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4.0 Introduction: -

Hot axle box in a railway vehicle occurs when inadequate wheel-bearing lubrication or mechanical flaws (bearing failure) cause an increase in temperature. If undetected, the bearing temperature can continue to rise until there is a bearing “burn-off” which may cause a derailment.

Currently hot boxes are detected on running trains by station staff by listening to the whistling sound of bearings and visually due to discoloration of axle-boxes and grease oozing out. At station or in yards, when the trains stop, hot axle-boxes are detected by physically touching the axle-box cover. Of late, hand held non-contact infrared thermometers are also being used at major stations for checking the temperature of axle-boxes.
Hot Axlebox Hot Wheel Detector system (HAHW system) is a fully automated wayside detection system. It consists of data acquisition equipment deployed by the side of railway track which acquires temperatures of axle boxes and wheels treads / rims. The acquired data is analyzed and axle boxes running hot due to some defects and wheels running hot due to brake-binding are identified. Alarms are raised when the parameters are found exceeding limits. These alarms are dispatched in the form of SMS alerts or any other suitable means. The parameters acquired by system are also relayed to a computer server which is available to users of the system through a website.

RDSO along with IIT, Kanpur have developed fully automated infrared sensor based wayside detection system that can make measurements of temperature of axle boxes and wheel treads/rims on a train traveling up to 70kmph. This specification, although based on this prototype, has been framed such that it is sufficiently broad in nature to permit any potential/existing manufacturers, developers, system integrators and tenderers to supply such equipment to Indian Railways provided they meet the requirements spelled out in this specification.

The purpose of this specification is to spell out the functional and technical requirements of a HAHW system to enable manufacturers, developers, system integrators and tenderers to supply such equipment to Indian Railways on requirement.

5.0 Abbreviations: -

Some of the abbreviations used in this document are listed in the table for reference.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>ABBREVIATION</th>
<th>EXPANDED FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>RDSO</td>
<td>Research Design Standards Organization, Ministry of Railways, Lucknow</td>
</tr>
<tr>
<td>2.</td>
<td>IIT-Kanpur</td>
<td>Indian Institute of Kanpur</td>
</tr>
<tr>
<td>3.</td>
<td>HAHW</td>
<td>Hot Axlebox Hot Wheel Detector</td>
</tr>
<tr>
<td>4.</td>
<td>DRM</td>
<td>Divisional Railway Manager</td>
</tr>
<tr>
<td>5.</td>
<td>ASM</td>
<td>Assistant Station Master</td>
</tr>
<tr>
<td>6.</td>
<td>IR</td>
<td>Indian Railway</td>
</tr>
<tr>
<td>7.</td>
<td>KMPH</td>
<td>Kilo Meter Per Hour</td>
</tr>
<tr>
<td>8.</td>
<td>KW</td>
<td>Kilo Watt</td>
</tr>
<tr>
<td>9.</td>
<td>NCT</td>
<td>Non Contact Thermometer</td>
</tr>
<tr>
<td>10.</td>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>11.</td>
<td>OFC</td>
<td>Optical Fiber Cable</td>
</tr>
<tr>
<td>12.</td>
<td>RH</td>
<td>Relative Humidity</td>
</tr>
<tr>
<td>13.</td>
<td>SMS</td>
<td>Short message service</td>
</tr>
<tr>
<td>14.</td>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
</tbody>
</table>

6.0 Credential/eligibility requirements: -

Those manufacturers, developers, system integrators and tenderers wishing to supply such equipment to Indian Railways must fulfill the following criteria: -

6.1 Foreign Manufacturers who have supplied at least 100 Hot Axle Box Hot Wheel Detector equipments similar to these specifications to major railroads are eligible to supply.

6.2 Developers/System Integrators/Companies in India who have associated with either IIT/Kanpur or RDSO in developing/improving/maintaining trackside equipment are eligible to supply.
7.0 **Scope:** - The HAHW system shall be supplied on turnkey basis. The HAHW system shall mean and include all equipment by the side of the track, cables – electric, fibre-optic etc., server computer, website, client computer, 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

7.1 **Supply:** - Supply of

7.1.1 HAHW site equipment as per paragraph 8.3,
7.1.2 Concomitant accessories as per paragraph 8.9,
7.1.3 Optional accessories, if ordered, as per paragraph 8.10,
7.1.4 Spares as per paragraph 8.11,
7.1.5 Maintenance tool kit as per paragraph 8.12,
7.1.6 Literature as per paragraph 8.13,
7.1.7 Printed copy of the software as per paragraph 7.12.1.
7.1.8 Material, as required for civil engineering work, as per para 7.4.1
7.1.9 Power cables, as suitable to the trackside equipment, as per para 7.4.2.
7.1.10 Modem, as suitable to the trackside equipment, as per para 7.4.3

7.2 **Delivery** to site/sites (as finalised by DRM-Mechanical of concerned Division of Indian Railways): - The supplier shall deliver the above items within one month after written confirmation from DRM-Mechanical which should include signed drawing of the site, readiness of site and assurance of main power supply at least within three km from proposed installation site.

7.3 **Joint inspection at site:** - The supplier shall carry out a joint check of delivered items at the site with the representative of DRM-Mechanical before installation is done to avoid subsequent complaints regarding short shipment/transit damages. It is necessary that the consignee to do this joint inspection immediately on receipt of the machine to avoid commissioning delay due to shortages/transit damages.

7.4 **Installation at site:** - Installation of the system would be done by and under the supervision/direction of firm’s Engineers. It shall include the following: -

7.4.1 Civil engineering and other allied works (if required) such as construction of grouting supports for steel enclosures/equipments, control box, battery box etc., earthwork for power cables for a maximum distance of three km.

7.4.2 Electrical engineering: laying of power cables for a maximum distance of three km from the site to the main power distribution box where the DRM-Mechanical has made the availability of electrical power of 230 V 50 Hz.

7.4.3 Provision of mobile connection and internet connection for transfer of data and display of reports and audio-visual alarms from site of installation to centralized location (as finalised by DRM-Mechanical of concerned Division of Indian Railways). The recurring expenditure on mobile connectivity for first one year from the date of commissioning shall be borne by the supplier. Subsequent expenditure shall be borne by Indian
Railways for which the necessary arrangements have to be done in advance by DRM-Mechanical.

7.5 **Commissioning:** - The contractor shall arrange calibration and commissioning of system. Adequate number of team of technical experts will be made available so that the commissioning delays are eliminated.

7.6 **Prove-out:** - The contractor or his agent shall demonstrate to DRM-Mechanical the compliance of the equipment to this specifications by conducting suitable tests, as per para 8.8 during commissioning. The detailed procedure of these tests shall be provided by the equipment supplier and conducted as per the requirement and to satisfaction of the DRM-Mechanical.

7.7 **Training:** - The supplier shall provide five days training to nominated personnel of DRM-Mechanical in following areas:

- 7.7.1 Operation of HAHW system
- 7.7.2 Calibration of HAHW system
- 7.7.3 Trouble shooting and Maintenance of HAHW system
- 7.7.4 Reading and interpretation of reports, alarms and SMS’s etc.

7.8 **Maintenance during warranty period:** - The supplier shall maintain the HAHW system for the entire period of 24 months during warranty at no extra cost.

7.9 **Warranty:** - Warranty of the full system for a period of at least 24 months from date of commissioning shall be offered by the potential/existing manufacturers, developers, system integrators and tenderers.

7.10 **Maintenance after warranty period:** -

- 7.10.1 The supplier shall confirm after-sales comprehensive maintenance service including supply of all necessary spares and consumable, at least for 3 years after expiry of free warranty period of 24 months. The rate/cost and other terms and conditions of such after-sales service shall be furnished along with the offer, which shall be taken into account while evaluating the tender and selecting the system. In case of dissolution of the supplier’s company, the firm capable of handling the AMC shall be indicated failing which the firm shall liable for damages. In case of merger / takeover of the supplier’s company, the new entity shall be responsible for the AMC

- 7.10.2 AMC should ensure a minimum uptime of 95% for the equipment calculated quarterly.

- 7.10.3 The AMC should include preventive maintenance schedules as well as breakdown maintenance etc. All maintenance activity will be carried out as per standard maintenance, practice prescribed by manufacturer of the system.

- 7.10.4 DRM-Mechanical shall, however, reserves the right to award after-sales comprehensive maintenance service for any period up to seven years.

7.11 **Web-server** – The supplier shall launch and maintain an internet web –server at any location with following features and as per para 7.12: -

- 7.11.1 Multiple User password protected log-in
7.11.2 Differential access and usage rights to multiple level of users e.g. write-only, read-only, administrator rights
7.11.3 Facility to export data in other data base formats e.g. MS-Excel
7.11.4 The supplier shall offer at least three designs for web-user interface for selection.
7.11.5 Sufficient capacity to handle data traffic with fast data transfer rate for all users

7.12 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.

7.12.1 The supplier shall mandatorily transfer the complete software and source code of the website, server computers and client computers etc. to Indian Railways. The offer shall indicate the price of the software.

7.12.2 It shall not be mandatory for the supplier to transfer the complete software and source code of the HAHW equipment. However, the offer shall indicate the price of the software. Indian Railways shall reserve the right to purchase the complete software and source code of the HAHW equipment any time within ten years from the date of commissioning.

7.12.3 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.
7.12.4 The data shall not be divulged by the supplier to anyone other than DRM-Mechanical and to those authorized by DRM-Mechanical.

The above shall be in compliance with additional requirements as specified below.

8.0 Technical Requirements: -

8.1 Installation requirements: -

8.1.1 The HAHW system shall be installed such that it does not infringe the latest revision of Indian Railways Schedule of Dimensions 1676mm Gauge or any other statutory dimensions of Indian Railways. This is also subject to site clearances and hence clearance for this aspect shall be provided for individual sites by the respective DRM-Mechanical based on the equipment drawings and other documents to be submitted by the supplier as required by DRM-Mechanical.

8.1.2 During installation and commissioning of the site equipment, if the regular train traffic is to be stopped, the DRM-Mechanical of concerned division shall arrange stoppage of train traffic and the supplier shall work at site as directed by the DRM-Mechanical

8.1.3 The HAHW system shall be installed such that it does not either require or cause stoppage of train traffic when it is being functioning/ not functioning/under breakdown/under maintenance.
8.1.4 Apart from the proximity sensor which may be installed on the rails in such a way that they do not damage or get damaged by the wheels of railways vehicles, the other components of the HAHW system should not normally cause modification/alteration/removal of any other track or signal or electrical traction structure. In case, any manufacturer feels that this condition cannot be complied with, the offer should explain the required modification/alteration/removal of any other track or signal or electrical traction structure in detail.

8.1.5 The HAHW system shall be of such configuration that it can be installed on single/multiple line sections and should function in either direction of movement of train.

8.1.6 The HAHW system shall be installed in such a way that it is not prone to theft and damages. The equipment shall be so constructed as to prevent unauthorized access to the system. Adequate locking shall be provided for this purpose.

8.1.7 The HAHW system shall capable of being powered by single phase power supply of voltage range varying from 110V to 230V, 50 +/-3Hz The maximum load on the power supply system shall not exceed one 1kVA.

8.1.8 The equipment shall be installed in such a manner that it is adequately protected (so as to prevent malfunctions) from

8.1.8.1 Vibrations from passing trains, track maintenance vehicles/equipment

8.1.8.2 Direct sunlight on the lenses of the pyrometers or the heat sensing equipment

8.1.8.3 Heat from the sunlight

8.1.9 The supplier shall help DRM-Mechanical of the concerned division of Indian Railways in selection of site of installation. For this, the supplier and DRM-Mechanical shall organize a joint survey after placement of order but before delivery of equipment at site. However, the decision of DRM-Mechanical regarding site shall be final and binding on the supplier. Since the decision of selection of site by DRM-Mechanical shall be final, he should ensure that the site of installation (a) should be on a straight and level track, (b) should be sufficiently near to a station where the trains speed is less than 70 kmph, (c) should be at least one train lengths (of the longest train in the section) away from the outermost approaching stopping signal of the station (d) Since it takes less or about 10 minutes for acquisition of data, processing the data, generation of alarms and transmission of alarms, the site of HAHW equipment should be such that the train reaches yard/station at least 20 minutes after it passes the HAHW equipment so that the TXR/station staff gets adequate notice to be in a position to inspect the vehicle for which the HAHW equipment has raised an alarm (e) should be within 3 km of main power distribution. (f) should not be generally theft-prone although no written assurance from DRM-Mechanical is required in this regard. (g) Proper bedding of sleepers / ballast shall be ensured to minimize vertical / lateral displacement of the rail on passage of the wheel (This is required to correctly maintain the
location of target sensing zones of the axle boxes and wheels with respect to the detector sensors).

8.2 Functional requirements: -

8.2.1 The system should be capable of automatic detection of approaching train, 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.

8.2.2 System availability: - The HAHW system is expected to run in 24x7 mission critical modes (available round the clock perennially) without any human intervention. An uptime of better than 95% is expected and should be built in the design of the equipment.

8.2.3 Environmental conditions - The system shall be capable of functioning in the following environment: -

8.2.3.1 The system should be able to work in ambient temperature range of 0˚ to 70˚C and in direct sunlight.

8.2.3.2 Relative humidity up to 95% or more.

8.2.3.3 All transducers and associated wiring are to be properly protected /cased to avoid damage by tamping/packing tools etc. used for track maintenance works.

8.2.3.4 The system should be rugged and tamper-proof to work round the clock in harsh and dusty outdoor environment exposed to sun, cold, rain, wind etc. without any need of any special chamber for the purpose.

8.2.3.5 The equipment shall be capable of working in non-air conditioned environment in the field.

8.2.3.6 Data acquisition system, electronics, shall be enclosed in suitable steel enclosure with IP67 protection to avoid ingress of water and dust.

8.2.3.7 On IR, at present, the toilet discharge from the passenger coaches is allowed to fall directly on the tracks. As such, the system should be adequately protected.

8.2.3.8 The equipment shall be suitable for installation on AC/ DC electrified and non-electrified sections.

8.2.3.9 It shall be suitable in all areas including where locomotives having thyristor-controlled single phase or 3-phase induction motors haul passenger or freight trains and where chopper controlled EMU stocks are operated. The equipment should be suitably protected from such EMI/RFI.

8.2.4 The system should be able to measure temperature of all types of axle boxes fitted on different types of wheel sets used on the Indian Railways. Range of wheel diameters used on the Indian Railways is in the range of 770-1100mm.
8.2.5 The system should be capable of functioning with trains consisting up to 100 vehicles (400 axles) of all categories, i.e. locomotives, passenger coaches and freight wagons operating on Indian Railways.

8.2.6 The system should be capable of acquiring the temperate of axleboxes and wheels of trains moving up to 70 kmph.

8.2.7 Train parameters to be acquired: - The system shall be capable of measuring the following parameters of passing trains.

8.2.7.1 Parameters for every axle

8.2.7.1.1 Temperature of both axleboxes of a wheelset.
8.2.7.1.2 Temperature of both wheel treads of a wheelset.
8.2.7.1.3 Speed of each axle while passing site

8.2.7.2 Parameters for one train

8.2.7.2.1 Date of train passing
8.2.7.2.2 Time of train passing
8.2.7.2.3 Average speed of train
8.2.7.2.4 Total no. of axles passed in this run
8.2.7.2.5 Total number of vehicles in the rake.
8.2.7.2.6 Type of train and type of vehicles in the rake (based on wheel base/inter-axle distance)
8.2.7.2.7 Ambient temperature
8.2.7.2.8 Range, least count and permissible errors of acquired data

The following shall be the least count and measurement tolerances for parameters that are required to be acquired. This table details the minimum values better than this is preferable.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Parameter</th>
<th>Range</th>
<th>Resolution</th>
<th>Error Tolerance</th>
<th>Repeatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Date / Time</td>
<td>5-150 °C</td>
<td>1 minute or better</td>
<td>± 5 min</td>
<td>± 1 °C</td>
</tr>
<tr>
<td>2.</td>
<td>Axle box temperature</td>
<td>5-500 °C</td>
<td>1 °C or better</td>
<td>± 2 °C</td>
<td>0.1% of reading in °C + 1 °C</td>
</tr>
<tr>
<td>3.</td>
<td>Wheel temperature</td>
<td>-10°C to +90 °C</td>
<td>1 °C or better</td>
<td>± 1.5 °C</td>
<td>±1.0 °C</td>
</tr>
<tr>
<td>4.</td>
<td>Ambient temperature</td>
<td>0-70 kmph</td>
<td>0.5 kmph</td>
<td>± 5% of value</td>
<td>± 2%</td>
</tr>
<tr>
<td>5.</td>
<td>Number of axles</td>
<td>2-400</td>
<td>1 number</td>
<td>No errors. The system should report an error and fail safely in case of erroneous acquisition.</td>
<td>The number of errors should be less than 1 per 10000.</td>
</tr>
</tbody>
</table>

8.3 Hardware requirements: -
The system shall have the at least the following hardware and any other hardware as considered necessary by potential/existing manufacturers, developers, system integrators and tenderers. The hardware listed below is for guidance and not exhaustive. The hardware presently used in the prototype is indicated only for general guidance of potential/existing manufacturers, developers, system integrators and tenderers. The potential/existing manufacturers, developers, system integrators and tenderers may offer to supply a HAHW system with hardwares of different specifications subject to their meeting the RDSO specification.

8.3.1 The HAHW system shall be housed in suitable steel sheet enclosure consist of the following component:

8.3.1.1 Adequate numbers (so as to acquire temperature of axle boxes and wheel treads/rims of both the sides of a railway vehicle in a train) of Pyrometers/sensors with response time to meet the speed criteria with focusable optics for spot of measurement of the order of 0.3 mm or less (to achieve better accuracy) for non-contact temperature measurements on metals, ceramics, graphite with LASER pointing system for target identification (targeting LASER light should have capability to switch on and off on requirement) for acquisition of axlebox temperature and wheel tread/rim temperatures. The pyrometer/sensor should provide current output proportional to the temperature sensed. The pyrometer/sensor should have a repeatability of 0.1% or reading of 1 degree C or better. The offer shall provide complete details. As explained in para 8.2.3.7 that the discharge from the toilets of the trains falls unregulated on the track and may fall on the sensors if they are mounted on the rail or tie/sleeper, the design of the sensors should be such that it is still able to perform in such a condition, without failure to generate report for any train which may arrive at site within 5 minutes after passing of the previous train whose discharge from the toilet may have impaired the functioning of the sensors. The offer shall provide complete details as to how this aspect has been taken care of in the design adequately.

8.3.1.2 The mounting arrangement of the sensors shall be provided in complete details also elaborating on features which provide shock, vibration and electrical isolation. In case the sensors are mounted on the rail or tie/sleeper, or any other track component, the offer shall be referred to RDSO for getting clearance for such an arrangement from Track Design Directorate. It may be noted that inter-sleeper/tie distance on majority of the track on Indian Railways is 600 mm.

8.3.1.3 Suitable temperature sensor for sensing of ambient temperature. The offer shall provide complete details.

8.3.1.4 Data acquisition and processing system: - The data acquisition system shall be such that it acquires, processes and transmits the data in real time preferably within 10 minutes. The offer shall provide complete details.
8.3.1.5 UPS (Uninterrupted Power Supply) and Battery back-up: - UPS system of sufficient capacity shall be provided to automatically switch to back-up battery power in case of failure of main power, to allow the HAHW system at site to function of at least 8 hours on back-up power and to charge the back-up batteries from main power as well as solar power (if opted by the indenting DRM-Mechanical). The UPS shall be capable of working from main power voltage as low as 110V to 270 V and produce a stable supply for operation of all equipment at site. The battery shall be of maintenance free type. The offer shall provide complete technical details.

1.1.1.1 Adequate nos. of magnetic proximity switches/transducers (or suitable train trigger sensors) mounted on rails to acquire presence/approach of a train from either direction, direction of the train, number of axles in a train, speed of axles and to synchronize data capture from all temperature sensors. The mounting of these switches shall be such that (a) they do not infringe with wheels when the wheels pass over them (b) do not get damaged by the wheels (c) do not interfere with any other signalling equipment presently installed on Indian Railways. They shall be of rugged industrial grade construction and enclosed in a weather-proof enclosure. It should be possible to integrate it with data acquisition hardware and software to start and stop the data acquisition. The offer shall provide complete technical details.

1.1.1.2 The above hardware shall be effectively integrated to deliver output as specified herein these specifications.

1.1.1.3 At present, a system for Automatic Vehicle Identification (RFID based) is under trial on Indian Railways. The HAHW system shall be of modular construction such that RFID reader (which will be supplied at site to the supplier of HAHW system by DRM-Mechanical in future) can be integrated with the HAHW system without any additional cost. The integration shall be such that in the train reports as explained in these specifications the data of each axlebox & wheel are tagged to unique vehicle numbers as read by RFID reader. The tenderer shall provide details in their offer as to which present makes of RFID based system can be integrated with their supplied HAHW system.

8.4 Software requirements: -

8.4.1 There shall also be provision in software of the trackside equipment for increasing the number and type of limits and it should be possible for user to change alarm levels and types of alarms. If these require modification to the system / backend software at the server these will done by the manufacturer whenever required without any additional cost and shall be deemed as a part of the supply / maintenance agreement.
8.4.2 The software of the trackside equipment shall constantly keep a watch on time taken for analysis. In case time is exceeding 10 minutes for analysis, the system should automatically take required corrective action.

8.4.3 The software of the trackside equipment shall have in-built diagnostic features for ease in maintenance. The software shall be so designed that a system test is performed after every boot up and a diagnostic report with suitable warning and error massage as found necessary with date & time are transmitted to the server systems.

8.4.4 The trackside equipment shall have the capability to record and locally store raw captured data for upto 500 trains and the processed reports for upto 20000 trains.

8.4.5 Presently the format of data transfer from the trackside detector to server is not controlled on the Indian Railways. Manufacturers of the systems are free to use their own formats. A logical XML based standard format permitting integration on a common server system (present under development) shall be issued and all equipment suppliers shall have to ensure compliance to the same. The equipment provider shall also upgrade software for already supplied equipment without further cost under warrantee / AMC.

8.4.6 The supplier shall be responsible for providing the server system and required software for collecting data, storage and presentation of reports sent by the trackside equipment. The source code of the server system shall be shared by the supplier with concerned DRM-Mechanical.

8.5 Maintainability requirements: -

8.5.1 Modules liable to develop faults shall be plug-in types to enable the replacement of the defective ones quickly.

8.5.2 The units shall be fabricated from industrial grade components.

8.5.3 The layout of the components and wiring shall be such that all parts are easily accessible for inspection, repairs and replacement.

8.5.4 The system shall be designed in such a way that for maintenance, only replacement of card is required at site.

8.5.5 All the components of the equipment at site shall be suitably protected against atmospheric voltage surges both for common mode (voltage that appear between two conductors and earth) and differential mode (voltage that appear between two conductors) in order to limit the harmful effects of lightning. The offer shall provide details of the design used for such protection.

8.5.6 Wiring shall be colour coded or otherwise marked to differentiate between various connections.

8.5.7 Label (s) shall be provided in the units, which will show details for easy identification.

8.5.8 The supplier shall indicate special maintenance instruments and tools, which may be necessary for proper adjustments and maintenance of the
equipment and supply them, if so, required by the purchaser of the equipment.

8.6 Safety Requirements: -

8.6.1 The system shall be designed on fail-safe principles. Unsafe condition shall not develop due to faults and adequate safety margins must be incorporated in the design for systematic and random failures.

8.6.2 Equipment shall be designed according to fail-safe principles:

8.6.3 No single failure results in an un-safe condition.

8.6.4 A fault must be detected and cleared quickly so that the probability for another fault to occur simultaneously which can lead to unsafe condition.

8.6.5 Hardware faults, both open circuit and short circuit of one or more components, shall not lead to unsafe condition.

8.6.6 The immunity to the interference current shall not be affected by component failure.

8.6.7 The equipment shall not fail on wrong side due to harmonic interference generated by 3 phase thyristor, single phase thyristor, chopper controlled, tap changer or other such technologies, locomotives.

8.6.8 The equipment shall be insensitive to extraneous magnetic or electrical fields.

8.6.9 The equipment shall be suitably protected through at least two tier shielding or grounding arrangements against external EMI interference.

8.6.10 The equipment along with protective measure shall be so designed that it is not affected in case electrified OHE (Over Head Equipment) or lightning falls in its vicinity.

8.7 Output requirement: -

8.7.1 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 DRM-Mechanical. The source code of the server and the website shall be shared by the supplier with DRM-Mechanical. The website shall have the following features: -

8.7.1.1 Password based access so that only authorized personnel by DRM-Mechanical can enter/edit/view/download data and reports

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

8.7.2 The supplier shall supply a desktop computer at nominated place by DRM-Mechanical of the configuration as specified in the clause on concomitant accessories.
8.7.3 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.

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

8.7.5 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.

8.7.6 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 10 minutes from the passage of last wheel of the train.

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

8.7.8 The system shall be able to communicate alarms and acquired data to users immediately after passage of a train without any human intervention. The following modes of communication are recommended.

8.7.9 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 10 minutes beyond the passage of the last axle. These messages will convey the following minimum data:

- Date / time of train
- Direction of movement
- Vehicle position from start of train
- Axle number where the parameters where found out of range.
- Short description / error code (should be easily understandable without need of referring to a table)

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

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

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

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

8.7.10.3 When the difference in temperatures of the axle boxes on the same axle is different beyond a certain limit.
8.7.10.4 When the difference in temperatures of wheels of an axle, a trolley/bogie or a vehicle exceed the average temperatures of the bogie or the vehicle

The supplier may also suggest other criteria/basis for raising an alarm which shall be considered by Indian Railways. During the warranty period or the maintenance period, if due to experience gained/as a result of study, if new basis of alarms are to be incorporated in the system, then supplier shall modify the software within a reasonable time at no extra cost to Indian Railways.

8.7.11 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 10 minutes after the passage of the last axle.

Where required by special site conditions, OFC / Copper cable / RF-Link connectivity shall be provided by the system provider for transfer of data.

The backend server systems shall be maintained and operated by the system provider. 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 suitable for use from desktops / laptops / netbooks and smart phones. Users of the systems shall be provided logins / passwords for accessing the data.

8.8 Proving-out test requirement: - The supplier and the DRM-Mechanical shall conduct the following proving out tests after commissioning for five days: -

8.8.1 Consistency test: -

8.8.1.1 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. Minimum acceptance shall be at 90%.

8.8.1.2 The complete data report (without missing any axle) including temperatures for at least 90% of the trains passed shall be generated.

8.8.2 Calibration test: - The trackside equipment shall be calibrated by a black-body source or other method (to be elaborated by the tenderer in the offer).

8.8.3 Since the trackside equipment’s pyrometer are specially designed to take measurement of temperatures while it is in motion at a very 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 by the HAHW equipment are as under: -

8.8.3.1 Checking for inconsistency in the train reports: - For each train the reports should be checked for following aspects: -
8.8.3.1.1 That the ambient temperature reported by the HAHW equipment and any other thermometer is ± 1.5 °C

8.8.3.1.2 That the temperature of axle boxes and wheels are not below ambient for each train.

8.8.3.1.3 That there is correlation of at least 75 % between temperature measurements of left side and right side excluding the axles for which there is some abnormality reported by HAHW equipment.

8.8.3.2 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) 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. The correlation should be at least 75%.

8.8.4 Any other test as suggested by the supplier and agreed to by Indian Railways. The tenderer shall provide details in the offer.

8.9 Concomitant Accessories:

The scope of supply shall include following concomitant accessories whose cost shall be included in basic cost of machine. For information of the purchaser, the cost of these accessories shall also be quoted separately in the tender.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Data access terminal for divisional control office: - Quad Core Intel Core i7 and i5, Dual Core Intel i5 and i3 processors. RAM 1333MHz DDR3 non-ECC (unbuffered): 2GB, 4GB X 4 DIMM slots, SATA 3.0Gb/s 7200RPM with 8MB DataBurst Cache up to 320GB (Chassis supports up to two internal drives (2.0TB maximum storage capacity), Integrated High Definition Audio, DVD writer, 19”TFT Monitor, Optical Mouse, Keyboard, Colour Laser Printer A3 with network and Wi-Fi support at least 10/3 pages per minute or better, Licensed version of Window 7 – with required client and data presentation software for HAHW system.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Uninterrupted online-stabilized power supply of 230±10Volts, 50±3 Hz / battery backup with at least 4-hour backup for the above work station</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Black body source for calibration of temperature sensors or some other suitable equipment for calibration depending on the model being offered by the tenderer. Complete technical details shall be provided in the offer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Hand-held non-contact pyrometer similar to Fluke 62</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Suitable link including the required hardware to send/receive data to remote computer installed in DRM Office/TXR’s Office/next station ASM’s Office. The link from the sensing station to the</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
reporting station should preferably be wireless with suitable range. The firm shall also quote rate of wireless connectivity with recurring charges on monthly basis.

6 Any other fixture/equipment for alignment of the sensors, if required. Complete technical details shall be provided in the offer.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solar panel of adequate capacity with direct connection to battery backup of on-line UPS to ensure uninterrupted power supply to the equipment by the side of the track</td>
<td>1 set</td>
<td></td>
</tr>
</tbody>
</table>

8.10 Optional accessories: -

The scope of supply shall include following optional accessories (if opted for by DRM-Mechanical and if included in the final purchase order) whose cost shall not be included in basic cost of machine for evaluating the tender. Any other accessory, which in the opinion of the tenderer can improve effectiveness and reliability of HAHW system, shall be clearly indicated and quoted separately. For information of the purchaser, the cost of these accessories shall also be quoted separately.

8.11 Spares: -

The spares shall be delivered along with the machine.

A list of recommended perishable and non-perishable spares required for normal maintenance of equipment on daily working basis for two years should be furnished and quoted separately.

The quantities shall relate in case of non-perishable spares, to two years normal maintenance and in case of perishable spares to the duration of its shelf life or two years whichever is less. Shelf-life should be indicated with the quotation for spares.

8.12 Maintenance Tool Kit: -

One set of complete tool kit per system for maintenance and operation e.g. lens cleaning kit etc. shall be delivered along with the one site equipment. A list of recommended tools for normal maintenance of equipment on daily working basis for two years should be furnished and quoted separately.

8.13 Literature: -

The supplier shall provide following literature in two copies to DRM-Mechanical along with the delivery of HAHW system, concomitant and optional accessories, spares etc.

8.13.1 Complete drawings
8.13.2 Operating manual
8.13.3 Maintenance manual
8.13.4 Spare part catalogue
The Tenderers shall provide a list of literature to be supplied with the machine in his offer to the tender.

9.0 Special features

Special features incorporated in the machine, if any shall be indicated separately bringing out their advantages and limitations.

10.0 Other Conditions of contract: - All other terms of conditions not specified herein shall be as per Indian Railways Standard Conditions of Contract.