

**CA-241: DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, INTEGRATION, TESTING AND COMMISSIONING OF ROLLING STOCK, COMMUNICATION BASED SIGNALLING & TRAIN CONTROL, TELECOMMUNICATION, PLATFORM SCREEN DOORS AND DEPOT MACHINERY & PLANT OF LINE 5 (Phase 1 – KAPURBAWADI - KASHELI - DHAMANKAR NAKA & Phase 2 -DHAMANKAR NAKA - BHIWANDI- KALYAN APMC) OF MUMBAI METRO RAIL PROJECT OF MMRDA INCLUDING 5 YEARS OF COMPREHENSIVE MAINTENANCE AFTER 2 YEARS OF DEFECT LIABILITY MAINTENANCE PERIOD**

Addendum No. 3, Part II					
Sr. No.	Part	Section	Clause No.	Original Clause	Ammended Clause
<b>Section 6B1</b>					
6B1.41	Part II	Section 6-B1	2.18.2	(ii) The Noise and Vibration Assurance Plan shall include: <ul style="list-style-type: none"> <li>• Expected total car noise levels, and sub-system noise levels for all equipment and systems including Noise Simulation Report as per 2.18.1(ix) above.</li> <li>• Expected vibration levels for equipment, system and measurement locations specified herein.</li> <li>• Expected dynamic characteristics of the primary and secondary suspension.</li> <li>• Details of proposed approach to determining noise and vibration of the cars.</li> <li>• All codes and standards to be used during the design and verification of the cars.</li> <li>• Plan for noise and vibration design reviews.</li> <li>• Details of proposed sub-system testing to be carried out during the design and manufacture of the cars.</li> <li>• Details of proposed rake testing to demonstrate specification compliance.</li> </ul>	(ii) The Noise and Vibration Assurance Plan shall include: <ul style="list-style-type: none"> <li>• Expected total car noise levels, and sub-system noise levels for all equipment and systems including Noise Simulation Report as per 2.18.1(ix) above.</li> <li>• Expected dynamic characteristics of the primary and secondary suspension.</li> <li>• Details of proposed approach to determining noise and vibration of the cars.</li> <li>• All codes and standards to be used during the design and verification of the cars.</li> <li>• Plan for noise and vibration design reviews.</li> <li>• Details of proposed sub-system testing to be carried out during the design and manufacture of the cars.</li> <li>• Details of proposed rake testing to demonstrate specification compliance.</li> </ul>
6B1.42	Part II	Section 6-B1	3.21.5.	3.21.5. Train Resistance: The following train resistance formulae shall be used by the Contractor to determine train resistance and guaranteed performance for all alignments, for At-grade, Elevated & Underground sections, along with the bid. For At-grade and Elevated corridors: $TR = 14.01 + 0.264V + 0.00191V^2$ N/tonne For Underground sections: $TR = 21.96 + 0.4222V + 0.00876 V^2$ N/t Where, V= Speed in kmph <ul style="list-style-type: none"> <li>• The curve resistance may be taken as 500/r kg per tonne,</li> </ul> Where r = radius of curvature in metres. <ul style="list-style-type: none"> <li>• Starting resistance shall not be less than 5 kg/ton.</li> </ul> The Contractor shall use these formulas for all alignments for At-grade, Elevated & Underground corridor for giving performance details. <b><u>However, the Contractor may propose any other proven train resistance formula in which case they shall submit the proof of proveness in their submission.</u></b>	3.21.5. Train Resistance: The following train resistance formulae shall be used by the Contractor to determine train resistance and guaranteed performance for all alignments, for At-grade, Elevated & Underground sections, along with the bid. For At-grade and Elevated corridors: $TR = 14.01 + 0.264V + 0.00191V^2$ N/tonne For Underground sections: $TR = 21.96 + 0.4222V + 0.00876 V^2$ N/t Where, V= Speed in kmph <ul style="list-style-type: none"> <li>• The curve resistance may be taken as 500/r kg per tonne,</li> </ul> Where r = radius of curvature in metres. <ul style="list-style-type: none"> <li>• Starting resistance shall not be less than 5 kg/ton.</li> </ul> The Contractor shall use these formulas for all alignments for At-grade, Elevated & Underground corridor for giving performance details.
6B1.43		<b>Not Used</b>			
6B1.44	Part II	Section 6-B1	5.10.6	The torque value considered for design of gears and coupling shall correspond to maximum tractive effort requirement for worst duty cycle. The torque value shall be taken with new wheel diameter. The temperature for type test shall be taken as 46°C i.e., ambient + 10°C proximity effect. The design value of gear box drive and coupling shall correspond to high tractive effort mode of operation and the design shall conform to the requirements of ERTS clause 3.22.7, 3.23, 8.1.9 and 8.9.9(iii).	The torque value considered for design of gears and coupling shall correspond to maximum tractive effort requirement for worst duty cycle. The torque value shall be taken with new wheel diameter. The design value of gear box drive and coupling shall correspond to high tractive effort mode of operation and the design shall conform to the requirements of ERTS clause 3.22.7, 3.23, 8.1.9 and 8.9.9(iii)
6B1.45	Part II	Section 6-B1	11.2.7	In the event of the failure of both VACs on a car, an emergency ventilation system shall operate automatically to admit fresh air directly into the car to maintain the required oxygen level in accordance with ASHRAE 62. During neutral section negotiation emergency ventilation mode shall not be invoked in general. Other Conditions for invoking emergency ventilation mode shall be as RAMS analysis. The induction of outside fresh air shall not be less than 12m <sup>3</sup> /h/person as per EN14750-1 category B vehicle, under fully loaded train conditions. The emergency ventilation fans in the saloon shall be fed from the 110V DC supply in the event of non-availability of 415V AC supply from single inverter provided in each car. or inverter inside each VAC with proven performance.	In the event of the failure of both VACs on a car, an emergency ventilation system shall operate automatically to admit fresh air directly into the car to maintain the required oxygen level in accordance with ASHRAE 62. During neutral section negotiation emergency ventilation mode shall not be invoked in general. Other Conditions for invoking emergency ventilation mode shall be as RAMS analysis. The induction of outside fresh air shall not be less than 12m <sup>3</sup> /h/person as per EN14750-1 category B vehicle, under fully loaded train conditions. The emergency ventilation fans in the saloon shall be fed from the 110V DC supply in the event of non-availability of 415V AC supply from single inverter provided in each car. or inverter inside each VAC with proven performance. Necessary size exhaust air discharge openings shall also be available. Emergency ventilation for 1 hours, or the time needed to fully evacuate AW3 passengers from the train from one side front egress door, whichever is higher of the two, should be provided.
6B1.46	Part II	Section 6-B1	11.7.1	The condenser and evaporator coils shall be of copper having copper fins. Condenser fins spacing shall be no closer than 3 mm and evaporator fins shall be 2.5 mm or more apart, in order to prevent dirt/dust build up. Thickness of fins shall be minimum 0.2 mm. The coil assembly shall be mounted in a stainless steel / copper alloy frame. Cleaning of condenser and evaporator coils should not be required earlier than 6 months after putting the train into revenue service. The proposed frequency of cleaning of coils in Mumbai climate shall be furnished.	The condenser and evaporator coils shall be of copper having copper fins. Condenser fins spacing shall be no closer than 3 mm and evaporator fins shall be 2.5 mm or more apart, in order to prevent dirt/dust build up. Thickness of fins shall be minimum 0.15 mm. The coil assembly shall be mounted in a stainless steel / copper alloy frame. Cleaning of condenser and evaporator coils should not be required earlier than 6 months after putting the train into revenue service. The proposed frequency of cleaning of coils in Mumbai climate shall be furnished.

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Addendum No. 3, Part II					
Sr. No.	Part	Section	Clause No.	Original Clause	Ammended Clause
6B1.47	Part II	Section 6-B1	15.22.2 (iii) (a)	<p>These tests shall be conducted inside a Climate Chamber for judging the cooling and dehumidification performances of the VAC system for Summer, Monsoon, high ambient, low ambient, high humidity and any other ambient conditions as per EN 14750 or any other equivalent standard and Engineer's requirements. Heating and humidifying equipment shall be provided in the car for test purposes.</p> <p>Testing shall be done for different passenger loads for:</p> <ul style="list-style-type: none"> <li>• Pre-cooling (with full passenger occupancy heat load) - Set temperature should be achieved in 30 minutes.</li> <li>• Regulation (doors closed) - Cooling capacity of VACs shall be sufficiently high to demonstrate 3 complete regulation cycles during the regulation test.</li> <li>• Doors open-close - It should be done for 10 cycles as per EN 14750, and/or for door open- close cycles for complete to-and-fro route run, as decided by the Engineer.</li> </ul> <p>Any other test as required by the Engineer shall also be conducted.</p>	<p>These tests shall be conducted inside a Climate Chamber for judging the cooling and dehumidification performances of the VAC system for Summer, Monsoon, high ambient, low ambient, high humidity and any other ambient conditions as per EN 14750 or any other equivalent standard and Engineer's requirements. Heating and humidifying equipment shall be provided in the car for test purposes.</p> <p>Testing shall be done for different passenger loads for:</p> <ul style="list-style-type: none"> <li>• Pre-cooling (with Nil passenger occupancy heat load) - Set temperature should be achieved in 30 minutes.</li> <li>• Regulation (doors closed) - Cooling capacity of VACs shall be sufficiently high to demonstrate 3 complete regulation cycles during the regulation test.</li> <li>• Doors open-close - It should be done for 10 cycles as per EN 14750, and/or for door open- close cycles for complete to-and-fro route run, as decided by the Engineer.</li> </ul> <p>Any other test as required by the Engineer shall also be conducted.</p>
6B1.48	Part II	Section 6-B1	4.13.1 (i)	<p>(i) Driving console layout and facilities shall be designed to meet all possible modes of operation including UTO/non-UTO, Manual Driving in line/depot/stabling yards etc. The layout of the driving console is proposed to be standardised in accordance with the driving console of Line 2 &amp; 7 train in order to have smooth interoperability of train pilot among different lines of Mumbai Metro and to have common Driving Motion Simulator. Employer/Engineer will provide necessary layout details to be incorporated.</p>	<p>(i) Driving console layout and facilities shall be designed to meet all possible modes of operation including UTO/non-UTO, Manual Driving in line/depot/stabling yards etc. The layout of the driving console is proposed to be standardised in accordance with the driving console of Line 2 &amp; 7 train (refer Annexure 2.9 for images) in order to have smooth interoperability of train pilot among different lines of Mumbai Metro and to have common Driving Motion Simulator. Employer/Engineer will provide necessary layout details to be incorporated</p>