

This course can be adapted to virtual classroom mode

Diesel Engines Performances - Level 2

5 days
Overview

PMD2-EN-A

LEVEL

Expert

PURPOSE

This course provides a deeper knowledge on Diesel engines and their related fields: pollution, fuels, lubricants, engine design, evolution of injection and supercharging technologies.

LEARNING OBJECTIVES

Upon completion of the course, participants will be able to:

- take in account the environmental situation that explains the regulations related to exhaust emissions, better understand combustion and diesel injection physics, the efficiency and performances improvement parameters,
- master the fuel and lubricant specifications and impacts on the engine's operation,
- size a turbocharger and match it to an engine,
- choose a depollution strategy and to select an after-treatment system,
- understand the operating principles and the strategies associated to the engine management.

WAYS AND MEANS

MOT/PMD1-E + MOT/PMD2-E give a full overview of the field of Diesel truck engines, through interactive talks and numerical exercises.

Agenda

ATMOSPHERIC POLLUTION & REGULATIONS

Atmospheric pollution, main impacts on health, share of transports.
Pollutants emitted by engines (regulated and non regulated). Regulations related to the vehicles exhaust emissions.

0.25 d

EFFICIENCY & PERFORMANCES

Global efficiency, combustion efficiency, thermo-dynamic efficiency, cycle type efficiency, mechanical efficiency.
Thermal balance.
Loading and volumetric efficiency.

0.25 d

LUBRICANT

Engine oils SAE viscosity classification. Diesel engine oils EPI and ACEA classifications.
Problems of the diesel and engine and the lubrication: lubricant behavior with the soot (dispersion); fuel sulfur content (TNB and ashes content); cylinder resurfacing; lubricant compatibility with after-treatment systems (DPF).
Oil filtration. Follow-up of in-service lubricants.

0.5 d

DIESEL FUEL

Production in refineries, manufacturing constraints in Europe and in the US.

0.5 d

Characteristics related to the use on engine: cetane, cold engine operability, distillation, viscosity, sulfur content.

Specifications: Fuel diesel in Europe, fuel Diesel in US, fuel for building machines, for boats.

DIESEL COMBUSTION & INJECTION

1.5 d

Pollutants formation: HC, CO, NO_x, particles, depending on temperature and the air-fuel ratio in the combustion chamber.

Fuel jet formation and characterization in the chamber. Role of swirl.

Influence of engine parameters on emissions, consumption, noise: load, injection advance, exhaust gas recirculation (internal, external, cooling), swirl, injection pressure. Examples of some test results interpretation.

Diesel injection system operating: injectors-pumps, solenoid common-rail, piezo, with pressure amplification.

Information about variable timing systems interest and technology.

AFTER-TREATMENT

0.5 d

Oxidation catalysts. Diesel particulates filter (DPF).

Selective reduction Catalyst (SCR) using urea. Other systems.

SUPERCHARGING

1.5 d

Turbochargers operating principle: compression and expansion energies, geometric characteristics, flow adjustment, cooling.

Compressor pressure-flow map and operating limits (pumping, speed, efficiency).

Turbine characteristics, saturation.

Technologies of the turbocharger different parts: materials, lubrication, reliability aspects.

Twin-scroll, variable geometry, dual supercharging turbochargers.

Matching a turbocharger to an engine: choice of the compressor and of the turbine depending on the engine characteristics and performances.

Participants will carry out a practical exercise of turbocharger adaptation.