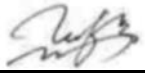
TUVASAS DMU 124R
Painting specification

Approved by	29.Jan.2010	J.H. PARK	
Reviewed by	29.Jan.2010	B.S. YOO	
Written by	07-Nov-2008	Y.D. KIM	
	Date	Name	Signature

Revision History

Issue	Page	Revision		Date
		From	To	
0		First issue		12.07.2008
A	11	-	Added Note	01.29.2010
B	1	Turkey Tuvasas DMU (84)	TUVASAS DMU 124R	15.Oct.2014
C	4	NFPA 130	Changed fire standard (DIN5510,EN45545) Changed Clause5. 4 Interior (Driver's cab)	31.Mar.2015
D	15	Pastel turquois RAL 6034	Traffic Red RAL 3020	26.Jan.2016
		Pastel turquois RAL 6034	Pastel Blue RAL 5024	
	16	-Refer to the relative drawing - RAL 6034	Traffic Red RAL 3020	
		-Refer to the relative drawing	Signal White RAL 9003	
		TBD	Telegrey4 RAL 7047	
		TBD	Traffic Red RAL 3020	

Contents

1. Introduction 4
2. Application Standards 4
3. Technical description 4
3.1. General 4
3.2. Paint 4
3.3. Priming 5
3.4. Application of paint 5
3.5. Repairs to damaged surfaces 6
3.6. Testing and inspection 6
4. Application of Painting for each Component 7
4.1. Under Frame (Center sill, Bolster, End sill, Cross beam and Bracket) 7
4.2. Bolster Hidden Part 7
4.3. Keystone plate – upper side & lower side 7
4.4. Outside of Carbody (Cab, Side, End and Roof) 8
4.5. Inside of Carbody (Side, Roof and End) 8
4.6. Hidden part (each surface of carbody contacted to air spring, center pivot and coupler) 9
4.7. Mechanical equipments for under-frame and roof 9
4.8. Reservoir Tank (Outside) 9
4.9. Exhaust muffler 9
4.10. Pipe 10
4.11. Bogie and bogie parts 10
4.12. Boxes of Under Floor (Wiring box, Valve box, Inspection Cover & etc.) 11
4.13. Outer surface of cover in Driver's desk, outer surface of Inspection cover 11
4.14. Panel of electric power distributor 12
4.15. Mask of Driver's cab (F.R.P) 12
4.16. Driver's desk (F.R.P) 13
5. Colors 14

1. Introduction

This specification will be applied to painting of vehicle interior and exterior for Diesel train set (hereafter DMU) of Turkish Wagon Industry Co.(hereafter, TUVASAS)

2. Application Standards

-UIC 564-2 APPENDIX 13 (1991) Regulations relating to fire protection and fire-fighting measures in passenger-carrying railway vehicle or assimilated vehicle used on international services.

-DIN5510-2 Preventive fire protection in rail way vehicles – Part 2 : Fire Behaviour and fire side effects of materials and parts – Classification, requirements and test methods.

-EN45545-2 Railway applications - Fire protection on railway vehicles - part 2 : Requirements for fire behaviour of materials and components

3. Technical description

3.1. General

The contractor using the paint on the equipment will conform to the Rolling Stock Performance Specification.

All metal surfaces shall be prepared and painted as described this document, unless otherwise approved by customer. Fiber-glass Reinforced Polyester (Hereafter FRP) shall also be painted as this document, and the painted system shall be compatible with the material.

Wire and cable, Hoses, Power resister, Heat transfer surface, Linkage, and Fasteners thread shall not be painted. But if the material of Heat transfer surface is mild steel, it should be painted by silicon paint.

All painting material shall form a high quality finishing system resistant to corrosion, chipping and fading, and shall retain the gloss level.

The life cycle of top coating is usually 10years under normal using condition, and life cycle of bottom coating (Primer) is 20 years under normal using condition.

3.2. Paint

All painting materials would form a high quality finishing system resistant to corrosion, chipping and fading, and shall retain the gloss level. Areas exposed to corrosive fluids or cleaning solutions shall be protected with coatings resistant to those fluids. The interior surfaces of equipment enclosures shall be primed and given one coat of white insulating varnish or one coat of white enamel paint. All paint shall be supplied in the manufacturer's sealed containers, which shall be clearly labelled with the following information:

- Name of manufacturer.
- Brand name and specification type.
- Primer, undercoat or finish coat.
- Interior or exterior use.
- Colour.

- Batch number and date of manufacture.

- Category of Hazard.

Paint shall be stored in sealed containers where it is not exposed to extreme temperatures. The temperature of the store shall be such that the paint is not damaged in any way. Any special storage conditions recommended by the manufacturer shall be observed.

Paint which has not been used within the "shelf life" period specified on the containers, or within 12 months of the date of manufacture, whichever is the lesser, shall be replaced.

Surface Preparation

Surfaces shall be thoroughly cleaned to remove all dirt, grease, etc., and all loose scale shall be removed.

Blast cleaning shall be carried out in accordance with this document. The abrasive shall be free of contamination. The maximum amplitude (peak to trough) of the blast cleaned surface shall not exceed 0.1mm. Surfaces shall be protected within 8 hours of having been blast cleaned.

Mechanical cleaning shall be carried out by power driven tools, such as abrasive grinding discs or etc., followed by steel-wire brushing to remove all loosened material. Excessive burnishing of the metal through prolonged application of rotary wire brushes shall be avoided. Surfaces shall be protected within 4 hours of having been mechanically cleaned.

3.3. Priming

Surfaces shall be primed within 8 hours of having been cleaned. All surfaces shall be thoroughly degreased and be free from dust and dirt prior to the application of an approved primer. If the cleaned surface deteriorates below the specified standard, then the affected areas shall be cleaned again.

The dry film thickness shall generally be 50 microns. Damaged surfaces shall be re-prepared, except that small areas may be touched up by brush applied paint if agreed by customer.

3.4. Application of paint

Paint shall be applied in accordance with the manufacturer's instructions. Thinners shall not normally be used. If thinners are added, they shall be the type and quantity recommended by the manufacturer and precautions shall be taken to prevent any excess being added. The paint, when applied, shall be completely uniform in texture and free from particles so that the dried film will be smooth and even coloured.

All painting shall be carried out by skilled painters under competent supervision.

Painting shall be carried out only in such atmospheric conditions that customer may consider suitable and in which water is not liable to condense on the surface to be painted.

No paint shall be applied when the air temperature at the location of the work is less than 7°C. All surfaces to be painted shall be completely free from moisture at the time of applying the paint. No paint shall be applied when the relative humidity exceeds 90% or when the

surface to be coated is less than 30℃ above the dew point. Any painting, which is adversely affected by weather conditions following application shall be repaired by the Contractor.

Unless otherwise agreed by customer, each coat of paint shall be applied to produce a continuous film of paint of similar color and even thickness. As soon as the first priming coat has dried, an extra coat of paint shall be applied by brush to edges, corners, crevices, etc., using paint of a similar composition to the priming coat, but in a contrasting shade. Successive coats shall have different shades for identification, and each coat shall be thoroughly dry before the application of a further coat.

The first undercoat shall be applied on a clean, dry, sound, primed surface and each coat shall be thoroughly dry before application of the subsequent coat.

Finishing coats shall be carefully applied such that on completion the surface is free from runs, sags, brush marks, etc.

In all cases, any coat that has become damaged or defective in any way shall be repaired before application of the subsequent coat.

The dry paint film thickness shall be measured using instruments.

In order to obtain the dry film thickness specified, the Contractor shall ensure that the coverage rate given by the paint manufacturer will enable this thickness to be attained.

Wet film thickness gauges may be used for checking, but shall not be permitted as a means of predicting the dry film thickness.

3.5. Repairs to damaged surfaces

Painted surfaces which have been damaged shall be cleaned to the bare material and the edges of the undamaged paint levelled with an abrasive.

The fully specified painting systems shall then be reapplied and the new paint shall overlap the existing paint by at least 50mm all around the affected part.

3.6. Testing and inspection

The Contractor shall conduct by dry film thickness measurements and electrical inspection of the painted surfaces with equipment and shall repaint and repair as necessary to comply with the requirements stated herein.

After repaired and repainted areas have dried sufficiently, the Contractor shall test the integrity of the full paint system using a methodology approved by customer. Painting thickness which are specified in microns shall be measured with an approved magnetic type dry film thickness gauge. Discontinuities and voids in the paint system shall be determined with an approved low voltage detector of the wet sponge type. Any paint surface not in compliance with requirements shall be repainted, repaired, and re-inspected until all the requirements of the Performance Specification are met.

4. Application of Painting for each Component

D.F.T will be applied from 30 μm to 120 μm at partial area which is hard to work for primer coat and finish coat

4.1. Under Frame (Center sill, Bolster, End sill, Cross beam and Bracket)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Finish Coat1	3rd	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	4th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)

4.2. Bolster Hidden Part

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface	1st	To remove the oil. And remove the fat rust by the wire brushing						
Preparation	2nd	Rust converter	15~20 (Brush: once or twice)				MIN. 24	ACTOBER
Primer coat	3rd	Poly urethane or epoxy primer	40~60				4~18	

4.3. Keystone plate – upper side & lower side

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Sound Damping Coat	2nd	Water based coating material	800~1200	59	0.6	1.7	MIN. 24	Light Beige
* NOTE : Sound Damping Coat should be applied to the region on which insulation and rubber are not installed, and D.F.T will be applied from 500μm to 2000μm at partial area which hard to work.								

4.4. Outside of Carbody (Cab, Side, End and Roof)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Putty Filling	3rd	Filler	Ave : 1,500 (Max.) Point : 3,500 (Max)	86	0.860	1.163	MIN. 4	After grinding
Grinding	4th							Dry Sanding #100~220 Sand Paper
Intermediate Coat	5th	Polyuretha ne	80~150				MIN. 10	Thinner (30% of Painting)
Polishing	6th							Dry Sanding 1) #220 2) #320 Sand paper
Touch-up Paint	7th	Polyuretha ne	3~10				MIN. 10	Bared metal area
Finish Coat1	8th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	9th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting) Color ; TBD

4.5. Inside of Carbody (Side, Roof and End)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Sound Damping Coat	3rd	Water based coating material	800~1200	59	0.6	1.7	MIN. 24	Light Beige
* NOTE : Sound Damping Coat should be applied to the region on which insulation and rubber are not installed, and D.F.T will be applied from 500μm to 2000μm at partial area which hard to work.								

4.6. Hidden part (each surface of carbody contacted to air spring, center pivot and coupler)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Zinc Rich Primer	15~20				MIN. 6	

4.7. Mechanical equipments for under-frame and roof

Major components shall be applied to the manufacturer's own standards. Major components are limited follow; Engine & accessories, Transmission & accessories, cooling device & accessories, Coupler device, APU device & accessories and brake equipment.

4.8. Reservoir Tank (Outside)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Finish Coat1	3rd	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	4th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)

4.9. Exhaust muffler

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)						
Primer Coat	2nd	Heat resisting Silicon primer	20~30	40	20.000	0.050		Thinner (30% of Painting)
Finish Coat1	3rd	Heat resisting Top Coat	30~40	32	10.638	0.094		Thinner (30% of Painting) Color ; silver

4.10. Pipe

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Finish Coat1	3rd	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	4th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)

Note : Stainless steel and copper pipe will not be painted.

4.11. Bogie and bogie parts

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	Not application of grit blast : Axle
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Finish Coat1	3rd	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	4th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting) Color

Note:

The primer and finish coating shall be applied on all exposed area except as follows:

(1) Application primer only: All machined face except for area indicated specially in drawing.

(2) Not application primer and finish: Area indicated specially in drawing. (Rubber parts, Earth pad, Adjusting liner, Fastener and etc.)

(3) It is permitted functional component to be coated in accordance with paint specification of subcontractor. (Suspension parts, damper, wheel and axle, driving gear and etc)

4.12. Boxes of Under Floor (Wiring box, Valve box, Inspection Cover & etc.)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Putty Filling	3rd	Filler	1,000 (Max.)	86	0.860	1.163	MIN. 4	Loss 10%
Grinding	4th	-	-				-	Dry Sanding #100~220 Sand Paper
Finish Coat1	5th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	6th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting) Color ; TBD

Note: In case of stainless steel box, it shall be proceed as followings,
(1) Remove dust, oil and other contamination using by solvent cleaning or grit blast.
(2) Remove spatters, soot and treat with acid picking after welding.

4.13. Outer surface of cover in Driver's desk, outer surface of Inspection cover

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Putty Filling	3rd	Filler	1,000 (Max.)	86	0.860	1.163	MIN. 4	Loss 10%
Grinding	4th	-	-				-	Dry Sanding #100~220 Sand Paper
Finish Coat1	5th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	6th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of

								Painting) Color ; TBD

4.14. Panel of electric power distributor

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove rust, Oil and Debris by grit blast (SIS Sa 2 – 2 ½)					MAX. 8	
Primer Coat	2nd	Epoxy Primer	50~60	51	8.475	0.118	MIN. 6	Thinner (30% of Painting)
Finish Coat1	3rd	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting)
Finish Coat2	4th	Urethane Topcoat	25~30	36	12.048	0.083	MIN. 10	Thinner (30% of Painting) Color ; TBD

4.15. Mask of Driver's cab (F.R.P)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st	Remove indentation and pinhole on the surface. Surface polishing, drying (Sand paper # 80) Surface putty filling.						
Primer Coat	2nd	Epoxy Primer	50~60				12~24	To paint 2 times Drying condition : 80°C x 20min/1 times
Touch-up putty and polishing	3rd	Filler	1000 (Max.)				MIN. 6	To polish with sand paper #220 ~ 320
Surface coat	4th	Polyurethane	50~60				12~24	To paint 1 times Drying condition : 80°C x 30min
Polishing	5th							To polish with sand paper #220 ~ 320

Finish coat1	6th	Acrylic polyurethane enamel	50~60				12~24	To paint 2 times Drying condition : 80°C x 20min/1 time
Finish coat2	7th	Acrylic polyurethane enamel	20~30				8 or more	To paint 1 times Drying condition : 80°C x 20min

4.16. Driver's desk (F.R.P)

Process	No.	Paint Type	D.F.T (μm)	SVR (%)	Theoretical Spread Rate (m^2/L)	Theoretical Required Amount (L/ m^2)	Interval to Next Step (HR)	Remarks
Surface Preparation	1st						8 or less	
Primer Coat	2nd	Epoxy Primer	50~60				8~16	After the first painting, wait by 20~30 minutes then paint again
Putty filing	3rd	Filler	1000 (Max.)				6 or more	
Touch-up putty	4th	Filler	0.5 or less				6 or more	
Polishing	5th							Dry sanding #220~320 sand paper
Surface coat	6th	Polyurethane	50~60				12~24	To paint 1 times Drying condition : 80°C x 30min
Touch-up putty	7th	Filler	0.5 or less				6 or more	To remove pin hole
Polishing	8th							Dry sanding #220~320 sand paper
Finish coat	9th	Urethane Topcoat	25~30				8~24	Embossing, black, semi-reflection for outer surface of cover in driver's desk

5. Colors

Colours are taken from the RAL, NCS and UN. Where a finish cannot be adequately described by the RAL, NCS and UN code, a sample will be made available. The finish colours are subject to approval by customer.

Components (painted items)	Substrate	Finish (Color)	Remarks
1. Exterior			
1) Carbody			
a. Roof	Steel	Squirrel Gray RAL 7000	
b. Roof corner (Upside)	Steel	Squirrel Gray RAL 7000	
c. Side	Steel	Signal White RAL 9003	
d. Window Frame	Steel	Jet Black RAL 9005	
e. Side Color Belt (Below Window)	Steel	Dark Blue RAL 2703045 Red RAL 0405070	Color tape applied after Painting
f. Bottom & Bottom side	Steel	Iron Gray RAL 7011	
g. Window line (Side & end)	Steel	Black Gray RAL 7021	
h. Outside Speaker	Steel	Signal White RAL 9003	
2) Skirt			
a. Front	FRP	Iron Gray RAL 7011	
b. Side	Steel	Iron Gray RAL 7011	
3) Underframe			
a. Keystone plate	Steel	Light beige	
b. Cross Beam	Steel	Black Gray RAL 7021	
c. Sill (Side & End)	Steel	Black Gray RAL 7021	
4) Cab Mask			
a. Roof (Front of Cab Air-con.)	FRP	Signal White RAL 9003	
b. Front (Area of TCDD Mark)	FRP	Signal White RAL 9003	
c. Front Belt (Left / Right)	FRP	Red RAL 0405070	Color tape
d. Front (Light Area & Line)	FRP	Squirrel Gray RAL 7000	

Components (painted items)	Substrate	Finish (Color)	Remarks
e. Bottom (Coupler Area)	FRP	Iron Gray RAL 7011	
5) Air Conditioner Cover	STS	Iron Gray RAL 7011	
2. Interior (Passenger room)			
a. Interior side and cab partition panels	FRP	Telegrey4 RAL 7047	Embossing
b. Ceiling panels(Including Passenger Information Board & Fluorescent Lights & Reading Lamp)	Steel/AL	Telegrey4 RAL 7047	
c. Return air grilles for saloon	AL	Telegrey4 RAL 7047	
d. Duct panels	AL	Telegrey4 RAL 7047	
e. Covings	AL	Telegrey4 RAL 7047	
f. Air diffuser	AL	Traffic Red RAL 3020	
h. Saloon 2-seater shell	FRP	Squirrel Gray RAL 7000	
i. Passenger seat frame	Steel / AL	Squirrel Gray RAL 7000	
j. Saloon partition panel	AL	Pastel Blue RAL 5024	
k. Electric Equipment (LJB,GDB,BECU T/B,HVAC GDB)	Steel	Signal White RAL 9003	
3. Interior (Service room)			
- Interior side panels(Toilet etc)	FRP	Telegrey4 RAL 7047	Embossing
- Ceiling panels	AL	Telegrey4 RAL 7047	
- End panel and covers	AL	Telegrey4 RAL 7047	
- Switch panel and covers	AL	Telegrey4 RAL 7047	
4. Interior (Driver's cab)			
- Interior panels (Front, Side, Rear, Partition)	FRP	Telegrey4 RAL 7047	Embossing
- Interior panels (Ceiling, Covers)	FRP	Telegrey4 RAL 7047	Embossing
- Driver's desk body(Including Desk Panel & Public Address System)	AL/FRP	Jet Black RAL 9005	Embossing
- Driver's seat frame	Steel	Jet Black RAL 9005	
- Moldings	AL	-	Anodizing
- Front view Camera Bracket	Steel	Telegrey4 RAL7047	

Components (painted items)	Substrate	Finish (Color)	Remarks
5. Window & Door skin			
- Passenger side door			
a) Exterior Skin	AL	Traffic Red RAL 3020	
b) Interior Skin	AL	Traffic Red RAL 3020	
- Cab side door panel			
a) Exterior Skin	AL	Signal White RAL 9003	
b) Interior Skin	AL	Telegrey4 RAL 7047	
- Cab partition door panel			
a) Exterior Skin	STS	Telegrey4 RAL 7047	
b) Interior Skin	STS	Telegrey4 RAL 7047	
- Partition door panel			
a) Frame	AL	-	Anodizing
- End Door panel			
a) Exterior Skin	STS	Traffic Red RAL 3020	
b) Interior Skin	STS	Traffic Red RAL 3020	
6. Under Frame equipment			
- Power pack Frame		According to REDD10146 (Color scheme of under floor equipment)	
- Main Engine & Accessories			
- Turbo Transmission			
- Cardan shafts			Rotating component
- Axle drive units			
- APU Engine & Accessories			
- APU Generator			
- Coupler device			
- Compressor motor unit			
- Air dryer			
- Distributor Valve			
- Pressure Switch Box	Steel		
- Air reservoirs	Steel		

Components (painted items)	Substrate	Finish (Color)	Remarks
- Module Frame	Steel		
- Air pipe	Cooper		
- Electric Box	Steel		Except the Battery Box & Battery Control Box
- Electric Conduit	AL		
- Fuel pipe	Steel		
- Oil pipe			
***Fuel pipe and oil pipe should be treated with phosphate inside and outside**			
- Cooling pipe	STS or Cooper	According to REDD10146 (Color scheme of under floor equipment)	Identified by color tape partially.
- Water pipe	Cooper		Identified by color tape partially.
- Discharge pipe	STS		
- Exhaust pipe			
- Battery box (including control box)	STS		
- Water tank	Steel		
- Sewage tank	STS		
- Fuel Tank	Steel		
7. Bogie			
- Bogie Frame	SMA490B	Black Gray RAL 7021	

* NOTE :
1. All sub-suppliers must submit sample (6 pcs, 100X100mm) to Tuvasas for approval.
2. All interior panels should be manufactured in accordance with approved sample color by Tuvasas.
3. Gloss Level : Interior except “embossing” is 60±10%, Exterior is over than 80%
4. The color of not described components be applied to original color of supplier goods.

*. Abbreviation
1) FRP – Fiber Glass Reinforce Plastic
2) STS – Stainless Steel
3) AL– Aluminum
4) Belt – Color Tape