

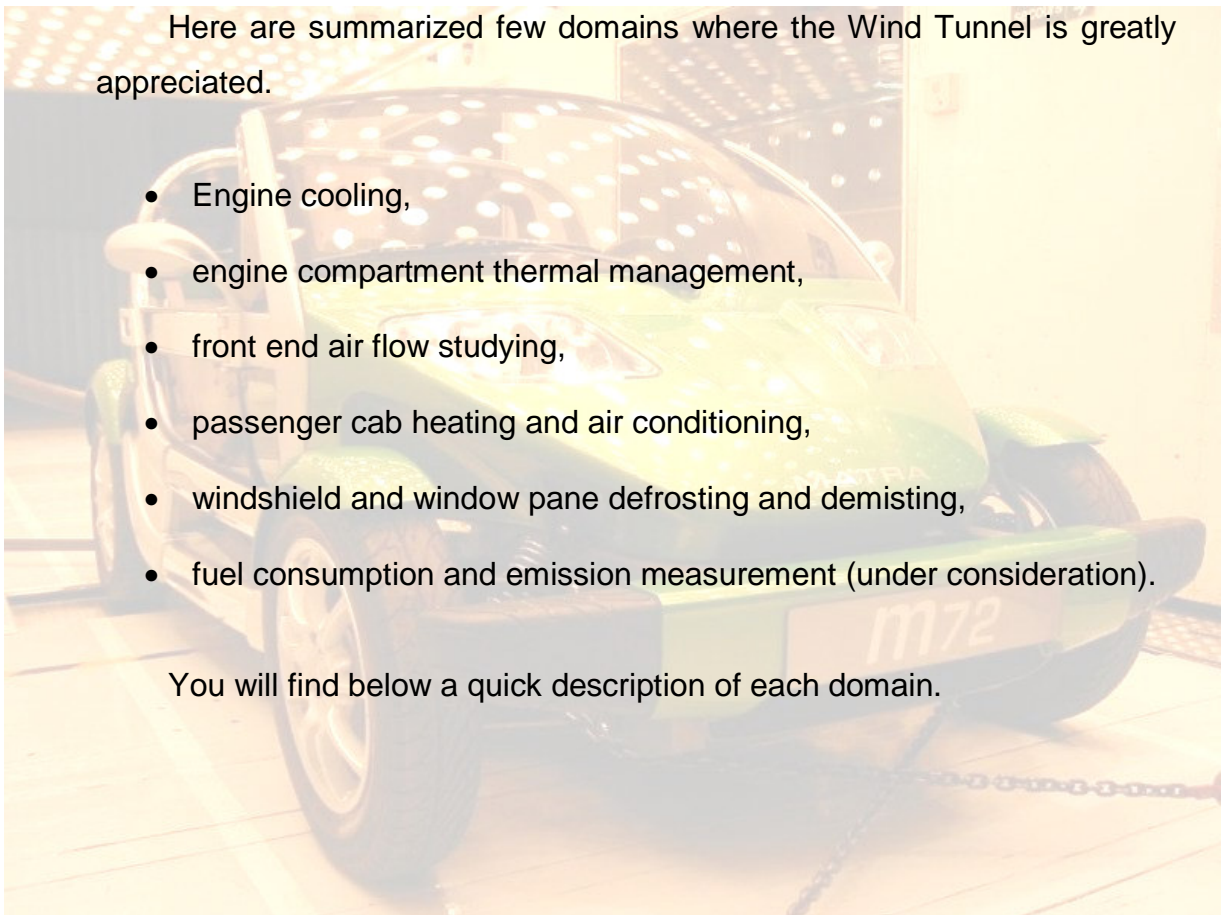
## Tests Reference

From the early stage of development to the ultimate validation, the Wind Tunnel facility is a valuable tool for automotive makers and their suppliers.

Here are summarized few domains where the Wind Tunnel is greatly appreciated.

- Engine cooling,
- engine compartment thermal management,
- front end air flow studying,
- passenger cab heating and air conditioning,
- windshield and window pane defrosting and demisting,
- fuel consumption and emission measurement (under consideration).

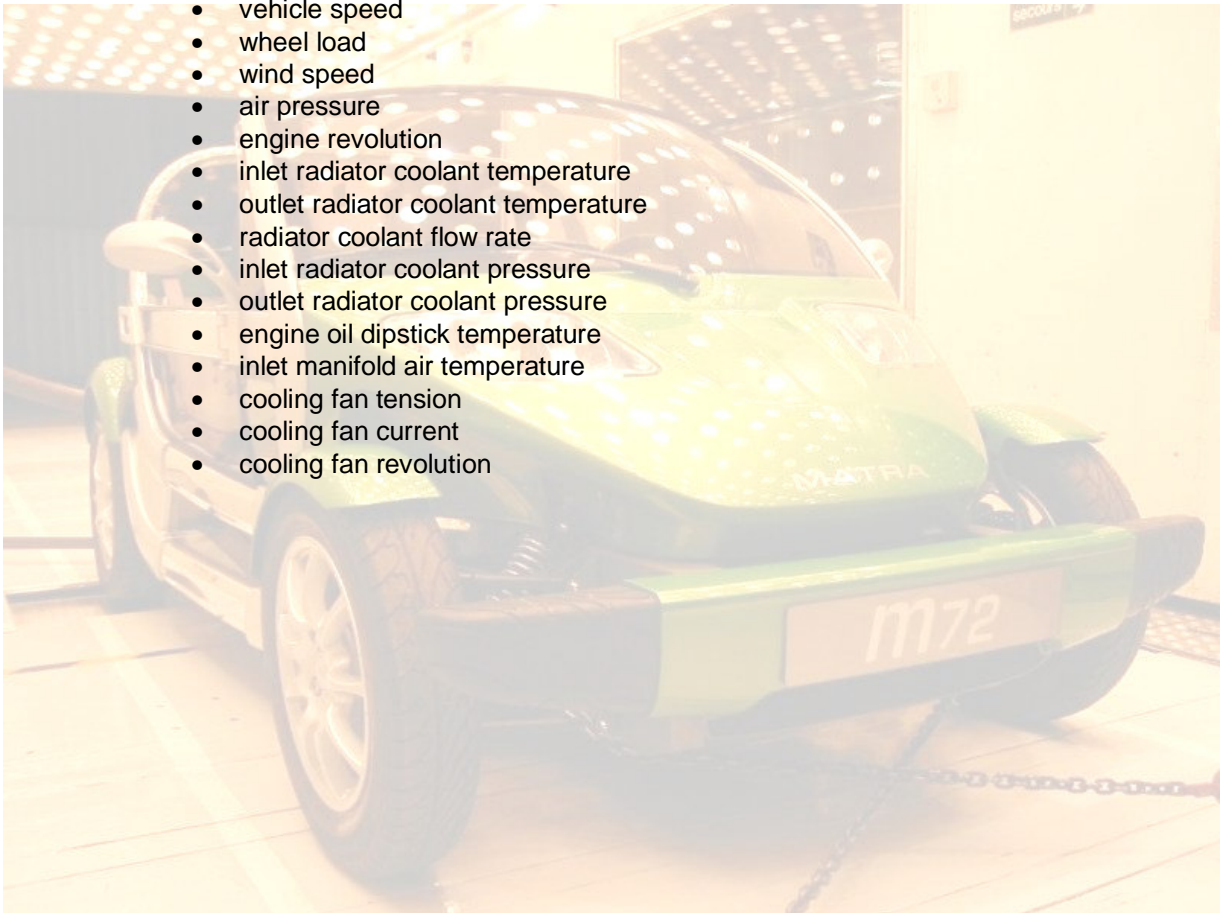
You will find below a quick description of each domain.



## Tests Reference

### Engine cooling test

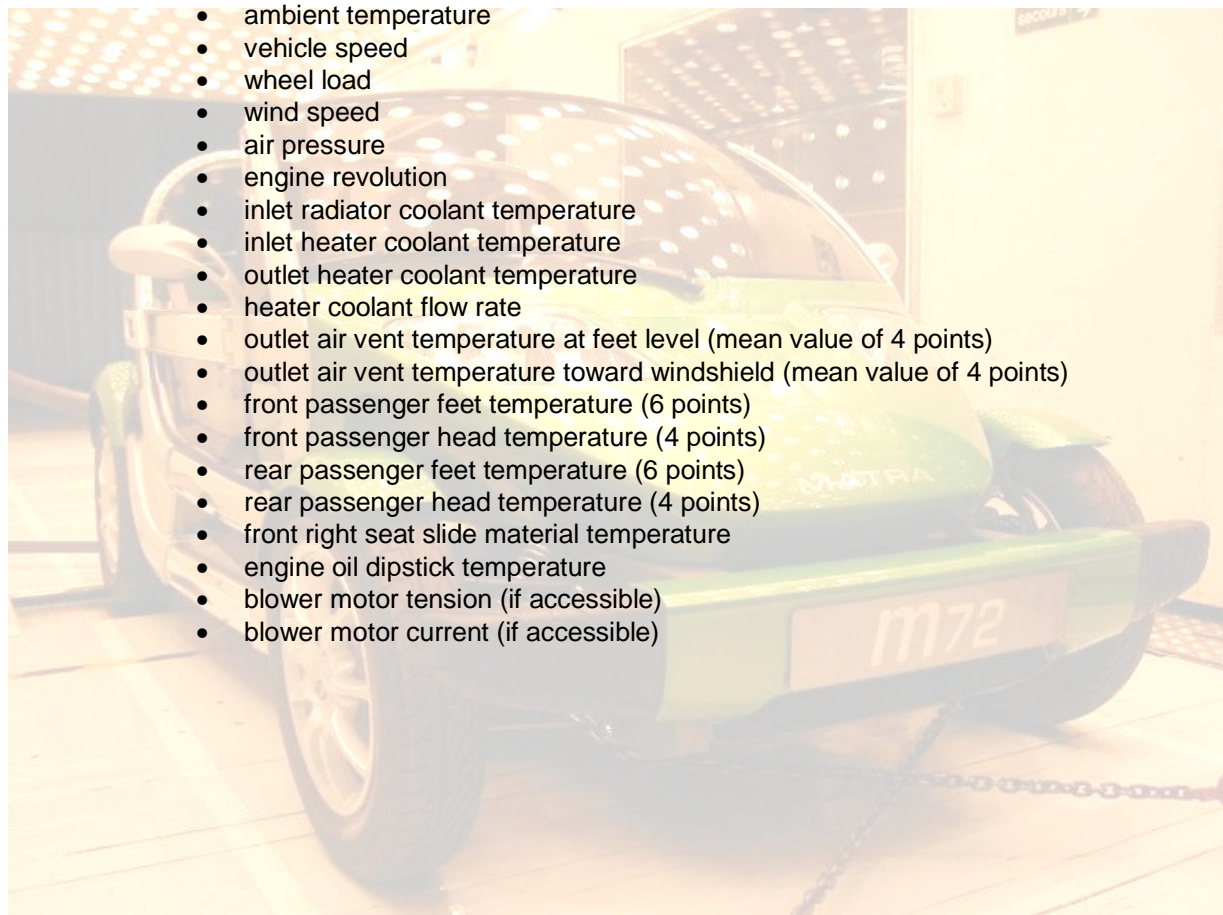
1. Definition
  - Coolant circuit performances appraisal.
2. Appraisal criteria
  - inlet radiator coolant temperature
  - engine oil temperature (dipstick)
3. Measurement (typical list, could be enlarged)
  - ambient temperature
  - vehicle speed
  - wheel load
  - wind speed
  - air pressure
  - engine revolution
  - inlet radiator coolant temperature
  - outlet radiator coolant temperature
  - radiator coolant flow rate
  - inlet radiator coolant pressure
  - outlet radiator coolant pressure
  - engine oil dipstick temperature
  - inlet manifold air temperature
  - cooling fan tension
  - cooling fan current
  - cooling fan revolution



## Tests Reference

### Cab heating test

1. Definition
  - Heating cab system performance appraisal
2. Appraisal criteria
  - outlet air vent temperature
  - passenger cab mean temperature at head and feet level
3. Measurement (typical list, could be enlarged)



## Tests Reference

### Defrosting and demisting test

1. Definition

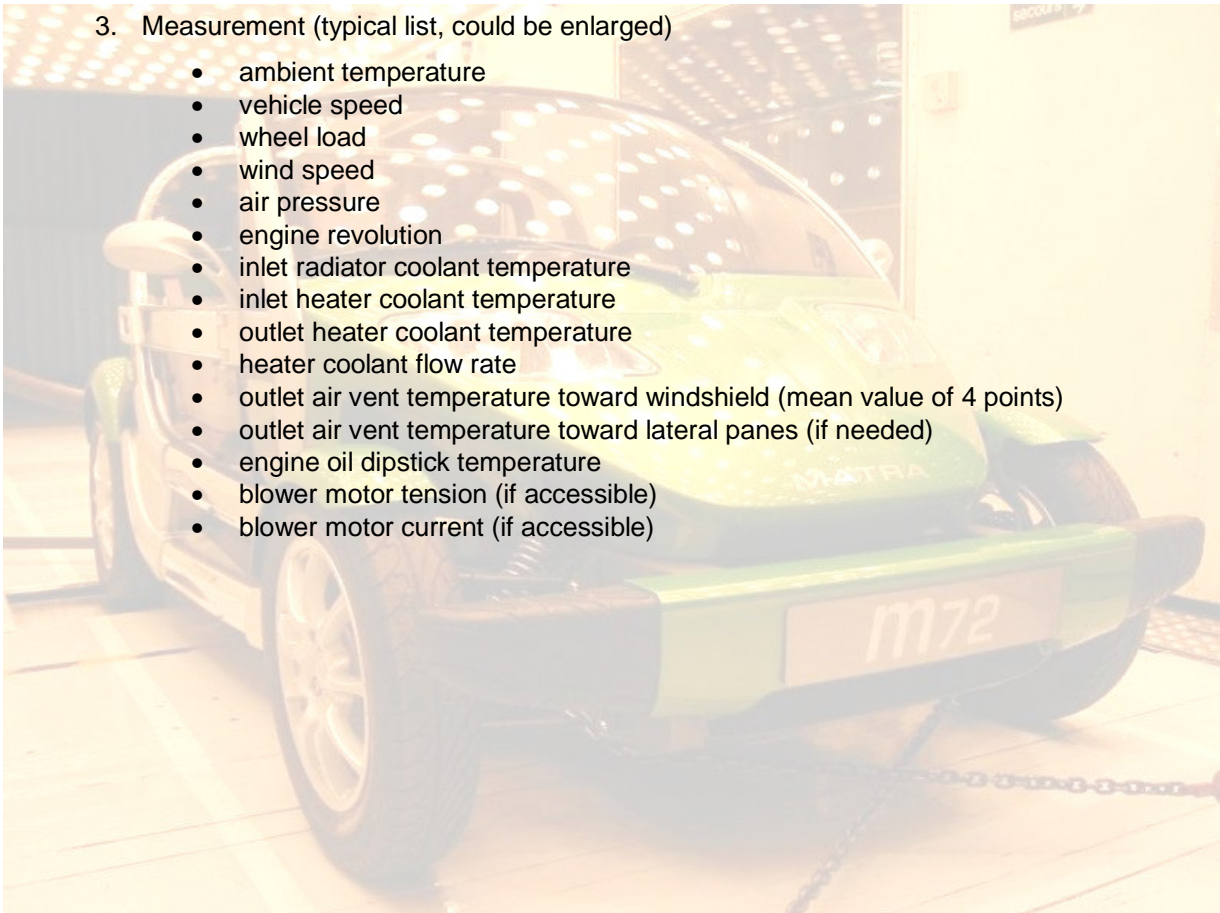
- Windshield, lateral and rear window panes defrosting and demisting system performance appraisal.

2. Appraisal criteria

- outlet air vent temperature
- Duration needed by the system to clear a sufficient area allowing driver forward and backward sight.

3. Measurement (typical list, could be enlarged)

- ambient temperature
- vehicle speed
- wheel load
- wind speed
- air pressure
- engine revolution
- inlet radiator coolant temperature
- inlet heater coolant temperature
- outlet heater coolant temperature
- heater coolant flow rate
- outlet air vent temperature toward windshield (mean value of 4 points)
- outlet air vent temperature toward lateral panes (if needed)
- engine oil dipstick temperature
- blower motor tension (if accessible)
- blower motor current (if accessible)



## Tests Reference

### Air conditioning test

1. Definition
  - Passenger cab air conditioning system performance appraisal
2. Appraisal criteria
  - outlet air vent temperature
  - passenger cab mean temperature at head and feet level
  - AC loop refrigerant high pressure
3. Measurement (typical list, could be enlarged)

- ambient temperature
- vehicle speed
- wheel load
- wind speed
- air pressure
- engine revolution
- inlet radiator coolant temperature
- engine oil dipstick temperature
- outlet dashboard air vent temperature (generally 4 points)
- front passenger feet temperature (6 points)
- front passenger head temperature (4 points)
- rear passenger feet temperature (6 points)
- rear passenger head temperature (4 points)
- front right seat slide material temperature
- blower motor tension (if accessible)
- blower motor current (if accessible)
- AC loop refrigerant high pressure (if vehicle fitted)
- AC loop refrigerant low pressure (if vehicle fitted)
- condensor fan tension
- condensor fan current
- condensor fan revolution

#### Note

A thorough study of air conditioning system behaviour will imply to add temperature and pressure sensors at both inlet and outlet location for each component and to measure the refrigerant flow rate of the loop. This can only be made by removing the entire AC loop in workshop for equipment.

This relatively complex operation needs to be planned long time enough.

## Tests Reference

### Air flow test

#### 1. Definition

- Measurement of the air flow rate through the cooling system module depending of either the vehicle speed, air entrance aperture or air path sealing. The flow rate as well as the temperature of the coolant is stated very precisely by means of an external circuit.

#### 2. Appraisal criteria

- radiator heat rejection
- "thermal equivalent" air speed through the radiator.

#### 3. Measurement (typical list, could be enlarged)

- ambient temperature
- wind speed
- air pressure
- inlet radiator coolant temperature
- outlet radiator coolant temperature
- Radiator coolant flow rate
- motor fan tension
- motor fan current
- fan revolution

