Technical Specification for on track Multipurpose Tamper for B.G. (1676mm Gauge)

(Specification No: TM/HM/MPT-367 Rev.04 of 2024)

1.0 GENERAL:

1.1 With the mechanization of track maintenance activities on Indian Railways, machines are required for spot tamping of concrete sleepers on plain track and turnouts and special locations like switch expansion joints, glued joints, L-Xing with check rails, ballasted track with guard rails on bridges, curve etc. without removing check/guard rails. These machines have to be very sturdy and suitable for heavy duty operation to tamp the modern concrete sleepers' turnout and plain track with concrete sleepers. Simultaneously the machine has to be suitable for the transport of engineering materials, equipment and workmen for day to day working. This specification has been designed for such a multi-purpose machine hereinafter called "machine''.

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

1.3 The bidder shall specify the make/model offered and furnish a detailed technical description of the same. System/subsystem of the working mechanism of the machine as per clause 3.0 in particular and all the items of the specification in general shall be described in detail in the "Technical Description" along with sketches to show the manner in which the requirements of the specification are accomplished by the machine (model) offered.

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

2.1 The diesel-powered self-propelled machine shall be of latest design, robust, reliable and suitable for working on the Indian Railways plain track, transition and curved track (up to 10°) and turnouts and special locations as mentioned at clause 1.1 above on Broad Gauge (1676

mm). It shall be basic tamping machine for tamping of plain track as well as points and crossing. The machine shall be provided with end- cabins at either end and be capable of being driven from these cabins at full speed in travel mode. Additional working cabin may be provided to facilitate the view of working area during working. Quality assurance during manufacturing of the machine shall be as per ISO-9001. The welding standard followed for manufacturing of machine shall be to ISO:3834 or EN:15085 or any other equivalent standard for welding railway vehicle and components. The manufacturer shall specify the standard followed and certify that it meets the welding standard mentioned above.

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

2.3 The design and dimensions of the machine and components shall be to metric standards and shall comply with provision of Indian Railways Schedule of Dimensions-1676 mm gauge (BG), revised, 2022 incorporating all correction slips/amendments. The profile of the machine (including its units) longitudinally and in cross section during transfer as self-propelled machine or towed in train formation as last vehicle shall be within the maximum moving dimensions (MMD), is enclosed as Annexure-I. The successful tenderer(s) shall provide sketches of the machine in plan and elevation and shall give calculation along with Vogel's to ensure that the machine does not cause infringement while moving on a 10° curve at any cross section.

2.4 In the past Indian Railways to the Indian Railways Schedule of Dimensions-1676 mm gauge (BG), revised, 2022 incorporating all correction slips/amendments 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 incorporating all correction slips/amendments 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 Railway, the condonation of the same may be permitted by Indian Railways. However, only those infringements which are acceptable shall be permitted.

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

2.6 Axle load of the machine shall be less than 22.82 t with minimum axle spacing of 1800 mm. Load per metre shall not exceed 7.67 t Stresses in the tracks & bridges shall be calculated by IR/RDSO based on design data submitted by the firm as per (Annexure IV), 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 50 mm margin between new and permitted worn wheel diameter shall be available, but this shall not be less than 30 mm. Permitted worn out wheel diameter shall be specified by the manufacturer. The diameter of wheel for assessment of permitted axle load will be the worn-out wheel diameter. The new wheel profile in the machine shall be as per Indian Railways standard drawing attached as Annexure-VII which is titled as “WORN WHEEL PROFILE”.

Note: Annexure-VII “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 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.

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 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 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 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 under the above limiting conditions. The machine shall be able to work on single/multiple lines as well as between platforms without infringing the traffic movement on the adjoining track.

2.12 The machine 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	:	Up to 2250 m above mean sea level
Relative Humidity	:	Up to 100%
Maximum rail temperature	:	76° C

All the system components on the tamping machine shall be covered by roof or other suitable sturdy covering so that the system & components vulnerable to moisture ingress are not adversely affected during rains and 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 in both directions at the same speed. Driving cabin shall be at both end of the machine for this purpose. 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 The machine shall be capable of working without requiring power block in electrified sections. 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 The machine or its any part shall not infringe the adjoining track as per “Indian Railways Schedule of Dimensions–1676 mm gauge (BG), revised, 2022 incorporating all correction slips/amendments”, while working as well as opening and closing of work. It shall be possible to permit trains at full speed on the adjoining track except on turnouts. Minimum spacing of tracks is 4265 mm centre to centre.

2.16 The machine shall also be capable of carrying about 05 trackmen along with their tools. Suitable seating arrangement and adequate space shall be provided.

2.17 There shall be one loading platform for keeping the tools and small P. way materials/machines at one end of the machine of length not less than 7000 mm so as to carry the half length of rails (6500 mm). The width of this open platform shall be equal to the width of the machine as per the permitted schedule of dimension prevalent on Indian Railways as mentioned above. The loading platform shall be provided all-around with a sidewall/ Railing of minimum 450 to 600 mm height to protect the men and materials from falling. The approximate gross tonnage expected on this loading platform shall be limited up to 7.0 t and the detail of engineering tools & materials required on this loading platform is as given in annexure-VI attached.

2.18 All operations for work and travel shall be controlled from a spacious fully enclosed cabin permitting unobstructed view in both directions.

3.0 WORKING MECHANISM:

3.1 The machine shall be capable of tamping plain track as well as for spot attention of points and crossings and other miscellaneous track locations, handling of P. way material including rails, sleepers, switches & Crossings, their stacking on the material platform. It shall also be capable to tamp effectively the special track locations such as level crossing with check rails, SEJ portion, ballasted track with guard rails on bridges, glued joint, curve etc.

3.2 The machine shall be capable of automatic lifting, leveling, lining and tamping of track to achieve the laid down track geometry standards, with proper packing for various kind of track structures.

3.3 Separate split head tamping unit shall be provided for each rail and each unit comprising of tamping tools shall be operated hydraulically. Each of the two halves of the tamping units shall be able to be lowered and put into action separately from the other. Additionally, both halves of the unit shall be able to be displaced laterally. It shall be possible to adjust the tamping tools such that all accessible tamping zones on either side of the rails and sleepers are tamped effectively. The tamping units shall be provided with necessary arrangements for lateral shifting to adjust them on the rails in curves, turnout, SEJ and other such special track locations. It shall be possible to tamp all four rails of the switch up to heel block. The minimum lateral adjustment of tamping units (for both outer and inner) shall not be less than 270 mm from their normal position. It shall be possible to rotate and adjust tamping unit from operator’s seat for tamping of slanting sleepers in turnout. Since the machine is predominantly to be used for spot attention and tamping on such spots may be required to be done without any general lift, the tamping system shall be capable of giving effective tamping at spots and correct the track geometry even when no general lift is given.

3.4 Tamping action shall be based on vibratory squeeze principle to achieve a durable compaction with tamping tools operating under the same pressure but independent of one another.

3.5 Amplitude of vibration, vibration pressure, vibration frequency, squeezing pressure, squeezing time and tamping depth of tamping tools in tamping units shall be such that durable compaction under the sleeper is achieved. Details of all the above parameters will be submitted in the offer.

3.6 The squeezing action shall stop automatically after the tamping tools encounter the resistance from the ballast equal to the pre-selected squeezing pressure. The squeezing pressure and squeezing time shall be variable so that it can be adjusted according to ballast conditions.

3.7 The lifting system shall be such that the track can be lifted without bearing on the ballast. It shall be possible to lift track up-to 150mm in one go depending on the requirement. While working on track with no limitation of space, the lifting system shall hold the rail continuously rather than releasing and re-lifting the rail at every tamping cycle. To ensure easy lift at all locations the machine shall be provided with lifting hooks and lifting rollers clamp both or any similar device capable of lifting the track as mentioned above. However, the lifting/lining system and actual tamping shall be so synchronized that the track is stiffly held in position and there is no movement in the track when the tamping tool is inserted for tamping. This is required to ensure that the lift and slew are not altered during the process while track is being tamped. It shall also be capable to lift properly the glued insulated joint, switch expansion joint and special joints with one meter long fishplate.

3.8 The working cabin shall be so located that the operator faces towards the direction of movement of machine to facilitate tamping of track. The lifting/lining units shall normally be so located that they are visible to the operator from the working cabin and their operation by operator shall not require assistance of another person. Camera with monitor shall be provided for the assistance of operator if required. Sufficient No. of CCTV cameras shall be provided to assist the operator carry out the tamping operations shall be provided. 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.

3.9 The free length between the two bogies shall be long enough to permit the track lifting and lining up-to 150 mm in one go, having 60 kg rails on concrete sleeper, without excessive stresses in the rail or on the lifting mechanism.

3.10 The machine shall be provided with automatic leveling equipment which will permit correct leveling of the track and points &crossings including provision of super elevation along with tamping.

3.11 The tamping tool holding arrangement in tamping arm of tamping bank shall be such that no hammering is required for fixing and removing the tamping tools. Also tamping tools shall not loosen/drop during working.

3.12 The machine shall be fitted with automatic lining equipment capable of carrying out lining simultaneously with leveling. It shall be possible to adjust the lining unit longitudinally depending upon the position of sleepers and fittings etc, in the turnout. If required, the machine shall be able to slew the track up to 150 mm in one go. The lining unit shall have two rollers for each rail or other suitable arrangement to avoid derailing of the lining rollers.

3.13 The machine shall be able to achieve the following tolerance: -

Unevenness	:	±1 mm on 3.6 m Chord
Cross level	:	±1 mm
Alignment	:	±2 mm on 7.2 m Chord
Twist	:	1 mm/m on 3.0 m base

Also not more than 10 peaks per km should exceed the value specified as under:

Unevenness	:	4 mm on 3.6 m Chord
Cross level	:	-
Alignment	:	± 3 mm on 7.2 m Chord
Twist	:	1.39 mm/m on 3.0 m base.

3.14 It shall be possible to control the target track geometry parameters, in infinitely variable steps, from the operator's/front cabin. To achieve track tolerance mentioned in clause 3.13, suitable hydraulic valves (servo control) shall be provided.

3.15 The machine shall be capable of carrying out on plain track, automatic lifting, leveling, tamping and lining of 800 sleepers or more in an effective hour of working in case of single insertion and when tamping turnouts, it shall be capable of tamping one 1 in 12 turnout complete with one rail length (13 m) on straight portion on the approaches of the turnouts in an effective hour of working at the following machine parameters:

a) Squeezing time of 0.8 sec to 1.2 sec.
b) Squeezing pressure of 110 kg/cm² to 120 kg/cm² for plain track and 125 kg/cm² to 135 kg/cm² for turnouts.
c) Tamping depth upper edge of tool blade shall be15-20 mm below the bottom of the sleeper.

The time shall be counted from start to finish of tamping work at work place. Stoppage of work not attributable to machine shall be discounted. The setting up time and winding uptime 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. The setting up time shall be counted from the time machine arrives at site to the time work is started. The winding up time will be counted from the time the work is stopped to the time machines starts moving away from the work site. Dimensions of sleepers are given in Annexure–VI. The supplier shall furnish the complete details of the tamping cycle of the machine, its timings and other operational details to show the compliance to this performance parameter.

3.16 The machine shall be provided with suitable hydraulically operated compactors on both sides to compact the shoulder ballast. It shall be possible to suitably retract the shoulder ballast compactors near the mast or signal posts etc.

3.17 The machine shall be capable of automatic leveling, lining and tamping of turnouts with Cast Manganese Steel (CMS) and built-up crossing of angles 1 in 8.5, 1 in 12 and 1 in 16 laid on concrete sleepers (52kg, 60 kg and wider) without dismantling the turnout.

3.18 The machine shall be capable of tamping, lifting and lining of track laid on pre-stressed concrete sleepers with long welded rails, short welded rails and fish-plated rails as per Annexure-VI. The normal sleeper spacing centre to centre in different track structures on Indian Railways is 550 mm to 650 mm and the clear spacing between sleepers varying from 260 mm to 405 mm.

3.19 The maximum depth of concrete sleeper is up-to 235 mm. On Indian Railways, rail top to sleeper bottom depth may vary from 365 mm to 425 mm. The machine, although having zone of influence of tamping confined to approximately 150 mm depth below the bottom of sleepers, shall effectively compact ballast depth ranging from up-to 350 mm. There shall be provision for step less adjustment of the penetration depth of tamping tools to suite different types of rails and sleepers. The machine shall be provided with a mechanical penetration assistance system to achieve full penetration even in caked ballast bed. The tamping units shall be equipped with a vibration control system. The system shall increase the mechanical induced vibration for easy penetration while lowering the tamping units.

3.20 For handling of engineering materials & equipment a suitable telescopic crane arrangement may be provided at one end of the material platform. The crane shall be capable of lifting. 1.5t load over front at such a minimum lifting radius up to 3000 mm that it is possible to load &unload 60 kg CMS crossing, 6.5 m long 60 kg Rail, & concrete sleeper (details as per annexure-VI) from machine to the Railway track below & vice versa. It shall be possible to work with this crane in electrified sections of Indian Railways without taking power block. Proper slings or any other equivalent arrangement required for picking up rails, sleepers or crossings shall be supplied as part of the crane.

3.21 The crane operation shall be such that there is no infringement to overhead electric equipment during crane maneuvering/extension/shortening and there is no infringement to the Indian Railways Schedule of Dimensions-1676mm gauge (BG), revised, 2004 with latest corrigendum and up to date correction slips issued, on the adjacent track at 4265 mm track centers. In case there is a possibility of boom getting lifted to infringe the overhead electric equipment, suitable safety device to prevent such an eventuality shall be provided.

3.22 The working cabins of the machine shall be air-conditioned. The air-conditioning provided shall be of robust industrial design capable of operating in highly dust laden environment. However, the electronic equipment shall be so designed that it shall be able to work without air conditioning under the climatic conditions described in clause 2.12 of the specification.

3.23 The machine shall be provided with a computerized unit for the overall control of its working system for all possible track geometry. The system shall be so designed that for working on tracks with pre-decided target geometry, the standard track geometry data as well as correction values can be entered prior to work either directly on system or via USB, CD or DVD. For working on tracks with unknown target geometry(precision mode), it shall be possible to determine the correction values by making a measuring run and subsequent geometry compensation of the recorded data considering obligatory point and constrains of lifting and lining etc. The machine shall also be capable of correcting/smoothen alignment of the track on curves by working in smoothing mode/compensation mode when theoretical track geometry is either not known or not required to be known and when due to location of track defects, the tracks slewing value are expected so large that they cannot be implemented without additional measure and it is decided to smoothen the curve rather than bringing it to the targeted/design profile. Interactive processing of the target profile by the operator shall be possible. Track parameters shall be displayed in graphic as well as text form on a colour monitor. Pre and post tamping graph shall be superimposed and also it should be capable to display in tabular from at desired distance. It shall be possible to guide the lifting and lining system of the machine continuously and automatically by this unit. The machine shall be capable of measuring and recording the longitudinal level of both rails, alignment of datum rail (versine), cross level (super elevation) and twist in real time before and after the tamping by the machine. These parameters shall be displayed on screen and its print out (printing arrangement to be provided) could be taken whenever required. It shall also record progress vis - a - vis time and it shall be possible to take all the above data on USB drive. The software shall be Windows based. The hardware shall be sturdy for operations under conditions of shock, vibrations, dust, electromagnetic influences from outside and interruption of power supply. The unit shall have adequate memory to keep records of minimum 100 km track length of work performed; new track geometry obtained and enables transfer of the data via USB.

3.24 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 software shall be window based. The hardware shall be sturdy for operation under conditions of shock, vibrations, dust, electromagnetic influence from outside and interruption of power supply. The detailed specifications of the laptop (tough book) are enclosed as Annexure-VIII.

3.25 Important tamping parameters like datum rail, general lift, single insertion or double insertion, design or smoothening mode, time of start and finish of work, squeezing pressure, squeezing time, vibration pressure and tamping depth etc shall be shown on a display in the working cabin. It shall have an inbuilt storage to store the above parameters of minimum 100 hours of tamping work. The storage however shall not be less than 500 GB. It shall be possible to draw these data from the system itself after work via USB port on a memory stick for the purpose of record.

3.26 A programmable logic control system shall be provided in the machine so that the work like lifting, lining, tamping and work drive of machine will commence only when all conditions for their working/movement are fulfilled.

3.27 The machine shall be equipped with GPS, GSM/GPRS based remote monitoring capabilities for various track parameters and vital parameters of track machine. It shall also have facility to interface with Human Machine Interference (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. Weekly reports per machine shall summarize performance data and shall provide information about tamping work performed. Tamping distance, incomplete levelling and incomplete penetration counts etc along with machine position. 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).

3.28 In case of failure of the up and down cylinders of tamping unit, there shall be an arrangement for lifting the all tamping units mechanically by lifting equipment like trifor/chain pulley etc. Any other alternative arrangement for mechanically lifting tamping unit in such failures may also be provided.

3.29 The machine shall be equipped with a centralized computer-based control and monitoring system which shall monitor the health of machine working system such as engine (lubricant oil pressure, temperature, rpm with engine running hours) hydraulics (hydraulic pressure in different units, water temperature, oil level in tank pneumatic (pneumatic pressure of main reservoir, brake cylinder electrical (charging/discharging rate, voltage). There shall be provision of recording and logging of machine working hours and such gauge shall also be displayed on the monitor of the computer installed in operator cabin. All these data shall be displayed on a monitor installed in working cabin and there shall be facility to store these data for 100 engine running hours. Minimum storage of 500 GB shall be available for this purpose. Arrangement for providing 4G/5G internet connection for sending data in soft format directly from the computer shall also be available for storage recorded data.

3.30 The machine shall be equipped with an electronic device for measuring and recording the following track parameters in real time:

i) Alignment on minimum 7.2 m chord length
ii) Longitudinal level on minimum 3.6 m chord length
iii) Cross level difference and twist at every 0.6 m or less (twist shall be reported in mm/m on 3.0 m base)
iv) Super elevation
v) Lifting value

The hardware shall consist of a touch panel computer with flash disc and an ink-jet printer. There shall be provision to fix threshold value of above parameters and it shall be possible to

draw reports to allow evaluations when threshold values are overstepped. Standard deviations shall also be calculated in 200 m sections for the track parameters i.e alignment of the reference rail, longitudinal level and twist. It shall have an inbuilt storage to store the above parameters of minimum 100 hours of tamping work. The storage however shall not be less than 500 GB for this purpose.

3.31 The AGC (automatic guiding computer) system/software shall be capable of recording pre and post tamping track parameters i.e., unevenness, cross level, alignment in analogue format at every 1 m interval. Also, the AGC (automatic guiding computer) system/software shall be capable to work out the “standard deviation” (SD) of the track parameters before and after tamping to assess the correct picture of the quality of work done by the machine.

3.32 The machine shall be capable to work in manual mode also in case of failure of computer/software/display units along with provision of manual feeding with separate display of required data. Necessary calculation chart shall be provided with each machine.

3.33 All inputs values like general lift, super elevation, tamping depth, versine etc. shall be also displayed on the panel board in addition to display unit of AGC (automatic guiding computer).

3.34 Tamping tools provided with machine shall be wear resistant and have carbide tips.

4.0 DIESEL ENGINE:

4.1 The machine shall be powered by diesel engines preferably indigenous with proven record of service in tropical countries with wide service network in India. Robust construction and low maintenance cost are of particular importance. 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 vehicle, shall have proven record of design manufacture & supply of engines for heavy duty industrial use/locomotives application/track vehicles application/self-propelled railway rolling stocks (with speed potential as needed for vehicle or more) application. 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 to fix devices to upgrade to higher emission norms in future.

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

4.3 High speed diesel oil to Indian standard specification shall normally be used. A minimum fuel tank capacity sufficient for continuous operation for eight hours but not less than 1400 liters shall be provided.

4.4 Sight glass type fuel measuring gauge preferably 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. The capacity of the battery must be selected on such a way that, in the event of a battery charge failure and a

50% discharged battery, the battery should be able to work for 30 minutes with all safety and operational functions. 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 area over the spilled lubricants. 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. 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 shall have electronic control module (ECM) or similar arrangement for taking out operating parameters on real time basis such as rpm, load, fuel oil pressure, fuel consumption, 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 clause 3.26. It shall also be possible to transfer these data on USB device through the centralized computer-based control.

4.10 The engine shall be enclosed in a weather protective, sound and dust resistant enclosure to minimize 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 area 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.

4.11 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.

5.0 DRIVE MECHANISM:

5.1 The machine shall be provided with an efficient traction drive system for traction during the operation. It shall be equipped with separate power transmission circuits for high-speed travelling in traveling mode and slow cyclic movement in working mode.

5.2 The driving mechanism for travel drive shall be rugged to perform satisfactorily during the life cycle of the machine. The machine’s driving system shall be through hydro dynamically/hydraulic 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.

5.3 The driving mechanism, in working mode, shall be adequately designed to handle the acceleration and braking forces at each tamping cycle. A suitable synchronization circuit to control the synchronization of lifting/lining/tamping 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-synchronization.

5.4 The tenderer shall provide the necessary technical details including circuit diagrams and detailed technical specifications of all mechanical, hydraulic, pneumatic electrical/electronic parts with make and model if using from open market to confirm the above requirements.

5.5 Adequate control equipment including gauges, instruments and safety devices to monitor driving and working performance of machine shall be provided in working and driving cabins near operator's seat.

5.6 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-today maintenance schedules.

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

5.8 The machine shall be equipped with adequate safety circuit such that any unit/part, which may endanger the safety is unlocked and the air pressure in brake circuit is less than 5 bars, the machine shall not move during run drive. The indication of locking and unlocking of all units shall be displayed in the cabin.

5.9 Onboard system for online monitoring the quality of hydraulic oil in hydraulic circuit and filtration as required shall be provided. The gauge shall clearly indicate if 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. Supplier shall note that the machine shall be working under extreme dusty conditions and the cooling mechanism shall 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 2.12 above, the system oil temperature does not go beyond range specified by the supplier.

7.0 BRAKES:

7.1 The machine shall be equipped with compressed air brake 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 coach/wagon when the machine is hauling them. Fail safe braking mechanism system shall be provided so that any failure of brake circuit, will result in automatic application of brake. The brakes shall be protected from ingress of water, grease, oil or other substances, which may have an adverse effect on them. The brake 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 applying by foot.

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

7.3 There shall be provision of mechanical 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. The emergency braking distance (EBD) of the machine on the Indian Railways 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 shall be provided by the supplier. Brake design details are to be submitted as per Annexure-IX.

7.4 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 also an easy arrangement to release the parking brake in case of emergency.

7.5 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.

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

8.0 HORNS, HOOTERS,SAFETY SWITCHES AND EMERGENCY BACKUP SYSTEMS:

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 locations for use during travelling to warn the workmen of any impending danger. Control/switch 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 m 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 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 also.

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

8.4 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 signaling 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.

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

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 coach/wagon or other vehicles and

running it in train formation as last vehicle and for attachment with the coach, locomotives and wagon.

10.0 SUSPENSION SYSTEM:

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

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

11.1 The electrical equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The 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 of4.8 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. Preferably electric power of 24 V (maximum up to 110 V) shall be used for operation of any electrical circuit.

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

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

11.4 In addition to swiveling LED floodlights mentioned in para 11.1, powerful swiveling 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. 15.6. 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.

12.0 CABINS:

12.1 The machine shall be equipped with fully enclosed sound and heat insulated cabins with safety glass windows. Cabin at both ends (one of which shall be used for working also) shall be air conditioned for dust free atmosphere. However, the electronic equipment shall be so designed that it shall be able to work without air conditioning under the climatic conditions described in clause 2.12. The air conditioner shall be of robust, industrial design capable of operating in highly dust laden environment. In view of the high ambient temperature prevailing in India, special attention shall be paid to free circulation of air and ventilation in the driver's cabin. The air conditioner shall be of robust, industrial design capable of operating in highly dust laden environment. The air-conditioning units shall not be roof and under-frame mounted for safety and maintenance purpose. 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 staff has full view on both the sides, to avoid any danger to them from trains on the adjacent track. Additional driver's cabins shall be provided if the view while driving is not clear for safe travel in both directions. The design of cabin shall be as per UIC CODEX-651.

12.2 The gauges, warning panel, instruments and control panel shall be suitably located in the operator's cab so that they can be observed by the operator without undue fatigue. Screen wipers preferably operated by compressed air or electricity shall be provided on the wind screen.

12.3 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.

12.4 The machine shall be provided with well tool box on material loading platform for keeping the tools and spares required for onsite repair of the machine to attend the breakdowns and other working requirements.

12.5 Necessary inter-communication system shall be provided inter-connecting all the cabins and should be so oriented that the operator, sitting in either cabin/working cabin, can distinctly hear the conversation and shall also be the provision of recording the conversation for inter-communication system. The volume control adjustment (preset) of inter-communication system shall be provided on amplifier (PCB).

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

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

13.0 CHASSIS AND UNDER-FRAME:

13.1 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 sections 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 the last vehicle.

13.2 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.

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- 2.

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.-3 dated 28.02.2017 with latest amendment.

14.9 Two nos. 50 t manually operated hydraulic lifting jack, with more than 300 mm traversing facility (maximum weight 160 kg) suitable to lift the machine frame at lifting point, should be 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.

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 INSTRUCTION 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 specialized equipment. All special tools shall be listed and catalogued illustrating the method of application. The tenderer shall along with his offer submit the list of tools to be supplied along with each machine. The list can be modified to suit the purchaser's requirement, while examining the offer.

15.2 Detailed operating manual, maintenance and service manual, user manual indicating capabilities of machine, prepared in English language with colour and four hard copies & soft copies of each of the same shall be supplied with each machine.

15.3 The supplier/manufacturer (successful tenderer(s)) shall also supply diagrams in hard copies & soft copies of electrical, hydraulic, pneumatic and electronic circuits used on the machine. Trouble shooting diagram/table shall also be supplied. In addition, the supplier shall provide dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc. Main features such as type, rpm & discharge etc of items like hydraulic pumps, motors shall be furnished by the supplier/manufacturer.

15.4 The tenderer shall along with his offer, submit the list of tools, manuals, circuit diagrams and other technical literature/drawings in English language to be supplied along with each machine as above, for operation, servicing, maintenance, assembly overhauling, periodic overhauling and troubleshooting guides/manuals. The list can be modified to suit the purchaser's requirement, while examining the offer.

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

15.6 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 made in India) with a minimum 7.5 KVA capacity capable of welding up to 5 mm. electrode (dia) 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 liters.

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

15.8 One set of all the manuals and diagrams shall also be sent to the Principal/IRTMTC/ Praygraj, one set for Chief Workshop Manager (Track Machines), CPOH Workshop, PO. Dhoomanganj, Prayagraj -211011, one set for Chief Workshop Manager (Track Machines), CPOH Workshop, South Central Railway, Rayanapadu, Vijaywada, Dist.-Krishna, Andhra Pradesh-521241, one set for Chief Workshop Manager (Track Machines), CPOH Workshop, Eastern Railway, Bhutbagan Railway Colony, Kanchrapara, P.S: Bizpur, P.O.: Kanchrapara, West Bengal-743145, one set for Chief Engineer. C.P.O.H, Western Railway, Divisional Office, Near Chamunda Mata Mandir, Naroda Road, P.O.–SaijpurBodha, Ahmedabad-382345,one set to PED/TMM/RDSO/Lucknow, one set to EDTK (MC)/Railway Board and one set to Director General/IRICEN/Pune 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 shall also be sent to above mentioned authorities.

15.9 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.

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

16.0 SPARE PARTS:

16.1 The tenderer shall quote, apart from main equipment, separately for the mandatory spares as well as for recommended spares required for two years i.e., working for about 2000 hrs of operation along with description, part number, quantity, cost, whether imported or indigenous. The expected life of components/spare parts shall be advised along with their condemning limits.

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

16.3 For indigenous parts and brought 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 CERTIFICATES:

17.1 Copies of 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 machine under normal working condition shall be indicated, specifying their duties and minimum qualifications.

19.0 OPTIONAL EQUIPMENT:

19.1 Tenderer is expected to quote for optional equipment separately, if any 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.

20.0 WARRANTY:

20.1 The machine shall be warrantied 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 tamping 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 be made in any part of the equipment offered, the warranty period of 18 months would commence from the 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/replacement shall be borne by the supplier.

20.2 Warranty period should be extended for the breakdown of the machine in lieu of spares & service engineer.

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21.0 INSPECTION OF THE MACHINE:

21.1 While inspecting the machine before dispatch from the supplier's premises, the inspecting officer to be nominated by the purchaser 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 issue of the inspection certificate and approval for dispatch of the machine as per Annexure–III enclosed.

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

- Machine shall 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.

- 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.

21.3 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 15.0, in English language, including operation, service and field maintenance manuals/instructions user manual and complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/description and other relevant technical details as a reference documents in soft & hard copies.

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

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

Clause	Clause no.	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-assemblieswith serial number wherever applicable.

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

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

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

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

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

i) Maker's test certificate.
ii) Manufacturer's internal quality inspection report.
iii) Quality certificates of bought out assemblies/sub-assemblies.
iv) Cross section of the machine super imposed on the Indian Railwaymaximum moving dimensions (IR MMD).
v) Vogel's diagram.
vi) List of spare parts to be dispatched along with the machine.
vii) List of tools to be dispatched along with the machine.
viii) List of manuals, drawings, spare parts catalogues, etc. to be 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) The code of procedure for ultrasonic testing along with ultrasonic testing report of wheels and axles of all types used in the machine.

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

22.0 TRAINING AND SERVICE ENGINEERS:

22.1 The supplier shall provide at his own expense the services of competent engineers during the warrantee period for warranty 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.

22.2 During the warrantee period of the machine, the supplier must ensure trouble free availability of the machine in good working condition for at least 90% of the time and accordingly they must ensure availability of spares & services of competent service engineers at prompt disposal of user railways.

23.0 ACCEPTANCE TEST:

23.1 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.

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

23.1.2. Testing for negotiability of 10°curves and 1 in 8.5 turnouts.

23.1.3. Construction and engineering of the machine and its ability to perform all the functions as laid down in the specification.

23.1.4. Illumination for the working and surrounding area of the machine sufficiently illuminated for efficient working during night as per clause no. 11.4.

23.1.5. Actual output and performance test to be conducted on the first machine.

These tests shall be conducted under field conditions on Indian Railways. An electrified section shall be chosen for this test.

The general conditions of tests shall be as follows: - Refer clause 3.0

i) Machine crew shall be either trained personnel of Indian Railways or the staff of the supplier.
ii) Dry weather, ambient temperature between -5°C to 55^0 C.
iii) Straight track or curve with radius not less than 175 m.
iv) Gradients up to 1 in 33 (3%)
v) Straight track with gradient up to 1 in 200.
vi) Rails and sleepers in good conditions and properly fastened.
vii) Concrete sleepers.
viii) Clean ballast cushion up to 150 mm in sufficient quantity below the bottom of the sleepers and generally not cemented.
ix) LWR track.
x) Regular sleeper spacing of 550 mm to 650 mm with a tolerance of ± 20 mm on straight track.
xi) Formation good.
xii) General lift up to 20mm.
xiii) Maximum slew up to ±10 mm.

Test to be conducted:

At the parameters specified by the tenderer against clause 3.15 the machine shall be capable of carrying out on plain track, automatic lifting, leveling, tamping and lining of 1000 sleepers or more in an hour of effective working in case of single insertion. When tamping turnouts, it shall be capable of tamping one 1 in 12 turnout complete with one rail length on straight portion on the approaches of the turnouts in an effective hour of working. Stoppage of work not attributable to machine shall be discounted. The time shall be counted from the time the machine arrives at the place of work to the time it is ready to start back from work after winding up operation. The setting up time and winding uptime 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.

23.1.6. 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.

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

25.0 SPEED CERTIFICATE:

25.1 **Provisional Speed Certificate**

Whenever a new rolling stock is introduced in Indian Railways, a provisional speed certificate is issued by Research, Design and Standards Organization (RDSO) of Indian Railways at Lucknow, based on certain design parameters of the machine. Final speed certificate of the machine is given after conducting detailed oscillation trial of the machine, which shall be 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 Railways track is taken from Commissioner of Railways Safety.

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

a) Current supplier, 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 Supplier, whose models are not approved/ or new:

As soon as the supplier completes the design of the machine as per specification, the technical details as per Annexure (IV & V) which in no case shall be more than six months from signing of contract, shall be supplied to Track Machine and Monitoring Directorate of RDSO of Indian Railways 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 (IV & V)) can also be asked for issue of provisional speed certificate for the machine .The firm will also submit the technical details as per pro-forma placed at Annexure-X. The supplier shall submit the dynamic simulation report of the machine on his own cost on professional track vehicle simulation software. The machine shall have to fulfil the acceptance criteria specified at Annexure-II.

c) New supplier, whose models are new:

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

25.2 **Final Speed Certificate:**

Final speed certificate of the machine shall be 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-II 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-XV. The decision of the railway will be final and binding.

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

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

26.0 MARKING & COLOUR OF MACHINE:

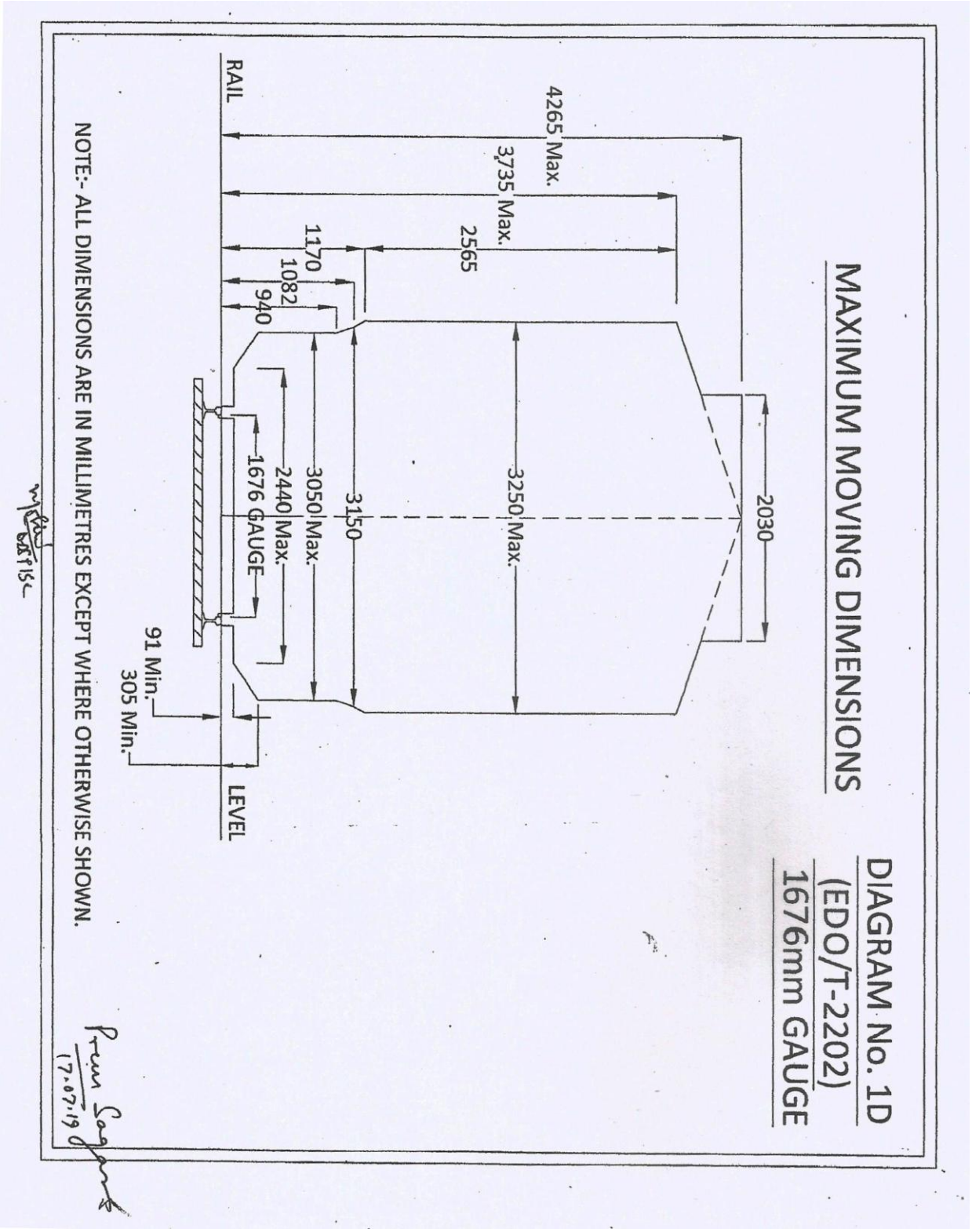
26.1 The machine body shall be painted in golden yellow colour of Indian Standard Colour Code of 356 as per IS: 5or RAL No. 1028 - Melon yellow. The exterior painting shall be polyurethane binder based conforming to RDSO Specification No. M&C/PCN/100/2013 (Specification for Epoxy cum Polyurethane Painting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

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

i) India Railways logo of height between 300 mm to 600 mm as suitable on all four faces of the machine.
ii) The text “INDIAN RAILWAYS” shall be written in bold and in black colour of size equal to or slightly smaller than the size of logo but of size not less than 250 mm on both side faces and below the Indian Railways logo.
iii) 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 below the text “INDIAN RAILWAYS” mentioned above.
iv) If required, the manufacturers name may be written in 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.
v) Suitable signage to warn the operator and machine working staff against the 25 KV OHE shall be stenciled on the machine at appropriate location.
vi) The speed of machine in case self-propelled and in train formation shall be marked on machines.

****

Annexure-I


MAXIMUM MOVING DIMENSIONS
DIAGRAM No. 1D
(EDO/T-2202)
1676mm GAUGE
4265 Max.
3735 Max.
2565
1170
1082
940
RAIL
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

Acceptance Criteria during Oscillation Trials

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

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

i) A lateral force lasting over a length of more than 2 m should not exceed the Prud-Homme's limit of k (1+P/3) tones. Where P is the axle load in tones, k=0.85 for wooden sleepers and k=1 for concrete sleepers.

ii) ii) Isolated peak values exceeding the above limit are permissible provided the record shows establishing characteristics of the vehicle subsequent to the disturbance.

iii) A derailment coefficient should be worked out in the form of ratio between the lateral force (Hy) and the wheel load (Q) continuously over a period of $1/20^{th}$ second; the value HY/Q shall not exceed 1.

iv) The values of acceleration recorded in the cab at location as near as possible to the bogie pivot (as near as possible to axle in case of four wheelers) shall be limited to 0.55gboth 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 vehicles where measurement of forces is not possible, the evaluation shall be in terms of ride index based on the accelerations measured as detailed in Para2 (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 movement of the bogie in straight and curved track with cant deficiency as prescribed in IRPWM-June, 2020 with latest amendment and lateral force and derailment coefficient of accelerations as the case may be.

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

3.1. 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 1.39mm./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 2.78mm./M inclusive) Above 10.00 mm. on chart (above 2.78

		mm./M.)
(3) Gauge	A B C	Up-to and ±3 mm. (inclusive) ±3 mm to & ±6 mm. (inclusive) Above ±6 mm
(4) Alignment (7.2 M. chord)	A B C	Up-to 3mm versine (inclusive) More than 3 mm and less than 5 mm versine. 5 mm. versine and above.

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

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-III

INSPECTION CERTIFICATE

CERTIFICATE OF INSPECTION OF TRACK MACHINE (.....)BY INSPECTING OFFICIAL AND APPROVAL FOR DISPATCH OF MACHINES.
(STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that Ihave inspected the machine (type)_____bearing Sl.No._____ from (date) _____to _____at (Place) _____ for its conformity/non-conformity with respect to the laid down Technical Specifications in contract Agreement No._____ dated_____between President of India through Director Track (Machines) 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 Railway.

For M/s._____
_____

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

Annexure-IV

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. Maximum axle load per meter :
   IV. Type of bogie :
   V. Weight of each bogie :
   VI. Weight of each bolster :
   VII. 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. Sprung mass on primary suspension :

9. Stiffness of suspension coil spring/magi spring :

10. Rate of deflection of primary spring :

11. Number of springs per nest :

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

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

14. 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. :

15. 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	:

16. Maximum braking force coming on to the rails per wheel

	at working axle	:
	at transfer axle	:

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

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

19. Height of floor from rail level. :

20. Type of coupler provided -Indian Railways Standard

I.	Coupling	:
II.	Buffer	:

21. Engine Make, Model, Power Rating etc.

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

Annexure-V

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

Name of the machine _____Model_____

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

Annexure-VI

Details of rails and sleepers used for different Track structures

Sr. No.	Rails			Sleepers				
	Rail Section	Weight (kg/m)	Height (mm)	Description	Length (mm)	Width (bottom) (mm)	Height (mm)	Weight (kg.) (approx.)
1.	60 kg 90 UTS	60.34	172	Wider concrete Sleeper	2750	285	235	350
2.	52 kg 90 UTS	51.89	156	Concrete Sleeper	2750	250	220	300

PROCEDURE OF DRAWING:-

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

NOTE:

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

③	SS/24/04	DIMENSION 73.7 DELETED
②	J.S. 00/3/94	REVISED & REDRAWN
①	J.S. 00/7/92	CO-ORDINATES OF ARCS SHOWN
ALT/AUTH.		DESCRIPTION

9/04	
3/94	
3/92	
DATE	

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

B.G.

R.D.S.O. (C)

GROUP XXX3

WORKING FILE

PROFILE

SKETCH-94146

Annexure-VIII

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

CPU	Intel Core i-5-7440HQ processor, speed 3.8 GHz or higher version
Operating System	Latest windows 11 professional or higher version
RAM	32 GB DDR5 or more and expandable minimum 128 GB
Storage	Shock protected removable HDD SATA 500 GB expandable up to 1 TB
Display	Minimum 15.6” Full HD with refresh rate of 144 Hz or better with sunlight readable display, anti-reflective and anti-glare treatment
Keyboard	LED backlit 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 (minimum IP65), Key board and touch pad
Pre Loaded Software	Latest Antivirus software for 18 months validity Microsoft office standard 2021 or latest complete bundle (Licensed copy with CD backup)
Power supply	Long life Li-ion battery, minimum 8700 m AH
Warranty	5-year warranty

Annexure-IX

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

1.	Tare & gross weight of the vehicle in Kilograms	
2.	Brake power in Kilograms	
3.	Type of Brake blocks	
4.	Brake block area in Square Centimeters	
5.	Brake Rigging Diagram	
6.	Type of Brake system	

Annexure-X

Machine data to be submitted along with dynamic simulation report of the machine

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 (Vehicle 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		Rear bogie full assembly		vehicle frame full structure	Full weight of vehicle (Front bogie + rear bogie +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 vehicle frame		
		Vertical stiff	Lateral stiff	Longitudinal stiff		Vertical stiff	Lateral stiff	Longitudinal stiff

9.	Damping force details (If hydraulic damper used give there rating force per meter/second)						
10.	Clearance in mm or radian provided for motion between bogie frame and vehicle 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.	Dimension 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 XI

Salient features of the Braking System of the Machine

1.0 Braking System

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

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

2.0 Vehicle should have provision of following braking mechanism.

2.1. Direct Brakes:

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

2.2. Indirect Brake:

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

2.3. Emergency Brakes:

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

2.4. Mechanical Parking brake:

Machine should be equipped with wheel operated system connected to braking lever with rigid chain link arrangement. This system should be capable to stop the machine in rolling condition during emergency. This shall also be used after parking of machine to prevent rolling of machine in standstill condition. This system should be provided in one cabin only.

2.5. Parking brake:

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

Annexure-XII

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-XIII

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-XIV

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 XV

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