

SECTION - F

TECHNICAL SPECIFICATION

TECHNICAL SPECIFICATION FOR DYNAMIC TRACK STABILIZER

1.0 GENERAL

- 1.1 Conventional tamping machines are used for levelling, tamping and lining work of track. These maintenance operations result in reduction in lateral stability of track thus 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 deep screening.
- 1.2 The Technical Specifications have been drafted to reflect the performance and quality requirements of the equipment in a neutral manner without bias to any specific manufacturer. The tenderers are requested to carefully study the specification and assure that their equipment fully comply with these specifications. Thereafter, if a tenderer feels that his equipment can substantially meet the performance and quality requirements of the equipment but does not fully satisfy a particular 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 deviations from the specifications, giving 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' in particular and all the items of the specifications in general shall be described in detail in the "Technical Description", alongwith 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 CD showing the working of machine in real time under field conditions.

2.0 DIMENSIONAL AND OPERATING REQUIREMENTS

- 2.1 The diesel powered equipment 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 robust, reliable and 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).

- 2.3 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 Revision -2004. 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.
- 2.4 Adequate clearance shall be allowed so that no component infringes the Minimum clearance of 102 mm from rail level while travelling.
- 2.5. 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.
- 2.6. It shall have a minimum 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 riding quality and speed criteria laid down in Clause 2.9 and rail wheel contact stresses for 72 UTS rails are within permissible limits. Forged wheels to Indian Railways profile shall be provided on the machine. The worn out wheel diameter based on the criteria of rail wheel contact stresses for various maximum axle loads are as under:

| Maximum Axle load (tonne) | Minimum worn out wheel diameter (mm) |
|---------------------------|--------------------------------------|
| 20.32 | 816 |
| 20.0 | 805 |
| 19.5 | 787 |
| 19.0 | 768 |
| 18.5 | 750 |
| 18.0 | 732 |
| 17.5 | 713 |
| 17.0 | 700 |
| 16.5 | 680 |

- 2.7. It shall be capable of negotiating curves upto 10° curvature (176 m radius), super elevation upto 185 mm and gradients upto 3% in travel mode. The supplier shall specify the minimum attainable speed under the above limiting conditions, which in any case shall not be less than 40 kmph.
- 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 : $0^\circ - 55^\circ\text{C}$
- Altitude: : Sea level-700m
- 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 75 kmph and at a speed of 80 kmph when hauled in a train formation. 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.

- 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 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. 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.
- 2.13 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 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.
- 3.2 During the operation, the machine shall be capable of lowering the track in a controlled manner, while maintaining the pre-stabilised geometry. Proper longitudinal and cross-level control mechanisms/ systems shall be provided to achieve pre-stabilised track geometry. The manufacturer shall clearly explain the mechanism in its offer. The machine shall also be able to apply maximum vertical load i.e. 12 tonnes on each rail without controlled settlement of track.
- 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 independent stabilizing units, applying 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/fishplated rails laid on prestressed 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. For this purpose, a proportional servo controlled levelling system, automatically controlling the degree of settlement of the 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, this 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 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 stops.
- 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, the lateral vibrations 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.
- 4.0 DIESEL ENGINE**
- 4.1 The machine shall be powered by 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 derating 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 one of such designs/brand which are being manufactured indigenously and /or such designs whose after sales 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 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 button start type.
- 4.6 Since the engine is to work outdoor under extreme dusty conditions, the air intake system shall be designed suitably so as not to allow dust through air intake system.
- 4.7 There is a likelihood of dust deposition over the engine body and surrounding area over the lubricants 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, lub. oil pressure shall be direct reading time 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, 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 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.
- 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 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-synchronisation.

- 5.3 Suitable differential systems may be provided between coupled wheels on the same bogie.
- 5.4 Suitable flow divider/throttling arrangement may be provided to equalise the tractive effort amongst different 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 and detailed specifications of all electronic /electrical parts to conform the above requirements.
- 5.6 Adequate gauges (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.

6.0 COOLING SYSTEM

- 6.1 The cooling system shall be efficient and designed for a maximum ambient temperature of 55°C. 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 2.8 above, the system oil temperature does not go beyond 85 degree centigrade.

7.0 BRAKES

- 7.1 The machine shall be fitted with the airbrakes 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 55⁰ 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 air 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 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 50 kmph.

8.0 HORN AND SAFETY SWITCHES

- 8.1 The equipment shall be provided with electric horns facing outwards at each end of the machine at suitable location to warn the workman of any impending danger at the work spot or from on-coming trains. The horns shall be distinctly audible from a distance of atleast 400 mts. from the machine. These electric/pneumatic horns /hooters shall be operated by means of push buttons provided in the cabins. 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 Machine shall be provided with emergency back up 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 IR design on both ends for coupling it with other vehicles for running in train formation.

10.0 ELECTRIC EQUIPMENT AND LIGHTING

- 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. The flasher lights at both ends shall be provided on the machine to give indication for the train arriving on the other line.

11.0 CHASSIS & UNDER FRAME

- 11.1 The chassis shall be 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 underframe shall be sufficiently robust for safe travel of the machine in train formation and not necessarily as the last vehicle.

12.0 CABINS

- 12.1 The machine shall be equipped with fully enclosed 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.

- 12.2 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.
- 12.3 The operator's cabin shall be ergonomically designed to have easy access to all the controls. The operator shall have a full view of the working area from the operating seat to have a full control over the work.
- 12.4 The 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 dustladen 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.
- 12.5 On screen wipers preferably operated by compressed air shall be provided on the wind screens.
- 12.6 Fire extinguisher (dry chemical type) shall be provided in the cabs.
- 12.7 The machine shall be provided with adequate space for keeping the tools and spares required for on site repair of the machine to attend the breakdowns and other working requirements.

13.0 TOOLS AND INSTRUCTIONS MANUALS

- 13.1 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.
- 13.2 Detailed operating manual, maintenance and service manual shall be specifically prepared and three copies of these shall be supplied with each machine. These shall be specially prepared in English language and four copies these shall be supplied with each machine.
- 13.3 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 dimension drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc., 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 these shall be supplied with each machine.
- 13.4 The tenderer shall alongwith his offer, submit the list of tools, manuals, circuit diagrams and other technical literature/drawings to be supplied alongwith each machine as above, for operation, servicing, maintenance, assembly overhauling, periodic overhauling and trouble shooting guides/manual. The list can be modified to suit the purchaser's requirement,

while examining the offer.

13.5 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. These shall be prepared in English language.

13.6 One portable welding plant of reputed make (preferably manufactured in India) with a minimum 11KW/16 HP capacity alongwith sufficient cable or lead shall be provided with the machine for day - to-day repairing of machine and its wearing parts.

13.7 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 sets.

14.0 SPARE PARTS

14.1 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).

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

14.3 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.

15.0 MAKER'S TEST CERTIFICATE

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

16.0 OPERATORS

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

17.0 OPTIONAL EQUIPMENTS

17.1 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.

18.0 INSPECTION OF THE MACHINE

18.1 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-II enclosed.

19.0 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 (IV & V) 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 IV & V) 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.

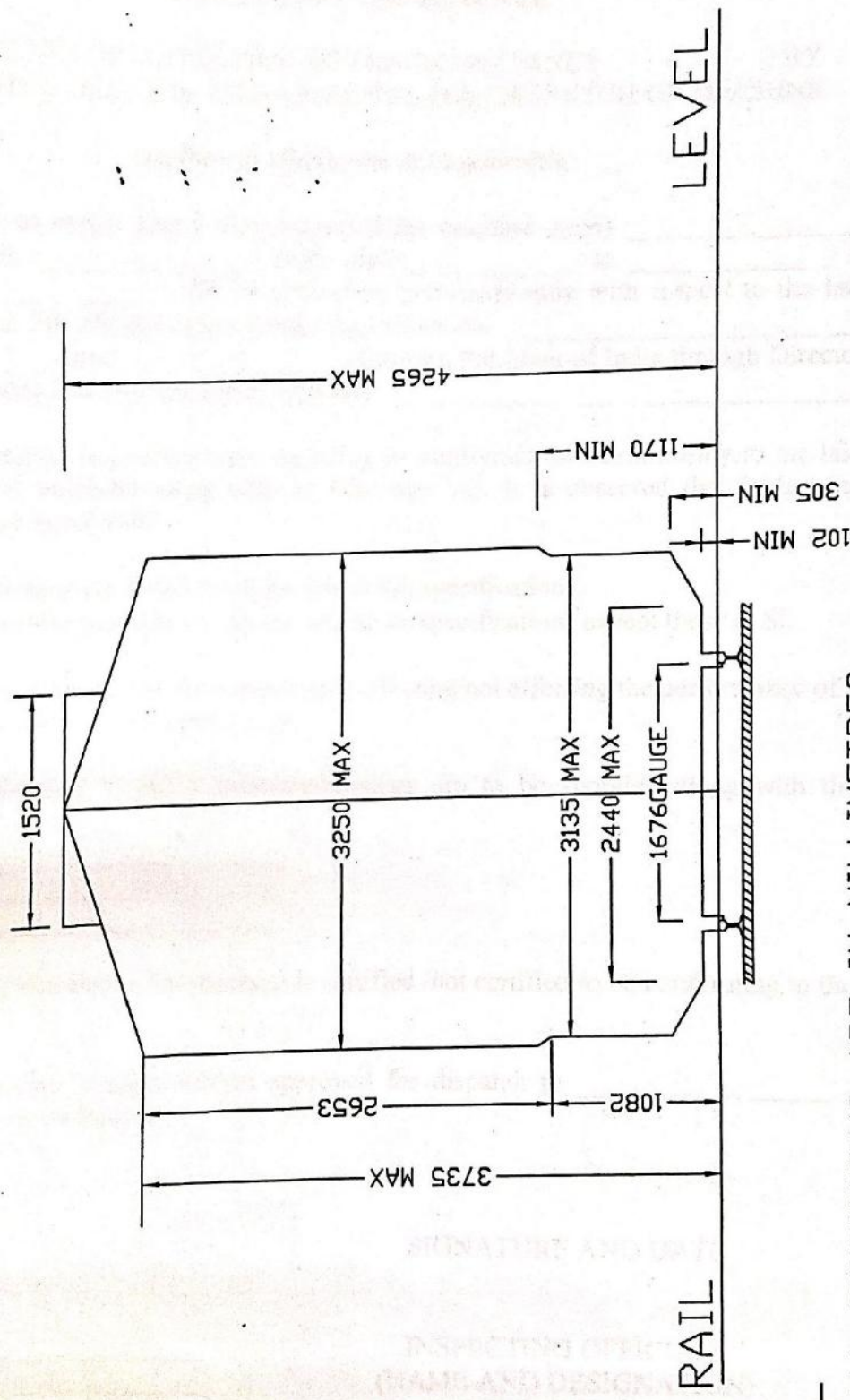
20.0 Acceptance Test

- 20.1 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.
- 20.2 The dimensional check of loading gauge, i.e. maximum moving dimensions, buffer heights, clearances etc.
- 20.3 Testing for negotiability of 10° curve and 1 in 8 $1\frac{1}{2}$ turnouts.
- 20.4 Running speed test on the Indian Railway mainline track on the first machine in accordance with the procedure outlined at **Annexure-III**.
- 20.5 Construction and engineering of the machine and its ability to perform all the functions as laid down in specifications above.
- 20.6 Actual output and performance tests: This test shall be conducted on the first machine, 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 $+10^\circ\text{C}$ to 40°C .
 - (c) Plain track or curve upto 1000 mm radius.
 - (d) Gradient upto 1/200.
 - (e) Rails fastened to all sleepers.
 - (f) Concrete/wooden/metal sleepers.
 - (g) Ballast clean up to 100 mm in sufficient quantity below the bottom of sleepers and generally not cemented.
 - (h) LWR track
 - (i) Formation good
 - (j) Regular sleeper spacing of 65 cm or 60 cm with a tolerance of + 3 cm.
 - (k) Amount of lowering up to 20 mm.
- 20.7 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.
- 21.0 Should any modification be found necessary as a result of the tests, the same shall be carried out by the supplier at his own expenses.

DIAGRAM No. 1D (EDD/T-2202)

1676mm GAUGE

MAXIMUM MOVING DIMENSIONS



NOTE:-
ALL DIMENSIONS ARE IN MILLIMETRES
EXCEPT WHERE OTHERWISE SHOWN.