# INDIAN RAILWAYS


## FUNCTIONAL REQUIREMENT SPECIFICATION

## FOR

## INDIGENIZED WHEEL SLIDE PROTECTION DEVICE

## FOR LHB COACHES

## OF

## INDIAN RAILWAYS

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# Functional Requirement Specification for Indigenized Wheel Slide Protection Device for LHB Coaches

## 1. FOREWORD

The Wheel Slide Protection (WSP) device fitted to a vehicle has the role of reducing excessive wheel slide resulting from brake applications in situations where wheel/rail adhesion is temporarily impaired (inclement weather conditions, fouling of the rail) and of preventing wheels from locking.

LHB type Mainline Coaches have been provided with Wheel Slide Protection Device. At present, Wheel Slide Protection Devices for LHB coaches are being imported from OEMs, which results in higher cost of the equipment. This FR specification is intended to develop Wheel Slide Protection (WSP) Device indigenously in India to reduce the overall cost of equipments and to ensure availability of spares and parts.

## 2. FUNCTIONAL REQUIREMENT

2.1 WSP shall conform to requirements as per UIC 541-05.

2.2 The WSP is activated by a temporary reduction in braking force. The WSP exploits available wheel/rail adhesion to a maximum and improves it by providing controlled wheel slide so that any increase in braking or stopping distance is kept to a minimum.

2.3 The WSP Unit shall retain full functionality, regardless of the braking force requested, up to a speed 20% greater than the maximum running speed of the vehicle for which it is designed.

2.4 The WSP Unit shall function reliably from maximum speed to a minimum speed of approx. 5Km/h.

2.5 The WSP Unit shall function reliably independent of the moving direction.

2.6 The WSP Unit shall have provision for automatically switch on and switch off for electrical supply to WSP Unit on receiving an electrical signal from pressure switch mounted in FP line in Brake Control Panel when the coaches are not in use.

2.7 The WSP Unit shall have Additional output lines for attachment of speedometer, vacuum toilet system and door sub-systems.

2.8 The WSP shall so vary the braking force as to make maximum use of available adhesion and improve it by providing controlled wheel slide.

2.8.1 Sliding of the wheel on the rail shall be restricted in order to avoid damage. This wheel slide shall not cause the axle to lock.

2.8.2 The speed of rotation of the wheel sets is calculated on the basis of information provided by sensors, and monitors by regulators or automatic control systems. This transit commands to the WSP actuators to reduce or restore braking power, either totally or partially.

2.9 The WSP Unit is to guarantee a sufficient and safe operation. Moreover, a failure of the WSP Unit should not have any influence on the braking function of this vehicle or of the whole train set.

2.10 The WSP shall not have a detrimental effect on the constituent parts of the vehicle i.e braking gear, wheel tread, axle box etc.

2.11 The consumption of compressed air as a result of WSP actuation shall be reduced to a minimum.

2.12 At no time shall the actuation of the WSP lead to a greater braking force being applied than initiated by the braking command.

2.13 The WSP system shall take permitted wheel diameter differences on a given vehicle into account when evaluating speed.

2.14 Power supply to the WSP shall be so designed as to guarantee that the WSP powers up. At the latest, powers shall be available when the vehicle is set in motion.

2.15 WSP systems require an electrical power supply to function, this can be provided by the vehicle or by the WSP itself.

2.16 If the electronic WSP does not supply its own power, fluctuations in power within the limits of ± 30% supply voltage shall not affects its functioning.

2.17 The WSP shall continue functioning without failure under fluctuations in nominal voltage of up to atleast ± 30%. If the nominal voltage fluctuation exceeds the limits where it does not work properly, the WSP shall shut down without disturbing the braking system. As soon as supply voltage reverts to the permitted range, the WSP shall automatically return to nominal functioning.

2.18 The WSP shall be capable of initiating tests or checks by means of which a number of malfunction or faults can be detected. Independent of these continuous tests, which are inherent to the electronic or micro processing system, availability tests and the monitoring of proper functioning shall be adopted to the technology employed and defined on the basis of fault analysis specific to architecture of each WSP and its environment. Testing and monitoring during running shall not impair the braking functions. On no account shall testing or monitoring jeopardise the securing of the train when stationary.

2.19 Any faults detected shall be displayed on the fault code and stored in a fault memory. In the event of power supply failure, WSP shall ensure that the fault codes remains stores in the memory.

## 3. DESIGN REQUIREMENT

3.1 The WSP unit shall consist of the following components:-

3.1.1 Microprocessor-based control unit (1 pc) consisting of the following
- I. Power Supply
- II. Control Unit
- III. Micro processor
- IV. Input/Output

3.1.2 Connector (1 Pc.)

3.1.3 Speed sensors (with cable of 2000mm length**)** with integrated amplifier (4 Pc) and mounting bracket

3.1.4 Connector Plug (4 Pc)

3.1.5 Anti Skid Valve (4 Pc)

3.1.6 Junction boxes for speed sensor (4 pcs)

3.1.7 Junction boxes for Dump valve (2 pcs)

3.1.8 Housing (4 pcs)

3.1.9 Phonic Wheels (4 pcs) with M8 bolts to IS:1364 Pt.III clause 10.9 and washers to IS:3063 type-B.

3.1.10 Cable for complete wiring of anti-skid system 150Mtr.

3.1.11 Pressure switch (1 pc) 1.3/1.8 $Kg/cm^2$ in FP line (if necessary to switch on/off the WSP depending on the pressure).

3.2 The WSP Unit should have sturdy design, long maintenance intervals and easy to repair.

3.3 The WSP Unit has to work axle-selective, that means it has to be a four-axle/four channel configuration.

3.4 It is to be ensured, that manual correction for wheel diameter is not required by WSP.

3.5 The standard execution unit shall apart from the wheel slide protection be equipped with the following additional speed depending signal and functions for: Controlled Discharge Toilet at 30 kmph. The speed output signal of WSP to CDTS should be remain closed contact for speed less than 30 kmph.

3.6 The microprocessor wheel slide protection shall have additional module for kilometre performance. So that total kilometre earned by the coach (WSP unit) can be recorded and it can be correlated with the Error Code.

3.7 The microprocessor unit housing shall have a standard 19" rack for the minimal execution. Supplier shall indicate maximum temperature and humidity for safe working of his equipment. The unit is proposed to be mounted in non-air-conditioned area of the coaches.

3.8 WSP software should have suitable user friendly interface and should store at least the following data w.r.t. time and date for minimum period of three months.

a) Error code

b) Dump valve activation date & time; Axle number and reference speed/speed of all four axles.

3.9 Supply voltage to microprocessor rack shall be 110V DC nominal.

3.10 The supply of the microprocessor shall switch-off automatically after a certain period of time when the vehicle is not in use.

3.11 Wheel slide protection system shall employ pole wheel of 80 teeth fitted on to Security disc to FIAT-SIG Drg. No. 1902094 ver-4 on the one end of each axle as shown in FIAT-SIG drawing No. 1268823 ver-02. For the purpose of standardization and enabling physical interfacing with the bearings, it is desirable that the pole wheel should be as per Parizzi Drawing No. V12014.

3.12 Axle box mounted speed sensor (one for each axle) shall be employed as a transmitter and shall fulfil the requirements of this specification. In order to achieve physical interfacing of speed sensor with front cover of axle box and pole wheel, the sensor shall be fitted in the front cover as per FIAT-SIG Drawing no, 1902713 ver-06 and 1902714 ver-07. The tenderer shall ensure it that proper gap between pole wheel and speed sensor is maintained for proper functioning of the wheel slide protection system.

3.13 The speed sensor should have the following characteristics:

- Protection against mechanical damage.
- Resistance to corrosion.
- Durable and maintenance free.

- Protection against HF interference.
- Temperature range from-5 deg. C to + 60 deg. C.
- Protection on all input and output against reverse polarity, and short circuit connection.
- Constant output signal, when stationary for functional diagnosis.
- Permissible insulation test voltage of 1500 VAC and 50 Hz for one minute.
- Blank flange with cover.

## 4. Energy Supply for Electrical/Electronic Components of the WSP Equipment

4.1 For the energy supply of electrical and electronic components of the WSP Unit a 110 V direct current voltage is available in the vehicles.

## 5. Mechanical Strength Requirements

5.1 All components of the WSP Unit are to be designed according to the mechanical strength requirements stipulated in UIC 566. If required corresponding proofs are to be submitted.

## 6. Service Life

6.1 The coaches manufactured by Indian Railways are designated for a service life of 35 years. The WSP Unit is to be developed and designed accordingly. The supplier should specify the recommended maintenance schedules/practices clearly to achieve the desired life.

## 7. Reliability

7.1 The reliability of the WSP Unit or the parts and components included in the supplier's scope of delivery is to guarantee a mileage of 200,000 km without any failures. The conditions for proving a trouble free mileage are to be coordinated with LHB. The design of all parts has to guarantee that under normal operating conditions a mileage of 1,000,000 km will be reached without any replacements. The supplier should specify the recommended maintenance schedules/practices clearly to achieve the desired life.

## 8. Design Suitable for Easy Maintenance

8.1 The design of the WSP Unit is to allow an easy maintenance.