

# SINGAPORE CIVIL DEFENCE FORCE

Our Ref. : CD/FSSD/12/02/03/01

Your Ref :

Date : 1 Oct 2014



HQ Singapore Civil Defence Force  
91 Ubi Avenue 4  
Singapore 408827  
Tel : 68481457  
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Registrar, Board of Architects  
Registrar, Professional Engineers Board  
President, Singapore Institute of Architects  
President, Institution of Engineers, Singapore  
President, Association of Consulting Engineers, Singapore

Dear Sir/Mdm

## FIRE SAFETY REQUIREMENTS FOR USE OF PLASTICS IN BUILDING CONSTRUCTION

Clause 3.15.14 of the Fire Code<sup>1</sup> currently prohibits the use of plastics<sup>2</sup> for building construction. SCDF has recently undertaken a review and has developed a set of fire safety requirements (reference FSR 10:2014) to facilitate the use of plastics for building construction.

2. Qualified Persons (QPs) who intend to use plastics for wall, ceiling, roof covering, floor and related finishes<sup>3</sup> shall ensure that the use of plastics meet the requirements stated in the FSR. QPs will also need to ensure that these plastic materials are listed in accordance with the requirements of the Product Listing Scheme (PLS) before they can be used, except for plastic floor finishes where the listing requirement will only take effect from 1 Apr 2015<sup>4</sup>.

3. This FSR shall take effect from 1 Oct 2014, and will supersede the earlier SCDF circulars on the use of plastics dated 27 Aug 2012, 7 Feb 2013 and 31 May 2013.

4. Please convey the contents of this circular to members of your Institution/Association/ Board. The circular is also available in CORENET-e-Info: <http://www.corenet.gov.sg/einfo>.

<sup>1</sup> Extract of CI 3.15.14 of Fire Code: "Walls, ceilings, roof covering and finishes shall not contain any plastic material."

<sup>2</sup> The definition of plastics can be found in FSR 10:2014.

<sup>3</sup> These include finishes in buildings and lift cars.

<sup>4</sup> For plastic floor finishes which require fire testing based on the FSR, QPs will be allowed conditional use of the plastic floor finishes, provided the materials get listed under the Product Listing Scheme by 1 Apr 2015.



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5. For any clarification on the requirements for use of plastics, please contact MAJ Tong Hong Haey at DID: 68481448 (e-mail address: [tong\\_hong\\_haey@scdf.gov.sg](mailto:tong_hong_haey@scdf.gov.sg)) or Mr Pang Tong Teck at DID: 68481403 (e-mail address: [pang\\_tong\\_teck@scdf.gov.sg](mailto:pang_tong_teck@scdf.gov.sg)).

Yours faithfully,

(transmitted via e-mail)

MAJ Tan Chung Yee  
SCDF Fire Safety Standing Committee  
for Commissioner  
Singapore Civil Defence Force

cc

CEO, BCA  
CEO, URA  
CEO, HDB  
CEO, JTC  
CE, LTA  
CE, SPRING Singapore  
President, REDAS  
President, IFE  
President, SISV  
President, FSMAS  
President, SCAL  
Honorary Secretary, SPM  
SCDF Fire Safety Standing Committee





FIRE SAFETY AND SHELTER DEPARTMENT  
SINGAPORE CIVIL DEFENCE FORCE

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# FIRE SAFETY REQUIREMENTS FOR THE USE OF PLASTICS IN BUILDING CONSTRUCTION

FSR 10:2014

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Effective Date: 1 Oct 2014

*Released by:*

Fire Safety Consultation Branch  
Fire Safety & Shelter Department

(Total 9 pages)

# FIRE SAFETY REQUIREMENTS FOR THE USE OF PLASTICS IN BUILDING CONSTRUCTION

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## 1. DEFINITION OF PLASTICS

- 1.1 Plastics refer to any group of organic materials which, though stable in use at ambient temperatures, are plastic at some stage in their manufacture and then can be shaped by the application of heat and/or pressure<sup>5</sup>. Plastics can be categorised as either thermoplastics<sup>6</sup> or thermosetting<sup>7</sup> plastics. See Figure 1A.

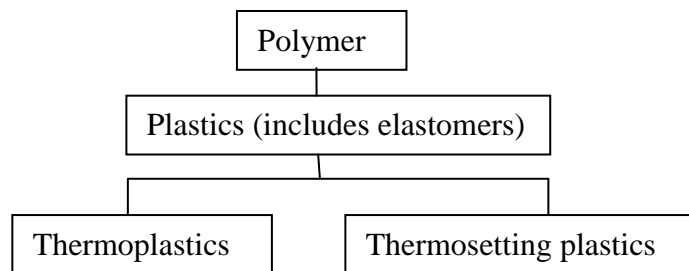


Figure 1A: Categorisation of plastics

## 2. KEY FIRE SAFETY REQUIREMENTS

- 2.1 Tables 2A, 2B and 2C<sup>8</sup> list the relevant fire test standards and acceptance criteria to facilitate the use of plastics<sup>9</sup> for various building applications. Tables 2D to 2I state the situations in which the fire tests will be exempted or required, as well as the situations in which the use of plastics will not be allowed regardless of the fire test results. The use plastics for wall, ceiling, roof covering, floor and related finishes is only allowed if the conditions stated in this FSR are met.

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<sup>5</sup> <https://espace.cern.ch/safety-rules-regulations/en/definitions/pages/definitions.aspx>

<sup>6</sup> Thermoplastics refer to a class of plastic materials that is capable of being repeatedly softened by heating and hardened by cooling. A material can be considered as thermoplastics if it is a synthetic polymeric material which has a softening point below 200°C when tested to BS EN ISO 306:2004 method A120 *Plastics – Thermoplastic materials – Determination of Vicat softening temperature*.

<sup>7</sup> Thermosetting plastics refer to a class of plastic materials that will undergo a chemical reaction by the application of heat, pressure, catalysts, etc, leading to a relatively infusible, non-reversible state.

<sup>8</sup> For each test category, only one fire test is needed to demonstrate the acceptable fire risk level.

<sup>9</sup> Fire retardants are also allowed to be used to enhance the fire performance of plastics for building construction provided the retardants are applied in suppliers' factories according to the retardants' respective standards. Accelerated weathering tests will also be required to assess the effect of weather on fire retardants applied on external building applications.

## 2.2 Acceptable fire tests and corresponding acceptance criteria

### Relevant fire tests for floor material/finishes

Test category	Fire risk	Applicable fire test standards	Acceptance criteria
A	Toxicity emission	• BS 6853 Annex B	• $R < 1.0$
		• BS EN 45545-2	• $CIT < 0.75$
		• EN ISO 5659-2	• $CIT < 0.75$
B	Smoke density	• EN 13501-1	• Smoke classification to be <i>sI</i> rating.
		• EN 14041	
		• EN ISO 9239-1	
C	Ease of ignition / Fire spread	• ASTM E662	• Smoke density, $D_{s,max} < 450$
		• NFPA 258	
		• EN ISO 5659-2	• Smoke density, $D_{s,max} < 150$
C	Ease of ignition / Fire spread	• EN 13501-1	<u>Sprinklered premises</u>
		• EN 14041	• Sleeping occupancy: Class C <sub>fl</sub> or better
C	Ease of ignition / Fire spread	• EN ISO 9239-1	• Non-sleeping occupancy: Class D <sub>fl</sub> or better
		• ASTM E648	<u>Unsprinklered premises</u>
C	Ease of ignition / Fire spread	• NFPA 253	• Sleeping occupancy: Class B <sub>fl</sub> or better
			• Non-sleeping occupancy: Class C <sub>fl</sub> or better
			• Critical Radiant Flux (CRF) $> 0.45 \text{ W/cm}^2$

Table 2A: Fire tests and acceptance criteria for plastic floor material/finishes

### Relevant fire tests for wall and ceiling material/finishes

Test category	Fire risk	Applicable fire test standards	Acceptance criteria
D	Toxicity emission	• BS 6853 Annex B	• $R < 1.0$
		• BS EN 45545-2	• $CIT < 0.75$
		• EN ISO 5659-2	• $CIT < 0.75$
E	Smoke density	• EN 13501-1	• Smoke classification to be of <i>sI</i> rating
		• EN ISO 5659-2	• Flaming droplet classification to be <i>d0</i> rating
F	Fire spread	• NFPA 285	• $VOF_4 < 300 \text{ min}$
		• EN 13501-1	• To comply with existing Fire Code requirements.
		• BS 476	• Internal wall finishes: Cl 3.13 of Fire Code
			• External wall finishes: Cl 3.5 of Fire Code
			• To pass criteria in NFPA 285

Table 2B: Fire tests and acceptance criteria for plastic wall/ceiling material/finishes

Relevant fire tests for roof covering

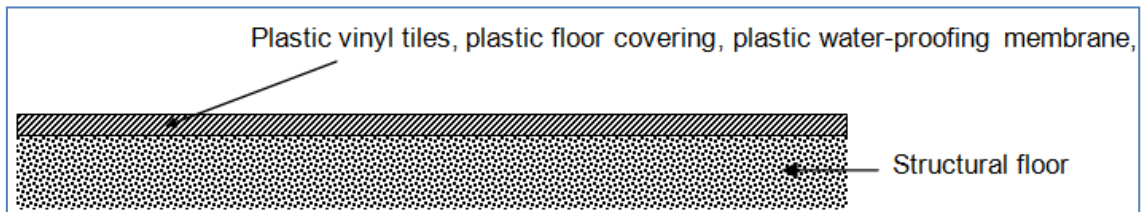
Test category	Fire risk	Applicable fire test standards	Acceptance criteria
G	Toxicity emission	<ul style="list-style-type: none"> <li>Not critical. Generally exposed to external.</li> </ul>	
H	Smoke density	<ul style="list-style-type: none"> <li>EN 13501-1</li> </ul>	<ul style="list-style-type: none"> <li>Generally not critical if exposed to external.</li> <li>If exposed as ceiling on the underside, then must meet requirements for ceiling (achieve <i>s1-d0</i> rating).</li> </ul>
J	Fire spread	<ul style="list-style-type: none"> <li>EN 13501-5</li> </ul>	<ul style="list-style-type: none"> <li>Class B<sub>ROOF</sub></li> </ul>
		<ul style="list-style-type: none"> <li>BS 476-3</li> </ul>	<ul style="list-style-type: none"> <li>Class AA/AB/AC</li> </ul>
		<ul style="list-style-type: none"> <li>BS 476-6/7</li> </ul>	<ul style="list-style-type: none"> <li>Class 1</li> </ul>
		<ul style="list-style-type: none"> <li>ASTM E108</li> </ul>	<ul style="list-style-type: none"> <li>Class A</li> </ul>

Table 2C: Fire tests and acceptance criteria for plastic roof material

**2.3 Conditions for the use of plastics in various building applications**

Plastic floor finishes (uncovered)

Figure 2D: Plastic floor finishes overlaid on structural floor

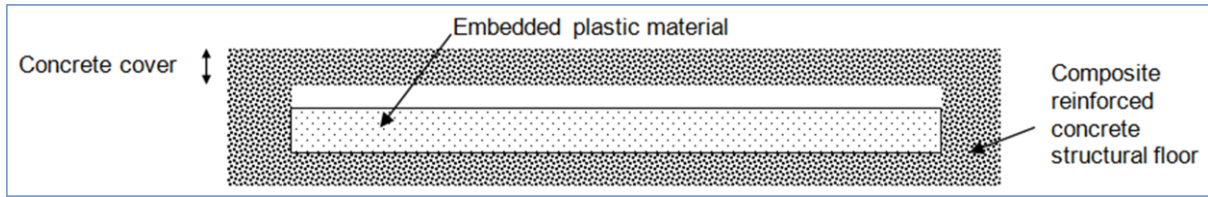


S/N	Material construction	Assessment	Exemption / Remarks
1	Non-combustible material.	Allowed	No further fire test required.
2	Material thickness not exceeding 10mm	Allowed	<ul style="list-style-type: none"> <li>No further fire test required.</li> <li>For sprinklered premises, material not exceeding 20mm can be exempted from the tests in Table 2A.</li> </ul>
3	Use in open-to-sky conditions.	Allowed	No further fire test required.
4	Use in exit staircase / exit passageways	Not allowed	To protect key escape routes.
5	Material thickness exceeding 10mm	Allowed with conditions	Allowed if pass test categories (A), (B) and (C) in Table 2A.

Table 2D: Fire safety requirements for uncovered plastic floor finishes

Plastic material cast into (embedded within) structural floor system

Figure 2E: Plastic material embedded within masonry floor

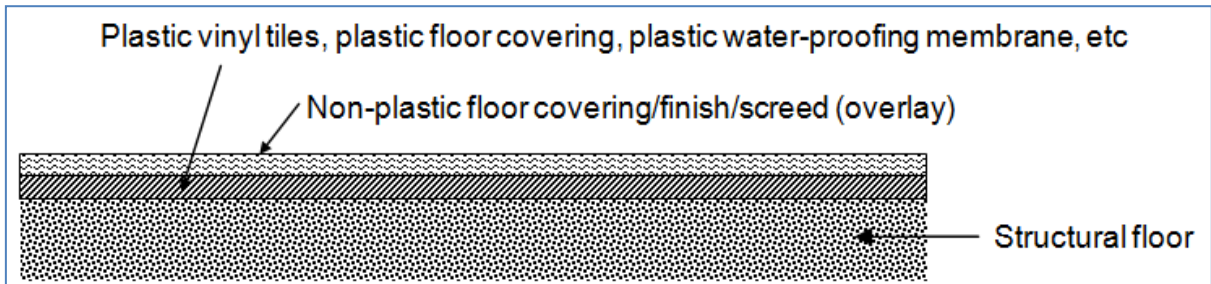


S/N	Material construction	Assessment	Exemption / Remarks
1	Non-combustible material.	Allowed	No further fire test required.
2	Material thickness not exceeding 10mm	Allowed	<ul style="list-style-type: none"> <li>No further fire test required.</li> <li>For sprinklered premises, material not exceeding 20mm can be exempted from the tests in Table 2A.</li> </ul>
3	Use in open-to-sky conditions.	Allowed	No further fire test required.
4	Use in exit staircase / exit passageways	Not allowed	To protect key escape routes.
5	Material thickness exceeding 10mm	Allowed with conditions	<ul style="list-style-type: none"> <li>If masonry cover is less than 25mm thick, the material shall pass test categories (A), (B) and (C) in Table 2A.</li> <li>If masonry cover is at least 25mm thick all around the embedded plastic, tests in Table 2A are exempted.</li> <li>The locations where embedded plastics are installed shall be clearly indicated on the plans submitted to SCDF.</li> </ul>

Table 2E: Fire safety requirements for plastics embedded within masonry floor

Plastic floor finishes (covered)

Figure 2F: Plastic floor finishes laid on structural floor, and covered by a non-combustible overlay



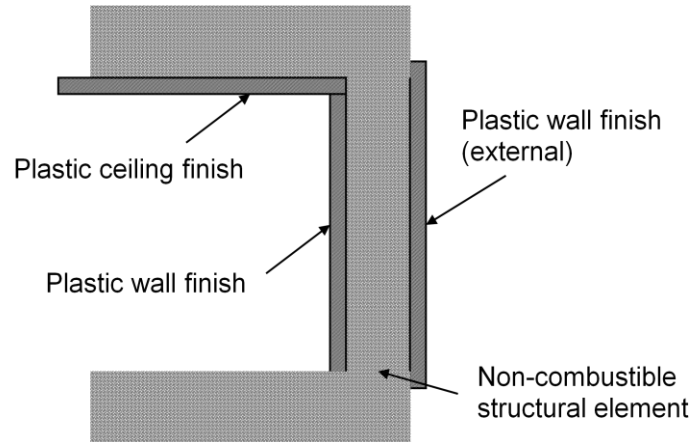
S/N	Material construction	Assessment	Exemption / Remarks
1	Non-combustible material.	Allowed	No further fire test required.
2	Material thickness not exceeding 10mm	Allowed	<ul style="list-style-type: none"> <li>No further fire test required.</li> <li>For sprinklered premises, material not exceeding 20mm can be exempted from the tests in Table 2A.</li> </ul>
3	Use in open-to-sky conditions.	Allowed	No further fire test required.
4	Use in exit staircase / exit passageways	Not allowed	To protect key escape routes.
5	Material thickness exceeding 10mm	Allowed with conditions	<ul style="list-style-type: none"> <li>Allowed if pass test categories (A), (B) and (C) in Table 2A.</li> <li>If the overlay is non-combustible and at least 25mm thick, test category (C) in Table 2A is exempted</li> </ul>

Table 2F: Fire safety requirements for covered plastic floor finishes



Plastic wall or ceiling material/finishes

Figure 2G: Plastic wall or ceiling material/finishes installed internally/externally

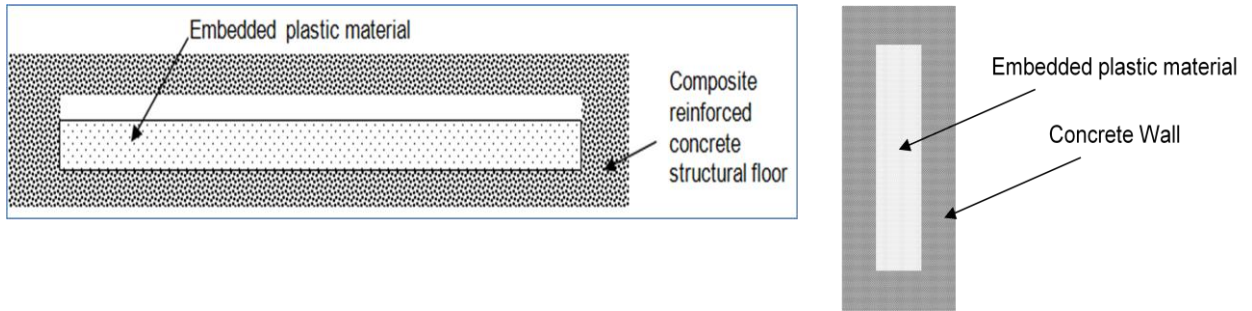


S/N	Material construction	Assessment	Exemption / Remarks
1	Non-combustible material.	Allowed	No further fire test required.
2	Material thickness not exceeding 1mm	Allowed	No further fire test required.
3	Use in exit staircase / exit passageways	Not allowed	To protect key escape routes.
4	Material thickness exceeding 1mm	Allowed with conditions	Allowed if pass test categories (D), (E) and (F) in Table 2B, unless specifically exempted for external building applications.

Table 2G: Fire safety requirements for plastic wall or ceiling material/finishes

Plastic material embedded in masonry wall/ceiling

Figure 2H: Plastic material embedded within wall/ceiling



S/N	Material construction	Assessment	Exemption / Remarks
1	Non-combustible material.	Allowed	No further fire test required.
2	Material thickness not exceeding 1mm	Allowed	No further fire test required.
3	Use in exit staircase / exit passageways	Not allowed	To protect key escape routes.
4	Material thickness exceeding 1mm	Allowed with conditions	<ul style="list-style-type: none"> <li>• If masonry cover is less than 25mm thick, the material shall pass test categories (D), (E) and (F) in Table 2B.</li> <li>• If masonry cover is at least 25mm thick all around the embedded plastic, tests in Table 2B are exempted.</li> <li>• The locations where embedded plastics are installed shall be clearly indicated on the plans submitted to SCDF.</li> </ul>

Table 2H: Fire safety requirements for plastic material embedded in masonry wall/ceiling

*Plastic roof covering*

S/N	Material construction	Assessment	Exemption / Remarks
1	Non-combustible material.	Allowed	No further fire test required.
2	Material thickness not exceeding 1mm	Allowed	No further fire test required.
3	Use in exit staircase / exit passageways	Not allowed	To protect key escape routes.
4	Material thickness exceeding 1mm	Allowed with conditions	<ul style="list-style-type: none"><li>• Allowed if pass test category (J) in Table 2C, as well as test category (H) in Table 2C if exposed on underside.</li><li>• Exempted from test categories (H) and (J) if the requirements specified for skylights in Clause 3.13.5(b) of the Fire Code are complied with.</li></ul>

Table 2I: Fire safety requirements for plastic roof covering