

Test plan – H2Fly DOE

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| --- | --- |
| Test number | TV500106\_1 |
| Test descriptive name | H2Fly DOE |

Contents

[2 Test information 2](#_Toc870396045)

[2.1 Test program (protocol and operating conditions references) 4](#_Toc706596554)

[2.1.1 Estimated H2 consumption 4](#_Toc1632876364)

[2.2 Test task activity scheduling 4](#_Toc268183992)

[2.3 Task resource need 5](#_Toc1675491524)

[3 Experimental 5](#_Toc1836011598)

[3.1 Test cycle schematic overview 6](#_Toc1408187699)

[3.2 Data analysis 6](#_Toc1274544075)

[4 Appendix A: Test plan Q&A 6](#_Toc848932574)

**Revision log**

*When the Test Plan is in released (approved) the revision log is changed to a and the document is copied into a new file with the name ended with revision name (a).  
The original file can be revised continuously until the test has ended (b0 and above).  
The revision number should be increased each time the document has been reviewed.*

|  |  |  |  |
| --- | --- | --- | --- |
| Revision | Date | Change | By |
| a0 | 2023-12-15 | First draft | Simon Lindholm |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# Test information

*Template usage instruction: Follow the instructions in grey italic for each row, the text will disappear automatically once you fill something into the table. If it says “Choose an item” or “enter a date” there will be a drop down menu available after clicking the field and then the down arrow.*

*The following table can be filled in by copying information from the test request document, more information can be added if applicable.*

|  |  |
| --- | --- |
| Topic | Design-of-experiment test on a 275c P10 stack according to OpCons relevant for H2Fly application. |
| Target | Construction of a model which can predict P10 stack behavior at higher current outside previous P10 operating windows. |
| Test motivation | *H2Fly are interested in pushing the boundaries for which currents are possible to run with the P10 stack. DOE exists for the P10 stack but not above 600A. To characterize stack functionality in this test window this new DOE is required.* |
| Expected results | *The stack will handle most of the test window well but struggle at high currents when humidity is low and flowrate is high, or at high current and low gas pressures.*  *Dataset main deliverable to customer. Report will still be written and shared but not before years end.* |
| Related tests [Test numbers] | *TV12810000\_14* |
| Project number | *500106* |

|  |  |
| --- | --- |
| Test number [Eg. TV12810000\_1] | TV500106\_1 |
| Test descriptive name [Sensitivity test, DOE etc.] | H2Fly DoE |
| Test responsible | Simon Lindholm |

|  |  |
| --- | --- |
| External partner | H2Fly |
| External responsible |  |
| External test number |  |

*This table can be removed if no external partner is involved.*

## Test program (protocol and operating conditions references)

Fill in each step to be carried out within the test program. Each step needs to be coupled with documentation that explains/defines what should be done e.g. a script operating condition description or a test protocol.

Table 1 Test procedure.

|  |  |  |  |
| --- | --- | --- | --- |
| Step | Type of protocol | Protocol/script/SOC reference | Step time (h) |
| 1 | Polarization curve | [Subscript\_Maranda polcurve\_231201\_SOC.xlsx](https://powercellsweden.sharepoint.com/:x:/s/AE-TV/EfJqzi-XLdRIhjJPGdGEB-IBWkZjfGsstVu1dcCv0JdSNw?e=Tpb8Fe) | 2 |
| 2 | DoE test | [Subscript\_H2Fly DOE\_231128\_SOC.xlsx](https://powercellsweden.sharepoint.com/:x:/s/AE-TV/ETXyprwEjZRHmcrPA6P_yA8BcqvnS7cIUj18olpCkaJiTQ?e=xPOqvN) | 200 |
| 3 | Polarization curve | [Subscript\_Maranda polcurve\_231201\_SOC.xlsx](https://powercellsweden.sharepoint.com/:x:/s/AE-TV/EfJqzi-XLdRIhjJPGdGEB-IBWkZjfGsstVu1dcCv0JdSNw?e=Tpb8Fe) | 2 |
|  |  |  | Total: 204 |

*Only define the actual steps in this test plasn. Test object history will be defined in the experimental part.*

### Estimated H2 consumption

11340 Nm3/8.5 Bundles over 150h of total runtime, corresponding to 75.6 Nm3/h or 0.06 Bundles/h.

## Test task activity scheduling

Table 2 Test task activity scheduling.

|  |  |
| --- | --- |
| Task | Planned date |
| Test preparation start | 2023-11-21 |
| Test station start | 2023-12-18 |
| Estimated test finalization | 2024-01-19 |
| Estimated report finalization | 2024-01-26 |

*Add more rows with tasks if applicable. Copy this table for the report and add column for actual dates, to follow up test planning.*

## Task resource need

Table 3 Test resource need estimation

|  |  |
| --- | --- |
| Task | Estimated time (days) |
| Test preparation | 12 |
| Test operation (person) | 7 |
| Test operation (station) | 7 |
| Data analysis | 2 |
| Reporting | 2 |

*Add more rows with tasks if applicable. Copy this table for the report and add column for actual times, to follow up test planning.*

# Experimental

*Use information from test request where possible.*

|  |  |
| --- | --- |
| Type of test | DOE |
| Test object | P-stack (S3 C-sample) |
| Number of cells | 275 |
| MEA | H0C |

|  |  |
| --- | --- |
| Test object model code and serial number | 0601510008379030452B3705W |
| Test object activation date | At RB prior to shipment to PCG |
| Test object history or logbook reference | E.g. Describe object history or attach link to log book. One can also attach logbook or description in appendix if relevant. |
| Test station | UTR59 |
| Equipment that needs to be reserved/installed | Metis + Cellsense  Extra Leviton cable between stack and test station junction box |
| Additional sensorization | Humidity sensor on cathode outlet  dP sensors on all fluids  Double CVM (Metis on Cathode inlet side and Cellsense on Cathode outlet side) |
| Stack purpose after test | Sell to H2Fly |

## Test cycle schematic overview

Block diagram/flowchart.

## Data analysis

Create tasks and estimate time so that proper resources can be accumulated in *2.3 Task resource need*.

*This section is in draft state, feel free to add more information.*

Table 4 Data analysis

|  |  |
| --- | --- |
| Standard analysis selection | Protocol reference |
| Choose an item. | Sympathy |
| Choose an item. |  |

*Add more rows with analysis methods if needed.*

# Appendix A: Test plan Q&A

*Can be removed when planning is finished.*

|  |  |
| --- | --- |
| Question | Answer |
| How do we use revision in the revision log? | Dokumentet heter PCS-Q-074 och finns här (avsnitt 4.4.1): [QMS, PCS-Q-074, Product information mgmt](https://powercellsweden.sharepoint.com/:w:/r/sites/QMS/_layouts/15/Doc.aspx?sourcedoc=%7B456867E6-A43B-4029-9AD5-903334E64DE8%7D&file=Product%20Information%20Management.docx&action=default&mobileredirect=true) |
| Is the test plan intended to be a living document even after the test has been initiated? | Before the test can be started the test plan needs to be approved. The approved TP gets revision “a” status and is copied out with the *file name* followed by “\_a”, and should be locked.  Changes of the test plan after test start generates a change in original the test plan which will generate a b0, b1 etc. status. Changes should also be pointed out in general guidelines of the report. |
| Where is the operating conditions stated, can I attach a table? | The operating conditions are stated in a separate file; the SOC (Script operating conditions). The SOC table can be inserted in the document, however for the sake of revision handling it is better to refer to the SOC file directly. |
| Test resource and date outcome? |  |