INDIAN RAILWAYS

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SPECIFICATION FOR FULLY SEALED GANGWAYS FOR VANDE BAHART TRAINSET AND LHB COACHES

1. FOREWORD

1.1 The gangway is flexible part of the train, allowing the relative movements between the coaches and offering passenger a secure and comfortable passageway. It protects passengers and staff from falling out of the train and protects against external environmental conditions.

1.2 The aesthetically designed gangway shall have one Full Module between two coaches and should have quick coupling arrangement for quick attachment and detachment between the adjacent coaches at depot/yard or during train operation. There shall be quick release mechanism on one end and other end should be fastened easily with coach body.

1.3 This specification is intended to cover the technical requirements/provisions relating to materials, construction and tests of fully sealed gangways (Full Module) for Vande Bharat Trainset and LHB Coaches to be used over Indian Railway and does not include all the necessary provisions of the contracts.

1.4 This specification draws references to some of the relevant EN, ISO and other Indian Standard specifications. Unless otherwise stated, the latest version of the relevant specification shall be taken as reference.

2. GENERAL

2.1 Following shall be applicable when this item appears in RDSO's vendor directory:

"All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11 dated 07.07.2023 (titled "Vendor-Change in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.

2.2 The Govt. of India policy on 'Make in India' shall apply.

2.3 Manufacturer will ensure the usage of environment friendly material and energy efficient instruments/equipment.

3. DEFINITION & EXPLANATION

3.1 'Supplier' means the present firm / company on whom the order of the supply of fully sealed gangways for Vande Bharat Train set or LHB coach is placed.

3.2 'Purchaser' means the Indian Railways on behalf of the President of India who are purchasing the fully sealed gangways for Vande Bharat Train set or LHB coach.

3.3 'Inspecting Authority' means the Organization or its representative nominated by the Purchaser to inspect the fully sealed gangways for Vande Bharat Train set or LHB on his behalf.

3.4 The Research Designs and Standards Organization, Manak Nagar, Lucknow – 226011 is hereafter referred to as RDSO.

3.5 Indian Railways is hereafter referred to as IR.

3.6 'Engineers' means officials of the RDSO or any other officials authorized by RDSO, Lucknow.

4. OPERATING CONDITION

4.1 **Ambient Conditions**

(i) Ambient temperature : -10 ^{0}C to 60 ^{0}C
(ii) Altitude : Sea level to 2500m
(iii) Max. operating temperature : 70 ^{0}C
(iv) Rainfall : Very heavy and continuous (up to 2500 mm during rainy season) Max. Wind velocity 145 kmph.
(v) Humidity : Yearly average 75% and 30 days continuously 75% to 95%

(i) During dry weather, the atmosphere is likely to be dusty. The dust sedimentation level shall be as per class 3S2 as per Para A.2.4 of IEC: 60721-3-5
(ii) Temperature variations can be quite high in the same journey or short period of time.
(iii) Cars operate in coastal areas with continued exposure to salt laden air.
(iv) Shock and Vibration suitable for traction rolling stock application as per IEC 61373/ IEC 60077-1.
(v) The equipment shall be designed to perform thermal shocks such as sudden change of temperature while entering / exiting tunnel

5. WORKING CONDITION: Gangway shall work under following working conditions:

Train speed	160 Kmph for LHB Coaches and upto 200 Kmph for Vande Bharat Train set
Minimum Curvature	152.4 meter for Depot 175 meter for Main line
Gradient	1:100
Passenger load @ 60 kg per person	10 person/m^2 max.

6. SCOPE

6.1 The scope includes the design, manufacture, testing, supply, installation and commissioning of fully sealed gangways (Full module) for Vande Bharat Train set cars and LHB coaches operating at 200/160 Kmph speed on Indian Railways. The supplier shall be responsible for the provisions of all accessories including fasteners for Sealed gangway as per requirement of installation.

7. PARTICULAR REQUIREMENTS

7.1 Vendors willing to supply gangway assemblies for the use of Indian Railways shall register themselves with nodal agency nominated by Indian Railway for vendor development. The firm should possess valid ISO: 9001 certificate for manufacture of same/similar item at his works

address. The certifying body which issues the ISO: 9001 certificate shall be accredited by an accreditation body that is a part of the International Accreditation Forum (IAF) under the Multilateral Recognition Arrangement (MLA). The list of all such accreditation bodies is available at the IAF website at: http://www.iaf.nu.

7.2 The firm along with their principals shall have adequate infrastructures for manufacturing, testing and quality control requirements for gangway assembly as detailed in **Annexure-I** of this specification. This will be verified by nodal agency nominated by Indian Railway for vendor development at the time of registration of the firm.

7.3 Since gangway system is a safety related item, in-service trials shall be necessary for OEM design before full clearance is given for supply.

7.4 Simulation FEA: Vender shall have well established proper design wing with qualified and competent design professionals. They should have capability of doing FEA analysis and simulation.

7.5 Vendor shall have pan–India maintenance facilities for maintenance of their supplied product.

7.6 Source of manufacture of each component shall be provided by the vendor at the time of design stage.

7.7 Firm shall have at least one technically qualified and experienced personnel in the field of rubber industry/intercar gangway system having industrial experience of not less than 07 years. The firm shall submit complete details of qualification and experience of personnel involved.

7.8 Vendors shall ensure that gangway to that particular design are supplied with components manufactured from the sources as indicated at the time of design approval and used for type testing.

8. MECHANICAL INTERFACES

8.1 The gangway system will be fixed on the car body end wall. The supplier has to ensure and confirm that offered gangway assembly/system will fit in the existing car body end wall.

8.2 No change will be permitted in the car body structure. The supplier shall make effort to mount the gangway assembly/system on the existing car body structure.

8.3 There should not be any infringement with existing structure. This shall be ensured during designing.

8.4 List of relevant drawings of Vande Bharat Train set and LHB coach is given in **Annexure-II** for reference.

8.5 The supplier shall guarantee all internal/external interfaces of the gangway system.

9. SCOPE OF SUPPLY

9.1 The scope of supply of fully sealed gangway shall include the following major items including all fasteners/hardware required for installation of the system. However, it is supplier's responsibility to ensure supply of all necessary accessories needed for reliable performance of sealed gangway.

S.N.	Item Description	Material	Qty / Coach
1.	Car Body Frame 1	ASTM-A240, Type 304	01
2.	Bellow Assembly	Silicon fire retardant rubber with fabric compliant to EN 45545-2, R1-HL3	01
3.	Ceiling Panel Assembly	AA:6063-T5/IS:63400 or Equivalent	01
4.	Interior Assembly	FRP/GFRP compliant to EN 45545-2 HL3	02
5.	Latching Assembly	AA:6063-T5/IS:63400 or Equivalent	01
6.	Fairing Assembly	AA:6063-T5/IS:63400 or Equivalent	02
7.	Bridge plate assembly	AA:6063-T5/IS:63400 or Equivalent	01
8.	Car Body Frame 2	ASTM-A240, Type 304	01

10. DESIGN REQUIREMENTS

10.1 The gangway structure shall be designed to withstand mechanical stresses, vibrations, and forces that can occur during train operation.

10.2 The gangway system shall comply with structural and safety requirement as specified in EN 16286-1.

10.3 The gangway system shall comply with fire safety requirement according to EN 45545 HL3.

10.4 **The gangway system shall be provided with emergency release mechanism to quickly separate the coaches within 10 minutes in case of emergency.**

10.5 The gangway system shall ensure an airtight and weatherproof connection between adjacent passenger coaches during operation.

10.6 The noise value shall be equal to or less that 27dB from gangway center when recorded in accordance with EN 16286-2 / ISO 16283 Part-1 2014 / ISO 717/DIN 52210 Part-1 1989/IS 9901 Part-III-84 OR Equivalent spec for rolling stock.

10.7 The sealing mechanism shall effectively prevent the ingress of water, dust, and external contaminants.

10.8 The gangway shall be provided with sufficient thermal and acoustic insulation to ensure that the overall air conditioning performance and noise performance of the Train are achieved.

10.9 The interior design shall be fitted with smooth and aesthetically pleasing panelling and shall ensure that no potential finger or dirt traps exist.

10.10 Handrails and grip points shall be strategically positioned to assist passengers in maintaining balance while traversing the gangway.

10.11 The gangway shall provide secure and slip-resistant walking surfaces for passengers.

10.12 The floor through the inter-car gangway shall be maintained as nearly as possible at the same height as the rest of the car floor.

10.13 Sudden height changes shall be less than 15mm high in nominal position and it shall be ramped so as not to cause inconvenience to passengers.

10.14 Vertical gaps between the hinged moving tread-plates of the inter-car gangway and the general floor level of the car shall not exceed 5mm. The means shall be provided to minimise wear of the floor by the sliding action of each moving tread plate.

10.15 The design of the floor shall be such that the relative movement between adjacent vehicle ends does not cause sliding floor plates to lift in such a way as could cause injury, in particular to sandal-clad or bare feet.

10.16 The gangway shall adhere to accessibility standards, ensuring that passengers with reduced mobility can comfortably and safely use the system.

10.17 Clear markings and visual cues shall guide passengers with disabilities.

10.18 The horizontal clearway for wheelchairs shall be at least 800mm up to a minimum height of 1450 mm

10.19 The headroom in the inter-car gangway area shall be at least 1950mm, and the clear width at least 550mm.

10.20 The centre line of the gangway shall be coincidental with the centre line of the Vehicles.

10.21 An inter-car gangway structures shall be totally interchangeable with one another.

10.22 The gangway system shall be designed with durable materials that can withstand the operational environment and require minimal maintenance over its lifecycle.

10.23 The components of the gangway system shall give a service life as per following tables under normal conditions of use:

S.No.	Components of gangway system	Service Life in years
1.	Silicon bellows	12
2.	Flexible side panels	08
3.	Wearable parts	05
4.	Metal parts	12

10.24 The gangway shall maintain its performance and remain stable over the full range of relative vehicle movements encountered in normal operation.

10.25 Crash Behaviour: In case of crash scenario, the component of Gangway system shall not prevent the function of the energy absorber element or anti-climbers. The minimum length of compressed Gangway components shall be taken into accounts.

10.26 The system shall allow for easy access and inspection of critical components for routine maintenance and repair.

10.27 Maintenance procedures and intervals shall be clearly documented and provided to Indian Railways.

11. SUBMISSION OF TECHNICAL DOCUMENTS:

11.1 The firm shall submit the following documents at the time of vendor registration for approval by Nodal agency nominated by Indian Railway for vendor development:

a. Interface drawings
b. Major assembly drawings/Installation drawings
c. Load/strength calculation of gangway system along with FEA report
d. Quality Assurance plan
e. Test scheme for type test and routine test.
f. Maintenance Manual
g. List of spare parts for In-service requirements.

11.2 The design shall be developed based on the space envelope available and technical & performance requirements given in this specification and sound engineering practice in accordance with the international standards. The firm shall submit 3D parametric Model and 2D drawings of the inter-car Gangways (the General arrangement and interface details with the car body) in hard (A1/A2 Size) and soft copy.

11.3 These drawings shall contain the necessary details/dimensions as specified and shall show sufficiently sectioned view of the equipment so that every component of the equipment is identified.

11.4 Material grade / specifications for each component shall be indicated on the relevant drawings of the firm and the firm shall supply copies of translation in English of such specifications / drawings other than Indian Standards specification to Nodal agency nominated by Indian Railway for vendor development

11.5 The design shall be developed in SI units.

11.6 'Approval' of the design means the approval of the general design features. Notwithstanding the approval, the supplier will be wholly responsible for the performance of the gangway system as well as individual components offered.

11.7 **Simulation Validation of Gangway before prototype:**

a) FEA of gangway in various load of cases as per appendix-G.
b) Software validation of curve testing.

12. PROTOTYPE INSPECTION

12.1 The manufacturer shall offer at least 2 Nos. Prototype fully sealed gangway assembly complete for necessary testing in accordance to Para 14 of this specification. The tests for all the requirements as laid down in this specification are mandatory for product approval.

12.2 The Prototype inspection of gangway assembly shall be carried out at manufacturer's premises by authorized representative of Nodal agency nominated by Indian Railway for vendor development. The manufacturer shall provide, without extra charges, material, tools and any other assistance, which may be considered necessary for any test / examination and dimensional checking.

13. PURCHASE INSPECTION

13.1 The purchase inspection of gangway assembly shall be carried out at the premises of manufacturer by the inspection authority nominated by the purchaser.

13.2 The Inspecting Authority shall make audit checks of the manufacturing procedure 'Internal Quality Assurance System' to ensure that the gangway assembly offered for inspection is manufactured strictly as per 'Internal Quality Assurance System' and the manufacturer has carried out all the tests/inspections during manufacturing stage to ensure that the gangway assembly as well as their components are manufactured strictly to the specification/drawing and quality standard of the collaborator. During audit checks the inspection Authority shall see from the records of 'Internal Quality Assurance' that the Raw material used for the manufacture of sealed gangway is as per specification laid down.

13.3 Manufacturer shall maintain the internal tests record and present to the Inspection Authority.

13.4 Inspecting authority shall have access to all detailed manufacturing/original collaborator's drawings for all items of equipment. The firm shall be obliged to show these drawings as and when called for.

13.5 Inspection Authority shall conduct the necessary routine tests of the gangway assembly from each lot of purchase thereof in accordance to para 14 of this specification as per test check sheet approved by Nodal agency nominated for vendor development.

13.6 Inspecting authority will carry out inspection as per procedure commonly agreed during design freeze to reassure that the material is being furnished in accordance with these specifications.

In this regard the supplier shall not be entitled to object on any ground whatsoever on the nature and procedure of testing that may be followed by the inspecting authority in line with commonly agreed procedure during design freeze.

14. TESTS

14.1 Type Tests

14.1.1 The following tests under Table -1 shall constitute type tests and shall be carried out in accordance with test method given against each test at the time of Prototype approval of new entrant or at the time of design change or localization of-existing design:

Table - 1

S.No.	Description of Test	Sample Size	Test Method
1.	Weight Check	1 Set	Appendix -A
2.	Min. curve test	1 Set	Appendix -B
3.	Air tightness test	1 Set	Appendix -C
4.	Heat insulation test	1 Set	Appendix -D
5.	Sound/Noise Dampening test	1 Set	Appendix -E
6.	Rain test (Leakage test)	1 Set	Appendix -F
7.	Load test	1 Set	Appendix -G
8.	Fire Test (for all non-metallic items) as per EN 45545-2, R1-HL3.	1 Set	Appendix -H
9.	Endurance Test	1 Set	Appendix -I
10.	Emergency Release mechanism timing check (It should not take more than 10 min.)	1 Set	As per required functionality

14.1.2 All the Fire tests except HRR mentioned at S.No. 1 (b) of Appendix H shall be type test and shall be carried out once in a year or after every 500 coach sets or there is any change made to their tested formulation, whichever is earlier. These fire tests shall be conducted at any CERTIFIER lab or labs empaneled by RDSO.

14.1.3 All the Fire tests mentioned in Appendix 8 should be in single report. No separate report will be acceptable at the time of initial approval stage.

14.2 Routine Tests

14.2.1 The following tests under Table – 2 shall constitute routine tests and shall be done for each lot of purchase order by inspecting authority nominated by the purchaser:

Table - 2

S.No.	Description of Test	Sample Size	Test Method
1.	Visual examination	10%	-
2.	Dimensional check	2%	-
3.	Functionality check of Latching mechanism	2%	-
4.	Heat Release Test MARHE (Max.) HL3 as per EN 45545-2 for all non-metallic items	2%	ISO:5660-1 : 50 kW/m2

14.3 **Compatibility Type Testing:**

14.3.1 The gangway system offered by any new supplier shall be compatible with the existing range of already supplied gangway and coach configurations. The supplier shall be fully responsible for the compatibility between different makes of sealed gangway and it shall be ensured by the actual fitment at car/rake during prototype stage.

15. FIELD TRIAL

15.1 The gangway assembly shall be subjected to field trials according to para 15.2. The following parameters shall be monitored during the trial period:

a) Any visible damage, wear and corrosion.
b) Leaks or gaps in sealing mechanism
c) Handrails to be checked for sturdiness and proper height.
d) Effectiveness of emergency release mechanism
e) Stability of gangway during both stationary and dynamic conditions.
f) Any other defects.

15.2 The conditions of field trials shall be applicable as under:

S. N.	Status of Vendor	Past supply of sealed Gangway to IR	Field Trial Mandate
1.	Conditional Developmental Vendor (Indigenous design)	Nil	Field trial shall be mandatory on minimum 30 Coaches (Preferably 2 Rakes) for period of 12 Months.
		Already supplied more than 30 coach set to IR which have completed 1 year of satisfactory service from the date of fitment	No trial needed. Firm shall be included as developmental vendor for Sealed Gangway based on past performance.
2.	Conditional Developmental Vendor (OEM Design)	Nil	Field trial shall be mandatory on minimum 30 Coaches (Preferably 2 Rakes) for period of 6 Months.
		Already supplied more than 30 coach set to IR which have completed 6 Months of satisfactory service from the date of fitment	No trial needed. Firm shall be included as developmental vendor for Sealed Gangway based on past performance.

15.3 After satisfactory performance of fully sealed gangway in field trials, gangway system offered may be considered for regular service on IR Coaches.

16. WARRANTY & COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT (CAMC)

16.1 The initial warranty on gangway assembly is 60 months from date of train commissioning or 72 months from date of supply. Firm shall replace free of cost at primary depot location of Indian railway the whole system or portion of items which malfunction during the warranty period.

16.2 The firm must offer CAMC along with OE offer for 72 months that is applicable from date of train commissioning or 78 months from date of supply. Firm has to submit the list along with unit price rate of the following:

a. Must change spares
b. Spares required during periodic overhauling
c. Any other spares that may be required

17. SPARE PARTS, UNIT EXCHANGE SPARES & CONSUMABLES:

17.1 Supplier shall provide recommended list of spare parts required for maintenance of the Fully Sealed Gangways (Full module) 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 and quantity of each component.

17.2 Supplier 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.

18. AFTER SALES SERVICES:

18.1 Firm may be required to send his technical expert during the installation and commissioning of their equipment on cars.

18.2 Firm 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.

18.3 Firm shall associate with Indian Railways during the trials. He shall also undertake to modify the equipment supplied, if required as a result of trials.

18.4 Firm shall supply in three sets hard copies and soft copies in pen drive of the Operation & Maintenance Manuals, Spare parts catalog and Servicing Instructions.

18.5 Manuals should normally include:

18.5.1 Details of attention to be given during IOH / POH or any other schedule.

18.5.2 Details of gauges, jigs & fixtures, tools, machinery and plant for maintenance of gangway system.

18.5.3 Typical defects and their remedial measures.

18.5.4 List of spares for day-to-day maintenance and at the time of IOH / POH in the form of periodic overhaul kit.

18.6 Identification codes (manufacturer's name / trademark) 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.

18.7 Maintenance standards including clearances and tolerances at various locations and permissible limits of wear for good service performance of equipment.

18.8 Firm 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.

19. PREVENTIVE COATINGS

19.1 Equipment to be supplied shall be free from injurious defects that may impair their strength. Supplier shall also ensure that all items are adequately treated and painted (excluding flange faces) to prevent corrosion.

19.2 All parts of gangway system shall be painted with two coats of paints with colours as specified by IR before supply. The surface of light alloy castings shall be anodized.

20. MARKING

20.1 Identification codes (manufacturer's name / trade mark) and month & year of manufacture details shall be pasted or riveted on the main equipment.

21. PACKING

21.1 Supplier shall ensure that all outer and exposed portions of the various items of fully sealed gangway system for Vande Bharat Train set and LHB coaches are covered with suitable protection / packing material to prevent ingress of foreign matter / damage during handling, storage and stone throwing on it etc.

21.2 Supplier shall also ensure that all items of fully sealed gangway system for Vande Bharat Train set and LHB coaches in assembled condition are adequately packed before dispatch to prevent damage in transporting, handling, and storage.

22. TRAINING

22.1 Adequate number of Railway officials shall be trained to cover all aspects of fully sealed gangway system for Vande Bharat Train set and LHB coaches which shall cover familiarization maintenance, troubleshooting & functionality of various sub systems of gangway system. The number and days of training shall be mutually agreed between purchaser and supplier.

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APPENDIX-A

WEIGHT CHECK

The weight of the gangway components shall be checked as per relevant drawings. The Total weight of the Gangway assembly shall not exceed the maximum weight specified in the assembly drawing.

APPENDIX-B

MIN. CURVE TEST

Install the gangway on the curve passing test bench, and couple it. The train simulator should be able to pass the minimum fixed radius curve and the minimum fixed radius reverse curve during the movement of the gangway. The test shall be carried out 3 times.

When normally coupled, the minimum curve radius that can be passed is R152.4M for depot and R 175M for mainline. However, purchaser reserves the rights for physical validation at any point of time, whenever it is required.

APPENDIX-C

AIR TIGHTNESS TEST

The air tightness test (before putting drain hole) shall be carried out as per EN 16286- 1:2013 after minimum curve passing test. The gangway simulates in the coupling state of vehicle, is installed on the test frame and forms a closed test chamber.

Inflate to test chamber in order to increase pressure, until the pressure in the test chamber exceeds the maximum charge pressure as specified in the below table, measure the time of leakage in the corresponding depressurization interval in test chamber. The test shall be carried out not less than 3 times, and take the average of three tests as the test result.

The time taken for air pressure reduction from maximum to minimum in sealed gangway shall be as per following table:

Vehicle Speed (km/h)	Pressure Range (Max to Min)	Dropping Time (In seconds)
V<200	From 3600Pa to 1350Pa	>18

APPENDIX-D

HEAT INSULATION TEST

Heat transfer coefficient shall be K ≤ 5.0 W/(M2°K) and shall be done for bellow in accordance to EN/ISO 6946 or Equivalent spec for rolling stock.

APPENDIX-E

SOUND/NOISE DAMPENING TEST

The weighted noise reduction shall be NRw≤ 27dB from gangway centre and shall be done in accordance with EN 16286-2 / ISO 16283 Part-1 2014 / ISO 717/DIN 52210 Part-1 1989/IS 9901 Part-III-84 OR Equivalent spec for rolling stock.

APPENDIX-F

RAIN TEST (WATER OR LEAKAGE TEST)

This test shall be conducted as a static type test using a gangway installed in test rig that represents the interface of the adjacent vehicle. The test conditions as per following table:

S.NO.	TEST CONDITION	SUPPLIER TYPE TEST
1.	Ambient temperature of test site	>0 C, no freezing phenomenon
2.	No of nozzles	Min. As shown in below fig. However more/ less can be taken as per requirements to ensure water cover the complete surface of the gangway system except the bottom area.
3.	Delivery Rate	12 ± 0.5 liters/min per nozzles
4.	Pressure	3 ± 0.5 bar
5.	Distance between the gangway	500 ± 50 mm and nozzles
6.	Distribution of nozzles	Full cone 90°
7.	Duration of the Test	Minimum 15 minutes

Water shall be sprinkled for the period of minimum 15 minutes as shown in below fig. The total delivery rate of water and the pressure shall be recorded before and after the test. After the rain test, get into the gangway passing area, inspect gangway for ingress of water and record. Water seepage and leakage phenomenon shall not appear.

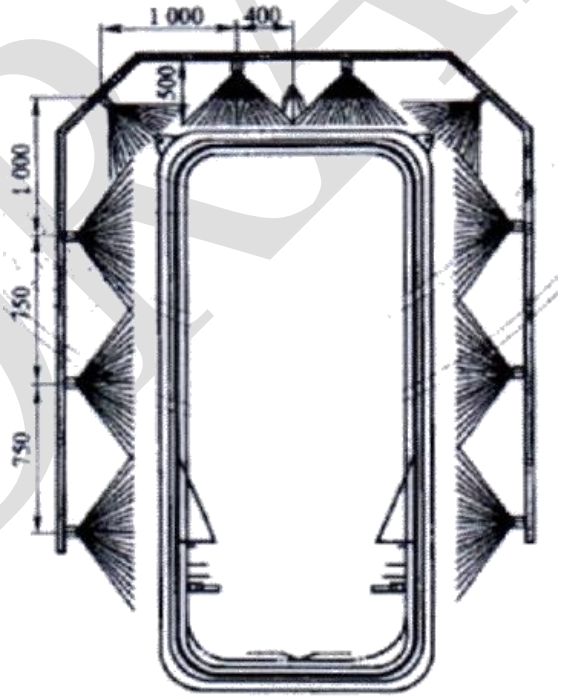

Fig.1 : Spray arrangements of Gangway

APPENDIX-G

VERTICAL LOAD APPLIED TO BRIDGE SYSTEM

Gangway vertical load test shall be carried out with a downward force of 10 people/m^2@60 kg person which has been distributed on the lower platform of gangway. No significant permanent deformation is present after the removal of load. No obvious deforms, damage or abnormality shall be reported.

DYNAMIC LOADS ON GANGWAY SYSTEM AND FIXATION

Accelerations, as well as forces generated by relative movements shall be taken in to account.

HORIZONTAL LOAD:

Gangway sidewall of the clearway shall carry a load simulating a person leaning against sidewall. Concentrated perpendicular loads acting from within the gangway shall be applied without causing any permanent deformation.

1. A load of 15% x 80kg x 9.81 m/s2 = 120N representing the hand of a person over an area of 0.1 mx 0.1 m on any area of the surface of the gangway.
2. A load of 80 kg x 9.81 m/s2 = 800 N representing the shoulders of a person over an area of vertical extension of 0.2 m and a horizontal extension of 0.5 m centered at 1.3m above floor level anywhere on that line.

The gangway shall stay in the gauge of the vehicle.

AERODYNAMIC LOAD:

The gangway shall be capable of resisting against aerodynamic loads that occur when trains are crossing in open air tunnels, without showing any permanent deformation.

APPENDIX-H

FIRE TEST (FOR ALL NON-METALLIC ITEMS) AS PER EN 45545-2

The test result shall comply as per following table :

S.No.	PROPERTIES	VALUES	TEST METHOD
1.	Fire & Smoke characteristics	R1, HL3	
a)	Lateral spread flame CFE(Minimum).	20 kW/m2	IS0-5658-2
b)	Heat release rate (Cone calorimeter method) MARHE(Max.)	60 kW/m2	IS0:5660-1:50 kW/m2
c)	Smoke generation Ds (4) (Max)	150 Dimensionless	EN ISO:5659-2:50 kW/m2
d)	Smoke generation VOF4 (Max)	300 min	EN ISO :5659-2:50 kW/m2
e)	Gas analysis in smoke chamber using FTIR technique CIT_G (Max)	0.75 Dimensionless	EN 17084 Method 1 :50kW/m2

APPENDIX-I

GANGWAY FATIGUE / ENDURANCE TEST

1. TEST PURPOSE

Fatigue test is to verify the performance of gangway under long-term movement and to judge whether the service life of the product meets the requirements through the actual running of vehicle conditions. This shall be done one time for one project. This test shall be repeated, if any major design modification is done by the supplier for same project.

2. TEST CRITERIA

Displacement curve provided by Railway

3. TEST PLACE

As specified by the OEMs/Mutual agreement between ICE and Supplier.

4. TEST EQUIPMENT

Displacement test bench and gangway

5. TEST CONTENT

5.1 DESCRIPTION OF THE TEST RIG

The test rig shall be a steel construction, in which the whole gangway can be mounted. This occurs at two planes representing the vehicle interfaces. These two planes can be moved relatively to each other to simulate all vehicle positions occurring during operation (curve-driving, roll movement in transverse direction and pitching in longitudinal direction, height misalignment or combinations of these movements).

It shall be possible to mount additional parts to the vertical planes in order to simulate

Illustration 1 shows the principle vehicle/wagon positions during curve- driving.

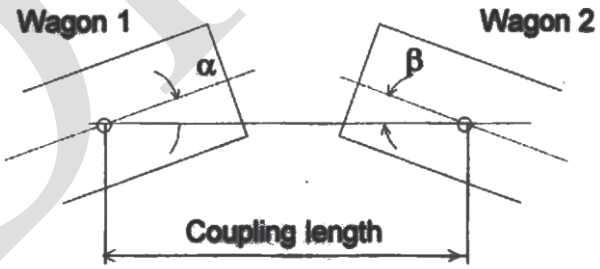

Illustration 1: Curve driving - schematic

The coupling distance and the distance from the coupling point to the screw-on plane of the gangway shall be adjusted by an adequate construction of the test rig. The angles and can hydraulically be changed according to the respective vehicle positions.

The coupling distance shall be extended or reduced, to simulate "Draw" and "Buff" conditions. The "Draw" and "Buff' conditions shall be set manually if these settings cannot be programmed to the single movement steps. "Draw" and "Buff' settings shall be superimposed to several cycles. This applies also for settings of height misalignments.

Both possibilities, simulating height misalignment and roll movements, are shown in illustration 2 and 3.

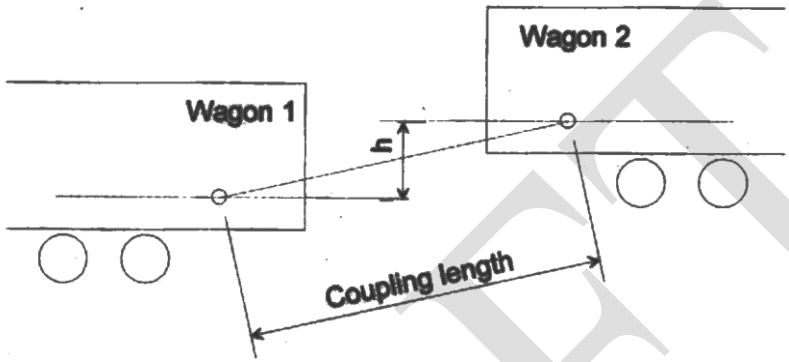

Illustration 2: Height misalignment - schematic

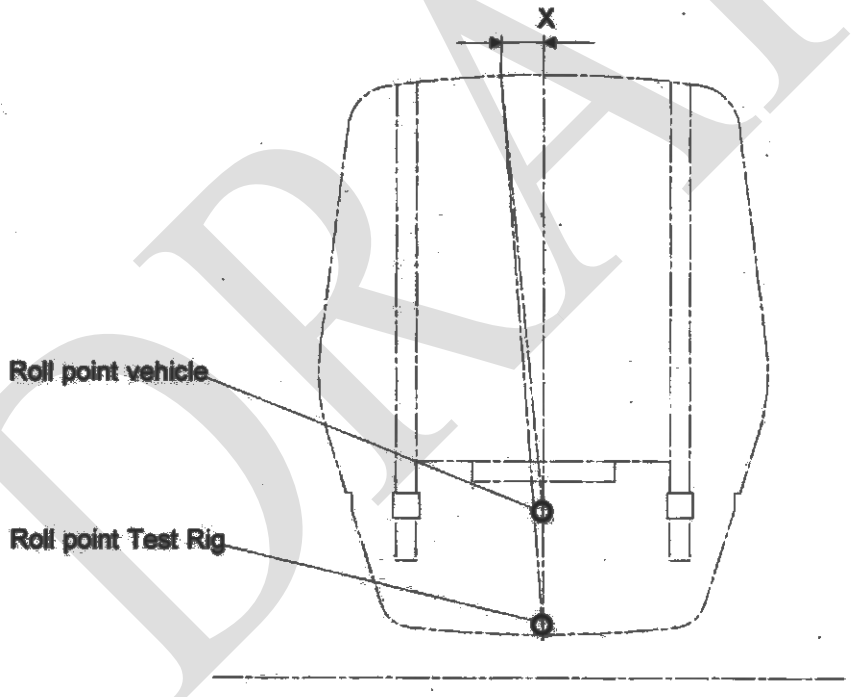

Illustration 3: Roll movement - schematic

Height misalignment, roll and pitching movements shall be adjusted hydraulically too. These values can only be set at one plane of the test rig. Counter-movements of the vehicle planes are added- up and set at this plane of the test rig. The impeccable function of the gangway shall be tested by simulating the vehicle positions required by ICF.

5.2 TEST RIG AND COUPLER SUPPORT

The wagon coupler (connection beam with similar mechanical properties as well as a coupler's gangway support sliding surface) shall be positioned between the interfaces of the test rig in a way that all movements including height misalignment can be simulated through movements of the test rig interfaces. The coupler as fixed assembly group shall remain unmoved. With this motion sequence the movement simulation complies with the movements to be expected actually in reality. Thus, the Endurance Test represents the real behavior of the gangway and the coupler and the behavior of both to each other which can be expected in reality.

5.3 TEST CONDITIONS

The gangway (two coupled gangways halves/full module) shall be mounted in the test rig in the same way as it will be installed on the trains. The test bench has to be able to perform all specified movements automatically.

The gangway has to be inspected to check if it is installed correctly and it has no damages.

5.4 TEST CYCLES AND SEQUENCES

Smallest curve radius at track = R175 m

Smallest curve radius in depot = R152.4 m (all turnouts in depot = 152.4m)

Aside from the 175 m curves the curves greater than 175 m at the track curves will not be considered for the Endurance Test. Crossovers with radius greater than 175 m at track will not be considered due to the minor meaning regarding movement stress and occurrence.

5.5 TEST SEQUENCE

The cycle consists of 2 times 16 steps (= 32 steps). The full track sequence is 21 cycles.

Track test cycle: Track back and forth 21 times per cycle

		Type	Radius	Direction	Pitch (3° between cars) [^{0}]	Roll first car [^{0}]	Roll second car [^{0}]
	straight						
1	a	entry	175	left		right	
2	a	curve	175	left	hump R2000		
3	a	leaving	175	left	hump R2000		left
4	straight						
5	c	entry	175	right		left	
6	c	curve	175	right			
7	c	leaving	175	right			right
8	straight						
9	d	entry	175	right		left	
10	d	curve	175	right	valley R2000		
11	d	leaving	175	right	valley R2000		right
12	straight						

13	e	entry	175	left		right	
14	e	curve	175	left			
15	e	leaving	175	left			left
16	straight						
17	17….32 = same steps in opposite order						
….							
32							

The depot sequence consists of 2 times 34 steps (=68 steps)

Depot sequence: back and forth 1 time per cycle

		Type	Radius	Direction	Pitch [^{0}]	Roll first car [^{0}]	Roll second car [^{0}]
	straight						
1	2	entry	152.4	left		right	
2	2	curve	152.4	left			
3	3	curve	152.4	left-right			
4	3	s-curve	152.4	left-right		left	
5	3	curve	152.4	left-right		left	left
6	3	leaving	152.4	left-right			left
7	straight						
8	4	entry	152.4	right-left		left	
9	4	curve	152.4	right-left			
10	4	s-curve	152.4	right-left			right
11	4	curve	152.4	right-left		right	
12	5	curve	152.4	left		right	
13	6	curve	152.4	left			
14	6	leaving	152.4	left			
15	7	entry	152.4	left			
16	7	curve	152.4	left			
17	7	leaving	152.4	left			left
18	straight						
19	9	entry	152.4	left		right	
20	9	curve	152.4	left			
21	9	leaving	152.4	left			left
22	straight						
23	9	entry	152.4	left		right	
24	9	curve	152.4	left			
25	9	leaving	152.4	left			left
26	straight						
27	1	entry	152.4	right		left	
28	1	curve	152.4	right			
29	1	leaving	152.4	right			right
30	straight						
31		entry	152.4	left		right	
32		curve	152.4	left			
33		leaving	152.4	left			left
34							
35	35 …. 68 = repetition of same steps.						
…							
68							

5.6 TEST EXECUTION

A complete test cycle consists of 21 track test cycles and 1 depot sequence.
One test cycle consists of (32 x 21 =) 672 plus 68 = 740 steps.
The Endurance Test consists of 700 test cycles, respectively (700 x 740 =) 518,000 steps.

The above endurance test scheme can be changed with mutual agreement between ICF and supplier during design approval stage so as to incorporate near operational situations.

6. ACCEPTANCE CRITERIA: Following acceptance criteria shall be followed.

(a) Corrugated bellow:
- No fracture, tear or crack shall be allowed in bellow.
- The gangway corrugated bellow is not allowed to be pulled out from the frame.
- The gangway bellow fabric is not allowed to be pulled out from the bellow.
- There shall not be disconnection and unfastening of the corrugated bellow

(b) The aluminium frame of the corrugated bellow shall be free of serious distortion and deformation, and no crack is allowed at the welding position.

(c) The fasteners shall be free from defects / damage, etc.

7. CONCLUSION

(a) If any of the above acceptance criteria is/are not meeting after the testing, the test shall be stopped, record it when the above occurs and the test conclusion is "the gangway cannot meet the fatigue test requirements of specification".

(b) After the fatigue test, if the above criteria are met through observation (visual/ other), it shall be determined that gangway has passed the fatigue testing.

ANNEXURE - I

INFRASTRUCTURE AND TESTING FACILITIES REQUIRED FOR MANUFACTURING OF SEALED GANGWAY ASSEMBLY FOR USE IN VANDE BHARAT TRAINSET CAR & LHB COACHES

1. SCOPE

This section covers the infrastructural requirement for manufacture and testing of fully sealed gangway for use in Vande Bharat train set car and LHB coaches.

2. REQUIREMENTS

All the vendors seeking registration with Indian Railways shall comply with all the requirements mentioned below.

3. MANUFACTURING FACILITIES

3.1. The manufacturer shall have adequate space and covered area with cemented floor to accommodate the following.

a) Damp free place for storage of raw material and finished products.
b) Adequate Manufacturing area
c) Finishing, Assembly, Rejection and Inspection area
d) Testing area should be free from dust, moisture and temperature controlled
e) Storing and dispatch of finished products.

3.2. Firm shall have following in house manufacturing facilities at their premises :

i) Cutting Table
ii) Cutting/skiving knives
iii) Stitching/sewing (single & Double needle type) machines of Reputed make
iv) Pneumatic staplers
v) Crimping/punching pneumatic & Hydraulic tools
vi) Final Assembly tables
vii) Child parts assembly table
viii) Pneumatic Rivet guns
ix) MIG welding machines for frame welding
x) Bending Tools and Jig for bending Aluminium frames
xi) CAD and FEA simulation facilities with suitable software license
xii) Other regular tools like Measuring tape, Measuring scale, Magnifying glass, Gloss meter, coating thickness gauge, Facilities for lifting and weighing, Weighing Scale, Necessary jigs & Fixtures for manufacture of components of gangway etc used for manufacturing, assembly line, inspection and testing of the gangway assembly.

4. TESTING FACILITIES:

4.1 Firm should have in-house testing facilities for following tests as per test method given in this specification:

i) Visual & Dimensions
ii) Weight Check
iii) Minimum curve test

iv) Air Tightness test
v) Leakage (Rain Test)
vi) Endurance test
vii) Heat release rate (HRR) as per EN 45545-2
viii) Load Test

4.2 For fire properties other than HRR as mentioned in Appendix-H, firm should have in-house testing facility at their own premises or testing is to be done from labs empanelled by RDSO or any CERTIFER labs. The testing charges shall be borne by the manufacturer.

4.3 The firm should have arrangement for periodical calibration of all the equipment and test instruments.

5 QUALITY CONTROL REQUIREMENTS

5.1 The firm should have acquired ISO: 9001certification from the agency accredited by an accreditation body which is a part of International Accreditation Forum (IAF), and the product for which the approval is sought should be broadly covered in the scope of the certification for manufacture and supply.

5.2 The Quality manual of the firm for ISO: 9001 should clearly indicate at every stage the control over manufacturing and testing of the said railway product.

5.3 There should be a system to ensure the traceability of the product from raw material stage to finished product stage. The system should also facilitate to identify the raw material composition from the finish product stage.

5.4 It should be ensured that there is a Quality Assurance Plan for the product detailing the following various aspects.

- Organisation chart
- Process flow chart
- Process control chart
- Stage inspection details from the raw material stage to finish product stage.
- Various Parameters to be checked and level of acceptance of such parameters indicated and method to ensure control over them.
- Disposal system of rejected raw material and components

5.5 There should be at least one full time technologist having a minimum Master's degree in relevant field with experience of at least 3 years or Bachelor's degree in relevant field with experience of at least 5 years or a person with Diploma in relevant field with 12 years' experience. He should be free from day-to-day production, testing and quality control responsibilities. He should be mainly responsible for development of a product, analysis of products, control over raw material, and corrective action in case of difficulties in achieving the parameters.

5.6 Ensure that the in-charge of the Quality Control Section is having a qualification of minimum Master's degree in relevant field with experience of at least 3 years or Bachelor's degree in the relevant field with a minimum of 5 years' experience or alternatively he should be a Diploma holder with minimum of 12 years' experience. He should be actively involved in day-to-day activities of quality control / stage inspection / compliance of QAP etc.

5.7 The firm must ensure that proper analysis is being done on monthly basis to examine the rejections at various internal stages and it is documented.

5.8 The firm should ensure that latest version all the relevant specifications, IS & EN Standards are available with the firm.

6 DOCUMENTATION

Firm shall maintain the following documents/records:

6.1 A well-documented Quality Plan.
6.2 Incoming raw material register with Test Certificates references of suppliers and internal test results.
6.3 Stage inspection results including finished products results.
6.4 Records of internal rejection and its analysis vis-à-vis action plan.
6.5 Records of final products inspection by accepting agencies, Non–conformity reports and case analysis as well as action taken thereof.
6.6 Ensure that proper systems are available for dealing with customer complaint.

7. TRAINING

Training needs should be identified for all concerned officials and regular training shall be organised and imparted on maintenance of machines, quality assurance, safety parameters etc.

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ANNEXURE-II

REFERNCE DRAWINGS

Sr. No.	Coach Type	Drawing No.	Remarks
1.	Vande Bharat Train 18	728-2-5-001	Assembly Drg.
2.	Vande Bharat Train 18	728-2-5-003	Coach Parameters
3.	LHB Coach	LZ15100	End wall of coach
4.	LHB Coach	LE11166/LE11165	Front Part/Headstock
5.	LHB Coach	1 10113.0.24.100.001	Foot plate arrangement
6.	LHB Coach	1 10113.0.05.000.001	CBC
7.	LHB Coach	LE90009	Coach Layout