Ref No: BHEL-Jhansi/RBMV/001

EXPRESSION OF INTEREST

FOR

Selection of vendor for

Hydrodynamic transmission (Torque converter) & Gearbox (for final axle drive) for Rail Borne Maintenance Vehicle (RBMV) having underslung diesel engine coupled with Hydrodynamic Transmission

&

3-year Annual Maintenance contract

Issued by:

Bharat Heavy Electricals Limited, having registered office at

BHEL House, Siri Fort New Delhi-110049 and

Also office at

Locomotive Engineering Division,

BHEL, Jhansi – 284120,

Uttar Pradesh, INDIA

(Here after referred to as 'BHEL')

DISCLAIMER

All information contained in this EOI provided / clarified are in good interest and faith. The information contained in this Expression of Interest document or subsequently provided to Applicant(s), whether verbally or in documentary or any other form, by or on behalf of BHEL, is provided on the terms and conditions set out in this EOI and such other terms and conditions subject to which such information is provided.

The purpose of this EOI is to provide interested parties with information that may be useful to them in the formulation of their application for qualification and subsequent selection pursuant to this EOI. This EOI is not an offer by BHEL to the prospective Applicant(s) or any other person. This EOI is neither intended nor shall it be construed as creating or requiring any ongoing or continuing relationship or commitment with any party or person. This is not an offer or invitation to enter into an agreement of any kind with any party.

Though adequate care has been taken in the preparation of this EOI document, the interested firms shall satisfy themselves that the document is complete in all respects. The information is not intended to be exhaustive. Interested Agencies are required to make their own enquiries and assumptions wherever required. Intimation of discrepancy, if any, should be given to the specified office immediately. If no intimation is received by this office by the date mentioned in the document, it shall be deemed that the EOI document is complete in all respects and firms submitting their interest are satisfied with the EOI document in all respects.

The issue of this EOI does not imply that BHEL is bound to select and shortlist Applicant(s) for next stage or to enter into any agreement(s) with any Applicant(s). BHEL reserves all right to reject any applications submitted in response to this EOI document at any stage without assigning any reasons thereof. BHEL also reserves the right to withhold or withdraw the process at any stage. Neither BHEL nor its employees and associates will have any liability, loss, expense or damage which may arise from or be incurred or suffered in connection with anything contained in this EOI document or any matter deemed to form part of this EOI document, the information and any other information supplied by or on behalf of BHEL. BHEL accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance/use of any statements/information contained in this EOI by the Applicant. BHEL is not making any representation or warranty, express or implied, as to the accuracy or completeness of any information/statements made in this EOI.
The Applicant shall bear all its costs associated with or relating to the preparation and submission of its Application including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by BHEL or any other costs incurred in connection with or relating to its Application. All such costs and expenses will remain with the Applicant and BHEL shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by an Applicant in preparation or submission of the Application, regardless of the conduct or outcome of the EOI.

1.0 INTRODUCTION

This Expression of Interest (EoI) seeks response from Original Equipment Manufacturer (OEMs) meeting the eligibility criterion as defined in EOI and ready to associate with BHEL for the following two major components of RBMV machine:

i. Hydraulic transmission using hydro-dynamic elements and preferably provided with hydraulically reversible arrangement with anti-vibration mounting pads, mounting brackets & bolts, standstill detector & associated equipment's and controls as per Technical Specification- No. TM/HM/RBMV/422 Rev.01 of 2019.

ii. Axle drive gearbox of suitable gear ratio, complete with powered axle & torque arm assembly as per Technical Specification- No. TM/HM/RBMV/422 Rev.01 of 2019.

And

3 years Annual Maintenance contract (AMC) of Hydrodynamic transmission (Torque Converter) & Gear Box (for final axle drive) after the expiry of warranty period.

2.0 ABOUT BHEL

Bharat Heavy Electricals Limited (BHEL) is a Central Public Sector Enterprise, wherein Government of India is holding 63.17% of its equity. One of the largest engineering and manufacturing companies of its kind in India having a turnover of more than USD 4 billion. The company is engaged in the design, engineering, manufacture, construction, testing, commissioning and servicing of a wide range of products and services for the core sectors of the economy, viz. Power, Transmission, Industry, Transportation, Renewable Energy, Oil & Gas and Defence with over 180 product offerings to meet the needs of these sectors.

Since its inception in 1964, BHEL has been the solid bedrock of evolution of India's Heavy Electrical Equipment industry. BHEL has a mammoth 20,000 MW per annum capability for manufacturing of power generation equipment. With a widespread network of 16 manufacturing facilities, 2 repair units, 4 regional offices, 8 service centres, 1 subsidiary, 3 active joint ventures, 15 regional marketing centres, 3 overseas offices and current project execution at more than 150 project sites across India and abroad, BHEL manufactures a wide range of high quality & reliable products adhering to national and international standards.

With key focus on project execution, the worldwide installed base of power generating equipment supplied by BHEL has exceeded 185 GW. BHEL's equipment that account for about 60% of the country's total generation from thermal utility sets (coal based), stand a testimony to its valuable contribution towards nation building. BHEL's global competitiveness has established its footprint in all the inhabited continents with references in 83 countries.

The high level of quality & reliability of BHEL products is a testimony to its adherence to international standards by acquiring and adapting some of the best technologies from leading companies in the world including General Electric, Siemens AG, Mitsubishi Heavy Industries Ltd. etc., together with technologies developed in its own R&D centres. BHEL invests more than 2.5% of turnover on R&D and innovation.

BHEL has been designing and manufacturing rolling stock for rail and urban transportation. BHEL has also been manufacturing Motors, Power electronics and Controllers for various transportation applications at its various factories.

In transportation sector, BHEL is into the manufacture of complete electric and diesel electric locomotives and electrical assemblies/components including traction motors, traction transformers, power & auxiliary converters and controls, gear wheels etc. We are a regular supplier

of propulsion equipment of ACEMU/MEMU. India's first air-conditioned ACEMU train operational in Mumbai is equipped with BHEL's electrics and propulsion system.

At our Jhansi plant, we manufacture complete Electric Locomotives up to 6000 HP rating for mainline application of Indian Railways, Diesel Electric Locomotives from 350 HP to 3250 BHP rating. Till date, we have supplied cumulatively more than 725 nos. of main line electric locomotives to Indian Railways and diesel electric locomotives for shunting operations to various industries.

Our Jhansi plant have an installed capacity of 75 nos. locomotives per year. At Jhansi, we have complete state-of-the-art facilities for manufacturing, fabrication and testing of bogies, loco shells, under frames and other mechanical components of locomotives. We have recently developed India's first state-of-the-art WAG7 Electric Locomotive with regenerative capabilities. We have also developed India's first Traction Motor for 9000HP Electric Locomotives.

Among electrical propulsion equipment, we manufacture and supply traction motors, traction transformers, power converters(IGBT) & controls, auxiliary converters(IGBT) and vehicle control units for electric locomotives, diesel electric locomotives, EMUs, DEMUs & and metros trains of Indian Railways. Our manufacturing range includes complete solution for ACEMU/MEMU, IGBT based 3-phase drive equipment up to 6000HP rating. BHEL has also been in the forefront of providing maintenance and spares/replacement support to Indian Railways for their locomotive fleet. We have full-fledged service department located at major centres in the country.

We are establishing state-of-the-art design, engineering and manufacturing facility at BHEL, which is presently under progress at Bhopal Unit. The upcoming facilities shall be able to cater requirement of Stainless Steel Coaches for EMUs for urban transportation and Trainsets for semi high-speed Rail transportation.

More details about the entire range of BHEL's products and operations can be obtained by visiting our web site www.bhel.com.

3.0 PURPOSE

3.1 Indian Railways (IR) is the 4th largest railway network in the world with the track length of more than 1 Lakhs km. In order to have a proper and regular maintenance of the entire track, IR requires different types of track maintenance machines. IR have set an ambitious target for complete mechanization of track maintenance by the year FY 2024.

3.2 In order to meet the plan, 3-tier System of track maintenance shall be adopted on Indian Railways for mechanized maintenance as per Indian Railways Permanent Way Manual. In 3 tiers of track maintenance, one is Mobile Maintenance Units (MMU). The MMU shall be equipped with small track machines, tools & equipments used for day to-day track maintenance. To accommodate and transport these equipments and track workmen at worksite each MMU shall be provided with one self-propelled vehicle like Rail Borne Maintenance Vehicle (RBMV).

3.3 Ministry of Railways (Railway Board), New Delhi have floated an E-global tender No. TM 1922 for procurement of design, Manufacture, Supply, Testing and Commissioning of 430 nos. Rail Borne Maintenance Vehicle (RBMV) having underslung diesel engine coupled with Hydrodynamic Transmission.

3.4 RBMV shall be self-propelled diesel-powered, 8-wheeler bogie type, with bi-directional operation with diesel hydraulic drive. It shall be powered by two sets of power pack for rail traction application. Each set of power pack shall comprise an under slung diesel engine transmitting power through hydro dynamic transmission and cardan shaft(s) to the axle drive mounted on the inner axle of each bogie.

3.5 The intent of this Expression of Interest hereinafter referred to as the “EOI” is to invite applications from interested Party/Parties who are willing to Partner/Work Jointly with BHEL for hydraulic transmission and drive axle for participation in the Railway Board tender for Design, Manufacture, Supply, Testing, Commissioning of 430 nos. Rail Borne Maintenance Vehicle (RBMV). For reference and further details, complete tender document can be downloaded from IREPS website link given under

(https://www.ireps.gov.in/epsn/nitViewAnonyms/rfq/nitPublish.do?nitId=3078618&activity=viewNIT

3.6 The EOI process involves selection of interested party/parties who make an application in accordance with the provisions of this EOI (the "Applicant"). At the end of this process, BHEL expects to select Applicant(s) who shall be invited for further deliberations on requirements regarding supply, installation and commissioning of Hydrodynamic transmission (Torque Converter) & Gear Box (for final axle drive). In addition, the party is required to provide 3 years AMC of Hydrodynamic transmission (Torque Converter) & Gear Box (for final axle drive) after expiry of warranty period.

3.7 BHEL shall select party/parties who meet the PQR as per clause 5 of this EOI.

4.0 INSTRUCTION TO APPLICANTS:

4.1 ***Reputed business entities may submit their application as per Annexure -1*** (along with supporting documents for PQR) by Post/e-mail/hand in 2 copies (Original+1) so as to reach us on or before 10th March' 2020 at the following address:

Sr.Dy. General Manager / LME
Locomotive Engineering Division,
Bharat Heavy Electricals Limited
Jhansi – 284120, Uttar Pradesh, India
Telephone: +91-510-2412609, 2412686
Mobile: +91-9453001075
Fax: +91-510-2412114
Email: kd_manjhi@bhel.in, girish.raj@bhel.in

Note: Original signed copy shall be sent immediately so as to reach within 7 days of e-mail.

4.2 The details submitted by the Applicant(s) shall be complete in all respects and BHEL may seek clarifications/additional information as considered necessary. Such clarifications/additional information must be provided within 2 days of BHEL request.

4.3 The EOI process involves seeking willingness of interested party/parties and selecting party/parties amongst all who make an application in response to this EOI.

4.4 Any request for further information or clarification on the EOI document may be submitted to above address *within 07 days from date of issue of EOI*.

4.5 Responses to EOI are to be submitted in English only. Supporting documents, as required, should also be in English language. In case of some documents being available in languages other than English, the Applicant shall necessarily provide duly authenticated translated version of the same in English.

4.6 Duly authorized representative of the Applicant(s) shall sign on each page of the document. Response to EOI should be prepared in such a way so as to provide a straight forward, concise description of Applicant's capabilities.

4.7 Notwithstanding anything contained in this EOI, BHEL reserves the right to accept or reject any Application and to annul the EOI Process in whole or part, at any time without any liability or any obligation for such acceptance, rejection or annulment, and without assigning any reasons thereof.

4.8 BHEL reserves the right to verify all statements, information and documents submitted by the Applicant in response to the EOI. Any such verification or lack of such verification by BHEL shall not relieve the Applicant of his obligations or liabilities hereunder nor will it affect any rights of BHEL.

4.9 The EOI process shall be governed by, and construed in accordance with, the laws of India and the Courts at New Delhi shall have exclusive jurisdiction over all disputes arising under, pursuant to and/ or in connection with the EOI process.

4.10 All costs incurred for participation in the EOI shall be borne by the Applicant (s).

4.11 Any request for further information or clarification on the EOI document may be submitted in writing to us. BHEL may respond to the queries raised/clarifications sought to the best of its ability. However, no extension of time or date for submission of response to EOI shall be given on the ground that BHEL has not responded to any query/clarification raised by any party.

5.0 Pre-Qualifying Criteria (PQR):

The prospective party/ respondent must meet the pre-qualification requirement as applicable and tabulated below, supported with relevant documents/ credentials/ certificates for further consideration:

Technical Criteria	
Design, Manufacturing and Supply capabilities	
A.	The vendor should be regular manufacturer of either Hydrodynamic transmission or Gearbox and have supplied such systems for railway application (locomotive/track machines such as RBMV/UTV/Tower wagon etc.) to Indian Railways or in at least two countries national/main line passenger carrying public railway transportation systems (Govt/Private/Metro) in addition to their country of incorporation. They must have adequate technical knowledge and practical experience in supplying the equipment's. Applicant to submit documentary evidence along with EOI response.
B.	Equipment supplied by applicant must be working satisfactorily and in successful operation for at least 2 years till the date of issue of EOI. Applicant to submit documentary evidence.

6.0 Technical description of Hydrodynamic transmission (Torque Converter) & Gear Box (for final axle drive)

1. The power shift transmission shall be hydrodynamic so that there is no wear and tear in field operation. The tenderer shall give the full technical data of the power transmission system.
2. The power pack and transmission equipment shall be mounted on the under frame so that whole assembly occupies as little space over floor as possible.
3. Transmission shall be either step less or minimum 3 steps bi-directional with maximum speed possible in both forward as well as in reverse direction.
4. The transmission shall provide smooth shifting at full power while shifting to higher or lower steps.
5. The combined performance of the twin power equipment shall not be inferior to the tractive effort curve placed at Annexure–A.
6. Transmission shall have provision of secondary lubrication arrangement to provide protection to transmission from damage during towing in train formation.
7. Transmission shall be coupled with underslung diesel engine of rating 400hp@2100rpm. Diesel engine shall be of Cummins or equivalent make.
8. The auxiliary loads driven by Diesel engine shall be of about 150 hp (approx.). Thus, suitable transmission meeting these power requirements to be offered.
9. The tentative layout of RBMV machine shall be as per the sketch in Annexure –B.
10. The maximum permissible axle load for the RBMV machine is 20.3 tonne. So, RBMV machine weight shall be kept within the limit of 80 tonne including 15 tonne payload.
11. The maximum speed of the RBMV machine (self-propelled travel mode without trailing load) shall be 100kmph. The machine shall be tested during trial by Inspection agency (RDSO) at the speed of 110 kmph (10% higher than rated speed).So, Transmission & Gearbox to be offered for RBMV machine must be capable to reach the required speed with the wheel diameter of 952 mm (New).

For detail please refer to attached Railway board tender spec - No. TM/HM/RBMV/422 Rev.01 of 2019

7.0 Additional information:

A.	Annual Maintenance Contract (AMC)
i.	The applicant shall be responsible for AMC of all items/Components of Hydrodynamic transmission (Torque Converter) & Gear Box (for final axle drive). All materials/spares/consumables and labour requirement shall be arranged by successful applicant during the course of AMC. The Annual Maintenance shall be for 3 years after expiry of warranty period. The vendor should quote servicing and break down maintenance charges (8 hours per day); including lodging and boarding for the service engineer, during post warranty 3 years AMC and separately quote the conveyance charges (in km basis) for journey on deputation performed by the service engineer, during AMC period.
B.	Warranty:-
i.	Warranty period of transmission & gearbox shall be same as defined for RBMV machine mentioned in the IR tender. RBMV machine shall be warranted for 2000 effective working hours or 24 months from the date of commissioning and proving test of machine at ultimate destination in India whichever shall be earlier. Effective working hours for this purpose will be traffic block time during which RBMV is deployed for work. Should any design modification be made in any part of the machine offered, the warranty period of 24 months would commence from the date of commissioning and proving test of the RBMV 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 shall be borne by the supplier. Item-wise list of spares per machine during warranty period shall be offered excluding all types of consumables. During warranty period, scheduled maintenance of Components shall be done by the successful contractor for which no extra cost shall be paid by BHEL/Indian Railways. Applicants are required to stocks adequate stocks of spares and service engineers of the Hydrodynamic transmission (Torque Converter) & Gear Box (for final axle drive) in India to attend the machine during warranty and beyond warranty up to a minimum of 20 years of commissioning of the machines or up to the completion of codal life of the machines as defined in the Indian Railway guidelines whichever is higher.

Annexure-1

Information to be submitted by Applicant

1. Name of the Company:
2. Legal status of the Company:
3. Brief description of the Company including details of its business groups/subsidiaries/ affiliates:
4. Date of Incorporation:
5. Date of Commencement of Business:
6. Full address including Telephone nos. / Fax nos.:

   Registered Office:

   Head Office:

   Address for communication:

   Contact Details:

   Office Address in India, if any:

7. Documents to be enclosed:

   Filled up Annexure -2 along with all applicable documents considered relevant to meet PQR and support evaluation criteria indicated in Applicant's response column of Annexure 2.

(Sign & Company Seal)

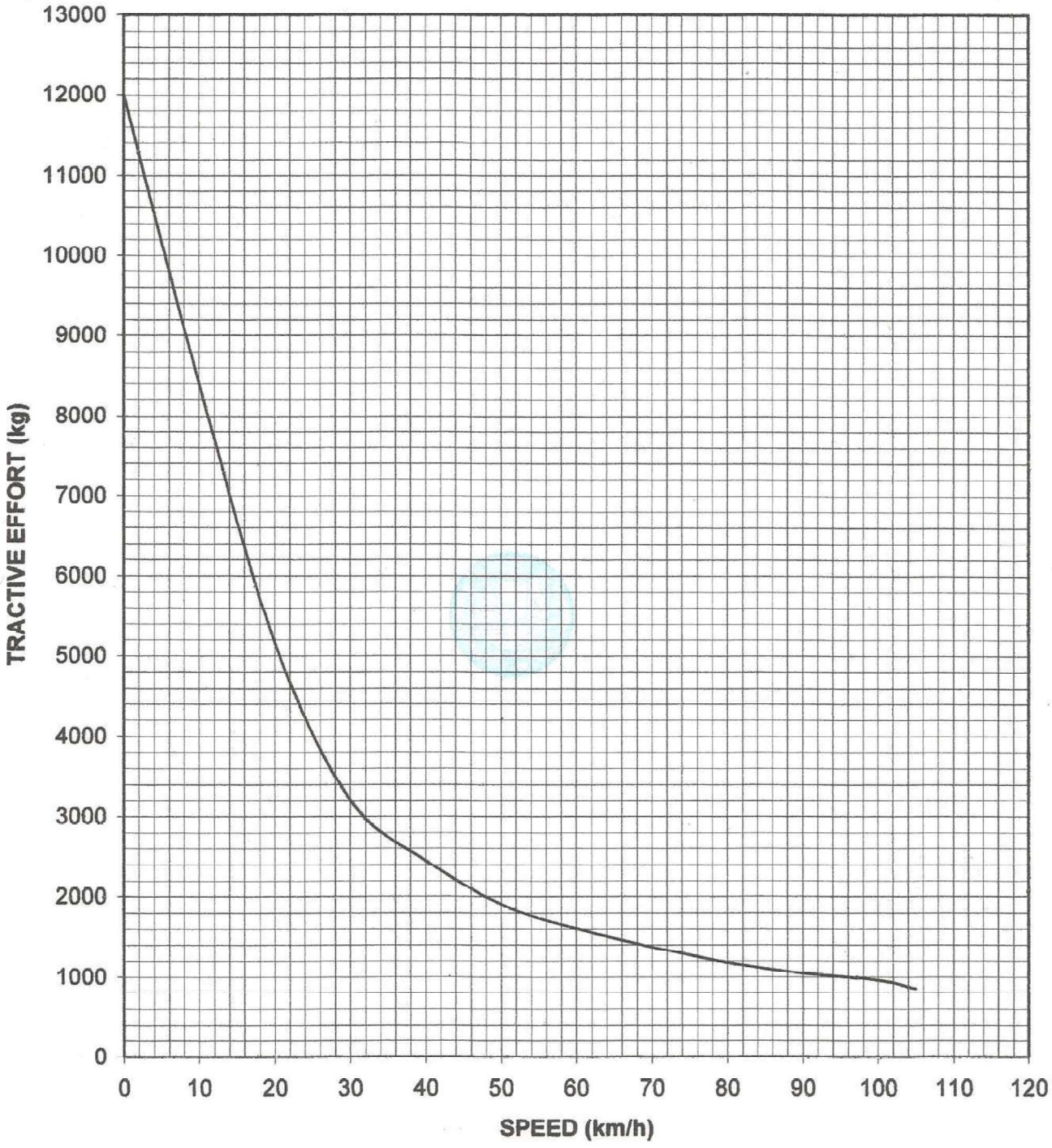
Authorized signatory

Annexure-2

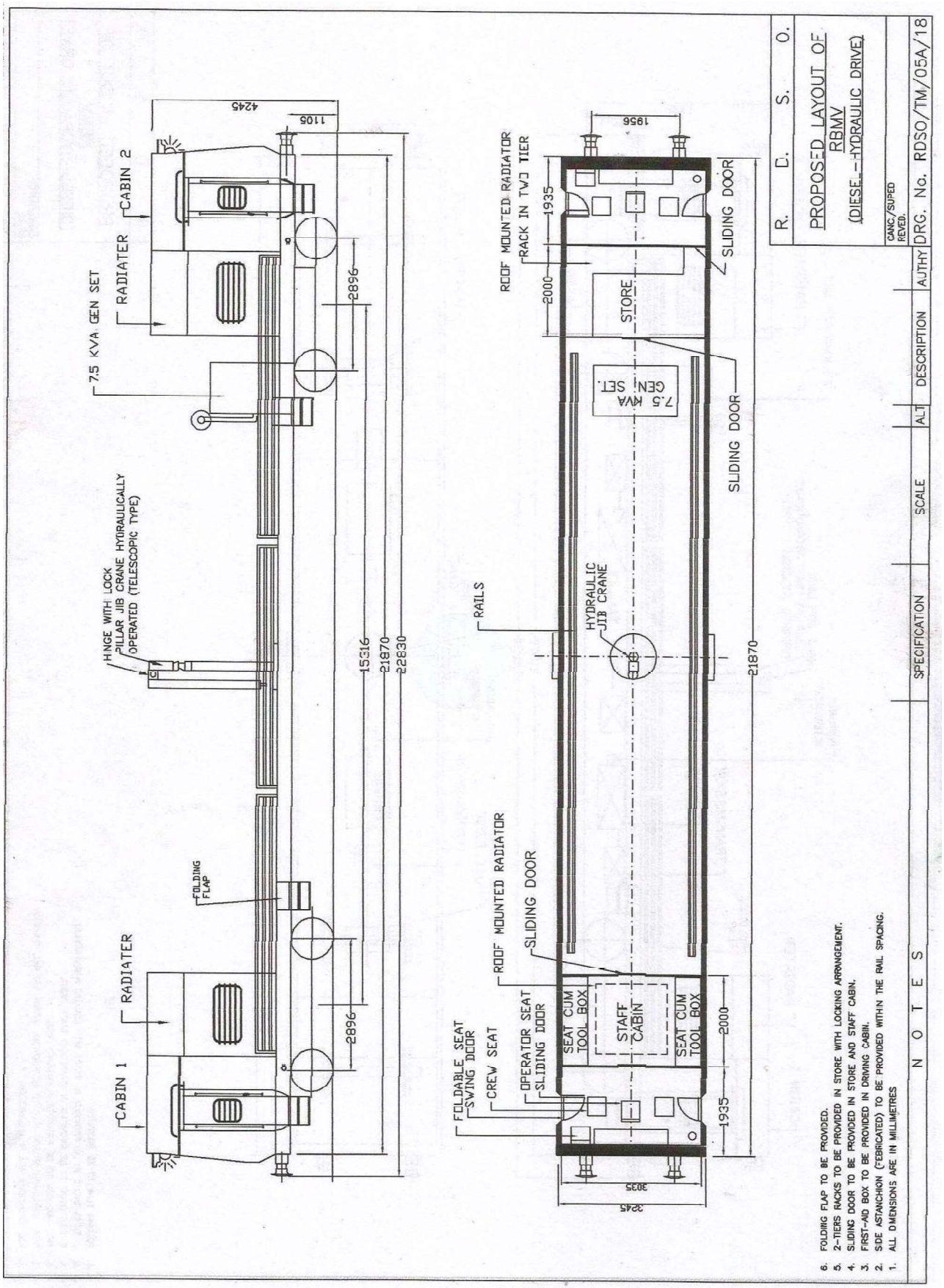
Eligibility Criteria		***Applicant's Response***	
Technical Criteria		***Meeting the criteria*** *Yes / No*	***Documentary evidence:*** *Enclosed / To be submitted later*
Design, Manufacturing and Supply capabilities			
A.	The vendor should be regular manufacturer of either Hydrodynamic transmission or Gearbox and have supplied such systems for railway application (locomotive/track machines such as RBMV/UTV/Tower wagon etc.) to Indian Railways or in at least two countries national/main line passenger carrying public railway transportation systems (Govt/Private/Metro) in addition to their country of incorporation. Applicant to submit documentary evidence along with EOI response.		
B.	Equipment supplied by applicant must be working satisfactorily and in successful operation for at least 2 years till the date of issue of EOI. Applicant to submit documentary evidence.		
Additional financial information to be submitted by applicant			
A.	Applicant to submit the financial statement of last 3 years indicating Turnover, audited profit and loss statement alongwith supporting documents.		

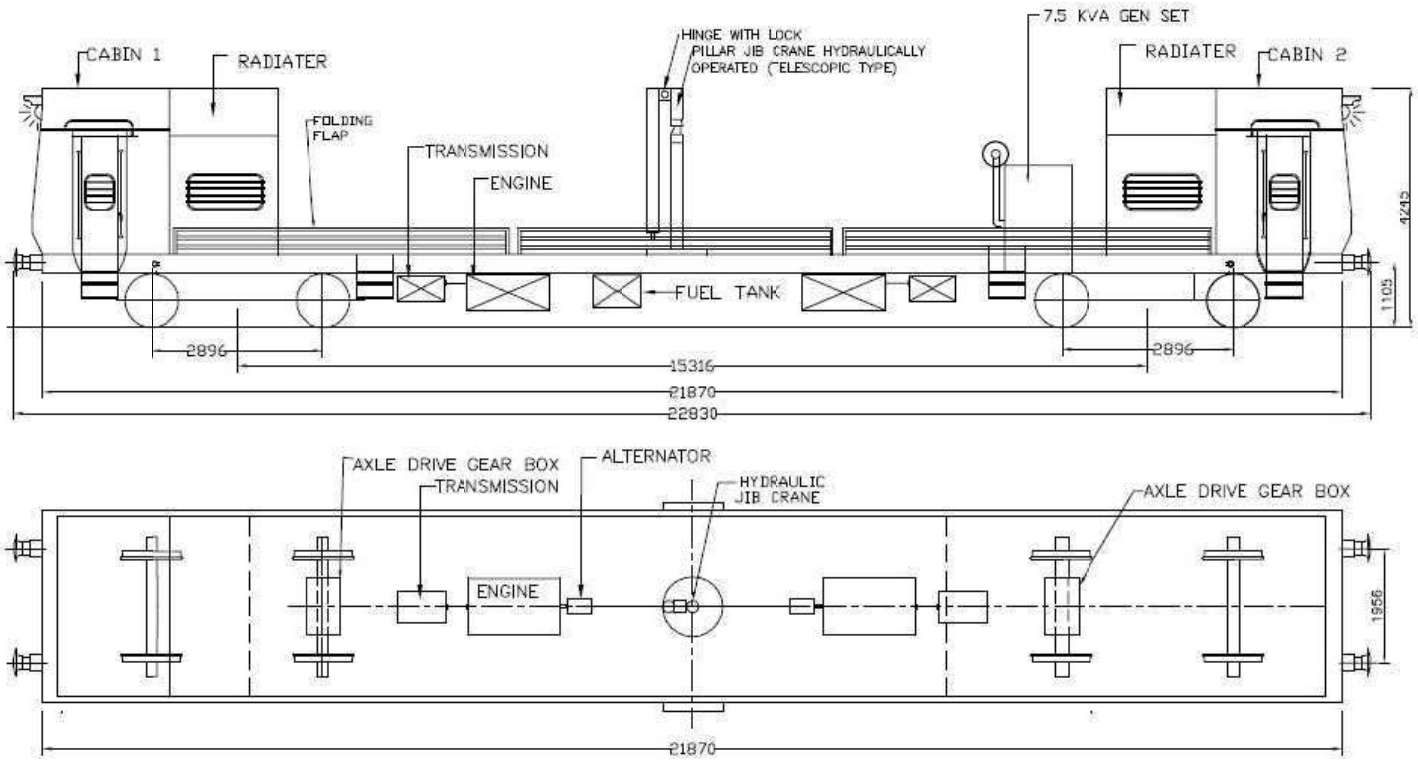
ANNEXURE-A

TRACTIVE EFFORT Vs SPEED CURVE FOR RAIL BORNE MAINTENANCE VEHICLE (RBMV)



ANNEXURE-B


R. D. S. O.
PROPOSED LAYOUT OF RBMV
(DIESEL-HYDRAULIC DRIVE)
CANC./SUPED REVED.
DRG. No. RDSO/TM/05A/18
SPECIFICATION
SCALE
ALT
DESCRIPTION
AUTHY
NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES
2. SIDE ASTANCHION (FABRICATED) TO BE PROVIDED WITHIN THE RAIL SPACING.
3. FIRST-AID BOX TO BE PROVIDED IN DRIVING CABIN.
4. SLIDING DOOR TO BE PROVIDED IN STORE AND STAFF CABIN.
5. 2-TIERS RACKS TO BE PROVIDED IN STORE WITH LOCKING ARRANGEMENT.
6. FOLDING FLAP TO BE PROVIDED.
CABIN 1
CABIN 2
RADIATER
RADIATER
7.5 KVA GEN SET
HINGE WITH LOCK PILLAR JIB CRANE HYDRAULICALLY OPERATED (TELESCOPIC TYPE)
FOLDING FLAP
ROOF MOUNTED RADIATOR
RACK IN TWO TIER
SLIDING DOOR
SLIDING DOOR
STORE
7.5 KVA GEN SET
RAILS
HYDRAULIC JIB CRANE
ROOF MOUNTED RADIATOR
FOLDABLE SEAT SWING DOOR
CREW SEAT
OPERATOR SEAT SLIDING DOOR
SEAT CUM TOOL BOX
STAFF CABIN
SEAT CUM TOOL BOX
4245
1105
2896
15316
21870
22830
2896
1956
1935
2000
21870
2000
1935
3035
4245



6. FOLDING FLAP TO BE PROVIDED.
5. 2-TIERS RACKS TO BE PROVIDED IN STORE WITH LOCKING ARRANGEMENT.
4. SLIDING DOOR TO BE PROVIDED IN STORE AND STAFF CABIN.
3. FIRST-AID BOX TO BE PROVIDED IN DRIVING CABIN.
2. SIDE ASTANCHION (FEBRICATED) TO BE PROVIDED WITHIN THE RAIL SPACING.
1. ALL DIMENSIONS ARE IN MILLIMETRES

NOTES	SPECIFICATION	SCALE	ALT	DESCRIPTION	AUTHY

R. D. S. O.

PROPOSED LAYOUT OF RAIL BORNE MAINTENANCE VEHICLE(RBMV) (DIESEL-HYDRAULIC DRIVE)

CANC./SUPED
REVED.

DRG. No. RDSO/TM/05B/18

सत्यमेव जयते

INDIAN RAILWAYS

Technical Specification for on track Rail Borne Maintenance Vehicle (RBMV) for B.G. (1676 mm)

(Specification No: TM/HM/RBMV/422 Rev.01 of 2019)

S. No.	Month & Year of approval	Revision/Amendment	Reason for Amendment
1.	February-2019	Nil	First Issue
2.	December-2019	Rev. 01	Technical Review

Signature			
Name & Designation	(Ravi Kumar) SSRE/TM **Prepared By**	(Muslim Ahmad) ARE/TM (Om Prakash) DTM-III **Checked By**	(S. C. Srivastava) ED/TM **Approved By**

Issued By:

Track Machine & Monitoring Directorate
Research Designs and Standards Organization
Manak Nagar, Lucknow-226011

TECHNICAL SPECIFICATIONS FOR RAIL BORNE MAINTENANCE VEHICLE (RBMV) FOR BROAD GAUGE (1676 mm)

(Specification No. TM/HM/RBMV/422 Rev.01 of 2019)

1.0 GENERAL

1.1 3-tier System of track maintenance shall be adopted on Indian Railways for mechanized maintenance as per Indian Railways Permanent Way Manual. In 3 tiers of track maintenance, one is Mobile Maintenance Units (MMU). The MMU shall be equipped with small track machines, tools & equipments used for day to-day track maintenance. To accommodate and transport these equipments and track workmen at worksite each MMU shall be provided with one self-propelled vehicle. This specification has been framed to reflect the technical performance and quality requirements of such vehicle, hereinafter called Rail Borne Maintenance Vehicle (RBMV).

1.2 The technical specifications have been drafted to reflect the performance and quality requirements of the RBMV in a neutral manner without bias to any specific manufacturer. Bidders are requested to carefully study the specifications and assure that their machine full comply with these specifications. Thereafter, if a bidder feels that his machine can substantially meet the performance and quality requirements of the machine but does not fully satisfy a particular specification, he 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 bidder shall specify the make/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, along with the sketches to show the manner in which the requirements of the specifications are accomplished by the RBMV (model) offered.

1.4 Photographs and videos of the type of the RBMV offered, in working mode and technical literature shall be enclosed with the offer. The photographs shall also show close-ups of various working assemblies/systems and the full RBMV. The tenderer shall also furnish compact disc or DVD or USB showing the working of RBMV in real time under field conditions. 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 Railways officials.

1.5 The bidder shall be entirely responsible for the execution of the contract strictly in accordance with the terms and conditions of the specification not withstanding any approval, which RDSO or the Inspecting Officer may have given:

- Of the detailed drawings prepared by the bidder.
- Of his sub- bidders for materials, components & sub-assemblies.
- Of other parts of the work involved in the contract.
- Of the tests carried out by the bidder/Sub- bidder or RDSO or the Inspecting Officer.

2.0 DIMENSIONAL AND OPERATING REQUIREMENTS

2.1 The RBMV shall be self propelled diesel-powered, 8-wheeler bogie type, with bi-directional operation with diesel hydraulic drive. The RBMV shall be robust, of latest design, reliable and suitable for working on the Indian Railways broad gauge (1676 mm gauge). The design and dimensions of the machine components shall be to metric standards and shall comply with provision of Indian Railways Schedule of Dimensions–1676 mm gauge (BG), revised, 2004 with latest corrigendum and up to date correction slips issued. Quality assurance during manufacturing of the RBMV shall be according to ISO-9001. The welding standard followed for manufacturing of machine shall conform to ISO: 3834, EN: 15085 or any other equivalent standard for welding railways vehicles and components. The manufacturer shall specify the standard followed and certify that it meets the welding standard mentioned above. The RBMV shall be suitable for working on straight, transition, curved track (up to 10°) and on turn out broad gauge (1676 mm) of Indian Railways.

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

2.3 In the past Indian Railways have condoned certain infringements to the Indian Railways Schedule of Dimensions–1676 mm gauge (BG), revised, 2004 with latest corrigendum and up to date correction slips issued 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 operational requirements of Indian Railways. 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 Indian Railways. Where an infringement to Indian Railways Schedule of Dimensions–1676 mm gauge (BG), revised, 2004 with latest corrigendum and up to date correction slips issued 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 Indian Railways, the condonation of the same may be permitted by Indian Railways. However, only those infringements which are acceptable shall be permitted.

2.4 Adequate clearance shall be allowed so that no component/part infringes the minimum vertical clearance of 91 mm from rail level while travelling on track up to condemnation limit of wheel.

2.5 Wherever applicable axle load of RBMV shall be less than 20.32 tonnes with minimum axle spacing of 1.83 m while moving on track. Load per meter shall not exceed 7.67 tonnes. 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 track and bridges of Indian Railways. Stresses in the track and bridges shall be calculated by IR/RDSO based on

design data submitted by the firm as per Annexure–VII and decision of IR/RDSO shall be final in this regards.

2.6 The floor height of the open platform shall be within minimum 1145 mm (loaded) to maximum 1345 mm (unloaded).

2.7 It shall have a minimum wheel diameter of 914 mm (new wheel profile). However, lesser diameter up to 730 mm (new wheel profile) can also be considered, provided it meets the criteria condition laid down in clause 2.4 at its condemnation limit and also 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 50 mm margin between new and permitted worn wheel diameter are available, but this should not be less than 20 mm. The worn out wheel diameter (condemning worn out diameter) based on the criteria of rail wheel contact stresses for various maximum axle loads are as under:

Maximum Axle load (tone)	Minimum worn out wheel diameter (mm)
22.82	908.00
22.00	878.00
21.50	860.00
21.00	841.00
20.32	816.00
20.00	805.00
19.50	787.00
19.00	768.00
18.50	750.00
18.00	732.00
17.50	713.00

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.

2.8 The new wheel profile in the machine shall be as per Indian Railways standard drawing attached as Annexure-III which is titled as “WORN WHEEL PROFILE’.

2.9 Wheels shall be conforming to Indian Railways 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 mention the standard followed & shall submit detailed design calculation along with material parameters at the time of supply of the machine.

2.10 The non-powered axles shall be conforming to Indian Railways 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.

2.11 The powered axles shall be conforming to Indian Railways 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 mention the standard followed & submit detailed design calculation along with material parameters at the time of supply of the machine.

2.12 Roller bearing shall be grease lubricated & sealed and also supplied by any manufacturer approved by UIC/AAR. Roller bearing shall be conforming to EN 12080:2017 and shall have minimum L10 life of $3X10^6$ km (3.0 million km) when computed as per method given in ISO Standard 281/1.

2.13 It shall be capable of negotiating curves up to 10^o curvature (175 m radius), super elevation up to 185 mm, maximum cant deficiency 100 mm and gradients up to 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.

2.14 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	:	-5^0 C to 55°C
Altitude	:	up to 1800 m above mean sea level
Humidity	:	up to 100%
Maximum rail temperature	:	70^o C
Rain fall	:	Fairly heavy
Atmospheric condition	:	Very dusty, heavy fog

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

2.15 During transfer from one station to another (self propelled travel mode without trailing load), it shall be capable of travelling on its own speed at 100 kmph. It shall be capable of being hauled in train formation as last vehicle at a speed not less than 100 kmph. It shall be capable of hauling empty/loaded wagon or 8 wheeler coach gross weight 90 tonnes approximately) at a speed not less than 50 kmph. It shall be able to negotiate steepest gradient of 1 in 33 prevailing on Indian Railways with this trailing load. During towing of the machine (RBMV) simple neutral position of gears shall be sufficient, no opening of cordon shaft etc shall be required.

2.16 It shall be capable of working and travelling without requiring power block in electrified sections except while lifting the swivelling platform for inspection of FOB/ROB mentioned in clause 3.8. On Indian Railways, 25 KV or 2x25 KV AC power supply is used for traction through an overhead wire at 5500 mm above rail level. On bridges and tunnels, the height is restricted to 4800 mm.

2.17 While working on double/multiple 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 4265 mm centre to centre. The RBMV or its any part shall not infringe adjoining track as per Indian Railways Schedule of Dimensions 1676 mm gauge (BG), revised-2004 with the latest corrigendum and up to date correction slips issued, during travelling or its operation including opening and closing of the work.

2.18 The RBMV shall be capable of carrying pay load of 15 t. The description of crane, equipment storage space shall be such as to ensure equal axle loads. Design shall be such as to afford easy inspection and maintenance. Guiding principle in selection of assemblies should be

the easy availability of wearing components.

2.19 The General layout of RBMV shall be in accordance with RDSO drawing no. RDSO/TM/05A/18 placed at Annexure–XII/A. Any other layout submitted by the tenderer may also be considered, provided it meets with overall requirement of space on the vehicle, speed/running characteristics of the vehicle and the desired amenities asked for in the subsequent paragraphs of this specification. It shall be powered by two sets of power equipment, for rail traction application, each set comprising of an under slung diesel engine transmitting power through hydro dynamic transmission and cardan shaft(s) to the axle drive mounted on the inner axle of each bogie. The conceptual power equipment layout to RDSO drawing no. RDSO/TM/05B/18 is placed at Annexure-XII/B.

2.20 The equipment and their arrangement shall withstand satisfactorily the vibration and shocks normally encountered in service as indicated below:

a	Maximum vertical acceleration	3.0 g
b	Maximum longitudinal acceleration	5.0 g
c	Maximum train acceleration	2.0 g
	(g being the acceleration due to gravity)	

2.21 The scope of supply of equipment for each RBMV shall be as under:

SN	Item Description	Qty./RBMV
1.	Fuel efficient diesel engine, of adequate capacity with anti-vibration mounting pads, mounting brackets & bolts, engine driven alternator for charging battery for engine cranking, cooling equipment complete with radiator, hydraulic system, cooler and Fuel pipes, check valve, hoses and fittings.	2
2.	Hydraulic transmission using hydro-dynamic elements and preferably provided with hydraulically reversible arrangement with anti-vibration mounting pads, mounting brackets & bolts, standstill detector & associated equipments and controls.	2
3.	Axle drive gearbox of suitable gear ratio, complete with powered axle & torque arm assembly.	2
4.	Cardan shaft for drive between: a) Input to transmission (if, required) b) Between Transmission and Axle drive	 2 2
5.	Controls and instrumentations for two cabs for bidirectional operation of vehicle.	2 sets
6.	Battery: 12 V 180 AH for engine starting, controls and lightings.	2 nos. for each engine
7.	Speed indicator cum recorder for one cab and only speed indicator for other cab	1 set
8.	Hydraulic pump driven by either of the engines for power supply to the crane operation.	1 set

3.0 WORKING MECHANISM:

3.1 The RBMV shall be capable of working on all types of track structures including long welded rails of 60Kg/52Kg/90R on concrete/metal/wooden sleepers on plain track as well as turn-outs (1 in 8.5 to 1 in 16) as per IRS layout.

3.2 There shall be a loading platform on the RBMV itself so that it is possible to carry minimum 2 rails of 13 m length each with weight per unit length of 60 Kg/m and/or two sets of switch and stock rail assembly along with fittings CMS crossings along with equipments loaded on the RBMV itself. Weights, dimension of the Rails, CMS crossings and equipments to be carried on RBMV platform in Annexure-IV/A, Annexure-IV/B, Annexure-X/A and Annexure-X/B without infringing the maximum moving dimensions.

3.3 The loading platform shall be provided all-around with a collapsible sidewall/railing of about 45 to 60 centimeters height to protect the men and materials from falling.

3.4 The RBMV shall have a crane as per requirements indicated in clause 4.0 to handle heavy permanent way materials such as rails, sleepers, crossings, switches and SEJs etc. The crane fixed on the RBMV should be capable of efficiently handling the equipments and materials to be carried on RBMV.

3.5 There shall be well designed adequate space to store small track machines, tools and equipments as per Annexure-X/A and Annexure-X/B. For this a room of sufficient size is required to be provided. The store shall have well-designed racks to accommodate above material and some small track machines and its spare parts, consumables etc as per details shown in Annexure –XI.

3.6 There shall be enough seating space for the officials accompanying RBMV. For this, one cabin having seating capacity of 12 persons shall be provided as given in the general layout.

3.7 Two number of tool boxes shall be provided along the wall of store and cabin. These tool boxes shall have a width of approximately 600 mm and cushioned seats shall be provided on the top of toolboxes. The top of the box shall be designed in such a way that the seats do not fall when the boxes are opened. Small cantilever sheds shall be provided over these boxes.

3.8 There shall be provision of lifting and swivelling platform for inspection of the underneath of FOB/ROB, a lifting and swivelling platform with hydraulically operated mechanized adjustment for height and rotation and capable of taking minimum 280 kg load with under-noted features shall be provided over the roof. Control for lifting, lowering and swivelling shall be provided on the platform. The raising and swivelling of the platform shall be gradual and without jerks. In addition two emergency stop switches shall be provided on each side of the platform to bring the RBMV to an emergency halt. Two search lights of 24 V (100 w) halogen lamps with intensity of light as 3.2 lux at 3.20 m distance shall be provided on the platform for inspection of the ROB/FOB. Searchlights shall be capable of swivelling on universal joints type support and swivelling control shall be from inside of the either cabin. Mechanical locking arrangement shall be provided to avoid lifting of platform during running of RBMV.

a)	Length of platform	4500 mm

b)	Width of platform	1500 mm
c)	Platform floor level above rail level when elevated	6150 mm
d)	Maximum lifting time to full height	45 s
e)	Rotation range of platform towards sides	90^0
f)	Side shifting reach of platform	4200 mm
g)	Full height of collapsible railing above platform floor	800 mm
h)	Maximum time of rotation from 0^0 position to 90^0	45 s

3.9 Since the RBMV is to work in dusty environment, all the components including gearboxes, bearings, pumps, electric and electronic control shall be robust. Pumps, electric and electronic control shall be of robust design, shielded and sealed from the dust and spill over ballast pieces. Suitable protections covers must be provided so that these components do not fail prematurely. The various assemblies and the RBMV as a whole shall provide adequate safety to workmen working close-by in connection with the RBMV operations. The necessary safety equipment shall form a part of the RBMV tools and plants. The tenderer shall indicate these items in their offer.

3.10 The entire RBMV including bogies, superstructure along with equipment is to be effectively earthed as per standard practice for rolling stock.

3.11 The RBMV shall be capable of continuous running at 100 kmph on generally tangent track followed by frequent to and fro movement at crawling speed for 1.5 hr. to 5.5 hr.

4.0 CRANE

4.1 The RBMV shall have hydraulically operated fixed type crane mounted on it and the crane shall be without outriggers/jacks. The crane shall be of knuckle boom or pillar jib type with telescopic jib.

4.2 The crane shall be structurally integrated with the under frame of RBMV. Mounting arrangement shall be made in the under frame so that it should be rigid and upright without infringing BG moving gauge during run.

4.3 The crane shall be capable of lifting a load of 1t at 8m radius with 360^0 swing. The tenderer shall submit the lifting capacities at various radii. The crane should be capable of loading/unloading P Way materials lying along the track on either side viz. rails, concrete sleepers, switches and SEJs etc. (the details of which may be obtained from RDSO), from ground and 1.2 m below rail level to RBMV and vice-versa. Suitable attachment like loading platform, lifting tackles/lifting clamps for handling the heavy materials shall be provided along with crane. The tenderer shall submit the details of the same. Slings required for picking up rails, sleepers or crossings shall also be supplied as part of the crane. Necessary make-up blocks (if required) shall be supplied by manufacturer/supplier for steady transfer of load during operation of the crane.

4.4 It shall be possible to start the loading/unloading at site within five minutes of arrival. In case, the tenderer is not able to meet the above requirement, the set-up time shall be indicated by the tenderer and shall have to ensure the same during testing.

4.5 The crane operation shall be such that there is no infringement with overhead electric equipments including adjacent track, if available either by crane or items to be lifted as indicated in clause 4.3 above. Suitable safety devices shall be provided to prevent such infringement, if any. The crane shall be properly secured while traveling to protect it from damages.

4.6 The crane operation shall be arranged from both traction power packs and shall be operated with one of them at a time.

4.7 Tenderer shall submit hydraulic schematic diagram for crane operation, load charts and stability calculation.

4.8 The RBMV shall be provided with emergency backup system to wind up the crane in the event of failure of prime mover or power transmission system of the machine. The emergency backup system shall be able to be operated manually also.

4.9 The system shall be provided with suitable hydraulic valve to protect against accidental lowering of load due to system failure.

4.10 The operation of crane viz. hoisting, derricking, slewing shall be hydraulic. The hydrostatic system shall have hydraulic pumps, motors and their equipment of proven make and reliable. During movement of the RBMV the operation of the crane shall be strictly prohibited. Provision in the crane operation shall be provided so that no power from traction power packs shall be transmitted during movement of the RBMV.

5.0 DIESEL ENGINE:

5.1 Diesel engine complete shall be offered as per clause 2.21 under scope of supply. Twin under slung power pack, each powered by fuel-efficient diesel engine of adequate capacity shall power RBMV. The diesel engines preferably indigenous with proven record of service in tropical countries with wide service network in India. Robust construction and low maintenance cost are of particular importance.

5.2 Expected mean life to major parts of the engine for overhauling shall not be less than 8000 engine running hours. The tenderer shall indicate the continuous horsepower at rated output of offered engine under site condition. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions referred in clause 2.14.

5.3 The supplier shall indicate the total horsepower required for auxiliaries with break-up of power requirements for each of the auxiliary machines at rated output and net power input to the transmission.

5.4 The engine shall be provided with a flywheel mounted flexible coupling. The coupling shall be of adequate capacity to withstand high deflection and torque (at starting, stopping and due to any misfiring of the cylinders) so that no damage is caused to transmission and engine components in service.

5.5 Filters for engine air intake shall be of adequate airflow capacity with restriction indicator to ensure satisfactory performance under dusty environment.

5.6 Air intake with filters, ducts and exhaust arrangement shall be compatible with engine system and shall be located at suitable position within the overall dimensions of the vehicle.

5.7 The tenderer shall furnish a copy of type test report of the engine by a statutory body in support of their claim regarding performance, reliability and specific fuel consumption.

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

5.9 The diesel engine for RBMV and crane operation shall work satisfactorily with High speed diesel oil conforming to IS specification no.1460 (2005).

5.10 A separate fuel tank with adequate capacity sufficient for continuous operation of 24 hours shall be provided. Sight glass type fuel measuring gauge preferably of full height shall be provided on the fuel tank.

5.11 For starting the engine, storage batteries of well-known indigenous make with wide service network in India shall be provided. The engine shall normally be push/pull button start type or key type.

5.12 There is a likelihood of dust deposition over the engine body and surrounding area over the lubricants spills over. These locations shall 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.

5.13 Since the engine has 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.

5.14 The engine parameter monitoring gauges like temperature, rpm, and lube oil pressure shall be direct reading type mounted on the engine, backed up by electrical/mechanical gauges in the operator's cabin showing the absolute readings along with safe limits suitably colored. There shall be audio visual warning (safety mechanism) to the operators in case of any of these parameters exceeding the safe limit and engine will shut down automatically.

5.15 Suitable and rugged mechanism shall be provided to start the prime mover at no load and gradual loading after the start of the prime mover at no load/minimum load and gradual loading after the start of the prime mover. A fail-safe clutch mechanism, if required, may be provided to meet this requirement. The engine power take off shall be coupled to the main gear box through flexible/cardon shaft (propeller shaft). The engine shall be mounted on suitable Anti vibration mountings.

5.16 The engine shall have Electronic Control Module (ECM) or similar arrangement for taking out operating parameters on real time basis such as RPM, load, fuel consumption, temperature, pressure and diagnostic data as well as trip and historical data. These data

shall be displayed and stored on a panel/PC to be provided in operator's cabin. It shall also be possible to transfer these data on USB device.

5.17 The engine shall be enclosed in a weather protective, sound and dust resistant enclosure to minimize 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.

5.18 In order to adhere to pollution control norms, the diesel engine should be electronically controlled emmissionized engine with minimum compliance of tier 2 stage/UIC-II/BS-II standard.

5.19 The tenderer shall furnish the information regarding make and model of the engine proposed to be used and details of agency which will provide after sales service support and availability of spares in India, details of diesel engine and its controls to assess its conformity with the engines already operating on track machines on Indian Railways. If the machine design incorporates an engine, not already operating with the purchaser, the model of the engine is liable for change as per the technical requirements and the maintenance logistics with the purchaser after technical negotiations with the supplier. Nothing extra shall be payable on this account.

5.20 Indigenously available hydraulic oil and approved by OEM shall be used. Hydraulic tank of adequate capacity shall be provided at suitable location. Hydraulic hoses of proven make shall be used.

5.21 The exhaust pipe shall be horizontal and located under floor avoiding the position near footsteps to the RBMV.

5.22 Engine mounted alternator of adequate capacity with rectifier for the speed range between idle and maximum of engine speed shall be provided on each engine to supply 24 V DC for charging the battery provided for engine starting, controls and lightings.

6.0 TRANSMISSION:

6.1 The power shift transmission shall be hydrodynamic so that there is no wear and tear in field operation. The tenderer shall give the full technical data of the power transmission system.

6.2 The power pack and transmission equipment shall be mounted on the under frame so that whole assembly occupies as little space over floor as possible.

6.3 Transmission shall be either step less or minimum 3 steps bi-directional with maximum speed possible in both forward as well as in reverse direction.

6.4 The transmission shall provide smooth shifting at full power while shifting to higher or lower steps.

6.5 The cardan shaft shall be of robust design and well proven in performance capability, suitable for transmitting rated horsepower and maximum torque encountered during operation. The resultant angularity of cardan shaft shall be maintained within 5º.

6.6 The combined performance of the twin power equipment shall not be inferior to the tractive effort curve placed at Annexure–XIII. Supplier shall submit TE vs Speed curve superimposed with above curve with complete matching calculation of offered power equipment along with equipment lay out drawing.

6.7 Transmission shall have provision of secondary lubrication arrangement to provide protection to transmission from damage during towing in train formation.

7.0 COOLING SYSTEM:

7.1 Radiator of adequate capacity for cooling the water, lubricating oil and transmission oil, shall be provided. The cooling system shall be with excess capacity of 30% towards choking. The heat dissipating requirement of the transmission oil shall be heat equivalent of 30% of the maximum horsepower input to the transmission under most adverse site conditions.

7.2 The fan and the cooling arrangement shall be of adequate capacity to cope up with the service demands under the most severe temperature conditions. The maximum water temperature shall not normally exceed 85 ºC, the safe operating temperature of the engine. The system shall be adequately pressurized and vented to avoid all possibilities of cavitations. The complete technical details of the radiator and its fan shall be furnished.

7.3 The tenderer shall indicate the suitable location for mounting radiator and submit mounting details of radiator assembly, fan drive arrangement such that all equipments fit completely within the overall dimensions of RBMV.

8.0 BRAKES:

8.1 The self-propelled RBMV shall be provided with twin pipe graduated release compressed air brake system so that while attached in train formation as last vehicle, RBMV can be braked by the traction vehicle having air braking system.

8.2 The RBMV shall be fitted with compressed air brakes system which shall apply brake equally on all wheels which can be applied from driving cabins and provision shall be made to connect air brake system of the machine to that of coach/attached wagon when the RBMV is hauling it. Fail safe braking mechanism system shall be provided so that in case of any failure of brake, there shall be arrangement of automatic application of brake. The pneumatic parking brake shall also be spring loaded so that in case of drop in pneumatic pressure below certain value the brake will be automatically applied. The brakes shall be protected from ingress of water, grease, oil or other substances, which may have an adverse effect on them. The brake shoe lining shall be suitable for high ambient temperature of 55º C. The force required for operating the brake shall not exceed 10 kg at the handle while applying by hand and 20 kg on the pedal, when applied by foot.

8.3 The brake system/rigging shall be bogie mounted and shall be provided with non-asbestos composition ‘K’ type brake blocks.

8.4 The RBMV shall be provided with the following additional brake equipment:

I. Air dryer of approved make conforming to Spec. No. MP- 0.01.00.06(Rev-0.03), March '2007 should be provided.
II. Stand alone VCD of approved make conforming to Spec. No. MP-0.34.00.04 (Rev-04), Dec '2008 should be provided.
III. D-1 Emergency brake valve (Air brake) in each driving cab on the extreme right hand side.
IV. Standby brakes, in case of failure of distributor valve or any component in the brake system.
V. Mechanical brakes shall also be provided for parking.

8.5 Adequate safety straps shall be provided below the moving components of the brake rigging and other components to prevent falling on the track in the event of failure of any component. All the brake rigging pins/joints shall be provided with bulb type cotters.

8.6 RBMV shall be provided with engine mounted twin cylinder air compressors (one with each engine). The total FAD of compressor shall be 350 lpm at 8 kg/cm^2 at idle speed of the engine. The tenderer shall ensure the adequacy of offered compressor. Tenderer shall submit compressor capacity calculations in this regard. Cut-in and cut-out of compressors will be at 7 kg/cm^2 and 8 kg/cm^2 pressure respectively.

8.7 The supplier shall submit details of brake system covering brake schematic diagram, working principle, brake power diagram, number, dimension & type of brake block and literature on brake equipments proposed along with offer.

8.8 There shall be provision of emergency brake application using the compressed air in the machine, either travelling alone or coupled with the camp coach or loaded wagon, in addition to the normal braking system of the machine. The emergency braking distance (EBD) of the machine (fully loaded i.e. 20.32x4=81.28 t) on the Indian Railways track from the maximum designed speed to zero on a level track shall not be more than 600 m. In this regard necessary design calculations for the braking effort and EBD at the maximum design speed of the machine on level track & at falling grade of 1 in 33 shall be provided by the supplier. Brake design details of the RBMV for calculation of EBD are to be submitted as per Annexure- V.

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

8.10 The braking system shall be designed so as to meet the air reserve requirement for repeated braking as required in normal operation. In addition, the machine shall be equipped with suitable air brake system in the driving cabins so that the coach while being hauled by the machine can be braked.

9.0 HORN, HOOTER AND SAFETY SWITCHES:

9.1 The RBMV shall be provided with dual tone (low tone & high tone) electric/pneumatic horns facing outwards at each end of the RBMV at suitable locations for use during travelling to warn the workmen of any impending danger. 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 m 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. Minimum two nos. safety stop/switches in front on both side and two nos. in rear on both side-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 signaling cable, joggle fish plate etc. during working, the working can be stopped immediately.

9.2 In addition, separate electric horns with push button type switches shall be provided at suitable locations in all cabins(s) and on machine body for communication between the machine staff and operator about infringement/malfunctioning or any other trouble.

9.3 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. Additional 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 by remote switch at a distance of at least 300 m from the hooter.

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

10.0 HOOKS AND BUFFERS:

10.1 The RBMV shall be fitted with transition coupling as per RDSO specification no. RDSO/2009/CG-22 with latest revision along with side buffers to RDSO drawing no. RDSO/SK-98145 with latest alteration on both ends for coupling it with trailing wagons, coach & locomotives while running in train formation as last vehicle. As per Indian Railways schedule of dimensions, the maximum and minimum height of the buffer centre from rail level is 1105 mm and 1030 mm respectively.

11.0 HEAD LIGHT, FLASHER LIGHT, MARKER LIGHT AND OTHER LIGHTING ARRANGEMENTS:

11.1 The electrical equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The RBMV shall be equipped with twin beam headlight assembly, conforming to RDSO's specification no. RDSO/2017/EL/SPEC/0134 (Rev-0) with the latest amendments ensuring a light intensity of 3.2 lux at ground level at track centre at a distance of 305 m away on a clear dark night, at each end and with two front and rear parking lights, which can be switched to red or white according to the direction of the travel. Powerful swiveling floodlights shall also be provided to illuminate the working area sufficiently bright for efficient working during night. In addition minimum eight power point locations (24 volt 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. Specification for DC-DC converter for electric loco/diesel electric loco no. is ELRS/SPEC/DC-DC converter/0021, (rev-1, Sept'2004 or latest). Preferably electric power of 24 V shall be used for operation of any electrical circuit.

11.2 The amber colour LED based flasher lights producing not less than 500 lux at 1 m and 55 lux at 3 m in line measurement in axial direction from flasher light to RDSO Spec No. ELRS/SPEC/LFL/0017 (Rev-1) of Sept-2004 or latest shall be provided at both ends in the machine to give indication to the train arriving on other line about any impending danger.

11.3 The Machine shall be provided with marker light to RDSO specification no. is ELRS/SPEC/PR/0022, (Rev-1) October'2004 or latest.

11.4 Reputed make fans 24 V DC operated shall be mounted in all cabins at suitable locations. Each fan shall be controlled by its own switch. The fan base shall be insulated from the coach body and the coach wiring shall be terminated to 2-way connectors supplied with the fan and fixed on the ceiling.

12.0 CHASSIS & UNDER FRAME:

12.1 The chassis shall be fabricated from standard welded steel sections and of steel sheets, so as to permit transportation of the RBMV in train formation as the last vehicle, without endangering safety of the train. The under frame shall be constructed with rolled steel section and/or plates shall be designed to withstand a horizontal squeeze load of 102 t at CBC rear stops or 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.

12.2 There shall be provision of properly exhibited/conspicuous jacking and lifting points on the machine under-frame for helping in quick handling of machine in case of derailment/accident as well as during maintenance at workshop. The jacking and lifting points shall be obstruction free and easily accessible, so that jacks can be fitted/placed conveniently.

13.0 CABINS:

13.1 The RBMV shall have both ends with driver's compartment. The RBMV shall be equipped with fully enclosed cabins with safety glass window. In view of the high ambient temperature prevailing in India, special attention should be paid to free circulation of air and ventilation in the driver's cabin. It shall be possible to have a clear view of the track ahead while driving the RBMV in either direction. The design of drivers cab shall be as per UIC-651. Visibility diagram should be submitted along with the design details.

13.2 Entry & exit door to RBMV's cabin shall open on the loading platform area so that the same operator can work easily in the cabin and on crane of RBMV both and he exits RBMV with good view of adjacent tracks.

13.3 The gauges, instruments and control panels shall be suitably located in the operator's cabin so that they can be observed without undue fatigue to the operator. Wind screen

wiper arm and blade assembly to be provided as per RDSO Spec. No. C - K 306 with latest revision.

13.4 The driver's seat shall be of the folding and swivelling type to permit the driver to manipulate the controls either while sitting or standing. The seat frame or swivelling arrangement shall be robust design, easy to operate and hold in any desired position. The driver's seat cushioning shall be as per RDSO specification no. C - K607 with latest revision properly vented and upholstered with covering to RDSO specification no. RDSO/2008/CG-07 (Latest).

13.5 Sitting space in each of the driving cabs for 4 persons in addition to the driver. For this purpose a foldable cushion seat shall be provided.

13.6 Suitable number of fire extinguisher (dry chemical type) shall be provided in the cabins. The chemicals used for extinguishing fire by such fire extinguishers shall not chemically react with electronic equipment/components, PCBs, cables etc.

13.7 Proper design layout, protective device and prevention measures for outbreak of fire shall be ensured. For fire prevention "Code of Practice for Prevention of Fires on DMUs" conforming to document no. CMI-K 402(Rev-1) with latest amendments shall be suitably followed as guidelines.

13.8 The machine shall be equipped with speed indicator and recording equipment of range between 0–120 kmph for recording the speed of the machine in real time basis. The equipment shall conform to RDSO specification no. MP-0-0.3700-07, Rev-04, Aug'17 or latest. The recorded data shall be retrievable on computer through memory card/pen drive. It shall 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.

13.9 Control panel with operator's seat shall be provided at a suitable place near the crane for its operation. The equipment and controls shall be arranged near operator's seat to facilitate easy access for operation of the crane. Care shall be taken to protect the controls from environmental hazards.

13.10 The floor of RBMV in driver's cab and staff cabins shall consist of 2 mm thick PVC sheet to RDSO STR No. RDSO/2006/CG-12 (Latest) with 12 mm Compreg sheet to RDSO STR No.C-9407 (Latest) as padding below the PVC flooring sheet. At other places steel galvanized Chequered plates of 6 mm thick shall be provided to IS: 2062.

13.11 Cattle guard of suitable design to ICF drg. no. DMU/DPC3-2-6-301 shall be provided at the driving ends of RBMV.

14.0 SUSPENSION SYSTEM

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

15.0 TOOLS AND INSTRUCTIONS MANUALS:

15.1 Each RBMV shall be supplied with a complete kit of tools required by the operator in emergency and for normal working of the RBMV. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire RBMV including specialized 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, 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/manuals. The list can be modified to suit the purchaser's requirement, while examining the offer.

15.2 Detailed operating manual, maintenance & service manuals and user manual indicating capabilities of machine shall be specifically prepared in English language and four hard as well as soft copies of these shall be supplied with each RBMV.

15.3 As a part of service manual, the manufacturer shall also supply circuit diagram in hard and soft copies of electrical, hydraulic, pneumatic electronic circuits used on the RBMV. Trouble shooting diagram/table shall also be supplied. In additions, the manufacturer shall provide dimensional drawings with material description of items like rubber seals, washers, springs, bushes, metallic pins etc. and main features such as type; discharge etc of items like hydraulic pumps, motors and such other bought out components/assemblies shall be furnished by the tenderer. These shall be specially prepared in English language and four copies of these shall be supplied with each RBMV.

15.4 The supplier/manufacturer shall provide detailed technical drawings and specifications of wheels and axles used in the machine (RBMV).The above details shall be provided in four sets with each machine (RBMV).

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

15.6 One set of all the manuals and diagrams in hard as well as in soft copy (one set for a group of similar machines) shall be sent to the principal/IRTMTC, Allahabad, one set to be sent to ED/TMM Directorate, RDSO, Lucknow, one set to DTK (MC)/Railway Board and one set to Director/IRICEN/Pune along with supply of first machine of similar group. In case, there is any subsequent amendment in above documents based on field performance, the amendment/amended documents should also be sent to above mentioned authorities.

15.7 A draft copy of all documents to be supplied with the machine shall 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 shall be carried out and compliance shall be reported to RDSO as well as the Inspecting officer of the first machine.

15.8 One portable diesel operated D.C. welding generator (with the provision of auxiliary output of minimum 2.5 KW, 230 V AC for lighting) of reputed make (preferably made in India) with a minimum 7.5 KVA capacity capable of welding up to 5 mm (dia) electrode at 60% duty cycle shall be supplied. Sufficient length of cable or lead shall be provided with the machine of welding plant for day to day repairing work of the machine and its wearing parts. The diesel tank capacity shall be not less than 15 liters.

16.0 SPARE PARTS

16.1 The expected life of the components/spare parts shall be advised along with their condemning limits. The RBMV shall be supplied with necessary spare parts for the operation and maintenance of the RBMV for a period of two years. The spare parts required shall be detailed in a separate list indicating description, part number, quantity and whether imported or indigenous.

16.2 The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service the life of the RBMV (25 years). It is preferred that the spares shall be stored in India and will be available at short notice say maximum within a month.

16.3 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 RBMV for inspection.

16.4 Grease nipples shall conform to IS specification No. 4009. All the grease nipples & adapters, wherever used, shall be tack welded to prevent them from unscrewing and falling off in service.

17.0 OPTIONAL EQUIPMENT

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

18.0 MAKER'S TEST CERTIFICATE:

18.1 Copies of the Maker's certificate guaranteeing the performance of the RBMV shall be supplied in duplicate along with the delivery of each RBMV.

19.0 OPERATORS:

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

20.0 INSPECTION OF THE MACHINE

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

20.2 Following arrangements shall be made by the supplier/manufacturer at the inspection premises for carrying out inspection of the RBMV by inspecting officials:

- RBMV to be stabled on straight & level BG track. The length of the track shall be at least 10 m more than buffer to buffer length of RBMV.
- In order to check maximum moving dimensions in cross section, a sturdy frame of Indian Railways max moving dimensions shall be provided by the manufacturer and passed over the RBMV holding it perpendicular to track, centre aligned with track centre. Adequate arrangements shall be made to the satisfaction of inspecting official.

20.3 The following documents shall be provided to the Inspecting Officer at least 30 days in advance of the date of inspection.

i) One copy of complete technical literature mentioned in clause 15, in English language, including operation, service and field maintenance manuals/instructions and complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/ description and other relevant technical details as a reference documents for the inspecting officer.

ii) Cross section of the machine super imposed on Indian Railways maximum moving dimensions envelope shall be provided to inspecting officer (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:

Clause no.	Clause	Comments of Supplier/manufacturer	Comments of Inspecting Officer

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 shall be provided to IO, containing serial number wherever applicable.

vi) Draft inspection report shall be prepared by the manufacturer, containing all annexure mentioned at para 20.4.

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 (IO) keeping in view the Inspecting Officer's comments, if any.

20.4 List of documents to be annexed in the draft inspection report shall 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 Indian Railways maximum moving dimensions (IR MMD).
v. Vogel's diagram.
vi. List of spare parts to be dispatched along with the RBMV.
vii. List of tools to be dispatched along with the RBMV.
viii. List of manuals, drawings, spare parts catalogues, etc. to be dispatched along with the RBMV, duly indicating the number of sets of each.
ix. Manufacturere's certificate on standard followed for design of wheels and axles against clause 2.9 to 2.11.

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

21.0 TRAINING & SERVICE ENGINEERS:

21.1 The contractor shall provide at his own expense the service of competent engineers during the warrantee period for warrantee related issues. The service engineers shall be available for the commissioning of the RBMV for regular service. E-Learning Courses shall be arranged for imparting training to Railways operators. In addition the service engineer shall provide hands on training to Railways staff in calibration, operation, repairing and maintenance of the RBMV in field to make them fully conversant with the RBMV. 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 vehicle.

22.0 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 of Indian Railways based at Lucknow, based on certain design parameters of the vehicle. Final speed certificate of the vehicle shall be after conducting detailed oscillation trial of the vehicle, which shall be 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 Railways track is taken from Commissioner of Railways 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 frame 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 clause (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-(VII & VIII) 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-VII & VIII) can also be asked for issue of provisional speed certificate for the machine. The firm will also submit the technical details as per pro-forma placed at Annexure-II for NUCARS or similar track vehicle dynamic simulation. The supplier shall submit the NUCARS or similar track vehicle simulation report. The simulation charge shall be borne by supplier, if the simulation will be done by Indian Railways.

c. New suppliers, whose models are new:

The technical details shall be supplied as detailed in para (b) above.

22.2 **FINAL SPEED CERTIFICATE:**

Final speed certificate of the machine shall be given after conducting detailed oscillation trials of the machine. For this purpose Railways shall conduct running speed tests on the Indian Railways main line track on one of the machines supplied to them preferably with in warranty, in accordance with procedure outlined in Annexure- IX with the machine running up to speed 10% higher than the maximum speed mentioned in clause 2.15 above.

23.0 ACCEPTANCE TEST:

23.1 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 commissioning of the RBMV. 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.

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

23.1.2 Performance of crane as per para 4.0.

23.1.3 Testing for negotiability on 1 in 8 ½ turnouts.

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

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

25.0 WARRANTY:

The RBMV shall be warranted for 2000 effective working hours or 24 months from the date of commissioning and proving test of machine at ultimate destination in India whichever shall be earlier. Effective working hours for this purpose will be traffic block time during which RBMV is deployed for work.

Should any design modification be made in any part of the machine offered, the warranty period of 24 months would commence from the date of commissioning and proving test of the RBMV 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 shall be borne by the supplier.

26.0 MARKING & COLOUR OF MACHINE :

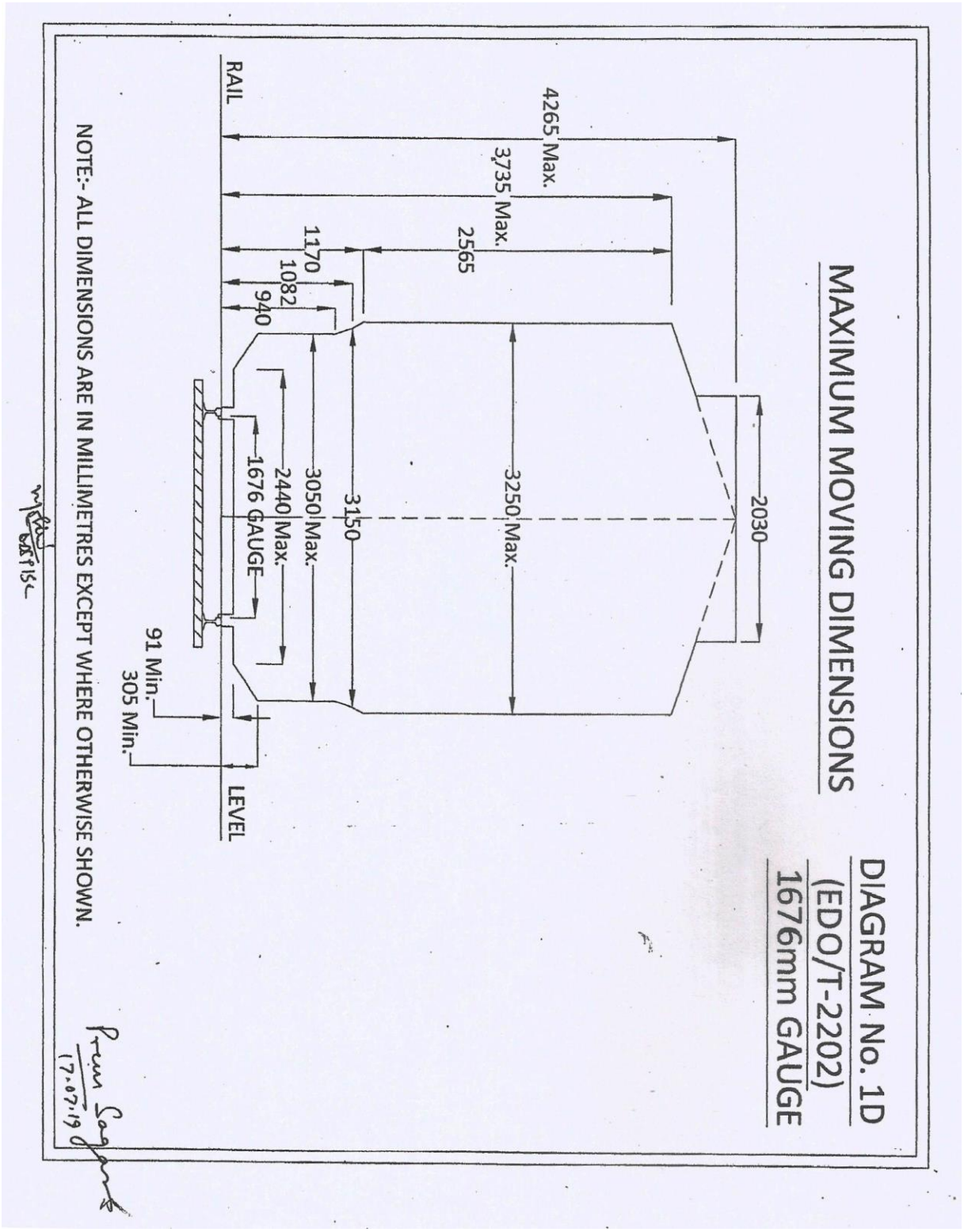
26.1 The machine body shall be painted in golden yellow colour of Indian Standard Colour code of 356 as per IS:5. The exterior painting shall be polyurethane binder based conforming to RDSO Specification No. M&C/PCN/100/2013 (Specification for epoxy cum polyurethane painting system –two packs for the exterior painting of railway coaches, diesel and electric locomotives and other industrial applications) or ISO 12944.

26.2 Following should be written on the machine at appropriate location

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 manufacturer’s logo may be provided at not more than two locations and should be of size less than 200 mm.

****

Annexure-I


MAXIMUM MOVING DIMENSIONS
DIAGRAM No. 1D
(EDO/T-2202)
1676mm GAUGE
RAIL
4265 Max.
3735 Max.
2565
1170
1082
940
2030
3250 Max.
3150
3050 Max.
2440 Max.
1676 GAUGE
91 Min.
305 Min.
LEVEL
NOTE:- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHERWISE SHOWN.

Annexure-II

Machine details required for simulation of machine on NUCARS or similar Track-vehicle simulation software

S. No.	Component's Name	Parameters required						
		C.G. of component in x, y, z direction from rail level in mm (reference point 1st axle)			Mass in kg and mass moment of inertias in kg. m^2 of component in three dimension space about their C.G.			
		X	Y	Z	Mass	Ixx	Iyy	Izz
1.	Super structure with vehicle frame (Machine structure kept on secondary suspension of front and rear bogie)							
2.	Front Bogie frame including brake rigging							
3.	Rear Bogie frame including brake rigging							
4.	Transmission system device (hydraulic. Mechanical or electrical traction motors							
5.	Wheel axle set including axle boxes which constitute the unsprung mass							
6.	Mass of Items included in unsprung mass partially or fully along with their name per axle	1	2	3		4		Total unsprung mass in tonnes
7.	Total weight of components in tonnes	Front bogie full assembly		Rear bogie full assembly		Machine frame full structure		Full weight of vehicle (All bogies + vehicle car body or super structure)

8.	Suspension stiffness details in kg/mm	Primary suspension element stiffness per axle box between bogie and axle box			Secondary suspension element stiffness per side between bogie and machine frame		
		Vertical stiff	Lateral stiff	Longitudinal stiff	Vertical stiff	Lateral stiff	Longitudinal stiff
9.	Damping force details (If hydraulic damper used give there rating force per meter/second)						
10.	Clearance in mm or radian provided for motion between bogie frame and machine frame for relative motion (motion stopper)	Vertical direction	Lateral direction	Longitudinal direction	Rotation about vertical axis	Rotation about Lateral axis	Rotation about Longitudinal axis
11.	Detail of location of suspension elements	Detail of location of suspension springs and dampers and shock absorbers with support drawing			Detail of location of suspension springs and dampers and shock absorbers with support drawing		
12.	Details of centre pivot arrangement working and location	Provide detail arrangement drawing and description					
13.	Set of drawings and design description	Concerning with general arrangement of vehicle, bogie general arrangement, suspension arrangement details, suspension clearances drawing, detail written description of configuration and loading pattern accompanies design particular of vehicle bogie.					

Annexure-III

Annexure-IVA

Sizes and Weight of Some of the P-way Materials and Small Track Machines to be Normally Loaded on RBMV platform

Sl. No.	Description	Length (mm)	Width (mm)	Height (mm)	Weight (kg.) (approx.)
1.	Normal Concrete Sleeper	2750	150	220	300
2.	Wider Concrete Sleeper	2750	285	235	350
3.	Wooden Sleeper	2750	250	130	100
4.	Steel Trough Sleeper	2680	257	106	79
5.	60 kg Rail (2 nos.)	6500	150	172	785
6.	52 kg Rail	6500	136	156	676
7.	60 kg 1 in 12 CMS crossing	4350	521	172	980
8.	60 kg 1 in 16 CMS crossing	5400	496	172	
9.	Abrasive rail Cutter	1070	420	950	30
10.	Rail Drilling Machine	1030	450	570	60
11	Rail Tensor	1700	400	300	700

Annexure-IV B

Sizes and Weight of Some of the P-way Materials to be loaded on Attached Flat Wagon

Sl. No.	Description	Approx. Length (mm)	Weight of half set (switches) including all fittings (kg) (approx.)
1.	Over Riding Switch (curved) 52 Kg (1 in 12)	Tounge-12356 Stock-13000	2410
2.	Over Riding Switch (curved) 60 Kg (1 in 12)	Tounge -12356 Stock- 13000	2700
3.	Over Riding Switch (curved) 60 Kg (1 in16)	Tounge -12935 Stock- 13000	2800
4.	Rail Length 60 kg	13000	780
5.	Rail Length 52 kg	13000	676

Annexure-V

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

Tare & gross weight of the machine in Kilograms
Brake power in Kilograms
Type of Brake blocks
Brake block area in Square Centimeters
Brake Rigging Diagram
Type of Brake system

Annexure-VI

INSPECTION CERTIFICATE

CERTIFICATE OF INSPECTION OF RBMV (MODEL No.....)
BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF RBMV. (STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that I have inspected the RBMV_____bearing Sr.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 (MC) /Railway Board and M/s. (Name of Supplier) _____ _____.

The detailed inspection note regarding its conformity/non-conformity to the laid specifications is enclosed along with this certificate. It is observed that (strike out whichever is not applicable):-

- The RBMV conforms to all the laid down specifications.
- The RBMV 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 machine:

1. _____
2. _____
3. _____

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

The RBMV is approved/not approved for dispatch to _____ _____(Consignee) Indian Railways.

SIGNATURE AND DATE
INSPECTING OFFICIAL
(NAME AND DESIGNATION)
For and on Behalf of President of India

For M/s._____
_____

Annexure –VII

Particulars Required in Respect of the Rolling Stock under Consideration

1. A diagram showing elevation salient dimensions :

   a) Wheel spacing, Wheel diameter, bogie centres, and axle load.

      I. Overall length of the vehicle :
      II. Length over head stock :
      III. Length over buffers :
      IV. Distance apart for center 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 Railways 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 clc circuit in specified sections under defined conditions. :
5. Maximum design speed :
   I. Own Power :
   II. In train formation

6. Unsprung weight per axle in tonnes
   I. Driving axle :
   II. Running axle :

7. Expected lateral force in tonnes per axle At maximum design speed. :

8. Increase in the impact load during motion(Dynamic Augment) :

9. Method of operation -
   Whether single only or coupling together is possible. If coupling is possible, the number which can be coupled and what is trailing load. :

10. Maximum tractive effort per axle in tonnes -

11. Maximum braking force coming on to the rails per wheel
    at working axle :
    at transfer axle :

12. Drawing indicating suspension arrangement details of bogie and axle. :

13. Height of centre of gravity from rail level. :

14. Height of floor from rail level. :

15. Type of coupler provided -Indian Railways Standard
    I. Coupling :
    II. Buffer :

16. Any infringement to the moving dimensions :
    (Sketch provided in the Indian Railways Standard Schedule of Dimensions – Chapter IV (A)).

Annexure – VIII

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

Name of the machine _____ Model_____

Sr.No.	Item
1.	a) Brake System details
	b) Gross Braking Ratio
2.	Brake 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/worn wheel flange/rail and other locations for the negotiability of the vehicle on curve and turn out (enclose Vogel's 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-IX

ACCEPTANCE CRITERIA DURING OSCILLATION TRIALS

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

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

   I. A lateral force lasting over a length more than 2 metres should not exceed the Prud-Homme's limit of K (1 + P/3) tonnes. Where P is the axle load in tonnes, K=0.85 for wooden sleepers and K= 1 for concrete sleepers.
   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 g both in vertical and lateral directions. The peak values up to 0.60 g may be permitted if the records do not indicate a resonant tendency in the region of peak value.
   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.

Annexure-X/A

List of Equipment & Tools to be kept on RBMV

S.No.	Description of items to be kept on RBMV	Length (cm)	Width (cm)	Height (cm)	Qty.	Unit Weight (Kg)	Total weight (Kg)
1.	Walkie Talkie (04 sets in a box)	20	10	10	4 sets	01	04
2.	Portable field telephone	15	15	15	1	04	04
3.	Disc cutter	107	42	95	1	30	30
4.	Rail cutting machine	110	50	60	1	65	65
5.	Rail drilling machine	103	45	57	1	60	60
6.	Chamfering kit (Torque wrench, chamfering unit, box wrench etc. in a box).	130	20	20	1	12	12
7.	Rail welding equipment with hydraulic (mechanical tensor)	450	60	80	2 set	785(635)	1570 (1270)
8.	Weld Trimmer Power-Pack Trimmer-	117 120	37 62	55 28	1	150	150
9.	Rail profile grinder K-oil operated (electrical operated)	102	46	35	1	80 (30)	80 (30)
10.	4 no. off-track hand-held tamper with 2 generators Generator Set – Tools (brief case) -	80 62	45 41	70 14	1 set	180	180
11.	Lifting jack-Hydraulic (mechanical)	30	16	25	4	21 (11)	84 (44)
12.	Lifting cum slewing device- TRALIS	70	80	60	2	60	120
13.	De-stressing items (complete set for de-stressing 3 km LWR)						
13.1	Rail Tensors- Hydraulic (mechanical)	170	40	30	2 sets	350(200)	700(400)
13.2	600 rollers, (one roller @ 10 m) (in a box) (for 3 km)- (for 1 km)-	110 (110)	30 (30)	312 (104)	1 set	1500	1500
13.3	30 wooden mallets	92	28	15			
14.	PWI Inspection kit including vernier, micrometer, rail thermometer, etc, having 26 items	50	10	38	1	10	10
15.	Gauge-cum-level	185	8	7	1	3.5	3.5
16.	Rail dolly	323	80	94	6	80	480
17	Rail (mono) cum road trolley	65	40	30	2	18	36

18.	Warning system consisting of				1 set	2	2
18.1	Red banner flag				2	-	-
18.2	Red hand signal lamp	30	25	25	1	-	-
18.3	Green hand signal flag				1	-	-
18.4	Detonator (In a Box)				10	-	-
18.5	Remote control hooter	25	12	25	1	12	12
19.	Gas cutting equipment with accessories				1	5	5
A.	Weight of equipment excluding de-stressing material as mentioned in item no.13						2908(2505)
B	Weight of equipment excluding off-track tamper materials as mentioned item no.10, 11 & 12						4712 (4062)
C	Additional weight of equipment T&P, manpower normally to be loaded on the RBMV						2081
D	Design Weight (A+C)						(4989)-5t

Note:

i) During de-stressing, fastening will also be required for casual/ through renewal. The same will be transported separately.

ii) The Gang tools like crow bars, hammer, beaters, rail tongues etc. required for de-stressing work will be transported separately.

iii) It is assumed that during de-stressing work, the item listed at sl.no.10, 11 & 12 shall not be used. Also T&P required for 1.0 km of de-stressing shall only be taken to site.

iv) It is assumed that de-stressing work is not required for the whole year. As such the items listed at sl.no.13.1 and 13.2 shall not be required to be taken to site all the time. With 5 t design payload capacity, and minor adjustment of T&P, machines etc, required for specific site, it will be possible to take care of most of the situation for which the RBMV shall be use.

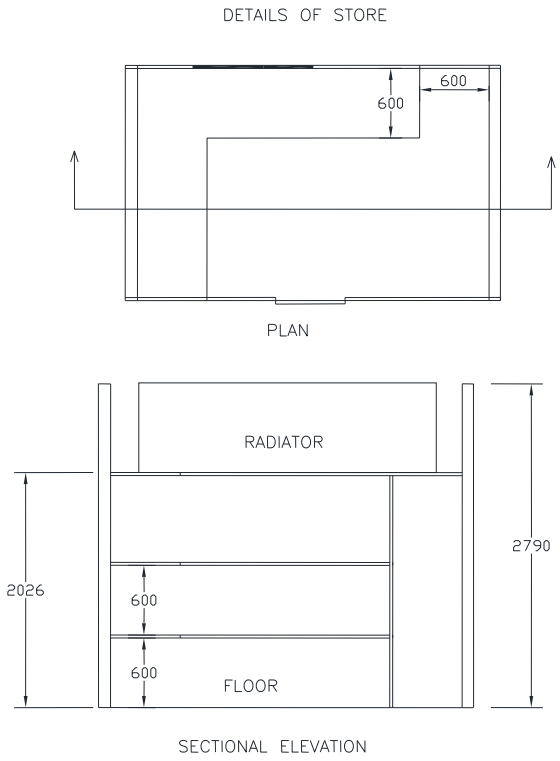
Annexure-X/B

ADDITIONAL LIST OF EQUIPMENT, TOOLS & MANPOWER NORMALLY REQUIRED FOR MMU-1 ALONG WITH THEIR WEIGHT TO BE LOADED ON RAIL BORNE MAINTENANCE VEHICLE (RBMV)

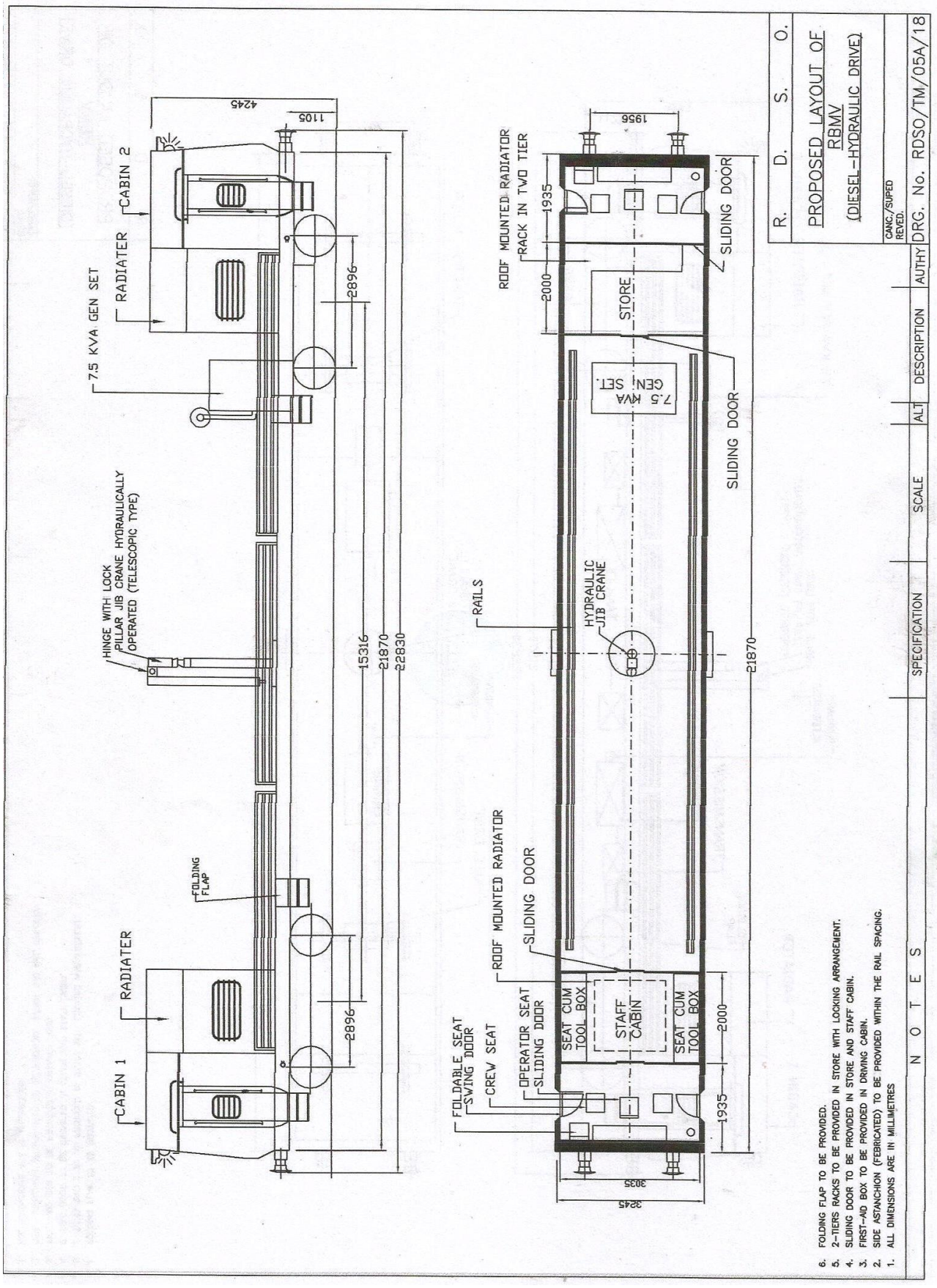
S. No.	Description of items to be kept on RBMV	Length (cm)	Width (cm)	Height (cm)	Qty.	Unit Weight (Kg)	Total weight (Kg)
1.0	Manpower				15	65	975
2.0	First-Aid Box	25	15	20	1	3	3
3.0	60 kg rails of 6.5m length/Glued joints	650	16	18	2	390	780
4.0	Gang tools						
4.1	Crow bar				2	35	70
4.2	Rail tongs				2	10	20
4.3	Beater				2	5	10
4.4	Hand Claw				2	1	2
5.0	Fastening						
5.1	ERC, Steel/GFN liners, rubber pads				5 each	1.4	7
5.2	SEJ bolt				1	1	1
5.3	130 mm size bolts	30	30	20	4	1	4
5.4	Stretcher bar bolt				1	5	5
5.5	Wooden block + clamps	30	25	20	2+2	15	60
5.6	Joggle fish-plate (One 60 kg + one 52 kg)	64	4	12	1+1	32	64
5.7	One meter long fish-plate (One 60 kg + one 52 kg)	100	4	12	1+1	40	80
6						Grand Total	2081

Annexure-XI

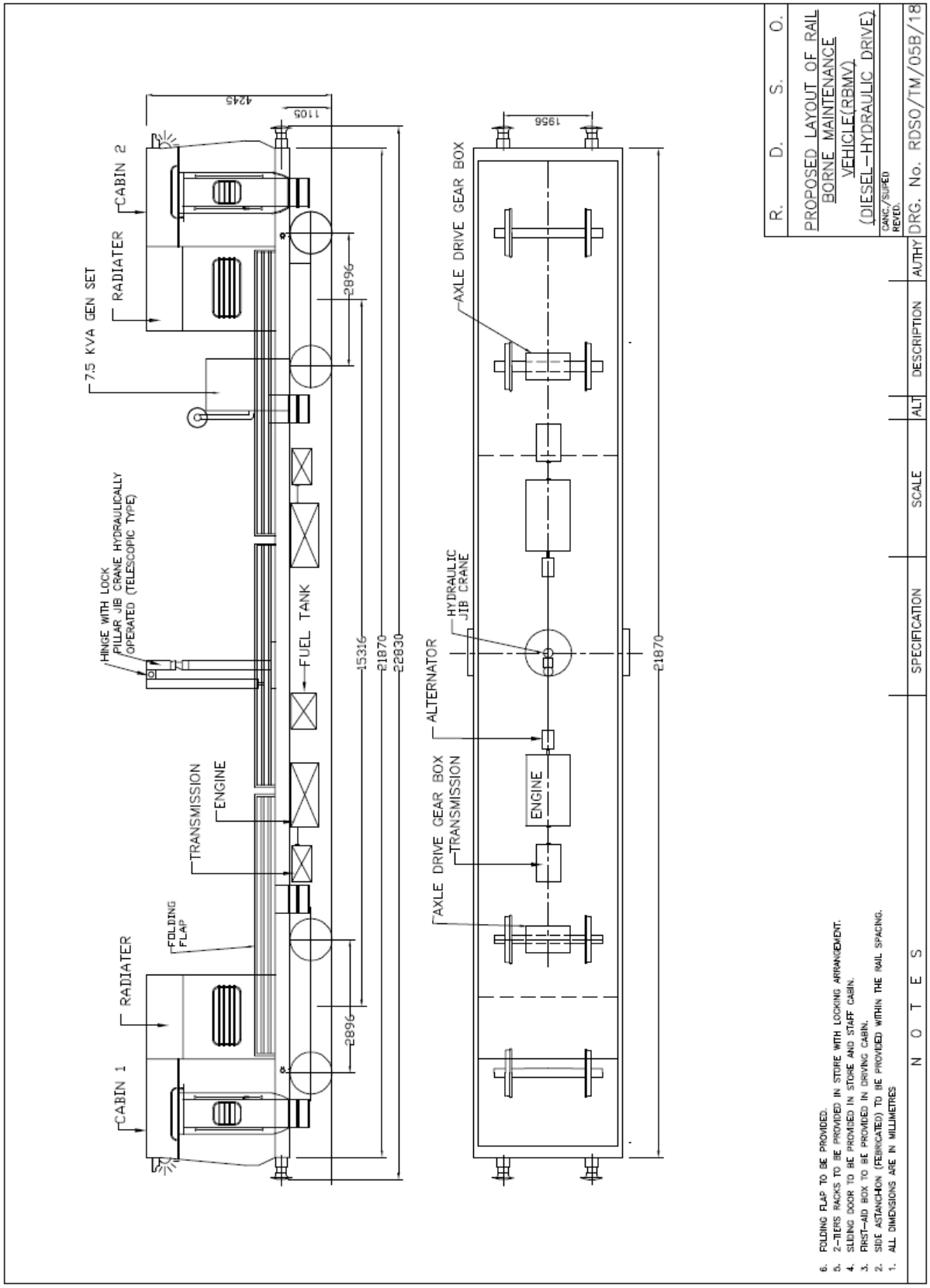
Tentative Layout of Store Rake



Annexure-XII/A



Annexure-XII/B



Annexure-XIII

TRACTIVE EFFORT Vs SPEED CURVE FOR RAIL BORNE MAINTENANCE VEHICLE (RBMV)