

BRAND : “ PIPECO ”

PRODUCT : DOMESTIC WATER TANK

DESCRIPTION : PLUMBING INSTALLATION

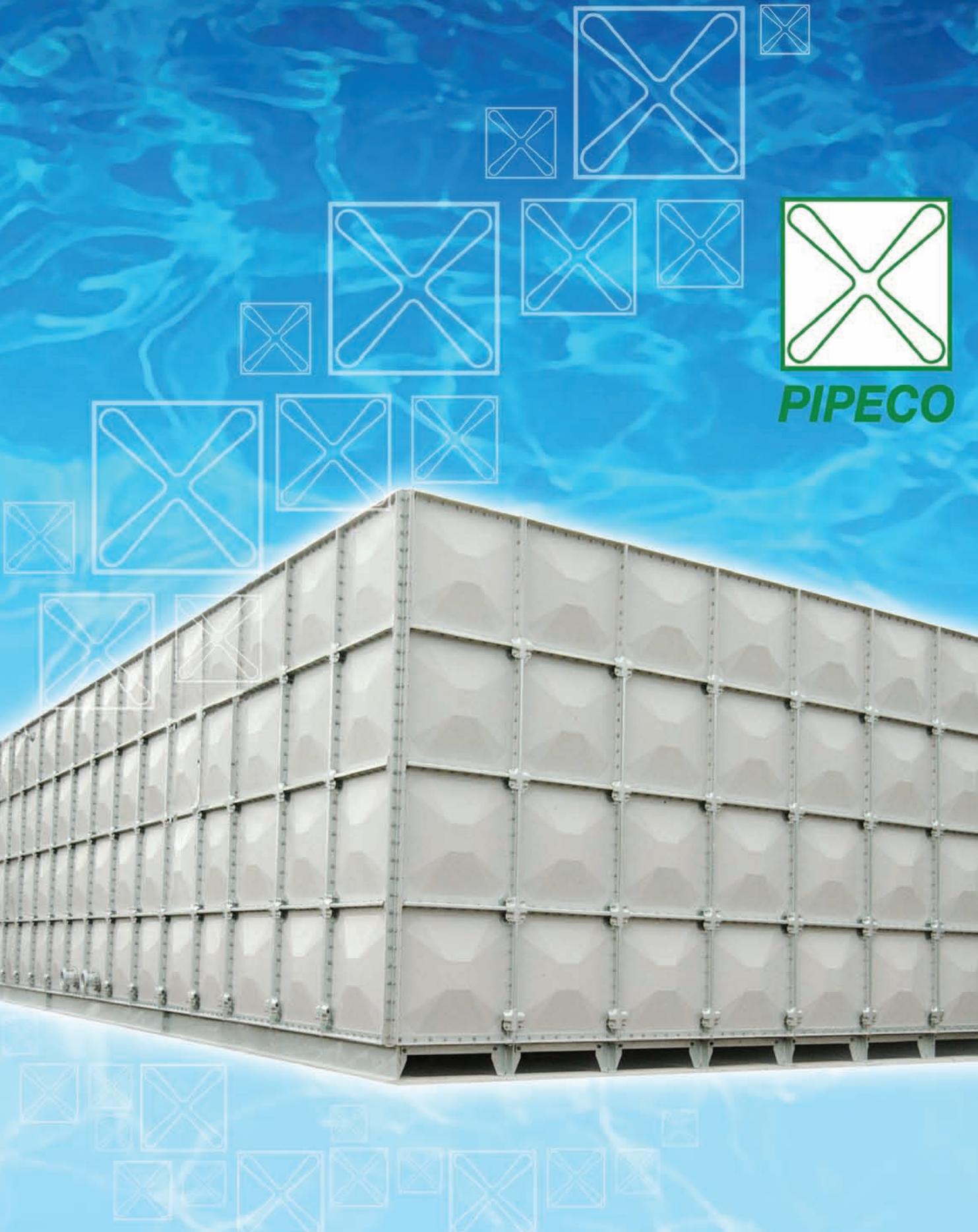
Pipeco GRP/FRP Panel Tank Job Reference

Alantic Grove Building @ Harrison Road
 Alexandra Technopark Block B
 Amara Services Apartment and Hotel @ Sentosa
 AMD Chai Chee factory @ Chai Chee Lane
 American College @ Preston Road
 Anglican High School @ Upper Changi Road
 Atrium Condominium @ Geylang
 Australian Embassy
 Botanic Condominium @ Lloyd Road
 Braddell-Westlake Secondary School
 Bukit Panjang Community Club
 Bukit View Secondary School
 CHJ (Katong) Primary School
 CHJ Primary School @ Chestnut Drive
 CHJ School @ Burghley Drive
 Causeway Point Shopping Centre Newater
 Cedar Primary School
 CentrePoint Shopping Centre Extension
 Changi Air Base West
 Changi Budget Terminal @ Changi Airport
 Corporation Place @ Corporation Road
 Courts Megastore @ Tampines
 D'Lotus Condominium @ Lorong Ampas
 DownTown East New Complex @ Pasir Ris
 Elias Park Primary School
 ETLA Building @ Changi North Street 2
 Flight Training Centre @ Changi North Rise
 Fragrance Hotel @ Balestier Road
 Fragrance Hotel @ Upper Serangoon Rd
 Frontier ePark Flatted factory @ Ubi Avenue 3
 Fuchun Primary School @ Woodlands Ave 1
 Furama River Front Hotel @New Bridge Road
 FusionPolis
 GLS Warehouse @ Joo Koon Circle
 Gallaher Tobacco Factory @ Loyang Way
 Giant Supermarket @ Tampines
 Goodrich Aerostructures Services Centre
 Hendon Camp @ Changi
 Hotel 81 @Upper Serangoon Rd
 Hulhule Island Hotel @ Maldives
 IKEA Homes Furnishings @ Tampines
 Jurong Garden School @ Woodlands Ring Road
 Jurong Point Condominium
 Jurong West Community Club
 K.K Hospital (Waste water Storage Tank
 Kallang Leisure Park Complex
 Keppel Fels Office Building @ Gul Road
 Kovana Apartment @ Kovan Road
 Kranji Camp @ Lorong Kebasi

Lacasa Condominium @ Woodlands
 Lasalle-Sia College of The Arts New City Campus
 Leith Park Apartment @ Leith Road
 Liang Court Shopping Centre
 LTA Kallang Paya Lebar Expressway
 MacDonald Building @ Orchard Road
 Marina Square Air-Cond Make-UP Water Tank
 Marine Police Coast Guard Complex @ Palau Brani
 Molex @ Woodlands Industrial Park
 NTU Teaching & Laboratory Facility Building
 NTU - Administration Offices Building
 Pulau Tekong Camp
 PRISH Church of The Holy Trinity @ Pasir Ris St 72
 PSA Pulau Subar Laut (Sister Islands)
 Quincy Hotel @ Mount Elizabeth
 Raffles Institution @ Bishan Street 21
 Replacement Water Tank for Aljunied Town Council
 Replacement Water Tank for Bishan - Toa Payoh Town Council
 Replacement Water Tank for Holland - Bukit Panjang Town Council
 Replacement Water Tank for Hong Kah Town Council
 Replacement Water Tank for Jalan Besar Town Council
 Replacement Water Tank for Jurong Town Council
 Riviera Residences @ Riviera Drive
 Robertson Blue Condominium @ Robertson Road
 Scenic Condominium @ Balestier Road
 Seletar Air Base Hanger 700
 Showa Denko @ Pioneer Road
 Singapore Museum
 SOHO Selegie Complex @ Selegie Road
 Soitec Wafer Plant @ Pasir Ris
 ST Aerospace Hanger 3 @ Paya Lebar Airport
 Tanglin Club New Complex
 Tanjung Gul Camp
 Temasek Tower
 The Cascadia Condominium @ Bukit Timah Road
 The Raintree Condominium @ Hindhele Road
 The Sail Condominium @ Marina Bay
 Thomson View Condominium
 Trinity Christian Centre
 Urbana Condominium @ River Valley
 Varsity Park Condominium
 Water Garden @ Farrer Road
 West Pharmaceutical @ Joo Koon
 West Spring Primary School @ Senja Road
 Woodlands District Cooling System @ Woodlands Ind Park 2
 Waterloo Community Centre
 Yishun Church
 Xilinx Building@Changi Business Park Vista
 Yokogawa @ Bedok South Road



Glass Reinforced Polyester (GRP/FRP) Sectional Water Tank



GENERAL SPECIFICATIONS

Standard : PIPECO GRP/FRP Sectional Water Tank complied to Singapore Standard SS 245 : 1995 and BS 7491 Part 3 : 1994

Materials : Resin - Isophthalic unsaturated polyester resin with technical requirement as in BS 3532 specification

Reinforcement - Reinforcement of a sandwich like construction consisting of a non-woven synthetic core with large diameter fiber, with fiberglass on other side and mechanically stitch bonded.

Woven Roving used is in accordance to woven roving fabrics of E-glass fiber for the reinforcement of polyester resin systems BS 3749 specification.



Manufacturing Process : A) Resin Transfer Moulding (RTM) Hot Closed Mould Injection

Manufacture under licence from Plastech Thermoset Tectonics using MIT® Technology.
B) Hot Press Moulded (SMC)

Support for Panels : External reinforcement - Hot Dipped Galvanised Steel

Internal reinforcement - Stainless Steel Grade 304 tie-rod or tie-bar

Sealing Materials : Non-toxic Rubber Foam to be used for all jointing between tank panel flanges.

Bolts, Nuts and Washers : Internal - Stainless Steel 304

External - Hot dip galvanised steel

Tank Cover : Cover panel support by PVC pipes complete with one 600mm diameter manhole for each compartment.

Ladder : External ladder - Galvanised Steel or Aluminium

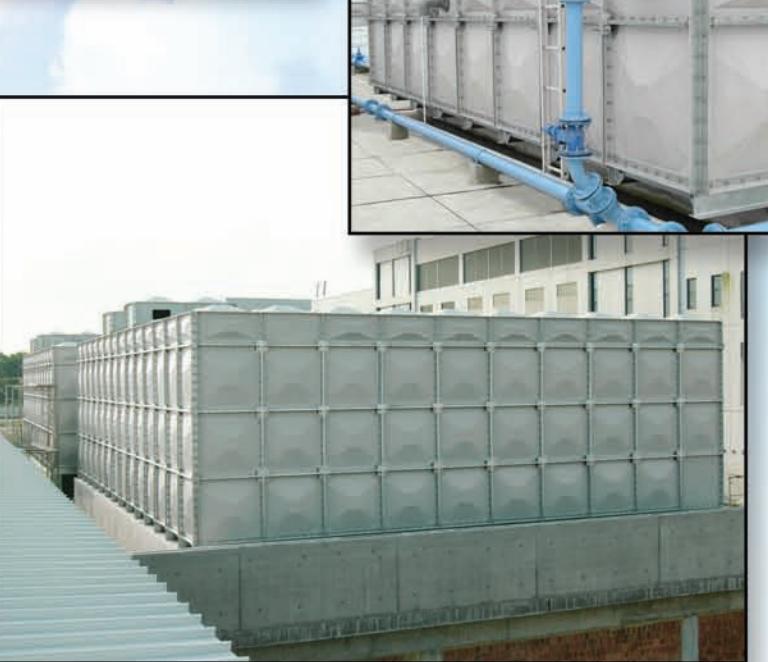
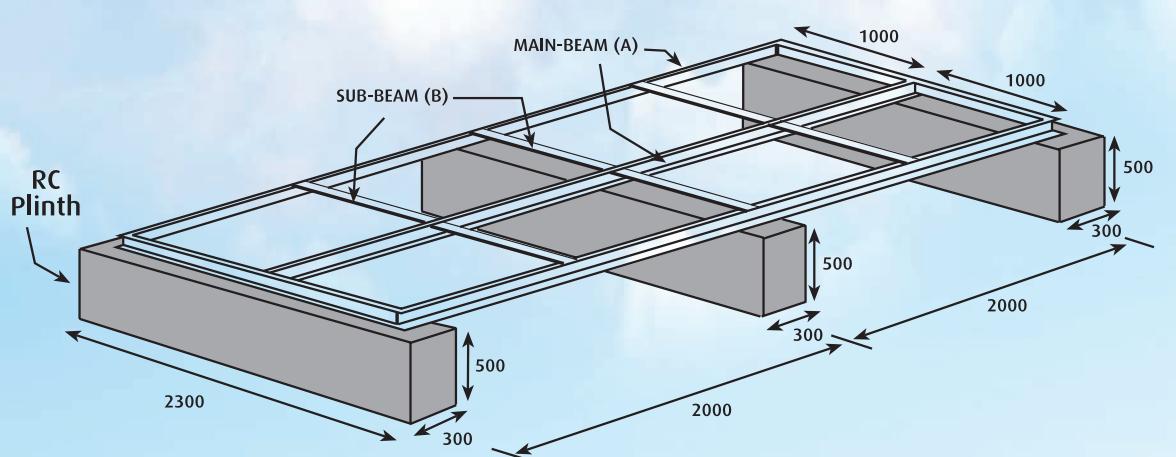
Internal ladder - PVC or Aluminium

Water Level Indicator : Transparent tube complete with level marking and aluminium casing.

Skid Base : Hot dipped galvanised steel for "C" channel or I-beam skid base

Tank Height	Main Beam "A"	Sub Beam "B"	R C Plinth C/C
1.0m	C-Channel - 125 x 65 x 6mm	Angle - 65 x 65 x 6mm	2.0m C/C
1.5m	C-Channel - 125 x 65 x 6mm	Angle - 65 x 65 x 6mm	2.0m C/C
2.0m	C-Channel - 150 x 75 x 6mm	Angle - 75 x 75 x 6mm	2.0m C/C
2.5m	C-Channel - 150 x 75 x 6mm	Angle - 75 x 75 x 6mm	2.0m C/C
3.0m	I-Beam - 150 x 100 x 13.39kg/m	Angle - 75 x 75 x 9mm	2.0m C/C
3.5m	I-Beam - 150 x 100 x 17.86kg/m	Angle - 75 x 75 x 9mm	2.0m C/C
4.0m	I-Beam - 203 x 133 x 26.79kg/m	Angle - 75 x 75 x 9mm	2.0m C/C

* We reserve the right to provide alternative design



HEAD OFFICE & MAIN FACTORY PIPECO SDN BHD.

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Tel : 673-2-652721, 652696, 652720
Fax : 673-2-652760
Email : weeita@brunei.bn

Test Report No. 7191178609-MEC18-LAS
dated 25 JAN 2018



PSB Singapore

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SUBJECT:

Testing of GRP Water Tank Panel

Choose certainty.
Add value.

TESTED FOR:

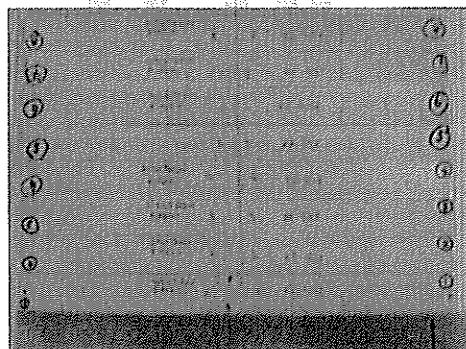
Pipeco Tanks Singapore Pte Ltd
38 Changi South Street 1
Singapore 486765

Attn : Mr. Freddy Lim Siang Hoe

SAMPLES DESCRIPTION:

The following test specimens cut from GRP water tank panel as shown in Figure 1 were submitted by Pipeco Tanks Singapore Pte Ltd on 5 January 2018 for testing.

Test Item	Approximate Dimension	Quantity
Tensile Strength	300 mm x 25 mm x 5 mm	8 pcs



Photograph of sample submitted

A handwritten signature in black ink, appearing to read "J. Lim".

A handwritten signature in black ink, appearing to read "Y. Wong".



LA-2007-0310-A LA-2007-0314-G The results reported herein have been performed in accordance with the
LA-2007-0311-F LA-2007-0315-E laboratory's terms of accreditation under the Singapore Accreditation Council
LA-2007-0312-B LA-2007-0316-C . Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked
LA-2007-0313-G LA-2010-0464-D "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-
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Laboratory:
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Co. Reg. No. 199002667R

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Test Report No. 7191178609-MEC18-LAS
dated 25 JAN 2018



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TEST METHODS:

SS 245 : 2014

Specification For Glass Reinforced Polyester Sectional Water Tanks

Tensile Strength, Appendix B

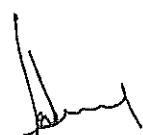
Nominal Specimen Dimension : 300 mm x 25 mm x 5 mm (With four end-pieces)
Length of Grips Separation : 200 mm
Crosshead Speed : 10 mm/min
No. of Determination : 5

TEST RESULTS:

Characteristic	Unit	Results (GRP Water Tank)	SS 245 : 2014 Requirement
Maximum Tensile Strength, average	MN/m ²	97 131 106 80 118 Average : 107	70 (min)

REMARK:

The test was witnessed by Mr. Hassan Bin Kasim from Pipeco Tanks (M) Sdn Bhd on 24 January 2018.



Leong Ann Seow
Higher Associate Engineer



Kong Siew Yong
Product Manager
Polymer Products
Mechanical Centre

Test Report No. 7191178609-MEC18-LAS
dated 25 JAN 2018



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July 2011

Test Report No. 7191161904-MEC17/02A-LAS
dated 25 AUG 2017



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SUBJECT:

Testing of "PIPECO" GRP / FRP Sectional Water Storage Tank

Choose certainty.
Add value.

TESTED FOR:

Pipeco Tanks Singapore Pte Ltd
38 Changi South Street 1
Singapore 486765

Attn : Mr. Freddy Lim Siang Hoe

SAMPLES DESCRIPTION:

The following test specimens cut from water storage tank panel and sealing material labelled as below in Figure 1 were submitted by Pipeco Tanks Singapore Pte Ltd for testing.

S/No	Test Items	Approximate Dimensions	Quantity	Date Received
1	Flexural Properties	240 mm x 12 mm x 9 mm	8 pcs	24 May 2017
2	Glass Content	25 mm x 25 mm x 4 mm	6 pcs	11 August 2017
3	Barcol Hardness	200 mm x 200 mm x 8 mm	3 pcs	11 August 2017
4	Water Absorption	75 mm x 25 mm x 3 mm	6 pcs	11 August 2017
5	Permanent Compressive Strain	50 mm Width x 5 mm Thickness	1 Roll	24 May 2017

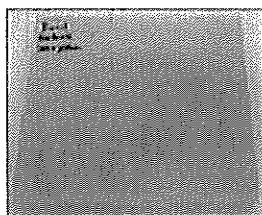


Figure 1A : GRP Water Tank Panel

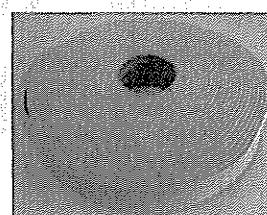


Figure 1B : Sealing Material



LA-2007-0310-A LA-2007-0314-G The results reported herein have been performed in accordance with the
LA-2007-0311-F LA-2007-0315-E laboratory's terms of accreditation under the Singapore Accreditation Council
LA-2007-0312-B LA-2007-0316-C - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked
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Test Report No. 7191161904-MEC17/02A-LAS
dated 25 AUG 2017



PSB Singapore

TEST METHODS:

SS 245 : 2014

Specification For Glass Reinforced Polyester Sectional Water Tanks

1. Permanent Compressive Strain, Appendix A

Nominal Specimen Dimension	:	50 mm x 50 mm x 5 mm
Test Condition	:	23 ± 2 °C / 22 Hrs
No. of Piles	:	6
No. of Determination	:	3

2. Bending Properties, Appendix C

Nominal Specimen Dimension	:	240 mm x 12 mm x 9 mm
Support Span	:	152 mm
Crosshead Speed	:	4.04 mm/min
No. of Determination	:	5

3. Glass Content, Appendix D

Nominal Specimen Dimension	:	25 mm x 25 mm x 4 mm
Muffle Furnace Temperature	:	625 ± 20 °C
No. of Determination	:	3

4. Barcol Hardness, Appendix E

Nominal Specimen Dimension	:	200 mm x 200 mm x 8 mm
No. of Determination	:	18

5. Water Absorption, Appendix F

Nominal Specimen Dimension	:	75 mm x 25 mm x 3 mm
Conditioning of Test Specimen	:	50 ± 2 °C for 24 Hrs
Immersion Condition	:	23 ± 2 °C for 24 Hrs
No. of Determination	:	3

Two handwritten signatures are present here, one on the left and one on the right, both appearing to be initials or names.



PSB Singapore

TEST RESULTS:

S/No.	Characteristics	Unit	Results (GRP Water Tank)	SS 245 : 2014 Requirements
1	25% Permanent Compressive Strength, average	%	3.2	4 (max)
2a	Bending Strength, average	MN/m ²	167	100 (min)
2b	Elastic Modulus in Bend, average	MN/m ²	11953	6000 (min)
3	Glass Content, average	%	33	25 (min)
4	Barcol Hardness, average	-	59	30 to 90% of the resin manufacturer's specification whichever is higher
5	Water Absorption, average	%	0.2	0.5 (max)

REMARKS :

1. The Barcol Hardness specification provided by the client is 30 minimum in the certificate of analysis COA of GRP material.
2. The results were found to be complied to SS 245 : 2014 Requirements.



Leong Ann Seow
Higher Associate Engineer



Kong Siew Yong
Product Manager
Polymer Products
Mechanical Centre

Test Report No. 7191161904-MEC17/02A-LAS
dated 25 AUG 2017



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SUBJECT:	Hydrostatic test of "PIPECO" GRP / FRP sectional water storage tank panel.	Choose certainty. Add value.
TESTED FOR:	Pipeco Tanks Singapore Pte Ltd 38 Changi South Street 1 Singapore 486765 Attn: Mr. Freddy Lim	
TEST METHOD:	In accordance with SS 245: 2014 Specification for Glass Reinforced Polyester Sectional Water Tank; - Clause 10.1.3 Hydrostatic Test	
TEST SAMPLE:	3 units of "PIPECO" GRP / FRP water storage tank panels having a size of 1 meter (width) X 1 meter (width) were received on 17 Jul 2017.	
TEST RESULTS:		

1. DIMENSIONS OF PANEL

Test Specimen S/No.	Dimensions of panel				
	Tolerance in External Dimensions (Length & Breadth)			Tolerance in Flange	
	Date of Test	Test Results	SS 245: 2014 Requirements	Test Results	SS 245: 2014 Requirements
S1	19 Jul 2017	Passed. Within ± 1 mm tolerance.	Tolerance in the external dimensions (length and breadth) of each panel shall be within ± 1 mm of nominal size.	Passed. Within ± 1° tolerance.	Tolerance in the flange angle shall be within ± 1 °.
S2	19 Jul 2017				
S3	19 Jul 2017				



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TEST RESULTS: (CONT'D)

2. HYDROSTATIC TEST

Test Specimen S/No.	Date of Test & Temperature	Weight of panel (kg)	Thickness of panel (mm)	Visual Defects	Hydrostatic Test	
					Test Results	SS 245: 2014 Requirements
S1	19 Jul 2017 27.7°C	30.96	1) 12.1 2) 14.8 3) 10.0	No defects was observed	Passed	Shall not burst, crack or leakage up to test pressure of 2.25 Bar
S2	19 Jul 2017 30.8°C	30.98	1) 12.1 2) 15.3 3) 9.8		Passed	
S3	19 Jul 2017 30.9°C	31.30	1) 12.4 2) 15.5 3) 9.9		Passed	

Note: Test pressure, ghp X 6 = $(9.81 \times 3.8 \times 1000 \times 6)/10^5 = 2.25$ Bar



Figure 1: Thickness measurements points

David Li
Testing Officer

Ong Khay Beng
Executive Engineer
Building
Mechanical Centre



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APPENDIX: PHOTOS TAKEN DURING TEST

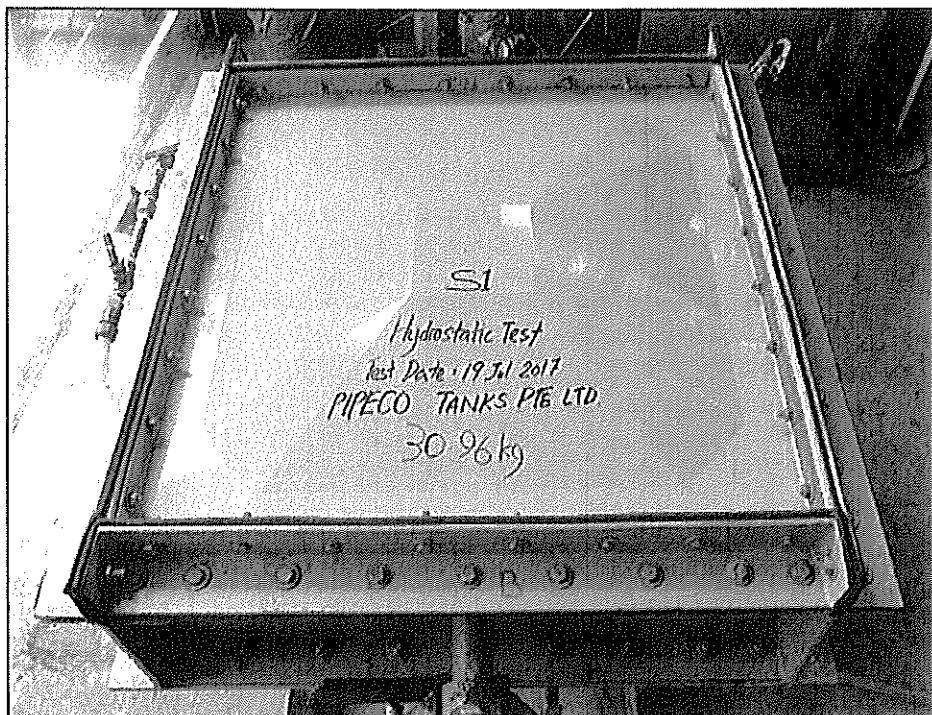
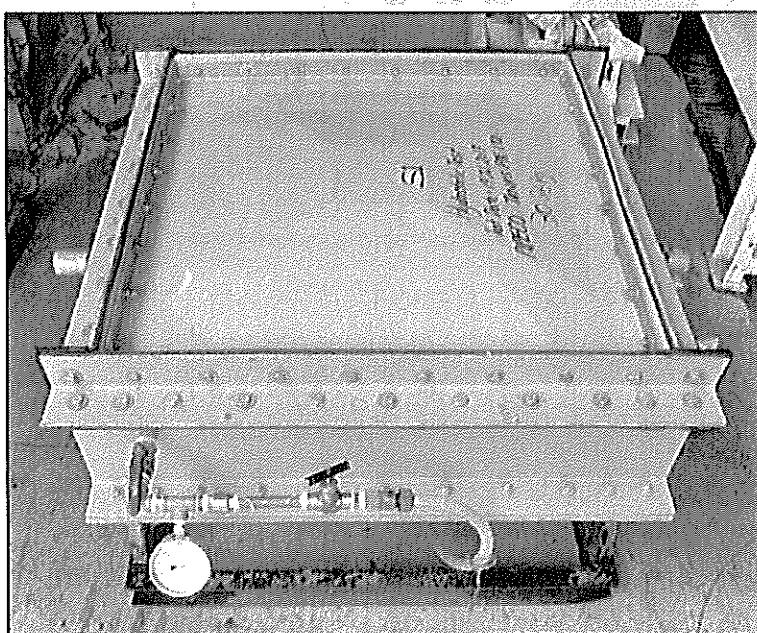


Figure 2: Typical "PIPECO" GRP / FRP sectional water storage tank panel



Ravinder Singh

Figure 3: Typical hydrostatic test set-up

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This is an architectural technical drawing of a large rectangular storage tank. The tank is oriented horizontally and features several vertical support columns along its length. On the left side, there is a vertical pipe assembly with various fittings, valves, and a pump unit labeled 'Pump Unit'. A horizontal pipe connects the pump unit to the top of the tank. On the right side, there is another vertical pipe assembly with a valve and a horizontal pipe leading away from the tank. The drawing includes detailed dimensions for the tank's width, height, and depth, as well as specific dimensions for the pipe sections and valve locations. The style is characteristic of industrial or civil engineering blueprints.

Ravinder S

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Choose certainly.
Add value.

SUBJECT: Testing of "PIPECO" GRP / FRP sectional water storage tank

TESTED FOR: Pipoco Tanks Singapore Pte Ltd
38 Changi South Street 1
Singapore 486765
Attn: Mr. Freddy Lim

TEST METHOD: In accordance with SS 245: 2014 Specification for Glass Reinforced Polyester
Sectional Water Tank;
a) Clause 10.2.1 – Leakage
b) Clause 10.2.2 - Deflection test

SAMPLES DESCRIPTION: 1 unit of 1 meter (width) X 1 meter (width) X 4 meter (height)
"PIPECO" GRP / FRP sectional water storage tank was erected
for leakage and deflection tests.

DRAWING SUBMITTED: 1 sheet of drawing



LA-2007-0310-A
LA-2007-0311-F
LA-2007-0312-B
LA-2007-0313-G

LA-2007-0314-G
LA-2007-0315-E
LA-2007-0316-C
LA-2010-0464-D

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our inspection body/laboratory

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dated 14 Sep 2017



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TEST RESULTS:

1) Deflection test

Test date: 23 Aug 2017

Test sample: 1m (w) X 1m (w) X 4m (ht) erected "PIPECO" GRP / FRP sectional water storage tank

Location of panel	Panel size (meter)	Deflection (mm)		SS 245; 2014 Requirements
		Immediately when the tank was filled with water	After 2 hours	
1	1 X 1	0.81	1.09	
2	1 X 1	3.98	4.16	
3	1 X 1	6.04	6.68	
4	1 X 1	3.74	4.18	
5	1 X 1	1.29	1.44	
6	1 X 1	4.43	4.88	
7	1 X 1	6.04	6.59	
8	1 X 1	3.68	3.97	
9	1 X 1	1.24	1.28	Shall not exceed 40 mm.
10	1 X 1	3.84	4.14	
11	1 X 1	5.87	6.47	
12	1 X 1	3.36	3.69	
13	1 X 1	0.71	0.87	
14	1 X 1	4.14	4.60	
15	1 X 1	6.04	6.71	
16	1 X 1	3.48	3.90	
17	1 X 1	4.28	4.56	Shall not exceed 10 mm.

Note: Refer to Figure 2 on page 4 for the location of panels.

Test Result: Complied

A handwritten signature in black ink, appearing to read "Ravidra Jit".



PSB Singapore

TEST RESULTS: (CONT'D)

2) Leakage test

Test date: 23 Aug 2017 (5:20 PM) to 25 Aug 2017 (5:20 PM)

Test sample	Test Result	SS 245: 2014 Requirements
1m(w) X 1m(w) X 4m(ht) erected "PIPECO" GRP / FRP sectional water storage tank	No water leakage was observed.	No visible sign of leakage shall be observed throughout the 48 hrs of standing.

Note: Refer to Figure 2 on page 4 for the test sample setup.

Test Result: Complied

3) Thickness measurements

Location of panel	Panel size (meter)	Weight of panel (Kg)	Thickness measurements (mm)		
			1	2	3
1	1 X 1	14.12	4.5	6.2	7.8
2	1 X 1	16.38	5.1	7.3	10.2
3	1 X 1	19.50	6.4	8.5	9.7
4	1 X 1	30.56	12.3	14.8	9.9
17 (Bottom panel)	1 x 1	26.44	9.9	13.0	9.9
Top panel (with cover)	1 X 1	17.08	-	6.8	5.0

Note: Refer to Figure 2 on page 4 for the location of panels.

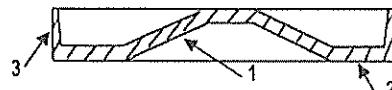


Figure 1: Thickness measurements points

David Li
Testing Officer



Ong Khay Beng
Executive Engineer
Building
Mechanical Centre



PSB Singapore

APPENDIX: PHOTOS TAKEN DURING TEST

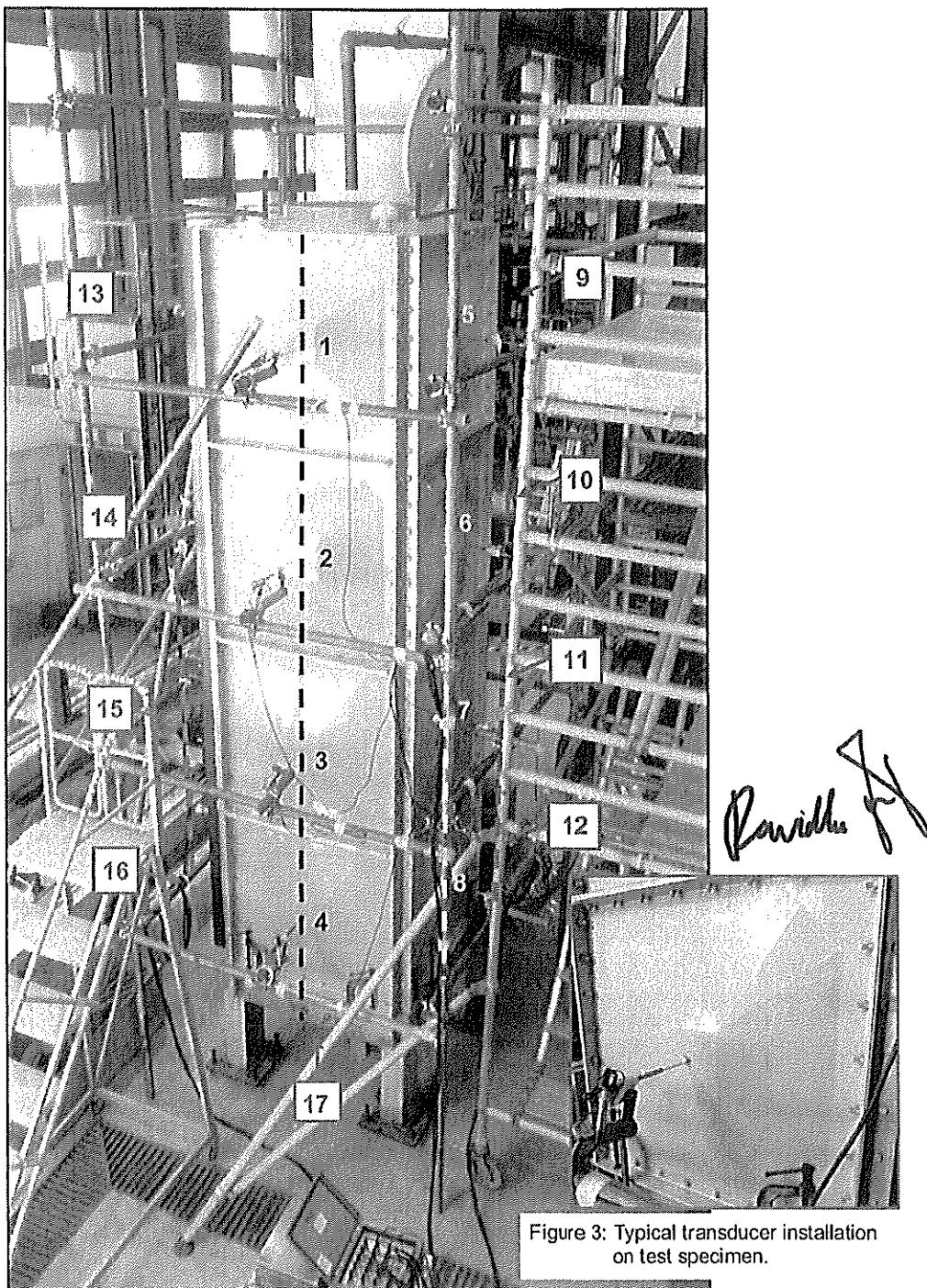


Figure 2: Erected 1m (w) x 1m (w) x 4m (ht) "PIPECO" GRP water tank with location of transducer points.



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APPENDIX: PHOTOS TAKEN DURING TEST (CONT'D)

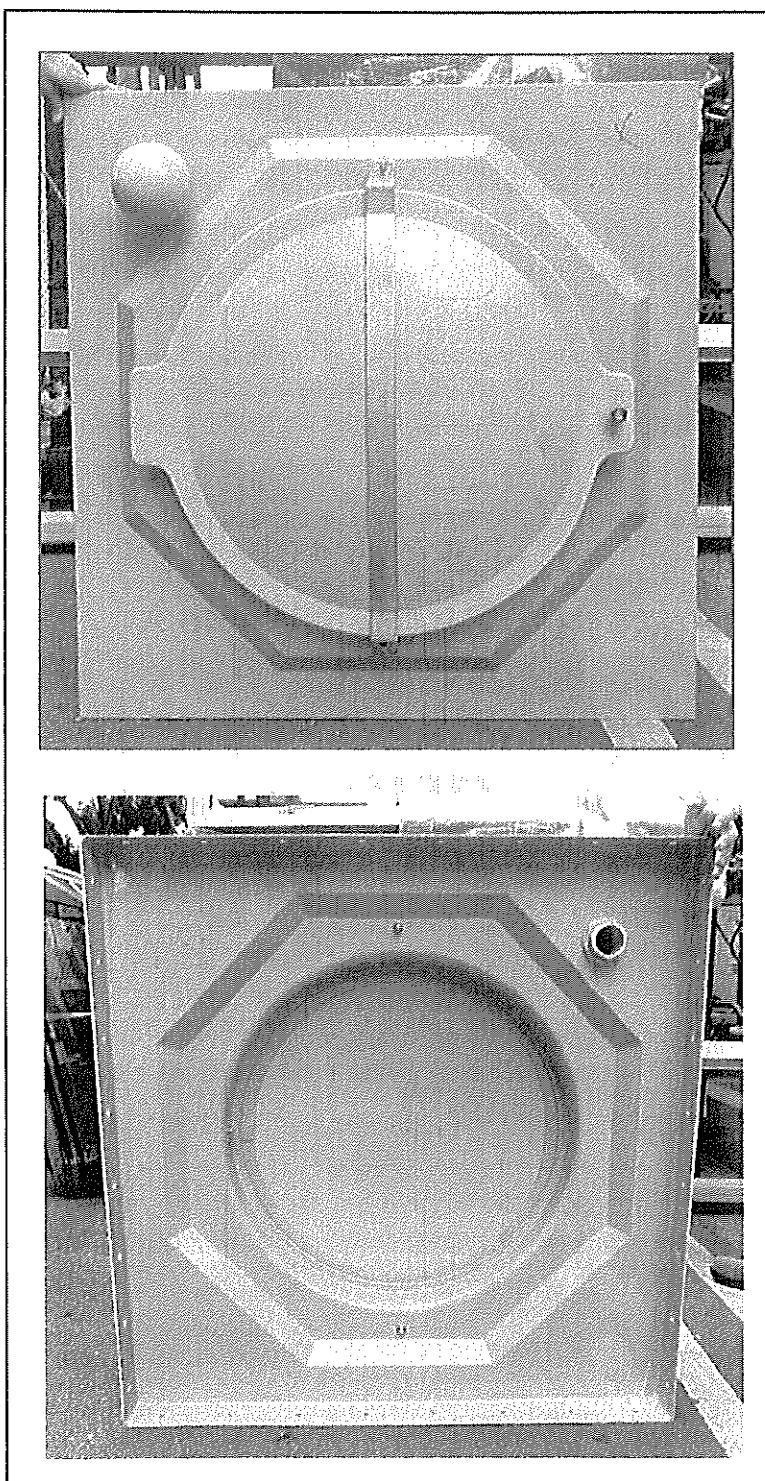


Figure 4: Top panel with cover

Ravindra J



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APPENDIX: PHOTOS TAKEN DURING TEST (CONT'D)

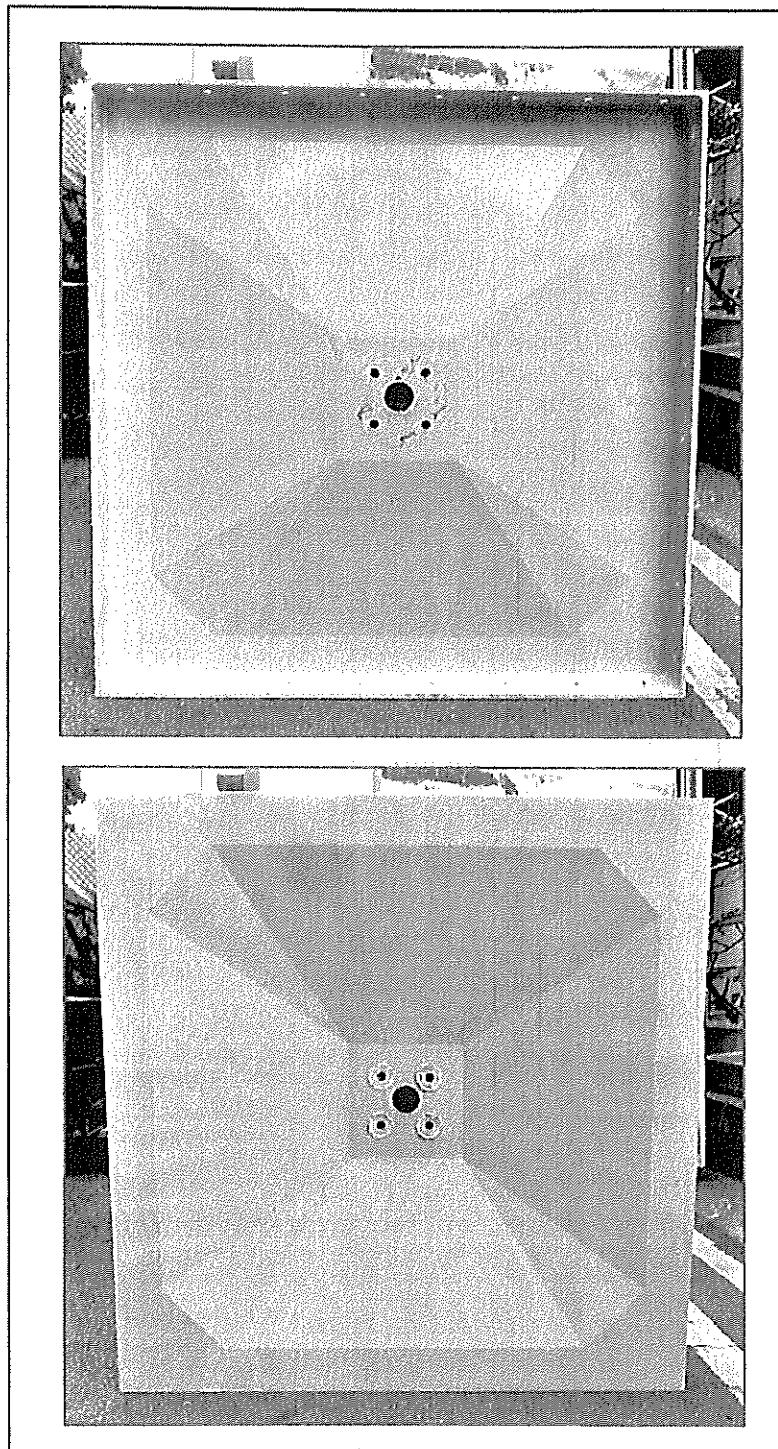


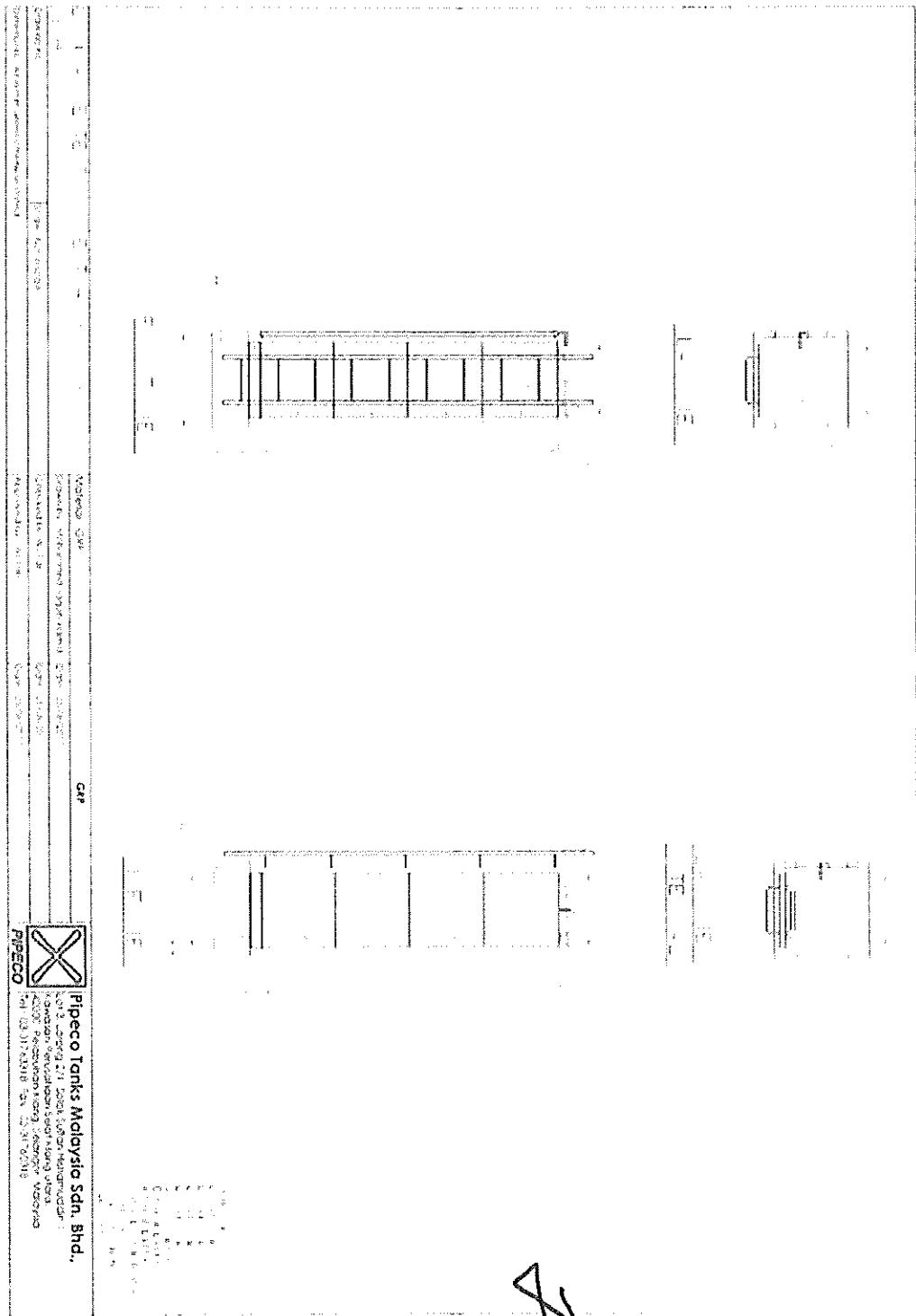
Figure 5: Bottom panel

A handwritten signature in black ink, appearing to read "David J."

Test Report No. 7191161904-MEC17-01-DL
dated 14 Sep 2017



PSB Singapore



Ravelli Jr.

Test Report No. 7191161904-MEC17-01-DL
dated 14 Sep 2017



PSB Singapore

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July 2011

TEST REPORT: 7191161904-CHM17-03-LSM

Date: 08 SEP 2017

Tel: +65 68851335 Fax: +65 67784301

Client's Ref:

Email: Sihai.LI@tuv-sud-psb.sg

Note: This report is issued subject to the Testing and Certification Regulations of the TÜV SÜD Group and the General Terms and Conditions of Business of TÜV SÜD PSB Pte Ltd. In addition, this report is governed by the terms set out within this report.



PSB Singapore

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SUBJECT

Testing of galvanised material for GRP water tank

CLIENT

Pipeco Tanks Singapore Pte Ltd
38 Changi South Street 1
Singapore 486765

Attn : Mr. Freddy Lim Siang Hoe

SAMPLE SUBMISSION DATE / TEST DATE

29 May 2017 / 05 Jun 2017

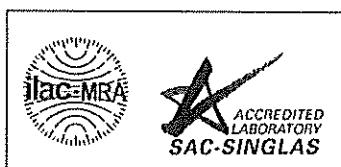
DESCRIPTION OF SAMPLE

One set of galvanised bolts, nuts, bracket, steel pipe and external ladder was received.

METHOD OF TEST

ISO 1461:2009

Hot dip galvanized coatings on fabricated iron and steel articles -- Specifications and test methods



LA-2007-0380-A
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G

LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C
LA-2010-0464-D

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this Report are not included in the SAC-SINGLAS Accreditation Schedule for
our Inspection body/laboratory

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www.tuv-sud-psb.sg
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
1 Science Park Drive, #02-01
Singapore 118221
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RESULTS

Sample Marked	Average zinc coating mass per unit area of steel surface, g/m ²	ISO 1461 Requirements
Nut (Thread Diameter = 11.7 mm)	626	Min 360 (Thread diameter > 6mm)
Bolt (Thread Diameter = 11.7 mm)	590	Min 360 (Thread diameter > 6mm)
Bracket (Thickness = 2.8 mm)	755	Min 325 (Thickness < 3mm)
Steel Pipe (Thickness = 1.2 mm)	430	Min 325 (Thickness < 3mm)
External Ladder (Thickness = 1.2 mm)	589	Min 325 (Thickness < 3mm)


LEOW SIONG MING
TECHNICAL EXECUTIVE


for DR LI SIHAI
AVP / SENIOR CHEMIST
COATINGS & INDUSTRIAL CHEMICALS
CHEMICAL & MATERIALS

TEST REPORT: 7191161904-CHM17-03-LSM
08 SEP 2017



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July 2011

TEST REPORT: S09MEC02966-3B-EO

Date: 15 JUL 2009

Tel: +65 68851291 Fax: +65 67784301

Client's Ref: -

Email: Huayi.CHEN@tuv-sud-psb.sg

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PSB Singapore

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SUBJECT

Metal toxicity test of GRP/FRP material to meet the requirements and compliance to AS/NZS 4020:2005 Appendix H.

CLIENT

Pipeco FRP Tanks Sdn Bhd
No. 9 Jalan Sungai Kayu Ara 32/37
Taman Bahagia, Seksyen 32
40460 Shah Alam, Selangor
Malaysia

Attn: Mr Tan Eng Huat / Mr Edmund Loh

SAMPLE SUBMISSION DATE

18 May 2009

DESCRIPTION OF PRODUCT

Type of Material : GRP/FRP Material (Internal Ladder + Internal Ladder Bracket + Internal Bolt, Nut & Washer + Bracing + Centre Lug)

DESCRIPTION OF SAMPLE

Two sets of cut GRP/FRP material (Internal Ladder + Internal Ladder Bracket + Internal Bolt, Nut & Washer + Bracing + Centre Lug) were tested. Both sets of sample consisted of an approximate surface area of 2186mm².

METHOD OF TEST

AS/NZS 4020:2005 Products for use in contact with drinking water.
(To be evaluated in accordance with WHO Guidelines for Drinking Water Quality, 2004.)

- 1) Sample Preparation – Appendix A.
- 2) Scaling Factor – Derivation and Application, Appendix B.
- 3) Test Method – Extraction of Metals, Appendix H (Elemental Analysis by ICP-MS).



Laboratory:
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LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G
LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.

TEST REPORT: S09MEC02966-3B-EO
15 JUL 2009



PSB Singapore

RESULTS

Sample Marked	GRP/FRP Material (2 nd Extraction)		Requirements
Elements (unit = mg/litre)	Sample 1	Sample 2	WHO Guidelines for Drinking Water Quality (2004) (mg/litre) max
Antimony, Sb	< 0.003	< 0.003	0.02
Arsenic, As	< 0.007	< 0.007	0.01
Barium, Ba	< 0.01	< 0.01	0.7
Cadmium, Cd	< 0.001	< 0.001	0.003
Chromium, Cr	< 0.01	< 0.01	0.05
Copper, Cu	< 0.1	< 0.1	2
Lead, Pb	< 0.01	< 0.01	0.01
Mercury, Hg	< 0.001	< 0.001	0.001
Molybdenum, Mo	< 0.01	< 0.01	0.07
Nickel, Ni	0.01	0.01	0.02
Selenium, Se	< 0.01	< 0.01	0.01
Silver, Ag	< 0.01	< 0.01	0.1 *

Note:

< : Less than

* : The requirement for silver, (Ag) is taken from AS/NZS 4020:2005.

Scaling Factor : Not applied, the product was tested by immersion method. Both sets of sample with an approximate surface area of 2186mm² was exposed to 1 litre of test water.

REMARKS

- 1) The water extract of the samples satisfied the WHO Guidelines for Drinking Water Quality (2004) with respect to all the toxic metals.
- 2) The results stated in this report relate to sample or samples of the product submitted for testing. Any changes in the material formulation, the process manufacture, the method of application, or the surface area-to-volume ratio in the end use, could affect the suitability of the product for the use in contact with drinking water.

MS ELSIE OW
TECHNICAL EXECUTIVE

DR CHEN HUAYI
ASSISTANT VICE PRESIDENT
ELEMENTAL AND ENVIRONMENTAL ANALYSIS
CHEMICAL & MATERIALS

TEST REPORT: S09MEC02966-3B-EO
15 JUL 2009



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March 2009

TEST REPORT: S09MEC02966-3A-EO

Date: 15 JUL 2009

Tel: +65 68851291 Fax: +65 67784301

Client's Ref: -

Email: Huayi.CHEN@tuv-sud-psb.sg

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SUBJECT

Metal toxicity test of stainless steel material to meet the requirements and compliance to AS/NZS 4020:2005 Appendix H.

CLIENT

Pipeco FRP Tanks Sdn Bhd
No. 9 Jalan Sungai Kayu Ara 32/37
Taman Bahagia, Seksyen 32
40460 Shah Alam, Selangor
Malaysia

Attn: Mr Tan Eng Huat / Mr Edmund Loh

SAMPLE SUBMISSION DATE

18 May 2009

DESCRIPTION OF PRODUCT

Type of Material : SS316 Rods

DESCRIPTION OF SAMPLE

Two pieces of cut SS316 rods were tested. The surface area of each SS316 rod is 7652mm².

METHOD OF TEST

AS/NZS 4020:2005 Products for use in contact with drinking water.

(To be evaluated in accordance with WHO Guidelines for Drinking Water Quality, 2004.)

- 1) Sample Preparation – Appendix A.
- 2) Scaling Factor – Derivation and Application, Appendix B.
- 3) Test Method – Extraction of Metals, Appendix H (Elemental Analysis by ICP-MS).



Laboratory:
TUV SUD PSB Pte. Ltd.,
Testing Services
No.1 Science Park Drive
Singapore 118221



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LA-2007-0382-B
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LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C

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3 Science Park Drive, #04-01/05
The Franklin, Singapore 118223
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TEST REPORT: S09MEC02966-3A-EO

15 JUL 2009



PSB Singapore

RESULTS

Sample Marked	SS316 Rods (1 st Extraction)		Requirements
Elements (unit = mg/litre)	Sample 1	Sample 2	WHO Guidelines for Drinking Water Quality (2004) (mg/litre) max
Antimony, Sb	< 0.003	< 0.003	0.02
Arsenic, As	< 0.007	< 0.007	0.01
Barium, Ba	< 0.01	< 0.01	0.7
Cadmium, Cd	< 0.001	< 0.001	0.003
Chromium, Cr	< 0.01	< 0.01	0.05
Copper, Cu	< 0.1	< 0.1	2
Lead, Pb	< 0.01	< 0.01	0.01
Mercury, Hg	< 0.001	< 0.001	0.001
Molybdenum, Mo	< 0.01	< 0.01	0.07
Nickel, Ni	< 0.01	< 0.01	0.02
Selenium, Se	< 0.01	< 0.01	0.01
Silver, Ag	< 0.01	< 0.01	0.1 *

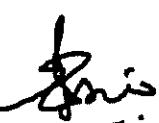
Note:

< : Less than

* : The requirement for silver, (Ag) is taken from AS/NZS 4020:2005.

Scaling Factor : Not applied, the product was tested by immersion method. Both sets of sample with an approximate surface area of 7652mm² was exposed to 1 litre of test water.**REMARKS**

- 1) The water extract of the samples satisfied the WHO Guidelines for Drinking Water Quality (2004) with respect to all the toxic metals.
- 2) The results stated in this report relate to sample or samples of the product submitted for testing. Any changes in the material formulation, the process manufacture, the method of application, or the surface area-to-volume ratio in the end use, could affect the suitability of the product for the use in contact with drinking water.



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TECHNICAL EXECUTIVE



DR CHEN HUAYI
ASSISTANT VICE PRESIDENT
ELEMENTAL AND ENVIRONMENTAL ANALYSIS
CHEMICAL & MATERIALS

TEST REPORT: S09MEC02966-3A-EO
15 JUL 2009



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March 2009

TEST REPORT: S09MEC02966/2-LYP

Date: 14 JUL 2009 Tel: +65 68851346 Fax: +65 67732912

Client's Ref: QM-0409-151 Email: Yin-Pheng.LEONG@tuv-sud-psb.sg

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SUBJECT

Testing of Sealing Material Sample for Use in Contact with Water Intended for Human Consumption
with regard to their Effect on the Quality of the Water.

CLIENT

PIPECO FRP TANKS SDN BHD
No.9 Jalan Sungai Kayu Ara 32/37
Taman Bahagia, Seksyen 32
40460 Shah Alam
Selangor, Malaysia

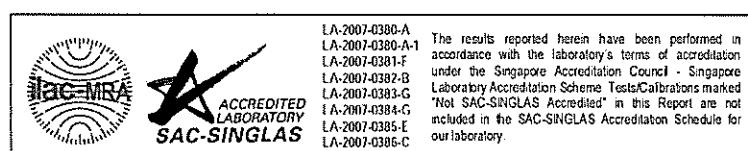
Attn : Mr Tan Eng Huat / Mr Edmund Loh

SAMPLE SUBMISSION DATE / TEST DATE

18 May 2009 / 18 May 2009

DESCRIPTION OF SAMPLE

10 number of 'PIPECO' brand sealing material (each of dimensions 120mm x 60 mm x 11mm)



Laboratory:
TÜV SUD PSB Pte. Ltd.
Testing Services
No.1 Science Park Drive
Singapore 118221

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Fax : +65-6776 8670
E-mail: testing@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 19900267R

Regional Head Office:
TÜV SUD Asia Pacific Pte. Ltd.
3 Science Park Drive, #04-01/05
The Franklin, Singapore 118223
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TEST REPORT: S09MEC02966/2-LYP

14 JUL 2009



PSB Singapore

METHOD OF TEST

Singapore Standard 375 : 2001 "Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water".

- Part 1 "Specification"
- Part 2:1 "Method of test - Samples for testing"
- Part 2:2.1 "Methods of test - Odour and flavour of water - General method of test"
- Part 2:3 "Methods of test - Appearance of water"
- Part 2:4 "Methods of test - Growth of aquatic microorganisms"
- Part 2:5 "Methods of test - The extraction of substances that may be of concern to public health (Cytotoxicity test)"
- Part 2:6 "Methods of test - The extraction of metals"

Singapore Standard 375 : 2001 is an adoption of British Standard 6920 : 2000.

RESULTS

(1) Odour and Flavour of Water

Extraction temperature : 25°C

Surface area : 15 000 mm²

- 1.1 All the test panelists reported no discernable odour in the 24 hour chlorinated and unchlorinated test extract and no discernable flavour in the first and second dilutions of the same chlorinated and unchlorinated test extracts.
- 1.2 The results obtained show that the sample complies with the requirements of SS 375 : Part 2:2:1 for the odour and flavour of water test.

(2) Appearance of Water

Extraction temperature : 25°C

Surface area : 15 000 mm²

2.1 Colour and Turbidity of the first extract of single sample

Test	Sample	Requirements of SS 375 : Part 1 : Specification (Maximum admissible level)
Colour (Hazen units)	Less than 5	5
Turbidity (FNU)	0.17	0.5

- 2.2 The results obtained show that the sample complies with the requirements of SS 375 : Part 2:3 for the appearance of water test.

TEST REPORT: S09MEC02966/2-LYP
14 JUL 2009



PSB Singapore

RESULTS (cont'd)

(3) Growth of Aquatic Microorganisms

Test temperature : 30°C
Surface area : 15 000 mm²

- 3.1 The mean dissolved oxygen concentration of the control was 7.80 mg/litre.
- 3.2 The mean dissolved oxygen difference (MDOD) of the test and reference materials were as follows:

Test Materials	MDOD (mg/l)	Requirements of SS 375 : Part 1 : Specification (MDOD, mg/l)
Negative reference	0.18	0.0 ± 0.6
Positive reference	5.83	7.5 ± 2.5
Test product (Single sample)	0.97	< 1.69

- 3.3 The results obtained show that the sample complies with the requirements of SS 375 : Part 2:4 for the growth of aquatic micro-organisms test.

(4) The Extraction of Substances that may be of concern to public health

Extraction temperature : 25°C
Surface area : 15 000 mm²

- 4.1 The extracts from the sample and the blank were used to prepare culture media for use with the Monkey Kidney Cell Line (Vero ATCC CCL81).
- 4.2 The extract from the single sample exhibited confluent growth of cells, thus indicating a non-cytotoxic response.
- 4.3 The test reagent blank exhibited confluent growth of cells.
- 4.4 The results obtained show that the sample complies with the requirements of SS 375 : Part 2:5 for the cytotoxicity test.

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RESULTS (cont'd)

(5) The Extraction of Metals (Elemental Analysis by ICP-MS)

Extraction temperature : 25°C

Surface area : 15 000 mm²

5.1 Concentration of metals determined in the first extracts of two samples.

Metal	Sample 1	Sample 2	Requirements of SS 375 : Part 1 : Specification (Maximum allowable concentration)
Aluminium, Al µg/l	< 20	< 20	200
Antimony, Sb µg/l	< 0.5	< 0.5	5
Arsenic, As µg/l	< 1.0	< 1.0	10
Barium, Ba µg/l	< 100	< 100	700
Cadmium, Cd µg/l	< 0.5	< 0.5	3
Chromium, Cr µg/l	< 5.0	< 5.0	50
Iron, Fe µg/l	< 20	< 20	200
Lead, Pb µg/l	< 1.0	< 1.0	10
Manganese, Mn µg/l	< 5.0	< 5.0	50
Mercury, Hg µg/l	< 0.1	< 0.1	1
Nickel, Ni µg/l	< 2.0	< 2.0	20
Selenium, Se µg/l	< 1.0	< 1.0	10
Silver, Ag µg/l	< 1.0	< 1.0	10

5.2 The results obtained show that the sample complies with the requirements of SS 375 : Part 2:6 for the extraction of metals test.

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Notes :

FNU : Formazine nephelometric unit

mg/l : milligrams per litre

µg/l : micrograms per litre

< : Less than

The above test results relate to the sample as received.

Remarks :

The above results show that the sample complies with the requirements of SS 375 : 2001 : Part 1 and Part 2 and is deemed suitable for use in contact with water intended for human consumption.

A handwritten signature in black ink, appearing to read "Aw Hwee Ying".

MS AW HWEE YING
TECHNICAL EXECUTIVE

A handwritten signature in black ink, appearing to read "Kam-Leong Yin Pheng".

MRS KAM-LEONG YIN PHENG
PRODUCT MANAGER
MICROBIOLOGY
CHEMICAL & MATERIALS

TEST REPORT: S09MEC02966/2-LYP
14 JUL 2009



PSB Singapore

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March 2009



National
Metrology Centre

TEST REPORT : OL002850

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Customer Pipeco Tanks Singapore Pte Ltd
38 Changi South Street 1
Singapore 486765

Subject Details

Subject Water Tank – Sunlight Transmission Test
Test Sample GRP/FRP Sectional Storage Water Tank
1m x 1m x 4 m (HT)

Sales Order No. 2028020820
Test Date 2017-09-18

Site Ambient Conditions

Temperature 30 °C
Relative Humidity 83 % relative humidity

17/09/17
[Handwritten signature]

Bay Swee Pheng
Testing Officer

A handwritten signature of Liu Yuanjie.

Liu Yuanjie
Approving Officer
Optical Metrology

For further enquiries, please contact the calibration officer at Tel +65 62791955, Fax +65 62791992 or Email
bay_swee_pheng@nmc.a-star.edu.sg

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Method of Testing

The subject has been tested at TUV SUD PSB Pte Ltd, 1 Science Park Drive open site between 11.00 am to 11.30 am under the ambient conditions stated above with a horizontal illuminance value of more than 10 klx.

The measurement was carried out using a working standard illuminance meter S380 (s/n: 3B044), which is traceable to national reference standards maintained at NMC.

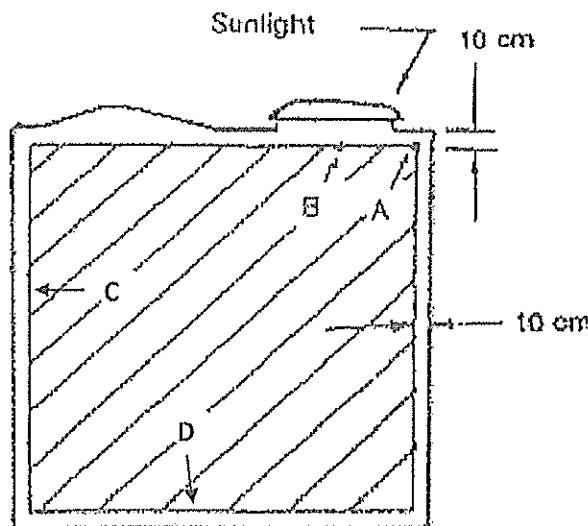
The illuminance measurements on the water tank were performed in accordance with the method described in the appendix J of the Singapore Standard SS 245 : 2014. The Ratio was calculated based on the following formula:

$$\text{Ratio} = \frac{\text{ILLUMINANCE INSIDE THE TANK (lux)}}{\text{ILLUMINANCE OUTSIDE THE TANK (lux)}}$$

Results of Testing**Testing results of Water Tank – Sunlight Transmission Test**

(Test Sample: GRP/FRP Sectional Water Storage Tank 1m x 1m x 4m (HT)):

Position	Ratio
Corner (point A)	0.000 001 00
Manhole (point B)	0.000 001 30
Tank wall (point C)	0.000 000 60
Tank Bottom (point D)	0.000 000 32



Remark: The Ratio shall not exceed 0.001 as required by Singapore Standard SS 245 : 2014

The expanded uncertainty of measurement is 25 % of the indicated value of test meter, estimated at a level of confidence of approximately 95 % with a coverage factor k = 2.

The user should determine the suitability of the subject for its intended use.

27 Aug

Testing Officer