



Procedure no. ZP/198/008/D/22

Attachment no. 2 to ORS

**Detailed description of fully automated fuel cell test station**

**Fully Automated Fuel Cell Test Station:**

- 100:1 turndown (max:min flow) on all Mass Flow Controllers (MFC),
- 80 NLPM max. humidified anode flow, 1 x MFC: H<sub>2</sub>,
- 200 NLPM max. humidified cathode flow, 1 x MFC: Air,
- 316 stainless steel (or higher grade) for all di-water and humidified gas-handling components,
- Automatic contact humidification module (up to 90C dew point, higher temperatures available),
- Contact Humidification with Rapid Response Dew Point for both anode and cathode sides. 1-2 second dew point transient response time for pure H<sub>2</sub> and pure Air streams,
- Automated bypass with 100% full isolation of humidifier which permits delivery of facility-supplied gas directly to stack,
- Electric reheat module (up to 110C inlet gas),
- Nitrogen purge rotameters on anode and cathode, activated on e-stop or user command,
- Automatic back pressure control module (0-3 Barg),
- Exhaust cooling heat exchangers,
- Stack end-plate heater PID controllers, 2x 2A max. (1ph AC mains voltage),
- Automated liquid coolant/heating module with conductivity monitoring: 0.5-5 LPM, 40-90C, 0-3 Barg,
- Programmable air cooled load bank with dual range operation (10%/100%). Maximum: 2KW, 75V, 350A, max. current available down to ~0.0V at stack
- Load bank with an analogue input for an external AC perturbation signal
- Load bank dynamic response: min. 10KHz,
- min.20 channels of CVM (Cell Voltage Monitor) included (+/- 5V range, +/- 1mV accuracy),
- Automation software,
- H<sub>2</sub> gas detector (CE, ATEX, UL, CSA) for test station E-stop and warning,
- Facility requirements: 3 phase electrical power, pressurized fluid supplies (di water, cooling water, reactant gases), exhaust gas handling, water drain, flammable/hazardous gas detection, fume extraction,
- min. 3 Gas lines of CO, CO<sub>2</sub>, CH<sub>4</sub> includes bulkhead connector, safety shutoff valve and 1 MFC),
- min. 2 Gas lines for corrosive gases, H<sub>2</sub>S, NH<sub>3</sub> includes bulkhead connector, safety shutoff valve and 1 MFC,
- Possibility of Dead Ended Operation,
- Bypass ion filtration system on coolant loop. For deionized water or WEG operation,
- Integrated Carbon Monoxide detector, CE, ATEX rated,
- CE marking and conformity.