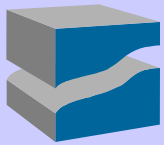
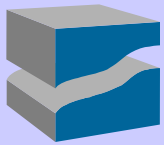


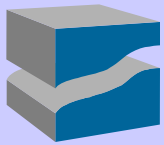
Turbo charger deposits Background

- **Crankcase gases will be included in regulated emissions**
  - ✓ **Korea**
  - ✓ **Japan New Short Term (JNST, 2004-5)**
  - ✓ **US07**
  - ✓ **Euro 5**
- **Closed Crankcase Ventilation (CCV)**
- **Oil mist/oil residue through TC and CAC**
- **May result in heavy deposits in TC and/or CAC**



Turbo charger deposits Background

DEPOSITS = f(TEMPERATURE, OIL QUALITY, OIL QUANTITY, TIME)



Turbo charger deposits Background

- **Available tests**
  - ✓ **OM 441LA (Boost pressure loss)**
    - ❑ **Not available after 2006**
  - ✓ **MTU test (Glass ware)**
    - ❑ **Problems with precision and field correlation**

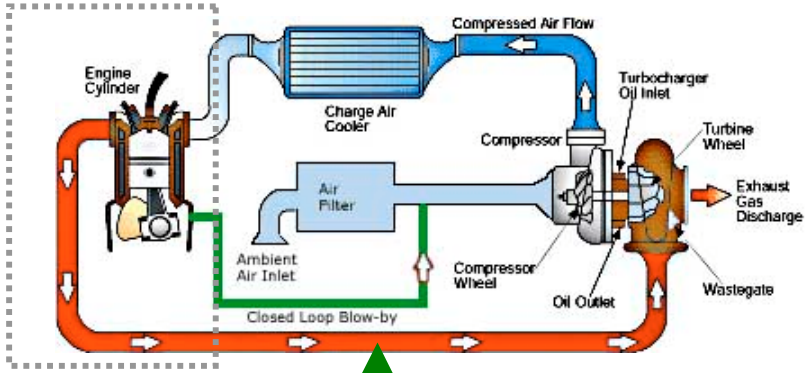
Turbo charger deposits
New Test Development @ APL, Germany

- **Lab test instead of engine test**
  - ❑reliable
  - ❑cost efficient
  - ❑short
  - ❑as close as possible to real life

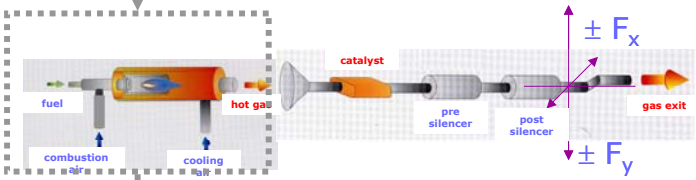
- **Given APL criteria**
  - ❑real TC
  - ❑no glass ware; no metal strips
  - ❑temperatures & pressures similar to engine
  - ❑oil amount similar to engine
  - ❑„oil preparation“ similar to engine

ACEA

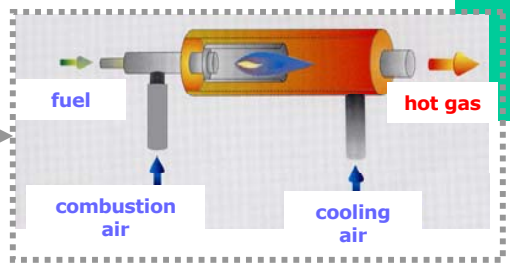
Turbo charger deposits
Principles of APL test



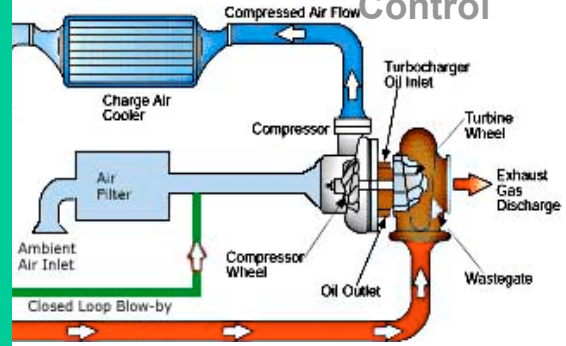
hot gas blow-by



Air, Oil, (Fuel)



Pressure Control



TC Lubrication

ATTACHMENT 12, 5 OF 11

Turbo charger deposits
Principles of APL test

- TC from VW 1.9L TDI
  - ❑Compression ratio and temperature similar to HD
- Reference oils
  - ❑RL 196 (OM 441LA high ref)
  - ❑RL 133 (OM 441LA low ref)
  - ❑Oil A (between RL 196 and 133)
- Rating criteria: deposit weight

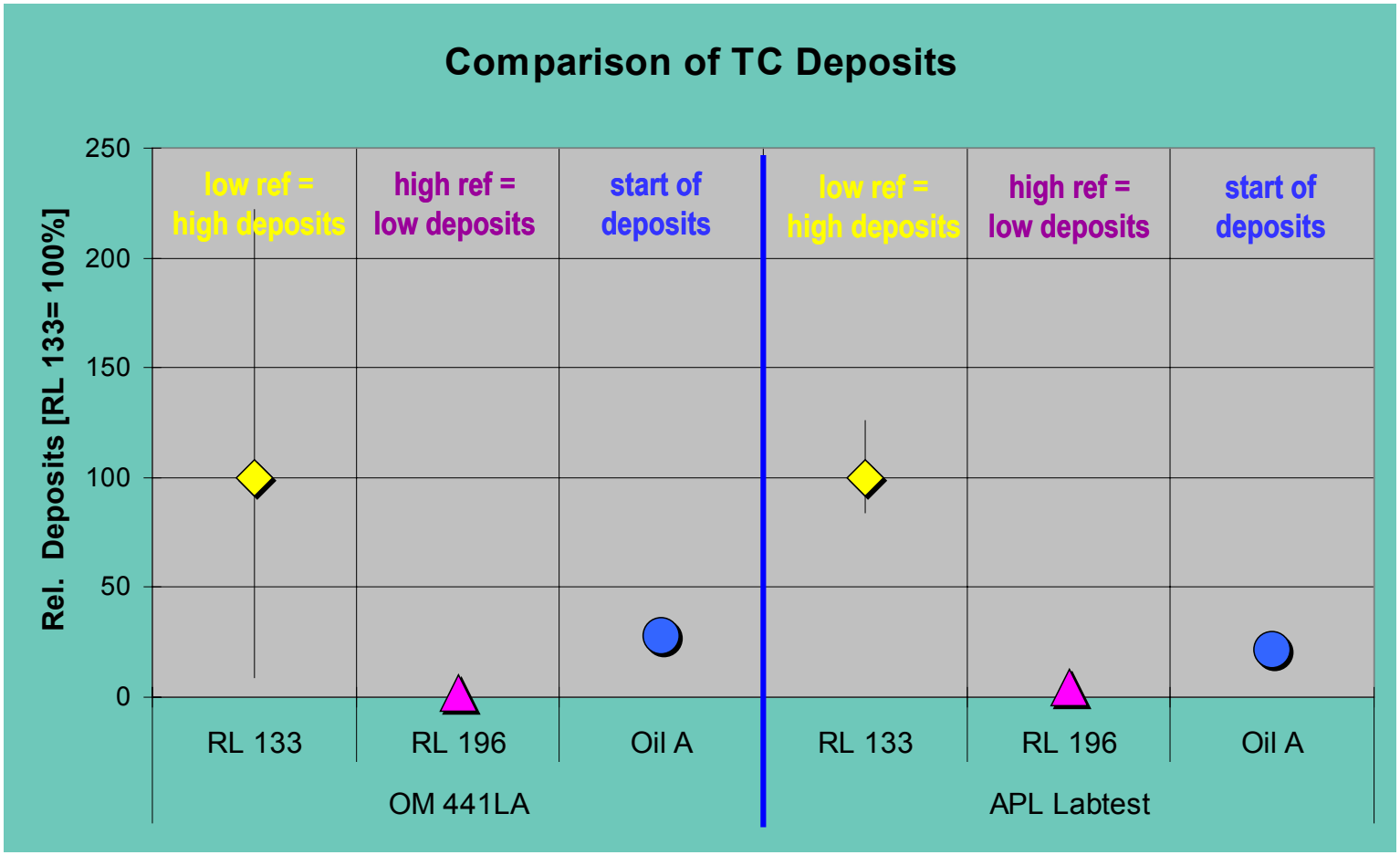
Turbo charger deposits
Principles of APL test

- **Cost estimate per test**
  - ~ 4.500 € [TC reused]
  - ~ 5.200 € [1 TC/test]

- **Cost estimate per test installation** [hot gas burner, test rig control system, TC lubrication, blow-by preparation system, etc.]
  - ~ 100.000 – 130.000 €

ACEA

Turbo charger deposits
Results of APL test



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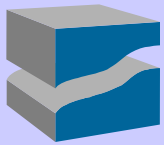
Turbo charger deposits
Results of APL test

RL 133

RL 196

Oil A



Turbo Charger Deposits
Current Status

- **Active working group**
- **Large membership**
  - ❑ European OEMs
  - ❑ Oil and additive industry
  - ❑ TC manufacturer
  - ❑ Independent labs
- **Need established**

Turbo Charger Deposits
Next Steps

- **Alternative test criteria**
  - ❑ TC efficiency
- **Increase severity**
  - ❑ Duration
  - ❑ Temperature
- **Identify current pass and fail oils with field correlation**
- **Next meeting @ APL April 13**