

**Reasoned document for the comments received on “Vinyl Film for Exterior and Interior application in Indian Railways AC/Non-AC coaches”**

**Draft Specification No RDSO/2006/CG-13 Rev.02**

In view of Railway Board letter no. 98/M/(C)/137/8 Vol. (I) dated 13.02.2019 & 11.04.2019 and item no B-24 of MoM of CDE’s meeting held at MCF/RBL a draft specification no. RDSO/2006/CG-13 Rev.02 for “Vinyl Film for Exterior and Interior application in Indian Railways AC/Non-AC coaches” was been uploaded for 1 month for comments. Following 12 firms along with Railways & PUs were requested to offer comments on draft specification no. RDSO/2006/CG-13 Rev.02 vide letter no. MC/MK/3 dated 18.09.2019 and 17.09.2019 respectively.

1. M/s 3M India Limited, 48-51, Electronics City, Hospur Road, Bangalore-560100
2. M/s Avery Dennison India Pvt. Ltd., Narsinghpur Industrial Area, Six Kilometre Stone, Delhi Jaipur Highway, Gurgaon- 122001
3. M/s Premier Polyfilm Ltd, 40/1A, Site-IV, Industrial Area, Sahibabad, Ghaziabad-201 010.
4. M/s Responsive Industries Ltd., Betagaon, Mahagaon Road, Near Gaushala, Boiser (East), Thane-401 501.
5. M/s RMG Polyvinyl India Ltd. 10/1, Industrial Area, Sikandrabad, Distt. Bulandshahar-203 205.
6. M/s LG Hausys India Pvt. Ltd., Delta Tower, 6th Floor, Plot No.-54, Sector-44, Gurgaon-122 002.
7. M/s Selvel Media Services, 710, Meghdoot, 94, Nehru Place, Nehru Place, Delhi-110019.
8. M/s Goto customer Service, C - 40, Okhla Industrial Area, Phase - II, Delhi-110000
9. M/s Pioneer Publicity Corporation pvt. Ltd., Pioneer House 2 C/6, New Rohtak Road, Karol Bagh, Delhi – 110005.
10. M/s J. C. Decaux pvt. Ltd, No.231, Phase 3, Okhla Industrial Area Phase 3, Delhi – 110020.
11. M/s Ajay Industries, HO: 78/46, 1st Floor, Capital Chambers, Latouche Road, Kanpur.
12. M/s Meghdoot Media & Marketing, New Delhi.

In view of the same, 05 firms i.e. M/s 3M India Limited, M /s Avery Dennison India Pvt. Ltd., M/s LG Hausys India Pvt. Ltd., M/s Ajay Industries & M/s Meghdoot Media & Marketing have given their comments/suggestions on draft specification no RDSO/2006/CG-13 Rev.02. A meeting of firms was called for discussion on the draft specification no. RDSO/2006/CG-13 Rev.02 on 07.11.2019 and to discuss on the individual comments of the firms. The representatives of following manufacturer/suppliers/partners attended meeting and discussion was done on clause by clause of Part-I and Part-II of the draft specification with representatives of M&C Dte/RDSO and Carriage Dte/RDSO.

1. M/s 3M India Limited
2. M/s Avery Dennison India Pvt. Ltd
3. M/s LG Hausys India Pvt. Ltd.
4. M/s Meghdoot Media & Marketing
5. M/s Ajay Industries
6. M/s D. N. Marketing
7. M/s Techno Experts
8. M/s DuPont
9. M/s Emprise

In view of the comments received from firms namely M/s 3M India Limited, M /s Avery Dennison India Pvt. Ltd., M/s LG Hausys India Pvt. Ltd., & M/s Meghdoot Media & Marketing who have given their comments on clause by clause on draft spec RDSO/2006/CG-13 Rev.02 have been tabulated in form of reasoned documents. The comments of M/s Ajay Industries are general information regarding use of Non-PVC material:

Cl. No.	Content	1. M/s 3M India Limited, Bangalore	2. M/s Avery Dennison India Pvt. Ltd., Gurgaon	3. M/s LG Hausys India Pvt. Ltd., Gurgaon	4. M/s Meghdoot Media & Marketing	RDSO Remarks
<b>0.0</b>	<b>Forwards:</b>					
0.1	This specification has been prepared in two parts. Part-I covers the requirements of existing RDSO specification for “Vinyl Films for Advertising on Exterior of Indian Railway Coaches” with Option-A and Option-B. Part-II has been included to cover the requirements of “Self Adhesive, Decorative Vinyl Film for Interior Application in AC/Non-AC Coaches of Indian Railways” with Option-A and Option-B.	No comments received	Part-I Covers the requirements of existing RDSO specification for “Self Adhesive Films for Advertising on Exterior of Indian Railway Coaches” with Option-A and Option-B.	<b>General opinion:</b> (1) All technical parameters are very well covered by RDSO.  (2) We request RDSO to include only material suppliers who has direct presence in India through its office and Employee support. This ensures in case of any failure, Railway can reach out to local suppliers’ office for any warranty claim or technical support. While all responsibilities of quality execution and warranty have been given to film suppliers, in	No comments received	The issue was discussed in meeting with firms, all the firms were in view that the material of the film should be “Non PVC, Self adhesive Eco-friendly and Disposable”. In view of the same the clause may be modified as:  This specification has been prepared in two parts. Part-I cover the requirements of existing RDSO specification for “Eco-friendly and Disposable” films for Advertising on Exterior of Indian Railway Coaches” with Option-A and Option-B.

				case of failure, Indian Railway cannot reach out to suppliers who have no presence in India. Railway has to fight for any big warranty claim/failure in International Court.		Part-II has been included to cover the requirements of "Eco-friendly and Disposable" films for Interior Application in AC/Non-AC Coaches of Indian Railways" with Option-A and Option-B.
<b>Part-I</b>						
1.0	<b>SCOPE</b> Vinyl films are being used for advertisements on vehicle bodies. This specification covers the technical requirements of vinyl films to be used for advertising on the exterior of Indian Railway passenger coaches without causing any damage to the painted surface. The IR coaches are painted with either alkyd or PU top coat systems. The advertisers should procure and use the films to this specification for application on IR coaches. The film as per option - A should be used for short term application upto six months and the film as per option - B for long term application above six months and upto one year.	No comments received	No change	No comments received	<b>PVC Free Recyclable &amp; Eco Friendly</b> Vinyl films are being used for advertisements on vehicle bodies. This specification covers the technical requirements of vinyl films to be used for advertising on the exterior of Indian Railway passenger coaches without causing any damage to the painted surface. The IR coaches are painted with either alkyd or PU top coat systems. The <b>advertisers / supplier / contractor</b> should procure and use the films to this specification for application on IR coaches. The film as per option - A should be used for short term application upto six months and the film as per option - B for long term application above six months and upto one year	The issue was discussed in meeting with firms, all the firms were in view that the material of the film should be "Non PVC, Self adhesive Eco-friendly and Disposable". In view of the same the clause may be modified as: This specification covers the technical requirements of Non PVC, Self adhesive Eco-friendly and Disposable films here after referred as "film" to be used for advertising on the exterior of Indian Railway passenger coaches without causing any damage to the painted surface. The IR coaches are painted with either alkyd or PU top coat systems. The advertisers should procure and use the films to this specification for application on IR coaches. The film as per option - A should be used for short term application upto six months and the film as per option - B for long term application above six months and upto one year.
2.0	<b>AREA OF APPLICATION ON COACHES</b> Area of application on coaches shall be the complete side panel excluding the doors & windows, barring areas carrying mandatory markings of coach. The IR logo in these coaches shall be applied in the center of the coach above the windows.	No comments received	No change		Agreed and Comply	2 <sup>nd</sup> para added due to cover complete application system: Area of application on coaches shall be the complete side panel excluding the doors & windows, barring areas carrying mandatory markings of coach. The IR logo in these coaches shall be applied in the center of the coach above the windows. The manufacture/supplier of film shall provide the procedures dealing with the application method, position of joints and method of sealing of joints and edges, procedure for patch repair, removal with Do's

						& Don'ts and mode of disposal of such films to IR/consignee.
<b>3.0 GENERAL REQUIREMENTS</b>						
3.1	The advertiser should submit the following documents along with the tender for their offers to be technically evaluated: - Printed/published technical data/Material safety data sheet/brochure of the product in original (Base film/Inks/Edge Sealers) proposed to be used along with attested test certificate from a government-accredited laboratory for the tests mentioned in this specification. The tests may have been got done by the OEM from a Govt. accredited laboratory.	Adhesive should be removable without leaving any residue on the rail painted surface. Material to be RoHS compliant. Graphics should be having good adhesion strength of the exterior rail surface. Face graphics should be reliable to easy to clean. Finished graphics should be compliant to EN 45455 standards.	The advertiser should submit following documents along with the Tender for their offers to be technically evaluated: • Printed Published Technical data, Material Safety Data Sheet & Brochure of the Base Film & Over-laminate Proposed to be used. • Attested Test Certificate's from a Government-Accredited laboratory for the tests mentioned in this specification. The tests may have been got done by the OEM from a Govt. accredited laboratory. • The Advertiser Should also Submit the Tender Specific Authorization Letter issued by the OEM • ROHS & REACH Compliance Certificate for the Base Film & Overlaminated • The OEM should be India Registered, should have Self Adhesive Vinyl Manufacturing Presence in India along with PAN India Network and Operations in India for more than 12+ yrs. A documentary proof for all should be provided.		Agreed and Comply	Point no. 1 & 2 of M/s Avey Dennison is already covered in cl. 3.2 of part-I. point no. 3 may be the part of tender doc. Point no. 4 regarding RoHS and REACH complaints certificate for the base film and over laminate, following may be added in cl. 3.2 of part-I. "The film, pigment and ink used for printing should not be hazardous to health and environment and should be compliant to National/International health and environmental norms (like REACH & RoHS or equivalent). A documentary proof regarding the compliance of the same should be provided. The material of film shall also be confirming to the National/International standards and should also confirm the statutory norms of Government of India. A documentary proof for the same shall be provided. Point no. 5 may be the part of eligibility criteria and it cannot be part of specification.
3.2	The advertiser should submit the following documentation along with sample before starting supply and application to the concerned rolling stock engineer:  -	No comments received	No comments received	No comments received	No comments received	-----
	Warranty card from manufacturer of graphic film in original quoting the tender	No comments received	Same (No change)	No comments received	Agreed and Comply	As discussed during meeting the new clause added as: -The film, pigment and ink used for printing should not be hazardous to health and environment and should be compliant to National/International health and environmental norms (like REACH & RoHS or equivalent). A documentary proof regarding the compliance of the same should be provided. The material of film shall also be confirming to the National/International standards and should also confirm the statutory norms of Government of India". A documentary proof for the same shall be provided.

	number for which the PO (Purchase Order) has been received by advertiser, specifying all tests for durability and weathering and environmental exposure for the films used with photograph of applied graphic.					view that the "E-warranty" added in the clause: E-warranty from manufacturer of graphic film in original quoting the tender number for which the PO (Purchase Order) has been received by advertiser, specifying all tests for durability and weathering and environmental exposure for the films used with photograph of applied graphic.
	Work test certificate in original from the manufacturer of the film.	No comments received	Work Test Certificate (WTC) in original from the Manufacturer of the Base & Over-laminate film.	No comments received	CIPET certificate provided.	Already covered
	Manufacturer of base film and finished product (giving the manufacturing plant details).	No comments received	Same (No change)	No comments received	Universal products no. 53/5, 4th cross, SSI Area, Rajajinagar, Bangalore-560010	-----
	Film material including production certificate of conformance.	No comments received	MSDS (Material Safety Data Sheet) for the Base film, Over-laminate Film.	No comments received	Polyethylene (PE)	Comment of M/s Avery Dennison is not acceptable as it is on the part of manufacturer.
	Film color/pigmentation and/or print color.	No comments received	ROHS & REACH Compliance Certificate for the Base Film & Over-laminate	No comments received	Base film white colour	RDSO comment as cl. 3.1 above.
	Adhesive designation & group.	No comments received	Same (No change)	No comments received	Water based	---
	Sealing material and sealing method.	No comments received	Same (No change)	No comments received	No comments received	----
	Thickness (adhesive, film, print, sealing) with production tolerances	No comments received	Same (No change)	No comments received	Film- 125 micron, Adhesive-20 micron, Release PE- 135micron	Discussed in meeting with firms and M&C Dte representative and it was decided that there is no need to change in existing clause.
	Characteristic values as specified in this specification.	No comments received	Same (No change)	No comments received	No comments received	----
	The keeping of the specific values determined in the specification must be proved by presenting the test certificate from a government accredited laboratory.	No comments received	Same (No change)	No comments received	CIPET certified and will be proved by authentic lab as per instructions of Railway user.	-----
	The film removal procedure.	No comments received	Same (No change)	No comments received	The existing film will be removed as past norms & standard. Removed film will be sent to specific place as per instructions of Railway user.	As discussed during meeting with firms, all the firms were in view that the "disposal" added in the clause: The film removal and disposal procedure.
	An undertaking to follow all safety precautions at the worksite.	No comments received	No comments received	No comments received	Agreed to Comp	---
3.3	--					New clause for sampling criteria for easy in inspection: TESTS: - The test shall be conducted as prescribed in relevant specification mentioned against each test. - Test pieces shall be cut from the samples in the required

						<p>number and in the appropriate manner as specified in the individual methods of test.</p> <ul style="list-style-type: none"> <li>- In any consignment, all the rolls of film offered against one dispatch note and of same design/composition shall constitute one lot.</li> <li>- Conformity of the lot to the requirements of the specification shall be ascertained for each lot separately. The number of samples to be drawn will be as follows:</li> </ul> <p style="text-align: center;">Table-1</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Lot size (Rolls)</th> <th>No. of rolls to be selected</th> </tr> </thead> <tbody> <tr> <td>1 to 10</td> <td>1</td> </tr> <tr> <td>11 to 50</td> <td>2</td> </tr> <tr> <td>51 to 100</td> <td>3</td> </tr> <tr> <td>101 to 200</td> <td>4</td> </tr> </tbody> </table> <p>All the tests given in Table-1 shall be carried out on each lot except Durability and Weathering Resistance test. The test for Durability and weathering resistance test shall be done once in a year or on successful supply of 50 rolls of film whichever is earlier.</p>	Lot size (Rolls)	No. of rolls to be selected	1 to 10	1	11 to 50	2	51 to 100	3	101 to 200	4
Lot size (Rolls)	No. of rolls to be selected															
1 to 10	1															
11 to 50	2															
51 to 100	3															
101 to 200	4															

4.0 OPERATING CONDITIONS FOR GRAPHICS						
4.1	<b>Ambient conditions:</b> The graphics shall perform satisfactorily under the following climatic conditions:	No comments received	No change	No comments received	No comments received	---
	Ambient temperature - 4°C to 50°C Altitude Sea level to 2500m Max. Sun temperature 70°C Relative humidity 40% to 100%	No comments received	No comments received	No comments received	Support Upto 70° C Support Upto 70° C, after 70° C shrinkage may happen	The issue of Ambient temperature was discussed in meeting with firms, and it was decided that Ambient temperature should be as existing.
	The rainfall is fairly heavy.	No comments received	No comments received	No comments received	No comments received	---
	During dry weather, the atmosphere is likely to be dusty.	No comments received	No comments received	No comments received	No comments received	---
	Temperature variations can be quite high in the same journey or short period of time.	No comments received	No comments received	No comments received	No comments received	---
	Coaches operate in coastal areas with continued exposure to salt laden air.	No comments received	No comments received	No comments received	No comments received	---
4.2	<b>Maintenance conditions:</b>	No comments received	No comments received	No comments received	No comments received	pH value not mentioned in

	The coach exteriors are cleaned with mildly acidic cleaning agents and using brushes with non-metallic bristles or automatic car washing plants.					earlier but it should be mentioned. The clause may be modified as: The coach exteriors are cleaned with mildly acidic cleaning agents (pH value 2.5 to 5.0) and using brushes with non-metallic bristles or automatic car washing plants
<b>5.0</b>	<b>TECHNICAL REQUIREMENTS OF POLYMERIC CALENDARED GRAPHIC FILM – OPTION-A</b>					
	The graphic film will consist of three layers namely the base film (PVC), adhesive layer and release liner. The completed film should be over laminated and edge sealed.	No comments received	The graphic film will consist of three layers namely the Base film, Adhesive layer, Release liner. The completed film should be over laminated and edge sealed. (PVC deleted)	No comments received	Film Consist of three layers namely the base film Polyethylene (PE), adhesive layer and release PE liner.	Discussed in meeting with firms and M&C Dte representative and it was decided that the clause should be modified as: The graphic film shall be Non PVC, Self-adhesive Eco-friendly and Disposable. It will consist of three layers namely the base film, adhesive layer and release liner. The completed film should be over laminated and edge sealed..
<b>5.1 BASE FILM REQUIREMENTS</b>						
5.1.1	Base Film will be polymeric calendared PVC film having thickness not more than 100 microns. Plasticizers and other additives materials must not emerge or exude.	No comments received	Base Film will be Non-PVC from Polyolefin Category of Material having thickness not more than 80 microns. Any additives materials must not emerge or exude.	No comments received	Base Film will be Polymeric calendared PE film having thickness of 125 microns.	The issue of thickness of film was discussed in meeting with firms and M&C Dte representative, all the firms were in view that the film thickness should not be more than 80 microns in place of 100 microns specified in the spec. In view of the same the clause may be modified as: Base Film will be Non-PVC, self adhesive eco-friendly and disposable having thickness not more than 80 microns. The film should be free from halogen, chlorine or any plasticiser which has been banned by National/International environment and health agency like MoEF, ROHS, REACH etc.
5.1.2	The film shall be white in color. The unprocessed base film shall have a gloss value of more than 70 when measured with 60 degree gloss meter.	No comments received	The film shall be Opaque white in color. The Opacity of Base Film will Provide Excellent Hiding Power, so that the Colour of Coach Does not affect the printed Graphic Colours and they Appear Vibrant. The unprocessed base film shall have a gloss value of more than 70 when measured with 60 degree gloss meter.	No comments received	Agreed and able to do same	Discussed in meeting with firms and M&C Dte representative and it was decided that there is no need to change in existing clause. As per M&C Dte comments vide note no. M&C PCN/I/64/1 Vol-III dt. 14.11.2019 the clause may be modified as: The film shall be white in colour. The unprocessed base film shall have a gloss value of more than 70 when measured with 60° angle of incidence by gloss meter.

5.1.3	<b>Thickness:</b> The nominal thickness of the unprinted film including adhesive shall be between 0.080mm to 0.130mm. The test procedure for measuring thickness is ASTM D3652.	No comments received	Thickness: The nominal thickness of the unprinted film including adhesive shall be between 80 to 110 microns. The test procedure for measuring thickness is ASTM D3652. Separate clause - The Base Film Should be 100% Chlorine & Phthalate Free & Must Comply to RoHS & REACH. - The Base Film should have a Clearly Defined MSDS	No comments received	The nominal thickness of the unprinted film including adhesive without release liner shall be between 0.14mm to 0.160mm. The test procedure for measuring thickness is ASTM D3652.	The issue of nominal thickness of unprinted film was discussed in meeting with firms, and it was decided that there will be no need to change in existing thickness of unprinted film. Retain with existing clause.
<b>5.2 REQUIREMENTS FOR ADHESIVIES</b>						
5.2.1	The adhesive shall stick, without the use of an activator such as solvents or heat, on any metallic and non-metallic, polished and clean surfaces, free from any grease or silicone without producing wrinkles, rolling up, tearing or detaching.	No comments received	Same (No change)	No comments received	OK	-----
5.2.2	The adhesive should be of gray color acrylate base. The gray color adhesive will provide good hiding power so that color of the coach does not affect the printed graphic colors and they appear vibrant.	No comments received	The adhesive should be of Solvent Free, Acrylic Emulsion Base.	No comments received	The adhesive should be of Natural white color water base. The white color adhesive will provide good hiding power so that color of the coach does not affect the printed graphic colors and they appear vibrant.	Discussed in meeting with firms and M&C Dte representatives, in view of comments at 0.1 above the existing clause may be modified as: The adhesive should be of gray colour acrylate base. The gray colour removable adhesive shall provide good hiding power so that colour of the coach does not affect the printed graphic colours and they appear vibrant.
5.2.3	The graphics film should have inbuilt air channels in the adhesive layer to ensure release of air bubbles during application which will result in fast application and the same should be clearly marked on the backing liner.	No comments received	No comment	No comments received	Agreed and able to do the same.	-----
<b>5.3 REQUIREMENTS FOR RELEASE LINER</b>						
5.3.1	The release liner protects the adhesive against dirt contamination and prevents the film from unintended agglutination.	No comments received	Same (No change)	No comments received	Agreed and comply the same.	-----
5.3.2	The release liner will be paper, coated with polyethylene on both sides to have resistance to moisture and solvent during printing and application.	No comments received	The release liner will be Clay Coated Kraft Liner with or without any Polyethylene Coat. It should have Good resistance to the moisture and Inks during printing and application Process.	No comments received	The release liner will be Polyethylene to keep recyclable value of the products and to have resistance to moisture and solvent during printing and application	Discussed in meeting with firms and M&C Dte representatives, in view of comments at 0.1 above the existing clause may be modified as: The release liner will be paper, coated with disposable polyethylene to have resistance to moisture and solvent during printing and application.
5.3.3	In addition, the adhesive power of the release liner shall not be so strong that the adhesive detaches on removal of the release liner.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
5.4	<b>REQUIREMENTS FOR PRINTING OF BASE FILMS TO CONVERT INTO GRAPHICS</b> Films shall be printed with digital printing	No comments received	Films shall be printed with Inkjet Digital Printing Technology, Using Eco Friendly Inks.	No comments received	Film shall be printed on Solvent, Eco Solvent, UV technology digital printing.	Comments of M/s Avery Dennison & M/s Meghdoot are not accepted as digital printing technology is a generic word for

	technology.					all types of digital printing. The requirement of ink has been already deliberated in RDSO comments in clause 3.0 (General requirement) of Part-I.
<b>5.5 REQUIREMENTS OF EDGE SEALING OF PRINTED GRAPHICS</b>						
5.5.1	Edge sealing is required on the edges of the vinyl to give protection against peeling off of the graphics film and preventing damages of the graphics film against vandalism.	No comments received	Same (No change)	No comments received	Agreed and comply the same No comments received	Vinyl will be replaced by "film"
5.5.2	The edge sealing material shall be clear acrylic/alkyd/PU resin applied on all the overlap joints of the film and the end edges of the film with at least 4mm footprint covering 2mm on both the exposed edges.	No comments received	No change in existing clause. Separate clause MSDS of the Edge Sealant shall be provided	No comments received	Agreed and comply the same No comments received	Comments of M/s Avery Dennison not accepted. Discussed in meeting with firms and M&C Dte representative and it was decided that the clause should be added in this clause: The edge sealing material shall be clear acrylic/alkyd/PU resin applied on all the overlap joints of the film and the end edges of the film with at least 10mm footprint covering 5mm on both the exposed edges.
5.5.3	-	-	-	-	-	Discussed in meeting with firms and M&C Dte representative and it was decided that the additional clause should be as: The edge sealer should become water resistant within four hours of application.
<b>5.6 REQUIREMENTS OF OVER LAMINATE</b>						
5.6.1	The surface of the graphic films shall be over laminated in an appropriate way in order to guarantee the resistance against operating stress and weather, acids, alkalis, salt solutions, scratch and tear from foreign objects.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
5.6.2	The graphics film should have an over laminate supplied by the same manufacturer of the graphics film. The over laminate should be a PVC film attractive glass finish and should be UV stabilized, which is to be tested to ASTM G152 for protection against deterioration and fading.	No comments received	The graphics film should have an over laminate supplied by the same manufacturer of the graphics film. The over laminate should be a Non-PVC from Polyolefin family film attractive gloss finish and should be UV stabilized, which is to be tested to ASTM G152 for protection against deterioration and fading.	No comments received	Agreed and comply the same	PVC Film will be replaced by "Non PVC, self adhesive eco-friendly and disposable film" and test details provided and clause modified as:  The graphics film should have an over laminate supplied by the same manufacturer of the graphics film. The over laminate should be a Non PVC, Self adhesive Eco-friendly and Disposable film attractive gloss finish and should be UV stabilized, which is to be tested to ASTM G152 using xenon arc/QUV panel machines at 0.63 nanometer UV A lamps with 4 hour condensation and 4



						hour UV exposure for min at 250 hrs. Post cycle specular gloss value, delta E colour change; visual discolouration has to be reported. The colour change should not be more than delta E=3, measured by approved photo spectro densitometer (The instrument measures colour value) for protection against deterioration and fading.
5.6.3	Over laminate should be applied on the printed graphics as per recommendation by the manufacturer of the graphics film after the printing has been done on the graphics film.	No comments received	No change in existing clause. Separate clause: - The over Laminate should have an Anti-graffiti Feature, Abrasion Resistance & should comply with the Anti-Graffiti test ASTM D6578. All marking agents should be removed with an average rating of not less than 8. - The Over laminate Film Thickness shall not be More than 36 Microns (As per ASTM-D3652). - The Nominal Thickness of Over Laminate Film shall not be More than 70 Microns (ASTM-D3652)	No comments received	Agreed and comply the same	The suggestion of M/s Avery Dennison has been already covered in clause 1.4 of option-B of Part-II. Clause may be modified as: The finished graphic prior to application should be able to pass the anti-graffiti test when tested as per ASTM D6578 where all the marking agents should be removed with an average rating of not less than 8.
<b>6.0 CHARACTERISTICS OF FINISHED GRAPHICS PRIOR TO APPLICATION:</b>						
Discussed in meeting with firms and M&C Dte representative and it was decided that the following details may be added in this clause: The finished graphic film prior to application should be able to pass the anti-graffiti test when tested as per ASTM D6578 where all the marking agents should be removed with an average rating of not less than 8						
6.1	<b>Thickness:</b> The film thickness shall be not more than 0.180mm +/- 15%, with sealing and print color. The test procedure for measuring thickness is ASTM D3652	No comments received	The film thickness shall be not more than 0.160mm +/- 15%, with sealing and print color. The test procedure for measuring thickness is ASTM D3652.	No comments received	The film thickness shall be not more than 0.160mm +/- 15%, with sealing and print color. The test procedure for measuring thickness is ASTM D3652.	Discussed in meeting with firms and M&C Dte representative and it was decided that there is no need to change in existing clause.
6.2	<b>Adhesive Power:</b> The films shall stick on any metallic and non-metallic surface, free from grease and silicone, without producing wrinkle, roiling up, detaching or tearing. The adhesive power of at least 9N on standard steel panel.	No comments received	The films shall stick on any metallic and non-metallic surface, free from grease and silicone, without producing wrinkle, roiling up, detaching or tearing. The ultimate adhesive power shall be of at least 9N/25mm on standard steel panel	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representative and all were in view that adhesion power of at least 9N is low. M&C Dte and Firms were in view that adhesion power should be at least 15N this force will not affect on paint during removal of film from the coach surface. In view of the above the clause may be modified as: The films shall stick on any metallic and non-metallic surface, free from grease and silicone, without producing wrinkle, roiling up, detaching or tearing. The adhesive power of at least 15N/25mm on standard steel panel. When tested as per ASTM D-4541.
6.3	<b>Flammability:</b> The graphic film should fall under min.	Finished graphics should be compliant to EN 45455	Same (No change)	No comments received	The Graphic Film should not burn upto 90°C	Discussed in meeting with firms and it was brought out that

	class-B when tested as per UIC-564-2 OR Appendix-12.	standards.			temperature. It should not catch the Fire	when going for Non-PVC material the test procedure will be as UIC-564-2 OR Appendix-4 in place of Appendix-12. In view of above and comments of M&C Dte vide note no M&C/PCN/1/64/1 Vol-III dated 14.11.2019, the clause may be modified as: The graphic film should fall under min. Class-A when tested as per UIC-564-2 OR Appendix-4 (for Non-thermoplastic material) or Film should meet EN45545-2, HL-3.
6.4	<b>Temperature Resistance:</b> The film shall be resistant to temperatures between -10°C and +70°C without any visible changes such as detachment cracks, bubble formation and color changes. This property is to be tested as per clause 9.3.	No comments received	Same (No change)	No comments received	Agreed and comply the same	----
6.5	<b>Resistance to Detergents:</b> The graphic films shall be resistant to detergents used by the IR for exterior cleaning of the coaches. The surface of the sealed film shall not soften and the color and the adhesive power shall not change. The same applies to surface softening and to all kind of detachments (waves, bubbles etc.). This should be tested as per clause 9.4.	No comments received	Same (No change)	No comments received	Agreed and comply the same for laminated printed graphics	Comments of M/s Meghdoot not accepted. The clause retain as existing.
<b>6.6 Marking of the Product:</b>						
6.6.1	For identification the box of the accepted finished products shall be clearly printed/marked with capital letters having height of more than 50mm	No comments received	Same (No change)	No comments received	Agreed and comply the same	----
6.6.2	The marking should consist of the date of manufacture (month and year for example 12/04) of the finished product as well as manufacturer of the base material.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
<b>7.0 APPLICATION OF GRAPHICS</b>						
7.1	Applications of Graphics have to be done using recommended application tools as mentioned by the manufacturer of the graphic film. The applicator has to show experience/training certificate of doing similar application on any moving vehicle by the manufacturer of the graphic film.	No comments received	Same (No change)	No comments received	Agreed and comply the same	----
7.2	Application of the graphic film has to be done on the surface without using any soap solution and water. (Dry application to make faster application and protect the paint of the coach).	No comments received	No comment	No comments received	Agreed and comply the same	-----
7.3	The application tool should be a nylon molded squeeze with low friction sleeve, which will prevent scratches on the graphics, and a nylon rivet brush with	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----

	wooden handle to apply graphics on the rivets.					
<b>8.0 REMOVAL OF FILMS</b>						
8.1	The time taken for removal of previous graphic & application of new graphic films should not be more than three hours per coach.	No comments received	Same (No change)	No comments received	Agreed and comply the same	----
8.2	The removal of the applied film should not be tedious. The removal should be done using a hot air blower but the temperature should not exceed 70°C. In case any film or adhesive residue is observed after removal the residue should be possible to remove by use of ISO propyl alcohol and lint free cloth.	No comments received	The removal of the applied film should not be tedious. The removal should be done using a hot air blower but the temperature should not exceed 70°C. In case any film or adhesive residue is observed after removal the residue should be possible to remove by use of Water/ISO propyl alcohol and lint free cloth.	No comments received	Agreed and comply the same	M/s Avery Dennison & M/s Meghdoot comments are not accepted. During meeting all firms were agreed with existing clause. In existing clause, residue will be replaced by "film"
8.3	The removal in no way should damage the painted surface of the coach. The advertiser shall be liable for damages evident after removal of the film. The coach should be returned in the same condition as it was handed over initially.	No comments received	Same (No change)	No comments received	Agreed and comply the same	----
8.4	The advertiser shall be responsible for removal of the film at the time of termination of contract. The security deposit may accordingly be retained till the time of termination of contract	No comments received	Same (No change)	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representative and all were in view that the clause may be modified as: The advertiser shall be responsible for removal and disposal of the film at the time of termination of contract. The security deposit may accordingly be retained till the time of termination of contract
<b>9.0</b>	<b>TESTING THE VINYL GRAPHIC FILM</b>	No comments received	<b>TESTING THE NON-PVC GRAPHIC FILM</b>	No comments received		<b>Clause may be modified as: TESTING OF THE GRAPHIC FILM</b>
9.1	<b>Adhesive power:</b> The adhesive power shall be tested as per ASTM D3330, procedure A for 180° peel strength on a standard test panel of Stainless Steel, conditioned as per ASTM D4332 at a peel off velocity of 360mm/minute.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
9.2	<b>Controlled release Adhesion:</b> This shall be tested visually for presence of air channels on the adhesive side of the base film after the removal of release liner.	No comments received	No comments	No comments received	Agreed and comply the same	-----
9.3	<b>Temperature resistance:</b> Two test specimens 25mm x 200mm are stuck onto test plates of stainless steel, polished to a completely plane surface and are subsequently stored at standard reference atmosphere. The specimens are subjected to temperature changes for seven cycles, each cycle comprising of 8 hours of -10°C and 16 hours of 90°C	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----

9.4	<p><b>Resistance against detergents:</b> The test is to be carried out with two, test solutions. Duration of test: 24 hrs.</p> <table border="1"> <thead> <tr> <th>'A' Solution:</th> <th>'B' Solution:</th> </tr> </thead> <tbody> <tr> <td>40% phosphoric acid 15% emulsifying agent 45% water (distilled)</td> <td>10% Fatty alcohol polyethylene Glycol ether - 10% Sodium cumene sulphonate (40% solution) - 5% NTA liquid (40% solution) Triton A, BASF - 5% Triethanolamine - 20% Totally demineralized water - 60%</td> </tr> </tbody> </table> <p>Emulsifying agent: Oleyl-stearyl alcohol mix (with Iodine value 50) with 10-mol ethylene oxide. Max application concentration for test solution A and B 1:4 respectively.</p>	'A' Solution:	'B' Solution:	40% phosphoric acid 15% emulsifying agent 45% water (distilled)	10% Fatty alcohol polyethylene Glycol ether - 10% Sodium cumene sulphonate (40% solution) - 5% NTA liquid (40% solution) Triton A, BASF - 5% Triethanolamine - 20% Totally demineralized water - 60%	No comments received	Comments on solution only	No comments received	Agreed and comply the same	-----
'A' Solution:	'B' Solution:									
40% phosphoric acid 15% emulsifying agent 45% water (distilled)	10% Fatty alcohol polyethylene Glycol ether - 10% Sodium cumene sulphonate (40% solution) - 5% NTA liquid (40% solution) Triton A, BASF - 5% Triethanolamine - 20% Totally demineralized water - 60%									
<b>10.0 Packing:</b>										
	Cut films are to be dispatched, bundled up and securely packed in cardboard. Other graphics are to be rolled up on a cardboard roll/tube with the film side on the outside and shall be dispatched under safe transit.	No comments received	Same (No change)	No comments received	Agreed and comply the same	Clause may be modified as: Cut films are to be dispatched, bundled up and securely packed in cardboard. Other graphics are to be rolled up on a cardboard roll/tube with the film side on the outside and shall be dispatched under safe transit. Supplier shall take all precautions to avoid any damage to films during the transit.				
<b>11.0 Guarantee and replacement:</b>										
11.1	The time period of guarantee should be six months for stuck films.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----				
11.2	The supplier shall replace all the graphics rejected on final acceptance due to their non-compliance with the requirements and those product that show deficiencies during the time period of guarantee by products complying with the requirements within a period of six weeks.	No comments received	Same (No change)	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representative and it was decided that the clause should be added in this clause: Period of six weeks replaced with "four weeks.				
11.3	The warranty for the printing inks should be available with the manufacturer /printer of the graphic film from the ink supplier.	E-warranty should be given by the original film manufacturer for each coach.	Same (No change)	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representatives, in view of comments at 0.1 above the existing clause may be modified as: The warranty for the printing inks should be available with the manufacturer /printer of the graphic film from the ink supplier. The firm shall provide E-warranty of the film from the OEM.				
<b>12.0 TECHNICAL REQUIREMENTS OF CAST VINYL GRAPHICS FILM - OPTION B</b>										

	The graphic film will consist of three layers namely the base film (PVC), adhesive layer and release liner. The completed film should be over laminated and edge sealed.	No comments received	The graphic film will consist of three layers namely the Base film, Adhesive layer, Release liner. The completed film should be over laminated and edge sealed. PVC deleted.	No comments received	The graphic film will consist three layers namely the base film ( <b>PE</b> ), Adhesive layer and release PE liner. The completed film should be over laminated and edge sealed.	M/s Avery Dennison & M/s Meghdoot comments are accepted and the clause may be modified as: "The graphic film will consist of three layers namely the base film, adhesive layer and release liner. The completed film should be over laminated and edge sealed".
<b>12.1 BASE FILM REQUIREMENTS</b>						
12.1.1	Base Film will be cast PVC film having thickness not more than 50 microns. Plasticizers and other additives materials must not emerge or exude. The films shall not include any materials having harmful effect on painted surfaces, human beings and environment.	No comments received	Base Film will be Non-PVC from Polyolefin Category of Material having thickness not more than 100 microns. Any additives materials must not emerge or exude.	No comments received	Base Film will be cast PE film having thickness not more than 150 microns. Plasticizers and other additives materials must not emerge or exude. The films shall not include any materials having harmful effect on painted surfaces, human beings and environment.	The issue of material & thickness of base film was discussed in meeting, except M/s Ajay Industries all were in view that the base film thickness of 50microns should be reviewed and kept as 80microns. Whereas M/s Ajay Industries has told to keep it up to 150microns. Based on the views of majority of firms and as discussed on earlier clause 5.1.1, the clause may be modified as: Base film will be Non-PVC, Self adhesive, Eco-friendly and disposable film having thickness not more than 80 microns. The film should be free from halogen, chlorine or any plasticiser which has been banned by National/International environment and health agency like MoEF, ROHS, REACH etc. The films shall not include any materials having harmful effect on painted surfaces, human beings and environment.
12.1.2	The film shall be white in color with whiteness index of 100 to 90 as per test method ASTM E313.	No comments received	The film shall be Opaque white in color. The Opacity of Base Film will Provide Excellent Hiding Power, so that the Colour of Coach Does not affect the printed Graphic Colours and they Appear Vibrant. The unprocessed base film shall have a gloss value of more than 70 when measured with 60° gloss meter.	No comments received	Same (no change)	M/s Avery Dennison comment is not accepted. During meeting all firms were agreed with existing clause. Retain as existing clause
12.1.3	<b>Thickness:</b> The nominal thickness of the unprinted film including adhesive shall be between 0.080mm to 0.130mm. The test procedure for measuring thickness is ASTM D3652.	No comments received	<ul style="list-style-type: none"> <li><b>Thickness:</b> The nominal thickness of the unprinted film including adhesive shall be between 100 to 130 microns. The test procedure for measuring thickness is ASTM D3652.</li> </ul> <b>Additional clause:</b> <ul style="list-style-type: none"> <li>The Base Film should be 100% Chlorine &amp; Phthalate Free &amp; Must</li> </ul>	No comments received	Thickness: The nominal thickness of the unprinted film including adhesive shall be between 0.140mm to 0.170mm. The test procedure for measuring thickness is ASTM D3652.	M/s Avery Dennison & M/s Meghdoot comments are not accepted. During meeting all firms were agreed with existing clause. Retain as existing clause.

			Comply to RoHS & REACH. • The Base Film should have a Clearly Defined MSDS.			
<b>12.2 REQUIREMENTS FOR ADHESIVIES</b>						
12.2.1	The adhesive shall stick, without the use of an activator such as solvents or heat, on any metallic and non-metallic, polished and clean surfaces, free from any grease or silicone without producing wrinkles, rolling up, tearing or detaching.	No comments received	The adhesive shall stick without the use of an activator such as solvents on any metallic and non-metallic, polished and clean surfaces, free from any grease or silicone without producing wrinkles, rolling up, tearing or detaching. (Heat deleted)	No comments received	Agreed and comply the same	M/s Avery Dennison comment is not accepted. Retain as existing clause.
12.2.2	The adhesive should be of gray color acrylate base. The gray color adhesive will provide good hiding power so that color of the coach does not affect the printed graphic colors and they appear vibrant.	No comments received	The adhesive should be of Solvent Free, Acrylic Emulsion Base.	No comments received	Agreed and comply the same	M/s Avery Dennison comment is not accepted. Retain as existing clause.
12.2.3	The adhesive should have features of controlled adhesive release, which will protect the paint of the coach. After the release liner has been removed, the films having controlled release adhesive shall be able to slide freely on the substrate before its final installation. Film can be positioned and finally applied by squeezing out permanent adhesive using a nylon molded squeeze without using any activator such as solvent or heat.	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
12.2.4	The graphics film should have inbuilt air channels in the adhesive layer to ensure release of air bubbles during application which will result in fast application and the same should be clearly marked on the backing liner as controlled release type	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
<b>12.3 REQUIREMENTS FOR RELEASE LINER</b>						
12.3.1	The release liner protects the adhesive against dirt contamination and prevents the film from unintended agglutination.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
12.3.2	The release liner will be paper, coated with polyethylene on both sides to have resistance to moisture and solvent during printing and application	No comments received	The release liner will be Clay Coated Kraft Liner without any Polyethylene Coat. It should have Good resistance to the moisture and Inks during printing and application Process.	No comments received	The release liner will be polyethylene on both sides to have resistance to moisture and solvent during printing and application. Paper, coated deleted.	Discussed in meeting with firms and M&C Dte representatives, in view of comments at 0.1 above the existing clause may be modified as: The release liner will be paper, coated with disposable polyethylene on both sides to have resistance to moisture and solvent during printing and application.
12.3.3	In addition, the adhesive power of the release liner shall not be so strong that the adhesive detaches on removal of the release Liner.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
<b>12.4 REQUIREMENTS FOR PRINTING OF BASE FILMS TO CONVERT INTO GRAPHICS</b>						
12.4.1	Films shall be printed with digital printing technology with eco-friendly low emission solvent inks.	Printing with low VOC & Green gold certification inks.	Films shall be printed with Inkjet Digital Printing Technology, Using Eco Friendly Inks.	No comments received	Agreed and comply the same	The requirement of ink has been already deliberated in RDSO comments in clause 3.0 (General requirement) of Part-I. Discussed in meeting with firms

						and M&C Dte representatives, in view of comments at 0.1 above the existing clause may be modified as: Films shall be printed with digital printing technology with eco-friendly inks and shall be certified by any National/International norms for low emission of chemicals.
12.4.2	The graphic has to be printed with printing resolution of the minimum of 360 dpi by 760 dpi to maximum of 720 dpi by 1440 dpi (Dots/inch).	No comments received	Nil comment	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representatives, in view of comments at 0.1 above the existing clause may be modified as: The graphic has to be printed with printing resolution of the minimum of 720 dpi by 1440 dpi (Dots/inch).
12.4.3	The printing Inks shall be approved by the manufacturer of the graphics film and should carry a comprehensive warranty for maximum of 2 years against any kind of fading of colors and cracking.	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
<b>12.5 REQUIREMENTS OF EDGE SEALING OF PRINTED GRAPHICS</b>						
12.5.1	Edge sealing is required on the edges of the vinyl to give protection against peeling off of the graphics film and preventing damages of the graphics film against vandalism	No comments received	Same (No change)	No comments received	Agreed and comply the same	Vinyl will be replaced by "film"
12.5.2	The edge sealing material shall be clear acrylic/alkyd/PU resin applied on all the overlap joints of the film and the end edges of the film with at least 4mm footprint covering 2mm on both the exposed edges.	No comments received	Same (No change)	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representative and it was decided that the clause should be added in this clause: The edge sealing material shall be clear acrylic/alkyd/PU resin applied on all the overlap joints of the film and the end edges of the film with at least 10mm footprint covering 5mm on both the exposed edges.
12.5.3	-	-	-	-	-	Discussed in meeting with firms and M&C Dte representative and it was decided that the additional clause should be as: The edge sealer should become water resistant within four hours of application.
<b>12.6 REQUIREMENTS OF OVER LAMINATE</b>						
12.6.1	The surface of the graphic films shall be over laminated in an appropriate way in order to guarantee the resistance against operating stress and weather, acids, alkalis, salt solutions, scratch and tear from foreign objects.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
12.6.2	The graphics film should have an over laminate supplied by the same	No comments received	The graphics film should have an over laminate supplied by the same	No comments received	The graphics film should have an over laminate	PVC Film will be replaced by "Non PVC, self adhesive eco-

	manufacturer of the graphics film. The over laminate should be a PVC film attractive glass finish and should be UV stabilized, which is to be tested to ASTM G152 for protection against deterioration and fading.		manufacturer of the graphics film. The over laminate should be a Non-PVC from Polyolefin family film attractive gloss finish and should be UV stabilized, which is to be tested to ASTM G152 for protection against deterioration and fading.		supplied by the same manufacturer of the graphics film. The over laminate should be a PVC/PE film attractive glass finish and should be UV stabilized, which is to be tested to ASTM G152 for protection against deterioration and fading.	friendly and disposable film” and test details provided and clause modified as: The graphics film should have an over laminate supplied by the same manufacturer of the graphics film. The over laminate should be a Non PVC, Eco-friendly and disposable film attractive gloss finish and should be UV stabilized, which is to be tested to ASTM G152 using xenon arc/QUV panel machines at 0.63 nanometer UV A lamps with 4 hour condensation and 4 hour UV exposure for min at 500 hrs. Post cycle specular gloss value, delta E colour change; visual discolouration has to be reported. The colour change should not be more than delta E=3, measured by approved photo spectro densito meter (The instrument measures colour value) for protection against deterioration and fading.
12.6.3	Over laminate should be applied on the printed graphics as per recommendation by the manufacturer of the graphics film after the printing has been done on the graphics film.	No comments received	No change in existing clause. Separate clause - The over Laminate should have an Anti-graffiti Feature, Abrasion Resistance & should comply with the Anti-Graffiti test ASTM D6578. All marking agents should be removed with an average rating of not less than 8. - The Over laminate Film Thickness shall not be More than 36 Microns (As per ASTM-D3652). - The Nominal Thickness of Over Laminate Film shall not be More than 70 Microns (ASTM-D3652)	No comments received	Agreed and comply the same	The suggestion of M/s Avery Dennison has been already covered in clause 1.4 of option-B of Part-II and it should be added in clause 13.0 as below. “The finished graphic prior to application should be able to pass the anti-graffiti test when tested as per ASTM D6578 where all the marking agents should be removed with an average rating of not less than 8”.
<b>13.0 CHARACTERISTICS OF FINISHED GRAPHICS PRIOR TO APPLICATION:</b> Discussed in meeting with firms and M&C Dte representative and it was decided that the following details may be added in this clause: The finished graphic film prior to application should be able to pass the anti-graffiti test when tested as per ASTM D6578 where all the marking agents should be removed with an average rating of not less than 8						
13.0	-	-	-	-	-	As above cl. 12.6.3 the cl. Modified as: The finished graphic film prior to application should be able to pass the anti-graffiti test when tested as per ASTM D6578 where all the marking agents should be removed with an average rating of not less than 8.
13.1	<b>Thickness:</b> The film thickness shall be not more than 0.150mm <u>+15%</u> , with sealing and print	No comments received	The film thickness shall be not more than 0.160mm +/- 15%, with sealing and print color. The test procedure for	No comments received	Agreed and comply the same	Discus in the meeting and clause Retain as existing.



	color. The test procedure for measuring thickness is ASTM D3652		measuring thickness is ASTM D3652.			
13.2.1	<b>Gloss Value:</b> The minimum gloss value shall be 70 achieved at 60° measured by gloss meter as per ASTM D523, Gloss value retention after two years should not be less than 30 at 60° measured by gloss meter as per ASTM D523	No comments received	The films shall stick on any metallic and non-metallic surface, free from grease and silicone, without producing wrinkle, roiling up, detaching or tearing. The ultimate adhesive power shall be of at least 9N/25mm on standard steel panel	No comments received	Agreed and comply the same	M/s Avery Dennison comment not acceptable. Discuss in the meeting and clause Retain as same.
13.2.2	-	-	-	-	-	Discussed in meeting with firms and M&C Dte representative and it was decided that the following details may be added in this clause: For every tender, a control sample of size 8' x 4' appropriately numbered shall be preserved for comparing gloss values and colour properties of the finished coaches in service for that particular tender.
13.3	<b>Durability &amp; Weathering Resistance:</b> The graphic films shall be durable & resistant to weathering for at least one year in permanent outdoor-exposure. No kind of detachment, cracks, bubbles or similar effects shall occur during the applied state. The supplier shall submit proof of test from reputed independent laboratory (Govt. Accredited) of accelerated weathering, UV and environmental exposure as per ASTM G152 using xenon arc/QUV panel machines at 0.63 nanometer UV A lamps with 4 hour condensation and 4 hour UV exposure for min at 250 hrs. Post cycle specular gloss value, delta E color change; visual discoloration has to be reported. The color change should not be more than delta E=3, measured by approved photo spectro densito meter (The instrument measures color value).	No comments received	Same (No change)	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representative and it was decided that the exposure for min at 250 hrs should be modified as 500 hrs.
13.4	<b>Adhesive Power:</b> The films shall stick on any metallic and non-metallic surface, free from grease and silicone, without producing wrinkle, rolling up, detaching or tearing. The adhesive power shall be between 17N- 25N as per clause 16.1.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
13.5	<b>Flammability:</b> The graphic film should fall under min. class B when tested as per UIC-564-2OR Appendix 12	Finished graphics should be compliant to EN 45455 standards.	Same (No change)	No comments received	Agreed and comply the same	Discussed in meeting with firms and it was brought out that when going for Non-PVC material the test procedure will be as UIC-564-2 OR Appendix-4 in place of Appendix-12. In view of above and comments of M&C Dte vide note no

						M&C/PCN/I/64/1 Vol-III dated 14.11.2019, the clause may be modified as: The graphic film should fall under min. Class-A when tested as per UIC-564-2 OR Appendix-4 (for Non-thermoplastic material) or Film should meet EN45545-2, HL-3.
13.6	<b>Temperature Resistance:</b> The film shall be resistant to temperatures between -10°C and +100°C without any visible changes such as detachment cracks, bubble formation and color changes. This property is to be tested as per clause 16.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
13.7	<b>Dimensional Stability:</b> The shrinkage of the graphic films after application shall not exceed 0.2%. This is to be tested as per clause 16.4	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
13.8	<b>Resistance to Detergents:</b> The graphic films shall be resistant to detergents used by the IR for exterior cleaning of the coaches. The surface of the sealed film shall not soften and the color and the adhesive power shall not change. The same applies to surface softening and to all kind of detachments (waves, bubbles etc.). This should be tested as per clause 16.5.	No comments received	Same (No change)	No comments received	Agreed and comply the same	-----
13.9	<b>Wash and Attrition Resistance:</b> The graphic films shall not suffer any visible color and gloss changes, detachments, cracks, bubbles etc. during external coach washing in accordance with IR field practices. Furthermore the films shall not expand. The graphic films along with over laminate shall not show any visible color and gloss changes when tested as per ASTM D1044 using cleaning solution as per clause 16.5.	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
<b>13.10 Marking of the Product:</b>						
13.10 .1	For identification the box of the accepted finished products shall be clearly marked with a capital letters having height of more than 50mm either by printing, stamping or needle perforation.	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
13.10 .2	The marking should consist of the date of manufacture (month and year for example 12/04) of the finished product as well as manufacturer of the base material.	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
<b>14.0 APPLICATION OF GRAPHICS</b>						
14.1	Applications of Graphics have to be done using recommended application tools as mentioned by the manufacturer of the graphic film. The applicator has to show experience/training certificate of doing similar application on any moving vehicle	No comments received	Nil comment	No comments received	Agreed and comply the same	-----

	by the manufacturer of the graphic film.					
14.2	Application of the graphic film has to be done on the surface without using any soap solution and water. (Dry application to make faster application and protect the paint of the coach).	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
14.3	The application tool should be a nylon molded squeeze with low friction sleeve, which will prevent scratches on the graphics, and a nylon rivet brush with wooden handle to apply graphics on the rivets.	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
<b>15.0 REMOVAL OF FILMS</b>						
15.1	The time taken for removal of previous graphic & application of new graphic films should not be more than three hours per coach	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
15.2	The removal of the applied film should not be tedious. The removal should be done using a hot air blower but the temperature should not exceed 70°C. In case any film or adhesive residue is observed after removal the residue should be possible to remove by use of ISO propyl alcohol and lint free cloth.	No comments received	Nil comment	No comments received	Agreed and comply the same	Clause has been corrected as: The removal of the applied film should not be tedious. The removal should be done using a hot air blower but the temperature should not exceed 70°C. In case any film or adhesive residue is observed after removal the film, it should be possible to remove it by use of Iso-propyl alcohol and lint free cloth.
15.3	The removal in no way should damage the painted surface of the coach. The advertiser shall be liable for damages evident after removal of the film. The coach should be returned in the same condition as it was handed over initially	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
15.4	The advertiser shall be responsible for removal of the film at the time of termination of contract. The security deposit may accordingly be retained till the time of termination of contract.	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
<b>16.0 TESTING THE VINYL GRAPHIC FILM (Clause may be modified as TESTING OF NON-PVC, ECO-FRIENDLY AND RECYCLABLE FILM)</b>						
16.1	<b>Adhesive power:</b> The adhesive power shall be tested as per ASTM D3330, procedure A for 180° peel strength on a standard test panel of Stainless Steel, conditioned as per ASTM D4332 at a peel off velocity of 360mm/minute	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
16.2	<b>Controlled release adhesion:</b> This shall be tested visually for presence of air channels on the adhesive side of the base film after the removal of release liner	No comments received	Nil comment	No comments received	Agreed and comply the same	-----
16.3	<b>Temperature resistance:</b> Two test specimens 25mm x 200mm are stuck onto test plates of stainless steel, polished to a completely plane surface and are subsequently stored at standard reference atmosphere. The specimens are	No comments received	Nil comment	No comments received	Agreed and comply the same	-----

	subjected to temperature changes for seven cycles-each cycle comprising of 8 hours of -10°C and 16 hours of 90°C.									
16.4	<p><b>Dimensional stability:</b> Four 160mm x160mm test specimens are stuck onto degreased and etched aluminum plates with the dimension of 150x150x8mm and are stored for 72 hours in standard reference atmosphere. The projecting test specimen is then cut with a sharp knife (razor blade) along the test plate. Afterwards, the test specimens are stored for 48 hrs at 70°C and are then cooled down for 2 hours in standard reference atmosphere of 23+/-1°C and 50% relative humidity. Measurement of the shrinkage at two measuring points in longitudinal and transverse directions should be done</p>	No comments received	Nil comment	No comments received	Agreed and comply the same	-----				
16.5	<p><b>Resistance against detergents:</b> The test is to be carried out with two, lest solutions. Duration of test: 24 hrs.</p> <table border="1"> <thead> <tr> <th>'A' Solution:</th> <th>'B' Solution:</th> </tr> </thead> <tbody> <tr> <td>40% phosphoric acid 15% emulsifying agent 45% water (distilled)</td> <td>10% Fatty alcohol polyethylene Glycol ether - 10% Sodium cumene sulphonate (40% solution) - 5% NTA liquid (40% solution) Triton A, BASF - 5% Triethanolamine- 20% Totally demineralized water - 60%</td> </tr> </tbody> </table> <p>Emulsifying agent: Oleyl-stearyl alcohol mix (with iodine value 50) with 10 mol ethylene oxide. Max. application concentration for test solution A and B 1:4 respectively</p>	'A' Solution:	'B' Solution:	40% phosphoric acid 15% emulsifying agent 45% water (distilled)	10% Fatty alcohol polyethylene Glycol ether - 10% Sodium cumene sulphonate (40% solution) - 5% NTA liquid (40% solution) Triton A, BASF - 5% Triethanolamine- 20% Totally demineralized water - 60%	No comments received	Comments on solution only	No comments received	Agreed and comply the same	-----
'A' Solution:	'B' Solution:									
40% phosphoric acid 15% emulsifying agent 45% water (distilled)	10% Fatty alcohol polyethylene Glycol ether - 10% Sodium cumene sulphonate (40% solution) - 5% NTA liquid (40% solution) Triton A, BASF - 5% Triethanolamine- 20% Totally demineralized water - 60%									
17.0	<p><b>Packing:</b> Cut films are to be dispatched, bundled up and securely packed in cardboard. Other graphics are to be rolled up on a cardboard roll/tube with the film side on the outside and shall be dispatched under safe transit.</p>	No comments received	Nil Comment	No comments received	Agreed and comply the same	Clause may be modified as: Cut films are to be dispatched, bundled up and securely packed in cardboard. Other graphics are to be rolled up on a cardboard roll/tube with the film side on the outside and shall be dispatched under safe transit. Supplier shall take all precautions to avoid any damages to film during the transit.				
18.0	<p><b>Guarantee and replacement:</b></p>	No comments received	Nil Comment	No comments received		-----				
18.1	The lime period of guarantee should be 1year for stuck films.	No comments received	Nil Comment	No comments received	Agreed and comply the same	-----				

18.2	The supplier shall replace all the graphics rejected on final acceptance due to their noncompliance with the requirements and those product that show deficiencies during the time period of guarantee by products complying with the requirements within a period of six weeks.	No comments received	Nil Comment	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representative and it was decided that the clause modified with "four weeks".
18.3	The warranty for the printing inks should be available with the manufacturer /printer of the graphic film from the ink supplier.	E-warranty should be given by the original film manufacturer for each coach.	Nil Comment	No comments received	Agreed and comply the same	Discussed in meeting with firms and M&C Dte representatives, in view of comments at 0.1 above the existing clause may be modified as: The warranty for the printing inks should be available with the manufacturer /printer of the graphic film from the ink supplier. The firm shall provide E-warranty of the film from the OEM.

**Part-II**

**SELF ADHESIVE, DECORATIVE VINYL FILM FOR INTERIOR APPLICATION IN AC/NON-AC COACHES OF INDIAN RAILWAYS**

**(Clause may be modified as ECO-FRIENDLY AND DISPOSABLE FILMS FOR INTERIOR APPLICATION IN AC/NON-AC COACHES OF INDIAN RAILWAYS)**

**1.0 Scope**

1.1	Self adhesive, decorative Vinyl Film to be used on interiors of Indian Railways Passenger Coaches to improve coach interior aesthetics with its technical & infrastructural requirements and testing methods.	No comments received	No Change	No comments received	Agreed and comply the same	Decorative Vinyl Film will be replaced by "Non PVC, self adhesive eco-friendly and disposable film"
1.2	Requirements of adhesion with coach interior panels (metallic, non-metallic and composite materials), washability, cleanability, edge sealing, scratch resistant and damage repair (patch repair) of self adhesive Vinyl Film.	No comments received	No Change	No comments received	Agreed and comply the same	Vinyl Film will be replaced by "film"

**2.0 Area of Application on Coaches**

	Area of application on coaches shall be the coach interior panels of metallic, non-metallic and composite materials excluding the window area. The manufacture/supplier of vinyl film for interior shall provide the procedures dealing with the application method, position of joints and method of sealing of joints and edges, removal with Do's & Don'ts and mode of disposal of such vinyl films to IR/consignee. The manufacturer/supplier should study the coach interior of Indian Railways AC and Non-AC coaches for better appreciation of coach interiors.	No comments received	<b>APPLICATION OF GRAPHICS</b> <ul style="list-style-type: none"> <li>• Applications of Graphics have to be done using recommended application tools as mentioned by the manufacturer of the graphic film. The applicator has to show experience/training certificate of doing similar application on any moving vehicle by the manufacturer of the graphic film.</li> <li>• Application of the graphic film has to be done on the surface without using any soap solution and water. (Dry application - for Ease of Application). The surface should be rubbed down by means of grade 220 emery paper and cleaned with a soft cloth before application of fleet graphic film.</li> <li>• The application tool should be a nylon molded squeeze with low friction sleeve, which will prevent</li> </ul>	No comments received	Agreed and comply the same	Comments of M/s Avery Dennison are not accepted. The existing clause covers the requirement of application and removal of films which have to be provided by the manufacturer. The clause may be modified as: Area of application on coaches shall be the coach interior panels of metallic, non-metallic and composite materials excluding the window area. The manufacturer/supplier of the film for interior shall provide the procedures dealing with the application method, position of joints and method of sealing of joints and edges, procedure for patch repair, removal with Do's & Don'ts and mode of disposal of such the films to
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			<p>scratches on the graphics, and a nylon rivet brush with wooden handle to apply graphics on the rivets.</p> <p><b>REMOVAL OF FILMS</b></p> <ul style="list-style-type: none"> <li>• In case removal of vinyl film/residual adhesive film is required within the warranty period because of manufacturing/application/printing defects, the OEM will arrange to get the film replaced at no cost to the Railways.</li> <li>• The time taken for removal of previous graphic &amp; application of new graphic films should not be more than eight hours per coach.</li> <li>• The removal of the applied film should not be tedious. The removal should be done using a hot air blower but the temperature should not exceed 70°C. In case any film or adhesive residue is observed after removal, it should be possible to remove the residue by use of ISO propyl alcohol and lint free cloth or other proprietary solution, by the OEM, without any surface damage. Within the warranty period, the removal has to be done by the OEM.</li> <li>• The removal should in no way damage the painted surface of the coach. The OEM shall be liable for damages evident after removal of the film. The coach should be returned in the same condition as it was handed over initially.</li> </ul>			<p>IR/consignee. The manufacturer/supplier should study the coach interior of Indian Railways AC and Non-AC coaches for better appreciation of coach interiors.</p>
<b>3.0 General Requirements:</b>						
	<p>The general requirement for Self adhesive, decorative Vinyl Film for interior of IR coaches shall be as per clause 3.0 of Part-I for Specification for Vinyl Films for Advertising on exterior of Indian Railway Coaches.</p>	<ol style="list-style-type: none"> <li>1) Bidder Experience in Rail industry should be 5 years.</li> <li>2) The bidder should have minimum of 10 applicators who should be trained and certified by an original film manufacturer for interior installation on rail cars. Valid copy of authorization of applicators should be submitted along with tender.</li> <li>3) The original film manufacturer should have an established in-house design studio with capability of producing creative</li> </ol>	<p>Comments same as clause 3.0 of Part-I</p>	<p>No comments received</p>	<p>Agreed and comply the same</p>	<p>Point no. 1 to 4 of M/s 3M is not acceptable as the suggestions may be a part of tender doc. Clause retain as existing. Decorative Vinyl Film will be replaced by "film"</p>

		<p>designs by using contemporary software. A letter from manufacturer of films stating this should be attached.</p> <p>4) The OEM manufacturer of the films must possess a local lab set-up in India along with required infrastructure and QC team to assure quality of goods supplied and to ensure that the complaints are resolved rapidly. A letter from film manufacturer detailing the number of the people and location of the laboratory should be furnished.</p>				
<b>4.0 Coach Inside Conditions:</b>						
4.1	Inside condition of the coach may be considered as under:	No comments received	No change	No comments received	Agreed and comply the same	----
4.1.1	The ambient conditions inside a Non-AC coaches may be considered similar to the ambient condition as mentioned under para 5.4 below, as there is no environment control inside a Non-AC coach. However in summer days, the value of upper range of the temperature may go up to 60°C nearby the roof ceiling. There may be remarkable variation in temperature inside of the coach from floor level to roof level.	No comments received	No change	No comments received	Agreed and comply the same	-----
4.1.2	Wind flow velocity nearby the windows may be considered in Non-AC coaches as windows may remain in open condition during journey.	No comments received	No change	No comments received	Agreed and comply the same	----
4.1.3	Ingress of water/moisture through windows of Non-AC coaches during rainy season may also be considered. Outside and inside areas of lavatories are more prone to splashing of water/accelerated moisture. Cleaning agents are generally used for cleaning of lavatories.	No comments received	No change	No comments received	Agreed and comply the same	----
4.1.4	In AC coaches, the passenger area has a control environment except lavatory area and doorways area. However, windows have been provided with sealed windows.	No comments received	No change	No comments received	Agreed and comply the same	-----
4.1.5	The provisions of interior furnish and amenities provided in the coach may vary from coach to coach. In some areas of coach, the furnishing surface may be sunk-in type or projected.	No comments received	No change	No comments received	Agreed and comply the same	----
<b>5.0 Operating and General Requirements of Coach:</b>						
5.1	The self adhesive, decorative vinyl film should work satisfactorily under the following operating conditions of IR coaches.	No comments received	No change	No comments received	Agreed and comply the same	Decorative Vinyl Film will be replaced by "film"



5.2	<p><b>Coach Dynamics:</b> Self adhesive, <b>decorative</b> vinyl film shall withstand satisfactorily the vibrations and shocks normally encountered in service as indicated below: i) Maximum vertical acceleration 1.0g ii) Maximum longitudinal acceleration 3.0g iii) Maximum transverse acceleration 2.0g The vibrations are of sine wave form and the frequency vibration is between 10 Hz to 50 Hz. The amplitude 'a' expressed in millimeters is given as a function of f, by equations a = 25/f for values of f from 1 Hz to 10 Hz. a = 250/f<sup>2</sup> for values of f exceeding 10Hz and up to 50 Hz. In the direction corresponding to the longitudinal movement of the vehicle, the self adhesive, <b>decorative</b> vinyl film shall be capable of withstanding for 30 min. at 50 Hz. Vibrations of such a value that the max. acceleration is equal to 3g.</p>	No comments received	No change	No comments received	Agreed and comply the same	Decorative Vinyl Film will be replaced by "film"
5.3	<p><b>Coach-body displacement encountered under dynamic conditions:</b> i) Vertically- ±100 mm ii) Laterally - ±55 mm iii) Longitudinally- ±10 mm iv) Bogie rotation about center pivot- ±4°</p>	No comments received	No change	No comments received	Agreed and comply the same	---
5.4	<p><b>Ambient conditions for a coach fitted with self adhesive, <b>decorative</b> vinyl film:</b> (i) Ambient temperature: -4°C to 50°C Altitude: Sea level to 2500m Relative humidity: 40% to 95% (ii) The rainfall is fairly heavy. (iii) During dry weather, the atmosphere is likely to be dusty. (iv) Temperature variations can be quite high in the same journey or short period of time. (v) Coaches operate in coastal region with continued exposure to salt laden air.</p>	No comments received	No change	No comments received	Agreed and comply the same	Decorative Vinyl Film will be replaced by "film"
<p><b>6.0 Technical Requirements of Vinyl Films:</b> "Vinyl film" will be replaced by "Pre-patterned film".</p>						
<p><b>Option A- Prepatterned Vinyl Films:</b> "Vinyl film" will be replaced by "Pre-patterned film".</p>						
6.1	<p>he pattern, design and print color of <b>vinyl</b> film shall be mutually agreed between the IR/Consignee and manufacturer/supplier of prepatterned vinyl film for interior application of the IR coaches and shall meet the following requirements:</p>	No comments received	<p><b>Suggestion:</b> The pattern, design and print color of vinyl film shall be mutually agreed between the IR/Consignee and manufacturer/supplier of <b>Decorative Prepatterned film</b> for interior application of the IR coaches and shall meet the following requirements: <b>Reason:</b> The Word "<b>Decorative</b>" needs to</p>	<p>Selecting agreed pattern, design and print color of Vinyl Films between IR/Consignee and Manufacturer/ Supplier should have some defined criteria, as every manufacturer/ Supplier has some Unique designs, which can create Monopoly Situation <b>- In our Opinion/ Suggestion:</b> IR/</p>	Agreed and comply the same	<p>Comments of M/s Avery Dennison &amp; M/s LG Hausys not accepted, as it is not a part of specification. "Vinyl film" will be replaced by "film".</p>



			added to provide more clarity	Consignee should give fair chance to other Film Supplier as well by selecting nearby pattern match, so that there is Competition and IR gets competitive bidding. Of course, Vendor who gets the order has to use material from only one supplier (One Pattern) to maintain uniformity		
6.1.1	The prepatterned vinyl film should not require any printing or lamination activity prior to application on coach interior substrate.	No comments received	No change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".
6.1.2	The prepatterned vinyl film for interiors of the coach shall have a proven and established technology/system on National/International Railway Systems. The documentary proof for the same should be provided.	No comments received	<p><b>Suggestion:</b> The <b>Decorative</b> prepatterned vinyl film for interiors of the coach shall have a proven and established technology/system on National/International Railway Systems. The OEM should be India Registered, should have Self Adhesive Vinyl Manufacturing Presence in India along with PAN India Network and Operations in India for more than 12+ yrs. A documentary proof for all should be provided.</p> <p><b>Reason:</b> Since the Warranty Period is if of 6 Years, Film should be sourced only from a Reputed, Established Global OEM &amp; have their Wide &amp; Substantial Presence in India so as to cater to any future risks / liabilities on the Performance of the film And Compliance to "Make in India" No. P-45021/2/2017-B.E.-II</p>	In case of mandatory prior Experience, new Manufacturer/ Supplier cannot participate despite of meeting all the specified technical specification - In Our Opinion/Suggestion: New manufacturer/ supplier should give fair chance to associate with IR/Consignee, if they have all test certificates from approved lab by RDSO, as mentioned in RDSO specs.	Agreed and comply the same	Comments of M/s Avery Dennison & M/s LG Hausys not accepted. Discussed in meeting with firms and all firms were in view that clause may be retained as existing. "Vinyl film" will be replaced by "film".

6.1.3	The prepatterned <b>Vinyl</b> film shall be self adhesive, decorative, attractive and shall be enhancing/improving interior aesthetics of Indian Railways AC & Non-AC coaches.	No comments received	No change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".
6.1.4	The <b>vinyl</b> film shall be able to be applied as per the actual furnishing (metal, FRP laminates, composite materials etc) inside the coach and shall perform satisfactorily under Indian weather condition, Indian Railway operating condition as mentioned in clause 4.0 & 5.0 above and wide spectrum of users of Indian Railways AC and Non-AC coaches. The manufacturer/supplier shall advise the adhesive designation and group used for self adhesion of prepatterned vinyl film which shall be capable to release air during application.	No comments received	<p><b>Suggestion :</b> The Decorative Prepatterned vinyl film shall be able to be applied as per the actual furnishing (metal, FRP laminates, composite materials etc) inside the coach and shall perform satisfactorily under Indian weather condition, Indian Railway operating condition as mentioned in clause 4.0 &amp; 5.0 above and wide spectrum of users of Indian Railways AC and Non-AC coaches. The manufacturer/supplier shall advise the adhesive type used for self adhesion of Decorative prepatterned vinyl film</p> <p><b>Reason:</b> Since the Vinyl Would be Thick i.e. 150+ Micron, Air Egress Channels are not required. Air Egress Channels incurs additional Cost &amp; does not have any performance advantage.</p>	No comments received	Agreed and comply the same	Comment of M/s Avery Dennison not accepted. Discussed in meeting with firms and all firms were in view that clause may be retained as existing. "Vinyl film" will be replaced by "film".
6.1.5	The material, thickness and production tolerances of prepatterned <b>vinyl</b> film shall be confirming to the National/International standards and should also confirm the statutory norms of Government of India. The prepatterned vinyl film, pigment and ink used for printing should not be hazardous to health and environment and should be compliant to National/International health and environmental norms. A documentary proof regarding the compliance of the above should be provided. The test procedure for measuring thickness of the film to ASTM-D3652.	<ul style="list-style-type: none"> <li>• Thickness range should be mentioned. 200micron ± 20 micron</li> <li>• Material should be RoHS compliant.</li> </ul>	<p><b>Suggestion:</b> <b>6.1.5 Base Film Requirement</b> The Material, Thickness Production tolerances of prepatterned vinyl film shall be confirming to the National/International standards and should also confirm the statutory norms of Government of India. The prepatterned vinyl film, pigment and ink used for printing should not be hazardous to health and environment. It should be compliant to National/International health and environmental norms Such as REACH &amp; ROHS. A documentary proof regarding the compliance of the above should be provided</p> <p><b>Reason –</b> Specific Compliances such as REACH &amp; ROHS Mentioned.</p>	Thickness of Product is not mentioned? - In Our Opinion/ Suggestion: Minimum thickness - e.g 170 Micron (as thickness may vary with embossing pattern) should be mentioned.	Agreed and comply the same	The issue of thickness of film was discussed in meeting with firms, all the firms were in view that the film thickness should be 150-200 microns. In view of the same the clause may be modified as: The material, thickness and production tolerances of pre-patterned Non PVC, self adhesive eco-friendly and disposable film shall be 150-200 microns and shall be confirming to National / International standards and should also confirm the statutory norms of Government of India. The pre-patterned film, pigment and ink used for printing should not be hazardous to health and environment and should be compliant to National/International health and environmental norms. A documentary proof regarding the compliance of the above should be provided. The test procedure for measuring thickness of the film shall be as per ASTM-D3652.

6.1.6	The prepatterned vinyl film shall not show any effect and any damage to the actual interior substrate during application/removal of the vinyl film.	No comments received	No change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".
6.1.7	The prepatterned vinyl film shall not sustain tea, coffee, lipstick, any natural & artificial colour, oil, grease stain etc and shall be easily removed by water/recommended cleaning agent. Dust and dirt shall not be easily stuck on the surface of prepatterned vinyl film.	No comments received	<b>Suggestion –</b> The <b>Decorative</b> prepatterned vinyl film shall not stain from Tea, Coffee, Isopropyl Alcohol, Water, Salt Spray, Vegetable, and Tomato Ketchup Etc. The Stains of Same shall be Removal by water/recommended cleaning agent. Dust and dirt shall not be easily stuck on the surface of <b>Decorative</b> prepatterned vinyl film. <b>Reason –</b> Tea, Coffee, Isopropyl Alcohol, Water, Salt Spray, Vegetable, and Tomato Ketchup are the common Items used by the Passengers and the film should have a good resistance to them.	No comments received	Agreed and comply the same	Comment of M/s Avery Dennison not accepted. Clause retain as existing. "Vinyl film" will be replaced by "film".
6.1.8	The prepatterned vinyl film shall be Hydrophobic, resistance to UV aging and weathering and shall have good abrasion resistance, cleanability, washability and should not be easily removed by nail/keys or by any other manual activity of the coach occupant etc.	<b>Weathering test is missing:</b> The film shall be durable & resistant to weathering. No kind of detachment, cracks, bubbles or similar effects shall occur during the applied state. The supplier shall submit proof of test from reputed independent laboratory (Govt. Accredited) of accelerated weathering, UV and environmental exposure as per ASTM G152-13 using xenon arc/QUV panel machines at 0.63 nanometer UV A lamps with 4-hour condensation and 4-hour UV exposure for min of 1000 hrs. Post cycle note down visual discoloration has to be reported. No major visual change in color is allowed.	No change	No Test method is mentioned? In Our Opinion/ Suggestion: Test Method should be clearly mentioned.	Agreed and comply the same	The issue was discussed in meeting with firms, all the firms were in view that a new clause for "Weathering test as per clause 13.3 of Part-I" should be included in Part-II. In view of same, a new clause no. 6.1.21 has been added. "Vinyl film" will be replaced by "film".
6.1.9	The prepatterned vinyl film shall be capable for edge sealing at the edges/joints/ends of the vinyl film for protection against peeling off and shall prevent damages to the vinyl film by vandalism. The prepatterned vinyl film shall allow maintainer of the coach to do patch work if and when required during maintenance of the coach.	No comments received	No change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".
6.1.1	The manufacturer of prepatterned vinyl film shall advise edge sealing material for	No comments received	No change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".

0	sealing of overlap joints/edges/ends of the film. The edge sealing material shall not affect the interior aesthetics of the coach and should also be capable to address the requirements mentioned in (iii) to (v) of clauses 5.4 above.					
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6.1.1 1	<p>The prepatterned <b>vinyl</b> film for interior application of the coach shall comply with the fire worthiness property as mentioned below:</p> <table border="1"> <thead> <tr> <th>S. N.</th> <th>Property</th> <th>Required value</th> <th>Test Method</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Resistance to spread of flame</td> <td>Class A</td> <td>Appendix-4 of UIC 564-2 OR</td> </tr> <tr> <td>2.</td> <td>Deterioration of visibility due to smoke</td> <td>Class A</td> <td>Appendix-15 of UIC 564-2 OR</td> </tr> <tr> <td>3.</td> <td>Limiting Oxygen Index</td> <td>Min. 35</td> <td>IS: 13360 Part-6, Section-19</td> </tr> <tr> <td>4.</td> <td>Toxicity</td> <td>&lt;1</td> <td>NCD:1409</td> </tr> <tr> <td>5.</td> <td>Heat Release Rate (MARHE i.e. Maximum Average Rate of Heat Emission in KW/m<sup>2</sup>) as specified in EN 45545-2:2013</td> <td>R1 (HL3)</td> <td>ISO 5660-1: 50 kW/m<sup>2</sup></td> </tr> </tbody> </table>	S. N.	Property	Required value	Test Method	1.	Resistance to spread of flame	Class A	Appendix-4 of UIC 564-2 OR	2.	Deterioration of visibility due to smoke	Class A	Appendix-15 of UIC 564-2 OR	3.	Limiting Oxygen Index	Min. 35	IS: 13360 Part-6, Section-19	4.	Toxicity	<1	NCD:1409	5.	Heat Release Rate (MARHE i.e. Maximum Average Rate of Heat Emission in KW/m <sup>2</sup> ) as specified in EN 45545-2:2013	R1 (HL3)	ISO 5660-1: 50 kW/m <sup>2</sup>	<p>Flammability should be tested according to EN 45545-2: 2016 as EN-45545-2 covers, Spread of Flame (ISO 5658-2), Smoke Density 1 Toxicity (25kw/ml or 50 kW/ ml) (ISO 5659-2) Heat Release for the passenger safety (ISO 5660-1) EN45455-2:2016 test standard is specified detailed testing with hazardous chemicals details which is always stands high for passenger safety and specify minimum Hazardous level. For interior R1 HL2 for General Trains &amp; R1HL3 for the coaches operates in underground/under bridge.</p>	<p><b>Suggestion –</b> The <b>Decorative</b> prepatterned vinyl film for interior application of the coach shall comply to the fire worthiness properties and Should Meet the Requirements of EN45545 for Set R1 (EN45545-2 + A1:2015) for a <b>HL3</b> Hazard Level Classification as per Below Table:</p> <table border="1"> <thead> <tr> <th>Requirement set (used for)</th> <th>Test Method Reference</th> <th>Parameter Unit</th> <th>Requirement Definition</th> <th>HL3</th> </tr> </thead> <tbody> <tr> <td rowspan="5">R1 (IN1A;1N1B;IN1D;IN1E; 1N4; 1N5; 1N6A; IN7; IN8; IN9B; IN11; IN12A; IN12B; IN14; F5)</td> <td>T02 ISO 5658-2</td> <td>CFE kW/m2</td> <td>Minimum</td> <td>20 a</td> </tr> <tr> <td>T03 01 ISO 5660-1 : 50 KW/M2</td> <td>MARHE kW/m2</td> <td>Minimum</td> <td>60</td> </tr> <tr> <td>T10.01 EN ISO 5659-2 : 50 KW/M2</td> <td>Ds(4) dimensionless</td> <td>Minimum</td> <td>150</td> </tr> <tr> <td>T10.02 EN ISO 5659-2 : 50 KW/M2</td> <td>VOF4 min</td> <td>Minimum</td> <td>300</td> </tr> <tr> <td>T11.01 EN ISO 5659-2 : 50 KW/M2</td> <td>CITG dimensionless</td> <td>Minimum</td> <td>0.8</td> </tr> </tbody> </table> <p><b>Reason –</b> EN45545 R1 at HL3 is the most stringent Test and comprises all other fire test &amp; Only 1 Certificate is enough to establish it Fire Behavior.</p>	Requirement set (used for)	Test Method Reference	Parameter Unit	Requirement Definition	HL3	R1 (IN1A;1N1B;IN1D;IN1E; 1N4; 1N5; 1N6A; IN7; IN8; IN9B; IN11; IN12A; IN12B; IN14; F5)	T02 ISO 5658-2	CFE kW/m2	Minimum	20 a	T03 01 ISO 5660-1 : 50 KW/M2	MARHE kW/m2	Minimum	60	T10.01 EN ISO 5659-2 : 50 KW/M2	Ds(4) dimensionless	Minimum	150	T10.02 EN ISO 5659-2 : 50 KW/M2	VOF4 min	Minimum	300	T11.01 EN ISO 5659-2 : 50 KW/M2	CITG dimensionless	Minimum	0.8	No comments received	Agreed and comply the same	<p>The issue was discussed in meeting with firms, M/s 3M &amp; M/s Avery Dennison were in view that all the fire test property mention under this clause should be done as per EN-45545.</p> <p>Presently in IR all the existing interior furnishing materials of coaches are being tested as per the test method mentioned in this clause.</p> <p>As discussed in the meeting the clause may be modified as: Required value of HRR modified as: Max. 60 kW/m<sup>2</sup> (The value is as per (R1-HL3) in table-5 of EN 45545-2:2013).</p> <p>Alternatively the tests prescribed as above in this clause can be done as per EN45545-2 (R1-HL3) by the accredited lab.</p> <p>“Vinyl film” will be replaced by “film”.</p>
S. N.	Property	Required value	Test Method																																																					
1.	Resistance to spread of flame	Class A	Appendix-4 of UIC 564-2 OR																																																					
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3.	Limiting Oxygen Index	Min. 35	IS: 13360 Part-6, Section-19																																																					
4.	Toxicity	<1	NCD:1409																																																					
5.	Heat Release Rate (MARHE i.e. Maximum Average Rate of Heat Emission in KW/m <sup>2</sup> ) as specified in EN 45545-2:2013	R1 (HL3)	ISO 5660-1: 50 kW/m <sup>2</sup>																																																					
Requirement set (used for)	Test Method Reference	Parameter Unit	Requirement Definition	HL3																																																				
R1 (IN1A;1N1B;IN1D;IN1E; 1N4; 1N5; 1N6A; IN7; IN8; IN9B; IN11; IN12A; IN12B; IN14; F5)	T02 ISO 5658-2	CFE kW/m2	Minimum	20 a																																																				
	T03 01 ISO 5660-1 : 50 KW/M2	MARHE kW/m2	Minimum	60																																																				
	T10.01 EN ISO 5659-2 : 50 KW/M2	Ds(4) dimensionless	Minimum	150																																																				
	T10.02 EN ISO 5659-2 : 50 KW/M2	VOF4 min	Minimum	300																																																				
	T11.01 EN ISO 5659-2 : 50 KW/M2	CITG dimensionless	Minimum	0.8																																																				
6.1.1 2	<p>The prepatterned <b>vinyl</b> film for interior application of the coach shall meet the requirement of adhesive power, control release adhesion, temperature and resistance against detergent as per clause 9.0 (testing the vinyl graphic film) of Part-I of this specification. The dimensional stability of the films should be tested as per clause 16.4 of Part-I of this</p>	<p>Adhesive power is missing: Adhesion power is too less in the draft specification. Should be change to minimum of 17 N.</p>	<p><b>Suggestion –</b> The <b>Decorative</b> prepatterned vinyl film for interior application of the coach shall meet the requirement of adhesive power, temperature and resistance against detergent as per clause 9.0 (testing the vinyl graphic film) of Part-I of this specification. The dimensional stability of the films</p>	No comments received	Agreed and comply the same	<p>Discussed in meeting with firms and M&amp;C Dte representatives and all were in view that adhesion power of at least 9N is low. M&amp;C Dte and Firms were in view that adhesion power should be at least 17N/25mm to minimize the vandalism of film by the coach</p>																																																		

	specification and shall not show shrinkage of film exceeding 0.2%.		should be tested as per clause 16.4 of Part-I of this specification and shall not show shrinkage of film exceeding <b>0.2%</b> <b>Reason –</b> Since the Vinyl Would be Thick i.e. 150+ Micron, Air Egress Channels are not required. Also, Air Egress Channels incurs additional Cost & it does not have any performance advantage.			occupants. In view of the above the clause may be modified as: The film for interior application of the coach shall meet the requirements of adhesive power, control release adhesion, temperature and resistance against detergent as per clause 9.0 (testing the graphic film) of Part-I of this specification. The dimensional stability of the films should be tested as per clause 16.4 of Part-I of this specification and shall not show shrinkage of film exceeding 0.2%. The film used for interior shall have an adhesive power of at least 17N/25mm when tested as per ASTM D-4541.
6.1.1 3	The prepatterned vinyl films shall not show any visible color changes when tested as per ASTM D1044 using cleaning solution as per clause 9.4 of Part-I of this specification.	No comments received	No Change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "films".
6.1.1 4	The abrasion resistance test of the prepatterned vinyl film shall be as per ASTM-D4060.	Need to mention the no. of cycle and acceptance level. 7000 cycles & acceptance level post the testing should be no Major difference wear out of pattern when compared with control sample. Photographs of high res should attached and reported.	No Change	No comments received	Agreed and comply the same	Discussed in meeting with firms and all firms were in view that number of cycle of abrasion test should be specified as minimum 7000 cycles. In view of the same the clause may be modified as: The abrasion resistance test of the film shall be tested as per ASTM-D4060 for a minimum 7000 cycles.
6.1.1 5	The prepatterned vinyl film shall be temperature resistance and shall withstand a temperature of (-) 10°C to (+) 80°C without any visible change like detachment, cracks, bubble formation, fading of color etc.	No comments received	<b>Suggestion –</b> The Decorative prepatterned vinyl film shall be temperature resistance and shall withstand a temperature of (-) 30°C to (+) 80°C without any visible change like detachment, cracks, bubble formation, fading of color etc. <b>Reason –</b> Widen the Service Range Temperature for more durability.	No comments received	Agreed and comply the same	Discussed in meeting with firms and all firms were in view that clause may be retained as existing. "Vinyl film" will be replaced by "film".
6.1.1 6	The prepatterned vinyl film shall be temperature resistance and shall be tested as per ASTM D 2115-17. There shall be no delamination or visible change in film.	No comments received	No Change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".
6.1.1 7	The prepatterned vinyl film shall be thermal cycle resistance and shall be tested as per ISO 14188:2012(E). There shall be no delamination or visible change in film.	No comments received	No Change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".
6.1.1	The prepatterned vinyl film shall be moisture resistance and shall be tested as	No comments received	No Change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".

8	per ASTM D5637-05. There shall be no delamination or visible change in film.					
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6.1.1 9	The prepatterned vinyl film shall be cold impact resistance and shall be tested as per ASTM D1790-14. There shall be no crack in film.	No comments received	No Change	No comments received	Agreed and comply the same	"Vinyl film" will be replaced by "film".
6.1.2 0	The prepatterned vinyl film shall be Resistance to Solvents, Cleaners, and other Chemicals as listed below: <ul style="list-style-type: none"> <li>• Water, Chloride (10%), Sodium Hydroxide (10%) &amp; Ethanol – 24hrs.</li> <li>• Hydrogen Peroxide &amp; Isopropyl Alcohol – 72hrs.</li> </ul> The Test method shall be as per ASTM D-543. There shall be no visible change in the films.	No comments received	<b>Suggestion –</b> The Decorative prepatterned vinyl film shall be Resistance to Solvents, Cleaners, and other Chemicals as listed below: <ul style="list-style-type: none"> <li>• Water – 7 Days</li> <li>• Chloride (10%), Sodium Hydroxide (10%) &amp; Ethanol – 24hrs.</li> <li>• Hydrogen Peroxide &amp; Isopropyl Alcohol – 72hrs.</li> <li>• Ethyl Alcohol – 6 Hours</li> <li>• The Test method shall be as per ASTM D-543. There shall be no visible change in the films.</li> </ul> <b>Reason –</b> Increased the Resistance to Water from 24hrs to 7 Days as our country being Tropical and certain Regions have Rains Continuously for Days Added Chemical Ethyl Alcohol – 6 Hours as the Film should be resistance to Alcohol Spills if any.	No comments received	Agreed and comply the same	Discussed in meeting with firms and all firms were in view that clause may be retained as existing. "Vinyl film" will be replaced by "film".
6.1.2 1	<b>New Clause</b>	----	----	----		The issue was discussed in meeting with firms, all the firms were in view that a new clause for "Weathering test as per clause 13.3 of Part-I" should be included in Part-II. In view of same, a new clause no. 6.1.21 has been added as: <b>Durability &amp; Weathering Resistance:</b> The films shall be durable & resistant to weathering for at least six years in permanent indoor-exposure. No kind of detachment, cracks, bubbles or similar effects shall occur during the applied state. The supplier shall submit proof of test from reputed independent laboratory (Govt. Accredited) of accelerated weathering, UV and environmental exposure as per ASTM G152 using xenon arc/QUV panel machines at 0.63 nanometer UV A lamps with 4 hour condensation and 4 hour UV exposure for min at 1000 hrs. Post cycle specular gloss value, delta E colour change; visual discolouration has to be reported. The colour



						change should not be more than delta E=3, measured by approved photo spectro densitometer (The instrument measures colour value).
<b>7.0 Marking of the Product:</b>						
7.1	The marking of the product shall be as per clause 6.6 of Part-I of this specification.	No comments received	No change	No comments received	Agreed and comply the same	----
<b>8.0 Packing:</b>						
8.1	The packing of the product shall be as per clause 10.0 of Part-I of this specification.	No comments received	No change	No comments received	Agreed and comply the same	-----
<b>9.0 Guarantee and replacement:</b>						
9.1	Guaranty of the product shall be 6 years from the date of application against manufacturing defects, fading of color/pigments, loss of adhesion, poor workmanship and any other defects which may contribute to unsatisfactory performance of film	Along with Guarantee & replacement. It is required to incorporate e-warranty system should be given for every coaches by the Original film manufacturer. The mechanism of e-warranty system influence correct methodology of application & tracking system if there are any quality issues of the film and installation error.	Same (No change)	No comments received	Agreed and comply the same	The suggestion of M/s 3M was discussed in the meeting with firms. All the firms were in view that alongwith Guaranty & Replacement, E-warranty by OEMs should also be included for more transparency about the product. The firms also brought out that E-warranty of film include individual coach no., date of application, firm and OEM name on line etc which can be accessed by the user at anytime. In view of same, the clause may be modified as: Guaranty of the product shall be 6 years from the date of application against manufacturing defects, fading of colour / pigments, loss of adhesion, poor workmanship and any other defects which may contribute to unsatisfactory performance of film.
9.2	The manufacturer/supplier shall replace all the films rejected on final acceptance due to their noncompliance with the requirements and those product that show deficiencies during the time period of guarantee by products complying with the requirements within a period of six weeks.	No comments received	Same (No change)	No comments received	Agreed and comply the same	As discussed in the meeting with firms the clause may be modified as: The manufacturer/supplier shall replace all the films rejected on final acceptance due to their noncompliance with the requirements and those product that show deficiencies during the time period of guarantee by products complying with the requirements within a period of four weeks. The firm shall provide E-warranty of the film from the OEM
<b>Option B- Printable Vinyl Films:</b>		No comments received	<b>Suggestion: Option B – Printable Vinyl Films</b> The graphic film will consist of three layers namely the base film (PVC), adhesive layer and release liner. The	No comments received	No comments received	“Printable Vinyl film” will be replaced by “Printable films”.

			completed film should be over laminated and edge sealed			
1.0	The color of printable vinyl film shall be mutually agreed between the IR/Consignee and manufacturer/supplier of printable vinyl film for interior application of the IR coaches and shall meet the following requirements:	No comments received	<b>BASE FILM REQUIREMENTS</b> <b>1.1.1</b> Base Film will be cast PVC film having thickness not more than 50 microns. Plasticizers and other additives materials must not emerge or exude. The films shall not include any materials having harmful effects on painted surfaces, human beings and environment. <b>1.1.2</b> The film shall be white in color with whiteness index of 100 to 90 as per test method ASTM E 313. <b>1.1.3</b> Thickness: The nominal thickness of the unprinted film including adhesive shall be between 0.070 mm to 0.090 mm. The test procedure for measuring thickness is ASTM D 3652. <b>1.1.4</b> The Base Film should be Complaint and Passes the Standard of EN45545 R1 at HL3, Certificate to be provided.	No comments received	Agreed and comply the same	Comments of M/s Avery Dennison not accepted. Discussed in meeting with firms and all firms were in view that clause may be retained as existing. "Vinyl film" will be replaced by "film".
1.1	The printable vinyl film shall be provided with anti-graffiti over laminate to avoid any manual graffiti on the surface of the film.	No comments received	<b>1.1 REQUIREMENTS FOR ADHESIVIES</b> <b>1.1.2</b> The adhesive shall stick, without the use of an activator such as solvents or heat, on any metallic and painted, primered, polished and clean surfaces, free from any grease or silicone without producing wrinkles, rolling up, tearing or detaching. <b>1.1.3</b> The adhesive should be of gray color acrylate base. The gray color adhesive will provide good hiding power so that color of the coach does not affect the printed graphic colors and they appear vibrant. <b>1.1.4</b> The adhesive should have features of controlled adhesive release which will protect the paint of the coach. After the release liner has been removed, the films having controlled release adhesive shall be able to slide freely on the substrate before its final installation. Film can be positioned and finally applied by squeezing out permanent adhesive using a nylon molded squeeze without using any activator such as solvent or heat. <b>1.1.4</b> The graphics film should have inbuilt air channels in the adhesive layer to ensure release of air bubbles during application which will result in fast application	No comments received	Agreed and comply the same	Comments of M/s Avery Dennison already covered in 6.1.12 of Part-II which is referred in clause 1.5 below. "Vinyl film" will be replaced by "film".
1.2	The printable vinyl film shall be able to be	No comments received	<b>REQUIREMENTS FOR RELEASE</b>	• Solvent, Eco Solvent,	Agreed and comply the	Comments of M/s Avery

	printed with suitable printing method/technology. The manufacturer/supplier shall suggest suitable printing method/technology along with inks used for printing on such printable vinyl film. The pigment of printable vinyl film and ink used for printing should not be hazardous to health and environment and shall be compliant to National/International health and environmental norms. A documentary proof regarding the compliance of the above should be provided.		<p><b>LINER</b></p> <p>1.2.1 The release liner protects the adhesive against dirt contamination and prevents the film from unintended agglutination.</p> <p>1.2.2 The release liner will be paper, coated with polyethylene on both sides to have resistance to moisture and solvent during printing and application.</p> <p>1.2.3 In addition, the adhesive power of the release liner shall not be so strong that the adhesive detaches on removal of the release liner.</p>	<p>LATEX or any Digital Printing technology? - In Our Opinion/Suggestion: It should be clearly mentioned for uniformity in Printing (e.g. latex or Eco Solvent). Solvent printing is not recommended as it contains Volatile Components and very strong odour which can be harmful.</p> <ul style="list-style-type: none"> <li>Type of Base Printable Vinyl as well as Over Lamination is now here clearly mentioned, whether it will be PVC Polymeric or PVC Cast? - In Our Opinion/ Suggestion: Since it is Six years Warranty, then it should be Cast Vinyl only.</li> </ul>	same	Dennison and M/s LG Hausys have been already covered in the clause. "Vinyl film" will be replaced by "film".
1.3	The manufacturer/supplier shall get approval of design/pattern to be printed on printable vinyl film by the IR/Consignee.	No comments received	<p><b>1.3 REQUIREMENTS FOR PRINTING OF BASE FILMS TO CONVERT INTO GRAPHICS</b></p> <p>1.3.1 Films shall be printed with digital printing technology with ecofriendly low emission solvent inks.</p> <p>1.3.2 The graphic has to be printed with printing resolution of the minimum of 720 dpi by 1440 dpi (dots/inch).</p> <p>1.3.3 The printing inks shall be approved by the manufacturer of the graphics film and should carry a comprehensive warranty for minimum of 6 years against any kind of fading of colors and cracking.</p>	No comments received	Agreed and comply the same	M/s Avery Dennison comments are not accepted. During meeting all firms were agreed with existing clause. "Vinyl film" will be replaced by "film".
1.4	The finished graphic prior to application should be able to pass the anti-graffiti test when tested as per ASTM D6578 where all the marking agents should be removed with an average rating of not less than 8.	No comments received	<p><b>1.4 REQUIREMENTS OF EDGE SEALING OF PRINTED GRAPHICS</b></p> <p>1.4.1 Edge sealing is required on the edges of the vinyl to give protection against peeling off of the graphics film and preventing damages of the graphics film against vandalism.</p> <p>1.4.2 The edge sealing material shall be clear acrylic/alkyd/PU resin applied on all the overlap joints of the film and end edges of the film with at least 10 mm footprint covering 4 mm on both the exposed edges.</p> <p>1.4.3 A slight change is expected in the gloss value at the joints where edge sealer is applied depending on the viewing angle. The edge sealer should become water resistant within four hours of application.</p>	No comments received	Agreed and comply the same	Clause to be revised as marked. Comments of M/s Avery Dennison regarding requirement of edge sealing has already been specified under clause 6.1.10 of part-II
1.5	The printable vinyl film shall also confirm	<ul style="list-style-type: none"> <li>Base film:</li> </ul>	<b>1.5 REQUIREMENTS OF OVER</b>	No comments received	Agreed and comply the	1. Comments of M/s 3M

	<p>the requirements given under clauses 6.1.2, 6.1.3, 6.1.4, 6.1.5, 6.1.6, 6.1.7, 6.1.8, 6.1.9, 6.1.10, 6.1.11, 6.1.12, 6.1.13, 6.1.14, 6.1.15, 6.1.16, 6.1.17, 6.1.18, 6.1.19, 6.1.20 and 6.1.21 of Part-II, Option-A of this specification</p>	<p>Base film should be cast white in color with whiteness index of 100 to 90 as per the test method ASTM E313.</p> <ul style="list-style-type: none"> <li>• Material parameters as new clause:</li> <li>• Thickness range should be mentioned with the adhesives: with adhesive the base film thickness shouldn't be more than 90microns</li> <li>• Material should be RoHS compliant.</li> <li>• Self adhesive as new clause:</li> <li>• Base film should be self adhesive, and able to withstand large format digital printing requirements.</li> <li>• Adhesive power as new clause: Adhesive power should be minimum of 17N as 9N adhesive is too low.</li> <li>• Flammability requirements covered in 6.1.11.</li> <li>• Additional requirements pointed out:</li> <li>• <b>Weathering and durability:</b> The graphic films shall be high durable &amp; resistant to weathering. No kind of detachment, cracks, bubbles or similar effects shall occur during the applied state. The supplier shall submit proof of test from reputed independent laboratory (Govt. Accredited) of accelerated weathering, UV and environmental exposure as per ASTM G 152 using xenon arc/QUV panel machines at 0.63 nanometer UV A lamps with 4-hour condensation and 4 hour UV exposure for min of 1000 hrs. Post cycle specular, delta E color change, visual discoloration has to be</li> </ul>	<p><b>LAMINATE:</b></p> <p>1.5.1 The surface of the graphic films shall be over laminated with anti-graffiti over laminate to avoid any manual graffiti on the surface of the film and in an appropriate way in order to guarantee the resistance against operating stress and weather, acids, alkalis, salt solutions, scratch and tear from foreign objects.</p> <p>1.5.2 The graphics film should have an over laminate supplied by the same manufacturer of the graphics film. The over laminate should be a ETFE\PU\PET Polymer film with attractive gloss finish and should be UV stabilized, which is to be tested to ASTM G 152 for protection against deterioration and fading.</p> <p>1.5.3 Over laminate should be applied on the printed graphics as per recommendation by the manufacturer of the graphics film after the printing has been done on the graphics film.</p> <p>1.5.4 The Overlamine Film should be Complaint and Passes the Standard of EN45545 R1 at HL3, Certificate to be provided.</p>		<p>same</p>	<p>regarding Adhesive power already covered in clause 6.1.12 of Part-II.</p> <ol style="list-style-type: none"> <li>2. Weathering test has been included in spec as clause 6.1.21 of Part-II.</li> <li>3. Comments of M/s Avery Dennison regarding Flammability requirements of the film already covered in 6.1.11.</li> <li>4. "Vinyl film" will be replaced by "film".</li> </ol>
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		<p>reported. The color change should not be more than delta E=3, measured by approved photo spectra densitometer (The instrument measures color value).</p> <ul style="list-style-type: none"> <li>• <b>Adhesive color:</b> Base film adhesive should be grey in color.</li> <li>• <b>Gloss value:</b> Gloss requirements Gloss value should be mentioned in the specification for the over laminate. gloss value should be minimum of 80 when it is measured in 60 deg angle with appropriate gloss meter</li> </ul>				
<b>2.0 Marking of the Product:</b>						
2.1	The marking of the product shall be as per clause 6.6 of Part-I of this specification.	No comments received	<p><b>Marking of the Product:</b> For identification the box of the accepted finished products shall be clearly marked with capital letters having height of more than 50 mm either by printing, stamping or needle perforation. The marking should consist of the date of manufacture (month and year for example 12/04) of the finished product as well as manufacturer of the base material (cast vinyl film). To have proper traceability, one tile on each coach shall carry identification code of the OEM and applicator and the month &amp; year of application. The codes shall be assigned by OEMs in consultation with RCF or any other railway agency as specified in the tender.</p>	No comments received	Agreed and comply the same	M/s Avery Dennison comments are not accepted. During meeting all firms were agreed with existing clause.
<b>3.0 Packing:</b>						
3.1	The packing of the product shall be as per clause 10.0 of Part-I of this specification.	No comments received	Comments same as clause 10.0 of Part-I	No comments received	Agreed and comply the same	M/s Avery Dennison comments are not accepted. During meeting all firms were agreed with existing clause.
<b>4.0 Guarantee and replacement:</b>						
4.1	Guaranty of the product shall be 6 years <b>from the date of application</b> against manufacturing defects, fading of color/pigments, loss of adhesion, poor workmanship and any other defects which may contribute to unsatisfactory performance of film.	Along with Guarantee & replacement. It is required to incorporate e-warranty system should be given for every coaches by the Original film manufacturer. The mechanism of e-warranty system influence correct methodology of application & tracking system if there are any quality issues of the film	Same (No change)	No comments received	Agreed and comply the same	The suggestion of M/s 3M was discussed in the meeting with firms. In view of above, the clause may be modified as: Guaranty of the product shall be 6 years from the date of application against manufacturing defects, fading of colour / pigments, loss of adhesion, poor workmanship and any other defects which



		and installation error.				may contribute to unsatisfactory performance of film.
4.2	The manufacturer/supplier shall replace all the films rejected on final acceptance due to their noncompliance with the requirements and those product that show deficiencies during the time period of guarantee by products complying with the requirements within a period of six weeks.		Same (No change)	No comments received	Agreed and comply the same	As discussed in the meeting with firms the clause may be modified as: The manufacturer/supplier shall replace all the films rejected on final acceptance due to their noncompliance with the requirements and those product that show deficiencies during the time period of guarantee by products complying with the requirements within a period of four weeks. The firm shall provide E-warranty of the film from the OEM

**Comments/suggestions on Other than Clause mentioned of M/s Ajay Industries, M/s 3M India Limited & M/s Avery Dennison are as under:**

<p><b>5. Comments/suggestions of M/s Ajay Industries:</b></p> <p>“As evident that under the guide lines issued by your esteemed Ministry vide letter No. 2019/EnHM/11/01 dated 19.08.2019 where in it was accepted that Indian Railway has been identified as “Waste Generator”. Under these rules need to take adequate preventive measures to follow plastic waste management rules to 2016 along with amendment issued on 27.03.2018 minimize the generation of plastic waste and eco-friendly disposal w.e.f. 02.10.2109 along with other advisories issued by Ministry of Environment &amp; Health in the same context various states government and industries has already taken initiatives to strictly ban the use of “single use plastics” and all other plastic materials which cannot be recycle such as PVC (Poly Vinyl Chloride) just to the name.</p> <p>Sir, Railways have taken a decision to use Vinyl Films FOR USE ON EXTERIOR AND INTERIOR OF THE RAILWAY COACHES. Since these films are made of PVC (Poly Vinyl Chloride) which is non-biodegradable and non-recyclable and is a single use plastic thus is a big concern to environment and health of human beings as these PVC Vinyl films after being removed from coaches are being usually burnt or sent to landfills. When burnt, PVC releases carcinogenic gases, which are heavier than air and is the second most cause of cancer in the world.</p> <p>Moreover, because it is much heavier than air, it creates a blanket of gases thus reducing the supply of oxygen in the near vicinity. The ash residue of PVC renders soil, water and air acidic.</p> <p>Phthalates known as Plastizers (environmentally hazardous plastics additives) are a group of industrial chemicals that add flexibility and resilience to consumer and building products, particularly those made out of polyvinyl chloride (PVC) or vinyl plastic. Phthalate plasticizers are not chemically bound to vinyl; they can leach, migrate or evaporate into indoor air and concentrate in household dust. Building materials such as vinyl flooring and other consumer products containing phthalates can result in human exposure through direct contact and use, indirectly through leaching into other products, or general environmental contamination. Humans are exposed through ingestion, inhalation, and dermal exposure during their whole lifetimes.</p> <p>Another major concern with the use of PVC vinyl films, they are incapable to reflect solar heat and radiation, in result absorb heat rises the temperature inside of the coaches. Recently few accidents took place where in few passenger died because of heat stroke in Non-AC coaches. Information was sought by Railway Board vide letter referred Railway Board’s Letter No. 2019/M(C)/442/134 Dt 11.07.2019 in reference to Lok Sabha Question No. 4026 regarding action plan to reduce temperature in the coaches.</p> <p>Alternate ECO Friendly Solution’s:</p> <p>DuPont™ surface protection technology has been used in many market applications ranging from automotive components, bus, train, aircraft interiors and feet graphic to building surface protection. The latest application is now available on Digital Wide Format Printed materials for exterior and wall coverings for interiors.</p> <p>ECO Friendly print substrate with Tyvek for Exterior: Utilizing the expertise and technical knowhow from DuPont, our team has developed and launched Digital Wide Format Printed materials. These materials are coated on ECO Friendly print substrate with Tyvek (a 100% recyclable material proven over 50 years across the globe) with environmentally safe water-based chemicals. In addition to long durable life, it is by self having excellent reflectance of radiations i.e. reflect solar heat (more than 93% and sun light by more than 80%) to provide a great comfort to the travelers during hot summer.</p> <p>Inovis Composite wall covering for Interior:</p> <p>Inovis wall coverings are manufactured with proven DuPont™ Surface Protection Technology – Tedlar® which was developed in 1948 and been used for interior applications in bus, train and aircrafts for decades. Designed to meet the specific needs of interior spaces witnessing high traffics, Inovis wall coverings are among the highest performing wall coverings in the market and offer outstanding functionalities including stain resistance and ease of cleaning, safety and hygiene, and environment friendliness. These unique features of Inovis wall coverings help to maintain the newness and freshness of the interior space and enable clean, safe and healthy environment.</p> <p>We are ready with above ECO Friendly Solution’s, looking forward to its potential benefits towards passengers safety, new interiors and exterior look to coaches, long durable life, negligible effect to the environment etc., it is humbly requested to issue needful directives to the RDSO and PU’s to consider the use of above solutions and discontinue to use of</p>	<p>Comments/suggestions of M/s Ajay Industries has been examined and it is found that firm has given their views for discouraging the use of PVC films used for exterior and interior application in IR coaches as the PVC is a non-biodegradable and non-recyclable and is a single use plastic thus is a big concern to environment and health of human beings.</p> <p>Other firms participated in comments on RDSO draft specification have also brought to use Non-PVC film materials which should be eco-friendly and recyclable.</p> <p>In view of the comments of M/s Ajay Industries and other firms, “Vinyl/Vinyl Film/PVC Film/ Cast PVC film” have been replaced with “Non PVC, self adhesive eco-friendly and recyclable film” in whole specification.</p>
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PVC Vinyl Film, to attain long term benefits to Indian Railways, Society and Environment at large and thus fulfill the dream of Hon'ble Prime Minister "We have to move towards 'zero-defect and zero effect" Zero defect in production with no adverse effect on the environment".								
<b>1. Comments/suggestions of M/s 3M India Limited:</b>								<b>RDSO remarks</b> Additional suggestions of M/s 3M on exterior application of vinyl film is not accepted as it is not a part of specification.
	Rail advertisement	Base film	Digital Printing Requirements	Requirements of Over laminate	Finished Graphics requirements	Benefits	Quality assurance	
Additional comment	Introduce short term branding operation for short term application	White film and should be removable adhesive	Printing with low VOC & Green gold certification inks		Adhesive should be removable without leaving any residue on the rail painted surface. Base material to be RoHS compliant. Film to be stiff which leads able to apply the film without laminates.	Cost effective solution with advantages removable adhesive to keep the Rail coach fresh look without any residue		
Option-A	Intermediate branding	Introduce non-PVC base film with air release feature adhesive should have responsible property of adhesive should be removable	Printing with low VOC and green gold certification inks	Non-PVC clear over laminate gloss finish able to withstand UV and sustained environmental conditions such as high and low temperature and dirt should have anti-graffiti property	Adhesive should be removable without leaving any residue on the rail painted surface. Material to be RoHS compliant. Graphics should be having good adhesion strength of the exterior rail surface. Face graphics should be reliable to easy to clean. Finished graphics should be compliant to EN 45455 standards.	PVC free sustainable solution. Green guard certification passenger safety-fire resistance (should meet EN 45455-2 standards)	E-warranty should be given by the original manufacturer for each coaches.	
Option-B	Long term branding	Introduce non-PVC based film with air release feature adhesive should have responsible property of adhesive should be removable	Printing with low VOC and green gold certification inks.	Non-PVC clear over-laminate gloss finish able to withstand UV and sustained environmental condition such as high and low temperature and dirt should be having minimum of 85%. Gloss retention after 2 years weathering should pass anti-graffiti test.	Adhesive should be removable without leaving any residue on the rail painted surface. Base material to be RoHS compliant. Graphics should be having better adhesion strength to the exterior rail surface. Face graphics should be reliable to easy to clean. Finished graphics should be compliant to EN 45455 standards. Graphics should be durable finished. Graphics should be passed anti-graffiti test.	PVC 3 sustainable solution. Green guard certification passenger safety-fire resistance (should meet EN 45455-2 standards) long term durable solution.		
<b>2. Comments/suggestions of M/s Avery Dennison:</b>								Most of the issues raised by M/s Avery Dennison already covered in the spec.
<b>2.0 CHARACTERISTICS OF FINISHED GRAPHICS PRIOR TO APPLICATION:</b>								
2.1.1 Thickness: The film thickness shall be not more than 0.140mm +/- 15%, with sealing and print color. The test procedure for measuring thickness is ASTM D 3652.								
<b>2.1.2 Gloss Value:</b> The minimum gloss value shall be 70 achieved at 60° measured by gloss meter as per ASTM D 523. Gloss value shall not drop below 50 at 60° measured by gloss meter as per ASTM D 523, at any point of time during the service life of eighteen months from the date of application.								
2.1.3 For every tender, a control sample of size 8' x 4' appropriately numbered shall be preserved for comparing gloss values and colour properties of the finished coaches in service for that particular tender.								
2.1.4 For each rake, gloss values for two coaches shall be measured and recorded after application on the coach. The spectro densito meter should be used for recording the colour characteristics. These values along with that of the control sample should be recorded on the quality check list for each rake.								
<b>2.2 Durability and Weathering Resistance:</b>								
2.2.1 The graphic films shall be durable and resistant to weathering for atleast 24 months in permanent outdoor – exposure. No kind of detachment, cracks, bubbles or similar effects shall occur during the applied state. The supplier shall submit proof of test from reputed independent laboratory (govt. accredited) of accelerated weathering, UV and environmental exposure as per ASTM G 152 using xenon arc/QUV panel machines at 0.63 nanometer UV A lamps, with 4 hour condensation and 4 hour UV exposure for min of 250 hrs. Post cycle specular gloss value, delta E color change, visual discoloration has to be reported. The color change should not be more than delta E=3, measured by approved spectro densito meter (The instrument measures color value).								
<b>2.3 Adhesive Power:</b>								
2.3.1 The films shall stick on any metallic and painted surface, free from grease and silicone, without producing wrinkle, rolling up, detaching or tearing. The adhesive power of at least 17N – 25N as per clause 9.1								
<b>2.4 Flammability:</b> The graphic film should fall under min. class B when tested as per UIC-564-2OR Appendix 12.								

**2.5 Temperature Resistance:**  
The film shall be resistant to temperatures between -10°C and +100°C without any visible changes such as detachment cracks, bubble formation and color changes. This property is to be tested as per clause 9.3.

**2.6 Dimensional stability:**  
The shrinkage of the graphic films after application shall not exceed 0.2%. This is to be tested as per clause 9.4.

**2.7 Resistance to Detergents:**  
The graphic films shall be resistant to detergents used by the IR for exterior cleaning of the coaches. The surface of the sealed film shall not soften and the color and the adhesive power shall not change. The same applies to surface softening and to all kind of detachments (waves, bubbles etc.). This should be tested as per clause 9.5

**2.8 Wash and Attrition Resistance:**  
The graphic films shall not suffer any visible color and gloss changes, detachments, cracks, bubbles etc. during external coach washing in accordance with IR field practices. Furthermore, the films shall not expand. The graphic films along with over laminate shall not show any visible color and gloss changes when tested as per ASTM D 1044 using cleaning solution as per clause 9.5.

**5.0 TESTING THE VINYL GRAPHIC FILM**

**5.1 Adhesive power:**  
The adhesive power shall be tested as per ASTM D 3330, procedure A for 180° peel strength on a standard test panel of Stainless Steel, conditioned as per ASTM D 4332 at a peel off velocity of 360mm/minute.

**5.2 Controlled release adhesion:**  
This shall be tested visually for presence of air channels on the adhesive side of the base film after the removal of release liner.

**5.3 Temperature resistance:**  
Two test specimens 25mm x 200mm are stuck onto test plates of stainless steel, polished to a completely plane surface and are subsequently stored at standard reference atmosphere. The specimens are subjected to temperature changes for seven cycles-each cycle comprising of 8 hours of - 10°C and 16 hours of 100°C.

**5.4 Dimensional stability:**  
Four 160 mm x 160 mm test specimens are stuck onto degreased and etched aluminum plates with the dimension of 150 x 150 x 8 mm and are stored for 72 hours in standard reference atmosphere. The projecting test specimen is then cut with a sharp knife (razor blade) along the test plate. Afterwards, the test specimens are stored for 48 hours at 700 C and are then cooled down for 2 hours in standard reference atmosphere of 23 +/- 10 C and 50% relative humidity. Measurement of the shrinkage at two measuring points in longitudinal and transverse directions should be done.

**5.5 Resistance against detergents:**  
The test is to be carried out with two, test solutions.  
Duration of test: 24 hrs.

'A' Solution:	'B' Solution:
40% phosphoric acid 15% emulsifying agent 45% water (distilled)	10% Fatty alcohol polyethylene Glycol ether - 10% Sodium cumene sulphonate (40% solution) - 5% NTA liquid (40% solution) Trilon A, BASF - 5% Triethanolamine - 20% Totally demineralized water - 60%

Emulsifying agent: Oleyl - stearyl alcohol mix (with iodine value 50) with 10-mol ethylene oxide.  
Max. Application concentration for test solution A and B 1:4 respectively.

**5.6 Fire Worthiness**  
The **Decorative** prepatterned vinyl film for interior application of the coach shall comply to the fire worthiness properties and Should Meet the Requirements of EN45545 for Set R1 (EN45545-2 + A1:2015) for a **HL3** Hazard Level Classification as per Below Table:

Requirement set (used for)	Test Method Reference	Parameter Unit	Requirement Definition	HL3
R1 (IN1A;1N1B;IN1D;IN1E; 1N4; 1N5; 1N6A; IN7; IN8; IN9B; IN11; IN12A; IN12B; IN14; F5)	T02 ISO 5658-2	CFE kW/m2	Minimum	20 a
	T03 01 ISO 5660-1 : 50 KW/M2	MARHE kW/m2	Minimum	60
	T10.01 EN ISO 5659-2 : 50 KW/M2	Ds(4) dimensionless	Minimum	150
	T10.02 EN ISO 5659-2 : 50 KW/M2	VOF4 min	Minimum	300
	T11.01 EN ISO 5659-2 : 50 KW/M2	CITG dimensionless	Minimum	0.8

**Reason –**  
EN45545 R1 at HL3 is the most stringent Test and comprises all other fire test & Only 1 Certificate is enough to establish it Fire Behavior.

**6.0 Credentials – OEM of Base, Over laminate Film & Edge Sealant**  
The OEM should be India Registered, should have Self Adhesive Vinyl Manufacturing Presence in India along with PAN India Network and Operations in India for more than 12+ yrs. A documentary proof for all should be provided.



