RAIL COACH FACTORY, KAPURTHALA

(MECHANICAL DESIGN DEPARTMENT)

SCHEDULE OF TECHNICAL REQUIREMENTS FOR GLOBAL POSITIONING SYSTEM (GPS) BASED PASSENGER INFORMATION SYSTEM FOR GARIB RATH SLEEPER COACHES

MDTS 172 REV.-NIL DATED : 14.11.2006

NAME	DESIGNATION	SIGNATURE	DATE	LEVEL
RAKESH DUGGAL	SSE/FD		14-11-06	Prepared
PRADEEP SHARMA	ADE/D1		14/11/06	Agreed
RAVI NARULA	DY.CME/D		14/11/06	Reviewed
S.K. AGRAWAL	CDE		15/11/06	Approved

Issue/Rev	Details of Changes	Date

PREPARED BY

14/11/06

AGREED BY

1. SCOPE:

1.1 This specification covers the requirement of design construction, pre-wiring, performance, tests, supply, commissioning and after sales service of Global Positioning System (GPS) based Passenger Information System (PIS) for Garib Rath Sleeper Coaches of Indian Railways.

1.2 These trains are proposed to run on the following routes of Indian Railways:

a) Delhi-Patna

b) Delhi-Mumbai

c) Delhi-Chennai

d) Saharsa-Amritsar

Lockable route selector control to be provided to ensure assess by authorised personnel only.

1.3 The system shall be designed as a standalone unit with 110 V AC input for its operation. Position Data of the current station location shall be received from Geostationary Satellites through GPS receiver module attached with antenna. Necessary electronic circuitry including power supply, shall be built inside the Display Board Unit (DBU) or in a separate enclosure suitably housed near the DBU. The DBU shall be driven with high intensity LEDs. System software shall be an integral part of the unit which also incorporates display route data based on defined route map. **Provision to be kept for later on change of Route Map as per requirements of Traffic Deptt. Of IR.** There shall not be any wiring between the coaches. The display unit provided inside the coach shall display the following :-

- Welcome message
- Message about Next approaching station
- Message for displaying the name of approaching station

PREPARED BY

14/11/06
AGREED BY

- Real Time Clock, Train Speed and Journey Route (Up or Down Train).
- Message for displaying the name of current leaving station
- General information and instructions related to passenger safety, as agreed between manufacturer/supplier and the purchaser/user
-
- The system should be capable of displaying up to 20 No.s of Bilingual Messages

1.4 The GPS receiver module shall receive the co-ordinates (longitude and latitude) information of the current location from Geostationary Satellites through GPS antenna which shall be mounted on the coach roof and attached with the GPS receiver. The information is transmitted to the CPU which in turn decodes this position information received and fetches the index code of the location name from the stored data.

2. SERVICE CONDITIONS:

2.1 The equipment shall be sturdy and suitable for the following service conditions normally to be met in service:

2.1.1	Ambient	:	-5°C to +55°C
2.1.2	Train speed	:	Up to160 kmph
2.1.3	Humidity	:	Up to 98% during rainy season
2.1.4	Altitude	:	Max 1200 metres above sea level
2.1.5	Atmosphere	:	Very dusty atmosphere with dust of composite brake block shoe. Seasonal heavy snowfall and fog is expected in service.

14/11/06

PREPARED BY AGREED BY

2.1.6 Vibrations : The equipment, system and their mounting arrgt shall be designed to withstand the vibrations and shocks encountered in service as specified below:

a) Maximum vertical acceleration : 3.0 g

b) Maximum lateral acceleration : 3.0 g

c) Maximum longitudinal acceleration : 3.0 g

('g' being the value of acceleration due to gravity)

The vibrations are sinusoidal form of vibration, the frequency 'f lies between' 1 Hz and 100 Hz and their amplitude 'a', expressed in mm, is given as a function of 'f' by the equation:

$a = 25/f$ for values of 'f ' between 1 Hz and 10 Hz

$a = 250/f^2$ for values of 'f ' between 10 Hz and 50 Hz

3. SCOPE OF SUPPLY:

3.1 1. DBU consisting of followings:-

a)	Power supply module	:	1 Nos./coach
b)	GPS receiver	:	1 Nos./coach
c)	CPU module	:	1 Nos./coach
d)	LED Matrix board	:	1 Nos./coach
2. Antenna with connection cable.		:	1 Nos./coach
3. Power Supply Cable		:	1 Nos./coach
4)Any special/Screened Cable if required:			1 Nos./Coach

PREPARED BY

14/11/06

AGREED BY

4. STANDARDS:

RDSO/ELRS/SPEC/S1/0015	:	Reliability of electronics used in Rolling Stock application
IEC 1108-1 (1996-06)	:	Global Positioning system (GPS) – Receiver equipment-Performance standards, Methods of testing and required test results.
IEC 60077	:	Rules of electric traction equipment
IEC 60571	:	Electronic equipment used on rail vehicles

5. POWER SUPPLY SYSTEM:

5.1 The general lighting inside the EOG coaches is provided by 110 V, 50 Hz AC supply derived from 750 V, AC, 50 HZ supply from power car through inter vehicle couplers and 50 KVA cum 3 KVA step down transformers. This 110V AC supply shall be provided to GPS based passenger information system for its operational requirements.

6. TECHNICAL REQUIREMENTS:

6.1 Passenger Information Board

The passenger information board shall be mounted in each car to display visual information like approaching station name, journey messages etc. to the train passengers. The unit shall be –

- Microprocessor based control
- Data communication via RS-485 data bus
- Software controlled multiplexed data for LED driving
- Individual LED accessibility for controlling and inbuilt control for Auto dimming based on ambient light intensity.

PREPARED BY

14/11/06

AGREED BY

- Overall LED display area – As maximum as permitted by overall size of DBU.
- Character height – 80mm approx.
- DBU / LED specification –
  - Size : Either 3mm dia through hole type with 16 rows and 112 columns (one line scrolling) at a pitch of 5mm (both in Column and Row)
    OR SMD 0603 with 16 Rows and 128 Columns (one line scrolling) centred at 4.5 mm pitch alongside the Row and 5 mm alongside the Column(Between Two Rows), from reputed manufacturer.
  - Colour : Red
  - View angle: +_ 45 degree.
  - Intensity : >100 mcd
- Multilingual (Hindi & English) alphanumeric display for journey messages
- Light Grey colour shade_Enclosure to shade no. 631 of IS:5-94, as approved by RCF, with provisions for fixing to meet vehicle interior requirements
- Antiglare, tinted, toughened glass screen to protect and enhance contrast ratio
- Power input : 110 V, AC ± 15% (Max. 70 W per display)
- Operating temperature range -5 °C to +55°C
- Relative humidity – upto 95% (non condensed)
- Overall size of DBU shall not exceed 600mm (Length) x 140mm (Width) x 100mm (Depth). Supporting electronic circuitry can be enclosed in a separate enclosure of suitable size and at suitable location as approved by RCF. Suitable, elegantly designed **mounting brackets are to be supplied with the system** for easy and sleek installation inside the coach.

14/11/06

PREPARED BY AGREED BY

- Since the trains are required to run on 4 defined routes, provisions shall be made on each display to select the route through lockable route selector control to avoid unauthorised assess. **Provision to be kept to ADD or EDIT data in future for any other than specified route also.**

- Route mapping shall be done by the supplier and a copy shall be submitted to RCF for reference.

6.2 GPS Specification

- L1 Frequency, C-A code (SPS) with 12 (or higher) independent tracking channels.
- NMEA-0183 compatible output.
- 1Hz update rate.
- Reacquisition Time <250m sec.
- Cold start better than 35 seconds.
- Hot start better than 5 seconds.
- Antenna- external, active passive with built in antenna bias circuitry.
- Antenna short circuit protection.
- Built in Antenna supervisory circuit for determination of active antenna open or short state.
- Built in non-volatile RTC with battery backup option.
- Should be provided with magnetically mounted active antenna powered directly through GPS receiver.
- Operating Temperature -40 C to +85 degree centigrade.

7. CONSTRUCTIONAL REQUIREMENT:

7.1 Robust designed, Powder Coated Housing in Light Grey colour shade, both for DB'' and supporting electronic circuitry box shall be constructed out of minimum 0.8 mm thick CRCA sheet to IS: 513 Grade-O.

7.2 All the above units in PI system shall be inter connected by means of reliable connectors. The wiring of the solid state devices and the PCB etc. shall meet the above RDSO specification requirements.

7.3 Sound engineering practices shall be adopted in fabrication of the boxes.

PREPARED BY

AGREED BY 14/11/06

7.4 The components of the panel shall be mounted as approved by RCF. All operational controls shall be provided on the panel and shall be accessible to the maintenance personal.

7.5 The power supply cable used should be of Electron Beam cross linked cable type or equivalent rated PTFE cables.

7.6 The wiring shall be with PTFE cable wherever required and bus arrangement for RS 485 ports. The wiring shall be such that to facilitate easy maintenance and safety of the operator.

7.7 All the terminal boards used in the unit shall be of FRP/SMC and properly secured to rigid members of the panel

7.8 The power source arrangement shall be preferably inbuilt in the DBU, however due to dimensional constraint of the DBU, power supply can be separately mounted in supporting electronic circuitry box.

7.9 The power connections to the terminal board for various units shall be terminated properly taking into consideration the creepage, clearances, safety, etc.

7.10 All the control connections, wherever necessary, shall be terminated in a terminal board with terminal studs and numbered for easy maintenance as per the scheme. The usage of plug in type connectors of any approved make shall be desirable.

7.11 All the units shall be provided with mounting holes for fixing in the coach. The minimum size of the fixing screws shall be M6 hexagonal head galvanised screw.

7.12 Earthing lug shall be provided on the units for external coach earthing connections.

7.13 The plug in type connectors shall be accessible by the operator for easy connection and removal during service with protection for un-authorised assess.

14/11/06

PREPARED BY AGREED BY

7.14 The supplier shall get approved the following details for all the items before supply :-

i) Fixing dimensions in mm

ii) Overall dimension in mm

iii) Schematic/Block diagram with component details.

iv) Weight in kgs

7.15 The dimensions and mounting arrangement of the equipment mentioned in this specification are tentative and shall be finalized mutually between purchaser and supplier till approval of prototype by RCF. The dimensional drawings with all details including the weight of the equipment shall be submitted for approval by ICF.

7.16 The display unit shall have IP-23 protection and the antenna unit shall have IP 54 protection.

8. INSPECTION:

8.1 All materials and work covered by this specification shall be inspected by agency nominated by RCF.

8.2 The equipment offered shall be tested at RCF or firm's premises or both, as per this specification subject to overall satisfactory performance of the system, to certified by inspecting agency of RCF.

8.3 The cost of the inspection of the ordered equipment and the works shall be borne by the manufacturer.

8.4 The manufacturer shall inform RCF well in advance for carrying out the inspection of the ordered equipment.

9. TESTS:

9.1 One complete unit from the ordered quantity, with all accessories, shall be type tested for prototype tests (clearance).

PREPARED BY

14/11/06

AGREED BY

9.2 The following shall constitute the type tests and shall be done on the firms unit for each purchase order unless otherwise stated and in every 50th unit, if the ordered quantity is more than 50 numbers. These tests shall be conducted at the manufacturer's premises. All the facility for the conduction of the tests shall be provided by the manufacturer at the manufacturing premises free of cost.

9.2.1 Check for dimensional requirements, as per approved drawings :-

All the requirements covered in the specification and approved drawings shall be checked by using appropriate test equipment such as gauges, scales, fixtures, etc. available with the manufacturer.

9.2.2 Check for constructional requirements, as specified and as furnished in the approved drawing as well as for sound engineering practices.

9.2.2.2 All the requirements specified in this specification and in the approved drawings as well as for sound engineering practice shall be checked. For items like, operations involved for cleaning before painting, the practices adopted by the manufacturer shall be checked in the manufacturing process of similar items.

9.2.3 Insulation Resistance Test:

The insulation resistance of the unit shall be more than 10 mega ohms, when tested with an insulation tester having an output voltage of 500V, dc between the input and output terminals, shorted together and the earth terminal on the enclosure, in the prevailing ambient conditions.

9.2.4 Dielectric Test:

The unit shall be subjected to voltage of 1.5 kV with nominal frequency of 50 Hz from a high voltage tester for one minute between the earth terminal on the enclosure and the input and output terminals shorted. The unit shall be considered to have withstood tests if neither a disruptive discharge nor a flashover occurs.

9.2.5 Performance Test:

9.2.5.1 The input voltage, input current, output voltage, output current, etc. shall be recorded at input voltage of 110V +- 15% AC.

9.2.5.2 During the performance test, the antenna shall be positioned stationary as well as the position changed to obtain the similar position of the moving train by distance variation and record the signals and parameters as specified by the manufacturer.

9.2.6 Test for protective features:

9.2.6.1

The required conditions shall be simulated to check those specified in the offer by the manufacturer:

i) Over voltage and under voltage at input terminals.

ii) Earth leakage and earth fault of the unit.

iii) Input connections with incorrect polarity.

9.2.7 Test for enclosure:

This test shall be done as specified in IS:13947 latest for IP23 and IP54 class as applicable or as declared by the manufacturer for display unit and antenna unit for fitment in the coach.

9.2.8 Vibration Test:

(To be done on any of first 25 units or in case of ordered quantity being less than 25 one out of the ordered quantity – Reference IEC 60571 – latest).

This test shall be done in three directions at right angles by securing the same to a machine producing vibrations of sinusoidal form with adjustable amplitude and frequency.

The frequency of the vibrating machine shall be progressively vary from 1 to 100 Hz within a time not less than four minutes, the amplitude of the oscillations being that indicated in clause 2.1.7 as a function of a frequency. If resonance is produced, the corresponding frequency shall be maintained for thirty minutes in each case. If no such resonance is observed, the item shall be subjected to vibrations at a frequency of 10 Hz with an amplitude of 2.5mm for 30 minutes.

The display and the CPU module unit shall be subjected to 50 Hz vibrations such nature that the maximum acceleration is equal to 30m/sec. (amplitude = 0.3mm), the equipment being in operation for two minutes.

PREPARED BY

14/11/06

AGREED BY

The display and the CPU module unit shall be considered to have met the requirements, if the same is functional with no damage or abnormality.

9.2.9 Endurance test:

9.2.9.1 The GPS receiver with antenna, power supply module, CPU module and LED matrix, display board shall be tested for endurance with an input voltage of 110 V + 25% - 30% ac for 40 hrs continuously. The unit shall perform with no error.

9.2.10 Dry heat & damp heat test (to be done on any one of first 25 units or in case of ordered quantity being less than 25 one out of the ordered quantity).

9.2.10.1 Dry heat & damp heat test shall be conducted on all PCBs of the display and CPU module as per the latest IEC 60571. The temperature for dry heat test shall be 70°C. The unit shall function normally after the test.

NOTE: A test procedure shall be agreed between the purchaser and manufacturer and the unit tested according to the agreed test programme at the manufacturer's premises. Cost of the test shall be borne by the manufacturer.

10. Marking:

10.1 All the individual units shall be provided with a name/rating plate on the enclosure. The following information shall be available either by etching process or by engraving or screen printed.

i) Manufacturer's name and address

ii) Serial number of the equipment

Note:

The first two digits shall indicate the year of manufacture

Next two digits month

Next three digits manufacturing serial number

14/11/06

PREPARED BY AGREED BY

11. Guarantee:

All the above units of the complete PIS system shall be guaranteed for a period of eighteen months from the date of commissioning or twenty four months from the date of supply whichever is earlier. Type defect, if any shall continue to attract guarantee obligation till the same is successfully overcome. The successful tenderer shall offer prompt, free after sales service during the guarantee period at RCF as well as at any of the Zonal Railways of India.

12. Maintenance Manual:
Successful tenderer shall supply one number of operational and maintenance manual per unit in addition 2 manuals extra per order. The draft copy of the manual shall have the RCF approval.

13. Spares:

13.1 The tenderer shall furnish a list of recommended spares for maintenance of all the individual units of passenger information system in the offer. The break up price of the spares offered shall be furnished. In case of custom built spares, brief write up shall also be furnished to identify the item in regard to their function in the item. Based on the experience of the Railways and the recommendations of the tenderer, supply of spares as needed would be included in the purchase order.

13.2 The tenderer shall also give a guarantee that the components/spares required for the unit would be made available for at least 15 years from the date of commissioning and would not become obsolete during the above period.

14. Details to be furnished by the tenderer:

i) Clause by clause confirmation on the requirements specified in this specification. Offers where clause wise comments are not furnished are likely to be **summarily rejected**.

PREPARED BY

14/11/06

AGREED BY

ii) Deviation, if any, shall be brought out clearly duly indicating the techno economical merits and demerits.

iii) Write up on the principle of design proposed, supported by dimensional, schematic/wiring drawing. The complete drawings in triplicate shall be submitted by the successful tenderer for approval by RCF before supply.

iv) Dimensions and weight for all of the individual units of passenger information system proposed.

v) Experience in design, manufacture and supply of comparable product, any supply made to Indian Railways with details of supply and service performance. The facilities available for manufacture, quality control and testing, for PCB and other solid state equipment.

vi) Infrastructure arrangement shall meet the requirement as specified in specification RDSO/ELRS/Spec/S1/0015 – Reliability of Electronics used in Rolling Stock application.

vii) After sales service centre details, with spares availability, their phone/fax numbers at major cities of different railway zones.

viii) The firm intending to do the work of providing passenger information system must have the experience in the field of passenger information system in suburban rail vehicles. Credentials including past experience shall be submitted with the offer.

14/11/06

PREPARED BY AGREED BY