WB produces >>>





3. EXTERNAL FLOATING ROOF SEAL SYSTEMS







WB, World Best Products, World Best Service, World Best Technology

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• WBIFR Construction Works in World Wide Customer's Job Site



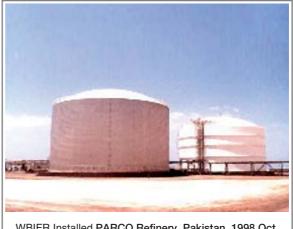
WBIFR Installed in Japanese Oil Company, 2002 Dec.



Tianjin Terminal in China



WBIFR Installed in Rayong Oil Refinery in Thai 2003, Oct.



WBIFR Installed PARCO Refinery, Pakistan, 1998 Oct.



I.F.R Construction Works in VOPAK Tank Terminal in Korea



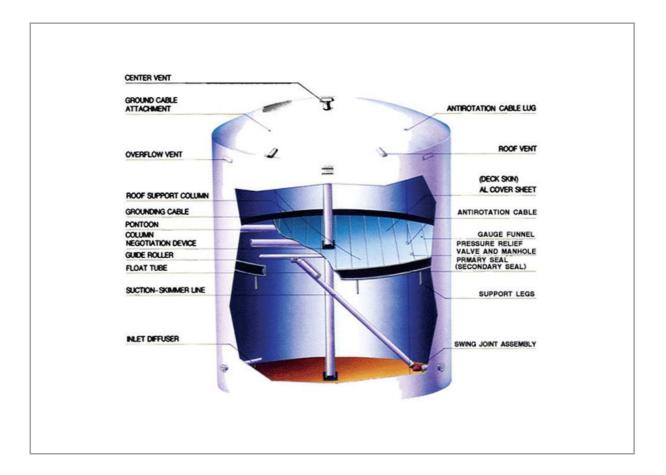
I.F.R Construction Works in VOPAK Tank Terminal in Korea



Cutaway View of WBIFR

WB advance designed internal floating roof are equipped with the following standard components including special swing joints incorporating with suction and oil skimmer lines.

Now we have supplied over one thousand five hundred (1,500) sets of WBIFR & tank seals products to all around oil and petroleum industries.





• WB Design : API 650 Appendix H Codes and Standards Design

For the petroleum and chemical industries, API Standard 650 "Welded Steel Tanks for Oil Storage" is the most widely accepted Standard for the design of liquid storage tanks. Also, WB's Internal Floating roof designed and constructed in accordance with the API Standard 650 Appendix H, provides the designer with selection of allowable stress to suit each design condition, which specified by the tank owner.

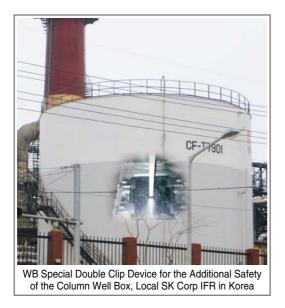
The Standard's API 650 Appendix H, "internal floating roofs", gives similar requirements for floating roof tanks having a fixed roof at the top of the tank.



Erection Views for the WBIFR Clamp Beam & Temporary Support of Pontoon

These choices allow very excellent internal floating covers to be installed economically when many quantities of storage are required.

Its design as described in API Standard 650 is the results of more sophisticated analysis of stress for improved use of the steel in large tanks.



Although the API Standards design are widely accepted throughout the world oil industries, many countries have specified national codes and standards regulation for the design and construction of covered storage tanks. When you have opportunity to design aluminum floating cover products, please contact to World Bridge first, our design team and quality products will meet such standard of your requirements.

cncvietnam.com.vn05

WB Advanced Quality Control System

Maintenance Free

WBIFR are virtually maintenance free system for the long time service in your petroleum storage tank. The high quality AI. alloy materials give you a proven record of service life and no corrosion occurrence, therefore, do not need often maintenance works.

Designed for Good Operation works

WBIFR is custom designed for your tank and your specific design requirements to ensure no product contamination and minimum evaporation losses during tank operation time.

All metallic components of WBIFR have performed successful service in your product tank for over twenty (20) years lifetime.

Easy Installation Works

The overall installation and assembly works of the AI. floating roof and appurtenances will be easily assembled and convenience for clean-up, inspection, testing and commissioning works.

Safety Control & Good Welding Products

All of the pontoons are fully produced automatic welding system and individually shop-tested at 40 PSI (2.8kg/cm2) to insure leak proof integrity. Random spot checks are not acceptable under our quality control procedure. We are always testing one hundred percent (100%) of our pontoons (products) at our modern test facilities before loading for the final shipment.

Concentrated Load Testing Works

We perform the air test and inspection as our standard test & inspection works on every pontoon which were developed by us according to API Standard 650 Appendix H. Normally we tested twice (2) strong pressure to our pontoon against API design requirement.

Guarantees and Performances

Our internal floating cover will guarantee that the equipment required performance conditions which stated in customer's specification following to API STD 650 Appendix H.

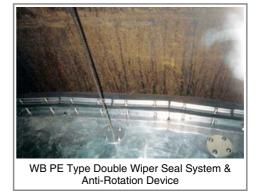


Concentrated Load Test for the Al. Deck Skin and Others Component. Inside of WB Factory for the Test IFR Sample, 1999 Jan.

WB Specialized Designing & Manufacturing Capabilities

1.Design and Engineering Works

EPA and other country's regulation.



WBIFR is an all aluminum construction and thus light weight structure.

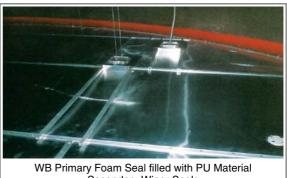
WB's guality aluminum internal floating roof Is designed to meet all present regulation and air pollution control standard (VOC) in petroleum industries, especially U.S.

WBIFR can be reduced evaporation loss by up to 97%

2.Manufacturing Works for Al. and SUS **Materials**

according to API standard-publication 2519 and API 650 Appendix H, requirement.

WBIFR is produced from corrosion resistant lightweight aluminum material, positive buoyancy is provided by many, individually sealed top quality tubular pontoon products. The design of WBIFR is completely computerized.



Secondary Wiper Seals

Information obtained from the customers is used by the computer which produces a detailed printed-out of all required parts dimensions together with a production drawing. WBIFR installation required a minimum works on the tank and usually can be done within a week based on tank less than 30M diameters with seven (7) normal erection crews.



WBIFR Column Well Inspection Work in Local SK Corp. Oil Storage Tank

3.Inspection & Supervision Works

One of the most important areas of our floating cover is stringent guality control program. Our specialized QC inspector can perform all necessary tests before shipment.

Therefore our products shall not be loaded until inspection procedures have been satisfied. Our special QC inspectors are knowledgeable on all of the most recent national regulations and international design requirement. Normally we are kindly recommended to invite our experienced supervisor during your first tank's erection works at job site.

WB Specialized Engineering & Manufacturing Capabilities

4.Repair Works

Our company provides a comprehensive range of services works for the repair of existing internal floating covers, regardless of anybody products. These service works include primary and secondary seals repair, pontoon tube replacement and structural repairs in terms of extension of long service life. During the last twenty (20) years, WB provide many repair job in Japan as well as many other country new installation works to oil refinery including many tank farm.



Japanese Oil Company, 1999 March

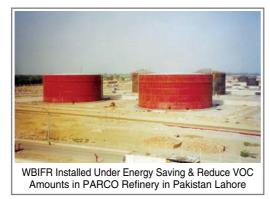
5.Economics

The amount of vapor reduction in our internal floating covers can virtually add to profit in your tankage. Also it is designed to exceed the standard life expectancy due to more good structural strength and serious quality control program.



6.Service for Customer Satisfaction

As our customers prepare to invest a significant amount of money and time in new or retrofit internal floating covers systems. More and more the question should arise us as to the qualified reliable suppliers. Providing rapid response, best quality products, superior design, and a full range of services works have been helped as World Bridge to the reliable supplier to the oil companies and petrochemical industry to all around the world.







TANK FITTING PRODUCTS

Various Erection & Assembling Works of WBIFR



Tubular Pontoon (Tube) and Clamp Beam Assembling Works in Japanese Construction Company



Underneath View s of WBIFR



Deck Skin Assembling Work / Japanese Oil Company



Pressure & Vacuum Breaker System

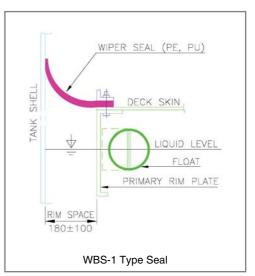




Typical Seal Systems of WBIFR

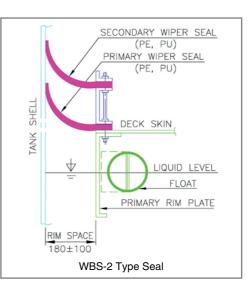
WBS-1 SINGLE WIPER SEAL

THE VAPOR MOUNTED SINGLE WIPER SEAL is designed to prevent vapor leakage and to protect from possible VOC and vapor loss. This standard seal design called SINGLE WIPER SEAL is made from elastic synthetic rubber and special polyethylene materials.



WBS-2 DOUBLE WIPER SEAL

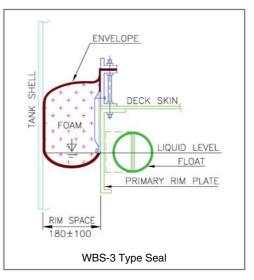
THE VAPOR-MOUNTED DOUBLE WIPER SEAL is designed to provide a double sealing system technology using elastic synthetic rubber products. This standard seal design called DOUBLE WIPER SEAL is made from high quality elastic synthetic rubber and polyethylene material.



• WBS-3 FOAM SEAL

THE LIQUID-MOUNTED FOAM SEAL is designed to install a complete sealing system, which is composed of foam filled section with various suitable envelope materials. Teflon (PTFE) envelope materials are also available to provide long service life for BTX and high aromatic content products tanks.

And also use PTFE (Teflon) two layers envelop product to get more reliable seals service life on your tank.

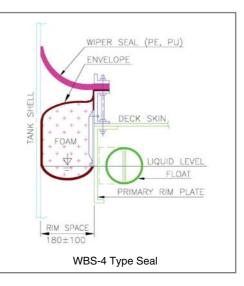


Typical Seal Systems of WBIFR

WBS-4 FOAM + WIPER SEAL

This seal is designed to install a double sealing system, which is composed of PRIMARY FOAM FILLED SEAL AND SECONDARY WIPER SEAL and prevents vapor loss of liquid products completely. PTFE (Teflon) envelope materials are also available to provide long service life for BTX products tank. This standard design can effectively reduce VOC emission and product losses.

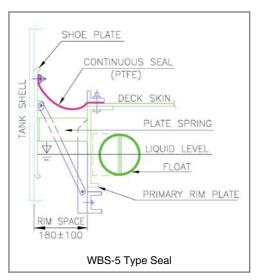
We believe this type of seal design will give you the most reliable seal performance on your tank.



WBS-5 MECHANICAL SHOE SEAL

This seal is designed especially for long service life under no repair and maintenance works in oil companies as well as many oil tank terminals. This seal system is good for high aromatic service tank like a BTX and all kinds of petroleum storage tanks.

Stainless steel 304 shoe plate and other materials are used for steel parts and PTFE (Teflon) is used for continuous seal. The whole seal service life exceeds more than thirty (30) years. Other continuous seal materials are also available upon specific liquid storage.





Good Maintained Product Tank with WBIFR



Local Oil Terminal installed with Good Quality WBIFR

ALUMINUM DOME COVERS

Components for Internal Floating Roof System

The standard tanks are furnished with a spiral stairway and platform, an inlet and outlet nozzle, a shell and roof vents, and a gauge hatch etc.

The following are partial lists of those accessories, which are supplied in terms of customer specification.

- 1. Float well (for automatic tank gauge)
- 2. Gauge hatch with self-closing, non-sparking cover is located on the fixed roof.
- 3. Automatic Bleeder Vent: when a greater pumping rate is specified, additional venting design can be required.
- 4. Corrosion Gauge
- 5. Ladder
- 6. Screened Vents in the shell and roof are available if required.
- 7. Diffuser
- 8. Roof manway
- 9. Column Seals are provided on each column to support the fixed roof.
- 10. Special seals are also provided on the internal pipe when furnished.

• Fluids Handled by WB Internal Floating Roof System

ACETIC ACIDETHYL BENZENENAPHTHAACETONEETHYLCHLORIDENATURAL GAS 12ACRYLONITIRILEETHYLENE DIAMINEPHTHALIC ACIDAROMATIC DISTILLATEFUEL OILPLATFORMATEAVIATION GASOLINEGAS CONDENSATEDPLATFORMER CHARGE
ACRYLONITIRILEETHYLENE DIAMINEPHTHALIC ACIDAROMATIC DISTILLATEFUEL OILPLATFORMATE
AROMATIC DISTILLATE FUEL OIL PLATFORMATE
AVIATION GASOLINE GAS CONDENSATED PLATFORMER CHARGE
BENZENE GASOLINE REFORMER CHARGE
BTX RAFFINATE HEPTANE CHARGE RUBBER SOLVENT
BUTHYLE ACETATE HEXANE SLOP OIL
CYCLOHEXANE KEROSENE SOUR CRUDE
DIESEL FUELS METHYL ALCOHOL STYRENE MONOMER
DIMETHYL FORMAMIDE METHYL ETHYL KETONE TOLUENE
ETHYL ACETATE METHYL ISOBUTYL KETONE VINYL ACETATE MONOMER (VAM
ETHYL ALCOHOL NAPHTALENE XYLENE

Note: Other hydrocarbon products are available with WBIFR systems. But please consult with us for the special products & seal materials.

Material Specification for Typical Al. Internal Floating Roof

1.SHEETING (ALUMINUM DECK SKIN PLATE) MATERIAL : ASTM B209-3003 (H16) SIZE : 1.670^w X 0.6^T (STANDARD) 2.FLOAT TUBE ("L" ARE DECIDED BY DESIGN CONDITION, MAX. LENGTH IS 6,000MM) MATERIAL : ASTM B209-5052 (H32) SIZE : 1.3^T X Ø 250^T or 300 (MAIN & RIM) 3.CLAMP BEAM (CHANNEL) : STANDARD LENGTH IS 5,000MM. MATERIAL : ASTM B221-6063 SIZE : UPPER BEAM, 56 X 32 X 37 X 5,000 & LOWER BEAM, 56 X 32 X 37 X 5,000 → STANDARD CONNECTION JOINT BAR : 25 X 25 X 204^L 4.RIM PLATE (RIM PLATE SPLICE BAR, AL., 5052 (H32) 100 X 500^L X 2[⊤] MATERIAL : ASTM B209-5052 (H32) SIZE : PRIMARY, 300 X 70 X 3000^LX 2^T & SECONDARY, 30 X 100 X 2990^LX 2^T 5.MANWAY & COLUMN WELL : → THE SIZE OF COLUMN WELLS IS VARIOUS ACCORDANCE WITH COLUMN DIAMETER. MATERIAL : ASTM B209-502 (H32) SIZE : COVER, 2T (STANDARD) WELL BOX, 1.5^T (STANDARD) 6.VACUUM BREAKER: LEG, AL, 6063. O.D 50X26X2,000^L : ASTM B209-5052 (H32), ASTM B221-6063 MATERIAL SIZE : PALLET, 300 X 300 X 2T, NECK, Ø 250 X 180^H X 1.5^T & FLANGE, 350 X 350 X 1.5" SEAL, RUBBER PLATE, 350 X 350 X 5" **7.ADJUSTABLE LEG & HOUSING** MATERIAL : ASTM B209-5052 (H32) SIZE : LEG, Ø 50 X 3[⊤] X1,500[⊥] LEG HOUSING, Ø 60 X 3[™] LEG HOUSING FLANGE, NYLON Ø 120 X 5^T or ALUMINUM Ø 120 X 3^T

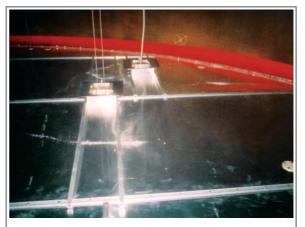


Material Specification for Typical Al. Internal Floating Roof

8. TUBE SADDLE & STRAP MATERIAL : ASTM B209-5052 (H32) SIZE : SADDLE, 50 X 494 X 2^T (Ø 250) & 50 X 555 X 2^T (Ø 300) STRAP, 50 X 690 X 1.5^T (Ø 250) & 50X 772 X 1.5^T (Ø 300) 9. STUB DRAIN MATERIAL : ASTM B221-6063 SIZE : Ø 25X300X1.0^T **10. ANTI-ROTATION CABLE** MATERIAL : A555 SIZE : Ø 6.4XL ("L" IS DECIDED BY HEIGHT OF TANK) **11. GROUND CABLE & TYPING WIRE** MATERIAL : A555 SIZE : Ø 3.2XL ("L" IS DECIDED BY LENGTH BETWEEN TOP AND I.F.R.) 12. BOLT&NUTS MATERIAL : STAINLESS STEEL SIZE : M10 X 25MM, M10 X 50MM, M10 X 80MM, M10 X 170MM&M6 X 15MM **13. COVER TO SHELL SEAL** WBS-4 SEAL 1) ENVELOPE-Select suitable material for serviced product case by case. 2) FOAM BLOCK-Polyurethane SECONDARY WIPER SEAL : POLYURETHANE OR Polyethylene (Option : Teflon Cover Seal) Note : The above materials are subject to changing customer's specific requirement.



Tubular Pontoon (tube) and Clamp Beam Assembling Works in Japanese Construction Company



Secondary Wiper Seal & Well Box for Level Indicator

• The Overview of Stainless Steel I.F.R Rim Plates / Float Tubes



WB Stainless Steel 304 Materials of Rim Plate Products, 2005 Jan.



WB Good Finished Pontoon Products for the Final Air Pressure Test Works, 2005 Jan.



WB Good Finished Pontoon Products for Export to Japan. Material Stainless Steel 304, 2005 Jan.



Tubular Pontoon of WB World Best Quality Internal Floating Cover Systems, 2005 Jan.



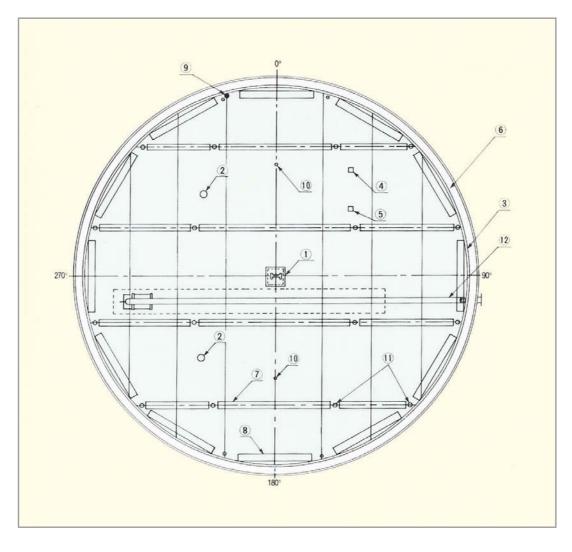
WB Raw Material Storage Area for the Clean IFR Products, 2005 Jan.



WB Best Quality Deck Skin Materials for the 40ft Export Container Shipment

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• General Views of WB Internal Floating Roof



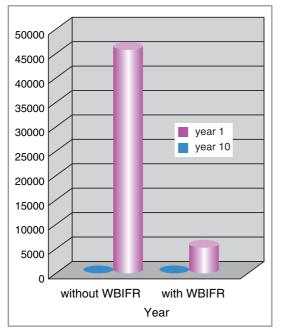
- **1. COLUMN NEGOTIATING DEVICE**
- 2. STUB DRAIN
- 3. RIM PLATE
- 4. MANWAY (MANHOLE)
- 5. VACUUM BREAKER
- 6. PRIMARY SEAL (SECONDARY SEAL)
- 7. MAIN FLOATS
- 8. RIM FLOATS
- 9. ANTI-ROCATION CABLE
- 10. GROUND CABLE
- 11. SUPPORT LEGS
- 12. SUCTION/SKIMMER LINE

Our Scope of supply works is included

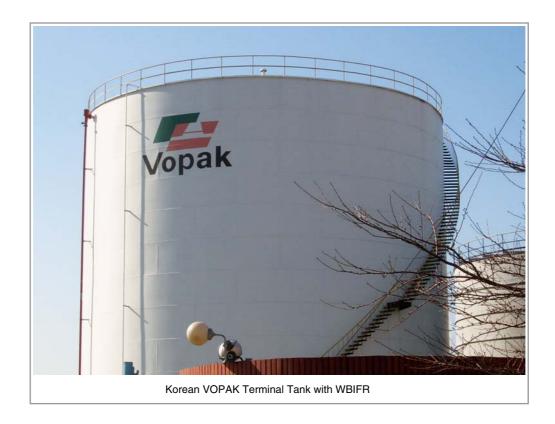
- 1. All of components for Aluminum Internal floating Cover System.
- 2. Mechanical Design and Performance Guarantee.
- 3. Quality Plan, Test & Inspection based on the applicable codes, and purchaser's specification.
- 4. Supervision for Internal floating Cover Erection Works.

Details Evaporation Loss Comparison Table

Comparison Table with or without WORLD BRIDGE Internal Floating Roof System



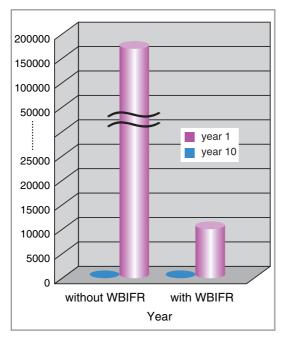
Tank Diameter	12m				
Tank Height	10m				
Tank Volume	1130m ³				
10Tank turnovers/year Evaporation loss from tank without WBIFR					
Breathing loss (lit.)	14,180				
Working loss (lit.)	32,960				
Total (lit.)	47,140				
Evaporation loss from same tank fitted with WBIFR					
Breathing loss (lit.) 4,500					
Working loss (lit.)	15				
Total (lit.)	4,515				
Annual product savings (lit.)	42,625				
WBIFR efficiency %	90.4				



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Details Evaporation Loss Comparison Table

Comparison Table with or without WORLD BRIDGE Internal Floating Roof System



20m 14m					
14m					
4400m ³					
10Tank turnovers/year Evaporation loss from tank without WBIFR					
40,700					
128,100					
168,800					
Evaporation loss from same tank fitted with WBIFR					
9,300					
20					
9,320					
158,480					
95					

The above example gives an accurate indication of the effectiveness of both methods in reducing evaporation loss. WBIFR will reduce the emission losses up to 90% ~ 97% based on tank diameter and annual turnover.

These tables are derived from the latest formula of API 2519 and shows typical evaporation loss from internal floating tanks.

Calculation based on the following conditions					
Product	Gasoline RVP 13psi				
Molecular Weight	65				
Product Density (15℃)	5.6lb/gal				
Condensed vapor density (15°C)	4.9lb/gal				
Storage Temperature	25~35℃				
Daily Temperature Change	5~6°C				





no problems to operate even big Taiwan's earthquake accident in 2000.

TANK FITTING PRODUCTS

World Historic Record of Taiwan Formosa Project

In 1999, WB have awarded world largest single orders from Taiwan Formosa Petrochemical Corp. including crude oil tanks seal orders (Dia. 87m X 28 sets, External Floating Roof Type Tanks) and it was completed successful installation & operation works before planned completion schedules. Formosa Taiwan also had replaced big orders to World Bridge for the total thirty-six (36) WBIFR (62M Dia. x 12, 48M Dia. x 12sets, 38MDia. x 12set) for the product storage tanks. Now all of our products are operated very well under tropical climates in Taiwan country and found

• Total order values were USD 5Mil Dollars for crude tank seals & WBIFR system.

Total thirty-six WBIFR (Tank Dia. 62Mx12sets, 48Mx12sets & 38Mx12sets) / WBS-2 Double Wiper Seal Type Total twenty-eight External Floating Roof Seal Systems (87M Dia.X28sets) / WB-1 Phantograph Type Mechanical Shoe Seal +WB-50 Secondary Seal System



WBIFR Partial Construction View of Formosa Petrochemical Corp. In 1999 Taiwan



WBIFR Data Sheet

Tank Data Sheet for Internal Floating Roof Seal

Our Ref. No.	:		Date	1
Customer Ref. No.	:			
Client	:			
Project Name	:			
Tank No.	:			
Service Product Name	:			
Specific Gravity	:			
Seal Type	:			UWBS-2 Double Wiper Seal
		🗆 WBS-3 Foam	Seal	🗆 WBS-4 Foam & Wiper Seal
		□ WBS-5 Mech	anical Seal (🗌 F	Require Secondary Seal)
Tank I.D		· · · · · · · · · · · · · · · · · · ·		
	:		mm	
Tank Height			mm	
Inlet Flow Rate (m ³ /hr)				
Outlet Flow Rate (m ³ /hr)	:			
Dipping Pipe (From Tank	Roof to T	「ank Bottom)		
		Size (Inch)	Quantity (Ea)	
Center Column	1			
Outer Column				
Sampling Gauge	:			
Leveling Gage	:			
Temperature Gage	:			
Ladder	:	x		
ETC	:			



Floating Suction & Oil Skimmer Line Systems

1. Construction Features



WB Floating Oil Skimmer Line



WB Central Supported Type Swing Joint. Size From 6" to 30" Dia.

More Specification

- 1. Typical Material
- Swing Joint: Cast Iron or Aluminum
- Suction Pipe: Aluminum, Stainless Steel or Carbon Steel
- Flange: ANSI150# S.O.F.F
- Floating Tube: Aluminum, Stainless Steel or Carbon Steel
- 2. Minimum tank open size required for Swing Joint passage (See below table)



• Features are:

- 1. The above assembly is designed using Aluminum, Stainless Steel or Carbon Steel.
- 2. Simple installation works.
- 3. Maintenance Free

MINIMUM TANK OPEN SIZE FOR SWING JOINT PASSAGE										
Swing	4"	6"	8"	10"	12"	16"	20"	24"	28"	30"
Joint										
Size										
Min.	15"dia	18 ^{1/2} "dia	22"dia	26 ^{5/8} "dia	30 ^{3/4} "dia	38 ^{1/2} "dia	46 ^{1/4} "dia	54 ^{1/4} "dia	60"dia	70"dia
Tank										
Hole										

TANK FITTING PRODUCTS

Floating Suction & Oil Skimmer Line Systems

2. Technical Introduction

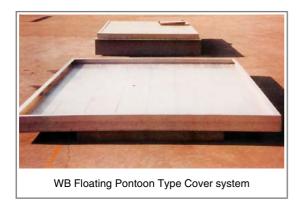
The swing joint of floating suction line is the most important parts. WB, we produce world best quality central supported type of joint to keep long service life and trouble free service works on above ground storage tanks. Due to our many experience works on Jet A-1 and other aviation oil storage tank, we can supply best quality swing joint to your suction and oil skimmer lines. Because of its design, the Swing Joint is balanced, leak tight, and has no tendency to pull apart and because of its simple construction, there are no parts to get out of adjustment. This gives the Swing Joint a clear advantage over other types of joints used in storage tank applications.



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TANK FITTING PRODUCTS

API Oil-Water Separator Cover System (Floating & Fixed Type)





Hydrocarbon emissions from oil-water separators pond are major environmental problems. Our Oil-Water separator cover systems is custom designed to meet your operating requirement and provide safe and structurally sound yet simple method of meeting your air quality requirements. This custom design provides maximum surface coverage and minimizes changes to your present operating procedures.

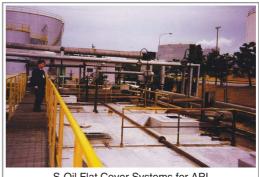
Actual construction details will vary from one installation to another, but the unique panel construction combining great strength, rigidity and buoyancy, provide full surface floating contact over most of the separator. This concept eliminates hazardous vapors and emissions before they begin and enhances the safe operation of the separator. Also by eliminating vapors the recovered oil is generally of a higher quality. The operation of the Oil-Separator Cover System is entirely passive. WORLD BRIDGE can design and supply both floating covers and fixed cover systems on your API-CPI ponds.

After a site inspection, the renovation objectives are reviewed with your environmental, engineering and operating personnel. Special consideration must be given to these areas.

- Maximum Surface Coverage
- Hydraulic Elevations
- Liquid Level Variations Sludge Removal System
- Maintenance Access Live Loads Imposed
- Condition of Side Walls
 - Anticipated ph Range
- Skimming Device
- Weir Control
- Operator Access
- Site Accessibility

VOC removal system: We can supply and recommend VOC removal system together with our fixed cover products.

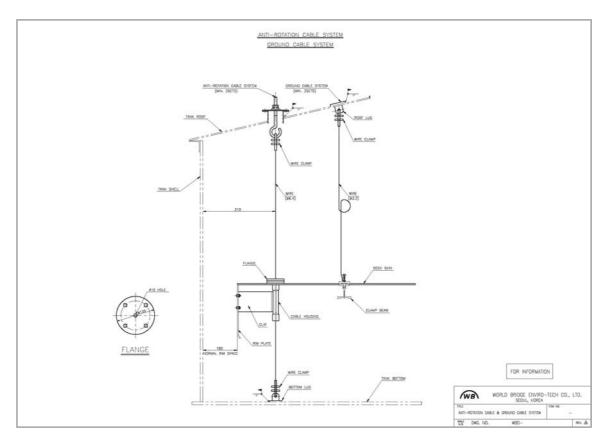


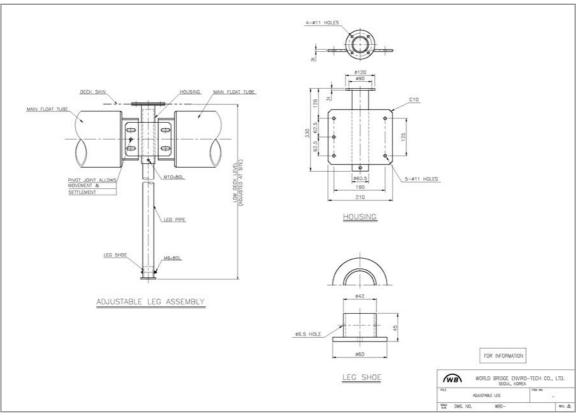


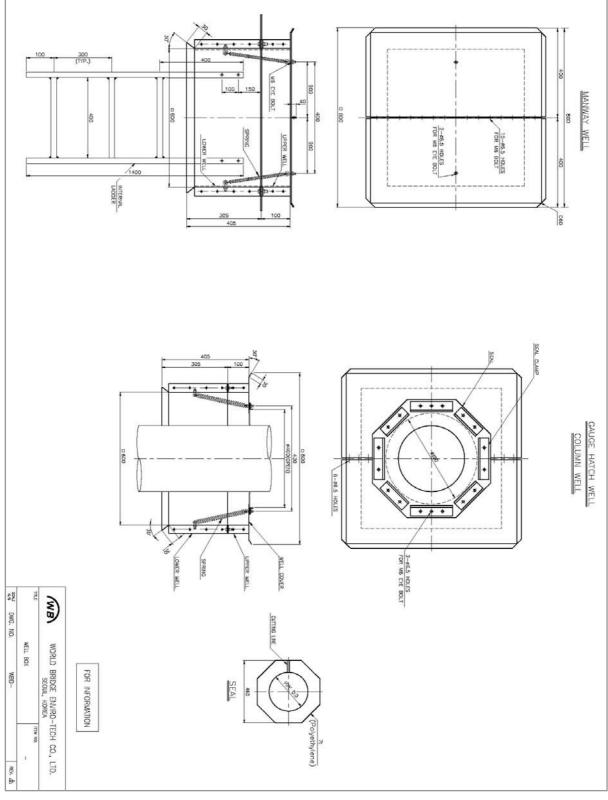
S-Oil Flat Cover Systems for API



WBIFR Reference Drawings







WBIFR Reference Drawings

• WBIFR Reference Drawings

