



**BEML LIMITED**  
**BENGALURU**  
**R & D CENTER**

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**MRS1 Project**  
**Procurement Technical Specification**  
**of Coloured Graphic Film for Exterior**  
**Wrapping of Metro carbody**  
**& Exterior Labels**

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	Name	Date	Signature
Approved By	PV Gayathri	16.06.2020	
Reviewed By	Krishna Prasad B	16.06.2020	
Prepared By	Sunil Kumar R	16.06.2020	



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## 1. Introduction

### 1.1. General

This Procurement Technical specification (PTS) specifies the Technical requirements of Coloured Graphic Films for exterior wrapping of Stainless steel Metro car & Exterior labels on “Supply & Apply” basis, for the MRS1 project to be supplied for Mumbai Metro Line - 2 & 7.

BEML will carry out all required works and activities as Contractor to the Employer for MRS1 project, while the subcontractor shall be responsible for all works required in this PTS with regard to Coloured Graphic film and exterior labels on Supply & Apply basis and shall be responsible for supporting the BEML activities as contractor for MRS1 project.

The scope of work includes all items of work which may be required to meet the performance requirements, reliable and efficient operation of trains and meeting the best international practices even if not specifically mentioned in this PTS.

### 1.2. Train Composition

The rake formation shall generally be as follows:

3 Car unit formation : DM – T – M –

6 Car Train formation: DM –T–M – M – T – DM

In case of 8-car formation (if required):

2 Car train formation : – T – M –

8 Car Train formation: DM – T – M – T – M – M – T – DM

where,

DM : Driving Motor Car

T : Trailer Car with pantograph

M : Non -Driving Motor Car

### 1.3. Climatic & Environmental Conditions

The car shall operate reliably and safely under the climatic and environmental conditions of Mumbai. Accordingly, the coloured graphic films shall be designed to operate with satisfactory performance under the following Mumbai environmental conditions.

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Description	Limiting Values
Maximum ambient temperature (See note below)	36 °C
Minimum temperature	14.3 °C
Humidity	≥ 95% RH
Rainfall	The annual precipitation is 2,078 mm with 34%(709mm) falling in the month of July.
Atmosphere during hot season	Extremely dusty including bird feathers
Maximum wind speed	150 km/h
Vibration and Shocks	The sub-systems & their mounting arrangements shall be designed to withstand satisfactorily the vibration and shocks encountered in service as specified in IEC 61373 and IEC 60571.
SO <sub>2</sub> level in atmosphere	80 – 120 mg/m <sup>3</sup>
Suspended particulate matter in atmosphere (TSPM)	360 – 540 mg/m <sup>3</sup>
Flood Proofing	The traction sub-systems mounted on the under-frame will be designed to permit propulsion of the train at 10 kmph through water up to a depth of 50mm above rail level. Traction sub-systems shall be made splash proof in accordance with International Standards
Life	The Metro car is designed for min. 35 years of life. Accordingly, the subject items & accessories shall also not deteriorate in their performance for 35 years

**Note:**

- 1) The temperature of the metal surfaces of the vehicles when exposed directly to the sun, for long periods of time, may be assumed to rise to 70 °C.
- 2) Any moisture condensation shall not lead to any malfunction or failure.
- 3) Adequate margin shall specially be built into the design particularly to take care of the higher ambient temperatures, high humidity, dusty and corrosive conditions, etc. prevailing in Mumbai area.

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#### 1.4. Vehicle Performance Requirements

The vehicle performance requirements with fully loaded train and tangent track are as per the following table.

Item		All Corridors
Safe speed	With inflated secondary suspension	90 kmph
	With deflated secondary suspension	80 kmph
Maximum operational speed	With inflated secondary suspension	80 kmph
	With deflated secondary suspension	70 kmph
Minimum Design Average Acceleration rate for fully loaded (AW3) train on level tangent track shall be as under: 0 kmph to 40 kmph 0 kmph to 60 kmph 0 kmph to 80 kmph		1.0 m/s <sup>2</sup> 0.75 m/s <sup>2</sup> 0.40 m/s <sup>2</sup>
Minimum Operational Average Acceleration rate for AW2 loaded train on level tangent track shall be as under: 0 kmph to 35 kmph 0 kmph to 60 kmph 0 kmph to 80 kmph		1.20 m/s <sup>2</sup> 0.80 m/s <sup>2</sup> 0.45 m/s <sup>2</sup>
Average Service braking rate from 80 kmph to standstill for fully loaded(AW3) train on level tangent track.		1.0 m/s <sup>2</sup>
Average Service braking rate from 80 kmph to standstill for AW2 train on level tangent track.		1.1 m/s <sup>2</sup>
Average Emergency braking rate from 80 kmph to 0 kmph for fully loaded trains on level tangent track		1.3 m/s <sup>2</sup>
Jerk rate (Maximum)		0.75 m/s <sup>3</sup>
Annual running distance of one train (for design purpose)		150,000 km
Note : The specified average minimum acceleration shall be the finally achieved values inclusive of the specified jerk rate		

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### 1.5. Track structure Parameters

The MRS1 cars will operate with the track parameters as specified in the following table:

Description	Elevated and At-grade Corridor		Underground Corridor
	Ballasted	Ballast less (DFF)	Ballast less (DFF)
Track Laying Gauge	1435 mm		
Rail Type (Main Line & Depot)	60 EI (UIC 60) 880/HH	60 EI (UIC 60) 1080/HH	60 EI (UIC 60) 1080/HH
Rail Profile	UIC 861-3		
Inclination Of Rail	1 in 20		
Sleeper Spacing (Main line)	600 mm ± 10mm	600 mm ± 10mm	700 mm ± 10mm
Sleeper Spacing (Depot)	650 mm ± 10mm	Not applicable	
Ballast Cushion Depth(Main line)	300mm	Not applicable	
Ballast Cushion Depth (Depot)	250mm	Not applicable	
Standard Rail Length	13m and 18m	18m	
Rail Panel Lengths	Longer than 200m		
Minimum Radius of Curvature	200m-Underground 110m-Elevated 100m-Depot		
Minimum Turn out Radius.- (Main line)	1 in 9 - 300m radius 1 in 7- 190m radius		
Minimum Turn Out Radius Depot	1 in 7 - 190m radius		
Maximum Cant Permissible	110 mm		
Maximum Cant Desirable	110 mm		
Maximum Cant Deficiency Permissible	85mm		
Maximum Cant Deficiency Desirable	85 mm		
Maximum Permissible Cant Gradient	1 in 440		
Maximum Desirable Cant Gradient	1 in 720		
Turn-out Speed : Turnout (1 in 9) R-300	45 km/h	45 km/h	40 km/h
Turn-out Speed : Scissors (1 in 9) R-300	45 km/h	45 km/h	40 km/h
Turn-out Speed : In Depots (1 in 7) R-190	35 km/h	35 km/h	25 km/h
Turn-out Speed : Turnout (1 in 7) R-190	35 km/h	35 km/h	25 km/h



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Turn-out Speed : Turnout(1 in 12) R-410	50 km/h	50 km/h	50 km/h
Turn-out Speed : Turnout(1 in 12) R-410	50 km/h	50 km/h	50 km/h
Turn-out Speed : Turnout (1 in 8.5) R-218	30 km/h	30 km/h	30 km/h
Turn-out Speed : Turnout(1 in 8.5) R-218	30 km/h	30 km/h	30 km/h
Maximum Gradient Main Line	4%		
Maximum Gradient Depot Connection	4%		
Minimum vertical curve radius of curvature	1500m		

#### 1.6. Principal Notional Vehicle Dimensions/ Leading Particulars

Description		Dimension
Gauge		1,435 mm
Maximum Length over body(including end-fairings)	DM car	22,010 mm
	T and M cars	22,010 mm
Maximum Length over couplers for all cars		23,000 mm
Maximum Width over Body		3,200 mm
Minimum Passenger Saloon Headroom		2,050 mm
Locked down pantograph height for 25kV AC cars from rail level at Car Centre Line		4,048 mm
Maximum Floor height above rail level of any unloaded vehicle		1,130 mm
Minimum Floor height above rail level of fully loaded vehicle		1,100 mm
Maximum height of coupler above rail level for unloaded vehicle		815 mm
Minimum height of coupler above rail level for fully loaded vehicle		740 mm
Bogie Wheel Base	Maximum	2400 mm
	Minimum	2200 mm
Distance between bogie centres	Maximum	15,100 mm
	Minimum	14,400 mm
Wheel diameters	New	860 mm
	Fully worn	780 mm
Maximum axle load		17 Tonne (including all tolerances as per IEC 1133-1992)

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## 2. Definitions

The following definitions are applicable to this PTS.

**“Employer”** means Delhi Metro Rail Corporation Limited (DMRC), its legal successors and assignees.

**“Subcontractor”** means the Supplier who supplies the required coloured graphic films to BEML for MRS1 project.

**“Contractor”** means the person or persons appointed by the Employer to undertake the execution of the works for MRS1 project.

**“Contract”** means the contract between Subcontractor and BEML in relation to the supply of coloured graphic films for MRS1 project.

**“Engineer”** means any person nominated or appointed from time to time by the Employer to act as the Engineer for the purposes of the Contract and notified as such in writing to the Contractor.

**“Engineer's Representative”** means any Assistant of the Employer appointed from time to time by the Employer.

**“BEML”** means the Contractor to procure the coloured graphic films for MRS1 project.

## 3. Qualification Criteria

- (i) The scope of work includes external wrapping of Stainless Steel Metro carbody with self-adhesive Coloured vinyl graphic films & Exterior labels on “Supply & Apply” basis. Accordingly, the sub-contractor shall be an OEM of cast vinyl graphic films with experience in application or an authorized convertor and applicator of graphic film OEM.
- (ii) The subcontractor shall have experience in supply and apply of graphic films for Exterior wrapping of stainless steel Railway vehicle carbody. Certificate of compliance by graphic film OEM as proof for having experience in train wraps on stainless steel carbody shall be submitted by the subcontractor.
- (iii) The supplied and applied graphic films on carbody exterior, by the subcontractor, should have been in use and have established their satisfactory performance and reliability on at least three Mass Rapid Transit Systems in revenue service over a period of three years or more (in each MRTS) either outside the country of origin in three different countries or in an MRTS in India. Satisfactory Revenue service performance certificates for a period of 3 years or more from end users/ Metro Operators for the above shall be submitted along with the technical offer.
- (iv) The sub-contractor, if a convertor and applicator, shall have valid authorization letter against this tender from the graphic film OEM for supply and apply of the OEM films. The graphic film OEM shall also submit a letter of certification that the proposed applicator has requisite knowledge on the subject films, has been trained by the OEM on application and removal of their films on stainless steel railway rolling stock.

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- (v) Along with the technical offer, the subcontractor shall fill-up vendor approval form for their supplies meeting the above requirements, and submit for DMRC vendor approval. Selection of vendor is subject to DMRC approval.
- (vi) The firm should undertake to provide the support during DLP period.
- (vii) The firm should give an undertaking to supply spares for a minimum period of 10 years from the date of last car supplied by BEML under this contract.

#### **4. Scope of work**

The scope of work includes external wrapping of Stainless steel carbody & exterior labels of Mumbai Metro Line-2 & line-7 cars on “Supply and Apply basis” by the sub-contractor. The scope of work covers the supply of graphic film and all materials including the tooling and consumables required for application of the film and the application of the film on Metro carbody in the premises of the designated Depots or BEML factory. The sub-contractor shall make his own arrangement for the required labour, materials and any other accessories, deemed essential, for the proper application of the graphic films.

#### **5. Place of application of the graphic film**

Mumbai Metro Depots or BEML factory. The sub-contractor shall employ qualified and trained team for application in both the places.

#### **6. Area of application**

The wrapping is to be applied to the train sides only including door leaves and excluding window glasses. The colour scheme and the respective area of application shall generally be as per the attached drg nos GR/4504, GR/4505, 525-28101 & 525-28201. However, the subcontractor shall take actual measurements on the Metro cars in accordance with design at his own cost and expense after award of the contract.

#### **7. Rolling Stock details**

The wrapping is to be applied to the exterior of the Metro car side wall including door leaves but excluding side glass windows.

The Car body side wall skin is made of Austenitic Stainless steel to grade SUS 301L-DLT with 2J finish. Spot-welding is the major welding process adopted for joining of the side wall skin to inner frame and hence thousands of spot welds exist on the outer side wall skin. Two Longitudinal seam-weld joints running along the entire length of the car are provided on the outer side wall skin. The door outer skin material is Austenitic Stainless steel to grade SUS 304 2J finish.

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The sub-contractor shall take note of the car body exterior window glasses and the exterior sealant application on the complete side wall.

The subcontractor shall offer compatible and durable coloured graphic film considering the above carbody details.

The Exterior labels are exterior grade, weather resistant cast vinyl labels. The exterior labels generally include company logo, Car Nos., lifting & Jack points.

## 8. Technical Requirements

### 8.1. General

The Wrapping material shall be cast vinyl pre-pigmented graphic films with self adhesive. The finished product shall consist of three layers viz., graphic film, adhesive and release liner and an over laminate film and edge sealed after application. The graphic film (along with adhesive and Liner), the Over laminate and edge sealer shall be offered by the graphic film OEM taking into account 8 years durability in the environmental conditions in which the graphic film has to operate and Metro car running and maintenance conditions. Technical Data sheets shall be submitted along with the technical offer.

The product offered against this PTS shall have a durability of 8 years in the Mumbai environmental conditions and in the Rolling stock operational conditions of Line-2 & Line-7 of Mumbai. The test report proving 8 years durability shall be submitted along with the technical offer.

The cast pre-pigmented vinyl film shall be supplied in different colours as per the attached colour scheme drg nos.GR/4504 and GR/4505.

All material selected for external wrapping including adhesive shall comply with the following requirements:

- Compatible with Stainless steel car body and painted door materials.
- substantially free of halogen and shall be environmental friendly and shall not include any elements that may cause environmental problems or handling hazards.
- No material should be used which, in their normal installed state, emit products that are known to be toxic or irritative.
- Suitable for the prevailing summer, winter and monsoon climates in Mumbai
- Resists alkalis, acids, salt and water.
- Guaranteed colour-fast lifetime of minimum of 8 years of full-time operation
- Comply with EN 45545 HL-3 R7 Fire safety standards
- Resistant to auto wash plant cleaning brushes and detergents.

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- The product after removing should leave no adhesive residue.
- The external wrapping material should not get torn away even when the train is running at maximum operational speed of 80 kmph in extreme weather conditions of Mumbai city.
- The adhesive shall stick, without the use of an activator such as solvents or heat, on the Metro carbody, free from any grease or silicone without producing wrinkles, rolling up, tearing or detaching

## 8.2. Coloured Graphic Film

The graphic film shall consist of three layers namely the base film, adhesive layer and release liner. The completed film shall be over laminated and edge sealed after application

### 8.2.1. Base film

Base Film shall be pre-pigmented cast vinyl film which is 3D conformable  
Thickness ~ 70 microns ( only film).

Plasticizers and other additives materials must not emerge or exude.

The films shall not include any materials having harmful effect on stainless steel surfaces, human beings and environment.

No digital/ screen printing permitted.

Required Pre-pigmented Colour films :

Colour	
Red	RAL 3028 for Line-7
Blue	Pantone 287c
Yellow	RAL 1021 for Line-2
White	RAL 9010

### 8.2.2. Adhesive

Adhesive shall be Repositionable clear solvent based acrylic adhesive

The adhesive shall stick, without the use of an activator such as solvents or heat, on stainless steel 2J finish surfaces, free from any grease or silicone without producing wrinkles, rolling up, tearing or detaching.

The adhesive should have features of controlled adhesive release, which will protect the surface 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

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applied by squeezing out permanent adhesive without using any activator such as solvent or heat.

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” or “With inbuilt air release Channels”

### **8.2.3. Release liner**

The release liner shall be highly stable PE coated paper with moisture resistance.

The release liner shall protect the adhesive layer against dirt contamination and prevent the film from unintended agglutination.

The adhesive power of the release liner shall not be so strong that the adhesive detaches on removal of the release liner.

The brand name of the manufacturer should be clearly printed on the release liner for easy identification.

### **8.2.4. Edge sealing of graphic film**

Edge sealing is required on the edges of the graphic film to give protection against peeling off of the graphics film and preventing damages of the graphics film against vandalism.

The edge sealing material shall be clear acrylic/alkyd/PU resin or an approved clear tape that shall be applied on all the overlap joints of the film and the ends/ edges of the film with at least 10 mm footprint covering 5 mm on both the exposed edges.

The edge sealer shall become water resistant within 4 hours of application.

### **8.2.5. Over laminate**

The surface of the graphic films shall be over laminated to guarantee the resistance against operating stress and weather, resistance to scratch and tear from foreign objects.

The graphics film shall have an overlamine supplied by the same manufacturer of the graphics film. The overlamine shall be anti-graffiti film and should be UV stabilized.

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### 8.3. Finished Exterior Films prior to application:

**Thickness:** The film thickness shall be not more than 0.170mm +/- 15%.

**Tensile Strength :** The tensile strength shall be measured as per ASTM D1000 and shall have a minimum value of 100 N/25mm.

**Gloss Value:** The minimum gloss value shall be 80 achieved at 60° measured by gloss meter as per ASTM D 523. Gloss value retention after 8 years should not be less than 85% of the initial value measured by same ASTM method.

#### **Durability & Weathering Resistance:**

The graphic films shall be durable & resistant to weathering for at least 8 years in permanent outdoor-exposure. No kind of detachment, cracks, bubbles or similar effects shall occur during the applied state. Accelerated weathering, UV and environmental exposure test reports as per SAE J 2527 for a minimum of 1500 hrs. from accredited labs shall be submitted. Post cycle specular gloss value, delta E color change, visual discoloration has to be reported and shall not be more than delta E = 3.

**Adhesive Strength:** 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 strength shall be min. 17N/25mm on steel on 24 hrs of application as per ASTM D3330 procedure-A for 180°.

**Fire Safety :** The graphic film shall comply with EN45545-2 HL3 R7 and the test reports from accredited labs as per EN 17025 shall be submitted. Heat release rate of the film shall be minimum and shall be tested and reported.

**Temperature Resistance:** The film shall be resistant to temperatures between -10°C and +90°C without any visible changes such as detachment cracks, bubble formation and color changes.

**Dimensional Stability:** The shrinkage of the graphic films after application shall not exceed 0.2%.

**Resistance to Detergents & Auto Wash plant:** The graphic films shall be resistant to detergents and Auto wash plant brushes and their operation. The applied film shall not get affected by the rotational speed of the Auto-wash plant brush and the used detergents.

The graphic films shall not suffer any color and gloss changes, detachments, cracks, bubbles, expansion, softening, adhesion loss, etc. during coach washing at the Auto-Wash plant.



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The graphic film OEM shall undertake to study the Mechanised Cleaning of the Metro cars and the brushes and detergents used in the Auto Wash plant in the depot and shall guarantee that the offered product and its performance is not affected because of the regular mechanized cleaning of the cars in the depot.

**Anti-Graffiti:** The finished graphic prior to application should be able to pass the anti-graffiti test ASTM D 6578 where all the marking agents should be removed with an average rating of not less than 8.

Resistance to Acid Alkali, Salt spray and moisture shall be as per table. 1.

#### 8.4. Exterior Labels

The technical requirements of exterior labels are similar to exterior wrapping films detailed at clause 8.2 & 8.3. However, the exterior label films shall be of printable quality whereas exterior wrapping film are pre-pigmented films.

Sl. No.	Description	Exterior Labels	
		Vinyl labels	
1.	Face film		
	Material	Cast vinyl	
	Thickness	80 μm ± 10%	
2.	Adhesive		
	Material	Clear, Acrylic	
3.	Over laminate film		
	Thickness	40 μm ± 10%	
	Gloss	Min 80 at 60 <sup>o</sup>	
	UV Stabilized	Yes	
	Anti-graffiti	Min 8 as per ASTM D6578	
4.	Liner		
	Material	Kraft Paper coated with polyethylene on both sides	
5.	Total film thickness	170 μm ± 15%	
6.	Type of printing	Screen printing	
7.	Durability	8 years	
8.	Dimensional stability as per DIN 30646	0.2 % Max	
9.	Temperature Range		



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	Application Service	10°C Min. -10°C to 90 °C
10.	Adhesion on steel on 24 hrs on application as per ASTM D3330	Min.1400 -1500 gm / 2.5 cm
11.	Tensile strength as per ASTM D 1000	Min.30 N / 2.5 cm
12.	Acid & Alkalis (salt solutions 7 hrs in 1/10 Sulphuric acid and 1/10 NaOH)	No peeling off, edge lifting or deterioration in properties/appearance
13.	Rub resistance (200 cycles at 2 kg load in a rub tester as per BS 3110)	Printed text shall remain legible.
14.	Fire safety requirements	EN45545-HL3 R7
15.	Weather Resistance as per SAE J 2527	Min. 1600 hrs
16.	Salt spray (5% NaCl aq. At 35°C for 240 hrs. ASTM B117)	No peeling off, edge lifting or deterioration in properties/appearance
17.	Moisture resistance (168 hrs immersion at 50°C and 95% RH)	No peeling off, edge lifting or deterioration in properties/appearance

Table 1: Physical & Mechanical Properties of Exterior Labels

#### 8.5. Service Life

The sub-contractor shall ensure a guaranteed revenue service life of 8 years for the proposed and supplied Coloured Graphic Films and exterior labels.

#### 8.6. Fire Safety

The Coloured Graphic Film & Exterior labels shall be selected to reduce to the maximum extent practical, the heat load, rate of heat release, propensity to ignite, rate of flame spread, smoke, emission and toxicity of combustion gases

The Coloured Graphic Film & Exterior labels shall confirm to fire safety requirements as per EN 45545, HL-3 R7 requirements. Fire safety test reports as per EN 45545 HL-3 from labs accredited as per EN 17025 shall be submitted before FAI.

#### 8.7. Compatibility to Graphic film to Carbody side Wall Material

The graphic film OEM shall submit a letter of Guarantee that the products offered against the tender will not in anyway affect the base Stainless steel carbody material. SUS 301L-DLT 2J finish and the offered film along with adhesive has been tested and certified for

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compatibility with stainless steel material and that the application and removal will not affect the finish/ aesthetics / appearance of the substrate stainless steel or affect the life and utility of Stainless Steel car body material.

#### **8.8. Graphic Film Removal/ Repair**

The subcontractor shall submit the detailed procedure for graphic film removal and repair work, along with the technical offer.

#### **8.9. Workmanship and Finish**

The subcontractor shall ensure that the Coloured Graphic Film shall be free from surface defects such as voids, cracks, edge delamination, waviness, discolouration and other visual defects.

### **9. Quality Assurance Program**

The subcontractor shall hold ISO 9001/ IRIS certification and shall manufacture the product accordingly. The subcontractor shall submit a copy of ISO 9001 / IRIS certification along with the offer. The subcontractor shall monitor and control the Quality systems as per ISO 9001/IRIS guidelines. BEML and/or DMRC's representative may periodically conduct compliance audits of the Subcontractor's Quality management system.

The subcontractor shall submit Quality Assurance Plan (QAP) based on ISO 9001 / IRIS guidelines.

### **10. Scope of Supply**

The sub-contractor shall be responsible for the scope of "supply and apply" of the Coloured Graphic Film and exterior labels, which shall comprise, unless specifically excluded, the design, manufacture, testing, commissioning and replacement of defective items during the Defect Liability Period and required tools for the proper installation of the Coloured Graphic Film, as a minimum.

The sub-contractor shall have responsibility for suitability of the proposed Coloured Graphic Film and exterior labels and their performance at the environmental conditions specified at Clause 1.3

BEML Production incharge, BEML quality representative/ customer inspector shall be entitled to monitor the application activities and any improvements/feedbacks suggested shall be taken up suitably.

sub-contractor shall be responsible to get the final inspection clearance from BEML QC and customer inspector and also responsible to clear all snags with respect to subject work . Any minor changes in scope of work/ drawing amendments(if any) to absorbed by sub-contractor without any additional cost.

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### **10.1. Supply of Coloured Graphic Film**

The Coloured Graphic Film and exterior labels shall be supplied as per the drawing dimensions and confirming to this PTS requirement, as a minimum.

Technical Data Sheets of the graphic film with adhesive, the over laminate and the edge sealer shall be submitted by the graphic film OEM, along with the technical offer.

The graphic film OEM shall submit a letter of compliance stating that the graphic films offered against this tender are selected by them keeping in view the Mumbai Environmental conditions and Operational parameters of the Metro car and all the technical requirements of this PTS to provide a satisfactory revenue service performance of 8 years without any peel off, blistering, bubbling, delamination, edge lifting, softening, color fading, gloss and adhesion loss etc.,

### **10.2. Application Of Coloured Graphic Film & Exterior Labels**

Applications of Graphics must be done using recommended application tools as mentioned by the manufacturer of the graphic film. The applicator must show experience/training certificate of doing similar application on Railway vehicles, by the manufacturer of the graphic film. The application must be in accordance with the approved Procedure. The sub-contractor shall submit the procedure and obtain BEML/DMRC approval before application.

Application of the graphic film must be done on the surface preferably not using any soap solution and water.

The application tool shall not make any scratches on the graphics. The graphic film shall adherable on the weld areas also as shown in drawings GR/4504 and GR/4505(Refrence carbody image shown in drg).

### **10.3. Removal Of Coloured Graphic Film**

In case removal of vinyl film/residual adhesive film is required within the warranty period because of manufacturing/application defects, the subcontractor shall arrange to get the film replaced at no cost to BEML.

The time taken for removal of previous graphic & application of new graphic films should not be more than eight hours per Metro car. 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 subcontractor, without any surface damage. Within the warranty period, the removal has to be done by the subcontractor.

The removal should in no way damage the 2J finish of the Stainless steel surface of the coach. The subcontractor 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.

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#### **10.4. Method Statement For Application And Removal**

The graphic film OEM shall submit a Method Statement for the application and removal process. This shall detail any special materials and tooling required. The full technical specification of the selected film material shall be included in the document.

The Method Statement shall be submitted to BEML/DMRC for approval before commencing the application.

#### **10.5. Tools**

All the application tools required for application and removal of the graphic films is to subcontractor scope. The list of tools shall be submitted along with the technical offer.

#### **10.6. Submission of Samples**

The sub-contractor shall submit 3 no. of A4 size samples of each of the Coloured Graphic Film and exterior labels, meeting the technical requirements of this PTS and obtain BEML/DMRC approval, before application.

#### **10.7. Packing**

The Subcontractor shall pack properly in order that in transit and after supply of the Coloured Graphic Film to the place allocated by BEML, no damage to the Coloured Graphic Film shall occur.

### **11. Type Tests & Routine Tests**

The Coloured Graphic Film and exterior labels shall be type and routine tested in accordance with relevant standards and specifications by the graphic film OEM. All such tests shall be carried out at the sub-contractor's cost, wherever performed, in the presence of and to the satisfaction of BEML and DMRC, who reserves the right to witness any or all of the tests and to require submission of any or all test specifications and reports.

The type test procedure/ protocol describing all tests to meet the technical requirements of this PTS, the international standards adopted, the testing equipment used, the acceptance criteria shall be prepared by graphic film OEM, submitted to BEML/DMRC and approval obtained before undertaking the tests.

All the tests shall be carried out at external accredited labs, at sub-contractor's cost. If graphic film OEM has in-house test facilities and the labs are accredited, then, tests can be carried out in-house. However, Accelerated weathering and Durability type tests shall necessarily be carried out at external accredited labs.

BEML and DMRC reserve the right to reasonably call for additional tests, if necessary.

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Sl. No.	Kind of Test	Test Method	Type Test	Routine Test
1	Thickness	I.S. 7809 Pt-II, ASTM D3652	O	O
2	Total thickness	I.S. 7809 Pt-II, ASTM D3652	O	O
3	Adhesion test	On stainless steel after 24 hrs of application as per ASTM D3330	O	O
4	Tensile strength	ASTM D 1000	O	O
5	Dimensional Stability	DIN 30646	O	-
6	Gloss at 60°.	ASTM D 523 by Gloss meter	O	O
7	Anti-graffitti	ASTM D 6578	O	
8	Acid & Alkali Resistance	7 hrs in 1/10 Sulphuric acid and 1/10 NaOH	O	-
9	Rub resistance for exterior labels	200 cycles at 2 kg load in a rub tester as per BS 3110	O	-
10	Weather Resistance	SAE J 2527	O	-
11	Moisture resistance	168 hrs immersion at 50°C and 95% RH	O	-
12	Salt spray	5% NaCl aq. At 35°C for 240 hrs. ASTM B117	O	-
13	Fire Safety	EN 45545 HL-3 R7	O	-
14	Wash plant trials	Resistant to wash plant chemicals and brush	O	-

### 11.1. First Article Inspection (FAI)

The subcontractor shall offer the Coloured Graphic Film for First Article Inspection by BEML/ DMRC in accordance with the BEML/DMRC approved FAI plan prior to serial production in order to confirm that the item produced fully complies with the approved technical specifications, System design and manufacturing process.

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The Subcontractor shall ensure that the produced Coloured Graphic Film is compliant to all requirements prior to inviting for testing and FAI. The pre-test result prior to official testing/FAI shall be submitted with the invitation letter to request BEML/ DMRC witness.

At the FAI, the subcontractor shall make available all pertinent design and manufacturing process documentation, test records, material certifications, etc.

During FAI ,if any inspections or tests indicate that specific hardware or documentation does not meet the specified requirements, the appropriate items shall be repaired, replaced, upgraded, or added by the Subcontractor at their own cost, as necessary to correct the noted deficiencies. After correction of deficiency, all tests necessary to verify the effectiveness of the corrective action shall be repeated.

If FAI has to be repeated due to non-compliances / deficiencies noticed, the cost towards the same and the cost towards BEML/DMRC visit to subcontractor's place for witness of re-FAI shall be to subcontractor's responsibility.

Upon acceptance of the FAI by BEML/DMRC, the subcontractor can proceed to manufacture all pertinent hardware. The hardware must meet or exceed the quality standards set at the FAI, and must incorporate any comments made by BEML/DMRC at the FAI.

Subcontractor shall note that BEML/DMRC FAI clearance will not relieve the subcontractor's responsibility towards design, development, testing, manufacture and supply during the revenue service.

At any point of time, during the execution of the contract, if BEML/DMRC has any concerns about the quality of the product supplied, BEML/DMRC reserves the right to randomly draw samples from any of the supply lots and the sub-contractor shall carryout the type tests at accredited outside labs and shall submit the reports.

## 12. Appendices

### 12.1. Drawings

Sl No.	Drawing no	Description
1	GR/4504	Exterior colour film arrangement-DM
2	GR/4505	Exterior colour film arrangement-M&T
3	525-28101	Arrangement exterior colour scheme-DM
4	525-28201	Arrangement exterior colour scheme-M&T
5	525-28127	Label, Jacking point mark
6	525-28128	Label, Rerailing mark

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7	525-28130	Cab mask colour belt
8	525-28131	BEML front logo
9	525-28132	MMRD Side logo
10	525-28133	Label, Exterior car no.
11	525-28134	MMRD Front logo

## 12.2. Documents

- Vendor Approval form.
- Technical offer Submittals Check List.

## 13. Submittals with Technical Offer









The Subcontractor shall provide as a minimum, the following along with the technical offer.






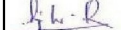




1. Complete Technical Offer for Colored Graphic Film and Exterior labels including technical description.
2. Complete Technical details as per clause 8.
3. Technical Data Sheet of the graphic film with adhesive, liner, overlamine and edge sealing.
4. Technical Data Sheet of the exterior label film with adhesive, liner & overlamine.
5. Type test reports and Fire safety test report copies of earlier similar projects.
6. Supporting documents for Qualification Criteria compliance (Clause 3).
7. Duly filled Vendor approval form along with supporting documents including QAP & ITP for MRS1 project, company profile with infrastructure facilities, product range etc., and satisfactory revenue service performance certificate from end user/Metro corporations for the Supplied and Applied Coloured Graphic Film.
8. Clause wise comments against this PTS Document No. GR/TD/5018

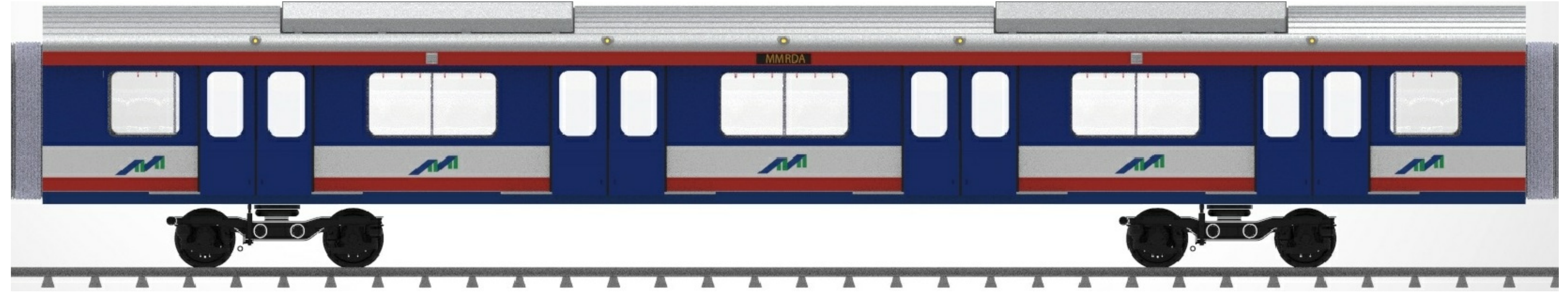




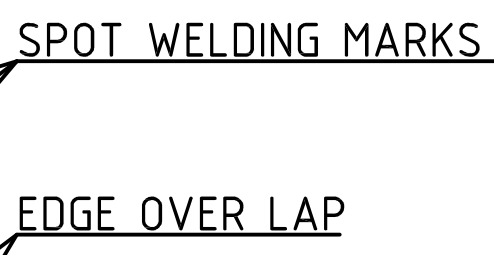


GRADE No.	N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1
VALUE	50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025
SYMBOL												

SL.No	QTY	PART / STOCK No.				DESCRIPTION	SIZE	COMPANY STD./S		Wt. (Kg)	
								MATERIAL			
						PRODUCT	MUMBAI METRO CARS - L2 & L7				
						REF DRG					
						MATERIAL					
						HEAT TREAT.		APPD		17.06.2020	
						SURFACE TREAT.		REVD		17.06.2020	
						TITLE	EXTERIOR COLOUR		CHKD		17.06.2020
							FILM		DRWN	pt. Suresh	17.06.2020
							ARRANGEMENT-M&T		SCALE		SHEET 1 OF 1
							NTS				-
ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD	 BEML LIMITED <small>NEW FRONTIERS, NEW DREAMS</small>		DRG No.		GR-4505	ALT 



## LINE-7 COLOUR SCHEME

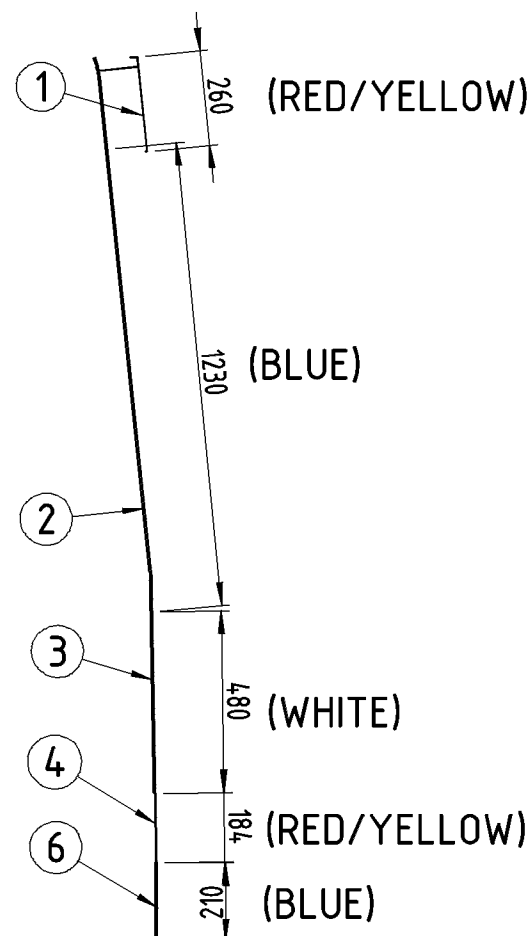
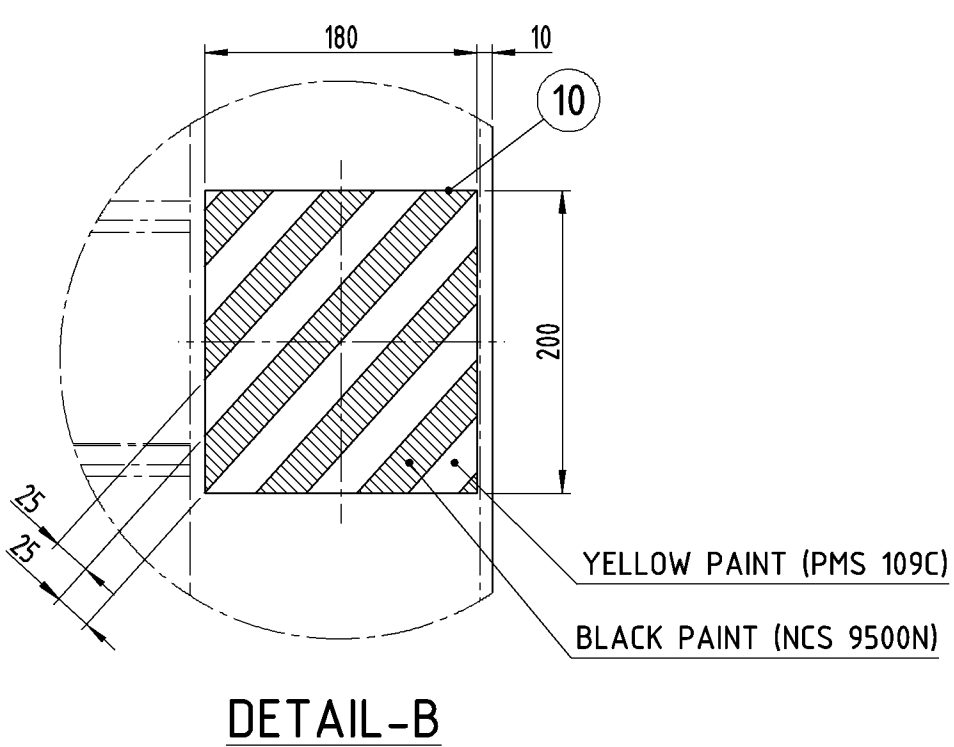


REFERENCE CARBODY IMAGE

**UNCONTROLLED**









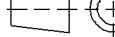
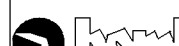

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		TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~
FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227											
UNSPECIFIED TOLERANCES FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 202 (PT-I) (MEDIUM)							QUALITY OF WELD JOINTS REF. RD 230 MEDIUM				
VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C							<div>STATUS:</div> <div>PROTO/PRODUCTION</div>				
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96											

[illegible]

SECTION C-C

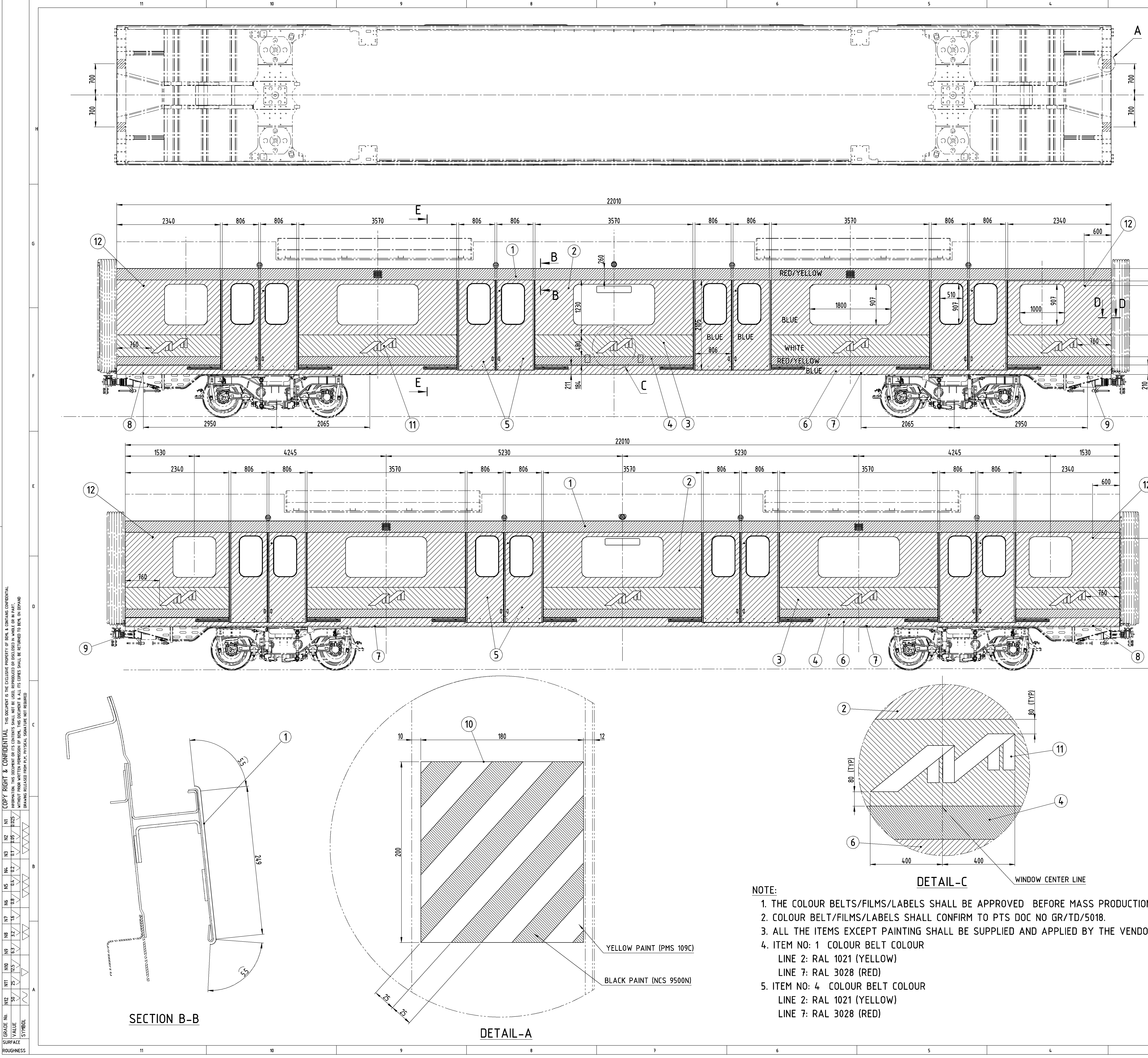
1. THE COLOUR BELTS/FILMS/LABELS SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. COLOUR BELT/FILMS/LABELS SHALL CONFIRM TO PTS DOC NO GR/TD/5018.
3. ALL THE ITEMS EXCEPT PAINTING SHALL BE SUPPLIED AND APPLIED BY THE VENDOR.
4. ITEM NO: 1 COLOUR BELT COLOUR  
LINE 2: RAL 1021 (YELLOW)  
LINE 7: RAL 3028 (RED)
5. ITEM NO: 4 COLOUR BELT COLOUR  
LINE 2: RAL 1021 (YELLOW)  
LINE 7: RAL 3028 (RED)

17	1	525-28001	EXTERIOR PAINTING-DMC	PAINTING	-	
16	1	525-28134	MMRD FRONT LOGO	-	-	
15	4	525-28133	LABEL, EXTERIOR CAR NO.	-	-	
14	8	525-28132	MMRD SIDE LOGO	-	-	
13	1	525-28131	BEML FRONT LOGO	-	-	
12	1	525-28130-301	CAB MASK COLOUR BELT-LH	-	-	
11	1	525-28130-300	CAB MASK COLOUR BELT-RH	-	-	
10	4	525-28101-10	RE-RAILING MARK	PAINTING		R600146800-PMS 109C (YELLOW PAINT) R605112500- NCS 9500N (BLACK PAINT)
9	2	525-28128-301	LABEL, RERAILING MARK-RH	-	-	
8	2	525-28128-300	LABEL, RERAILING MARK-LH	-	-	
7	4	525-28127	LABEL, JACKING POINT MARK	-	-	
6	2	525BD70002	SIDE COLOUR FILM-3	210x20492		PANTONE 287C (BLUE)
5	16	525BD70006	DOOR COLOUR FILM	806x2150		PANTONE 287C (BLUE)
4	2	525BD70005	BOTTOM.COLOUR BELT (DM CAR)	184x13826		REF. NOTE 5
3	2	525BD70003	SIDE, COLOUR FILM-2 (DM CAR)	480x13826		RAL 9010 (WHITE)
2	2	525BD70001	SIDE, COLOUR FILM-1 (DM CAR)	1230x13826		PANTONE 287C (BLUE)
1	2	525BD70004	TOP, COLOUR FILM (DM CAR)	260x20492		REF. NOTE 4
SL.No.	QTY	PART / STOCK No.	DESCRIPTION	SIZE	COMPANY STD./LS MATERIAL	
						Wt. (Kg)

						PRODUCT	MUMBAI METRO CARS - L2 & L7				
						REF DRG					
						MATERIAL	-				
						HEAT TREAT.		APPD		13.03.2020	
						SURFACE TREAT.		REV'D		13.03.2020	
						TITLE	ARR,T EXTERIOR			CHKD	13.03.2020
							COLOUR SCHEME, DM			DRWN	13.03.2020
										SCALE	1:40
											SHEET 1 OF 1
										Wt.	-
										DRG No.	
							BEML LIMITED				ALT
ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD	AN ISO 9001:2015 CERTIFIED ORGANIZATION		525-28101			

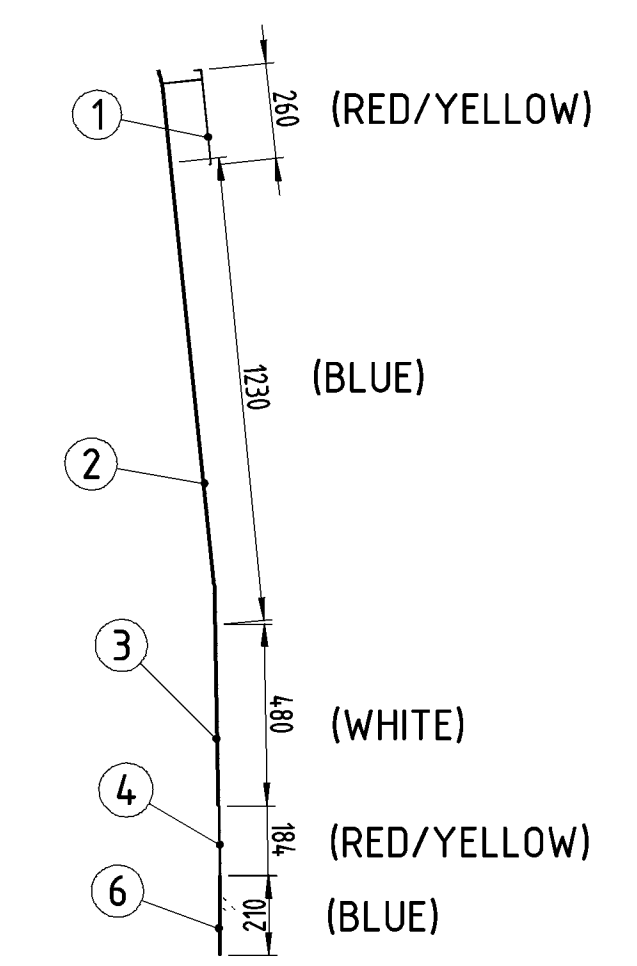


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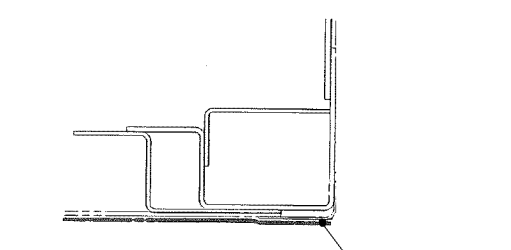


3		2					1				
MACHINING DEVIATIONS FOR LINEAR DIMENSIONS		RANGE	0 – 6	6 – 30	30 – 120	120 – 315	315–1000	1000–2000	2000–4000	ABOVE 4000	RA
		TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~
FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227											
UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM)							QUALITY OF WELD JOINTS REF. RD 230 MEDIUM				
VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.							STATUS: PROTO/PRODUCTION				
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96											

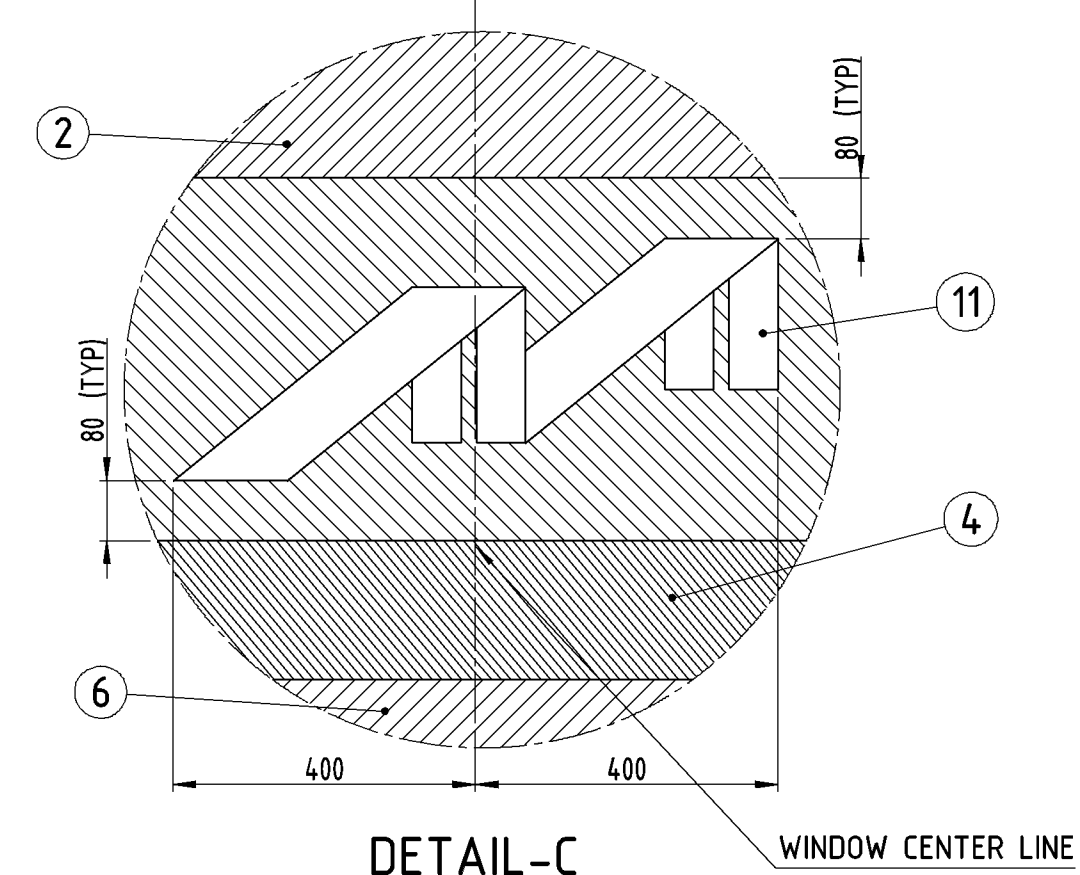
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SECTION E-E



SECTION D-D



DETAIL-C

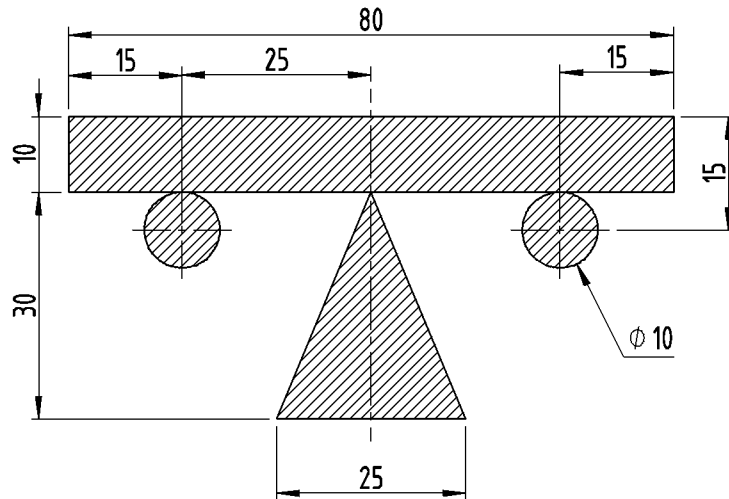
NOTE:

1. THE COLOUR BELTS/FILMS/LABELS SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. COLOUR BELT/FILMS/LABELS SHALL CONFIRM TO PTS DOC NO GR/TD/5018.
3. ALL THE ITEMS EXCEPT PAINTING SHALL BE SUPPLIED AND APPLIED BY THE VENDOR.
4. ITEM NO: 1 COLOUR BELT COLOUR  
LINE 2: RAL 1021 (YELLOW)  
LINE 7: RAL 3028 (RED)
5. ITEM NO: 4 COLOUR BELT COLOUR  
LINE 2: RAL 1021 (YELLOW)  
LINE 7: RAL 3028 (RED)

12	4	525-28133	LABEL, EXTERIOR CAR NO.	-	-
11	10	525-28132	MMRD SIDE LOGO	-	-
10	4	525-28201-10	RE-RAILING MARK	PAINTING	R600146800-PMS 109C (YELLOW PAINT) R605112500-NCS 9500N (BLACK PAINT)
9	2	525-28128-301	LABEL, RERAILING MARK-RH	-	-
8	2	525-28128-300	LABEL, RERAILING MARK-LH	-	-
7	4	525-28127	LABEL, JACKING POINT MARK	-	-
6	2	525BD70007	SIDE COLOUR FILM-3	210x22010	PANTONE 287C (BLUE)
5	16	525BD70006	DOOR COLOUR FILM	806x2105	PANTONE 287C (BLUE)
4	2	525BD70008	BOTTOM, COLOUR BELT (M/T CAR)	184x15390	REF NOTE 5
3	2	525BD70010	SIDE, COLOUR FILM-2 (M/T CAR)	480x15390	RAL 9010 (WHITE)
2	2	525BD70011	SIDE, COLOUR FILM-1 (M/T CAR)	1230x15390	PANTONE 287C (BLUE)
1	2	525BD70012	TOP, COLOUR FILM (M/T CAR)	260x22010	REF NOTE 4
SL.No.	QTY	PART / STOCK No.	DESCRIPTION	SIZE	Wt. (Kg)
MUMBAI METRO CARS - L2 & L7					
PRODUCT REF DRG					
MATERIAL					
HEAT TREAT.					
SURFACE TREAT.					
TITLE					
ARR,T EXTERIOR COLOUR SCHEME, M&T					
SCALE 1:40					
DRG No. 1 OF 1					
SHEET 1 OF 1					
ALT					
bentl BEML LIMITED					
525-28201					



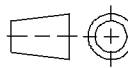

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~
FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227										
UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM)							QUALITY OF WELD JOINTS REF, RD 230 MEDIUM			
VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.						STATUS:	PROTO/PRODUCTION			
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96										



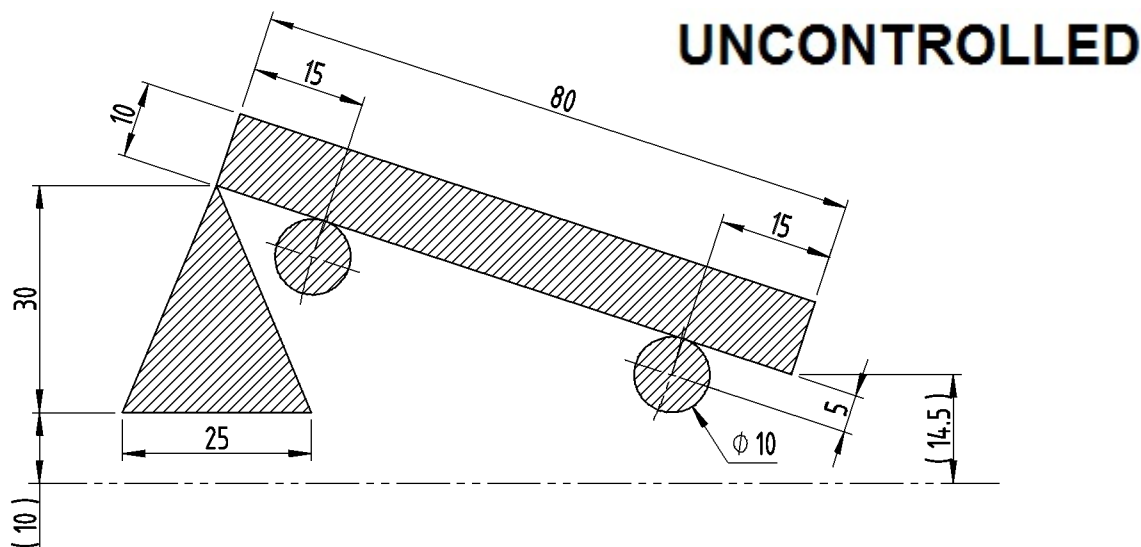
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## NOTE:

1. THE LABEL SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. MATERIAL: CAST VINYL FILM CONFORMING TO PTS OF LABEL DOC. NO. GR/TD/5018.
3. OUTDOOR LIFE (DURABILITY) OF LABEL SHALL BE MINIMUM 8 YEARS WITHOUT FADING.
4. COLOUR : YELLOW-PMS 109C
5. PRINTING : SCREEN PRINTING

GRADE No.	VALUE	SYMBOL	ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD	PRODUCT	DESCRIPTION	SIZE	COMPANY STD./I.S	Wt. (Kg)
N1	0.025	▽											
N2	0.05	▽											
N3	0.1	▽											
N4	0.2	▽											
N5	0.4	▽											
N6	0.8	▽											
N7	1.6	▽											
N8	3.2	▽											
N9	6.3	▽											
N10	12.5	▽											
N11	25	▽											
N12	50	▽											
SURFACE ROUGHNESS									MUMBAI METRO CARS - L2 & L7				
									REF DRG				
									MATERIAL -				
									HEAT TREAT.				
									SURFACE TREAT.				
									TITLE				
									APPD <i>[Signature]</i> 13.03.2020				
									REV D <i>[Signature]</i> 13.03.2020				
									CHKD <i>[Signature]</i> 13.03.2020				
									DRWN <i>[Signature]</i> 13.03.2020				
									SCALE NTS  SHEET 1 OF 1 Wt. -				
									DRG No. 525-28127 ALT 				
									BEML LIMITED 525-28127				

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~
FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227										
UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM)							QUALITY OF WELD JOINTS REF. RD 230 MEDIUM			
VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.							STATUS:	PROTO/PRODUCTION		
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96										



DRG NO	REMARK
525-28128-300	AS DRAWN
525-28128-301	OPPOSITE













**NOTE:**

1. THE LABEL SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. MATERIAL: CAST VINYL FILM CONFORMING TO PTS OF LABEL DOC. NO. GR/TD/5018.
3. OUTDOOR LIFE (DURABILITY) OF LABEL SHALL BE MINIMUM 8 YEARS WITHOUT FADING.
4. COLOUR : YELLOW-PMS 109C
5. PRINTING : SCREEN PRINTING

NOTE:

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SURFACE ROUGHNESS		N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1
GRADE No.													
VALUE		50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025
SYMBOL													

**NOTE:**

1. THE COLOUR BELT SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. MATERIAL: CAST VINYL PRE PIGMENTED FILM CONFORMING TO PTS OF LABEL DOC. NO. GR/TD/5018.
3. OUTDOOR LIFE(DURABILITY) OF COLOUR BELT SHALL BE MINIMUM 8 YEARS WITHOUT FADING.
4. COLOUR : RAL 1021 (YELLOW)- FOR LINE-2.  
: RAL 3028 (RED)-FOR LINE-7.

MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~
FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227										
UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM)							QUALITY OF WELD JOINTS REF, RD 230 MEDIUM			
VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.							STATUS:	PROTO/PRODUCTION		
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96										

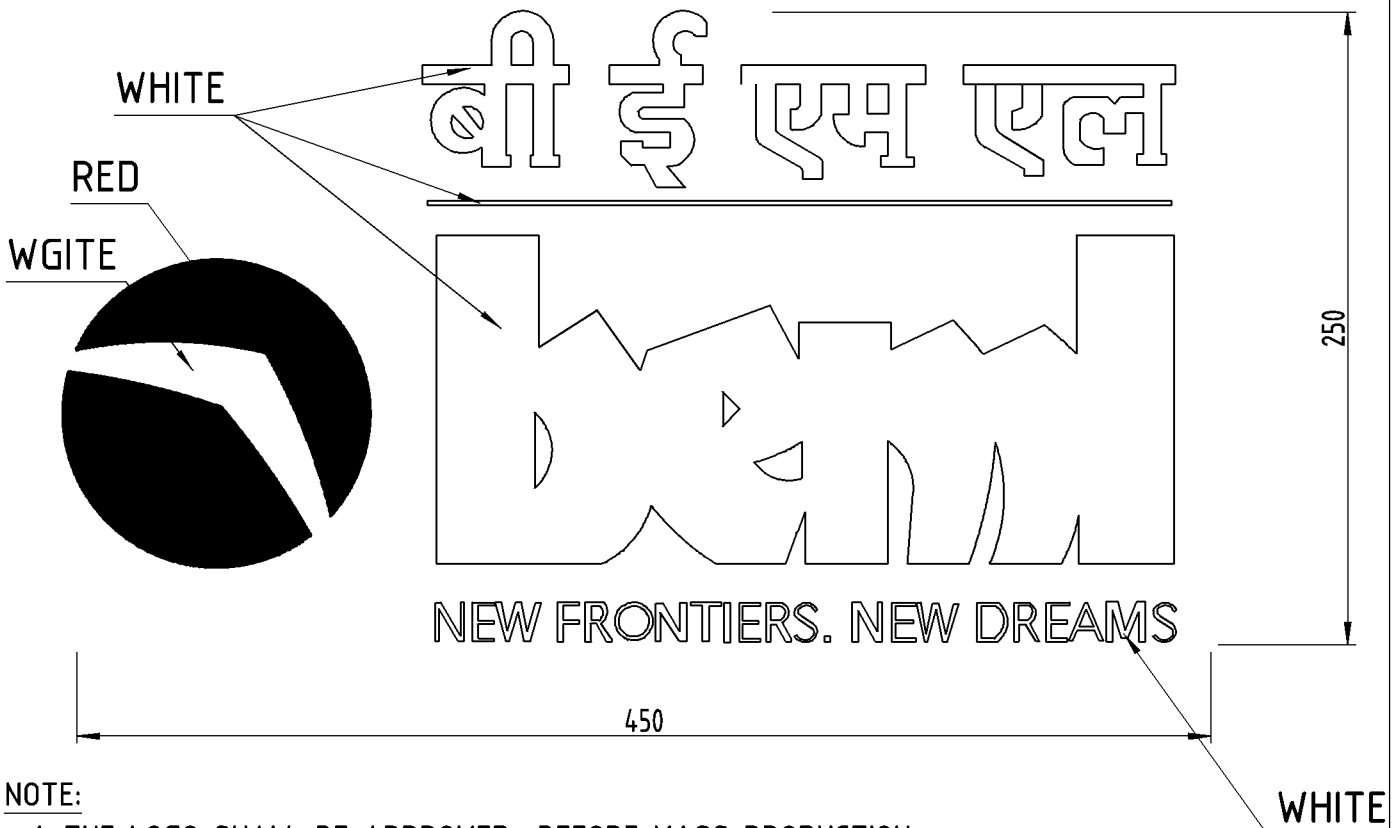
DRG NO	REMARK
525-28130-300	AS SHOWN
525-28130-301	OPP HAND DRAWN

# UNCONTROLLED

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MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 – 6	6 – 30	30 – 120	120 – 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~
FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227										
UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM)							QUALITY OF WELD JOINTS REF, RD 230 MEDIUM			
VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.						STATUS:	PROTO/PRODUCTION			
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96										



NOTE:

1. THE LOGO SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. MATERIAL: CAST VINYL FILM CONFORMING TO PTS OF LABEL DOC. NO. GR/TD/5018.
3. OUTDOOR LIFE (DURABILITY) OF LOGO SHALL BE MINIMUM 8 YEARS WITHOUT FADING.
4. COLOUR : WHITE: RAL 9010  
RED: PANTONE 7409 C
5. PRINTING : SCREEN PRINTING

UNCONTROLLED

GRADE No.	VALUE	SYMBOL	SL.No.	QTY	PART / STOCK No.	DESCRIPTION	SIZE	COMPANY STD./I.S	Wt. (Kg)
N1	0.025	▽	N2	0.05	▽	N3	0.1	▽	
N4	0.2	▽	N5	0.4	▽	N6	0.8	▽	
N7	1.6	▽	N8	3.2	▽	N9	6.3	▽	
N10	12.5	▽	N11	25	▽	N12	50	▽	
ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKD	APPD	BEML FRONT LOGO			
SURFACE ROUGHNESS									
						PRODUCT	MUMBAI METRO CARS - L2 & L7		
						REF DRG			
						MATERIAL	-		
						HEAT TREAT.		APPD	13.03.2020
						SURFACE TREAT.		REVD	13.03.2020
						TITLE		CHKD	13.03.2020
								DRWN	13.03.2020
								SCALE	
								NTS	
								SHEET	
								1 OF 1	
								Wt.	
								-	
								ALT	
								-	



BEML LIMITED

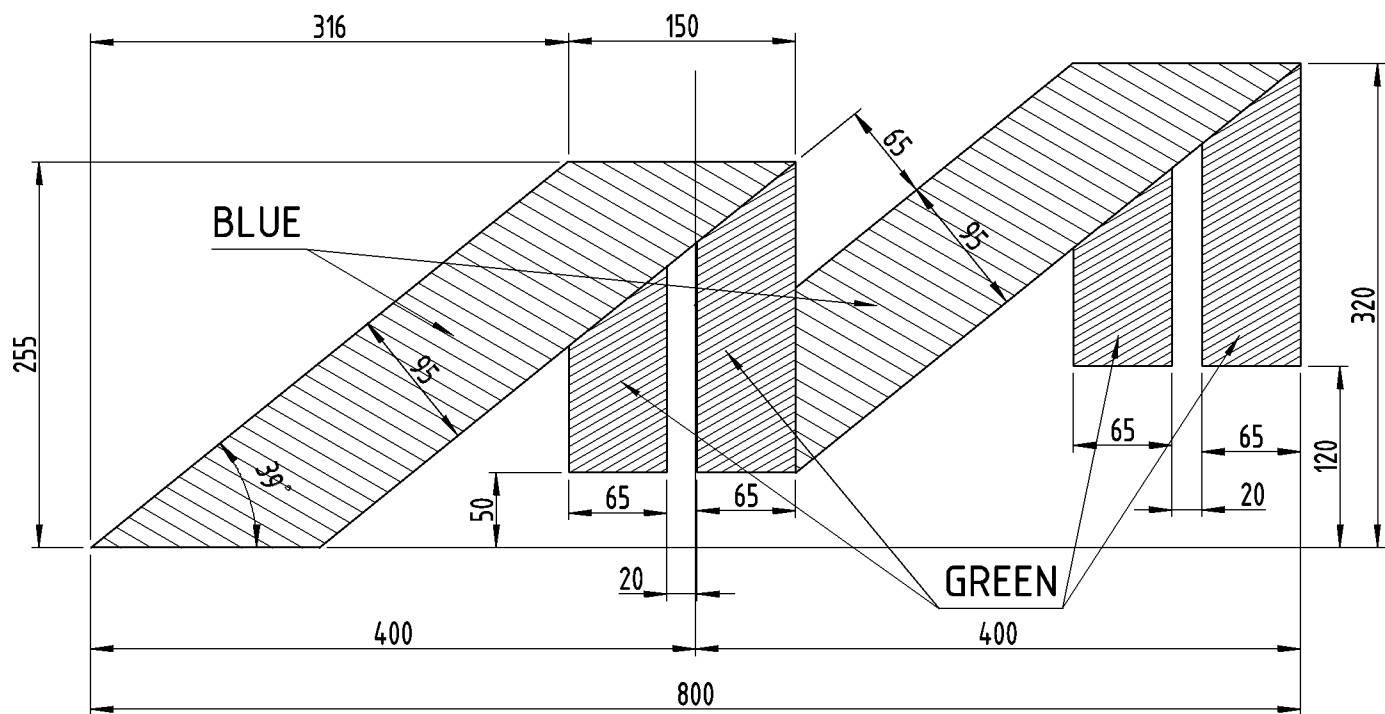
APPD	13.03.2020
REVD	13.03.2020
CHKD	13.03.2020
DRWN	13.03.2020
SCALE	
NTS	
SHEET	1 OF 1
Wt.	
-	
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525-28131

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SURFACE ROUGHNESS		N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1
GRADE No.													
VALUE		50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025
SYMBOL													




MACHINING DEVIATIONS FOR LINEAR DIMENSIONS	RANGE	0 - 6	6 - 30	30 - 120	120 - 315	315-1000	1000-2000	2000-4000	ABOVE 4000	RA
	TOLERANCE	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	~
FOR DIMENSIONAL TOLERANCES OF SHEET METAL PARTS AND WELDED STRUCTURES, REFER STD. RD-227										
UNSPECIFIED TOLERANCE FOR LINEAR AND ANGULAR DIMENSIONS REF. IS 2102 (PT-1) (MEDIUM)							QUALITY OF WELD JOINTS REF, RD 230 MEDIUM			
VALUES OF SURFACE TEXTURE SHALL BE AS PER COMPANY STD DS. 1012.C.						STATUS:	PROTO/PRODUCTION			
WELDING SHALL BE CARRIED OUT AS PER IS: 9595-96										



# UNCONTROLLED

**NOTE:**

1. THE LOGO SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. MATERIAL: CAST VINYL FILM CONFORMING TO PTS OF LABEL DOC. NO. GR/TD/5018.
3. OUTDOOR LIFE (DURABILITY) OF LOGO SHALL BE MINIMUM 8 YEARS WITHOUT FADING.
4. COLOUR : PANTONE 287C (BLUE)  
RAL 6038 (LUMINOUS GREEN)
5. PRINTING : SCREEN PRINTING

SL.No.	QTY	PART / STOCK No.	DESCRIPTION				SIZE	COMPANY STD./I.S	Wt. (Kg)		
									MATERIAL		
						PRODUCT	MUMBAI METRO CARS - L2 & L7				
						REF DRG					
						MATERIAL	-				
						HEAT TREAT.					
						SURFACE TREAT.					
						TITLE					
						MMRD SIDE LOGO	APPD			13.03.2020	
							REVD			13.03.2020	
							CHKD			13.03.2020	
							DRWN	N. Siva Sreen		13.03.2020	
							SCALE			SHEET	Wt.
							1:10			1 OF 1	-
							DRG No.				ALT
							525-28132				
ALT.NO.	ECN NO/CHANGES	DATE	BY	CHKO	APPO	 <b>BEM</b> LIMITED <small>NEW FRONTIERS. NEW DREAMS</small>					



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DRAWING RELEASED FROM PLM, PHYSICAL SIGNATURE NOT REQUIRED

4-R5

# ED 101

250.5

WHITE

BLACK

**NOTE:**








1. LABEL SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. MATERIAL: CAST VINYL FILM CONFORMING TO PTS OF LABEL DOC. NO. GR/TD/5018.
3. OUTDOOR LIFE (DURABILITY) OF LABEL SHALL BE MINIMUM 8 YEARS WITHOUT FADING.
4. COLOUR: BLACK : PANTONE BLACK C  
WHITE : PANTONE WHITE C
5. PRINTING : SCREEN PRINTING

# UNCONTROLLED


**bent**  
 NEW FRONTIERS. NEW DREAMS.**BEML LIMITED**

525-28133

A4

GRADE No.	N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1
VALUE	50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025
SYMBOL												

SL.No.	QTY	PART / STOCK No.				DESCRIPTION		SIZE	COMPANY STD./I.S		Wt. (Kg)
									MATERIAL		
						PRODUCT	MUMBAI METRO CARS - L2 & L7				
						REF DRG					
						MATERIAL	-				
						HEAT TREAT.			APPD		13.03.2020
						SURFACE TREAT.			REVD		13.03.2020
						TITLE			CHKD		13.03.2020
						MMRD FRONT LOGO		DRWN		13.03.2020	
								SCALE		SHEET	Wt.
								1:10		1 OF 1	-
								DRG No.		ALT	
ALT.NO.	ECN NO/CHANGES		DATE	BY	CHKD	APPD	<b>BEM LIMITED</b> <small>NEW FRONTIERS. NEW DREAMS</small>		525-28134		



1. THE LOGO SHALL BE APPROVED BEFORE MASS PRODUCTION.
2. MATERIAL: CAST VINYL FILM CONFORMING TO PTS OF LABEL DOC. NO. GR/TD/5018.
3. OUTDOOR LIFE (DURABILITY) OF LOGO SHALL BE MINIMUM 8 YEARS WITHOUT FADING.
4. COLOUR : RAL 9010 (PURE WHITE)  
RAL 6038 (LUMINOUS GREEN)
5. PRINTING : SCREEN PRINTING

Date:

Proforma No: MRS1/BEML/V.NNO/CAT- \_\_/\_\_\_\_\_/M/\_\_\_\_

<b>CHECKSHEET FOR</b> <b>SUBMISSION OF DOCUMENTS FOR</b> <b>NOTICE OF NO OBJECTION FOR SUB-CONTRACTOR/VENDOR FROM DMRC</b>			
<b>ITEMS:</b>			
<b>Category</b>	<b>A</b>	Items manufactured outside India and proposed to be used in all MRS1 trains.	<input type="checkbox"/>
	<b>B</b>	Items manufactured outside India and proposed to be used in all MRS1 trains but likely to be localised after some part quantity from OEM (shall be declared by BEML).	<input type="checkbox"/> Equivalent Localisation Quantity : __ Trainsets
	<b>C</b>	Locally manufactured items proposed to be used in all MRS1 trains.	<input type="checkbox"/>
<b>1</b>	<b>Proforma for Submission of documents</b>		<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>2</b>	<b>Vendor Details</b>	Annexure-I	<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>3</b>	<b>Sub-Vendor Detail</b>	Annexure-I	<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>4</b>	<b>Certificate from BEML</b>	Annexure-II	<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>5</b>	<b>Copy of technical purchase specification of BEML</b>		<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>6</b>	<b>Inspection and Test Plan</b>		<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>Note:</b>	<b>1</b>	Incomplete documents will not be reviewed by DMRC.	
	<b>2</b>	Items used in DMRC's existing rolling stock do not automatically qualify for use unless specifically approved by DMRC for this project.	
<div style="display: flex; justify-content: space-between; align-items: flex-end; padding-top: 20px;"> <div>(BEML Limited)</div> <div>_____ (Proposed Vendor)</div> </div>			

Date:

Proforma No: MRS1/BEML/V.NNO/CAT-\_\_\_/\_\_\_/P1/\_\_\_

PROFORMA FOR SUBMISSION OF DOCUMENTS FOR NOTICE OF NO OBJECTION FOR SUB-CONTRACTOR/VENDOR FROM DMRC					
1	Item description				
2	Vendor particulars along with proposed manufacturing unit submitted in Annexure-I		<input type="checkbox"/> YES <input type="checkbox"/> NO		
3	Technical Specification & Inspection Plan		—		
3.1	Enclosed copy of Technical Purchase Specification of BEML		<input type="checkbox"/> YES <input type="checkbox"/> NO		
4	Details of experience/ satisfactory performance to establish compliance with ERTS 3.2.2.				
The Information shall be submitted in following format:					
S.No.	Mass Rapid Transit System where proposed sub-system/equipment/component has been used	Country	Quantity Used	Period in satisfactory Revenue Service [from/to] (Min 3 yrs in each MRTS)	Manufacturing Unit
	1	2	3	4	5
1	1				
	2				
	3				
2	1				
	2				
	3				
3	1				
	2				
	3				
4	1				
	2				
	3				
4.1	Based on above, is the proposed item compliant with ERTS 3.2.2				<input type="checkbox"/> YES <input type="checkbox"/> NO
4.2	Is the proposed manufacturing unit compliant with ERTS 3.2.2				<input type="checkbox"/> YES <input type="checkbox"/> NO
4.3	Confirmation that the subsystems used in MRS1, as proposed herein, shall have NO CHANGE in source, manufacturing unit, components, specification, material etc. from those approved unless got specifically approved from DMRC.				<input type="checkbox"/> CONFIRMED <input type="checkbox"/> NOT CONFIRMED
4.4	Information submitted herein as above is certified as correct, strictly in accordance with the MRS1 contract conditions and has been verified by BEML. In case any information is found to be factually incorrect or at variance with contract conditions at any stage, BEML commits to replace the concerned 'sub-system' in complete fleet as per the instructions of engineer, which shall be final and binding. In such case, BEML shall not be eligible either for seeking any claim whatsoever or for seeking extension of contract delivery period.				<input type="checkbox"/> CONFIRMED <input type="checkbox"/> NOT CONFIRMED
4.5	Confirmation that DMRC may depute a team of Engineers (around six) at Sub-contractor/vendor's office for requisite duration with a view to expedite finalization of designs in accordance with contract 'MRS1' conditions ERGS 5.11.3.				<input type="checkbox"/> CONFIRMED <input type="checkbox"/> NOT CONFIRMED
5	Notwithstanding the vendor approval communicated by DMRC on the proposal of BEML, responsibility for manufacture, testing, supply, commissioning and quality control shall continue to rest solely with BEML and BEML will be solely responsible for meeting all contractual requirements.				<input type="checkbox"/> CONFIRMED <input type="checkbox"/> NOT CONFIRMED
<div style="display: flex; justify-content: space-between;"> <span>(BEML Limited)</span> <span>_____ (Proposed Vendor)</span> </div>					

Date:

Proforma No: MRS1/BEML/V.NNO/CAT- \_\_\_ / \_\_\_ /P2/ \_\_\_

<b>6</b>	<b>Category B - Sourcing from facilities in India after supply of agreed quantity from approved manufacturing unit.</b>	
<b>6.1</b>	In case OEM wants to use manufacturing facilities in India (other than his own) for items for which the OEM has been approved, it shall enter into an agreement with such selected Indian equipment manufacturer and obtain prior approval from DMRC. No change in composition, rating, type, model no., manufacturing process, quality standards, design, etc. and make of the components used in assemblies/sub-assemblies of such equipment as manufactured by the approved parent vendor shall be made without specific prior approval of the Engineer.	
<b>6.2</b>	In case the vendor uses his own facilities for indigenization after part supply of equipment from the approved manufacturing unit, no change in design, component type/make, quality standards, manufacture procedure, sourcing of materials etc. shall be made without specific prior approval of the Engineer.	
<b>6.3</b>	In case OEM wishes to change/make/type specifications, etc. of any sub-components for supplies to be sourced from Indian facility, specific prior approval of the Engineer shall be obtained for changes made, model, specification, etc. Responsibility for obtaining such prior approval shall rest solely with the contractor.	
<b>6.4</b>	In case of local manufacturing of carbody or any other item(s) manufactured by BEML/OEM and used in initial trains, BEML shall be exclusively responsible for all quality assurance and inspection and their implementation and also ensure provision of physical partition as per the ERGS 1.1.7	
<b>7</b>	<b>Category C- Locally Manufactured Items</b>	
<b>7.1</b>	Does the manufacturing unit satisfy ERTS 3.2.2	<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>7.2</b>	If not, basis/justification for proposal to be submitted for DMRC review	<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>8</b>	<b>BEML confirms that in terms of ERTS 3.2.2, they would seek Notice of No Objection for Sub-Contractor/Vendor from DMRC notwithstanding the item(s) being used in DMRC's existing rolling stock.</b>	<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>9</b>	<b>BEML shall submit Certificate as per enclosed Annexure-II confirming:</b>	
<b>9.1</b>	Compliance with Clause 6.6 of ERGS and GCC Clause 5.8 regarding supply of software tools/documents/materials etc.	
<b>9.2</b>	Compliance with Clause 8.12 of ERGS regarding supply of all drawings, specifications, patterns etc. in case the manufacture of these items is discontinued by the proposed vendor.	
<b>10</b>	<b>Commitment from the vendor that in case of any future procurement action by DMRC, he shall quote directly to DMRC.</b>	
<b>11</b>	<b>Commitment from the Vendor to provide technical support through permanent positioning of Vendor's staff at depots for meeting DLP obligations as per ERTS clause 3.2.5.</b>	
<b>12</b>	<b>BEML commits that the vendor shall be complying with all relevant contract clauses.</b>	
<div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div>(BEML Limited)</div> <div>_____ (Proposed Vendor)</div> </div>		

Date:

Proforma No: MRS1/BEML/V.NNO/CAT- \_\_\_/\_\_\_/\_\_\_/A1/\_\_\_

<b>Annexure-I</b>	
<b>SUB-Contractor/VENDOR/SUB-SUPPLIER DETAILS</b>	
<b>1</b>	Vendor/Sub-supplier OEM Name
<b>2</b>	Details of item proposed to be sourced
<b>3</b>	Sourcing by: <div style="display: flex; justify-content: space-between;"> <span>(a) BEML <input type="checkbox"/></span> <span>(b) Proposed Main vendor <input type="checkbox"/></span> </div>
<b>4</b>	Marketing Office/Head Office
<b>4.1</b>	Complete address (including website)
<b>4.2</b>	Contact person details in Head Office
<b>•</b>	Name
<b>•</b>	Designation
<b>•</b>	Telephone
<b>•</b>	Fax
<b>•</b>	Mobile
<b>•</b>	Email
<b>5</b>	Details of proposed compliant plant/manufacturing unit from where item is proposed to be sourced
<b>5.1</b>	Complete address (including website)
<b>5.2</b>	Contact person details
<b>•</b>	Name
<b>•</b>	Designation
<b>•</b>	Telephone
<b>•</b>	Fax
<b>•</b>	Mobile
<b>•</b>	Email
<b>5.3</b>	Supply details of the manufacturing unit for the proposed item or item with similar design.
<b>5.4</b>	It is confirmed that the proposed manufacturing unit and the vendor are fully compliant with ERTS 3.2.2
<b>5.5</b>	We commit that in case of any future procurement action by DMRC, the proposed vendor shall quote directly to DMRC without any involvement of BEML.
<b>5.6</b>	We confirm that we will provide technical support through permanent positioning of our staff at depots for meeting DLP obligations as per ERTS clause 3.2.5.
<b>5.7</b>	We have carefully gone through all relevant clauses of the MRS1 Contract and shall fully abide by the contract conditions and decisions communicated by DMRC during contract execution without exception.
<div style="display: flex; justify-content: space-between;"> <span>(BEML Limited)</span> <span>_____ (Proposed Vendor)</span> </div>	

Date:

Proforma No: MRS1/BEML/V.NNO/CAT- \_\_ / \_\_ /A2/ \_\_

<b>Annexure-II</b>	
<b><u>Certificate for compliance with Contract conditions regarding Software requirements.</u></b>	
<p>This is certified that in the contract between BEML and _____ (proposed vendor) for supply of _____, specific conditions for confirming total compliance with the following contract condition/clauses have been included and agreed to between BEML and _____(proposed vendor):</p>	
<b>(a)</b>	<p><b>Clause 6.6 of ERGS and GCC 5.8</b></p> <p>It is certified that we shall provide full access of application software(s) and any other software /hardware tools to DMRC which they may specifically require for the intended purpose specified in this specification. For all commercial software BEML shall provide all available documentation for the application and maintenance of that software.</p> <p>Complete documentation along with the software to be supplied by BEML and its Vendor(s) shall comprise of Signal flow diagram, flow charts, functional blocks, details of signals, interpretations so as to enable engineer to debug and implement vehicle/train level modifications based on DMRC's experience, operational &amp; maintenance requirements. Full access to the application software to DMRC shall be provided for this purpose.</p> <p>It shall be possible for DMRC to modify/change various parameters/logics used in the software and implement the changes on trains. Full facilities including any software/hardware tools, simulation/test bench which are essential for this purpose shall be supplied.</p> <p>It is committed to supply the software/hardware etc. within the scope specified in respective clauses of ERTS relevant for the proposed item/vendor and we would be fully complying with GCC 5.8</p>
<b>(b)</b>	<p><b>Clause 8.12 of ERGS:</b></p> <p>It is certified that _____ (proposed vendor) will supply all drawings, specifications, patterns and any other information required by DMRC for arranging such items in case the manufacture of these items is discontinued within 10 years by the proposed vender.</p>
<div style="display: flex; justify-content: space-between;"> <span>(BEML Limited)</span> <span>_____ (Proposed Vendor)</span> </div>	

**Undertaking for Technical/Service Support**

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**To Delhi Metro Rail Corporation Ltd.**

We \_\_\_\_\_ (proposed Vendor) shall provide Technical/Service support during Commissioning and post Commissioning period, till completion of the Defect Liability Period, for Mumbai Metro Line 2 & 7, 'MRS1' Project from their local office in India.

\_\_\_\_\_  
BEML Limited

(sign, Name & designation with stamp)

\_\_\_\_\_  
Proposed Vendor

(sign, Name & designation with stamp)



## APPENDIX 2

	<b>TECHNICAL OFFER SUBMITTALS CHECK SHEET</b>	<b>Project MRS1</b>
<b>Aggregate</b>	<b>Procurement Technical Specification of Coloured graphic film for exterior wrapping Metro carbody &amp; Exterior labels</b>	<b>PTS DOC No.: GR/TD/5018</b>
<b>BEML Enquiry/ RFQ Reference :</b>		

Sl. No.	DETAILS	SUBMITTED	NOT SUBMITTED
1	Complete Technical Offer for Colored Graphic Film and Exterior labels including technical description.	<input type="checkbox"/>	<input type="checkbox"/>
2	Complete Technical details as per clause 8.	<input type="checkbox"/>	<input type="checkbox"/>
3	Technical Data Sheet of the graphic film with adhesive, liner, overlamine and edge sealing.	<input type="checkbox"/>	<input type="checkbox"/>
4	Technical Data Sheet of the exterior label film with adhesive, liner & overlamine.	<input type="checkbox"/>	<input type="checkbox"/>
5	Type test reports and Fire safety test report copies of earlier similar projects.	<input type="checkbox"/>	<input type="checkbox"/>
6	Supporting documents for Qualification Criteria compliance (Clause 3).	<input type="checkbox"/>	<input type="checkbox"/>
7	Duly filled Vendor approval form along with supporting documents including QAP & ITP for MRS1 project, company profile with infrastructure facilities, product range etc., and satisfactory revenue service performance certificate from end user/Metro corporations for the Supplied and Applied Coloured Graphic Film.	<input type="checkbox"/>	<input type="checkbox"/>
8	Clause wise comments against this PTS Document No. GR/TD/5018	<input type="checkbox"/>	<input type="checkbox"/>

**Note : Incomplete submissions are liable for Rejection.**

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Signature of the Bidder with Seal