150 years

BASF
We create chemistry

Retrofit in China

Bob Chen
Head of Commercial China,
Mobile Emissions Catalysts Asia Pacific

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HDD Retrofit Asia Pacific

- Hong Kong franchised Bus & HDD Truck
- Beijing Bus
- Shanghai Tunnel Service Vehicles
- Guangzhou Bus
- Macau Bus & Truck
- Shenzhen Bus
- Bangkok Thailand Bus and Truck
- Hong Kong Stationary Engine
- Hong Kong Ferry

History of Hong Kong Retrofit

- More than 35,000 units DOC were retrofitted in Hong Kong truck to improve emission from Pre-Euro to Euro II in 2000
- More than 2,300 units DPF were retrofitted on Hong Kong Franchised Bus to meet Euro IV/V target in 2009
- 3 units SCR+AMOX systems are retrofitted on Hong Kong Franchised Bus to reduce NOx emission and an on-road trial in 2013 as pilot run.
- 3,900 buses is under retrofit in 2015 by DCH, using DOC+CSF+SCR System.

Government Support is a Must

- HK Government is subsidizing HK franchised bus operators for retrofitting Euro II and Euro III engine.

- DCH worked with HK franchised bus operators and HK Vocational Training School to do the test of verifying the technology from BASF

Lessons Learned

- Retrofit project is more challenged
  - Old engine and different model/characteristic
  - No access to the original engine control unit, additional separated control unit may be requested for after-treatment control (e.g. DPF regeneration, Urea injection system…)
- System approach for retrofit project
  - OEMs-System integrator-Catalyst supplier work closely
  - Make different catalog for the target vehicles and design the system for vehicle group (not only target at a single vehicle) based on the typical engine out
  - Sufficient data collection is important for different system design
  - Engineering work by integrator to ensure the system work well (space constrain, control system…)
- Trial run test on road is necessary to validate the system
  - Based on different vehicle catalog and after treatment system
  - Collect more data to optimize the system

Role and Responsibility

- **End customer - Kowloon Bus**
  - Application specification
  - Raw emissions and conversion target define
- **System integrator - DCH**
  - Auxiliary equipment selection (e.g. urea, fuel injectors, pump, sensor)
  - Package design, engineering, and fabrication
  - Final calibration (such as urea, and fuel injection strategy) and turn-key
- **Catalyst supplier - BASF**
  - Work closely with system integrator and end customer
  - Select appropriate catalyst technology and calculate catalyst volume
  - Recommend and define operating window

Select Best Fit Technology and System

- System configuration & dimensions
- Engine control system: Mechanical pump or electronic control?
- Space velocity
- if needed: regeneration strategy
  - passive NO_2
  - active NO_2
  - active O_2
- Engine characteristics
  - Raw emissions, especially NO_x → required NO_x conversion and PM reduction requirement
  - Temperatures: in cycle, engine map, T_{max}
- Quality of fuel (desulfation strategy)

Preparation Works for CSF/SCR

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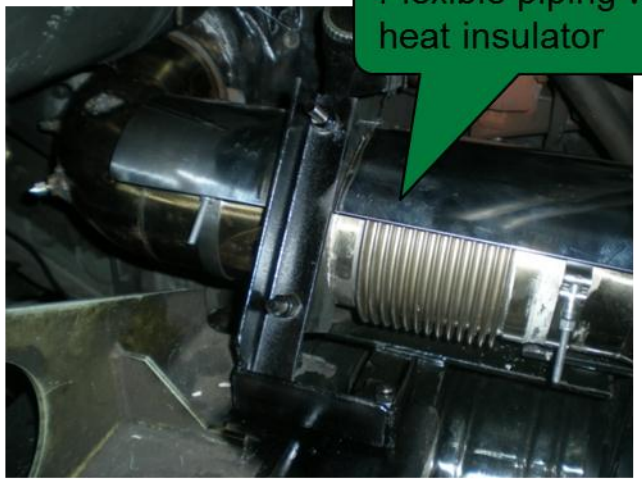
ECMA Emission Controls Manufacturers Association

Preparation Works for CSF/SCR



Flexible piping with heat insulator

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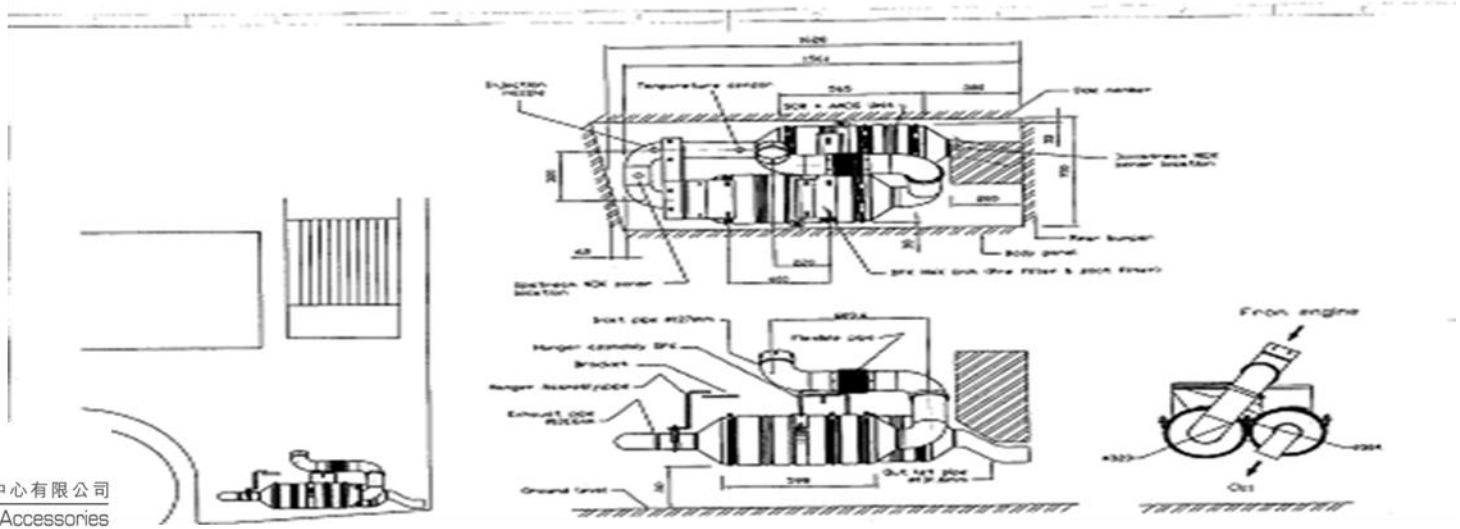
Muffler System



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China Local Developed System

- Low Cost whole system
- Burning system can be shared among buses
- No calibration needed
- Based on BASF CSF

Photo Provided by Ningbo Shikai


Thank you!