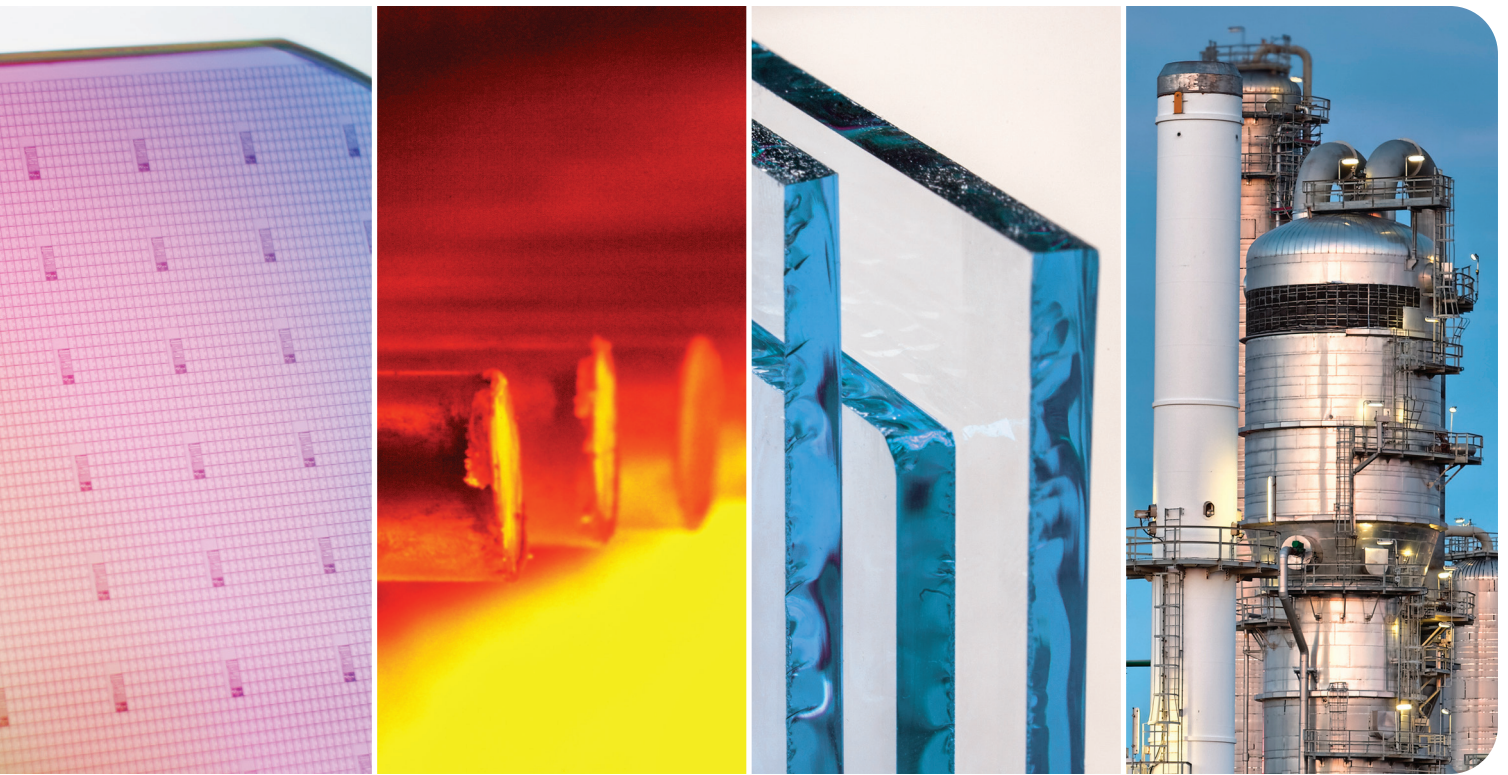


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# Hydrogen Generators

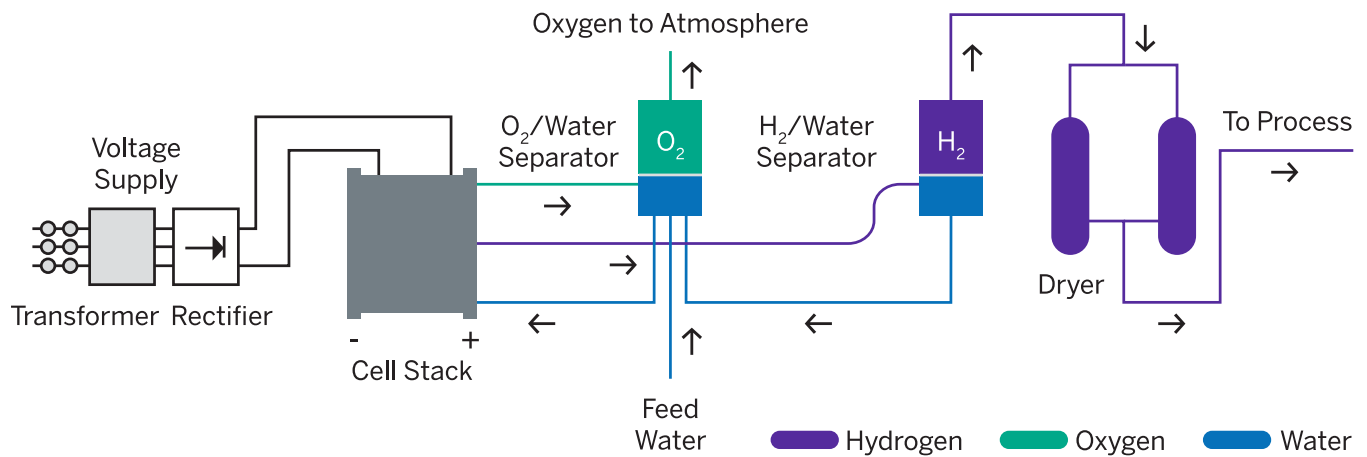


For High Purity Industrial Applications

number one by nature®

# Proton Exchange Membrane (PEM) Hydrogen Generator

Nel Hydrogen PEM water electrolyzers are designed to meet the specific needs of high purity industrial applications. They provide fast response times and production flexibility without producing carbon dioxide – carbon intensity of hydrogen reflects electrical energy input. These state-of-the-art units offer turnkey solutions for the growing need for reliable, cost-effective hydrogen supply.



Electrolysis is the process of splitting the water molecule into hydrogen and oxygen using electricity. The inputs to this process are simply feed water and the electrical current supplied to the electrolyser.

## TRANSFORMER/RECTIFIER

The transformer and rectifier convert the AC power supply into DC current input.

## CELL STACK

The cell stack is based upon proton exchange membrane technology. Hydrogen gas is generated at the cathode at customer convenient pressures. Oxygen gas is produced at the anode at pressures close to ambient. The full differential pressure design provides for safe, simple operation.

## H<sub>2</sub>/WATER SEPARATOR

The H<sub>2</sub>/Water Separator removes liquid water from the high pressure hydrogen and safely recycles it back to the system water tank.

## DRYER

The dryer will dry the gas to reach the suitable dew-point. It consists of multiple beds filled with a regenerative desiccant to absorb the water.

# Compact Hydrogen Generators

The C, H and S Series water electrolyzers feature state-of-the-art PEM technology in integrated, compact packages. They are easy to site in general purpose indoor areas.

- Pure hydrogen at process pressure – up to 30 barg (435 psig) hydrogen and 99.9995% or 99.9998% purity, depending on unit
- Economical hydrogen supply – tracks with electric costs
- Increased safety – no caustic chemicals
- Virtually zero stored hydrogen – eliminates the risk of flooding the space
- Small footprint – fraction of space needed compared to cylinders or trailers
- Reliable supply of hydrogen – field-proven reliability
- Fast and easy installation – virtually anywhere in a facility
- Automated – safe, unattended operation
- Low maintenance – requires as little as 4 hours of maintenance per year

## C Series

C Series electrolyzers produce up to 30 Nm<sup>3</sup>/h of hydrogen gas at 99.999+% purity. They are ideal for a variety of industrial applications. These units replace the need for hydrogen tube trailers or liquid hydrogen storage, reducing operational safety risks associated with delivered hydrogen. They are easy to install in general purpose area.



## H Series

H Series electrolyzers offer turnkey solutions for small-scale applications requiring up to 6 Nm<sup>3</sup>/h of hydrogen gas at 99.999+% purity. These units make a minimal impact on facility floor space and are easy to maintain.



## S Series

S Series electrolyzers produce up to 1.05 Nm<sup>3</sup>/h of hydrogen gas at 99.999+% purity. They replace the need for hydrogen cylinders in a variety of industrial processes. Each unit is low maintenance, compact, quiet, and can be installed virtually anywhere in a facility.



SPECIFICATIONS	C10	C20	C30
Nominal Production Rate	10 Nm <sup>3</sup> /h	20 Nm <sup>3</sup> /h	30 Nm <sup>3</sup> /h
Production Capacity Dynamic Range	0 to 100%	0 to 100%	0 to 100%
Power Consumption by System	6.2 kWh/Nm <sup>3</sup>	6.0 kWh/Nm <sup>3</sup>	5.8 kWh/Nm <sup>3</sup>
Purity	99.999+%	99.999+%	99.999+%
O <sub>2</sub> -Content in H <sub>2</sub>	< 1 ppm v	< 1 ppm v	< 1 ppm v
H <sub>2</sub> O-Content in H <sub>2</sub>	< 2 ppm v	< 2 ppm v	< 2 ppm v
Delivery Pressure	30 barg (435 psig)	30 barg (435 psig)	30 barg (435 psig)
Dimensions			
Electrolyser Enclosure – L x W x H	2.5 m x 1.2 m x 2 m	2.5 m x 1.2 m x 2 m	2.5 m x 1.2 m x 2 m
Power Supply Enclosure – L x W x H	1.7 m x 1 m x 2 m	1.7 m x 1 m x 2 m	1.7 m x 1 m x 2 m
Ambient Temperature	5 to 40°C	5 to 40°C	5 to 40°C
Electrolyte	Proton Exchange Membrane	Proton Exchange Membrane	Proton Exchange Membrane
Feed Water at Maximum Production	9 l/h	17.9 l/h	26.9 l/h

SPECIFICATIONS	H2	H4	H6
Nominal Production Rate	2 Nm <sup>3</sup> /h	4 Nm <sup>3</sup> /h	6 Nm <sup>3</sup> /h
Production Capacity Dynamic Range	0 to 100%	0 to 100%	0 to 100%
Power Consumption by System	7.3 kWh/Nm <sup>3</sup>	7.0 kWh/Nm <sup>3</sup>	6.8 kWh/Nm <sup>3</sup>
Purity	99.999+%	99.999+%	99.999+%
O <sub>2</sub> -Content in H <sub>2</sub>	< 1 ppm v	< 1 ppm v	< 1 ppm v
H <sub>2</sub> O-Content in H <sub>2</sub>	< 5 ppm v	< 5 ppm v	< 5 ppm v
Delivery Pressure	15 barg/30 barg option	15 barg/30 barg option	15 barg/30 barg option
Dimensions – L x W x H	1.8 m x 0.8 m x 1.9 m	1.8 m x 0.8 m x 1.9 m	1.8 m x 0.8 m x 1.9 m
Ambient Temperature	5 to 50°C	5 to 50°C	5 to 50°C
Electrolyte	Proton Exchange Membrane	Proton Exchange Membrane	Proton Exchange Membrane
Feed Water at Maximum Production	1.83 l/h	3.66 l/h	5.50 l/h

SPECIFICATIONS	S10	S20	S40
Nominal Production Rate	0.27 Nm <sup>3</sup> /h	0.53 Nm <sup>3</sup> /h	1.05 Nm <sup>3</sup> /h
Production Capacity Dynamic Range	0 to 100%	0 to 100%	0 to 100%
Power Consumption by System	6.1 kWh/Nm <sup>3</sup>	6.1 kWh/Nm <sup>3</sup>	6.1 kWh/Nm <sup>3</sup>
Purity	99.999+%	99.999+%	99.999+%
O <sub>2</sub> -Content in H <sub>2</sub>	< 1 ppm v	< 1 ppm v	< 1 ppm v
H <sub>2</sub> O-Content in H <sub>2</sub>	< 5 ppm v	< 5 ppm v	< 5 ppm v
Delivery Pressure	13.8 barg (200 psig)	13.8 barg (200 psig)	13.8 barg (200 psig)
Dimensions – L x W x H	0.8 m x 1 m x 1.1 m	0.8 m x 1 m x 1.1 m	0.8 m x 1 m x 1.1 m
Ambient Temperature	5 to 40°C/5-50°C option	5 to 40°C	5 to 40°C
Electrolyte	Proton Exchange Membrane	Proton Exchange Membrane	Proton Exchange Membrane
Feed Water at Maximum Production	0.26 l/h	0.47 l/h	0.94 l/h

For reference only – specifications are subject to change. Please contact Nel Hydrogen for solutions to best fit your needs.

# Containerized MW Scale Hydrogen Plants

Nel Hydrogen is the acknowledged expert in large scale electrolyzers. The M Series containerized modular platform enables flexible plant configuration and quick installation for medium to large hydrogen plants based on water electrolysis technology.

With minimal maintenance and siting requirements, containerized M Series electrolyzers can produce up to 492 Nm<sup>3</sup>/h of hydrogen gas at 99.9995% purity on-demand. Featuring a modular design with units that can be grouped together, these systems offer solutions that are well-suited for a variety of industrial applications.



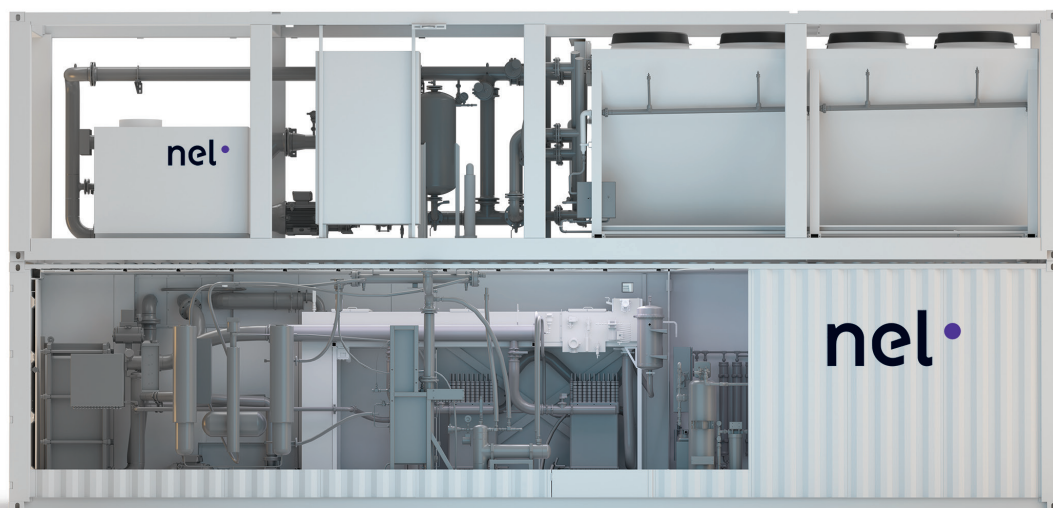
SPECIFICATIONS	MC250	MC500
Net Production Rate	246 Nm <sup>3</sup> /h	492 Nm <sup>3</sup> /h
Production Capacity Dynamic Range	10 to 100%	10 to 100%
Power Consumption at Stack at 100% Capacity <sup>1</sup>	4.7 kWh/Nm <sup>3</sup>	4.7 kWh/Nm <sup>3</sup>
Purity – with optional high purity dryer	99.9995%	99.9995%
O <sub>2</sub> -Content in H <sub>2</sub>	< 1 ppm v	< 1 ppm v
H <sub>2</sub> O-Content in H <sub>2</sub>	< 5 ppm v	< 5 ppm v
Delivery Pressure	30 barg	30 barg
Dimensions		
Process Container – W x D x H	12.2 m x 2.5 m x 3 m	12.2 m x 2.5 m x 3 m
Rectifier/Transformer Container – W x D x H	6.1 m x 2.5 m x 2.6 m	6.1 m x 2.5 m x 2.6 m
Ambient Temperature <sup>2</sup>	-20 to 40°C	-20 to 40°C
Electrolyte	Proton Exchange Membrane	Proton Exchange Membrane
Potable Water Consumption <sup>3</sup>	1.5 l/Nm <sup>3</sup> or 15.9 l/kg of H <sub>2</sub>	1.5 l/Nm <sup>3</sup> or 15.9 l/kg of H <sub>2</sub>

*For reference only – specifications are subject to change. Please contact Nel Hydrogen for solutions to best fit your needs.*

<sup>1</sup> Dependent on configuration and operating conditions.

<sup>2</sup> Additional low ambient and high ambient temperature options available.

<sup>3</sup> Potable water quality can affect usage, see SFM1087.











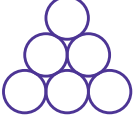





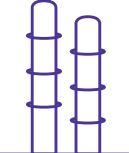

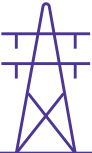



Side cutaway view of MC500 Electrolyser Enclosure and optional Thermal Control System – installation may vary.



# Find the Right Fit for Your Application

With more than 2,800 systems installed in over 75 countries and on all seven continents, our PEM water electrolyzers are creating value around the world. These hydrogen generators offer clear advantages over older, conventional methods of hydrogen delivery. Our industrial customers are able to realize a rapid payback while dramatically improving plant safety by minimizing storage and handling. Whether your need is for a large scale hydrogen plant or a compact system, our engineers will custom tailor a solution to match your application.

## Markets We Serve

 Additive manufacturing	 Ammonia and fertilizer	 Cement	 Chemical
 Crystal growth	 Distributed gasses	 Food and drug	 Glass
 Iron and steel	 Laboratory	 Leak detection	 Lower flammability limit detectors
 Meteorology	 Mining	 Petrochemical and refining	 Polysilicon
 Power generation	 Semiconductor	 Thermal processing	 Transport

