TECHNICAL SPECIFICATIONS FOR RAIL BORNE MAINTENANCE VEHICLE (RBMV) FOR BROAD GAUGE (1676 mm)

(Specification No. TM/HM/RBMV/422 Rev.03 of 2024)

1.0 GENERAL

1.1 3-tier System of track maintenance shall be adopted on Indian Railways for mechanized maintenance as per Indian Railways Permanent Way Manual. In 3 tiers of track maintenance, one is Mobile Maintenance Units (MMU). The MMU shall be equipped with small track machines, tools & equipments used for day to-day track maintenance. To accommodate and transport these equipments and track workmen at worksite each MMU shall be provided with one self-propelled vehicle. This specification has been framed to reflect the technical performance and quality requirements of such vehicle, hereinafter called Rail Borne Maintenance Vehicle (RBMV).

1.2 The technical specifications have been drafted to reflect the performance and quality requirements of the RBMV in a neutral manner without bias to any specific manufacturer. Bidders are requested to carefully study the specifications and assure that their machine full comply with these specifications. Thereafter, if a bidder feels that his machine can substantially meet the performance and quality requirements of the machine but does not fully satisfy a particular specification, he shall mention the deviations if any, in the statement of deviation from the specifications, giving the details how the functional requirements are going to be met with.

1.3 The bidder shall specify the make/model offered and furnish a detailed technical description of the same. System/sub-systems of the working mechanisms of the machine as per clause 3.0 in particular and all the items of the specifications in general shall be described in detail, along with the sketches to show the manner in which the requirements of the specifications are accomplished by the RBMV (model) offered.

1.4 Photographs and videos of the type of the RBMV/other similar type of on-track machines manufactured offered, in working mode and technical literature shall be enclosed with the offer. The photographs shall also show close-ups of various working assemblies/systems and the full RBMV/other similar type of on-track machines. The tenderer shall also furnish a video in USB showing the working of RBMV in real time under field conditions. Tenderer shall also submit the names of countries & railways where the offered machines/other similar type of on-track machines are working and where their working at site can be visited by Indian Railways officials.

1.5 The bidder shall be entirely responsible for the execution of the contract strictly in accordance with the terms and conditions of the specification not withstanding any approval, which RDSO or the Inspecting Officer may have given:

- Of the detailed drawings prepared by the bidder.
- Of his sub- bidders for materials, components & sub-assemblies.
- Of other parts of the work involved in the contract.
- Of the tests carried out by the bidder/Sub- bidder or RDSO or the Inspecting Officer.

2.0 DIMENSIONAL AND OPERATING REQUIREMENTS

2.1 The RBMV shall be self-propelled diesel-powered, 8-wheeler bogie type, with bi-directional operation with diesel hydraulic drive. The RBMV shall be robust, of latest design, reliable and suitable for working on the Indian Railways broad gauge (1676 mm gauge). Quality assurance during manufacturing of the RBMV shall be according to ISO-9001. The welding standard followed for manufacturing of machine shall conform to ISO: 3834, EN: 15085 or any other equivalent standard for welding railways vehicles and components. The manufacturer shall specify the standard followed and certify that it meets the welding standard mentioned above. The RBMV shall be suitable for working on straight, transition, curved track (up to 10°) and on turn out broad gauge (1676 mm) of Indian Railways.

2.2 The design and dimensions of the machine and components shall be to metric standards and shall comply with provision of Indian Railways Schedule of Dimensions-1676 mm gauge (BG), revised, 2022 incorporating all correction slips/amendments. The profile of the RBMV longitudinally and in cross section during transfer as self-propelled vehicle or towed in train formation shall be within. The maximum moving dimensions are shown in Annexure-I. The tenderer shall provide sketches of the RBMV, both in plan and elevation and shall give calculations along with Vogel's diagram to ensure that the RBMV does not cause any infringement while moving on a 10^{o} curve at any cross-section.

2.3 No condonation will be permitted to the dimensions mentioned in Indian Railways Schedule of Dimensions-1676 mm gauge (BG), revised, 2022 incorporating all correction slips/amendments.

2.4 Adequate clearance shall be allowed so that no component/part infringes the minimum vertical clearance of 91 mm from rail level while travelling on track up to condemnation limit of wheel.

2.5 Wherever applicable axle load of RBMV shall be less than 22.82 tonnes with minimum axle spacing of 1800 mm while moving on track. Load per meter shall not exceed 7.67 tonnes. Stresses in the track and bridges shall be calculated by IR/RDSO based on design data submitted by the firm as per Annexure–VII and decision of IR/RDSO shall be final in this regards.

2.6 The floor height of the open platform shall be within minimum 1145 mm (loaded) to maximum 1345 mm (unloaded).

2.7 The maximum and minimum permitted diameter of new wheel is 1092 mm and 740 mm respectively. However it shall have a desirable wheel diameter of 914 mm. Minimum permitted diameter of worn wheel is 710 mm. It is desirable that 50 mm margin between new and permitted worn wheel diameter are available, but this should not be less than 30 mm.

Permitted worn out wheel diameter should be specified by the manufacturer. The diameter of wheel for assessment of permitted axle load will be the worn out wheel diameter. The new wheel profile in the machine shall be as per Indian Railways standard drawing attached as Annexure-III which is titled as “WORN WHEEL PROFILE’.

Note: Annexure-III “WORN WHEEL PROFILE” is currently standard new wheel profile of Indian Railways.

2.8 Wheels shall be conforming to Indian Railways Standard R-19/93 with latest revision or European Standard EN13262 with latest revision and design shall duly conform to European Standard EN 13979 with latest revision. The supplier shall mention the standard followed & shall submit certificate for detailed design calculation along with material parameters at the time of supply of the machine. However, in case of wheels sourced from already supplying Indian suppliers, giving wheels to Indian Railways, 3rd party/RITES Inspection certificate of the wheels to be provided in lieu of design and material parameters certificate.

2.9 The non-powered axles shall be conforming to Indian Railways Standard R-16/95 with latest revision or European Standard EN 13261(EA1N) with latest revision. The supplier shall submit detailed design calculation along with material parameters at the time of supply of the machine. However, in case of non-powered axles sourced from already supplying Indian suppliers, giving non-powered axles to Indian Railways, 3rd party/RITES Inspection certificate of the non-powered axles to be provided in lieu of design and material parameters certificate.

2.10 The powered axles shall be conforming to Indian Railways Standard R-43/92 with latest revision or European Standard EN 13261(EA4T) with latest revision. The design shall conform to EN: 13103:1:2017 or latest. The supplier shall mention the standard followed & submit certificate for detailed design calculation along with material parameters at the time of supply of the machine. However, in case of powered axles sourced from already supplying Indian suppliers, giving powered axles to Indian Railways, 3rd party/RITES Inspection certificate of the powered axles to be provided in lieu of design and material parameters certificate.

2.11 Roller bearing shall be grease lubricated & sealed and also supplied by any manufacturer approved by UIC/AAR. Roller bearing shall be conforming to EN 12080:2017 or RDSO Spec. No. C-8527 and shall have minimum L10 life of as 2 X 10^6 km (2.0 million km). When computed as per method given in ISO Standard 281/1.

2.12 It shall be capable of negotiating curves up to 10^o curvature (175 m radius), super elevation up to 185 mm, maximum cant deficiency 100 mm and gradients up to 3% in travel mode. The supplier shall specify the maximum attainable speed of the machine along with empty/loaded wagon or 8 wheeler coach (gross weight 90 tonnes approximately) under the limiting conditions.

2.13 It shall be capable of continuous operation during the varying atmospheric and climatic conditions occurring throughout the year in India. The range of climatic conditions is as follows:

Ambient temperature	:	-5^0 C to 55°C
Altitude	:	up to 2250 m above mean sea level
Relative Humidity	:	up to 100%
Maximum rail temperature	:	76^o C
Rain fall	:	Fairly heavy
Atmospheric condition	:	Very dusty, heavy fog

All the system components on the machine, which are vulnerable to moisture ingress and adversely affected during rains, shall be covered by roof or suitable arrangement so that the machine is able to work continuously even during rains.

2.14 It shall be capable of travelling on its own speed at 100 kmph in normal prevailing track conditions. It shall also be capable of being hauled in train formation as last vehicle at a speed not less than 100 kmph. Since the machine is likely to cover long distances on its own power, the travel drive system shall be robust to sustain these requirements during the life of the machine. It shall be capable of hauling empty/loaded wagon or 8 wheeler coach (gross weight 90 tonnes approximately) at minimum speed of 70 kmph in normal prevailing track conditions. During towing of the machine (RBMV) simple neutral position of gears shall be sufficient, no opening of cordon shaft etc shall be required.

2.15 It shall be capable of working and travelling without requiring power block in electrified sections except while lifting the swivelling platform for inspection of FOB/ROB mentioned in clause 3.8. On Indian Railways, 25 KV or 2x25 KV AC power supply is used for traction through an overhead wire at 5500 mm above rail level. On bridges and tunnels, the height is restricted to 4800 mm.

2.16 While working on double/multiple line sections, it shall not infringe the adjoining track and it shall be possible to permit trains at full speed on that track. Minimum spacing of track is 4265 mm centre to centre. The RBMV or its any part shall not infringe adjoining track as per Indian Railways Schedule of Dimensions 1676 mm gauge (BG), revised 2022 with the latest corrigendum and up to date correction slips issued, during travelling or its operation including opening and closing of the work.

2.17 The RBMV shall be capable of carrying pay load of 15 t. The description of crane, equipment storage space shall be such as to ensure equal axle loads. Design shall be such as to afford easy inspection and maintenance. Guiding principle in selection of assemblies should be the easy availability of wearing components.

2.18 The general tentative layout of RBMV shall be in accordance with RDSO drawing no. RDSO/TM/05A/18 placed at Annexure–XII/A. Any other layout submitted by the tenderer may also be considered, provided it meets with overall requirement of space on the vehicle, speed/running characteristics of the vehicle and the desired amenities asked for in the subsequent paragraphs of this specification. It shall be powered by two sets of power equipment, for rail traction application, each set comprising of an under slung diesel engine transmitting power through hydro dynamic transmission and cordon shaft(s) to the axle drive mounted on the inner axle of each bogie. The two power pack units shall be synchronized such that they work like a single unit when controlled from either of the cabins. Provision shall also be made to isolate any power pack and run the vehicle with a single power pack unit. The conceptual power equipment layout to RDSO drawing no. RDSO/TM/05B/18 is placed at Annexure-XII/B.

3.0 WORKING MECHANISM:

3.1 The RBMV shall be capable of working on all types of track structures including long welded rails of 60Kg/52Kg on concrete/metal sleepers on plain track as well as turn-outs as per IRS layout.

3.2 There shall be a loading platform on the RBMV itself so that it is possible to carry minimum 2 rails of 13 m length each with weight per unit length of 60 Kg/m and/or two sets of switch and stock rail assembly along with fittings CMS crossings along with equipments loaded on the RBMV itself. Weights, dimension of the Rails, CMS crossings and equipments to be carried on RBMV platform in Annexure-IV, Annexure-X/A and Annexure-X/B without infringing the maximum moving dimensions.

3.3 The loading platform shall be provided all-around with a collapsible sidewall/railing of about 45 to 60 centimeters height to protect the men and materials from falling.

3.4 The RBMV shall have a crane as per requirements indicated in clause 4.0 to handle heavy permanent way materials such as rails, sleepers, crossings, switches and SEJs etc. The crane fixed on the RBMV should be capable of efficiently handling the equipments and materials to be carried on RBMV.

3.5 There shall be well designed adequate space to store small track machines, tools and equipments as per Annexure-X/A and Annexure-X/B. For this a room of sufficient size is required to be provided. The store shall have well-designed racks to accommodate above material and some small track machines and its spare parts, consumables etc as per details shown in Annexure –XI.

3.6 There shall be enough seating space for the officials accompanying RBMV. For this, one cabin having seating capacity of 12 persons shall be provided as given in the general layout.

3.7 Two number of tool boxes shall be provided along the wall of store in the cabin. These tool boxes shall have a width of approximately 600 mm and cushioned seats shall be provided on the top of toolboxes. The top of the box shall be designed in such a way that the seats do not fall when the boxes are opened.

3.8 There shall be provision of lifting and swivelling platform for inspection of the underneath of FOB/ROB, a lifting and swivelling platform with hydraulically operated mechanized adjustment for height and rotation and capable of taking minimum 400 kg load with under-noted features shall be provided over the roof. Control for lifting, lowering and swivelling shall be provided on the platform. The raising and swivelling of the platform shall be gradual and without jerks. In addition two emergency stop switches shall be provided on each side of the platform to bring the RBMV to an emergency halt. Two search lights of 24 V (100 w) halogen lamps with intensity of light as 3.2 lux at 3.20 m distance shall be provided on the platform for inspection of the ROB/FOB. Searchlights shall be capable of swivelling on universal joints type support and swivelling control shall be from inside of the either cabin. Mechanical locking arrangement shall be provided to avoid lifting of platform during running of RBMV.

a)	Length of platform	4500 mm
b)	Width of platform	1500 mm
c)	Platform floor level above rail level when elevated	6150 mm
d)	Maximum lifting time to full height	45 sec
e)	Rotation range of platform towards sides	90^0
f)	Side shifting reach of platform	3200 mm
g)	Full height of collapsible railing above platform floor	1100 mm
h)	Maximum time of rotation from 0^0 position to 90^0	45 sec

3.9 Since the RBMV is to work in dusty environment, all the components including gearboxes, bearings, pumps, electric and electronic control shall be robust. Pumps, electric and electronic control shall be of robust design, shielded and sealed from the dust and spill over ballast pieces. Suitable protections covers must be provided so that these components do not fail prematurely. The various assemblies and the RBMV as a

whole shall provide adequate safety to workmen working close-by in connection with the RBMV operations. The necessary safety equipment shall form a part of the RBMV tools and plants. The supplier shall supply the safety equipment as per Annexure-XVII.

3.10 The entire RBMV including bogies, superstructure along with equipment is to be effectively earthed as per standard practice for rolling stock.

3.11 The RBMV shall be capable of continuous running at 100 kmph on generally tangent track followed by frequent to and fro movement at crawling speed at 5.5 kmph.

4.0 CRANE

4.1 The RBMV shall have hydraulically operated fixed type crane mounted on it. The crane shall be of knuckle boom or pillar jib type with telescopic jib. The working radius of the crane shall be minimum 12 m. The minimum weight to be lifted at 12 m is 1.3 t. The capacity of the crane is allowed to reduce on the track with cant and gradient. The crane should have a feature which should control the lifting capacity automatically at different slew angles on tracks with cant, gradient and super elevation. The crane should be reputed make and it shall also be certified by the reputed certification agency like TUV or equivalent.

4.2 The crane shall be structurally integrated with the under frame of RBMV. Mounting arrangement shall be made in the under frame so that it should be rigid and upright without infringing BG moving gauge during run.

4.3 The crane shall be capable of lifting a load of 2 t at 8 m radius on level track with 360° swing. The tenderer shall submit the lifting capacities at various radii. The crane should be capable of loading/unloading P.Way materials lying along the track on either side viz. rails, concrete sleepers, switches and SEJs etc. (the details of which may be obtained from RDSO), from ground and 1.2 m below rail level to RBMV and vice-versa. Attachment like rail lifting hook assembly (Mechanical type), sleeper hook assembly (Mechanical type), 02 nos. of 3 ton x 3 mtr Safety Strap for handling the heavy materials shall be provided along with crane. The tenderer shall submit the details of the same. Slings required for picking up rails, sleepers or crossings shall also be supplied as part of the crane. Necessary make-up blocks (if required) shall be supplied by manufacturer/supplier for steady transfer of load during operation of the crane.

4.4 It shall be possible to start the loading/unloading operation at site within five minutes of arrival. No outriggers should be required to be extended/fixed during the normal crane operation (say up to 8 tonne-meters). In the case of handling of heavier loads use of outriggers may be required. A suitable stability monitoring system for this purpose shall be provided in the crane. Supply of necessary outriggers (Hydraulically operated) duly fixed on the proper location on the RBMV machine with proper design calculations shall be ensured. The outriggers should be fitted with hydraulic lock to sustain the ram in the event of hydraulic failure so that automatic retraction of the rams cannot take place.

4.5 The crane operation shall be such that there is no infringement with overhead electric equipments including adjacent track, if available either by crane or items to be lifted as indicated in clause 4.1, 4.3 & 4.4 above. Suitable safety devices shall be provided to prevent such infringement, if any. The crane shall be properly secured while traveling to protect it from damages.

4.6 The crane & outriggers can be operated with the radio remote control and fixed control levers.

4.7 The crane operation shall be arranged from both traction power packs and shall be operated with one of them at a time.

4.8 Tenderer shall submit hydraulic schematic diagram for crane operation, load charts and stability calculation.

4.9 The RBMV shall be provided with emergency backup system to wind up the crane in the event of failure of prime mover or power transmission system of the machine. The emergency backup system shall be able to be operated manually also.

4.10 The system shall be provided with suitable hydraulic valve to protect against accidental lowering of load due to system failure.

4.11 The operation of crane viz. hoisting, derricking, slewing shall be hydraulic. The hydrostatic system shall have hydraulic pumps, motors and their equipment of proven make and reliable. During movement of the RBMV the operation of the crane shall be strictly prohibited. Provision in the crane operation shall be provided so that no power from traction power packs shall be transmitted during movement of the RBMV.

5.0 DIESEL ENGINE:

5.1 Twin under slung power pack, each powered by fuel-efficient diesel engine of adequate capacity shall power RBMV. The diesel engines preferably indigenous with proven record of service in tropical countries with wide service network in India. Robust construction and low maintenance cost are of particular importance.

5.2 Expected mean life to major parts of the engine for overhauling shall not be less than 8000 engine running hours. The tenderer shall indicate the continuous horsepower at rated output of offered engine under site condition. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions referred in clause 2.14. Manufacturer of diesel engines, proposed to be provided on vehicle, shall have proven record of design manufacture & supply of engines for heavy duty industrial use/locomotives application/track vehicles application/self-propelled railway rolling stocks (with speed potential as needed for vehicle or more) application.

5.3 The supplier shall indicate the total horsepower required for auxiliaries with break-up of power requirements for each of the auxiliary machines at rated output and net power input to the transmission.

5.4 The engine shall be provided with a flywheel mounted flexible coupling. The coupling shall be of adequate capacity to withstand high deflection and torque (at starting, stopping and due to any misfiring of the cylinders) so that no damage is caused to transmission and engine components in service.

5.5 Filters for engine air intake shall be of adequate airflow capacity with restriction indicator to ensure satisfactory performance under dusty environment.

5.6 Air intake with filters, ducts and exhaust arrangement shall be compatible with engine system and shall be located at suitable position within the overall dimensions of the vehicle.

5.7 The tenderer shall furnish a copy of type test report of the engine by a statutory body in support of their claim regarding performance, reliability and specific fuel consumption.

5.8 The supplier shall furnish the information regarding make and model of the engine proposed to be used and details of agency which will provide after sales service support and availability of spares in India.

5.9 The diesel engine shall work satisfactorily with High speed diesel oil conforming to IS specification no.1460 (2005).

5.10 A separate fuel tank with adequate capacity sufficient for continuous operation of 12 hours shall be provided. Sight glass type fuel measuring gauge preferably of full height shall be provided on the fuel tank.

5.11 For starting the engine, storage batteries of well-known indigenous make with wide service network in India shall be provided. The engine shall normally be push/pull button start type or key type. A battery management system to be provided. It should report too low battery voltage to the machine operator and protect the battery from deep discharge. The capacity of the battery must be selected in such a way that, in the event of a battery charge failure and a 50% discharged battery, the machine should be able to work for 30 minutes with all safety and operational functions. There shall be also an indicator for charging of both main and programmer battery displayed on the panel board.

5.12 There is a likelihood of dust deposition over the engine body and surrounding area over the lubricants spills over. These locations shall be easy to access for daily cleaning and routine maintenance. For water cooled engines, the engine cooling radiator shall be easily accessible for regular maintenance like checking the coolant level and topping up of the coolant whenever necessary. Such maintenance activity shall not require the staff to climb up the machine roof. In case, air cooled engines are proposed by the supplier, maintenance equipment for cleaning and maintenance of the air cooling fins shall be provided by the supplier along with the machine.

5.13 Since the engine has to work outdoor under extreme dusty conditions, the air intake system shall be designed suitably so as not to allow dust through air intake system.

5.14 The engine parameter monitoring gauges like temperature, rpm, and lube oil pressure of electrical/mechanical gauges type shall be provided in the operator's cabin showing the absolute readings along with safe limits suitably colored. There shall be audio visual warning (safety mechanism) to the operators in case of any of engine parameters exceeding the safe limit and engine will shut down automatically.

5.15 Suitable and rugged mechanism shall be provided to start the prime mover at no load and gradual loading after the start of the prime mover at no load/minimum load and gradual loading after the start of the prime mover. A fail-safe clutch should be provided to meet this requirement. The engine power take off shall be coupled to the main gear box through flexible/cordon shaft (propeller shaft). The engine shall be mounted on suitable Anti vibration mountings.

5.16 The engine shall have Electronic Control Module (ECM) or similar arrangement for taking out operating parameters on real time basis such as RPM, load, fuel consumption, temperature, pressure and diagnostic data as well as trip and historical data. These data shall be displayed and stored on a panel/PC to be provided in operator's cabin. It shall also be possible to transfer these data on USB device.

5.17 In order to adhere to pollution control norms, the diesel engine should be electronically controlled emmissionized engine with minimum compliance of EPA tier 2/EURO stage 2/BS-II standard or higher emission norms and sufficient space to be kept in machine to fix device to upgrade to higher emission norms in future.

5.18 The supplier shall furnish the information regarding make and model of the engine proposed to be used and details of agency which will provide after sales service support and availability of spares in India, details of diesel engine and its controls to assess its conformity with the engines already operating on track machines on Indian Railways. If the machine design incorporates an engine, not already operating with the purchaser, the model of the engine is liable for change as per the technical requirements and the maintenance logistics with the purchaser after technical negotiations with the supplier. Nothing extra shall be payable on this account.

5.19 Indigenously available hydraulic oil and approved by OEM shall be used. Hydraulic tank of adequate capacity shall be provided at suitable location. Hydraulic hoses of proven make shall be used.

5.20 The exhaust pipe shall be horizontal and located under floor avoiding the position near footsteps to the RBMV.

5.21 Engine mounted alternator of adequate capacity with rectifier for the speed range between idle and maximum of engine speed shall be provided on each engine to supply 24/110 V DC for charging the battery provided for engine starting, controls and lightings.

6.0 TRANSMISSION:

6.1 The RBMV shall be provided with an efficient traction drive system for traction during the operation. The power shift transmission shall be hydrodynamic so that there is no wear and tear in field operation. The tenderer shall give the full technical data of the power transmission system. The supplier shall submit the self-certification for Electromagnetic compatibility (EMI/EMC) of the machine.

6.2 The power pack and transmission equipment shall be mounted on the under frame.

6.3 Transmission shall be either step less or minimum 3 steps bi-directional with maximum speed possible in both forward as well as in reverse direction.

6.4 The transmission shall provide smooth shifting at full power while shifting to higher or lower steps.

6.5 The cordon shaft shall be of robust design and well proven in performance capability, suitable for transmitting rated horsepower and maximum torque encountered during operation. The resultant angularity of cordon shaft shall be maintained within 5º.

6.6 The combined performance of the twin power equipment shall not be inferior to the tractive effort curve placed at Annexure–XIII. Supplier shall submit TE vs Speed curve superimposed with above curve with complete matching calculation of offered power equipments along with equipment lay out drawing.

6.7 Transmission shall have provision of secondary lubrication arrangement to provide protection to transmission from damage during towing in train formation.

7.0 COOLING SYSTEM:

7.1 Radiator of adequate capacity for cooling the water, lubricating oil and transmission oil, shall be provided. The cooling system shall be with excess capacity of 30% towards choking. The heat dissipating requirement of the transmission oil shall be heat equivalent of 30% of the maximum horsepower input to the transmission under most adverse site conditions.

7.2 The fan and the cooling arrangement shall be of adequate capacity to cope up with the service demands under the most severe temperature conditions. The maximum water temperature shall not normally exceed 85 ºC, the safe operating temperature of the engine. The system shall be adequately pressurized and vented to avoid all possibilities of cavitations. The complete technical details of the radiator and its fan shall be furnished.

7.3 The tenderer shall indicate the suitable location for mounting radiator and submit mounting details of radiator assembly, fan drive arrangement such that all equipments fit completely within the overall dimensions of RBMV.

8.0 BRAKES:

8.1 The self-propelled RBMV shall be provided with twin pipe graduated release compressed air brake system so that while attached in train formation as last vehicle, RBMV can be braked by the traction vehicle having air braking system.

8.2 The RBMV shall be fitted with compressed air brakes system which shall apply brake equally on all wheels which can be applied from driving cabins and provision shall be made to connect air brake system of the machine to that of coach/attached wagon when the RBMV is hauling it. Fail safe braking mechanism system shall be provided so that in case of any failure of brake, there shall be arrangement of automatic application of brake. The brakes shall be protected from ingress of water, grease, oil or other substances, which may have an adverse effect on them. The brake shoe lining shall be suitable for high ambient temperature of 55^{o} C. The force required for operating the brake shall not exceed 10 kg at the handle while applying by hand and 20 kg on the pedal, when applied by foot.

8.3 The brake system/rigging shall be bogie mounted and shall be provided with non-asbestos composition ‘K’ type brake blocks.

8.4 The RBMV shall be provided with the following additional brake equipment:

I. Air dryer of approved make conforming to Spec. No. MP- 0.01.00.06 (Rev-0.03), March '2007 or any other make already in operation in other track machines in Indian Railways should be provided.
II. D-1 or any other makes already in operation in other track machines in Indian Railways as per UIC norms. Emergency brake valve (Air brake) in each driving cab on the extreme right hand side.
III. Standby brakes, in case of failure of distributor valve or any component in the brake system.
IV. The spring loaded pneumatic parking brake shall be provided. There shall be also an easy arrangement to release the parking brake in case of emergency
V. Mechanical brakes shall also be provided for parking.

8.5 Adequate safety straps shall be provided below the moving components of the brake rigging and other components to prevent falling on the track in the event of failure of any component. All the brake rigging pins/joints shall be provided with bulb type cotters.

8.6 RBMV shall be provided with engine mounted twin cylinder air compressors (one with each engine). The total FAD of compressor shall be 350/280 lpm at 8 kg/cm^2 at idle speed of the engine. The tenderer shall ensure the adequacy of offered compressor. Tenderer shall submit compressor capacity calculations in this regard. Cut-in and cut-out of compressors will be at 7 kg/cm^2 and 8 kg/cm^2 pressure respectively.

8.7 The supplier shall submit details of brake system covering brake schematic diagram, working principle, brake power diagram, number, dimension & type of brake block and literature on brake equipments proposed along with offer.

8.8 There shall be provision of mechanically operated emergency brake application (operated by a hand lever) in both driver end cabins using the compressed air in the machine, either travelling alone or coupled with the camp coach or loaded wagon, in addition to the normal braking system of the machine. The emergency braking distance (EBD) of the machine (fully loaded i.e. maximum 20.32x4=81.28 t) on the Indian Railways track from the maximum designed speed to zero on a level track shall not be more than 600 m. In this regard necessary design calculations for the braking effort and EBD at the maximum design speed of the machine on level track & at falling grade of 1 in 33 shall be provided by the supplier. Brake design details of the RBMV for calculation of EBD are to be submitted as per Annexure- V.

8.9 Clearly visible brake lights shall be provided at both the ends of the machine, which will be automatically operated when brake is applied and switched off when brake is released. This will be required to alert the operator of machine following this machine when the machines are working in groups.

8.10 The braking system shall be designed so as to meet the air reserve requirement for repeated braking as required in normal operation. In addition, the machine shall be equipped with suitable air brake system in the driving cabins so that the coach while being hauled by the machine can be braked.

8.11 An annexure containing functional requirement on the Brake system of the vehicle is attached as annexure XIV.

9.0 HORN, HOOTER AND SAFETY SWITCHES:

9.1 The RBMV shall be provided with dual tone (low tone & high tone) electric/pneumatic horns facing outwards at each end of the RBMV at suitable locations for use during travelling to warn the workmen of any impending danger. Control shall be provided in close proximity to the driver permitting the driver to operate either horn individually or both horns simultaneously. The horns shall be distinctly audible from a distance of at-least 400 m from the machine and shall produce sound of 120-125 dB(A) at a distance of 5 meter from horn (source of sound). The higher tone horn shall have fundamental frequency of 370 ±15 hertz. Minimum two nos. safety stop/switches in front on both side and two nos. in rear on both side–should be provided all around so that in case of any danger to worker as well as hitting of any obstructions by working unit like signaling cable, joggle fish plate etc. during working, the working can be stopped immediately. Safety stop indication should be displayed/glow in operator's cabin.

9.2 In addition, separate electric horns with push button type switches shall be provided at suitable locations in all cabins(s) and on machine body for communication between the machine staff and operator about infringement/malfunctioning or any other trouble.

9.3 Pneumatically/electrically operated hooters capable of producing intensity of sound between 105-110 dB at a distance of 5 meter (when measured in still air in a closed room) and variation in intensity of sound shall not be more than 5 dB. The hooter shall be provided facing outwards at each end of the machine at suitable locations, operated by means of push buttons provided in the cabins to warn the staff working on/around the machine about approaching train on adjoining track. Additional switches for such hooter shall be provided outside on the machine frame and near the both side exit gates so that it can be operated by staff present at work site near the machine. The hooter shall also be operatable by remote switch at a distance of at least 300 m from the hooter.

10.0 HOOKS AND BUFFERS:

10.1 The RBMV shall be fitted with transition coupling as per RDSO specification no. RDSO/2009/CG-22 with latest revision along with side buffers to RDSO drawing no. RDSO/SK-98145 with latest alteration on both ends for coupling it with trailing wagons, coach & locomotives while running in train formation as last vehicle. As per Indian Railways schedule of dimensions, the maximum and minimum height of the buffer centre from rail level is 1105 mm and 1030 mm respectively.

11.0 HEAD LIGHT, FLASHER LIGHT, MARKER LIGHT AND OTHER LIGHTING ARRANGEMENTS:

11.1 The electrical equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The RBMV shall be equipped with twin beam headlight assembly, conforming to RDSO's specification no. RDSO/2017/EL/SPEC/0134 (Rev.02) with the latest amendments ensuring a light intensity of 4.8 lux at ground level at track centre at a distance of 305 m away on a clear dark night, at each end and with two front and rear parking lights, which can be switched to red or white according to the direction of the travel. Powerful swiveling floodlights shall also be provided to illuminate the working area (10 meter radius) sufficiently bright for efficient working during night. Specification for DC-DC converter for electric loco/diesel electric loco no. is ELRS/SPEC/DC-DC converter/0021, (rev-1, Sept'2004 or latest). Preferably electric power of 24 V shall be used for operation of any electrical circuit.

11.2 In addition to swivelling floodlights mentioned in para 11.1, powerful swivelling floodlights shall also be provided at each corner of the machine to illuminate the surrounding area sufficiently bright for efficient working during night. In addition minimum twelve power point locations (230/250 V AC socket) shall be provided on outside frame of the machine two in front, two in rear and four on both sides for providing lighting arrangements during night working. Suitable light fittings shall also be provided which will be used during night working otherwise it should be kept at a secure place provided on the machine. Illumination survey or light assessment or Lux level survey report shall be submitted by the supplier.

11.3 The amber colour LED based flasher lights producing not less than 500 lux at 1 m and 55 lux at 3 m in line measurement in axial direction from flasher light to RDSO Spec No. ELRS/SPEC/LFL/0017 (Rev-1) of Sept-2004 or latest shall be provided at both ends in the machine to give indication to the train arriving on other line about any impending danger.

11.4 The Machine shall be provided with marker light to RDSO specification no. is ELRS/SPEC/PR/0022, (Rev-1) October'2004 or latest.

11.5 Reputed make fans 24/110 V DC operated shall be mounted in all cabins at suitable locations. Each fan shall be controlled by its own switch. The fan base shall be insulated from the coach body and the coach wiring shall be terminated to 2-way connectors supplied with the fan and fixed on the ceiling.

12.0 CHASSIS & UNDER FRAME:

12.1 The chassis shall be fabricated from standard welded steel sections and of steel sheets, so as to permit transportation of the RBMV in train formation as the last vehicle, without endangering safety of the train. The under frame shall be constructed with rolled steel section and/or plates shall be designed to withstand a horizontal squeeze load of 102 t at CBC rear stops or 51 t at each buffing point without any permanent distortion. The under frame shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as the last vehicle. The supplier shall submit the squeeze load test report to the Railways and RDSO.

12.2 There shall be provision of properly exhibited/conspicuous jacking and lifting points on the machine under-frame in case of derailment/accident as well as during maintenance at workshop. The jacking and lifting points shall be obstruction free and easily accessible, so that jacks can be fitted/placed conveniently.

13.0 SAFETY FEATURES:

13.1 The protective earth connects all metallic parts (e.g. apparatus housing, machine body, work equipment) to the earth potential. To protect the axle bearings from current flow, the current is transmitted to the wheel set via earth brushes. The earthing concept shall be documented.

13.2 Functionally related loads are to be protected by circuit breakers in order to keep the effects of faults low and to facilitate fault location.

13.3 Stand-alone vigilance control device (VCD) of approved make conforming to RDSO specification no. MP-0.34.00.04 (Rev-04), Dec-2008 shall be provided.

13.4 The machine shall have automatic fire/smoke detection systems. This shall be capable of detecting a smoke/fire in machine. Suitable number (not less than 6) of fire extinguisher (dry chemical type) shall be provided in the cabins. Easily accessible fire extinguishers are to be installed in the cabins. The exact positioning is determined within the framework of the interior concept. The chemicals used for extinguishing fire by such fire extinguishers shall not chemically react with electronic equipment/components, PCBs, cables etc.

13.5 All electrical wiring in the machine shall be done with e-beam cables conforming to RDSO's Specification No ELRS/SPEC/ELC/0019 Rev.-3 dated 28.02.2017 with latest amendment.

13.6 Two nos. 50 t manually operated hydraulic lifting jack, with more than 300 mm traversing facility suitable to lift the machine frame at lifting point, should be made provided to meet out the urgency. Also a hydraulic hand pump unit should also be provided to operate any other emergent operation of hydraulic cylinders and other such equipment specific to the machine for restoring failed units of the machine during working, shall be provided on the machine.

13.7 Signal exchange light (signal flashing scheme) similar to Vande Bharat for exchanging signal conforming to CLW specification no. CLW/MS/03/0670 or latest shall be provided in the machine.

13.8 A clutch system or any other alternate system should be provided to either disengage the hydraulic pumps or to divert the hydraulic oil away from burst hose and direct it to the hydraulic tank, in case of bursting of hydraulic hoses fitted in pumps.

13.9 Machine shall be suitable for maintenance and operation, even for changing parts & oil filling under OHE of restricted height.

13.10 Necessary provision should be made to record the CCTV footage for reference during investigation/enquiry of an unusual incident for at least 30 days.

13.11 Safety equipment like pullers, tirfor and other such equipment specific to the machine for restoring failed units of the machine during working shall be provided on the machine.

14.0 CABINS:

14.1 The RBMV shall have both ends with driver's compartment with provision of Air Conditioner of suitable capacity. The RBMV shall be equipped with fully enclosed cabins with safety glass window. In view of the high ambient temperature prevailing in India, special attention should be paid to free circulation of air and ventilation in the driver's cabin. It shall be possible to have a clear view of the track ahead while driving the RBMV in either direction. The design of driver's cab shall be as per UIC CODEX-651. Visibility diagram should be submitted along with the design details.

14.2 Entry & exit door to RBMV's cabin shall open on the loading platform area so that the same operator can work easily in the cabin and on crane of RBMV both and he exits RBMV with good view of adjacent tracks.

14.3 The gauges, instruments and control panels shall be suitably located in the operator's cabin so that they can be observed without undue fatigue to the operator. Wind screen wiper arm and blade assembly to be provided as per RDSO Spec. No. C - K 306 with latest revision.

14.4 The driver's seat shall be of the folding and swivelling type to permit the driver to manipulate the controls either while sitting or standing. The seat frame or swivelling arrangement shall be robust design, easy to operate and hold in any desired position. The driver's seat cushioning shall be as per RDSO specification no. C - K607 with latest revision properly vented and upholstered with covering to RDSO specification no. RDSO/2008/CG-07 (Latest).

14.5 Sitting space in each of the driving cabs for 2 persons in addition to the driver and assistant driver. For this purpose a foldable cushion seat shall be provided.

14.6 The machine shall be equipped with speed indicator and recording equipment of range between 0-160 kmph for recording the speed of the machine in real time basis. The equipment shall conform to RDSO specification no. MP-0-0.3700-07, Rev 07, Aug'17 or latest. The recorded data shall be retrievable on computer through memory card/pen drive. It shall be provided in the driving cabin at suitable place and recording system should have sufficient memory to keep the speed record of minimum 15 days which should always be stored for retrieving as per requirement.

14.7 Control panel with operator's seat shall be provided at a suitable place near the crane for its operation. The equipment and controls shall be arranged near operator's seat to facilitate easy access for operation of the crane. Care shall be taken to protect the controls from environmental hazards.

14.8 The floor of RBMV in driver's cab and staff cabins shall consist of 2 mm thick PVC sheet to RDSO STR No. RDSO/2006/CG-12 (Latest) with 12 mm Compreg sheet to RDSO STR No.C-9407 (Latest) as padding below the PVC flooring sheet. At other places steel galvanized Chequered plates of 6 mm thick shall be provided to IS: 2062.

14.9 Detachable type cattle guards shall be provided under each buffer beam. The cattle guard shall be fitted with adjustable rail guards so as to maintain the minimum free space above the rails under all conditions. Cattle guard shall be as per RCF Drawing No. EM26108 with Latest Revision or similar.

14.10 Operators cab camera with recording facility & voice logger conforming to RDSO specification no. RDSO/SPN/TC/106/2022 Version 2.0 or latest shall be provided.

14.11 The electric supply in the cabin for operation of electrical instruments, gauges etc. shall not be more than of 110 V.

14.12 First aid box with medicines & other items shall be supplied with each machine and shall be mounted at an appropriate place.

15.0 SUSPENSION SYSTEM

15.1 The suspension system shall be of two-stage type with suitable spring and damping arrangement. Springs for primary and secondary suspension shall be designed to cater for actual service conditions. Effective measures shall be adopted to minimize the weight transfer while starting, stopping and during runs.

16.0 TOOLS AND INSTRUCTIONS MANUALS:

16.1 Each RBMV shall be supplied with a complete kit of tools required by the operator in emergency and for normal working of the RBMV. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire RBMV including specialized equipment. All special tools shall be listed and catalogued illustrating the method of application. The tenderer shall along with his offer, submit the list of tools, manuals, circuit diagrams and other technical literature/drawings in English language to be supplied along with each machine as above, for operation, servicing, maintenance, assembly overhauling, periodic overhauling and troubleshooting guides/manuals. The list can be modified to suit the purchaser's requirement, while examining the offer.

16.2 Detailed operating manual, maintenance & service manuals and user manual indicating capabilities of machine shall be specifically prepared in English language and four hard as well as soft copies of these shall be supplied with each RBMV.

16.3 As a part of service manual, the manufacturer shall also supply circuit diagram in hard and soft copies of electrical, hydraulic, pneumatic electronic circuits used on the RBMV. Trouble shooting diagram/table shall also be supplied. In additions, the manufacturer shall provide dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc. and main features such as type; discharge etc of items like hydraulic pumps, motors and such other bought out components/assemblies shall be furnished by the tenderer. These shall be specially prepared in English language and four copies of these shall be supplied with each RBMV.

16.4 The successful tenderer(s) shall provide detailed technical drawings and specifications of wheels and axles used in the machine (RBMV) along with detailed code of procedure for ultrasonic testing axles of all types and test report of wheels shall be submitted along with other documents. The above details shall be provided in four sets with each machine (RBMV).

16.5 While offering the RBMV for first inspection, the supplier shall submit one copy of complete technical literature in English including operation, service and field maintenance manuals/instructions, complete electrical, hydraulic and pneumatic circuit diagrams, troubleshooting charts, component drawings/description and other relevant technical details for keeping as a reference document for the inspecting officer.

16.6 One set of all the manuals and diagrams in hard as well as in soft copy (one set for a group of similar machines) shall be sent to the Principal/IRTMTC, Allahabad, one set for Chief Workshop Manager (Track Machines) CPOH Workshop, PO. Dhoomanganj, Prayagraj -211011, one set for Chief Workshop Manager (Track Machines) CPOH Workshop, South Central Railway, Rayanapadu, Vijaywada, Dist.-Krishna, Andhra Pradesh-521241, one set for Chief Workshop Manager (Track Machines) CPOH Workshop, Eastern Railway, Bhutbagan Railway Colony, Kanchrapara, P.S: Bizpur, P.O.: Kanchrapara, West Bengal-743145, one set for Chief Engineer. C.P.O.H, Western Railway, Divisional Office, Near Chamunda Mata Mandir, Naroda Road, P.O. –

SaijpurBodha, Ahmedabad-382345 and one set to be sent to PED/Infra-I, RDSO, Lucknow along with supply of first machine of similar group. One set shall also be provided in soft copy only to EDTK (M & MC)/Railway Board and Director General/IRICEN/Pune. In case, there is any subsequent amendment in above documents based on field performance, the amendment/amended documents should also be sent to above mentioned authorities

16.7 A draft copy of all documents to be supplied with the machine shall be sent 3 months in advance of inspection of the first machine to RDSO for their review regarding adequacy and manner of detailing. Necessary modifications and further detailing as per RDSO's comments shall be carried out and compliance shall be reported to RDSO as well as the Inspecting officer of the first machine.

16.8 One portable diesel operated D.C. welding generator (with the provision of auxiliary output of minimum 2.5 KW, 230 V AC for lighting) of reputed make (preferably made in India) with a minimum 7.5 KVA capacity capable of welding up to 5 mm (dia) electrode at 60% duty cycle shall be supplied. Sufficient length of cable or lead shall be provided with the machine of welding plant for day to day repairing work of the machine and its wearing parts. The diesel tank capacity shall be not less than 15 liters.

17.0 SPARE PARTS

17.1 The expected life of the components/spare parts shall be advised along with their condemning limits. The RBMV shall be supplied with necessary spare parts for the operation and maintenance of the RBMV for a period of two years. The spare parts required shall be detailed in a separate list indicating description, part number, quantity and whether imported or indigenous.

17.2 The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service the life of the RBMV (25 years). It is preferred that the spares shall be stored in India and will be available within 7 (seven) days.

17.3 For indigenous parts and bought out components and assemblies, the source (original equipment manufacturer's reference and part no.) and other relevant technical details shall be supplied while offering the first RBMV for inspection.

17.4 Grease nipples shall conform to IS specification No. 4009. All the grease nipples & adapters, wherever used, shall be tack welded to prevent them from unscrewing and falling off in service.

18.0 OPTIONAL EQUIPMENT

18.1 Tenderer is expected to quote for optional equipment if any separately for each item giving the advantages/functions of such optional equipment. Tenderer shall also indicate whether such equipments are already in use on machine elsewhere indicating the user railway system.

19.0 MAKER'S TEST CERTIFICATE:

19.1 Copies of the Maker's certificate guaranteeing the performance of the RBMV shall be supplied in duplicate along with the delivery of each RBMV.

20.0 OPERATORS:

20.1 The number of operators and allied staff for working of the RBMV under normal condition shall be indicated, specifying their duties and minimum qualifications.

21.0 INSPECTION OF THE MACHINE

21.1 While inspecting the machine before dispatch from the supplier's premises, the inspecting officer shall verify the conformity of the machine with respect to individual specification as above. The conformity/non- conformity with respect to each item shall be jointly recorded before issue of the Inspection certificate and approval for dispatch of the machine as per Annexure –VI enclosed.

21.2 Following arrangements shall be made by the supplier/manufacturer at the inspection premises for carrying out inspection of the RBMV by inspecting officials:

- RBMV to be stabled on straight & level BG track. The length of the track shall be at least 10 m more than buffer to buffer length of RBMV.

- In order to check maximum moving dimensions in cross section, a sturdy frame of Indian Railways max moving dimensions shall be provided by the manufacturer and passed over the RBMV holding it perpendicular to track, centre aligned with track centre. Adequate arrangements shall be made to the satisfaction of inspecting official.

21.3 The following documents shall be provided to the Inspecting Officer at least 30 days in advance of the date of inspection.

i) One copy of complete technical literature mentioned in clause 16, in English language, including operation, service and field maintenance manuals/instructions and complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/ description and other relevant technical details as a reference documents in soft & hard copies .

ii) Cross section of the machine super imposed on Indian Railways maximum moving dimensions envelope shall be provided .

iii) Clause by clause comments of the manufacturer to be sent for his review. Comments should state manufacturer's conformity of compliance of each of the requirement stated in each clause, elaborating where necessary the details/manner in which the requirement has been complied. The proforma for the clause-wise comments is given below:

Clause no.	Clause	Comments of Supplier/manufacturer	Comments of Inspecting Officer

iv) Manufacturer's Internal Quality Inspection Report of the machine.

v) Manufacturer's quality certificate and/or test reports for bought out assemblies/sub-assemblies shall be provided to IO, containing serial number wherever applicable.

vi) Draft inspection report shall be prepared by the manufacturer, containing all annexure mentioned at para 21.4.

vii) Details of arrangements made for checking maximum moving dimensions for his approval.

viii) Illumination survey or light assessment or Lux level survey report.

Supplier will incorporate amendments/further clarification in the above documents to the satisfaction of the Inspecting Officer (IO) keeping in view the Inspecting Officer's comments, if any.

21.4 List of documents to be annexed in the draft inspection report shall include:

i. Maker's Test Certificate.
ii. Manufacturer's Internal Quality Inspection Report.
iii. Quality Certificates of Bought out assemblies/sub-assemblies.
iv. Cross section of the machine super imposed on the Indian Railways maximum moving dimensions (IR MMD).
v. Vogel's diagram.
vi. List of spare parts to be dispatched along with the RBMV.
vii. List of tools to be dispatched along with the RBMV.
viii. List of manuals, drawings, spare parts catalogues, etc. to be dispatched along with the RBMV, duly indicating the number of sets of each.
ix. Manufacturere's certificate on standard followed for design of wheels and axles against clause 2.9 to 2.11.
x. The code of procedure for ultrasonic testing along with ultrasonic testing report of wheels and axles of all types used in the machine

These above documents in soft & hard copies shall be part of final inspection report.

22.0 TRAINING & SERVICE ENGINEERS:

22.1 The contractor shall provide at his own expense the service of competent engineers during the warrantee period for warrantee related issues. The service engineers shall be available for the commissioning of the RBMV for regular service. E-Learning Courses shall be arranged for imparting training to Railways operators. In addition the service engineer shall provide hands on training to Railways staff in calibration, operation, repairing and maintenance of the RBMV in field to make them fully conversant with the RBMV. The engineers shall also advise the Railways on appropriate maintenance, testing, operating, repair and staff training facilities that are necessary for the efficient performance of the vehicle.

23.0 SPEED CERTIFICATE:

23.1 PROVISIONAL SPEED CERTIFICATE:

Whenever a new rolling stock is introduced in Indian Railways, a provisional speed certificate is issued by RDSO of Indian Railways based at Lucknow, based on certain design parameters of the vehicle. Final speed certificate of the vehicle shall be after conducting detailed oscillation trial of the vehicle, which shall be a time taking process. Therefore, issue of provisional speed certificate for the vehicle becomes a necessity and

based on the same, the approval of running of the vehicle on Indian Railways track is taken from Commissioner of Railways Safety.

For issue of provisional speed certificate, the following actions are required to be taken by the suppliers:

a. Current suppliers, whose models are approved:

The supplier shall give details of the model, year of introduction in Indian Railway, details of speed certificate issued etc. The supplier shall certify that no change has taken place in the model being offered with respect to design of under frame i.e. suspension system/arrangement, wheel & axle assembly, bogie, braking arrangement, loading pattern of the vehicle etc. and the distribution of axle loads, lateral forces, un-sprung mass and braking force coming on rails is the same. If, there is any change in above respect, the action shall be taken as detailed in clause (b) below. Machines that are similar shall be decided by RDSO/Railway Board based on data submitted by the firm and decision of RDSO/Railway Board shall be final in this regards.

b. Current suppliers, whose models are not approved/ or new:

As soon as the supplier completes the design of the machine as per specifications, the technical details as per Annexure-(VII & VIII) which in no case should be more than six months from signing of contract, shall be supplied to Track Machine and Monitoring Directorate of RDSO for processing of provisional speed certificate for the machine so that it can be permitted to move on track. On case-to-case basis, more technical details (other than mentioned in Annexure-VII & VIII) can also be asked for issue of provisional speed certificate for the machine. The firm will also submit the technical details as per pro-forma placed at Annexure-II. The supplier shall submit the dynamic simulation report of the machine on his own cost on professional track vehicle simulation software. The machine shall have to fulfill the acceptance criteria specified at Annexure-II.

c. New suppliers, whose models are new:

The technical details shall be supplied as detailed in para (b) above.

23.2 **FINAL SPEED CERTIFICATE:**

Final speed certificate of the machine shall be given after conducting detailed oscillation trials of the machine. For this purpose Railways shall conduct running speed tests on the Indian Railways main line track on one of the machines supplied to them preferably with in warranty, in accordance with procedure outlined in Annexure- IX with the machine running up to speed 10% higher than the maximum speed mentioned in clause 2.15 above. However railway could conduct detailed oscillation trials of the machine as per EN-14363. The decision of the railway will be final and binding.

23.3 **List of drawings & documents for processing of speed certificate of the machine:**

The supplier shall submit the drawings, documents and details as per the pro-forma attached as Annexure-XV & Annexure-XVI and duly signed with seal in hard and soft copies in A3 size in high resolution in English language (other than mentioned in

Annexure-VII & VIII). The supplier shall submit the documents accommodating the following details:

a. The machine drawing in Maximum Moving Dimension (MMD) to drawing no. 1D (EDO/T-2202)1676 mm Gauge of IRSOD-2022 shall be submitted.
b. All dimensions are to be marked as per IRSOD-2022 in the drawings.
c. Provide sketches of the machine, both in plan and elevation and shall give calculations along with Vogel's diagram to prove that the machine does not cause any infringement while moving on a 10° curve at any cross-section.
d. Squeeze load test report to the concerned railway/s and RDSO.
e. All types of brakes shall be shown in air brake circuit schematic diagram as per technical specification.
f. Braking distance calculations shall be submitted for level track as well as for falling gradient of 1 in 33 at design speed.
g. The supplier shall submit the self-certification for Electromagnetic compatibility (EMI/EMC) of the machine.
h. Dynamic simulation result of the machine, brake design details of the machine for calculation of emergency braking distance & all other details shall be submitted as per annexure of technical specification.

24.0 ACCEPTANCE TEST:

24.1 In addition to verification of the various items of specifications covered earlier, the following tests shall be carried out in India at the purchaser's premises by the purchaser's nominee at the time of commissioning of the RBMV. The pre-commissioning tests shall be completed and the machine shall be commissioned within 90 days of its arrival at the premises of the final consignee.

24.1.1 Dimensional check of loading gauge, i.e. maximum moving dimensions, buffer heights, clearances, length of machine, bogie distance, clearance on curves etc.

24.1.2 Performance of crane as per para 4.0.

24.1.3 Testing for negotiability on 1 in 8 ½ turnouts.

24.1.4 Construction and engineering of the RBMV and its ability to perform all the functions as laid down in the specifications above.

24.1.5 Illumination for the working and surrounding area of the machine sufficiently illuminated for efficient working during night as per clause no. 11.2.

24.1.6 Should any modification be found necessary as a result of the tests, these shall be carried out by the supplier at his own expenses.

24.1.7 Ultrasonic testing of axles shall be done preferably at the purchaser's premises. If not possible at the purchaser's premises, same to be done during at the time of acceptance tests at consignee facility.

25.0 WARRANTY:

The RBMV shall be warranted for 2000 effective working hours or 18 months from the date of commissioning and proving test of machine or 24 months from date of delivery at ultimate destination in India whichever shall be earlier. Effective working hours for this purpose will be traffic block time during which RBMV is deployed for work. Warranty period of 18/24 months shall be extended for the period/s of idling or breakdown (during warranty period) on supplier account. The warranty of machine also includes the warranty of engine(s).

Should any design/failure modification be made in any part of the machine offered, the warranty period of 18 months would commence from the date of commissioning and proving test of the RBMV for the purpose of that part and those parts which may get damaged due to defects in the new replaced part. The cost of such modification shall be borne by the supplier.

26.0 MARKING & COLOUR OF MACHINE :

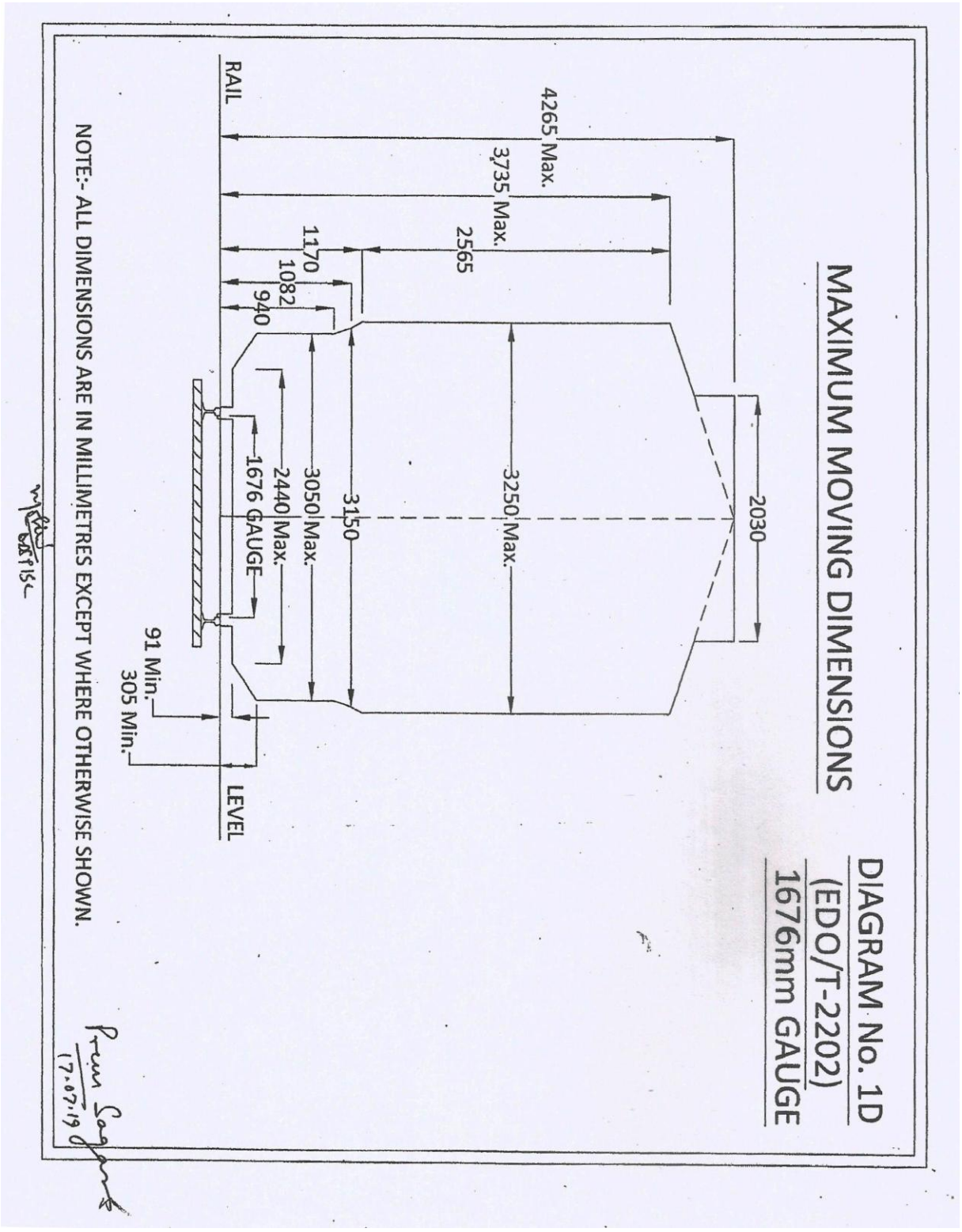
26.1 The machine body shall be painted in golden yellow colour of Indian Standard Colour code of 356 as per IS:5 or RAL No. 1028-Melon Yellow. The exterior painting shall be polyurethane binder based conforming to RDSO Specification No. M&C/PCN/100/2013 (Specification for epoxy cum polyurethane painting system –two packs for the exterior painting of railway coaches, diesel and electric locomotives and other industrial applications) or ISO 12944.

26.2 Following should be written on the machine at appropriate location

i) India Railways logo of height between 200 mm to 400 mm as suitable on all four faces of the machine.
ii) On both side faces and below the Indian Railways logo, the text “INDIAN RAILWAYS” to be written in bold and in black colour of size equal to or slightly smaller than the size of logo but of size not less than 150 mm.
iii) Below the text “INDIAN RAILWAYS” mentioned above, machine model and manufacturing year should be written in black colour and in letter of size less than the size in which Indian Railways is written but not less than 100 mm in any case.
iv) If required, the manufacturers name may be written in size not more than 100 mm and should not be at more than four locations. Also the manufacturer’s logo may be provided at not more than two locations and should be of size less than 100 mm.
v) Suitable signage to warn the operator and machine working staff against the 25 KV OHE shall be stenciled on the machine at appropriate location.
vi) The speed of machine in case self-propelled and in train formation shall be marked on machines.

****

Annexure-I


MAXIMUM MOVING DIMENSIONS
DIAGRAM No. 1D
(EDO/T-2202)
1676mm GAUGE
RAIL
4265 Max.
3735 Max.
2565
1170
1082
940
2030
3250 Max.
3150
3050 Max.
2440 Max.
1676 GAUGE
91 Min.
305 Min.
LEVEL
NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

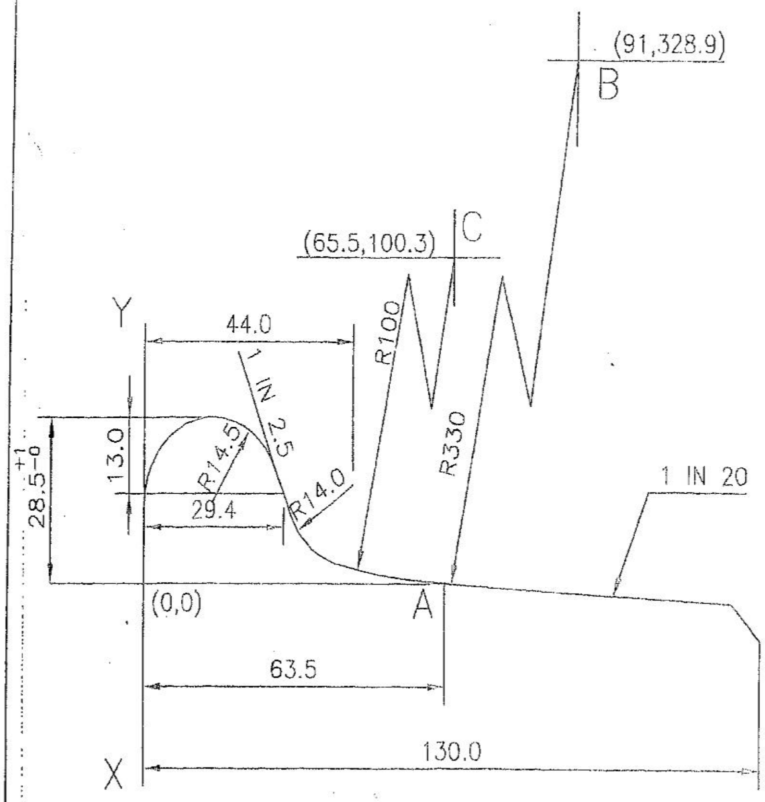
Annexure-II

Machine details required for simulation of machine on dynamic simulation software

S. No.	Component's Name	Parameters required						
		C.G. of component in x, y, z direction from rail level in mm (reference point 1st axle)			Mass in kg and mass moment of inertias in kg. m^2 of component in three dimension space about their C.G.			
		X	Y	Z	Mass	Ixx	Iyy	Izz
1.	Super structure with vehicle frame (Machine structure kept on secondary suspension of front and rear bogie)							
2.	Front Bogie frame including brake rigging							
3.	Rear Bogie frame including brake rigging							
4.	Transmission system device (hydraulic. Mechanical or electrical traction motors							
5.	Wheel axle set including axle boxes which constitute the unsprung mass							
6.	Mass of Items included in unsprung mass partially or fully along with their name per axle	1	2	3		4		Total unsprung mass in tonnes
7.	Total weight of components in tonnes	Front bogie full assembly		Rear bogie full assembly		Machine frame full structure		Full weight of vehicle (All bogies + vehicle car body or super structure)

8.	Suspension stiffness details in kg/mm	Primary suspension element stiffness per axle box between bogie and axle box			Secondary suspension element stiffness per side between bogie and machine frame		
		Vertical stiff	Lateral stiff	Longitudinal stiff	Vertical stiff	Lateral stiff	Longitudinal stiff
9.	Damping force details (If hydraulic damper used give there rating force per meter/second)						
10.	Clearance in mm or radian provided for motion between bogie frame and machine frame for relative motion (motion stopper)	Vertical direction	Lateral direction	Longitudinal direction	Rotation about vertical axis	Rotation about Lateral axis	Rotation about Longitudinal axis
11.	Detail of location of suspension elements	Detail of location of suspension springs and dampers and shock absorbers with support drawing			Detail of location of suspension springs and dampers and shock absorbers with support drawing		
12.	Details of centre pivot arrangement working and location	Provide detail arrangement drawing and description					
13.	Set of drawings and design description	Concerning with general arrangement of vehicle, bogie general arrangement, suspension arrangement details, suspension clearances drawing, detail written description of configuration and loading pattern accompanies design particular of vehicle bogie.					

Annexure-III



PROCEDURE OF DRAWING:–

1. DRAW A VERTICAL LINE X–Y.
2. DRAW SEMI–CIRCLE OF 14.5R TANGENTIAL TO LINE X–Y.
3. DRAW LINE 1:2.5 TANGENTIALLY TO 14.5R SEMI–CIRCLE.
4. DRAW A HORIZONTAL LINE AT 28.5mm FROM THE TOP OF THE FLANGE. AND LOCATE Pt. 'A' AT 63.5mm FROM THE LINE X–Y.
5. FROM Pt. A LOCATE CENTRE 'B' OF ARC OF 330R ON A VERTICAL LINE AT 91mm FROM X–Y.
6. DRAW ARC OF 330R FROM CENTRE 'B'
7. LOCATE CENTRE 'C' ON VERTICAL LINE AT A HORIZONTAL DISTANCE OF 65.5mm FROM THE LINE X–Y SUCH THAT BC= (330–100) ie 230mm.
8. DRAW ARC OF 100R WITH CENTRE AS 'C'.
9. DRAW ARC OF RADIUS 14mm TANGENTIALLY TO 100R ARC AND LINE 1:2.5.
10. DRAW LINE 1:20 TANGENTIALLY TO 330R ARC.
11. DRAW A VERTICAL LINE AT A DISTANCE OF 30mm FROM THE FLANGE END.

NOTE:

CO–ORDINATES OF POINTS B & C ARE BASED ON NOMINAL DIMENSION OF 28.5mm.

ALT.	AUTH.	DESCRIPTION	DATE
3	SS/24/04	DIMENSION 73.7 DELETED	9/04
2	J.S. CD/3/94	REVISED & REDRAWN	3/94
1	J.S. CD/ /92	CO–ORDINATES OF ARCS SHOWN	3/92

SUPERSEDED BY:		
SUPERSEDES:		
SCALE 1:1	P	
	C	
	D	G.V.RAMAN
	T	
	J.S.	

WORN WHEEL PROFILE

B.G. | R.D.S.O. (C) | GROUP XXX3 | SKETCH-91146

Annexure-IV

Sizes and Weight of Some of the P-way Materials and Small Track Machines to be normally loaded on RBMV platform

Sl. No.	Description	Length (mm)	Width (mm)	Height (mm)	Weight (kg.) (approx.)
1.	Normal Concrete Sleeper	2750	150	220	300
2.	Wider Concrete Sleeper	2750	285	235	350
3.	Wooden Sleeper	2750	250	130	100
4.	Steel Trough Sleeper	2680	257	106	79
5.	60 kg Rail (2 nos.)	6500	150	172	785
6.	52 kg Rail	6500	136	156	676
7.	60 kg 1 in 12 CMS crossing	4350	521	172	980
8.	60 kg 1 in 16 CMS crossing	5400	496	172	
9.	Abrasive rail Cutter	1070	420	950	30
10.	Rail Drilling Machine	1030	450	570	60
11	Rail Tensor	1700	400	300	700

Annexure-V

BRAKE DESIGN DETAILS OF THE MACHINE FOR CALCULATION OF EMERGENCY BRAKING DISTANCE

Tare & gross weight of the machine in Kilograms
Brake power in Kilograms
Type of Brake blocks
Brake block area in Square Centimeters
Brake Rigging Diagram
Type of Brake system

Annexure-VI

INSPECTION CERTIFICATE

CERTIFICATE OF INSPECTION OF RBMV (MODEL No.....)
BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF RBMV. (STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that I have inspected the RBMV_____bearing Sr.No._____ from (date)_____to_____at (Place)_____ for its conformity/non-conformity with respect to the laid down Technical Specifications in contract Agreement No._____dated_____ between President of India through Director Track (MC) /Railway Board and M/s. (Name of Supplier) _____ _____.

The detailed inspection note regarding its conformity/non-conformity to the laid specifications is enclosed along with this certificate. It is observed that (strike out whichever is not applicable):-

- The RBMV conforms to all the laid down specifications.
- The RBMV conforms to all the laid down specifications except those at Sl. No._____.
- The above deviations are minor/major affecting/not affecting the performance of the equipment in substantial way.

The following T and P/manuals/drawings are to be supplied along with the machine:

1. _____
2. _____
3. _____

Based on the above, the RBMV is certified/not certified to be conforming to the specifications.

The RBMV is approved/not approved for dispatch to _____ _____(Consignee) Indian Railways.

SIGNATURE AND DATE
INSPECTING OFFICIAL
(NAME AND DESIGNATION)
For and on Behalf of President of India

For M/s._____
_____

Annexure –VII

Particulars Required in Respect of the Rolling Stock under Consideration

A diagram showing elevation with salient dimensions :

a) Wheel spacing, Wheel diameter, bogie centres, and axle load.

I. Overall length of the vehicle :
II. Length over head stock :
III. Length over buffers :
IV. Distance apart for center of buffers :
V. Max./Min. height of centers of buffers(above rail level) :

b) I. Wheel base :
II. Axle load (max) :
III. Maximum axle load per meter
IV. Type of bogie
V. Weight of each bogie
VI. Weight of each bolster
VII. Bogie Centres :

Wheel dimension :
I. New :
II. Worn out :

I. Tread and flange profile of the wheel indicating clearly whether it is Indian Railways standard profile or differs from standard flange profile. :
II. Wheel gauge dimension (back to back of tyre flange). :

Whether the stock is designed to be used as a general purpose or in a closed ci in specified sections under defined conditions. :

Maximum design speed :
I. Own Power :
II. In train formation

Unsprung weight per axle in tonnes
I. Driving axle :
II. Running axle :

Sprung weight per axle in tonnes
I. Driving axle
II. Running axle

Sprung mass on primary suspension

Stiffness of suspension coil spring/magi spring

Rate of deflection of primary spring

Number of springs per nest

Expected lateral force in tonnes per axle At maximum design speed. :

Increase in the impact load during motion(Dynamic Augment) :

Method of operation -
Whether single only or coupling together is possible. If coupling is possible, the number which can be coupled and what is trailing load. :

Maximum tractive effort per axle in tonnes –

I.	At working drive	at start
		at operation speed
II.	At transfer drive	at start
		at maximum speed

Maximum braking force coming on to the rails per wheel
at working axle:
at transfer axle:

Drawing indicating suspension arrangement details of bogie and axle:

Height of centre of gravity from rail level:

Height of floor from rail level:

Type of coupler provided -Indian Railways Standard
I. Coupling:
II. Buffer:

Engine Make, Model, Power Rating etc:

Any infringement to the moving dimensions:
(Sketch provided in the Indian Railways Standard Schedule of Dimensions – Chapter IV (A)).

Annexure – VIII

Following information as detailed below is also required along with the information required for processing the case for issue of provisional speed certificate for new vehicles

Name of the machine _____ Model_____

Sr.No	Item
1.	a) Brake System details
	b) Gross Braking Ratio
2.	Brake rigging arrangement drawing and calculation of braking force
3.	Maximum Braking Effort. at start and at the speed of operation - a) At working drive at start : at operation speed : b) At transfer drive at start : at maximum speed :
4.	Characteristics of springs used in suspension indicating free height, working height, dynamic range, stiffness and locations etc.
5.	Characteristics of the dampers if used, and over all damping factors and locations of dampers. Calculation of the following frequency of the vehicle to be attached :- i) Bouncing ii) Pitching iii) Rolling Wave length of free axle and bogie
6.	Write up and salient design calculation on suspension system, type of suspension-whether it is of coil suspension with or without dampers and laminated bearing springs and double link suspension.
7.	What are lateral clearance of axle box/worn wheel flange/rail and other locations for the negotiability of the vehicle on curve and turn out (enclose Vogel's diagram for negotiability on maximum degree of curve and turn out permitted on Indian Railways) of new and worn out wheel.
8.	Wheel and axle assembly drawings.
9.	Calculation for flange force.
10.	Technical specifications of Vehicle supplied.
11.	Calculation of natural frequency.
12.	Calculation of spring characteristics and critical speed of the vehicle.
13.	Simulation result showing ride index, lateral force and acceleration results.
14.	A certificate regarding the speed of the vehicle for which it has been designed.

Annexure-IX

ACCEPTANCE CRITERIA DURING OSCILLATION TRIALS

1. The speed potential of the machine offered by the supplier should be established based upon oscillation trials conducted in India. The tests will be conducted at speed usually 10% higher than the maximum speed potential indicated by the supplier for the machine under consideration and the following criteria satisfy for the same. For conducting the tests, a section of mainline track will be selected as per Third Report of the Standing Criteria Committee, Revision-1: Criteria for assessment of stability/riding of rolling stock, (Document No. TG-CR-4.2.3-2, March 2013) with latest amendment over which there is no temporary speed restrictions and which is considered by the Railway as being in a generally run down condition for mainline standards, but without speed restrictions. The vehicle will be tested generally for new and worn wheel clearance conditions and where relevant for operation in the forward and backward directions. The vehicle selected for tests will be one in average condition for normal maintenance.

2. The criteria applicable for establishing speed potential as per Third Report of the Standing Criteria Committee as applicable on date (21.04.2022) is given below for general information purpose which may be amended from time to time will be as follows:

   I. A lateral force lasting over a length more than 2 metres should not exceed the Prud-Homme's limit of K (1 + P/3) tonnes. Where P is the axle load in tonnes, K=0.85 for wooden sleepers and K= 1 for concrete sleepers.
   II. Isolated peak values exceeding the above limit are permissible provided the record shows establishing characteristics of the vehicle subsequent to the disturbances.
   III. A derailment coefficient should be worked out in the form of ratio between the lateral force (Hy) and the wheel load (Q) continuously over a period of $1/20^{th}$ second, the value Hy/Q shall not exceed 1.
   IV. The values of acceleration recorded in the cab at location as near as possible to the bogie pivot (as near as possible to axle in case of four wheelers) shall be limited to 0.55 g both in vertical and lateral directions. The peak values up to 0.60 g may be permitted if the records do not indicate a resonant tendency in the region of peak value.
   V. In the case of such vehicles where measurement of forces is not possible, the evaluation shall be in terms of ride index based on the accelerations measured as detailed in Para 2 (IV) above which shall not be greater than 4.5 but a limit of 4.25 is preferred.
   VI. A general indication of stable running characteristics of the vehicle as evidenced by the movements of the bogie in straight and curved track with cant deficiency as prescribed in IRPWM-June, 2020 with latest amendment and lateral force and derailment coefficient of accelerations as the case may be.

3. **SELECTION OF TEST TRACK (**Third report of the standing criteria committee, revision-1: Criteria for assessment of stability/riding of rolling stock, (Document No. TG-CR-4.2.3-2March-2013) with latest amendment**:**

3. Oscillation trials shall be conducted over a section containing the following:

3.3.1. A Tangent (straight) track - of about 1 km length. Efforts shall be made to conduct trials over two such stretches.
3.3.2. A Station Yard having facing/trailing points, and
3.3.3. A curved track having about 2ºcurves of length about 700-800m. Normally, above criteria shall be applicable. However, in case of non-availability of 2ºcurves fit for requisite speed, following shall be applicable:

- For C&M I Vol I Standard Track: A curved track having 1.75º to 2.2ºcurve of about700-800 m and a curved track having 0.5º to 1ºcurve of length about 700-800 m.

- For other than C&M I Vol I Standard Track: A curved track having $1.75^0$to 2.2^0 curve of about 700-800 m and a curve track having $1^0$to 1.5^0curve of length about 700-800 m.

4 Indian Railways track is classified in two categories:

- Main line track - fit for operation less than 110 Kmph,
- High Speed (C&M I Volume I) track, permitting operation upto 160 kmph.

5 Since main line standard track permits speeds less than 110 kmph, in case the test vehicle is designed to run at speeds 110 kmph and beyond, its Oscillation trials become necessary on High-Speed track also.

6 A vehicle suspension should be so designed that it should be able to run freely on all Indian Railways tracks (in certain cases, it may become necessary to place a restriction in running of vehicle on some track structures due to various reasons). Since Oscillation trials cannot be conducted all over the Railway system, the section chosen for detailed Oscillation trials should be a representative 'run down' section. The section should generally be such that 90% of Indian Railways track should be better than this section - the philosophy being that if a vehicle manages to run satisfactorily on this track stretch, it will be able to run satisfactorily anywhere else on Indian Railways.

7 At present, the track geometry parameters are 'peak based' and not Standard Deviation based. Subject to fulfilment of stipulations of 2.4 above, the parameters of the selected track should be as per the following:

Parameters	**Main line Standard (Speeds below 110 kmph)**
Unevenness	B or C
Twist	B or C or D
Gauge	B or C
Alignment	B or C

Parameters	Category	Extent of irregularities
Broad Gauge		
(1) Unevenness (3.6 M chord).	A B C D	0-6 mm. (inclusive) 6 mm. (exclusive) to 10 mm. (inclusive) 10 mm. (exclusive) to 15 mm. (inclusive) Above 15 mm
(2) Twist (3.6 M base) Note- 1 mm./M = 3.6 mm. on chart	A B C D	0-5.0 mm. on chart (up-to and inclusive of 1.39 mm./M) 5-7.5 mm. on chart (1.39 mm./M to 2.08 mm./M inclusive) 7.5-10.0 mm. on chart (2.08 mm./M to 2.78 mm./M inclusive) Above 10.00 mm. on chart (above 2.78 mm./M.)
(3) Gauge	A B C	Up-to and ±3 mm. (inclusive) ±3 mm to & ±6 mm. (inclusive) Above ±6 mm
(4) Alignment (7.2 M. chord)	A B C	Up-to 3mm versine (inclusive) More than 3 mm and less than 5 mm versine. 5 mm. versine and above.

For certain trials only limited sections can be available due to constraints of axle load, speeds, bridges, signaling, structures etc. For such limited sections, if test stretches are not available as per above criteria, stretches should generally be selected such that 90% of the track of these limited sections should be better than the stretch chosen for conduct of trials for issue of speed certificate. However, the limitation of trial shall be clearly indicated in speed certificate issued subsequent to such trials.

8 After detailed oscillation trials have been completed and the safe speed thereby determined, a 'Long Confirmatory Run' should be conducted in each of the configurations as per requirement. The basic idea of the 'long run' is to confirm that the values of parameters are in general conformity with the values found in the detailed trial section.

(a) Cover a long distance (say, 10-50 kms) at the maximum speed determined by oscillation trials of the configuration.
(b) Cover a few 'hard spots' like level crossings, culverts and bridges as far as possible. Riding of the vehicle over such points (resonance or amplitude build up) will be specially mentioned in the trial report.

Annexure-X/A

List of Equipment & Tools to be kept on RBMV

S.No.	Description of items to be kept on RBMV	Length (cm)	Width (cm)	Height (cm)	Qty.	Unit Weight (Kg)	Total weight (Kg)
1.	Walkie Talkie (04 sets in a box)	20	10	10	4 sets	01	04
2.	Portable field telephone	15	15	15	1	04	04
3.	Disc cutter	107	42	95	1	30	30
4.	Rail cutting machine	110	50	60	1	65	65
5.	Rail drilling machine	103	45	57	1	60	60
6.	Chamfering kit (Torque wrench, chamfering unit, box wrench etc. in a box).	130	20	20	1	12	12
7.	Rail welding equipment with hydraulic (mechanical tensor)	450	60	80	2 set	785(635)	1570 (1270)
8.	Weld Trimmer Power-Pack Trimmer-	117 120	37 62	55 28	1	150	150
9.	Rail profile grinder K-oil operated (electrical operated)	102	46	35	1	80 (30)	80 (30)
10.	4 no. off-track hand-held tamper with 2 generators Generator Set – Tools (brief case) -	80 62	45 41	70 14	1 set	180	180
11.	Lifting jack-Hydraulic (mechanical)	30	16	25	4	21 (11)	84 (44)
12.	Lifting cum slewing device- TRALIS	70	80	60	2	60	120
13.	De-stressing items (complete set for de-stressing 3 km LWR)						
13.1	Rail Tensors- Hydraulic (mechanical)	170	40	30	2 sets	350(200)	700(400)
13.2	600 rollers, (one roller @ 10 m) (in a box) (for 3 km)- (for 1 km)-	110 (110)	30 (30)	312 (104)	1 set	1500	1500
13.3	30 wooden mallets	92	28	15			
14.	PWI Inspection kit including vernier, micrometer, rail thermometer, etc, having 26 items	50	10	38	1	10	10
15.	Gauge-cum-level	185	8	7	1	3.5	3.5
16.	Rail dolly	323	80	94	6	80	480
17	Rail (mono) cum road trolley	65	40	30	2	18	36
18.	Warning system consisting of				1 set	2	2
18.1	Red banner flag				2	-	-

18.2	Red hand signal lamp	30	25	25	1	-	-
18.3	Green hand signal flag				1	-	-
18.4	Detonator (In a Box)				10	-	-
18.5	Remote control hooter	25	12	25	1	12	12
19.	Gas cutting equipment with accessories				1	5	5
A.	Weight of equipment excluding de-stressing material as mentioned in item no.13						2908(2505)
B	Weight of equipment excluding off-track tamper materials as mentioned item no.10, 11 & 12						4712 (4062)
C	Additional weight of equipment T&P, manpower normally to be loaded on the RBMV						2081
D	Design Weight (A+C)						(4989)-5t

Note:

i) During de-stressing, fastening will also be required for casual/ through renewal. The same will be transported separately.

ii) The Gang tools like crow bars, hammer, beaters, rail tongues etc. required for de-stressing work will be transported separately.

iii) It is assumed that during de-stressing work, the item listed at sl.no.10, 11 & 12 shall not be used. Also T&P required for 1.0 km of de-stressing shall only be taken to site.

iv) It is assumed that de-stressing work is not required for the whole year. As such the items listed at sl.no.13.1 and 13.2 shall not be required to be taken to site all the time. With 5 t design payload capacity, and minor adjustment of T&P, machines etc, required for specific site, it will be possible to take care of most of the situation for which the RBMV shall be use.

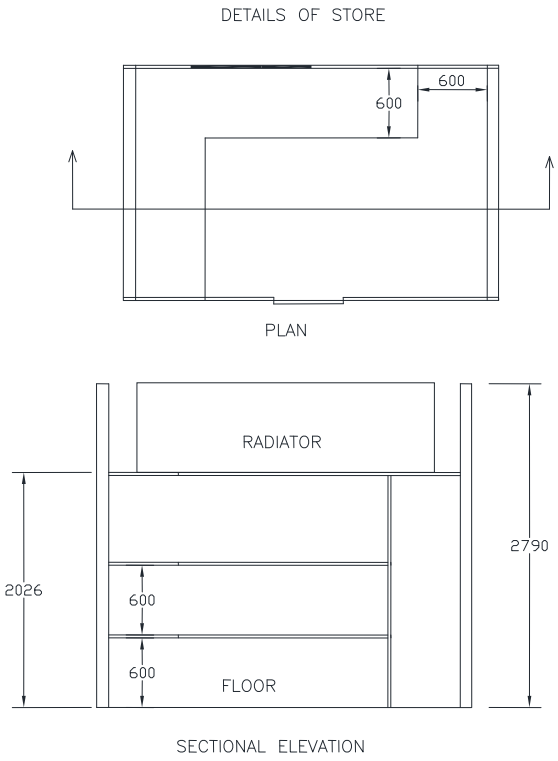
Annexure-X/B

ADDITIONAL LIST OF EQUIPMENT, TOOLS & MANPOWER NORMALLY REQUIRED FOR MMU-1 ALONG WITH THEIR WEIGHT TO BE LOADED ON RAIL BORNE MAINTENANCE VEHICLE (RBMV)

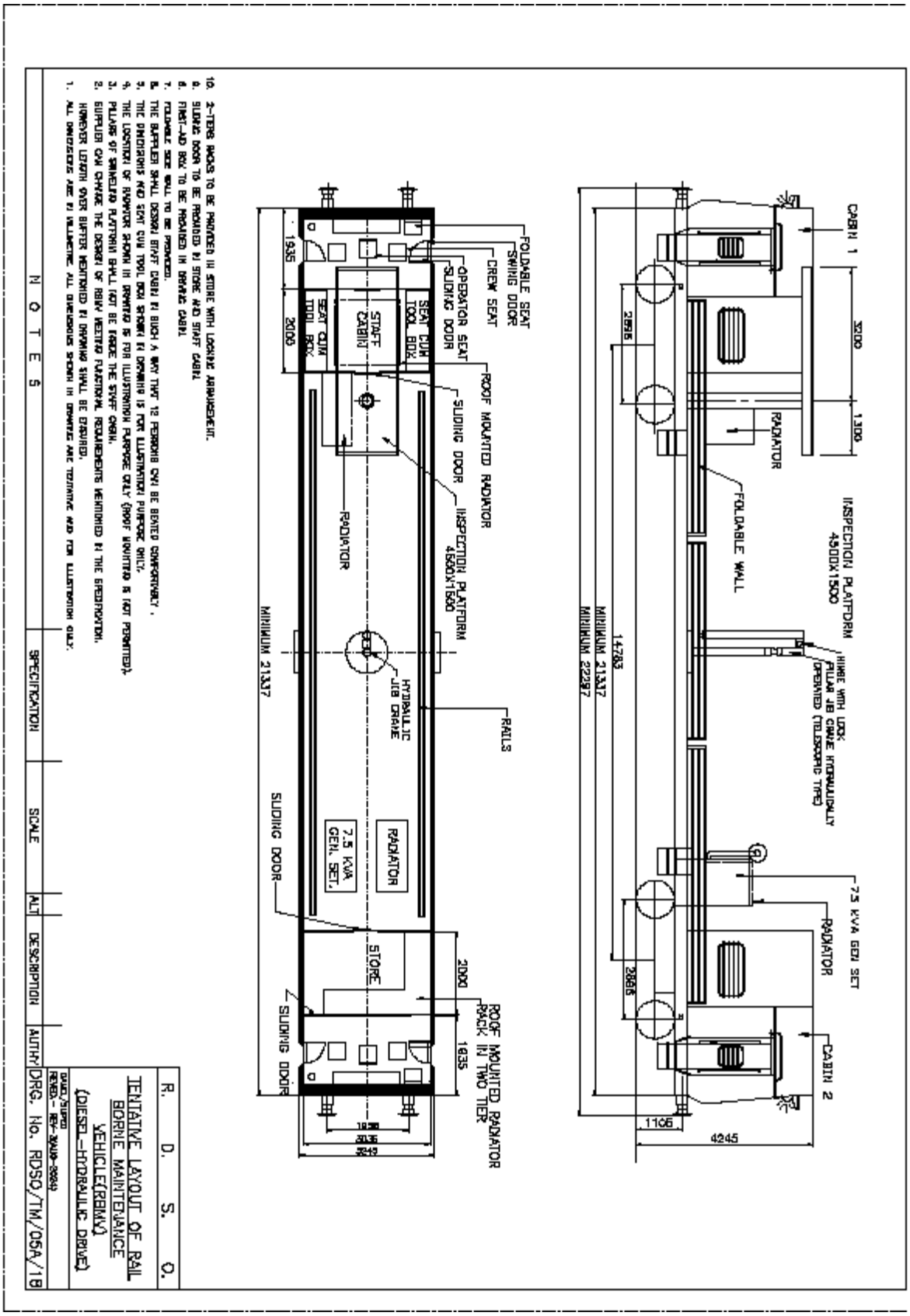
S. No.	Description of items to be kept on RBMV	Length (cm)	Width (cm)	Height (cm)	Qty.	Unit Weight (Kg)	Total weight (Kg)
1.0	Manpower				15	65	975
2.0	First-Aid Box	25	15	20	1	3	3
3.0	60 kg rails of 6.5m length/Glued joints	650	16	18	2	390	780
4.0	Gang tools						
4.1	Crow bar				2	35	70
4.2	Rail tongs				2	10	20
4.3	Beater				2	5	10
4.4	Hand Claw				2	1	2
5.0	Fastening						
5.1	ERC, Steel/GFN liners, rubber pads				5 each	1.4	7
5.2	SEJ bolt				1	1	1
5.3	130 mm size bolts	30	30	20	4	1	4
5.4	Stretcher bar bolt				1	5	5
5.5	Wooden block + clamps	30	25	20	2+2	15	60
5.6	Joggle fish-plate (One 60 kg + one 52 kg)	64	4	12	1+1	32	64
5.7	One meter long fish-plate (One 60 kg + one 52 kg)	100	4	12	1+1	40	80
~~6~~						Grand Total	2081

Annexure-XI

Tentative Layout of Store Rake



Annexure-XII/A

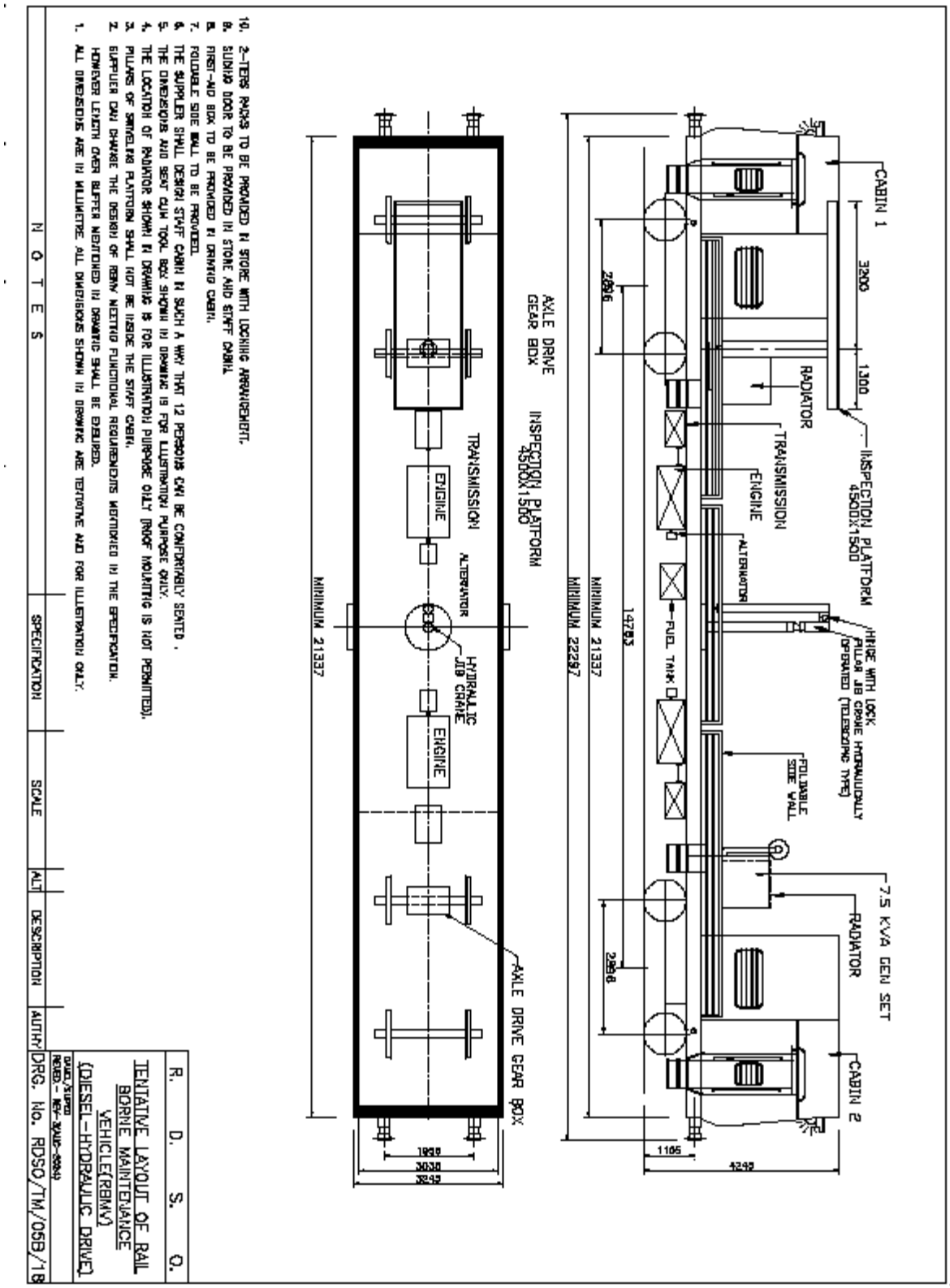


N O T E S

1. ALL DIMENSIONS ARE IN MILLIMETRE. ALL DIMENSIONS SHOWN IN DRAWING ARE TENTATIVE AND FOR ILLUSTRATION ONLY.
2. HOWEVER LENGTH OVER BUFFER MENTIONED IN DRAWING SHALL BE ENSURED.
   SUPPLIER CAN CHANGE THE DESIGN OF RBMV WEITHT PLATFORM REQUIREMENTS MENTIONED IN THE SPECIFICATION.
3. PILLARS OF SWIVELLED PLATFORM SHALL NOT BE FIXED TO THE STAFF CABIN.
4. THE LOCATION OF RADIATOR SHOWN IN DRAWING IS FOR ILLUSTRATION PURPOSE ONLY (ROOF MOUNTED IS NOT PERMITTED).
5. THE DIMENSIONS AND SEAT CUM TOOL BOX SHOWN IN DRAWING IS FOR ILLUSTRATION PURPOSE ONLY.
6. THE BUFFERS SHALL DESIGN STAFF CABIN IN SUCH A WAY THAT 12 PERSONS CAN BE SEATED COMFORTABLY.
7. FOLDABLE SIDE WALL TO BE PROVIDED.
8. FIRST-AID BOX TO BE PROVIDED IN STORE AND STAFF CABIN.
9. SLIDING DOOR TO BE PROVIDED IN STORE AND STAFF CABIN.
10. 2-TIERS RACKS TO BE PROVIDED IN STORE WITH LOCKING ARRANGEMENT.

						R. D. S. O.
						TENTATIVE LAYOUT OF RAIL BORNE MAINTENANCE VEHICLE(RBMV) (DIESEL-HYDRAULIC DRIVE)
						DRAWN/TRACED REVISED - REF- 3939-2024
		SPECIFICATION	SCALE	ALT	DESCRIPTION	AUTH/ DRG. No. RDSO/TM/05A/1B

Annexure-XII/B



NOTES

10. 2-TIERS RACKS TO BE PROVIDED IN STORE WITH LOCKING ARRANGEMENT.
9. SLIDING DOOR TO BE PROVIDED IN STORE AND STAFF CABIN.
8. FIRST-AID BOX TO BE PROVIDED IN DRIVING CABIN.
7. FOLDABLE SIDE WALL TO BE PROVIDED.
6. THE SUPPLIER SHALL DESIGN STAFF CABIN IN SUCH A WAY THAT 12 PERSONS CAN BE COMFORTABLY SEATED.
5. THE DIMENSIONS AND SEAT CUM TOOL BOX SHOWN IN DRAWING IS FOR ILLUSTRATION PURPOSE ONLY.
4. THE LOCATION OF RADIATOR SHOWN IN DRAWING IS FOR ILLUSTRATION PURPOSE ONLY (ROOF MOUNTING IS NOT PERMITTED).
3. PILLARS OF SWIVELING PLATFORM SHALL NOT BE INSIDE THE STAFF CABIN.
2. SUPPLIER CAN CHANGE THE DESIGN OF RBMV MEETING FUNCTIONAL REQUIREMENTS MENTIONED IN THE SPECIFICATION. HOWEVER LENGTH OVER BUFFER MENTIONED IN DRAWING SHALL BE ENSURED.
1. ALL DIMENSIONS ARE IN MILLIMETRE. ALL DIMENSIONS SHOWN IN DRAWING ARE TENTATIVE AND FOR ILLUSTRATION ONLY.

NO.	DESCRIPTION	AUTH	DATE
ALT			

SCALE

SPECIFICATION

R. D. S. O.

TENTATIVE LAYOUT OF RAIL BORNE MAINTENANCE VEHICLE(RBMV) (DIESEL-HYDRAULIC DRIVE)

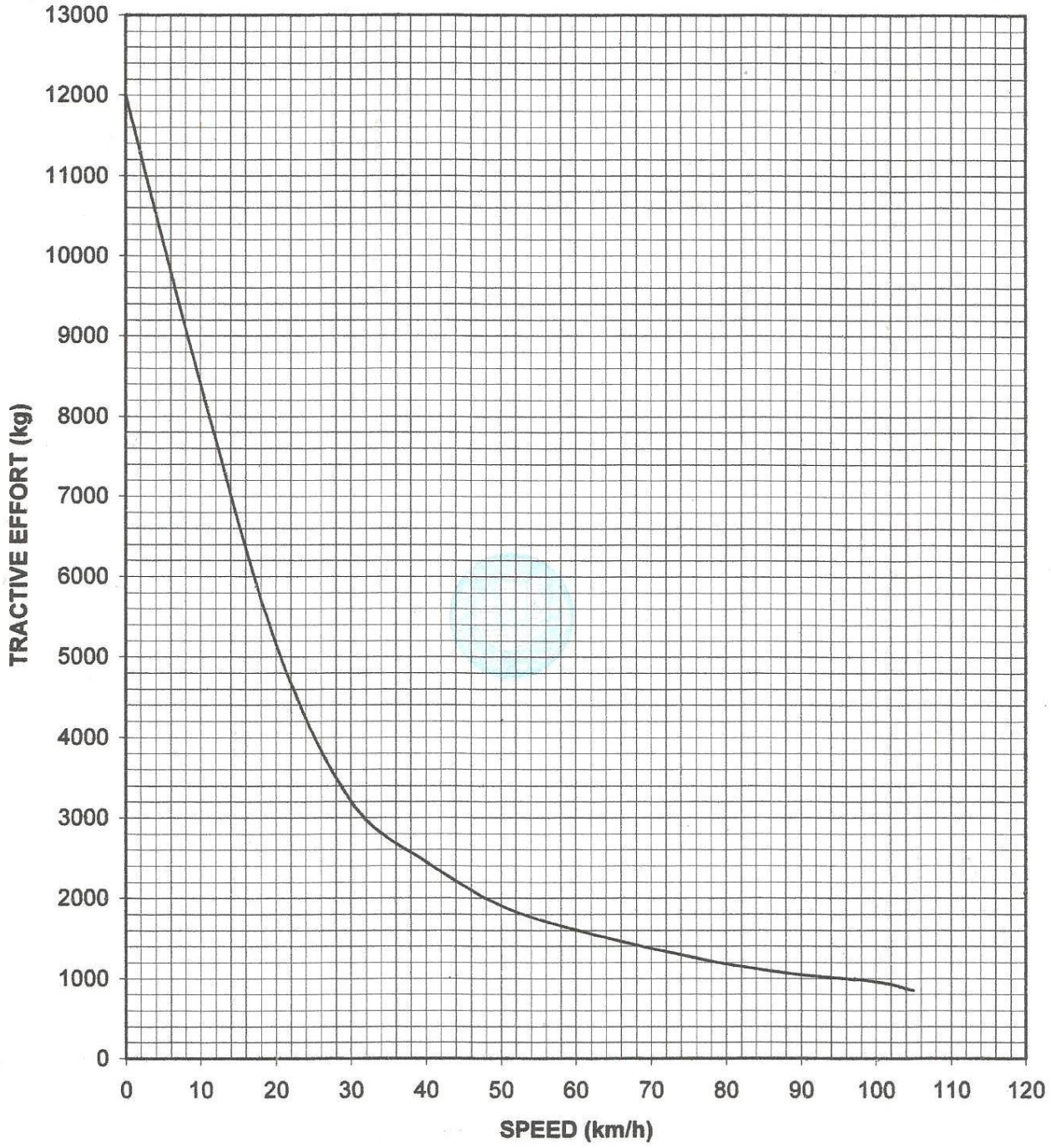
DRAWN/TRACED
REVISED - NOT TO BE REVISED

DRG. No. RDSO/TM/05B/18

ANNEXURE-XII/B

Annexure-XIII

TRACTIVE EFFORT Vs SPEED CURVE FOR RAIL BORNE MAINTENANCE VEHICLE (RBMV)



Annexure-XIV

Salient features of the Braking System of the Machine

1.0 Braking System

Machine should be equipped with proper braking system to ensure safety and controls the machine in case of an emergency as well as in routine operation while moving in travel, working and train formation mode.

1.1. The machine shall be fitted with the compressed air brakes system which shall apply brake equally on all wheels and provision shall be made to connect the Indian Railways standard locomotives.

2.0 Vehicle should have provision of following braking mechanism.

2.1. Direct Brakes:

Machine should have provision of direct braking system to be operated by compressed air. The pneumatic valve should be provided to operate at system pressure of 7 kgf/cm^2 with dual type pressure gauge, Air regulator and Reservoir. SA-9 Brake system with hand lever being used in Indian Railways may also be used. Effective braking distance certificate should be submitted at ruling gradient of 1 in 33, 1 in 60 and for flat locations. This system is applicable for machine braking only. This system should be provided in both cabins.

2.2. Indirect Brake:

Indirect Brake should be capable to stop the machine in case of pressure drop and should be compatible to connect with Indian Railways standard locomotives. This indirect braking system should have separate Air reservoir, KE valve and Air charging valve with through connected steel Brake pipes to connect Locomotives in travel mode during pulling of vehicle in train formation. System may have existing braking A-9 type of valve being used in Indian Railways. Manufacture design should have compatibility to connect Locomotive of Indian Railways train brake system. This system should be provided in both cabins.

2.3. Emergency Brakes:

This system should be connected with indirect braking system for sudden braking in emergency. This system shall be equipped with Pneumatic valve. Operation of Pneumatic valve should be with hand lever. This emergency system shall be connected with BP of machine and shall be operative through indirect braking system. This system should be provided in both cabins.

2.4. Mechanical Parking brake:

Machine should be equipped with wheel operated system connected to braking lever with rigid chain link arrangement. This system should be capable to stop the machine in rolling

condition during emergency. This shall also be used after parking of machine to prevent rolling of machine in standstill condition. This system should be provided in one cabin only.

2.5. Parking brake:

Machine should be equipped with spring loaded pneumatically operated parking brake system. In this system, braking of one bogie is to be carried out with spring loaded Pneumatic Cylinder. Brake should automatically be applied on wheels if air pressure falls below 3 bar or by application of knob after parking of vehicle. There shall be also an easy arrangement to release the parking brake in case of emergency.

Annexure-XV

Check list for drawings, documents, certificates etc.

SN	Documents/Drawings	Contract specification clause no.	Submitted (Y/N)
1.	Welding standard certificate.		
2.	Dynamic simulation report		
3.	The details design calculation along with material parameters and standard followed for manufacturing of wheels and test reports as per standard followed.		
4.	The details design calculation along with material parameters and standard followed for manufacturing of non-powered axle and test reports as per standard followed.		
5.	The details design calculation along with material parameters and standard followed for manufacturing of powered axle and test reports as per standard followed.		
6.	Hauling capacity of machine		
7.	Tenderer shall furnish following information: (i) Make and model of the engine (ii) Name of agency which will provide after sales support and assured supply of spare parts (iii) Details of diesel engines and its conformity with the engines already operating on track machines in Indian railways		
8.	Fuel tank capacity		
9.	Supplier shall provide the necessary technical details and circuit diagrams of all electronic/electrical, hydraulic and pneumatic parts.		
10.	Types of brakes (i) Direct (ii) Indirect (iii) Emergency brake (iv) Spring loaded parking brake (v) Mechanical parking brake		
11.	List of safety equipments		
12.	Emergency backup system details		
13.	List of tool kit, manuals (Operating, Maintenance & Spares parts list), circuit diagram (electrical, hydraulic & pneumatic) and technical literature/drawings and troubleshooting guides/manuals in English language for operation, servicing, maintenance, assembly overhauling and periodic overhauling.		
14.	Dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc.		
15.	Detailed technical drawings and specifications (along with dimensional drawings for preparation of ultrasonic testing procedure) of all types wheels and axles used in the machine.		

16.	Details of portable diesel operated D.C. welding generator.		
17.	The tenderer's shall quote, apart from main equipment, separately for the mandatory spares as well as for recommended spares required for two years of operation along with description of part number, quantity, cost, whether imported or indigenous. The expected life of components/spare parts shall be advised along with their condemning limits. The supplier shall be responsible for the subsequent availability of spare parts to ensure trouble service for the life of the machine (25 years).		
18.	Advantages/functions of optional equipment, if provided and also indicate whether such equipment is already in use on machine elsewhere indicating the user railway system.		
19.	Copies of the Maker's certificate guaranteeing the performance of the machine shall be supplied in duplicate along with the delivery of each machine.		
20.	Documents and drawings (duly signed with seal) in English language in hard (A3 size) & soft copies with high resolution		
21.	Infringement Description		

List of drawings		
SN.	**Item**	**Compliance status (Y/N)**
1.0	GA drawing & MMD	
2.0	Suspension drawings	
3.0	Worn wheel profile	
4.0	Bogie arrangement drawing (type of bogie)	
5.0	Coupler & buffer drawing (type of coupler)	
6.0	Air brake circuit drawings	
7.0	Brake rigging arrangement drawing	
8.0	Engine make, Model & power	
9.0	Transmission system details	
10.0	EBD Calculation	
11.0	Vogel diagram	
12.0	Dynamic Simulation Results	
13.0	EMI/EMC certificate	
14.0	Technical Details (Annexure) of technical specifications	

Annexure-XVI

List of dimensions to be marked in drawings and details required to be submitted:

SN	Infringement Description	Status (Y/N)	(To be marked in)
1.0	**Wheels & Axles**		
1.1.	Wheel gauge, or distance apart, for all wheel flanges		Worn wheel profile
1.2.	Wheel diameter on the tread of new carriage or wagon wheel, measured at 63.5 mm from the wheel gauge face.		
1.3.	Projection for flange of new tyre, measured from tread at 63.5mm from wheel gauge face		
1.4.	Thickness of flange of tyre, measured from wheel gauge face at 13 mm from outer edge of flange.		
1.5.	Width of tyre		
1.6.	Incline of tread		
1.7.	Worn out wheel diameter		
2.0	**Height of Floors**		
2.1.	Height above rail level for floor of any unloaded and loaded vehicle		GAD
3.0	**Buffers & Couplings**		
3.1.	Distance apart for centres of buffers		GAD
3.2.	Height above rail level for centres of buffers & CBC couplers Max (unloaded): Min (loaded):		
3.3.	Bogie type		
3.4.	Coupler type		
4.0	**Wheel Base & Length of Vehicles**		
4.1.	Distance apart of bogie centres for bogie vehicles.		GAD
4.2.	Rigid wheel base for bogie truck of any vehicle		
4.3.	Length of body or roof for bogie vehicles.		
4.4.	Length over centre buffer couplers or side buffers for bogie vehicles.		
4.5.	Distance apart between any two adjacent axles		
4.6.	Distance from adjacent bogie centre to end of body or roof on either side of vehicle		
4.7.	Length of the machine over headstock		
5.0	**Maximum Moving Dimensions (In Diagram ID)**		
5.1.	MMD drawing No. is to be mentioned		GAD
5.2.	Maximum width of Vehicle		GAD & MMD
5.3.	Maximum height above rail level at centre		MMD
5.4.	Maximum height above rail level at sides		MMD
5.5.	Minimum height (clearance) above rail level when fully loaded		GAD & MMD
6.0	**Details of joint between vehicles if more than one unit**		**GAD**

7.0	**Technical information of vehicles**		
7.1.	Maximum Design Speed (Own power & In train formation)		GAD
7.2.	Maximum Axle Load (in empty and loaded condition)		
7.3.	Maximum Tractive Effort per axle in tones		
7.4.	Maximum Braking Force per axle in tones		
7.5.	Weight of Vehicle (Tare & Gross) in tones		
7.6.	Height of Centre of Gravity (CG) of vehicle above rail level		
7.7.	Engine Make, Model & power rating		

Annexure-XVII

Safety Equipment

Sr. No.	Item Description	Quantity
1.	Hooter (manually operated)	2 nos.
2.	Wooden Blocks	4 nos.
3.	Crow bars	4 nos.
4.	Emergency pneumatic/hydraulic hose off sizes (complete with end fitting)	-----
5.	4 cells flasher light LED lamp cum flasher light (rechargeable)	1 no.
6.	Skids	4 nos.
7.	Safety Helmet	For all Staff
8.	Protection clothing , safety shoes, safety goggles and safety gloves	For all Staff
9.	Reflective Safety Jacket	For all Staff
10.	Tail lamp	1 no.