NANOCHEM®

WK-Series (White Knight™) Gas Purifiers

Overview

NANOCHEM® WK-Series (White Knight™) purifiers offer the highest lifetimes and the best impurity removal efficiencies in a very economical design. The in-line design enables a very compact footprint and allows drop-in replacement of competing hardware designs. The WK-Series is available in a number of sizes for point-of-use applications to bulk gas purification.

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
- Compact footprint; inline design
- Easy to install and operate
- No heating or cooling required
- Quick start up
- All metal parts, type 316L stainless steel, or Nickel 200
- Economical, low cost of ownership

MATHESON
The Gas Professionals

Impurities Removed

Gas Type	Contaminants	Outlet Purity
Inerts - Nitrogen (N_2), Argon (Ar), other inerts	H_2O	< 86 ppt
	O_2	< 50 ppt
	CO	< 100 ppt
	CO_2	< 10 ppt
	Benzene	764 ppq
	Toluene	938 ppq
	Ethylbenzene	746 ppq
	m, p - Xylene	426 ppq
	o - Xylene	689 ppq
	TMDSO	697 ppq
	Refractories*	< 697 ppq
	H_2	< 1 ppb
Ammonia (NH_3)	H_2O	< 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 NH_3	
	Napthenic and Paraffins	85% removal
	Ethyl Benzene	96% removal
	Dissolved other HC	<200 ppb
	Hydrocarbons from Gaseous NH_3	
	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) *continued*	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_2O	< 100 ppt
	O_2	< 100 ppt
	CO_2	< 100 ppt
	CO**	< 1 ppb
	Chlorosilanes, disilane, siloxanes, arsine, phosphine	
Hydrogen (H_2)	H_2O	< 100 ppt
	O_2	< 100 ppt
	CO_2	< 100 ppt
Methane (CH_4)	CO**	< 1 ppb
Ethane (C_2H_6), other HC	NOx, SOx, H2S	
Sulfur Hexafluoride (SF_6)	H_2O in inert gas	< 100 ppt
	O_2 in inert gas	< 100 ppt
	CO_2 in inert gas	< 100 ppt
Carbon Tetrafluoride (CF_4)	H_2O in sulfur hexafluoride	< 10 ppb
	O_2 in sulfur hexafluoride	< 10 ppb
Other Fluorocarbons	H_2O in sulfur hexafluoride	< 10 ppb
	O_2 in sulfur hexafluoride	< 10 ppb
Oxygen (O_2),	H_2O	< 10 ppb
Carbon Dioxide (CO_2),	H_2O	< 10 ppb
Nitrous Oxide (N_2O)	H_2O	< 10 ppb
Carbon Monoxide (CO)	Metal Carbonyls: Fe, Ni	
Corrosives (HCl, HBr, Cl_2, SiH_2Cl_2, $SiHCl_3$, BCl_3)	H_2O in inert gas	< 1 ppb
	H_2O in HBr	< 100 ppb
	H_2O 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 TMDSO (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 NANOCHEM® NHX™ Purifier

Impurity/Matrix	Capacity (L/L)	Efficiency (ppb)	Challenge (ppm)	Method
H_2S in He	6	<0.3 (D/L)	50	GC-AED
H_2S in Ar	31	<0.3 (D/L)	35	API-MS
H_2S 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-70 WK-75	WK-300	WK-500	WK-700	WK-2500	WK-5000
Media bed volume	50 ml 55 ml	300 ml	500 ml	700 ml	2500 ml	5000 ml
Maximum flow rate (in nitrogen), slpm (NM^3/hr)	10 (0.6)	75 (4.5)	150 (9.0)	225 (13.5)	500 (30)	800 (48)
Pressure Drop at maximum flow rate (psi), tested in N_2 at 90 psi inlet	< 1 (<0.007 MPa)	TBD	< 5 (<0.04 MPa)	< 7 (<0.05 MPa)	< 5 (<0.04 MPa)	< 4 (<0.03 MPa)
Max permissible operating pressure, psi	1000 (7 MPa)	500 (3.5 MPa)	500 (3.5 MPa)	500 (3.5 MPa)	500 (3.5 MPa)	500 (3.5 MPa)

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

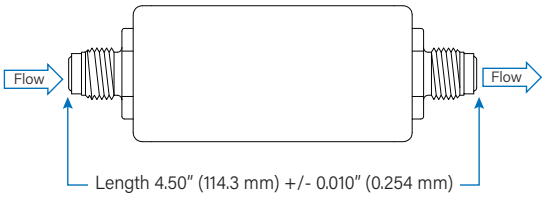
Connections

- Male inlet and outlet connections, 1/4" VCR - compatible

Options

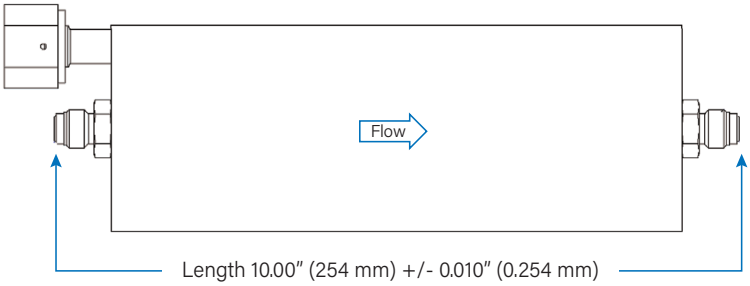
- Inlet and outlet isolation valves
- Three-valve manifold with isolation and bypass valves allows disconnection of purifier without interrupting process gas flow

Dimensions



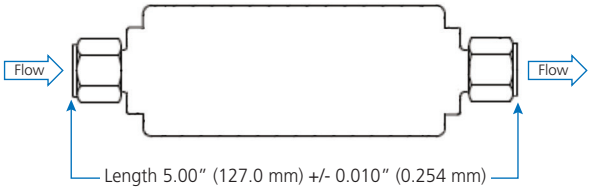
Length 4.50" (114.3 mm) +/- 0.010" (0.254 mm)
Width 1.50" (38.1 mm) +/- 0.010" (0.254 mm)

NANOCHEM® Purifier Model WK-70



Length 10.00" (254 mm) +/- 0.010" (0.254 mm)
Width 3.00" (76.2 mm) +/- 0.010" (0.254 mm)

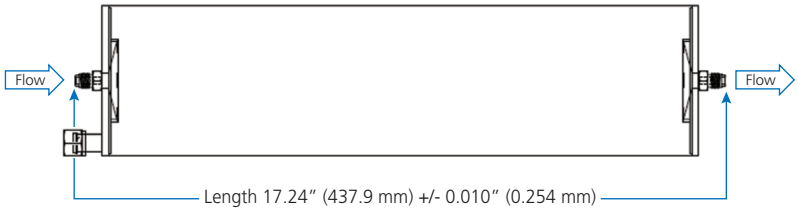
NANOCHEM® Purifier Model WK-700



Length 5.00" (127.0 mm) +/- 0.010" (0.254 mm)
Width 1.50" (38.1 mm) +/- 0.010" (0.254 mm)

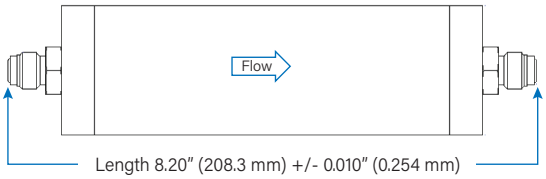
NANOCHEM® Purifier Model WK-75

**actual media volume is 55 ml*



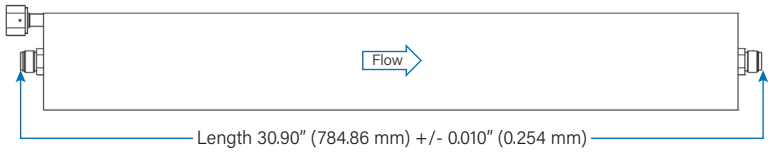
Length 17.24" (437.9 mm) +/- 0.010" (0.254 mm)
Width 4.00" (101.6 mm) +/- 0.010" (0.254 mm)

NANOCHEM® Purifier Model WK-2500



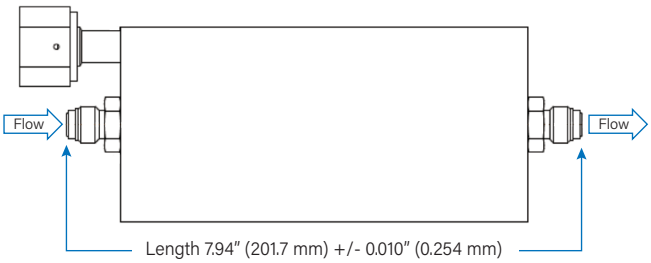
Length 8.20" (208.3 mm) +/- 0.010" (0.254 mm)
Width 2.00" (50.8 mm) +/- 0.010" (0.254 mm)

NANOCHEM® Purifier Model WK-300



Length 30.90" (784.86 mm) +/- 0.010" (0.254 mm)
Width 4.00" (101.6 mm) +/- 0.010" (0.254 mm)

NANOCHEM® Purifier Model WK-5000



Length 7.94" (201.7 mm) +/- 0.010" (0.254 mm)
Width 3.00" (76.2 mm) +/- 0.010" (0.254 mm)

NANOCHEM® Purifier Model WK-500

Dimensions in inches (mm)

Note: Purifiers are shown in horizontal position for illustration purposes only. Purifiers must be installed vertically.

Models WK-75, WK-300, WK-500, WK-700, WK-2500 and WK-5000 have a 0.003 µm particle filter.

Nanochem Purification
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