A-SUNG
CLEAN PVC
PIPING
SYSTEM

CLEANFLOW™
Korea's Best

A-SUNG CLEAN PVC PIPING SYSTEM

THE FIRST AND STILL THE BEST

A-SUNG Plastic Valve Clean Flow-Tech

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A-SUNG CLEAN PVC PIPING SYSTEM

1. Features of A-Sung Clean PVC (CLEANFLOW™)

1) **CLEANFLOW™** is shock-proof and minimizes elution of heavy metals.
2) Pipes are manufactured in compliance with requirements for Portable water piping system (Korean Standard M3401)
3) Inner surface of pipe is very smooth and uniform in surface with limited number of bumps and porosity, making pipes safe from bacteria proliferation. In addition, almost noTOC elutes.
4) **CLEANFLOW™** providesgood resistance to general drugs and chemicals.

2. Product quality

1) Quality standard of **CLEANFLOW™** piping system
CLEANFLOW™ piping system comply with quality criteria for PVC piping system (Korean Standard M3401) as follows :

Descriptions	Test category	Test method	Remark
Dimension	Average diameter	KSM3401	These test categories are also used by Korea Agency for Technology and Standards to assess quality of PVC products.
	diameter		
	Thickness		
Essential performance	Tensile strength	KSM3401	
	water pressure		
	Flatness		
	vicat softening temperature		
In-use conformity	Internal roughness	KSB0161 KSM0100 KSM3401 Appendix#2	* **CLEANFLOW™** pipes gained New Product (NeP) certification from the Ministry of Commerce, Industry and Energy
	Electric conductivity		
	Dissolution Test		

3. Results of performance and property tests

Tested category	Test standards	Test results	Remarks
Tensile strength	Tensile strength should be more then 4.7KN/㎠ at 15˚C(59˚F) (480kgf/㎠)	508.6kg/㎠	
Water pressure	No defects such as leakage should be detected for 1 minute at hot water pressure of 2.45MPa (25kgf/㎠)	Passed	
Joint water pressure	No leakage should be detected for 1 minute at hot water pressure of 2.45MPa (25kgf/㎠)	Passed	**CLEANFLOW™** pipe test Installation temperature : 23˚C(73.4˚F), Adhesives : 80# Test samples : 100mm pipe & socket Pressure rating of 40kgf/㎠ for an hour. No defect
Impact resistance	Pipe should remain intact after the impact at 0˚C and 20˚(68˚F)	Passed	
Flatness	There should be neither crack nor fissure when the pipe is flattened until the outer diameter is 1/2 of the original size at 23˚C (73.4˚F)	Passed	
Softening temperature	Higher than 76˚C (168.8˚F)	82.0˚C (179.6˚F)	
Elution of heavy metals	Total elutingamount of each heavy metal eluted should not exceed the limit below at room temperature (see table 4.)	Passed	
Internal roughness	Less than Rmax(JIS) 0.5㎛	0.06㎛	KSB0161

Testing institute : Korea Testing and Research Institute (KTR)

4. Eluting limit test results

Haavy metals	Maximum eluting limit	Eluting test results for CLEANFLOW™
Electrolytic reaction	2㎲/cm	1㎲/cm
Pb	Less than 2 ppb	Not detected
Ca	Less than 100 ppb	10.6 PPb
Zn	Less than 20 ppb	14.3 PPb
Sn	Less than 10 ppb	Not detected
Na	Less than 50 ppb	0.15 PPb
K	Less than 10 ppb	0.4 PPb
Mg	Less than 5 ppb	1 PPb
Mn	Less than 5 ppb	0.8 PPb
Ba	Less than 5 ppb	Not detected
Si	Less than 15 ppb	Not detected
Fe	Less than 10 ppb	1 PPb
Al	Less than 10 ppb	1 PPb

Testing institute : Korea Testing and Research Institute (KTR)

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5. Eluting test results of valves Test valve Type

Test valve Type	15day					30day				
	Pb (ppb)	Ca (ppb)	Zn (ppb)	Cd (ppb)	Sn (ppb)	Pb (ppb)	Ca (ppb)	Zn (ppb)	Cd (ppb)	Sn (ppb)
UNION BALL VALVE	ND	32	20	ND	ND	ND	28	175	ND	ND
DIAPHRAGM VALVE	ND	58	14	ND	ND	ND	59	43	ND	ND

Testing institute: Korea Testing and Research Institute (KTR)

※ NOTE
1) Valve SIZE : 1″
2) Seal material of union ball valve : PTFE, Diaphragm material of diaphragm valve : EPDM+PTEF
3) ND = not detected

6. TOC test results of valves

TEST VALVE TYPE	Seal / Diaphragm Material TEST TYPE	TOC condition (ppm)		
		24 hours 20˚C (68˚F)	24 hours 40˚C (104˚F)	30 days (room temperature)
UNION BALL VALVE	EPDM	0.35	0.35	2.1
DIAPHRAGM VALVE	PTEF	0.8	0.8	0.5

Testing institute: Korea Testing and Research Institute (KTR)

7. Comparison of Clean PVC pipe products

Test category		Conventional PVC Pipes	CLEANFLOW™	Brand X
Surface Roughness		1.5㎛(RA)	0.05㎛(RA)	0.06㎛(RA)
Elution Test (15 Days)	Pb	9ppb	Not detected	Not detected
	Ca	30,000ppb	10.6ppb	15.3ppb
	Zn	10ppb	14.3ppb	20.1ppb
	Sn	5ppb	Not detected	Not detected
Electrical conductivity		30.0(㎲/㎝)	Less then 1(㎲/㎝)	Less then 1(㎲/㎝)

Testing institute: Korea Testing and Research Institute (KTR)

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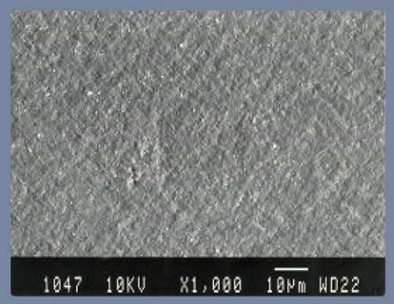
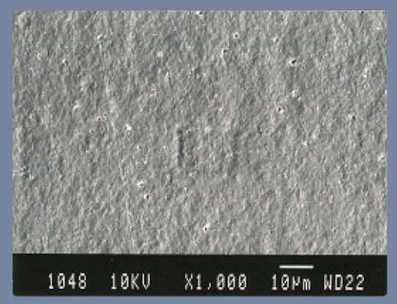
8. Surface profile comparison

CLEANFLOW™	Brand X
 (Intensity of illumination on the surface)	 (Intensity of illumination on the surface)
Surface roughness of 0.05㎛(RA) when **CLEANFLOW™** pipe is enlarged up to 1000 times	Surface roughness of 0.06㎛(RA) when an imported rival pipe is enlarged up to 1000 times

Testing institute: Korea Testing and Research Institute (KTR)

9. Results of tensile creep tests (changes in the outer diameter and length)

Description			Unit	Pressure Standard	Test result		Test method
Creep in hot-pressure-loaded pipe			–	4kgf/㎠ 60℃ 240h	Passed		KSM ISO 1167
	Measurement Condition	Time (h)			Outer diameter	Length	
Outer diameter	60℃(140℉)0kgf/㎠	0	mm		114.9	635.5	KSM ISO 3126
	60℃(140℉)0kgf/㎠	1			115.1	635.7	
	60℃(140℉)0kgf/㎠	3			115.1	635.7	
	60℃(140℉)0kgf/㎠	6			115.1	635.8	
	60℃(140℉)0kgf/㎠	9			115.1	635.8	
	60℃(140℉)0kgf/㎠	24			115.2	635.8	
	60℃(140℉)0kgf/㎠	48			115.2	635.8	
	60℃(140℉)0kgf/㎠	72			115.2	635.8	
	60℃(140℉)0kgf/㎠	168			115.2	635.8	
	60℃(140℉)0kgf/㎠	240			115.2	635.8	
※ Measurement was conducted at the spot 4"off from both bottom lids. At baseline, the outer diameter and length was 114.6mm and 634.5mm, respectively, at room temperature without pressure.							

Testing institute: Korea Testing and Research Institute (KTR)

| A-SUNG PRODUCTS |

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Clean PVC Piping system

Material	:	CLEAN PVC
Main applications	:	semiconductor manufacturing, water purification, water treatment, LCD and PDP
Size	:	15mm~250mm (JIS)
Working pressure	:	10kgf/㎠ (114.24PSI)
Working temperature	:	0°C ~ 60°C (0°F~140°F)
Connector types	:	Socket, Screw (PT) or flange
Connecting method	:	Welding and adhesive bonding

HT-PVC Piping system

Material	:	HT-PVC
Main applications	:	Water treatment, chemical treatment, wastewater treatment, seawater desalination, desulfurization system and power generation system
Size	:	15mm ~ 100mm (JIS)
Working pressure	:	10kgf/㎠ (114.24PSI)
Working temperature	:	-20°C ~ 90°C (-4°F~194°F)
Connector types	:	Socket, Screw (PT) or flange
Connecting method	:	welding and adhesive bonding

U-PVC Piping system

Material	:	U-PVC
Main applications	:	water treatment, chemical treatment, wastewater treatment, seawater desalination, desulfurization system, power generation system and coating system
Size	:	15mm ~ 250mm (JIS) 1/2"~ 10" (ANSI)
Working pressure	:	10kgf/㎠ (114.24PSI)
Working temperature	:	0°C ~ 60°C (0°F~140°F)
Connector types	:	Socket, Screw (PT) or flange
Connecting method	:	welding and adhesive bonding

PP Piping system

Material	:	PP
Main applications	:	Water treatment, chemical treatment, wastewater treatment, seawater desalination, desulfurization system and power generation system
Size	:	15mm~350mm (JIS)
Working pressure	:	10kgf/㎠ (114.24PSI)
Working temperature	:	-20°C ~ 90°C (-4°F~194°F)
Connector types	:	Socket, Screw (PT) or flange
Connecting method	:	welding

C-PVC System

Material	:	C-PVC
Main applications	:	water treatment, chemical treatment, wastewater treatment, seawater desalination, desulfurization system, power generation system and water supply system
Size	:	15mm ~ 200mm (JIS) 1/2"~ 8" (ANSI)
Working pressure	:	10kgf/㎠ (114.24PSI)
Working temperature	:	-20°C ~ 90°C (-4°F ~ 194°F)
Connector types	:	Socket, Screw (PT) or flange
Connecting method	:	welding and adhesive bonding

PVDF Piping system

Material	:	PVDF
Main applications	:	Water treatment, chemical treatment, water purification, wastewater treatment and semiconductor manufacturing
Size	:	15mm~100mm (JIS)
Working pressure	:	10kgf/㎠ (114.24PSI)
Working temperature	:	-40°C ~ 120°C (-40°F~248°F)
Connector types	:	Socket, Screw (PT) or flange
Connecting method	:	welding