the qualities of the oil to decline throughout the period between oil changes.
• This platform of engines has been designed from the ground up to be a true multi fuel unit.


• Will also run and perform on all gasolines where necessary, 80,87,91,95 including 100LL along with all bio derivitives.

• Hydrogen gas.

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CONDOR

- 302kg (664lbs)
- 1638bhp
- Multi Fuel
- Jet Fuel
- Gasoline
Basic Dimensions
Performance predictions of the naturally aspirated AX-100 engine were conducted to examine power output at altitudes ranging from sea level to 60,000 feet.

This study reflects the WOT (wide open throttle) performance at the altitudes considered. A propeller power absorption curve is shown for reference. The propeller absorbs 1000 hp @ 5300 rpm at sea level.

As altitude is increased, fuel injection rate is reduced to maintain a best power air/fuel ratio of 12.0 to 13.5 at all rpms.

The power predictions reflect that of an un-tuned engine as inlet and exhaust system ducting have not been defined at this time.

Maximum rated power at sea level is 1259 bhp @ 5300 rpm with corresponding bmep of 94 psi (6.5 bar).

Approximately 930 bhp @ 5150 rpm is available at 8k feet, the maximum altitude requirement for the NA engine.
AX-100 WOT Power Output At Altitude
Engine is Naturally Aspirated

Power, hp

Engine rpm

- SL
- 10k
- 20k
- 30k
- 40k
- 50k
- 60k
- Prop Power @ SL
AX-100 WOT Power Output At Altitude
Engine is Naturally Aspirated

Power, hp

Engine rpm

SL  8k  Prop Power @ SL
Predicted Brake Horsepower and Torque Available at Sea Level

**AX-100 WOT Performance at Sea Level**

*Engine is Naturally Aspirated*

- **Power, hp**
- **Torque, ft-lb**
- **Engine rpm**

- **Blue line**: SL BHP
- **Pink line**: SL Torque, Ft-lb
## Competition

<table>
<thead>
<tr>
<th>Name</th>
<th>Weight</th>
<th>Power Max Continuous</th>
<th>Fuel Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1000J/G</td>
<td>302kg</td>
<td>1638bhp</td>
<td>BSFC, 0.380 lb/hp-h (231g/kW-h)</td>
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<tr>
<td>(278kg’s using magnesium)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pratt &amp; Whitney PT6</td>
<td>280kg</td>
<td>1585bhp</td>
<td>BSFC, 0.507 lb/hp/h (308 g/kW/h)</td>
</tr>
</tbody>
</table>

- 60% mission range increase
- Lower operating cost
- Lower acquisition cost
CONDOR
Fitted with a 5 blade MT prop
Can be fitted with most manufactures props, including fully beta capable units
Higgs Diesel

**E-330J/G**

- 137kg (301.4lbs)
- 350bhp ~ 500bhp
- Multi Fuel:
  - Jet fuel
  - Diesel
  - Gasoline

Hawks