

INDIAN RAILWAYS



SPECIFICATION FOR DOUBLE LEAF AUTOMATIC SLIDING DOOR FOR SUB-URBAN / METRO COACHES OF INDIAN RAILWAYS

S. No.	Month/Year of issue	Revision / Amendment	Page No.	Issues/Changes
1.	May 2020	Nil	-N/A-	Draft

Issued by:
Research Designs and Standards Organization
Manak Nagar, Lucknow - 226011.

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1. Introduction:

This specification covers the design, development, testing, manufacture, supply, commissioning, integrated testing including all hardware required for installation of pre-fabricated, pre-wired, double leaf automatic sliding door for sub – urban / metro coaches of Indian Railways.

The construction of door leaf, painting schedule, thermal and acoustic insulation shall be designed for mounting within the coach body space envelope without any interference.

The contractor shall provide the interface between TCMS & door control signals in accordance with the interface requirements for double leaf automatic sliding door. The contractor shall meet the communication protocol requirements of the TCMS.

The door control shall be interlocked with the train's zero speed circuitry so that the doors cannot be opened until the train is stopped.

In case of changes in the technical parameters for supply made by contractor, the same may be allowed, if they meet functional & technical requirements of this specification and relevant standards to RDSO clearance.

2. Definition & Explanation:

- 2.1 'Automatic closing' means powered closing of the door without intervention by the passenger.
- 2.2 'Door operation' means all door operating sequences.
- 2.3 'Enabled door' means door released by the train crew or an automatic system to permit operation by the door button.
- 2.4 'Locked door' means closed door held closed by a mechanical device.
- 2.5 'Isolated door' means door which is locked and not available for use.
- 2.6 'Unlocked door' means door with mechanical door locking released.
- 2.7 'Train crew' means persons authorized to carry out the duties for door operation.
- 2.8 'Power operated door system' means door system which operates doors in opening and closing direction by machine power.
- 2.9 'Manual doors' means the doors closing and/or opening of which is operated by hand power of crew or passengers.
- 2.10 'Leading edge' means edge of the door, leading during closing movement.
- 2.11 'Contract' means agreement between manufacturer of the door system and buyer of that door system.
- 2.12 'Tenderer' means firm / company from whom the offer of the supply of automatic door locking and opening mechanism is invited.
- 2.13 'Contractor' means the present firm / company on whom the order of the supply of the automatic door locking and opening mechanism is placed.

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- 2.14 'Purchaser' means the Indian Railways on behalf of the President of India who are purchasing the automatic door locking and opening mechanism.
- 2.15 'Inspecting Authority' means the Organization or its representative nominated by the Purchaser to inspect the automatic door locking and opening mechanism on his behalf.
- 2.16 The Research Designs and Standards Organization, Manak Nagar, Lucknow – 226011 is hereafter referred to as RDSO.
- 2.17 Indian Railways is hereafter referred to as IR.
- 2.18 In case Tenderer needs any clarification in respect of any clause of this specification or regarding the drawings, the Tenderer shall obtain the same from purchaser / Director General (Carriage), RDSO.
- 2.19 'Engineers' means officials of the RDSO or any other officials authorized by RDSO, Lucknow.

3. Service conditions:

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

4.1	Ambient Temperature	0°C to +50°C
4.2	Train Speed	130 KMPH
4.3	Humidity	Up to 98% during rainy season
4.4	Altitude	Coastal area to maximum 1000 meter above sea level
4.5	Atmosphere	The dust sedimentation level shall be as per class 3S2 as per para A.2.4 of IEC: 60721-3-5
4.6	Rain Fall	Very heavy and continuous (heaviest in 24 hrs. is 994mm), Annual rainfall 1082 mm to 2500 mm. Max. Wind velocity 145kmph
4.7	General	Suitable for traction rolling stock application as per IEC 60077-1. The equipment's shall be designed to perform thermal shocks such as Sudden change of temperature while entering / exiting tunnel

The door system should be adequately protected against accidental short circuit due to dropped tools, fasteners etc. and stones thrown on the door system by the anti-social elements during abnormal situations.

The environmental conditions for Railway equipment are given in EN 50125-1, such as temperature range, humidity, pollution, ice snow and rain etc. Any deviation from the specified performance, e.g. at the temperature extremes, shall be specified in the contract.

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4. Governing Specifications: The following governing specifications (Latest revision) are to be referred:

- EN 14752 Railway applications. Bodyside entrance systems for rolling stock.
- EN 45545 Fire protection on railway vehicles.
- EN 61373 Railway applications. Rolling stock. Shock & Vibration Tests.
- EN 50155 Railway applications. Rolling stock. Electronic equipment.
- EN 50200 Method of test for resistance to fire of unprotected small cables.
- IEC 60571 Electronic equipment used on Rail vehicles.
- IEC 60077 Railway applications. Electric equipment for rolling stock.
- EN 60529 Degree of protection provided by enclosures (IP Code).
- EN 50121 Railway applications. Electromagnetic compatibility.
- EN 50125 Railway applications. Environmental conditions for equipment.
- EN 50126 Railway applications: Reliability, Availability, Maintainability and Safety
- EN 50128 Railway applications – Communication, signaling and processing systems.
- IEC 61375 Train Communication Network.
- EN 50215 Railway applications. Rolling Stock. Testing of rolling stock on completion of construction and before entry into service

5. Scope of Supply:

The scope of supply includes pre-fabricated, pre-wired double leaf automatic sliding door for sub – urban / metro coaches of Indian Railways with its associated accessories such as door control unit, micro switches including all hardware required for installation of the system. The door control mechanism shall be designed for a sliding door with a throughway of minimum of 1210 mm width and 1884 mm height unless otherwise specified. The scope also includes installation and commissioning of the complete door system inside the coaches of EMU / MEMU / Metro rakes.

The following are the physical equipment per door system unless quantity is mentioned specifically in the tender document.

- a. Minimum one pair of externally hung, sliding door. The doors shall be electrically driven.
- b. A pair of door leaf with a low noise bottom guide provision.
- c. A mechanism to isolate and lock the door mechanically both from inside and outside in eventually of any door failure. The isolation device is operable from both inside and outside of vehicle.
- d. A double-glazed insulated window glasses for each door leaf.
- e. One door operating mechanism with door control unit (DCU), drive motor and transmission along with associated equipment and limit switches in pre-wired, ready to install condition.

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- f. One door indication lamp each for inside and outside. The color of LED lamp shall be Amber.
- g. Seal lands to improve the acoustics for both door leaf.
- h. One Emergency egress device for each door, with a butterfly type handle and required operating cable.
- i. On each side of every coach, one external emergency device that can be fitted into a recess of coach body with handle and required operating cable.
- j. Two number of square keys for each four coaches of supply. The design of square key (for mechanical isolation device) must be as per EN 14752:2019 Annex H.
- k. All the parts of door operation shall be pre-wired and for connection with coach wiring, WAGO type terminal / connector may be used.

6. Design & Prototype Approval:

- 6.1 The prototype approval by RDSO shall be mandatory in case of supply of a new design or any design change of doors earlier supplied by the tenderer.
- 6.2 Qualified vendor shall submit the design of double leaf automatic sliding door for approval.
- 6.3 Necessary installation and interface drawings of double leaf automatic sliding door shall include technical data, detailed drawing of different components and fixing arrangements of different components shall be submitted by the contractor.
- 6.4 Particulars of the past supply of double leaf automatic sliding door and its subsystems or of the similar design used in other railways in the world supported by their field experience shall be provided.
- 6.5 The details of maintenance, operation and performance etc. of the double leaf automatic sliding door shall be submitted by the contractor.
- 6.6 Complete details of the system functional description, acceptance test specification and its associated analysis report of double leaf automatic sliding door shall be submitted by the contractor.
- 6.7 The test plan and test procedures for prototype testing shall be submitted by contractor to RDSO for approval. The test scheme should include complete testing as mentioned para 14.3 of this specification. The supplier shall be responsible for the type and function tests of door.
- 6.8 The type tests shall be carried out at the works of manufacturer in presence of RDSO / IR representative. The function test shall be carried out at the purchaser (PUs) premises in presence of firm & IR representative.

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7. Training:

Adequate number of Railway officials shall be trained to cover all aspects of double leaf automatic sliding door which shall cover familiarization maintenance, troubleshooting & functionality of various sub systems of Automatic door. The number and days of training shall be mutually agreed between purchaser and contractor.

8. Packing & Transportation:

- 8.1 Contractor shall ensure that all outer and exposed portions of the various items of double leaf automatic sliding door are covered with suitable protection / packing material to prevent ingress of foreign matter / damage during handling, storage and stone throwing on it etc.
- 8.2 Contractor shall also ensure that all items of double leaf automatic sliding door in assembled condition are adequately packed before dispatch to prevent damage in transporting, handling and storage.

9. Technical Design Requirements:

9.1 Door Leaf / Door Panel:

- 9.1.1 Door system shall generally be compliant with EN14752 unless otherwise specified.
- 9.1.2 Door leaf shall be made of stainless steel / aluminum.
- 9.1.3 There shall be a filler material that can be either aluminum honeycomb or PU foam.
- 9.1.4 Thickness of the door leaf must be 30 mm to 32 mm.
- 9.1.5 The inner and outer skin of the door should be formed in such a way as to be lightweight, of adequate strength, and internally reinforced and formed into an integral unit, in such a way as to prevent injury to passengers or staff.
- 9.1.6 Joints and edges shall be thoroughly sealed against ingress of moisture with drain holes located at the bottom of the doors to allow drainage of condensate.
- 9.1.7 Doors shall be vibration free and insulated against heat and sound transmission. Exterior and interior surfaces of the door leaf shall be finished to match the adjacent surfaces of coach. The doors shall be free from dimples, warping, spot welding depressions and any other blemish.
- 9.1.8 The door leaf design shall enable any portion of the door leaf visible to be cleaned.
- 9.1.9 The door leaf shall be such that when the doors are closed they form a weather tight seal extending the full height of the door.
- 9.1.10 Weight of door leaf shall be made to keep as minimum as possible.
- 9.1.11 Each door leaf shall have two hand grip arrangement for manual movement of door leaf. One on inside of leaf, the other one on the outer side. The inner side handle grip shall be positioned close to the leading edge of the leaf and 1000 to 1200 mm from the vehicle floor. Outside handle shall be accessible from track level hence shall be placed approx. 100 to 150 mm above the coach floor level.
- 9.1.12 When close, door leaf shall be capable of withstanding loads imposed by passengers leaning on them under crush loading conditions. The doors shall be designed and tested such that the door leaf sustain such pressure with no permanent deformation.

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9.2 Window:

- 9.2.1 Doors shall be fitted with transparent windows to allow passengers to identify the presence of a platform. Door windows shall be replaceable without removal of the door leaf.
- 9.2.2 There shall not be any condensation of moisture due to the air gap. The window glass must be sealed appropriately with door leaf with a glue / Sealant.
- 9.2.3 Window frame should be designed to prevent water ingress into the door leaf by bonded glue.
- 9.2.4 All door window shall be fitted with safety glass which shall be bonded with door leaf & sealant used shall meet fire & smoke requirements as per EN 45545, HL2.
- 9.2.5 Strength of the window glass must meet IS:2553: 2019 Part II, Annexure A.
- 9.2.6 In respect of solar gain, thermal insulation, replacement criteria, strength, resistance to pressure, transmission of light, and solar heat gain, these windows shall be identical with those of the coach windows.

9.3 Door Guide / Seal:

- 9.3.1 Door guides and supports shall be mounted within the section of doorway protected by the door seals and other suitable means from inside and outside ensuring that no ingress of dust, debris, or any other foreign matter likely to result in excessive wear or incorrect operation of the door equipment.
- 9.3.2 Any seal shall not require regular cleaning. Sealing shall be effective under all operating conditions from tare to crush loading and particularly shall be resistant to atmospheric and chemical deterioration and to vandalism.
- 9.3.3 The materials used for the door movement and seals shall take into account of hygroscopic effects in high humidity tropical environments.
- 9.3.4 It shall be ensured that water does not enter / get trapped inside the door leaf due to condensation or otherwise.
- 9.3.5 Sealing arrangements on external sliding door leaf shall meet the following requirements:
- The door shall be sealed against draughts, water and noise. In the event of ingress of water or dirt with the doors in the open position provision shall be made to ensure that rapid draining takes place and that no surrounding equipment or systems are affected in any way.
 - Positive sealing along entire door opening and door leaf inner surfaces to eliminate in rush of tunnel air due to the piston effect.
 - Door sealing arrangement shall be adequate to prevent water ingress due to torrential rain and coach washing through automatic wash plant.
 - The sealing arrangement shall take into consideration of coach body manufacturing tolerance and deflections under fully load conditions.
 - All gasket provided in the doors shall be so designed that there is no possibility of their getting loose during service. Life of the gaskets / seals shall be minimum 08 years.
 - Door sealing shall also be such that the coach interior noise specification is satisfied.

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- Adequate care shall be taken to ensure no part of door machinery is visible from inside / outside the coach.
- Any seal shall not require regular cleaning. Seals shall be effective under all operating conditions from tare to crush loading and particularly shall be resistant to atmospheric and chemical deterioration and to vandalism.
- Suitable profile of seals shall be ensured so that it shall not come out during service life.

9.4 Door Mechanism:

- 9.4.1 The door mechanism shall have safety provision whereby the train shall not start unless all doors have been closed and locked.
- 9.4.2 It shall be possible to monitor the status of each door on the train operator's cab visual display unit (VDU).
- 9.4.3 An indication confirming that all doors are closed shall be provided in the driving cab on the both end.
- 9.4.4 The Door mechanism shall be operated through a high reliability electric motor (with IP 44 protection). All components of the drive mechanism shall be designed for high reliability and low field maintenance. All components of drive transmission including lead screw / spindle used for drive shall be designed for a minimal field attention with high reliability. The mechanism shall have a design life of minimum 1.5 million cycle of operations.
- 9.4.5 Limit switches used shall be of high reliability and with IP 65 protection.
- 9.4.6 The door operating mechanism shall be of a proven design in service.
- 9.4.7 The door system shall operate correctly with the coach battery voltage supply range between 77V to 137.5V DC & shall follow EN 50155 / IEC 60571 requirements.
- 9.4.8 The door lock mechanism shall be bi – stable type and shall be secured in locked / unlocked over centre position by positive spring load.
- 9.4.9 The design of the system shall allow that even with the loss of power, the door leaf can always be manually pushed into the closed position.
- 9.4.10 The door operating mechanism shall be housed within the coach above the doorway lintels. The design shall provide ease of access for maintenance.
- 9.4.11 The complete mechanism shall be modular and mounted on a rigid frame so that it can be adjusted as in situ for alignment and be removed as an integral unit from the coach.

9.5 Door Controller Unit:

- 9.5.1 A microprocessor based Door Controller Unit (DCU) shall control each pair of door leaf and shall be an integral part of door control assembly.
- 9.5.2 The door controller unit of a proven design shall be equipped with self – diagnostic functions and shall communicate with TCMS.
- 9.5.3 Supply to DCUs shall be in such a loop that the redundancy can be ensured in case of breakage of any one wire.

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9.5.4 The door position measurement and detection shall be accurate and real time measurement of the distance moved by each leaf. Door closed position shall be double checked through two independent arrangements.

9.5.5 The door controller unit shall qualify the electro-magnetic compatibility requirements as per EN 50121 – 3 – 2 and protective factors procured by casing as per EN 60529 – IP21.

9.5.6 Door system shall be at least SIL 2 compliant at train level for all the safety related functions and shall not allow:

- Door opening when train not at standstill,
- Door opening at standstill on track side,
- Train departure with an open door,
- Non opening of two door leaf in case of emergency;

The SIL levels as above shall be validated and shall ensure that the train shall not move from a station unless the doors are closed and locked unless intentionally permitted by the crew member.

9.6 Other Technical parameters:

9.6.1 All equipment should be designed to eliminate the rattling and resonance at all speeds up to maximum running speed and aerodynamic forces caused by ambient wind, train motion, or the passage of other trains. All of equipment's, sub-assemblies and components shall be subjected to shock and vibration test as per IEC 61373.

9.6.2 The electrical equipment of the door system shall be designed to meet the requirements of IEC 60077-1, Para 8.2.1, 'Operating conditions'.

9.6.3 All control software shall comply with the requirements of EN 50128 (Railway applications – Communication, signaling and processing system)

9.6.4 It shall be possible for the owner to modify / change various parameters / logics used in the software and implement the changes on trains.

9.6.5 All non – metallic materials used in Passenger Door System shall confirm to fire safety requirements of EN 45545 HL2.

9.6.6 Fire resistant cables shall be proposed for circuits, which should survive for long periods during fire. The cables and wires for door / DCU shall be fire resistant in compliant to EN 50200.

9.6.7 Sound reduction index R_w of the door leaf assembly measured as per EN ISO 10140-2 shall be equal to or greater than 30 dBA.

9.6.8 There shall be no swelling and dimensional changes of the door leaf and functional performance changes of the door system after the ageing test. The ageing test of door leaf shall be done as per ISO 9142.

10. Door Opening and Closing:

10.1 Opening and closing time of the passenger doors shall be adjustable in the range of 2.0 to 4.5 seconds.

10.2 The end of the closing and opening stroke (about 100 mm) shall be damped or cushioned to reduce impact and / or minimize possible injury to passengers.

10.3 All doors on the train shall fully open within 2.5 to 2.5 seconds from the initiation of the open door command.

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- 10.4 All doors on the train shall fully close within 2.5 to 3.5 seconds from the initiation of the close door command.
- 10.5 An audible warning that is audible from inside and outside the vehicle shall be provided to warn passengers prior to door closure, release and opening. The detailed parameter of the audible warning should be qualified and tested as per EN 14752.
- 10.6 At the centre line top position of each door, (both exterior as well as interior) amber colour indicator lamps will be blinking / flashing during the door opening and closing.

Indicator Light Characteristics (Indicative):

- Ultra High Luminance LED, Brightness ≥ 75 mcd,
- Enclosure Protection: IP 65 or better
- Indicator Light provided at inside of Coach - Dia: 20 mm,
- Indicator Light provided at outside of Coach - Dia: 40 mm,
- Viewing Angle: 170°

11. Emergency Release of Doors:

- 11.1 To be able to unlock and open a door in case of an emergency, one external emergency egress device, on each side of coach shall be provided. This device shall be operable from outside the vehicle from platform level or track – side.
- 11.2 To be able to unlock and open a door in case of an emergency, one internal emergency egress device shall be provided on inside of each coach.
- 11.3 The operating force of the emergency egress device shall be as per Para 5.5.1.3 of EN 14752 and shall not exceed 150 N.
- 11.4 The device is a rotary axle mounted on a painted rectangular panel. Operation of the emergency egress device shall release the locking mechanism of the respective door and the door can be opened manually when the train is at standstill.
- 11.5 When the train is on speed, after using of emergency egress device, door closing mode shall be applied on the motor for a limited period of time until the train is stopped.
- 11.6 Reset of the emergency handle should be possible by turning into the original position, after resetting the emergency handle, the door control shall switch back to normal operation.
- 11.7 The device shall be key or handle operated. The colour of the emergency egress handle shall be red (RAL 3020 in accordance with DIN 6164 – 1 AND din 6164 – 2).

12. Door Failure (Isolation Device):

- 12.1 In case of door failure, the door should be mechanically locked and placed in an out of use state.
- 12.2 The operation could be made with the isolation device fitted on right door leaf (viewed from outside of train), by actuating the square spindle. It can be actuated from inside and outside of the coach.
- 12.3 The isolation lock can only be operated when the door leaf is in fully closed position. If the door is closed & locked with the isolation lock, the safety loop shall be bypassed and inform the DCU about the “door cut out status”.

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- 12.4 When the isolation is activated, the door shall be mechanically locked in the closed position. Manually isolated doors shall be enunciated on the train operator's cab visual display unit (VDU).
- 12.5 The door red indicator lamps will be continuously glowing from both inside & outside of the coach which indicates that the door has already mechanically locked and not in use. The characteristic of these indicators are mentioned at para 10.6
- 12.6 If someone activates the emergency device, the isolation device shall not be deactivated.
- 12.7 The system is reset by rotating the square spindle back to its initial position. A red and green dot on interior and exterior door leaf to indicate the status of isolation device shall be provided.

13. Passengers Access Protection:

- 13.1 When a non – elastic rod with a maximum rectangular cross section of 10 mm x 30 mm is trapped with its long edge vertically between the door leading edge and the frame of the door shall not be indicated as closed and locked. The requirement shall be verified at three positions, the bottom, the middle and the top of the door. If soft horizontal bottom rubbers are provided, this requirement applies from the bottom edge of the door leaf upwards above the rubber.
- 13.2 The maximum force exerted on an obstacle during final closing stroke shall not exceed the following values:
 Peak force $F_p < 300$ N,
 Effective force during first closing attempt $F_e < 150$ N,
 Mean effective force including further closing attempts $F_E < 200$ N,
 The values specified shall be measured using a device and method as described in Annexure-D of EN 14752. Measurement on each door may not be required if the system provides constant performance.
- 13.3 An obstacle with maximum dimension of 10 mm dia rod trapped with its long edge vertically between two door leaf shall be withdrawn slowly in outward direction with a force not higher than 150 N, measured perpendicularly to the door surface. Alternatively, the door shall not be indicated closed and locked. The requirements shall be verified at the middle position only of the door.
- 13.4 If an obstruction is detected, the door shall stop. The closing force of the obstructed door shall be removed. The door shall reopen by 50 mm (Maximum 25 mm each door leaf) when an obstruction is detected. After a specified delay (adjustable between 0 to 5s), the door shall attempt to close again. If an obstruction persists, each door leaf shall stop again and the closing force of the obstructed door shall be removed. After the specified delay, the door shall attempt to close again. If the obstruction is still present the door shall reopen by 50 mm (Maximum, 25 mm each door leaf) and remain stationary, reporting a fault to the TCMS.
- 13.5 A red colour indicator lamp will be flashed from both inside & outside of the coach along with buzzer warning which indicates that the door has failed to close due to obstacle. The characteristic of indicator is mentioned at para 10.6

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- 13.6 If the obstacle is faced during opening, then door shall stop at the same position and wait for new command. However, the door should be able to manually push in open or close direction either by passenger or crew member.
- 13.7 Door closed and obstruction sensing information shall be sent to each of the Door Controller Unit (DCU) to TCMS.
- 13.8 The number of obstructions during opening or closing shall be logged by the door control system as an aid to diagnosing door system problems.

14. Categories of Tests:

14.1 Type Tests

A comprehensive series of measurements shall be made covering all the relevant parameters to ensure the performance requirements of Double leaf automatic sliding door. The tests conditions shall be as per EN 14752.

14.2 Functional tests on the fully assembled vehicle / train consist

The tests shall be carried out in accordance with EN 14752 & EN 50215 to prove that the entrance system functions correctly in accordance with this standard.

The checks shall include all door indicators, safety circuits and control system for normal and emergency access and egress.

- 14.3 The type and function tests are to be carried as detailed in Annexure – E of EN 14752 which is also detailed below:

SN	Sub – Clause of EN 14752	Test description	Type test	Function Test
1	4.1.1.1	Minimum width	X	X
2	4.1.1.2	Minimum height	X	X
3	4.2.1.1	Passenger retention forces	X	
4	4.2.1.5	Ability to withstand vibration and shock	X	
5	4.5.1	Electric and pneumatic power supplies	X	
6	4.6.1	Fire protection (Sample of components)	X	
7	4.6.2.1	Sound insulation	X	
8	4.6.2.2	Thermal insulation	X	
9	4.7.1	Hardware	X	
10	4.7.2	Software for electronic door control systems	X	
11	4.9	Protection against electrical hazards	X	

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12	4.10.2	Water tightness	X	X
13	5.1.3	Interlocking of released doors		X
14	5.1.5.1	Power-operated door systems	X	X
15	5.1.6	Out-of-service devices	X	X
16	5.2.1.3.2	Audible Alert	X	X
17	5.2.1.3.3	Visual Alert	X	X
18	5.2.1.4.1	Sensitivity of obstacle detection	X	X
19	5.2.1.4.2	Door impact	X	X
20	5.2.1.4.3	Obstacle removal force (Bar)	X	
21	5.5.1.2	Emergency egress conditions	X	X
22	5.5.1.3	Operating force of emergency egress device	X	
23	5.5.1.4	Impact of load on a door leaf	X	
24	5.5.1.5	Manual force to open the door	X	
25	5.5.1.6	Emergency egress device operation		X
26	5.5.3.2	Access conditions	X	X
27	5.5.3.2.2	Operating force of access device	X	
28	5.5.3.2.3	Impact of load on a door leaf	X	
29	5.5.3.2.4	Manual force to open the door	X	
30	5.5.3.2.5	Access device operation		X
31	5.6.1	Passenger access door area illumination		X
32	5.6.2	Status Indication		X

Note: "X" means applicability of tests.

15. Reliability, Availability, Maintainability and Safety (RAMS):

- 15.1 If analyses concerning RAMS are required, the guidelines given in EN 50126 shall apply. The details of the analyses shall be stated in the contract.
- 15.2 The Double leaf automatic sliding door shall be designed with the appropriate level of safety, reliability and maintainability. Reliability performance shall be demonstrated based on either theoretical and/or experimental data. A RAMS program plan shall be provided to demonstrate the tenderer approach and organization to implement the required RAMS process.

Signature			
Authority & Designation	S.K. Chaurasia JE/Design/Carriage Prepared By:	Ajay Kr. Srivastava SSE/Design/Carriage Checked By:	Shailendra Kr. Sharma Jt. Director/E&S/Carriage Approved By:

15.3 A large no. of doors has to open and close at every station, very high reliability of operation is necessary. The door system equipment provided under this specification shall meet or exceed an MTBF (Mean-Time-Between-Failure) of 27,500 hours per doorway. The bidder shall quote MTBF Figures. The MTBF Figure shall be supported by the date for the equipment already in use and supplied by vendors.

15.4 As a minimum, the following analyses shall be performed and submitted for review:

- a. Preliminary Hazard Analysis
- b. Failures Modes Effects and Criticality Analysis
- c. Fault Tree Analysis
- d. Operating and Support Hazard Analysis

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