TECHNICAL OPINION REPORT

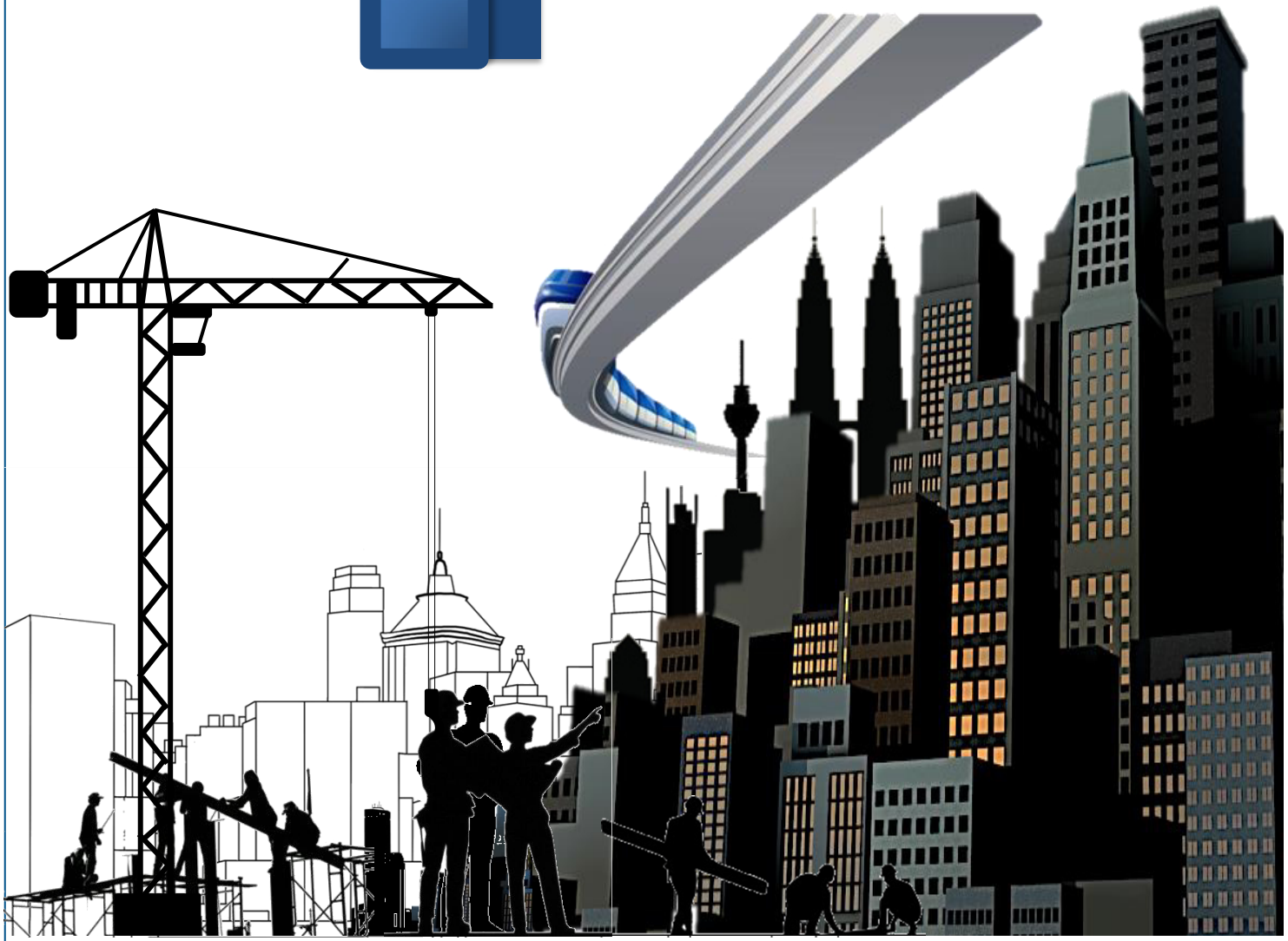
SUBMITTED TO CIDB MALAYSIA | OCTOBER 2015

PRODUCT

VT-620 LM MS Sealant

APPLICANT

Vital Technical Sdn. Bhd.



FOREWORD

Construction Industry Development Board (CIDB Malaysia) is a statutory body enacted under the Act 520 in 1994. Its mission is to develop Malaysian Construction Industry towards global competitiveness. To support this mission, a number of functions were formulated and one of them is to encourage the improvement of construction techniques and materials. Under this function, CIDB carry out assessment and appraisal of any kind of product, technology, and innovation that are related to the construction industry, and to publish the findings in the form of Technical Opinion.

Technical Opinion aims to provide reference to the relevant / interested parties in the construction industry. It has been modelled based on international recommended practice. It is prepared on behalf of CIDB by the Technical Expert Panel, which is set-up by CIDB and the members of Technical Expert Panel are drawn from experts specialized in relevant construction product, material, and technology.

The assessment of construction product, material, and technology is done by the Technical Expert Panel, based on the application and usage of that particular product, material, and technology in the construction industry. Industry players may use this Technical Opinion as a reference/supporting document for regulatory and approving authorities, architects, engineers etc. whenever dealing with new products and technologies in the construction indsutry.

CIDB Technical Expert Panel Committee for VT-620 LM MS Sealant

Technical Expert Panel

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Ir. Dr. Lim Char Ching	(Technical Expert Panel)	Jabatan Kerja Raya (JKR)
Assoc. Prof. Khiew Poi Sim	(Technical Expert Panel)	University of Nottingham Malaysia
Mr. Rahmad Abd. Shukor	(Technical Expert Panel)	SIRIM QAS International Sdn. Bhd.

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Natasha Binti Dzulkalnine	CREAM

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Definitions

Technical Opinion Programme	A programme initiated by CIDB with the aim to evaluate products, materials, components or system with regard to, but not limited to IBS. It normally covers wide range of innovative products to be used in local construction industry
Technical Expert Panel	Individuals that are selected based on their expertise in polymer study or building material application, particularly in construction sealant.
Modified Silicon (MS) Sealant	As stated in Sacramento Metropolitan Air Quality Management District Rule 460, sealant refers to any material with adhesive properties that is applied as a rope or bead and that is formulated for use primarily to fill, seal, waterproof, or weatherproof gaps or joints between two surfaces. According to the Adhesive and Sealant Council (ASC), Modified Silicon (MS) Sealant is a kind of hybrid sealant, which also refers to as silylated polyether, modified urethane, or silyl terminated polypropylene oxide. Hybrid sealants are claimed to combine the strength of polyurethanes with the weathering resistance of silicones. They are solvent-free, isocyanate-free, and allow for the customization of viscosity and early strength development for various applications due to their formulation versatility.

Abbreviations

ASC	Adhesive and Sealant Council
ASTM	American Society for Testing and Materials
BS	British Standard
CIDB	Construction Industry Development Board
CP	Check Point
CREAM	Construction Research Institute of Malaysia
FTIR	Fourier Transform Infra-Red Spectroscopy Analysis
HDPE	High Density Polyethylene
IBS	Industrialised Building System
JKR	Jabatan Kerja Raya
MKRM	Makmal Kerja Raya Malaysia
MS	Modified Silicon
OOS	Out-of-specification
QA	Quality Assurance
QC	Quality Control
PE	Polyethylene
PP	Polypropelene
SIRIM	Standards and Industrial Research Institute of Malaysia
TÜV	Technischer Überwachungs-Verein
uPVC	Unplasticized Polyvinyl Chloride
UK	United Kingdoms
USA	United States of America
UV	Ultraviolet
VOC	Volatile Organic Compound

Symbols

g	gram
lbf	pound-force
mm	millimetre
mm^2	square millimetre
N	Newton
^oC	degree Celsius
L	litre
cm^2	square centimetre
ml	millilitre
W	Watt
%	percentage
min	minute
h	hour
nm	nanometre

List of Tables

1.0 IDENTIFICATION

1.1 Name of Product

VT-620 LM MS Sealant

1.2 Country of Origin

Japan

1.3 Date of Evaluation

14th May 2015	:	First meeting of Technical Expert Panel
2nd July 2015	:	Second meeting of Technical Expert Panel

1.4 Purpose

Modified Silicon (MS) Sealant is a high-performance sealant, developed based on advanced MS Polymer Technology, which is used for connection and expansion joints in building.

1.5 Applicant & Address

Vital Technical Sdn. Bhd.

No. 93, Jalan Industri 3/3, Rawang Integrated Industrial Park, 48000, Rawang, Selangor.

Contact Person	:	Mr. Liow Song Ching
Telephone	:	03 – 60920000
Fax	:	03 – 60920099
Email	:	sales6@vitaltechnical.com

2.0 DESCRIPTIONS

2.1 General Description of Product

VT-620 LM MS Sealant is a low modulus elastomeric MS sealant, formulated with patented MS polymer of Kaneka Corporation Japan.

2.2 Element of Product

2.2.1. Raw Material

MS Polymer, Plasticizer, Calcium Carbonate, Titanium Oxide, Thixotrope, Antioxidant, UV Absorber, Dehyration Agent, Adhesion Promoter, Hardening Catalyst

2.2.2. Manufacturing Process

The manufacturing process of VT-620 LM MS Sealant is as shown in Figure 1.

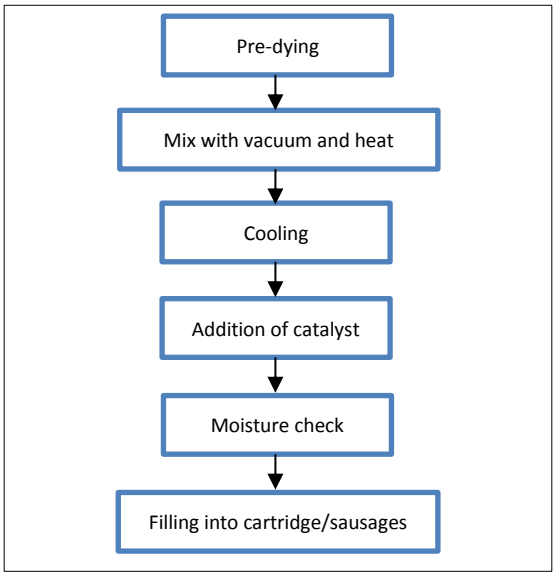

Figure 1: Manufacturing Process

2.2.3. Product Packaging

VT-620 LM MS Sealant is packaged as follow:

a) 290ml cartridge
b) 600ml sausage

2.3 Usage Application

VT-620 LM MS Sealant can be used to seal assemblies of concrete, functioning as a metal panel weather seal, window perimeter sealing, window weather seal, and as adhesive. It can also be used as top sealing in glazing systems, especially in combination with emulsion paints.

It can be applied without primer, to seal glazed surfaces, porcelain, coated metal, epoxy and polyester panels, polystyrene, uPVC, stainless steel, anodized aluminium and finish wood.

2.4 Usage Limitation

VT-620 LM MS Sealant should not be:

a) used for areas subject to continuous chlorinated water immersion, such as swimming pools, spas etc.
b) constantly immersed in salt water
c) used for Polyethylene (PE), Polypropelene (PP), Teflon, Neoprene and bituminous surfaces
d) used for structural glass glazing applications
e) painted with alkyd resin paint due to curing inhibition of the paint

f) used in trafficable joints greater than 10mm width, without a steel cover plate

2.5 Usage Advantages

The advantages of using MS Sealant are as follows:

a) Paintable
b) Less dirt streaking
c) Weather / UV resistance
d) No air bubbling
e) Solvent, silicone, and isocyanates free
f) Primerless bonding to most surfaces
g) Work on wet/damp substrates
h) Minimum shrinkage after curing
i) Elongation at break >900% and with movement capability ±50%
j) Fast curing time
k) Stable storage / shelf life

2.6 Special Conditions for Storage and Skills

2.6.1 Storage

a) The product should be stored in a dry and cool place with temperature below 25°C.
b) Shelf life: 9 months from the date of production in High Density Polyethylene (HDPE) cartridge; and 12 months from the date of production, in aluminium foil sausage.

2.6.2 Skills

a) Can be handled by average construction worker, with simple demonstration for workers who never apply joint sealants.
b) Following the normal practice of sealant applications.

3.0 BASIS OF APPRAISAL

3.1 Documents Received from the Applicant

The following documents were received from Vital Technical Sdn. Bhd. for product evaluation by the Technical Expert Panel.

3.1.1. Test reports on the product

a) Test report produced by Technischer Überwachungs-Verein SÜD PSB (TÜV SÜD PSB) Singapore on:
   i. staining and colour change
   ii. extrudability

iii. rheological (flow) properties
iv. Indentation hardness
v. tack-free time
vi. cyclic adhesion & cohesion under cyclic movement
vii. effects of heat ageing
viii. effects of accelerated weathering
ix. adhesion-in-peel
x. material Identification
(*see Appendix A, TÜV SÜD PSB Singapore*)

b) Test Report on Tensile Strength and Elongation at Break (*see Appendix B, SIRIM Berhad*)

c) Test Report on Volatile Organic Compound (VOC) (*see Appendix C, ACUMEN Scientific Sdn. Bhd.*)

d) Test Report on Weathering Test (*see Appendix D, Vital Technical Sdn. Bhd.*)

3.1.2. General Information

a) General information of the product (*see Appendix E, Product Brochure of VT-620 LM MS Sealant, Vital Technical Sdn. Bhd.*)

b) Technical data and specification of the product (*see Appendix F, VT-620 Technical Data Sheet, Vital Technical Sdn. Bhd.*)

3.1.3 Product Description

a) Product description of VT-620 LM MS Sealant (*see Appendix G, Slideshow presentation of the product, Vital Technical Sdn. Bhd.*)

b) Material safety data sheet (*see Appendix H, VT-620 Material Safety Data Sheet, Vital Technical Sdn. Bhd.*)

4.0 MATERIAL: STANDARDS, SPECIFICATIONS AND TESTS

4.1 Technical Properties of VT-620 LM MS Sealant

The following test results are extracted from the test reports provided by Vital Technical Sdn. Bhd.

4.1.1 *ASTM C920 : 2008 Standard Specification for Elastomeric Joint Sealants*

Series of test were performed by TÜV SÜD PSB Singapore on 19th October 2012 and 23rd April 2014 following the standard test method specified in ASTM C920 : 2008 Standard for Elastomeric Joint Sealants. The summary of the test results is shown in Table 4.1. The full test report is attached in Appendix A.

Table 4.1: Summary of Test Results on Series of Test Stated by ASTM C920 : 2008

Test	'VT-620 LM MS Sealant'	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Staining and Colour Change	No staining and no colour change	The sealant shall not cause any visible staining on the top surface of a white cement mortar base
Extrudability	> 10 ml / min	Type S (single component), grade NS (non-sag or gunnable sealant) shall have an extrusion rate time of not < 10 ml / min
Rheological (Flow) Properties	Vertical displacement: 0 mm sag Horizontal displacement: No deformation	Grade NS (non-sag) or gunnable sealant shall have flow characteristics such that it does not sag > 4.9mm in vertical displacement and shall show no deformation in horizontal displacement (refers to Type II and IV sealants)
Indentation Hardness (Shore A) Test piece 1, average Test piece 2, average	 36 36	T (traffic) sealant shall have a hardness reading of not < 25 or > 50 after being properly cured NT (non-traffic) sealant shall have a hardness reading of not < 15 or > 50 after being properly cured
Tack-Free Time	No transfer of test specimens to the polyethylene film	There shall be no transfer of the sealant to the polyethylene film when tested at 72 hours
Cyclic Adhesion & Cohesion	No bond failure	The total loss in bond and cohesion areas among the three specimens tested for each surface shall not be >9cm^2 with mortar substrates
Effects of Heat Ageing on Weight Loss, Cracking and Chalking, average	1.0% No cracking and chalking	The sealant shall not lose > 7% of its original weight or show any cracking and chalking
Effects of Accelerated Weathering	No cracks after UV exposure and bend test	The sealant shall show no cracks after the specified UV exposure at cold temperature and the bend test
Adhesion-In-Peel	39.3 N (8.9 lbf) cohesive failure within the sealant and no adhesive bond loss between sealant and substrate for each test piece	The peel strength for each individual test shall not be < 22.2 N (5 lbf) and the sealant shall show no > 25% adhesive bond loss for each individual test
Material Identification / Verification	Modified silicone-based material	-

4.1.1.1 Staining and Colour Change

Staining and colour change test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The description of the test is as Table 4.2.The results are shown in Table 4.3.

Table 4.2: Description of Staining and Colour Change Test

Item	Description
Test Cycle	8 hours UV exposure at 55 °C and 4 hours condensation at 45 °C
Exposure Duration	100 hours
No. of determination	1 for staining test, 1 for colour change test, 1 as control

Table 4.3: Result of Staining and Colour Change Test

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Staining and Colour Change	No staining and no colour change	The sealant shall not cause any visible staining on the top surface of a white cement mortar base

4.1.1.2 Extrudability

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The description of the test is as Table 4.4.The results are shown in Table 4.5.

Table 4.4: Description of Staining and Colour Change Test

Item	Description
Apparatus	Pcynometer and caulking gun
Test Pressure	40 psi
No. of determination	1

Table 4.5: Result of Extrudability Test

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Extrudability	> 10 ml / min	Type S (single component), grade NS (non-sag or gunnable sealant) shall have an extrusion rate time of not < 10 ml / min

4.1.1.3 Rheological (Flow) Properties of Sealant

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The description of the test is as Table 4.6.The results are shown in Table 4.7.

Table 4.6: Description of Rheological (Flow) Properties of Sealant

Item	Description
Method	Test method for 'Type II' sealant
Test Conditions	a) 4.4 °C in environmental chamber for 4 hours b) 50 °C in oven 4 hours
No. of determination	2 for vertical and horizontal displacements

Table 4.7: Result of Rheological (Flow) Properties of Sealant

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Rheological (Flow) Properties of Sealant	Vertical displacement: 0 mm sag Horizontal displacement: No deformation	Grade NS (non-sag) or gunnable sealant shall have flow characteristics such that it does not sag > 4.9 mm in vertical displacement and shall show no deformation in horizontal displacement (refers to Type II and IV sealants)

4.1.1.4 Indentation Hardness (Shore A)

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The results are shown in Table 4.8. The test conditions are as follows:

Test conditions:

a) 23 °C and 50% relative humidity for 7 days
b) 38 °C and 95% relative humidity for 7 days

No. of determinations: 2 or 3 points per test piece

Table 4.8: Indentation HardnessTest

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Indentation Hardness (Shore A) Test piece 1, average Test piece 2, average	 36 36	T (traffic) sealant shall have a hardness reading of not < 25 or > 50 after being properly cured NT (non-traffic) sealant shall have a hardness reading of not < 15 or >50 after being properly cured

4.1.1.5 Tack-Free Time

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012 with number of determinations are two (2). The results are shown in Table 4.9.

Table 4.9: Result of Tack-Free Time Test

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Tack-Free Time	No transfer of test specimens to the polyethylene film	There shall be no transfer of the sealant to the polyethylene film when tested at 72 hours

4.1.1.6 Cyclic Adhesion and Cohesion

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The results are shown in Table 4.10. The test and cyclic test conditions are as follows:

Test conditions:

a) 23 °C and 50% relative humidity for 7 days
b) 38 °C and 95% relative humidity for 7 days
c) Immersion in distilled water at 23°C for 7 days
d) Drying in oven at 70 °C for 7 days

Cyclic Test conditions:

Stage A-10 cycles of joint movements:

a) The joint width was compressed from 12.7mm to 9.5mm at 3.2mm/h
b) It was extended from 9.5mm to 15.9mm at 3.2mm/h
c) It was compressed again from 15.9mm to 12.7mm at 3.2mm/h

Stage B-10 cycles of joint movements:

a) The joint width was compressed to 9.5mm and conditioned at 70°C for 16 to 20 hours 3.
b) After ageing, the test specimens were cooled to 23°C for 2 to 3 hours
d) The joint width was extended to 15.9mm at -26°C and 3.2mm/h
c) The specimens were removed and allowed to condition to room temperature

Table 4.10: Result of Cyclic Adhesion and Cohesion Test

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Cyclic Adhesion and Cohesion	No bond failure	The total loss in bond and cohesion areas among the three specimens tested for each surface shall not be > 9 cm^2 with mortar substrates

4.1.1.7 Effects of Heat Ageing on Weight Loss, Cracking and Chalking

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The results are shown in Table 4.11. The test conditions are as follows:

Test conditions:

a) 23°C and 50% relative humidity for 28 days

b) 70°C for 21 days

Table 4.11: Result of Effects of Heat Ageing on Weight Loss, Cracking and Chalking Test

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Effects of Heat Ageing on Weight Loss, Cracking and Chalking, average	1.0 % No cracking and chalking	The sealant shall not lose > 7 % of its original weight or show any cracking and chalking

4.1.1.8 Effects of Accelerated Weathering

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The description of the test is as Table 4.12. The results are shown in Table 4.13.

Table 4.12: Description of Effects of Accelerated Weathering Test

Item	Description
Test cycle	8 hours UV exposure at 55°C and 4 hours condensation at 45°C
Lamp designation	Flourescent UVA 340 nm
Exposure duration	250 hours
No. of determinations	3 (1 as control)
Bend test Apparatus	Steel mandrel
Test condition	-26°C for 24 hours
No. of determinations	3

Table 4.13: Result of Effects of Accelerated WeatheringTest

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Effects of Accelerated Weathering	No cracks after UV exposure and bend test	The sealant shall show no cracks after the specified UV exposure at cold temperature and the bend test

4.1.1.9 Adhesion-In-Peel

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The description of the test is as Table 4.14 The results are shown in Table 4.15.

Table 4.14: Description of Adhesion-In-Peel Test

Item	Description
Test conditions	a) 23°C and 50% relative humidity for 7 days b) 38°C and 95% relative humidity for 7 days c) Immersion in water at 23°C for 7 days
Substrate	Mortar
Crosshead speed	50.8 mm/min
No. of determinations	4

Table 4.15: Result of Effects of Adhesion-In-Peel Test

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Adhesion-In-Peel	39.3 N (8.9 lbf) cohesive failure within the sealant and no adhesive bond loss between sealant and substrate for each test piece	The peel strength for each individual test shall not be < 22.2 N (5 lbf) and the sealant shall show no > 25% adhesive bond loss for each individual test

4.1.1.10 Material Identification

The test was performed by TÜV SÜD PSB Singapore on 15th August 2012. The material identification was performed by Fourier Transform Infra-Red Spectroscopy Analysis (FTIR). The results are shown in Table 4.16.

Table 4.16: Result of Material Identification

Type of Test	Result	ASTM C920:2008 Standard Specification for Elastomeric Joint Sealants
Material Identification	Modified silicone-based material	-

4.1.2 Test on Strength and Elongation at Break

The test was performed by the Testing Services Department, SIRIM QAS International Sdn. Bhd. on 23rd September 2014. The full test report is attached in Appendix B.

Table 4.17: Summary of Test Results on Strength and Elongation at Break

Type of Test	Result	Test Method
Tensile Strength, N/mm^2	1.33	ASTM D412 Specimen type: Dumbbell Die C Test speed: 500 mm/minute Number of specimen tested: 5 Date of test: 19 September 2014

4.1.3 *Test on VOC*

The test was performed by Acumen Scientific Sdn. Bhd. on 7th June 2011. The full test report is attached in Appendix C.

Table 4.18: Summary of Test Results on VOC

Type of Test	Units	Analysis Result	Standard Method / Technique / Equipment Used
Volatile Organic Compound	g/L	10	USEPA Test method 24 and SCAQMD Method 303-91 and using equations set out in L.N. 107 of 2009 Air Pollution Control (VOC) (Amendment) Regulation 2009

4.1.4 *Weathering Test*

The test was performed in-house by Vital Technical Sdn. Bhd. from 13th July 2012 to 23rd October 2013. The full test report is attached in Appendix D.

Test Method:

ASTM C 1442 – 06 Conducting tests on Sealants using Artificial Weathering Apparatus

- **Apparatus**: QUV chamber with fluorescent UVA-340 lamps. Irradiance set to 0.89 W / (m^2 . nm) at 340 nm
- **Specimen thickness**: 20 mm
- **Test Cycle**: 8 hours UV exposure at 60°C and 4 hours condensation at 50°C
- **Exposure duration**: 10,000 hours

Table 4.19: Sample Description

Sample	Description	Colour	Shore A Hardness
1	VT-620 (Batch no. L20120709)	White	33

Table 4.20: Results of Shore A Hardness Test

Sample	0 Hour		After 7000 Hours		After 10000 Hours	
	Appearance	Shore A Hardness	Appearance	Shore A Hardness	Appearance	Shore A Hardness
1	-	33	No crack, Surface dirty & look a bit greyish	33	No crack, Surface dirty & look greyish	33

5.0 LIST OF INTERNATIONAL STANDARDS

A list of International Standards and test method related to sealant is shown in Table 5.1 and Table 5.2, respectively.

Table 5.1: Standards for Sealant

No.	Country	Standard
1.	USA	**ASTM C920:2008** "Standard Specification for Elastomeric Joint Sealant", American Society for Testing and Materials (ASTM)
2.	UK	**BS ISO 11600:2003+A1:2011** "Building construction. Jointing products. Classification and requirements for sealants"

Table 5.2 Standards Test Method for Sealant

No.	Standard	Description
1.	ASTM C510: 2011	"Standard Test Method for Staining and Colour Change of Single or Multi-Component Joint Sealants", American Society for Testing and Materials (ASTM)
2.	ASTM C1183:2008	"Standard Test Method for Extrusion Rate of Elastomeric Sealants", American Society for Testing and Materials (ASTM)
3.	ASTM C639:2011	"Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants ", American Society for Testing and Materials (ASTM)
4.	ASTM C661:2011	"Standard Test Method for Idention Hardness of Elastomeric Type Sealants by Means of a Durometer", American Society for Testing and Materials (ASTM)
5.	ASTM C679:2009	" Standard Test Method for Tack Free Time of Elastomeric Sealants", American Society for Testing and Materials (ASTM)
6.	ASTM C719:2005	"Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle)", American Society for Testing and Materials (ASTM)
7.	ASTM C1246:2006	"Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants After Cure", American Society for Testing and Materials (ASTM)

8.	ASTM C793:2010	"Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants", American Society for Testing and Materials (ASTM)
9.	ASTM C794:2010	"Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants", American Society for Testing and Materials (ASTM)
10.	ASTM D412	"Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension", American Society for Testing and Materials (ASTM)
11.	ASTM C1442: 2011	"Standard Practice for Conducting Tests on Sealants Using Artificial Weathering Apparatus", American Society for Testing and Materials (ASTM)
12.	BS EN ISO 7389:2003	"Building construction, Jointing products, Determination of elastic recovery of sealants", International Organisation for Standardisation
13.	BS EN ISO 8339:2005	"Building construction, Sealants, Determination of tensile properties (Extension to break)", International Organisation for Standardisation
14.	BS EN ISO 8340:2005	"Building construction, Sealants, Determination of tensile properties at maintained extension", International Organisation for Standardisation
15.	BS EN ISO 10590:2005	"Building construction, Sealants, Determination of tensile properties of sealants at maintained extension after immersion in water", International Organisation for Standardisation
16.	BS EN ISO 9047:2003	"Building construction, Jointing products, Determination of adhesion/cohesion properties of sealants at variable temperatures", International Organisation for Standardisation
17.	BS EN ISO 10563:2005	"Building construction, Sealants, Determination of change in mass and volume", International Organisation for Standardisation
18.	BS EN ISO 7390:2003	"Building construction, Jointing products, Determination of resistance to flow of sealants", International Organisation for Standardisation

6.0 QUALITY ASSURANCE / QUALITY CONTROL

6.1 QA / QC plan

Production of MS sealant is separated into two parts: mill-base mixing and static mixing. Throughout the entire production process, QC tests are performed in three check points. All three check points are performed for every batch of MS Sealant production.

At the first check point (CP), moisuture content is determined after the heating process. Sample was directly extracted from the mixing. Immediately after extracting the sample, it is directly injected into the Karl-Fischer Titrateor. Upon completion of the mill-base mixing, tests will be performed as the second QC check point.

Once the second QC check point has passed all the tests, the mill-base will be fed into the static mixer to proceed with the mixing process and filled into sausages/cartridges. During the filling process, four samples will be taken after a set number of intervals. Some test are performed on all four samples while some tests are only performed on the first sample.

The following steps will be taken, in the case of properties being out-of-specification (OOS):

- During the first CP, the production process will only proceed to the next step if the moisture content is below 900 ppm. Else, the mill-base will be heated for another 30 minutes before getting another sample and retesting the moisture content.

- During the second and third CP, any property that is OOS will be retested with a fresh sample. If the property is still OOS after retest, the mill-base or filled sausages/cartridges will be placed on-hold to determine the cause of OOS and plan the corrective measures to bring the property back into the specification will be performed.

(*see Appendix I, Vital Technical Sdn. Bhd.*)

7.0 VALIDITY OF OPINION

7.1 Condition

The Technical Opinion Report given herein is based on a comprehensive evaluation of the product based on formal discussion with the Applicant together with documents and product information made available by the Applicant to the Technical Expert Panel.

This Technical Opinion report is valid for the product specification submitted for evaluation by Vital Technical Sdn. Bhd. It is the responsibility of the Applicant to notify CIDB of any changes in the product specification mentioned in this report.

7.2 Recommendations from Technical Expert Panel

The recommendations are made after a thorough evaluation conducted by the Technical Expert Panel. In the opinion of the Technical Expert Panel, the product has a potential to be used in the local construction industry.

However, it is recommended that the following test shall be conducted at local third party accredited laboratory:

i. Accelerated weathering test in accordance to ASTM C1442 or ASTM G155 for an exposure duration of at least 100 hours.

ii. The hardness and colour change shall be determined after the accelerated weathering test.

7.3 Validity

This Technical Opinion Report shall become invalid and irrelevant in the event the product does not comply with relevant International Standards or any approved equivalent Standards currently in use. CIDB has the right to publicly announce any withdrawal related to this report subject to the terms above. This report is valid for three (3) years from the date of issuance.

8.0 APPROVED OPINION ABSTRACT

The Technical Expert Panel concludes that this product has a potential to be used in Malaysian construction industry. However, additional tests shall be carried out at accredited laboratory locally.

Dr. Foo Chee Hung
Chairman

Ir. Dr. Lim Char Ching
Technical Expert Panel

Assoc. Prof. Dr. Khiew Poi Sim
Technical Expert Panel

Mr. Rahmad Abd. Shukor
Technical Expert Panel

August 2015

9.0 REFERENCE

Edward M. Petrie (2010) *MS Polymers in "Hybrid" Sealants*, EMP Solutions. The Adhesive and Sealant Council, Inc.

Sacramento Metropolitan Air Quality Management District Rule 460 Definitions Adhesives And Sealants Products Type

Appendix A

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Test Report No. 7191041458-MEC12/01-ED (221400271)
dated 19 Oct 2012

PSB Singapore

Choose certainty.
Add value.

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.

SUBJECT:

Testing of sealant

TESTED FOR:

Vital Technical Sdn Bhd
No. 93, Jalan Industri 3/3
Rawang Integrated Industrial Park
48000 Rawang
Selangore Darul Ehsan
Malaysia

Attn : Ms Carol Lai

SAMPLE DESCRIPTION:

The following items were received on 15 Aug 2012 as shown:

Sample	Size	Quantity
'VT-620 LM MS Sealant'	300 ml/cartridge	12 cartridges
'VT-602 Concrete Primer'	150 ml	1 bottle

TEST METHODS:

Staining And Colour Change

1. ASTM C510 : 2005 Standard Test Method For Staining And Colour Change Of Single Or Multi-Component Joint Sealants

Test cycle	:	8 hours UV exposure at 55°C and 4 hours condensation at 45°C
Exposure duration	:	100 hours
No. of determination	:	1 for staining test, 1 for colour change test, 1 as control

Extrudability

2. ASTM C1183 : 2008 Standard Test Method For Extrusion Rate Of Elastomeric Sealants
(Cross Reference: ASTM D1475 : 2008 Standard Test Method For Density Of Liquid Coatings, Inks And Related Products)

Apparatus	:	Pycnometer and caulking gun
Test pressure	:	40 psi
No. of determination	:	1

Flow Properties

3. ASTM C639 : 2007 Standard Test Method For Rheological (Flow) Properties Of Elastomeric Sealants

Method	:	Test method for 'Type II' sealant
Test conditions	:	a) 4.4°C in environmental chamber for 4 hours b) 50°C in oven for 4 hours
No. of determinations	:	2 for vertical and horizontal displacements

Hardness

4. ASTM C661 : 2006 Standard Test Method For Indentation Hardness Of Elastomeric-Type Sealants By Means Of A Durometer

Test Conditions:
a) 23°C and 50% relative humidity for 7 days
b) 38°C and 95% relative humidity for 7 days
c) 23°C and 50% relative humidity for 7 days
No. of determinations : 2, 3 points per test piece

Tack-Free Time

5. ASTM C679 : 2003 Standard Test Method For Tack-Free Time Of Elastomeric Sealants

No. of determinations : 2

Cyclic Adhesion & Cohesion

6. ASTM C719 : 2005 Standard Test Method For Adhesion And Cohesion Of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

Test Conditions:
a) 23°C and 50% relative humidity for 7 days
b) 38°C and 95% relative humidity for 7 days
c) 23°C and 50% relative humidity for 7 days
d) Immersion in distilled water at 23°C for 7 days
e) Drying in oven at 70°C for 7 days

Cyclic Test Conditions:
Stage A-10 cycles of joint movements:
a) The joint width was compressed from 12.7mm to 9.5mm at 3.2 mm/h
b) It was extended from 9.5mm to 15.9mm at 3.2 mm/h
c) It was compressed again from 15.9mm to 12.7mm at 3.2 mm/h
Stage B-10 cycles of joint movements:
a) The joint width was compressed to 9.5mm and conditioned at 70°C for 16 to 20 hours
b) After ageing, the test specimens were cooled to 23°C for 2 to 3 hours
c) The joint width was extended to 15.9mm at -26°C and 3.2 mm/h
d) The specimens were removed and allowed to condition to room temperature
No. of determinations : 3

Effects Of Heat Ageing

7. ASTM C1246 : 2006 Standard Test Method For Effects Of Heat Ageing On Weight Loss, Cracking, And Chalking Of Elastomeric Sealants After Cure

Test Conditions:
a) 23°C and 50% relative humidity for 28 days
b) 70°C for 21 days

No. of determinations	:	3, 1 as control

Effects Of Accelerated Weathering

8. Adopted ASTM C793 : 2005 Standard Test Method For Effects Of Accelerated Weathering On Elastomeric Joint Sealants

Test cycle	:	8 hours UV exposure at 55°C and 4 hours condensation at 45°C
Lamp designation	:	Fluorescent UVA 340 mm
Exposure duration	:	250 hours
No. of determinations	:	3 (1 as control)
Bend test		
Apparatus	:	Steel mandrel
Test condition	:	-26°C for 24 hours
No. of determinations	:	3

Adhesion-In-Peel

9. ASTM C794 : 2006 Standard Test Method For Adhesion-In-Peel Of Elastomeric Joint Sealants

Test Conditions:
a) 23°C and 50% relative humidity for 7 days
b) 38°C and 95% relative humidity for 7 days
c) 23°C and 50% relative humidity for 7 days
d) Immersion in water at 23°C for 7 days

Substrate	:	Mortar
Crosshead speed	:	50.8 mm/min
No. of determinations	:	4

Material Identification/Verification

10. Material Identification/Verification By Fourier Transform Infra-Red Spectrometric Analysis (FTIR)

CONDITIONING:

Unless otherwise specified, all test specimens were tested at 23 ± 2°C and 65 ± 5% relative humidity.

TEST RESULTS:

Test	'VT-620 LM MS Sealant'	ASTM C920 : 2008 Standard Specification For Elastomeric Joint Sealants
1. Staining And Colour Change	No staining and no colour change	The sealant shall not cause any visible staining on the top surface of a white cement mortar base
2. Extrudability	>10 ml/min	Type S (single component), grade NS (non-sag or gunnable sealant) shall have an extrusion rate time of not < 10 ml/min
3. Rheological (Flow) Properties	Vertical displacement: 0 mm sag Horizontal displacement: No deformation	Grade NS (non-sag) or gunnable sealant shall have flow characteristics such that it does not sag >4.8mm in vertical displacement and shall show no deformation in horizontal displacement (refers to Types II and IV sealants)
4. Indentation Hardness test piece 1, average test piece 2, average	 36 36	T (traffic) sealant shall have a hardness reading of not <25 or >50 after being properly cured NT (non-traffic) sealant shall have a hardness reading of not <15 or >50 after being properly cured
5. Tack-Free Time	No transfer of test specimens to the polyethylene film	There shall be no transfer of the sealant to the polyethylene film when tested at 72 hours
6. Adhesion & Cohesion Under Cyclic Movement	No bond failure	The total loss in bond and cohesion areas among the three specimens tested for each surface shall not be >9 cm2 with mortar substrates
7. Effects Of Heat Ageing On Weight Loss, Cracking And Chalking, average	1.0% No cracking and chalking	The sealant shall not lose >7% of its original weight or show any cracking and chalking
8. Effects Of Accelerated Weathering	No cracks after UV exposure and bend test	The sealant shall show no cracks after the specified UV exposure and shall show no cracks after exposure at cold temperature and the bend test
9. Adhesion-In-Peel, average	39.3 N (8.9 lbf) cohesive failure within the sealant and no adhesive bond loss between sealant and substrate for each test piece	The peel strength for each individual test shall not be <22.2 N (5 lbf) and the sealant shall show no >25% adhesive bond loss for each individual test
10. Material Identification/ Verification By FTIR	Modified silicone-based material (refer to Figure 1)	-

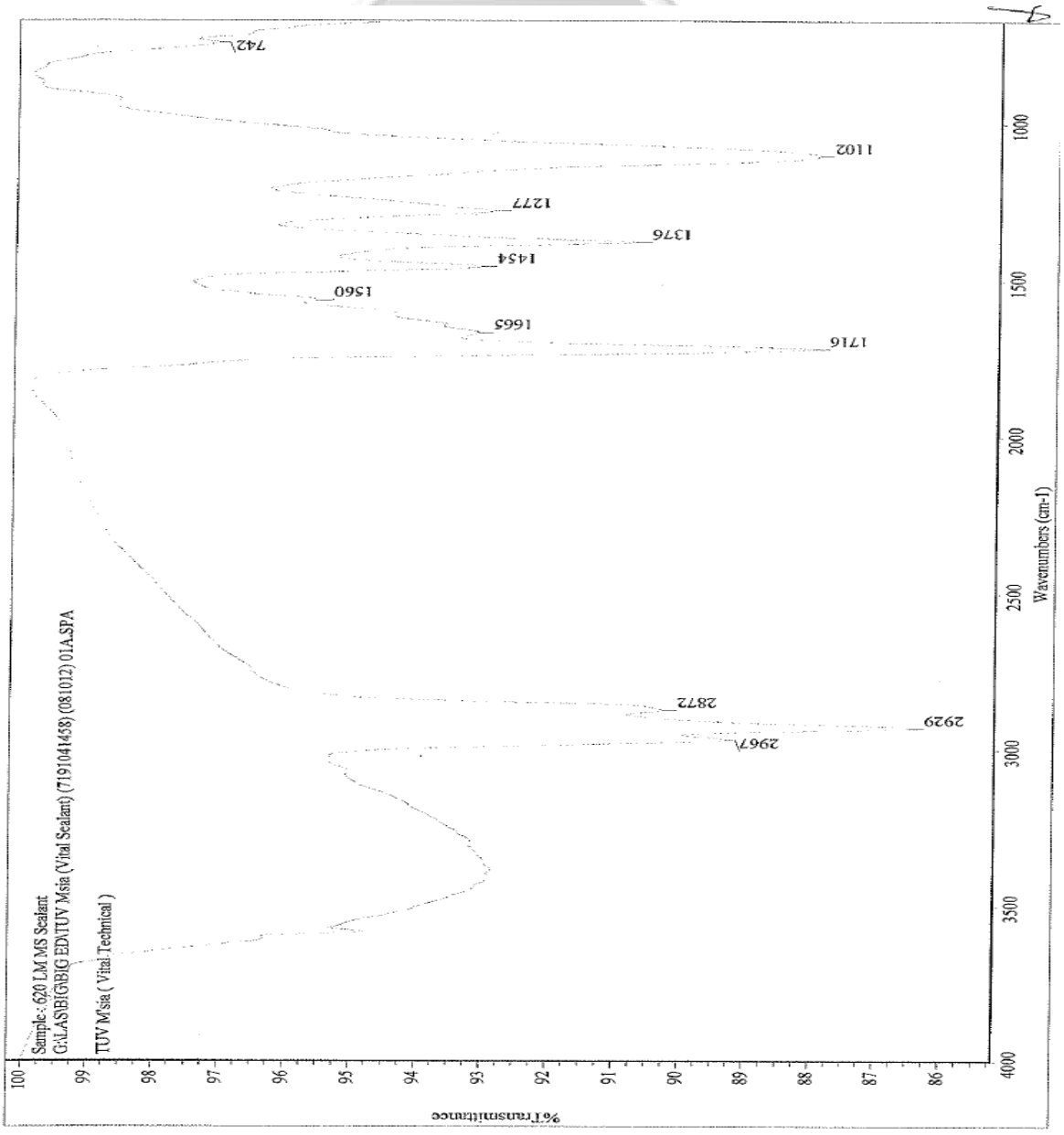
REMARKS:

1. The test conditions for staining and colour change tests and effects of accelerated weathering test were adopted from ASTM G154 : 2006 Standard Practice For Operating Fluorescent Light Apparatus For UV Exposure Of Non-Metallic Materials.
2. As specified by the client, the primer was applied onto mortar substrates for stain and colour change, adhesion/cohesion cyclic and adhesion-in-peel tests prior to application of the sealant.

Eddie Suwand
Senior Associate Engineer

Sebestian Koh
Engineer
Automotive & Industrial Group
Mechanical Centre

Photo 1 : IR spectrum of 'VT-620 LM MS Sealant'



Please note that this Report is issued under the following terms :

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.

2. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.

3. Nothing in this report shall be interpreted to mean that TÜV SÜD PSB has verified or ascertained any endorsement or marks from any other testing authority or bodies that may be found on that sample.

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5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

July 2011

Test Report No. 7191082380-MEC14-ED (221404100)
dated 23 Apr 2014

PSB Singapore

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Add value.

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.

SUBJECT:

Testing of sealant

TESTED FOR:

Vital Technical Sdn Bhd
No. 93, Jalan Industri 3/3
Rawang Integrated Industrial Park
48000 Rawang
Selangor Darul Ehsan
Malaysia

Attn : Ms Carol Lai

SAMPLE DESCRIPTION:

The following items were received on 26 Feb 2014 as shown:

Sample	Size	Quantity
'VT-620 LM MS Sealant' Primer : '602 Concrete Primer'	290 ml/cartridge 100 g	2 cartridges 1 tin

TEST METHOD:

Adopted ASTM C920 : 2008 Standard Specification For Elastomeric Joint Sealants

Cyclic Adhesion & Cohesion

ASTM C719 : 2005 Standard Test Method For Adhesion And Cohesion Of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

Test Conditions:

a) 23°C and 50% relative humidity for 7 days
b) 38°C and 95% relative humidity for 7 days
c) 23°C and 50% relative humidity for 7 days
d) Immersion in distilled water at 23°C for 7 days
e) Drying in oven at 70°C for 7 days

TÜV SÜD PSB

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

Phone : +65-6885 1333
Fax : +65-6776 8670
E-mail: testing@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
3 Science Park Drive, #04-01/05
The Franklin, Singapore 118223

Cyclic Test Conditions:
Stage A-10 cycles of joint movements:
a) The joint width was compressed from 12.7mm to 6.4mm at 3.2 mm/h
b) It was extended from 6.4mm to 19.1mm at 3.2 mm/h
c) It was compressed again from 19.1mm to 12.7mm at 3.2 mm/h
Stage B-10 cycles of joint movements:
a) The joint width was compressed to 6.4mm and conditioned at 70°C for 16 to 20 hours
b) After ageing, the test specimens were cooled to 23°C for 2 to 3 hours
c) The joint width was extended to 19.1mm at -26°C and 3.2 mm/h
d) The specimens were removed and allowed to condition to room temperature
No. of determinations : 3 for Class 50

CONDITIONING:

Unless otherwise specified, all test specimens were tested at 23 ± 2°C and 65 ± 5% relative humidity.

TEST RESULT:

Test	'VT-620 LM MS Sealant'	ASTM C920 : 2008 Standard Specification For Elastomeric Joint Sealants
Adhesion & Cohesion Under Cyclic Movement, Class 50	No bond failure	The total loss in bond and cohesion areas among the three specimens tested for each surface shall not be >9 cm^2 with mortar substrates

REMARKS:

1. The class movement 50 was specified by the client.
2. As specified by the client, the primer was applied onto the mortar substrates and allowed to dry till-tack free prior to application of the test sample.

Eddie Suwand
Senior Associate Engineer

Eng Aik How
Product Manager
Building
Mechanical Centre

Please note that this Report is issued under the following terms :

1. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment. Unless otherwise stated in this report, no tests were conducted to determine long term effects of using the specific product/equipment.

2. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.

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4. This report shall not be reproduced wholly or in parts and no reference shall be made by the Client to TÜV SÜD PSB or to the report or results furnished by TÜV SÜD PSB in any advertisements or sales promotion.

5. Unless otherwise stated, the tests were carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

July 2011

Appendix B

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SIRIM QAS International Sdn. Bhd. (410334-X)
No. 1, Persiaran Dato' Menteri, Section 2, P.O. Box 7035
40700 Shah Alam, Selangor Darul Ehsan, Malaysia
Tel: (603) 55446045/40
Fax: (603) 55446039

TEST REPORT

REPORT NO : 2014PC0530	PAGE NO : 1 OF 3

Applicant	: Vital Technical Sdn. Bhd. No. 93, Jalan Industri 3/3 Rawang Integrated Industrial Park 48000 Rawang Selangor Darul Ehsan
Manufacturer	: - same as above -
Product	: VT-620 LM MS Sealant; Trademark/Brand: V-Tech
Reference Standard	: ASTM D 412: 2006a (Reapproved 2013) – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
Description of Sample	: 10 pieces of dumbbell shape test specimens
Date Received of Complete Application	: 19 September 2014
Job No.	: J20141460517
Description of Test Results	: The test results of the submitted test sample are described in Page 2 of this test report
Issued date	: 23 September 2014

Approved Signatory:

.....
(Siti Rohana Ahmad)
Testing Executive

.....
(Dr Ahmad Fuad Md. Yusuf)
Head
Plastics and Composite Materials Section
Testing Services Department

Results:

'VT-620 LM MS Sealant; Trademark/Brand: V-Tech'

No.	Test	Results	Test Method
1	Tensile Strength, N/mm^2	1.33	ASTM D 412 Specimen type: Dumbbell Die C Test speed: 500 mm/minute Number of specimen tested: 5 Date of test: 19 September 2014 (Refer to Figures 1 and 2 for test specimens before and after test)
2	Elongation at Break, %	1,300	

Note: The test specimens were prepared by the applicant.

Results (Continued):

'VT-620 LM MS Sealant; Trademark/Brand: V-Tech'

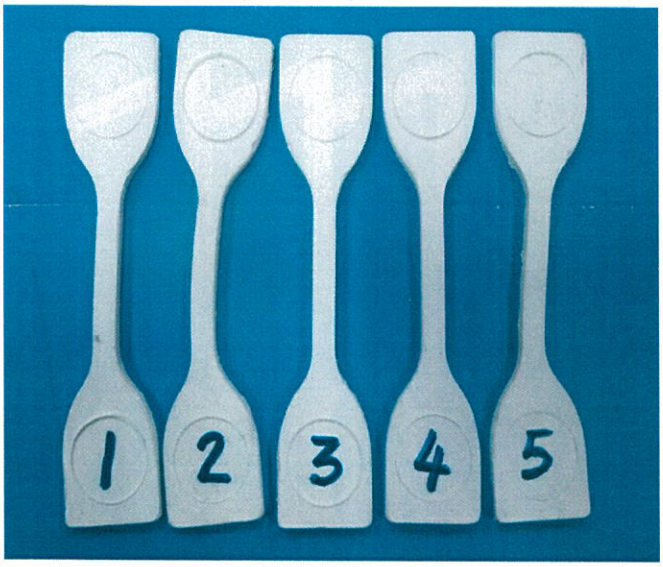

Figure 1. Photograph of sample 'VT-620 LM MS Sealant' – Before test

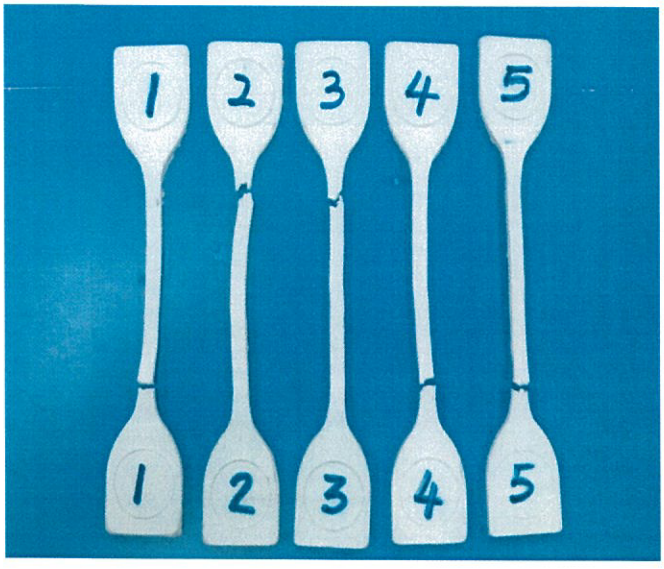

Figure 2. Photograph of sample 'VT-620 LM MS Sealant' – After test

Appendix C

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偉德工藝有限公司

Vital Technical Sdn. Bhd. (Co.No.: 589221-K)
No: 93, Jalan Industri 3/3, Rawang Integrated Industrial Park,
48000 Rawang, Selangor, Malaysia.
tel: +603-6092 0000 **fax:** +603-6092 0099
email: sales@vitaltechnical.com **www.vitaltechnical.com**

1st March 2012

Dear Valued Customer / Business Partners,

RE: "V-tech" VT-620 LM MS Sealant VOC Compliance

This is to confirm that **"V-tech" VT-620 LM MS Sealant** has been tested by an Independent Lab for Volatile Organic Compound (VOC) content in accordance to South Coast Air Quality Management District (SCAQMD) rule 1168.

The VOC content of **VT-620 LM MS Sealant** is **<10 g/L** (refer to the attached test report). This is **lower than the 250g/L VOC limit in SCAQMD rule 1168**. Hence we can confirm that **VT-620 LM MS Sealant is Low VOC compliance**.

We wish to confirm that **The Malaysia Green Building Index (GBI)** rating system adopts the SCAQMD regulation. Hence **VT-620 LM MS Sealant** is meeting the Malaysia GBI rating requirement.

Should you require further information concerning the above product, please do not hesitate to contact us.

Thank you.

Yours sincerely,
For Vital Technical Sdn. Bhd.

Cheong Chee Leong
General Manager

ACUMEN
ONE STOP ANALYSIS SOLUTIONS

ACUMEN SCIENTIFIC SDN. BHD. *(514926-V)*
Plot No. 256, Tingkat Perusahaan 5, Kawasan Perindustrian Perai 2, 13600 Perai, Penang, Malaysia
Tel : +604-388 3609 Fax : +604-388 3708
Email : inquiry@acumen.com.my Website : www.acumen.com.my

CERTIFICATE OF ANALYSIS

VITAL TECHNICAL SDN. BHD.
93, Jalan Industry 3/3,
Rawang Integrated Industrial Park,
48000, Rawang, Selangor.
Tel : +603-6092 0000 Fax : 03-6092 0099
Attn : Ms Carol

Certificate No : CN/nCML0029/0611
Sample Log Code : nCML0034/0611
Sample Received Date : 03-Jun-2011
Complete Analysis Date : 07-Jun-2011
Date Issue : 07-Jun-2011

Sample Description : VT-620
Analysis results :

Parameter	Units	Analysis Result	Standard Method/Technique/Equipment Used
		-	
Volatile Organic Compound Test	g/L	<10	USEPA Test method 24 and SCAQMD Method 303-91 and using equations set out in L.N. 107 of 2009 Air Pollution Control (VOC) (Amendment) Regulation 2009

Remark : -

Teem Chin Mean
Manager
M.Sc., AMIC,
A/2152/4620/04

ND denotes not detected

(< ***Numeric number***) denotes detection limits

Appendix D

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Title: ***Weather testing on MS Sealant VT-620***

Test Period:

From 13 July 2012 to 23 October 2013

Sample Description:

Sample	Desciption	Colour	Shore A hardeness
1.	VT-620 (Batch no. L20120709)	White	33

Test Method:

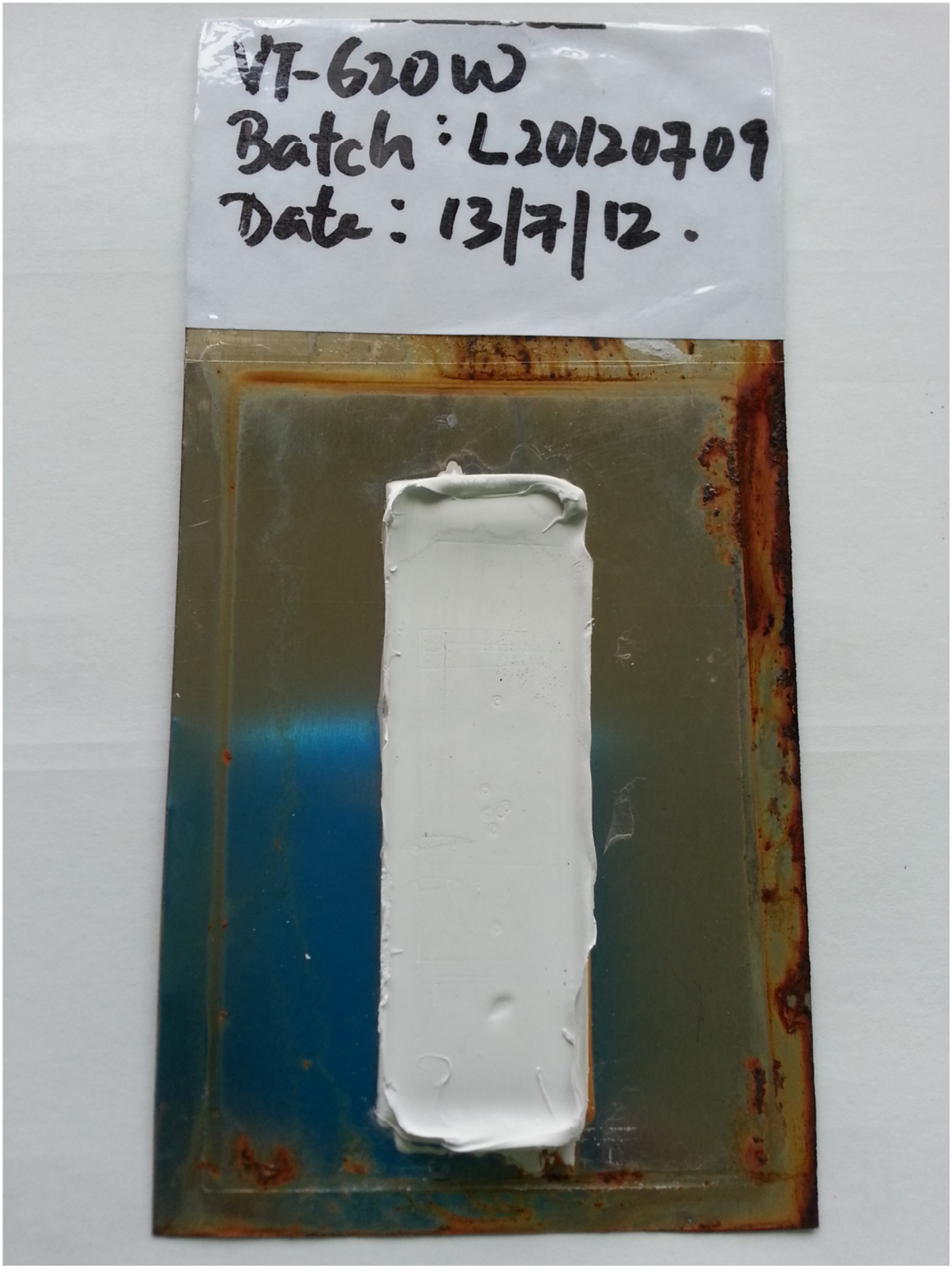
ASTM C 1442 – 06 Conducting tests on Sealants Using Artificial Weathering Apparatus

- **Apparatus:** QUV chamber with fluorescent UVA-340 lamps. Irradiance set to 0.89 W/(m².nm) at 340 nm.
- **Specimens thickness:** 20 mm
- **Test Cycle:** 8 hours UV exposure at 60℃ & 4 hours condensation at 50℃.
- **Exposure duration:** 10,000 hours

Test Results:

Sample	0 Hour		After 7000 Hours		After 10000 Hours	
	Appearance	Shore A Hardness	Appearance	Shore A Hardness	Appearance	Shore A Hardness
1	-	33	No crack, Surface dirty & look a bit greyish	33	No crack, Surface dirty & look greyish	33

Remark: Kindly refer next page picture for the appearance after 10,000 hours


VT-620W
Batch : L20120709
Date : 13/7/12.

Appendix E

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V-tech®

Adhesive, Sealant & Waterproofing

ADVANCE MS-POLYMER TECHNOLOGY

VT-620 / VT-620S LM MS Sealant

- ASTM C-920 Compliant
- 50% Movement Capability
- Paintable
- Less-Streaking (Aluminium Composite Panel)
- Good UV Resistant
- Solvent, Silicone & Isocyanates free
- Primerless Bonding to Most Surfaces

Description: A one component, high performance sealant based on advance Ms Polymer Technology. It is Solvent, Silicone and Isocyanates Free and Non-staining for natural stones applications. It has an excellent UV, weather and temperature resistance. It has excellent adhesion over a wide variety of substrates and is paintable with most common industrial paints.

Applications: Ideal for connection and expansion joints in building. Top sealing in glazing systems especially in combination with emulsion paints. It may be used without primer, to seal assemblies of concrete, glazed surfaces, porcelain, coated metal, epoxy and polyester panels, polystyrene, uPVC, stainless steel, anodized aluminum and finish wood.

Available Color: White, Grey, Teak & Black
Content: 290ml (cartridge), 600ml (sausage)
Carton Quantity: 20 cartridges/carton, 20 sausages/carton

Product Specification:

Curing System	Moisture Curing
Density	1.55 g/ml (White & Grey color) 1.52 g/ml (Black color)
Skin over time	35 - 60 minutes
Elongation at break (ASTM D412)	> 1000%
Shore A Hardness (ASTM C661)	25 – 35
VOC content (California Air Resources Board Method 310)	< 4%
Joint movement capability (ASTM C719)	±50%
Application Temperature	5℃ to 40℃
Service Temperature	-30℃ to 100℃
Shelf Life	9 months

Towards a Greener Future

www.vitaltechnical.com

LOW VOC CONTENT

Green Bonding & Sealing Solutions

Features:

Paintable

✓Paintable (MS Polymer)

Non-paintable (Silicone Sealant)

PAINTABLE

It is paintable with various types of paint. This improves the aesthetic finishing of the joints.

Flexible Seal & Good UV Resistance

✓Good UV Resistance (MS Polymer)

Poor UV Resistance - Sealant Cracking (PU Sealant)

GOOD UV RESISTANCE

It features >50% movement capability, hence specially suitable for large concrete expansion joint.
It is suitable for various outdoor and indoor sealing and bonding applications.

Less-Streaking

✓Less-streaking (MS Polymer)

Streaking (Silicone Sealant)

LESS DIRT PICK UP (LESS-STREAKING)

It has no static charge to attract dust particles, hence, it will reduce the dust deposit on the surface of the sealant.
This reduces streaking problems that are common with silicone sealants.
This helps to save on cleaning and maintenance cost as well.

Primerless Bonding to Most Substrates

Cohesive Failure (MS Polymer)

Adhesive Failure (Silicone Sealant)

PRIMER-LESS BONDING

It has good bonding to most substrates without the need of primer. It can also bond to other difficult to bond substrates such as aluminum, stainless steel, polycarbonate, ABS, PVC, etc.

Applications:

Perimeter Sealing

Concrete Expansion Joint

Aluminium Composite Panel

Aluminium Panel Bonding

Project Referance

Mont Kiara 28 Malaysia

407 Kediaman Terengganu & Sri Jati 948

Tiong Nam Industries Parks

Solar Farm Tukang Minyak Melaka

www.vitaltechnical.com

Manufactured and Packed for
Vital Technical, LLC
Pasadena, California 91101, USA.
email: sales@vitaltechnical.com www.vitaltechnical.com

Distributed by:

Appendix F

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	VITAL TECHNICAL SDN. BHD. **Tecnical Data Sheet** **VT-620/VT-620S** **VT-620FC/VT-620SFC** **LM MS Sealant**		**Issued Date:** 14/02/11 **Revision No.:** 24 **Revised Date:** 01-04-15 **Page:** 1 of 2

Product Specification:

Curing System	Moisture Curing
Density	1.56 g/mL (White & Grey colour) 1.55 g/mL (Black colour)
Skin over time	35 - 60 minutes
Tensile at break (ASTM D412)	1.0 N/mm²
Elongation at break (ASTM D412)	>900%
Lap Shear Strength, Al to Al (ASTM D1002)	0.5 N/mm²
Shore A Hardness (ASTM C661)	25 - 35
VOC content (USEPA Test Method 24)	< 10g/L
Joint movement capability (ASTM C719)	±50%
Application Temperature	5°C to 40°C
Service Temperature	-30°C to 100°C
Packaging	290ml (cartridge), 600ml (sausage)

Features

1. ASTM C-920 compliant
2. ±50% movement capability
3. Paintable
4. Less dirt streaking
5. Good UV resistance
6. Solvent, Silicone & Isocyanates free
7. Primerless bonding to most surfaces
8. No air bubbling

Green Bonding & Sealing Solutions

Product Description:

A single component, high-performance sealant based on advanced MS Polymer Technology. It is solvent, silicone and Isocyanates free. It is excellent in UV, weather and temperature resistance. It has excellent adhesion over a wide variety of substrates and is paintable with most types of common industrial paints.

Applications:

Ideal for connection and expansion joints in building. Top sealing in glazing systems especially in combination with emulsion paints. It may also be used without primer, to seal assemblies of concrete, glazed surfaces, porcelain, coated metal, epoxy and polyester panels, polystyrene, uPVC, stainless steel, anodized aluminum and finish wood.

Direction:

- Surfaces must be clean, dry and free of dirt, grease, oil or water.
- For a neat finish, apply masking tape and remove it before sealant has skinned over.
- Cut tip off and puncture the internal foil seal with nozzle. Cut nozzle at 45° angle to desire bead-width and apply to substrate with cartridge gun.
- Tooling time is 30minutes, tack free time is 35 - 60 minutes.
- Uncured sealant can be cleaned up with mineral spirits.
- Use approved backing material for joints over 10mm deep.

Limitation:

The LM MS Sealant should **not** be:

- Used for areas subject to continuous chlorinated water immersion, such as swimming pools, spas etc.
- Constant immersed in salt water.
- Used for PE, PP, Teflon, Neoprene and bituminous surfaces.
- Used for structural glass glazing applications.
- Paintable with alkyd resin paint because curing inhibition of the paint.
- Used in trafficable joints greater than 10mm width.For trafficable joint above 10.0mm width, a steel cover plate is required.

Caution:

- Uncured adhesive / sealant causes skin and eyes irritation upon contact.
- Avoid contact with eyes, skin and mouth.
- In case of contact with eyes, flush with water immediately for 15 minutes. If irritation persists, seek medical attention.
- Keep out of reach of children. Use in well ventilated areas.

Storage

- Store in a dry and cool place with temperature below +25°C.
- From the date of production, 9 months in HDPE cartridge; and 12 months in aluminium foil sausage.

- END -

Appendix G

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Japanese MS(Modified Silicone) Polymer Sealant Technologies

VITAL TECHNICAL

www.VitalTechnical.com

Liow Song Ching
sales6@vitaltechnical.com
+6012-3807978

INTRODUCTION

- Manufacturing, packaging & distribution of **adhesive, sealant & waterproofing** products
- ISO-9001 & ISO14001 certified
- Products exported to >60 countries
- Largest MS sealant manufacturer in South East Asia
- OEM of global sealant/adhesive brands

OUR BRAND

- Exporting to >60 countries (65% export Vs. 35% Domestic)
- House Brand - 80% of total sales
- Registered / Registering Trademarks in >40 countries

Range of Products

Sealants
- MS Sealants
- Silicone Sealants
- Polyurethane(PU) sealants
- Acrylic Sealants
- Construction Adhesive
- Caulking materials
- RTV Gasket Maker
- Small joint sealant
- SSG Structural Silicone Sealant
- Insulating Glass sealant

Adhesives
- Solvent Cement
- Epoxy adhesives
- Contact adhesives
- Spray Adhesives
- Super glue
- Household adhesives
- Anaerobic adhesives
- Automotive adhesives
- PVAC (Wood Flooring) adhesives
- Vinyl Flooring adhesives

Others
- Putty Fillers
- Wood Fillers
- Primer
- Caulking/Sausage Guns

Waterproofing
- Bitumen emulsion coating
- Acrylic elastomeric coating
- Bitumen flashing tape
- SBR Latex
- Cement based

Our Construction Solutions..

Concrete Joint

Metal Panel Weather Seal

Window Perimeter Sealing
(aluminum to concrete wall)

Window Weather Seal
(glass to aluminum)

Our Construction Solutions..

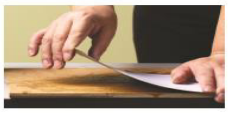
Waterproofing

Flooring Adhesives

Shower Screen/Wet Area

PVC/ABS Solvent Cement

Construction Adhesive



Contact Adhesive

4 FACTORIES IN MALAYSIA..

R&D FACILITIES

- R&D Laboratory

- KF Titrator

- Viscometer

- Tensile Tester

- QUV Weathering Tester

PRODUCTION FACILITIES

BASIC FUNCTIONS OF SEALANTS

- Sealing joints between building elements and accommodate movement
- Prevent ingress/egress of:
  - *Water/Moisture/Snow*
  - *Noise – Acoustic Control*
  - *Heat/Fire*
  - *Air/Vapor/Smoke*
  - *Dust/Dirt*
  - *Light*
  - *Chemicals*
- Improve aesthetics

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TYPES OF SEALANTS

new advanced technologies

- Hybrid sealants
  - STPE(MS), STPU/SPUR, STP, SMP
- Polyurethane(PU) sealants *(old version of STPU)*
- Silicone sealants – *neutral VS acetic*
- Acrylic sealants
- Polysulfide sealants
- Others

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MS SEALANTS

- MS (*Modified Silicone/Silane*) sealants
  - a.k.a. Hybrid, STPE (Silyl Terminated Polyether), or SMP (Silyl Modified Polymer) sealants
- MS polymers are products of Kaneka Corporation Japan
- most used type of construction sealant in Japan
- Available in Japan since >30 years ago
- Combine the strengths of PU and silicone sealants without their inherent weaknesses
  - e.g. *Better weathering characteristics than PU sealants, but without the odor and unpaintability problems of silicone sealants.*

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History of MS Sealants

1978
Started commercial production of MS Polymer in **Japan**

1997
Started commercial production of MS Polymer in **Europe**

2008
Started introduction of MS Polymer in **SE Asia**

2009
Started commercial production of MS Polymer in **US**

2010
Started marketing work as **Kaneka Malaysia**

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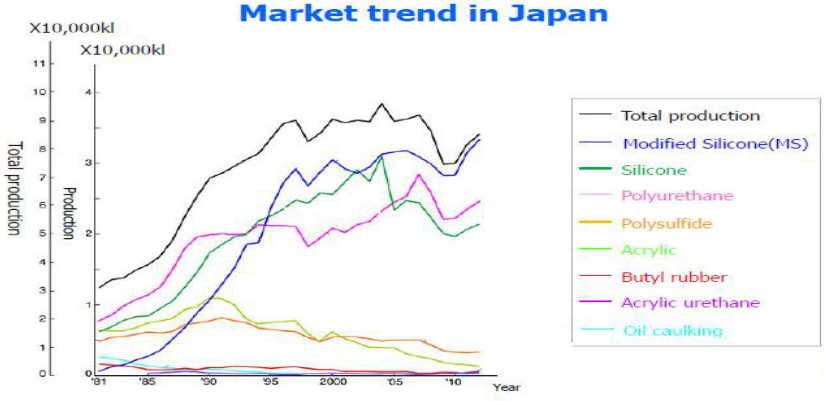
Elastomeric Construction Sealant
Market trend in Japan



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VT-620 LM MS SEALANT

- **High Performance MS Polymer Sealant**
  - Movement capability: ±50%
  - Elongation at break: >900%
  - Shore A hardness: 25-35
  - Low VOC Compliant (SCAQMD)
- **ASTM C-920 :** 2008 Standard Specification For Elastomeric Joint Sealants
- **ASTM C-719 Class 50**
- 290ml cartridge & 600ml sausage
- Color – White, Grey, Black & Teak

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VT-620 – ASTM C920 COMPLIANT
STANDARD SPECIFICATION FOR ELASTOMERIC JOINT SEALANTS

Test Report No. 7191041458-MEC12/01-ED (221400271)
dated 19 Oct 2012

PSB Singapore

TEST RESULTS:

Test	'VT-620 LM MS Sealant'	ASTM C920 : 2008 Standard Specification For Elastomeric Joint Sealants
1. Staining And Colour Change	No staining and no colour change	The sealant shall not cause any visible staining on the top surface of a white cement mortar base
2. Extrudability	>10 ml/min	Type S (single component), grade NS (non-sag or gunnable sealant) shall have an extrusion rate time of not < 10 ml/min
3. Rheological (Flow) Properties	Vertical displacement: 0 mm sag Horizontal displacement: No deformation	Grade NS (non-sag) or gunnable sealant shall have flow characteristics such that it does not sag >4.8mm in vertical displacement and shall show no deformation in horizontal displacement (refers to Types II and IV sealants)
4. Indentation Hardness test piece 1, average test piece 2, average	36 36	T (traffic) sealant shall have a hardness reading of not <25 or >50 after being properly cured NT (non-traffic) sealant shall have a hardness reading of not <15 or >50 after being properly cured
5. Tack-Free Time	No transfer of test specimens to the polyethylene film	There shall be no transfer of the sealant to the polyethylene film when tested at 72 hours
6. Adhesion & Cohesion Under Cyclic Movement	No bond failure	The total loss in bond and cohesion areas among the three specimens tested for each surface shall not be >9 cm2 with mortar substrates
7. Effects Of Heat Ageing On Weight Loss, Cracking And Chalking, average	1.0% No cracking and chalking	The sealant shall not lose >7% of its original weight or show any cracking and chalking
8. Effects Of Accelerated Weathering	No cracks after UV exposure and bend test	The sealant shall show no cracks after the specified UV exposure and shall show no cracks after exposure at cold temperature and the bend test
9. Adhesion-In-Peel, average	39.3 N (8.9 lbf) cohesive failure within the sealant and no adhesive bond loss between sealant and substrate for each test piece	The peel strength for each individual test shall not be <22.2 N (5 lbf) and the sealant shall show no >25% adhesive bond loss for each individual test
10. Material Identification/ Verification By FTIR	Modified silicone-based material (refer to Figure 1)	-

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VT-620 Application 1/5
Precast Concrete Wall Panel Joints

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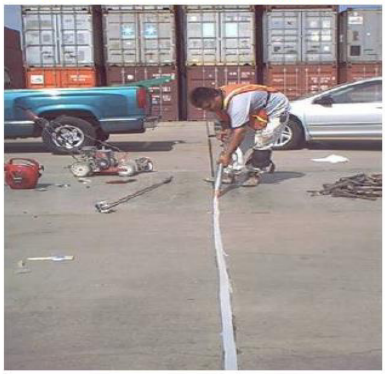
VT-620 Application 2/5
Concrete Joints
(Construction, Expansion, Contraction, Control, Isolation, Joints etc.)



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VT-620 Application 3/5
Metal Panel Cladding (e.g. ACP)

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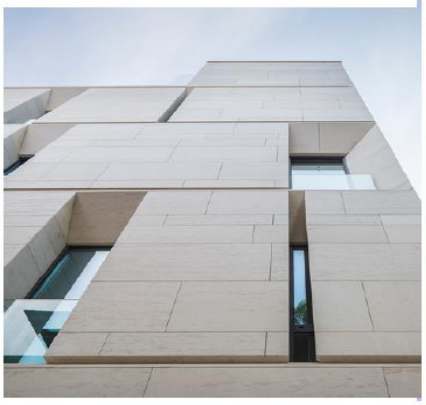
VT-620 Application 4/5
Stone Façade (e.g. marble, granite, limestone)



VT-620 Application 5/5
Door/Window Perimeter Joint
(gap between door/window aluminum/PVC frame and concrete wall)

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MS Sealant Applications in Constructions

PU Sealant Replacement

- Concrete joints
  - Control/Expansion/Isolation/ Construction Joints etc.
  - Precast Wall Panel Joints
- Door/Window frame perimeter sealing

Silicone Sealant Replacement

- Weather seal
  - Metal Panels (ACP)
  - Natural Stone

MS sealants are not suitable for outdoor glass sealing/bonding

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MS SEALANTS – ADVANTAGE 1/12

Good Weather / UV Resistance

much better than polyurethane (PU) sealants!

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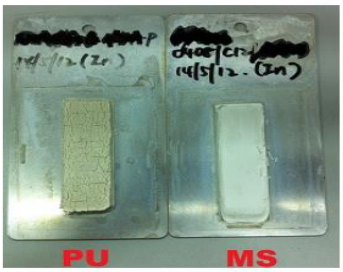
Problem of PU sealants
Bad UV resistance - Cracking problem



ASTM C 1442-06 (QUV test)
Standard Practice for Conducting Tests on Sealants Using Artificial Weathering Apparatus

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ASTM C 1442-06 (QUV test)

QUV chamber with fluorescent UVA-340 lamps. To determine the effects of actinic radiation, elevated temperature, and moisture on sealants and their constituents under controlled laboratory artificial weather test conditions.

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VT-620 – ASTM C 1442-06 (QUV TEST)
CONDUCTING TESTS ON SEALANTS USING ARTIFICIAL WEATHERING APPARATUS

Title: ***Weather testing on MS Sealant VT-620***

Test Period:

From 13 July 2012 to 23 October 2013

Sample Description:

Sample	Desciption	Colour	Shore A hardeness
1.	VT-620 (Batch no. L20120709)	White	33

Test Method:

ASTM C 1442 – 06 Conducting tests on Sealants Using Artificial Weathering Apparatus

- **Apparatus:** QUV chamber with fluorescent UVA-340 lamps. Irradiance set to 0.89 W/(m².nm) at 340 nm.
- **Specimens thickness:** 20 mm
- **Test Cycle:** 8 hours UV exposure at 60 °C & 4 hours condensation at 50 °C.
- **Exposure duration:** 10,000 hours

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VT-620 - QUV Accelerated Weathering Test

Test Results:

Sample	0 Hour		After 7000 Hours		After 10000 Hours	
	Appearance	Shore A Hardness	Appearance	Shore A Hardness	Appearance	Shore A Hardness
1	-	33	No crack, Surface dirty & look a bit greyish	33	No crack, Surface dirty & look greyish	33

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MS sealant QUV test result
After >20,000 QUV hours (abt 20 years of actual weather)
Observed on 25/10/214, test started 14/05/2012

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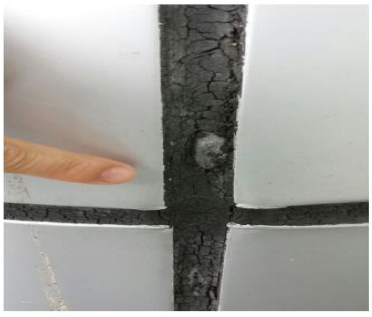
Problem of PU sealants
Bad UV resistance - cracking problem



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Problem of PU sealants
Bad UV resistance - cracking problem

Cracked PU(Polyurethane) Sealant
(Window Perimeter Joint)

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Problem of joints sealed with cement grout
Non Elastomeric - cracking problem

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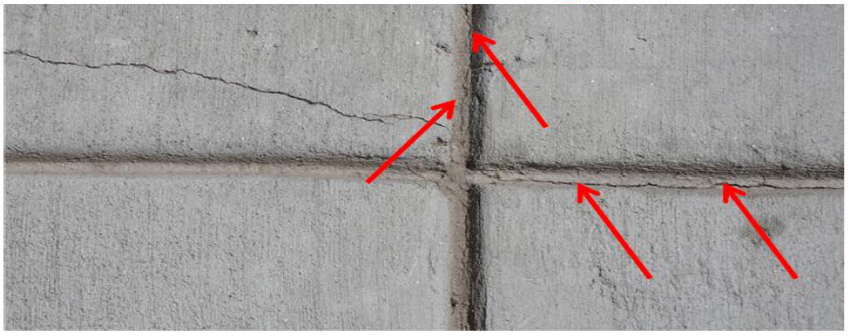
Problem of joints sealed with cement grout
Non Elastomeric - cracking problem



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Problem of joints sealed with cement grout
Non Elastomeric – adhesion failure

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MS SEALANTS – ADVANTAGE 2/12

No Bubbling

Which is a common problem of polyurethane (PU) sealants!

- ✓ *The bubbles/foams/blisters in PU sealants are due to the formation of CO^2.*
- ✓ *The formation of CO^2 is the result of the reaction of the isocyanate with moisture.*
- ✓ *Polyurethane sealants contain isocyanate*
- ✓ *MS sealants do not contain isocyanate*

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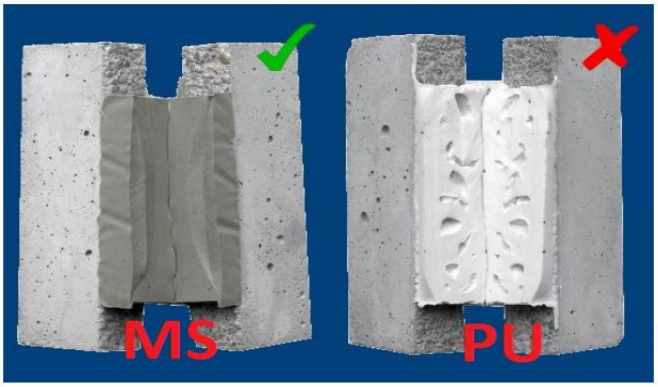
Problem of PU sealants
Bubbling

Bubble - formation of CO_2, result of the reaction of the isocyanate with moisture during curing of PU sealants

Problem of PU sealants
Bubbling



Problem of PU sealants
Bubbling

Aesthetically Unpleasing

Problem of PU sealants
Bubbling

Can cause cohesive failure of sealant over time (sealant bead breaks within itself)

MS SEALANTS – ADVANTAGE 3/12

Damp Substrate Bonding/Sealing

- *Applying sealants before or after rain?*
- *Taboo of polyurethane (PU) sealants!*

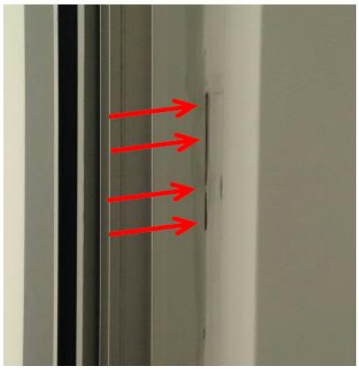
MS SEALANTS – ADVANTAGE 4/12

Min. Shrinkage After Cure

because MS sealants do not contain solvent or water

unlike Polyurethane/Acrylic sealants, which can contain solvent/water that evaporates during curing process and causes shrinkage!

Problem of PU sealants
Shrinkage After Cure



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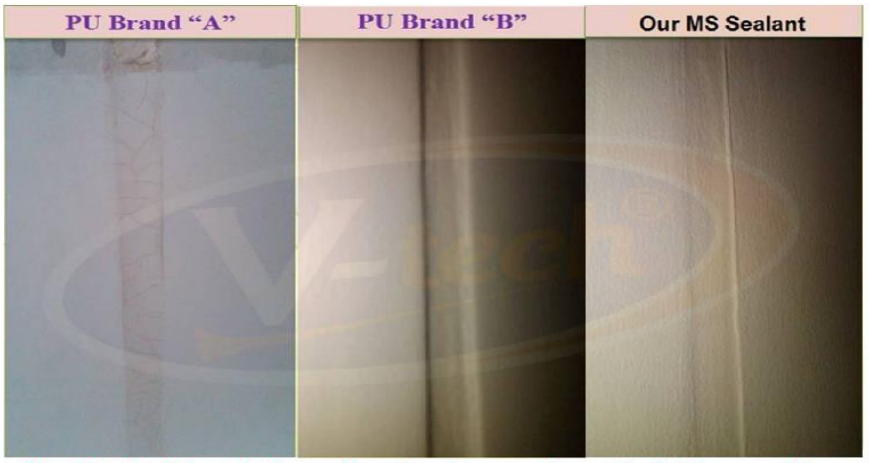

MS SEALANTS - ADVANTAGE 5/12
(LOW MODULUS)

Excellent Mechanical Performance

- Elongation at Break (>900% ASTM D412)
- Movement Capability (±50%, ASTM C719)

They matter for working joints!

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VT-620 – ASTM C719 compliant
Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

Test Report No. 7191082380-MEC14-ED (221404100)
dated 23 Apr 2014

PSB Singapore

Cyclic Test Conditions:
Stage A-10 cycles of joint movements:
a) The joint width was compressed from 12.7mm to 6.4mm at 3.2 mm/h
b) It was extended from 6.4mm to 19.1mm at 3.2 mm/h
c) It was compressed again from 19.1mm to 12.7mm at 3.2 mm/h
Stage B-10 cycles of joint movements:
a) The joint width was compressed to 6.4mm and conditioned at 70°C for 16 to 20 hours
b) After ageing, the test specimens were cooled to 23°C for 2 to 3 hours
c) The joint width was extended to 19.1mm at -26°C and 3.2 mm/h
d) The specimens were removed and allowed to condition to room temperature
No. of determinations : 3 for Class 50

CONDITIONING:

Unless otherwise specified, all test specimens were tested at 23 ± 2°C and 65 ± 5% relative humidity.

TEST RESULT:

Test	'VT-620 LM MS Sealant'	ASTM C920 : 2008 Standard Specification For Elastomeric Joint Sealants
Adhesion & Cohesion Under Cyclic Movement, Class 50	No bond failure	The total loss in bond and cohesion areas among the three specimens tested for each surface shall not be >9 cm² with mortar substrates

VT-620 – ASTM D 412 compliant
Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

SIRIM QAS International

TEST REPORT

REPORT NO : 2014PC0620	PAGE NO : 1 OF 3

Applicant : Vital Technical Sdn. Bhd.
No. 93, Jalan Industri 3/3
Rawang Integrated Industrial Park
48000 Rawang
Selangor Darul Ehsan

Manufacturer : - same as above -

Product : VT-620 LM MS Sealant; Trademark/Brand: V-Tech

Reference Standard : ASTM D 412: 2006a (Reapproved 2013) – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

Results:

'VT-620 LM MS Sealant; Trademark/Brand: V-Tech'

No.	Test	Results	Test Method
1	Tensile Strength, N/mm²	1.33	ASTM D 412 Specimen type: Dumbbell Die C Test speed: 500 mm/minute Number of specimen tested: 5 Date of test: 19 September 2014 (Refer to Figures 1 and 2 for test specimens before and after test)
2	Elongation at Break, %	1,300	

Note: The test specimens were prepared by the applicant.

MS sealants – Advantage 6/12

Faster Curing Time

PU sealants generally have slower skinning/curing time, hence more susceptible to issues like:
- *dirt pickup and raindrop damage before skin forming*
- *adhesion/cohesion failure occurs due to joint movement before sealant fully cures*

MS SEALANTS – ADVANTAGE 7/10

Green Product

No hazardous materials *like isocyanate, formaldehyde, solvent, heavy metals, etc.*

<4% of VOC(Volatile Organic Compound) contents
-Complies to SCAQMD rule 1168 *(VT-620)*

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ACUMEN
ONE STOP ANALYSIS SOLUTIONS

ACUMEN SCIENTIFIC SDN. BHD. (514929-V)
Plot No. 256, Tingkat Perusahaan 5, Kawasan Perindustrian Perai 2, 13600 Perai, Penang, Malaysia
Tel : +604-388 3666 Fax : +604-388 3798
Email : inquiry@acumen.com.my Website : www.acumen.com.my

CERTIFICATE OF ANALYSIS

VITAL TECHNICAL SDN. BHD.
93, Jalan Industry 3/3,
Rawang Integrated Industrial Park,
48000, Rawang, Selangor.
Tel : +603-6092 0000 Fax : 03-6092 0099
Attn : Ms Carol

Certificate No	:	CN/nCML0029/0611
Sample Log Code	:	nCML0034/0611
Sample Received Date	:	03-Jun-2011
Complete Analysis Date	:	07-Jun-2011
Date Issue	:	07-Jun-2011

Sample Description : VT-620
Analysis results :

Parameter	Units	Analysis Result	Standard Method/Technique/Equipment Used
		-	
Volatile Organic Compound Test	g/L	<10	USEPA Test method 24 and SCAQMD Method 303-91 and using equations set out in L.N. 107 of 2009 Air Pollution Control (VOC) (Amendment) Regulation 2009

Remark : -

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Problem of PU sealants – contain Hazardous Materials like isocyanate, mercury/lead based catalysts, solvent, etc.

(formulations from different manufacturers may vary)

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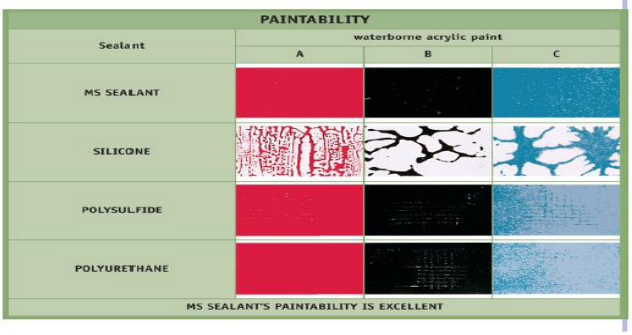
Reasonable caution must be exerted to avoid inhalation or contact

MS SEALANTS – ADVANTAGE 8/10

Good paintability on cured sealant (water based paint)

MS sealant

Silicone sealant



MS SEALANTS – ADVANTAGE 9/10

Non-Staining on adjacent substrates like natural stone or anodized aluminium

- because MS sealant does no contain Silicone Oil
("Silicone Oil" – i.e. "plasticizer" contained in silicone sealants, which is less "reactive" chemically, will "migrate" into adjacent substrates)

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Ralph Lauren showroom, Pavilion Shopping Mall, Kuala Lumpur

Staining at stone facade (Kuala Lumpur, Malaysia)

MS SEALANTS – ADVANTAGE 10/10

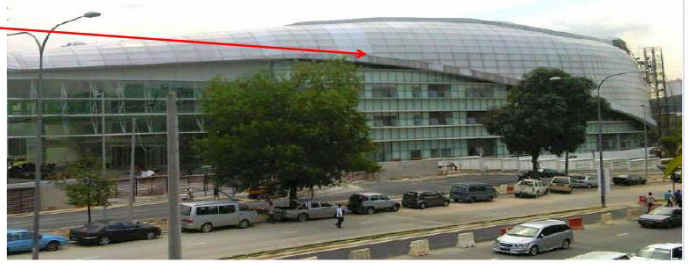
Less Fluid "Streaking" on Metal Facade Cladding

- *Because of lower electrostatic charge (5-8 times lower than silicone sealants) that attracts less air-borne dust*
- *Reactive 'plasticizer' that does not 'migrate' onto the sealant surface – unlike silicone oil of silicone sealant*

FAÇADE CLADDING SEALED WITH SILICONE SEALANTS

During Construction (early 2012) – Dirt streaking observed

Nearly completed (Oct 2012) – Serious Dirt streaking problem



ASTM D4470 -Standard Test Method for Static Electrification:

Silicone sealants have 5-8 times higher electrostatic charge than MS sealants – and will pick up more air-borne dusts

Static electricity of MS and Silicone sealant

Product Name	Color	Product category		Max. Electrostatic Charge(KV), ASTM D4470*
NF1105 (Kaneka's lab sample)	White	MS sealant	MS	0.154
SR A	White	1K silicone sealant	SR	0.887
SR B	Gray	1K silicone sealant with non-stone staining feature	SR	1.130

- Data obtained by Trace Laboratories, Inc. MD, USA
- Sample size: 150mm x 150mm x 3mm

Comments

- SR shows relatively higher electrostatic charge.
- The fact that SR (Silicone) shows dirt streaking when used for building joint sealant is said to be caused by high electrostatic charge.
- Particularly, SR B, supposed to be best non-staining SR available showed highest electrostatic charge.

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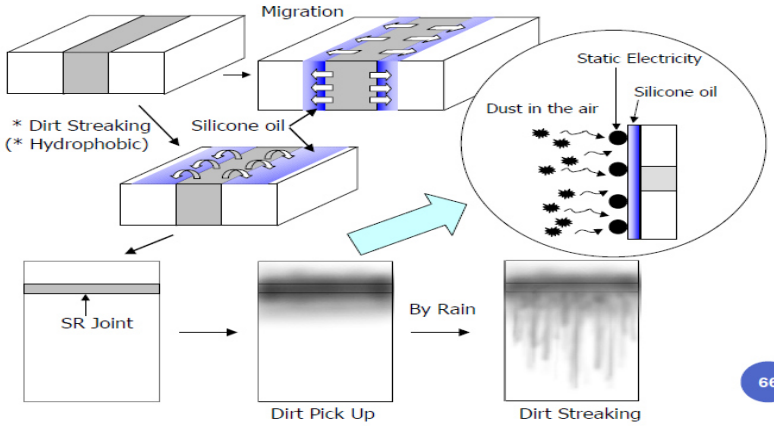

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Dirt-Streaking Test on Aluminum Composite Panels
MS VS Silicone

Comparison Sealants

– Before on 29th November 2011

MS | Silicone A | Silicone B

Dirt-Streaking Test on Aluminum Composite Panels
MS VS Silicone

Comparison Sealants on Dirt Streaking issue
– After 1 year plus since November 2011

MS | Silicone A | Silicone B

*Latest observed was on 4th March 2013

Dirt-Streaking Test on Aluminum Composite Panels
MS VS Silicone

Sealant specimens applied on panels in September 2013

MS | Silicone A | Silicone B

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Dirt-Streaking Test on Aluminum Composite Panels
MS VS Silicone

After 5 months – dirt 'streaking' observed on panels applied with silicone sealants but not the one with MS

MS | Silicone A | Silicone B

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Ever seen problem like this?
Aluminum window profile contaminated by silicone sealant.

MS SEALANTS – ADVANTAGE 11/12

Stable Storage /Shelf Life

PU sealants are bad in heat resistance and unstable in storage/shelf life

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MS SEALANTS – ADVANTAGE 12/12

Competitive Pricing

comparable with PU and silicone sealants, and very competitive against other hybrid sealants

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MS SEALANTS
PROJECT REFERENCES IN INDONESIA

- Project Name: **The Oak**
- Project Type: Apartment
- Location: Jakarta, Indonesia
- Application: Precast Wall Panel Joint
- Contractor:PT.CaturBangunMandiri
- Architect:ImageQreator
- Owner:MahardhikaPropertindo
- Precast: PT. Griyaton Indonesia

- Project Name: **Metropark**
- Project Type: Apartment
- Location: Jakarta, Indonesia
- Application: Precast Wall Panel Joint
- Contractor: PT.TotalindoEkaPersada
- Architect: MegatikaInternational
- Owner: AlamHijauTeduh(subsidiaryAPL)
- Precast: PT. Griyaton Indonesia

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MS SEALANTS
PROJECT REFERENCES IN INDONESIA

- Project Name: **Grandhika City Hotel**
- Project Type: Integrated
- Location: Jakarta, Indonesia
- Application: Concrete Column to Wall
- Contractor: PT.AdhiPersadaGedung
- Owner: PT.AdhiPersadaGedung
- Precast: PT. Griyaton Indonesia

- Project Name: **Sekolah Kusuma Bangsa**
- Project Type: School
- Location: Palembang, Indonesia
- Application: ACP
- Contractor: PT.AdhiPersadaGedung
- Sub Con: PT. Surya Mas
- Owner: SKB

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MS SEALANTS
PROJECT REFERENCES IN THE PHILIPPINES

- Project Type: Mixed Development
- Project Name: Bayport West
- Location: Manila, Philippines
- Application: Precast Wall Panel Joint

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MS SEALANTS
PROJECT REFERENCES IN THE PHILIPPINES

- Project Type: Condominium
- Project Name: Torre Sur
- Location: Philippines
- Application: Precast Wall Panel Joint

- Project Type: Condominium
- Project Name: Twin Oaks Place
- Location: Philippines
- Application: Precast Wall Panel Joint

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MS SEALANTS
PROJECT REFERENCES IN THE PHILIPPINES

- Project Type: Shopping Mall
- Project Name: Estancia Mall
- Location: Philippines
- Application: Precast Wall Panel Joint

- Project Type: University Campus Building
- Project Name: De La Salle University
- Location: Philippines
- Application: Precast Wall Panel Joint

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MS SEALANTS
PROJECT REFERENCES IN MALAYSIA

- Project Type: Condominium
- Project Name: 28 Mont Kiara (a.k.a MK28 or Mont Kiara Aria),
- Location: Mont Kiara, KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: KS Kiara Ville
- Location: Mont Kiara, KL, Malaysia
- Application: Window Perimeter Sealing

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MS SEALANTS
PROJECT REFERENCES IN MALAYSIA

- Project Type: Condominium
- Project Name: Soho Suites
- Location: KLCC area, KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: Quadro Residences
- Location: KLCC area, KL, Malaysia
- Application: Window Perimeter Sealing

MS SEALANTS
PROJECT REFERENCES IN MALAYSIA

- Project Type: Bungalow
- Project Name: The Mansion
- Location: Desa Park City, KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Terrace & Condo
- Project Name: The Breezeway
- Location: Desa Park City, KL, Malaysia
- Application: Window Perimeter Sealing

MS SEALANTS
PROJECT REFERENCES IN MALAYSIA

- Project Type: Condominium
- Project Name: SAVILLE MELAWATI
- Location: KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: SETAPAK GREEN
- Location: KL, Malaysia
- Application: Window Perimeter Sealing

MS SEALANTS
PROJECT REFERENCES IN MALAYSIA

- Project Type: Industrial Buildings
- Name: TiongNam Industrial Park
- Location: Petaling Jaya, Selangor, Malaysia
- Application: ACP Weather Sealing

- Project Type: Solar Farm
- Project Name: Tukang Minyak Solar Farm
- Location: Tukang Minyak, Malacca, Malaysia
- Application: Solar Panel – aluminum frame sealing

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MS SEALANTS
PROJECT REFERENCES IN MALAYSIA

- Project Type: Apartment (IBS)
- Project Name: Seri Intan
- Location: Setia Alam, Selangor
- Application: Precast Concrete Wall Panel joint

- Project Type: Apartment (IBS)
- Project Name: Seri Jati
- Location: Setia Alam, Selangor
- Application: Precast Concrete Wall Panel joint

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MS SEALANTS
PROJECT REFERENCES IN MALAYSIA

- Project Type: Apartment (IBS)
- Project Name: 407 unit Kediaman
- Location: Terengganu, Malaysia
- Application: Precast Concrete Wall Panel joint

- Project Type: Monument Bulilding
- Project Name: Dataran Pahlawan Negara
- Location: Putrajaya, Malaysia
- Application: Concrete Slab Expansion joint

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MS Sealants
Project References In Malaysia

- Project Type: Bridge
- Project Name: Second Penang Bridge
- Location: Penang, Malaysia
- Application: Bridge Girder Expansion joint

- Project Type: Serviced Residence
- Project Name: Banyan Tree Signatures
- Location: KL, Malaysia
- Application: Window Perimeter Sealing

MS Sealant
Reference: Pre-Cast Concrete Modular Houses in Japan

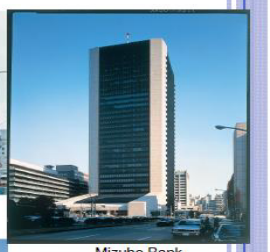
Daiwa House

Sekisui Houses

Japanese buildings that used MS Sealants

Tokyo Metropolitan Government
(1991)

Osaka Hilton
Hotel
(1986)



Mizuho Bank

Pacifico Yokohama
(1991)

NEC Japan
HQ

Case Study: Water leakage from wall panel joint

interior

Case Study: Water leakage from wall panel joint

interior

90

SpecialChem
connect • innovate • accelerate

Silyl Terminated Construction Sealants

SpecialChem | Edward M Petrie - Aug 26, 2009

Property	MS Polymer	Polyurethane	Silicone
Environmental friendliness	10	5	9
Non-bubbling	10	6	10
Low temperature gunnability	10	8	10
Slump resistance	10	10	10
Quick cure	10	7	10
Storage stability	10	7	9
Body (tooling)	8	10	8
Weather resistance	8	6	10
Adhesion to various substrates	10	5	8
Mechanical properties	10	10	10
Heat resistance, mechanical stability	9	8	10
Non-dirt pickup	10	10	5
Stain resistance	8	8	5
Paintability with water-based paint	10	10	3

Table 2: Performance Comparison of MS, Polyurethane, and Silicone Sealants[3]

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Sources:
http://www.adhesives.org/docs/default-document-library/hybrid_sealants_may2010-final-(1).pdf
http://www.specialchem4adhesives.com/resources/articles/article.aspx?id=3042

Sealant Cost Is Insignificant In Overall Project Cost, But When Sealant Fails, It Fails Big Time!

- *Adhesive/cohesive failure causes water leakage and units unlivable*
- *Stained/Streaked stone/metal panel façade that causes unpleasant aesthetic issues and high maintenance fee*
- *Very significant cost, time, and effort required to identify and repair failed sealant (especially sealant applied at external wall of high floors!)*

So why still use PU sealants which are known to have short service life (5-10 years), and silicone sealants, which will stain/streak the building façade??

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THANK YOU

93

Name: Liow Song Ching
Email: sales6@vitaltechnical.com
Mobile: +6012-3807978

MS Sealants
Project References in Indonesia

- Project Name: **The Oak**
- Project Type: Apartment
- Location: Jakarta, Indonesia
- Application: Precast Wall Panel Joint
- Contractor:PT.CaturBangunMandiri
- Architect:ImageQreator
- Owner:MahardhikaPropertindo
- Precast: PT. Griyaton Indonesia

- Project Name: **Metropark**
- Project Type: Apartment
- Location: Jakarta, Indonesia
- Application: Precast Wall Panel Joint
- Contractor: PT.TotalindoEkaPersada
- Architect: MegatikaInternational
- Owner: AlamHijauTeduh(subsidiaryAPL)
- Precast: PT. Griyaton Indonesia

MS Sealants
Project References in Indonesia

- Project Name: **Grandhika City Hotel**
- Project Type: Integrated
- Location: Jakarta, Indonesia
- Application: Concrete Column to Wall
- Contractor: PT.AdhiPersadaGedung
- Owner: PT.AdhiPersadaGedung
- Precast: PT. Griyaton Indonesia

- Project Name: **Sekolah Kusuma Bangsa**
- Project Type: School
- Location: Palembang, Indonesia
- Application: ACP
- Contractor: PT.AdhiPersadaGedung
- Sub Con: PT. Surya Mas
- Owner: SKB

MS Sealants
Project References in the Philippines

- Project Type: Mixed Development
- Project Name: Bayport West
- Location: Manila, Philippines
- Application: Precast Wall Panel Joint

MS Sealants
Project References in the Philippines

- Project Type: Condominium
- Project Name: Torre Sur
- Location: Philippines
- Application: Precast Wall Panel Joint

- Project Type: Condominium
- Project Name: Twin Oaks Place
- Location: Philippines
- Application: Precast Wall Panel Joint

MS Sealants
Project References in the Philippines

- Project Type: Shopping Mall
- Project Name: Estancia Mall
- Location: Philippines
- Application: Precast Wall Panel Joint

- Project Type: University Campus Building
- Project Name: De La Salle University
- Location: Philippines
- Application: Precast Wall Panel Joint

MS Sealants
Project References In Malaysia

- Project Type: Condominium
- Project Name: 28 Mont Kiara (a.k.a MK28 or Mont Kiara Aria),
- Location: Mont Kiara, KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: KS Kiara Ville
- Location: Mont Kiara, KL, Malaysia
- Application: Window Perimeter Sealing

MS Sealants
Project References In Malaysia

- Project Type: Condominium
- Project Name: Soho Suites
- Location: KLCC area, KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: Quadro Residences
- Location: KLCC area, KL, Malaysia
- Application: Window Perimeter Sealing

MS Sealants
Project References In Malaysia

- Project Type: Bungalow
- Project Name: The Mansion
- Location: Desa Park City, KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Terrace & Condo
- Project Name: The Breezeway
- Location: Desa Park City, KL, Malaysia
- Application: Window Perimeter Sealing

MS Sealants
Project References In Malaysia

- Project Type: Condominium
- Project Name: SAVILLE MELAWATI
- Location: KL, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: SETAPAK GREEN
- Location: KL, Malaysia
- Application: Window Perimeter Sealing

MS Sealants
Project References In Malaysia

- Project Type: Industrial Buildings
- Name: TiongNam Industrial Park
- Location: Petaling Jaya, Selangor, Malaysia
- Application: ACP Weather Sealing

- Project Type: Solar Farm
- Project Name: Tukang Minyak Solar Farm
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- Project Type: Apartment (IBS)
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- Location: Setia Alam, Selangor
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- Application: Bridge Girder Expansion joint

- Project Type: Serviced Residence
- Project Name: Banyan Tree Signatures
- Location: KL, Malaysia
- Application: Window Perimeter Sealing

MS Sealants
Project Reference in Malaysia

- Project Type: Mixed development
- Project Name: 1 Medini
- Location: Iskandar, Johor, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: The Cantonment
- Location: Penang, Malaysia
- Application: Window Perimeter Sealing

MS Sealants
Project Reference in Malaysia

- Project Type: Condominium
- Project Name: X2 Residency
- Location: Puchong, Malaysia
- Application: Window Perimeter Sealing

- Project Type: Condominium
- Project Name: Paragon Residences
- Location: Johor Bahru, Johor, Malaysia
- Application: Window Perimeter Sealing

MS Sealants
Project Reference in Malaysia

- Project Type: Industrial Buildings
- Name: TiongNam Industrial Park
- Location: Petaling Jaya, Selangor, Malaysia
- Application: ACP Weather Sealing

- Project Type: Solar Farm
- Project Name: Tukang Minyak Solar Farm
- Location: Tukang Minyak, Malacca, Malaysia
- Application: Solar Panel – aluminum frame sealing

MS Sealants
Project Reference in Malaysia

- Project Type: Commercial Building
- Project Name: Parkcity Commerce Square
- Location: Bintulu, Sarawak
- Application: ACP weather seal

- Project Type: Hospital
- Project Name: Jesselton Medical Centre
- Location: KK, Sabah, Malaysia
- Application: ACP weather seal

Appendix H

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1. Identification of the substance/preparation and of the company/undertaking

Product name : VT-620/VT-620S LM MS Sealant
VT-620FC/VT-620SFC

Company : Vital Technical Sdn. Bhd.
No. 93, Jalan Industri 3/3,
Rawang Integrated Industrial Park,
48000 Rawang, Selangor,
Malaysia.

Telephone : +603 - 6092 0000
Fax : +603 - 6092 0099
Email : sales@vitaltechnical.com
Website : http://www.vitaltechnical.com

2. Hazard(s) identification

GHS Classification
Not hazardous

GHS Label: None

Signal word: None

Hazard Statement(s): None

Precautionary Statement(s):

P264	Wash hands thoroughly after handling.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352	IF ON SKIN: Wash with soap and water.
P305+P351+P338	IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing.
P333+P313	If skin irritation or a rash occurs: Get medical advice/attention.
P337+P313	If eye irritation persist: Get medical advice/attention.

3. Composition/Information on ingredients

Chemical name	CAS No.	EINECS	% (w/w)	Toxicology Data
Silyl-terminated polyether	-	-	>20	**LD_{50} oral (rat):** ≥ 20 g/kg **LD_{50} dermal (rabbit):** > 2 g/kg **LC_{50} inhalation:** No data

4. First-aid measures

- **Inhalation:** Remove to fresh air, keep warm and at rest. Contact physician if discomfort persists.
- **Skin contact:** Remove contaminated clothing. Rinse with copious amount of water. Contact physician if discomfort persists.
- **Eye contact:** Contact lenses should be removed. Rinse with copious amount of water immediately, seek medical advice if necessary.
- **Ingestion:** Seek medical advice immediately. DO NOT induce vomiting. Drink plenty of water followed by milk if available. Never give anything by mouth to an unconscious person.

Avoid contact with skin and eyes. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

5. Fire-fighting measures

- **Suitable extinguishing media:** Use dry chemical powder, foam, carbon dioxide, water fog.
- **Special fire fighting procedures:** Keep up-wind to avoid fumes. Use self-contained breathing apparatus in confined areas.
- **Unusual fire/explosion hazards:** None known.
- **Hazardous combustion products:** Carbon monoxide, carbon dioxide, oxides of nitrogen.
- **Protective measures in fire:** Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

6. Accidental release measures

- **Person-related safety precautions:** Wear protective equipment. Keep unprotected persons away. Ensure adequate ventilation.
- **Measure for cleaning/collecting:** Absorb with liquid binding material (sand, diatomite, acid binders, universal binders, sawdust, etc). Dispose of contaminated material as waste according to item 13.
- **Additional information:** Prevent spillage from entering drainage/sewer systems. Spillages or uncontrolled discharges into watercourses must be IMMEDIATELY alerted to the Environmental Agency or other appropriate regulatory body.

7. Handling and storage

- **Handling:** Ensure good ventilation during processing. Do not eat, drink or smoke while handling.
- **Protection against fire/explosion:** General rules of fire prevention should be observed.
- **Storage:** Keep tightly closed and dry. Store in a well-ventilated area, protected from direct sunlight and heat, with temperature below 25°C.

8. Exposure controls/personal protection

- **Industrial hygiene:** Remove immediately all contaminated clothing. Do not inhale vapor. Wash hands and contaminated areas with water and soap before leaving the work site. Do not eat, drink or smoke while using the product. Change clothing before leaving workplace.
- **Hand protection:** Suitable protective gloves like nitrile or viton are recommended. The breakthrough time of the selected glove must be greater than the intended use period.
- **Respiratory protection:** An organic respirator NIOSH-approved for organic vapors is recommended where local ventilation is not adequate.
- **Eye protection:** Protective goggles/safety glasses.

9. Physical and chemical properties

- **Form** : Paste
- **Color** : Various colors
- **Odor** : Characteristic
- **Boiling temperature** : Not determined
- **Flash point** : 63°C (Closed Cup)
- **Solubility in water** : Insoluble
- **VOC Content** : <10g/L (USEPA Test Method 24)
- **Specific gravity** : Approx. 1.56 g/mL (White & Grey colour), Approx. 1.55 g/mL (Black colour)

10. Stability and reactivity

- **Stability:** Stable when stored under recommended conditions.
- **Conditions to avoid:** Open flame, sparks and heat.
- **Hazardous decomposition products:** Carbon monoxide, carbon dioxide, oxides of nitrogen.
- **Hazardous polymerization:** None known if used for intended purposes.
- **Incompatible materials:** Avoid contact with acids, fluorine, and magnesium with hydrogen.

11. Toxicology information

No specific oral, inhalation or dermal toxicology data is known for this product.

- **Oral:** Expected to be slightly toxic.
- **Inhalation:** Expected to be slightly toxic.
- **Dermal:** Expected to be sensitizing.

12. Ecological information

- **Persistence/Degradability :** Not determined
- **Ecology toxicity :** Not determined

Individual components of this mixture have been independently tested by the raw material suppliers and any known results have been presented above. The results for the individual components may not be representative of the ecological toxicity of this finished product. This finished product has not been tested to determine individual toxicological/ecological limits Great caution should be taken to prevent release to the environment. See Section 13 for further information.

13. Disposal information

Preferred method of disposal includes incineration under controlled conditions in accordance with all local and national laws and regulations. The generation of waste should be avoided or minimized wherever possible. Untreated material is not suitable for disposal. Waste, even in small quantities, should never be poured down into drains, sewers or watercourses. Waste must be disposed of in accordance with federal, state and local environmental control regulations. This material, when properly mixed and cured at the proper mix ratio, may be safely landfilled.

14. Transport information

Road transport (ADR)
Not regulated

Marine transport (IMDG)
Not regulated

Air transport (IATA)
Not regulated

15. Regulatory information

EU Classification: Not hazardous.

EU Risk(R) Phrases: None

EU Safety(S) Phrases:

S25	Avoid contact with eyes.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S28	After contact with skin, wash immediately with plenty of soap with water.
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.

16. Other information

Definitions:

- **EINECS** : European Inventory of Existing Commercial Chemical Substances.
- **TLV** : Threshold Limit Value.
- **LD_{50}** : The minimum dose required for lethal effects in 50% of a given population of test specimens.
- **NIOSH** : National Institute for Occupational Safety and Health.

All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee these are the only hazards that exist. The details contained herein are based on our present state of knowledge and experience in characterizing our product with regard to any possible safety requirement. We do, however, pass them on without any warranty or property assurances.

Appendix I

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偉德工藝有限公司

Vital Technical Sdn. Bhd. (Co.No.: 589221-K)
No: 93, Jalan Industri 3/3, Rawang Integrated Industrial Park,
48000 Rawang, Selangor, Malaysia.
tel: +603-6092 0000 **fax:** +603-6092 0099
email: sales@vitaltechnical.com **www.vitaltechnical.com**
GST No.: 001608491008

11th August 2015

CONSTRUCTION INDUSTRY DEVELOPMENT BOARD MALAYSIA (CIDB)

Attn: Dr. Foo Chee Hung

RE: MS Sealant QC Plan

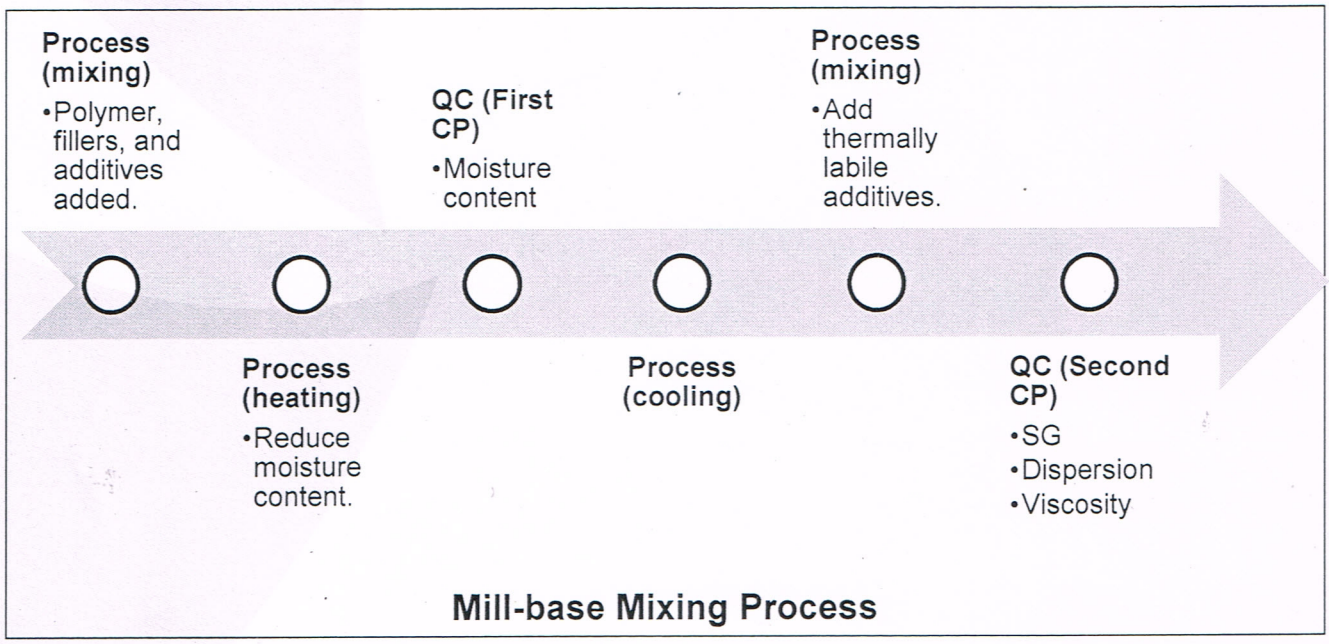
Our reference : 11/H15/LTR/A015

Production of MS sealant is separated into two parts: mill-base mixing and static mixing. Throughout the entire production process, QC tests are performed in three check points. All three check points are performed for every batch of MS Sealant production.

At the first check point, moisture content is determined after the heating process. Sample was directly extracted from the mixing. Immediately after extracting the sample, it is directly injected into the Karl-Fischer Titrator.

Upon completion of the mill-base mixing, tests will be performed as the second QC check point.

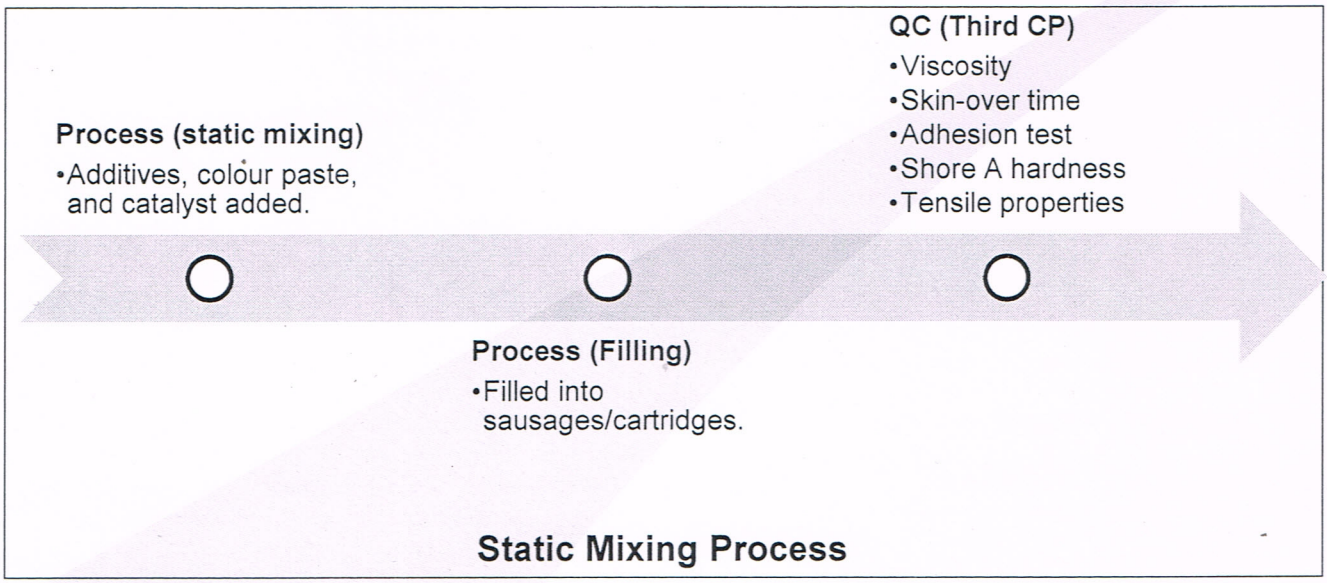
Once the second QC check point has passed all the tests, the mill-base will be fed into the static mixer to proceed with the mixing process and filled into sausages/cartridges. During the filling process, four samples will be taken after a set number of intervals. Some tests are performed on all four samples while some tests are only performed on the first sample.



Mill-base Mixing Process

偉德工藝有限公司

Vital Technical Sdn. Bhd. (Co.No.: 589221-K)
No: 93, Jalan Industri 3/3, Rawang Integrated Industrial Park,
48000 Rawang, Selangor, Malaysia.
tel: +603-6092 0000 **fax:** +603-6092 0099
email: sales@vitaltechnical.com **www.vitaltechnical.com**
GST No.: 001608491008



Static Mixing Process

First CP

Test(s)	Reference	Frequency
Moisture content	WI-LA-32	Every batch

Second CP

Test(s)	Reference	Frequency
Specific gravity	WI-LA-03	Every batch
Dispersion	-	Every batch
Viscosity (1 rpm)	WI-LA-05	Every batch
Viscosity (5 rpm)	WI-LA-05	Every batch
Thixotropy index	-	Every batch

Third CP

Test(s)	Reference	Frequency
Viscosity (1 rpm)	WI-LA-05	All samples
Viscosity (5 rpm)	WI-LA-05	All samples
Thixotropy index	-	All samples
Skin-over time	WI-LA-34	All samples
Adhesion test	WI-LA-53	All samples
Shore A Hardness	WI-LA-33	First sample
Tensile at break	WI-LA-31	First sample
Elongation at break	WI-LA-31	First sample

偉德工藝有限公司

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tel: +603-6092 0000 **fax:** +603-6092 0099
email: sales@vitaltechnical.com **www.vitaltechnical.com**
GST No.: 001608491008

Out-of-specification (OOS)

In the case of properties being out-of-specification, the following steps will be taken.

During the first CP, the production process will only proceed to the next step if the moisture content is below 900 ppm. Else, the mill-base will be heated for another 30 minutes before getting another sample and retesting the moisture content.

During the second and third check points, any property that is OOS will be retested with a fresh sample. If the property is still OOS after retest, the mill-base or filled sausages/cartridges will be placed on-hold to determine the cause of OOS and plan the corrective measures to bring the property back into the specification will be performed.

Should you require further information concerning the above matter, please do not hesitate to contact us.

Yours sincerely,
For Vital Technical Sdn. Bhd.

Alex Ng
Assistant Technical Manager

ISBN 978-967-5317-97-2

CONSTRUCTION INDUSTRY DEVELOPMENT BOARD
Tingkat 10, Menara Dato' Onn,
Putra World Trade Centre (PWTC), No. 45,
Jalan Tun Ismail, 50480 Kuala Lumpur

CONSTRUCTION RESEARCH INSTITUTE OF MALAYSIA
Makmal Kerja Raya Maysia (MKRM),
CIDB Wilayah Persekutuan, 1st Floor, Block E, Lot 8,
Jalan Chan Sow Lin, 55200 Kuala Lumpur