Reasoned Document:

Para no. and 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 – A of RDSO specification no.									
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.

<table>
<tr>
<td></td>
<td>report as a part of type test report. Details of applicable standards for characteristic testing are mentioned in para. 7 of Section – B.</td>
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<td>synthetic rubber to achieve the properties Separate documents will be provided about the properties of rubber for each products during the developmental stage.</td>
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<td></td>
<td>vendors.</td>
<td>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.</td>
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<td>6.3.2.1</td>
<td>Details of metal parts
<table>
<tr><th>S. No.</th><th>Item</th><th>Details of metal parts</th></tr>
<tr><td>1</td><td>Centre Pivot Bearing</td><td>S355J2 to EN 10025 – 5 ~~or~~ Equivalent</td></tr>
<tr><td>2</td><td>Spring pad</td><td>S355J2 to EN 10025 – 5 ~~or~~ Equivalent</td></tr>
<tr><td>3</td><td>Primary Bump Stop</td><td>St W22/HR 3/E 350 C ~~or~~ Equivalent</td></tr>
<tr><td>4</td><td>Lateral Buffer</td><td>S235 JR ~~or~~ Equivalent</td></tr>
<tr><td>5</td><td>Axle guide bearing / Primary Suspension Bush</td><td>S355J2 to EN 10025 – 5 and 42 Cr Mo4 (for inner rod) ~~or~~ Equivalent</td></tr>
<tr><td>6</td><td>Traction Rod</td><td>S355J2 to EN 10025 – 5 (outer tube) and 42CrMo4+QT (for Inner pin of ball joint & handle bar) ~~or~~</td></tr>
</table>
</td>
<td>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.</td>
<td>----------</td>
<td>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.</td>
<td>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.</td>
<td>Equivalent Material to be added Grade EN19 is equivalent grade.</td>
<td>MTC will use equivalent grade/ standard of material in Metal bonded rubber suspen- sion component in Vande Bharat Trains.</td>
<td>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/certifications for replacing them with Indian Standards/ certifications or our own standards, to the extent possible for development of Indigenous vendors.</td>
<td>Suggestion of firms has been accepted provision of alternate material has been made.</td>
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			~~Equivalent~~							
	7	Stabilizer Link	S355J2 to EN 10025 – 5 (outer tube) and 42CrMo4+QT (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 FIAT Bogie, material should be as per respective RCF drawing given as under: **SN** / **Item** / **RCF Drawing No.** 1 / Traction Centre Elastic Joint / LW06102 Alt. b 2 / Rubber Pad For Primary Suspension / LW01101 Alt. b 3 / Primary Bump Stop / LW01102 Alt. d 4 / Lateral Bump Stop / LW05104 Alt. d 5 / Axle Box Pivot Bush with Solid or Hollow Pin Construction / LW01100 Alt. d 6 / Ball Joint Traction Lever / LW06100	----------	----------	----------	SN-1 Materials of metallic parts are accepted as per latest version of IS: 1161-YST 240 SN-2 Materials of metallic part is recommended to use as per latest versions of IS: 2062 E250C Latest Version SN-3 Materials of metallic plate is recommended to use as per latest versions of IS: 2062 E250C Latest Version. Bolt/Screw is recommended to use grade 8.8 SN-4 Materials of metallic parts are accepted as per latest version of IS: 1875 -Class-1A SN-5 Materials of metallic Inner parts is	----------	----------	----------	Suggestion of M/s Premier seals has been accepted and accordingly, para updated.

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

						exposed fire hazard.			
6.4.1.2	**Degreasing:** The metal plates shall be degreased to ensure metal surface is free from oil before grit/shot blasting. For degreasing an PLC controlled degreasing line shall be used. Alkaline Degreasing shall be preferred to remove heavy oils and contaminants from the metal surface. Test shall be carried out to check the contamination of oil or grease on the degreased surface. A special ink, 30-Accu-Dyne Test Pen or equivalent may be used to perform the test. A line may be drawn at different locations on the cleaned metal surface using cotton swab or a 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.	----------	----------	----------	Noted and accepted. However, in the event of an observation where there is a break in the drawn line(s), it indicates the presence of oil, grease, or foreign particles. In such cases, the affected metal parts shall be degreased again until the lines are continuously formed, ensuring a completely oil-free surface.	----------	----------	PLC controlled degreasing line should not be mandatory. It will be left to vendor and vendor should decide based on volume of work.	Suggestion of M/s United Engineering is not acceptable. To minimize the human interface during inprocess activities automation is required.
6.4.1.3	**Grit/Shot Blasting:** After degreasing, the metal plates shall be grit/shot blasted to ensure clean, rough surface optimized for adhesive properties. It shall be performed within 2 hours or as recommended by OEM of the degreasing operation as mentioned above. The grits/shots shall be as per IS 4683/ IS 4606 or any other nationally /internationally recognized standard. After grit/shot blasting, blasted surface must be cleaned either using solvent or dry air blow (free of oil and water) or vacuum to remove all dusts from blasted surface. Quality of blasted surface cleanliness can be	**Sand Blasting should also be included. Sand blasting on parts which is having less thickness to prevent distorting on parts. Thickness of roughness varies from part thickness, shape and complexity of geometry, hence general values of roughness should not be defined and manufacturer should mention these values in their QAP partwise.**	----------	Metal parts will be grit blasted to create surface roughness, in GMT India. GMT India has the facility to measure surface roughness.	The blasted surface roughness shall be maintained within the range of Rz 22 to 36 microns (or an equivalent Ra value) to prevent breakage at sharp corners, a common issue associated with grit or shot blasting. This specification aligns with international best practices and ensures the integrity of the bonding surface. *Exceeding Rz 36 microns is not recommended, as higher roughness*	After degreasing, the metal plates shall be Sand/grit/shot blasted to ensure clean, rough surface optimized for adhesive properties. It shall be performed within 2 hours or as recommended by OEM of the degreasing operation as mentioned above. The grits/shots shall be as per IS 4683/ IS 4606 or any other nationally /internationally	Loading & unloading of metal parts can be manual. Hence this is not related to quality of product.	Automatic loading and unloading of parts in Grit/shot Blasting Machine should not be mandatory . It will be left to vendor and vendor should decide based on volume of work.	Request of M/s Avadh and M/s Shakti accepted and Sand Blasting is also included. Loading and Unloading should be automatically. To install this facility 6 month time shall be given. In the clause, it is already mentioned that another type of surface preparation may also be acceptable with approval of RDSO.

	ascertained using tape test. To get good bond performance, blasted surface roughness Ra will be in the range 10 - 20 microns or Rz in the range 40 - 75 microns. In case there exist standard guidelines /recommendations/instructions from OEM of the bonding agent for the surface preparation, the same can be used for the best performance of the bonding agent. However, Firms shall obtain approval from the Carriage Directorate /RDSO 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.				*levels increase the risk of sharp corner developing crack or partially break, potentially leading to bonding failure.* Additionally, automatic loading and unloading do not contribute to the quality of blasting. Therefore, the use of a manual loading and unloading system should be permitted.	recognized standard. After grit/shot blasting, blasted surface must be cleaned either using solvent or dry air blow (free of oil and water) or vacuum to remove all dusts from blasted surface. Quality of blasted surface cleanliness can be ascertained using tape test. To get good bond performance, blasted surface roughness Ra will be in the range 10 - 20 microns or Rz in the range 40 - 75 microns. In case there exist standard guidelines /recommendations/instructions from OEM of the bonding agent for the surface preparation, the same can be used for the best performance of the bonding agent. However, Firms shall obtain approval from the Carriage Directorate /RDSO 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 blasting and cleaning of metal surface, Primer Chemlok 205 needs to be applied on all	----------	----------	----------	Noted and accepted the points regarding the primer, adhesive,	----------	After blasting process, metal parts	Automatic spray coating machine with automatic sensors,	No change is envisage.

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

	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 further processing.				
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.	----------	Compound weighing system having SCADA (PLC System) chemical and Carbon weight control and Output of rubber weighing system automatically picked up as input by SCADA system should not be mandatory. It will be left to vendor and vendor should decide based on volume of work.	Suggestion of M/s United Engineering M/s Premier Seals is not acceptable. To minimize the human interface during inprocess activities automation is required.
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 auto-feeding 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 • Stabilizer link body • Inner pin of ball joint of Traction rod and Stabilizer link • Inner pin of Axle guide bearing / Primary Suspension For FIAT Bogie: • Inner pin of Ball joint traction lever. • Inner pin of Ball Joint Roll Link • Inner pin of Axle Box Pivot Bush	**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 Suspension 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%**.**

	<table><tr><td>Bush</td><td></td></tr></table> For raw material of other items Magnetic Particle Testing shall be performed on sample basis. Test certificate / report from in house facilities / sub-vendor end / third party laboratory should be submitted with each supply.								
6.6	**Ultrasonic testing (for casting and forging items):** Ultrasonic testing (UT testing) must be conducted in accordance with DIN EN 12680-3, taking into account the general principles of DIN EN ISO 16810. The qualification and certification of test personnel must comply with DIN EN ISO 9712. **Acceptance criteria for UT:** Classification of defects according to EN 10308 (Q3) or EN 10228 (category 3) / Inspection level 2. 100 % For evidence of internal condition Ultrasonic Testing shall be performed on raw material (on sample basis as per ISO:2500) of following items: <table><tr><td>Vande Bharat Trains, Vande Metro, EMU and MEMU underslung</td><td>For FIAT Bogie</td></tr><tr><td>• Traction rod body • Stabilizer link body • Inner pin of ball joint of Traction rod and • Stabilizer link • Inner pin of Axle guide</td><td>Inner pin of Ball joint traction lever. Inner pin of Ball Joint Roll Link Inner pin of Axle Box Pivot Bush</td></tr></table>	----------	----------	----------	The acceptance criteria as per EN 10228-1 are accepted. However, the evidence of external condition or visual examination sample size <u>shall comply with IS 2500, not ISO 2500.</u>	----------	MTC is recommending 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 Suspension Bush	----------	**On the basis of 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 %.

	bearing / Primary • Suspension 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, metal-bonded 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.	----------	----------	----------	----------	----------	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	----------	----------	----------	<u>The electroplating thickness should be revised to 8µ m as per</u>	----------	----------	----------	**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//T0 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 %.

						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 life.			
6.11	The frequency dependence of stiffness shall be demonstrated for each item during prototype testing.	----------	----------	Dynamic stiffness test will be conducted during prototype testing.	Frequencies dependence stiffness or Dynamic stiffness testing can be deferred for now, as existing qualification methods, including static stiffness and fatigue testing, are sufficient to assess performance, and most manufacturers do not have the required testing facilities. Additionally, dynamic stiffness testing requires well-defined parameters such as frequency range, load	To optimize testing requirements while ensuring reliable performance validation, Dynamic Mechanical Analysis (DMA) can be made optional, provided alternative methods such as Finite Element Analysis (FEA) and selective physical testing are used to verify frequency-dependent stiffness behavior. DMA requires specialized equipment and can be time-consuming	----------	----------	Earlier M/s Premier had recommended for Frequencies dependence stiffness with following recommendation: *During prototype testing, the frequency dependence of stiffness must be demonstrated to understand material behavior under loading Conditions. Using a high-accuracy machine like the branded Testing Machine for 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-to-metal 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.	No change is 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 Co-efficient and modulus of elasticity as a	No change is envisage.

					modulus of elasticity as a function of temperature can be deferred for now for metal-bonded rubber products used in rail bogies. These components primarily function as suspension elements where 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 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.			function of temperature should not be mandatory. Product validation should be based on endurance testing followed by field trial.	
8.0	**GUARANTEE:** The Metal Bonded Rubber components including accessories shall be guaranteed for satisfactory performance for ~~72~~ 48 months from the date of supply or ~~2000 000 km~~ 36 months from date of fitment whichever is earlier. Satisfactory performance for	----------	----------	----------	The guarantee/warranty period specified is well accepted. However, the criteria for defect deterioration during the service period of the product(s) should be clearly defined for each	----------	----------	----------	Criteria for LHB coaches already mentioned in CAMTECH Maintenance manual. Criteria for items of Vande Bharat Coaches shall be decided after submission of

	this purpose means that Metal Bonded Rubber components or any of its part shall neither show any kind of deterioration which is likely to render it unserviceable nor lose its characteristics as stipulated in this specification. During the guarantee period for reasons attributable to manufacturing /design defects. In the event of "Non satisfactory Performance" of any of the items as indicated above, supplier will have to replace the same at his own expenses without levying any cost involved in transportations handling and replacement of such items on the purchase				component. This includes specifying acceptable limits for: Crack formation: Maximum permissible length and depth of cracks on the rubber surface. Debonding: Maximum allowable length and depth of debonding between rubber and metal. Clearly defining these parameters will help establish a standardized performance evaluation method and ensure objective assessment during the warranty period.				maintenance manual by firms.
9.0	**INSTALLATION COMMISSIONING AND MAINTENANCE:** On placement of order, supplier whose items will be purchased for the first time for installation on the coaches, shall have to be depute his representative at his own expenses to associates with the purchaser in installation and commissioning of the equipment on the first ten twenty coaches. He shall also depute to his representative during maintenance schedule undertaken on his equipment as per maintenance booklet supplied by him. With every order for supply of the Metal Bonded Rubber components, the supplier shall have to supply maintenance instructions in the form of two booklet (Hard Copy) and one	----------	----------	Maintenance manual will be provided for each part, including mounting instructions, if necessary. Training will be provided once, during initial supply.	Rubber-to-metal bonded products are designed, developed, and manufactured to meet the required stiffness and fitment dimensions; therefore, deputing personnel for fitment and installation is not necessary. All relevant product details will be included in the drawings and maintenance manual. However, the maintenance manual will not be provided with every lot of supply. Instead, it will be submitted to RDSO in both PDF format and hard copy. 1) Specification	----------	----------	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/maintenance practice must be avoided.	**On the basis of remarks of vendors Para. modified as under:** On placement of order, supplier whose items will be purchased for the first time for installation on the coaches, shall have to be depute his representative at his own expenses to associates with the purchaser in installation and commissioning of the equipment on the first twenty coaches. ~~He shall also depute to his representative during maintenance schedule~~

	copy on compact disc. (MS-Office Compatible) in English along with approved drawings of Metal Bonded Rubber components. The maintenance booklet supplied by the supplier shall cover the following aspect in detail: 1) Specification of Metal Bonded Rubber components. 2) Working principle based upon the actual construction. 3) Constructed details giving sketch, drawing and photo copy etc. identification various items and their part number etc. for easy identification. 4) Procedure for dismantling using sequential steps with the help of sketch etc. 5) Procedure for assembly, using sequential step 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 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 defects is rejectable or non rejectable. 9) List of other defects and their remedies. 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 the acceptance / rejection criteria				cannot be covered in maintenance manual 2) No specific requirement as the part is fit and run. 3) Not necessary as nature of the part 4) Out of supplier scope 5) Out of supplier scope 6) Out of supplier scope 7) As per RDSO specification and QAP 8) Not common practice for the products 9) There are no remedies for the defects in product(s) 10) Included in maintenance manual 11) To be inspected quarterly for the cracks and debonding 12) Crack on the rubber, debonding as per maintenance manual 13) Not necessary on these products				~~undertaken on his equipment as per maintenance booklet supplied by him.~~ ~~With every order for supply of the Metal Bonded Rubber components, the supplier shall have to supply maintenance instructions in the form of two booklet (Hard Copy) and one copy on compact disc. (MS-Office Compatible) in English along with approved drawings of Metal Bonded Rubber components.~~ The maintenance booklet supplied by the supplier shall cover the following aspect in detail: ~~1. Specification of Metal Bonded Rubber components.~~ 2. Working principle based upon the actual construction. 3. Construction details giving sketch, drawing and photo ~~copy~~ etc.. ~~identification various items and their~~ Part number ~~etc~~. of item for easy identification. 4. Procedure for dismantling from bogie using sequential steps with the help of

	of cracks.								sketch etc. 5. Procedure for assembly in bogie, using sequential step 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 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 defects is 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

									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/maintenance 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 - B									
1.0 /	**Rubber compound test during purchase inspection:**	**Please specify the standard of bond strength test on product and stroke elasticity.**	----------	----------	----------	Specify the acceptance values or range and the test standards for each tests.	----------	----------	Acceptance values shall be as per 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. 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 radial deflection test including force displacement characteristics at tare and extreme load. g) Static axial deflection / stiffness test. h) Torsional stiffness test. i) Fatigue test. j) Radial and axial characteristics 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) 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. m) Salt spray test for 1000 Hrs. as per EN13913. n) Ozone resistance test at 50pphm and 23°C 40°C, for 24 hr. o) Resistance against	----------	----------	----------	a) Mechanical tests on the metal part may not be possible on vulcanized product and recommended to accept the NABL accredited test report provided by supplier, however chemical composition test may be conducted on unbonded metal parts. b) Rubber Characteristics is as per comments on clause 7.0 c) Dimensional is accepted d) As per comments on para 6.0 Section B on bonding strength e) Coating thickness is accepted f) Static radial is accepted g) Static axial is accepted h) Torsional stiffness is accepted. i) Fatigue test is accepted j) Nothing to comment k) Radial & axial characteristics after fatigue can be done but acceptance criteria are not	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.	Accepted by MTC, SST test as per EN13913 following ISO 9227 (MTC proposing SST On test specimen, Not on the component)	----------	a) For Mechanical properties report of NABL lab will be acceptable. However, if required sample of metal part can be taken from unbonded metal part. b) DMA test report shall be provided during initial registration / proto type testing. c) --- d) Bond strength test shall be conducted directly over the product. M/s GMT was advised to provide details regarding the Bond strength test over product i.e. test method, applicable load, acceptance criteria etc. However, M/s GMT has not provided the details. It is again advised to submit the details for further review. e) ----- f) ----- g) ----- h) ----- i) ----- j) ----- **k)** Thermal ageing test will be done on rubber test specimen at 70 °C for 14 Days. **M/s GMT was**

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

					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				
	2. Spring Pad 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 temperature (-40°C) and High temperature (+70°C)	----------	----------	----------	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.	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.	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.

	after 24 hour soaking of sample piece at - 40°C and +70°C. l) Salt spray test for 1000 Hrs. as per EN13913. m) Ozone resistance test at 50pphm and 40°C, for 24 hr. n) Settlement / Creep test (This test will be carried out on the finished part, at 70.4 kN 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 cleaning agent* **p)** The frequency dependence of stiffness.								
	3. Primary Bump Stop 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 and 91.5 kN load. g) Fatigue test. h) Vertical characteristics after	----------	----------	----------	Comments are same as above in "Centre Pivot Bearing" except below: i) Accepted the vertical characteristics 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 abrasive conditions. Additionally, unlike standalone rubber components, metal-bonded rubber products in bogie applications do not undergo frictional wear, further eliminating the necessity for abrasion resistance testing.	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.	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). • Remark of M/s Premier Seals regarding Abrasion Test has been accepted.

	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. l) 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 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) Fatigue test.	----------	----------	----------	Comments are same as above in "Centre Pivot Bearing" except below: i) Accepted the vertical characteristics 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 abrasive conditions. Additionally, unlike standalone rubber components, metal-bonded rubber products in bogie applications do not	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.	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). • Remark of M/s Premier Seals regarding Abrasion Test has been accepted.

	h) Vertical characteristics after 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. l) Salt spray test for 1000 Hrs. as per EN13913. m) Ozone resistance test at 50 pphm and 40°C, for 24 hr. n) Resistance against cleaning agent* o) The frequency dependence of stiffness.				undergo frictional wear, further eliminating the necessity for abrasion resistance testing.				
	5. Axle Guide Bearing / Primary Suspension Bush 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 radial deflection and stiffness test including load vs	----------	----------	----------	Comments are same as above in "Primary Bump Stop" Stiffness testing shall be as per Annexure A Clause (f) specified tare load and extreme load value shall be verified.	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.	Accepted by MTC, SST test as per EN13913 following ISO 9227 (MTC proposing SST On test specimen, Not on the component)	----------	Comments as para. 3.3 above

	deflection characteristics at tare (2.3 kN) and extreme load (7.2 kN). g) Static axial stiffness / deflection test. h) Torsional and Cardenic angle test. i) Torsional stiffness test j) Fatigue test. k) Radial characteristics, axial characteristics, Torsional stiffness, Torsional and Cardanic angle test after fatigue test l) 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) 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. n) Salt spray test for 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.								
	6. Traction Rod 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 radial deflection and stiffness test including load	----------	----------	----------	As per above comments Stiffness test shall be as per Annexure A	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.	Accepted by MTC, SST test as per EN13913 following ISO 9227 (MTC proposing SST On test specimen, Not on the component)	----------	Comments as para. 3.3 above

	vs Deflection characteristics at tare load (60 KN), maximum load (150 KN) extreme load and ultimate compression load 210 KN. Static axial stiffness / deflection test. g) Static axial deflection / stiffness test h) Torsional and Cardenic angle test. i) Torsional stiffness test j) Fatigue test. k) Radial characteristics, axial characteristics, Torsional stiffness, Torsional and Cardanic angle test after fatigue test l) 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) 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. n) Salt spray test for 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.								
	7. Stabilizer Link 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.	----------	----------	----------	As per above comments Stiffness test shall be as per Annexure A Clause (q) Abrasion resistance testing is generally not required for metal-	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.	Accepted by MTC, SST test as per EN13913 following ISO 9227 (MTC proposing SST On test specimen, Not on the component)	----------	Comments as para. 3.3 above

	e) Coating thickness of electroplating C Paint layer (DFT). f) Static radial deflection and stiffness test including load vs Deflection characteristics at tare load, nominal load (30 KN), extreme load (50 KN) and ultimate compression load 62 KN. g) Static axial deflection / stiffness test including axial deflection at 2KN (nominal load) and 4 KN (exceptional load). h) Torsional and Cardanic angle test. i) Torsional stiffness test. j) Fatigue test. k) Radial characteristics, axial characteristics, Torsional stiffness, Torsional and Cardanic angle test after fatigue test l) 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) 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. n) Salt spray test for 1000 Hrs. 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). q) Resistance against cleaning agent* r) The frequency dependence of stiffness.				bonded rubber components used in rolling stock bogies, as these parts do not experience continuous abrasive conditions. Additionally, unlike standalone rubber components, metal-bonded rubber products in bogie applications do not undergo frictional wear, further eliminating the necessity for abrasion resistance testing.				
	Cleaning agent test: (The part will be dipped in 6% Oxalic acid (cleaning agent), at room temperature and	----------	----------	----------	The concentration of oxalic acid should be revised to **2% instead of 6%**, as higher	----------	----------	----------	**Matter has been referred to M&C Directorate/ RDSO for further**

	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).				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.				**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) Load deflection characteristics / stiffness characteristic in axial, radial, torsional, conical mode as mentioned in drawing must be measured after applying few cycles for pre-setting of rubber parts. e) 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. f) No. of cycles 1 x10^6 cycles (1 million). g) Endurance test must be completed continuously for ~~10 million~~ 1 million cycles. h) Apply the loads for respective components as per Table in Annexure – A in Section - B. i) Routine tests consists of col- 1 to col- 5 of Table in Annexure – A in Section - B. j) Type testing consists of col-1 to col-6 of in Annexure – A in Section - B.	----------	Dynamic cycle should be 6 lac. on primary load axis instead of 10 lac. as it is pratical from machine availablity & fixture life.	**5.1.e** Test frequency will be between 0.5 to 1 Hz. Frequencies higher than this will heat up the rubber portion, resulting in burn-out. **5.1.f** Test can be conducted for 6,00,000 cycles, taking reference of Train-18 parts.	a) Accepted b) Accepted c) Accepted d) This is parameter is for static load testing, therefore, it is not possible to carry out. e) Minimum frequency shall be considered 2 Hz and component exceeds 7°C with respect to room temperature shall be consider 15°C f) Accepted g) It shall be as per Clause 5.2 in Section B, because there is intervals where as in this clause it is mentioned as continuous cycles on 1 million h) Will be commented on Section B i) Accepted, if the routine test is considered as pre-despatch static load testing. Static testing shall not be the part of Endurance testing.	----------	----------	----------	• Test cycles and frequency shall be as per RDSO specification. • Comment of M/s Premier Seals against para. (d) needs to elaborate. • Suggestion of M/s Premier Seals against para. (e) accepted and minimum frequency for dynamic load updated as 2 Hz.

					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 endurance test.				
5.4	Endurance test of Metal Bonded Rubber components shall be conducted by the firm at an interval of every 3 years. It shall be verified by representative of nodal agency nominated for vendor development.	----------	----------	The quality of the product over time is ensured through serial testing, rubber characteristics and serial 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.	----------	----------	----------	----------	Suggestion of M/s GMT is not acceptable. Periodic endurance test has been introduced to ensure the long term reliability of product in field during series production.
6.0	**Bonding strength test:** The objective of this test is to determine bond strength between metal and rubber. This	----------	----------	----------	Accepted to conduct the Bond Strength test as per IS: 3400 (Part XIV/Sec 2) on specimens, ensuring a	----------	----------	----------	M/s GMT was advised to provide more details i.e. test method, applicable

	test is conducted as per IS: 3400 (Part – XIV/ Sec. 2), ISO 814:2017 or latest revision. The bond should be capable of bearing a minimum stress level of 40 Kg/cm². Bond strength test shall be conducted directly over the product.				minimum strength of 40 kg/cm². However, the bond strength test on the product itself will not follow the standard test method. Instead, the applied load will be 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				load, acceptance criteria etc. However, M/s GMT has not given any response. It is again advised GMT to provide the details as asked by RDSO.
7.0	Physical tests of rubber compound for Metal Bonded Rubber components:	----------	----------	----------	Accepted for 1, 3 (to be referred to specific gravity in No. 15), 4, 5, 6, 7, 8, 9. The homogeneity of rubber is not a critical factor for metal- bonded rubber components used in rolling stock bogies, as their performance primarily depends on bonding strength, stiffness, and durability rather than uniform rubber composition. Additionally, also accepted 10, 12, 14 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 (Part 23) / ASTM D2240 Tensile Strength – IS: 3400 (Part 1) Elongation – IS:	----------	----------	----------	Thermal ageing test will be done on rubber test specimen at 70 °C for 14 Days. For other tests suggestion of M/s Premier Seals has been accepted and standards has been added in list.

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>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)</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="10">Annexure – A (Endurance test load conditions)</td></tr>
<tr><td></td><td>Centre Pivot Bearing
(Axial Load test 1)</td><td>Typographical error is noticed on displacement readings at radial load test column of Centre Pivot Bearing.
<table><tr><th>Mentioned as</th><th>Changes required as</th></tr><tr><td>d= 0,95 mm ± 15% at 80 kN
d=1,35 mm ± 15% at 120 kN</td><td>d= 0.95 mm ± 15% at 80 kN
d=1.35 mm ± 15% at 120 kN</td></tr></table>Fatigue/endurance test (to be applied simultaneously) :
Radial load: ±100 kN,
Axial load : ± <s>22.5</s> 2.4 kN,
Torsional angle: (±3°)

“Frequency to be defined for each type of load test. 3Hz is applicable for all type of load applications? Please clarify”</td><td>----------</td><td>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.</td><td>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</td><td>----------</td><td>----------</td><td>----------</td><td><u>M/s Avadh</u>
• Necessary Correction has been made as suggested.
• Frequency of each type load may be suggested for further examination.

<u>M/s GMT</u>
The torsional stiffness test shall be done on sample basis during purchase inspection.

<u>M/s Premier Seals</u>

Firm is advised to give technical presentation at RDSO regarding the issue of axial load test.</td></tr>
</table>

					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 non-functional 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:** Recommended stiffness value is 80Nm/° **Conical:** Noted	----------	----------	----------	**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 - C												
	S. No.	**Test**	**Details / Remarks**	**Number of samples**	----------	----------	----------		----------	----------	----------	M/s Premier Seals is advised to provide more details regarding the comment on Coating thickness.
1.0	**1**	Visual Examination	• Free from burrs and other surface defects. • All Sharp corners shall be rounded off. • Finished parts shall be free from Porosity and sponginess, crack or defects in rubber structure. • Metal surface shall be Zinc Nickle plated or painted.	2% samples of the lot or minimum 5 samples whichever is more				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 recommended as per ISO 19598 - Fe//ZnNi8//Cn//T0 6) Deflection stiffness test is accepted 7) Weight inspection is accepted 8) Marking inspection is accepted				
	2	Dimension verificati	As per approved drawing of	2% samples of the								

			on	firm.	lot or minimum 5 samples whichever is more							
		3	Rubber compound test(mechanical-physical characteristics)	Test to be conducted on rubber slab & report will be prepared for each rubber batch (mechanical-physical characteristics). Acceptance criteria should be as approved drawings / QAP. Type of Rubber: Tensile strength : Elongation at break: Hardness: Specific Gravity: Bond strength								

			test on final product: Stroke elasticity:									
	4	Chemical & mechanical property of metal parts	The mechanical and chemical characteristics of the used metals have to be verified. Acceptance criteria should be as approved drawings / QAP. Acceptance criteria should be as approved drawings / QAP.									
	5	Coating thickness of electroplating / painting (DFT)	~~As per approved drawing of firm~~. Minimum 12 µ and also meet the approved drawing of firm.	2% samples of the lot or minimum 5 samples whichever is more								

				.							
	6	Deflection/ Stiffness test	As per approved drawing of firm.	5% samples of the lot or minimum 10 samples whichever is more.							
	7	Weight	As per approved drawing of firm.	2% samples of the lot or minimum 5 samples whichever is more.							
	8	Marking	As per approved drawing of firm duly confirming to Annexure - 8.	2% samples of the lot or minimum 5 samples whichever is more							

	.								
3.0	**Details of tests during Prototype Testing / Type Testing:**	---------	----------	----------	---------	----------	---------	----------	----------
	1. Traction Centre Elastic Joint 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) Ultimate compassion load test. i) Fatigue Test. j) Radial Stiffness test, Axial Stiffness test and Ultimate compassion load 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 and axial stiffness test at low temperature (-	----------	----------	----------	a) Mechanical tests on the metal part may not be possible on vulcanized product and recommended to accept the NABL accredited test report provided by supplier, however chemical composition test may be conducted on unbonded metal parts. b) Rubber Characteristics is as per comments on clause 7.0 in Section B c) Dimensional is accepted d) As per comments on para 6.0 Section B on bonding strength e) Coating thickness	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.	----------	----------	**<u>M/s Shakti</u>** Comment as per para 3.0.1)/Section – B **<u>M/s Premier Seals</u>** a) For Mechanical properties report of NABL lab will be acceptable. However, if required sample of metal part can be taken from unbonded metal part. b) DMA test report shall be provided during initial registration / proto type testing. c) --- d) Bond strength test shall be conducted directly over the product. M/s GMT was advised to provide details regarding the

	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. n) Ozone resistance test at 50pphm and 40°C, for 24 hr. o) Resistance against cleaning agent.* p) The frequency dependence of stiffness				is accepted f) Static radial is accepted g) Static axial is accepted h) Ultimate compression load test is accepted i) Fatigue test is accepted j) Radial C axial characteristics after fatigue can be done k) Thermal ageing test will be done on rubber test specimen, at 70°C, for 72 hrs as per IS 3400 Standard, to check the variation in tensile strength, Hardness and elongation at break from unaged rubber test specimen sample. This test condition is sufficient and recommended for testing the aging properties of rubber test specimen. l) The static deflection test at low (-40°C) and high (+70°C) temperatures is not suitable for this product, as the rubber material used in its manufacturing is not designed to function effectively at these extreme				Bond strength test over product i.e. test method, applicable load, acceptance criteria etc. However, M/s GMT has not provided the details. It is again advised to submit the details for further review. e) ----- f) ----- g) ----- h) ----- i) ----- j) ----- k) Thermal ageing test will be done on rubber test specimen at 70 °C for 14 Days. **M/s GMT was advised to provide more details i.e. test procedure, acceptance criteria etc. along with other required details for further examination. However, M/s GMT has not provided the details. It is again advised to submit the details for further review.** l) Test procedure and acceptance limit shall be as per static load

					temperatures. Additionally, the necessary testing facilities for conducting such evaluations are not available m) 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 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 Section-A				tests mentioned in Annexure – B. m) Metal part of component may be cut for Salt spray test. n) ----- o) Resistance against cleaning agent - Shall be carried out as per RDSO specification. p) Comment as per para. 6.11/ Section - A.
	2. **Rubber Pad for Primary Suspension** 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) 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	----------	----------	----------	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.	----------	----------	**<u>M/s Shakti</u>** Comment as per para 3.0.1)/Section – B **<u>M/s Premier Seals</u>** Comments as in para. 3.0.1)/Section - C

	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) Static 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. k) Salt spray test 1000 Hrs. as per EN13913. l) Ozone resistance test at 50pphm and 40°C, for 24 hr. m) Resistance against cleaning agent.* n) The frequency dependence of stiffness.								
	3. **Primary 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) Vertical Stiffness test g) Fatigue Test. h) Vertical 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) 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. k) 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

	l) 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 g) 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 (+70°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 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 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. l) 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	----------	----------	----------	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

	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 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) 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. l) Ozone resistance test at 50pphm and 40°C, for 24 hr. m) Resistance against cleaning agent.*	----------	----------	----------	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) The frequency dependence of stiffness								
	9. Rubber Spring 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) 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.	----------	----------	----------	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

	l) 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 x10^6 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 Section - C. **j)** Type testing consists of col-1 to col-5 of in Annexure – B in Section - C.				consists of 1 to 4 of the Table in Annexure B in Section is not 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 is missing				advised to provide the details.
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, load deflection characteristics in vertical, axial and torsional mode (as given in respective drawing) should not differ more than 15 % from the values recorded before endurance test.	----------	----------	----------	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) Permanent set value for Rubber Spring for FIAT Bogie is requested to revise at 8% considering the geometry and as per IS 3400 Part 10. For the remaining products 2% is well accepted. e) Noted f) Noted g) It is recommended for ±20% of variation on stiffness value before and after endurance test.	----------	----------	----------	b) Sign of failure is not acceptable. d) Permanent set should not more than 2%. It is same as earlier specification issued by RCF. g) This tolerance of 15 % has been given as per EN 13913.
Annexure – B (Endurance test and static test load conditions for components of FIAT Bogie)									
	Traction center elastic joint	----------	----------	----------	Accepted all the parameters except Axial Stiffness.	----------	----------	----------	Tolerance in stiffness is given as 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									
4.0	**MANUFACTURING FACILITIES** Following manufacturing facilities	----------	----------	----------	It is recommended to include a provision for	1. Firm shall have injection or transfer	1) Available with	**2) O**utsourcing should be allowed	1. No change is envisage.

	shall be available with the firm: 1. 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 – 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 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 in-built 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 and data logging (PLC Control). 3. Accepted - CNC Machine is available 4. Not applicable, because sharp edges are being removed by machining process in all the types of metallic components. Bench grinding cannot control the uniformity. 5. Accepted but	injection moulding machines of adequate capacity for manufacturing of Metal Bonded Rubber components. The Injection Moulding machine should have following features – a. Pre-plasticizing and Injection system b. Mould Clamping System c. Hydraulic Power System d. Heating/Cooling System e. 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. Sand Blasting Machine or	required setup 2) Accepted by MTC 3) MTC proposing CNC machine related work can be Outsourced to Sub vendor 4) MTC proposing CNC machine related work can be Outsourced to Sub vendor 5) Accepted by MTC 6) Accepted by MTC 7) MTC proposing CNC machine related work can be Outsourced to Sub vendor 8) MTC proposing Manual Spraying method with control quality check also give better result. 12) This facility is 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 should be in-house. 3. Machining facility may be outsourced and para. has been modified as under: *"The firm shall have CNC machines in house or at Sister / Allied concern for manufacturing / machining of metal parts of metal bonded rubber components.* ***This facility can be outsourced with prior approval of RDSO.*** *Same should be mentioned in QAP.* ***Machining facilities shall be verified by RDSO."*** 4. Para. has been modified as under: *"Bench grinding machines to remove sharp edges from the sheared/blanked or bent steel plates, if required.* ***This facility can be outsourced with prior approval of RDSO.*** *Same should be mentioned in QAP."* *5.* Sand *blasting is permitted and para. modified, accordingly.* 6. RDSO specification shall be followed.

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

	~~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.~~ 17. Manufacturers shall ensure that the system exists to check the dimensional accuracy of the mould before its use. 18. In-house availability of minimum infrastructure for maintenance and polishing of dies and moulds. 19. The firm shall have the environment friendly painting / electroplating facility which shall consists of a painting line covering all the processes/requirements involved and suitable system for drying of the paint in a sequential manner so that the dirt and dust does not get embedded with paint. In case, the firm is not having painting / electroplating facilities in-house, the firm shall take prior approval to outsource the painting / electroplating process. 20. Chemical weighing balance – 5 kg				designed and developed Injection mould and it is also advisable to carry out the Mould Flow Analysis to ensure proper filling during the vulcanisation process 16. Nothing to comment 17. Shall be inspected the dimensions on moulded product as inspection of mould cavity dimension is critical process. 18. Accepted and also permitted to outsource 19. The painting facility is accepted; however, electroplating shall be outsourced. Setting up an in-house electroplating process within a rubber moulding unit is not feasible due to stringent government regulations and environmental compliance requirements. 20. For improved accuracy, weighing scales with appropriate	available to measure the thickness of adhesive coats at primer application & final application stage. The instrument shall be capable of measuring the thickness of coating in microns. 11. Close mixing mill (Banbury) or Kneader or intermix of suitable capacity for mixing of rubber and chemical with suitable cooling arrangement shall be available. A digital temperature indicator for monitoring the temperature of kneader chamber during mixing of rubber compound to avoid scorching. This facility should be available inhouse at OEM (if applicable) / allied /sister concern / group company / firm premises. 12. Open mixing mill for sizing of rubber sheets. The open mixing mill shall be equipped with suitable			

					capacities should be used based on the material type and required precision. A 5 kg weighing balance is not suitable for rubber, as it is too small for bulk weighing. Similarly, for accelerators, where only a few grams are required, a 5 kg balance lacks the necessary precision. It is recommended to use dedicated weighing balances with suitable capacities for rubber, accelerators, carbon, and master chemicals to ensure accurate measurements and process consistency.	cooling arrangement and digital temperature indicator. 13. Suitable facility for cutting of Rubber strips is available with firm. 14. Suitably designed dies & injection moulds as per relevant specification and drawing. 15. Manufacturers shall ensure that the system exists to check the dimensional accuracy of the mould before its use. 16. In-house availability of minimum infrastructure for maintenance and polishing of dies and moulds. 17. The firm shall have the environment friendly painting / electroplating facility which shall consists of a painting line covering all the processes/requirements involved and suitable system for drying of the paint in a sequential manner so that the dirt and dust does not get embedded			

						with paint. In case, the firm is not having painting / 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 machine cum load vs deflection testing machine having capacity to measure deflection at load of 200 KN (min.), Torsional and cardanic rotation upto 15^0 in static condition and having simultaneously cyclic movements of all three actuators capable for endurance testing of axle box 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 can be outsourced from NABL / Govt. approved laboratory with prior approval of RDSO.	----------	----------	----------	----------	Minimum three axis testing machine cum load vs deflection testing machine having capacity to measure deflection at load of 200 KN (min.), Torsional and cardanic rotation upto 100 KN in static condition and having simultaneously cyclic movements of all three actuators capable for endurance testing of axle box 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	----------	----------	Firm should ensure that testing machine should be able to measure Torsional and cardanic rotation upto 15^0 .

						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 RDSO.				pyrometer inside the ozone chamber.				
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 components having manufacturing defects are identified and destroyed so that such components are not used during assembly of air spring.	----------	----------	----------	It appears that the mentioned of "Air Spring" may be a typographical error, and the intended 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	----------	----------	----------	Error corrected and para. updated.
6.4.4	System to ensure that bought out components are strictly as per requirements laid down in the specification /drawing.	----------	----------	----------	Systems are in place for inspection, testing, and verification of	----------	----------	----------	---------

					reports for all incoming raw materials to ensure compliance with quality standards and specifications. And requirements are specified in check sheets.				
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	----------	----------	----------	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 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.	----------	----------	----------	RDSO spec should be followed.
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.				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.	----------	----------	----------	----------

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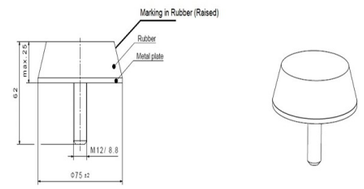
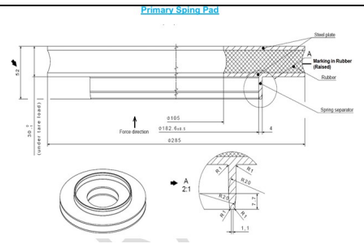
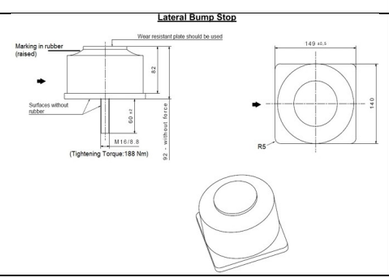
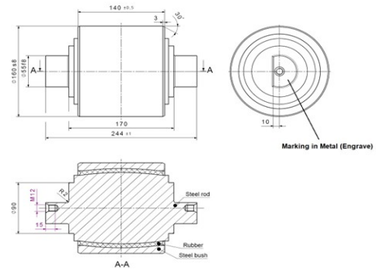
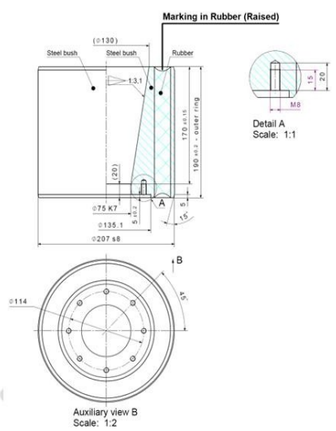
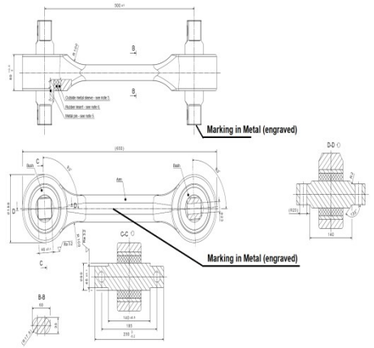
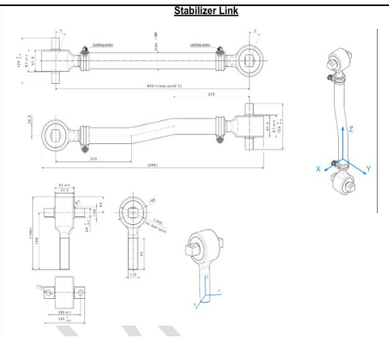
Annexure - 1	**Primary Bump Stop**  **Notes:** 1) Load deflection characteristics (Testing Speed 30 mm/min.)- Axial Load (kN) / Deflection (mm) 10 / 3.7 – 5.7 18 / 5.2 – 7.2 91.5 (exceptional load) / 11.0 (Approx.) 2) Maximum permissible torque of M12 bolt 40 Nm. 3) Minimum coating thickness ~~8~~ 12 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 thickness prefers Section A clause 6.8.3	----------	Final approved drawing will be referred.	----------	----------
Annexure - 2	**Primary Sping Pad**  **Notes:** 1) Load deflection characteristics (Testing Speed 10 mm/mir Nature of load / 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% @ 30 kN ~ (3) Radial Stiffness 1.5 kN/mm ± 15%. 4) Radial Force 7.5 kN. 5) Minimum coating thickness ~~8~~ 12 µm.	----------	----------	----------	<u>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.</u> 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.
Annexure - 3	**Lateral Bump Stop**  	----------	----------	----------	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.

	Notes: 1) Nominal Load : 18 kN 2) Exceptional Load: 50.5 kN 3) Axial (Vertical) Stiffness : 0.7 kN/mm ± 15% @ 5 mm ~ 10 mm. 4) Minimum coating thickness 8 12 µm. 5) Built-in hard-stop system which block deflection higher than 30 mm.				integrated child components. Load deflection characteristics as per Annexure A – S. No 4 Electroplating thickness prefer Section A clause 6.8.3				
Annexure - 4	**Primary Suspension Bush (Axle Guide Bearing)**  **Notes:** 1) Required Stiffness: • Radial Stiffness : 12 kN/mm ± 15% @ 15 mm ~ 30 mm (Testing mm/min). • Axial Stiffness : 7.2 kN/mm ± 15%. • Torsional Stiffness (C_{yy}) : 72Nm/^{0} ± 15%. 2) Maximum Allowable Loads: • Axial Load : ± 40 kN • Radial Load: ± 60 kN • Static Tare Load ; 2.3 kN • Static Extreme Load : 7.2 kN 3) Maximum torsion angle (around Y axis) : ± 6^0 4) Maximum cardanic angle (around X axis) : ± 2^0 ssss	----------	----------	----------	Provide a sketch or outlined drawing as a reference for overall dimensions. The product is designed to achieve the desired stiffness values in direction of radial, axial, torsional and conical by incorporating an increased number of integrated child components. Load deflection characteristics as per Annexure A – S. No 5	----------	Final approved drawing will be referred	----------	Required dimensions are already mentioned in Annexure.
Annexure – 5	**Center Pivot Bearing** 	----------	----------	----------	Load deflection characteristics as per Annexure A – S. No 1 Electroplating thickness prefer Section A clause 6.8.3	----------	Final approved drawing will be referred	----------	----------

	Notes: 1) Radial Load vs deflection characteristics (Testing Speed 5 mm/min.)- Load (kN) | Deflection (mm) 80 | 0.95 ± 15% 120 | 1.35 ± 15% 2) Stiffness Characteristic: Radial Stiffness | 80 kN/mm ± 15% Axial Stiffness | 5.5 kN/mm ± 15% Torsional Stiffness | 620 Nm/^{0} ± 15% 3) Minimum coating thickness 8 12 µm.								
Annexure - 6	Traction Rod  **Notes:** 1) **Stiffness Characteristic:** Radial Stiffness | 34 kN/mm ± 15% Axial Stiffness | 8.0 kN/mm ± 15% 2) **Working Condition:** Radial Load (nominal) | 60 kN Radial Load (max.) | 150 kN Radial Load (crush) | 210 kN 3) **Torsion angle:** Nominal | ± 7.5^0 Maximum | ± 11^0 4) **Cardanic angle:**	----------	----------	----------	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 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 longer lifespan.	----------	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.

	<table><tr><td>Nominal</td><td>± 5.5⁰</td></tr><tr><td>Maximum</td><td>± 9⁰</td></tr></table> 5) Coating thickness (µm) : 140 – 250 6) Steel according to EN 10083 (C45+QT or 42CrMo4+QT)								
Annexure - 7	Stabilizer Link  **Notes:** 1) Type of joints: Ball Joint 2) Working Condition: <table><tr><td>Load</td><td>Nominal (kN)</td><td>Exceptional (kN)</td></tr><tr><td>F_z</td><td>± 30.0</td><td>± 50.0</td></tr><tr><td>F_y</td><td>± 2.0</td><td>± 4.0</td></tr><tr><td>F_x</td><td>1.0</td><td>1.0</td></tr></table> 3) Cardanic Angle and Torsional Angle for each bush: <table><tr><td>Condition</td><td>Cardanic Angle</td><td>Torsional Angle</td></tr><tr><td>Normal</td><td>5.0⁰</td><td>12.0⁰</td></tr><tr><td>Exceptional</td><td>8.5⁰</td><td>21.0⁰</td></tr></table> 4) Stiffness of Ball Joint: <table><tr><td>Radial Stiffness</td><td>50 kn/mm ± 15%</td></tr><tr><td>Axial Stiffness</td><td>10.5 kN/mm ± 15%</td></tr><tr><td>Cardanic Stiffness</td><td>42 Nm/⁰</td></tr><tr><td>Torsional Stiffness</td><td>46 Nm/⁰</td></tr></table> 5) Min. length : 590 ± 2 mm Max. length : 640 ± 2 mm 6) Locking Screws: ISO 4042, M12 X 1.5 X 60 – 8.8 or higher 7) Coating Thickness (µm) : 200 – 300 8) Radial Deflection of Ball Joint <table><tr><td>Load (kN)</td><td>Deflection (mm)</td></tr><tr><td>50</td><td>1.15 ± 15%</td></tr><tr><td>60</td><td>1.30 ± 15%</td></tr></table>	----------	----------	----------	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.

Annex-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 the mould cavity. *Batch number marking on rubber is not possible as it takes marking impression engraved on mould cavities.* Additionally, considering cost-effectiveness 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	----------	Manufacturer's initial with month & year 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 month and year to be embossed at # location in legible and suitable letter height on rubber surface	----------	
	Annexure 1 to 7	Wherein tolerances are not mentioned in the drawings, **Tolerance standard to be defined.**	----------	----------	----------	----------	----------	----------	Noted