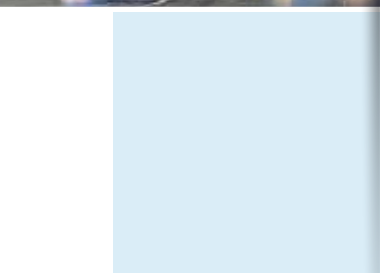
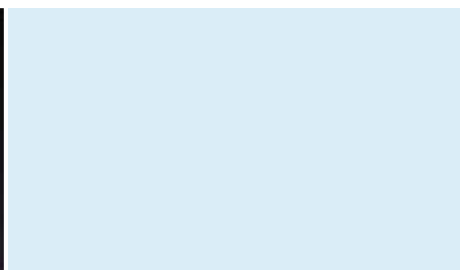




# HA THANH

a Rubber & Flake lining industry company

## RUBBER LINING FLAKE LINING



# RUBBER LINING FLAKE LINING

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**CUSTOMER FIRST | QUALITY FIRST | HONEST AND TRUSTWORTHY**

Ha Thanh sets strict inspection standards to secure stable quality  
We deliver the high-quality products with added "Responsibility"



Rubber and Resin lining technology has been applied to various kinds mechanical devices, such as a water purification equipment, population control equipment, sea water desalination equipment and medical products manufacturing, etc...

Ha Thanh industrial Co., Ltd. is specialised in surface protection and offers solutions anti-corrosion, abrasion and chemical damage. We provide rubber lining and glass flake lining services to Chemical Processing, Petro Chemicals, Petroleum, Chlor-Alkali, Power Generation & FGD Equipment, Wind Energy / Wind Tower, FERTILIZER, Mining, Steel Mill, Pulp & Paper Industry, Pharmaceutical, Food, Environment Air Pollution Control, Water Treatment, Marine Ship Building,

Ha Thanh uses rubber materials and applies lining technique of OHJI Rubber and Chemicals Co., Ltd from Japan. OHJI was established in 1957, is one of the world's leading companies rubber lining techniques for corrosion resistance, high temperature resistance and with standing strong impact. Currently rubber lining is being widely applied in heavy industries.



## ► Information

<b>Company name</b>	Ha Thanh Industrial Co., Ltd.
<b>Establishment</b>	September 24 <sup>th</sup> , 2011
<b>Head Office</b>	R.24-7, Floor 24 Victory Tower, Phu My Hung Urban, No. 12 Tan Trao Street Tan Phu ward, District 7, Ho Chi Minh City
<b>Tel</b>	+84 28-5413 8661   Mobile: 0909 927 826
<b>E-mail</b>	sales@hathanhcorp.com
<b>website</b>	<a href="https://htic-rubber.vn">https://htic-rubber.vn</a>
<b>Factory</b>	Vung Tau Comercial Port - Factory 5A-5B No. 973, 30-4 Street, Ward 11, Vung Tau City
<b>Employee</b>	34 persons
<b>Iso Certificate</b>	9001-2015
<b>Business</b>	Design, Fabrication, Control and Application Rubber lining application maintenance & supervisory work Rubber Molding, Glass Flake lining application, Flake material
<b>Business Partner</b>	OHJI Rubber & Chemicals Co., Ltd. (Japan)



## ► Product Lining

Pipes	Media filter vessel
Storage Tank	Caustic Soda Tank (NaOH tank)
Pickling Tank - Pickling resin tank	Anion / Cation / Mixed bed Vessel
Degreasing Tank	Treatment of gases and fluids
Plating Tank	Iron-and-steel and metallurgic industry
Gypsum Reactor	Mineral treatments
Ion Exchange Tower	Launder equipment
Thickener	Attrition Scrubbers
Hydrochloric Acid Tank (HCL Tanks)	Transport of dangerous materials
Desalination System	Paper industry
Pure Water Production System	Naval and fishing sector
Phosphoric Acid Equipment	Piping
Phosphoric Acid Condenser	Washer / Cleaner machine
High Analysis Compound Fertilizer	Barrel washer
Water Box Condenser	Offshore pipe
Incineration Plant	Offshore riser clamp
Wet Flue Gas Desulfuration	Chemical vessel
Systems (FGD)	Chemical transportation
Sea water pipe	DAP units
Sand filter for Salt Water	Rubber Modling

## ► Services

1. In-Shop Rubber Lining
2. On-Site Rubber Lining
3. Maintenance & Repair
4. Pipe Rubber Coating
5. Flake Lining
6. Blast & Painting
7. Steel Fabrication
8. Neoprene Riser Clamps





# Introduction

## ► Summary of Ha Thanh

Since our establishment in 2011, Ha Thanh Industrial Co., Ltd. is Vietnamese company who is distributor of OHJI Japan for supplying industrial rubber on 2012 and concerning lining engineering business in 2013. With receiving OHJI Japan's word leading rubber technology, their support, spending a lot of time to work together and well-trained lining techniques from Japanese experts and Thailand technicians, we undertook over hundred domestic and export rubber lining project in chemical, power station, water treatment and other industries after serval years to built and developing. We can provide more capability of rubber lining tanks and pipe in not only domestic market but also export market, with quality of Japanese material and technology base.



Office 2020

We are making efforts to develop high level rubber lining market and get customer's reliability in Vietnam with leading spirit "Quality-First and Customer-Centric".



Factory 2014



Factory 2014



Office 2014

## ► Quality Management

We obtained the ISO 9001-2015 in February 2016. With our purpose is Quality first.

Ha Thanh applies strict product quality management process according to the standards of Japanese rubber and chemical manufacturer - OHJI.



Certificate: 00071845/20/Q



Certificate: 00071845/20/Q



# Ha Thanh Rubber Lining Workshop Factory

RUBBER LINING EQUIPMENT & FACILITIES	QUANTITY
Rubber lining workshop	1600m <sup>2</sup>
Storage Yard	900m <sup>2</sup>
Grit Blasting Room	80m <sup>2</sup>
Painting Room	400m <sup>2</sup>
Garden	150m2
Large - sized Vulcanizing Autoclave (Ø4,000 x 12,000mmL) / Adamson Type	1
Small - sized Vulcanizing Autoclave (Ø1,300 x 3,600mmL)	1
Inner Pipe Blasting Equipment (1 inches ~ 20 inches)	2
Gantry Crane 10T; Overhead Hoist 2T, 5T	4
Air Compressor (100HP) (20HP) (1HP, 2HP, 5HP, 10HP)	6
Forklift Truck	1
Truck for Site lining	4
Horizontal Steam Boiler for Shop lining (1,0 Ton/hr) (1,2 Ton/hr)	2
Portable Boiler for Site lining (50 kg/hr) (1,500 Ton/hr) and Accessories	2
Portable Induction Machine remove Rubber, Flake, Plastic and Paint	1



Rubber lining factory



Storage yard



Large size vulcanizing autoclave



Small sized vulcanizing autoclave



Rubber lining factory



Gantry crane 10T



Overhead cranes 3x5T



Blasting shop

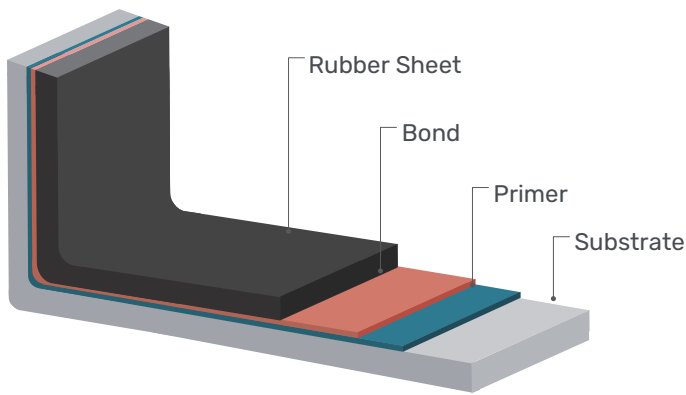


Small Garden

# What's Rubber Lining

## Corrosion Protection and Abrasion Resistance

It is said that the first natural rubber lining for industrial corrosion resistance has begun in Europe in the 1920s. Now, rubber lining shows remarkable development thanks to the progress of synthetic rubber adhesives. It is well known throughout all industries that have problem of corrosion of the most efficient way to prevent corrosion.



## Rubber Lining System

Rubber sheets shall be firmly bonded to the steel. Substrate after application of primer and adhesive. After lining provides rubber elasticity, superior. Strength and chemical resistance.

## ► Why Rubber Lining

**Great resistance against heat, weather, ozone, chemical, oil & abrasion**

Corrosion occurs when a metal is immersed in liquid which contains water or corrosive substances. Rubber Lining will solve the problem. Rubber lining provides excellent corrosion resistance by applying the rubber sheets onto the metal surface to protect the steel substrate from corrosive environment.

Rubber lining provides a reliable and long-lasting protection against corrosion, chemical attack, thermal shock, abrasion, weathering action or other extreme conditions.

## Features and Advantage of Rubber Lining

- |                       |                             |
|-----------------------|-----------------------------|
| • Chemical resistance | • Reliable application      |
| • Shock resistance    | • Accurate lining thickness |
| • Abrasion resistance | • Excellence bonding        |
| • Pressure resistance | • Defect detection          |
| • Elasticity          |                             |

Features of Rubber Lining

Advantage of Rubber Lining







Rubber sheets shall be firmly bonded to steel substrate after application of primer and adhesive. Lining is done by hand by our experienced staff for a durable finished product. After application of rubber sheets and proper vulcanizing, rubber lining provides rubber elasticity, superior strength and chemical resistance.

Rubber Lining is an application method used to protect multiple types of systems by lining corrosion and abrasion-resistant rubber upon the surface.

## Examples of Rubber Lining Application

### Pollution Control Equipment

Mainly applied to environmental loading reduction equipment in power plant and various plant.



- Water Box Condenser
- Incineration Plant
- Wet FGD Systems

### Non-Ferrous Metals Refining Industry

Mainly application to electrolysis refining system for zinc, nickel, copper, and chemical treatment equipment.



- Gypsum Reactor
- Ion Exchange Tower
- Thickner

### Inorganic Chemical Industry

Mainly applied to processing equipment and storage tank for caustic soda, hydrochloric and other high corrosive.



- Hydrochloric Acid Tank
- Desalination System
- Pure Water Production System

### Chemical Fertilizer Industry

Mainly applied to phosphoric acid equipment and treatment equipment for impurities like fluorine chemical.



- Phosphoric Acid equipment
- Phosphoric Acid Condenser
- High-Analysis Compound Fertilizer Equipment

### Iron and Steel Industry Industry

Mainly applied to chemical treatment system for steel plate treatment equipment for chemical and waste gas.



- Pickling Tank
- Degreasing Tank
- Plating Tank

### Transport Equipment

Shock and vibration absorbing rubber material will be applied to transporting vessels for corrosive chemical.



- Chemicals Cargo Ship
- Lorry Tank
- Tanker

# General Rubber Lining Procedure

The process of Ha Thanh rubber lining is all done by hand. Qualified and trained staff allow us to provide



All lining equipment shall be blasted to meet surface preparation standard Sa 2.5 or SSPC SP-10 by using grit or sand blasting. (Mainly grit blasting).

Blasted surfaces shall be coated with special primer for rubber lining. Appropriate rubber cement (adhesive) bonding shall be applied.

Rubber sheet cut into the suitable size shall be firmly bonded to the substrate with hand roller to eliminate air pockets between the rubber and the substrate.

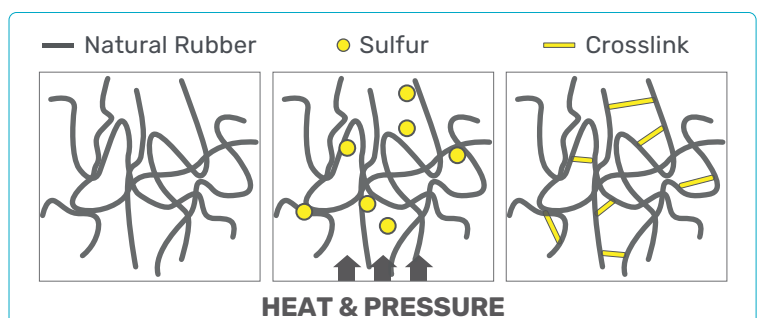
## Vulcanizing Autoclave

Before rubber has been vulcanized, It is not sufficiently elastic and strong, there it can be easily damaged and broken down. Vulcanization gives rubber strength, elasticity, durability, resistance and physical stability.

During vulcanizing, rubber is heater with sulfur create cross-links (bridges) between sulfur atoms and rubber molecules, sulfur bridges hold the rubber chains together so as not to break easily. As result, vulcanized rubber becomes stiffer and stronger but retains elasticity.

Uncure natural rubber is stickly and soft at high temperature, but low temperature it becomes stiff and brittle, and it how low elascity and strength. Crosslink gives the rubber elastomeric properties.

The more sulfur used, the more crosslinks can be formed, and the harder the rubber become.



high-level and stable quality.

Vulcanization

Inspection

Packing  
& Delivery



Vulcanizing autoclave (ID4m\*12mL)



Pinhole inspection



External paint and packing



Open or direct steam curing



Hardness inspection



Shipping

Autoclave curing shall be carried out with pressured steam for shop lining. Open steam curing at atmospheric pressure in case of on-site application.

Any defects shall be found and repaired through pinhole, hardness, thickness and appearance inspection.

Equipment shall be external painted according to customers requirements. Packing to avoid any damage during shipping.

A Variety of methods for curing

Autoclave	① Autoclave	② Open Steam	③ Internal Steam	④ Self	⑤ Cured	⑥ Pre-Cured
Rubber Sheet	Uncured	Uncured	Uncured	Uncured	Cured	Pre-Cured
Condition	High Temperature (Steam)	High Temperature Atomospheric Pressure	High Temperature (Steam)	Operation	-	Operation
Application	Shop Lining	Field Lining Large Equipment	Field Lining Pressure Equipment	Partial Repair	Field Lining Partial Repair	Large Tank Partial Repair

## OHJI Rubber Sheet

Rubber Sheet The Roller head Extruder forms the rubber compound into beautiful rubber sheets which feature a smooth surface, uniform thickness and without any air inclusions. One of the most distinctive feature of the roller head unit is high performance. It provides a stable supply of high quality rubber sheets with good resistance to corrosion and wear.

OHJI manufacture all processes from designing of mixture, kneading to sheeting.

Ha Thanh use OHJI rubber and aheshive apply on to metal surface or concrete surface.



## Characteristics of Rubber lining Material

◎: Excellent ○: Good △: Not good ×: Bad

	Natural Hard Rubber	Natural Soft Rubber	Butyl Rubber	Chloroprene Rubber
Weather Resistance	◎	△	◎	◎
Heat Resistance	○	△	○	○
Acid Resistance	◎	△	◎	○
Alkali Resistance	◎	◎	◎	○
Abrasion Resistance	×	◎	△	○
Vapor Permeability	◎	△	◎	○
Characteristics	Chemical stability. Resistance to almost all inorganic chemicals. Heat resistance. Machinability.	Inferior to hard rubber in chemical resistance. Resistance to abrasion and shock. Mainly used for slurry abrasion resistance.	Soft rubber with chemical resistance. Blisters caused by vapor or gases will hardly ever occur. Mainly used for FGD systems and equipment working under high operating temperature.	Well balanced rubber offering mechanical properties and resistance to heat and oil, also excellent in ozone resistance. Mainly used for seawater pipes and water box condenser.



OHJI's rubber lining materials are used for a wide variety of applications. Our experienced technical staff shall select the material which will be best suited for your needs.

## Natural Hard Rubber

OHJI - HARD

Material	Characteristics	General Application	Curing Method		Hardness
			Autoclave	Open steam	
E-5	Hard rubber used for chemical resistance under high temperature condition. Less flexible than E-7.	Electrolytic equipment. Recovery system for hydrochloric acid & alcohol. Bromine production equipment.	●		70 ~ 90 Type/Shore D
E-5I	Compound of low Ca and Mg.	Special for Cell - liquor of IM electrolysis.	●		60 ~ 80 Type/Shore D
E-7	Wide range of corrosion resistance. Excellent flexibility. Standard grade of natural hard rubber.	Hydrochloric acid, Dilute sulfuric acid, Phosphoric acid, Caustic soda, etc.	●		65 ~ 85 Type/Shore D
E-7i	Compound of low Ca and Mg.	IM electrolysis. Used for the case of disrelishing metal ion.	●		65 ~ 86 Type/Shore D
E-8	Used for oxide and osmotic agent, such as gaseous chlorine.	For equipment for gaseous chlorine (wet) of electrolysis in saturated.	●		70 ~ 90 Type/Shore D
E-15	General hard rubber for site application.	Used when the organic solvent such as SO is mixed such as gaseous chlorine. Same as E-7		●	60 ~ 80 Type/Shore D
E-16	Fast vulcanizing hard rubber. Used as SH type (Soft-Hard-Soft lining). Gaseous chlorine.	Same as E-7		●	60 ~ 80 Type/Shore D
E-18	For gaseous chlorine for site application.	Same as E-8		●	65 ~ 85 Type/Shore D
E-20	Hard rubber for site application. Compound of low Ca and Mg.	Same as E-7I		●	60 ~ 80 Type/Shore D

\* With regard to service condition, in the case of food-related, E-7, E-15 are certified by the Japan Ministry of Welfare No.85

# Rubber Lining Material

## Natural Soft Rubber

OHJI-SOFT

Material	Characteristics	General Application	Curing Method		Hardness
			Autoclave	Open steam	
<b>R-4</b>	Used in the case of extreme slurry abrasion where R-6 is not sufficient.	For abrasion resistance of slurry.	●	●	42 ± 7 Type A
<b>R-5</b>	Inadequate for slurry abrasion, but applicable for abrasion with large diameter of coarse particle and high loading.	For special abrasion resistance.	●	●	62 ± 7
<b>R-6 (R-16)</b>	Standard grade of natural soft rubber for acid resistance. Alkali - resistance and slurry abrasion resistance shall be separately considered.	Storage and piping for chemical resistance. Suitable for caustic soda.	●	●	62 ± 7 Type A
<b>R-7 (R-17)</b>	Inadequate for general acid and alkali resistance. Used for surface application of single or on hard rubber.	Hydrofluoric acid resistance (Only a little amount in phosphoric acid).	●	●	67 ± 7
<b>R-8 (R-18)</b>	Soft rubber blended with hard rubber for vulcanization.	Used as SH type (SH-8168, SH-8078, SH-78)	●	●	70 ± 7 Type A
<b>R-8i</b>	Compound of low Ca and Mg.	Same as R-6 and R-8	●	●	42 ± 7 Type A

\* With regard to service condition, in the case of food-related, R-6 (R-16) is certified by the Japan Ministry of Welfare No.85.

## Butyl Rubber

OHJI-I

Material	Characteristics	General Application	Curing Method		Hardness
			Autoclave	Open steam	
<b>B-5 (B-15)</b>	Standard grade of butyl rubber. The most chemical resistance rubber. Excellent in vapor permeability among the natural rubber. Certified as water supply standard. (JWWA Z109:2004).	Excellent resistance to HSO and HFFGD equipment. Phosphoric acid plant.	●	●	57 ± 7 Type A
<b>B-5C (B-15C)</b>	Halogenated (chlorinated) butyl rubber. Same performance as B-15 (B-15).	FGD system in overseas.	●	●	57 ± 7 Type A
<b>B-5S</b>	Pre-cured type butyl rubber. Not necessary for vulcanization.	Large size tank for field. For repair at FGD system.	Not required	Not required	52 ± 7 Type A
<b>B-7 (B-17)</b>	Butyl rubber for NaClO (Black).	Storage and piping of hypo-chlorite soda.	●	●	57 ± 7 Type A
<b>B-115</b>	Non contamination grade for phosphoric acid.	High quality phosphoric acid storage.	●	●	52 ± 7 Type A
<b>B-215</b>	Non contamination grade for sulfuric acid.	High quality sulfuric storage.	●	●	52 ± 7 Type A

\* With regard to service condition, in the case of food-related, B-5 (B-15), B-7 (B-17) are certified by the Japan Ministry of Welfare No.85.

## Chloroprene Rubber

OHJI-PRENE

Material	Characteristics	General Application	Curing Method		Hardness
			Autoclave	Open steam	
C-5	Better performance for workability of lining application.	Seawater pipe. Water box condenser.	●	●	62 ± 7 Type A
C-55	Self vulcanization type of CR. Vulcanization with operating temperature.	NaOH storage, PAC, CaCl. Wastewater treatment equipment.	●	●	62 ± 7 Type A
C-55F	Food grade of self vulcanization type of CR.	Storage tank for NaOH as a food additive.	●	●	62 ± 7 Type A
C-6	Standard grade of CR. Except oxidizing chemical resistance, heat and oil resistance, also excellent in ozone resistance. Can be applied for coexistent with hydrofluoric acid such as phosphoric acid production.	Phosphoric acid production related equipment. Seawater pipe. Water box condenser.	●	●	62 ± 7 Type A
H-411	Certified with standard of water service (JIS K 6353-1997).	Tap water piping.	●		62 ± 7 Type A

\* With regard to service condition, in the case of food-related, C-55F is certified by the Japan Ministry of Welfare No.85.

## Special Material (EPDM)

OHJI-S

Material	Characteristics	General Application	Curing Method		Hardness
			Autoclave	Open steam	
S-2	Certified as water supply standard. (JWWA Z108:2004). Heat and ozone resistance.	Water supply equipment with heat.	●		70 ± 7 Type A
S-6	Certified as water supply standard. (JWWA Z108:2004). Heat and ozone resistance.	Water supply equipment with heat.	●		64 ± 7 Type A

## Special Material (NBR)

OHJI-N

Material	Characteristics	General Application	Curing Method		Hardness
			Autoclave	Open steam	
N-8	Soft rubber with oil resistance.	Bucket of oil storage.	●		70 ± 7 Type A

# Rubber Lining Material

## Natural Soft and Rubber (SH/SH Type)

Material	Characteristics																															
SH-74	Although soft rubber type (R, C, B and S type) is not be damaged by shock or vibration, there is a problem in this point for hard rubber type (E type). When hard rubber is used for corrosion resistance and shock and vibration resistance need to be taken advantage, triple layer application or soft~hard~soft (SH type) is used. SH (Sunhard) specifies the sign of each structure (hard-soft and soft-hard-soft) from metal surface, and the contents of thickness and material differs depending on the required service condition. In this case, therefore, it is seperately specified. Designed value of standard hardness differs from by each rubber structure.																															
SH-8078																																
SH-78	<table><tr><th rowspan="2">Material</th><th colspan="3">SH Type Structure (Material of Each layer)</th><th rowspan="2">Curing Method</th><th rowspan="5">©Hardness tester (according to JIS K6256)  A: Type A Durometer  D: Type D Durometer  ©Temperature: 23±2°C</th></tr><tr><th>Substrate</th><th>Middle Layer</th><th>Facing Surface</th></tr><tr><td>SH-8168</td><td>R-8</td><td>E-16</td><td>R-8</td><td>Open steam</td></tr><tr><td>SH-8168</td><td>SH-8078</td><td>E-7</td><td>R-8</td><td rowspan="3">Autoclave</td></tr><tr><td></td><td>SH-78</td><td>-</td><td>R-8</td></tr><tr><td>SH-76</td><td>SH-76</td><td>-</td><td>R-6</td></tr></table>					Material	SH Type Structure (Material of Each layer)			Curing Method	©Hardness tester (according to JIS K6256)  A: Type A Durometer  D: Type D Durometer  ©Temperature: 23±2°C	Substrate	Middle Layer	Facing Surface	SH-8168	R-8	E-16	R-8	Open steam	SH-8168	SH-8078	E-7	R-8	Autoclave		SH-78	-	R-8	SH-76	SH-76	-	R-6
Material	SH Type Structure (Material of Each layer)			Curing Method	©Hardness tester (according to JIS K6256)  A: Type A Durometer  D: Type D Durometer  ©Temperature: 23±2°C																											
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SH-8168	R-8	E-16	R-8	Open steam																												
SH-8168	SH-8078	E-7	R-8	Autoclave																												
	SH-78	-	R-8																													
SH-76	SH-76	-	R-6																													

\* With regard to service condition, in the case of food-related, SH-8078 is certified by the Japan Ministry of Welfare No.85



# Chemical Resistance of Rubber Lining

## Chemical Resistance Charts

### Inorganic Acids

O: Satisfactory Δ: Marginal X: Unsatisfactory

Chemical	Formula	Conc. %	Natural						Chloroprene Rubber		Butyl Rubber		EFDM	
			Hard		Soft		Soft & Hard							
			E-7		R-6		SH-8078		C-6		B-5		S-6	
			RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	10	O	O	O	X	O	O	O	Δ	O	O	O	Δ
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	30	O	O	O	X	O	O	O	Δ	O	O	O	Δ
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	50	O	O	O	X	O	O	O	Δ	O	O	O	Δ
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	70	O	X	X	X	Δ	X	Δ	X	O	O	O	X
Hydrochloric Acid	HCL	10	O	O	O	X	O	O	Δ	X	O	Δ	Δ	X
Hydrochloric Acid	HCL	35	O	O	O	X	O	Δ	X	X	O	X	X	X
Nitric Acid	HNO <sub>3</sub>	1	X	X	X	X	X	X	X	X	Δ	X	Δ	X
Sulfurous Acid	H <sub>2</sub> SO <sub>3</sub>	0.5	O	O	X	X	O	Δ	O	X	Δ	X	X	X
Phosphoric Acid	H <sub>3</sub> PO <sub>4</sub>	-	O	O	O	O	O	O	O	O	O	O	O	O
Hydrofluoric Acid	HF	1	O	O	X	X	O	X	O	X	O	O	X	X
Hydrofluoric Acid	HF	48	Δ	X	X	X	X	X	X	X	O	X	X	X
Carbonic Acid	H <sub>2</sub> CO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	Δ
Chlorine Water	CL <sub>2</sub>	Conc.	O	Δ	X	X	O	X	X	X	X	X	X	X
Chlorine Gas	CL <sub>2</sub>	Wet	O	O	X	X	O	X	X	X	X	X	X	X
Hydrobromic Acid	HBr	40	O	O	O	X	O	Δ	Δ	X	O	X	O	X
Hydrogen Sulfide Water	H <sub>2</sub> S	-	O	O	O	Δ	O	Δ	O	Δ	O	O	O	Δ
Chromic Acid	H <sub>2</sub> CrO <sub>4</sub>	1	Δ	X	X	X	X	X	X	X	O	X	X	X

### Inorganic Alkalis

O: Satisfactory Δ: Marginal X: Unsatisfactory

Chemical	Formula	Conc. %	Natural						Chloroprene Rubber		Butyl Rubber		EFDM	
			Hard		Soft		Soft & Hard							
			E-7		R-6		SH-8078		C-6		B-5		S-6	
			RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C
Caustic Soda	NaOH	48	O	O	O	O	O	O	O	O	O	O	O	O
Caustic Potash	KOH	25	O	O	O	O	O	O	O	O	O	O	O	O
Ammonium Hydroxide	NH <sub>4</sub> OH	28	O	Δ	Δ	X	O	Δ	Δ	X	O	X	X	X

# Chemical Resistance of Rubber Lining

## Inorganic Salts Solution

O: Satisfactory Δ: Marginal X: Unsatisfactory

Chemical	Formula	Conc. %	Natural						Chloroprene Rubber		Butyl Rubber		EFDM	
			Hard		Soft		Soft & Hard							
			E-7		R-6		SH-8078		C-6		B-5		S-6	
			RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C
Sodium Hypochlorite	NaClO	-	Δ	X	X	X	Δ	X	X	X	O	Δ	X	X
Calcium Hypochlorite	Ca(ClO) <sub>2</sub>	-	O	-	Δ	X	-	O	X	-	O	-	-	-
Sodium Chlorate	NaClO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	Δ
Potassium Chlorate	KClO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Sodium Chlorate	NaCl	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Calcium Chloride	CaCl <sub>2</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Zinc Chloride	ZnCl <sub>2</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Ammonium Chloride	NH <sub>4</sub> Cl	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Sodium Sulfate	Na <sub>2</sub> SO <sub>4</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Sodium Bicarbonate	NaHCO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Potassium Bichromate	K <sub>2</sub> Cr2O <sub>7</sub>	-	O	Δ	O	Δ	O	Δ	O	Δ	O	O	O	Δ
Sodium Sulfate	Na <sub>2</sub> SO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Potassium Sulfate	K <sub>2</sub> SO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Sodium Sulfate	Na <sub>2</sub> S	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Potassium Sulfate	K <sub>2</sub> S	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Sodium Thiosulfate	Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Sodium Phosphate	Na <sub>3</sub> PO <sub>4</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Potassium Carbonate	KCL	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Ammonium Carbonate	(NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Ferric Chloride	FeCl <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Ammonium Sulfate	(NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Stannous Chloride	SnCl <sub>2</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Chromium Chloride	CrCl <sub>2</sub>	-	O	Δ	O	Δ	O	O	O	O	O	O	O	O
Nickel Sulfate	NiSO <sub>4</sub>	-	O	O	O	Δ	O	O	O	O	O	O	O	O
Silver Nitrate	AgNO <sub>3</sub>	-	O	Δ	O	Δ	O	Δ	O	Δ	O	O	O	O
Aluminum Sulfate	Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	-	O	O	O	O	O	O	O	O	O	O	O	O
Sodium Silicate	Na <sub>2</sub> O.SiO <sub>2</sub>	-	O	O	O	O	O	O	O	O	O	O	O	O
Sodium Aluminate	NaAlO <sub>2</sub>	-	O	O	O	O	O	O	O	O	O	O	O	O
Magnesium Hydroxide	Mg(OH) <sub>2</sub>	-	O	O	O	O	O	O	O	O	O	O	O	O
PAC	[AL <sub>2</sub> (OH)nCl <sub>6</sub> -n]M	-	O	O	O	O	O	O	O	O	O	O	O	O

# Chemical Resistance Of Rubber Lining

## Organic Acids

O: Satisfactory Δ: Marginal X: Unsatisfactory

Chemical	Formula	Conc. %	Natural						Chloroprene Rubber		Butyl Rubber		EFDM	
			Hard		Soft		Soft & Hard							
			E-7		R-6		SH-8078		C-6		B-5		S-6	
			RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C
Acetic Acid	CH <sub>3</sub> COOH	10	O	O	X	X	O	X	X	X	O	Δ	-	-
Glacial Acid	CH <sub>3</sub> COOH	10	O	Δ	-	-	-	-	-	-	-	-	-	-
Formic Acid	HCOOH	90	O	Δ	O	x	Δ	-	O	Δ	O	X	O	-
Oxalic Acid	(COOH) <sub>2</sub>	20	O	O	O	-	O	O	O	Δ	O	O	-	-
Butyric Acid	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	100	O	Δ	X	X	-	-	-	-	-	-	-	-
Tartaric Acid	(CH OH COOH) <sub>2</sub>	50	O	O	O	X	O	O	O	O	O	O	-	-
Lactic Acid	CH <sub>3</sub> CH(OH)COOH	25	O	O	-	-	-	-	-	-	-	-	-	-

## Organic Compound

O: Satisfactory Δ: Marginal X: Unsatisfactory

Chemical	Formula	Conc. %	Natural						Chloroprene Rubber		Butyl Rubber		EFDM	
			Hard		Soft		Soft & Hard							
			E-7		R-6		SH-8078		C-6		B-5		S-6	
			RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C	RT	70°C
Acetone	CH <sub>3</sub> COCH <sub>3</sub>	-	Δ	Δ	Δ	X	Δ	X	Δ	X	O	Δ	-	-
Methanol	CH <sub>3</sub> OH	-	O	O	O	X	O	Δ	O	Δ	O	O	-	-
Ethanol	C <sub>2</sub> H <sub>5</sub> OH	-	O	O	O	X	O	Δ	O	Δ	O	O	-	-
n- Propylalcohol	C <sub>3</sub> H <sub>7</sub> OH	-	O	O	O	X	O	Δ	O	Δ	O	-	-	-
n- Butanol	C <sub>4</sub> H <sub>9</sub> OH	-	O	Δ	-	-	O	Δ	O	-	O	-	-	-
Formaldehyde	HCHO	-	O	O	O	X	O	O	O	X	O	X	O	X
Glycerin	C <sub>3</sub> H <sub>5</sub> (OH) <sub>2</sub>	-	O	O	O	Δ	O	O	O	O	O	Δ	O	Δ
Ethylene Glycol	(CH <sub>2</sub> OH) <sub>2</sub>	-	O	O	O	Δ	O	O	O	Δ	O	ΔX	O	Δ
Triethanolamine	N(CH <sub>2</sub> CH <sub>2</sub> OH) <sub>3</sub>	-	O	O	O	Δ	O	O	O	Δ	O	Δ	-	-
Glucose	C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>	-	O	O	O	Δ	O	O	O	Δ	O	Δ	O	Δ

## Remarks on Chemical Resistance Charts

Chemical resistance are determined according to rest results and actual long-term performance. And accurate material selection requires careful consideration in term of operating condition and specifications of equipment.

Therefore, please consult with us in advance for selection of rubber material against your chemical.

## Rubber Lining Products



Vessel



Spools



Pipe



Pickling line



Plater cell



FGD bar



Cover / Roof of chemical tank



Strainers





Chemical Processing Tower



Mining box



Plater tray



Chemical tank of truck



Lining Agitator



Chemical Lorry truck



Tank



Valve

# Rubber Molding and Expansion Joint

## Rubber Molding

Industrial Rubber molding are required extraordinary precision and secure performance.

Ha Thanh supply the variuos value-added products, such as seal for civil engineering, packing, shock absorbers, gaskets, O-rings, are used in various industries and so on.

We provide mass production high quality products quickly and effectively.



Flexible joint



Big water stop gasket



EPDM gasket



Water-stop packing



Small product



Water gate gasket

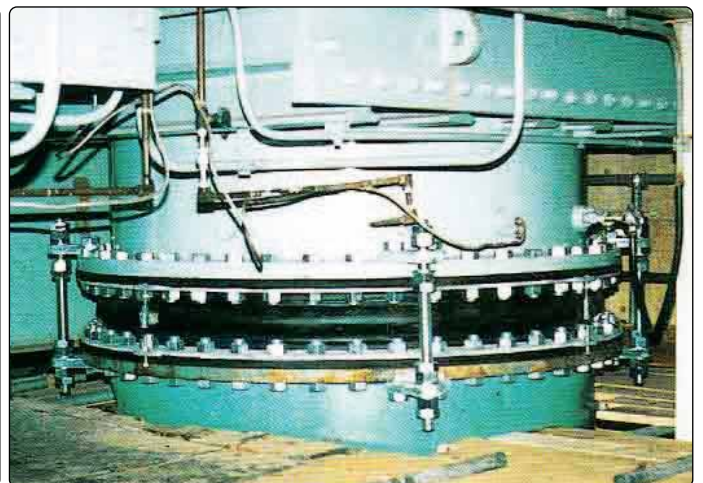
## Expansion joint solves a piping system problem

Used in the middle of pipe to absorb extension and compression at pipe line which occur owing to vibration, noise and temperature change. For both delivery and suction.

**Characteristics:** Arch structure for flexible part of the body absorbs various kinds of deformation brought by external force.



Expansion joint



Expansion joint



We have currently carried out the lining application for the large-diameter pipes of over 10,000m<sup>2</sup> and 52 set boat landing for the overseas big project.

Our rubber lining shop of approx. 1200m<sup>2</sup> and the storage yard of 800m<sup>2</sup> in Ba Ria-Vung Tau Province. And we can expand more yard depend on customer equipments provides. As for manufacturing facilities, we have the large-sized autoclave of 4,000Ø x 12,000L, the small-sized autoclave of 1,300Ø x 3,600L, etc... We undertake application jobs for various pipes from small-diameter pipe of 25A to large-diameter pipe of more than 1,000A as per your request. We have special tools and facilities for inside pipe rubber lining from 1 inches to 12 inches for save cost and time to deliver with large quantity order.



Both face rubber lining resin pickling tank



Lining butyl rubber on mining tank for anti-shock



Both face tank Rubber lining at HT Shop



Lining hard rubber on chemical tower with over 10m length



Finished vulcanization chemical vessel



Rubber lining sea strainers equipment at shop

## In-shop Rubber Lining

Our experienced technical staff shall select the material which will be best suited for your needs.

### Our Method of Vulcanization

- Autoclave: Good rubber properties and bonding by pressured steam curing.
- Atmospheric pressure steam curing.
- Internal steam curing.

We do lining from small size to large dimension.



Lining pipe spool



Lining small equipment



Lining tower



Lining square tank



Lining Plater cell both face



Lining vessel



## Neoprene Riser Clamps

We have currently carried out the lining application ribbed pipe, riser clamp, hot and cold bonding for the long pipes of approx. 1,500m<sup>2</sup> and 52 set boat landing for the overseas offshore big project.

Ribbed sheet for riser clamp.

We also offer option PTFE (Teflon) liner for high temperature or more service condition.



Finishing Neoprene Rubber lining for wind tower



Neoprene Rubber lining for wind tower



High quality 25mm Neoprene-lined rubber by Ha Thanh



High quality 25mm Neoprene-lined rubber by Ha Thanh



High quality 25mm Neoprene-lined rubber pre-erection in wind tower



Neoprene-lined rubber completed on wind tower

## Riser Pipe Coating

Ha Thanh offers corrosion protection coating which protect offshore platform risers from exposure to seawater immersion, splash zone and ocean air.

Riser pipes are used in floating platforms to connect the wellhead located on the sea floor to the floating drilling rig. We can offer perfect riser pipe coating which provide high performance and corrosion resistance in harsh environment, especially even in the most corrosive area, the plash zone.



Primer & rubber cement coating



Primer & rubber cement coating



Pipe rubber coating



Bend riser pipe



Checked with hardness tester



Ozone resistance



We are able to undertake rubber product for other marine and offshore equipment.

Riser Clamps are used to support vertical runs of piping and restrain the riser so that it is fixed.

**Please contact us for more details.**



Riser clamps with Neoprene lining



Riser clamps with Neoprene lining from small pieces to large size



Riser pipe with Neoprene, EPDM lining



Riser clamps assemblies with Neoprene lining



Ribbed pipe rubber lining



Riser clamp rubber lining



### High Corrosion Control Technology

#### Perfect Service System in Site/Field lining

Large and huge equipment which is not able deliver to shop and for maintenance can be lined at site field. We provide equipment, machine, facilities and materials self-curing rubber or open steam rubber at site or customer shop.

All processes will be supervised by the qualified staff who have been trained on how to take appropriate measure to handle organic solvents or to assemble scaffolding. Our staff are high trained enough to carry out field work safely.

Ha Thanh applied rubber lining technique of OHJI Rubber and Chemicals Co., Ltd from Japan.

We meet every need from raw material to inspection including designing and manufacturing of rubber sheets, removing the existing old liners, and re-lining with the new rubber sheets. We take full responsibility for completing all the processes.



Boiler and autoclave install at site for direct steam and vulcanizing.



HCl storage tank on site lining



A strong team keep promise supply best quality



HCL tank on site lining for tanker



## Our Rubber Sheet

- Uniform Thickness • No contamination • No air pocket in sheet.

## Our Method of Vulcanization on Field work

- Atmospheric pressure steam curing: Good rubber properties and bonding by pressured steam curing.
- Internal steam curing • Hot water curing • Self curing (ambient cure) • Pre-cured (cold bonding).



HCL tank on site lining



Lining check



Cleaning



Access gate hot bonding



Ha Thanh team apply self cure rubber on slurry tank at site.





### Lining for Large Equipment

Ha Thanh apply OHJI rubber and OHJI has developed their own know-how and compounding technologies of self-curing rubber in response to increasing demand for field lining.

We meet every need from raw material to inspection including designing and manufacturing of rubber sheets, removing the existing old liners, and re-lining with the new rubber sheets.

We take full responsibility for completing all the processes.

### Perfect Service System in Field Lining

Huge equipment like large tank which is not able to be transported can be lined at site.

All Processes will be supervised by the qualified measures to handle organic solvents or to assemble scaffolding. Our staff are highly trained enough to carry out field work safely.

### Professional Quality

Field lining worker are highly skilled and well experienced. We supply the best rubber material and complete the project work.





Full Range of Maintenance

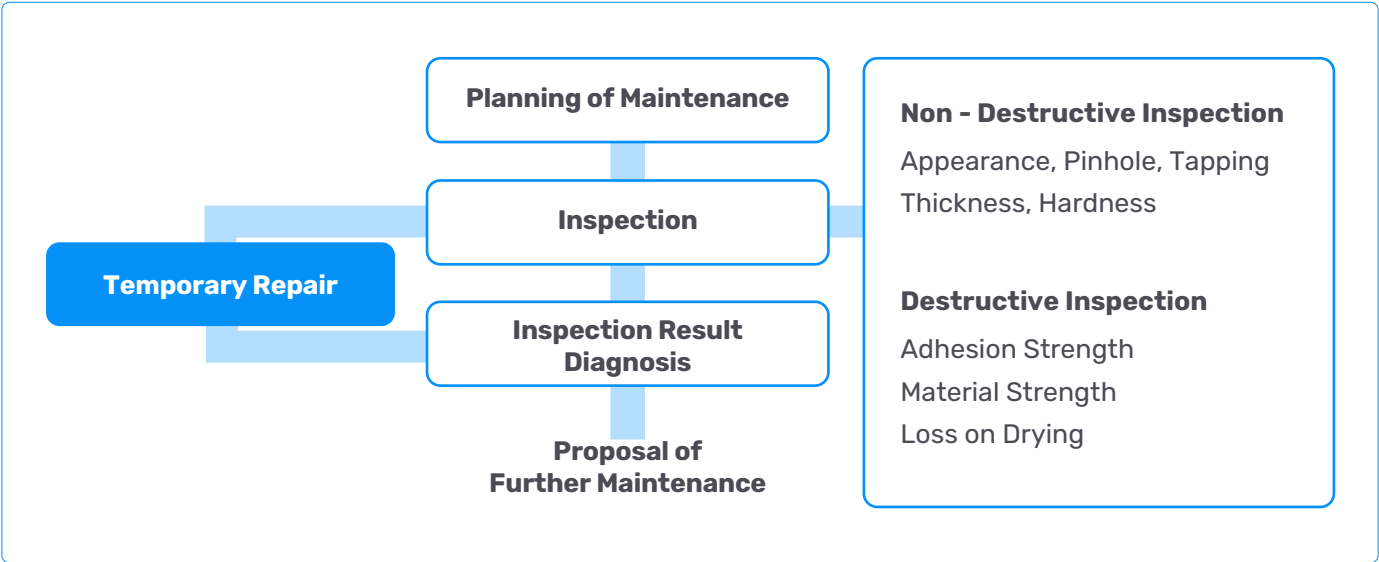
We learn and work under OHJI Japan with many years and carried out over 100 work rubber lining and glass lake lining records. We are capable of producing total maintenance services, such as prediction of rubber liner and emergency repair.

We offer high - quality maintenace service to prevent serious accidents.

Complete maintenance and reliable follow-up service system, that is only possible with lining authority.

Consulting Flow Chart of Maintenance Services

We build customer trust by consulting lining technologies from material selection to maintenance services based on our experienced of materials, application and management.





## Diagnosis at Site by Qualified Staff

Experienced expert staff will test and analyze the every detail.

We can carry out temporary repair works and suggest maintenance plan for further safety operation and trouble prevention.



### Leakage, Corrosion

Rubber lining is severely damaged by corrosion. Corrosion of substrate generate a leakage.



### Blister

Vapor penetration through a rubber liner will decrease bond strength between a rubber lining and substrate. It results in the formation of blisters.



### Trouble Examples



Separation



Crack



Partial Wearing



Wear and Less thickness



### Full Range of Maintenance

We are capable of producing total maintenance services, such as prediction of rubber liner and emergency repair.

Our rubber material have cultivated know-how in on-site lining method and mixture technology of vulcanizing rubber.

### Lining FGD equipment



Complete maintenance and reliable follow-up service system, that is only possible with lining authority. We offer high-quality maintenance service to prevent serious accidents.



Spray zone check



FGD side shell check



Flake lining spot repair



Thickness check



### We placement new steel and apply new rubber lining

Remove old rubber lined after several years used and apply new rubber.



### We placement new steel and apply new rubber lining



Replace old susbtrate after 18 years used



Metal corroded



Re-lining



Re-lining



Ha Thanh sets strict inspection standards to secure stable quality. We deliver the high-quality products with added "Responsibility".

## Profile Surface Inspection

All lining equipment shall be blasted to meet surface preparation standard Sa 2.5 or SSPC SP-10 by using grit or sand blasting. (Mainly grit blasting).



Profile Surface Check



Measuring Profile



## Visual and Hammering Inspection

Check the appearance for entire lining surface to ensure there's no damage, blister and poor joint



## Hardness Inspection

The hardness shall be measure to check within the tolerance



## Thickness Inspection

The thickness shall be measured to check within the tolerance



## Pinhole Inspection

Check the entire lining area using pinhole tester to see if there is no pinhole.



### Reinforced Corrosion Protective Lining

Flake Lining is anti-corrosive coating systems for severe exposures. Flake compound is made from thermosetting liquid resin mixed with glass flakes as barrier fillers make the coating much more durable and prevent permeability of corrosive substances, as the layers of laminated glass flakes (50~100 layers in 1mm thickness) form a highly impermeable structure.

Flake lining has excellent chemical resistance against most of acid, base, solvent and gas. Type of resin could be selected in accordance to the kind of service chemical.

Our flake materials use for application has imported from OHJI (Japan) manufacture. We are provide flake materials and the supervisor which will be best suited for your needs.

#### GOOD POINT

- 1 Easy field application - Material hardening at normal temperature.
- 2 Short application time - Easy for maintenance.
- 3 Excellent chemical resistance and high temperature service - Up to 150°C for gas.

#### NOT GOOD POINT & SOLUTION

- 1 Shock absorption - Combination of application with FRP reinforcement.
- 2 Abrasion resistance - Compounding with ceramic resin or rubber reinforcement.
- 3 Workmanship defect - Need to supervise workmanship during application and quality control.

### Feature of Flake Lining

Excellent resistance to various acids, base, solvents & gases

Very small vapor permeability

Prevention of permeability

Small shrinkage at curing

Small thermal expansion

Curing at room temp

Easily application at site

Maintenance free

Short time application

Flake Lining Material

Material			Code	Base Resin	Features	Thickness	Volume	Method
OHJI FLAKE	Heavy Duty (Thick type)	#100	HF-141	Het acid Polyester resin	For oxidizing chemicals	2mm (2 coats)	4kg/m <sup>2</sup>	Trowel
			HF-161	Bis type Vinylester resin	Standard (100°C / Liquid)			
			HF-181	Novolac type Vinylester resin	Heat resistance (150°C /Gas)			
	Light Duty (Thin type)	#200	HF-261	Bis type Vinylester resin	Standard (100°C / Liquid)	0.8mm (2 coats)	1.8kg/m <sup>2</sup>	Spray Roller
			HF-281	Novolac type Vinylester resin	Heat resistance (150°C /Gas)			
		#300	HF-341	Het acid Polyester resin	For oxidizing chemicals	0.4mm	1kg/m <sup>2</sup>	Spray Roller
			HF-361	Bis type Vinylester resin	Standard (55°C / Liquid)			
			HF-381	Novolac type Vinylester resin	Heat resistance (150°C /Gas)			
OHJI PRIMER			PR-60	Bis type Vinylester resin	For metal surface			
			PR-90	One component liquid type High-penetration Urethane resin	For adhesion of different kinds of resin For concrete surface		0.3kg/m <sup>2</sup>	
OHJI TOP COAT			TC-40	Het acid Polyester resin	For smooth surface Easy cleaning Dust prevention		0.3kg/m <sup>2</sup>	Spray Roller Brush
			TC-60	Bis type Vinylester resin				
			TC-80	Novolac type Vinylester resin				

Physical Properties

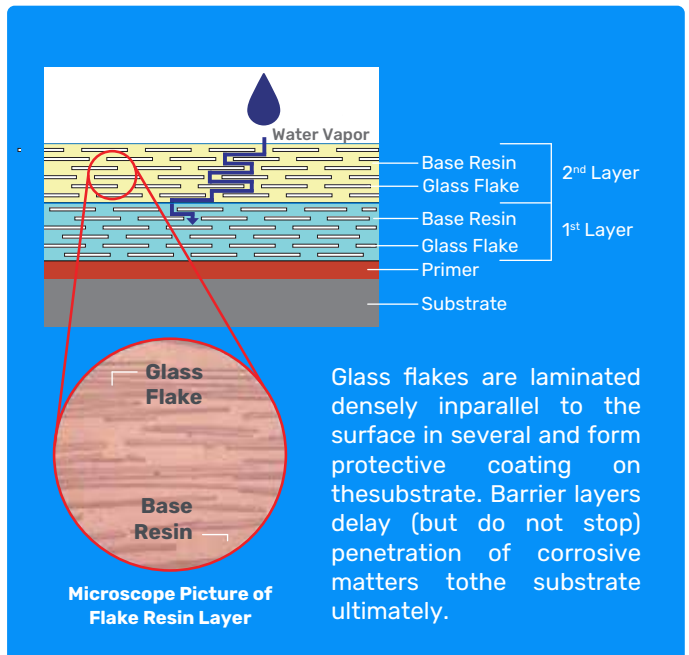
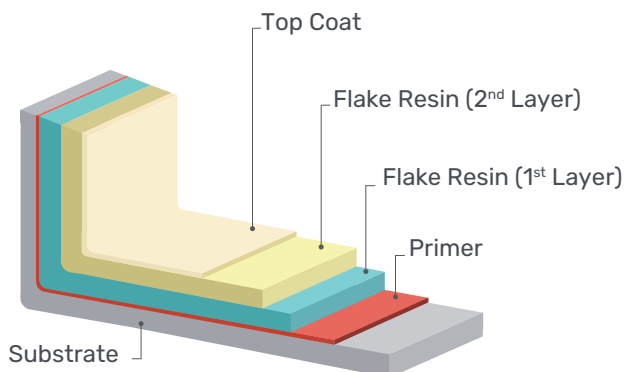
Test Item		#100	#200	#300	Remarks
Bending Strength	(MPa)	70	60	60	JIS K 7203
Tensile Adhesive Shear Strength	(MPa)	35	30	30	JIS K 7113
Adhesion Strength	(MPa)	13~16	13~16	13~16	JIS K 6850
Flexural Modulus	(MPa)	0.9x10 <sup>4</sup>	5.3x10 <sup>4</sup>	0.42x10 <sup>4</sup>	JIS K 7203
Tensile Modulus	(MPa)	1.0x10 <sup>4</sup>	0.4x10 <sup>4</sup>	5.3x10 <sup>4</sup>	JIS K 7113
Cure Shrinkage Rate	(%)	0.10	0.15	0.15	Length Direction
Tensile Elongation	(%)	0.5	1.1	1.10	JIS K 7113
Vapor Permeability	(g/24hr•m <sup>2</sup> •mmHg/cm)	3.6x10 <sup>-4</sup>	1.7x10 <sup>-3</sup>	1.7x10 <sup>-3</sup>	JIS K 7203
Barcol Hardness		40	40	40	ASTM-244
Taber Abrasion Coefficient		40~50	40~50	40~50	
Liner Expansion Ratio	(/°C)	2.0~2.2x10 <sup>-5</sup>	2.0~2.2x10 <sup>-5</sup>	2.0~2.2x10 <sup>-5</sup>	JIS K 6911
Max. Working Temperature	In Liquid (/°C)	100	54~60	49~55	
	In Gas (/°C)	150	150	150	

# We Do Flake Lining

Flake lining system is designed to withstand severe exposures. Laminated glass flakes with chemical resistant resin delay penetration of corrosion to the substrate.

## 50~100 Layers In 1mm Thickness

Flake compound is made from thermosetting liquid resin mixed with glass flakes in micron thick, and applied in a thickness of 0.5~3.0mm. Glass flakes as barrier fillers make the coating much more durable and prevent permeability of corrosive substances, as the laminated glass flakes form a highly impermeable structure.



### Surface Preparation



(1) Blasting ISO 8501-1 Sa 2.5

### Primer Layer



(2) Primer Coating

### Glass Flake Lining Layer



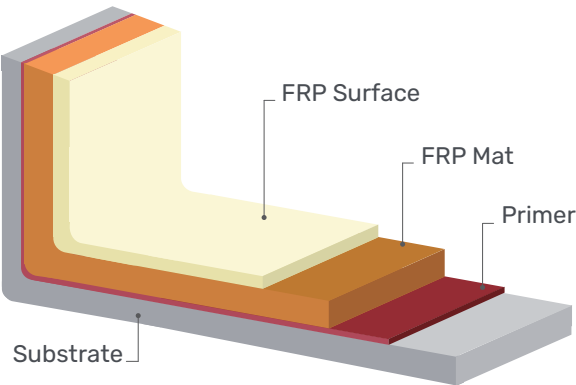
(3) 1st Coat of lining

## Flake Lining

**Flake resin patty is well mixed with proper quantity of hardner, and then applied with trowel or roller. In general flake lining, two layers of glass flakes in each 1mm thickness to prevent involution of air and pinhole.**

FRP Lining

Degradation or corrosion brought by aging could cause leakage and potentiall yellow underground storage tanks to leak containments. FRP Lining providessuperior corrosion resistance by applying FRP over inside surface of tanks. FRPimproves the durability of tanks and helps to prevent the leakage accident.



Material	Base Resin
DR-4000	Het acid Polyester resin
DR-6000	Bis type Vinylester resin
DR-8000	Novolac type Vinylester resin

After FRP lining has been completed, it structurally acts as a secondary containment tank inside of the tank.

General Flake Lining and FRP Lining Procedure

Glass Flake Lining Layer



(4) 2<sup>nd</sup> Coat of Lining

FRP Lining Layer



(5) FRP and Glass Mat lining

Final Layer



(6) Top coat

FRP Lining

FRP lining structurally acts as a secondary containment tank inside of thesubstrate.



# Chemical Resistance of Flake Lining

Working Temperature		Working Condition	
A	Maximum allowable temperature	1	Liquid
B	Maximum 70°C	2	Splash
C	Maximum 60°C	2	Dry Gas
D	Maximum 40°C		
T	Confirmation Test Required		
N	Not Recommended		

\*In liquid: Soaking and Wet Gas, Out of liquid: Splash and Dry Gas

\*Maximum Allowable Temperature (used approx. 30minutes per a day) 100 series is up to 149°C, 200 series is up to 188°C

Chemicals	Formula	Conc. %	Series		
			100	200	300
Hydrochloric Acid	HCL	1~20%	B1	C2	C2
Hydrochloric Acid	HCL	20~37%	B2	C3	C3
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	2~20%	A1	T	T
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	20~50%	B1	N	N
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	50~70%	C1	N	N
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	70~80%	T	N	N
Sulfuric Acid	H <sub>2</sub> SO <sub>4</sub>	80~98%	N	N	N
Sulfurous Acid	H <sub>2</sub> SO <sub>3</sub>	saturation	A1	D1	D1
Nitric Acid	HNO <sub>3</sub>	5%	B1	T	T
Nitric Acid	HNO <sub>3</sub>	10%	C1	N	N
Nitric Acid	HNO <sub>3</sub>	25%	D1	N	N
Nitric Acid	HNO <sub>3</sub>	40%	D1	N	N
Nitric Acid	HNO <sub>3</sub>	60%	D2	N	N
Concentrated Nitric Acid	HNO <sub>3</sub>	-	N	N	N
Nitrous Acid	HNO <sub>2</sub>	-	C1	T	T
Hydrofluoric Acid	HF solution	1~10%	T	N	N
Hydrofluoric Acid	HF solution	10~53%	N	N	N
Hydrofluoric Acid	H <sub>2</sub> SiF <sub>6</sub>	-	T	N	N
Phosphoric Acid	H <sub>3</sub> PO <sub>4</sub>	20%	A1	T	T
Phosphoric Acid	H <sub>3</sub> PO <sub>4</sub>	saturation	A1	T	T
Chromic Acid	CrO <sub>3</sub>	10%	B1	N	N
Hydroiodic Acid	HI Solution	29%	D1	T	T
Hydrobromic Acid	HBr Solution	20%	D1	T	T
Acetic Acid	CH <sub>3</sub> COOH	0~10%	C1	D1	D1
Acetic Acid	CH <sub>3</sub> COOH	10~50%	D1	A2	A2

Chemicals	Formula	Conc. %	Series		
			100	200	300
Acetic Acid	CH <sub>3</sub> COOH	50~100%	T	C2	C2
Acetic Anhydride	(CH <sub>3</sub> CO) <sub>2</sub> O	-	D2	N	N
Acrylic Acid	CH <sub>2</sub> CHCOOH	-	D1	N	N
Acrylic Acid	HOOCH(CH <sub>2</sub> ) <sub>4</sub> COOH	-	D1	D1	D1
Benzenesulfonic Acid	C <sub>6</sub> H <sub>5</sub> SO <sub>3</sub> H	-	A1	D1	D1
Benzonic Acid	C <sub>6</sub> H <sub>5</sub> COOH	-	A1	D1	D1
Butyric Acid	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>2</sub> COOH	-	C1	T	T
Chloroacetic Acid	CH <sub>2</sub> CLCOOH	-	C3	D3	D3
Chlorosulfonic Acid	ClSO <sub>3</sub> H	-	N	N	N
Citric Acid	C <sub>3</sub> H <sub>4</sub> (OH)(COOH) <sub>3</sub> ·H <sub>2</sub> O	-	A1	D1	D1
Dichloroacetic Acid	CHCL <sub>2</sub> COOH	20%	A1	D1	D1
Formic Acid	HCOOH	-	D1	D2	D2
Glycolic Acid	OCH <sub>2</sub> COOH	-	C1	T	T
Lactic Acid	CH <sub>3</sub> CHOHCOOH	1~20%	A1	D1	D1
Lactic Acid	CH <sub>3</sub> CHOHCOOH	20%-conc.	D1	N	N
Laulic Acid	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>10</sub> COOH	-	A1	D1	D1
Maleic Acid	(CHCOOH) <sub>2</sub>	-	D1	N	N
Maleic Acid	HOOCC(OH)CH <sub>2</sub> COOH	-	C1	C2	C2
Oleic Acid	C <sub>18</sub> H <sub>34</sub> O <sub>2</sub>	-	B1	D1	D1
Toluene Sulfonic Acid	C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> )SO <sub>3</sub> H	weak	A1	D1	D1
Oxalic Acid	C <sub>2</sub> H <sub>2</sub> O <sub>4</sub>	-	A1	D1	T
Stearic Acid	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>16</sub> COOH	-	B1	T	T
Succinic Acid	HOOCH <sub>2</sub> CH <sub>2</sub> COOH	-	D1	T	D1
Tartaric Acid	(CH(OH)COH) <sub>2</sub>	-	A1	D1	D1
Dibutyl Phthalate	C <sub>6</sub> H <sub>4</sub> (COOC <sub>4</sub> H <sub>9</sub> ) <sub>2</sub>	-	B1	D1	D1

# Chemical Resistance of Flake Lining

## Solvents

Chemicals	Formula	Conc. %	Series		
			100	200	300
Acetone	$(CH_3)_2CO$	-	N	N	N
Bezaldenyde	$C_6H_5CHO$	-	N	N	N
Benzene	$C_6H_6$	-	T	N	N
Carbon Disulfide	$CS_2$	-	D3	N	N
Carbon Tetrachloride	$CCl_4$	-	D1	D2	D2
Cholorobenzene	$C_6H_5Cl$	-	T	N	N
Heptane	$CH_3(CH_2)CH_3$	-	A1	A2	A2
MEC	$C_2H_5COisoC_4H_9$	-	N	N	N
MIBK	$CH_3C_6H_5$	-	D2	N	N

## Organic Matter

Chemicals	Formula	Conc. %	Series		
			100	200	300
Toluene	$CH_3COOC_4H_9$	-	D1	D1	D1
Butyt Acetate	$C_6H_5NH_2$	-	D1	N	N
Formaldehyde	$HCOH$	-	A1	D1	D1
Hexane	$C_6H_{14}$	-	A1	A2	A2
Aliphatic Hydrocarbon	$C_nH_{2n+2}$	-	A1	C1	D1
Aliphatic Hydrocarbon	-	-	T	T	T
Kerosene	-	-	A1	C1	D1
Naphtha	-	-	C1	C1	D1
Crude Oil	-	-	A1	C1	D1
Perchloroethylene	$CCl_2:CCl_2$	-	T	-	-
Phenol	$C_6H_5OH$	5%	T	N	N
Trichloroethylene	$CHCl:CCl_2$	-	N	N	N

## Breach

Chemicals	Formula	Conc. %	Series		
			100	200	300
Hydrochloric Water	$HCl+HClO$	-	A1	T	T
Hydrogen peroxide	$H_2O_2$	-	D1	D1	D1
Hypochlorous Acid	$HClO$	-	N	N	N
Sodium Hypochloride	$NaClO$	-	D1	N	N
Sodium Peroxide	$Na_2O_2$	-	T	T	T

## Organic Matter

Chemicals	Formula	Conc. %	Series		
			100	200	300
Alum	$Al_2M(SO_4)_4$	saturation	C1	C1	D1
Aluminium Chloride	$AlCl_{3.6}HO_2$	-	A1	C1	D1
Ammonium Chloride	$NH_4Cl$	-	A1	C1	D1
Ammonium Thiosulfate	$(NH_4)_2S_2O_2$	-	A1	C1	D1
Ammonium Sulfate	$(NH_4)_2SO_4$	-	A1	C1	D1
Ferric chloride	$FeCl_{3.6}H_{20}$	-	B1	N	N
Potassium Perchromate	$K_2Cr_2O_7$	-	A1	C1	D1
Potassium Chloride	$KCL$	-	A1	C1	D1
Potassium Permanganate	$KMnO_4$	-	A1	C1	D1
Potassium sulfate	$K_2SO_4$	-	A1	C1	D1
Sodium Bicarbonate	$NaHCO_3$	Baking Soda	A1	C1	D1
Sodium Carbonate	$Na_2CO_{3.10}H_{20}$	-	A1	T	T
Sodium chloride	$NaCl$	-	A1	C1	D1
Sodium sulfate	$Na_2SO_{4.10}H_{20}$	-	A1	C1	D1
Sodium sulfate	$Na_2S_9H_2O$	-	B1	D1	D1
Sodium Thiosulfate	$Na_2S_{203.5}H_2O$	Hypo	A1	C1	D1
Sodium Cyanide	$NaCN$	-	A1	C1	D1

## Alkalis

Chemicals	Formula	Conc. %	Series		
			100	200	300
Ammonium Hydroxide	$NH_4OH$	20%	B1	D3	D3
Calcium Hydroxide	$Ca(OH)_2$	Slaked Lime	B1	D1	D1
Potassium Hydroxide	$KOH$	10%	B1	A2	A2
Sodium	$NaOH$	10%	B1	A2	A2

## Galvanization Bath

Chemicals	Formula	Conc. %	Series		
			100	200	300
Chromic Galvanization	-	40%	N	N	N
Copper Galvanization	(Cyanide)	-	D1	C2	C2
Cupper Galvanization	(Acid)	-	A1	C2	C2
Nikel Galvanization	(Bright)	-	A1	D2	D2
Zink Galvanization	(Sulfate)	-	A1	C1	D1

# Chemical Resistance of Flake Lining

Working Temperature		Working Condition	
A	Maximum allowable temperature	1	Liquid
B	Maximum 70°C	2	Splash
C	Maximum 60°C	2	Dry Gas
D	Maximum 40°C		
T	Confirmation Test Required		
N	Not Recommended		

\*In liquid: Soaking and Wet Gas, Out of liquid: Splash and Dry Gas

\*Maximum Allowable Temperature (used approx. 30minutes per a day) 100 series is up to 149°C, 200 series is up to 188°C

## Pulp

Chemicals	Formula	Conc. %	Series		
			100	200	300
Black Liquor	NH <sub>4</sub> OH	-	A1	D	T
Sulfite Pulp	H <sub>2</sub> SO <sub>3</sub>	-	A1	C1	D1
White Liquor	KOH	-	A1	C1	D1

## Gases

Chemicals	Formula	Conc. %	Series		
			100	200	300
Ammonia	NH <sub>3</sub>	Dry	C1	A3	A3
Chlor Dioxide	ClO <sub>2</sub>	-	C1	D2	D2
Chlorine Dioxide	Cl <sub>2</sub>	Dry	C3	T	T
Hydrogen Sulfide Gas	H <sub>2</sub> S	-	A1	C1	D1
Sulfur Dioxide	SO <sub>2</sub>	Wet, Dry	A1	C1	D1
Sulfur Trioxide	SO <sub>3</sub>	Wet	D1	T	T

## Alcohols

Chemicals	Formula	Conc. %	Series		
			100	200	300
Ethl Alcohol	C <sub>2</sub> H <sub>5</sub> OH	-	A1	C1	D1
Isopropyl Alcohol	(CH <sub>3</sub> ) <sub>2</sub> CHOH	-	A1	D1	D1
Methyl Alcohol	CH <sub>3</sub> OH	Methanol	D1	D1	T

## Foods

Gulucose	-	-	A1	C1	D1
Vinegar	-	-	A1	C1	1
Soybean Oil	-	-	A1	C1	D1

## Others

Chemicals	Formula	Conc. %	Series		
			100	200	300
Hypo	-	Fixing Bath	A1	C1	D1
Jet Fuel	-	-	A1	C1	D1
Brine	-	-	A1	C1	D1
Tor Oil	-	-	A1	C1	D1
Distilled Water	H <sub>2</sub> O	-	B1	C1	D1
Cyclohexane	C <sub>6</sub> H <sub>12</sub>	-	T	T	T
Chloroform	CHCl <sub>3</sub>	-	N	N	N
Cresol	CH <sub>3</sub> C <sub>5</sub> HOH	-	N	N	N
Dichlor Ethylene	ClCH <sub>2</sub> CH <sub>2</sub> Cl	-	N	N	N
Fluoro Silicic Acid	-	-	T	N	N
Vinyl Acetate	CH <sub>3</sub> COOCHCH <sub>2</sub>	-	T	T	T
Xylene	(CH <sub>3</sub> ) <sub>2</sub> C <sub>6</sub> H <sub>5</sub>	-	T	N	N
Isoforon	-	-	D1	T	T
Lecithin	-	-	T	T	T
Naphthalene	C <sub>10</sub> H <sub>8</sub>	-	T	T	T
Trichlororthane	C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub>	-	T	T	T
Triethylamine	(C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> N	-	T	T	T
Picric Acid	HOC <sub>6</sub> H <sub>2</sub> (NO <sub>2</sub> ) <sub>3</sub>	-	T	T	T
Pyridine	C <sub>5</sub> H <sub>5</sub> N	-	N	N	N

## Remarks on Chemical Resistance Charts

Chemical resistance are determined according to test results and actual long-term performance and accurate material selection requires careful consideration in terms of operating condition and specifications of equipment. Therefore, please consult with us in advance for selection of rubber material against your chemical.

Equipment to be flake lined are becoming larger recently, and also the operation condition become complicated and severe for continuous anti-corrosion performance.



Piping



Piping



Absorber



FGD



Pickling Resin Tank



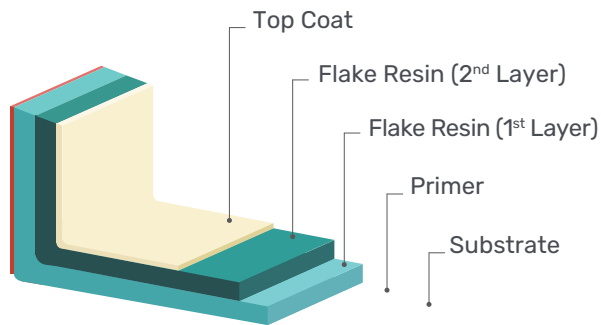
Pickling Resin Tank



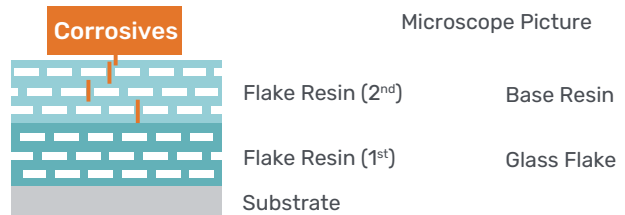
# Flake Lining for Concrete Tank

Below is OHJI product supplied by Ha Thanh for coating the concrete water tank of power plant on 2015. We apply new glass flake lining wear protection equipment and repair.

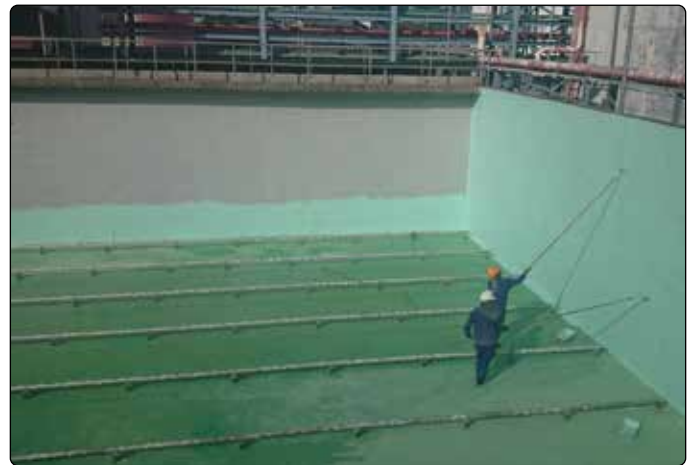
## Flake Lining System



Glass flakes are laminated densely and form a stable barrier structure. It prevents permeation of vapor and gases that lead to corrosion.



Before glass flake coating



After glass flake coating



Before glass flake coating



After glass flake coating

## Flake Lining for Concrete Tank

Resin lining Technology has been applied to various kinds of mechanical devices, such as a water purification equipment, pollution control equipment, seawater desalination equipment, and medical product manufacturing equipment.

Product: Flake & FRP Lining System for Crude Brine (NaCl) Dissolving Tanks

**OHJI LINING SYSTEM: C-4-2.5; Layer: PR 90 + HF 161 + FRP + TC 60; Total Lining Thickness: Average 2.5mm**



Surface preparation before apply primer coat PR-90



Completed primer coat PR-90



Apply OHJI HF-161 Flake lining by trowel



Lining FRP layer (M+M+SM) onto HF-161 layer



Apply final Topcoat TC-60



Pinhole check quality



## Domestic Projects

**06/04/2015**

Ha Thanh completed 400sqm Rubber lined tanks and pipeline, for the transport of phosphoric acid, waste acids and hydrochloric acid for 02 Platform Supply Vessel (PSV) project of Vard Vietnam belong to Vard AS Group - Norway.

Tank capacities: Beyond standard offshore supply (i.e. fuel, water, mud ect.) the PSV has capacity to carry substantial dangerous and noxious liquid chemicals in bulk including but not limited to MEG, TEG, NaOH, HCl and H2S Scavenger.

Vessel name: Is the MMA Plover and its sister vessel MMA Brewster.



**11/05/2017**

Ha Thanh had finished rubber lining and delivered 14 units of trash filter in salty and impurities (Basket Strainer) for NSRP (NSRP - NGHI SON REFINERY AND PETROCHEMICAL LLC) meet the technical, quality, time delivery requirements and rigorous supervision of JGCS Consortium. JGC Corporation (Japan), Chiyoda (Japan), GS E&C (Korea), SK E&C (Korea).





**On 7 March, 2018**

Ha Thanh had finished 238m<sup>2</sup> rubber lining for 8 tanks of Boiler water and waste water treatment systems with high quality and on-time delivery required, supply and installation for expansion package of Vinh Tan 4 Thermal Power Plant under EVN (Vietnam Electricity Corporation).



## Oversea Projects

**20/04/2016**

Ha Thanh had completed rubber lining (Hot and Cold bonding) of 52 set boatlanding of wind tower (Apprx. 2000m<sup>2</sup>) for Belwind II Offshore Wind Farm for client exported to Europe with requirement very high quality and accuracy. Ha Thanh had worked 57 consecutive days and completed on schedule, quality as customer requested.

Warranty: 5 years.



**25/08/2017**

Ha Thanh had finished rubber lining and delivered 9 units vessel/ tower /pipe spools of water treatment in food industry for client export to Japan Korn Starch.



[illegible]





## **Requirements for Substrate Preparation**

So that you will get the professional rubber lining job you expect, certain requirements (structure, shape, welding, etc) must be met before you send your substrate to us

For your details information, please contact us for follow the Guidance and requirement standard for design and fabrication on rubber lining



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