

# TANK SAFETY & PROTECTION DEVICES



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# Aurora Works Co., Ltd.

## Company Profile:

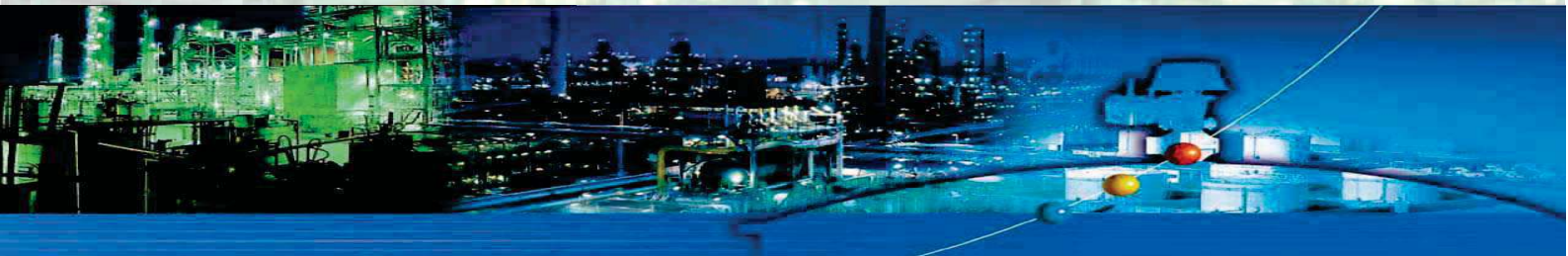
With more than 15 years' experience for engineering team, Aurora Works Co., Ltd. is a market leader in the following field;

- Supply Tank Protection Devices, Instrumentation & Valves.
- Support a wide range of industries from manufacturing to process control integrators.

## Industrial Applications include:

- Power plant, Cogeneration Plants
- Petrochemical
- Chemical Processing
- Automotive Manufacturing
- Food and Beverage
- Cement Industries
- Oil & Gas; Crude and Product Tank Farms
- Refinery
- Pulp & Paper
- Water & Water Treatment
- Steel and Metal.
- Pharmaceutical
- A system integrator and Lump Sum Turn Key Project for Plant Automation System, Instrumentation process control system, SCADA /DCS, Fire & gas detection, etc.
- Service; Trouble Shooting, Calibration, Commissioning Start Up.
- Training Courses for latest technology to customer.

In addition, we support the expansion of industry in the Eastern Part of Thailand, we, Aurora Works Co., Ltd. have established Rayong Workshop Center to provide customer with fast, effective and efficient services.



## OUR CUSTOMERS





# LETTER OF AUTHORIZATION "KSPC"



## AGENCY AGREEMENT

THIS AGREEMENT IS MADE ON THE DAY OF 01<sup>TH</sup>, JAN. 2017.

### BETWEEN

KOREA STEEL POWER CORPORATION.  
AS MANUFACTURER.  
488-1, WOLHA-RO, TONGJIN-EUP, GIMPO-SI, GYEONGGI-DO, KOREA  
TEL : 82-31-998-3825~7 FAX : 82-31-998-3828

### AND

AURORA WORKS CO.,LTD  
888/24 SOI PRACHAUTHIT ROAD, THUNG KHURU,  
BANGKOK 10140  
TEL : 66 2815-5114 FAX : 66 2815-6128

(HEREIN AFTER REFERRED TO AS 'AGENT')

### 1. APPOINTMENT OF AGENT

- 1.01 COMPANY HEREBY APPOINTS THE AGENT AS ITS EXCLUSIVE REPRESENTATIVE FOR THE SALE OF COMPANY PRODUCTS/SERVICES AND EQUIPMENT. THE AGENT ACCEPTS THE SAID APPOINTMENT AND AGREES TO PROVIDE THE SERVICES SPECIFIED IN THIS AGREEMENT.
- 1.02 REPRESENTATION OF COMPANY IN THE ASSIGNED AREA WILL BE CONDUCTED BY THE HEREIN NAMED AGENT, AND ANY DEVIATION MUST BE APPROVED AND AGREED TO BY COMPANY PRIOR TO WRITTEN CONSENT. SUCH CONSENT MUST BE OBTAINED BEFORE ANY SALES ARE MADE OR COMMISSIONS WILL BE DISTRIBUTED TO AGENT BY COMPANY.
- 1.03 AGENT IS AN INDEPENDENT CONTRACTOR AND COMPANY SHALL IN NO MANNER BE CONSIDERED HIS EMPLOYER AND COMPANY SHALL NOT BE LIABLE FOR ANY ACT AS EMPLOYER, INCLUDING BUT NO LIMITED TO PAYMENT OF ANY TAXES, EXPENSES OR OTHER COSTS OF DOING BUSINESS.



PAGE 1 Aurora Works Co.,Ltd

IN WITNESS WHEREOF, THE PARTIES HERE TO HAVE EXECUTED THIS AGREEMENT

ON 01<sup>TH</sup>, JAN, 2017

AURORA WORKS CO.,LTD



BY:

KOMGRICH DEEJAMALA / MANAGING DIRECTOR

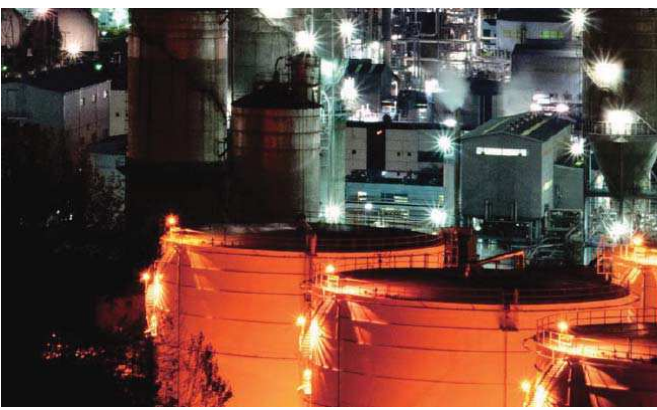
KOREA STEEL POWER CORP AS MANUFACTURER

BY



HWA JIK JEONG / MANAGING DIRECTOR

## Products Certified



# COMPANY OVERVIEW

Since its foundation in 1991 at Republic of Korea, **KSPC** has been developing industrial valves. Appointed as the Domestic-Product Development Enterprise for Tank Safety Valve, KSPC produces safety devices for flammable and nonflammable storage tanks by focusing on industrial valves.

Since then, KSPC's own Research Institute of Technology was established and its FMRC factory was approved in 1996, which serves as a momentum for KSPC to gain recognition on its product reliability and competitiveness. Supplying high-quality systems optimized for various fields such as petrochemical refinery, chemical treatment plant and natural gas supply line, KSPC also guarantees the maintenance of systems after delivery.

Through continuous research and development, KSPC has won many domestic and overseas certifications and patents, such as ATEX certification, ISO9001, ISO 14001, KFI, achieving recognition on the performance of its products. Having established quality goals that meets the requirements of ISO, KSPC concentrates on the improvement of its effectiveness and efficiency, standardizes process quality control, employees experts and enhances company-wide quality education for achieving systematic quality control.



# KSPC



# K.S.P.C VISION & MOTTO

VISION **1** Safety is the first and most important. **2** Think about Environment

MOTTO Truly think and consider customers. Truly make eco-friendly products. Truly think safe world

## QUICK ACCESS TO ITEM CATALOGS IN QR CODES

PRESSURE VACUUM RELIEF VALVE .....



FLAME ARRESTER .....



EMERGENCY RELIEF VALVE .....



GAUGE HATCH COVER .....



NITROGEN BLANKETING VALVE .....



Quick access to KSPC website in QR code .....  
[www.ikspc.com](http://www.ikspc.com)



Quick access to valve operating video in QR code .....





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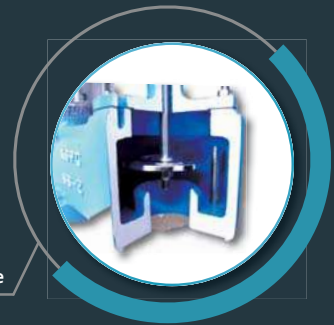
# PRESSURE VACUUM RELIEF VALVE



Model | KSBB/BS type



Disc Assembly



Internal Structure

✦ **Pressure Vacuum Relief Valve** is designed to protect low pressure storage tanks from excessive pressure or vacuum created by thermal expansion (and contraction) and product movement into(out of) the tank and at the same time minimizing costly product evaporation/loss.

SETTING PRESSURE	WEIGHT LOADED MODEL	±20 mmW.C ~ +700/-430 mmW.C
	SPRING LOADED MODEL	+700/-430 mmW.C~ ±9,000 mmW.C
SIZE RANGE	DN 50 ~ DN 350 with ASME 150# flanges (different connections available on request)	
BODY MATERIAL	Aluminum, Carbon Steel, 304 Stainless Steel and 316 Stainless Steel with various trims (different materials available on request)	
RULES & CERT.	API 2000, ATEX	

# VALVE OPERATION & SIZING CALCULATION

## A. VALVE OPERATION

According to API 2000 code, the **Pressure vacuum relief valve** are designed, manufactured and tested. The Pressure Vacuum Relief Valves are used on liquid storage Tanks which designed by API 520/API 650 and Others process vessels or systems to prevent structural damage due to excess internal pressure or vacuum.

This valve has functions to intake the air under constant pressure during unloading and rising Temperature, and to discharge the overpressure generated during pouring the liquid and falling Temperature on storage tank. This is the safe valve to control the deflation(vacuum) and inflation(pressure) of several storage tanks.



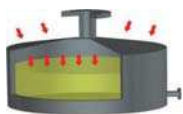
The function of prevention of natural evaporation of fluids

**THE EFFECT OF ENERGY REDUCTION** In case of gasoline, to minimize the natural evaporation of stores saves 98m<sup>3</sup> per year. (Based on the tank diameter: 30.4m x tank capacity 8690m)



The function of protection of over-pressure

**THE EFFECT OF PREVENTION OF EXPLORATION** With the exception of influx and efflux of stores, it is Kept always closed to prevent the diffusion of exploration into tank.



The function of protection of under pressure

**THE EFFECT OF PREVENTION OF CORROSION** (The effect of extension of life). To keep the stabilization of constant gas pressure generated pressure generated inside tank, prevents inside of the tank from corrosion by the temperature of gas.

**WHEN TANK IS UNLOADING PHENOMENA AND THE PRESSURE** is above the setting(operational fixing pressure), the Pressure Vacuum Relief Valves operates automatically to protect the storage tank from the deflation or malformation.

The weight loaded type models are designed to provide tank protections for both pressure and/or vacuum of set point to max 75/-43 mbarg.

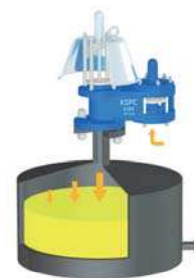
Over 75/-43 mbarg set point till 900/-900 mbarg, consider to be installed spring loaded type. Safety relief valve is not used in controlling the extra setting of pressure and consider Emergency vent for External fire and Rupture case.

The set point of Pressure vacuum relief valve is fixed by the customer's order or Project's Specification. but it is designed to adjust the pressure / vacuum setting in case. The way of change adds additional counter weight for Weight loaded type. The way of change for spring loaded as follow,

To increase the setting pressure turns the press. adjusting screw clockwise. To decrease the setting pressure turns the press. adjusting screw counter-clockwise. Before change set point of disc Assy, should be consulting the factory or our local representative.



Loading condition



Unloading condition



## B. VALVE SIZING CALCULATION

© Required Inbreathing and Out-breathing capacity for your applications should be determined by using API2000 standard.

**B-1 Total Out-breathing caused by liquid movement and vaporization**  
 - Liquid movement (section 3.3.2.2.1 in API 2000 7th)

$$\dot{V}_{op} = \dot{V}_{pff}$$

$\dot{V}_{op}$  : Out-breathing volumetric flow rate (Nm<sup>3</sup>/h of air) at the actual pressure and temperature conditions of the tank vapor space with a vapour pressure equal to or less than 5.0 kPa.

$\dot{V}_{pff}$  : Maximum volumetric filling rate (Nm<sup>3</sup>/h) of nonvolatile liquids.

$$\dot{V}_{op} = 2.0 \cdot \dot{V}_{pff}$$

$\dot{V}_{op}$  : Out-breathing volumetric flow rate (Nm<sup>3</sup>/h of air) at the actual pressure and temperature conditions of the tank vapor space with a vapour pressure greater than 5.0 kPa.

$\dot{V}_{pff}$  : Maximum volumetric filling rate (Nm<sup>3</sup>/h) of volatile liquids.

- Thermal effect (section 3.3.2.3.2 in API 2000 7th)

$$V_{OT} = Y \cdot V_{tk}^{0.9} \cdot R_i$$

Y : is a factor for the latitude.

(search for the number in the table. Refer API2000 3.3.2.3.2)

Latitude	Y-factor
Below 42°	0.32
Between 42° and 58°	0.25
Above 58°	0.2

$V_{tk}$  : is the tank volume. (m<sup>3</sup>)

$R_i$  : is the reduction factor for insulation.

$$R_{inp} = \frac{A_{inp}}{A_{tts}} \cdot R_{in} + \left(1 - \frac{A_{inp}}{A_{tts}}\right) R_{in} \frac{1}{1 + \frac{h \cdot l_{in}}{\lambda_{in}}}$$

There are three cases in getting  $R_i$ .

No. insulation :  $R_i=1$

Fully insulated :

- $h$  : The inside heat-transfer coefficient (W/m<sup>2</sup>·K)
- $l_{in}$  : the wall thickness of the insulation (m)
- $\lambda_{in}$  : The thermal conductivity of the insulation (W/m·K)

3) Partially insulated

- $A_{tts}$  : The total tank surface area (shell and roof) (m<sup>2</sup>)
- $A_{inp}$  : The insulated surface area of the tank (m<sup>2</sup>)

**B-2 Total In-breathing caused by liquid movement and vaporization**

- Liquid movement (section 3.3.2.2.1 in API 2000 7th)

$$V_{ip} = V_{pe}$$

$V_{pe}$  : Out-breathing volumetric flow rate (Nm<sup>3</sup>/h of air) at the actual pressure and temperature conditions of the tank vapor space with a vapour pressure equal to or less than 5.0 kPa.

$V_{ip}$  : Maximum volumetric filling rate (Nm<sup>3</sup>/h) of nonvolatile liquids.

- Thermal effect (section 3.3.2.3.2 in API 2000 7th)

$$\dot{V}_{it} = C \cdot V_{tk}^{0.7} \cdot R_i$$

C : is a factor that depends on vapour pressure, average storage temperature and latitude.

Latitude	C-factor for various conditions			
	Vapour pressure			
	Average storage temperature, °C			
	Hexane or similar		Higher than hexane, or unknown	
	<25	≥25	<25	≥25
Below 42°	4	6.5	6.5	6.5
Between 42° and 58°	3	5	5	5
Above 58°	2.5	4	4	4

$V_{tk}$  : is the tank volume. (m<sup>3</sup>)

$R_i$  : is the reduction factor for insulation. The way to calculate ' $R_i$ ' is equivalent to the method which is in the upper part of this page.

© The size of the valve shall be selected by comparing our certified flow / pressure drop diagrams with calculated inbreathing and out breathing.

- Check point

- 1) Set pressure : The adjusted pressure or vacuum which valve start to open.
- 2) Over pressure : Pressure increase at the valve inlet above the set pressure or vacuum.
- 3) Over pressure calculation

- Example.1

- Valve set pressure = 50mm.W.C
- Tank Design pressure = 80mm.W.C
- Max. allowable over pressure = 60% (80mm.W.C = 1.6times of 50mm.W.C)

- Example.2

- Valve set vacuum = -50mm.W.C
- Tank Design vacuum = -100mm.W.C
- Max. allowable over pressure = 100% (-100mm.W.C = 2times of -50mm.W.C)

- 4) Size select comparing flow/pressure drop diagram with calculated inbreathing and out breathing

- Example (Check figure 01 & 02)

- Calculated Out breathing = 500Nm<sup>3</sup>/hr
- Valve set pressure = 80mm.W.C
- Calculated Max. allowable over pressure = 60%

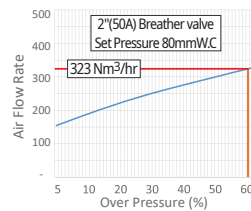


Figure 01  
 2" Valve flow capacity not enough to meet calculated Out breathing 500Nm<sup>3</sup>/hr

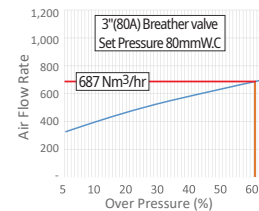


Figure 02  
 3" Valve flow capacity enough to meet calculated Out breathing 500Nm<sup>3</sup>/hr

- 5) According to API2000, The maximum overpressure shall be 2times of adjusted set pressure or vacuum. If the fully open position of the valve disc is not achieve at two times the adjusted valve set pressure, one step above size or additional measuring point(=additional valve) are required until the fully open position is reached to calculated in/out breathing.

\* Note : Direct-acting vent valve are typically available in size from 50mm to 350mm.



# VENT TO ATMOSPHERE PRESSURE VACUUM RELIEF VALVE

❖ Vent to ATM pressure vacuum relief valves are an advanced design for vent to atmosphere applications.

Designed manufactured and tested according to the API2000 code. It is a safety device made in response to the pressure and vacuum in the storage tank. Opening at accurate settings, it protects the tank from damages due to explosion and vacuum, minimizes the loss of product by preventing leakage of the tank and protects environment from poisonous gases.



Model | **KSPR type**

Pressure relief



Model | **KSPS type**

Pressure relief  
(Spring loaded type)



Model | **KSVR/VS type**

Vacuum relief



Model | **KSBB/BS type**

Pressure / vacuum relief



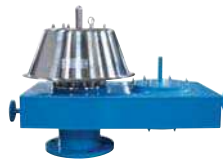
Model | **KSBBFI type**

Vent to ATM pressure /  
vacuum relief w /  
flame arrester



Model | **KSBBFH type**

Vent to ATM pressure /  
vacuum relief w /  
flame arrester



Model | **KSBBJ type**

Pressure vacuum relief w /  
steam jacket



Model | **KSBBFY type**

Pressure/  
vacuum relief w /  
dehumidifier



# **PIPE AWAY** **PRESSURE VACUUM RELIEF VALVE**

❖ Pipe away pressure vacuum relief valves are an advanced design for pipe away application.

Designed manufactured and tested according to the API2000 code. It is a safety device made in response to the pressure and vacuum in the storage tank. Opening at accurate settings, it protects the tank from damages due to explosion and vacuum, minimizes the loss of product by preventing leakage of the tank and protects environment from poisonous gases.



Model | **KSBD type**

Pressure relief  
Vacuum relief



Model | **KSDS TYPE**

Pressure relief  
Vacuum relief  
(Spring loaded type)



Model | **KSBG/BS type**

Pressure / vacuum relief



Model | **KSBGFI type**

Pipe away pressure /  
vacuum relief w /  
flame arrester



Model | **KSBGFH type**

Pipe away pressure /  
vacuum relief w /  
flame arrester



Model | **KSPO type**

Pressure Vacuum Relief Valve (Pilot Operated)  
\*Advantage : Fully open at 10% over pressure.  
Leakage rate of 0.015% Nm<sup>3</sup>/hr  
or less at 90% of set point.



# FLAME ARRESTER



Model | KFD type



Element



Internal Structure

❖ **Flame Arrester** is used for preventing flame transmission when an explosion is occurred inside of the piping which full of explosive mixed gas

OPERATING TEMPERATURE @ PRESSURE	+60 °C @ 0.11 Mpa
SIZE RANGE	DN 50 ~ DN 1000 with ASME 150# flanges (different connections available on request)
BODY MATERIAL	Aluminum, Carbon Steel, 304 Stainless Steel and 316 Stainless Steel with various trims (different materials available on request)
RULES & CERT.	ISO 16852, ATEX



# FLAME ARRESTER OPERATION & SELECTION

Flame arresters are passive devices with no moving parts. Flame arresters prevent the propagation of flame from the exposed side of the unit to the protected side by the use of wound crimped metal ribbon type flame cell element (Figure 03). This construction produces a matrix of uniform openings that are carefully constructed to quench the flame by absorbing the heat of the flame. This provides an extinguishing barrier to the ignited vapour mixture. Under normal operating conditions the flame



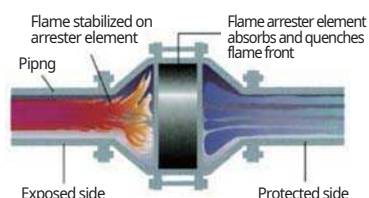
Figure 03

arrester permits a relatively free flow of gas or vapour through the piping system. If the mixture is ignited and the flame begins to travel back through the piping, the arrester will prohibit the flame from moving back to the gas source.

## Flame arrester operation

When the combusted gas pass through the heat exchange lattice net of the element bank of the flame arrester in inline Flame arrester type, the combusted gas ignited by the quenching is completely extinguished by lowering the temperature under below the natural ignition point. Thus, this item is designed to extinguish the fire automatically, and the heat is absorbed by the element bank of flame arrester and the fire cannot be spread.

## MESG (Maximum Experimental Safe Gap)



Measurement of the maximum gap between two equatorial flanges on a metal sphere that will prevent a flame from being transmitted from the sphere to the surrounding flammable mixture. MESG is dependent on gas composition, The stoichiometric mixture is used to determine the minimum MESG value for a given gas.

Range of application (marking)		Requirements for test mixture			
Explosion group	MESG of mixture mm	Gas type	Gas purity by volume %	Gas in air by volume <sup>2</sup> %	Safe gap of gas-air mixture mm
IIA1	≥1,14	Methane	≥98	8,4 ± 0,2	1,16 ± 0,02
IIA <sup>2</sup>	>0,90	Propane	≥95	4,2 ± 0,2	0,94 ± 0,02
IIB1 <sup>1</sup>	≥0,85	Ethylene	≥98	5,2 ± 0,2	0,83 ± 0,02
IIB2 <sup>2</sup>	≥0,75			5,7 ± 0,2	0,73 ± 0,02
IIB3 <sup>3</sup>	≥0,65			6,6 ± 0,3	0,67 ± 0,02
IIB1 <sup>1</sup>	≥0,50	Hydrogen	≥99	45,0 ± 0,6	1,16 ± 0,02
IIC	<0,50	Hydrogen	≥99	28,5 ± 2,0	1,16 ± 0,02

## Flame arrester selection

Flame propagation poses significant dangers to systems and personnel in industries worldwide. Careful consideration must be taken to determine whether to use a Flame Arrester or a Detonation Flame Arrester. There are two basic determinations when evaluating the intended application:

Q. The location of the ignition source from the flame arrester, and;

Q. What needs to be protected.

First, determine the location of all potential ignition sources (i.e. flare, vacuum pump, blower, burner, lightning strike, static discharge, etc).

Second, evaluate the system to determine exactly what should be protected (i.e., the gas source, process component, personnel, upstream process facility, tank, etc.).

When you have determined the ignition source(s) and what is to be protected, the following parameters should be evaluated in order to determine the appropriate flame arrestment protective device:

1. Length and configuration of pipe and pipe between ignition source and arrester.
2. System gas grouping.
3. Initial operating pressure.

## 4. Flame stabilisation on element.

All of these variables affect the performance of the arrester and can also affect the dynamics of flame propagation

### Inline and End of Line Applications

The inline flame arrester and the end of line (free vent) arrester are used to stop flame propagation of confined and unconfined low pressure deflagrations. They are typically used for limited piping applications when the system operating pressure is near atmospheric levels.

### Detonation application

The detonation flame arrester is an advanced technology flame arrester. They are used to stop the high pressures and velocities associated with detonation. They stop confined and unconfined low and high pressure deflagrations, stable and overdriven detonations. Application parameters for the detonation flame arresters far exceed those of flame arresters for pipe lengths, configurations, system operating pressures, and flame stabilization. Our flame arresters are designed, manufactured and tested according to BS7244, BSEN12874 and ISO16852 test standards and codes.

### System gas grouping

The type of gas in the system and its corresponding gas group determines the design of the arrester element. The SS316L element must be designed to accommodate the specific gas group that could possibly ignite and propagate in the system. The available designs consist of International Electric Code (IEC) group gases into IIB, IIA and IIC, the National Electric Code (NEC) groups gases into A, B, C and D categories depending on the MESG value of the gas.

## GAS GROUP CHART

### Group A

Acetylene

### Group B (IIC)

Butadiene  
Ethylene oxide  
Hydrogen  
Manufactured gases containing more than 30% Hydrogen (by volume)  
Propylene oxide  
Propyl nitrate

### Group C (IIB3)

Acetaldehyde  
Cyclopropane  
Diethyl ether  
Dimethylhydrazine  
Ethylene  
Hydrogen sulfide  
\*Methanol (methyl alcohol)  
Methyl mercaptan  
Unisymmetrical dimethyl hydrazine  
UDMN)

### Group D (IIA)

Acelone  
Acrylonitrile  
Ammonia  
Benzene  
Butylene  
1-Butanol (butyl alcohol)  
2-Butanol (secondary butyl alcohol)  
Cyclohexane  
N Butyle acetate  
sobutyl gacetate  
Ethone. echoll  
Ethanol (ethyl alcohol)  
Ethyl acetate.  
Ethyl acrylate  
Ethylene dichloride  
Gasoline  
Heptanes  
Hexanes  
soprene  
Methane (natural gas)  
Methyl acrylate  
Methylamine  
Methyl ethyl ketone  
Methyl mercaptan

### Group D (IIA) (continued)

3-Methyl-1-butanol  
isoamyl alcohol)  
Methyl isobutylketone  
2-Methyl-1 propanol  
isobutyl alcohol)  
Methyl-2-propanol  
tertiary butyl alcohol  
Naphtha (petroleum)  
N Propyl acetate  
Octanes  
Pentanes  
1-Pentanol (amyl alcohol)  
Propane  
1-Propanol (propyl alcohol)  
2-Propanol (isopropylalcohol)  
Propylene  
Styrene  
Toluene  
Turpentine  
Vinylacetate  
Vinyl chloride  
Xylenes

# DEFLAGRATION FLAME ARRESTERS

❖ Deflagration flame arrester is used for protect storage tank from deflagrations.



Model | **KSFI type**

Inline flame arrester  
Possible to install vertically  
and horizontally



Model | **KSFE type**

End line flame arrester  
Should be installed vertically



Model | **KSFH type**

Inline flame arrester  
Possible to install vertically  
and horizontally



Model | **KSFL type**

Inline flame arrester  
Should be Install horizontally



Model | **KSFIJ type**

Flame arrester w/  
steam jacket



Model | **KSFT type**

Inline flame trap



Model | **KSFI-A**

Inline flame arrester,  
possible to install vertically  
and horizontally



Model | **KSFE-S type**

End line flame arrester, Should  
be installed vertically



Model | **KSFE-A type**

End line flame arrester, Should  
be installed vertically





# **DETONATION FLAME ARRESTERS**

- ❖ Detonation flame arresters provide positive protection against flame propagation in piping systems that are manifolded or have long runs.

The arresters are designed to stop and ignited flammable vapour mixture travelling at subsonic or supersonic velocities.

They are also designed to protect against continuous burning against the 316LSS flame cell elements for a specific period



**Model | KFD type**

Inline flame arrester  
Possible to install vertically and horizontally



**Model | KSFLD type**

Inline flame arrester  
Should be installed horizontally



**Model | KSFD type**

Inline flame arrester  
Should be installed horizontally



**Model | KSFM type**

Inline flame arrester  
Should be installed right angle pipe line

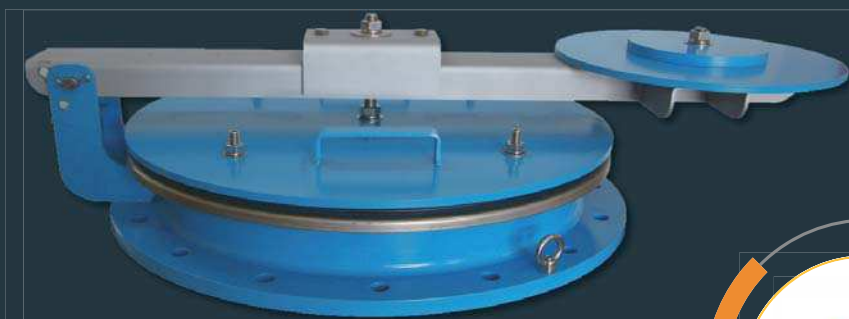


**Model | KSFD-A type**

Inline detonation flame arrester,  
Possible to install vertically and horizontally



# EMERGENCY RELIEF VALVE



Model | KSEPK type



Disc Assembly



Self Closing

❖ **Emergency relief valve** open to greatly increase the venting capacity of petroleum storage tanks when the internal pressure rises above the set point. it remains closed tightly when internal pressure below the settings.

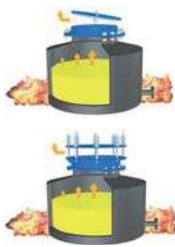
SETTING PRESSURE	WEIGHT LOADED MODEL	+50 /-25 mmW.C ~ ±700 mmW.C
	SPRING LOADED MODEL	+700/-20 mmW.C ~ ±9,500/-700 mmW.C
SIZE RANGE	DN 400 ~ DN 750 with ASME 150# or API 650 flanges (different connections available on request)	
BODY MATERIAL	Aluminum, Carbon Steel, 304 Stainless Steel and 316 Stainless Steel with various trims (different materials available on request)	
RULES & CERT.	API 2000, ATEX	

# VALVE OPERATION & SIZING CALCULATION

## A. Valve operation

Emergency relief valve is the safety valve to protect the storage tank from the inflation (pressure) with the function to discharge rapidly the overpressure developed during external fire around the storage tank or the Excessive fluid intake more than the capacity of pump planned.

Emergency relief valve is designed to be Cushioned air seating, Teflon (PTFE/FEP-2 Layer) seating diaphragm are Standard. It minimize sticking caused by resinous vapors and atmospheric moisture. The Seat tightness is 75% of set point by API 2000. It is designed to be self closing under normal operation by Internal Guide & external Hinge and the restraining cable to Connect the Cover assembly and Flanges also serve a grounding cable.



The Emergency relief valve provides pressure / or vacuum relief when the tank is loading phenomena and external fire or Rupture cases also the pressure is above the setting (Operational Fixing pressure), the Emergency relief valve operate automatically to protect the storage tank from inflation.

The weight loaded type model max. set point is 70/-43mbarg and spring loaded type is till 900/-900 mbarg.

## B. Valve Sizing

Where the fluid properties are similar to those of hexane, the required venting capacity can be determined as table 03.

If the height of the tank exceeds 9.14 meters, use the same number to the tank which is higher than 9.14 meters for calculation. If wetted surface area is wider than 260 m<sup>2</sup>, there are two cases. Refer to the following table 01.

Wetted surface area <i>A<sub>TWS</sub></i> , m <sup>2</sup>	Design pressure kPa (gauge)	Required Venting Calculation Nm <sup>3</sup> /h of air
<260	≤103.4	See table 03
≥260	≤7	19910
≥260	>7 and ≤103.4	$q = 2082 \cdot F \cdot A_{TWS}^{0.82}$

Table 01

$$A_{TWS} = \pi \cdot D \cdot L \quad A_{TWS} = \pi \cdot D \cdot L \cdot 9.14$$

(In case of L < 9.14 meters)                      (In case of L > 9.14 meters)

Where the fluid properties are other than hexane, the required venting capacity can be calculated given by below equation.

$$q = 906.6 \cdot \frac{Q \cdot F}{L} \cdot \left(\frac{T}{M}\right)^{0.5}$$

- Q* is the heat input from fire exposure as given by Table 02, expressed in watts.
- F* is the environmental factor from table 09 (API 2000 Clause 3.3.3.3.2).
- L* is the latent heat of vaporization of the stored liquid at the relieving pressure and temperature, expressed in joules per kilogram.
- T* is the absolute temperature of the relieving vapor, expressed in kelvins
- M* is the relative molecular mass of the vapor

Wetted surface area <i>A<sub>TWS</sub></i> , m <sup>2</sup>	Design pressure kPa (gauge)	Heat Input, <i>Q</i> W
<18.6	≤103.4	63,150 <i>A<sub>TWS</sub></i>
≥18.6 and <93	≤103.4	224,200 * ( <i>A<sub>TWS</sub></i> <sup>0.566</sup> )
≥93 and <260	≤103.4	630,400 * ( <i>A<sub>TWS</sub></i> <sup>0.388</sup> )
≥260	>7 and ≤103.4	43,200 * ( <i>A<sub>TWS</sub></i> <sup>0.82</sup> )
≥260	≤7	4,129,700

Table 02

Wetted area <sup>a</sup> (Square meters)	Venting Requirement (Nm <sup>3</sup> /h)	Wetted area <sup>a</sup> (Square meters)	Venting Requirement (Nm <sup>3</sup> /h)
2	608	35	8086
3	913	40	8721
4	1,217	45	9322
5	1,521	50	9895
6	1,825	60	10,971
7	2,130	70	11,971
8	2,434	80	12,911
9	2,738	90	13,801
11	3,347	110	15,461
13	3,955	130	15,751
15	4,563	150	16,532
17	5,172	175	17,416
19	5,780	200	18,220
22	6,217	230	19,102
25	6,684	260	19,910
30	7,411	>260 <sup>b</sup>	-

Table 03

The size of the valve shall be selected by comparing our certified flow / pressure drop diagrams with calculated inbreathing and out breathing.

### Check point.

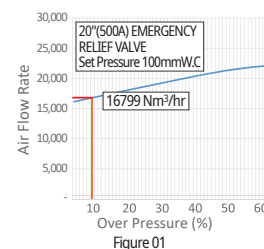
- 1) Set pressure : The adjusted pressure or vacuum which valve start to open.
- 2) Over pressure : Pressure increase at the valve inlet above the set pressure or vacuum.
- 3) Overpressure calculation

### Example

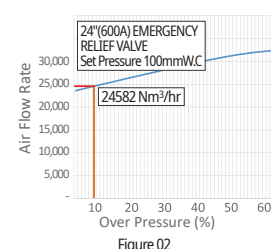
- Valve set pressure = 100mm.WC(90% or same as tank design pressure)
- Tank Design pressure = 100mmWC
- Max. allowable over pressure = 10%(Emergency relief valve set pressure is usually 90% or same as Tank design pressure hence max. allowable design pressure is 10% generally) Size select comparing flow/pressure drop diagram with calculated emergency out breathing.

### Example (Check figure 01 & 02)

- Calculated Out breathing = 19,910Nm<sup>3</sup>/hr
- Valve set pressure = 100mmWC
- Calculated Max. allowable over pressure = 10%



20" Valve flow capacity not enough to meet calculated Out breathing 19,910Nm<sup>3</sup>/hr



24" Valve flow capacity enough to meet calculated Out breathing 19,910Nm<sup>3</sup>/hr





## WEIGHT LOADED TYPE



Model | **KSEP type**

Pressure relief



Model | **KSEPK type**

Pressure relief  
Hinged type  
- closed automatically



Model | **KSEV type**

Pressure / vacuum relief



Model | **KSEVK type**

Pressure / vacuum relief  
Hinged type  
- closed automatically



Model | **KSEVJ type**

Pressure /  
vacuum relief w /  
steam jacket



Model | **KSEPW type**

Pressure relief  
Water seal type  
- zero leakage at set point

## SPRING LOADED TYPE



Model | **KSES type**

Pressure relief



Model | **KSESV type**

Pressure / vacuum relief

# NITROGEN BLANKETING VALVE



Model | DST100/200 type

✦ **Nitrogen Blanketing Valve** helps gas pressure to maintain In constant state in the vapour space of storage tanks.

When liquid run out from storage tanks or vacuum state take place because of temperature dripping, N2 blanketing Valve has a ability of control desired pressure within the fixed limits.

Besides about subjects, prevents air and humidity from entering into storage tank, so it can preserve product, and also protect from a fire.

It protects the tank from explosion by restriction spark. It prevents the outflow of fluid by evaporation.

## • DIMENSION TABLE

SIZE	DST-100			DST-200	
	½"	¾"	1"	1½"	2"
N.D	15	20	25	40	50
A	290	290	290	340	340
Approx. H	355	355	355	415	415

NOTE Standard Connection(ANSI 150LB flange) and JIS or different types are available upon request.

## • GENERAL SPECIFICATION

MODEL	DST-100	DST-200
SIZE	½" ~ 1"	1" ~ 2"
SET PRESSURE	30 ~ 5000mmW.C	
CONNECTION	FNPT / ANSI 150# & 300#, Etc	
MATERIAL	SS304, SS316, Etc.	
USED GAS	N2 (Nitrogen)	
SENSING PORT	NPT½"	

## • TECHNICAL SPECIFICATION

SET PRESSURE		MINIMUM INLET PRESSURE	TEMP.
1.2 ~ 1.4" W.C	1.3 ~ 3.1 psi		
3.5 ~ 10" W.C	2.3 ~ 3.5 psi		
8 ~ 18" W.C	3.0 ~ 6.0 psi		

## GAUGE HATCH COVER & SLOT DIPPING DEVICES



Model | KSEVK type

Operating pressure  
- 0.01 kg/cm<sup>2</sup>



Model | KSGH type

Operating pressure  
- 0.03 kg/cm<sup>2</sup>



Model | KSSD-A type



Model | KSSD type



Model | T-2000-TSS-01 type

∴ **KSPC's Sampling and Gauging Hatch Cover** is designed to provide quick access for product gauging, temperature measurement or sampling.

∴ **KSSD Series Sampling Device** is designed for gauging the height of liquid levels, measuring the depth of water bottoms, taking temperature, and taking sample of liquids held in storage tank, without relieving pressure within the tank.

## VACUUM BREAKER & AIR RELEASE VALVE



Model | KSVBJ type

∴ **Air release valve** is designed to release accumulated air pockets from the system, while pressured pipelines. Air pockets increase energy consumption because pumping operation will be at higher water heads to overcome pressured air. Air release valves are have function to protect high shock and surge pressure, water hammer and liquid overflow from fresh or sea water pipelines.



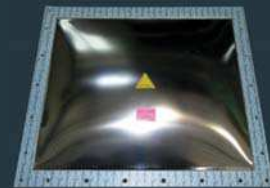
# RUPTURE DISC



Rupture Disc holder and disc assembly



Rupture Disc



Explosion Panel

✦ **A Rupture Disc** is a non-mechanical safety device to relief when it is occurred that excessive pressure is over the critical pressure in a pressure system

✦ **When is it required a Rupture Disc?**

- In case of a rapid rise in pressure as a result of runaway reaction and so on
- In case that there is any concern that fixtures cause other safety device malfunction
- In case that any leakage is not permitted
- In case that it contains strong corrosive fluid
- In case that it requires large relieving capacity in an instant by polymerization and so on
- Severe conditions such as high or low temperature

✦ **Features**

- Special material and structure (It is easy to select material and is economical) And there is no size limit
- Constant rupture performance and release all of fluid
- Instantaneous release of maximum capacity
- Extensive service environment (strong corrosive fluid, temperature, liquid, gas, powder, etc.)
- Zero Leakage
- Extension of safety valve life
- Possible to check the Piping of outlet during operating
- Extension of overhaul period
- Easy to handle and cost reduction

✦ **Applicable Code**

- ASME Sec. VIII Div.1
- ISO 6718
- ISO 4126-2-6
- API RP520
- KOSHA Safety Certification

✦ **When is it required a Rupture Disc?**

- Stainless Steel (304SS, 316SS, 317SS, etc)
- Carbon Steel
- Duplex
- Aluminum
- Nickel, Inconel, Monel, Hastelloy, Titanium, Tantalum
- Graphite
- Teflon
- Maximum usable Temperature

Teflon	200 °C	Monel	483 °C
Aluminum	120 °C	Inconel	592 °C
Stainless Steel	483 °C	Hastelloy	483 °C
Nickel	403 °C	Graphite	371 °C

✦ **Application of Rupture Disc**

1) Primary Case



2) Secondary Case



3) Combination Case



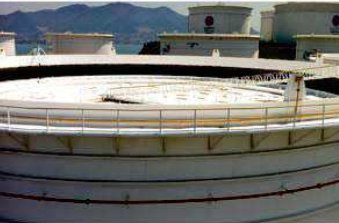
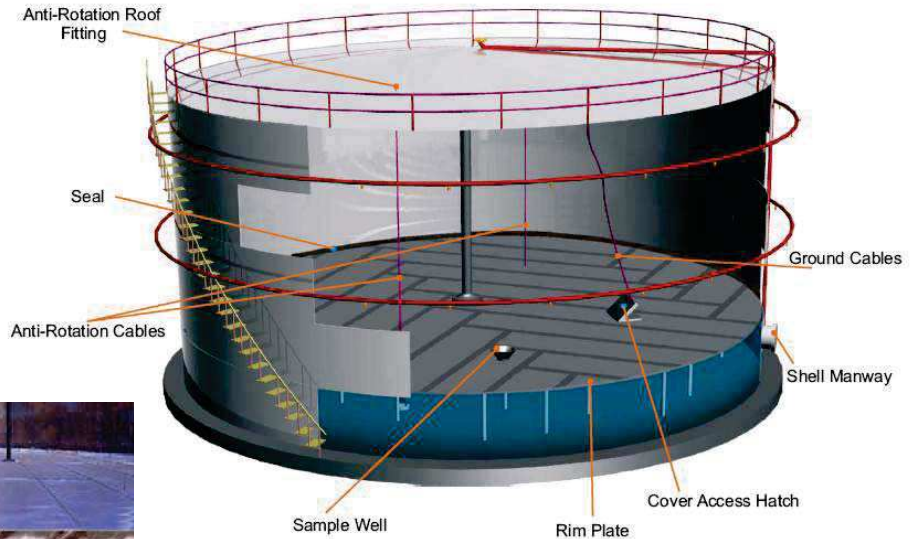
4) External Fire Case



# Above Ground Storage Tank

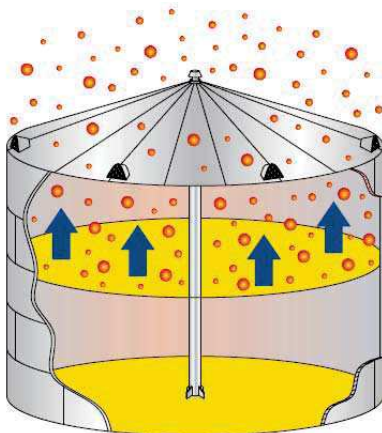
## General of Internal Floating Roof

- Emission from organic liquids in storage occur because of evaporative loss of the liquid during its storage and as a result of changes in the liquid level.
- The emission sources vary with tank design as does the relative contribution of each type of emission source
- Tank Works products understand vapor loss mechanisms and are one of the best methods to reduce vapor evaporation and organic liquids emission.

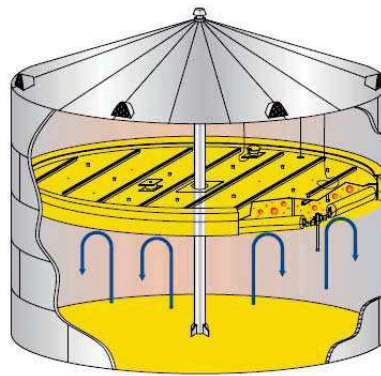


## Storage Tank Protection Equipment

- Internal Floating Roofs
- External Floating Roofs Seal
- Aluminum Dome Roof
- Drain System
- Floating Suction & Oil Skimmer
- Tank Fitting



Vapor Loss without Floating Roof



Vapor Prevention with Floating Roof

SAFETY IS THE FIRST & MOST IMPORTANT



# SERVICE SOLUTION



# GOODS PRODUCTS





# KSPC PROJECT REFERENCE LIST

F.Y.	Client Name	Project Name / EPC
MAR 2020	Thai Rotary Engineering Public Co., Ltd	P11P4358_END LINE PRESSURE VACUUM RELIEF VALVE
FEB 2020	Milott Laboratories Co., Ltd.	Flame Arrester 2" / 5 SETS
FEB 2020	GC Maintenance and Engineering Co., Ltd. (GCME)	SD-20-19269_Refined Glycerine II FEED (OSBL) Verification Project
JAN 2020	Bangchak Biofuel Company Limited	Bangchak Refined Glycerin Plant Project - Instrument on Top Tank Lot 2
DEC 2019	PTT Global Chemical Public Co., Ltd.	10641641_PTT GC#6_ Pressure Vacuum Relief Valve
DEC 2019	Bangchak Biofuel Company Limited	Bangchak Refined Glycerin Plant Project - Instrument on Top Tank
DEC 2019	Sutee Dished Heads and Metal Form Co., Ltd.	JA-62/0161 Pressure Vacuum Relief Valve 2" / 7 Sets
NOV 2019	Thai Rotary Engineering Public Co., Ltd	P11P3996 MR187675 Pressure Vacuum Relief Valve & Gauge Hatch
SEP 2019	LCB Corporation Company Limited	Emergency Vent Cover 24" and Slot Dipping Device 8"
AUG 2019	Solvay ( Bangpoo ) Specialty Chemicals Ltd.	PVRV with FA for tank PVRV T-306 and T-364
AUG 2019	Thai Sugar Ethanol Company Limited	100,000 LPD Fuel Grade Ethanol Plant (Phase II) Project
JUL 2019	TTCL Public Company Limited	D189 Olefins Reconfiguration Project (ORP)
JUL 2019	Solvay (Bangpoo) Specialty Chemicals Ltd.	Vacuum Relief Valve Model : KSBG TYPE 3"
JUL 2019	PTT Global Chemical Public Co., Ltd.	D189 Olefins Reconfiguration Project (ORP) By TTCL Public Co.,Ltd.
MAY 2019	PTT Global Chemical Public Co.,Ltd.	Project: 10534425 : 1010253266 / I1
MAY 2019	PM SILALERT Co.,Ltd.	Project CUP4 phase1 GPSC
APR 2019	SCG Chemical (MOC plant.)	Emergency Pressure / Vacuum Relief Valve 24"
MAR 2019	Thai Tank Terminal	PO & POLYOLS_PIP3351 PROJECT By Thai Rotary Engineering
MAR 2019	PTT Phenol Co.,Ltd.	PVV-12-0301 and Emergency Manhole at TK-1201
FEB 2019	Almendra (Thailand) Ltd.	N2 BLANKETING VALVE 1/2" DST 100 TYPE
FEB 2019	IRPC Public Company Limited.	EMERGENCY VENT VALVE_KSPC PG 220
JAN 2019	SCG Chemicals Co.,Ltd.	I-18-092 TPE_HD3 LP Loading Safety Improvement
DEC 2018	PTT Global Chemical Public Co.,Ltd.	10460961//EMERGENCY RELIEF VALVE 24"KSEPK TYPE
DEC 2018	PTT Global Chemical Public Co.,Ltd.	D189 Olefins Reconfiguration Project (ORP) By TTCL Public Co.,Ltd.
DEC 2018	Gulf SRC Company Limited (GSRC)	GED GSRC New CCPP Project By Best Tech & Engineering
NOV 2018	Global Chemical Co.,Ltd.	KSBSFI TYPE & KSGH TYPE 4" By Phenix Engineering
AUG. 2018	Global Green Chemicals Public Co.,Ltd.	Methyl Ester Plant II Project By K THAI CONTRACTOR
AUG. 2018	UBE Group (Thailand) Co.,Ltd.	PC-18031, SVR
AUG 2018	Thai Rotary Engineering Public Co.,Ltd.	B11P2953 : Request urgent quotation for PVRV
AUG 2018	IRPC Public Company Limited	1100097375: Emergency Vent Valve 20"
AUG 2018	Henkel (Thailand) Ltd.	Henkel Project By Technical system engineering
JUN 2018	SCG Chemicals Co.,Ltd.	Redundant Naphtha Andpygaspipeline Project

# History:

2019  
-  
2020



Provide the special list - service training Elmess factory / ULEZEN in Germany.)  
Product KSPC / certified ATEX / Ex for Breather Valves and Flow laboratory third party.  
- Setting up New Rayong Branch Office

2018



9 September 2018  
"Anniversary 10<sup>th</sup> Years"  
AURORA WORKS CO., LTD

2017



New Office  
AURORA WORKS CO., LTD.  
(Head Office)  
888/24 Soi Prachauthit 86  
Thung Khru, Bangkok 10140

2016



Add on Representative Agent with:  
- SKS Control / Finland

2015



Add on Representative Agent with:  
- Delta Control / UK  
(Pressure solution)

2014



Add on Representative Agent with:  
- Fossil / Canada (Level solution)  
- Barton Firtop / UK  
(Mechanical solution)  
- Simco / UK (Level solution)

2013



Add on Representative Agent with:  
- FC Korea / Korea  
(Flow meter solution)  
- Technical / Italy  
(Valves solution)

2012

Expansion head office for Training center for instrumentation & tank protection device program.

Add vendor lists customer more than 50 accounts in Thailand

- PTT ME                      - PTT GC  
- PTT PLC                    - PTT EP  
- SCG Chemical            - CBES Group  
- Bang Chak Petrochemical

Coverage with EPC in Thailand

- Thai Rotary  
- Unimit Engineering  
- Foster Wheeler  
- TRC

Training Tank protection device program

- Toyothai  
- Thai Rotary  
- IRPC / Lube tank farm  
- PTT GC / Tank farm AR1

2011



Setting up "Rayong Branch Office" to coverage of sales market in Petro chemical Oil & Gas industries



Aurora Works Co., Ltd agreement with KSPC company (Korea) to start up "Exclusive Distributor agent of KSPC" (Tank protection device) in Thailand

2010

Add vendor lists with Key-account customer:

- Glow Energy            - EGAT  
- PTT AR                    - TIG  
- IRPC                        - TPI Polene  
- PTT Chemical          - Unilever  
- PTT PE

2009



Representative of authorization industrial products:

- Elmess / Germany  
- GSI / USA  
- NEW FLOW / Taiwan  
- Temperature Control / Australia

2008

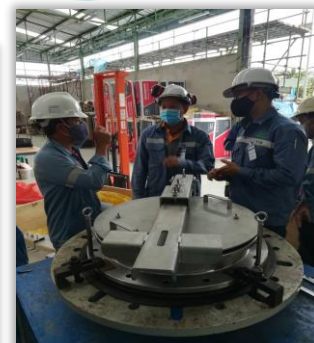
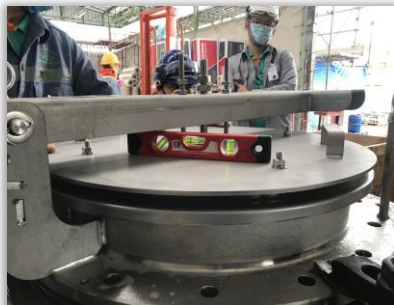


First Established as Aurora Works co., ltd. In the Business of sale and service to Industrial products and consultants





# MECHANICAL & INSTRUMENT SERVICE SOLUTION







## About Us

Aurora Works Co., Ltd. was established in 2008 with more than 10 years' experience in petrochemical oil & gas, Power plant, cement plant, pulp & paper in Thailand markets.

With representative & distribution, and services of instrumentation, electrical, mechanical c/w valves solution, Such as; Tank protection device, Water level detection products, Flow, Temperature, Pressure, Control Valve and cover engineering service.

## Mission

Be recognized as the leading supplier in delivering smarter of Tank protection devices & instrumentation and solutions.

Aurora Works is the exclusive distributor for K.S.P.C. (Korea), Fossil (Canada), Klopper (Germany), EPIC-SKS (Finland), Elmess (Germany), Barton Firtop (UK), Delta Mobrey (UK), Simco (UK), Technical (Italy), and MAX MÜLLER (Switzerland).

## Vision

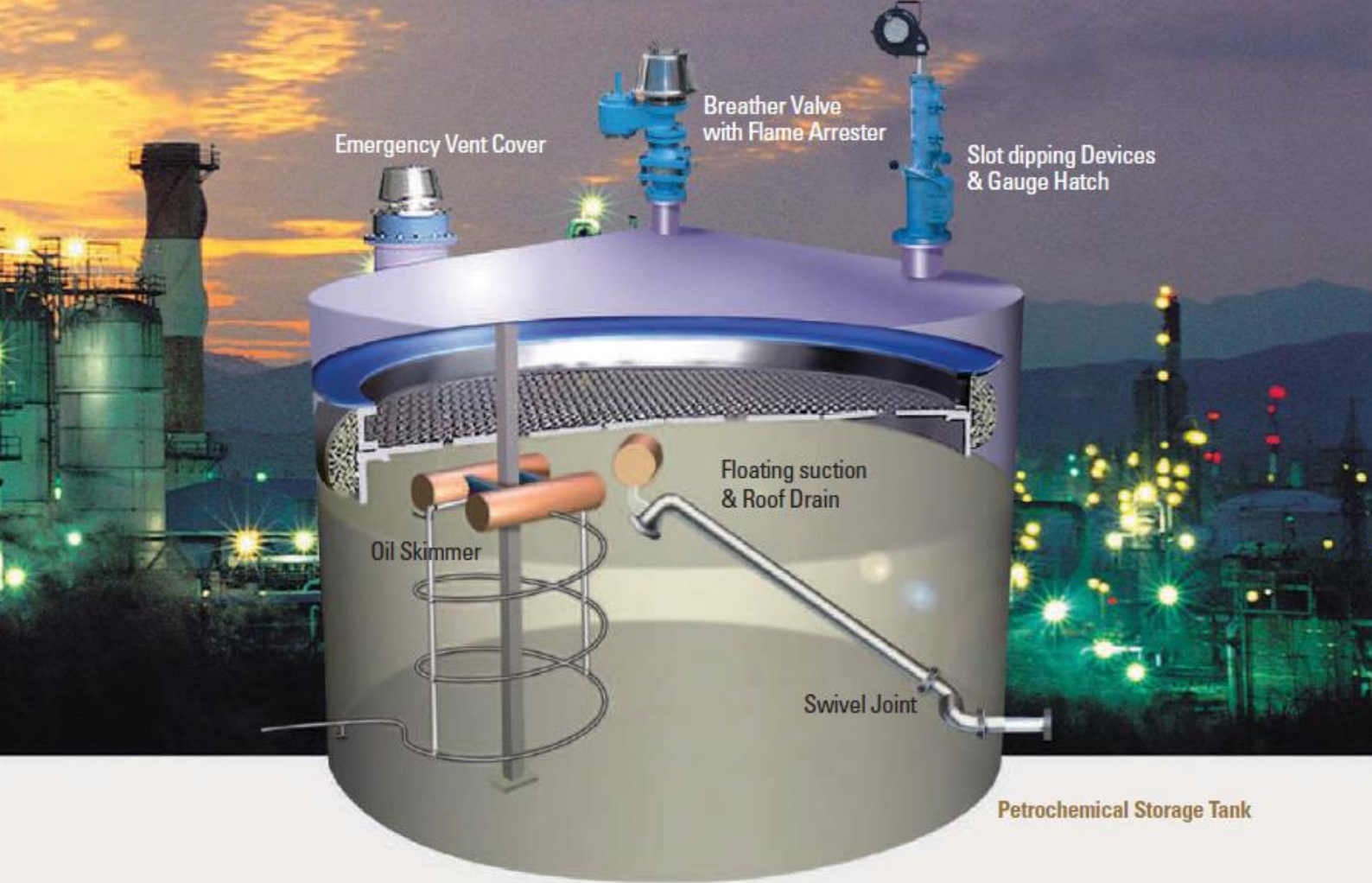
To deliver superior customer services and solutions to our customers effectively and efficiently.

## HEAD OFFICE - BANGKOK



## NEW BRANCH OFFICE - RAYONG





## PRODUCTS & SERVICES

### PRODUCTS AUTHORIZATION

- |                   |                                 |             |
|-------------------|---------------------------------|-------------|
| 1. KSPC           | Tank Protection Devices         | Korea       |
|                   | (API2000)BS7244 and BSEN 12874) |             |
| 2. Fossil         | High pressure water             | Canada      |
|                   | Column LG.                      |             |
| 3. Delta Mobrey   | Pressure Transmitters           | UK          |
| 4. Barton Firtop  | Basket Strainer                 | UK          |
| 5. Technical      | Safety Valves (API 526)         | Italy       |
| 6. Simco          | Reflex/Transparent              | UK          |
|                   | Magnetic Level (Premium grade.) |             |
| 7. Elmess         | Submersible Heater              | Germany     |
| 8. Klopper        | Heater Tracing System           | Germany     |
| 9. Lapp Automatic | Thermocouple, RTD               | Finland     |
| 10. Max Müller AG | Process illumination            | Switzerland |

### SERVICE DEPARTMENT

1. Calibrate and inspection test PVRV (Breather valves, ERV, Blanketing regulator) following API2000
2. FAT / SAT and commissioning Electric – heater (Exd.) / Blower heater + control panel unit.
3. Calibrate field instruments such as; Pressure / Temperature Gauge, Transmitter, Controller & switches and safety valves following (API 527).
4. Retrofit YARWAY ports glass, Clark reliance conductivity probes to FOSSIL / New installation & Replacement maintenance.
5. Preventive maintenance UPS and battery under APC brand
6. PLC programmer project
7. Training for API 2000 for low pressure venting



## Aurora Works Co., Ltd.

E-mail: [info@aurora-works.com](mailto:info@aurora-works.com) | <http://www.aurora-works.com>

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