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Materials, Structures and Geotechnical Testing

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GST No. 000782290944



TEST REPORT

ISSUED BY : KUALA LUMPUR OFFICE REPORT NO. : MIS 025/18/R 0309
DATE : 27-Apr-18 PAGE NO. : 1 OF 14

- 1 Test Requested :
1. Density, Absorption and Voids in Hardened Concrete.
*2. Scaling Resistance of Concrete surface exposed to deicing Chemicals.
3. Rapid Chloride Permeability Test.
*4. Apparent Chloride Diffusion Coefficient of Cementitious Mixture by Bulk Diffusion.
*5. Dry Film Thickness of Protective Coating (By Destructive Means)
*6. Wet Film Thickness Average Coating Thickness
*7. Carbon Dioxide Permeability for Coating Materials
*8. Water Vapour Transmission (Wet-Cup Method)
- 2 Customer :
DRITECH CHEMICALS SDN BHD
23-3a, Oval Damansara 685
Jalan Damansara
60000 Kuala Lumpur.
- 3 Project :
Mass Rapid Transit (MRT2).
- 4 Date Tested :
13-Mar-18 to 18-Apr-18
- 5 Category of Testing :
Laboratory Testing
- 6 Test Method :
- ASTM C642, ASTM C672, ASTM C 1202, ASTM C1556, ASTM D4138, ASTM D4414, BS EN 1062 & BS EN ISO 7783.
- 7 Equipment Serial No. :
- E2/2(Balance), E3/6(Caliper), E9/2A(Oven), E15/2(Digital Multimeter) - Traceable to Pyrometro.
- 8 Remarks :
a) The above test is solely based on the sample submitted by customer.
b) No copy of this report is valid without special original red stamp.
c) * Item no. 2, 4, 5, 6, 7 and 8 are NOT SAMM Accredited

The accuracy of test measurements are probability at 95% confidence level.

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Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Sample Description : System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).
 Source : Dritech Chemicals Sdn Bhd Lab.Ref : C245/18

SUMMARY OF TEST RESULTS

Item	Description	Test Results	
		Treated	Control
1	Density, Absorption, and Voids (Porosity)		
	- Absorption after immersion for 36 hours (%)	0.07	0.54
	- Volume of permeable voids (%)	0.07	0.67
	- Percentage Improvement for Water Absorption as per Control Specimen is (%)	87.0	
2	Scaling Resistance after 50 cycles	No Effect	
3	Rapid Chloride Permeability Test (Corrected charge passed) (coulombs)	0.00	84.20
	- Percentage Improvement for RCPT as per Control Specimen is (%)	100.0	
4	Apparent Chloride Diffusion Coefficient (m ² /s)	6.51E-14	
5	Dry Film Thickness (μm)	168	
6	Wet Film Thickness Average Coating Thickness (μm)	458.3	
7	Carbon Dioxide Permeability (Carrier Gas) Equivalent air layer thickness (m)	286.3	
8	Water Vapour Transmission (g/m ² .d)	14.86	

Certified by,


 Yap Seow Keong
 Technical Manager



Prepared by : Aida
 Checked by : Affa

Lab.Ref : C245/18

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DENSITY, ABSORPTION AND VOIDS IN HARDENED CONCRETE

Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Sample Description : **System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).**
 Source : Dritech Chemicals Sdn Bhd Test Environmental Condition :-
 Date Tested : 15-Mar-18 Temperature, °C : 28.8 - 30.9
 Tested by : Ken Relative Humidity (RH), % : 65.0 - 68.0
TEST METHOD : ASTM C 642-13

Sample Reference			Treated		Control
			1	2	1
Mass of oven dry sample in air	= A	(g)	708.8	753.4	759.1
Mass of surface dry sample in air after immersion in water	= B	(g)	709.1	753.7	763.0
Mass of surface dry sample in air after immersion and boiling	= C	(g)	709.2	753.9	763.2
Apparent Mass of sample in water after immersion	= D	(g)	367.5	414	422.3

RESULTS

ABSORPTION AFTER IMMERSION IN WATER	$= \frac{B - A}{A} \times 100$	(%)	0.04	0.04	0.51
ABSORPTION AFTER IMMERSION FOR 36 HOURS	$= \frac{C - A}{A} \times 100$	(%)	0.06	0.07	0.54
			0.07		0.54
BULK DENSITY - SURFACE DRY, ρ	$= \frac{A}{C - D}$	(Mg/m ³)	2.07	2.22	2.23
BULK DENSITY AFTER IMMERSION, ρ	$= \frac{B}{C - D}$	(Mg/m ³)	2.08	2.22	2.24
BULK DENSITY AFTER IMMERSION FOR 36 HOURS, ρ	$= \frac{C}{C - D}$	(g ₁) (Mg/m ³)	2.08	2.22	2.24
APPARENT DENSITY, ρ	$= \frac{A}{A - D}$	(g ₂) (Mg/m ³)	2.08	2.22	2.25
VOLUME OF PERMEABLE VOIDS	$= \frac{g_2 - g_1}{g_2} \times 100$	(%)	0.05	0.09	0.67
			0.07		0.67

Measurement uncertainty.

Sample reference	Bulk Density After Immersion for 36 hours, ρ (Mg/m ³)	Apparent Density, ρ (Mg/m ³)	Volume of Permeable Voids (%)
Treated 1	± 0.02	± 0.02	± 0.01
Treated 2	± 0.02	± 0.02	± 0.01
Control 1	± 0.02	± 0.02	± 0.01

Note : Without boiling procedure due to coating did not provide breathing for internal air.

Remarks : Percentage Improvement for Water Absorption as per Control Specimen is : **87.0%**

Certified by

Yap Seow Keong
 Technical Manager



Prepared by : Aida
 Checked by : Afifa

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**SCALING RESISTANCE OF CONCRETE SURFACES
EXPOSED TO DEICING CHEMICALS**

Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Sample Description : System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).
 Substrate Mix Details : Grade 40 MPa Concrete
 Source : Dritech Chemicals Sdn Bhd
 Type of Deicer Used : Calcium Chloride Solution
 Rate of Application : 4g of Anhydrous calcium chloride for 100ml of water
 Specimen Conditioning Procedure : Ambient Room
 Freezing Cabinet S/N : E20/04 Balance S/N : E02/02
 Tested by : Ken Date Tested : 05-Mar-18

Test Environmental Condition :- Temperature, °C : 27.0 - 29.6
 Relative Humidity (RH), % : 58.0 - 60.0

TEST METHOD : ASTM C 672-12

Sample Reference	Examination for Visual Rating of the Test Specimen Surface after Prescript Exposed Cycles					Remarks
	5	10	15	25	50	
1	0	0	0	0	0	-
2	0	0	0	0	0	Slight loss of gloss and discolouration
3	0	0	0	0	0	-

Results : After 50 cycles Exposed no Scaling effect.

Notes : 1) Place specimens in a freezing environment for 16 to 18h. At the end of this time remove them from the freezer and place them in laboratory air at 23 ± 2.0°C [73.5 ± 3.5°F] and a relative humidity of 45 to 55% for 6 to 8 h. Add water between each cycle as necessary to maintain the proper depth of solution. Repeat this cycle daily, flushing off the surface thoroughly at the end of each 5 cycles. After making a visual examination, replace the solution and continue the test.

2)

Rating	Condition of Surface
0	no Scaling
1	very slight scaling (3 mm [1/8 in.] depth, max, no coarse aggregate visible)
2	slight to moderate scaling
3	moderate scaling (some coarse aggregate visible)
4	moderate to severe scaling

Certified by

Yap Seow Keong
 Technical Manager



Prepared by : Aida
 Checked by : Afifa

Lab.Ref : C245/18

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Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Sample Description : **System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).**

SUMMARY OF RAPID CHLORIDE PERMEABILITY TEST RESULT

Structure	Date of Casting	Specimen Reference	Corrected charge passed (coulombs)		* Relative chloride permeability
			Specimen	Average	
Primer (Drigard CP 700) and Top Coat (Drigard CF 900) - Treated Specimen.	-	1	0.0	0.0	Negligible
		2	0.0		Negligible
		3	0.0		Negligible
Control Specimen (Without Coating)	-	C1	84.2	84.2	Negligible

Note :

- * Refer ASTM C1202-12, Table X1.1

Table X1.1 : Chloride ion penetrability based on charge passed.

Charge passed (coulombs)	Chloride Ion Penetrability
> 4,000	High
>2,000 - 4,000	Moderate
>1,000 - 2,000	Low
100 - 1,000	Very Low
< 100	Negligible

Certified by,


 Yap Sen Keong
 Technical Manager



Lab.Ref : C245/18

REPORT NO. : MIS 025/18/R 0309

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RAPID CHLORIDE PERMEABILITY TEST

Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Structure : Primer (Drigard CP 700) and Top Coat (Drigard CF 900) - Treated Specimen.
 Tested by : Zul
 Type of Specimen received : Cube Type of Concrete : Normal Curing History of Specimen : Moist Curing
 Test Environmental Condition : Temperature, °C : 25.2 - 25.4 Relative Humidity(RH) ,% : 42.0
 Test Method : ASTM C1202 - 12.

Specimen Reference		1					2					3				
Location of specimen within core		Middle					Middle					Middle				
Diameter of specimen (mm)		100.0					100.0					100.0				
Length of specimen (mm)		50.0					50.0					50.0				
*Date of casting		-					-					-				
*Date of Testing		13-Mar-18					13-Mar-18					13-Mar-18				
Age at time of test (days)		-					-					-				
Density of specimen (kg/m ³)		2210					2210					2180				
Resistor, R (Ohms)		1					1					1				
Initial Temperature of Specimen (°C)		27.4					27.4					27.4				
Applied Voltage Cell (°C)		24.6					24.6					24.6				
Time	Elapse Time (Hours)	Air Temp. °C	Voltage, (millivolt)		Current, I (milliamperes)		Temperature, °C		Voltage, (millivolt)		Current, I (milliamperes)		Temperature, °C			
			NaCl	NaOH	NaCl	NaOH	NaCl	NaOH	NaCl	NaOH	NaCl	NaOH	NaCl	NaOH		
10:30 AM	0:0 (Initial)	25.2	0.0	0.0	0.0	0.0	25.0	25.0	0.0	0.0	24.9	24.9	0.0	0.0	25.0	25.0
11:00 AM	0:30	25.2	0.0	0.0	0.0	0.0	25.0	25.0	0.0	0.0	24.9	24.9	0.0	0.0	25.0	25.0
11:30 AM	1:00	25.2	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	25.0	25.0	0.0	0.0	25.1	25.0
12:00 PM	1:30	25.2	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	25.0	25.0	0.0	0.0	25.1	25.0
12:30 PM	2:00	25.2	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	25.0	25.0	0.0	0.0	25.1	25.0
1:00 PM	2:30	25.3	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	25.1	25.1	0.0	0.0	25.1	25.1
1:30 PM	3:00	25.3	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	25.2	25.1	0.0	0.0	25.2	25.1
2:00 PM	3:30	25.4	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	25.2	25.1	0.0	0.0	25.2	25.1
2:30 PM	4:00	25.4	0.0	0.0	0.0	0.0	25.1	25.1	0.0	0.0	25.2	25.1	0.0	0.0	25.2	25.1
3:00 PM	4:30	25.4	0.0	0.0	0.0	0.0	25.2	25.2	0.0	0.0	25.3	25.2	0.0	0.0	25.2	25.1
3:30 PM	5:00	25.4	0.0	0.0	0.0	0.0	25.2	25.2	0.0	0.0	25.3	25.2	0.0	0.0	25.3	25.2
4:00 PM	5:30	25.4	0.0	0.0	0.0	0.0	25.2	25.2	0.0	0.0	25.3	25.2	0.0	0.0	25.3	25.2
4:30 PM	6:00	25.4	0.0	0.0	0.0	0.0	25.2	25.2	0.0	0.0	25.3	25.2	0.0	0.0	25.3	25.2

Sample Reference	1	2	3
Maximum current recorded mA	0.0	0.0	0.0
Total Charge passed during the 6 hours period $Q = 900 (I_0 + 2I_{30} + 2I_{60} + \dots + 2I_{330} + I_{360})$, where Q = charge passed (coulombs) I ₀ = current (amperes) immediately after voltage is applied. I _t = current (amperes) at t min after voltage is applied	0.0	0.0	0.0
Corrected charge passed $Q_s = Q_x \times \left[\frac{95}{x} \right]^2$ Q _s = charge passed (coulombs) through a 95mm diameter specimen Q _x = charge passed (coulombs) through x in. dia. Specimen. x = diameter (in.) of the non standard specimen	0.0	0.0	0.0
Average Corrected charge passed (Coulombs)	0.0		
Measurement Uncertainty (%)	-	-	-

Remarks :- Percentage Improvement for RCPT as per Control Specimen is : 100%

Prepared by : Aida

Checked by : Afifa

Lab.Ref : C245/18

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RAPID CHLORIDE PERMEABILITY TEST

Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 *Structure : **Control Specimen (Without Coating)**
 Tested by : Zul
 Type of Specimen received : Cube Type of Concrete : Normal Curing History of Specimen : Moist Curing
 Test Environmental Condition : Temperature, °C : 25.2 - 25.4 Relative Humidity(RH) ,% : 42.0
 Test Method : **ASTM C1202 - 12.**

Specimen Reference		C1																		
Location of specimen within core		Middle																		
Diameter of specimen (mm)		100.0																		
Length of specimen (mm)		50.0																		
*Date of casting		-																		
*Date of Testing		13-Mar-18																		
Age at time of test (days)		-																		
Density of specimen (kg/m ³)		2230																		
Resistor, R (Ohms)		1																		
Initial Temperature of Specimen (°C)		27.4																		
Applied Voltage Cell (°C)		24.6																		
Time	Elapse Time (Hours)	Air Temp. °C	Voltage, (millivolt)	Current, (milliamps)	Temperature, °C NaCl	Temperature, °C NaOH														
10:30 AM	0:0 (Initial)	25.2	1.5	1.5	25.1	25.0														
11:00 AM	0:30	25.2	2.3	2.3	25.1	25.1														
11:30 AM	1:00	25.2	2.8	2.8	25.1	25.1														
12:00 PM	1:30	25.2	3.3	3.3	25.1	25.1														
12:30 PM	2:00	25.2	3.7	3.7	25.2	25.1														
1:00 PM	2:30	25.3	4.5	4.5	25.2	25.2														
1:30 PM	3:00	25.3	4.7	4.7	25.2	25.2														
2:00 PM	3:30	25.4	5.0	5.0	25.2	25.2														
2:30 PM	4:00	25.4	5.1	5.1	25.2	25.2														
3:00 PM	4:30	25.4	5.3	5.3	25.3	25.2														
3:30 PM	5:00	25.4	5.6	5.6	25.3	25.2														
4:00 PM	5:30	25.4	5.8	5.8	25.4	25.2														
4:30 PM	6:00	25.4	6.0	6.0	25.4	25.2														

Sample Reference		C1																		
Maximum current recorded		mA					6.0													
Total Charge passed during the 6 hours period $Q = 900 (I_0 + 2I_{30} + 2I_{60} + \dots + 2I_{330} + I_{360})$, where Q = charge passed (coulombs) I ₀ = current (amperes) immediately after voltage is applied. I _t = current (amperes) at t min after voltage is applied							93.3													
Corrected charge passed $Q_s = Q_x \times \left[\frac{95}{x} \right]^2$ Q _s = charge passed (coulombs) through a 95mm diameter specimen Q _x = charge passed (coulombs) through x in. dia. Specimen. x = diameter (in.) of the non standard specimen							84.2													
Average Corrected charge passed		(Coulombs)					84.2													
Measurement Uncertainty		(%)					± 2.03													

Prepared by : Aida
 Checked by : Afifa

Lab. Ref : C245/18

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**DETERMINING THE APPARENT CHLORIDE DIFFUSION COEFFICIENT OF
 CEMENTITIOUS MIXTURE BY BULK DIFFUSION**

Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Sample Description : System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).
 Source : Dritech Chemicals Sdn Bhd
 Method of Sampling : Grinding Dust Powder Sampling Date : 16-Apr-18
 Date Start Submersion : 21-Feb-18 Mixture Details : G40 MPa
 Period of Exposure : 56 days Curing Employed : Air Cure
 Date Tested for Chloride : 18-Apr-18 Tested by : Ken
 Test Environmental Condition :- Temperature, °C : 27.0 - 29.5
 Relative Humidity (RH), % : 56.0 - 59.0

TEST METHOD : ASTM C 1556 - 11a (2016)

Sample Reference	Control	Primer (Digard CP 700) & Top Coat (Digard CF 900)		
		1	2	3
Specimen No.	1	1	2	3
Specimen Exposure Time, <i>t</i> (s)	4838400	4838400	4838400	4838400
Initial Chloride - Ion Concentration of the Sample, <i>C_i</i> (% m/m)	0.0018	0.0010	0.0010	0.0010
Depth Below Exposed Surface, <i>x</i> (m)	0.0010	0.0010	0.0010	0.0010
Chloride - Ion Concentration Measure at Depth, <i>x</i> and Exposed Time, <i>t</i> , <i>C(x,t)</i> (% m/m)	0.0067	0.0015	0.0012	0.0013
Projected Chloride Concentration at the Interface between Exposure Liquid and Test Specimen Determine by Regression Analysis, <i>C_s</i> (% m/m)	0.0091	0.0041	0.0029	0.0033
Apparent Chloride Diffusion Coefficient, <i>D_a</i> (m ² /s)	4.10E-12	7.54E-14	5.61E-14	6.39E-14
Average	4.10E-12	6.51E-14		

Note : Submersion exposure liquid (165 ± 1 g NaCl per litre water)

Certified By,


 Yap Seow Heong
 Technical Manager



Prepared by : Aida
 Checked by : Alifa

Lab. Ref : C245/18

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APPARENT CHLORIDE DIFFUSION COEFFICIENT OF CEMENTITIOUS MIXTURE BY BULK DIFFUSION
(Chloride Concentration Analysis of The Powder Samples)

Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Sample Description : **System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).**
 Source : Dritech Chemicals Sdn Bhd
 Date Tested : 19-Apr-18
 Tested by : Ken & Zul Date of Powder Grinding : 16-Apr-18
 Mix Details : G40 MPa Hana Chloride Test Kit S/N : K1322/12
 Test Environmental Condition : - Temperature, °C : 28.0 - 30.1
 Relative Humidity (RH), % : 56.0 - 59.0

TEST METHOD : ASTM C 1152 - 04e1 & ASTM C 1556-11a

Grinded Powder Sample Depth Interval, $C(x,t)$ (mm)	Specimen Reference			
	Contol	1	2	3
	Chloride - Ion Content (% m/m)			
0 - 1.0	0.0275	0.0048	0.0029	0.0046
1.0 - 2.0	0.0112	0.0031	0.0028	0.0038
2.0 - 3.0	0.0084	0.0020	0.0025	0.0024
3.0 - 4.0	0.0063	0.0018	0.0024	0.0023
4.0 - 5.0	0.0052	0.0018	0.0023	0.0020
5.0 - 6.0	0.0049	0.0017	0.0015	0.0018
6.0 - 8.0	0.0037	0.0017	0.0014	0.0014
8.0 - 10.0	0.0021	0.0016	0.0014	0.0011
Average	0.0087	0.0023	0.0022	0.0024
Initial of the Specimen Prior to Submersion, C_i	0.0018	0.0010	0.0010	0.0010

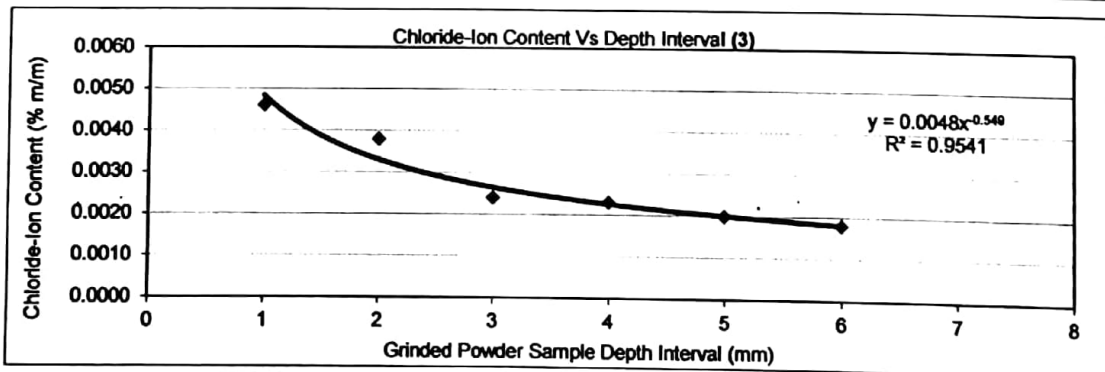
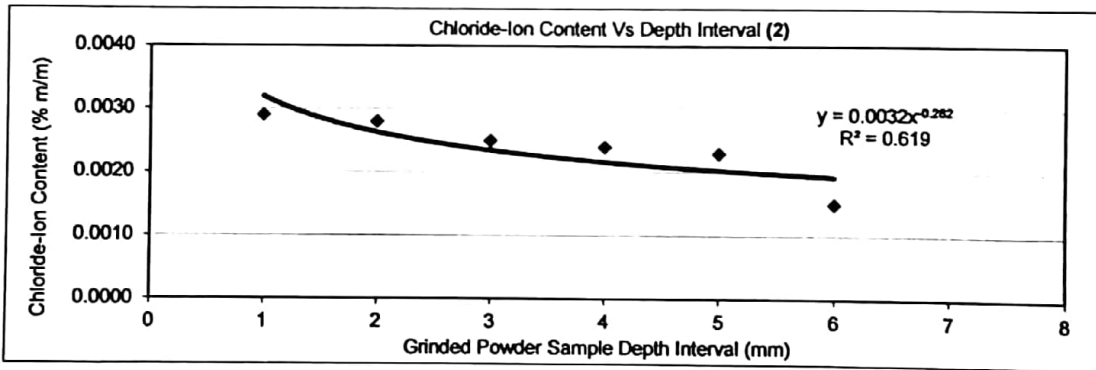
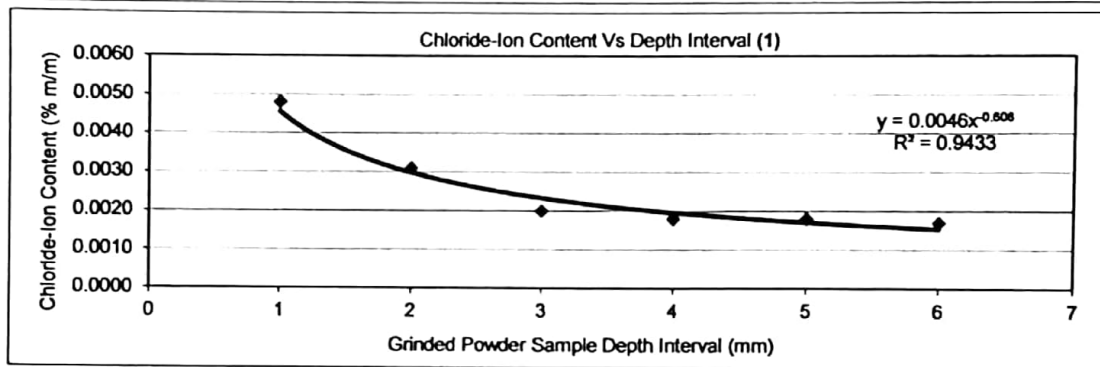
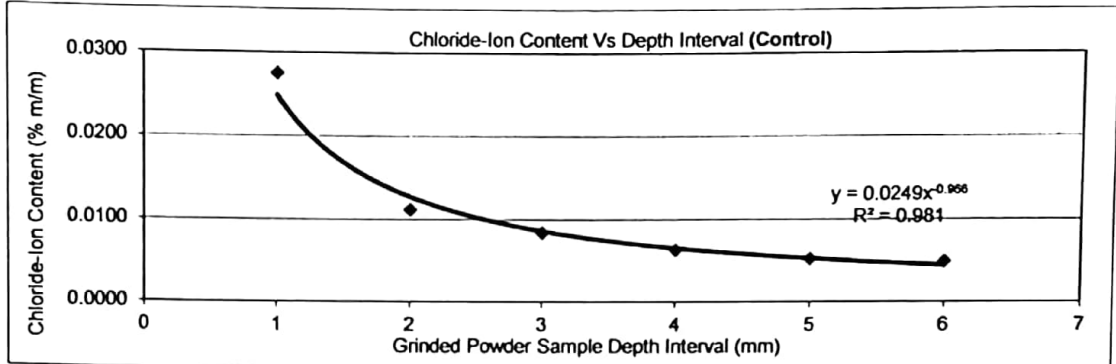
Certified by

Yap Seow Keong
 Yap Seow Keong
 Technical Manager



Prepared by : Aida
 Checked by : Affa

Customer : DRITECH CHEMICALS SDN BHD
 Source : Dritech Chemicals Sdn Bhd



Certified By,

Yap Seow Keong
 Yap Seow Keong
 Technical Manager



Prepared by : Aida
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**MEASUREMENT OF DRY FILM THICKNESS OF
PROTECTIVE COATING
(BY DESTRUCTIVE MEANS)**

Customer : DRITECH CHEMICALS SDN BHD

Project : Mass Rapid Transit (MRT2).

Sample Description : **System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).**

Source : Dritech Chemicals Sdn Bhd

Description of Sample : Primer Drigard CP 700, Top Coat Drigard C900

Tested by : Ken

Paint Inspection Gauge S/N : 20010/030

Date Tested : 26-Mar-18

Test Environmental Condition : - Temperature , °C : 25.0 - 26.0

Relative Humidity (RH) , % : 58.0 - 60.0

TEST METHOD : ASTM D 4138 - 07a

Sample Marking	Coating Thickness, μm		
	Minimum Thickness	Maximum Thickness	Average Thickness
1	155	180	168

Certified By,

Yap Seow Keong
Technical Manager



Prepared by : Aida
Checked by : Afifa

Lab.Ref : C245/18

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**MEASUREMENT OF WET FILM THICKNESS OF PROTECTIVE COATING
(BY NOTCH GAUGES)**

Customer : DRITECH CHEMICALS SDN BHD
Project : Mass Rapid Transit (MRT2).
Sample Description : **System : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).**
Source : Dritech Chemicals Sdn Bhd
Wet Film Notch Gauge Serial No. : 12371
Date Tested : 14-Mar-18
Tested by : Ken
Test Environmental Condition :-
Temperature , °C : 28.7 - 29.3
Relative Humidity (RH) , % : 66.0 - 67.0

TEST METHOD : ASTM D 4414-95 (2013)

Spot Reference No.	Individual Measurement of Coating Thickness, µm			AVERAGE
	1	2	3	
1st Coating	225	200	250	225.0
2nd Coating	225	225	250	233.3
Total Coating of 2 Coats	450	425	500	458.3

Certified by


Yap Seow Keong
Technical Manager



Prepared by : Aida
Checked by : Afifa

DETERMINATION OF CARBON DIOXIDE PERMEABILITY FOR COATING MATERIALS
(Carrier Gas Method)

Customer : DRITECH CHEMICALS SDN BHD
 Project : Mass Rapid Transit (MRT2).
 Coating Description : **System** : - Primer (Drigard CP 700) and Top Coat (Drigard CF 900).
 Substrate Description & Thickness : 100mmφ x 10.0mm thick G40 MPPa Concrete Piece Coated with Drigard CP 700 & CF 900 system.
 Conditioning Procedure : By Customer
 Sample Reference : 1, 2 & 3
 Source : Dritech Chemicals Sdn Bhd
 Date Tested : 19-Mar-18 Tested by : Ken & Yap
 Test Environmental Condition : Temperature , °C : 28.0 - 29.0
 Relative Humidity (RH), % : 57.0 - 58.0

TEST METHOD : BS EN 1062-6 : 2002, Method B

Calibration volume, V_c : 1.509E-05 m³ Carbon Dioxide Gas Analyzer S/N : 022123
 Effective area of test sample, A : 6.36E-03 m²
 Ambient atmospheric pressure during calibration, p_{amb1} : 101.135 kPa

Specimen No.		1	2	3	Average
Ambient atmospheric pressure during measurement, p_{amb2}	kPa	101.325	101.325	101.325	
Measurement temperature at cell during measurement,	T_m K	297.765	297.765	297.765	
Difference in the carbon dioxide concentration in the measuring and carrier gas, Δc	g/m ³	7.73	7.83	7.67	
Time start test : (Initial)	(hrs. / min.)	9:00	9:30	10:00	
Time ending test : (Concentration in the carrier gas reached steady state)	(hrs. / min.)	13:53	14:35	15:15	
Time to reach the calibration mark, t (Concentration in the carrier gas reached steady state)	(minutes)	293	305	315	
Carbon dioxide permeability, $i = \frac{V_c \times 7.68 \times 10^3 \times p_{amb1}}{A \times t \times \Delta c \times T_m \times p_{amb2}}$	g/(m ² .d)	0.0388	0.0368	0.0364	
Dry film thickness of coating or coating system, s	μm	185.0	190.0	190.0	
The thickness of substrate, t_s	m	0.0102	0.0103	0.0103	
Diffusion equivalent air layer thickness, $s_D = \frac{D_{CO_2} \times \Delta c }{i}$	m	274.7	293.4	290.7	286.3
Diffusion resistance number, $\mu = \frac{s_D}{s + t_s}$		1.48E+06	1.54E+06	1.53E+06	1.52E+06

Note : Measuring Gas = 10% (v/v) CO₂ / 90% (v/v) N₂
 Carrier Gas = N₂ or air
 D_{CO_2} is the diffusion coefficient for carbon dioxide in air, in square metres per day ($D_{CO_2} = 1.38 \text{ m}^2/\text{d}$ in air at 23 °C)
 $|\Delta c|$ is the difference, in grams per cubic metres, in carbon dioxide concentration of the carbon dioxide-free air and the carbon dioxide-containing air ($|\Delta c| = 180 \text{ g/m}^3$ for 10% (v/v) at 23 °C)

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Lab.Ref : C245/18

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DETERMINATION OF WATER VAPOR TRANSMISSION PROPERTIES
(Wet Cup Method)

Customer : DRITECH CHEMICALS SDN BHD
Project : Mass Rapid Transit (MRT2).
Sample Description : Primer (Drigard CP 700) and Top Coat (Drigard CF 900) - Treated Specimen.
Climate Chamber S/N : E20/01
Type of Coating : Non-Self-Supporting
Type of Substrate used : Grade 50.0 MPa
Substrate average thickness : 10.0 mm
Height of water in cup, mm : 25.0 mm
Conditioning Climate Chamber : Temperature , °C : (23 ± 2) Relative Humidity (RH), % : (50±5)

Balance S/N : E02/09
Date Tested : 16-Mar-18
Tested by : Ken

TEST METHOD : BS EN ISO 7783 : 2011 (Wet Cup Method A)

Water Method

Data	1 (Initial)	2	3	4	5	6	7	8	9	10
Date	12-Mar-18	12-Mar-18	12-Mar-18	12-Mar-18	13-Mar-18	14-Mar-18	16-Mar-18			
Time, (hr:min)	9:00	12:00	1:00	5:00	9:00	9:00	9:00			
Time Interval (hrs)	0	3	4	8	24	48	96			
Mass of test Specimen + Dish (g)	Specimen Ref.	1	324.26	324.22	324.22	324.22	324.14	324.08	323.88	
		2	343.45	343.42	343.41	343.40	343.38	343.35	343.15	
		3	350.65	350.62	350.62	350.62	350.58	350.55	350.33	

RESULT

Specimen Reference	1	2	3	AVG
Water Vapor Transmission				
Weight change, grains, g = G	0.20	0.20	0.22	
Time during which G occurred, h = t	48	48	48	
Slope of the straight line, g/h = G/t	0.0042	0.0042	0.0046	
Test area (cup mouth area), m ² = A	0.007	0.007	0.007	
Water-vapour transmission rate (V), g/m ² d WVT = ((G/t)/A) X 24	14.400	14.400	15.771	14.857
Permeance				
Standard atmospheric pressure at test temperature (101.325 Pa at 23°C) Pa = P _o	101.325	101.325	101.325	
Coating dry Film Thickness (μm) = d	180	180	170	
Water -vapour diffusion equivalent air layer thickness, S _d (m) = 20.4 / V	1.42	1.42	1.29	
Water-vapour resistance factor, μ = (S _D / d) x 10 ⁶	7889	7889	7588	7789

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