

INDIAN RAILWAYS



SPECIFICATION FOR SINGLE LEAF AUTOMATIC PLUG DOOR INCLUDING LOCKING AND OPENING MECHANISM FOR BG MAINLINE PASSENGER LHB COACHES OF INDIAN RAILWAYS

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PART-I : GENERAL**SPECIFICATION FOR SINGLE LEAF AUTOMATIC PLUG DOOR INCLUDING LOCKING AND OPENING MECHANISM FOR BG MAINLINE PASSENGER LHB TYPE COACHES OF INDIAN RAILWAYS****1. INTRODUCTION:**

Single leaf Automatic plug doors in the LHB coaches to prevent accidental falling of passengers from running trains. Single leaf Automatic plug door including locking and opening mechanism is a sophisticated complex system in which the coach doors shall remain closed whenever the train starts from Railway station. Similarly, these doors remain closed till the train stops at the next station and eliminate chances of passengers detraining from the moving train. However, Brake should be applied when any door is in open condition while train speed is more than 5 kmph. The installation and commissioning of the complete door system shall be made in the LHB type coaches. These doors can be locally opened by pressing emergency. Single leaf Automatic plug door including locking and opening mechanism in coach is required to ensure high degree of reliability and safety. These doors have to be reliable as any malfunction can affect train operation and can result in delays. At the same time, adequate safety mechanism needs to be built into the system to ensure safety of passengers during en-training and de-training and also in case of emergent situation like fire or accidents. Control of these doors with guard is an essential requirement for trouble free and safe operation. Consequently, guard vehicles need to be up-graded with a door control panel on account of provision of Single leaf automatic door including locking and opening system.

2. DEFINITION & EXPLANATION:

- 2.1 'Single leaf Automatic Plug Door' means body side panel or panels available for passenger access and egress, including its components.
- 2.2 'Automatic closing' means powered closing of the door without intervention by the passenger.
- 2.3 'Door operation' means all door operating sequences.
- 2.4 'Door button' means device to initiate door opening or closing command.
- 2.5 'Enabled door' means door released by the train crew or an automatic system to permit operation by the door button.
- 2.6 'Locked door' means closed door held closed by a mechanical device.
- 2.7 'Isolated door' means door which is locked and not available for use.
- 2.8 'Unlocked door' means door with mechanical door locking released.
- 2.9 'Train crew' means persons authorized to carry out the duties for door operation.
- 2.10 'Power operated door system' means door system which operates doors in opening and closing direction by machine power.
- 2.11 'Manual doors' means the doors closing and/or opening of which is operated by hand power of crew or passengers.
- 2.12 'Leading edge' means edge of the door, leading during closing movement.

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- 2.13 'Contract' means agreement between manufacturer of the door system and buyer of that door system.
- 2.14 'Tenderer' means firm / company from whom the offer of the supply of automatic door locking and opening mechanism is invited.
- 2.15 'Contractor' means the present firm / company on whom the order of the supply of the automatic door locking and opening mechanism is placed.
- 2.16 'Purchaser' means the Indian Railways on behalf of the President of India who are purchasing the automatic door locking and opening mechanism.
- 2.17 'Inspecting Authority' means the Organization or its representative nominated by the Purchaser to inspect the automatic door locking and opening mechanism on his behalf.
- 2.18 The Research Designs and Standards Organization, Manak Nagar, Lucknow – 226011 is hereafter referred to as RDSO.
- 2.19 Indian Railways is hereafter referred to as IR.
- 2.20 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.
- 2.21 'Engineers' means officials of the RDSO or any other officials authorized by Railway Board, Ministry of Railways.
- 2.22 'Guard' means a person whose job is to be in-charge of train. Guard is the in-charge of the running train.

3. SCOPE:

This specification covers requirements of Single leaf automatic plug door including locking and opening mechanism for BG mainline LHB coaches of Indian Railways and is in two parts. Part-I covers general requirements regarding supply, installation, commissioning and maintenance while Part-II covers the functional & design requirements.

This specification covers requirements of provisions of Single leaf automatic plug door including locking and opening mechanism for BG mainline coaches of LHB design including disabled friendly coaches.

Single leaf automatic plug door including locking and opening mechanism shall be suitable and technically feasible such that it can be provided on new build coaches giving due consideration to various designs of Indian Railway coaches.

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 subject to RDSO clearance.

4. SCOPE OF SUPPLY:

- 4.1 The purchaser shall specify the quantities of Single leaf automatic plug door including locking and opening mechanism to be purchased along with proper assessment of bill of materials, installation and commissioning work by Tenderer.
- 4.2 The scope of work includes acceptance testing, installation and commissioning on the coaches as per requirements covered in this specification.

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5. DESIGN INPUTS:

The space available over the doorway inlet inside the LHB Type coaches for the fitment of the Single leaf automatic plug door including locking and opening mechanism shall be as per RCF drawing no LZ10105 / LZ10106 with latest alterations.

6. APPROVAL OF DESIGN & PROTOTYPE:

- 6.1 After getting PO from PU's / Zonal Railway, approval of design for the Single leaf automatic plug door including locking and opening mechanism for each coach variant as mentioned in clause 4.1 and clause 4.2 shall be done by RDSO separately.
- 6.2 The details of conceptual design of Single leaf automatic plug door including locking and opening mechanism as per clause 5 shall include technical data, detailed drawing of different components and fixing arrangements of different components of the Single leaf automatic plug door including locking and opening mechanism and shall be submitted by the contractor to RDSO.
- 6.3 Particulars of the past supply of Single leaf automatic plug door including locking and opening mechanism and its subsystems or of the similar design used in other airways, railways and roadways in the world supported by their field experience shall be provided to RDSO.
- 6.4 The details of load calculation of load bearing components of the Single leaf automatic plug door including locking and opening mechanism shall be submitted by the contractor to RDSO.
- 6.5 The details of maintenance, operation and performance etc. of the Single leaf automatic plug door including locking and opening mechanism shall be submitted by the contractor to RDSO.
- 6.6 The details of jigs and tools required for the maintenance of the Single leaf automatic plug door including locking and opening mechanism shall be submitted by the contractor to RDSO.
- 6.7 The detailed drawing showing electrical wiring in the coach circuit required for proper functioning of the Single leaf automatic plug door including locking and opening mechanism along with detailed calculation for electrical power / air consumption per coach shall be submitted by the contractor to RDSO.
- 6.8 Complete details of the system functional description, acceptance test specification and its associated analysis report of Single leaf automatic plug door including locking and opening mechanism shall be submitted by the contractor to RDSO.
- 6.9 The fire resistance of Single leaf automatic plug door including locking and opening mechanism shall be specified in the contract to allow the overall vehicle fire requirements to be achieved as per applicable requirements of EN 45545.
- 6.10 Firm shall submit the para wise compliance of specification along with their remark to RDSO.
- 6.11 Initially first prototype of Single leaf automatic plug door including locking and opening mechanism shall be fitted by firm in one coach regarding satisfactory fitment w.r.t. coach interfacing.

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- 6.12 Prototype Single leaf automatic plug door including locking and opening mechanism shall be fitted in at least one coaches along with two power car at both ends and the functionality shall be jointly verified by RDSO, Pus / Zonal Railways along with Firm's representative.
- 6.13 At the final stage, the prototype Single leaf automatic plug door including locking and opening mechanism shall be functionally tested by complete rake formation by RDSO, Pus / Zonal Railways along with Firm's representative.

7. INSTALLATION AND COMMISSIONING:

The Tenderer shall be liable for the successful installation & commissioning of the Single leaf automatic plug door including locking and opening mechanism for proper operation in the service. Installation, maintenance and operation manual and training shall be provided to appropriate staff prior to completion of installation of 'Single leaf automatic plug door including locking and opening mechanism' on first coach & rake.

8. CONTRACTOR'S RESPONSIBILITY:

8.1 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, not withstanding any approval which purchaser or the Inspecting Officer may have given for the following:

- a) The detailed drawings/assembly drawings with general dimensions prepared by the contractor.
- b) His sub-contractor for materials.
- c) The test carried out either by the contractor and / or by the purchaser and / or the Inspecting Officer.

9. ON-SITE REPAIR/REPLACEMENT:

The contractor shall replace at site all products rejected on final acceptance due to their non-compliance with the requirements covered in this specification. The contractor shall also replace those products which show deficiencies during the time period of warranty by products complying with the requirements within a period of one week for the purpose of warranty support. The contractor will provide two e-mail addresses of different domains from the date on which an e-mail/telephonic message/fax has been sent. A fax or other mode of communication will also have same sanctity for counting number of days.

10. SPARE PARTS, UNIT EXCHANGE SPARES & CONSUMABLES:

- 10.1 The offer shall include recommended list of spare parts required for maintenance of the Single leaf automatic plug door including locking and opening mechanism and spares in the form of kit for various sub-assemblies for the maintenance at the time of POH. The list shall give the Part number, quantity and latest 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 the equipment to the design supplied to Indian Railways.

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10.3 In order to ensure the availability and utilization of Single leaf automatic plug door including locking and opening mechanism, 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-tear or occasional failure. Tenderer shall therefore, submit a classified list of spares, (unit exchange, spares & stage / normal maintenance) for each type of equipment used in Single leaf automatic plug door including locking and opening mechanism recommended for stocking.

11. MAINTENANCE OF EQUIPMENTS IN SERVICE:

- 11.1 Contractor shall arrange for adequate technical service supports at his own cost to ensure that the Single leaf automatic plug door including locking and opening mechanism supplied is performing satisfactorily during the stipulated warranty period.
- 11.2 Contractor shall also depute his staff on request by the Purchaser / RDSO, to investigate and attend to specific problems that may come up during actual operation of Single leaf automatic plug door including locking and opening mechanism.
- 11.3 Contractor shall associate with Indian Railways during the trials of Single leaf automatic plug door including locking and opening mechanism. He shall also undertake to modify the equipment supplied, if required as a result of trials/during trials.
- 11.4 The Contractor shall arrange to supply soft copies & at least 5 hard of the Operation & maintenance manual and service instructions for proper maintenance of his own proprietary equipment. The number of manuals to be supplied shall be 5 against first contract and 2 at every contract and shall be supplied free of cost.
- 11.5 Manuals shall be illustrate, containing information pertaining to the principle of operation, maintenance schedule of all the proprietary items of equipment being supplied, precautions for passengers and maintenance staff. The manual shall also contain information on the following:
- Details of attention required to Single leaf automatic plug door including locking and opening mechanism during IOH / POH or any other schedule shall be defined. The maintenance requirement of the Single leaf automatic plug door including locking and opening mechanism should be clearly spelt out by the contractor.
 - Major maintenance interval requiring disassembly/dismounting of the Single leaf automatic plug door including locking and opening mechanism should coincide with IOH/POH schedule of the coaches of IR as below:

Maintenance Schedule of LHB Design Coaches	
Trip Schedule D1	Every Trip/Weekly
Monthly Schedule/D2	Monthly + 3 days
Six Monthly Schedule/D3	Half yearly + 15 days
Shop Schedule-I (SS-I)	18 Months +30 days/ 6 Lakhs Kms earned whichever is earlier
Shop Schedule-II (SS-II)	3 Years/ 12 Lakhs Kms earned whichever is earlier
Schedule-III (SS-III)	6 Years/ 24 Lakhs Kms earned whichever is earlier

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- Test procedure and standards for various Single leaf automatic plug door including locking and opening mechanism equipments on test bench as well as single unit / coach / rake testing.
- Details of gauges, jigs & fixture, tools, machinery and plant for maintenance of Single leaf automatic plug door including locking and opening mechanism.
- Typical defects and their remedial measures.
- List of spares for day-to-day maintenance and for POH in the form of periodic overhaul kit.
- Identification codes for main equipment and their component parts to avoid mixing of different applications by mistake.
- Tenderer shall submit the frequency and detailed work content of various inspection / maintenance schedule necessary for maintenance of Single leaf automatic plug door including locking and opening mechanism offered by him. Whether these requirements are time based or distance travelled based shall be indicated for each schedule.
- The contractor shall also arrange to supply along with equipment Wall charts of all equipment being supplied by him for display in maintenance depots. These shall be supplied @ 5 sets against first contract and @ 2 sets against every subsequent contract and shall be supplied free of cost. These charts shall be pictorial, showing all components along with their Part Nos. for each item of equipment.
- The contractor shall supply revised Maintenance manuals and Wall charts incorporating necessary changes in the Maintenance manuals and Wall charts already supplied by them for earlier contracts, if required. The copies of Maintenance manuals and Wall charts are meant for wider circulation on Railways and fresh copies shall be furnished as stipulated even if there are no changes in the manuals & wall charts furnished against earlier contract.

12. TRAINING:

Adequate number of Railway officials shall be trained to cover all aspects of Single leaf automatic plug 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.

13. PACKING & TRANSPORTATION:

13.1 Contractor shall ensure that all outer and exposed portions of the various items of Single leaf automatic plug door including locking and opening mechanism are covered with suitable protection / packing material to prevent ingress of foreign matter / damage during handling, storage and stone throwing on it etc.

13.2 Contractor shall also ensure that all items of Single leaf automatic plug door including locking and opening mechanism in assembled condition are adequately packed before dispatch to prevent damage in transporting, handling and storage.

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PART-II: FUNCTIONAL & DESIGN REQUIREMENTS

1. FUNCTIONAL REQUIREMENTS:

1.1 Ambient Conditions:

The Single leaf automatic plug door including locking and opening mechanism shall be capable of operating efficiently inspite of dirt, dust, mist, torrential rain, heavy sand or stone storms and presence of oil vapours and radiant heat etc. to which the rolling stock is normally exposed in service over Indian Railways. The Single leaf automatic plug door including locking and opening mechanism shall perform satisfactorily under the following climatic conditions:

- i) Ambient temperature : -10⁰C to 50⁰C
- ii) Maximum Sunlight temperature : 70⁰C
- iii) Altitude : Sea level to 2500 m
- iv) Relative humidity : 40% to 100%
- v) The rainfall is fairly heavy.
- vi) During drying weather, the atmosphere is likely to be full of dirt & dust.
- vii) Temperature variation may be quite high in the same journey or short period of time.
- viii) Coaches running in coastal areas with continued exposure to salt laden air.
- ix) Airborne contaminants like smoke and chemical vapors.
- x) Conducting particles like metal clips and fillings.
- xi) Abrasion damage and
- xii) Vibration and shock.

Moreover, the Single leaf automatic plug door including locking and opening mechanism should be able to adequately protect against accidental short circuit due to dropped tools, fasteners etc. and stones thrown on the system by the anti-social elements during abnormal situations such as procession, strikes.

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.

1.2 Maintenance Conditions:

The coach exteriors are cleaned with mildly acidic cleaning agents and using brushes with non-metallic bristles or automatic car washing plants. All exterior panels including end panels are to be hosed with water and brushed with diluted soft soap (detergent solution). The strength of solution may be increased or decreased according to RDSO specification No. M&C/PCN/101/2007. The system should not be affected by this cleaning either in performance, reliability or aesthetic.

1.3 Power Supply Availability:

110V DC supply is available from the coach circuits. This supply varies from 77 V to 137.5 V with 15% ripple in AC & Non-AC, SG and EOG LHB type coaches. The system is only allowed available power supply i.e. 110V DC.

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1.4 Air Supply Availability:

- 1.4.1 Air at 6 Bar from feed pipe is available in coaches on run in brake system air-reservoir of 75 liters. A limited quantity of air up to 15 liters per coach per operation (Opening/Closing) can be made available for the Single leaf automatic plug door including locking and opening mechanism, if needed. Requirement of compressed air per door and per coach for each cycle should be specified. Further, requirements of additional air reservoir per coach shall be clearly specified in the scope of supply by the tenderer.
- 1.4.2 As the air supplied from the coach may contain certain amount of contaminants and moisture, the contractor may provide (if required) suitable filter and dehumidifier for maintenance free working of the door system. High quality, maintenance free and leak proof isolating valve is to be provided for filter cleaning. The compressed air from the compressor may contain oil up to 20 ppm and water droplets for diesel and electric locomotive application. The contractor shall ensure satisfactory operation of the Single leaf automatic plug door including locking and opening mechanism under such conditions and if it is considered necessary by the contractor, additional oil separator/filter may be included in the offer. The contractor shall indicate the type of media used for removal of oil from compressed air before the air enters the Single leaf automatic plug door including locking and opening mechanism along with the periodicity of its replacement.

2. DESIGN REQUIREMENTS:

- 2.1 The Single leaf automatic plug door including locking and opening mechanism must be robust enough to encounter vibrations and jerks, light in weight and proven design. The automatic plug door including locking and opening mechanism shall be designed to withstand the effects of vibrations and shocks as defined for equipment attachments in EN 12663. If vibration and shock testing of sensitive mechanical components is specified in the contract, this shall be carried out in accordance with EN 61373.
- 2.2 The design of the Single leaf automatic plug door including locking and opening mechanism shall be aesthetically appealing, easy in operation, passenger friendly and do not cause any injury to the passengers.
- 2.3 The design of the Door panel / leaf will be built up with the requirement as follows:
- Frame / Panel / Leaf: Spot welding type stainless steel / Aluminium frame, welded, with straight corners, sandwich type filled with PU – foam core, bonded together via hot – bond process with the skins and the frame or Spot welding type stainless steel doors.
 - Window (mounted by rubber profile or bonded with PU sealants), Straight insulated glass, corners with radii, glass clear, silk screen printing on edges.
 - Finger protection rubber: Material EPDM, pre – mounted on door leaf at leading edge, Fire resistance according to BS 6853 category 1b.
 - Surrounding seal: Material EPDM, pre – mounted on door leaf at leading edge, Fire resistance according to EN45545 -2 HL2/HL3.

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- Guiding systems, rollers, joints, insulated cables, sleeve etc., exposed to operating problems in winter conditions (frost, ice etc.), must be well protected against the effects of bad weather.
 - Insulated cables must be fitted in such a way that water cannot accumulate and freeze.
 - Sleeve and other recesses must be provided with sufficient ventilation and drainage.
 - Open and hollow weather – stripping, in which water can accumulate, must be avoided. The elastomers chosen must be provided with sufficient resilient to withstand low temperature.
 - Each door must be fitted with two operating handles, one on the inside, the other on the outside, or with operating push – buttons.
 - It is recommended to indicate the opening direction of the door by means of an arrow placed near the inside handle.
 - When the doors close, there must be no risk of jamming, injury to persons or damage to luggage.
 - When closed, entrance doors must not project beyond the vehicle body.
 - The other design parameters of Door panel / leaf should be as per Para 4.1 of EN 14752:2015
 - The doors must be constructed as to ensure as complete tightness as possible to air and noise
 - Water tightness test according to EN 14752.
- 2.4 The main / entrance body side doors of the coach shall be locked mechanically when closed. Once locked the device shall remain locked until the door is released and an opening command is received or the emergency egress device is operated. Once locked the locking device shall remain locked even if the power supply to the door system is available or not.
- 2.5 The main / entrance body side doors of the coach shall be locked mechanically when closed. However, the automatic opening command must not become operative until the door has been unlocked from the master control until except in any emergency case.
- 2.6 The closing devices must be designed and maintained in a state which ensures safe performance of their function in normal service.
- 2.7 In particular, the fixed parts (latch) and moving parts (pivot pins, hinged pivot pins) of locking devices must always have sufficient overlap.
- 2.8 Door – closing mechanisms must be so designed that self – locking “on” closure is ensured. This state must also be maintained during normal service.
- 2.9 Door locking and unlocking control must be independent for each coach.

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- 2.10 The design of Single leaf automatic plug door including locking and opening mechanism shall allow user to open the doors from outside of the coach also, for the purpose there should be an external mechanical access device by which the door can be opened from external side of the coach in case of any emergency. This external emergency release mechanism shall be protected from inadvertent operation by the use of a frangible cover or a sprung metal flap that must be deliberately broken before operated by the passenger. However, these should be an additional feature for crew member to operate outside emergency opening device by using an authorized key.
- 2.11 On the front of locks for square keys, there must be a marker line that is in in the vertical position, when the lock is open, and in the horizontal position, when the lock is closed.
- 2.12 The Guard door must be independent to train speed. These doors can be opened & closed at any time by guard.
- 2.13 The electrical and pneumatic equipment of the door shall be designed to meet the requirements of EN 60077-1:2002, 8.2.1, 'Operating conditions'.
- 2.14 Automatic door control circuit shall employ Hard Wired feed & return rake control wires.
- 2.15 For transmission of train communication signal in trains form one coach to another coach, provision of suitable means for inter coach communication shall be made. The connector should follow these requirements:-
- 20 Pins electrical connector with all core terminated with 2.5 square mm wire
 - Modular rectangular connectors with protective cover must be designed in accordance with EN 175301 – 801 and should be resistant to dirt, water, vibration and high mechanical strain suitable for temperature up to -40°C to +125°C. IP 65 or better, aluminum die cast connector with protective cover must have powder coated housing with screw locking. Connector must be tested and certified as per DIN EN 175301 – 801, DIN EN 60664 – 1, DIN EN 61984, IEC 60529, BS EN 45545, DIN IEC 60352-2, IEC 61373 / EN 50155 and UL 94 VO.
 - Female (Jumper side) coupling shall have conduit with glands for exposed length & socket side wires shall be protected by a flexible braiding.
 - The jumper cable should meet the following standards: - EN 50155/ EN50121 for transmitted signal interface, EN 45545 for Fire & Smoke, Ingress Protection: IP 65 or better, EN 50125 for Environmental condition etc.
 - Nominal voltage is 110 V DC.
- 2.16 The Single leaf automatic plug door including locking and opening mechanism shall be designed to work and maintain continuity even one or more of the automatic door system fitted coaches added / removed The kind of communication shall be done hard wired. For this purpose, the coach to coach connector, following hard wire wiring should follow these requirements:-
- a. Hard Wire / Pin Coding:
- Wire / Pin coding "1" & "10" with 0 Volt (continuous type) to be used as Isolated Signal Ground / Common Negative.

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- Wire / Pin coding “2” with 110 Volt DC (continuous type) to be used as other panel enabled.
- Wire / Pin coding “3” with 110 Volt DC (continuous type) to be used as Door release left.
- Wire / Pin coding “4” with 110 Volt DC (continuous type) to be used as Door release right.
- Wire / Pin coding “5” with 110 Volt DC (pulse type) to be used as Open released the doors.
- Wire / Pin coding “6” & “7” to be used to indicate all doors closed loop (110 Volt DC signal to be used)
- Wire / Pin coding “8” with 110 Volt DC (pulse type) may be used as closed the doors.
- Other wire shall be terminated and may be used as spare or another function.

2.17 The details of coach to coach connector which may be used are as under:-

Jumper Assembly, Female type coupling, Qty. 02 Nos.			
SL. No.	Description	Qty. / Assly.	Make
1	Connector Housing	1	Harting Manufacturer type No. 19400160513 / Phoenix Manufacturer type No. 1411884 or Similar
2	Supporting Frame	1	Harting Manufacturer type No. 09140160313 / Phoenix Manufacturer type No. 1417400 or Similar
3	Insert	1	Harting Manufacturer type No. 09140203101 / Phoenix Manufacturer type No. 1414373 or Similar
4	Crimp Contact	20	Harting Manufacturer type No. 09330006223 / Phoenix Manufacturer type No. 1674862 or Similar
5	Plug	1	Harting Manufacturer type No. 09140023101 / Phoenix Manufacturer type No. 1417376 or Similar
6	Socket Contact	2	Harting Manufacturer type No. 09150043113 / Phoenix Manufacturer type No. 1636091 or Similar

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7	Crimp Contact	8	Harting Manufacturer type No. 09150006225 / Phoenix Manufacturer type No. 1672440 or Similar
8	Adapter	1	Harting Manufacturer type No. 09140009915 / Phoenix Manufacturer type No. 1420486 or Similar

Note: One Jumper Assembly should be provided at Power Panel Side of coach while other Jumper Assembly should be provided diagonally & opposite end of the coach. However, Guard coach should have required at one end side Jumper Assembly (Socket Assembly side of the Coach).

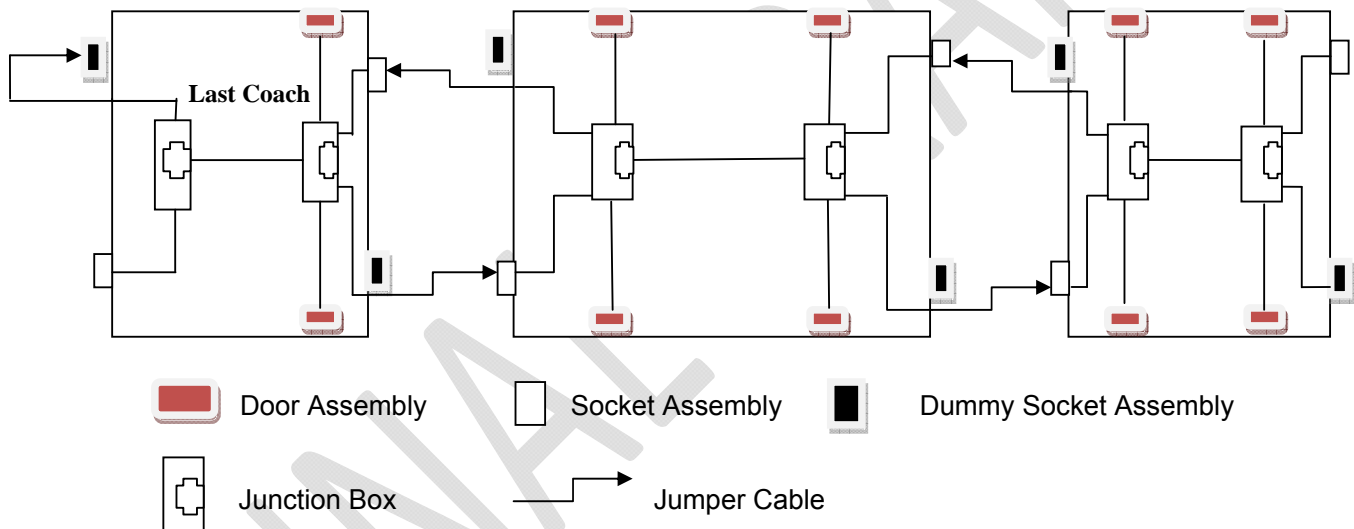
Socket Assembly, Male Type, Qty. 04 Nos. (02 + 02 at Both side end of Coach)			
SL. No.	Description	Qty. / Assly.	Make
1	Base Panel	1	Harting Manufacturer type No. 09400160317 or 09400160311 & 09400165411/ Phoenix Manufacturer type No. 1411060 & 1418445 or Similar
2	Supporting Frame	1	Harting Manufacturer type No. 09140160303 / Phoenix Manufacturer type No. 1417405 or Similar
3	Insert	1	Harting Manufacturer type No. 09140203001 / Phoenix Manufacturer type No. 1414372 or Similar
4	Crimp Contact	20	Harting Manufacturer type No. 09330006123 / Phoenix Manufacturer type No. 1674817 or Similar
5	Pin Element	1	Harting Manufacturer type No. 09140023001 / Phoenix Manufacturer type No 1417374 or Similar
6	Pin Contact	2	Harting Manufacturer type No. 09150043013 / Phoenix Manufacturer type No. 1636088 or Similar
7	Crimp Contact	8	Harting Manufacturer type No. 09150006125 / Phoenix Manufacturer type No. 1674914 or Similar

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8	Adapter	1	Harting Manufacturer type No. 09140009915 / Phoenix Manufacturer type No. 1420486 or Similar
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Note: One Socket Assembly at both end of the coach (Jumper Cable side) should be used as a Dummy Socket Assembly (Which should be closed by their connector cover, if not used) wherein Pin No. 6 & 7 should be short. Dummy socket assembly should be provided at one end Power Panel Side of coach while other end should be provided diagonally & opposite end of the coach. However, Guard Coach should have required at one side (Jumper Cable Side) Socket Assembly.

2.18 The proposed internal & coach to coach wiring are as under:



- 2.19 The Single leaf automatic plug door including locking and opening mechanism wiring shall be designed to work and maintain continuity even coach rotated with 180° (reverse direction) or if only one side power car is attached.
- 2.20 The Single leaf automatic plug door including locking and opening mechanism shall meet the requirements of electromagnetic compatibility (EMC). Electronic equipments of Single leaf automatic plug door including locking and opening mechanism shall be designed to comply with the requirements of EN 50155 and EN 50121-3-2. The transmitted signals shall not have any interference with the other train operation network wires and shall not be affected by power surges.
- 2.21 The Single leaf automatic plug door including locking and opening mechanism shall be designed to work and maintain continuity from a centralized location through a master control unit. The master control unit can be provided either in guard's compartment or as decided by the Indian Railways and should be protected against any suspected vandalism and in such a manner that it does not adversely affect the working of the

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coach system, coach aesthetics and does not cause any injury to the occupants. The guard's compartment shall be with the train and when if it is within one of coaches, this coach can be assembled with any coach's configuration of rake. The locking and opening control of the doors shall be accessed through centralized master control unit. The slave control units for local door control shall be provided in each coach. However, the master control unit in closed guard's compartment of the rake at other end shall become un-operational to eliminate the possibility of misuse.

- 2.22 The Single leaf automatic plug door including locking and opening mechanism shall be designed in such a way that doors on platform side shall be opened by the guard when a train reaches at station by selection of appropriate side push button in the Master control unit.
- 2.23 The push force required for opening and closing the unlocked door after operating the emergency device shall be in accordance with EN 14752: 2015.
- 2.24 During all door operations and under all power supply conditions, door movements shall be smooth, controlled and devoid of jerks or any violent motion.
- 2.25 Automatic plug doors shall close/open normally after removal of an obstruction or when the power supply is lost, removed or interrupted.
- 2.26 All the components of Single leaf automatic plug door including locking and opening mechanism shall be adequately protected against passenger intrusion and be vandal resistant at all times, particularly during the door operating cycle.
- 2.27 The operation of the doors and all associated equipments of the Single leaf automatic plug door including locking and opening mechanism shall not be impaired during the life of the doors by normal or abnormal operating conditions. The control system shall be designed in such a manner that at least two independent faults shall occur at the same time before the respective door opens un-commanded if the door is not enabled. If the enable signal cannot be transferred through the train because of interfacing problems with existing vehicle, the requirement only applies when the speed exceeds 5 km/h.
- 2.28 The master and slave control units of Single leaf automatic plug door including locking and opening mechanism shall be of a proven design, equipped with self-diagnostic functions.
- 2.29 The opening and closing time of the all automatic plug doors on rake shall be adjustable in the range of 4 to 6 seconds. The end of the closing stroke shall be damped or cushioned to reduce impact and minimize possible injury to passengers. All automatic plug doors on the rake shall fully open within 4 to 6 seconds from initiation of the "Door Open" command. All automatic doors on the rake shall fully close within 4 to 6 seconds from the initiation of the "Door Close" command.
- 2.30 For provision of applying the brake, when any door of the train is open, it may be ensured that the BP line pressure should not to drop instantaneously and maximum pressure drop is up to 3 Kg / cm².
- 2.31 An isolation handle may be provided in the guard compartment so that Guard may by pass the brake application if any door is open. However, an illuminative alarm buzzer is activated & shall continuously work when the train moves with any of the doors in open condition until the door has been closed.

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2.32 A reset push button may be provided on Guard panel to reset the brake application which can only be done once all doors are closed or train speed is less than 5 km / hr. After push the reset brake button by guard, the BP line should be fully charged actively and the brake will be released so that train is ready to move immediately to avoid any further delay.

3. LOCKING MECHANISM AND EMERGENCY RELEASES:

3.1 The doors shall be equipped with a robust locking mechanism that shall automatically engage mechanically when the door is closed, whether power or air pressure is available or not. The lock mechanism shall be independent irrespective of electrical / pneumatic pressure availability & shall stay remain closed and locked once locked. The locking device shall be linked to electricity so that in case of power failure, the doors get unlocked with the activation of emergency release device. The operating force of the emergency egress device shall not exceed 150 N. The location & design of emergency egress device shall be in accordance with as per Para 4.3.2 of EN 14752: 2015.

3.2 The locked mechanism shall withstand a minimum force of at least 1200 N applied in the opening direction without breaking or becoming unlocked. The locked mechanism shall be capable of withstanding the forces that occur when passengers are leaning or falling against the door panels without causing any non-elastic deformation or loss of operation (service force is repetitive). The mechanical strength of the door system should be qualify as per EN 14752:2015, Para 4.2.1.1

3.3 Means to unlock and open the door under emergency conditions shall be provided on the interior of the coach. The suitable emergency knob / lever to be provided inside of the coach which is accessible to the passengers for opening of the door in the emergent situation Activation of emergency device shall cause the brake application.

3.4 With the Activation of interior emergency release shall remove power/air from the door drive to allow the door to be opened mechanically. However, a sticker message may also be provided near the emergency device which indicates for how to use along with warning message to avoid unauthorized use of this emergency device.

3.5 When the interior emergency release mechanism is activated, the door status warning red lights inside & outside of the coach shall immediately begin to blink at 1 Hz along with audible alarm until the mechanism is reset and door has been closed & locked.

3.6 The operating force of the emergency egress device shall be as per Para 5.5.1.3 of EN 14752:2015 and shall not exceed 150 N.

3.7 The emergency egress device shall be Bi-stable type. On activation, it shall unlock the door & stay unlocked until the manual intervention for reset.

3.8 The Door control unit shall be able to integrate with TCN as per IEC – 61375 for operation & doors status.

4. DOOR OPERATION:

4.1 Passengers shall be protected from injury by a moving door by the obstacle detection provisions of the door control system.

4.2 The door opening time shall be adjustable to between 4 to 6 seconds. Door opening time is defined as the time from initiating the door open command to achieving 95% of fully open excluding any open warning delay time.

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- 4.3 The door closing time shall be adjustable to between 4 to 8 seconds. Door closing time is defined as the time from initiating the close command to achieving door close and locked status excluding any close warning delay time.
- 4.4 Door operation shall be smooth and rattle free. Door velocity shall be controlled so that the fully open and closed positions can be achieved without sudden or violent movement.
- 4.5 The preset door opening and closing times shall not be materially affected by the normal range of supply voltage experienced (+25%, - 30%) of nominal voltage (110V DC).
- 4.6 It shall be permissible to apply mechanical power in the close direction if the emergency release is activated while the train is in motion.

5. DOOR CONTROL:

- 5.1 Automatic plug doors controls shall be electrically operated from supply through train wire available in the coach circuits. The single leaf automatic plug door including closing, and opening mechanism shall continue to operate correctly with the coach battery (+25%, - 30%) of nominal voltage (110V DC). The automatic plug door control system shall ensure the safe operation of the automatic plug doors on the rake and shall be classified as a Safety Critical System.
- 5.2 The Train Guard/Crew shall have full use of all single leaf automatic plug door controls available from master control unit provided in the Guard's compartment. These controls shall be activated when the master control switch is not in the "OFF" position and other cab is not enabled.
- 5.3 The Train Guard/Crew shall be provided with the following single leaf automatic plug door controls / indicator ergonomically located at a guard panel to facilitate door operation:
- One barrel key for ON / OFF master control unit
 - One indicator for other panel enable
 - One push button to check all indicator test
 - One illuminating latching push button for open LS of the door of coaches.
 - One illuminating latching push button for open RS of the door of coaches.
 - One latching switch to open the doors to which the release signal has been given.
 - One push button for closing the all the doors (Left / Right / Both)
 - One push button to give open / close command to guard door within power car.
 - One indicator for green loop / status about all close door

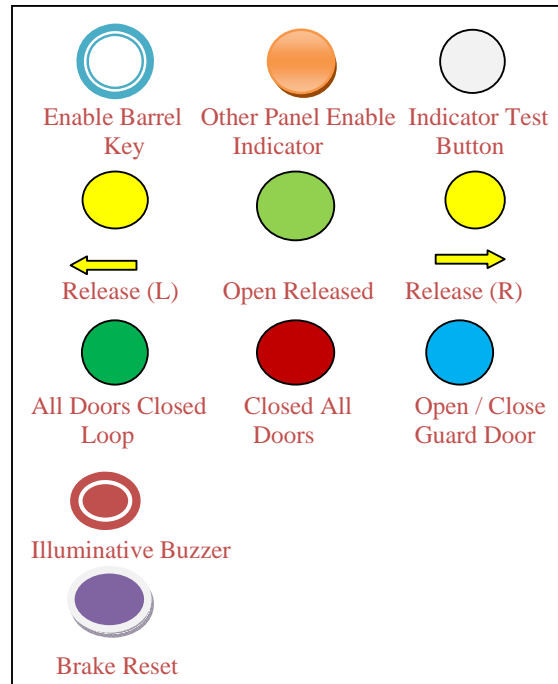
Additionally device like one Push button for reset the brake application, one illuminative alarm buzzer (110 ± 10 dB, Frequency 1900 ± 50 Hz) may also be providing on Guard panel.

Indicative sizes of Guard Panel & Buttons are as below:

- Each Button Dia : 30 mm
- CD of Button (Horizontally) : 80 mm
- CD of Button (Vertically) : 60 mm
- Volume of Guard Panel : 500 mm x 400 mm x 210 mm

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- Colour code of the Button : As shown in sketch



- 5.4 Each automatic door close / open circuit shall be designed to be totally independent from each other, ensuring that failure of one side door shall not affect the other.
- 5.5 All push buttons shall be connected in the circuit to ensure that no single false feed or earth fault can activate the automatic doors without the action of the operator even though all the prerequisite parameters are available.
- 5.6 For opening the door, Guard should press previously either left or right button which available at Guard Panel and then press the release button.
- 5.7 The local door control mechanism shall be designed to interface with the master door control system (DCU) and provide a secure indication of door closed & locked status and secure and safe means of opening and closing the door as commanded by train line signals from the master control system.
- 5.8 Circuit configuration shall be such that any short initiate a series of self checks in order to validate its correct operation.
- 5.9 Upon power up, the local door control system shall initiate a series of self checks in order to validate its correct operation. If the local system is 'OK' then a "system normal" indication shall be available to the master control system. If the system fails its self-test then the system shall revert to a safe condition and require a Reset before further use is possible.
- 5.10 If the door is already closed and locked on power up or reset, then the door system shall be capable of providing "door closed & locked" status without further command inputs from the master control system.
- 5.11 Upon successful completion of the startup sequence, the door operator shall react to any valid command that might be present.

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5.12 The automatic door operating mechanism shall be housed within the coach above the doorway lintels. The design shall provide ease of access for maintenance. The complete mechanism shall be modular and mounted on a rigid frame so that it can be adjusted in-situ for alignment and be removed as an integral unit from the coach. The entire door mounting hardware and door actuation hardware must be readily accessible for adjustment and removal.

6. PASSENGER DOOR OPENING:

6.1 The door shall be equipped to prevent persons and obstacles (e.g. luggage) from being trapped during opening of the door as far as practicable and to minimize the risks and the extent of the injuries caused by the door equipment.

6.2 Once a valid door open command from master control unit has been received, the local door controller shall commence the door opening sequence. The door controller shall indicate loss of door closed & locked status within 800-1200 milli second of receiving the open command.

6.3 Once the door has reached at least 95% of the fully open position, a “Door Open” by electronic door control unit.

6.4 A door open audible warning that is audible from inside and outside the vehicle shall be provided to warn passenger prior to door open. The warning shall commence immediately on receipt of the Open command. There shall be an adjustable delay time (0-3 seconds) before the door begins to open. The warning shall cease once the door is at least 90% open.

6.5 Audio Buzzer Characteristics:

- A fast pulsed tone (6 pulses per second – 10 pulses per second)
- Frequency: 1900 ± 50 Hz;
- Sound Level: 90 ± 5 dB

6.6 In addition, a warning that is visible from inside and outside the vehicle shall be provided by flashing the door shall be provided to warn passenger prior to door open.

6.7 Indicator Light Characteristics:

- Ultra High Luminance LED, Brightness ≥ 75 mcd
- Colour: Red, 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°

6.8 When opening the unlocked door (after operating the emergency device) the manual force to be exerted by a person (inside or outside the vehicle) shall not exceed 150 N at an opening speed of up to 5 cm/second. The force shall be applied in door open direction. Means to apply the force shall be available.

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7. PASSENGER DOOR CLOSING:

- 7.1 Automatic closing shall be initiated with an alarm at each closing door to warn passengers that the door is about to close. Local closing shall initiate an alarm at the allocated door prior to door closure.
- 7.2 Door shall remain open until a Door Close command is generated. The door close sequence shall begin within 1-2 second of Door Close command receipt. However, loss of low speed signals, door shall close without wait for close command.
- 7.3 On receipt of the Door Close command, an audible door close warning that is audible from inside and outside the vehicle shall be immediately provided to warn passengers prior to door closure. The characteristic of audible warning is mentioned at para 6.6
- 7.4 In addition, a warning that is visible from inside and outside the vehicle shall be provided by flashing the door closed & locked status to warn passengers prior to door closure. The characteristic of visual warning is mentioned at Part II of para 6.7
- 7.5 The audible/visual warning shall cease once the doors are closed & locked.

8. PASSENGERS ACCESS PROTECTION:

- 8.1 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.
- 8.2 The maximum force exerted on an obstacle during final closing stroke shall not exceed the following values:
 Peak force $F_p \leq 300$ N,
 Effective force during first closing attempt $F_e \leq 150$ N,
 Mean effective force including further closing attempts $F_E \leq 200$ N,
 The values specified shall be measured using a device and method as described in Annexure-D of EN 14752: 2015. Measurement on each door may not be required if the system provides constant performance.
- 8.3 An obstacle with maximum dimension of 10 mm dia rod trapped with its long edge vertically between the leading door edge and the frame or between two door panels 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.
- 8.4 If the obstacle faced during closing, the automatic door shall reclose 3 times, this shall be adjustable. In the event that the automatic door fails to close following the three attempts, further door movement shall cease on the offending automatic door and door will go to and remain in full open position unless again command has been not generated. A Red colour light will be continuously glowing from both inside & outside of the coach along with buzzer warning which indicates that the door has failed to

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close due to obstacle. The characteristic of audible & visual warning is mentioned at Part II of para 6.5 & 6.7. The audible/visual warning shall cease once the doors are closed & locked.

8.5 If the obstacle faced during opening, then door will move to close come in pause position and stay there unless again command has been not generated.

8.6 Door closed and obstruction sensing information shall be sent from each coach in the rake to Master Door Controller.

8.7 The number of obstructions during opening or closing shall be logged by the door control system as an aid to diagnosing door system problems.

9. CLOSED AND LOCKED STATUS (CLS) INDICATION:

9.1 Local door closed and locked status shall not be indicated unless the door panel is safely closed and locked. Closed & locked status shall be vitally provided and shall be indicated directly from the mechanisms (limit switches or equivalent) sensing the closed status and the locked status of the door and its lock. The door Closed & Locked Status (CLS) shall be broken prior to unlocking and opening the door and shall be indicated only after the door is positively closed and locked. No single point failure of the door closed and locked monitor circuit shall result in an unsafe condition.

9.2 For the purposes of troubleshooting, the door control system shall maintain a log of any and all loss of Closed & Locked Status (CLS) after it has been achieved and no open command is present.

10. CUT-OUT / ISOLATION DEVICE:

10.1 A cut out device shall be provided on each side of the coach at door location, accessible only by train crew that can be used to put a door out of service in the event of malfunction. The location of Cut – Out / Isolation device shall be in accordance with as per Para 5.1.6.1 of EN 14752: 2015.

10.2 When the doors locked out (Cut-out is applied) mechanically in the event of malfunction, the cut out device bypassing the train lines. A Red colour light 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 Part II of para 6.7

10.3 Operation of the cut-out device shall cause the local door system to store data in such a way that it is saved in its memory and can be extracted into a portable computer via the diagnostic port. However, the controller shall no longer log faults nor shall it continue to indicate a fault to the master control system or update status indications, except for emergency release status over any train network. The door controller shall ignore any further open or close commands until such point as the cut-out device is restored to the in-service position.

11. ELECTRICAL AND ELECTRONIC REQUIREMENTS:

11.1 The door system shall meet all applicable requirements of IEC 60571 or EN 50155.

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- 11.2 The door system shall have provision to adequately bond the metal parts of the equipment to the vehicle body shell. A suitable ground stud shall be provided on each item of electrical equipment.
- 11.3 Every system component shall incorporate shielding, filtering and other devices or techniques that may necessary to successfully pass all Electro-Magnetic-Interference (EMI) test requirements of this specification. For systems that can affect vital functions, failure of such systems shall be detected and disabled to prevent vital system faults and unsafe conditions. Such failures shall be included in the system's hazard analysis.
- 11.4 The door system equipment shall be designed to comply with the requirements of the current version of EN 50155 and EN 50121-3-2.
- 11.5 The software shall be designed to the necessary software safety integrity level (SSIL) to achieve the overall safety requirements for the door system. EN 50128-2001 gives rules concerning software for Railway control and protection systems.
- 11.6 Electrical equipment shall be designed to prevent direct and indirect contact with live components in accordance with requirements given in EN 50153.
- 11.7 Door system components requiring access during maintenance for door setting/adjustment shall not be positioned in the immediate proximity of any hazardous area, i.e. potential trapping hazard or electrical hazard, alternatively a local isolation system shall be provided.
- 11.8 The characteristics of the short circuit current shall be stated in the offer by the Tenderer.

12. RELIABILITY, AVAILABILITY, MAINTAINABILITY AND SAFETY (RAMS):

- 12.1 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.
- 12.2 The Single leaf automatic plug door including locking and opening mechanism 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 Sub-contractor's approach and organization to implement the required RAMS process.
- 12.3 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.
- 12.4 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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