30th Asia Expert Meeting on Electric Power Train (R100) and Exhaust Emission (R40, R83)

Date : July 17, 2012 (TUE) 9:30 - 17:00

Place : Bahagian Teknologi Maklumat,
Jabatan Pengangkutan Jalan Malaysia
Jalan Teknokrat 5, 63000 Cyberjaya, Selangor

Agenda of meeting :-

8:30 - 9:30	**Registration & Breakfast**
9:30 - 9:45	**Opening address :** from JPJ
9:45 - 10:00	**Message :** from JASIC
10:00 - 11:30	**R40 General Information : Technical Requirements & Testing**
	Speaker : Mr. Futohashi
	Q & A & Discussion
11:30 - 13:00	**R83 General Information : Technical Requirements & Testing**
	Speaker : Mr. Nakata
	Q & A & Discussion

13:00 - 14:30 Lunch

14:30 - 16:30	**R100 General Information :**
	1. Technical Requirements
	Speaker : Mr. Okura
	2. Testing
	Speaker : Mr. Takagi
	Q & A & Discussion
16:30	**Coffee Time**
	End of Meeting

What's R40 & WMTC ?

Motorcycle Exhaust Emissions

17 July 2012 in Malaysia

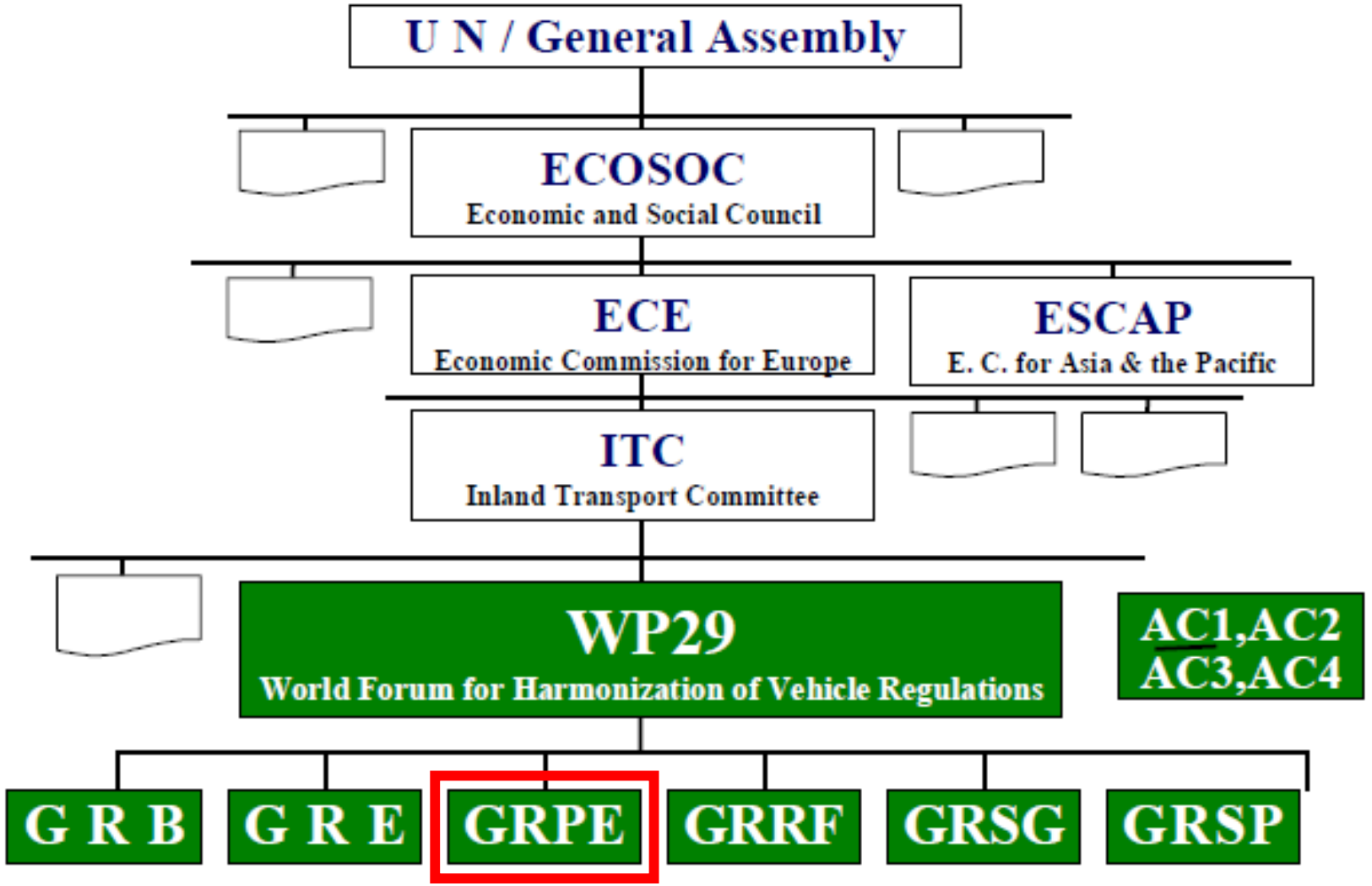
JASIC Futohashi,Kimio

1.Technical Requirements

2.Testing

3.Summary

WP29 Organization



1958 Agreement

UN/ECE

R40-00

R40-01

ECE_R40

EU Directive

Euro 1

Euro 2

Euro 3

EEC_97_24

1998 Agreement

GTR

GTR2 : WMTC

http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29registry/gtr2.html

WMTC_org

WMTC_edit

WMTC_class_reduced

WMTC_indicator

WMTC_gearshift

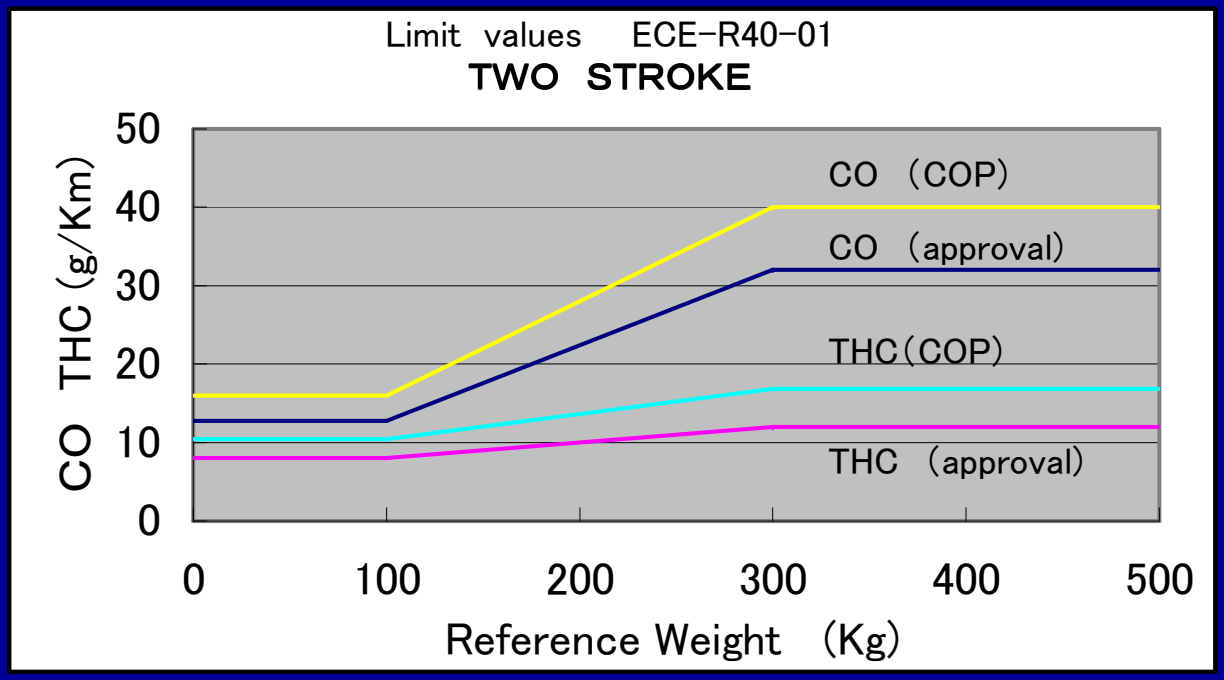
JAPAN

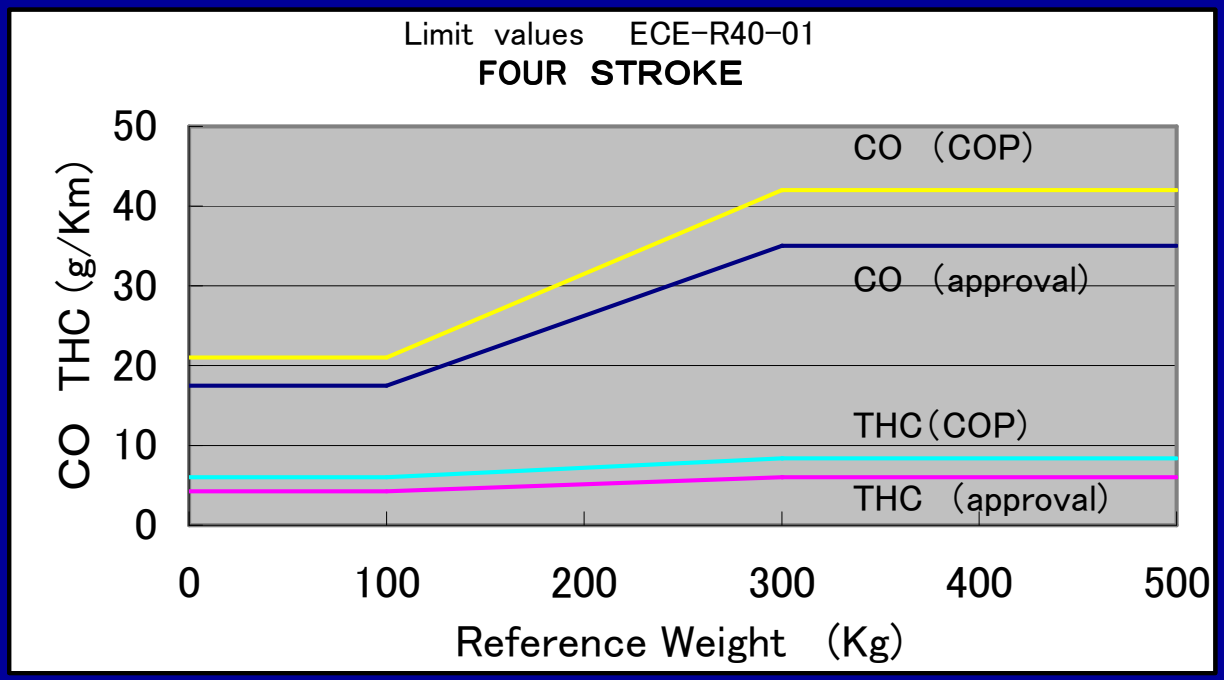
USA

UN-R & EU Directive

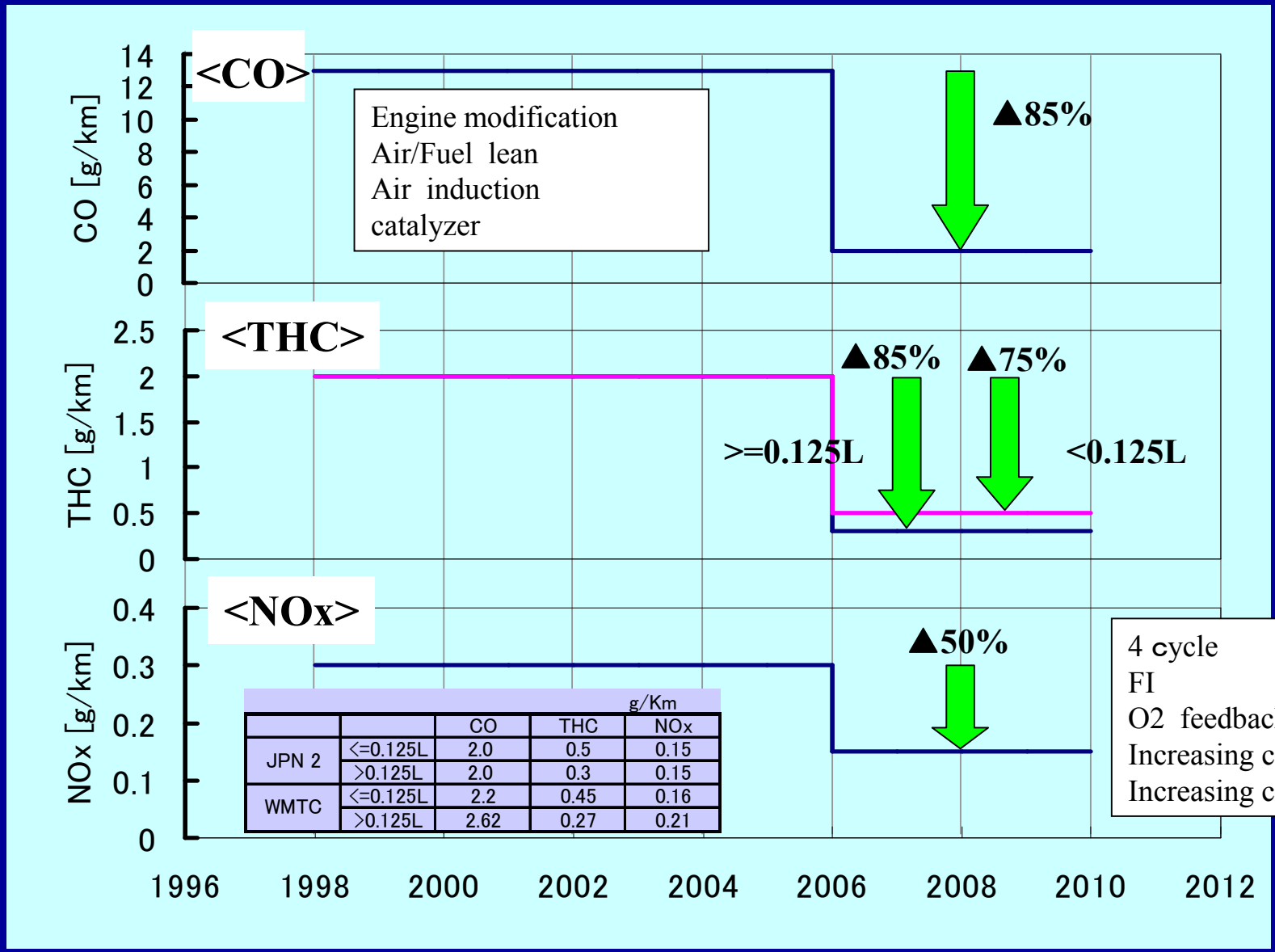
YEAR	Regulation	Driving Cycle	Cold Start	Running Resistance	Limit Values (g/km)			REMARKS
					CO	THC	NOx	
1979	UN R40-00	UDC	NO	UN R40	25-50	7-10	-	4stroke
					16-40	10-15	-	2stroke
1988	UN R40-01	UDC	NO	UN R40	17.5-35	4.2-6.0	-	4stroke
					12.8-32	8-12	-	2stroke
1999	Euro1	UDC	NO	UN R40	13	3	0.3	
2003	Euro2	UDC	NO	UN R40	5.5	1(1.2)	0.3	without 40sec idling ( ):capacity<150cc
2006	Euro3	UDC+EUDC	YES	ISO11486	2	0.3(0.8)	0.15	
2007		WMTC	YES	ISO11486	2.62	0.33(0.75)	0.22(0.17)	( ):Vmax<130km/h
					Limit Values (mg/km)			
(2014)	Euro4	WMTC	YES	ISO11486	1970	250(560)	170(130)	※Not officially decided yet.
(2017)	Euro5	WMTC	YES	ISO11486	1140	170(380)	90(70)	
(2020)	Euro6	WMTC	YES	ISO11486	1000	100	68	

UN R40-01


Limit values ECE-R40-01
TWO STROKE
CO THC (g/Km)
50
40
30
20
10
0
CO (COP)
CO (approval)
THC(COP)
THC (approval)
0
100
200
300
400
500
Reference Weight (Kg)


Limit values ECE-R40-01
FOUR STROKE
CO THC (g/Km)
50
40
30
20
10
0
CO (COP)
CO (approval)
THC(COP)
THC (approval)
0
100
200
300
400
500
Reference Weight (Kg)

JAPAN Regulation



g/Km

		CO	THC	NOx
JPN 2	<=0.125L	2.0	0.5	0.15
	>0.125L	2.0	0.3	0.15
WMTC	<=0.125L	2.2	0.45	0.16
	>0.125L	2.62	0.27	0.21

GTR（Global Technical Regulation）

already registered

- GTR1 (Door locks)
- GTR2 (WMTC) Motorcycle exhaust emission
- GTR3 (Motorcycle brakes)
- GTR4 (WHDC)
- GTR5 (WWH-OBD)
- GTR6 (Safety glazing materials)
- GTR7 (Head restraints)
- GTR8 (Electric stability control system)
- GTR9 (Pedestrian safety)
- GTR10 (Off-cycle emissions)
- GTR11 (Non mobile machinery (NRMM))
- GTR12 (Identification and operation of motorcycle controls, tell-tales and indicators)

Development of WMTC

Worldwide **M**otorcycle **C**ertification Procedure

Around the year 2000, amid discussions on strengthening of emission regulations for motorcycles in the EU, it was eagerly desired that a test cycle must be newly established that reflects actual conditions of use.

In response to this thought, IMMA proposed that a "worldwide uniform test cycle" should be established.

The work was officially started in the year 2000 by a group of experts (WMTC-FE) for establishment of a GTR Worldwide Motorcycle Certification Procedure (WMTC) at the UN/WP29/GRPE

Based on the data which were collected in Japan, the United States, Europe and China, a three-part test cycle was newly established in which running was simulated on three different types of road (urban road, suburban road and highway).

GTR-2 (first version) was established in Aug. 2005.

ECE/TRANS/180/add.2 (still insufficient for implementation)

Since the 1st version was issued…

Revision of vehicle classification

Modification of reduced (low speed) cycles

GTR-2(amendment-1) was issued in Jan. 2008.
ECE/TRANS/180/add.2/Amend.1

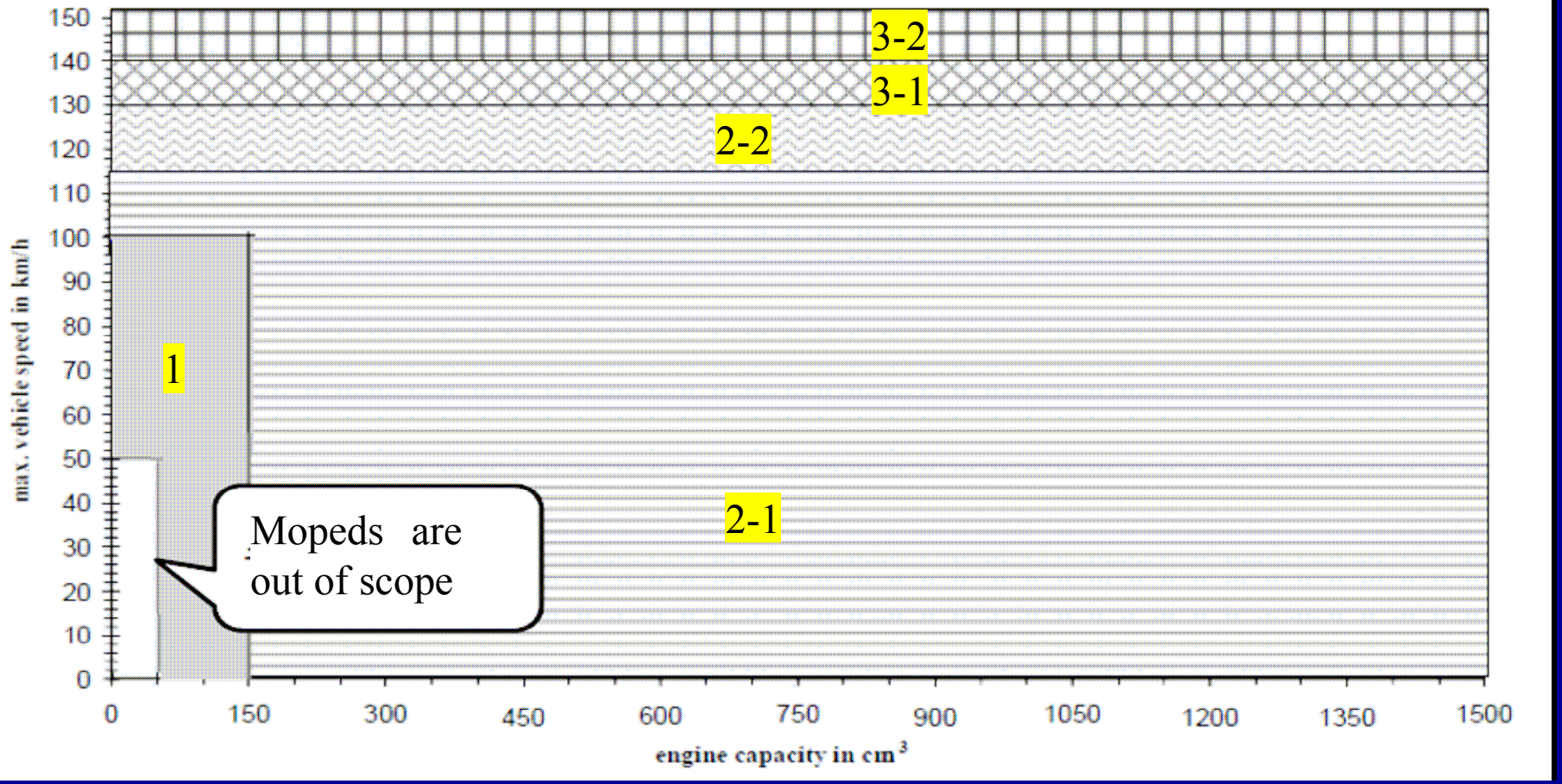
Revision of gearshift prescription … agreed.

The limit values was decided … agreed.

Vehicle Classification for WMTC

	Vehicle Classification					
	Class 1(1)	Class 2.1		Class 2.2	Class 3.1	Class 3.2
ENGINE CAPACITY (CC)	<150	<150	≥150	---	---	---
MAX.SPEED (km/h)	<100	≥100, <115	<115	≥115, <130	≥130, <140	≥140

Note(1): Moped (<50cc, <50km/h) are out of scope



WMTC limit value

Principal limit value (Japanese limit value)

ECE/TRANS/180/Add.2/Amend.2

2011.10.28

	CO		HC		NOx	
Vehicle Class	Class 1 and Class 2	Class 3	Class 1 and Class 2	Class 3	Class 1 and Class 2	Class 3
Limit Values(mg/km)	2200	2620	450	270	160	210

Alternative A (India)

	CO		HC+NOx		
Vehicle Class	Class 1 and Class 2.1	Class 2.2 and Class 3	Class 1 and Class 2.1	Class 2.2	Class 3
Limit Values(mg/km)	1870	2620	1080	920	550

Alternative B (US)

	CO	HC	HC+NOx
Vehicle Class	All	Class 1 and Class 2	Class 3
Limit Values(mg/km)	12000	1000	800

Alternative C (Euro-3)

	CO	HC		NOx	
Vehicle Class	All	Class 1 and Class 2	Class 3	Class 1 and Class 2	Class 3
Limit Values(mg/km)	2620	750	330	170	220

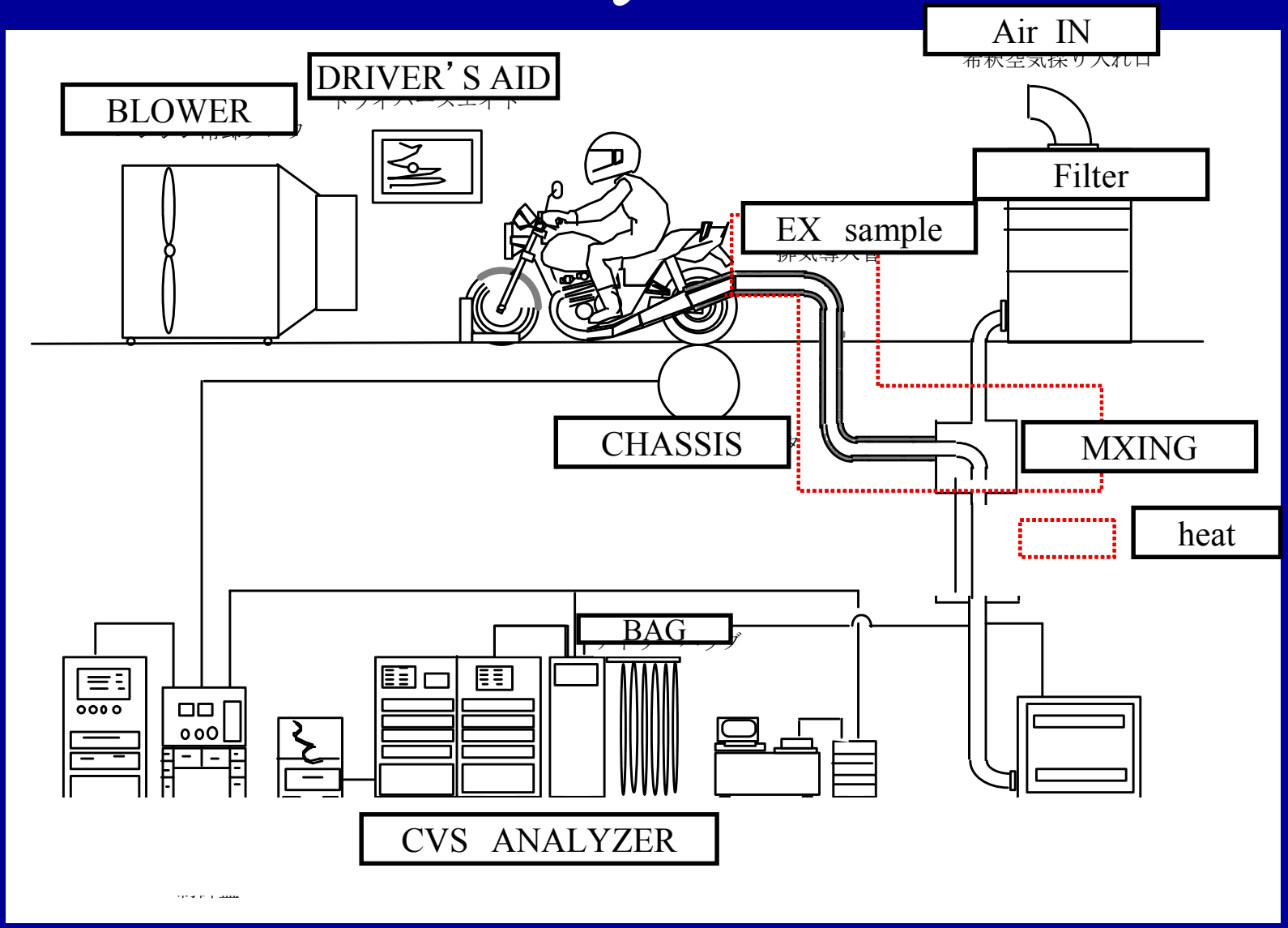
1.Technical Requirements

2.Testing

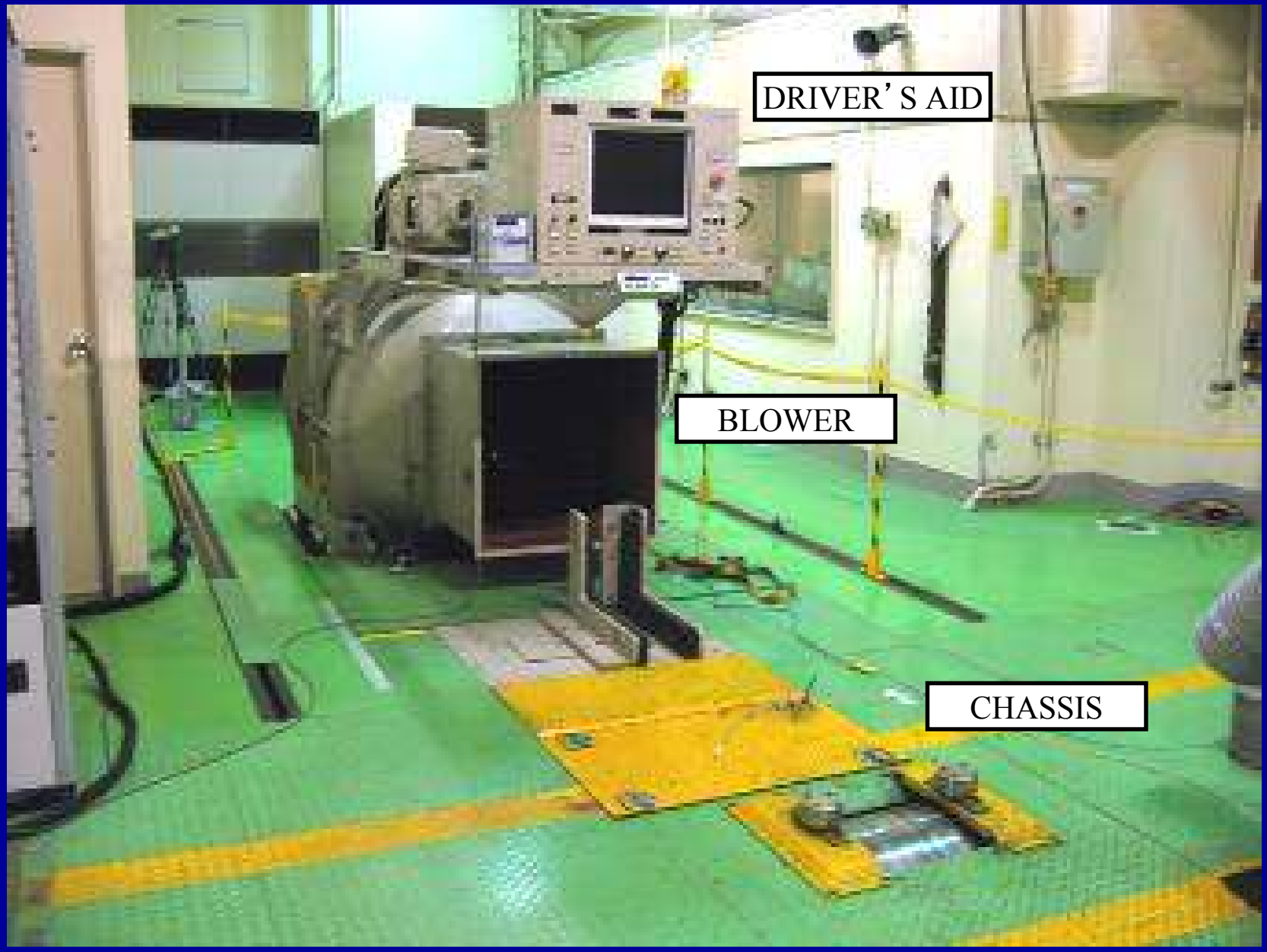
3.Summary

Chassis dynamometer test room

Exhaust Gas Analytical Flow



Exhaust Gas Measuring Facility



Exhaust Gas Analyzing Facility

Operating Cycle

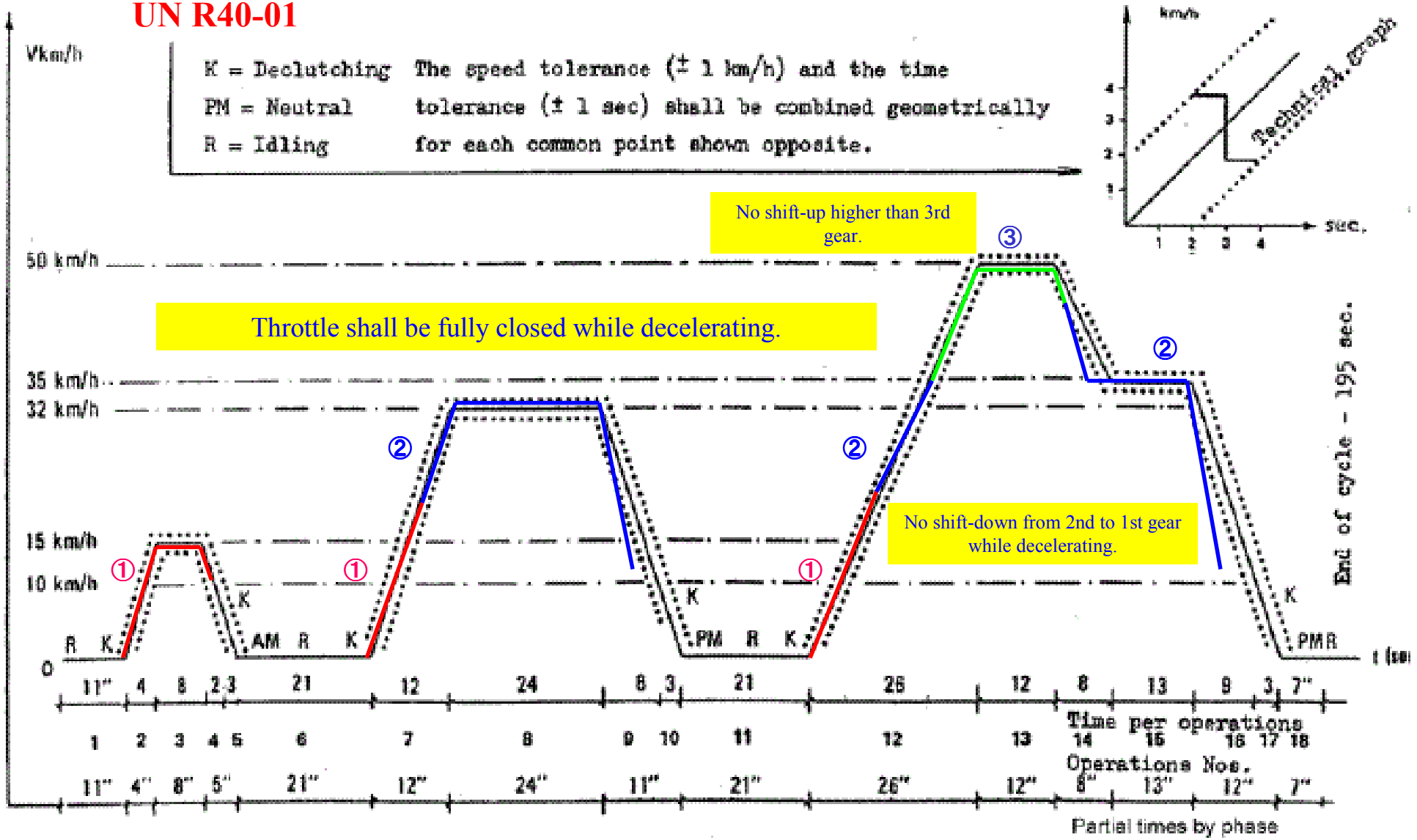
UN R40-01 OPERATING CYCLE ON THE DYNAMOMETER

No. of operation	Nature of operation	Phase	Acceleration m/sec^2	Speed km/h	Duration of each		Cumulative time sec	Gear to be used in the case of a manual-shift gear-box
					Operation sec	Phase sec		
1	Idling	1			11	11	11	6 sesc. PM 5 sec. K*/
2	Acceleration	2	1.04	0-15	4	4	15	In accordance with paragraph 2.3
3	Steady speed	3		15	8	8	23	
4	Deceleration	4	-0.69	15-10	2	5	25	
5	Deceleration, clutch disengaged		-0.92	10-0	3		28	K
6	Idling	5			21	21	49	16 sec. PM 5 sec. K
7	Acceleration	6	0.74	0-32	12	12	61	In accordance with paragraph 2.3
8	Steady speed	7		32	24	24	85	
9	Deceleration	8	-0.75	32-10	8	11	93	
10	Deceleration, clutch disengaged		-0.92	10-0	3		96	K
11	Idling	9			21	21	117	16 sec. PM 5 sec. K
12	Acceleration	10	0.53	0-50	26	26	143	In accordance with paragraph 2.3
13	Steady speed	11		50	12	12	155	
14	Deceleration	12	-0.52	50-35	8	8	163	
15	Steady speed	13		35	13	13	176	
16	Deceleration	14	-0.68	35-10	9	12	185	
17	Deceleration, clutch disengaged		-0.92	10-0	3		188	K
18	Idling	15			7	7	195	7 sec. PM

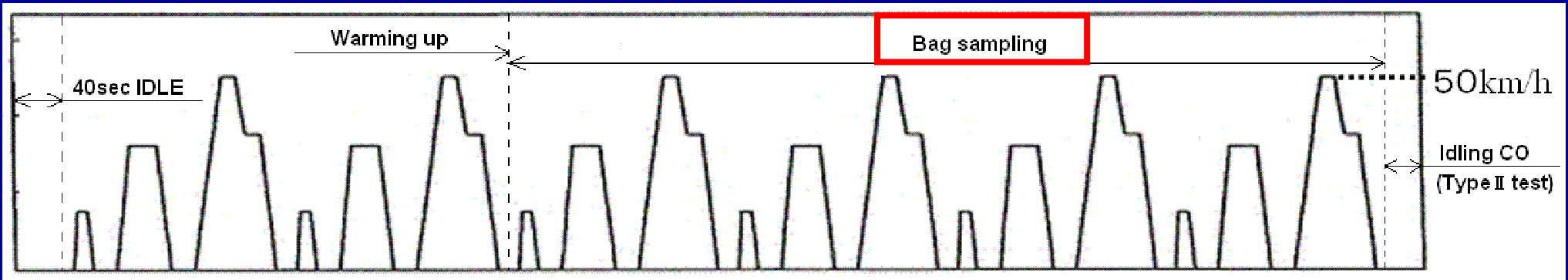
*/PM = Gears in neutral, clutch engaged.
K = Clutch disengaged.

OPERATING CYCLE FOR PETROL ENGINES FOR THE TYPE-I TEST

UN R40-01



Emission measuring methods for UN R40-01



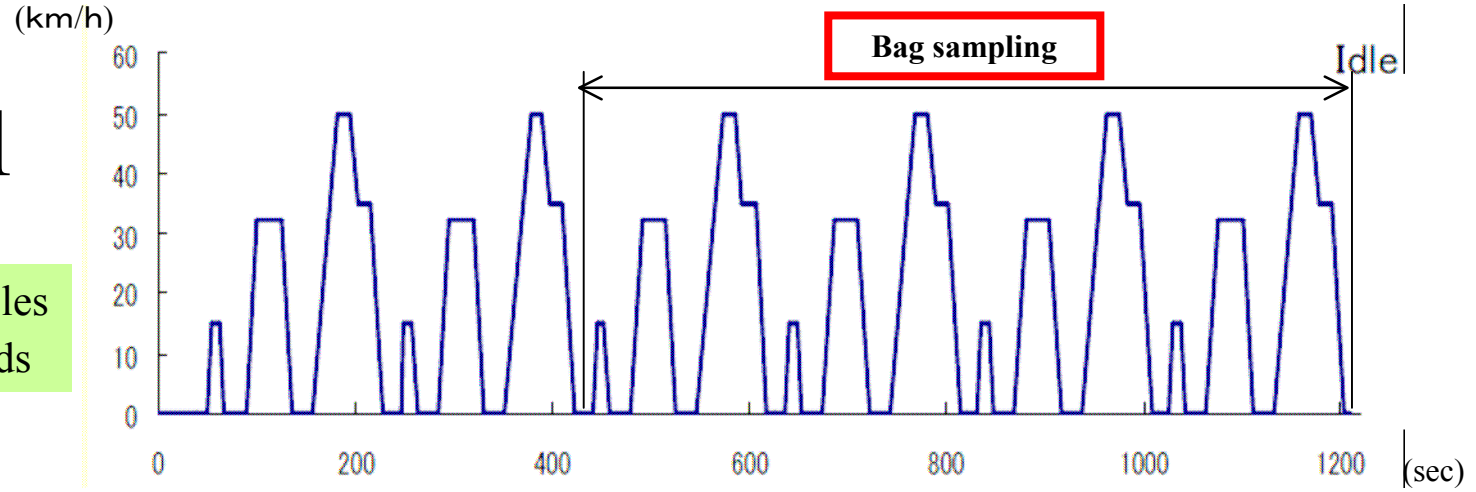
195sec/cycle × 6 = 19min30sec

Total distance : approx 6km

Emission measuring methods for Euro1 / Euro2

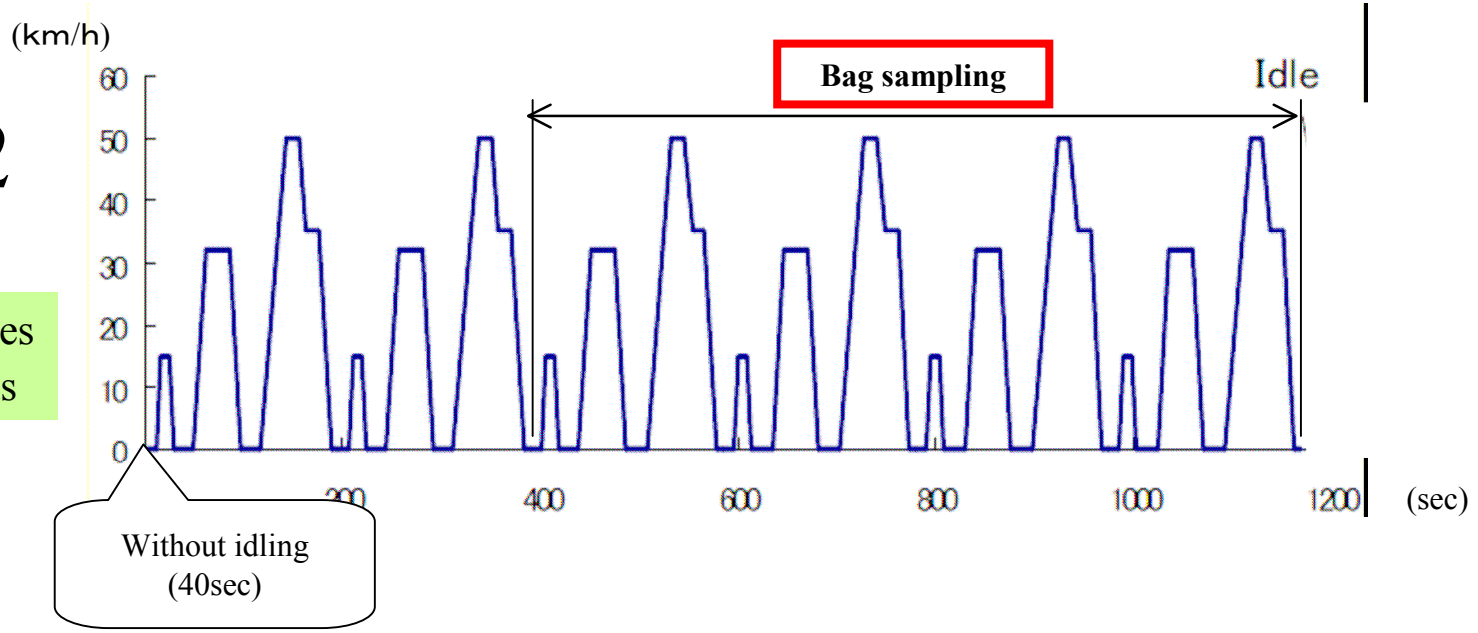
Euro1

All Motorcycles except mopeds



Euro2

All Motorcycles except mopeds



Emission measuring methods for Euro3

Class Ⅰ

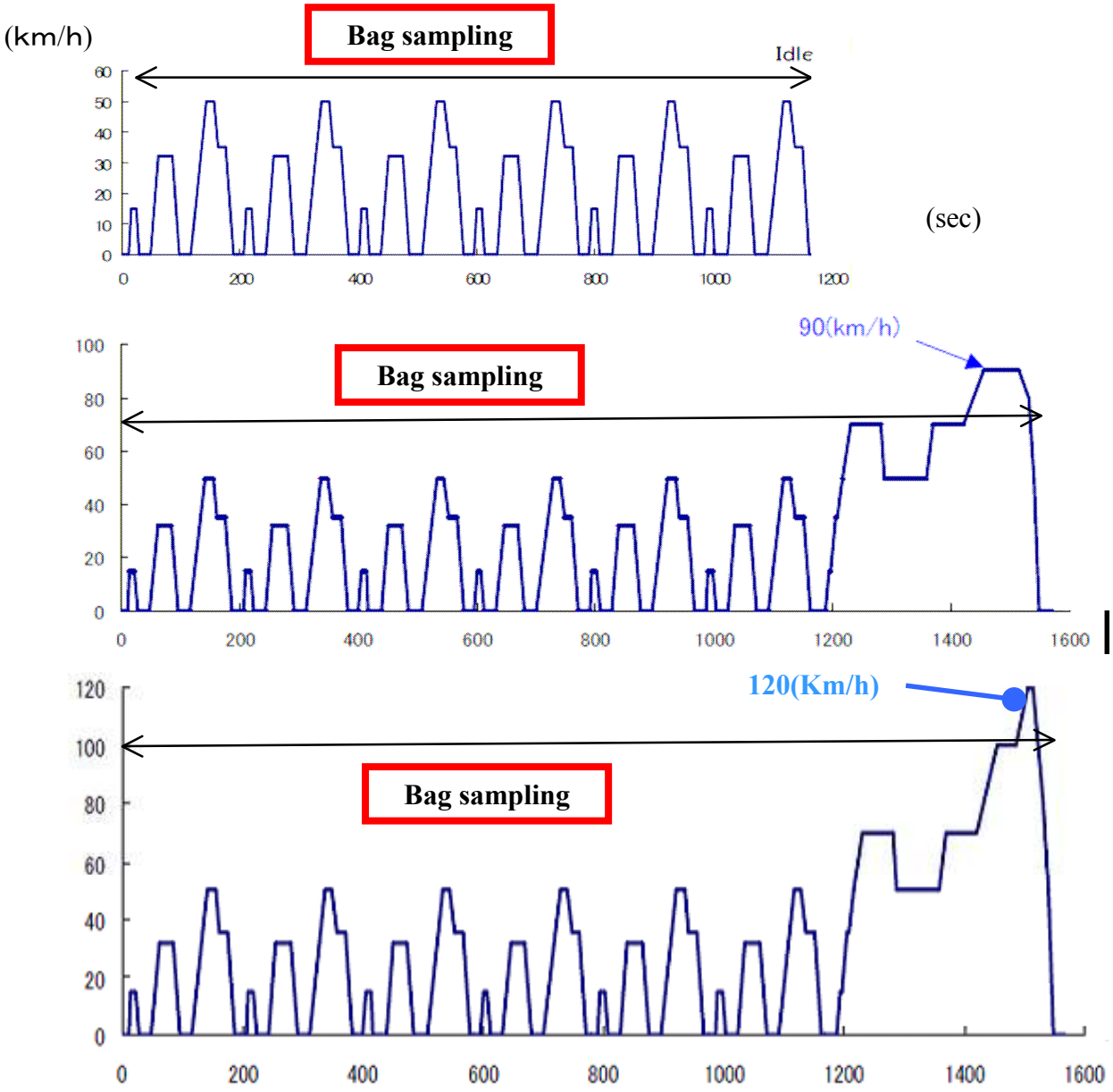
Engine capacity＜150cc
except mopeds

Class Ⅱ

Engine capacity≧150cc

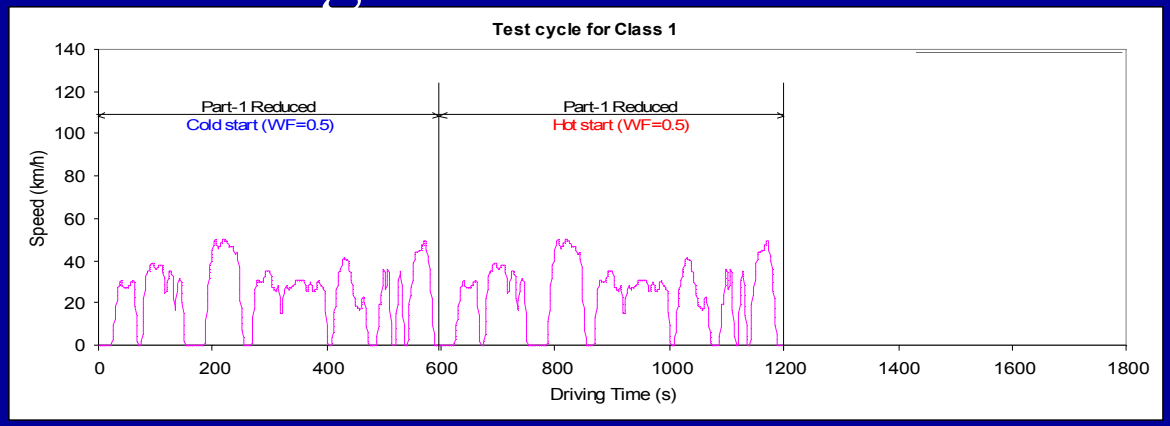
Max speed 110>Km/h

Max speed >=110Km/h

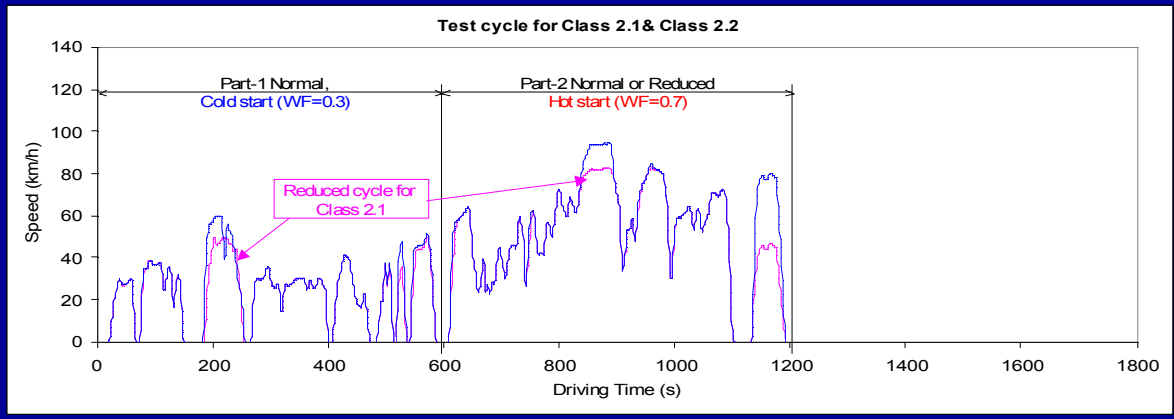


Emission measuring methods for WMTC

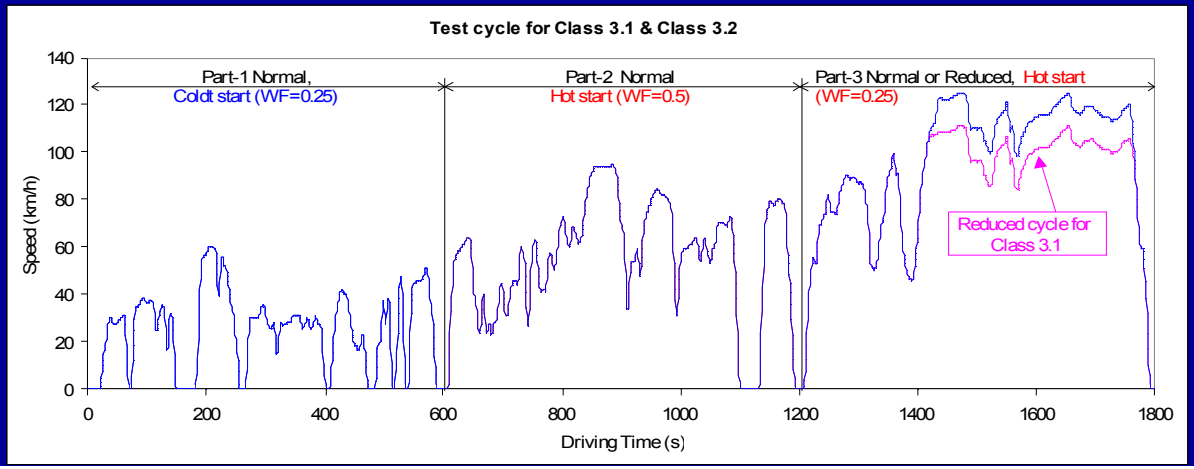
Class 1



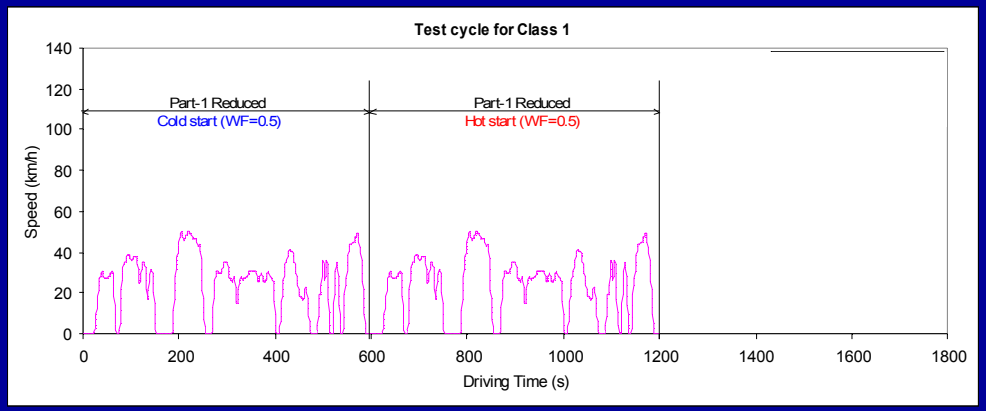
Class2

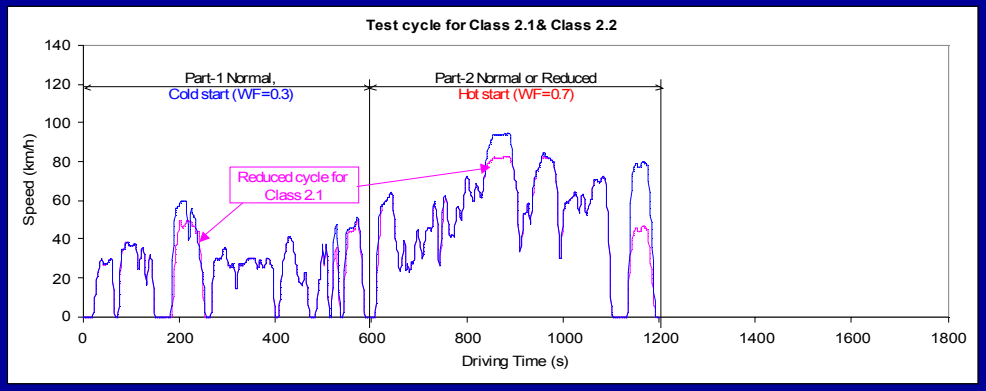


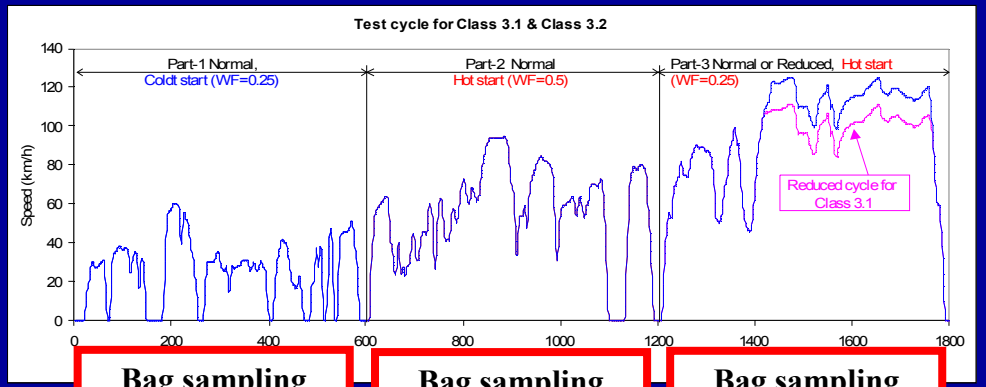
Class3



Weighting factors for WMTC



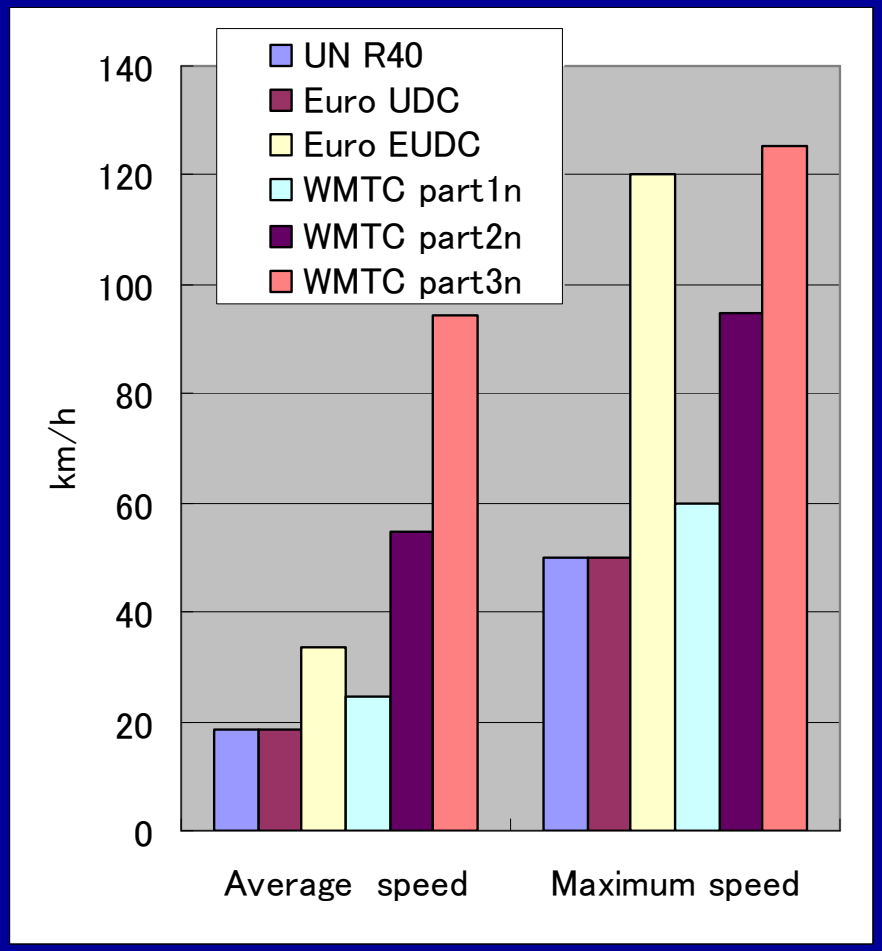


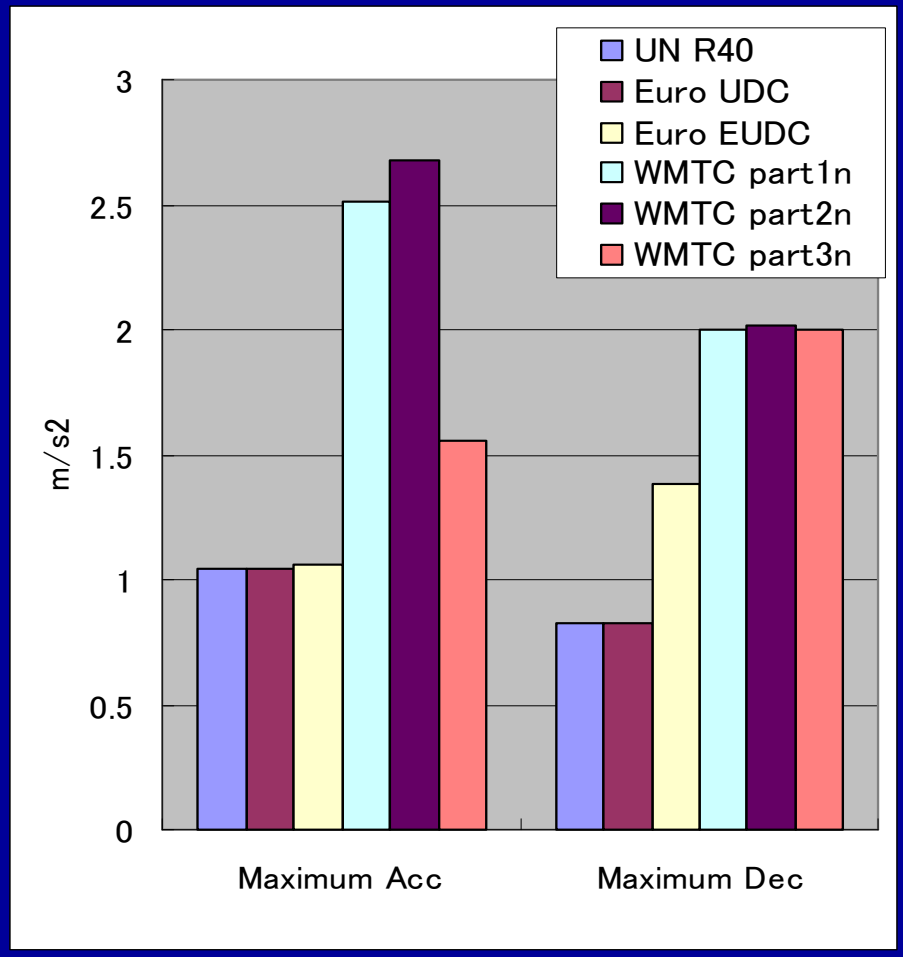


Bag sampling (BAG-1) | **Bag sampling (BAG-2)** | **Bag sampling (BAG-3)**

Vehicle class	Cycle	Weighting
Class 1	Part 1, cold	50 per cent
	Part 1, hot	50 per cent
Class 2	Part 1, cold	30 per cent
	Part 2, hot	70 per cent
Class 3	Part 1, cold	25 per cent
	Part 2, hot	50 per cent
	Part 3, hot	25 per cent

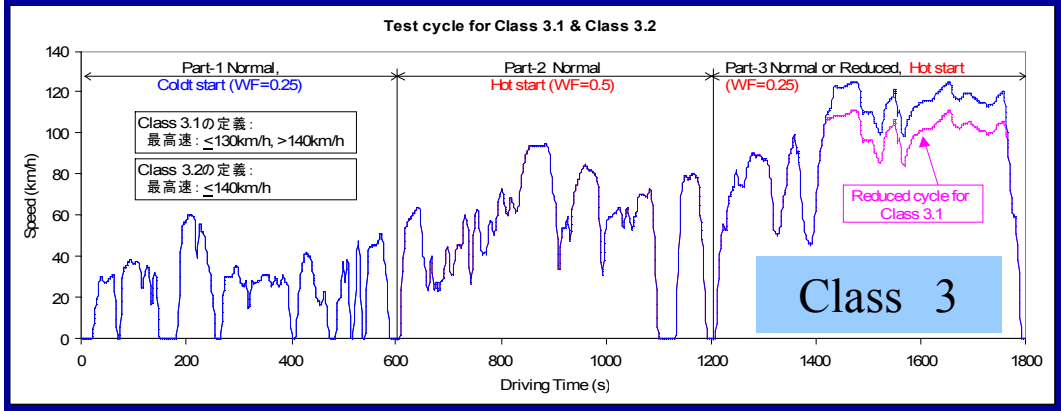
Comparison among existing test cycles





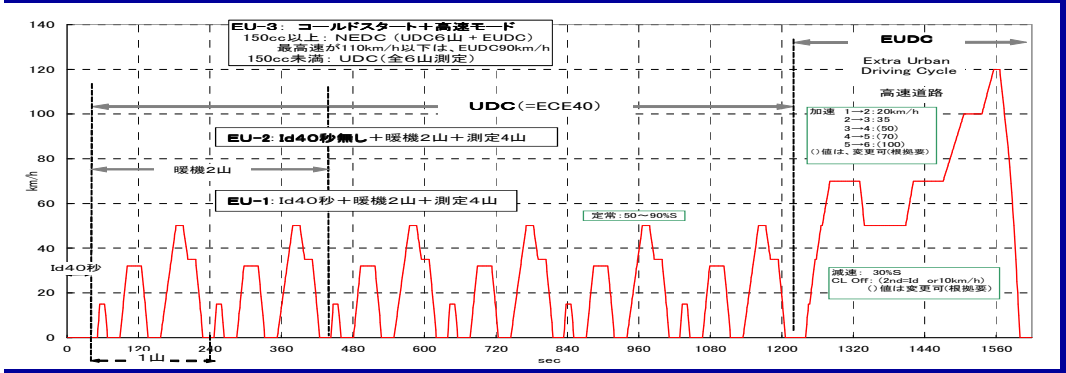
JASIC

《WMTC》



- Transient running mode
- Test method classified by maximum speed and engine capacity
- Less idling time
- Larger acceleration

《Euro3》



- Trapezoidal running mode
- Test method classified by engine capacity
- Larger idling time
- Less acceleration

Running Resistance

UN R40-01 / Euro1 / Euro2 (UN R40)

Force=KV^2

Reference mass(kg)	Equivalent inertia mass(kg)	Power absorbed(50km/h:kW)
RM≦105	100	0.88
105<RM≦115	110	0.90
115<RM≦125	120	0.91
125<RM≦135	130	0.93
135<RM≦150	140	0.94
150<RM≦165	150	0.96
165<RM≦185	170	0.99
185<RM≦205	190	1.02
205<RM≦225	210	1.05
225<RM≦245	230	1.09
245<RM≦270	260	1.14
270<RM≦300	280	1.17
300<RM≦330	310	1.21
330<RM≦360	340	1.26
360<RM≦395	380	1.33
395<RM≦435	410	1.37
435<RM≦480	450	1.44
480<RM≦540	510	1.50
540<RM≦600	570	1.56
---	---	--(at 50 km/h)

Euro3 / WMTC (ISO11486)

Force=$a+bV^2$

Reference mass(kg)	Equivalent inertia mass(kg)	Coefficient	
		aT(N)	bT(N/(km/h)2)
95<RM≦115	100	8.8	0.0215
105<RM≦115	110	9.7	0.0217
115<RM≦125	120	10.6	0.0218
125<RM≦135	130	11.4	0.0220
135<RM≦145	140	12.3	0.0221
145<RM≦155	150	13.2	0.0223
155<RM≦165	160	14.1	0.0224
165<RM≦175	170	15.0	0.0226
175<RM≦185	180	15.8	0.0227
185<RM≦195	190	16.7	0.0229
195<RM≦205	200	17.6	0.0230
205<RM≦215	210	18.5	0.0232
215<RM≦225	220	19.4	0.0233
225<RM≦235	230	20.2	0.0235
235<RM≦245	240	21.1	0.0236
245<RM≦255	250	22.0	0.0238
255<RM≦265	260	22.9	0.0239
265<RM≦275	270	23.8	0.0241
275<RM≦285	280	24.6	0.0242
285<RM≦295	290	25.5	0.0244
295<RM≦305	300	26.4	0.0245
305<RM≦315	310	27.3	0.0247
315<RM≦325	320	28.2	0.0248
325<RM≦335	330	29.0	0.0250
335<RM≦345	340	29.9	0.0251
345<RM≦355	350	30.8	0.0253
355<RM≦365	360	31.7	0.0254
365<RM≦375	370	32.6	0.0256
375<RM≦385	380	33.4	0.0257
385<RM≦395	390	34.3	0.0259
395<RM≦405	400	35.2	0.0260
405<RM≦415	410	36.1	0.0262
415<RM≦425	420	37.0	0.0263
425<RM≦435	430	37.8	0.0265
435<RM≦445	440	38.7	0.0266
445<RM≦455	450	39.6	0.0268
455<RM≦465	460	40.5	0.0269
465<RM≦475	470	41.4	0.0271
475<RM≦485	480	42.2	0.0272
485<RM≦495	490	43.1	0.0274
495<RM≦505	500	44.0	0.0275
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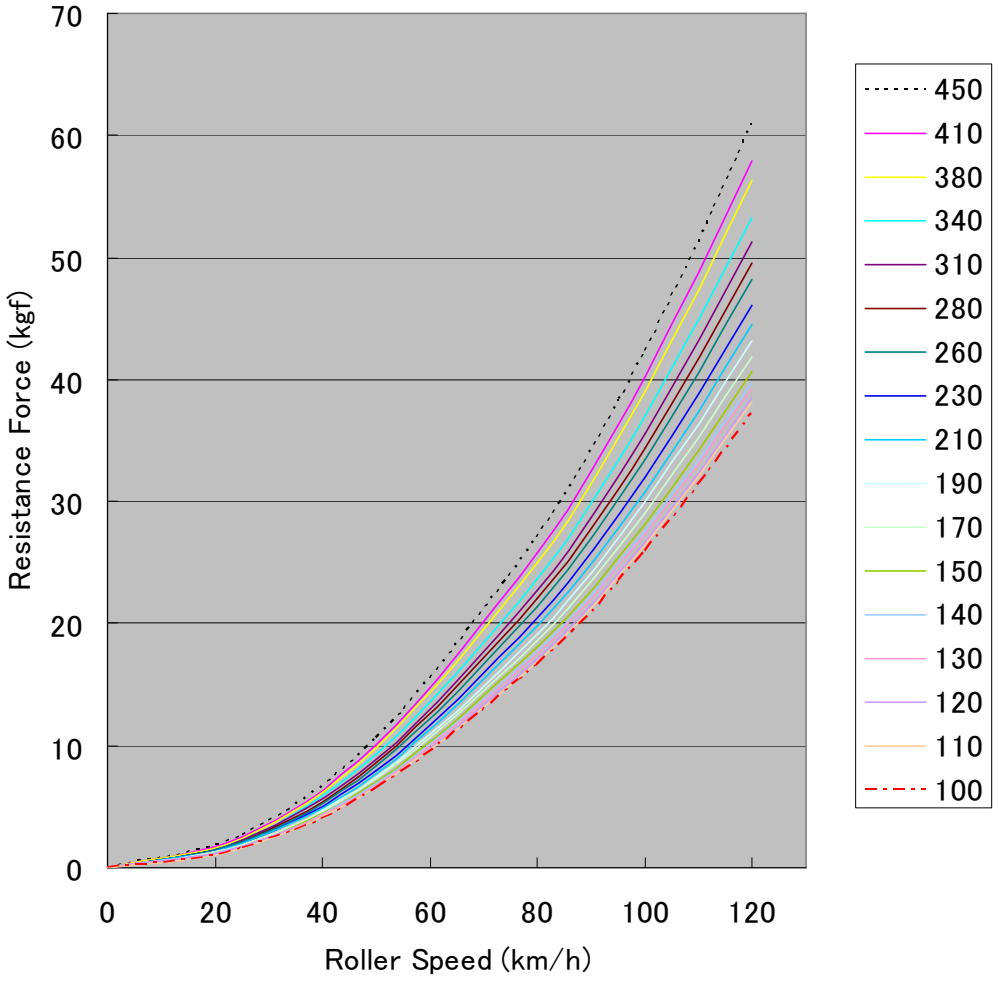
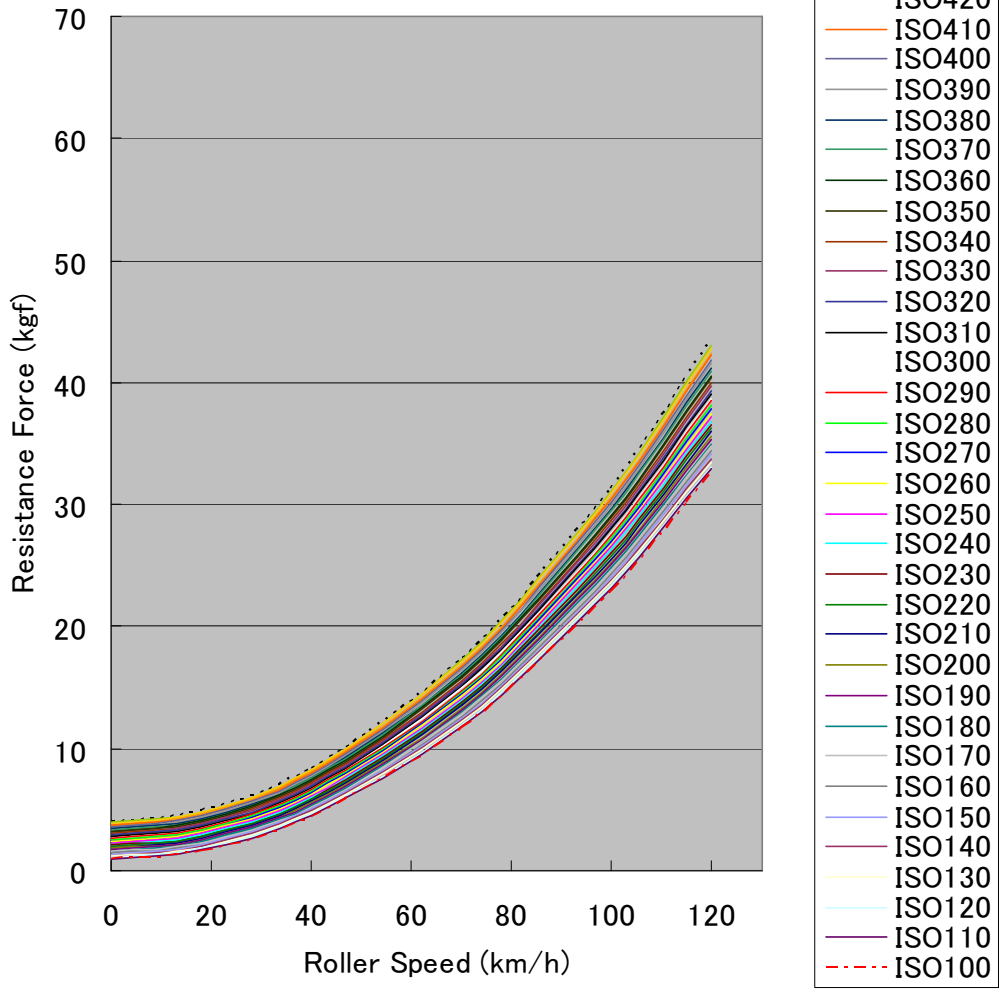
Running Resistance

UN R40-01 / Euro1 / Euro2 (ECE R40)



Euro3 / WMTC (ISO11486)



Gearshift prescription for WMTC

Phase indicators definition by applying 4

"Table A5-1: Cycle part 1, reduced speed for vehicle classes 1 and 2-1, 1 to 180 s

time in s	roller speed in km/h	phase indicators				time in s	roller speed in km/h	phase indicators				time in s	roller speed in km/h	phase indicators			
		stop	acc	cruise	dec			stop	acc	cruise	dec			stop	acc	cruise	dec
0	0,0	x				61	29,6				x	121	31,2			x	
1	0,0	x														x	
2	0,0	x														x	
3	0,0	x														x	
4	0,0	x															x
5	0,0	x															x
6	0,0	x															x
7	0,0	x															x
8	0,0	x															x
9	0,0	x															x
10	0,0	x															x
11	0,0	x															x
12	0,0	x															x
13	0,0	x													x		
14	0,0	x													x		
15	0,0	x													x		
16	0,0	x				77	17,3		x			137	25,4		x		
17	0,0	x				78	22,0		x			138	29,2		x		
18	0,0	x				79	26,2		x			139	31,6		x		
19	0,0	x				80	29,4		x			140	32,1				x
20	0,0	x				81	31,1		x			141	31,6				x
21	0,0	x				82	32,9		x			142	30,7				x
22	1,0		x			83	34,7		x			143	29,7				x
23	2,6		x			84	34,8		x			144	28,1				x
24	4,8		x			85	34,8		x			145	25,0				x
25	7,2		x			86	34,9		x			146	20,3				x
26	9,6		x			87	35,4		x			147	15,0				x
27	12,0		x			88	36,2		x			148	9,7				x
28	14,3		x			89	37,1		x			149	5,0				x
29	16,6		x			90	38,0		x			150	1,6				x
30	18,9		x			91	38,7			x		151	0,0	x			
31	21,2		x			92	38,9			x		152	0,0	x			
32	23,5		x			93	38,9			x		153	0,0	x			
33	25,6		x			94	38,8			x		154	0,0	x			
34	27,1		x			95	38,5			x		155	0,0	x			
35	28,0		x			96	38,1			x		156	0,0	x			

- STOP （IDLE)
- ACCELERATION
- CRUISE
- DECELERATION

3. Phase indicators

In order to avoid different interpretations in the application of the gearshift equations and thus to improve the comparability of the test, fixed phase indicators are assigned to the speed pattern of the cycles. The specification of the phase indicators is based on JARI's definition of the 4 driving modes as shown in the following table:

Table A13-1: Definition of driving modes

4 modes	Definition
Idle mode	vehicle speed < 5 km/h and -0.5 km/h/s (-0.139 m/s²) < acceleration < 0.5 km/h/s (0.139 m/s²)
Acceleration mode	acceleration ≥ 0.5 km/h/s (0.139 m/s²)
Deceleration mode	acceleration ≤ - 0.5 km/h/s (- 0.139 m/s²)
Cruise mode	vehicle speed ≥ 5 km/h and -0.5 km/h/s (-0.139 m/s²) < acceleration < 0.5 km/h/s (0.139 m/s²)

The indicators were then modified in order to avoid frequent changes during relatively homogeneous cycle parts and thus improve the driveability. Figure A13-2 shows an example from cycle part 1.

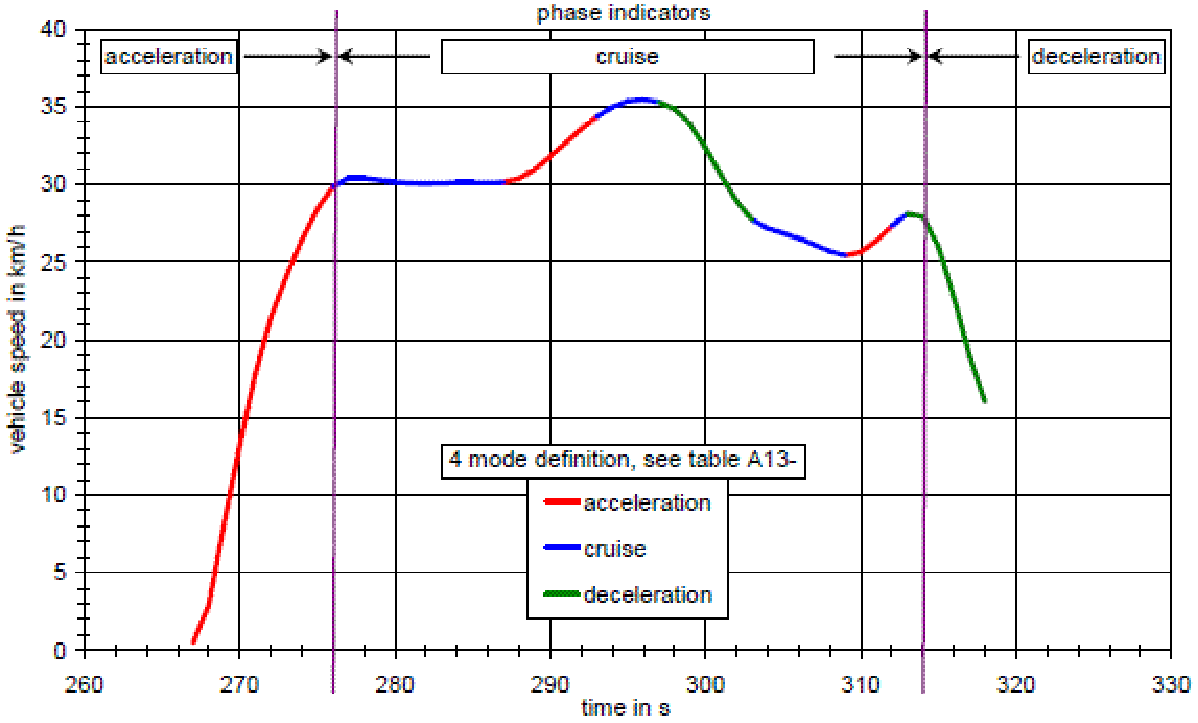


Figure A13-2: Example for modified phase indicators

WMTC Gearshift

6.5.5.2.1.1. Step 1 – Calculation of shift speeds

Upshift speeds ($v_{1\rightarrow 2}$ and $v_{i\rightarrow i+1}$) in km/h during acceleration phases shall be calculated using the following equations:

Equation 6-1:

$$v_{1\rightarrow 2} = \left[(0.5753 \times e^{(-1.9 \times \frac{P_n}{m_k + 75})} - 0.1) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_1}$$

Equation 6-2:

$$v_{i\rightarrow i+1} = \left[(0.5753 \times e^{(-1.9 \times \frac{P_n}{m_k + 75})}) \times (s - n_{idle}) + n_{idle} \right] \times \frac{1}{ndv_i}, \; i = 2 \text{ to } ng\text{-}1$$

Where:

i	is the gear number (≥ 2),
ng	is the total number of forward gears,
P_n	is the rated power in kW,
m_k	is the kerb mass in kg,
n_{idle}	is the idling speed in min^{-1},
s	is the rated engine speed in min^{-1},
ndv_i	is the ratio between engine speed in min^{-1} and vehicle speed in km/h in gear i.

The clutch shall be disengaged, if:

(a) The vehicle speed drops below 10 km/h; or

(b) The engine speed drops below $n_{idle} + 0.03 \times (s - n_{idle})$;

(c) There is a risk of engine stalling during cold start phase.

6.5.5.2.1.3. Step 3 – Corrections according to additional requirements

The gear choice has then to be modified according to the following requirements:

(a) No gearshift at a transition from an acceleration phase to a deceleration phase. The gear that was used for the last second of the acceleration phase shall be kept for the following deceleration phase unless the speed drops below a downshift speed.

(b) No upshifts or downshifts by more than 1 gear, except from gear 2 to neutral during decelerations down to stop.

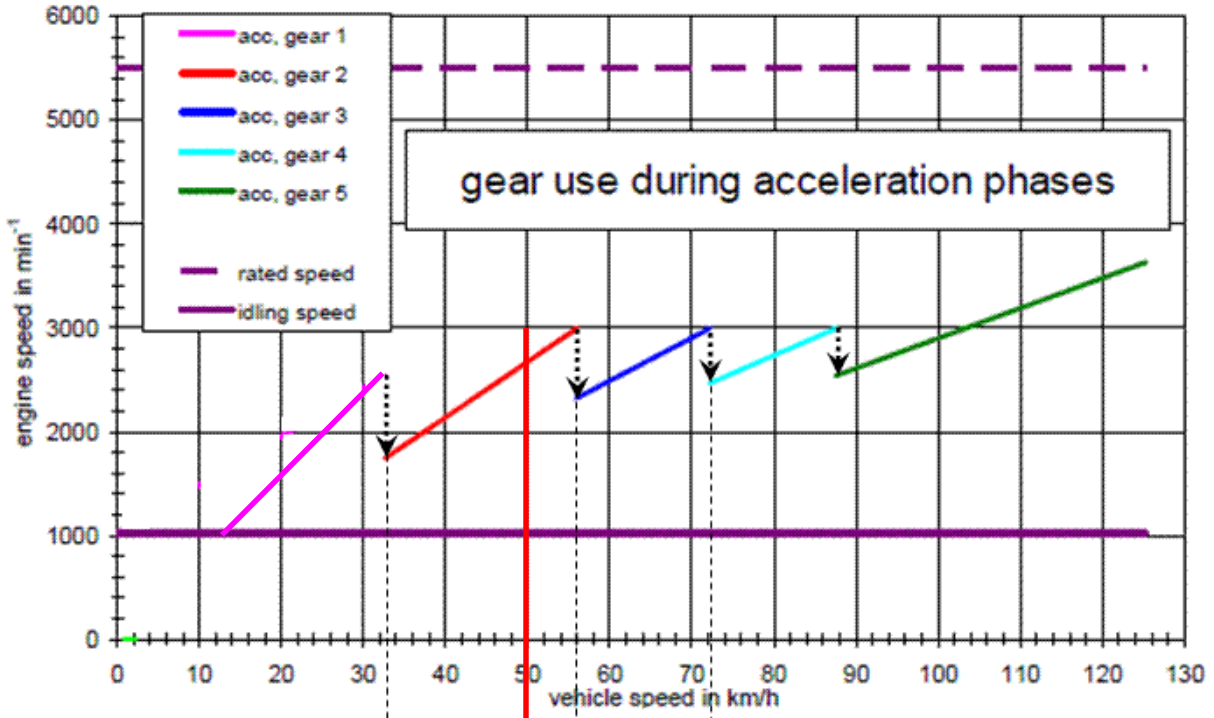
(c) Upshifts or downshifts for up to 4 seconds are replaced by the gear before, if the gears before and after are identical. (Examples: 2 3 3 3 2 will be replaced by 2 2 2 2 2, 4 3 3 3 3 4 will be replaced by 4 4 4 4 4 4).

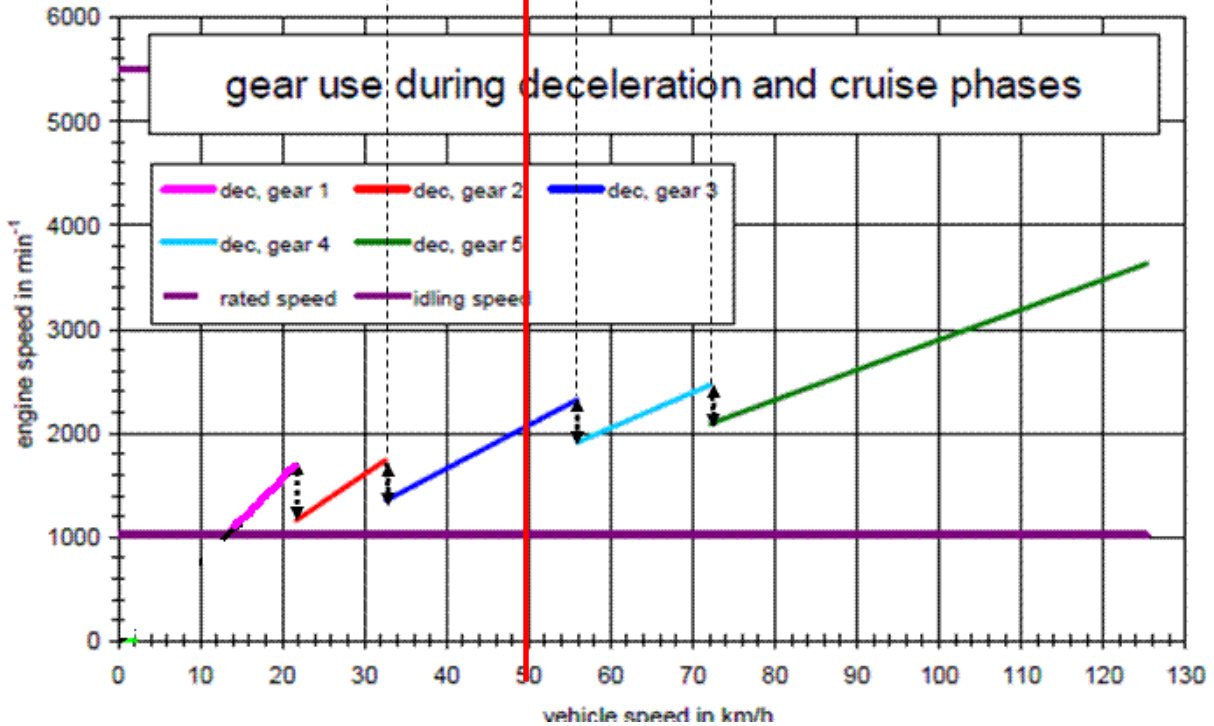
(d) No downshift during an acceleration phase.

6.5.5.2.2. Optional Provisions

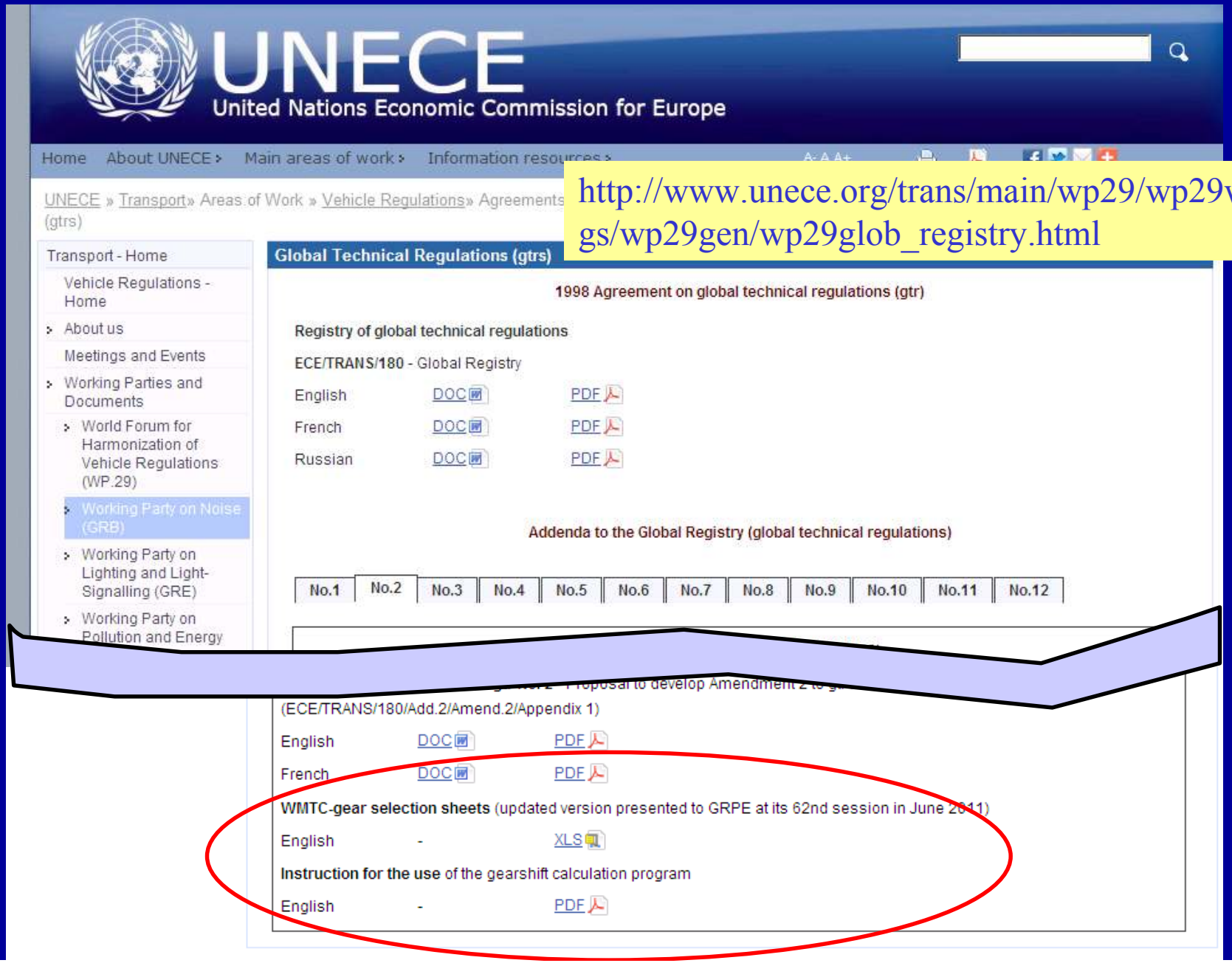
The gear choice may be modified according to the following provisions:

(a) The use of lower gears than determined by the requirements described in paragraph 6.5.5.2.1. is permitted in any cycle phase. Manufacturers' recommendations for gear use shall be followed, if they do not result in higher gears than determined by the requirements described in paragraph 6.5.5.2.1.


gear use during acceleration phases
acc, gear 1
acc, gear 2
acc, gear 3
acc, gear 4
acc, gear 5
rated speed
idling speed
engine speed in min-1
vehicle speed in km/h
0
1000
2000
3000
4000
5000
6000
0
10
20
30
40
50
60
70
80
90
100
110
120
130

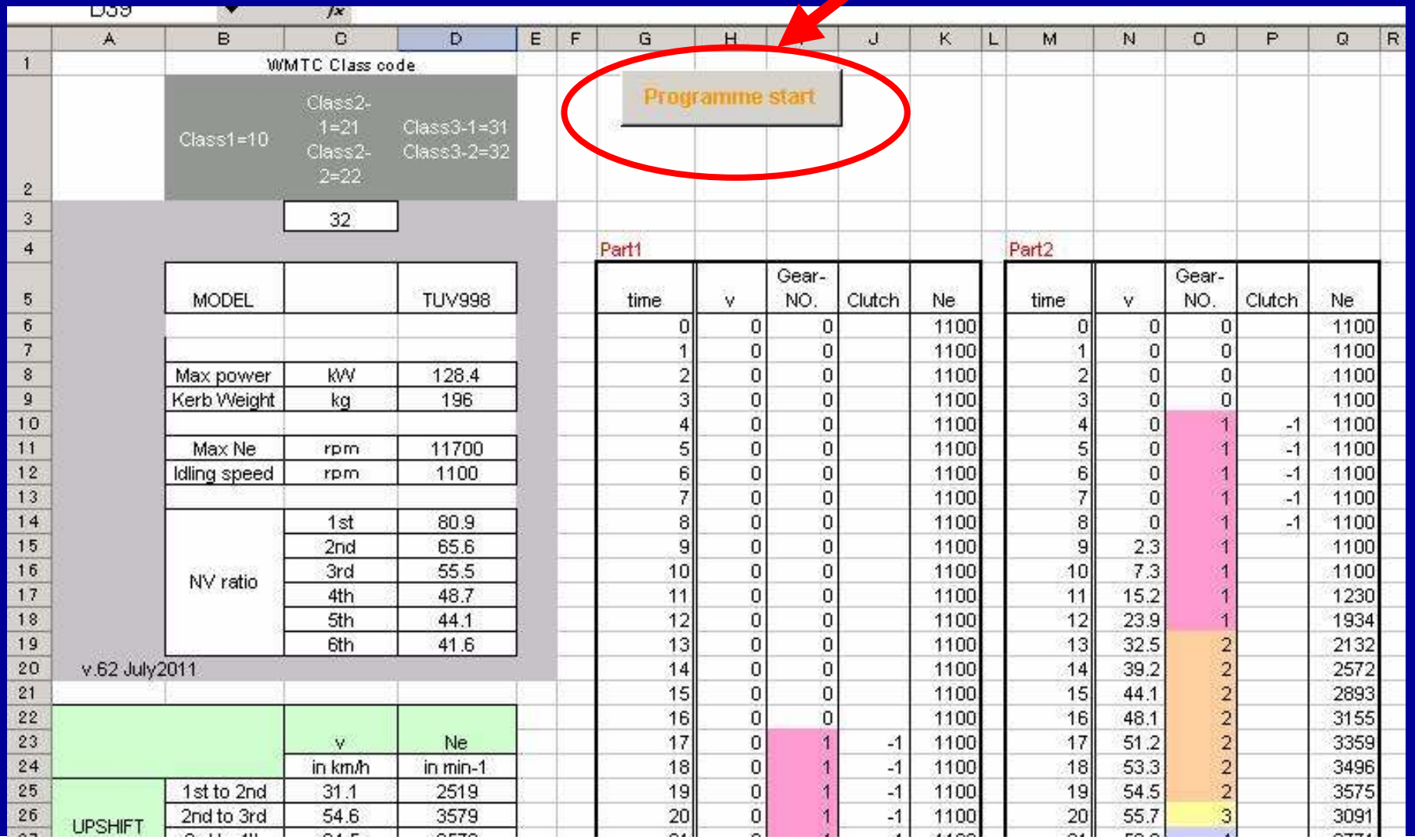

gear use during deceleration and cruise phases
dec, gear 1
dec, gear 2
dec, gear 3
dec, gear 4
dec, gear 5
rated speed
idling speed
engine speed in min-1
vehicle speed in km/h
0
1000
2000
3000
4000
5000
6000
0
10
20
30
40
50
60
70
80
90
100
110
120
130

UNECE Website HP (WMTC Gearshift)



Gear calculation input seat

start



	A	B	C	D
1		WMTC Class code		
2		Class1=10	Class2-1=21 Class2-2=22	Class3-1=31 Class3-2=32
3			32	
4				
5		MODEL		TUV998
6				
7				
8		Max power	kW	128.4
9		Kerb Weight	kg	196
10				
11		Max Ne	rpm	11700
12		Idling speed	rpm	1100
13				
14		NV ratio	1st	80.9
15			2nd	65.6
16			3rd	55.5
17			4th	48.7
18			5th	44.1
19			6th	41.6
20	v.62 July2011			
21				
22			v	Ne
23			in km/h	in min-1
24		1st to 2nd	31.1	2519
25		2nd to 3rd	54.6	3579
26	UPSHIFT			

Programme start

Part1

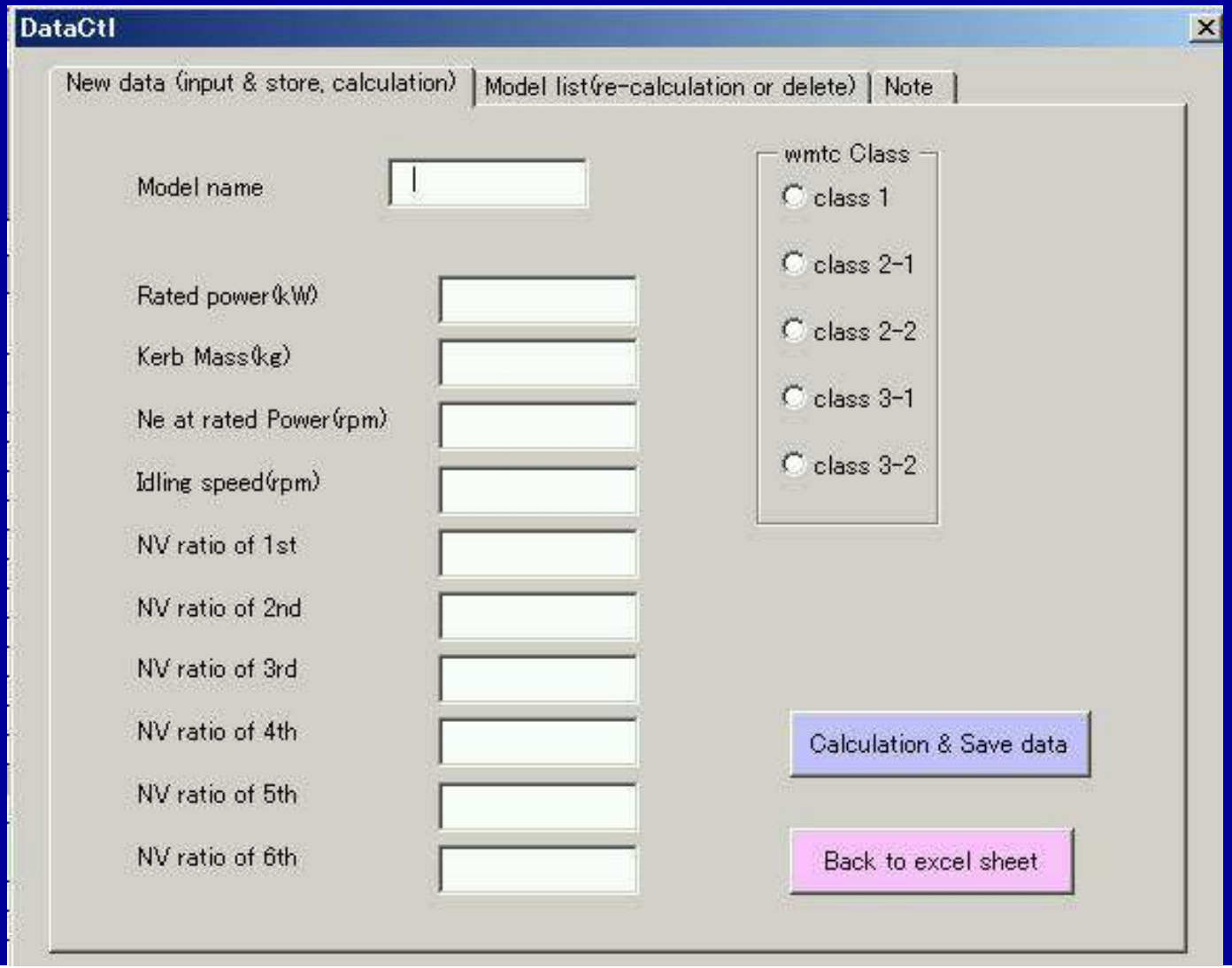
time	v	Gear-NO.	Clutch	Ne
0	0	0		1100
1	0	0		1100
2	0	0		1100
3	0	0		1100
4	0	0		1100
5	0	0		1100
6	0	0		1100
7	0	0		1100
8	0	0		1100
9	0	0		1100
10	0	0		1100
11	0	0		1100
12	0	0		1100
13	0	0		1100
14	0	0		1100
15	0	0		1100
16	0	0		1100
17	0	1	-1	1100
18	0	1	-1	1100
19	0	1	-1	1100
20	0	1	-1	1100

Part2

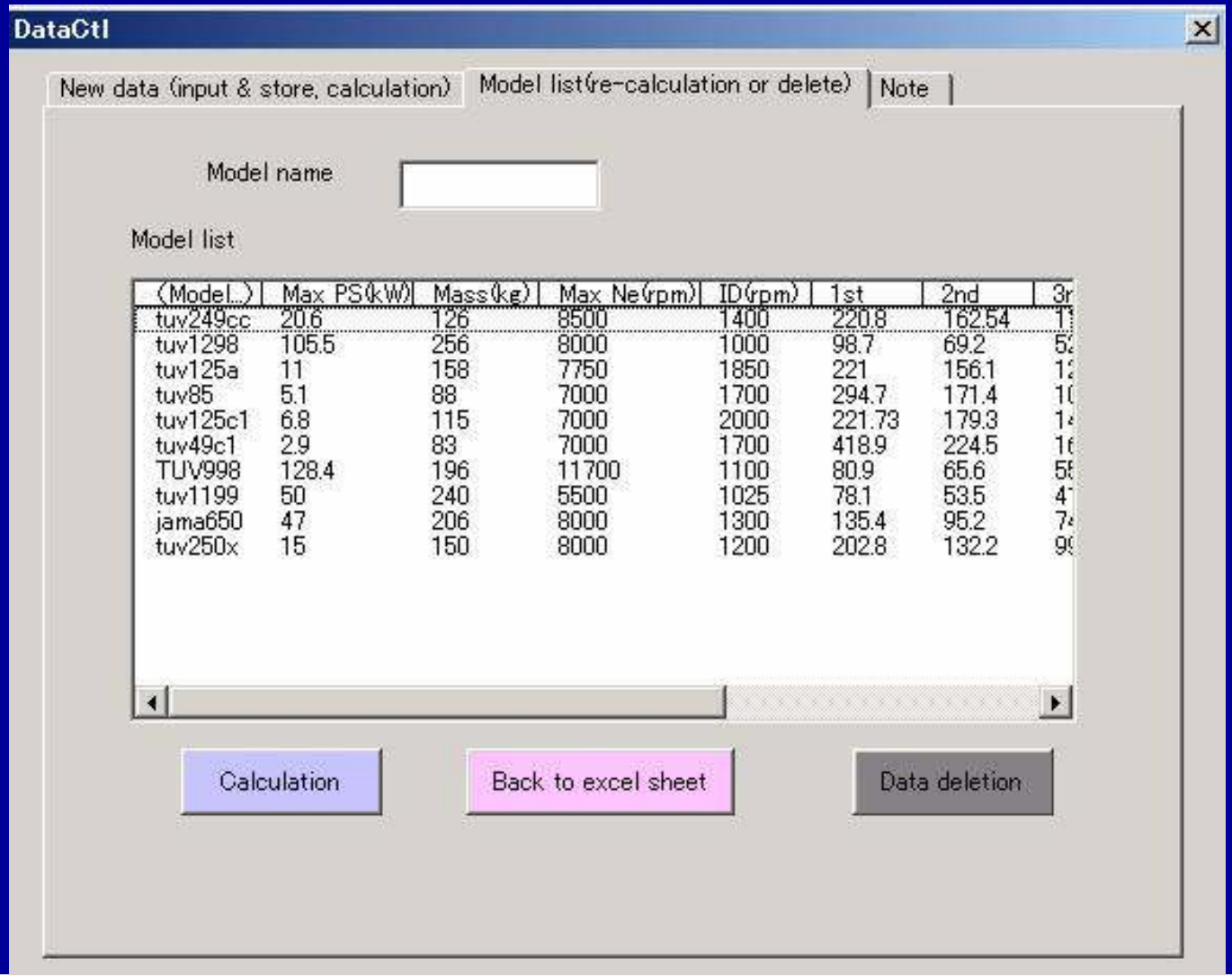
time	v	Gear-NO.	Clutch	Ne
0	0	0		1100
1	0	0		1100
2	0	0		1100
3	0	0		1100
4	0	1	-1	1100
5	0	1	-1	1100
6	0	1	-1	1100
7	0	1	-1	1100
8	0	1	-1	1100
9	2.3	1		1100
10	7.3	1		1100
11	15.2	1		1230
12	23.9	1		1934
13	32.5	2		2132
14	39.2	2		2572
15	44.1	2		2893
16	48.1	2		3155
17	51.2	2		3359
18	53.3	2		3496
19	54.5	2		3575
20	55.7	3		3091

Gear calculation input seat

New calculation



Gear calculation input seat recalculation



Gear calculation result

time

speed

Gear No.

Class1=10	Class2-1=21 Class2-2=22	Class3-1=31 Class3-2=32
	32	

programme start

MODEL		tuv1199
Max power	kW	50.0
Kerb Weight	kg	240
Max Ne	rpm	5500
Idling speed	rpm	1025
NV ratio	1st	78.1
	2nd	53.5
	3rd	41.5
	4th	34.2
	5th	29.0
	6th	

v.61 Dec2011

		v	Ne
		in km/h	in min-1
UPSHIFT Acc-phase	1st to 2nd	31.8	2482
	2nd to 3rd	54.8	2929
	3rd to 4th	70.6	2929
	4th to 5th	85.6	2929
	5th to 6th		
Clutch disengaged	1st to clutch	14.8	1159
	2nd to clutch	21.7	1159
	3rd to clutch	27.9	1159.25
	2nd to 1st	21.7	1159

Part1 time	v	Gear-NO.	Clutch	Ne	Part2 time	v	Gear-NO.	Clutch	Ne	Part3 time	v	Gear-NO.	Clutch	Ne
0	0	0		1025	0	0	0		1025	0	0	0		1025
1	0	0		1025	1	0	0		1025	1	0	0		1025
2	0	0		1025	2	0	0		1025	2	0	0		1025
3	0	0		1025	3	0	0		1025	3	0	1	-1	1025
4	0	0		1025	4	0	1	-1	1025	4	0	1	-1	1025
5	0	0		1025	5	0	1	-1	1025	5	0	1	-1	1025
6	0	0		1025	6	0	1	-1	1025	6	0	1	-1	1025
7	0	0		1025	7	0	1	-1	1025	7	0	1	-1	1025
8	0	0		1025	8	0	1	-1	1025	8	0.9	1		1025
9	0	0		1025	9	2.3	1		1025	9	3.2	1		1025
10	0	0		1025	10	7.3	1		1025	10	7.3	1		1025
11	0	0		1025	11	15.2	1		1187	11	12.4	1		1025
12	0	0		1025	12	23.9	1		1867	12	17.9	1		1398
13	0	0		1025	13	32.5	2		1739	13	23.5	1		1835
14	0	0		1025	14	39.2	2		2097	14	29.1	1		2273
15	0	0		1025	15	44.1	2		2359	15	34.3	2		1835
16	0	0		1025	16	48.1	2		2573	16	38.6	2		2065
17	0	1	-1	1025	17	51.2	2		2739	17	41.6	2		2226
18	0	1	-1	1025	18	53.3	2		2852	18	43.9	2		2349
19	0	1	-1	1025	19	54.5	2		2916	19	45.9	2		2456
20	0	1	-1	1025	20	55.7	3		2312	20	48.1	2		2573
21	0	1	-1	1025	21	56.9	4		1946	21	50.3	2		2691
22	1	1		1025	22	57.5	4		1967	22	52.6	2		2814
23	2.6	1		1025	23	58	4		1984	23	54.8	2		2932
24	4.8	1		1025	24	58.4	4		1997	24	55.8	3		2316
25	7.2	1		1025	25	58.5	4		2001	25	55.2	3		2291
26	9.6	1		1025	26	58.5	4		2001	26	53.9	3		2237
27	12	1		1025	27	58.6	4		2004	27	52.7	3		2187

1.Technical Requirements

2.Testing

3.Summary

Summary

◆UN-R40： Old version

◆WMTC: New world-wide test procedure

Already introduced: EU, Japan

We hope to introduce WMTC in Malaysia.

Thank you for your attention !

Light-duty Exhaust Emission Regulations
< UN Regulation R83 >

JASIC

Environmental Regulations

Vehicle Emissions

Tailpipe Emissions

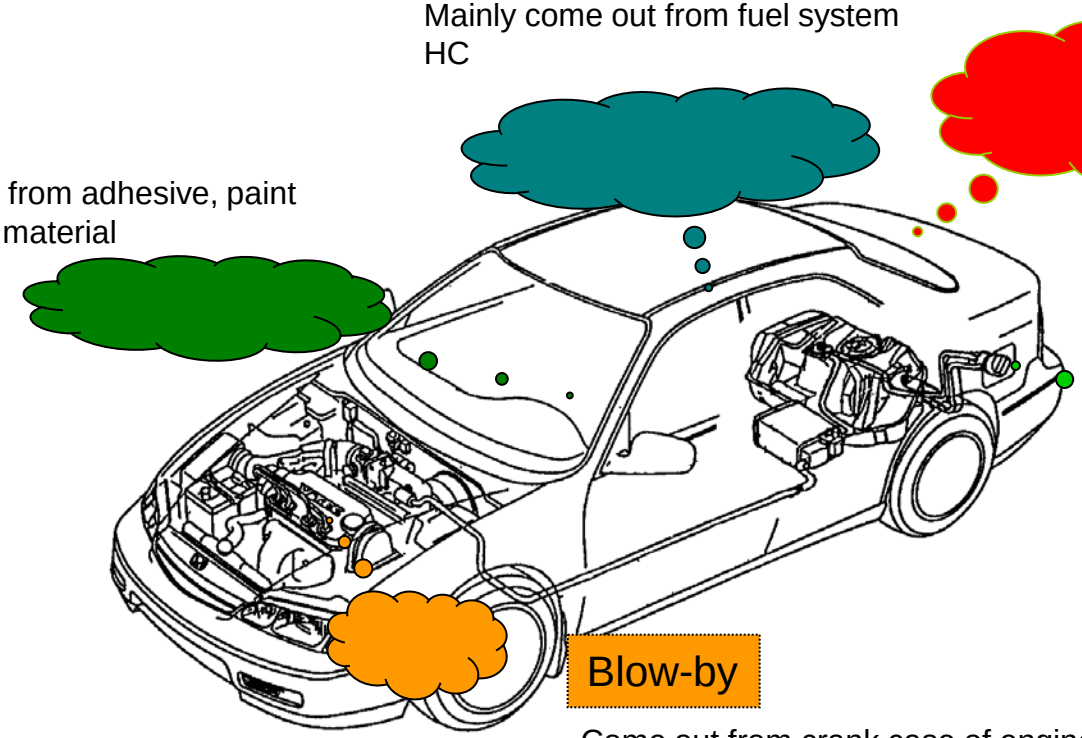
come from engine combustion
CO/HC/NO**x**

Evaporative Emission

Mainly come out from fuel system
HC

VOC

Come out from adhesive, paint
Resinous material
HC…



Refueling Emissions

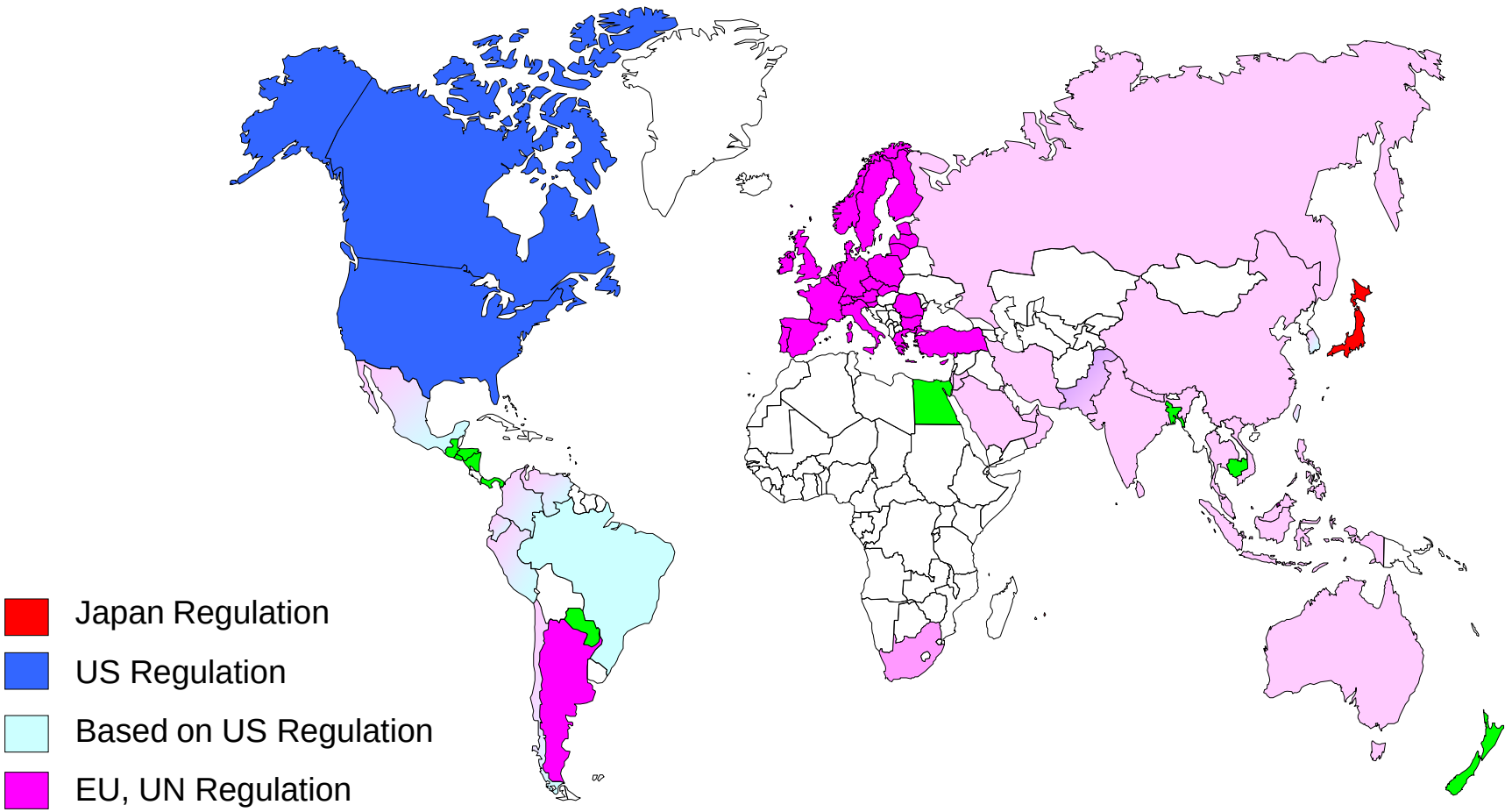
Comes out from fuel inlet when refueling
HC

Blow-by

Come out from crank case of engine

Several kind of gases are emitted from a vehicle

Environmental Regulations in The World



Environmental Regulations in The World

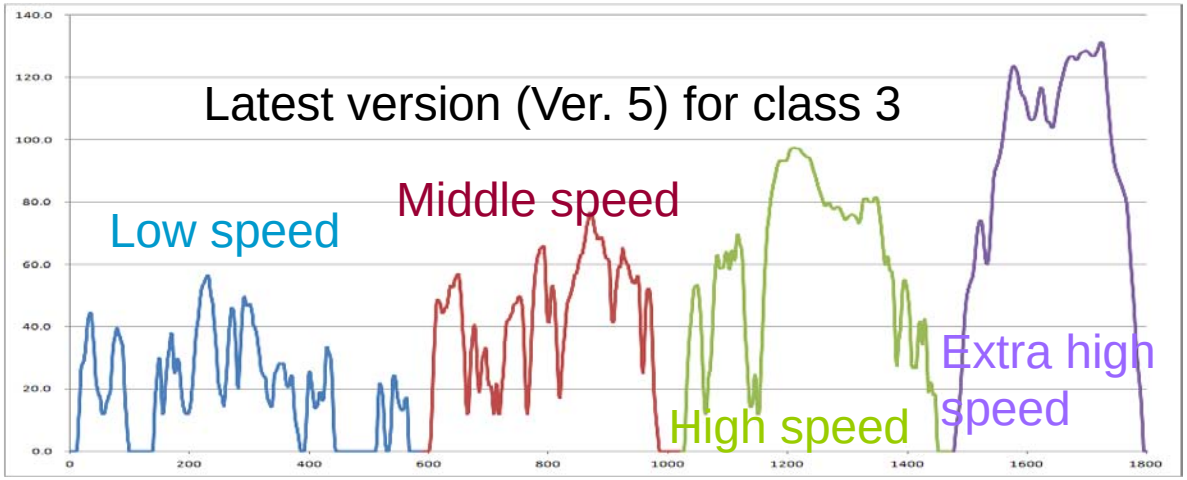
	EU / UN	Malaysia	USA	Japan	Australia	Indonesia	Thailand	Singapore	Philippines	Vietnam
Idle Emission	●		●	●	●	●	●			●
Tailpipe Emission	●	●	●	●	●	●	●	●	●	●
Low Temp. Emission	●		●		●					
Crankcase Emission	●		●	●	●		●		●	●
Evaporative Emission	●		●	●	●		●		●	●
Durability	●		●	●	●		●		●	●
OBD	●		●	●	●		○			

Worldwide harmonized Light vehicles Test Procedure

- Concept / Purpose : The United Nations are considering world harmonized test procedure for light vehicles.

Latest Vehicle class category

Vehicle Class	P_{mr} W/kg	v_{max} km/h	Speed class, cycle number								
			Low 1	Medium 1	Low 2	Medium 2	High 2	Low 3	Medium 3	High 3	Extra high 3
1	≤ 22	< 70	X								
		≥ 70	X	X							
2	> 22 but ≤ 34	< 90			X	X					
		≥ 90			X	X	X				
3	> 34	< 135						X	X	X	
		≥ 135						X	X	X	X



Worldwide harmonized Light vehicles Test Procedure

-2007	2008	2009	2010-2013	2014-2016	2017-
WP.29 decided to set up an informal group under GRPE.	Road map planning Japan & OICA proposed work plan.	☆ Road map was approved.	GTR regulation text will be considered Phase I •driving cycle •test procedure off cycle, Air conditioning	Phase II •low temperature •altitude •durability •in-use surveillance	Phase III •standard •reference fuel

By end of 2013, EC needs this new test cycle & test procedure because of political issue.

2. Organization during Phase I Work

WLTP Informal Group
Chaired by TBD
Secretary : N. ICHIKAWA

Technical Sub-Groups

DHC Group
Chaired by

Mandate : develop worldwide harmonized light duty driving cycle

DTP Group
Chaired by

Mandate : develop worldwide harmonized light duty test procedure

It is under the consideration that both chairperson also have a responsibility for "gtr TEXT"

DTP Sub-Group Organization

	Leader	Co-Leader
PN/PM	Chris Parkin (UK)	Caroline Hosier (Ford-EU)
Gaseous constituents	Oliver Moersch (Daimler)	TBD (EC/JRC)
Lab. Process * (ICE)	Stephan Redmann (German) Beatrice Lopez (France)	Werner Kummer (Audi)
Lab. Process (EV/HEV/PHEV/FCV)	Kazuki Kobayashi (JAPAN) Per Ohlund (Sweden)	Yutaka Sawada (JAMA-E)
Reference Fuel	Bill Coleman (VW)	TBD (EC)

UN Regulation R83 S5

History of UN Regulation R83

Series	Date of entry into force	NOTE
00	1989/11/05	Urban driving cycle only
01	1992/12/30	Euro-1 Addition of the extra urban driving cycle
02	1995/07/02	
03	1996/12/07	Euro-2
04	1999/11/13	
05	**2001/03/29**	**Addition of OBD provisions** **A limit : Euro-3** **B limit : Euro-4**

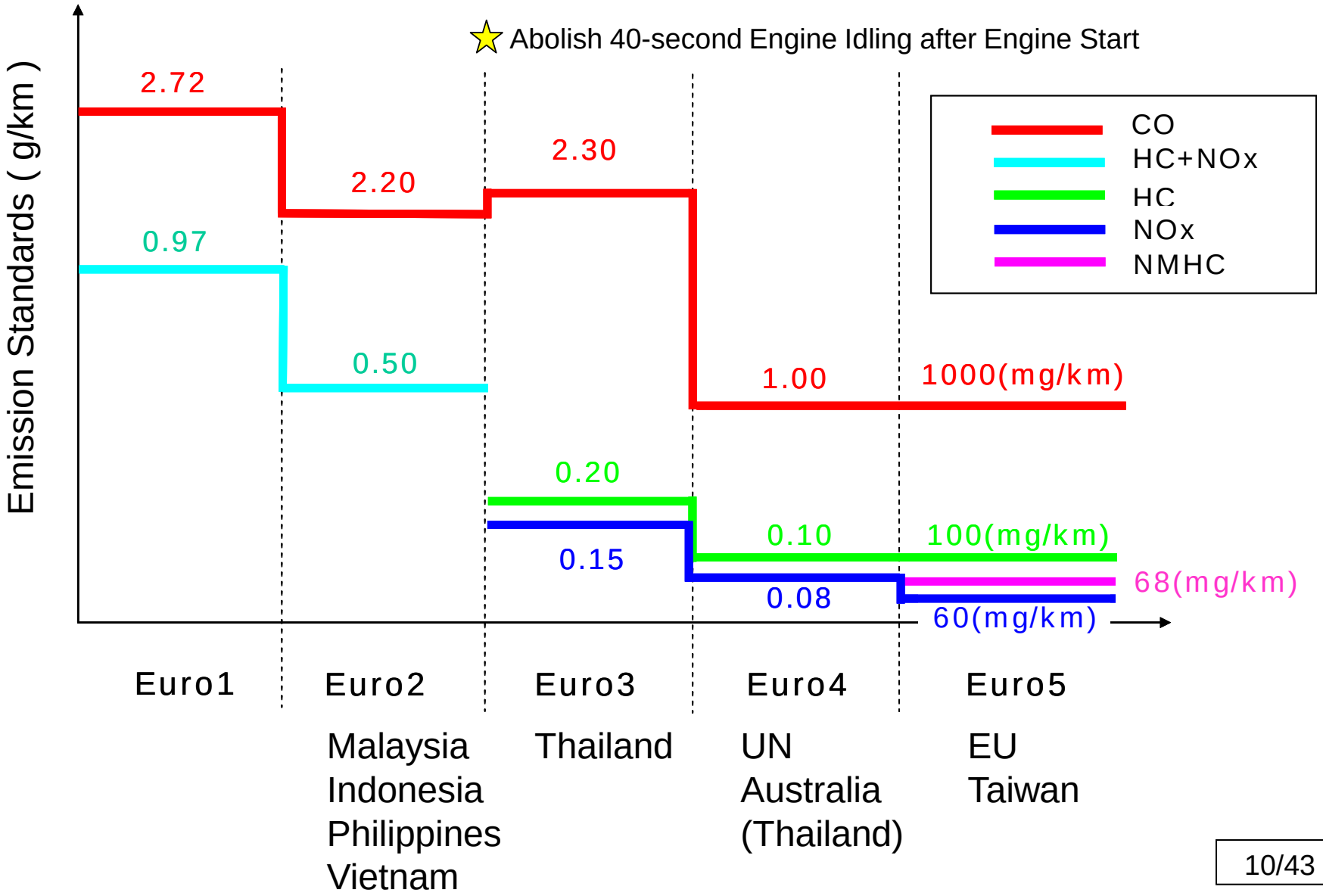
Addendum 82: Regulation No. 83

Revision 3

Incorporating all valid text up to:

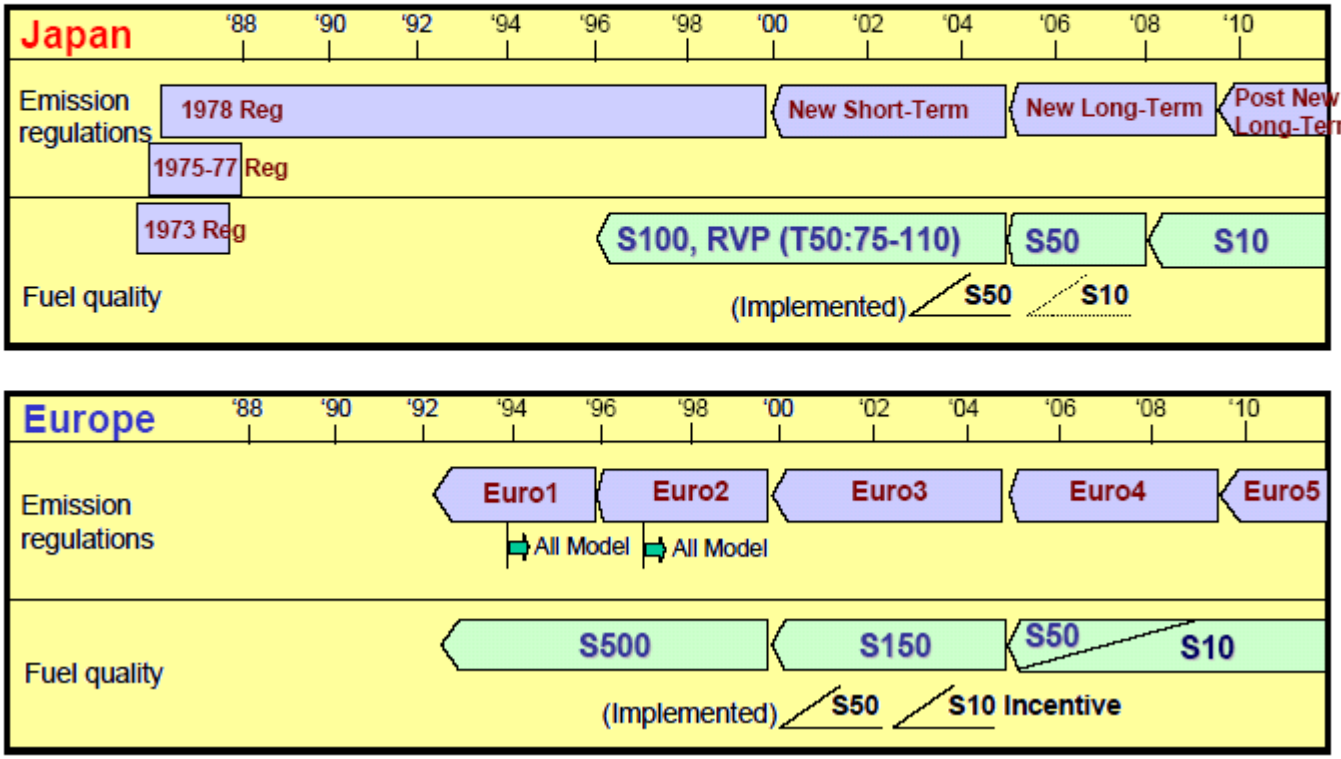
Incorporating all valid text up to the 05 series of amendments - Date of entry into force: 29 March 2001
Supplement 1 to the 05 series of amendments - Date of entry into force: 12 September 2001
Supplement 2 to the 05 series of amendments - Date of entry into force: 21 February 2002
Corrigendum 1 to the 05 series of amendments subject of Depositary Notification C.N.111.2002.TREATIES-1 dated 8 February 2002
Corrigendum 2 to the 05 series of amendments subject of Depositary Notification C.N.883.2003.TREATIES-1 dated 2 September 2003
Supplement 3 to the 05 series of amendments - Date of entry into force: 27 February 2004
Supplement 4 to the 05 series of amendments - Date of entry into force: 12 August 2004
Corrigendum 3 to the 05 series of amendments subject of Depositary Notification C.N. 1038.2004.TREATIES-1 dated 4 October 2004
Supplement 5 to the 05 series of amendments – Date of entry into force: 4 April 2005

History of Emission Standards



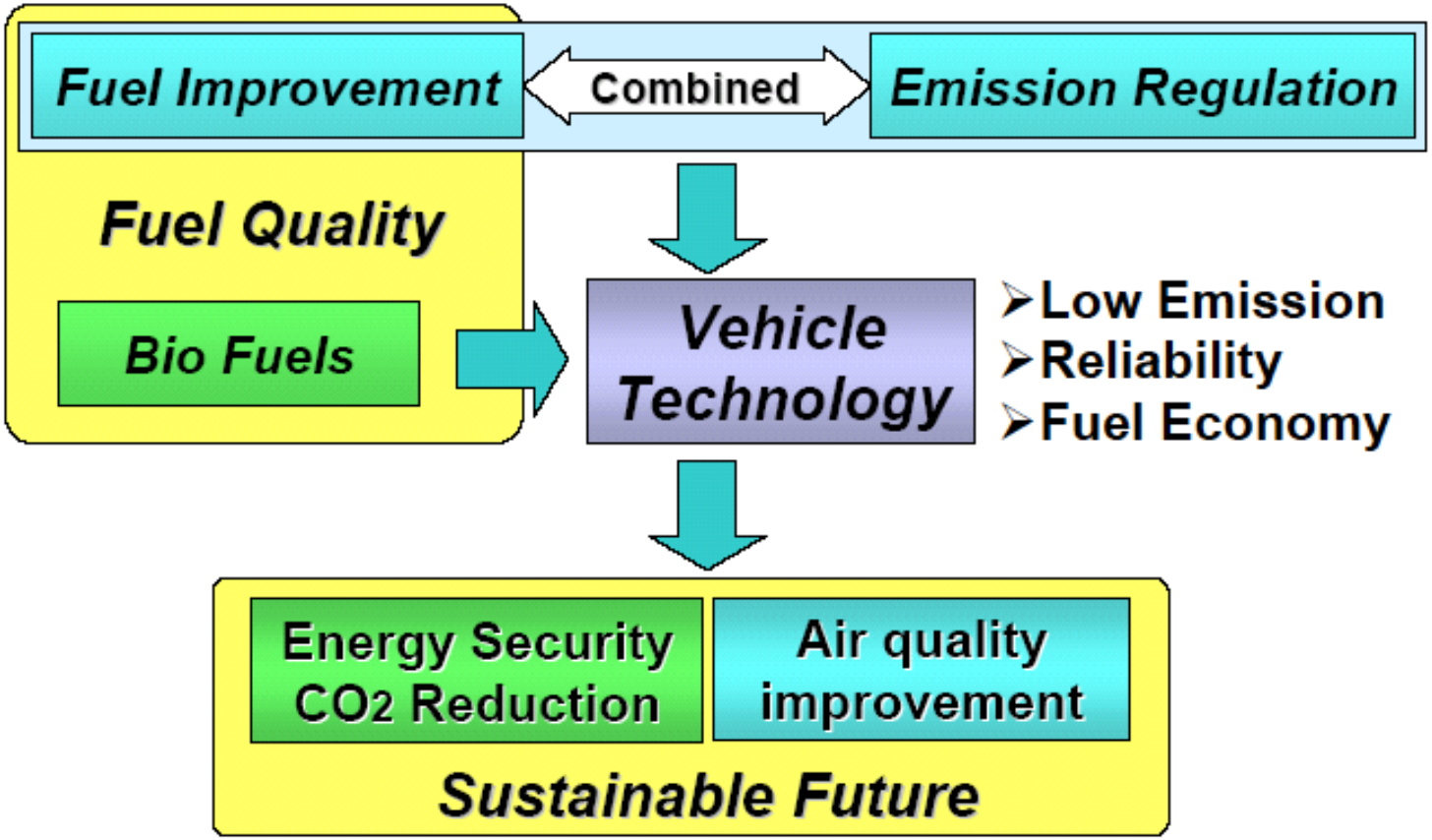
Emission and Fuel Regulations in JP & EU

(Gasoline)



Emission regulation has been enforced under fuel improvement.

Relations between Fuel Improvement and Vehicle Technology



Gasoline Quality for Low Emissions

Fuel quality to maximize the catalyst performance;

- **For air fuel ratio control**
  - **Distillation properties (and RVP)**
  - **Detergent (preventing deposits)**
- **For quicker warm up of catalyst**
  - **Lowering sulfur**
- **For keeping higher conversion efficiency**
  - **Lowering sulfur**
  - **Metal Free**

Contents of UN Regulation R83-S5

Contents of UN Regulation R83-5

ANNEXES

Scope

- This Regulation applies to vehicles of categories M and N 1/ as shown by Table A, with regard to the tests foreseen for these vehicles in Table B.

Table A

Vehicle category	Max. mass	Positive-ignition engined vehicles including hybrid vehicles			Compression-ignition engined vehicles including hybrid vehicles
		Petrol	NG	LPG	Diesel
M_1	< 3.5 t	R83	R83	R83	R83
	> 3.5 t	R83	-	-	-
M_2	-	R83	-	-	R49 or R83
M_3	-	R83	-	-	-
N_1	-	R83	R49 or R83	R49 or R83	R49 or R83
N_2	-	R83	-	-	R49 or R83
N_3	-	R83	-	-	-

Scope

Table B

Different routes for type-approval and extensions

Type-approval test	Positive-ignition engined vehicles of categories M and N			Compression-ignition engined vehicles of categories M_1 and N_1
	Petrol-fuelled vehicle	Bi-fuel vehicle	Mono-fuel vehicle	
Type I	Yes (maximum mass ≤ 3,5 t)	Yes (test with both fuel types) (maximum mass ≤ 3,5 t)	Yes (maximum mass ≤ 3,5 t)	Yes (maximum mass ≤ 3,5 t)
Type II	Yes	Yes (test with both fuel types)	Yes	-
Type III	Yes	Yes (test only with petrol)	Yes	-
Type IV	Yes (maximum mass ≤ 3,5 t)	Yes (test only with petrol) (maximum mass ≤ 3,5 t)	-	-
Type V	Yes (maximum mass ≤ 3,5 t)	Yes (test only with petrol) (maximum mass ≤ 3,5 t)	Yes (maximum mass ≤ 3,5 t)	Yes (maximum mass ≤ 3,5 t)
Type VI	Yes (maximum mass ≤ 3,5 t)	Yes (maximum mass ≤ 3,5 t) (test only with petrol)	-	-
Extension	Section 6	Section 6	Section 6	Section 6; M_2 and N_2 with a reference mass ≤ 2 840 kg (1)
On-board diagnostics	Yes, in accordance with section 8.1.1 or 8.4	Yes, in accordance with section 8.1.2 or 8.4	Yes, in accordance with section 8.1.2 or 8.4	Yes, in accordance with sections 8.2, 8.3 or 8.4

"Bi-fuel vehicle" means a vehicle that can run part-time on petrol and also part-time on either LPG or NG.

"Mono-fuel vehicle" means a vehicle that is designed primarily for permanent running on LPG or NG, but may also have a petrol system for emergency purposes for starting only, where the petrol tank does not contain more than 15 litres of petrol;

Type Approval Tests

Type Approval Tests

Std. / Requirement	Euro 1 (91/441/EEC)	Euro 2 (94/12/EC)	Euro 3 (98/69/EC)	Euro 4 (98/69/EC)	Euro 5 (EC715/2007)	Euro 6 (EC715/2007)
ECE Reg.(R83/XXseries)	01	03	05（A)	05 (B)	06	-
Type I Test (Tailpipe Emissions) Driving Cycle：NEDC	○	○	○ (No 40-sec. Idle)	○ (No 40-sec. Idle)	○ (No 40-sec. Idle)	○ (No 40-sec. Idle)
Type II Test (Idle Emissions) *	○	○	○	○	○	○
Type III Test (Crank Case Emissions)*	○	○	○	○	○	○
Type IV Test (Evaporative Emissions) *	○ (2g/test)	○ (2g/test)	○VT-SHED (2g/test)	○VT-SHED (2g/test)	○VT-SHED (2g/test)	○VT-SHED (2g/test)
Type V Test (Durability)	○ (80,000km)	○ (80,000km)	○ (80,000km)	○ (80,000km)	○ (160,000km)	○ (160,000km)
Type VI Test (Cold CO/HC Emissions) *	-	-	○	○	○	○
Test Fuel	E0	E0	E0	E0	E5,B5	E5,B5
OBD	-	-	○	○	○	○
OBD IUPR	-	-	-	-	○	○
COP	○	○	○	○	○	○
In-use COP	-	-	○	○	○	○

* : No Requirement for Vehicle with Compression Ignition Engine

Type Approval Tests

Contents

Type I Tailpipe emission ▶ Current Malaysia Regulation

Type II Idling emission

Type III Crankcase gases emissions

Type IV Evaporative emissions

Type V Durability of anti-pollution devices

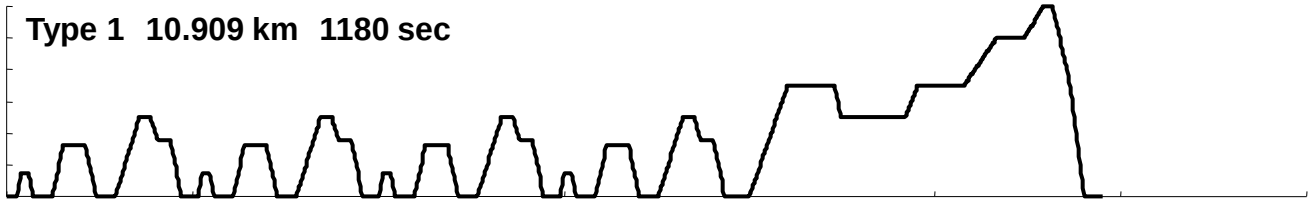
Type VI Low ambient temperature emissions

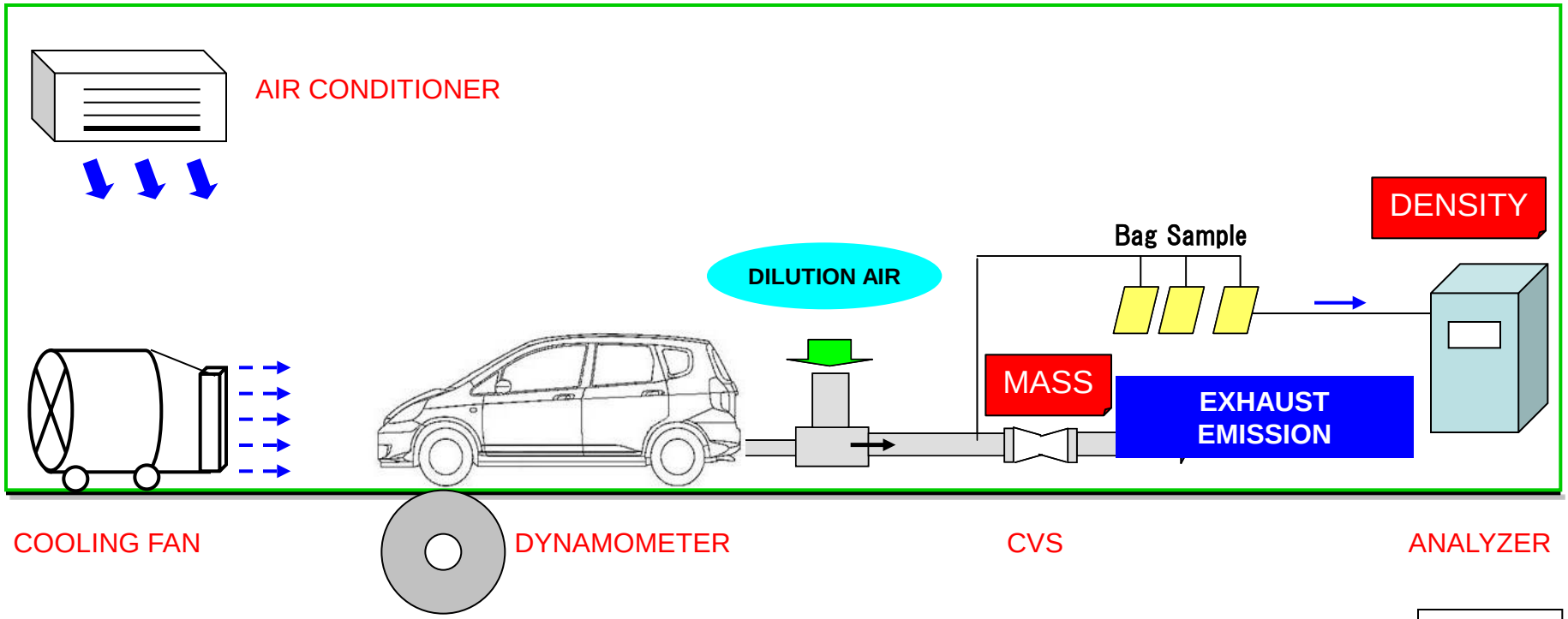
OBD On-board-diagnostic system

Type Approval Tests

Type I Test

Tailpipe emissions emitted from cold engine start to the end of driving cycle are measured. The emissions must not exceed applicable emission limits.



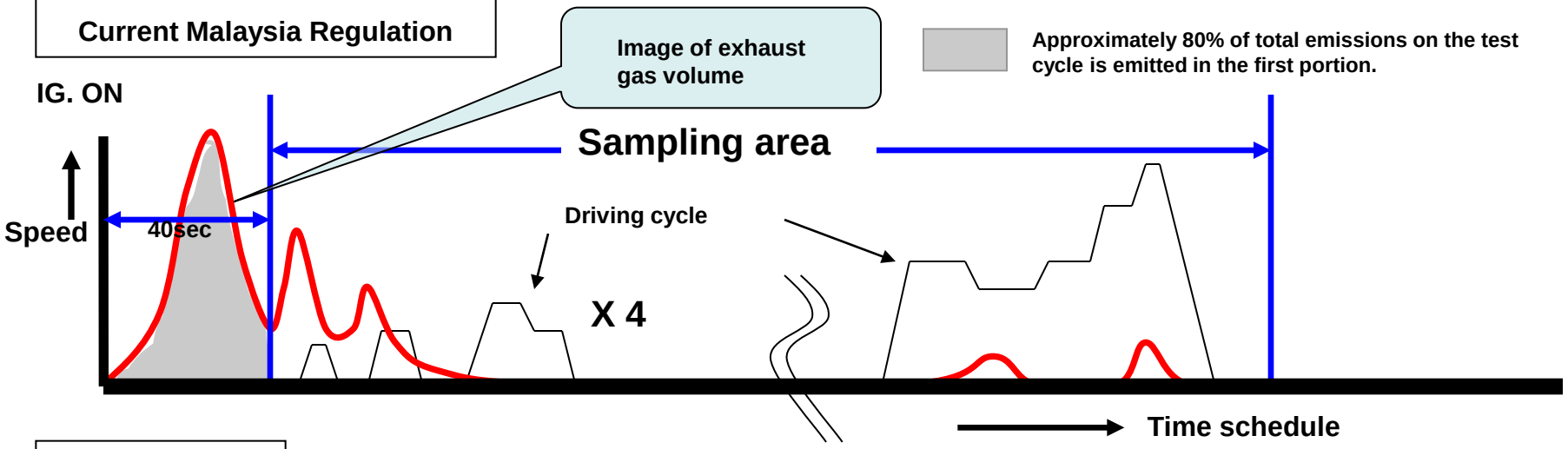


Type Approval Tests

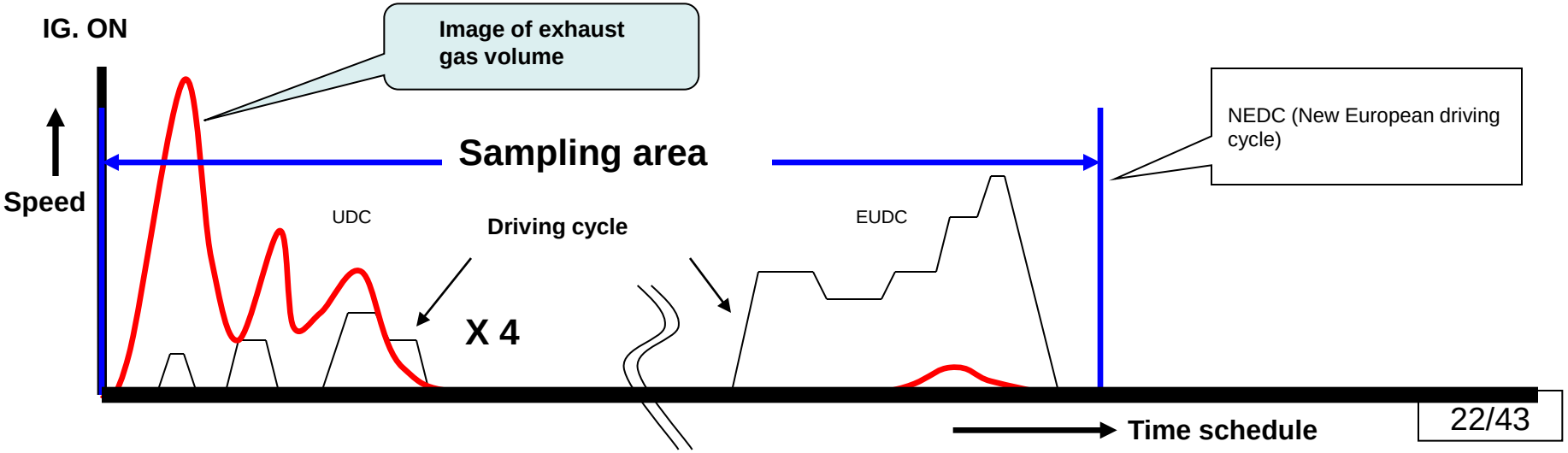
Type I Test

~ R83 S3

Current Malaysia Regulation



R83 S4 ~

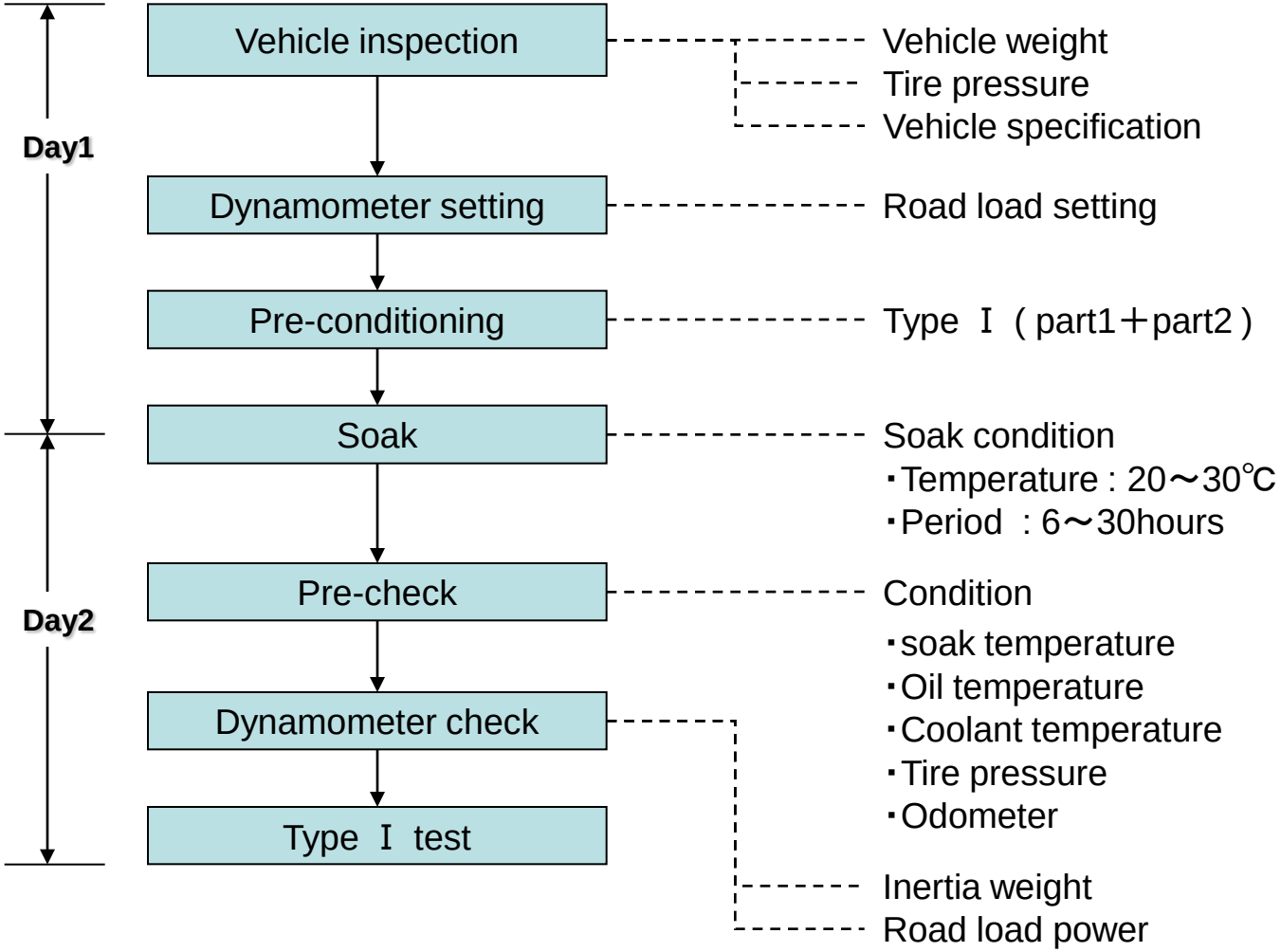


Type Approval Tests

Type I Test

For EURO5 & EURO6, CH4 Analyzer and PN measurement systems are necessary

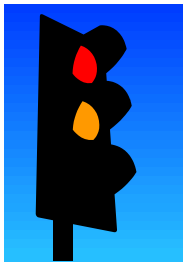
Test Procedure



Type II Test

Carbon monoxide emissions are measured at normal and high engine idle speeds.

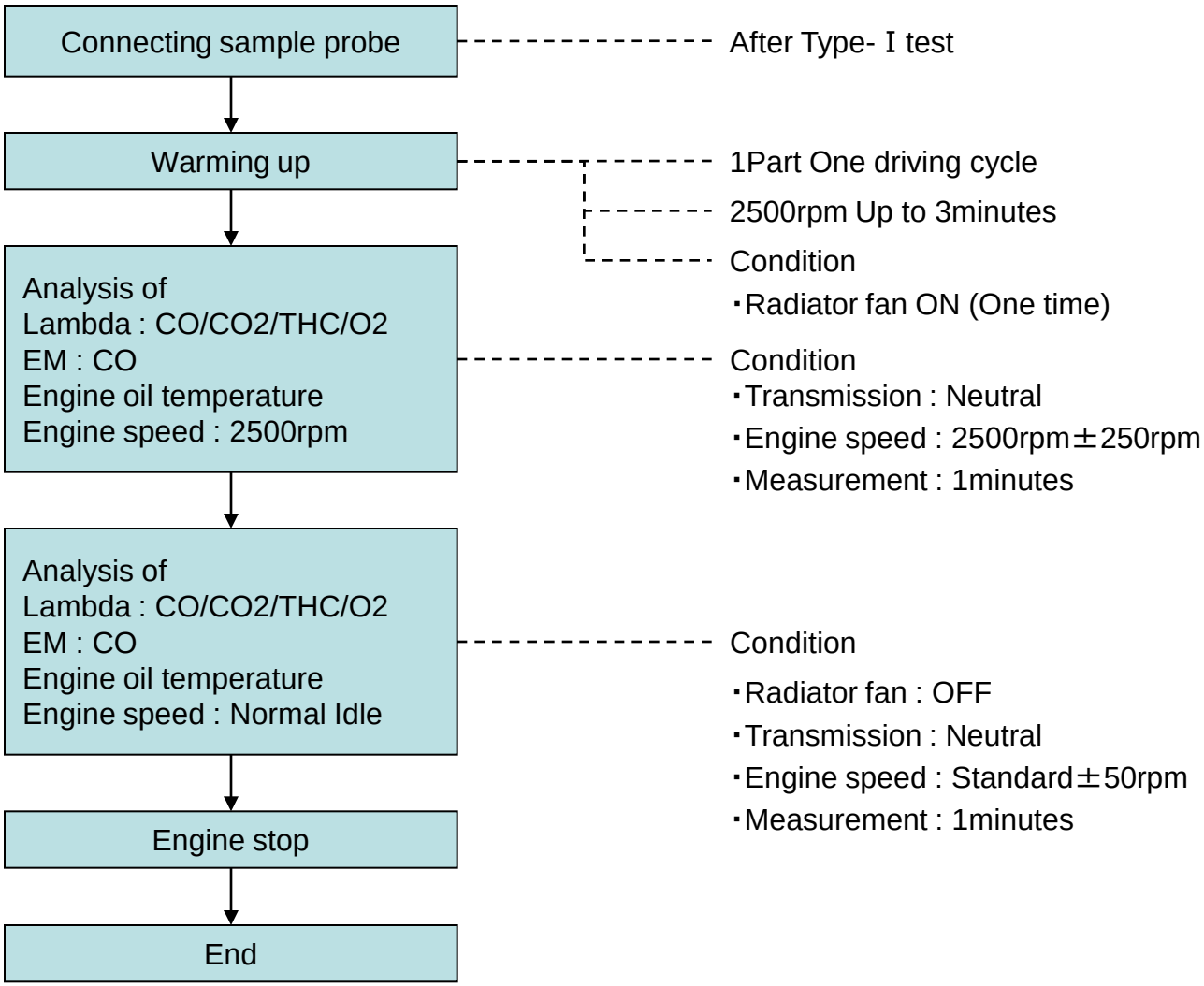
The carbon monoxide content by volume of the exhaust gases emitted at the engine idling must not exceed 3.5%.



Type Approval Tests

Type II Test

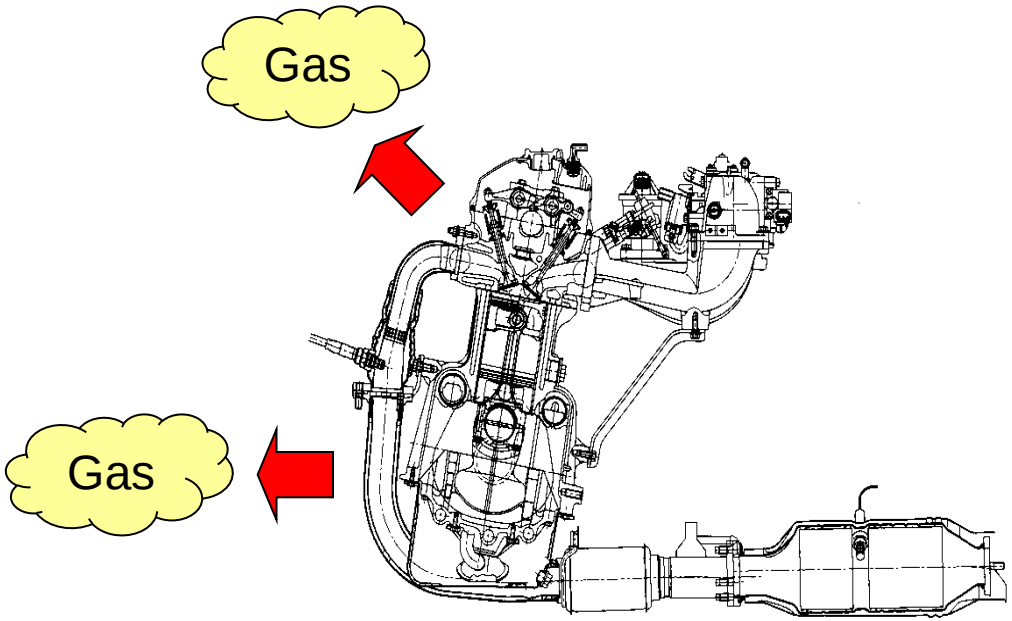
Test Procedure



Type III Test

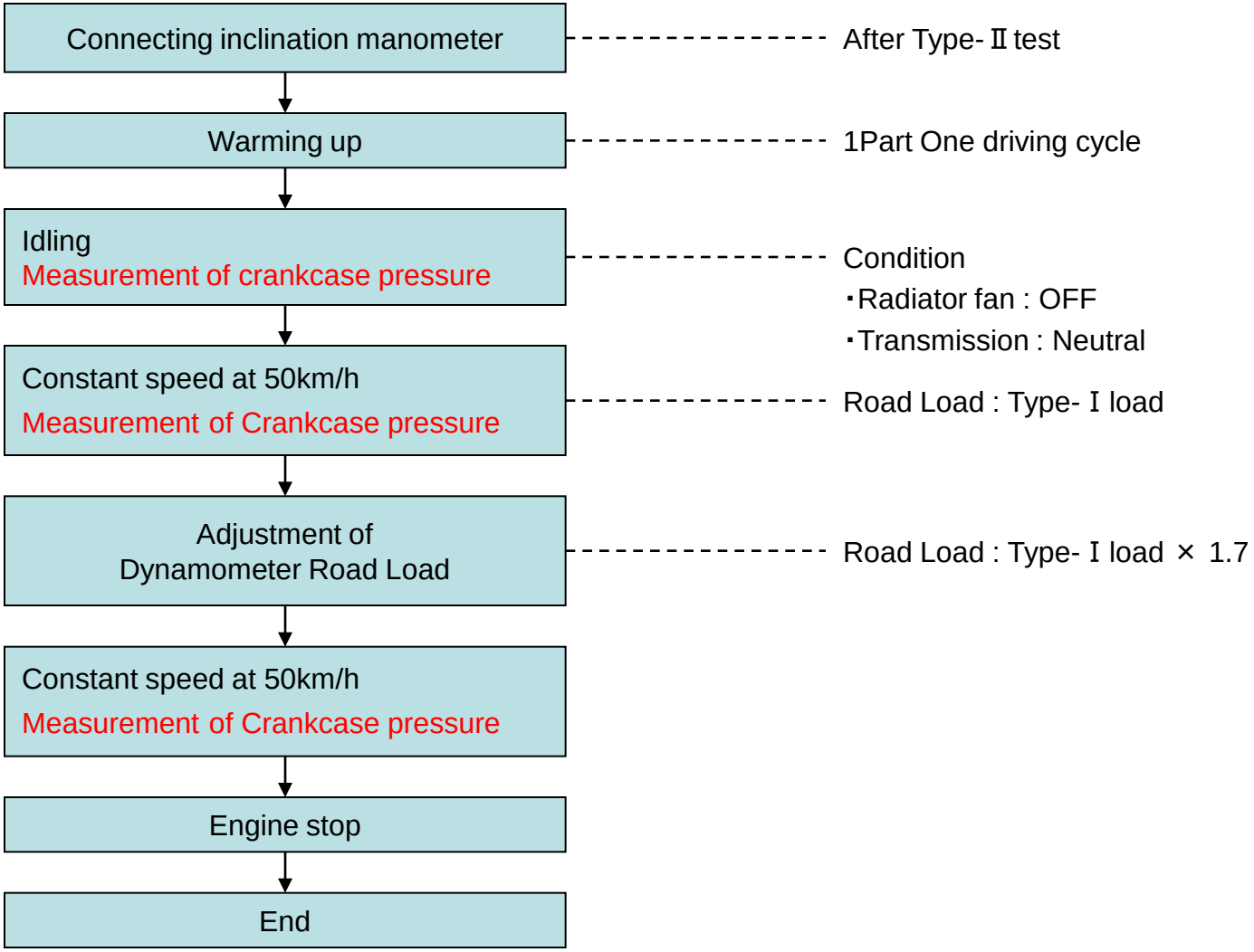
Any crankcase gas must not be released into atmosphere.

The crankcase pressure is measured at a cruse driving. The crankcase pressure must not exceed atmospheric pressure during the measurement time.



Type III Test

Test Procedure



Type Approval Tests

Type IV Test

Hydrocarbon emissions are measured during a short vehicle parking after the vehicle operates (hot soak), and during a diurnal vehicle parking.

The evaporative emission tests consist of the following phases:

- Urban (Part One) and extra-urban (Part Two) driving
- Hot soak loss measurement (HSL) : 1 hour
- Diurnal breathing loss measurement (DBL) : 24 hours

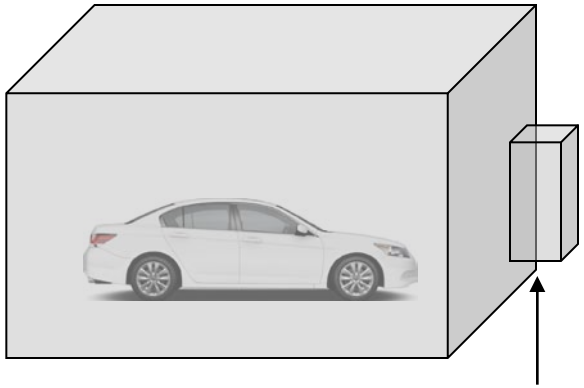
Total emissions of HSL and DBL must not exceed emission limit of 2g.

Type Approval Tests

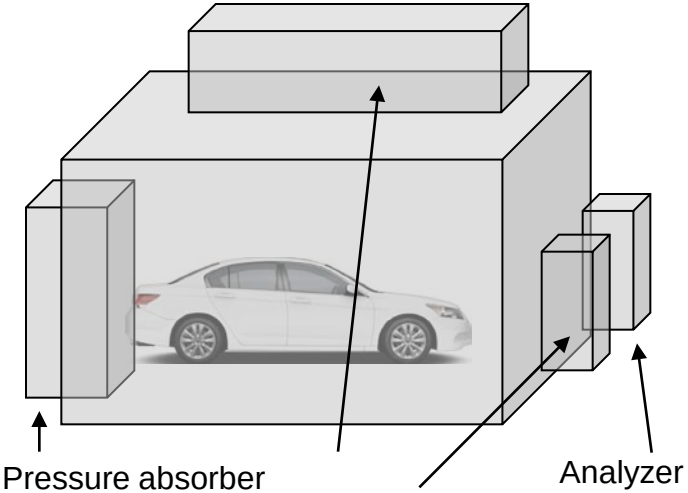
Type IV Test

Test Equipments

Normal SHED(91/441/EC)

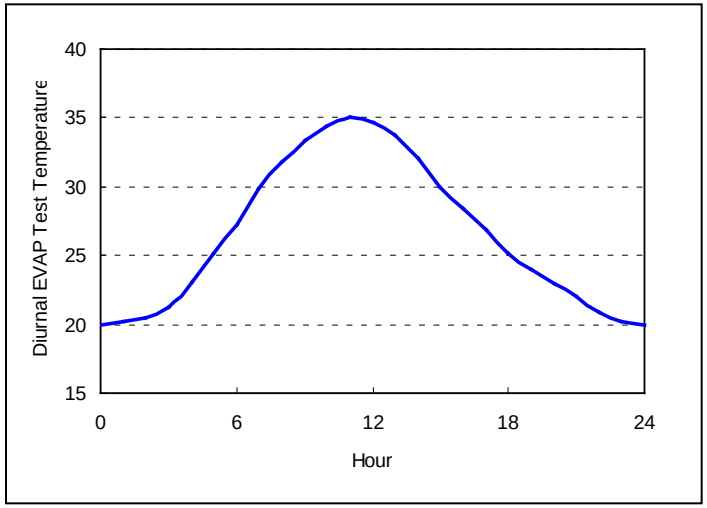


VT-SHED(98/69/EC~)

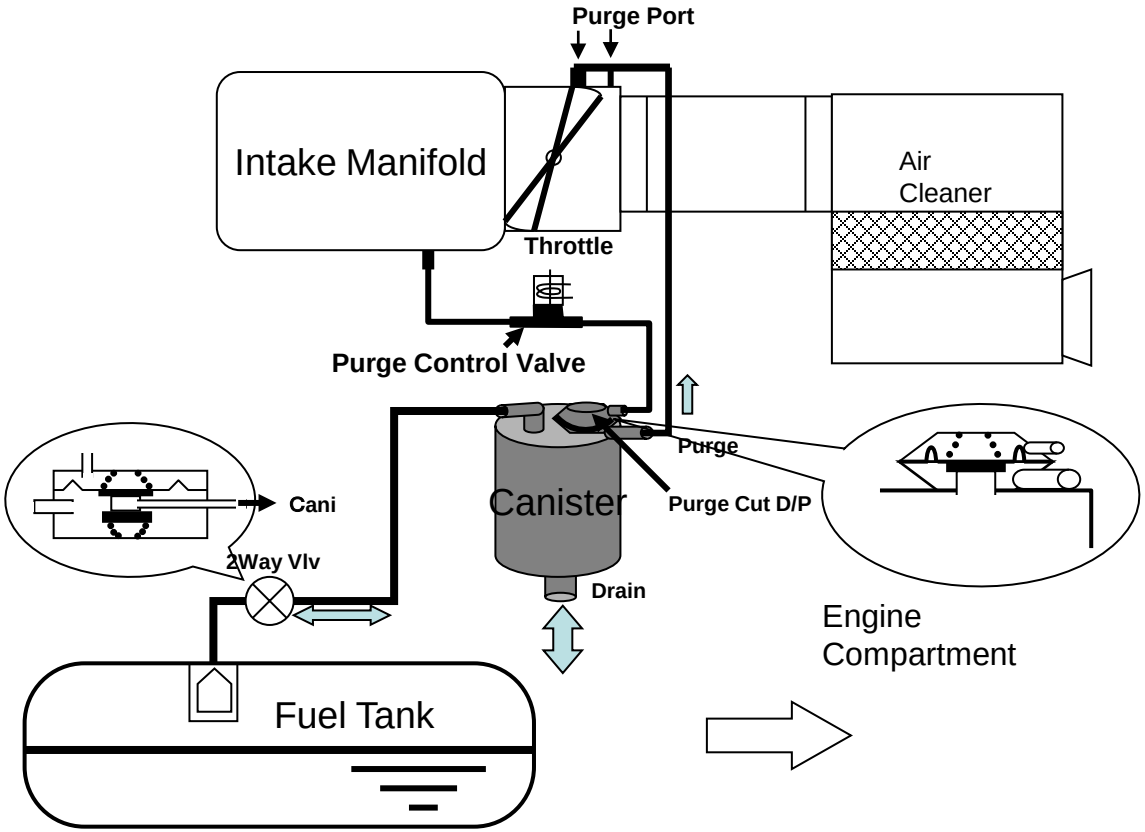


VT SHED

DBL Test Temperature Profile



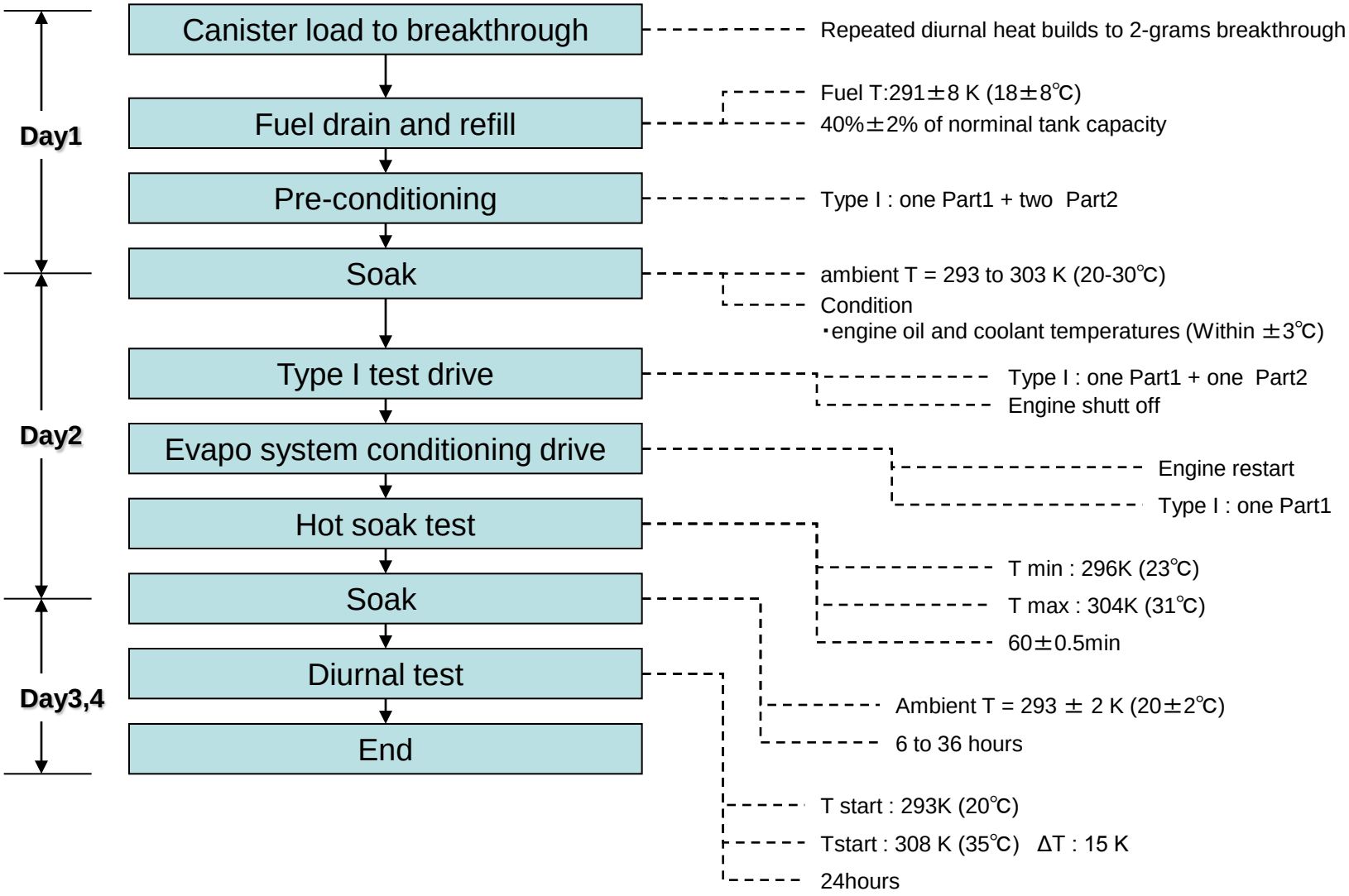
Evaporative Emission Control System



Type Approval Tests

Type IV Test

Test Procedure



Type V Test

The following deterioration factors are applied to emission results of certification test vehicle to estimate the useful life emission level.

		Deterioration factors				
	Pollutant	CO	HC	NO_x	HC + NO_x (1)	Particulates
Engine Category	Positive-ignition Engine	1.2	1.2	1.2	-	-
	Compression-ignition engine	1.1	-	1	1	1.2

(1) For compression ignition engined vehicles

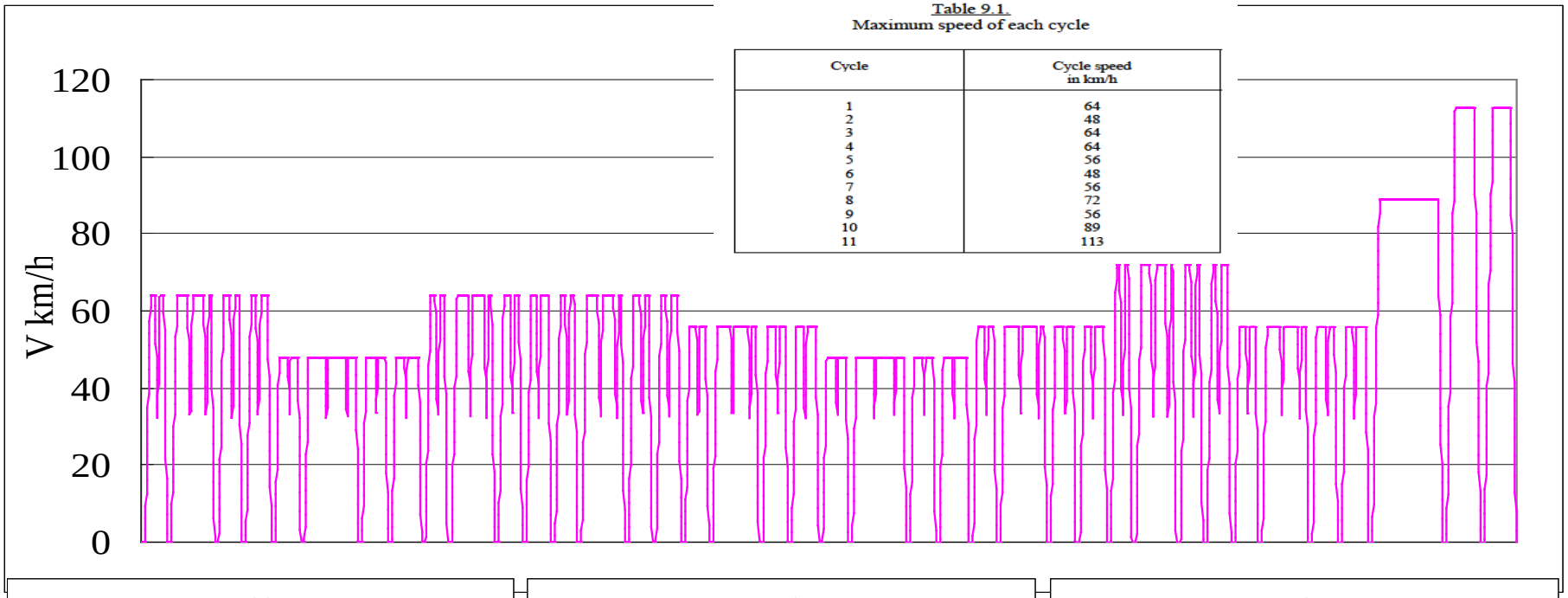
In stead of using the above deterioration factors, a manufacturer can choose to conduct durability tests.

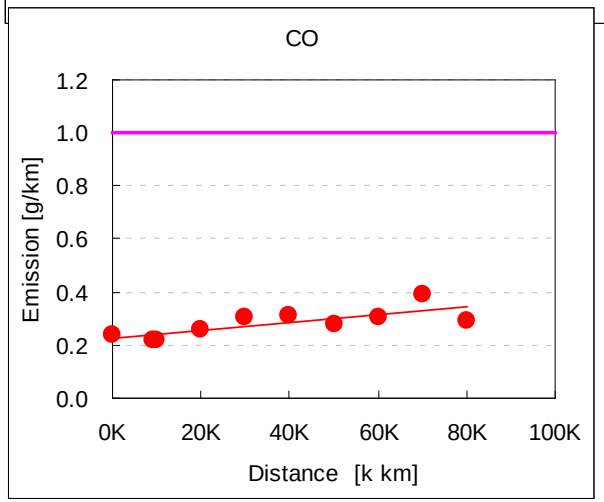
Type Approval Tests

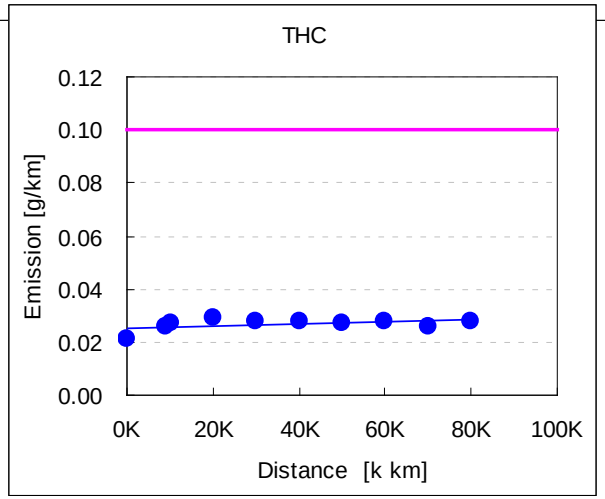
Type V Test

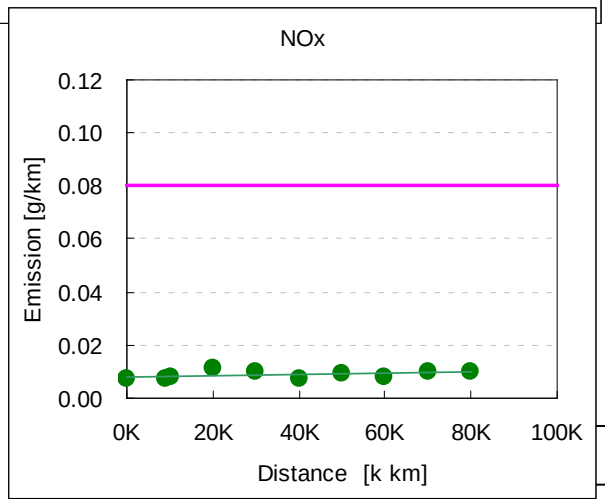
Table 9.1.
Maximum speed of each cycle

Cycle	Cycle speed in km/h
1	64
2	48
3	64
4	64
5	56
6	48
7	56
8	72
9	56
10	89
11	113









Type Approval Tests

Type VI Test

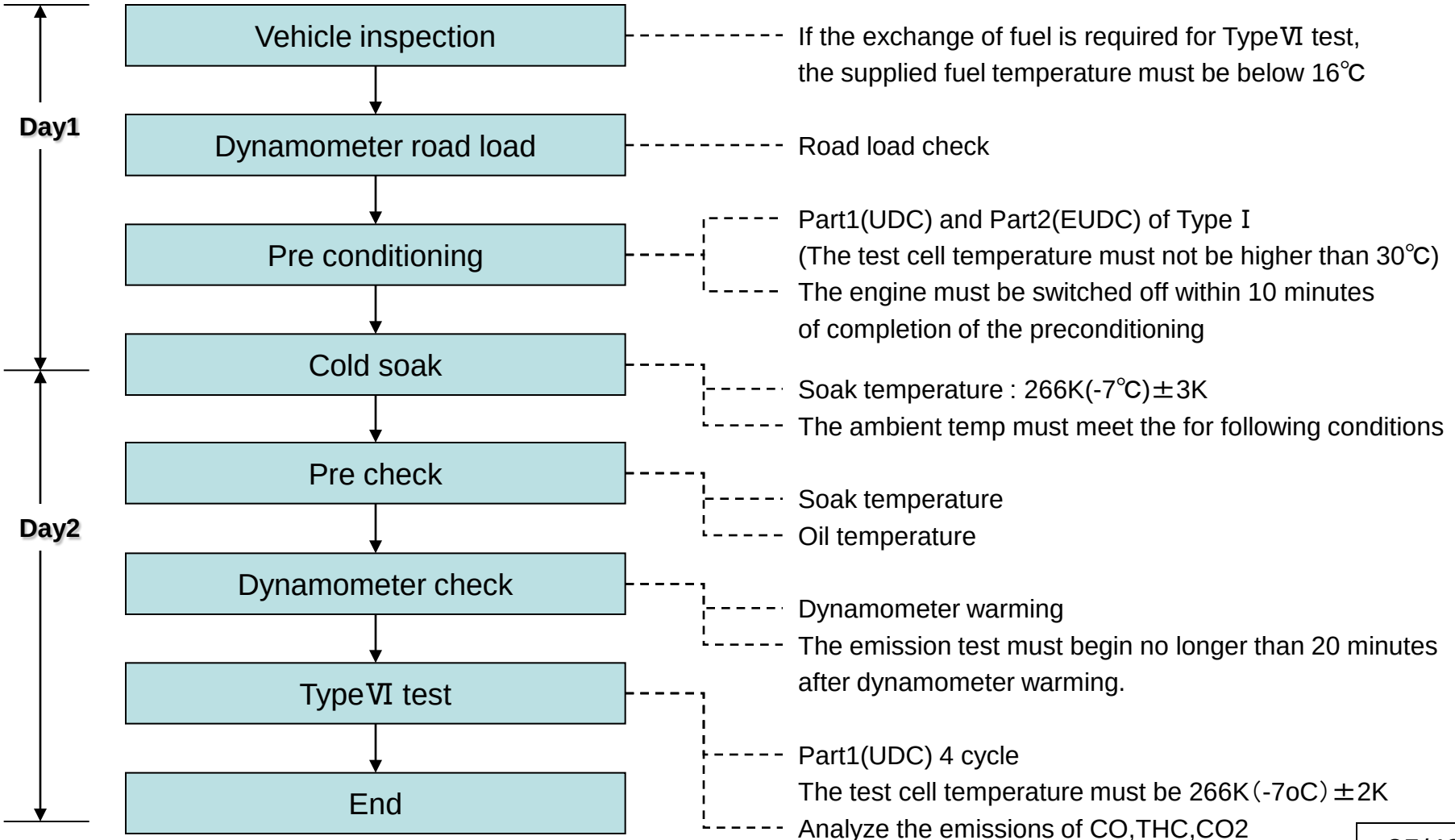
Carbon monoxide and hydrocarbon tailpipe emissions emitted from cold engine start to the end of driving cycle are measured at low atmospheric temperature of 266 degrees K ± 3 degrees K (-6.7 degrees C).

The CO and HC emissions must not exceed emission limits of 15g/km and 1.8g/km, respectively.

Type Approval Tests

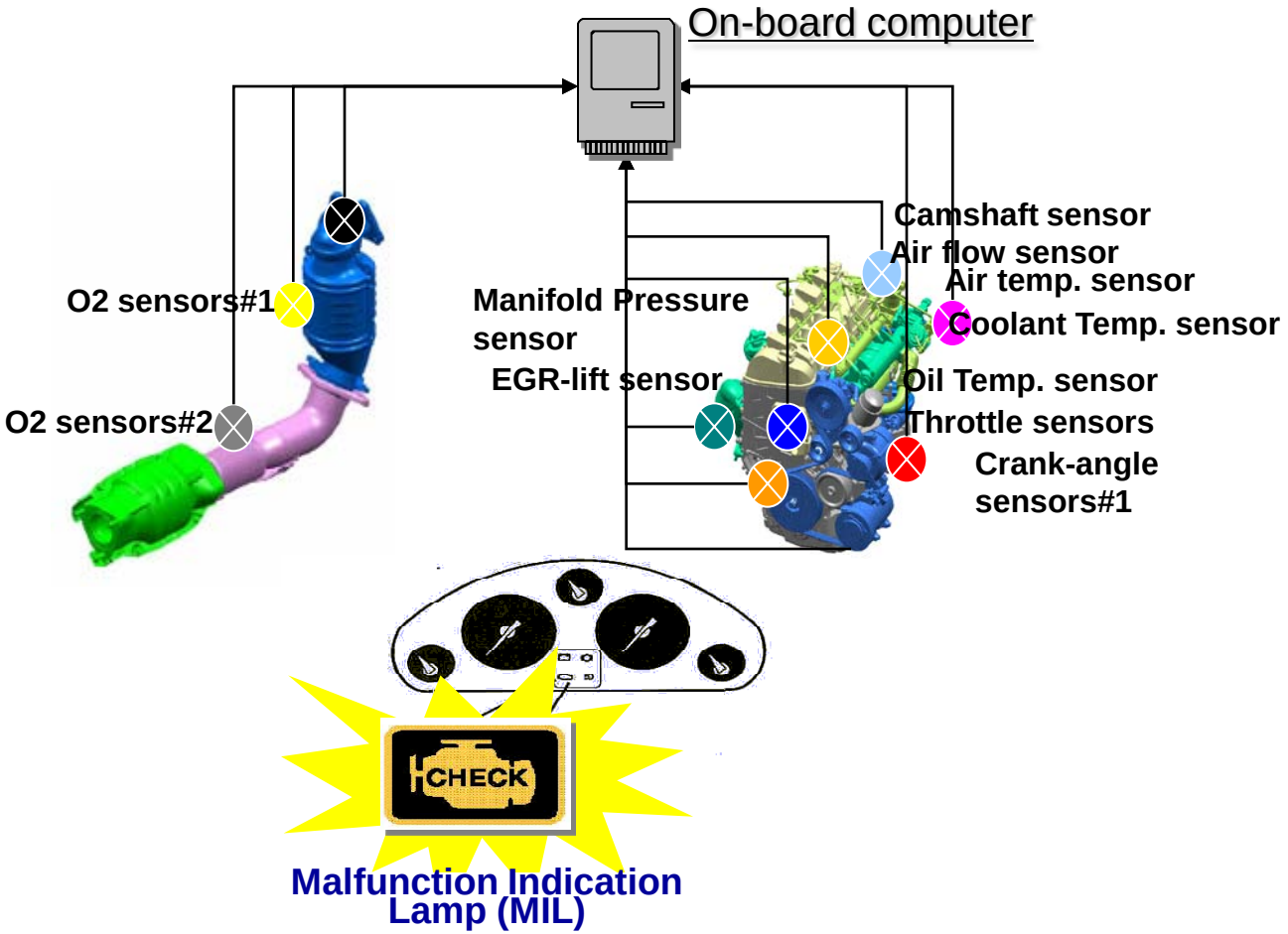
Type VI Test

Test Procedure



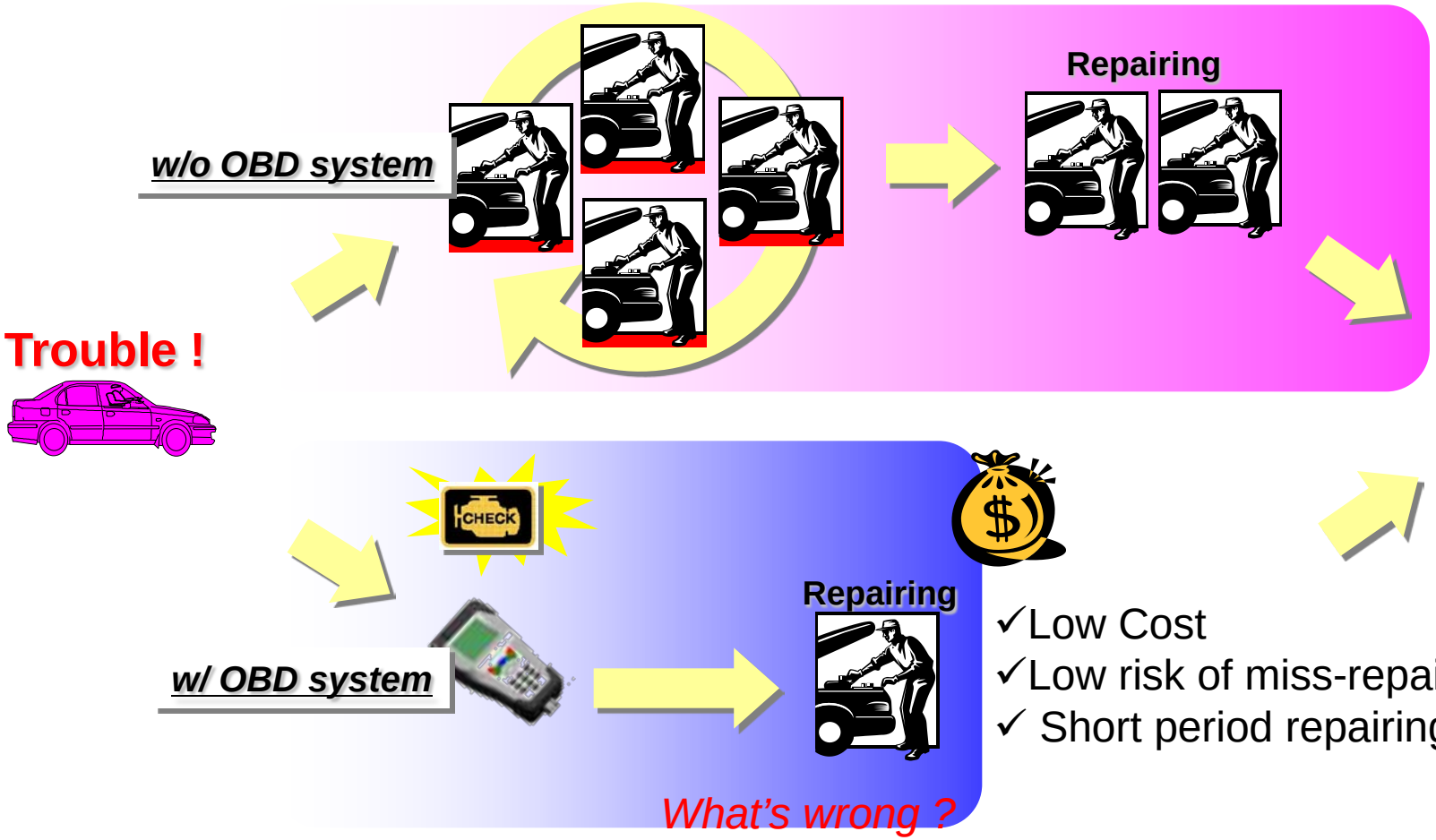
On-board Diagnostic System (OBD)

On-board computer watches whether or not emission related components or systems correctly work. If the computer detects malfunction or deterioration of the component, malfunction indicator light (MIL) in the instrument panel will be illuminated to make a driver realize some problem occurs.



Type Approval Tests

OBD



✓Low Cost
✓Low risk of miss-repairing
✓ Short period repairing

A repair technician can use a scan tool to diagnose emission related components

Type Approval Tests

OBD

In according to Appendix1 in Annex 11, demonstration tests are defined as follows. (minimum request)

	Monitor Devices	*Malfunctions*	*Emission Measure*[*1]	*OBD Test Tools*[*2]
1. Catalyst Diagnosis	Catalytic converter	Catalyst Deterioration	Available	Deteriorated catalyst
2. Misfiring Diagnosis	Misfiring	Unique/multi-cylinder misfiring	Available	Simulator
3. O2 sensor Diagnosis	O2 sensor	Sensor un-active Circuit check	Available	Simulator
4. Input/Out sensor Diagnosis	EGR system	Low Flow-rate	Available	Simulator
	Fuel system	Amount of over-rich & over-lean	Available	Simulator
	2nd Air Injection	Injector of function/circuit check	NA	NA
5. Evapo.Purge control valve Diagnosis	Evaporation system	Leak and/or purge defect	NA	NA
6. Other Diagnosis	Electronic device	Function and/or circuit check	NA	NA

Note;

*1; not necessary when emission does NOT exceed OBD limit, and dependence of each manufacturer's strategy.
*2; methods and/or tools are dependence on manufacturers.

Type Approval Tests

OBD

Catalyst Test

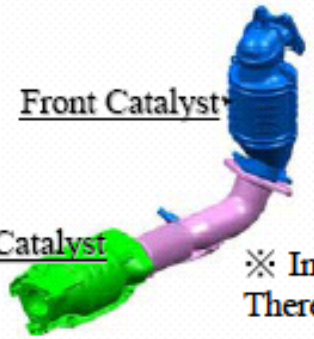
Removing "normal catalyst" (3 or more hours approx.)

Normal catalyst

Deteriorated catalyst

Manufacture strategy !
- by Heating Impact
- by Chemical Impact

Attaching "Deteriorated catalyst"(2 or more hours approx.)
※ 2 sets catalysts are mounted in V-type engine.



※ In case of combined catalyst, front catalyst must be deteriorated in prior to the rear catalyst. Therefore, the rear catalyst may be full-useful aged catalyst. It depends on manufacturer strategy.

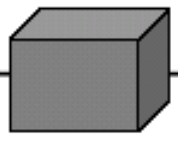
OBD

O2 Sensor Test

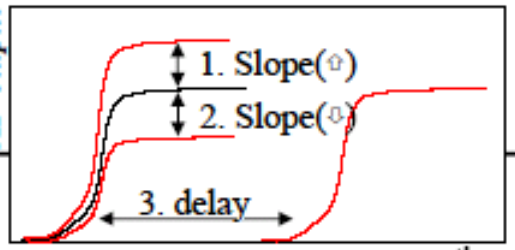
Regarding to "O2 sensor" demonstration,
"electrical simulator" is utilized to modify the sensor signal !
Simulated malfunctions are three types currently.

Simulated malfunction
A; large slope
B; small slope
C; response delay

Normal O2 sensor



Simulator Box



Power-train Computer

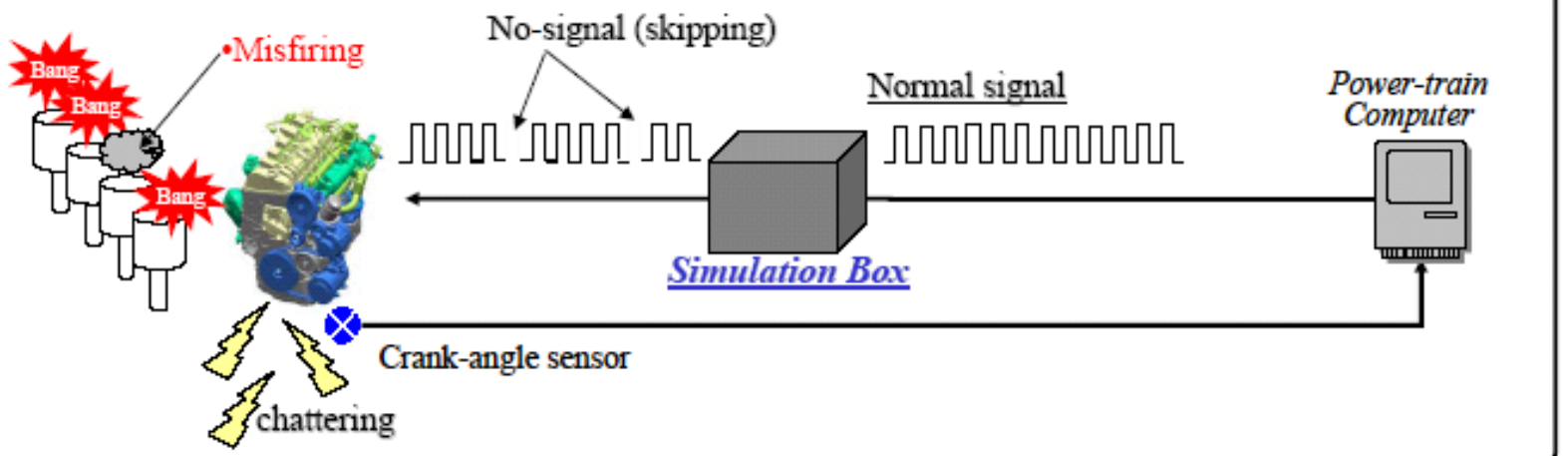
Engine Control

※ "The method" depends on Manufacture. It is required to confirm the principle and procedure before the test.

OBD

Engine Misfire Test

Regarding to "Misfiring" demonstration,
"electrical simulator" is utilized to generate no-igniting condition !
Simulated malfunctions are "single-order misfiring".



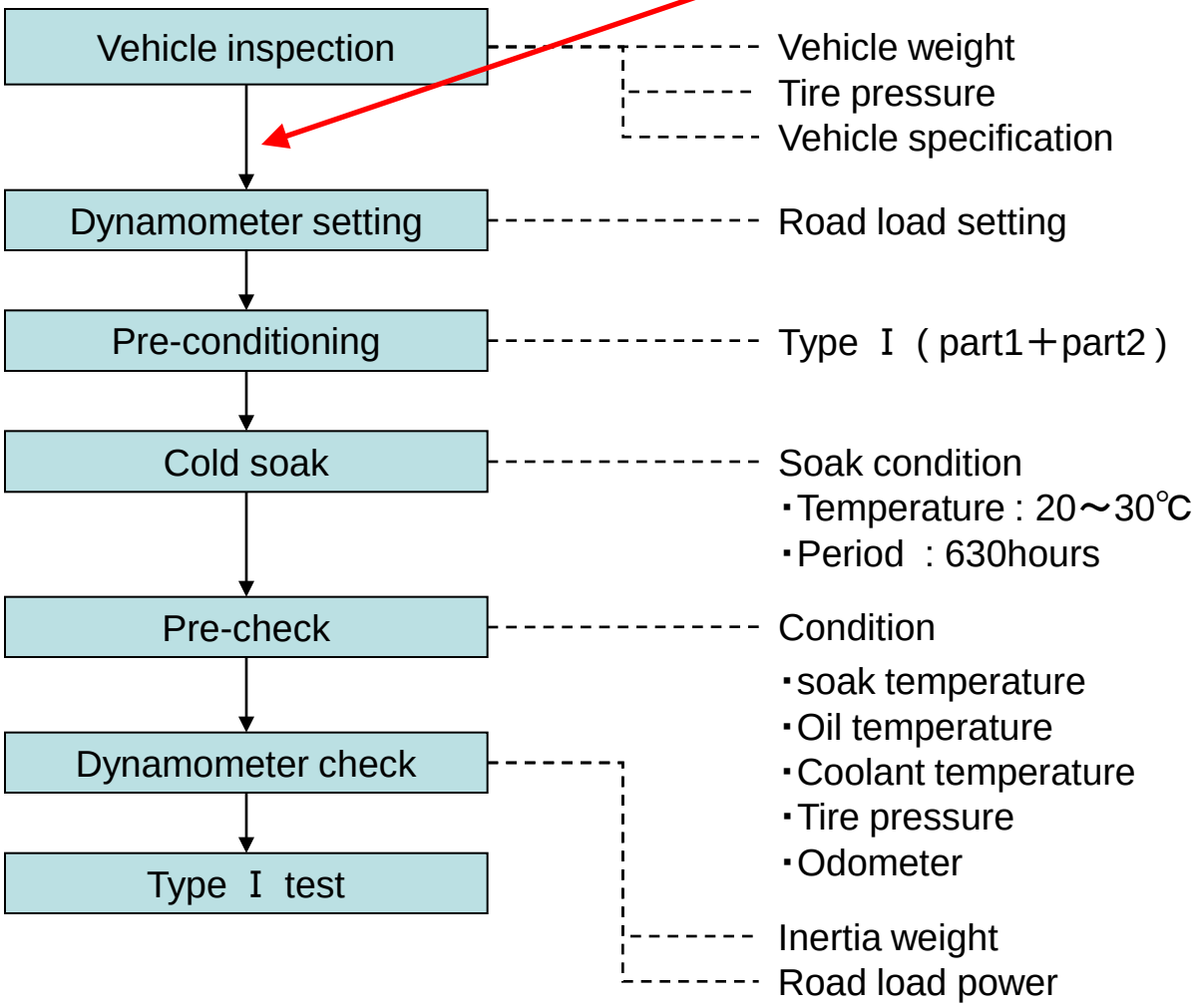
※ "Misfiring method" depends on Manufacture. It is required to confirm the principle and procedure before the test.

Type Approval Tests

OBD

Installation of the malfunction threshold item

Test Procedure



Thank you for your attention.

COP (Conformity of Production)

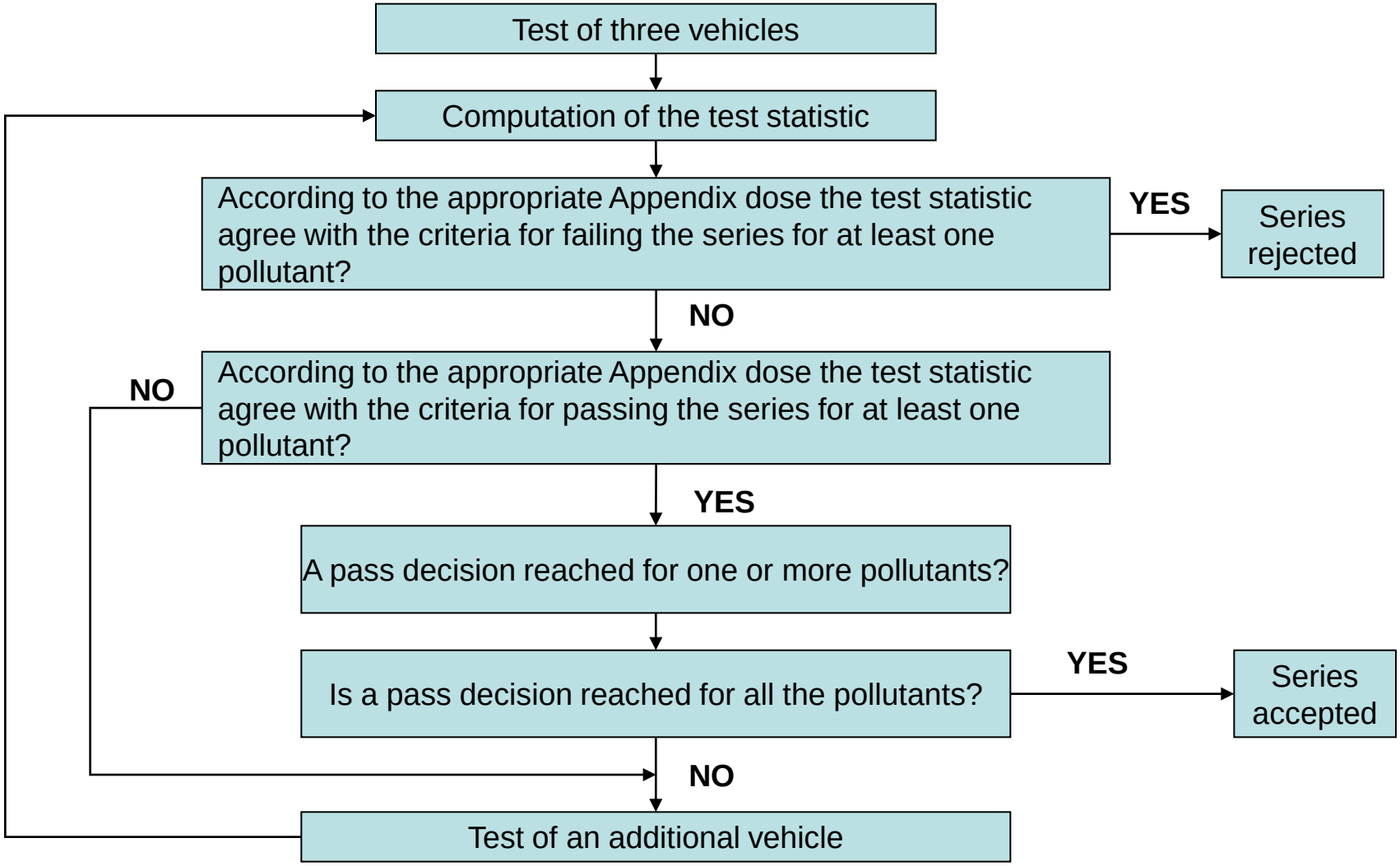
As a general rule, conformity of production with regard to limitation of emissions from the vehicle (test Types I, II, III, and IV) is checked based on the description given in the communication from and its annexes.

◆In case of Type I

- Three vehicles are selected at random in the series and are tested as described in Paragraph5.3.1. The deterioration factors are used in the same way. The limit values are given in paragraph5.3.1.4.
- The production of a series is deemed to conform or not to conform on the basis of a sampling test of the vehicle once a pass decision is reached for all the pollutants or a fail decision is reached for one pollutant, according to the test criteria applied in the appropriate Appendix.
- When a pass decision has been reached for one pollutant, that decision will not be changed by any additional tests carried out to reach a decision for the other pollutants. (figure 1 blow)

COP (Conformity of Production)

Figure 1



R100 General Information
- Technical Requirements -

July 17, 2012

JASIC
Kazuma OKURA

Contents

About R100

History

1997/02 ECE R100-00

2007/09 ELSA[1)] in GRSP

2007/11 Japanese Regulation
(Attachment 110[2)])

2010/12 ECE R100-01

[1)] Informal Group on Electric Safety

[2)] Technical Standard for Protection of Occupants against High Voltage in Electric Vehicles and Hybrid Electric Vehicles

About R100

Target

<EV>

<HV>

<FCV>

Technical Requirements
0. Definition

<High Voltage>
the classification of an electric component or circuit, if its working voltage is > 60 V and < 1500 V DC or > 30 V and < 1000 V AC root mean square (rms).

<Rechargeable energy storage system (RESS)>
the rechargeable energy storage
system that provides electric energy for electric propulsion.

<Electric power train>
the electrical circuit which includes the traction motor(s), and may include the RESS, the electric energy conversion system, the electronic converters, the associated wiring harness and connectors, and the coupling system for charging the RESS.

Technical Requirements
1. Protection against Electoric Shock

Protection against Direct Contact

<Requirement>

The protection against direct contact with live parts[1)] shall comply with IPXXD[2)] inside the passenger compartment or luggage compartment and IPXXB[3)] in areas other than the passenger compartment or luggage compartment. These protections (solid insulator, barrier, enclosure, etc.) shall not be able to be opened, disassembled or removed without the use of tools.

1) live parts : the conductive parts intended to be electrically energized in normal use.
2) IPXXB, IPXXD : protection degrees

<Purpose>

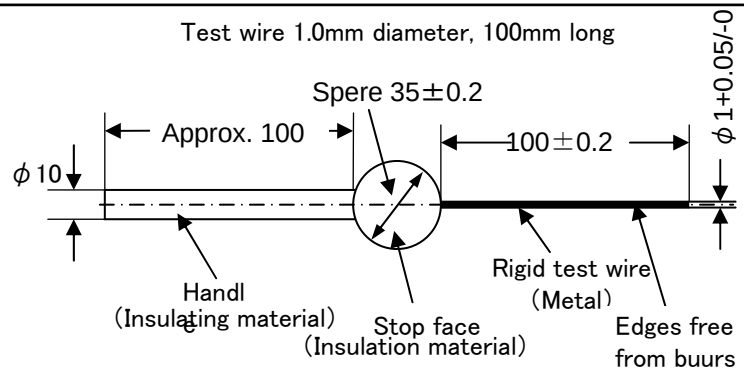
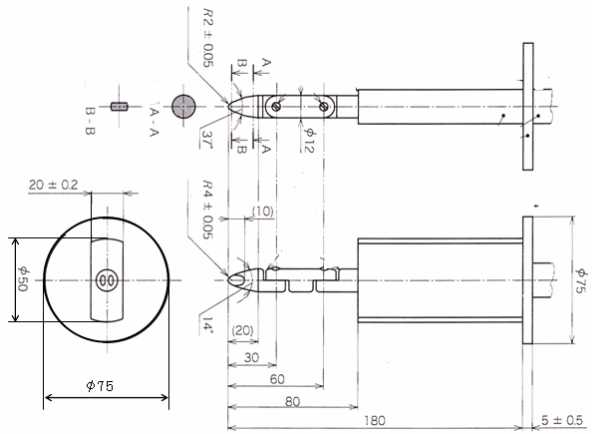
to prevent human body from touching “high voltage”.

<Measure>

barrier, enclosure : ex. aluminum casting case etc.
exception : connector, service disconnect

Technical Requirements
1. Protection against Electoric Shock

Protection against Direct Contact

Protection degrees	Access probe	Test force
IPXXD		10 N +/- 10%
IPXXB		1 N +/- 10%

Technical Requirements
1. Protection against Electoric Shock

Protection against Direct Contact

<Requirement>

The symbol shall appear on or near the RESS. The symbol background shall be yellow, the bordering and the arrow shall be black.

The symbol shall also be visible on enclosures and barriers, which, when removed expose live parts of high voltage circuits.
This provision is optional to any connector for high voltage buses
This provision shall not apply to any of the following cases:
(a) Where barriers or enclosures cannot be physically accessed, opened, or removed; unless other vehicle components are removed with the use of tools;
(b) Where barriers or enclosures are located underneath the vehicle floor.

<Requirement>

Cables for high voltage buses which are not located within enclosures shall be identified by having an outer covering with the colour orange.

<Purpose>

to prevent users from opening, disassmbling, removing unconsciously.

Technical Requirements
1. Protection against Electoric Shock

Protection against Indirect Contact

<Requirement>

For protection against electrical shock which could arise from indirect contact, the exposed conductive parts, such as the conductive barrier and enclosure, shall be galvanically connected securely to the electrical chassis by connection with electrical wire or ground cable, or by welding, or by connection using bolts, etc. so that no dangerous potentials are produced.

The resistance between all exposed conductive parts and the electrical chassis shall be lower than 0.1 ohm when there is current flow of at least 0.2 amperes.

<Purpose>

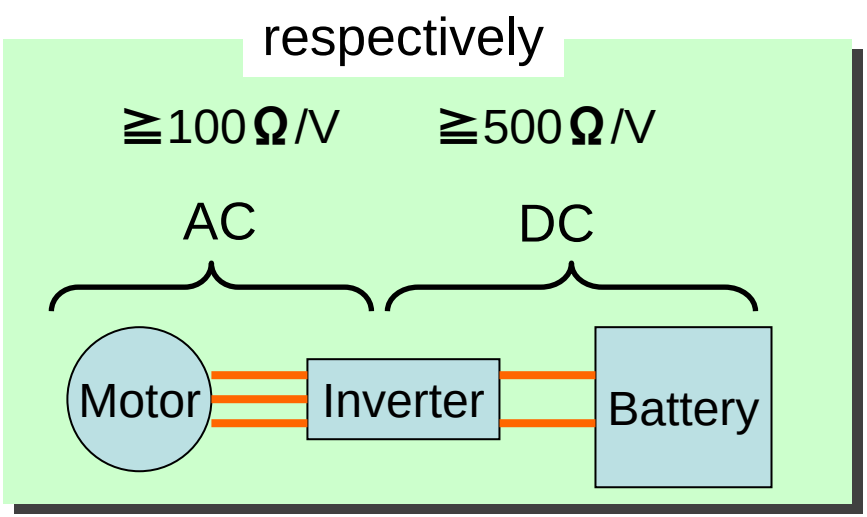
to prevent human body from getting an electric shock even if insulation resistance between the live parts and the exposed conductive parts decreases.

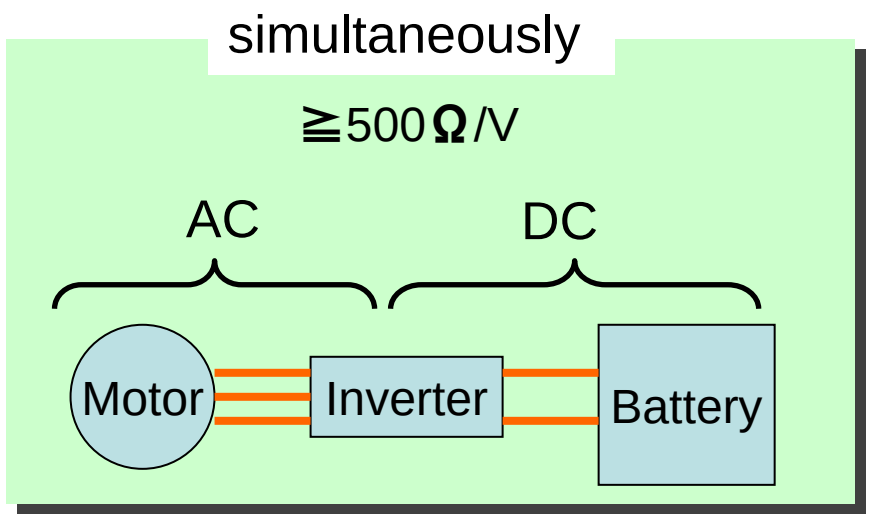
Technical Requirements
1. Protection against Electoric Shock

Insulation Resistance

<Requirement>

If AC high voltage buses and DC high voltage buses are galvanically isolated from each other, isolation resistance between the high voltage bus and the electrical chassis shall have a minimum value of 100 ohms/volt of the working voltage for DC buses, and a minimum value of 500 ohms/volt of the working voltage for AC buses.





Technical Requirements
1. Protection against Electoric Shock

Insulation Resistance

<Exception for Fuel cell vehicles>

If the minimum isolation resistance requirement cannot be maintained over time, then protection shall be achieved by any of the following:

(a) Double or more layers of solid insulators, barriers or enclosures that meet the requirement in paragraph 5.1.1. independently;

(b) On-board isolation resistance monitoring system together with a warning to the driver if the isolation resistance drops below the minimum required value.

<Reason>

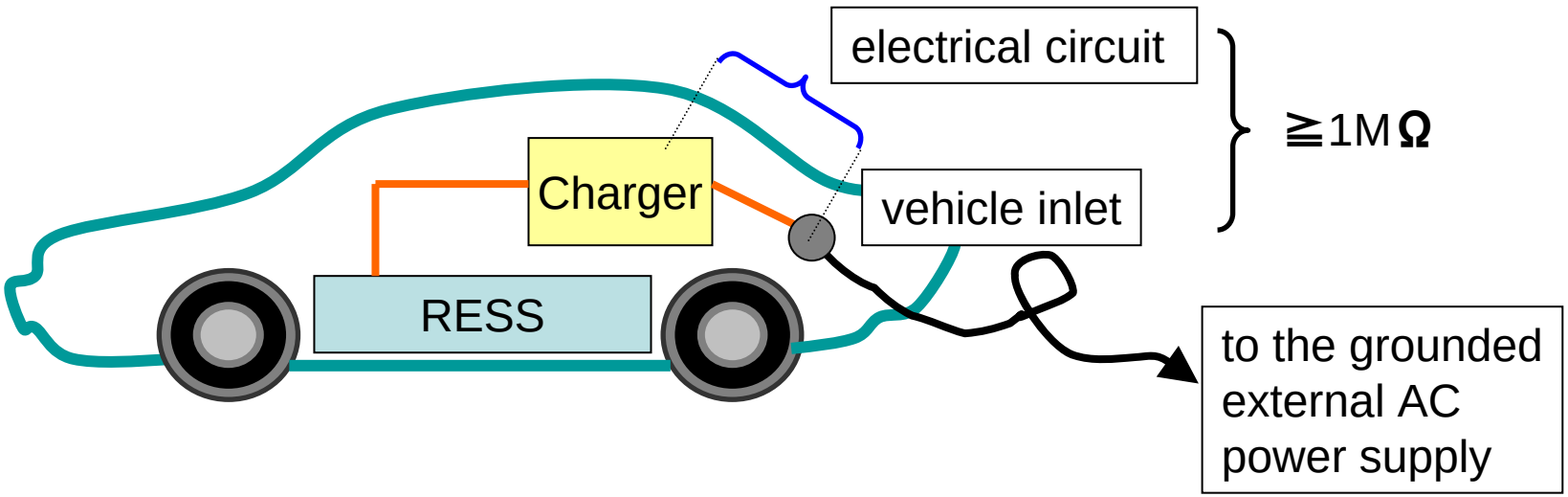
difficult to keep insulation resistance of FCVs

Technical Requirements
1. Protection against Electoric Shock

Insulation Resistance

<Requirement>

For the vehicle inlet intended to be conductively connected to the grounded external AC power supply and the electrical circuit that is galvanically connected to the vehicle inlet during charging of the RESS, the isolation resistance between the high voltage bus and the electrical chassis shall be at least 1 megohm when the charger coupler is disconnected. During the measurement, the traction battery may be disconnected.



Technical Requirements
2. Battery

Protection against excessive current

<Requirement>

The RESS shall not overheat.

If the RESS is subject to overheating due to excessive current, it shall be equipped with a protective device such as fuses, circuit breakers or main contactors.

However, the requirement may not apply if the manufacturer supplies data that ensure that overheating from excessive current is prevented without the protective device.

<Background>

RESS includes not only “battery” but also “capacity” which is not able to store so big energy to cause overheat.

Technical Requirements
2. Battery

Accumulation of Gas

<Requirement>

Places for containing open type traction battery that may produce hydrogen gas shall be provided with a ventilation fan or a ventilation duct to prevent the accumulation of hydrogen gas.

<Backgroud>

This requirement basically follows the provision in R100-00 for “hazardous gases from battery”. In R100-01, “hazardous gases” is clearly defined “hydrogen gas produced form open type traction battery”.

Technical Requirements
2. Battery

Hydrogen Emissions

<Requirement> same as R100-00

This test shall be carried out on all vehicles equipped with open type traction batteries.

The test shall be conducted following the method described in Annex 7 to the present Regulation. The hydrogen sampling and analysis shall be the ones prescribed. Other analysis methods can be approved if it is proven that they give equivalent results.

During a normal charge procedure in the conditions given in Annex 7, hydrogen emissions shall be below 125 g during 5 h, or below 25 x t2 g during t2 (in h).

During a charge carried out by an on-board charger presenting a failure (conditions given in Annex 7), hydrogen emissions shall be below 42 g. Furthermore the on-board charger shall limit this possible failure to 30 minutes.

Technical Requirements
3. Functional Safety

Indicator for “Ready to Run”

<Requirement>

At least a momentary indication shall be given to the driver when the vehicle is in "active driving possible mode".

However, this provision does not apply under conditions where an internal combustion engine provides directly or indirectly the vehicle's propulsion power.

When leaving the vehicle, the driver shall be informed by a signal (e.g. optical or audible signal) if the vehicle is still in the active driving possible mode.

<Backgroud>

This requirement follows the provision in R100-00, but the exemption is added in consideration of hybrid vehicles.

Technical Requirements
3. Functional Safety

Ground Protection

<Requirement>

In the case of motor vehicles which are intended to be connected to the grounded external electric power supply through the conductive connection, a device to enable the galvanical connection of the electrical chassis to the earth ground shall be provided.

The device should enable connection to the earth ground before exterior voltage is applied to the vehicle and retain the connection until after the exterior voltage is removed from the vehicle.

Compliance to this requirement may be demonstrated either by using the connector specified by the car manufacturer, or by analysis.

<Background>

This requirement is provided as a connection device, because grounding cannot be ensured only by vehicles.

Technical Requirements
3. Functional Safety

Prevention against Vehicle Movement with Charging Connection

<Requirement>

If the on-board RESS can be externally charged by the user, vehicle movement by its own propulsion system shall be impossible as long as the connector of the external electric power supply is physically connected to the vehicle inlet.

This requirement shall be demonstrated by using the connector specified by the car manufacturer.

<Purpose>

To prevent a vehicle from tearing off the charging cable.

Technical Requirements
3. Functional Safety

Indicator of the drive direction

<Requirement >

The state of the drive direction control unit shall be identified to the driver.

<Background>

Electric vehicles nomally control the drive direction only by the traction motor control, not by mechanical devices such as reverse gear .

Uniform provisions concerning the approval of vehicles with regard to specific requirements **for the electric power train** (**UNECE No.100**)

Presented by
Shunsuke TAKAGI
NTSEL
National Traffic Safety and Environment Laboratory

Outline

- Introduction
- Regulation system
- How to test? (Example: Hybrid car)

Introduction

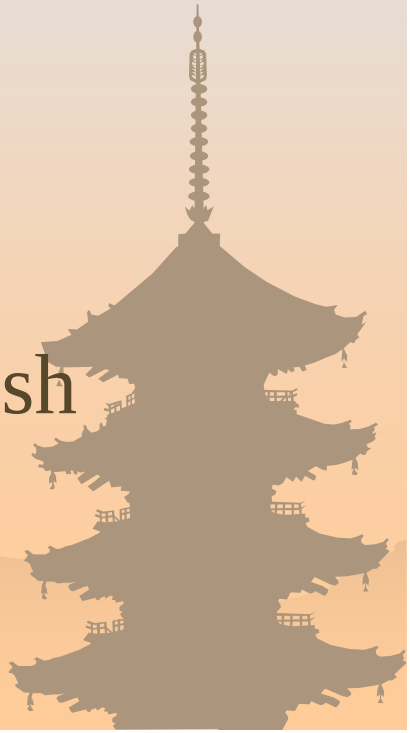
- There is an increasing number of hybrid and electric vehicles in the world, and the trend will continue to grow.

HV

EV

Introduction

- Drivers and passengers are at risk of touching high voltage device in vehicles
- United Nations established R100 as a regulation for electric power trains.
- This regulation does not cover post crash safety requirements of road vehicles.



Regulation system

After Crash

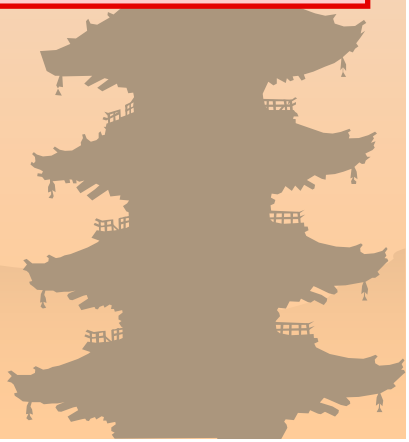
Full wrap rigid barrier test
(No. 12/ 48.3 km/h (30 mph))

Offset deformable barrier test
(No. 94/ 56 km/h)

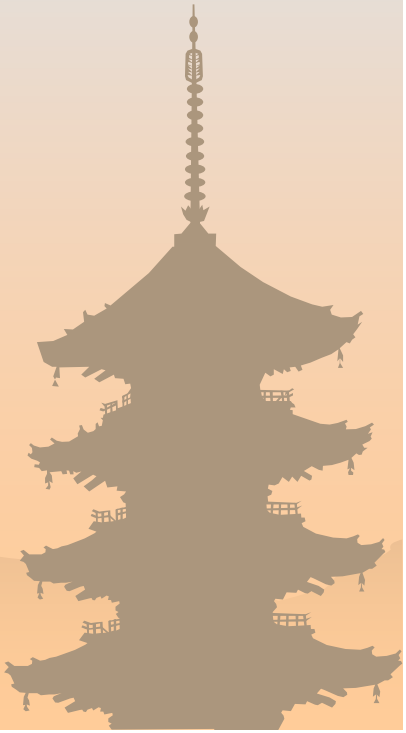
Side impact test
(No. 95/ 50 km/h)

Normal use

Normal use
(No. 100)



How to test?



What type of vehicles?

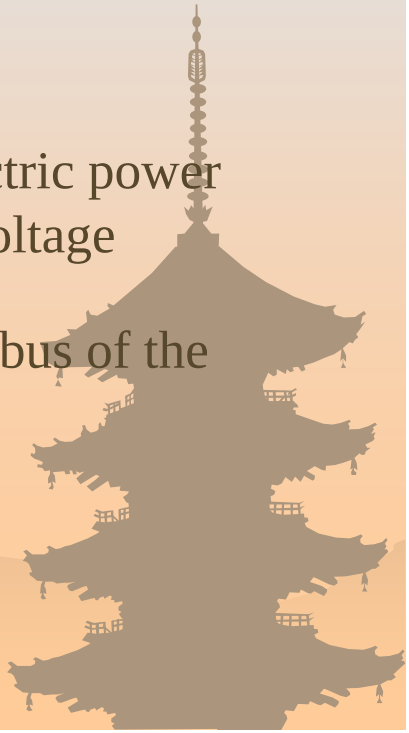
Scope

- Electric power train of road vehicles
- **M and N category**

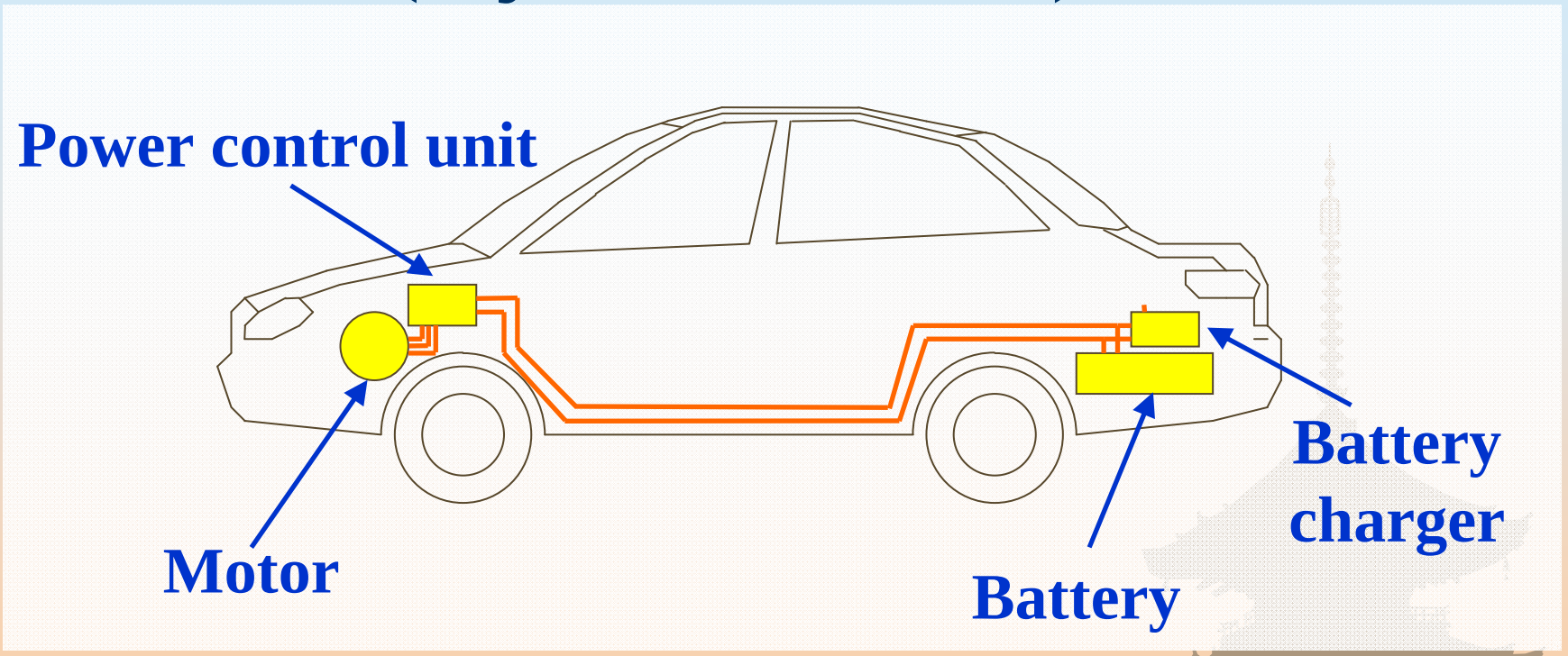
  (Category M - Power-driven vehicles having at least four wheels and **used for the carriage of passengers**,)

  (Category N - Power-driven vehicles having at least four wheels and **used for the carriage of goods**)

- Maximum design speed exceeding **25 km/h**
- Equipped with one or more traction motor(s) operated by electric power
- Not permanently connected to the grid, as well as their high voltage components
- Systems which are galvanically connected to the high voltage bus of the electric power train.



Model case
(Hybrid vehicle)

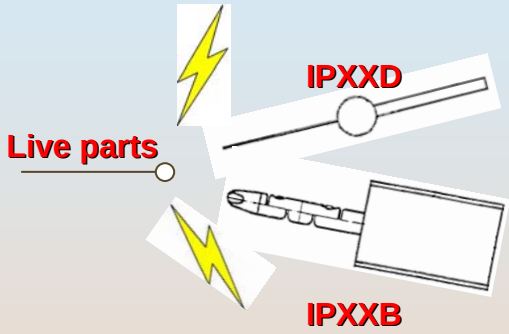


High Voltage Bus

Exposed Conductive Part

Requirements

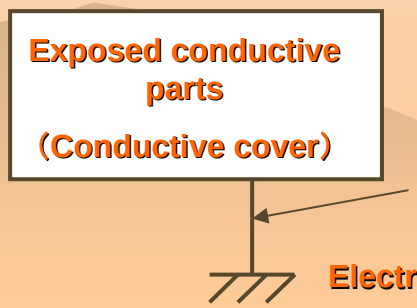
Protection against direct connect



No conntact allowed

Warning label required

Proteciton against indirect contact



Resistancemust be lower than 0.2 ohms

Measurement of isolation resitance

Measurement with mega-ohm tester, or according to below method

First step

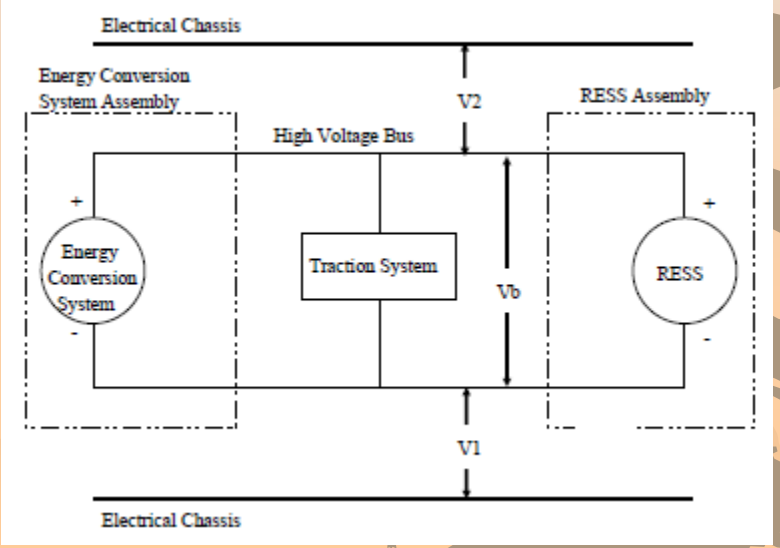
(in the case of $|V_1| \geqq |V_2|$)

Second step

Isonlation resistance is

$$R_i = \left(\frac{1}{V'_1} - \frac{1}{V_1} \right) \times R_0 \times V_b$$

Working voltage of 500 ohms/volt more required



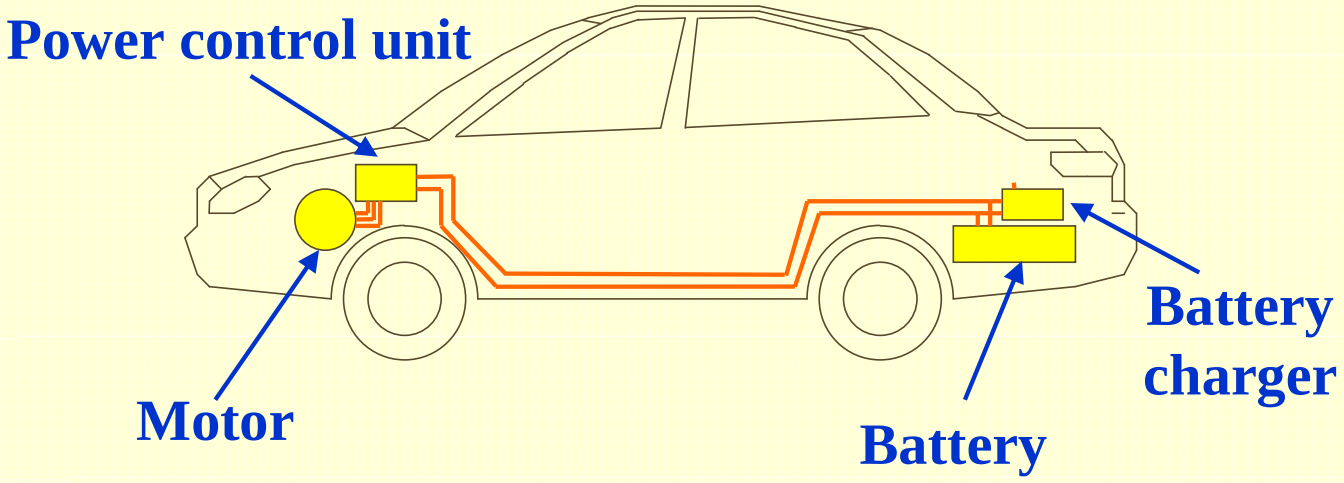
Equipment

Glove

IPXXD
(Wire model)

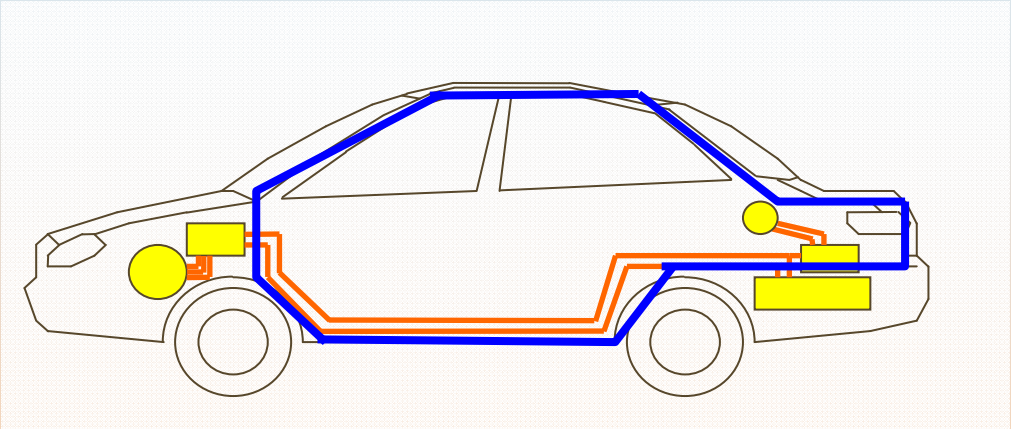
IPXXB
(Finger model)

Test



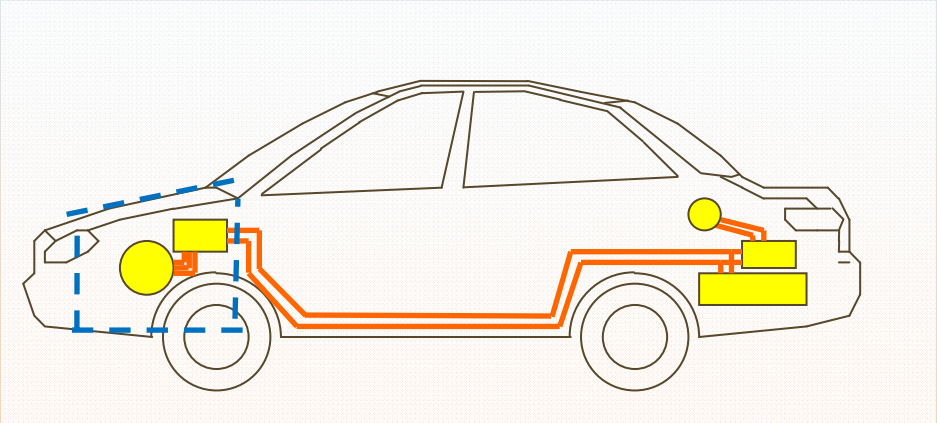
Protection against direct contact

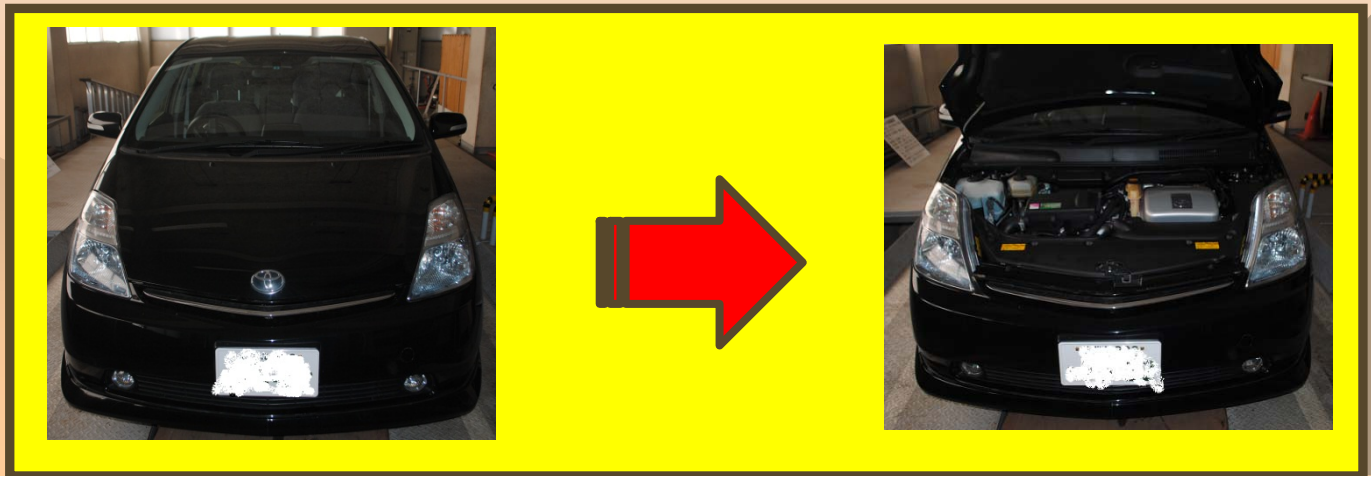
5.1.1.1.
For protection of live parts inside the passenger compartment or luggage compartment, the protection degree IPXXD shall be provided.



Protection against direct contact

5.1.1.2.
For protection of live parts in areas other than the passenger compartment or luggage compartment, the protection degree IPXXB shall be satisfied.





Finger model

Protection against direct contact

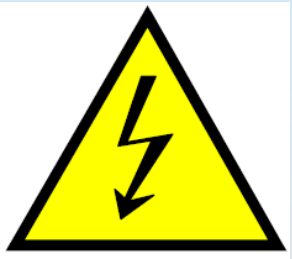
5.1.1.3. Connectors

5.1.1.4. Service disconnect

For a service disconnect which can be opened, disassembled or removed without tools, it is acceptable if protection degree IPXXB is satisfied under a condition where it is opened, disassembled or removed without tools.

Protection against direct contact

5.1.1.5.
Marking
5.1.1.5.1.
The symbol shown in Figure 1 shall appear on or near the RESS.
The symbol background shall be yellow, the bordering and the arrow shall be black.



5.1.1.5.2. The symbol shall also be visible on enclosures and barriers, which, when removed expose live parts of high voltage circuits. This provision is optional to any connector for high voltage buses. This provision shall not apply to any of the following cases:

Protection against direct contact

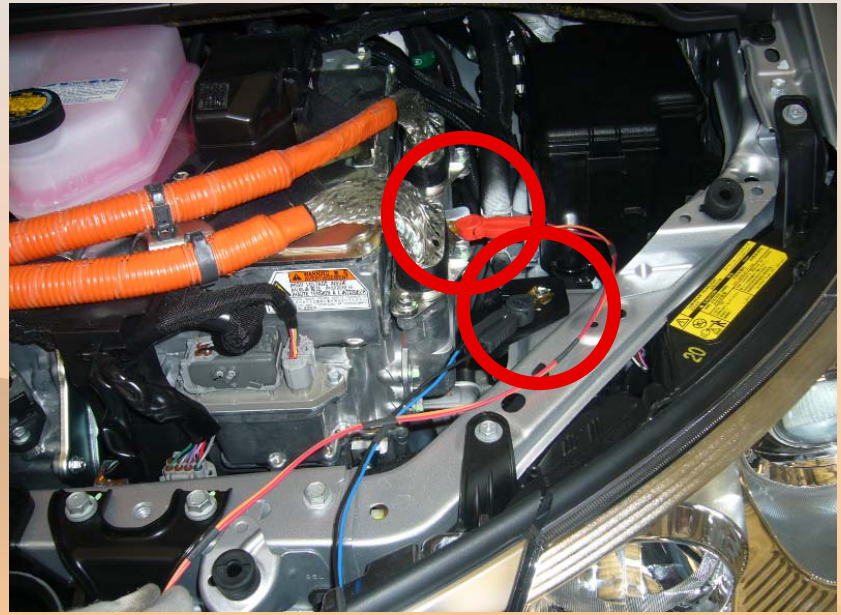
5.1.1.5.3.
Cables for high voltage buses which are not located within enclosures shall be identified by having an outer covering with the colour orange.

Protection against indirect contact

5.1.2.1. For protection against electrical shock which could arise from indirect contact, the exposed conductive parts, such as the conductive barrier and enclosure, shall be galvanically connected securely to the electrical chassis by connection with electrical wire or ground cable, or by welding, or by connection using bolts, etc.
so that no dangerous potentials are produced.

Protection against indirect contact

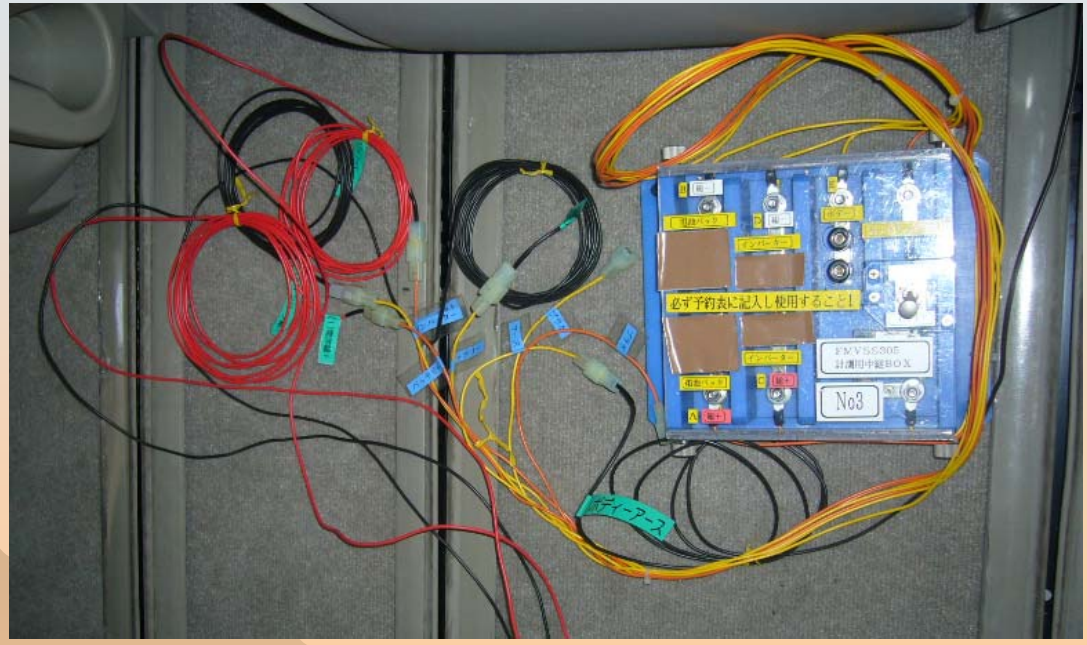
5.1.2.2.
The resistance between all exposed conductive parts and the electrical chassis shall be lower than 0.1 ohm when there is current flow of at least 0.2 amperes.
This requirement is satisfied if the galvanic connection has been established by welding.



Isolation resistance

5.1.3.

Isolation resistance



Rechargeable energy storage system (5.2.)

5.2.1. *Protection against excessive current*
The RESS shall not overheat.

If the RESS is subject to overheating due to excessive current, it shall be equipped with a protective device such as fuses, circuit breakers or main contactors.
However, the requirement may not apply if the manufacturer supplies data that ensure that overheating from excessive current is prevented without the protective device.

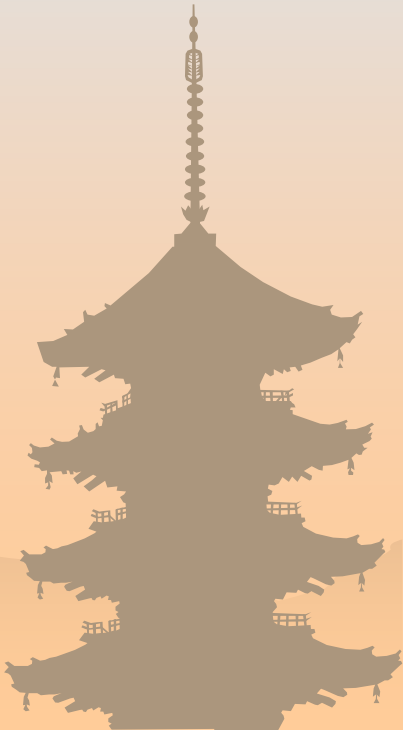
Fuse

Functional safety (5.3.)

At least a momentary indication shall be given to the driver
when the vehicle is in "active driving possible mode".

When leaving the vehicle, the driver shall be informed by a signal (e.g. optical or audible signal) if the vehicle is still in the active driving possible mode.

Thank you



Minutes of Meeting
30th JASIC Asia Expert Meeting in Malaysia

1. Date: Tuesday, 17 July 2012, 9:00 to 15:30

2. Place: Information Technology Division, Malaysian Road Transport Department (JPJ) in Cyberjaya, Malaysia

3. Organizer: JPJ
Attendees: Total of 43 representatives of government and industry organizations, including JPJ, Malaysian Institute of Road Safety Research (MIROS), Standards and Industrial Research Institute of Malaysia (SIRIM), Malaysian Automotive Association (MAA), Motorcycle & Scooter Assemblers And Distributors Association of Malaysia (MASAAM), and automotive manufacturers such as Volvo, Proton, Nissan, Honda, Suzuki, Kawasaki, and Perodua.

4. Attendees from Japan (JASIC):
Five members comprised of Mr. Okura of Nissan Motor, who explained the legal requirements of R100 (Electric Power Train); Mr. Takagi of NTSEL, who explained the test method of R100; Mr. Futohashi of Yamaha Motor, who explained R40 (Exhaust Emission [Motor Cycle]); Mr. Nakata of Honda Motor, who explained R83 (Emission of Pollutants According to Engine Fuel Requirements); and Mr. Nanbu, who represented the JASIC Secretariat.

5. Outline of the meeting
Representing the organizer, Mr. Azizul Bin Abdul Aziz, Mechanical Engineer of JPJ, gave an opening address, and Mr. Nanbu, as a representative of the JASIC Secretariat, explained the goals and objectives of the meeting. After these speeches, presentations were given by Mr. Futohashi on R40 (Exhaust Emission [Motor Cycle]), Mr. Nakata on R83 (Emission of Pollutants According to Engine Fuel Requirements), Mr. Okura on the legal requirements of R100 (Electric Power Train), and by Mr. Takagi on the test requirements of R100, each presentation followed by a Q&A session. Through discussions held in an animated and friendly atmosphere and with the questions from the attendees having been answered, the meeting successfully ended.

R40 General Information, Technical Requirements & Test Method: Presentation by Mr. Futohashi (Yamaha Motor)

First, the technical requirements were explained, and then the test requirements were discussed. Finally, a summary was presented. With a demonstration of calculation of engine speeds accompanying gearshifts, understanding on the details of the Worldwide Harmonized Motorcycle Emission Test Cycle (WMTC), which should be reflected in the global uniform test requirements in the future, was deepened.

* Main questions and answers

Q: What will happen after EURO3?

A: It is possible that EURO4 will be skipped and EURO5 will be in effect. But it is yet to be determined when this will happen.

R83 General Information, Technical Requirements & Test Method: Presentation by Mr. Nakata (Honda Motor)

First, background information related to R83, such as adoption status and contents of the emissions regulations in each country, contents and changes of the EU Directive at each phase, etc., was given. The details and implementation procedures of the type approval testing were explained next, and the COP requirements were also discussed at the end.

* Main questions and answers

Q1: Is the failure simulator used in the OBD approval testing built inside the vehicle, or is it to be mounted externally?

A1: It is a separate unit intended for external fitting.

Q2: Regarding fuels and emission control systems, would it be a problem if the EURO-2 fuel and the EURO-4 regulation were combined? In Singapore, diesel with a sulfur content of 50 ppm and gasoline with a sulfur content of about 500 ppm are used while the EURO-4 regulation has been adopted. Also, how about the effect of metal-free fuels?

A2: High sulfur contents cause catalyst deteriorations. In particular, detection errors may occur in OBD catalyst monitors. Hence, to avoid such errors, it is important to lower the sulfur content.

(The question on metal-free fuels could not be answered due to lack of knowledge.)

Q3: What kind of requirements does R49 has?
A3: It has requirements on emissions testing using an engine bench, which apply to large vehicles where vehicle testing on a dynamometer cannot be performed.

R100 General Information, Technical Requirements: Presentation by Mr. Okura (Nissan Motor)

First, history of the development of the regulation up to the latest version and the scope of the regulation were explained. And then, the provisions on protection against electric shocks, batteries, and functional safety assurance were introduced.

R100 Test Method: Presentation by Mr. Takagi (NTSEL)

After the relations between R100 and other regulations and positioning of R100 were explained, the test method in accordance with the regulation was presented specifically, using a hybrid vehicle as an example.

* Main questions and answers

Q1: How is the electric conduction indicated when a finger or wire model is used?
A2: It is indicated by lighting of the warning lamp installed in the device.

Q2: Is the device made for testing? Or purchased? If it is purchased, who is the manufacturer?
A2: Purchased. We think it is a Japanese product but do not know the manufacturer.

Q3: Is there any future plan on hydrogen fuel-cell vehicles?
A3: The fuel-cell vehicles are still expensive and need time.

Q4: Noise should be very low, but could the quietness become a problem?
A4: Being quiet is good for environment but is a problem from the standpoint of safety. In Japan, it is considered dangerous, and legislation of the regulation is being discussed with the related countries.

Q5: How many electric vehicles are being placed on the market in Malaysia?
A5: Currently, 18 in the case of four-wheeled vehicles and about 400 in the case of motorcycles.

Q6: Is there any order of testing between R100 and R94/95?
A6: If the same vehicle is used in testing, R94/95 follows R100.

Six members standing in the middle in the front row are the main presenters: Mr. Nakata, Mr. Okura, Mr. Aziz, Mr. Futohashi, Mr. Takagi, and Mr. Nanbu.