

Test plan – H2Fly Extended DOE test

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| --- | --- |
| Test number | 501006\_2 |
| Test descriptive name | H2Fly High temperature (HT) DOE |

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**Revision log**

|  |  |  |  |
| --- | --- | --- | --- |
| Revision | Date | Change | By |
| a0 | 20240503 | 200 test points | Adam Benson |
| a1 | 20240527 | Second draft: 600 test points (outlet temperature: 65 to 105 degrees Celsius). | Abdinasir Farhan |
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|  |  |  |  |
|  |  |  |  |

# Test information.

|  |  |
| --- | --- |
| Topic | High temperature (HT) design-of-experiment test on an HT MEA incorporated P10 short-stack. |
| Target | To construct a DOE which can map the HT P10-stack behavior within operating conditions relevant to H2Fly. |
| Test motivation | Running a high temperature DOE test on a P10 short stack serves three purposes:  **(1)** Better insight into the P10 stack as well the state-of-the-art high temperature MEA, particularly their integration. **(2)** To evaluate whether the change of MEA has significant effect on performance of the P10 stack.  **(3)** Gain further understanding of P10 stack behavior at high temperature (up to 105 degrees Celsius outlet). |
| Expected results | The P10 stack with HT MEA will perform adequately in the 95C operating window below. High temperature performance is currently unknown.  Currents below 600A should be fine but stack might struggle with currents above 600A in combination with low pressures and/or stoichiometries due to mass transport losses.  Stack and MEA will operate at the requested high temperature and current range without major degradation  **Dataset main deliverable to customer. A written test report will also be delivered.** |
| Related tests [Test numbers] | *TV500106\_1* |
| Project number | 500106 |

|  |  |
| --- | --- |
| Test number | *TV500106\_2* |
| Test descriptive name | H2Fly High temperature (HT) DOE |
| Test responsible | Abdinasir Farhan |

## Test program (protocol and operating conditions references)

Step times reported in table 1 are a rough estimate and will depend on how many test points are included in the DOE and how many can be run (some points will likely be impossible to run). The hold time at each test point should be around 20 minutes (ca 5 min transition and 15 min to reach steady state). Preliminary, 600 test points are planned, the total runtime will be 200h (and roughly 220h when including heating, ramp times etc.). If conditioning and polarization curves (before and after DOE test) are included, the estimated total time of the test campaign is approximately 242h.The total test time can then be rounded up to 250h to account for lab stops, Emergency test station stops and other unforeseen breaks.

Table 1 Test procedure.

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Type of protocol | Protocol/script/SOC reference | Step time (h) |
| 1 | Conditioning |  | 2 |
| 2 | Polarization curve BOT |  | 2 |
| 3 | DOE test |  | 220 |
| 4 | Conditioning |  | 2 |
| 5 | Polarization curve EOT |  | 4\* |
|  |  |  | Total: 242 |

*\*Step 5 is made up of two polcurves (Performed before high temperature range and at the end of test).*

## Test task activity scheduling

Table 2 Test task activity scheduling.

|  |  |
| --- | --- |
| Task | Planned date |
| Test preparation start | 2024-05-27 |
| Test station start | 2024-06-10 |
| Estimated test finalization | 2024-08-15\* |
| Estimated report finalization | 2023-08-31 |

*\*Assumes test is performed during working hours (8h days).*

## Task resource need

Table 3 Test resource need estimation

|  |  |
| --- | --- |
| Task | Estimated time (days) |
| Test preparation | 8 |
| Test operation (person) | 22 |
| Test operation (station) | 31\* |
| Data analysis | 7 |
| Reporting | 7 |

*\*Assumes the whole test being performed during working hours*

# Experimental

*Use information from test requests where possible.*

|  |  |
| --- | --- |
| Type of test | Design of Experiment |
| Test object | P10 |
| Number of cells | 23 |
| MEA | Custom high temperature (HT) MEA |

## Data analysis

Table 4 Data analysis

|  |  |
| --- | --- |
| Standard analysis selection | Protocol reference |
| Polarization curve analysis | Sympathy for Data |
| DOE analysis | Excel: Averaged steady-state value |

## Postmortem

None.