



**MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)**

**Request No. :** MDL 0690/56

**Date :** 23 April 2013

**Date of request:** 28 March 2013

**Page :** 1 of 7

**REPORT ON ANALYSIS/TESTING**

**For**

**SUN CHAN ENGINEERING CO., LTD.**

**7 Soi Nacniwas 18, Nacniwas Road, Lat Phrao, Bangkok 10230**

**Testing/analysis/investigation of :** Aluminum waterproof gate Brand : DAYU

**Method of testing/analysis/investigation :** Waterproof test, Pressure resistance test and Hit resistance test according to the specified procedure under the customer approval.  
(Test site : SUN CHAN ENGINEERING CO., LTD.)

**Result of testing/analysis/investigation :**

The test results are attached.

**Tested/analysed/investigated by**

1. *A. Prayong*
2. *S. Pantis*

**Approved by**

*C. Chamornut*  
(Ms. Chalothorn Bhamornut)  
Director of Material Property Development Laboratory

**Examined by**

*P. Rachan*  
(Ms. Rachaneepen Pensit)



**This report contains 7 pages and 3 annexes.**

FS-MPAD-GEN-510-1-01/02/48

**Remark :** The above results are valid exclusively for tested/analysed samples as mentioned in this report. Publication of the results on testing and analysis is prohibited unless written permission is obtained from the governor of TISTR



MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

REPORT

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 2 of 7

**INTRODUCTION**

SUN CHAN ENGINEERING CO., LTD. has commissioned the Material Properties Analysis and Development Centre, Thailand Institute of Scientific and Technological Research (MPAD/TISTR) to perform waterproof test, pressure resistance test and hit resistance test of the aluminum waterproof gate Brand : DAYU. The set-up configuration and the installation of the aluminum waterproof gate are shown in Figs. 1.1 and 1.2 in Annex 1, respectively.

The tests were performed according to the specified procedures under the customer approval. The aluminum waterproof gate was installed with concrete container by the customer and the test conditions including test position and period, water height, weight of steel block, impact position and momentum were also designated by the customer .

**TEST PROCEDURE :** (See Annexes 1-3)

**Waterproof test and Pressure resistance test**

1. Install the aluminum waterproof gate with concrete container conducted by the customer as shown in Fig. 1.2.
2. Install dial indicator for the first point at the center of bottom sheet of the gate as shown in Fig.1.3
3. Install dial indicator for the second point at the center of the next upper sheet of the gate, as shown in Fig.1.4.
4. Adjust dial indicator to zero position before filling water.
5. Fill up water to a height of 190 cm, as shown in Fig.1.5.
6. Monitor leakage by visual and read the deflection of aluminum waterproof gate sheets via the dial indicators of both points, and record the values
7. Retain the water in the container and leave it for 24 hours.
8. After 24 hours, record the deflection values and observe any leak.

FS-MPAD-MDE-510-1-01/02/48



MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

REPORT

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 3 of 7

**Hit resistance test**

1. Prepare the equipment by hanging the steel block of 25 kg to the front wall by using the wire rope. Arrange the vertical distance from the point of hanging to the hit point. (at the junction of 4<sup>th</sup> sheet and 5<sup>th</sup> sheet from the bottom) as shown in Fig.2.1.
2. Measure the vertical distance from the hanging point to the middle of the steel block by adjusting the length to 1.27 meters.
3. Lift up the steel block from the horizontal line to the specified height (Figs. 2.1 and 3.2), and then freely release the steel block to hit onto the junction of aluminum waterproof gate sheets without any repeating hit.
4. Visually inspect the hit point for any leak or damage.
5. Repeat steps 1-4 by adjusting the length to 1.40 meters for the hit resistance test at the center of the aluminum waterproof gate sheet (at the center of 4<sup>th</sup> sheet from the bottom) (Fig. 2.2).

**TEST EQUIPMENT :**

- Dial indicator : resolution 0.01 mm
- Steel tape : resolution 1 mm
- Steel block: 25 kg by weight with a cross-sectional area of 50 cm<sup>2</sup>



FS-MPAD-MDL-510-1-01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

REPORT

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 4 of 7

**TEST DATE :** 2-3 April 2013 (Onsite test)

**TEST RESULTS :**

The test results for waterproof test and pressure resistance test of the aluminum waterproof gate are shown in Tables 1-2. The test results of hit resistance test are shown in Table 3. The deflection of the aluminum waterproof gate measured by Dial indicator are shown in Figs 1-2. and Appearance of a dent after hit resistance test is shown in Figs. 3-4. The calculation of the related parameters including water volume, static pressure and momentum for the specified conditions are shown in Annex 3.

Table 1 The results of waterproof test of the aluminum waterproof gate.

Test conditions: 1.90 meters height of water for 24 hours

Area monitoring	Test results at the first hour	Test results at 24 hours
Junction between waterproof sheets	No leak found	No leak found
Junction between water proof gates and concrete container	No leak found	No leak found

Table 2 The results of pressure resistance test of the aluminum waterproof gate.

Test conditions: 1.90 meters height of water for 24 hours

Point No.	Deflection at 24 hr.(mm)	% Deflection at 24 hrs.(mm)	Force at maximum depth (kgw.)	Pressure at maximum depth (Ton/m <sup>2</sup> )	Average pressure (Ton/m <sup>2</sup> )
1	3.02	2.8	4,259.8	1.9	0.95
2	6.05	5.6			

FS-MPAD-MDL-510-1-01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

REPORT

Customer : SUN CHAN ENGINEERING CO., LTD.

Page :5 of 7

Table 3 The results of hit resistance test of the aluminum waterproof gate.

Test conditions: 1.90 meters height of water and 25 kg. steel block

Point No.	Distance from hanging point to the middle of the steel block (m)	Momentum (kg·m/sec)	Height from the horizontal line to the middle of the steel block (m)	Angle between the wire rope and the vertical line before hitting ( degree)	Hitting velocity before hitting (m/sec)	Test results
1.The junction of 4 <sup>th</sup> sheet and 5 <sup>th</sup> sheet from the bottom	1.27	70	0.4006	46.8	2.80	Found a dent but no leak
2.The center of 4 <sup>th</sup> sheet from the bottom	1.40	70	0.4014	44.5	2.81	Found a dent but no leak

FS-MPAD-MDL-510-1-01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

REPORT

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 6 of 7



Point No.1



Point No. 2

Fig. 1 Adjust dial indicator to zero position before filling up water to the height of 1.90 m



Point No. 1



Point No. 2

Fig.2 Deflection of the aluminum waterproof gate after retaining water at the height of 1.90 m for 24 hrs.

FS-MPAD-MDL-510-1-01/02/48

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MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

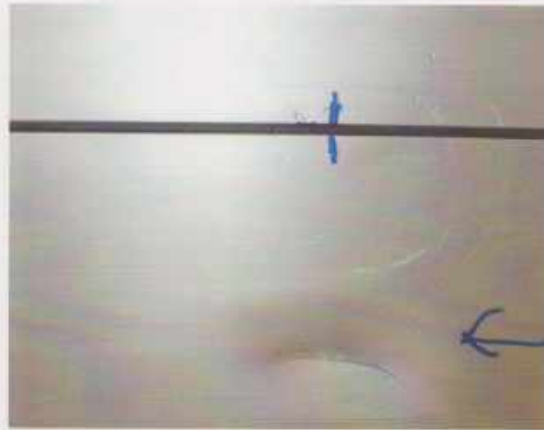
Request No. : MDL 0690/56

Date : 23 April 2013

REPORT

Customer : SUN CHAN ENGINEERING CO., LTD.


Page : 7 of 7



Junction between aluminum waterproof sheets

Center area of aluminum waterproof sheet

Fig. 3 Appearance of a dent after hit resistance test.



FS-MPAD-MDL-516-1-01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

ANNEX 1

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 1 of 4

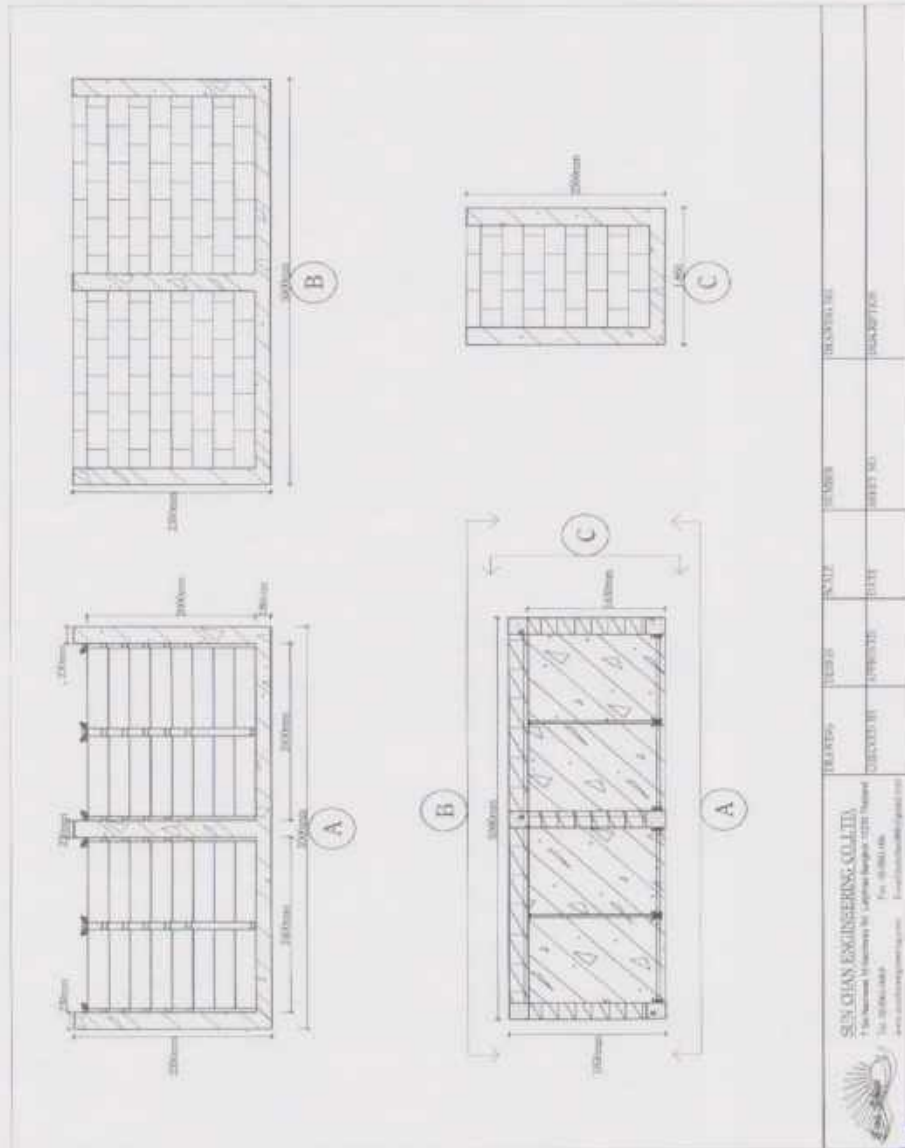


Fig. 1.1 The set-up configuration of the aluminum waterproof gate (Provided by the customer).

FS-MPAD-MDL-510-2-01/02/48





MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

ANNEX 1

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 2 of 4



Before installation



After installation

Fig. 1.2 Overview of the aluminum waterproof gate after installation for test.

FS-MPAD-MDL-510-2-01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

ANNEX 1

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 3 of 4



Fig. 1.3 Installation of Dial indicator for pressure resistance test at point No.1

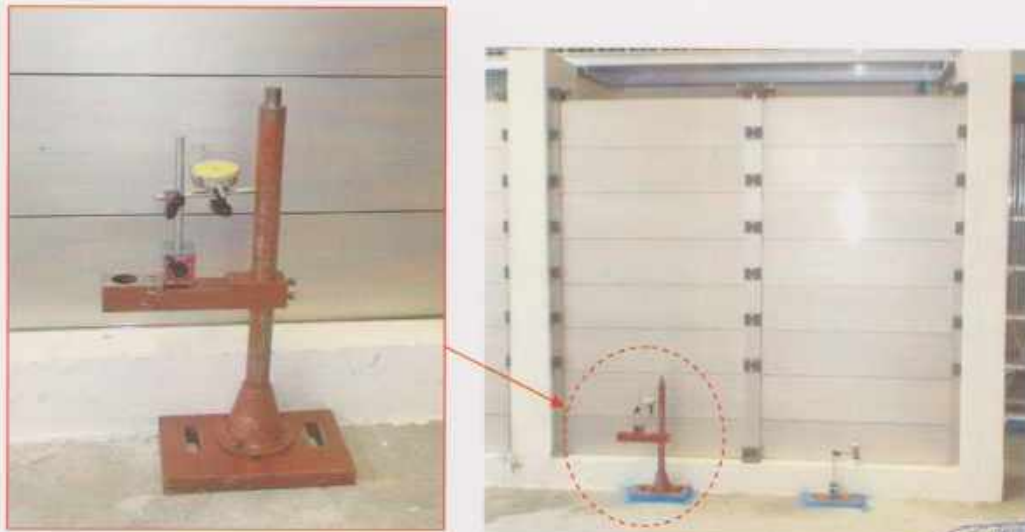


Fig. 1.4 Installation of Dial indicator for pressure resistance test at point No.2

FS-MPAD-MDL-510-2-01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

ANNEX 1

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 4 of 4

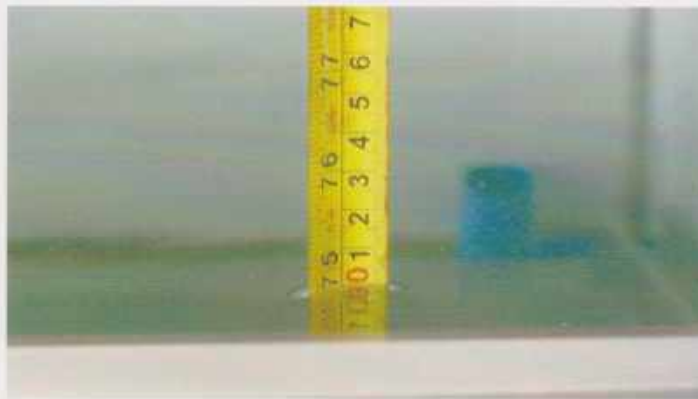


Fig. 1.5 Filling up water to a height of 190 cm

FS-MPAD-MDL-510-2-01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

ANNEX 2

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 1 of 2



Fig 2.1 Equipment preparation for hit resistance test using the vertical distance of 1.27 m from the hanging point to the middle of the steel block. (at the junction of 4<sup>th</sup> sheet and 5<sup>th</sup> sheet from the bottom).

FS-MPAD-MDL-510-2\*01/02/48

MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

ANNEX 2

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 2 of 2



Fig 2.2 Equipment preparation for hit resistance test using the vertical distance of 1.40 m from the hanging point to the middle of the steel block (at the center of 4<sup>th</sup> sheet from the bottom).



FS-MPAD-MDL-510-2-01/02/48

**1. Calculation of water volume**

$$V = W \times L \times H$$

When  $V = \text{Volume (m}^3\text{)}$

$W = \text{Width (m) ; 2.36 m}$

$L = \text{Length (m) ; 1.49 m}$

$H = \text{Height (m) ; 1.90 m}$

Then  $V = 2.36 \times 1.49 \times 1.92$   
 $= 6.681 \text{ m}^3$

**2. Calculation of static pressure**

**2.1 Pressure at maximum depth**


$$P = \gamma H$$

When  $P = \text{Water pressure (kg/ m}^2\text{)}$

$\gamma = \text{Water density (kg/ m}^3\text{)}$

$H = \text{Water height (m)}$

Then  $P = 1000 \times 1.90$   
 $= 1,900 \text{ kg/ m}^2 = 1.9 \text{ ton/ m}^2$



FS-MPAD-MDL-510-2-01/02/48

**2.2 Calculation of reacting force**

$$F = P \times A$$

$$F = \frac{1}{2} \gamma H^2 \times W$$

When  $F$  = Total force reacting with waterproof gate having  $W = 2.36$  m

$$P = \gamma H = \text{Pressure at maximum depth (kg/m}^2\text{)}$$

Then

$$F = \frac{1}{2} 1000 \times (1.9)^2 \times 2.36$$

$$F = 4,259.8 \text{ kg} = 4.2598 \text{ ton}$$

**2.3 Calculation of reacting pressure**

$$P = \frac{F}{A}$$

Then  $P = \frac{4.2598}{2.36 \times 1.9} = 0.95 \text{ ton/m}^2$

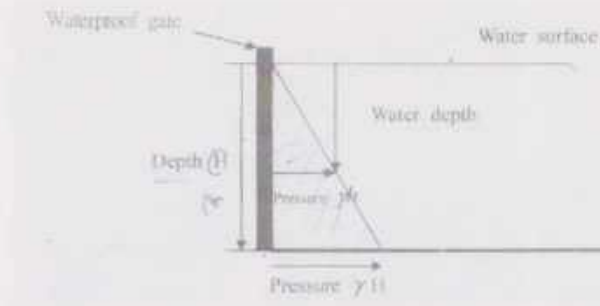


Fig. 3.1 Static water pressure distribution from water surface

FS-MPAD-MDL-510-2-01.0248



MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0690/56

Date : 23 April 2013

ANNEX 3

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 3 of 4

**3. Calculation of momentum**

$m$  = weight of steel block (kg) , specified at 25 kg by the customer

$I$  = momentum (kg· m/sec), specified at 70 kg· m/sec by the customer

$v$  = Hitting velocity before hitting (m/sec)

$l$  = Length of wire rope from the hanging point to the middle of the steel block (m)

$\theta$  = Angle between the wire rope and the vertical line before hitting (degree)

$h$  = Height from the horizontal line to the middle of the steel block (m)

**3.1 Calculation of angle and height for lifting the steel block**

When  $I = mv$

$$v = \sqrt{2gl(1 - \cos\theta)}$$

and  $l = 1.27$  m and  $\theta = 46.8$  degree

$$\text{Then } v = \sqrt{2 \times 9.81 \times 1.27(1 - \cos 46.8)}$$

$$v = 2.80 \text{ m/sec}$$

Remark: Angle  $\theta$  is obtained by Trial and error calculation using the momentum value of 70 kg· m/sec

$$\text{When } I = mv = 25 \times 2.80 = 70 \text{ kg· m/sec}$$

$$\text{Then } h = l - l \cos\theta$$

$$h = 1.27 - (1.27 \times \cos 46.8)$$

$$h = 0.4006 \text{ m}$$



FS-MPAD-MDL-510-2-01/02/48

Thailand Institute of Scientific and Technological Research

35 Mu 3, Technopolis, Khlong 5, Khlong Luang, Pathum Thani 12120, Thailand

Tel: (66) 0 2577 9000 Fax: 0 2577 9009

E-mail : [tistr@tistr.or.th](mailto:tistr@tistr.or.th) Website : [www.tistr.or.th](http://www.tistr.or.th)



When  $l = 1.40$  m and  $\theta = 44.5$  degree

$$\text{Then } v = \sqrt{2 \times 9.81 \times 1.4(1 - \cos 44.5)}$$

$$v = 2.81 \text{ m/sec}$$

Remark: Angle  $\theta$  is obtained by Trial and error calculation using the momentum value of 70 kg·m/sec

$$\text{When } l = mv = 25 \times 2.81 = 70.25 \text{ kg·m/sec}$$

$$\text{Then } h = l - l \cos \theta$$

$$h = 1.4 - (1.4 \times \cos 44.5)$$

$$h = 0.4014 \text{ m}$$

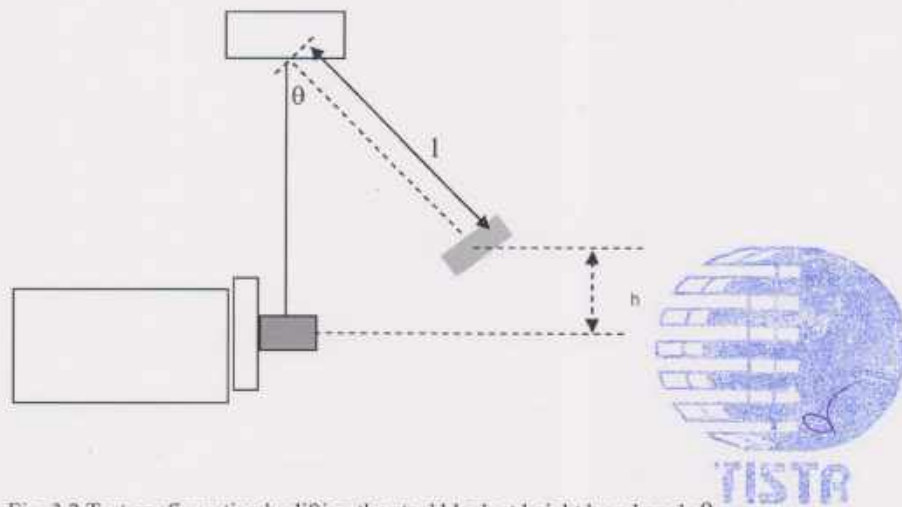


Fig. 3.2 Test configuration by lifting the steel block at height  $h$  and angle  $\theta$ .

FS-MPAD-MDL-510-2-01/02/48



**MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)**

**Request No. :** MDL 0357/56(R)

**Date :** 14 June 2013

**Date of request :** 8 January 2013

**Page :** 1 of 3

**REPORT ON ANALYSIS / TESTING**

**For**

**SUN CHAN ENGINEERING CO., LTD.**

**7 Soi Nacniwas 18, Nacniwas Road, Lat Phrao, Bangkok 10230**

**Testing/analysis/investigation of** : Aluminum waterproof gate Brand:DAYU

**Method of testing/analysis/investigation :** Tensile test according to JIS Z 2241-2011 and Chemical analysis followed the manual of SPECTROLAB M10

**Result of testing/analysis/investigation :-**

The test results are attached.

**Tested/analysed/investigated by**

1. Chanisa Suwairak  
2. S. Nalinthorn  
3. \_\_\_\_\_  
4. \_\_\_\_\_

**Approved by**

Chalothorn Bhamornsut  
.....  
(Ms. Chalothorn Bhamornsut)  
Director of  
Material Property Development Laboratory  
TISTR

**Examined by**

S. Nalinthorn  
.....  
(Ms. Nalinthorn Suwaporncharuwach)

**This report contains 3 pages.**

FS-MPAD-GEN-510-1-01/02/48

**Remark :** The above results are valid exclusively for tested/analysed samples as mentioned in this report. Publication of the results on testing and analysis is prohibited unless written permission is obtained from the governor of TISTR.



**MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)**

**Request No. :** MDL 0357/56 (R)

**Date :** 14 June 2013

**REPORT**

**Customer :** SUN CHAN ENGINEERING CO., LTD.

**Page :** 2 of 3

SUN CHAN ENGINEERING CO., LTD. has commissioned the Material Properties Analysis and Development Centre, Thailand Institute of Scientific and Technological Research (MPAD/TISTR) to carry out tensile test and chemical composition analysis of the Aluminum waterproof gate Brand:DAYU.

The specimens for tensile test were prepared by MPAD. The results are as follows :

**Test date :** 9 January 2013

**Test temperature :** 25 °C

**Testing machine :** Electromechanical Universal Testing Machine SCHENCK RSA 250

**The results of tensile test of Aluminum waterproof gate Brand:DAYU**

Specimen	T1	T2	T3
Thickness (mm)	2.02	1.99	2.07
Width (mm)	25.08	25.04	25.05
Cross sectional area (mm <sup>2</sup> )	50.66	49.83	51.85
Load at 0.2% offset yield strength (N)	11,670	11,109	11,620
Maximum tensile load (kN)	12.810	12.135	12.705
0.2% Offset yield strength (N/mm <sup>2</sup> )	230.35	222.93	224.11
Tensile strength (N/mm <sup>2</sup> )	252.86	243.53	245.03
Elongation (%)	12.14	12.24	12.56
Location of fracture	In the length	In the length	In the length

FS-MPAD-MDL-510-1-01/02/48



MATERIAL PROPERTIES ANALYSIS AND DEVELOPMENT CENTRE (MPAD)  
MATERIAL PROPERTY DEVELOPMENT LABORATORY (MDL)

Request No. : MDL 0357/56 (R)

Date : 14 June 2013

REPORT

Customer : SUN CHAN ENGINEERING CO., LTD.

Page : 3 of 3

The chemical analysis results of composition to classify the type of material.

Measurement report: 1/9/2013 2:16:16 PM

Method : Al-01

Model: Al-base global program

Sample: Aluminum waterproof gate Brand : DAYU

Average of 3 measurements

Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Ag	B	Bi	P
0.428	0.162	0.0022	0.0077	0.555	0.0029	0.0035	0.0037	0.0107	0.00003	0.00020	0.00011	0.0013
Pb	V	Zr	Al									
0.0015	0.0095	0.00077	98.8									



FS-MPAD-MDL-510-1-01/02/48