

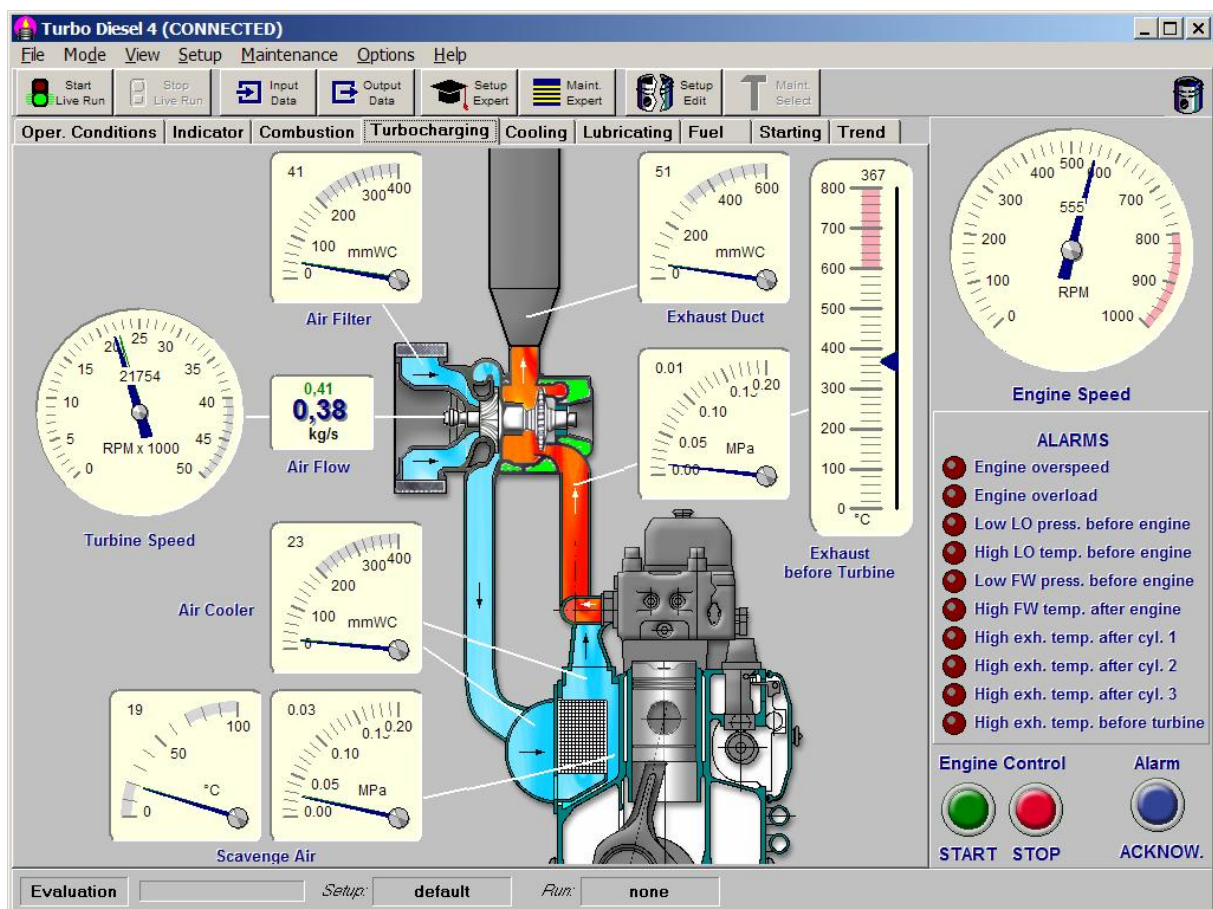
Turbo Diesel 4



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 operation conditions affect engine parameters; fault recognition; breakdowns; and the relationship between engine technical state and the maintenance actions.



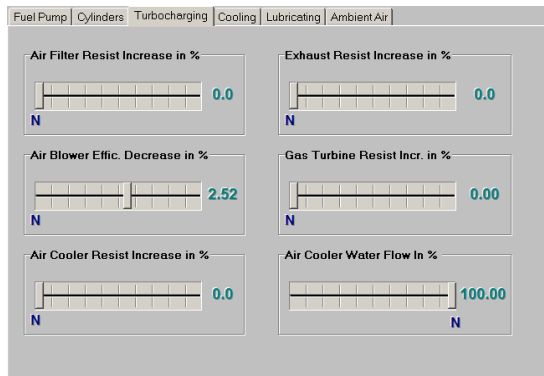
Turbo Diesel 4 is an ideal complement to the marine engineer training syllabus. It enhances student's understanding of engine operations, and gives valuable transfer training to more experienced engineers. **Turbo Diesel 4** is also a powerful teaching and testing tool, it provides a ready-made framework for instructors to create their own lessons with multiple choice questions linked to the simulated engine.

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.

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Turbo Diesel 4 has five operation modes:

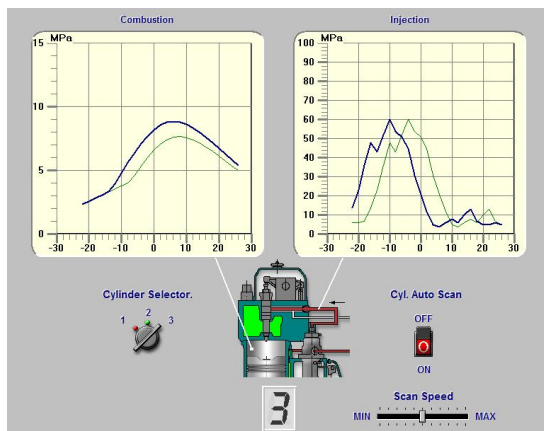


Evaluation mode (default): The trainee can freely change the technical state of the engine elements as well as the engine load and operation conditions. This includes the possibility of inspecting the present technical state of the engine elements. This mode can be used for testing the relation between the engine operation conditions or the technical state on one side and the engine operation parameters on the other side.

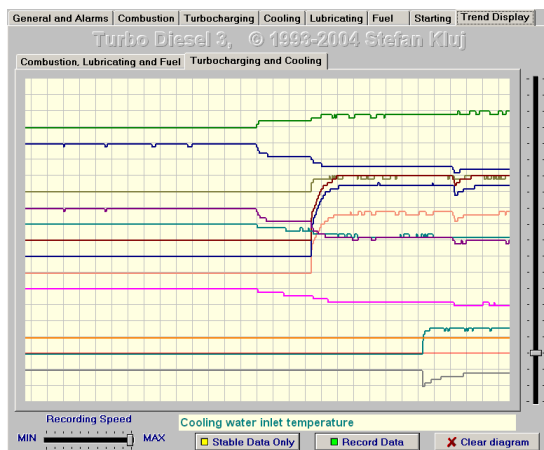
Available maintenance			Maintenance history	
Name	Price	Step		
Cooling Pump Repair	\$ 200	0	Step 5 - Air Side Washing	
Water Temp. Controller Adjustment	\$ 10	0	Step 5 - Gas Side Washing	
Cooling System Washing	\$ 100	0		
Oil Filter Cleaning	\$ 20	0		
Oil Temp. Controller Adjustment	\$ 10	0		
Engine Bearing Repair	\$ 800	0		
Turbocharger General Repair	\$ 300	0		
Air Side Washing	\$ 10	5		
Gas Side Washing	\$ 10	5		
Air Filter Cleaning	\$ 50	0		
Air Cooler Cleaning	\$ 100	0		
Exhaust System Cleaning	\$ 300	0		
Cylinder No. 1 Repair	\$ 800	0		
Cylinder No. 2 Repair	\$ 800	0		
Cylinder No. 3 Repair	\$ 800	0		
Fuel Pump No. 1 General Repair	\$ 500	0		
Fuel Pump No. 2 General Repair	\$ 500	0		
Fuel Pump No. 3 General Repair	\$ 500	0		
Fuel Pump No. 1 Adjustment	\$ 50	0		
Fuel Pump No. 2 Adjustment	\$ 50	0		
Fuel Pump No. 3 Adjustment	\$ 50	0		

Price to be paid: \$ 20

Live Run mode: Changes in the engine technical state are simulated automatically "in the background" by the computer. The trainee can only perform maintenance and repair activity and change the engine speed, but he cannot control directly the present technical state. The maintenance tasks have their conventional prices and all these expenses will be taken into account later while calculating the final results. The duration of successful diesel operations renders the player certain incomes; so the final result is actually the difference between the global income and the global cost. The Live Run is very useful for diagnostic knowledge assessment.

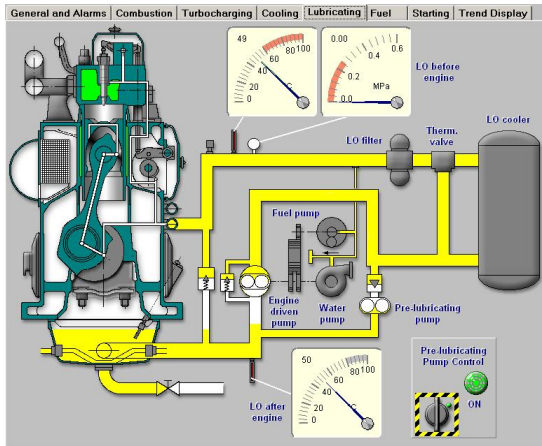


Combustion and injection diagram: The combustion pressure and the fuel injection pressure curves are displayed online. Many faults will influence the shape of both curves, and this simplifies the diagnostic analysis and improves the understanding of the working process

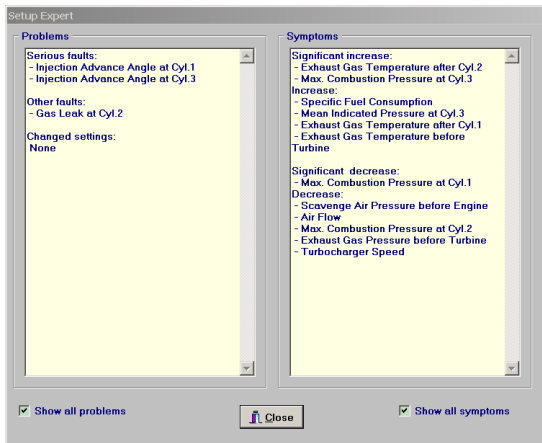


Time diagram: The time diagram shows the parameter deviation change as a function of a time. This feature is especially useful in Live Run mode.

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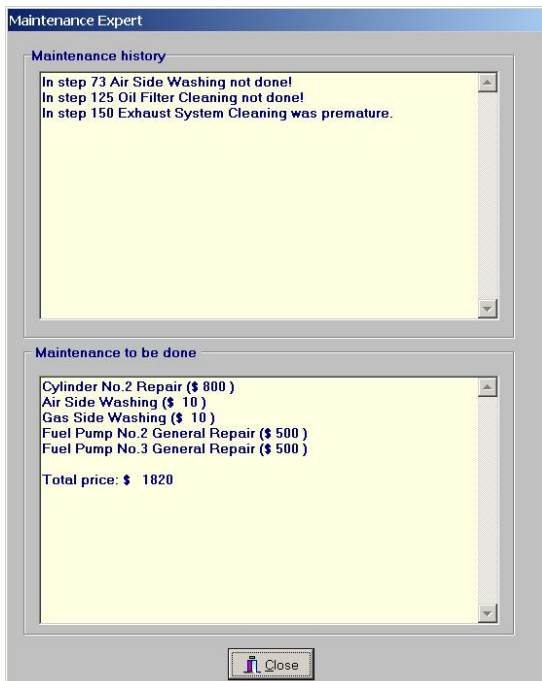


The auxiliary systems: The several most important diesel engine auxiliary systems have been implemented as well. The fuel, lubricating and starting air system can be used for the engine preparation and for the simulation of the related faults to.



Turbo Diesel has been equipped with two very useful 'Experts': Setup Expert and Maintenance Expert, especially with stand-alone learning in mind. Both experts are very useful also when the teacher is present because the student can very precisely analyse all his errors and learn from them.

The **Setup Expert** can always explain the relation between the change in the engine setup and the change in operation parameters, as this is very important when learning about e



The **Maintenance Expert** on the other hand can always suggest necessary maintenance and evaluate which maintenance was necessary but not done. The upper **History** sub-window shows information about necessary (but not done) and the unnecessary (but done) 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 should be very useful in the Live Run especially, mainly at the early stage of education.

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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,
- graphic adapter, working with resolution 1024 x 768, 32 MB RAM and True Color mode (please consider that the program can not be used at lower screen resolution),
- Microsoft Windows™ 98/NT/2000/XP, Vista,
- Sound card with speakers or headphones

For further information please contact: