MAHARASHTRA STATE POWER GENERATION CO.LTD.
(MAHAGENCO)

1X660 MW BHUSAWAL TPS UNIT-6

TECHNICAL SPECIFICATION
FOR
ELEVATORS

SPECIFICATION NO.: PE-TS-415-502-A001, Rev-01

BHARAT HEAVY ELECTRICALS LIMITED
(A Govt. of India Undertaking)
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, U.P
INDIA

INDEX

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

IA – Specific Technical Requirement (Mechanical)

SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

1.1 This specification includes, but not limited to, design (i.e. preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, material selection, manufacture, fabrication, assembly, inspection, testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables, mandatory spares (if applicable) along with spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, minor civil works, erection & commissioning, carrying out trial run at site, preparation of drawings in 3D (if applicable) and carrying out acceptance /performance guarantee/Functional/Demonstration tests at site (As applicable), training of customer/client O&M staff (if applicable) & final handing over to end customer in flawless condition for elevator package complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order for **1X660 MW BHUSAWAL TPS UNIT-6 in Maharashtra State** and necessary accessories including supply of mandatory spares, erection and commissioning spares, special maintenance tools and tackles etc.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the responsibility of providing such facilities to complete the supply, erection and commissioning of the **Elevators** and its accessories.

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Section-III of the specification**.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the Deviation schedule enclosed with NIT; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context.

1.11 The standard quality plan is included in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the quality plan as minimum requirement during manufacturing and testing.

1.12 Site Visit before submission of offer.

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details wrt existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

1.13 Compliance cum confirmation certificate is to be accepted by bidder without any modification.

1.14 Other requirements

Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

1.0 Introduction

Passenger elevator shall be provided for access to various operating floors / platforms in TG Building, Service Building, & ESP Control building for 1X660 MW BHUSAWAL TPS UNIT-6 to facilitate movement of operating and maintenance personnel.

2.0 Scope of equipment supply and services

2.0.1 Design, Engineering, Manufacture, Inspection & Testing at manufacturer's works or at their sub-vendor's works, painting at manufacturer's or at their sub-vendor's works, duly packed for transportation to site, delivery to site, storage and handling at site, mandatory spares, Erection & Commissioning, carrying out trial run and Acceptance / functional tests at site & final painting of Passenger Elevators for 1X660 MW BHUSAWAL TPS UNIT-6 as listed below: -

Sl. No	Building	No of Lifts	Cap.	No of landings	Total Rise	Type	Rated Speed	Type of floor
1.	TG Building	1 No.	2000 Kg	0.0M, 8.5M, 17.0M, 24.0M, 32.5M & 38.0M (Six (06) including Ground)	38.0 M	Passenger cum Goods Elevator Conventional Type.	1 m/s	MS chequered flooring base & framework with shock absorber
2.	Service building	2 Nos.	884 Kg	0.0M, 4.25M, 8.5M, 12.75M & 17.0M (Five (05) including Ground)	17.0 M	Passenger Elevator Conventional Type.	1 m/s	MS chequered flooring base & framework with shock absorber
3.	ESP Control Room Building	1 No.	680 Kg	0.0M, 3.7M, 8.7M & 12.4M, 17.3M (Five (05) including Ground)	17.3 M	Passenger Elevator Conventional Type.	1 m/s	MS chequered flooring base & framework with shock absorber

2.0.2 Elevator shall include but shall not be limited to the following: -

1) Elevator car with SS 304, 1.5 mm (min) thick sheet of hair line finish.

2) Guide rails for car and counterweights.

3) Counterweight.

4) DCEM brakes.

5) Spring buffer for car and counterweight.

6) Driving arrangement including motor, gear box, sheaves etc.

7) All electrical equipment including power cable, control cable, controller panel, safety devices including push buttons, limit switches, safety switches, indicators etc.
8) Isolating switch / MCBs.

9) Car doors, car ceiling and hoist way doors of SS 304, 1.5 MM (min) thick sheet of hair line finish.

10) Car operating panel, digital control, car position indicator at all floors, luminous hall buttons, auto door operating mechanism, alarm bell, car light & car fan.

11) Intercom connection through EPABX.

12) Ropes for hoisting.

13) Circuit breaker, switch fuse unit etc. in machine room for terminating the power supply cable (power supply cable provided by purchaser up to machine room level), other power/control and trailing cabling and equipment earthling.

14) Ladder in pits.

15) Emergency light with rechargeable battery.

16) All fixing materials require fixing rails, brackets, equipment including nuts and bolts.

17) Fascia plates (750 mm minimum) & sill angels.

18) Full length infra-red Curtain safety feature in door along with pressure limiter as an extra mechanical safety.

19) Any other equipment required to meet the requirement of local statuary and regulatory body and prevailing lift etc.

20) Car lighting, LED along with fittings for illumination level of 100 lux.

21) Elevator shaft, pit cable conduit fixtures, switches 3 pin or as required by bidder during erection / maintenance purpose at every 3 m.

22) Mirror for the car rear panel.

23) Floor announcement cum music system to be provided.

24) Maintenance tools and tackles along with un-priced list with the offer.

25) Three (03) sided SS- mirror finish hand railing at suitable height.

26) Minor civil work including grouting as well as foundation bolt grouting as required during installation of elevator.

27) Bidder shall include scaffoldings required in their scope of supply for erection.

28) Automatic rescue device with battery drive - Modern advanced electronic drive system of rescuing passenger trapped in an elevator shall be provided.

29) Emergency safety devices - The lift shall be provided with safety device attached to the lift car frame and sustaining the lift car up at governor tripping speed with full rated load in car.

30) All steel embedment for fixing landing doors / indicators etc. to the elevator well shaft and fascia plate shall be supplied by the bidder.

31) Guide rails complete with supporting brackets for the car and counter weights.

32) Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drives and control mechanism. All foundation anchor bolts, sleeves, anchoring steels and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel etc. and other anchorages.

33) Any other steel works as well as all other accessories / components not specified in the technical specification but necessary for making the elevator complete.

34) All minor building works including the supply of steel items, associated with installations of equipments in the machine room hoist way, hoist way door, frames and elevator pit, shall form part of bidder's scope of supply & service, BHEL / customer will provide the elevator well complete with foundation and brick walls around the lift well together with overhead machine room. The machine room will be provided with RCC floor slab with necessary pockets for anchor bolts and slots.

35) Dummy landing/s, as required in case travel between two consecutive landings is more than 11 m, shall be considered by bidder in his offer.

36) Any other requirement stipulated by state statuary body and prevailing local lift act requirement shall also to be included by bidder in their scope.

37) Bidder shall use latest IS 14665 (all parts) for outline dimensions of elevator & shaft, installation, operation, maintenance & inspection and testing and for elevator components design.

38) Mandatory Spares:

A complete unused and new set of Mandatory Spare parts shall be supplied. The items supplied shall be of the best quality and specially protected against rusting in tropical climate. The minimum requirement of mandatory spare parts is listed in Annexure –II section-IA of this specification.

39) Split Air conditioner (reputed make) of min 2 Ton capacity in the machine room which includes fans, air filter and accessories to prevent dust ingress in the machine room. However, successful bidder shall furnish the heat load calculation and capacity of air conditioner after considering all actual heat loads of elevator machine room during detail engineering stage for selection of final capacity of air conditioner.

40) 1/2 Kg CO2/suitable type Fire extinguisher in bidder scope. Fixing arrangement shall be provided in Car accordingly.

NOTES:

1) Flooring for elevators shall be as per scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification with MS steel frame suspended on the car frame with spring isolation element as indicated in the Data sheet.

2) Functional Guarantee test shall be carried out at site for over speed test and over load test, travel and hoist speed checks as per latest IS :14665. Bidder shall refer the requirement mentioned elsewhere in this specification.

3) Car, landing door and car ceiling shall be of SS-304 sheet with thickness (min) 1.5 mm.

4) Min dimensions as specified in applicable IS 14665 (all five parts) shall be considered / provided for lift shaft / pit / car / M/c Room. Safety requirement shall be as per latest IS 14665 (Relevant part). Bidder to refer the civil input drawings attached in the specification for different buildings.

5) Elevators pit for TG Building, Service Building and ESP Control Building shall be bare pit (i.e. pit without any RCC block / pedestal for buffer for CAR & CWT). Accordingly, MS structure & buffer required for elevator resting shall be provided by bidders.

6) All Equipment's / facilities needed for erection & commissioning shall be in bidder's scope.

7) Bidder to note that all LT Power cables (Fixed power and control cables etc), Trailing cable and instrument / signal cable for elevator shall be as per electrical

specification. The circular trailing cables shall be either in accordance with IS 4289 Part-I (elastomer insulated) or IS 4289 Part II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC 60227-6.

8) Make of various bought out items & QAP shall be subject to approval of BHEL / Customer during detail engineering stage without any commercial implication at contract stage.

9) Bidder shall supply erection and commissioning spares as required during E&C stage without any commercial implication.

10) Car frame and structure (guide brackets, supports, MS Structure for buffer car & counterweight, etc) shall be painted with epoxy based paint for all elevators.

11) Protection class for Elevator traction machine (elevator motor) shall be IP 55 & Protection class for door motor shall be IP 54 and main control panel shall be min IP 54 and elevator control shall be VVVF type. Push buttons, Car operating Panel, Landing Operating Panel, and other equipment shall be IP-54.

12) Factor of safety for rope shall be 12 (min).

13) All Landing door shall be fire rated for at min 2 hours or as per latest IS / as per the state statutory requirement whichever is more stringent.

14) Motor shall be S4 duty with insulation class F & temp rise limited to class B.

15) Bidder shall submit the following documents (min) for BHEL/customer approval during detail engineering stage: -

a) General arrangement of Elevator
b) Technical data sheet of elevator
c) Technical data sheet of motor along with power, control and trailing cable details
d) Wiring schematic diagram
e) MQP for elevator along with test procedure of various components.

16) Bidder shall comply to the quality requirements as enclosed with specification. Quality plan shall be submitted by the successful bidder for approval during detail engineering.

17) Bidder shall confirm that supply, installation and commissioning of elevator shall be completed within project schedule as indicated elsewhere from placement of intent / letter of intent.

18) Bidder shall be responsible for obtaining all necessary approval from statutory and regulatory body and lift inspector. However, purchaser will furnish required information time to time basis, if required.

19) Elevator shall be provided with AC VVVF type drive control system.

20) The local statutory clearance approval / permit board shall be placed on lift cabin.

3.0 SCOPE OF SERVICES

Scope of services will broadly include the following: -

1) Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection of complete elevator package.
2) Painting of all equipments / items within the battery limit.
3) Unloading, storage, handling and transportation at site for all items of elevator.
4) Minor civil and structural works shall be carried out by the bidder if required at site for which no additional commercial implication shall be entertained by BHEL.
5) Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities, if any, shall be arranged by the successful bidder at their own cost.
6) Functional testing of complete elevator package.
7) Preparation of civil input drawings including elevator pit, shaft, machine room etc.
8) Preparation of all necessary drawings / data sheets / documents / calculations as required for obtaining necessary local administration permits / approval from statutory authority and make arrangements for inspection and tests required thereby for necessary approval on behalf of the customer. Fees as required for obtaining approval from statutory bodies shall also be included in the scope of work of the bidder.
9) Any other service as required for making the installation complete in all respect and satisfactory erection and commissioning of the system.
10) Relevant requirements as per GCC, ECC & SCC.

4.0 Exclusion

1) Complete civil works for hoist way, machine room, pit complete with the side enclosure (brick / RCC), interconnecting platform (if any) and monorail beam.

2) Electric hoist with travelling trolley of 3T capacity to facilitate handling of equipment in the machine room.

3) Power supply cable (AC 415 V, 3 Ph, 50 Hz) up to machine room level & earthing at one point in machine room. Further cabling (all cables including power, control, earthing and instrumentation as per tender specification) shall be provided by the bidder.

4) Electrical exclusion as per separate scope sheet attached in the specification.

5.0 Operation

Elevator shall have provision to meet followings operational requirements: -

a) Selective simplex / duplex collective (As applicable), automatic operation with or without attendant through illuminated push button station located inside the lift car.

b) Door operating shall be automatic door operation and electronic door protection system for opening / closing of car and landing doors.

c) Bidder shall provide car operating panel with luminous buttons, car position indication in car (both visual and audio) combined with direction arrows, overload warning indicator, battery operated alarm bell and emergency light and fan and hands free speaker telephone set with suitable battery, charger and controls.

d) Bidder shall provide emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers/ display (both audio and visual as out of service).

e) Suitable arrangement shall be provided to intimate unit control room during emergency in the form of audio visual alarm.

f) Two (2) push buttons, one for upward movement and the other for downward movement at each intermediate landing and one (1) push button at each terminal landing shall be provided in order to call the car. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the bidder.

g) All fixtures shall be in stainless steel face plates.

h) Push buttons shall be fixed in the car for holding the door open for any length of time required.

i) All other safety / protection / operation interlocks as required by IS – 14665 (all parts) latest edition.

6.0 Electric Motor

The driving motors shall conform to IS 325 and suitable for variable voltage variable frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415 V (+/- 10% variation), 3 Phase, 4 wire, 50 Hz (+5% to -5% variation) supply. Motors shall be provided with class F insulation & temp rise limited to class 130 (B).

7.0 Controls

The control shall be variable voltage and variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation. Suitable control panels shall be provided in the machine room. The lift will be automatically stopped by upper and lower terminal switches. The elevators will have an emergency stop switch, limit switches and other safety devices according to statutory rule.

8.0 Cables and wirings

a) All the cables except trailing cables shall be as per IS 1554-1 or IS 7098-1. The PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type.

b) Trailing cable:
The circular trailing cables shall be either in accordance with IS 4289 Part-I (elastomer insulated) or IS 4289 Part II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC 60227-6.

All wiring/ cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the elevator supplier. Alternatively, armoured cables may be used. However, bidder shall refer detailed specification of cables / wirings elsewhere in the specification.

9.0 Earthing

The elevator structures and all equipment including metal conduits shall be effectively earthed with earth conductors provided in the machine room as per IS 3043.

10.0 DESIGN CRITERIA

The design criteria and equipment specification will be as follows:

i) The rated speed will be 1.0 m/ sec (for all elevators). Proper allowance will be made for impact and wear and the factor of safety for rope shall not be less than twelve

(12) or as per IS 14665 (all parts). The suspension wire rope will confirm to IS-14665 or approved equivalent international standard.

ii) The lift will be providing with automatic travelling device which will take care of overrun and under run of the car and rope stretch that the car floor is within 6.0 mm from the landing level at the floors while in operation.

iii) The lift will be equipped with upper and lower terminal switches arranged to stop the car automatically within the limit of the top car clearance and bottom run-by, from the any normal operating speed.

iv) The elevator car shall be provided with SS-304 sheet fabricated, hair line finish (including landing doors of the car), flooring as indicated at scope of supply ref cl. No. 2.0.1, Section IA of Technical Specification, concealed fan and indirect lighting, emergency lighting, intercom, car position and travel direction indicator.

v) As the elevator is to provide service in a power station, it is necessary for the equipment to be specially coated (painted). This will include application of anticorrosive paint as applicable. The electrical equipment will have enclosures meeting degree of protection as covered under electrical specification.

vi) The elevator as a whole will comply with relevant Indian Standard i.e. 14665 or approved international standard. The outline dimensions of electric lift shall meet the requirements of IS 14665 (latest edition).

vii) The elevator shall be provided with AC VVVF type drive control system.

viii) Doors are automatic, center opening with emergency key opening at all landings, horizontal sliding type for car as well as for hoist way. Trap door shall be provided by civil contractor as per IS-14665 (latest edition).

11.0 Other Technical Requirements

1) Characteristic curves of all motors shall be furnished by the bidder during detail engineering stage for approval showing torque, speed, current and voltage.

2) Electrical requirements shall be as per requirements enclosed elsewhere in the specification.

3) Complete elevator installation shall be in accordance with the requirements of concerned approving authority.

4) In case of any contradictory requirement amongst the various clauses within the specification and clarifications not having been sought by the bidders, the most

stringent requirement as per interpretation of BHEL's engineer shall be final and binding on the bidder for which BHEL will not entertain any commercial implication.

5) Data sheets of various items shall be prepared by the bidder and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.

6) GA drawing indicating design data, material of construction etc. shall be prepared by the bidder during detail engineering stage based on specification / contractual requirement and there should be no commercial implication on account of finalization of the drawings and documents.

7) O & M manual shall be furnished to BHEL / customer / consultant for approval during detailed engineering stage.

8) Field quality plan / quality assurance plan / check list shall be prepared by the bidder for each item of elevator and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.

9) All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.

10) Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.

11) Bidder to note that all the drawings shall be prepared in Auto Cad version and required number of hardcopies and soft copies shall be furnished to BHEL during detailed engineering stage. Exact requirement of number of hard copies and soft copies of all drawings and documents as required by BHEL / customer / consultant shall be informed to the successful bidder during detail engineering stage and bidder to furnish the same for which no additional cost shall be entertained.

12) 21 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.

13) Civil works will be provided by BHEL / customer. Hence, bidder has to furnish the civil inputs in time. Bidder has to carry out the rectification in the civil works in the

event of any changes in the civil input data furnished by them or delay in submission of input data by them. Bidder to furnish the civil foundation drawing along with the loading data for approval during detailed engineering stage showing / indicating the followings: -

a) Scope of work by BHEL and bidder shall be indicated with different legend or in the form of note.
b) Recommended locations of earthing pads.
c) Civil loads along with detailed calculation of loading.
d) Details of pockets / cut outs as required for anchor bolts.

14) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.

15) All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

16) All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.: -

a) All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.

b) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

17) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.

18) Bidder to furnish prices and unit price of each item of proposed system as per BHEL's price format only along with the final price bid.

19) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.

20) Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, PG test / functional test procedure, list of sub – vendors (mechanical, C & I and erection and commissioning), technical specification and material of construction, painting specification / schedule, dispatch schedule etc. of various items as required by BHEL / customer / consultant shall be submitted to BHEL / customer / consultant during detail engineering stage for approval and the approved drawings / documents shall be adhered by the bidder without any commercial implication.

21) "Technical deviations" shall be clearly indicated in bidder's offer in prescribed format only.

22) All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No. and customer / consultant's drawing no; which will be forwarded to the successful bidder during detail engineering stage.

VOLUME III-I

SECTION – 1/B

ELEVATORS

CONSULTANT : PROCON ENGINEERS

CONTENTS

1.0 INTRODUCTION

1.1 This section covers the Elevators which will be required for various power plant activities during erection and maintenance purposes and for running of 1 X660 MW Power plant.

2.0 CODES AND STANDARDS

2.1 The design, manufacture and testing of the elevators and components thereof shall, unless specifically stated otherwise, conform to the following specific codes and standards as applicable, including its latest amendments subsequent to the date of publication as mentioned below :

2.1.1 IS-14665 : Electric Traction Lifts.

2.1.2 IS-2365 : Specification for Steel Wire Suspension Ropes for Lifts and Hoists.

2.1.3 State Elevator and Escalator Act.

2.1.4 State Elevator and Escalator Rules.

2.1.5 Indian Electricity Act.

2.1.6 Indian Electricity Rules.

2.1.7 Any other acts/standards as applicable as mentioned in Volume II of this specification.

2.2 The installation of the elevators under this section shall be carried out in conformity with the local acts/rules with latest amendments which are in force, including the rules of fire lifts, as shall be required by the Bidder to obtain license for the elevator from concerned authorities.

2.3 Technical requirements of the elevators shall be as given in Attachments enclosed to this section.

2.4 Minimum acceptable degree of protections for various equipment are presented in Annexure-I.

2.5 In case of any contradiction between the above standards and attachments, the stipulation in the attachments shall prevail and shall be binding on the Contractor.

Stipulations in this section shall prevail in case of any contradiction between this section and other relevant sections/ volumes.

3.0 SCOPE OF WORK

The scope of works under this section shall be as below. Items though not specifically mentioned but needed to make the installation of the elevators complete in all respects are also to be furnished by the Contractor.

3.1 SCOPE OF SUPPLY

3.1.1 The scope of supply of Elevators is as follows.

(a) Two (2) goods cum passenger elevator complete with all accessories shall be furnished for steam generator unit at the suitable location so that the same can be used for the movement of man and materials for the inspection and maintenance of the various steam generator parts. The lift shall be connected to the steam generator structural steel and as such part of the lift load shall be transferred to the steam generator columns. The Bidder shall ensure that the steam generator columns are designed to take the loads due to the lift shafts and connecting platforms at different elevations. The preferable location of elevators is indicated on the layout drawings.

Both the elevators shall also have access to mill area, to feeder floor to bunker tripper area.

(b) One (1) goods cum passenger elevator complete with all accessories to be located in the B-C Bay. These shall be connected to the turbine house/B-C Bay structural steelwork and as such part of their loads may be transferred to the main T-G house/B-C Bay structural steelwork columns. The Bidder shall ensure that these columns are designed to take care of the loads due to elevator shafts and connecting platforms at different elevations. Elevator shall be located

between B-C Bay columns on relevant layout drawings (enclosed to this specification) to serve various floor elevations.

(c) Two (2) passenger elevators of 884 kg capacity each complete with all accessories for Service Building

(d) One (1) goods cum passenger elevator complete with all accessories shall be provided for crusher house.

(e) One (1) Rack & Pinion type Stack elevator complete with all accessories shall be in the chimney at the suitable location.

3.1.2 The above elevators shall be provided with the following accessories as applicable,

(a) Elevator car complete with door, door hangers and tracks, push button station, operating panel, car position indicators, illumination fittings, fan fittings and other required accessories. Lighting point and plug point shall be provided over the elevator car roof for the purpose of maintenance work.

(b) Mast, guide rails, guide rollers and structural steels, terminal buffers and guide rail lubrication device.

(c) Complete drive machinery and accessories e.g. electric motor, gear box etc., electrical and control equipment including cables & isolating switch starting from Owner's power supply point including Power & lighting distribution boards.

(d) Necessary brakes and limit switches, safety locks for car and landing door & all other protective devices including switch, fuse, starters etc. All rigid/flexible conduit, ferrules, lugs, glands, terminal blocks, cable clamps, general purpose flexible/Trailing cables automatic, levelling device and other miscellaneous items, as required.

(e) Hoist-way doors and push button station with digital lights at each landing.

(f) Provision of Battery back up for emergency lighting inside the Elevator car and alarm, in case of power failure.

(g) Facility of intercom in the Elevator car with necessary wiring for connection from car to a terminal box adjacent to bottom most landing and to the Plant Control room as well as Maintenance Engineer room.

(h) Any other fittings and accessories required for safe and efficient operation of the equipment.

(i) Supply of first fill of lubricants, painting etc.

(j) All required foundation plates and/or base plates, anchor bolts lifting lugs, eye bolts etc. wherever necessary.

(k) Firemen's switch as per rules of fire lifts.

(l) Earth leakage circuit breaker.

3.1.3 Supply of one set of special tools and tackle for maintenance of the elevator.

3.1.4 Supply of Mandatory Spares as required

3.1.5 List of Recommended Spare Parts for five (5) years operation of the elevator along with various drawings, data, test reports and certificates, erection manual, operation and maintenance manual etc. as required by the applicable clauses of this Specification. Earth leakage circuit breaker shall be provided by the bidder on the lift installation as per requirements of inspector of lifts.

3.2 SCOPE OF SERVICES

3.2.1 The complete service of unloading, in-plant transportation, handling, storage, erection, final check-up, testing and commissioning including arranging of all labour, supervision, erection tools, equipment and consumables and final paintings.

3.2.2 For erection and complete commissioning of the elevator, all necessary insulated wiring in conduits or tubing together with necessary fittings, metal boxes, troughs and ducts, trailing cables, suitable earthing of machines and elevator etc. shall be supplied and installed by the Contractor in conformity with the Indian Electricity Rules or IS Codes as applicable.

3.2.3 Conducting all necessary tests at manufacturer's works and also after completion of erection specified hereinafter to full satisfaction of Owner or the concerned local Government Inspectorate/Authority. All test gadgets, instruments; test weights etc. necessary for conducting test at site shall be arranged by the Contractor. All test certificate/load test certificate should be acceptable to the concerned local Government Inspectorate/Authority.

3.2.4 Complete maintenance training to personnel for independent maintenance of elevator.

4.0 OPERATION AND CONTROL PHILOSOPHY

4.1 The elevators, while starting from any level, shall start at rated speed but during stopping, elevator shall slow down to lower speed when the car reaches around one meter of the selected landing floor and stop when reached the landing floor. The control system shall be microprocessor based with AC variable voltage and variable frequency drive.

4.2 The elevators specified herein shall be operated in selective collective automatic mode of operation as defined in IS-14665. Operation and Control features of this elevator shall be as follows :

4.2.1 One push button for each of the all landings shall be provided inside the car. Two push buttons, one "Up" button and one "down" button, shall be provided at each of the intermediate landings. The uppermost and lower most landings shall be provided with one push button.

4.2.2 Calls initiated by the car or landing push buttons shall be registered and stored until answered, irrespective of the car being in motion or any landing door being open.

4.3 The car shall answer calls in one direction of travel, that is all "UP" landing calls shall be answered when the car travels in the upward direction and

"DOWN" landing calls shall be answered when the car travels in the downward direction, except in the case of uppermost or lowermost calls which shall be answered as soon as they are reached irrespective of the direction of travel of the car.

4.4 Besides the automatic mode of operations described above, the elevators shall have provision for attendant operation also, transfer of operation between automatic control and attendant operation being achieved by a key operated switch in the car.

4.5 The operation of the elevators shall be through push button station located inside the lift car. Suitable interlock shall be provided so that the elevators shall not move unless the door are properly closed. The landing doors of any floor shall not open when the elevator is not on that floor. Push buttons shall be fixed in one car for holding the doors open for any length of time required.

4.6 Both the elevators for steam generator unit shall have doors opening towards boiler and mill side respectively. Logics will be developed for opening the doors for common landing at boiler & mill side and identified single side opening (Boiler or Mill). Total number of push button for landings will be decided accordingly. The naming for these buttons would indicate 'Boiler' or 'MILL' along with floor number as the case may be i.e. if door is opening towards boiler or mill side. For common landing, push button would indicate only floor number.

4.7 The elevators under this section shall be treated as "Fire Lifts". "Fire Switch" in a glass front box shall be provided adjacent to the lifts at the entrance level, the function of which is to enable the fire authority to take over the complete control of the lifts, when required. When the switch is on, landing call points shall become inoperative and the lift shall be on the car control only. When the switch is off, the lift shall return to normal working.

4.8 STACK ELEVATOR

4.8.1 The elevators, while starting from any level, shall start at rated speed and shall slow down to lower speed on actuation of the landing limit switches.

4.8.2 The elevator shall be operated by a push button system consisting of buttons for "UP" and "DOWN" and a button for "next level".

4.8.3 Door shall be manually closed and opened but shall open only when the Cage reaches the landing.

4.8.4 The elevator shall be operated in a Semi-automatic mode.

4.9 The elevator after a predetermined speed shall actuate the over-speed brake Governor. The governor pawl due to the centrifugal action shall actuate the incorporated mechanism and stop the downward motion

5.0 PERFORMANCE REQUIREMENT

Performance requirement for the elevators shall be guided by the Attachments/Annexure enclosed with this Volume.

6.0 DESIGN AND CONSTRUCTION

6.1 LOAD AND SPEED

6.1.1 The elevator shall lift a pay load against rated load or its nearest as per manufacturer's present standard in addition to the weight of the car and its accessories and shall travel at a rated speed as indicated in the applicable Annexure.

6.1.2 All mechanical and electrical operating devices and trailing cable shall be designed for outdoor operation with dusty and high humidity condition and shall operate equally well in any ambient temp as per project data.

6.1.3 Elevator shall be capable of operating from the bottom most landing to the top most landing with intermediate stops at all landings, as stipulated.

6.2 CAR/CAGE

6.2.1 Size

The dimensions of the lift car/cage and car/cage platform and door shall be as per IS-14665.

6.2.2 Car/Cage Frame

Lift car/cage shall be carried in a complete frame of steel which shall be sufficiently rigid to withstand the operation of the safety gear without permanent deformation to the car/cage frame.

At least four renewable guide shoes or guide shoes with renewable linings or set of roller guides shall be provided, two at the top and two at the bottom of the car/cage frame.

6.2.3 Car Enclosure

Car/cage shall be enclosed on all sides by means of car/cage body and door. The sides of the car/cage shall be lined with heavy gauge sheet steel panels properly braced and reinforced. The enclosure shall be flush on the inside and securely fastened to the platform. Car/cage inside enclosure shall be of stainless steel plate of grade SS:304 of bright finish.

Car/cage of the elevators specified herein shall be equipped with decorated Stainless Steel hand rails on three sides. Car/cage shall be equipped with fan with grills and suitable lighting complete with decorative fittings. The light shall be left burning during the whole time the lift is available for use.

Necessary provisions shall be made for adequate ventilation of the car/ cage. Ventilation openings shall be provided in the enclosure walls as per requirement of IS-14665.To permit switching off the power supply to the lift without switching off the fan and light, a separate switch shall be provided for fan and light.

The enclosure of lift car shall withstand the maximum possible thrust applied normally at any point, excepting any vision panel, without permanent deformation. Glass shall not be used in the lift car except for the following purposes:

(a) As covers for certificate.

(b) For lighting fixtures.

(c) For appliances used in connection with the operation of the car.

(d) For vision panels and mirrors.

Suitable arrangement to secure isolating cushion between car/cage and the steel car/cage-frame shall be provided.

Telephone or paging facility shall be installed in the lift car/cage. The Bidder shall provide suitable cabinets in the car/cage to house hand sets. The Bidder shall also provide necessary wiring for telephone or paging connection from the car/cage to a terminal box adjacent to the lift well.
The car/cage panels shall be given final painting. The type and colour of the final painting shall be subject to the approval of the Owner/Consultant.

6.2.4 Platform

Car Platform

It shall be constructed of structural steel shapes securely fastened together with one layer of wood flooring. Floor of the elevators shall be as specified in Datasheet. The platform construction shall be designed based on rated loads evenly distributed.

Since, the car levelling devices will be used; substantial aprons of sufficient depth shall be fitted to the car floor to ensure that no space is permitted between the threshold and the landing while the car is being levelled to a floor.

Cage Platform

Cage platform shall be constructed of Aluminium chequered plate and attached to the cage frame.

6.2.5 Roof

Car Roof

Car roof shall be covered with sheet metal. The construction of roof shall be strong enough to be capable of supporting at least two persons.

A three pin plug socket with switch of industrial type having adequate capacity for a hand lamp shall be fitted on top of the lift car for use by persons working thereon during maintenance.

Cage Roof

Cage roof shall be strong enough to withstand the weight of the equipment and shall be provided with an escape hatch electrically interlocked with hoist control system. Cage roof shall be provided with Tubular steel handrail to protect the equipment.

6.3 DOORS

6.3.1 Type of door

6.3.1.1 Car

Type of car doors shall be as indicated in the Annexure and made of steel provided with necessary rubber buffers. Doors for fire lifts shall have fire resistance for minimum one hour. The final paints on car door shall be same as that of the car.

6.3.1.2 Cage

Cage door shall be made of MS Angle & Perforated sheet with mechanical and electrical interlocking to prevent cage door from being operated until the cage door and landing level enclosure doors are fully closed.

Cage door shall be bi-parting/sliding type and hoist-way door shall be swinging type.

6.3.2 Door Hangers and Tracks

Hangers and tracks for car/cage door and each hoist way door shall be furnished. Suitable material shall be used to minimise noise. Ball bearing, rollers or equal arrangement shall be provided to take upward thrust of the doors. Suitable devices shall be furnished for transmitting motion from one door panel to the other.

All required materials for landing entrance e.g. extruded aluminium or equivalent sills, strut angles, headers etc. shall be provided.

6.3.3 Door Operators

The door operation shall have power opening and power closing. Necessary electric type door operators shall be furnished. The car door shall mechanically connect and shall move simultaneously during opening and closing. The necessary door cushioning devices shall be furnished.

The car door shall open automatically when the car stops at a landing. Should the electric power fail, the door operator shall be so designed that doors can be manually opened from within the car. Necessary door locking devices shall be furnished. Necessary switches shall be furnished in the elevator machine room to control the operation of the door.

Cage doors shall be manually operated.

6.4 CAR SELF-LEVELING DEVICE

The elevator shall be equipped with automatic self-levelling devices, to bring the car to the floor landings. These self-levelling devices shall correct for over travel and rope stretch.

6.5 OPERATING PANEL

6.5.1 Car

In the car, an operating panel containing push buttons, numbered to elevations of the landings served, two-position key-operated switch, marked to indicate, "With Attendant" and "without Attendant" shall be furnished. Emergency stop switch; a buzzer; an emergency call button connected to a bell shall be provided by the Contractor at the bottom most landing of each elevator and also in the control room with an indication to serve as an emergency signal. A non-stop button; push button, or switches for lighting and fan; up push button, down push button, one door open push button and other push buttons, switches, emergency light, telephone hand set etc, as required shall be provided.

The emergency call button mentioned above shall have two sets of potential free contact and shall be suitably wired upto the control panel in the machine room for indication or annunciation at unit Control Room.

When the key switch in the car operating panel is set at the attendant position, the attendant shall have full control of the operation of the elevator. Any hoistway calls which are then registered shall cause a buzzer to sound in the car operating panel and the appropriate indicator light to illuminate.

6.5.2 Cage

Operating panel shall be furnished in the cage containing push buttons, one button for emergency stop, one button for hooter, one for "up" direction and one for "down" direction, button for next landing and switch for light and fan. One auxiliary panel shall be furnished and mounted on the ground level enclosure. Panel shall be equipped with a main "ON-OFF" selector switch.

6.6 CAR POSITION INDICATOR IN CAR

For the elevators, signal indication above the entrance in the car shall be provided by the appropriate numeral (which shall be the elevation of the respective floor) being illuminated when the car is passing the corresponding floor. The indication shall remain illuminated when the car stops at a floor. Up and down direction, jewel lights shall also be provided.

6.7 PUSH BUTTON STATION AND CALL-REGISTERED LIGHTS FOR CAR

6.7.1 The elevators shall be equipped with a push button station consisting of a single up or down push button at terminal landings and up and down push buttons at each intermediate landing including call registered lights (up or down call registered lights at each terminal landing and both up and down call-registered lights at all intermediate landings). These shall illuminate when the corresponding button is pressed to indicate that the call is registered and shall remain illuminated until the call is answered. An illuminated car position indicator shall be provided above the entrance of all the landings.

6.8 The word "Fire Lift" shall be conspicuously displayed in radium paint on the lift landing doors of the elevators designated as fire lifts.

6.9 SAFETY SHOE DEVICE ON CAR DOOR

Safety shoe device shall be furnished on car doors. Safety shoe shall extend the full height on the closing edges of the car doors. The arrangement shall be such that should the safety shoe touch a person or an object while the door is closing, the car door shall return to the open position. The doors shall remain open until the expiration of a pre-determined interval and then close automatically.

6.10 EMERGENCY EXIT

6.10.1 Car

Elevator car shall be provided with an emergency exit of adequate dimensions. The location of the emergency exit shall be at the top of the car.

6.10.2 Cage

Cage roof shall be provided with an escape hatch electrically interlocked with hoist control system.

6.11 BUFFERS

6.11.1 Car

The terminal buffers shall be furnished for stopping the car and the counter-weight at the extreme ends of travel. All structural steel members required to install the buffer shall be supplied under this section.

6.11.2 Cage

Sufficient number of buffers of spring-loaded type shall be fitted below the cage. The buffers shall be capable of stopping the Cab without permanent damage or deformation to themselves or any other part of the equipment.

6.12 LOAD PLATE FOR CAR/CAGE

A load plate giving the rated payload of the elevator shall be fitted in the car/cage in a conspicuous position. The rated load shall be given in kilograms and in number of passengers.

6.13 COUNTER-WEIGHTS AND COUNTER-WEIGHT FRAMES

Counter-weight sections shall be mounted on structural metal frames so designed to retain the weights securely in its place.
Counter-weight frames shall be guided on each guide rail by upper and lower guiding members attached to the frame.

A substantial metal counter-weight guard of required length shall be provided at the bottom.

6.14 GUIDES FOR CAR AND COUNTER-WEIGHT

Car and counter-weight guides shall be of rigid steel and shall be continuous throughout the entire length and shall be provided with adequate steel bracings and stiffeners. The necessary lubrication device for guide rail shall be provided.

6.15 LIMIT SWITCHES

6.15.1 Car

Normal terminal limit switches to slowdown and stop the car automatically, shall be provided at terminal landings and final limit switches shall be furnished to automatically cut-off the power and apply the brake, should the car travel beyond the terminal landings.

6.15.2 Cage

Double limit switches shall be provided to ensure cage stops at top and bottom position. An ultimate 3-position over-travel limit switch which will cut off power and control supply in the event of over travel shall be provided. It should also be possible to manually turn the switch to off position.

6.16 CONTROLLER & TRACTION MACHINE

6.16.1 The design ambient temperature shall be taken as 50° C. The insulation of motor shall be class "F" and temperature rise shall be limited to Class "B".

6.16.2 Complete details of controller and traction machine shall be furnished by the Bidder.

6.16.3 The elevators being offered with Microprocessor based AC variable voltage and variable frequency type control, motor and generator shall be mounted on independent shafts coupled with proper coupling.

6.16.4 Number of starts per hour for which motor shall be capable, shall be selected by the Bidder for the given applications and in accordance with applicable code/standard.

6.16.5 Necessary brakes shall be provided in the traction machine.

6.16.6 Protective relays shall be furnished on the controller to protect against phase reversal, low voltage and phase failure. Overload and other protective relays shall also be furnished for traction motor. Single phasing preventor shall also be provided to protect motor while running at no-load.

6.17 LIGHTING

6.17.1 Car

Lighting shall be provided in machine room, lift well and lift cabin.

LED LIGHTING

Two (2) 40 W Fluorescent tubes with fittings shall be provided at each of the machine room and the lift cabin whereas incandescent G.L.S. lamp shall be provided in the lift well. Emergency lighting shall be provided in all the places including Cabin. All necessary wires, conduits, junction boxes shall be supplied. In the lift cabin, indirect illumination type fitting shall be provided.

6.17.2 Cage

Cage shall be equipped with a 220 volts A.C. 20W fluorescent lamp fixtures as interior light. Emergency lighting shall be provided in the mast structure, landings, cage etc. and other places, as required. Other lighting arrangement shall be provided as per consultation.

6.18 GROUNDING

Grounding of all enclosure of live parts shall be done as per applicable Electricity Rules with latest amendment. All structures of the lift shall also be grounded.

6.19 OTHER ELECTRICAL ITEMS

6.19.1 Car

Special care and precaution shall be taken regarding the handing of lift trailing cable loops between the points of suspension. A 1/4" sling rope should be used for tying up. Conductor and insulation of these trailing cables shall be flexible with suitable reinforcement provided.

All control cables shall have crimped type lugs and wire numbering ferrules at either ends.

6.19.2 Cage

Trailing cables shall be specifically designed for the specific service and shall conform to IS: 4289.

A Cable trolley is to be provided to wind and rewind the cable and to keep the cable in tension and suitable cable guides are to be provided to prevent damage to cable.

6.20 SAFETY GEARS FOR CAR

The elevator shall be provided with one or more safety devices capable of stopping and sustaining the lift car with full rated load in the car at governor tripping speed.

When the safety gear is applied, decrease in the tension of the governor rope or motion of the car in the descending direction shall not release the safety gear.

6.21 SAFETY DEVICE FOR CAGE

An over speed governor in constant mesh with the rack by means of a pinion shall be provided to protect the cage against over speed during the cab downward motion. Safety hooks shall be provided for positive engagement of rack and pinion.

Hooter shall be provided as an emergency alarm and should have a provision to be actuated from the inside of the cage.

6.22 OVER SPEED GOVERNOR

The elevator shall be equipped with over speed governor device which operates to apply the safety gear in the event of the speed of the car in the descending direction exceeding a predetermined limit.

6.23 BRAKES

6.23.1 Car

The machine shall be provided with direct current spring set, solenoid released, double shoe brakes of sufficient capacity to stop the car at any position with the design load. These brakes shall be designed in such a way to apply automatically in the event of power supply failure. The details of equipment offered shall be indicated in the offer.

6.23.2 Cage

The drive unit shall incorporate an electromagnetic disc type brake and an external manual brake release to be provided in the Cage. The brake should be such that during power failure the brakes should be applied automatically to prevent any further movement of the cage and to be released only when power is restored.

6.24 ROPE

Suitable traction steel hoist ropes of the sizes and number to ensure proper wearing qualities shall be supplied. As a minimum, the number of ropes shall comply with the factor of safety requirements of Indian Standard for lift/elevator. The full details of ropes, the maker's name, trade name, breaking strength, designed factor of safety of all ropes shall be submitted with the bid.

6.25 BRINGING OF STRANDED LIFT

During prolonged power failure, arrangement shall be provided, so that, after cutting out supply point manually through hand wheel, the lift stranded between two floors may be brought to the nearer floor.

Alternative offer for bringing the stranded lift to the nearer floor by automatic winding arrangements may be given and price quoted separately.

6.26 LIFTING ATTACHMENTS

All equipment/component shall be equipped with suitable lifting attachments, e.g. lifting lugs, eye bolts etc. to facilitate erection and maintenance.

6.27 LANDING & GROUND ENCLOSURE FOR CAGE

A three-sided enclosure with one access door shall be provided for the bottom most landing. At each platform landing above the bottom most landing, a one sided enclosure with access door shall be provided.

The space underneath the bottom most landing enclosure shall be enclosed. A staircase shall be provided for access to the cage.

6.28 DRIVE UNIT FOR CAGE

Drive unit shall consist of two (2) AC squirrel cage induction motors, reduction gear, drive pinion, over-speed governor and brakes. The drive