TECHNICAL SPECIFICATION FOR HEAVY DUTY ON TRACK TAMPERs
FOR TAMPING
PLAIN TRACK AND POINTS & CROSSING FOR BG (1676 mm Gauge)

1.0 GENERAL

1.1 These specifications are laid down for a machine for the tamping of concrete sleepers on turnouts which includes track tamping on turnout approaches along with lining and levelling. These specifications have been designed for such a turn out cum plain track tamping machine herein after called ‘machine’ which should be suitable for track geometry correction and tie tamping on turnouts and also on plain track. The machine shall be robust and sturdy to deal with the initial rough track geometry after the linking, and be capable of improving the track geometry up to main line high speed standard. 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 substantially high output, as laid down in the specifications below, while achieving highest quality of work.

1.2 The 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 machine 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.

1.3 The bidder shall specify the model offered and furnish a detailed Technical Description of the same. System/sub-systems of the working mechanisms of the machine as per para ‘3’ in particular and all the items of the specifications in general shall be described in detail in the “Technical Description”, along with the sketches to show the manner in which the requirements of the specifications are accomplished by the machine (model) offered.

1.4 Photographs of the type of machine in working mode shall be enclosed with the offer. This shall also show close-ups of various working assemblies/systems and the full machine. The tenderer shall furnish a video Compact Disk showing the working of machine in real time under field conditions.

2.0 DIMENSIONAL AND OPERATING REQUIREMENTS

2.1 The diesel-powered machine shall be robust, reliable and suitable for working on Indian Railways. The design and dimensions of the machine components shall be to metric standards. Quality assurance during manufacturing of the machine shall be according to ISO-9001. The machine shall be suitable for working on straight, transition and curved tracks (upto 10 degree) on broad gauge (1676 mm) of Indian Railways.

2.2 The machine shall be a self propelled bogie type vehicle with minimum 4 axles (2 bogies). The profile of the On track equipment longitudinally and in cross section during transfer as self-propelled vehicle or towed in train formation shall be within the Indian Railways Standard metric BG schedule of Dimensions (Rev-2004). The maximum moving dimensions are enclosed at Annexure-I. The
tenderer shall provide sketches of the machine in plan and shall give calculations to prove that the machine does not cause infringement while moving on a 10° curve.

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

2.4 Axle load shall be lesser than 20.32t with minimum axle spacing of 1.83 m. Load per metre 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 desirable wheel diameter of 915 mm (New wheel profile). However, lesser diameter upto 730 mm (New wheel profile) can also be considered, provided it meets the speed and riding quality criteria as laid down in clause 2.9 and 21.4 and also rail wheel contact stresses for 72 UTS are within permissible limits. Forged wheels to Indian Railway Profile shall be provided on the machine. The worn out wheel diameter(condemning worn out 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 (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.32</td>
<td>816</td>
</tr>
<tr>
<td>20.0</td>
<td>805</td>
</tr>
<tr>
<td>19.5</td>
<td>787</td>
</tr>
<tr>
<td>19.0</td>
<td>768</td>
</tr>
<tr>
<td>18.5</td>
<td>750</td>
</tr>
<tr>
<td>18.0</td>
<td>732</td>
</tr>
<tr>
<td>17.5</td>
<td>713</td>
</tr>
<tr>
<td>17.0</td>
<td>700</td>
</tr>
<tr>
<td>16.5</td>
<td>680</td>
</tr>
</tbody>
</table>

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

2.7 It shall be capable of negotiating curves upto 10° curvature (176 m radius), super elevation upto 185 mm and gradients upto 3%. The supplier shall specify the minimum attainable speed under the above limiting conditions which in any case shall not be less than 40 kmph.

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

- Ambient temperature: 0° - 55°C
- Altitude: Sea level to 1750m
- Humidity: 40% to 100%
- Maximum rail temp.: 70°C

2.9 During transfer from one station to another, it shall be capable of travelling on its
own at a speed of 80 kmph and 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 without significant break down/failure. The speed of the machine while hauling a 8-wheeler coach should not be less than 50kmph.

2.10 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.

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

2.12 The machine or its any part shall not infringe the adjoining track as per the Indian Railways schedule of Dimension 1676 gauge (BG) revised 2004 with latest correction slip 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 4.265 m centre to centre.

2.13 The machine shall be equipped with pneumatically operated block brakes acting on all wheels. The machine shall be equipped with a mechanically operated parking brake. 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 Separate tamping unit shall be provided for each rail, each unit comprising of tamping tools operated hydraulically. It shall be possible to tamp all four rails of the turnout. For the same, four independent tamping units shall be provided with necessary arrangement for lateral shifting to adjust them on the rail of the turnout. Tamping unit shall also be adjustable from operators seat for tamping of slanting sleepers. Similarly it shall be possible to adjust the tamping tools in a manner so that all the accessible tamping zone on either side of the rails and sleepers are tamped effectively provided there is space for tamping tools to go into the ballast. It shall be possible to tamp longer sleeper in one operation.

3.2 Tamping action shall be based on vibratory squeeze principal with tamping tools operating under the same pressure but independent of one another. The amplitude, vibration frequency and squeezing pressure to achieve a durable compaction on different track structures as mentioned in para 3.1 shall be specified.

3.3 Amplitude, vibration frequency and squeezing pressure of tamping tools shall be such that durable compaction under the sleeper is achieved.

3.4 The tamping tools shall come to rest automatically after they encounter the resistance from the ballast to the pre-selected pressure. The pressure shall be variable so that, it can be adjusted according to ballast conditions. It shall be possible to vary the peak squeezing pressure exerted by the tamping tools, to suit the different type of track structure.

3.5 The lifting system shall be such that the track can be lifted without bearing on ballast shoulders outside the sleepers. The machine frame and lifting system shall be strong enough to withstand the track lifting forces for all type of track structure for 150mm lift in one go depending upon the requirement.
3.6 The free length between the two bogies should be long enough to permit the track lifting up to 150mm in one go, with 60kg rails on concrete structure, without excessive stresses in the rail or on the lifting mechanism.

3.7 The machine shall be provided with the automatic leveling equipment, which will permit correct leveling of the track and Point & Xing including provision of super elevation along with tamping.

3.8 While working on plain track, the lifting system should hold the rail continuously, rather than releasing and re-lifting of rail at every tamping cycle.

3.9 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 the sleepers and fitting etc. in the turnout. The machine shall be able to slew the track up to at least 150mm in one go on all types of track structure.

3.10 The machine shall be able to achieve the following tolerances

- Unevenness $\pm 1\text{mm}$ on 3.6m chord
- Cross level $\pm 1\text{mm}$
- Alignment $\pm 2\text{mm}$ on 7.2m chord
- Twist $1\text{mm/m}$

3.11 The machine shall be capable of carrying out on plain track, automatic lifting, levelling, tamping and lining of 1000 sleeper in an hour of working. When tamping turnout, it shall be capable of tamping two 1 in 12 turnouts complete with 10 sleepers on straight portion on the approaches of the turnouts in an hour of working.

3.12 The machine shall be capable of automatic leveling, lining and tamping of turnout with CMS and built up crossing of angles 1 in 8-1/2, 1 in 12 and 1 in 16 laid on wooden, steel or concrete sleepers without dismantling the turnout. The machine shall be provided with facility (computerized) of pre and post measurement of track parameter i.e. unevenness, cross level, alignment and twist and optimization of the same for corrections of above parameter along with conditions to be applied for taking obligatory points. All these parameters shall be displayed on the computer screen. The system should be windows compatible and it shall be able to transfer data through USB port (Pen drive etc.) directly in excel format. The system shall be so designed that while working on tracks with pre decided track geometry, the standard track geometry data as well as correction values can be entered prior to work directly on system via USB, Pen drive or CD ROM. For working on tracks with unknown track geometry, it shall be possible to determine the correction values by making the measuring run and subsequent geometry compensation of the recorded data considering obligatory points and constraints of lifting and lining etc. Interactive processing of the target profile by the operator shall be possible. The unit shall have adequate memory to keep records of work performed, new track geometry obtained and enables transfer of data via USB, Pen drive or CD ROM as required.

3.13 The machine shall also be capable of tamping, lifting and lining up to 60kg/m long welded rails, short welded rails and fish plated track with rails laid on concrete sleepers, steel trough sleepers, CST-9 or wooden sleeper as the minimum clear distance between the joint sleeper is 50 mm, the machine shall be able to tamp
these two sleepers together. The normal sleeper spacing in different track structure in IR is 50Cms to 75Cms.

3.14 The machine shall be capable of slewing of track if required, up to 150mm in one go on all types of track structures. The machine shall also be capable of lifting the track if required up to 150mm in one go on all type of track structures.

3.15 The machine’s diving system shall be through hydro dynamically/ hydrostatically coupled power shift arrangement capable of achieving full speeds in travel mode in both the directions.

3.16 The tamping tools shall be capable of tamping ballast up to a depth of 150mm below the bottom of the sleepers. There shall be provision for step less adjustment of depth of tamping tools.

3.17 It shall be possible to control the target track geometry parameters infinitely variable steps, from the operators/front cabin. To suit this suitable proportional/ Servo control system shall be provided.

3.18 Considerable pull is applied on the rail while operating the machine from one line on the turnout for tamping or lifting. The other tracks on the turn out acts as an anchor and adds to the requirement of lifting force. This may results in overstressing of the fastenings of the track from which the machine is operating. The machine therefore shall have arrangement to lift the other track of the turnout also while the track on which the machine is working is lifted for tamping. Refer para 3.6 also. Proper mechanism shall be provided to ensure that the lifting of the other track is carried synchronously and the lifting operation is cut off automatically when desired or when the specified lift is reached.

3.19 The working cabins of machine shall be air conditioned. However electronic equipment shall be so designed that it shall be able to work without air conditioning under the climatic conditions, described in para 2.8.

3.20 On Indian Railways, rail top to sleeper bottom depth may vary from 260mm to 420mm. There shall be provision for step less adjustment of the penetration depth of tamping tools to suit different types of rail and sleepers.

3.21 In addition to the computer system provided on the machine for its own controls, the machine shall be provided with one additional 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 are enclosed as annexure-IV.

3.22 The machine shall be warranted for 1200 effective working hours or 3,50,000 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. Effective working hours will be traffic block time during which machine is deployed for tamping work.

4.0 DIESEL ENGINE

4.1 The machine shall be powered by diesel engine (s) 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 shall furnish the details of diesel engine and its controls to assess its conformity with the engines already operating on track machines on IR. If the machine-design incorporates an engine not already operating with the purchaser, the model of the engine is liable for change as per the technical requirements and the maintenance logistics with the purchaser after technical negotiations with the supplier. Nothing extra shall be payable on this account.

4.3 High speed diesel oil to Indian Standard Specification shall be normally used. A minimum fuel capacity sufficient for continuous operation for 8 hrs 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 where the lubricants spill 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 colored. There shall be audio visual warning (safety mechanism) to the operators in case of any of these 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.

4.10 The engine power take off shall be coupled to the main gear box 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. The machine’s driving system shall be through hydro dynamically/hydrostatic coupled power/transmission arrangement capable of achieving full speeds in travel mode in both the directions. 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.
5.2 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.

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

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

5.5 The supplier shall provide the necessary technical details including circuit diagrams to confirm the above requirements.

5.6 Adequate gauges (flow meter) and solenoid valves shall be provided near linkage assembly, for indication, flow control and carrying out necessary adjustment in the field.

5.7 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.

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 should be maintainable under these conditions.

6.2 Adequate heat transfer arrangement for hydraulic system shall be designed and provided so that under extreme heat conditions as mentioned in para 2.8 above, the system oil temperature does not go beyond 85 degree centigrade.

7.0 BRAKES

7.1 The machine shall be fitted with the air-brakes system 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. The force required for operating the brake shall not exceed 10 kg at the handle while applying by hand and 20 kg on the pedal, when applied by foot. In addition, mechanical brakes shall also be provided for use in an eventuality of failure as well as for parking.

7.2 Machine shall be equipped with suitable air brake valves so that while working in train formation, machine can be braked by the traction vehicle. In addition, the machine shall be equipped with suitable air brake system in the driving cabins so that the camping coach while being hauled by the machine can be braked.

7.3 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 designed speed on a level track shall not be more than 600m. In this regard necessary design calculations for the braking effort and EBD at the maximum design speed of the machine on level track & at falling grade of 1 in 33 should be provided by the supplier. Brake design details are to be submitted as per annexure V.

8.0 HORN AND SAFETY SWITCHES

8.1 The machine shall be provided with electric/pneumatic horns/hooters facing outwards at each end of the machine at suitable locations to warn the workman of any impending danger at the work spot or from on-coming train. The horns/hooters shall be distinctly audible from a distance of at least 400m from the machine. These electric horns/hooters shall be operated by means of push buttons provided in the cabs to warn the staff working on/around the machine about approaching train on adjoining track. Adequate nos. of safety stop switches should be provided all around, so that in case of any danger to the worker during work, the working can be stopped immediately.

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

8.3 Machine shall be provided with emergency backup system to wind up the machine in the event of failure of prime mover or power transmission system of the machine.

9.0 HOOKS AND BUFFERS

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

10.0 SUSPENSION SYSTEM:

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

11.0 ELECTRIC EQUIPMENT AND LIGHTING

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 headlight assembly conforming to RDSO’s specification No.ELRS/SPEC/PR/0024 Rev-1, Sept 2004 with 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 swiveling floodlights shall also be provided to illuminate the working area sufficiently bright for efficient working during night. The amber colour flasher light shall be provided at both ends on the machine to give indication to the arriving train on other line about any impending danger.
12.0 CHASSIS & UNDER FRAME

12.1 The chassis shall be fabricated from standard welded steel sections and of steel sheets, so as to permit transportation of the machine in train formation without endangering safety of the train. The under frame shall be constructed with rolled steel sections and/or plates & shall be designed to withstand maximum static squeeze test load of 200t without any permanent distortion. The under frame shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as last vehicle.

13.0 CABINS

13.1 The machine shall be equipped with fully enclosed air conditioned and pressurized cabins with safety glass window at both the ends. It shall be possible to have a clear view of the track ahead while driving the machine in both the directions from the cabins at either end. The cabin layout shall be such that, before leaving the machine, the operating staff has full view on both the sides, to avoid any danger to them from trains on the adjacent tracks.

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

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

13.4 One screen wiper preferably operated by compressed air or electrically operated shall be provided on each of the wind screens.

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

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

14.0 TOOLS AND INSTRUCTIONS MANUALS

14.1 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.

14.2 Detailed operating manual, maintenance and service manuals, user manual shall be specifically prepared and four copies of these shall be supplied with each machine.

14.3 The 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 dimensioned drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc. Main features such as type, discharge etc. of items like hydraulic pumps-motors and such other items shall be furnished
by the supplier. These shall be specially prepared in English language and four copies of these shall be supplied with each machine. The tenderer shall furnish the details of such other bought out components/assemblies.

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

14.5 While offering the machine for first inspection, the supplier shall submit three copies of complete technical literature including operation, service and maintenance manuals. Complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/description and other relevant technical details so as to maintain master copies of these documents in Indian Railway Institutions and a reference document for the inspecting officer. All the above documents shall be available in English language also.

14.6 One portable welding plant of reputed make (Preferably made in India) with a minimum 11 KW/16 H.P capacity along with sufficient cable or lead shall be provided with the machine for day to day repairing of machine and its wearing parts.

14.7 The firm shall provide detailed technical drawings and specifications of wheels and axles used in the machine along with detailed code of procedure for ultrasonic testing of wheels and axles of all types. The above details shall be provided in four sets.

14.8 One set of all the manuals and diagrams should also be sent to the Principal/IRTMTC, Allahabad, one set to ED/TMM, RDSO, Lucknow, one set to DTK(MC)/Railway Board and one set to Director/IRICEN/Pune along with supply of first machine. In case, there is any subsequent amendment in above documents based on field performance, the amendment/amended documents should also be sent to above mentioned authorities.

15.0 SPARE PARTS

15.1 The expected life of the components shall be advised along with their condemning limits. The machine shall be supplied with necessary spare parts for the operation and maintenance of the machine for a period of two years i.e. working for about 2000 hrs. The spare parts required shall be detailed in a separate list indicating description, part no., quantity and weather imported or indigenous.

15.2 The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service for the life of the machine (Minimum 15 years).

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

16.0 MAKER’S TEST CERTIFICATE

16.1 Copies of the Maker’s certificate guaranteeing the performance of the machines shall be supplied in duplicate along with the delivery of each machine.
17.0 OPERATORS

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

18.0 OPTIONAL EQUIPMENTS

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

19.0 INSPECTION OF THE MACHINE

19.1 While inspecting the machine before dispatch from the supplier's premises, the inspecting officer nominated by 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 the issue of the “Inspection certificate and approval for despatch of the machine” as per Annexure-VI enclosed.

20.0 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, un-sprung mass and braking force coming on rails is the same. If, there is any change in above respect, the action shall be taken as detailed in 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 (II, VII and VIII) 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 (II, VII and VIII) can also be asked for issue of provisional speed certificate for the machine.

c) New suppliers, whose models are new:
The technical details shall be supplied as detailed in para (b) above.
21.0 ACCEPTANCE TEST

21.1 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 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.

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

21.3 Testing for negotiability of 10° curve and 1 in 8 1/2 turnouts.

21.4 Running speed tests on the Indian Railway mainline track on the first machine in accordance with the para 2 of Annexure-IX with the machine running up to speed 10% higher than maximum speed mention in para 2.9 above.

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

21.6 Actual output and performance tests to be conducted on first machine.

These tests shall be conducted under field conditions on I.Rly. An electrified section shall be chosen for this test. The field conditions and tests to be conducted shall be as follows:

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

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

c) Points and crossings on straight track or curve with radius minimum upto 1000 m.

d) Gradient upto 1/200.

e) Rails and sleepers in good conditions and properly fastened.

f) Concrete/wooden/metal sleepers.

g) Ballast upto 100mm below the bottom of sleeper and generally not cemented.

h) Good formation.

i) Regular sleeper spacing of 65cm or 60cm on straight track and 45.7cm to 68.5 cm. on turnouts with a tolerance of + 3 cms.

j) General lift during working upto 20mm and Lifting of tack/Points and crossing in non tamping mode of 150 mm in one go.

k) Maximum slew during working upto+10mm and Slewing of track/ Points and crossing in non tamping mode of +150mm in one go.

l) Stoppage of work is not attributable to machine shall be discounted

m) The machine shall be able to tamp 1000 sleepers in one hour of working in plain track. The machine shall also be able to tamp 2 nos. 1in 12 turnout including 10 sleepers on straight portion on each side in one hour of work. The time shall be counted from start to finish of tamping work at workplace

22.0 Should any modification be found necessary as a result of the test, these shall be carried out by the supplier at his own expenses.
## Machine details required for simulation of machine on NUCARS or similar Track-vehicle simulation software

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>Component’s Name</th>
<th>Parameters required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C.G. of component in x, y, z direction from rail level in mm (Referenced point 1st axle)</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>6.</td>
<td>Mass of Items included in unsprung mass partially or fully along with their name per axle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total weight of components in tonnes</td>
<td>Front bogie full assembly</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Suspension stiffness details in Kg/mm</td>
<td>Primary suspension element stiffness per axle box between bogie and axle box</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Damping force details (If hydraulic damper used give there rating force per meter/second)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Clearance in mm or radian provided for</td>
<td>Vertical direction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>11.</td>
<td>Dimension of location of suspension elements</td>
<td>Detail of location of suspension springs and dampers and shock absorbers with support drawing</td>
</tr>
<tr>
<td>12.</td>
<td>Details of centre pivot arrangement working and location</td>
<td>Provide detail arrangement drawing and description</td>
</tr>
<tr>
<td>13.</td>
<td>Set of drawings and design description</td>
<td>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.</td>
</tr>
</tbody>
</table>
PROCEDURE OF DRAWING:

1. Draw a vertical line at a distance of 28.5 mm from the plane end.

2. Draw a horizontal line at 4.48 mm from the plane end.

3. Draw a tangent line to 14.5 mm.

4. Draw a horizontal line at 28.2 mm.

5. From point A, locate center C at 4.48 mm.

6. Draw a tangent line to 14.5 mm from point A.

7. Draw a horizontal line at 4.48 mm.

8. Draw an arc of radius 16 mm with center A, C.

9. Draw an arc of a radius 23.5 mm with center A, C.

10. Draw a tangent line to 7 1/2 mm at line X-Y.

NOTE:

- The dimensions are based on nominal dimensions.
- All dimensions are in millimeters.
### Specifications of Heavy duty Industrial Quality Water proof & shock proof laptop (Toughbook)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU</strong></td>
<td>Intel Core i-5 540 M at clock speed of 2.53 GHz or higher version</td>
</tr>
<tr>
<td><strong>Operating System</strong></td>
<td>Windows 7 professional or higher version</td>
</tr>
<tr>
<td><strong>RAM</strong></td>
<td>2 GB (DDR 3 1066 MHz) or more</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>Shock mounted flex connect hard drive with quick release 250 GB -540 M or More</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>13.1” XGA touch screen- LED backlit with Intel Graphics</td>
</tr>
<tr>
<td><strong>Keyboard</strong></td>
<td>Backlit 61 key QWERTY keyboard</td>
</tr>
<tr>
<td><strong>Wireless</strong></td>
<td>Integrated Gobi TM 2000 mobile broadband, Bluetooth</td>
</tr>
<tr>
<td><strong>Durability features</strong></td>
<td>MIL-STD-810G &amp; IP65 certified (6’ drop)</td>
</tr>
<tr>
<td></td>
<td>MIL-STD-461F certified</td>
</tr>
<tr>
<td></td>
<td>UL1604 certified model</td>
</tr>
<tr>
<td></td>
<td>HDD heater</td>
</tr>
<tr>
<td></td>
<td>Magnesium alloy w/ handle</td>
</tr>
<tr>
<td></td>
<td>Shock-mounted flex-connect HDD with quick-release</td>
</tr>
<tr>
<td></td>
<td>Reinforced locking port covers</td>
</tr>
<tr>
<td><strong>Additional features</strong></td>
<td>WebCam</td>
</tr>
<tr>
<td><strong>Pre LoadedSoftwares</strong></td>
<td>Antivirus software for 18 months validity</td>
</tr>
<tr>
<td></td>
<td>Microsoft office 2007 complete bundle</td>
</tr>
</tbody>
</table>
BRAKE DESIGN DETAILS OF THE MACHINE FOR CALCULATION OF EMERGENCY BRAKING DISTANCE

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tare &amp; gross weight of the machine in Kilograms</td>
</tr>
<tr>
<td>Brake power in Kilograms</td>
</tr>
<tr>
<td>Type of Brake blocks</td>
</tr>
<tr>
<td>Brake block area in Square Centimetres</td>
</tr>
<tr>
<td>Brake Rigging Diagram</td>
</tr>
<tr>
<td>Type of Brake system</td>
</tr>
</tbody>
</table>
ANNEXURE-VI

INSPECTION CERTIFICATE CERTIFICATE OF INSPECTION OF TRACK MACHINE
( ) BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF MACHINES

(STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that I have 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 as Annexure'A'. 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 alongwith the machine:
______________________________
______________________________
______________________________

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

The machine is approved/not approved for despatch to ____________
____________________(Consignee) Indian Railway.

SIGNATURE AND DATE

For M/s.________________________
______________________________
INSPECTING OFFICIAL
(NAME AND DESIGNATION)
for and on Behalf of President of India
Particulars Required in Respect of the Rolling Stock Under Consideration

1. A diagram showing elevation salient dimensions:
   a) Wheel spacing, Wheel diameter, bogie centres, and axle load.
      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. Increase in the impact load during motion (Dynamic Augment)

9. 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.

10. Maximum tractive effort at start and at the speed of operation:
    i) at working drive at start:
    ii) at transfer drive at start:

11. Maximum braking force coming on to the rails per wheel
   at working axle : 
   at transfer axle : 
12. Drawing indicating suspension arrangement details
    of bogie and axle.
13. Height of centre of gravity from rail level
14. Height of floor from rail level
15. Type of coupler provided - Indian Railways Standard
    Coupling : 
    Buffer : 
16. Any infringement to the moving dimensions
    Sketch provided in the Indian Railways Standard Schedule of Dimensions –
    Chapter IV (A).
Annexure : VIII

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

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Brake System details</td>
</tr>
<tr>
<td>a)</td>
<td>Gross Braking Ratio</td>
</tr>
<tr>
<td>2.</td>
<td>Brake rigging arrangement drawing and calculation of braking force</td>
</tr>
</tbody>
</table>
| 3.    | Maximum Braking Effort. at start and at the speed of operation -
| a)    | at working drive at start |
|       | at operation speed : |
| b)    | at transfer drive at start |
|       | at maximum speed : |
| 4.    | Characteristics of springs used in suspension indicating free height, working height, dynamic range, stiffness and locations etc. |
| 5.    | Characteristics of the dampers if used, and over all damping factors and locations of dampers. Calculation of the following frequency of the vehicle to be attached :-
|       | Bouncing i) Pitching ii) Rolling iii) Rolling |
|       | Wave length of free axle and bogie |
| 6.    | Write up and salient design calculation on suspension system, type of suspension-whether it is of coil suspension with or without dampers and laminated bearing springs and double link suspension. |
| 7.    | What are lateral clearance of axle box / 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 |
| 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. |
1  The speed potential of the machine offered by the firm should be established based upon oscillation trials conducted in India. The tests will be conducted at speed usually 10% higher than the maximum speed potential indicated by the firm for the machine under consideration and the following criteria satisfy for the same. For conducting the tests, a section of mainline track will be selected over which there is no temporary speed restrictions and which is considered by the 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 will be as follows:

i) A lateral force lasting more than 2 metres should not exceed the Prud-Homme's limit of 0.85 \((1 + \frac{P}{3})\) where \(P\) is the axle load.

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

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

iv) The values of acceleration recorded in the cab at location as near as possible to the bogie pivot (as near as possible to axle in case of four wheelers) shall be limited to 0.55 kg both in vertical and lateral directions. The peak values upto 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 Para 2 (iv) above which shall not be greater than 4.5 but a limit of 4.25 is preferred.

vi) A general indication of stable running characteristics of the vehicle as evidenced by the movements of the bogie in straight and curved track and lateral force and derailment coefficient of accelerations as the case may be.