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रेल मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

अनुसंधान अभिकल्प एवं मानक संगठन रेल मंत्रालय
RESEARCH DESIGNS AND STANDARDS ORGANISATION
MINISTRY OF RAILWAYS

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भारतीय रेलों के लिए पैसेन्जर एलीवेटर की तकनीकी विषिष्टि
TECHNICAL SPECIFICATION FOR PASSENGER ELEVATOR FOR INDIAN RAILWAYS

SN	Amendment		Revision		Reason
	Number	Date	Number	Date	
1	1	24.11.15	-	-	Rly bd. Letter no. 2012/elect(G) /150/7 dated 02.09.2013 and SC Rly letter no. E.252/Lifts /2013-14 Dt. 10.02.2015. Amdt. cl.: 2.3, 2.8, 2.9, 4.0, 5.8, 6.1.2.7, 6.2, 6.5.1, 6.5.3, 6.5.5, 6.6.2, 6.9.2.1, 6.9.5.2, 6.9.7.1, 6.10.3.2, 6.21.2, 6.21.3, 6.23.1, 6.23.4.1, 11.0 and annex-1. Add. Cl.: 6.15.4, 6.22.6, 6.22.7, 6.22.11, 13.2.4, 19.2, 19.3 & 19.4. Del. Cl.: 6.6.4, 6.9.1.4. & 6.9.6.3.
2			1	26.12.19	Rationalized the specification to improve its reliability and clarity.
3			2	-----	Rationalized the specification in line with the current technical upgradation and to improve its reliability and clarity.

जारीकर्ता
~~ऊर्जा एवं पर्यावरण प्रबंधन~~ पवार सप्लाई एवं ई एम यू निदेशालय
अनुसंधान अभिकल्प एवं मानक संगठन
मानक नगर लखनऊ – 226011

ISSUED BY
~~ENERGY AND ENVIRONMENT MANAGEMENT~~ POWER SUPPLY AND EMU DIRECTORATE
RESEARCH DESIGNS AND STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW-226011

Approved by:

PED/PS & EMU

Prepared by: SSE/EM	Checked by: Dir/EM

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TECHNICAL SPECIFICATION FOR PASSENGER ELEVATOR FOR INDIAN RAILWAYS

1. FOREWORD

Elevators facilitate the vertical transportation of railway passengers and others at railway stations and buildings. This specification will facilitate the provision of safe and high quality elevators on the Indian Railway (IR) network.

2. SCOPE

2.1. The specification seeks to define the objectives, guidelines and requirements for design, manufacture, supply, installation, testing and commissioning, preparation of maintenance/ operations manual and imparting training to maintenance/ operations personnel in respect of heavy duty elevators.

2.2. Elevators are machine room/machine room less ~~are required to be machine room less~~, gear-less and the same shall be suitable for railway stations, be they underground or over ground (please refer item 10 of Annexure-1). User will decide the requirement machine room based on their site condition. In absence of any specific mention to the contrary in the tender, it will be deemed that the railway station is of overground and machine room less type. The elevator should be fit for use by elderly as well as differently abled passengers. Although focus of the spec. is on vertical movement of passengers from Foot-over-Bridge (FOB) to platform, concourse, circulating area, etc., the spec. is equally suited for multi-storied buildings (please refer item 1 of Annexure-1).

2.3. Elevators shall be heavy duty type and capable of operating safely and smoothly at a rate of 180 motor starts per hour or above for a period of not less than 20 hours per day, seven day a week. The elevators should be designed for minimum 10,00,000 operations per year.

2.4. The Contractor shall be fully responsible for obtaining relevant safety certificate or license or any other authorization required from statutory authorities as a pre-requisite for taking up the work of commissioning and regular operation of Machine-room less & Gear-less Elevators. The firm shall also obtain the relevant safety certificate from statutory authority in respect of individual elevators. Fee, if any, for obtaining such license/ certificate shall be borne by the contractor. The aforesaid provision shall be applicable to contractual warranty period and (if applicable) AMC period also.

2.5. The Contractor shall submit to the railway, relevant safety and clearance certificates for each equipment, as obtained from the statutory authorities.

2.6. The Contractor shall be responsible to supply and install any signage/ graphics required for fulfillment of relevant statutory authority's norms, whether or not specifically mentioned in the spec.

2.7. Railways shall furnish the particulars of their specific requirements by filling in all the entries, as per the format given in Annexure 1.

2.8. Based on the available resources and contractual obligations a user railway may decide either composite work contract of lift installation (both Civil and electrical) or do tender separately by both department.

2.9. Railways will need to carry out site feasibility study prior to proposing the work. In respect of Elevators to be provided for transferring passengers from FOB to the level below i.e. platform, concourse, etc., railways shall carry out a detailed survey for feasibility of shaft for the Elevator as also the FOB extension along with its support structure; in addition, detailed survey would need to be carried out to ascertain the number of Elevator car doors required. If the site necessitates that landing doors at platform level and FOB levels be provided on different (opposite) faces of the shaft due to space constraint, then the Elevator will need to be provided with two sets of car doors. While inviting tenders, railways must submit their site specific requirements as per item 7 of Annexure-1. A joint note between concern SSE (Elect.) and IOW (Engg.) shall be prepared to find out all the requirements as per the site condition.

2.10. *Lift Contractor's scope of work*

Contractor's scope shall include but not be limited to the following:

(i) Design, supply, installation, testing and commissioning of machine room/ Machine-room less and Gear-less Elevators in stations/ buildings for vertical transportation of passengers (including the differently abled and elderly);

(ii) Supply and fixing of guide rails and related items

(iii) The elevator shall be supplied in accordance with specific requirements of the site, as furnished by the railway (please refer Annex-1).

(iv) Minor civil works (limited to minor items such as chipping, repair or touchup in the shaft for carrying out the elevator installation)

(v) The contractor shall provide all wiring and apparatus, suitable for the specified electrical supply and the same shall be approved during design stage.

(vi) Transportation of material and equipments to site, for installation;

(vii) Scaffolding works and barrier fencing at the landings (only to the extent required for installation of Elevators);

(viii) Enclosures and supporting brackets for housing and fixing of equipment;

(ix) Shaft lighting and electrical sockets;

(x) All equipment, fixtures and materials reasonably required for interface with other Contractors;

(xi) Provision of CCTV inside the lift and its integration compatibility with IRNIYANTRAC.

(xii) Training; and

(xiii) Documentation

NOTE: The following items shall also form a part of contractor's scope if specifically asked for in the tender:

(a) Special tools, testing and diagnostic equipment and measuring instruments.

(b) Maintenance for specified period.

2.11. ~~*Railways'*~~ *Raiways' and Civil contractor scope of work*

2.11.1 As for site preparation works (civil and electrical), with the exception of items of works specifically kept under contractor's scope by this specification, all the other works shall automatically fall under railways' scope. The site preparation works ~~to be undertaken by railways~~ may typically include: construction of the Elevator shaft including pit; construction of FOB extension for connecting the main passage to Elevator shaft; raised platform/profiling required for prevention of ingress of water into the Elevator shaft; any miscellaneous works (if required), to offer a clear site to the elevator contractor; canopy above the landing doors (where required); provision of architraves; provision of drain pipe in the lift well at slightly higher level than main drain, so that the inflow of water from outside can be avoided. The drain pipe to be connected to main drain a suitable pump and sump at pit of the shaft to be provided to discharge water in drain pipe; provision of earth pits for achieving an earth resistance of max 1 ohm (for elevators, railways shall provide separate earthing pits); making single phase and three phase LT power supply available for the Elevator, etc.

2.11.2 Elevator shaft should ~~preferably~~ be either of RCC or Steel structure decided by the user as per the site requirements. If brick construction is used, then it is recommended that the minimum thickness of shaft wall shall be 230 mm and RCC tie-beams shall be provided at the bracket fixing levels and any other equipment fixing locations. The location of the RCC tie-beams shall be provided by the Elevator contractor. In case of steel structure a suitable protection/cover should be used to all the sides of frame. The shaft/well should confirm to IS 17900 part-1.

2.11.3 Elevator contractor will provide communication port at ITB at machine room ~~and at SCR~~. The control wiring from machine room to SCR shall be done by railway through separate contract or its own resources ~~contractor.~~ ~~The elevator contractor will facilitate the connection at ITBs.~~

3. APPLICABLE STANDARDS

IS ~~14665~~ 17900: Part 1	~~Specification for passengers lifts~~ Lifts for the Transport of Persons and Goods: Safety Rules.
IS 17900: Part 2	Lifts for the Transport of Persons and

	Goods : Design Rules.
IS 17900: Part 3	Lifts for the Transport of Persons and Goods: Specifications for Planning and Selection
IS 17900: Part 6	Lifts for the Transport of Persons and Goods: Guide for Maintenance of Lifts
BS EN-81-~~1~~ 20	Safety Rules for the construction and installation of lifts ~~Part 1: Electrical Lifts~~
IEC 60364	Standard on Electrical installation for building
IS 15330	Installation and maintenance of Lifts for handicapped persons – Code of practice
~~IS 15785~~	~~Installation and maintenance of lift without conventional machine rooms – Code of practice~~
~~IS 8216~~	~~Guide for inspection of lift wire ropes~~
~~IS 14665: Part 1~~	~~Electric Traction Lifts – Part 1: Guidelines for outline dimensions of passenger, goods, service and hospital lifts~~
IS 14665: Part 2: Sec ~~1 and~~ 2	Electric Traction Lifts – Part 2: Code of practice for installation, Operation and maintenance: ~~Section 1: Passenger and goods lifts;~~ Section 2: Service Lifts
IS 14665: Part 3: Sec ~~1 and~~ 2	Electric Traction Lifts – Part 3: Safety rules: ~~Section 1: Passenger and goods lifts;~~ Section 2: Service Lifts
~~IS 14665: Part 4: Sec 1-9~~	~~Electric Traction Lifts – Part 4: Components~~
IS 14665: Part 5	Electric Traction Lifts – Specification Part 5: Inspection manual
IS 15999: Part-1/ IEC 60034: Part – 1	Rotating electrical machines - Rating and performance
IS 15999: Part-2/ IEC 60034: Part – 2-1	Rotating electrical machines - Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)

IS 2365/BS EN 12385-5	Steel Wire Ropes for Lifts — Minimum Requirements Steel wire ropes. Safety. Stranded ropes for lifts
IS 14700 (Part 6/Sec 3) / BS EN 61000-6-3	Electromagnetic compatibility (EMC) - Generic standards - Emission standard for residential, commercial and light-industrial environments
IS 14700: Part 6 (Sec-2)/ BS EN 61000-6-1	Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments
BS EN 12015	Electromagnetic compatibility - Product family standard for Lifts, escalators and passengers conveyors -Emission.
BS EN 12016	Electromagnetic compatibility - Product family standard for Lifts, escalators and passenger conveyors -Immunity.
IS:17806/ISO 7465	Passenger Lifts and service lifts. Guide rails for car & counterweight – T type
BS EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods
IS 14671/ BS 5655: Part 10	Lifts and service lifts – Specification for the testing and examination of Lifts and service lifts
EN 81 – 71	Safety rules for the construction and installation of lifts — Particular applications to passenger lifts and goods passenger lifts — Vandal resistant lifts
IS: 4289-2/ IEC 60227-6	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 6: Lift cables and cables for flexible connections

NOTE:

i. The elevator shall generally confirm to this specification however for parameters and performance criteria's not explicitly covered in this specification should be governed by standards mentioned above. In case of conflict between standards the preference should be given in the order of Railway Board Instructions, IS, IEC, ISO, EN.

ii. The latest version of the above mentioned standards shall be applicable.

4. OPERATING CONDITIONS (SERVICE CONDITIONS)

The equipment shall be sturdy and suitable for the following service conditions to be normally met in service:

Ambient Temperature	–5°C to +50°C
Humidity	Relative humidity: 40% to 95%
~~Altitude~~	~~Max 1,200 meters above sea level (1,800 meters for J&K area)~~
Atmosphere	Extremely dusty and desert weather and desert terrain in certain areas. The dust content in air may be as high as 1.6mg/m3. During dry weather, the atmosphere is likely to be full of dirt and dust. The rainfall can be fairly heavy.
Coastal area	The equipment shall be designed to work in corrosive atmosphere. Stations in coastal areas have continued exposure to salt laden air.

5. GENERAL REQUIREMENTS

5.1 The construction of all Elevators shall conform to latest editions of IS-~~14665~~ 17900, ~~IS 15785,~~ IS-15330, and EN 81-~~1~~ 20.

5.2 Each Elevator shall have its own driving machine. The method of drive shall be Electric Traction with gearless motor having a provision of VVVF Control; regenerative drive shall be provided by default~~, if specifically asked for by the purchaser (please refer item 8, Annexure - 1)~~. ~~In absence of any mention to the contrary in the tender, it will be deemed that regeneration feature is not required.~~ The system, including all sub-systems and equipments shall be of proven design.

5.3 The design of the Elevators shall be such that no major repair shall be necessary for a period of 20 years from the date of issue of Certificate of Taking Over. This of course is based on the assumption that prescribed inspections are carried out periodically and routine maintenance as well as cleaning is carried out. The term 'Major repair' shall mean replacement of car frame, car enclosure, car and landing doors, Elevator shaft wiring (except travelling cables), guide rails, drive machine, and driving sheave; parts attached to these components, which are subjected to normal wear and tear, are excluded.

5.4 The design of Elevators shall take into consideration fire prevention, elimination of dust and dirt traps, and easy accessibility for cleaning and routine maintenance.

5.5 The gearless drive machine shall be mounted on guide rails accommodated within the Elevator shaft. The power switchgear and main control equipment can be located suitably inside or near the Elevator shaft. Location of the same is to be decided in coordination with the railway and railway appointed civil contractor. No separate machine-room will be provided for machine room-less ~~and Gear-less~~ Elevators.

5.6 Elevators are critical to vertical transportation of passengers and staff and particularly so for the differently abled and elderly. So, elevator reliability is very important for IR. The reliability, availability and

maintainability of equipment/ components shall be judged on the basis of Call Out Ratio (COR) i.e. engineer visits to the site for unscheduled maintenance of an elevator. Firms should endeavor that the COR does not exceed 2.5 per elevator per year. Railways should consider levying a penalty on firms, in event of the COR exceeding 2.5. Relevant penalty provisions, if any, shall be incorporated by the railways in their special conditions of tender. In absence of such penalty provision in the special conditions of tender, no penalty shall be levied on the firm; even if COR are in excess of 2.5.

5.7 *Elevator Speed:*

5.7.1 For transfers between FOB and platform level, the nominal speed for elevators in either direction shall be 1.0 m/s. The spec does not permit the railways any other option in the matter of speed of Elevator for transfers between FOB and platform level at railway stations.

5.7.2 In respect of applications other than transfers between FOB and platform level, unless otherwise specified in the tender, the nominal speed for Elevators in either direction shall be: 1.0 m/s for up to 6 stops; and 1.5 m/s for 7 to 13 stops. Should the railway have valid reasons to specify a speed different from the aforesaid, then it can indicate the same at item 3 of Annexure-1.

5.8 **Elevator dimension /capacity:**

5.8.1 For all passenger areas: The standard Elevator car and shaft dimensions for 14/20/26 persons capacity Elevators have been specified in Cl. 11 with minimum size of inside area of lift is 1500mm x1500 mm (as per the Rly. Bd. letter no. 2019/Stn.Dev.-1/03/06/Policy/ PwDs), Railways must choose one of the three aforesaid Elevator capacities (refer item 2 of Annexure-1). Although the standard shaft and pit sizes prescribed in Cl. 11 are expected to be compatible with Elevators of any make, railways however are advised to consult the contractor and seek his written confirmation before proceeding with the construction of shaft and pit. If so necessitated by site conditions, railway can specify car dimensions i.e. width and depth that are different from that prescribed in Cl. 11 (refer item 5 of Annexure 1), but with the car area same as in Cl. 11; In such case, the railway would need to hold consultation with all stakeholders and then arrive at the corresponding shaft dimensions. The Contractor shall be responsible to accommodate the Elevator within the shaft sizes agreed to with the railway. The Contractor shall co-ordinate with the railway and railway appointed civil contractor for all matters related to minor variations in shaft size (depth and width) ~~as well as out of plumbness as specified in Clause 11~~. These variations shall be accommodated in the design by the contractor by way of provision of suitable guide brackets/ fabricated steel channels without any additional charges. The contractor shall be responsible for any delay on this account.

5.8.2 For all non-passenger areas: Size of the lifts may be decided by user railway as per the recommended dimensions given in table 6 of IS

17900 and accordingly shaft dimension will be chosen as per the same IS 17900. If necessitated by the site conditions, railways can specify any other dimensions but these should fulfill the conditions of variation given in the IS. In such case, the railway would need to hold consultation with all stakeholders and then arrive at the corresponding shaft dimensions.

5.9 ~~Elevator Shaft size, Car size and clear opening width and height of both the car and landing entrance shall not be less than those specified in Clause 11~~ .

5.10 On award of contract, the contractor shall at the earliest physically check the site and verify the approximate travel and all other relevant information through co-ordination with the railway and railway appointed civil contractors.

5.11 ~~The headroom (overhead) and pit depth for each Elevator in the shaft shall be as specified in Clause 11~~. In the submittals, the contractor shall furnish the requirement in respect of reaction load on the walls and in the pit and other relevant shaft requirements. The Contractor is required to interface with the railway as well as with railway appointed civil Contractor in respect of the Elevator shaft requirements.

5.12 The running clearance of each Elevator between the Elevator car threshold and landing door sill shall not be less than 15mm but not more than 30mm.

5.13 Wherever hanging pits are required, the railways shall mention the same at item 11 of Annexure-1. Further, where hanging pits are involved, the shaft size is likely to vary from the size indicated in Cl. 11 ~~prescribed in IS 14665~~. Accordingly, the contractor shall coordinate with railway for construction of shaft of appropriate size.

5.14 Suitable provisions shall be made in hardware/software so that there should not be loss of any data due to power failure or any type of power disturbance, etc. This shall be reviewed and finalized at design stage.

6. SYSTEM DETAILS

The elevator shall comprise of all parts and accessories, which are necessary for its efficient operation, whether specifically mentioned or not. The key parts and accessories along with their functions and features are listed as follows:

6.1 Traction Drive System

6.1.1 Motor

6.1.1.1 Driving motor shall be of AC permanent magnet synchronous type (with no slip rings) designed for special duty cycles required for Elevator operation. It should have a high starting torque, high power factor, high efficiency and low energy consumption. The efficiency of driving motor shall not be less than 85%. The motor should conform to IS 15999/IEC 60034: Part 1 & 2.

6.1.1.2 The motor shall be capable of not less than 180 starts per hour without excessive temperature rise.

6.1.1.3 The maximum temperature rise of the winding shall not exceed 50^0C above ambient temperature when operated under normal condition.

6.1.1.4 Provision shall be made to enable the speed to be checked at main Control cubicle. The device for speed checking itself has been included in the scope through Cl. 6.28 (e).

6.1.1.5 The motor shall carry a nameplate giving full details of its ratings and characteristics.

6.1.1.6 The motor used shall have Class 'F' insulation with IP-21 protection and shall be designed for 110% of rated load.

6.1.1.7 The motor shall be designed to conform to S5 – 60% CDF (cyclic duration factor). Duty cycles are defined as per IEC duty cycles for non peak and peak period of operation.

6.1.2 Brake

6.1.2.1 The Electro-magnetic brake shall be of the spring applied and electrically released type.

6.1.2.2 The brake shall be capable of stopping and holding the Elevator car in its downward travel to rest (with 125% of its rated load) from the maximum rated speed. In this condition, the retardation of the Car shall not exceed that resulting from the operation of the Safety gear or stopping on the buffer.

6.1.2.3 Springs used to apply the brake shoes (two nos.) shall be in compression and adequately supported. Powder coating or other alternative Anti-corrosion measures to be ensured.

6.1.2.4 Brake linings shall be of renewable, incombustible, non-asbestos materials and shall be secured to the brake shoes so that normal wear shall not weaken their fixings. Band brakes shall not be used.

6.1.2.5 No earth fault, short circuit or residual magnetism shall prevent the brake from being applied in the event of loss of power supply to the Elevator motor and control circuit.

6.1.2.6 A means of adjusting the brake plunger stroke shall be provided.

6.1.2.7 The Elevator machine shall be fitted with emergency device capable of facilitating the brake to be released by hand/ electrical switch. In case of manual emergency device it shall require a constant effort to keep the brake open. The emergency device shall be handle/electrical switch operated and be provided in MAP (Maintenance Access Panel). The handle/electrical switch should be robust and able to bear human intervention. This aspect shall be evaluated during detailed design stage. It is desirable that a mechanical (independent of electrical system) arrangement may be provided for rescuing the trapped passengers. The rescue operation

shall be possible even when the total load of the car with passengers become equal to the mass of the counterweight. Only trained authorized person should be permitted to use mechanical handle ~~release~~/electrical switch.

6.1.3 Driving Sheaves

6.1.3.1 The sheaves shall be manufactured in steel or SG iron or alloyed cast iron and free from cracks, sand holes and other defects with truly machined surface in order to ensure perfect alignment of all bearings and thereby also reduce noise generation. The sheaves shall be fitted with sealed for life lubricated bearings.

6.1.3.2 The sheaves shall have machined rope/belt grooves that can be reworked for future wear.

6.1.3.3 Adequate provision shall be made to prevent any suspension ropes leaving the groove due to rope/belt slack or introduction of foreign objects.

6.1.3.4 The deflector or secondary sheave assembly, where used, shall be mounted in proper alignment with the traction sheaves.

6.1.4 Alignment

6.1.4.1 The brake plunger, collar, sleeve, motor, sheaves and all bearings shall be mounted and assembled so that proper alignment of these parts is maintained

6.1.4.2 The assembly shall be reviewed and rectified when excessive noise is emitted during operation.

6.1.5 Anti-Vibration Supports

The whole traction machine shall be mounted on appropriate anti-vibration supports to minimize noise and vibration.

6.2 Hoisting Rope/ Belt

6.2.1 At least three (3) steel wire ropes/ two (2) belts especially manufactured for Elevator use shall be employed for suspension of Elevator car and counterweight. The main suspension ropes/ belt shall be in accordance with latest versions of EN 81-~~1~~20, IS:17900 ~~14665 (part-4, Sec.3)~~ and the strength, construction and diameter of rope for the car and counterweight shall conform to latest version/ amendments of IS: 17900 ~~14665 (Part-4/Sec.-8)~~/IS-2365 or EN-12385-5. A plate giving the number, size and ultimate tensile strength of the rope used shall be permanently fixed to the crosshead.

6.2.2 Steel/coated steel belt of adequate size and number is to be provided and capacity / strength thereof will be verified at design/ testing stage. The coated steel belt shall be provided with continuously operating monitoring system as per IS 15785.

6.2.3 Before installation, manufacturer's certificates shall be supplied for each set of hoisting ropes/ belt with the following data:

(a) Type of wire rope/belt
(b) Dimension in mm
(c) Manufacturer's rated breaking strength
(d) Month and year the ropes/ belt were manufactured
(e) Manufacturer's name

6.2.4 The factor of safety based on maximum static load for car and counterweight ropes/ belt shall be at least 12.

6.2.5 The ropes/belt shall be attached to dead-end hitch assemblies, fitting to supporting beams, car frames, counterweights by means of suitable termination. A locking device or anti-twist rope device shall be fitted to the roping system. Alternately, approved arrangement for wedge type rope fastening may be used.

6.2.6 Compensation ropes/belt or any other arrangement shall be provided if necessary to achieve the leveling required and smooth starting.

6.2.7 Each rope/belt shall be fitted with a suitable shackle, spring, seat washer, shackle nut & lock and shackle nut split pin.

6.3 Counterweight

6.3.1 The counterweights shall be in accordance with IS 17900 ~~14665 (Part 4, Sec 3)~~ and EN 81-~~1~~ 20. The counterweights (filler weights) shall be made of cast iron, wrought iron or steel and shall be appropriately secured. They shall be of uniform density and physical dimensions.

6.3.2 Counterweights shall be guarded by means of a rigid, galvanized steel sheet screen extending from a position 300mm above the pit floor to a position at least 2.0 m above the pit floor.

6.3.3 The counterweight shall be balanced to 40 to 50 % (±3%) of the rated load.

6.3.4 Guide shoes shall have non-metallic renewable linings and be provided at the top and bottom of the counterweight. Guide shoes shall be adjustable type. A self-lubricating system (container with oil) shall be provided on top guide shoes.

6.4 Clearances and Run-by for Car and Counterweight

6.4.1 The top clearance of the car and counterweight shall be as stated in IS Standards.

6.4.2 The bottom run by of car and counterweight shall be as per relevant IS Standards.

6.4.3 When the car rests on its fully compressed buffer, there shall be a vertical clearance of at least 600 mm between the pit floor and the lowest structural or mechanical part, equipment or device installed beneath the car platform except:

i) Guide shoes, safety-jaw assemblies and platform aprons, guards or other equipment located within 300mm, measured horizontally from the sides of the car platform.

ii) Compensating sheaves

However, when the car rests on its fully compressed buffer, there shall be a vertical clearance of not less than 50mm between any part of the car and any obstruction of device mounted on the pit.

6.4.4 The clearance between the car/counterweight and the hoist-way enclosure shall be at least 20 mm except on the side for loading and unloading.

6.4.5 The clearance between the car and the counterweight shall be at least 40mm. The clearance between the counterweight and the counterweight screen shall be at least 20 mm.

6.5 Guides and Fixings

6.5.1 Hard drawn ~~Planed~~ steel tees shall be provided as guides for the Elevator car and counterweight, as appropriate, erected plumb and fixed securely to the Elevator shaft by steel brackets. The bracket shall be solidly fixed with the steel structure/RCC beam/RCC slab. The guide rails shall be connected by steel fish plates. Details of guides and associated items shall be scrutinized and finalized at detailed design stage.

6.5.2 The rail contact surfaces of the connecting rail plates and back of the guide rail ends shall be accurately machined and fitted at site to form smooth joints.

6.5.3 The strength of the guides, their attachments and joints shall comply IS 17900 ~~14665 part 4.~~

6.5.4 The stem sections of all guides shall be tongued and grooved to provide matched joints. The guides and their fixings shall be able to withstand the forces imposed by a fully loaded car travelling at tripping speed of the governor, due to the application of the safety gear, without permanent deformation or bending due to the uneven loading of the car. The guide rail brackets shall be designed for 20 years life.

6.5.5 Guide rail brackets shall be of steel and bolted securely to the building or structure steelworks. The brackets shall be designed and located such that the rail will not deflect more than 5 mm under normal and Safety Gear operation. There shall be a minimum of two brackets per piece of guide rail and the distance between brackets shall not be more than half the length of each piece of guide rail. The bracket should be fixed to RCC beams/RCC slab using chemical bolts ~~of Hiliti make or other~~ EOTA approved brand of fasteners manufactured ~~as per ETGA document no. 001TR029~~ with cold forming process. This particular requirement is to be ensured during interface with designated civil contractor. It is the sole responsibility of the Elevator Contractor to check the strength of the shaft wall and get it certified from the railway appointed civil Contractor/Engg. The guide rail brackets for steel structure shaft shall be scrutinized and finalized at

detailed design stage and same will be provided during steel structure fabrication.

6.5.6 The fixing of guide rails to their brackets and to the building structure shall permit compensation, either automatically or by simple adjustment, due to normal settling of the building or shrinkage of concrete.

6.6 Buffer

6.6.1 Buffers shall be installed as a means of stopping the car and counterweight at the extreme limits of travel.

6.6.2 Buffers shall be of spring type/energy dissipation type and the same shall comply IS: 17900 ~~14665 (part 4, Sec. 1)~~. If any manufacturer offers PU (polyurethane) type buffer same may be accepted by consignee after evaluating the supporting documents submitted by the manufacturer about the performance of PU buffers.

6.6.3 Buffers in the pit shall be mounted on steel frame, which shall extend between both the car and counterweight guide rails.

6.7 Governor

6.7.1 The speed governor shall be in accordance with IS: 17900 ~~14665 (part 4, Sec.4)~~ and shall be adjustable to actuate the safety gears, located overhead and driven by governor rope suitably connected to the car and mounted on its own pulleys.

6.7.2 Tripping speed of the over speed governor shall be chosen between: 115% to 140% in respect of 1m/sec; or 115% to 132% in respect of 1.5m/sec. The tripping of the over-speed governor for the safety gear shall occur when the car speed exceeds the rated speed downwards.

6.7.3 A mechanically operated safety switch shall be provided to disconnect the power supply to the motor when the governor is activated.

6.7.4 The governor shall be of "V" groove wheel design.

6.7.5 The governor rope shall be of steel and shall comply IS: 17900 ~~14665.~~

6.7.6 The rope shall be maintained in tension by means of weighted or spring loaded tension sheaves located in the pit.

6.7.7 An over speed governor shall also be provided to the counterweight in case of Hanging pit. The Contractor is required to interface with the railway and railway appointed civil contractor for the requirements of hanging pits.

6.8 Diverting pulleys

6.8.1 All diverting pulleys necessary for suspension of car/counterweight or diverting the suspension rope/belt to counterweight shall be of cast iron, grooved for wire ropes complete with shaft, bearings. They shall incorporate devices to prevent:

(i) The suspension ropes, when slack, leaving the grooves.

(ii) The entry/ ingress of objects between rope and grooves.

6.8.2 The diverter assembly, where used, shall be mounted in proper alignment with the traction sheaves.

6.9 Car and Car Frame

6.9.1 Guide Shoes

6.9.1.1 Adjustable guide shoes shall be provided and properly fitted at the top and bottom on each side of the car frame and the counterweight frame. The guide shoes shall be slipper type.

6.9.1.2 An oil container for automatic lubrication of the guide rails shall be provided. The material of the oil container shall preferably be metallic.

6.9.1.3 Slipper type guide shoes shall be of milled cast iron or steel frame type or sheet metal with non-metallic renewable liners, of low coefficient of friction and good wear resistance, which require minimal lubrication. A drip tray fabricated from galvanized steel sheet shall be provided to avoid lubricating oil spillage.

6.9.2 Car Frame

6.9.2.1 A suitable car frame fabricated from galvanized steel, bolted, or welded together to form a rigid structure shall be provided. ~~A suitable~~ The car frame should be fabricated from cold rolled (min. 3mm or above ~~up to 4mm~~ thickness) and hot rolled sheet (min. ~~4mm~~ 3 mm or above thickness)/ formed steel hot dipped galvanized / Spray Galvanized, bolted and / or welded together to form a rigid structure shall be provided.

6.9.2.2 The deflection of the members carrying the platform shall not exceed 1/1000th of their span under static conditions with the rated load uniformly distributed over the platform.

6.9.2.3 It shall be able to withstand the operation of the safety gear or any condition of loading without permanent deformation and shall not transfer the load to the enclosure.

6.9.2.4 The safety factor of the frame shall not be less than five (5).

6.9.2.5 A data plate shall be attached to the cross head members of the car frame giving the following information:

(a) Rated load of the Elevator,
(b) Speed of the Elevator,
(c) Year of manufacture.

A Do's and Don'ts instruction plate shall be provided after getting approval at the design stage. Instructions should be imprinted on a metal plate for durability. There should be two different plates one outside and one inside the car. These plates should be very friendly and simple.

6.9.3 Car Enclosure

6.9.3.1 Car enclosure shall be of Scratch Resistant Stainless steel of ~~not less than~~ nominal 1.5 mm in thickness and securely fastened to the car platform and so supported that it cannot be loosened or become displaced in ordinary service or on the application of safety gear or on buffer engagement.

6.9.3.2 Final finishes of the walls, ceiling and floor shall be finalized during design stage.

6.9.3.3 No wood or other combustible materials shall be used for any part of the Elevator car including car door and emergency trap door.

6.9.3.4 The enclosure shall be designed and supported such that when subjected to a pressure of 335N applied horizontally at any point over an area of 5 cm^2 on the walls from the inside of the cars toward the outside, there shall be no permanent deformation and deflection shall not be more than 10mm.

6.9.3.5 The enclosure shall be insulated to prevent the transmission of noise and vibration from the car frame.

6.9.3.6 To facilitate differently abled persons, suitable tubular stainless steel handrails of size as mentioned in IS 15330 shall be provided. Handrails shall be provided on: 3 sides in cars with single set of doors; or on 2 sides in cars with two sets of doors (except the area covering Car Operating Panel) extending to within 150 mm of all corners.
Handrail parameters are given below.

Height of handrail	900 mm (+0/-25 mm) above floor
Diameter of handrail	30 mm to 45mm
Clearance of handrail from lift wall	Min 45mm

6.9.3.7 A toe guard shall be provided for the car doors conforming to ~~Paragraph 8.4 of~~ EN 81 ~~Part 1~~ 20. The toe guard for elevators shall be made of galvanized sheet steel of not less than 1.5mm thick ~~and painted~~ and shall be adequately braced at the back. The depth of the toe guard shall be sufficient to prevent any object from being trapped between the underside of the car platform and the landing during re-leveling operation (with a minimum of 700 mm).

6.9.3.8 Emergency instructions (as per annexure-4) plate including emergency contact number ~~plate~~ shall be provided with front transparent acrylic sheet with flush screw arrangement ~~such that the contact numbers could be changed~~. The location and design shall be finalized during design stage.

6.9.3.9 Safety instructions for elevator users shall be provided inside the car in international signage pattern. The instruction plate shall provide guidance to the passengers on how to act at the time of

Elevator breakdown/ entrapment and rescue operation. The location and design shall be finalized during design stage.

6.9.4 Car Platform

6.9.4.1 The car platform shall be constructed from cold/hot rolled steel (spray galvanized). The floor finish shall be made of 6 mm thick Aluminum chequered plate which shall be fixed to platform top sheet with pilfer proof screws. If single sheet is not used, it can be in two pieces fixed with pilfer-proof screws. The platform shall be designed on the basis of the rated load evenly distributed with a minimum safety factor of five (5). Design calculations shall be submitted by the contractor at the design stage.

6.9.4.2 The car platform shall be insulated to prevent the transmission of noise and vibration from the car frame to the platform.

6.9.5 Car roof

6.9.5.1 The portion of the car roof visible from inside the car shall be made of Stainless Steel finish. ~~False ceiling shall not be provided~~. There should be provision of stainless steel false ceiling inside the car which enable installation of all the lighting and other fixtures with anti-theft provision. A suitable adjustment in false ceiling should be done to incorporate the provision of trap door. ~~Light fittings and fan shall be provided on car roof and suitably protected against theft~~. An appropriate gap should be maintain between inside roof of car and false ceiling so that it should not disturb the essential dimensions mention in the IS 17900.

6.9.5.2 The car roof shall be suitably constructed and reinforced to permit the maintenance and inspection of the Elevator shaft equipment by maintenance personnel standing on the car roof. It shall be capable of supporting a vertical force of 2000N at any portion without causing permanent damage. Permanent, hinged and foldable safety balustrades or any other suitable arrangement forming an integral part of car top maintenance platform shall be provided. The design shall be subject to the review during detailed design stage. The roof of the car shall be provided with a trap door of size 450mm x 450mm below ~~for 13~~ 15 passengers elevator and 610(W) mm X 450(H)mm for above 15 ~~20 and 26~~ passengers elevator to enable rescue of passengers in case the lift get struck up and ARD does not work. Care shall be taken that the opening of the trap door is from outside and should not obstructed by any other equipments installed on the roof.

6.9.5.3 Perforated mesh construction of the roof or wooden platform(s) on the car roof shall not be acceptable.

6.9.5.4 The car roof shall be fitted with guard rails set as at a height and of suitable dimensions and strength to protect maintenance personnel.

6.9.5.5 The car junction box shall be with IP 54 protection. The travelling cables and the car enclosure wiring shall be installed at the car top.

6.9.6 Ventilation

6.9.6.1 Each Elevator car shall be adequately ventilated to a minimum standard of 20 air changes per hour. The fans shall be located above the suspended ceiling or recessed in the car ceiling, as appropriate, to achieve cross-flow ventilation. Details of ventilation system if required shall be finalized at design stage.

6.9.6.2 The noise level of Fan used for ventilation shall be ~~within the limits as stipulated in Cl. 11.~~ -Max 55 dB(A) at 1 meter above floor level.

6.9.6.3 Fan shall automatically start on registering the command. The car ventilation fan shall be switched off within a period which shall be adjustable from ~~5~~ 30 second to ~~1~~5 minutes after the last registered call is answered. However, fan Switch shall be provided to disable auto-starting of the Fan when not desired.

6.9.7 Car Interior and Elevator Finishes

6.9.7.1 Unless otherwise specified elsewhere in this specification, the following finishes for the Elevator shall be complied with:

I. Landing Finishes:	
i. Landing Plate, Indicators, MAP, etc.	Scratch Resistant Stainless Steel
ii. Landing Doors	i. Scratch Resistant Stainless steel/ with fire rating as per IS 17900 ~~14665 part I~~ ii. Glass panels with stainless steel scratch resistant/hairline finish frame. (ref. cl. no. 6.10.1.1.iv)
II. Car Finishes:	
i. Car Transom Panels	Scratch Resistant Stainless steel
ii. Car Wall:	
a) Front Panels	Scratch Resistant Stainless steel
b) Side Panels (incl. COP)	Scratch Resistant Stainless steel
c) Back Panels	Scratch Resistant Stainless steel
iii. Car Doors	Scratch Resistant Stainless steel Glass panels with stainless steel scratch resistant/hairline finish frame
iv. Car Floor finish	6 mm thick Aluminum Chequered plate
v. Car Ceiling	Scratch Resistant Stainless steel panels with sufficient LED down lights
vi. Car Kick-Plates and skirting	Scratch Resistant Stainless steel

vii. Hand/grip rail	Hairline Finish Stainless steel of straight through type and supported from min. 3 locations.
viii. Buffer rail	Thermoplastic Elastomeric or suitable material enclosed in Scratch resistant stainless steel frame with minimum height of 100mm x (width of the car minus 100mm) long shall be suitably fixed to take the impact of wheel chair foot rest
III. Hall Button and Display Faceplate:	
Scratch Resistant Stainless Steel	

6.9.7.2 The contractor shall further note that:

(i) Wherever scratch resistant stainless steel has been asked finish shall be honey comb or moon rock or hairline.

(ii) Joints in all surfaces shall be coordinated. All fixings are to be of the hidden/pilfer proof type (cover strips at joints are not acceptable).

(iii) All stainless steel materials specified for car finishes shall be of grade SS 304.

(iv) Key details in respect of car interiors, doors, interfaces with civil structure and finishes have been spelt out in the spec. Minor details, if any, shall be finalized at the design stage.

6.9.8 Illumination of Cars and Lighting Fixtures

6.9.8.1 LED light fittings shall be provided to achieve a minimum illumination level of 150 lux at the floor of Elevator car.

6.9.8.2 The number of fittings should be two or more.

6.9.8.3 In case indirect lighting is used, it shall be got approved during design stage.

6.9.9 Emergency Lighting

For emergency lighting, a subset of lighting fixtures for normal lighting, shall be backed up by a dedicated UPS with 2 hours of battery back up. With emergency lighting, the minimum luminous intensity measured at floor level and on the car operating panel shall be 100 lux.

6.10 Elevator Doors

6.10.1 Car and Landing Doors

6.10.1.1 General requirements of doors

(i) Each Elevator shall be provided with horizontal sliding doors complete with door frames, arranged in centre opening with two panels. The doors shall be heavy duty and shall be designed for minimum of 180 door opening/closing operations in one hour.

(ii) Depending on the site, the elevator car can have single or two sets of car doors. The purchaser is required to furnish this information (please refer item 7 of Annexure-1). In absence of any mention to the contrary in the tender, it will be deemed that only one set of car doors are required.

(iii) ~~Unless otherwise specified,~~ The car and landing door panels shall be either imperforate and fabricated from stainless steel (grade 304) of at least 1.5mm thick or glass panels with stainless steel scratch resistant/hairline finish frame. In case of non-sandwich door construction, the back of door panels shall be treated with an anti-drumming compound/ tape/ sheet covering minimum 30% of the panel area which is non-combustible and shall not emit toxic fume when affected by fire. This shall be got approved during design stage.

(iv) Special Requirement for Elevators with car and landing doors made of glass panels with stainless steel hairline / Scratch – resistant frame:

Car roof shall be stainless steel cover panels exposed to public view with a collapsible maintenance platform or any other suitable arrangement. It shall be able to sustain two persons and be able to resist a vertical force of 2000 N at any position without permanent deformation. Glass shall comply with the following requirements:

A. General:

i. All glass shall be clear float glass.

ii. Glass thickness shall not be less than 10 mm. The selection of glass thickness and type shall be in accordance with the information contained in BS: 6262, BS 952: Part 1, BS: 6206 and European Standard EN-81, Annex J or equivalent international standard.

iii. Particular regard shall be given to adequacy of glass thickness to withstand the calculated design loads and types of location to satisfy safety recommendations. Any reduction in strength characteristics due to acid etching, etc. shall be taken into account.

iv. Where the edge of laminated glass is to be exposed, the interlayer material must be shown to be resistant to the effects, including clouding and delaminating, of moisture absorption and contact with normal industrial strength cleaning solutions.

v. The Contractor shall conduct a thermal stress analysis of the glazing system, undertake thermal calculations and make due allowance for toughened glass.

vi. All glass shall be manufactured and processed in a factory where the quality control procedures comply with ISO 9000 (BS 5750, or equivalent international standard) and are independently maintained.

vii. No glass shall be used which contains scratches, chips, bubbles or other blemishes which are likely to lead to failure at loadings less than which the unit is designed to withstand.

viii. The glass shall be free of all discernible body and surface faults, and no glass which exhibits discernible optical or reflective distortions shall be used.

ix. Unless reviewed without objection by the "Engineer", all glazing shall be marked with permanent identification in accordance with BS 6206, and in a position visible but not prominent at the bottom left hand corner of the glazing unit.

x. Glazing shall be provided with edges that are ground, have a frosted appearance and arises chamfered and polished.

xi. Toughened glass shall be tempered on a roller hearth furnace and shall conform to Class 'A' Classification of BS 6206 or equivalent international standard. Vertical toughening shall not be permitted. Glass panel of landing door shall have minimum one hour fire rating.

xii. All toughened glass shall be heat soak tested to prevent the risk of spontaneous glass breakage due to nickel sulphide inclusions and other impurities. The method of heat soak testing shall be determined by the glazing manufacturer, such that after testing the probability of failure in service shall be less than one in 130 tonnes of glazing. The Contractor and glazing manufacturer shall, after testing, demonstrate by statistical analysis of test data that the probability of failure is not greater than the specified value.

xiii. All edgework, holes and notches in the toughened glass shall be completed before the toughening process.

xiv. Permissible roll distortion inherent in toughened glass shall be restricted to the horizontal plane when glazed/ installed, and local defects such as tong marks shall not be permitted.

xv. Dimensional tolerance on panel size shall be ±1 mm of the theoretical dimension required.

B. Glass door elevator cars is to meet the following performance criteria:

i. Laminated glass with one pane of toughened glass and one pane of heat strengthened glass.

ii. Glass panels to be capable of resisting applied loads when supported at each corner by a bolt fitted within a hole drilled in the glass.

Applied loads:

Dead Self-weight of glass. Dead loads imposed by adjacent glass panels (if any).

Live Normal to panel 0.75 KN/m².

Live loads 0.75 KN/m²@ mid pane.

Impact Equivalent to 50 Kg baggage trolley @1.8m/sec.

iii. Laminated toughened glass shall be capable of resisting point impacts, to the toughened face, equivalent to an 85 mm hardened steel ball freely dropped from a height of 3 m, carried out in accordance with BS 5544.

iv. The glass shall remain in place if either one or both panes break.

v. The glass shall be free of bow sufficient to cause visual distortion when viewed normal to glass.

vi. Maximum deflection under applied loads 15 mm.

vii. Statistical / failure rate of glass under normal operating load <0.4%.

C. All glass shall be marked to identify that it has been tested and inspected to manufacturer's standard which is reviewed without objection by the Employer's Representatives.

D. The tolerance of glass shall be within:

i. Panel size + 3 mm.

ii. Step in laminated edge + 3 mm.

iii. Bolt holes position + 2 mm.

E. A typical 5 mm gap shall be allowed between adjacent glass panels and between edges of glass panel and stainless steel corner. The gaps shall be sealed with a suitable sealant material. Extent of seal shall be from the base of the floor to the top of the glass walls. All areas of glass edges subject to contact with the sealant shall be treated with a separator chemical to mitigate the chemical reaction between the PVB interlayer and sealant. The Contractor shall conduct standard test from the glass manufacturer to demonstrate compatibility between sealant and PVB interlayer, the width of edge de-lamination is not to exceed 1 mm under simulated exterior exposure for a period of $2^{1/2}$ years.

(v) Stainless steel landing door shall have a minimum of 1 hours fire rating. Landing door with glass panels shall have minimum of 1 hour fire rating. These doors shall be suitably tested and fire certificate should be provided.

(vi) The doors shall be able to withstand a thrust of 300 ~~345~~ N over 5 sq. cm.

(vii) The car doors shall be provided with an electric contact arranged to prevent the normal operation of the Elevator unless the gate is in closed position. The car gate shall be arranged to give the minimum clear opening width as specified.

6.10.1.2 Door Frames

Door frames shall be of at least 1.5 mm thick stainless steel in Scratch resistant finish and shall comprise head and jamb sections of the same material. The door frames shall be suitably braced and reinforced. The frames shall be provided with adjustable wall anchors or comparable devices to permit bonding of these anchors or devices into the walls after the frames are in place. All frames shall be securely fastened to sills and hanger supports, and shall be returned to the hoist way side to present a neat appearance.

6.10.1.3 Door Sills

(i) Door sills shall be slotted. All door sills (visible portion) shall be of stainless steel with non-slip wearing surfaces and the sill shall be capable of withstanding a load of 400kg.

(ii) The sills shall be supported on steel anchor plates securely fastened to the landing door sill supports. The costs for providing all the necessary steel support for the door sills shall be deemed to have been included in the Contract.

(iii) Toe guards similar to those provided to the car door sill shall be provided beneath each landing door sill complying to EN-81-~~1~~ 20.

6.10.1.4 Door Hangers and Rollers

(i) Both car and landing doors shall be fitted with sheaves type door hangers. The sheaves wheels shall be tyred with a sound attenuating material and shall rotate on a grease packed precision ball bearing. The up thrust of the door shall be taken by a roller mounted underside to the hanger track.

(ii) The roller shall be mounted on an eccentric stud to provide for adjustment. Alternately, any other approved device for door adjustment may be used. The hanger tracks shall be either of formed cold rolled steel or of cold drawn steel of heavy section with surfaces shaped to conform to the tread of the hanger sheaves and rollers. Suitable means shall be used to transmit motion from one door panel to the other.

(iii) The proveness of design of the heavy duty door shall be specifically evaluated during detailed design stage.

6.10.1.5 Supports and Covers

(i) Structural steel angles, if provided, shall be furnished and of sufficient size to accommodate the door closing equipment. The angles shall be continuous and securely bolted to the sills and the building structure.

(ii) Hanger cover plates shall be made of galvanized steel, for Elevators with landing as well as car door made of stainless steel. These covers shall be removable, and so arranged as to ensure hanger accessibility from within the Elevator car for maintenance purposes.

6.10.1.6 Self Closing

Gravity or spring actuated self-closing device shall be fitted to the landing doors so as to automatically re-close the doors when manually opened by means of the emergency unlocking device. The gravity weight shall move freely and quietly within its enclosure fixed at each end of the door sill and be protected from falling into the Elevator shaft due to any reason. This device shall not be accessible to public.

6.10.1.7 Locking Device

(i) Each landing door and car door shall be provided with an accepted locking and interlocking device to prevent the operation of the Elevator unless all ~~landing~~ doors are closed and locked.

(ii) The locking mechanism in the car door should be such that it should not be tampered from inside the car.

(iii) It shall not be possible to open the landing door from the landing side without a landing door key.

(iv) The locking device shall have at least IP 20 protection.

(v) The electric contacts of the door locking device shall open positively independent of gravity.

(vi) Each landing door panel shall be provided with its own locking device.

(vii) Provision shall be made for opening of all landing door locks by means of a landing door key by an authorized person irrespective of the position of the Elevator car.

6.10.1.8 Fascia

Fascia shall be provided as per EN 81-~~1~~20. Where the gap between the car door sill and surface of the Elevator shaft wall exceed 125 mm, galvanized sheet steel fascia plates of not less than 1.5 mm thick shall be provided. These shall be fixed between the undersides of landing entrance sills and the top of the door hanger case to form a flush surface in the path of travel at the car entrance. The plates shall cover the whole width of the landing door and extend by 150 mm on each side of the door. It shall be rigid and properly reinforced.

6.10.1.9 Door Profile

To avoid the trapping of fingers in between Car frame and Car door, profile shall be provided and the gap after provision of profile, if any, shall not be more than 5mm.

6.10.2 Door Operators

6.10.2.1 The door operator for each Elevator shall consist of a motor, operating mechanism, linkages and switches to give adjustable or variable speed door operation and shall be adjusted to ensure

smooth, fast opening and closing. The average door speed shall be between 150–250 mm/sec. The car and landing doors shall operate simultaneously and quietly while the Elevator car is leveling.

6.10.2.2 Stainless steel cover of not less than 1.5mm thick shall be provided for the car and landing door headers to prevent the accumulation of dust in door locking devices, door tracks and mechanism.

6.10.2.3 In "Without Attendant" mode, if no command is registered or due to abnormality of Elevator safety circuit, after the expiry of a preset time interval of 10-30 seconds (adjustable), the door shall re-open once for 30 seconds (adjustable so as to enable the passengers to exit) and close.

6.10.2.4 In "With Attendant" operation, the car and landing doors shall open automatically but the closing of doors will be subject to the pressure on "Door Close" button. During the closing motion it shall be possible to reverse quickly and open the doors by pressing of the "Door Open" button.

6.10.2.5 The door lock shall prevent the car doors from being opened by the door operator or by force when the car is moving or is not stopped within the unlocking zone of a landing.

6.10.2.6 Electric interlocks shall be provided to ensure that Elevator will not operate, if the car door is not closed and locked.

6.10.2.7 If the car door is forced open, the Elevator shall stop and the alarm activated (even when the Elevator is out of order) until the door is fully closed. The audiovisual alarm signal shall be sent to the designated landing as well as to any Control Room, if provided.

6.10.3 Door Safety Devices

6.10.3.1 Electrically Operated Proximity Detection Device

(i) Electrically operated proximity detector/ infrared curtain devices(s) shall be installed on the leading edge of the car doors. The device(s) shall create two dimensional zone of protection. Two dimensional detection shall be for a height of at least 1800 mm of the door. The zone of detection shall move forward as the doors close and the presence of a person, if within this zone, shall activate the detector to stop the closing movement of the doors and re-open them before hitting the person. The device shall have provision to switch off two dimensional detection. Any additional device (i.e. photocells etc.) which helps in operating the door flawlessly may be included suitably.

(ii) After a preset time interval (which is programmable) the doors shall start to close again in the absence of further interruption.

(iii) A passenger entering or leaving the car shall not cause the doors to stop and re-open unless the door's edge reaches a certain predetermined proximity to the passenger.

(iv) The contractor shall consider the ambient condition before deciding the sensitivity of the device. This device should not be so sensitive to sunlight as would result in mal operation.

(v) If the doors are prevented from closing by the pressing of hall and/or car buttons or a person in their path for an adjustable pre-set time, the safety devices, except the mechanical door safety edge, shall be rendered inoperative to cause door reversals. The doors shall proceed to close at a reduced speed and a buzzer located on the car shall sound before and during the closing.

6.10.3.2 Mechanical Force Limiting Device

Mechanical Force Limiting Devices shall be provided for each car door for preventing door closing when a passenger is entering or leaving the car. This should act as a backup protection to 2D-infrared curtain. For metro rail application 3-D infra red curtain may be provided if purchaser specially mention in the tender documents.

6.11 Controllers

6.11.1 The Elevator's motion, travel-direction, speed, stopping, etc. shall be controlled by a compact and reliable microprocessor-based controller that is specifically designed for safe Elevator operation. Up gradation of software shall be possible at the installation site itself.

6.11.2 Controllers shall be of proven design and would ensure continuous-operation of the Elevator over its service life.

6.11.3 The interface should be able to drive a LED based Elevator Status Display Panel (ESDP) which is described later and that may be planned by the railways to be housed in the station/ building control room.

6.11.4 All high voltage (110V or above) contact points shall be protected from accidental contact in a situation where controller doors are open.

6.11.5 Where applicable, controller shall be separated into two distinct halves i.e. Motor Drive side and Control side. High voltage motor power conductors shall be routed so as to be physically segregated from rest of the controller.

6.11.6 Field conductor termination points shall be segregated into: high voltage (>30V DC and >110V AC) and low voltage (<30V DC and <110V AC).

6.11.7 Controllers shall be designed and tested for Electromagnetic Interference (EMI) immunity in accordance with EN 12016.

6.11.8 Elevator controllers shall be housed in IP54 protected, 1.5mm thick powder coated cabinet with hinged door, lockable with a dedicated key.

6.11.9 The MAP panel cover shall be of stainless steel SS 304 grade.

6.11.10 The Elevators shall be suitable to be connected to remote monitoring software (as per cl. 6.24). It should be possible to monitor Elevator status with remote monitoring application. For this purpose, the contractor shall install web based protocols along with necessary hardware in the Controller. Necessary executable files, if any, will be required to be given free of cost by the supplier on a CD/ or any other storage device.

6.11.11 Provision for sending SMS message to minimum 10 pre-specified phone numbers for identified unusual occurrences should be available in the controller. Provision of SIM and payment of data charges should be borne by Elevator manufacturer/supplier till Elevator is under warranty and beyond warranty the firm undertaking AMC has to extend this facility. Firm should also provide concerned Railway free of cost facility for viewing the system performance data on the manufacturer's web portal until the contractual warranty period of the system. After the warranty period, the remote monitoring facility shall be available as a part of AMC.

6.11.12 The controller should be designed to be compatible with IR-NIYANTRAC.

6.12 VVVF Drive

6.12.1 The Elevator shall comprise of a VVVF drive (variable speed control drive), functionally integrated with the Elevator controller to control the driving motor. On installation, this shall ensure the Elevator's movement and speed control.

6.12.2 The VVVF drive shall also result in smooth acceleration/ de-acceleration during the motor starting/ stopping for reducing/ limiting the starting current and the frictional wear and tear of the brake liner.

6.12.3 The VVVF drive shall result in better and comfortable ride quality - with jerk-free starts and stops.

6.13 Regenerative Drive

6.13.1 In regenerative drive, the car, counterweight and braking system generate energy that is converted into electrical current that can be used elsewhere. The energy regeneration system must be linked back to the electrical network for the electricity to be used elsewhere.

6.13.2 The harmonic levels should be within prescribed limits even after incorporation of the regenerative drive.

6.13.3 Regenerative braking module shall be provided compulsorily ~~if the railway specifically asks for the same in the tender (refer item 8 of Annexure -1).~~

6.14 Requirements of Control Cards

Although not a mandatory requirement for design approval, the contractor is encouraged to make use of the guidance being provided here for quality of control cards.

6.14.1 Electronic components used in the controller or elsewhere in the system shall generally meet the requirements mentioned as follows (documentary evidence in support of the same should be given):

(i) DC Link capacitors shall be rated for max temp of 85° C and other capacitors shall be rated for max. temp of 105° C.

(ii) Resistances shall preferably be made of metal film of adequate rating having a tolerance of not more than 10%.

(iii) Switching devices such as transistors, IGBTs, MOSFETs, etc. shall have minimum junction temp. of 150° C.

(iv) Devices shall have adequate thermal margin at ambient temp. of 55°C

(v) Fiber glass epoxy of grade FR 4 or superior shall be used for PCB boards having a nominal board thickness of 1.6mm and copper cladding thickness of 70 microns for power cards and 35 microns for control cards. Both track width and spacing between the tracks shall be 0.5 mm nominal and in no case shall be less than 0.3 mm. Assembled PCBs shall be given a conformal coating for protection/resistance against chemicals, fungus and humid weather.

6.14.2 Control cards should withstand the environmental tests (as per IEC 60068/ IS 9000) listed below. Controller working shall be checked after the tests. The cards which will be required to undergo environmental tests shall be decided during design stage.

a) Dry Heat Test: 50°C±2°C for 16 hours
b) Damp Heat Test (Steady state): 40°C, 95% RH for 4 days
c) Damp Heat Test (Cyclic): 40°C, 93% RH for 6 cycles (duration of one cycle shall be 24hrs)
d) Cold Test: 0°C for 16 hours
e) Change of temperature Test: -10°C to 50°C for 3 cycles (rate of change in temperature shall be 3°C per minute)

6.14.3 Control cards should withstand the vibration tests as per IS 9001/IEC 60068

6.15 Car Operating Panel

6.15.1 Car operating panels (COP) and car call buttons shall be ergonomically designed and of robust construction and shall be got approved at the design stage. The car operating panel shall be

integrated and flush mounted, on one of the side panels. All buttons on the panel shall be of robust design and construction and flush with the panel. All buttons shall be vandal resistant as per EN 81-71 with designations and Braille marked on it.

6.15.2 The face plate of Car operating panel shall be made of stainless steel grade 304. Each car operating panel shall contain, but not limited to the following:

(i) Flush Mounted COP on the side Panel.

(ii) An alarm button in yellow color with bell shaped symbol, when pressed, shall activate the alarm hooters provided at the designated floor and register the alarm condition through the Elevator Status Display Panel at Station Control Room (SCR), if ESDP is provided.

(iii) An Orange / red "Car Overload" indication with announcement in English and Hindi or only in English, as decided by the railway, shall be provided.

(iv) Two vertical rows (where appropriate) of car call buttons for floor designations bearing numerals/ alphabets with integrated Braille code for visually impaired. For 2 stop Elevators, the button marking should be up or down arrow.

(v) A "Door-Open" button which, when pressed, shall cause the closing door to reopen or when continuously pressed shall keep the door open.

(vi) A "Door-Close" button which, when pressed, shall cause the door to close to shorten the door open time.

(vii) An intercom button (self illuminating feedback type), when pressed, shall allow direct communication with the personnel in the Station Control Room (SCR), and main control cubicle.

(viii) A capacity plate engraved / etched onto the car operating panel shall indicate the rated load in kilograms and the maximum number of passengers to be carried. The size and design of the lettering shall be submitted at design approval stage.

(ix) An "ON/OFF" switch whereby the ventilation fan can be switched on and off.

(x) Each button shall be of micro-push (of less than 2 mm stroke) suitable for heavy duty and vandal proof type. The response light shall be either orange or red when illuminated.

6.15.3 A key operated switch shall be provided on the car operating panel at a suitable location to facilitate Elevator operation as follows:

(i) One or more switches whereby the following modes of operation can be effected as desired:

(a) With Attendant

(b) Without Attendant

(c) Operation by Firemen in accordance with IS 17900 ~~14665~~ and statutory requirements.

(ii) "UP/DOWN" buttons which shall cause a car to travel in the desired direction. These buttons shall be operative only during the "Attendant" operation.

6.15.4 A switch should be provided in accordance with IS 17900 ~~14665 1 part 2~~ for operation by fireman.

6.16 Car Position Indicator

6.16.1 The car position indicators shall be provided inside the car and also on each landing in the Hall-way. These indicators shall not be part of COP inside the car or Call buttons (in the Hall way). The location of the indicators shall be above the door.

6.16.2 The faceplate of the car position indicator shall be made of stainless steel grade 304. The Stainless steel plate should be minimum 2 mm thick and its mounting arrangement should have two sunken screws. This plate should be pilfer-proof. Floor numbers shall be digitally displayed using minimum 5 x 7 square dot matrix LED/LCD. There shall also be an arrow in motion vividly and dynamically indicating car movement and direction. It shall also be capable of displaying/ scrolling (at least 8 characters) simple message such as: floor names e.g. 'Concourse'/ 'Platform'/ 'Foot Over bridge'; 'Out of service'; 'Under Maintenance'; 'Firemen'; etc. which may be decided based on mutual agreement between the railway and the contractor. The surface of the display unit shall be non-glare type.

6.17 Elevator Inter-Communication System

6.17.1 The Contractor shall provide an Elevator inter-communication between the Elevator Car, main control cubicle and SCR room consisting of master and slave stations. The Contractor shall offer the system from a proven vendor and provide details thereof during design approval stage.

6.17.2 All stations shall be equipped with handsets except those slave stations installed inside the Elevator cars, which shall be of the hands free type.

6.17.3 The handsets/ intercoms shall be supplied from a UPS power supply so that the intercom's working remains unaffected in event of failure of mains power supply.

6.17.4 A master station shall be supplied and installed in the Station Control Room (SCR). A single intercom system shall be installed to handle calls from all Elevators and it shall be handset type with caller identification facility.

6.17.5 A slave station shall be supplied and installed in the main control cubicle and also in each Elevator car. The loudspeaker and microphone unit of the slave station shall be concealed in the car operating panel. The necessary cabling, conduits including from SCR room to main control cubicle etc. shall be provided by the Contractor (please refer item 12 of Annexure-1). Routing shall be

finalized in consultation with the railways. It should be possible to decipher the identity of calling Elevator at the SCR room. For easy identification, elevators should be numbered inside the car as well as at each landing.

6.18 Certificate Holder

A framed and glazed panel made of stainless steel of minimum ~~2~~ 1.5 mm thickness, suitable to display the Elevator safety certificate shall be provided above the car operating panel. ~~This shall be got approved at design stage.~~

6.19 Hallway Equipment

6.19.1 Hall Call Buttons

One (1) set of hall call buttons shall be provided for each Elevator at every floor served. The set of buttons shall be installed on the wall adjacent to each Elevator landing. The faceplate shall be made of stainless steel grade 304 with hairline finish. The Stainless steel plate for mounting the indicators and landing call buttons should be minimum 2 mm thick and its mounting arrangement should have two Sunken Screws. This plate should be pilfer-proof. All buttons shall be vandal resistant as per EN 81-~~1~~20 with designations and Braille marked on it. The hall call buttons shall be micro-push type and suitable for heavy duty. The response light of the call buttons shall be orange or red, when illuminated. When a Elevator arrives at the hall, the illumination shall cease.

6.19.2 Hall Position Indicator

6.19.2.1 The faceplate of the car position indicator shall be made of scratch-resistant stainless steel grade 304. The Stainless steel plate should be minimum 2 mm thick and its mounting arrangement should have two Sunken screws. This plate should be pilfer proof. Floor numbers shall be digitally displayed using minimum 5x7 square dot matrix LED/LCD. There shall also be an arrow in motion vividly and dynamically indicating car movement and direction. It shall also be capable of displaying/ scrolling (at least 8 characters) simple message such as: floor names e.g. 'Concourse'/ 'Platform'/ 'Foot Over bridge'; 'Out of service'; 'Under Maintenance'; 'Firemen'; etc. which may be decided based on mutual agreement between the railway and the contractor. The surface of the display unit shall be non-glare type.

6.19.2.2 In case of Elevators for buildings, one set of Hall lanterns shall be provided for each Elevator at every floor served. The set of lanterns shall be installed on the wall adjacent to or on top of each Elevator landing. Prior to the car's arrival, the hall lantern shall begin flashing and the chime shall sound twice. This provision is not required for elevators for transfer of passengers between FOB and platform levels at railway stations.

6.19.3 Elevator Designation Number Sign

6.19.3.1 At each landing, Car Designation Number Signs shall be supplied and installed next to each Elevator by the Contractor. The Job number of Elevator (as recorded on the Elevator license) shall also be indicated on the plate.

6.19.3.2 The Number Signs shall be made of stainless steel grade 304 hairline finishes. They shall fit into the designated space to be coordinated with the purchaser and shall be subject to the acceptance of the purchaser.

6.19.4 *Pilfer proof Design*

The Elevator equipment (i.e. Indicators, landing call plate, MCB, etc.), if any at Ground level, should be pilfer proof.

6.20 Elevator Functions

The Elevator shall incorporate the following functions:

(i) Door Nudging Feature:

If the Elevator doors are kept open longer than the pre-determined time, an override alarm shall sound to alert the passenger that the doors must close so that system performance is not adversely affected.

(ii) Next Landing:

The car shall automatically proceed to the nearest floor with a functioning landing door if the car doors fail to open at the designated floor.

(iii) Door Reversal Device:

When an object is caught in or interferes with the opening or closing of the doors, the doors shall reverse direction on detection.

(iv) Safety Door Edge:

When a passenger comes in contact with the door safety edge when the doors are closing, the doors shall re-open.

(v) Overload Holding Stop:

When the car load exceeds the pre-determined weight, it shall set off an overload buzzer with the announcement of overloading as also the illumination of a visual “Overload” signal inside the car. Further, the Elevator shall not operate and the doors shall remain open. The load cell /strain gauge mounted on the car frame shall be used as load weighing device. The devices to be used for sensing the overload in the car should be most reliable and complete technical details thereof should be furnished during design approval.

(vi) Electronic Door Safety:

When passengers are boarding or exiting the car as the doors are closing, the doors shall re-open before touching the passengers.

(vii) Homing Service:

This function shall automatically home the respective Elevators to the pre-assigned floors. After transporting passengers to the assigned floor, the Elevator shall automatically home to its pre-assigned floor.

(viii) Up/Down Selective Collective Automatic Operation:

The Elevator shall respond to all registered hall calls and car calls automatically. It shall respond to all registered hall calls and car calls in the direction of service. When no call is registered then after a pre-set adjustable period, the Elevator car shall come to designated floor and open the door for 30 seconds (adjustable time) and then park the car there with closed door.

6.21 Electrical Requirements

6.21.1 Each Elevator shall be provided with a main control cubicle to accommodate all electrical switchgear. A caution notice with the wording "Danger-415V/240V A.C. Do Not Remove Cover Unless Incoming Supply is Switched Off" shall be affixed to the cover/door.

6.21.2 The Elevators shall be designed to operate on a 415V ±10% AC, 3 phase, 4 wire, 240V±10% 50Hz AC single phase power supply. Power supply up to Elevator's main control cubicle will be provided and terminated by the purchaser and in this regard, the contractor shall coordinate with the railway. Main switch/MCB Box with ELCB/RCCB/RCBO, etc. should be in lockable enclosure and in scope of Elevator contractor. MCB box shall be IP-54. All ELCB, RCCB, RCBO, MCBs & Switches should be of reputed makes. The lighting requirement shall be at least 100 lux throughout the shaft and 200 lux near machine & controller. Socket outlets of 15A capacity shall be provided by the Elevator Contractor inside the shaft, at every floor.

6.21.3 Hoist-way and car top safety switches shall be rated to IP 54 (minimum). All switchgear and other auxiliary apparatus shall be of accepted design and labelled for identification.

6.21.4 The control wiring shall be laid out neatly and clearly in cable sleeves and all terminals and cables shall be labelled or marked for identification.

6.21.5 All casing, covers, trucking and armouring shall be thoroughly and efficiently earthed and adequate protection shall be provided to prevent fuses and circuit breakers from arcing to earth or between phases.

6.21.6 Metallic trunking and metallic conduits shall be provided for cables put on the walls of shaft and car top. The ends of the trunking/conduits shall be sealed to prevent ingress.

6.21.7 Maintenance Access Panel (MAP) should preferably be located at top floor level. All controller enclosure shall be pilfer proof and have ingress protection rating as specified in Clause 11 of the spec.

6.21.8 The design of contactors and relay contacts shall be such that the

break and make contacts shall not be closed at the same time at any position of the armature. The operating conditions shall be as follows:

(a) If, one of the break contacts (i.e. normally closed) is closed, all the make contacts are open.

(b) If, one of the make contacts (i.e. normally open) is closed, all the break contacts are open.

6.21.9 In the control and safety circuits, the mean value of operating voltage (in case of direct current) or the r.m.s. value (in case of alternating current), between conductors or between conductor and earth shall not exceed 250V.

6.21.10 In event of failure of normal electric supply, the supply to alarm bell system, intercom system, emergency car lighting and 50% ventilation fans shall be automatically switched to a UPS with battery backup. The battery shall be of sealed maintenance free / Lithium-ion type with total capacity sufficient to maintain the operation of above equipment for at least 2 hours. The rating of UPS and battery shall be scrutinized and finalized during design approval.

6.21.11 The insulation of all wiring including those within the controller shall be of flame retardant, low smoke halogen free (FRLSZH) type for underground stations only and FRLS for over ground stations and service buildings, complying with the special cable requirement of this Specification.

6.21.12 All field wiring shall be multi-strand copper conductor type. No joints shall be permitted in any cables or wires in any location.

6.21.13 All wires shall be run in galvanized conduit or steel trunking. All conduit outlets shall be bushed with insulating bushes of accepted pattern. All wiring connections to switches shall be provided in such a way to suit the device. All conduits shall be provided with-IP 54 glands.

6.21.14 The arrangements of terminals at either end of flexible trailing cables shall be identical and the terminal blocks marked to identify the cables connected to them. The cable boxes and wiring for the car light and the alarm bell shall be entirely independent of the Elevator control wiring. Flexible trailing cables shall be securely clamped at each end so that the weight is not supported by any fixing of the various cores. The outer sheath of these cables shall be of waterproof and flame retardant material. A total of 10 or 10% of the total number of wires used (whichever is more) and 2 spare shielded cables shall be provided per Elevator. The outer sheath of these cables shall be of flame resistant material which shall not emit toxic fume when affected by fire i.e. Fire retardant Low Smoke Halogen Free (FRLSZH) type cables and conductors for underground stations and FRLS type cables and conductors for over ground stations and service buildings shall be used.

6.21.15 The compatibility of MCB, RCCB, RCBO and ELCB used for Elevators shall be verified with the requirement of the Elevators. The MCB, RCCB, RCBO & ELCB are in the Elevator Contractor's scope. However, termination of main incoming cable on the MCB/ ELCB/RCCB/RCBO provided by the Elevator Contractor, shall be the responsibility of purchaser.

6.21.16 Harmonics generation in VVVF system – OEM shall design the VVVF system in such a manner that generation of harmonics is minimal. OEM shall also provide suitable harmonics filters to eliminate harmonics. Ceiling limits for "total harmonics distortion" (THD) shall be as per IEEE 519-1992 and values mentioned in clause 8.3 may be referred.

6.22 Provision for LED Based Elevator Status Display Panel

6.22.1 An LED based Elevator Status Display Panel (ESDP) shall be provided by the Elevator contractor, if the purchaser has specifically asked for the same in the tender (refer item 9 of Annexure-1).

6.22.2 Status monitoring and control points shall be provided in the ESDP panel as per the following list:

(a) Provision of elevator fault/trip signal & button
(b) Provision of elevator car alarm signal
(c) Provision of power available and failure status
(d) Provision of elevator under maintenance signal
(e) Provision of elevator under working signal
(f) Provision of buzzer test button
(g) Provision of LED test button
(h) Provision of Alarm accept button
(i) Provision of buzzer

Design of the ESDP panel shall be scrutinized and details finalized at design approval stage.

6.22.3 The elevator fault/trip signal shall be activated whenever there is a fault in the elevator system, which causes a breakdown. The signal shall be latched on for at least 10 seconds. It shall only be reset after the fault is cleared.

6.22.4 The panel shall be made of SS 304 grade with ~~1.6~~ 1.5 mm thickness sheet. Width of the panel will vary according to the number of Elevators on a particular station.

6.22.5 Audible Buzzer with 80 dB(A) to 85 dB(A) noise should operate whenever the LED indications "Under Fault" or "Alarm Button Pressed" turn ON. The audible buzzer shall turn OFF with the pressing of "Alarm Accept Button" but the visual indication shall persist until the fault is cleared.

6.22.6 It may be possible from RMS to switch off the lift for parking, the elevator shall complete the last landing or car call, if any and return

to the designated landing and stop there with both the car and landing doors open for 15-20 seconds with audio announcement that lift is going to be shut down and then door should get close. The "Not in service" indicator shall be illuminated on the landing indicator automatically for a pre - determined time and then extinguished. The car light and ventilation fan shall be switched off automatically at the same time. The essential buttons e.g. door open, intercom and alarm bell etc. on the car operating panels shall be remained functional and illuminated when the elevators have been parked and locked out.

6.22.7 Upon actuation by RMS for non - parking, the elevator shall be switched back to normal operation and both the car light and ventilation fan shall be switched on automatically.

6.22.8 Each colour LED should be circular in shape with a diameter of 28.5 mm and text should be in black colour English Words with Arial Font of size 20.

6.22.9 A prototype of ESDP should be installed in the Station Control Room (SCR) at one station, before taking up mass implementation for all stations.

6.22.10 The contractor shall provide all wiring and apparatus, suitable for the specified electrical supply and the same shall be approved during design stage. Insulation of all wiring, including those within the Elevator shaft, shall be of flame retardant, low smoke, halogen free (FRLSZH) type for underground stations only and FRLS for over ground stations and service buildings, complying with the special cable requirement of this Specification. The purchaser shall furnish the approximate cabling distance from Elevator to SCR (please refer item 12 of Annexure-1).

6.22.11 Elevator contractor will provide communication port at ITB, at machine room and at SCR. The control wiring from machine room to SCR shall be done by railway contractor. The elevator contractor will facilitate the connection at ITBs.

6.23 Special Emergency Operations for Elevators

The Elevator operation system shall be designed to provide the following emergency operations. The Elevator Contractor shall provide the Interface terminal boards (ITBs) with terminals for terminating the fire and power failure signals to be provided by the railways. The Elevator Contractor shall provide the cabling up to the ITB.

6.23.1 Emergency Operation of Elevators in the Event of Power Failure:

In event of power failure or power interruption or single phasing (or any problem in the power supply system which affects the normal operation of the Elevators), the Automatic Rescue Device (ARD) shall

act and complete its operation. After power supply) resumes elevator should automatically return to its normal mode operation. .

6.23.2 *Emergency Operation of Elevators in the Event of Fire*

In the event of fire when any fire detection device is activated, all Elevators shall automatically be brought to the designated floor (to be designated during design approval stage) and be parked there with the doors open for 15-20 seconds and thereafter the doors would close. All Elevators shall be automatically rendered inoperative after they have been brought to the designated floor. The essential buttons such as "Door Open", intercom and alarm bell, etc. on the car operating panels shall remain functional and illuminated. Normal operation of the Elevators shall be manually reset by the operation of a reset key switch.

6.23.3 *Emergency Operation of Elevators in the Event of Power Failure and Fire*

In the event of power failure and fire, the operation of the Elevators shall be in accordance with the "Emergency Operation of Elevators in the Event of fire" and in such event, DG set power supply/ other alternate source (if any) shall be fed to the elevator. If such a power supply is non-existent or non-functional, then the Automatic Rescue Device shall act and rescue the passengers inside the elevator.

6.23.4 *Automatic Rescue Device*

6.23.4.1 Features

a. A battery back-up based device shall be provided to bring the Elevators to one of the nearest landings in the event of power failure. The rescue device shall be able to move the Elevators with any load from no load to full load at reduced speed to one of the nearest landings and shall open the doors upon reaching the landing. Thereafter, the Elevator doors shall remain open ~~closed~~ until resumption of power supply, at which point the Elevators shall automatically reset to normal.

b. The direction of travel shall depend upon the load in the Elevator.

c. During this operation, all safety features of the Elevator shall remain operational. In case of Power failure (including single phasing / unbalanced phase) elevator should operate with the Automatic Rescue Device (ARD) and Electronic Rescue Tool (ERT) mode immediately or within 5 to 10 second of power cut and lift should reach nearest landing within 1 minutes. The software for providing this feature is subject to the Employer's acceptance.

d. The landing accuracy in rescue mode shall be as stipulated in Cl. 10.4.

e. The battery should be sealed maintenance free/ lithium ion type. The capacity of the battery when fully charged shall be capable of operating the Elevator at rated load for a minimum of 3 rescue trips without further charging. To ensure this, the same battery should be capable to perform the test for 6 trips without intermediate charging at the time of commissioning. The battery shall be housed in a cabinet/ rack with a corrosion proof finish. ~~For low battery identification, a buzzer shall be provided.~~ Provision of battery health monitoring system is compulsory in each elevator. The elevator working should be integrated with battery health monitoring system. If, battery health goes down the lift should not work. It should also give prior intimation in case battery condition deteriorates.

f. The device shall immediately stop the Elevator and prevent further movement, if there is a short circuit or open circuit in the inverter output.

g. The contractor shall submit the calculations in respect of battery rating during design approval stage.

h. During ARD operation a simple announcement will work to inform the passenger. The language of announcement should be as simple as possible and it should be bilingual (any two- English/Regional /Hindi).

6.23.4.2 The device shall not modify the Elevator design and all its original safety features. The device shall be an additional accessory to the Elevator and shall not in any way affect the performance of the Elevator.

6.23.4.3 The charger for ARD's UPS shall be adequately sized to charge its batteries. Maintenance free batteries conforming to the relevant Indian or international standard shall be provided. There shall be no tripping of UPS during the working of Rescue Device. The design of UPS and its charger shall be scrutinized and finalized during design approval stage.

6.24 Elevator Monitoring and Fault diagnostic system

6.24.1 Remote Monitoring device Specification

i. The performance of the REMOTE MONITORING device should as much as possible, ensure that the maintenance outcomes of the Lifts in the prevailing requirements of the Lifts maintenance codes are tracked and monitored at all times

ii. Any electronic devices installed for the purpose of the REMOTE MONITORING Solution shall not compromise the safe operations and EMC requirement of the Lifts. The electromagnetic compatibility shall comply with the requirements of IS 17805 (Part 1) and IS 17805 (Part 2).

iii. The REMOTE MONITORING Solution should support an open

standard interface for its performance data, such as Open Platform Communications Unified Architecture (OPC UA). OPC UA or Similar plate form shall provide a single, secure, and reliable cross-platform framework for accessing a variety of data.

iv. The design of the REMOTE MONITORING solution should be planned as a whole, and the data resource sharing and interconnection with the elevator safety public information service platform should be fully considered.

- When a REMOTE MONITORING device fails due to power failure or any technical reason, the security and integrity of basic data should not be affected.

v. The REMOTE MONITORING device should be able to adapt to the needs of data storage, have required query and retrieval capabilities, and respond to equipment failures, events and alarm information

- A data visualization platform shall be provided to the lift owner or his representative by the service provider of the Remote monitoring Solution to provide real-time insights on the lift status and performance.

6.24.2 System architecture

The REMOTE MONITORING Solution system architecture shall consist of the following

a) Data Acquisition
b) Data Pre-processing
c) Data Analytics

i. A data acquisition system shall be used to continuously monitor and track the performance data of the lift.

ii. The data acquisition system should be collecting performance data from the lifts also when normal power supply to the system is interrupted. In such scenario, it is not necessary to collect any data after the lift completed their emergency operations and parked at the designated floor or designated level.

iii. The data sampling frequency will depend on the performance parameters and the amount of storage available. It should be sufficient such that it does not affect the accuracy and precision of the data analytics.

d) The data acquisition system shall be of either the intrusive type or non-intrusive type. The intrusive or non-intrusive data acquisition system shall be of the read-only function.

6.24.3 Data Pre-Processing

i. To minimize the latency of data analytics and reduce the strain on the central data diagnostic resources, a data pre-processing unit incorporating edge analytics should be provided.

ii. The data pre-processing unit should also be capable of separating performance data collected from the data acquisition system into

different categories. Critical data NOTE should be sent immediately for data diagnostics purposes while less critical data can be uploaded when the network bandwidth is less congested.

NOTE: Critical data are any information collected from the Lifts operations that are pertinent in the prediction of imminent breakdowns or safety related issues.

6.24.4 Transmission and Storage of Data

i. The transmission of data shall be through a secure network.
ii. Data transmitted shall be stored in physical data centre or Remote Monitoring server.
iii. Data transmission and storage should meet security requirements specified in section 6.

6.24.5 Data Analytics

Edge Analytics

6.24.5.1 Edge Analytics is an approach to data collection and analysis in which an automated analytical computation is performed on-site on data from a sensor, network device or other component instead of waiting for the mostly unprocessed data to be sent back to centralized data storage for analysis. All new lifts have such capability for future use in IR NIYANTRAC.

6.24.5.2 The analytics tool should be capable of analyzing trends, patterns and relationship of data sets in order to identify anomalies in the performance data of the lifts.

6.24.5.3 Data analytics tools such as regression, decision trees, clustering, or machine learning should be employed to predict potential failures of lift components and future breakdowns of the lift.

6.24.5.4 The data analytics shall have predictive maintenance capability. It shall be able to issue a recommendation to carry out part replacement, repair or maintenance on the lift before a breakdown occurs. For urgent cases, such as breakdowns or faults which could lead to breakdowns imminently, the system should be able to provide information including the level of urgency for maintenance personnel to rectify the problem immediately. For the less urgent ones, the system should provide information and schedule the maintenance or repair to take place in the coming days or weeks or on the next scheduled maintenance.

6.24.5.5 The data analytics shall also provide recommendations to improve the maintenance programme, including recommendations and guidance for maintenance personnel to carry out their required maintenance tasks, with the aim of improving the first time fix rate.

6.24.6 **Monitoring Outcomes**

The following minimum information corresponding to Table 1 & Table 1A shall be monitored and piped to the data analytics system to generate recommendations on possible rectification works and the suggested timeline to complete them.

Table 1: List of Monitoring Outcomes – Lifts

Lift system and their sub- system	**Monitoring Outcomes**
1. Traction Machine	To be able to monitor and analyse the performance of the lift and identify potential issues with the traction machine; and provide recommendation on possible rectification works and indicate when they are required.
2. Brakes	To be able to monitor and analyse the performance of the lift and identify potential issues with the brakes; and provide recommendation on possible rectification works and indicate when they are required.
3. Car and Landing Doors (including door protective devices)	To be able to monitor and analyse the performance of lift and identify potential issues with the car and/or landing doors system; and provide recommendations on possible rectification works and indicate when they are required.
4. Levelling Devices	To be able to monitor and analyse the performance of the lift and identify potential occurrences and instances of mis-leveling; and provide recommendations on possible rectification works and indicate when they are required.
5) Fault Diagnosis including the following components: a) Overspeed Governor b) Safety Gear c) Controller and Inverter Drive d) Buffer e) Compensation System	To be able to monitor and analyse the performance of the lift and indicate if one or more of the following fault(s) is/are possible cause(s) for the stoppage of the lift: • Overspeed Governor Activation • Safety Gear Activation • Controller and Inverter Drive Failure • Buffer Activation • Compensation System Activation • Ascending Car Overspeed Protection Activation • Unintended Car Movement Protection Activation • Fire Emergency • Power Failure

Table 1A — Parameters for Remote Monitoring of Lifts

Sl. No.	Parameter	Unit	Purpose / Remarks
1.	Door opening/closing cycles	Number	To monitor door operation frequency and detect abnormal behaviour

Sl. No.	Parameter	Unit	Purpose / Remarks
2.	Door operation time	Seconds	To assess door performance and detect delays or malfunctions
3.	Travel cycles/Trips	Number	To monitor usage intensity
4.	Car operating panel (COP) inputs	Status (On/Off)	To record user commands
5.	Landing operating panel (LOP) inputs	Status (On/Off)	To record floor call inputs
6.	Motor current	Ampere (A)	To detect abnormal load conditions
7.	Motor voltage	Volt (V)	To verify power supply quality
8.	Motor temperature	°C	To prevent overheating and ensure safe operation
9.	Inverter/drive status	Status/Fault codes	To monitor drive functioning
10.	Car load	Percentage / kg	To detect overloading
11.	Floor levelling accuracy	mm	To detect levelling faults
12.	Ride comfort indicators (acceleration, jerk, vibration)	m/s^2	To assess quality of ride
13.	Emergency alarm activation	Status (On/Off)	To detect mantrap and emergency situations
14.	Emergency light status	Status (On/Off)	To confirm availability during power failure
15.	Intercom/communication line status	Active/Fail	To ensure connectivity of monitoring system
16.	Error/fault codes	As per OEM	To identify faults and initiate corrective action
17.	Brake status	Status	To monitor safe stopping of the lift
18.	Rope tension sensor	Status/Deviation	To detect rope slippage or uneven load
19.	Safety gear activation	Status (On/Off)	To confirm triggering in emergency

Sl. No.	Parameter	Unit	Purpose / Remarks
20.	Overspeed governor status	Status (On/Off)	To detect overspeed conditions
21.	Power consumption	kWh	To monitor energy efficiency
22.	Battery backup/UPS status	Status (Healthy/Low)	To ensure availability during outages
23.	Ambient machine-room/car temperature	°C	To monitor environmental conditions
24.	Vibration/noise monitoring	dB / Frequency spectrum	To detect mechanical wear or anomalies
25.	IoT/Remote Monitoring Device connectivity	Active/Fail	To confirm continuous data availability

Note: The list may be further extended by mutual agreement between the customer and service provider, depending on system design and monitoring capability.

6.24.7 Remote Testing, Intervention and Control

For REMOTE MONITORING Solution that comes with remote testing, software update, control and intervention function, they shall neither interfere with the safety of the lift nor compromise the safety of the users who are using the lifts.

NOTE: Remote testing, software update, control and intervention function can be used only for troubleshooting, minimizing mantrap occurrences and reducing rescue duration.

6.24.8 Cyber security Requirements

6.24.8.1 This section specifies the cyber security requirements for the control system of the REMOTE MONITORING Solution. This includes computers, operating systems, applications, and other programmable configurable components that form part of the security function of the system. Remote systems and services are excluded.

6.24.8.2 It is intended to cover REMOTE MONITORING Solution installed in both new and existing lifts.

6.24.8.3 Information transmitting from lift to remote monitoring (as per cl. no. 6.24.1 to 6.24.8) should also be available on a suitable ports viz RS-232/ RS-485/ USB/ Ethernet, etc. at maintenance access panel (MAP). In future this port may be utilized for tapping the required information for IRNIYANTRAC.

6.24.9 An Elevator monitoring and fault diagnostic system shall be provided for each Elevator by the Elevator Contractor in MAP. This system shall provide an auxiliary output port on the controller for plugging the laptop and downloading historical data. For downloading of such data, suitable interface output ports shall be provided. Suitable software shall be provided for downloading of data; such data shall be analyzed and presented by railways through MS Office, a software commonly available on office PCs.

6.24.10 The microprocessor based diagnostic system shall have self-checking feature and provision for indicating/ displaying common Faults (that may occur during the Elevator's operation) by a fault-code or fault's brief description on an on-board and easily-visible LED/ LCD based display-unit. This would enable the maintenance personnel to pinpoint specific fault(s) and rectify them quite-quickly, thus ensuring minimum downtime of the Elevator. The diagnostic system shall store the last 100 faults with date and time stamp. The type and number of faults stored is subject to approval at design stage.

6.24.11 A suitable dome shape IP based CCTV system shall be installed inside lift for the surveillance of elevator inside area. A minimum storage of one week to be available in the memory card of the CCTV camera. Output of this CCTV should be available at a suitable port at MAP.

6.25 Pit Facilities

6.25.1 Buffers shall be provided in the Elevator pit.

6.25.2 A safety switch to prevent the car from moving when the governor rope tension weight is out of position, shall be provided.

6.25.3 Fixed cat ladders shall be provided between the bottom landing and the pit floor by the Contractor.

6.25.4 Two stop switches, one at bottom landing level in the shaft and the other in the pit shall be provided, which when in the "STOP" position shall prevent any movement of the Elevator car including movement during inspection/ test operation, until both the switches are set to "RUN" position. Further details in respect of the switches are as follows:

(i) The switch shall have a mushroom head (red). It shall be locked off when pushed and reset manually.

(ii) First stop switch shall be accessible from the lower landing on opening of the landing door and the second switch from the pit floor.

(iii) A stainless steel faceplate of not less than 2mm in thickness, indelibly marked "Pit Stop Switch" in both English, Hindi and local vernacular language characters and with legends to show the "STOP" and "RUN" positions shall be provided and fixed immediately adjacent to the switch.

(iv) The knob of these switches or plate shall have fluorescent glow.

6.25.5 The Contractor shall liaise with the railway to ensure that the latter (railway) makes a provision for proper drainage and pumping from the Elevator pit as per clause no. 2.9.2. For elevator pits on railway platforms, this may call for provision of pump, etc. by the railway. In case of buildings or other applications, the need for such drainage will be assessed by the contractor and railway; based on such assessment, railway shall make the necessary provisions.

6.26 Corrosion Protection

The Contractor shall take into consideration, the corrosive effect of the atmosphere in the Elevator design.

6.26.1 All steel components (5mm thick & above) shall be hot dipped galvanized in accordance with BS EN ISO 1461, with minimum thickness of 85 µm.

6.26.2 All parts constructed in sheet steel (less than 5mm) shall be either galvanized by the hot dipped process or fabricated from hot dipped galvanized sheet steel or spray galvanized ~~and~~ or epoxy painted.

6.26.3 All mechanical and cast iron assemblies shall be cleaned and painted. The running surfaces of car guides shall be treated with an accepted rust preventive compound.

6.26.4 In general, hardware, fastenings, screws and shims shall be hot-dipped galvanized. However, visible screws and fastenings shall generally be of stainless steel. Epoxy painting/spray galvanised paint will be permitted only for onsite damage repairs.

6.26.5 Wherever corrosion protection on ferrous components has been damaged in handling, it shall be rectified by a top coat of epoxy paint or spray galvanised paint.

6.26.6 The contractor shall provide all parts, hardware fastenings, screws, components, assemblies and shims conforming to latest Indian Standards.

6.27 Provision for the Differently Abled

All Elevators shall comply with the Rly. Bd. letter no. 2019/Stn.Dev.-1/03/06/Policy/PwDs) and be provided with following features:

(a) Elevator control buttons at locations and height specified in IS 15330.

(b) Hall-call buttons at locations and height specified in IS 15330.

(c) Hand rails shall be provided on the side walls of the Elevator at height & locations specified in IS:15330. An international symbol of access for the differently abled shall be permanently and conspicuously displayed at each and every Elevator landing next to the Elevator entrance. Braille notations indicating the floor levels shall be integrated in each button at the handicap COP and handicap hall call buttons.

(d) A customizable digital voice system for announcing the car position, opening/closing of doors, direction of travel and messages shall be provided as per IS:15330.

(e) A laminated framed toughened glass safety mirror shall be installed on rear panel of elevators above the handrail i.e 900 mm above the floor. To facilitate easy reversal/ exit of person on wheel chair from the elevator without the need of rotating the wheel chair in the elevator

6.28 Accessories

Each Elevator shall be provided with the following accessories:

(a) Two sets each of all necessary keys for the landing door, operating panel, etc.

~~(b) One 500V insulation resistance testing meggar~~

~~(c) One multimeter having facility to measure: AC and DC currents and voltages, power factor and resistance~~

~~(d) Galvanisation thickness meter~~

~~(e) Device for checking the speed of elevator~~

~~(f) Noise measuring instrument~~

(g) Maintenance barrier.

6.29 Earthing Arrangement

All of the elevator's equipments, structures and other metallic parts shall be effectively grounded by the contractor to the incoming earthing conductor to be provided by railways. The earthing arrangements will be as per the standard practice conforming to IS-17900 ~~14665~~ and IS: 3043.

6.30 Special Cable Requirements

6.30.1 All cables and wiring for overground stations and service buildings shall be fire retardant. For cables to be used in underground stations, the additional requirement is that they shall be made from low smoke and halogen free materials. No bare Conductor shall be used in any Elevator as it may cause electrocution danger to the personnel. All cables except those within the enclosed controller and travelling cables shall comply the following requirements:

(i) Power and control cables shall be rated for 1100V and 600V grade respectively.

(ii) The conductor shall be of stranded conductor composed of plain annealed copper wire complying with IS: 8130/ IEC: 60228, Class 2.

(iii) The insulation shall consist of an extruded layer of cross-linked polyethylene complying with IS: 8130/ IEC 502.

(iv) Fire retardant, low smoke, halogen free materials shall meet the following requirements:

(a) The value of smoke generated shall meet the requirements of the relevant clauses of IS 7098/ BS 7846, when a sample of the complete cable is tested in accordance with IEC 61034-1 and 2 (3 m Cube Test). The light transmission values shall be minimum of 60%.

(b) The maximum specific optical density shall be 170 under the non-polluted condition as per ASTM E662.

(c) IEC 332 Parts 1 and 3, Category B, tests on single and bunched cables under fire conditions.

(d) Limiting Oxygen Index of at least 30, to ASTM D 2863.

(e) A temperature index (TI) of 260°C to ASTM D 2863.

(f) All insulation is to be moisture and heat resistant, with temperature ratings appropriate to the application conditions, and in no case lower than 90°C.

(g) When a sample of the cable is subjected to a combustion test for the determination of the amount of halogen acid gases (other than hydrofluoric acid) as set out in IEC 754 - Part 1, the halogen acid evolved shall not exceed a maximum of 0.5%.

Fire retardant materials shall meet the requirements of item (c), (d), (e) and (f) only. The amount of halogen acid gases evolved as per IEC 754 – Part 1 shall not exceed 20% for these cables.

6.30.2 The above requirements shall be met without compromising the mechanical and electrical properties of cables both during and after installation to meet the other requirements of this Specification.

6.30.3 Though not mandatory, manufacturers are encouraged to provide anti-termite and pest-resistant cables. In future, RDSO may consider making this requirement mandatory.

6.30.4 Travelling cables shall comply IEC 60227 Part-6/ EN 50214-2006.

6.30.5 The control cables within enclosed cabinet may be with PVC insulation.

6.31 Noise Generation

6.31.1 The whole of the Elevator assembly, including the opening and closing of the car and landing doors shall be quiet in operation and shall be free of rattling or squeaking noises. Elevator door operation shall be smooth to avoid the transmission of impact noise to the surrounding structure.

6.31.2 Noise levels resulting from the operation of the Elevator, including direct sound transmission, breakout noise and re-radiation of structure borne noise shall not exceed 55dB(A) (fast response) at 1.5m from the Elevator shaft and 1.5m above the floor.

6.31.3 Machinery noise level under normal operating conditions shall not exceed 70 dB(A) at 1m from the equipment in free field.

6.31.4 The total noise level in a moving Elevator car shall not exceed 55dB at 1 m away from the fan with ventilation fan in operation.

6.32 Riding Comfort

Apart from noise (whose permissible value is mentioned in clause 6.31), lateral quaking, acceleration, jerk and vertical vibration are the other parameters based on which 'Ride Comfort' and its quality is measured. These parameters are defined below (definition as per ISO 18 738):

i. **Lateral Quaking:** A sideways acceleration/ deceleration measured in gal.
ii. **Acceleration/deceleration:** A rate of acceleration/ deceleration measured on the z-axis velocity and expressed in metres per second squared (m/s2).
iii. **Jerk:** The rate of change of z-axis acceleration/ deceleration, attribute to lift motion control and expressed in metres per second cubed (m/sec3).

The contractor by performing suitable tests as per ISO 18738 shall ensure that following permissible values of above parameters shall be achieved for satisfactory ride comfort quality:

Parameter	**Unit**	**Permissible Value**
Acceleration / De-acceleration (adjustable)	m/sec^2	: 0.5
Maximum Jerk	m/s^3	: 2.0
Maximum Vertical Vibration	Gal	: 20 (Pk to Pk) (1 to 100 Hz)
Maximum Lateral Quaking	Gal	: 12 (Pk to Pk) (1 to 12 Hz)

7. INTERFACES

7.1 The Contractor is required to interface with railway or civil contractor appointed by railway in respect of the Elevator shaft requirement. The Contractor shall co-ordinate with the railway or civil contractor appointed by railway, to finalize all the details.

7.2 The Contractor shall co-ordinate with the railways and/ or railway appointed civil contractor with regard to the following specific issues:

(a) space requirements, including tolerances to be complied by civil engineering works.
(b) fixing requirements
(c) loads induced on the building, by the elevator
(d) interface with architectural finishes
(e) location for power supply termination point
(f) information on embedded parts, box-outs, etc. so as to enable railway's civil contractors to provide the necessary works.

(g) hanging pits (if any), including the shaft dimensions
(h) equipment access route
(i) scaffolding, lifting, etc. to be carried out by the elevator contractor (only to the extent required for elevator installation)
(j) ventilation requirement
(k) integration with railway's fire protection system (if any)
(l) provision of drainage with suitable pump and sump at the pit

8. ELECTROMAGNETIC COMPABILITY REQUIREMENT (EMC)

8.1 General

The contractor shall take adequate measures to reduce conducted, induced, and radiated emissions, especially the levels of harmonics, to acceptable values as specified by the relevant international standards or by the concerned statutory authority.

8.2 Inter-System EMC

The Contractor shall ensure that all equipment supplied shall have minimum Radio Frequency Interference introduced onto the main network and comply with the Electromagnetic Compatibility (EMC) requirements of the following standards: BS EN 61000-6-1, BS EN 61000-6-3, BS EN 12015 and BS EN 12016.

8.3 Harmonic distortion

The total harmonic distortion (THD) caused by the Elevator equipment to the supply mains at the power supply input terminals of the Elevator shall not exceed the following values when the Elevator is travelling up at full load and rated speed:

Rated load Current (I_L)	THD (%)
$200A \leq I_L < 400A$	<12.0
$20A \leq I_L < 200A$	<15.0
$I_L < 20A$	<20.0

8.4 Installation and Mitigation Guidelines

8.4.1 IEC1000-5 series of guidelines must be observed wherever applicable.

8.4.2 An earthing system should be designed to assure personnel safety and protection of installations against damage. It should also serve as a common voltage reference and contribute to the mitigation of disturbances

8.4.3 Bonding of all exposed metallic parts of all equipment and connecting them to the earthing network is a way for meeting safety requirements and minimize noise voltages due to potential differences. Necessary arrangements to ensure proper bonding shall be ensured by the contractor.

9. SOFTWARE SUPPORT

9.1 The Contractor shall submit their software support plan during design approval stage.

9.2 All changes, bug fixes, updates, modifications, amendments and new versions shall not result in any non-conformance with this specification.

9.3 The Contractor shall submit all new versions to the railways for review at least 2 weeks prior to their installation.

9.4 The new versions of software shall not degrade the operation of the system.

10. SAFETY DEVICES/FEATURES

Safety gear should comply with the provisions mentioned in EN 81-~~1~~20.

In addition to the elevator safety devices/ features mentioned elsewhere in this spec., the following shall also be provided.

10.1 Anti-man-trap Features

The Elevator shall have the following software features to avoid Man-trap situation:

(a) The doors shall open and close once after power up. This feature shall allow the passenger inside the car to exit by opening the door once after every power up.

(b) The doors shall open and close once after completion of correction drive. When there is power failure during the running of the Elevator and the power resumes immediately (before rescue operation) the controller shall drive the car to the next landing and open the door.

(c) The doors shall open and close once after completion of sync. drive. When the system memory is lost on the position and when the power up is initiated the controller shall drive the car to bottom terminal landing and open the door.

(d) The doors shall open and close if the Elevator is idle for 30 seconds. This feature shall allow the passenger to exit if he is not making a car call or the car operating buttons do not function.

(e) The Elevator doors shall open automatically if the Elevator is at a floor level and the safety chain is broken. This feature shall allow the passenger inside the car to exit safely.

10.2 Water sensors shall be provided in the Elevator pits. The requirement of water sump in the Elevator pits shall be co-ordinated with the railway.

10.3 An inspection control panel shall be fitted on the top of the Elevator car for maintenance purpose. The design of the inspection control panel shall comply with the following requirements and prevent the Elevator car from being operated accidentally:

(a) It shall not be possible to control the Elevator car from any other position after the NORMAL/TEST change-over switch has been set to the TEST position. When in the TEST position, the UP and

DOWN continuous pressure push buttons within this panel shall become operative.

(b) An ON/OFF switch shall be provided which shall render the Elevator inoperative in any mode, when the switch is kept in the "OFF" position.

(c) The Elevator car shall only move when all safety devices are in the safe position.

(d) The Elevator car shall move in either direction only on continuous pressure of the appropriate direction button at a car speed not exceeding 0.25m/s.

(e) The control panel shall incorporate an adequately protected permanently located light fixture with a separate switch and a min. 5A switch socket outlet.

(f) A door operator ON/OFF switch shall be provided. The door operator shall only be operative when the switch is at the "ON" position.

(g) A terminal stop limit switch shall be provided to stop the car from traveling in an upward direction. When this switch is activated, it shall not stop the car from operating in the down direction.

(h) All switches and buttons on the inspection control station shall be clearly engraved / marked with their functions. All buttons and switches shall be shrouded against accidental operation, with the exception of the emergency stop button.

10.4 The Elevator shall be provided with a floor-levelling device, which shall automatically bring the Elevator car to stop within ±5 mm of the level of the floor for which a stop has been initiated regardless of the load or direction of travel. In case of Emergency Rescue mode, the car should stop within ± 10mm of the level of floor.

10.5 An automatic re-leveling device shall be provided which returns the Elevator to the floor automatically should the Elevator creep down or move up from floor level due to rope/belt stretch for any distance more than 15 mm. This device shall be operative at all floors served, whether the landing and car doors are opened or closed.

10.6 Each Elevator car shall be provided with Progressive type safety gear mounted on the lower member of the car frame structure. This safety gear shall be capable of operating only in the downward direction and capable of stopping the car with full load at the tripping speed of the over speed governor, by gripping the guides and holding the car stationary. The motor circuit shall be opened by a switch on the safety gear before, or at the same time the safety gear is applied. It shall be possible to release the safety gear by raising the Elevator car without the use of any special tools.

10.7 A mechanical device and electrical device shall be provided to prevent the car movement resulting from maintenance/ inspection that can be dangerous to persons carrying out maintenance/ inspection works from inside the car or car roof.

10.8 A phase protection device and 3 phase as well as single phase earth leakage protection device shall be provided in the main control cubicle of each Elevator to prevent the Elevator car from moving in the event that there is a phase failure, or the phase of the power supply being reversed due to any reason whatsoever. These devices, when activated, shall cause a visual indicator to illuminate on the main control cubicle, until the fault has been rectified.

10.9 As in the case of Power failure (including single phasing / unbalanced phase) Elevator should operate in the Emergency Rescue mode.

10.10 Each Elevator shall be provided with overload device as mentioned in Cl. 6.20(v).

10.11 An over speed governor shall be provided as per Cl. 6.7. In case of hanging pits, it shall be governed as per Cl. 6.7.7.

10.12 Two stop switches shall be provided as per Cl. 6.25.4 to prevent any movement of the Elevator car during inspection/test operation.

10.13 A safety switch to prevent the car from moving when the governor rope tension weight is out of position shall be provided.

10.14 Terminal and Limit switches shall be provided as per IS 17900 ~~14665 (Part 3/ Sec 1).~~

11. PERFORMANCE /TECHNICAL REQUIREMENTS

The requirements for the Elevators have been summarized in the Table given below:

Sl. No.	ITEM DESCRIPTION		~~For 13 Persons~~	~~For 20 Persons~~	~~For 26 Persons~~
A	**DESIGN CRITERIA & PERFORMANCE**	For non-passenger area	**For passenger area**		
1.	Rated Load,	As per IS 17900 ~~14665-1~~	952~~-884~~ kg	1360 Kg	1764 kg
2.	Rated Speed (see Cl. 5.7)	Refer cl. no. 5.7	1.0 m/s; 1.5 m/s	1.0 m/s; 1.5 m/s	1.0 m/s; 1.5 m/s
3.	Standard Car Size (Width x Depth) (please refer item 5 of Annexure-1 and cl. no. 5.8)	As per IS 17900 ~~14665-1~~	As per IS 17900 ~~14665-1 (Metro Railway may adopt size as per IS 14665-1 or higher as per requirement)~~	As per IS 17900 ~~14665-1 (Metro Railway may adopt size as per IS 14665-1 or higher as per requirement)~~	As per IS 17900 ~~14665-1 (Metro Railway may adopt size as per IS 14665-1 or higher as per requirement)~~
4.	Car Height (Min.)	2400 mm	2400 mm	2400 mm	2400 mm
5.	Max. Motor Starts/hour	180	180	180	180
6.	Levelling Accuracy (Typical)	± 5 mm for normal operation; ± 10mm for emergency rescue mode	± 5 mm for normal operation; ± 10mm for emergency rescue mode	± 5 mm for normal operation; ± 10mm for emergency rescue mode	± 5 mm for normal operation; ± 10mm for emergency rescue mode
7.	Re-levelling Accuracy (Typical)	± 15 mm	± 15 mm	± 15 mm	± 15 mm
8.	~~Max. Sill Load (Car and Landing)~~ Door sill load withstanding capacity	400 kg	~~Aluminum/Stainless steel with slots~~ 400 kg	~~Aluminium/Stainless steel with slots~~ 400 kg	~~Aluminium/Stainless steel with slots~~ 400 kg

9.	Motor Insulation Class	F	~~F~~	~~F~~	~~F~~
10.	Designed Number of Operations/Year	1000,000	1000,000	10,00,000	10,00,000
11.	Designed Lifetime of Hoisting Function	20 Years @ 10,00,000 starts per year	20 Years @ 10,00,000 starts per year	20 Years @10,00,000starts per year	20 Years @ 10,00,000 starts per year
12.	Designed Lifetime of Ropes/Belts (Min.)	8 years @ 10,00,000 starts/year	8 years @ 10,00,000 starts/year	8 years @ 10,00,000 starts/year	8 years @ 10,00,000 starts/year
13.	Safety Factor of Suspension Ropes/ belts (Min.)	12	12	12	12
14.	All Operating Push Buttons	As per EN 81-20	As per EN 81-20	As per EN 81-20	As per EN 81-20
B	**RIDE COMFORT**		-		
15.	Acceleration/ Deceleration Rate (Adjustable)	0.5 m/s2	0.5 m/s2	0.5 m/s2	0.5 m/s2
16.	Max. Jerk	2 m/s3	2 m/s3	2 m/s3	2 m/s3
17.	Max. Vertical Vibration In Car	20 Gal Pk - Pk (1 -100 Hz)	20 Gal Pk - Pk (1 -100 Hz)	20 Gal Pk -Pk (1 -100 Hz)	20 Gal Pk -Pk (1 -100 Hz)
18.	Max. Lateral Quaking	12 Gal Pk-Pk	12 Gal Pk-Pk	12 Gal Pk-Pk	12 Gal Pk-Pk
19.	Noise In Car (with Fan in operation)	Max 55 dB(A)	Max 55 dB(A)	Max 55 dB (A)	Max 55 dB (A)
C	**SHAFT EQUIPMENTS**		-		
20.	Tentative size and weight of Car Guide Rails	To be designed as per IS 17900 ~~14665-1~~	To be designed as per IS 17900	To be designed as per IS 17900	To be designed as per IS 17900

21.	Tentative size and weight of Counterweight Guide Rails	To be designed as per IS 17900 ~~14665-1~~	To be designed as per IS 17900 ~~14665-1~~	To be designed as per IS 17900 ~~14665-1~~	To be designed as per IS 17900 ~~14665-1~~
22.	Car Buffer (6.6.2)	Spring/Energy dissipation	Spring/ Energy dissipation	Spring/ Energy dissipation	Spring/ Energy dissipation
23.	Counterweight Buffer	Spring/Energy dissipation	Spring/Energy dissipation	Spring/Energy dissipation	Spring/Energy dissipation
24.	Car Sling	Refer cl. no. 6.9.2	Refer cl. no. 6.9.2	Refer cl. no. 6.9.2	Refer cl. no. 6.9.2
25.	Counterweight frame	Fabricated from Sheet steel. Cold Rolled Steel above 3 mm and Hot Rolled Sheets above 3 mm thick	Fabricated from Sheet steel. Cold Rolled Steel above 3 mm and Hot Rolled Sheets above 3 mm thick	Fabricated from Sheet steel. Cold Rolled Steel above 3 mm and Hot Rolled Sheets above 3 mm thick	Fabricated from Sheet steel. Cold Rolled Steel above 3 mm and Hot Rolled Sheets above 3 mm thick
26.	Over speed Governor with test groove -Type	Centrifugally operated	Centrifugally operated	Centrifugally operated	Centrifugally operated
27.	Car Safety Gear	Progressive type	Progressive type	Progressive type	Progressive type
28.	Counterweight Safety Gear	Progressive type where ever applicable (floating pit situation)	Progressive type where ever applicable (floating pit situation)	Progressive type where ever applicable (floating pit situation)	Progressive type where ever applicable (floating pit situation)
29.	Over Speed Governor tension weight switch	Required	Required	Required	Required
30.	Water Sensor in Pit	Required	Required	Required	Required
31.	Elevator shaft width and depth tolerance	+ 75 mm - 0 mm	+ 75 mm - 0 mm	+75 mm - 0 mm	+75 mm - 0 mm
32.	Verticality Tolerance/ plumbness of Elevator	50 mm	50 mm	50 mm	50 mm

	Shaft				
D	**CARS**				
33.	Guide shoes	Sliding with replaceable liners	Sliding with replaceable liners	Sliding with replaceable liners	Sliding with replaceable liners
34.	Car panel thickness	Minimum 1.5mm thick	Minimum 1.5mm thick	1.5mm thick	1.5mm thick
35.	Car Fan	Refer cl. no. 6.9.6	Refer cl. no. 6.9.6	Refer cl. no. 6.9.6	Refer cl. no. 6.9.6
36.	Car Junction box Protection	IP 54	IP 54	IP 54	IP 54
37.	Car Handrail	Refer cl. no. 6.9.3	Refer cl. no. 6.9.3	Refer cl. no. 6.9.3	Refer cl. no. 6.9.3
38.	Buffer Rail	On the rear side of car	On the rear side of car	On the rear side of car	On the rear side of car
39.	Mirror (cl. 6.27- e)	Required	Required	Required	Required
E	**DOORS**				
40.	Car Doors; clear opening width and height of both the car and landing entrance	Refer cl. no. 5.8	Refer cl. no. 5.8	Refer cl. no. 5.8	Refer cl. no. 5.8
41.	Landing Doors Locking	Both door panels mechanically locked individually	Both door panels mechanically locked individually	Both door panels mechanically locked individually	Both door panels mechanically locked individually
42.	Protection class for Car and Landing doors locking device	IP20	IP20	IP20	IP20
43.	Steel Door thickness	Minimum 1.5 mm Stainless Steel sheet	Minimum 1.5 mm Stainless Steel	Minimum 1.5 mm Stainless Steel	Minimum 1.5 mm Stainless Steel sheet (cl.

		(cl. no. 6.9.7.2)	sheet (cl. no. 6.9.7.2)	sheet (cl. no. 6.9.7.2)	no. 6.9.7.2)
44.	Fire rating of landing door	As per IS ~~14665~~17900	As per IS ~~14665~~17900	As per IS ~~14665~~17900	As per IS ~~14665~~17900
45.	Car door lock	Electrical lock Required	Electrical lock Required	Electrical lock Required	Electrical lock Required
46.	Door Safety Devices	Refer cl. no. 6.10.3	2D Infrared Curtain of light & For metro rail application 3-D infra red curtain may be provided if purchaser specially mention in the tender documents.	2D Infrared Curtain of light & Mechanical Force Limiting Device.	2D Infrared Curtain of light & Mechanical Force Limiting Device.
F	**Machine**		-		
47.	Machine	Refer cl. no. 6.1	Refer cl. no. 6.1	Refer cl. no. 6.1	Refer cl. no. 6.1
~~48.~~	~~Motor Insulation Class / Type of Enclosure~~	~~Refer cl. no. 6.1~~	~~Class F / IP21~~	~~Class F / IP21~~	~~Class F / IP21~~
G	**ELEVATOR MAJOR COMPONENTS FINISH**				
49.	Car panel	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant
50.	Car entrance panel	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant

51.	Car operating panel	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant
52.	Car ceiling	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant
53.	Handrail	Stainless steel Hairline Finish	Stainless steel Hairline Finish	Stainless steel Hairline Finish	Stainless steel Hairline Finish
54.	Car flooring	Min 6 mm thick Aluminium chequered plate	Min 6 mm thick Aluminium chequered plate	Min 6 mm thick Aluminium chequered plate	Min 6 mm thick Aluminium chequered plate
55.	Landing entrance frame	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant
56.	Doors-Car & Landing	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant	Stainless steel Scratch Resistant
57.	Guide Bracket Assembly	Refer cl. no. 6.5	Refer cl. no. 6.5	Refer cl. no. 6.5	Refer cl. no. 6.5
58.	Car/ Counterweight guide rail	Refer cl. no 6.5	Refer cl. no 6.5	Refer cl. no 6.5	Refer cl. no 6.5
59.	Counterweight Guard	Refer cl. no. 6.3	Refer cl. no. 6.3	Refer cl. no. 6.3	Refer cl. no. 6.3
60.	Counter weight frame	Refer cl. no. 6.3	Refer cl. no. 6.3	Refer cl. no. 6.3	Refer cl. no. 6.3
61.	Filler Weight	Refer cl. no. 6.3	Refer cl. no. 6.3	Refer cl. no. 6.3	Refer cl. no. 6.3
62.	Sling	Hot dip Galvanised / Spray Galvanised & epoxy painted	Hot dip Galvanised /Spray Galvanised & epoxy painted	Hot dip Galvanised /Spray Galvanised & epoxy painted	Hot dip Galvanised /Spray Galvanised & epoxy painted
63.	Floor Assembly	Spray Galvanised & epoxy painted	Spray Galvanised & epoxy painted	Spray Galvanised & epoxy painted	Spray Galvanised & epoxy painted
64.	Roof Assembly	Spray Galvanised & epoxy painted	Spray Galvanised & epoxy painted	Spray Galvanised & epoxy painted	Spray Galvanised &

					epoxy painted
H	**ELECTRICAL BUILDING INTERFACE**		-		
65.	Main Supply Voltage	400 Volt ± 10 %, 3-phase	400 Volt ± 10 %, 3-phase	400 Volt ± 10 %, 3-phase	400 Volt ± 10 %, 3-phase
66.	Frequency	50 Hz ± 3%	50 Hz ± 3%	50 Hz ± 3%	50 Hz ± 3%
67.	Main Fuses	As per design requirement	3x20 Amp	3 x 20 Amp.	3x20 Amp
68.	Main Switch Rating	As per design requirement	32 Amp	32 Amp.	32 Amp
69.	Main Switch Position (External)	Recommended on Top most landing	Recommended on Top most landing	Recommended on Top most landing	Recommended on Top most landing
70.	Shaft Lighting	Refer cl. no. 6.21	Refer cl. no. 6.21	Refer cl. no. 6.21	Refer cl. no. 6.21
71.	ESDP (Elevator Status Display Panel) (Optional item)	Refer cl. no. 6.22	Refer cl. no. 6.22	Refer cl. no. 6.22	Refer cl. no. 6.22
72.	Signalization Voltage	12 to 30 VDC	12 to 30 VDC	12 to 30 VDC	12 to 30 VDC
I	**CIVIL BUILDING INTERFACE**		-		
73.	Head Room (Minimum)	For speeds upto 1 m/s: 4250 mm; For speeds above 1 m/s: As per IS ~~14665-1~~ 17900	For speeds upto 1 m/s: 4250 mm; For speeds above 1 m/s: As per IS ~~14665-1~~ 17900	For speeds upto 1 m/s: 4500mm; For speeds above 1 m/s: As per IS ~~14665-1~~ 17900	For speeds upto 1 m/s: 4600mm; For speeds above 1 m/s: As per IS~~14665-1~~ 17900
74.	Pit (Minimum)	As per IS ~~14665-1~~ 17900	1600 mm	1800 mm	1850 mm
75.	Shaft Size for Elevators with Counterweight safety	Refer cl. no. 5.8	2500 mm W X 1900 mm D or in	2600 mm W X 2300 mm D or in	2950 mm W X 2350 mm D or in exceptional

			exceptional cases, as mutually agreed based on car size	exceptional cases, as mutually agreed based on car size	cases, as mutually agreed based on car size
J	**CONTROL SYSTEMS**				
76.	Control Type	Full Collective	Full Collective	Full Collective	Full Collective
77.	Controller	Refer cl. no. 6.11	Refer cl. no. 6.11	Refer cl. no. 6.11	Refer cl. no. 6.11
78.	Drive System	Refer cl no. 6.12	Refer cl no. 6.12	Refer cl no. 6.12	Refer cl no. 6.12
79.	Power Factor	0.9 and above	0.9 and above	0.9 and above	0.9 and above
80.	Auto Fan & Light Cut-Off	Refer cl. no. 6.9.6	Refer cl. no. 6.9.6	Refer cl. no. 6.9.6	Refer cl. no. 6.9.6
K	**CODES AND NORMS**				
81.	Safety Codes	EN81-20; IS:15785; IS:15530 ; IS:14665/ IS 17900; BS EN 50126	EN81-20; IS:15785; IS:15530; IS:14665/ IS 17900; BS EN 50126	EN81-20; IS:15785; IS:15530 ; IS:14665/ IS 17900; BS EN 50126	EN81-20; IS:15785; IS:15530 ; IS:14665/ IS 17900; BS EN 50126
82.	Electromagnetic Compatibility, EMC	EN12015 (emission) and EN12016 (immunity)	EN12015 (emission) and EN12016 (immunity)	EN12015 (emission) and EN12016 (immunity)	EN12015 (emission) and EN12016 (immunity)
83.	Electrical Protection	As per requirements specified	As per requirements specified	As per requirements specified	As per requirements specified
84.	Requirements For Physically Challenged Use	As per requirements specified	As per requirements specified	As per requirements specified	As per requirements specified

L	**PERIPHERAL FUNCTIONS**		-		
85.	Communication System	Refer cl. no. 6.17	Refer cl. no. 6.17	Refer cl. no. 6.17	Refer cl. no. 6.17
86.	Alarm	In each landing and SCR activated by Alarm button in Car	In each landing and SCR activated by Alarm button in Car	In each landing and SCR activated by Alarm button in Car	In each landing and SCR activated by Alarm button in Car
87.	Attendant Function	Operated with Key switch	Operated with Key switch	Operated with Key switch	Operated with Key switch
88.	EAS (Elevator announcement system)	English/Hindi/ Regional	English/Hindi/ Regional	English/Hindi/ Regional	English/Hindi/ Regional
89.	Load Weighing Device (Overload)	Refer cl. no. 6.20	Refer cl. no. 6.20	Refer cl. no. 6.20	Refer cl. no. 6.20
90.	Full Load Bypass (For Elevators serving more than 2 stops)	By passes landing calls when load in car exceeds 80% of rated load	By passes landing calls when load in car exceeds 80% of rated load	By passes landing calls when load in car exceeds 80% of rated load	By passes landing calls when load in car exceeds 80% of rated load
91.	Automatic Rescue Device	Refer cl. no. 6.23.4	Refer cl. no. 6.23.4	Refer cl. no. 6.23.4	Refer cl. no. 6.23.4
92.	Fireman elevator functionality	Refer cl no. 6.15	Refer cl no. 6.15	Refer cl no. 6.15	Refer cl no. 6.15
93.	Surge Suppressor / Power filters/ Over Voltage Protection	Required (to be provided separately for Control Circuit also)	Required	Required	Required

~~94.~~	~~Surge Suppressor / Over Voltage Protection~~	~~Required separately for Control Circuit also~~	~~Required separately for Control Circuit also~~	~~Required separately for Control Circuit also~~	~~Required separately for Control Circuit also~~
95.	Anti Man-trap features	As in Cl. 10.1	As in Cl. 10.1	As in Cl. 10.1	As in Cl. 10.1
M	**SIGNALISATION**				
96.	Car Operating Panel	Refer cl. no. 6.15	Refer cl. no. 6.15	Refer cl. no. 6.15	Refer cl. no. 6.15
97.	Car Indicator	Refer cl. no. 6.16	Refer cl. no. 6.16	Refer cl. no. 6.16	Refer cl. no. 6.16
98.	Landing Indicator	Refer cl. no. 6.16	Refer cl. no. 6.16	Refer cl. no. 6.16	Refer cl. no. 6.16

12. KEY TECHNICAL INFORMATION TO BE SUPPLIED BY BIDDER, ALONG WITH THEIR OFFER:

SN	Feature	RDSO Spec. Clause	Details
.1	**Basic Information:**		
a)	Rated Speed	5.7 & 11(SN2)	
b)	Passenger Capacity and Load	11(SN1)	
~~c)~~	~~Regenerative drive (if asked in tender)~~	~~6.13~~	
d)	No. of Car Doors	6.10.1.1(ii)	
e)	Is Elevator Status Display Panel being offered?	6.22.1	
.2	**Machine:**		
a)	Main Driving Motor	6.1.1	
b)	Current in Amps at rated Outputs		
c)	Make and type		
d)	Type of enclosure	6.1.1.6	
e)	Voltage between terminals		
f)	Output in KW		
g)	Weight		
h)	Speed in RPM at rated Output		
i)	Class of insulation	6.1.1.6	
j)	Temperature rise on full Load	6.1.1.3	
.3	**Brake:**		
a)	Make		
b)	Type	6.1.2.1	
c)	Width & diameter of brake wheel		
d)	Method of adjustment		

SN	Feature	RDSO Spec. Clause	Details
e)	Provision for emergency brake Release	6.1.2.7	
.4	**Car:**		
a)	Dimension (internal)	11(SN3)	
b)	Weight (Approx.)		
c)	Rated Load	11(SN1)	
d)	Acceleration		
e)	Retardation		
f)	Method of suspension		
g)	Type of guide shoes	6.9.1	
.5	**Guide Rail:-**		
(i)	**For Car :-**		
a)	Size and weight in kg per liner meter in Tee sec	11(SN20)	
b)	No. of Sections		
c)	Spacing of intermediate Supports		
d)	Method of lubrication	6.9.1.2	
(ii)	**For Counter weight :**		
a.	Size and weight in kg per liner meter in Tee sec	11(SN21)	
b.	No. of Sections		
c.	Spacing of intermediate Supports		
d.	Method of lubrication	6.9.1.2	
.6	**Control Equipments:-**		
(i)	**Control Systems :-**	11(J)	
a.	System of control and working DC voltage for control	11 (SN78); 6.11	
b.	Type of VVVF control Details	11 (SN80) 6.12	

SN	Feature	RDSO Spec. Clause	Details
(ii)	**Self Leveling Systems :**		
a.	Type of car leveling Device	11(SN6)	
b.	Any special features		
(iii)	**Limit Switches :-**		
a.	Type	10.14	
b.	Any special features		
.7	**Suspension Ropes/belts :-**	6.2	
a.	No. of ropes/belts	6.2.1	
b.	Size and no. of strands in each rope/belt	6.2.1 6.2.2	
c.	Factor of Safety	6.2.4	
d.	Method of attachment to the car	6.2.5	
e.	Method of attachment to the counter weight	6.2.5	
.8	**Counter weight:-**	6.3	
a.	No. of sections		
b.	Weight of each section		
c.	Type of guide shoes	6.3.4	
d.	Method of load equalization of ropes/belts		
.9	**Finishing:**	6.9.7	
a.	Full particulars should be given		
.10	Protection devices, details provided in the Elevator	10	
.11	Special inclusions, if any		

13. DESIGN CRITERIA & SUBMITTALS

13.1 Design Criteria

(a) Where similar equipment or sub-systems of a different rating are already proven in service, then the design shall be based on such

equipment. In case these stipulations are not fulfilled, the Contractor shall furnish sufficient information to prove the basic soundness and reliability of the offered sub-system. The design shall be guided by the following criteria:

(i) Service proven design

(ii) Application of state-of-the-art Technology

(iii) Complete system design life of 20 years

(iv) In as far as possible, design life of sub-systems/ components shall be as follows:

Elevator Component	**Design life (years)**
Safety gear rope	8
Governor	20
Anti Creep device, where provided	20
Hoisting hoisting rope/belt	8
Contractors/relays*	10
Traction machine/motor	20
Hall and Car buttons	~~15~~ 10

* Frequently operating contactors/relays may have lesser life of 5 years

(v) Minimum life cycle cost

(vi) Low maintenance cost

(vii) Use of interchangeable, modular components

(viii) Extensive and prominent labelling of parts, cables and wires

(ix) Use of unique serial numbers for trace-ability of components

(x) High reliability and ensure Zero passenger trapping

(xi) Low energy consumption

(xii) System safety

(xiii) Adequate redundancy and factor of safety.

(xiv) Fire and smoke protection

(xv) Use of fire retardant materials

(xvi) Environment friendly

(xvii) Adherence to operational performance requirements

(xviii) Maximum utilization of indigenous materials and skills, subject to quality conformity.

(b) Adequate margin shall be built into the design particularly to take care of the higher ambient temperatures, dusty conditions, and high seasonal humidity, etc. prevailing in different parts of the country.

13.2 Submittals

13.2.1 The bidder must submit following documents along with the offer:

A. Preliminary design details

(i) Preliminary technical details of various components & sub-systems.

(ii) Technical details in ref. to Cl. ~~11~~12.0 for each type of Elevator offered. Details are to be furnished as per following performa:

~~S. No.~~	~~Technical Details required as given in table of Cl. 11.0 in specs~~	~~Offered parameter~~

(iii) Codes & standards complied.

B. Clause wise compliance (to the RDSO spec.) matrix.

S. No.	RDSO spec. clause no.	Documents type/description	Page no.		Remarks
			From	To	

C. Technical information called for in Cl. 12.0

S. No.	Technical Details required as given in table of Cl. 12.0 in specs	Offered parameter

D. System reliability, availability and maintainability. Expected maximum value of COR.

E. Factory Quality Assurance Plan.

F. List of testing facility available (Testing tools, Zigs, instruments, testing tower/test rig)

13.2.2 The contractor (successful bidder) will be required to submit the following at detailed design stage:

A. Elevator layout/General Arrangement Drawing/Shop drawings giving:

(i) Plan, elevation and sectional views of Elevator & its major components, key dimensions, rail bracket spacing, entrance details

(ii) Rail and buffer forces; reactions and loads imposed on the: (a) guide rails which shall be transferred to structure including shaft wall and pit; and (b) hoisting beam

(iii) Clearances, car & counterweight runby & top clearance

(iv) Clearance inside hoistway and pit dimensions

(v) Locations and sizes of access doors, hoistway entrances and frames

(vi) Wiring layouts for each Elevator

(vii) Refuge space on top of car and pit
(viii) Controller and drive space layout
(ix) Information on space requirements
(x) Civil & electrical interface details

B. Technical data and details

(i) Design approach
(ii) Clause wise (RDSO Spec.) compliance matrix.
(iii) Codes & standards complied
(iv) Technical data, details and/ or drawings of various components & sub-systems
(v) Summary of factor of safety compliances
(vi) Design/ expected life of safety gear rope, governor, anti-creep device, hoisting rope/belt, contactors/ relays and traction machine/ motors.
(vii) Elevator functions / operational, safety, diagnostic, anti-mantrap features
(viii) Last resort evacuation measures provided in the elevator
(ix) Design verification & validation
(x) Design Calculation in respect of: loads imposed on structure; and rail forces
(xi) Position of counterweight
(xii) Car & counterweight rail
(xiii) Car and landing doors
(xiv) Buffer
(xv) Car frame & Platform
(xvi) Counterweight frame
(xvii) Car panel strength
(xviii) Machine supports & beams
(xix) Pit details
(xx) Ventilation area
(xxi) Number of air changes
(xxii) Clearances
(xxiii) Motor Power and its efficiency
(xxiv) Motor bearing life
(xxv) VVVF drive rating
(xxvi) Battery rating for UPS for emergency lighting, telecom, etc.
(xxvii) Battery rating for ARD
(xxviii) Braking Resistance – its material, current withstanding capacity, test reports, etc
(xxix) Cables & wires
(xxx) Stainless steel finishes
(xxxi) Dust and water ingress protection of various enclosures
(xxxii) Corrosion protection / painting details

(xxxiii) Weight chart (weight carried by rope/belt)

(xxxiv) Traceability

(xxxv) Fire and smoke prevention (for items required to be fire rated, the relevant data should be furnished)

C. All drawings/ data required to be passed on to the railway appointed Civil Contractor for taking up civil works (e.g. shaft dimensions, locations of rail brackets, etc.)

D. Expected heat dissipation of elevator equipment in control room space and machine space (BTU) based on max. possible full load starts/hr

E. Prototype test plan including test protocol

F. Type test reports in respect of systems/ sub-systems that will form part of the Elevator to be supplied

G. Type Test report in support of EMI/EMC compliance

H. Factory Acceptance Test Plan for equipments

I. Manufacturing quality plan with routine tests with typical inspection reports.

J. Automatic fault identification and isolation arrangement

K. Calculations in support of equipment ratings

L. Design and proving protection devices/ systems and its validation

M. Component / sub-system Vendor details.

N. System reliability, availability and maintainability. Expected maximum value of COR

O. Draft Operation and Maintenance manual, covering the following contents:

(i) Drawings, installation and maintenance instructions, and other data pertinent to the components used in Elevator systems, including detailed data for all components, including disassembly, inspection/ gauging/ torque requirements, inspection and testing schedules, reassembly, testing methods and other related information. Manuals shall cover all mechanical and electrical components, operating panels, controls and indicators. Exploded view drawings shall be included to facilitate repair and maintenance functions.

(ii) Circuit wiring diagrams shall be provided for all electrical circuits. They shall be in A3 size paper suitably treated to prevent deterioration from dirt or age. Fault diagnosis procedures and circuit diagrams/Block diagrams, detail information, software and technical data shall be provided to assist in trouble shooting for breakdown during normal operation and maintenance.

(iii) Bill of Materials (BOM) for each Elevator. The BOM will be a list of all assemblies, subassemblies and replacement components/ parts of the Elevator. This detail will be required in the future for placing orders on the OEM for individual replacement parts and for other managerial purposes.

(iv) Maintenance tool manuals.

P. Material Safety Data Sheet (MSDS) and Product data sheets

Q. Electrical Systems: Layout of electrical system including motor, control panel; disconnect switches directional start and stop key switches; emergency stop switches and covers; scheme for electrical grounding of Elevator; light fixtures and control devices; schematic diagram including single line power diagram of the Elevator system, control wiring diagram and sequence of operation, indicating interface connections.

R. Accidents:

R1. Safety evaluation reports

R2. Short technical note, highlighting the Elevator sub-system failures which can impact safety.

R3. Hazard identification and control documentation

R4. Short technical note listing the failures whose simultaneous occurrence can lead to accident situations. Steps that can be taken to avoid such accident situations.

13.2.3 The contractor (successful bidder) will be required to submit the following to the railway at installation and commissioning stage:

(i) Construction and Installation Plan including site safety plan;
(ii) Installation & Commissioning Quality Plans;
(iii) Installation instruction for all equipment;
(iv) Operation and Maintenance Manuals (one soft and one hard copy per station);
(v) Records and drawings of equipment installed;
(vi) All other records of construction, including hidden parts;
(vii) Site test report of equipment;
(viii) As built drawings including interface drawings; and
(ix) Other documentation as required, by the railways.

13.2.4 If type testing of elevator to be supplied has already been conducted by RDSO, no fresh documents required for type testing of elevator need to be submitted again. A type test certificate alone will be sufficient in this case.

14. TESTING & INSPECTION

Inspection & Testing stages and details thereof shall be in accordance with the plan furnished in Annexure-2. An indicative list of type, routine and acceptance tests is enclosed at Annexure-3. The

Contractor shall prepare a comprehensive type, routine and acceptance inspection & testing protocol (encompassing the requirements laid down in EN–81, IS–17900/IS14665 as also Annexure-3 of this spec.) and submit the same to RDSO for approval. The protocol should also include: method for conducting the tests; list of testing tools and instruments; and reference to the relevant standards, accepted documents and drawings. Inspection and testing shall be carried out in accordance with the test protocols as approved by RDSO. Notwithstanding the provisions of this spec., railways can invite tender/ place order with the provision of accepting the material on the basis of firm's written clause-by-clause confirmation of the spec., routine tests and acceptance tests alone, wherever this is considered necessary by CEE. Firm must have complete testing facility including test rig/testing tower for witnessing type test by RDSO.

14.1 Type Testing of Complete Elevator and its sub-systems

14.1.1 Type testing has been required once for a particular passenger capacity of a particular make. If a make has already passed type testing of higher passenger capacity its lower passenger capacity lift will be deemed passed in type testing by RDSO. After making any major design changes which will affect reliability/safety the lift will be offered for fresh type test.

14.1.2 On successful conclusion of scrutiny of contractor's designs and drawings, RDSO shall issue a design clearance and direct the firm to take up manufacturing of 1 no. elevator and offer the same for type testing.

14.1.3 One complete Elevator as also its sub-systems shall be type tested. Type testing of the complete Elevator shall be done as per the protocol approved by RDSO. The Elevator selected for type testing shall be representative of the types to be supplied.

14.1.4 The complete elevator as well as its sub-systems shall be type tested preferably at the manufacturer's test facility or at an accredited laboratory. In case part or complete testing is not possible at the manufacturer's works/ test facility or at an accredited laboratory, then those tests shall be conducted at site. Final decision with regard to the place of conducting the type testing shall be taken during design stage.

14.1.5 The contractor shall submit the available prior type test reports in respect of type tests listed in the protocol. These reports must pertain to complete elevator as also the systems and sub-systems that are to actually form a part of Elevators to be supplied to IR. The contractor should also submit an action plan for carrying out any type-tests that still remain to be carried out.

14.1.6 RDSO would have the right at its discretion, to either witness the type test(s) of Elevator and its key sub-assemblies at the test facility of respective manufacturers/suppliers and/ or accredited laboratories or to accept the type test reports generated by those

test facilities/ laboratories as sufficient evidence that the elevator and its sub-systems have been type tested.

14.1.7 If the product is being manufactured initially in a foreign country, RDSO representative at its discretion, may like to visit and witness any of the Type Tests, at their own cost. The Contractor shall co-ordinate the program, in such case.

14.1.8 At least 3 weeks notice shall be given to RDSO for inspection and type testing.

14.1.9 After successful conclusion of type test and scrutiny of test results, RDSO shall issue a type test clearance certificate and direct the firm to commence bulk manufacturing. Type test clearance granted to the Contractor is liable to be withdrawn in the event that he carries out any major change at a later date in the design or Bill of material without RDSO's approval or if he supplies sub-assembly of inferior specification/ quality, thus compromising on reliability.

14.2 Elevator Routine Testing

14.2.1 Routine testing relates to the bulk manufacturing stage.

14.2.2 Routine testing entails tests and inspections that are conducted at the works of Elevator manufacturer and/or the works of its key sub-suppliers, as per the relevant standards. These tests are required to be carried out on each elevator as well as its sub-systems.

14.2.3 The railway representative/ inspection agency/ testing authority would have the right at its discretion, to witness routine test(s) of Elevator's key sub-assemblies during the Elevator's manufacturing and/or accept the test results/ reports of respective manufacturer's/supplier's in-house quality control (test reports should be furnished for systems and sub-systems that are to actually form a part of the Elevator to be supplied to IR), as sufficient evidence that the routine tests have been carried out.

14.2.4 If the Product is being manufactured initially in a foreign country, purchaser's representative/ inspection agency/ testing authority at its discretion, may like to visit and witness any of the routine tests, at their own cost. The Contractor shall co-ordinate the program, in such case.

14.2.5 At least 3 weeks' notice shall be given to the railway representative/ inspection agency/ testing authority to be present for the routine testing and inspection.

14.3 Elevator Pre-Dispatch Verification of Packing List

14.3.1 Before the ordered goods (complete Elevator system kits), as per the offered dispatch lot are dispatched, purchaser's representative/ inspection agency shall verify completeness of the dispatch lot as per order details/ contractor's packing list and if everything is in order, issue the "Dispatch approval certificate".

14.3.2 Thereafter, the Contractor can dispatch the goods to the consignee.

14.4 Elevator installation and Final Acceptance Testing

After installation, on-site acceptance tests shall be carried out on the Elevator in the presence of railway's representative/ inspection agency/ testing authority. After satisfactory completion of inspection/ testing, the railway representative/ inspection agency/ testing authority will authorize the commissioning of the Elevator for public use by issuing an "Elevator installation final acceptance certificate".

15. ACCESSIBILITY

15.1. The Elevator design shall allow easy and safe accessibility to authorized persons for inspection, maintenance, repairs and cleaning.

15.2. Maintenance Access Panel (MAP) shall be lockable to avoid access to unauthorized persons.

16. MOVEMENT OF MATERIALS

Completely assembled Elevator or its sub-assemblies (which cannot be handled manually), shall be:

(a) Equipped with fittings for being lifted/ moved by a lifting device, or

(b) Designed in a way, to allow the attachment of above type fittings, e.g. threaded holes, or

(c) Designed/ shaped in a way, to allow easy attachment to the lifting device or transportation means.

17. LABELLING & MARKING

17.1 All equipment and apparatus, inside or outside the switchboard, including instruments, meters and relays shall be labeled or marked adequately.

17.2 In addition, warning labels shall be fitted at all points, where the removal of covers/ panels may expose live equipment, operating above 50V between circuits or to earth and shall bear the inscription 'Danger- Live Parts' in red color that is clearly visible from a viewable distance.

18. PACKING, SHIPPING & DELIVERY

18.1 All equipment shall be properly inspected before the shipment. An inspection tag bearing the word "INSPECTED" or "INSPECTION PASSED" giving details of the inspection date, etc. shall be attached to the Packaged Consignment. All four sides of the packaged consignment shall contain details of the Consignee, Consignor and Contract no.

18.2 Appropriate caution notices such as "Fragile" or "Handle with care" or "Keep Upright" etc. along with internationally accepted visual display symbols shall be displayed on the outside surface of the boxes, crates and packages.

18.3 The Contractor shall be responsible for the safe transportation and delivery of materials to the location, as specified by the purchaser.

19. INSTALLATION & COMMISSIONING

19.1 All works at the installation site shall be carried out in accordance with the standard acceptable methods and practices of installation of elevators and electrical equipment.

19.2 The Elevator Contractor shall be responsible for the timely and proper setting out of the Works which shall include verifying the positions, levels, dimensions and alignment of elevator pits, supports, shaft, walls and floor openings, etc. Any error in the civil construction in so far as they relate to the Works shall be immediately brought to the attention of the "Engineer" and the Designated Contractor to allow prompt rectification by the Designated Contractor so as to avoid delays to the Works. The Elevator Contractor shall not be entitled to claim for any additional costs incurred by him arising out of such errors in the civil construction, if such additional costs could reasonably have been avoided had the Elevator Contractor carried out timely and proper setting out of the Works.

19.3 Once the elevator shaft is handed over to the contractor to commence installation, they shall be responsible for providing fencing and barricades to protect his working areas during the installation period for the safety of his workers and other personnel working in the station until the taking over of the lift by Railways.

19.4 The Elevator Contractor shall be responsible for the installation of all guide rail brackets, separator, sill supports, hanger brackets including drilling and all related materials. The Elevator contractor shall verify and satisfy themselves in respect to the loading capability of the shaft wall holding the bracket etc. If the Elevator Contractor feels that load test is necessary/ required, then he can arrange the same in co-ordination with civil contractor.

19.5 All equipment, sub-assemblies, structures, etc. shall be installed as per the respective sub-contractor's installation instructions.

19.6 Special care shall be taken for leveling/ plumbing, which shall be done meticulously before any equipment, sub-assembly or structure is fixed finally in position.

19.7 Adequate care shall also be taken during installation of the complete Elevator to avoid damage to any equipment, sub-assembly or building structure.

19.8 Railways will be responsible for the civil engineering works required for installation and commissioning of elevator at the designated locations. The Contractor will provide a terminal board near elevator and Railways will provide electrical wiring and earthing upto this terminal board. Railways will provide site assembly area with proper power connection as per the extant rules. For more details on railways' scope of work, please see Cl. 2.9.

20. ON-SITE SUPPORT TO CONTRACTOR

20.1 The purchaser/ user railways would extend facilities on free-of-charge basis, to the Contractor for storing: the product; and installation,

testing and commissioning equipment/ tools/ accessories, etc., at a suitable location, as close as possible to the installation site.

20.2 This shall include providing a separate lockable/ secure material-storage cum site office with electrical supply, light and fan fittings, etc.

21. AFTER SALES SERVICE

21.1 The bidder shall indicate in the offer, the facilities available with the bidder or local agent for providing the required after sales service during warranty and post warranty periods. The bidder will also mention service organizations located in India and the availability of trained staff and maintenance spares, etc.

21.2 The Contractor shall provide and ensure servicing facilities throughout the warranty period of the system. After the warranty period is over, the Contractor should give service support for trouble shooting and for obtaining spare parts for AMC period.

21.3 The Contractor shall during the contractual warranty period and (if applicable) AMC period, ensure that, in case a consignee reports a failure, qualified service engineers visit the site within 24 hours from the time of complaint. The firm should provide a toll free number for registering complaints however firm should respond to any complain registered by consignee via toll free number, fax, e-mail, per bearer at address given by the Contractor or through any other means. The responsibility to keep the current failure reporting address/contact number/email address/fax number details will rest with the consignee.

22. MAINTENANCE

22.1 The Contractor shall provide free-of-charge maintenance service (and all the works specified) including required spares, for the specified warranty period.

22.2 During the warranty period, the above maintenance service shall include all preventive, scheduled and corrective maintenance and additionally, all service-request calls made by the purchaser/ user railways. For this, the Contractor would be required to provide a comprehensive maintenance and service plan, for review and acceptance by the purchaser or his authorized representative.

22.3 The maintenance work-system shall ensure safety of the personnel and equipment.

22.4 In event of any failure, requiring design modifications, etc. in the Elevator, the Contractor shall undertake to submit its details for a review by the Purchaser or his authorized representative. On reaching consensus and post-modification, the Contractor shall undertake fresh testing and re-commissioning, if required.

22.5 Annual Maintenance Contract (AMC)

22.5.1 The bidder is required to quote separately for a comprehensive annual maintenance contract (AMC) for the Elevator supplied

against the specification, which will be inclusive of all spares, material and labour costs along with work schedule if required to do so as per special condition of the tender documents.

22.5.2 The contractor shall be responsible to keep all the Elevators along with all connected ancillary equipments/apparatus/ machines, as have been stated under the scope of work and specification, in perfect working condition, on any day during the tenure of the contract (excepting the period of programmed shut down). In case, any Elevator is out of order, for failure/ breakdown of the Elevator or of any other related/ancillary equipments/apparatus/machines, the Elevator shall be attended immediately, within a period of 24 hours of being informed.

22.5.3 The consignees should communicate their option to enter into AMC reasonably in advance. The AMC agreement should be signed in time so that the elevators do not remain without maintenance cover after the expiry of warranty.

23. TRAINING

The Contractor shall package all training instructions/ demonstrations for correct operation and maintenance of the Elevator into a three working days self contained training program. The contractor shall organize one training programme per 20 nos. Elevators ordered. For orders less than 20 nos. Elevators, at least one training programme will be organized. For orders that are not integer multiples of 20 nos., rounding off will apply (e.g. for 50 nos. Elevators, 3 nos. training programmes will be organized). The training programme(s) will be held in India only at contractors' head office or at any other location as agreed between railway administration and the contractor.

24. OPERATION & MAINTENANCE MANUAL

24.1 The Contractor shall provide operations and maintenance manuals, for the use by the supervisory, operating and technical staff of the purchaser.

24.2 Each manual shall be divided into indexed sections explaining the subject matter in logical steps. Soft copy of manuals should be in searchable PDF format. The soft copy should be such that if required by the Railways multiple copies can be made from the original soft copy of manual.

24.3 The operations manual shall contain the principle and operational details of the complete system under the normal and emergency conditions.

24.4 Details of the common faults that might occur in the complete system &/or any of its key components/sub-assemblies and their rectification shall also be included.

24.5 The maintenance manual shall contain the maintenance and servicing instructions for the complete system along with explanatory notes and drawings as necessary.

24.6 The periodic maintenance schedule recommended by the Contractor for the satisfactory performance of the system shall also be included.

24.7 Elevators being a critical public safety item, a draft of operations and maintenance manual should be submitted to the purchaser for approval with regard to its completeness and comprehensiveness. The final version of operations and maintenance manual should be issued on the basis of purchaser's comments.

24.8 It is recommended that the operation and maintenance manuals be shipped along with the Elevator shipment. In any case, Operation and Maintenance manuals are to be supplied to railways well before final testing/ commissioning of Elevators.

25. QUALITY ASSURANCE

25.1 The Bidder shall prepare and furnish their QA plan documentation, as per their ISO: 9000 program being followed. It shall include and clearly mention the procedures ensuring that all equipment/ materials/systems & sub-systems are properly specified, designed, purchased, recorded, inspected, installed and tested at appropriate stages.

25.2 It shall also provide the confirmation that the handling, storage and delivery arrangements have been satisfactory.

25.3 The Contractor shall prepare and submit a Quality Assurance programme in accordance with requirements contained in the Specification.

ANNEXURE - 1

THIS PERFORMA MUST BE FILLED IN BY THE PURCHASER FOR EACH ELEVATOR AND SHOULD BE PART OF TENDER DOCUMENT

Name of the Railway Station/Building: ……

S. No.	Description	Parameter	Information
1.	Is the Elevator required for: transfer between FOB and platform at Station; OR a Building (please refer Cl. 2.2)		
2.	Capacity ~~(13/20/26 persons)~~	in Persons	
3.	Elevator Speed (in respect of elevator to be utilized in applications other than transfers between FOB and the level below) (please refer Cl. 5.7.2)	in m/s	-
4.	Car travel height	in meters	-
~~#~~5.	~~Are the Car dimensions required to be different from the standard dimensions mentioned in IS 1790014665. at Cl. 11 (sr. no. 3) of the spec.?~~	~~Yes/No~~	
	~~If yes, then the purchaser shall need to furnish the alternative dimensions. Care has to be taken that the car dimensions should comply the conditions of variations given in the IS 14665. inside area should remain the same as specified in Cl. 11 (sr. no. 3).~~	~~If yes, then please furnish:~~ ~~W_e (in mm)~~ ~~D_e (in mm)~~ ~~(W_e: width of the car and D_e: depth of the car)~~	
6.	No. of stops		-
7.	No. of car doors required (at many sites, due to space constraints, 2 sets of car doors become necessary) (please refer Cl. 2.9.1 & 6.10.1.1 (ii))		
~~8.~~	~~Regenerative drive requirement (please refer Cl. 5.2)~~	~~Yes/No~~	~~-~~
9.	LED based Elevator Status Display Panel (ESDP) requirement (please refer Cl. 6.22)	Yes/No	-

10.	Type of station (i.e. underground or overground) (please refer Cl. 2.2)		
11.	Is hanging pit involved at the site? (please refer Cl. 5.13)	Yes/ No	
12.	Approx. cabling distance from elevator to Station Control Room (SCR) (please refer Cl. 6.17.5 and Cl. 6.22.10)		
~~#13.~~	~~Will Car doors be different from the standard dimensions stated in IS 14665 at Cl. 11 (sr. no. 40)?~~	~~Yes/ No~~	
	~~If yes, then the purchaser shall need to furnish the alternative dimensions. (the alternate dimensions asked for by purchaser must be consistent with the limits prescribed in Cl. 11 (sr. no. 40))~~	~~If yes, then please furnish:~~ ~~W_{ed} (in mm)~~ ~~H_{ed} (in mm)~~ ~~(W_{ed}: width of the car door and H_{ed}: height of the car door)~~	
~~#~~14.	Is 3-D infra red curtain required? (Cl. no. 6.10.3.2)	Yes/ No	
15	Shaft/well type	RCC/steel structure	
16	Requirement of Machine room	Yes/ No	

Note:

1. In respect of Sl. No. 3, in absence of any specific mention by the purchaser, the requirement will be deemed to be 1 m/s for upto 6 stops and 1.5 m/s for 7 to 13 stops.
2. In respect of Sl. No. 7, in absence of any specific mention by the purchaser, the requirement will be deemed to be 1 set of car doors.
3. ~~In respect of Sl. No. 8, in absence of any specific mention by the purchaser, it will be deemed that regenerative drive is not required.~~
4. In respect of Sl. No. 9, in absence of any specific mention by the purchaser, it will be deemed that ESDP is not required.
5. In respect of Sl. No. 10, in absence of any specific mention by the purchaser, the requirement will be deemed to be for overground station.
6. In respect of Sl. No. 11, in absence of any specific mention by the purchaser, it will be deemed that hanging pit is not involved.
7. In respect of sl. No. 15 & 16, in absence of any specific mention by the purchaser, the shaft /well will be deemed as RCC type and machine room less.

~~# The points mentioned against # are applicable only for metro railway~~.

ANNEXURE - 2

DETAILED TESTING & INSPECTION PLAN

Type of Inspection / Testing	Where	Frequency	When	On What	Who Conducts	Final Action
Type Testing of complete Elevator	Relevant manufac-turer or supplier's works/ Third party	Refer cl. no. 14.1.1 ~~For each contract. For repeat contracts, if there is a design change or if reliability is below the target.~~	Latest before Commissio ning of the first Elevator	Complete Elevator	RDSO	RDSO issues "Elevat or type test clearan ce".
Type Testing of Elevator Sub-systems	Relevant manufact urer/ supplier's works/ Third party	Refer cl. no. 14.1.1 ~~For each contract. For repeat contracts, if there is a design change or if reliability is below the target.~~	Latest before Commissio ning of the first Elevator	Elevator's Key Sub-assembli es.	Internationally accredited testing Agency/ Lab (approached by relevant contractor). RDSO may accept certified copies of above Type Test certificates, in-lieu of actual Tests. RDSO representative may choose to be present himself to witness any test, at its own discretion.	

Type of Inspection / Testing	Where	Frequency	When	On What	Who Conducts	Final Action
Routine testing	Relevant manufact-urer/ supplier's works	Each order and each Elevator	During manufacturing	Elevator's Key Sub-assemblies	- Relevant contractor, by their In-house QC. - However, testing authority may accept certified copies of the above Test Results/ Reports, as sufficient evidence of the execution of the Routine Tests &/or choose to be present himself to witness any test, at its own discretion.	Testing authority issues "Elevator routine testing approval certificate".
Pre-dispatch verification of packing list	Elevator Contractor's works	Offered dispatch Lot	Before dispatch of the complete Elevator to installation Site	Complete Elevator Kit.	Purchaser's representative/ testing agency.	Testing agency issues "Dispatch approval certificate".
Final acceptance inspection/ testing	At the installation site	Each order and each Elevator	After installation & commissioning of the complete Elevator & after all the above mentioned Tests are satisfactorily completed	Complete Elevator.	Contractor in presence of purchaser's representative/ testing authority.	Purchaser/ Testing authority issues "Elevator final acceptance certificate".

ANNEXURE-3

TYPE, ROUTINE & ACCEPTANCE TESTS

Part A1: Type Tests on Complete Elevator#

1. One complete Elevator shall be made available for type testing. The selected Elevator shall be representative of the types to be supplied.
2. Complete Elevator system including traction drive system, in addition to the controller, Elevator car enclosure, landing and car doors, protection devices and call fixtures shall be assembled on a test rig or inside a test tower to undergo comprehensive running and functional testing to verify compliance with the Specification.
3. The tests shall include the following minimum requirements:
   a) Verification of the suitability of the traction drive system;
   b) Verification of the car operation and response to call fixtures, door operation including the safety edges, all indications and signalling features, and car top control features;
   c) Full load tests on safety gear;
   d) Measurement of electrical readings and verification of the operating speed under various loading conditions;
   e) Verification of riding comfort and levelling accuracy under various load conditions.
   f) Verification of the fault indication and fault diagnosis features.
   g) Verification of the construction of the various control panels to the specification shall be done. Insulation resistance and high voltage tests shall be conducted in accordance with the test protocol.
   ~~h) Any additional testing as required by BS 5655 Part 10.~~
   i) A 12-hour duty cycle test, during which the Elevator shall run continuously with the contract load for 12 hours and shall travel up and down with intermediate stops such that the number of starts per hour as specified.
   j) Complete functional tests on the isolating transformer and ripple filter if provided
   k) Operation of the battery back-up device and the battery operated power supply.
   l) Simulation of the emergency homing sequence during fire and power failure.
   m) Evidence in support of quality of welding and casting processes (e.g. radiographic examination reports, etc)

For certain tests, the type testing authority i.e. RDSO may choose to rely upon previous type test reports/conformance certificates, as long as they pertain to similar design and comparable rating. However, the manufacturer cannot demand this as a matter of right

Part A2. Type Tests on Elevator Sub-systems#

The type testing authority i.e. RDSO shall generally witness the following set of type tests for the purpose of safety verification (the list of tests can be enlarged, if required)

S. No.	Key Sub-Assy./ Part of Elevator	Frequency	Scope of Test
1.	Driving motor	1 unit	Insulation test: i) Insulation resistance of windings using 1000V megger shall not be less than 200 M Ohm. ii) Insulation resistance of thermistors subject to 1000V for 5 seconds shall not be less than 200 M Ohm. Windings shall be earthed. iii) Main winding shall be pressure tested to 2000V r.m.s. for 60 seconds. During this test, thermistor wires shall be grounded to earth. iv) Cold resistance of windings shall be recorded before start of test.
			Total harmonic distortion test

S. No.	Key Sub-Assy./ Part of Elevator	Frequency	Scope of Test
			Dynamic test: i) No load current and speed shall be recorded at rated voltage and frequency for the windings. ii) Full load, 75%, 50% and 25% load tests shall be carried out at rated speeds and rated voltage and frequency. Current, torque and speed shall be recorded for each load. Input power, efficiency and power factor shall be established and recorded for each. iii) Temperature rise test on full load shall be carried out on the windings. Voltage shall be 415V. Frequency shall be as rated. iv) Ambient temperature, casing temperature, input power voltage, and current shall be recorded at 15 minute intervals for the first two hours and 30 minute intervals subsequently until temperature levels off. v) When the temperature has levelled off, the motor shall be switched off and the winding temperature rise shall be established using the resistance method as specified in BS 4999 Part 101. vi) A momentary overload of 200% of rated torque/full load shall be applied for 15 seconds. The motor shall not stall or abruptly change speed. vii) A locked rotor test (where applicable) shall be carried out at rated voltage and frequency for the windings. Current and Voltage shall be recorded and Torque calculated. viii) The voltage, current, power, efficiency, power factor vs. torque characteristics shall be drawn from the results obtained.

S. No.	Key Sub-Assy./ Part of Elevator	Frequency	Scope of Test
2.	Controller	1 unit of each type of controller	a) Physical construction check. The construction of the control cubicle shall be checked against the agreed drawings. Facilities to padlock incoming fused isolator shall be checked. Verification of the protection classification shall be conducted and/or provided. b) High Voltage and other Tests: ~~i) Earth leakage circuit breakers shall be tested on both poles. The current and time required to trip shall be recorded. Similarly, the dc earth leakage unit shall be tested and values should be recorded.~~ ii) High Voltage testing at 2000V ac r.m.s. for 60 seconds between: phase to phase and phase to earth. iii) Control wiring itself shall be pressure tested at 1,500V ac r.m.s. for 60 seconds between control/auxiliary wiring and frame. Insulation tests shall be carried out before and after the above tests by a 1000V insulation tester. The insulation resistance thus measured shall not be less than 200M ohm. iv) All protection on electronic circuits shall be tested by a 500 V insulation tester. Wiring to all electronic components shall be meggered. v) Verification of the protection circuit shall be carried out in accordance with the approved procedures. Temperature rise during the tests shall be recorded and verified. c) Electrical tests, such as: - Functional test - Protection circuit verification - Temperature rise test

S. No.	Key Sub-Assy./ Part of Elevator	Frequency	Scope of Test
3.	Braking system	1 unit of each type of brake	-- Dimensional check to verify compliance with the manufacturing drawings -- Property tests like starting voltage, Release voltage, delay time, Insulation resistance in cold and heated condition, temperature rise -- Reliability/endurance test -- Full functionality test -- Demonstration of brake adjustment and settings
4.	Elevators Inter-communication System	1 set	Full functional test
5.	Environmental tests on Control cards	1 unit of each type of control card	
6.	Landing Door Fire rating	-	~~Two hours~~ Test certificate
7.	Buffer	-	Load vs. deflection test report
8.	Cables	-	Test certificates of each type of cable
9.	IP protection for all applicable items	-	Test certificate
10.	Wire rope/belt	-	Test certificates of each type of rope/ belt
11.	Overspeed Governor	-	Test certificate
12.	Fan and Light	1 unit of each type	Test certificate
13.	Door IP protection		Test certificate
14.	Materials used		Test certificate

For certain tests, the type testing authority i.e. RDSO may choose to rely upon previous type test reports/conformance certificates, as long as they pertain to similar design and comparable rating. However, the manufacturer cannot demand this as a matter of right

ANNEXURE - 3; contd...

Part B: Routine Tests

S. No.	Key Sub-Assy./ Part of Elevator	Frequency	Scope of Test
1.	Driving machines	Random	-- Insulation resistance of winding -- High voltage test (2kV for 1 min.) on the stator winding
		100%	-- Dynamic test for a period of 4 hours continuously without stopping, except for changing of direction, 2 hours in each direction, at rated speed and 25% load conditions. The test is to ensure that no undue vibration or abnormal temperature rise occurs in any component.
2.	Power Supply units	100%	The assembled power supply unit shall be checked in accordance with the test protocol along with surge protectors, power filters, etc.
3.	Main Control Cubicle / MAP Panel /ARD/ & other panels where provided	100%	-- The complete control cubicle shall be checked with a simulator to verify correct wiring connection and function of the electrical/ electronic devices. -- Insulation resistance of the control wiring and electronic components shall be conducted in accordance with the test protocol.
4.	Call Button and Fixtures	Random	-- Visual check for manufacturing quality -- The assembled fixtures shall be inspected and functionally tested accordance with the test protocol.
5.	Hoist & Governor Rope/belt	Random	Manufacturer's certificate or sample test
6.	Overspeed Governor and Safety Gear	Random	Manufacturer's certificate or sample test

S. No.	Key Sub-Assy./ Part of Elevator	Frequency	Scope of Test
7.	Car Enclosure and Door Assembly	Random	-- Visual & dimensional checks and Layout -- Quality of the finishing and to ensure the correct type of materials -- Protection of the finished assembly shall be inspected in accordance with the test protocol.
8.	Evidence in respect of quality of welds or castings	Random	

Annexure-3; contd...

Part C1: Acceptance checks (Elevator Site Checking and Inspection)

A test and inspection protocol shall be prepared for each of the following critical phases of work. Following are the minimum requirements:

a) Setting out the plumb lines;
b) Erection and alignment of guide rails and rail brackets
c) Erection and alignment of landing doors, jamb, sills, header, etc.
d) Erection of Elevator shaft and Elevator pit equipment;
e) Erection of car enclosures;
f) Positioning of machine equipment and control cubicles;
g) Installation of the hoist ropes/belt and governor rope
h) Erection of landing fixtures and car fixtures;
i) Installation of hoist way and Head room trunking prior to installation of wiring;
j) Installation of wiring and cabling
k) Installation of car fixture and car top equipment
l) Earthing and bonding checks

ANNEXURE - 3; contd...

Part C2: Final Acceptance Inspection & Testing

S. No.	Elevator's Parameter/ Feature To Be Inspected/ Tested	Scope of Test
1.	Tests shall be carried out on each Elevator in accordance with the relevant provisions of BS 5655 Part 10, which shall include but not be limited to the following:	
i.	Starting current, running current and supply voltage	Readings shall be taken at the rated speed of each Elevator in both directions of operation under no load, balanced load and full load conditions.
ii.	1000 V AC testing	Both power and control wiring of the controller shall be tested between lines connected together and earth at 1000V 50Hz for 1 min. The control wiring shall be separately tested between poles and earth. Immediately following each test, a 1000 V dc insulation tester shall show an insulation resistance of not less than 3 M ohms. All field wiring shall withstand a 1000 V megger test on site and each conductor shall show an insulation resistance to earth of not less than 3 M ohms.
iii.	Over-speed governor	(a) Shall be tested to ensure that it will activate when the speed exceeds the limits prescribed in the spec. (b) Functional tests on the safety gear with no load at rated speed by manually tripping the governor.
iv.	Test on the car and landing doors system	(a) Checking of the condition of the landing and car door for smooth operation, (b) Functional tests on the door closing time, door speed, re-opening, safety edge, proximity detection landing and car door contacts of the door lock.
v.	All the landing call buttons, indicators and	Functional tests

	all function provided in key-switch operated cabinet mounted below the car operating panels	
vi.	Emergency call buttons	Functional tests
vii.	Final limit switches, terminal slow down and terminal over travel limit switches	Functional tests
viii.	Following safety switches and devices: a. Overload device. b. Phase protection device. c. Floor levelling accuracy and re-levelling at different loads. d. Over current protection device. (e) Counterweight safety (if applicable)	Functional tests
ix.	UPS unit	-- Functional tests -- 2 hour duration test
x.	Car top maintenance panel	Functional tests
xi.	Intercom system	Functional tests
xii.	Buffer	Compress buffer test
xiii.	Clearance	Running clearance tests
xiv.	Elevator management, monitoring and fault diagnostic system	Functioning test
xv.	Noise/ sound level	Noise level of the complete Elevator, individual machinery and inside car with fan operation
xvi.	Automatic Rescue Device/ Battery backup device	-- 6 time operation without intermediate charging to be done
xvii.	Track machine, motor brake and control equipment.	Complete function tests. Temperature readings of Elevator controller and equipment shall be taken every fifteen minutes for at least 2 hours or the duration of test whichever is longer
xviii.	Floor levelling accuracy and re-levelling at different loads	Functional test

xix.	Emergency Power and Fire operation	In event of power failure and/ or fire, the elevator should operate in a manner as laid down in the spec.
xx.	Functional tests of all features and functions not included in the above but required as per this specs and EN 81-~~1~~20.	
2.	Twelve Hour Run	Each Elevator shall run continuously with the rated load for 12 hours and shall travel up and down with intermediate stops such that the number of max starts is as per the specification. Railways shall arrange uninterrupted power supply for the said period. If uninterrupted supply is not available, 12 running hours period shall be ensured with minimum interruptions. Modalities for the same may be worked out between the contractor and the purchaser.

Note: The contractor shall prepare comprehensive test protocols, integrating the requirements of EN–81, ~~IS–14665,~~ IS-17900 as also Annexure-3 of this spec. and obtain RDSO's approval for the same.

Annexure-4

Emergency instructions:

आपातकालीन निर्देश

बिजली जाने पर लिफ्ट हल्के झटके के साथ रुक जाएगी, लिफ्ट की इमरजेंसी लाईटे जलती रहेंगी।

- **धैर्य रखें। आप लिफ्ट में सुरक्षित हैं :**

लिफ्ट कुछ सेकंड के अन्दर स्वयं चलेगी। दो मिनट के अन्दर लिफ्ट अपने गंतब्य पर पहुंचेगीदरवाजे स्वतः खुल , । जायेंगे

- **लिफ्ट के दरवाजों के साथ छेड़छाड़ न करें यह खतरनाक है, एवं सुरक्षा प्रणाली को बाधित करेगा।**

यदि लिफ्ट न चले -: तो कृपया यह काम करें ,

(1)	आपातकालीन अलार्म बटन दबाएँ	
(2)	आपातकालीन नंबरों पर बात करें	

संपर्क नंबर :

असुविधा के लिए खेद है।

Emergency Instructions

In case of power failure, the lift will stop with a slight jolt.

The emergency lights of the lift will be working.

- **Be Patient: You are safe in the lift.**

The lift will start automatically in few seconds. Within 2 minutes lift will reaches to its destination, the doors will open automatically.

- **Do not tamper the lift doors, it is dangerous and will interrupt the security system.**

If the lift does not start, please do the following:-

(1)	Press the emergency alarm button	
(2)	Call emergency numbers	

Contact Numbers:

Inconvenience caused is deeply regretted.