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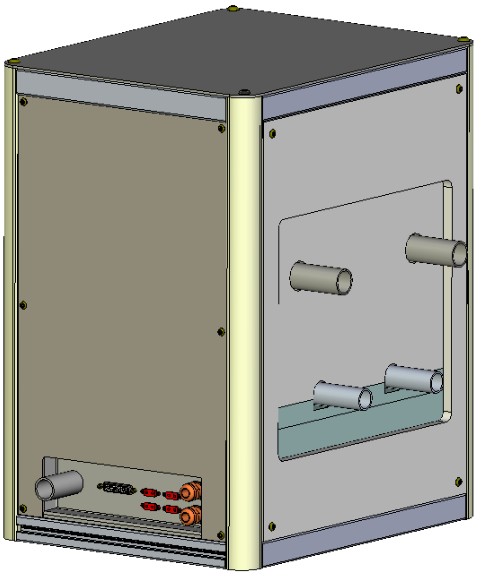
	1.1			



Article Number: 0856

ISM V3.3 with ESC2 cells

1 Introduction

The staxera integrated stack module (ISM) is a solid oxide fuel cell (SOFC) module according to DIN IEC 62282-2. The ISM consists of a SOFC stack within an insulated enclosure. It is intended for integration within a SOFC system or test station. The ISM converts chemical potential energy to electrical and thermal energy via an electrochemical process operating at a nominal temperature of between 700°C and 850°C.

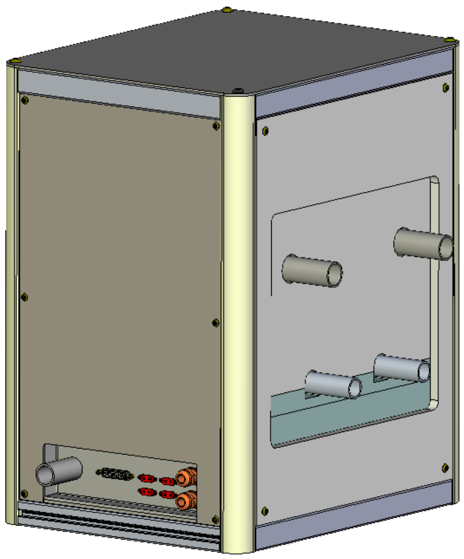


Figure 1: Integrated Stack Module

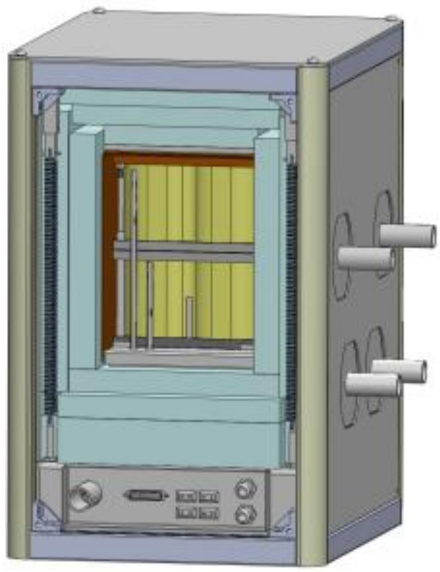


Figure 2: Cut-away view showing stacks

Further general information regarding SOFC stacks can be obtained from the USA's National Energy Technology Laboratory's Fuel Cell Handbook:

http://www.netl.doe.gov/technologies/coalpower/fuelcells/seca/pubs/FCHandbook7.pdf

2 General safety strategy

This section presents the general safety strategy of the ISM, with particular reference to Section 4.1 of DIC IEC 62282-2.

2.1 Safety concept and design solutions

The ISM includes a gas tight welded sheet-steel enclosure around the stack. This enclosure is designed as a cathode manifold and also as a housing to prevent the leakage of any anode gases to the environment. In the event of crossover between anode and cathode, all combustible or hazardous anode gases will remain within this sheet-steel enclosure, and can only exit the ISM via either the anode exhaust tube or the cathode exhaust tube.

2.2 Leak of flammable gases

The ISM satisfies DIN EN 62282-2 Section 4.2.4 as the operating temperature of the ISM (850°C) is above the self-ignition temperature of the gases used in the ISM. If the ISM is operated at a temperature below the self-ignition temperature of the gases (defined as 700°C), then the ISM should be brought to a safe operating mode by using purge gas.

If the operator operates the ISM below 700°C with flammable gases (such as hydrogen), and a crossover leak occurs between anode and cathode, then an explosive mixture can be created.

In normal operation there are no leaks from the ISM. If a failure in the ISM occurs, flammable or poisonous gases (such as hydrogen or carbon monoxide) can leak from the ISM. Possible paths of a leak could be weld points, through-oxidation of the sheet metal, or the pressure take-off points (tube and connectors). The ISM should only be operated within a ventilated enclosure such as an enclosed test station or an enclosed system.

2.3 High temperature

The ISM has an internal operating temperature of 850°C. Some components (in particular the current take off rods underneath the ISM) have a high temperature (> 70°C) during operation. These components are enclosed behind the floor plate of the ISM. Do not remove the floor plate or touch the ISM during operation. All external surfaces of the ISM have an operating temperature less than 70°C.

2.4 Mechanical hazards

The ISM has no significant mechanical hazards.

2.5 Electrical isolation between stack and housing

The stack is electrically (galvanically) isolated from the housing.

A galvanic isolation test according to DIN EN 62282-2 Section 5.7 (< 1 mA at 500 V, when the ISM is at an operating temperature of 850°C) is in planning.

2.6 High voltage at current cables

The ISM can generate a voltage of up to 80 V, measurable at the end of the two current cables. Do not touch the current cables during operation. The current cables should be connected to the electronic load (or DC-DC/AC converter) according to all relevant local electrical regulations.

2.7 High voltages at thermocouple sockets

Some thermocouples within the ISM are inserted into the core of the stack. During operation these thermocouples are exposed to the stack voltage, which can be up to 80 V. Any data acquisition equipment connected to these thermocouples should have a galvanic isolation between each channel of at least 80 V.

2.8 Soot deposition and pressure build up

Some anode gas compositions can thermodynamically generate carbon particles, or soot. Soot deposition can be predicted, as a function of gas composition and temperature. Soot deposition can be prevented by maintaining a sufficiently high ratio of steam to carbon (for example a steam to carbon ratio of 2 if methane is used as the fuel). If soot is deposited within the ISM during operation, this can block the internal flow channels and lead to pressure build up or even the failure of a connection, producing a leak of a flammable or poisonous gas.

2.9 Safety during disposal

The ISM includes hazardous materials (for example nickel) and must be disposed of according to all relevant local laws and regulations. staxera offers a disposal service for the ISM. Please contact staxera at customer-service@staxera.de for further information.

For further information please refer to the section “Disposal” in this document.

2.10 Safety issues if damaged

The ISM includes hazardous materials, for example nickel. If the ISM is heavily damaged, hazardous dust (for example nickel dust) can be released. The ISM should be placed inside a dust proof container and then disposed of. staxera offers a disposal service for the ISM. Please contact staxera at customer-service@staxera.de for further information.

2.11 Liability issues

This document contains information developed from operation of staxera ISMs and stacks within staxera test environments and is presented in good faith to the best of staxera's knowledge.

Please be aware that different system set ups may lead to different behavior of the stacks. staxera can not be held liable for damages of the stack occurring during operation even if the above recommendations are applied.

3 Product description

3.1 General

Item	Specification	Comment
Height	575 mm	
Width	447 mm	
Depth	357 mm	Excluding gas interface tubes
Volume	92 liters	Excluding gas interface tubes
Mass	≤ 65 kg	

3.2 Stack design

Item	Specification	Comment
Stack	Mk200, 60 cell	
Cells	Electrolyte supported	Supplied by H.C. Starck
Seals	Glass / ceramic	
Interconnectors	Stamped sheet metal	Crofer 22 APU

3.3 Performance (defined operating point)

Item	Specification	Comment
Electrical power	≥ 1100 W	at current interface
Electrical current	26.2 A	Results in ≥ 75% fuel utilization
Electrical voltage	≥ 42 V	At current interface
Operating temperature	850°C	
Anode gas composition	40% H_2 in N_2	Without humidification
Anode gas flow rate	36 Nl/min	
Anode gas inlet temperature	800°C	T1001 anode inlet
Cathode composition	atmospheric	Alternative: dry compressor air
Cathode flow rate	~ 150 Nl/min	Flow rate is adjusted to realize stack operating temperature.
Cathode inlet temperature	650°C	T2001 cathode inlet
Operating temperature	850 - 860°C	Whichever stack core temperature is the highest: T2101, T2102, T2103, T2104, T2105, T2106
Operating pressure	5 - 10 mbar gauge	

3.4 Performance guarantee

Item	Specification	Comment
Electrical power	1100 W	At defined operating point
Lifetime	1000 hours	At defined operating point
Thermal cycling	20 cycles	At defined cycle process
Pressure drop anode	≤ 15 hPa	At defined operating point
Pressure drop cathode	≤ 15 hPa	At defined operating point
External temperature	≤ 70°C	At defined operating point At any point on metal housing

3.5 Admissible fuel composition

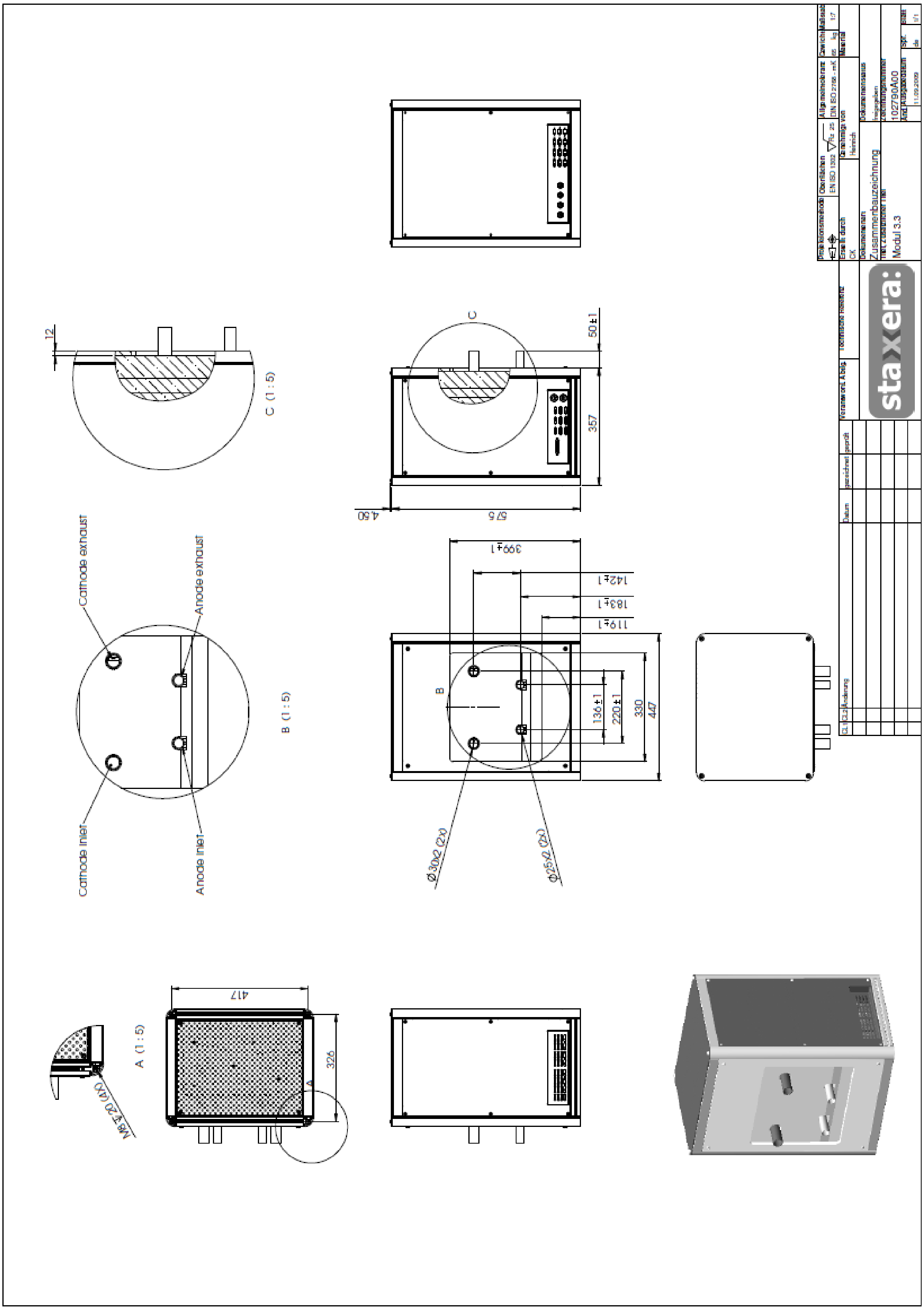
Anode gas may be composed of any mixture of fuels (H_2, CO, CH_4) and dilutants (N_2, H_2O, CO_2). Other fuels (such as pipeline natural gas, biogas, landfill gas, ethanol, petrol, diesel, etc) should first be reformed to a gas containing the components listed above.

Note – fuel compositions which lead to soot deposition should be avoided. This can be predicted using thermodynamic equilibrium calculations. For example, if methane (CH_4) is used as a fuel, the steam / carbon ratio should be greater than 2 to avoid carbon deposition. Please contact staxera at customer-service@staxera.de for more information.

3.6 Typical emissions

The anode exhaust gas composition is defined by the anode inlet gas composition (and flow rate) and the magnitude of electrical current flow in the stack. If current is drawn, oxygen is added to the anode gas mixture.

3.7 Product drawing



3.8 Process and instrumentation interfaces

The ISM is supplied with the following interfaces:

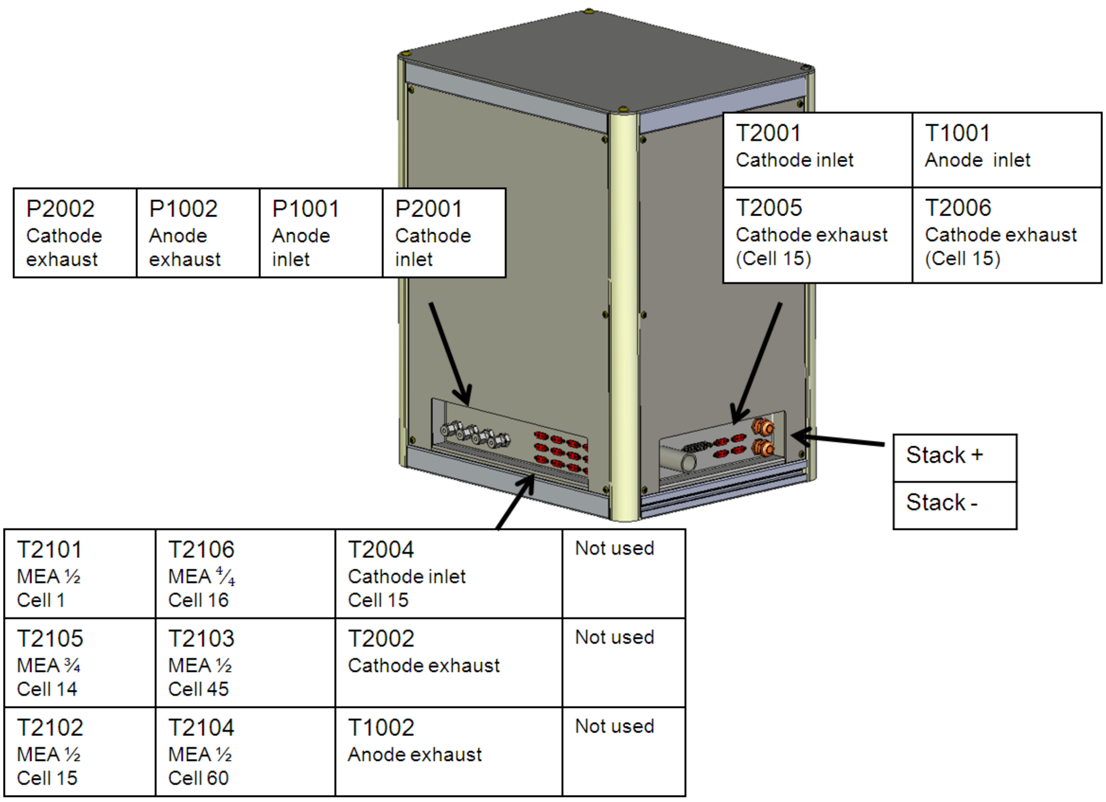
Interface	Specification	Comment
Cathode inlet	30x2mm tube	Material: 1.4841 Note: the system or test station may not transfer forces to the tubes. This may cause the tubes or the construction within the ISM to bend or fail. Compensators should be used between the ISM and the system or test station.
Cathode exhaust	30x2mm tube	
Anode inlet	25x2mm tube	
Anode exhaust	25x2mm tube	
Current	2 cables, 2m long	Copper area 16mm2
Voltage	25 pin Sub-D socket	12 blocks each of 5 cells
Temperature	Type-N miniature sockets (twelve) Note: stack core thermocouples are exposed to the stack voltage. Data acquisition equipment should have > 80 V electrical insulation between channels. 	T1001 Anode inlet (tube) T1002 Anode exhaust (tube) T2001 Cathode inlet (tube) T2002 Cathode exhaust (tube) T2004 Cathode inlet (stack) T2005 Cathode exhaust (stack) T2006 Cathode exhaust (stack) (T2006 is twin of T2005) T2101 MEA 1/2, cell 1 T2102 MEA 1/2, cell 15 T2103 MEA 1/2, cell 45 T2104 MEA 1/2, cell 60 T2105 MEA 3/4, cell 14 T2106 MEA 4/4, cell 16
Pressure take-off	6mm compression fitting (four)	P1001 Anode inlet P1002 Anode exhaust P2001 Cathode inlet P2001 Cathode exhaust
Structural	Bosch profile 30mm	Material: aluminium
Ground (earth)	Any point on Bosch profile	

3.9 Detailed description of interfaces

3.9.1 Location of process interfaces (gases)

Please refer to the product drawing for the location of process interfaces (gases).

3.9.2 Location of interfaces (instrumentation)



3.9.3 Fuel

The fuel interfaces are tubes with a 25mm outer diameter and a 2mm wall thickness. staxera recommends using an orbital TIG welding machine to join the ISM with the system. Alternatively, a flange can be welded to the tube. After welding, the fuel tubes should be thermally insulated so as to prevent excessive heat transfer to the structural housing.

3.9.4 Air

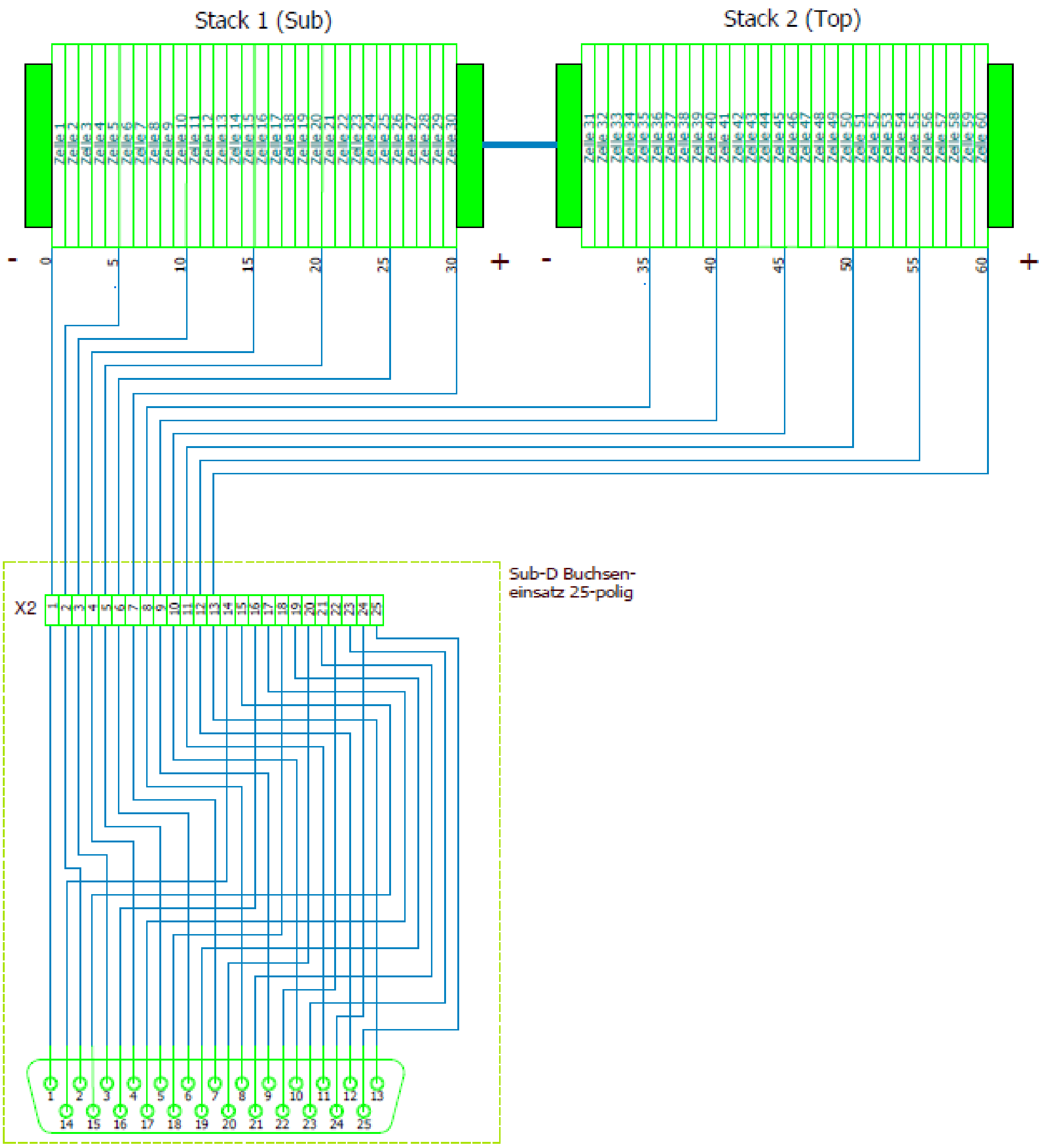
The air interfaces are tubes with a 30mm outer diameter and a 2mm wall thickness. staxera recommends using an orbital TIG welding machine to join the ISM with the system. Alternatively, a flange can be welded to the tube. After welding, the air tubes should be thermally insulated so as to prevent excessive heat transfer to the structural housing.

3.9.5 Current

The current interface is two cables, 16mm^2 with length 2m, without cable shoes. The customer should fit appropriate cable shoes to suit their inverter or electronic load.

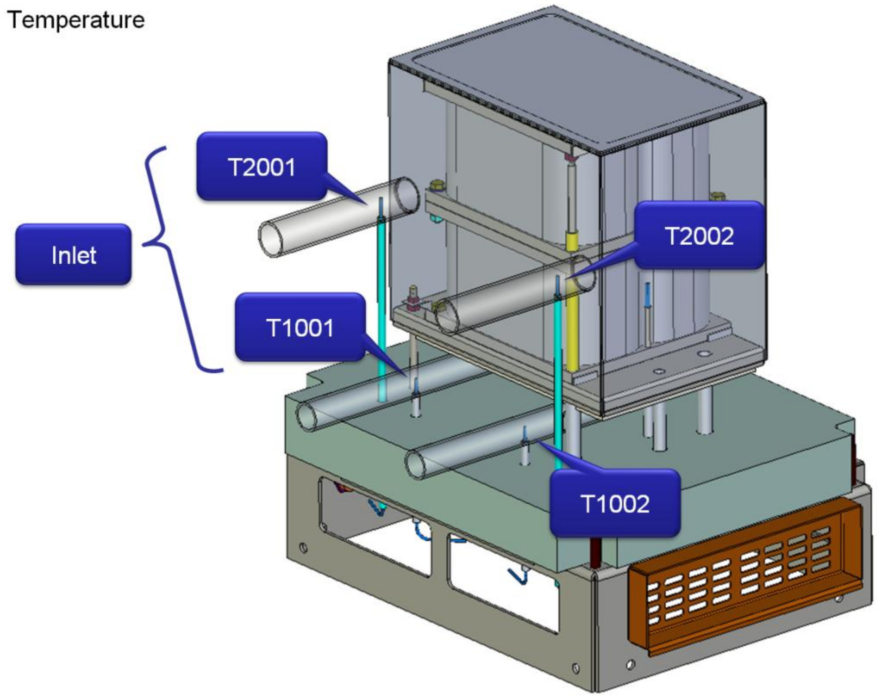
3.9.6 Cell voltages

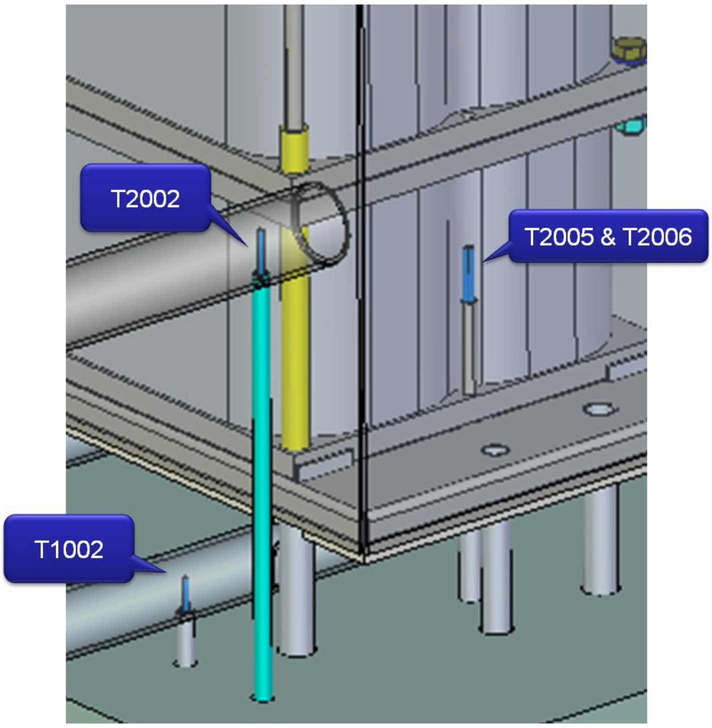
The ISM is supplied with voltage signals for 12 blocks of 5 cells each. The interface is a standard Sub-D socket.

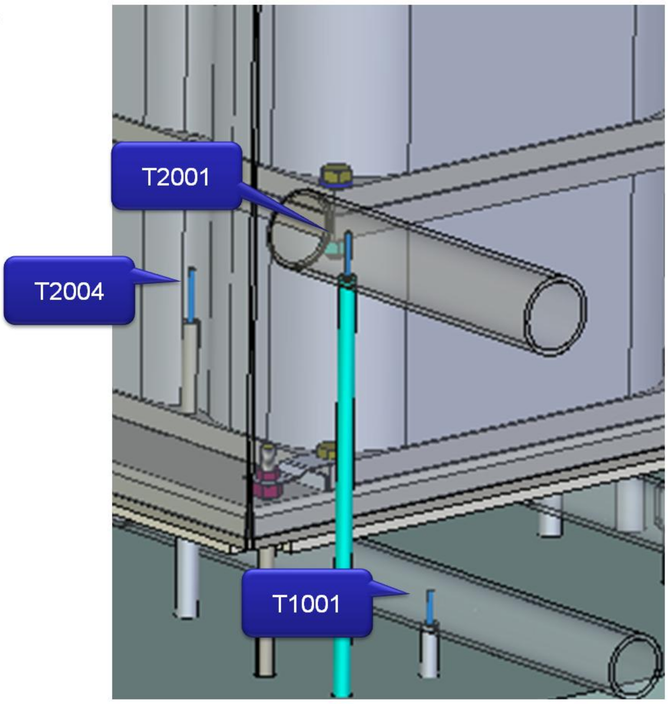


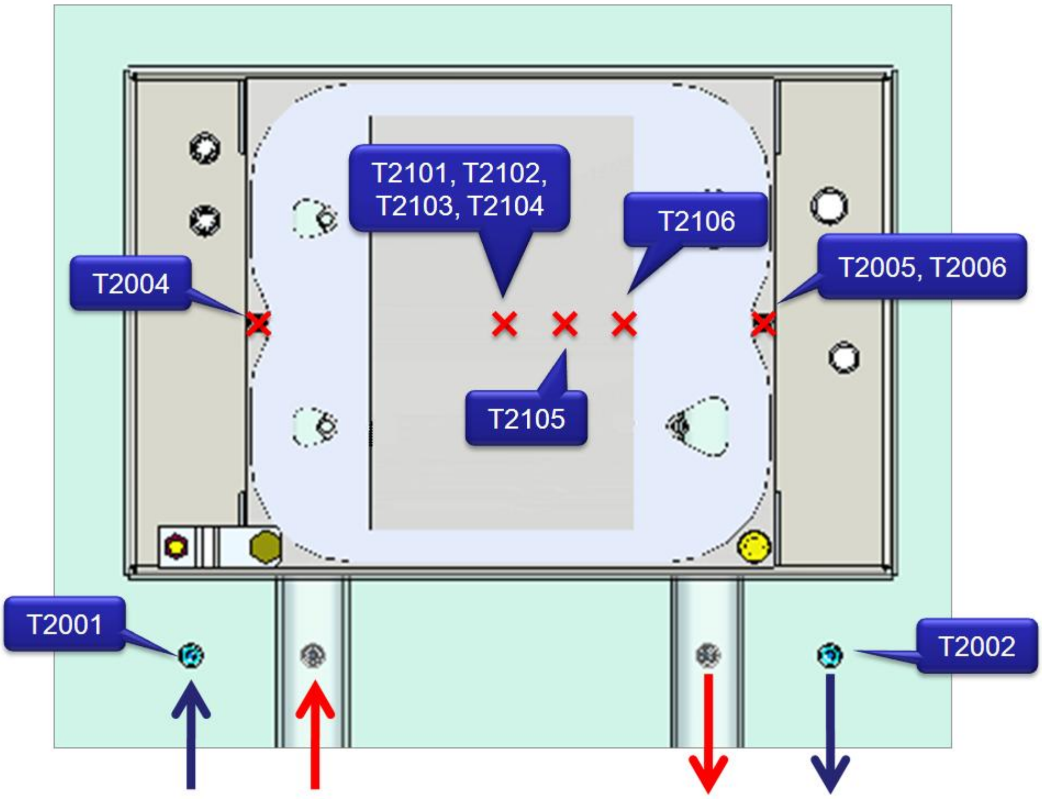
3.9.7 Temperature

The ISM is supplied with type-N thermocouples for all temperature measurements. The customer interface is miniature panel sockets. For more information on the sockets please refer to: http://www.tc.co.uk/thermocouple/thermocouple_connectors.htm. The following diagrams describe the location of the thermocouples inside the ISM.



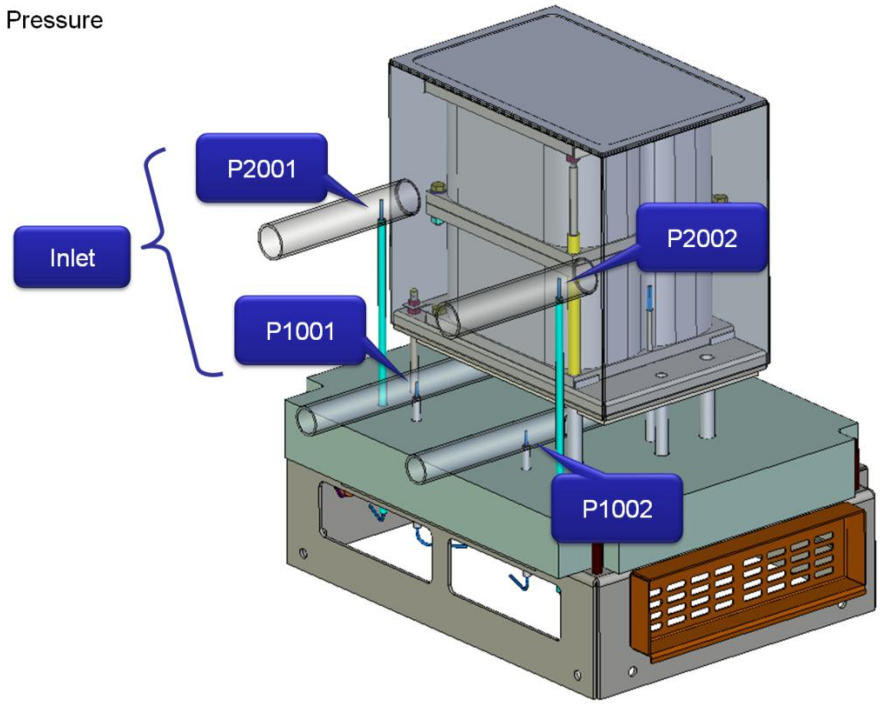



T2001
T2004
T1001


T2101, T2102,
T2103, T2104
T2106
T2004
T2005, T2006
T2105
T2001
T2002

3.9.8 Pressure

The ISM is supplied with pressure take off points to enable measurement of the pressure at the four gas interfaces. The following diagram describes the location of the pressure take-off points.



3.10 Operating limits

Please refer to the section “Operation Manual”.

3.11 Gas leakage

This section is not relevant as the operating temperature of the ISM (850°C) is above the self-ignition temperature of the gases used in the ISM.

4 Installation manual

This section describes how to install the ISM in a test station or system, with particular reference to Section 7.4.1 of DIN IEC 62282-2.

4.1 Unpacking

The ISM is mounted on a wooden pallet which can be lifted with a forklift. Packaging can be removed using simple hand tools. Retain the packaging materials for future use.

4.2 Handling, transport and storage

Handling - the ISM should be lifted by two persons, using the two handles supplied. Place the ISM on a flat surface. Do not tip the ISM more than 20° from vertical.

Transport - the ISM should be packaged on a Euro-Pallet, as it was delivered. Use standard truck transport. Avoid falls > 5cm.

Storage - standard cool dry warehouse environments are acceptable for storage.

4.3 Orientation

The ISM should be maintained upright at all times. Do not tip the ISM more than 20° from vertical.

4.4 Fixing method (in test station)

The ISM is supplied with a frame made with 30mm Bosch-Rexroth aluminum profile extrusions. The ISM can be structurally fixed by bolting to this frame.

Mount the ISM on two beams, allowing free ventilation of air to the lower portion of the ISM. This prevents the sensor cables from overheating.

4.5 Gas connections

The four gas tubes (anode and cathode, inlet and exhaust) could contain explosive gas mixtures (hydrogen and air) during operation. Therefore, all connections between the ISM and the system (or test-station) should be gas-tight. One method is as orbital welding. Alternatively, flanges can be welded onto the tubes.

4.6 Current connection

The ISM is supplied with two current cables, 2 m long, without cable shoes. Red is positive, black is negative. The customer should attach cable shoes to the cables, according to the required dimensions of the electronic load (or DC-DC or DC-AC converter).

4.7 Temperature measurement

All temperature sensors installed within the ISM are Type-N thermocouples. The customer interface is a miniature panel socket. Please also refer to Section 2: Safety Issues for a description of the risk of high voltages at the customer interface.

4.8 Voltage measurement

Some of the stack interconnector plates have been fitted with a platinum wire to enable voltage measurement. The voltages measured can be over 42 volt, therefore care should be taken to avoid contact during operation. The customer interface is a Sub-D plug.

4.9 Pressure measurement

The four gas tubes (anode and cathode, inlet and exhaust) each have a pressure take off leading to a 6mm compression fitting. The customer can fit an extension line or a pressure sensor to these compression fittings. Take care to avoid leaks in all connections, as the gas inside the ISM could be an explosive mixture (hydrogen and air).

4.10 Ventilation

In normal operation the ISM has zero leakage from the internal volume (anode/cathode) to the outside air. The stack is surrounded in a welded steel housing. Nevertheless, when operating the ISM in a test station, staxera recommends ventilating the test station with 5 – 10 volume changes per hour.

4.11 General notes and prohibited handling

Do not expose the ISM to excessive shock and vibration.

5 Operation manual

This section describes how to operate the ISM, with particular reference to Section 7.4.2 of DIN IEC 62282-2.

Detailed information regarding recommended test procedures is available in an accompanying document „ISM Test Procedures“. Please contact staxera at customer-service@staxera.de for a copy of this document, or for further information.

5.1 Introduction

The ISM must be installed within a system or test-station before it can be operated. The system or test-station supplies the necessary gases, current control, and safety systems required for operation.

System or test station operators must be trained or otherwise permitted to operate the equipment.

5.2 Special process for the first heat up and operation

The ISM is assembled and quality-controlled by staxera in Dresden, Germany. The first time the ISM is operated it requires a special heat up and operation process. Afterwards, the ISM can be operated normally. staxera can also conduct this process for the customer, as an optional extra service. Please contact staxera at customer-service@staxera.de for further information.

The special start up process is the same as the normal start up process, but is conducted slower. See the accompanying document „ISM Test Procedures“ for full detail.

5.3 General sequence of operations

The ISM is heated up by the anode and cathode process gases, which can be supplied at up to 850°C. Above 700°C, fuel can be supplied and current drawn. Above 820°C, the cathode air temperature is reduced to 650°C. The ISM temperature is controlled by adjusting the cathode air flow rate.

To shut down, reduce the current to zero, reduce the air and fuel flow rates to a low value, introduce purge gas, and then turn off the pre-heaters.

For full details please refer to the accompanying document „ISM Test Procedures“.

Safety note - purge gas should be supplied to the ISM at all times when the temperature is below 700°C, as described in the section “General safety strategy”. Above 700°C, explosive and hazardous gases (such as hydrogen or carbon monoxide) can be supplied to the anode side.

5.4 Temperature control

The staxera ISM generates both thermal and electrical energy during operation. To maintain stable operating temperatures, the stack must be cooled. This thermal sink should be dynamically matched to the thermal source, which is proportional to stack power.

Two methods of cooling are available: convective cooling using cathode air, or reactive cooling using internal reforming of methane on the surface of the cell.

For full details of recommended procedures please refer to the accompanying document „ISM Test Procedures".

5.4.1 Convective cooling

When little or no methane is supplied to the stack the only available cooling method is convective. staxera recommends using the cathode air as the thermal sink (as opposed to cooling with the anode fuel gas). The air flow rate should be controlled so that the maximum stack core temperature remains in the target zone of 855°C – 860°C.

5.4.2 Internal reforming

If a methane/water mixture is supplied to the stack, the methane will be reformed to hydrogen and carbon monoxide on the surface of the cell. This will cool the stack. Less cathode air is then required to cool the stack.

5.4.3 Thermal transients

The stack core temperature should be closely observed during transients such as changes in load. The thermal sink (cathode air flow rate) should always be carefully matched with the thermal source (stack power). The air flow should generally be adjusted parallel with changes in current, ideally using predictive control.

If the current load is suddenly removed, then the cathode air flow should also be reduced as fast as possible.

5.5 Frequency of inspection

The ISM contains no user-serviceable components, and therefore does not require regular inspections.

5.6 Normal and emergency shut down procedures

To shut down, reduce the current to zero, reduce the air and fuel flow rates to a low value, introduce purge gas, and then turn off the pre-heaters.

In an emergency, simply reduce current and gas flows to zero.

For full details please refer to the accompanying document „ISM Test Procedures".

5.7 Storage procedure and conditioning

The ISM does not require particular conditioning prior to storage. Simply follow the normal shut down procedure.

5.8 General notes and prohibited operation

Observe the operating limits.

5.9 Information on the physical environment where appropriate

Observe the operating limits.

5.10 Electrochemical leakage test

Small leakages or anode-cathode crossover can be detected using an electrochemical leakage test. This involves removing the current and then shutting off all gas flows to the stack. The time resolved change in cell voltages is used to determine if a leak is present.

For full details of this procedure please refer to the accompanying document „ISM Test Procedures“.

5.11 Operating limits

Item	Limit	Comment
Cathode inlet temperature	≤ 850°C	T2001 cathode inlet (tube)
Cathode exhaust temperature	≤ 830°C	T2005 / T2006 cathode exhaust (stack)
Anode inlet temperature	≤ 850°C	T1001 anode inlet (tube)
Anode exhaust temperature	≤ 850°C	T1002 anode exhaust (tube)
Stack core temperature	≤ 860°C	T2101, T2102, T2103, T2104, T2105, T2106
Cathode inlet temperature gradient	≤ 50°C/min ≤ 4°C/min	Heating up to operating temperature Cooling down from operating temperature
Anode inlet – cathode inlet temperature gradient	≤ 250°C ≤ 250°C	T1001 – T2001 anode > cathode T2001 – T1001 cathode > anode
Pressure difference Anode-Cathode (inlet)	≤ 30 hPa ≤ 30 hPa	P1001 – P2001 anode > cathode P2001 – P1001 cathode > anode
Operating pressure	≤ 30 hPa gauge	
Operating altitude	≤ 1000 m	
Minimum voltage	3 V 36 V	per 5-cell block At current interface
Current	≤ 30 A	
Current ramp	2 A/min 30 A/min	Increasing current Decreasing current
Air utilization	≤ 60 %	
Fuel utilization	≤ 80 %	

5.12 Troubleshooting

Open circuit voltage (OCV) too low:

- Check anode gas composition, anode gas flow rate, an ISM temperature
- Check for leaks in the connection between anode gas supply and ISM anode inlet
- Check for leaks or broken cells by conducting an electrochemical leakage test

Power too low:

- Check anode gas composition, anode gas flow rate, an ISM temperature
- Check for leaks in the connection between anode gas supply and ISM anode inlet
- Check for leaks or broken cells by conducting an electrochemical leakage test

Voltage at end of current cable does not match voltage at platinum wires:

- Values should only be equal during open circuit (0 Ampere)
- Check pin number in Sub-D plug – complete stack voltage uses first and last platinum wire

6 Maintenance manual

This section describes the maintenance of the ISM, with particular reference to section 7.4.3 of DIN IEC 62282-2.

The ISM does not contain any user-serviceable components. The ISM should not be disassembled by the customer.

7 Parts list

This section describes the ISM parts list, with particular reference to section 7.4.4 of DIN IEC 62282-2.

The ISM does not contain any user-serviceable components. The ISM should not be disassembled by the customer.

8 Recycling and Disposal

8.1 Recycling

The aluminium housing can be recycled. All other components should be disposed of.

8.2 Disposal

The ISM includes hazardous materials, for example nickel, and should not be disposed of as standard waste. If the ISM is heavily damaged, hazardous dust (for example nickel dust) can be released. The ISM should be placed inside a dust proof container and then disposed of. staxera offers a disposal service for the ISM. Please contact staxera at customer-service@staxera.de for further information.

9 Compliance with DIN IEC 62282-2

9.1 Section 1 - Scope

The ISM is compliant with Section 1 – Scope; as it is a solid oxide fuel cell and is capable of operation under the following conditions:

- altitude up to 1 000 m
- air containing approximately 21 % ± 1 % oxygen by volume

9.2 Section 4.1 – General safety strategy

Refer to the section "General Safety Strategy" of this document.

9.3 Section 4.2 – Design requirements

The ISM is compliant with this section; as it has been designed in accordance with a risk assessment. The ISM enclosure is rated IP00 (non-protected) as the end-use equipment (system or test station) has a protective enclosure.

9.4 Section 4.2.2 – Leakage

In normal operation the ISM has zero leakage from the internal volume (anode/cathode) to the outside air. The stack is surrounded in a welded steel housing. Nevertheless, when operating the ISM in a test station, staxera recommends ventilating the test station with 5 – 10 volume changes per hour.

In normal operation crossover between anode and cathode does not occur. If crossover does occur, it does not result in hazardous condition if the operating temperature is greater than 700°C. As specified in the section "General Safety Strategy", the customer should only allow combustible or hazardous gases to flow to the anode when the ISM operating temperature is above 700°C. If the temperature is below 700°C, purge gas should be used on the anode side.

9.5 Section 4.2.3 – Pressurized operation

The ISM is not permitted for pressurized operation.

9.6 Section 4.2.6 – Pipes and fittings

The ISM is compliant with this section. Any compartment enclosing plastic or elastomeric components used to convey flammable gases shall be protected against the possibility of overheating.

9.7 Section 4.2.7 – Electrical components

The ISM does not contain electrical components.

9.8 Section 4.2.8 – Terminals and electrical connections

The ISM is compliant with this section.

9.9 Section 4.2.9 – Live parts

The ISM is compliant with this section. All live parts are fully enclosed.

9.10 Section 4.2.10 – Insulating materials

The ISM is compliant with this section.

9.11 Section 4.2.11 – Bonding

The ISM is compliant with this section.

9.12 Section 4.2.12 – Shock and vibration

The ISM can tolerate standard freight by air. Do not expose the ISM to excessive shock and vibration.

9.13 Section 4.2.12 – Means for monitoring

The ISM is compliant with this section. Means for monitoring stack temperature and stack and/or cell voltages are provided.

9.14 Section 7.1 – Nameplate

The ISM is compliant with this section.

9.15 Section 7.2 – Marking

The ISM is compliant with this section.

9.16 Section 7.3 – Warning label

The ISM is compliant with this section; as it includes the following warning labels:

- shock hazard
- high temperatures

9.17 Section 7.4 – Documentation

The ISM is compliant with this section. The required information can be identified by referring to the following table:

General safety strategy	Refer to Section 2 of this document
Type of fuel and oxidant	Refer to Section 3 of this document
Fuel and oxidant supply pressure	Refer to Section 5 of this document

Fuel and oxidant consumption	Refer to Section 3 of this document
Maximum fuel leakage rate	Refer to Section 9.4 of this document
Fuel and oxidant supply temperature	Refer to Section 3 of this document
Maximum exhaust temperature	Refer to Section 3 & 5 of this document
Typical emissions	Refer to Section 3.6 of this document
Range of ambient temperature and humidity for operation and storage	Refer to Section 4.2 of this document
Range of altitude	Refer to Section 10.1 of this document
Permissible shock and vibration	Refer to Section 10.12 of this document
Normal stack operating temperature	Refer to Section 3 of this document
Maximum surface temperature	Refer to Section 3 of this document
Coolant species	Refer to Section 3 of this document
Coolant inlet and outlet temperature	Refer to Section 3 of this document
Coolant supply pressure	Refer to Section 3 of this document
Type of protection devices	Refer to Section 2 of this document
Purging and ventilation	Refer to Section 4.10 and 9.4 of this document
Dimensions	Refer to Section 3 of this document
Weight	Refer to Section 3 of this document
Electrical output ratings	Refer to Section 3 of this document
Maximum electrical overload	Refer to Section 5 of this document
Auxiliary power supply	Not relevant
End-product use	Refer to Section 1 of this document
Location of earth connection	Refer to Section 3.7 of this document
End-of-life procedures	Refer to Section 8 of this document

9.18 Section 7.4.1 – Installation manual

Please refer to the section “Installation Manual“ of this document for installation instructions

9.19 Section 7.4.2 – Operation manual

Please refer to the section “Operation Manual” of this document for operating instructions.

9.20 Section 7.4.3 – Maintenance manual

Please refer to the section “Maintenance Manual” of this document for maintenance instructions.

9.21 Section 7.4.4 – Parts list

Please refer to the section “Parts List” of this document.