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1. NORMAL CONDITIONS FOR TEST

- Number of samples: 1 - 3
- Standard test gas: 5,000 ppm hydrogen in clean air and 20,000 ppm hydrogen in clean air
- Flow rate of test gas: 2 SLM
- Supply voltage: 5 V, ± 0.25 V
- Ambient temperature: 27 °C
- Pressure: 100 KPa
- Humidity: dry (< 2% RH)
- Orientation: facing up

2. TEST METHODS AND TEST DATA

2.1 Unpowered Storage

(Comment: not executed. Instead, samples were placed in 85 °C and powered for 200 h)

- Must proceed all other tests
- Temperature profile
- -25 °C for 24 h
- Ambient for 24 h
- 60 °C for 24 h
- Ambient for 24 h

2.2 Calibration curve (accuracy)

- Samples are exposed to clean air: 5,000 ppm, 10,000 ppm, and 20,000 ppm hydrogen in clean air successively

Samples	Clean air	5,000 ppm	Error %	10,000 ppm	Error %	20,000 ppm	Error %
1	57	5,064	1.28 %	10,036	0.36 %	20,298	1.49 %
2	56	5,140	2.80 %	10,144	1.44 %	20,361	1.81 %
3	0	4,838	-3.24 %	9,841	-1.59 %	20,090	0.45 %

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2.3 Short-term stability (repeatability)

- Samples are exposed to six applications of 20,000 ppm hydrogen in clean air for 3 m, followed by exposure to clean air for 7 m
- Take indication at the end of each exposure of hydrogen and clean air

Sample 1

Application	Clean air	20,000 ppm	Error %
1	24	20,434	2.17 %
2	55	20,464	2.32 %
3	79	20,483	2.42 %
4	93	20,494	2.47 %
5	103	20,503	2.51 %
6	109	20,504	2.52 %

Sample 2

Application	Clean air	20,000 ppm	Error %
1	0	20,403	2.01 %
2	0	20,401	2.00 %
3	0	20,389	1.94 %
4	0	20,376	1.88 %
5	0	20,360	1.80 %
6	0	20,345	1.72 %

Sample 3

Application	Clean air	20,000 ppm	Error %
1	0	20,245	1.22 %
2	0	20,274	1.37 %
3	0	20,296	1.48 %
4	0	20,312	1.56 %
5	0	20,323	1.61 %
6	0	20,328	1.64 %

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2.4 Temperature stability

- Set chamber temperature to -20 °C, 20 °C, and 55 °C
- At each temperature:
  - Expose to clean air until temperature stabilization, then dwell for 1 h
  - Take indication
  - Expose to 5,000 ppm hydrogen until temperature stabilization, then dwell for 1 h
  - Take indication
  - Expose to 20,000 ppm hydrogen until temperature stabilization, then dwell for 1 h
  - Take indication

Sample 1

Temperature	Clean air	5,000 ppm	Error %	20,000 ppm	Error %
-20 °C	152	4,943	-1.14 %	19,415	-2.93 %
20 °C	0	4,966	-0.68 %	20,291	1.46 %
55 °C	90	5,296	5.92 %	21,018	5.09 %

Sample 2

Temperature	Clean air	5,000 ppm	Error %	20,000 ppm	Error %
-20 °C	150	4,987	-0.26 %	19,414	-2.93 %
20 °C	0	5,043	0.86 %	20,470	2.35 %
55 °C	24	5,213	4.26 %	20,899	4.50 %

Sample 3

Temperature	Clean air	5,000 ppm	Error %	20,000 ppm	Error %
-20 °C	0	4,690	-6.20 %	19,414	-2.93 %
20 °C	0	4,976	-0.48 %	20,127	0.64 %
55 °C	0	4,410	-11.80 %	20,362	1.81 %

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2.5 Long-term stability (thermal cycling)

Verify long-term stability using thermal cycling as acceleration.

1. Ramp to -40 °C
2. Maintain at -40 °C for 1 h
3. Ramp to 85 °C
4. Maintain at 85 °C for 1 h
5. Repeat 1 – 4 for 7 cycles
6. Perform functional check
    a. Ramp from 85 °C to 27 °C
    b. Flow clean air to reduce humidity to < 2 %
    c. Maintain at 27 °C for 1 h
    d. Take indication
7. Repeat 1 – 6 for 4 more times (35 cycles in total)

Hydrogen ppm in clean air	Functional check 1	Functional check 2	Functional check 3	Functional check 4	Functional check 5
1	150	-72	-97	-175	52
2	32	-218	-175	-161	53
3	31	-224	-186	-187	79

2.6 Humidity effect

Verify that the sensor can effectively eliminate the impact of ambient humidity.

1. Place three sensors into an environmental chamber, which is set to 40 °C and 20 % RH
2. Maintain for 30 m
3. Raise the chamber humidity to 50 % RH, and flow 10,000 ppm dry hydrogen (balanced with air) into the chamber
4. Maintain for 30 m
5. Read sensor output

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Sample	Expected (ppm)	Actual (ppm)	Error %
1	9,622	9,120	-5 %
2	9,622	9,241	-4 %
3	9,622	9,315	-3 %