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# STEYR MOTORS M1 Turbodiesel

Multi Fuel Capability

# STEYR MOTORS M1



- STEYR MOTORS M1 engines are developed to meet the specified power, emissions and fuel consumption with Diesel fuel according **EN590**. For any other fuel, a restricted operational performance has to be accepted. However, calibrations for alternative fuels are offered on special customers' requests.
- Besides EN590, STEYR MOTORS M1 engines (without exhaust gas after treatment system) can be operated on:
  - Other **Diesel** fuels: ASTM D975 1D & 2D, JIS K2204 1&2, NATO F-54
  - **Jet fuels** (usually with reduced power output): Jet A, Jet A-1, MIL JP-8, JP-5, NATO F-34, F-35, F-44, F-63, F-65
  - **Marine distillates** (with special calibration only, except F-75) : NATO F-75, F-76, ISO 8217 DMX, DMA
  - **Light heating oils** (with special calibration only): DIN 51603, ASTM D396 1&2, BS 2869 A2, CSR 441
  - **Bio fuels** (usually with reduced power output; special care regarding fuel ageing is necessary): EN14214 (incl. any blend with EN590), Australian Bio-Diesel Standard (incl. any blend with EN590)

# Marine Distillates and Light Heating Oils



- Marine distillates and light heating oils have a higher density specified than Diesel fuel.
- Thus, the injected fuel mass at same injection volume command is higher.
- This leads to increased power output and therefore mechanical and/or thermal overload of the engine.
- Additionally, the higher fuel density also causes higher injection pressure causing mechanical overload of the unit injectors and unit injectors' drive.
- The overload can be prevented by reducing the maximum injection volume command.
- Such a special calibration will result in too low power when running on Diesel, but prevents any damages due to thermal or mechanical overload as described above.

# Jet Fuels & Bio Fuels



- Jet Fuels:
  - The usually reduced power output when using Jet fuels is due to the usually lower density of Jet fuels compared to Diesel fuel.
  - The lower density causes a reduced fuel injection mass at same injection volume command.
- Bio Fuels:
  - The reduced power output when using bio fuels is due to the usually lower heating value of such fuels.
  - More details about the special care regarding fuel ageing are described in the Motor Monitor (The STEYR MOTORS Magazine) 04/09.
- A reduced power output can be compensated by a special calibration – this calibration however cannot be used with standard Diesel fuel due to the risk of thermal and/or mechanical overload of the engine.

# The STEYR MOTORS M1 Multi Fuel Power Compensation



- A special calibration or power losses can be avoided by using a compensation function.
- The power reduction due to use of *jet fuels* is due to significantly lower fuel density → if the injection volume is increased, the power loss can be compensated
- Most *marine distillates* and *light heating oils* would result in increased power output due to significantly higher fuel density → injection volume has to be reduced in order to avoid continuous overload of engine mechanics
- By adding a fuel density sensor, the calibration can compensate the effect of different fuel densities all together. The power output of the engine becomes independent from fuel density.
- A multi fuel power compensation is currently under development.