

# Measurement of Hydrogen

## GTR 15: Annex 8 - Appendix 7

### Fuel consumption measurement of compressed hydrogen fuel cell hybrid vehicles

Fuel consumption shall be measured using the gravimetric method in accordance with paragraph 2. of this appendix.

At the request of the manufacturer and with approval of the responsible authority, fuel consumption may be measured using either the pressure method or the flow method. In this case, the manufacturer shall provide technical evidence that the method yields equivalent results.

→ Nowadays use of Flow meter method for CS (NOVC) is allowed (if equivalency is proofed)

# Question: Can the flow meter method also be used for CD (if accuracy proved)?

Is the use of Flow meter method during CD less accurate as during CS?

Flowmeter devices are calibrated under stationary conditions. Under these conditions very accurate devices are on the market available nowadays.

Example of a device used for certification:

#	Referenz Durchfluss (g/s)	Analog Ausgang (mA)	Analog entspricht (g/s)	Abweichung Analog (g/s)	Abweichung Analog (%)	Viskosität Prüfling (mm <sup>2</sup> /s)	Temperatur Prüfling (°C)	Dichte Prüfling (kg/l)
1	3,04512	20,243	3,04554	0,00041	0,01	0,9393	23,01	0,9975
2	2,06200	14,989	2,06048	-0,00152	-0,07	0,9398	22,99	0,9975
3	0,96015	9,126	0,96107	0,00092	0,10	0,9370	23,12	0,9974
4	0,49379	6,636	0,49425	0,00046	0,09	0,9381	23,07	0,9974
5	0,26946	5,437	0,26944	-0,00003	-0,01	0,9385	23,05	0,9975
6	0,16766	4,894	0,16763	-0,00003	-0,02	0,9419	22,89	0,9975
7	0,10049	4,535	0,10031	-0,00018	-0,18	0,9419	22,89	0,9975



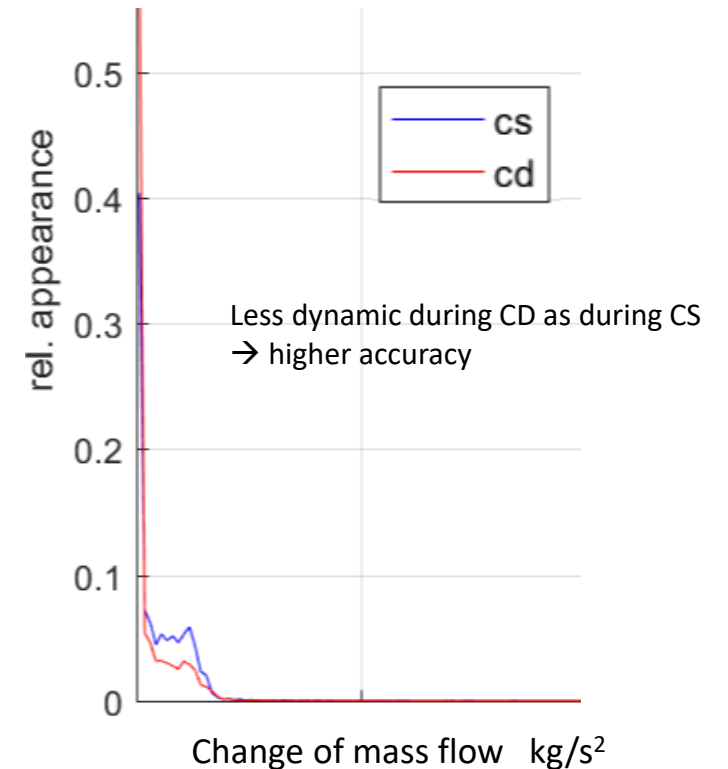
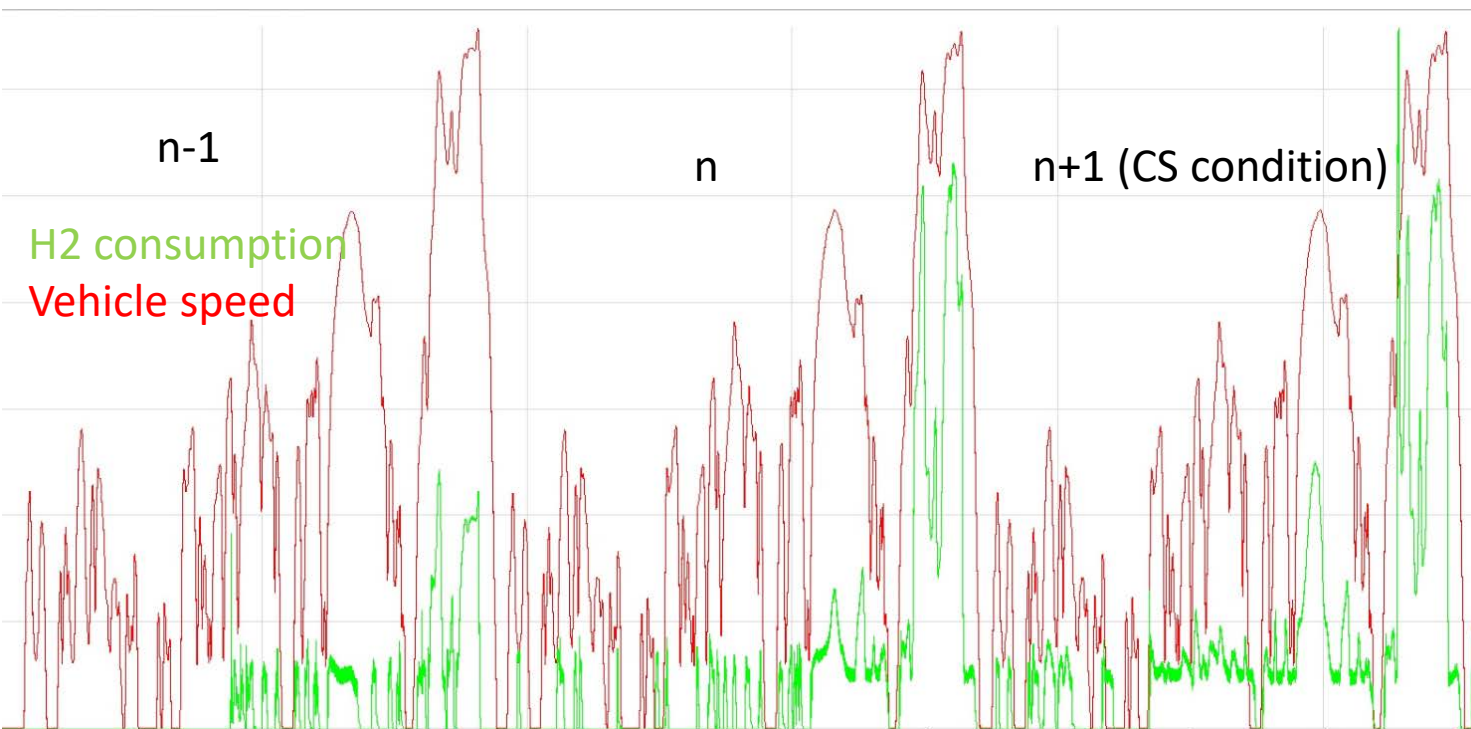
Deviation in %

# Question: Can the Flow meter method also be used for CD (if accuracy proved)

Is the use of Flow meter method during CD less accurate as during CS?

Fuel cell behaviour during CD is similar as during CS but,

- Dynamic is less than during CS because power peaks are compensated by the REESS. Less dynamic leads to higher accuracy
- The absolute fuel consumption during CD is on a lower level than during CS (CD consumption is about 50% less compared to CS Consumption). This or even a higher change is not of significance for the accuracy of flow meter device (see slide before).



**→ Conclusion: Flow meter method under CD condition is more accurate than under CS condition. No need to modify Annex 8 - Appendix 7. It also fits for OVC – FCHEV.**