California’s New Credit Program for Future Motor Vehicle Air Conditioning Systems

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California Air Resources Board
Evolution of Regulations

CA

- **2009 MY**: AB 1493 (Pavley) Rule
- **2012 MY**: Largely aligned AC credit schemes
- **2017 MY**: LEV III Rule

US

- **2009 MY**: EPA 2012-2016 Rule
- **2012 MY**: Different AC credit schemes
- **2017 MY**: Largely aligned AC credit schemes with slight difference
- **2017 MY**: EPA 2017-2025 Rule
### LEV III AC Credit Program: Direct (Leakage) Credit

- Overall structure (aligned with U.S. national program):
  - For HFC-134a AC systems:

  \[
  \text{Direct Credit} = \text{Max Credit} \times \left(1 - \frac{\text{LeakRate}}{\text{Avg Leak Rate}}\right)
  \]

<table>
<thead>
<tr>
<th></th>
<th>MaxCredit (gCO$_2$e/mi)</th>
<th>Avg Leak Rate (g/yr)</th>
<th>Leak Rate (g/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>12.6</td>
<td>16.6</td>
<td>Evaluated using SAE J2727</td>
</tr>
<tr>
<td>Trucks</td>
<td>15.6</td>
<td>20.7</td>
<td></td>
</tr>
</tbody>
</table>

- For low GWP AC systems:

\[
\text{Direct Credit} = \text{Max Credit} \times \left(1 - \frac{\text{GWP}}{1,430}\right) - \text{Hi Leak Dis}
\]

<table>
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<th>MaxCredit (gCO$_2$e/mi)</th>
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<tbody>
<tr>
<td>Cars</td>
<td>13.8</td>
</tr>
<tr>
<td>Trucks</td>
<td>17.2</td>
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</tbody>
</table>
• High Leak Disincentive

\[
Hi\text{LeakDis} = \text{MaxDis} \times \left(\frac{\text{LeakRate} - \text{LeakThreshold}}{\text{DfltLeakRate} - \text{LeakThreshold}}\right)
\]

• High Leak Disincentive encourages automakers to continue using leakage reduction technologies after transition to low GWP refrigerants.

• Importance of having low leak rates:
  – helps reduce the possibility of recharging low GWP AC systems with an incorrect, but much cheaper, high GWP refrigerant (i.e., HFC-134a)
  – helps prevent the loss of AC efficiency due to undercharging
LEV III uses different sliding scale values for High Leak Disincentive than USEPA final rulemaking.

<table>
<thead>
<tr>
<th></th>
<th>CARB</th>
<th>USEPA</th>
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<tbody>
<tr>
<td><strong>Cars</strong></td>
<td><img src="#" alt="Scheme in LEV III" /></td>
<td><img src="#" alt="Scheme in EPA 2017-25 MY FRM" /></td>
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<tr>
<td>High Leak Disincentive (gCO₂e/MT)</td>
<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
</tr>
<tr>
<td>1.8</td>
<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
<td><img src="#" alt="Credentials" /></td>
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<td>8.3</td>
<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
<td><img src="#" alt="Increase with increased charge" /></td>
</tr>
<tr>
<td>13.1</td>
<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
<td><img src="#" alt="1.5% &lt; charge" /></td>
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<td><strong>Trucks</strong></td>
<td><img src="#" alt="Scheme in LEV III" /></td>
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<td>High Leak Disincentive (gCO₂e/MT)</td>
<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
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<td>2.1</td>
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<td>10.4</td>
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<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
<td><img src="#" alt="Increase with increased charge" /></td>
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<tr>
<td>11.0 (charge ≤ 733g)</td>
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</tr>
<tr>
<td>14.3 (charge &gt; 733g)</td>
<td><img src="#" alt="AC Leak Rate (g/yr)" /></td>
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Final CARB indirect AC credit program is identical to what USEPA proposed in the NPRM for the national 2017-2025 model year GHG Regulations

Based on comments and additional testing, USEPA modified the AC indirect program initially proposed

- Altered requirements for credit qualification
  - Reporting only option for the 2017-2020 MYs
  - Comparison to a baseline vehicle for the 2021-2025 MYs

- Refined AC17 Test procedure

- Clarified terminology and added flexibilities (e.g., engineering evaluation in lieu of baseline vehicle testing)
• In November, staff is going to the Board with a proposed rule that would accept compliance with the national 2017-2025 MY GHG rule as compliance with the LEV III GHG regulation

• A small number of clarifying edits to CARB’s GHG program are also proposed
  – Updating SAE J2727 to February 2012 version
  – Incorporation of the final AC17 test procedure by reference

• No other “harmonizing” changes are being proposed at this time
Proposed ARB contract with U.C. Davis to conduct an advanced plug-in electric vehicle (PEV) usage and charging behavior study (pending Board approval in December)

- Recruit 100-150 PEV households and collect travel and charging behavior data on all household vehicles
- Analyze household travel and charging data to inform state policy on PEVs
- As part of this study, researchers will collect data on PEV heater and AC usage to understand if/how behavior differs over time and between PEV types (or modes)
- If possible, the effect of climate control on efficiency will be modeled
Proposed Research Activities Relating to Electric Vehicles (cont.)

• Proposed ARB contract with U.C. Davis to conduct a study on new car buyers’ valuation of zero-emission vehicles (ZEVs) (pending Board approval in December)
  – Survey 1,700 new car buying households in California online and interview roughly 40 of them to collect information on decision-making process, awareness and knowledge of ZEVs, and factors influencing new car purchases
  – Complementary research efforts in Northeast and Northwest states
  – Analyze data to identify effective policy to educate consumers and remove barriers or enhance motivations for adoption of near- or pure-ZEVs

• Upcoming Request for Proposal (RFP) on potential vehicle road load reduction to be released soon
  – Potential secondary benefit of extending battery range of EVs
  – Interested investigators can let us know to be notified when scope of work is released
• CARB’s AC direct credit program largely aligns with U.S. federal credit program except that it has more stringent High Leak Disincentive terms.

• CARB’s AC indirect credit program harmonized with the federal credit program as proposed in the NPRM.

• In November, the Board is poised to adopt provisions that accept compliance with the national GHG program as compliance with LEV III GHG rule.
Direct Emissions (Refrigerants and Leakage)

- Research Division
  - Dr. Tao Zhan (staff lead), (916) 445-9495, tzhan@arb.ca.gov
  - Dr. John Collins (manager), (916) 327-8097, jcollins@arb.ca.gov

Indirect Emissions (System Efficiency) and Off-Cycle Credits

- Mobile Source Control Division
  - Dr. Leela Rao (staff lead), (626) 350-6469, lrao@arb.ca.gov
  - David Chen (manager), (626) 350-6579, dchen@arb.ca.gov

For more information, visit
http://www.arb.ca.gov/cc/hfc-mac/hfc-mac.htm
http://www.arb.ca.gov/msprog/levprog/leviii/leviii.htm