TECHNICAL SPECIFICATION FOR DYNAMIC TRACK STABILIZER FOR BG (1676 mm Gauge) (Specification No. TM/HM/DTS/379 Rev. 03 of 2024)

1.0 GENERAL

1.1 Conventional tamping machines are used for levelling, tamping and lining work of track. These maintenance operations for correcting track parameters require lifting of track and it in turn result in reduction in lateral stability of track. Due to reduced lateral stability, the track parameters achieved after tamping is likely to get disturbed after passage of train, making tamping redundant, and also rendering track unsuitable for high speeds immediately after maintenance. With the increased quantum of traffic moving at high speeds, it is very essential to restore the stability of track as early as possible. This specification has been drafted for on track stabilising machine which can be put to work behind tamping machines to achieve desired consolidation of track and to obviate the need to impose speed restrictions immediately after maintenance tamping as also for faster relaxation of speed restrictions after Track renewal/deep screening. These specifications have been designed for such a Dynamic Track Stabilizer hereinafter called “machine’’.

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

1.3 The tenderer 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 para '3.0' in particular and all the items of the specifications in general shall be described in detail in the “Technical Description”, along with the sketches to show the manner in which the requirements of the specifications are accomplished by the machine (model) offered.

1.4 Photographs and videos of the type of machine/other similar type of on-track machines manufactured offered in work mode and technical literature shall be enclosed with the offer. This shall also show close-ups of various working assemblies/systems and the full machine/other similar type of on-track machines. The tenderer shall furnish a video in USB showing the working of machine other similar type of on-track machines under field condition. 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 diesel powered machine shall be robust, reliable and suitable for working on Broad

Gauge (1676 mm) Indian Railways. The design and dimensions of the machine components shall be to metric standards and shall comply with provision of Indian Railways Schedule of Dimensions -1676 mm gauge (BG), revised, 2022 with latest corrigendum and up-dated correction slips issued. Quality assurance during manufacturing of the machine shall be according to ISO-9001. The welding standard followed for manufacturing of machine shall be to ISO:3834, EN:15085 or any other equivalent standard for welding of railway vehicle and components. The manufacturer shall specify the standard followed and certify that it meets the welding standard mentioned above. The machine shall be suitable for working on straight, transition and curved tracks (up to 10 degree) on Broad gauge (1676 mm) of Indian Railways.

2.2 The machine shall be a self-propelled bogie type vehicle with minimum 4 axles (2 bogies).

2.3 In the past Indian Railways have condoned certain infringements to the Indian Railways Schedule of Dimensions –1676 mm gauge (BG), revised, 2022 with the latest corrigendum and up to date correction slips issued of such dimensions as Rigid wheel Base, Length of stocks, Distance apart of bogie centres and maximum height of floor above Rail level in certain track machines after due consideration of their design features vis-à-vis safety and operation requirements of Indian Railways. However, condonation of an infringement in another track machine in the past does not by itself entitle the manufacturer to assume acceptance of the same in other track machines by Indian Railways. Where an infringement to Indian Railways Schedule of Dimensions –1676 mm gauge (BG), revised, 2022 with the latest corrigendum and up to date correction slips issued is considered necessary by the manufacturer as intrinsic to the design of the machine for meeting the work performance requirements laid down in this specification while meeting the safety and operational requirements of Indian Railways, the condonation of the same may be permitted by Indian Railways. However, only those infringements which are acceptable shall be permitted.

2.4 The profile of the on-track machine longitudinally and in cross section during transfer as self-propelled vehicle or towed in train formation as last vehicle shall be within the Indian Railways Schedule of Dimensions–1676 mm gauge (BG), revised, 2022 with latest corrigendum and up-dated correction slips issued. The minimum and maximum moving dimensions are enclosed as Annexure-I. The successful tenderer(s) shall 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 infringement while moving on a 10° curve at any cross section.

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

2.6 Wherever applicable, axle load of the machine shall be lesser than 20.32t with minimum axle spacing of 1.83 m while moving on track. Load per metre shall not exceed 7.67 t. Axle loads up to 22.82 t and lower axle spacing may be permitted, provided the load combinations do not cause excessive stresses in the tracks & bridges of Indian Railways. Stresses in the tracks & bridges shall be calculated by IR/RDSO based on design data submitted by the firm as per Annexure-VIII, and decision of IR/RDSO shall be final in this regard.

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 50mm margin between new and permitted worn wheel diameter should be 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 Railway 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 wheel to Indian railways, 3rd party/RITES Inspection certificate of the wheels to be provided in lieu of design and material parameters certificate.

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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 certificate for 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 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 The machine along with 8-wheeler coach/wagon (maximum gross weight 90 t approximately) shall be capable of continuously negotiating curves up to 10° curvature (175 m radius), super elevation up to 185 mm, maximum cant deficiency 75 mm and gradients up to 1 in 33 (3%) in travel mode. The supplier shall specify the minimum attainable speed by the machine under the above limiting conditions.

2.12 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°C to + 55°C
Altitude	: Sea level to 2250 m above mean sea level
Humidity	**:** up- to 100%
Maximum rail temp.	: 76°C

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

2.13 During transfer from one station to another, it shall be capable of travelling on its own as well as when hauled in a train formation as last vehicle at a speed of 70 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. The machine shall be capable of hauling an 8-wheeler coach/wagon (90 ton approximately) at the specified speed above in level track.

2.14 It shall be capable of working and travelling without requiring power block in electrified sections. 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.

2.15 While working as well as opening and closing of work on double/multiple line sections, it shall not infringe the adjoining track except on turnouts and it shall be possible to permit trains at full speed on that track. Minimum spacing of track is 4265 mm. The machine or its any part shall not infringe the adjoining track as per Schedule of Dimensions of Indian Railways, revised 2022 with latest correction slip issued, while opening and closing the work.

2.16 It shall be possible to drive the machine in both directions from both side cabins at the same speed.

3.0 WORKING MECHANISM

3.1 The Dynamic Track Stabilizer shall be put to work normally behind tamping machines. It shall be capable of working at varying speeds to achieve effective and continuous stabilisation of the track. It shall be capable of stabilizing not less than 2.5 km. of track in one hour of effective working. The stabilizing speed shall be adjustable infinitely at speeds from 0 – 2500 m/hour. When used behind tamping machine (with general lift of 20-30 mm) on concrete sleeper track with at least 100 mm clean ballast cushion, it should be able to increase the lateral ballast resistance of individual concrete sleepers on an average by minimum 25% of Lateral resistance left immediately after one pass of Dynamic Track Stabilizer. The method of estimating lateral ballast resistance and its increase is given in Annexure-X.

3.2 During the operation, the machine shall be capable of lowering the track in a controlled manner, while maintaining the pre-stabilized geometry. Proper longitudinal and cross-level control mechanisms shall be provided to achieve this. The manufacturer shall clearly explain the mechanism in its offer.

3.3 The machine shall be capable of continuous stabilization of track including typical Indian Railways concrete sleeper track. To achieve a lasting consolidation of such heavy track, the machine shall be equipped with two or more independent stabilizing units, applying equally a maximum vertical static load of 12 tonnes each.

3.4 To achieve a controlled lowering of the track, the stabilizing unit shall be capable of pre loading the track as mentioned in above clauses. While pre-loading the track by stabilizing unit, the driving wheels should provide adequate adhesion to avoid wheel slippage/loss of traction. To ensure sufficient traction and avoid the risk of derailment, the total weight of the machine shall be at least 2.5 times the maximum possible vertical stabilizing load.

3.5 The machine shall be capable of operation on various types of track structures like 90 R/52 kg/60 kg Long welded rails/short welded/fish plated rails laid on pre-stressed concrete sleepers with 100 mm to 350 mm ballast cushion. The horizontal and vertical force and frequency of vibration shall be adjustable so as to carry out effective stabilization on various types of track structures.

3.6 The machine shall be equipped with suitable mechanism to control the degree of settlement of the track. For this purpose, suitable hydraulic valves for controlled levelling system, automatically controlling the degree of settlement of track shall be provided. This installation shall copy the pre-stabilizing geometry by automatically increasing/relieving the vertical load on the stabilizing units. For optimum results, levelling system shall work independently for the left and right hand rail.

3.7 It shall be possible to steplessly preselect the frequency of vibrations which shall be between 0-45 Hz. for optimum adjustment to suite the various kinds of track structure.

During work near fixed structures like bridges/guard rail/check rail, it shall be possible to pre-select a frequency within that range which is beyond the natural frequency of the structure. In this context, it is also essential that the vibrations be automatically cut off, when the machine speed is below certain minimum speed to be specified by the manufacturer.

3.8 The machine shall be equipped with a frequency modulation measuring unit for optimum regulation of frequency. The machine shall be equipped with display units for monitoring vibration frequency, amplitude of vibration and degree of settlement on both rails.

3.9 To avoid damages on the rail surface by excess friction and force by the rollers and to achieve a force free resettlement of the ballast grains, only lateral vibrations shall be permitted and those lateral vibrations by stabilizing unit shall be created without any vertical impact.

3.10 It shall be able to work on single and double track sections as well as on platform lines.

3.11 It shall also be capable of working on points and crossing of 1 in 8.5, 1 in 12 and 1 in 16 crossing angles and laid on wooden/steel through/concrete sleepers.

3.12 It shall be capable of carrying out stabilization work in both directions in constant pressure mode.

3.13 For optimum stabilization of track behind deep screening and Track renewal, the machine shall be able to achieve it by increasing preload and adjusting frequency and other parameters. The machine shall have work in maximum settlement/constant load mode & controlled settlement/variable pre-load mode (levelling mode).

3.14 For working on concrete sleeper track, the manufacturer should suggest preload, frequency of vibration, speed of working, amplitude of vibration and adjustment of other parameters etc to achieve

i) Optimum consolidation behind tamping machine and simultaneously retaining post tamping track parameters.

ii) Maximum consolidation behind unconsolidated deep screened or new track.

The detail of track on PSC sleeper is attached as Annexure-IV .The manufacture shall also suggest the parameters for different possible track conditions except where there is embedded rail.

3.15 The machine should be equipped with a centralised computer based control and monitoring system which shall monitor the health of machine working system such as engine (lube oil pressure, temperature, rpm and engine running hours), hydraulics (hydraulic pressure in different units, temperature, oil level in tank), pneumatic (pressure of different units), electrical (charging/discharging rate, voltage) etc. All these data shall be displayed on a monitor installed in working cabin and there should be facility to store these data for 100 engine running hours. Minimum storage of 500 GB should be available for this purpose.

3.16 In addition to the computer system provided on the machine for its own controls, the machine shall be provided with an industrial quality heavy duty portable computer (Laptop-tough book) for keeping record of overall aspects of working, spares management and reporting. The detailed specifications of the laptop (Tough book) are enclosed as Annexure-V.

3.17 The machine shall be equipped with GPS, GSM/GPRS based remote monitoring capabilities for various track parameters and vital parameters of track machine, and it shall also have facility to interface with human machine interface (HMI)/display and various other sensors. The Dashboard shall ensure a comprehensive view of whole fleet and

highlights machines requiring attention with alert. Data for required machine maintenance shall be possible to be entered via the Dashboard, if required, which will be done by machine operator of IR. In addition to local storage at machine in the hard disk, these whole data shall be stored in cloud based software for further interlinking with Track Machine Management System (TMMS) by Indian Railways. The Software shall be made available for min.10 years incl. all required maintenance activities and updates. The SIM for data transfer shall be provided as well as Recharge of the same shall be ensured for min.10 years by the supplier(s).

3.18 Camera with monitor shall be provided for the assistance of operator if required. Besides this additional cameras shall be fixed on the machine so that video of the important working units of machine which are working on track, location of worksite and post-work track can be recorded. They shall have built-in function for recording and thus can record directly to any standard storage media, such as SD cards. Sufficient internal memory space of shall also be available to record CCTV footage for at least 30 days.

4.0 DIESEL ENGINE

4.1 The machine shall be powered by diesel engine 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. The manufacturer of the engine shall have acquired quality assurance certification of ISO:9001. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions mentioned in clause 2.12. Manufacturer of diesel engines, proposed to be provided on machine, shall have proven record of design, manufacture & supply of engines for heavy duty industrial use/locomotives application/track machines application/self-propelled railway rolling stocks (with speed potential as needed for machine or more) application.

4.2 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. The engine shall be of such design/brand which are being manufactured indigenously and/or such designs having after sale service facilities available in India. 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.

4.3 High-speed diesel oil to Indian Standard Specification shall be normally used. A minimum fuel capacity sufficient for continuous operation for 8 hrs shall be desirable. However, tank capacity in no case, shall be less than 1400 litres.

4.4 Sight glass type fuel measuring gauge of full height shall be provided on the fuel tank.

4.5 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 start 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. There shall be also an indicator for charging battery displayed on the panel board.

4.6 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.

4.7 There is a likelihood of dust deposition over the engine body and surrounding areas where the lubricants spill over. These 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 with imposition of power block of the OHE. 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.

4.8 Suitable and rugged mechanism shall be provided to start the prime mover at minimum/no load and gradual loading after the start of the prime mover. A fail-safe clutch mechanism should be provided to meet this requirement.

4.9 The engine power take off shall be coupled to the main gear box through a flexible coupling/cordon shaft (propeller shaft). The engine shall be mounted on suitable Anti Vibration Mountings.

4.10 The engine shall have Electronic Control Module (ECM) or similar arrangement for capturing operating parameters on real time basis such as rpm, fuel consumption, load, temperature, pressure and diagnostic data as well as trip and historical data. These data shall be displayed and stored on a centralized computer and monitoring system as mentioned in para 3.15 above. It shall also be possible to transfer these data on USB device through the centralised computer based control.

4.11 In order to adhere to pollution control norms, the diesel engine shall 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 devices to upgrade to higher emission norms in future.

4.12 The engine shall be enclosed in a weather protective, sound and dust resistant enclosure to minimise engine noise and to prevent oozing out of oil spills etc. from engine area to the exhaust manifold and adjacent machine components, hoses, electrical cables fittings as a protection against fire. All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance of the engine and allow good access to and visibility of instruments, controls, engine gauges, etc. Sufficient louvers shall be provided to allow the total engine cooling air requirements used in this application.

5.0 DRIVE MECHANISM

5.1 The machine shall be provided with an efficient traction drive system for traction during the operation. The machine's driving system shall be through hydro dynamically (for running) and hydro-dynamically/hydro-statically (for working) coupled power/transmission with shift arrangement capable of achieving full speeds in travel mode in both the directions. The supplier shall submit the self-certification for Electromagnetic compatibility (EMI/EMC) of the machine. The system shall be so designed that all the driving wheels work in synchronization and there is no slippage/skidding of the wheels during the work drive. The driving mechanism for travel drive shall be rugged to perform satisfactorily during the life cycle of the machine.

5.2 The driving mechanism, in working mode, shall be adequately designed to handle the acceleration and braking forces. A suitable synchronization circuit to control the synchronization of levelling process with the machine drive/braking system in working mode shall be provided to prevent any damage to the machine systems on account of non-synchronisation.

5.3 Suitable differential systems may be provided between coupled wheels on the same bogie.

5.4 Suitable flow divider/throttling arrangement may be provided to equalise the tractive effort amongst different powered bogies.

5.5 The tenderer shall provide the necessary technical details including circuit diagrams and detailed specifications of all electronic/electrical, hydraulic & pneumatic parts to conform the above requirements.

5.6 Adequate control equipment including gauges, instrument and safety devices shall be provided in working and driving cabins near operator's seat. Solenoid valves with indicator shall be provided near linkage assembly, for indication, flow control and carrying out necessary adjustments in the field.

5.7 To the extent possible, hydraulic and pneumatic component/assembly shall be fixed at suitable location, preferably on the side frame of the machine, so as to avoid the need of going on top of the machine for day- to- day maintenance schedules.

5.8 The pneumatic circuit shall be provided with air dryer, air lubricator, water separator and safety valves for the smooth working of pneumatic components.

5.9 The machine shall be equipped with adequate safety circuit such that any unit/part which may endanger the safety is unlocked, the machine shall not move during run drive. The indication of locking and unlocking of all units shall be displayed in the cabins.

5.10 Onboard system for online filtration and monitoring the quality of hydraulic oil in hydraulic circuit as required shall be provided. The gauge shall clearly indicate when the hydraulic oil is contaminated beyond the permissible limits and requires immediate replacement.

6.0 COOLING SYSTEM

6.1 The cooling system shall be efficient and designed for a maximum ambient temperature of 55°C (as per clause 2.12). Supplier may note that the machine shall be working under extreme dusty conditions and the cooling mechanism should be maintainable under these conditions.

6.2 Adequate heat transfer arrangement shall be designed and provided so that under extreme heat conditions as mentioned in para 2.12 above, the system oil temperature does not go beyond the range specified by the supplier.

7.0 BRAKES

7.1 The machine shall be fitted with compressed air-brakes system which shall apply brake equally on all wheels and provision shall be made to connect air brake system of the machine to that of camping coach/wagons when the machine 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 pneumatic parking brake shall also be spring loaded so that in case of drop in pneumatic pressure below certain value the brake will be automatically be applied. 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° 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. In addition, mechanical brakes shall also be provided for use as parking.

7.2 Machine shall be equipped with suitable arrangement of braking so that while working in train formation as last vehicle, machine can be braked by the traction vehicle having compressed air braking system. In addition, the machine shall be equipped with suitable air-brake systems in the driving cabins so that the attached wagons or coach while being hauled by the machine can be braked.

7.3 There shall be provision of emergency brake application using the compressed air in the machine either travelling alone or coupled with the coach/wagons, in addition to the normal braking system of the machine, using the compressed air. The emergency braking distance (EBD) of the machine on the Indian Railway Track, at the maximum design speed on level track shall not be more than 600 m. 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 should be provided by the supplier. Brake design details are to be submitted as per Annexure VI.

7.4 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.

7.5 The pneumatic parking brake should also be spring loaded so that in case of drop in pneumatic pressure below certain value the brake will be automatically be applied. Mechanical brakes shall also be provided in addition for use as parking. There shall be an easy arrangement to release the parking brake in case of emergency.

7.6 An annexure containing functional requirement on the Brake system of the vehicle is attached as annexure XII.

8.0 HORN, HOOTER AND SAFETY SWITCHES

8.1 The machine shall be provided with dual tone (low tone & high tone) electric/pneumatic horns facing outwards at each end of the machine at suitable location for use during travelling to warn the workman 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 at a distance of 5 meter from horn (source of sound). The higher tone horn shall have fundamental frequency of 370 ±15 hertz. These horns shall be operated by means of push buttons provided in the cabins.

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

8.3 Machine shall be provided with emergency backup system to wind up the machine 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 and may also use a manual hydraulic power pack in addition to the emergency generator/battery based electric hydraulic systems.

8.4 Pneumatically/electrically operated hooters capable of producing intensity of sound between 105-110 dB at a distance of 5 m (when measured in still air in a closed room) with variation in intensity of sound shall not be more than 5 dB shall be provided. 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. Additionally, 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 from remote switch at a distance of at least 300 m from the hooter.

8.5 Adequate numbers of safety stop/switches shall be provided all around so that in case of any danger to worker as well as hitting of any obstructions by working unit like signalling cable, joggle fish plate etc. during work, the operator can be warned or the machine can be stopped immediately. Safety stop indication should be displayed/glow in operator's cabin.

9.0 HOOKS AND BUFFERS

9.1 The machine 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 other vehicles for running in train formation and for attachment with the coach, locomotives and wagon.

10.0 HEAD LIGHT, FLASHER LIGHT, MARKER LIGHT AND OTHER LIGHTING ARRANGEMENTS

10.1 The electrical equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The machine shall be equipped with twin beam LED headlight assembly, conforming to RDSO specification no. RDSO/2017/EL/SPEC/0134 (Rev.03) with 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. The amber colour LED based flasher lights producing not less than 500 lux at 1 meter and 55 lux at 3 meter 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 on the machine to give indication for the train arriving on the other line about any impending danger. Preferably electric power of 24 V (maximum up to 110 V) shall be used for operation of any electrical circuit.

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

10.3 In addition to swivelling LED floodlights mentioned in para 10.1, powerful swivelling LED 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 eight 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. The power supply to all the fittings and sockets operated with 230/250 V AC shall be fed by welding plant as mentioned in clause no. 15.8. Illumination survey or light assessment or Lux level survey report shall be submitted by the supplier. Average illumination level shall be 15 Lux on 6 m meter width along the machine both sides and also up to 6 m length on both ends.

11.0 CHASSIS & UNDER FRAME

11.1 The chassis shall be of standard welded steel sections and of steel sheets so as to permit transportation of the machine in train formation without endangering safety of the train. The under frame shall be constructed with rolled steel section and/or plates and shall be designed to withstand a horizontal squeeze load of 102 t at CBC rear stop 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 last vehicle.

11.2 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. There should be no any rigid unit along the rail up-to 350 mm from wheel tread and 525 mm above rail level.

12.0 SUSPENSION SYSTEM

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

13.0 CABINS

13.1 The machine shall be equipped with fully enclosed, sound and heat insulated cabins with safety glass window at both the ends. It shall be possible to have a clear view of the track ahead while driving the machine in both the directions from the cabins at either end. The cabin layout shall be such that, before leaving the machine, the operating staffs has full view on both the sides, to avoid any danger to them from trains on the adjacent tracks. The design of cabin shall be as per UIC-651.

13.2 The gauges, instruments and control panel shall be suitably located in the operator's cab so that they can be observed without undue fatigue to the operator.

13.3 The operator's cabin shall be ergonomically designed to have easy access to all the controls. The operator shall have a full view of the working area from the operating seat to have a full control over the work.

13.4 The working cabins of the machine shall be air-conditioned for dust free atmosphere. The air-conditioning provided shall be of robust industrial design capable of operating in highly dust laden environment. The air-conditioning units shall not be roof mounted or under-frame mounted for safety and maintenance purpose. "However", the electronic equipment shall be so designed that they shall be capable of work without air-conditioning under the climatic conditions described in para 2.12**.**

13.5 On- screen wiper preferably operated by compressed air or electricity shall be provided on each of the wind screens.

13.6 The machine shall be provided with adequate space for keeping the tools and spares required for on-site repair of the machine to attend to the breakdowns and other working requirements.

13.7 If more than one cabin is used, necessary inter-communication system shall be provided inter-connecting all the cabins and shall be so oriented that the operator, seating on the seat of either cabins/working cabin, can distinctly hear the conversation.

13.8 The cabins shall have seating arrangement for six machine staff (total of both cabins) including 2 driving/working seats in each cabin.

13.9 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 should be retrievable on computer through memory card/pen drive. It shall be provided in the driving cabin at suitable place and recording system shall have sufficient memory to keep the speed record of minimum 15 days which should always be stored for retrieving as per requirement.

14.0 SAFETY FEATURES

14.1 Provision for protective earthing against electrical hazard shall be in line with EN 50153: Railway applications - Rolling stock - Protective provisions relating to electrical hazards. All electrical equipment shall be provided with essential interlocks & keys as may be adequate to ensure the protection of the equipment and the safety of those concerned with its operation and maintenance.

14.2 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.

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

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

14.5 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.

14.6 The fire protection on machine shall be designed and constructed in accordance with EN 45545.The applicable Hazard level will be HL-3.The supplier shall furnish the relevant fire load calculations in hard as well as in soft copy. One set shall be sent to the Principal/IRTMTC, Allahabad, one set to be sent to PED/Infra-1, RDSO, and Lucknow, one set to EDTK (MC) /Railway Board and one set to Director General/IRICEN/Pune along with supply of first machine by the successful bidder.

14.7 The machine shall have automatic fire/smoke detection systems in accordance with EN 45545. This shall be capable of detecting a smoke/fire in machine. On detection of a possible smoke/fire, the system shall give warning in form of audio visual alert.

14.8 All electrical wiring in the machine shall be done with e-beam cables conforming to RDSO's Specification No ELRS/SPEC/ELC/0019 Rev.-4 with latest amendment.

14.9 Two nos. 50 t manually operated hydraulic lifting jack(maximum weight 30 kg), 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 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.

14.10 Necessary provision should be made to record the conversation between staff present in the cabs for reference during enquiry of any unusual incident/accident.

14.11 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.

14.12 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.

14.13 A clutch system should be provided to disengage all hydraulic pumps in case of bursting of hydraulic hoses fitted in pumps.

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

15.0 TOOLS AND INSTRUCTIONS MANUALS

15.1 Each machine shall be supplied with a complete kit of tools required by the operator in emergency and for normal working of the machine. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire machine including specialised 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 to be supplied along with each machine.

15.2 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/manual. The list can be modified to suit the purchaser's requirement, while examining the offer.

15.3 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.

15.4 While offering the machine for first inspection, the supplier shall submit one copy of complete technical literature including operation, service and field maintenance manuals/instructions, complete electrical, electronic, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/description and other relevant technical details for keeping as reference document for the inspecting officer. These shall be prepared in English language. One set of documents each to be submitted to PED/TMM directorate, RDSO, Lucknow, Principal/IRTMTC-Allahabad, Director/IRICEN/Pune and to Director/TMC/Railway Board respectively along with supply of first machine of similar group. 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.

15.5 Detailed operating manual, maintenance and service manual, user manual indicating capabilities of the machine prepared in English language and four hard copies and soft copies of these shall be supplied with each machine. These shall be prepared in English language.

15.6 The manufacturer (successful tenderer(s)) shall also supply circuit diagrams in four hard copies & soft copies of electrical, hydraulic, pneumatic and electronic circuits used on the machine. Trouble shooting diagram/table shall also be supplied. In additions, the supplier shall provide dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc., and the main features such as type, discharge etc. of items like hydraulic pumps, motors etc. and the supplier/manufacturer shall furnish the details of such other bought out components/assemblies. These shall be specially prepared in English language and in four hard copies & soft copies these shall be supplied with each machine.

15.7 The successful tenderer(s) shall provide detailed technical drawings and specifications of wheels and axles used in the machine 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 three four sets with each machine.

15.8 One portable diesel operated D.C welding plant (with the provision of auxiliary output of minimum 2.5 KW, 230 V AC for lighting) of reputed make (preferably manufactured 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 cable or lead shall be provided with the welding plant for day-to-day repairing of machine and its wearing parts. The diesel tank capacity shall be not less than 15 litres.

16.0 SPARE PARTS

16.1 The expected life of the components/spares shall be advised along with their condemning limits. The machines shall be supplied with necessary spare parts for the operation and maintenance of the machine for a period of two years i.e. working for about 2000 hrs. The spare parts required shall be detailed in a separate list indicating description, part number, quantity and whether imported or indigenous and their source of supply (OEM details).

16.2 The manufacturer shall be responsible for the subsequent availability of spare parts (In India with payment in Indian Rupees) to ensure trouble free service for the life of the machine (20 years). It is preferred that the spares are stored in India and are available within 7 (seven) days.

16.3 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 machine for inspection.

17.0 MAKER'S TEST CERTIFICATE

17.1 Copies of the Maker's certificate guaranteeing the performance of the machines shall be supplied in duplicate along with the delivery of each machine.

18.0 OPERATORS

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

19.0 TRAINING AND SERVICE ENGINEERS

19.1 The supplier shall provide at his own expense the services of competent engineers during the warrantee period for warrantee related issues. The service engineers shall be available for the commissioning of the machine for regular service. E-Learning courses module shall be arranged for imparting training to railway operators. In addition the service engineer shall provide hands on training to railway staff in calibration, operation, repairing and maintenance of the machine in field to make them fully conversant with the machine. 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 machines.

20.0 OPTIONAL EQUIPMENTS

20.1 Tenderer is expected to quote for optional equipment separately for each item giving the advantages/functions of such optional equipment. Tenderer shall also indicate whether such equipment is already in use on machines elsewhere indicating the user Railway system.

21.0 WARRANTY:

21.1 The machine shall be warranted for 2000 effective working hours or 18 months from date of commissioning and proving test of equipment 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 machine is deployed for ballast stabilizing 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 equipment offered, the warranty period of 18 months would commence from the date of commissioning and proving test of equipment 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.

22.0 INSPECTION OF THE MACHINE

22.1 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 machine's conformity/non-conformity with respect to each item shall be jointly recorded, before the issue of the “Inspection certificate and approval for dispatch of the machine” as per Annexure-VII enclosed.

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

i) Machine 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 machine.

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

22.3 The following documents shall be provided to the Inspecting Officer (IO) at least 30 days before the proposed date of inspection.

i) One copy of complete technical literature mentioned in clause 14, 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 for the inspecting officer (IO).

ii) Cross section of the machine super imposed on Indian Railways maximum moving dimensions envelope shall be provided to inspecting officer(IO) in advance.

iii) Clause by clause comments of the manufacturer to be sent to Inspecting Officer (IO) in advance 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 to be provided to inspecting officer (IO), containing serial number wherever applicable.

vi) Draft Inspection Report shall be prepared by the manufacturer, containing all annexures mentioned at para 21.4

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

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

22.4 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 tobe dispatched along with the machine.

vii. List of tools tobe dispatched along with the machine.

viii. List of Manuals, Drawings, Spare Parts Catalogues, etc. tobe dispatched along with the machine, duly indicating the number of sets of each.

ix. Manufacturere's certificate on standard followed for design of wheels and axles against clause 2.8 to 2.10.

x. Illumination survey or light assessment or Lux level survey report.

xi. 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.

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 machine. Final speed certificate of the machine is given after conducting detailed oscillation trials of the vehicle, which is a time taking process. Therefore, issue of provisional speed certificate for the machine becomes a necessity and based on the same, the approval of running of the machine on Indian Railway track is taken from commissioner of Railway 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 Railways, 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 machine etc and the distribution of axle loads, lateral forces, un-sprung mass, tractive effort and braking force coming on rail and they remain the same. If there is any change in any of the above parameters action shall be taken as detailed in Para (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 (VIII&IX) which in no case shall be more than six months from signing of contract, shall be submitted by the supplier to Track Machine and Monitoring Directorate of RDSO of Indian Railways based at Lucknow, 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(VIII&

IX) can also be asked for issue of provisional speed certificate for the machine. The supplier 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. The machine shall have to fulfil the acceptance criteria specified at Annexure-XI.

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 is given after conducting detailed oscillation trials of the machine. For this purpose railway shall conduct running speed tests on the Indian Railways main line track on one of the machines supplied to them preferably within warranty in accordance with procedure outlined in Annexure-XI with the machine running up to speed 10% higher than the maximum speed mentioned in clause 2.13 above. However railway could conduct detailed oscillation trial of the machine as per EN-14363. The track geometry for trial (as per EN-14363) shall be as per Annexure-XVI. The decision of the railway will be final and binding.

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 the commissioning of the machine. 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 The dimensional check of loading gauge, i.e. maximum moving dimensions, buffer heights, clearances, length of machine, bogie distance and clearance on curves etc.

24.1.2 Testing for negotiability of 10^0 curves and 1 in 8.5 turnouts.

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

24.1.4 Actual output and performance tests: **Refer clause 3.0:**

These tests shall be conducted under field conditions on Indian Railway. An electrified section shall be chosen for the tests.

The general conditions of the test shall be as follows:

(a) The machine crew shall be either trained personnel of Indian Railways or the staff of the supplier.
(b) Dry weather, ambient temperature between -5^0 C to $+55^0$ C.
(c) Track on straight or on curve of minimum 1000m radius.
(d) Gradientupto1/200
(e) Rails and sleepers in good conditions and properly fastened.
(f) Concrete Sleeper.
(g) Clean ballast cushion of minimum 100mm in sufficient quantity below the bottom of sleepers and generally not cemented.
(h) LWR track with ballast as per standard profile (Annexure-IV)
(i) Formation good
(j) Regular sleeper spacing of 550 mm to 650 mm with a tolerance of ± 20 mm.

24.1.5 Illumination for the working and surrounding area of the machine sufficiently illuminated for efficient working during night as per clause no. 10.3.

24.1.6 **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-XIII, Annexure-XIV and Annexure-XV and duly signed with seal in hard and soft copies in A3 size in high resolution in English language (other than mentioned in Annexure-VIII & IX). 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. All types of brakes shall be shown in air brake circuit schematic diagram as per technical specification.

e. Braking distance calculations shall be submitted for level track as well as for falling gradient of 1 in 33 at design speed.

f. The supplier shall submit the self-certification for Electromagnetic compatibility (EMI/EMC) of the machine.

g. 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.

Actual test to be conducted:

a) The track, meeting the above general condition should be tamped by good quality tamper with 30 mm general lift and then one round of stabilization by machine in controlled settlement mode at stabilization parameters specified by manufacturer, shall be done. The amount of lowering of track as measured should be limited to maximum 20 mm and track parameters left by tamper should be simultaneously retained in general within acceptable limit.

b) The setting up time and winding up time of the machine shall be measured, and the total time taken by the two operations of setting up and winding up of the machine together shall not exceed 10 minutes.

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

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. The exterior painting shall be polyurethane binder based conform 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.

Following shall be written in black on the machine at appropriate location in English &Hindi as per direction of Indian Railways official:

i) Indian Railways logo of height between 300 mm to 600 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” shall be written in bold and in black colour in letters of size equal to or slightly smaller than the size of logo but of size not less than 250 mm.

iii) Below the text “INDIAN RAILWAYS” mentioned above, machine model and manufacturing year shall be written in black colour and in letter of size less than the size in which Indian Railways is written but not less than 200 mm in any case.

iv) If required, the manufacturers name may be written in letters of size not more than 150 mm and shall not be at more than four locations. Also the manufacturer’s logo may be provided at not more than two locations and shall be of size less than 200 mm.

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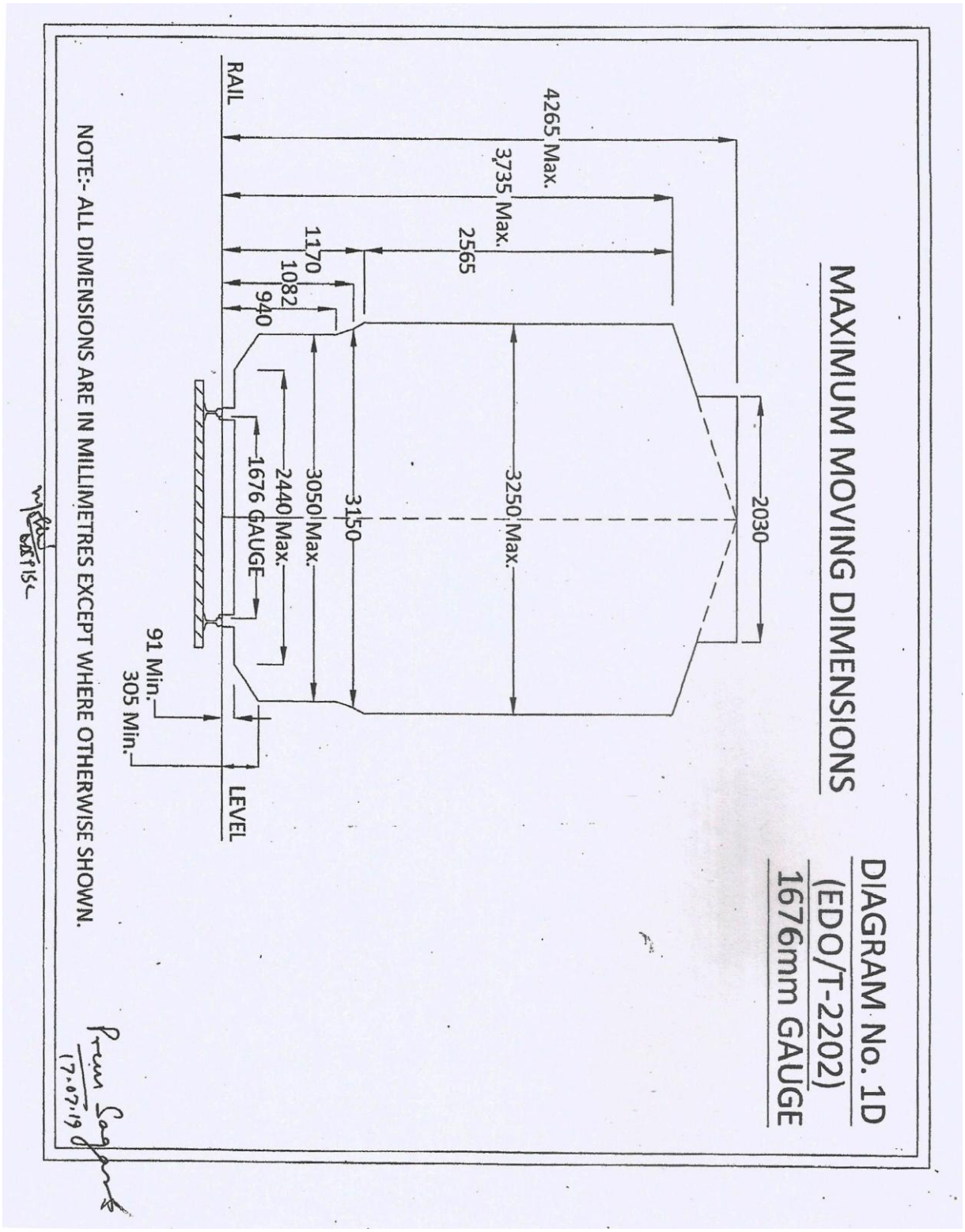

MAXIMUM MOVING DIMENSIONS
DIAGRAM No. 1D
(EDO/T-2202)
1676mm GAUGE
RAIL
4265 Max.
3735 Max.
2565
1170
1082
940
2030
3250 Max.
3150
3050 Max.
2440 Max.
1676 GAUGE
91 Min.
305 Min.
LEVEL
NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

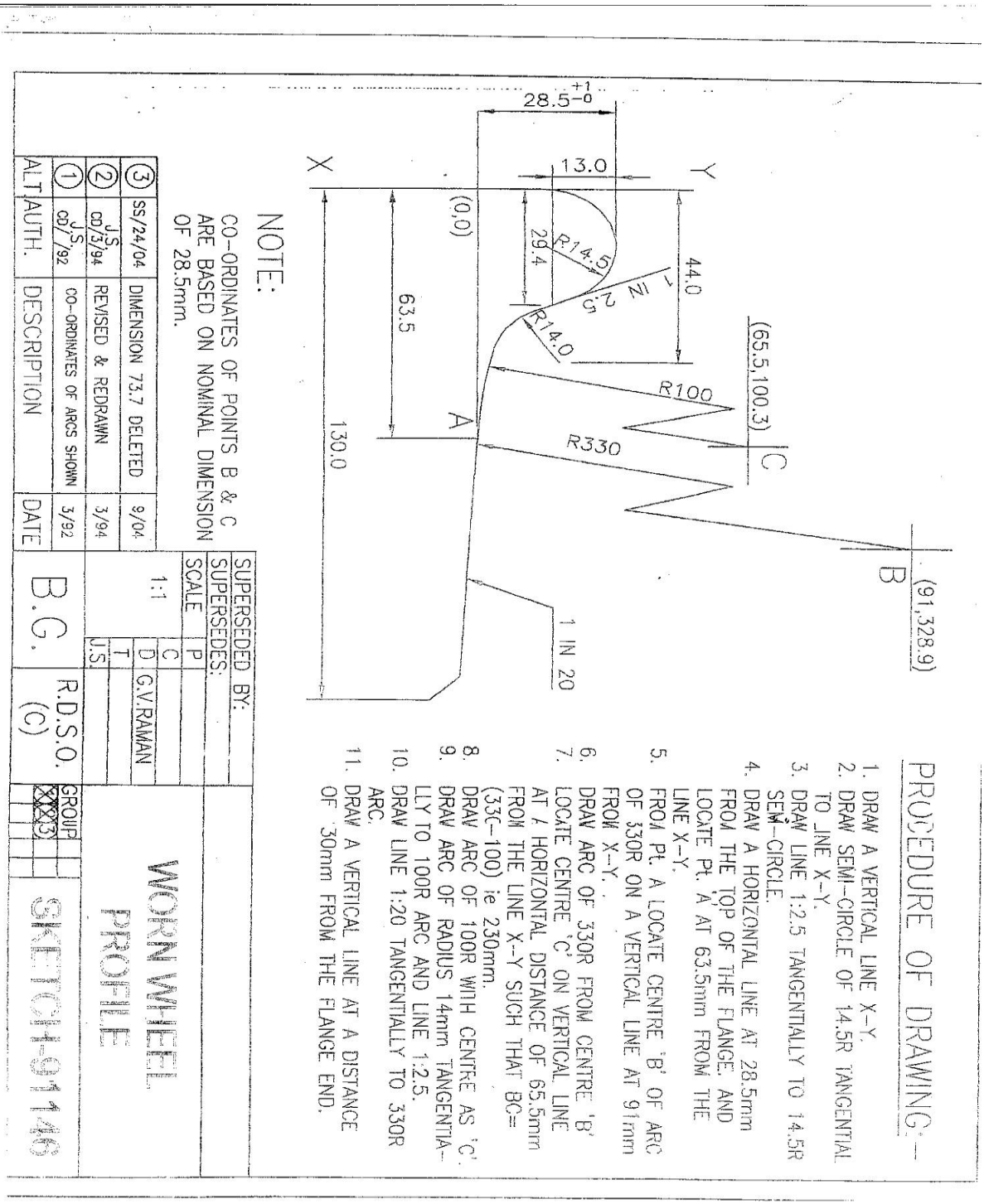
Annexure-II

Machine details required for simulation of machine on Track- vehicle 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	5	6	Total unsprung mass in tonnes
7.	Total weight of components in tonnes	Front bogie full assembly		Central 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	Lateral	Longitudinal	Vertic	Lateral	Longitudinal	

		stiff	stiff	stiff	al stiff	stiff	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 / 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/7/92	CO-ORDINATES OF ARCS SHOWN	3/92

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

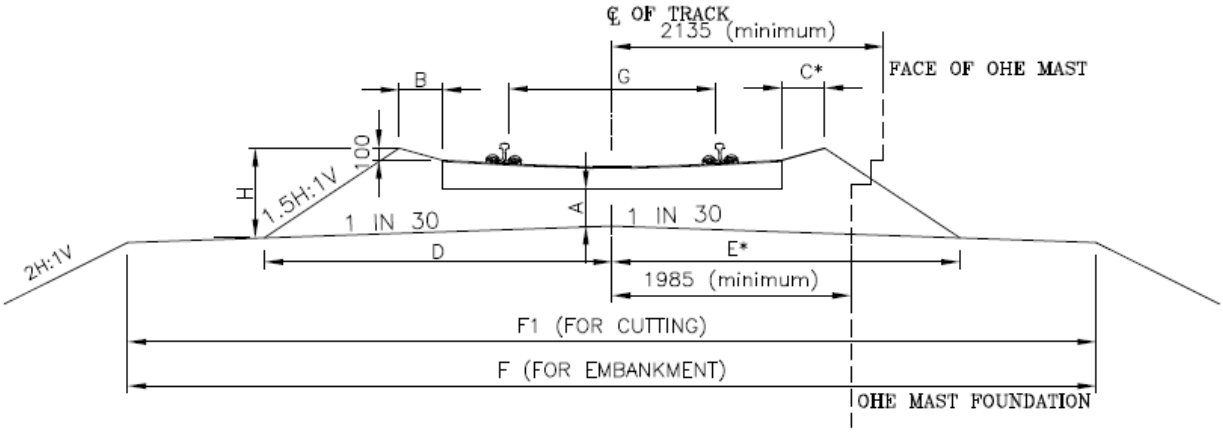
B.G.
R.D.S.O. (C)
GROUP XXXX

WORN WHEEL PROFILE

SKETCH-9146

Annexure-IV

Details of track on PSC sleeper



G Gauge	Type of Sleeper	A	B	C*	D	E*	F	F1	H	Quantity of Ballast per meter in	
										Straight Track (M^3)	Curved Track (M^3)
1676 mm	PRC	250	350	500	2693	2851	7850	7850	646	2.030	2.120
		300	350	500	2772	2930	7850	7850	698	2.304	2.401
		350	350	500	2851	3009	7850	7850	751	2.585	2.690

Remarks :

1 Depth of ballast cushion should be provided as per Para 263(2)(a)of IRPWM.

2 Cross-Slope of 1 in 30 shall be provided for New Works.

3 Suitable dwarf walls shall be provided in case of cuttings, if necessary for retaining ballast.

4 *On outer side of curves only.

5 The cess width on existing track is to be increased on programmed basis wherever required so that minimum cess width as per side slope given above is ensured.

6 All dimensions are in mm.

7 The theoretical clearance between face of OHE mast foundation and end of sleeper at ideal condition is minimum 610 mm.

Annexure-V

Specifications of Heavy duty Industrial Quality Water proof & shock proof Laptop (Tough book)

CPU	Intel Core i-5 -7440HQ processor, speed 2.8 GHz up to 3.8 GHz or higher version
Operating System	Latest windows 10 professional or higher version
RAM	8 GB DDR4 or more and expandable upto minimum 32 GB
Storage	Shock protected removable HDD SATA 500 GB expandable up to 1 TB
Display	Minimum 15.6" high definition LED/TFT/LCD or better with sunlight readable display, anti reflective and anti glare treatment
Keyboard	LED Backlit 61 key QWERTY keyboard with integrated numeric pad. Touchpad with vertical scrolling support.
Wireless	Integrated Gobi 2000 mobile broadband or better, Bluetooth V 4.0 or better.
Durability features	Product shall be fully rugged, durable and meet the latest MIL standard. Moisture/water and dust resistant screen, Key board and touch pad.
Pre Loaded Software's	Antivirus software for 18 months validity. Microsoft office 2007 or latest complete bundle (Licensed copy with CD backup)
Power supply	Long life Li-ion battery, minimum 8700m AH
Warranty	5-year warranty

Annexure-VI

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 Centimetres
Brake Rigging Diagram
Type of Brake system

Annexure-VII

INSPECTION CERTIFICATE

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

This is to certify that I have inspected the machine_____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 Executive Director/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 machine conforms to all the laid down specifications.
- The machine 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 machine is certified/not certified to be conforming to the specifications.

The machine is approved/not approved for dispatch to_____(Consignee) Indian Railways.

SIGNATURE AND DATE
INSPECTING OFFICIAL

For M/s._____
_____

(NAME AND DESIGNATION)
for and on Behalf of President of India

Annexure-VIII

Particulars Required in Respect of the Rolling Stock under Consideration

1. 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. Bogie Centres :

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

3. 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). :

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

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

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

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

8. Stiffness of suspension coil spring/Megi spring

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

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

11. 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. :

12. Maximum tractive effort at start and at the speed of operation -
      I. At working drive at start :
         at operation speed :
      II. At transfer drive at start :
         at maximum speed :

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

14. Drawing indicating suspension arrangement details of bogie and axle. :

15. Height of centre of gravity from rail level. :

16. Height of floor from rail level. :

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

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

Annexure-IX

Following information as detailed below is required for processing the case for issue of provisional speed certificate for new machines

Name of the machine_____Model_____

Sr.No.	Item
1.0	a)Brake System details
	b)Gross Braking Ratio
2.0	Brake rigging arrangement drawing and calculation of braking force
3.0	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 :
4.0	Characteristics of springs used in suspension indicating free height, working height, dynamic range, stiffness and locations etc.
5.0	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
6.0	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 doubles link suspension.
7.0	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.
8.0	Wheel and axle assembly drawings
9.0	Calculation for flange force
10.0	Technical specifications of Vehicle supplied.
11.0	Calculation of natural frequency
12.0	Calculation of spring characteristics and critical speed of the vehicle.
13.0	Simulation result showing ride index, lateral force and acceleration results.
14.0	A certificate regarding the speed of the vehicle for which it has been designed.

Annexure-X

Method for measuring Lateral Ballast Resistance

For testing of lateral ballast resistance of Individual sleepers, either of the following method shall be used.

Method-I :

By the side of the sleepers to be tested, well grouted Rail post will be erected for taking lateral reaction. Between the sleeper to be tested and Rail post, horizontal jack and proving ring combination will be placed. ERC of the sleeper to be tested and of 6-7 sleepers on both side of sleeper to be tested should be removed and both rail lifted manually to the extent that sleeper to be tested is completely free and can move laterally under the rail when horizontal load is applied. Horizontal reaction from rail post is taken by jack and force is applied on sleeper through proving ring gradually and max load applied by the jack before sleepers movement starts is measured in proving ring as max ballast resistance of that sleeper. Average value of different sleepers tested is taken as average ballast resistance.

Method-II :

RDSO has developed a frame for taking reaction which can be used in place of Rail pillars. Similar to above, the freed rail shall be lifted and instead of Rail pillars, reaction shall be taken from this frame. This frame is so designed that it takes support from the track rails in place of separate rail pillars.

Following measurements shall be taken

a. Initial Lateral ballast resistance -Average (of six sleeper reading).(A)
b. After tamping Lateral Ballast resistance- Average(of six sleeper reading) (B)
c. After working of Stabilizer- Average(of six sleeper reading) (C)

The percentage increase in lateral Ballast resistance after working of stabilizer shall be calculated as

$$= \frac{C - B}{B} * 100$$

Annexure-XI

ACCEPTANCE CRITERIA DURING OSCILLATION TRAILS

1.0 The speed potential of the machine offered by the firm 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 firm 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 over which there is no temporary speed restrictions and which is considered by the Railways as being in a generally run down condition for mainline standards, but without speed restrictions. The machine will be tested generally for new and worn clearance conditions and where relevant for operation in the forward and backward directions. The machine selected for tests will be one in average condition for normal maintenance.

2.0 The criteria applicable for establishing speed potential 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 shall be limited to 0.55 g both in vertical and lateral directions. The peak values up-to 0.6 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 machines 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 and lateral force and derailment coefficient of accelerations as the case may be.

3.0 **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**:**

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

(i) A Tangent (straight) track - of about 1 km length. Efforts shall be made to conduct trials over two such stretches.
(ii) A Station Yard having facing/trailing points, and
(iii) 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.

3.2. 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.

3.3. 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.

3.4 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.

3.5 At present, the track geometry parameters are 'peak based' and not Standard Deviation based. Subject to fulfillment 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	Up-to and ±3 mm. (inclusive)

	B C	±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.

3.6 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 XII

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 machinein 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-XIII

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.	Worn wheel profile		
4.	The details design calculation along with material parameters and standard followed for manufacturing of wheels and test reports as per standard followed.		
5.	The details design calculation along with material parameters and standard followed for manufacturing of non-powered axle and test reports as per standard followed.		
6.	The details design calculation along with material parameters and standard followed for manufacturing of powered axle and test reports as per standard followed.		
7.	Hauling capacity of machine		
8.	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		
9.	Fuel tank capacity		
10.	Supplier shall provide the necessary technical details and circuit diagrams of all electronic/electrical, hydraulic and pneumatic parts.		
11.	Types of brakes (i) Direct (ii) Indirect (iii) Emergency brake (iv) Spring loaded parking brake (v) Mechanical parking brake		
12.	List of safety equipments		
13.	Emergency backup system details		
14.	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.		
15.	Dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc.		
16.	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.		
17.	Details of portable diesel operated D.C. welding generator.		
18.	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).		
19.	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.		
20.	Copies of the Maker's certificate guaranteeing the performance of the machine shall be supplied in duplicate along with the delivery of each machine.		
21.	Documents and drawings (duly signed with seal) in English language in hard (A3 size) & soft copies with high resolution		
22.	Infringement Description		

Annexure-XIV

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-XV

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 XVI

Track Geometry as per EN-14363 of Indian Railway Track for Oscillation Trials

Speed Band	Speed (kmph)	Unevenness				Alignment			
		TL90	TL70	TL50	QN3	TL90	TL70	TL50	QN3
SB-I	>130	2.45	1.65	1.30	12.14	1.89	1.23	0.99	8.81
SB-II	110 &<=130	2.83	2.00	1.57	13.08	2.10	1.43	1.15	8.99
SB-III	100 &<=110	3.73	2.45	1.90	16.59	2.52	1.63	1.29	10.64
SB-IV	<=100	3.74	2.53	1.97	18.26	2.65	1.72	1.36	12.18