

HYDROGEN PURIFICATION: DE-OXO DRYERS

ON2Quest
SUSTAINABLE GAS GENERATION & PURIFICATION



INNOVATIVE DESIGN: PURE PERFORMANCE



HYDROGEN DE-OXO DRYERS

ON2Quest's hydrogen de-oxo dryers are designed to efficiently remove residual oxygen and water from relatively high purity hydrogen streams. The most common application is the upgrading of product gas streams from electrolyzers and the recovery of spent industrial gases. The standardised product range offers skid-mounted systems that can be easily integrated with electrolyzers in terms of hardware and controls. It can also be delivered as integrated containerised systems for standalone operations.

THE EQUIPMENT



The standardised de-oxo dryers come in two variations; a closed loop system, designed for the highest possible hydrogen recovery, and an open loop system, designed for lowest possible power consumption and capital expenditure.

All systems are based on customised catalysts for oxygen removal and carefully selected adsorbents for subsequent water removal. The systems offer the highest in-class efficiency by a unique three-bed dryer design which allows us to always have one vessel in drying mode, one vessel in polishing mode and one vessel in regeneration mode. This reduces the amount of adsorbent as well as the single vessel size and less energy is required when a vessel is in regeneration mode. Each system is also equipped with a heat recovery module to increase the regeneration efficiency.

The standardised products are available in six different capacities, capable of handling feed gas streams between 20 and 2000 Nm³/h. With a turndown ratio up to 25%, there will always be a skid available to be integrated with electrolyzers up to 5 MW.

UNIQUE PROPOSITION



HIGHEST IN-CLASS EFFICIENCY

Three-bed design allows for smaller adsorbent beds and therewith less heat requirement for regeneration.



TWO VARIATIONS

Offering the choice between optimal hydrogen recovery or minimal energy consumption.



PROCESS EFFICIENCY

With the addition of an extra vessel, the effectiveness of the process allows a reduction of adsorbent materials and therewith reactor volume.



ADJUSTABLE QUALITY

Purity level and dew point of product gas can be changed during operation.



REDUCED MAINTENANCE

Adsorbents are regenerated less often, increasing lifetime and reducing maintenance expenses.



RELIABILITY

In the unlikely event of component failure, the system switches to two-vessel mode, allowing to continue operations at reduced output.

TWO DISTINCT PLATFORMS

H2-CL

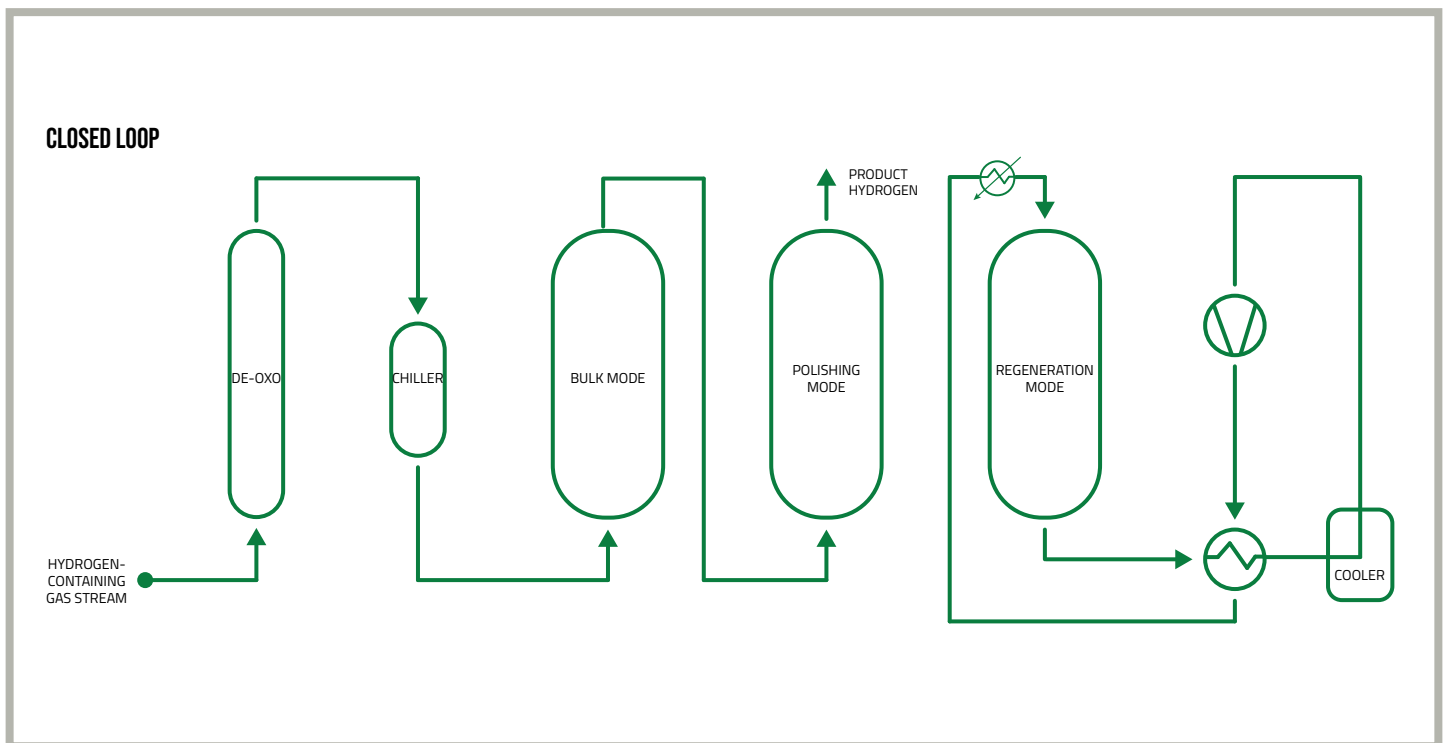
The H2-CL is a closed loop purification system, removing residual oxygen and water from high purity hydrogen streams. With the three-bed design, a continuous product gas flow is achieved. During operation, there is always one vessel in regeneration mode, which requires heated gas to pass through the bed. By using a separate closed gas loop, no product gas is lost, and full recovery of the inlet gas stream is achieved.

H2-OL

The H2-OL is functionally the same as the closed loop system but without the external gas loop for regeneration. Instead, a small portion of the pure hydrogen product gas is used to regenerate the vessel that has previously been in drying mode. The system and operational costs will be lower due to the absence of the external regeneration loop, noting that part of the product gas stream is lost during operation.

WORKING PRINCIPLE

HOW IT WORKS



The inlet hydrogen stream that contains oxygen and water is first directed through the de-oxo reactor where oxygen is converted into water with a small portion of the hydrogen from the feed gas stream.

The wet gas stream is then cooled and led into the three-bed dryer. When in full operation, one vessel is always in drying mode to take out the bulk of the water content.

The second vessel polishes the product gas from the first vessel to generate ultra pure hydrogen at the required dew point, while the third vessel is in regeneration mode, preparing for a new cycle.

Once the vessel in drying mode is saturated, it goes into regeneration mode. The vessel that was in polishing mode, still has enough capacity left and switches to drying mode.

The third vessel that was in regeneration mode is now deployed as polishing vessel. By switching continuously through this cycle, there will always be a steady product stream.

The most effective design as shown in the diagram is the closed loop system. An external regeneration loop assures that no product gas is lost.

SPECIFICATIONS



SPECIFICATIONS

Platform	H2-CL	H2-OL
Technology	Closed loop dryer	Open loop dryer
Design standards	CE, PED, ATEX	CE, PED, ATEX
Input specifications		
Feed flow rate [Nm ³ /h]	20 - 2000	20 - 2000
Max. feed gas pressure [bar(g)]	16 (30 optional)	16 (30 optional)
Feed gas temperature [°C]	5 - 40	5 - 40
Operational specifications		
Turndown [%]	25 - 100	25 - 100
Max. yield [% of feed gas]	100	97.5
Dew point [°C]	- 65	- 65
Max. oxygen content output [ppm]	5	5
Max. water content output [ppm]	5	5

MODELS

Platform	Model	Feed Flow Range	Dimensions		
			Width	Depth	Height
		Nm ³ /h	meters		
H2-CL	20	5 - 20	1.1	1.3	1.0
	50	12.5 - 50	1.1	1.3	1.3
	100	25 - 100	1.2	1.5	2.3
	200	50 - 200	1.5	2.0	2.3
	500	125 - 500	2.1	2.5	2.3
	1000	250 - 1000	2.4	2.7	2.3
	2000	500 - 2000	2.5	3.0	2.3
H2-OL	20	5 - 20	0.7	1.0	1.0
	50	12.5 - 50	0.7	1.0	1.3
	100	25 - 100	0.7	1.0	2.3
	200	50 - 200	0.8	1.1	2.3
	500	125 - 500	1.0	1.3	2.3
	1000	250 - 1000	1.3	1.6	2.3
	2000	500 - 2000	1.7	2.0	2.3

KEY BENEFITS



COST SAVINGS

- Three-bed design reduces direct material costs.
- Smaller beds require less energy for regeneration.
- Lesser regeneration cycles increase maintenance intervals.
- Lower pressure variant (<16 bar) available.



INTEGRATION

- Skid-mounted, easy integration.
- Automated dew point control.
- Automated cycle settings, based on input flow and output requirements.



RELIABILITY

- Two-vessel mode possible in case of component failure.
- Closed loop system capable of switching to open loop mode in case of component failure.



FLEXIBILITY

- Load following design.
- Wide modulation range.
- Adjustable purity and dew point setting.



ENVIRONMENTALLY FRIENDLY

- Highest in-class efficiency with three-bed design with smaller vessels.
- Heat recovery module reduces electricity consumption.



PACKAGED SOLUTION

- Skid-mounted and pre-tested at factory.
- No additional cost for installation on site.

QUALITY CERTIFICATIONS



APPLICATIONS



ELECTROLYSERS



HYDROGEN FUELLING STATION



HYDROGEN COMPRESSOR STATION



HYDROGEN SEASONAL STORAGE



INDUSTRIAL GAS UPGRADING & RECYCLING



EUROPE

NETHERLANDS

Wiekenweg 44A | 3815 KL Amersfoort | The Netherlands

T +31 33 888 1224

E europe@on2quest.com



ASIA

SINGAPORE

8 Cleantech Loop | Blk E #06-70 CleanTech Three | Singapore 637145

T +65 6950 1488

E asia@on2quest.com

