

NANOCHEM[®]

WK-9000H (White Knight™) Gas Purifiers

Overview

NANOCHEM[®] WK-9000H (White Knight™) purifiers offer the highest lifetimes and the best impurity removal efficiencies in a very economical design. The WK-9000H purifiers are available in both single and dual configurations. The optional dual purifier bypass includes a purge manifold.

Features and Benefits

- For point-of-use to bulk flow specialty gas purification
- **Highest Lifetimes**
- **Best Impurity Removal Efficiencies**
 - Removes critical contaminants to sub part-per-trillion levels
- Enhances manufacturing process economy and improves equipment performance
- Provides consistently high purity gas under fluctuating inlet impurity conditions
- Improves component lifetime and reduces particle generation by removing moisture from corrosive gases
- Easy to install and operate
- No heating or cooling required
- Quick start up
- Metal parts are type 316L stainless steel, or Nickel 200
- Particle filters are PTFE
- Economical, low cost of ownership



Impurities Removed

Gas Type	Contaminants	Outlet Purity	
Inerts - Nitrogen (N ₂), Argon (Ar), other inerts	H ₂ O	< 86 ppt	
	O ₂	< 50 ppt	
	CO	< 100 ppt	
	CO ₂	< 24 ppt	
	Benzene	< 156 ppq	
	Toluene	< 93 ppq	
	Ethylbenzene	< 96 ppq	
	m,p-Xylene	< 79 ppq	
	o-Xylene	< 112 ppq	
	Refractories*	< 134 ppq	
	H ₂	< 1 ppb	
	Ammonia (NH ₃)	H ₂ O	< 45 ppb
O ₂		< 0.1 ppb	
CO ₂		< 11 ppb	
Carbamate		< 11 ppb	
GeH ₄		< 1 ppb	
SiH ₄		< 3 ppb	
Siloxanes		< 40 ppb	
Metals			
Al		< 0.6 ppb	
Cu		< 0.27 ppb	
Fe		< 0.8 ppb	
K		< 0.35 ppb	
Na		< 0.27 ppb	
Si		< 1.3 ppb	
W		< 0.11 ppb	
Zn		< 0.27 ppb	
Zr		< 0.11 ppb	
Hydrocarbons from Liquid NH₃			
Naphthenic and Paraffins		85% removal	
Ethyl Benzene		96% removal	
Dissolved other HC		<200 ppb	
Hydrocarbons from Gaseous NH₃			
n-Butane		< 30 ppb	
Ethylbenzene	< 30 ppb		
Carbon Dioxide (Purifier material HCX)	Isopropyl Alcohol	< 200 ppt	
	Acetone	< 93 ppt	
	Propene	< 1 ppt	
	Ethanol	< 1 ppt	
	Carbon Disulfide	< 1 ppt	
	Hexane	< 1 ppt	
	Benzene	< 1 ppt	

Gas Type	Contaminants	Outlet Purity	
Carbon Dioxide (Purifier material HCX) <i>continued</i>	Heptane	< 1 ppt	
	Toluene	< 1 ppt	
	m,p-Xylene	< 1 ppt	
	o-Xylene	< 1 ppt	
	Ethyl Toluene	< 1 ppt	
	1,3,5-Trimethyl Benzene	< 1 ppt	
	1,2,4-Trimethyl Benzene	< 1 ppt	
	DichloroBenzene	< 1 ppt	
Silane (SiH ₄)	H ₂ O	< 100 ppt	
	O ₂	< 100 ppt	
	CO ₂	< 100 ppt	
	CO**	< 1 ppb	
	Chlorosilanes, disilane, siloxanes, arsine, phosphine		
Hydrogen (H ₂)	H ₂ O	< 100 ppt	
	O ₂	< 100 ppt	
	CO ₂	< 100 ppt	
Methane (CH ₄)	CO**	< 1 ppb	
Ethane (C ₂ H ₆), other HC	NO _x , SO _x , H ₂ S		
	Sulfur Hexafluoride (SF ₆)	H ₂ O in inert gas	< 100 ppt
		O ₂ in inert gas	< 100 ppt
CO ₂ in inert gas		< 100 ppt	
Carbon Tetrafluoride (CF ₄)	H ₂ O in sulfur hexafluoride	< 10 ppb	
	O ₂ in sulfur hexafluoride	< 10 ppb	
Other Fluorocarbons	H ₂ O in sulfur hexafluoride	< 10 ppb	
	O ₂ in sulfur hexafluoride	< 10 ppb	
Oxygen (O ₂),	H ₂ O	< 10 ppb	
Carbon Dioxide (CO ₂),	H ₂ O	< 10 ppb	
Nitrous Oxide (N ₂ O)	H ₂ O	< 10 ppb	
Carbon Monoxide (CO)	Metal Carbonyls: Fe, Ni		
Corrosives (HCl, HBr, Cl ₂ , SiH ₂ Cl ₂ , SiHCl ₃ , BCl ₃)	H ₂ O in inert gas	< 1 ppb	
	H ₂ O in HBr	< 100 ppb	
	H ₂ O in HCl	< 100 ppb	
	Volatile Metals***		
	Mo	< 4 ppb	
	Ti	< 13 ppb	
	Fe(CO) ₅	< 50 ppb	

Impurity removal depends on purifier material and incoming gas specification

*Refractories as TMSO (Tetramethyldisiloxane)

**CO is removed efficiently by OMX & OMX-Plus™ media at low flow rates (recommend 1/10 of normal flow rate)

***Metals removed as measured on wafer via VPD-ICPMS:

Al, Ca, Cr, Fe, Mg, Ni, K, Na, Zn

Metals removal as demonstrated by intrinsic resistivity measurements on wafer grown by TCS:

Without MTX Purifier: <200 ohm-cm

With MTX Purifier: > 2500 ohm-cm and total metals on water <1E10 atoms/cm²

Analytical Characterization of NANO-CHEM® NHX™ Purifier

Impurity/Matrix	Capacity (L/L)	Efficiency (ppb)	Challenge (ppm)	Method
H ₂ S in He	6	<0.3 (D/L)	50	GC-AED
H ₂ S in Ar	31	<0.3 (D/L)	35	API-MS
H ₂ S in NH ₃	25	<45 (D/L)	1000	FTIR
CO ₂ in He	5	<11 (D/L)	500	GC-DID
CO ₂ in NH ₃	–	<11 (D/L)	25	GC-DID
GeH ₄ in N ₂	–	<0.1 (D/L)	2.5	API-MS
SiH ₄ in N ₂	–	<0.1 (D/L)	2.5	API-MS
Siloxanes in N ₂	–	<0.1 (D/L)	(trace)	API-MS
GeH ₄ in NH ₃	–	<0.5 (D/L)	1.0	GC-AED
SiH ₄ in NH ₃	–	<1 (D/L)	1.0	GC-AED
TEOS (siloxane) in NH ₃	–	<40 (D/L)	640	GC-DID
O ₂ in NH ₃	–	<50 (D/L)	100	GC-DID

Purifier Models

	WK-9000H Single Purifier	WK-9000H Dual Purifier
Media bed volume	9000 ml	9000 ml
Maximum flow rate (in nitrogen), slpm (NM ₃ /hr)	2000 (120)	4000 (240)*
Pressure Drop at maximum flow rate (psi), tested in N ₂ at 90 psi inlet	<17 (<0.12 MPa)	<17 (<0.12 MPa)
Max permissible operating pressure, psi	250 (1.7 MPa)	250 (1.7 MPa)

*Both purifiers must be used in parallel path configuration

Specifications

- 0.003 µm filter with 99.9999999% retention (PTFE or 316L SS)
- Internal surface finish < 15 µin Ra
- Maximum operating temperature is 40°C
- Inlet and outlet isolation valves

Connections

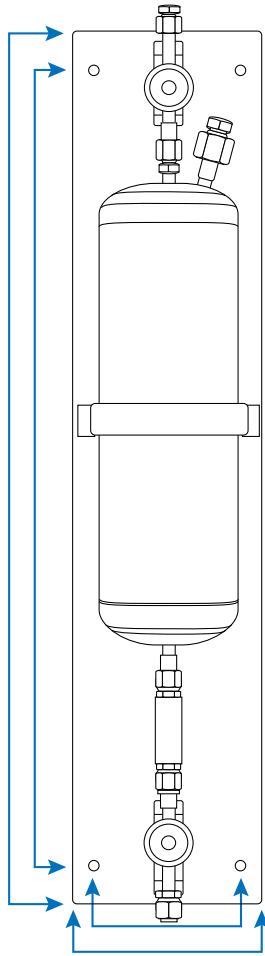
- Male inlet and outlet connections, 1/2" face seal

Options

- Three-valve manifold with isolation and bypass valves allows disconnection of purifier without interrupting process gas flow

Dimensions

WK-9000H



Mounting Holes: Width 6.68" (169.7 mm) +/- 0.010" (0.254 mm)

Back Plate: Width 8.75" (222.3 mm) +/- 0.010" (0.254 mm)

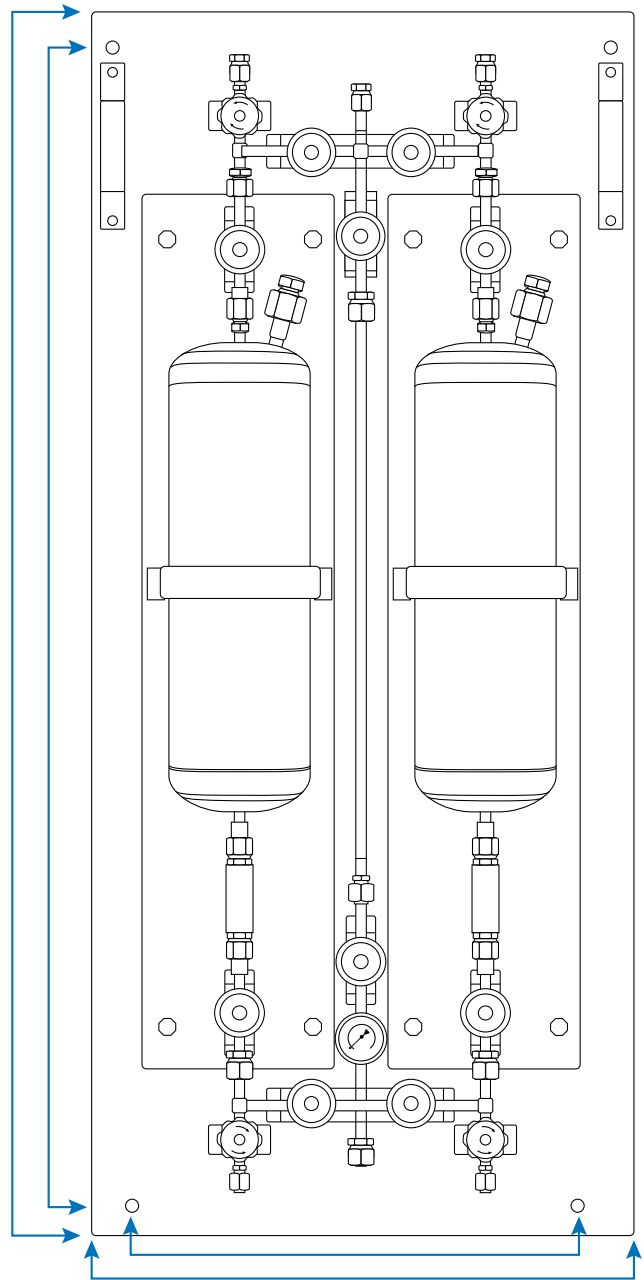
Mounting Holes: Length 36.00" (914.4 mm) +/- 0.010" (0.254 mm)

Back Plate: Length 40.00" (1016.0 mm) +/- 0.010" (0.254 mm)

NANOCHEM® Single Purifier Model WK-9000H

Dimensions in inches (mm)

WK-9000 DUAL



Mounting Holes: Width 22.00" (558.8 mm) +/- 0.010" (0.254 mm)

Back Plate: Width 25.00" (635.0 mm) +/- 0.010" (0.254 mm)

Mounting Holes: Length 53.00" (1346.2 mm) +/- 0.010" (0.254 mm)

Back Plate: Length 56.00" (1422.4 mm) +/- 0.010" (0.254 mm)

NANOCHEM® Dual Purifier Model WK-9000H with Bypass Model BP-WK-9000

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