



Government of India

**भारत सरकार
रेल मंत्रालय**

**Technical Specification
For
Hot Axle box Hot Wheel Detector System**

**Specification No. RDSO-SPN-RE-HAHW-2017(Rev.2)
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(Draft)**

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ABBREVIATIONS

AC	Alternating Current	IRPWM	Indian Railways Permanent Way Manual
CAMC	Comprehensive Annual Maintenance Contract	NABL	National Accreditation Board for Testing and Calibration Laboratories
HAHW	Hot Axle box Hot Wheel	RFID	Radio Frequency Identification
ICD	Interface control document	TCP/IP	Transmission Control Protocol/Internet Protocol
IR	Indian Railway	UPS	Uninterruptible power supply

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1.0 Introduction: -

Hot Axle box Hot Wheel Detector (HAHW) is an automated wayside detection system for detecting hot axle boxes & locked wheels by monitoring temperature of the axle box bearings, wheel rim/discs and brake discs. The purpose of this specification is to spell out the functional and technical requirements of a HAHW system.

2.0 Technical Requirements: -

2.1 HAHW system should be compatible with various types of axle box bearings and brake systems deployed on the rolling stock being used on IR.

2.2 Temperature measurement range and tolerance requirements:

S.N	Parameter	Measurement Range	Resolution	Accuracy
1.	Axle box temperature	0 - 150 °C (Minimum)	± 2 °C or better	± 2 °C or better
2.	Wheel & brake disc temperature	0 - 650 °C (Minimum)	± 5 °C or better	± 10 °C or better

2.3 It should conform to following technical/operational requirements.

S.N	Technical/Operational parameters	Requirements
1.	Scanner response time	upto 2 ms (millisecond)
2.	Operating speed	0 - 200 Kmph
3.	Train length	upto 1000 Axles
4.	Train headway	3 minutes between trains having upto 1200 axles each.
5.	Degree of protection for electronics	IP 66
6.	Degree of protection for optics	IP 54
7.	Wheel detector (trigger) sensors	IP 67
8.	Ambient temperature range	0° to 70°C
9.	Relative humidity	upto 100%

2.4 The system should have multi-beam scanners per site as detailed below mounted suitably on a specially designed sleeper or structure to cover a wide range of wheelset designs.

No. of Scanners	Position	Purpose
02 (Each with 8 beams)	Outside rail guage (Placed on both sides)	To scan axle bearings temperature.
02 (Each with 4 beams)	Inside rail guage	To scan wheels & brake discs temperature. (The orientation/direction of beams shall be user adjustable/configurable. The target area focus of the beams shall be decided by consignee at the time of commissioning of the system).

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- 2.5 Necessary sensor mounting arrangement that can be easily disassembled / reassembled shall be provided by the firm. The drawings of mounting arrangement of sensors to be submitted along with the offer.
- 2.6 In case, disc brakes are not fitted on the rolling stock, then sensors designed for measurement of temperature of disc brakes will remain in idle/off condition.
- 2.7 Each 8-beam axle box scanner should be able to measure thermal radiation emitted from target zone of rolling stock, which have a minimum target area length of 100 mm as specified in EN 15437-1:2009.
- 2.8 The bearing scan zone should cover Inboard Seal region, Inboard Raceway region, Spacer Ring region and Outboard Raceway region.
- 2.9 The scanner/sensor should be capable of measuring radiations in the wavelength ranging between Long Wavelength Infrared (8 – 14 microns) or Medium Wavelength Infrared (3 – 5 microns) or any combination of such sensors to achieve parameters as in para 2.2.
- 2.10 It should function in either direction of movement of train.
- 2.11 Auto calibration functionality should be inbuilt into the system, details of which shall be submitted along-with the offer.
- 2.12 Time between passing of the train and communication to the central control server should not exceed 5 minutes.
- 2.13 The system should be capable of automatic detection of approaching train along-with identification of type of rolling stock (Locomotives, Wagons, ICF or LHB Coach, BV, etc), automatic switching-on of relevant sensors, automatic measurement of temperatures while the train is in motion, automatic transmission of data, alarms and reports and automatic switching off of relevant sensors to conserve electrical power.
- 2.14 The bidder should refer typical track profile – As per IRPWM 2004 amended from time to time. The bidder shall acquaint himself with the existing track geometry, installation etc. before offering the system.
- 2.15 The relevant National/International standards are given below. The equipment should conform to the relevant clauses of the applicable standards.

S.N	Norms & regulations	Application areas
1.	EN 15437-1:2009	Axle box condition monitoring – Interface and design requirements.
2.	EN 50121- 4	Railway applications – Electromagnetic compatibility – Part 4: Emission and immunity of the signalling and telecommunications apparatus.
3.	EN 50125- 3	Railway applications – Environmental conditions for equipment – Part 3: Equipment for signalling and telecommunications.
4.	EN 60950- 1	General safety requirement for the information technology equipment.
5.	ISO 14837-1	General guidance on mechanical vibration for ground-borne noise and vibration arising from rail systems.

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6.	EN 61000-4-9:1993/A1:2001	Electromagnetic compatibility (EMC) - Part 4-9: Testing and measurement techniques - Pulse magnetic field immunity test
7.	EN 50128	Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems
8.	2006/95/EC	Electrical equipment designed for use within certain voltage limits

In addition to above, the system should also comply with any other national/international standard which is relevant to the technology for similar application in the railway domain.

- 2.16 The system should be modular and remotely maintainable.
- 2.17 The system should be equipped with robust, networked, alert-management software with full suite of graphical analysis and diagnostic tools. Full TCP/IP support should be inbuilt into the system to facilitate smooth integration into all existing railway data networks.
- 2.18 The system should be able to withstand shock and vibration generated produced during train operation.
- 2.19 The system should have provision for interfacing with RFID based automatic vehicle identification module.
- 2.20 The system should have capability to integrate with 3rd party system for which Interface control document (ICD) will be provided by Indian railways. Firm will supply the ICD for the HAHW System to the Indian railways.

3.0 Functional requirements: -

- 3.1 Train parameters to be acquired: - Temperature of axle boxes, wheels rim and brake disc and speed of a wheel set of identified stock.
- 3.2 System shall log the date of train passing, time of train passing, speed of train, number of axles passed, total number of vehicles in the rake and type of stock.

4.0 Scope of supply: -

The HAHW system shall be supplied on turnkey basis. The HAHW system shall include all equipment by the side of the track, electric cables, server computer, website, client computer/laptop, modem, SMS delivery system, software of the track-side equipment and software of the central server and any other element necessary for optimal functioning of the system. The scope shall include complete HAHW site equipment along-with concomitant accessories, maintenance toolkit etc. for fully functioning of system.

- 4.1 **Installation at site:** - Installation of the system should be done by and under the supervision/direction of firm's Engineers. It shall include the following: -
- 4.1.1 Provision of cabin/enclosure to house accessories/ auxiliaries (to be installed at site along with the supplied system) will be under the scope of supply of supplier.
- 4.1.2 Laying of power cables including trenching & associated works from the site to the main power distribution box where the consignee has made the availability of electrical power of 230 V, 50 \pm 3 Hz. The length of cable will depend upon the

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distance between location of equipment and the site of main power distribution box.

4.1.3 Provision of internet connection for transfer of data and display of reports and audio-visual alarms from site of installation to centralized location (as decided by consignee of concerned division of Indian Railways). The recurring expenditure on internet connectivity during warranty from the date of commissioning.

4.2 **Web-server** – The supplier shall launch and maintain an internet web –server at any location (in India) with following features-

4.2.1 Multiple User password protected log-in

4.2.2 Differential access and usage rights to multiple level of users e.g. write-only, read-only, administrator rights

4.2.3 Facility to export data in other data base formats e.g. MS-Excel and XML.

4.2.4 Adequate capacity to handle data transfer for all authorized users (to be controlled by providing username and password) who shall access through public internet.

4.3 **Ownership and confidentiality of data and software:** - All the data being generated by the HAHW equipment, website, servers etc. with respect to Indian Railway operations shall be the property of Indian Railways.

4.3.1 The data shall be compiled, stored in a medium, transferred and made available in a format as finally decided by Indian Railways in consultation with final supplier preferably in MS-Excel at present but other formats may be accepted later by consignee if found suitable.

4.3.2 The data shall not be divulged by the supplier to anyone other than consignee and to those authorized by consignee.

Apart from the details mentioned in this documents, any other accessory/component/system(s) essentially required for proper functionality of the HAHW system, will fall under the scope of supply of the tenderer.

5.0 **Installation requirements:** -

5.1 The HAHW system shall not infringe dimensions as per envelope drawing given in annexure-I.

5.2 AC power 230V, 50 +/-3Hz. shall be made available at installation site by consignee. The maximum load on the power supply system should not exceed one KVA.

5.3 UPS system having at least 8 hours backup power.

6.0 **Software requirements:** -

6.1 The trackside equipment shall have the capability to record and locally store raw captured data for last up to 500 trains and the processed reports for upto 5000 trains.

6.2 The supplier shall be responsible for providing required software for collecting data, storage and presentation of reports sent by the trackside equipment.

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7.0 Safety Requirements: -

The equipment shall not fail on wrong side due to harmonic interference generated by thyristors, chopper controlled tap changer/ drives or other such technologies in locomotives.

8.0 Output requirement: -

8.1 The supplier shall launch, operate and maintain an internet-based website during warranty and during comprehensive maintenance period for making available the train reports to remote users authorized by consignee. The website shall have the following features: -

8.1.1 Password based access so that only authorized personnel by consignee can enter/edit/view/download data and reports

8.1.2 Differential privileges to different levels of users to access the resources of the website

8.2 The supplier shall supply a desktop computer/ laptop at nominated place by consignee of the configuration as specified in the clause on concomitant accessories.

8.3 The system output shall consist of data reports. Data acquired by the system shall be sent to a web server and the following reports shall be available to the users on demand.

8.4 Detailed report: - This report shall be in detail showing all parameters as acquired by the remote wayside detector.

8.5 Exception report: - This report shall be an abridged version of the detailed report showing only the list of axles where the parameters have exceeded the prescribed limits.

8.6 Alarms report through SMS: - Reports for alarms based on parameters exceeding the prescribed limits shall be sent to users through SMS. In case of delay in transmission of full reports, the system shall have the capability to send SMS directly to limited number of users. The delay shall be deemed to have occurred if the data is not dispatched within 5 minutes from the passage of last wheel of the train.

8.7 Alarms report through App: - The firm should develop a mobile application for the user to get various alerts along with relevant positions through push notifications.

8.8 Diagnostic reports: - The system shall be capable of running self-diagnosis programs and report the result through the website and by SMS.

8.9 Alarms: - Parameters exceeding the specified limits require alarms to be sent to users. These alarms should be sent in the form of SMS message. These alarms shall be transmitted immediately on detection of the condition. Transmission delay should not exceed 5 minutes beyond the passage of the last axle. These messages will convey the following minimum data:

8.9.1 Date / time of train

8.9.2 Direction of movement

8.9.3 Vehicle position from start of train

8.9.4 Axle number where the parameters where found out of range.

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8.9.5 Short description / error code

In case of error in recording or any system failure, alarms shall be generated and transmitted similarly.

8.10 Basis of alarms: - It should be possible to raise graded alarms, at least for the following conditions:

8.10.1 When the temperature of the axle box or the wheel or brake disc exceeds the specified temperature. This should be of multiple level thresholds.

8.10.2 When the temperature of the axle box or the wheel or brake disc exceeds beyond a certain limit above the ambient temperature.

8.10.3 When the difference in temperatures of the axle boxes on the same axle is different beyond a certain limit.

8.10.4 When the temperatures of wheels or brake disc of an axle, a trolley/bogie or a vehicle exceed the average temperatures of the bogie or the vehicle beyond a certain limit.

8.10.5 In case, IR decides to include new types of alarms in the system, then supplier shall modify the software within a reasonable time at no extra cost to Indian Railways.

8.11 **Captured Data Reports:** - The report of the data captured by the system shall be relayed by the wayside device via suitable communications media to a secure web server on the internet within 5 minutes after the passage of the last axle. The server shall be maintained and operated by the bidder. These servers shall be capable of storing and displaying (upon demand) parameter reports for up to last 5 years. The access to these reports shall be provided by web based clients optimised for use from desktops / laptops / notebooks and smart phones. Users of the systems shall be provided logins / passwords for accessing the data.

9.0 **Type of Tests:**

Inspection and testing of the equipment shall include all inspections, tests, checks, procedures etc., whether mechanical, electrical or software related as required to ensure that the equipment supplied meets the technical & functional requirements stipulated in the specification. The tenderer shall submit details of test plan for proposed system for each level of testing. However any addition/deletion/modification in the test plan can be considered on mutually agreeable basis. The successful bidder shall depute team of engineers to perform all level of testing and ensure availability of testing facilities, typing tools and spare parts in adequate quantity for these tests. All the instruments, apparatus, devices, sensors etc. used during all levels of inspection and testing should have valid calibration certificate issued by an independent authority or institute approved by NABL/IR or accredited lab.

9.1 **Factory Acceptance Test** – All technical and design features shall be inspected and witnessed by nominated inspection agency at the firm’s premises. During the factory acceptance test, firm shall demonstrate the capability of the system to sense temperature at designated speed mentioned in specification. Test scheme shall be finalized by inspecting/ tendering agency jointly with the firm. Necessary consumables rigs, calibrated gauges / equipment etc. may be provided by firm at its premises for FAT.

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- 9.2 **Proving-out tests at site** – All Functional requirement will be checked at installation site of IR by consignee/ Zonal Railway as per test protocol finalized by consignee/ Zonal Railway in consultation with the supplier. The supplier and consignee shall conduct the following proving out tests after commissioning: -
- 9.2.1 The trackside equipment shall be calibrated by a black-body source or other method (to be elaborated by the tenderer in the offer). The error should not exceed 2% (in centigrade scale). The system should be calibrated by the supplier at every six months.
 - 9.2.2 All the trains should be correctly recorded with regard to direction of motion, date and time of passing, speed, no. of axles, no of locomotives, no of vehicles other than locomotives and type of rolling stock (Locomotives, Wagons, ICF or LHB Coach, BV, etc).
 - 9.2.3 The complete data report (without missing any axle) including temperatures for at least 98% of the axles passed shall be generated.
 - 9.2.4 Since the trackside equipment's sensors are specially designed to take measurement of temperatures while it is in motion at a high speed, normal methods e.g. hand-held non-contact pyrometers may not be used for direct correlation of temperatures of axles and wheels taken by HAHW system. Therefore, some of the indirect methods which can be used for verification of temperatures recorded (for each train) by the HAHW equipment are as under: -
 - 9.2.4.1 The ambient temperature reported by the HAHW equipment and any other thermometer is $\pm 2^{\circ}\text{C}$.
 - 9.2.4.2 The temperature of axle boxes and wheels are not below ambient for each train.
 - 9.2.4.3 There should be correlation of at least 75 % between measured temperature of left side and right side excluding the axles for which there is some abnormality reported by HAHW equipment when the verification is done within 30 minutes of train passing the HAHW site.
 - 9.2.4.4 Indirect verification of temperatures reported by the HAHW system by measurement of temperatures by measuring the temperatures of the axle boxes and wheels after the trains have come to stop using hand-held pyrometers (supplied as concomitant accessory) at convenient station/yard. Some variation is expected depending on the time the train has passed the HAHW and the time the same train is checked in the station/yard. The variation should be consistent.
 - 9.2.5 Any other test as suggested by the supplier and agreed to by consignee. The tenderer shall provide details in the offer.
- 9.3 If in IR's opinion, instruments, apparatus, devices, etc. used by the supplier need calibration or re-calibration, then such instruments, apparatus, devices, etc. shall be calibrated by an independent authority or institute approved by NABL/Govt. or accredited labs.
- 10.0 **Warranty:**
The supplier shall confirm warranty of complete system for a period of at least 24 months from date of successful commissioning i.e date of start of field trial.

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11.0 Comprehensive Annual Maintenance Contract (CAMC):

The bidder shall also submit the offer for comprehensive annual maintenance contract (CAMC) of the system for 03 years. The period of CAMC of the system will start after competition of warranty period.

12.0 Training:

The supplier shall provide training for minimum 50 man days to nominated personnel in the premises of consignee or mutually agreed location/ facility in following areas.

12.1 Operation of HAHW system

12.2 Calibration of HAHW system

12.3 Trouble shooting and Maintenance of HAHW system

12.4 Reading and interpretation of reports, alarms and SMS's etc.

13.0 Submission of documents:

13.1. **Test certificates:** Test records, test certificates, sensor's data sheet, performance curves, tables, etc., of all inspections and tests, whether or not witnessed by IR personnel , shall be supplied as soon as practicable after performance of each inspection or tests. Two (02) sets of above mentioned documents shall be supplied properly bound in books. The softcopies of the said documents should also be provided by the firm.

13.2. All test certificates shall be endorsed with sufficient information for identification of the equipment and material to which the certificates refer.

13.3. **Literature:** - The supplier shall provide following literature in two copies to consignee along with the delivery of HAHW system.

13.3.1. Complete drawings

13.3.2. Operating manual

13.3.3. Maintenance manual

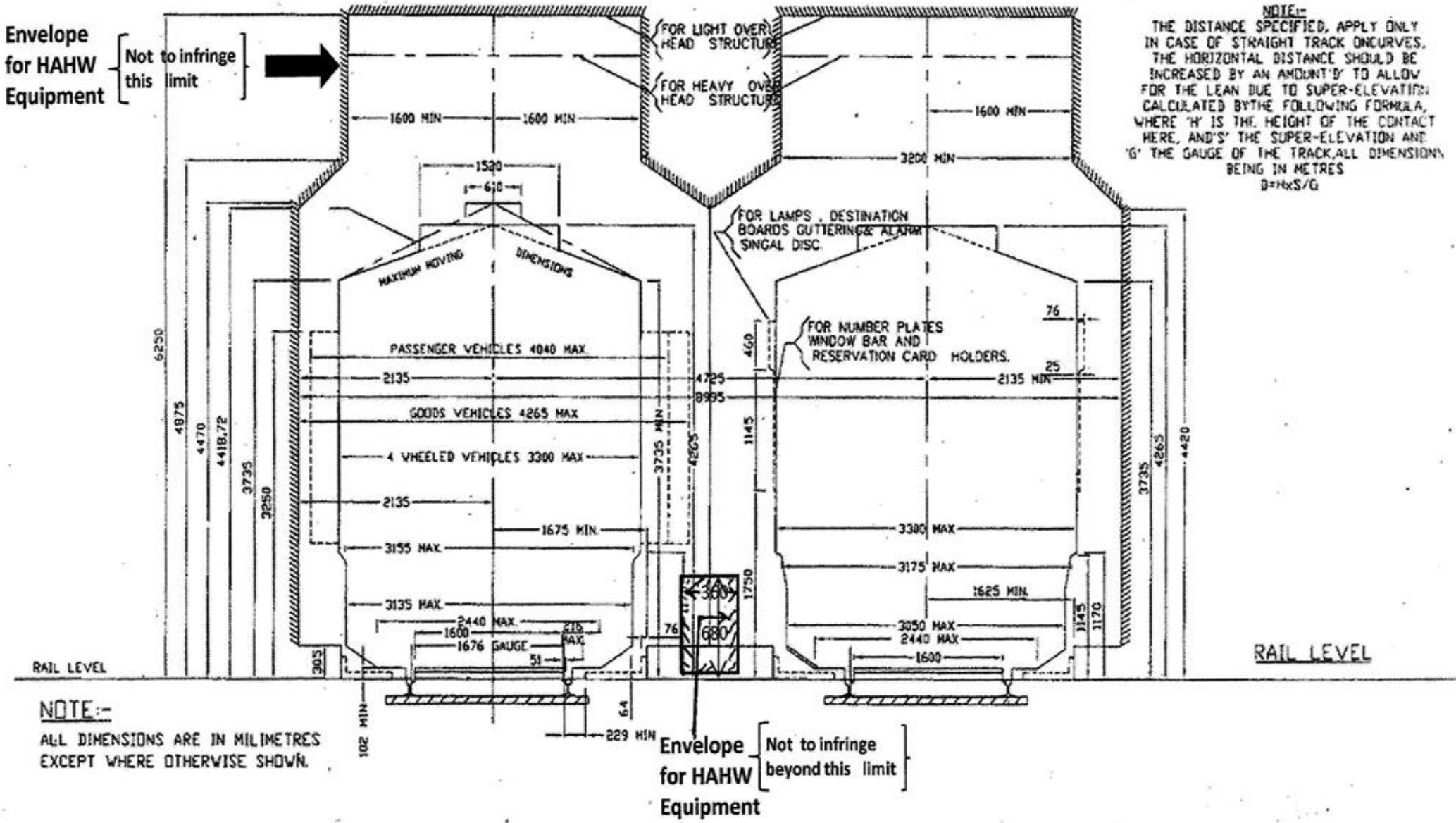
13.3.4. Spare part catalogue

The tenderers shall provide a list of literature to be supplied with the machine in his offer.

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STANDARD DIMENSIONS OUT OF STATIONS
TO SUIT 25 KV.A.C. TRACTION SCHEDULE-I-CHAPTER-I

DIAGRAM NO. 1C
1676 mm GAUGE



NOTE:-
THE DISTANCE SPECIFIED, APPLY ONLY IN CASE OF STRAIGHT TRACK ON CURVES. THE HORIZONTAL DISTANCE SHOULD BE INCREASED BY AN AMOUNT 'D' TO ALLOW FOR THE LEAN DUE TO SUPER-ELEVATION. CALCULATED BY THE FOLLOWING FORMULA, WHERE 'H' IS THE HEIGHT OF THE CONTACT HERE, AND 'S' THE SUPER-ELEVATION AND 'G' THE GAUGE OF THE TRACK, ALL DIMENSIONS BEING IN METRES
 $D = H \times S / G$

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