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TECHNICAL SPECIFICATION

FOR

Self Propelled Auger Vehicle for digging of foundations of Over Head Lines

Specification No.: TI/SPC/OHE/AUGER/0090 (02/2009)

(February 2009)

ISSUED BY:

TRACTION INSTALLATION DIRECTORATE
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Amendment Number	Amendment /Revision	Total pages including drawings	Date of Issue
0	New	17	

	PREPARED BY	CHECKED BY	APPROVED BY
SIGNATURES			
DATE	16/2/09	16.02.09	16.02.09
DESIGNATION	DTI/PSI	EDTI	EDTI/Co-ord

COPY NUMBER

ISSUED BY ..... **SIGNATURE** ..... **DATE** .....

ISSUED TO .....

Index

SELF PROPELLED AUGER VEHICLE FOR DIGGING OF FOUNDATIONS OF OVER HEAD LINES

1.0 GENERAL

1.1 This specification is for a "*Self Propelled Auger Vehicle for digging of foundations of Over Head Lines on B.G. (1676mm) Routes of Indian Railways*". The Vehicle having power auger (henceforth called vehicle) shall be capable of digging cylindrical foundations required for over head lines. The vehicle shall be robust, sturdy and capable of operating under the conditions prevailing on IR and complete with all the required accessories.

1.2 Tenderers are requested to carefully study the specification and assure that their equipment fully complies with these specifications.

1.3 The tenderer shall specify the model(s) offered and furnish their details technical description. Systems/sub-systems and working mechanisms of the auger vehicle shall be described in necessary details in the "Technical Description", along with the sketches to depict the manner in which the requirements of the specifications are accomplished by the auger vehicle (model) offered.

1.4 Details including sketches/photographs of the similar auger vehicle having been supplied to others shall be enclosed with the offer. The photographs shall also show close-ups of various working assemblies/systems and the full auger vehicle. The tenderer shall furnish a video CD showing the working of auger vehicle under field conditions.

1.5 The offered equipment meets the performance and quality requirements of the auger vehicle substantially but does not fully satisfy a few system specifications clauses, the tenderer shall mention the variation in a statement of deviation from the technical specifications, giving the details how the functional requirements are going to be met with. The tenderer may seek clarifications, if any, from the purchaser prior to submission of the bids.

2.0 SCOPE OF SUPPLY

The auger vehicle shall be self driven and shall be capable of:

a. Driving at 80 kmph at level gradient.
b. Equipped with hydraulically powered auger.

3.0 SYSTEM's REQUIREMENTS:

3.1 The profile of the equipped vehicle longitudinally and in cross section during movement shall be within the maximum moving dimensions shown in the Indian Railways Standard BG schedule of Dimensions (metric)-Rev-2004. These dimensions are shown at Annexure-I. The tenderer shall provide sketches of the equipped vehicle in plan and shall give calculations to prove that the equipped vehicle does not cause infringement while moving on a 10° curve at any cross section.

3.3 Adequate clearance shall be allowed so that no component infringes the minimum vertical clearance of 102 mm from rail level while travelling under worst operating condition.

3.4 Wherever applicable, axle load shall be less than 20.32 tonne with minimum axle spacing of 1.83 m. Load per metre shall not exceed 7.67 t.

3.5 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:-

Atmospheric Temperature	Metallic surface temperature under sun: 75°C max and in shade 55 °C max.
Humidity	100% saturation during rainy season
Reference site condition	i) Ambient Temp : 50° C ii) Humidity : 100% iii) Altitude : 1000m above mean sea level, 2000 m in J&K area.
Rain fall	Very heavy in certain areas. The vehicle shall be designed to permit its running at 10 kmph in flood water level of 102 mm above rail level
Atmosphere during hot weather	Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/m^3. In mainly iron ore and coalmine areas, the dust concentration is very high affecting the filter and air ventilation system
Coastal area	The vehicle and its component shall be deigned to work in coastal areas in humid and salt laden atmosphere with maximum pH value of 8.5, sulphate of 7 mg per litre, max. concentration of chlorine 6 mg per litre and max conductivity of130 micro Siemens/cm.
Vibration	The equipment, subsystem and their mounting arrangement shall be designed to withstand satisfactorily the vibration and shocks encountered in service as specified High level of vibration and shocks. Accelerations over 500 m/s^2 have been recorded at axle box level for long periods during run. Vibrations during wheel slips are of even higher magnitude.
Wind Speed	High wind speed in certain areas, with wind pressure reaching 150 kg/m^3

3.6 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 track centre spacing is 4.265 m. The Auger vehicle or its any part shall not infringe the adjoining track as per "Schedule of Dimensions of Indian Railways".

4.0 FUNCTIONAL REQUIREMENTS OF DRILLING SYSTEM:

4.1 Driving:

- Cabs for 8 passengers, plus the driver for driving in both directions. The driving cab should be electrically heated.
- One movable video camera suitable mounted for observing the activity from inside the cabin.
- One generating set (230 V ac – 10 KVA) to cater for all electrical loads including lighting.
- Engine of suitable capacity to drive the vehicle at 80 kmph.
- Transmission shall be diesel hydraulic or diesel electric type

- Shall be equipped with flood light for night working
- Suitable brake system.
- PA system for addressing to staff.

4.2 Auger (powered by separate diesel engine)

• Type	Continuous flight
• Diameter of hole	600 mm
• Depth	5000 mm
• Digging speed	30 meter per hour
• Horizontal Reach	2-5 meters from centre of track

- The auger shall be controlled by a separated cabin which will facilitate easy deployment and operation. The control shall be interlocked with vehicle control to ensure vehicle movement when auger is fully retracted and locked.

Note: The auger should have centre tube for pumping in concrete.

4.3	**Coupling**	RDSO specification no.56-BD-07
4.4	Brake	UIC approved with composite brake block
4.5	Wheels	IRS R-19/93
4.6	Axle	IRS R-43/92
4.7	Wheel Profile	SK-91146
4.8	Safety features	UIC approved. Horn, flasher Units, marker light, head lights, speed recorder, emergency brake valves, parking brake, fire extinguishers, emergency stop switches, electrically operated wipers, dead man's handle etc.

5.0 DESIGN DEVELOPMENT: The vehicle shall be robust, reliable and suitable for working on Indian Railways. Quality assurance during manufacturing shall be according to ISO-9001.

a) The contractor shall develop the design based on the details given in this specification and sound engineering practices.

b) The design shall be based on S.I.Units.

c) From the information given in this specification and instructions of RDSO, the contractor shall prepare a full set of engineering drawings and submit the same to RDSO for approval in three copies.

d) The successful tenderer, hereafter called contractor shall submit the entire technical data, design calculations to RDSO for approval before commencing construction of

auger vehicle or placing orders on sub-contractors. Data pertaining to the rating of functional sub assemblies and stresses in the main structural members, mounting etc. shall also be made available.

e) Assumptions made with regard to live load, impact load etc. with the stipulated calculations of the design as finally developed to satisfy RDSO that the requirement of the specification are fully complied with.

f) Material specifications, manufacturing tolerances and other details, which are necessary for manufacture for each component shall be indicated on the drawings and three copies (in English) of such drawings & specifications shall be supplied to RDSO along with the drawings.

g) The technical specification and drawings submitted shall include the following:

i) Complete overall dimensions of the individual units of Auger vehicle superimposed on the Maximum Moving Dimensions (MMD), gauge etc. to ensure that no part of the Auger vehicle goes beyond these dimensions

iii) Life and weight of all the major subcomponents

iv) Calculations to establish the adequacy of installed power for different functional combinations of auger vehicle.

iv) Any calculations, designs, drawings, schedules, information, data, progress charts etc. required by the RDSO in connection with the contract shall be furnished by the Contractor at his own expenses. In case of any ambiguity in the interpretation of design and drawing, the decision of RDSO shall be final and conclusive.

6.0 APPROVAL OF DRAWINGS:

a) "Approval" to the drawing means the approval to the general adoptability of the design features. The contractor shall be wholly and completely responsible for correctness of dimension, materials, strength and performance of components. The contractor, when submitting proposals or designs for approval of the RDSO, shall draw attention to any deviation or departure from the specification involved in his proposals or drawings.

b) Drawings for approval shall be submitted in standard size (s) along with main calculation details in triplicate.

c) Three sets of tracings of the RDSO approved drawings/ calculations and six sets of their prints shall be supplied by the contractor to the consignee. The tracings shall be on mylar (polyester paper) of durable quality. Drawings shall be made on Auto CAD. 3 soft copies on DVDs shall also be supplied to the consignee along with hard copies as mentioned above.

d) Each set of tracings shall form a complete set of working drawings, the first sheet being the index and the following sheets being arranged properly to show the various assemblies, sub- assemblies and components of complete works in the following sequence:

(i) Lists of all parts grouped in to major assembly with details of numbers per set, weight, specification material and drawing reference against each item (Bill of material).

(ii) General arrangement drawings of complete equipment sets. Diagram of lubrication points indicating type of lubricant. Sub-assembly arrangement in proper and logical sequence.

(iii) Detailed drawings: - On detailed drawing sheets, each part shall be identified by an alphabetic letter and the list of all parts forming the sub-assembly shall be tabulated just above the title block on the same sheet giving details against each alphabetic letter.

e) The tenderer whose bid is accepted, shall be required to submit a "Quality Assurance Plan" by giving details as to how the quality of specific product is proposed to be assured. Supply of the equipment shall commence only after "Quality Assurance Plan" has been approved by RDSO.

7.0 CONTRACTOR'S RESPONSIBILITY:

The contractor shall be entirely responsible for the execution of the contract strictly in accordance with the terms of this specification and the conditions of contract, notwithstanding any approval which RDSO or the Inspecting officer may have given:

(a) Of the detailed drawing prepared by the contractor.
(b) Of the sub-contractors for materials.
(c) Of other parts of the work involved by the contractor.
(d) Of the tests carried out either by the contractor or by the RDSO or the Inspecting Officer.

8.0 STANDARD DRAWINGS AND SPECIFICATIONS:

a) The Contractor shall procure RDSO specifications & drawings for manufacturing of the Auger vehicle, including those referred to in this specification on payment basis from RDSO.

b) Indian Railways standard (IRS) specifications and Schedule of Dimension 1676 mm gauge (BG) revised 2004 (SOD)may be obtained on payment from the Manager, Government of India Publications, Civil Lines, Delhi 110 006 (INDIA).

9.0 TOOLS AND INSTRUCTIONS MANUALS:

i. Each auger vehicle shall be supplied with a complete kit of tools required by the operator in emergency and for normal working. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire Auger vehicle including specialized equipment. All special tools shall be listed and catalogued illustrating the method of application.

ii. Detailed operating manual, maintenance, service and assembly overhauling manuals shall be specifically prepared in English language and thee copies of these shall be supplied with each Auger vehicle.

iii. The manufacturer shall also supply schematic diagrams of electrical, hydraulic, pneumatic and electronic circuits used on the Auger vehicle. Trouble shooting diagram/ table shall also be supplied. Main features of items like hydraulic pumps-motors and such other bought out items shall be furnished by the supplier.

iv. The tenderer shall, along with his offer, submit the list of tools, manuals, circuit diagrams and other technical literature/ drawings to be supplied along with each

Auger vehicle as above, for operation, servicing, maintenance, assembly overhauling, periodical overhauling of the Auger vehicle and troubleshooting guides.

v While offering Auger vehicle for first inspection the supplier shall submit three copies of complete technical literature including operation, service and field maintenance instructions and workshop manuals for overhauling of the assemblies and the Auger vehicle, complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/ description and other relevant technical details for the reference of inspection officer.

vi One portable welding plant of reputed make with a minimum 11 kW/16 HP capacity along with sufficient cable or lead shall be provided with the Auger vehicle for day to day repairing of Auger vehicle and its wearing parts.

10.0 SPARE PARTS:

i. The expected life of the components shall be advised along with their condemning limits.

ii. The tenderer, along with the offer, shall furnish the required spare parts details in a separate list indicating description, part number, quantity, price, cost, whether imported or indigenous and their source of supply (OEM details). Firm shall have to quote their spares prices. These prices of spares will however be not used for tender evaluation purpose.

iii. The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service for the life of the Auger vehicle (for a minimum period of 20 years).

iv. For indigenous parts and bought out components and assemblies, the source and other relevant technical details shall be supplied while offering the first Auger vehicle for inspection.

11.0 MANUFACTURER'S TEST CERTIFICATE:

Copies of the Maker's certificate guaranteeing the performance of the Auger vehicles shall be supplied in duplicate along with the delivery of each equipped Auger vehicle.

12.0 OPERATOR's TRAINING:

The requirement of operators and allied staff for running the Auger vehicle under normal working condition shall be indicated, specifying their duties and minimum qualifications.

The contractor shall provide training for the two such groups of 8 persons & one supervisor at site per vehicle supplied.

13.0 OPTIONAL EQUIPMENT:

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

14.0 INSPECTION OF THE AUGER VEHICLE:

a) Auger vehicle shall be inspected and tested by the Director General/TI [DG/TI]/RDSO, Lucknow or his authorized representative. All the tests specified in the spec shall be carried. The firm shall arrange, all the necessary apparatus, labour and assistance required to get the specified tests conducted in the presence of purchaser's representative. If certain facilities are not available for the tests, manufacturer may arrange these tests outside, with the approval of RDSO.

b) Before giving call to RDSO for prototype testing, the manufacturer shall submit a detailed test schedule having details of each test and nature of the test, venue of the test and the duration of each test and the total number of days required to complete the test at one stretch. Once the test schedule is approved, the test shall invariably be done accordingly.

c) In case, any dispute or disagreement arises between the manufacturer and RDSO/Purchaser during the process of testing, as regards to the type test and /or the interpretation and acceptability of the type test results, it shall be brought to the notice of DG/TI/RDSO, whose decision shall be final and binding.

d) The Auger vehicle's conformity/ non-conformity with respect to each item shall be jointly recorded, before the issue of the "Inspection certificate and approval for dispatch of the auger vehicle" as per Annexure- II enclosed

e) No material shall be dispatched or packed until it has been passed by the Inspecting Officer. Such passing shall in no way exonerate the contractor from their obligation in respect of quality and performance of the car.

f) All critical steel welding joints shall be subjected to radiographic testing after manufacture / repair, to a suitable scheme/ standard suggested/approved by RDSO.

15.0 ACCEPTANCE TEST:

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

15.1 Dimensional check of loading gauge, i.e. maximum moving dimensions, buffer heights, clearances etc.

15.2 The riding quality tests shall be conducted at a speed which is 10% higher than the maximum specified operating speed on a section of mainline track over which there are no temporary speed restrictions and which is considered by the railway as being in a generally run down condition for main line standards but without speed restrictions. The tests shall be conducted from a reasonably low speed, which is considered safe by the Indian Railways, upwards insteps of 10-15 km/h to establish the performance at the specified speeds. The oscillation trials details are at annexure-V

15.3 Construction and engineering of the auger vehicle and its ability to perform all the functions as laid down in the specifications above. These tests shall be conducted under field conditions. The procedure shall be as follows:

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

b) Dry weather, ambient temperature between + 10^0 C to 40^0 C .

c) Auger shall be utilized for digging in average good soil in banks and cuttings having bearing pressure 11000 kg/m^2 and moorum soil having bearing pressure 22000 kg/m^2. The speed of digging shall not be less than 30 meters per hour.

16.0 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 tack is taken from commissioner of Railway safety.

As soon as the supplier completes the design of the auger vehicle as per specifications, the technical details as per Annexure (III & IV) shall be supplied for processing of provisional speed certificate for the auger vehicle so that it can be permitted to move on track. On case to case basis, more technical details (other than mentioned in Annexure III & IV) can also be asked for issue of provisional speed certificate for the machine.

17.0 WARRANTY:

17.1 Any part of the car failing or proving unsatisfactory in service due to defective design, material or workmanship within 36 months from the date of delivery in India shall be repaired/replaced by the contractor at his own expense.

17.2 The firm shall indicate the maintenance schedules to be followed by Railways during warranty period, during AMC & after AMC.

17.3 The firm shall specify the number of free services for the warranty period and it shall be included in the contract. However, these shall not be part of evaluation criteria.

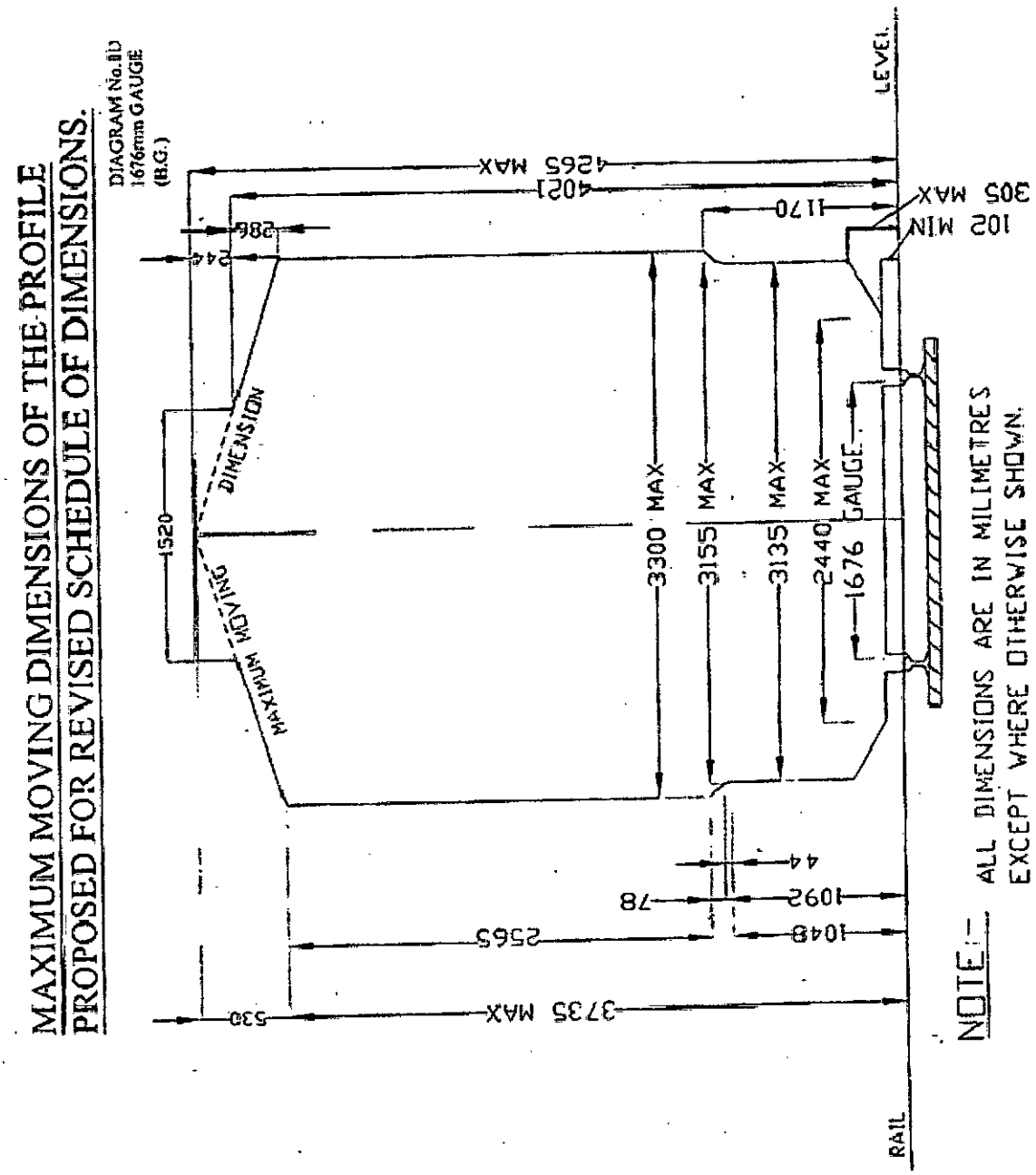
17.4 Should any design or material modification be made in any part of the equipment offered or as a result of any assembly/sub-assembly offered or as a result of any defect/lacuna/ fault/short-coming in the original design features or material the period of 36 months for that assembly/sub-assembly would commence from the date modified part is commissioned in service.

17.5 During the course of warranty period, the firm shall supply all spares free of cost for both scheduled & unscheduled maintenance.

18.0 COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT

Supplier shall quote for comprehensive annual maintenance charges for next five year after warranty/guarantee period. The cost of AMC shall be considered for evaluating the inter se tender position. The firm shall have to enter into this first AMC of 5 years which shall commence after expiry of the warranty period. It shall be mandatory for both Railways and firm to enter into this AMC of 5 years. All spare parts during the course of AMC shall be supplied & fitted by firm free of cost; whether these spares are required for either scheduled or for unscheduled maintenance.

Annexure-I


MAXIMUM MOVING DIMENSIONS OF THE PROFILE
PROPOSED FOR REVISED SCHEDULE OF DIMENSIONS.
DIAGRAM No. III
1676mm GAUGE
(B.G.)
LEVEL
4265 MAX
4021
1170
305 MAX
102 MIN
286
244
DIMENSION
MAXIMUM MOVING
1520
3300 MAX
3155 MAX
3135 MAX
2440 MAX
1676 GAUGE
44
78
1092
1048
2565
530
3735 MAX
RAIL
NOTE:- ALL DIMENSIONS ARE IN MILIMETRES
EXCEPT WHERE OTHERWISE SHOWN.

ANNEXURE-II

INSPECTION CERTIFICATE

CERTIFICATE OF INSPECTION OF AUGER VEHICLE BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF AUGER VEHICLES

(STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that I have inspected the Auger vehicle (type) _____ bearing Sl. No._____ from(date)_____to date_____at (place)____ _____for its conformity with respect to the laid down Technical Specifications in contract Agreement No. _____date_____between President of India through Purchaser 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. It is observed that (strike out whichever is not applicable):-

a. The Auger vehicle conforms to all the laid down specifications.

b. The Auger vehicle conforms to all the laid down specifications except those at Sl. No. _____The above deviations are minor/ major affecting/ not affecting the performance of the equipment in substantial way.

The following T and P/ manuals/ drawings are to be supplied along with the Auger vehicle:_____
_____
_____
_____
_____

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

The Auger vehicle is approved/ not approved for dispatch to_____ (consignee) Indian Railway.

SIGNATURE AND DATE

INSPECTING OFFICIAL
(NAME AND DESIGNATION)
For and on behalf of President of India.

For M/s_____

ANNEXURE:III

PARTICULARS REQUIRED IN RESPECT OF THE ROLLING STOCK UNDER CONSIDERATION

(FOR EACH INDIVIDUAL UNIT)

1. A diagram showing elevation salient dimensions Wheel spacing, Wheel diameter, bogie centers and axle load. :

a) I) Overall length of the vehicle :
   ii) Length over head stock :
   iii) Length over buffers :
   iv) Distance apart for Centre 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. Un-sprung weight per axle in tones

   i) Driving axle :
   ii) Running axle :

7. Expected lateral force in tones per axle at maximum design speed :

8. Method of operation (Only Driving Cars)

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 (COG) from rail level :
Height of floor from rail level :
Type of coupler provided – Indian Railway standard

Coupling :
Buffer :

ANNEXURE-IV

Following information as detailed below is also required along with the information required as per Annexure 'III' for processing the case for issue of provisional speed certificate for new vehicle.

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

ANNEXURE-V

Oscillation Trials

1. The speed potential of the Vehicle offered by the firm should be established based upon oscillation trials conducted in India. The tests will be conducted at speed usually 10 % higher than the maximum speed potential indicated by the firm for the Vehicle under consideration and the following criteria satisfy for the same. For conducting the tests, a section of mainline track will be selected over which there is no temporary speed restrictions and which is considered by the Railway as being in a generally run down condition for mainline standards, but without speed restrictions. The vehicle will be tested generally for new and worn clearance conditions and where relevant for operation in the forward and backward directions. The vehicle selected for tests will be one in average condition for normal maintenance.

2. The criteria applicable for establishing speed potential will be as follows:

   i) A lateral force sustained for more than 2 meters should be considered and it should not exceed the Prud'Homme's limit of 0.85 (10+ P/3) kN where P is the axle load.

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

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

   iv) The values of acceleration recorded in the cab at location as near as possible to the bogie pivot (as near as possible to axle in case of four wheelers) shall be limited to 0.55 kg both in vertical and lateral directions. The peak values upto 0.6 g may be permitted if the records do not indicate a resonant tendency in the region of peak value.

   v) In the case of such vehicles where measurement of forces is not possible, the evaluation shall be in terms of ride index based on the accelerations measured as detailed in Para 2(iv) above which shall not be greater than 4.5 but a limit of 4.25 is preferred.

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