

Rail Coach Factory Kapurthala

Dated 14.05.2019

MD35131

Sub: Issue of specification No. MDTS25267 Rev08.

Please find enclosed a copy of following specification for information and necessary action at your end.

S. No	Description	Specification No.
1.	Technical Specification for single leaf Automatic sliding door main entrance door plug door for LHB Design coaches for operation at 200 kmph.	MDTS25267 Rev08.

My 21/05/19
 (Abhey Priya)
 Dy.CME/D-II

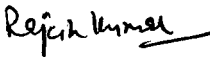
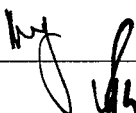
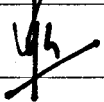
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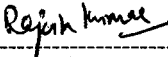
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
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Specification	Technical specification for Single leaf automatic sliding Main entrance Plug door for LHB design coaches for operation at 200 Kmph	MDTS25267 Rev08 Page 1 of 25 Date 27.03.2019

Designation	Name	Signature	Date	Level
SSE/Fur	Rajesh Sharma		27.03.19	Prepared
Dy.CME/D-II	Abhey Priya		21.05.19	Agreed & Reviewed
CDE	Manish Bhimte		21.5.19	Approved

Rev. No.	Details of changes	Date
01	Suggestions/comments incorporated.	22.10.14
02	Requirement of train control unit made specific to generator car and other associate changes.	19.01.15
03	Clause 2.1 (viii) added regarding interface portal of door frame in the car body structure. Clause 3.1 modified for provision of door steps to board the train from platform and audible and visual alarm for emergency opening device. Clause -36 added for drawings. Clause 4.2 deleted -repetition of clause 4.1. Clause-8.30 added. For provision that train will not start till all the doors are closed i.e. brake will apply if train start when any of the door is opened.	31.05.16
04	<ul style="list-style-type: none"> The provision of adjustable foot step has been eliminated from the scope of supply and made optional (clause-3.2 added). The cost of door steps will not be considered for inter-se ranking of the offers. Clause 4.9 added, the contractor shall quote or comprehensive annual maintenance contract with user. The cost of comprehensive annual maintenance contract will not be considered for inter-se ranking of the offers. Clause 4. 10 added, firm will also give individual cost of each coach i.e. for chair car, executive chair car and power car with control unit. 	06.03.17
05	Clause 4.9 modified that the cost of comprehensive annual maintenance contract will be considered for inter-se ranking of the offers. However, comprehensive annual maintenance contract will remain as optional.	20.03.17
06	Clause 2.1 (viii), technical requirements clause 4&7 modified to accommodate all type of rakes as it was previously covering only Tejas rake. Technical requirements para 5 deleted.	08.02.18



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07	Clause 10.5 added for AMC to correlate with AMC under clause 4.9.	18.06.18
08	Clause 8.1 For door supplied by the contractor, in case of any part of the door system failing or proving unsatisfactory in service due to defective design, material or workmanship, within 84 months from the date of supply or 72 months from the date of commissioning of coach, whichever is earlier and shall replace the same at his own cost and risk. Further, should any design modification be made in any part of the equipment offered, the period of 72 months would commence when the modified part is commissioned in service.	27.03.19

Rajakumar

Prepared By

My

Agreed By

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1. Preamble:

- 1.1. This specification covers design, development, supply and installation and commissioning of pre fabrication, pre wiring, single leaf automatic sliding main entrance plug door assembly complete including drive gear (electric) locking and local control elements and with its associated accessories and all hardware required for installation of system.
- 1.2. This specification is intended to cover the general conditions and technical requirements/provisions related to materials, constructions and tests and do not include all the necessary provisions of the contracts.
- 1.3. The coaches are required for long distance passenger transportation on locomotive hauled high-speed trains and the door shall be designed to meet the performance requirements enumerated in subsequent clauses of this specification. Other specifications relevant to door system may be referred to in conjunction with this specification.
- 1.4. In case the tenderer needs any clarification in respect of any clause of this specification or regarding the exhibited drawings, the tenderer shall obtain the same from RCF.

2. Eligibility criteria: (Must Requirement for the evaluation of offer)

- 2.1. Single leaf automatic sliding main entrance plug door is a sophisticated complex system and requiring expertise in design, development and testing. The tenderer shall have adequate experience with the offered door system on high speed trains (200 km/h and above). The following eligibility criteria will be applicable:
 - i. The supplier should have well established design, manufacturing and testing facilities for the tendered type items and has adequate technical knowledge with relevant practical experience.
 - ii. The supplier should have designed, manufactured and supplied the tendered type of door systems for trains operating at 200 km/h or above on at least 500 coaches or their principles have designed, manufactured and supplied the system for trains operating at 200 km/h or above on at least 500 coaches. The automatic sliding plug door installed by the tenderer in the past should have completed minimum 3 years satisfactory service till the date of advertisement of the tender.
 - iii. The supplier should submit the performance details of the single leaf automatic sliding main entrance plug door systems along with the offer.

Rajesh Kumar
Prepared By

MM
Agreed By

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- iv. The supplier has adequate financial stability and status to meet the obligations under the purchase order for which he is required to submit a report from a recognized bank or financial institution.
- v. The supplier has adequate manufacturing capacity and capability to manufacture and supply the items offered within the agreed delivery schedule.
- vi. The supplier has established quality control systems and organization to ensure adequate control at all stages of the manufacturing process.
- vii. The tenderer must submit detailed clause-wise comments on the specification. In absence of above, offers shall be deemed as incomplete and may not be considered.
- viii. The supplier has to confirm that the offered door assembly/system will fit in the carbody door frame to drawing No's: LZ10105 and LZ10106 No change will be permitted in the carbody structure.

3. Scope of supply:

3.1. This specification covers the design, development, supply and installation and commissioning of Guard panel, pre-fabricated, pre wired single leaf automatic sliding plug door assembly complete including drive gear, locking and local control elements with its associated accessories and all hardware required for installation of system. The installation and commissioning of the complete door system shall be made in the LHB Coaches by the supplier. The Automatic Sliding Plug Door installed in entire rake shall be accessed and will be controlled by Guard panel as centralized door control equipment via hard wired train lines. The Guard panels to be installed in generator car by the supplier, Generator cars are always remain first and last coach of the train. Within the rake there shall be two Guard panels with the same interface. All control commands for doors issued from Guard panel shall be delivered by hard wiring throughout the rake to all installed automatic sliding plug doors. The train line wiring and necessary inter coach connectors and wiring will be in tenderers scope. Required no of wires, their sizes, number of terminal blocks, cable length will be finalized during design freeze. Contractor will supply portal sealing frame and necessary hardware to install the door leaf as per RCF sealing frame drawing. On application of emergency opening device, audible and visual alarm needs to be raised for attention of crew member.

3.2. **Optional:** The tenderer must give cost separately for door steps arrangement required to board the train from platform. The door step has to compensate the gap between edge of platform and edge of coach. It has to compensate the gap between platform level and coach floor level also. The cost of door steps will not be considered for inter-se ranking of the offers.

Rajesh Kumar

Prepared By

My

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4. Submission of documents along with the offer (MUST Requirement for evaluation of the offer):

- 4.1. The tenderer shall submit the details of scope of supply along with the offer which will be used for technical evaluation of the offer only. The supplier has to get drawing, compliance to specs approved from CDE/RCF in event they get purchase order.
- 4.2. Technical documents indicating brief description and functioning of each equipment and whole system.
- 4.3. Schematic indicating dispositions of all the components/equipments on coach body.
- 4.4. The tenderer shall submit the relevant documents towards the eligibility criteria as a proof of compliance.
- 4.5. The estimated weights and centre of gravity for door should be given. The weight for the scope of supply per entrance should be less than 140kg and kept minimal.
- 4.6. Supplier should devote particular attention to the design of door to get quiet operation condition. The sound attenuation of the closed door leaf should be at least 27dB (A) according ISO 140. The thermal conductivity should not be more than 4,7W/m²K.
- 4.7. Tenderer shall enclose the relevant installation drawings of the proposed door arrangement which shall contain details regarding material, interface dimensions, specifications, estimated weight and fire load of the scope of supply. The mechanical forces of the door system acting in the interfaces to the coach body should be submitted.
- 4.8. The list of spares for servicing for (i) reserve equipment (ii) spare parts for maintenance and (iii) parts subjected to wear.

Note: The door suppliers are responsible for door functioning and therefore, a complete supply of the various equipments is a must.

- 4.9. The contractor shall enter into a comprehensive annual maintenance contract with user for three years for maintaining the automatic plug door system. The firm shall coordinate with user during scheduled maintenance viz. quarterly, half yearly, annual maintenance as required for trouble free and proper functioning of the automatic plug door system including repair/replacement of defective/malfunctioning items. Firm shall list out in the offer consumable items with unit cost and sources of supply which will be required for the scheduled maintenance so that the user can keep a stock of these items. Tenderers shall quote rate for this maintenance contract separately along with the offer for automatic plug door system. The cost of comprehensive annual maintenance contract will be considered for inter-se ranking of the offers. However, comprehensive annual maintenance contract will remain as optional.

Rajkumar

Prepared By

MM

Agreed By

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4.10. Firm will also give individual cost of each coach i.e. for chair car, executive chair car and power car with control unit.

5. Submission of documents along with the offer (MUST Requirement for evaluation of the offer):

5.1. Tenderer shall give in his offer, reference of countries/ trains/ coaches where similar door arrangement supplied by the firm is used in the following Performa:

- 5.1.1. Name of country
- 5.1.2. Railway
- 5.1.3. Name of train service.
- 5.1.4. Number of coaches fitted with the system offered.
- 5.1.5. Year of supply
- 5.1.6. Gauge.
- 5.1.7. Maximum speed
- 5.1.8. Experience on performance.

6. Deviations (MUST be spelled out clearly in the offer):

6.1. In case the offer does not correspond to this specification in any respect, a "Deviation statement" shall be submitted by the tenderer. This statement shall clearly give the clause-wise deviations with technical reasons for the same.

6.2. Clauses not covered by the deviation statement shall be deemed to be acceptable to the tenderer in all respects. In case a deviation statement is not submitted, it would be taken that the complete specification is acceptable to the tenderer.

6.3. In addition to the offer against this specification, the tenderer may submit alternative offers giving adequate technical justifications for the same.

7. Contractor's responsibility:

7.1. The contractor shall be responsible for the execution of the contract strictly in accordance with the terms of this specification and the conditions of contract, notwithstanding any approval which purchaser or the inspecting Officer may have given for the following.

- 7.1.1. The detailed drawings prepared by the contractor.
- 7.1.2. His sub-contractors for materials
- 7.1.3. Other parts of the work involved by the contractors.
- 7.1.4. The test carried out either by the contractor and/or by the purchaser and / or the Inspecting Officer.
- 7.1.5. Approval of UIC where available shall be indicated.

8. Guarantee / Warranty:

Rejith Kumar

Prepared By

[Signature]
Agreed By

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8.1. For door supplied by the contractor, in case of any part of the door system failing or proving unsatisfactory in service due to defective design, material or workmanship, within 84 months from the date of supply or 72 months from the date of commissioning of coach, whichever is earlier and shall replace the same at his own cost and risk. Further, should any design modification be made in any part of the equipment offered, the period of 72 months would commence when the modified part is commissioned in service.

8.2. Door shall be subjected to detailed trials as per specification. Any modifications found necessary as a result of these tests or further service trials shall be carried out by the contractor at his own cost in the coaches in a manner approved by the purchaser. All key and manufacturing drawings incorporating the modifications shall be submitted to RCF for final approval.

9. Maintainability:

9.1. The door equipment shall give a satisfactory maintenance free service for a period of seven years from the date of commission. The quality of installation of the door system would be approved according to installation protocol approved by RCF for door system which shows the door portal tolerances before installation and the adjustable mechanical parameters of the door.

10. Spare parts, reserve apparatus, wearing pieces and AMC:

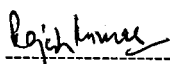
10.1. The offer shall include recommended list of spare parts required for day-to-day maintenance of the door equipment and spares in the form of kit for the various sub-assemblies for the maintenance at the time of POH. The list shall include the part number, quantity required and price of each component.

10.2. Tenderer shall ensure availability of all spares for a period of at least 10 years. This shall be irrespective of the fact whether the tenderer or his sub contractor(s) have stopped manufacturing of the equipment to the design supplied to IR,

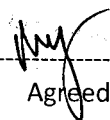
10.3. In order to ensure the highest availability and utilization of the system, a certain number of standby units of principal assemblies are required. In addition, it is proposed to stock sufficient minor components and spares to meet renewal and replacement on account of wear or occasional failure, for a period of 5 years service. Tenderer shall, therefore, submit a classified list of spares, (unit exchange, spares & stage / normal maintenance) for each type of equipment of door system, which he recommends for stocking.

10.4. The tenderer shall indicate in an itemized list, the life expectancy of components subjected to wear under Indian conditions.

10.5. The tenderer must offer for an annual maintenance contract with railways for 3 years period after expiry of warranty period. Tenderer should provide price breakup of AMC clearly specifying schedule of replacement of spares, must change spares, price of each spare and labour cost etc. In case, a offer is received without AMC or without above details, RCF



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reserves the right to reject the offer. The cost of AMC is not to be taken for inter-alia ranking of the offer.

11. Prices:

- 11.1. The contractor shall give price of total system and shall also submit the prices of various items of the equipment-giving break up of all the components of the various items.
- 11.2. Purchaser reserves the rights to either buy the complete equipment as offered or any part thereof based on the item wise break up of prices indicated by the contractor.
- 11.3. Contractor is also required to submit a detailed indigenization programme for large-scale adoption of the system offered by him to IR.

12. After sales services:

- 12.1. Contractor may be required to send his technical expert during the installation and commissioning of their equipment on coach/coaches.
- 12.2. Contractor shall also depute his technical expert on request by the Purchaser / RDSO to investigate and attend to specific problems that may come up during actual operation.
- 12.3. Contractor shall associate with Indian Railways during the trials. He shall also undertake to modify the equipment supplied, if required as a result of trials.
- 12.4. Contractor shall supply at-least 10 compact discs of the Operation & Maintenance Manuals and Servicing Instructions. These should normally include:
 - 12.4.1. Details of attention to be given during IOH / POH or any other schedule.
 - 12.4.2. Test procedure and standards for various door requirements on test bench as well as single coach / rake testing.
 - 12.4.3. Details of gauges, jigs & fixtures, tools, machinery and plant for maintenance of door equipment / system.
 - 12.4.4. Typical defects and their remedial measures.
 - 12.4.5. List of spares for day to day maintenance and at the time of IOH / POH in the form of periodic overhaul kit.
 - 12.4.6. Identification codes (manufacturer's name / trade mark) and month & year of manufacture shall be punched / engraved on the main equipment and their component parts to avoid mixing by mistake of different applications and for setting down warranty claim for smooth and efficient working.
 - 12.4.7. Maintenance standards including clearances and tolerances at various locations and permissible limits of wear for good service performance of equipments.
- 12.4.8. Tenderer shall submit the frequency and detailed work content of various inspection / maintenance schedules necessary for maintenance of the system offered by him. Whether these requirements are time based or distance travelled based shall be indicated for each schedule.

Rajesh Kumar

Prepared By

[Signature]

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13. Packing:

- 13.1. Contractor shall ensure that all outer parts and exposed threaded portions of the various items of the system are suitably covered with protection caps to prevent ingress of foreign matter / damage to threads during handling and storage.
- 13.2. Contractor shall also ensure that all items of the system equipment in an assembled condition are adequately packed before dispatch to prevent damage in transporting, handling and storage. The safe transportation shall be the responsibility of manufacture.

(Brief Description of technical requirements)

1. Climatic and Environmental Conditions: The door arrangement shall operate reliably and safely under following climatic and Environmental conditions:

- | | |
|--------------------------------------|-------------------------------|
| 1.1. Maximum temperature under sun | 70 deg. C |
| 1.2. Maximum temperature under shade | 45 deg. C |
| 1.3. Minimum temperature | 5 deg. C |
| 1.4. Altitude Sea level to | 652 meters |
| 1.5. Humidity | 100% saturation rainy season. |
| 1.6. Rain falls | Fairly heavy. |
| 1.7. Atmosphere during hot weather | Dusty |

2. Other parameters:

- 2.1. Train Speed: 200 kmph
 2.2. Train Passing Speed: 200 kmph
 2.3. Aerodynamic load pulses: max. +/- 2500Pa [UIC566: 1990; § 2.1.2.1]
 2.4. Dry weather — dust and dirt in atmosphere.
 2.5. Exposure to Salt Laden Air in coastal areas.

3. Overall dimensions of coach:

- | | |
|--|---------------------------|
| 3.1 Gauge | 1676 mm |
| 3.2 Length over coach body | 23540 mm |
| 3.3 Length over buffer | 24000 mm |
| 3.4 Buffer centres | 1956 mm |
| 3.5 Maximum distance between wheel | 12340 mm |
| 3.6 Maximum operating speed [for AC (EOG) & Generator Coach] | 200 kmph |
| 3.7 Wheel diameter | New 915 mm
Worn 845 mm |

Raj Kumar

Prepared By

[Signature]

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- | | |
|--|----------------------|
| 3.8 Wheel base | 2560 mm |
| 3.9 Minimum clearance above rail level loaded and worn condition | 102 mm under |
| 3.10 Maximum bogie rotation & swing | 3.5", 82 mm |
| 3.11 Width over body | As shown in drawings |

Environment: Coaches shall be working in coastal area with salt laden and corrosive atmosphere.

4. Rake composition:

Rake composition of different type of coaches depending upon the type of rake may be decided at the time of tender.

5. Track parameters:

- | | |
|--|--------------|
| 5.1. Maximum gradient and their length | 1% and 250 m |
| 5.2. Sharpest curvature | 175m radius |
| 5.3. Max. Super elevation | 165mm max. |

6. Mechanical interfaces:

6.1. The door and accessories have interface with sidewall, roof end parts, AC trough, lavatory module, door way ceiling, door frame etc depending upon the type of rake/coaches and relevant drgs. to be procured from CDE/RCF at the time of design freeze.

6.2. The firm should make the automatic plug doors suitable for coaches for which this item has been tendered. The relevant and latest drgs. for shell sub-assemblies and other drgs. will be provided to successful bidders at the time of design freeze of the plug door.

6.3. The supplier shall make effort to mount the door on the existing structure. There should not be any infringement with existing structure/accessories. This shall be agreed during design freeze.

6.4. The supplier shall guarantee all internal interfaces of the system.

7. Design Requirements:

7.1. The Door System describes passenger access door must be manufactured in compliance to EN14752: 2005.

7.2. The single leaf automatic sliding plug door system must be robust enough to encounter vibrations and jerks, light in weight and proven design. The mounting arrangement shall be designed to withstand satisfactorily the vibration and shocks encountered in service in compliance to EN61373.

7.3. The material used in door system must comply with EN45545-2.

Rajinder

Prepared By

MJ

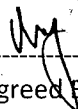
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- 7.4. The Door control unit incorporated in door system shall be manufactured in compliance to EN50155.
- 7.5. The Electronic product should comply with EMC emission and immunity levels as Per EN50121-3-2.
- 7.6. The Product software needs to be developed in compliance to EN50128.
- 7.7. The Door system should be manufactured in compliance to UIC566 and not contradict EN regulations.
- 7.8. The Door system should have easy to use diagnostic system with different levels of detail (flash code on DCU, offline analysis with service tool).The door system should have Powerful supporting tools for data analysis and measurement.
- 7.9. The door system should have modular and standardized door control platform which can be configured according customer requirements.
- 7.10. The door leaf shall not plug out more than 70mm in the lower area of the door leaf.
- 7.11. The door system should ensure sound insulation of the system min 27dB(A)ISO140-3.
- 7.12. The door system should be using Passive Sealing System to keep it operable and tight with small rubber damage.
- 7.13. The inner and outer skin of the door leaf shall 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.
- 7.14. Doors shall be vibration free and insulated as defined in technical characteristics against heat and sound transmission. The doors shall be free from dimples, warping, spot welding depressions and any other blemish.
- 7.15. When door is closed and locked, door leaves shall be capable of withstanding loads imposed by passengers according to EN14752. The doors shall be designed and tested such that the door leaves sustain such pressure with no permanent deformation. The Contractor shall submit test procedure based on best international practices.
- 7.16. Door windows shall be replaceable without removal of the door leaf.
- 7.17. No single defect or failure of any part of any door system shall produce a situation capable of causing injury to any door user.
- 7.18. Door guides and supports shall be mounted within the section of doorway protected by the door seals and shall not allow ingress of dirt, debris, or any other foreign matter likely to result in excessive wear or incorrect operation of the door equipment.



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- 7.19. The materials used for the door track rollers and seals shall take into account of hygroscopic effects in high humidity tropical environments.
- 7.20. A microprocessor based Door Controller Unit (DCU) shall control each door and shall be an integral part of door control assembly. The door controller unit of a proven design shall be equipped with self-diagnostic functions.
- 7.21. The doors 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. Tightness to be achieved with passive seals.
- 7.22. Positive sealing along entire saloon door opening and door leaf inner surfaces to eliminate in-rush of tunnel air due to the piston effect.
- 7.23. Door sealing shall also be such that the saloon interior noise specification is satisfied. Door sealing arrangement shall be adequate to prevent water ingress due to torrential rain and coach washing through automatic wash plant (according EN14752).
- 7.24. The sealing arrangement shall take into consideration of coach body manufacturing tolerance and deflections under fully loaded conditions.
- 7.25. Adequate care shall be taken to ensure no part of door machinery is visible from inside / outside the saloon when door is closed. The Door system shall be designed in such a way that doors on platform side should open when train reaches standstill at station (when Guard has actively enabled the relevant side to open).
- 7.26. During opening sequence a movement monitoring to be provided to protect the door drive mechanism from mechanical overloading.
- 7.27. The operating element of emergency device shall be located inside the coach according to EN14752:4.3.2. 1. The emergency equipment shall also be located outside the coach.
- 7.28. It shall be possible to lock a door out of use from inside the vehicle according to EN14752:5.1.6
- 7.29. Key of the Staff, using the emergency access device shall be according to EN14752 Annex H.
- 7.30. The provision should be made in the system that train will not start till all the doors are closed i.e. brake will apply if train start when any of the door is opened.

8. Door System - Configuration:

- 8.1. The Sliding Plug Door System for passenger access shall be compliant to EN 14752-2005.

Rejin Kumar

Prepared By

[Signature]

Agreed By

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8.2. The Plug door system is basically formed by a door leave, a drive unit mechanism located in the upper portal area and a component rack located at the rear side. The opening and closing movements of the doors are combined plug out/plug in and sliding movements. Door system should plug out and in with a plug movement of 35°. Door System — Component Overview Outside: the system should have a door leaf with handgrip, push button, window, door cut out device (square key operated) and an emergency unlocking device (square key operated). Door system — component overview inside: the system should have a portal seal frame, opening push button, closing push button, drive unit, door cut out device (square key operated), DCU, door leaf, component rack, crew square key, operating panel, close warning buzzer, door status LED, emergency unlocking device etc.

9. Door Leaf:

- 9.1. Door leaf and their accessories shall be constructed of corrosion resistant materials.
- 9.2. Doors when closed should be not rattling and effectively sealed to prevent entry of water, dirt and debris under normal operating conditions.
- 9.3. Door leaf should be of Sandwich-Construction with welded aluminium frame. Leaf-Camber should be according coach-shape.
- 9.4. Window on the door should be of insulated safety glass and mounted to a rubber seal.
- 9.5. Provision of finger protection to be offered on leading edge of each door leaf to protect passengers according EN14752:2005.
- 9.6. Provision of handgrips inside and outside on each door leaf to support manual opening and closing. They should be positioned to allow operation from rail as well as platform level.

10. Door Operator (Drive Unit):

- 10.1. The operator shall be overhead mounted, readily accessible for maintenance and well protected from rain, dirt and other environmental factors.
- 10.2. The door operator and its linkages shall be designed with sufficient internal damping to prevent the door from bouncing.
- 10.3. The door shall not use long belts to drive the door leaf. The use of a spindle/spindle nut is preferred. The spindle/nut system shall be maintenance free at least 10 years.
- 10.4. The door operator and operating linkages shall be designed such that the effective closing force measured at the leading edge of the door panel shall be according to EN14752:2005 through entire cycle.
- 10.5. All side doors shall be adjusted to be opened or closed manually with a maximum force of 155 N with door operator without power supply.

Rejith Kumar

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NT

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- 10.6. The DCU shall be designed to work from a master control unit placed in Generator car.
- 10.7. Doors shall be electrically operated from under 110 V DC supply.
- 10.8. Door system shall continue to operate correctly with the coach battery voltage supply range between 77 V to 143 V.
- 10.9. The Door control unit should be as per EN50155. It should be equipped with RS232 or USB serial link for maintenance.
- 10.10. Shock and vibration resistant according EN61373.
- 10.11. Environmental tested according EN50155, IEC60571
- 10.12. EMC tested according EN50121-3-2
- 10.13. Easy to use diagnostic system with different levels of detail (flash code or digital display on DCU, offline analysis with service tool)
- 10.14. A modular and standardized door control platform which can be configured according customer requirements.
- 10.15. The DCU is able to communicate with CAN to provide fast and reliable exchange of control or diagnostic data.
- 10.16. The door locking must provide a secure locking status in case of power failure. The door locking must provide a two steps locking sequence. The latch mechanism of the door lock shall preferably horizontal latches for easy adjustment and resistance against portal deformation during train operation. The door locking device shall incorporate both a latch and a hook to positive lock the door under all portal deformation when coach is operated at speeds.

11. Door Train Control Equipment - Guard Panel

- 11.1. The Automatic Sliding Plug Door installed in entire rake shall be controlled and maintain continuity with an according control unit within the rake (Guard panel)
- 11.2. Within the rake there shall be two Guard panels with the same interface.
- 11.3. The position of these Guard panels shall be flexible within the rake e.g. one panel placed in 1st coach, the other panel placed in last coach (generator car). Any reconfiguration of the consist shall not influence the functionality of the Guard panel(s).
- 11.4. All control commands for doors issued from Guard panel shall be delivered by hard wiring throughout the rake to all installed automatic sliding plug doors.
- 11.5. The Guard panel functionality shall be designed in a way that there is only one "leading" panel within the rake. When two coaches with Guard panels are initially

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coupled, the activation of one panel shall deactivate the second panel so that only one panel is able to set command signals to the train wires. A signal lamp on the Guard panel shall indicate that another panel is activated.

- 11.6. The Guard panel shall have push buttons to activate the door functional commands. The Guard panel installation location will be finalized during design freeze. Guard panel shall be designed that in the future installation position the left / right push buttons are oriented in a way that they are clearly showing to each length side of the coach. Activating the according button will release the doors which are oriented on the same side.
- 11.7. Guard panel shall be designed in way which allows a retrofit installation in existing coaches.
- 11.8. Guard panel shall fulfill ingress protection class IP54.

12. Guard Panel Operation — Functional design elements:

In order to activation of push buttons to be effective and secure, a key must be used to gain access to the push buttons.

12.1 illumination push button - release open (right)

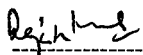
By operating corresponding push button in Guard panel all the doors of right side needs to be enabled open whereas all automatic doors on the left side of the rake shall be remain closed and locked. Pushing the button will lead to a continuous signal which will remain active unless the "doors closed" signal will deactivate it. Release status shall be continuously monitored by Guard panel in order to indicate if the doors of the according side are released. This monitoring function shall be active even if the panel is deactivated.

12.2. Illuminated Push button - release open (left)

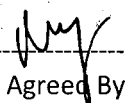
By operating corresponding push button in Guard panel all the doors of left side needs to be enabled open whereas all automatic doors on the right side of the rake shall be remain closed and locked. Pushing the button will lead to a continuous signal which will remain active unless the "doors closed" signal will deactivate it. Release status shall be continuously monitored by Guard panel in order to indicate if the doors of the according side are released. This monitoring function shall be active even if the panel is deactivated.

12.3. Push button - all doors closed

Close all doors - once this command is initiated from Guard panel all the doors shall be closed and locked. At the same time all release commands (continuous signals) shall be deactivated when command is initiated. Pushing the button will lead to an impulse signal. There shall be means to open the generator/Guard door manually despite all door close command is active both from inside as well outside. Same means will be



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used by Guard to enter the train at platform to gain the access of Guard panel and maintenance staff in maintenance depot.

12.4. Indicator lamp - all doors closed

Doors closed - Guard panel shall be capable of monitoring the status of all doors closed by having feedback from all coaches about door closed status by hard wiring only. This monitoring function shall be active even if the panel is deactivated.

12.5. Push button - open all doors

Once this command is initiated from Guard panel all the doors of the before released side(s) will be opened. Pushing the button will lead to an impulse signal.

12.6. Indicator lamp - other panel enabled

Guard panel shall be capable of monitoring the status of other activated Guard panels by hard wiring only. This monitoring function shall be active even if the panel is deactivated and be able to monitor at least a second panel. This monitoring shall also work when a third panel is installed in the train consist.

12.7. Switch to activate / deactivate panel (on/off)

Switch shall be foreseen to activate or deactivate the Guard panel.

13. Door System - Characteristic:

13.1. When opening the door, DCU shall start with the unlocking sequence first, after which the sliding movement of the door panels will be initiated. At the end of the sliding motion the doors will be in the fully open position. Door opening and closing movements are driven by one electrical drive which slides the door in open and close position.

14. Functional Requirements:

14.1. Door opening: each movement of the door in opening direction, where an opening instruction is transacted through button of the passenger, driver, train crew and maintenance staff.

14.2. Door opening: will take place in event of train speed is zero, doors are side selective released for opening and train comes to stand still from running.

14.3. Door closing: Each movement of the door in closing direction, where either a closing desire is transacted through pressures of a switch, button by the passenger, Guard or switch off of door release signal or there is no zero speed signal.

14.4. Door open audible warning that is audible from outside and inside the vehicle shall be provided to warn passenger prior to door open. There shall be adjustable delay time before the door begins to open.

Rajinder Kumar

Prepared By

[Signature]

Agreed By

Rail Coach Factory, Kapurthala		
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- 14.5. Emergency device: In an emergency the passenger has the possibility of unlocking and of opening thus with hands by operating emergency device subjected to train speed less than 5kmph.
- 14.6. Door should open completely in less than 5 seconds from the initiation of opening command with a tolerance of 1 second.
- 14.7. Door should close completely in less than 5 seconds from the initiation of closing command with a tolerance of 1 second.
- 14.8. Emergency device of doors can be reset and become active. In case of power failure door can be operated manually.
- 14.9. The opening and closing movement of the door leaf will be done using motor current monitoring and way/time monitoring to avoid trapping obstacles.
- 14.10. Automatic door closing shall initiate with an alarm at each closing door to warn passengers about initiation of door closure. In addition a warning that is visible from outside the vehicle shall be provided by flashing the door close and locked status to warn passengers prior to door closure.

15. Obstacle Detection:

- 15.1. The door should be equipped with motor current monitoring which allows to detect an entrapped object of the following size 60x30mm diameter (according EN14752:5.2.1.4.1
- 15.2. If obstacle 15x100mm gets trapped and door is locked, the obstacle is removable with a maximum force according to EN14752 :5.5.1.4
- 15.3. The maximum force exerted on obstruction shall not exceed the values according to EN14752:5.2.1.4.2 measured with a device as described in EN14752.
- 15.4. If obstacle is detected during the movement of the door leaf, complete reopening or partially re-opening (value to be defined) should take place. Closing of door should take place after a delay (To be defined).
- 15.5. If obstacle persists five attempts as described above are tried. If the obstacle still persists again, the door stays in position in a free state.
- 15.6. If obstacle is detected during the opening movement of the door leaf, the door will try to open again after a predefined time. After a second attempt to open the door, if obstacle is still present the door will accept this position as open position.

16. Interlocking:

- 16.1. No spurious electrical signals shall cause any door to be released or opened. The Contractor will be required to provide a comprehensive Safety Audit to prove this point to the satisfaction of the Engineer.

Rajesh
Prepared By

MY
Agreed By

Rail Coach Factory, Kapurthala		
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- 16.2. There shall be no single point failure of equipment or wiring, or two point failure with one failure undetected, which would cause a door, which is not released for opening to open without being commanded.
- 16.3. The door controls shall be interlocked with the side selective door release signal so that the doors cannot be opened until the doors are released by train staff. Door release signals shall be hard wired and interlocked with the train speed less than 5kmph.

17. Emergency Release of Doors:

- 17.1. Means of operating doors by staff shall however be provided for emergency situations as described below:
- 17.2. On each side of every coach, one device shall be provided, close near to the passenger entrance door but beyond the sweep of the door leaf. This device shall be operable from outside the vehicle from platform level and track level. Operation of this device shall release the —locking mechanism. Manual emergency release device shall be unobtrusive, flushed with, or recessed into, the coach side, but readily available in an emergency.
- 17.3. The manual emergency release device shall be provided with spring loaded cover to avoid unauthorized use. This shall require a special key so that only authorized personnel can operate the same.
- 17.4. Second device shall be provided inside saloon at each door. Operation of this device shall release the locking mechanism of the respective door subject to train is at speed less than 5kmph.

18. Door Indicator Light:

- 18.1. One warning lamp & Buzzer is used at each door, they carry out different functions.
- 18.2. Door Closed or opened — indicators not illuminated.
- 18.3. Imminence of door closing: these indicators warn by flashing.
- 18.4. Door during opening or closing: these indicators warn by flashing.
- 18.5. Door in failure: these indicators are illuminated.
- 18.6. Door Cutout: these indicators are illuminated.

19. Locking:

- 19.1. Locking should be passive and two stage lock mechanism for door system closed and locked.
- 19.2. When train is running door should remain closed and locked.

Rajiv Kumar

Prepared By

M. J.

Agreed By

Rail Coach Factory, Kapurthala		
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19.3. The design of system should allow that even with loss of power the door leaf can always be manually pushed into the closed position and can withstand the full service loads.

19.4. Mechanical locking should be released via Bowden cable from both inside and outside manually.

20. Door Controls:

20.1. General:

- 20.1.1. Door control lines from Guard station are hardwired
- 20.1.2. Door control lines are receiving power supply from generator car.
- 20.1.3. The train lines and their +/- supply are transmitted via intercar connection cables to each coach
- 20.1.4. The local door control units must be capable to receive these potential free signals.
- 20.1.5. Following signals are transmitted hardwired:
 - 20.1.5.1. Door release left side (steady signal as long as doors are released)
 - 20.1.5.2. Door release right side (steady signal as long as doors are released)
 - 20.1.5.3. Central open (pulse signal)
 - 20.1.5.4. Central close (pulse signal)
 - 20.1.5.5. Door closed indication (loop of all door closed switches)

21.2. The Guard shall be having access to following automatic door controls located in their control panel through MCU to facilitate door operation:

- 20.2.1. Open left door (release)
- 20.2.2. Open right door (release)
- 20.2.3. Central open
- 20.2.4. Central close

20.3. Each automatic door close open circuit shall be designed to be completely independent from each other. Failure of one side shall not affect the other.

20.4. DCU shall be designed to interface with Guard panel (MCU).

20.5. Circuit configuration shall be such that any short circuit in the individual DCU, door system monitoring or the door motor and power control circuits shall cause protective

Rajesh Kumar
Prepared By

[Signature]
Agreed By

Rail Coach Factory, Kapurthala		
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device to operate and shall not affect door closed/locked status. A reverse polarity protection shall be integrated into the DCU.

20.6. Once a valid door command from Guard panel/master door control unit originates the DCU shall commence the door opening sequence. All feedback from DCU to master control unit shall be sent within 100ms of receiving the open command.

20.7. Passenger Door Button Location:

20.7.1. Passenger door button location shall be according to EN14752:4.3.1.4

20.7.2. All internal door buttons should be mounted between 1m and 1.4m above the coach floor level.

20.7.3. All external door buttons should be mounted between 1m and 1.4m above the platform level.

20.7.4. When door open and close buttons are provided the upper button shall be the "open" button.

20.7.5. The door buttons shall be positioned such that an opening door doesn't create a trapping hazard for the operating hand.

21. Software Development:

21.1. Software is safety certified, Software for railway control and protection systems according EN50128:2001 and EN50128:2011.

21.2. Software documentation follows internationally accepted standards, Software Documentation for Rail Equipment and Systems according EN50128 up to SWSIL2 certification.

21.3. The network communication shall be in place for the following type of communication module CAN and optionally for MVB, RS485.

22. Guard information:

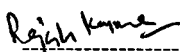
22.1. Guard should have information of door status (non responsive to door open Command) by crew member.

22.2. All doors locked signal

22.3. Major door failure information by crew member which necessitate a manual lockout and declare the door not fit for operation.

23. Interface Responsibility:

23.1. The location of mounting points and the design of equipment installation comprising of the Door shall be as per interface drawings and to be got approved from



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