

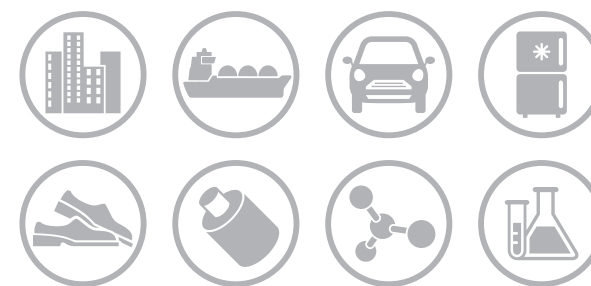


**WOOJO HIGHTECH**  
The Polyurethane Company



## Make a difference in **Polyurethanes**

The world's best polyurethane system manufacturer with the leading technology and the best products



### WOOJO HIGHTECH CO.,LTD.

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# Make a difference in Polyurethanes

WOOJO HIGHTECH is a privately held manufacturer of the world's finest polyurethane system and polyester polyol combining high-tech and expertise to provide highly effective solutions to customers worldwide. We are fully committed to our mission to take the lead in the development of polyurethane field.

## Business Areas:

- Cryogenic Insulations  
(Carrier Cargo Tanks, Land Storage Tanks, Pipes for LNG, LEG and LPG)
- Construction Insulations (Board, Panel, Block, Spray)
- Pre-Insulated Pipe (PIP) Insulations
- Refrigerator Insulations
- Automotive and Furniture System
- Coating System
- C.A.S.E Application
- Polyester Polyol
- Technical Consulting

We will continue to make the utmost efforts to supply best products and services to our customers while strictly adhering to best practices in health, safety and environment.



## CORPORATE HISTORY

- 2007** • Established WOOJO Chemical Co., Ltd.
- 2009** • Completed Polyurethane System Plant
  - PU System Capacity : 3,000 MT/yr
  - Prepolymer Capacity : 400 MT/yr
- ISO 9001 Certification
- Korea Venture Company Certification
- 2010** • Relocated to Newly Founded Factory in Chung-ju (Chung-ju High-Technology Industrial Complex)
- Expanded Production Capacity
  - PU System Production : 10,000 MT/yr
  - Polyester Polyol Production : 5,000 MT/yr
- Changed Name of Company to 'WOOJO HIGHTECH Co., Ltd'
- Established R&D Center
- 2011** • ISO 14001 Certification
- Eco-friendly Material Certification
- 2012** • Inno-biz Certification
- 2013** • LNG Cargo Tank Insulation System (MHI)
- Acquired Class Type Approval (LR, NK)
- 2014** • LNG Cryogenic Spray System (HHI)
- 2015** • Established 2nd Factory (Capacity 24,000MT)
- INEOS Ethane(LEG) Project - RG Pipe Insulation in UK
- PESOL for Shipbuilding & Construction Applications
- 2016** • Acquired Class Type Approval (ABS, KR)
- 2017** • Expanded Overseas Markets in India, Mongolia, China, Japan and etc.
- 2018** • Excellent Human Resource Management Certification

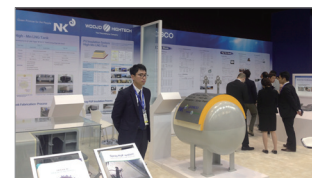
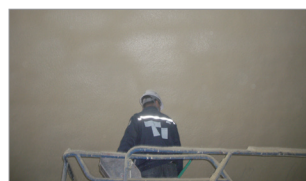
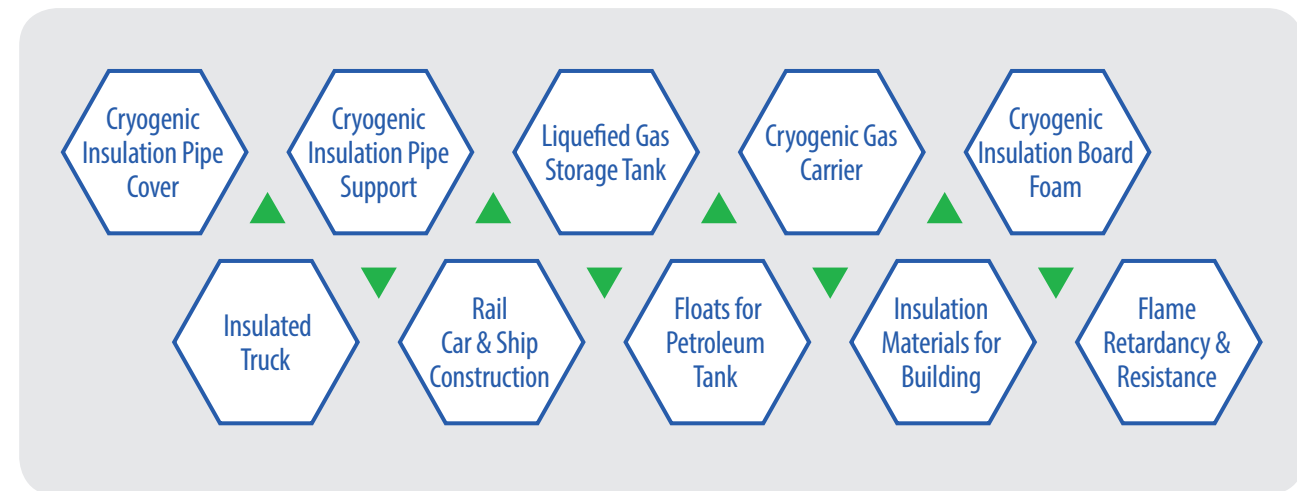




PIR and PU foams are widely used in the gas liquefaction industry, showing excellent performance and behavior at critical temperatures. Being strongly resistant to thermal shocks, our cryogenic system materials can effectively withstand a wide range of operating temperatures.

WOOJO HIGHTECH is specialized in the insulation of gas carriers with highly qualified professionals offering a unique combination of advanced engineering, technical insight, expert knowledge, and project management skills through years of experience in the field of marine gas insulation.

## Core Business and Primary Activities

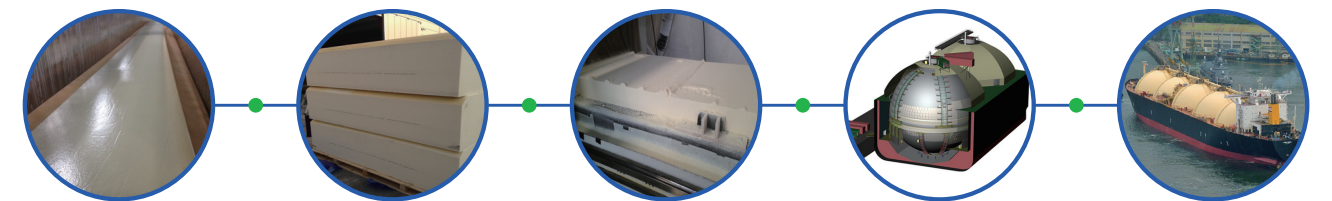


WOOJO HIGHTECH produces cryogenic insulation materials such as PUF/RPUF Blocks, Pipe Covers, Pipe Supports, Foam Sprays for LNG/LPG/Carrier Cargo Tanks, LNG Fuel Tanks and Land Tanks and Pipe Plants.

## LNG CARRIER CARGO TANK / LAND STORAGE TANK INSULATION

LNG and LPG are transported in carriers to consuming regions by sea. Tank insulation is important for low-temperature liquefied gas (LNG, LPG) carriers, and our insulation technology minimizes the evaporative (boil-off) loss of liquefied gas.

- Low density polyurethane foam for insulation of Moss type LNG carriers
- High density polyurethane foam for insulation of Membrane type LNG carriers
- Insulation PU panel installed on inside wall of LNG storage tank



## LNG PIPE COVER / PIPE SUPPORT

Pipe covers and supports provide energy-efficient thermal insulation, easy handling and flame retardancy. We provide a wide range of product portfolio covering all types of Cryogenics, High Temperature & Standard Pipe Supports, Clamps, Sliders and Related Fabrications for Offshore, Onshore & Subsea Applications.



## LNG, LEG AND LPG CARRIER CARGO & FUEL TANK SPRAY TYPE INSULATION

Our spray foam system is developed to improve insulation efficiency, minimize maintenance and reduce application time based on our extensive experiences in working with polyurethane foam for LNG, LEG and LPG cargo tank and LNG fuel tank Insulations.

- Very short application time at shipyards
- Improved weather exposure resistance during assembly
- No protection needed for outdoor storage of insulated tanks
- Improved insulation life time
- Best thermal efficiency







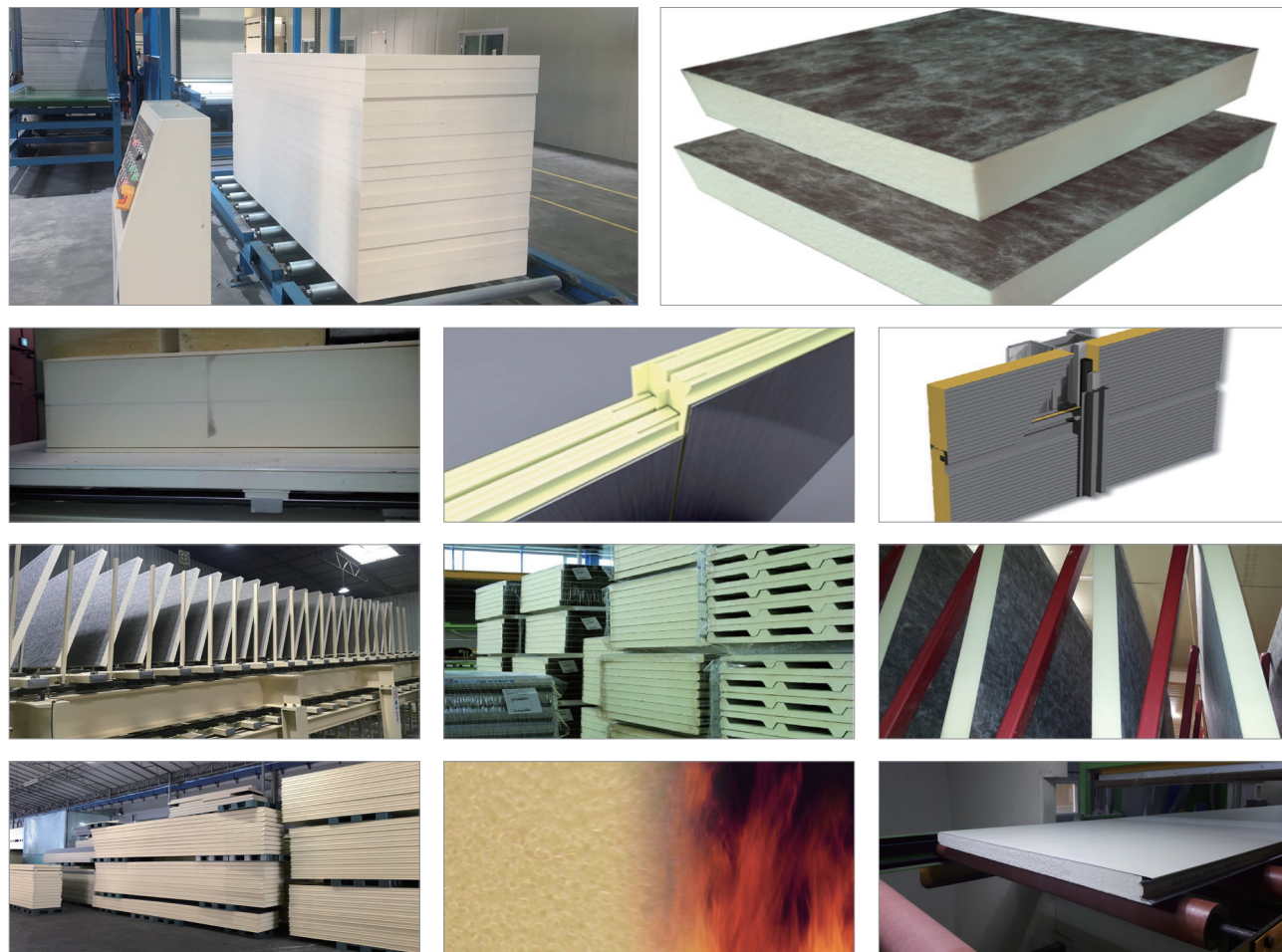
WOOJO HIGHTECH has been manufacturing top quality insulation materials in construction boards, blocks, sandwich panels that are :



## INSULATION BOARD, BLOCK, SANDWICH PANEL

Our construction materials show excellent physical properties and long-lasting durability.

We specially formulate our PIR (Polyisocyanurate) rigid foam to improve flame retardancy, thermal stability and efficiency while maintaining superior physical properties.



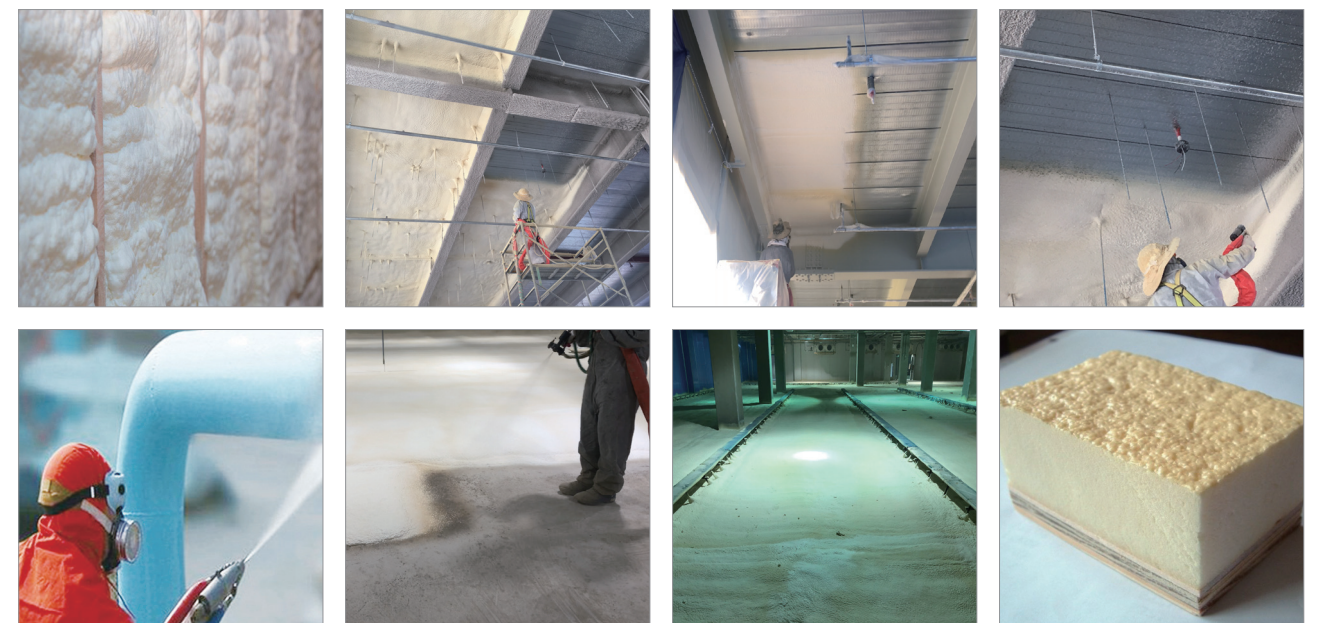
With our spray foam systems, uniform foam layers can be easily applied onto even complicated surfaces.

## WOOJO HIGHTECH CAN PROVIDE

- Cost effective systems - various density and energy saving
- Continuous training on job site
- Spray foamers - quality and training programs by WOOJO HIGHTECH
- Eco-efficiency - from raw materials to the final products
- Long durability
- Good adhesion
- Good sound absorption
- DIN 4102 Part 1, class B2 grade fire resistance

## APPLICATIONS

- Eco-foam for residential buildings and wooden houses
- Walls and roofs in barns
- Walls in low temperature storages
- Sprays for roof
- In-situ spray for receiving tanks
- Water based low density foam







Polyurethane is the most effective insulation material preventing heat loss, maintaining temperature to prevent freezing or cracking. In addition, it provides a high mechanical strength, flexibility and good flowability. Popular construction and engineering uses of Polyurethane include offshore oil and gas pipelines and heating and plumbing services for power stations, chemical plants and refineries.

## Features and benefits of Polyurethane pipe insulation :

Features	Construction Benefits
Low thermal conductivity	Prevent heat loss / Insulate against freezing
Suitable over wide temperature range	Wide temperature range -170°C to +190°C
Production versatility to suit application	Factory manufactured or in-situ
Compatibility with pipe materials	Compatible with steel, PE, PP, PVE or HDPE
Exclusive WOOJO HIGHTECH systems	Combine flexibility with thermal resistance
Good durability	Short maintenance/long life cycle

We offer innovative solutions for high/low temperature tolerance pipe and flexible pipe systems and technologies.

## APPLICATIONS

- Pre-insulated pipes for district heating
- Pre-insulated pipes for petroleum pipelines or carrying cold media



Rigid polyurethane insulating foam makes a major contribution to sustainability and eco-design by reducing the energy required to keep refrigerators and freezers. The insulation efficiency of polyurethane foams is a key property for the low temperature preservation of food during processing, storage and distribution to consumers.

## ADVANTAGES OF OUR PU MATERIALS

- Robust and strong
- Very light and thus reducing transportation costs
- Good demold properties
- Good K-factor
- Good surface quality
- Long-term stability

## APPLICATIONS

- HCFCs and HFCs blowing agent type refrigerator
- Hydro carbon (such as cyclo pentane) blowing agent type refrigerator
- Cold rooms and storages
- Refrigerated vans and wagons
- Reefer containers
- Gimchi refrigerators
- Small sized refrigerators (wine, cosmetic)







Polyurethane foam offers automotive designers and manufacturers the means to produce seating that can be easily assembled, disassembled and recycled. It also meets the highest performance specifications over a wide range of firmness without added weight. Through many years of service, and even under heavy use, polyurethane foam retains its original firmness, shape and resiliency.

Reaction Injection-Molded(RIM) polyurethane are used to maximize the shock absorption of fenders, bumpers and spoilers, without adding weight or bulk. Lightweight RIM polyurethanes can help give cars better gas mileage and allow engineers the freedom to create innovative designs that otherwise would never be possible.

## APPLICATIONS

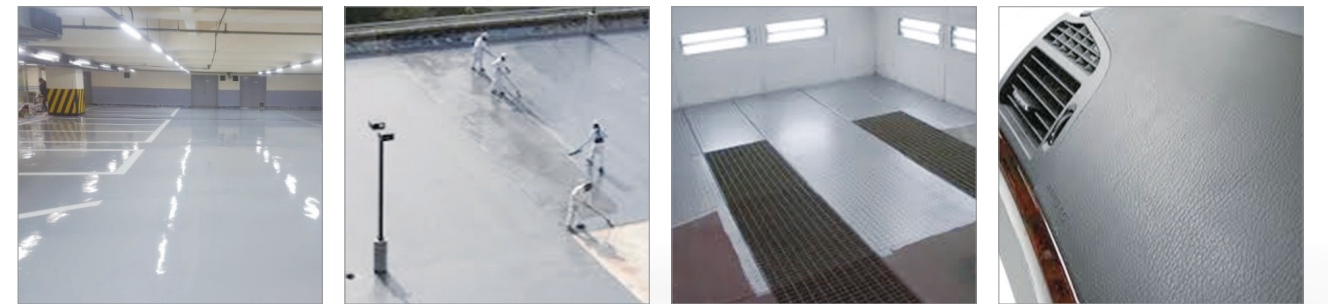
- Flexible foam for automotive and sofa
- Headrest/Armrest
- Integral skin
- Air-spoiler
- Dust protector
- Wood imitation
- S-RIM for auto supporter
- Sun visor
- Edge rounding foam for furniture (table etc.)
- Flexible/Rigid air filter foam
- Slow recovery foam (viscoelastic foam)



Polyurethane/Polyurea coating systems have numerous possibilities and a wide range of outstanding properties. It is nowadays being used almost everywhere especially for a long lasting surface protection.

## FEATURES

- High resistance to abrasion and impact
- Chemical resistance
- Impermeability to liquids
- Crack-bridging
- Slip resistance
- Electrical conductivity
- Weather stability and color fastness
- Easy cleaning and care
- Good leveling







To produce cellular PU foams and solid polyurethanes, we offer a wide range of special systems that are cost-effective and environmentally compatible. Our versatile PU systems are also successful in various applications in C.A.S.E.(Coating, Adhesive, Sealant, Elastomer).

Polyurethane adhesives provide advantage of strong bonding, while polyurethane sealants provide tighter seal. Polyurethane elastomers can be molded into almost any shape. They are lighter than metal, offer superior stress recovery and can resist to many environmental factors.

### APPLICATIONS

- Adhesive agent for EPS/Glass wool
- Primer for cryogenic gas tank
- Car modeling resin
- Thermal break barrier for windows
- Cleaning PIG for pipe
- Rock consolidation for tunnel
- In line skates wheel
- Soft hydro gel for medical/electronics
- Medical casting
- PCB resin
- Grouting system



WOOJO HIGHTECH, as a leading manufacturer of polyester polyols(WJESPOL), provides polyester polyols having a wide range of utility in both Polyurethane and Polyisocyanurate applications; full range of aromatic, aliphatic polyester polyols used in rigid foam, flexible foam and C.A.S.E..

WOOJO HIGHTECH is equipped with highly advanced manufacturing facility tailored for producing a wide range of products, including low and high viscosity products as well as products with high aromatic contents featuring excellent miscibility with other materials and exceptional anti-smoke features.

### FEATURES OF WJESPOL

- Low thermal conductivity for cryogenics
- Low viscosity for PIR/cryogenics
- High flame retardancy for PIR
- Variety of polyols from high to low viscosity
- Good miscibility with polyether polyols, etc.







System	Product	Use and Features	Overall Density (Kg/m <sup>3</sup> )	Blowing Agent		
				HFC-365/227 or HFC 245fa	Hydro-carbon	HFO
<b>CRYOGENIC</b>						
Spray Foam	VESPOL®	<ul style="list-style-type: none"> <li>• PU spray foam system for insulation of LPG, LEG tank, LNG fuel tank etc.</li> <li>• Good thermal conductivity, dimensional stability</li> </ul>	40~45	●		●
	WR 5075	<ul style="list-style-type: none"> <li>• PU spray foam system for RG pipe</li> <li>• Good surface flatness</li> <li>• Good thermal conductivity</li> <li>• Good adhesion strength</li> </ul>	55~65	●		●
PU Block Foam	WR 4100	• PU insulation foam system for the LNG cargo tank (membrane type)	120~140	●		
	WR 4002	<ul style="list-style-type: none"> <li>• PU insulation foam system for the LNG cargo tank (MOSS type)</li> <li>• This product has obtained TA certificate</li> </ul>	40~48	●		
Coating	VESCOAT®	• The hybrid type of fire retardant coating system for VESPOL protection	950~1100			
	WCR 7025	• The hybrid type of fire retardant coating system for VESPOL and WR 5075 protection	950~1100			
	WPR series	• This product is a primer for improving adhesion between LG tanks such as LNG, LPG and LEG and PU foam spray	950~1100			

System	Product	Use and Features	Overall Density (Kg/m <sup>3</sup> )	Blowing Agent			
				HCFC-141b	HFC-365/227 or HFC 245fa	Hydro-carbon	Water
<b>CONSTRUCTION</b>							
Panel	WR 1200	<ul style="list-style-type: none"> <li>• PUR Discontinuous Panel system</li> <li>• Good dimensional stability</li> </ul>	40~45	●	●	●	
	WR 2004	<ul style="list-style-type: none"> <li>• PUR panel system(Continuous type)</li> <li>• Good dimensional stability</li> </ul>	40~45	●	●		
	WR 2010	<ul style="list-style-type: none"> <li>• PIR panel system(Continuous type)</li> <li>• Excellent flame retardancy property</li> <li>• Good dimensional stability</li> </ul>	42~48	●	●		

System	Product	Use and Features	Overall Density (Kg/m <sup>3</sup> )	Blowing Agent			
				HCFC-141b	HFC-365/227 or HFC 245fa	Hydro-carbon	Water
<b>CONSTRUCTION</b>							
Board	WR 2019	<ul style="list-style-type: none"> <li>• PIR board system(continuous type)</li> <li>• Low thermal conductivity</li> <li>• Middle line speed(~15m/min.~)</li> </ul>	32~45			●	
	WR 2012	<ul style="list-style-type: none"> <li>• PIR board system(continuous type)</li> <li>• Low thermal conductivity</li> <li>• Low line speed(5~10m/min.)</li> </ul>	32~45			●	
Spray	WR 5010	• ECO-friendly PU spray foam system	10~12				●
	WR 5030	<ul style="list-style-type: none"> <li>• Refrigerated warehouse spray foam system</li> <li>• Low-thermal dimensional stability</li> </ul>	32~34	●			
	WR 5040	<ul style="list-style-type: none"> <li>• Cold storage freezer warehouse spray foam system</li> <li>• Low-thermal dimensional stability</li> </ul>	34~36	●			
	WR 5050	• Roof insulating of house, building, factory, structure etc.	45~50	●			
Polyurea	WCR 7025	• Protection polyurea coating system of roof insulating PU spray foam	950~1100				
UBR (Unit Bath Room)	WR 1260	<ul style="list-style-type: none"> <li>• UBR system</li> <li>• Good adhesion with ceramic tile</li> <li>• Good dimensional stability</li> </ul>	80~100	●			
	WR 1100	<ul style="list-style-type: none"> <li>• UBR system</li> <li>• Good dimensional stability</li> </ul>	50~60	●			●
	WR 1100W	<ul style="list-style-type: none"> <li>• UBR system</li> <li>• All water blown PU foam system</li> </ul>	50~60				●
Injection System	WR 6001	<ul style="list-style-type: none"> <li>• General injection PU foam system</li> <li>• Water tank, Sculpture, Cavity etc.</li> <li>• Low density</li> </ul>	35~40	●			
	WR 6002	<ul style="list-style-type: none"> <li>• General injection PU foam system</li> <li>• Water tank, Sculpture, Cavity etc.</li> <li>• Water blown system</li> <li>• Good mechanical strength</li> </ul>	35~40				●





System	Product	Use and Features	Overall Density (Kg/m <sup>3</sup> )	Blowing Agent			
				HCFC-141b	HFC-365/227 or HFC 245fa	Hydro-carbon	Water
<b>REFRIGERATOR</b>							
Refrigerator	WR 6010	<ul style="list-style-type: none"> <li>Refrigerator &amp; Showcase</li> <li>Good dimensional stability and demouldability</li> <li>Good dimensional stability</li> </ul>	38~42	●			
	WR 6020	<ul style="list-style-type: none"> <li>Mainly household refrigerator</li> <li>Good flowability of mixture</li> <li>Excellent demouldability</li> <li>Low thermal conductivity</li> <li>Good dimensional stability</li> </ul>	38~42			●	
	WR 6030	• Small size freezer or refrigerator	38~42	●			
Cryogenic Chamber	WR 6040	• Cryogenic chamber insulation	45~55		●	●	
Commercial Type	WR 6050	• Refrigerator or freezer of commercial model	38~42	●			
	WR 6060	• Leisure ice box	32~37				●

<b>SHOE SOLE</b>							
Mid Sole	WSR 9100	• Running shoes	280~320				●
Out Sole	WSR 9200	• Shoes	550~650				●
In Sole	WSR 9300	• Running shoes & Shoes	260~280				●
Direct Sole	WSR 9400	• Safety shoes & Combat boots	400~1100				●

<b>AUTOMOBILE</b>							
Seat Foam	WFR 8000	• Car seat	40~50				●
	WFR 8005	• High resilience seat-back • Dual hardness seat-back, Cushion	50~60				●
Head Rest	WFR 8010	• Head rest	55~65				●

System	Product	Use and Features	Overall Density (Kg/m <sup>3</sup> )	Blowing Agent			
				HCFC-141b	HFC-365/227 or HFC 245fa	Hydro-carbon	Water
<b>AUTOMOBILE</b>							
ISF	WFR 8020	<ul style="list-style-type: none"> <li>Integral skin foam</li> <li>Arm rest</li> </ul>	200~250			●	●
	WFR 8030	<ul style="list-style-type: none"> <li>Integral skin foam</li> <li>Steering wheel</li> </ul>	200~700			●	●
In-panel	WFR 8040	• Instrument panel	60~100				●
Semi Rigid	WFR 8050	<ul style="list-style-type: none"> <li>Semi rigid foam</li> <li>Side impact</li> </ul>	35~45				●
Air Filter	WFR 8060	• Binder for air filter	50~80 Non-foam				●

<b>PIPE</b>							
Pre-Insulated Pipe (PIP)	WR 3000	• General PIP	60~80	●	●		
	WR 3010	• Repair of general PIP	60~80	●	●		
	WR 3020	• Repair of high temperature PIP	80~100	●	●		
	WR 3030	• Large caliber PIP	60~80	●	●	●	
	WR 3040	• Small caliber PIP	60~80	●	●	●	
Pipe Cover	WR 3100	<ul style="list-style-type: none"> <li>General pipe cover</li> <li>Household, Industrial</li> </ul>	40~50		●		
	WR 3101	<ul style="list-style-type: none"> <li>Industrial pipe cover</li> <li>Used of eco-friendly blowing agent</li> </ul>	40~50		●		
	WR 3102	<ul style="list-style-type: none"> <li>Cryogenic pipe cover</li> <li>LNG, LPG, LEG etc. pipe cover of land and sea</li> </ul>	50~60		●		
Pipe Support	WR 3200	<ul style="list-style-type: none"> <li>Pipe support</li> <li>LNG pipe support of land and sea</li> </ul>	110~550		●	●	●



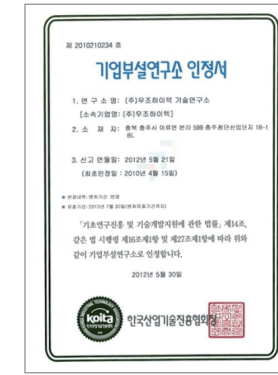
Product	OH Value (mg KOH/g)	Viscosity (cPs, 25°C)	Acid Value (mg KOH/g)	Water Content (wt%)	Use and Features					
					Adhesion Improve	Good Miscibility / Flowability	Panel, Board, Spray etc.	Flame Retardancy	Highly Aromatic Content	Flexible Lamination Foam (LF)
WJESPOL 1100	60 ± 10	4,000 ± 1,000	Max. 1.0	Max. 0.1	●					
WJESPOL 1200	285 ± 15	350 ± 100	1.0~2.0	Max. 0.15	●					
WJESPOL 2100	300 ± 15	3200 ± 700	3.5~4.5	Max. 0.1		●	●			
WJESPOL 2102	315 ± 15	2500 ± 500	1.0~2.0	Max. 0.1			●			
WJESPOL 2105	330 ± 10	2100 ± 250	1.0~2.0	Max. 0.1			●			
WJESPOL 2300	245 ± 15	8000 ± 2000	1.6~2.0	Max. 0.1			●			
WJESPOL 2301	310 ± 20	3500 ± 700	1.5~2.0	Max. 0.1			●			
WJESPOL 4101	190 ± 10	1200 ± 200	Max. 1.0	Max. 0.1	●	●	●			
WJESPOL 7200	245 ± 10	7000 ± 2000	Max. 1.0	Max. 0.1			●	●		
WJESPOL 7204	300 ± 10	16000 ± 5000	Max. 1.5	Max. 0.1			●	●		
WJESPOL 7300	200 ± 10	10000 ± 2000	Max. 2.5	Max. 0.1			●	●		
WJESPOL 7301	175 ± 10	9000 ± 2000	Max. 1.0	Max. 0.1	●		●			
WJESPOL 9003	175 ± 15	4000 ± 2000	Max. 1.5	Max. 0.2					●	



ISO 9001



ISO 14001



Certificate of Corporate Research Institute



Certificate of NIPPON KAIJI KYOKAI (PU BOARD)



Certificate of NIPPON KAIJI KYOKAI (PU SYSTEM)



Certificate of ABS (PU SYSTEM PDA)



Certificate of ABS (Manufacture Assessment)



Certificate of KR (PU SYSTEM)



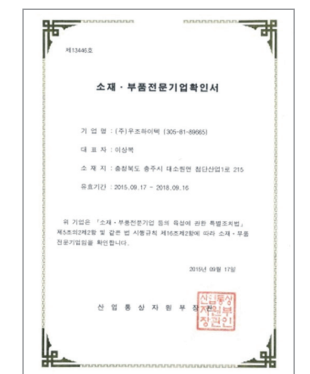
Certificate of Noncombustible Material



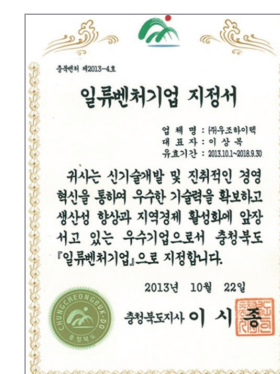
Certificate of INNO-BIZ



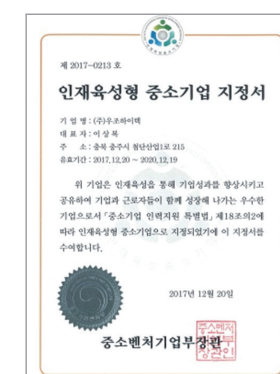
Certificate of MAIN-BIZ



Certificate of Parts and Materials Specialized Company



Certificate of First-class Venture Company



Certificate of Excellent Human Resource Management