TECHNICAL SPECIFICATION FOR DYNAMIC TRACK STABILIZER
FOR BG (1676 mm GAUGE)
(Specification No. TM/HM/DTS/379 Rev. 01 of 2016)

1.0 GENERAL

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

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

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

1.4 Photographs of the type of machine offered in work 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 cassette, compact disc or DVD or USB showing the working of machine in real-time under field condition. Tenderer shall also submit the names of countries & Railways where the offered machines are working and where their working at site can be visited by Indian Railway officials.

2.0 DIMENSIONAL AND OPERATING REQUIREMENTS

2.1 The diesel powered equipment machine shall be robust, reliable and suitable for working on Broad Gauge(1676 mm) Indian Railways. The design and dimensions of the machine components shall be to metric standards and should comply with provision of Indian Railways Schedule of Dimensions – 1676 mm gauge (BG), revised, 2004 with latest corrigendum and up-dated correction slips issued. Quality assurance during manufacturing of the machine shall be according to ISO-9001. The welding standard followed for manufacturing of machine should be to ISO:3834, EN:15085 or any other equivalent standard for welding of railway vehicle and components. The manufacturer should specify the standard followed and certify that it meets the welding standard mentioned above. The machine shall be suitable for working on straight, transition and curved tracks (up to 10 degree) on broad gauge (1676 mm) of Indian Railways.
2.2 The machine shall be a self-propelled bogie type vehicle with minimum 4 axles (2 bogies).

2.3 In the past IR have condoned certain infringements to the Indian Railways Schedule of Dimensions –1676 mm gauge (BG), revised, 2004 of such dimensions as Rigid wheel Base, Length of stocks, Distance apart of bogie centres and maximum height of floor above Rail level in certain track machines after due consideration of their design features vis-à-vis safety and operation requirements of IR. However, condonation of an infringement in another track machine in the past does not by itself entitle the manufacturer to assume acceptance of the same in other track machines by IR. Where an infringement to Indian Railways Standard BG schedule of Dimensions (metric)-2004 print is considered necessary by the manufacturer as intrinsic to the design of the machine for meeting the work performance requirements laid down in this specification while meeting the safety and operational requirements of IR, the condonation of the same may be permitted by IR. However, only those infringements which are acceptable shall be permitted.

2.34 The profile of the on-track equipment machine longitudinally and in cross section during transfer as self-propelled vehicle or towed in train formation as last vehicle shall be within the Indian Railways Schedule of Dimensions –1676 mm gauge (BG), revised, 2004 standard metric BG schedule of Dimensions, Revision 2004 with latest corrigendum and up-dated correction slips issued. The minimum and maximum moving dimensions are enclosed in 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 at any cross section.

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

2.56 Wherever applicable, 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 up to 22.82 tonnes and lower axle spacing may be permitted, provided the load combinations do not cause excessive stresses in the tracks & bridges of IR. Stresses in the tracks & 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 regard.

2.67 It shall have a minimum wheel diameter of 914 mm (new wheel profile). However, lesser diameter upto 730 mm (new wheel profile) can also be considered provided it meets the riding quality and speed criteria laid down in Clause 2.9.5 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. It is desirable that 50mm margin between new and permitted worn wheel diameter should be available, but this should not be less than 20mm. The worn out wheel diameter based on the criteria of rail wheel contact stresses for various maximum axle loads are as under:

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<th>Maximum Axle load (tonne)</th>
<th>Minimum worn out wheel diameter (mm)</th>
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<td>22.00</td>
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<td>18.5</td>
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Permitted worn out wheel diameter should be specified by the manufacturer. The diameter of wheel for assessment of permitted axle load will be the worn out wheel diameter. The new wheel profile in the machine shall be as per Indian Railway standard drawing attached as Annexure-III which is titled as "WORN WHEEL PROFILE'.

2.8 Wheels shall be conforming to Indian Railway Standard R-19/93 or European Standard EN13262 or any other equivalent standard (for product requirement) and design shall duly conform to European Standard EN 13979 or other equivalent standard. The supplier shall submit detailed design calculation along with material parameters at the time of supply of the machine.

2.9 The non-powered axles shall be conforming to Indian Railway Standard R-16/95 or European Standard EN 13261(EA1N) or any other equivalent standard. The supplier shall submit detailed design calculation along with material parameters at the time of supply of the machine.

2.10 The powered axles shall be conforming to Indian Railway Standard R-43/92 or European Standard EN 13261(EA4T) or any other equivalent standard (for product requirement). The design shall conform to EN: 13104 or any other equivalent standard. The supplier shall submit detailed design calculation along with material parameters at the time of supply of the machine.

2.11 It shall be capable of negotiating curves upto $10^\circ$ curvature (176 m radius), super elevation upto 185 mm and gradients upto 3% in travel mode. The supplier shall specify the minimum attainable speed by the machine (without trailing load) under the above limiting conditions which in any case shall not be less than 40 kmph.

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

- Ambient temperature: 0$^\circ$–5 to + 55°C
- Altitude: Sea level -700 to 1750 m above Mean sea level
- Humidity: 40% to 100%
- Maximum rail temp.: 70$^\circ$ C

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

2.13 During transfer from one station to another, it shall be capable of travelling on its own at a speed of 80 kmph and at a speed of 100 kmph when hauled in a train formation as last vehicle. Since the machines are likely to cover long distances on their own power, the travel drive system should be robust to sustain these requirements during the life of the machine without much break down/failure. The machine should be capable of hauling an 8-wheeler coach/Wagon (90 ton approximately) at a maximum speed of not less than 50kmph. It should be able to negotiate steepest gradient of 1 in 33 prevailing on Indian Railways.
2.104 It shall be capable of working without requiring power block in electrified sections. 25 KVA current AC power supply 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.

2.115 While working on double line sections, it shall not infringe the adjoining track and it shall be possible to permit trains at full speed on that track. Minimum spacing of track is 4.265 m or 4265 mm. The machine or its any part shall not infringe the adjoining track as per Schedule of Dimensions of Indian Railways, revised –2004 while opening and closing the work.

2.12 The machine shall be equipped with pneumatically operated brake blocks 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.

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

3.0 WORKING MECHANISM

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

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

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

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

3.5 The machine shall be capable of operation on various types of track structures like 90 R/52 Kg./60 kg. Long welded rails/short welded/fish plated rails laid on pre-stressed concrete/steel-trough /CST-9/ wooden sleepers with 100 mm to 300 mm ballast cushion. The horizontal and vertical force and frequency of vibration shall be adjustable so as to carry out effective stabilization on various types of track structures.

3.6 The machine shall be equipped with suitable mechanism to control the degree of settlement of the track. The settlement of track should be limited to less than 20 mm. For this purpose, a proportional servo controlled levelling system, automatically controlling the degree of settlement of track shall be provided. This installation shall copy the pre-stabilizing geometry by automatically increasing/relieving the vertical load on the stabilizing
units. For optimum results, levelling system shall work independently for the left and right hand rail.

3.7 It shall be possible to steplessly preselect the frequency of vibrations which shall be between 0-45 Hz. for optimum adjustment to suite the various kinds of track structure. During work near fixed structures like bridges, it shall be possible to pre-select a frequency within that range which is beyond the natural frequency of the structure. In this context, it is also essential that the vibrations be automatically cut off, when the machine speed is below certain minimum speed stops to be specified by the manufacturer.

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

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

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

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

3.12 It shall be capable of carrying out stabilization work in both directions. The machine’s driving system shall be through hydro-dynamically coupled power shift arrangement, capable of achieving full speeds in travel mode in both the directions.

3.13 The tenderer shall indicate the name of the Railway system where the types of machines offered are working.

3.13 For optimum stabilization of track behind deep screening and Track renewal work where retention of track parameters is not important, the machine shall be able to achieve it by increasing preload and adjusting frequency and other parameters.

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

   i) Best possible consolidation behind tamping machine and simultaneously retaining post tamping track parameters,
   ii) Maximum consolidation behind unconsolidated deep screened or new track.

The detail of track on PSC sleeper is attached as Annexure-IV. The manufacture should also suggest the parameters for different possible track conditions and also for track at special locations like Bridges, Level crossing, points and crossing etc.

3.15 The machine should be equipped with a centralised computer based control and monitoring system which shall monitor the health of machine working system such as engine (lube oil pressure, temperature, rpm etc.), hydraulics (hydraulic pressure in different units, temperature, oil level in tank etc), pneumatic (pressure of different units), electricals (charging/discharging rate, voltage etc.). All these data should be displayed on a monitor installed in working cabin and there should be facility to store these data for 100 Engine Running Hours. Minimum storage of 500 GB should be available for this purpose. Arrangement for providing 3G/4G internet connection for sending data in soft format directly from the computer should also be available.

3.16 To monitor the working of machines, closely from anywhere in the country from any
location, suitable number of IP based cameras are to be installed. The camera should be fixed on machine at such location that the live video of the important working units of machine which are working on track, location of worksite and post-work track can be seen by the authorized person with commonly used browsers in India over the internet. Camera should be password protected and be decentralized, IP based. It should have recording function built-in and thus can record directly to any standard storage media, such as SD cards. Internal memory space of 500GB should also be available.

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

4.0 DIESEL ENGINE

4.1 The machine shall be powered by indigenous diesel engine preferably indigenous, with proven record of service in tropical countries. 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. The engine should be of such design /brand which are being manufactured indigenously and/or such designs having whose after sale service facilities are available 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 8 hrs will be desirable.

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

4.5 For starting the engine, storage batteries of well-known make shall be provided. The engine shall normally be push/pull button start type or key 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 areas over 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, 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 these parameters exceeding the safe limit.

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

4.10 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.

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

4.12 In order to adhere to pollution Control norms, the diesel engine should be electronically controlled emissionized engine with minimum compliance of tier 2 stage.

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

5.0 DRIVE MECHANISM

5.1 The machine should be provided with an efficient traction drive system for traction during the operation. The machine’s driving system shall be through hydro dynamically/hydrostatically (for running) and hydro-dynamically/ hydrostatically (for working) coupled power shift 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. A suitable synchronization circuit to control the synchronization of lifting/lining 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 equalise 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 tenderer shall provide the necessary technical details including circuit diagrams and detailed specifications of all electronic/electrical parts to conform the above requirements.

5.6 Adequate gauges should be provided in working and driving cabins near operator’s seat (flow meters) and Solenoid valves shall be provided near linkage assembly, for indication, flow control and carrying out necessary adjustments in the field.

5.7 To the extent possible, hydraulic and pneumatic component/assembly 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- to-day maintenance schedules.

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

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

5.10 Onboard system for online filtration and monitoring the quality of hydraulic oil in hydraulic circuit should be provided. The gauge should clearly indicate if the hydraulic oil is contaminated beyond the permissible limits and requires immediate replacement.
6.0 COOLING SYSTEM

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

6.2 Adequate heat transfer arrangement shall be designed and provided so that under extreme heat conditions as mentioned in para 2.812 above, the system oil temperature does not go beyond 85 degrees centigrade specified range.

7.0 BRAKES

7.1 The machine shall be fitted with compressed airbrakes applying brakes equally on all wheels and provision shall be made to connect air brake system of the machine to that of camping coach/wagons when the machine is hauling it. Fail safe braking mechanism system shall be provided so that in case of any failure of brake circuit will result in automatic application of brake. The brakes shall be protected from ingress of water, grease, oil or other substances, which may have an adverse effect on them. The brake lining shall be suitable for high ambient temperature of 55°C. The force required for operating the brake shall not exceed 10 kg at the handle while applying by hand and 20 kgs 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 arrangement of braking air valves so that while working in train formation as last vehicle, machine can be braked by the traction vehicle having compressed air braking system. In addition, the machine shall be equipped with suitable air-brake systems in the driving cabins so that the attached wagons or camping coach while being overhauled by the machine can be braked. The speed of the machine while hauling a 8 wheeler coach should not be less than 80 kmph.

7.3 There should be provision of emergency brake application in the machine either travelling alone or coupled with the coach/wagons, in addition to the normal braking system of the machine, using the compressed air. The emergency braking distance (EBD) of the machine on the Indian Railway Track, at the maximum design speed on level track shall not be more than 600 m. Design calculations for the braking effort and EBD at the maximum design speed of the machine on level track & at falling grade of 1 in 33 should be provided by the supplier. Brake design details are to be submitted as per Annexure VI.

The emergency braking distance (EBD) of the machine coupled with a loaded camping coach (maximum trailing load 65 ton) on the Indian Railway Track, at the maximum design speed shall not be more than approximately 600m. In this regard necessary design calculations for the braking effort and EBD at the maximum design speed of the machine should be provided by the supplier.

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

8.0 HORN, HOOITER AND SAFETY SWITCHES

8.1 The equipment machine shall be provided with dual tone (low tone & high tone) electric/pneumatic horns facing outwards at each end of the machine at suitable location for use during travelling to warn the workman of any impending danger at the work spot or from on-coming trains. Control shall be provided in close proximity to the driver permitting the driver to operate either horn individually or both horns simultaneously. The horns shall
be distinctly audible from a distance of at least 400 mts. from the machine and shall produce sound of 120-125 dB at a distance of 5 meter from horn (source of sound). The higher tone horn shall have fundamental frequency of 370 ±15 hertz. These electric/pneumatic horns/hooters shall be operated by means of push buttons provided in the cabins and also should have remote control operation so that look out man standing at a distance of 150 m. away from the machine can operate the electric horn/hooter to warn the staff working on/around the machine about the approaching train on the adjacent line. Adequate nos. of safety stop switches shall be provided all around so that in case of any danger to worker during working, 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 In addition, separate electric horns with push bottom type switches shall be provided at suitable locations in all cabins and on machine body for communication between the machine staff about infringement/malfunctioning or any other trouble.

8.4 Machine shall be provided with emergency backup system to wind up the machine in the event of failure of prime mover or power transmission system of the machine. The emergency backup system should be able to be operated manually and may also use a manual hydraulic power pack in addition to the emergency generator/battery based electric hydraulic systems.

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

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

9.0 HOOKS AND BUFFERS

9.1 The machine shall be fitted with hooks and buffers of IR design provided with CBC on both ends for coupling it with other vehicles for running in train formation and for attachment with the coach, locomotives and wagon.

10.0 ELECTRIC EQUIPMENT HEAD LIGHT, FLASHER LIGHT AND OTHER LIGHTING ARRANGEMENTS

10.1 The electrical equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The machine shall be equipped with twin-beam headlight assembly conforming to RDSO 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 swivelling flood lights shall also be provided to illuminate the working area sufficiently bright for efficient working during night. In addition, minimum eight power point locations (24volt DC/15-amp socket) shall
be provided on outside frame of the machine two in front, two in rear and two on both sides for providing lighting arrangements during night working. The amber colour LED based flasher lights producing not less than 500 lux at 1 meter and 55 lux at 3 meter in line measurement in axial direction from flasher light at both ends shall be provided at both ends on the machine to give indication for the train arriving on the other line. Preferably electric power of 24 V (maximum up to 110 V) shall be used for operation of any electrical circuit.

11.0 CHASSIS & UNDER FRAME

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

12.0 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.

13.0 CABINS

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

13.2 The gauges, panel 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 The working cabins of the machine shall be air-conditioned for dust free atmosphere. The air-conditioning provided shall be of robust industrial design capable of operating in highly dust laden environment. However, the electronic equipment shall be so designed that they shall be capable of work without air-conditioning under the climatic conditions described in Para 2.8.12

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

13.6 Suitable no. of fire extinguisher (dry chemical type) shall be provided in the cars, cabin.

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

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

13.9 The cabins shall have seating arrangement for at least six machine staff.

13.10 The machine shall be equipped with speed indicator and recording equipment of range between 0 - 120 km/h for recording the speed of the machine in real time basis. The recorded data should be retrievable on computer through memory card/pen drive. It
should be provided in the driving cabin at suitable place and recording system should have sufficient memory to keep the speed record of minimum 15 days which should always be stored for retrieving as per requirement.

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

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

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

14.4 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, electronic, 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 as reference document for the inspecting officer. These shall be prepared in English language. One set of documents each to be submitted to TMM directorate, RDSO, & one set to IRTMTC-Allahabad, IRICEN/Pune and to Director/TMC/Railway Board respectively.

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

14.6 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 addition, the supplier shall provide dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc., and the main features of items like hydraulic pumps-motors, and the tenderer shall furnish the details of such other bought out components/assemblies. These shall be specially prepared in English language and four copies of these shall be supplied with each machine.

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 three four sets.

14.8 One portable diesel operated D.C welding plant (with the provision of auxiliary output of minimum 2.5 KW, 230 V AC for lighting) of reputed make (preferably manufactured in India) with a minimum 11 KW/16 HP 5 KVA capacity capable of welding upto 5 mm. electrode (dia) at 60% duty cycle shall be supplied. Sufficient cable or lead shall be provided with the welding plant machine for day-to-day repairing of machine and its wearing parts.
15.0 SPARE PARTS

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

15.2 The manufacturer shall be responsible for the subsequent availability of spare parts (in India with payment in Indian Rs) to ensure trouble-free service for the life of the machine (15 years). It is preferred that the spares are stored in India and are available at short notice say maximum within a month.

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 TRAINING AND SERVICE ENGINEERS

a) 18.1 The contractor-supplier shall provide at his own expense the services of competent engineers during the warrantee period for warrantee related issues. The service engineers shall be available for the commissioning of the machine for regular service. E-Learning courses module should be arranged for imparting training to railway operators. In addition the service engineer shall provide hands on training to railway staff in calibration, and for training to the operation, repairing and maintenance staff of the machine in field to make them fully conversant with the machine. The engineers shall also advise the Railways on appropriate maintenance, testing, operating, repair and staff training facilities that are necessary for the efficient performance of the machines.

b) The supplier must ensure availability of sufficient stock of spares & services of competent service engineers at their prompt disposal for trouble free availability of the machine in good working condition for at least 90% of the days during the warranty period of the machine with respect to issues covered under warranty obligation failing which warranty period will be extended corresponding to the idling period beyond specified in this clause.

19.0 OPTIONAL EQUIPMENTS

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

20.0 WARRANTY:

The machine shall be warranted for 1200 effective working hours or 18 months from date of commissioning and proving test of equipment or 24 months from date of delivery at ultimate destination in India whichever shall be earlier. Effective working hours for this purpose will be traffic block time during which machine is deployed for ballast stabilizing work. Should any design modification be made in any part of the equipment offered, the warranty period of 18 months would commence from the date of commissioning and proving test of equipment for the purpose of that part and those parts which may get
damaged due to defects in the new replaced part. The cost of such modification should be borne by the supplier.

201.0 Inspection of the Machine

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

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

i) Machine to be stabled on straight & level BG track. The length of the track should be at least 10 m more than buffer to buffer length of machine.

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

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

i) One copy of complete technical literature mentioned in clause 14, in English language, including operation, service and field maintenance manuals/instructions and complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/ description and other relevant technical details as a reference documents in soft & hard copies for the inspecting officer.

ii) Cross section of the machine super imposed on IR maximum moving dimensions envelope shall be provided to IO in advance.

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

<table>
<thead>
<tr>
<th>Clause no.</th>
<th>Clause</th>
<th>Comments of Supplier/manufacturer</th>
<th>Comments of Inspecting Officer</th>
</tr>
</thead>
</table>

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

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

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

vii) Details of arrangements made for checking Maximum Moving Dimensions for his approval.

Supplier will incorporate amendments/further clarification in the above documents to the satisfaction of the Inspecting Officer keeping in view the Inspecting Officer’s comments, if any.
21.4 List of documents to be annexed in the draft Inspection Report should include:

   i.  Maker's Test Certificate.
   ii. Manufacturer's Internal Quality Inspection Report
   iii. Quality Certificates of Bought out assemblies/sub-assemblies
   iv.  Cross section of the machine super imposed on the IR MMD
   v.  Vogel's diagram
   vi.  List of spare parts to be dispatched along with the machine
   vii. List of tools to be dispatched along with the machine
   viii. List of Manuals, Drawings, Spare Parts Catalogues, etc. to be dispatched along with the machine, duly indicating the number of sets of each.
   ix.  Manufacturer's certificate on standard followed for design of wheels and axles against clause 2.8 to 2.10.

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

212.0 ISSUE OF PROVISIONAL SPEED CERTIFICATE

22.1 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 (VIII & IX) which in no case should be more than six months from signing of contract, shall be supplied to Track Machine and Monitoring Directorate of RDSO for processing of provisional speed certificate for the machine so that it can be permitted to move on track. On case-to-case basis, more technical details (other than mentioned in Annexure (VIII & IX) 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.

22.1 Final Speed Certificate:

Final speed clearance of the machine is given after conducting detailed oscillation trials of the vehicle. For this purpose railway shall conduct running speed tests on the Indian Railway main line track on one of the machines supplied to them preferably within
warranty in accordance with procedure outlined in Annexure-III with the machine running up to speed 10% higher than the maximum speed mentioned in clause 2.13 above.

223.0 ACCEPTANCE TEST

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

223.1.1 22.2 The dimensional check of loading gauge, i.e. maximum moving dimensions, buffer heights, clearances etc.

223.1.2 22.3 Testing for negotiability of 10° curve and 1 in 8 1/2 turnouts.

223.1.4 22.4 Running speed test on the Indian Railway mainline track on the first machine in accordance with the procedure outlined at Annexure-III.

223.1.3 22.5 Construction and engineering of the machine and its ability to perform all the functions as laid down in specifications above.

223.1.4 22.6 Actual output and performance tests:

This test shall be conducted on the first machine. These tests shall be conducted under field conditions on Indian Railway. The general conditions of the test shall be as follows:

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

(b) Dry weather, ambient temperature between +10-5°C to 40+55°C.

(c) Plain track or curve—minimum 1000 meter radius.

(d) Gradient up to 1/200

(e) Rails fastened to all sleepers.

(f) Concrete/wooden/metal sleepers.

(g) Clean ballast cushion clean up to 100 mm in sufficient quantity below the bottom of sleepers and generally not cemented.

(h) LWR track with ballast as per standard profile (Annexure-IV)

(i) Formation good

(j) Regular sleeper spacing of 65 cm or 60 cm with a tolerance of +3\(\pm\)2 cm.

(k) Amount of lowering up to 20 mm

Actual test to be conducted:

a) Amount of lowering of track up to 20 mm

a) The track, meeting the above general condition should be tamped by good quality tamper with 30 mm general lift and then one round of stabilization by DTS in controlled settlement mode at stabilization parameters specified by manufacturer, shall be done. Quality of track achieved shall be as below:

i) The increase in lateral ballast resistance of individual sleeper on an average as left after tamping should increase by 25% of the value after tamping. Minimum six sleepers should be tested for the purpose of taking average value. This test shall be conducted for the first machine by RDSO.

ii) The amount of lowering of track should be limited to 20 mm and track parameters left by tamper should be simultaneously retained in general within acceptance limit.
b) The setting up time and winding up time of the machine shall be measured, and the total time taken by the two operations of setting up and winding up of the Machine together shall not exceed 10 minutes.

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

22.8 23.2 Should any modification be found necessary as a result of the tests, the same shall be carried out by the supplier at his own expenses.

25.0 MARKING & COLOUR OF MACHINE:

25.1 The machine body shall be painted in golden yellow colour of Indian Standard Colour code of 356 as per IS:5. The exterior painting shall be polyurethane binder based conform to RDSO Specification No. M&C/PCN/100/2013 (Specification for Epoxy cum Polyurethane Painting System – Two packs for the Exterior Painting of Railway Coaches, Diesel and Electric Locomotives and other Industrial Applications) or ISO 12944.

25.2 Following should be written in black on the machine at appropriate location in English & Hindi as per direction of Indian Railway official

i) India Railways logo of height between 300 mm to 600 mm as suitable on all four faces of the machine.

ii) On both side faces and below the Indian Railways logo, the text “INDIAN RAILWAYS” to be written in Bold and in Black colour of size equal to or slightly smaller than the size of logo but of size not less than 250 mm.

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

iv) If required, the Manufacturers Name may be written in size not more than 150 mm and should not be at more than four locations. Also the Manufacturers Logo may be provided at not more than two Locations and should be of size less than 200mm.

***************
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>Mass in Kg and Mass moment of inertias in Kg-m^2 of component in three dimension space about their C.G.</td>
</tr>
</tbody>
</table>

<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>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 unsprung mass</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></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7.</td>
<td>Total weight of components in tonnes</td>
<td>Front bogie full assembly</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>Vertical stiff</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>10.</td>
<td>Clearance in mm or radian provided for motion between bogie frame and machine frame for relative motion (motion stopper)</td>
<td>Vertical direction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rotation about vertical axis</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></td>
<td></td>
<td></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>
DETAIL OF TRACK ON PSC SLEEPER

1. ALL DIMENSIONS ARE IN MILLIMETRES.
### Specifications of Heavy duty Industrial Quality Water proof & shock proof Laptop (Tough book)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</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 up to 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” 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>The product shall be durable and meet the latest MIL standard. Fire and dust resistant screen, keyboard and touch pad.</td>
</tr>
<tr>
<td>Pre Loaded Softwares</td>
<td>Antivirus software for 18 months validity</td>
</tr>
<tr>
<td></td>
<td>Microsoft Office 2007 complete bundle</td>
</tr>
<tr>
<td>Power supply</td>
<td>Li-ion battery, minimum 5400 m AH</td>
</tr>
<tr>
<td>Warranty</td>
<td>Warranty</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>
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
Annexure-VII

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.</td>
<td>a) Brake System details</td>
</tr>
<tr>
<td></td>
<td>b) 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></td>
<td>a) at working drive at start at operation speed</td>
</tr>
<tr>
<td></td>
<td>b) at transfer drive at start at maximum speed</td>
</tr>
<tr>
<td>4.</td>
<td>Characteristics of springs used in suspension indicating free height,</td>
</tr>
<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>and locations of dampers. Calculation of the following frequency of</td>
</tr>
<tr>
<td></td>
<td>the vehicle to be attached:</td>
</tr>
<tr>
<td></td>
<td>i) Bouncing</td>
</tr>
<tr>
<td></td>
<td>ii) Pitching</td>
</tr>
<tr>
<td></td>
<td>iii) Rolling</td>
</tr>
<tr>
<td></td>
<td>Wave length of free axle and bogie</td>
</tr>
<tr>
<td>6.</td>
<td>Write up and salient design calculation on suspension system,</td>
</tr>
<tr>
<td></td>
<td>type of suspension whether it is of coil suspension with or</td>
</tr>
<tr>
<td></td>
<td>without dampers and laminated bearing springs and double link</td>
</tr>
<tr>
<td></td>
<td>suspension.</td>
</tr>
<tr>
<td>7.</td>
<td>What are lateral clearance of axle box / horn, wheel flange/rail and</td>
</tr>
<tr>
<td></td>
<td>other locations for the negotiability of the vehicle on curve and</td>
</tr>
<tr>
<td></td>
<td>turn out (enclose Vogels Diagram for negotiability on maximum</td>
</tr>
<tr>
<td></td>
<td>degree of curve and turn out permitted on Indian Railways) of new</td>
</tr>
<tr>
<td></td>
<td>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>
</tbody>
</table>