Reasoned Document:

Para no. a	nd Details in RDSO spec	M/s Avadh Comments	M/s Bony Comments	M/s GMT	M/s Premier Seals	M/s Shakti	M/s MTC	M/s United	RDSO remarks
Section – /	of RDSO specification no.	1	1	I.		1			I
5.2.i	They should possess valid ISO and IRIS certificate							IRIS certification is largely based on ISO 9001:2015 plus Railway-specific requirements. IRIS certification should be optional for vendors having ISO 9001:2015 certification particularly for small scale industry. It involves additional financial burden. Moreover, Railway-specific requirements (covered under IRIS in addition to ISO 9001:2015) can be ensured by IR.	IRIS is Railway specific certification and Metal Bonded Rubber components are critical Railway Items. Hence, IRIS required. In view of this, 6 month time from date of issue of specification shall be given to obtain IRIS certificate.
5.4.3	The Metal Bonded Rubber components for Vande Bharat Trains and FIAT Bogie of a particular design shall be subjected to in-service trials on a minimum of twenty coach sets for one year on IR's system. Further supplies shall generally be permitted after satisfactory performance of service trials.					The Metal Bonded Rubber components for Vande Bharat Trains Bogie of a particular design shall be subjected to in-service trials on a minimum of twenty coach sets for one year on IR's system. Exemption granted to firms that have approved & supplied metal- bonded rubber components for FIAT bogies.			As the bogie and Metal Bonded Rubber components design are different in Vande Bharat trains & LHB Coaches. Therefore, field trial will be mandatory for both type of Bogies.
6.3.1	The rubber should be natural rubber suitably compounded to conform to the requirements stipulated in this Specification. Supplier should test the characteristics of rubber compound and submit the test		Natural rubber alone or blend with synthetic rubber.		By considering the required stiffness value, dimension and life of the product(s) it can suitably compounded Natural rubber or blend with			Basic properties of Rubber should be provided by RDSO for uniformity among the supplier and also help to small scale	Suggestion of M/s Premier seals and M/s Bony has been accepted and blending of synthetic rubber is permitted.

	repor stand testin	t. Detaiİs lards for	art of type test of applicable characteristic tioned in para. 7			synthetic rubber to achieve the properties Separate documents will be provided about the properties of rubber for each products during the developmental stage.			vendors.	Suggestion of M/s United Engineering is not acceptable. Since each OEM has their own design philosophy, it is better for each OEM to have their own rubber properties which can be mentioned in QAP and verified during routine inspection.
6.3.2.1	Detai	Is of metal Item Centre Pivot Bearing Spring pad Primary Bump Stop Lateral Buffer Axle guide bearing / Primary Suspensi on Bush Traction Rod	Details of metal parts S355J2 to EN 10025 – 5 er Equivalent S355J2 to EN 10025 – 5 er Equivalent St W22/HR 3/E 350 C er Equivalent S235 JR er Equivalent S355J2 to EN 10025 – 5 and 42 Cr Mo4 (for	Equivalent material should be permitted as availability of exact grades in market is limited and pricing shall increase significantly. However, the alternate/equivalent material's properties shall be equal or higher than the specified grade.	Equivalent grade of metals needed, in case European Grade metals are not available in India. GMT India will ensure that all physical and mechanical properties are met.	SN-3 Specified material grades for the metal plate is accepted, but the screws/bolts shall be of grade 8.8 SN-4 Recommended material as per BOM-1 SN-5 Recommended material as per BOM-2 SN-6 Recommended material as per BOM-3 SN-7 Recommended material as per BOM-4 List of BOM material is given at the end of this document.	Equivalent Material to be added Grade EN19 is equivalent grade.	MTC will use equivalent grade/ standard of material in Metal bonded rubber suspen- sion component in Vande Bharat Trains.	Window should be open for using the equivalent grade of the material should be allowed, Railway Board vide its letter No. 2021/RS(G)/779/6 (1) dated 22.05.2021 has also issued instructions to remove the foreign standards/certificat ions for replacing them with Indian Standards/ certifications or our own standards, to the extent possible for development of Indigenous vendors.	provision of

		Equivalent				
	7	Stabilizer S355J2 to Link EN 10025 -				
		5 (outer tube) and				
		42CrMo4+Q				
		T (for Inner				
		pin of ball				
		joint, handle				
		bar, Handle				
		bar eye LH				
		& RH) or				
		Equivalent.				
		Stabilizer				
		link				
		assembly				
		clamp fixing				
		nut shall be Steel lock				
		nut (make:				
		Flaig +				
		Hommel /				
		TVS /				
		Bossard)				
6.3.3.2	For F	FIAT Bogie, material should as per respective RCF	 	 SN-1 Materials of metallic parts are	 	 Suggestion of M/s Premier seals has
		ng given as under:		accepted as per latest		been accepted and
	SN	Item RCF		version of IS: 1161-		accordingly, para
		Drawin		YST 240 SN-2		updated.
		g No.		Materials of metallic part is recommended		
	1	Traction LW061		to use as per latest		
		Centre Elastic 02 Alt. b Joint		versions of IS: 2062		
	2	Rubber Pad LW011		E250C Latest Version		
		For Primary 01 Alt. b		SN-3 Materials of metallic plate is		
		Suspension		recommended to use		
	3	Primary Bump LW011		as per latest versions		
	4	Stop 02 Alt. d Lateral Bump LW051		of IS: 2062 E250C		
		Stop 04 Alt. d		Latest Version.		
	5	Axle Box LW011		Bolt/Screw is recommended to use		
		Pivot Bush 00 Alt. d		grade 8.8 SN-4		
		with Solid or Hollow Pin		Materials of metallic		
		Construction		parts are accepted as		
	6	Ball Joint LW061		per latest version of IS: 1875 -Class-1A		
		Traction 00		SN-5 Materials of		
		Lever		 metallic Inner parts is		

			11			1			
	7	Ball Joint Roll	LW051		accepted as per latest				
		Link	08 Alt. b		version of IS: 1875				
	8	Rubber Pad	LW051		Class-1A.Outer				
		For	09 Alt. c		IS:1161 YST 240 as				
		Longitudinal			per latest Version SN-				
		Bump Stop			6 Materials of metallic				
			LWOE1		parts are accepted as				
	9	Rubber	LW051						
		Spring	20		per latest version of				
					IS: 1875- Class-IV				
					SN-7 Materials of				
					metallic parts are				
					accepted as per latest				
					version of IS: 1875-				
					Class-IV SN-8				
					Materials of metallic				
					parts are accepted as				
					per latest version of				
					IS: 2062- E410 SN-9				
					Materials of metallic				
					parts are accepted as				
					per latest version of				
					IS:1570- Part – III.				
6.3.4	The	Metal Bonded	Rubber	 	 The current suppliers	Fire resistance test			No change is
0.0.1		onents shall be			produce Metal Bonded				envisage. However,
		oly to dissipate he			Rubber components	fire resistance test			one year time shall
					without fire-retardant				
	devel	•	rubber			should be application			be provided to
		ent. Metal Bonde			properties, and we	specific.			upgrade the product
		onents should co			request acceptance of				as per EN 45545
		5545 with hazard	l l		the same. We are	 Fire resistance as 			with hazard level
	2 und	der the requireme	ent set of		actively developing	per EN 45545 (R9 ,			HL-2 under the
	'R9'.				technology to meet	HL-2) is typically			requirement set of
					EN 45545 – HL2 (R9)	essential for			'R9'.
					requirements,	components used			
					targeting compliance	in areas with high			
					within 2 to 3 years.	fire risk, such as			
					Additionally, the	interior furnishings,			
					components will be	cables, and			
					designed to dissipate	passenger			
					heat energy	compartments.			
					effectively, ensuring	Metal Bonded			
					durability and	Rubber			
					functional reliability.	Components are			
					This phased approach	generally used in			
					allows continued	mechanical and			
	1					structural			
					supply while				
					progressing toward full	applications (e.g.,			
					fire safety compliance	bushings, mounts,			
						and suspension			
	1					elements) where			
						their primary			
						function is to			
						absorb vibration			
						and shock rather			
1	I					than serve as an	I	I	1

					exposed fire			
					hazard.			
6.4.1.2	Degreasing: The metal plates		 	Noted and accepted.			PLC controlled	Suggestion of M/s
	shall be degreased to ensure			However, in the event			degreasing line	United Engineering
	metal surface is free from oil before grit/shot blasting. For			of an observation where there is a				is not acceptable. To minimize the
	degreasing an PLC controlled			break in the drawn			be left to vendor	
	degreasing line shall be used.			line(s), it indicates the			and vendor should	
	Alkaline Degreasing shall be			presence of oil,			l .	activities automation
	preferred to remove heavy oils and contaminants from the metal			grease, or foreign particles. In such			volume of work.	is required.
	surface. Test shall be carried out			cases, the affected				
	to check the contamination of			metal parts shall be				
	oil or grease on the degreased surface. A special ink, 30-Accu-			degreased again until the lines				
	Dyne Test Pen or equivalent			are continuously				
	may be used to perform the test.			formed, ensuring a				
	A line may be drawn at different locations on the cleaned metal			completely oil-free surface.				
	surface using cotton swab or a			Surface.				
	brush dipped in the ink or pen. If							
	the ink form as a continuous							
	line, it indicates the surface is free from oil. The Degreased							
	Metal Plates shall always be							
	handled with gloves, it shall							
	never be handled with bare hands.							
	nands.							
6.4.1.3	Grit/Shot Blasting: After	Sand Blasting should	 Metal parts	The blasted surface	After degreasing,	Loading &	Automatic loading	Request of M/s
0.4.1.5	degreasing, the metal plates	1	 will be grit	roughness shall be	the metal plates	unloading of	and unloading of	•
	shall be grit/shot blasted to	blasting on parts	blasted to	maintained within the	shall be	metal parts	parts in Grit/shot	Shakti accepted and
	ensure clean, rough surface optimized for adhesive		create surface	range of Rz 22 to 36	Sand/grit/shot blasted to ensure	can be	_	Sand Blasting is also included.
	optimized for adhesive properties. It shall be performed	distorting on parts.	roughness, in GMT India.	microns (or an equivalent Ra value)	clean, rough	manual. Hence this is	mandatory . It will	also included.
	within 2 hours or as	Thickness of	GMT India	to prevent breakage	surface optimized	not related to	be left to vendor	Loading and
	recommended by OEM of the	roughness varies from	has the facility	at sharp corners, a	for adhesive	quality of	I .	Unloading should be
	degreasing operation as mentioned above. The	part thickness, shape and complexity of	to measure surface	common issue	properties. It shall be performed within	product.	decide based on volume of work.	automatically. To install this facility 6
	grits/shots shall be as per IS	geometry, hence	roughness.	associated with grit or shot blasting. This	2 hours or as			month time shall be
	4683/ IS 4606 or any other	general values of		specification aligns	recommended by			given.
	nationally /internationally recognized standard. After	roughness should not be defined and		with international best	OEM of the degreasing			In the clause, it is
	grit/shot blasting, blasted			practices and ensures	operation as			already mentioned
	surface must be cleaned either	mention these values		the integrity of the bonding surface.	mentioned above.			that another type of
	using solvent or dry air blow (free of oil and water) or vacuum	in their QAP partwise.		Exceeding Rz 36	The grits/shots shall be as per IS			surface preparation may also be
	to remove all dusts from blasted			microns is not	4683/ IS 4606 or			acceptable with
	surface. Quality of blasted			<u>recommended,</u> <u>as</u>	any other nationally			approval of RDSO.
	surface cleanliness can be			<u>higher roughness</u>	/internationally			

	ascertained using tape test. To			levels increase the	recognized				
	get good bond performance,			risk of sharp corner	standard. After				
	blasted surface roughness Ra				grit/shot blasting,				
				developing crack or					
	will be in the range 10 - 20			partially break,	blasted surface				
	microns or Rz in the range 40 -			potentially leading to	must be cleaned				
	75 microns. In case there exist			bonding failure.	either using solvent				
	standard guidelines			<u></u>	or dry air blow (free				
	/recommendations/instructions			A -1 -1:4: 11: 4: -	of oil and water) or				
	from OEM of the bonding agent			Additionally, automatic	vacuum to remove				
				loading and unloading	1				
	for the surface preparation, the			do not contribute to the	all dusts from				
	same can be used for the best			quality of blasting.	blasted surface.				
	performance of the bonding			Therefore, the use of a	Quality of blasted				
	agent. However, Firms shall			manual loading and	surface cleanliness				
	obtain approval from the				can be ascertained				
	Carriage Directorate /RDSO for			unloading system	using tape test. To				
	the alternate process before			should be permitted.	get good bond				
	use. The Grit/shot Blasting shall				performance,				
	be performed in a Blasting				blasted surface				
	Machine having automatic				roughness Ra will				
	loading and unloading of parts.				be in the range 10 -				
	The Blasted Metal Plates shall				20 microns or Rz in				
	always be handled with gloves,				the range 40 - 75				
	it shall never be handled with				microns. In case				
					1				
	bare hands.				there exist				
					standard guidelines				
					/recommendations/in				
					structions from OEM				
					of the bonding agent				
					for the surface				
					1				
					preparation, the				
					same can be used for				
					the best performance				
					of the bonding agent.				
					However, Firms shall				
					obtain approval from				
					the Carriage				
					Directorate /RDSO				
					1				
					for the alternate				
					process before use.				
					The Grit/shot Blasting				
					shall be performed in				
					a Blasting Machine				
					having automatic				
					loading and				
					unloading of parts.				
					The Blasted Metal				
					Plates shall always				
					be handled with				
					gloves, it shall never				
					be handled with bare				
					hands.				
6.4.1.4	Adhesive Application: After	 		Noted and accepted		After blasting	Automatic spray	No change	is
	blasting and cleaning of metal			the points regarding		•	coating machine	envisage.	
	surface, Primer Chemlok 205			the primer, adhesive,		process,	with automatic	-	
	needs to be applied on all					metal parts	sensors,		
		I	ı		1		- ,		

S	surfaces & edges of metal,			 and application	 will be stored	temperature and	
w	within one hour of blasting by			method. However,	in closed	SCADA controller	
S	spray method using HVLP (High			proving the suitability	con- dition to	PLC should not be	
	Volume Low Pressure) spray			of any other superior	avoid	mandatory. It will	
	gun to maintain uniform			bonding agent as an	expose to	be left to vendor	
	adhesive thickness throughout			alternative to Chemlok	dust & rust	and vendor should	
_ I	the metal surface. Dry Film			is challenging for the	(environment	decide based on	
	Thickness of primer Chemlok).	volume of work.	
	205 needs to be maintained in			supplier due to a lack	'		
	the range 5 – 10 microns. Once			of in-depth knowledge	MTC is		
	Primer Chemlok 205 is applied,			about bonding agents.	recommendin		
	it is to be dried at room			Therefore, it must be	g manual		
	temperature for at least 30			addressed that any	spray coating		
I I	minutes or as prescribed by			alternative bonding	system for		
	adhesive manufacturer. Once			agent used shall meet	adhesive with		
	Primer Chemlok 205 is applied			the required bonding	controlled		
	and dried, cover coat Chemlok			strength specified in	environment		
_ I	6411 needs to be applied by			this specification.	& quality		
	spray method using HVLP spray			Additionally, the	checks.		
	gun. Dry Film Thickness of			adhesive spray or	CHECKS.		
	Chemlok 6411 will be 18 – 25			coating application			
	l l						
	microns. Total Dry Film			method may differ from			
	Thickness (Chemlok			Chemlok, and such			
	205+Chemlok 6411) will be 23 –			variations must be			
1	35 microns. Once Chemlok			accepted by RDSO.			
	6411 is applied, it needs to be			Regarding the			
	dried at room temperature for at			automatic spray			
	least 30 minutes or as			coating machine, the			
	prescribed by adhesive			requirement for an			
	manufacturer. Any other			automatic sensor,			
	bonding agent superior to			temperature control,			
	mentioned bonding			and SCADA-			
	agents can also be used with			integrated PLC—			
	prior approval of Carriage			while PLC control is			
	Directorate/RDSO, Lucknow.			acceptable, the			
	The Adhesive application shall			SCADA requirement			
	be carried out using automatic			shall be relaxed—			
	spray coating machine with			provided the spray			
	automatic sensors, temperature			coating machine			
	and SCADA controller PLC. Any			ensures uniform			
d	deviation to this shall have to be			thickness and			
g	got approved from Carriage			consistent application			
	Directorate/RDSO, Lucknow.			quality.			
Т	The Coated Metal Plates shall			1 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
	always be handled with gloves,						
	it shall never be handled with						
	bare hands.						
	The adhesive application shall			 The adhesive	 		No change is
	be done in a separate room			application shall be			envisage.
	which is free from dirt/dust and			carried out in a			
	having proper exhaust facility.			dedicated space that			
				is free from dirt and			
		1	l l				
	Ensure that the metal plates			I			
w	Ensure that the metal plates which are ready for use after			dust, with an			
w a	Ensure that the metal plates			I			

	covered trolleys/boxed/bin and stored in a controlled environment having temperature and humidity control as recommended by OEM of the adhesive to avoid surface contamination till it is put on to moulding press.		controlled environment. However, this requirement shall be optional for facilities with a clean shop floor environment where dust and dirt contamination are not a concern. Additionally, the storage system for adhesive-coated metal parts is accepted, provided it ensures proper protection and prevents contamination before			
6.4.2.1	Weighing of Compounds as per the Recipe: The Weighing of rubber shall be done through electronic weighing machine. Based on the weight of the rubber, weighing of other compounds shall be done by the weighing system having SCADA (PLC System) chemical and Carbon weight control. Output of rubber weighing system shall be automatically picked up as input by SCADA system.		It is recommended to keep as an optional requirement as the quality requirement of the products can be met even without this system.	MTC is receiving premixed rubber compound from MTC Spain. Adding final chemical takes place at MTC India before molding.	System) chemical and Carbon weight control and Output of rubber	M/s Premier Seals is not acceptable. To minimize the human interface
6.4.2.2	Mixing: The mixing of Chemical/Compounds shall be carried out in appropriate mixing machine Banburry/ Intermix having pressure and temperature control. The Firm shall specify the Rheograph having an upper control limit and lower control limit as per the best Industry Practices. The dispersion/distributive test shall also be carried out as per the Standard Test for which the Firm shall mention the acceptable limit and methodology in the QAP.	 Add Kneader also with SCADA control and an autofeeding system similar to intermix & Banbury. The Dispersion Kneader, as its name suggests, is ideal for achieving excellent dispersion in compounds at relatively low temperatures. The Kneader is for high dispersion quality,	 Noted the point however, it shall also be permitted to use the Kneader as per clause 12 at Section D. Internal mixer provides good quality of dispersion There is no necessary requirement of dispersion test as Rheo/Mooney viscosity test is sufficient for quality control.		 	No change is envisage.

			consistent compound mixing & particularly for natural rubber, low temperature result in high durability.				
6.4.2.3	Storage: The Rubber compound before the mixing of accelerator shall always be stored in a control atmosphere having temperature and humidity control as per the Standard Practices.			After mixing the accelerators, the rubber compound shall always be stored in a controlled atmosphere with regulated temperature and humidity, as per standard practices. This ensures consistency in compound properties, prevents premature curing, and maintains optimal processing characteristics. However, maintaining a controlled atmosphere before mixing the accelerators is not essential.			No change is envisage.
6.4.2.4	Moulding: Metal Bonded Rubber Components shall be manufactured by Injection moulding process only. The temperature and moulding time of Injection moulding process shall be optimized for proper curing of rubber. Rheometer shall be used for this optimization.	Metal Bonded Rubber Components shall be manufactured by Injection moulding process/Transfer Injection Moulding process. Annexure (i) is attached in our document for more details about transfer injection moulding process and injection moulding process.		The accepted moulding process is Injection Moulding; however, it should be noted that the Rheometer is not part of the moulding process. Rheometer testing is conducted during the compound testing and validation stage before moulding to determine the optimal curing characteristics. The temperature and moulding time of the Injection Moulding process should be optimized based on Rheometer data, but	Metal Bonded Rubber Components shall be manufactured by Transfer or Injection moulding or Transfer Injection moulding process only. The temperature and moulding time of Injection moulding process shall be optimized for proper curing of rubber. Rheometer shall be used for this optimization. In transfer moulding, the rubber is first heated in a transfer pot and then pushed into the mould cavity		No change is envisage. The Rheometer is not part of Injection Moulding Process. It should be used to optimizing the moulding process.

				the Rheometer itself is not directly involved in the moulding process.	through a sprue system. This ensures uniform flow and reduces trapped air, leading to stronger bonding between rubber and metal components. Transfer moulding is			
					well-suited for intricate rubber-metal bonded components with thin walls and complex profiles. Transfer moulding allows precise control over curing due to uniform			
					rubber flow, reducing defects like under-cure or scorch marks. Transfer moulding is an industry- preferred process for metal-bonded rubber parts due to			
					its superior bond strength, lower defects, and material efficiency.			
6.4.3	The rubber (after injection moulding) shall be smooth and free from pinholes, blisters and any other visual flaws. All sharp edges and burrs shall be removed from the metal parts. Before applying primer coat for achieving the required bond strength between metal and rubber, the metal, which are ready for use, should be stored suitably to avoid contamination of the metal surface. The metal to rubber bonding shall be uniform and to the standard laid down later in this specification.	The rubber (after injection moulding/transfer injection moulding) shall be smooth and free from pinholes, blisters and any other visual flaws.		Moulding defects in rubber can be visually analyzed on the outer surfaces exposed to air. However, internal defects such as blowholes and improper curing must be inspected during each setup. This can be done by conducting trial moulding without adhesive-coated metal parts, allowing the rubber to be cut and examined for any internal defects. Additionally, the storage of metal parts is accepted, provided it ensures proper	To ensure the rubber surface is smooth and free from pinholes, blisters, and visual defects, and to achieve uniform metal-to-rubber bonding, incorporating additional machine options can significantly enhance process control and product quality. Transfer Injection Moulding Machine provides better rubber flow control, ensuring uniform		No change is envisage.	

			protection and prevents contamination before further processing.	filling and reducing bonding defects. Reduces flash and post-processing requirements, leading to smoother surfaces.		
6.5	Magnetic Particle Testing (for casting and forging items): Magnetic Particle Testing shall be performed in accordance with DIN EN 1369, considering the general principles of magnetic particle testing in accordance with EN ISO 9934-1 / DIN EN 10228-1. The qualification and certification of testing personnel must comply with DIN EN ISO 9712. Acceptance criteria for MT test: Classification of defects according to EN 10228 / Inspection level 2 / Quality category 4. For evidence of external condition 100 % shall be performed on raw material (on sample basis as per ISO:2500) of following items: Vande Bharat Trains, Vande Metro, EMU and MEMU underslung Traction rod body Inner pin of ball joint of Traction rod and Stabilizer link body Inner pin of Axle guide bearing / Primary Suspen sion	Magnetic Particle Testing (for casting and forging items): Magnetic Particle Testing shall be performed in accordance with DIN EN 1369, considering the general principles of magnetic particle testing in accordance with EN ISO 9934-1 / DIN EN 10228-1. The qualification and certification of testing personnel must comply with DIN EN ISO 9712. Acceptance criteria for MT test: Classification of defects according to EN 10228 / Inspection level 2 / Quality category 4. For evidence of external condition 10 % shall be performed on random sampling basis.	The acceptance criteria as per EN 10228-1 are accepted. However, the evidence of external condition or visual examination sample size shall comply with IS 2500, not ISO 2500.		Accepted by MTC for following parts for vande bharat trains: Traction rod body Stabilizer link body Inner pin of ball joint of Traction rod and Stabilizer link Inner pin of Axle guide bearing / Primary Suspensi on Bush	On the basis of comments of M& C Directorate, acceptance criteria and sample size updated as under: Classification of defects according to EN 10228-1/Quality class - 4 and Inspection ASNT/ISNT Level-2 For evidence of external condition MPT shall be performed on raw material 100%.

	Duah	1				
6.6	Magnetic Particle performed on sal certificate / report facilities / sub-verparty laborator submitted with each Ultrasonic testing	rt from in house endor end / third y should be ch supply. ng (for casting	 	 The acceptance	 MTC is	 On the basis of
	and forging item Ultrasonic testing must be conducte with DIN EN 1266 account the gene DIN EN ISO 168 qualification and test personnel m DIN EN ISO 971 Acceptance crit Classification of according to EN EN 10228 (categ Inspection level 2 100 % For evider condition Ultraso be performed on sample basis as following items: Vande Bharat Trains, Vande Metro, EMU and MEMU underslung • Traction rod I body • Stabilizer link body • Inner pin of	ns): g (UT testing) ed in accordance 80-3, taking into eral principles of 10. The I certification of nust comply with 2. teria for UT: defects 10308 (Q3) or gory 3) / 2. nce of internal onic Testing shall raw material (on per ISO:2500) of		criteria as per EN 10228-1 are accepted. However, the evidence of external condition or visual examination sample size shall comply with IS 2500, not ISO 2500.	recommendin g to follow Ultrasonic or radiography for following parts of VB: • Traction rod body Stabilizer link body • Inner pin of ball joint of Traction rod and Stabilizer link • Inner pin of Axle guide bearing / Primary Suspensi on Bush	comments of M& C Directorate, acceptance criteria and sample size updated as under: Classification of defects according to EN10308/EN 10228- 3/Quality class - 3 and Inspection ASNT/ISNT Level-2 For evidence of external condition UT shall be performed 100 %.

	heaving /			I	I	
	bearing / Primary • Suspensio n Bush					
	Test certificate / report from in house facilities / sub-vendor end / third party laboratory should be submitted with each supply.					
6.7	Welding Quality: Welding quality shall be as per DIN EN15085-3 2. Quality Level of Irregularities of Welded Connections shall be as per DIN EN ISO 5817 (Quality level B, C or D acc. to drawing) If the welding facility is outsourced, nodal agency for Vendor development can visit the facilities of sub-vendor.		Considering the present scenario in Indian industries, very few suppliers hold the specified welding certifications, and those that do primarily use them for their internal bulk production. Typically, metalbonded rubber manufacturers do not have such facilities. Therefore, rather than mandating the specified certifications, it is suggested to focus on testing the welding strength to ensure it meets the required performance criteria. This approach would be more practical and inclusive while maintaining the necessary quality standards.			RDSO specification should be followed.
6.8.1	2K-EP DS metal primer should be applied with a thickness of 60-100 µm and after it a 2K-EP thick film with thickness of 100-120 µm. Both paintings should be water dilutable, resistant to cleaning agents and shall be Fireproof (make: WEILBURGER/Walter Mäder AG/ Akzo Nobel). Documentary evidence shall be submitted for verification.		 stariuaius.	Accepted by MTC. Also, MTC proposing Epoxy based primer & Polyurethane based cover coating for painting application.		RDSO specification should be followed.
6.8.3	Metal parts (exposed to environment) which is not bonded with rubber should be Zinc Nickle	 	 The electroplating thickness should be revised to 8µ m as per	 		Clause has been re- write as under: Metal parts (exposed

	Electroplated according to ISO 19598 with minimum coating thickness of 12 μm or painted with minimum coating thickness of 140 μm.		ISO 19598- Fe//ZnNi8//Cn//TO instead of 12µm. A higher thickness significantly increases processing time and poses a greater risk of deteriorating both the bonding integrity and rubber quality during the electroplating process. Maintaining an 8µm thickness ensures adequate corrosion protection while minimizing adverse effects on bonding. This thickness level provides protection for at least five years under typical Indian climatic conditions. Additionally, the painting process must comply with Clause 6.8.1 to ensure alignment with the specified standards and performance requirements			to environment) which is not bonded with rubber should be Zinc Nickle Electroplated according to ISO 19598 with minimum coating thickness of 12 µm. If painting is used at any part then minimum coating thickness shall be 140 µm.
6.9	Disposal: The material selection of the Metal Bonded Rubber components must be made in such a way that later can be re- cycled at the end of its service life or be able to be disposal without the use of special measure.		 Recycling rubber bonded with metal presents a significant challenge due to the strong adhesion between the materials. However, if metal parts be extracted separately and effectively recycled, ensuring sustainable disposal practices		 	No change is envisage.
6.10	Ash content in Rubber compound should be maximum 5 %.	 	 	Increasing the ash content to 7% allows for a higher proportion of reinforcing fillers like carbon black, silica, or metal oxides.	 	Ash content should be maximum 5 %.

			I	T	1	-	
					These fillers improve abrasion resistance, tensile strength, and durability, which are crucial for railway and automotive applications. Higher ash content (within controlled limits) enhances thermal stability and oxidation resistance, making the rubber compound more durable in high-temperature and harsh environmental conditions. Certain fillers in the		
					ash contribute to better adhesion		
					between rubber and		
					metal in metal-		
					bonded components. A slight increase in		
					ash content can		
					improve bond		
					strength, leading to longer component		
0.44	The feet was a state of the sta		Dimania		life.		Farlian M/a Dramian
6.11	The frequency dependence of stiffness shall be demonstrated	 	Dynamic stiffness test	Frequencies dependence stiffness	To optimize testing requirements while		 Earlier M/s Premier had recommended
	for each item during prototype		will be	or Dynamic stiffness	ensuring reliable		for Frequencies
	testing.		conducted	testing can be	performance		dependence stiffness
			during	deferred for now, as	validation, Dynamic		with following
			prototype testing.	existing qualification	Mechanical Analysis (DMA) can be made		recommendation:
			tooting.	methods, including static stiffness and	optional, provided		During prototype
				fatigue testing, are	alternative methods		testing, the
				sufficient to	such as Finite		frequency
				assess performance,	Element Analysis (FEA) and selective		dependence of stiffness must be
				and most	physical testing are		demonstrated to
				manufacturers do not have the required	used to verify		understand material
				testing facilities.	frequency-		behavior under
				Additionally, dynamic	dependent stiffness behavior.		loading Conditions. Using a high-
				stiffness testing	DMA requires		accuracy machine
				requires well-defined	specialized		like the branded
				parameters such as	equipment and can		Testing Machine for
				frequency range, load	be time-consuming		static loads ensures

				amplitude, and temperature conditions, and it must be conducted either on standard rubber specimens or the actual bonded product for accurate evaluation.	and expensive, increasing prototype development costs.		precise stiffness measurement, allowing for reliable assessment of performance under varying load conditions. This helps verify the material's suitability for real-world applications, ensuring long-term reliability. Hence, recent comments of M/s Premier is not acceptable now. M/s GMT and M/s Trelleborg is advised to explain the difference between Frequencies dependence stiffness test and Dynamic stiffness testing alongwith test procedure and other details so that details can be further examined.
7.0	vi) Firm shall submit FEM/FKM analysis report along with proposal drawing. FEM/FKM report shall simulate and analyze the structural behavior of the rubber-tometal bonded product. Evaluate stress distribution, deformation, strength to meet functional loads, life of the product and other performance indicators to optimize the design		 			 FEM/FKM analysis report should not be mandatory. Product validation should be based on endurance testing followed by field trial.	envisage.
7.0	Vii) Firm shall submit DMA (Dynamic mechanical analyzer) for Deflection Co-efficient and modulus of elasticity as a function of temperature.		 	The requirement for DMA (Dynamic Mechanical Analysis) to determine the deflection coefficient and		 Submission of DMA (Dynamic mechanical analyzer) for Deflection Coefficient and modulus of elasticity as a	No change is envisage.

					T =	
			modulus of elasticity		function of	
			as a function of		temperature	
			temperature can be		should not be	
			deferred for now for		mandatory.	
			metal-bonded		Product validation	
			rubber products		should be based	
			used in rail bogies.		on endurance	
			These components		testing followed by	
			primarily function		field trial.	
			as suspension			
			elements where			
			1			
			parameters such			
			as static and			
			dynamic stiffness,			
			fatigue life, and			
			shear/ compression			
			characteristics are			
			more relevant for			
			performance			
			evaluation.			
			Additionally, DMA			
			testing is typically			
			conducted on pure			
			elastomeric			
			materials rather			
			than bonded			
			assemblies, as the			
			presence of metal			
			1 -			
			significantly affects			
			the results. Given			
			the current industry			
			practices and			
			available qualification			
			methods, such as			
			static stiffness and			
			fatigue testing, DMA			
			testing can be			
			considered in future			
			improvements if			
			necessary for further			
			material			
			characterization.			
8.0	GUARANTEE:	 	 The guarantee/warranty	 		Criteria for LHB
	The Metal Bonded Rubber		period specified is well			coaches already
	components including		accepted.			mentioned in
	accessories shall be		However, the criteria			CAMTECH
	guaranteed for satisfactory		for defect			Maintenance
	performance for 72 48 months		deterioration during			manual. Criteria for
	from the date of supply or 2000		the service period of			items of Vande
	000 km 36 months from date of		the product(s)			Bharat Coaches
	fitment whichever is earlier.		should be clearly			shall be decided
			defined for each			after submission of
	Satisfactory performance for		acilica ioi cacil			

this purpose means that Moral Bonded Robber compromis or any of its part shall nother allow the compromis or any of its part shall nother allow the compromis or any of its part shall nother allow the compromis or any of its part shall nother allow the compromis or any of its part shall nother allow the is skell station. During the third specification. During the third specification. During the antitionable to manufacturing design defects. In the over for Non satisfactory Performance of any of the items are represented of such liens on the purchase In stationable to manufacturing any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses without leaving any controlled the same at his cover expenses with the purchased for the first item for any controlled the same at his cover items and the cover expenses of the same at his cover items and the cover expenses of the same at his cover items and the cover expenses of the same at his cover items and the cover expenses of the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover the cover expenses of the cover items and the cover								
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components, the supplier shall have to supply maintenance instructions in the form of two RDSO in both PDF format and hard copy. RDSO in both PDF format and hard copy.		1						
have to supply maintenance instructions in the form of two format and hard copy.								
instructions in the form of two during maintenance					I			-
	i contract of the contract of	have to supply maintenance					i	**************************************
LUDDKELLDRU LUDVIRU ODE L.					iormat and hard copy.			
booklet (Hard Copy) and one 1) Specification schedule		instructions in the form of two						during maintenance

copy on compact disc. (MS-	cannot be covered	undertaken on his
Office Compatible) in English	in maintenance	equipment as per
along with approved drawings of	manual	maintenance
Metal Bonded Rubber	2) No specific	booklet supplied by
components.	requirement as the	him.
	part is fit and run.	
The maintenance booklet	3) Not necessary as	With every order for
supplied by the supplier shall	nature of the part	supply of the Metal
cover the following aspect in	4) Out of supplier	Bonded Rubber
detail:	scope	components, the
1) Specification of Metal	5) Out of supplier	supplier shall have
Bonded Rubber components.		to supply
2) Working principle based	scope	maintenance
upon the actual construction.	6) Out of supplier	instructions in the
3) Constructed details giving	scope	form of two booklet
sketch, drawing and photo	7) As per RDSO	(Hard Copy) and
	specification and	` ' ' '
copy etc. identification various items and their part	QAP	one copy on
· · ·	8) Not common	compact disc. (MS-
number etc. for easy	practice for the	Office Compatible)
identification.	products	in English along with
4) Procedure for dismantling	9) There are no	approved drawings
using sequential steps with	remedies for the	of Metal Bonded
the help of sketch etc.	defects in	Rubber
5) Procedure for assembly,	product(s)	components.
using sequential step with	10) Included in	
the help of Sketch etc.	maintenance	The maintenance
6) Jigs, tool, other material and	manual	booklet supplied by
details of special set ups	11) To be inspected	the supplier shall
etc., necessary for item 4	quarterly for the	cover the following
and 5 above.	cracks and	aspect in detail:
7) Testing procedure and		
facility, required along with	debonding	1. Specification of
their details.	12) Crack on the	Metal Bonded
8) Comprehensive details	rubber, debonding	Rubber
containing legible sectional	as per	components.
view of defects normally	maintenance	2. Working principle
obstruct or may happen on	manual	based upon the
Metal Bonded Rubber	13) Not necessary on	actual
components with clear	these products	construction.
remarks, whether the defects		3. Construction
is rejectable or non		details giving
rejectable.		
		sketch, drawing
9) List of other defects and their		and photo copy
remedies.		etc
10) Periodicity for various		identification
maintenance activities on		various items
time and distance basis.		and their Part
11) Do's and don'ts for		number etc. of
maintenance officials.		item for easy
12) Rejection criteria in field.		identification.
13) Pictorial view, dimensional		4. Procedure for
details of tool and method to		dismantling from
measure the depth / width of		bogie using
cracks along with the		sequential steps
acceptance / rejection criteria		with the help of
acceptance / rejection entend		

of oracles	T	ı	ı	I	1	akatah ata
of cracks.						sketch etc. 5. Procedure for
						5. Procedure for assembly in
						hogie using
						bogie, using sequential step with the help of
						with the help of
						Sketch etc.
						6. Jigs, tool, other
						material and
						details of special
						set ups etc.,
						necessary for
						item 4 and 5
						above.
						7. Testing
						procedure and
						facility, required
						facility, required along with their
						details.
						8. Comprehensive
						details
						containing
						legible sectional
						view of defects
						normally obstruct
						or may happen on Metal Bonded
						Rubber
						components with
						clear remarks,
						whether the
						whether the defects is rejectable or
						rejectable or
						non rejectable.
						9. List of other
						defects and their
						remedies, if any.
						10. Periodicity for
						various
						maintenance
						activities on time
						and distance
						basis.
						11. Do's and don'ts for maintenance
						officials.
						12. Rejection criteria
						in field.
						13. Pictorial view,
						dimensional
						details of tool
						and method to
						measure the
						depth / width of
						cracks along with
	•	·l		•		.

					the acceptance / rejection criteria of cracks.
12.0	Marking: Each Metal Bonded Rubber components shall be legibly marked by using suitable means to indicate the following: a) Manufacturer's initials. b) Month and year of the manufacturer. c) Batch no. d) Identification marks i.e. Serial number, part number, batch number etc. Location of marking should be such that it would not wear during service. Identification details shall be visible even after assembly. Marking shall be done on the metal part and rubber part of an individual item. If marking is not possible on rubber part, then marking on metal part only permitted. Marking scheme shall be part of drawing and approved by nodal agency nominated by Indian Railways for vendor development.		Each product will be marked with the following details: a) Manufacturer ID or Logo b) Month and Year of Manufacture c) In place of batch number will go for Part Number or PL Number d) Due to the nature of the moulding process, batch and serial numbers are not possible on rubber surface. Marking on the rubber part is preferable, as it ensures durability and visibility without adding extra cost. However, additional marking on the metal part increases manufacturing costs. It would be beneficial to optimize the marking process to balance compliance and cost-effectiveness.		RDSO specification should be followed.
13.0	Packing: The Metal Bonded Rubber components and Axle Box Pivot Bush for FIAT Bogie shall be suitably packed to protect against any damage that may occur during transit and handling. Packing is to ensure that items should not touch each other and shall be protected by corrugated boxes and wooden	 	 The material will be packed in a suitable box to prevent dents or damage during transit, loading, and unloading. Proper packaging will ensure that items do not come in direct contact with each other, minimizing the risk of surface defects.	 	 No change is envisage.

	packing. Any hole which may contaminate dust shall be suitably covered with plastic or rubber cap.						
14.0	Maintenance Manual: The supplier shall provide at least one copy free of cost for each consignment, a detailed maintenance manual for maintenance and overhaul purposes.			A soft copy of the maintenance manual can be provided, covering periodic inspection, storage conditions, cleaning procedures, and acceptance or replacement criteria. The manual will also include guidelines for identifying cracks in the rubber or partial debonding between rubber and metal in metal-bonded rubber products.		Being standalone product, maintenance booklet should not be mandatory. There is no scope of any maintenance spare in this case. Moreover, these products having numbers of suppliers and hypothetical situation of different fitment/maintenan ce practice must be avoided.	RDSO specification should be followed.
15.0	Nominated agency may draw samples for quality check to test any property mentioned in this specification at its discretion. The vendor shall arrange testing of these samples at a reputed outside laboratory as decided between the nominated agency and the vendor. The testing charges should be borne by the vendor.			The type of testing to be conducted is not clearly specified—whether it applies to the vulcanized, ready-to-supply product or the raw material. Additionally, clarification is needed on whether stiffness testing pertains to the final product or the raw material properties. If stiffness characteristics are to be tested, it should be carried out at the supplier's premises to ensure accurate assessment under controlled conditions.	Nominated agency may draw samples for quality check to routine test any property mentioned in this specification at its discretion. The vendor shall arrange testing of these samples at a reputed outside laboratory as decided between the nominated agency and the vendor. The testing charges should be borne by the vendor.		Samples may be ready - to- supply product or product available at consignee end / field or raw material/ master batch. Testing include routine testing as well as any other test which is part of type test of that particular component.
Section - I	Rubber compound test during purchase inspection:	Please specify the standard of bond	 		Specify the acceptance values or	 	Acceptance values shall be as per
		strength test on product and stroke elasticity.			range and the test standards for each tests.		specification / drawing of component.
3.0	Details of tests during Acceptance testing (Purchase		 			 	

Inspection)					
1. Centre Pivot Bearing a) Mechanical properties of Metal parts to be assessed as per drawing/approved QAP.	 	 a) Mechanical tests on the metal part may not be possible on vulcanized product and	Thermal ageing test will be done on rubber test specimen at 70 °C for 7 Days.	Accepted by MTC, SST test as per EN13913 following ISO 9227 (MTC	 a) For Mechanical properties report of NABL lab will be acceptable. However, if required sample
b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B		recommended to accept the NABL accredited test	Specify test procedures and acceptance values for static deflection test for both low	proposing SST On test specimen, Not on the component)	of metal part can be taken from unbonded metal part. b) DMA test report
c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B.		report provided by supplier, however chemical composition test	temperature and high temperature.		shall be provided during initial registration / proto type testing.
e) Coating thickness of electroplating C Paint layer (DFT).		may be conducted on unbonded metal			c) d) Bond strength test shall be
f) Static radial deflection test including force displacement characteristics at tare and extreme load.		parts. b) Rubber Characteristics is as per comments on			conducted directly over the product. M/s GMT was advised to
g) Static axial deflection / stiffness test.h) Torsional stiffness test.		clause 7.0 c) Dimensional is			provide details regarding the Bond strength
i) Fatigue test. j) Radial and axial characteristics after fatigue test.		accepted d) As per comments on para 6.0			test over product i.e. test method, applicable load,
k) Thermal ageing test (This test will be done on rubber test specimen, at 70°C, for 14 days as		Section B on bonding strength e) Coating thickness			acceptance criteria etc. However, M/s GMT has not
per ISO 188, to check the variation in tensile strength, Hardness and		is accepted f) Static radial is accepted g) Static axial is			provided the details. It is again advised to submit the
elongation at break from unaged sample). I) Static deflection test at low temperature (-40°C)		accepted h) Torsional stiffness is accepted.			details for further review. e)
and High temperature (+70°C) after 24 hour soaking of sample piece		i) Fatigue test is accepted j) Nothing to comment			g) h) i)
at - 40°C and +70°C. m) Salt spray test for 1000 Hrs. as per EN13913. n) Ozone resistance test at		k) Radial & axial characteristics after fatigue can			j) k) Thermal ageing test will be done on rubber test
50pphm and 23°C 40°C, for 24 hr. o) Resistance against		be done but acceptance criteria are not			specimen at 70 °C for 14 Days. M/s GMT was

cleaning agent*	known	advised to provide
p) The frequency ——	l) Thermal ageing test	more details i.e.
dependence of stiffness.	will be done on	test procedure,
dependence of sunness.	rubber test	acceptance
	specimen, at	criteria etc. along
	70°C, for 72 hrs.	with other
	as per IS 3400	required details for
	Standard, to	further
	check the variation	examination.
	in tensile strength,	However, M/s GMT
	Hardness and	has not provided
	elongation at	the details. It is
	break from unaged	<u>again</u> advised to
	rubber test	submit the details
	specimen sample.	for further review.
	This test condition	
	is sufficient and	I) Test procedure
	recommended for	and acceptance
	testing the aging	limit shall be as
	properties of rubber	per static load
		tests mentioned in Annexure – A.
	test specimen.	m) Metal part of
	m) The static deflection	component may
	test at low (-40°C)	be cut for Salt
	and high (+70°C)	spray test.
	temperatures is	n)
	not suitable for this	o) Resistance
	product, as the	against cleaning
	rubber material used in its	agent - Shall be
		carried out as per
	manufacturing is	RDSO
	not designed to	specification.
	designed to function effectively	p) Comment as per
	at these extreme	para. 6.11.
	temperatures.	
	Additionally, the	
	necessary testing	
	facilities for	
	conducting such	
	evaluations are not	
	available	
	n) Salt spray test for	
	1000 hours is not	
	suitable for this	
	product. As per	
	ISO 9227, a 360-	
	hour test is	
	recommended,	
	which provides	
	equivalent	
	corrosion	
	protection for over	
	protection for over	

2 Continue Park		five years in service, considering India's climatic conditions. o) Nothing to comment p) Accepted on ozone resistance test q) Accepted by dipping 2% Oxalic acid for 1 hour r) As per comments on Clause 6.11 in Section-A	Thormal against test	Accented by	
a) Mechanical properties of Metal parts to be assessed as per drawing/approved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. e) Coating thickness of electroplating C Paint layer (DFT). f) Static vertical deflection and stiffness test including load vs deflection characteristics at tare and extreme load. g) Static lateral stiffness / deflection test (pairwise). h) Fatigue test. i) Vertical and lateral characteristics after the fatigue test. j) Thermal ageing test (This test will be done on rubber test specimen, at 70°C, for 14 days as per ISO 188, to check the variation in tensile strength, Hardness and elongation at break from unaged sample). k) Static deflection test at low		Comments are same as above in "Centre Pivot Bearing" except below: i) Accepted the vertical and lateral characteristics test after the fatigue. n) Creep testing is not required for this part, as permanent settlement or creep is inherently evaluated during the fatigue test cycle under dynamic loading conditions. Given the behavior of rubber, permanent settlement primarily occurs within the initial 30% of the 1-million-cycle fatigue test. Therefore, a separate creep test is redundant.	acceptance values for	Accepted by MTC, SST test as per EN13913 following ISO 9227 (MTC proposing SST On test specimen, Not on the component)	Comments as above (3.1). Settlement / Creep test shall be carried out as per RDSO specification.
temperature (-40°C) and High temperature (+70°C)					

of Metal parts to be assessed of Metal parts to be assessed below: for 7 Days. following ISO 9227 (MTC regarding Abrasion Test							
and v 70°C. (1) Salt spray test for 1000 his, as per EN13913. (2) Cozer relationation test at 20 plant and 40°C, for 24 and	after 24 hour soaking of						
and *70°C. (i) Sall spay test for 1000 Hits, as per EN13913 Proces resistance test at Spiptim and 40°C, for 24 (ii) Salfement / Creep test (The test will be carried out on the finished part at 70.4 kN constant axial lead, for 14 days, at a rarbert size of the part, during service.) (ii) In height due to eletiment of the part, during service.) (ii) Resistance against the finishing tau to eletiment of the part, during service.) (iii) Primary Bump Stop (iii) The frequency dependence of stiffness. (iii) Rechanical properties of Metals on the service of	-						
Salt spray test for 1000 Hrs. as per EN19913. m) Ozone resistance test at Spythm and 4PC, for 24 for 100 F	• •						
Hrs. as per EN 19313. m) Ozone resistance test at Solphim and 40°C. for 24 ft. Soldhermer I. Cereb test Chris test will be carried out on the finished part, at 170 4 kN constant axial load, for 14 days, at ambient temperature. The changes in height, due to asthermer of the part, cluring service.) 1. Primary Bump Stop 2. Primary Bump Stop 3. Primary Bump Stop 3. Primary Bump Stop 4. Accopied by	I						
nn) Ozone resistance test at SUpphr and 40°C, for 24 Mr. n) Settlement / Creep test (This test will be contrect out of the Company of the Com	,						
Sopphim and AO°C, for 24 hz. hz. 1) Settlement / Creep test (This test will be carried out on the final body for the constant asid body for the temperature. The change in height, due to settlement of rubber will be recorded. This gives a prediction of total settlement of the part, during service.) 2) Resistance against dependence of stiffness. 2) Primary Bump Stop 3) Mechanical properties of Metal properties of Metal properties of Metal parts to be assessed a drawing proved OAP. 3) Characteristics of Rubber, For rubber refer para, 7, 0 of Section – B. 4) Characteristics of Rubber, For rubber refer para, 7, 0 of Section – B. 5) Characteristics of Rubber, For rubber refer para, 7, 0 of Section – B. 6) Characteristics of Rubber, For rubber refer para, 7, 0 of Section – B. 6) Characteristics of Rubber, For rubber refer para, 7, 0 of Section – B. 6) Characteristics of Rubber, For rubber refer para, 7, 0 of Section – B. 6) Conding this rubber components used in rolling stock bodyes, as those parts do not experience continuous advanced configuration. The parts of the continuous advanced configuration to purpose the components used in rolling stock bodyes, as those parts do not experience continuous advanced configuration to purpose the components used in rolling stock bodyes, as those parts do not experience continuous advanced configuration to purpose the components used in rolling stock bodyes, as those parts do not experience continuous advanced configuration to purpose the components used in rolling stock points. The parts to be components used in rolling stock points as per para, 8, 0 of Section – B. 9) Coating this rubber components used in rolling stock points as per para, 8, 0 of Section – B. 1) Salvacion for this per products in bodye applications not only a part of the rubber components, metal-bonded rubber	·						
n. In Settlement / Craep test (This test will be carried out on the frinkehop stay, at 70.4 kit constant avail load, for 14 days, at ambient temperature. The change of rubber will be monorised. This gives a prediction of total settlement of the part, during service.) 7. Primary Bump Botip 8. Commerts are same as above in commercial dearing against cleaning against cleaning against properties of Metal parts to be assessed as pure of drawinglap parts to be assessed as pure of drawinglap provided (APP). 8. Commercial are same as above in same a	, , , , , , , , , , , , , , , , , , ,						
n) Settlement / Craep test (This test will be carried out on the finished part, at 70.4 kN constant value load, for 14 days, st ambient temperature. The charge of the charge of the charge of rubber will be recorded. This gives a prediction of total settlement of the part, during service.) 3. Primary Sump Stop a) Mechanical properties of Metal parts to be assessed as per complete of provide (parts). The frequency of the fatigue. By Accepted the section test of the fatigue. By Accepted the fatigue accepted the fatigue accepted the fatigue. By Accepted the fatigue accepted the fat							
(This test will be carried out on the finished part, it? 70.4 kth constant avial load, for 14 days, at ambient temperature. The change in hergift, due to settlement of the part, during service.) a) the finished part of the part, during service.) a) Resistance against cleaning agent? p) The frequency dependence of stiffness. 3. Primary Burnp Stop a) McCanted properties and the settlement of the part, during service.) a) McCanted properties and the settlement of the part, during service.) a) McCanted properties and the settlement of the part, during service.) a) McCanted properties and the settlement of the part, during service. b) McCanted properties are shown in "Contre Phila" before an 170 control to the settlement of the part, during service.) a) McCanted properties are shown in "Contre Phila" before an introduct from a 170 control to the settlement of the part, during service.) b) Characteristics of Rubber for the part, during service. (AAP) b) Characteristics of Rubber for number on the part, during service. c) Dimensional, appearance, weight and marking, depending and veight and marking, or selection the part of the part	I						
on the finished part, at 70.4 kN constant avail load, for 14 days, at ambient temperature. The change in height, due to settlement of rubber with be recorded. This gives a prediction of total settlement of the part, of total settlement of total settlement of total settlement of total settlement of the part, of total settlement	,						
M Constant axial load, for 14 days, at ambient temperature. The change in height, due to settlement of rubber will be recorded. This gives a prediction of total settlement of the part. during service.) O Resistance against clearing agent? P The frequency dependence of stiffness. 3. Primary Bump Stop a Mechanical properties of Metal parts to be assessed as per drawing/ap proved QAP. D) Acapited Specimen at 70 Constant axial service and drawing/ap proved QAP. D) Characteristics of Rubber For Lubber refer para 7,0 of Section – B. C) Dimensional, appearance, weight and marking. D) Characteristics of section—B. D) Characteristics of section—B. Solot Section—B. Static vertical deflection and stiffness test including load will deflect on the properties of the properties as per drawing/ap proved QAP. Soloton—B. C) Dimensional, appearance, weight and marking. D) Static vertical deflection and stiffness test including load will deflect on tharacteristics at lare, and externed tool and stiffness test including load will deflect the state of the properties of the properties of the properties at lare, and externed tool and stiffness test including load will deflect the properties of the properties of the properties and the properties of the properties and the properties and the properties of the properties and the properties of the properties and the properties of the properties of the properties and the properties and the properties of the properties and the properties of the properties of the properties and the properties of the pr	(This test will be carried out						
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deflection characteristics at tare, and extreme load and 91.5 kN load. g) Fatigue test. your first should be seen that the same and the same and tare, and extreme load and undergo frictional wear, further eliminating the necessity for abrasion	,						
tare, and extreme load and 91.5 kN load. g) Fatigue test. b) Vortice below to the content of th							
91.5 kN load. g) Fatigue test. b) Vortice less the contact of the second of the secon							
g) Fatigue test. necessity for abrasion	·						
I lecessity for abrasiation after							
resistance testing.	· ·						
	11) VELLICAL CHALACTERISTICS ALLER			resistance testing.			

	the fatigue test.					
	i) Thermal ageing test (This					
	test will be done on rubber					
	test specimen, at 70°C, for					
	14 days as per ISO 188, to					
	check the variation in tensile					
	strength, Hardness and					
	elongation at break from					
	unaged sample).					
	j) Abrasion resistance test (This					
	test will be done on rubber					
	test specimen, as per ISO					
	4649).					
	k) Static deflection test at low					
	temperature (-40°C) and					
	High temperature (+70°C)					
	after 24 hour soaking of					
	sample piece at - 40°C and					
	+70°C.					
	 Salt spray test for 1000 Hrs. 					
	as per EN13913.					
	 m) Ozone resistance test at 					
	50pphm and 40°C, for 24 hr.					
	n) Resistance against cleaning					
	agent*					
	o) The frequency dependence of					
	stiffness.					
	4. Lateral/Side Buffer	 	 Comments are	Thermal ageing test	Accepted by	 • Comments as
	a) Mechanical		same as above in	will be done on	MTC, SST	above (3.1).
	properties		"Centre Pivot	rubber test	test as per	• Remark of M/s
	of Metal		Bearing" except	specimen at 70 °C	EN13913	Premier Seals
	parts to be		below:	for 7 Days.	following ISO	regarding
	•		BCIOW.	loi / Days.	9227 (MTC	Abrasion Test has
	assessed					
			i) Assented	Specify test	proposing	
	as per		i) Accepted	Specify test	proposing SST On test	been accepted.
1	drawing/ap		the vertical	procedures and	SST On test	
	drawing/ap proved		the vertical characteristi	procedures and acceptance values for	SST On test specimen,	
	drawing/ap		the vertical characteristi cs test after	procedures and acceptance values for static deflection test	SST On test specimen, Not on the	
	drawing/ap proved		the vertical characteristi cs test after the fatigue.	procedures and acceptance values for static deflection test for both low	SST On test specimen,	
	drawing/ap proved QAP.		the vertical characteristi cs test after the fatigue. k) Abrasion resistance	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not	procedures and acceptance values for static deflection test for both low	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not required for metal-	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B.		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not required for metal- bonded rubber	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance,		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not required for metal- bonded rubber components used in	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking.		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not required for metal- bonded rubber components used in rolling stock bogies, as	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not required for metal- bonded rubber components used in rolling stock bogies, as these parts do not	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B.		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not required for metal- bonded rubber components used in rolling stock bogies, as these parts do not experience continuous	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
	drawing/ap proved QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. e) Coating thickness of		the vertical characteristi cs test after the fatigue. k) Abrasion resistance testing is generally not required for metal- bonded rubber components used in rolling stock bogies, as these parts do not	procedures and acceptance values for static deflection test for both low temperature and high	SST On test specimen, Not on the	
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QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. d) Bond strength test as per para. 6.0 of Section – B.	-				1		
b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. b) Characteristics of Rubber. Specify test procedures and acceptance values for static deflection test for both low temperature and high							
For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. d) Bond strength test as per para. 6.0 of Section – B.	QAP.			l .	for 7 Days.	tollowing ISO	
For rubber refer para. 7.0 of Section – B. C) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. For rubber refer para. 7.0 of Section – B. Clause (q) Abrasion resistance testing is generally not required for metal-	b) Characteristics of Rubber.			as per Annexure A			
Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para, 6.0 of Section – B. Section – B. Clause (q) Abrasion resistance testing is generally not para, 6.0 of Section – B.	,				Specify test		
c) Dimensional, appearance, weight and marking. d) Bond strength test as per para, 6.0 of Section – B. Clause (q) Abrasion resistance testing is generally not required for metal-						SST On test	
c) Dimensional, appearance, weight and marking. d) Bond strength test as per para, 6.0 of Section – B. Clause (q) Abrasion resistance testing is generally not required for metal-				Clause (a) Abresier		specimen,	
d) Bond strength test as per para, 6.0 of Section – B.							
para, 6.0 of Section – B.					•		
					I		
temperature.	para. 6.0 of Section – B.			required for metal-			
					iemperature.		

-\	Continue this leave and			handad wubbar			
e)				bonded rubber			
	electroplating C Paint layer			components used in			
£/	(DFT).			rolling stock bogies,			
')	Static radial deflection and			as these parts do not			
	stiffness test including load			experience			
	vs Deflection characteristics			continuous abrasive			
	at tare load, nominal load (30			conditions.			
	KN), extreme load (50 KN)			Additionally, unlike			
	and ultimate compression			standalone rubber			
	load 62 KN.			components, metal-			
g)	Static axial deflection / stiffness			bonded rubber			
	test including axial deflection at			products in bogie			
	2KN (nominal load) and 4 KN			applications do not			
1-1	(exceptional load).			undergo frictional			
h)	9			wear, further			
.,	test.			eliminating the			
1)	Torsional stiffness test.			necessity for abrasion			
])	Fatigue test.			resistance testing.			
K)	Radial characteristics, axial						
	characteristics, Torsional						
	stiffness, Torsional and						
	Cardanic angle test after						
11	fatigue test Thormal agoing test (This						
''	Thermal ageing test (This test will be done on rubber						
	test specimen, at 70°C, for						
	14 days as per ISO 188, to						
	check the variation in tensile						
	strength, Hardness and						
	elongation at break from						
m)	unaged sample). Static deflection test at low						
111)	temperature (-40°C) and						
	High temperature (+70°C)						
	after 24 hour soaking of						
	sample piece at - 40°C and						
	+70°C.						
n)							
'	as per EN13913.						
o)	Ozone resistance test at						
	50pphm and 40°C, for 24 hr.						
p)	Abrasion resistance test						
	(This test will be done on						
	rubber test specimen, as per						
	ISO 4649).						
(p	9						
	agent*						
r)	The frequency dependence of						
	stiffness.						
	eaning agent test:	 		The concentration of	 		Matter has been
,	he part will be dipped in 6%			oxalic acid should be			referred to M&C
	kalic acid (cleaning agent), at			revised to 2% instead			Directorate/ RDSO
roc	om temperature and			of 6%, as higher		<u> </u>	for further

		T	I		I	T	T	
	observed. The part has to last			concentrations can				examination.
	for 20 seconds one hour in the			adversely affect				
	solution. It is then cleaned with			natural rubber.				
	water and checked for			Prolonged exposure				
	appearance. The acceptance			to a highly				
	criterion is that there must be			concentrated solution				
	no damage, on both rubber			may lead to				
	appearance and rubber-to-			degradation of rubber				
	1			•				
	metal bonding).			properties and impact				
				rubber-				
				to-metal bonding				
				performance.				
5.1	Endurance Test procedure:	 Dynamic cycle	5.1.e Test	a) Accepted				 Test cycles and
	a) Rubber components to be	should be 6 lac. on	frequency will	b) Accepted				frequency shall
	placed in a proper fixture to	primary load axis	be between	c) Accepted				be as per RDSO
	facilitate application of static	instead of 10 lac.	0.5 to 1 Hz.	d) This is parameter is				specification.
	and dynamic loads.	as it is pratical from	Frequencies	for static load				· ·
	b) Test temperature should be (27	machine availablity		testing, therefore, it				 Comment of M/s
	±5) °C.	& fixture life.	this will heat					Premier Seals
	c) Machine speed should be	S IIMGIO IIIO.	up the rubber	is not possible to				against para. (d)
			portion,	carry out.				needs to
	10+5 mm/minute.			e) Minimum				elaborate.
	d) Load deflection characteristics		resulting in	frequency shall be				
	/ stiffness characteristic in		burn-out.	considered 2 Hz				• Suggestion of
	axial, radial, torsional, conical		- 45-	and				M/s Premier
	mode as mentioned in drawing		5.1.f Test can	component				Seals against
	must be measured after		be conducted	exceeds 7°C with				para. (e)
	applying few cycles for pre-		for 6,00,000	respect to room				accepted and
	setting of rubber parts.		cycles, taking	temperature shall				minimum
	e) Minimum frequency of		reference of	be consider 15°C				
	dynamic load must be 3		Train-18	f) Accepted				frequency for
	Hz. If temperature		parts.	l '				dynamic load
	buildup in metal bonded			g) It shall be as				updated as 2
	•			per Clause 5.2				Hz.
	rubber components			in Section B,				
	exceeds 7°C with			because there				
	respect to room			is intervals				
	temperature i.e. (27±5)			where as in				
	°C, the frequency can			this clause it is				
	be reduced by 0.5 Hz.			mentioned as				
	f) No. of cycles 1 x10 ⁶ cycles (1			continuous				
	million).			cycles on 1				
	g) Endurance test must be			1				
	completed continuously for 10			million				
	million 1 million cycles.			h) Will be commented				
				on Section B				
	h) Apply the loads for respective			i) Accepted, if the				
	components as per Table in			routine test is				
	Annexure – A in Section - B.			considered as				
	i) Routine tests consists of col- 1			pre-despatch				
	to col- 5 of Table in Annexure –			static load				
	A in Section - B.			testing. Static				
	j)Type testing consists of col-1 to			_				
	col-6 of in Annexure – A in			testing shall not				
	Section - B.			be the part of				
				Endurance testing.				

				j) Type test on the 1 to 6 in Annexure A in Section B is accepted, but S No. 7 is missing		
5.2	 Parameters to be measured: a) Load deflection characteristics / stiffness characteristic in axial, radial, torsional, conical mode as mentioned in drawing at temperature (27 ± 5) °C and machine speed 10 mm / minute to be measured at following interval: Before starting of endurance test. After completion of 50000 cycles, 500000 cycles and one million cycle of endurance test respectively. A rest of 16 to 24 hours may be permitted before measuring the values. b) Temperature built up during the test at regular intervals (minimum once in 24 hours) along with atmospheric temperature at that moment. c) Permanent set in rubber component after completion of test. 		Test can be conducted for 6,00,000 cycles, taking reference of Train-18 parts.	a) Accepted. But it is mismatching interval period in endurance testing with 5.1.g in Section B. b) Noted c) Noted		M/s GMT Test cycles and frequency shall be as per RDSO specification for LHB as well as Vande Bharat (T 18) parts. M/s Premier Seals Para. 5.1.g in Section B has been removed.
5.3.	 Qualification parameters: a) Characteristics conformance to the specified values. b) No sign of failure (no physical damage, no bond failure, no crack on rubber etc.) c) No excessive wear. d) No abnormal permanent set (max. allowed 2%). e) No abnormal increase in temperature. f) Manufacturer interpretation of test results. g) After the endurance test, Stiffness (axial stiffness, radial stiffness, torsional stiffness as per requirement) should not differ by more than 15 % from the values recorded before 	c) No Excessive wear "Please specify the limit"	5.3.g The ±15% tolerance represent the delivery tolerances, after the fatigue test, we should consider the ± 20% functional tolerances.	a) Noted b) Noted but there shall be some acceptance criteria in terms of bond failure and crack on rubber like length and depth either debonding or crack on rubber c) Noted d) Noted. However, the values may vary depending on the specific product. For		M/s GMT Suggestion of M/s GMT is not acceptable. This tolerance has been given as per EN 13913. M/s Premier Seals b) Sign of failure is not acceptable. d) Permanent set should not more than 2%. g) This tolerance of 15 % has been given as per EN 13913.

	endurance test.			Lateral Buffer, an		
				abnormal		
				permanent set of at least 5% is		
				required,		
				considering the		
				product geometry and the		
				general		
				compression set of		
				the compound, which is typically		
				25% as per IS		
				3400 Part 10. For		
				all other		
				components, a 2% permanent set is		
				well accepted.		
				e) Noted f) Noted		
				g) It is recommended		
				for ±20% of		
				variation on stiffness value		
				before and after		
5.4	Endurance test of Metal Bonded		The quality of	endurance test.		Suggestion of M/s
3.4	Rubber components shall be	 	the product		 	 GMT is not
	conducted by the firm at an		over time is			acceptable. Periodic
	interval of every 3 years. It shall be verified by representative of		ensured through serial			endurance test has been introduced to
	nodal agency nominated for		testing,			ensure the long term
	vendor development.		rubber characteristic			reliability of product in field during series
			s and serial			production.
			static testing.			
			The fatigue			
			test is used to			
			qualify the			
			design. As long as the			
			design is			
			unchanged, there is no			
			need to			
			repeat the fatigue test.			
			ratigue test.			
6.0	Bonding strength test:	 		Accepted to conduct the Bond Strength test	 	 M/s GMT was
	The objective of this test is to determine bond strength			as per IS: 3400 (Part		advised to provide
	between metal and rubber. This			XIV/Sec 2) on		more details i.e. test
				specimens, ensuring a		method, applicable

	test is conducted as per IS: 3400			minimum strength of			load, acceptance
	(Part – XIV/ Sec. 2), ISO			40 kg/cm ² .			criteria etc.
	814:2017 or latest revision. The						
				However, the bond			However, M/s GMT
	bond should be capable of			strength test on the			has not given any
	bearing a minimum stress level			1 0			
	of 40 Kg/cm ² . Bond strength test			product itself will not			response. It is again
	shall be conducted directly over			follow the standard test			advised GMT to
	the product.			method. Instead, the			provide the details
	the product.			applied load will be			as asked by RDSO.
				calculated based on			
				the bonded surface			
				area and multiplied by			
				40 kg/cm² to determine			
				the required strength.			
				Will not be applicable			
				for some of the			
				products Primary Stop,			
				Spring Pad, Lateral			
				Buffer and Stabilizer			
				Link, Traction Rod			
7.0	Physical tests of rubber						Thormal againg tost
7.0		 		Accepted for 1, 3 (to be	 		Thermal ageing test
	compound for Metal Bonded			referred to specific			will be done on
	Rubber components:			gravity in No. 15), 4, 5,			rubber test specimen
				6, 7, 8,			at 70 °C for 14 Days.
				9. The homogeneity			For other tests
				of rubber is not a			suggestion of M/s
				critical factor for			Premier Seals has
				1			been accepted and
				metal- bonded rubber			standards has been
				components used in			added in list.
				rolling stock bogies,			added in list.
				as their performance			
				primarily depends on			
				bonding strength,			
				stiffness, and			
				durability rather than			
				uniform rubber			
				composition.			
				Additionally, also			
				accepted 10, 12, 14			
				accepted 10, 12, 14			
				44 11 1 1 1 1			
				11. Heat aged for 72			
				hrs at 70°C For S No.			
				13 as per clause no.			
				6.3.4 in Section A			
				Prefer Testing			
				standard are:			
				Hardness - IS: 3400			
				1			
				(Part 23) / ASTM			
				D2240			
				Tensile Strength – IS:			
				3400 (Part 1)			
				Elongation – IS:			
1	1	I	I	Liuriyaliuri — 13.	l	I	Ī

Annexure – A (Endurance test load condit			3400 (Part 1) Compression Set – IS: 3400 (Part 10) Rebound Resilience: ISO 4662 / ASTM D1054 Tear Strength – ASTM D624 TYPE C Heat aged – IS:3400 (Part 4) Ozone - ASTM D1149 Ash Content – IS: 3400 (Part 22) Specific Gravity – IS 3400 (Part-9)		
Centre Pivot Bearing (Axial Load test 1)	Typographical error is noticed on displacement readings at radial load test column of Centre Pivot Bearing. Menti	The torsional stiffness test cannot be performed as a serial testing. The costs and effort to test the torsional stiffness with the serial parts will be very high. The quality of the product can be ensured testing only the radial stiffness.	1. Axial: Referring to the load-displacement (LD) values at 2.4 kN and 46 kN, the calculated stiffness at 2.4 kN is 16 kN/mm, while at 46 kN, it is 6.05 kN/mm. This is not feasible, as the stiffness value should increase with higher loads rather than decrease. Formation of load vs deflection is not behavior of rubber. From the angle of product design and simulation we recommend to measure the deflection values are d = 1.0 mm at 4.7kN ± 15% d = 2.00 mm at 9.4kN ± 15% d = 7.60 mm at 46kN ± 20% 2. Radial: Accepted and Will follow 3. Torsional: Accepted		M/s Avadh Necessary Correction has been made as suggested. Frequency of each type load may be suggested for further examination. M/s GMT The torsional stiffness test shall be done on sample basis during purchase inspection. M/s Premier Seals Firm is advised to give technical presentation at RDSO regarding the issue of axial load test.

				4. Fatigue / endurance test: Accepted and Will follow		
Lateral Buffer	We understand that cycle load is 9kN ± 9kN. Please confirm.			Compressive load test / vertical stiffness test: Accepted and Will follow Fatigue / endurance test: Accepted and Will follow	 	 9 KN is static load and ± 9 KN is Dynamic load.
Spring Pad (Radial load test 2)			Same case as for the torsional stiffness of the centre pivot bearing, no need to test the radial stiffness, it would lead to a substantial increase of the costs.	Lateral: It is recommende d to consider the below value d = 6 mm±15% at 12.5 kN d = 2.9 mm±15% at 5.7 kN Compressive load test / vertical stiffness test: Stiffness measurement value is accepted. Height measurement is recommended as below: At 60.2 kN = 30 mm ± 15% (deflection 1.5 mm) At 70.4 kN = 29.7 mm ± 15% (deflection 1.8 mm) Fatigue / endurance test: Accepted and Will follow		M/s GMT The torsional stiffness test shall be done on sample basis during purchase inspection. M/s Premier Seals Radial load test shall be as per RDSO specification. In compressive load test height under at 60.2 kN shall be (30+0/-1) mm. Accordingly, correction has been made.
Primary Bump Stop		Primary Bump Stop Fatigue Axial load (± 6 kN): It should be 6 ± 6 kN because this part not possible to test in negative direction.		Compressive load test / vertical stiffness test: Deflection measurement : At 8 kN = 4.3±1mm At 15 kN = 6.2±1 mm Height measurement: Height measurement at the exceptional load of		M/s GMT Suggestion of M/s GMT has been accepted and load during Fatigue test modified as (6 ± 6 kN) M/s Premier Seals • Load deflection characteristic should be done as per RDSO

			91.5 kN shall not be performed as it represents a nonfunctional extreme condition where rubber may undergo permanent deformation, making the measurement irrelevant for operational performance evaluation. Fatigue / endurance test: Accepted and Will follow		specification. • Deflection characteristic at 91.5 KN load shall be checked during Type Testing. It will not be part of purchase inspection.
Axle Guide Bearing		(Axial load test) Same case as for the torsional stiffness of the centre pivot bearing. The costs and effort to test the torsional and conical stiffness with the serial parts will be very high. The quality of the product can be ensured testing only the radial stiffness.	Axial: We recommend the stiffness measure of 6.8 kN/mm ±15% between 10 to 20 kN Radial: Stiffness measurement is accepted Torsional:		M/s GMT The torsional and conical stiffness test shall be done on sample basis during purchase inspection. M/s Premier Seals Axial and Torsional Stiffness shall be as per RDSO specification.
Axle Guide Bearing (Fatigue test)	 	The combination of the 4 load directions increases the complexity of the test, it cannot be performed in	Fatigue / endurance test: Accepted and Will follow	 	 M/s GMT RDSO specification should be followed and load shall be applied simultaneously.

		the GMT laboratory, it would have to be offered separately.			
Rubber metal bush of traction rod assembly		Same case as for the torsional stiffness of the centre pivot bearing. The costs and effort to test the torsional and conical stiffness with the serial parts will be very high. The quality of the product can be ensured testing only the radial stiffness.	Axial: Stiffness value is accepted, but test speed shall 10 mm/min Radial: Stiffness value is accepted Torsional: Accepted and will follow Conical: Accepted and will follow Fatigue / endurance test: Accepted and Will follow		M/s GMT The torsional and conical movement test shall be done on sample basis during purchase inspection. M/s Premier Seals Test speed updated as 10 mm/min.
Ball joint of Stabilizer link assembly		(Axial load test) Same case as for the torsional stiffness of the centre pivot bearing. The costs and effort to test the torsional and conical stiffness with the serial parts will be very high. The quality of the product can be ensured testing only the radial stiffness.	Axial: Accepted and will follow Radial: Accepted and Will follow Torsional: Accepted and will follow Conical: Stiffness Value - reference Fatigue / endurance test: Accepted and Will follow		M/s GMT The torsional and conical stiffness test shall be done on sample basis during purchase inspection.

SECTIO N	N - C						
1.0	S. Test No. 1 Visual Examina tion	burrs and other surface defects	er Im es 6 Imp s of e t or ini um sp socione		1) Accepted visual examination parameters and sampling size specified. 2) Dimension verification is accepted 3) A test report will be provided for every 300 kg of rubber, except for the Bond Strength test, as it pertains specifically to rubber testing. 4) Will provided test certificate from NABL accredited Lab for metal parts for each lot purchased. 5) Coating thickness is recommen ded as per ISO 19598 - Fe//ZnNi8// Cn//T0 6) Deflection stiffness test is accepted 7) Weight inspection is accepted 8) Marking inspection is accepted		M/s Premier Seals is advised to provide more details regarding the comment on Coating thickness.
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		drawings /							
		QAP.							
		Type of							
		Rubber:							
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3.0	Details of tests during Prototype Testing / Type Testing:						 	
	1. Traction Centre Elastic Joint				a) Mechanical	Thermal ageing test	 	M/s Shakti
	a) Mechanical properties of Metal				tests on the	will be done on		Comment as per
	parts to be tested as per approved drawing/ QAP.				metal part may not be possible	rubber test specimen at 70 °C		para 3.0.1)/Section B
	b) Characteristics of Rubber. For				on vulcanized	for 7 Days.		
	rubber refer para. 7.0 of Section –				product and	l ser i Dayer		M/s Premier Seals
	B.				recommended	Specify test		a) For Mechanical
	c) Dimensional, appearance, weight and marking.				to accept the	procedures and		properties report
	d) Bond strength test as per para.				NABL accredited test	acceptance values for static deflection test		of NABL lab will
	6.0 of Section – B.				report provided	for both low		be acceptable.
	e) Coating thickness of				by supplier,	temperature and high		However, if required sample
	electroplating C Paint layer (DFT).				however	temperature.		of metal part can
	f) Radial Stiffness test				chemical			be taken from
	g) Axial Stiffness test				composition test may be			unbonded metal
	h) Ultimate compassion load test.				conducted on			part. b) DMA test report
	i) Fatigue Test. j) Radial Stiffness test, Axial				unbonded metal			shall be provided
	Stiffness test and Ultimate				parts.			during initial
	compassion load test after				b) Rubber Characteristics			registration / proto type
	fatigue test.				is as per			testing.
	k) Thermal ageing test (This test will be done on rubber				comments on			c)
	test will be done of rubber test specimen, at 70°C, for				clause 7.0 in			d) Bond strength test shall be
	14 days as per ISO 188, to				Section B			test shall be conducted
	check the variation in tensile				c) Dimensional is accepted			directly over the
	strength, Hardness and				d) As per comments			product. M/s
	elongation at break from unaged sample).				on para 6.0			GMT was advised to
	Radial and axial stiffness				Section B on			provide details
	test at low temperature (-				bonding strength e) Coating thickness			regarding the
	· ,	l .	I	<u> </u>	o) Codding unchiess		l .	

40°C) and High	is accepted	Bond strengt
temperature (+70°C) after	f) Static radial is	test over produc
24 hour soaking of sample	accepted	i.e. test
piece at -40°C and	g) Static axial is	method,
+70°C.	accepted	applicable load
m) Salt spray test 1000 Hrs. as per	h) Ultimate	acceptance
EN13913.	compression load	criteria etc.
n) Ozone resistance test at	test is accepted	However, M/s
50pphm and 40°C, for 24 hr.	i) Fatigue test is	GMT has not
o) Resistance against cleaning	accepted	provided the
agent.*	j) Radial C axial	details. It is
p) The frequency dependence of	characteristics after	again advised
stiffness	fatigue can be done	to submit the
	k) Thermal ageing	details for
	test will be done	
	on rubber test	further review.
	specimen, at	e)
	70°C, for 72 hrs	1)
	as per IS 3400	g)
	Standard, to	h)
	check the	
	variation in	J)
	tensile strength,	k) Thermal agein test will be don
	Hardness and	on rubber tes
	elongation at	specimen at 7
	break from	°C for 14 Days.
	unaged rubber	M/s GMT wa
	test specimen	advised to
	sample. This test	
	condition is	provide mor
	sufficient and	details i.e. tes
	recommended	procedure,
	for testing the	<u>acceptance</u>
	aging properties	<u>criteria etc</u>
	of rubber test	along wit
	specimen.	<u>other</u>
	I) The static	<u>required</u>
	deflection test	details fo
	at low (-40°C)	further
		examination.
	and high	However, M/
	(+70°C)	GMT has no
	temperatures is	provided th
	not suitable for	details. It i
	this product, as	again advise
	the rubber	to submit th
	material used	
	in its	details fo
	manufacturing	<u>further review</u>
	is not designed	
	to function	I) Test procedur
	effectively at	and acceptance
	these extreme	limit shall be a
		per static loa

		temperatures.			tests mentioned
		Additionally, the			in Annexure – B.
		necessary testing			m)Metal part of
		facilities for			component may be cut for Salt
		conducting such			spray test.
		evaluations are			n)
		not available			o) Resistance
		m) Salt spray test for 1000 hours is not			against cleaning
		suitable for this			agent - Shall be
		product. As per			carried out as per
		ISO 9227, a 360-			RDSO
		hour test is			specification.
		recommended,			p) Comment as per
		which provides			para. 6.11/
		equivalent			Section - A.
		corrosion			
		protection for over			
		five years in			
		service,			
		considering India's climatic			
		conditions.			
		n) Accepted on			
		ozone resistance			
		test			
		o) Accepted by			
		dipping 2% Oxalic			
		acid for 1 hour			
		p) As per comments			
		on Clause 6.11 in			
2 Pubbor Pad for Primary		Section-A Same as above	Thermal ageing test		M/s Shakti
2. Rubber Pad for Primary Suspension	 	 comments	will be done on	 	Comment as per
a) Mechanical properties of Metal		Commonto	rubber test		para 3.0.1)/Section
parts to be tested as per			specimen at 70 °C		– B
approved drawing/ QAP.			for 7 Days.		
b) Characteristics of Rubber. For			,		M/s Premier Seals
rubber refer para. 7.0 of Section			Specify test		Comments as in
_B.			procedures and		para. 3.0.1)/Section - C
c) Dimensional, appearance,			acceptance values for		- 0
weight and marking. d) Bond strength test as per para.			static deflection test		
d) Bond strength test as per para. 6.0 of Section – B.			for both low temperature and high		
e) Coating thickness of			temperature.		
electroplating C Paint layer			tomporaturo.		
(DFT).					
f) Static Vertical Stiffness test					
g) Fatigue Test.					
h) Static Vertical Stiffness test after					
fatigue test.					
i) Thermal ageing test (This					
test will be done on rubber					

b) c) d)	Fatigue Test. Vertical Stiffness test after fatigue test.		Same as above comments	Thermal ageing test will be done on rubber test specimen at 70 °C for 7 Days. Specify test procedures and acceptance values for static deflection test for both low temperature and high temperature.		M/s Shakti Comment as per para 3.0.1)/Section - B M/s Premier Seals Comments as in para. 3.0.1)/Section - C
g)	Vertical Stiffness test Fatigue Test. Vertical Stiffness test after fatigue					
j) k)	Thermal ageing test (This test will be done on rubber test specimen, at 70°C, for 14 days as per ISO 188, to check the variation in tensile strength, Hardness and elongation at break from unaged sample). Vertical Stiffness test at low temperature (-40°C) and High temperature (+70°C) after 24 hour soaking of sample piece at -40°C and +70°C. Salt spray test 1000 Hrs. as per EN13913.					

I) Ozone resistance test at 50pphm and 40°C, for 24 hr. m) Resistance against cleaning agent.* n) The frequency dependence of stiffness.					
 4. Lateral Bump Stop a) Mechanical properties of Metal parts to be tested as per approved drawing/ QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. e) Coating thickness of electroplating C Paint layer (DFT). f) Axial Compressive Stiffness test after fatigue Test. h) Axial Compressive Stiffness test after fatigue test. i) Thermal ageing test (This test will be done on rubber test specimen, at 70°C, for 14 days as per ISO 188, to check the variation in tensile strength, Hardness and elongation at break from unaged sample). j) Axial Compressive Stiffness test at low temperature (-40°C) and High temperature (+70°C) after 24 hour soaking of sample piece at -40°C and +70°C. k) Salt spray test 1000 Hrs. as per EN13913. l) Ozone resistance test at 		Same as above comments	Thermal ageing test will be done on rubber test specimen at 70 °C for 7 Days. Specify test procedures and acceptance values for static deflection test for both low temperature and high temperature.		M/s Shakti Comment as per para 3.0.1)/Section - B M/s Premier Seals Comments as in para. 3.0.1)/Section - C

50pphm and 40°C, for 24 hr. m) Resistance against cleaning agent.* n) The frequency dependence of stiffness.					
 5. Axle Box Pivot Bush a) Mechanical properties of Metal parts to be tested as per approved drawing/ QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. e) Coating thickness of electroplating C Paint layer (DFT). f) Radial Stiffness test g) Axial Stiffness test h) Torsional Stiffness test. i) Fatigue Test. j) Radial Stiffness test, Axial Stiffness test and Torsional Stiffness test after fatigue test. k) Thermal ageing test (This test will be done on rubber test specimen, at 70°C, for 14 days as per ISO 188, to check the variation in tensile strength, Hardness and elongation at break from unaged sample). l) Radial, axial and torsional stiffness test at low temperature (-40°C) and High temperature (-40°C) after 24 hour soaking of sample piece at -40°C and +70°C. 		Same as above comments	Thermal ageing test will be done on rubber test specimen at 70 °C for 7 Days. Specify test procedures and acceptance values for static deflection test for both low temperature and high temperature.		M/s Shakti Comment as per para 3.0.1)/Section - B M/s Premier Seals Comments as in para. 3.0.1)/Section - C

m) Salt spray test 1000 Hrs. as per EN13913. n) Ozone resistance test at 50pphm and 40°C, for 24 hr. o) Resistance against cleaning agent.* p) The frequency dependence of stiffness.					
 6. Ball Joint Traction Lever a) Mechanical properties of Metal parts to be tested as per approved drawing/ QAP. b) Characteristics of Rubber. For rubber refer para. 7.0 of Section – B. c) Dimensional, appearance, weight and marking. d) Bond strength test as per para. 6.0 of Section – B. e) Coating thickness of electroplating C Paint layer (DFT). f) Radial deflection test. g) Torsional deflection test. h) Conical deflection test. i) Fatigue Test. j) Radial deflection test after fatigue test. k) Thermal ageing test (This test will be done on rubber test specimen, at 70°C, for 14 days as per ISO 188, to check the variation in tensile strength, Hardness and elongation at break from unaged sample). l) Radial deflection test at low temperature (-40°C) and High temperature (+70°C) after 24 hour soaking of sample piece at -40°C and +70°C. m) Salt spray test 1000 Hrs. as per EN13913. 		Same as above comments	Thermal ageing test will be done on rubber test specimen at 70 °C for 7 Days. Specify test procedures and acceptance values for static deflection test for both low temperature and high temperature.		M/s Shakti Comment as per para 3.0.1)/Section - B M/s Premier Seals Comments as in para. 3.0.1)/Section - C

n) Ozone resistance test at 50pphm and 40°C, for 24 hr. o) Resistance against cleaning agent.* p) The frequency dependence of			
stiffness.			
7. Ball Joint Roll Link a) Mechanical properties of Metal	Same as above comments	Thermal ageing testwill be done on	<u>M/s Shakti</u> Comment as per
parts to be tested as per	Comments	rubber test	para 3.0.1)/Section
approved drawing/ QAP.		specimen at 70 °C	- B
b) Characteristics of Rubber. For rubber refer para. 7.0 of Section		for 7 Days.	M/s Premier Seals
−B.		Specify test	Comments as in
c) Dimensional, appearance, weight and marking.		procedures and	para. 3.0.1)/Section - C
d) Bond strength test as per para.		acceptance values for static deflection test	
6.0 of Section – B.		for both low	
e) Coating thickness of electroplating C Paint layer (DFT).		temperature and high temperature.	
f) Radial Stiffness characteristic test.			
g) Axial Stiffness characteristic test			
h) Torsional stiffness test.			
i) Cardanic stiffness test. j) Fatigue Test.			
k) Radial Stiffness characteristic			
test, Axial Stiffness			
characteristic test, Torsional stiffness test and Cardanic			
stiffness test after fatigue test.			
I) Thermal ageing test (This test will be done on rubber test			
specimen, at 70°C, for 14 days			
as per ISO 188, to check the			
variation in tensile strength, Hardness and elongation at			
break from unaged sample).			
m) Radial Stiffness characteristic test, Axial Stiffness			
characteristic test, Torsional			

				I		
stiffness test and Cardanic						
stiffness test at low temperature						
(-40°C) and High temperature						
(+70°C) after 24 hour soaking of						
sample piece at -40°C						
and+70°C.						
n) Salt spray test 1000 Hrs. as per						
EN13913.						
o) Ozone resistance test at						
50pphm and 40°C, for 24 hr.						
p) Resistance against cleaning						
agent.*						
q) The frequency dependence of						
stiffness.						
8. Rubber Pad for Longitudinal	 	 Same as above	Thermal ageing test			M/s Shakti
Bump Stop		comments	will be done on			Comment as per
a) Mechanical properties of			rubber test			para 3.0.1)/Section
Metal parts to be tested as			specimen at 70 °C			– B
per approved drawing/ QAP.			for 7 Days.			
b) Characteristics of Rubber. For			ioi i Days.			M/s Premier Seals
rubber refer para. 7.0 of Section			Specify test			Comments as in
- B.			procedures and			para. 3.0.1)/Section
c) Dimensional, appearance,			acceptance values for			- C
weight and marking.			static deflection test			
d) Bond strength test as per para.			for both low			
6.0 of Section – B.			temperature and high			
e) Coating thickness of			temperature.			
electroplating C Paint layer			temperature.			
(DFT).						
f) Vertical deflection test.						
1 '						
1 0,						
h) Vertical deflection test after fatigue						
test.						
i) Thermal ageing test						
(This test will be done						
on rubber test specimen,						
at 70°C, for 14 days as						
per ISO 188, to check the						
variation in tensile						
strength, Hardness and						
elongation at break from						
unaged sample).						
j) Vertical deflection test at low						
temperature (-40°C) and High						
temperature (+70°C) after 24						
hour soaking of sample piece						
at - 40°C and +70°C.						
k) Salt spray test 1000 Hrs. as per						
EN13913.						
Ozone resistance test at						
50pphm and 40°C, for 24 hr.						
m) Resistance against cleaning						
agent.*						
 9			1	I .	I .	1

n) The free arrangement of the	T	1	1			
n) The frequency dependence of						
stiffness						
			_			
9. Rubber Spring			 Same as above	Thermal ageing test	 	M/s Shakti
a) Mechanical properties of			comments	will be done on		Comment as per
Metal parts to be tested as				rubber test		para 3.0.1)/Section
per approved drawing/ QAP.				specimen at 70 °C		– B
b) Characteristics of Rubber. For				for 7 Days.		
rubber refer para. 7.0 of Section				l ser / Baye.		M/s Premier Seals
– B.				Specify test		Comments as in
c) Dimensional, appearance,						para. 3.0.1)/Section
				procedures and		- C
weight and marking.				acceptance values for		
d) Bond strength test as per para.				static deflection test		
6.0 of Section – B.				for both low		
e) Coating thickness of				temperature and high		
electroplating C Paint layer				temperature.		
(DFT).						
f) Vertical deflection test.						
g) Fatigue Test.						
h) Vertical deflection test after fatigue						
test.						
i) Thermal ageing test						
(This test will be done						
on rubber test specimen,						
at 70°C, for 14 days as						
per ISO 188, to check the						
variation in tensile						
strength, Hardness and						
elongation at break from						
unaged sample).						
j) Vertical deflection test at low						
temperature (-40°C) and High						
temperature (+70°C) after 24						
hour soaking of sample piece						
at - 40°C and +70°C.						
k) Salt spray test 1000 Hrs. as per						
EN13913.]					

	Ozone resistance test at 50pphm and 40°C, for 24 hr. m) Resistance against cleaning agent.* n) The frequency dependence of stiffness				
	*Test Method: (The part will be dipped in 2-to c% Oxalic acid (cleaning agent), at room temperature and observed. The part has to last for 20 seconds one hour in the solution. It is then cleaned with water and checked for appearance. The acceptance criterion is that there must be no damage, on both rubber appearance and rubber-to-metal bonding).		 The concentration of oxalic acid should be revised to 2% instead of 6%, as higher concentrations can adversely affect natural rubber. Prolonged exposure to a highly concentrated solution may lead to degradation of rubber properties and impact rubber-to-metal bonding performance.		 Matter has been referred to M&C Directorate/ RDSO for further examination.
5.1	 Endurance Test procedure: a) Rubber components to be placed in a proper fixture to facilitate application of static and dynamic loads. b) Test temperature should be (27 ± 5) °C. c) Machine speed should be 10+5 mm/minute. d) Minimum frequency of dynamic load must be 3 Hz. If temperature buildup in metal bonded rubber components exceeds 7°C with respect to room temperature i.e. (27±5) °C, the frequency can be reduced by 0.5 Hz. e) Load deflection characteristics must be measured after applying few cycles for pre-setting of rubber parts. f) No. of cycles- 1 x10⁶ cycles (1 million). g) Endurance test must be completed continuously for 1 million cycles. h) Apply the loads for respective components as per Table in Annexure – B in Section - C. i) Routine tests consists of col- 1 to 		a) Accepted b) Accepted c) This is parameter for static load testing; therefore, it is not possible to carry out. d) Minimum frequency shall be 1 Hz considering the some of the product like Rubber Springs for FIAT Bogie where travel distance of actuator is high e) Pre-setting of rubber parts is not applicable in endurance testing f) Accepted g) Accepted h) Accepted i) Routine test		c) Comment need to elaborate. d) Suggestion of M/s Premier Seals against para. (d) accepted and minimum frequency for dynamic load updated as 2 Hz. e) Presetting is for measurement of characteristic before starting of endurance test. i) Applicable for measurement of characteristics after endurance test. j) Only relevant parameters are given. Ifany other information is required, firm is

	col- 4 of Table in Annexure – B in				consists of 1 to				advised to
	Section - C.				4 of the Table in				provide the
	j) Type testing consists of col-1 to				Annexure B in				details.
	col-5 of in Annexure – B in				Section is not				dotano.
	Section - C.				applicable in				
					endurance test				
					j) Type test on				
					the 1 to 5 in				
					Annexure B in				
					Section C is				
					accepted, but				
					S No. 6 to 8/9				
	A 115 11				is missing				
5.3	Qualification parameters:				a) Noted				b) Sign of failure is
	a) Characteristics conformance to				b) Noted but there				not acceptable.
	the specified values.				shall be some				d) Permanent set
	b) No sign of failure (no physical				acceptance				should not more
	damage, no bond failure, no				criteria in terms				than 2%. It is
	crack on rubber etc.)				of bond failure				same as earlier
	c) No excessive wear.				and crack on				specification
	d) No abnormal permanent set				rubber like				issued by RCF.
	(max. allowed 2%).				length and				g) This tolerance of
	e) No abnormal increase in				depth either				15 % has been
	temperature.				debonding or				given as per EN
	f) Manufacturer interpretation of				crack on rubber				13913.
	test results.				c) Noted				
	g) After the endurance				d) Permanent set				
	test, load deflection				value for				
	characteristics in				Rubber Spring				
	vertical, axial and				for FIAT Bogie				
	torsional mode (as				is requested to				
	given in respective				revise at 8%				
	drawing) should not				considering the				
	differ more than 15				geometry and				
	% from the values				as per IS 3400				
	recorded before				Part 10. For the				
	endurance test.				remaining				
					products 2% is				
					well accepted.				
					e) Noted				
					f) Noted				
					g) It is				
					1				
					recommended				
					for ±20% of				
					variation on				
					stiffness value				
					before and after				
				<u> </u>	endurance test.				
Annexu	re – B (Endurance test and static test lo	ad conditions for co	mponents of FIAT B	ogie)	T	T		Γ	T= .
	Traction center elastic joint				Accepted all the				Tolerance in
					parameters except Axial				stiffness is given as
					Stiffness.				per close criteria

			Load: 2,000 kg Deflection: 5.8 mm ±15% shall be treated as ±20%				mentioned in EN 13913.
Ball Joint Roll Link		 	Accepted all the parameters, however tolerance on radial stiffness value is suggested as below Acceptance Criteria (Radial): Apply test load of 6000 kg and deflection should be 1.0 to 1.6 mm. Average radial stiffness between 0 kg -1700 kg should be 4280 kg/mm ±20%				Acceptance criteria updated as under: Apply test load of 6000 kg and deflection should be 1.0 to 1.6 mm. Average radial stiffness between 0 kg -1700 kg should be 4280 kg/mm ±15%
Rubber Spring			Accepted the specified stiffness/load deflection values; however, it is recommended to reduce the loading speed to 100 mm/min, as the proposed 15 mm/sec (900 mm/min) is excessively high. Currently, no standard testing equipment manufacturers provide such a high loading speed. Moreover, stiffness measurement at such elevated speeds does not yield any additional technical benefits or functional improvements for the product.				Test shall be done at speed of 15 mm/sec as this speed is already accepted by RCF during approval of QAPs of various vendors.
Section –D	1	ı	Luc	[. 	4) 4	1000	
4.0 MANUFACTURING FACILITIES Following manufacturing facilities		 	It is recommended to include a provision for	Firm shall have injection or transfer	1) Available with	2) Outsourcing should be allowed	1. No change is envisage.

shall be available with the firm:

- Firm shall have transfer / injection moulding machine of adequate capacity for manufacturing of Metal **Bonded Rubber** components. The Injection Moulding machine should have following features -
- Pre-plasticizing and Injection system
- Mould Clamping System
- iii. Hydraulic Power System
- Heating/Cooling System iv.
- PLC based control with adequate clamping force
- 2. Swaging machine and dye for removal of internal stress.
- 3. The firm shall have CNC machines in house or at Sister / Allied concern for manufacturing / machining of metal parts of metal bonded rubber components. Same should be mentioned in QAP.
- 4. Bench grinding machines to remove sharp edges from the sheared/blanked or bent steel plates.
- 5. Shot blasting machine with adequate table diameter. The shot blasting machine shall have in-built sieving facility to screen under-sized shots.
- 6. Automatic PLC controlled ultrasonic degreasing plant to remove accumulated dirt/dust, black spots etc.
- 7. Press of suitable capacity for shearing / cutting of steel plates if required. This facility can be outsourced with prior approval of RDSO.
- 8. Suitable spraying facilities for application of adhesive. The spraying machine shall have an inbuilt provision of stirring the adhesive.
- 9. A dirt/dust free room with proper

a *vacuum pumping* system to effectively remove entrapped air from the mould cavity. This will help ensure proper material flow, minimize voids, and enhance the bond strength between rubber and metal. Recommended features:

- i. Pre-plasticizing and Injection system
- ii. Mould Clamping System
- iii. Hydraulic Power System
- iv. Heating/Cooling System
- v. PLC-based control with adequate clamping force
- vi. Vacuum pumping system for air evacuation from the mould cavity
- 2. Accepted Swaging Machine is available with all controls data and logging (PLC Control).
- Accepted CNC 3. Machine available
- 4. Not applicable, because sharp edges are being removed machining process in all the types metallic components. Bench grinding cannot control the uniformity. 5. Accepted but

injection moulding of machines adequate capacity for manufacturing of Metal Bonded Rubber components. The Injection Moulding machine should have following features

- a. Pre-plasticizing and Injection
- b. Mould Clamping System c. Hydraulic
- g System e. PLC based control with
- 2. Swaging internal stress.
- have CNC machines in house or at Sister / Allied concern for rubber components. Same should
- Bench grinding machines to remove sharp edges from the sheared/blanke d or bent steel plates.
- Sand Blasting Machine

setup 2) Accepted by MTC 3) MTC

required

proposing

d to Sub

proposing

machine

work can

Outsource

d to Sub

vendor

5) Accepted

6) Accepted

7) MTC

CNC

be

8) MTC

by MTC

by MTC

proposing

machine

work can

Outsource

proposing

Manual

method

control

quality

result.

12) This

check also

give better

facility is

with

Spraving

d to Sub

vendor

related

related

vendor

CNC

be

4) MTC

CNC machine related work can be Outsource

- system
- Power System d. Heating/Coolin
 - adequate clamping force
 - machine and dye for removal of The firm shall
 - manufacturing / machining of metal parts of metal bonded be mentioned in QAP.
- available sister concern firm

- to developmental vendor.
- 3)Outsourcing should be allowed to developmental vendor 4) Outsourcing
- should be allowed to developmental vendor
- 6) PLC controlled degreasing line should not be mandatory. It will be left to vendor and vendor should decide based on volume of work. **18)** Outsourcing should be allowed to developmental vendor

- 2. Swaging facility be should inhouse.
- 3. Machining facility may be outsourced and para. has been modified under:

"The firm shall have CNC machines in house or at Sister / Allied concern for manufacturing machining of metal parts of metal bonded rubber This components. facility can outsourced with prior approval of RDSO. Same should be mentioned in QAP. Machining facilities shall be verified by RDSO."

- 4. Para. has been modified under: "Bench grinding machines remove sharp edges from the sheared/blanked or bent plates, if required. This facility can be outsourced with prior approval of RDSO. Same should be mentioned in QAP." Sand *blasting* is
- permitted and para. modified, accordingly.
- 6. **RDSO** specification shall be followed.

exhausts facility for adhesive	periodic manual Shot blasting premises.	7. Outsourcing is
application	sieving or machine with	already permit.
10. Elcometer or any other	Girt/Shot shall adequate table	8. Spraying facility
scientific accurate measuring	be permitted as diameter. The	should be
equipment available to	it does give shot blasting	automatic as
measure the thickness of	much of machine shall	mentioned in
adhesive coats at primer	advantage by have in-built	para.
application & final application	having in- built sieving facility	9. RDSO spec.
stage. The instrument shall be	sieving. to screen	should be
capable of measuring the	6. Accepted shots.	followed.
thickness of coating in	7. Outsourcing of 6. Degreasing	10. Provision of
microns.	stamping plant to	suitable
11. Firm shall have a	components remove	instrument is
system to measure	shall be accumulated	already made in
the adhesive film	permitted, dirt/dust,	spec. 11X
thickness at the	similar to the black spots	12. Option of
specified frequency	allowance for etc.	Kneader has
and the same is	forged and cast 7. Press of	been removed.
recorded.	components in suitable	For remaining,
12. Close mixing mill (Banbury) or	metal-bonded capacity for	RDSO spec.
Kneader or intermix of suitable	rubber shearing /	should be
capacity for mixing of rubber	products. cutting of	followed.
and chemical of suitable	8. Accepted steel plates	13. –
capacity for mixing purpose or	9. Shall be dirt/dust if required.	14. –
kneader with suitable cooling	free space This facility	15. –
arrangement shall be	10. Accepted with a can be	16X
available. A digital temperature	suitable DFT outsourced measuring with prior	17. RDSO spec.
indicator for monitoring the	ineasuring conreval of	should be
temperature of kneader	matument. Priso	followed.
chamber during mixing of	Direct 8 Suitable	18. RDSO spec.
rubber compound to avoid	measurement	should be
scorching. This facility should	facilities for	followed.
be available inhouse at OEM (if	blasted surface application of	19. Outsourcing is
applicable) / allied /sister	Is not reasible; adhesive. The	already
concern / group company /	instead, it shall spraying	permitted.
firm premises.	be conducted machine shall	20. –
13. Open mixing mill for	using a suitable have an in-built	
sizing of rubber	3M-type tape provision of	
sheets. The open	placed on the stirring the	
mixing mill shall be	metal part(s) or adhesive.	
equipped with	a non-blasted 9. A dirt/dust	
suitable cooling	metal plate free room	
arrangement and	during the spray with proper	
digital temperature	application. exhausts 11. Nothing to facility for	
indicator.		
14. Suitable facility for cutting of	oonmone p	
Rubber strips is available with	121710000100111111111111111111111111111	
firm.	organisation of	
15. Suitably designed dies &	group of company any other 13. Accepted scientific &	
injection moulds as per relevant specification and drawing.	14. Accepted accurate	
16. Manufacturers shall have a	15. Suitably measuring	
	equipment	
<u> </u>		· .

system of measurement of	designed and available to
moulds for their accuracy for	developed measure the
various dimensions and profile	Injection mould thickness of
on weekly basis or after a	and it is also adhesive coats
production of 500 3000 pieces,	advisable to at primer
whichever is earlier and the	carry out the application &
observations of the mould are	Mould Flow final application
recorded.	Analysis to stage. The
17. Manufacturers shall ensure that	instrument shall
the system exists to check the	ensure proper be capable of filling during the
dimensional accuracy of the	vulcanisation measuring the
mould before its use.	I INICKNESS OF I
18. In-house availability of	process coating in
minimum infrastructure for	16. Nothing to microns.
maintenance and polishing of	comment 11. Close mixing
dies and moulds.	in an extent the Hilli (Baribury)
19. The firm shall have the	inspected the or Kneader or
environment friendly painting /	dimensions on intermix of
electroplating facility which	moulded suitable
shall consists of a painting line	product as capacity for
covering all the	inspection of mixing of
processes/requirements	mould cavity rubber and
involved and suitable system	dimension is chemical with
	critical suitable cooling
for drying of the paint in a	process. arrangement
sequential manner so that the	18. Accepted and shall be
dirt and dust does not get	also permitted to available. A
embedded with paint. In case,	outsource digital
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electroplating facilities in-	racility is
house, the firm shall take prior	accepted; monitoring the temperature of
approval to outsource the	however, kneader kneader
painting / electroplating	electropiating chambor during
process.	shall be mixing of
20. Chemical weighing balance –	outsourced. rubber
5 kg	Setting up an in-
	house avoid
	electroplating scorching. This
	process within a facility should
	rubber moulding be available
	unit is not inhouse at
	feasible due to OEM (if
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						electroplating		!
						facilities in-		
						house, the firm		
						shall take prior		
						approval to		
						outsource the		
						painting /		
						electroplating		
						process.		
						18. Chemical		
						weighing		
						balance – 5 kg		
5.0	INSPECTION AND TESTING						 	
	FACILITIES							
	Following inspection s testing							
	facilities are required:							
5.2	Minimum three axis testing					Minimum three axis	 	Firm should ensure
	machine cum load vs deflection					testing machine		that testing machine
	testing machine having capacity to					cum load vs		should be able to
	measure deflection at load of 200					deflection testing		measure Torsional
								and cardanic
	KN (min.), Torsional and cardanic					1		
	rotation upto 15 ⁰ in static condition					capacity to		rotation upto 15 ⁰ .
	and having simultaneously cyclic					measure deflection		
	movements of all three actuators					at load of 200 KN		
	capable for endurance testing of					(min.), Torsional		
	axle box pivot bush Metal Bonded					and cardanic		
	Rubber components of FIAT					rotation upto 100		
	Bogie as per Annexure - B at					KN in static		
	inhouse / with allied or sister							
	concern / with principal for					having		
	simultaneous load application with					simultaneously		
	facility of data acquisition system					cyclic movements		
	and graphical output. This facility					of all three		
	can be outsourced from NABL /					actuators capable		
	Govt. approved laboratory with					for endurance		
	prior approval of RDSO.					testing of axle box		
	prior approvar or NDSO.							
						pivot bush Metal		
						Bonded Rubber		
						components of		
						FIAT Bogie as per		
						Annexure - B at		
						inhouse / with allied		
						or sister concern /		
						with principal for		
						simultaneous load		
						application with		
						facility of data		
						acquisition system		
						and graphical		
						output. This facility		
1	į	İ	İ	1	1	i output. This facility	İ	1

				can be outsourced from NABL / Govt. approved laboratory with prior approval of RDSO.		
5.6	Minimum two hot air ovens of minimum 250 degree cointegrate capacity to facilitate the testing of rubber product specimen attached with automatic continuous time temperature recorder to record the exact temperature duration of ageing.		The requirement for a minimum of two hot air ovens with a 250°C capacity shall be relaxed to either one oven of the specified capacity or suitable hot air ovens capable of carrying out the ageing process, considering that the ageing temperature for rubber will be below 100°C. However, maintaining two ovens is acceptable to ensure testing efficiency.		One oven should be compulsory for developmental vendor	RDSO spec. should be followed.
5.13	Facility for abrasion resistance and resistance to cleaning agent.	 	 Abrasion resistance testing for metal-bonded rubber products used in Vande Bharat and FIAT Bogies is not recommended, as suspension components are not exposed to abrasive conditions. However, testing for resistance to cleaning agents, as specified in *Test Method in Section B and Section C, is accepted.		 	Suggestion of M/s Premier Seals has been accepted. Accordingly, requirement of Abrasion resistance test has been removed from specification.
5.14	Ozone test machine attached with automatic continuous time temperature recorder to record the exact temperature duration of ageing. This facility can be	 	 Recording of test duration and temperature can be effectively achieved by placing a		 	Noted.

	outsourced from any Govt. / NABL approved laboratory/sister/ allied concern with prior approval of		pyrometer inside the ozone chamber.			
	RDSO.					
5.15	Equipment to test Compression Set as per ASTM D-395 with suitable steel spacers.	 	 Compression set test as per IS 3400 Part 10 shall be permitted		 	Suggestion of M/s Premier Seals accepted and option of per IS 3400 Part 10 has been added in para
5.24	Universal testing machine or suitable test equipment with load indicator having a least-count of minimum 20.0 kg with adequate capacity to apply the required load for conducting tests as specified in relevant specification, drawing(s) along with the facility to draw a graph for load deflection characteristics	 	 Accepted and can be tested on 330 kN Zwick UTM machine for the better accuracy and consistent performance. The requirement shall have computerised branded machine in order to achieve high precision testing result.	A Three-Axis Load Deflection Machine meets all the stated requirements for testing, making the use of a Universal Testing Machine (UTM) unnecessary.	 	Option of suitable test equipment already given in para.
6.3	Vendor / its sub-vendor from where welded components outsourced should have EN 15085-2 Class - I certification for welding quality. Nominated nodal agency for Vendor development can visit the facilities of sub-vendor.		 The requirement for EN 15085-2 Class-I certification should be relaxed, as it may be challenging to find certified vendors in India under the current conditions. Instead, a weld strength test requirement can be defined to ensure quality compliance. This approach would maintain welding integrity while making it feasible for a wider range of vendors to participate.			RDSO spec should be followed.
6.4.2	System to ensure Swaging / Internal Stress Removal.	 	 This requirement is applicable for circular products where rubber is bonded between the inner and outer metal		 	Noted.

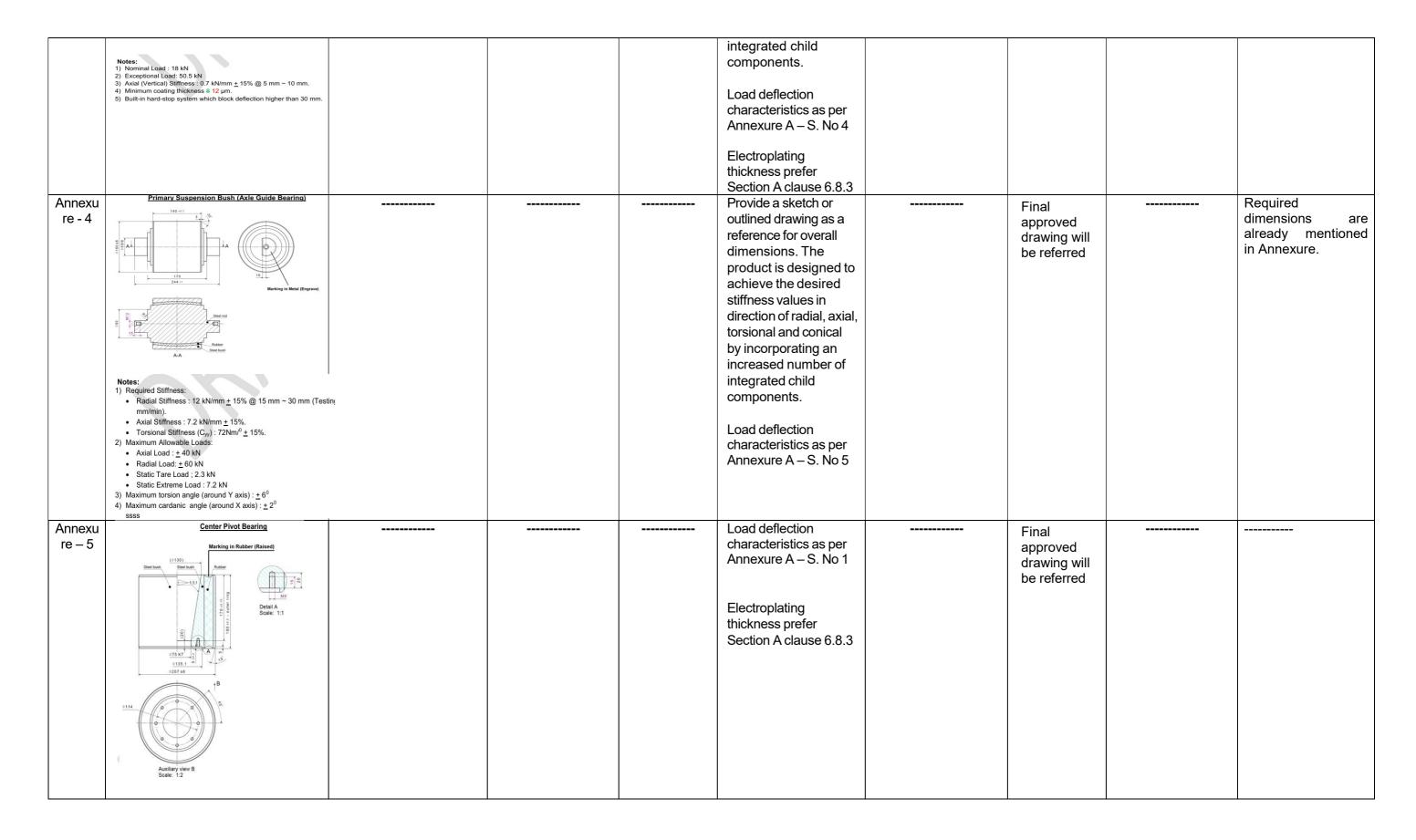
				components to		
				eliminate internal		
				stresses caused by the		
				shrinkage factor of		
				rubber. The		
				percentage of		
				swaging should be		
				defined by the		
				supplier, supported		
				by evidence through		
				product simulation,		
				FEA, or other		
				validated		
				engineering		
				methods to		
				ensure stress relief and		
				long-term performance		
				integrity.		
6.4.3 System to ensure that compo				It appears that the	 	 Error corrected and
having manufacturing defects	are			mentioned of " <mark>Air</mark>		para. updated.
identified and destroyed so th	at			Spring" may be a		
such components are not us				typographical error,		
during assembly of air spring				and the intended		
daming accombly of all opinion	"			reference should be		
				"Metal Bonded		
				Rubber"		
				components. As per		
				standard		
				manufacturing		
				practices,		
				checkpoints are		
				established at every		
				stage of the		
				process to ensure		
				quality control.		
				Components that do		
				not meet the required		
				specifications at any		
				checkpoint are		
				removed from the		
				production line and		
				prevented from		
				advancing to the next		
				stage. This ensures		
				that only compliant		
				components proceed		
				further, maintaining		
				overall product integrity		
				and reliability		
6.4.4 System to ensure that bought				Systems are in place	 	
components are strictly as pe	ſ			for inspection, testing,		
requirements laid down in the				and verification of		
specification /drawing.						
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6.4.6	System to ensure that moulds are checked at regular interval to maintain dimensionally accuracy before release for production. Manufacturers shall have a system of measurement of moulds for their accuracy for various dimensions and profile on weekly basis or after a production of 500 3000 pieces, whichever is earlier and the observations of the mould are recorded	 	 reports for all incoming raw materials to ensure compliance with quality standards and specifications. And requirements are specified in check sheets. Dimensional verification is conducted on the moulded product, as checking the interior dimensions of the mould cavity is a highly critical process due to the absence of direct measurement instruments. As per industry best	 		RDSO spec should be followed.
			practices, mould dimensions are validated through measurements of the moulded product to ensure accuracy. Implementing a system to check moulds at regular intervals is essential; however, the feasibility of directly measuring mould cavity dimensions is limited. Instead, dimensional accuracy should be assessed on the moulded components, and any deviations should trigger an inspection of the mould.			
8.1	Full time rubber technologist having minimum Bachelor degree and with 5 years of experience or Diploma in relevant field with 10 years of experience.	 	 	 	Full time rubber technologist should not be mandatory for Developmental vendor.	RDSO spec should be followed.
8.2	The Quality Control Section shall be separately headed by a full-time technical expert having a minimum Bachelor's degree in Mechanical/Automobile/ Mechatronics etc. with	 	 The QA department is well-structured with multiple qualified professionals	 	Should not be compulsory for developmental vendor.	RDSO spec should be followed.

at least 5 years of experience or diploma in Mechanical/ Automobile/ Mechatronics etc. with at least 10 years of experience. He shall be free from day-today production C testing responsibilities. He shall be mainly responsible for development for product, failure analysis, planning corrective and preventive action, control over raw material, devising actions in case of difficulties in achieving the parameters etc.	1		handling advanced quality management and regular production quality control. Given this, the requirement for a dedicated full-time technical expert may be reconsidered. The existing team effectively oversees product development, failure analysis, corrective and preventive actions, raw material control, and process optimization, ensuring compliance with quality standards		
8.3 Production/ inspection activities shall be headed by a graduate engineer with at least 5 years of experience or a diploma holder with at least 10 years of experience. He shall be actively involved in day-to-day activities of stage inspection / compliance of QAP etc.			The production and inspection activities are already managed by well-experienced graduate engineers, with systems in place for cost reduction and continuous improvement. The existing team effectively oversees stage inspections with QA team, QAP compliance, and process optimization, ensuring efficient operations and quality assurance.	 	

Annexu re - 1	Notes: 1) Load deflection characteristics (Testing Speed 30 mm/min.)- Axial Load (NN) Deflection (mm) 10 3.7 - 5.7 18 5.2 - 7.2 91.5 (exceptional load) 2) Maximum permissible torque of M12 bolt 40 Nm. 3) Minimum coating thickness 8 12 µm.	 	Noted. The material of the screw/bolt shall be grade 8.8 Load deflection characteristics as per Annexure A – S. No 3. A thin rubber layer on the circumference of the metal plate shall be permitted, provided the diameter is controlled to Ø75 mm. Electroplating	 Final approved drawing will be referred.	
			thickness prefers Section A clause 6.8.3		
Annexu re - 2	Notes: 1) Load deflection characteristics (Testing Speed 10 mm/mir Nature of Load (kN) Deflection (mm) Tare 60.2 1.5 ± 10% Nominal 70.4 1.8 – 2.1 Exceptional 91.5 2.4 – 2.6 2) Axial (Vertical) Stiffness: 38.9 kN/mm ± 15%. 4) Radial Force 7.5 kN. 5) Minimum coating thickness 8 12 µm.		The total height dimension of 52 mm differs from the 60 mm specified in ECE drawing number MT18Br2001451-2. RDSO shall clarify whether the required dimension should be maintained at 52 mm or 60 mm. Load deflection characteristics as per Annexure A – S. No 2 Electroplating thickness prefers Section A clause 6.8.3	 Final approved drawing will be referred	Total height is 52 mm. RDSO drawing (Annexure) should be followed.
Annexu re - 3	Lateral Bump Stop When recited plan should be used Surfaces serious Tightening Torque 188 Nm) RB	 	Provide a sketch or outlined drawing as a reference for overall dimensions. The product is designed to achieve the desired stiffness value by incorporating an increased number of	 Final approved drawing will be referred	 Required dimensions are already mentioned in Annexure.

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	Notes: 1) Radial Load vs deflection characteristics (Testing Speed 5 mm/min.)- Load (kN)		Devide		
Annexu re - 6	Traction Rod Substitute of the state of the		Provide a sketch or outlined drawing as a reference for overall dimensions. The product is designed to achieve the desired stiffness values by incorporating an increased number of integrated child components. Load deflection characteristics as per	Final approved drawing will be referred Radial and Axial stiffness will be conducted only on ball joints and NOT on assembly	Required dimensions are already mentioned in Annexure.
	Notes:		Annexure A – S. No 6		
	1) Stiffness Characteristic: Radial 34 kN/mm ± Stiffness 15% Axial 8.0 kN/mm ± Stiffness 15% 2) Working Condition: Radial 60 kN Load (nominal) Radial 150 kN Load (max.) Radial 210 kN Load (max.)		Coating thickness shall be as per comment in Section A – Clause 6.8.1 i.e 160 – 220 µm RDSO shall define whether the replacement of the metal- bonded rubber bush should be done separately or as a complete assembly after its service life, considering that the forged traction rod component has a significantly		
	(crush) 3) Torsion angle: Nominal ± 7.5° Maximum ± 11° 4) Cardanic angle:		longer lifespan.		

Nominal ± 5.5° Maximum ± 9° 5) Coating thickness (μm): 140 – 250 6) Steel according to EN 10083 (C45+QT or 42CrMo4+QT)				
Notes: 1) Type of joints: Ball Joint		Provide a sketch or outlined drawing as a reference for overall dimensions. The product is designed to achieve the desired stiffness values by incorporating an increased number of integrated child components. Load deflection characteristics as per Annexure A – S. No 6 Coating thickness shall be as per comment in Section A – Clause 6.8.1 i.e 160 – 220 µm RDSO shall define whether the replacement of the Ball Joint should be done separately or as a complete assembly after its service life, considering that the forged rod component has a significantly longer lifespan.	Radial and Axial stiffness will be conducted only on ball joints and NOT on assembly. Torsional and Cardanic stiffness and angles are calculated values, derived from FEM. Not tested in serial production. Will be type tested only once.	Required dimensions are already mentioned in Annexure. Torsional and Cardanic stiffness shall be verified on sample basis during purchase inspection.

Ann ex-8	Manufacturer's initial with month, year and batch no. to be punched / engraved to a minimum depth of 0.4 mm at *location in letter height of 6 mm minimum and Manufacturer's initial with quarter month and year to be embossed at # location in legible and suitable letter height on rubber surface:		 	Laser marking shall be permitted with a depth of less than 0.4 mm at a specified location on metal parts (4-6 mm letter height). However, engraving on rubber is not feasible; instead, embossing shall be done using	 Manufacture r's initial with month & year to be punched / engraved to a minimum depth of 0.4 mm at *location in letter height	
		Wherein tolerances are		shall be done using the mould cavity. Batch number marking on rubber is not possible as it takes marking impression engraved on mould cavities. Additionally, considering costeffectiveness and manufacturing feasibility, laser marking should be preferred over engraving with depth of 0.2 to 0.4 mm on metal parts at # location, provided the legibility and durability of the marking meet the required standards	*location in letter height of 6 mm minimum and Manufacture r's initial with month and year to be embossed at # location in legible and suitable letter height on rubber surface	Noted
		not mentioned in the drawings, Tolerance standard to be defined.				