RAIL COACH FACTORY, KAPURTHALA

MD46121

Date: 06.02.2025

Sub: Issue of specification no MDTS 29410 Rev 0 for Vande Bharat 20 car (Chair Car) Train set Project Procurement Technical Specification for Crash buffer.

Please find enclosed copy of specification no MDTS 29410 Rev 0 for Vande Bharat 20 car (Chair Car) Train set Project Procurement Technical Specification for Crash buffer for information and necessary action please.

Dy.CME/Shell/Design

CME/QA , CPLE, CWE/Fur, CWE/Shell, CMM/HSQ, CMM/TKJ

Dy CMM/Fur/LHB, Dy CMM/G,

Dy.CPLE-I, Dy.CPLE-III, AWM/Plg

Dy.CMM/Fur, Dy CME/Bogie

Dy CME/QA-I, III, CMT, ACMT

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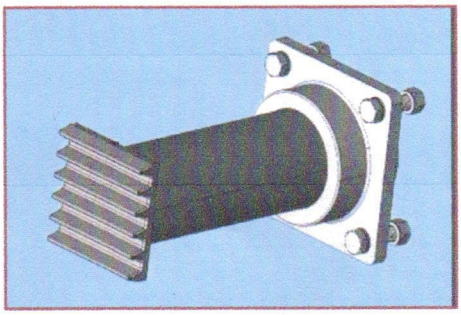
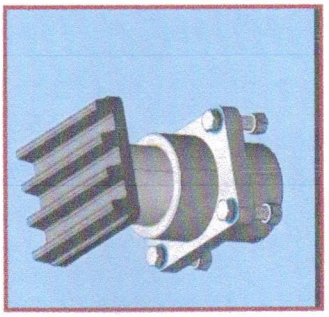
Dy. CME/D/Fur

Specification for the procurement for crash buffers for Vande Bharat Chair Car (RCF) with ALSTOM propulsion system





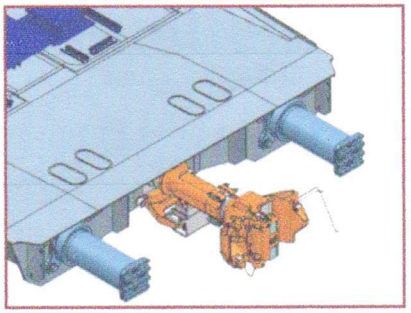


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Table of Contents

Jagdish Singh

Jagdish Singh

1. Introduction

1.1. General

1.1.1. This document specifies the technical requirements for design, development, manufacture, supply, testing and support for installation of side crash buffers on car body structure to be supplied for Semi-High speed (160 kmph) 20 car Trainset.

1.1.2. RCF will carry out all required works and activities as contractor to the employer for Vande Bharat chair car project, while the contractor shall be responsible for all works required in this PTS with regard to side crash buffers and shall be responsible for supporting the RCF activities as contractor for RCF project

1.1.3. Contractor should have adequate experience in design, development, manufacture, supply, testing and support for installation of side crash buffers on car body structure as per RCF/ICF technical requirements.

1.1.4. Any issues arising in design, development, manufacture, supply, testing and support for installation of side crash buffers with the employer i.e., RCF, Kapurthala shall be addressed by the contractor at his own cost to the satisfaction of RCF, Kapurthala.

1.1.5. The scope of work covers design, development, manufacture, supply, testing and support for installation of side crash buffers on carbody structure and the training of operation and maintenance personnel of the RCF/ICF on the side crash buffers.

1.1.6. The scope of work includes all items of work which will be required to meet the performance requirements, reliable and efficient operation of trains and meeting the best international practices even if not specifically mentioned in these PTS.

1.1.7. The contractor shall study all the clearances required for the mounting of side crash buffers on car body structure and accommodate the same in the design of side crash buffers.

1.1.8. The quality, aesthetics, design and overall workmanship of side crash buffer as a whole shall be to international standards and the quality of OEM.

1.1.9. The firm shall maintain data wise in-house quality control system and in-house quality control records etc. for in stage process of inspection, testing and the same along with Quality Assurance Plan (QAP).

1.1.10. This PTS shall be read in conjunction with Schedule of Technical Requirements of ICF Spec. No. ICF/MD/SPEC-411, Issue Status: 01, Rev.03 dt. 24.03.2023, ICF MD SPEC- 398, ISSUE status-01, Rev.00 dt. 04.04.2022 for design, development, manufacture, supply, testing and

Jagdish Singh

manufacturing of side crash buffers and any other factor, which may cause such dispute. The entire responsibility to settle any such disputes/ matters lies with the contractor.

1.1.12. Contractor shall communicate well in advance about the details required to design, development, manufacture, supply, testing and support for installation of side crash buffers on car body structure from RCF/ICF.

1.1.13. Contractor shall make all communications by writing a physical/Email/formal letter to project manager of RCF with seal and signature of the competent authority.

1.1.14. The contractor shall have the whole and sole responsibility of side crash buffers in terms of design, development, manufacture, supply, testing and support for installation of side crash buffers on car body structure. It is the responsibility of the contractor to get the approval for all drawings from RCF/ICF before going for production.

1.2. Train set and side crash buffer Configuration

Coach 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

* - Frontal side crash buffers with ant climbing feature (4 Nos per rake)
+ - Intermediate side crash buffers with ant climbing feature (76 Nos per rake)

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

Jasdish Singh

1.4. Climatic & Environmental Conditions

The car shall operate reliably and safely under the climatic and environmental conditions specified at ICF MD Spec- 398 clauses 1.6. Accordingly, the side crash buffer shall be designed to operate with satisfactory performance under the following conditions as per at ICF MD Spec-398 clause 1.6.

Description Limiting Values	Description Limiting Values
Atmospheric temperature	Maximum temperature: 50-degree Celsius Maximum touch temperature of metallic surface under the Sun: 75 degree Celsius and in shade: 55 degree Celsius Minimum temperature: -10 degree Celsius
Humidity	100% saturation during rainy season
Solar radiation	1 kW/m2
Altitude	1000 meter above mean sea level
Rainfall	Very heavy and continuous rainfall in certain areas (up to 2500 mm during rainy season)
Atmospheric conditions	Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/m3. In many iron ore and coal mine areas, the dust concentration is very high affecting the filter and air ventilation system
Coastal area	Humid and salt laden atmosphere. The equipment shall function in accordance with this Specification when subjected continuously to a humid and salt laden atmosphere with maximum pH value of 8.5, sulphate content of 7 mg per liter, maximum concentration of chlorine 6 mg per liters and maximum conductivity of 130 micro-Siemens / cm.
Vibration	The vibration and shock levels recorded on various Sub-systems in existing Trains of IR are generally more than the limits given in IEC 61373 particularly at axle box, and traction motor. Accelerations over 50g have been recorded at axle box levels during run. Vibrations during wheel slips are of even higher magnitude. High level of vibrations above 30g have been measured at traction motor on IR's Trains, which increase up to 50g with worn gear pinion.
Wind speed	High wind speed in certain areas, with wind pressure reaching 216 kg/m2 as per IS:875-Part 3(2015)
Flood level	The Train shall function in accordance with these Specifications and Standards in the event of flooding up to 203 mm above Rail Level as follows: In the event of flooding at any level below Rail Level, the Train shall operate in full compliance with these Specifications and Standards.

Jagdish Singh

	In the event of flooding at a height between Rail Level and 203 mm above Rail Level, the Train shall operate in full compliance with these Specifications and Standards with the exception that it is permissible to restrict the operation of the Train to a maximum of 8 km/h. Allowance is to be made in addition for increase in the height of water level due to the "bow wave" effect of the Train passing through the water.
Flood Proofing of the under slung Equipment	Water proofing test will be conducted on Traction and Auxiliary Converter by dipping them up to a height equivalent to 650 mm from rail level (under fully wheel worn condition) in stationary water for 12 hours. There should be no water ingress and Converters shall function normal after the test. Traction Motor with gearbox shall be tested for water proofing as defined in ICF MD Spec-398 clause 3.4.6.10.1 Other underslung equipment shall have IP protection as mentioned in ICF MD Spec-398 clause 3.1.9. However, even in case of flood levels more than the mentioned above, the equipment shall not get damaged and it should be possible to rejuvenate the equipment with minor attention without any adverse effect on their performance. Axle box shall be adequately flood proof.

1.4.1. In developing the detailed design, the supplier shall acquaint himself and take note of the environmental operating conditions prevailing on IR specially during heavy monsoon, track flooding conditions, saline, humid and dusty atmosphere etc.

1.4.2. Any moisture condensation shall not lead to any performance deterioration of the supplied equipment

1.4.3. Adequate margin shall specially be built into the design particularly to take care of the higher ambient temperatures, high humidity, dusty and corrosive conditions, etc. prevailing in India.

1.5. Performance Requirements of Train (ICF MD Spec -398, Chap. 2)

The performance requirements of the train shall be governed according to following table.

Item	Values
Maximum operational speed during service	160 kmph
Maximum operational speed	180 kmph

Jagdish Singh

during testing	
Minimum deceleration during full-service braking following jerk limit	0.8 m/s2
Maximum deceleration at any speed	1 m/s2
Jerk rate (Maximum)	0.7 m/s3
Average running distance of one train (for design purpose	2,000 km/day

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

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

Gauge	Broad Gauge 1676mm
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 over riding 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 165mm for operation
Maximum cant deficiency	100 mm
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.

1.7. Definitions and Abbreviations

Jagdish Singh

The following definitions and abbreviations are applicable to the PTS.

"**Employer**" means RCF -Kapurthala, its legal successors and assignees.

"**Contractor**" means the Supplier who supplies the required side crash buffer to RCF for Vande Bharat C/Car version (16 TS) project. Contractor shall carry out the works in accordance 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 and EN15227:2020 or equivalent international standards with regard to side crash buffer.

"**Side crash Buffers**" means both Front and Intermediate side crash buffers, which has energy absorbing elements with anti-climbing features. Side crash Buffers shall absorb energy by means of physical deformation of its components. Side crash buffers shall not have any electronic, electrical components.

"**Contract**" means the contract between Contractor and RCF in relation to the supply of side crash buffer for Vande Bharat project- c/car version (16 TS) project.

"**Engineer**" means any person nominated or appointed from time to time by the employer to act as the engineer for the purposes of the contract and notified as such in writing to the contractor.

1.8. Precedence of Documents

1.8.1. This PTS shall be read in conjunction with ICF MD SPEC-398 & ICF/MD/SPEC-411. It is the intent that all contractors providing equipment or services to RCF shall comply with the Employer's requirements. When the Employer does not have any specific requirements, the contractor shall comply with the requirements of this PTS as appropriate. Contractors must comply with the requirements stated herein unless otherwise agreed to in writing by RCF. Any conflict between the Employer's requirements and this specification shall be brought to RCF's immediate notice for resolution prior to making a contract. After making a contract, the contractor shall comply with RCF's Interpretation for any discrepancies.

1.8.2. This PTS shall in no way relieve the contractor from any requirements specified in the ICF MD SPEC-398 & ICF/MD/SPEC-411and EN 15227:2020 or latest. In case of conflict among contract documents, the following order of priority shall govern:

Order of Precedence	Document title
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	EN15227:2020
4	General Terms and Condition (GTC)
5	PTS

2. Qualification Criteria

Jagdish Singh

2.1. Contractor shall be an Original Equipment Manufacturer (OEM) of side crash buffers for Semi-High-speed trains (operating speed – 160 kmph and above) having experience in design, development, manufacture, supply, testing and support for installation of side crash buffers on carbody structure and shall provide the documentary evidences for the same.

2.2. The proposed type of side crash buffers shall be of proven design i.e., the design of equipment components etc., shall be based on sound, proven and reliable engineering practices. The proposed type of side crash buffers should have been in revenue service with satisfactory performance on Semi-High-speed trains (operating speed – 160 kmph and above), against regular order (not development order) and shall have proven credentials in train sets of 160 kmph and above operational speed, in at least one project.

2.3. The contractors shall provide offer as a complete kit. The complete kit of side crash buffers with anticlimbing feature includes design, development, manufacture, supply, testing, and support for installation of both front side crash buffers and intermediate side crash buffers, suitable hardware as required to installation on carbody, rectification of defects & associated equipment, necessary to facilitate operation and maintenance of side crash buffers which includes testing of equipment, supply of spare parts, operation and maintenance manual and training. The offers received for complete kit shall be considered for technical evaluation. All other offers shall not be considered for technical evaluation. Supporting documents for proving the same shall be submitted along with technical offer for technical evaluation

2.4. The contractor shall provide ISO 9001:2015/ IRIS certification or equivalent international certification along with the technical offer and shall manufacture the products accordingly.

2.5. The contractor shall submit QAP, ITP, company profile with infrastructure facilities, product range etc., along with technical offer.

2.6. The contractor should undertake to provide the support during Testing & Commissioning, service trials and revenue service either by themselves or through sister company or a partner in India. The firm shall submit detailed proposal in this regard

3. Design Interface Responsibilities

3.1. Design Interface:

3.1.1. At design stage, RCF 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 side crash buffers shall be defined by the contractor and approved by RCF/ICF 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 side crash buffer systems on the carbody.

Yagdish Singh

3.1.2. Contractor shall provide suitable mounting brackets if required, and interface drawings for complete installation side crash buffers. However, welding of the mounting brackets to the carbody wherever required (as proposed by the contractor) will be carried out at RCF and contractor shall provide the required support.

3.1.3. Any changes of the components comprising of side crash buffers shall be defined by the contractor and approved by RCF/ICF in order to avoid the mechanical interference with other equipment of the vehicle. It is the responsibility of the contractor to get the approval from RCF/ICF.

3.1.4. In order to implement interface requirements, the contractor shall provide the information required by RCF/ICF and shall provide the interface data voluntarily for ensuring the performance of the side crash buffers which need to be used for the mechanical and functional interface.

3.1.5. The contractor shall co-operate and co-ordinate with the coupler supplier and other qualified supplier to arrive at an effective crash energy management concept. The contractor shall provide all relevant data requested by the coupler supplier to calculate the efficacy of crash energy management (CEM) system.

3.1.6. Even if technical information or drawings are approved by RCF/ICF, the contractor shall have responsibility to change/solve/modify design failure of production, quality problems and safety issues at own cost.

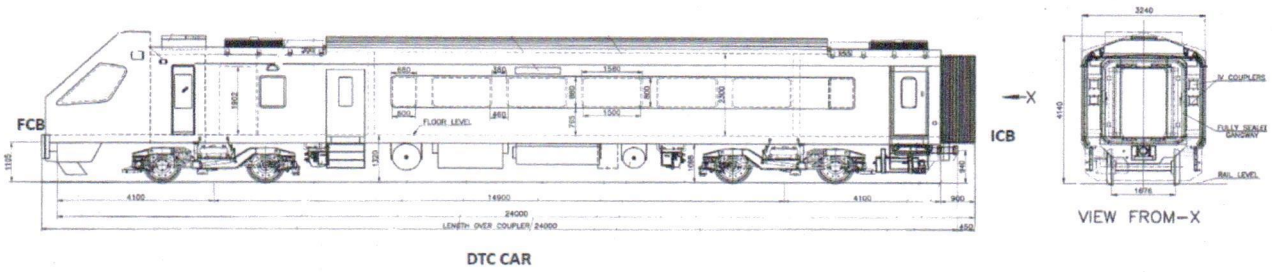
3.1.7. The contractor shall keep in mind that any side crash buffers initially proposed by him should be customized to meet a situation of this project or the need of ICF. So, the contractor shall implement it to side crash buffers without additional cost. Contractor shall solve all issues for proper operation of side crash buffers at contractor's own cost.

3.1.8. Contractor shall not raise a request for the change in PO value or claim additional cost to complete the work after the placement of PO. There is no provision for the amendment of the RCF's PO value for whatsoever reason.

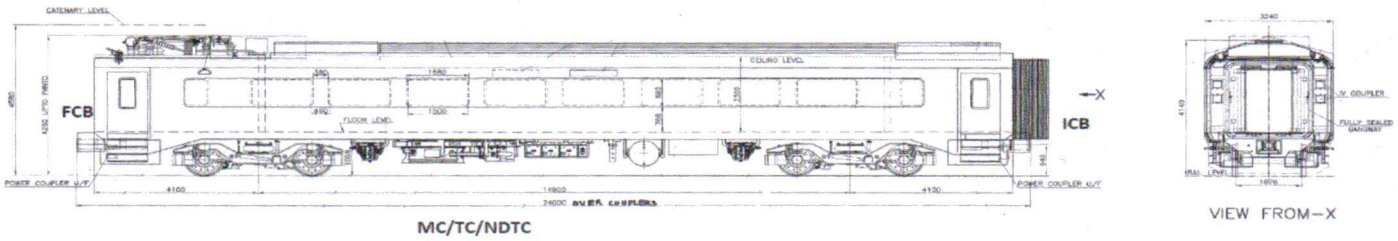
3.2. Overall Car body & Coupler Interface Dimensions:

3.2.1. The proposed design of the side crash buffers shall take into account the following carbody dimensions and limits for the side crash buffer

Jagdish Singh



DTC CAR



MC/TC/NDTC

Figure:1 Carbody and side crash buffer details

Side crash Buffers Parameters	Frontal side crash buffer	Intermediate side crash buffer
Length of side crash buffer from mounting plane of Under frame	660 mm(Approx.)	260 mm (Approx.)

Note: The above dimensions of side crash buffer are indicative only and may be subject to change during the detail design phase. The contractor shall accommodate the same without any cost implication to RCF.

4. Technical Requirements

4.1. General

4.1.1. The contractor shall meet the requirements of ICF MD Spec – 398, ICF MD Spec - 411 clauses and EN15227:2020 mentioned therein for energy absorption device and for the design, development, manufacture, supply, testing and support for installation of side crash buffers on carbody structure including the training of operation and maintenance staff of the RCF/ICF.

Jagdish Singh

4.1.2. The contractor shall co-operate and co-ordinate with the coupler supplier and other qualified suppliers to arrive at an effective crash energy management concept. The sub-contractor shall provide all relevant data requested by the coupler supplier and other qualified supplier to calculate the efficacy of crash energy management (CEM) system. Any errors occurring due to communication gap between contractor, coupler supplier and other qualified supplier in design, development and manufacturing of side crash buffers shall be rectified by the contractor without cost implications to RCF.

4.1.3. All metal parts inside/outside which are exposed to atmosphere shall be corrosion resistant. Sealing material used shall not loose in service, any of their essential properties such as adhesiveness and moisture resistance due to ageing and humidity variations.

4.1.4. All fasteners shall have corrosion resistance coating with self-locking arrangement and conform to the relevant Indian Standards or equivalent standards. The contractor shall address all fastener related issues during service.

4.1.5. Contractor shall provide suitable mounting brackets if required, and interface drawings for complete installation of all types of side crash buffers to the respective coaches. However, welding of the mounting brackets to the carbody wherever required (as proposed by the contractor) will be carried out by RCF and contractor shall provide the required support for the same.

4.1.6. When selecting the materials, the general aspects of environmental acceptability, the degradability of the materials used without residues and the later recycling are to be taken into consideration.

4.1.7. The equipment is to be of a light weight design. When choosing other weight-saving materials, cost and mechanical strengths and reliability are to be taken into consideration.

4.1.8. The contractor shall carry out the supply and supporting the commissioning activities at RCF Kapurthala works at no additional cost as per project requirement.

4.1.9. The contractor shall support in all aspects in obtaining customer clearance of the prototype side crash buffers after successful completion of type tests.

4.1.10. The contractor shall carry out any modification/alteration based on results of the type tests on the first proto if required.

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

4.2.1. The proposed side crash buffer by the sub-contractor against this PTS shall satisfy the "Proven Design" clause 3.1.8 of ICF MD Spec-398.

4.2.2. The proposed type of side crash buffers should have been proven design i.e., the design of equipment components etc., shall be based on sound, proven and reliable engineering practices. The proposed type of side crash buffers shall have proven credentials in train sets

Jagdish Singh

of 160 kmph and above operational speed in at least one project.

4.2.3. The contractor shall manufacture and supply the side crash buffers only from such manufacturing units that have supplied the side crash buffers that fulfill the proven design requirements as above.

4.2.4. Other design and performance requirements of ICF MD Spec-398 and ICF MD Spec - 411 and EN 15227:2020 standard relevant to crashworthiness shall be complied.

4.2.5. The contractor shall be fully responsible, for the suitability, adequacy, integrity, durability and practicality of the proposed side crash buffers. The contractor shall warrant that the contractor's proposals meet the ICF MD spec-398 and ICF MD Spec - 411 and EN 15227:2020 standard requirements and is fit for the purpose thereof. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the specification requirements or any part thereof, the contractor's proposal shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at contractor's own cost.

4.2.6. The contractor shall warrant that the works have been or will be designed, developed, manufactured, installed and otherwise constructed and to the highest standards available using proven up-to-date good practice.

4.2.7. Metallic surfaces of the equipment shall not show any signs of corrosion or get corroded. In case of occurrence of corrosion in any of the supplied side crash buffers, the contractor shall rectify as advised by the RCF without additional cost to RCF.

4.3. Technical Information of side crash buffers

4.3.1. The proposed side crash buffers along with anti-climbing feature shall have suitable proven energy absorption feature with associated collapse features incorporated into the side crash buffers. The front side crash buffer shall absorb the energy of 815±5 kJ at an approximate force of 1600±5 kN utilizing the complete stroke length of minimum 500 mm.

4.3.2. The intermediate side crash buffers shall absorb the energy of 65±5 kJ at an approximate force of 600±5 kN utilizing the complete stroke length of 100±5 mm.

4.3.3. The above technical details may be subject to minor change during the detail design phase. Contractor shall propose appropriate side crash buffers along with anti-climbing feature for Vande Bharat c/car version cars. Contractor shall consider all relevant parameters during design stage like stroke, energy absorption and impact force etc. and also inputs from coupler suppliers and other qualified supplier while finalizing the side crash buffers. Contractor shall make request in writing for all input data required to design, develop, manufacture the side crash buffers along with anti-climbing feature. Contractor shall submit all design related calculations and obtain RCF approval before going for production. It is the responsibility of the contractor to get the approval for all drawings from RCF before going for production.

Jagdish Singh

4.3.4. The Side crash buffers shall be mounted on to carbody by means of bolting system for ease of maintenance and replacement. All required hardware like bolts, nuts, screws, washers, etc. of the international quality shall be supplied by contractor.

4.3.5. Side crash buffers along with anti-climbing feature shall be of metallic in nature and preferred metal is corrosion resistant steel. In case of bimetals are used, it's the responsibility of contractor to take all the measures and considerations to avoid bimetallic corrosion or galvanic effect. Contractor shall consider relevant design factors to reduce the tendency of corrosion.

4.3.6. Crashworthiness:

The design and crash worthiness of the Car body shall be in accordance to EN 15227:2020 (Category C1) - 'Railway application- Crashworthiness requirement of the railway vehicle body'. The energy absorption devices shall be designed to minimize 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 side crash buffers.

4.3.7. The contractor is responsible for the maintenance as applicable.

4.3.8. Bill of Material (BOM)

All components and sub-components used in side crash buffer assembly shall be highly reliable and should have established its satisfactory performance in any of similar rolling stock /other railways.

The contractor shall submit the complete Bill of Material (BOM) for side crash buffer with anti-climbing feature along with the list of models /make and list of projects in which these items are used, during preliminary design phase.

The contractor shall submit the complete Bill of Material (BOM) for side crash buffers along with anti-climbing feature to RCF for design approval before supply. Bill of materials of all bought out items shall be submitted with make and part number.

4.4. Weight

4.4.1. To minimize energy costs, great importance will be placed on achieving practical designs of minimum car weight whilst meeting specified structural and performance requirements. Accordingly, the weight of the side crash buffers shall be kept to a minimum. The total weight of side crash buffer shall not exceed by more than +4% of the estimate weights as per relevant drawings.

4.4.2. The contractor shall submit details of estimated weights and center of gravity for side crash buffers along with the technical offer.

Yasdish Singh

4.5. Painting procedure

The side crash buffers shall be cleaned and shall be free from oil/grease and shall be shot blasted with SS grits to SA2.5 and Primer Painted with Epoxy Primer. After painting epoxy-based zinc phosphate primer (two packs), as per RDSO PSECN M&C/PCN/100/2018 or latest. Side crash buffers to be painted with high performance anti-corrosion epoxy coating (two packs) as per RDSO PSECN. M&C/PCN/123/2006 or latest. Side crash buffers shall be painted with total dry film thickness not be less than 100 microns. Machined surface, greasing points, glass, moving parts to be covered before painting. Only approved brand paint should be used. Color shade (RAL CODE) shall be finalized during the design stage. The contractor shall consider the guidelines of IS:2932-74 category 2 or any equivalent standard on approval of RCF. The contractor shall submit the painting scheme to RCF for approval.

4.6. RAMS Requirements

4.6.1. The Contractor shall design the side crash buffers to ensure Guaranteed Reliability, Guaranteed Punctuality and high degree of safety in order to provide a dependable service. The optimization of the system with respect to reliability, availability, maintainability and safety (RAMS) shall form an integral element of these Procurement Technical Specifications. The plan for reliability, availability, maintainability and safety shall conform to EN 50126/ IEC 61709/ IEC 62278.

4.6.2. Maintenance Schedule (Clause 2.20 of ICF MD Spec-398)

Contractor shall submit the basic maintenance schedules of the proposed side crash buffers along with anti-climbing feature. Minimum interval between two maintenance schedules in the depot for the proposed systems should be based on international standards/norms. Average running distance of a rake may be considered as 2000 kilometer per day.

The sub-contractor shall provide the details and relevant calculations on LIFE CYCLE COST (LCC) for side crash buffers.

The maintenance program prepared by contractor shall have the following objectives:

- Enhancement of availability
- Minimization of maintenance costs
- Minimization of coach downtime/MTTS (meantime to restore serviceability)

4.7. Quality Assurance Program

Jagdish Singh

4.7.1. The contractor shall hold ISO 9001:2015/ IRIS or equivalent standard certification and shall manufacture the product accordingly. The contractor shall submit a copy of ISO 9001:2015/IRIS or equivalent standard certification along with the technical offer. The contractor shall monitor and control the Quality systems as per ISO 9001:2015/IRIS or equivalent standard guidelines. RCF 's representative may periodically conduct compliance audits of the Contractor's Quality management system.

4.7.2. Quality assurance plan: The contractor shall submit Quality Assurance Plan (QAP) based on ISO 9001:2015/IRIS or equivalent standard guidelines during the preliminary design phase for manufacture and inspection of the side crash buffers and to be submitted for RCF's approval. It is the responsibility of the contractor to get all necessary approval from RCF.

5. Scope of Supply

5.1. General

5.1.1. The contractor shall be responsible for the scope of design, development, manufacture, supply, testing and support for installation of side crash buffers on carbody structure, which shall comprise, unless specifically excluded, design, development, manufacture, supply, testing and support for installation of side crash buffers on carbody structure, and rectification of defects & associated equipment necessary to facilitate operation and maintenance of side crash buffers which includes special tools and spare parts, operation and maintenance manual and training.

5.1.2. All design, development, manufacturing and Installation drawings to be submitted to RCF for review and approval. RCF's approval are must before going for production. It is the responsibility of the contractor to get the approval for all design and drawings from RCF before going for production.

5.1.3. The Side crash buffers shall be mounted on to carbody by means of bolting system for ease of maintenance and replacement. All required hardware like bolts, nuts, screws, washers, etc. of the international quality shall be supplied by contractor.

5.1.4. If any special tools/equipment are required for installation of side crash buffer onto carbody, the contractor shall supply 10 nos. of such equipment at his own cost.

5.1.5. The Contractor shall meet the system technical requirements for Side crash buffers in accordance with ICF Spec. No. ICF/MD/SPEC-411, Issue Status: 01, Rev.03 dt. 24.03.2023, ICF MD SPEC-398, ISSUE status-01, Rev.00 dt. 04.04.2022) and EN15227:2020 (or latest) as a minimum.

5.1.6. Contractor shall provide all components related to side crash buffer as required by the Vande Bharat c/car version (16 TS) project.

Jagdish Singh

5.2. Side crash buffers quantity details:

Sl. no.	Description	Qty/ car				Qty/TS
		DTC	MC	TC	NDTC	
1.	Front side crash buffer with anti-climbing features	2	0	0	0	04
2.	Intermediate side crash Buffers with anti climbing features	2	4	4	4	76

5.3. Finite element analysis of side crash buffers

5.3.1. The contractor shall carryout the 3D simulation of both front and intermediate side crash buffers using ANSYS-LSDYNA/RADIOSS to verify the energy absorption capacity of side crash buffers.

5.3.2. The contractor shall provide all input, output files of finite element analysis to RCF for verification.

5.3.3. The contractor shall submit the detailed report on finite element analysis of side crash buffers and obtain the approval from RCF before going for the production. Contractor shall accommodate any design changes/modifications suggested by RCF based on the outcome of finite element analysis at contractor's own cost.

5.3.4. The following result entities of finite element analysis shall be part of analysis report

1. Force vs Time Plot
1. Force vs Displacement Plot
2. Energy vs Time Plot
3. Displacement vs Time
4. Maximum Force Value
5. Maximum Stroke Value
6. Energy Absorbed Value (based on force and test sample displacement data)
7. Deformation pattern at various time steps till the utilization of complete stroke.

5.3.5. The Finite element analysis and physical type test results shall show a close correlation in accordance to EN 15227:2020, Annexure-B.

5.4. Design Submission and Deliverables

Jagdish Singh

5.4.1. The objective of the design submission process is to ensure that the proposed resulting works comply with the specifications, are capable of being produced consistently to exacting quality standards, achieve low life cycle costs and can be operated safely to the satisfaction of the Engineer.

5.4.2. The contractor shall submit all necessary documents viz., documents and drawings describing function, description, product description, design calculations, interface requirement description, RAM requirement description, Life cycle calculations, Type test specifications, list and details of spares, related calculations etc.

5.4.3. The contractor shall provide all input, output files of finite element analysis.

5.4.4. The drawings and documents shall be delivered in English with the data format of, respectively, latest Auto CAD (2015) release. (Document - MS Word, spread sheet - MS excel, data base files - MS Access, Presentation file - MS Power Point).

5.4.5. For regular exchange of data, UG, Catia and Solid works for CAD platform shall be used.

5.4.6. The contractor shall provide 3D model of all Side Crash Buffers and its components & 2D drawings to RCF for preparing engineering mockup.

5.4.7. In the event that a statutory body (e.g., Government of India Ministry of Railways, RDSO, etc.) requires design information in a particular format, it shall be incumbent upon the contractor to provide the same, as directed by RCF.

5.4.8. Confidentiality – The design, documentation, reports and drawings created by the contractor as per the scope of work shall be submitted to RCF and shall be intellectual property of RCF and shall not be shared, used or saved in any form except for fulfilling the requirement of manufacture of the coaches as per this scope.

5.4.9. Design Deliverables

The following design documents/drawings shall be delivered as a minimum to RCF according to the time schedule defined by RCF.

Stage	Document/Deliverable	Submission and approval
Tender offer	Supporting documents for Qualification criteria as per Cl. 2.	Along with tender technical offer
	Vendor documents including QAP, ITP, company profile with infrastructure facilities, product range etc., as per Cl. 2.	
	General Technical Description of proposed side crash buffers and concept drawings.	
	General arrangement drawings of proposed side crash Buffers	
	Preliminary cad models in step files (*.stp format) or .prt.	

Jagdish Singh

	Type Test procedure document for dynamic destructive Testing	
	A report on energy absorption capacity of side crash buffer	
	Estimated weights of Front side crash buffer and Intermediate side Crash buffers (refer Cl. 4.4)	
	Tender & PTS clause by Clause compliance	
Design Review Stage	General System Technical Description of proposed Side Crash buffer, with complete technical specification details of sub components and its functionality.	At the earliest upon placement of PO, LOI/ contract award, submission and further updates including RCF approval
	Side crash buffers design Drawings (Dimensional Installation Drawings: UG or CATIA/SolidWorks file)	
	3D model of Side crash buffers assembly in UG/CATIA/SolidWorks file	
	Material specification of all components	
	Weight details	
	Finite element analysis for energy absorption capacity of side crash buffers with anti-climbing features and its detailed calculations per Cl. 5.3 All input/output files of Finite element analysis using ANSYS-LSDYNA/RADIOSS.	
	Documents related to Interfacing with carbody and other Systems	
	List of standards and codes	
	Quality Assurance Plan	
	Bill of Materials (BOM) of complete side crash buffers with anti-climbing features assembly	
	RAMS Deliverables as per Cl. 4.5	
	Type test plan for side crash buffer (Impact testing)	
Final Design Review stage	Final design drawings of complete side crash buffers assembly and its components in AutoCAD/UG or CATIA/SolidWorks file)	At the earliest upon placement of PO, LOI/ contract award, submission and further updates including RCF approval.
	Final 3D model of side crash buffers assembly and its components in UG/CATIA/SolidWorks file.	
	Type test Procedure (incl. record sheet) & test Reports	
	FAI Procedure & Report	
	Operation and maintenance manuals & Electronic manual	
	RAMS Deliverables (final)	
	Detailed Training proposal	
	All As-Built Drawings (Final drawings) of each part of side crash buffers in UG, AutoCAD, CATIA & Solid works.	

Jagdish Singh

Note: Over and above-mentioned documents, contractor shall submit any additional documents required by RCF without any cost implication.

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

5.5. ICF's Spec. & PTS Compliance

5.5.1 The contractor shall offer a valid and fully compliant proposal for the side crash buffers system as detailed in ICF's Spec. and PTS.

5.5.2 The contractor shall submit, along with the technical offer, the Clause-by-Clause Compliance for ICF's Spec. and PTS:

5.5.3 Offers with Non-compliance and deviations to any of the clauses in ICF's Spec. and PTS clauses with regard to side crash buffers, are liable for rejection.

5.6. Operation and Maintenance Manuals (O&M Manual)

5.6.1. Operation and Maintenance manuals/instructions with trouble shooting guides, shall be supplied for all the items under the scope of the contractor. Maintenance manuals/instructions shall be supplied in the form of A4 size book, giving explored views of assemblies, 3D snap shots, part numbers, drawings & dimensions. Photos shall be incorporated to the manual for easy identification of the process. The manuals shall be submitted both in hard and soft copies and in a presentable manner. 20 hard copies of each manual shall be supplied. This is prerequisite for claiming 100% payment.

5.7. Spare parts catalogue

5.7.1. The contractor shall submit 8 copies of spare parts catalogue for all the items under their scope of supply. The spare parts catalogue shall be standard, well organized and complete, with part numbers and drawing references. Photos shall be incorporated for easy identification of the process. Spare parts catalogue shall be submitted both in hard and soft copies in a presentable manner.

5.8. Training

5.8.1. The contractor shall provide comprehensive training to RCF staff (maintenance, operating, training instructor and engineering). The aim of training is to enable the RCF personnel to effectively carry all aspects of the operation (normal, failure, recovery and emergency), maintenance and training requirements for item under the scope of work.

5.8.2. Train sets will be commissioned at various maintenance depots over Indian Railways. Contractor shall depute personnel to impart training to operation and maintenance staff of the various maintenance depots. Firm shall impart training regarding all sub systems within their scope of work. A minimum of 7 days training shall be provided in each maintenance depot.

Yagdish Singh

6. Testing and commissioning

6.1. General

6.1.1. The contractor shall submit Inspection, Testing and Commissioning Plan according to the technical requirements during the design stage.

6.1.2. The side crash buffers shall be type-tested in accordance with detailed respective test procedures to be drawn up by contractor and agreed by RCF which shall take into account the requirements of respective international standards and this PTS and test program drawn up by the contractor to demonstrate that the individual equipment to meet the specified technical requirements. The test plan shall be approved by RCF. It is the responsibility of the contractor to get the approval from RCF.

6.1.3. Wherever any equipment, system or sub-system is not specifically covered by an internationally recognized specification or test procedure or where the type tests prescribed by an international standard do not adequately cover the requirement, tests which are acceptable both to the contractor and to RCF, shall be devised.

6.1.4. Change of manufacturing place may require re-type test.

6.1.5. RCF 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 reasonably call for additional tests as are considered necessary, including the quality of welds particularly in highly stressed areas, by nondestructive testing methods. RCF may, if considered necessary, call for conducting optional tests as per relevant standards without any additional cost to RCF. In case of repetition of tests, as decided by RCF, entire cost including that of RCF representative(s) shall be borne by the contractor.

6.1.6. The results of all tests shall be submitted to the RCF, who will record his conclusions as to whether or not the equipment being tested has passed satisfactorily.

6.1.7. The Contractor shall be responsible for undertaking and passing all necessary testing activities for side crash buffers.

6.1.8. Prior to the start of testing, RCF shall have all approved test plans and procedures for the test and all relevant prerequisite testing shall have been completed by contractor.

6.1.9. If there is a problem during testing & commissioning, the contractor should depute his engineer to solve the problem within 48 hours of RCF's request to do so.

6.1.10. All test & inspection specifications and reports including all repair activities and check- lists shall be submitted to and approved by RCF.

6.2. Equipment Type Test

Yagdish Singh

6.2.1. The side crash buffers shall be type tested in accordance with technical requirements and as per the requirements of EN15227:2020 Annexure-B or equivalent standard at contractor's works, at his own cost. The type test shall be of dynamic & destructive type to assess the energy absorption capacity of each type of side crash buffers with anti-climbing feature.

6.2.2. The following result entities shall be extracted from the destructive type test

1. Force vs Time Plot
2. Force vs Displacement Plot
3. Energy vs Time Plot
4. Displacement vs Time
5. Maximum Force Value
6. Maximum Stroke Value
7. Energy Absorbed Value (based on force and test sample displacement data)
8. Deformation pattern at various time steps till the utilization of complete stroke.

6.2.3. The physical type test and finite element analysis results shall show a close correlation in accordance to EN 15227:2020, Annexure-B.

6.2.4. Type test shall be carried out on 2 samples of front side crash buffers and 2 samples of intermediate side crash buffers. The additional side crash buffers required for the destructive type testing shall be to the contractor's account and will not be the part supply quantity.

6.2.5. 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.

6.2.6. RCF reserves the right to call for additional test, if necessary, at no additional cost implications to RCF.

6.3. First Article Inspection (FAI)

6.3.1. The contractor shall offer the first set of Side Crash Buffers 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.

6.3.2. FAI shall be witnessed by the RCF nominated agency/engineer as per relevant standard/International practices/specifications. If RCF desires, in process inspection can be carried out at manufacturing stage also.

6.3.3. At the FAI, the contractor shall make available all pertinent design and manufacturing process documentation, quality records, test records, material certifications, gauges

Jagdish Singh

calibration/certificate etc.

6.3.4. If FAI has to be repeated due to non-compliances/ deficiencies noticed, the cost towards the same and the cost towards RCF's visit to contractor's place for witness of re-FAI shall be to contractor's account.

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

6.4. Installation and Commissioning

6.4.1. After the Side Crash buffers are delivered, the contractor shall depute his engineers/personnel for the installation and commissioning of the side crash buffers on the first two train sets. Modifications/ corrections, if any, shall be carried out by the contractor at his own cost.

7. Appendices

I). ICF Spec. No. ICF/MD/SPEC-411, Issue Status: 01, Rev.03 dt. 24.03.2023.
II). ICF MD SPEC-398, ISSUE status-01, Rev.00 dt. 04.04.2022.

8. Submittals with Technical Offer

The Contractor shall provide as a minimum, the following along with the technical offer:

1. Complete technical offer for side crash buffers assembly including technical description document for each type of side crash buffers, general arrangement drawings of each type of side crash buffers, Collision / Impact and crash energy absorption simulation document and estimated weights.
2. Supporting documents for Qualification Criteria compliance including QAP, ITP, company profile with infrastructure facilities, product range etc.,
3. Clause-by-Clause compliance for
   1. PTS
   2. ICF Spec. No. ICF/MD/SPEC-411, Issue Status: 01, Rev.03 dt. 24.03.2023.
   3. ICF MD SPEC-398, ISSUE status-01, Rev.00 dt. 04.04.2022.

Jagdish Singh