

Standard of Coast Down Test at Practical Road

KES T – E017

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1. Scope of Application

This standard is applicable for a test car driven on mileage accumulation chassis dynamometer.

2. Purpose

This test is for acquiring driving resistance from coast down test at practical road to reproduce it for the test on chassis dynamometer.

3. Test Preparation

3.1 Units and terminology

(1) Units are based on the regulation for technical standard formulation.

(2) Light-Duty Vehicle (LDV) : This is a passenger car or a derived car with less than 12 people capacity.

3.2 Road or track test facilities : To acquire requisite data, a test road or track must be straight, flat, and far enough. Required distance varies as the shape of a car, inclination of test road, and air condition. But required minimum distance is 1~2km expectedly.

The surface of a test road or track must be hard and flat. Structure and composition of the surface must be similar to those of normally used road.

Inclination must be less than 0.5% and crown must be the minimum. Inclination of all test sections must be 0.1% constantly.

Test must be carried out to both sides of the road or track. When data is acquired, there must be no disturbance from other cars, and surface must be dry. To reduce different effect of sudden gust, obstacles or irregular changes on the surface must be as little as possible.

3.3 Test car preparation

3.3.1 Prepare car for formal data measurement whose specification is for USA and Canada.

- (1) Car body and engine parts must be those of the last specification at the test time.
- (2) The distance covered shall be more than 3,000km.

3.3.2 Car inspection and adjustment

- (1) Inspect if suspension height and posture of the car is within design standard.
- (2) Use genuine parts for those which affect on air resistance like body, under cover, wheel cover, air part, etc
- (3) Adjust wheel alignment to normal standard.
- (4) Adjust brake to normal standard and confirm that there is no squeal.
- (5) Exchange lubricant of the driveline (T/M, differential) for genuine one.

3.3.3 Tire preparation and adjustment

- (1) Determine type and pressure of the tire by mutual agreement with related department.
- (2) Being broken in more than 100km (recommended by EPA of USA), new tire can be used for test tire. Break-in is carried out with standard tire pressure, wheel alignment, etc for the test car or car of same specification. Tread depth of test tire must be at least 50% of that of original tire.
- (3) Adjust tire pressure to the specified value
Set up tire pressure 0.4kg/cm higher than specified value, and soak more than 6 hours indoors.(Adjust tire with it attached to the car.) After that, set up tire pressure to the specified value before driving the car. Set up tire pressure three times for the car.

3.4 Measuring instruments preparation

3.4.1 Required measuring instruments

- (a) Non-contact speedometer

- (b) Anemoscope
- (c) Anemometer
- (d) Thermometer
- (e) Barometer
- (f) Tire pressure gauge

3.4.2 Inspect measuring instruments are operated normally. If not, correct them.

3.5 Test condition

3.5.1 Test weight : Empty weight must be within $\pm 45.36\text{kg}$ and driving wheel gross total weight must be within $\pm 22.68\text{kg}$ in comparison with design weight. (with fuel 40% filled, driver excluded and instruments included)

3.5.2 Air condition

(1) Standard air condition

- (a) Wind speed : 0m / sec
- (b) Temperature : 20°C
- (c) Atmospheric pressure : 98Kpa (at 20°C)

(2) According to the A / C of EPA, regulated test condition is as follows.

- (a) Atmospheric temperature : $5^{\circ}\text{C} \sim 35^{\circ}\text{C}$
- (b) Atmospheric pressure : $787.4 \sim 658.8 \text{ mmHg}$
- (c) Mean wind speed : Less than 4.4m / sec
- (d) Maximum gust speed : Less than 6.7m / sec
- (e) The direction of the wind : The same as the direction of the test road and track (direction of the driving) and direction must be constant.
- (f) Course condition : Dry

(3) KIA engine test team recommended that wind should be static, the maximum wind speed should be less than 1m/sec , air temperature should be more than 15°C .

3.5.3 Air condition measurement

Measure air condition data one time per one round.

- (1) Wind : Measuring instruments of wind speed and the direction of the wind must be set up within 2km of test road or track. Selected position must be located at the side of the test road or track that is close to the center of the test area and at approximately same height of geometric center of the car (0.5~1.5m of height is recommended by KIA engine test team).
- (2) Temperature : Thermometer must be set up within 2km of the test road or track and located as close to the test road or track as possible. Because thermometer measures air temperature, it must be kept away from sunlight or radiant energy source.
- (3) Atmospheric pressure : Select atmospheric pressure as that of the test location without compensating for the sea level altitude. It is recommended that a barometer would be set up within 2km of the test road or track.
- (4) Other conditions : Determine other conditions, such as the existence of number plate or antenna, by mutual agreement with a person in charge of development in advance.

4. Test Method

4.1 Test at practical road

- 4.4.1 Simulation of the test car : Simulate and finally check the condition of instruments and the car before driving to test road or track.
- 4.4.2 Warming-up : To stabilize the temperature of tire and lubricant drive the car for 30minutes at the speed of 80KPH before starting test. 30 minutes for warming-up is enough time for most of the LDV (Light-Duty Vehicle).
- 4.4.3 Test condition inspection

Air condition test : Check if the air condition is appropriate for test.

(1) Road condition test : Check if the road is appropriate for test by inspecting road surface and the existence of other cars.

(2) If conditions mentioned above are not satisfied, hold test till they are satisfied.

4.4.4 Test operation : Measure car speed and time (or driving distance and time) at 10KPH (or 50m, 100m) intervals while coasting down from 120KPH to 20KPH (100~20KPH is recommended by EPA of USA) with following driving mode. Refer to operation process of non-contact speedometer (E4-04-01) for operation of instruments during test time. Carry out coast down test more than 10 rounds (3 rounds is recommended by EPA of USA), where one round is consist of directions of A and B (B is the opposite direction of A).

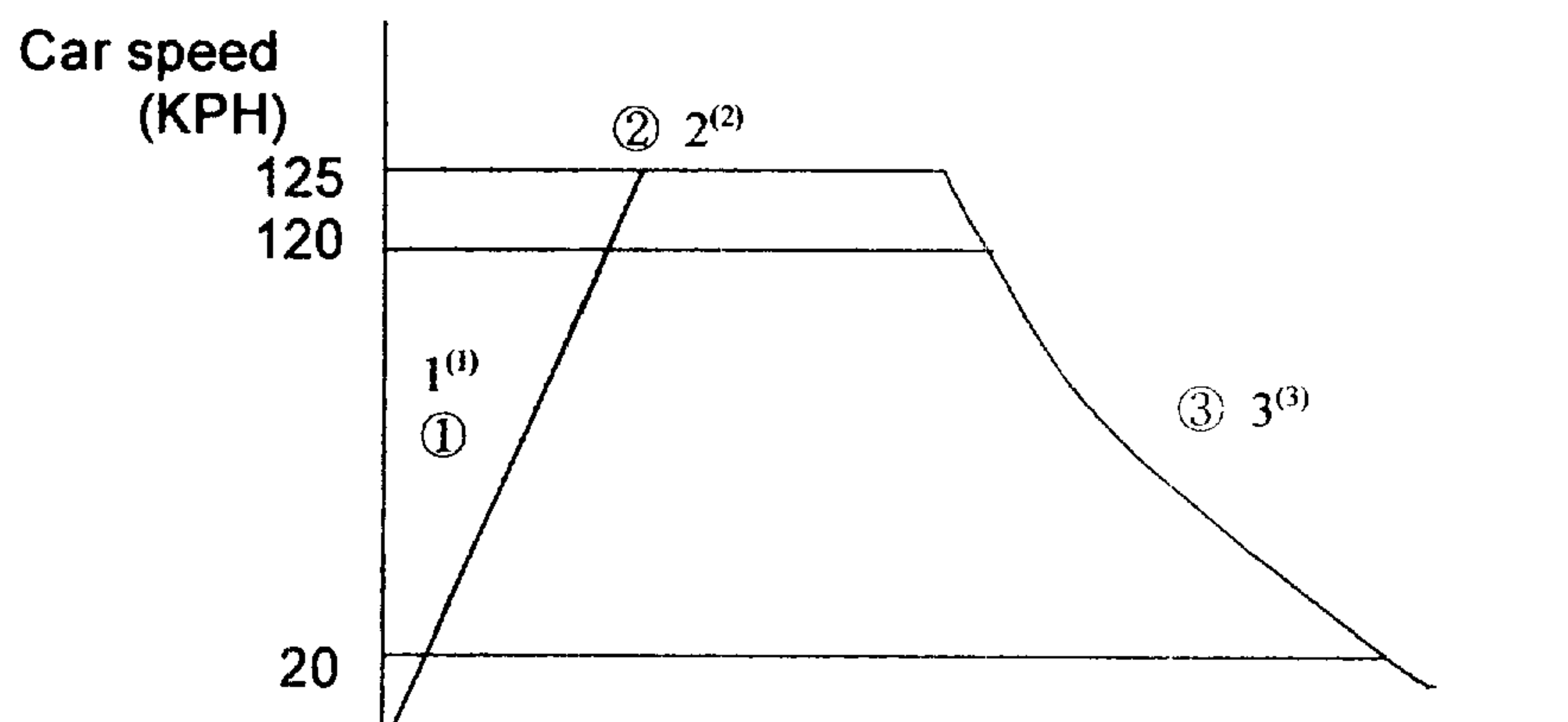


Figure 1. Driving mode of coast down test

Annotation ⁽¹⁾ Accelerate car at the rate of about 0.889m / sec approximately.

⁽²⁾ Drive at constant speed of 125KPH for a few seconds.

⁽³⁾ Coast down with neutral gear, and if at all possible, refrain from operation of steering device. (Clutch should be attached)

4.4.5 Measuring air condition during test : Measure air condition one time per one round of coast down test.

4.4.6 Test weight : Determine test weight by measuring weight of the car shortly after completing coast down test.(with driver and instruments included)

4.4.7 Measure tire pressure after completing the test.

5. Data Recording

5.1 Output data of non-contact speedometer

- (1) In case that output data is based upon speed
 - See data 1.
- (2) In case that output data is based upon driving distance
 - See data 2.

Data 1

- Coast down D -

Wind Strrt - End -

Speed (km/H)	Distance (M)	Time (sec)	Time A (sec)
120.0	0.6	0.00	
115.0	68.7	2.12	2.12
110.0	146.5	4.62	2.50
105.0	231.5	7.48	2.86
100.0	311.4	10.30	2.82
95.0	393.7	13.36	3.06
90.0	480.9	16.77	3.41
85.0	568.7	20.40	3.63
80.0	652.3	24.08	3.68
75.0	748.7	28.59	4.51
70.0	839.3	33.16	4.57
65.0	938.7	38.46	5.30
60.0	1031.1	43.82	5.36
55.0	1132.4	50.19	6.37
50.0	1236.2	57.35	7.16
45.0	1333.4	64.76	7.41
40.0	1436.8	73.74	8.98
35.0	1548.9	84.40	10.66
30.0	1642.4	94.90	10.50
25.0	1735.2	107.19	12.29

Speed 120.5KM/H

Data 2 -Coast Down D- Wind Strrt -End-			
Distance (M)	Time (sec)	Speed (KM/H)	factor (-6)
0.0	0.000		
50.0	1.514	118.9	
100.0	1.564	115.1	0.0700
150.0	1.619	111.2	0.0696
200.0	1.672	107.7	0.0607
250.0	1.732	103.9	0.0621
300.0	1.792	100.4	0.0560
350.0	1.857	96.9	0.0546
400.0	1.924	93.6	0.0506
450.0	1.994	90.3	0.0475
500.0	2.069	87.0	0.0457
550.0	2.147	83.8	0.0425
600.0	2.229	80.8	0.0400
650.0	2.321	77.6	0.0399
700.0	2.415	74.5	0.0361
750.0	2.522	71.4	0.0363
800.0	2.638	68.2	0.0345
850.0	2.764	65.1	0.0326
900.0	2.896	62.2	0.0297
950.0	3.041	59.2	0.0283
1000.0	3.191	56.4	0.0253
1050.0	3.360	53.6	0.0246
1100.0	3.552	50.7	0.0237
1150.0	3.767	47.8	0.0224
1200.0	3.995	45.1	0.0199
1250.0	4.297	41.9	0.0216
1300.0	4.629	38.9	0.0191
1350.0	4.999	36.0	0.0169
1400.0	5.885	30.4	0.0141
1450.0	5.847	30.8	0.0133
1500.0	6.334	28.4	0.0110
1550.0	7.009	25.7	0.0116
1600.0	7.814	23.0	0.0101
1650.0	9.166	19.6	0.0113

6. Data Processing

6.1 Data processing using computer

- (1) Using computer program, calculate rolling resistance coefficient and air resistance coefficient from data measured with non-contact speedometer.