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***RDSO -SPN-RE-HAHW-2017(Rev. 1)***

*Hot Axle box Hot Wheel Detector System*

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## 4.0 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 bearings, wheel rim/disks and brake disks. The purpose of this specification is to spell out the functional and technical requirements of a HAHW system.

## 5.0 Technical Requirements: -

1. HAHW system should be compatible with various types of bearings and brake systems deployed on the rolling stock being used on IR.
2. It should conform to following national/international standards:
  - a. Degree of protection for electronics- IP66
  - b. Degree of protection for optics- IP 54
  - c. Wheel contacts- IP67.
  - d. Hot wheel detector scanner measurement range- 0 °C – 700 °C
  - e. Hot box detector measurement range- 0 °C – 200 °C

- f. The system should have four multi-beam (8 beams) scanners per site mounted suitably on a specially designed hollow sleeper to cover a wide range of wheelset designs.
- g. The sensor width of each 8-beam scanner should be in the range - 50 mm to 120 mm
- h. Auto calibration functionality should be inbuilt into the system, details of which shall be submitted along-with the offer.
- i. It should function in either direction of movement of train.
- j. Time between passing of the train and communication to the central control server should not exceed 5 minutes.
- k. 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.
- l. The system should be able to work in ambient temperature range of 0° to 70°C and relative humidity up to 100%.

S. No	Parameter	Resolution	Accuracy	Repeatability
1.	Axle box temperature	2 °C	± 2°C	± 2°C
2.	Wheel temperature	3 °C	± 5°C	± 5°C

- m. Operational capability requirements –
  - (i) Operating speed- 0-250kmph
  - (ii) Train length- upto 1000 axles
  - (iii) Train headway (1500axles): 3 minutes
  - (iv) Typical track profile- As per IRPWM 2004 amended from time to time: Latest correction Slip(ACS-144)
  - (v) Redundant auto calibration(RAC)
  - (vi) Response time should be less than 2 ms (millisecond)
  - (vii) The bearing scan zone should cover Inboard Seal region, Inboard Raceway region, Spacer Ring region and Outboard Raceway region.
  - (viii) The infrared sensor should be capable of measuring radiations in the wavelength ranging between 8 to 15 microns
  - (ix) D:S ratio for the sensors used should be indicated by the tenderer in the offer
- n. Regulation and norms applicable-
  - (i) EN 55011:98 + A 1:99 + A2:02 : class B
  - (ii) EMV550121-4:00(immunity test)
  - (iii) 73/23/CE, 93/68/CE
  - (iv) EC Directive 2006/860/CE
  - (v) EN55022:98 class A
  - (vi) EN55024:98
  - (vii) EN61000-6-4:01
  - (viii) EN61000-4-2:2009
  - (ix) EN61000-4-3:2006 +A1:2008+A2:2010
  - (x) EN61000-4-4:2004 +A1:2010
  - (xi) EN61000-4-5:2006
  - (xii) EN61000-4-6:2009

- (xiii) EN6100-4-8:2010
- (xiv) EN61000-4-9:1993+A1:2001
- (xv) EN6100-4-11:2004
- (xvi) EN 55011:2009+A1:2010
- (xvii) EN 60068-1:1994
- (xviii) EN 60068-2-1:2007
- (xix) EN 60068-2-2:2007
- (xx) EN 60068-3-4:2002
- (xxi) EN 60068-2-52:1996
- (xxii) 2006/679/EC
- (xxiii) EN50121-1:2006
- (xxiv) EN50121-4:00
- (xxv) EN61000-6-2:00
- (xxvi) EN60950:00
- (xxvii) EMV ENV50121-4
- (xxviii) RFI IS:402 & IS 706
- (xxix) EN 15437-1
- (xxx) EN 62040-1: 2009
- (xxxi) EN 62040-2: 2007
- (xxxii) 2006/95/EG
- (xxxiii) EN 61439-1:2011
- (xxxiv) CENELEC EN 50126
- (xxxv) IEC 61131 series
- (xxxvi) IEC 60529
- (xxxvii) EN 50128
- (xxxviii) EN 50125-3

The system design shall relate and comply with the above mentioned standards. (In case of any contradiction, the strictest standard shall apply). In addition to above, any other national/international standard which is relevant to the technology for similar application in the railway domain will also have to be complied with.

The system should be modular, auto-calibrating and remotely maintainable. The system should be designed for compatibility with all important Railway Standards, some of which have been mentioned in this document above.

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.

The system should be equipped with infrared scanners preferably installed in a hollow sleeper. Multi-channel sensors ensure a complete scan of each component avoiding false alarm associated with single point temperature. The scanners should use multiple beams (8 beams) for enhanced reliability. The scanned values for the individual axles and brakes of each rolling stock of the train shall be processed by electronic equipment installed in a trackside cabin and forwarded to the control room.

The system should have inbuilt intelligent vibration control technology to enhance the life and reliability of the scanners and of the systems.

The system should have provision for interfacing with RFID based automatic vehicle identification module.

## 6.0 Installation requirements: -

- i. The HAHW system shall not infringe dimensions as per envelope drawing given in annexure-I.
- ii. AC voltage range 110V to 230V, 50 +/-3Hz. shall be made available at installation site by Railway. The maximum load on the power supply system should not exceed one KVA.

#### **7.0 Functional requirements: -**

- i. Train parameters to be acquired: - Temperature of axle boxes, wheels treads/rim/brake disc and speed of a wheelset.
- ii. 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.

#### **8.0 Hardware requirements: -**

- i. In case the sensors are mounted on the rail or tie/sleeper or specially designed sleeper by tenderer, the technical details and drawing(s) of such sleeper should be forwarded by purchaser to RDSO for technical clearance.
- ii. UPS system of at least 8 hours on back-up power and to charge the back-up batteries from main power shall be provided to automatically switch to back-up battery power in case of failure of main power.
- iii. The HAHW system shall have provision for integration with RFID reader likely to be installed by IR in future for automatic identification of vehicles.

#### **9.0 Software requirements: -**

- i. 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 10000 trains.
- ii. The supplier shall be responsible for providing required software for collecting data, storage and presentation of reports sent by the trackside equipment.

#### **10.0 Safety Requirements: -**

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.

#### **11.0 Output requirement: -**

- i. 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 website shall have the following features: -
  - a) Password based access so that only authorized personnel by DRM-Mechanical can enter/edit/view/download data and reports
  - b) Differential privileges to different levels of users to access the resources of the website
- ii. The supplier shall supply a desktop computer at nominated place by DRM-Mechanical of the configuration as specified in the clause on concomitant accessories.
- iii. 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.

- iv. Detailed report: - This report shall be in detail showing all parameters as acquired by the remote wayside detector.
- v. 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.
- vi. 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.
- vii. Diagnostic reports: - The system shall be capable of running self-diagnosis programs and report the result through the website and by SMS.
- viii. 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:
  - Date / time of train
  - Direction of movement
  - Vehicle position from start of train
  - Axle number where the parameters were found out of range.
  - Short description / error code

In case of error in recording or any system failure, alarms shall be generated and transmitted similarly.
- ix. Basis of alarms: - It should be possible to raise the alarms, at least for the following conditions:
  - a) When the temperature of the axle box or the wheel exceeds the specified temperature. This should be of multiple level thresholds.
  - b) When the temperature of the axle box or the wheel exceeds beyond a certain limit above the ambient temperature.
  - c) When the difference in temperatures of the axle boxes on the same axle is different beyond a certain limit.
  - d) 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
  - e) 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.
- x. 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.

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.

## 12.0 Submission of documents:

- (i) **Test certificates:** Test records, test certificates, performance curves, tables, etc., of all inspections and tests, whether or not witnessed by IR personal, 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.
- (ii) All test certificates shall be endorsed with sufficient information for identification of the equipment and, material to which the certificates refer.

## 13.0 Type of Tests:

- (i) 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 requirements of the specification.
- (ii) Inspection and testing shall comprise, but not limited to :
  - a. Mechanical and chemical testing of materials
  - b. Destructive and non-destructive tests of materials
  - c. Checks of fits and assemblies.
  - d. Dimensional checks.
  - e. Inspection of paints and coatings
  - f. Electrical tests
  - g. Functional tests, Performance tests
  - h. Acceptance tests:
    - Type tests
    - Routine tests
    - Proving-out tests
- (iii) The techniques, equipment and instrumentation to be use for these tests, checks, inspection, examinations, etc. shall be in accordance with internationally accepted standards, rules or codes, and in particular those mentioned in the specification.
- (iv) 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 IR.

## 14.0 Proving-out test requirement: -

The supplier and the DRM-Mechanical shall conduct the following proving out tests after commissioning: -

- i. **Consistency test: -**
  - a) 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%.
  - b) The complete data report (without missing any axle) including temperatures for at least 90% of the trains passed shall be generated.
  - c) **10 axles randomly selected, temperature will be checked by handheld calibrated IR temperature Gun at the nearby station in stopped condition. The variation in result should not be more than 5%.**
- ii. **Calibration test: -** In addition to calibration test during the commissioning of system, the autocalibration functionality shall also be demonstrated at the site during the commissioning of the system. The error should not exceed 2%.

**15.0 Literature: -**

The supplier shall provide following literature in two copies to DRM-Mechanical along with the delivery of HAHW system.

- i. Complete drawings
- ii. Operating manual
- iii. Maintenance manual
- iv. Spare part catalogue

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

**16.0 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, 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

**i. Supply: -** Supply of

- a) HAHW site equipment
- b) Concomitant accessories
- c) Spares
- d) Maintenance tool kit
- e) Literature
- f) Material, as required for civil engineering work
- g) Power cables, as suitable to the trackside equipment
- h) Modem, as suitable to the trackside equipment

**ii. 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: -

- a) Civil engineering and other allied works (if required) such as construction of hut of suitable size to house UPS, batteries, electronic and electrical equipment, solar power system etc.; grouting supports for steel enclosures/equipments, control box, battery box etc., necessary work e.g. trench etc. for power cables for a maximum distance of three km. In case the offered system requires track crossing or sleeper replacement, the offer shall be evaluated by Research Directorate of RDSO in consultation with Track Directorate of RDSO and necessary approvals shall be organized. Therefore the supplier shall provide the required technical details in the offer.
- b) 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.
- c) 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 finalized 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.

**iii. Web-server –** The supplier shall launch and maintain an internet web –server at any location with following features-

- a) Multiple User password protected log-in
- b) Differential access and usage rights to multiple level of users e.g. write-only, read-only, administrator rights



- c) Facility to export data in other data base formats e.g. MS-Excel and XML.
- d) The supplier shall offer at least two designs for web-user interface for selection.
- e) Sufficient capacity to handle data traffic with fast data transfer rate for all authorized users (to be controlled by providing username and password) who shall access through public internet access.

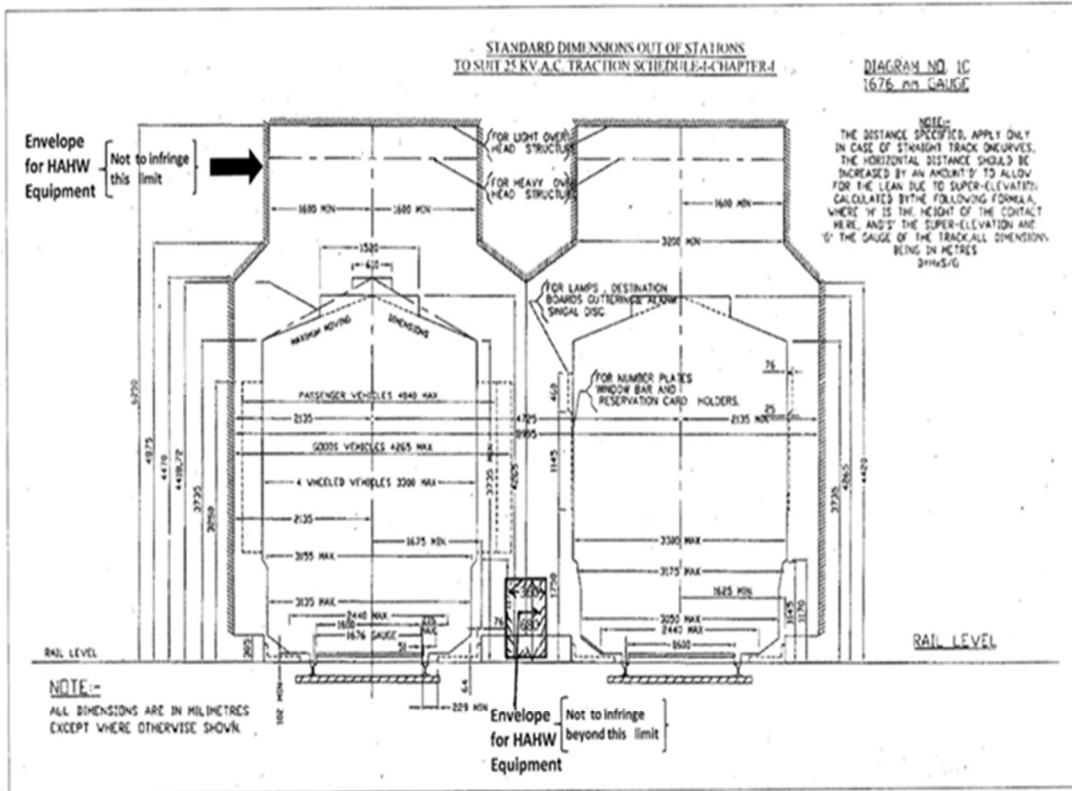
**iv. Ownership and confidentiality of data and software:** - All the data being generated by the HAHW equipment, website, servers etc. with respect to Indian Railway operations shall be the property of Indian Railways.

- i. 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 Indian Railways if found suitable.
- ii. The data shall not be divulged by the supplier to anyone other than DRM-Mechanical and to those authorized by DRM-Mechanical.

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

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Annexure -1



FEM