California’s Regulatory Proposal for Reducing Greenhouse Gas Emissions from Mobile Air Conditioning

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California Air Resources Board
Evolution of Regulations

CA

2009 MY

AB 1493 (Pavley)

MAC improvements earn credits for GHG emissions

US EPA

2012 MY

Federal Rule

Credit method similar to CA Pavley approach via “Rose Garden Agreement”

2017 MY

LEV III

Mandatory requirements (proposal):

• Low-GWP refrigerant
• Low leak rate
• Indirect emissions limit

New Federal Rule

Credit method similar to CA Pavley approach via “Rose Garden Agreement”
LEV III MAC Requirement 1: GWP ≤ 150 (100% for 2017 MY)

• **Benefits**
  – Provides a nearly 90% direct emission reduction
  – Harmonizes with EU’s MAC Directive (Directive 2006/40/EC)

• **Potential candidates / SNAP approval:** HFC-152a (approved), R744 (CO\(_2\)) (pending), and HFO-1234yf (pending)

• **Movement toward use of low-GWP refrigerant**
  – GM and Aston Martin plan to introduce HFO-1234yf for 2017 or prior models
  – Chemical manufacturers indicated their ability to provide sufficient supply of HFO-1234yf with firm purchase commitment and sufficient lead time
  – Several stakeholders have expressed concerns about proposed timeline
  – A multi-year phase-in as proposed by some stakeholders would delay climate benefits, result in larger HFC banks, and cause more potential cross-contamination during service
LEV III MAC Requirement 2: Fleet Average Leak Rate ≤ 9 g/yr

- Low leak rate is important, regardless of refrigerant used
  - Maintain efficiency
  - Reduce need for maintenance
- Leak rate will be evaluated using SAE J2727-type standards for AC using low-GWP refrigerants
- 9 g/yr (refrigerant) is achievable
  - 18 g/yr around 2003 MY (US EPA), 50% reduction feasible (I-MAC)
  - 14-15g/yr for 2009 MY (Minnesota MAC Leakage Database, CA MAC certification programs, Ward’s Auto data), depending on how leak rates are averaged
  - Some commercially available MAC platforms using premium technologies are already achieving 9 g/yr
  - Some carmakers appear on track for meeting 9 g/yr
  - Several stakeholders have expressed concerns about stringency of proposed leak rate limit
LEV III MAC Requirements 1 & 2: Estimated Emission Reduction

Refrigerant Emissions from Light-Duty Vehicles in California

Potential emission reduction: \( \geq 90\% \) by 2040
ARB is proposing to develop a fleet average MAC indirect emissions standard
- Evaluate through a Whole-Vehicle Performance Test Procedure

For LEV III going to the Board this year, ARB will propose initial adoption of US EPA’s Idle Test procedure and AC Efficiency Credits scheme as a placeholder
- Amend the regulation after developing a performance test procedure and an MAC indirect emissions standard in ~2 years
- Implementation to begin in 2017

Performance test benefits
- Able to evaluate all current and new technologies under realistic solar load and driving conditions
- Enforceable
LEV III MAC Requirement 3 (Cont.): Proposed Performance Test Procedure

- **Elements of proposed test procedure:**
  - Simulated solar load (e.g., 1 hour soak at 850 W m\(^{-2}\))
  - Moderate ambient cell conditions (e.g., 25\(^\circ\)C, 50% RH)
  - Transient test cycle (e.g., SC03+HWFET)
  - Evaluate AC during both initial cool down and steady state temperature control

- **Difference between CO\(_2\) from AC-off cycle and CO\(_2\) from weighted average of AC-on cycles (cool down and steady state) must be ≤ the standard**
• California’s new vehicle GHG emission standards for 2017 MY and beyond will be incorporated into the Low Emission Vehicle regulation (LEV III)

• Mandatory requirements for MAC proposed under LEV III:
  – Low-GWP refrigerant
  – Limit on leak rate
  – Limit on indirect emissions (evaluated by performance test)

• LEV III is under development, and is expected to go to the Board in October, 2011. We are still accepting comments on all aspects of the proposal.
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http://www.arb.ca.gov/msprog/levprog/leviii/leviii.htm