



# IMM STANDARD

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**IMM FP03:2020**

**DRIED COATING FINGERPRINTING  
OVERALL PROCEDURES USING FTIR AND  
OTHER RELATED METHODS**

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**INSTITUTE OF MATERIALS, MALAYSIA**

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## Contents

	<b>Page</b>
Foreword .....	1
1 Scope .....	2
2 Terms and definitions .....	2
3 Dried coating fingerprinting qualification.....	3
4 Sample collection.....	4
5 FTIR test method .....	5
5.1 FTIR spectrophotometer .....	5
5.2 Sample preparation .....	5
5.3 Sample annotation .....	5
5.4 Instrumental analysis .....	5
5.5 Spectra analysis .....	5
5.5.1 Reference spectrum .....	6
5.5.2 Degree of similarity ( <i>r</i> ) .....	6
6 Qualification of dried coating .....	6
6.1 Qualification of Reference sample (new formulation) .....	6
6.2 In-house dried coating batch-to-batch monitoring (by paint manufacturer) ...	6
6.3 Random/scheduled on-site analysis (by owner) .....	7
6.4 Retained dried coating sample .....	7
6.4.1 Dispute of results from 3 <sup>rd</sup> -party testing laboratory.....	7
7 Dried Coating Fingerprint Certificate .....	7
7.1 Physical analyses .....	7
7.2 Structural analyses.....	8

**Contents** *(continued)*

	<b>Page</b>
7.3 Confidentiality .....	8
7.4 Signatory.....	8
8 Execution of dried coating FTIR fingerprinting .....	8
8.1 Certified signatory for in-house Dried Coating Fingerprint Certificate .....	8
8.2 3 <sup>rd</sup> -party testing laboratory .....	8
8.3 Coating inspector .....	9
8.4 Fabricator, contractor, sub-contractor .....	9
8.5 External auditor.....	9
8.6 End user .....	9
Annex A Dried Coating Fingerprint Certificate.....	10
Annex B Test Method Assessment of 3 <sup>rd</sup> -Party Testing Laboratory in relation to dispute in Fingerprint Certificate for raw material, paint and dried coating sample....	14
Bibliography.....	15
Acknowledgements.....	16

## Foreword

**Institute of Materials, Malaysia (IMM)** is a non-profit professional society that promotes honourable practice, professional ethics and encourages education in materials science, technology and engineering. Engineers, academicians, technicians, skilled workers and professionals are amongst its members exceeding 6800. Registered with the Registrar of Societies on 6<sup>th</sup> November 1987, the Malaysian Materials Science & Technology Society (MMS) changed its name to the Institute of Materials, Malaysia (IMM) on 16<sup>th</sup> June 1997. The objectives of the IMM include the following:

- Training and development of individuals and companies in Malaysia to attain professional recognition in various fields of materials science, technology and engineering.
- Development of IMM standards as recommended guidelines for good technical practice for consideration and implementation by various industries of materials science, technology and engineering.

IMM FP03:2020, *Dried coating fingerprinting overall procedures using FTIR and other related methods* was developed by the IMM Task Force on Coating Fingerprinting.

This standard will be subjected for review to reflect current needs and conditions. Users and other interested parties may submit comments on the contents of this standard for consideration in future versions.

Compliance with this Standard does not of itself confer immunity from legal obligations.

## **DRIED COATING FINGERPRINTING OVERALL PROCEDURES USING FTIR AND OTHER RELATED METHODS**

### **1. Scope**

This Standard emphasizes the evaluation of dried coating fingerprint, with the aim of reaffirming the consistency of the dried coating applied with reference to the qualified dried coating. This Standard covers the fingerprint requirement of different coating systems for qualification, quality control and verification.

This Standard includes:

- i. Fingerprinting qualification for dried coatings
- ii. Test method to fingerprint the dried coatings on substrate
- iii. Criteria and execution of Dried Coating Fingerprint Certificate

NOTE. The requirement of coating fingerprinting is stated in various specifications and standards, namely ISO 12944-9:2018, ASTM D7588-11(2018) and ASTM D2621-87. However, all of these standards are lacking with respect to the interpretation of FTIR spectra or the estimation of the degree of similarity between two FTIR spectra. Hence, there is a need to establish a working standard for the execution of coating fingerprinting. IMM FP01:2019 was developed with respect to the interpretation of FTIR spectra or the estimation of the degree of similarity between two FTIR spectra. The application of interpretation of FTIR with estimation of the degree of similarity between two FTIR spectra is extended to paint raw materials in IMM FP02:2020 and dried coatings in IMM FP03:2020.

### **2. Terms and definitions**

For the purposes of this document, the following terms and definitions apply.

#### **2.1. 3<sup>rd</sup>-party laboratory**

laboratory independent of the manufacturer, supplier, designer or owner of the tested items, nor the authorized representative or a subsidiary of any of these parties.

#### **2.2. attenuated total reflectance (ATR)**

measures the changes that occur in an internally reflected IR beam when the beam comes into contact with a sample.

#### **2.3. auditor**

a person who conducts a systematic review on the execution of Dried Coating Fingerprinting Certificate.

#### **2.4. certificate of analysis (COA)**

document that confirms a product meets its product specification, as obtained from testing performed.

#### **2.5. container**

an object used for or capable of holding, especially for transport or storage, such as bottle, can, bag, drum and so on.

**2.6. correlation**

the interdependence of the spectra from sample to that of Reference.

**2.7. dried coating**

solid film on a substrate having protective, decorative, or specific technical properties.

**2.8. Fourier-transform infrared (FTIR)**

when infrared radiation is passed through a sample, some radiation is absorbed by the sample and some is transmitted. The resulting signals are generated at the detector. The Fourier-transform converts the detector output to an interpretable spectrum that may provide molecular structural insights.

**2.9. material safety data sheet (MSDS)**

document that provides information regarding safety and health of related substances and products.

**2.10. owner**

a person who acquire possession, ownership or rights to the use or services of the paint by payment

**2.11. paint**

pigmented coating material in liquid form that when applied to a substrate, forms a solid film having protective, decorative, or specific technical properties.

**2.12. Reference sample**

the sample that has been subjected to qualification test and referred to as standard.

**2.13. shall**

expressing an instruction, command or a strong assertion

**2.14. should**

used to indicate obligation, duty, or correctness

**2.15. technical data sheet (TDS)**

document that provides information regarding a specific product.

**2.16. triplicate**

the repetition of the set of experiment by means of same sample in three replications.

**3. Dried coating fingerprinting qualification**

Dried coating fingerprinting qualification shall be imposed for coating projects with total surface area of 1000 m<sup>2</sup> or more, or as required by the owner. The new coating has to pass all the performance tests, as agreed by the owner. The coating formulation that has changed after qualification shall be requalified. The coating formulation after qualification shall be consistent for batch-to-batch dried coating applied.

The qualification tests shall be carried out or witnessed and certified by an independent 3<sup>rd</sup>-party authority, or to be agreed by the owner. The recommended 3<sup>rd</sup>-party testing laboratory shall be recognized by the owner for a grace period of at least 3 years prior to accreditation by authorized body.

Fingerprint check may serve as a verification tool to confirm that the dried coatings applied on substrate(s) are identical to those subjected to qualification test, by means of the degree of similarity (*r*) of FTIR spectra.

Routine batch check shall be carried out on the first and every subsequent batch of the dried coating in a qualified dried coating to substantiate the accuracy of batch-to-batch dried coating applied.

NOTE. Routine batch check discloses the distinction between the dried coating applied with qualified dried coating.

FTIR fingerprinting for dried coating shall be made to the single-layer or multi-layer coating on the substrate(s) (e.g. structure, test panel, paint test card etc). The sample shall be mixed, applied, and dried/cured under the conditions as per paint manufacturer’s instruction. In addition, dried coating fingerprinting qualification shall be applicable to both single and multi-layer dried coatings. For single-layer, the sample is analyzed directly. For multi-layer dried coating, each layer is analyzed separately.

**4. Sample collection**

Sample(s) (i.e. single or multi-pack paint) shall be mixed, applied, and dried/cured under the conditions as per paint manufacturer’s instruction on substrate(s) (e.g. structure, steel test panel, paint test card etc).

Single or multi-layer dried coating sample(s) from each batch shall be prepared on substrate(s). For multi-layer sample, staggered layers can be applied on one substrate (refer to Figure 1) or each layer on one substrate. Subsequently, three sampling locations are used for each layer from **Left** (1 sample), **Center** (1 sample) and **Right** (1 sample) of the layer. The sample shall not exhibit any hard skin, grains and sediments, running or sagging.

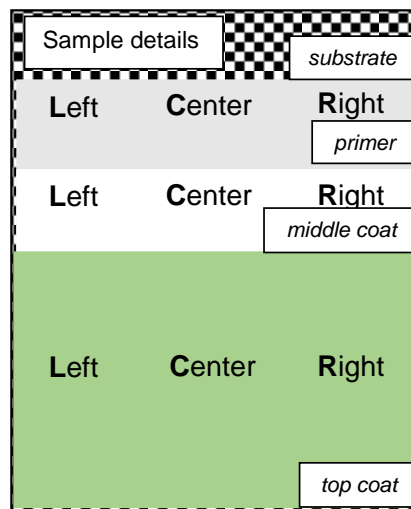


Figure 1. Schematic diagram of sampling locations at **Left**, **Center** and **Right** of the multi-layer dried coating on a substrate



## 5. FTIR test method

### 5.1. FTIR spectrophotometer

Both mobile and handheld FTIR spectrophotometers are suitable for on-site analysis, while the benchtop spectrophotometer shall be used for laboratory analysis. The results obtained from benchtop, mobile and handheld spectrophotometers should be comparable.

The FTIR spectrophotometer shall encompass a wavenumber range of at least  $4000\text{ cm}^{-1} - 700\text{ cm}^{-1}$  with resolution of no less than  $4\text{ cm}^{-1}$ . In addition, the FTIR spectrophotometer shall be equipped with single or multi-bounce ATR with horizontal arrangement. The common ATR crystal materials are diamond, zinc selenide (ZnSe) and germanium (Ge), with the spectral range of  $4000\text{ cm}^{-1} - 650\text{ cm}^{-1}$ ,  $4000\text{ cm}^{-1} - 650\text{ cm}^{-1}$ , and  $4000\text{ cm}^{-1} - 700\text{ cm}^{-1}$  respectively. The ATR crystal material shall be compatible and not react with the respective dried coating sample. The finite comparison of the spectra is recommended (but not essential) to be obtained with same ATR crystal material.

### 5.2. Sample preparation

Sample(s) (i.e. single or multi-pack paint) from the container(s) shall be mixed and subsequently applied and dried/cured on substrate(s) under the conditions as per paint manufacturer's instruction.

Single or multi-layer sample(s) (i.e. dried coating) from each batch to be applied on substrate(s). For multi-layer sample, staggered layers can be applied on one substrate (refer to Figure 1) or each layer on one substrate. Subsequently, one sample is obtained from the Center of each layer for each batch of the dried coating applied.

### 5.3. Sample annotation

Sample annotation is required to reproduce the spectrum and the information shall include:

- a) Sample name;
- b) Batch number;
- c) Date and time being analyzed;
- d) Analyst and/or company name;
- e) FTIR brand and model, spectral range, number of sample scans (min 32), number of background scans (min 32), resolution;
- f) ATR crystal material; and
- g) Spectral correction (if any).

### 5.4. Instrumental analysis

The analyses are recorded in absorbance mode by averaging 32 scans at a maximum resolution of  $4\text{ cm}^{-1}$ . Each sample is required to have a minimum of triplicate analyses. A background infrared spectrum shall be collected prior to each sample analysis.

The dried coating sample shall be complete in contact with the ATR crystal. Sufficient force shall be imposed on the substrate, in order to obtain a good spectrum.

### 5.5. Spectra analysis

A comprehensive examination of the original spectrum is required prior to spectrum processing. It is recommended to retain the original spectra for further deliberation. The spectra shall not be baseline corrected or subjected to any other types of spectral correction.

The commercially available FTIR software contains different algorithms for processing FTIR spectra.

For the Dried Coating Fingerprint Certificate, only the *compare* function is involved. A *compare* function or equivalent shall be used in all cases.

The range of wavenumbers of fingerprint region for dried coating is as shown in Annex A.

### 5.5.1. Reference spectrum

Reference spectrum shall be generated from the average spectra of **Left**, **Center** and **Right** on a substrate (refer Clause 4).

Paint manufacturer shall average a minimum of nine spectra from **Left**, **Center** and **Right** on a substrate (with minimum of three spectra from each location).

### 5.5.2. Degree of similarity (*r*)

The degree of similarity, which is termed correlation (*r*), of the spectra is generated by comparing the spectra of the sample to that of the Reference spectrum using *compare* features of the FTIR software.

The degree of similarity is directly proportional to quantities of *r*, i.e.  $r = 1$  represents the complete matching of the sample spectrum to that of the Reference spectrum. The acceptance criterion is set at  $r \geq 0.900$ , with tolerance of  $\pm 0.002$  (or the range of  $0.898 - 1.000$ ).

It is to be noted that the degree of similarity has no correlation with the performance of the dried coating. The  $r \geq 0.900$  (with tolerance of  $\pm 0.002$ ) is only an indication that the batch of the dried coating supplied has high degree of similarity as compared to the Reference dried coating that passed the qualification test.

## 6. Qualification of dried coating

### 6.1. Qualification of Reference sample (new formulation)

The qualification of the Reference sample is approximated by degree of similarity (*r*) from the in-house and 3<sup>rd</sup>-party testing laboratories, as given by Equation 1.

$$r_{\text{Ref}} = \sqrt{r_{\text{Ref in-house}} \times r_{\text{Ref 3rd-party}}} \quad (\text{Equation 1})$$

The acceptance criterion for the qualification of Reference sample is  $r_{\text{Ref}} \geq 0.90 \pm 0.01$  for the whole FTIR region. The successfully qualified Reference sample is employed as standard for in-house batch-to-batch monitoring, random/scheduled on-site analysis, and retained dried coating sample analysis.

### 6.2. In-house dried coating batch-to-batch monitoring (by paint manufacturer)

For each batch of paint production, sample(s) (i.e. single or multi-pack paint) from the container(s) shall be mixed, applied, and dried/cured under the conditions as per paint manufacturer's instruction on substrate(s). The *r* is approximated by referencing the Reference sample to the sample collected from the **Center** of the dried coating for every subsequent batch of the dried coating applied.

If the *r* of the sample spectrum is  $\geq 0.900$  (with tolerance of  $\pm 0.002$ ) for whole FTIR region as compared to the Reference spectrum, then the sample is accepted.

If the  $r$  of the sample spectrum is  $< 0.898$  for whole FTIR region as compared to the Reference spectrum, a verification test using samples from each location (**Left**, **Center** and **Right**) of the dried coating is required, prior to rejection of the whole lot of dried coating applied.

### 6.3. Random/scheduled on-site analysis (by owner)

For the on-site dried coating sampling (using handheld or mobile FTIR spectrophotometer), one sample from the **Center** of the randomly selected dried coating is required. The  $r$  for on-site sample spectrum is approximated by referencing the Reference sample to the on-site collected dried coating sample.

If the  $r$  of the sample spectrum is  $\geq 0.900$  (with tolerance of  $\pm 0.002$ ) for whole FTIR region as compared to the Reference spectrum, then the sample is accepted.

If the  $r$  of the sample spectrum  $< 0.898$  as compared to the Reference spectrum for whole FTIR region, verification test of the on-site dried coating sample shall be carried out by 3<sup>rd</sup>-party testing laboratory (recommended by the owner).

If the 3<sup>rd</sup>-party analysis of on-site dried coating sample demonstrated  $r < 0.898$  as compared to the Reference spectrum, an additional verification test of the retained dried coating sample shall be carried out by 3<sup>rd</sup>-party testing laboratory, prior to rejection of the whole lot of dried coating.

### 6.4. Retained dried coating sample

The paint manufacturer shall retain one dried coating sample from every new dried coating applied and submit for 3<sup>rd</sup>-party testing laboratory (recommended by the owner) to act as a verification tool whenever there is a dispute on the dried coating applied on-site. For each batch of the dried coating, single or multi-layer samples (i.e. dried coating on substrate(s)) is/are kept as retained dried coating sample.

The  $r$  is approximated by referencing the Reference sample to the retained dried coating from **Center** of the container. If the  $r$  of the sample spectrum is  $\geq 0.900$  (with tolerance of  $\pm 0.002$ ) for whole FTIR region as compared to the Reference spectrum, then the sample is accepted.

If the  $r$  of the sample spectrum is  $< 0.898$  for whole FTIR region as compared to the Reference spectrum, a verification test using samples from each location (**Left**, **Center** and **Right**) of the dried coating is required, prior to rejection of the whole lot of dried coating.

#### 6.4.1. Dispute of results from 3<sup>rd</sup>-party testing laboratory

The 3<sup>rd</sup>-party laboratories (recommended by the owner) yielding contrasting results shall complete the Test Method Assessment checklist (Annex B) in the presence of representatives from the respective laboratories. Upon completion of the checklist and site verification, the respective laboratories shall perform the testing of samples (not limited to certified reference material) prepared by the paint manufacturer in the presence of representatives from all respective laboratories.

## 7. Dried Coating Fingerprint Certificate

The Dried Coating Fingerprint Certificate is comprised of two parts, namely physical analyses and structural analyses, as shown in Annex A. This certificate is applicable for single or multi-layer dried coatings.

### 7.1. Physical analyses

Physical analyses are performed by in-house testing laboratory as required by the owner. The MSDS, TDS, COA and certificate of % purity by manufacturer shall be appended whenever applicable.

For the inorganic components in the dried coating, the paint manufacturer shall either attach the original COA with Dried Coating Fingerprint Certificate or reproduce the data from the original supplier without appending the COA. However, the latter shall be cross-referenced to the original supplier's COA document number for future traceability.

## **7.2. Structural analyses**

Structural analysis is performed using FTIR. The inorganic components in the dried coating that are IR inactive shall be appended with other compliances such as certificate of percent purity by the (metal) manufacturer.

The FTIR analysis shall provide the spectrum that is properly identified and labelled, as listed in Clause 5.3. Other information necessary to duplicate the sampling and/or spectral collection shall be provided as well.

## **7.3. Confidentiality**

The Dried Coating Fingerprint Certificate shall be converted into non-editable digital format and/or encrypted, e.g. in PDF format and recommended to be with password protection. It shall not be circulated through social media which would violate the confidentiality of the company or to the customers.

## **7.4. Signatory**

The Dried Coating Fingerprint Certificate shall be signed by a certified signatory (optional: who has passed the IMM Certified Fingerprint Quality Controller course). The certified signatory shall include name, function, IMM membership number (optional) and Coating Fingerprint Quality Controller rubber stamp (optional). All pages of Dried Coating Fingerprint Certificate shall be either signed or initialed by certified signatory.

The Dried Coating Fingerprint Certificate can be signed by employee under the supervision of the certified signatory. The signatory (i.e. the employee) shall include name, function of the employee and shall be counter-signed by the same certified signatory giving his/her name, function, IMM membership number (optional) and Coating Fingerprint Quality Controller rubber stamp (optional).

# **8. Execution of dried coating fingerprinting**

## **8.1. Certified signatory for in-house Dried Coating Fingerprint Certificate**

The Dried Coating Fingerprint Certificate shall be generated per batch basis by the paint manufacturer for qualification of dried coating fingerprinting, for routine batch check on every subsequent batch of the dried coating for the qualified dried coating, for scheduled client's audit or random client's audit as requested by client as deemed necessary, and for verification test of the retained dried coating sample.

## **8.2. 3<sup>rd</sup>-party testing laboratory**

The 3<sup>rd</sup>-party testing laboratory shall perform the qualification of dried coating fingerprint and certify the on-site dried coating sample applied on schedule or random basis. In addition, 3<sup>rd</sup>-party testing laboratory shall verify the retained dried coating sample whenever there is a dispute on the on-site dried coating sample.

**8.3. Coating Inspector**

Coating inspector shall prepare and certify the dried coating fingerprint monitoring report for on-site dried coating applied on schedule or random basis. In addition, coating inspector shall perform the schedule or random basis on-site dried coating fingerprint structural analysis by handheld or mobile FTIR spectrophotometer.

**8.4. Fabricator, contractor, sub-contractor**

The fabricator, contractor or sub-contractor will receive the Dried Coating Fingerprint Certificate either in hardcopy or submitted separately in digital format. The fabricator, contractor or sub-contractor shall validate the Dried Coating Fingerprint Certificate submitted by coating inspector on a scheduled or random basis for on-site dried coating fingerprint structural analysis by handheld or mobile FTIR spectrophotometer.

**8.5. External auditor**

The external auditor shall review and validate the Dried Coating Fingerprint Certificate and dried coating fingerprint (scheduled/random) monitoring report.

**8.6. End user**

The end user shall review and validate the Dried Coating Fingerprint Certificate and dried coating fingerprint (scheduled/random) monitoring report.

## Annex A (informative)

### Dried Coating Fingerprint Certificate

<b>Company name:</b>	e.g. Company ABC	<b>Country:</b>	e.g. Malaysia				
<b>Certificate number:</b>	e.g. epoxy/001/02Jan2020	<b>Date:</b>	e.g. 2 Jan 2020				
<b>Number pages:</b>	e.g. 05	<b>Type of substrate:</b>	e.g. carbon steel panel				
<b>Grade of surface finish / surface preparation:</b>		e.g. SA 2.5					
<b>Section 1: General information</b>							
<b>Product name:</b>	e.g. Epoxy coating systems	<b>Product type:</b>	e.g. new construction on carbon steel without insulation				
<b>Date of issue:</b>	<b>Primer</b> (e.g. Inorganic zinc silicate)	<b>Middle coat</b> (e.g. High solid epoxy)	<b>Top coat</b> (e.g. Aliphatic polyurethane)				
Trade name	e.g. IOZ123	e.g. Epoxy123	e.g. PU123				
Generic	e.g. IOZ	e.g. Epoxy	e.g. PU				
Factory location	e.g. Shah Alam, Selangor	e.g. Shah Alam, Selangor	e.g. Shah Alam, Selangor				
Batch number	e.g. 1234567A	e.g. 1234567B	e.g. 1234567C				
Painting date	e.g. 02 Jan 2020	e.g. 04 Jan 2020	e.g. 06 Jan 2020				
Product technical data sheet number	e.g. TDS123A	e.g. TDS123B	e.g. TDS123C				
Material safety data sheet number	e.g. MSDS123A	e.g. MSDS123B	e.g. MSDS123C				
Drying or curing conditions	e.g. ageing cure at 40 °C for 2 days, RH%= 70 %	e.g. ageing cure at 40 °C for 2 days, RH%= 70 %	e.g. ageing cure at 40 °C for 2 days, RH%= 70 %				
Dried film thickness	e.g. 75 µm	e.g. 150 µm	e.g. 60 µm				
Design life	e.g. 5 years	e.g. 5 years	e.g. 5 years				
<b>Section 2: Test methods and results</b>							
<b>Physical analyses</b>							
		<b>Primer</b> (e.g. Inorganic zinc silicate)		<b>Middle coat</b> (e.g. High solid epoxy)		<b>Top coat</b> (e.g. Aliphatic polyurethane)	
<b>Parameters</b>	<b>Method</b>	<b>Specification with tolerance</b>	<b>Test result</b>	<b>Specification with tolerance</b>	<b>Test result</b>	<b>Specification with tolerance</b>	<b>Test result</b>
Color code	e.g. BS 4800 RAL Color Standards	e.g. color difference (dE) < 1	e.g. light grey	e.g. color difference (dE) < 1	e.g. white	e.g. color difference (dE) < 1	e.g. navy blue
<i>Please add</i>							

Structural analyses					
Infrared spectra	Dried coating sample as applied on substrate. Degree of similarity ( $r$ ) $\geq 0.900^*$ (tolerance = $\pm 0.002$ or range of $r = 1.000 - 0.898$ )				
	Method	Wavenumber range	Primer (e.g. Inorganic zinc silicate)	Middle coat (e.g. High solid epoxy)	Top coat (e.g. Aliphatic polyurethane)
e.g. 3-staggered layer on one substrate	IMM FP03	700-4000 $\text{cm}^{-1}$	e.g. $0.986 \pm 0.001$	e.g. $0.999 \pm 0.001$	e.g. $0.986 \pm 0.001$
		900-2000 $\text{cm}^{-1}$	e.g. $0.986 \pm 0.001$	e.g. $0.999 \pm 0.001$	e.g. $0.986 \pm 0.001$

\*average results of triplicate analyses

Section 3: FTIR test details (as per IMM FP03)				
Analyst & company name	e.g. Name & Company ABC Sdn Bhd			
Brand & model of FTIR	e.g. FTIR Brand XYZ & model: 2016			
Type of FTIR spectrophotometer	e.g. benchtop / mobile / handheld			
Benchtop: ATR crystal material	e.g. diamond, zinc selenide (ZnSe), germanium			
Spectral correction (circle) <b>Note:</b> correction is <u>NOT</u> recommended.	YES <input checked="" type="radio"/> NO <input type="radio"/> <b>[Note: if YES, please state the correction(s) made]</b> e.g. automatic baseline correction			
Spectral range ( $\text{cm}^{-1}$ )	e.g. 700 - 4000 $\text{cm}^{-1}$			
No. of sample scans (min 32)	e.g. 32 scans			
No. of background scans (min 32)	e.g. 32 scans			
Resolution (min 4 $\text{cm}^{-1}$ )	e.g. 4 $\text{cm}^{-1}$			
<i>High sensitivity compare</i> algorithm for degree of similarity in absorbance mode	<b>Note:</b> Correlation <i>compare</i> algorithm of the FTIR software should depend on both $x$ - (wavenumber) and $y$ - (absorbance) vectors. <i>High sensitivity compare</i> algorithm, which analyzes the variations <i>via</i> summation of the squared differences of each variation from the overall mean OR equivalent, should be used.			
	Dependence on BOTH $x$ - and $y$ -vectors (circle)	<input checked="" type="radio"/> YES / NO	<i>High sensitivity compare</i> algorithm (circle)	<input checked="" type="radio"/> YES / NO
Trade name and batch number of Reference spectrum for primer	e.g. IOZ123 & 1234567A-Reference			
Trade name and batch number of Reference spectrum for middle coat	e.g. Epoxy123 & 1234567B-Reference			
Trade name and batch number of Reference spectrum for top coat	e.g. PU123 & 1234567C-Reference			

Notes:

1. Full range of FTIR spectra for primer, middle coat and top coat without automatic baseline correction and in absorbance mode are to be attached with this report (raw data).
2. Compliance to matching criteria values does not exclude meeting the requirements of other QA/QC checks e.g. drying time, gloss, hiding power etc.
3. Methods used shall refer to the latest published document.
4. This certificate is applicable to all systems.
5. This certificate can be submitted in CD or other digital formats.

The undersigned hereby declare that all the analytical tests were performed according to the procedures specified herein and that this report represents a true and accurate record of the results obtained.

<b>Authorized QA/QC Executive:</b>	<b>Validated by (preferably by IMM certified Coating Fingerprint Quality Controller):</b>
e.g. <div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>NAME</b>  <b>Company ABC Sdn Bhd</b>                  (123456-X)                  QC Department             </div>	e.g. 
<b>Signature:</b> e.g. <i>Name</i>	<b>Signature:</b> e.g. <i>Yoga Salim</i>
<b>Date:</b> e.g. 8 Jan 2020	<b>Date:</b> e.g. 8 Jan 2020
<b>IMM membership member:</b> (optional to be IMM member)	<b>IMM membership member:</b> (optional to be IMM member)

<b>Section 4: Compulsory appendices (to be submitted in CD or other digital formats)</b>	
Appendix 1	Overlay Reference and sample FTIR spectra for primer <b>(Note: In addition, raw data of Reference and sample FTIR spectra must be provided in two raw data files)</b>
Appendix 2	Overlay Reference and sample FTIR spectra for middle coat <b>(Note: In addition, raw data of reference and sample FTIR spectra must be provided in two raw data files)</b>
Appendix 3	Overlay Reference and sample FTIR spectra for top coat <b>(Note: In addition, raw data of Reference and sample FTIR spectra must be provided in two raw data files)</b>
Appendix 4	Certificate of analyses which are relevant to the in-house standard testings
Appendix 5	Certificate of % purity of zinc by metal manufacturer for organic zinc paint & inorganic zinc paint <b>OR</b> certificate of analysis of alum paste for silicone-aluminum paint / glass flake for glass flake polyester / inorganic filler for any paint

END OF REPORT

**Received & checked (preferably by IMM certified Coating Fingerprint Quality Controller):**

**Date:** e.g. 15 Jan 2020



*Melissa Chan*

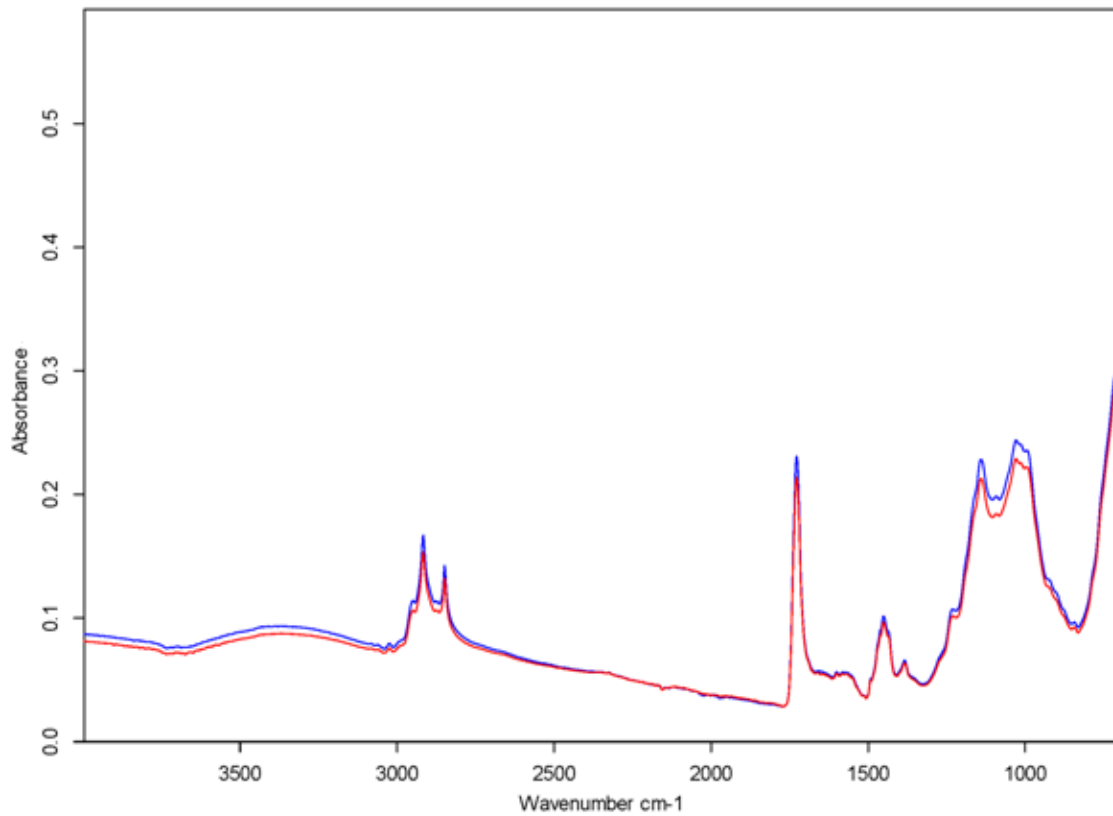


**Appendix 1** Overlay Reference and sample FTIR spectra for middle coat

**Reference spectrum – red** (generated by averaging the FTIR spectra from **Left, Center and Right** of the dried coating sample for the sample sent for qualification for coating systems and products for offshore application)

**Sample spectrum – blue** (for each batch of production, sample at the location of **Center** of the dried coating)

**Degree of similarity ( $r$ ) = 0.999**



Note: Analogues of Appendix 2 and Appendix 3 are not shown in this standard but shall be appended if applicable.

## Annex B (informative)

### Test Method Assessment of 3<sup>rd</sup>-Party Testing Laboratory in relation to dispute in Fingerprint Certificate for raw material, paint and dried coating samples

Test Method Assessment of 3 <sup>rd</sup> -Party Testing Laboratory in relation to dispute in Fingerprint Certificate for raw material, paint and dried coating samples		
Attach all the analysis data as references.		
SECTION 1: Information of the 3 <sup>rd</sup> -Party Testing Laboratory		
Name of the laboratory		
Representative of (which company)		
SECTION 2: Requirement of the laboratory		
SECTION 2.1: Accreditation		
Company/Institution is accredited to the following: [ ] SMM/ MS ISO IEC 17025 [ ] Others (Specify _____)		
Date of last audit		
Pending/ Unresolved non-compliances report (If any)		
SECTION 2.2: Competency of FTIR Analyst		
Haw many years of experience? (Min: One year)		
Qualification		
Professional Membership		
SECTION 3: FTIR Spectrophotometer		
SECTION 3.1: Description of Benchtop FTIR		
Brand and Model		
ATR Crystal material		
No. of background scans (min 32)		
No. of sample scans (min 32)		
Resolution (4 cm <sup>-1</sup> )		
Spectral range (min 4000 – 700 cm <sup>-1</sup> )		
SECTION 3.2: Calibration and Maintenance		
Calibrated by [ ] In-house [ ] 3 <sup>rd</sup> -party (Specify _____)		
Last calibration date		
Last Maintenance Record		
SECTION 3.3: Analysis		
Standard operation procedure (SOP)		
SECTION 4: Certified Coating Fingerprint Quality Controller (FPQC)		
Name of FPQC		
IMM membership number		
Certificate number		

## Bibliography

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- [4] Shell Global Solutions International B. V. Design and Engineering Practice (Technical Specification) (DEP 30.48.0031-Gen) (2017). *Protective Coatings for Onshore and Offshore Facilities.*
- [5] PETRONAS Technical Standards (Technical Specification) (PTS 15.20.03) (2016). *Protective Coatings and Linings.*
- [6] NACE International Standard SP0108-2008, *Corrosion Control of Offshore Structures by Protective Coatings*
- [7] ISO 15528:2013, *Paints, varnishes and raw materials for paints and varnishes - Sampling.*
- [8] IMM FP01:2019, *Coating fingerprinting overall procedures for paints using FTIR and other related methods*

## Acknowledgements

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