

บริษัท เอเชีย เคมิคอล แอนด์ เอ็นจิเนียริง จำกัด  
ASIAN CHEMICALS & ENGINEERING CO., LTD.  
205, Mah 3, Thapae Rd., K.M.10, Bangkok 10642, Thailand  
Tel: +66 (0) 2746 7646 Fax: +66 (0) 2745 1211 Email: info@asec.co.th



### Acceptance Test Procedures

#### Purpose:

For testing the efficiency of ammonia scrubber

#### Steps in system testing:



FOR THE CUSTOMER'S CONSIDERATION  
OF DELIVERY, THE CUSTOMER SHALL  
BE RESPONSIBLE FOR THE FOLLOWING:  
1. THE CUSTOMER SHALL NOT SIGN THE  
COMPLIANCE WITH CONTRACTUAL  
OBLIGATIONS.  
☒ 1. REVERSE AND ACCEPTED, MAKE LAMP PROCEED  
☐ 2. PLEASE RETURN DOCUMENT AFTER  
RESPONDING OUR COMMENTS, WORKING  
PROCEED ON BASIS OF REVIEW DOCUMENTS  
☐ 3. PLEASE RETURN DOCUMENT AFTER  
RESPONDING OUR COMMENTS, WORKING  
PROCEED ON BASIS OF REVIEW DOCUMENTS



บริษัท เอเชีย เคมิคอล แอนด์ เอ็นจิเนียริง จำกัด  
ASIAN CHEMICALS & ENGINEERING CO., LTD.  
205, Mah 3, Thapae Rd., K.M.10, Bangkok 10642, Thailand  
Tel: +66 (0) 2746 7646 Fax: +66 (0) 2745 1211 Email: info@asec.co.th



### Performance Testing

No.	Test Description	Design	Test	Remark.
1				
2				
3				

Remark: This efficiency has designed for normal inlet temperature. It can not work at high temperature because  $\text{NH}_3$  can be absorbed by water solution at 60 °C max.



# ASIAN CHEMICAL & ENGINEERING CO., LTD.

CUSTOMER	: THAI ETHANOLAMINES CO., LTD.
PROJECT NAME	: AMMONIA SCRUBBER PACKAGE
PRODUCTION	: SCRUBBER
SERIAL NUMBER	: A-2014

## A-2014 INSTRUMENT DATA SHEET

### DESIGN CRITERIA / PERFORMANCE

TYPE OF ABSORPTION TOWER	: VERTICAL SCRUBBER, COUNTER-CURRENT FLOW
SUPERFICIAL VELOCITY	: 0.076 m/sec
CONTACTING TIME	: 193.32 sec
LIQUID / GAS RATIO	: 67.53 for Normal Case/ 1406.87 for Max. Case
DESIGN PRESSURE	: 3.5 / FULL VACUUM kg/cm <sup>2</sup> (g)

### CONSTRUCTION

MODEL / BRAND	: SDV 900-3000, ACE
DIAMETER	: 900 mm
HEIGHT	: 7.043 m
SUCTION SIZE	: 50, 50 AND 100 mm
DISCHARGE SIZE	: 200 mm
MATERIAL OF STRUCTURE	: STEEL

### ACCESSORIES

ZACKING	
TYPE	: PALL RING
MATERIAL	: STAINLESS STEEL
SIZE	: 25 mm

### SPRAY NOZZLES

TYPE	: FULL CONE NOZZLE
MATERIAL	: STAINLESS STEEL
SPRAY ANGLE	: 190°
MALE PIPE SIZE	: 1/2"
CAPACITY	: 40 L/min @ 0.2 bar
MODEL / BRAND	: 1/2 HH51-SS 150 (20) SPIRAL JET
MALE PIPE SIZE	: 1/2"
CAPACITY	: 167 L/min @ 0.7 bar
MODEL / BRAND	: 1 HH51-SS 150 (40) SPIRAL JET

D	11/07/2008	CHANGED SERIAL NUMBER	R.W.	J.W.		REV.	SHEET
C	10/06/2008	RE ISSUE	R.W.	J.W.			
REV.	DATE	DESCRIPTION	BY	CHKD		D	1 OF 1

# ASIAN CHEMICAL & ENGINEERING CO., LTD.

CUSTOMER	: THAI ETHANOLAMINES CO., LTD.
PROJECT NAME	: AMMONIA SCRUBBER PACKAGE
PRODUCTION	: FRESH WATER TANK
SERIAL NUMBER	: D-2010

## A-2014 INSTRUMENT DATA SHEET

### SPECIFICATION

TYPE	: VERTICAL CYLINDER TANK
CAPACITY	: 10,000 LITER
DIAMETER	: 2,000 mm
HEIGHT	: 3,200 mm
MODEL / BRAND	: SVID 10/2000, ACE

### MATERIAL

CORROSION BARRIER	: ORTHOPHTHALIC RESIN
STRUCTURAL LAYER	: ORTHOPHTHALIC RESIN

D	11/07/2008	CHANGED SERIAL NUMBER	R.W.	J.W.		REV.	SHEET
C	10/06/2008	RE ISSUE	R.W.	J.W.			
REV.	DATE	DESCRIPTION	BY	CHKD		D	1 OF 1





บริษัท เอเชีย เคมีคอล เอ็นจิเนียริ่ง จำกัด  
**ASIAN CHEMICALS & ENGINEERING CO., LTD.**  
 105 Moo 5, Tripath Rd., K.M.10, Bangplee-Yot, Bangkok, Bangkok 10510  
 105 Moo 5 ถนนพหลโยธิน กม.10 แขวงคลองจั่น เขตจตุจักร กรุงเทพฯ 10510  
 Tel: +66 (0) 2759 7500 Fax: +66 (0) 2759 7511 Email: info@aceco-dh.com



www.aceco-dh.com

## A-2014 General Description



บริษัท เอเชีย เคมีคอล เอ็นจิเนียริ่ง จำกัด  
**ASIAN CHEMICALS & ENGINEERING CO., LTD.**  
 105 Moo 5, Tripath Rd., K.M.10, Bangplee-Yot, Bangkok, Bangkok 10510  
 105 Moo 5 ถนนพหลโยธิน กม.10 แขวงคลองจั่น เขตจตุจักร กรุงเทพฯ 10510  
 Tel: +66 (0) 2759 7500 Fax: +66 (0) 2759 7511 Email: info@aceco-dh.com



www.aceco-dh.com

## AIR POLLUTION CONTROL SYSTEM A-2014 AMMONIA SCRUBBER PACKAGE

### Introduction

Air pollution has been a significant aspect in Thailand and risky for human being. Contaminants are fumes, toxic gas molecules, particulates, smoke etc. Pollution control system is then needed to treat the contaminant to improve air quality.

The wet scrubber is a gas absorption unit which is used as an air pollutant emission treatment by physical and/or chemical mechanism. This system is the most effective and inexpensive with high loading concentration and volume of air pollutant.

### Process Description

Gas absorption is where a chemical species (or several species's) in the gas phase is removed by contacting the gas with a liquid phase in which the species is (or the species are) soluble. Mass transfer can occur via two different fundamental mechanisms, chemical species from the gas phase transfer to the liquid phase. It is important to choose a solvent in which the solubility of the gas is high. This will increase the rate of absorption and decrease the amount of solvent required. Sometimes high solubility is caused by a reaction, between the gas and the liquid, but if either the chemical species transferred or the solvent is to be recovered the reaction must be reversible.

Absorption of odorant like AMMONIA is a mass - transfer process, where the odorant designed scrubbing system will have a capacity of treating 35.54 CMH. This system designed on one stage operation consisting of vertical packing tower which has main equipment, recirculation pump, exhaust fan and instrument. In this case, the waste gas (AMMONIA) will be absorbed by fresh water in packed tower.

Ammonium hydroxide is a weak base that is partially ionized in water according to the equilibrium:





บริษัท เอเชียเอ็น เคมีคอล แอนด์ เอ็นจิเนียริง จำกัด  
**ASIAN CHEMICALS & ENGINEERING CO., LTD.**  
 7072, Main 2, Thapaeak Rd., KAL 10, Bangkok-Yai, Bangkok, Samutprakan 10540  
 7072 หมู่ 2 ถนนเทพารักษ์ กม.10 คลองหลวง อ.บางพลี จ.สมุทรปราการ 10540  
 Tel: +66 (0) 2759 7549 Fax: +66 (0) 2981 8211 Email: info@aceco-th.com



The efficiency of mass transfer depends on the following factor.

- have a plenty of surface area contact
- well mix between gas and liquid
- appropriated contact time
- gas/liquid is more soluble in liquid

A common apparatus used in gas absorption is the packed tower. However, the device consists of the following detail.

#### 1. Packed Tower (Wet Scrubber)

It is a vertical column, equipped with a gas inlet and distributing space at the bottom; a liquid inlet and distributor at the top; gas and liquid outlets at the top and bottom called counter-current flow, respectively; and a supported mass of inert solid shapes, called tower packing. The packing support is typically a screen, corrugated to give it strength, with a large open area so that flooding does not occur at the support.

#### 2. Spray nozzles

This device is a common apparatus used in wet scrubber. A liquid inlet is distributed over the top of the packing by spray nozzles. The kind of this spray is Full Cone as shown in figure 1 which liquid inlet is circularly distributed in tower. It is also easy to take off for cleaning.



Figure 1 Full Cone Spray Nozzle



บริษัท เอเชียเอ็น เคมีคอล แอนด์ เอ็นจิเนียริง จำกัด  
**ASIAN CHEMICALS & ENGINEERING CO., LTD.**  
 7072, Main 2, Thapaeak Rd., KAL 10, Bangkok-Yai, Bangkok, Samutprakan 10540  
 7072 หมู่ 2 ถนนเทพารักษ์ กม.10 คลองหลวง อ.บางพลี จ.สมุทรปราการ 10540  
 Tel: +66 (0) 2759 7549 Fax: +66 (0) 2981 8211 Email: info@aceco-th.com



#### 3. Packing

It is a major part in packed towers, which are commonly used in gas absorption. The packing are used to establish an intimate contact between vapors and liquid used to wash the objectionable components. ACE designation is used stainless steel Pall Ring 38 mm as shown in Figure 2. The advantage is low pressure drop, corrosion resistance, larger specific area means larger area available for contact between gas and liquid and therefore more efficient absorption operation.



Figure 2 Stainless Steel Pall Ring 38 mm.

#### 4. Pump

The fresh liquid is distributed over the top of packing and contacted with waste gas. This liquid is enriched in solute as it flows down the tower and then drain the liquid out (Figure 3).

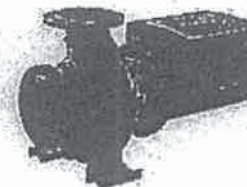


Figure 3 Pump





บริษัท เอเชีย เคมิคอล แอนด์ เอ็นจิเนียริ่ง จำกัด  
ASIAN CHEMICALS & ENGINEERING CO., LTD.  
305/3055, Thepachon Rd., KALAN, Bangkok-Yai Bangkok, Sampran 10540  
2045 หมู่ 5 ต.คลองตันเหนือ อ. คลองเตย จ. กรุงเทพฯ 10540  
Tel: +66 (0) 2738 7349 Fax: +66 (0) 2382 5811 Email: info@aceco-in.com  
www.aceco-in.com



## A-2014 Technical Data

- Design Basis

- Design Calculation for Ammonia Scrubber

## ASIAN CHEMICALS & ENGINEERING

### AMMONIA SCRUBBER PACKAGE (DIVISION OPTION)

PAGE NO.	DE 12	REV. 0
CUSTOMER	THAI ETHANOLAMINES CO., LTD	
PROJECT CODE	AETP 07090402	
PROJECT NAME	AMMONIA SCRUBBER PACKAGE	
PREPARED BY	RWEEAPORN	
CHECKED BY	S.PREECHA	
APPROVED BY	J.WORABECH	
ISSUED DATE	27	FEBRUARY 2008

### DESIGN BASIS

#### ABSORPTION SCRUBBER FOR AMMONIA SCRUBBER (A-2014) (NORMAL CASE)

☛ TOTAL AIR CAPACITY FOR PEAK FLOW	: 33.54 CMH @ Temperature 60 °C
☛ INLET CONDITION	
- PRESSURE	: ATMOSPHERE
- OPERATING TEMPERATURE	: 60 °C FOR NORMAL (MAX 145 °C)
- INLET GAS POLLUTANT	: NH <sub>3</sub> and N <sub>2</sub>
- NH <sub>3</sub> INLET GAS CONCENTRATION	: 191.334 mg/m <sup>3</sup> (0.80 kph)
☛ TYPE OF ABSORPTION TOWER	: VERTICAL SCRUBBER, COUNTER-CURRENT FLOW
☛ SUPERFICIAL VELOCITY	: 0.016 m/sec
☛ CONTACTING TIME	: 193.32 sec.
☛ LIQUID/GAS RATIO	: 67.52 m <sup>3</sup> /m <sup>3</sup>
☛ SCRUBBING LIQUID	: WATER
☛ PACKING TYPE	: FALL RING 35 mm.
☛ PACKING HEIGHT	: 3,000 mm.
☛ EXPECTED PRESSURE ACROSS VESSEL	: <0 mbar
☛ NH <sub>3</sub> OUTLET GAS CONCENTRATION	: 25 ppm (16 mg/m <sup>3</sup> ) @ Temperature 40 °C

REMARK: 1. Absorption has designed for normal inlet temp. It can not work at high temp. because NH<sub>3</sub> can be absorbed by Water solution at 60 °C. max. But all selected equipments and instruments can be used at temp. 145 °C



ASIAN CHEMICALS & ENGINEERING	PAGE NO.	DS 2/2	REV. 0
	CUSTOMER	THAI ETHANOLAMINES CO., LTD.	
	PROJECT CODE	AET/0700662	
	PROJECT NAME	AMMONIA SCRUBBER PACKAGE	
	PREPARED BY	R.WEERAPORN	
AMMONIA SCRUBBER PACKAGE (DIVISION OPTION)	CHECKED BY	S.FREBCHA	
	APPROVED BY	J.WORADECH	
	ISSUED DATE	27	FEBRUARY 2008

DESIGN BASIS	
ABSORPTION SCRUBBER FOR AMMONIA SCRUBBER (A-2014) (MAXIMUM CASE)	
☛ TOTAL AIR CAPACITY FOR PEAK FLOW	: 15.54 CMH @ Temperature 60 °C
☛ INLET CONDITION	
- PRESSURE	: ATMOSPHERE
- OPERATING TEMPERATURE	: 60 °C FOR NORMAL (MAX 148 °C)
- INLET GAS POLLUTANT	: NH <sub>3</sub> and H <sub>2</sub>
- MAX. NH <sub>3</sub> INLET GAS CONCENTRATION	: 1,134.697 mg/m <sup>3</sup> (111.4 kg/m <sup>3</sup> )
☛ TYPE OF ABSORPTION TOWER	: VERTICAL SCRUBBER COUNTER-CURRENT FLOW
☛ SUPERFICIAL VELOCITY	: 0.016 m/sec
☛ CONTACTING TIME	: 193.32 sec
☛ LIQUID/GAS RATIO	: 1406.87 l/m <sup>3</sup>
☛ SCRUBBING LIQUID	: WATER
☛ PACKING TYPE	: PALL RING 38 mm.
☛ PACKING HEIGHT	: 3,000 mm.
☛ EXPECTED PRESSURE ACROSS VESSEL	: < 3 mbar
☛ NH <sub>3</sub> OUTLET GAS CONCENTRATION	: 25 ppm (16 mg/m <sup>3</sup> @ Temperature 40 °C)
REMARK: 1. Absorption has designed for normal inlet temp it can not work at high temp because NH <sub>3</sub> can be absorbed by Water Solution at 60 °C max. But all selected equipments and instruments can be used at temp. 148 °C	

CHINWIT/DRAWING-A/SC/AET/0700662/REV.000/A0700662/000.DOC

FM-TCH-DBA-01-R00



บริษัท เอเชียเอ็น เคมีคัล แอนด์ เอ็นจิเนียริ่ง จำกัด  
ASIAN CHEMICALS & ENGINEERING CO., LTD.  
195 Moo 3, Thaparak Rd., K.A.T., Bangpakong, Prachinburi 31140  
Tel: +66 (0) 2129 3545 Fax: +66 (0) 2129 3511 Email: info@ace-eh.com



## CALCULATION OF INLET GAS CONCENTRATION FOR AMMONIA SCRUBBER PACKAGE (A-2014)

### Previous Data from Customer

Total Gas Mass Flow Rate (NH<sub>3</sub> + N<sub>2</sub>)

Design Temperature

: NH<sub>3</sub> inlet

### Present Data from Customer (Max. case)

Total Gas Mass Flow Rate (NH<sub>3</sub> + N<sub>2</sub>)

Design Temperature

: NH<sub>3</sub> inlet

### Present Data from Customer (Normal Case)

Total Gas Mass Flow Rate (NH<sub>3</sub> + N<sub>2</sub>)

Design Temperature

: NH<sub>3</sub> inlet





บริษัท เอเชียเอ็น เคมีคอล แอนด์ เอ็นจิเนียริ่ง จำกัด  
**ASIAN CHEMICALS & ENGINEERING CO., LTD.**  
 7615 Moo 3, Thapaeat Rd., K.M.10, Bangkok-Yai, Bangkok, Samutprakan 10540  
 โทร 02 2158 7340 โทร 02 2158 7340 โทร 02 2158 7340 โทร 02 2158 7340  
 Tel: +66 (0) 2158 7340 Fax: +66 (0) 2158 7340 Email: info@aceco-ai.com



# **CALCULATION OF PRESSURE DROP IN PACK COLUMN**

## **1. Ammonia Scrubber Package (A-2014) (Maximum Case)**

- Scrubber area
- Mixing gas mass flow rate  
Mixing gas mass velocity (G)
- Liquid flow rate (Dissolution approx. = 1,000 kg/m<sup>3</sup>)  
Liquid mass velocity (L)

From  $G = 176.10 \text{ kg/m}^2\text{hr}$   
 $L = 78,616.35 \text{ kg/m}^2\text{hr}$   
 $\rho_{\text{mix}} = 3.159 \text{ kg/m}^3$   
 $\rho_{\text{water}} = 1,000 \text{ kg/m}^3$

From

Use  $u_p = 0.0156 \text{ m/s} \Rightarrow 0.0512 \text{ ft/s}$

For Pall Ring

For these con

Packi

Pressure drop

Pressure from

Total pressure



บริษัท เอเชียเอ็น เคมีคอล แอนด์ เอ็นจิเนียริ่ง จำกัด  
**ASIAN CHEMICALS & ENGINEERING CO., LTD.**  
 7615 Moo 3, Thapaeat Rd., K.M.10, Bangkok-Yai, Bangkok, Samutprakan 10540  
 โทร 02 2158 7340 โทร 02 2158 7340 โทร 02 2158 7340 โทร 02 2158 7340  
 Tel: +66 (0) 2158 7340 Fax: +66 (0) 2158 7340 Email: info@aceco-ai.com



## **2. Ammonia Scrubber Package (A-2014) (Normal Case)**

- Scrubber area
- Mixing gas mass flow rate  
Mixing gas mass velocity (G)
- Liquid flow rate (Dissolution approx. = 1,000 kg/m<sup>3</sup>)  
Liquid mass velocity (L)

From  $G = 10.69 \text{ kg/m}^2\text{hr}$   
 $L = 3,773.59 \text{ kg/m}^2\text{hr}$   
 $\rho_{\text{mix}} = 0.191 \text{ kg/m}^3$   
 $\rho_{\text{water}} = 1,000 \text{ kg/m}^3$

From

Use  $u_p = 0.0156 \text{ m/s} \Rightarrow 0.0512 \text{ ft/s}$

For Pall Ring JS

For these condi

Packing

Pressure drop

Pressure from m

Total pressure



FIG. 14-48. Concentrated pressure drop correlation of Eckert/Lewy, as modified by Sieder. To convert inches H<sub>2</sub>O to mm H<sub>2</sub>O, multiply by 2.54. From *Process Heat Transfer and Applications* by Ralph E. Sieder, Jr., copyright © 1984 by Gulf Publishing Co., Houston, Texas. Used with permission. All rights reserved.



บริษัท เอเชีย เคมีคอล แอนด์ เอ็นจิเนียริง จำกัด  
**ASIAN CHEMICALS & ENGINEERING CO., LTD.**  
 205 Moo 2, Thungmahat, K.M.12, Bangplee Sub, Bangplee, Samutprakan 10540  
 205 หมู่ 2 ต.ทุ่งมหาตม์ อ.บ.12 บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 10540  
 Tel: +66 (0) 2709 1640 Fax: +66 (0) 2715 8211 Email: info@aceco.com



### Calculation of Bottom Liquid Flowrate

For Amagata-Sieder (A-2018)

From

Given

Substituted in equation (2)

When the diameter of drain piping is 150 mm (0.15 m)

From

and





บริษัท เอเชียเอ็น เคมีคัล แอนด์ เอ็นจิเนียริง จำกัด  
ASIAN-CHEMICALS & ENGINEERING CO., LTD.  
785/2001, Thapae Rd., K.M.10, Bangkok 10540  
785/201, 202, Thapae Rd., K.M.10, Bangkok 10540  
Tel: +66 (0) 2388 7505 Fax: +66 (0) 2385 8211 Email: info@ace-ty.com



## A-2014 Operation Manual / Specification

REVISIONS	
NO.	DESCRIPTION
1	Initial Issue
2	As per drawing
3	As per drawing
4	As per drawing
5	As per drawing
6	As per drawing
7	As per drawing
8	As per drawing
9	As per drawing
10	As per drawing
11	As per drawing
12	As per drawing
13	As per drawing
14	As per drawing
15	As per drawing
16	As per drawing
17	As per drawing
18	As per drawing
19	As per drawing
20	As per drawing
21	As per drawing
22	As per drawing
23	As per drawing
24	As per drawing
25	As per drawing
26	As per drawing
27	As per drawing
28	As per drawing
29	As per drawing
30	As per drawing
31	As per drawing
32	As per drawing
33	As per drawing
34	As per drawing
35	As per drawing
36	As per drawing
37	As per drawing
38	As per drawing
39	As per drawing
40	As per drawing
41	As per drawing
42	As per drawing
43	As per drawing
44	As per drawing
45	As per drawing
46	As per drawing
47	As per drawing
48	As per drawing
49	As per drawing
50	As per drawing
51	As per drawing
52	As per drawing
53	As per drawing
54	As per drawing
55	As per drawing
56	As per drawing
57	As per drawing
58	As per drawing
59	As per drawing
60	As per drawing
61	As per drawing
62	As per drawing
63	As per drawing
64	As per drawing
65	As per drawing
66	As per drawing
67	As per drawing
68	As per drawing
69	As per drawing
70	As per drawing
71	As per drawing
72	As per drawing
73	As per drawing
74	As per drawing
75	As per drawing
76	As per drawing
77	As per drawing
78	As per drawing
79	As per drawing
80	As per drawing
81	As per drawing
82	As per drawing
83	As per drawing
84	As per drawing
85	As per drawing
86	As per drawing
87	As per drawing
88	As per drawing
89	As per drawing
90	As per drawing
91	As per drawing
92	As per drawing
93	As per drawing
94	As per drawing
95	As per drawing
96	As per drawing
97	As per drawing
98	As per drawing
99	As per drawing
100	As per drawing

PROJECT: Shodden Unit  
DRAWN BY: [Signature]  
CHECKED BY: [Signature]  
DATE: 01/05/2015

FOR THE ETHIOPIAN PROJECT  
SUBMITTED TO: [Signature]  
DATE: 01/05/2015





บริษัท เอเชีย เคมีคอล แอนด์ เอ็นจิเนียริ่ง จำกัด  
ASIAN CHEMICALS & ENGINEERING CO., LTD.  
7875 Moo 3, Theparak Rd., K.M.10, Bangpho-Yai, Bangkok, Samutprakan 10540  
7876 หมู่ 3 ถนนเทพารักษ์ กม.10 บางโพธิ์ใหญ่ กรุงเทพฯ สมุทรปราการ 10540  
Tel: +66 (0) 2799 7540 Fax: +66 (0) 2795 5211 Email: info@aschem.com  
www.aschem.com



## A-2014 Operation Manual of Air Pollution Control System

### Pre-start up checking

Before start up and using the dirty air scrubber, the general condition of the system have to be checked as follows:

- 1) Check the water level inside the fresh water tank, whether it is filled or not.
- 2) Check the circulation pump condition if it is ready for operation.
- 3) Check the rotational direction of circulation pump if it is in the correct direction following the sign besides the pump.
- 4) Check the normally "open - close" valve position as follows:
  - Suction, discharge valves of circulation pump normally open.
  - Pressure gauge valve normally open.
  - Drain valve and waste water outlet valve normally open.
- 5) Check the packing condition if there are scales attached; turn on the pump to clean the packing media first.

### System start up

Follow the specified steps:

- 1) Turn on the fresh water inlet valve to scrubber

### System shut down

Follow the specified steps:

- 1) Turn off the fresh water inlet valve to scrubber



บริษัท เอเชีย เคมีคอล แอนด์ เอ็นจิเนียริ่ง จำกัด  
ASIAN CHEMICALS & ENGINEERING CO., LTD.  
7875 Moo 3, Theparak Rd., K.M.10, Bangpho-Yai, Bangkok, Samutprakan 10540  
7876 หมู่ 3 ถนนเทพารักษ์ กม.10 บางโพธิ์ใหญ่ กรุงเทพฯ สมุทรปราการ 10540  
Tel: +66 (0) 2799 7540 Fax: +66 (0) 2795 5211 Email: info@aschem.com  
www.aschem.com



### Automatic control system of water filling into fresh water tank

If the water in the fresh water tank is lower than the "L" or low level, the solenoid valve will be turned on to fill in the water to the fresh water tank until the water level is at "H" or high level. Then the solenoid valve will be turned off.

### Automatic control system of circulation pump

When  $\text{NH}_3$  inlet gas concentration increased to set point value (Maximum Case) and water in the fresh water tank is higher than the "L" or low level, the circulation pump will be turned on.

And then, if the water level in the fresh water tank is at Low / Low; the circulation pump will be shut down automatically for preventing the circulation pump to "Run Dry" and be damaged.

Finally, if  $\text{NH}_3$  inlet gas concentration is decreasing to less than the set point value, the circulation pump will be shut down automatically.