


RAIL COACH FACTORY, KAPURTHALA

MD46121

Date: 31.01.2025

Sub: Issue of specification no MDTS 29411 Rev 0 for Vande Bharat 20 car (Chair Car) Train set Project Procurement Technical Specification for Couplers and Draft Gear.

Please find enclosed copy of specification no MDTS 29411 Rev 0 for Vande Bharat 20 car (Chair Car) Train set Project Procurement Technical Specification For Couplers and Draft Gear for information and necessary action please.


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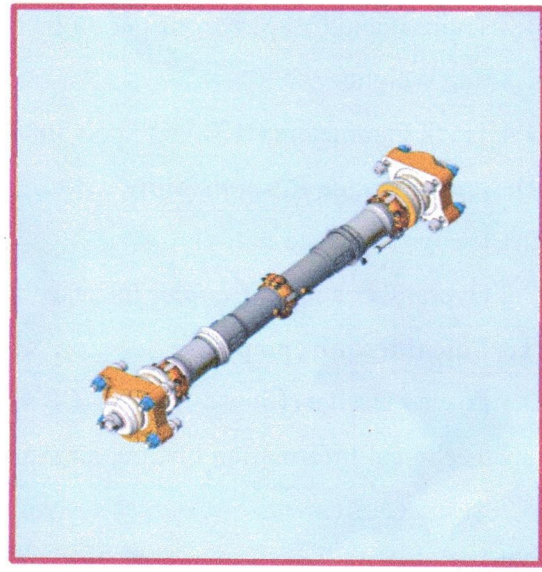
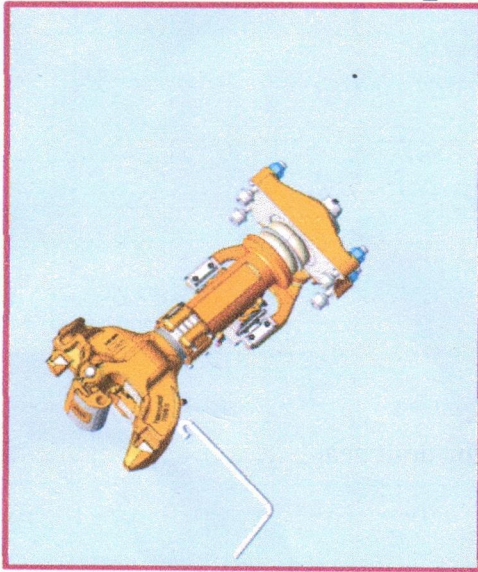
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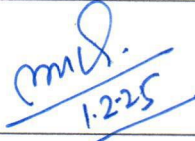
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Specification for the procurement couplers for RCF Vande Bharat Chair Car (20 Car) with ALSTOM Propulsion system

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**Vande Bharat 20 car (Chair Car) Train set Project
Procurement Technical Specification
For Couplers and Draft Gear**



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1. Introduction

1.1. General

This document specifies the technical requirements of Couplers and Draft Gear to be supplied for Semi-High speed (160 kmph) 20 car Train set Chair Car on Vande Bharat platform. The Couplers and Draft Gear shall comply in all respects with ICF Spec. No.ICF/MD/SPEC-411, Issue Status: 01, Rev.03 dt. 24.03.2023 and ICF MD SPEC-398, ISSUE status-01, Rev.00 dt. 04.04.2022.

RCF will carry out all required works for this project, while the contractor shall be responsible for all works required in this PTS (Procurement Technical Specification) with regard to Couplers and Draft Gear and shall be responsible for supporting the RCF project.

The scope of work covers design, development, testing, manufacture, supply, commissioning and integrated testing of the coupler systems including draft gear and the training of Operation and Maintenance personnel of the owner on the coupler systems including draft gear.

1.2. Train set and Coupler Configuration:

20 coaches – 5 basic units, each unit consisting of 4 coaches.
For 20 car formation –

* DTC+ MC + TC + MC2 + MC + TC + MC2 + NDTC + MC + TC + MC2 + NDTC/EC + NDTC/EC3 + MC + TC + MC2 + MC + TC + MC2 + DTC2 *

DTC – Driving Trailer Coach,
MC – Motor Coach,
TC - Trailer Coach,
NDTC – Non-Driving Trailer Coach

“ * “ : AAR ‘H’ – Type tight lock Front coupler (2 Nos per rake)

“ + “ : Semi-permanent coupler (19 Sets, 1 set consisting of 2 Nos)

1.3. Car Weights (as per suspension diagram no. TS/MC-9-0-005):

	DTC-Car	MC-Car	TC-Car	NDTC-Car
Tare weight	50.11 T	56.58 T	55.03 T	49.15 T
Fully loaded	54.44 T	63.06 T	61.51 T	53.57 T
Passenger Load	Max. 4.33 T	Max.6.48 T	Max. 6.48 T	Max. 4.41 T
Max. Axle load	Max.13.72 T	Max.15.96 T	Max. 15.7 T	Max.13.44 T

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for

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1.4. Track Parameters (ICF MD Spec-398 clause 1.5) :

The Vande Bharat Trains c/car variant will operate with the track parameters of the Government as specified in the following table:

Gauge	BroadGauge1676mm
Schedule of dimension	Indian Railways Schedule of Dimensions for Broad Gauge (1676 mm) Revised, 2004 with latest addendum and Corrigendum slips
Sharpest curve to be negotiated	145.83 meter radius(horizontal); 2500 meter radius (vertical)
Sharpest reverse Curve to be negotiated	145.83 meter radius(horizontal) back to back with or without any straight portion in between
Sharpest turn out to be negotiated	6400mm overriding switch(curved) BG(1673mm)for 60kg (UIC) or 52 kg rail for 1 in 8½(crossing angle, tanθ) turnouts on pre stressed concrete sleepers
Maximum super elevation	185 mm for design 165mmforoperation
Maximum cant deficiency	100mm
Maximum gradient	1:37
Permitted track tolerances	The track shall be maintained to as per provisions of Indian Railways Permanent Way Manual, June-2020, containing track geometry standards under Para 522.

Indian Railway Permanent Way Manual June – 2020 specifies the maximum cant deficiency as 100mm. Speed on curve shall be decided on the basis of Indian Railways Permanent Way Manual, June – 2020. In case of cant deficiency of more than 100 mm, if the rolling stock is able to negotiate on curves within parameters of safety and also the forces assessed on track are within limit, the Rolling Stock would be acceptable. However, such a case would require sanction of Railway Board

2. Design Interface Responsibilities

2.1. Design Interface:

At design stage, RCF/RDSO shall be responsible for defining the technical requirements and the design constraints. The location of mounting points and the design of equipment installation comprising of Couplers and draft-gear shall be defined by the contractor and approved by RCF/RDSO in order to avoid any mechanical interference with other equipment for the vehicle. The contractor shall be responsible for mounting methods and providing all requisite materials for mounting of the coupler systems including draft gear on the car body.

2.2. Overall Car body & Coupler Interface Dimensions:

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The proposed design of the AAR H type tight lock front coupler and semi-permanent coupler shall take into account the following car body dimensions and limits for the coupler dimensions.

Figure-

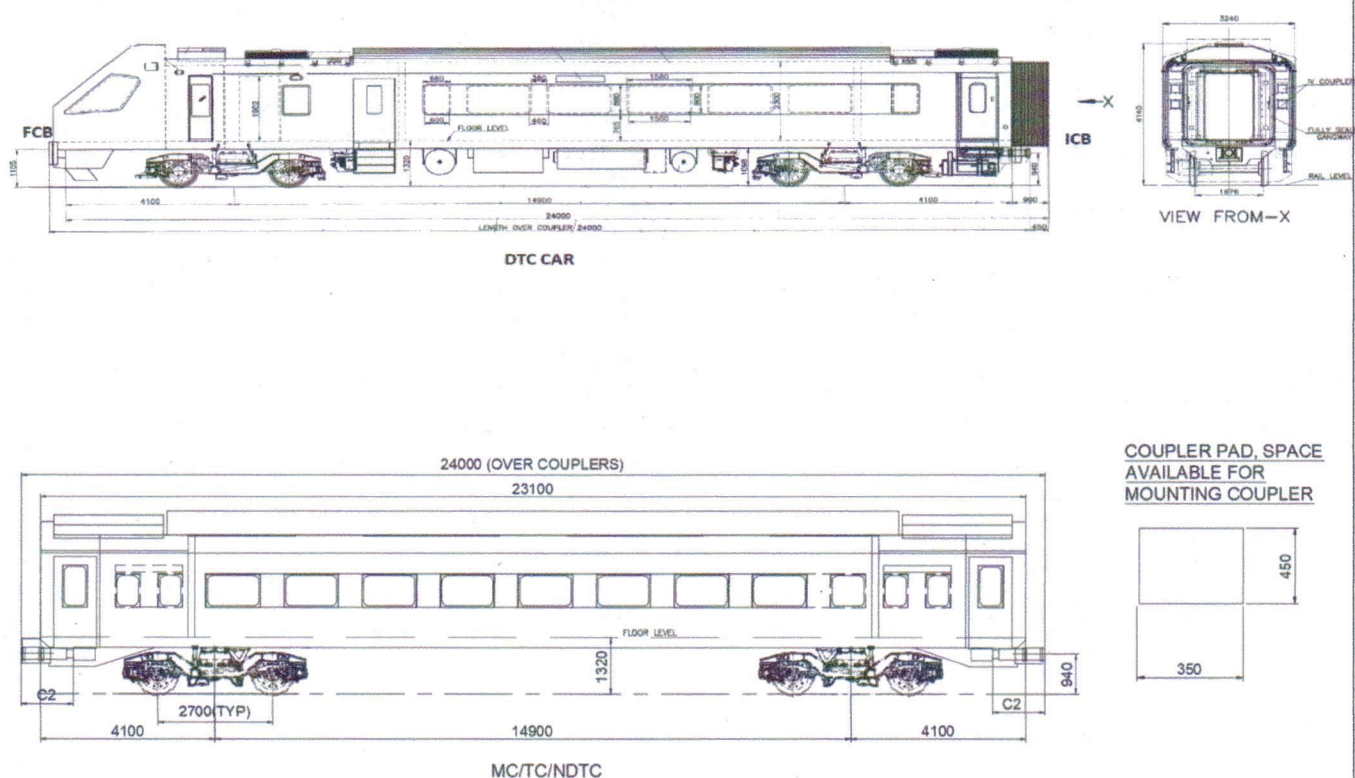


Figure-1: Carbody and Coupler mounting details

	Front AAR-H type Coupler	Semi permanent Coupler (SPC)
Length of Coupler from Coupler face to Pivot Point	1030mm	1030mm
Length of coupler from coupler face to mounting face On coupler pad	1200-1300mm	1200-1300mm
Space available beyond coupler mounting pad	500-600mm	500-600mm
Car body stiffness	250kN/mm	

Note: The above dimensions may be subject to minor change during the detail design phase. The contractor shall accommodate the same without any cost.

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[Signature]

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3. Technical Requirements

3.1. Proven Design (Clause 3.1.8, of ICF MD -398)

The proposed coupler systems including draft gear by the contractor against this PTS shall satisfy the "Proven Design" clause 3.1.8 of ICF MD Spec-398. The Proposed type of Coupler systems including Draft gear should have been proven design i.e., the design of equipment components etc., shall be based on sound, proven and reliable engineering practices. The contractor may conduct such tests and trials as may be necessary to establish the reliability and efficiency of such technology and designs in accordance with the good industry practice

3.2. Technical Information of Coupler systems including draft gear

The proposed coupler systems including draft gear shall have suitable proven energy absorption feature with associated collapse features incorporated into the coupler draft gear. The coupler shall sustain no permanent damage when a fully loaded 20 -car train set collides with an impact speed up to 5km/h with another stationary fully loaded 20-car train with braked (maximum parking brake) and un-braked conditions. Collision mass to be considered for Impact energy simulation and for design of coupler systems including draft gear is fully loaded i.e., 68Ton. Collision / Impact energy absorption Simulation report /analysis document shall be submitted along with the technical offer.

The contractor shall submit the predicted values for the following in respect of fully loaded 20-car train set.

- a) The maximum collision speed at which there is no structural damage to car body and the coupler.
- b) The minimum collision speed at which the coupler energy absorption device

3.2.1. Compressive and Tensile Strength (Clause 3.33, ICF MD Spec-398)

The design of the couplers and draft gear shall comply with the following carbody strength specification: The Car body design will be lightweight and corrosion resistant and rugged to withstand the tractive and braking effort as well as impact and accidental damage. The mechanical strength of car body will conform to EN 12663 (Category P1), where in compressive load shall be 2000kN applied at the end of the carbody at the centerline of the coupler and tensile force shall be 1000kN (higher force of 1500kN may be required for certain types of coupling) . The design of coach body will be compatible in respect of crashworthiness with EN 15227 (Category C1) standard.

3.2.2. Crashworthiness

The design and crash worthiness of the Car body will be in accordance to EN15227 (Category C1) -'Railway application- Crashworthiness requirement of the railway vehicle body'. The Car structure and its supplemental energy absorption devices will be designed to minimize

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accelerations transmitted to Users, by absorbing collision energy, whilst not permitting one vehicle to over-ride another, nor to telescope one into another. A suitable proven energy absorption feature with associated collapse and anti-climbing features shall be incorporated into the coupler/buffers or other structural members. The contractor shall submit the crash energy absorption Simulation/analysis report for crash scenario along with the technical offer, clearly indicating the energy levels absorbed by couplers and energy levels to be absorbed by carbody.

3.2.3. Coupling within Train (Clause 2.13, ICF MD Spec-398)

It shall be possible to attach a locomotive fitted with AAR-E/H type coupler having buffer/CBC height as per IRSOD 2004 with latest amendment with the coupler of Driving Car for clearing block section and movement of train set. If the couplings between coaches within the train are of different type, rescue couplers shall be provided. It shall be possible to fit these rescue couplers with the couplers of the coaches so that they can be attached to Locomotives of Indian Railways so as to haul the coaches in exigencies.

Contractor shall provide suitable type of coupler Adapter as a rescue coupler, which shall accommodate AAR-H coupler head on one end and semi-permanent coupler on the other end, with height difference of 165mm. The adapter shall be capable of rescuing full loaded 20 cars in rake with rescue speed upto 10kmph. The weight of adapter shall be such that it should be easily handled by one person during rescue operation. **Each trainset shall be supplied with two nos. of coupler adapter (Drg.52351005).**

3.2.4. Coupler with Draw and Buffing Gear (Clause 3.28, ICF MD Spec-398)

3.2.4.1. Driving end of Driving Cars shall be provided with suitable coupling arrangement as it can be coupled with existing couplers of existing locomotives in IR, i.e., AAR "H" type tight lock center buffer coupler. The Coupler head profile shall be such that it shall be possible to attach a locomotive fitted with air brake hose coupling arrangement as per RDSO specification number 02-ABR-02 (Specification for Air Brakes for Freight and Passenger Stock of Indian Railways) and AAR-E/H type coupler having buffer/CBC height as per IRSOD 2004 with latest amendment with the coupler of Driving Car. **All cars shall have crashworthiness features.**

3.2.4.2. For other ends of cars, proven couplers on Trainset (of 160kmph and above) shall be used.

3.2.5. AAR "H" type tight lock Coupler

3.2.5.1. The AAR "H" head contour shall be as per S-168 of APTA SS-M-002-98 (completely machined). The guard arm of coupler head shall be at the vertical centre of the coupler head. The slack when two couplers of same make are coupled together shall be up to 2.0mm only in the new condition.

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- 3.2.5.2. For AAR "H" coupler, Double Rotary lock lifter should be provided with an additional anti-creep mechanism by providing rib in addition to existing rib to prevent unintended lifting of lock lift lever with maximum gap of 37mm between them (the hook of the uncoupling rod with dia 1" should be in between ribs). A tertiary arrangement of locking of the toggle by inserting a locking pin in its bottom hole/slot for preventing unintended lifting of lock to be made. This locking pin arrangement should provide positive locking by means of its own gravity.
- 3.2.5.3. The AAR "H" Coupler operating mechanism shall comprise of rigid steel members for articulation. Use of wire or any other limp/flexible material in the articulation shall be not be accepted. The coupler operating mechanism should have proper locking arrangement for anti-vandalism. Locking screw arrangement with protective cover to prevent lifting of uncoupling rod by unauthorized persons shall be provided. It should be possible to operate the locking mechanism with the help of key as per RDSO drg. no. CG-10100 or any suitable proven locking mechanism may be proposed.
- 3.2.5.4. While achieving all other requirements of the specification, the AAR "H" type coupler has to be so designed that it is relatively jerk free (longitudinal jerks).
- 3.2.5.5. The AAR "H" coupler shall be equipped with a integral self-centering device to prevent the coupler from swinging transversely when uncoupled.
- 3.2.5.6. The design of AAR "H" coupler head shall enable coupling of two couplers with a maximum displacement of their center lines by 90mm, without manual assistance.
- 3.2.5.7. The horizontal gathering range of the coupler head shall be 110mm on either side of the longitudinal center lines of the coaches without manual assistance on straight track.
- 3.2.5.8. The couplers should couple at maximum range as mentioned above. Moreover, coupler should be able to negotiate on steepest curve of radius as specified at clause 1.4 of this document.
- 3.2.5.9. The AAR -H front coupler shall, in conjunction with the draft-gear automatically effect mechanical coupling, however, uncoupling shall be manually from track side. Both coupling and uncoupling arrangements shall be fool proof and shall utilize both the hands with built in safety precautions against possible hazards.

3.2.6. AAR "H" type Coupler Operation :

All completely assembled couplers must be carefully checked for operation. The knuckles and other operating parts must perform their function in an entirely satisfactory manner.

3.2.6.1. Opening

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Coupler knuckle must throw to the open position by a continuous rotary force applied by hand through the operating rod from rod handle.

3.2.6.2. Closing

Coupler knuckle must rotate to the fully closed position to permit drop of the lock to the locked position by a continuous steady force applied by hand on the knuckle nose.

3.2.6.3. Lockshut

Coupler lock must automatically drop to the locked position when the knuckle is closed as described in section 3.2.6.2. Coupler knuckle is locked shut when the lock drops to seat on, or to within 1/8inch(0.32 cm) of seating on the knuckle tail lock shelf.

3.2.6.4. Lock set (Such that single person is able to perform uncoupling operation).

Coupler is put on lock set when the knuckle is restrained from opening while force is applied through the operating/uncoupling rod to raise the lock above the knuckle tail. When the rod is eased back and release, the lock must rest on the forward tope edge of the knuckle thrower lock leg. The knuckle then must be free to rotate open by hand force applied on inside face of the knuckle nose. Coupler then must perform the function of knuckle closer and lock drop as mentioned above. Note: Lock should only be lifted within 20mm from tail self when prying it upward by a pry bar even when rotary system is free to rotate and simultaneously there should be surface contact between bottom of knuckle tail self and toggle top face.

3.2.7. Semi-Permanent Couplers and Draft-gear :

Semi- Permanent coupler should not sag in uncoupled condition and it should be possible to couple two halves of semi- permanent coupler without any external assistance. After coupling, such means shall not limit normal operating movement of the coupler. This arrangement shall accommodate the full range of height variation between adjacent vehicles when being coupled.

3.2.7.1. Uncoupling or re-coupling shall not damage electrical connections. It shall not be necessary to give preventative maintenance attention to these connections between vehicle overhauls.

3.2.7.2. The draft-gear shall meet the requirements specified in Clause 3.28 of ICF MD SPEC. -398.

3.2.7.3. The coupler shall be maintained horizontal by means of easily adjustable supports which shall take care of loss of coupler height within the car body.

3.2.8. Articulation Range for coupler system

Suitable mechanism may be provided for limiting the horizontal articulation of the coupler to a maximum of 18° on each side of the coupler center line, however this articulation should not be less than 10°. Similarly, the vertical articulation should be in range of min 4 -7°.

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3.2.9. Maintenance

The coupler shall not generally require any maintenance up-to intermediate overhaul. Any greasing if required shall be in in-situ only

3.3. Test Requirements of Coupler system

The coupler system proposed shall meet the following test requirements.

3.3.1. Coupler head and the draft gear housing shall be tested by applying a tensile load of 1000kN and compressive load of 2000kN with use of strain gauges. The residual strain shall be below 0.2% after release of load. No fracture shall be observed at a load of 1500kN.

3.3.2. Bending test of the coupler body shall be carried out by applying a concentrated force of 300kN in graduated step at the centre of the coupling length of 1030mm. The residual strain shall be below 0.2% after load release. No fracture shall be observed on application of 500kN. Load application step will be in multiple of 100-200kN.

3.4. Weight

The total weight of couplers shall not exceed by more than +4% of the estimate weights /as per relevant drawings. The contractor shall submit details of estimated weights and center of gravity for coupler and draft-gear along with the technical offer.

3.5. Fire Safety

The contractor shall submit a Fire-safety Plan providing the list of Non-metallic material items, wires & cables that are proposed to be used in the coupler systems including draft gear with details of material, applied mass, fire safety compliance (Flammability, smoke, toxicity) and fire load calculations, during the preliminary design phase. All non-metallic materials used in the coupler assembly shall comply with fire safety requirements of EN45545 Part 1 to 7 (Category 3-S, Hazard level HL3) latest editions.

3.6. Quality Assurance Program

The contractor shall hold ISO 9001/ IRIS certification and shall manufacture the product accordingly. The contractor shall submit a copy of ISO 9001-2018 / IRIS certification along with the offer. The contractor shall monitor and control the Quality systems as per ISO 9001/IRIS guidelines. RCF representative may periodically conduct compliance audits of the Contractor's Quality management system.

3.7. Simulations Analysis.

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The contractor shall submit the following simulations/Analysis. Collision mass to be considered for Impact energy simulation and for design of coupler systems including draft gear is i.e, 68 Ton.

- a) The Simulation/analysis report for Collision / Impact energy absorption for a fully loaded 20 –car train set collides with an impact speed up to 5km/h with another stationary fully loaded 20-car train with braked and un-braked conditions along with tender offer.
- b) The crash Simulation/analysis report in accordance to EN 15227, Category-C1, along with tender offer.

3.8. Engineering Support.

The contractor shall provide technical assistance by attending the design review meeting with RCF team, until design is approved by RCF.

3.9. Referred Spec. & PTS Compliance.

The contractor shall offer a valid and fully compliant proposal for the Coupler system as detailed in referred Spec. and PTS.

The contractor shall submit, along with the technical offer, the Clause by Clause Compliance for referred Spec. and PTS:

Offers with Non-compliance and deviations to any of the in referred Spec. and PTS clauses with regard to Coupler system, are liable for rejection.

4. Testing and commissioning

The Couplers and Draft Gears shall be type and routine tested in accordance with technical requirements and to relevant standard at subcontractor's works, at his own cost.

All such tests shall be carried out at the contractor's cost, wherever performed, in the presence of and to the satisfaction of RCF, who reserves the right to witness any or all of the tests and to require submission of any or all test specifications and reports.

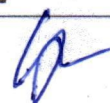
RCF reserves the right to reasonable call for additional test, if necessary.

The contractor shall carryout the following type tests and routine tests as a minimum for both front semi-automatic coupler and semi permanent coupler and shall submit the reports.

S.No.	Kind of Test		Type Test	Routine Test
1	Strength test of Coupler along with Draft gear	Tension	√	-
		Compression	√	
2	Bending test of coupler body		√	-

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3	Shear-off bolt test		√	-
4	Test of Coupler head with	Tension	√	-
5	locking of Front coupler assy.	Compression	√	-
6	Test on Bearing bracket of	Tension	√	-
7	Front coupler and SPC	Compression	√	-
8	Test on Coupler Shank of	Tension	√	-
	Front coupler and SPC	Compression		-
9	Compression test on Buffer element/ Collapsible element(D-tube)/feature		√	-
10	Tension test on Muff coupling		√	-
11	Gathering Range test of AAR-H head		√	-
12	Coupling and uncoupling Performance test		√	√
13	Fire performance Test		√	-
14	Visual inspection		√	√
15	Dimensional inspection		√	√

4.1. First Article Inspection (FAI)

The contractor shall offer the first set of Coupler assembly for First Article Inspection by RCF in accordance with the Engineer approved FAI plan prior to serial production, in order to confirm that the item produced fully complies with the technical specifications, System design and manufacturing process. After clearance from RCF, mass production shall be taken up.

Contractor shall note that the Engineer FAI clearance will not relieve the contractor's responsibility towards design, production, quality, reliability, availability, maintainability and safety of the systems and sub-systems during the revenue service.

4.2. Installation and Commissioning

After the couplers are delivered, the contractor shall depute his Engineer for the installation and commissioning of the couplers on the First Train set.

Modifications/ corrections, if any, shall be carried out by the contractor at his own cost.

5. Appendices

1. ICF Spec. No. ICF/MD/SPEC-411, Issue Status : 01,Rev.03 dt. 24.03.2023.
2. ICF MD SPEC-398, ISSUE status-01, Rev.00 dt. 04.04.2022).
3. Drg No 52351005
4. EN-15227, EN 12663, EN-45545 Part 1 to 7.

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