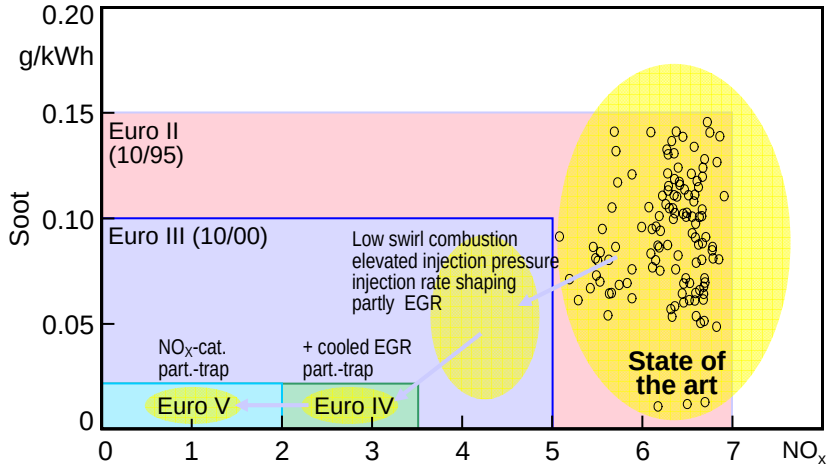
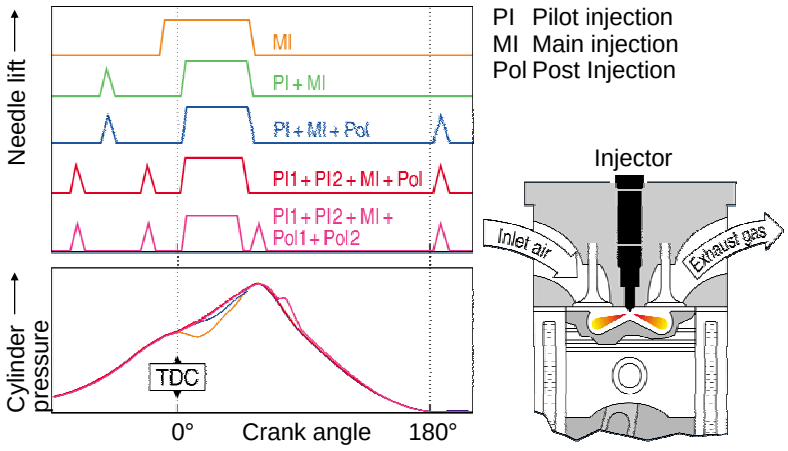
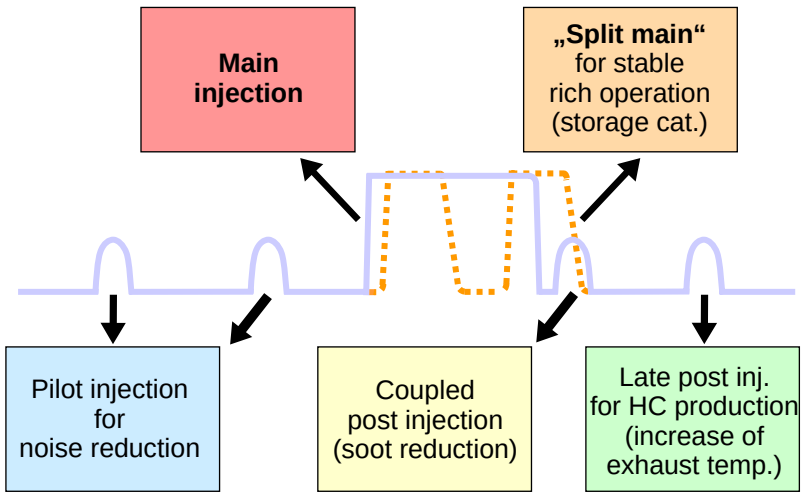
Type Approval Data of HD Engines (> 85 kW)



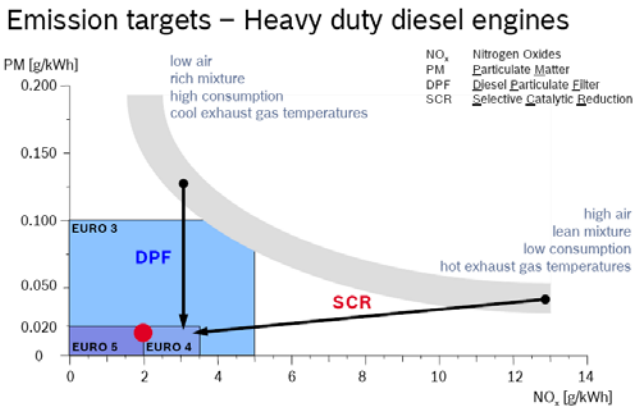
CR System – Comparison of Injection Strategies



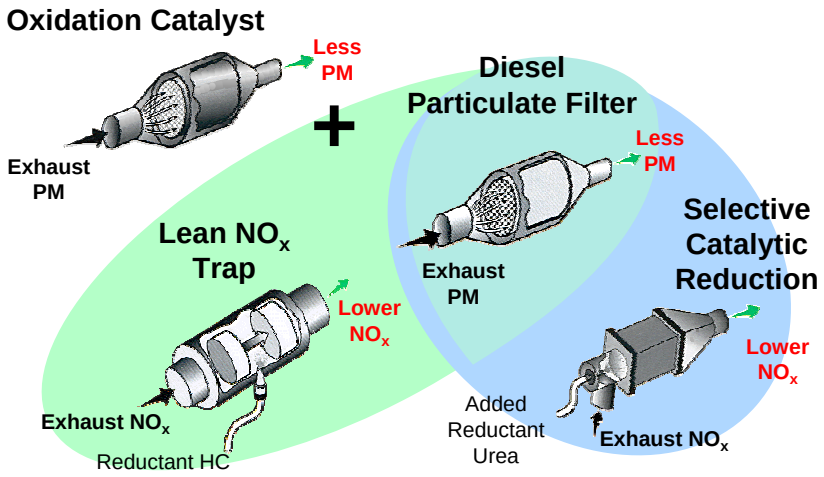
Common Rail System – Passenger Car



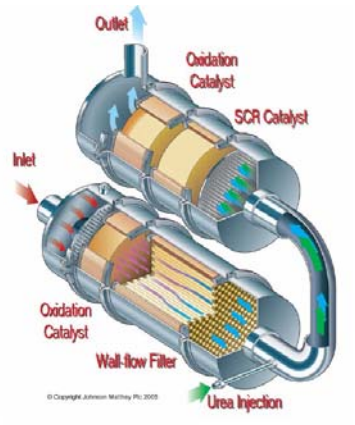
Diesel Motoru Emisyon Hedefleri



Diesel Emission Reduction Technologies



SCR NOx İndirgeme Prensibi



SCR NOx İndirgeme Prensibi

- Use ammonia (NH_3) to reduce NOx to N_2 under oxidizing conditions

$$4\,NO + 4\,NH_3 + O_2 \longrightarrow 4\,N_2 + 6\,H_2O$$

$$6\,NO_2 + 8\,NH_3 \longrightarrow 7\,N_2 + 12\,H_2O$$

- Ammonia can be derived from a number of sources (e.g. urea, ammonium carbamate, liquid ammonia etc)
- NO_2 promotes SCR activity:

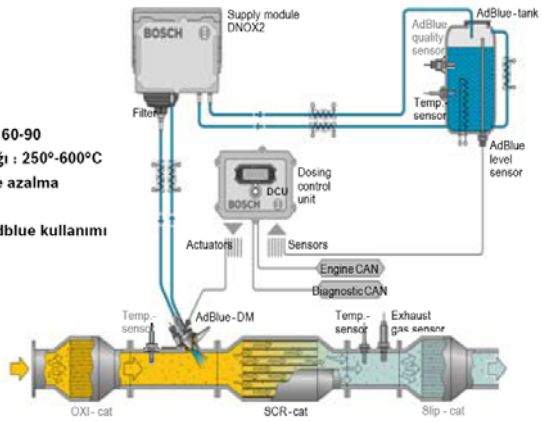
$$2NH_3 + NO + NO_2 \rightarrow 2N_2 + 3H_2O$$ VERY FAST REACTION

- Proven in stationary source applications for 30 yrs
- Has been introduced for Euro IV and Japan 05 vehicles

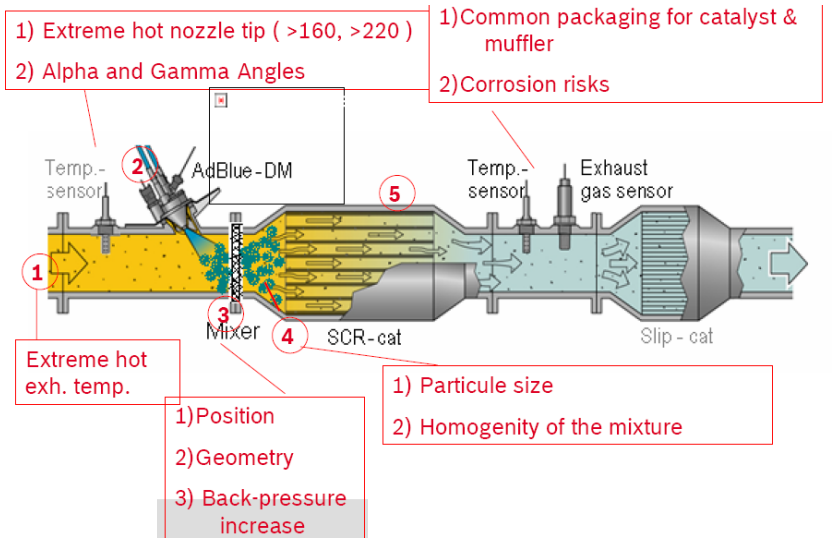
DeNOx Çalışma Prensibi ve Kazançlar

☺ Çevrim oranı : % 60-90
☺ Çalışma sıcaklığı : 250°-600°C
☺ Yakıt tüketiminde azalma

☹ Dozlama için Addblue kullanımı
☹ Yatırım maliyeti



SCR (Selective Catalytic Reduction) for NOx Reduction

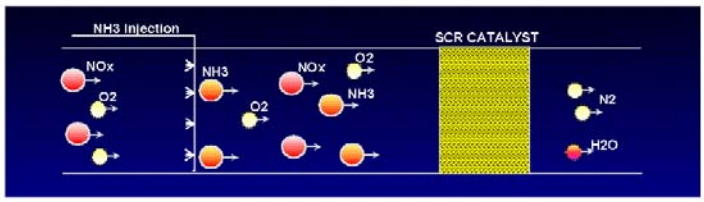


SCR

- **Ammonia containing compounds added to diesel exhaust to reduce NO_x to N_2.**
  - **e.g., $NH_3 + NO + 1/4O_2 \Rightarrow N_2 + 3/2H_2O$**
  - **Excess ammonia is often needed resulting in NH3 escaping or "slip"**
  - **This ammonia must be removed by a secondary step.**
- **NH_3 slip is currently not regulated in US, however for sociability and environmental reasons, Cummins chose to use Ammonia Oxidation (AMOX) Catalyst* device to ensure that ammonia slip to ambient is minimal**
- **An AMOX catalyst can be used to convert the NH_3 slip to $N_2 + H_2O$**
  - **Candidate catalysts: zeolite-based and alumina-supported metal or metal oxide catalysts**
  - **Temperature and water content play a big role in the functioning and aging of these catalysts**

*** Also called Selective catalytic oxidation (SCO) or Ammonia Slip catalyst**

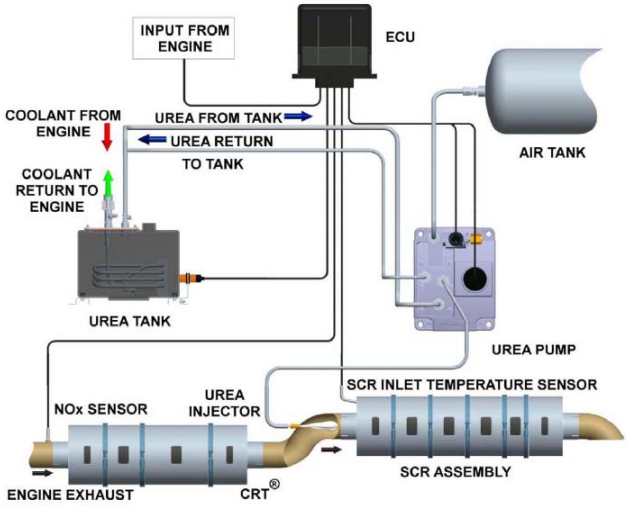
SCR



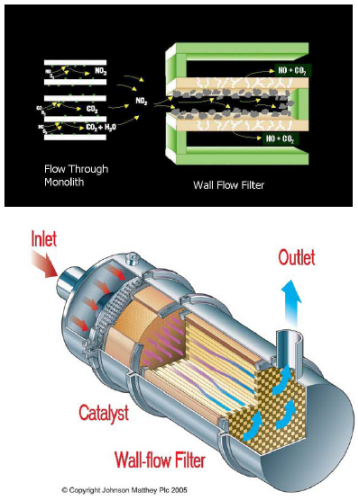
Primary Reactions:

- $4NO + 4NH_3 + O_2 = 4N_2 + 6H_2O$
- $6NO_2 + 8NH_3 = 7N_2 + 12H_2O$
- $NO + NO_2 + 2NH_3 = 2N_2 + 3H_2O$

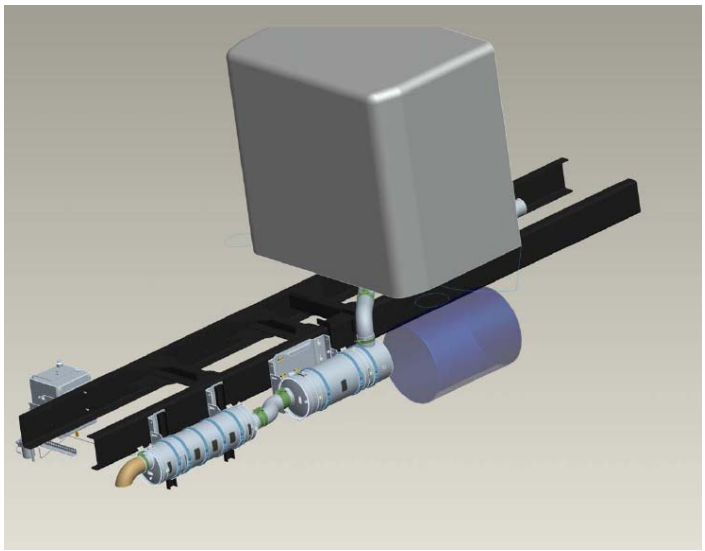
SCR



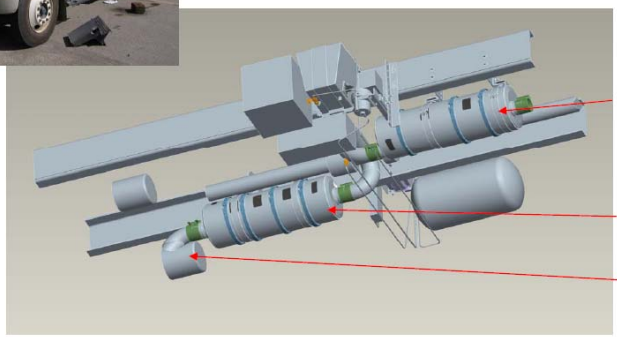
Oxidasyon Katalizörü ve Partikül Filtresi



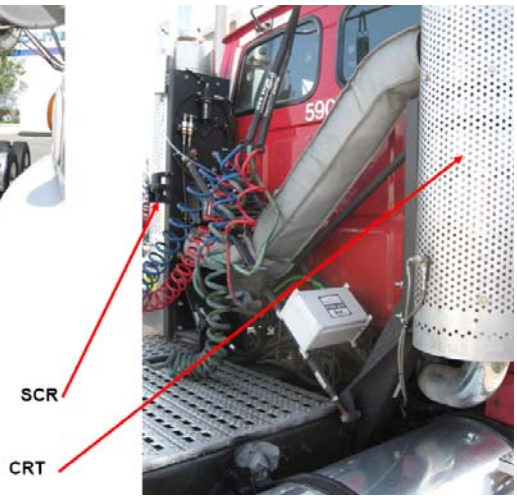
SCR



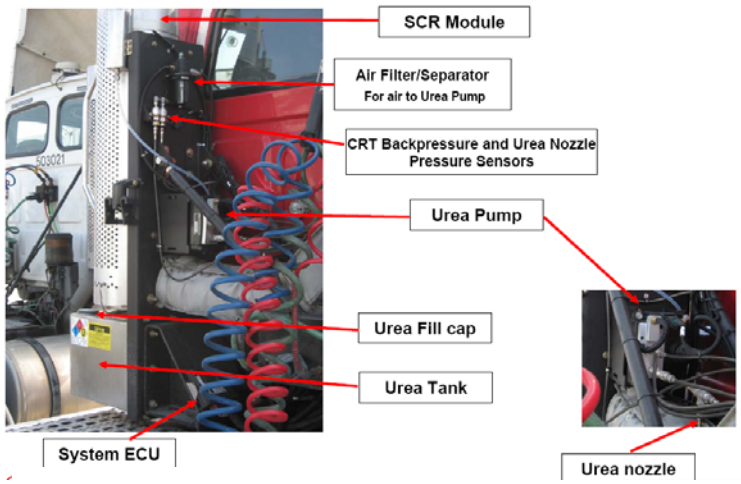
SCR



SCR



SCR



DeNOx

ETC-Test with SCR on HD Application