CELLGAS

by SIEBC group

WELL STIMULATION USING NITROGEN INJECTION



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INTRODUCTION TO NITROGEN INJECTION TECHNOLOGY

Nitrogen injection is a proven and efficient method for **well stimulation** and production enhancement in the oil and gas industry. By introducing nitrogen gas into the wellbore, the hydrostatic pressure of the fluid column is reduced, allowing hydrocarbons trapped in the reservoir to **flow more easily** to the surface.

Physically, **nitrogen reduces the density and viscosity** of the well fluids and helps displace liquid phases such as water, heavy crude, or emulsions. Chemically, nitrogen is **inert and non-reactive** with hydrocarbons or reservoir rock, preventing corrosion and undesired reactions that could alter formation properties.

This process also helps clean up wells with liquid loading, enables safe pressure control during maintenance, and prevents oxidation by displacing oxygen in pipelines and process equipment.

Why Nitrogen?

- Inert and non-corrosive gas
- Non-flammable, ensuring operational safety
- Easily generated on site via membrane or PSA systems
- Low cost and minimal logistical requirements
- Environmentally friendly and versatile for multiple applications



TYPICAL OILFIELD APPLICATIONS

- Stimulation of wells in low-permeability reservoirs
- Temporary gas lift to assist production
- Well cleanup in cases of high liquid accumulation
- Inerting pipelines and equipment before maintenance
- Pressure control during hydraulic fracturing operations

BOOST WELL PERFORMANCE

INJECT EFFICIENCY WITH NITROGEN

SAFETY EFFICIENCY PRESSURE

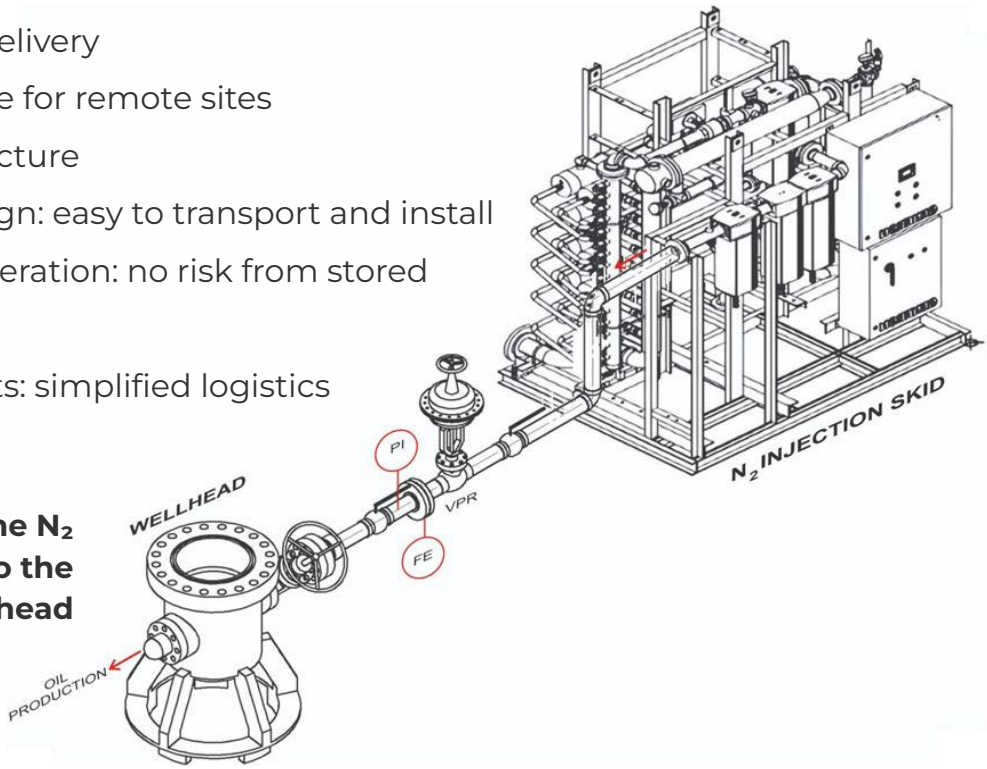
BENEFITS FOR YOUR OPERATIONS

- Immediate boost in hydrocarbon production
- Reduced well intervention time
- Improved secondary recovery efficiency
- Lower environmental risks
- Cost-effective solution for mature or marginal fields



OPERATIONAL ADVANTAGES

- On-site nitrogen generator: no need for cryogenic supply or delivery
- High availability: suitable for remote sites or areas lacking infrastructure
- Compact, modular design: easy to transport and install
- Continuous and safe operation: no risk from stored pressurized gas
- Reduced operating costs: simplified logistics and lower maintenance



Connection of the N_2 injection line to the wellhead

MEMBRANE TECHNOLOGY

Operating Principle

Membrane nitrogen generation is based on the selective permeability of gas molecules through hollow polymer fibers. Compressed, clean, and dry air enters the membrane module, where oxygen, moisture, and trace gases permeate through the fiber walls faster than nitrogen. The remaining gas stream, rich in nitrogen, exits the module as the final product.

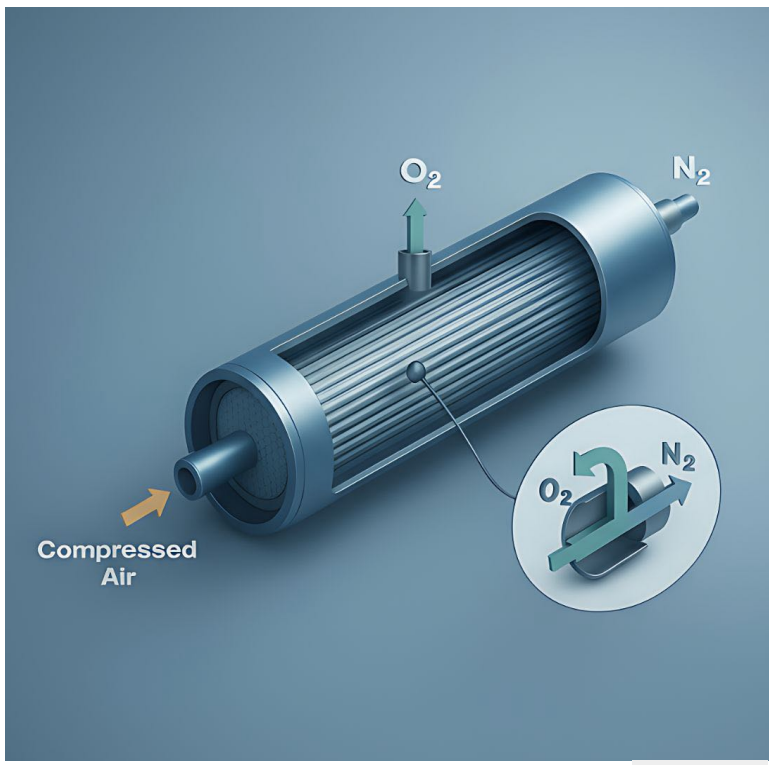
Advantages



- Robust and simple design with no moving parts
- Fast start-up and continuous nitrogen production
- Adjustable purity ideal for most oilfield applications
- Compact, modular, and containerized systems for field deployment
- Low maintenance and long service life

Typical Applications

- Well stimulation and cleanup
- Temporary gas lift and inertization
- Pressure control in hydraulic fracturing
- Purging of pipelines and process systems



Limitations

For processes demanding very high nitrogen purity (above 95–97%), membrane systems may become less efficient. In such cases, PSA systems are the preferred option.

MEMBRANE TECHNOLOGY

Technical data

CELLGAS N2 Membrane								
Specifications*				Product MODEL - N2 purity				
N2 capacity (Nm^3/h)	Air req. (Nm^3/min)	Inlet DN	Outlet DN	Purity 95%	Purity 96%	Purity 97%	Purity 98%	Purity 99%
50	2,1	32	25	80295005	80296005	80297005	80298005	80299005
70	2,9	32	25	80295007	80296007	80297007	80298007	80299007
100	4,2	40	25	80295010	80296010	80297010	80298010	80299010
150	6,4	50	32	80295015	80296015	80297015	80298015	80299015
200	8,5	50	40	80295020	80296020	80297020	80298020	80299020
400	17	65	50	80295040	80296040	80297040	80298040	80299040
500	20	80	50	80295050	80296050	80297050	80298050	80299050
600	25	80	50	80295060	80296060	80297060	80298060	80299060
800	33	100	65	80295080	80296080	80297080	80298080	80299080
1000	41	100	65	80295100	80296100	80297100	80298100	80299100
1200	49	100	80	80295120	80296120	80297120	80298120	80299120
1500	61	125	80	80295150	80296150	80297150	80298150	80299150
2000	82	150	100	80295200	80296200	80297200	80298200	80299200

* Air requirement and connection sizes are indicative and may vary with the selected nitrogen purity.

Technical Indicators

- Nitrogen Flow Rate: 1~5000 Nm/h
- Nitrogen purity: 95%~99.5%
  (Non-oxygen content)
- Nitrogen pressure: 0.1~1.6 MPa (adjustable)
- Nitrogen dew point: 0~-60 °C







PSA (PRESSURE SWING ADSORPTION) TECHNOLOGY

Operating Principle

PSA technology relies on twin adsorption vessels filled with carbon molecular sieves (CMS). As compressed air passes through, oxygen and trace gases are selectively adsorbed while nitrogen passes through as the product gas. The system alternates between adsorption and regeneration cycles to ensure a continuous supply.

Advantages

- Nitrogen purity up to 99.999%
- High stability and pressure for sensitive applications
- Energy-efficient with automatic cycle control
- Containerized modular systems for easy installation
- Designed for continuous, heavy-duty industrial use

Applications

- Enhanced oil recovery (EOR)
- Reservoir pressurization
- Chemical and petrochemical industries
- Environments requiring ultra-high purity



PSA (PRESSURE SWING ADSORPTION) TECHNOLOGY

Technical data

CELLGAS N2 PSA																
		Purity 97%			Purity 99%			Purity 99.9%			Purity 99.99%			Purity 99.999%		
Product MODEL	N2 capacity (Nm³/h)	Air req. (Nm³/min)	Inlet DN	Outlet DN	Air req. (Nm³/min)	Inlet DN	Outlet DN	Air req. (Nm³/min)	Inlet DN	Outlet DN	Air req. (Nm³/min)	Inlet DN	Outlet DN	Air req. (Nm³/min)	Inlet DN	Outlet DN
80399000	5	0,2	16	12	0,2	16	12	0,3	15	15	0,4	15	15	0,5	25	15
80399001	10	0,4	15	15	0,4	15	15	0,6	15	15	0,8	15	15	1	25	15
80399002	20	0,7	15	15	0,8	15	15	1,2	25	15	1,6	25	15	1,9	25	15
80399003	30	1,1	25	15	1,2	25	20	—	—	—	—	—	—	2,9	40	25
80399004	40	1,5	25	20	1,6	25	20	2,3	25	20	3,2	32	25	3,9	40	25
80399005	50	1,8	25	20	2	25	25	—	—	—	—	—	—	—	—	—
80399006	60	2,2	25	25	2,4	25	25	3,5	32	25	—	—	—	5,8	40	32
80399008	80	2,9	32	25	3,2	32	25	4,7	32	25	6,4	40	32	7,7	50	32
80399010	100	3,7	32	25	4	32	25	5,8	40	32	8	40	32	9,7	50	40
80399015	150	5,5	32	25	6	32	25	—	—	—	—	—	—	—	—	—
80399020	200	7,3	40	32	8	40	32	11,7	50	32	16	65	50	19,3	80	50
80399030	300	11	40	32	12	40	32	17,5	50	40	24	80	65	29	100	65
80399040	400	14,7	50	40	16	50	40	23,3	65	40	32	100	65	—	—	—
80399060	600	22	65	50	24	65	50	35	65	50	48	125	80	—	—	—
80399080	800	29,3	80	65	32	80	65	46,7	80	65	64	150	100	—	—	—
80399100	1000	36,7	80	65	40	80	65	58,3	125	80	80	200	125	—	—	—
80399150	1500	55	125	80	60	125	80	87,5	150	100	—	—	—	—	—	—
80399200	2000	73,3	150	100	80	150	100	—	—	—	—	—	—	—	—	—
80399300	3000	110	200	100	120	200	100	—	—	—	—	—	—	—	—	—

Technical Indicators

- Nitrogen Flow Rate:1~5000 Nm/h
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TECHNICAL FEATURES

Available Equipment

Typical portable skid for nitrogen injection — **modular assembly**, easily transported by 4x4 truck, light vehicle, or trailer. Designed for reliable, continuous operation in oilfield and industrial environments.

Pressure and Flow Capacities

- Customizable to meet project requirements - nitrogen boosters available.
- Systems are built to handle a **wide range of pressures and flow rates** while maintaining stable nitrogen purity.

Stable and Reliable

- Proven and advanced technology, validated in field operations
- High-quality components ensure long-term performance
- Multiple online monitoring and protection systems
- Capable of operating efficiently under various loads and environmental conditions

Intelligent Control

- Smart PLC control system
- Optional intelligent monitoring supporting remote communication
- One-click start/stop operation
- Automatic standby mode when nitrogen demand is low

TECHNICAL FEATURES

Rich Configurations

• Monitoring of oxygen content, dew point, flow rate, and pressure (standard or optional)

• Continuous online monitoring and automatic adjustment of nitrogen purity

Leading in Energy Efficiency

• Nitrogen purity can be set and adjusted according to operational needs

• Optimized control ensures minimum energy consumption per cubic meter produced

Purity Guaranteed

• Continuous online monitoring and automatic regulation

• Off-spec nitrogen is automatically vented to maintain product quality

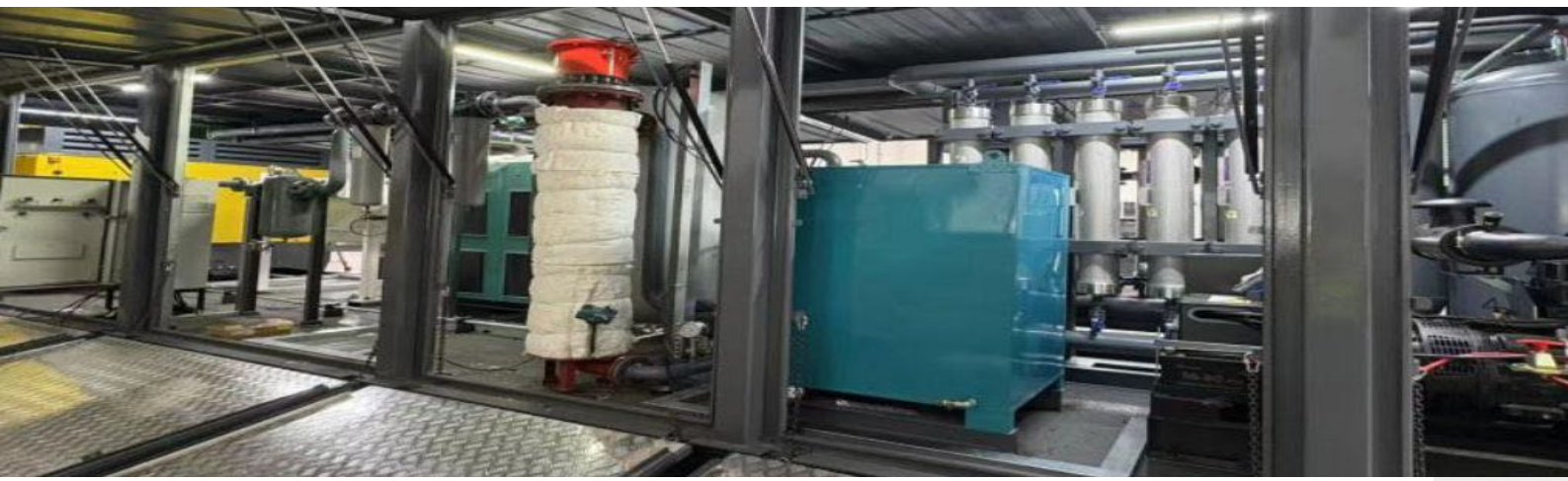
Monitoring and Control Systems

• Smart PLC control system

• Optional intelligent monitoring supporting remote communication

• One-click start/stop operation

• Automatic standby mode when nitrogen demand is low



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