

## OBJECTIVES

To update knowledge of the participants in the areas of function, combustion, injection systems, post-treatment and Diesel oils.

After completion of the course, the participants know:

- the functioning of Diesel engines: combustion process, origin and how to reduce the pollutants
- the criteria for engine - turbo-charging adaptation
- the associated products and their circuits in the engine: Diesel oil and lubricants.

## COURSE CONTENT

### CHARACTERISTICS OF FUELS FOR DIESEL ENGINES 0.25 day

Ignition delay and auto-ignition ability: cetane number

Cold resistance properties: fuel filter plugging, cloud point, pour point, filterability limit temperature.

Lubricating ability. Sulfur content. Additives.

Rape seed oil and esters.

### DIESEL COMBUSTION 1.25 days

Mechanisms of pollutant formation: particulates, nitrogen oxide, carbon monoxide, hydrocarbons.

Influence of temperature, air/fuel ratio, injection timing at partial load and full load, fuel-air mixing efficiency, injection pressure, nozzle hole diameter, swirl number.

Fuel spray characteristics and behaviour. Flow inside the nozzle holes, cavitation.

Optimisation of the combustion system: generation of swirl in the cylinderhead, bowl in the piston, fuel injection system.

Exhaust gas recirculation (EGR): mechanism of influence on NOx emissions, NOx / particulates trade-off, EGR cooling, with or without by-pass, high and low pressure EGR, specific problems for heavy duty trucks.

Problems of starting in cold conditions (noise, smoke, instability) and solutions: glow-plug, intake air heating.

### INJECTION SYSTEM TECHNOLOGIES 0.5 day

Nozzle holes manufacturing and characterisation. Discharge coefficient, effective flow area.

Cam driven and common-rail systems: principle and classification of current fuel injection systems.

Comparison of unit-injector and common-rail systems.

Evolution of common-rail systems from Bosch, Delphi, Siemens. Piezo injectors.

### TURBOCHARGING 0.5 day

Principle and technology of a turbocharger. Design, materials, constraints, lubrication.

Compressor field. Turbine behaviour.

Dimensioning of compressor and turbine for adaptation to a given engine.

### AFTER-TREATMENT OF EXHAUST GASES 0.5 day

Emission regulations evolution for passenger cars and heavy duty trucks.

Oxidation catalysts: structure, light-off temperature, conversion rate, aging.

Particulate traps (DPF: Diesel Particulate Filter): structure, trapping efficiency, regeneration with fuel additive or catalyzed filter. Regeneration strategy, influence on oil drain intervals and engine durability.

NOx trap: principle and limitations.

Selective Catalytic Reduction (SCR) with urea: principle, installation on heavy duty trucks.

### ▲ Who should attend?

Engineers and technical staff desiring to improve in developing, implementing diesel engines for industrial and road vehicles application and their use.

### ▲ Duration

**3 days**

### ▲ Dates & Location

**Non scheduled**

**May be organized for a single company**

### ▲ Lecturers from

- ENSPM FI - IFP Training
- ENSPM/IFP
- INDUSTRY

Ref. **MOT / MOTD-E**