

This course can be adapted to virtual classroom mode

Diesel Engineers

5 days
Overview

MDIES-EN-A

LEVEL

Knowledge

PURPOSE

This course provides a deeper knowledge on Diesel operation, combustion, injection systems, after-treatment fuels and lubrication (car, heavy duty trucks, off-road).

LEARNING OBJECTIVES

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

- understand Diesel engine operation: combustion process, pollutants origin and reduction,
- understand the engine-turbocharger adaptation criteria,
- size the turbocharger,
- know the associated products and their circuits: fuels and lubricants,
- select the right after-treatment system.

WAYS AND MEANS

One of our best-sellers.
More heavy-duty vehicles oriented, comparing personal vehicle, trucks, off-road on real basis.

Agenda

DIESEL ENGINES: COMBUSTION & OPERATING

1 d

Diesel combustion mechanisms: pollutants formation (particles, HC, CO, NOx), fuel jet required characteristics, air mixture, streamline in the combustion chamber (swirl and squish), combustion system optimization with regards to the performances/depollution trade-off. Interest of multiple injections (pilot injection, split injection, post-injection) as for noise and depollution.
Combustion modes with improved air/fuel mixture: HPC (highly premixed combustion), HCCI (homogeneous charge compression ignition).
Exhaust gas recirculation (EGR): how it reduces nitrogen oxide rate, trade-off with low and high load particles emissions, EGR cooling, high and low pressure EGR.
Start and cold start: factors of smoke and noise when cold; start assistance with warp up at intake, glow and post-glow plug.

COMBUSTION NOISE

0.25 d

Noise origin, measurements, cracking noise, burst noise.
Solutions to reduce noise.

TURBOCHARGING

0.5 d

Interest and limits of turbocharging on Diesel engine: temperature before turbine, cylinder pressure, thermo-mechanical stresses in the cylinder head.
Technologies of the different parts: compressor, turbine, main bearings.

Adaptation of the turbocharger to a given engine: choosing the turbocharger, compressor map limits (pumping, overspeed, sonic cutoff), choosing the turbine, free-floating, wastegate or variable geometry control, twin-scroll turbine; dual turbocharging.

DIESEL ENGINE FUELS

0.5 d

Diesel fuel main characteristics and specifications (density, cetane rating, viscosity, lubricating capacity, volatility, sulfur, ...), and impact on the engine behavior, additives properties.

Impact of the fuel composition on the regulated and non regulated pollutant emissions.

Specifications: Diesel fuel compared with domestic fuel and with Jet A1, new Diesel fuels, methylic ester of vegetable oils (EMVH).

INJECTION SYSTEMS TECHNOLOGIES

0.75 d

Description and operating of injection systems on cars and industrial heavy truck engines: low pressure circuits, pumps, ducts, injectors and nozzles.

Managing the fuel injection laws with Common-rail systems, solenoid injector or piezo, injector pump, unit pumps, hydraulic assisted pumps.

Design restrictions and precautions. Filtration. Evolutions.

ENGINE MANAGEMENT SYSTEM

0.5 d

General presentation of the engine management system: components (sensors, actuators...) and software functions (mapping and strategies).

Fuel management: rail pressure control and injected flow control.

Air loop: EGR and turbocharger management.

Software torque structure: drivers request, inter-systems operation, limits and thermo-mechanical protections.

Inspection and warranty of engine operating: components electric diagnostic, strategies functional diagnostic.

DIESEL ENGINES LUBRICATION

0.5 d

SAE classification of viscosity and API and ACEA specifications of lubricants for Diesel engines.

Lubricant role and functional properties related to the lubrication critical points.

Chemical composition and composition requirements (premature ageing of after-treatment devices). Filtration.

EXHAUST GAS AFTER-TREATMENT

1 d

Situation, history and general issues, regulations and approval cycles.

Mechanisms of Diesel oxidation catalysis specific reactions: catalyst structure and operating principle (noble metals, performances criteria, functional definitions, efficiency, field, initiation, conversion rate, sulfur and particles oxidation).

Nitrogen oxides conversion: decomposition, selective reduction catalyst (SCR) hydrocarbons and ammonia, Diesel sequential.

Specific treatments: NOx traps, liquid/solid urea DeNOx, hydrocarbons SCR reduction.

Particles treatment: particles structure, Diesel particle filters - DPF- (silicium carbide, ceramics, metallic), DPF regeneration (with additives or catalysis), consequences (consumption, #P, cost, ...). Evolution towards 4-way catalysis (DPNR, others, ...). Limiting Diesel catalyst ageing. Diesel On Board Diagnostics (OBD).