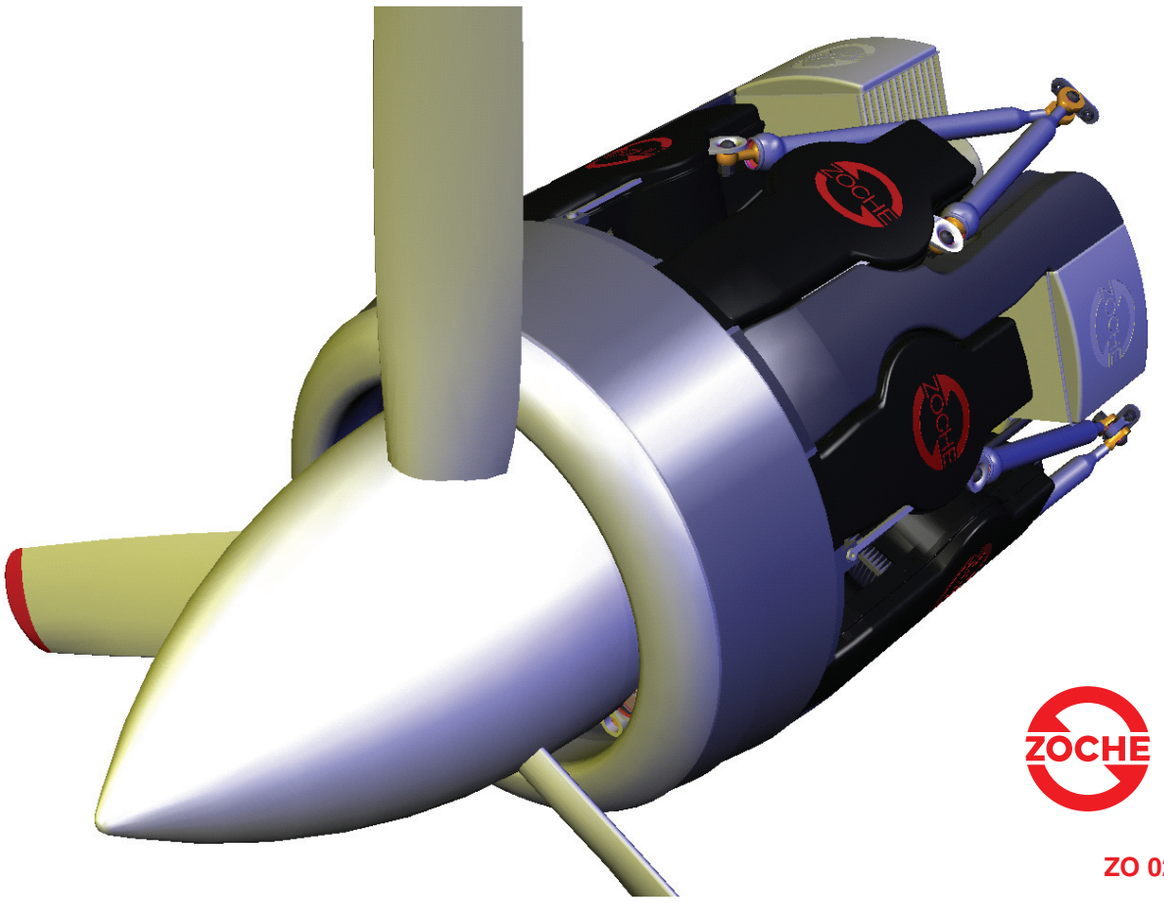
The Diesel engine has demonstrated the lowest specific fuel consumption of any prime mover (as low as .26 lb/hp hr for very large 2-stroke marine Diesels). It uses fuel which is much cheaper and still contains more energy per gallon than gasoline or avgas. Decades ago there were several Diesel aircraft engines (built by Guiberson, Packard, Rolls-Royce, Clerget, Fiat and others).

In the 1930´s the Junkers “Jumo 205” supercharged 2-stroke Diesel was used in scheduled transatlantic service between Europe and South America; it had a cruise BSFC of .356 lb/hp hr and a specific weight of only 1.5 lb/hp. “Jumo” Diesel engines delivered full sealevel power up to 40,000 feet and powered aircraft flying at 50,000 feet.



ZO 02A

Following these almost forgotten examples we are developing a new piston engine for general aviation: the **ZOCHE aero-diesel**.

It is a direct drive, air cooled, radial two-stroke cycle Diesel with 4 cylinders per row. It features two stage charging (turbo- and supercharger), direct fuel injection and intercooling.

Compared to the opposed-cylinder, spark ignited aircraft engine, **ZOCHE aero-diesels** offer many advantages:

- The engine has half the specific weight, half the frontal area and burns less fuel. This leads to remarkable improvements of aircraft parameters: payload, range and speed will be markedly better.
- Environmentally progressive – low CO_2 emissions due to low fuel consumption, low NO_x due to two stroke principle, low soot and unburnt hydrocarbon emissions due to modern high pressure injection. Diesel and jet fuels contain no toxic substances like lead, benzene or scavengers. No fuel availability problem wordwide.
- Greatly reduced fuel costs – **ZOCHE aero-diesels** burn fewer lb/hp hr; Diesel or jet fuel has more lb/gallon and costs less per gallon.
- Very low noise emission due to two-stroke and turbocharging.
- Easy to operate – one power lever only. No mixture, no alternate air, no aux fuel pump, no magneto switches, no mandatory temperature, boost or power restrictions.
- Very low vibration level – the 4 cylinder bank can be 100% balanced for all rotating and reciprocating inertias. Torque vibration is minimal due to one power pulse per cylinder per revolution.
- Full aerobatic pressure lubrication.
- Good reliability and low maintenance cost due to the lack of a reduction drive, the very low parts count and the use of reliable Diesel components. Streamlined installation without any hoses.
- High inflight reliability – no carburetor-icing, no magneto or spark-plug problems, no vapor lock. Turbine inlet temperature is so low that it needs no monitoring. Even cylinder head temperatures are not critical.
- Safe electrical power – directly driven overload protected brushless starter-generator – no belts, gears, or bearings.
- Reliable starting and inflight restarting through powerful and highly efficient starter-generator. Cold start and acceleration to 2,500 rpm within a second has been demonstrated.
- Reduced ‘hot and high’ problems – sealevel power at least up to 9,000 feet.
- Dramatically reduced fire hazard – Diesel fuel has a much lower flammability. Exhaust manifold temperature is about 720°F lower.
- No rubber hoses: all ducts for oil, hydraulics and manifold air are integrated into the castings.

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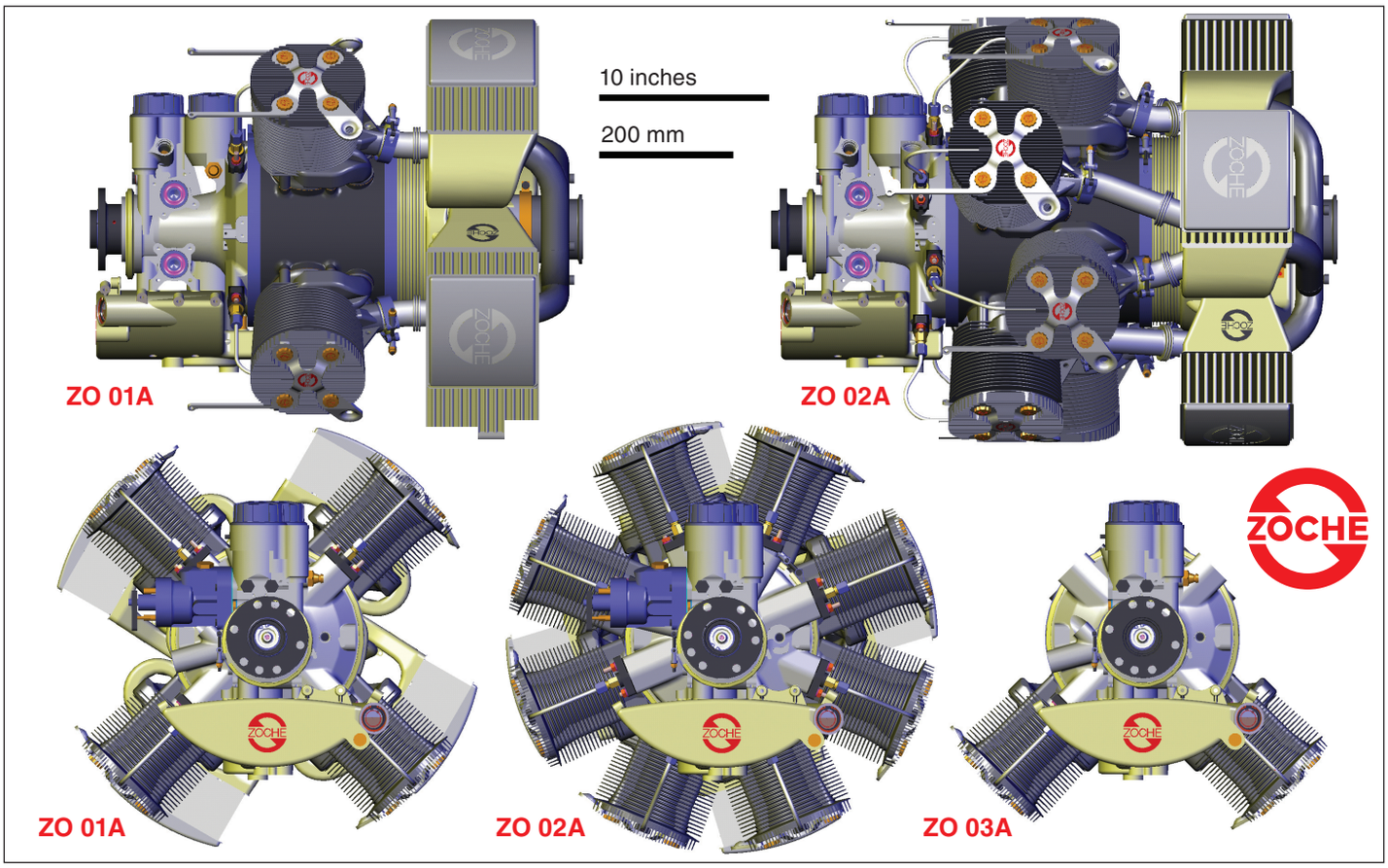
The very compact **ZOCHE aero-diesel** incorporates the latest cylinder technology as well as refinements like tungsten counterweights and full aerobatic pressure lubrication. The **ZOCHE aero-diesel's** high efficiency reduces the amount of rejected heat, thereby minimizing cooling air requirement. Cooling problems are further reduced by the fact that there are no areas in this Diesel engine which demand such exact cooling as the cylinder head of a spark ignited engine. Charge air pressure is generated by a combination of a highly efficient mechanical blower and a newly developed advanced turbocharger, reducing power loss at altitude. The quadruple flow compressor scroll is integral to the monobloc intercooler, resulting in a very high efficiency of the turbocharger and intercooler installation. The intake manifold is an integral part of the crankcase casting. The fuel injection pump together with its feed pump, the fuel filter and all connecting plumbing are integrated into the crankcase assembly, further reducing the parts count and improving reliability. The integrated dry sump oil reservoir features a sight glass for easy inspection.



	ZO 01A	ZO 02A	ZO 03A
Power at 2,500 rpm	**110 kW • 150 hp**	**220 kW • 300 hp**	**51 kW • 70 hp**
Displacement	2.66 liter • 162.6 cu inches	5.33 liter • 325.3 cu inches	1.33 liter • 81.3 cu inches
Height	555 mm • 21.8 inches	648 mm • 25.5 inches	405 mm • 15.9 inches
Width	555 mm • 21.8 inches	648 mm • 25.5 inches	555 mm • 21.8 inches
Diameter including cooling ducts	648 mm • 25.5 inches	648 mm • 25.5 inches	
Length	725 mm • 28.5 inches	835 mm • 32.9 inches	725 mm • 28.5 inches
Weight	**84 kg • 185 lbs**	**123 kg • 271 lbs**	**55 kg • 121 lbs**
Bore / Stroke	95 / 94 mm • 3.74 / 3.70 inches	95 / 94 mm • 3.74 / 3.70 inches	95 / 94 mm • 3.74 / 3.70 inches
Piston Speed at 2,500 rpm	7.83 m/sec • 1,540 fpm	7.83 m/sec • 1,540 fpm	7.83 m/sec • 1,540 fpm
Compression Ratio	17 : 1	17 : 1	17 : 1
Intake Manifold Pressure	3 bar abs • 87 inch Hg	3 bar abs • 87 inch Hg	3 bar abs • 87 inch Hg
Intake Manifold Temperature	80°C • 176°F	80°C • 176°F	80°C • 176°F
Turbine Inlet Temperature	< 550°C • < 1,000°F	< 550°C • < 1,000°F	< 550°C • < 1,000°F
Pressure Lubrication	5 bar • 72 psi	5 bar • 72 psi	5 bar • 72 psi
Max Power BSFC	225 g/kWh • .365 lb/hp hr	225 g/kWh • .365 lb/hp hr	235 g/kWh • .381 lb/hp hr
Cruise (75%) BSFC	212 g/kWh • .346 lb/hp hr	212 g/kWh • .346 lb/hp hr	220 g/kWh • .357 lb/hp hr
Cruise (75%) Consumption	**21.1 l/hr • 5.57 gal/hr**	**42.1 l/hr • 11.13 gal/hr**	**10.1 l/hr • 2.68 gal/hr**
Fuels	**Diesel Fuel # 2, Jet Fuel JP 4, JP 5, JP 8, Jet A**		

Propeller Shaft Rotation is clockwise (viewed from anti-propeller end), there are 4 Accessory Drive Pads running at Crankshaft Speed (2 clockw., 2 ccw). Weight includes: Starter-Generator (10 kW), hydraulic Prop-Governor, Turbo- and Supercharger, Oil- and Fuel-Filter. Motor Mounts are at the Rear of the Cylinder Heads. CG is located in the Plane of the Cylinders. Engines will be certified to JAR-E and FAR 33, a TBO of 2,000 hours is anticipated.

Patents DE 3525665, DE 4020826, EP 0231223, US 4,781,028, US 5,197,416, Japan 63-500818 (...)
"**aero-diesel**" is a Registered Trademark.

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