

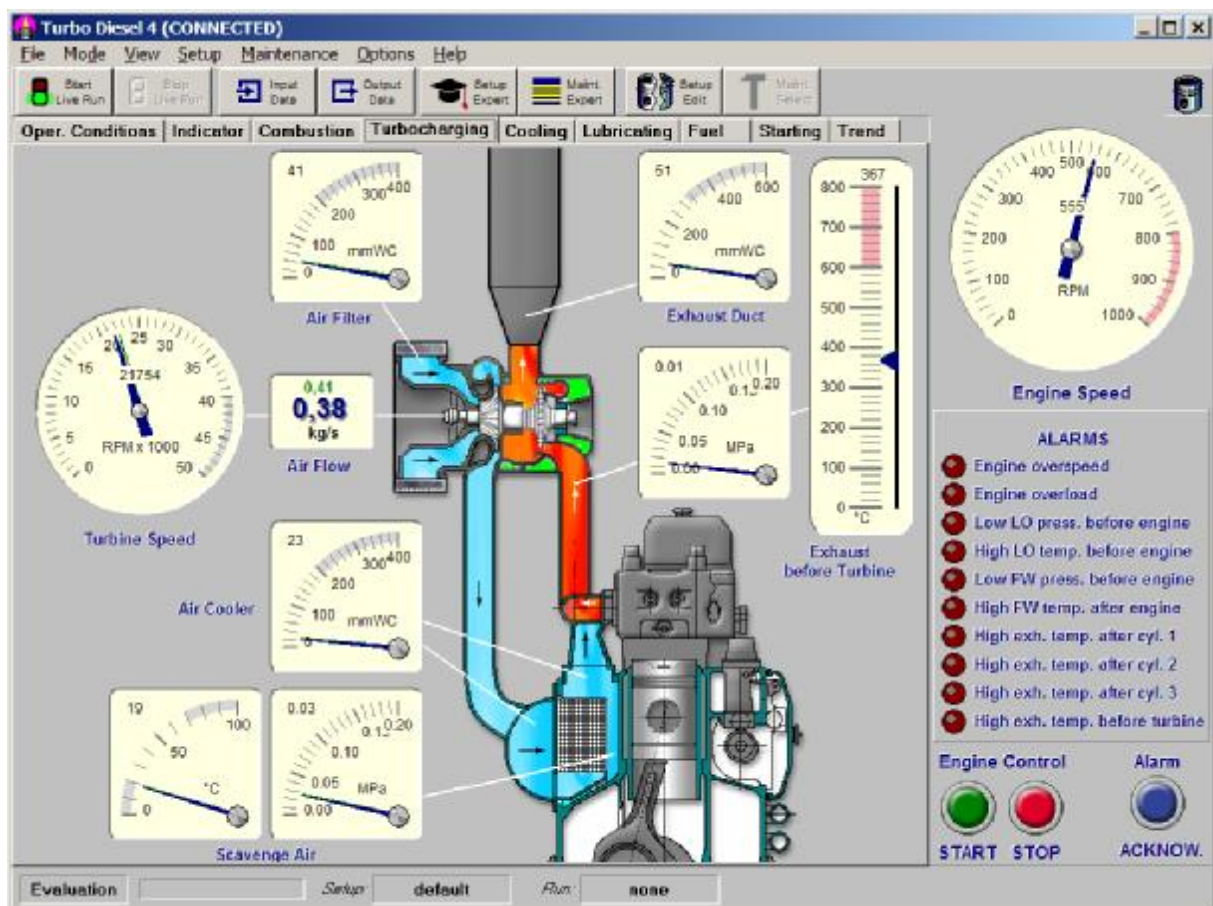


Type Approved  
to STCW 95

Marine Diesel Engine Diagnostic Simulator

# Turbo Diesel 4

**Turbo Diesel 4** is a PC-based training program which makes the user responsible for the operation and maintenance of a marine diesel engine. **Turbo Diesel 4** is particularly effective in teaching how load and other operating conditions affect engine parameters; fault recognition; breakdowns; and the relationship between engine technical state and maintenance actions. The major new version 4 includes modelling of the fuel injection process, a ready-to-use syllabus of exercises, and multi-channel engine, pump, starting air and alarm sounds.

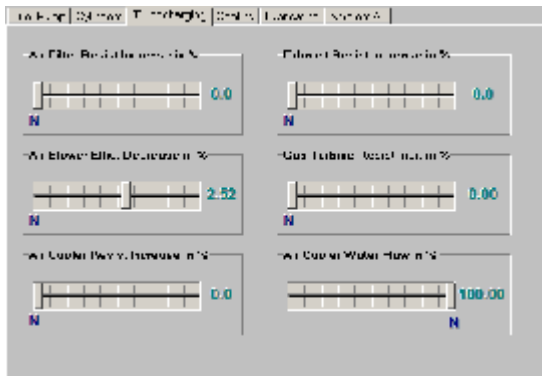


**Turbo Diesel 4** is an ideal complement to the marine engineer training syllabus. It enhances student understanding of engine operations, and gives valuable transfer training to more experienced engineers. It is also a powerful teaching and testing tool, and now includes 15 hours of ready-made lessons within the accompanying manual. The software can be networked and the package includes free instructor software for LAN installation.

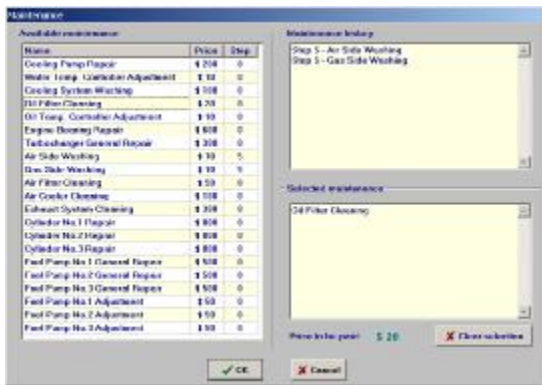
**Turbo Diesel 4** has been developed to comply with:

- STCW Code: Section A-1/12 and Section B-1/12.
- ISM Code: Section 6 and Section 8.

Turbo Diesel 4 has three operation modes:

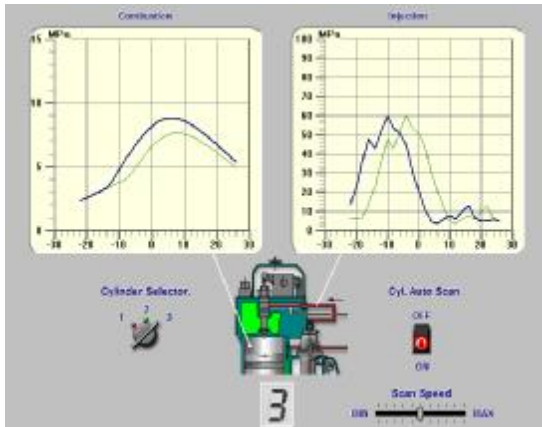


**Evaluation mode** (default). The trainee can freely change the technical state of the engine elements as well as the engine load and operating conditions. This includes being able to inspect the current technical state of the engine elements. Evaluation mode can be used for testing the relationship between engine operation conditions or technical state and engine operation parameters.



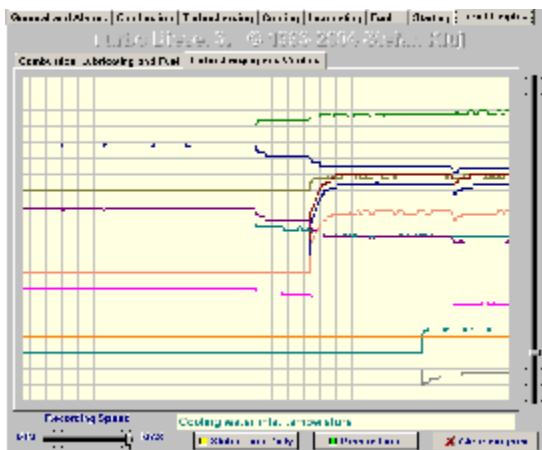
**Live Run mode.** Changes in engine technical state are simulated "in the background" by the computer. The trainee can carry out maintenance and repair and change engine speed, but he cannot control the technical state.

Maintenance tasks have their "costs" and successful diesel operation earns the student certain "incomes". His final result is the difference between his total income and total costs. The result also highlights the cost of any necessary maintenance which the student did not carry out. **Live Run mode** is very useful for diagnostic knowledge assessment.

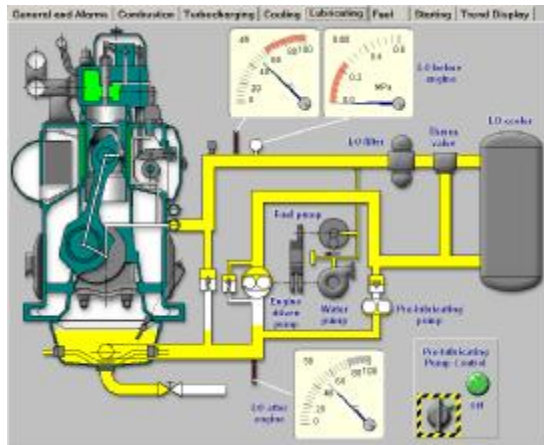


**Replay Run mode.** Live Runs can be saved on disk and replayed in this mode. The user can navigate between single run steps using simple recorder-like key-presses. **Replay Run mode** can be used for Live Run debriefing and evaluation.

Combustion pressure and fuel injection pressure curves, pictured opposite, are influenced by many faults. Monitoring these pressure curves aids the diagnostic process and improves understanding of the effects of faults on the shape of both curves.



**Time Diagram.** This shows the parameter deviation change as a function of time. This feature is very useful in Live Run mode.



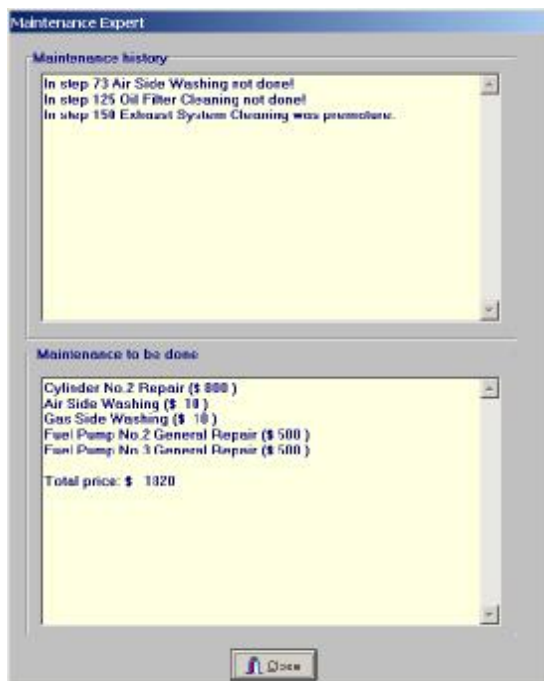
### Auxiliary systems

The most important diesel engine auxiliary systems have been modelled. The fuel, lubricating and starting air systems can be used for engine preparation and for the simulation of related faults.



**Turbo Diesel** is also equipped with two very useful 'Experts' which are especially valuable for students working on their own because the student can very precisely analyse his errors and learn from them.

**Setup Expert** can always explain the relationship between a change in engine setup and change in operating parameters. This is important when learning about engine diagnostics.



**Maintenance Expert** will indicate any necessary maintenance and evaluate what maintenance was necessary but not done.

The upper **History** window shows information about maintenance which was not done and any unnecessary maintenance. This information is very useful especially when working in Run Replay mode.

The lower **To Do** window shows all maintenance necessary in the current technical state. This feature is very useful in the Live Run mode, particularly for students in the early stages of their training.

**The following engine parameters can be observed in Turbo Diesel 4:**

- set engine revolution speed
- set engine load
- actual engine revolution speed
- engine torque
- engine power
- engine specific fuel consumption
- engine mean effective pressure
- cylinder combustion pressure curves (for each cylinder separately)
- fuel pump injection pressure curves (for each cylinder separately)
- cylinder maximum pressure (for each cylinder separately )
- cylinder exhaust gas temperature (for each cylinder separately)
- cylinder mean indication pressure (for each cylinder separately)
- lubricating oil inlet pressure
- lubricating oil inlet temperature
- lubricating oil outlet temperature
- cooling water inlet pressure
- cooling water inlet temperature
- cooling water outlet temperature
- ambient air pressure
- ambient air temperature
- turbocharger revolution speed
- scavenge air pressure
- scavenge air temperature
- air flow
- exhaust gas pressure before turbine
- air pressure drop at the air filter
- air pressure drop at the air cooler
- air temperature after the air cooler
- exhaust gas temperature before turbine
- exhaust gas pressure after turbine

**The following simulations can be chosen and mixed in Turbo Diesel 4:**

- air filter - an increase of the air path resistance
- air blower - a decrease of the air flow efficiency
- gas turbine - an increase of the gas path resistance
- air cooler - a decrease of the air resistance
- gas leak through the piston rings or valves (or both)
- fuel effective quantity decrease
- injection advance angle change
- decrease of cooling efficiency
- friction coefficient increase
- set engine speed change
- engine load change
- ambient air (pressure and temperature)
- air cooling water flow change
- cylinder cooling water temperature
- lubricating oil temperature change
- lubricating oil pressure drop at the oil filter
- clogged and worn injector nozzle

**The following maintenance and repairs can be simulated in Turbo Diesel 4:**

- cooling pump repair
- water temp. controller adjustment
- cooling system washing
- lubricating pump repair
- oil filter cleaning
- oil temp. controller adjustment
- engine bearing repair
- turbocharger general repair
- air side washing
- gas side washing
- air filter cleaning
- air cooler cleaning
- exhaust system cleaning
- cylinder general repair (piston rings and cylinder head)
- fuel pump general repair
- fuel pump adjustment
- injection valve repair.

**Hardware and software requirements**

- PC-class computer (min. Pentium III, 700 MHz)
- Minimum 128 MB RAM (recommended 256 MB)
- Hard disk drive with about 30 MB free space
- Fast graphics adapter, resolution 1024 x 768, 32 MB RAM and True Colour mode (NB Turbo Diesel cannot be used at a lower screen resolution)
- Microsoft Windows™ 98/NT/2000/XP, Vista
- Sound card with speakers or headphones