INNOVATIVE GAS SYSTEMS

Nitrogen On Demand

NITROGEN GENERATORS

Largest Product Offering

Highest Efficiency

Highest Purity

Lowest Cost

From Concept To Completion, We Sell Solutions!

NITROSWING® – Nitrogen Generators

OUR TECHNOLOGY

IGS has over 30 years experience in the design and manufacturing of Pressure Swing Adsorption (PSA) plants. We are at the forefront of this technology and have the flexibility to provide the right package to meet all customer requirements. IGS' NITROSWING® nitrogen generator systems use the basic principle of passing air over adsorbent material which bonds with oxygen to leave a rich stream of nitrogen.

The adsorptive separation of air is accomplished in the following process steps:

1. FEED AIR COMPRESSION AND CONDITIONING

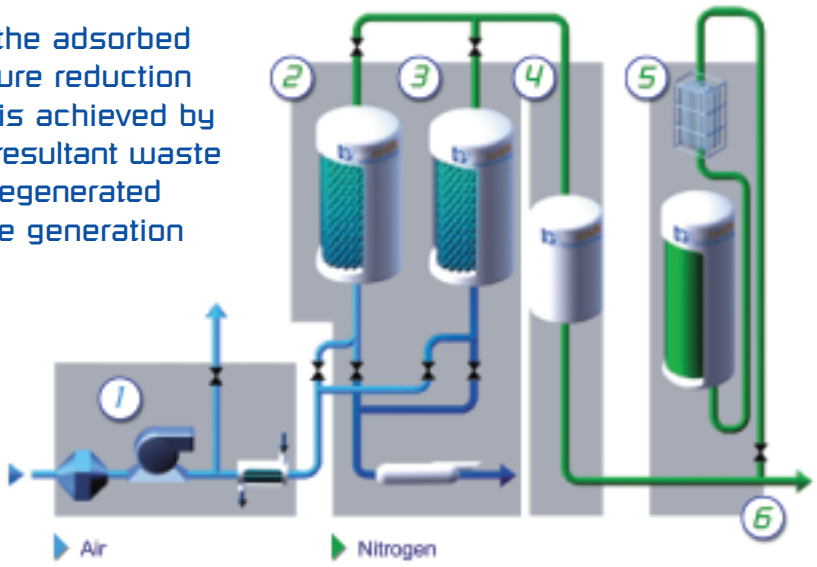
The ambient (inlet) air is compressed by an air compressor, subsequently dried by an air dryer and filtered before entering the process vessels.

2. PRESSURIZATION AND ADSORPTION

The pre-treated air is passed into a vessel filled with Carbon Molecular Sieve (CMS) where the oxygen is adsorbed preferentially in the CMS pores so that nitrogen with an adjustable purity (down to a residual O2 content of 50 ppm) remains in the gas stream. Before the adsorption capacity of the CMS is fully utilized, the nitrogen separation process is interrupted, and the switching of the adsorber vessels is initiated.

3. DESORPTION

The saturated CMS is regenerated (i.e. the adsorbed gases are released) by means of pressure reduction below that of the adsorption step. This is achieved by a simple pressure release system. The resultant waste stream is vented into atmosphere. The regenerated adsorbent can now be used again for the generation of nitrogen.



4. NITROGEN RECEIVER

Adsorption and desorption take place alternately at equal time intervals. This means that the continuous generation of nitrogen can be achieved with two adsorbers, one being switched at adsorption and the other at regeneration. Constant product flow and purity is ensured by a connected product buffer vessel that stores the nitrogen at purities up to 99.995% and pressures up to 9 bar(g)/130 PSIG.

5. OPTIONAL BACKUP SYSTEM

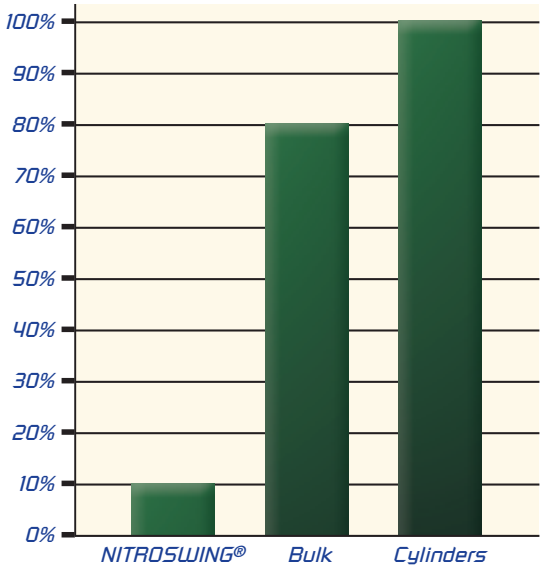
6. NITROGEN PRODUCT

The result is a constant stream of on-site produced high purity nitrogen at cost significantly below that of liquid or bottled gases.

Highlights and System Features

HIGHLIGHTS

- Proven designs with over 30 years experience building one of the world's largest portfolios of nitrogen generators with units starting at 0.6 Nm3/h/ 22 SCFH
- Over 1,500 industrial systems installed in every part of the globe
- Plants designed for years of trouble free operation. Many plants older than 20 years still have original Carbon Molecular Sieve material
- Cost advantage of a NITROSWING® nitrogen generator
  - Cost saving of 70% over Bulk Liquid or 90% over nitrogen cylinders
  - No safety or handling issues with bulky high pressure cylinders or dangerous cryogenic liquids
  - No complicated supply contracts with ever escalating charges



SYSTEM FEATURES

- IGS supplies two types of NITROSWING® nitrogen generator systems:

The economical standard pressure system with output pressure up to 6.2 bar(g) (90 psig) and the High Pressure System for situations where up to 9 bar(g) (130 psig) is required.

- Purities to 99.995%
- Plant capacity to 300 T/D, 10,000 Nm3/h or 380,000 scfh
- Automatic part load operation to 30% of design capacity
- Fully automated for unattended operation
- Delivery pressure to 9 bar(g) / 130 psig
- Flexible design for all locations
  - Indoor
  - Outdoor
  - Skids
  - Offshore platforms
- Skidded and containerized systems
- Custom designed systems to meet your exact requirements

Safety:
- Low Operating Pressure

Economy:
- Low Operating Costs
- Low Air Consumption
- Low Pressure Drop
- High User Pressure

Convenience:
- Fully Automated
- Unattended Operation

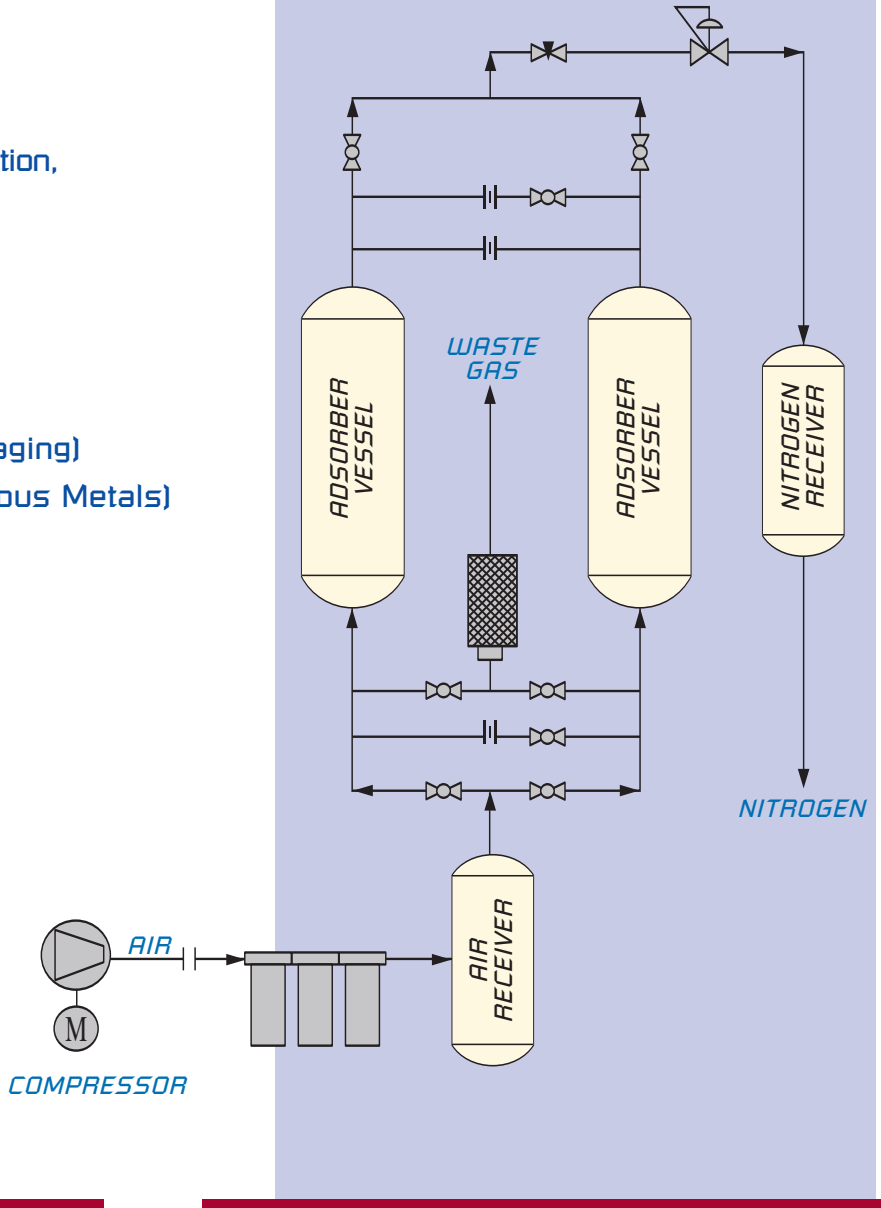
Reliability:
- Easy to Install
- Easy to Maintain
- Safe process operation for long CMS life

All systems supported by our global service network.

Standards and System Options

STANDARD APPLICATIONS

- Chemical Manufacturing (Blanketing, Material Transfer)
- Electronics (Storage, Furnace Application, Wave Soldering)
- Laser Cutting
- Food Processing & Packaging
- Tire Filling
- Plastics (Injection Molding)
- Pharmaceuticals (Blanketing, Packaging)
- Heat Treatment (Ferrous & Non-Ferrous Metals)



STANDARD COMPONENTS

- Air Filters
- Adsorber Vessels
- Pneumatic Valves
- Piping and Instrumentation
- Safety Valve
- Exhaust Muffler
- Nitrogen Pressure and Flow Regulator
- Control System with Allen-Bradley PLC
- Skid Mounted
- Hour Meter
- Pressure Switch for automated Idle-Mode

OPTIONS

- Oxygen Analyzer (Zirconium Oxide type)
- Product Flow Meter
- Air Receiver Tank
- Nitrogen Buffer Tank
- Fail-Safe Package (off-spec nitrogen automatically vented to atmosphere*)
- Bottle Filling Station
- Purities to 99.9999% with the DeOxo System
- Feed Air Compressor
- Product Booster Compressor
- Monitor Package (with AB PanelView, indicating Product Pressure, Product Temperature, Oxygen Concentration and Product Flow**)
- Enhanced PLC with Telemetry
- Dew Point Analyzer

* Only in combination with Oxygen Analyzer Option
** Includes Oxygen Analyzer and Flow Meter

Standard Pressure NITROSWING® Nitrogen Generator Specifications

		SI 7.5 Bar(g) feed pressure			US Standard 110 PSIG feed pressure		
MODEL	Oxygen %	Output N2 Nm3/h	Output P bar(g)	Feed Air Nm3/m	Output N2 SCFH	Output P PSIG	Feed Air SCFM
NS-2	5	3.4	5.0	0.12	130	73	4.5
	3	2.8	5.5	0.11	107	80	4.2
	2	2.5	5.7	0.10	94	83	3.9
	1	2.1	6.0	0.10	78	87	3.7
	0.5	1.7	6.1	0.09	64	88	3.4
	0.1	1.1	6.2	0.07	42	90	2.8
	0.01	0.7	6.2	0.07	26	90	2.6
	0.005	0.6	6.2	0.08	22	90	3.1
NS-4	5	6.6	5.0	0.23	251	73	8.8
	3	5.5	5.5	0.21	207	80	8.1
	2	4.8	5.7	0.20	182	83	7.6
	1	4.0	6.0	0.19	152	87	7.1
	0.5	3.3	6.1	0.17	124	88	6.6
	0.1	2.1	6.2	0.14	81	90	5.4
	0.01	1.3	6.2	0.13	49	90	5.0
	0.005	1.1	6.2	0.16	42	90	6.0
NS-8	5	13.1	5.0	0.46	499	73	17.5
	3	10.9	5.5	0.42	413	80	16.1
	2	9.5	5.7	0.40	361	83	15.2
	1	8.0	6.0	0.37	302	87	14.2
	0.5	6.5	6.1	0.34	246	88	13.1
	0.1	4.3	6.2	0.28	162	90	10.8
	0.01	2.6	6.2	0.26	98	90	10.0
	0.005	2.2	6.2	0.32	84	90	12.0
NS-10	5	17.8	5.0	0.62	675	73	23.7
	3	14.7	5.5	0.57	558	80	21.8
	2	12.9	5.7	0.54	488	83	20.5
	1	10.8	6.0	0.51	409	87	19.2
	0.5	8.8	6.1	0.47	333	88	17.7
	0.1	5.8	6.2	0.38	219	90	14.6
	0.01	3.5	6.2	0.36	133	90	13.5
	0.005	3.0	6.2	0.43	114	90	16.2
NS-20	5	34.1	5.0	1.20	1295	73	45.4
	3	28.2	5.5	1.10	1071	80	41.9
	2	24.7	5.7	1.04	938	83	39.4
	1	20.6	6.0	0.97	784	87	36.9
	0.5	16.8	6.1	0.89	638	88	33.9
	0.1	11.0	6.2	0.74	420	90	28.0
	0.01	6.7	6.2	0.68	255	90	26.0
	0.005	5.8	6.2	0.82	219	90	31.2
NS-35	5	56.8	5.0	1.99	2158	73	75.7
	3	47.0	5.5	1.84	1785	80	69.8
	2	41.1	5.7	1.73	1563	83	65.6
	1	34.4	6.0	1.62	1307	87	61.4
	0.5	28.0	6.1	1.49	1064	88	56.6
	0.1	18.4	6.2	1.23	699	90	46.6
	0.01	13.0	6.2	1.32	492	90	50.1
	0.005	9.6	6.2	1.37	365	90	52.0
NS-50	5	83.1	5.0	2.92	3157	73	110.8
	3	68.7	5.5	2.69	2610	80	102.1
	2	60.1	5.7	2.53	2285	83	96.0
	1	50.3	6.0	2.37	1912	87	89.9
	0.5	41.0	6.1	2.18	1556	88	82.7
	0.1	26.9	6.2	1.80	1023	90	68.2
	0.01	16.4	6.2	1.67	622	90	63.3
	0.005	14.0	6.2	2.00	534	90	76.0

		SI 7.5 Bar(g) feed pressure			US Standard 110 PSIG feed pressure		
MODEL	Oxygen %	Output N2 Nm3/h	Output P bar(g)	Feed Air Nm3/m	Output N2 SCFH	Output P PSIG	Feed Air SCFM
NS-75	5	124	5.0	4.36	4722	73	166
	3	103	5.5	4.02	3904	80	153
	2	90	5.7	3.78	3418	83	144
	1	75	6.0	3.54	2860	87	134
	0.5	61	6.1	3.26	2328	88	124
	0.1	40	6.2	2.68	1530	90	102
	0.01	25	6.2	2.49	931	90	95
	0.005	21	6.2	2.99	798	90	114
NS-100	5	176	5.0	6.17	6678	73	234
	3	145	5.5	5.68	5522	80	216
	2	127	5.7	5.34	4834	83	203
	1	106	6.0	5.00	4044	87	190
	0.5	87	6.1	4.60	3292	88	175
	0.1	57	6.2	3.80	2163	90	144
	0.01	35	6.2	3.53	1317	90	134
	0.005	30	6.2	4.23	1129	90	161
NS-150	5	245	5.0	8.60	9308	73	327
	3	203	5.5	7.92	7697	80	301
	2	177	5.7	7.45	6739	83	283
	1	148	6.0	6.97	5637	87	265
	0.5	121	6.1	6.42	4589	88	244
	0.1	79	6.2	5.29	3015	90	201
	0.01	48	6.2	4.91	1835	90	187
	0.005	41	6.2	5.90	1573	90	224
NS-200	5	341	5.0	11.96	12950	73	454
	3	282	5.5	11.02	10709	80	419
	2	247	5.7	10.36	9375	83	394
	1	206	6.0	9.70	7843	87	369
	0.5	168	6.1	8.93	6384	88	339
	0.1	110	6.2	7.36	4195	90	280
	0.01	67	6.2	6.84	2554	90	260
	0.005	58	6.2	8.20	2189	90	312
NS-300	5	497	5.0	17.44	18886	73	663
	3	411	5.5	16.07	15618	80	611
	2	360	5.7	15.11	13672	83	574
	1	301	6.0	14.15	11438	87	538
	0.5	245	6.1	13.02	9310	88	495
	0.1	161	6.2	10.74	6118	90	408
	0.01	98	6.2	9.97	3724	90	379
	0.005	84	6.2	11.97	3192	90	455
NS-400	5	675	5.0	23.67	25631	73	899
	3	558	5.5	21.81	21196	80	829
	2	488	5.7	20.50	18555	83	779
	1	409	6.0	19.20	15523	87	730
	0.5	333	6.1	17.67	12635	88	672
	0.1	219	6.2	14.58	8303	90	554
	0.01	133	6.2	13.53	5054	90	514
	0.005	114	6.2	16.24	4332	90	617
NS-500	5	831	5.0	29.15	31567	73	1108
	3	687	5.5	26.87	26104	80	1021
	2	601	5.7	25.25	22852	83	960
	1	503	6.0	23.65	19118	87	899
	0.5	410	6.1	21.77	15561	88	827
	0.1	269	6.2	17.95	10226	90	682
	0.01	164	6.2	16.67	6224	90	633
	0.005	140	6.2	20.00	5335	90	760

Larger capacity systems are available upon request.
IGS offers full customer engineered systems for large capacity or special specifications.

High Pressure NITROSWING® Nitrogen Generator Specifications

		SI 10 Bar(g) feed pressure			US Standard 145 PSIG feed pressure		
MODEL	Oxygen %	Output N2 Nm3/h	Output P bar(g)	Feed Air Nm3/m	Output N2 SCFH	Output P PSIG	Feed Air SCFM
NS-2H	5	4.4	7.0	0.15	166	102	5.8
	3	3.6	7.5	0.14	138	109	5.4
	2	3.2	7.7	0.13	120	112	5.1
	1	2.7	8.0	0.12	101	116	4.7
	0.5	2.2	8.1	0.11	82	117	4.4
	0.1	1.4	8.2	0.09	54	119	3.6
	0.01	0.9	8.2	0.09	33	119	3.3
	0.005	0.7	8.2	0.11	28	119	4.0
NS-4H	5	8.5	7.0	0.30	322	102	11.3
	3	7.0	7.5	0.27	267	109	10.4
	2	6.1	7.7	0.26	233	112	9.8
	1	5.1	8.0	0.24	195	116	9.2
	0.5	4.2	8.1	0.22	159	117	8.4
	0.1	2.7	8.2	0.18	104	119	7.0
	0.01	1.7	8.2	0.17	64	119	6.5
	0.005	1.4	8.2	0.20	54	119	7.8
NS-8H	5	16.9	7.0	0.59	641	102	22.5
	3	14.0	7.5	0.55	530	109	20.7
	2	12.2	7.7	0.51	464	112	19.5
	1	10.2	8.0	0.48	388	116	18.3
	0.5	8.3	8.1	0.44	316	117	16.8
	0.1	5.5	8.2	0.36	208	119	13.9
	0.01	3.3	8.2	0.34	126	119	12.9
	0.005	2.9	8.2	0.41	108	119	15.4
NS-10H	5	22.8	7.0	0.80	867	102	30.4
	3	18.9	7.5	0.74	717	109	28.0
	2	16.5	7.7	0.69	627	112	26.3
	1	13.8	8.0	0.65	525	116	24.7
	0.5	11.2	8.1	0.60	427	117	22.7
	0.1	7.4	8.2	0.49	281	119	18.7
	0.01	4.5	8.2	0.46	171	119	17.4
	0.005	3.9	8.2	0.55	146	119	20.9
NS-20H	5	43.8	7.0	1.54	1664	102	58.4
	3	36.2	7.5	1.42	1376	109	53.8
	2	31.7	7.7	1.33	1205	112	50.6
	1	26.5	8.0	1.25	1008	116	47.4
	0.5	21.6	8.1	1.15	820	117	43.6
	0.1	14.2	8.2	0.95	539	119	36.0
	0.01	8.6	8.2	0.88	328	119	33.4
	0.005	7.4	8.2	1.05	281	119	40.1
NS-35H	5	73.0	7.0	2.56	2774	102	97.3
	3	60.4	7.5	2.36	2294	109	89.7
	2	52.8	7.7	2.22	2008	112	84.3
	1	44.2	8.0	2.08	1680	116	79.0
	0.5	36.0	8.1	1.91	1367	117	72.7
	0.1	23.6	8.2	1.58	898	119	59.9
	0.01	16.7	8.2	1.69	633	119	64.4
	0.005	12.3	8.2	1.76	469	119	66.8
NS-50H	5	106.7	7.0	3.75	4056	102	142.3
	3	88.3	7.5	3.45	3354	109	131.2
	2	77.3	7.7	3.24	2937	112	123.3
	1	64.6	8.0	3.04	2457	116	115.5
	0.5	52.6	8.1	2.80	2000	117	106.3
	0.1	34.6	8.2	2.31	1314	119	87.7
	0.01	21.0	8.2	2.14	800	119	81.4
	0.005	18.0	8.2	2.57	686	119	97.7

		SI 10 Bar(g) feed pressure			US Standard 145 PSIG feed pressure		
MODEL	Oxygen %	Output N2 Nm3/h	Output P bar(g)	Feed Air Nm3/m	Output N2 SCFH	Output P PSIG	Feed Air SCFM
NS-75H	5	160	7.0	5.60	6067	102	213
	3	132	7.5	5.16	5017	109	196
	2	116	7.7	4.85	4392	112	184
	1	97	8.0	4.55	3674	116	173
	0.5	79	8.1	4.18	2991	117	159
	0.1	52	8.2	3.45	1965	119	131
	0.01	31	8.2	3.20	1196	119	122
	0.005	27	8.2	3.84	1025	119	146
NS-100H	5	226	7.0	7.92	8581	102	301
	3	187	7.5	7.30	7096	109	278
	2	163	7.7	6.86	6212	112	261
	1	137	8.0	6.43	5197	116	244
	0.5	111	8.1	5.92	4230	117	225
	0.1	73	8.2	4.88	2780	119	185
	0.01	45	8.2	4.53	1692	119	172
	0.005	38	8.2	5.44	1450	119	207
NS-150H	5	315	7.0	11.05	11961	102	420
	3	260	7.5	10.18	9891	109	387
	2	228	7.7	9.57	8659	112	364
	1	191	8.0	8.96	7244	116	341
	0.5	155	8.1	8.25	5896	117	313
	0.1	102	8.2	6.80	3875	119	258
	0.01	62	8.2	6.31	2358	119	240
	0.005	53	8.2	7.58	2022	119	288
NS-200H	5	438	7.0	15.37	16641	102	584
	3	362	7.5	14.16	13762	109	538
	2	317	7.7	13.31	12047	112	506
	1	265	8.0	12.47	10079	116	474
	0.5	216	8.1	11.47	8203	117	436
	0.1	142	8.2	9.46	5391	119	360
	0.01	86	8.2	8.79	3281	119	334
	0.005	74	8.2	10.54	2813	119	401
NS-300H	5	639	7.0	22.41	24269	102	852
	3	528	7.5	20.65	20069	109	785
	2	462	7.7	19.41	17569	112	738
	1	387	8.0	18.18	14698	116	691
	0.5	315	8.1	16.73	11963	117	636
	0.1	207	8.2	13.80	7862	119	524
	0.01	126	8.2	12.81	4785	119	487
	0.005	108	8.2	15.38	4102	119	584
NS-400H	5	867	7.0	30.41	32936	102	1156
	3	717	7.5	28.03	27236	109	1065
	2	627	7.7	26.35	23844	112	1001
	1	525	8.0	24.68	19947	116	938
	0.5	427	8.1	22.71	16236	117	863
	0.1	281	8.2	18.73	10669	119	712
	0.01	171	8.2	17.39	6494	119	661
	0.005	146	8.2	20.87	5567	119	793
NS-500H	5	1067	7.0	37.46	40563	102	1423
	3	883	7.5	34.52	33544	109	1312
	2	773	7.7	32.45	29365	112	1233
	1	646	8.0	30.39	24566	116	1155
	0.5	526	8.1	27.97	19996	117	1063
	0.1	346	8.2	23.07	13140	119	877
	0.01	210	8.2	21.41	7998	119	814
	0.005	180	8.2	25.70	6856	119	977

Larger capacity systems are available upon request.
IGS offers full customer engineered systems for large capacity or special specifications.

IGS References and Standards

Customer Reference List

- Abbott
- Air Products
- BASF
- BJ Services
- Degussa
- EMS Chemie
- Ferrero Rocher
- Ferrostaal
- Hoek Loos
- Holox
- Hutchinson Technology
- KTI
- Lorenz-Bahlsen Snack World
- Lurgi
- Messer
- Mitsubishi Heavy Industries
- Odra Gas
- Sandvik
- Slovako Farma
- Uhde
- Zimmer AG
- And Hundreds More

Industry Standards

All IGS supplied systems are designed and built to ASME and CE standards. The system can be modified to any standard according to customer specification. We have supplied many systems to the following optional standards:

- DIN
- ANSI
- API
- IEC/NEC
- NFPA/RINA
- IP/NEMA
- CE/PED
- GOST R/GGTN
- Cenelec
- Beseefa
- Lloyds
- DNV
- Customer Specifications

Systems Sold:

IGS has sold over 1,500 Nitrogen Generating Systems

- Chemical Processing Industry: 500
- Food Processing and Wine Storage: 400
- Heat Treatment: 100
- Metal Processing: 50
- Laboratories: 60
- Pharmaceutical: 40
- Laser Cutting: 25
- And many more specialized applications

IGS INNOVATIVE GAS SYSTEMS

- Innovative Gas Systems is a global technology company with operational centers in North America, Europe and Asia.
- Our products are world class with over 75 patents supporting our innovative technology in Nitrogen membranes, Nitrogen PSA, Oxygen PSA/VPSA, Hydrogen generating plants and unique knowledge in environmental incineration and catalytic waste gas oxidation plants.
- Please visit our website for a review of the complete list of products from IGS or contact one of our local sales associates directly.

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