

**Reasoned document on Specification No. TI/SPC/OHE/NETRA/0143, for Specification for B.G. OHE parameter Recording cum test car (NETRA) for electric traction at 160 kmph.**

- Based on comments received from Carriage Directorate and discussion held, some remaining clauses pertaining to self-propelled version have also been removed.

S.N.	Clause No.	Description	Firm's Comments (M/s Meidensha Corporation)	RDSO remark
1.	1.2.19	The "Make in India" policy of Government of India shall be applicable.	Our OHE inspection system is manufactured in Japan. It can be installed on cars in India.  Remarks: Condition of OHE is rarely changed immediately.	Noted
2.	2.1.1	Atmospheric Temperature:  Metallic surface temperature under sun: 75°C max and in shade 55 °C max.	Metallic surface temperature is max 55°C under sun and shade.	Not accepted.  It is a requirement of Indian Railways hot territory.
3.	3.1.4 (A)	Stagger of the Contact Wire:  Stagger is defined as the distance of the contact wire from the center-line of the pantograph, measured transverse to the track. (Suitable compensation shall be made for transverse oscillations of the locomotive/OHE Recording Car which affect the centerline of the pantograph from the vertical). The system employed should enable measurement of stagger of two contact wires simultaneously (at overlaps and turnouts) up to a limit of $\pm 500$	Our system's measurement range for stagger is up to $\pm 300$ mm. Requirement of $\pm 500$ mm is not available.	Not accepted. It is a requirement of Indian Railways.  clause is renumbered as 4.9.10.1.

		mm. The stagger of contact wire may be measured using any non-contact measurement method. The accuracy of stagger measurement should be minimum $\pm 10$ mm. sampling distance for Stagger measurement shall be 200mm.		
4.	3.1.4(E)	<p>Measurement of Setting Distance (Implantation):</p> <p>Setting Distance is distance measured from centre line of track to the inner face of traction mast. This varies in the range of 2100 mm to 7000 mm.</p> <p>System should be able to measure the setting distance to an accuracy level of <math>\pm 10</math> mm.</p> <p>System should be able to have Data storage of at least 50 lakh masts and transfer it for printing of reports.</p>	<p>The system measures transversal distance from centerline of track to the inner face of traction mast in the range of 2000mm to 4000mm. The accuracy is <math>\pm 32</math>mm. The diameter of mast should be 300mm or more.</p> <p>Up to 10000 masts can be stored.</p>	<p>Not accepted</p> <p>clause is renumbered as 4.9.10.5 and self-explanatory and to be complied.</p>
5.	3.1.4(H)	<p>Pantograph acceleration and displacement:</p> <p>The vertical acceleration of the pantograph as well as its vertical displacement shall be measured continuously when the OHE car is in motion. The lateral acceleration as well as lateral sway of the pantograph pan, with reference to the central line of the pantograph in static condition shall also be measured continuously. It is the responsibility of the manufacturer/supplier to select and provide an accelerometer of adequate accuracy to give correct value. Vertical and lateral displacement</p>	<p>A measurement range for height is from 4500mm to 5500mm.</p>	<p>Comment is not relevant to this Clause.</p> <p>clause is renumbered as 4.9.10.8.</p>

		take into account displacement at pantograph level due to body of NETRA car shall also be recorded.		
6.	3.1.4(I)	<p>Body Vertical Acceleration and Tilt:</p> <p>The measurement of body vertical acceleration and displacement shall also be done continuously.</p> <p>(i) Accelerometer fitted to underside of OHE car body. Any track irregularity which can affect the vertical movement of the OHE car body and hence its effect on the pantograph can thus be recorded.</p> <p>(ii) Four linear sensors with differential transformers (one on each spring) used for measurement of compression of primary suspension. The sum of four voltage outputs by sensors provides knowledge of vertical movement of bogie. The tilt information is obtained by finding difference between sum of the two signals from the left side &amp; sum of the two signals from the right side.</p> <p><b>Any other method, which is more accurate and suitable to measure at higher speed of recording car, may be offered. If the manufacturer feels that his proposed method is superior to the methods given above, manufacturer/firm have to submit the detailed procedure and justification for acceptance of the</b></p>	<p>Our system measures only body vertical movement value of the car body for Height.</p> <p>Remark:</p> <p>Acceleration value is not necessary to compensate for the measured value in our system.</p>	<p>Clause is self-explanatory and to be complied. Renumbered as 4.9.10.9.</p>

		<p><b>purchaser; contractors” design should have given satisfactory performance for a minimum period of two years on railway networks elsewhere.</b> Tilt information at Pantograph level shall also be recorded. It is the responsibility of manufacturer/supplier to select desired design to find out tilt.</p>		
7.	3.1.4 (J)	<p>Body lateral acceleration and displacement:</p> <p>The measurement of body lateral acceleration may be carried out by any of the following three arrangements: (i) Accelerometer fitted to underside of OHE car body. This will detect lateral impulses in the OHE car body which if excessive shall reflect on the stagger measurement.</p> <p>(ii) Lateral motion measured by two linear potentiometers placed symmetrically about the bogie axis of rotation. The half sum of the two voltages shall give the lateral motion, independently of bogie rotation. Any other method, which is more accurate and suitable to measure at higher speed of recording car, may be offered. <b>If the firm feels that his proposed method is superior to the methods given above, firm have to submit the detailed procedure and justification for acceptance of the purchaser; contractors” design should have given satisfactory performance for a minimum period of two years on railway networks</b></p>	<p>Our system measures only <u>body lateral movement</u> value of car body for Stagger.</p> <p>Remark: Acceleration value is not necessary to compensate measured value in our system.</p>	<p>Clause is self-explanatory and to be complied. Renumbered as 4.9.10.10.</p>

		<b>elsewhere.</b> Lateral displacement at Pantograph level shall also be recorded.		
8.	3.1.4(K)	<p>Mast Identification System:</p> <p>BFB, RSJ, Fabricated K, B, type Masts, Fabricated Portals are normally used in OHE. The GPS receiver shall identify the location of OHE masts co-relating with measured data. Geographical positioning system shall be utilized for the mast identification along the track. The GPS/optical mapped data is in text file and shall be required to be correlated with the software of measuring instrument system so that the location of the measured data is automatically display/printed along with the event recorded. Accordingly, chart recorder/report output shall indicate the exact location of recorded event, giving the mast number. Alternatively, optical identification system can also be employed to detect the Catenary Wire support (Mast) along the track continuously. The Optical Mast Identification system shall be active where GPS is not visible such as through tunnels and other critical locations. GPS data shall be transferable to PC/Laptop using suitable software and accessories. The GPS data shall be provided by the Railways. Antenna of sufficient cable length shall also be provided. The accuracy required for mast location shall be minimum <math>\pm 4</math> meter. Any other method, which is more accurate and suitable to measure at higher speed of OHE Recording</p>	<p>The GPS location finding is not supported in the system. Beams, steady arms, cantilever tubes from Mast are found by sensor.</p> <p>Remark: Our system must resist Mast location before inspection.</p>	<p>Clause is self-explanatory and to be complied.</p> <p>clause is renumbered as 4.9.10.11</p>

		Car, may be offered. If the manufacturer feels that their proposed method is superior to the methods given above, manufacturer has to submit the detailed procedure and Justification for acceptance of the purchaser. Contractors' design shall have earlier given satisfactory performance for a minimum period of two years on railway networks elsewhere.		
9.	3.1.4(P)	<p>Measurement of Voltage:</p> <p>Using a dividing bridge, information is transmitted through cable to instrumentation cubicle and is displayed in the observation cabin. Any other better method may also be considered.</p>	Our system do not have this function.	<p>Clause is to be complied.</p> <p>Clause is renumbered as 4.9.10.16.</p>
10.	3.1.4(R)	<p>Video and audio recording of OHE Pantograph interaction:</p> <p>The objective is to have a continuous visual record of the dynamic interaction taking place between the pantograph and contact wire. The dynamic behavior of locomotive or OHE Car pantograph and contact wire interaction shall be observed and recorded continuously by means of a high resilient high speed video camera. The camera shall be fixed on OHE car. If necessary, a rotating tilting frame which can be manipulated from inside the observation dome of OHE Car and the camera should be of automatic focus control type, sun shroud for protection against direct sunshine and weather-proof housing to protect the camera</p>	Audio recording is not available.	<p>Clause is to be complied.</p> <p>Clause is renumbered as 4.9.10.18.</p>

		<p>from wind, rain and dust may be provided. Alternatively, the camera may be mounted in an insulated transparent dome. Flood lights suitable to illuminate the pantographs particularly in tunnels should be fitted on either side of the observation dome to facilitate visual observation with naked eye.</p> <p>While the OHE and pantograph behavior is being observed visually, a continuous recording shall be made on digital camera system. The digital recording shall have instant replay facilities. Replay facility at any desired slow speed and also frame by frame required. The storage capacity of the recording shall be decided during design approval stage. A suitable sound track recording arrangement shall also be provided so that comments made by observers, may be simultaneously recorded. It should be possible to co-relate the events of video recording to location (km) of the event. The video imaging system to record the dynamic interaction between OHE-Pantograph shall be provided. The recording shall be made through the video recorder continuously by means of a high resilient high speed digital camera capable of taking 50 frame/second or higher. It should be possible to view it on a colour monitor/TV and output it to a video printer. The monitor should be mounted for easy transportation. Suitable software for processing and plotting the recorded parameter in X-Y co-ordinates is also</p>		
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		required. Necessary video monitor for making system functional is included in the scope of supply successful manufacturer. The equipments shall be immune to the radio interference that may be caused by sparks generated by the loss of contact between the locomotive pantograph and OHE.		
<b>M/s ADJ Comments</b>				
1.	3.1.4(C)	Measurement of Contact Wire Thickness: Thickness implies the diameter of Contact Wire. The diameter of the new 107 mm <sup>2</sup> size contact wire is 12.24 mm and its condemning limit is 8.25 mm. Provision for measurement of diameter of Contact Wire of size 150 mm <sup>2</sup> and 193 mm <sup>2</sup> shall have to be made in the system. The measurement of diameter of contact wire may be made using any non-contact measurement method. The accuracy of contact wire thickness measurement should be minimum 0.1 mm. Sampling distance should be 100 mm	<p><b>Change request:</b> Accuracy <math>\pm 0.5</math>mm Reason for change: Due to production tolerance of contact wires and movements of flexible contact wires, accuracy of <math>\pm 0.2</math>mm is impossible to achieve, considering all OEMs use the indirect methods of the wear calculation.</p> <p><b>Request for Modification:</b> Measurement of Contact Wire Thickness: Thickness implies the diameter of Contact Wire. The diameter of new 107 mm<sup>2</sup> size contact wire is 12.24 mm and its condemning limit is 8.25 mm. Provision for measurement of diameter of Contact Wire of size 150 mm<sup>2</sup> and 193 mm<sup>2</sup> shall have to be made in the system. The measurement of diameter of contact wire may be made using any non contact</p>	<p>Not accepted as it is requirement of Indian Railway.</p> <p>Clause is renumbered and shifted at 4.9.10.3</p>

			measurement method. The accuracy of contact wire thickness measurement should be minimum 0.5 mm. Sampling distance should be 100 mm.										
<b>Carriage Directorate comments/suggestions</b>													
1.		new clause	<p>“Furnishing materials such as artificial leather seat covering, flooring material, vestibule material, GFRP paneling, cushioning material etc. shall satisfy the requirements of fire properties as per following or superior International standard”.</p> <table border="1" data-bbox="1163 862 1572 1271"> <thead> <tr> <th>Name of Test</th> <th>Specified Value</th> <th>Test method</th> </tr> </thead> <tbody> <tr> <td>Resistance to spread of flame</td> <td>Class A</td> <td>Relevant Appendix of UIC 564-2</td> </tr> <tr> <td>Limiting oxygen index</td> <td>Min 35</td> <td>IS 13360 / IS 13501</td> </tr> </tbody> </table>	Name of Test	Specified Value	Test method	Resistance to spread of flame	Class A	Relevant Appendix of UIC 564-2	Limiting oxygen index	Min 35	IS 13360 / IS 13501	<p>Incorporated as per Carriage Directorate note no.MC/TW, dated 27.10.2021 &amp; 04.02.2022</p> <p>Clause is mentioned at 3.7.9.12 in red ink.</p>
Name of Test	Specified Value	Test method											
Resistance to spread of flame	Class A	Relevant Appendix of UIC 564-2											
Limiting oxygen index	Min 35	IS 13360 / IS 13501											

				Deterioration of visibility due to smoke	Class A	Relevant Appendix of UIC 564-2	
				Toxicity	<1	NCD - 1409	
				Heat Release Rate (MAR HE in kW/m <sup>2</sup> ) as specified in EN-45545-2	HL3	ISO 5660 - 1	

2.		<p>new clause</p> <p>FEA of major components/subcomponents and squeeze load test</p>	<p>As per Carriage Note No. MC/TW, dated 04.2.2022.</p> <p>The mechanical strength of Railcar body shall conform to UIC 566 or EN 12663-1:2010 standard. In case the Railcar body is designed in accordance with EN 12663-1:2010 standard, the requirement given for category P-I vehicles along with the stipulation of 1500kN static tensile load shall be considered.</p> <p>The design of the coach body shall be such as to ensure that under fully loaded condition, the maximum vertical deflection of the structure shall be less than 1/1000 the of the center distance between bogies.</p> <p>Stress/deflection analysis of the car body shell in accordance with requirements mentioned in Clause 3.1.1&amp; 3.1.2 above shall be done by Finite Element Method (FEM) using a recognized software such as NASTRAN, ANSYS or similar and shall be submitted for approval.</p>	<p>Accepted and incorporated at clause no 3.1.1,3.1.2 &amp; 3.1.3</p>
3.	Annexure-IV		<p>Dimension of the tentative general layout of OHE Recording Car is not readable. The same layout is to be provided in readable copy so that mentioned dimensions in layout drawing may be examined.</p>	<p>readable tentative layout is attached at annexure-II</p>
4.	Annexure-V	Diagram of maximum moving dimension.	<p>The diagram of maximum moving Dimension may be replaced as per ACS-27 of IRSOD 1676 mm (BG)</p>	<p>Accepted.</p>

			Revised 2004. Minimum clearance from rail level should be uploaded in view of latest correction slips to IRSOD.	Amended IRSOD drawing attached at Annexure-III.
5.	Clause no. 4.1 (3)	Centre Buffer Transition with screw coupling conforming RDSO's Specification No. 56-BD 07 along with the side buffer arrangement to RDSO's Drawing Number SK-98145.  OR Centre Buffer Coupler (CBC) arrangement for High Tensile Tight lock CBC with AAR 'H' type head and balance draft gear to RDSO specification no. RDSO/2011/CG-03 and drg no. CG-K4012.	As per comments of Carriage directorate vide Note No. MC/TW, dated 04.2.2022,  Centre Buffer Coupler (CBC) arrangement for High Tensile Tight lock CBC with AAR 'H' type Tight Lock Coupler with Transition Screw Coupling to RDSO specification no. RDSO/2009/CG-22-22 (Rev.01) and drg. No. CG-K4012	modified and clause has been renumbered as clause 3.1.4.

6.	4.3.6	All non-metallic and furnishing materials such as artificial leather seat covering, flooring material, vestibule material, GFRP paneling, cushioning material etc. shall satisfy the requirements of resistance to spread of flame and deterioration in visibility due to smoke etc. as per UIC 564-2 OR Class A or superior International standard.	<p>“Furnishing materials such as artificial leather seat covering, flooring material, vestibule material, GFRP paneling, cushioning material etc. shall satisfy the requirements of fire properties as per following or superior International standard”.</p> <table border="1" data-bbox="1056 540 1591 1320"> <thead> <tr> <th data-bbox="1056 540 1262 691">Name of Test</th> <th data-bbox="1262 540 1367 691">Specified Value</th> <th data-bbox="1367 540 1591 691">Test method</th> </tr> </thead> <tbody> <tr> <td data-bbox="1056 691 1262 878">Resistance to spread of flame</td> <td data-bbox="1262 691 1367 878">Class A</td> <td data-bbox="1367 691 1591 878">Relevant Appendix of UIC 564-2</td> </tr> <tr> <td data-bbox="1056 878 1262 1029">Limiting oxygen index</td> <td data-bbox="1262 878 1367 1029">Min 35</td> <td data-bbox="1367 878 1591 1029">IS 13360 / IS 13501</td> </tr> <tr> <td data-bbox="1056 1029 1262 1252">Deterioration of visibility due to smoke</td> <td data-bbox="1262 1029 1367 1252">Class A</td> <td data-bbox="1367 1029 1591 1252">Relevant Appendix of UIC 564-2</td> </tr> <tr> <td data-bbox="1056 1252 1262 1320">Toxicity</td> <td data-bbox="1262 1252 1367 1320">&lt;1</td> <td data-bbox="1367 1252 1591 1320">NCD - 1409</td> </tr> </tbody> </table>	Name of Test	Specified Value	Test method	Resistance to spread of flame	Class A	Relevant Appendix of UIC 564-2	Limiting oxygen index	Min 35	IS 13360 / IS 13501	Deterioration of visibility due to smoke	Class A	Relevant Appendix of UIC 564-2	Toxicity	<1	NCD - 1409	clause is renumbered and shifted at clause no. 3.7.9.12.
Name of Test	Specified Value	Test method																	
Resistance to spread of flame	Class A	Relevant Appendix of UIC 564-2																	
Limiting oxygen index	Min 35	IS 13360 / IS 13501																	
Deterioration of visibility due to smoke	Class A	Relevant Appendix of UIC 564-2																	
Toxicity	<1	NCD - 1409																	

			Heat Release Rate (MARHE in kW/m <sup>2</sup> ) as specified in EN-45545-2	L3	ISO 5660 - 1	
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7.	Clause 5.2.8	One Indian style stainless steel WC with separate overhead Tank, Stainless Steel Sink and other accessory fitting including shower shall be provided. The WC shall be provided with an exhaust Fan.	<p>Lavatory shall be replaced as below:</p> <p>“One Indian style stainless steel lavatory with separate overhead Tank, Stainless Steel Sink along with other accessory fitting including shower shall be provided. The lavatory system shall be provided which is compatible with IR DRDO Bio- Toilet and along with provision of exhaust Fan”.</p> <p>Shower drain should be discharged separately on lavatory.</p>	<p>Accepted and incorporated. Indian Style WC and toilet engagement sign also incorporated.</p> <p>Clause is renumbered &amp; mentioned in draft specification at clause 3.3.11.</p>
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8.	4.1(3)	Brake system & Parking Brake	<p>Carriage Dte comments vide note 27.10.2021 &amp; 04.02.2022</p> <p>(i) LHB coaches with FIAT bogies have Axle Mounted Disc Brake system (including parking brake) which is governed as per RDSO specification <b>RDSO/2011/CG-04</b> (latest version). Copy of the specification is enclosed herewith.</p> <p>(ii) If the brakes for subject coach is proposed to be used as 'Disc brakes' as per above specification, the parameters like ambient temperature, altitude &amp; max. gradient etc. mentioned in the draft spec. May please be reviewed as per RDSO specification <b>RDSO/2011/CG-04</b> (latest version).</p>	<p>Accepted.</p> <p>clause is renumbered and incorporated at 3.1.5 in redraft spec.</p> <p>Environmental conditions have also been checked and are in line with the Carriage spec referred.</p>
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9.	New clause		<p>As per VDG group of carriage Directorate/RDSO note no. MC/TW, dated 04.02.2022, carriage dte suggested that two separate specifications of annexure may be made for these two different scenarios i.e. LHB Coach platform and global tender for complete new coach designing.</p> <p>for scenario one i.e. NETRA coach on LHB Platform with bogie, only leading parameters as follows may be provided for design of internal components.</p>	<p>Accepted and specification has been changed accordingly.</p> <p>scope has been modified and mentioned at Clause no. 1.2</p>
10.			<p>At page 30 and S. No. 10 for testing, for oscillation trials, clear cut criteria should be specified. Further oscillation trials condition at page 30 contradicts Ride Quality test at S. No. 7.4 at page 42. (as per first draft spec).</p>	<p>clause modified &amp; renumbered in redraft spec at clause no. 5.2 of Chapter-5</p>
11.			<p>At S. No. 10 on page 14 minimum clearance from rail level should be updated in view of correction slips to IRSOD.(as per first draft spec)</p>	<p>Leading parameters suggested by Carriage have been incorporated in Clause 3.1</p>
12.			<p>Duct for DG set Exhaust emission should be arranged that it does not affect the visibility from the dome with non-infringement to IRSOD 1676mm (BG) Revised 2004 with latest amendments.</p>	<p>New clause no. 3.5.2 is mentioned as following:          "Duct for DG set Exhaust emission should be arranged on the roof side so that it does not affect</p>

				the visibility from the dome and also do not infringe with IRSOD 1676mm (BG) Revised 2004 with latest amendments".
<b>Power Supply &amp; EMU Directorate</b>				
1.	Clause No. 4.2	Safety Measures	Provision of ELCB/RCCB of suitable rating for each 230V AC circuit (Kitchen appliances) to be ensured.	Accepted.  added new sub Clause 3.7.8 as: provision of suitable protective switch gear similar to the LHB system.
2.	Clause No. 4.3	Fire prevention Measures for Equipment Design.	<p>(i) Provision of Electrical wiring code of practice no. EL/TL/48(Rev.1)-2005 or latest to be ensured.</p> <p>(ii) Provision of the code of practice no. EL/TL/56-1992 or latest for train lighting maintenance and prevention of fires on 110 V DC Self- Generating coaches to be ensured.</p> <p>(iii) Provision of the code of Practice No. RDSO/PE/O/0008-2005(Rev. 0) or latest for prevention of fire to be ensured.</p>	Accepted  Mentioned at clause no. 3.7.9

			<p>(iv) Provision of all the electrical item/material i.e. cable, MCB conduit etc. Of RDSO/ICF/RCF approved sources to be ensured.</p> <p>(v) Provision of the flexible poly-amide conduit for protection of cable as per RDSO Specification No. RDSO/PE/SPEC/AC/0138-2009 (Rev.1) or latest is to be ensured.</p> <p>(vi) Provision of fire barrier and fire suppression system to be made similar to RDSO Specification no. RDSO/PE/SPEC/AC-0192 2018 Rev.-1.</p>	
3.	Clause No. 5.2.2	Air-conditioning Equipment	Provision of Air-Conditioning system with the adequate capacity and specification is to be specified.	Accepted and modified. Mentioned at clause no. 3.3.5, 3.3.6 and 3.8
4.	Clause No. 6.3	Power Supply arrangement to Air-Conditioning & other load	Provision of DA Set with adequate capacity and specification is to be specified.	Accepted and modified Mentioned at clause no. 3.5 of spec
5.	Clause No. 6.5.1		The specification No. RDSO/PE/Spec/TL/0119-2000" may be corrected as No. RDSO/PE/SPEC/TL/0119-2008 (Rev-0).	Accepted and modified. Mentioned at clause no. 3.6.2 of redrafted spec.

6.	Clause No. 6.5.3	Reading light shall be provided as per RDSO Specification No. RDSO/PE/SPEC/0091(Rev-1)	The Specification No. RDSO/PE/SPEC/0091 (Rev-1) may be corrected as No. RDSO/PE/SPEC/TL/0091-2000 (Rev-1).	Accepted and modified.  Mentioned at  Clause no. 3.6.4 of redraft spec.
7.	Chapter-6	Electrical Equipment and Power Supply Arrangement	Provision of Switch Board Cabinet with Specification is to be specified.	accepted.  clause is mentioned at 3.4.3.
8.	Chapter-4, Clause No. 4.1 (3) Batteries		The clause may be reviewed in line with clause no. 6.2.  In addition to above, following shall be ensured:  (i) The tentative General Layout of OHE Recording Car as per Annexure-IV drawing no. HY90002 is not legible and therefore fresh layout drawing shall be incorporated.  (ii) Provision of battery charger with specification in clause no. 6.4.3 shall be explored.	accepted  Clause 4.1 (3) is modified and renumbered as 3.5  Legible and modified GA Layout attached at Annexure-II.  provision of battery charger as per specification RDSO/PE/SPEC/AC/0183 (Rev 1) or latest mentioned at clause no. 3.5
<b>Electrical Directorate Comments vide letter no. EL/2.2.1/High Reach, dated 08.10.2021</b>				
1.	Clause No. 4.1 (4) and	(i) One high reach pantograph having capability to operate at the speed of 160 kmph shall be provided as per RDSO's specification no.	Pantograph specification may be corrected as No.	Accepted.

	Clause No. 5.3.1	RDSO/2007/EL/SPEC/0054, Rev 2, November 2015 or latest and shall be procured from the approved source of RDSO/CLW or any other IR's manufacturer approving organization approved sources.	RDSO/2007/EL/SPEC/0054 Rev 3, May 2019 or latest.	clause modified and renumbered as clause no. 3.3.15.1
<b>Diesel Loco modernisation Works (DMW) Comments vide letter no. DMW/M/Drg/NETRA/Comp. No. 83309, dated 10.11.2021</b>				
1.	1.2.4	The OHE recording car shall be 2-tier B.G. (1676mm Gauge) AC sleeper coach based on the LHB platform  including the coach body, Bogies and wheel sets, Brake system, draw gear, exterior window with glass &  protective level of exterior paint.	Since DMW is supposed to manufacture this OHE parameter recording car, therefore, RDSO may indicate existing drawing numbers for LHB shell, Bogies, Brake system, draw gear, suspension etc.	Accepted  Coach will be manufactured by production unit of Indian Railways as per standard LHB design. Mentioned at 1.2.4 of spec.
2.	1.2.5	The interior of the coach shall include compartment walls, light fittings, fan fitting/fixtures etc. as per standard 2-tier AC LHB coach.	Interior layout with number/size of compartments (instrument, machine, conference, driver cabin) location of kitchenette, toilet and corridor with minimum size is	Accepted.  Tentative layout is attached with the redraft specification (annexure-II). Coach manufacturer is to prepare GA accordingly and submit

			required.	to RDSO for approval as per existing IR norms.
3.	1.2.6	<p>The space for accommodating, One DG set of suitable capacity with sound proof compartment, a well furnished air conditioned instrument room and other identical area like observation dome and staff/officer's cabin including adequate lights and fans shall be provided.</p>	<p>Size of DG room may be mentioned. It may be clarified whether DG set is to be kept in instrument room or separate room made for it?</p>	<p>Accepted.</p> <p>DG set shall be kept in separate area as mentioned Tentative layout.</p>
4.	1.2.8	<p>The coach shall be provided with an observation dome in the roof near the pantograph (as indicated in tentative layout at Annexure-IV) so as to observe interaction between the contact wire of the OHE and the pantograph. Two to three persons shall be able to sit comfortably in the observation dome. The upper portion of the dome shall be of polycarbonate/FRP with reinforcement if required for adequate strength and shall also</p>	<p>Roof layout for location of observation dome and roof equipments including pantograph may be provided.</p>	<p>Accepted.</p> <p>Observation Dome and pantograph has been indicated in Tentative layout attached. For other roof equipment, coach manufacturer shall prepare layout in consultation with measuring instrumentation supplier and get it approved from RDSO along with GA layout of OHE recording Car (NETRA) as</p>

		<p>be insulated for 25 KV AC voltage. The firm will submit a test certificate/report from Government lab (like CPRI)/NABL accredited lab for the confirmation of observation dome material for insulation of 25kV AC voltage. The arrangement of observation dome shall be such that a clear view of the contact wire and pantograph is obtained by the persons in the observation dome without any strain. The chair provided in the observation dome shall have adjustable height, back rest with back and front adjustment just like in an automobile OHE car.</p>		mentioned in Clause 3.3.15.2.
5.	1.2.9	<p>Cupboards shall be provided for storage of catalogues and spare parts. All items/equipment required to make the OHE recording car fully operational to measure and record the proposed OHE parameters will fall under the scope of supply of the successful firm, whether specifically mentioned or not. This includes final testing of</p>	Tentative size and number of cupboards may be provided	<p>Accepted.</p> <p>Numbers as indicated in Tentative layout attached. Size is to be decided by Coach manufacturer based on space available.</p>

		<p>the entire system including the commissioning trials over Indian Railway Track to check the overall efficacy of</p> <p>the system with desired precision/accuracy.</p>		
6.	1.2.11	<p>Software packages along with the suitable hardware &amp; system support for analyzing the recorded data and</p> <p>generating the required reports. The reporting formats shall be mutually decided during design approval stage.</p>	<p>Reporting formats to be decided jointly with RDSO</p>	<p>Noted.</p> <p>To be decided at design approval stage.</p>
7.	1.3.1	<p>The OHE recording system with all related instrumentation / electronic system shall be installed in an IR Broad</p> <p>Gauge (1676 mm) Coach which will be supplied by the Purchaser. The coach will consist of a LHB shell</p> <p>mounted on FIAT bogies provided with hooks and buffer for attachment to other rolling stocks of IR.</p>	<p>Since DMW is supposed to manufacture this OHE parameter recording car, it is suggested that existing LHB shell should be used with minimum modification. RDSO may specify the drawing number of LHB shell to be used. Interior layout drawing may be provided.</p> <p>Existing FIAT bogies may be used without any modification. Interior</p>	<p>Accepted.</p> <p>Since application is different, change in layout from existing LHB coach is unavoidable. Coach manufacturer shall prepare layout according to tentative layout attached and submit GA layout and coach balancing diagram to RDSO for approval as per IR norms as mentioned in Clause 3.2.</p>

			layout should be such that there is no load distribution problem.	
8.	1.11	Training:	Necessary training shall be provided to both RDSO and concerned PUs officials jointly.	Noted.  To be arranged by Coach manufacturer as per their contract condition with instrumentation supplier.  Clause is renumbered and mentioned as 4.6 of draft spec.
9	1.19.1	Detailed operating manual, maintenance and service manual and driver handbook shall be specifically  prepared for the OHE Recording Car and at least 3 copies each of the same shall be supplied free of charge  per OHE Recording Car to the consignee and three copies to RDSO. The operating manual shall include  chapters on:.....  .....	This car is not self propelled type.  Driver handbook may not be required.	Noted.  Requirement removed.
10.	3.1	measured parameter	Earlier tender for MRI could not be finalized due to very high rates	Not a part of specification.

			quoted by a single vendor. Since the specifications for OHE parameter recording car are more advanced, RDSO may advise likely sources (indigenous/global) for this.	
11.	3.2.2	<p>The exact format for presentation of reports over computer monitor and plotter/printer shall be mutually</p> <p>decided after award of the tender. Such presentation may take the form of continuous display correlated with</p> <p>the mast location and recorded parameters and kilometric progressive over a suitable scale or may take the</p> <p>form of reports generated on the basis of accidence of certain threshold values. The processing software shall</p> <p>take care of the requirement of IR gauge and OHE for the purpose.</p>	Format to be decided jointly with RDSO	<p>Accepted.</p> <p>At the time of design approval as per Clause 4.10.1.</p>

12.	4.1(3)	Vehicle parameter	RDSO may advise existing drawing numbers of Axle, Wheel, wheel profile, Bogie Brake system etc. to be followed.	Accepted.  Provided in the specification in relevant clauses. Wheel, Wheel profile, axle, bogie, brake system etc. shall be as per existing LHB coach system as mentioned in Annexure-I.
13.	4.4.1	<p>OHE parameter recording cum test (measurement) Car shall have automatic fire/smoke detection systems.</p> <p>This shall be capable of detecting a smoke/fire in Car. On detection of a possible smoke/fire by means of suitable detection system, the system shall have different levels of response to be finalised at design stage.</p> <p>Necessary integration with door-closing system shall be ensured so that in case of a smoke/fire, door shall open after the train has stopped.</p>	Detailed specification for fire/smoke detection systems may be provided	Provided.
14.	5.1	OHE RECORDING CAR BODY	Since DMW is supposed to manufacture this OHE recording	Tentative layout is attached.

		<p>The OHE recording system with all related instrumentation / electronic system shall be installed in an IR Broad</p> <p>Gauge (1676 mm) Coach which will be supplied by the Purchaser. The coach will consist of a LHB shell</p> <p>mounted on FIAT bogies provided with hooks and buffer for attachment to other rolling stocks of IR.</p>	<p>car, it is suggested that existing LHB shell and FIAT bogies may be used without any major modification. RDSO may provide tentative layout of OHE car including interior and roof layout. It may be clarified whether existing AC sleeper LHB shell with 4 lavatories at the end or RA inspection type arrangement at ends can adopted.</p>	<p>Coach manufacturer shall prepare layout according to tentative layout attached and submit GA layout and coach balancing diagram to RDSO for approval</p>
15.	5.2.1	<p><b>Material Cabin:</b></p> <p>A material cabin shall be provided adjoining instrumentation cabin having adequate space and proper locking</p> <p>arrangement for the storage of costly equipments and fittings. The Cabin shall have two steel almirah (with five shelves) for keeping costly items &amp; essential records.</p>	<p>RDSO may provide tentative layout of complete OHE recording car.</p>	<p>Tentative layout attached.</p>

16.	5.2.2	<p>Air Conditioning Equipment:</p> <p>The Air Conditioners shall be of adequate capacity and energy efficient with 5 Star rating to be provided in</p> <p>Instrument room, conference room, cabins and dome. The design calculation shall be submitted to RDSO at design approval stage.</p>	<p>Instead of separate AC in different cabins, central AC with ducting arrangement same as used in AC sleeper LHB coaches also mentioned in 1.2.4 can be used.</p> <p>To fulfil Para 4.4.2 condition, central AC system will be more suitable.</p>	Noted. Clause modified.
17.	5.2.4	<p>Instrument Room: Instrument Room shall be air conditioned and well furnished to keep on board computers, TV, DVD, Printer &amp; Plotter, UPS and other interface equipment, storage of Hard Copies, Reports and other such requirement. The</p> <p>Technical specifications of all the equipment to be provided in the instrument room shall be furnished to RDSO</p> <p>at design approval stage. Suitable ergonomically designed good quality furniture shall be provided to meet the</p>	<p>It is suggested that RDSO may freeze the maximum dimensions of different cabins/partitions inside the coach.</p>	<p>Accepted.</p> <p>Coach manufacturer shall prepare layout and according to tentative layout attached and submit GA layout and coach balancing diagram to RDSO for approval</p>

		requirement		
18.	5.2.6	<p>Conference Room:</p> <p>Conference Room shall be air conditioned having adequate space to accommodate cushioned sofa with centre table and Latest HD-LED 24-inch TV monitor with 02 USB&amp; HDMI ports for required interface. It shall have well illumination including night lamps, Reading Lamps and 02 mobile/Laptop charging points and one power point.</p> <p>Design/ Specification/ Drawing shall be got approved by purchaser.</p>	<p>Location of conference room inside the coach and Seating capacity of conference room may be defined.</p>	<p>Accepted.</p> <p>Coach manufacturer shall prepare layout and according to tentative layout attached and submit GA layout and coach balancing diagram to RDSO for approval</p>
19.	5.2.7	<p>Staff Cabins:</p> <p>One air conditioned Cabin with four cushioned Berths and one air conditioned Cabin with two cushioned Berths shall be provided. The Cabins shall have separate entry and have windows on both sides. The Cabins shall preferably be not over the wheels and made sound proof as far as possible. In addition, two folding berths shall</p>	<p>Dimensions of staff cabins may be mentioned.</p>	<p>---do---</p>

		be provided at suitable location without cabin.		
20.	5.2.8	<p>Lavatory:</p> <p>One Indian style stainless steel WC with separate overhead Tank, Stainless Steel Sink and other accessory</p> <p>fitting including shower shall be provided. The WC shall be provided with an exhaust Fan.</p>	Existing lavatories of LHB coach may be used so that the modification work can be reduced	To be provided as per tentative layout.
21.	5.2.9	<p>Provision of two Mobile Charging points to be provided in each Cabin &amp; working area and one charging point in</p> <p>each driving cab.</p>	<p>This coach is not self propelled type. So, whether driving cab is still required?</p> <p>Also, Driver desk to control various equipment like raise/lowering panto, tail light, illumination control, pneumatic control etc to be provided in driver cab or instrument room??</p>	Noted. Requirement modified as clause no. 3.3.9 of redrafted spec.
22.	5.2.10	Kitchenette:	It is assumed that the kitchen load	Kitchen load will be taken care by EOG/HOG

		<p>A kitchenette approximately 1500mmX2000mm shall be provided with exhaust fan on one of the windows.</p> <p>Windows for cross ventilation shall also be provided. Kitchenette shall have provision for keeping cooking range</p> <p>(LPG cylinder, a refrigerator, microwave oven, Cooking utensils and complete dinner set. A detailed list of</p> <p>provision in kitchen shall be submitted along with the offer.</p>	will be taken by mentioned DG set.	<p>supply. DG set is to be used in case of non availability of these supplies.</p> <p>Mentioned as clause no. 3.5 of redrafted spec.</p>
23.	5.2.11	<p>Communicating doors:</p> <p>Each driving cab shall have independent entry from both sides. The OHE Recording Car lobby shall have entry from both the cab through communication inside the OHE Recording Car shall be provided. It shall be possible to isolate the cabins using sliding doors with locking arrangements.</p>	Same as at clause no. 5.2.9.	Noted. Requirement modified. Mentioned as per tentative GA layout.
24.	5.3.1	One high reach pantograph having capability to operate at the speed of 160 kmph shall be provided as per	This will require revolving type chairs in observation dome to view the pantograph in either direction.	Coach manufacturer shall prepare layout and according to tentative layout attached and submit GA layout and coach balancing diagram

		<p>Specification No. RDSO/2007/EL/SPEC/0054 Rev 2, November 2015 or latest and shall be procured from the</p> <p>approved source of RDSO/CLW/DLW or any other IR's manufacturer approving organization approved</p> <p>sources. In case the same is not from the approved sources, type testing shall be carried out by RDSO.</p> <p>The roof layout and instrumentation fitment on roof shall be so configured that it is possible to view the</p> <p>pantograph from the observation dome. Pantograph shall be so configured so as to give correct measurement</p> <p>from low to high speed. The roof layout and instrumentation fitment shall be so configured that it is possible to</p> <p>view either of the pantograph from the observation dome.</p>	<p>Existing roof of LHB shell will require modification for fitment of</p> <p>Pantographs, Observation dome and other instruments /sensors etc. RDSO may provide roof layout.</p>	<p>to RDSO for approval as mentioned 3.3.15.2.</p>
25.	5.3.2	<p>Complete pneumatic circuit including compressor, D.C. power supply etc. for raising and lowering of pantograph is covered in the scope of work and has to be provided by the manufacturer.</p>	<p>Capacity of compressor and reservoir may be specified.</p> <p>Location of compressor may be</p>	<p>Accepted.</p> <p>Compressor is to be located in DG set area. Clause have been</p>

			indicated. Also, requirement of stand by compressor shall be clarified.	modified suitably. Claus no. Changed to 3.3.15.3.
26.	5.4	<p><b>OBSERVATION DOME:</b></p> <p>An air conditioned observation dome shall be provided in the roof near the pantograph so as to observe interaction between the contact wire of the OHE and the pantograph. The observation dome shall be the part of instrument room. The provision for two to three persons shall be able to sit comfortably in the observation dome behind/side of the chair. The upper portion of the dome shall be of polycarbonate/FRP with reinforcement if required for adequate strength and shall also be insulated for 25 kV. The sitting arrangement in observation dome shall be ergonomically designed in such a way that an unobstructed view of the interaction between</p>	RDSO may provide complete layout of OHE parameter recording car.	Coach manufacturer shall prepare layout and according to tentative layout attached (annexure-II)and submit GA layout and coach balancing diagram to RDSO for approval.

		<p>contact wire and pantograph is obtained by the persons in the observation dome without any strain. The</p> <p>cushioned chair provided in the observation dome shall have adjustable height, back rest with back and front</p> <p>adjustment just like in an automobile Car.</p>		
27.	5.14.9	<p>The car manufacturer before undertaking manufacture should make 3-D model drawings on suitable CAD</p> <p>software and submit them for approval of the interior-furnishing scheme.</p>	<p>Drawings to be submitted to RDSO for approval.</p>	Noted
28.	6.2.1	<p>Battery for controls:</p> <p>110 V, 120 Ah, VRLA type batteries of approved make, conforming to RDSO/PE/SPEC/AC/0009-2014 (Rev.2)</p> <p>or latest, shall be provided for controls &amp; lighting which cater to all auxiliary electrical load of the OHE</p> <p>Recording Car for two hours and only lighting and fan load for five hours in case of auxiliary alternator failure.</p>	<p>Location of batteries to be defined.</p> <p>What will be driving source for auxiliary alternator?</p> <p>Capacity and mounting</p> <p>location/arrangement of auxiliary alternator, if any, to be defined.</p>	<p>Clause modified as 3.4.4.</p> <p>Requirement of Auxiliary alternator removed as supply will be provided through EOG/HOG or DG set as mentioned in Clause 3.5.</p>

29.	6.2.2	Terminals/sockets for charging the batteries from external charging equipment shall also be provided. The location of the batteries shall be such that no damage occurs due to tools and equipment inadvertently falling on them and battery fuse. If the cells are packed in two rows in the battery box, a hylam sheet shall separate the two rows. The battery shall be charged by the engine driven alternator/rectifier.	Whether DA set mentioned in 6.2.2 and 6.3 are same or different for lighting and AC load?	Requirement of DA set is removed as Coach will be powered by EOG/HOG and battery charger is specified for charging batteries as in the LHB coaches. However, charging the batteries through external source is retained. Clause modified accordingly. Renumbered clause 3.5
30.	6.3	<p>Power supply arrangement to air conditioning &amp; other loads: The supplier shall provide one DG set (noise-free)</p> <p>preferably under-slung type of adequate capacity each, which shall generate 415 V, ac, 50Hz. 3-phase power supply for air-conditioning, lights and fans, computers, chart recorders, printer, measuring equipment, UPS etc.</p> <p>The successful supplier will have to provide a dual UPS (un-interrupted power supply) system including</p> <p>maintenance-free battery so that in the event of the failure of supply from diesel generator set, during the run,</p>	As per clause 1.2.6, DG set to be accommodated in sound proof compartment. For provision of DG set with auxiliary alternator modification in LHB bogie is required. Provision for conventional arrangement of LHB coaches with IV coupler, feeder box, transformer and battery box for EOG utilisation to be provided	<p>Accepted.</p> <p>Requirement reviewed and modified as 3.5 mentioned in redrafted spec.</p>

		the measurements, data processing, recording and display systems are not affected for at least 2 hrs and a skeleton light/fan service is also available. Supplier shall furnish the design calculation of DG-set capacity for meeting the requirement of electrical load of the OHE Recording Car.	or not??  In case of failure of DG set what will be backup source for ACs?	
<b>Comments of Track Directorate</b>				
1.	2.2 (2)  Minimum radius of curve	Normally 175 meters, however, the vehicle shall also be capable of negotiating on curves having radius of 145 meters. For minimum radius of curvature for slip points, turnouts or crossover roads, para 17 of chapter- II of Schedule-1 of IRSOD (BG) Revised 2004 shall be applicable which provide for minimum of 175 meters radius curves in case of 1 in 8.5 scissors crossover.	Modifies as under:  Normally 175 meters, however, the vehicle may also be capable of negotiating on curves having radius of lower than 175m and upto 145 meters. For minimum radius of curvature for slip points, turnouts or crossover roads, para 17 of Chapter- II of Schedule1 of IRSOD(BG) Revised 2004 shall be applicable which provide for minimum of 175 meters radius curves in case of 1 in 8.5 scissors crossover.	Accepted  and clause modified.  clause 2.2(2)
2.	2.2 (4)	Maximum Cant Deficiency	Maximum Cantt Deficiency  100mm	Accepted and incorporated in Clause no. 2.2(4)
2.	2.2(6)	Maximum Gradient  1:33	1:37 however, the vehicle may also be capable of negotiating on gradient lower than 1:37 m and upto 1:33.	Noted

3.	2.2(8)	<p>Track Structure:</p> <p>The track shall be to a minimum standard of 90 R rail on sleepers with M+ 4 densities and minimum depth of ballast cushion below sleeper of 200 mm, which may consist of at least 75 mm clean and the rest in caked up condition on compact and stable formation. However speed will depend on axle load, Axle spacing, dynamic augment value of the rolling stock etc.</p>	<p>The track shall be to a minimum standard of 60Kg (90UTS) rail on sleepers with M+7 density and minimum depth of ballast cushion below sleeper of 300 mm, which may consist of at least 150 mm clean and the rest in caked up condition on compact and stable formation for a speed of 160kmph subject to the condition that the dynamic wheel load during oscillation trial should be not more than 160kN. However, speed will depend on axle load, axle spacing, dynamic augment value of the rolling stock etc on track structure lower than as mentioned above.</p>	Accepted and incorporated in clause no. 2.2(8)
4.	2.2(9)	<p>Permitted Track irregularities:</p> <p>The vehicle shall be capable to negotiate on track irregularities of various parameters classified as A, B, C or D as mentioned in para 607(1) and limiting values of Gauge, Unevenness and Twist for lower speeds have been specified in para 607(4) of Indian Railways Permanent Way Manual 2004 with latest A&amp;C slip. The tolerances given under para 607(2) are for suitability of operation at speed above 100 kmph for riding comfort of passengers and are not to be mistaken as limiting maintenance standards.</p>	<p>Permitted Track irregularities: (Track Geometry parameters)</p> <p>The vehicle shall be capable to negotiate on track Irregularities (Track Geometry parameters) as specified in para 522 of Indian Railways Permanent Way Manual 2020 with latest A&amp;C slip.</p>	accepted. Clause no. 2.2(9) is modified.

		Actual values observed during track recording may be much more than these values.  No safety limits for track geometry parameters have been laid down.		
5.	2.2(10)	Maximum permissible wheel Base, length of the OHE Recording Car, overhang beyond bogie center, buffer height, drawbar height etc  These shall conform to Indian Railway's Schedule of Dimension 1676 mm gauge (BG) Revised 2004 (with latest amendment). Adequate clearance shall be allowed so that no component of the OHE recording car shall infringe a minimum of 102 mm above rail level with wheels in fully worn-out conditions, full deflection of springs and effect of dynamics.	These shall conform to Indian Railways Schedule of Dimension 1676 mm gauge (BG) Revised 2004 (with latest amendment). Minimum clearance of 91 mm above rail shall be allowed so that no component of the OHE recording car shall infringe a minimum level with wheels in fully worn-out conditions, full deflection of springs and effect of dynamics.	Accepted and modified as clause no. 2.2(10)
6.	2.3	Maximum moving Dimension	Maximum moving dimensions required to be replaced by diagram 1D issued vide A & C Slip-27 to Indian Railway Schedule of Dimension (SOD) 1676 mm gauge (BG) revised 2004 (With Latest Amendments).	Accepted and modified as clause no. 2.3
7.	7.4	Riding Quality Test:  The riding quality tests shall be based on a detailed oscillation trial conducted as per provisions given in 3 <sup>rd</sup> Report of Standing Criteria Committee or latest, to establish the performance at the specified maximum operating speed.	para modified as under:  "The vehicle shall be accepted after conducting the satisfactory/successful oscillation trial on the track geometry parameter and acceptance criteria specified by 3 <sup>rd</sup> report of standing Criteria committee Rev.1"	Accepted.  Testing Directorate has also given comments on the same and incorporated in renumbered clause no. 5.2 of final draft spec.

Testing Directorate Comments vide note No. RM2/C/50, dated 02.09.2021				
1.	4.1 (10)		With regard to para 4.1 sub para 10, mentions that "The riding quality tests shall be based on detailed oscillation trial conducted at a speed 10% higher than the maximum specified operating speed on a section of mainline track conforming to test stretch as mentioned in 3rd Report of Standing Criteria Committee (prevalent at this time) or EN14363 or UIC518 whichever is applicable at the time of trial" whereas para 7.4 mentions that "The riding quality tests shall be based on a detailed oscillation trial conducted as per provisions given in 3rd Report of Standing Criteria Committee or latest, may be reconciled and corrected appropriately.	Noted and incorporated.  Clause is renumbered as 5.2 of final draft spec.
Redrafted specification and clauses are renumbered.				
1.	1.1 of redrafted spec.	Clause 1.1.8 to 1.1.10 & 1.1.13		Deleted not required.
2.	1.2.10	Maker's certificate		Shifted at clause 1.2.10.

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3.	2.4.2 (4 & 5)	Added contact and Catenary wire size		As mentioned in clause 2.4.2 (4 &5)
4.	Clause 3 of chapter-3	OHE recording Car body		Modified as mentioned clause in blue ink.
5.	3.3	The requirements in OHE recording Car (NETRA)		Modified clause as mentioned in redraft spec.
6.	3.3.4	Observation Dome		Modified clause as mentioned in redraft spec.
7.	3.3.6			Modified clause as mentioned in redraft spec.
8.	3.3.7	Instrument Room		Modified clause as mentioned in redraft spec.
9.	3.3.8	heading has been change as officer's cabin cum conference room.		Modification had been mentioned as clause 3.3.8 of redraft spec
10.	3.3.9	Staff Cabin		Modification had been mentioned as clause 3.3.9 of redraft spec.
11.	3.3.10	Heading has been changed as Crew cum material cabin.		Modification had been mentioned as clause 3.3.10 of redraft spec.

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12.	3.3.12	kitchenette		Modification had been mentioned as clause 3.3.12 of redraft spec.
13.	3.3.13	Doors		Modification had been mentioned as clause 3.3.13 of redraft spec.
14	3.3.14	Added new clause		mentioned as clause 3.3.14 of redraft spec.
15	3.3.15.3			added as "Compressor along with dedicated panel shall be mounted in DG set area". mentioned clause no. 3.3.15.3 of redraft spec.
16.	3.3.15.4	.		Added as  "The supply for these industrial plugs shall be 230V, 50 Hz AC. Two nos. of portable search lights giving diffused LED type light of 100 Watts shall be provided with each OHE car".  Mentioned clause no. 3.3.15.4 of redraft spec.

17.	3.3.15.5			Deleted para in blue ink as mentioned in redraft spec.
18.	3.3.17	Communication system		Modified para as mention in redraft spec.
19.	3.3.19			Added and modified as mentioned in clause no. 3.3.19 of redraft spec.
20.	3.1.1	Technical details of recording Car		Deleted all clauses as mentioned in blue ink. Specification covers all details.
21.	3.4.3	Added new requirements. "Switch Board Cabinet"		Added as para "Switch board Cabinet similar to LHB system shall be provided by the manufacturer as per RDSO's specification no. <u>RDSO/PE/SPEC/AC/0192-2018 Rev.1.</u> "
22	3.7.10 & 3.7.11	Automatic smoke/fire detection with Alarm System.		Clause is modified and mentioned at 3.7.10 of redraft spec. And also added clause 3.7.11.
23.	3.8	Added new requirements		Added clause as 3.8 as per clause no. 3.18 of RDSO spec No. RDSO/CG/P-20001

		Heating Ventilation and air-conditioning (HVAC)		(Schedule of technical and functional requirement for trains under the project PPP in passenger train operation).
24.	3.9	Ingress Protection.		Modified clause as mentioned in redraft spec.
25.				Routine/ acceptance test shifted at clause no. 5.4.
26.	Clause 4.0			Added new clause 4.0, 4.1 & 4.2.
27.	4.5	Added new heading "Scope of Supply" for Part-2 Instrumentation.		Added new clauses 4.5.1 to 4.5.4 and 4.5.11 to 4.5.13 mentioned in redraft spec.
28.	4.5.7, 4.5.8, 4.5.9 & 4.5.10			Shifted from Coach manufacturer scope to Instrumentation supplier scope and mentioned in red ink in final draft spec.
29.	4.6	Training		As per Track machine monitoring Directorate Document no. TM/IM/382 for Technical Specification

				for Integrated Track Monitoring System.  Mentioned at 4.6 of redraft spec in blue ink.
30.	4.7	Warranty		Warranty clause mentioned in redraft spec at 4.7 in blue ink.
31.	4.8	Comprehensive annual maintenance Contract.		Mentioned in clause no. 4.8 in blue ink.
32.	4.9.4			Clause is modified as mentioned 4.9.4 in blue ink.
33.	4.9.10.3	Measurement of contact wire thickness.		Added Contact wire thickness and condemning diameters are in table and modified clause as mentioned in clause 4.9.10.3.
34.	4.9.10.12	Detection of Hard Spot		Added as follows  "Any other method, which is more accurate and suitable to measure at higher speed of OHE Recording Car, may be offered". and clause is modified.

35.	4.9.10.14	Method of measurement of speed.		Clause modified and added as under  "or Any other suitable and accurate technology" and .
36.	4.9.10.15.	The method of measurement for distance run.		Clause modified and added as under  "or Any other better method may also be considered".
37.	4.9.10.18	Video and audio recording of OHE Pantograph interaction.		Sub Clause added, modified and reframed as mentioned at 4.9.10.18.
38.	4.14, 4.15 & 4.16	Calibration, diagnostics and simulation run, inspection and testing of measuring instruments, acceptance tests, field validation tests and documentation.		Clauses are modified in red ink and added new clause in blue ink as mentioned in Spec.
39.	Chapter-5 Clause 5.0	Type testing		Clause is modified as mentioned 5.0 in redraft spec.