Sociological survey of HVAC operating modes FORD-NAMI

Mark POLSTER
Andrey KOZLOV
Sociological survey design

The aim of sociological survey was to investigate car Heating, Ventilation and Air Conditioning (HVAC) system operation modes settings among of private car owners.

Questionnaire with 17 questions was prepared and distributed see [https://wiki.unece.org/download/attachments/65503585/How%20do%20you%20use%20HVAC.pdf?api=v2](https://wiki.unece.org/download/attachments/65503585/How%20do%20you%20use%20HVAC.pdf?api=v2)

20 respondents took part in the survey by Ford Motor Company employees (6 female and 14 male)

Respondents age distribution

- 55 respondents from 30 till 50 years
- 35 respondents more than 50 years
- 10 respondents younger than 30 years

The survey was carried out at Ford Motor Company’s Allen Park Test Laboratory (1500 Enterprise Dr., Allen Park, MI 48101 USA)

Data of survey October 2018
Cars age and powertrain type

Cars by fuel type:

- 100% gasoline

**Vehicle age**

- less than 3 years: 65%
- from 3 up to 5 years: 10%
- from 5 up to 10 years: 15%
- more than 10 years: 10%

**Powertrain type**

- Automatic transmission
- Manual transmission
- Hybrid-electric vehicle
HVAC system and cabin filter type

HVAC system type
- Automatic control: 55%
- Manual control: 45%

Cabin filter type
- No filter: 31%
- Dust filter: 50%
- Carbon filter: 19%
Place to store a car:
- Inside garage: 45%
- Outside: 55%

Pre-heat or pre-cool the interior prior to driving:
- No: 60%
- Yes, while waiting in the vehicle: 10%
- Yes, outside the vehicle with remote key fob or phone application: 30%

Time to pre-heat or pre-cool the interior:
- Less than 5 minutes: Summer 50%, Winter 20%
- 5 to 10 minutes: Summer 30%, Winter 40%
- 10 to 15 minutes: Summer 5%, Winter 20%
- More than 15 minutes: Summer 5%, Winter 20%
The time inside a car

Total time people usually drive inside a car daily

- From 1 to 2 hours: 60%
- From ½ to 1 hour: 35%
- More than 2 hours: 5%

Total time people usually are inside a parked car with engine running

- Never
- Less than 5 minutes
- 5 to 10 minutes
- 10 to 15 minutes
- More than 15 minutes

- Summer
- Winter
HVAC operation modes

Heating/conditioning - on/off

- Winter ON: 100
- Winter OFF: 20
- Summer ON: 80
- Summer OFF: 10

Auto Mode - on/off

- Winter ON: 70
- Winter OFF: 50
- Summer ON: 60
- Summer OFF: 40

Legend:
- parking
- driving
HVAC operation modes: recirculation

**Recirculation - on/off**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Winter (ON)</th>
<th>Summer (ON)</th>
<th>Winter (OFF)</th>
<th>Summer (OFF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking</td>
<td>6.7%</td>
<td>38.5%</td>
<td>93.3%</td>
<td>46.7%</td>
</tr>
<tr>
<td>Driving</td>
<td>17.6%</td>
<td>53.3%</td>
<td>82.4%</td>
<td>61.5%</td>
</tr>
</tbody>
</table>
The ventilation speed

Ventilation speed (winter)

<table>
<thead>
<tr>
<th></th>
<th>parking</th>
<th>driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>46.7</td>
<td></td>
</tr>
<tr>
<td>min</td>
<td>33.3</td>
<td>33.3</td>
</tr>
<tr>
<td>med</td>
<td></td>
<td></td>
</tr>
<tr>
<td>max</td>
<td>20</td>
<td>13.3</td>
</tr>
</tbody>
</table>

Ventilation speed (summer)

<table>
<thead>
<tr>
<th></th>
<th>parking</th>
<th>driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>38.5</td>
<td>28.6</td>
</tr>
<tr>
<td>min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>med</td>
<td>61.5</td>
<td></td>
</tr>
<tr>
<td>max</td>
<td></td>
<td>7.1</td>
</tr>
</tbody>
</table>
The ventilation direction

Ventilation direction (winter)

Ventilation direction (summer)
The temperature inside cars (°C)

Temperature inside a car (winter)

<table>
<thead>
<tr>
<th></th>
<th>parking</th>
<th>driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19-20</td>
<td>16,7</td>
<td>16,7</td>
</tr>
<tr>
<td>21-22</td>
<td>38,9</td>
<td>44,4</td>
</tr>
<tr>
<td>23-24</td>
<td>16,7</td>
<td>33,3</td>
</tr>
<tr>
<td>≥25</td>
<td>5,6</td>
<td></td>
</tr>
</tbody>
</table>

Temperature inside a car (summer)

<table>
<thead>
<tr>
<th></th>
<th>parking</th>
<th>driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤18</td>
<td>35,3</td>
<td>38,9</td>
</tr>
<tr>
<td>19-20</td>
<td>17,6</td>
<td>5,9</td>
</tr>
<tr>
<td>21-22</td>
<td>11,1</td>
<td></td>
</tr>
<tr>
<td>23-24</td>
<td>16,7</td>
<td></td>
</tr>
<tr>
<td>≥25</td>
<td>5,6</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

1. Analysis of HVAC operating modes was carried out among 20 private car owners in USA.
2. All cars were equipped with gasoline engines and 65% were less then 3 years old.
3. Around half of cars have HVAC system with automatic control and only 19% equipped with carbon cabin filters.
4. All owners pre-cool the interior during less than 5 minutes in summer time and 75% of owners pre-heat the interior during 5...10 minutes in winter time.
5. Most of owners, 60% use a car from 1 to 2 hours a day and around 50% of people keep engine running if they are waiting inside a car less than 5 minutes.
6. Around 70% of owners use air conditioning in summer time and almost all owners use air heating in winter time.
7. Around 40...50% of owners switch recirculation ON in summer time and only 7...18% - in winter time.
8. Around 50% people set the ventilation speed at minimal level in winter time and around 60% at medium level in summer time.
9. Most of people set inside temperature in the car cabin in the range of 21..22°C in winter time and from 19 till 22°C in summer time.
Thank you for your attention!