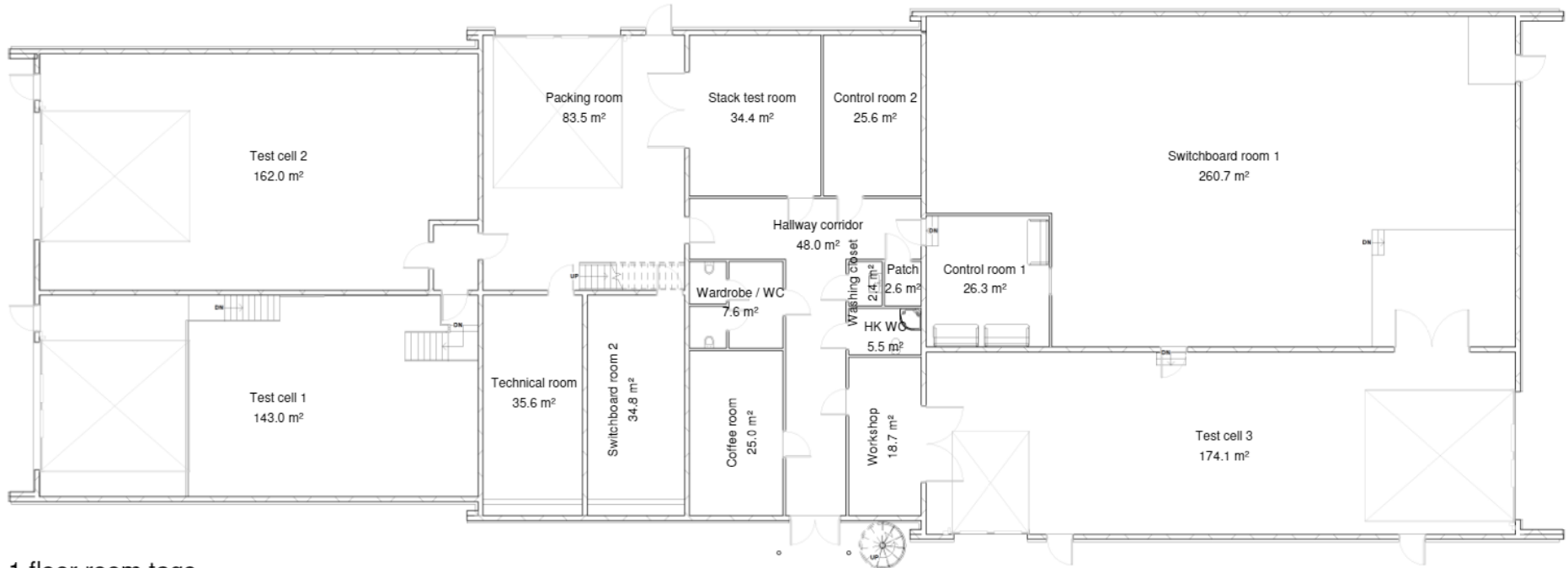


**Overview of the building**

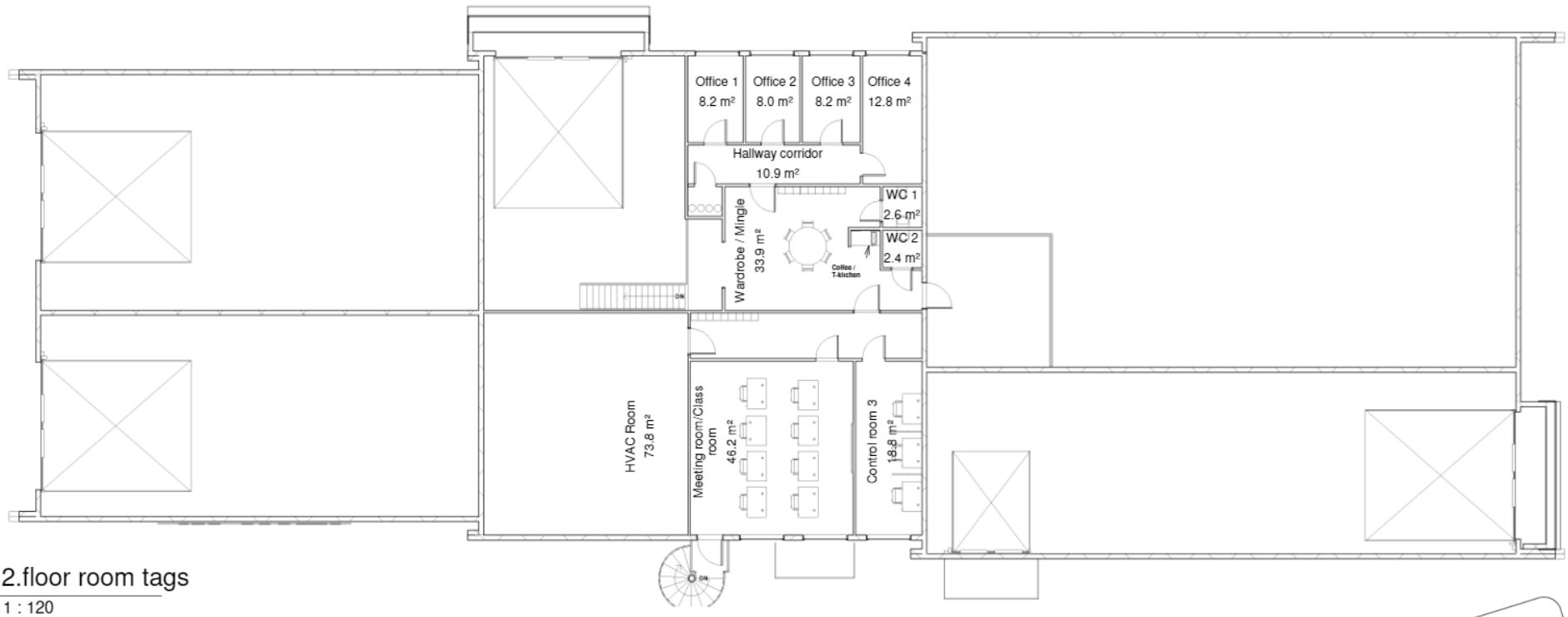
Facility	Area	Height	Industrial door	Application	Crane Capacity
Test cell 1	143.0 m <sup>2</sup>	6 m	B5.0m x H5.0m	Testing of Internal combustion engines	2x20 tons
Test cell 2	162.2 m <sup>2</sup>	6 m	B5.0m x H5.0m	Testing of Fuel cell systems	15 tons
Test cell 3	174.1 m <sup>2</sup>	6 m	B5.1m x H4.0m	Testing of Electrical machinery and power systems	10 tons
Switchboard room 1	260.7 m <sup>2</sup>	5.5 m	-	Power electronics, energy management systems, battery energy storage	3.2 tons
Switchboard room 2	34.8 m <sup>2</sup>	-	-	Possibility to connect MV equipment	-
Control room 1	26.3 m <sup>2</sup>	-	-	Internal Power Management System for optimized energy use	-
Control room 2	25.6 m <sup>2</sup>	-	-	--=--	-
Control room 3	18.8 m <sup>2</sup>	-	-	--=--	-
Packing room	83.5 m <sup>2</sup>	6 m	B5.1m x H4.0m	Storage	-
Workshop	18.7 m <sup>2</sup>	-	-		-
Technical room	35.6 m <sup>2</sup>	-	-	Contains components of utility systems	-
Wardrobe/WC	7.6 m <sup>2</sup>	-	-		-
Meeting room	46.2 m <sup>2</sup>	-	-	Meeting and presentation area for 15-20 persons	-
Coffee room	25 m <sup>2</sup>	-	-		-
Office 1	8.2 m <sup>2</sup>	-	-		-
Office 2	8.0 m <sup>2</sup>	-	-		-
Office 3	8.2 m <sup>2</sup>	-	-		-
Office 4	12.8 m <sup>2</sup>	-	-		-
Recreational area	33.9 m <sup>2</sup>	-	-		-
Stack test room	34.4 m <sup>2</sup>	2.9 m	-	Possibility to work on ESD sensitive equipment	-

### Overview of the building



1 1.floor room tags  
1 : 120

**Overview of the building**



<b>Electrical</b>	
<b>Electrical supply</b>	<b>Consumption capacities from/to grid</b>
400 V AC TN-C	approx. 400 kW
22 kV AC	4 MW
690 V AC	4 MW
450 V AC	1 MW
400 V AC	1.5 MW

**Feed- in grid connection**

Most testing activities that will take place at the facility will generate electrical power. It is required that this electrical power will be connected to the electrical grid for export, as dump load or cooling facilities for dump load will not be installed. The feed-in functionality is utilizing the same infrastructure as for consumption. Produced energy is fed from test equipment into the 690 V switchboard, via 2 x 2 MVA transformers up to 22 kV, before injection to the regional distribution grid.

The test centre provides a supervisory power management system for control and monitoring of power-to-grid feed-in. However, certain power quality requirement will apply to test clients. These requirements will be based on input from DSO and determined by Alltec Services in close dialogue with the clients.

**Emergency power system**

There will be installed an UPS system that will supply critical equipment and necessary parts of the plant while maintaining power until normal operation conditions are restored. The UPS system will comply with DSB regulations.

**Power Electronics**

**Test cell 3**

	<b>Speed</b>
<b>Motor skid 1 - Propulsion/Pumps</b>	
2x 2,4 MW induction motors Alconza	1200 rpm
1x 1,5MW dual winding PM motor	110 rpm
1x 3MVA synchronous generators	720 rpm
<b>Motor skid 2 - Drilling/Winch - testing of several machines on the same shaft</b>	
3x 110kW induction motors for drilling application testing or tandem operation	1200 rpm
1x 400kW induction motor for load simulation for drilling application testing	1200 rpm
Brake disc	
<b>Motor skid 3 - Grid stabilization</b>	
1x 400kW induction motor C3M 355 LX4	1800 rpm
1x 400kVA synchronous generator MJBM 315 MA4	1800 rpm
<b>Motor skid 4 - Testing of high frequency operations</b>	
1x 400kW permanent magnet machine	1200 rpm
1x 400kW induction motor	1200 rpm

Note: Fresh water cooling available in Test cell 3.

**Outdoor Utility area**

500kVA 400V diesel generator, day tank 1 m<sup>3</sup>  
 Diesel tank, 3 m<sup>3</sup>

**Batteries**

<b>Rated output energy</b>	<b>Rated continuous current</b>	<b>Output nominal voltage</b>	<b>Modules in series/string</b>
117 kWh	0.8 C	800 VDC	15

## Power Electronics

### Switchboard room 1

#### Motor inverter with passive rectifier

2700kW passive rectifier (PR) with motor inverter (MI), now connected as 4x 800kW MI

2x 800kW PR and MI

2700kW PR and MI, now connected as load bank

#### Switchboards

690V complete AHT switchboard for LLC

400V test switchboard

450V complete AHT switchboard

230V complete AHT switchboard

450V/230V complete AHT emergency switchboard

MV Switchboard with 4 heavy duty breakers, 3 contractor fields, 2 incoming fields

#### Transformers

2x LLC transformers 2MVA 690V and 1MVA 450V (690V/690V/450V/filter winding)

1500 kVA 12 pulse transformer (400V/690V/690V)

2x transformers 2MVA 22kV/690V

Transformer kiosk for test centre

MV LLC transformer (6.6kV/6.6kV/690V/690V/Filter winding), including filter. (4MVA, 4MVA, 2MVA,

#### Multidrive/DC hub/Hybrid converter

2x active rectifier (AR) 1500kW, with LCL filters

2x DC/DC chopper 2000A with LC filter

2x 2700kW MI

#### Other

1500kW training MI, only for training

2x 200kW water cooled brake resistors

Capacitor bank 5.7 MVar, damping reactors 50uH, 6.6kV

Heat testing equipment, including wood box and climatic control unit

<b>Tank Storage Area (Outdoor)</b>				
<b>Tank storage area (Outdoor)</b>	<b>Storage capacity</b>	<b>Distribution capacity</b>	<b>Distribution/Outlet pressure</b>	<b>Outlet temperature</b>
Hydrogen storage tanks	271 kg per 20 ft container	18 kg/h	< 6 bar(g)	-
Hydrogen electrolyser	-	18 kg/h (TBD)	35 bar (TBD)	-
Oxygen storage tanks	373 kg	15 kg/h	< 16 bar	-
Liquid Ammonia (ISO tank container) / Evaporator	approx. 13 tons	1200 kg/h	10 bar	approx. 65 °C (40 K superheat)
Natural gas/ Biogas compressor	-	511 kg/h	< 15 bar(g)	approx. 50 °C
Diesel storage tank	3-5 m3	-	-	-
Nitrogen storage bank	100 Nm3	Adjusted by demand	200 bar	-

**Note**

The test centre has available space for outdoor testing of large systems. The outdoor facilities have to be adapted to project-specific needs. Generally, the same facilities and technical systems that is available indoor in the test centre can be made available for the outside testing areas as well.

Storage and distribution of other gases can be arranged upon request.

The individual gases will be available at an interface panel in each test cell.

<b>Fuel Cell Systems</b>			
<b>Fuel Cell</b>	<b>Main fuel</b>	<b>Electrical power</b>	<b>Note</b>
PEMFC	Hydrogen	185 kW	Module from Powercell. Connected to external hydrogen supply, will also be able to operate on hydrogen produced from the NG container.
NG SOFC	Natural gas	ca. 80 kW	Container will be able to produce electricity from high temperature fuel cells (SOFC), water, CO2 and heat. Will also contain a hydrogen separator.
NH3 SOFC	Ammonia	ca. 80 kW	Container will be able to produce electricity from high temperature fuel cells (SOFC), water, nitrogen and heat.



**Utility Systems**

**Cooling**

Cooling system	Cooling Capacity	Cooling medium	Fluid temperature
Cooling plant	2 500 kW	-	-
TC1 HX cooling capacity	min. 1 652 kW	-	-
TC2 HX cooling capacity	min. 450 kW	-	-
TC3 HX cooling capacity	TBD kW	-	-
Primary circuit	-	30% ethylene glycol/water	< 32 °C
Secondary circuits	-	As required by customer	< 38 °C

Note: An additional heat exchanger can be connected to the main cooling medium circuit to provide an interface for district heating.

**Ventilation**

Ventilation system	Supply capacity
Supply capacity balanced, treated air (general HVAC)	12 000 m <sup>3</sup> /h
Supply capacity cooling/reactant air, TC1	approx. 30 000 m <sup>3</sup> /h
Roof-mounted exhaust fans, TC1	2 x 8 750 m <sup>3</sup> /h
Roof-mounted exhaust fans, TC2	2 x 8 750 m <sup>3</sup> /h

**Utility Systems**

<b>Exhaust systems</b>	<b>Note</b>
Combustion engine exhaust	Test cell 1 will be equipped for exhaust handling of combustion engines up to 3 MW. Emission treatment and/or reduction systems can be supported, but this must be agreed with test centre facilitator and adapted according to project needs.
Fuel cell process exhaust	The permanent fuel cell installations will require several different process exhaust treating methods, as resultant products may be toxic, explosive, or acidic. Infrastructure for handling of these substances will be provided. For special project needs, the test centre can facilitate exhaust handling systems after individual evaluation and agreement between project and test centre facilitator.

**Pressurized air compressor**

<b>Tank capacity</b>	<b>Distribution capacity (max)</b>	<b>Maximum pressure</b>
270 L (TBD)	640 L/min (TBD)	8 bar

## Safety

### Operation & Safety Systems

- Alltec Services – facility & operational safety manager – service provider
- Supervisory control & monitoring system (SCADA):
  - Fire and gas detection
  - Fault detection and alarm system
  - Automatic shutdown sequences (ESD/PSD) of testing equipment and gas system
  - Manual operator panels for shutdown initiation (ESD/PSD)
  - Active ignition source control
- Gas containing areas designed according to IEC Ex standards.
- Redundant gas evacuation and safety pressurization HVAC systems.
- Permit to work (PTW) and safe job analysis (SJA) operational procedures.
- Access control.

## Safety

### Safety Measures – Tank Storage Area

- Ammonia tank located inside dedicated custom designed concrete building.
  - Protection against impacts and nearby fire (reduces BLEVE potential).
  - Acts as spill basin
  - Reduces evaporation rate
  - Controllable point of gas release in case of leaks
  
- Blast wall against public road.
  - Also acts as protection against impact from road traffic.
  
- Fence to protect area from public access.
  
- Gas and flame detection with automatic shutdown functions.
  - Connected to supervisory control and monitoring system.
  - Direct notification to fire brigade.