

Laboratory	Mahindra Research Valley (MRV) Testing Laboratories, Mahindra & Mahindra Ltd., Plot No. 41/1, Anjur P.O., Chengalpattu, Tamil Nadu		
Accreditation Standard	ISO/IEC 17025: 2005		
Discipline	Mechanical Testing	Issue Date	29.06.2015
Certificate Number	T-3493	Valid Until	28.06.2017
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S. No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
I.	AUTOMOTIVE COMPONENTS			
1.	Automotive Components	Vibration Testing Methods for Automobile parts	JIS D-1601: 1995 Amd. 2013	Load 0.2 kgf to 900 kgf
		Resonance Frequency Detection		5 Hz to 2000 Hz
		Vibration Function		Acceleration: 75 g
		Vibration Endurance (Discrete Mode)		Displacement: 25 mm (peak to peak)
		Sweep Vibration Endurance (Sine Sweep Vibration)		Qualitative Type
2.	Half Shaft	Constant Velocity Universal joints for Half Shaft of Automobiles Test Type:	JASO C304: 89	
		Rotational Lash Twist angle		(-) 45 ° to 45°
		Static Torsional Strength Torque		Upto 11000 Nm
		Torsional Fatigue Strength		No. of Cycles to Fail the shaft
3.	Connecting Rod Connecting Rod	Connecting Rod Fatigue Displacement	MRV/FTL/SOP/02 Date: 01/06/14	Upto 10 mm (Compression)
		Performance Test Buckling or Yield	(AVL-F01N 0020)	Upto 250 kN (Compression)

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	Connecting Rod	Endurance Test SN Curve	MRV/FTL/SOP/02 Date: 01/06/14 (AVL-F01N 0020)	Load Upto 250 kN SN Curve X Axis:10 lacs to 100 lacs Y Axis: 5 kN to 100 kN
		Factor of Safety for Fatigue Strength		1.0 to 2.0
4.	Agricultural Tractor Seat	Tractors and Machinery for Agriculture: Seat belts Anchorage Strength Requirements	ISO3776-2: 2013(E) (Excluding Clause. 3.5)	1.0 kN to10.0 kN Qualitative Type
5.	Rear Axle of Off Road Vehicle	Bi Axial Durability	MRV/FTL/SOP/07 Date: 01/06/14 (SAE International 2014-01-2306)	Load:1.0 kN to 50 kN No. of Cycles: more than 250000 cycles Qualitative Type
6.	Agricultural Tractor ROPS: Rollover Protective Structure	On roll-over protection structures of wheeled agricultural or forestry tractors (static testing) Lateral/Longitudinal/ Vertical Force Displacement	2009/75/EC / Annexure 3, (Excluding Clause. 2.3)	Upto 120 kN Upto 500 mm Qualitative Type
7	Automotive Vehicle and its Subsystems	Full vehicle structural durability evaluation on 4 - post laboratory vertical road simulation Displacement Frequency	MRV/FTL/SOP/05 Date:01/06/14 (GMW14045) M32-13986-EN	Upto 125 mm 2 Hz to 50 Hz

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	Automotive Vehicle and its Subsystems	Vehicle Weight Wheel base Wheel track Acceleration	Version 3.5F	0.5 Ton to 4 Ton GVW 1.5 m to 4.2 m 1.3 m to 2.5 m 0.5 g to 50 g Vertical Spindle Acceleration on 4 poster correlation with vertical spindle acceleration measured on accelerated durability Test Track: Correlation 75 % to 95 %
8.	Hydraulic Lift Unit	Method of test for Hydraulic Power & Lifting Capacity of Agricultural Tractors	IS 12224: 1987 Amd. 2006	5 lpm to 65 lpm 1 bar to 230 bar 25 °C to 85 °C 25 kg to 2500 kg 0 to 75 ° 700 rpm to 3000 rpm Upto 3600 s Upto 1000 mm
		Flow		
		Pressure		
		Temperature		
		Load		
		Angle		
		Speed	IS 12224: 1987	
		Time	Amd. 2006	
		Distance		

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9.	Automotive Vehicle Body, Seat	Automotive vehicles – Safety belt anchorages – Specifications – Strength of anchorages Angle	IS 15139: 2002 Clause. 5	0.1 kN to 25 kN 1 ° to 15 ° Qualitative Type
10.	Automotive Vehicle Body	Torsional Stiffness	MRV/SEL/SOP/05 Date: 09/06/14 (Reference SAE Technical Paper No : 2013-01-1439 Date: 04/08/13 Torsion Case)	Load 5 kg to 490 kg 0.01 mm to 1000 mm Inclinometer: Range: 0.1 ° to 10 °
11.	Automotive Door System – Slam Durability Test	Door System - Slam Durability Gap Flushness Velocity Height Torque	MRV/SEL/SOP/04 Date: 09/06/14 (Ref.: GMW Test Procedure:15094 Date: Sep. 2006)	Load 5 N to 177 N Push Pull 0.1 N to 500 N 1.5 mm to 9.5 mm Upto 4.5 mm 0.1 m/s to 4 m/s 0.1 mm to 1000 mm 6 Nm to 30 Nm
12.	Body Panels	Performance Test Oil cunning. Load Length	MRV/SEL/SOP/03 Date: 09/06/14 (External Ref.: Pininfarina Test Procedure: 9T0066EN Date: 03/04/13)	1 kgf to 50 kgf 0.001 mm to 1000mm

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13.	Instrument Panel	Automotive Vehicle Interior Fitting – Procedure for Testing Energy Dissipating Materials	IS 15223: 2002 Annexure B	Velocity 5 km/h to 25 km/h Accelerometer Range: 0.1 g to 200 g Datalogger Range: 2 mv to 10 v
14.	Automotive Transmission Transaxle, Axle	Automotive Transmission, Transaxle, Axle Performance Tests Efficiency Measurement Input RPM Temperature: Output RPM Endurance test Maximum Load Maximum Speed	MRV/SEL/SOP/08 Date:11/06/14 (External Ref.: Ricardo-TP597 Date: 06/01/2010)	Input Torque:- Range: 5 Nm to 400 Nm LC: 1 Nm 800 rpm to 6000 rpm 20 °C to 120 °C 40 rpm to 3000 rpm Output Torque 5 Nm to 4200 Nm Qualitative Type
15	Tractor Transmission (2WD/ 4WD) & 4-WD Front Axle	Tractor Transmission & Front axle Performance Tests Efficiency Frictional Horse Power	MRV/SEL/SOP/07 Date:16/06/14 (Internal Ref.: M & M Standard (RA 2001) Date: 10/03/2001)	Input Torque 5 kg-m to 60 kg-m Input RPM 10 rpm to 2800 rpm Temperature: - 35 °C to 95 °C 4-WD Torque:- 5 kg-m to 40 kg-m Output Torque:- 40 kg-m to 1800 kg-m Output RPM: 1 rpm to 150rpm

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	Tractor Transmission (2WD/ 4WD) & 4-WD Front Axle	Endurance test	MRV/SEL/SOP/07 Date:16/06/14 (Internal Ref.: M & M Standard (RA 2001) Date: 10/03/2001)	Qualitative Type
16.	Component Testing (Rubber & Plastic Products)			
a.	Rubber/Rubber Components	Ozone Resistance	ASTM D-1149-07	(25 to 200) PPHM
		Brittleness test	ASTM D2137-11	(-) 50 °C to 125 °C
		Hardness Shore A	ASTM D2240-05	15 Shore A to 90 Shore A
b.	Rubber Hoses	Burst Pressure	IS 443 - 1975	5 kg/cm ² to 30 kg/cm ²
c.	Plastic/Rubber (Components/ Specimens)	Density, Specific Gravity of Plastics & Rubber Samples	ASTM D792-13	0.4 g/cc to 2.5 g/cc
d.	Plastic / Plastic Components	Hardness Shore D	ASTM D2240-05	20 Shore D to 90 Shore D
e.	Plastic (Specimen)	Heat Deflection Temperature	ASTM D648-07	25 °C to 300 °C
		Izod Impact Resistance	ASTM D256 - 10	Max 80 KJ/m ²
f.	Plastic / Painted Metallic Sheet (Components / Templates)	Gloss	ASTM D523 - 13	Gloss: 1 Units to 120 Units

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g.	Painted / Unpainted Plastic & Painted Metallic (Components & Templates)	Xenon-Arc Weatherability	SAE J2412 - 04	Delta E (Above 0.1)
h.	Painted Metallic Sheet (Components / Templates)	Corrosion Resistance	SAE J2334-03	Creepage (0.5 mm to 5mm)
i.	Painted Metallic Sheet	Paint Film Thickness	ASTM D7091 - 13	2 Microns to 200 Microns
j.	Painted / Unpainted Plastic & painted Metallic Sheet (Components / Templates)	Color	SAE J1545 - 05	Delta E (Above 0.1)
II. MECHANICAL PROPERTIES OF MATERIAL				
1.	Metals & Alloys – Raw Material & Components	Rockwell Hardness Testing	ASTM E18-15 IS 1586 (Part 1): 2012	HRC (20 to 70) HRB (70 to 100) HRA (50 to 100)
		Brinell Hardness Testing	ASTM E10-14 IS 1501 (Part 1): 2013	HBW 10/3000 (200 to 500) HBW 2.5/187.5 (200 to 500)
		Vickers Hardness Testing	ASTM E384-11 IS 1501 (Part 1): 2013	HV10 (100 to 500)

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	Metals & Alloys – Raw Material & Components	Micro Vickers Hardness Testing	ASTM E384-11 IS 1754: 2002	HV0.2 (300 to 800) HV1 (100 to 1000)
		Case Depth Measurement by Hardness Traverse Method	IS 6416: 1988 (RA 2012) SAE J423 (RA 1998)	0.05 mm to 10mm @ HV1 0.05 mm to 10mm @ HV0.2
		Tensile Testing at Room Temperature: Tensile Strength Yield Strength % Elongation Strain hardening exponent	ASTM –E8/E8M-13a	100 N/mm ² to 2000 N/mm ² 100 N/mm ² to 2000 N/mm ² 1 % to 60 % 0.1 to 1
		Macro Etch Testing using Stereo Zoom Microscope	ASTM E340-14 ASTM E381-01 IS 13015-91 (RA 2012) IS 11371-85 (RA 2012)	10X to 80X
		Microstructure Analysis using Optical Metallurgical Microscope	ASM Metals Hand Book Vol.9 Metallography & Microstructures	50X, 100X, 200X, 500X, 1000X
		Microstructure Analysis & Fractrography using Scanning Electron Microscope (SEM)	ASM Metals Hand Book Vol.12 Fractrography	5X to 300000X
		Element Analysis using SEM – Energy Dispersive Spectroscopy (EDS)	ISO 15632: 2012 ASTM E1508-12a	Quantitative Analysis

-X-X-X-X-X-X-X-X-X-X-X-X-X-