RAILWAY ENGINEERING

SPECIFICATION

HOT BOX DETECTOR SYSTEM

HTK-499

HTK 499 HOT BOX DETECTOR SYSTEM

1. Hot Box Detector And Associated Equipment

1.1 System Overview

The HTK 499 Hot Box Detector (HBD) is designed specially for detecting the temperature of bearings through collecting the infrared heat generated from these mentioned components of a train. The detection is achieved on real-time basis so a hot bearing can be traced and monitored and alarm can be raised if the temperature exceeds the alarm settings. The alarm is set at three settings of "Warm", "Hot" and "Extreme Hot".

The HBD consists of a processing computer unit, a scanner and a wheel sensor. The wheel sensor activates the scanner when a train is approaching. The Scanner will then scan and collect the infrared heat from the passing bearings and converts it into electric signal. The processing unit will then process the signal and forward the processed data to the External Notification System (ENS). The ENS shall be able to receive the process data within 2 minutes after the train passes.

The HBD measures the temperature of the bearings on moving trains at speeds of 3-240 km/hr (freight car and passenger car). The measurements are compared against the pre-set alarm levels. If a measurement is found to be outside the alarm limits the system raises an alarm via the communication channel. The system also gathers information on the bearing temperatures for statistical analysis and trending studies and dissimilates the information via the communication channel.

The Associated Equipment of the HBD System includes AEI Reader (AEI), Hot Wheel Detectors (HWD), Dragging Equipment Detectors (DED), Local Radio Notification (LRN), External Notification System (ENS) and Remote Access (RA) depending on the Purchaser's need.

1.2 The HBD System Requirements

1.2.1 System Location

The location of the HBD and Associated Equipment will be determined by the Purchaser of the equipment. In general, the following Items should be provided by the Purchaser :

- Nominate a section of track with at least 80km of straight line on solid trackbed.

- Provide power supply source of 240V AC +/- 5% 50Hz at site.

- Build an equipment hut with areas of $12m^2$ (3mx4m) and not less than 2m high within 30m from the track. Hut shall have air conditioning to limit the inside temperature of the hut between 0^oC and 40^oC.

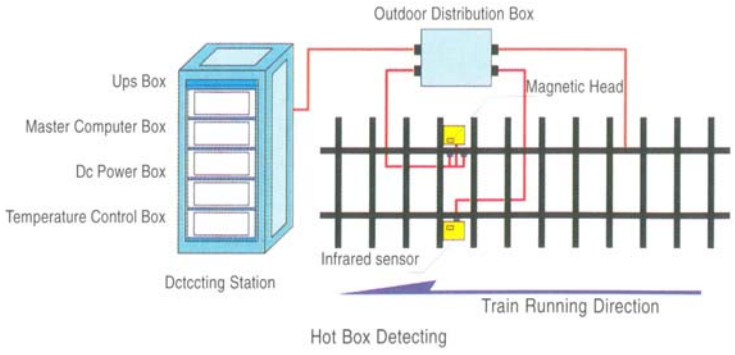
- Carry out all necessary civil work on site.

- Provide a dedicated telephone line for connection to the External Notification System ("ENS") at a location to be determined by the Purchaser. The dedicated phone line shall be "on-line" continuous for 24hours, 7 days a week.

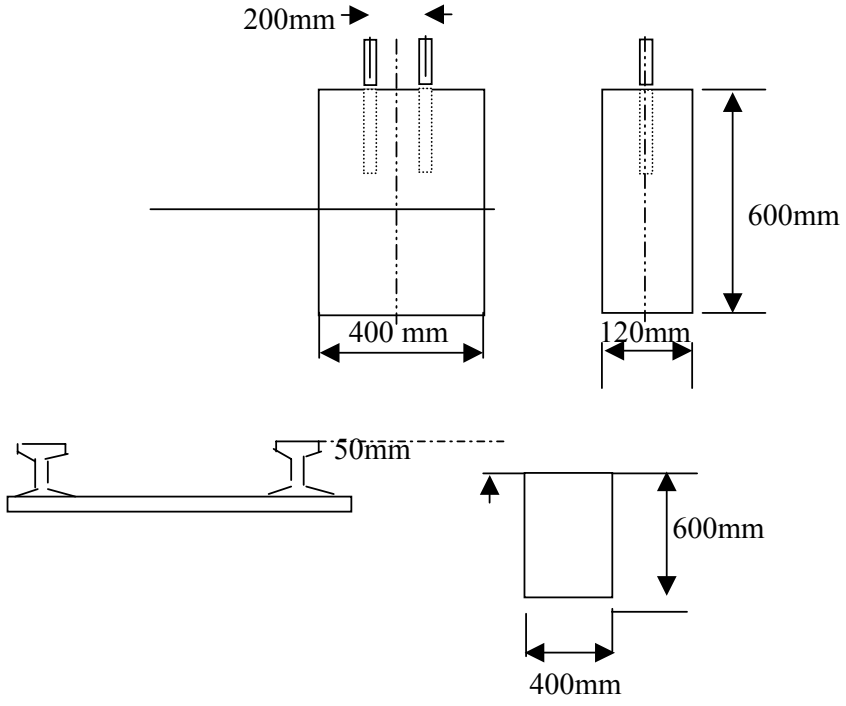
1.2.2 Groundline

The equipment in the hut and the sensors on the track should be protected from lightning strike in which two groundlines are to be established.

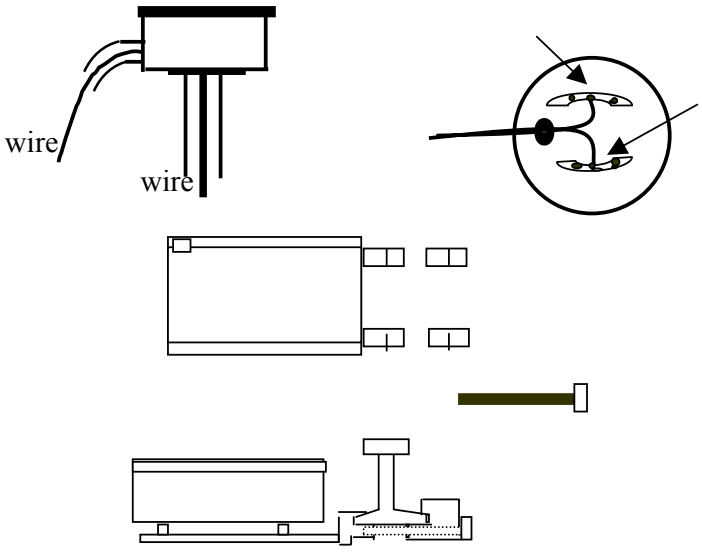
1.3 Installation



• The base of junction-box, and the installation of junction-box



• The installation of the wheel sensor and the detector box



2. The HTK-499 Hot Box Detector System

The HBD System consists of :

Hot Box Detector (HBD):

- Wheel sensors, which determine wheel presence.

Type U permanent magnetic with circle around. it can produce faradis mvoltage when the wheel passing and provide the signal to the host to handle.

Technique index sign:
Direct current resistance:1800 Ω
Static voice 〈 50 MV
The minimal speed of car is 3 km/h.

- Temperature Scanners, which measures the bearing temperature

Technique index sign:
Static sensitive degree : 50 mvs
Static voice 〈 30 MV
The rate of signal compare with voice >15db
The scope of train speed is :3-240km/h
Environment temperature:-45 — +80 °C

• Field Unit Processor, which processes wheel sensor inputs and bearing

temperatures to determine alarm conditions. It communicates the alarm information to the ENS Computer and the train driver. It also communicates the individual bearing temperatures to ENS Computer for statistical analysis and trending studies.

• Lightning, Spike,and Surge Protection
• UPS supply
• Equipment chest

The Associated Equipment consists of :

- **AEI Reader**, which identify the tags fitted to the vehicles.
- **Hot Wheel Detector (HWD)** which measures the temperature of wheels and brake disks of vehicles. It is same as hot bearing scanner.
- **Dragging Equipment Detector (DED)** which identifies any dragging equipment, such as a loose brake.
- **Local Radio Notification (LRN)** which advise each train driver via local train radio of any defects on the train.
- **External Notification System (ENS)** which enables downloading of field data to the external computer via modem.

3. Field Unit Processor to ENS Computer Primary Communication Interface

C.C.I.T.T RS-232C V.24 standard Baudrate：1200, 2400, 4800 and 9600. The data bits is 8 bits. The stop bit is 1bit. The parity bit is Odd. The flow control selection is None.

The interface has the ability to interface with the following methods of communication:

- Dedicated two/four-wire multi-drop leased line with modems operating in accordance with the CCITT V23 transmission standard.

- Public Switched Telephone Network with Dial -up modems. The modems use the Hayes compatible AT commands to control the modems. The interface allows the entry and alteration of the telephone number to be dialed to connect to the Manage system.

- GSM Cellular Telephone Network with GSM modems. The interface has the capability to interface with the GSM modems by using Hayes compatible AT commands to control the modems. The interface allows the entry and alteration of the telephone number to be dialed to connect to the TCMS system.

- Radio modems. The interface has the capability to interface with radio modems that have performance similar to the V23 modems regarding the RS-232 interface and allow for the times to establish reception and transmission.

- Direct cable connection.

4. The messages include:

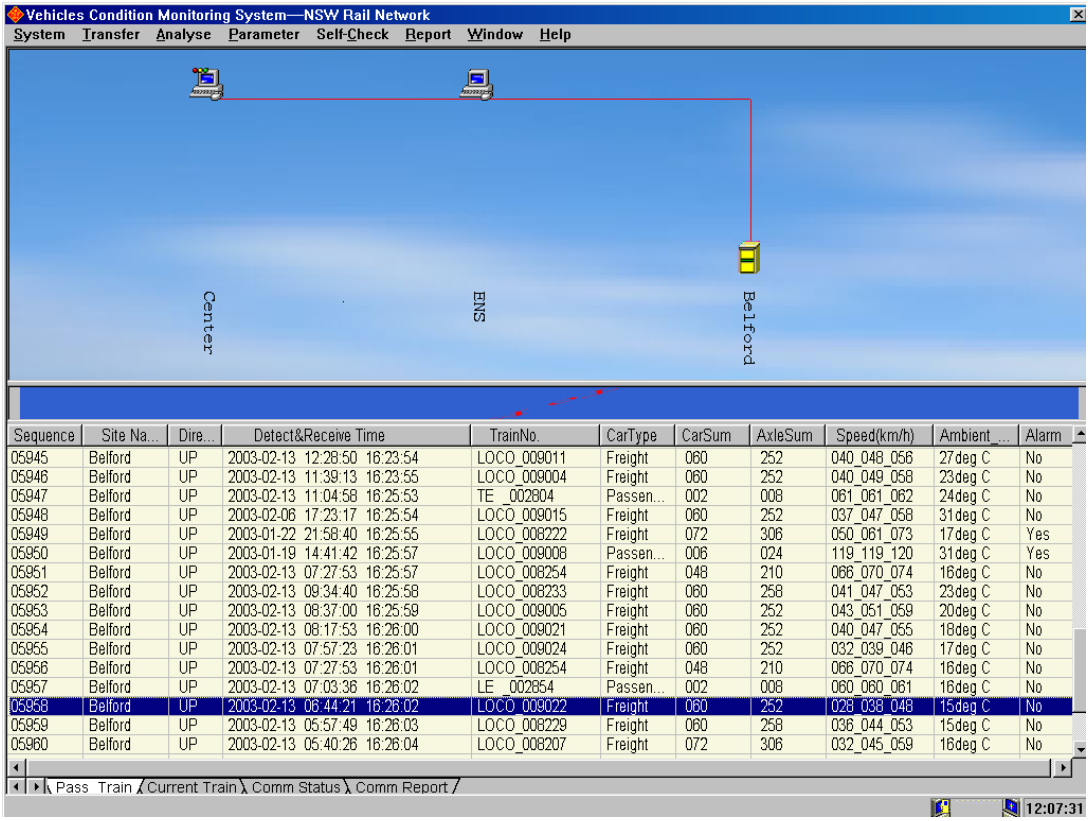
4.1 The message from the Field Processing Unit to the ENS Computer

4.1.1 No Message answer.

4.1.2 Message for the result of Self-check .

4.1.3 Message for the System acquiring train .

4.1.4 Message of the train condition tables . The message shall contain the following information.



- Message Identification header;
- Site Identification to identify the unit;
- Date and time of the passage of the train.（Time is recorded to the nearest whole second）;
- Number of Train and each vehicles.(If AEI equipment is selected);
- Direction of travel;
- minimum and maximum train speed;
- The Outdoor ambient temperature;

- Number of axles on the train;
- Number of vehicles on the train;
- Length of the train in metres;
- Number of times an axle miscount has occurred;
- train type ("freight" or class of passenger train);
- number of bearing boxes with a low temperature ;
- number of bearing boxes with a medium temperature ;
- number of bearing boxes with a high temperature;
- number of the hot bearing box ;

Report the following data for each vehicle of the train:

- the wagon axle number, starting at the brake handle end ;
- the bearing box temperature ;
- the alarm level (low, medium high) for the bearing box temperature ;

4.1.5 Message for the hot bearing

- Message Identification header
- Site Identification to identify the unit.
- Alarm sequence number
- Train Number if available.
- Alarm Time
  - Vehicle position in the train from the front.
  - Axle number on the train
  - Axle number on the vehicle
  - Side of the vehicle where the alarm occurred
  - Direction of travel
  - Type of alarm (Absolute Alarm Level, Average Deviation Alarm Level.)
  - Alarm level : warm, hot, extreme hot

4.2 The Message from ENS Computer to the Field Processing Unit

4.2.1 Site Identification to identify the unit.
4.2.2 Call data from the unit.
4.2.3 Acknowledgement messages for the information transmitted from the Field.

4.3 The Message from to the Field Processing Unit to the Train Driver

Message for the hot bearing (If a Local Radio Notification System is included.)

5. MAJOR COMPONENT CHARACTERISTICS:

5.1 Description

The Field Unit Processor obtains the temperature measurements and axle information from the passing trains. It presents the temperature measurements in Degrees Celsius for each bearing on both sides of the train. The Field Unit Processor compares each temperature measurement to the pre-set alarm level. If the value exceeds the limit, an alarm is raised to indicate the faulty bearing. The Field Unit Processor extracts the train composition information from the measured axle information. The Field Unit Processor executes self-check procedures to determine the operational status of the system. The Field Unit Processor stores and updates the configuration parameters. The Field Unit Processor stores train condition tables and hot bearing alarm tables.

5.2 Performance Characteristics

5.2.1 The system completes analysis of the train within 10 seconds from the last axle passing the detection site，without identify the "The end of Train" tags. In the event of a train stopping on the detector site, the train can be processed to identify the hot bearing alarms for all the vehicles that have passed the measurement point. The hot bearing alarms is communicated to the ENS Computer and the Train Driver.

5.2.2 The System process temperature measurements for each bearing on the train from the Bearing temperature scanner

- Irrespective of the direction of travel,
- For train speeds between 3 km/h and 240km/h.
- The results shall be in Degrees Celsius.

5.2.3 The system automatic identify the bearing type of each axle passing the measurement site, i.e., roller bearing or plain bearing.

5.2.4 The system measures both sides of a train consisting of a thousand axles . If the train is longer than a thousand axles, the system generates an alarm message.

5.2.5 The system determines the instantaneous speed of each of the axles. The system shall process the wheel pulses for train speeds between 3 km/h and 240 km/h. The speed is measured to an accuracy of 2% and presented with a resolution of 1 km/h.

5.2.6 The system transmits the hot bearing alarms immediately after completion of the analysis of the train.

5.2.7 The system transmits the hot bearing alarm information to the Train Driver using the Field Unit Processor To Train Interface.

5.2.8 The system transmits the train condition tables immediately after completion of the analysis of the train.

5.2.9 The system stores the train condition tables and the hot bearing alarm tables in a non-volatile store with a capacity for storing 240 trains consisting of 1000 axles each. The system shall use First In First Out principle to store the information of the last two hundred and forty trains.

5.2.10 The system allows the Technician to retrieve the train condition table and hot bearing alarm table from the stored tables.

5.3 Temperature Scanner

5.3.1 Description.
The Temperature Scanner measures the temperature of the passing bearing and provides a signal for further processing.

5.3.2 Performance characteristics.
The system measures both sides of the train simultaneously. The temperature measurement is between Ambient temperature and 200 Degrees Celsius.

5.3.3 The measurement result is independent of the direction of travel.

5.3.4 It is possible to measure temperatures for speeds between 3 km/h to 240 km/h.

5.3.5 Temperature Scanners is High-speed Heat sensitive resistance。

6. SYSTEM FEATURES

6.1 Rail Track

The HTK-499 HBD System are suitable for use on the following rail track :

- 47kg, 53kg, 60kg and 70kg rail
- Timber, concrete or steel sleeper

6.2 Power Failure

The HTK-499 HBD system shall include equipment to ensure that it continues to operate for not less than 24 hours after the loss of mains power. The HBD shall include batteries, battery charging equipment and automatic power supply switching components.

6.3 Environmental Compatibility

The HTK-499 HBD system offered is designed for continuous all-weather operation with particular reference to the following design parameters:

- Relative Humidity in the range 0% to 90% non-condensing,
- Rail Temperature in the range -20º to +70ºC, and
- Site ambient air temperature in the range -15º and +50ºC, as measured in shade 1.5 metres above the ground.
- Equipment to be fitted in contact with or adjacent to the track shall be designed to permit rapid replacement and should be capable of remaining in situ with its accuracy and utility being unaffected by mechanical tamping and vibration such as may take place during track maintenance procedures.
- Due to the proximity of the track, equipment will be exposed to high dust levels arising from passage of trains. The dust is known to be highly corrosive in conditions of high humidity. All equipment offered either for use within the site or for installation within close proximity of the track shall be suitable for these conditions.

6.4 Electromagnetic Compatibility

The HTK-499 HBD system will not interfere with, or be affected by, the operation of existing electrical, signalling or communication systems in use within the vicinity of each installation.

The HTK-499 HBD is suitable for operation in a busy either electrified or non-electrified lines.

The HTK-499 HBD will be unaffected by vibration, electro-magnetic radiation, induced or leakage currents, power surges or interruption, supply change-over, or any other ambient conditions typical to that environment.

The HTK-499 HBD will not interfere with or be affected by any track circuits used for railway signalling whether they are of the audio frequency jointless type, DC or the high voltage impulse type.

The HTK-499 HBD will be suitable for use in locations where Automatic Train Protection (ATP) is installed. The HBD will not interfere with the operation of ATP and shall not be affected by the operation of the ATP.

7. SPECIAL TESTING INSTRUMENTS FOR HBD

There are a number of Special Testing Instruments for the HBD.

7.1 Data Processor's Plug-in Board Tester

The Data Processor's Plug-in Board Tester (DPPBT) is an intelligent device for testing various plug-in boards fitting to STD bus in data processor as well as the ENS.

7.2 Simulated Signal Generator

The Signal Generator (SG) is used to generate simulated signals including train approaching, ambient temperature, axle journal temperature, etc to test the processing unit without field data input.

7.3 Functional Calibrator (In-Door Type)

The Functional Calibrator (FC) is used in the workshop/laboratory to calibrate and test the various settings of the scanner.

7.4 Infrared Temperature Meter

The Infrared Temperature Meter (ITM) is a hand held device and is used to measure the temperatures of the passing bearings.