

European
Automobile
Manufacturers
Association

MAC Indirect Emissions Workshop 14 July 2010 Roman Meininghaus

A

E

C

A





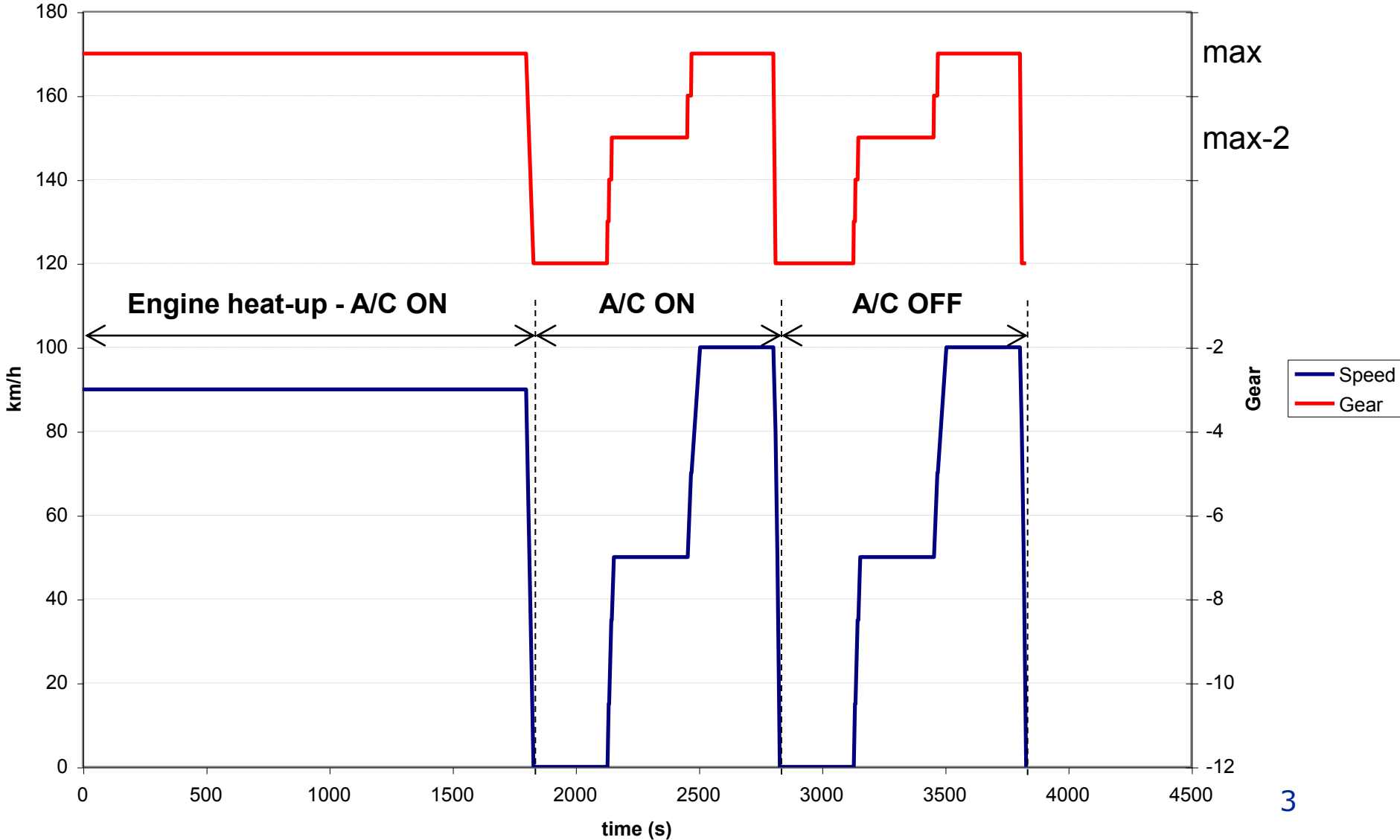
MAC efficiency

- Europe 3 speed test steady state
 - US idle test, technical features
 - California: considering ambitious test protocol
 - Other regions worldwide???
- worldwide harmonised test procedure
- Possible platforms exist, eg UNECE regulation
-
- Any test should be pragmatic, but also reflect technical improvements



ACEA Test Protocol Overview

Tests at 25°C / 40%, no sun





ACEA Test protocol details

	Min air flow	Max air temp @ vents
Small cars	210 kg/h	$\leq 15^{\circ}\text{C}$
Medium cars	230 kg/h	$\leq 15^{\circ}\text{C}$
Large cars	250 kg/h	$\leq 15^{\circ}\text{C}$

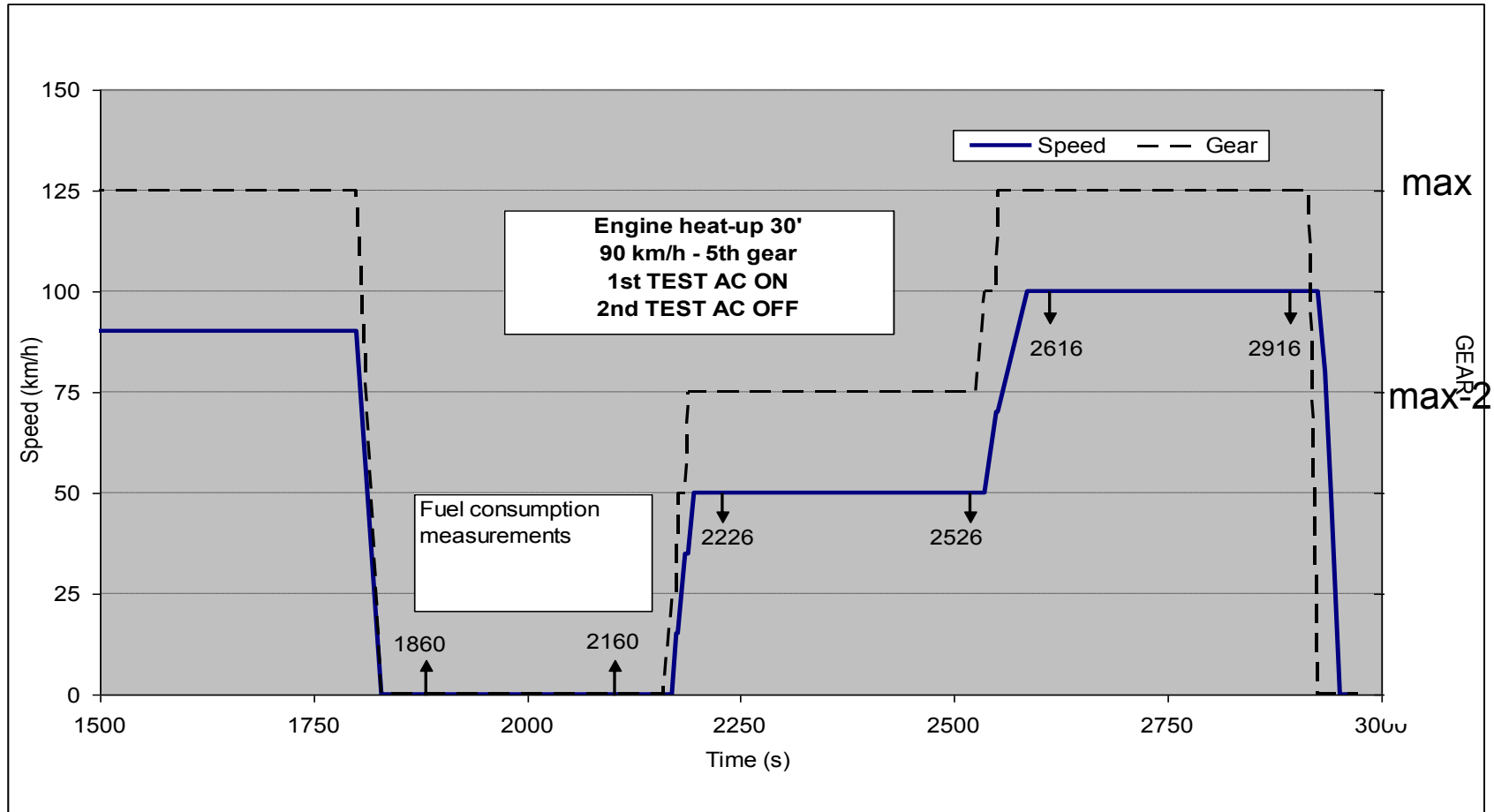
Under discussion

Test at

25°C / 40%, no sun

$\pm 2^{\circ}\text{C}$, $\pm 5\%$ RH, $\pm 1\text{mi/h}$

(*) See appendix for size calculation proposal





ACEA Test Protocol Details

- $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, and $40\% \text{ RH} \pm 5\%$ for *practical* testing reasons.
- Sampling shall only be done during *steady state* phases.
- Solar load to be taken into account with *fixed coefficient*
- The time fraction of idle/50/100 should be based on *representative driving conditions*, such as 23%, 46%, and 31%, of the total test time.
- **Question: How define AC on / off?**



Remarks on ambient conditions

Test cell conditions

- Criteria: pragmatic, cost efficient → use existing equipment, i.e.
 - **Standard emission test facilities for Type Approval**
 - Specifications in UNECE regulation 83: Test cell between 20 and 30°C, vehicle preconditioning ± 2 K of ambient T
 - Typical chassis dynamometer test bench for pollutant emissions measurements can be controlled at approx. $\pm 2^\circ\text{C}$ and $\pm 10\%$ RH.
 - Many of these standard test facilities cannot achieve higher temperatures, with satisfying accuracy.
- ACEA proposal $25^\circ\text{C} \pm 2^\circ\text{C}$, and $40\% \text{ RH} \pm 5\%$



Remarks on ambient conditions

Sun load

No solar lamps: requires extensive and detailed specifications, poor repeatability

No heater in the cabin: susceptible to errors, need for standardisation

*Recommendation: If needed, calculate correction factor specific for each vehicle type by **simplified approach***

Measurement of Tts-values (ISO 13837) of complete glazing, depending on average sun declination on each glass, integration of geometry is necessary

Advantages:

- ISO standard
- Limited input required: glass Tts value, geometric parameters
- Simple and robust = suitable for Type Approval



Remarks on ambient conditions

In cabin conditions

No in-cabin T measurements: susceptible to many errors
(position of T sensor, orientation of vent outlet flaps)

Recommendation: vent outlet T measurements

$T \leq 15 \pm X$ °C at vent outlets (needs further specification)

Use DIN 1946 part 3 (details in back up)

Advantages:

- Provide repeatable data
- Experience: matches passenger comfort criteria
- Simple and robust = suitable for Type Approval



Dynamic, 3-speed, Idle

Why ACEA promotes 3 speed test

	Dynamic	3 speed	Idle
Quick	-	0	+
Simple	-	+	+
Repeatable	-	+	+
Pragmatic	-	+	+
Cost efficient	-	+	+
Represent real world	0	0	-
Show technology improvements	+	+	0
Acceptance EU (for MAC test)	-	+	-
Acceptance US (for MAC test)	-	?	+



MAC setting

Settings	Auto	Manual
Temp control	On	n/a
Set temp	$\leq 22^{\circ}\text{C} \pm y^{\circ}\text{C}$	Vent temp $\leq 15 \pm x^{\circ}\text{C}$
Recirc	outside air or auto	outside air
Air distribution	Vents	Vents



Back Up



Details DIN 1946 Part 3

- *"Ventilation systems – Part 3: Airconditioning of passenger cars and commercial vehicles"*
- July 2006
- Objective: Guarantee comfortable climate in vehicle cabin at all external weather conditions
- Addresses:
 - Passenger cars and trucks
 - Comfort and safety issues
 - Outside air mode and recirc mode
 - (Testing) guidelines for air T, air RH, air speed, other parameters



Dynamic, 3-speed, Idle

Objective: integrate two approaches to achieve worldwide accepted test

	Dynamic	3 speed	Idle
Quick	-		
Simple	-		
Repeatable	-		
Pragmatic	-		
Cost efficient	-		
Represent real world	0		
Show technology improvements	+		
Acceptance EU (for MAC test)	-		
Acceptance US (for MAC test)	-		