

Proposal for C/D Test Temperature Range



India Presentation
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Ambient Air Density Variation

Reference Condition:

Reference	
Temp (degC)	20
Pressure (kPa)	100
Density (kg/m3)	1.19

Reference Formula :

$$\rho = \frac{1.293}{1 + 0.00367 t} * \frac{p}{1013.25}$$

* Source: TAP115/116

Temp. °C	Atm Pressure, hPa	Air density	Variation of Density from STD
5	1013.25	1.270	-5.41
20	1013.25	1.205	0.00
23	1013.25	1.192	1.02
25	1013.25	1.184	1.68
35	1013.25	1.146	4.88
40	1013.25	1.127	6.40
44	1013.25	1.113	7.58

➤ Density variation is within 7.5 % as allowed by ECE and Indian Regulation upto temperature of 44 deg C.

C/D Testing at Different Ambient Condition

- **To address the open point regarding C/D Test Temperature Range (i.e. 5~35 degC)**
- **C/D test conducted at different ambient conditions on test track as per ISO requirements were compared.**
- **Tests were done on two vehicles.**
- **The test results were corrected using the methodology as per the calculations provided in current Regulation.**
- **The corrected values were compared with tested (uncorrected) values for each vehicle to evaluate the efficacy of the temperature correction formula.**

Ambient Test Conditions

C/D test was done on the 2 different vehicles at different ambient conditions on test track.

Sl. No.	Parameters	Units	Condition 1	Condition 2
1	Temperature	deg C	38 ~ 40	32 ~ 34
2	Humidity	%	14~35	46~65
3	Atmospheric Pressure	hPa	980~985	992~995
4	Average Wind speed	m/sec	0.3~4.1	0.5~1.9

Test Results Summary “without correction”

Vehicle	Test Condition	F0 (N)	F2 (N/kmph ²)	P[50], kW	P[100], kW
A	1	97.02	0.0314	2.44	11.41
	2	98.75	0.0339	2.55	12.15
Percentage Difference [(1-2)/1*100]		-1.78	-7.93	-4.53	-6.48
B	1	127.93	0.0345	2.97	13.12
	2	130.17	0.0375	3.11	14.02
Percentage Difference [(1-2)/1*100]		-1.75	-8.74	-4.56	-6.85

Considering the RLD co-efficient values without correction :

- The difference in F0 value is about 2% whereas the difference in F2 value is 8%.
- The effect of temperature and pressure variation is more dominant on the F2 value because of air density variation.

Test Results Summary after correction

Vehicle	Test Condition	F0 (N)	F2 (N/kmph ²)	P[50], kW	P[100], kW
A	1	111.75	0.0356	2.79	13.00
	2	110.16	0.0356	2.77	12.94
Percentage Difference [(1-2)/1*100]		1.42	0.08	0.83	0.40
B	1	147.33	0.0391	3.40	14.95
	2	145.61	0.0395	3.39	15.02
Percentage Difference [(1-2)/1*100]		1.17	-1.05	0.28	-0.44

Considering the RLD co-efficient values after temperature and pressure correction :

- The difference in F0 and F2 value is about 1%.
- The effect of temperature and pressure correction significantly compensates for the variation in F2 value.
- The RLD co-efficients corrected from higher temperature range are higher than that corrected from lower temperature range.

Conclusion

- **The uncorrected results at the two different test conditions differ by 5%.**
- **The test results obtained at the different ambient conditions show good co-relation when the correction factor is used. The difference in the test results is about 1%.**
- **Density Variation is within 7.5% w.r.t reference upto a temperature variation upto 44deg C.**
- **Temperature correction holds good for correcting RLD co-efficient values upto 44 degC.**

The proposal of temperature range (5~40deg C) could be considered a good compromise for a Harmonized Solution, keeping in mind the average Indian ambient atmospheric conditions and robustness of the correction procedure.

Thank You for Your Attention