HFO-1234yf Vehicle Testing

**Testing Objective**

To check the performance of vehicle when HFO-1234yf is used as a refrigerant.

- Cooling capacity
- Refrigerant pressure

**Vehicle Description**

<table>
<thead>
<tr>
<th>Component</th>
<th>GS430 (Large Vehicle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressor</td>
<td>6 cylinders 160cc (Variable volume type)</td>
</tr>
<tr>
<td>Pulley ratio</td>
<td>1.22</td>
</tr>
<tr>
<td>Condenser</td>
<td>W660xH364xD16 f.p. 3.55</td>
</tr>
<tr>
<td>Evaporator</td>
<td>W293xH211xD38 f.p. 3.0</td>
</tr>
<tr>
<td>Expansion valve</td>
<td>TXV (optimized SH)</td>
</tr>
<tr>
<td>Hose</td>
<td>Rubber hose</td>
</tr>
<tr>
<td>Refrigerant charge</td>
<td>420 g (450 g for R-134a)</td>
</tr>
</tbody>
</table>

**Toyota Vehicle Drop-In Tests for HFO-1234yf**

**Vehicle Cool Down Results**

- HFO-1234yf pulls down to cooler temperature than R-134a, indicating higher cooling capacity.
- Pressures are similar.
Testing Objective
To see how HFO-1234yf performs across various vehicle air conditioning conditions.

- Capacity
- COP

System Test Bench Results

- No changes were made to system, including TXV; industry standard test conditions
- Both Capacity and COP are generally within 5% of R-134a performance.
  - This was recently confirmed at two outside labs.
- Lower compression ratio, low discharge temperature (1.2 °C [54 °F] lower at peak conditions)

- Further improvements likely with minor system optimization, for example:
  - Lower ΔP suction line and/or TXV optimization to maintain a more optimum superheat.

HFO-1234yf performance is comparable to R-134a, further improvement possible with minor optimization

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