Market Consultation

Ball valves for the benefit of N.V. Nederlandse Gasunie / HyStock

N.V. Nederlandse Gasunie
Groningen, May 2025

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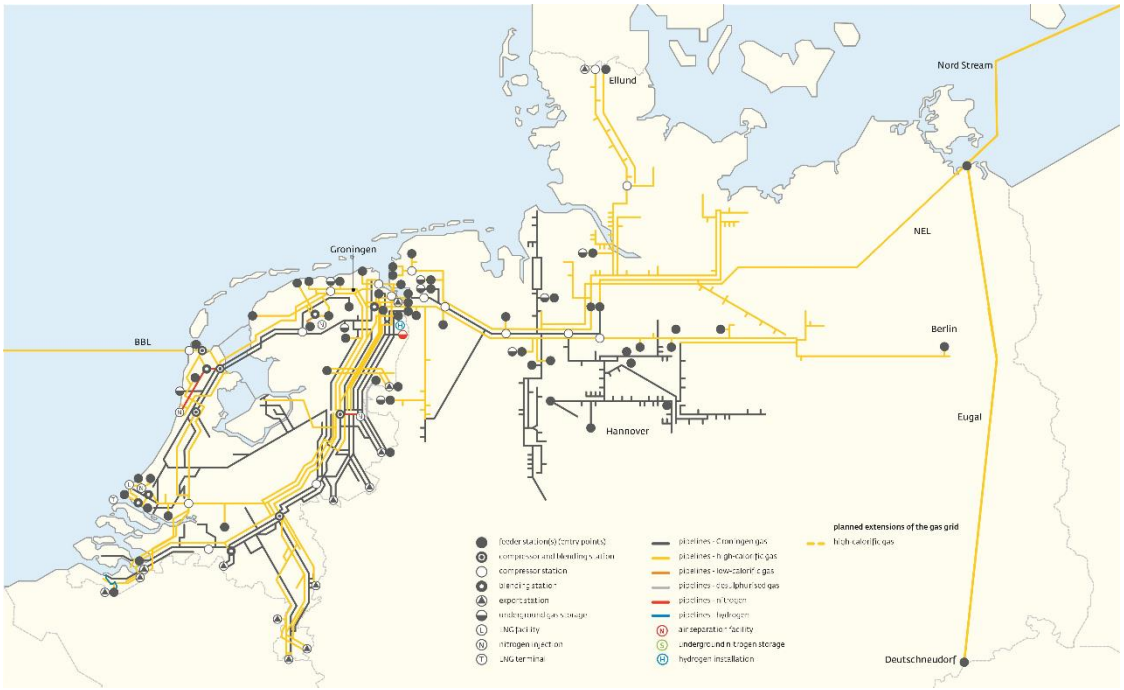
1 GENERAL INFORMATION

1.1 N.V. Nederlandse Gasunie

Gasunie is an energy infrastructure company. In the Netherlands and Northern Germany, we manage the infrastructure for large-scale transport, storage and conversion of gas, currently still mostly natural gas. With the energy transition, this is increasingly shifting towards green gas and hydrogen. We are also working on the construction and management of heat and CO_2 networks.

Our duty is to provide safe, reliable, affordable and sustainable energy infrastructure services, making energy available to everyone at all times. Safety, reliability, sustainability and cost awareness are paramount.

The Gasunie network is one of the largest high-pressure gas transport networks in Europe and consists of more than 15,000 km of pipelines, 1,000 gas receiving stations and dozens of installations in the Netherlands and Northern Germany. Gasunie's infrastructure is part of the 'gas roundabout' of Europe. This network allows the gas to be traded and transported easily. The annual throughput of gas is approximately 100 billion cubic meters.



Our mission
Gasunie is a leading company in the field of energy infrastructure in Europe. The transportation and storage of gas are our core business. We serve the public interest and facilitate the energy transition by offering integrated infrastructure services. We focus on value creation for our shareholder(s) and other stakeholders, and apply the highest industrial safety and business standards.

Our vision
We believe in a sustainable future with a balanced energy mix and a continuing role for gas from various sources. We believe that we offer our customers the best service by offering innovative solutions in the field of infrastructure, particularly gas infrastructure.

Our three pillars:

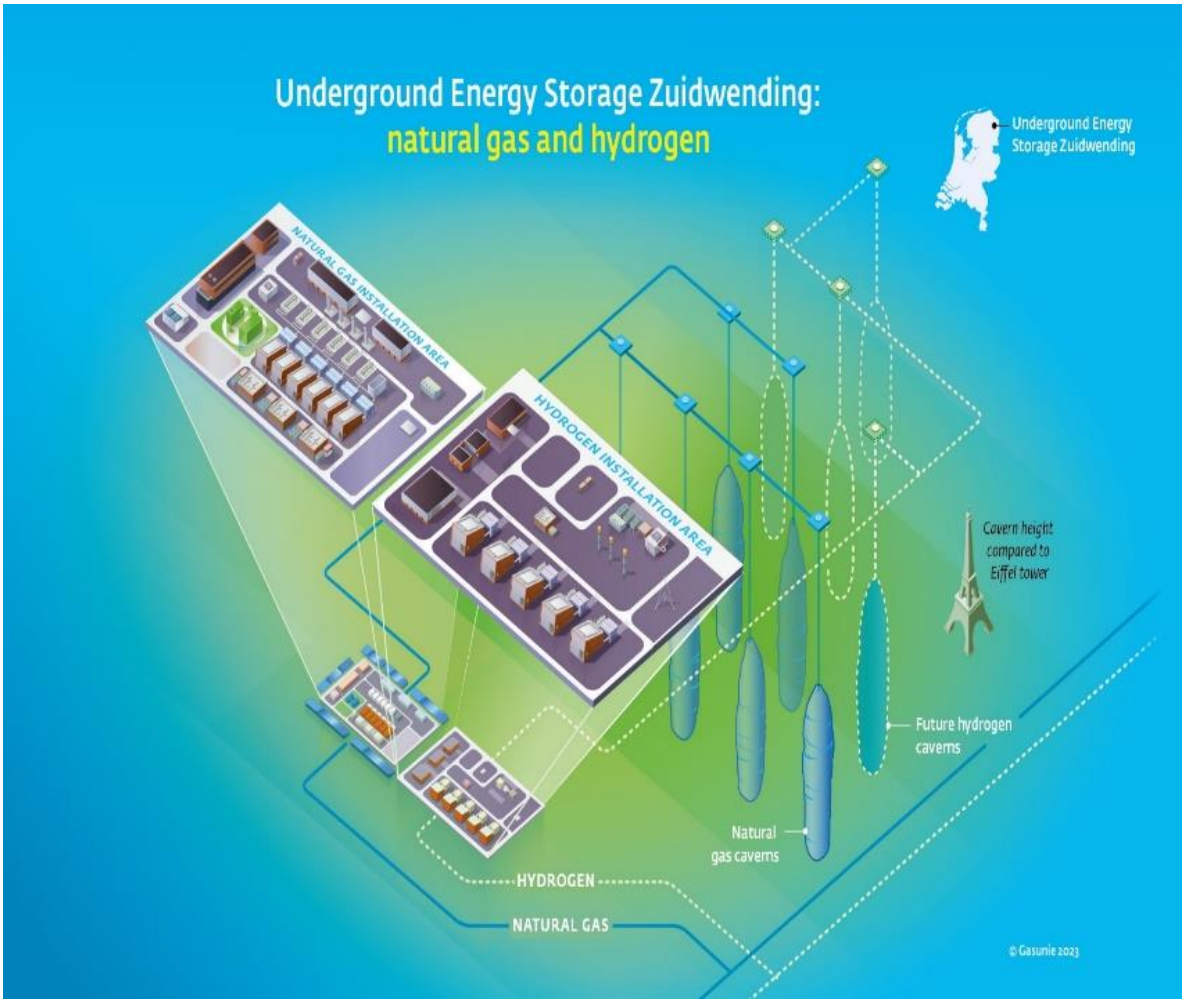
- Ensuring a safe, reliable, affordable and sustainable gas infrastructure in our key area.
- Contributing to efficient gas infrastructure and services for a well-functioning European natural gas and LNG market.
- Accelerating the transition to a CO_2-neutral energy supply.

More information about Gasunie can be found on https://www.gasunie.nl/en.

1.2 HyStock

Gasunie is working on the HyStock hydrogen storage project near Zuidwending in the Netherlands. Gasunie is planning to develop here the first large-scale hydrogen storage site in northwest Europe. The Zuidwending site is situated on top of a salt dome that is ideally suited to underground hydrogen storage. In this way energy can be stored. At the end of 2026, the first cavern and an above-ground installation will be put into operation. It is expected that four hydrogen caverns will be needed by 2030 to meet the demand. To this end, the current above-ground plant needs to be expanded. It is planned, that in the future the H2 caverns will connect to the H2 Back Bone project, which is still under development. With a connection to the national transport network for hydrogen (H2 Back Bone project), it will be possible for companies throughout Northwest Europe to supply and purchase hydrogen. In this way HyStock is facilitating the energytransition to a clean and sustainable society.

In addition to existing natural gas caverns owned by EnergyStock, 4 new caverns can be realised for hydrogen storage. The envisaged storage facility will be developed in steps, starting with a first cavern in 2026 and then expanding to at least four caverns in 2030.



The storage facility will be accessible to the entire market on an open-access basis. Via a connection to Gasunie's national hydrogen infrastructure, which is currently under development, the stored hydrogen can be offered by producers and supplied to customers throughout the country and to the industrial clusters in Germany and Belgium from 2026 onwards.

For more information about Gasunie's role in Hydrogen: see https://www.hystock.nl/en or https://www.gasunie.nl/en/expertise/hydrogen.

1.3 Ball valves

For the underground hydrogen storage project Hystock we need ball valves to:

- Regulating the flow of the hydrogen by opening, closing the flow channel.
- Isolating sections of a piping system to be closed off for maintenance or repairs without disrupting the entire installation.
- Safety protecting against overpressure by opening automatically when a certain pressure is exceeded.
- Etc.

Vendor is asked for the flowing services:

- Engineering of the valves (if required).
- Manufacture the valves.
- Delivery of the valves.

1.4 Scope

What we need is a carbon steel ball valves, ANSI class 600 and 1500 for use in the hydrogen gas systems with the following design criteria:

- nominal diameter: between 25 ≤ DN and ≤ 600.
- design pressure: 0 bar (e) < pd ≤ from 80 to 220 bar (e) (depending on the pipe class).
- design temperature: -20 °C < Td ≤ +80°C or +160 °C (depending on the pipe class).
- medium: hydrogen gas.

Numbers of required valves:

Line size	10 bar (g)		66.2 bar (g)	76.1 bar (g)		90 bar (g)	16 bar (g)	220 bar (g)		Total
	50 °C	80 °C	50 °C	80 °C	(leeg)	80 °C	80 °C	160 °C	80 °C	
DN 25	3	13		6		12			8	42
DN 50		2	9	131		25			175	342
DN 80			10	24		31			138	203
DN 100				14		8			20	42
DN 150	3	2					1		12	18
DN 200		2		4					5	11
DN 250				28				5	57	90
DN 300				10					4	14
DN 350									20	20
DN 400						6			12	18
DN 450						6				6
DN 500									6	6
DN 600			3	1	1					5
DN 750		5								5
Final total	**6**	**24**	**22**	**218**	**1**	**88**	**1**	**5**	**457**	**822**

1.5 Zuidwending.Process conditions

1.5.1 Medium composition (Hydrogen)

The hydrogen gas quality applicable for this specification is given in the table below:

Components	Unit	Value
Hydrogen (H_2)	mol/mol	≥ 0,98
Total sum of hydrocarbons including CH_4 (C_XH_Y)	mol/mol	≤ 0,015
Oxygen (O_2)	µmol/mol (ppm)	≤ 10
Total sum of inert gasses (N_2, He, Ar)	mol/mol	≤ 0,02
Carbon dioxide (CO_2)	µmol/mol (ppm)	≤ 20
Carbon monoxide (CO)	µmol/mol (ppm)	≤ 20
Total Sulphur including H_2S (S)	µmol/mol (ppm)	≤ 3
Formic acid (CH_3OOH)	µmol/mol (ppm)	≤ 10
Formaldehyde (CH_2O)	µmol/mol (ppm)	≤ 10
Ammonia (NH_3)	µmol/mol (ppm)	≤ 10
Halogenated components	µmol/mol (ppm)	≤ 0,05
Water dew point (H_2O)	°C @ 70 bara	≤ -8
Carbon dewpoint	°C @ 1-70 bara	≤ -2
Wobbe-index	$MJ/m^3(n)$	44,85 - 48,35
Other impurities	Shall not contain solid, liquid or gaseous material that might interfere with the integrity or operation of pipes or any gas appliance	

1.6 Directives and design codes

- Directive 2014/68/EU (PED)
- Directive 2006/42/EC
- EN 1983: 2013 Industrial valves - Steel ball valves
- EN 12516-1:2014+A1 Industriële afsluiters - Ontwerpsterkte van de behuizing

1.7 Basic requirements

1.7.1 Materials

Valves body, closures and pup pieces shall be made of unalloyed carbon steel P355NH (1.0565) or P355NL1 (1.0566) according to the EN-10028-3.

Valves shall not be made of cast iron, nodular or otherwise. Other materials shall be susceptible to the approval of Gasunie. Materials shall comply with EN-10028-3 with maximum yield strength of 360 MPa. Steels with a hardness above 225HV10, applicable for base material, HAZ- and weld area are susceptible to fatigue crack growth in hydrogen gas applications. Post welding heat treatment shall be performed on all welds to lower the hardness to 225HV10, this shall be performed in accordance with 4.7.6. The minimum elongation of the base and weld materials shall

be at least 20%. The hardness of the materials is not yet certain and can be changed in a later stage.

For all flanges the following requirement are applicable:
The preparation grade of the complete part before coating shall be P3 in accordance with NEN-EN-ISO 8501-3. Bolt holes shall be prepared on both sides.
Flange bore shall be in accordance with annex L of the specification. For pressure class 600, flanges shall have a raised face. For pressure class 1500, flanges shall have a RTJ flange.
Raised face (RF) flange facings shall have a resultant surface finish Ra = 3,2 µm – 6,3 µm in accordance with ASME B16.5.
Ring joint (RTJ): the side wall surface of the gasket groove shall not exceed 1,6mm roughness. (as per requirement in ASME B16.5 section 6.4.5)

1.7.2 Fatigue assessment

A fatigue assessment shall be performed on valves as per EN 13445-3:2021 section 18 in which the vendor shall prove through a fatigue test or calculations that the valve is suitable for **260.000 cycles** according to Table 1 of S.003843-LF-A435-013.
The allowed cycles per year per pressure fluctuation shall be calculated following the equations 18.10-17 till 18.10-20 of the EN 13445-3, and taking into account all correction factors of section 18. From the allowed pressure cycles, a "damage per pressure cycle" shall be stated by VENDOR. This "damage per cycle" is required to measure the accumulated damage over the operational life during operation (using the "reservoir cycle counting method" described in section 18.9.3).

1.7.3 Failure mode analysis

A failure mode analysis according API579-1 or BS7910 is required on all pressure vessels and their components that are subjected to repeated fluctuations of stress.
Vendor shall perform both a limit state analysis and a crack growth analysis to determine the minimum required wall thickness.

1.7.4 Fatigue crack growth

Fatigue is a relevant failure mechanism and therefore hydrogen-induced crack growth should be assessed.
To ensure timely detection of defects, a crack growth life of at least 12 years is used whereby the vessel can be inspected every 4 years. 0-measurement in new constructions will serve as a reference for any small embedded weld defects.
The crack growth analysis should be performed using the curve from B31.12, PL-3.7

$$\frac{da}{dN} = C_1 \cdot \Delta K_I^{m_1} + C_2 \cdot \Delta K_I^{m_2} + C_3 \cdot \Delta K_I^{m_3}$$

$\frac{da}{dN}$	=	Scheurgroei per cyclus	[mm]
C_1	=	$4.0812 \cdot 10^{-9}$	[-]
C_2	=	$4.0862 \cdot 10^{-11}$	[-]
C_3	=	$4.8102 \cdot 10^{-8}$	[-]
m_1	=	3.21063	[-]
m_2	=	6.4822	[-]
m_3	=	3.6147	[-]
ΔK	=	Range spanningsintensiteit	$MPa \cdot \sqrt{m}$

The calculation should be performed with an assumed defect of a=3 mm and 2c=50 mm.

1.7.5 Post-weld heat treatment

All welding shall be completed prior to post-weld heat treatment. No welding, hammering or deformation is permitted after post-weld heat treatment.
Post welding heat treatment shall be performed on all welds to lower the hardness to 225HV10.
PWHT shall be in accordance with the requirements of paragraph 1.6 and the applicable material specification(s) and standards EN ISO 17663.

Post weld heat treatment of the body weld is required when possible. In case post weld heat treatment on the body weld is not possible, the pup pieces or flanges shall be welded to the valve body on a disassembled valve body and the welding joints will be post-weld heat treated before assembly of the body.

1.7.6 Pup joints

For welds of fittings, appendages and piping equal to or above DN100, Post Weld Heat Treatment (PWHT) shall be applied. This would introduce a lot of heat to the body and the seat of the valve. To prevent damage to the valve trim, valves with welded ends and a diameter equal to or larger than DN100 shall be provided with an additional pup joint.
The size of the pup joint / pup piece on either end of the valve with welding ends or ends shall be one:

Above standard ETE dimension:
DN100 to DN250: 300mm on both sides.
DN300 and above: 500mm on both sides.

The pup pieces shall be made of the same material as the matching pipe i.e. P355NL1 and P355NH.

2 PROCEDURE

2.1 Schedule

Activity	Date / Period
Publication of the consultation via Tenderned	15 May 2025
Deadline submission questions	4 June 2025, 14:00 Hrs.
Note of Information	12 June 2025
Deadline submission of response	19 June 2025, 14:00 Hrs.

2.2 Exchange of information

The exchange of information for this market consultation is carried out electronically via Tenderned, www.tenderned.nl. The use of Tenderned is free of charge.

If you want to participate in this consultation, please answer the questions in Annex 1 via provided Q&A Form. You can send the Question Form to Paula Mol by e-mail: p.mol@gasunie.nl.

2.3 Uncertainties or questions?

If you have any questions, you can ask them through e-mail (p.mol@gasunie.nl), kindly requesting that the questions be bundled as much as possible in one e-mail message. The note with the answer to the questions (anonymised) will be shared via e-mail.

2.4 *Further procedure*

Gasunie shall treat all information sent by markets parties to Gasunie as confidential but is entitled to use the information provided for the preparation of the European tender procedure.

Gasunie reserve the right, when this is found useful, to engage (through e-mail or in person) with one or more suppliers as a result of the responses given to the market consultation. This is not an obligation, and Gasunie will decide whether to make use of it or not.

2.5 Conditions

By taking part in this market consultation you agree with the following conditions:

1. Communication is in the Dutch or English language.
2. All communication is exclusively with the contact person mentioned in paragraph 2.2.
3. Your answers are confidential and shall only be shared within Gasunie.
4. The provided information will only be used for further studies and advice.
5. The scope and requirements may change based on the provided information.
6. Gasunie is not bound by the results of the market consultation.
7. Participants cannot derive any rights based on this market consultation.
8. If needed, Gasunie reserves the right to change the planning.

ANNEX 1 QUESTION FORM