1.0 GENERAL:

1.1 These specifications are laid down for a robust and sturdy track tamping/lining, lifting and levelling high output machine (hereinafter called the machine), which should be suitable for track geometry correction and tie tamping on track for maintenance and renewal/construction sites. The machine shall be capable of improving the track geometry up to mainline high-speed standards and continuous tamping operation for high output. Considering the limited availability of traffic block on the Indian Railways, high output tamping machines are required to give substantially increased output economically and quantitatively as given in the subsequent paras.

1.2 As the machine may be required to work for a number of passes at a site to improve the track geometry, the machine should be capable of giving substantially high output, as laid down in the specifications below, while achieving the highest quality of work.

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

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

1.5 Photographs of the type of machine offered in working mode shall be enclosed with the offer. This shall also show close-ups of various working assemblies/systems of the machine. The tenderer shall also furnish a compact disc (computer enabled) or DVD or USB showing the working of machine in real time under field conditions.

2.0 DIMENSIONAL AND OPERATING REQUIREMENTS:

2.1 The diesel powered self propelled tamping machine shall be of the latest design, extremely reliable with minimum of four or more axles and suitable for working on the Indian Railway plain track, transition and curved track (upto 10°) on the Broad Gauge (1676 mm). The design and dimensions of
the machine and components shall be to metric standards. Quality assurance during manufacturing shall be as per ISO-9001.

2.2 The profile of the machine longitudinally and in cross section during transfer as self-propelled vehicle or towed in train formation shall be within the Indian Railways Schedule of Dimensions–1676mm gauge (BG), revised, 2004 with the latest corrigendum and up to date correction slips issued. The maximum moving dimensions are shown in Annexure-I. The tenderer shall submit sketches of the machine in plan and shall give calculations for moving dimensions on 10° curve to show the extent of lateral shift at the ends, centre and any other relevant cross sections. It shall be ensured that the machine does not cause infringement while moving on a 10° curve.

2.3 Adequate clearance shall be allowed so that no component/part shall infringe the minimum clearance of 102 mm from rail level while travelling.

2.4 The axle load of the machine shall be less than 20.32t with minimum axle spacing of 1.83m. Load per meter shall not exceed 7.67 t. Axle loads upto 22.82t and lower axle spacing may be permitted provided the load combinations do not cause excessive stresses in the track and bridges of IR. Stresses in the track and bridges shall be calculated by IR/RDSO based on design data submitted by the firm as per Annexure–II and decision of IR/RDSO shall be final in this regards.

2.5 It shall have a minimum wheel diameter of 914 mm (new wheel profile). However, lesser diameter up to 730 mm for new wheel profile can be permitted provided it meets the condition laid down in clause 2.3 at its condemnation limit as per design. and rail wheel contact stresses for 72 UTS rails are within permissible limits. Forged wheels to Indian Railways profile shall be provided on the machine. The worn out wheel diameter based on the criteria of rail wheel contact stresses for various maximum axle loads are as under:

<table>
<thead>
<tr>
<th>Maximum Axle load (tonne)</th>
<th>Minimum worn out wheel diameter</th>
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<tbody>
<tr>
<td>22.82</td>
<td>908.00</td>
</tr>
<tr>
<td>22.00</td>
<td>878.00</td>
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<tr>
<td>21.50</td>
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<tr>
<td>21.00</td>
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<tr>
<td>20.32</td>
<td>816mm</td>
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<tr>
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<td>732mm</td>
</tr>
<tr>
<td>17.50</td>
<td>713mm</td>
</tr>
<tr>
<td>17.42</td>
<td>710.00</td>
</tr>
</tbody>
</table>

2.6 It shall be capable of negotiating curves upto 10° curvature (175 m radius), super elevation upto 185mm and gradients upto 3% in travel
mode. The supplier shall specify the minimum attainable speed under the above limiting conditions, which in any case shall not be less than 40 kmph. The machine shall be able to work on single/multiple lines as well as between platforms without infringing the traffic movement on the adjoining tracks.

2.7 The machine should be capable of continuous operation during the varying atmospheric and climatic conditions encountered throughout the year in India. The range of climatic conditions is as follows:

- Ambient temperature - 0° C to 55° C
- Altitude - sea level to 1750m above mean sea level
- Humidity - 40 to 100 %
- Maximum rail temperature - 70° C

2.8 During transfer from one station to another, it shall be capable of travelling on its own at a speed of 80 kmph and at a speed of 100 kmph when hauled in a train formation. Since the machine is likely to cover long distances on its own power, the travel drive system should be robust to sustain these requirements during the life of the machine. The machine should be capable of hauling an 8-wheeler camping coach at a maximum speed of not less than 50kmph.

2.9 It shall be capable of working without requiring power block in electrified sections. 25 KVA current is used for traction through an overhead wire at 5.5 m above rail level. On bridges and tunnels, the height is restricted to 4.8 m.

2.10 The machine or its any part shall not infringe the adjoining track as per Indian Railways Schedule of Dimensions, 1676mm gauge (BG), revised-2004 with the latest corrigendum and up to date correction slips issued, while opening and closing of work. During working also it shall not infringe the adjoining track and it shall be possible to permit trains at full speed on that track. Minimum spacing of track is 4.265m centre to centre.

2.11 It shall be possible to drive the machine in both directions at the same speed.

2.12 The wheel profile shall be as per Indian Railway standard wheel profile provided in annexure-III.

3.0 **Working Mechanism**

3.1 The machine shall be capable of carrying out automatic lifting, levelling, lining and tamping of track to achieve the laid down track geometry standards, with proper packing for various kind of track structures, and at laid down minimum progress rate as stated below. 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, DVD or CD ROM. For working on tracks with unknown target geometry, 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 constraints of lifting and lining etc. 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. It shall be possible to guide the lifting and lining system of the machines continuously and automatically by this unit. The software shall be Windows based. The hardware shall be sturdy for operation under conditions of shock, vibration, dust, electromagnetic influences from outside and interruption of power supply. The unit shall have adequate memory to cover minimum 100 km track length to keep records of works performed, new track geometry obtained and enable transfer of the data via compact disc (computer enabled) or DVD or USB as required.

3.2 The machine shall be capable of carrying out automatic lifting, levelling, lining and tamping at the peak rate of 2600 sleepers per hour over a period of not less than 10 minutes and average 2000 sleepers in an hour of working. The time of working shall be counted from start to finish of tamping work at work place. The machine shall be capable of working on all type of track structures i.e. long welded, short welded or fish plated rails laid on wooden/CST-9/ST/Concrete sleepers on 90R/52kg/60 kg rails with uniform sleeper density, which may vary from 55 cms to 75cms. Dimensions of sleepers are given in annexure- IV.

3.3 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 performance parameter as per clause no. 3.2 above.

3.4 On the joint sleepers, with clear spacing being only 50 mm, the machine shall be equipped with a mechanism to tamp these two sleepers also.

3.5 The ballast depth ranging from 300 mm to 350 mm shall be effectively compacted having zone of influence of tamping confined to approximately 150 mm layer below the bottom of sleepers. There shall be provision for step less adjustment of the depth of tamping tools to suit different type of sleepers and Rails. The depth of concrete sleeper at rail seat is 210mm.

3.6 The tamping below the sleepers, after the track geometry correction, shall be based on vibratory squeeze principle to achieve a durable compaction. The amplitude, vibration frequency and squeezing pressure, to achieve a durable compaction shall be specified.

3.7 It shall be possible to vary the peak squeezing pressure exerted by the tamping tools, to suit the different types of track structures.

3.8 The tamping tools shall come to rest automatically after they encounter the resistance from ballast to pre-selected squeezing pressure and hold the squeezing pressure for pre-set time. It shall be possible to vary the squeezing pressure holding time, to suit the varying ballast conditions.
3.9 On Indian Railways, Rail top to sleeper bottom depth may vary from 260 mm to 420 mm.

3.10 The machine shall be provided with automatic levelling/lining equipment, which will permit correct levelling, alignment and, cross levels of the track including provision of super elevation along with tamping. Tolerances achievable shall be as follows:

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

3.11 It shall be possible to control the target track geometry parameters, in infinitely variable steps, from the operator's/front cabin. To suit this, suitable Proportional/Servo Control Systems shall be provided.

3.12 Separate tamping unit shall be provided for each rail, with adequate number of tamping tools to impart adequate vibrations and squeezing of the ballast below the sleepers. The tamping unit shall be provided with necessary arrangements for lateral shifting to adjust and align them centrally over the rails in sharp curves.

3.13 The work units i.e tamping, lifting and lining units shall be positioned on an under frame (satellite frame) separate from the main frame capable of cyclic movement from sleeper to sleeper, independent of the main frame, to facilitate continuous working for high output so that the operator does not get undue fatigue due to acceleration, pull, braking jolt in each tamping cycle. The movement of the satellite frame shall be synchronous with movement of main frame, so as to achieve a continuous tamping of track.

3.14 The lifting system shall be such that the track can be lifted without bearing on the ballast. The machine frame and lifting system shall be strong enough to withstand the track lifting forces for all types of track structures for 150 mm lifts in one go.

3.15 The free rail length between the two bogies should be long enough to permit the track lifting 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.

3.16 While working on track, the lifting system should hold the rail continuously, rather than releasing and re-lifting the rail at every tamping cycle. However, the lifting/lining system and actual tamping should be so synchronised 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.

3.17 The machine shall be fitted with automatic lining equipment capable of carrying out lining simultaneously with levelling. The machine shall also
have the ability to slew 60 kg concrete sleeper and rail track upto 150 mm in one go for all type of track structures.

3.18 The machine shall be capable of measuring and recording in real time on a print out, unevenness, alignment and cross level before and after the tamping by the machine. It shall also record progress vis-a-vis time.

3.19 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 minimum specifications of the laptop are enclosed as annexure-V.

3.20 The machine shall be warranted for 1200 working hours or 4,50,000 tamping insertions or 18 months from the date of commissioning and proving test of equipment or 24 months after delivery at ultimate destination in India which ever shall be earlier. Working hours for this purpose will be traffic block time during which machine is deployed for tamping work.

3.21 The tamping tool holding arrangement in tamping arm of tamping bank should be cylindrical compressible type with bolting and dowel arrangement such that no hammering is normally required for fixing and removing the tamping tools.

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 this specification elsewhere.

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

4.3 High speed diesel oil to Indian Standard Specification shall be normally used. A minimum fuel capacity, sufficient for continuous operation for eight hours, will be desirable.

4.4 Sight glass type fuel measuring gauge 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 button start type.

4.6 Since the engine is 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 lubricants spills over. These should be easy to access for daily cleaning and routine maintenance. 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 The engine parameter monitoring gauges like temperature, rpm, and lube oil pressure shall be direct reading type mounted on the engine backed up by electrical/mechanical gauges in the operator’s cabin showing the absolute readings along with safe limits suitably coloured. There shall be audio visual warning (safety mechanism) to the operators in case of any of the parameters exceeding the safe limit and engine shut down circuit in case of operator’s failure to respond.

4.9 Suitable and rugged mechanism should be provided to start the prime mover at no load and gradual loading after the start of the prime mover. A fail safe clutch mechanism, if required may be provided to meet this requirement. The engine power take off shall be coupled to the main gearbox through a flexible coupling. The engine shall be mounted on suitable Anti-Vibration Mountings.

5.0 Drive Mechanism:

5.1 The machine should be provided with an efficient traction drive system for traction during the operation.

5.2 The machine’s driving system shall be through hydro dynamically coupled power/transmission arrangement capable of achieving full speeds in travel mode in both the directions. However, the system should be so designed that all the driving wheels work in synchronization and there is no slippage/skidding of the wheels during the work drive.

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

5.5 Suitable flow divider/throttling arrangement may be provided to equalize the tractive effort amongst different bogies. Adequate gauges shall be provided to indicate the power sharing among different driving bogies to prevent overstressing of any traction bogie or its components.

5.6 The supplier shall provide the necessary technical details including circuit diagrams to confirm the above requirements.
5.7 Adequate gauges and solenoid valves shall be provided near linkage assembly, for indication, flow control and carrying out necessary adjustment in the field.

5.8 To the extent possible hydraulic and pneumatic component/assembly should 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.

5.9 The pneumatic circuit should be provided with air dryer for the smooth working of pneumatic components.

6.0 Chassis and Under frame:

The chassis shall be fabricated from standard welded steel sections and of steel sheets, so as to permit transportation of the machine in train formation without endangering safety of train. The under frame shall be constructed from rolled steel section and/or plates and shall be designed to withstand a horizontal squeeze load of 102t at buffers i.e. 51t at each buffing point. The under frame shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as the last vehicle.

7.0 Suspension System:

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

8.0 Hooks and buffers:

The machine shall be fitted with hooks and buffers of IRS design on both ends for coupling the machine to other vehicle or camping coach and running it in train formation.

9.0 Cabins:

9.1 The machine shall be equipped with fully enclosed cabins with safety glass windows for driving from both ends. The working cabin/cabins should be air-conditioned. However, the electronic equipment shall be so designed that it shall be able to work without air conditioning under the climatic conditions described in Para 2.7. The air conditioner shall be of 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. 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.
9.2 The gauges, warning panel and controls shall be suitably located in the operator’s cabins so that they can be observed without undue fatigue to the operator.

9.3 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.

9.4 Screen wipers preferably operated by compressed air or electrically operated shall be provided on the windscreens on both sides.

9.5 Suitable number of fire extinguisher (dry chemical type) shall be provided in all the cabins.

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

10.0 Cooling System

10.1 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 should be maintainable under these conditions.

10.2 Adequate heat dissipation arrangement for the hydraulic system shall be designed and provided so that under extreme heat conditions as mentioned in 2.7 above, the system oil temperature does not go beyond 85°C.

11.0 Brakes:

11.1 The machine shall be fitted with the compressed air brakes and provision shall be made to connect air brake system of the machine to that of camping coach when the machine is hauling it. 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.

11.2 Machine shall be equipped with suitable arrangement of braking so that while attached in train formation, machine can be braked by traction vehicle having compressed air braking system.

11.3 There should be provision of emergency brake application in the machine, either travelling alone or coupled with the camp coach, in addition to the normal braking system of the machine, using the compressed air. The emergency braking distance (EBD) of the machine on the Indian Railway Track, at the maximum design speed shall not be more than approximately 600m. 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 VI.

11.4 Mechanical brakes shall also be provided in addition for use as parking brakes.

11.5 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 to alert the operator of machine following this machine when the machines are working in groups.

12.0 Horn, Hooters and safety switches:

12.1 The machine shall be provided with electric/pneumatic horns facing outwards at each end of the machine at suitable locations for use during travelling and to warn the workmen of any impending danger at the work spot. The horns shall be distinctly audible from a distance of at-least 400 m from the machine. These horns shall be operated by means of push buttons provided in the cabins.

12.2 Adequate numbers of switches, for stopping the machine and for operating electric horns shall be provided all around the machine so that in case of any danger to worker as well as to the safety of machine during working, the operator can be warned and working can be stopped immediately.

12.3 Pneumatically operated 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.

12.4 Safety equipments like jacks, pullers, trifor and other such equipments specific to the machine for restoring failed units of the machine during working shall be provided on the machine.

12.5 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.

13.0 Electric equipment and lighting:

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 headlight assembly, conforming to RDSO specification no. ELRS/SPEC/PR/0024 revision-1, September, 2004 with the latest amendments ensuring a light intensity of 3.2 lux at ground level at track centre at a distance of 305 mts. 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 swivelling floodlights shall also be provided to illuminate the working area sufficiently bright for efficient working during night. The amber colour flasher lights shall be provided on both ends of the machine.
to give indication for the train arriving on other line about any impending danger.

14.0 Operators:

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

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.

15.2 Detailed operating, maintenance and service manual, shall be specifically prepared in English language and four copies of these shall be supplied with each machine.

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

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

15.5 One portable Diesel operated D.C. welding generator of reputed make (preferably made in India) with a minimum 5 KVA capacity along with sufficient length of cable or lead shall be provided with the machine for day to day repairing of machine and its wearing parts.

15.6 The firm shall provide detailed technical drawings and specifications of wheels and axles used on the machine. The above details shall be provided in four sets with each machine.

15.7 One set of all the manuals and diagrams should also be provided for Principal/IRTMTC, Allahabad, one set for ED/TMM, RDSO, Lucknow, one
set for DTK (MC)/Railway Board and one set for Director/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 should also be sent for above mentioned authorities.

16.0 **Spare Parts:**

16.1 The tenderer should 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, part number, quantity, cost, whether imported or indigenous. The expected life of components 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 for the life of the machine (15 years).

16.3 For indigenous parts and brought out components and assemblies, the relevant technical details shall be supplied while offering the first machine for inspection.

17.0 **Maker’s test certificate:**

Copies of maker’s certificate guaranteeing the performance of the machine should be supplied in duplicate along with the delivery of each machine.

18.0 **Optional Equipment:**

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

19.0 **Guarantee:**

In addition to the clause 9 of the special conditions of contract dealing with warranty, the following will apply.

Should any design modification be made in any part of the equipment offered, the period of 24 months would commence from the date of the modified part is commissioned in service 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 should be borne by the supplier.

20.0 **Inspection of the machine:**

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

21.0 Service Engineers:

The contractor shall provide at his own expense the services of competent engineers during the warranty period for warranty related issues. The service engineers shall be available for the commissioning of the machine for regular service, and for training to the operating, repairing and maintenance staff of 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.

22.0 Acceptance test:

22.1 In addition to verification of the various items of specifications covered earlier, the purchaser’s nominee shall carry out the following tests in India at the purchaser’s premises at the time of 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.

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

22.3 Testing for negotiability of 10 degree curve and 1 in 8 ½ turnout.

22.4 Running speed tests on the Indian Railway mainline track on the first machine in accordance with the procedures outlined in Annexure-VIII with the machine running upto speed 10% higher than the maximum speed mentioned in Para 2.8 above.

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

22.6 Actual output and performance test to be conducted on the first machine. These tests shall be conducted under field conditions on Indian Railway. An electrified section shall be chosen for this test. The general condition of test and test parameters shall be as follows:-

a) The machine crew shall be either trained personnel of Indian Railways or the staff of the contractor/supplier.

b) Dry weather, ambient temperature between +0°C to +55°C.

c) General lift during working upto 20mm.

d) Lifting of tack in non tamping mode of 150 mm in one go.

e) Maximum slew during working upto ±10mm.

f) Slewing of track in non tamping mode of ±150mm in one go.

g) Plain Track or curve of radius not less than 1000m

h) Clean ballast cushion upto 100 mm in sufficient quantity below the bottom of the sleeper and generally not cemented.

i) Straight track with gradient upto 1 in 200.

j) Long welded track on concrete/wooden/steel sleepers.

k) Rails and sleepers in good conditions and properly fastened.
l) Regular sleeper spacing of 60/65 cms with a tolerance of ±3 cms on straight track.
m) Good formation.
n) The machine shall able to tamp 2000 sleepers over a one hour period of working. The time shall be counted from start to finish of tamping work at work place. The machine shall also be able to achieve a peak tamping rate of 2600 sleepers per hour over a 10 minutes period. Stoppage of work not attributable to machine shall be discounted. The setting up time and winding up time shall be measured and the total time taken for two operations of setting up and winding up of the machine together shall not exceed 20 minutes.

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

23.0 Issue of Provisional Speed Certificate:

Whenever a new rolling stock is introduced in Indian Railways, a provisional speed certificate is issued by RDSO based on certain design parameters of the vehicle. Final speed clearance of the vehicle is given after conducting detailed oscillation trial of the vehicle, which is a time taking process. Therefore, issue of provisional speed certificate for the vehicle becomes a necessity and based on the same the approval of running of the vehicle on Indian Railway track is taken from Commissioner of Railway Safety. For issue of provisional speed certificate, the following actions are required to be taken by the suppliers.

a) Current suppliers, whose models are approved:

The supplier shall give details of the model, year of introduction in Indian Railway, details of speed certificate issued etc. The supplier shall certify that no change has taken place in the model being offered with respect to design of under carriage i.e. suspension system/arrangement, wheel & axle assembly, bogie, braking arrangement loading pattern of the vehicle etc. and the distribution of axle loads, lateral forces, unsprung mass, tractive effort and braking force coming on rail is the same. If there is any change in above respect, the action shall be taken as detailed in para (b) below:

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

As soon as the supplier completes the design of the machine as per specifications, the technical details as per Annexure IX & X shall be supplied 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 IX & X can also be asked for issue of provisional speed certificate for the machine. The firm will also submit the technical details as per performa placed at Annexure-II for NUCARS vehicle dynamic simulation.

c) New suppliers, whose models are new:

The technical details shall be supplied as detailed in para (b) above.
Machine details required for simulation of machine on NUCARS or similar Track-vehicle simulation software

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<th>Component’s Name</th>
<th>Parameters required</th>
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<tr>
<td></td>
<td>C.G. of component in x, y, z direction from rail level in mm (Referenced point 1st axle)</td>
<td>Mass in Kg and Mass moment of inertias in Kg- m^2 of component in three dimension space about their C.G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>1.</td>
<td>Super structure with vehicle frame (machine structure kept on secondary suspension of front and rear bogie)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Front Bogie frame including brake rigging</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Rear Bogie frame including brake rigging</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Transmission system device (hydraulic, Mechanical or electrical traction motors)</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Wheel axle set including axle boxes which constitute the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>unsprung mass</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mass of Items included in unsprung mass partially or fully along with their name per axle</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Front bogie full assembly</td>
<td>Rear bogie full assembly</td>
</tr>
<tr>
<td>7.</td>
<td>Total weight of components in tonnes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suspension stiffness details in Kg/mm</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Primary suspension element stiffness per axle box between bogie and axle box</td>
<td>Secondary suspension element stiffness per side between bogie and machine frame</td>
</tr>
<tr>
<td></td>
<td>Vertical stiff</td>
<td>Lateral stiff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
| 9. | Damping force details  
(If hydraulic damper used give there rating force per meter/second) |   |   |   |
| 10. | Clearance in mm or radian provided for motion between bogie frame and machine frame for relative motion (motion stopper) | Vertical direction | Lateral direction | Longitudinal direction | Rotation about vertical axis | Rotation about lateral axis | Rotation about longitudinal axis |
| 11. | 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. |   |   |   |   |
NOTE:
CO-ORDINATES OF POINTS B & C ARE BASED ON NOMINAL DIMENSION OF 28.5mm.

PROFILES

PROCEDURE OF DRAWING:
1. Draw a vertical line X-Y tangent to the Y axis.
2. Draw a semi-circle of 14.56 tangent to X-Y.
3. Draw a horizontal line at 28.4mm from X-Y.
4. Draw a horizontal line at 63.5mm from the line X-Y.
5. Draw a vertical line at a distance of 50mm from the flange end.
6. Locate centre C of arc from X-Y.
7. Locate centre B of arc from X-Y.
8. Draw arc of radius 165mm with centre X.
9. Draw arc of radius 110mm with centre X.
10. Locate point A on the arc and line 12.5mm from the line X-Y.
11. Draw a vertical line at a distance of 50mm from the flange end.
## SIZES OF DIFFERENT B.G. SLEEPERS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of sleeper</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length (mm)</td>
</tr>
<tr>
<td>1.</td>
<td>CONCRETE SLEEPER</td>
<td>2750</td>
</tr>
<tr>
<td>2.</td>
<td>WOODEN SLEEPER</td>
<td>2750</td>
</tr>
<tr>
<td>3.</td>
<td>STEEL TROUGH SLEEPER</td>
<td>2680</td>
</tr>
</tbody>
</table>
Specifications of Heavy duty Industrial Quality Water proof & shock proof Laptop (Tough book)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Intel Core i-5 processor , speed 2.4 GHz or higher version</td>
</tr>
<tr>
<td>Operating System</td>
<td>Windows 7 professional or higher version</td>
</tr>
<tr>
<td>RAM</td>
<td>2 GB or more and expandable upto 8GB</td>
</tr>
<tr>
<td>Storage</td>
<td>Shock mounted flex connect hard drive with quick release 500 GB or More</td>
</tr>
<tr>
<td>Display</td>
<td>Minimum 13&quot; high definition LED or better with anti reflective and anti glare treatment</td>
</tr>
<tr>
<td>Keyboard</td>
<td>Backlit 61 key QWERTY keyboard. Touchpad with vertical scrolling support.</td>
</tr>
<tr>
<td>Wireless</td>
<td>Integrated Gobi 2000 mobile broadband or better, Bluetooth V 4.0 or better.</td>
</tr>
<tr>
<td>Durability features</td>
<td>Product shall be durable and meet the latest MIL standard. Moisture and dust resistant screen, Key board and touch pad.</td>
</tr>
<tr>
<td>Pre Loaded Softwares</td>
<td>Antivirus software for 18 months validity Microsoft office 2007 complete bundle</td>
</tr>
<tr>
<td>Power supply</td>
<td>Long life Li-ion battery, minimum 5400 m AH</td>
</tr>
<tr>
<td>Warranty</td>
<td>3-year warranty</td>
</tr>
</tbody>
</table>
Annexure-VI

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

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tare &amp; gross weight of the machine in Kilograms</td>
<td></td>
</tr>
<tr>
<td>Brake power in Kilograms</td>
<td></td>
</tr>
<tr>
<td>Type of Brake blocks</td>
<td></td>
</tr>
<tr>
<td>Brake block area in Square Centimetres</td>
<td></td>
</tr>
<tr>
<td>Brake Rigging Diagram</td>
<td></td>
</tr>
<tr>
<td>Type of Brake system</td>
<td></td>
</tr>
</tbody>
</table>
CERTIFICATE OF INSPECTION OF …………………………………………… (Model No. ………………………..) BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF MACHINE.

(Strike out whichever not applicable)

This is to certify that I have inspected the ……………………………………… bearing Sl. No. ………………………………………from (date) …………………………..to ………………………..at (place) ………………………………………..for its conformity / non-conformity with respect to the laid down Technical Specification on contract Agreement No. ………………………………………..dated…………………………between the president of india through Director ………………………………………../RDSO/Lucknow and M/s. (Name of contractor) ………………………………………..The detailed inspection note regarding its conformity / non-conformity to the laid down specification is enclosed along with Annexure ‘A”. It is observed that:

(Strike out whichever is not applicable)

• The ……………………………………… conforms to all the laid down specifications.
• The ……………………………………… 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/machine/vehicle in substantial way.

The following T & P, manuals, drawings are to be supplied along with the machine.

1……………………………….
2……………………………….
3……………………………….

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

The ……………………………………………..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
ACCEPTANCE CRITERIA DURING OSCILLATION TRIALS

The speed potential of the machine offered by the firm should be established based upon oscillation trials conducted in India. The tests will be conducted at a speed usually 10% higher than the maximum speed potential indicated by the firm for the machine under consideration and the following criteria satisfy for the same. For conducting the tests, a section of mainline track will be selected over which there is no temporary speed restrictions and which is considered by the 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.

The criteria to assess the performance of the UTV in oscillation trials will be as applicable in Indian Railways at the time of actual oscillation trials.

However, the criteria applicable at present are given below:

1. A lateral force lasting more than 2 metres should not exceed the Prud Home’s limit of 0.85 \((1 + P/3)\) tonnes, where \(P\) is the axle load in tonnes.
2. Isolated peak values exceeding the above limit are permissible provided the record shows stabilizing characteristics of the vehicle subsequent to the disturbances.
3. 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 of \(Hy / Q\) shall not exceed 1.
4. The values of acceleration recorded in the cab at location as near as possible to axle, shall be limited to 0.55 g both in vertical and lateral directions. The peak values up to 0.60 g may be permitted, if the records do not indicate a resonant tendency in the region of peak value.
5. In case of such vehicles where measurement of forces is not possible, evaluation shall be in terms of ride index, based on the accelerations measured as detailed in para 4 above, which shall not be greater than 4.50, but a limit of 4.25 is preferred.
6. A general indication of stable running characteristics of the whole vehicle as evidenced by the movements of the bogie in straight, station yard and curved track and lateral force and derailment coefficient or accelerations as the case may be.
Annexure – IX

Particulars Required in Respect of the Rolling Stock Under Consideration

1. A diagram showing elevation salient dimensions:
   Wheel spacing, Wheel diameter, bogie centres, and axle load.
   a) i) Over all length of the vehicle:
   ii) Length over head stock:
   iii) Length over buffers:
   iv) Distance apart for Centre of buffers:
   v) Max./Min. height of centers of buffers above rail level:
   b) i) Wheel base:
   ii) Axle load (max):
   iii) Bogie Centres:

2. Wheel dimension:
   i) New:
   ii) Worn out:

3. i) Tread and flange profile of the wheel:
   indicating clearly whether it is Indian Railway 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. Expected lateral force in tonnes per axle at maximum design speed.

8. 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.

9. 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:

10. Maximum braking force coming on to the rails per wheel
    a) at working axle:
    b) at transfer axle:

11. Drawing indicating suspension arrangement details of bogie and axle.

12. Height of centre of gravity from rail level:

13. Height of floor from rail level:

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

15. Any infringement to the moving dimensions:
    Sketch provided in the Indian Railways Standard Schedule of Dimensions – Chapter IV (A).
Following information as detailed below is also required along with the information required as per Annexure 'A' for processing the case for issue of provisional speed certificate for new vehicle.

<table>
<thead>
<tr>
<th>S.no</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. a)</td>
<td>Brake System details</td>
</tr>
<tr>
<td>b)</td>
<td>Gross Braking Ratio</td>
</tr>
<tr>
<td>2.</td>
<td>Brake rigging arrangement drawing and calculation of braking force</td>
</tr>
<tr>
<td>3.</td>
<td>Maximum Braking Effort. at start and at the speed of operation -</td>
</tr>
<tr>
<td>a)</td>
<td>at working drive at start :</td>
</tr>
<tr>
<td></td>
<td>at operation speed :</td>
</tr>
<tr>
<td>b)</td>
<td>at transfer drive at start :</td>
</tr>
<tr>
<td></td>
<td>at maximum speed :</td>
</tr>
<tr>
<td>4.</td>
<td>Characteristics of springs used in suspension indicating free height, working height, dynamic range, stiffness and locations etc.</td>
</tr>
<tr>
<td>5.</td>
<td>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 iv) Wave length of free axle and bogie</td>
</tr>
<tr>
<td>6.</td>
<td>Write up and salient design calculation on suspension system, type of suspension whether it is of coil suspension with or without dampers and laminated bearing springs and double link suspension.</td>
</tr>
<tr>
<td>7.</td>
<td>What are 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.</td>
</tr>
<tr>
<td>8.</td>
<td>Wheel and axle assembly drawings</td>
</tr>
<tr>
<td>9.</td>
<td>Calculation for flange force</td>
</tr>
<tr>
<td>11.</td>
<td>Calculation of natural frequency</td>
</tr>
<tr>
<td>12.</td>
<td>Calculation of spring characteristics and critical speed of the vehicle.</td>
</tr>
<tr>
<td>13.</td>
<td>Simulation result showing ride index, lateral force and acceleration results.</td>
</tr>
<tr>
<td>14.</td>
<td>A certificate regarding the speed of the vehicle for which it has been designed.</td>
</tr>
</tbody>
</table>